GEI Consultants

Geotechnical
Water Resources
Environmental and
Ecological Services

Red River Aquatic Biological Monitoring Report 2005

Submitted to:
Molycorp, Inc.
Questa, NM

Prepared by:
GEI Consultants, Inc.
Chadwick Ecological Division
5575 South Sycamore Street, Suite 101
Littleton, Colorado 80120

November 2006
Project 062590

Lee Bergstedt
Project Manager

Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

The purpose of this report is to present data on fish populations, fish habitat, and benthic invertebrate populations collected in 2005 and to continue to evaluate the trends identified in biological parameters and sites monitored since 1997, as well as the sites added more recently as a result of other programs. Results from an additional study of Cabresto Creek fish populations and distribution that was conducted in fall 2005 are also included.

The study area includes the Red River from its headwaters to the confluence with the Rio Grande. The Questa Molybdenum Mine is adjacent to the north bank of the Red River in its middle reaches, between the towns of Red River and Questa. The tailing facility is located west of the Village of Questa, and the permitted discharge associated with the tailing facility (Outfall 002) enters the Red River downstream of the Village of Questa. Monitoring from 1997 through 2001 in the Red River basin consisted of 12 monitoring sites on the Red River and selected tributaries. With the initiation of the Remedial Investigation (RI) program under the direction of the US EPA, several additional sites were sampled beginning in 2002; and in 2004, one long-term monitoring site (Middle Fork) was dropped. A total of 16 monitoring sites were sampled in fall of 2005.

Fish population data for 2005 generally follow trends observed in previous years, indicating areas of stress in the middle reaches of the Red River although there is a the slight recovery in trout density observed at the Elephant Rock Campground site. These stresses are primarily the result of poor water quality and sediment input from hydrothermal scars and upwelling groundwater upstream of the mine. Fish populations were extremely limited at the June Bug Campground site and at the sites between Hansen Creek and Highway 522. Few or no resident trout or young-of-the-year (YOY) fish were found at most of the sites in this section of the river. At the reference sites and at sites downstream of Outfall 002, the populations of resident trout were healthy, with relatively high density and biomass in a wide range of year classes.

More complex fish habitat (i.e., higher habitat quality ratings) was available at the reference sites (Zwergle, Cabresto, Columbine), as well as the sites downstream of Outfall 002, in 2005 compared to the other monitoring sites. Low habitat quality ratings at the three sites downstream of Hansen Creek were due, in part, to the covering of habitat features by sediment in this reach of the Red River in fall 2005. Riffle habitat was dominant in terms of total area at nearly all sites. Higher levels of sediment at sites downstream of Goathill Campground may represent a plume of sediment moving downstream during runoff and during the summer of 2005.

Benthic invertebrate populations in spring and fall 2005 at the reference sites were diverse and healthy, as indicated by relatively high density, number of taxa, and number of sensitive EPT taxa. Population parameters were reduced for most sites downstream of the town of Red River to near Questa. At sites downstream of Highway 522, invertebrate density, number of taxa, and number of EPT taxa improved in both spring and fall 2005. At all sites along the river, including the sites in the most impacted reaches, at least some species of sensitive EPT taxa are present. This includes species of mayflies, which are especially sensitive to higher metal concentrations. This indicates that the river sustains at least some sensitive invertebrate species along its entire length.

Similar to the fish population data and previous monitoring efforts, trends in invertebrate population data in fall and spring 2005 indicate three general areas of impact in the Red River. Substantial reductions in population parameters initially occurred downstream of the town of Red River, with further reductions in populations occurring downstream of Hansen Creek, downstream of Capulin Canyon, and the upwelling ground water near Spring 13. Trends in invertebrate population data in 2005 were more similar to trends in 1995 through 2000 and in 2004 than to trends in 2001through 2003, with the lowest population parameters generally at the Questa Ranger Station and recovery of some population parameters at the Elephant Rock Campground site and in the vicinity of Columbine Creek. The data for 2002 and 2003 indicate that impacts in the middle reaches of the Red River were greater than those prior to 2001 or after 2003, probably due, in part, to the below average flows and increases in sediment accumulation that occurred in both 2002 and 2003.

An additional study conducted as part of additional efforts in 2005 surveyed the trout populations quantitatively and qualitatively in four segments of upper Cabresto Creek for the purpose of defining the distribution of native Rio Grande cutthroat trout, along with brook trout, brown trout, and rainbow trout in the upper Cabresto Creek watershed. Results of these surveys indicated that cutthroat trout were present throughout the surveyed portion of Cabresto Creek upstream of the Lake Fork Creek confluence. Genetic analyses of cutthroat trout tissues collected from one of the more upstream segments sampled indicated that the cutthroat trout population in this segment were pure Rio Grande cutthroat trout, with no sign of rainbow trout introgression. Brook trout were present at all but the most upstream segment of Cabresto Creek. As no significant barriers to fish movement were present in this segment, brook trout distribution is likely being limited by elevation, available habitat, competition with cutthroat trout, or some combination of these three factors. Brown trout, hybrid trout, and rainbow trout were only collected at the most downstream segment, downstream of Bonito Canyon.

Multiple physical and chemical factors appear to be influencing the distribution of trout and invertebrates along the length of the Red River. This was analyzed in depth by CEC (2005a) using trout and invertebrate population data, habitat evaluations, and extensive chemical data collected in 2002 and 2003. The factors influencing these communities apparently change in importance from year to year. Flow is an important factor in determining year-to-year trends in trout populations, especially density of YOY trout, but is less important for invertebrates. With any one year, sedimentation (percent riffle embeddedness) was probably the single most important factor determining the distribution of fish populations (accounting for 52% and 67% of the longitudinal variation in biomass). For invertebrates, percent embeddedness was not correlated with any population parameter in spring 2005 or spring or fall 2004, but was inversely correlated with number of taxa and number of EPT taxa in fall 2005. Water chemistry, particularly metals concentrations, exhibited few correlations with fish or invertebrate population data. Episodic summer rainstorms simultaneously add large amounts

of sediment and degrade water quality in the Red River, which confounds the relative influence of sedimentation and water chemistry on fish and invertebrates.
The data from 2005 support the conclusions from our previous reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b) which concluded that the primary impacts to the suitability of the Red River to sustain aquatic biota were occurring just downstream of the town of Red River, downstream of Hansen Creek, and downstream of Capulin Canyon. These three areas all have surface water and/or groundwater connections to the Red River in the area of natural hydrothermal scars. Downstream of the confluence of Cabresto Creek, conditions improved for both fish and benthic invertebrates.

These impacts in the Red River appear to be resulting from the input of excess sediment from a number of sources and decreased water quality, especially at locations receiving drainage from hydrothermal scars. Those reports further concluded that these impacts were present prior to the initiation of open pit mining at the Molycorp Questa Mine, and in reaches of the Red River upstream of the mine.

1.0 Introduction

Biological monitoring was initiated in 1997 to evaluate the effects of open pit mining operations and mine rock piles over a 30-year period on aquatic biota (i.e., fish and benthic invertebrate populations) in the Red River upstream, adjacent to, and downstream of the Questa Molybdenum Mine (Chadwick Ecological Consultants, Inc. [CEC] 1997, 1998). Our original report discussed the approach and scope of our evaluation in detail (CEC 1997). That discussion is not repeated here.

The biological monitoring program for fall of 2002 and spring and fall of 2003 was modified as the result of Molycorp entering into an Administrative Order of Consent (AOC) with the U.S. Environmental Protection Agency (U.S. EPA) to initiate the Molycorp Remedial Investigation (RI) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Specific changes to previous monitoring efforts for these years were reported previously (CEC 2003, 2002a), and generally included the addition of several monitoring sites and the collection of data on fish, invertebrate, and plant tissues, and extensive water quality measurements.

The purpose of this report is to present data on fish populations, fish habitat, and benthic invertebrate populations from sampling conducted in 2005 by GEI Consultants, Inc.-Chadwick Ecological Division (GEI) to continue to evaluate the trends identified in previous monitoring reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b). Additionally, this report updates the current status of the biological and habitat parameters at sites monitored since 1997, and continues to develop a database for these parameters at the new study sites added as a result of the RI efforts. This report also presents results from additional fish sampling of Cabresto Creek in fall 2005.

1.1 Background

The Questa Molybdenum Mine began operations in 1918, using underground mining methods (Schilling 1990, URS 2002). In 1965, the mine initiated open pit mining operations that continued until 1983 (URS 2002). Since 1983, the mine has continued operating using underground mining methods. Tailing from the mill are piped to tailing ponds near the Village of Questa **(Figure 1)**. Overburden from the open pit mining activities was deposited near the open pit on Molycorp property in areas that drain Spring Gulch, Sulphur Gulch, Goathill Gulch, and Capulin Canyon **(Figure 1)**.

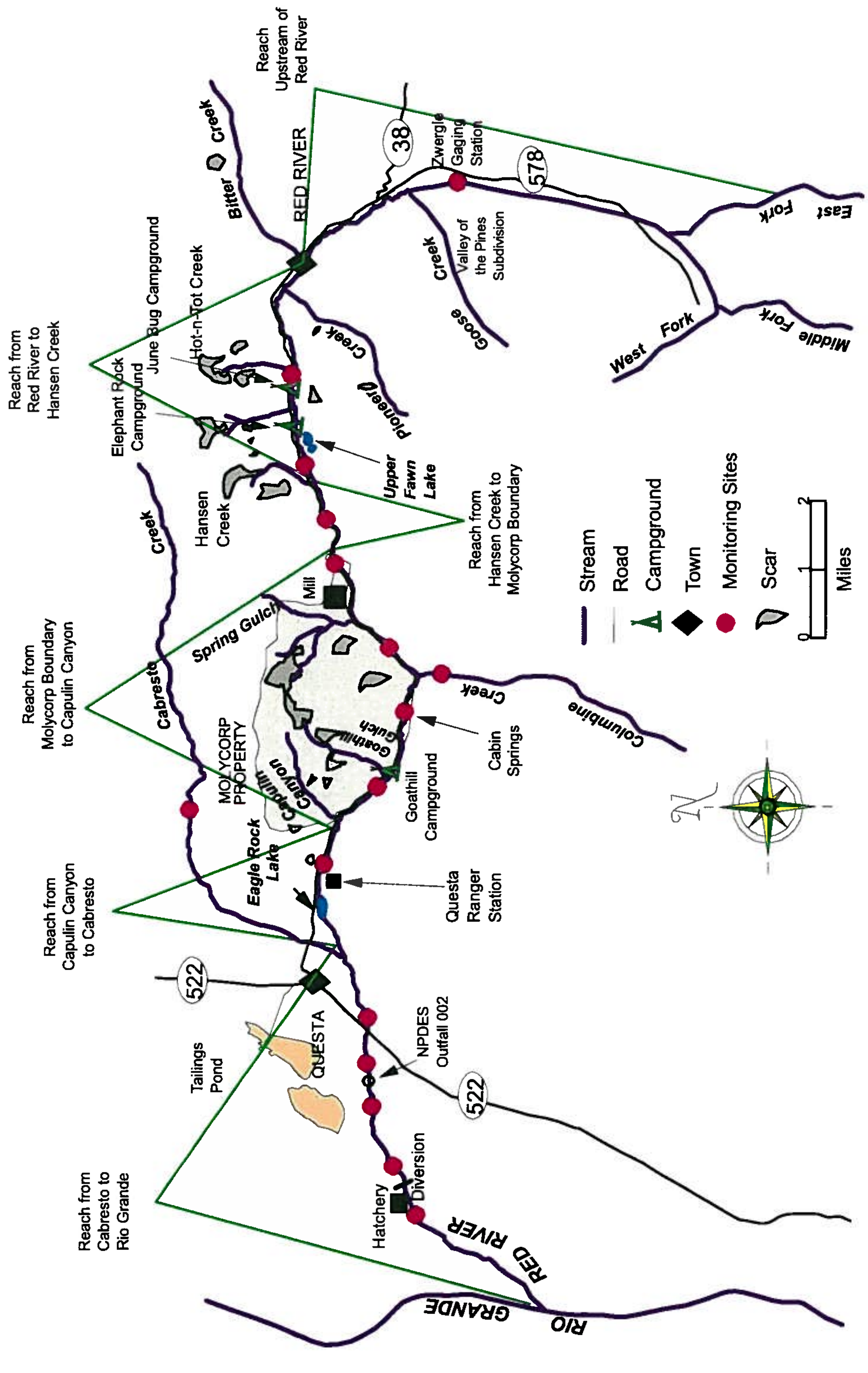


Figure 1: Red River study area with six river reaches and 2005 biological monitoring sampling sites

In order to evaluate long-term trends in aquatic biological data, the historical information has been divided into three time periods: baseline (prior to open pit mining), open pit and underground mine operation, and present conditions (CEC 1997). Baseline conditions refer to the period prior to 1966. This includes fish data collected in 1960 by the New Mexico Department of Game and Fish ([NMDGF] 1960) and benthic invertebrate data collected in 1965 by the U.S. Department of Health, Education, and Welfare ([USDHEW] 1966). During the period of open pit and underground mine operation, benthic invertebrate data were collected from 1970 to 1992, and fish data were collected from 1974 to 1988 (CEC 1997, 2005c). Present conditions refer to the benthic invertebrate data collected from 1997 through 2005 by CEC and in December 1995 by New Mexico Environment Department (NMED) and Molycorp (Woodward-Clyde 1996). Present conditions for fish include data collected from 1997 through 2005 by CEC, as well as data collected in 1975, 1979, 1997, 1999, 2001, 2002, 2003, 2004, and 2005 by NMDGF (1997, 1999, 2001, 2002, 2003, 2004, and 2005).

A detailed listing of all available data for baseline conditions, historic conditions in the intervening years of mine operation (data collected 1970-1992), and present conditions (through fall 2004) is contained in previous reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b, c).

Our initial study (CEC 1997) included an analysis of the historical information (the baseline period and the period of open pit and underground mine operation) in addition to the spring 1997 field sampling efforts. The conclusions from the first year of the study (1997) indicated that observed negative impacts to fish and benthic invertebrates in the Red River were caused primarily by naturally occurring hydrothermal scars downstream from the town of Red River, especially the scar drained by Hansen Creek and the scars in Capulin Canyon.

This pattern was evident during baseline condition, i.e., prior to open pit mining (pre-1966), during operation of the open pit and underground mine, and during the recent period. The trends indicated the open pit mine and mine rock piles did not measurably impact the suitability of the Red River to support aquatic organisms, given the pre-existing stress from the naturally occurring thermal scars and other impacts.

2.0 Study Area

The study area includes the Red River from its headwaters to the confluence with the Rio Grande. The Molycorp Questa Molybdenum Mine is adjacent to the north bank of the Red River in its middle reaches, between the towns of Red River and Questa **(Figure 1)**.

2.1 Study Sites

Recent monitoring through 2001 in the Red River basin consisted of 12 monitoring sites on the Red River and selected tributaries (CEC 2000, 2001, 2002). With the initiation of the RI sampling, several more sites were sampled (CEC 2003). A total of 14 stream sites were selected for RI sampling, nine of which were already established monitoring sites, while five were new sites; three additional established monitoring sites were not initialized as part of the RI. The monitoring site on the Middle Fork of the Red River was dropped from monitoring in 2004. Therefore, a total of 16 stream sites have been incorporated into the routine monitoring of the Red River and were sampled in fall of 2005. Study site locations for the 16 monitoring sites in 2005 (**Figure 1)** are as follows, and site abbreviations used throughout the report are in **bold**.

	Reference Sites
Cabresto Creek (**Cabresto Creek**)	Located 1.6 mi upstream of the Carson National Forest boundary, at an elevation of approximately 7,640 ft.
Columbine Creek (**Columbine Creek**)	Located approximately 400 yards upstream from its confluence with the Red River, at an elevation of approximately 7,880 ft.
Upstream of town of Red River (**Upstream of Town**)	Located on the Red River approximately 0.6 mi upstream from Goose Creek and 0.2 mi upstream from the abandoned gauging station (USGS 08264500), at an elevation of approximately 8,900 ft.
	Red River Upstream of Mine
June Bug Campground (**June Bug**)	This is the first site downstream of the town of Red River, and is located near the upstream end of June Bug Campground at an elevation of approximately 8,530 ft.
Downstream of Elephant Rock Campground, upstream from Hansen Creek (**Elephant Rock**)	Located 0.4 mi downstream from Elephant Rock Campground at an elevation of approximately 8,360 ft.
Downstream of Hansen Creek, upstream of mill (**Downstream of Hansen Creek**)	Located 0.8 mi upstream from the mill access road and 0.7 mi downstream from Hansen Creek, at an elevation of approximately 8,140 ft. This site corresponds to the "Bobita Campground" site of the NMDGF.

	Red River Upstream of Mine
Downstream of mine site boundary, upstream of mill **(Upstream of Mill)**	Located 1.4 mi downstream of Hansen Creek and 0.1 miles downstream of the eastern mine property boundary at an elevation of approximately 8,140 ft. This site was added in fall 2002. Although this site is adjacent to Molycorp property, it is upstream of the mill and the diversion.
Downstream of mill, upstream of Columbine Creek **(Upstream of Columbine)**	Located 1.1 mi downstream from the mill access road and upstream of Columbine Creek at an elevation of approximately 8,100 ft.
Downstream of Cabin Springs and Columbine well field **(Downstream of Cabin Springs)**	Located 0.4 mi downstream of the confluence with Columbine Creek at an elevation of approximately 7,800 ft. This site was added in fall 2002.
Goathill Campground **(Goathill)**	Located at the upstream end of Goathill Campground at an elevation of approximately 7,670 ft.
Upstream of Questa Ranger Station **(Questa Ranger Station)**	Located 0.4 mi upstream from the ranger station access road, just upstream from where the tailing pipeline crosses over the Red River. This site is downstream of Capulin Canyon and the area of groundwater upwelling near Spring 13. The elevation of this site is approximately 7,480 ft.
Upstream of Highway 522 **(Upstream of Highway 522)**	Located immediately upstream of the Highway 522 bridge at an elevation of approximately 7,260 ft. This site was added in fall 2002.
Downstream of Highway 522 and Questa WWTP **(Downstream of Highway 522)**	Located 0.4 mi downstream of the Highway 522 bridge and just of the Questa WWTP, at an elevation of 7,240 downstream ft. This site was added in fall 2002
Downstream of NPDES Outfall 002 **(Downstream of Outfall 002)**	Located 0.6 mi downstream of the Highway 522 bridge and 0.2 mi downstream of the NPDES Outfall 002 at an elevation of approximately 7,220 ft. This site was added in fall 2002.
Upstream of hatchery diversion **(Upstream of Hatchery)**	Located 0.3 mi upstream of the Red River fish hatchery diversion, at an elevation of approximately 7,120 ft.
Downstream of hatchery **(Downstream of Hatchery)**	Located 0.3 mi downstream of the Red River fish hatchery adjacent to the USGS gage (USGS 08266820), at an elevation of 7,070 ft. The site was added in 1999.

Additional fish sampling was conducted in Cabresto Creek in fall 2005 to investigate the status of the cutthroat trout population in this stream. Sampling was conducted in four separate segments of Cabresto Creek in order to provide data for another project. All four segments were upstream of the Lake Fork Creek confluence with Cabresto Creek **(Figure 2)**, as described below.

Additional Cabresto Creek Segments

Cabresto Creek Segment 1

This segment begins at the uppermost headwaters of Cabresto Creek and extends downstream for approximately a mile to an elevation of 10,522 ft. Most of this segment is located on private land and, thus, this segment did not have a quantitative fish sampling site located within it.

Cabresto Creek Segment 2

Segment 2 begins approximately 2.4 mi upstream of the confluence with Jiron Canyon and extends to that confluence at an elevation of 10,057 ft. Site CC-1, a quantitative fish sampling site, is located within this reach, approximately 8.6 road miles upstream of Forest Service Road 134A (Lake Fork Road).

Cabresto Creek Segment 3

This segment begins at the Jiron Canyon confluence and extends downstream approximately 4.5 mi to the Bonito Canyon confluence at an elevation of 9,069 ft. Site CC-2, a quantitative fish sampling site, is located within this reach approximately 5.0 road miles upstream of Forest Service Road 134A (Lake Fork Road) and 3.6 mi downstream of Site CC-1.

Cabresto Creek Segment 4

The upstream boundary of Segment 4 is at the Bonito Canyon confluence, and this segment extends approximately 3.3 mi downstream to the confluence with Lake Fork at an elevation of 8,565 ft. Site CC-3, a quantitative fish sampling site, is located within this reach approximately 1.5 road miles upstream of Forest Service Road 134A (Lake Fork Road).

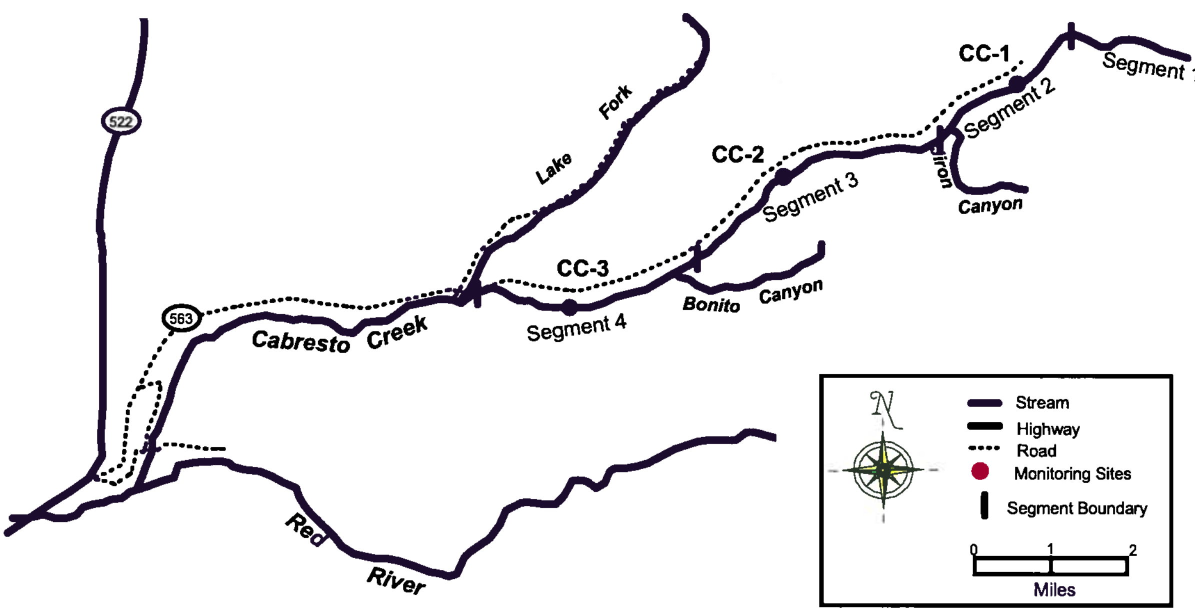


Figure 2: Cabresto Creek study area with fish sampling sites and segments.

3.0 Methods

3.1 Fish Populations

Fish populations were quantitatively sampled at all 16 monitoring sites in fall 2005, using similar methods as those used in 1997 through 2004. The section of stream sampled at each site was chosen to be representative of the habitat present in that reach of stream, in terms of pool/riffle ratio, shading, bank stability, etc. Sites were of sufficient length to ensure a representative section of the available habitat features, and ranged in length from 306 to 531 ft. in length.

Sampling was conducted by making two or more sampling passes through the stream sites using either bank or backpack electrofishing gear. Bank electrofishing equipment consisted of a 4,000-watt generator, a Coffelt voltage regulator (VVP-15), and two-to-four electrodes. Backpack electrofishing equipment consisted of a Coffelt BP-4 unit with one electrode.

Fish captured from each pass were kept separate to allow estimates of population density of each species using the maximum likelihood estimator in the "MicroFish" program developed by the U.S. Forest Service (Van Deventer and Platts 1983, 1989). If capture efficiency was high (≥ 70% of the fish captured on the first pass), as was the case in most instances in this study, then two passes were considered adequate for estimating population density (John Van Deventer, Boise State University, pers. comm. 1991). If more than 30% of the total number of fish collected were caught on the second pass, then an additional pass was made. All fish sampled were identified, counted, measured for length, weighed, and released. This sampling provided species lists, estimates of density (#/mile, #/acre), biomass (lbs/acre), and the size structure of the fish community.

Trout biomass is usually a more useful indicator of the status of the aquatic environment than density, especially for annual comparisons. While density can be skewed by high numbers of small, YOY fish or low numbers of older, larger fish, biomass is often a more stable and useful indicator from year to year (Platts and McHenry 1988). In our earlier reports, trout biomass was not the focus of our evaluation because much of the historic sources reported only density data. However, the results of fish sampling from 1997 through 2005, as well as recent results from NMDGF, include biomass data and allow year-to-year comparisons using biomass over a nine-year period.

In order to statistically compare between monitoring sites, density (#/acre) and biomass (lb/acre) data from 1997 through 2005 were used in a repeated measures ANOVA (Maceina *et al.* 1994, Zar 1999). In order to have a balanced study design, only the seven sites that have been sampled annually since 1997 were used. All sites added for the first time in fall 2002 for the RI study were eliminated from this analysis. Additionally, the Middle Fork site and the site downstream of the hatchery were eliminated since sampling did not begin at these sites until 1999. Since the sites upstream of town, Columbine Creek and Cabrestro

Creek are considered reference sites, data from these three sites were combined for this evaluation.

3.2 Fish Habitat

Fish habitat measurements were taken in spring and fall 2005 at all 16 monitoring sites. Instream habitat data were collected concurrently with the macroinvertebrate and fish population sampling.

Evaluation of habitat was made using a set of parameters developed and agreed upon for the RI by ourselves and representatives of the U.S. EPA, U.S. Fish and Wildlife Service, and NMED. The approach to habitat evaluation is based on the *RI/R4 Fish and Habitat Standard Inventory Procedures Hand Book* developed by the U.S. Forest Service (Overton *et al.* 1997). Individual habitat units were identified using the classification in Overton *et al.* (1997). Measurements within each habitat unit included length, wetted width, maximum depth, residual pool depth, average depth, habitat quality rating, percent fines by area (visual estimation), percent fines by grid, and embeddedness.

Habitat variables generally fell into one of three categories. First, measures of sedimentation included embeddedness, percent fines (particles < 4 mm) by area, and percent fines measured by grid. Embeddedness refers to the percentage of larger substrates buried by fine sediments (MacDonald *et al.* 1991). Embeddedness was calculated for each site by using an area weighted average of the values from each habitat unit. Embeddedness of riffles was calculated separately due to the importance of these habitat types in fish spawning and macroinvertebrate production. Percent fines by area is a visual estimation of the percentage of the surface area of bottom substrate that is comprised of fine sediments in the entire habitat unit. Percent fines by grid refers to the percentage of fine sediments in flowing areas of habitat units measured using a 49-intersection grid (Overton *et al.* 1997). Generally, this method is only used in low gradient riffles and scour pool tail crests (Overton *et al.* 1997); however, this method was also used in run habitat for habitat monitoring on the Red River. Percent fines by grid is a measure of sedimentation in higher velocity areas and, therefore, is expected to have lower values than percent fines by area.

Second, several variables describe the "size" of the site or habitat units. These variables include measurements of total length and width of the habitat units within a site. These two variables were then used to calculate the area of the individual habitat units within a site.

The third category included the depth variables. These included measurements of both the mean and maximum depth for habitat types within a site, and the residual pool depth. Residual pool depth refers to the depth of the water that would remain in a pool or run if there was no flow (MacDonald *et al.* 1991), i.e., pool depth at stage of zero flow. Depth variables were not measured in spring 2005.

The habitat quality rating is a subjective score ranging from one (very poor) to five (very good). The rating was based on an overall assessment of the ability of the habitat unit to support fish and benthic invertebrates based on all of the parameters discussed above. In addition, the rating was also based on such variables as the complexity of depth/velocity combinations, suitable trout cover, bank stability, etc.

Habitat unit types were summarized by calculating the total number of habitat units within a site, the number of habitat units of specific habitat types, and the percentage of total area of each habitat type.

3.3 Benthic Invertebrate Populations

Benthic macroinvertebrates were sampled in spring and fall 2005 at the 16 stream monitoring locations. Sampling methods were similar to those used in 1995 by NMED and Molycorp (Woodward-Clyde 1996) and by CEC from 1997 to 2004 (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b), and are briefly described below.

Benthic invertebrates were quantitatively sampled at each stream site by taking five replicate samples from similar riffle habitats. Sampling of riffles is adequate to assess characteristics of entire stream segments in biological monitoring programs (Rabeni *et al.* 1999). A modified Hess sampler, which encloses 0.086 m^2 and has a net mesh size of 500 μm (Canton and Chadwick 1984), was used to collect the invertebrate samples. Five replicate Hess samples were also collected in 1995 by NMED and Molycorp (Woodward-Clyde 1996). Five replicates provide a reliable estimate of both density and species composition of stream invertebrate communities (Canton and Chadwick 1988).

Collected organisms were preserved in the field with ethanol and delivered to the GEI laboratory (formerly Chadwick & Associates, Inc.) in Littleton, Colorado, for analysis. In the lab, organisms were sorted from the debris, identified to the lowest practical taxonomic level (depending upon the age and condition of each specimen), and counted (Lenat and Resh 2001). For most samples, the entire sample was sorted. However, for samples with relatively high numbers of invertebrates, subsampling was necessary. Subsampling consisted of sorting a minimum of 300 invertebrates in a fraction of the sample, with the remainder of the sample searched for large or rare invertebrates not present in the subsample (Vinson and Hawkins 1996, Carter and Resh 2001). The subsample fraction was at least 10% of the sample, with 58% of the samples sorted in their entirety. Chironomids were mounted and cleared prior to identification and counting. Chironomids were sent to Dr. Leonard Ferrington at the University of Minnesota, St. Paul, for identification.

This analysis provided species lists, estimates of density (#/m^2), and the total number of taxa present at each site. Further analysis included calculation of the Shannon-Weaver Diversity Index (H'), which the U.S. EPA recommends as a measure of the effects of stress on invertebrate communities (Klemm *et al.* 1990). This index generally has values ranging from 0 to 4, with values greater than 2.5 generally indicative of a healthy invertebrate community (Wilhm 1970). Diversity values less than 1.0 indicate a stream community under severe stress (Wilhm 1970, Klemm *et al.* 1990).

In mountain streams, such as those near the Questa Molybdenum Mine, the presence of mayfly (Ephemeroptera), stonefly (Plecoptera), and caddisfly (Trichoptera) taxa (collectively referred to as the EPT taxa) can be used as an indicator of water quality. These insect groups are considered to be sensitive to a wide range of pollutants (Plafkin *et al.* 1989, Wiederholm 1989, Klemm *et al.* 1990, Lenat and Penrose 1996, Wallace *et al.* 1996, Barbour *et al.* 1999, Lydy *et al.* 2000). Stress to aquatic systems can be evaluated by comparing the number of EPT taxa and the percent of EPT taxa (expressed as the percent of the number of EPT taxa relative to the total number of taxa) between unimpacted and potentially impacted sites. Impacted sites would be expected to have fewer EPT taxa and lower percent EPT taxa compared to unimpacted sites. These two parameters were analyzed in this study.

Clements (1991, 1994) and Clements *et al.* (1988) indicate that, when specifically looking at impacts due to metals, mayflies are particularly sensitive. Heptageniid mayflies are considered especially sensitive to metals (Kiffney and Clements 1994, Clements *et al.* 2002). This has been demonstrated in both descriptive and experimental studies (Clements *et al.* 2002). The absence of heptageniid mayflies appears to be a way to detect exposure to low concentrations of metals; therefore, the percent of the total density comprised by heptageniid mayflies was calculated.

In addition, a group of insect taxa have been identified as especially intolerant of metals in the Southern Rockies (Fore 2002). These metals intolerant taxa include the mayfly species *Drunella doddsi*, the Heptageniid mayfly genera *Cinygmula*, *Epeorus*, and *Rhithrogena*, the mayfly genus *Paraleptophlebia*, the stonefly genera *Skwala*, *Suwallia*, and *Sweltsa*, the caddisfly genus *Rhyacophila*, and the dipteran genus *Pericoma*. This metals intolerant taxa metric was calculated from the invertebrate data and is expected to decline as metal concentrations in the water increase.

To assess potential statistical differences in fish and benthic invertebrate population parameters between study sites and between population parameters and physical/chemical parameters, ANOVA with the Fisher's LSD multiple comparison test and/or correlation analysis were performed using the NCSS 2001 statistical software system (Hintze 2000) when appropriate. In this report, a level of 95% ($\alpha = 0.05$) was used to indicate significance. In order to approximate normality, the invertebrate density data were transformed ($\log_{10}$) prior to analysis (Elliott 1977). Additionally, data from the three reference sites were pooled prior to analysis. This provides comparisons that better reflect natural variation in the watershed. The summary data table in this report presents composite mean density values (untransformed). However, for the other parameters analyzed (total number of taxa, number of EPT taxa, percent EPT taxa, diversity), the summary data table presents the results of pooled numbers from the total of the five replicates.

3.4 Additional Cabresto Creek Fish Sampling

Additional fish surveys and genetic analyses were conducted in 2005 at the Cabresto Creek sites. Genetic analyses were conducted in order to determine if the cutthroat population throughout that area was a pure population, as it appeared to be based on observations in the field, or if it was introgressed with rainbow trout, in which case other options for restoring cutthroat trout populations in the area might be considered.

Fish populations were quantitatively and/or qualitatively sampled at four additional segments of Cabresto Creek on October 4-6, 2005. Quantitative sampling occurred at Sites CC-1, CC-2, and CC-3 located within Cabresto Creek Segments 2, 3, and 4, respectively **(Figure 2)**, and was conducted by the same methods as used at the long-term monitoring sites. The sites within these Cabresto Creek segments ranged in length from 271 to 320 ft. A more limited number of habitat parameters were recorded at these sites than at the monitoring sites, and included measurements of widths and lengths within the site, and observations of gradient, available fish habitat, riparian vegetation, and bank stability.

Qualitative fish sampling was also conducted throughout all or portions of Segments 1, 2, and 3. Qualitative sampling consisted of a single pass made through either a portion of the segment or the entire segment using backpack electroshocking gear. The fish collected were identified and then released, with observations of relative abundances recorded. The purpose of this qualitative sampling was to further determine the distribution of cutthroat trout, rainbow trout, brook trout, and brown trout in these sections of Cabresto Creek, and to determine habitat conditions and locations of any barriers to fish passage.

Additionally, 20 fin clips were taken from trout identified in the field as Rio Grande cutthroat trout (*Oncorhynchus clarki viriginalis*) collected from two locations in the upstream portion of Segment 2. These samples were sent to Genetic Identification Services in Chatsworth, California, for genetic analysis to determine if any evidence of introgression with rainbow trout existed in these trout. Results from the genetic analysis were then sent to a fisheries biologist with the NMDGF for further analysis using the New Mexico programs for determining purity of Rio Grande cutthroat trout. Further details on the methods used for the genetic analyses are given in Chadwick *et al.* (2005).

4.0 Results and Discussion

4.1 Fish Populations

4.1.1 Red River Monitoring

Three different trout species were collected in the Red River and its tributaries during sampling at the monitoring sites in fall 2005 **(Table 1)**. Brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) were the most widely distributed species collected **(Table 1 and Appendix A)**. Brown trout and/or rainbow trout were collected at all 16 of the stream sites. Brook trout (*Salvelinus fontinalis*) were common at the sites Upstream of Town and at Elephant Rock, and a single brook trout was also collected at the Cabresto Creek monitoring site. A resident strain of hybrid rainbow/cutthroat trout was the most abundant fish at the long-term monitoring site on Cabresto Creek, and was also collected from the Red River at the sites Upstream of Town, Elephant Rock, and Downstream of Hatchery. One white sucker was collected in the Red River at the Downstream of Highway 522 site **(Table 1)**.

Multiple size-classes of brook, brown, and hybrid trout were collected in 2005 in some areas of the Red River and its tributaries **(Appendix B, Figure B-1)**. This indicates the presence of resident, self-sustaining populations of these species in the Red River and its tributaries. Cutthroat trout (*Oncorhynchus clarki viriginalis*) have been collected infrequently in past years (CEC 2002a, b), suggesting that these fish may have migrated from nearby tributary streams. Rio Grande cutthroat trout were not collected at any Red River sampling site in 2005, and are not maintaining a viable population in this portion of the Red River or in the lower portion of Cabresto Creek or Columbine Creek.

Almost all of the rainbow trout collected at the sites on the tributaries and in the Red River were approximately eight inches in length or greater, the size that is routinely stocked by NMDGF (NMDGF unpublished stocking records) and the town of Red River. Only a few of the rainbow trout were between six and eight inches. Previous sampling by CEC has indicated that rainbow trout in the drainage are maintained by regular stocking by the NMDGF and the town of Red River (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b). As was true in 1997 through 2004, the rainbow trout collected during sampling in fall 2005 were all stocked fish. In order to minimize the effect of stocked fish on the interpretation of the data, the following discussions are based on trends for resident trout, defined as all trout which are maintained by natural reproduction in the drainage (brown, brook, hybrid, and cutthroat trout), and excludes the stocked rainbow trout.

Table 1: Fish population parameters for study sites on the Red River and tributaries, fall 2005. BRK= brook trout, BRN = brown trout, HYBRID = cutthroat/rainbow hybrid, RBT = rainbow trout, WS = white suckers.

Site	Species	# Collected	Density		Biomass lbs/acre
			#/mile	#/acre	
	Reference Sites				
Cabresto Creek	BRK	1	17	14	1.9
	BRN	21	356	304	42.3
	HYBRID	30	508	435	51.2
	RBT	12	203	174	45.8
	Total	64	1,084	927	141.2
Columbine Creek	BRN	45	793	523	89.6
	Total	45	793	523	89.6
Upstream of Town	BRK	25	325	137	12.1
	BRN	28	364	154	42.8
	HYBRID	4	52	22	5.8
	RBT	2	26	11	6.8
	Total	59	767	324	67.5
	Red River Downstream of Town				
June Bug	BRN	6	97	42	6.9
	RBT	12	194	85	26.0
	Total	18	291	127	32.9
Elephant Rock	BRK	16	266	104	2.4
	BRN	8	125	49	8.6
	HYBRID	1	16	6	0.8
	RBT	26	406	159	48.0
	Total	51	813	318	59.8
Downstream of Hansen Creek	RBT	11	138	64	28.6
	Total	11	138	64	28.6
Upstream of Mill	RBT	23	348	167	88.8
	Total	23	348	167	88.8
Upstream of Columbine	BRN	2	30	13	12.5
	RBT	7	106	45	23.6
	Total	9	136	58	36.1
Downstream of Cabin Springs	BRN	8	99	56	11.2
	RBT	5	62	35	12.5
	RBT	9	120	53	18.8
	Total	**17**	**227**	**100**	**21.7**
Questa Ranger Station	BRN	6	88	38	5.5
	RBT	4	59	26	12.3
	Total	**10**	**147**	**64**	**17.8**
Upstream of Highway 522	BRN	14	139	53	5.6
	RBT	86	851	325	103.5
	Total	**100**	**990**	**378**	**109.1**
Downstream of Highway 522	BRN	24	353	122	22.6
	RBT	25	368	127	44.9
	WS	1	15	5	0.1
	Total	**50**	**736**	**254**	**67.6**
Downstream of Outfall 002	BRN	51	598	249	61.4
	RBT	20	230	96	49.2
	Total	**71**	**828**	**345**	**110.6**
Upstream of Hatchery	BRN	24	441	167	27.4
	RBT	2	34	13	8.4
	Total	**26**	**475**	**180**	**35.8**
Downstream of Hatchery	BRN	43	676	237	66.3
	HYBRID	1	15	5	0.1
	RBT	18	309	108	63.4
	Total	**62**	**1,000**	**350**	**129.8**

Highest biomass and density of resident trout in fall 2005 occurred at the two tributary sites, Columbine and Cabresto creeks, and at the Red River site Upstream of Town **(Table 1)**. The fish population data show a pattern of decreasing resident fish biomass downstream of the town of Red River **(Table 1 and Figure 3)**. At the June Bug site, there was a decrease of 89% in the biomass of resident trout compared to the site upstream of the town of Red River **(Table 1 and Figure 3)**. This pattern indicates an impact to trout populations occurred adjacent to or immediately downstream of the town of Red River in 2005.

The low biomass of resident trout continued downstream to the Elephant Rock site, which had resident trout biomass of 11.8 lbs of fish/acre in 2005 **(Figure 3)**. At the next seven sites downstream, biomass remained low, varying from 0.0 to 12.5 lbs of resident trout/acre, less than a fourth of the biomass at the site Upstream of Town **(Figure 3)**. No resident trout were collected at the sites Downstream of Hansen Creek or Upstream of Mill, indicating a source of impact near the confluence with Hansen Creek.

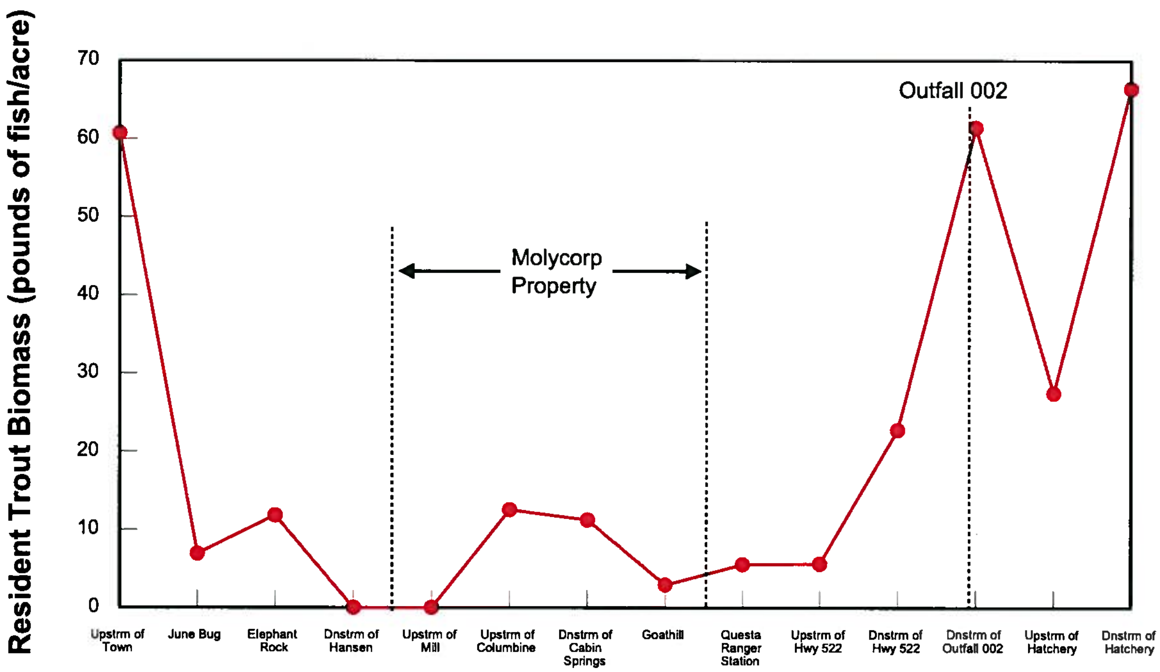


Figure 3: Trend in resident trout biomass (pounds of fish/acre), fall 2005.

Resident trout biomass then increased slightly downstream of Highway 522. Biomass was higher than upstream of the town of Red River at the sites Downstream of Outfall 002 and Downstream of Hatchery. The site Upstream of Hatchery had lower biomass than the sites bracketing it, but still had high biomass compared to almost all other sites. The substantial increase in biomass from upstream to downstream of the hatchery has been observed in previous years and has been, at least partially, attributed to nutrient enrichment from the hatchery outflow (CEC 2000, 2001, 2002, 2003, 2005a, b).

The trend in resident trout density in 2005 **(Figure 4)** was generally similar to that of trout biomass, with high numbers in the tributaries and in the Red River upstream of town and lower numbers downstream. Resident trout density at the June Bug site decreased by 87% in comparison to the Upstream of Town site. Density then increased substantially at the Elephant Rock site, indicating that some recovery of the trout population was occurring between the two sites. This increase was not reflected as much in the biomass, as many of the brook trout and brown trout collected at the Elephant Rock site were YOY trout that did not contribute appreciably to the total biomass.

No resident trout were collected at the Downstream of Hansen Creek site and the Upstream of Mill site and density remained low at the next site downstream, the Upstream of Columbine site. The site Downstream of Cabin Springs showed a moderate increase in density with 99 resident trout/mile, and density continued to increase slightly at the Goathill site **(Figure 4)**. The moderate increases in density at these two sites were likely the result of brown trout recolonization from the Columbine Creek reference site 0.4 miles upstream of the Downstream of Cabin Springs site.

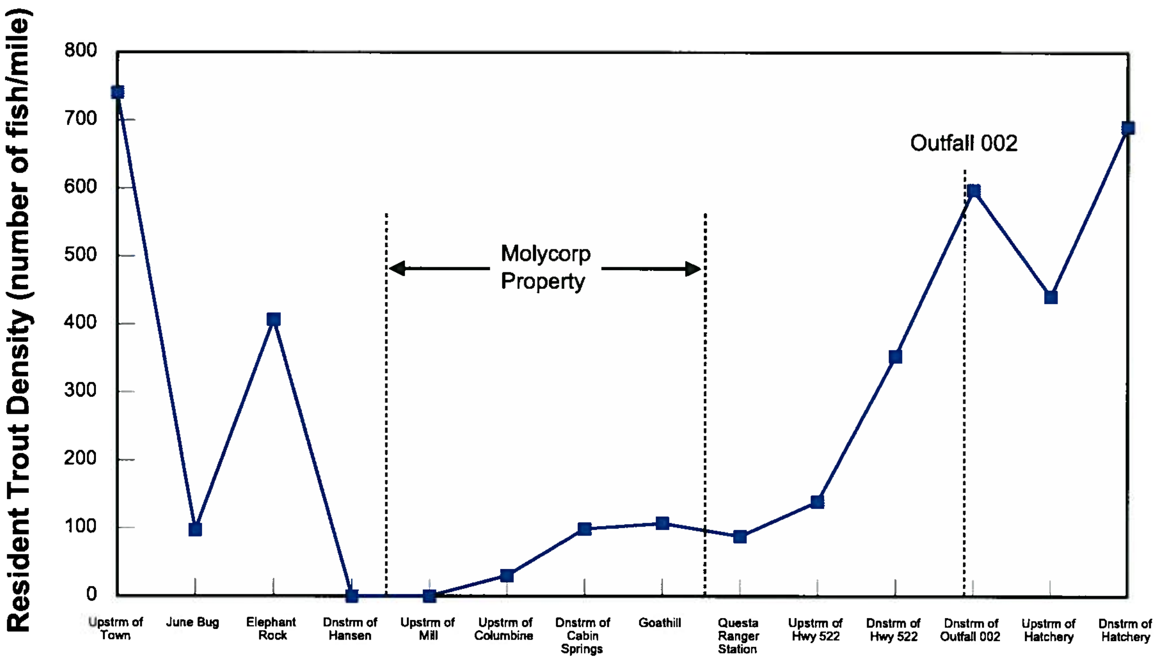


Figure 4: Trend in resident trout density (number of fish/mile), fall 2005.

Density again dropped at the Questa Ranger Station site, and remained low at the next site downstream before beginning to increase at the Downstream of Highway 522 site. Density remained relatively high at the remaining three downstream sites, with density at the site Downstream of Hatchery approaching the density observed at the site upstream of town.

There is a very distinct pattern for the resident fish population data from 2005, which indicates impacts to the populations. The three reference sites all had healthy resident trout populations with high biomass and high densities **(Table 1)**. Along the Red River, initial

impacts occur downstream of the town of Red River and upstream of the June Bug site. Biomass and density decrease substantially at this site **(Table 1, Figures 3 and 4)**. Mean biomass and density of resident trout at the eight sites from June Bug to Upstream of Highway 522 were only 6.2 lbs/acre and 107 trout/mile, respectively. Some recovery, particularly in density, was observed at the Elephant Rock site. YOY trout were rare or absent for most sites between June Bug and the site Upstream of Highway 522 **(Appendix B, Figure B-1)**.
Initial recovery of trout density begins to occur at the site Upstream of Highway 522 near Questa, and is very evident at the site Downstream of Outfall 002. Populations continue to recover at the two sites in the canyon near the fish hatchery. Biomass and density estimates at the Downstream of Outfall 002 and Downstream of Hatchery sites approached or exceeded values seen at the upstream reference sites **(Table 1, Figures 3 and 4)**, with numerous fish in a wide range of year classes **(Appendix B, Figure B-1)**.

4.2 Fish Habitat

4.2.1 Red River Monitoring

In spring 2005, an abbreviated list of habitat parameters was evaluated, excluding the depth and habitat quality parameters **(Table 2)**. In fall 2005, the complete list of habitat parameters was evaluated. Habitat complexity (in terms of the total number of habitat units) was generally greater at the reference sites than at the other sites on the Red River in spring and fall. The reference sites had 10 to 12 habitat units in spring and eight to 13 units in fall, whereas most of the sites on the Red River downstream of the town of Red River had eight habitat units or less in both spring and fall. Most of the sites had lengths of between 306 and 395 ft; however, some of the longer sites had relatively few habitat units, such as the Downstream of Hansen Creek site (421 ft long) with only four to five units, and the upstream of Highway 522 site (531 ft long) with five to seven units in spring and fall respectively **(Table 2)**.

Depth parameters varied little from the site upstream of the town of Red River to the site Downstream of Outfall 002. The depth parameters at the two sites near the hatchery were greater than most of the other sites **(Table 2)**. Accumulation of sediment tended to result in low residual pool depths at several sites, which is indicative of limited refuge areas for fish during low flow and winter conditions.

Mean habitat quality ratings were highest at the reference site Upstream of Town, at the Goathill site, and at the three most downstream sites on the river **(Table 2)**. Three of the 14 sites on the mainstem Red River had mean habitat quality ratings below 2.5. This included the three sites downstream of Hansen Creek. These low ratings were due, in part, to the covering of habitat features by sediment in this reach of the Red River in fall 2005. Columbine and Cabresto creeks, the two tributary sites, had relatively low ratings due to small stream size and shallow depths.

Table 2: General habitat characteristics of study sites on the Red River and tributaries, spring and fall 2005. Depth measurements and Habitat Quality Rating determined only in fall.

Site	# of Habitat Units		Mean Depth (ft)	Mean Max Depth (ft)	Residual Pool Depth (ft)	Mean Habitat Quality Rating
	Spring	Fall				
			Reference Sites			
Cabresto Creek	12	13	0.6	1.0	0.3	2.5
Columbine Creek	12	8	0.5	1.1	0.6	2.4
Upstream of Town	10	9	1.0	1.7	0.9	3.4
			Red River Downstream of Town			
June Bug	8	8	1.2	1.7	0.8	2.5
Elephant Rock	9	8	1.0	1.4	1.4	2.6
Downstream of Hansen Creek	5	4	1.1	1.6	0.6	2.0
Upstream of Mill	8	7	1.0	1.8	0.9	2.1
Upstream of Columbine	7	6	1.1	1.9	0.6	2.3
Downstream of Cabin Springs	12	11	1.1	1.9	0.7	3.2
Goathill	9	8	1.4	2.0	0.5	3.6
Questa Ranger Station	9	7	1.1	2.0	1.2	2.7
Upstream of Highway 522	5	7	0.9	1.8	1.0	3.0
Downstream of Highway 522	4	5	1.1	2.1	1.1	2.8
Downstream of Outfall 002	8	9	1.1	1.8	0.9	3.4
Upstream of Hatchery	8	7	1.3	2.5	1.4	3.9
Downstream of Hatchery	9	10	1.5	2.3	1.1	3.5

The dominant habitat type, in terms of total area, was riffle habitat at nearly all sites, followed by run habitat **(Figure 5)**. Pool habitat was less than 20% of the total area at most sites; and at five sites, there were no pools. However, the Elephant Rock and Downstream of Hatchery sites both had over 20% of the total area as pool habitat **(Figure 5)**.

Measurement of the percentage of substrate composed of fines (< 4 mm) showed consistent patterns for both methods used. Visual estimates were made over the entirety of all habitat units and usually result in higher values, while grid measurements represent the percent fines in higher velocity areas. For spring, both area and grid estimates showed substantial increases in percent fines relative to the reference site beginning and peaking at the Downstream of Hansen Creek site **(Figure 6)**. In fall, both the visual estimate and the grid measurements showed large increases in the percent fines relative to the reference sites beginning at the Elephant Rock site and continuing to the site Downstream of Hansen Creek **(Figure 6)**.

In both spring and fall, the percent fines by area was the highest of the site Downstream of Hansen Creek and percent fines by grid was the highest at this site in fall **(Figure 6)**. The area around Hansen Creek was a major source of sediment in 2005. Downstream of this site, the percentage of fine sediment generally declines in both spring and fall, especially with the grid measurements. In spring and fall, the percent fines measured by the grid method were almost always less than the visual estimation, as expected in the higher velocity areas.

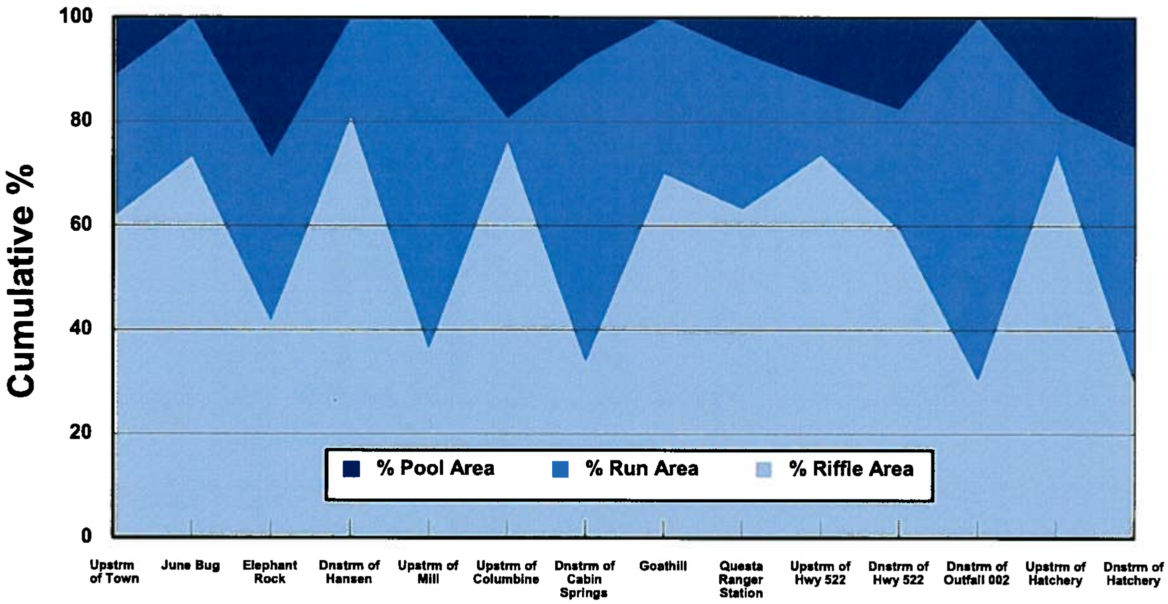


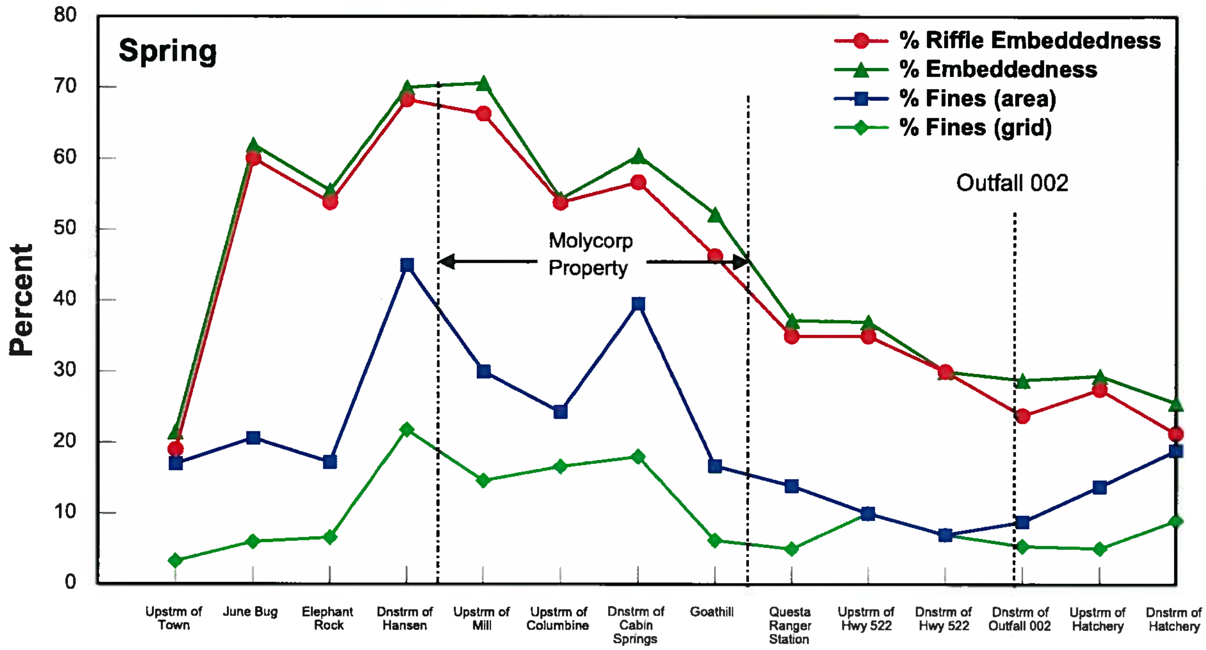
Figure 5: Percentage of habitat types for the Red River, fall 2005.

Percent embeddedness of the substrate showed a similar pattern to percent fines. Embeddedness increased substantially at the June Bug site in the spring and at the Downstream of Hansen Creek site in both spring and fall **(Figure 6)**. The Upstream of Mill site was the peak for embeddedness values in spring, while fall data peaked at the site Downstream of Hansen Creek **(Figure 6)**.

The percent embeddedness of the substrate in riffle habitat showed very similar patterns to overall embeddedness, although it tended to be lower in riffles **(Figure 6)**. Embeddedness in riffles was evaluated separately, since sedimentation in riffle areas is a better indicator of the effects of sediment on macroinvertebrate populations and trout reproduction.

Fish habitat in the Red River continued to be affected by the accumulation of sediment in the channel, but not to the extent observed previously (CEC 2003, 2005a). Spring runoff flows in the Red River were above average in 2005 (data from USGS gage #08265000 near Questa), and were substantially higher than those recorded in 2002 when spring flows were the lowest for the 1965 through 2005 period of record.

Increased flows apparently resulted in more flushing of sediment than was observed in 2002. In general, this flushing by high spring runoff reduced sediment levels at most sites between spring and fall 2005 **(Figure 6)**. However, it appears that this reduction was more pronounced in the upper half of the study area. From the Goathill Campground site downstream, many of the sediment parameters were as high or higher in fall 2005 after runoff. This may represent a plume of sediment that has been moving downstream from the upper sites during runoff and over the summer of 2005.



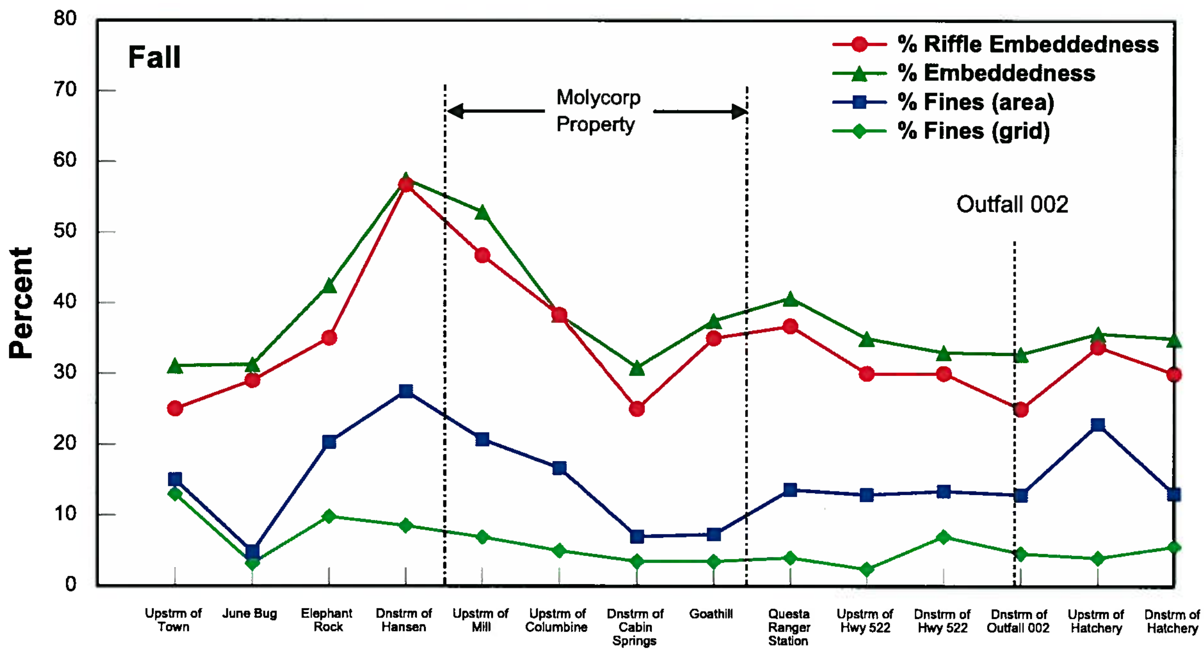


Figure 6: Comparison of percent riffle embeddedness, percent embeddedness, percent fines by area, and percent fines by grid for study sites on the Red River, spring 2005 **(top)** and fall 2005 **(bottom)**.

4.3 Benthic Invertebrate Populations

Columbine and Cabresto creeks represent tributary streams in the Red River drainage with minimal impacts due to human activities and hydrothermal scars. The site upstream of the town of Red River also is relatively unimpacted, at least with respect to the hydrothermal scars. Testing of this assumption indicated that benthic invertebrate populations at the upstream site on the Red River are comparable to the two unimpacted tributaries. Therefore, benthic invertebrate population parameters for these three sites are used as comparisons to evaluate the relative levels of impact in the Red River. These three sites combined provide suitable information on the range of reference conditions in order to evaluate impacts at the other Red River sites (CEC 2001). All three of these reference sites are also unaffected by the Molycorp mine.

4.3.1 Spring 2005

Most benthic invertebrate parameters had higher values at the reference sites than the sites in the Red River downstream of the town of Red River in spring 2005 **(Table 3 and Appendix C)**. The reference site Upstream of Town had an extremely high density and decreased diversity value in comparison to previous years for this site and to all other sites in spring 2005 **(Table 3)**. The low diversity value was likely due to the predominance of one midge taxa, *Orthocladius/Cricotopus* sp., which comprised 54% of the total density **(Appendix C)**. The low diversity and the dominance by a single taxon of midge indicate that even this reference site is exhibiting signs of impact in spring 2005. Despite being unusually low for this site, the diversity value was well above the 1.00 threshold that indicates a stream community under severe stress and approaching the 2.50 threshold that indicates a healthy invertebrate community (Wilhm 1970, Klemm *et al.* 1990).

The three monitoring sites upstream of the Molycorp property boundary and downstream of the town of Red River (June Bug, Elephant Rock, and Downstream of Hansen Creek sites) were all significantly lower ($p < 0.05$) than the three reference sites (combined) for number of taxa, number of EPT taxa, and number of metals intolerant taxa **(Table 4)**. Most of these sites had significantly lower values than the reference sites for the remaining parameters of density, percent EPT taxa, percent density mayflies, and percent density heptageniids as well. Exceptions occurred at June Bug and Elephant Rock. June Bug showed no significant differences for percent EPT taxa and percent density heptageniids, and had significantly higher percent density mayflies in comparison to reference site values. Density at Elephant Rock was not significantly different from reference site densities.

Table 3: Benthic invertebrate population parameters for study sites on the Red River and tributaries, spring 2005.

Site	Density (#/m^2)	Total # of Taxa	# EPT Taxa	% EPT Taxa	% Density Mayflies	% Density Heptageniids	# Metals Intolerant Taxa	Diversity Index (H')
	Reference Sites							
Cabresto Creek	9,527	57	23	40	20	4	9	4.87
Columbine Creek	10,546	58	30	52	57	24	11	4.03
Upstream of Town	70,664	41	17	41	2	<1	7	2.34
	Red River Downstream of Town							
June Bug	1,138	38	13	34	51	6	4	3.70
Elephant Rock	22,872	31	7	23	2	<1	3	2.54
Downstream of Hansen Creek	1,953	26	10	38	8	0	3	3.26
Upstream of Mill	1,948	36	9	25	21	<1	3	3.60
Upstream of Columbine	1,714	29	9	31	38	<1	4	3.33
Downstream of Cabin Springs	2,711	51	17	33	50	4	5	3.70
Goathill	4,417	46	16	35	6	3	4	2.46
Questa Ranger Station	328	22	7	32	6	2	2	2.39
Upstream of Highway 522	1,454	37	12	32	44	11	2	3.94
Downstream of Highway 522	3,269	38	11	29	29	4	3	3.06
Downstream of Outfall 022	9,658	45	12	27	11	<1	3	3.15
Upstream of Hatchery	12,209	34	14	41	4	<1	4	3.37
Downstream of Hatchery	12,406	41	13	32	4	0	2	3.79

At the four sites adjacent to the Molycorp property (Upstream of Mill, Upstream of Columbine, Downstream of Cabin Springs, and Goathill sites) in spring 2005, density, number of EPT taxa, percent EPT taxa, and number of metals intolerant taxa were all significantly lower ($p < 0.05$) than values at the reference sites (**Table 4 and Figure 7**). All sites, except the site Downstream of Cabin Springs, also had a significantly lower number of total taxa; and all sites, except the Goathill and Downstream of Cabin Springs sites, had a significantly lower percent density of heptageniids than the reference sites. Values for percent density of mayflies were either higher or not significantly different than the reference sites at three of these four sites, as all sites except the Goathill site had fairly high relative abundances of mayflies (21% - 50%). Mayflies are considered to be particularly sensitive to metal impacts (Clements *et al.* 1988, Clements 1991, 1994). Values for percent density mayflies and percent density heptageniid mayflies are also comparable to values for those parameters upstream of the Molycorp property boundary and downstream of the town of Red River **(Table 3)**.

The first site downstream of the Molycorp property, Questa Ranger Station, had reduced population parameters compared to the reference sites and most other study sites **(Tables 3 and 4, Figure7, and Appendix C)**. All population parameters at this site were significantly lower than the reference sites, and values for density and total number of taxa were the lowest values observed in the Red River in spring 2005.

Table 4: Statistical significance of benthic invertebrate parameters in relation to combined reference site data for study sites on the Red River, spring 2005. "+" is significantly greater than reference values, "-" is significantly less than reference values, and "n/s" is not significantly different than reference values. Data based on Fisher's LSD multiple comparison test.

Site	Density (#/m²)	Total # of Taxa	# EPT Taxa	% EPT Taxa	% Density Mayflies	% Density Heptageniids	# Metals Intolerant Taxa
	Red River Downstream of Town						
June Bug	-	-	-	n/s	+	n/s	-
Elephant Rock	n/s	-	-	-	-	-	-
Downstream of Hansen Creek	-	-	-	-	-	-	-
Upstream of Mill	-	-	-	-	n/s	-	-
Upstream of Columbine	-	-	-	-	n/s	-	-
Downstream of Cabin Springs	-	n/s	-	-	+	n/s	-
Goathill	-	-	-	-	-	n/s	-
Questa Ranger Station	-	-	-	-	-	-	-
Upstream of Highway 522	-	-	-	-	+	n/s	-
Downstream of Highway 522	-	-	-	-	n/s	n/s	-
Downstream of Outfall 002	n/s	-	-	-	-	-	-
Upstream of Hatchery	n/s	-	-	n/s	-	-	-
Downstream of Hatchery	n/s	-	-	-	-	-	-

The remaining five sites furthest downstream on the Red River (Upstream of Highway 522, Downstream of Highway 522, Downstream of Outfall 002, Upstream of Hatchery, and Downstream of Hatchery sites) demonstrated some recovery in most macroinvertebrate parameters in spring 2005 **(Tables 3 and 4, Figure 7, Appendix C)**. All of these sites had values higher than values at the Questa Ranger station in terms of density, number of taxa, number of EPT taxa, and diversity **(Table 3)**. This recovery may be due in part to ground water inputs and diluting flows from Cabresto Creek during the times of the year when this stream is not diverted for irrigation. Values for total number of taxa, total number of EPT taxa, and number of metals intolerant taxa at these sites were still significantly lower ($p < 0.05$) than values at the reference sites **(Table 4)**, but the three most downstream sites had density values comparable to reference site values. Additionally, the two sites bracketing Highway 522 had values for percent density mayflies and percent density heptageniids that were either greater than or not significantly different than values at the reference sites, and the site Upstream of Hatchery had a percentage of EPT taxa not significantly different from that at the reference sites **(Table 4)**.

The overall longitudinal trend in number of EPT taxa, percent EPT taxa, and number of metals intolerant taxa along the Red River in Spring 2005 show a declining pattern for these parameters, with the highest values generally upstream of the town of Red River and decreasing downstream of the town and remaining low until recovery begins downstream of Cabresto Creek **(Table 3)**. Almost all values were significantly lower than values at the reference sites for these three parameters **(Table 4)**. Most sites also had significantly lower density values than the reference sites, with the exception of the three most downstream sites and the Elephant Rock site.

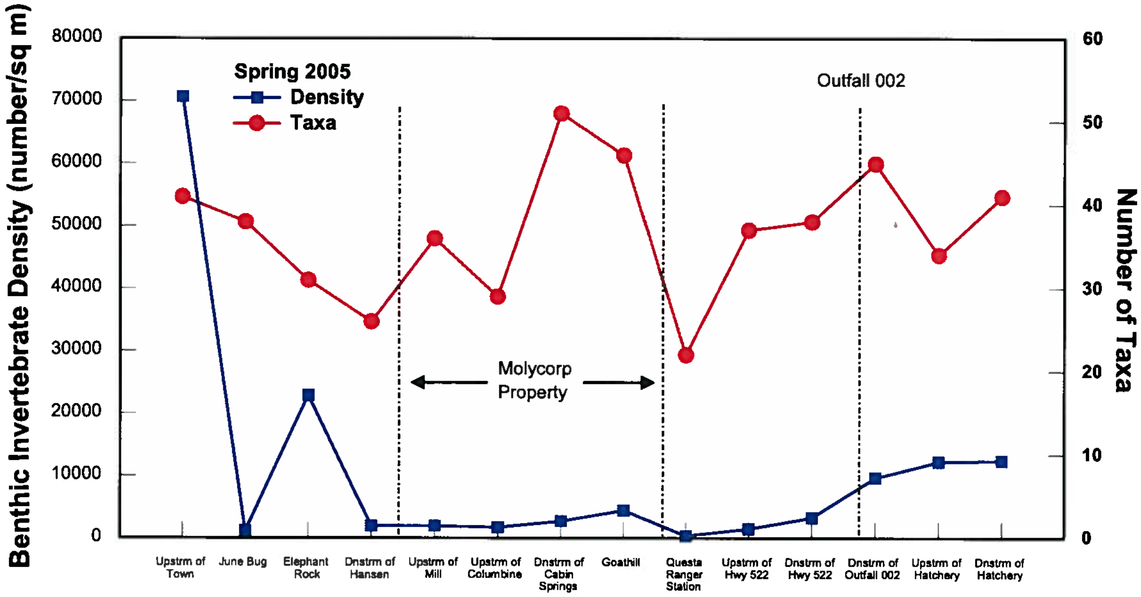


Figure 7: Trends in benthic invertebrate density (#/m^2) and total number of taxa, spring 2005.

The parameters of percent density mayflies and percent density heptageniids showed less clear patterns. Values for percent density mayflies were highly variable between sites, ranging from 2% at the Upstream of Town and Elephant Rock sites to 57% at the Columbine Creek site. Three sites, June Bug, Downstream of Cabin Springs, and Upstream of Highway 522, had significantly higher ($p < 0.05$) percent density mayfly values than the reference sites, with several other sites having no significant differences for this parameter. Percent density heptageniids was less variable between sites, but five of the sites had values that were not significantly different from those of the reference sites. Two sites, Downstream of Hansen Creek and Downstream of Hatchery, did not have any heptageniid mayflies collected. Both percent density of mayflies and percent density of heptageniids had unusually low values at the reference site Upstream of Town in Spring 2005, which contributed to the lack of clear patterns for these parameters. Although impacts are evident, the river was suitable to support benthic invertebrates at all sites sampled in spring 2005, including some sensitive EPT and metals intolerant species. Additionally, impacts were not as clearly defined or not evident at all for either of the mayfly relative abundance parameters, two parameters that are sensitive to metals. This indicates that impacts are probably more related to physical stresses, such as sedimentation.

The benthic invertebrate data trends in spring 2005 indicate three general areas of impact on the Red River. The first general area exhibiting impacts occurs immediately downstream of the town of Red River and upstream of the June Bug site, where declines in benthic invertebrate population parameters have consistently been documented in the past (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a). In spring 2005, this site exhibited a significant reduction ($p < 0.05$) in density, total number of taxa, number of EPT taxa, and number of metals intolerant taxa, trends that were evident through the entire river **(Table 4)**. The second area of impact in spring 2005 occurs downstream of Hansen Creek, where density and total number of taxa were again reduced **(Table 3)**. The third area of impact appears downstream of Capulin Canyon and the upwelling of groundwater near Spring 13, at the Questa Ranger Station site, where density, number of taxa, number of EPT taxa, and diversity were at or near the lowest values observed in spring 2005 **(Table 3)**.

4.3.2 Fall 2005

As was the case in spring 2005, many benthic invertebrate parameters had higher values at the reference sites than the other sites in fall 2005 **(Table 5 and Appendix D)**. At the three sites immediately downstream of the town of Red River (June Bug, Elephant Rock, and Downstream of Hansen Creek sites), all values for total number of taxa, number of EPT taxa, percent EPT taxa, and number of metals intolerant taxa were significantly lower ($p < 0.05$) than values at the reference sites **(Table 6)**. Trends among the remaining parameters were not easily identified. While the sites June Bug and Downstream of Hansen Creek had significantly lower densities than the reference sites, the Elephant Rock site had significantly higher density ($p < 0.05$) than the reference sites and had the highest density of all sites in fall. The relatively high density seen at this site was largely due to the presence of two midge taxa, *Cricotopus (Euorthocladius)* sp. and *Cricotopus/Orthocladius* sp., which together made up 35% of the total density. Percent density mayflies and percent density heptageniids at the June Bug site were not significantly different from values at the reference sites, and the Elephant Rock site had significantly lower percentages for those two parameters. The Downstream of Hansen Creek site had a significantly higher percent density mayflies, but showed no significant difference in percent density heptageniids in comparison to the reference sites.

At the four sites adjacent to the Molycorp property (Upstream of Mill, Upstream of Columbine, Downstream of Cabin Springs, and Goathill sites), total number of taxa, number of EPT taxa, and number of metal intolerant taxa were all significantly lower ($p < 0.05$) than the reference sites for fall 2005 **(Table 6 and Figure 8)**. Density was significantly lower at two of the four sites, Downstream of Cabin Springs and Goathill, but was not significantly different at the other two sites. Percent EPT taxa was significantly lower at all of these sites, except the Goathill site. The two mayfly parameters showed a different trend, as all of these sites had significantly higher ($p < 0.05$) percent density mayflies than the reference sites, and showed no significant differences in percent density heptageniids. All sites along the mine property had a high percentage of mayflies, ranging from 58% to 75% of the total density. Mayflies are considered to be particularly sensitive to metal impacts (Clements *et al.* 1988, Clements 1991, 1992).

Values for several parameters were low at the Questa Ranger station, with density and total number of taxa reaching their lowest values at this site in fall 2005 **(Table 5)**. The Questa Ranger station had significantly reduced density, total number of taxa, number of EPT taxa, and number of metal intolerant taxa ($p<0.05$) in comparison to reference site values **(Table 6 and Figure 8).** In contrast, values for percent EPT taxa and percent density mayflies at this site were significantly higher than at the reference sites, and percent density heptageniids showed no significant difference. This site had the highest percent EPT taxa value of all the sites, mainly due to the predominance of mayflies collected.

Table 5: Benthic invertebrate population parameters for study sites on the Red River and tributaries, fall 2005.

Site	Density ($\#/m^2$)	Total # of Taxa	# EPT Taxa	% EPT Taxa	% Density Mayflies	% Density Heptageniids	# Metals Intolerant Taxa	Diversity Index (H')
	Reference Sites							
Cabresto Creek	8,206	50	25	50	45	2	9	3.58
Columbine Creek	4,091	49	24	49	29	4	9	4.37
Upstream of Town	5,122	52	19	37	4	<1	6	4.53
	Red River Downstream of Town							
June Bug	3,409	44	19	43	24	<1	4	3.57
Elephant Rock	10,137	34	8	24	14	0	2	3.77
Downstream of Hansen Creek	2,279	27	9	33	67	<1	4	1.96
Upstream of Mill	4,943	32	10	31	62	<1	5	2.79
Upstream of Columbine	7,101	30	13	43	75	<1	5	2.16
Downstream of Cabin Springs	2,182	30	9	30	69	1	4	1.97
Goathill	2,024	28	12	43	58	3	5	2.67
Questa Ranger Station	985	21	12	57	52	3	3	2.61
Upstream of Highway 522	1,870	30	13	43	67	4	5	2.83
Downstream of Highway 522	3,148	35	17	49	64	5	4	2.65
Downstream of Outfall 002	3,933	40	15	38	56	4	3	3.06
Upstream of Hatchery	2,324	37	13	35	42	1	3	3.48
Downstream of Hatchery	5,654	37	10	27	35	1	2	3.26

The five sites furthest downstream on the Red River, from the site Upstream of Highway 522 to the site Downstream of Hatchery, had significantly lower values ($p < 0.05$) than the reference sites for total number of taxa, number of EPT taxa, and number of metal intolerant taxa in fall 2005. Two of these sites, Downstream of Outfall 002 and Downstream of Hatchery, had density values that were not significantly different from the reference sites, and percent density mayflies and percent density heptageniid values for all sites were either not significantly different or significantly higher than reference site values. The sites Upstream of Highway 522 and Downstream of Highway 522 also had percent EPT taxa values that were not significantly different from the reference sites, with all other sites having significantly lower percent EPT values.

The trends for fall 2005 indicate three general areas of impact in the Red River, as was observed for the spring data. Substantial reductions in population parameters initially occur downstream of the town of Red River, especially in taxa richness parameters. This is particularly evident since values at all sites for number of taxa, number of EPT taxa, and number of metals intolerant taxa were significantly lower than reference site values **(Table 6).** Reductions in populations also occur downstream of Hansen Creek and downstream of Capulin Canyon and the upwelling groundwater near Spring 13 **(Table 5).**

Table 6: Statistical significance of benthic invertebrate parameters in relation to combined reference site data for study sites on the Red River, fall 2005. "+" is significantly greater than reference values, "-" is significantly less than reference values, and "n/s" is not significantly different than reference values. Data based on Fisher's LSD multiple comparison test.

Site	Density (#/m^2)	Total # of Taxa	# EPT Taxa	% EPT Taxa	%Density Mayflies	% Density Heptageniids	# Metals Intolerant Taxa
	Red River Downstream of Town						
June Bug	-	-	-	-	n/s	n/s	-
Elephant Rock	+	-	-	-	-	-	-
Downstream of Hansen Creek	-	-	-	-	+	n/s	-
Upstream of Mill	n/s	-	-	-	+	n/s	-
Upstream of Columbine	n/s	-	-	-	+	n/s	-
Downstream of Cabin Springs	-	-	-	-	+	n/s	-
Goathill	-	-	-	n/s	+	n/s	-
Questa Ranger Station	-	-	-	+	+	n/s	-
Upstream of Highway 522	-	-	-	n/s	+	+	-
Downstream of Highway 522	-	-	-	n/s	+	+	-
Downstream of Outfall 002	n/s	-	-	-	+	n/s	-
Upstream of Hatchery	-	-	-	-	+	n/s	-
Downstream of Hatchery	n/s	-	-	-	n/s	n/s	-

Recovery of invertebrate populations begins to occur at the sites near the town of Questa, with increasing density, number of taxa, and number of EPT taxa **(Table 5 and Figure 8)**. However, the percentage of taxa as EPT taxa, mayflies, and heptageniid mayflies showed wide ranges of values, both at the reference and monitoring sites. This resulted in many of these values being not significantly different between individual sites and the combined reference sites for these parameters, or indicating that monitoring sites had significantly higher values than reference sites in many cases **(Table 6)**. As in the spring 2005 data, the fall data show that taxa richness parameters (number of taxa, number of EPT taxa, and number of metals intolerant taxa) suggest impacts, while densities and relative abundance parameters do not consistently show the same trends. This suggests physical stresses are more important in some areas of the Red River.

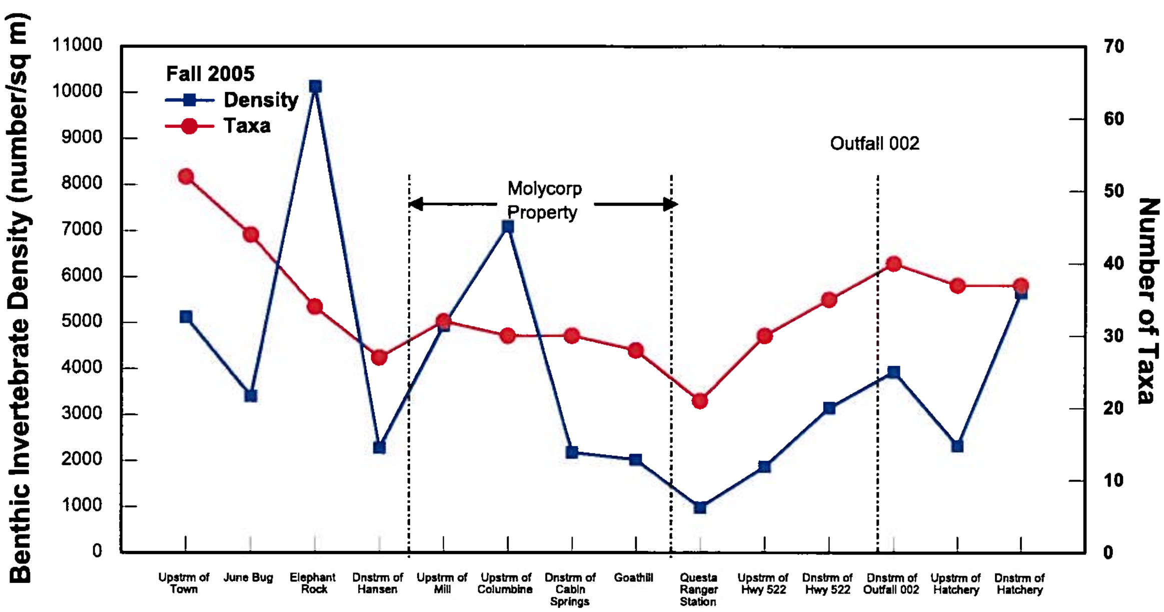


Figure 8: Trends in benthic invertebrate density (#/m^2) and total number of taxa, fall 2005.

4.4 Additional Cabresto Creek Study

Brook trout, brown trout, cutthroat trout, rainbow trout, and hybrid rainbow/cutthroat trout were collected from the four additional segments of upper Cabresto Creek surveyed in 2005 **(Figure 2, Table 7, Appendix E)**. Cutthroat trout were collected from all four segments, and brook trout were collected at all but the segment furthest upstream. Brown trout, hybrid trout, and rainbow trout were only collected at the most downstream segment.

Segment 1 of the additional Cabresto Creek sites was only sampled qualitatively as it was located mostly on private land. Observations made at this segment describe it as located predominately within a high alpine meadow, and having very small stream size and low gradient. Qualitative sampling was conducted in the downstream portion of this segment, and indicated that this segment contains only cutthroat trout **(Table 7)** at what appeared to be low densities.

Segment 2 was sampled qualitatively and quantitatively. This reach of the stream was characterized by a small, narrow canyon at the upstream end, and a wide meadow further downstream. Deeper water habitat was generally confined to pools on the outside of stream meanders and areas of undercutting in run habitat. Rocks and woody debris were uncommon, and the riparian area was dominated by grass. Banks were fairly stable except where evidence of cattle grazing was evident. Qualitative sampling was conducted through the entire length of this segment and indicated that cutthroat trout were the dominant species. Brook trout were also present in the downstream ½ mile of this segment but were rare. A site within this segment, Site CC-1 **(Figure 2)**, was surveyed quantitatively as well. Only cutthroat trout were collected from this site at fairly low densities and biomass **(Table 7)**, likely due to the smaller stream size and less available cover than found in the segments further downstream. As no significant barriers to fish movement were present in this segment, brook trout distribution is likely being limited by elevation, available habitat, competition with cutthroat trout, or some combination of these three factors.

Table 7: Fish population parameters for study segments on Cabresto Creek, fall 2005. BRK = brook trout, BRN = brown trout, CUT = Rio Grande cutthroat trout, HYBRID = cutthroat/rainbow hybrid, RBT = rainbow trout. X = present in qualitative sample only.

Segment/Site	Species	# Collected	Density		Biomass lbs/acre
			#/mile	#/acre	
Segment 1	CUT	X	--	--	--
Segment 2, Site CC-1	BRK	X	--	--	--
	CUT	33	586	810	66.3
	Total	**33**	**586**	**810**	**66.3**
Segment 3, Site CC-2	BRK	62	1,216	1,192	67.0
	CUT	54	1,059	1,038	62.7
	Total	**116**	**2,275**	**2,230**	**129.7**
Segment 4, Site CC-3	BRK	23	377	319	26.7
	BRN	33	541	458	54.1
	CUT	2	33	28	6.5
	HYBRID	3	49	42	4.9
	RBT	2	33	28	4.9
	Total	**63**	**1,033**	**875**	**97.1**

Segment 3 was sampled qualitatively and quantitatively as well. Throughout this segment, Cabresto Creek was more confined in a canyon section. Pool habitat was dominated by scour pools formed by boulders, but pools formed by woody debris and bank undercutting were also common. The riparian area was dominated by willow growth, and banks were generally stable. Some bank erosion was present at the downstream end of the segment. Qualitative sampling occurred in the top one mile of this segment. Brook trout populations were abundant within the canyon but became much less abundant near the top of the segment. The quantitative sampling conducted at Site CC-2 within Segment 3 resulted in the collection of brook trout and cutthroat trout. The two trout species collected were similar in terms of density and biomass, with brook trout being slightly higher for both parameters. Densities (#/acre) were nearly three times as high as those seen at Site CC-1 in Segment 2, and biomass was nearly twice as high **(Table 7)**. There were no significant barriers to fish movement present in this reach.

Segment 4 was sampled quantitatively at Site CC-3. Habitat at this site was similar to that seen at the long-term Cabresto Creek monitoring site located further downstream. Pool habitat consisted of scour pools, and little large woody debris existed in this segment. Some bank erosion was present. Brook trout, brown trout, cutthroat trout, rainbow trout, and cutthroat/ rainbow hybrids were collected at this site. Brown trout dominated the site in terms of both density and biomass, and brook trout were also common **(Table 7)**. No qualitative sampling was conducted, as it was obvious that the trout community was comprised of multiple species in this segment.

Fin clips were taken from 20 cutthroat trout in the upstream portion of Segment 2. Genetic analyses of these fin clips examined 480 alleles and found no alleles specific only to rainbow trout (Chadwick 2005). Based on this, the cutthroat trout from Segment 2 of Cabresto Creek are not introgressed with rainbow trout. Further analysis concluded that the population at this site is to be considered a "pure" population of Rio Grande cutthroat trout. Results of an earlier analysis conducted in 2002 on cutthroat trout collected in Segment 4 upstream of the Lake Fork confluence and downstream of Segment 3 showed that the trout were 83% pure, indicating that a mixed population of pure and introgressed Rio Grande cutthroat trout inhabit this section of Cabresto Creek (Chadwick 2005). Fin clips were not collected from any of the other segments in 2005, but field observations indicated that the cutthroats collected in Segment 3 appeared to be pure. As no barriers to fish passage were observed in these segments of Cabresto Creek, further genetic analyses are needed to determine how far upstream the introgressed cutthroat populations are present.

5.0 Recent Trends in Aquatic Biota

5.1 Fish

Fish population sampling data from fall 1997 through fall 2005 collected by GEI/CEC and data collected in August 1997, August 1999, August 2001, September 2002, August 2003, October 2004, and October 2005 by NMDGF (1997, 1999, 2001, 2002, 2003, 2004, 2005) were compared to evaluate recent year-to-year variability in fish populations. The sites Upstream of Town, Downstream of Hansen Creek, Questa Ranger Station, and Upstream of the Hatchery were sampled by NMDGF from 1997 through 2005 in odd years, and the site Downstream of Hatchery was sampled by NMDGF in 2002 and 2004. Data from fall 2002 through fall 2005 at the recently established sites were not included in this evaluation of trends as these sites have been sampled for only four years. Fish population data from spring 1997 are also not included in this analysis as the spring data are not directly comparable to data collected in fall. The presence of YOY fish tends to produce a seasonal trend of fewer fish being collected in spring compared to fall in any given year, which could complicate annual comparisons using both spring and fall data.

5.5.1 Overall Trends

In past years, the patterns in both resident trout density and biomass suggest that there may be at least three sections of the Red River that exhibit negative impacts to aquatic biota. The data from 1997 through 2005 collected by GEI/CEC **(Figures 9 and 10)**, clearly indicate that the natural hydrothermal scars, especially those drained by Hansen Creek, continue to result in a substantial negative impacts to the aquatic biota of the Red River (CEC 2001). The data from 1997 through 2005 collected by NMDGF also show higher density and biomass upstream of the scars and in the most downstream reach **(Figures 11 and 12)**.

Our earlier reports evaluating data from 1997 through 2000 (CEC 2001) suggested that there were initial impacts near the town of Red River and/or from Bitter Creek and Hot-n-Tot Creek that resulted in the reductions in trout populations evident at the June Bug site **(Figures 9 and 10)**. There was a subsequent increase in density and biomass at the Elephant Rock site. The second area of impact was near Hansen Creek. The site Downstream of Hansen Creek consistently contained low density and biomass of resident trout. There was some recovery at the next two sites, Upstream of Columbine Creek and Goathill **(Figures 9 and 10)**.

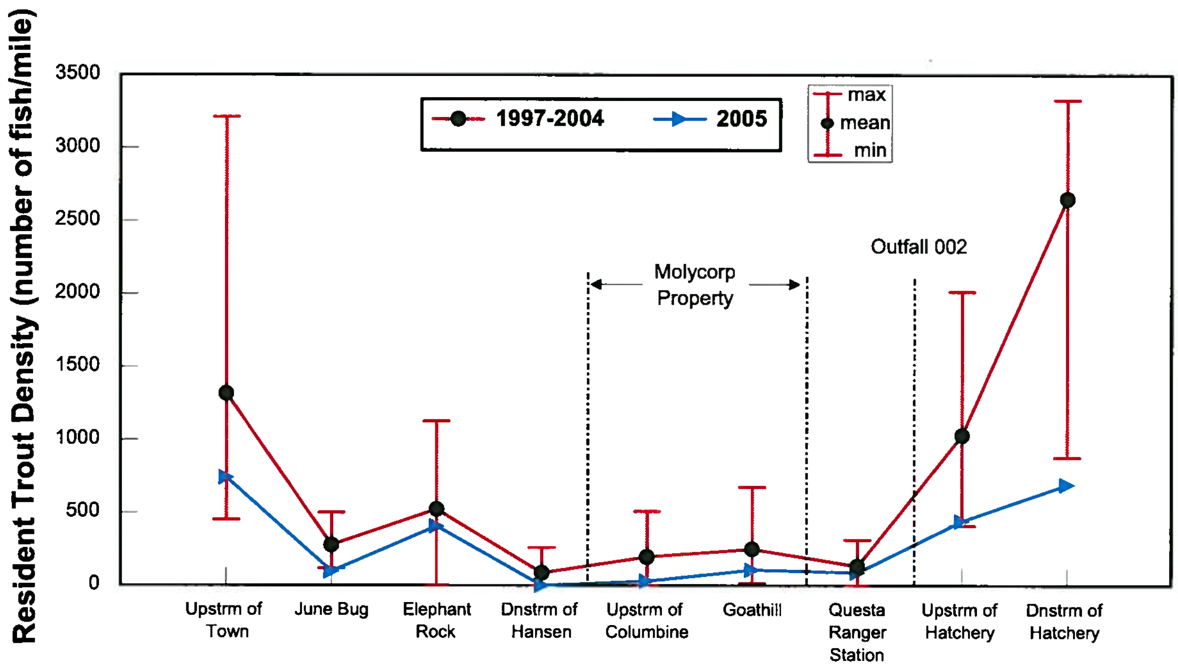


Figure 9: Comparison of resident trout density (#/ mile). Data collected in fall 1997 through 2005 by GEI/CEC.

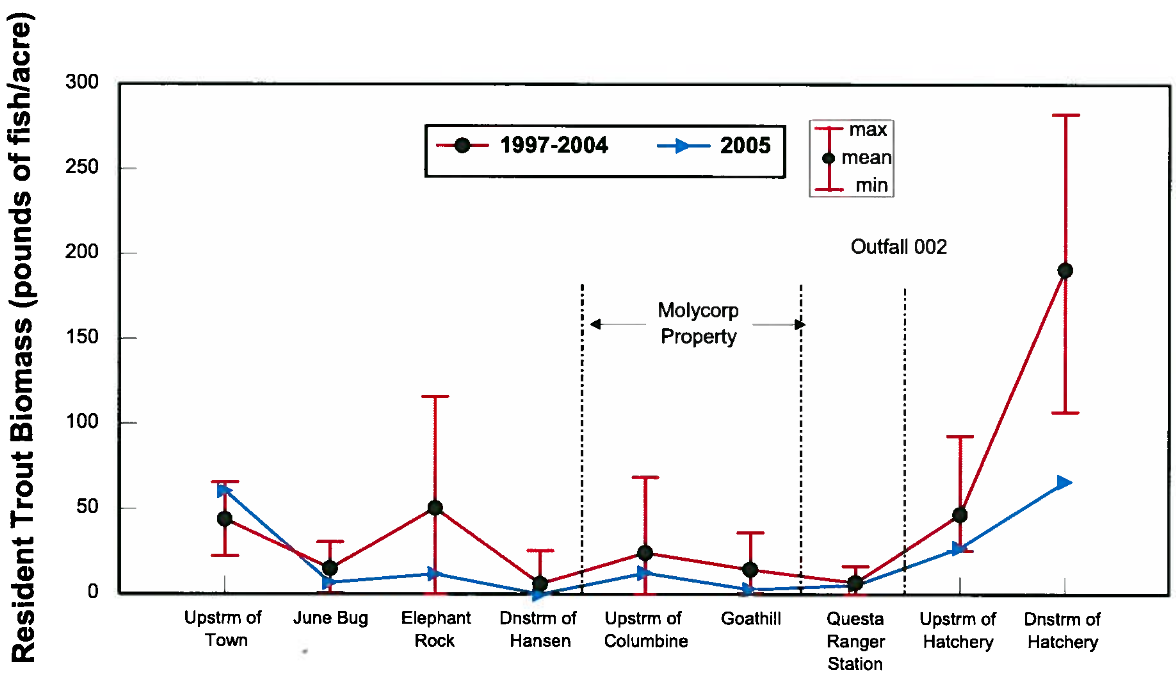


Figure 10: Comparison of resident trout biomass (lbs/acre). Data collected in fall 1997 through 2005 by GEI/CEC.

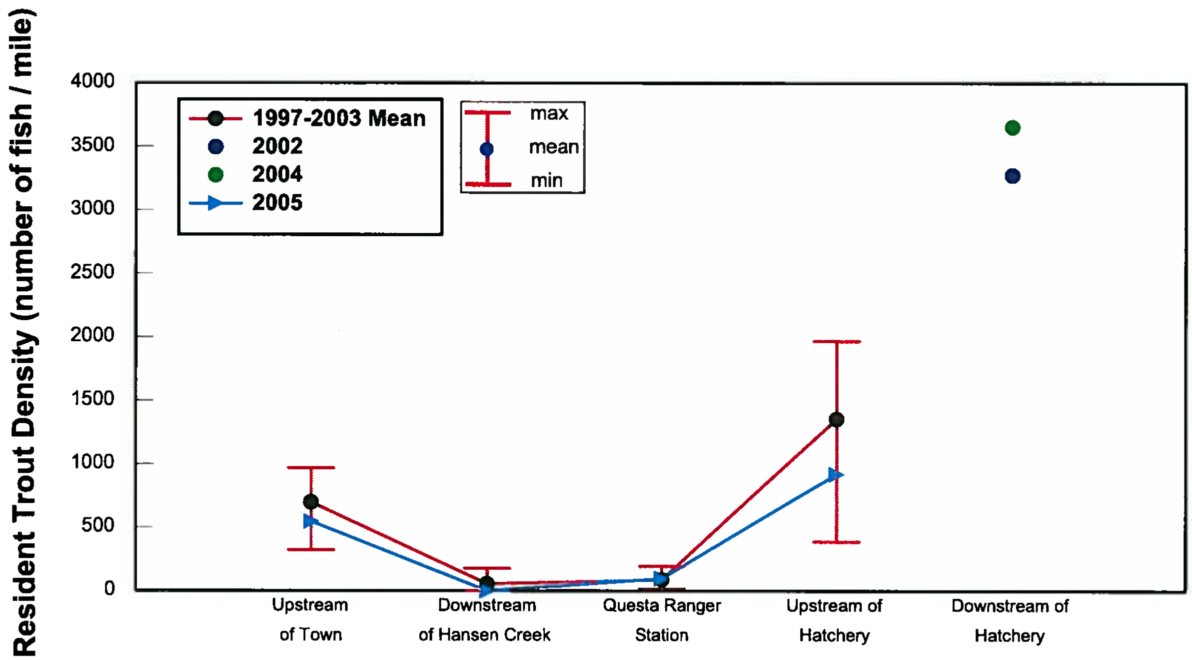


Figure 11: Comparison of resident trout density (#/mile). Data collected in late summer or fall 1997 through 2005 by NMDGF.

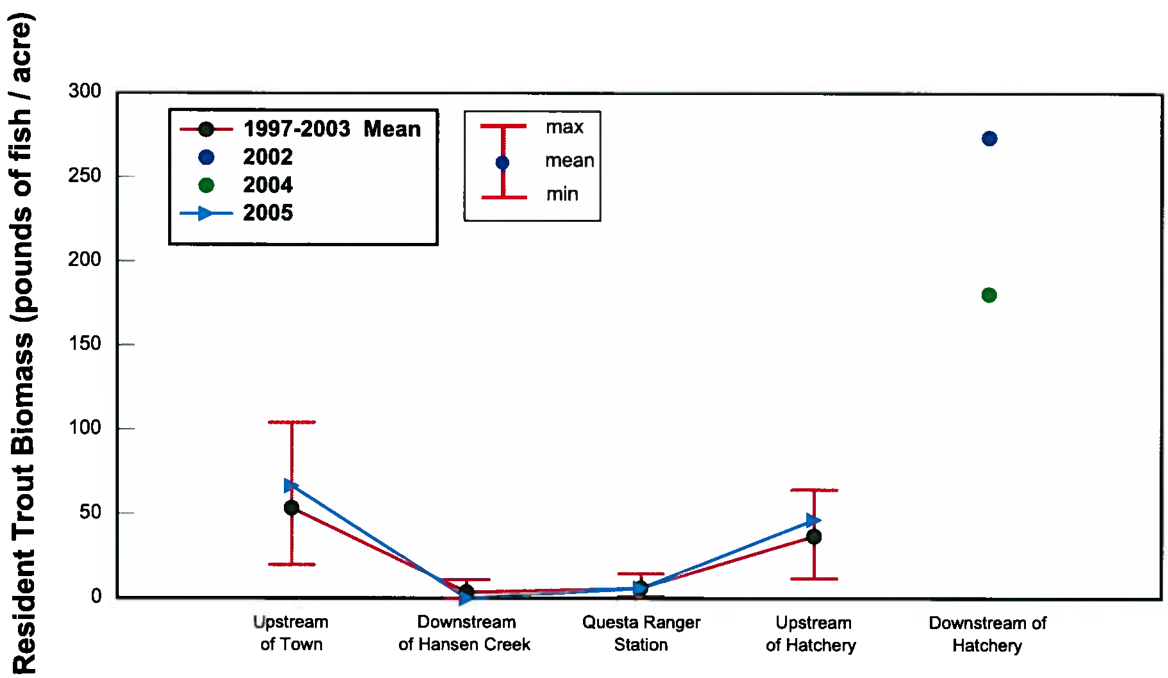


Figure 12: Comparison of resident trout biomass (lbs/acre). Data collected in late summer or fall 1997 through 2005 by NMDGF.

However, at the next site downstream near the Questa Ranger Station and downstream of Capulin Canyon, trout population levels decreased substantially, indicating a third area of impacts downstream of Goathill. There are hydrothermal scars in Capulin Canyon and areas of upwelling groundwater near Spring 13 that discharge into the Red River just upstream of the site near the Questa Ranger Station, and these may be contributing to the reduction in trout populations, especially during base flow periods.

This pattern of decreasing resident trout density and biomass and subsequent recovery in these three areas apparent from the 1997-2000 data was less evident in 2001 (CEC 2002) and was not evident at all in 2002, 2003, and 2004 (CEC 2003, 2005a). Density and biomass dropped to very low levels in 2002, 2003, and 2004 at the June Bug site and remained very low downstream to the site located downstream of Highway 522 and the Questa wastewater treatment facility. High density and biomass of trout had been found in 1997 through 2000 at the Elephant Rock site. However, from 2001 to 2004, the improvements seen at that site and upstream of Columbine Creek were not observed. In 2001, 2002, and 2004, no fish at all were captured at the site Downstream of Hansen Creek or at the site Upstream of Columbine Creek, and populations were very low in 2003. However, the pattern established by the 1997 through 2000 data was again observed in 2005. Decreases in density and biomass occurred upstream of the June Bug site; but the increases, particularly in density, at the Elephant Rock site indicate some recovery of the trout populations. As in most of the previous years, no resident trout were collected at the site Downstream of Hansen Creek, but population parameters rose slightly at Upstream of Columbine Creek and Goathill sites before dropping somewhat at the Questa Ranger Station site. The remainder of the sites indicate recovery of the trout population, with density and biomass rising.

Columbine Creek consistently has invertebrate and trout populations that indicate good water quality. Input of clean water from Columbine Creek should improve fish and invertebrate populations in the Red River. In some years, such as 2001, trout density and biomass levels in the Red River at the site near Goathill indicated some recovery was occurring from the impacts of Hansen Creek (CEC 2002). This pattern was seen to a lesser extent in 2005, with trout density increasing slightly at the Goathill site, but biomass remaining low. Dilution effects from Columbine Creek and YOY brown trout spawned in Columbine Creek may have contributed to this recovery.

Few resident trout were observed at the Questa Ranger Station site in 2005, as was similar to previous years (CEC 2002, 2003, 2005a, c, and **Figures 9 and 10**). The recently added sites downstream of the Questa Ranger Station site indicate that density and biomass begin to increase in this reach **(Table 1, Figures 3 and 4)**. Density and biomass are substantially increased at the sites Downstream of Outfall 002, Upstream of Hatchery, and Downstream of Hatchery, probably aided at the last of the two sites by the inflow of nutrient-rich water from the hatchery discharge. Data from NMDGF are available at five monitoring sites, and these data are consistent with our data and exhibit a similar overall trend of high density and biomass upstream of the town of Red River, low density and biomass in the middle reaches, and recovery near the fish hatchery **(Figures 11 and 12)**.

For most of the sites on the Red River in fall 2005, the pattern of density and biomass is similar to that of the period from 1997 through 2004 **(Figures 9 and 10)**. However, for the two sites in the downstream end of the study area, the sites Upstream and Downstream of Hatchery, the trout populations in fall 2005 had substantially lower density and biomass than in the past. Although the trend of recovery at these sites from the sections of the river upstream was still present; the populations did not recover to the levels as in past years. There are two factors which may have dampened the recovery at these sites in fall 2005. The first is the higher runoff flows that occurred in the spring of 2005. Both of these sites are fairly steep compared to the sites upstream, and high runoff flows probably resulted in high water velocities at these sites, reducing the suitability of the habitat for trout. The second factor may be the sediment plume **(Figure 6)** that resulted in higher than normal sediment levels at these sites in fall 2005.

Statistical analyses of our data from 1997 through 2005 support the conclusions observed as trends in trout populations. Repeated measures ANOVA (a nested, two-way [site × year] ANOVA) indicated that density (#/acre) and biomass (lbs/acre) at the three reference sites were significantly higher ($p < 0.05$) than at all of the long-term monitoring sites used in the analyses, except for the Elephant Rock and Upstream of Hatchery sites. These latter sites showed no significant difference in either parameter in comparison to the reference sites or other sites. As with the trend analysis, these results indicate that the first substantial impacts to the Red River fish community occur near the town of Red River and are first evident at the June Bug site. The lack of significant differences between the Elephant Rock site and the reference sites indicates that some recovery to the fish populations occurred downstream of the June Bug site. The significantly lower density and biomass at sites downstream of Hansen Creek confirm that Hansen Creek is the second area of impact, and the perennially low density and biomass at the Questa Ranger Station site indicate that Capulin Canyon and upwelling groundwater near Spring 13 initiates a third area of impact. As the density and biomass at the Upstream of the Hatchery site is not significantly different from the reference sites, some recovery of the resident trout populations is occurring throughout this reach downstream of the Questa Ranger Station site and Cabresto Creek.

5.2 Benthic Invertebrates

Benthic invertebrate data from fall 1997 through fall 2005 (CEC 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b) and early winter 1995 (Woodward -Clyde 1996) were compared to evaluate year-to-year variability in invertebrate populations **(Figures 13 and 14)**. This evaluation includes data from sites sampled since the 1990s. Data from the sites first established in 2002 were not included in this evaluation of long-term trends, as these sites have been sampled for only four years.

5.2.1 Overall Trends

The trends in all ten years are generally consistent, with reduced densities and number of taxa downstream of the town of Red River and downstream of Hansen Creek. Densities have varied over the years, but typically the highest densities were found at the site upstream of town or at one of the sites bracketing the hatchery, with lowest densities usually found at the Questa Ranger Station site or the downstream of Hansen Creek site **(Figure 13).** Number of taxa has generally been more consistent longitudinally along the river. The site Upstream of Town and the Questa Ranger Station site had the highest and lowest number of taxa, respectively, for eight of the ten years. The data collected in 2005 fit this pattern **(Figure 14)**.

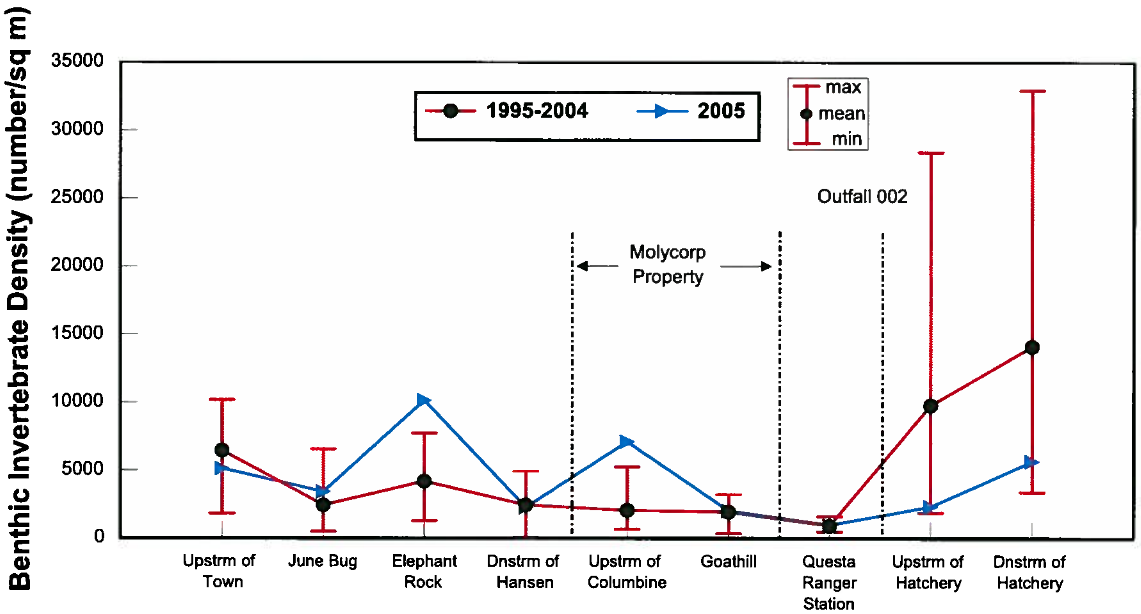


Figure 13: Comparison of benthic invertebrate density (#/m^2). Data collected by GEI/CEC in fall 1997 through 2005, and at corresponding sites by NMED and Molycorp in December 1995.

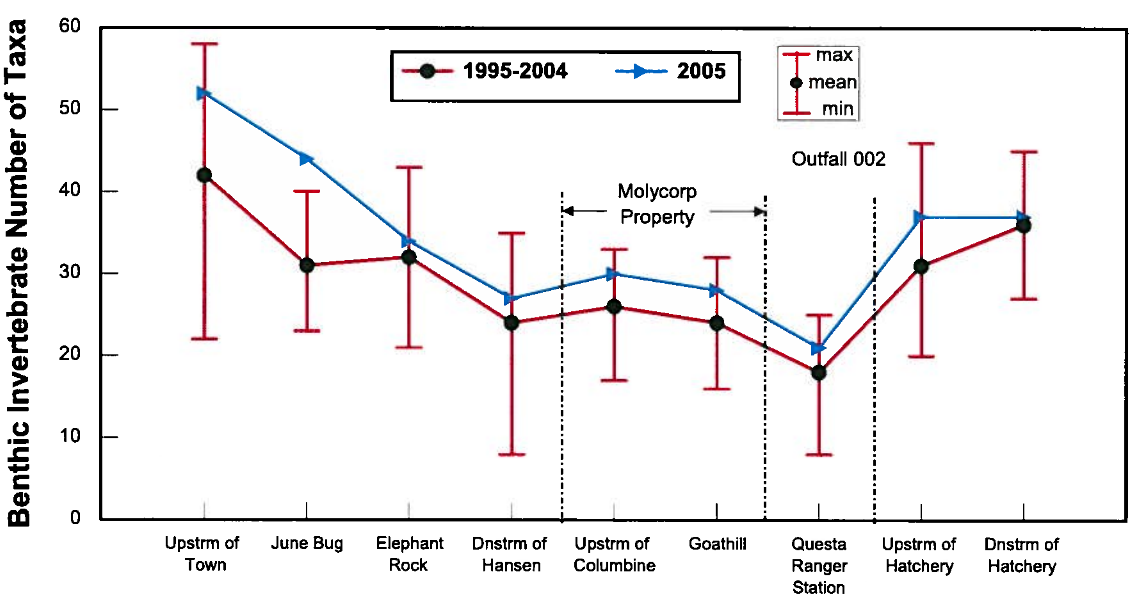


Figure 14: Comparison of number of benthic invertebrate taxa. Data collected by GEI/CEC in fall 1997 through 2005, and at corresponding sites by NMED and Molycorp in December 1995.

During nine of the ten years, density and number of taxa were relatively low at the June Bug site, just downstream of the town of Red River, as compared to the site upstream of Red River. In the years when this pattern did not hold (1998 for density, 1997 for number of taxa), there were actually lower levels at the site upstream of Red River (compared to previous years) rather than higher numbers at June Bug. This overall pattern demonstrates consistent impacts to benthic invertebrate populations near the town of Red River

During seven of the ten years, there was also a substantial decrease in density and number of taxa between the sites located upstream of Hansen Creek near the Elephant Rock Campground and the site located downstream of Hansen Creek. Density and number of taxa at the site Downstream of Hansen Creek in both 2002 and 2003 were lower than in years before or after. The pattern since 1995 demonstrates impacts in this section of the Red River, probably from Hansen Creek or upwelling groundwater in this vicinity. The site near the Elephant Rock Campground had the highest density reported from that site in fall 2005, while the site Downstream of Hansen Creek had one of the lowest.

The site near the Questa Ranger Station consistently had low density and almost always had the lowest number of taxa **(Figures 13 and 14)**. This site is downstream of Capulin Canyon and Spring 13 and had consistently represented the most impacted section of the Red River for benthic invertebrates, except in 2002 and 2003 when the site downstream of Hansen Creek exhibited the most stressed macroinvertebrate community. The historic trend of low density and low number of taxa at the Questa Ranger Station was observed again in 2004 and 2005. A trend of low benthic invertebrate population parameters was also found in the section of the river near the Questa Ranger Station by Jacobi *et al.* (1998).

The density and number of taxa trends in all ten years are consistent in exhibiting substantial recovery at the site upstream of the fish hatchery. This site is downstream of the confluence with Cabresto Creek. This pattern was repeated in 2005, although the increases in density and number of taxa were not as dramatic as in some previous years. This may be due to somewhat higher levels of sediment at this site in fall 2005. Apparently, the recovery pattern is enhanced by dilution water from Cabresto Creek when it is not diverted for irrigation, irrigation return flows, and groundwater discharge, which allows the benthic invertebrate populations to recover to levels comparable to those found in the reaches of the Red River upstream of Hansen Creek. This trend was also demonstrated in Jacobi *et al.* (1998).

The trend for number of EPT taxa, species that are considered to be sensitive to water quality, is different than the trends for density and number of taxa. For number of EPT taxa, there is generally an initial decrease downstream of the town of Red River, although this was not seen in 2004 or 2005 **(Figure 15)**. This decrease generally continues to the site Downstream of Hansen Creek. In most years, there is some recovery at the site Upstream of Columbine Creek (CEC 2002, 2003, 2005a, b, and **Figure 15**). The number of EPT taxa varies within a narrow range for all remaining study sites along the Red River. There is limited or no recovery downstream of Questa in most years, unlike what was evident for density and number of taxa.

Mayfly abundance, one of the most sensitive indicators of metals stress, varies widely from year to year at most sites **(Figure 16)**. The data from 2005 were within the range established in 1995 through 2004 at almost all sites, and were generally comparable to the long-term average. In 2005, the site Upstream of Town had the lowest mayfly abundance, and the site Upstream of Columbine Creek had the highest mayfly abundance for the period of record **(Figure 16)**. The data for all other sites were within the range seen in previous years. In most years, there had been a definite trend of reduced mayfly abundance beginning at the June Bug site and extending downstream to the site at the Questa Ranger Station; however, in the last two years, mayfly abundance at the June Bug site has been higher than at the site Upstream of Town. The general trend toward lower abundances at sites downstream of the June Bug Campground to the Questa Ranger Station site was offset in 2005 by high mayfly abundances at the Elephant Rock, Downstream of Hansen Creek, and Upstream of Columbine Creek sites. Mayfly abundance then decreased at the Questa Ranger Station site in 2005 as it had in previous years. In 2001, and to a limited extent in 2003 and 2005, there was subsequent recovery at the two sites that bracket the hatchery (CEC 2005a).

The trend for metals intolerant taxa is very similar to the trend for EPT taxa, with declines starting downstream of the town of Red River, and continuing to downstream of Hansen Creek **(Figure 17)**. Some recovery is generally seen at the site upstream of Columbine Creek, with subsequent declines downstream to the site at the Questa Ranger Station. Very little recovery is made at the sites downstream of the Questa Ranger Station. This trend is seen also in the 2005 data **(Figure 17)**, with the exception of the increase in metals intolerant taxa seen at the sites in the middle reaches of the river. Most values in 2005 are very similar to the mean values from 1995 through 2005 and generally within the range of values seen from 1995 through 2005. The number of metals intolerant taxa at the Elephant Rock site in 2005 was less than the minimum number seen at that site from 1995 through 2004.

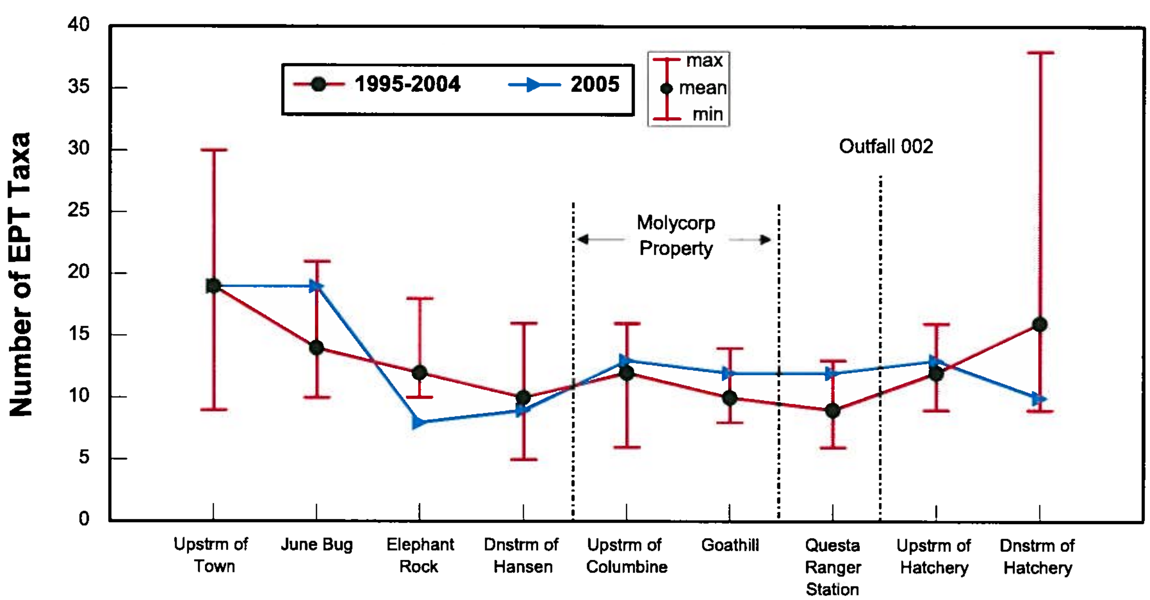


Figure 15: Comparison of number of EPT taxa. Data collected by GEI/CEC in fall 1997 through 2005, and at corresponding sites by NMED and Molycorp in December 1995.

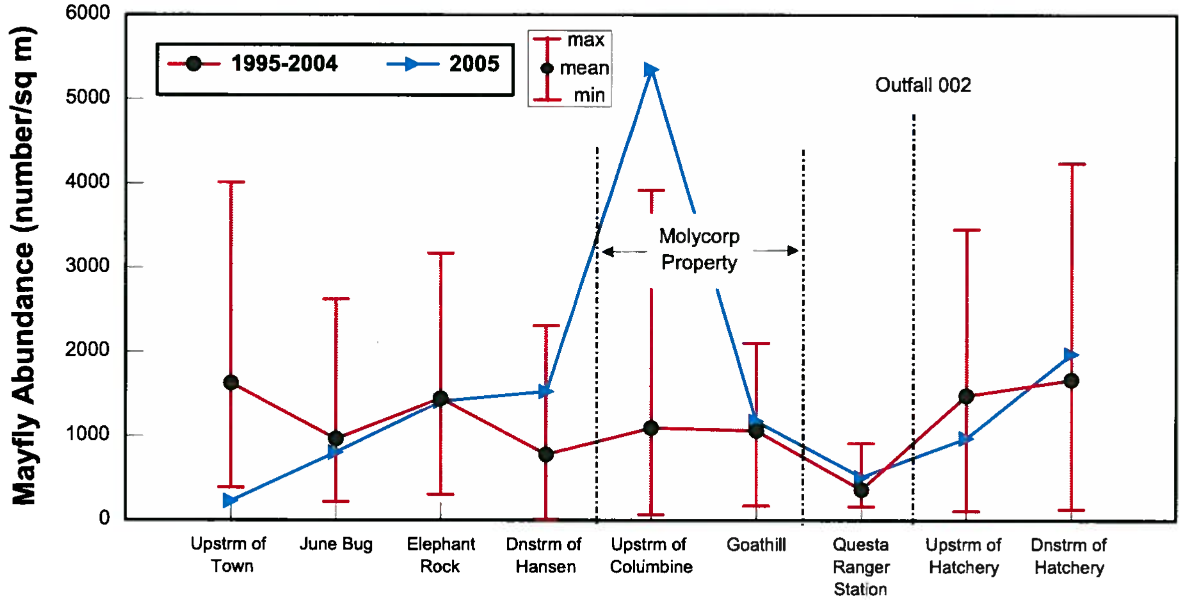


Figure 16: Comparison of mayfly abundance (#/m^2). Data collected by GEI/CEC in fall 1997 through 2005, and at corresponding sites by NMED and Molycorp in December 1995.

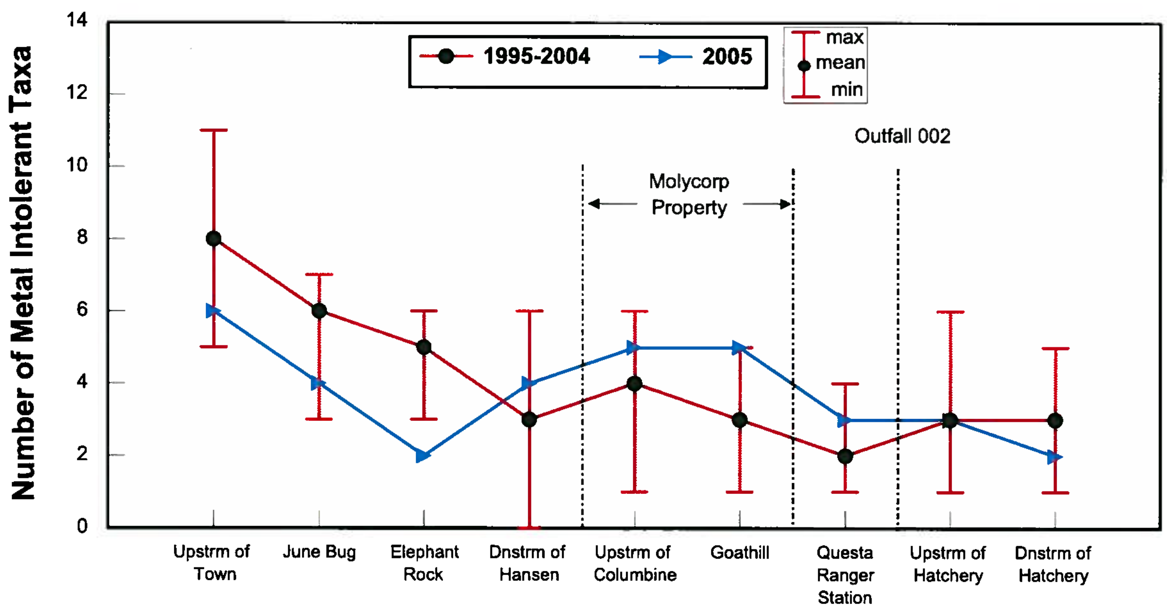


Figure 17: Comparison of metals intolerant taxa. Data collected by GEI/CEC in fall 1997 through 2005, and at corresponding sites by NMED and Molycorp in December 1995.

5.3 Potential Limiting Factors

Multiple physical and chemical factors appear to be influencing the distribution of trout and invertebrates along the length of the Red River. The factors of influence change in importance from year to year, as is seen in many natural populations (Hall and Knight 1981). Correlation analysis and all possible regressions analysis were conducted by CEC (2005a) using flow data, habitat data, and extensive water and sediment chemistry data (25 metals plus field parameters) collected in 2002 and 2003 at sites co-located with fish and benthic invertebrate sampling. Chemistry data were not available for similar analysis in 2005.

Flow is an important factor in determining year-to-year trends in trout populations, especially density of YOY trout (Chadwick *et al.* 2004), but is less important for invertebrates. Previous reports have demonstrated the influence of peak runoff flows on YOY density in the Red River (CEC 2005a), with fewer YOY trout in years of higher runoff. Fish population data from 2005 further support this relationship. Based on mean monthly discharge data from two USGS gages on the Red River within the study area, flows in spring 2005 were above average and were higher than what had been observed since 1997. Likely due to the high spring runoff flows, few to no YOY trout were collected at most sites. More YOY trout were collected in 2004 when spring flows were below average.

Habitat factors other than sedimentation were only weakly correlated with trout populations. Sedimentation is an important factor determining the distribution of fish (Newcombe and MacDonald 1991, Newcombe and Jensen 1996) and is an important factor in the Red River. For fish, 52% of the longitudinal variation in biomass in 2004 was explained by percent riffle embeddedness (CEC 2005b). In 2005, this number increased to 67%. For invertebrates in fall 2005, 64% and 72% of the longitudinal variation in number of taxa and number of EPT taxa, respectively, was explained by percent embeddedness. However, for invertebrates in spring 2005 and spring and fall 2004, percent embeddedness was not significantly correlated with any of the invertebrate parameters. Episodic summer rain storms add large amounts of sediment to the Red River while simultaneously degrading water quality, which confounds our ability to determine the relative influence of sedimentation and water quality on fish and invertebrates. Toxicity testing in 2003 showed substantial toxicity in the middle reaches of the river during storm runoff flows, but toxicity testing in fall 2002 during base flow showed no toxicity in the middle reaches of the Red River. Also, invertebrate populations in these reaches contained at least some sensitive species in all years.

6.0 Historical Trends in Aquatic Biota

6.1 Historical Reach Descriptions

In order to organize the available historical fish and benthic invertebrate data in our initial monitoring report (CEC 1997), the Red River was segmented into six reaches (**Figure 1**). These reaches were used to group data from multiple historical sampling sites into distinct, biologically significant parts of the river which contain roughly similar characteristics of channel morphology, habitat, potential impacts, etc. This allowed a more focused interpretation of the historical data. These same six reaches are also used to organize the monitoring data collected during 1997 through 2005. Summarized descriptions of the six reaches are presented below. More detailed descriptions were presented in our previous report (CEC 1997).

6.1.1 Upstream of Red River

This reach of the Red River includes its headwaters downstream to just upstream of the town of Red River. There is residential development in this portion of the river, primarily in the form of vacation homes and commercial lodges, but not to the extent present in the town of Red River. The substrate in this reach exhibits little accumulation of silt and sand, with low embeddedness.

6.1.2 Red River to Hansen Creek

This reach extends from the town of Red River to just upstream of the confluence with Hansen Creek. Bitter Creek flows into the Red River at the town of Red River. Bitter Creek and other drainages contain historical mining operations and natural hydrothermal scars, which apparently contribute sediment to the Red River. Impacts to this reach include channelization, erosion from the highway, outfall of the town of Red River's wastewater treatment facility, and runoff from natural hydrothermal scars drained by Bitter Creek and Hot-n-Tot Creek.

6.1.3 Hansen Creek to Molycorp Boundary

This reach extends from the confluence with Hansen Creek downstream to the eastern edge of the Molycorp property boundary. The major characteristic of this reach is the inflow of Hansen Creek, which drains a large area of hydrothermal scarring. Runoff from this scarring carries sediment into the Red River, creating a relatively large alluvial fan. Hansen Spring also apparently introduces substances to the Red River in this reach.

6.1.4 Molycorp Boundary to Capulin Canyon

Extending from the eastern Molycorp property boundary downstream to just upstream of Capulin Canyon, this reach contains the confluence with Columbine Creek, which joins the Red River from the south side of the valley. Columbine Creek is a small, clear stream with good water quality and low sediment load that adds diluting flows to the Red River, and is the largest tributary in the middle reaches of the Red River.

6.1.5 Capulin Canyon to Cabresto Creek

This reach extends from the confluence with Capulin Canyon downstream to just upstream of the confluence with Cabresto Creek, in the Village of Questa. As with the reach from Hansen Creek to the Molycorp eastern property boundary, a major feature in this reach is natural hydrothermal scars in Capulin Canyon. Although Capulin Canyon no longer drains directly to the Red River, near the mouth of Capulin Canyon is Spring 13 and an area of upwelling groundwater.

6.1.6 Cabresto Creek to Rio Grande

This reach extends from the confluence with Cabresto Creek, near the Village of Questa, downstream to the confluence of the Red River and the Rio Grande. At the upstream end of this reach, Cabresto Creek adds clear, high quality water with low sediment load to the Red River during parts of the year when it is not diverted for irrigation. The river valley widens at Questa, and portions of this reach through Questa have areas of unstable stream banks. The river widens and results in more shallow average water depths compared to downstream portions of this reach. The river valley and stream channel subsequently narrow again upstream of the state fish hatchery and the canyon remains narrow down to the Rio Grande.

6.2 Fish

Fish population data providing longitudinal patterns of fish density are available from three different time periods of mine operation **(Figure 18)**. Data from 1960 were collected prior to the initiation of open pit mining, and represent baseline data (NMDGF 1960, CEC 2005c). Data collected during the intervening period of open pit and underground mine operation (1974-1988 data) are also presented (CEC 2005c). Present conditions are represented by fall data collected from 1997 through 2005 by GEI/CEC and in August 1997, August 1999, August 2001, September 2002, August 2003, October 2004, and October 2005 by NMDGF.

As in past reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b), in order to make the data sets for the four periods comparable, only first-pass electrofishing data were used, since this was the primary sampling method used during the earlier studies. One-pass electrofishing is adequate to determine the species of fish present and a general measure of abundance in streams (Reynolds *et al.* 2003, Bateman *et al.* 2005). Also, since rainbow trout are largely maintained by stocking, and, as such, are not as directly controlled by habitat and water quality conditions as are resident fish, rainbow trout numbers have been omitted from the comparison. Finally, since most of the historic data only present density data, longitudinal comparisons of biomass are not made.

The longitudinal trends in fish density (number of fish/mile) are similar during all three time periods. The trends all indicate relatively high fish density upstream of the town of Red River, decreasing density downstream of Hansen Creek, and increasing density downstream of Cabresto Creek **(Figure 18)**. This trend holds for baseline conditions (1960 data), during the intervening period of open pit and underground mine operation (1974-1988), and present conditions (1997-2005 data). These are the same trends identified in our earlier reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b; Chadwick *et al.* 2005).

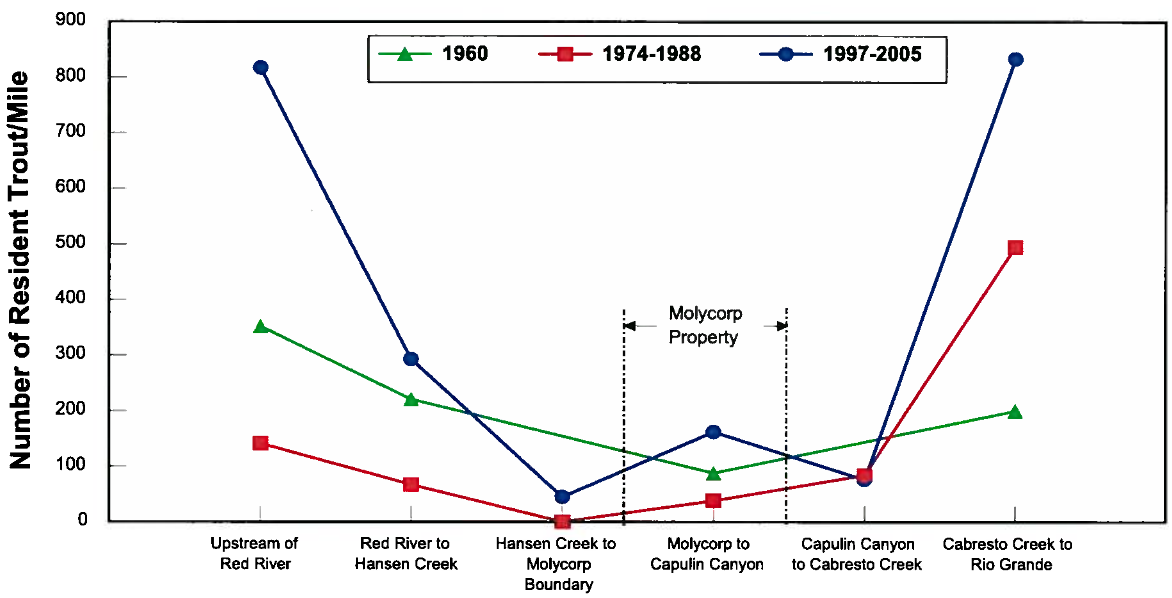


Figure 18: Longitudinal trends in resident trout density (#/mile) for baseline conditions (1960 data), open pit and underground mine operation (1974-1988 data), and present conditions (1997-2005 data). First pass electrofishing data only.

The trends in trout density in all three periods indicate that reductions in density reflecting the decreased suitability of the Red River to support trout first occur near the town of Red River. The trends in trout density in all three periods also indicate further impacts to trout downstream of Hansen Creek **(Figure 18)**. Downstream of Hansen Creek and through the section of the Red River adjacent to the Molycorp property, trout density remains low. During all three sampling periods, there was also a substantial increase in resident trout density in the reach of the Red River downstream of Cabresto Creek. In this lower reach of the river, trout density returned to levels comparable to or higher than those found in the reach upstream of the town of Red River **(Figure 18)**.

In all reaches, fish density is similar to or higher in 1997 through 2005 than during the baseline period (1960) or the period of open pit and underground mining (1974-1988). As mentioned previously, this may be due to differences in the methods and efficiency of collecting fish (CEC 2005c). However, these data suggest that the Red River supported at least as many fish during recent years as it did prior to the initiation of open pit mining.

6.3 Benthic Invertebrates

For benthic invertebrates, the collected data also were divided into three time periods. Baseline conditions were represented by data collected in 1965 (USDHEW 1966, CEC 2005b), apparently prior to the initiation of open pit mining. Data available from the intervening period (1970-1992) represent conditions during open pit and underground mining (CEC 2002b, Chadwick *et al.* 2005). Benthic invertebrate data collected in 1995 through fall 1999 and spring and fall 2000 through spring and fall 2005 represent present conditions. Present conditions also included the sites on the Middle Fork, downstream of the hatchery, and RI sites for the years when data were available.

Comparisons were made between periods using the two population parameters of density (#/m^2) and number of taxa. Techniques for sampling and analyzing invertebrates have varied between the periods (CEC 2005c), making direct comparisons over time difficult. However, assuming similar techniques were employed within each historical time period and standardizing densities to number of organisms/m^2, comparisons of the downstream trends are reasonable.

The longitudinal trends in density for the three sampling periods (1965, 1970-1992, and 1995-2005) show a similar pattern of decreasing density downstream from the headwaters of the Red River, with low densities of benthic invertebrates downstream of Hansen Creek **(Figure 19)**. In the remainder of the Red River from the Molycorp property downstream past Cabresto Creek, the data from the three sampling periods also have a similar trend **(Figure 19)**. Low densities continue to occur adjacent to the Molycorp Mine, and the lowest densities are found near the Questa Ranger Station in the reach of the river downstream of Capulin Canyon. This is followed by an increase in density in the reach downstream of Questa, after Cabresto Creek inputs relatively clean water into the Red River. This general trend has not changed since 1965.

The trend in number of taxa for the three sampling periods (1965, 1970-1992, and 1995-2005) indicates a gradual decrease in taxa along the length of the Red River to the reach downstream of Capulin Canyon **(Figure 20)**. This is followed by an increase in number of taxa downstream of Cabresto Creek for two of these periods (1970-1992, 1995-2005), but this increase was not observed in the baseline period.

In all six reaches, densities and number of taxa are substantially higher for data collected in 1995 through 2005 than during the baseline period and the period of open pit and underground mine operation **(Figures 19 and 20)**. As mentioned earlier, this may be partly due to different methods of data collection and analysis (CEC 2005c). However, these data indicate that the Red River is at least as suitable for sustaining benthic invertebrates in recent years as it was prior to the initiation of open pit mine operations.

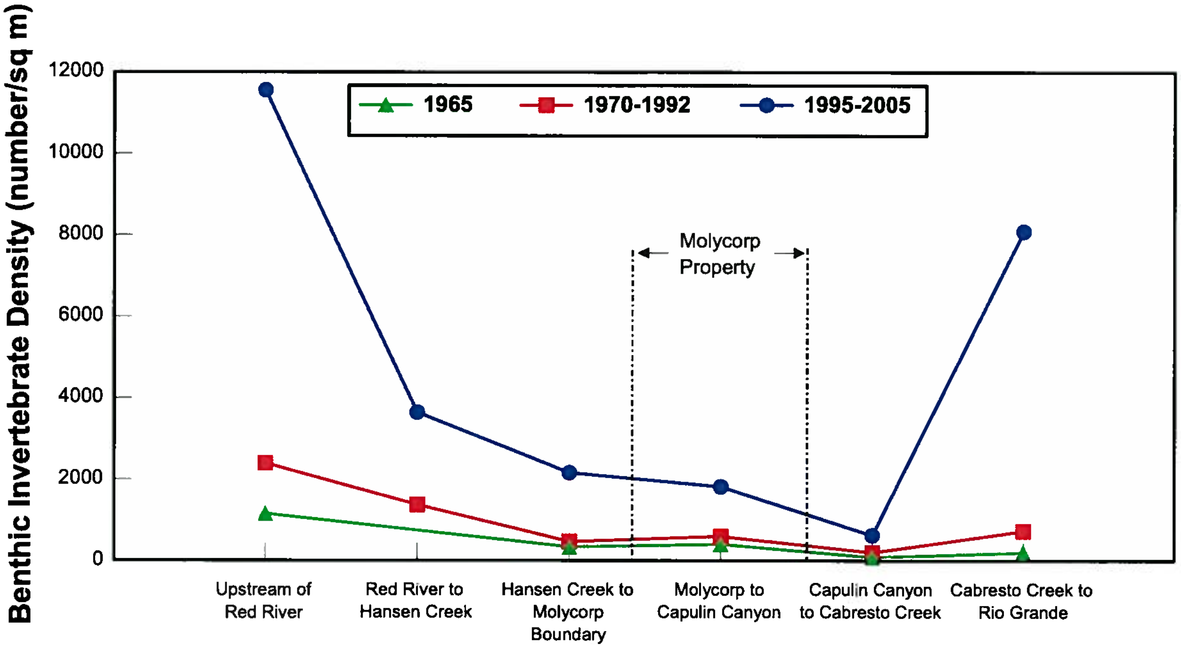


Figure 19: Longitudinal trends in benthic invertebrate density (#/m^2) for baseline conditions (1965 data), open pit and underground mine operation (1970-1992 data), and present conditions (1995-2005 data).

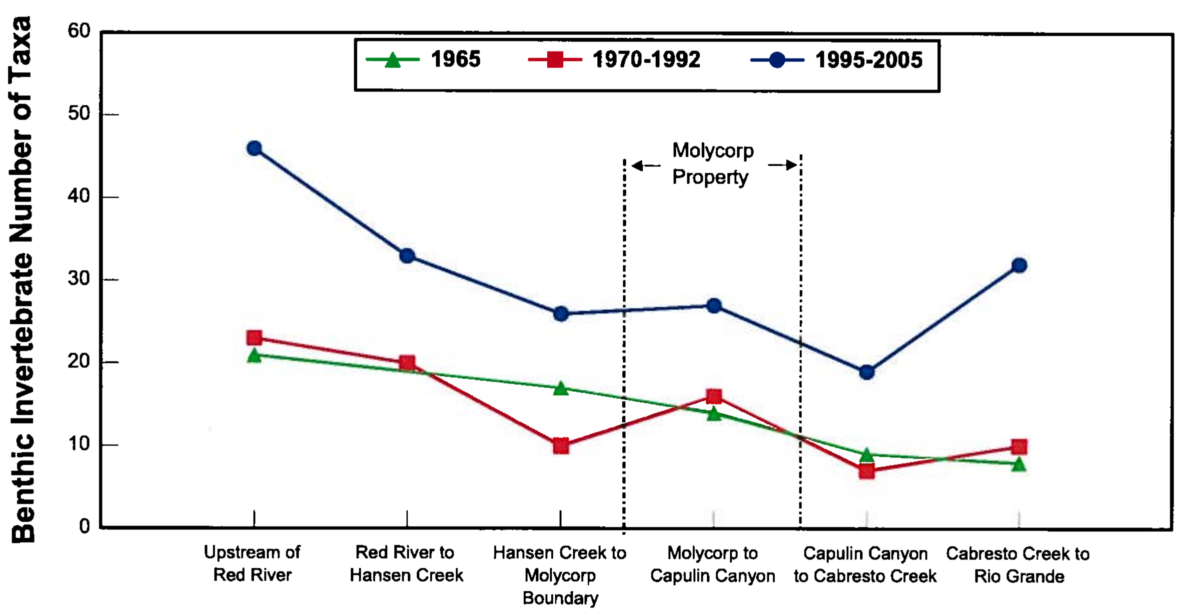


Figure 20: Longitudinal trends in number of benthic invertebrate taxa for baseline conditions (1965 data), open pit and underground mine operation (1970-1992 data), and present conditions (1995-2005 data).

7.0 Conclusions

Fish population data for 2005 continue to indicate areas of stress in the middle reaches of the Red River. These stresses are primarily the result of poor water quality and sediment input from hydrothermal scars and upwelling groundwater. Although some recovery was observed in trout density at the Elephant Rock site, resident trout populations were generally very limited at the sites between June Bug Campground and Highway 522. No or very few resident trout or YOY fish were found at most of the sites in this section of the river. At the reference sites and at sites downstream of Outfall 002, the populations of resident trout were healthy, with relatively high density and biomass and numerous fish in a wide range of year classes.

Resident trout populations in each year from 1997 through 2000 exhibited similar trends, indicating three areas of impact resulting in decreases in trout abundance. While the three areas of impact were still apparent in 2001 through 2004, these years differed in that no recovery of the trout populations at the Elephant Rock site occurred as had been observed in the past. The data from these years indicate that the impacts in the middle reach of the Red River were much greater than prior to 2001. The lower abundance of trout in 2001 through 2004 coincided with a drought period and increased accumulation of sediment in the Red River downstream of the hydrothermal scars. Trout population parameters in 2005 again indicated that some recovery, particularly in trout density, was occurring at the Elephant Rock site, as had been seen in 1997 through 2000. Possibly the return of this trend was linked to the above average flows from spring runoff that occurred in the Red River in 2005 reducing sediment at these sites. The 2005 data continue to indicate the three areas of impact downstream of the town of Red River, downstream of Hansen Creek, and downstream of Capulin Canyon.

Habitat evaluations in fall 2005 indicate that more complex fish habitat was available at the reference sites relative to the other monitoring sites, with these sites, as well as the sites downstream of Outfall 002, also receiving higher habitat quality ratings. Low habitat quality ratings occurred at the three sites downstream of Hansen Creek, and were due, in part, to the covering of habitat features by sediment in this reach of the Red River in fall 2005. All sites were dominated by riffle habitat in terms of total area. Percent fines and percent embeddedness generally increased downstream of the town of Red River, and peaked at the Elephant Rock, Downstream of Hansen Creek, or Upstream of Mill sites in spring and fall. Fish habitat in the Red River continues to be affected by the accumulation of sediment in the channel in 2005, but not the extent observed in many of the previous years. Higher levels of sediment in 2005 at sites downstream of Goathill Campground may represent a plume of sediment moving downstream during runoff and during the summer of 2005.

Benthic invertebrate populations at the reference sites were diverse and healthy, as indicated by relatively high density, number of taxa and number of sensitive EPT taxa. Population parameters were reduced for many sites downstream of the town of Red River to near Questa. At sites downstream of Highway 522, there was some recovery in density, total number of taxa, and total number of EPT taxa in spring and fall 2005.

Longitudinal trends in population parameters in spring and fall 2005 indicate three general areas of impact in the Red River, with substantial reductions in population parameters occurring downstream of the town of Red River, downstream of Hansen Creek, and downstream of Capulin Canyon. Similar to the trends in fish populations, trends in invertebrate population data in 2005 were more similar to trends in 1995 through 2000 and 2004 than to trends in 2001 through 2003. During most years, the lowest population parameters generally occurred at the Questa Ranger Station, and recovery of some population parameters occurred at the Elephant Rock site and in the vicinity of Columbine Creek. Longitudinal trends in invertebrate population parameters along the Red River in fall 2001 through 2003 differed in that all parameters, particularly density, reached levels lower than in other years in the middle reaches of the river, and showed little of the recovery seen at some sites in the other years. The data for 2002 through 2003 further indicate that impacts in the middle reaches of the Red River were greater than those prior to 2001 or after 2003, probably due, in part, to the below average flows and increases in sediment accumulation that occurred in both 2002 and 2003.

At all sites along the river, including those in the most impacted reaches, at least some species of sensitive EPT taxa are present. Mayflies, which are especially sensitive to higher metal concentrations, were also present at all sites. This indicates that the river sustains at least some sensitive invertebrate species along its entire length.

An additional study conducted as part of additional efforts in 2005 surveyed the trout populations quantitatively and qualitatively in upper Cabresto Creek for the purpose of defining the distribution of cutthroat trout, brook trout, brown trout, and rainbow trout in the upper Cabresto Creek watershed. Results of these surveys indicated that cutthroat trout were present throughout the portion of Cabresto Creek upstream of its confluence with Lake Fork Creek. Genetic analyses of cutthroat trout tissues collected from one of the upstream segments sampled indicated that the cutthroat trout in this segment are pure Rio Grande cutthroat trout, with no signs of introgression with rainbow trout. Brook trout were present at all but the most upstream segment of Cabresto Creek. As no significant barriers to fish movement were present in this segment, brook trout distribution is likely being limited by elevation, available habitat, competition with cutthroat trout, or some combination of these three factors. Brown trout, hybrid trout, and rainbow trout were only collected at the most downstream segment, downstream of Bonito Canyon.

The trends in trout density during recent conditions (1997 to present) were similar to those during baseline conditions (data collected in 1960) and the period of open pit and underground mining (data collected 1974-1988). The trends all indicate relatively high density of resident trout upstream of the town of Red River, decreasing density in the middle reaches of the river, and increasing density downstream of Cabresto Creek. These are the same trends identified in previous reports. However, the data from 2001 through 2005 indicated that the reductions in density downstream of the hydrothermal scars, just downstream of the town of Red River, were greater than in previous years.

The longitudinal trends in benthic invertebrate density for baseline conditions (data collected in 1965), the period of open pit and underground mining (data collected 1970-1992), and recent conditions (1995 to present) show a similar pattern of decreasing density downstream of the town of Red River, with low density downstream of Hansen Creek. In the middle reaches of the river, from the Molycorp property boundary downstream past Cabresto Creek, low densities continued to occur, reaching a minimum near the Questa Ranger Station in the reach downstream of Capulin Canyon and the upwelling of groundwater near Spring 13. This is followed by an increase downstream of Cabresto Creek. This general trend has not changed since 1965. The trend in number of taxa for the three sampling periods indicates a gradual decrease along the length of the Red River to the reach downstream of Capulin Canyon. This is followed by an increase in number of taxa downstream of Cabresto Creek in data collected since 1970; this recovery was not evident in the baseline period.

Our previous reports (CEC 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2005a, b) concluded that the primary impacts to the suitability of the Red River to sustain aquatic biota were occurring just downstream of the town of Red River, downstream of Hansen Creek, and downstream of Capulin Canyon. These three areas all have surface water and/or groundwater connections to the Red River in the area of natural hydrothermal scars. Downstream of the confluence of Cabresto Creek, conditions improved for both fish and benthic invertebrates.

These impacts in the Red River appear to be resulting from the input of excess sediment from a number of sources, and decreased water quality, especially at locations receiving drainage from hydrothermal scars. Those reports further concluded that baseline data indicated these impacts were present prior to the initiation of open pit mining at the Molycorp Questa Mine, and in reaches of the Red River upstream of the mine. The data from 2005 support these conclusions from our previous reports.

8.0 References

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*, 2nd Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Bateman, D.S., R.E. Gresswell, and C.E. Torgersen. 2005. Evaluating single-pass catch as a tool for identifying spatial pattern in fish distribution. *Journal of Freshwater Ecology* 20:335-345.

Canton, S.P., and J.W. Chadwick. 1984. A new modified Hess sampler. *Progressive Fish-Culturist* 46:57-59.

Canton, S.P., and J.W. Chadwick. 1988. Variability in benthic invertebrate density estimates from stream samples. *Journal of Freshwater Ecology* 4:291-298.

Carter, J.L., and V.H. Resh. 2001. After site selection and before data analysis: sampling, sorting, and laboratory procedures used in stream benthic macroinvertebrate monitoring programs by USA state agencies. *Journal of the North American Benthological Society* 20:658-682.

Chadwick, J.W. 2005. *Cabresto Creek Genetic Samples*. Technical Memorandum to Anne Wagner and Bob Haddad, November 14.

Chadwick, J.W., L.C. Bergstedt, D.J. Conklin, and S.P. Canton. 2004. Drought and trout - sometimes less is more. Pages 1-13. IN: de Carvalho Freitas, C.E., M. Petrere, Jr., A.A.F Rivas, and D. MacKinlay (eds.). Symposium Proceedings, *Fish Communities and Fisheries*. VI International Congress on the Biology of Fish, Manaus, Brazil.

Chadwick, J.W., S.P. Canton, D.J. Conklin, and L.C. Bergstedt. 2005. Determining sources of water quality impacts using biological monitoring: The Molycorp Questa Molybdenum Mine Example. Pages 211-223. IN: *Proceedings of a Joint Conference of American Society of Mining and Reclamation 22nd Annual National Conference*. June 19-23, 2005. Breckenridge, CO.

Chadwick Ecological Consultants, Inc. 1997. *Aquatic Biological Assessment of the Red River, New Mexico, in the Vicinity of the Questa Molybdenum Mine*. Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 1998. *Fall 1997 Data Addendum, Red River Aquatic Biological Assessment*. Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 1999. *Red River Aquatic Biological Monitoring, 1998*. Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2000. *Red River Aquatic Biological Monitoring, 1999*. Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2001. *Red River Aquatic Biological Monitoring, 2000*. Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2002. *Red River Aquatic Biological Monitoring, 2001.* Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2003. *Red River Aquatic Biological Monitoring, 2002.* Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2005a. *Red River Aquatic Biological Monitoring, 2003.* Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2005b. *Red River Aquatic Biological Monitoring, 2004.* Report prepared for Molycorp, Inc., Questa, NM.

Chadwick Ecological Consultants, Inc. 2005c. *Aquatic Biological Data on the Red River, Taos County, New Mexico, 1906-1994.* Report prepared for Molycorp, Inc., Questa, NM.

Clements, W.H. 1991. Community responses of stream organisms to heavy metals: A review of observational and experimental approaches. Pages 363-391. IN: Newman, M.C., and A.W. McIntosh (eds.). *Metal Ecotoxicology: Concepts and Applications.* Lewis Publishing, Inc., Chelsea, MI.

Clements, W.H. 1994. Benthic invertebrate community responses to heavy metals in the upper Arkansas River basin, Colorado. *Journal of the North American Benthological Society* 13:30-44.

Clements, W.H., D.S. Cherry, and J. Cairns, Jr. 1988. Impact of heavy metals on insect communities in streams: A comparison of observational and experimental results. *Canadian Journal of Fisheries and Aquatic Sciences* 45:2017-2025.

Clements, W.H., D.M. Carlisle, L.A. Courtney, and E.A. Harrahy. 2002. Integrating observational and experimental approaches to demonstrate causation in stream biomonitoring studies. *Environmental Toxicology and Chemistry* 21:1138-1146.

Elliott, J.M. 1977. *Statistical Analysis of Samples of Benthic Invertebrates.* Scientific Publication No. 25. Freshwater Biological Association, Ambleside, England.

Fore, L.S. 2002. Biological assessment of mining disturbance on stream invertebrates in mineralized areas of Colorado. Pages 347-370. IN: Simon, T.P. (ed.). *Biological Response Signatures: Indicator Patterns Using Aquatic Communities.* CRC Press, Boca Raton, FL.

Hall, J.D., and N.J. Knight. 1981. *Natural Variation in Abundance of Salmonid Populations in Streams and Its Implications for Design of Impact Studies, A Review.* EPA-600/3-81-021. Oregon State University, Department of Fisheries and Wildlife.

Hintze, J.L. 2000. *NCSS 2001 Statistical System for Windows.* Number Cruncher Statistical Systems, Kaysville, UT.

Jacobi, G.Z., L.R. Smolka, and M.D. Jacobi. 1998. *Benthic Macroinvertebrate Bioassessment of the Red River, New Mexico, U.S.A.* Presented at the 27th Congress of the International Association of Theoretical and Applied Limnology (SIL), Dublin, Ireland.

Kiffney, P.M., and W.H. Clements. 1994. Effects of heavy metals on a macroinvertebrate assemblage from a Rocky Mountain stream in experimental microcosms. *Journal of the North American Benthological Society* 13:511-523.

Klemm, D.J., P.A. Lewis, F. Fulk, and J.M. Lazorchak. 1990. *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters.* EPA/600/4-90/303. U.S. Environmental Protection Agency.

Lenat, D.R., and D.L. Penrose. 1996. History of EPT taxa richness metric. *Bulletin of the North American Benthological Society* 13:305-307.

Lenat, D.R., and V.H. Resh. 2001. Taxonomy and stream ecology _ the benefits of genus- and species-level identifications. *Journal of the North American Benthological Society* 20:287-298.

Lydy, M.J., C.G. Crawford, J.W. Frey. 2000. A comparison of selected diversity, similarity, and biotic indices for detecting changes in benthic-invertebrate community structure and stream quality. *Archives of Environmental Contamination and Toxicology* 39:469-479.

MacDonald, L.H., A.W. Smart, and R.C. Wissmar. 1991. *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Stream in the Pacific Northwest and Alaska.* EPA 910/9-91-001. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

Maceina, M.J., P.W. Bettoli, and D.R. DeVries. 1994. Use of split-plot analysis of variance design for repeated-measures fishery data. *Fisheries* 19(3):14-20.

New Mexico Department of Game and Fish. 1960. *Stream Survey Forms.*

New Mexico Department of Game and Fish. 1997. *Stream Survey Forms*, August 11-12, 1997.

New Mexico Department of Game and Fish. 1999. *Stream Survey Forms*, August 12-13, 1999.

New Mexico Department of Game and Fish. 2001. *Stream Survey Forms*, August 21-22, 2001.

New Mexico Department of Game and Fish. 2002. *Stream Survey Forms*, September 8, 2002.

New Mexico Department of Game and Fish. 2003. *Stream Survey Forms*, August 25-26, 2003.

New Mexico Department of Game and Fish. 2004. *Stream Survey Forms*, October 4, 2004.

New Mexico Department of Game and Fish. 2005. *Stream Survey Forms*, October 11-12, 2005.

Newcombe, C.P., and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. *North American Journal of Fisheries Management* 11:72-82.

Newcombe, C.P., and J.O. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. *North American Journal of Fisheries Management* 16:693-727.

Overton, C.K., S.P. Wollrab, B.C. Roberts, and M.A. Radko. 1997. *RI/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook.* General Technical Report INT-GTR-346. U.S. Department of Agriculture, Forest Service Intermountain Research Station, Ogden, UT.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross and R.M. Hughes. 1989. *Rapid Bioassessment Protocols for Use in Streams and Rivers.* EPA/444/4-89-001. U.S. Environmental Protection Agency.

Platts, W.S., and M.L. McHenry. 1988. *Density and Biomass of Trout and Char in Western Streams.* General Technical Report INT-241. USDA Forest Service, Intermountain Research Station, Ogden, UT.

Rabeni, C.F., N. Wang, and R.J. Sarver. 1999. Evaluating adequacy of the representative stream reach used in invertebrate monitoring programs. *Journal of the North American Benthological Society* 18:284-291.

Reynolds, L., A.T. Herlihy, P.R. Kaufmann, S.V. Gregory, R.M. Hughes. 2003. Electrofishing effort requirements for assessing species richness and biotic integrity in western Oregon streams. *North American Journal of Fisheries Management* 23:450-461.

Schilling, J. 1990. A history of the Questa Molybdenum (Moly) Mines, Taos County, New Mexico. Pages 381-386. IN: *New Mexico Geological Society Guidebook.* 41st Field Conference.

URS Corporation. 2002. *Molycorp Remedial Investigation/Feasibility Study Work Plan.* Prepared for Molycorp, Inc., Questa, NM.

U.S. Department of Health, Education, and Welfare. 1966. *A Water Quality Survey: Red River of the Rio Grande, New Mexico*. Federal Water Pollution Control Administration, Ada, OK.

Van Deventer, J.S., and W.S. Platts. 1983. Sampling and estimating fish populations from streams. *Transactions of the North American Wildlife and Natural Resource Conference* 48:349-354.

Van Deventer, J.S., and W.S. Platts. 1989. *Microcomputer Software System for Generating Population Statistics from Electrofishing Data - User's Guide for MicroFish 3.0.* General Technical Report INT-265/1989. U.S. Forest Service.

Vinson, M.R., and C.P. Hawkins. 1996. Effects of sampling area and subsampling procedure on comparisons of taxa richness among streams. *Journal of the North American Benthological Society* 15:392-399.

Wallace, J.B., J.W. Grubaugh, and M.R. Whiles. 1996. Biotic indices and stream ecosystem processes: results from an experimental study. *Ecological Applications* 6:140-151.

Wiederholm, T. 1989. Responses of aquatic insects to environmental pollution. Pages 508-557. IN: Resh, V.H., and D.M. Rosenberg (eds.). *The Ecology of Aquatic Insects.* Praeger Scientific, New York, NY.

Wilhm, J.L. 1970. Range of diversity index in benthic macroinvertebrate populations. *Journal of Water Pollution Control Federation* 42:R221-R224.

Woodward-Clyde. 1996. *Red River, New Mexico, Benthic Macroinvertebrate Survey - December 1995.*

Zar, J.H. 1999. *Biostatistical Analysis*, 4th Edition. Prentice Hall, Upper Saddle River, NJ.

Appendix A

Fish Data

MOLYCORP
09/29/2005
UPSTREAM OF TOWN

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRK	1	268	178	0.92	201.3	88.4
BRK	1	262	160	0.89	187.9	85.2
BRK	1	225	132	1.16	118.2	111.7
BRK	1	220	102	0.96	110.4	92.4
BRK	1	205	76	0.88	89.1	85.3
BRK	1	196	72	0.96	77.7	92.7
BRK	1	82	5	0.91		
BRK	1	81	7	1.32		
BRK	1	72	3.5	0.94		
BRK	1	70	3.4	0.99		
BRK	1	68	3.4	1.08		
BRK	1	67	5	1.66		
BRK	1	67	3	1.00		
BRK	1	64	2.9	1.11		
BRK	1	62	2.5	1.05		
BRN	1	300	285	1.06	289.9	98.3
BRN	1	290	272	1.12	262.2	103.7
BRN	1	290	252	1.03	262.2	96.1
BRN	1	272	186	0.92	216.9	85.8
BRN	1	257	140	0.82	183.3	76.4
BRN	1	255	160	0.96	179.1	89.3
BRN	1	253	168	1.04	175.0	96.0
BRN	1	249	156	1.01	166.9	93.5
BRN	1	245	135	0.92	159.1	84.8
BRN	1	234	126	0.98	138.9	90.7
BRN	1	230	110	0.90	132.0	83.4
BRN	1	229	120	1.00	130.3	92.1
BRN	1	222	118	1.08	118.8	99.3
BRN	1	221	118	1.09	117.2	100.6
BRN	1	219	88	0.84	114.1	77.1
BRN	1	218	106	1.02	112.6	94.1
BRN	1	211	90	0.96	102.2	88.0
BRN	1	201	74	0.91	88.5	83.6
BRN	1	199	74	0.94	85.9	86.1
BRN	1	160	36	0.88	45.0	79.9
BRN	1	117	18	1.12		
BRN	1	114	16	1.08		
BRN	1	114	14	0.94		
BRN	1	103	10	0.92		
HYBRID	1	243	154	1.07	160.0	96.3
HYBRID	1	229	134	1.12	133.1	100.7
HYBRID	1	225	128	1.12	126.0	101.6
HYBRID	1	189	58	0.86	73.4	79.0
RBT	1	309	320	1.08	321.1	99.7
RBT	1	297	244	0.93	284.8	85.7

MOLYCORP
09/29/2005
UPSTREAM OF TOWN

BRK	2	225	114	1.00	118.2	96.4
BRK	2	184	72	1.16	64.1	112.3
BRK	2	130	22	1.00	22.3	98.8
BRK	2	123	20	1.07		
BRK	2	86	5.5	0.86		
BRK	2	71	3.6	1.01		
BRK	2	69	3.4	1.03		
BRK	2	67	3.3	1.10		
BRK	2	66	2.2	0.77		
BRK	2	62	2.4	1.01		
BRN	2	320	350	1.07	351.0	99.7
BRN	2	256	182	1.08	181.2	100.4
BRN	2	226	116	1.00	125.3	92.6
BRN	2	89	7.6	1.08		

SUMMARY

BRK		LENGTH	WEIGHT	K	Wr
	N:	25	25	25	9
	MIN:	62	2.2	0.77	85.2
	MAX:	268	178	1.66	112.3
	MEAN:	123.7	40.2	1.03	95.9

BRN		LENGTH	WEIGHT	K	Wr
	N:	28	28	28	23
	MIN:	89	7.6	0.82	76.4
	MAX:	320	350	1.12	103.7
	MEAN:	217.6	126.0	0.99	90.9

HYB		LENGTH	WEIGHT	K	Wr
	N:	4	4	4	4
	MIN:	189	58	0.86	79.0
	MAX:	243	154	1.12	101.6
	MEAN:	221.5	118.5	1.04	94.4

RBT		LENGTH	WEIGHT	K	Wr
	N:	2	2	2	2
	MIN:	297	244	0.93	85.7
	MAX:	309	320	1.08	99.7
	MEAN:	303.0	282.0	1.01	92.7

MOLYCORP
09/29/2005
UPSTREAM OF TOWN

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRK	15	10	25	± --	0.182	137	± --	12.14
BRN	24	4	28	± 1.8	0.182	154	± 9.9	42.78
HYB	4	0	4	± 0.0	0.182	22	± 0.0	5.75
RBT	2	0	2	± 0.0	0.182	11	± 0.0	6.84

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRK	15	10	25	± --	0.074	338	± --	13.59
BRN	24	4	28	± 1.8	0.074	378	± 24.3	47.63
HYB	4	0	4	± 0.0	0.074	54	± 0.0	6.40
RBT	2	0	2	± 0.0	0.074	27	± 0.0	7.61

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRK	15	10	25	± --	0.077	325	± --	28.80
BRN	24	4	28	± 1.8	0.077	364	± 23.4	101.11
HYB	4	0	4	± 0.0	0.077	52	± 0.0	13.58
RBT	2	0	2	± 0.0	0.077	26	± 0.0	16.16

MOLYCORP
09/29/05
JUNE BUG

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	295	253	0.99	275.8	91.7
BRN	1	215	97	0.98	108.1	89.8
BRN	1	174	40	0.76	57.7	69.3
BRN	1	131	18	0.80		
BRN	1	130	25	1.14		
BRN	1	110	16	1.20		
RBT	1	352	419	0.96	476.2	88.0
RBT	1	276	232	1.10	228.2	101.7
RBT	1	251	156	0.99	171.2	91.1
RBT	1	240	122	0.88	149.5	81.6
RBT	1	238	152	1.13	145.8	104.2
RBT	1	236	119	0.91	142.1	83.7
RBT	1	225	102	0.90	123.0	82.9
RBT	1	215	99	1.00	107.2	92.3
RBT	1	204	71	0.84	91.5	77.6
RBT	1	199	80	1.02		
RBT	1	155	40	1.07		
RBT	2	200	72	0.90	86.2	83.6

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	6	6	6	3
	MIN:	110	16	0.76	69.3
	MAX:	295	253	1.20	91.7
	MEAN:	175.8	74.8	0.98	83.6

RBT		LENGTH	WEIGHT	K	Wr
	N:	12	12	12	10
	MIN:	155	40	0.84	77.6
	MAX:	352	419	1.13	104.2
	MEAN:	232.6	138.7	0.98	88.7

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	6	0	6	± 0.0	0.142	42	± 0.0	6.93
RBT	11	1	12	± 0.7	0.142	85	± 4.9	25.99

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	6	0	6	± 0.0	0.057	105	± 0.0	7.85
RBT	11	1	12	± 0.7	0.057	211	± 12.3	29.27

MOLYCORP
09/29/05
JUNE BUG

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	6	0	6	± 0.0	0.062	97	± 0.0	16.00
RBT	11	1	12	± 0.7	0.062	194	± 11.3	59.32

MOLYCORP
09/26/05
ELEPHANT ROCK

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRK	1	169	50	1.04	49.5	101.0
BRK	1	150	41	1.21	34.4	119.1
BRK	1	96	8.5	0.96		
BRK	1	87	6.5	0.99		
BRK	1	86	5.5	0.86		
BRK	1	86	5.4	0.85		
BRK	1	85	5.0	0.81		
BRK	1	79	4.3	0.87		
BRK	1	73	4.0	1.03		
BRK	1	70	3.4	0.99		
BRK	1	62	3.6	1.51		
BRN	1	309	296	1.00	316.4	93.5
BRN	1	163	44	1.02	47.6	92.5
BRN	1	142	29	1.01	31.6	91.7
BRN	1	58	2.8	1.44		
HYBRID	1	171	62	1.24	53.8	115.2
RBT	1	276	210	1.00	228.2	92.0
RBT	1	266	206	1.09	204.1	100.9
RBT	1	264	180	0.98	199.5	90.2
RBT	1	262	188	1.05	195.0	96.4
RBT	1	260	178	1.01	190.5	93.4
RBT	1	255	160	0.96	179.6	89.1
RBT	1	253	142	0.88	175.4	81.0
RBT	1	251	162	1.02	171.2	94.6
RBT	1	250	176	1.13	169.2	104.0
RBT	1	247	142	0.94	163.1	87.1
RBT	1	244	140	0.96	157.2	89.1
RBT	1	242	142	1.00	153.3	92.6
RBT	1	240	134	0.97	149.5	89.6
RBT	1	237	134	1.01	144.0	93.1
RBT	1	233	118	0.93	136.7	86.3
RBT	1	230	125	1.03	131.5	95.1
RBT	1	226	110	0.95	124.7	88.2
RBT	1	223	114	1.03	119.7	95.2
RBT	1	221	110	1.02	116.5	94.4
RBT	1	214	96	0.98	105.7	90.8
RBT	1	213	84	0.87	104.2	80.6
RBT	1	198	82	0.93		
RBT	1	183	50	0.82		
BRK	2	94	7.8	0.94		
BRN	2	252	148	0.92	173.0	85.6
BRN	2	193	74	1.03	78.5	94.3
BRN	2	163	44	1.02	47.6	92.5
BRN	2	62	2.5	1.05		
RBT	2	238	138	1.02	145.8	94.6

MOLYCORP
09/26/05
ELEPHANT ROCK

RBT	2	237	132	0.99	144.0	91.7
RBT	2	227	110	0.94	126.4	87.1
BRK	3	101	9.5	0.92		
BRK	3	95	7.7	0.90		
BRK	3	75	3.7	0.88		
BRK	3	56	1.7	0.97		

SUMMARY

BRK		LENGTH	WEIGHT	K	Wr
	N:	16	16	16	2
	MIN:	56	1.7	0.81	101.0
	MAX:	169	50	1.51	119.1
	MEAN:	91.5	10.5	0.98	110.1

BRN		LENGTH	WEIGHT	K	Wr
	N:	8	8	8	6
	MIN:	58	2.5	0.92	85.6
	MAX:	309	296	1.44	94.3
	MEAN:	167.8	80.0	1.10	91.7

HYBRID		LENGTH	WEIGHT	K	Wr
	N:	1	1	1	1
	MIN:	171	62	1.24	115.2
	MAX:	171	62	1.24	115.2
	MEAN:	171.0	62.0	1.24	115.2

RBT		LENGTH	WEIGHT	K	Wr
	N:	26	26	26	24
	MIN:	183	50	0.82	80.6
	MAX:	276	210	1.13	104.0
	MEAN:	238.1	137.0	0.98	91.5

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRK	11	1	4	17	± 4.2	0.164	104	± 25.6	2.41
BRN	4	4	0	8	± 1.8	0.164	49	± 11.0	8.64
HYBRID	1	0	0	1	± 0.0	0.164	6	± 0.0	0.82
RBT	23	3	0	26	± 0.4	0.164	159	± 2.4	48.02

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRK	11	1	4	17	± 4.2	0.066	258	± 63.6	2.71
BRN	4	4	0	8	± 1.8	0.066	121	± 27.3	9.68
HYBRID	1	0	0	1	± 0.0	0.066	15	± 0.0	0.93
RBT	23	3	0	26	± 0.4	0.066	394	± 6.1	53.98

MOLYCORP
09/26/05
ELEPHANT ROCK

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRK	11	1	4	17	± 4.2	0.064	266	± 65.6	6.16
BRN	4	4	0	8	± 1.8	0.064	125	± 28.1	22.05
HYBRID	1	0	0	1	± 0.0	0.064	16	± 0.0	2.19
RBT	23	3	0	26	± 0.4	0.064	406	± 6.3	122.62

MOLYCORP
10/04/05
DOWNSTREAM OF HANSEN

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
RBT	1	310	360	1.21	324.2	111.0
RBT	1	304	330	1.17	305.6	108.0
RBT	1	287	240	1.02	256.8	93.4
RBT	1	284	248	1.08	248.8	99.7
RBT	1	257	196	1.15	183.9	106.6
RBT	1	248	157	1.03	165.1	95.1
RBT	1	242	160	1.13	153.3	104.3
RBT	1	231	161	1.31	133.2	120.9
RBT	1	227	114	0.97	126.4	90.2
RBT	1	226	116	1.00	124.7	93.0
RBT	2	230	144	1.18	131.5	109.5

SUMMARY

RBT		LENGTH	WEIGHT	K	Wr
	N:	11	11	11	11
	MIN:	226	114	0.97	90.2
	MAX:	310	360	1.31	120.9
	MEAN:	258.7	202.4	1.11	102.9

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
RBT	10	1	11	± 0.7	0.172	64	± 4.1	28.56

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
RBT	10	1	11	± 0.7	0.070	157	± 10.0	31.78

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
RBT	10	1	11	± 0.7	0.080	138	± 8.8	61.58

MOLYCORP
10/04/05
UPSTREAM OF MILL

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
RBT	1	415	920	1.29	783.4	117.4
RBT	1	399	770	1.21	695.6	110.7
RBT	1	381	550	0.99	604.9	90.9
RBT	1	374	540	1.03	572.0	94.4
RBT	1	302	266	0.97	299.6	88.8
RBT	1	274	246	1.20	223.2	110.2
RBT	1	268	210	1.09	208.8	100.6
RBT	1	257	176	1.04	183.9	95.7
RBT	1	257	174	1.03	183.9	94.6
RBT	1	251	160	1.01	171.2	93.4
RBT	1	251	156	0.99	171.2	91.1
RBT	1	242	144	1.02	153.3	93.9
RBT	1	231	142	1.15	133.2	106.6
RBT	1	231	120	0.97	133.2	90.1
RBT	1	217	126	1.23	110.3	114.3
RBT	1	217	108	1.06	110.3	97.9
RBT	1	217	98	0.96	110.3	88.9
RBT	1	216	100	0.99	108.7	92.0
RBT	1	213	105	1.09	104.2	100.7
RBT	1	207	106	1.20	95.6	110.9
RBT	1	201	78	0.96	87.5	89.2
RBT	2	257	160	0.94	183.9	87.0
RBT	2	215	94	0.95	107.2	87.7

SUMMARY

RBT		LENGTH	WEIGHT	K	Wr
	N:	23	23	23	23
	MIN:	201	78	0.94	87.0
	MAX:	415	920	1.29	117.4
	MEAN:	264.9	241.3	1.06	97.7

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
RBT	21	2	23	± 0.9	0.138	167	± 6.5	88.84

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
RBT	21	2	23	± 0.9	0.056	411	± 16.1	99.17

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
RBT	21	2	23	± 0.9	0.066	348	± 13.6	185.13

MOLYCORP
10/03/05
UPSTREAM OF COLUMBINE

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	337	510	1.33	409.1	124.7
BRN	1	317	360	1.13	341.3	105.5
RBT	1	339	385	0.99	424.9	90.6
RBT	1	335	360	0.96	410.0	87.8
RBT	1	265	188	1.01	201.8	93.2
RBT	1	264	198	1.08	199.5	99.3
RBT	1	261	192	1.08	192.7	99.6
RBT	1	261	188	1.06	192.7	97.6
RBT	2	252	156	0.97	173.3	90.0

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	2	2	2	2
	MIN:	317	360	1.13	105.5
	MAX:	337	510	1.33	124.7
	MEAN:	327	435.0	1.23	115.1

RBT		LENGTH	WEIGHT	K	Wr
	N:	7	7	7	7
	MIN:	252	156	0.96	87.8
	MAX:	339	385	1.08	99.6
	MEAN:	282.4	238.1	1.02	94.0

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	2	0	2	± 0.0	0.155	13	± 0.0	12.47
RBT	6	1	7	± 1.0	0.155	45	± 6.5	23.62

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	2	0	2	± 0.0	0.063	32	± 0.0	13.92
RBT	6	1	7	± 1.0	0.063	111	± 15.9	26.43

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	2	0	2	± 0.0	0.066	30	± 0.0	28.77
RBT	6	1	7	± 1.0	0.066	106	± 15.2	55.64

MOLYCORP
09/29/05
DOWNSTREAM OF CABIN SPRINGS

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	261	192	1.08	191.9	100.0
BRN	1	256	174	1.04	181.2	96.0
BRN	1	212	98	1.03	103.7	94.5
BRN	1	211	88	0.94	102.2	86.1
BRN	1	172	60	1.18	55.8	107.5
BRN	1	121	18	1.02		
RBT	1	272	214	1.06	218.3	98.0
RBT	1	250	164	1.05	169.2	96.9
RBT	1	241	138	0.99	151.4	91.1
RBT	1	239	136	1.00	147.7	92.1
RBT	1	235	156	1.20	140.3	111.2
BRN	2	205	80	0.93	93.8	85.2
BRN	2	118	15	0.91		

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	8	8	8	6
	MIN:	118	15	0.91	85.2
	MAX:	261	192	1.18	107.5
	MEAN:	194.5	90.6	1.02	94.9

RBT		LENGTH	WEIGHT	K	Wr
	N:	5	5	5	5
	MIN:	235	136	0.99	91.1
	MAX:	272	214	1.20	111.2
	MEAN:	247.4	161.6	1.06	97.9

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	6	2	8	± 2.0	0.143	56	± 14.0	11.19
RBT	5	0	5	± 0.0	0.143	35	± 0.0	12.47

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	6	2	8	± 2.0	0.058	138	± 34.5	12.50
RBT	5	0	5	± 0.0	0.058	86	± 0.0	13.90

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	6	2	8	± 2.0	0.081	99	± 24.7	19.77
RBT	5	0	5	± 0.0	0.081	62	± 0.0	22.09

MOLYCORP
09/28/05
GOATHILL

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	157	40	1.03	42.6	93.9
BRN	1	148	39	1.20	35.8	109.1
BRN	1	147	33	1.04	35.0	94.2
BRN	1	146	34	1.09	34.3	99.0
BRN	1	146	32	1.03	34.3	93.2
BRN	1	131	23	1.02		
BRN	1	116	16	1.03		
BRN	1	98	10	1.06		
RBT	1	296	250	0.96	282.0	88.7
RBT	1	275	222	1.07	225.7	98.4
RBT	1	268	170	0.88	208.8	81.4
RBT	1	240	130	0.94	149.5	86.9
RBT	1	236	165	1.26	142.1	116.1
RBT	1	228	128	1.08	128.1	100.0
RBT	1	227	98	0.84	126.4	77.6
RBT	1	224	110	0.98	121.4	90.6
RBT	2	255	175	1.06	179.6	97.4

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	8	8	8	5
	MIN:	98	10	1.02	93.2
	MAX:	157	40	1.20	109.1
	MEAN:	136.1	28.4	1.06	97.9

RBT		LENGTH	WEIGHT	K	Wr
	N:	9	9	9	9
	MIN:	224	98	0.84	77.6
	MAX:	296	250	1.26	116.1
	MEAN:	249.9	160.9	1.01	93.0

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	8	0	8	± 0.0	0.171	47	± 0.0	2.94
RBT	8	1	9	± 0.9	0.171	53	± 5.3	18.80

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	8	0	8	± 0.0	0.069	116	± 0.0	3.29
RBT	8	1	9	± 0.9	0.069	130	± 13.0	20.92

MOLYCORP
09/28/05
GOATHILL

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	8	0	8	± 0.0	0.075	107	± 0.0	6.70
RBT	8	1	9	± 0.9	0.075	120	± 12.0	42.57

MOLYCORP
09/27/05
QUESTA RANGER STATION

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	252	154	0.96	173.0	89.0
BRN	1	163	44	1.02	47.6	92.5
RBT	1	284	210	0.92	248.8	84.4
RBT	1	270	206	1.05	213.5	96.5
RBT	1	265	204	1.10	201.8	101.1
BRN	2	205	82	0.95	93.8	87.4
BRN	2	171	52	1.04	54.8	94.8
BRN	2	162	40	0.94	46.7	85.6
BRN	2	137	20	0.78		
RBT	3	287	238	1.01	256.8	92.7

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	6	6	6	5
	MIN:	137	20	0.78	85.6
	MAX:	252	154	1.04	94.8
	MEAN:	181.7	65.3	0.95	89.9

RBT		LENGTH	WEIGHT	K	Wr
	N:	4	4	4	4
	MIN:	265	204	0.92	84.4
	MAX:	287	238	1.10	101.1
	MEAN:	276.5	214.5	1.02	93.7

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	2	4	0	6	± 2.6	0.156	38	± 16.7	5.47
RBT	3	0	1	4	± 1.7	0.156	26	± 10.9	12.30

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	2	4	0	6	± 2.6	0.063	95	± 41.3	6.20
RBT	3	0	1	4	± 1.7	0.063	63	± 27.0	13.51

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	2	4	0	6	± 2.6	0.068	88	± 38.2	12.67
RBT	3	0	1	4	± 1.7	0.068	59	± 25.0	27.90

MOLYCORP
09/27/05
UPSTREAM OF HIGHWAY 522

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	204	81	0.95	92.5	87.6
BRN	1	186	70	1.09	70.4	99.5
BRN	1	173	50	0.97	56.8	88.1
BRN	1	165	41	0.91	49.3	83.1
BRN	1	163	45	1.04	47.6	94.6
BRN	1	159	31	0.77	44.2	70.1
BRN	1	120	19	1.10		
RBT	1	328	335	0.95	384.6	87.1
RBT	1	300	310	1.15	293.6	105.6
RBT	1	293	238	0.95	273.4	87.1
RBT	1	286	228	0.97	254.1	89.7
RBT	1	284	226	0.99	248.8	90.8
RBT	1	282	248	1.11	243.5	101.8
RBT	1	275	175	0.84	225.7	77.5
RBT	1	274	188	0.91	223.2	84.2
RBT	1	273	174	0.86	220.8	78.8
RBT	1	271	204	1.02	215.9	94.5
RBT	1	271	164	0.82	215.9	76.0
RBT	1	270	203	1.03	213.5	95.1
RBT	1	269	179	0.92	211.1	84.8
RBT	1	263	173	0.95	197.2	87.7
RBT	1	262	182	1.01	195.0	93.4
RBT	1	262	178	0.99	195.0	91.3
RBT	1	260	178	1.01	190.5	93.4
RBT	1	258	163	0.95	186.1	87.6
RBT	1	257	163	0.96	183.9	88.6
RBT	1	257	159	0.94	183.9	86.4
RBT	1	256	166	0.99	181.8	91.3
RBT	1	255	158	0.95	179.6	88.0
RBT	1	254	166	1.01	177.5	93.5
RBT	1	254	158	0.96	177.5	89.0
RBT	1	254	154	0.94	177.5	86.8
RBT	1	253	168	1.04	175.4	95.8
RBT	1	252	166	1.04	173.3	95.8
RBT	1	252	153	0.96	173.3	88.3
RBT	1	250	161	1.03	169.2	95.2
RBT	1	249	152	0.98	167.2	90.9
RBT	1	249	147	0.95	167.2	87.9
RBT	1	249	132	0.86	167.2	79.0
RBT	1	248	152	1.00	165.1	92.0
RBT	1	248	139	0.91	165.1	84.2
RBT	1	248	130	0.85	165.1	78.7
RBT	1	246	170	1.14	161.1	105.5
RBT	1	245	163	1.11	159.2	102.4
RBT	1	243	130	0.91	155.3	83.7

MOLYCORP
09/27/05
UPSTREAM OF HIGHWAY 522

RBT	1	243	114	0.79	155.3	73.4
RBT	1	242	135	0.95	153.3	88.0
RBT	1	242	131	0.92	153.3	85.4
RBT	1	241	127	0.91	151.4	83.9
RBT	1	240	149	1.08	149.5	99.6
RBT	1	239	137	1.00	147.7	92.8
RBT	1	239	132	0.97	147.7	89.4
RBT	1	238	150	1.11	145.8	102.9
RBT	1	238	131	0.97	145.8	89.8
RBT	1	236	126	0.96	142.1	88.7
RBT	1	236	126	0.96	142.1	88.7
RBT	1	236	114	0.87	142.1	80.2
RBT	1	234	126	0.98	138.5	91.0
RBT	1	233	132	1.04	136.7	96.5
RBT	1	232	115	0.92	135.0	85.2
RBT	1	232	112	0.90	135.0	83.0
RBT	1	232	112	0.90	135.0	83.0
RBT	1	228	107	0.90	128.1	83.6
RBT	1	227	128	1.09	126.4	101.3
RBT	1	226	106	0.92	124.7	85.0
RBT	1	222	98	0.90	118.1	83.0
RBT	1	222	96	0.88	118.1	81.3
RBT	1	222	92	0.84	118.1	77.9
RBT	1	220	112	1.05	114.9	97.4
RBT	1	218	98	0.95	111.8	87.6
RBT	1	216	99	0.98	108.7	91.0
RBT	1	216	98	0.97	108.7	90.1
RBT	1	215	94	0.95	107.2	87.7
RBT	1	213	104	1.08	104.2	99.8
RBT	1	212	92	0.97	102.8	89.5
RBT	1	212	90	0.94	102.8	87.6
RBT	1	210	91	0.98	99.9	91.1
RBT	1	209	95	1.04	98.4	96.5
RBT	1	208	92	1.02	97.0	94.8
RBT	1	204	112	1.32	91.5	122.4
RBT	1	204	77	0.91	91.5	84.2
BRN	2	167	54	1.16	51.1	105.6
BRN	2	163	42	0.97	47.6	88.3
BRN	2	160	42	1.03	45.0	93.2
BRN	2	156	38	1.00	41.8	90.9
BRN	2	153	40	1.12	39.5	101.4
BRN	2	88	7.5	1.10		
RBT	2	264	182	0.99	199.5	91.2
RBT	2	242	154	1.09	153.3	100.4
RBT	2	240	121	0.88	149.5	80.9
RBT	2	227	108	0.92	126.4	85.5
RBT	2	204	77	0.91	91.5	84.2

MOLYCORP
09/27/05
UPSTREAM OF HIGHWAY 522

RBT	2	137	28	1.09		
BRN	3	229	106	0.88	130.3	81.4
RBT	3	260	184	1.05	190.5	96.6
RBT	3	259	184	1.06	188.3	97.7
RBT	3	244	147	1.01	157.2	93.5
RBT	3	241	145	1.04	151.4	95.8
RBT	3	236	120	0.91	142.1	84.4
RBT	3	209	95	1.04	98.4	96.5

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	14	14	14	12
	MIN:	88	7.5	0.77	70.1
	MAX:	229	106	1.16	105.6
	MEAN:	163.3	47.6	1.01	90.3

RBT		LENGTH	WEIGHT	K	Wr
	N:	86	86	86	85
	MIN:	137	28	0.79	73.4
	MAX:	328	335	1.32	122.4
	MEAN:	243.0	144.5	0.98	90.0

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	7	6	1	14	± 2.7	0.265	53	± 10.2	5.56
RBT	74	6	6	86	± 1.5	0.265	325	± 5.7	103.53

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	7	6	1	14	± 2.7	0.107	131	± 25.2	6.24
RBT	74	6	6	86	± 1.5	0.107	804	± 14.0	116.18

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	7	6	1	14	± 2.7	0.101	139	± 26.7	14.59
RBT	74	6	6	86	± 1.5	0.101	851	± 14.9	271.10

MOLYCORP
09/27/2005
DOWNSTREAM OF HIGHWAY 522

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	WS	Wr
BRN	1	270	187	0.95	212.2	88.1
BRN	1	268	182	0.95	207.6	87.7
BRN	1	264	104	0.57	198.5	52.4
BRN	1	257	180	1.06	183.3	98.2
BRN	1	242	149	1.05	153.4	97.1
BRN	1	232	127	1.02	135.4	93.8
BRN	1	230	125	1.03	132.0	94.7
BRN	1	202	83	1.01	89.8	92.4
BRN	1	200	72	0.90	87.2	82.5
BRN	1	195	66	0.89	80.9	81.6
BRN	1	191	65	0.93	76.1	85.4
BRN	1	190	57	0.83	74.9	76.1
BRN	1	188	53	0.80	72.6	73.0
BRN	1	181	51	0.86	64.9	78.6
BRN	1	175	41	0.77	58.7	69.8
BRN	1	173	41	0.79	56.8	72.2
BRN	1	170	45	0.92	53.9	83.5
BRN	1	164	48	1.09	48.5	99.1
BRN	1	124	14	0.73		
RBT	1	330	362	1.01	391.7	92.4
RBT	1	287	221	0.93	256.8	86.1
RBT	1	285	213	0.92	251.4	84.7
RBT	1	272	182	0.90	218.3	83.4
RBT	1	267	190	1.00	206.4	92.0
RBT	1	265	180	0.97	201.8	89.2
RBT	1	264	180	0.98	199.5	90.2
RBT	1	259	165	0.95	188.3	87.6
RBT	1	257	177	1.04	183.9	96.2
RBT	1	252	195	1.22	173.3	112.5
RBT	1	250	143	0.92	169.2	84.5
RBT	1	248	150	0.98	165.1	90.8
RBT	1	246	150	1.01	161.1	93.1
RBT	1	243	140	0.98	155.3	90.2
RBT	1	243	139	0.97	155.3	89.5
RBT	1	242	137	0.97	153.3	89.3
RBT	1	242	133	0.94	153.3	86.7
RBT	1	239	157	1.15	147.7	106.3
RBT	1	231	112	0.91	133.2	84.1
RBT	1	228	117	0.99	128.1	91.4
RBT	1	227	125	1.07	126.4	98.9
RBT	1	225	108	0.95	123.0	87.8
RBT	1	212	93	0.98	102.8	90.5
RBT	1	165	57	1.27		
BRN	2	228	112	0.94	128.6	87.1
BRN	2	192	66	0.93	77.3	85.4

MOLYCORP
09/27/2005
DOWNSTREAM OF HIGHWAY 522

BRN	2	175	48	0.90	58.7	81.7
BRN	2	174	54	1.03	57.7	93.5
BRN	2	168	46	0.97	52.0	88.4
RBT	2	252	184	1.15	173.3	106.2
WS	2	96	9.6	1.09		

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	24	24	24	23
	MIN:	124	14	0.57	52.4
	MAX:	270	187	1.09	99.1
	MEAN:	202.2	84.0	0.91	84.4

RBT		LENGTH	WEIGHT	K	Wr
	N:	25	25	25	24
	MIN:	165	57	0.90	83.4
	MAX:	330	362	1.27	112.5
	MEAN:	249.2	160.4	1.01	91.8

WS		LENGTH	WEIGHT	K	Wr
	N:	1	1	1	N/A
	MIN:	96	9.6	1.09	N/A
	MAX:	96	9.6	1.09	N/A
	MEAN:	96.0	9.6	1.09	N/A

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	19	5	24	± 2.5	0.197	122	± 12.7	22.59
RBT	24	1	25	± 0.4	0.197	127	± 2.0	44.91
WS	0	1	1	± --	0.197	5	± --	0.11

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	19	5	24	± 2.5	0.080	300	± 31.3	25.20
RBT	24	1	25	± 0.4	0.080	313	± 5.0	50.21
WS	0	1	1	± --	0.080	13	± --	0.12

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	19	5	24	± 2.5	0.068	353	± 36.8	65.37
RBT	24	1	25	± 0.4	0.068	368	± 5.9	130.13
WS	0	1	1	± --	0.068	15	± --	0.32

MOLYCORP
09/27/2005
DOWNSTREAM OF OUTFALL 002

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	420	920	1.24	785.4	117.1
BRN	1	376	520	0.98	565.9	91.9
BRN	1	310	278	0.93	319.5	87.0
BRN	1	309	264	0.89	316.4	83.4
BRN	1	307	230	0.79	310.4	74.1
BRN	1	258	163	0.95	185.4	87.9
BRN	1	252	146	0.91	173.0	84.4
BRN	1	245	148	1.01	159.1	93.0
BRN	1	244	138	0.95	157.2	87.8
BRN	1	235	126	0.97	140.6	89.6
BRN	1	233	122	0.96	137.1	89.0
BRN	1	228	107	0.90	128.6	83.2
BRN	1	225	118	1.04	123.6	95.4
BRN	1	224	108	0.96	122.0	88.5
BRN	1	221	102	0.94	117.2	87.0
BRN	1	219	95	0.90	114.1	83.2
BRN	1	210	91	0.98	100.8	90.3
BRN	1	209	80	0.88	99.4	80.5
BRN	1	200	72	0.90	87.2	82.5
BRN	1	197	71	0.93	83.4	85.1
BRN	1	196	73	0.97	82.2	88.9
BRN	1	195	71	0.96	80.9	87.7
BRN	1	195	68	0.92	80.9	84.0
BRN	1	194	70	0.96	79.7	87.8
BRN	1	192	68	0.96	77.3	88.0
BRN	1	186	68	1.06	70.4	96.7
BRN	1	185	62	0.98	69.2	89.5
BRN	1	184	64	1.03	68.1	93.9
BRN	1	182	60	1.00	66.0	91.0
BRN	1	182	55	0.91	66.0	83.4
BRN	1	179	61	1.06	62.8	97.1
BRN	1	178	56	0.99	61.8	90.7
BRN	1	177	59	1.06	60.7	97.1
BRN	1	176	54	0.99	59.7	90.4
BRN	1	176	52	0.95	59.7	87.1
BRN	1	174	55	1.04	57.7	95.2
BRN	1	174	53	1.01	57.7	91.8
BRN	1	168	45	0.95	52.0	86.5
BRN	1	166	45	0.98	50.2	89.6
BRN	1	164	43	0.97	48.5	88.7
BRN	1	163	47	1.09	47.6	98.8
BRN	1	157	39	1.01	42.6	91.6
BRN	1	126	20	1.00		
RBT	1	422	1050	1.40	824.0	127.4
RBT	1	289	262	1.09	262.3	99.9

MOLYCORP
09/27/2005
DOWNSTREAM OF OUTFALL 002

RBT	1	287	208	0.88	256.8	81.0
RBT	1	277	212	1.00	230.7	91.9
RBT	1	264	186	1.01	199.5	93.2
RBT	1	260	166	0.94	190.5	87.1
RBT	1	258	164	0.95	186.1	88.1
RBT	1	256	166	0.99	181.8	91.3
RBT	1	250	164	1.05	169.2	96.9
RBT	1	246	132	0.89	161.1	81.9
RBT	1	241	126	0.90	151.4	83.2
RBT	1	235	134	1.03	140.3	95.5
RBT	1	231	119	0.97	133.2	89.3
RBT	1	225	136	1.19	123.0	110.5
RBT	1	224	84	0.75	121.4	69.2
RBT	1	220	123	1.16	114.9	107.0
RBT	1	211	84	0.89	101.3	82.9
BRN	2	227	120	1.03	126.9	94.5
BRN	2	215	92	0.93	108.1	85.1
BRN	2	197	67	0.88	83.4	80.3
BRN	2	192	66	0.93	77.3	85.4
BRN	2	180	58	0.99	63.8	90.8
BRN	2	170	47	0.94	53.9	87.2
BRN	2	155	32	0.86	41.0	78.1
BRN	2	154	34	0.93	40.2	84.5
RBT	2	410	865	1.26	755.2	114.5
RBT	2	259	192	1.11	188.3	102.0
RBT	2	219	72	0.69	113.4	63.5

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	51	51	51	50
	MIN:	126	20	0.79	74.1
	MAX:	420	920	1.24	117.1
	MEAN:	209.4	111.8	0.97	88.8

RBT		LENGTH	WEIGHT	K	Wr
	N:	20	20	20	20
	MIN:	211	72	0.69	63.5
	MAX:	422	1050	1.40	127.4
	MEAN:	264.2	232.3	1.01	92.8

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	43	8	52	± 3.4	0.209	249	± 16.3	61.37
RBT	17	3	20	± 1.6	0.209	96	± 7.7	49.16

MOLYCORP
09/27/2005
DOWNSTREAM OF OUTFALL 002

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	43	8	52	± 3.4	0.085	612	± 40.0	68.42
RBT	17	3	20	± 1.6	0.085	235	± 18.8	54.59

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	43	8	52	± 3.4	0.087	598	± 39.1	147.39
RBT	17	3	20	± 1.6	0.087	230	± 18.4	117.79

MOLYCORP
09/28/05
UPSTREAM OF HATCHERY

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	258	157	0.91	185.4	84.7
BRN	1	254	143	0.87	177.1	80.8
BRN	1	239	109	0.80	147.8	73.7
BRN	1	234	112	0.87	138.9	80.6
BRN	1	227	92	0.79	126.9	72.5
BRN	1	217	82	0.80	111.1	73.8
BRN	1	198	62	0.80	84.7	73.2
BRN	1	196	53	0.70	82.2	64.5
BRN	1	189	69	1.02	73.8	93.5
BRN	1	178	39	0.69	61.8	63.1
BRN	1	168	38	0.80	52.0	73.0
BRN	1	163	28	0.65	47.6	58.8
BRN	1	141	17	0.61	31.0	54.9
BRN	2	245	128	0.87	159.1	80.4
BRN	2	216	102	1.01	109.6	93.1
BRN	2	215	93	0.94	108.1	86.1
BRN	2	189	68	1.01	73.8	92.2
BRN	2	177	38	0.69	60.7	62.6
BRN	2	176	43	0.79	59.7	72.0
BRN	2	175	42	0.78	58.7	71.5
BRN	2	166	34	0.74	50.2	67.7
RBT	2	347	412	0.99	456.0	90.4
BRN	3	234	125	0.98	138.9	90.0
BRN	3	194	70	0.96	79.7	87.8
BRN	3	171	43	0.86	54.8	78.4
RBT	3	251	173	1.09	171.2	101.0

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	24	24	24	24
	MIN:	141	17	0.61	54.9
	MAX:	258	157	1.02	93.5
	MEAN:	200.8	74.5	0.80	76.2

RBT		LENGTH	WEIGHT	K	Wr
	N:	2	2	2	2
	MIN:	251	173	0.99	90.4
	MAX:	347	412	1.09	101.0
	MEAN:	299.0	292.5	1.04	95.7

MOLYCORP
09/28/05
UPSTREAM OF HATCHERY

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	13	8	3	26	± 5.9	0.156	167	± 37.8	27.43
RBT	0	1	1	2	± --	0.156	13	± --	8.38

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	13	8	3	26	± 5.9	0.063	413	± 93.7	30.77
RBT	0	1	1	2	± --	0.063	32	± --	9.36

	1st Pass	2nd Pass	3rd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	13	8	3	26	± 5.9	0.059	441	± 100.0	72.43
RBT	0	1	1	2	± --	0.059	34	± --	21.92

MOLYCORP
09/28/05
DOWNSTREAM OF HATCHERY

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	352	410	0.94	465.4	88.1
BRN	1	337	382	1.00	409.1	93.4
BRN	1	321	300	0.91	354.2	84.7
BRN	1	312	273	0.90	325.6	83.8
BRN	1	303	266	0.96	298.6	89.1
BRN	1	293	262	1.04	270.3	96.9
BRN	1	257	203	1.20	183.3	110.7
BRN	1	257	186	1.10	183.3	101.5
BRN	1	257	165	0.97	183.3	90.0
BRN	1	242	133	0.94	153.4	86.7
BRN	1	238	140	1.04	146.0	95.9
BRN	1	238	136	1.01	146.0	93.1
BRN	1	232	136	1.09	135.4	100.5
BRN	1	231	103	0.84	133.7	77.1
BRN	1	228	105	0.89	128.6	81.7
BRN	1	226	114	0.99	125.3	91.0
BRN	1	222	104	0.95	118.8	87.5
BRN	1	217	102	1.00	111.1	91.8
BRN	1	217	97	0.95	111.1	87.3
BRN	1	212	113	1.19	103.7	109.0
BRN	1	212	98	1.03	103.7	94.5
BRN	1	209	98	1.07	99.4	98.6
BRN	1	204	82	0.97	92.5	88.7
BRN	1	202	84	1.02	89.8	93.5
BRN	1	202	81	0.98	89.8	90.2
BRN	1	198	71	0.91	84.7	83.9
BRN	1	197	87	1.14	83.4	104.3
BRN	1	197	73	0.95	83.4	87.5
BRN	1	194	75	1.03	79.7	94.1
BRN	1	139	31	1.15		
BRN	1	135	27	1.10		
BRN	1	120	20	1.16		
BRN	1	103	13	1.19		
HYBRID	1	84	5.8	0.98		
RBT	1	437	1090	1.31	915.8	119.0
RBT	1	394	780	1.28	669.5	116.5
RBT	1	266	196	1.04	204.1	96.0
RBT	1	260	180	1.02	190.5	94.5
RBT	1	244	180	1.24	157.2	114.5
RBT	1	238	111	0.82	145.8	76.1
RBT	1	237	119	0.89	144.0	82.7
RBT	1	235	102	0.79	140.3	72.7
RBT	1	220	109	1.02	114.9	94.8
RBT	1	220	103	0.97	114.9	89.6
RBT	1	218	96	0.93	111.8	85.9

MOLYCORP
09/28/05
DOWNSTREAM OF HATCHERY

RBT	1	188	63	0.95		
BRN	2	276	212	1.01	226.5	93.6
BRN	2	228	113	0.95	128.6	87.9
BRN	2	228	108	0.91	128.6	84.0
BRN	2	215	102	1.03	108.1	94.4
BRN	2	200	71	0.89	87.2	81.4
BRN	2	198	82	1.06	84.7	96.8
BRN	2	186	59	0.92	70.4	83.9
BRN	2	180	61	1.05	63.8	95.5
BRN	2	176	60	1.10	59.7	100.4
BRN	2	106	14	1.18		
RBT	2	473	1100	1.04	1163.5	94.5
RBT	2	245	133	0.90	159.2	83.6
RBT	2	234	128	1.00	138.5	92.4
RBT	2	233	116	0.92	136.7	84.8
RBT	2	215	93	0.94	107.2	86.7
RBT	2	208	92	1.02	97.0	94.8

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	43	43	43	38
	MIN:	103	13	0.84	77.1
	MAX:	352	410	1.20	110.7
	MEAN:	220.9	126.8	1.02	91.9

HYBRID		LENGTH	WEIGHT	K	Wr
	N:	1	1	1	N/A
	MIN:	84	5.8	0.98	N/A
	MAX:	84	5.8	0.98	N/A
	MEAN:	84.0	5.8	0.98	N/A

RBT		LENGTH	WEIGHT	K	Wr
	N:	18	18	18	17
	MIN:	188	63	0.79	72.7
	MAX:	473	1100	1.31	119.0
	MEAN:	264.7	266.2	1.00	92.9

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	33	10	46	± 6.7	0.194	237	± 34.5	66.25
HYBRID	1	0	1	± 0.0	0.194	5	± 0.0	0.06
RBT	12	6	21	± 9.7	0.194	108	± 50.0	63.38

MOLYCORP
09/28/05
DOWNSTREAM OF HATCHERY

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	33	10	46	± 6.7	0.079	582	± 84.8	73.80
HYBRID	1	0	1	± 0.0	0.079	13	± 0.0	0.08
RBT	12	6	21	± 9.7	0.079	266	± 122.8	70.81

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	33	10	46	± 6.7	0.068	676	± 98.5	188.97
HYBRID	1	0	1	± 0.0	0.068	15	± 0.0	0.19
RBT	12	6	21	± 9.7	0.068	309	± 142.6	181.34

MOLYCORP
09/30/05
CABRESTO CREEK

SPECIES	PASS	LENGTH	WEIGHT	K	Ws	Wr
BRK	1	211	60	0.64	97.2	61.7
BRN	1	268	192	1.00	207.6	92.5
BRN	1	245	142	0.97	159.1	89.2
BRN	1	218	108	1.04	112.6	95.9
BRN	1	216	92	0.91	109.6	84.0
BRN	1	213	92	0.95	105.1	87.5
BRN	1	205	93	1.08	93.8	99.1
BRN	1	188	56	0.84	72.6	77.1
BRN	1	184	51	0.82	68.1	74.8
BRN	1	182	56	0.93	66.0	84.9
BRN	1	170	48	0.98	53.9	89.1
BRN	1	162	32	0.75	46.7	68.5
BRN	1	158	33	0.84	43.4	76.0
BRN	1	154	37	1.01	40.2	92.0
BRN	1	154	33	0.90	40.2	82.0
BRN	1	147	32	1.01	35.0	91.3
BRN	1	139	35	1.30		
BRN	1	137	25	0.97		
BRN	1	129	23	1.07		
BRN	1	120	17	0.98		
BRN	1	118	16	0.97		
HYBRID	1	224	114	1.01	124.3	91.7
HYBRID	1	217	84	0.82	112.6	74.6
HYBRID	1	201	71	0.87	88.8	79.9
HYBRID	1	198	72	0.93	84.8	84.9
HYBRID	1	198	71	0.91	84.8	83.7
HYBRID	1	193	76	1.06	78.3	97.0
HYBRID	1	190	59	0.86	74.6	79.1
HYBRID	1	189	74	1.10	73.4	100.8
HYBRID	1	189	70	1.04	73.4	95.4
HYBRID	1	187	63	0.96	71.0	88.7
HYBRID	1	183	57	0.93	66.4	85.8
HYBRID	1	183	55	0.90	66.4	82.8
HYBRID	1	182	60	1.00	65.3	91.9
HYBRID	1	181	56	0.94	64.2	87.2
HYBRID	1	181	53	0.89	64.2	82.6
HYBRID	1	180	58	0.99	63.1	91.9
HYBRID	1	179	52	0.91	62.0	83.8
HYBRID	1	178	52	0.92	61.0	85.3
HYBRID	1	178	48	0.85	61.0	78.7
HYBRID	1	174	50	0.95	56.8	88.0
HYBRID	1	165	46	1.02	48.2	95.4
HYBRID	1	154	39	1.07	38.9	100.2
HYBRID	1	152	36	1.03	37.4	96.3
HYBRID	1	128	21	1.00		
HYBRID	1	114	14	0.94		

MOLYCORP
09/30/05
CABRESTO CREEK

HYBRID	1	57	1.5	0.81		
HYBRID	1	55	1.6	0.96		
HYBRID	1	47	0.9	0.87		
RBT	1	272	192	0.95	218.3	87.9
RBT	1	262	170	0.95	195.0	87.2
RBT	1	251	154	0.97	171.2	89.9
RBT	1	249	152	0.98	167.2	90.9
RBT	1	226	124	1.07	124.7	99.4
RBT	1	223	93	0.84	119.7	77.7
RBT	1	222	91	0.83	118.1	77.0
RBT	1	218	88	0.85	111.8	78.7
RBT	1	215	94	0.95	107.2	87.7
RBT	1	213	92	0.95	104.2	88.3
RBT	1	211	92	0.98	101.3	90.8
RBT	1	211	91	0.97	101.3	89.8
BRN	2	232	112	0.90	135.4	82.7
HYBRID	2	205	86	1.00	94.4	91.1
HYBRID	2	186	62	0.96	69.9	88.8

SUMMARY

		LENGTH	WEIGHT	K	Wr
BRK	N:	1	1	1	1
	MIN:	211	60	0.64	61.7
	MAX:	211	60	0.64	61.7
	MEAN:	211.0	60.0	0.64	61.7

		LENGTH	WEIGHT	K	Wr
BRN	N:	21	21	21	16
	MIN:	118	16	0.75	68.5
	MAX:	268	192	1.30	99.1
	MEAN:	178.0	63.1	0.96	85.4

		LENGTH	WEIGHT	K	Wr
HYBRID	N:	30	30	30	48
	MIN:	47	0.9	0.81	74.6
	MAX:	224	114	1.10	100.8
	MEAN:	168.3	53.4	0.95	88.2

		LENGTH	WEIGHT	K	Wr
RBT	N:	12	12	12	12
	MIN:	211	88	0.83	77.0
	MAX:	272	192	1.07	99.4
	MEAN:	231.1	119.4	0.94	87.1

MOLYCORP
09/30/05
CABRESTO CREEK

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRK	1	0	1	± 0.0	0.069	14	± 0.0	1.85
BRN	20	1	21	± 0.5	0.069	304	± 7.2	42.29
HYBRID	28	2	30	± 0.8	0.069	435	± 11.6	51.21
RBT	12	0	12	± 0.0	0.069	174	± 0.0	45.80

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRK	1	0	1	± 0.0	0.028	36	± 0.0	2.16
BRN	20	1	21	± 0.5	0.028	750	± 17.9	47.33
HYBRID	28	2	30	± 0.8	0.028	1071	± 28.6	57.19
RBT	12	0	12	± 0.0	0.028	429	± 0.0	51.22

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRK	1	0	1	± 0.0	0.059	17	± 0.0	2.25
BRN	20	1	21	± 0.5	0.059	356	± 8.5	49.52
HYBRID	28	2	30	± 0.8	0.059	508	± 13.6	59.80
RBT	12	0	12	± 0.0	0.059	203	± 0.0	53.44

MOLYCORP
09/30/2005
COLUMBINE CREEK

SPECIES	PASS	LENGTH (mm)	WEIGHT (g)	K	Ws	Wr
BRN	1	294	255	1.00	273.1	93.4
BRN	1	273	202	0.99	219.2	92.1
BRN	1	266	183	0.97	203.0	90.1
BRN	1	263	178	0.98	196.3	90.7
BRN	1	253	170	1.05	175.0	97.1
BRN	1	243	128	0.89	155.3	82.4
BRN	1	241	155	1.11	151.5	102.3
BRN	1	238	124	0.92	146.0	84.9
BRN	1	231	113	0.92	133.7	84.5
BRN	1	228	124	1.05	128.6	96.4
BRN	1	225	108	0.95	123.6	87.3
BRN	1	222	110	1.01	118.8	92.6
BRN	1	221	108	1.00	117.2	92.1
BRN	1	214	108	1.10	106.6	101.3
BRN	1	210	92	0.99	100.8	91.3
BRN	1	208	90	1.00	98.0	91.9
BRN	1	189	66	0.98	73.8	89.5
BRN	1	188	72	1.08	72.6	99.1
BRN	1	188	63	0.95	72.6	86.8
BRN	1	186	68	1.06	70.4	96.7
BRN	1	177	58	1.05	60.7	95.5
BRN	1	177	49	0.88	60.7	80.7
BRN	1	176	51	0.94	59.7	85.4
BRN	1	173	46	0.89	56.8	81.0
BRN	1	170	46	0.94	53.9	85.3
BRN	1	168	43	0.91	52.0	82.6
BRN	1	167	44	0.94	51.1	86.1
BRN	1	165	40	0.89	49.3	81.1
BRN	1	163	44	1.02	47.6	92.5
BRN	1	160	39	0.95	45.0	86.6
BRN	1	156	36	0.95	41.8	86.2
BRN	1	136	26	1.03		
BRN	1	129	19	0.89		
BRN	1	125	18	0.92		
BRN	1	123	17	0.91		
BRN	1	122	13	0.72		
BRN	1	113	13	0.90		
BRN	1	89	6	0.85		
BRN	2	258	172	1.00	185.4	92.7
BRN	2	192	68	0.96	77.3	88.0
BRN	2	167	46	0.99	51.1	90.0
BRN	2	157	38	0.98	42.6	89.2
BRN	2	132	21	0.91		
BRN	2	117	14	0.87		
BRN	2	113	13	0.90		

MOLYCORP
09/30/2005
COLUMBINE CREEK

SUMMARY

BRN		LENGTH	WEIGHT	K	Wr
	N:	45	45	45	35
	MIN:	89	6	0.72	80.7
	MAX:	294	255	1.11	102.3
	MEAN:	186.8	77.7	0.96	89.9

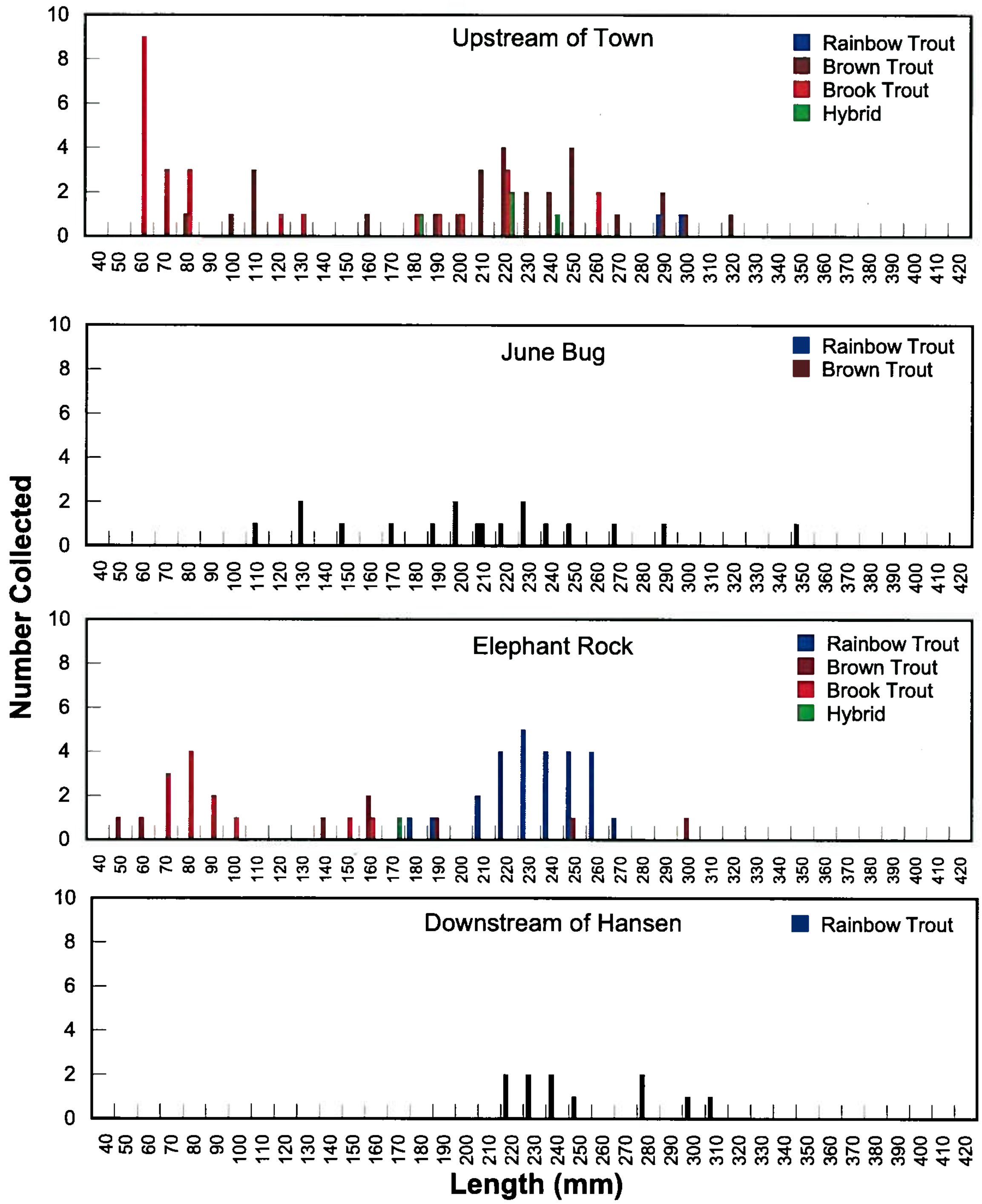
	1st Pass	2nd Pass	Pop Est	95% CI		Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRN	38	7	46	±	3.2	0.088	523	± 36.4	89.59

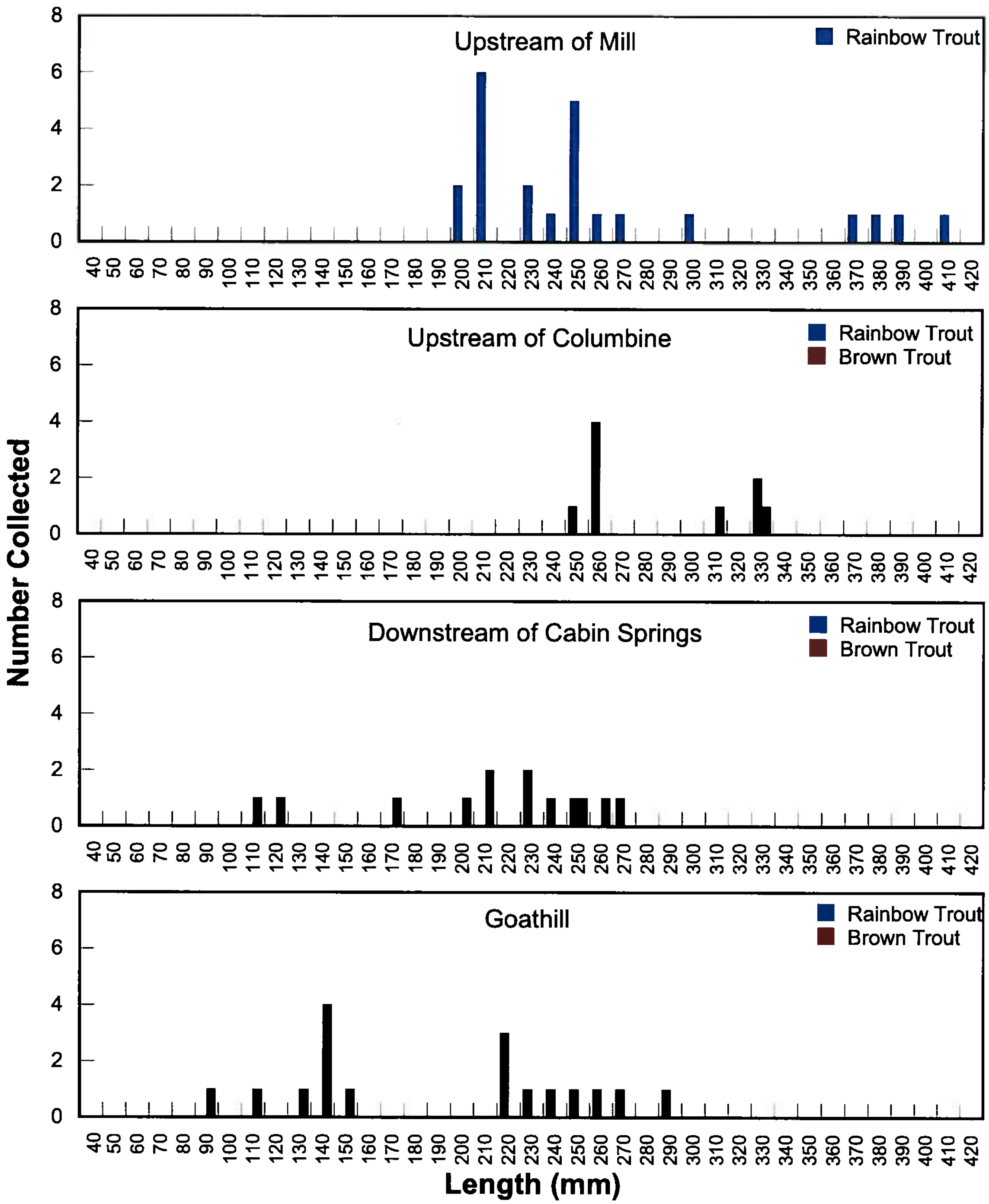
	1st Pass	2nd Pass	3rd Pass		Pop Est	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRN	38	7	46	±	3.2	0.036	1278	± 88.9	99.30

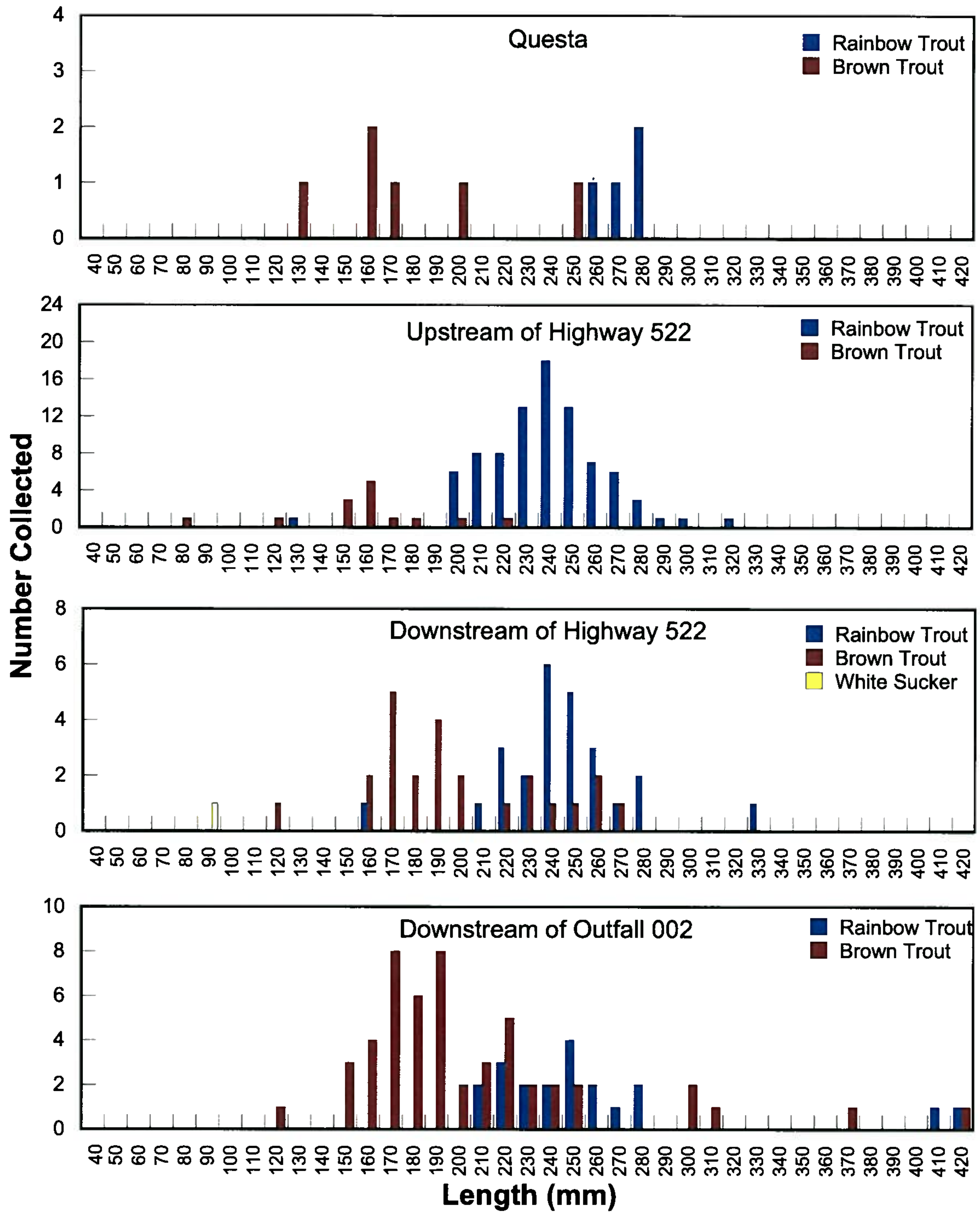
	1st Pass	2nd Pass	3rd Pass		Pop Est	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRN	38	7	46	±	3.2	0.058	793	± 55.2	135.84

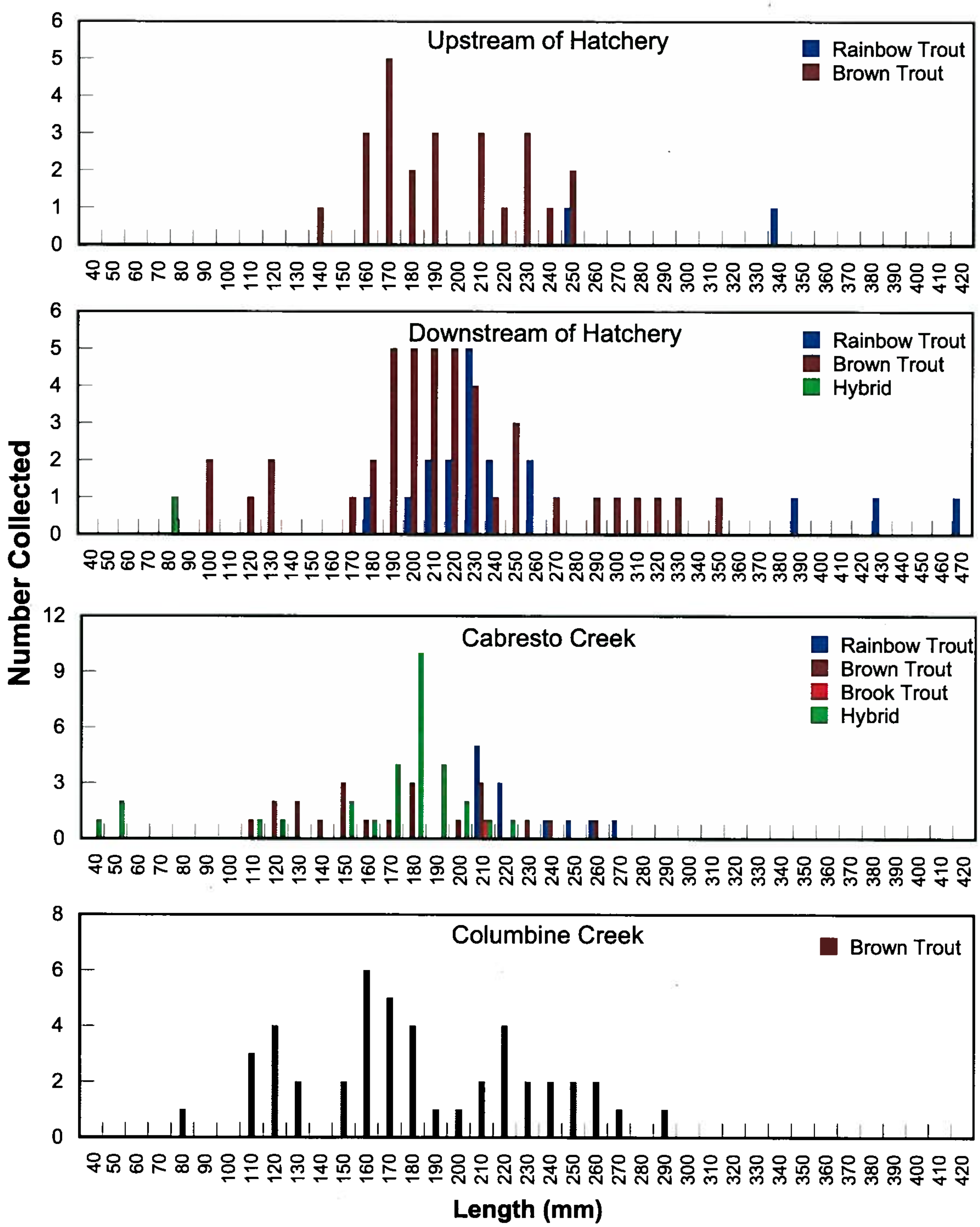
Appendix B

Fish Length-Frequency Histograms


Upstream of Town
Rainbow Trout
Brown Trout
Brook Trout
Hybrid
June Bug
Rainbow Trout
Brown Trout
Elephant Rock
Rainbow Trout
Brown Trout
Brook Trout
Hybrid
Downstream of Hansen
Rainbow Trout
Number Collected
Length (mm)


Upstream of Mill
Rainbow Trout
Upstream of Columbine
Rainbow Trout
Brown Trout
Downstream of Cabin Springs
Rainbow Trout
Brown Trout
Goathill
Rainbow Trout
Brown Trout
Number Collected
Length (mm)


Questa
Upstream of Highway 522
Downstream of Highway 522
Downstream of Outfall 002
Rainbow Trout
Brown Trout
White Sucker
Number Collected
Length (mm)


Upstream of Hatchery
Rainbow Trout
Brown Trout
Downstream of Hatchery
Rainbow Trout
Brown Trout
Hybrid
Cabresto Creek
Rainbow Trout
Brown Trout
Brook Trout
Hybrid
Columbine Creek
Brown Trout
Number Collected
Length (mm)

Appendix C

Macroinvertebrate Data

Spring 2005

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF TOWN OF RED RIVER
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1046**	**1534**	**954**	**116**	**2233**	**1177**
Baetis bicaudatus		233	116		698	209
Baetis tricaudatus	814	930			349	419
Cinygmula pa		116			116	46
Drunella dodds		23	12		244	56
Drunella grandis			12		12	5
Epeorus longimanus	116	116			116	70
Ephemerella dorothea	116	116	814	116	698	372
PLECOPTERA	**2105**	**1396**	**2454**	**1756**	**2675**	**2076**
Amphinemura sp					116	23
Doddsia occidentalis				12		2
Eucapnopsis brevicauda			12			2
Prostoia besametsa	1512	1396	1279	1628	1512	1465
Sweltsa sp.	593		1163	116	1047	584
COLEOPTERA	**1163**	**1163**	**814**	**128**	**361**	**726**
Heterlimnius corpulentus	1163	1163	814	128	361	726
TRICHOPTERA	**488**	**360**	**616**	**349**	**500**	**463**
Arctopsyche grandis			12		12	5
Brachycentrus americanus	23	244	372	233	116	198
Lepidostoma sp. E			116	116	12	49
Rhyacophila brunnea gr	349	116			116	116
Rhyacophila sibirica gr	116		116		244	95
DIPTERA	**110834**	**90376**	**42822**	**34564**	**18400**	**59400**
Antocha sp.		116	116			46
Ceratopogoninae	349	116	12		233	142
Diamesa sp.		3524				705
Dicranota sp.	233	12	116	12	361	147
Eukiefferiella sp					558	112
Micropsectra sp.	1105	2349				691
Neoplasta sp			116			23
Orthocladius/Cricotopus sp	60999	54056	32564	30982	11642	38049
Unid. Orthocladiinae	1105		1163			454
Pagastia sp.	42147	28203	6978	3442	2768	16708
Pericoma sp.	465	814	1745	116	1047	837
Prosimulium sp.					116	23
Pseudodiamesa sp	3326					665
Rhabdomastix sp					12	2
Rheocricotopus sp	1105	1186			1663	791
Tipula sp.			12	12		5
HYDRACARINA	**465**	**698**	**582**	**349**	**116**	**442**
Lebertia sp.	465	582	582	349		396
Protzia sp.					116	23
Sperchon/Sperchonopsis		116				23
TURBELLARIA	**116**	**349**	**582**		**465**	**302**
Polycelis coronata	116	349	582		465	302

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF TOWN OF RED RIVER
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA	**1279**	**4757**	**7723**	**4943**	**11689**	**6078**
Enchytraeidae			1291		896	437
Nais bretscheri	349	1710	640	186	896	756
Nais sp.	930	3047	5792	4757	9897	4885
TOTAL (#/sq. meter)	117496	100633	56547	42205	36439	70664
NUMBER OF TAXA	22	24	26	15	30	41
SHANNON-WEAVER (H')						2.34
TOTAL EPT TAXA	8	9	11	6	15	17
EPT INDEX (% of Total Taxa	36	38	42	40	50	41
EPHEMEROPTERA ABUNDANCE (% of Total Density	1	2	2	<1	6	2

MACROINVERTEBRATE DENSITY
CLIENT: MOYLCORP
SITE: JUNE BUG CAMPGROUND
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**791**	**744**	**314**	**291**	**757**	**579**
Baetis tricaudatus	407	477	233	233	523	375
Drunella grandis	314	116	58	58	105	130
Ephemerella dorothea	12				12	5
Rhithrogena hagen	58	151	23		105	67
Tricorythodes minutus					12	2
PLECOPTERA	**70**	**82**		**35**	**47**	**47**
Capniidae		12		12		5
Isocapnia sp.					12	2
Paraleuctra sp	12					2
Prostoia besametsa	35	23				12
Sweltsa sp.	23	47		23	35	26
COLEOPTERA	**12**	**12**		**12**	**23**	**11**
Heterlimnius corpulentus	12	12			23	9
Optioservus sp.				12		2
TRICHOPTERA	**70**	**35**	**81**	**23**	**35**	**48**
Arctopsyche grandis	35		35		12	16
Brachycentrus americanus	35	23	23	23	23	25
Rhyacophila sibirica gr		12	23			7
DIPTERA	**258**	**302**	**408**	**653**	**443**	**412**
Atherix pachypus	12		23			7
Brillia sp.		23				5
Ceratopogoninae	12		35	454	221	144
Conchapelopia/Thienemannimyia gr. sp				35		7
Diamesa sp.	35		35			14
Dicranota sp.		23	12		12	9
Hesperoconopa sp	12	23			12	9
Hexatoma sp		12				2
Neoplasta sp	12				12	5
Orthocladius (Euorthocladius) sp			93			19
Orthocladius/Cricotopus sp	93	116	105			63
Unid. Orthocladiinae			70	35		21
Pagastia sp.		70				14
Pericoma sp.	12	35		12		12
Polypedilum sp			35		186	44
Psilometriocnemus sp				47		9
Rheocricotopus sp.	70			35		21
Stempellinella sp				35		7
HYDRACARINA	**12**	**81**		**23**		**23**
Lebertia sp.	12	81		23		23
TURBELLARIA	**12**					**2**
Polycelis coronata	12					2

MACROINVERTEBRATE DENSITY
CLIENT: MOYLCORP
SITE: JUNE BUG CAMPGROUND
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**47**		**35**			**16**
Aeolosoma sp			12			2
Enchytraeidae	12		23			7
Nais sp.	35					7
TOTAL (#/sq. meter)	1272	1256	838	1037	1305	1138
NUMBER OF TAXA	22	17	16	14	15	38
SHANNON-WEAVER (H')						3.70
TOTAL EPT TAXA	9	8	6	5	9	13
EPT INDEX (% of Total Taxa	41	47	38	36	60	34
EPHEMEROPTERA ABUNDANCE (% of Total Density	62	59	37	28	58	51

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF ELEPHANT ROCK CAMPGROUND UPSTREAM FROM HANSEN CREEK
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**140**	**314**	**116**	**1175**	**535**	**456**
Baetis tricaudatus	70	233	58	582	244	237
Drunella grandis	12	81	58	593	291	207
Epeorus longimanus	58					12
PLECOPTERA					**58**	**12**
Sweltsa sp.					58	12
COLEOPTERA			**70**	**58**	**58**	**37**
Heterlimnius corpulentus			12		58	14
Optioservus sp.			58	58		23
TRICHOPTERA	**349**	**174**	**128**	**116**	**186**	**191**
Arctopsyche grandis		58				12
Brachycentrus americanus	349	116	128	58	186	167
Rhyacophila hyalinata gr				58		12
DIPTERA	**17852**	**16666**	**14573**	**15130**	**18005**	**16444**
Antocha sp.		58				12
Atherix pachypus	58	198	12	12	12	58
Brillia sp.					593	119
Ceratopogoninae	58					12
Cricotopus sp.	2256	3791	4303	1500	582	2486
Diamesa sp.					1175	235
Dicranota sp.			58		23	16
Hesperoconopa sp		12				2
Hexatoma sp		58	12			14
Neoplasta sp.	233	58	116	116	349	174
Orthocladius (Euorthocladius) sp	11293	8141	965	12002	14096	9299
Orthocladius/Cricotopus sp	3384	3803	7653	1500	1175	3503
Pagastia sp.		547	1442			398
Parorthocladius sp	570					114
Tipula sp.			12			2
HYDRACARINA	**116**		**291**	**174**	**116**	**140**
Lebertia sp.	58		291	174	116	128
Sperchon/Sperchonopsis	58					12
ANNELIDA						
OLIGOCHAETA	**581**	**3570**	**11956**	**2372**	**9351**	**5566**
Eiseniella tetraedra			12		12	5
Enchytraeidae	58	628	849		326	372
Nais bretscheri	58		430	93		116
Nais sp.	465	2942	10665	2279	9013	5073
MOLLUSCA						
GASTROPODA		**58**	**58**		**12**	**26**
Gyraulus sp.		58	58		12	26

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF ELEPHANT ROCK CAMPGROUND
UPSTREAM FROM HANSEN CREEK
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	19038	20782	27192	19025	28321	22872
NUMBER OF TAXA	16	16	20	13	18	31
SHANNON-WEAVER (H')						2.54
TOTAL EPT TAXA	4	4	3	4	4	7
EPT INDEX (% of Total Taxa)	25	25	15	31	22	23
EPHEMEROPTERA ABUNDANCE (% of Total Density)	1	2	<1	6	2	2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HANSEN CREEK, UPSTREAM OF MILL
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**256**	**35**	**93**	**233**	**198**	**163**
Baetis bicaudatus			12	12		5
Baetis tricaudatus	186	35	23	221	151	123
Drunella grandis	58		58		47	33
Tricorythodes minutus	12					2
PLECOPTERA	**12**	**35**		**70**	**47**	**32**
Amphinemura sp.					12	2
Sweltsa sp.	12	35		70	35	30
COLEOPTERA	**12**	**12**	**35**		**12**	**14**
Heterlimnius corpulentus		12			12	5
Optioservus divergens	12		35			9
TRICHOPTERA	**337**	**58**	**198**	**140**	**279**	**202**
Brachycentrus americanus	256	35	163	93	279	165
Hydropsyche sp			12			2
Rhyacophila coloradensis gr	58	23	23	35		28
Rhyacophila sibirica gr	23			12		7
DIPTERA	**1582**	**884**	**1582**	**2152**	**698**	**1379**
Atherix pachypus			23		12	7
Cricotopus sp.	151		198	488	105	188
Diamesa sp.	105	23	244	349	70	158
Eukiefferiella sp.		35	93	70	23	44
Neoplasta sp.	70	23	70	70	23	51
Orthocladius (Euorthocladius) sp.	1047	547	756	826	349	705
Orthocladius/Cricotopus sp.	209	256	198	279	81	205
Unid. Orthocladiinae				70		14
Rhabdomastix sp					12	2
Rheocricotopus sp.					23	5
HYDRACARINA	**116**	**12**	**12**	**140**	**70**	**70**
Lebertia sp.	116	12	12	140	70	70
ANNELIDA						
OLIGOCHAETA	**140**	**12**	**117**	**71**	**128**	**93**
Enchytraeidae	12		47	47	70	35
Nais sp.	128	12	70	12	58	56
Unid. Immature Tubificidae w/ Capilliform Chaetae				12		2
TOTAL (#/sq. meter)	2455	1048	2037	2806	1432	1953
NUMBER OF TAXA	16	12	17	17	18	26
SHANNON-WEAVER (H')						3.26
TOTAL EPT TAXA	7	4	6	6	5	10
EPT INDEX (% of Total Taxa)	44	33	35	35	28	38
EPHEMEROPTERA ABUNDANCE (% of Total Density)	10	3	5	8	14	8

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MINE SITE BOUNDARY, UPSTREAM OF MILL
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP* 3	REP 4	REP 5	COMPOSITE
INSECTA			NO INVERTEBRATES IDENTIFIED			
EPHEMEROPTERA	**360**	**512**		**453**	**326**	**413**
Baetis bicaudatus		23		23	58	26
Baetis tricaudatus	337	477		372	233	355
Drunella grandis	23	12		58	23	29
Rhithrogena hagen					12	3
PLECOPTERA	**59**			**47**	**35**	**35**
Prostoia besametsa	12					3
Sweltsa sp.	47			47	35	32
COLEOPTERA	**58**	**35**		**23**	**35**	**38**
Narpus concolor	23	12			12	12
Optioservus divergens	35	23		23	23	26
TRICHOPTERA	**791**	**732**		**1128**	**128**	**696**
Brachycentrus americanus	709	709		1047	81	637
Hydropsyche sp	70			81	47	50
Rhyacophila coloradensis gr	12	23				9
DIPTERA	**502**	**558**		**897**	**245**	**552**
Antocha sp.				12		3
Atherix pachypus	12	12		151	58	58
Ceratopogoninae				12		3
Conchapelopia/Thienemannimyia gr	12					3
Cricotopus sp.	93	128		163	35	105
Diamesa sp.	47	81		81	35	61
Dicranota sp.				12		3
Eukiefferiella sp	35			47	47	32
Hexatoma sp	12					3
Neoplasta sp		23		35	12	18
Orthocladius (Euorthocladius) sp	116	174		47		84
Orthocladius/Cricotopus sp	151	140		221	58	143
Unid. Orthocladiinae				23		6
Polypedilum sp				23		6
Rhabdomastix sp	12			12		6
Rheocricotopus sp.				58		15
Tipula sp.	12					3
HYDRACARINA	**12**	**139**		**35**	**152**	**85**
Aturus/Kongsbergia sp					12	3
Lebertia sp.	12	116		35	140	76
Sperchon/Sperchonopsis		23				6
NEMATODA		**140**				**35**
Unid. Nematoda		140				35

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MINE SITE BOUNDARY, UPSTREAM OF MILL
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP* 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**35**	**58**		**47**	**233**	**94**
Enchytraeidae		35			105	35
Nais sp.				12	105	29
Rhynchelmis sp.	35			23		15
Unid. Immature Tubificidae w/ Capilliform Chaetae		23		12	23	15
TOTAL (#/sq. meter)	1817	2174		2630	1154	1948
NUMBER OF TAXA	21	18		25	20	36
SHANNON-WEAVER (H')						3.60
TOTAL EPT TAXA	7	5		6	7	9
EPT INDEX (% of Total Taxa)	33	28		24	35	25
EPHEMEROPTERA ABUNDANCE (% of Total Density)	20	24		17	28	21

*Invertebrates contained in this sample could not be identified due to decomposition from a la of sufficient alcohol being added to the sample containe

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MILL, UPSTREAM OF COLUMBINE CREEK
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**244**	**1280**	**767**	**303**	**699**	**658**
Baetis bicaudatus	23	12	81	12	70	40
Baetis tricaudatus	221	1140	663	256	582	572
Drunella dodds		12				2
Drunella grandis		81	23	23	47	35
Rhithrogena hagen		35		12		9
PLECOPTERA	**12**		**81**			**19**
Sweltsa sp.	12		81			19
COLEOPTERA	**12**	**35**	**24**	**23**	**59**	**30**
Heterlimnius corpulentus					12	2
Narpus concolor			12			2
Optioservus sp.	12	35	12	23	47	26
TRICHOPTERA	**105**	**430**	**58**	**59**	**140**	**158**
Brachycentrus americanus	93	244	23	47	105	102
Hydropsyche sp.		105	12			23
Rhyacophila coloradensis gr	12	81	23	12	35	33
DIPTERA	**802**	**580**	**790**	**244**	**1139**	**711**
Atherix pachypus		23	35	35	23	23
Ceratopogoninae	12					2
Conchapelopia/Thienemannimyia gr. sp	23					5
Cricotopus sp.	116	58	244		395	163
Diamesa sp.	23	23	35	23		21
Dicranota sp.	12					2
Hesperoconopa sp				12		2
Neoplasta sp	58	23		58	23	32
Orthocladius (Euorthocladius) sp	93	174	174	23	221	137
Orthocladius/Cricotopus sp	442	279	302	93	442	312
Unid. Orthocladiinae					35	7
Pagastia sp.	23					5
HYDRACARINA	**23**	**23**	**93**	**12**	**198**	**70**
Lebertia sp.	23	23	81	12	186	65
Sperchon/Sperchonopsis			12		12	5
NEMATODA		**47**	**35**		**12**	**19**
Unid. Nematoda		47	35		12	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MILL, UPSTREAM OF COLUMBINE CREEK
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**35**	**82**	**47**	**47**	**35**	**49**
Enchytraeidae	35	70	35	47	12	40
Nais sp.		12	12		23	9
TOTAL (#/sq. meter)	1233	2477	1895	688	2282	1714
NUMBER OF TAXA	17	19	19	15	18	29
SHANNON-WEAVER (H')						3.33
TOTAL EPT TAXA	5	8	7	6	5	9
EPT INDEX (% of Total Taxa	29	42	37	40	28	31
EPHEMEROPTERA ABUNDANCE (% of Total Density	20	52	40	44	31	38

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF CABIN SPRINGS AND COUMBINE WELL FIELD
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1442**	**1408**	**1919**	**1176**	**873**	**1364**
Baetis bicaudatus	128	163	128	140	70	126
Baetis tricaudatus	1012	1093	1570	942	721	1068
Drunella doddsi	23	23	12	23		16
Drunella grandis	151	12	93	12	23	58
Epeorus longimanus			35	12	12	12
Ephemerella dorothea	12	12				5
Rhithrogena hageni	116	105	81	47	47	79
PLECOPTERA	**105**	**82**	**81**	**47**	**47**	**73**
Amphinemura sp.	47	23	23			19
Doddsia occidentalis		12				2
Plumiperla diversa		47				9
Prostoia besametsa			12	12		5
Pteronarcella badia			23			5
Sweltsa sp.	58		23	35	47	33
COLEOPTERA	**106**	**47**	**186**	**233**	**58**	**126**
Narpus concolor	12		12			5
Optioservus divergens	47	12	93	105	35	58
Optioservus quadrimaculatus	47	35	81	128	23	63
TRICHOPTERA	**337**	**186**	**628**	**535**	**187**	**374**
Brachycentrus americanus	221	105	442	337	140	249
Hydropsyche sp.	35	81	174	186	35	102
Lepidostoma sp. B			12			2
Rhyacophila coloradensis gr.	81			12	12	21
DIPTERA	**374**	**513**	**421**	**420**	**271**	**397**
Atherix pachypus	70	70	81	81	35	67
Brillia sp.			23	35	12	14
Ceratopogoninae	12					2
Conchapelopia/Thienemannimyia gr. sp.			23			5
Cricotopus sp.		47		12	35	19
Diamesa sp.			12			2
Eukiefferiella sp.	12	12	12	35	12	17
Gonomyia sp.					12	2
Hexatoma sp.	23		35		12	14
Limnophyes sp.			12		12	5
Neoplasta sp.	47	116	70	35	23	58
Orthocladius (Euorthocladius) sp.	70	58	12	12	12	33
Orthocladius (Symposiocladius) sp.					12	2
Orthocladius/Cricotopus sp.	128	93	93	163	58	107
Unid. Orthocladiinae		23	12		12	9
Unknown Orthocladiinae Genus		23	12			7
Pagastia sp.		12				2
Parametriocnemus sp.				23		5
Polypedilum sp.		23		12	12	9
Prosimulium sp.	12					2
Psilometriocnemus sp.			12		12	5
Rhabdomastix sp.		12				2
Rheocricotopus sp.		12				2
Simulium sp.		12		12		5
Stempellinella sp.			12			2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF CABIN SPRINGS AND COUMBINE WELL FIELD
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
HYDRACARINA	**35**	**46**	**12**	**70**	**12**	**35**
Lebertia sp.	35	23	12	47		23
Sperchon/Sperchonopsis		23		23	12	12
NEMATODA					**12**	**2**
Unid. Nematoda					12	2
ANNELIDA						
OLIGOCHAETA	**210**	**407**	**477**	**256**	**349**	**340**
Enchytraeidae	47	186	186	128	93	128
Nais sp.	70	35	186	81	221	119
Rhynchelmis sp.	93	186	105	47	35	93
TOTAL (#/sq. meter)	2609	2689	3724	2737	1809	2711
NUMBER OF TAXA	26	31	34	28	30	51
SHANNON-WEAVER (H')						3.70
TOTAL EPT TAXA	11	11	13	11	9	17
EPT INDEX (% of Total Taxa)	42	35	38	39	30	33
EPHEMEROPTERA ABUNDANCE (% of Total Density)	55	52	52	43	48	50

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: GOATHILL CAMPGROUND
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**559**	**187**	**232**	**175**	**256**	**281**
Baetis bicaudatus		35				7
Baetis tricaudatus	35			47	12	19
Drunella grandis	81	105	151	105	174	123
Ephemerella dorothea	12		35			9
Heptageniidae	12	12	23			9
Rhithrogena hageni	419	35	23	23	70	114
PLECOPTERA	**175**	**12**	**35**	**12**	**12**	**48**
Amphinemura sp.	12	12	23			9
Pteronarcella badia	23		12	12		9
Sweltsa sp.	140				12	30
COLEOPTERA	**94**	**82**	**105**	**59**	**129**	**94**
Heterlimnius corpulentus	23		12	12	12	12
Narpus concolor	12				35	9
Optioservus divergens	12	12	12		12	10
Optioservus quadrimaculatus	47	70	81	47	70	63
TRICHOPTERA	**1036**	**5897**	**698**	**3500**	**3222**	**2869**
Arctopsyche grandis	47					9
Brachycentrus americanus	837	5815	605	3477	3082	2763
Hydropsyche sp.	140	70	70	23	93	79
Lepidostoma sp. A					47	9
Micrasema bactro	12					2
Rhyacophila brunnea gr.		12				2
Rhyacophila coloradensis gr.			23			5
DIPTERA	**595**	**1967**	**443**	**583**	**560**	**828**
Antocha monticola				12		2
Atherix pachypus	314	198	47	361	221	228
Brillia sp.					12	2
Chaetocladius sp.					12	2
Clinotanypus pinguis	12				12	5
Cricotopus sp.	23		23			9
Diamesa sp.			12	12		5
Eukiefferiella sp.	35	1140		140	186	300
Heleniella sp.	23					5
Hesperoconopa sp.	47				12	12
Hexatoma sp.	12			12	12	7
Neoplasta sp.	35	47			23	21
Orthocladius (Euorthocladius) sp.			12	23		7
Orthocladius/Cricotopus sp.	70	570	337	23	58	212
Unid. Orthocladiinae			12			2
Pagastia sp.	12					2
Polypedilum sp.	12					2
Rhabdomastix sp.		12			12	5
HYDRACARINA	**47**	**233**	**128**	**349**	**152**	**182**
Aturus/Kongsbergia sp.				12	12	5
Hygrobates sp.				47		9
Lebertia sp.	47	221	93	267	105	147
Sperchon/Sperchonopsis			35	23	35	19
Testudacarus/Torrenticola		12				2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: GOATHILL CAMPGROUND
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**163**	**152**	**35**	**105**	**117**	**115**
Eiseniella tetraedra	12	35			12	12
Enchytraeidae	70	70	12	12	35	40
Nais sp.	81	47	23	93	70	63
TOTAL (#/sq. meter)	2669	8530	1676	4783	4448	4417
NUMBER OF TAXA	31	20	22	21	27	46
SHANNON-WEAVER (H')						2.46
TOTAL EPT TAXA	12	8	9	6	7	16
EPT INDEX (% of Total Taxa)	39	40	41	29	26	35
EPHEMEROPTERA ABUNDANCE (% of Total Density)	21	2	14	4	6	6

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF QUESTA RANGER STATION
SAMPLED: 03/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA				NO INVERTEBRATES FOUND		
EPHEMEROPTERA	**35**	**23**	**24**		**12**	**19**
Baetis tricaudatus	23	23			12	12
Ephemerella dorothea			12			2
Rhithrogena hagen	12		12			5
PLECOPTERA	**24**	**12**			**24**	**11**
Eucapnopsis brevicauda	12					2
Pteronarcella badia					12	2
Sweltsa sp.	12	12			12	7
COLEOPTERA	**93**	**70**				**32**
Narpus concolor	81	70				30
Optioservus sp.	12					2
TRICHOPTERA	**407**	**337**	**81**		**198**	**205**
Brachycentrus americanus	407	337	81		198	205
DIPTERA	**118**	**95**	**24**		**36**	**54**
Atherix pachypus	23					5
Brillia sp.	23	47				14
Ceratopogoninae	12	12	12			7
Eukiefferiella sp		12				2
Hesperoconopa sp	12		12			5
Hexatoma sp	12					2
Neoplasta sp					12	2
Orthocladius/Cricotopus sp	12				12	5
Unid. Orthocladiinae	12	12				5
Parametriocnemus sp		12				2
Polypedilum sp	12				12	5
ANNELIDA						
OLIGOCHAETA	**24**	**12**				**7**
Eiseniella tetraedra	12					2
Unid. Immature Tubificidae w/ Capilliform Chaetae	12	12				5
TOTAL (#/sq. meter)	701	549	129		270	328
NUMBER OF TAXA	17	10	5		7	22
SHANNON-WEAVER (H')						2.39
TOTAL EPT TAXA	5	3	3		4	7
EPT INDEX (% of Total Taxa)	29	30	60		57	32
EPHEMEROPTERA ABUNDANCE (% of Total Density)	5	4	19		4	6

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HWY 522 AND QUESTA WWTP
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**733**	**1023**	**826**	**1070**	**1104**	**951**
Baetis tricaudatus	70	81	23	105	221	100
Drunella grandis	640	570	733	884	709	707
Rhithrogena hagen	23	372	70	81	174	144
PLECOPTERA	**256**	**408**	**58**	**291**	**244**	**251**
Pteronarcella badia	244	361	35	291	209	228
Sweltsa sp.	12	47	23		35	23
COLEOPTERA	**255**	**81**	**210**	**128**	**338**	**203**
Narpus concolor	23		35	35	12	21
Optioservus divergens	81	23	47	23	105	56
Optioservus quadrimaculatus	151	58	128	70	221	126
TRICHOPTERA	**1151**	**1593**	**1268**	**1082**	**2676**	**1553**
Arctopsyche grandis		12			35	9
Brachycentrus americanus	907	1372	965	791	2361	1279
Glossosoma sp.		12				2
Hydropsyche sp.	186	174	256	291	233	228
Lepidostoma sp. A	58	23	35		47	33
Oecetis avara/disjuncta			12			2
DIPTERA	**211**	**223**	**199**	**152**	**281**	**212**
Atherix pachypus	12	12				5
Brillia sp.	23	12				7
Ceratopogoninae	23	70	47	35	35	42
Cricotopus sp.				12	12	5
Dicranota sp.			12			2
Eukiefferiella sp.	12	35			47	19
Heleniella sp					12	2
Hexatoma sp	23	47	23	47	35	35
Neoplasta sp.	12	23	58	35	47	35
Ormosia sp.			12			2
Orthocladius (Euorthocladius) sp	47	12		23	23	21
Orthocladius/Cricotopus sp	47	12			35	19
Pagastia sp.			12		35	9
Pericoma sp.	12					2
Psilometriocnemus sp			35			7
HYDRACARINA	**47**	**35**	**116**		**140**	**67**
Lebertia sp.	47	35	116		93	58
Hydryphantidae					12	2
Sperchon/Sperchonopsis					35	7
TURBELLARIA	**23**					**5**
Girardia sp.	23					5

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HWY 522 AND QUESTA WWTP
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**12**	**12**	**24**		**24**	**13**
Enchytraeidae					12	2
Lumbriculidae			12			2
Nais sp.	12		12		12	7
Unid. Immature Tubificidae w/ Capilliform Chaetae		12				2
MOLLUSCA						
GASTROPODA	**12**		**12**		**47**	**14**
Fossaria sp.	12		12		47	14
TOTAL (#/sq. meter)	2700	3375	2713	2723	4854	3269
NUMBER OF TAXA	24	22	23	14	27	38
SHANNON-WEAVER (H')						3.06
TOTAL EPT TAXA	8	10	9	6	9	11
EPT INDEX (% of Total Taxa)	33	45	39	43	33	29
EPHEMEROPTERA ABUNDANCE (% of Total Density)	27	30	30	39	23	29

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HIGHWAY 522
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**407**	**477**	**1000**	**605**	**709**	**640**
Baetis tricaudatus	140	256	326	326	244	258
Drunella grandis	267	81	209	174	372	221
Rhithrogena hagen		140	465	105	93	161
PLECOPTERA	**12**	**70**	**35**	**81**	**12**	**42**
Isoperla sp.	12					2
Pteronarcella badia		70	35	81	12	40
COLEOPTERA	**151**	**105**	**106**	**35**	**151**	**110**
Heterlimnius corpulentus		12	12			5
Narpus concolor	12	23	12		12	12
Optioservus divergens	58	35	47	12	81	47
Optioservus quadrimaculatus	81	35	35	23	58	46
TRICHOPTERA	**233**	**326**	**175**	**82**	**407**	**244**
Arctopsyche grandis		12			23	7
Brachycentrus americanus	70	244	140	47	244	149
Culoptila sp.	12					2
Hydropsyche sp	128	35	23	35	128	70
Lepidostoma sp. A		12				2
Limnephilidae			12			2
Rhyacophila coloradensis gr	23	23			12	12
DIPTERA	**489**	**235**	**222**	**280**	**652**	**373**
Atherix pachypus	23	12	47	58	81	44
Caloparyphus sp	23	12				7
Clinotanypus pinguis	12	12		12		7
Cricotopus sp.	58	35	35		209	67
Diamesa sp.	35					7
Dicranota sp.	23			12		7
Eukiefferiella sp	23	12		35		14
Hexatoma sp		12			12	5
Neoplasta sp	35	58	58		105	51
Orthocladius (Euorthocladius) sp	47		23	163	105	68
Orthocladius/Cricotopus sp	198	70	35		128	86
Parametriocnemus sp					12	2
Parorthocladius sp			12			2
Polypedilum sp	12					2
Pseudosmittia sp		12				2
Simulium sp.			12			2
HYDRACARINA	**47**	**35**	**23**		**47**	**31**
Lebertia sp	47	35			47	26
Sperchon/Sperchonopsis			23			5
ANNELIDA						
OLIGOCHAETA		**35**	**12**	**12**	**12**	**14**
Enchytraeidae		12		12		5
Lumbriculidae					12	2
Nais sp.		23	12			7

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HIGHWAY 522
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	1339	1283	1573	1095	1990	1454
NUMBER OF TAXA	22	25	20	14	20	37
SHANNON-WEAVER (H')						3.94
TOTAL EPT TAXA	7	9	7	6	8	12
EPT INDEX (% of Total Taxa	32	36	35	43	40	32
EPHEMEROPTERA ABUNDANCE (% of Total Density	30	37	64	55	36	44

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF OUTFALL 002
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1163**	**954**	**1140**	**593**	**1280**	**1026**
Baetis tricaudatus	47	256	58	93	233	137
Drunella grandis	1093	675	1082	500	1012	872
Paraleptophlebia sp		23				5
Rhithrogena hagen	23				35	12
PLECOPTERA	**23**	**93**	**326**	**47**	**384**	**175**
Amphinemura sp.	23					5
Isoperla sp.		23				5
Pteronarcella badia		70	326	47	384	165
COLEOPTERA	**814**	**814**	**1012**	**954**	**919**	**903**
Liodessus sp.		23				5
Narpus concolor		47	23		35	21
Optioservus divergens	326	337	407	372	419	372
Optioservus quadrimaculatus	488	407	582	582	465	505
TRICHOPTERA	**4547**	**4106**	**3838**	**5792**	**9653**	**5588**
Arctopsyche grandis			58		81	28
Brachycentrus americanus	3756	2721	2617	4071	5199	3673
Hydropsyche sp	768	1326	1128	1663	4338	1845
Lepidostoma sp	23	47	35	58	35	40
Limnephilus/Philarctus		12				2
DIPTERA	**674**	**1861**	**1373**	**2616**	**350**	**1374**
Atherix pachypus				12		2
Ceratopogoninae	116	140	256	174	151	167
Cricotopus sp.	47	58	23			26
Dicranota sp.	23	93		116		46
Eukiefferiella sp	302	1023	663	977	70	607
Hexatoma sp	70	116	93	151	47	95
Larsia (?) sp.		47				9
Neoplasta sp	23	23	35	58		28
Orthocladius (Euorthocladius) sp	23	140	70	430	12	135
Orthocladius/Cricotopus sp	70	140	163	279	35	137
Unid. Orthocladiinae				140		28
Pagastia sp.			35	279		63
Parametriocnemus sp		58				12
Pericoma sp.					35	7
Tipula sp.		23				5
Tvetenia sp			35			7
HYDRACARINA	**94**	**140**	**81**	**232**		**110**
Lebertia sp.	47	140	81	116		77
Sperchon/Sperchonopsis	47			116		33
CRUSTACEA						
AMPHIPODA				**12**		**2**
Hyalella azteca				12		2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF OUTFALL 002
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TURBELLARIA	**465**	**349**	**116**	**756**	**349**	**407**
Girardia sp.	465	349	116	756	349	407
NEMATODA	**23**		**23**			**9**
Unid. Nematoda	23		23			9
ANNELIDA						
OLIGOCHAETA	**69**	**69**	**81**	**70**		**59**
Enchytraeidae		23				5
Haplotaxis sp		23	12			7
Ilyodrilus/Tubifex	23					5
Limnodrilus sp.	23					5
Lumbriculidae			23			5
Nais sp.	23		23	35		16
Unid. Immature Tubificidae w/o Capilliform Chaetae		23	23	35		16
MOLLUSCA						
GASTROPODA		**23**				**5**
Fossaria sp.		23				5
TOTAL (#/sq. meter)	7872	8409	7990	11072	12935	9658
NUMBER OF TAXA	24	30	26	24	18	45
SHANNON-WEAVER (H')						3.15
TOTAL EPT TAXA	7	9	7	6	8	12
EPT INDEX (% of Total Taxa)	29	30	27	25	44	27
EPHEMEROPTERA ABUNDANCE (% of Total Density)	15	11	14	5	10	11

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HATCHERY
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**500**	**814**	**232**	**441**	**732**	**545**
Baetis tricaudatus	174	233	58	116	384	193
Drunella grandis	151	372	174	174	267	228
Epeorus grandis	35					7
Paraleptophlebia sp	93	58		116	81	70
Rhithrogena hagen	47	151		35		47
PLECOPTERA	**232**	**326**	**244**	**558**	**500**	**372**
Amphinemura sp.					35	7
Isoperla sp.	116	35	209	500	151	202
Pteronarcella badia	116	291	35	58	314	163
COLEOPTERA	**4129**	**2128**	**3303**	**3268**	**3919**	**3350**
Heterlimnius corpulentus	35	23				12
Narpus concolor	12	93				21
Optioservus divergens	756	651	1116	1105	1233	972
Optioservus quadrimaculatus	3210	1303	2152	2128	2605	2280
Zaitzevia parvula	116	58	35	35	81	65
TRICHOPTERA	**3117**	**941**	**1199**	**2476**	**1931**	**1933**
Brachycentrus americanus	1838	314	582	1372	1198	1061
Culoptila sp.		81			35	23
Hydropsyche sp	1163	488	582	930	582	749
Lepidostoma sp. A	116	35		174	116	88
Oecetis avara/disjuncta		23				5
Rhyacophila coloradensis gr			35			7
DIPTERA	**3221**	**2838**	**4977**	**7909**	**10188**	**5827**
Atherix pachypus	500	349	116	384	733	416
Ceratopogoninae	35	81	116	93	81	81
Cricotopus sp.	174	221				79
Eukiefferiella sp	1244	535	4187	5908	7490	3873
Hexatoma sp	12	35	58	35		28
Neoplasta sp		35	35			14
Orthocladius (Euorthocladius) sp	361	826	163	1489	930	754
Orthocladius/Cricotopus sp	709	605			640	391
Pagastia sp.	93	151			314	112
Tvetenia sp	93		302			79
HYDRACARINA	**93**	**46**	**209**		**35**	**77**
Lebertia sp.	35	23	151			42
Sperchon/Sperchonopsis	58	23	58		35	35
TURBELLARIA				**58**	**35**	**19**
Girardia sp.				58	35	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HATCHERY
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
NEMATODA	**58**	**58**	**58**		**81**	**51**
Unid. Nematoda	58	58	58		81	51
ANNELIDA						
OLIGOCHAETA	**58**		**35**		**81**	**35**
Enchytraeidae	58		35		81	35
TOTAL (#/sq. meter)	11408	7151	10257	14710	17502	12209
NUMBER OF TAXA	28	28	21	18	23	34
SHANNON-WEAVER (H')						3.37
TOTAL EPT TAXA	10	11	7	9	10	14
EPT INDEX (% of Total Taxa)	36	39	33	50	43	41
EPHEMEROPTERA ABUNDANCE (% of Total Density)	4	11	2	3	4	4

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HATCHERY
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**651**	**500**	**303**	**232**	**535**	**444**
Baetis bicaudatus					35	7
Baetis tricaudatus	558	384	291	174	407	363
Drunella grandis	93	116	12	58	93	74
PLECOPTERA	**582**	**1012**	**791**	**1047**	**687**	**823**
Isoperla sp.	582	1012	756	1047	675	814
Pteronarcella badia			35		12	9
COLEOPTERA	**1093**	**1943**	**629**	**3082**	**1849**	**1719**
Narpus concolor		12				2
Optioservus divergens	23	70	47	116	70	65
Optioservus quadrimaculatus	1070	1861	582	2966	1779	1652
LEPIDOPTERA	**12**		**35**			**9**
Petrophila sp.	12		35			9
TRICHOPTERA	**3093**	**4338**	**4059**	**6396**	**1884**	**3953**
Brachycentrus americanus	1570	2361	2326	4303	907	2293
Culoptila sp.			35	233	58	65
Glossosoma sp.	35	35			35	21
Hesperophylax sp	35					7
Hydropsyche sp.	1279	1861	1489	1686	849	1433
Lepidostoma sp. A			35			7
Oecetis avara/disjuncta				116		23
Rhyacophila coloradensis gr	174	81	174	58	35	104
DIPTERA	**3442**	**4664**	**5025**	**8547**	**4535**	**5241**
Atherix pachypus		47		116		33
Caloparyphus sp	116	198	326	233	267	228
Ceratopogoninae	58			116	93	53
Conchapelopia/Thienemannimyia gr. sp	105					21
Cricotopus sp.	930	1116	721	2082	1419	1254
Diamesa sp.	512	419	861	256	512	512
Dicranota sp.	116	116	349	291	174	209
Eukiefferiella sp	628	1116	2000	1814	779	1267
Orthocladius (Euorthocladius) sp	209	419		256	128	202
Orthocladius/Cricotopus sp	314	698	721	1558	256	709
Pagastia sp.	314	279		1558	256	481
Pericoma sp.			35			7
Polypedilum sp	105			267	523	179
Simulium sp.					35	7
Thienemanniella sp		140				28
Tipula sp.	35	116	12		93	51
HYDRACARINA	**93**				**35**	**26**
Hygrobates sp	35					7
Sperchon/Sperchonopsis	58				35	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HATCHERY
SAMPLED: 03/31/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
CRUSTACEA						
AMPHIPODA	**35**					**7**
Hyalella azteca	35					7
TURBELLARIA	**174**	**35**	**233**	**233**	**58**	**147**
Girardia sp.	174	35	233	233	58	147
ANNELIDA						
OLIGOCHAETA	**58**		**58**			**23**
Enchytraeidae	35		35			14
Nais sp.	23		23			9
MOLLUSCA						
GASTROPODA					**70**	**14**
Physa sp.					35	7
Radix auricularia					35	7
TOTAL (#/sq. meter)	9233	12492	11133	19537	9653	12406
NUMBER OF TAXA	29	22	23	22	28	41
SHANNON-WEAVER (H')						3.79
TOTAL EPT TAXA	8	7	9	8	10	13
EPT INDEX (% of Total Taxa	28	32	39	36	36	32
EPHEMEROPTERA ABUNDANCE (% of Total Density	7	4	3	1	6	4

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: CABRESTO CREEK
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1700**	**1929**	**1607**	**2570**	**1826**	**1927**
Baetis bicaudatus	47	81	93	81		60
Baetis tricaudatus	186	500	454	1047	465	530
Cinygmula par	47	23	35		23	26
Drunella doddsi	140	430	221	384	279	291
Drunella grandis			12		12	5
Epeorus longimanus	512	174	279	267	372	321
Ephemerella dorothea	675	698	454	698	675	640
Fallceon quilleri	70		47	93		42
Rhithrogena hageni	23	23	12			12
PLECOPTERA	**395**	**453**	**176**	**431**	**290**	**351**
Cultus sp.	116	151	35	233	23	112
Eucapnopsis brevicauda		23	12		23	12
Hesperoperla pacifica	116	93	105	163	151	126
Isoperla sp.		93	12			21
Prostoia besametsa		35			23	12
Sweltsa sp.	163	58	12	35	70	68
COLEOPTERA	**873**	**313**	**477**	**803**	**791**	**651**
Cleptelmis sp.		58		35		19
Heterlimnius corpulentus	628	174	442	384	628	451
Narpus concolor	12		35	35		16
Optioservus quadrimaculatus	233	81		349	163	165
TRICHOPTERA	**1895**	**1407**	**722**	**2488**	**1851**	**1672**
Brachycentrus americanus	186	35	12	35	47	63
Hydropsyche sp.	465	407	221	814	547	491
Lepidostoma sp. A	488	209	35	81	419	246
Micrasema bactro	186	93	128	430	140	195
Oligophlebodes minutus	372	547	128	814	535	479
Rhyacophila brunnea gr.		81	116	279	47	105
Rhyacophila sibirica gr.	198	35	47	35	116	86
Rhyacophila sp.			35			7
DIPTERA	**3452**	**3094**	**1852**	**11257**	**3093**	**4550**
Antocha sp.	116	233	140	1628	395	502
Ceratopogoninae	140	93	35	430	116	163
Conchapelopia/Thienemannimyia gr. s					58	12
Cricotopus (N.) nostocicola	151	361	186	1361	163	444
Diamesa sp.		81				16
Dicranota sp.	23	35	12	81	23	35
Eukiefferiella sp.	302	500	186	3547	279	963
Heleniella sp.	1012		70	279	58	284
Hexatoma sp.	23					5
Micropsectra sp.	616	500	256	814	558	549
Neoplasta sp.	23		12	198	93	65
Oreogeton sp.		23				5
Orthocladius (Euorthocladius) sp.		221	140	279	105	149
Orthocladius/Cricotopus sp.	81	151	140	1361	163	379
Pericoma sp.	768	233	291	547	419	452
Prosimulium sp.	23	267	279	198	372	228
Rheocricotopus sp.	81		35			23
Rheotanytarsus sp.	81	291	70	267	233	188
Simulium sp.		35				7
Tipula sp.	12					2
Tvetenia sp.		70		267	58	79

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: CABRESTO CREEK
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
HYDRACARINA	**47**		**24**			**13**
Lebertia sp.			12			2
Protzia sp.	47					9
Sperchon/Sperchonopsis			12			2
TURBELLARIA	**186**	**58**	**128**	**81**		**91**
Polycelis coronata	186	58	128	81		91
NEMATODA			**12**		**23**	**7**
Unid. Nematoda			12		23	7
ANNELIDA						
OLIGOCHAETA	**338**	**547**	**47**	**163**	**116**	**242**
Eiseniella tetraedra	12	23			23	12
Enchytraeidae	279	140	12			86
Nais sp.	47	384	35	163	93	144
MOLLUSCA						
PELECYPODA	**70**		**12**	**35**		**23**
Sphaerium sp.	70		12	35		23
TOTAL (#/sq. meter)	8956	7801	5057	17828	7990	9527
NUMBER OF TAXA	41	42	45	37	38	57
SHANNON-WEAVER (H')						4.87
TOTAL EPT TAXA	17	20	22	16	18	23
EPT INDEX (% of Total Taxa)	41	48	49	43	47	40
EPHEMEROPTERA ABUNDANCE (% of Total Density)	19	25	32	14	23	20

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: COLUMBINE CREEK
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**3210**	**8954**	**6152**	**4048**	**7558**	**5983**
Ameletus sp.		35				7
Baetis bicaudatus	419	930	791	535	930	721
Baetis tricaudatus	651	849	1547	628	1512	1037
Cinygmula pai	651	1779	1547	1186	2128	1458
Drunella dodds	35	81	209	70	81	95
Epeorus longimanus	698	1477	326	233	663	679
Ephemerella dorothe:	593	3105	1198	1140	1977	1603
Rhithrogena hagen	47	698	267	163	151	265
Rhithrogena robusta	116		267	93	116	118
PLECOPTERA	**222**	**570**	**895**	**535**	**1395**	**725**
Amphinemura sp.	105	349	267	256	663	328
Capnia sp.			35		35	14
Eucapnopsis brevicauda			58			12
Hesperoperla pacifica	12		35		116	33
Isoperla sp.	35				116	30
Paraleuctra sp.				23		5
Prostoia besametsa		35		23		12
Sweltsa sp.	70	151	442	233	465	272
Taenionema sp		35				7
Zapada cinctipes			58			12
COLEOPTERA	**407**	**616**	**1745**	**721**	**1396**	**977**
Heterlimnius corpulentus	395	616	1745	698	1396	970
Optioservus divergens	12			23		7
TRICHOPTERA	**316**	**592**	**395**	**302**	**430**	**407**
Arctopsyche grandis	70	81		23	35	42
Brachycentrus americanus	47	81		116	81	65
Glossosoma sp.		35				7
Hydropsyche sp.	12		35	23		14
Lepidostoma sp. A	12					2
Micrasema bactro	35		35			14
Neothremma sp	35					7
Rhyacophila brunnea gr	35	116	93		116	72
Rhyacophila coloradensis gr				23		5
Rhyacophila sibirica gr	12	81	174	47	198	102
Rhyacophila sp	58	198	58	70		77
DIPTERA	**223**	**1860**	**511**	**304**	**338**	**646**
Brillia sp.	70	616	23			142
Ceratopogoninae	12	81	35	47	35	42
Diamesa sp.			35			7
Dicranota sp.	12	81	116	70	81	72
Eukiefferiella sp	12			23		7
Heleniella sp		47			105	30
Hexatoma sp.		35				7
Maruina sp.			35			7
Micropsectra sp.		47	23	47		23
Neoplasta sp	12					2
Oreogeton sp.		35				7
Pagastia sp.		291	35	23		70
Parametriocnemus sp					35	7

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: COLUMBINE CREEK
SAMPLED: 03/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
DIPTERA (cont.)						
Pericoma sp.	12					2
Polypedilum sp		244				49
Prosimulium sp.		116	35	47	35	47
Rheocricotopus sp.		186				37
Simulium sp.		81				16
Tvetenia sp	93		174	47	47	72
HYDRACARINA	**12**					**2**
Lebertia sp.	12					2
TURBELLARIA			**35**	**116**	**35**	**37**
Girardia sp.			35			7
Polycelis coronata				116	35	30
ANNELIDA						
OLIGOCHAETA	**1337**	**2151**	**1325**	**814**	**3222**	**1769**
Eiseniella tetraedra	872	1640	1023	500	2687	1344
Enchytraeidae	465	395	244	314	384	360
Nais sp.		81	58		151	58
Telmatodrilis sp.		35				7
TOTAL (#/sq. meter)	5727	14743	11058	6840	14374	10546
NUMBER OF TAXA	33	35	33	30	28	58
SHANNON-WEAVER (H')						4.03
TOTAL EPT TAXA	21	18	19	18	17	30
EPT INDEX (% of Total Taxa)	64	51	58	60	61	52
EPHEMEROPTERA ABUNDANCE (% of Total Density)	56	61	56	59	53	57

Appendix D

Macroinvertebrate Data

Fall 2005

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF TOWN OF RED RIVER
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**199**	**220**	**187**	**453**	**81**	**228**
Baetis bicaudatus	70	58	70	174	23	79
Baetis tricaudatus	105	116	105	198	58	116
Drunella dodds				58		12
Epeorus deceptivus				23		5
Ephemerella dorothea	12	23	12			9
Heptageniidae	12	23				7
PLECOPTERA	**547**	**686**	**396**	**1256**	**488**	**674**
Capniidae			12	35		9
Cultus aestivalis	47	23	47		23	28
Prostoia besametsa	70	58	23	93	23	53
Sweltsa sp.	430	582	302	605	291	442
Taenionema sp				523	151	135
Zapada cinctipes		23	12			7
COLEOPTERA	**151**	**326**	**361**	**198**	**326**	**272**
Heterlimnius corpulentus	151	326	326	198	326	265
Narpus concolor			12			2
Optioservus castanipennis			23			5
TRICHOPTERA	**419**	**558**	**652**	**477**	**209**	**462**
Arctopsyche grandis	12		35			9
Brachycentrus americanus	314	500	535	326	151	365
Hydropsyche sp			12			2
Lepidostoma sp		35				7
Oligophlebodes minutus	12					2
Rhyacophila sibirica gr	81	23	58	151	35	70
Rhyacophila sp			12		23	. 7
DIPTERA	**2443**	**2722**	**2337**	**3418**	**1673**	**2519**
Ceratopogoninae	151	35	47		81	63
Chaetocladius sp			58			12
Cricotopus sp.		105	58	116		56
Diamesa sp.			58	163	140	72
Dicranota sp.		256	105	151	93	121
Erioptera sp			58	35	23	23
Eukiefferiella sp		58	116	116	35	65
Hexatoma sp		35	23		23	16
Micropsectra sp.	93	58	233			77
Muscidae			12			2
Neoplasta sp	12	81	35	35	81	49
Orthocladius (Euorthocladius) sp	58	58	174	512	337	228
Orthocladius/Cricotopus sp	523	454	442	116	70	321
Unid. Orthocladiinae	47	105				30
Pagastia sp.	570	733	523	395	302	505
Pericoma sp	814	558	279	407	174	446
Psilometriocnemus sp	47	58	58	221	140	105
Simulium sp.	35	93	58	1070	174	286
Tipula sp.		35		23		12
Tvetenia sp	93			58		30
HYDRACARINA	**1385**	**488**	**198**	**163**	**617**	**570**
Hygrobates sp		23	23	23		14
Lebertia sp	1326	465	163	140	582	535
Protzia sp.	12					2
Sperchon/Sperchonopsis	47		12		35	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF TOWN OF RED RIVER
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TURBELLARIA	**116**	**198**	**12**		**35**	**72**
Girardia sp.	116	198	12		35	72
NEMATODA	**47**					**9**
Unid. Nematoda	47					9
ANNELIDA						
OLIGOCHAETA	**860**	**256**	**233**	**116**	**116**	**316**
Eiseniella tetraedra		35				7
Enchytraeidae			12		23	7
Nais bretscheri	81	81	47			42
Nais sp.	779	140	174	116	93	260
TOTAL (#/sq. meter)	6167	5454	4376	6081	3545	5122
NUMBER OF TAXA	30	33	40	28	28	52
SHANNON-WEAVER (H')						4.53
TOTAL EPT TAXA	11	11	13	10	9	19
EPT INDEX (% of Total Taxa)	37	33	33	36	32	37
EPHEMEROPTERA ABUNDANCE (% of Total Density)	3	4	4	7	2	4

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: JUNEBUG CAMPGROUND
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**639**	**523**	**1501**	**733**	**629**	**805**
Baetis bicaudatus	267	244	861	407	454	447
Baetis tricaudatus	372	209	570	267	128	309
Drunella grandis		70		47		23
Ephemerella dorothea			47	12		12
Rhithrogena hagen			23		47	14
PLECOPTERA	**59**	**24**	**245**	**36**	**129**	**98**
Capniidae					12	2
Isoperla sp.			23	12		7
Leuctridae	12	12				5
Megarcys signata			35			7
Prostoia besametsa			47	12	12	14
Sweltsa sp.			93	12	70	35
Taenionema sp	35	12			12	12
Zapada cinctipes	12		47		23	16
COLEOPTERA	**47**	**46**	**23**	**35**		**30**
Heterlimnius corpulentus	35	23	23	35		23
Narpus concolor	12	23				7
TRICHOPTERA	**628**	**501**	**2384**	**559**	**361**	**886**
Arctopsyche grandis	23	12	105	35	35	42
Brachycentrus americanus	570	454	2256	512	314	821
Lepidostoma sp	12					2
Limnephilidae			23			5
Oligophlebodes minutus		35				7
Rhyacophila sibirica gr	23			12	12	9
DIPTERA	**721**	**572**	**1279**	**360**	**490**	**683**
Ceratopogoninae	12		23			7
Conchapelopia/Thienemannimyia gr					12	2
Cricotopus sp.	23	93	70	35	23	49
Diamesa sp.	35		35		12	16
Dicranota sp.	23		47		23	19
Eukiefferiella sp	128	35	116	23	35	67
Micropsectra sp.		58	116	23		39
Neoplasta sp	35	58	70	47	35	49
Orthocladius (Euorthocladius) sp	267	105	256	116	291	207
Orthocladius/Cricotopus sp	70	105	267	23	12	95
Unid. Orthocladiinae			35			7
Pagastia sp.	70	47		35		30
Parametriocnemus sp				23	12	7
Pericoma sp.		12	93	12	23	28
Psilometriocnemus sp	35	47	151	23	12	54
Simulium sp.	23	12				7
HYDRACARINA	**663**	**908**	**1652**	**977**		**840**
Lebertia sp.	605	861	1582	965		803
Sperchon/Sperchonopsis	58	47	70	12		37
NEMATODA		**47**				**9**
Unid. Nematoda		47				9

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: JUNEBUG CAMPGROUND
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
ANNELIDA						
OLIGOCHAETA	**71**	**70**	**140**		**12**	**58**
Eiseniella tetraedra	12					2
Enchytraeidae	12		93			21
Nais bretscheri		23	47		12	16
Nais sp.	47	47				19
TOTAL (#/sq. meter)	2828	2691	7224	2700	1621	3409
NUMBER OF TAXA	27	25	29	23	23	44
SHANNON-WEAVER (H')						3.57
TOTAL EPT TAXA	9	8	12	10	11	19
EPT INDEX (% of Total Taxa)	33	32	41	43	48	43
EPHEMEROPTERA ABUNDANCE (% of Total Density)	23	19	21	27	39	24

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF ELEPHANT ROCK CAMPGROUN
UPSTREAM FROM HANSEN CREEK
SAMPLED: 09/26/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**767**	**1639**	**1361**	**2001**	**1291**	**1412**
Baetis bicaudatus	209	616	663	896	523	581
Baetis tricaudatus	512	942	698	1070	733	791
Drunella coloradensis	23					5
Drunella grandis	23	81		35	35	35
PLECOPTERA		**35**		**35**		**14**
Sweltsa sp.		35		35		14
COLEOPTERA	**70**	**47**	**116**		**35**	**54**
Narpus concolor			35			7
Optioservus divergens	70	47	81		35	47
TRICHOPTERA	**210**	**1059**	**430**	**675**	**349**	**544**
Arctopsyche grandis	47	151	81	128	58	93
Brachycentrus americanus	163	896	349	547	291	449
Lepidostoma sp		12				2
DIPTERA	**4281**	**8060**	**6790**	**8875**	**5397**	**6679**
Atherix pachypus	721	1012	616	1279	384	802
Cardiocladius sp.	186					37
Ceratopogoninae		35				7
Cricotopus sp.	105	779	337	919	291	486
Diamesa sp.		186	174			72
Dicranota sp.				35		7
Eukiefferiella sp	756	779	523	233	291	516
Micropsectra sp.		186				37
Neoplasta sp	93	198	314	314	58	195
Orthocladius (Euorthocladius) sp	1140	2140	2059	3408	2721	2294
Orthocladius/Cricotopus sp	570	1361	1721	1814	721	1237
Unid. Orthocladiinae	105	186				58
Parametriocnemus sp			174			35
Pericoma sp.		35		35		14
Psilometriocnemus sp		198		454	291	189
Simulium sp.	605	930	698	384	640	651
Synorthocladius sp			174			35
Tipula sp.		35				7
HYDRACARINA	**233**	**896**	**186**	**884**	**268**	**493**
Lebertia sp.	233	896	151	849	233	472
Sperchon/Sperchonopsis			35	35	35	21
NEMATODA		**12**				**2**
Unid. Nematoda		12				2
ANNELIDA						
OLIGOCHAETA	**349**	**2244**	**116**	**849**	**1139**	**939**
Enchytraeidae					151	30
Nais bretscheri	23	267	35	116	58	100
Nais sp.	326	1977	81	733	930	809

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF ELEPHANT ROCK CAMPGROUN
UPSTREAM FROM HANSEN CREEK
SAMPLED: 09/26/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	5910	13992	8999	13319	8479	10137
NUMBER OF TAXA	19	26	20	20	19	34
SHANNON-WEAVER (H')						3.77
TOTAL EPT TAXA	6	7	4	6	5	8
EPT INDEX (% of Total Taxa	32	27	20	30	26	24
EPHEMEROPTERA ABUNDANCE (% of Total Density	13	12	15	15	15	14

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HANSEN CREEK, UPSTREAM OF MILL
SAMPLED: 10/04/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**477**	**1059**	**2501**	**2314**	**1291**	**1528**
Baetis tricaudatus	442	1047	2454	2256	1279	1496
Drunella grandis	23		47	58	12	28
Ephemerella dorothea		12				2
Rhithrogena hagen	12					2
PLECOPTERA			**12**		**12**	**4**
Sweltsa sp.					12	2
Zapada cinctipes			12			2
COLEOPTERA		**12**		**12**	**12**	**7**
Optioservus castanipennis				12		2
Optioservus divergens		12			12	5
TRICHOPTERA	**70**	**314**	**687**	**535**	**221**	**365**
Arctopsyche grandis	12	12	128	35		37
Brachycentrus americanus	58	302	547	500	221	326
Rhyacophila rotunda gr			12			2
DIPTERA	**59**	**83**	**165**	**340**	**154**	**159**
Atherix pachypus			12		35	9
Cricotopus sp.				23		5
Dicranota sp.		12			12	5
Micropsectra sp.		12		12		5
Neoplasta sp	12	12	12	12	12	12
Orthocladius (Euorthocladius) sp	12	23	47	12	47	28
Unid. Orthocladiinae				12		2
Pagastia sp.			12	12	12	7
Pericoma sp.	23			70	12	21
Pseudodiamesa sp		12	12	47		14
Psilometriocnemus sp	12	12	23	128	12	37
Simulium sp.			47	12	12	14
HYDRACARINA	**105**	**105**	**174**	**407**	**116**	**181**
Lebertia sp.	105	93	151	407	81	167
Sperchon/Sperchonopsis		12	23		35	14
ANNELIDA						
OLIGOCHAETA		**12**	**35**	**128**		**35**
Nais bretscheri				35		7
Nais sp.		12	35	93		28
TOTAL (#/sq. meter)	711	1585	3574	3736	1806	2279
NUMBER OF TAXA	10	14	16	18	15	27
SHANNON-WEAVER (H')						1.96
TOTAL EPT TAXA	5	4	6	4	4	9
EPT INDEX (% of Total Taxa)	50	29	38	22	27	33
EPHEMEROPTERA ABUNDANCE (% of Total Density)	67	67	70	62	71	67

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MINE SITE BOUNDARY, UPSTREAM OF MILL
SAMPLED: 10/04/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**2140**	**2291**	**2245**	**3908**	**4664**	**3050**
Baetis bicaudatus	1651	1861	1989	3222	3908	2526
Baetis tricaudatus	465	395	209	605	570	449
Drunella dodds				23		5
Drunella grandis	12		47		186	49
Rhithrogena hagen	12	35		58		21
PLECOPTERA	**12**	**35**		**23**	**23**	**18**
Sweltsa sp.	12	12			23	9
Taenionema sp		23		23		9
COLEOPTERA	**24**			**58**		**16**
Microcylloepus pusillus	12					2
Optioservus divergens	12			58		14
TRICHOPTERA	**209**	**314**	**639**	**954**	**1082**	**639**
Arctopsyche grandis	174	244	244	407	93	232
Brachycentrus americanus	35	58	395	547	989	405
Rhyacophila sibirica gr		12				2
DIPTERA	**709**	**534**	**1303**	**813**	**815**	**834**
Dicranota sp.	23	23	12	35		19
Eukiefferiella sp	58	23	47	58	35	44
Hexatoma sp	12			23		7
Micropsectra sp.		12		23	23	12
Neoplasta sp		12	12	58	140	44
Orthocladius (Euorthocladius) sp	105	58	314	58	47	116
Orthocladius (Symposiocladius) sp			47			9
Orthocladius/Cricotopus sp			23		23	9
Unid. Orthocladiinae		23	23			9
Unknown Orthocladiinae Genus			23			5
Pericoma sp.	81	23	209	93	256	132
Psilometriocnemus sp	93	209	267	209	198	195
Simulium sp.	337	151	326	233	93	228
Tvetenia sp				23		5
HYDRACARINA	**81**	**47**	**128**	**140**	**930**	**265**
Lebertia sp.	81	47	128	140	930	265
ANNELIDA						
OLIGOCHAETA	**105**	**116**	**117**	**127**	**140**	**121**
Eiseniella tetraedra			12			2
Enchytraeidae				23		5
Nais bretscheri				23		5
Nais sp.	105	81	70	81	70	81
Rhynchelmis sp.		35	35		70	28

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MINE SITE BOUNDARY, UPSTREAM OF MILL
SAMPLED: 10/04/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	3280	3337	4432	6023	7654	4943
NUMBER OF TAXA	18	20	20	22	17	32
SHANNON-WEAVER (H')						2.79
TOTAL EPT TAXA	7	8	5	7	6	10
EPT INDEX (% of Total Taxa)	39	40	25	32	35	31
EPHEMEROPTERA ABUNDANCE (% of Total Density)	65	69	51	65	61	62

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF MILL, UPSTREAM OF COLUMBINE CREEK
SAMPLED: 10/03/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**5559**	**4385**	**7373**	**2769**	**6663**	**5350**
Baetis bicaudatus	4792	3768	6745	2512	5617	4687
Baetis tricaudatus	721	593	558	198	930	600
Drunella dodds				12		2
Drunella grandis	23	12	35	35	58	33
Rhithrogena hagen	23	12	35	12	58	28
PLECOPTERA	**46**	**59**	**58**	**81**	**35**	**56**
Megarcys signata		12				2
Sweltsa sp.	23					5
Taenionema sp	23	35	58		35	30
Zapada cinctipes		12		81		19
COLEOPTERA	**23**	**35**			**70**	**26**
Heterlimnius corpulentus	23	35			35	19
Narpus concolor					35	7
TRICHOPTERA	**70**	**280**	**640**	**221**	**384**	**319**
Arctopsyche grandis		70	58		35	33
Brachycentrus americanus	47	198	582	221	349	279
Micrasema bactro	23					5
Rhyacophila rotunda gr		12				2
DIPTERA	**513**	**1094**	**1280**	**441**	**1070**	**880**
Atherix pachypus	47	12	93		35	37
Dicranota sp.			35	23		12
Eukiefferiella sp	47	70	35		35	37
Micropsectra sp.			35			7
Neoplasta sp	70	105	35	81	116	81
Orthocladius (Euorthocladius) sp	93	314	221	58	163	170
Orthocladius/Cricotopus sp	23				35	12
Pagastia sp.				12		2
Pericoma sp	116	47	116	81	209	114
Psilometriocnemus sp	47	302	361	163	326	240
Simulium sp.	70	221	349	23	116	156
Tvetenia sp		23			35	12
HYDRACARINA	**140**	**105**	**116**	**105**	**326**	**158**
Lebertia sp	140	105	116	105	326	158
ANNELIDA						
OLIGOCHAETA	**93**	**279**	**814**	**163**	**209**	**312**
Enchytraeidae		81		12	35	26
Nais sp.	93	198	814	151	174	286
TOTAL (#/sq. meter)	6444	6237	10281	3780	8757	7101
NUMBER OF TAXA	19	22	18	17	21	30
SHANNON-WEAVER (H')						2.16
TOTAL EPT TAXA	8	10	7	7	7	13
EPT INDEX (% of Total Taxa)	42	45	39	41	33	43
EPHEMEROPTERA ABUNDANCE (% of Total Density)	86	70	72	73	76	75

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF CABIN SPRINGS AND COLUMBINE WELL FIELD
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
COLLEMBOLA					**12**	**2**
Unid. Collembola					12	2
EPHEMEROPTERA	**1570**	**1547**	**1373**	**1849**	**1174**	**1502**
Baetis tricaudatus	1570	1535	1256	1814	1151	1465
Drunella dodds		12	12	23		9
Drunella grandis			47	12		12
Rhithrogena hagen			58		23	16
PLECOPTERA		**12**	**12**	**47**	**35**	**21**
Sweltsa sp.		12	12	47	23	19
Taenionema sp					12	2
COLEOPTERA		**12**	**23**	**70**	**47**	**31**
Narpus concolor				47	12	12
Optioservus sp.		12	23	23	35	19
TRICHOPTERA		**256**	**326**	**744**	**175**	**300**
Arctopsyche grandis		47	35	93	12	37
Brachycentrus americanus		209	291	628	163	258
Hydropsyche sp				23		5
DIPTERA	**163**	**129**	**326**	**386**	**281**	**254**
Atherix pachypus	23		81	35	47	37
Brillia sp.				12		2
Dicranota sp.		12	12			5
Eukiefferiella sp			12	12	12	7
Micropsectra sp.		12			12	5
Neoplasta sp	12		35			9
Orthocladius (Euorthocladius) sp		12				2
Orthocladius/Cricotopus sp		12	12			5
Unid. Orthocladiinae				12		2
Pagastia sp.	12					2
Pericoma sp.				12		2
Psilometriocnemus sp	116	58	151	279	198	160
Simulium sp.		23	23	12	12	14
Tipula sp.				12		2
HYDRACARINA	**47**	**58**	**47**	**35**	**58**	**49**
Lebertia sp.	47	58	47	35	58	49
ANNELIDA						
OLIGOCHAETA			**35**	**24**	**58**	**23**
Enchytraeidae				12		2
Nais sp.				12		2
Rhynchelmis sp.			35		58	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF CABIN SPRINGS AND COLUMBINE WELL FIELD
SAMPLED: 09/29/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	1780	2014	2142	3155	1840	2182
NUMBER OF TAXA	6	13	17	20	16	30
SHANNON-WEAVER (H')						1.97
TOTAL EPT TAXA	1	5	7	7	6	9
EPT INDEX (% of Total Taxa	17	38	41	35	38	30
EPHEMEROPTERA ABUNDANCE (% of Total Density	88	77	64	59	64	69

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: GOATHILL CAMPGROUND
SAMPLED: 09/28/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1070**	**1209**	**792**	**1617**	**1197**	**1176**
Baetis tricaudatus	977	1000	698	1430	1035	1028
Drunella doddsi		23	12	47	23	21
Drunella grandis	70	151	47	35	58	72
Epeorus deceptivus			12			2
Rhithrogena hageni	23	35	23	105	81	53
PLECOPTERA		**58**		**23**	**23**	**21**
Leuctridae		23				5
Pteronarcella badia		12		23		7
Sweltsa sp.		23			23	9
COLEOPTERA	**35**	**81**	**23**	**35**	**23**	**40**
Narpus concolor		58				12
Optioservus divergens	35	23	23	35	23	28
TRICHOPTERA	**70**	**314**	**47**	**303**	**198**	**186**
Arctopsyche grandis		23		12	12	9
Brachycentrus americanus	58	291	47	256	186	168
Oligophlebodes minutus	12					2
Rhyacophila sibirica gr				35		7
DIPTERA	**257**	**453**	**303**	**965**	**756**	**546**
Atherix pachypus	105	174	128	372	337	223
Conchapelopia/Thienemannimyia gr				12		2
Diamesa sp.	12					2
Dicranota sp.	12				12	5
Eukiefferiella sp		35		23	12	14
Micropsectra sp.		12			12	5
Orthocladius (Euorthocladius) sp		23	35		23	16
Orthocladius/Cricotopus sp			12			2
Pagastia sp.	12					2
Psilometriocnemus sp	116	116	105	477	244	212
Simulium sp.		93	23	81	116	63
HYDRACARINA	**59**	**12**	**23**			**18**
Lebertia sp.	47	12	23			16
Sperchon/Sperchonopsis	12					2
ANNELIDA						
OLIGOCHAETA		**174**		**12**		**37**
Nais sp.		174		12		37
TOTAL (#/sq. meter)	1491	2301	1188	2955	2197	2024
NUMBER OF TAXA	13	19	13	15	15	28
SHANNON-WEAVER (H')						2.67
TOTAL EPT TAXA	5	9	6	8	7	12
EPT INDEX (% of Total Taxa)	38	47	46	53	47	43
EPHEMEROPTERA ABUNDANCE (% of Total Density)	72	53	67	55	54	58

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF QUESTA RANGER STATION
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**512**	**407**	**476**	**581**	**581**	**512**
Baetis bicaudatus	407	337	337	500	477	412
Baetis tricaudatus	47	58	35	81	81	60
Cinygmula par	23					5
Drunella grandis	35	12	23			14
Rhithrogena hagen			81		23	21
PLECOPTERA	**35**	**12**	**12**	**24**		**15**
Leuctridae			12			2
Pteronarcella badia				12		2
Sweltsa sp.	23	12				7
Taenionema sp	12					2
Zapada cinctipes				12		2
COLEOPTERA		**12**	**23**		**35**	**14**
Narpus concolor					35	7
Optioservus castanipennis		12	23			7
TRICHOPTERA	**93**	**116**	**245**	**326**	**105**	**177**
Arctopsyche grandis		23	47	35	12	23
Brachycentrus americanus	93	93	198	291	93	154
DIPTERA	**93**	**268**	**384**	**350**	**140**	**246**
Atherix pachypus	23	23	35	70	12	33
Dicranota sp.				12		2
Hexatoma sp		12				2
Orthocladius (Euorthocladius) sp				12		2
Psilometriocnemus sp	70	233	349	256	128	207
HYDRACARINA	**12**		**35**		**59**	**21**
Lebertia sp.	12		35		47	19
Sperchon/Sperchonopsis					12	2
TOTAL (#/sq. meter)	745	815	1175	1281	920	985
NUMBER OF TAXA	10	10	11	10	10	21
SHANNON-WEAVER (H')						2.61
TOTAL EPT TAXA	7	6	7	6	5	12
EPT INDEX (% of Total Taxa)	70	60	64	60	50	57
EPHEMEROPTERA ABUNDANCE (% of Total Density)	69	50	41	45	63	52

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HIGHWAY 522
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
COLLEMBOLA					**12**	**2**
Unid. Collembola					12	2
EPHEMEROPTERA	**1024**	**1444**	**1245**	**1222**	**1338**	**1253**
Baetis bicaudatus	651	884	756	802	919	802
Baetis tricaudatus	291	454	372	326	302	349
Cinygmula pai		12				2
Drunella dodds				12		2
Drunella grandis	12	47	12	47	12	26
Rhithrogena hagen	70	47	105	35	105	72
PLECOPTERA	**12**	**35**	**47**	**12**	**93**	**40**
Hesperoperla pacifica					12	2
Pteronarcella badia	12	23	12	12	35	19
Sweltsa sp.			35		23	12
Zapada cinctipes		12			23	7
COLEOPTERA	**12**	**58**	**24**	**23**	**24**	**28**
Narpus concolor		23				5
Optioservus castanipennis		35	12	23	12	16
Optioservus divergens	12		12		12	7
TRICHOPTERA	**36**	**349**	**105**	**187**	**268**	**189**
Arctopsyche grandis	12	35	35		35	23
Brachycentrus americanus	12	302	58	140	221	147
Hydropsyche sp	12	12	12	47	12	19
DIPTERA	**71**	**640**	**303**	**163**	**583**	**351**
Atherix pachypus	12	58	23	35	12	28
Ceratopogoninae			23			5
Eukiefferiella sp		105	12	12	70	40
Hexatoma sp					12	2
Neoplasta sp	12	12			12	7
Orthocladius (Euorthocladius) sp			12			2
Orthocladius/Cricotopus sp		35				7
Pericoma sp	12					2
Psilometriocnemus sp	12	58	47	81	35	47
Simulium sp.	23	372	186	35	430	209
Tvetenia sp					12	2
HYDRACARINA	**12**		**12**			**5**
Lebertia sp	12		12			5
ANNELIDA						
OLIGOCHAETA	**12**					**2**
Nais sp.	12					2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HIGHWAY 522
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	1179	2526	1736	1607	2318	1870
NUMBER OF TAXA	16	18	18	13	21	30
SHANNON-WEAVER (H')						2.83
TOTAL EPT TAXA	8	10	9	8	11	13
EPT INDEX (% of Total Taxa	50	56	50	62	52	43
EPHEMEROPTERA ABUNDANCE (% of Total Density	87	57	72	76	58	67

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HIGHWAY 522
AND QUESTA WWTP
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1734**	**1337**	**2060**	**2210**	**2710**	**2010**
Baetis bicaudatus	663	430	407	442	558	500
Baetis tricaudatus	942	756	1454	1570	1791	1303
Drunella dodds	12					2
Drunella grandis	35	35	35	47	12	33
Epeorus sp.	12	23	12			9
Ephemerella dorothea		12	12			5
Rhithrogena hagen	70	81	140	151	349	158
PLECOPTERA	**70**	**23**	**24**	**71**	**82**	**54**
Cultus aestivalis			12	12		5
Hesperoperla pacifica					12	2
Pteronarcella badia					47	9
Sweltsa sp.	47	23		35	23	26
Taenionema sp			12	12		5
Zapada cinctipes	23			12		7
COLEOPTERA	**35**	**12**	**23**	**35**	**12**	**24**
Narpus concoloı	12			12		5
Optioservus castanipennis	23	12	23			12
Optioservus divergens				23	12	7
TRICHOPTERA	**989**	**396**	**861**	**1292**	**581**	**823**
Arctopsyche grandis	35		12		23	14
Brachycentrus americanus	861	361	802	1233	500	751
Hydropsyche sp	93	35	47	47	58	56
Lepidostoma sp				12		2
DIPTERA	**291**	**116**	**223**	**153**	**153**	**186**
Atherix pachypus			23	12	12	9
Dicranota sp.					12	2
Eukiefferiella sp			70	12		16
Hexatoma sp	47		12	23	12	19
Micropsectra sp.	23					5
Neoplasta sp	23	12				7
Orthocladius (Euorthocladius) sp				12		2
Orthocladius/Cricotopus sp	35	35	12	12	12	21
Unid. Orthocladiinae		23				5
Pagastia sp.			12			2
Polypedilum sp	12	23	12			9
Psilometriocnemus sp	128	23	47	47	58	61
Simulium sp.	23		35	35	47	28
HYDRACARINA	**47**	**70**	**35**	**93**	**12**	**51**
Lebertia sp.	47	47	35	81		42
Sperchon/Sperchonopsis		23		12	12	9
TOTAL (#/sq. meter)	3166	1954	3226	3854	3550	3148
NUMBER OF TAXA	21	17	21	22	18	35
SHANNON-WEAVER (H')						2.65
TOTAL EPT TAXA	11	9	11	11	10	17
EPT INDEX (% of Total Taxa)	52	53	52	50	56	49
EPHEMEROPTERA ABUNDANCE (% of Total Density)	55	68	64	57	76	64

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF NPDES OUTFALL 002
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1372**	**2035**	**1850**	**3524**	**2175**	**2191**
Ameletus sp.	12					2
Baetis bicaudatus	349	477	512	547	465	470
Baetis tricaudatus	907	1442	1140	2593	1477	1512
Drunella grandis	23	116	12	58	35	49
Rhithrogena hagen	81		186	326	198	158
PLECOPTERA	**47**	**36**	**47**	**35**	**24**	**37**
Cultus aestivalis		12				2
Hesperoperla pacifica					12	2
Pteronarcella badia	12	12	35	23	12	19
Sweltsa sp.	12	12	12			7
Taenionema sp				12		2
Zapada oregonensis gr	23					5
COLEOPTERA	**152**	**361**	**58**	**105**	**280**	**192**
Narpus concolor	12		23	12	47	19
Optioservus divergens	140	361	12	93	233	168
Zaitzevia parvula			23			5
TRICHOPTERA	**849**	**1686**	**838**	**512**	**884**	**953**
Arctopsyche grandis		35	58	12	12	23
Brachycentrus americanus	768	1430	698	302	686	777
Hydropsyche sp	81	221	70	198	186	151
Rhyacophila sp			12			2
DIPTERA	**477**	**571**	**536**	**279**	**478**	**467**
Atherix pachypus	23	12	12		12	12
Ceratopogoninae	58	105	12	23	23	44
Eukiefferiella sp	174	128	116	35	70	105
Hexatoma sp	12		23	35	35	21
Micropsectra sp.	12	35				9
Neoplasta sp	35	35	12			16
Orthocladius (Euorthocladius) sp	58	47	81	47	12	49
Orthocladius/Cricotopus sp			12			2
Unid. Orthocladiinae				23		5
Pagastia sp.		70		12		16
Psilometriocnemus sp		23		23		9
Simulium sp.	105	116	256	81	326	177
Tvetenia sp			12			2
HYDRACARINA	**59**	**105**	**23**	**35**	**24**	**49**
Lebertia sp.	47	47	23		12	26
Sperchon/Sperchonopsis	12	58		35	12	23
CRUSTACEA						
AMPHIPODA					**12**	**2**
Hyalella azteca cx					12	2
TURBELLARIA		**47**	**12**		**35**	**19**
Girardia sp.		47	12		35	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF NPDES OUTFALL 002
SAMPLED: 09/27/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
NEMATODA			**12**			**2**
Unid. Nematoda			12			2
ANNELIDA						
OLIGOCHAETA		**23**	**24**	**12**	**47**	**21**
Enchytraeidae			12			2
Nais sp.				12	12	5
Pristina sp.		23	12		23	12
Unid. Immature Tubificidae w/o Capilliform Chaetae					12	2
TOTAL (#/sq. meter)	2956	4864	3400	4502	3959	3933
NUMBER OF TAXA	22	23	27	21	24	40
SHANNON-WEAVER (H')						3.06
TOTAL EPT TAXA	10	9	10	9	9	15
EPT INDEX (% of Total Taxa)	45	39	37	43	38	38
EPHEMEROPTERA ABUNDANCE (% of Total Density)	46	42	54	78	55	56

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HATCHERY DIVERSION
SAMPLED: 09/28/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
COLLEMBOLA			**12**			**2**
Unid. Collembola			12			2
EPHEMEROPTERA	**896**	**954**	**525**	**1467**	**1036**	**975**
Ameletus sp.			12			2
Baetis bicaudatus	174	221	140	233	198	193
Baetis tricaudatus	663	698	326	1140	791	724
Drunella grandis	47	12	47	47	35	38
Ephemerella dorothea	12					2
Rhithrogena hagen		23		47	12	16
PLECOPTERA	**23**		**12**	**117**	**12**	**32**
Hesperoperla pacifica				12		2
Pteronarcella badia				70	12	16
Sweltsa sp.	23		12	35		14
COLEOPTERA	**267**	**256**	**174**	**733**	**431**	**373**
Narpus concolor				12		2
Optioservus castanipennis	267	256	174	442	419	312
Optioservus divergens				198		40
Zaitzevia parvula				81	12	19
TRICHOPTERA	**152**	**198**	**174**	**593**	**558**	**334**
Arctopsyche grandis		23		58	35	23
Brachycentrus americanus	140	140	151	326	430	237
Hydropsyche sp	12	23	23	209	93	72
Rhyacophila sp		12				2
DIPTERA	**396**	**302**	**339**	**1130**	**513**	**534**
Atherix pachypus	70	163	93	802	244	274
Ceratopogoninae	12		12	12		7
Cricotopus sp.	23		23		23	14
Eukiefferiella sp		58	12	70	140	56
Hexatoma sp	174	23	23	70	35	65
Micropsectra sp.			12			2
Neoplasta sp	12				12	5
Orthocladius (Euorthocladius) sp	23	23	81	35		32
Orthocladius/Cricotopus sp	47		47	93	12	40
Unid. Orthocladiinae			12		12	5
Paracladopelma sp				12		2
Protanyderus margarita				12		2
Psilometriocnemus sp	35	12	12	12		14
Simulium sp.		23	12		35	14
Tvetenia sp				12		2
HYDRACARINA	**70**	**35**	**82**	**70**	**59**	**63**
Lebertia sp.	47	23	70	47	47	47
Sperchon/Sperchonopsis	23	12	12	23	12	16
ANNELIDA						
OLIGOCHAETA			**12**	**47**		**11**
Enchytraeidae				47		9
Unid. Immature Tubificidae w/o Capilliform Chaetae			12			2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: UPSTREAM OF HATCHERY DIVERSION
SAMPLED: 09/28/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	1804	1745	1330	4157	2609	2324
NUMBER OF TAXA	18	17	23	27	20	37
SHANNON-WEAVER (H')						3.48
TOTAL EPT TAXA	7	8	7	10	8	13
EPT INDEX (% of Total Taxa	39	47	30	37	40	35
EPHEMEROPTERA ABUNDANCE (% of Total Density	50	55	39	35	40	42

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HATCHERY
SAMPLED: 09/28/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**3244**	**3512**	**1244**	**1593**	**279**	**1975**
Baetis bicaudatus	116	302	186	174	23	160
Baetis tricaudatus	2977	3001	1035	1407	209	1726
Drunella grandis	58	23		12		19
Rhithrogena hagen	93	186	23		47	70
PLECOPTERA			**12**			**2**
Sweltsa sp.			12			2
COLEOPTERA	**1547**	**1140**	**756**	**512**	**105**	**812**
Optioservus castanipennis	1547	582	384	512	58	617
Optioservus divergens		558	372		47	195
TRICHOPTERA	**3885**	**2628**	**1698**	**1163**	**82**	**1891**
Arctopsyche grandis	47					9
Brachycentrus americanus	1965	1303	826	675	12	956
Culoptila sp.	93	116	35			49
Hydropsyche sp	1745	1186	837	488	70	865
Lepidostoma sp	35	23				12
DIPTERA	**1606**	**907**	**770**	**351**	**117**	**748**
Atherix pachypus	23	23	47	35	35	33
Caloparyphus sp	12					2
Ceratopogoninae			12	12		5
Conchapelopia/Thienemannimyia gr		23				5
Cricotopus sp.			23	12		7
Diamesa sp.	35					7
Eukiefferiella sp	442	186	244	116	12	200
Hexatoma sp	58	47	12			23
Micropsectra sp.	35		12			9
Orthocladius (Euorthocladius) sp	58	105	93	47	23	65
Unid. Orthocladiinae		81				16
Parametriocnemus sp	35		12	12		12
Polypedilum sp	35					7
Prosimulium sp.	326	186	116	35	12	135
Protanyderus margarita				12		2
Psilometriocnemus sp	58	23	70	23	23	39
Simulium sp.	454	233	105	47	12	170
Tipula sp.			12			2
Tvetenia sp	35		12			9
HYDRACARINA	**93**	**23**	**12**	**35**	**35**	**40**
Lebertia sp.	93	23		12		26
Sperchon/Sperchonopsis			12	23	23	12
Testudacarus/Torrenticola					12	2
TURBELLARIA	**384**	**163**	**140**	**151**	**47**	**177**
Girardia sp.	384	163	140	151	47	177
ANNELIDA						
OLIGOCHAETA			**35**		**12**	**9**
Nais sp.			23		12	7
Unid. Immature Tubificidae w/o Capilliform Chaetae			12			2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: DOWNSTREAM OF HATCHERY
SAMPLED: 09/28/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TOTAL (#/sq. meter)	10759	8373	4667	3805	677	5654
NUMBER OF TAXA	25	21	26	19	17	37
SHANNON-WEAVER (H')						3.26
TOTAL EPT TAXA	9	8	7	5	5	10
EPT INDEX (% of Total Taxa	36	38	27	26	29	27
EPHEMEROPTERA ABUNDANCE (% of Total Density	30	42	27	42	41	35

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: CABRESTO CREEK
SAMPLED: 09/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**2512**	**2687**	**3048**	**6013**	**4281**	**3708**
Baetis bicaudatus	1337	1907	1605	3408	2559	2163
Baetis tricaudatus	675	512	861	1628	954	926
Cinygmula pai	174	35	93	151	70	105
Drunella dodds	35	140	47	174	140	107
Epeorus sp.	93	12	23	35	23	37
Ephemerella dorothe:	198	81	419	582	535	363
Paraleptophlebia sp				35		7
PLECOPTERA	**268**	**315**	**348**	**895**	**1022**	**569**
Capniidae	81	81	186	442	465	251
Cultus aestivalis	23	47	23	93	116	60
Hesperoperla pacifica	47	12	47	116	23	49
Isoperla sp.	12	12			23	9
Leuctridae	12					2
Megarcys signata	23		23		93	28
Sweltsa sp.		116	23	35		35
Taenionema sp		12	23	35		14
Zapada cinctipes	70	35	23	174	302	121
COLEOPTERA	**105**	**70**	**419**	**675**	**279**	**309**
Heterlimnius corpulentus	93	70	419	640	279	300
Narpus concolor	12			35		9
TRICHOPTERA	**502**	**500**	**813**	**1231**	**1140**	**837**
Arctopsyche grandis	12	70	23	267	116	98
Brachycentrus americanus	12	23		58		19
Hydropsyche sp	12	23		58	23	23
Lepidostoma sp	186	35	163	116	512	202
Micrasema bactro	70	128	209	384	326	223
Oligophlebodes minutus	186	151	395	174	70	195
Rhyacophila brunnea gr	12			58	23	19
Rhyacophila sibirica gr	12	70	23	116	70	58
Rhyacophila sp			23		23	9
DIPTERA	**594**	**746**	**3860**	**2838**	**2790**	**2168**
Atherix pachypus					23	5
Ceratopogoninae	12		116		23	30
Dicranota sp.		23	23		47	19
Empididae		12				2
Eukiefferiella sp				58		12
Hexatoma sp					23	5
Micropsectra sp.	12	105	186	70	70	89
Orthocladius (Euorthocladius) sp		12				2
Orthocladius/Cricotopus sp		12	23			7
Unid. Orthocladiinae				58		12
Pericoma sp.	570	547	3489	2652	2535	1959
Prosimulium sp.			23		23	9
Rheotanytarsus sp					23	5
Simulium sp.		35			23	12
HYDRACARINA	**71**	**81**	**93**	**105**	**93**	**89**
Hygrobates sp	12			35		9
Lebertia sp	47	81	70	35	70	61
Sperchon/Sperchonopsis	12		23	35	23	19

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: CABRESTO CREEK
SAMPLED: 09/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TURBELLARIA			**23**		**47**	**14**
Girardia sp.			23		47	14
NEMATODA			**23**			**5**
Unid. Nematoda			23			5
ANNELIDA						
OLIGOCHAETA	**268**	**407**	**837**	**35**	**942**	**498**
Eiseniella tetraedra	35		23			12
Enchytraeidae		12	116		35	33
Nais sp.	233	395	651	35	907	444
Pristina sp.			47			9
TOTAL (#/sq. meter)	4320	4806	9487	11792	10617	8206
NUMBER OF TAXA	31	31	34	31	35	50
SHANNON-WEAVER (H')						3.58
TOTAL EPT TAXA	21	20	19	21	20	25
EPT INDEX (% of Total Taxa)	68	65	56	68	57	50
EPHEMEROPTERA ABUNDANCE (% of Total Density)	58	56	32	51	40	45

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: COLUMBINE CREEK
SAMPLED: 09/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
INSECTA						
EPHEMEROPTERA	**1467**	**1105**	**953**	**1187**	**1198**	**1183**
Baetis bicaudatus	419	616	279	419	605	468
Baetis tricaudatus	70	35	93	12	12	44
Cinygmula par	186		140	151	116	119
Drunella coloradensis	12					2
Drunella dodds	640	337	337	500	372	437
Epeorus longimanus		35	23			12
Ephemerella dorothea	128	12	23	70	70	61
Rhithrogena robusta	12	70	58	35	23	40
PLECOPTERA	**663**	**1803**	**872**	**920**	**769**	**1005**
Capniidae	12	163	116	105	128	105
Hesperoperla pacifica	35	12	12	35		19
Isoperla sp.	58	12			12	16
Kogotus modestus					12	2
Leuctridae			12	47	12	14
Sweltsa sp.	174	802	209	395	151	346
Taenionema sp	279	640	349	326	419	403
Zapada cinctipes	105	174	174	12	35	100
COLEOPTERA	**814**	**384**	**198**	**337**	**198**	**386**
Heterlimnius corpulentus	814	384	198	337	198	386
TRICHOPTERA	**373**	**326**	**478**	**362**	**279**	**362**
Arctopsyche grandis	12	35	35	35	81	40
Brachycentrus americanus	12		23	12		9
Glossosoma sp.	35		12			9
Hydropsyche sp			12			2
Neothremma sp	47	35	81	12	12	37
Rhyacophila brunnea gr	58	93	70	47		54
Rhyacophila sibirica gr	209	151	233	256	163	202
Rhyacophila sp		12	12		23	9
DIPTERA	**280**	**315**	**689**	**291**	**279**	**370**
Brillia sp.	23					5
Ceratopogoninae	70	35	35	35		35
Dicranota sp.			12	12	23	9
Micropsectra sp.			47	70	23	28
Neoplasta sp	12				23	7
Oreogeton sp				23		5
Orthocladius (Euorthocladius) sp	116	81	209	128	128	132
Orthocladius/Cricotopus sp	12					2
Unid. Orthocladiinae			12			2
Parametriocnemus sp			12			2
Pericoma sp.	35	47	70	23	23	40
Prosimulium sp.		12	47		35	19
Rheotanytarsus sp			12			2
Simulium sp.		128	221		12	72
Tvetenia sp	12	12	12		12	10
HYDRACARINA	**35**			**24**		**11**
Lebertia sp	35			12		9
Protzia sp.				12		2

MACROINVERTEBRATE DENSITY
CLIENT: MOLYCORP
SITE: COLUMBINE CREEK
SAMPLED: 09/30/05

TAXA	REP 1	REP 2	REP 3	REP 4	REP 5	COMPOSITE
TURBELLARIA		**12**			**12**	**4**
Girardia sp.		12				2
Polycelis coronata					12	2
ANNELIDA						
OLIGOCHAETA	**872**	**280**	**685**	**1022**	**989**	**770**
Eiseniella tetraedra		47	209	81	93	86
Enchytraeidae	593	105	244	116	186	249
Lumbriculidae				81	279	72
Nais sp.	279	128	209	628	105	270
Rhynchelmis sp.			23	116	326	93
TOTAL (#/sq. meter)	4504	4225	3875	4143	3724	4091
NUMBER OF TAXA	30	28	37	31	32	49
SHANNON-WEAVER (H')						4.37
TOTAL EPT TAXA	19	17	21	17	17	24
EPT INDEX (% of Total Taxa)	63	61	57	55	53	49
EPHEMEROPTERA ABUNDANCE (% of Total Density)	33	26	25	29	32	29

Appendix E

Cabresto Creek Fish Data

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-1

SPECIES	PASS	LENGTH	WEIGHT	K	Ws	Wr
CUT	1	235	118	0.91	144.2	81.8
CUT	1	226	104	0.90	127.8	81.4
CUT	1	215	106	1.07	109.5	96.8
CUT	1	205	91	1.06	94.4	96.4
CUT	1	204	80	0.94	93.0	86.0
CUT	1	201	80	0.99	88.8	90.1
CUT	1	189	69	1.02	73.4	94.0
CUT	1	176	54	0.99	58.9	91.7
CUT	1	175	54	1.01	57.8	93.4
CUT	1	173	53	1.02	55.8	95.0
CUT	1	169	51	1.06	51.9	98.3
CUT	1	156	35	0.92	40.5	86.4
CUT	1	146	27	0.87	33.0	81.9
CUT	1	142	27	0.94	30.3	89.2
CUT	1	141	26	0.93	29.6	87.8
CUT	1	135	21	0.85	25.9	81.2
CUT	1	125	18	0.92		
CUT	1	119	15	0.89		
CUT	1	115	14	0.92		
CUT	1	110	12	0.90		
CUT	1	109	13	1.00		
CUT	1	109	12	0.93		
CUT	1	105	11	0.95		
CUT	1	100	9.5	0.95		
CUT	1	96	8.5	0.96		
CUT	1	94	8.5	1.02		
CUT	1	52	1.5	1.07		
CUT	2	198	66	0.85	84.8	77.8
CUT	2	102	10	0.94		
CUT	2	99	10	1.03		
CUT	2	99	8.6	0.89		
CUT	2	95	8	0.93		
CUT	2	50	1.3	1.04		

SUMMARY

CUT		LENGTH	WEIGHT	K	Wr
	N:	33	33	33	17
	MIN:	50	1.3	0.85	77.8
	MAX:	235	118	1.07	98.3
	MEAN:	141.4	37.1	0.96	88.8

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-1

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
CUT	27	6	34	± 3.5	0.042	810	± 83.3	66.25

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
CUT	27	6	34	± 3.5	0.017	2000	± 205.9	74.20

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
CUT	27	6	34	± 3.5	0.058	586	± 60.3	47.93

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-2

SPECIES	PASS	LENGTH	WEIGHT	K	Ws	Wr
BRK	1	242	132	0.93	147.6	89.5
BRK	1	212	84	0.88	98.6	85.2
BRK	1	201	62	0.76	83.9	73.9
BRK	1	194	67	0.92	75.3	89.0
BRK	1	185	44	0.69	65.2	67.5
BRK	1	181	40	0.67	61.0	65.6
BRK	1	177	38	0.69	57.0	66.7
BRK	1	174	35	0.66	54.1	64.7
BRK	1	169	39	0.81	49.5	78.8
BRK	1	168	34	0.72	48.6	70.0
BRK	1	165	34	0.76	46.0	73.9
BRK	1	163	30	0.69	44.3	67.7
BRK	1	162	27	0.64	43.5	62.1
BRK	1	159	30	0.75	41.1	73.0
BRK	1	155	25	0.67	38.0	65.7
BRK	1	154	32	0.88	37.3	85.8
BRK	1	152	25	0.71	35.8	69.8
BRK	1	152	21	0.60	35.8	58.6
BRK	1	150	27	0.80	34.4	78.4
BRK	1	150	22	0.65	34.4	63.9
BRK	1	147	29	0.91	32.4	89.6
BRK	1	147	27	0.85	32.4	83.4
BRK	1	145	20	0.66	31.0	64.4
BRK	1	143	16	0.55	29.8	53.8
BRK	1	142	23	0.80	29.1	78.9
BRK	1	141	19	0.68	28.5	66.6
BRK	1	140	23	0.84	27.9	82.4
BRK	1	132	12	0.52	23.3	51.4
BRK	1	129	19	0.89		
BRK	1	127	16	0.78		
BRK	1	125	18	0.92		
BRK	1	125	10	0.51		
BRK	1	124	22	1.15		
BRK	1	124	18	0.94		
BRK	1	122	16	0.88		
BRK	1	121	17	0.96		
BRK	1	120	16	0.93		
BRK	1	120	14	0.81		
BRK	1	119	15	0.89		
BRK	1	117	14	0.87		
BRK	1	115	15	0.99		
BRK	1	115	14	0.92		
BRK	1	114	14	0.94		
BRK	1	113	14	0.97		
BRK	1	113	14	0.97		
BRK	1	113	13	0.90		

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-2

BRK	1	113	9.4	0.65		
BRK	1	112	15	1.07		
BRK	1	111	14	1.02		
BRK	1	110	12	0.90		
BRK	1	109	13	1.00		
BRK	1	109	12	0.93		
BRK	1	107	11	0.90		
BRK	1	104	12	1.07		
BRK	1	67	3.5	1.16		
CUT	1	221	100	0.93	119.2	83.9
CUT	1	210	92	0.99	101.8	90.4
CUT	1	198	74	0.95	84.8	87.3
CUT	1	191	65	0.93	75.8	85.7
CUT	1	191	62	0.89	75.8	81.7
CUT	1	184	56	0.90	67.6	82.9
CUT	1	179	60	1.05	62.0	96.7
CUT	1	179	51	0.89	62.0	82.2
CUT	1	177	52	0.94	59.9	86.8
CUT	1	171	45	0.90	53.8	83.6
CUT	1	169	42	0.87	51.9	80.9
CUT	1	168	40	0.84	51.0	78.5
CUT	1	160	42	1.03	43.8	95.9
CUT	1	155	31	0.83	39.7	78.1
CUT	1	155	30	0.81	39.7	75.6
CUT	1	150	27	0.80	35.9	75.3
CUT	1	141	27	0.96	29.6	91.2
CUT	1	137	28	1.09	27.1	103.4
CUT	1	137	24	0.93	27.1	88.6
CUT	1	136	18	0.72	26.5	68.0
CUT	1	132	23	1.00	24.1	95.3
CUT	1	130	23	1.05	23.0	99.9
CUT	1	126	22	1.10		
CUT	1	126	18	0.90		
CUT	1	123	13	0.70		
CUT	1	122	19	1.05		
CUT	1	122	18	0.99		
CUT	1	122	17	0.94		
CUT	1	122	17	0.94		
CUT	1	121	17	0.96		
CUT	1	120	15	0.87		
CUT	1	116	15	0.96		
CUT	1	115	9.2	0.60		
CUT	1	111	14	1.02		
CUT	1	110	12	0.90		
CUT	1	94	9	1.08		
CUT	1	92	8.3	1.07		
CUT	1	91	7.9	1.05		

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-2

CUT	1	90	8.4	1.15		
CUT	1	90	7.5	1.03		
CUT	1	88	6.2	0.91		
CUT	1	87	8	1.21		
CUT	1	87	5.9	0.90		
CUT	1	86	7.5	1.18		
CUT	1	86	7.1	1.12		
CUT	1	84	6.2	1.05		
CUT	1	83	6	1.05		
BRK	2	195	64	0.86	76.5	83.7
BRK	2	157	37	0.96	39.5	93.6
BRK	2	128	19	0.91		
BRK	2	122	17	0.94		
BRK	2	121	15	0.85		
BRK	2	119	16	0.95		
BRK	2	116	14	0.90		
CUT	2	169	41	0.85	51.9	79.0
CUT	2	167	44	0.94	50.0	88.0
CUT	2	162	37	0.87	45.5	81.3
CUT	2	121	17	0.96		
CUT	2	116	16	1.03		
CUT	2	94	8.9	1.07		
CUT	2	84	6.8	1.15		

SUMMARY

BRK		LENGTH	WEIGHT	K	Wr
	N:	62	62	62	30
	MIN:	67	3.5	0.51	51.4
	MAX:	242	132	1.16	93.6
	MEAN:	139.6	25.5	0.84	73.3

CUT		LENGTH	WEIGHT	K	Wr
	N:	54	54	54	25
	MIN:	83	5.9	0.60	68.0
	MAX:	221	100	1.21	103.4
	MEAN:	133.3	27.4	0.96	85.6

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRK	55	7	62	± 2.0	0.052	1192	± 38.5	67.01
CUT	47	7	54	± 2.1	0.052	1038	± 40.4	62.70

MOLYCORP
10/05/05
CABRESTO CREEK - NRD-2

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRK	55	7	62	± 2.0	0.021	2952	± 95.2	75.28
CUT	47	7	54	± 2.1	0.021	2571	± 100.0	70.45

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRK	55	7	62	± 2.0	0.051	1216	± 39.2	68.36
CUT	47	7	54	± 2.1	0.051	1059	± 41.2	63.97

MOLYCORP
10/04/05
CABRESTO CREEK - NRD-3

SPECIES	PASS	LENGTH	WEIGHT	K	Ws	Wr
BRK	1	196	58	0.77	77.7	74.7
BRK	1	195	69	0.93	76.5	90.2
BRK	1	193	60	0.83	74.1	80.9
BRK	1	191	57	0.82	71.8	79.4
BRK	1	191	56	0.80	71.8	78.0
BRK	1	183	48	0.78	63.0	76.1
BRK	1	182	50	0.83	62.0	80.6
BRK	1	181	45	0.76	61.0	73.8
BRK	1	180	44	0.75	60.0	73.4
BRK	1	163	36	0.83	44.3	81.2
BRK	1	162	41	0.96	43.5	94.2
BRK	1	157	33	0.85	39.5	83.4
BRK	1	157	32	0.83	39.5	80.9
BRK	1	157	31	0.80	39.5	78.4
BRK	1	152	25	0.71	35.8	69.8
BRK	1	152	24	0.68	35.8	67.0
BRK	1	150	24	0.71	34.4	69.7
BRK	1	137	21	0.82	26.1	80.4
BRK	1	117	13	0.81		
BRK	1	114	12	0.81		
BRK	1	107	10	0.82		
BRN	1	276	208	0.99	226.5	91.9
BRN	1	244	152	1.05	157.2	96.7
BRN	1	225	100	0.88	123.6	80.9
BRN	1	224	123	1.09	122.0	100.8
BRN	1	211	102	1.09	102.2	99.8
BRN	1	205	77	0.89	93.8	82.0
BRN	1	196	68	0.90	82.2	82.8
BRN	1	195	71	0.96	80.9	87.7
BRN	1	182	54	0.90	66.0	81.9
BRN	1	174	49	0.93	57.7	84.9
BRN	1	173	52	1.00	56.8	91.6
BRN	1	172	51	1.00	55.8	91.4
BRN	1	172	51	1.00	55.8	91.4
BRN	1	171	50	1.00	54.8	91.2
BRN	1	169	56	1.16	53.0	105.7
BRN	1	164	41	0.93	48.5	84.6
BRN	1	163	40	0.92	47.6	84.1
BRN	1	155	40	1.07	41.0	97.6
BRN	1	155	30	0.81	41.0	73.2
BRN	1	141	24	0.86	31.0	77.5
BRN	1	138	28	1.07		
BRN	1	136	22	0.87		
BRN	1	133	22	0.94		
BRN	1	127	20	0.98		
BRN	1	123	20	1.07		

MOLYCORP
10/04/05
CABRESTO CREEK - NRD-3

BRN	1	119	16	0.95		
BRN	1	114	19	1.28		
BRN	1	111	14	1.02		
BRN	1	107	14	1.14		
BRN	1	105	13	1.12		
CUT	1	220	104	0.98	117.5	88.5
CUT	1	214	107	1.09	107.9	99.2
HYBRID	1	200	82	1.03	87.5	93.7
HYBRID	1	179	57	0.99	62.0	91.9
HYBRID	1	129	21	0.98		
RBT	1	217	105	1.03	110.3	95.2
RBT	1	189	54	0.80		
BRK	2	184	51	0.82	64.1	79.6
BRK	2	160	34	0.83	41.9	81.2
BRN	2	216	98	0.97	109.6	89.4
BRN	2	136	28	1.11		
BRN	2	112	15	1.07		

SUMMARY

BRK		LENGTH	WEIGHT	K	Wr
	N:	23	23	23	20
	MIN:	107	10	0.68	67.0
	MAX:	196	69	0.96	94.2
	MEAN:	163.5	38.0	0.81	78.6

BRN		LENGTH	WEIGHT	K	Wr
	N:	33	33	33	21
	MIN:	105	13	0.81	73.2
	MAX:	276	208	1.28	105.7
	MEAN:	165.0	53.6	1.00	88.9

CUT		LENGTH	WEIGHT	K	Wr
	N:	2	2	2	2
	MIN:	214	104	0.98	88.5
	MAX:	220	107	1.09	99.2
	MEAN:	217.0	105.5	1.04	93.9

HYBRID		LENGTH	WEIGHT	K	Wr
	N:	3	3	3	2
	MIN:	129	21	0.98	91.9
	MAX:	200	82	1.03	93.7
	MEAN:	169.3	53.3	1.00	92.8

MOLYCORP
10/04/05
CABRESTO CREEK - NRD-3

RBT		LENGTH	WEIGHT	K	Wr
	N:	2	2	2	1
	MIN:	189	54	0.80	95.2
	MAX:	217	105	1.03	95.2
	MEAN:	203.0	79.5	0.92	95.2

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (acre)	Density (#/acre)	95% CI	Biomass (lbs/acre)
BRK	21	2	23	± 0.9	0.072	319	± 12.5	26.72
BRN	30	3	33	± 1.2	0.072	458	± 16.7	54.12
CUT	2	0	2	± 0.0	0.072	28	± 0.0	6.51
HYBRID	3	0	3	± 0.0	0.072	42	± 0.0	4.94
RBT	2	0	2	± 0.0	0.072	28	± 0.0	4.91

	1st Pass	2nd Pass	Pop Est	95% CI	Site Area (ha)	Density (#/ha)	95% CI	Biomass (kg/ha)
BRK	21	2	23	± 0.9	0.029	793	± 31.0	30.13
BRN	30	3	33	± 1.2	0.029	1138	± 41.4	61
CUT	2	0	2	± 0.0	0.029	69	± 0.0	7.28
HYBRID	3	0	3	± 0.0	0.029	103	± 0.0	5.49
RBT	2	0	2	± 0.0	0.029	69	± 0.0	5.49

	1st Pass	2nd Pass	Pop Est	95% CI	Site Length (mile)	Density (#/mile)	95% CI	Biomass (lbs/mile)
BRK	21	2	23	± 0.9	0.061	377	± 14.8	31.58
BRN	30	3	33	± 1.2	0.061	541	± 19.7	63.93
CUT	2	0	2	± 0.0	0.061	33	± 0.0	7.68
HYBRID	3	0	3	± 0.0	0.061	49	± 0.0	5.76
RBT	2	0	2	± 0.0	0.061	33	± 0.0	5.78