SECTION 2.2

BIBLIOGRAPHY

SECTION 2.2.1

HISTORICAL (1953 - 1992)

BIOLOGICAL DATA

Barker, R.E. 1953. Fish Population check in the vicinity of Red River City. Memorandum to Homer Pickens, dated 11 September 1953.

This memo reports four small surveys made with an electrofishing unit at sites within Red River. Length of stream sampled was given, and only one electrofishing pass was conducted. Recovery was considered "poor" at the lowest site because the stream was muddy due to construction activities. Estimates of efficiency were not made for the other sites. Data were presented by species, with lengths reported for all fish at some sites and for only a few fish at other sites.

The first site was "midway between Mr. Lewis' Ranch and Red River in the open meadow." Mr. Lewis' ranch occupied most of the area west of the town of Red River bounded on the north by the Red River and on the east by Pioneer Creek. It did not include the Powder Puff Mountain ski resort along Pioneer Creek, now a part of Red River Ski Area. At the time of sampling, the city limits was approximately at the crest of the hill on the northwest end of Main Street, near what is now the Terrace-Towers Lodge. We have determined the location of this site to be west of that hill. The second site was described as "an 85 yard stretch straddling the bridge across Red River to Pioneer Creek." The third section was "just above Mr. Booker's pond." Mr. Booker's pond is located south of the intersection of SH 38 and SH 578. The final site was "above the Aspen Park Camp," which is located near the Mile 2 marker on SH 578, about 0.2 miles downstream of the Zwergle site.

Barker (1953) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
above Aspen Park Camp		**Upstream of Bitter Creek**				**3 Sep 1953**		**N36° 40' 45" W105° 22' 50"**	
CUT	22	310	--	--	--	--	--	1	375
BRK	1	14	--	--	--	133	--	1	375
near Mr. Booker's Pond		**Upstream of Bitter Creek**				**3 Sep 1953**		**N36° 42' 10" W105° 23' 55"**	
BRN	9	127	--	--	--	235	--	1	375
BRK	53	746	--	--	--	--	--	1	375
RBT	1	14	--	--	--	241	--	1	375
CUT	1	14	--	--	--	108	--	1	375
near Pioneer Creek		**Downstream of Bitter Creek**				**3 Sep 1953**		**N36° 42' 35" W105° 24' 35"**	
BRN	8	166	--	--	--	186	--	1	255
BRK	5	104	--	--	--	154	--	1	255
RBT	5	104	--	--	--	251	--	1	255
CUT	4	83	--	--	--	181	--	1	255
near Mr. Lewis' Ranch		**Downstream of Bitter Creek**				**3 Sep 1953**		**N36° 42' 40" W105° 25' 0"**	
BRN	6	106	--	--	--	192	--	1	300
RBT	1	18	--	--	--	203	--	1	300
BRK	2	35	--	--	--	146	--	1	300

* Estimated; accurate to ±5".

New Mexico Department of Game and Fish. 1960. Unpublished stream survey forms.

This report is comprised of five stream survey reports prepared by the NMDGF. Data are presented on stream survey field sheets, with general information on the stream conditions and habitat. Habitat variables include characterization of vegetative cover, beaver activity, percent pools, fish cover, bottom substrate, shading. A brief water chemistry analysis include temperatures, oxygen and carbon dioxide concentrations, alkalinity, pH, and hardness. Some of the reports include a survey of fish and/or benthic invertebrates.

Some of the stream survey reports have multiple dates, so it is not clear as to the actual date on which a particular part of the survey occurred. Not all of the blanks on each form were completed. Fish data are presented with the length of stream electrofished and an estimation of the efficiency with which the survey was conducted (based, presumably, on the clarity and velocity of the water). Collection of benthic invertebrates was described as having comprised one square foot and were probably collected with a Surber sampler.

Site A-4, sampled 26 May 1960, is described as "1.2 miles upstream from where road divides to east and west forks" on the west fork of the Red River. Beaver activity was identified 0.25 miles downstream of the survey point, and the fishing history was characterized as "light fishing pressure." No aquatic vegetation was reported. Although a fish population sample was not taken at the time, a suite of three one-square-foot samples was taken for benthic invertebrates to characterize the relative abundance and biovolume of "fish food." A total of 79 organisms was collected and identified to the Order level, including 45 Ephemeroptera (0.70 cm^3), 17 Plecoptera (0.30 cm^3), 11 Trichoptera (0.30 cm^3), and 6 Diptera (0.15 cm^3).

The stream survey form for Site A-5 has two dates, 24 June 1960 and 5 August 1960. Based on the stream habitat parameters presented (e.g., high flows characteristic of spring runoff), it appears that the habitat parameters and benthic invertebrates were collected on 24 June and the site revisited for fish population sampling on 5 August. This procedure is not without precedence; samples were taken on two separate dates at Site A-1, upstream of the hatchery. Site A-5 was located "[at] beginning of Blue Lake Trail" on the East Fork of the Red River. The Blue Lake Trail does not intersect with the East Fork Red River; we have assumed that this language refers to the Lost Lake Trail which begins at the end of the unimproved dirt road along the East Fork 0.75 miles north of Sawmill Creek. No beaver activity was identified at the site, and the fishing history was characterized as "[low] fishing pressure but good catches of cutthroat [trout] reported." Algae was present in "moderate" amounts. Both fish and benthic invertebrate populations were sampled. Invertebrates were identified to order or family level, with counts and volumes in cm^3 for each taxon. Taxa included four Plecoptera in two taxa (0.02 cm^3), 76 Trichoptera in six taxa (0.22 cm^3), 67 Ephemeroptera in three taxa (0.16 cm^3), two Coleoptera in two taxa (0.01 cm^3), and two Lepidoptera adults representing only a trace biovolume.

Two stream survey sheets were provided for the site at Junebug Campground, variously identified as Sites A-3 and A-6, but both bearing the date 6 October 1960 and identified as one mile west of Red River. Heavy fishing pressure was reported for this site with no sign of beavers or possible fish predators. Aquatic vegetation included "small" amounts of *Ranunculus*. Although general stream information varies between the two survey sheets, (one was recorded at 2:30 p.m. and the other at 5:45 p.m.), fish survey data on the back of the sheets have identical counts and lengths for each specimen. On the form with the time of 5:45 p.m., deformations were reported for three of the rainbow trout. The sheet timed at 5:45 p.m. described the invertebrate communities as "rich," with relative importance by volume as "Trichoptera, Plecoptera, Ephemeroptera" and by "quantity: Ephemeropter [*sic*], Trichoptera, Plecoptera." The other form, timed at 2:30 p.m., estimated the invertebrate communities as "average," with Trichoptera of importance by volume and Ephemeroptera of importance by quantity.

On the back of the Junebug Campground stream survey form with the time of 2:30 p.m., there was an additional report of fish data from Site A-2, located "[six] miles east of Questa" on 5 August 1960 (not Oct 1960 as reported in CEC [1997]). Lengths were reported for all fish and weights were reported for all but one of the fish collected. We have determined this to be upstream of Columbine Creek, but cannot be more accurate. The coordinates make this site functionally equivalent to the RI/FS Site RR-8.

The lowest site for which data was provided in the NMDGF (1960) stream survey was Site A-1, located "½ mile upstream from Red River Fish Hatchery" and sampled on 22 June 1960. Fishing history was described as "intensive", and beaver activity was evident. Though not directly observed, possible fish predators included kingfisher, and water snakes. Aquatic vegetation included "small" amounts of both algae and *Ranunculus*. The stream survey form reported that "[volume] flow was extremely high and prohibited fish sampling." A second visit was made on 21 October 1960, with 100 feet of stream sampled at an estimated 20% efficiency. Only data on fish lengths were provided with no weight data. Invertebrates were identified to order or family, including 397 Trichoptera in five taxa (7 cm^3), 54 Ephemeroptera in three taxa (0.92 cm^3), one Plecoptera representing only a trace amount of biovolume, two Coleoptera (0.01 cm^3), six Diptera in four taxa (0.02 cm^3).

These data are later summarized in Parish (1975b) in regard to minimum flows in the Red River. A postscript is added which states, "I hardly believe we can use the expanded fish per mile estimates from [Jim] Harrison's surveys."

NMDGF (1960) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
A-4		**West Fork**				**26 May 1960**		**N36° 36' 45" W105° 25' 0"**	
no fish sampled									
A-5		**East Fork at Blue Lake Trail**				**5 Aug 1960**		**N36° 36' 35" W105° 23' 5"**	
CUT	17	299	16.7	407	36.6	176	90	1 (70)	300
BRK	3	53	2.9	72	6.4	165	89	1 (70)	300
A-3, A-6		**Junebug Campground**				**6 Oct 1960**		**N36° 42' 25" W105° 26' 5"**	
RBT	13	404	--	--	--	211	--	1 (50)	170
BRN	7	217	--	--	--	161	--	1 (50)	170
A-2		**Upstream of Columbine Creek**				**5 Aug 1960**		**N36° 41' 10" W105° 30' 20"**	
RBT	11	194	17	--	--	234	142	1	300
BRN	5	88	2.8	--	--	165	51	1	300
A-1		**Upstream of Hatchery Diversion**				**21 Oct 1960**		**N36° 41' 5" W105° 38' 45"**	
BRN	6	317	--	--	--	311	--	1 (20)	100

* Estimated; accurate to ±5".

NMDGF (1960) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
A-4		**West Fork**		**26 May 1960**	**N36° 36' 45" W105° 25' 0"**
4**	283	--	75%	--	Total biovolume: 5.20 cm^3/m^2
A-5		**East Fork at Blue Lake Trail**		**24 Jun 1960**	**N36° 36' 35" W105° 23' 5"**
9	542	--	78%	–	Total biovolume: 1.47 cm^3/m^2
A-3, A-6		**Junebug Campground**		**6 Oct 1960**	**N36° 42' 25" W105° 26' 5"**
EPT taxa noted as present		--	--	--	--
A-1		**Upstream of Hatchery Diversion**		**22 Jun 1960**	**N36° 41' 5" W105° 38' 45"**
12	1,650	--	67%	–	Total biovolume: 28.6 cm^3/m^2

* Estimated; accurate to ±5".

** Order level only.

U.S. Federal Water Pollution Control Administration. 1966. *A Water Quality Survey, Red River of the Rio Grande New Mexico*. Report prepared for New Mexico Department of Public Health, Santa Fe, NM.

This report presented results of benthic invertebrate samples collected at eight sites on the Red River on 3 November 1965. A suite of three 1 ft^2 samples was taken at each site, presumably with a Surber sampler. Invertebrates were identified to the lowest practical taxonomic level (genus or species), with total numbers of individuals reported for each taxon in each sample. Invertebrates were characterized as "clean", "facultative", or "pollutional," and the Beck Biotic Index was calculated for each site. Although site descriptions are not included in the report, a map is provided. Site descriptions are provided in USEPA (1971, q.v.), which reports data from the same sites.

Site 6 was placed in the reach "Upstream of Molycorp property boundary" in CEC (1997); it should have been placed in the reach "Elephant Rock Campground" as it is in this report.

USFWPCA (1966) - Benthic Invertebrates

Site (in report)			Reach		Date		Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices		
							N36° 42' 5"
8		**Upstream of Bitter Creek**		**3 Nov 1965**			**W105° 23' 45"**
22	1,044	17	77	–	–		
							N36° 42' 25"
7		**Downstream of Bitter Creek**		**3 Nov 1965**			**W105° 24' 25"**
20	1,274	18	90	–	–		
							N36° 42' 25"
6		**Elephant Rock Campground**		**3 Nov 1965**			**W105° 26' 55"**
17	362	12	71	–	–		
							N36° 41' 0"
5		**Upstream of Goathill Gulch**		**3 Nov 1965**			**W105° 31' 15"**
14	402	10	71	–	–		
							N36° 42' 5"
4		**Questa Ranger/Gaging Station**		**3 Nov 1965**			**W105° 33' 50"**
9	86	6	67	–	–		
							N36° 41' 35"
3		**SH 522 Bridge**		**3 Nov 1965**			**W105° 36' 40"**
6	108	4	67	–	–		
							N36° 41' 5"
2-A		**Upstream of Hatchery Diversion**		**3 Nov 1965**			**W105° 38' 45"**
10	291	5	50	–	–		
							N36° 40' 55"
2		**Downstream of Hatchery**		**3 Nov 1965**			**W105° 39' 25"**
20	344	10	50	–	–		

* Estimated; accurate to ±5".

U.S. Environmental Protection Agency. 1971. *A Water Quality Survey, Red River and Rio Grande, New Mexico*.

This report presents continued sampling at the same sites as USFWPCA (1966, q.v.), conducted again in 2-5 November 1970. Three Surber samples were composited at each site to obtain the data, which are presented with a density estimate and total number of taxa. Taxa were characterized as "clean," "facultative," or "tolerant," and the Beck Biotic Index was calculated for each site. Additionally, extensive water quality and chemistry parameters were measured at each site, except Site 2A, over a four day period. It is not clear from the report on which date the benthic invertebrates were sampled. Graphical representation of invertebrate data collected in 1965 and 1966 is included. On a bemusing side note, the Trichoptera are identified as "three-winged organisms" on p. 14.

Site 8 was described as being "[immediately] above town of Red River above White Horse Stables area", 19.90 river miles upstream of the confluence of the Red River and the Rio Grande. This site is just upstream of the "Y"-shaped intersection of State Highways 38 and 578. Our copy of this report has photocopied, handwritten notes indicating that the distance might actually be 18.2 river miles. Elevation is given as 8,700 feet.

Site 7 is described as "[immediately] below town of Red River at Powder Puff Mountain Ski Resort", 18.30 river miles upstream of the confluence of the Red River and the Rio Grande. This site is assumed to be in the meadow between Graveyard Canyon and the hill on the northwest end of Main Street. Our copy of this report has photocopied, handwritten notes indicating that the distance might actually be 17.3 river miles. Elevation is given as 8,600 feet.

Site 6 is "1.7 miles above Moly Corp mine at park with old diversion dam", 14.80 miles upstream of the confluence of the Red River and the Rio Grande. This site is assumed to be at the Elephant Rock Campground. Elevation is given as 8,200 feet. This site appears to be upstream of Goathill Gulch.

Site 5 is located on the "Red River at first bridge coming from Questa to Red River; second bridge below (west) Moly Corp." It was located 11.20 river miles upstream of the confluence of the Red River and the Rio Grande. Elevation is given as 8,000 feet. This site appears to be upstream of Goathill Gulch.

Site 4 is located on the "Red River at Ranger Station; 2.2 miles east of Questa on Highway 38", 8.2 river miles upstream of the confluence of the Red River and the Rio Grande. Elevation is given as 7,444 feet.

Site 3 is located on the "Red River at Highway 3 [522] south of Questa", 5.90 river miles upstream of the confluence of the Red River and the Rio Grande. Elevation is given as 7,300 feet.

Site 2A is located "[above] fish hatchery, 0.25 miles." It is 4.10 river miles upstream of the confluence of the Red River and the Rio Grande. Elevation is not provided.

Site 2 is located at the "[lower] end of park, 0.25 miles below fish hatchery", 3.20 river miles upstream of the confluence of the Red River and the Rio Grande. Elevation is given as 7,100 feet.

USEPA (1971) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
8		**Upstream of Bitter Creek**		**2-5 Nov 1970**	**N36° 42' 5" W105° 23' 45"**
17	3,549	--	--	–	BBI = 30
7		**Downstream of Bitter Creek**		**2-5 Nov 1970**	**N36° 42' 25" W105° 24' 25"**
16	2,971	--	--	–	BBI = 31
6		**Elephant Rock Campground**		**2-5 Nov 1970**	**N36° 42' 25" W105° 26' 55"**
17	1,152	--	--	–	BBI = 29
5		**Upstream of Goathill Gulch**		**2-5 Nov 1970**	**N36° 41' 0" W105° 31' 15"**
11	933	--	--	–	BBI = 21
4		**Questa Ranger/Gaging Station**		**2-5 Nov 1970**	**N36° 42' 5" W105° 33' 50"**
11	449	--	--	–	BBI = 19
3		**SH 522 Bridge**		**2-5 Nov 1970**	**N36° 41' 35" W105° 36' 40"**
10	818	--	--	–	BBI = 19
2-A		**Upstream of Hatchery Diversion**		**2-5 Nov 1970**	**N36° 41' 5" W105° 38' 45"**
16	2,759	--	--	–	BBI = 27
2		**Downstream of Hatchery**		**2-5 Nov 1970**	**N36° 40' 55" W105° 39' 25"**
19	3,523	--	--	–	BBI = 26

* Estimated; accurate to ± 5".

Pennak, R.W. 1972. Freshwater biology. Pages 31-43. IN: *Final Report on Ecological Research and Rehabilitation Done for the Molybdenum Corporation of America*. Thorne Ecological Institute, Boulder, CO.

Data from six visits in 1971 to four sites on the Red River and one site on Pope Creek are presented in this report. For benthic macroinvertebrates, a suite of five samples were taken with a Surber sampler at each site on each date. Identification of invertebrates was conducted usually to the genus level and reported as a density estimate (in number of organisms/m^2) by taxon. Qualitative five-minute periphyton samples were collected, with identifications taken generally to the genus level and reported as a percentage of the total. Water quality parameters measured included temperature, pH, oxygen and carbon dioxide concentrations, suspended and dissolved organic and inorganic materials. It was noted that weather conditions near the settling ponds on 28 July 1971 and a burst tailings pipe on 8 October 1971 affected measurements. This report is referenced in a footnote in Pennak (1976, q.v.) as *Limnological Conditions in the Red River, New Mexico, During the Open Season of 1971, with Special Reference to the Effects of a Large Settling Pond Tributary*.

Site 1 was located "about 200 yards upstream from the southeast corner of Moly Corp property fence adjacent to Highway 38; one-half mile above the plant intake." Elevation was given as 8,200 feet.

Site 2 was located about two and one-quarter miles east of Questa, just above Eagle Rock Camp Ground and five miles below Station 1." Elevation was given as 7,450 feet. This site is assumed to be near the west end of Eagle Rock Lake since the east end of the lake is too marshy for a good campsite.

Site 3 was located "100 yards above Pope Creek inlet." Elevation was given as 7,160 feet.

Site 5 was located "200 yards above the Red River fish hatchery, and one mile below stations 3 and 4." Elevation was given as 7,080 feet.

Note: Site 4 was located on Pope Creek, 100 yards upstream of its confluence with the Red River. Data from this site are not included in this analysis.

Pennak (1972) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
1		**Upstream of Molycorp Boundary**		**17 May 1971**	**N36° 41' 55" W105° 28' 55"**
5	99	3	60	1.68	--
1		**Upstream of Molycorp Boundary**		**23-24 Jun 1971**	**N36° 41' 55" W105° 28' 55"**
9	210	7	78	4.20	--
1		**Upstream of Molycorp Boundary**		**28-29 Jul 1971**	**N36° 41' 55" W105° 28' 55"**
9	109	8	89	3.99	--
1		**Upstream of Molycorp Boundary**		**3-4 Sep 1971**	**N36° 41' 55" W105° 28' 55"**
9	90	7	78	2.73	--
1		**Upstream of Molycorp Boundary**		**8-9 Oct 1971**	**N36° 41' 55" W105° 28' 55"**
4	29	4	100	0.84	--
1		**Upstream of Molycorp Boundary**		**14-15 Nov 1971**	**N36° 41' 55" W105° 28' 55"**
10	160	7	70	2.94	--
2		**Eagle Rock Campground**		**17 May 1971**	**N36° 42' 10" W105° 34' 30"**
5	32	4	80	2.94	--
2		**Eagle Rock Campground**		**23-24 Jun 1971**	**N36° 42' 10" W105° 34' 30"**
5	74	2	40	1.05	--
2		**Eagle Rock Campground**		**28-29 Jul 1971**	**N36° 42' 10" W105° 34' 30"**
8	59	4	50	2.94	--
2		**Eagle Rock Campground**		**3-4 Sep 1971**	**N36° 42' 10" W105° 34' 30"**
6	50	4	67	1.26	--
2		**Eagle Rock Campground**		**8-9 Oct 1971**	**N36° 42' 10" W105° 34' 30"**
8	149	7	88	3.54	--
2		**Eagle Rock Campground**		**14-15 Nov 1971**	**N36° 42' 10" W105° 34' 30"**
7	50	5	71	2.31	--
3		**Upstream of Pope Creek**		**17 May 1971**	**N36° 41' 25" W105° 37' 55"**
11	290	9	82	7.14	--
3		**Upstream of Pope Creek**		**23-24 Jun 1971**	**N36° 41' 25" W105° 37' 55"**
9	216	6	67	3.78	--
3		**Upstream of Pope Creek**		**28-29 Jul 1971**	**N36° 41' 25" W105° 37' 55"**
8	326	6	75	5.04	--
3		**Upstream of Pope Creek**		**3-4 Sep 1971**	**N36° 41' 25" W105° 37' 55"**
8	82	6	75	0.84	--

Pennak (1972) - Benthic Invertebrates (cont.)

Site (in report)			Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices	
3			**Upstream of Pope Creek**		**8-9 Oct 1971**	**N36° 41' 25" W105° 37' 55"**
8	147	7	88	2.10	--	
3			**Upstream of Pope Creek**		**14-15 Nov 1971**	**N36° 41' 30" W105° 37' 5"**
8	617	7	88	3.36	--	
5			**Upstream of hatchery diversion**		**17 May 1971**	**N36° 41' 10" W105° 38' 40"**
9	299	7	78	10.9	--	
5			**Upstream of hatchery diversion**		**23-24 Jun 1971**	**N36° 41' 10" W105° 38' 40"**
7	479	5	71	16.8	--	
5			**Upstream of hatchery diversion**		**28-29 Jul 1971**	**N36° 41' 10" W105° 38' 40"**
8	199	5	63	13.6	--	
5			**Upstream of hatchery diversion**		**3-4 Sep 1971**	**N36° 41' 10" W105° 38' 40"**
6	571	3	50	1.6	--	
5			**Upstream of hatchery diversion**		**8-9 Oct 1971**	**N36° 41' 10" W105° 38' 40"**
5	479	3	60	10.9	--	
5			**Upstream of hatchery diversion**		**14-15 Nov 1971**	**N36° 41' 10" W105° 38' 40"**
7	84	4	57	1.6	--	

* Estimated; accurate to ± 5".

Pennak (1972) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
1	**Upstream of Molycorp Boundary**	**17 May 1971**	**N36° 41' 55" W105° 28' 55"**
1.85	Detritus (100)		
1	**Upstream of Molycorp Boundary**	**23 Jun 1971**	**N36° 41' 55" W105° 28' 55"**
0.99	Detritus (10), *Oscillatoria* (90)		
1	**Upstream of Molycorp Boundary**	**28 Jul 1971**	**N36° 41' 55" W105° 28' 55"**
0.36	Detritus (~100), diatoms		
1	**Upstream of Molycorp Boundary**	**3 Sep 1971**	**N36° 41' 55" W105° 28' 55"**
0.78	Detritus (100)		
1	**Upstream of Molycorp Boundary**	**8 Oct 1971**	**N36° 41' 55" W105° 28' 55"**
3.44	Detritus (100)		
1	**Upstream of Molycorp Boundary**	**14 Nov 1971**	**N36° 41' 55" W105° 28' 55"**
1.96	Detritus (100)		
2	**Eagle Rock Campground**	**17 May 1971**	**N36° 42' 10" W105° 34' 30"**
69.12	Detritus (90), fungi (5), *Oscillatoria* (?) (5), diatoms		
2	**Eagle Rock Campground**	**23 Jun 1971**	**N36° 42' 10" W105° 34' 30"**
2.05	Detritus (99.7), *Ulothrix*, *Oscillatoria*, diatoms		
2	**Eagle Rock Campground**	**28 Jul 1971**	**N36° 42' 10" W105° 34' 30"**
8.33	Detritus (~100), diatoms		
2	**Eagle Rock Campground**	**3 Sep 1971**	**N36° 42' 10" W105° 34' 30"**
30.02	Detritus (65), *Oscillatoria* (34), "*Chroococcus*"		
2	**Eagle Rock Campground**	**8 Oct 1971**	**N36° 42' 10" W105° 34' 30"**
12.78	Detritus (97), *Oscillatoria* (3), diatoms		
2	**Eagle Rock Campground**	**14 Nov 1971**	**N36° 42' 10" W105° 34' 30"**
64.12	Detritus (20), *Oscillatoria* (80), diatoms		
3	**Upstream of Pope Creek**	**17 May 1971**	**N36° 41' 25" W105° 37' 55"**
12.85	Detritus (69), *Oscillatoria* (30)		
3	**Upstream of Pope Creek**	**24 Jun 1971**	**N36° 41' 25" W105° 37' 55"**
0.98	Detritus (100)		
3	**Upstream of Pope Creek**	**29 Jul 1971**	**N36° 41' 25" W105° 37' 55"**
0.58	Detritus (100)		

Pennak (1972) - Periphyton (cont.)

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
3	**Upstream of Pope Creek**	**4 Sep 1971**	**N36° 41' 25" W105° 37' 55"**
10.37	Detritus (97), *Oscillatoria* (3)		
3	**Upstream of Pope Creek**	**15 Nov 1971**	**N36° 41' 25" W105° 37' 55"**
23.27	Detritus (20), *Chroococcus* (60), *Oscillatoria* (20)		
5	**Upstream of hatchery diversion**	**17 May 1971**	**N36° 41' 10" W105° 38' 40"**
4.55	Detritus (60), *Oscillatoria* (30), *Synedra* + *Tabellaria* + *Cymbella* (10)		
5	**Upstream of hatchery diversion**	**24 Jun 1971**	**N36° 41' 10" W105° 38' 40"**
0.67	Detritus (70), *Oscillatoria* (30), diatoms		
5	**Upstream of hatchery diversion**	**29 Jul 1971**	**N36° 41' 10" W105° 38' 40"**
95.25	Detritus (90), *Gomphonema* + *Navicula* (10), "little else"		
5	**Upstream of hatchery diversion**	**4 Sep 1971**	**N36° 41' 10" W105° 38' 40"**
294.82	Detritus (10), *Cladophora* (80), *Navicula* (5), *Tabellaria* (15)**, "little else"		
5	**Upstream of hatchery diversion**	**9 Oct 1971**	**N36° 41' 10" W105° 38' 40"**
39.08	Detritus (97), *Navicula* (1), *Cladophora* (1), *Oscillatoria* (1)		
5	**Upstream of hatchery diversion**	**14 Nov 1971**	**N36° 41' 10" W105° 38' 40"**
4.90	Detritus (15), *Gomphonema* (25), *Cladophora* (30), *Oscillatoria* (5), *Chroococcus* (20), *Navicula* + *Amphora* + *Cymbella* (5)		

* Estimated; accurate to ± 5".

** Percentage totals >100%; it is likely that percentage for *Tabellaria* should be 5%.

Patterson, B. 1974. Electrofishing Red River Below Hatchery. Memorandum to R. L. Brashears, dated 24 October 1974.

This memo reports results from electrofishing on 16 October 1974 at a site described as "a measured section of 0.15 mile (792 feet) from the lower end of campground upstream toward the hatchery". It is warned in the memo that the data should be considered to be "very conservative" because of river conditions with "high velocity, flow, slippery rocks, and deep holes and runs." Because of the uncertainty of capture efficiency, data were summarized according to four possible levels of efficiency (observation factors): 100%, 70%, 50%, and 25%. The memo indicates that the true estimate is "actually somewhere between the 25-50% observation factor." Only a single pass was conducted, and fish were identified as rainbow trout, brown trout, or suckers, and placed into 2-3 inch size classes.

In addition to the October 1974 data, the memo includes a summary of data from September 1973. At the same site, the population estimate was 936 trout/mile (582 trout/km), with an estimate of 416 rainbow trout/mile (259 rainbow trout/km). All trout were <9 inches (229 mm) in length. At another site electrofished near the hatchery in 1973, population estimates were 1,188 trout/mile (738 trout/km) and 1,021 rainbow trout/mile (634 rainbow trout/km).

The memo also cites creel census data collected from mid-May through August 1974. Nearly 14,000 trout were caught, of which 98.5% (13,734) were rainbow trout. The majority of the trout were ≤7 inches (178 mm) in length. The area for this census included the river below the hatchery.

Patterson (1974) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"At the hatchery"		**Downstream of hatchery**				**Sep 1973**		**N36° 40' 55" W105° 39' 25"**	
RBT	--	1,021	--	--	--	--	--	n.s	n.s.
BRN	--	167	--	--	--	--	--	n.s.	n.s.
0.5 mi. below hatchery		**Between hatchery and El Aujae Campground**				**Sep 1973**		**N36° 40' 40" W105° 39' 40"**	
RBT	--	416	--	--	--	<229	--	n.s.	n.s.
BRN	--	520	--	--	--	--	--	n.s	n.s.
0.5 mi. below hatchery		**Between hatchery and El Aujae Campground**				**16 Oct 1974**		**N36° 40' 40" W105° 39' 40"**	
RBT	331	2,207	--	--	--	--	--	1 (50)	792
BRN	36	240	--	--	--	--	--	1 (50)	792
WS	4	27	--	--	--	--	--	1 (50)	792

* Estimated; accurate to ± 5".
n.s. = not stated

Parish, B. 1975a. Red River Electrofishing. Memorandum to Bob Patterson, dated 10 November 1975.

This memo presents reports of fish data collection on the Red River from ten sites on 4-5 November 1975. At most sites, most fish were measured and weighed; however, a few fish were unidentified at several sites and their lengths were estimated in 2-3 inch size classes. If the data did not include weights for all the fish of a species at a site, a mean weight was not calculated for this report. Length and width of stream sampled were provided at each site. The introductory paragraph states that flow was measured at 17 cfs, but the location where flow was measured is not indicated or if the flow of 17 cfs is average for the entire river. Only one pass was conducted at each site. Summaries are presented for two sites in which an estimate of 95% efficiency is assumed.

Data from Station #7 were not included in CEC (1997).

Site	Description	Length	Width
Station #10	"Below bridge at East-West fork junction"	1/20 mile (264 feet)	19 feet
Station #9	"2 miles below #10"	1/20 mile (264 feet)	16 feet
Station #8	"2.9 miles below #10"	1/20 mile (264 feet)	22 feet
Station #7	"7 miles below #10"	1/20 mile (264 feet)	18 feet
Station #6	"June Bug Campsite"	1/10 mile (528 feet)	20 feet
Station #5	"Two miles above #4"	1/10 mile (528 feet)	14 feet
Station #4	"Just above Molycorp"	1/20 mile (264 feet)	15 feet
Station #3	"1.6 miles below #2"	1/20 mile (264 feet)	23 feet
Station #2	"1.2 miles above #1"	1/20 mile (264 feet)	29 feet
Station #1	"Head of Eagle Rock Lake"	1/20 mile (264 feet)	29 feet

Station #9 (2 miles below the forks) is assumed to be just upstream of the mouth of Black Copper Canyon because there is a road crossing near that point. Station #8 (2.9 miles below the forks) is assumed to be the meadow area between Fourth of July Canyon and Foster Park Canyon where an unimproved dirt road crosses the river to a residence. Station #5 is assumed to be the Elephant Rock Campground. Station #4 (just above Molycorp) is assumed to be 0.5 miles upstream of the mill facilities entrance and upstream of the eastern Molycorp boundary. Station #3 is assumed to be immediately upstream of the Goat Hill Campground. Station #2 is assumed to be near the mouth of Capulin Canyon. The rationale behind our assumptions includes access points and better site descriptions in later literature (Parish 1977a, 1977b, 1978a, q.v.).

Parish (1975a) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Station #10		**Just Downstream of the Forks**				**4-5 Nov 1975**		**N36° 37' 25" W105° 23' 35"**	
RBT	32	640	46.3	686	80	217	116	1	264
BRK	3	60	1.2	64	2	154	32	1	264
Station #9		**2.0 Mi. Downstream of the Forks**				**4-5 Nov 1975**		**N36° 38' 45" W105° 22' 55"**	
RBT	16	320	--	408	--	186	--	1	264
CUT	4	80	2.7	102	5.5	175	54	1	264
BRK	3	60	--	76	--	145	--	1	264
BRN	1	20	--	26	--	200	--	1	264
UNK	3	60	--	76	--	--	--	1	264
Station #8		**2.9 Mi. Downstream of the Forks**				**4-5 Nov 1975**		**N36° 39' 40" W105° 22' 50"**	
RBT	23	460	--	426	--	214	--	1	264
CUT	14	280	--	259	--	184**	--	1	264
Station #7		**Zwergle Gaging Station**				**4-5 Nov 1975**		**N36° 40' 25" W105° 22' 45"**	
RBT	3	60	--	68	--	262	--	1	264
CUT	4	80	--	91	--	211	--	1	264
Station #6		**June Bug Campground**				**4-5 Nov 1975**		**N36° 42' 25" W105° 26' 5"**	
RBT	2	20	0.6	20	0.9	160	45	1	528
BRN	15	150	2.9	153	4.7	143	31	1	528
WS	1	10	0.6	10	0.9	203	90	1	528
Station #5		**Elephant Rock Campground**				**4-5 Nov 1975**		**N36° 42' 25" W105° 26' 50"**	
RBT	4	40	2.6	58	5.9	196	102	1	528
BRN	1	10	0.2	15	0.5	121	35	1	528
Station #4		**Upstream of Molycorp property boundary**				**4-5 Nov 1975**		**N36° 41' 55" W105° 28' 55"**	
RBT	4	80	--	108	--	--	--	1	264
Station #3		**Goathill Campground**				**4-5 Nov 1975**		**N36° 41' 15" W105° 32' 25"**	
RBT	5	100	6.8	88	9.6	216	109	1	264
CUT	5	100	1.3	88	1.8	126	21	1	264
UNK	2	40	--	36	--	--	--	1	264
Station #2		**Near Mouth of Capulin Canyon**				**4-5 Nov 1975**		**N36° 41' 45" W105° 32' 55"**	
RBT	3	60	--	42	--	222**	--	1	264
Station #1		**Head of Eagle Rock Lake**				**4-5 Nov 1975**		**N36° 42' 10" W105° 34' 15"**	
BRN	4	80	4.6	56	5.2	224	93	1	264
RBT	5	100	9.8	70	11.1	258	158	1	264
WS	8	160	--	112	--	--	--	1	264

* Estimated; accurate to ± 5".

** Does not include fish placed into 2-3-inch categories.

Parish, B. 1976a. Electrofishing Results of Red River. Memorandum to Red River File A-1 and D-1, dated 19 July 1976.

This memo presents results from three sites sampled on 16 July 1976 in response to "the recent two Molycorp spills." Only a single pass was conducted, and fish were identified and divided into 2-3 inch size classes. Some fish were unidentified. There was no indication as to capture efficiency. The conclusion at the end of the report states that "there does not appear to be a decrease in the brown trout population in this area."

The three sites were identified only by verbal descriptions as "0.3 miles above Questa Ranger Station", "just above Eagle Rock Lake diversion", and "just above hatchery diversion." The site "0.3 miles above Questa Ranger Station" was incorrectly placed in the reach "Eagle Rock Campground" in CEC (1997); it should have been in the reach "Questa Ranger/Gaging Station" since that is the closest reach and there are no campgrounds between the ranger station and Capulin Canyon. CEC (1997) correctly indicated that there was a conflicting site location at the site just above the hatchery diversion, since Parish (1977a, q.v.), citing data from Parish (1976a), indicated that the site was "[above] the hatchery just below the hatchery diversion."

Parish (1976a) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
0.3 mi. above ranger station		**Questa Ranger/Gaging Station**				**16 Jul 1976**		**N36° 42' 5" W105° 33' 40"**	
RBT	13	173	--	--	--	--	--	1	396
BRN	2	27	--	--	--	--	--	1	396
UNK	2	27	--	--	--	--	--	1	396
above Eagle Rock Lake diversion		**Head of Eagle Rock Lake**				**16 Jul 1976**		**N36° 42' 10" W105° 34' 15"**	
RBT	16	320	--	--	--	--	--	1	264
BRN	5	100	--	--	--	--	--	1	264
WS	11	220	--	--	--	--	--	1	264
UNK	3	60	--	--	--	--	--	1	264
above hatchery diversion		**Upstream of hatchery diversion**				**16 Jul 1976**		**N36° 41' 10" W105° 38' 40"**	
RBT	22	440	--	--	--	--	--	1	264
BRN	10	200	--	--	--	--	--	1	264

* Estimated; accurate to ± 5".

Parish, B. 1976b. Electrofishing Lower Red River. Memorandum to Red River File, dated 8 September 1976.

This memo presents results from fish data collection at five sites on 7 September 1976. Site locations are not identified, except Station #5, which was located at the "Campground below hatchery." The memo does indicate that locations were "approximately ½ mile apart" and that the survey was completed within "approximately two miles below the hatchery." As such, data for the four unidentified sites were not included in CEC (1997), nor can precise locations be accurately determined. Each site was 1/20 mile (264 feet) in length, and efficiency was estimated at 75%. Flow was estimated at 30 cfs. Data were presented for rainbow and brown trout only, divided into 2-3 inch size classes. There was no indication if other species (i.e., white suckers) were observed.

For the purposes of this report, we have divided the stream between the hatchery and El Aujae Campground into four segments and used the limits of those segments to define locations.

Parish (1976b) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/mi	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Station #1		**Downstream of hatchery**				**7 Sep 1976**		**N36° 40' 55" W105° 39' 25"**	
RBT	27	540	--	--	--	--	--	1 (75)	264
BRN	10	200	--	--	--	--	--	1 (75)	264
Station #2		**Between hatchery and El Aujae Campground**				**7 Sep 1976**		**N36° 40' 40" W105° 39' 40"**	
RBT	18	360	--	--	--	--	--	1 (75)	264
BRN	17	340	--	--	--	--	--	1 (75)	264
Station #3		**Between hatchery and El Aujae Campground**				**7 Sep 1976**		**N36° 40' 30" W105° 39' 50"**	
RBT	18	360	--	--	--	--	--	1 (75)	264
BRN	35	700	--	--	--	--	--	1 (75)	264
Station #4		**Between hatchery and El Aujae Campground**				**7 Sep 1976**		**N36° 40' 20" W105° 40' 0"**	
RBT	27	540	--	--	--	--	--	1 (75)	264
BRN	28	560	--	--	--	--	--	1 (75)	264
Station #5		**El Aujae Campground**				**7 Sep 1976**		**N36° 40' 0" W105° 40' 5"**	
RBT	24	480	--	--	--	--	--	1 (75)	264
BRN	31	620	--	--	--	--	--	1 (75)	264

* Estimated; accurate to ± 5".

Pennak, R.W. 1976. *Aquatic Ecosystems of Red River, New Mexico, in October, 1976; A Comparison with Conditions in October, 1971*. Report prepared by Thorne Ecological Institute.

The same four sites as were sampled in October 1971 (Pennak 1972, q.v.) were sampled again in October 1976 in response to deepening of the settling ponds and "at least eight instances of broken and leaking pipes." An additional site was added just above Goat Hill Campground because "most of the pipeline leaks occurred very near this point." Chemical and physical parameters were measured at each site, including temperature, turbidity, suspended and dissolved organic and inorganic matter, oxygen and carbon dioxide concentrations, and pH. Since the report states that the study of 1971 was repeated, it can be assumed that benthic invertebrate populations were sampled with a suite of five Surber samples and periphyton was sampled with a five minute scraping, even though these methods were not explicitly stated. Invertebrates were identified to the genus level, with density estimates (organisms/m^2) and biomass (g/m^2). Although it appears that the periphyton were identified as in the 1971 study, only biomass (mg/5-minute scraping) are presented.

Periphyton taxa are presented in the text, but not associated by site. They included *Cladophora*, *Ulothrix*, and diatoms, as well as detritus.

Macroinvertebrate density at Site 1A (Goathill Campground) was reported in Table 5 of Pennak (1976) as 763.5 organisms/m^2 based on data from Table 3. Using summary data from Table 4, CEC (1997) reported a value for density of 808 organisms/m^2, rounding off the value to the nearest unit and noting the discrepancy. The higher value of 808.5 organisms/m^2 is also cited later in reports by the same author (Pennak 1977, q.v.).

Additionally, Pennak (1976) cites unpublished macroinvertebrate data on pages 9 and 11. These data were collected by Cuplin and Herkenhoff of the Bureau of Land Management at the Goathill Campground on 26 March 1976 and at the site above the hatchery diversion on 26 March and 30 June 1976. The only data presented in this report include a density estimate of 215.2 organisms/m^2 at the site above the hatchery diversion on 30 June 1976.

Pennak (1976) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
1		**Upstream of Molycorp property boundary**		**5-6 Oct 1976**	**N36º 41' 55" W105º 28' 55"**
--	562	--	--	6	--
1A		**Goathill Campground**		**5-6 Oct 1976**	**N36º 41' 15" W105º 32' 25"**
--	808	--	--	6.5	--
2		**Eagle Rock Campground**		**5-6 Oct 1976**	**N36º 42' 10" W105º 34' 30"**
--	170	--	--	1.4	--
3		**Upstream of Pope Creek**		**5-6 Oct 1976**	**N36º 41' 25" W105º 37' 55"**
--	765	--	--	6.6	--
5		**Upstream of hatchery diversion**		**5-6 Oct 1976**	**N36º 41' 10" W105º 38' 40"**
--	632	--	--	5.8	--

* Estimated; accurate to ± 5".

Pennak (1976) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
1	**Upstream of Molycorp property boundary**	**5-6 Oct 1976**	**N36º 41' 55" W105º 28' 55"**
112	--		
1A	**Goathill Campground**	**5-6 Oct 1976**	**N36º 41'15" W105º 32' 25"**
318.8	--		
2	**Eagle Rock Campground**	**5-6 Oct 1976**	**N36º 42' 10" W105º 34' 30"**
38.3	--		
3	**Upstream of Pope Creek**	**5-6 Oct 1976**	**N36º 41' 25" W105º 37' 55"**
494.2	--		
5	**Upstream of hatchery diversion**	**5-6 Oct 1976**	**N36º 41' 10" W105º 38' 40"**
360.9	--		

* Estimated; accurate to ± 5".

Pennak, R. W. 1977a. *Red River, New Mexico, Aquatic Ecosystems: March 1977 as Compared with 1971 and 1976.* Report submitted to the Molybdenum Corporation of America.

This report presents results from additional benthic invertebrate and periphyton sampling at five previously sampled locations on the Red River (Pennak 1972, 1976, q.v.) on 12-13 March 1977. Methods for macroinvertebrate sampling repeated those of the previous studies (five Surber samples, identified to the genus level), but only summary data for density (number of organisms/m^2) by order and total biomass were presented. A list of the taxa collected is included. Methods for periphyton sampling repeated those of previous studies (a single, 5-minute scraping of periphyton), but only total mass (mg) was presented. No specific algal taxa were listed in the document.

The published values for density at Site 1 and Site 2 were miscalculated as 112 organisms/m^2 and 555 organisms/m^2, respectively, in the document. Using the densities for each taxon, also presented in the document, we calculated the densities to be 787 organisms/m^2 at Site 1 and 112 organisms/m^2 at Site 2, and have used those numbers in the following table.

Pennak (1977a) - Benthic Invertebrates

Site (in report)			Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices	
1			**Upstream of Molycorp property boundary**		**12-13 Mar 1977**	**N36º 41' 55" W105º 28' 55"**
--	787	--	--	1.7	--	
1A			**Goathill Campground**		**12-13 Mar 1977**	**N36º 41' 15" W105º 32' 25"**
--	211	--	--	4.5	--	
2			**Eagle Rock Campground**		**12-13 Mar 1977**	**N36º 42' 10" W105º 34' 30"**
--	112	--	--	7.8	--	
3			**Upstream of Pope Creek**		**12-13 Mar 1977**	**N36º 41' 25" W105º 37' 55"**
--	2,018	--	--	17.3	--	
5			**Upstream of hatchery diversion**		**12-13 Mar 1977**	**N36º 41' 10" W105º 38' 40"**
--	1,875	--	--	51.6	--	

* Estimated; accurate to ± 5".

Pennak (1977a) - Periphyton

Site (in report)		Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)			
1		**Upstream of Molycorp property boundary**	**12-13 Mar 1977**	**N36º 41' 55" W105º 28' 55"**
220.9	--			
1A		**Goathill Campground**	**12-13 Mar 1977**	**N36º 41' 15" W105º 32' 25"**
1,669.3	--			
2		**Eagle Rock Campground**	**12-13 Mar 1977**	**N36º 42' 10" W105º 34' 30"**
8.4	--			
3		**Upstream of Pope Creek**	**12-13 Mar 1977**	**N36º 41' 25" W105º 37' 55"**
333.1	--			
5		**Upstream of hatchery diversion**	**12-13 Mar 1977**	**N36º 41' 10" W105º 38' 40"**
7,119	--			

* Estimated; accurate to ± 5".

Parish, B. 1977a. Electrofishing the Red River after Moly Corp Spill. Memorandum to Jim Yarbrough, dated 22 April 1977.

This memo presents data from fish sampling conducted on 7 April 1977 on previously established sites (Parish 1976b, q.v.) after a recent spill. The site above Goat Hill Campground had a flow of 4-5 cfs and was upstream of the spill; the site near the mouth of Capulin Canyon had a flow of 5 cfs; the site at the head of Eagle Rock Lake had a flow of 7-8 cfs. The lowest site has a slightly conflicting location description from that of Parish (1976, q.v.) in stating that it was "[above] the hatchery just below the hatchery diversion." This site had a flow of 12 cfs.

This memo also presents data first collected in 1975 (Parish 1975a, q.v.) for several sites; these data are not repeated here. However, the data for "Above Goat Hill campground" (Station #3 in Parish 1975a, q.v.) are apparently misrepresented by the addition of a rainbow trout in the 9- to 12-inch category, and the unidentified fish were not included.

Sampling was apparently conducted with only a single pass, and there was no indication as to the sampling efficiency. Fish were identified to species and divided into 2-3 inch size classes. It was noted that the river had been recently stocked near the hatchery. At the site near the mouth of Capulin Canyon, no fish were collected, but two dead rainbow trout were observed. Conclusions to the report indicate that a minimum of 960 fish were lost due to the spill, but that the number could have been as high as 2,220 fish depending on distribution of small fish throughout the river.

Parish (1977a) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
above Goat Hill campground		**Goathill Campground**				**7 Apr 1977**		**N36º 41' 15" W105º 32' 25"**	
BRN	4	40	--	--	--	--	--	1	528
RBT	69	690	--	--	--	--	--	1	528
CUT	1	10	--	--	--	--	--	1	528
Bear Canyon		**Near Mouth of Capulin Canyon**				**7 Apr 1977**		**N36º 41' 45" W105º 32' 55"**	
no fish	0	0	0	0	0	--	--	1	528
Head of Eagle Rock Lake		**Head of Eagle Rock Lake**				**7 Apr 1977**		**N36º 42' 10" W105º 34' 15"**	
WS	12	120	--	--	--	--	--	1	528
above hatchery/ below diversion		**Downstream of hatchery diversion**				**7 Apr 1977**		**N36º 41' 5" W105º 38' 50"**	
BRN	45	450	--	--	--	--	--	1	528
RBT	81	810	--	--	--	--	--	1	528

* Estimated; accurate to ± 5".

Parish, B. 1977b. C-15 Electrofishing Red River. Memorandum to Jim Yarbrough, dated 9 May 1977.

This memo repeats data from Parish (1977a, q.v.), and adds data from an additional seven sites. The Parish (1977a, q.v.) data are not repeated in the table, here. Most of these sites had also been sampled in November 1975 (Parish 1975a, q.v.); however, a new site was added at the Zwergle gaging station. The data presented here was collected 2 May 1977.

Site lengths of 1/10 mile (528 feet) were explicitly stated for all sites except Sites #8, #9, and #10. It is assumed that the site lengths at these three most upstream sites were also 1/10 mile because the summary indicated that 0.6 miles of stream were sampled downstream of the town (representing six sites) and 0.4 miles of stream were sampled upstream of town (representing four sites, including Sites #7, #8, #9, and #10). Apparently, only a single pass was conducted; fish were identified to species and divided into 2-3 inch size classes. Sampling efficiency was estimated to be 90%. Stream widths were not measured, so density estimates by area could not be calculated. It was noted that the stream had been stocked one week prior to sampling.

Site	Description	Length
Station #10	"Just below forks"	1/10 mile (528 feet) *
Station #9	"2 miles below forks"	1/10 mile (528 feet) *
Station #8	"2.9 miles below forks"	1/10 mile (528 feet) *
Station #7	"Old gauging station above town of Red River"	1/10 mile (528 feet)
Station #6	"June Bug Campground"	1/10 mile (528 feet)
Station #5	"Elephant Rock Campground"	1/10 mile (528 feet)
Station #4	".5 [*sic*] above Molycorp entrance"	1/10 mile (528 feet)
Station #3[a]	"Above Goat Hill campground"	1/10 mile (528 feet)
Station #2[a]	"Bear Canyon 1.2 miles above Eagle Rock Station"	1/10 mile (528 feet)
Station #1[a]	"Head of Eagle Rock Lake"	1/10 mile (528 feet)

* Assumed.

[a] See Parish 1977a.

Station #9 (2 miles below the forks) is assumed to be just upstream of the mouth of Black Copper Canyon because there is a road crossing near that point. Station #8 (2.9 miles below the forks) is assumed to be the meadow area between Fourth of July Canyon and Foster Park Canyon an unimproved dirt road crosses the river to a residence. Station #4 (0.5 miles above Molycorp entrance) is assumed to be 0.5 miles upstream of the mill facilities entrance and upstream of the eastern Molycorp boundary, since there is a site (Station #3) near the Goathill Campground (which would otherwise be the site 0.5 miles upstream of Molycorp entrance).

Parish (1977b) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Station #10		**Just Downstream of the Forks**				**2 May 1977**		**N36º 37' 25" W105º 23' 35"**	
RBT	107	1,070	--	--	--	--	--	1 (90)	528
CUT	2	20	--	--	--	--	--	1 (90)	528
BRK	1	10	--	--	--	--	--	1 (90)	528
Hybrid	2	20	--	--	--	--	--	1 (90)	528
Station #9		**2.0 Mi. Downstream of the Forks**				**2 May 1977**		**N36º 38' 45" W105º 22' 55"**	
RBT	81	810	--	--	--	--	--	1 (90)	528
BRK	3	30	--	--	--	--	--	1 (90)	528
CUT	2	20	--	--	--	--	--	1 (90)	528
Station #8		**2.9 Mi. Downstream of the Forks**				**2 May 1977**		**N36º 39' 40" W105º 22' 50"**	
RBT	141	1,410	--	--	--	--	--	1 (90)	528
CUT	7	70	--	--	--	--	--	1 (90)	528
Station #7		**Zwergle Gaging Station**				**2 May 1977**		**N36º 40' 25" W105º 22' 45"**	
RBT	38	380	--	--	--	--	--	1 (90)	528
BRK	5	50	--	--	--	--	--	1 (90)	528
CUT	8	80	--	--	--	--	--	1 (90)	528
Station #6		**June Bug Campground**				**2 May 1977**		**N36º 42' 25" W105º 26' 5"**	
RBT	47	470	--	--	--	--	--	1 (90)	528
BRN	3	30	--	--	--	--	--	1 (90)	528
CUT	1	10	--	--	--	--	--	1 (90)	528
BRK	2	20	--	--	--	--	--	1 (90)	528
Station #5		**Elephant Rock Campground**				**2 May 1977**		**N36º 42' 25" W105º 26' 50"**	
RBT	22	220	--	--	--	--	--	1 (90)	528
BRN	1	10	--	--	--	--	--	1 (90)	528
Station #4		**Upstream of Molycorp property boundary**				**2 May 1977**		**N36º 41' 55" W105º 28' 55"**	
no fish	0	0	0	0	0	--	--	1 (90)	528

* Estimated; accurate to ±5".

Pennak, R. W. 1977b. *Red River, New Mexico, Aquatic Ecosystems: October 1977 as Compared with October 1971 and October 1976.* Report submitted to Molybdenum Corporation of America.

This report presents results from additional benthic invertebrate and periphyton sampling at five previously sampled locations on the Red River (Pennak 1972, 1976, 1977a, q.v.) on 19-20 October 1977. Methods for macroinvertebrate sampling repeated those of previous studies by the same author (five Surber samples, identified primarily to the genus level), but only summary data for density (number of organisms/m^2) by Order and total biomass were presented. A list of the taxa is included. Methods for periphyton sampling repeated those of previous studies by the same author (a single, five-minute scraping), but only a total mass (mg) was presented. No specific algal taxa were listed in the document.

Pennak (1977b) - Benthic Invertebrates

Site (in report)			Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices	
1		**Upstream of Molycorp property boundary**		**19-20 Oct 1977**		**N36º 41' 55" W105º 28' 55"**
--	56	--	--	0.7	--	
1A		**Goathill Campground**		**19-20 Oct 1977**		**N36º 41' 15" W105º 32' 25"**
--	43	--	--	0.3	--	
2		**Eagle Rock Campground**		**19-20 Oct 1977**		**N36º 42' 10" W105º 34' 30"**
--	82	--	--	2.4	--	
3		**Upstream of Pope Creek**		**19-20 Oct 1977**		**N36º 41' 25" W105º 37' 55"**
--	159	--	--	1.1	--	
5		**Upstream of hatchery diversion**		**19-20 Oct 1977**		**N36º 41' 10" W105º 38' 40"**
--	224	--	--	2.5	--	

* Estimated; accurate to ± 5".

Pennak (1977b) - Periphyton

Site (in report)		Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)			
1		**Upstream of Molycorp property boundary**	**19-20 Oct 1977**	**N36º 41' 55" W105º 28' 55"**
5.4	--			
1A		**Goathill Campground**	**19-20 Oct 1977**	**N36º 41' 15" W105º 32' 25"**
3.4	--			
2		**Eagle Rock Campground**	**19-20 Oct 1977**	**N36º 42' 10" W105º 34' 30"**
3.6	--			
3		**Upstream of Pope Creek**	**19-20 Oct 1977**	**N36º 41' 25" W105º 37' 55"**
97.0	--			
5		**Upstream of hatchery diversion**	**19-20 Oct 1977**	**N36º 41' 10" W105º 38' 40"**
553.0	--			

* Estimated; accurate to ± 5".

Parish, B. 1978a. C-15 Electrofishing the Red River. Memorandum to Bob Patterson, dated 19 July 1978.

This memo presents data from fish sampling conducted on nine sites in the Red River on 13-14 July 1978. The sites correspond to those of Parish (1975a, 1977b, q.v.), except the site at the head of Eagle Rock Lake was dropped "since this never has been a very good location." The purpose of the fish sampling was to monitor the progress of fry planted on 24 June 1977, and the conclusion was made that these plants "could have contributed significantly to the 3-5 and 5-7 inch categories".

As in the past, only a single pass was conducted and fish were identified to species and divided into 2-3 inch size classes. At six sites, some fish were identified as "unclassified." Sampling efficiency was estimated at 70%, and it was noted that 2 inch (YOY) rainbow trout were plenteous at one site but "it would have been very easy to miss this size of [*sic*] they were anywhere other than in small backwater areas." The river had been stocked about a week prior to sampling. Site lengths were 1/10 mile at all sites, but widths were not given so density estimates by area could not be calculated.

The site 2 miles below the forks is assumed to be just upstream of the mouth of Black Copper Canyon because there is a road crossing near that point. The site 2.9 miles below the forks is assumed to be the meadow area between Fourth of July Canyon and Foster Park Canyon an unimproved dirt road crosses the river to a residence. The site 0.5 miles above Molycorp entrance is assumed to be 0.5 miles upstream of the mill facilities entrance and upstream of the eastern Molycorp boundary, since there is a site near the Goathill Campground (which would otherwise be the site 0.5 miles upstream of Molycorp entrance).

Parish (1978a) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Just below forks		**Just Downstream of the Forks**				**13-14 Jul 1978**		**N36º 37' 25" W105º 23' 35"**	
RBT	95	950	--	--	--	--	--	1 (70)	528
UNK	1	10	--	--	--	--	--	1 (70)	528
2 miles below the forks		**2.0 Mi. Downstream of the Forks**				**13-14 Jul 1978**		**N36º 38' 45" W105º 22' 55"**	
RBT	54	540	--	--	--	--	--	1 (70)	528
UNK	2	20	--	--	--	--	--	1 (70)	528
2.9 miles below the forks		**2.9 Mi. Downstream of the Forks**				**13-14 Jul 1978**		**N36º 39' 40" W105º 22' 50"**	
RBT	63	630	--	--	--	--	--	1 (70)	528
CUT	3	30	--	--	--	--	--	1 (70)	528
Old gauging station above town of Red River		**Zwergle Gaging Station**				**13-14 Jul 1978**		**N36º 40' 25" W105º 22' 45"**	
RBT	40	400	--	--	--	--	--	1 (70)	528
CUT	9	90	--	--	--	--	--	1 (70)	528
BRK	21	210	--	--	--	--	--	1 (70)	528
UNK	3	30	--	--	--	--	--	1 (70)	528
June Bug Campground		**June Bug Campground**				**13-14 Jul 1978**		**N36º 42' 25" W105º 26' 5"**	
RBT	73	730	--	--	--	--	--	1 (70)	528
BRN	11	110	--	--	--	--	--	1 (70)	528
BRK	4	40	--	--	--	--	--	1 (70)	528
UNK	8	80	--	--	--	--	--	1 (70)	528
Elephant Rock Campground		**Elephant Rock Campground**				**13-14 Jul 1978**		**N36º 42' 25" W105º 26' 50"**	
RBT	20	200	--	--	--	--	--	1 (70)	528
.5 miles above Molycorp entrance		**Upstream of Molycorp property boundary**				**13-14 Jul 1978**		**N36º 41' 55" W105º 28' 55"**	
RBT	2	20	--	--	--	--	--	1 (70)	528
Above Goat Hill Campground		**Goathill Campground**				**13-14 Jul 1978**		**N36º 41' 15" W105º 32' 25"**	
RBT	11	110	--	--	--	--	--	1 (70)	528
UNK	1	10	--	--	--	--	--	1 (70)	528
Bear Canyon 1.2 miles above Eagle Rock Lake		**Near Mouth of Capulin Canyon**				**13-14 Jul 1978**		**N36º 41' 45" W105º 32' 55"**	
RBT	13	130	--	--	--	--	--	1 (70)	528
WS	1	10	--	--	--	--	--	1 (70)	528
UNK	1	10	--	--	--	--	--	1 (70)	528

* Estimated; accurate to ±5".

Parish, B. 1978b. Electrofishing the Red River. Memorandum to Bob Patterson, dated 13 September 1978.

This memo presents results from fish sampling at three sites on the Red River upstream of town on 7 September 1978. The sites correspond to those previously sampled (Parish 1975a, 1977b, 1978a, q.v.), with apparently similar methods. A single pass was conducted, and fish were identified to species and divided into 2-3 inch size classes. Flow was measured at about 8 cfs, and upstream construction activities reduced water clarity at the lowest site (Zwergle gage). No indication was given as to the efficiency of sampling. The purpose of the sampling was "primarily to try and pick up rainbows about three inches long," and it was noted that the majority of the fish in the 5-7 inch category were close to 5 inches in length.

The sites corresponded to those of Parish (1975a, 1977b, 1978a, q.v.) but included only Sites 7, 9, and 10. These sites were described as follows: Station 7 "Old gauging station above Red River", Station 9 "Two miles below the forks", and Station 10 "Just below the forks." The site 2 miles below the forks is assumed to be just upstream of the mouth of Black Copper Canyon because there is a road crossing near that point.

Parish (1978b) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Station 10		**Just Downstream of the Forks**				**7 Sep 1978**		**N36º 37' 25" W105º 23' 35"**	
RBT	24	480	--	--	--	--	--	1	264
Station 9		**2.0 Mi. Downstream of the Forks**				**7 Sep 1978**		**N36º 38' 45" W105º 22' 55"**	
RBT	13	260	--	--	--	--	--	1	264
Station 7		**Zwergle Gaging Station**				**7 Sep 1978**		**N36º 40' 25" W105º 22' 45"**	
RBT	6	120	--	--	--	--	--	1	264
CUT	11	220	--	--	--	--	--	1	264
BRK	12	240	--	--	--	--	--	1	264
BRN	1	20	--	--	--	--	--	1	264

* Estimated; accurate to ±5".

Pennak, R. W. 1978a. *Summary Comments on Aquatic Conditions in the Red River on 29-30 March 1978.*

This brief, three-page report summarizes data from benthic invertebrate and periphyton collections from five previously established sites on 29-30 March 1978. Data are compared with that from May 1971 (Pennak 1972, q.v.) and March 1977 (Pennak 1977a, q.v.). Although not stated explicitly, data were presumably collected as in previous studies by the same author, with a suite of five replicate Surber samples for invertebrates and a 5-minute scraping on rocks for periphyton. Basic water quality parameters were collected as in previous studies by the same author.

This report mentions a "thin yellowish-tan chemical deposit" on substrate and invertebrates at Station 2 (above Eagle Rock Campground), but not at any other site. It had been observed previously and was assumed to originate from Molycorp operations as it was "not a 'naturally occurring' substance." This observation was later amended to the substance being "derived from naturally-occurring surface streamside deposits upstream from Station 2" (Pennak 1978b, q.v.).

Pennak (1978a) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1		**Upstream of Molycorp property boundary**		**29-30 Mar 1978**	**N36º 41' 55" W105º 28' 55"**
--	959	--	--	7.3	--
Station 1A		**Goathill Campground**		**29-30 Mar 1978**	**N36º 41' 15" W105º 32' 25"**
--	1,677	--	--	32.3	--
Station 2		**Eagle Rock Campground**		**29-30 Mar 1978**	**N36º 42' 10" W105º34'30"**
--	52	--	--	0.5	--
Station 3		**Upstream of Pope Creek**		**29-30 Mar 1978**	**N36º 41' 25" W105º 37' 55"**
--	907	--	--	6.2	--
Station 5		**Upstream of hatchery diversion**		**29-30 Mar 1978**	**N36º 41' 10" W105º 38' 40"**
--	1,402	--	--	18.5	--

* Estimated; accurate to ±5".

Pennak (1978a) - Periphyton

Site (in report)		**Reach**	**Date**	**Location***
Biomass (mg)	Taxa (relative abundance %)			
Station 1		**Upstream of Molycorp property boundary**	**29-30 Mar 1978**	**N36º 41' 55" W105º 28' 55"**
112.5	--			
Station 1A		**Goathill Campground**	**29-30 Mar 1978**	**N36º 41' 15" W105º 32' 25"**
3,012.0	--			
Station 2		**Eagle Rock Campground**	**29-30 Mar 1978**	**N36º 42' 10" W105º 34' 30"**
34.5	--			
Station 3		**Upstream of Pope Creek**	**29-30 Mar 1978**	**N36º 41' 25" W105º 37' 55"**
560.9	--			
Station 5		**Upstream of hatchery diversion**	**29-30 Mar 1978**	**N36º 41' 10" W105º 38' 40"**
1,792.5	--			

* Estimated; accurate to ±5".

Pennak, R. W. 1978b. *Summary Comments on Aquatic Conditions in the Red River, New Mexico, in 1978 as Compared to 1971-1977*. Report Submitted to the Molybdenum Corporation of America.

In addition to repeating data from collections in March 1978 (Pennak 1978a, q.v.), this report presents data from benthic invertebrate and periphyton sampling at five sites on 25-26 July 1978. Data are compared with data from June and July 1971 (Pennak 1972, q.v.). Although not stated explicitly, data were presumably collected as in previous studies by the same author, with a suite of five replicate Surber samples for invertebrates and a 5-minute scraping on rocks for periphyton. Basic water quality parameters were collected as in previous studies by the same author.

The yellowish-tan chemical deposit reported at Station 2 (above Eagle Rock Campground) in March 1978 (Pennak 1978a, q.v.) was noted in lesser quantities in July 1978. The characterization of the material was amended from an unnatural substance to one "thought to be derived from naturally-occurring surface streamside deposits upstream from Station 2." Samples were not taken at Station 1 (upstream of the Molycorp property boundary) due to turbid stream conditions.

Pennak (1978b) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1A		**Goathill Campground**		**25-26 Jul 1978**	**N36º 41' 15" W105º 32' 25"**
--	443	--	--	5.2	--
Station 2		**Eagle Rock Campground**		**25-26 Jul 1978**	**N36º 42' 10" W105º 34' 30"**
--	490	--	--	16.3	--
Station 3		**Upstream of Pope Creek**		**25-26 Jul 1978**	**N36º 41' 25" W105º 37' 55"**
--	211	--	--	1.8	--
Station 5		**Upstream of hatchery diversion**		**25-26 Jul 1978**	**N36º 41' 10" W105º 38' 40"**
--	2,207	--	--	21.1	--

* Estimated; accurate to ±5".

Pennak (1978b) - Periphyton

Site (in report)	**Reach**	**Date**	**Location***
Biomass (mg)	Taxa (relative abundance %)		
Station 1A	**Goathill Campground**	**25-26 Jul 1978**	**N36º 41' 15" W105º 32' 25"**
0.9	--		
Station 2	**Eagle Rock Campground**	**25-26 Jul 1978**	**N36º 42' 10" W105º 34' 25"**
110.8	--		
Station 3	**Upstream of Pope Creek**	**25-26 Jul 1978**	**N36º 41' 25" W105º 37' 55"**
246.3	--		
Station 5	**Upstream of hatchery diversion**	**25-26 Jul 1978**	**N36º 41' 10" W105º 38' 40"**
937.5	--		

* Estimated; accurate to ±5".

Parish, R. 1979. Letter to Herb Garn, dated 3 December 1979.

This letter presents results of fish sampling at two sites between the hatchery and the Rio Grande on 6-8 November 1979. A bank generator was used and at least two electrodes at both sites, but only a single pass was conducted. Efficiency was estimated at 50% for the site one mile downstream of the hatchery and 40% for the site 0.4 miles upstream of the confluence with the Rio Grande due to high flows. All fish, except one, were identified and divided into 2-3 inch size classes.

Both sites were designated Station A, but the verbal descriptions clearly identify the sites.

Parish (1979) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"1.0 miles below the fish hatchery"		**Between hatchery and El Aujae Campground**				**6-8 Nov 1979**		**N36º 40' 30" W105º 39' 50"**	
RBT	8	160	--	--	--	--	--	1 (50)	264
BRN	25	500	--	--	--	--	--	1 (50)	264
UNK	1	20	--	--	--	--	--	1 (50)	264
"0.4 miles above the mouth"		**La Junta Point**				**6-8 Nov 1979**		**N36º 39' 10" W105º 41' 20"**	
RBT	6	120	--	--	--	--	--	1 (40)	264
BRN	18	360	--	--	--	--	--	1 (40)	264
WS	11	220	--	--	--	--	--	1 (40)	264
Chub	2	40	--	--	--	--	--	1 (40)	264

* Estimated; accurate to ±5".

Pennak, R. W. 1979a. *Summary of Ecosystem Conditions in Red River (1971-1979) with Special Reference to Litigation at Santa Fe, Autumn 1979.*

This brief report presents results from benthic invertebrate sampling at eight sites in August and September 1979. Six of these sites were previously established (Pennak 1972, 1976, 1977a, b, 1978a, b, q.v.). Of the new sites, Station 6 was described as "0.8 km below the west edge of the Fish Hatchery," and Station 7 was described as "0.4 km above the mouth of the Red River." It was noted that the large boulder substrate at Station 7 precluded invertebrate sampling, although basic water quality measurements were taken, and benthic invertebrates were not sampled by this author at this site in subsequent studies (Pennak 1979b, 1981, 1983, 1984, q.v.).

Sampling was conducted as in previous studies by the same author, with a suite of five replicate Surber samples for invertebrates. In contrast to previous reports, this report does not present densities, but only biomass estimates. No specific dates were given for the sampling episodes in this document; however, a subsequent document (Pennak 1979b, q.v.) gives them as 5-7 August and 9-11 September 1979.

The biomass reported for Station 6 (downstream of the hatchery) on 9-11 September 1979 as 1.0 g/m^2 in this report was changed to 1.4 g/m^2 in Pennak (1979b, q.v.). The value of 1.4 g/m^2 is used in subsequent reports (Pennak 1981, q.v) and in the following table.

Pennak (1979a) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1		**Upstream of Molycorp property boundary**		**5-7 Aug 1979**	**N36º 41' 55" W105º 28' 55"**
--	--	--	--	1.6	--
Station 1A		**Goathill Campground**		**5-7 Aug 1979**	**N36º 41' 15" W105º 32' 25"**
--	--	--	--	0.6	--
Station 2		**Eagle Rock Campground**		**5-7 Aug 1979**	**N36º 42' 10" W105º 34' 30"**
--	--	--	--	0.2	--
Station 3		**Upstream of Pope Creek**		**5-7 Aug 1979**	**N36º 41' 25" W105º 37 '55"**
--	--	--	--	2.4	--
Station 5		**Upstream of hatchery diversion**		**5-7 Aug 1979**	**N36º 41' 10" W105º 38' 40"**
--	--	--	--	3.4	--
Station 6		**Between hatchery and El Aujae Campground**		**5-7 Aug 1979**	**N36º 40' 40" W105º 39' 40"**
--	--	--	--	1.7	--
Station 1		**Upstream of Molycorp property boundary**		**9-11 Sep 1979**	**N36º 41' 55" W105º 28' 55"**
--	--	--	--	0.4	--
Station 1A		**Goathill Campground**		**9-11 Sep 1979**	**N36º 41' 15" Q105º 32' 25"**
--	--	--	--	0.6	--
Station 2		**Eagle Rock Campground**		**9-11 Sep 1979**	**N36º 42' 10" W105º 34' 30"**
--	--	--	--	1.0	

Pennak (1979a) - Benthic Invertebrates (cont.)

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
					N36º 41' 25"
Station 3		**Upstream of Pope Creek**		**9-11 Sep 1979**	**W105º 37' 55"**
--	--	--	--	2.0	--
		Upstream of			**N36º 41' 10"**
Station 5		**hatchery diversion**		**9-11 Sep 1979**	**W105º 38' 40"**
--	--	--	--	1.0	--
		Below hatchery and			**N36º 40' 40"**
Station 6		**El Aujae Campground**		**9-11 Sep 1979**	**W105º 39' 40"**
--	--	--	--	1.4	--

* Estimated; accurate to ±5".

Pennak, R. W. 1979b. *Ecosystem Conditions in the Red River in the Late Summer of 1979: Effects of Abnormally High Runoff*. Report Submitted to the Molybdenum Corporation of America.

This report repeats summary data from Pennak (1979a, q.v.) for benthic invertebrate sampling conducted at six sites in August and September 1979. In addition, it provides data for periphyton sampling conducted at the same sites at the same times. Periphyton collection methods were similar to those used in previous studies by the same author (Pennak 1972, 1976, 1977a, b, 1978a, b, q.v.). Basic water quality parameters were collected as in previous studies by the same author. Periphyton were not sampled at Station 2 (upstream of Eagle Rock Campground) in September 1979.

The biomass reported for Station 6 (downstream of the hatchery) was reported as 1.0 g/m^2 in Pennak (1979a, q.v.) and changed to 1.4 g/m^2 in this report. The value of 1.4 g/m^2 is used in subsequent reports (Pennak 1981, q.v). Because the invertebrate data are merely repeated, with this single exception, a table summarizing the invertebrate data is not included here.

Pennak (1979b) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
Station 1	**Upstream of Molycorp property boundary**	**5-6 Aug 1979**	**N36º 41' 55" W105º 28' 55"**
1.1	--		
Station 1A	**Goathill Campground**	**5-6 Aug 1979**	**N36º 41' 15" W105º 32' 25"**
4.0	--		
Station 2	**Eagle Rock Campground**	**5-6 Aug 1979**	**N36º 42' 10" W105º 34' 30"**
6.9	--		
Station 3	**Upstream of Pope Creek**	**5-6 Aug 1979**	**N36º 41' 25" W105º 37' 55"**
1.1	--		
Station 5	**Upstream of hatchery diversion**	**5-6 Aug 1979**	**N36º 41' 10" W105º 38' 40"**
8.6	--		
Station 6	**Between hatchery and El Aujae Campground**	**5-6 Aug 1979**	**N36º 40' 40" W105º 39' 40"**
9.0	--		
Station 1	**Upstream of Molycorp property boundary**	**9-11 Sep 1979**	**N36º 41' 55" W105º 28' 55"**
26.8	--		
Station 1A	**Goathill Campground**	**9-11 Sep 1979**	**N36º 41' 15" W105º 32' 25"**
34.3	--		
Station 3	**Upstream of Pope Creek**	**9-11 Sep 1979**	**N36º 41' 25" W105º 37' 55"**
234.2	--		
Station 5	**Upstream of hatchery diversion**	**9-11 Sep 1979**	**N36º 41' 10" W105º 38' 40"**
133.4	--		
Station 6	**Between hatchery and El Aujae Campground**	**9-11 Sep 1979**	**N36º 40' 40" W105º 39' 40"**
124.8	--		

* Estimated; accurate to ±5".

Pennak, R. W. 1981. *Aquatic Ecosystem Conditions in the Red River, New Mexico, in July, 1981*. Report submitted to the Molybdenum Corporation of America.

This report presents benthic invertebrate and periphyton data from sampling conducted at seven previously established sites on 18-19 July 1981. Sampling methods were similar to those of previous studies by the same author (Pennak 1972, 1976, 1977a, b, 1978, 1979a, b, q.v.) for both invertebrates (five replicate Surber samples) and periphyton (5-minute scraping) at each site. A list of the benthic invertebrate taxa is included and invertebrate data are reported for biomass only in g/m^2. Periphyton data are reported only as mg/5-minute scraping. Basic water quality parameters were collected as in previous studies by the same author.

Pennak (1981) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1		**Upstream of Molycorp property boundary**		**18-19 Jul 1981**	**N36º 41' 55" W105º 28' 55"**
--	--	--	--	26.5	--
Station 1A		**Goathill Campground**		**18-19 Jul 1981**	**N36º 41' 15" W105º 32' 25"**
--	--	--	--	3.0	--
Station 2		**Eagle Rock Campground**		**18-19 Jul 1981**	**N36º 42' 10" W105º 34' 30"**
--	--	--	--	1.5	--
Station 3		**Upstream of Pope Creek**		**18-19 Jul 1981**	**N36º 41' 25" W105º 37' 55"**
--	--	--	--	6.7	--
Station 5		**Upstream of hatchery diversion**		**18-19 Jul 1981**	**N36º 41' 10" W105º 38' 40"**
--	--	--	--	4.9	--
Station 6		**Below hatchery and El Aujae Campground**		**18-19 Jul 1981**	**N36º 40' 40" W105º 39' 40"**
--	--	--	--	6.7	--

* Estimated; accurate to ±5".

Pennak (1981) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
Station 1	**Upstream of Molycorp property boundary**	**18-19 Jul 1981**	**N36º 41' 55" W105º 28' 55"**
414.6	--		
Station 1A	**Goathill Campground**	**18-19 Jul 1981**	**N36º 41' 15" W105º 32' 25"**
57.3	--		
Station 2	**Eagle Rock Campground**	**18-19 Jul 1981**	**N36º 42' 10" W105º 34' 30"**
61.5	--		
Station 3	**Upstream of Pope Creek**	**18-19 Jul 1981**	**N36º 41' 25" W105º 37' 55"**
423.6	--		
Station 5	**Upstream of hatchery diversion**	**18-19 Jul 1981**	**N36º 41' 10" W105º 38' 40"**
274.8	--		
Station 6	**Between hatchery and El Aujae Campground**	**18-19 Jul 1981**	**N36º 40' 40" W105º 39' 40"**
499.9	--		

* Estimated; accurate to ±5".

Melancon, S. M. S., L. S. Blakey, and J. J. Janik. 1982. *Site Specific Water Quality Assessment: Red River, New Mexico.* EPA 600/x-82-025. U. S. Environmental Protection Agency, Las Vegas, NV.

This report presents results of fish and benthic invertebrate sampling at eight sites on the Red River on 5-14 September 1980. Fish were sampled by seining and electrofishing with a backpack electrofishing unit. Fish were identified to species, weighed and measured for length Benthic invertebrates were sampled in five replicates with a standardized traveling kick net method. Sampled area was estimated at three m^2, but average number of organisms collected/replicate is provided in the summary table, below, in lieu of density. Benthic invertebrates were identified to the lowest practical taxonomic level (generally genus or species), with some Chironomidae to the subfamily level and Oligochaeta to the Class level. A total list of the taxa is given, and population data are presented as total number of individuals, number of taxa, and relative percentage of density by taxon. Benthic invertebrate samples collected at the lowest site were not processed.

Sites were designated by three digit numbers and the locations were described verbally. Descriptions also included characterization of substrate, a range for mean depths, and mean velocity. Site 055 was noted as being channelized with steep banks, and Site 057 was noted as being channelized and scoured by flooding in 1979.

Data from Sites 052 and 058 were not included in CEC (1997).

Site	Description	Substrate	Depth (m)	Velocity (m/s)
051	"Approximately 8.0 km upstream from Red River sewage treatment plant discharge at USGS gaging station"	rubble, gravel, small amounts of silt and sand	0.9-0.34	0.318
056	"Approximately 0.6 km upstream from Red River S.T.P. discharge at June Bug campground"	rubble, boulder, small amounts of gravel and sand	0.27-0.43	0.842
052	"Approximately 0.6 km downstream from Red River S.T.P. discharge at Elephant Rock campground"	rubble, boulder	0.27-0.49	0.393
053	"Approximately 3.4 km downstream from Red River S.T.P. discharge and 0.5 km upstream from Molycorp mine"	rubble, boulder	0.18-0.4	0.484
054	"Approximately 7.5 km downstream from Red River S.T.P. discharge and 150 m below Columbine Creek confluence"	"similar to 053"	0.18-0.30	0.758
055	"Approximately 10.0 km downstream from Red River S.T.P. discharge at Goathill campground"	boulder, rubble, gravel	0.24-0.37	0.704
057	"Approximately 17 km downstream from Red River S.T.P. discharge in Questa, NM; at cement highway bridge"	rubble, lesser amounts of gravel and boulder	0.18-0.37	0.758
058	"Approximately 200 m upstream from State Fish Hatchery and 1.2 km downstream from Molycorp discharge (Pope Lake)"	"Generally different from upstream sites"	0.24-0.43	1.230

Melancon *et al*. (1982) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
051		**Zwergle Gaging Station**				**5-14 Sep 1980**		**N36º 40' 25" W105º 22' 45"**	
CUT	13	229	8.9	--	--	172	63	n.s.	300
BRK	10	176	6.8	--	--	159	62	n.s.	300
RBT	5	88	7.9	--	--	237	144	n.s.	300
056		**June Bug Campground**				**5-14 Sep 1980**		**N36º 42' 25" W105º 26' 5"**	
BRN	1	35	0.9	--	--	149	41	n.s.	150
RBT	29	1,021	78.1	--	--	223	123	n.s.	150
052		**Elephant Rock Campground**				**5-14 Sep 1980**		**N36º 42' 25" W105º 26' 50"**	
BRK	1	18	1.1	--	--	205	95	n.s	300
BRN	5	88	6.9	--	--	215	126	n.s	300
RBT	2	35	2.1	--	--	217	98	n.s	300
053		**Upstream of Molycorp property boundary**				**5-14 Sep 1980**		**N36º 41' 55" W105º 28' 55"**	
RBT	4	70	6.2	--	--	236	143	n.s.	300
054		**Downstream of Columbine Creek**				**5-14 Sep 1980**		**N36º 40' 55" W105º 31' 0"**	
RBT	11	195	18.8	--	--	241	156	n.s.	300
055		**Goathill Campground**				**5-14 Sep 1980**		**N36º 41' 15" W105º 32' 25"**	
RBT	12	422	33.3	--	--	229	127	n.s.	150
057		**SH 522 Bridge**				**5-14 Sep 1980**		**N36º 41' 35" W105º 36' 40"**	
RBT	36	634	42.6	--	--	212	108	n.s.	300
BRN	8	142	7.9	--	--	187	90	n.s.	300
WS	2	35	1.6	--	--	185	75	n.s.	300
058		**Upstream of hatchery diversion**				**5-14 Sep 1980**		**N36º 41' 10" W105º 38' 40"**	
BRN	17	299	16.7	--	--	162	90	n.s.	300
RBT	6	106	4.5	--	--	180	68	n.s.	300

* Estimated; accurate to ±5".

n.s. = not stated.

Melancon *et al*. (1982) - Benthic Invertebrates

Site (in report)		Reach		Date	Location**
No. of Taxa	# Collected*	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
					N36º 40' 25"
051		**Zwergle Gaging Station**		**5-14 Sep 1980**	**W105º 22' 45"**
29	793	16	55	--	--
					N36º 42' 25"
056		**June Bug Campground**		**5-14 Sep 1980**	**W105º 26' 5"**
26	284	17	65	--	--
					N36º 42' 25"
052		**Elephant Rock Campground**		**5-14 Sep 1980**	**W105º 26' 50"**
29	339	18	62	--	--
		Upstream of Molycorp property			**N36º 41' 55"**
053		**boundary**		**5-14 Sep 1980**	**W105º 28' 55"**
19	171	13	68	--	--
					N36º 40' 55"
054		**Downstream of Columbine Creek**		**5-14 Sep 1980**	**W105º 31' 0"**
28	515	19	68	--	--
					N36º 41' 15"
055		**Goat Hill Campground**		**5-14 Sep 1980**	**W105º 32' 25"**
20	233	15	75	--	--
					N36º 41' 35"
057		**SH 522 Bridge**		**5-14 Sep 1980**	**W105º 36' 40"**
23	703	16	70	--	--

* Traveling kick sample method.

** Estimated; accurate to ±5".

Pennak, R. W. 1983. *Aquatic Ecosystem Conditions in the Red River, New Mexico, in October, 1982*. Report submitted to Molycorp, Inc.

This report presents results of benthic invertebrate and periphyton sampling conducted on 20-22 October 1982 at six previously established sites on the Red River. Methods were similar to those used in previous studies by the same author (Pennak 1972, 1976, 1977a, b, 1978, 1979a, b, 1981, q.v.) with a suite of five replicate Surber samples for invertebrates and a 5-minute scraping for periphyton at each site. Data for invertebrates were presented only for biomass (g/m^2) with a list of all the taxa collected in 1982. Periphyton data were presented as mg/5-minute scraping with the comment that the community was comprised of ". . . the usual 'healthy' assortment of diatoms and minute blue-green algal filaments plus detritus." Basic water quality parameters were collected as in previous studies by the same author.

Pennak (1983) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density ($\#/m^2$)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1		**Upstream of Molycorp property boundary**		**20-22 Oct 1982**	**N36º 41' 55" W105º 28' 55"**
--	--	--	--	4.4	--
Station 1A		**Goathill Campground**		**20-22 Oct 1982**	**N36º 41' 15" W105º 32' 25"**
--	--	--	--	1.9	--
Station 2		**Eagle Rock Campground**		**20-22 Oct 1982**	**N36º 42' 10" W105º 34' 30"**
--	--	--	--	1.4	--
Station 3		**Upstream of Pope Creek**		**20-22 Oct 1982**	**N36º 41' 25" W105º 37' 55"**
--	--	--	--	14.0	--
Station 5		**Upstream of hatchery diversion**		**20-22 Oct 1982**	**N36º 41' 10" W105º 38' 40"**
--	--	--	--	2.8	--
Station 6		**Between hatchery and El Aujae Campground**		**20-22 Oct 1982**	**N36º 40' 40" W105º 39' 40"**
--	--	--	--	9.8	--

* Estimated; accurate to ±5".

Pennak (1983) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
Station 1	**Upstream of Molycorp property boundary**	**20-22 Oct 1982**	**N36º 41' 55" W105º 28' 55"**
45.3	--		
Station 1A	**Goathill Campground**	**20-22 Oct 1982**	**N36º 41' 15" W105º 32' 25"**
168.0	--		
Station 2	**Eagle Rock Campground**	**20-22 Oct 1982**	**N36º 42' 10" W105º 34' 30"**
13.7	--		
Station 3	**Upstream of Pope Creek**	**20-22 Oct 1982**	**N36º 41' 25" W105º 37' 55"**
579.8	--		
Station 5	**Upstream of hatchery diversion**	**20-22 Oct 1982**	**N36º 41' 10" W105º 38' 40"**
140.6	--		
Station 6	**Between hatchery and El Aujae Campground**	**20-22 Oct 1982**	**N36º 40' 40" W105º 39' 40"**
204.7	--		

* Estimated; accurate to ±5".

Akroyd, B. 1984. Electrofishing Survey of Red River. Memorandum to Mike Hatch, dated 29 October 1984.

This memo presents results of fish sampling at five sites on the Red River downstream of the hatchery. A separate memo was attached which presented data from sampling at the same stations in June 1981. It was stated explicitly that a 110 volt bank generator was used in 1984, but methods for 1981 were not indicated; Akroyd (1988, q.v.) states that a 110 volt bank generator was used in 1981. The number of electrodes was not indicated for either survey. Most fish were identified to species and divided into 2-3 inch size classes; a few fish were unidentified. Efficiency was estimated at 50% due to high, murky water conditions, although that estimate was considered to be inaccurate (i.e., too high).

Finding exact locations for these sites is difficult because of the vague descriptions presented in the text of the memo. For example, the site one mile upstream of La Junta Point is also called the El Aquate camping area, which is identified on the USFS map of Carson National Forest as the El Aquaje recreation site in the same place as the El Aujae Campground on the USGS Guadalupe Mountain 7.5 minute topographical map. It is probable that the El Aquate (=El Aquaje) campground and the El Aujae campground refer to the same place, located two miles downstream from the hatchery, as amended in Akroyd (1987a, q.v.). However, there are also data for a separate site located two miles downstream of the hatchery. Therefore, the site described in the memo as "[two] miles below hatchery" is placed at a location 1.5 miles below the hatchery; this site was previously sampled as Site 4 in Parish (1976b, q.v.). The site "[one] mile above La Junta Point" is the El Ajuae Campground. La Junta Point is considered to be at the trail end 0.4 miles upstream of the confluence of the Red River and the Rio Grande, not at the confluence.

In CEC (1997), the data from the sites located one and two miles downstream of the hatchery were combined within the reach "Between hatchery and El Aujae Campground" for both 1981 and 1984; they are treated separately here.

Akroyd (1984) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"5. Just below hatchery."		**Downstream of hatchery**				**? Jun 1981**		**N36º 40' 55" W105º 39' 25"**	
BRN	13	130	--	--	--	--	--	1 (50)	528
RBT	16	160	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery."		**Between hatchery and El Aujae Campground**				**? Jun 1981**		**N36º 40' 30" W105º 39' 50"**	
BRN	18	180	--	--	--	--	--	1 (50)	528
RBT	4	40	--	--	--	--	--	1 (50)	528
"1. 2 miles below hatchery."		**Between hatchery and El Aujae Campground**				**? Jun 1981**		**N36º 40' 20" W105º 40' 0"**	
BRN	28	280	--	--	--	--	--	1 (50)	528
RBT	20	200	--	--	--	--	--	1 (50)	528
"3. One mile above La Junta Point."		**El Aujae Campground**				**? Jun 1981**		**N36º 40' 0" W105º 40' 5"**	
BRN	11	110	--	--	--	--	--	1 (50)	528
RBT	46	460	--	--	--	--	--	1 (50)	528
"4. La Junta Point"		**La Junta Point**				**? Jun 1981**		**N36º 39' 10" W105º 41' 20"**	
BRN	19	190	--	--	--	--	--	1 (50)	528
RBT	18	180	--	--	--	--	--	1 (50)	528
"5. Just below hatchery."		**Downstream of hatchery**				**24-25 Sep 1984**		**N36º 40' 55" W105º 39' 25"**	
BRN	23	230	--	--	--	--	--	1 (50)	528
RBT	14	140	--	--	--	--	--	1 (50)	528
UNK	1	10	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery."		**Between hatchery and El Aujae Campground**				**24-25 Sep 1984**		**N36º 40' 30" W105º 39' 50"**	
BRN	26	260	--	--	--	--	--	1 (50)	528
RBT	9	90	--	--	--	--	--	1 (50)	528
UNK	1	10	--	--	--	--	--	1 (50)	528
"1. Two miles below hatchery."		**Between hatchery and El Aujae Campground**				**24-25 Sep 1984**		**N36º 40' 20" W105º 40' 0"**	
BRN	34	340	--	--	--	--	--	1 (50)	528
RBT	5	50	--	--	--	--	--	1 (50)	528
"3. One mile above La Junta Point (El Aquate camping area)."		**El Aujae Campground**				**24-25 Sep 1984**		**N36º 40' 0" W105º 40' 5"**	
BRN	20	200	--	--	--	--	--	1 (50)	528
RBT	2	20	--	--	--	--	--	1 (50)	528
"4. La Junta Point."		**La Junta Point**				**24-25 Sep 1984**		**N36º 39' 10" W105º 41' 20"**	
BRN	29	290	--	--	--	--	--	1 (50)	528
RBT	3	30	--	--	--	--	--	1 (50)	528
UNK	2	20	--	--	--	--	--	1 (50)	528

* Estimated; accurate to ±5".

Patterson, B. 1984. Electrofishing Red River Below Hatchery. Memorandum to Dick McCleskey, dated 29 February 1984.

This memo presents results of fishing at a single site approximately one mile downstream of the hatchery. Although an explicit estimation of efficiency was not provided, it was stated that "[the] river was in a semi-murky runoff condition with a good flow of water which made it difficult to electrofish and to observe those fish stunned." Sampling upstream of the site was planned but not conducted due to poor water clarity. All fish, except a single unidentified specimen, were identified to species and divided into 2-3 inch size classes.

Patterson (1984) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
one mile below hatchery		**Between hatchery and El Aujae Campground**				**22 Feb 1984**		**N36º 40' 30" W105º 39' 50"**	
BRN	7	70	--	--	--	--	--	1	528
UNK	1	10	--	--	--	--	--	1	528

* Estimated; accurate to ±5".

Pennak, R. W. 1984. *Aquatic Ecosystem Condition in the Red River, New Mexico; October 1983*. Report submitted to Union Molycorp.

This report presents results from benthic invertebrate and periphyton sampling conducted at six sites on 18-20 October 1983. Methods were similar to those used in previous studies by the same author (Pennak 1972, 1976, 1977, 1978, 1979a, b, 1981, 1983, q.v.) with a suite of five Surber samples for invertebrates and a 5-minute scraping for periphyton at each site. A list of the invertebrate taxa collected in 1983 is included, and data from the samples are reported for biomass only in g/m^2. Periphyton data are reported as mg/5-minute scraping, with the note that the community composition was the ". . . usual and variable assortment of detritus, diatoms, and blue-green algae." *Oscillatoria* was reported to be dominant at Stations 2 (Eagle Rock Campground) and 3 (Upstream of Pope Creek), while diatoms were dominant at Station 6 (Between the hatchery and El Aujae Campground). Basic water quality parameters were collected as in previous studies by the same author.

Pennak (1984) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
Station 1		**Upstream of Molycorp property boundary**		**18-20 Oct 1983**	**N36º 41' 55" W105º 28' 55"**
--	--	--	--	2.7	--
Station 1A		**Goathill Campground**		**18-20 Oct 1983**	**N36º 41' 15" W105º 32' 25"**
--	--	--	--	1.5	--
Station 2		**Eagle Rock Campground**		**18-20 Oct 1983**	**N36º 42' 10" W105º 34' 30"**
--	--	--	--	2.4	--
Station 3		**Upstream of Pope Creek**		**18-20 Oct 1983**	**N36º 41' 25" W105º 37' 55"**
--	--	--	--	6.9	--
Station 5		**Upstream of hatchery diversion**		**18-20 Oct 1983**	**N36º 41' 10" W105º 38' 40"**
--	--	--	--	6.9	--
Station 6		**Between hatchery and El Aujae Campground**		**18-20 Oct 1983**	**N36º 40' 40" W105º 39' 40"**
--	--	--	--	6.0	--

* Estimated; accurate to ±5".

Pennak (1984) - Periphyton

Site (in report)	Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)		
Station 1	**Upstream of Molycorp property boundary**	**18-20 Oct 1983**	**N36º 41' 55" W105º 28' 55"**
21.6	--		
Station 1A	**Goathill Campground**	**18-20 Oct 1983**	**N36º 41' 15" W105º 32' 25"**
38.1	--		
Station 2	**Eagle Rock Campground**	**18-20 Oct 1983**	**N36º 42' 10" W105º 34' 30"**
236.8	--		
Station 3	**Upstream of Pope Creek**	**18-20 Oct 1983**	**N36º 41' 25" W105º 37' 55"**
194.7	--		
Station 5	**Upstream of hatchery diversion**	**18-20 Oct 1983**	**N36º 41' 10" W105º 38' 40"**
299.7	--		
Station 6	**Between hatchery and El Aujae Campground**	**18-20 Oct 1983**	**N36º 40' 40" W105º 39' 40"**
804.6	--		

* Estimated; accurate to ±5".

Jacobi, G. Z., and L. R. Smolka. 1984. *Intensive Survey of the Red River in the Vicinity of the Red River and Questa Wastewater Treatment Facilities and the Molycorp Complex, Taos County, New Mexico; January 25-27, 1984*. Report EID/SWQ-84/1, New Mexico Health and Environment Department, Santa Fe, NM.

This report presents results from benthic invertebrate sampling at two sites on the Red River bracketing the wastewater treatment plant (WWTP) outfall on 27 January 1984. A suite of three replicate samples was taken at each site using a circular sampler (Jacobi 1978). Additionally, water quality parameters were measured over a 48 hour period prior to collection of the benthic invertebrate samples at the same two sites and at five additional sites on the Red River.

The two sites are variously identified throughout the report. The site upstream of the WWTP effluent is referred to as Site 3, "Red River upstream from old lift station", and "Upstream from Red River WWTP outfall." It was at an elevation of 8,600 feet and was assigned an EPA Storet number of HRG-23.1. In the accompanying table, we have identified this location as the June Bug Campground. The site downstream of the WWTP effluent is referred to as Site 5, "Red River downstream from effluent outfall", and "Downstream from Red River WWTP outfall." It was at an elevation of 8,555 feet and was assigned an EPA Storet number of HRG-23.3.

Invertebrates were identified to genus or species. A list of the 27 invertebrate taxa collected is included, as well as densities (number of organisms/m^2) for each taxon. The total number of taxa is incorrectly reported as 24 taxa in the Results and Discussion section of the document. Total density, number of taxa, Shannon-Weaver Diversity Index (H'), equitability (Lloyd and Ghelardi 1964), community tolerance quotients (Winget and Mangum 1979), and the Biotic Condition Index (Winget and Mangum 1979) are calculated for each site. The percent similarity index between the two sites was 80%.

Jacobi and Smolka (1984) - Benthic Invertebrates

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
"Upstream from Red River WWTP outfall"		**June bug Campground**		**27 Jan 1984**	**N36º 42' 25" W105º 26' 5"**
22	2,071	15	68	--	H' = 3.13 Equitability = 0.59 CTQ_a = 35.71 BCI = 142.57
"Downstream from Red River WWTP outfall"		**Upstream of Elephant Rock Campground**		**27 Jan 1984**	**N36º 42' 25" W105º 26' 40"**
23	1,785	16	70	--	H' = 3.36 Equitability = 0.65 CTQ_a = 46.55 BCI = 107.00

* Estimated; accurate to ±5".

Akroyd, B. 1985. Electroshocking Lower Red River. Memorandum to Mike Hatch, dated 21 August 1985.

This memo presents data from fish sampling conducted at five previously established sites on the Red River on 12-14 August 1985. Methods were presumably similar to those used in 1981 and 1984 (Akroyd 1984, q.v.), with the exception of "some new gear . . . incorporated into the 110 volt generator." Most fish were identified to species and divided into 2-3 inch size classes; several fish were unidentified. Efficiency was estimated at 50%, although that estimate was considered to be inaccurate (i.e., too high). It was noted that one of the brown trout in each of the sites just below the hatchery and at La Junta Point was >762 mm in length.

As in Akroyd (1984, q.v.), site descriptions are vague and locations cannot be determined with accuracy. The same locations used in our summary of Akroyd (1984, q.v.) are used here as follows: the site described in the memo as "[two] miles below hatchery" is placed at a location 1.5 miles below the hatchery; this site was previously sampled as Site 4 in Parish (1976b, q.v.). The site "[one] mile above La Junta Point" is the El Aujae Campground. La Junta Point is considered to be at the trail end 0.4 miles upstream of the confluence of the Red River and the Rio Grande, not at the confluence.

In CEC (1997), the data from the sites located one and two miles downstream of the hatchery were combined within the reach "Between hatchery and El Aujae Campground"; they are treated separately here.

Akroyd (1985) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"1. Just below hatchery"		**Downstream of hatchery**				**12-14 Aug 1985**		**N36º 40' 55" W105º 39' 25"**	
BRN	11	110	--	--	--	--	--	1 (50)	528
RBT	1	10	--	--	--	--	--	1 (50)	528
UNK	4	40	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery"		**Between hatchery and El Aujae Campground**				**12-14 Aug 1985**		**N36º 40' 30" W105º 39' 50"**	
BRN	12	120	--	--	--	--	--	1 (50)	528
UNK	7	70	--	--	--	--	--	1 (50)	528
"3. Two miles below hatchery"		**Between hatchery and El Aujae Campground**				**12-14 Aug 1985**		**N36º 40' 20" W105º 40' 0"**	
BRN	20	200	--	--	--	--	--	1 (50)	528
RBT	1	10	--	--	--	--	--	1 (50)	528
"4. One mile above La Junta Point (El Aquate Camping Area)."		**El Aujae Campground**				**12-14 Aug 1985**		**N36º 40' 0" W105º 40' 5"**	
BRN	16	160	--	--	--	--	--	1 (50)	528
RBT	1	10	--	--	--	--	--	1 (50)	528
"5. La Junta Point"		**La Junta Point**				**12-14 Aug 1985**		**N36º 39' 10" W105º 41' 20"**	
BRN	22	220	--	--	--	--	--	1 (50)	528
RBT	1	10	--	--	--	--	--	1 (50)	528
UNK	5	50	--	--	--	--	--	1 (50)	528

* Estimated; accurate to ±5".

Smolka, L. R., and G. Z. Jacobi. 1986. *Water Quality Survey of the Red River, Taos County, New Mexico, April 15-17, 1985*. EID/SWQB/86/11. New Mexico Health and Environment Department, Santa Fe, NM.

This report presents results from benthic invertebrate sampling at four sites on the Red River on 18 April 1985. A suite of three replicate samples was taken at each site using a circular sampler (Jacobi 1978). Additionally, water quality parameters were measured over a 48 hour period prior to collection of the benthic invertebrate samples at the same four sites and at five additional sites on the Red River.

The sites are referred to by their EPA Storet number, with verbal descriptions of their locations.

Site (Storet #)	Description	Elevation (ft.)
HRG22	"Red River at the USGS Gauge @ Zwergle Dam."	8,880
HRG23.3	"Red River 100 yards below WWTP outfall."	8,555
HRG25	"Red River at the State Highway 3 bridge in Questa." [refers to the SH 522 bridge]	7,280
HRG27	"Red River ¼ mile below fish hatchery."	7,070

Most invertebrates were identified to genus or species; a few identifications were left at the Family level. A list of the 43 distinct invertebrate taxa collected is included, as well as densities (number of organisms/m^2) for each taxon. Total density, number of taxa, Shannon-Weaver Diversity Index (H'), community tolerance quotients (Winget and Mangum 1979), and the Biotic Condition Index (Winget and Mangum 1979) are calculated for each site. The percent similarity index between each pair of sites was calculated as follows.

Smolka and Jacobi (1986) - percent similarity index between sites for benthic macroinvertebrates

	HRG22	HRG23.3	HRG25	HRG27
HRG22	--	63%	36%	34%
HRG23.3		--	46%	39%
HRG25			--	60%
HRG27				--

Smolka and Jacobi (1986) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
HRG22		**Zwergle Gaging Station**		**18 Apr 1985**	**N36º 40' 25" W105º 22' 45"**
27	2,501	17	63	--	H' = 3.60 CTQ_a = 48.0 BCI = 104.2
HRG23.3		**Elephant Rock Campground**		**18 Apr 1985**	**N36º 42' 25" W105º 26' 40"**
21	916	14	67	--	H' = 3.79 CTQ_a = 36.7 BCI = 136.4
HRG25		**SH 522 Bridge**		**18 Apr 1985**	**N36º 41' 35" W105º 36' 40"**
17	388	10	59	--	H' = 3.48 CTQ_a = 44.7 BCI = 111.8
HRG27		**Downstream of hatchery**		**18 Apr 1985**	**N36º 40' 55" W105º 39' 25"**
20	2,047	15	75	--	H' = 2.29 CTQ_a = 51.1 BCI = 97.9

* Estimated; accurate to ±5".

Akroyd, B. 1987a. 1986 Electroshocking Survey Of The Lower Red River Revised To Show Correction in Estimated No./Mile. Memorandum to Mike Hatch, dated 5 January 1987.

This memo presents data from fish sampling conducted at four previously established sites and two new sites on the Red River on 5-6 November 1986. Methods were presumably similar to those used in previous studies by the same author (Akroyd 1984, 1985, q.v.). All fish were identified to species and divided into 2-3 inch size classes. Efficiency was estimated at 50%, and that estimate was considered to be reasonably accurate (in contrast to previous studies). The lowest site from previous studies by the same author, the site at La Junta Point, was not sampled in 1986.

As in Akroyd (1984, 1985, q.v.), site descriptions are vague and locations cannot be determined with accuracy. The site previously identified as the El Aquate camping area was amended to the El Aujae camping area in this memo. The same locations used in our summary of Akroyd (1984, q.v.) are used here as follows: the site described in the memo as "[two] miles below hatchery" is placed at a location 1.5 miles below the hatchery; this site was previously sampled as Site 4 in Parish (1976b, q.v.). The site "[one] mile above La Junta Point" is the El Aujae Campground.

In CEC (1997), the data from the sites located one and two miles downstream of the hatchery were combined within the reach "Between hatchery and El Aujae Campground"; they are treated separately here.

Akroyd (1987a) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/km	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"Above diversion"		**Upstream of hatchery diversion**				**5-6 Nov 1986**		**N36º41'5" W105º 38' 45"**	
BRN	9	238	--	--	--	--	--	1 (50)	200
RBT	17	449	--	--	--	--	--	1 (50)	200
"Below diversion"		**Downstream of hatchery diversion**				**5-6 Nov 1986**		**N36º 41' 5" W105º 38' 50"**	
BRN	30	792	--	--	--	--	--	1 (50)	200
RBT	17	449	--	--	--	--	--	1 (50)	200
"1. Just below hatchery"		**Downstream of hatchery**				**5-6 Nov 1986**		**N36º 40' 55" W105º 39' 25"**	
BRN	122	1,220	--	--	--	--	--	1 (50)	528
RBT	108	1,080	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery"		**Between hatchery and El Aujae campground"**				**5-6 Nov 1986**		**N36º 40' 30" W105º 39' 50"**	
BRN	98	980	--	--	--	--	--	1 (50)	528
RBT	5	50	--	--	--	--	--	1 (50)	528
"3. Two miles below hatchery"		**Between hatchery and El Aujae Campground**				**5-6 Nov 1986**		**N36º 40' 20" W105º 40' 0"**	
BRN	111	1,110	--	--	--	--	--	1 (50)	528
RBT	10	100	--	--	--	--	--	1 (50)	528
"4. One mile above La Junta Point (El Aujae Camping Area)"		**El Aujae Campground**				**5-6 Nov 1986**		**N36º 40' 0" W105º 40' 5"**	
BRN	69	690	--	--	--	--	--	1 (50)	528
RBT	5	50	--	--	--	--	--	1 (50)	528

* Estimated; accurate to ±5".

Akroyd, B. 1987b. 1987 Survey of Red River. Memorandum to Mike Hatch, dated 6 October 1987.

This memo presents data from fish sampling conducted at six previously established sites on the Red River on 21-23 September 1987. Methods were presumably similar to those used in previous studies by the same author (Akroyd 1984, 1985, 1987a, q.v.). All fish were identified to species and divided into 2-3 inch size classes. Efficiency was estimated at 50%. Water temperature and conductivity were measured at each site, except the sites bracketing the hatchery diversion. Data from the 1986 sampling event for the sites bracketing the hatchery diversion are repeated in this memo.

As in Akroyd (1984, 1985, 1987a, q.v.), site descriptions are vague and locations cannot be determined with accuracy. The same locations used in our summary of Akroyd (1984, q.v.) are used here as follows: the site described in the memo as "[two] miles below hatchery" is placed at a location 1.5 miles below the hatchery; this site was previously sampled as Site 4 in Parish (1976b, q.v.). The site "[one] mile above La Junta Point" is the El Aujae Campground. Specific dates are provided for Sites 1, 2, and 3, but not for any other of the other sites.

In CEC (1997), the data from the sites located one and two miles downstream of the hatchery were combined within the reach "Between hatchery and El Aujae Campground"; they are treated separately here.

Akroyd (1987b) - Fish

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"Above diversion"		**Upstream of hatchery diversion**				**21-23 Sep 1987**		**N36º 41' 5" W105º 38' 45"**	
BRN	11	290	--	--	--	--	--	1 (50)	200
RBT	1	26	--	--	--	--	--	1 (50)	200
"Below diversion"		**Downstream of hatchery diversion**				**21-23 Sep 1987**		**N36º 41' 5" W105º 38' 50"**	
BRN	33	871	--	--	--	--	--	1 (50)	200
RBT	3	79	--	--	--	--	--	1 (50)	200
"1. Just below hatchery"		**Downstream of hatchery**				**21 Sep 1987**		**N36º 40' 55" W105º 39' 25"**	
BRN	37	370	--	--	--	--	--	1 (50)	528
RBT	22	220	--	--	--	--	--	1 (50)	528
UNK	7	70	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery"		**Between hatchery and El Aujae campground"**				**23 Sep 1987**		**N36º 40' 30" W105º 39' 50"**	
BRN	42	420	--	--	--	--	--	1 (50)	528
RBT	7	70	--	--	--	--	--	1 (50)	528
UNK	4	40	--	--	--	--	--	1 (50)	528
"3. Two miles below hatchery"		**Between hatchery and El Aujae Campground**				**22 Sep 1987**		**N36º 40' 20" W105º 40' 0"**	
BRN	59	590	--	--	--	--	--	1 (50)	528
RBT	6	60	--	--	--	--	--	1 (50)	528
UNK	4	40	--	--	--	--	--	1 (50)	528
"4. One mile above La Junta Point (El Aujae Camping Area)"		**El Aujae Campground**				**21-23 Sep 1987**		**N36º 40' 0" W105º 40' 5"**	
BRN	54	540	--	--	--	--	--	1 (50)	528
RBT	4	40	--	--	--	--	--	1 (50)	528

* Estimated; accurate to ±5".

Smolka, L. R., and D. F. Tague. 1987. *Intensive Survey of the Red River, Taos County, New Mexico, August 18-21, 1986*. EID/SWQ-86/22. New Mexico Environmental Improvement Division, Santa Fe, NM.

This report presents results from benthic invertebrate sampling at five previously sampled sites on the Red River on 18-21 August 1986. Sites corresponded to sites sampled in Smolka and Jacobi (1984, 1986, q.v.). Both a traveling kick net method and circular sampler (Jacobi 1978) were used to sample invertebrates, but number of replicates is not stated. A total list of the taxa collected is given, with density (number of organisms/m^2) for each taxon at each site. Data presented include total density, number of taxa, the Shannon-Weaver Diversity Index, Community Tolerance Quotient, and the Biotic Condition Index for each site. The percent similarity index was calculated for all pairs of sites. Water quality data were collected at the five sites sampled for benthic invertebrate populations and at an additional three sites on the Red River. Akroyd (1987, q.v.) is appended for fish population data.

Smolka and Tague (1987) - percent similarity index between sites for benthic macroinvertebrates

Site	HRG22	HRG23.1	HRG23.3	HRG25	HRG27
HRG22	--	65%	62%	61%	48%
HRG23.1		--	77%	74%	56%
HRG23.3			--	85%	70%
HRG25				--	71%
HRG27					--

Smolka and Tague (1987) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
HRG22		**Zwergle Gaging Station**		**18-20 Aug 1986**	**N36º 40' 25" W105º 22' 45"**
16	1,567	11	69	--	H' = 3.03 CTQ_a = 44.5 BCI = 112.4
HRG23.1		**June Bug Campground**		**18-20 Aug 1986**	**N36º 42' 25" W105º 26' 5"**
21	1,145	15	71	--	H' = 3.33 CTQ_a = 40.1 BCI = 124.8
HRG23.3		**Elephant Rock Campground**		**18-20 Aug 1986**	**N36º 42' 25" W105º 26' 55"**
23	2,090	16	70	--	H' = 3.15 CTQ_a = 42.5 BCI = 117.6
HRG25		**SH 522 Bridge**		**18-20 Aug 1986**	**N36º 41' 35" W105º 36' 40"**
17	607	12	71	--	H' = 3.34 CTQ_a = 42.2 BCI = 118.5
HRG27		**Between hatchery and El Aujae Campground**		**18-20 Aug 1986**	**N36º 40' 55" W105º 39' 25"**
17	1,836	11	65	--	H' = 2.70 CTQ_a = 42.9 BCI = 116.6

* Estimated; accurate to ±5".

Akroyd, R. F., Jr. 1988. 1988 Surveys of Red River. Memorandum to Michael Hatch, dated 29 November 1988.

This memo presents data from fish sampling conducted at six previously established sites on the Red River on 26-30 September 1988. Methods were presumably similar to those used in previous studies by the same author (Akroyd 1984, 1985, 1987a, 1987b, q.v.), and the memo states that the previous surveys were all conducted with a 110 volt bank generator. Most fish were identified to species and divided into 2-3 inch size classes; a few fish were unidentified. Efficiency was estimated at 50%. Water temperature and conductivity were measured at each site, except the sites bracketing the hatchery diversion.

In addition, three new sites were added in which three sampling passes were conducted using backpack electrofishing gear. Site length, average stream width, and sampling time (in seconds) were measured at each site, as well as temperature and conductivity. Fish were identified by species, measured, and weighed for each pass.

The new sites are not given identifiers but are described verbally. The highest site was described as "[from] old Zwergel [*sic*] gauge (above town of Red River and confluence of Goose Creek) upstream 100 meters, average stream width 6.258 meters." The second site was "[just] above Elephant Rock campground, station length 100 meters, average stream width 5.4 meters." The lowest of these new sites was described as "[upstream] from irrigation diversion located just above the Questa Ranger Station, U.S.F.S., station length 100 meters, average stream width 8.14 meters." As in Akroyd (1984, 1985, 1987a, 1987b, q.v.), site descriptions for the sites downstream of the hatchery are vague and locations cannot be determined with accuracy. The same locations used in our summary of Akroyd (1984, q.v.) are used here as follows: the site described in the memo as "[two] miles below hatchery" is placed at a location 1.5 miles below the hatchery; this site was previously sampled as Site 4 in Parish (1976b, q.v.). The site "[one] mile above La Junta Point" is the El Aujae Campground. Specific dates are provided for all sites except those bracketing the hatchery diversion.

In CEC (1997), the data from the sites located one and two miles downstream of the hatchery were combined within the reach "Between hatchery and El Aujae Campground"; they are treated separately here.

Fish data are presented in the following table for each of the three passes for each site. Among the individual pass entries, density estimates are provided for the first pass only, for comparison with other data throughout this report. Following the individual pass data, a summary of all the data for the site is provided with the regressed population estimate.

Akroyd (1988) - Fish

Site (in report)		**Reach**				**Date**		**Location***	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
"Zwergel gauge"		**Zwergle Gaging Station**				**27 Sep 1988**		**N36° 40' 25" W105° 22' 45"**	
RBT	16	258	16.3	256	26.1	206	102	1/3	328
CUT	7	113	3.3	112	5.3	148	47	1/3	328
RBT	11	--	--	--	--	227	150	2/3	328
BRK	1	--	--	--	--	182	60	2/3	328
CUT	1	--	--	--	--	196	82	2/3	328
RBT	3	--	--	--	--	214	111	3/3	328
CUT	2	--	--	--	--	165	51	3/3	328
RBT	30	483	38.7	480	58	214	121	All 3**	328
BRK	1	16	0.6	16	1.0	182	60	All 3**	328
CUT	10	161	5.1	160	8.2	156	51	All 3**	328

Akroyd (1988) - Fish (cont.)

Site (in report)		Reach				Date		Location*	
Fish	Number Collected	#/mi	kg/km	#/ha	kg/ha	Mean Length (mm)	Mean Weight (g)	# of Passes (efficiency %)	Site Length (ft)
Elephant Rock Campground		**Elephant Rock Campground**				**26 Sep 1988**		**N36° 42' 25" W105° 26'50"**	
BRN	5	80	1.8	93	3.3	144	36	1/3	328
RBT	1	16	0.7	19	1.4	199	74	1/3	328
no fish	0	--	--	--	--	--	--	2/3	328
no fish	0	--	--	--	--	--	--	3/3	328
BRN	5	80	1.8	93	3.3	144	36	All 3**	328
RBT	1	16	0.7	19	1.4	199	74	All 3**	328
Questa Ranger Station		**Questa Ranger/Gaging Station**				**26 Sep 1988**		**N36° 42' 5" W105° 33' 50"**	
no fish	0	--	--	--	--	--	--	1/3	328
no fish	0	--	--	--	--	--	--	2/3	328
no fish	0	--	--	--	--	--	--	3/3	328
no fish	0	0	0	0	0	--	--	All 3**	328
"Above diversion"		**Upstream of hatchery diversion**				**26-30 Sep 1988**		**N36º 41' 5" W105º 38' 45"**	
BRN	36	950	--	--	--	--	--	1 (50)	200
RBT	13	343	--	--	--	--	--	1 (50)	200
"Below diversion"		**Downstream of hatchery diversion**				**26-30 Sep 1988**		**N36º 41' 5" W105º 38' 50"**	
BRN	47	1,241	--	--	--	--	--	1 (50)	200
RBT	24	634	--	--	--	--	--	1 (50)	200
"1. Just below hatchery"		**Downstream of hatchery**				**28 Sep 1988**		**N36º 40' 55" W105º 39' 25"**	
BRN	108	1,080	--	--	--	--	--	1 (50)	528
RBT	14	140	--	--	--	--	--	1 (50)	528
UNK	8	80	--	--	--	--	--	1 (50)	528
"2. One mile below hatchery"		**Between hatchery and El Aujae campground"**				**30 Sep 1988**		**N36º 40' 30" W105º 39' 50"**	
BRN	121	1,210	--	--	--	--	--	1 (50)	528
UNK	1	10	--	--	--	--	--	1 (50)	528
"3. Two miles below hatchery"		**Between hatchery and El Aujae Campground**				**30 Sep 1988**		**N36º 40' 20" W105º 40' 0"**	
BRN	120	1,200	--	--	--	--	--	1 (50)	528
UNK	1	10	--	--	--	--	--	1 (50)	528
"4. One mile above La Junta Point (El Aujae Camping Area)"		**El Aujae Campground**				**28 Sep 1988**		**N36º 40' 0" W105º 40' 5"**	
BRN	121	1,210	--	--	--	--	--	1 (50)	528
RBT	1	10	--	--	--	--	--	1 (50)	528
UNK	4	40	--	--	--	--	--	1 (50)	528

* Estimated; accurate to ±5".

** Expanded density data regressed according to Van Deventer and Platts (1983, 1986).

ENSR. 1988. *Aquatic Ecosystem Survey of the Red River, New Mexico*. Report prepared for Molycorp, Questa, NM.

This report presents results from benthic invertebrate and periphyton samples taken at seven sites on the Red River on 10-12 October 1988. Sites corresponded to sites sampled in Pennak (1984, q.v.), with the addition of Site 7, described as "[on] the Red River immediately upstream of its confluence with the Rio Grande near La Junta campground." Benthic invertebrates were collected at all sites except Site 7, with a suite of three Surber samples. At Site 7 a suite of three 30-35 second timed kick samples was collected. Benthic invertebrates were identified to the lowest practical taxonomic level, counted, and weighed for biomass (dryweight). Data presented for benthic invertebrates included total density (number of organisms/m^2), number of taxa, percent relative abundance/taxon, total biomass (g/m^2), Shannon-Weaver Diversity Index (H'), evenness (J'), Community Tolerance Quotient, and Biotic Condition Index for each site. A total list of taxa with density data are presented for each of the three replicates/site individually.

ENSR (1988) - Morisita Similarity Index between Sites for benthic invertebrates

Site	1	1A	2	3	5	6
1	--	45%	29%	43%	45%	6%
1A		--	46%	39%	81%	12%
2			--	13%	36%	5%
3				--	78%	56%
5					--	52%
6						--

Periphyton were sampled by scraping a known area (ranging from 16-36 in^2) with a pocket knife blade. Periphyton were identified to species or genus level, counted, and weighed for ash free dry weight (AFDW) for each site. A total list of taxa, with relative densities within taxonomic Divisions, is presented for each site.

Water quality data were collected at each site.

ENSR (1988) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass** (g/m^2)	Other Indices
1		**Upstream of Molycorp property boundary**		**10-12 Oct 1988**	**N36º 41' 55" W105º 28' 55"**
10	230	9	90	0.4989	H' = 2.92; J' = 0.88 CTQ_a = 29.10 BCI = 171.82
1A		**Goathill Campground**		**10-12 Oct 1988**	**N36º 41' 15" Q105º 32' 25"**
6	79	5	83	0.1104	H' = 1.96; J' = 0.76 CTQ_a = 30.50 BCI = 163.93
2		**Questa Ranger / Gaging Station**		**10-12 Oct 1988**	**N36º 42' 5" W105º 33' 50"**
3	108	3	100	0.2023	H' = 1.30; J' = 0.82 CTQ_a = 31.0 BCI = 161.29
3		**Upstream of Pope Creek**		**10-12 Oct 1988**	**N36º 41' 25" W105º 37' 55"**
11	362	7	64	0.5918	H' = 2.68; J' = 0.77 CTQ_a = 60.82 BCI = 82.21
5		**Upstream of hatchery diversion**		**10-12 Oct 1988**	**N36º 41' 10" W105º 38' 40"**
11	495	7	64	0.5028	H' = 2.56; J' = 0.74 CTQ_a = 59.18 BCI = 84.49
6		**Between hatchery and El Aujae Campground**		**10-12 Oct 1988**	**N36º 40' 40" W105º 39' 40"**
12	1,973	7	58	1.8034	H' = 1.66; J' = 0.46 CTQ_a = 50.25 BCI = 99.50
7		**La Junta Point**		**10-12 Oct 1988**	**N36º 39' 10" W105º 41' 20"**
10	K***	7	70	0.1191	--

* Estimated; accurate to ±5".

** Dry weight.

*** Qualitative samples only.

ENSR (1988) - Periphyton

Site (in report)	Reach	Date	Location*
AFDW (g/100 cm^2)	Taxa		
1	**Upstream of Molycorp property boundary**	**10-12 Oct 1988**	**N36º 41' 55" W105º 28' 55"**
0.3967	22 taxa; three dominant taxa are *Achnanthes minutissima*, *Oscillatoria sancta*, *Fragilaria vaucheriae*		
1A	**Goathill Campground**	**10-12 Oct 1988**	**N36º 41' 15" Q105º 32' 25"**
0.5644	18 taxa; three dominant taxa are *Oscillatoria nigra*, *Achnanthes minutissima*, *Fragilaria vaucheriae*		
2	**Questa Ranger/ Gaging Station**	**10-12 Oct 1988**	**N36º 42' 5" W105º 33' 50"**
0.0011	9 taxa; three most dominant are *Lyngbya nana*, *Achnanthes affinis*, *Oscillatoria tenuis*		
3	**Upstream of Pope Creek**	**10-12 Oct 1988**	**N36º 41' 25" W105º 37' 55"**
0.2225	22 taxa; three most dominant are *Achnanthes microcephala*, *Fragilaria vaucheriae*, *Oscillatoria sancta*		
5	**Upstream of hatchery diversion**	**10-12 Oct 1988**	**N36º 41' 10" W105º 38' 40"**
0.0844	25 taxa; three most dominant are *Oscillatoria sancta*, *Achnanthes minutissima*, *Fragilaria vaucheriae*		
6	**Between hatchery and El Aujae Campground**	**10-12 Oct 1988**	**N36º 40' 40" W105º 39' 40"**
0.6272	33 taxa; three most dominant are *Oscillatoria sancta*, *O. tenuis*, *Nitzschia paleacea*		
7	**La Junta Point**	**10-12 Oct 1988**	**N36º 39' 10" W105º 41' 20"**
0.3148	22 taxa; three most dominant are *Oscillatoria amoena*, *Fragilaria vaucheriae*, *Lyngbya versicolor*		

* Estimated; accurate to ±5".

Smolka, L. R., and D. F. Tague. 1989. *Intensive Water Quality Survey of the Middle Red River, Taos County, New Mexico, September 12 - October 25, 1988*. EID/SWQ-88/8. New Mexico Health and Environment Department, Santa Fe, NM.

This report presents results of benthic invertebrate sampling at five previously sampled sites and periphyton sampling at four sites on the Red River on 20-21 September 1988. Sites corresponded to sites sampled in Smolka and Jacobi (1984, 1986, q.v.) and Smolka and Tague (1987, q.v.). Both a traveling kick net method and circular sampler (Jacobi 1978) were used to sample invertebrates, but number of replicates is not stated. A total list of the taxa collected is given, with density for each taxon at each site. Data presented include total density, number of taxa, the Shannon-Weaver Diversity Index, Community Tolerance Quotient, and the Biotic Condition Index for each site. The percent similarity index was calculated for all pairs of sites.

Periphyton data were collected qualitatively by scraping various substrates in the river. One hundred diatom cells were counted and identified to species. Shannon-Weaver diversity was calculated for the diatom samples.

Water quality data were collected at the five sites sampled for benthic invertebrate populations and at an additional three sites on the Red River. Akroyd (1988, q.v.) is appended for fish population data.

Smolka and Tague (1989) - percent similarity index between sites for benthic macroinvertebrates

Site	1	5	6	7	11
1	--	30%	30%	37%	35%
5		--	66%	47%	33%
6			--	62%	27%
7				--	27%
11					--

Smolka and Tague (1989) - Benthic Invertebrates

Site (in report)			Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices	
1			**Zwergle Gaging Station**		**21 Sep 1988**	**N36º 40' 25" W105º 22' 45"**
28	2,038	17	61	--	H' = 3.77; even = 0.7 CTQ_a = 48 BCI = 104	
5			**June Bug Campground**		**21 Sep 1988**	**N36º 42' 25" W105º 26' 5"**
14	771	9	64	--	H' = 2.59; even = 0.6 CTQ_a = 41 BCI = 123	
6			**Elephant Rock Campground**		**21 Sep 1988**	**N36º 42' 25" W105º 26' 55"**
16	997	10	63	--	H' = 2.92; even = 0.7 CTQ_a = 42 BCI = 135	
7			**Upstream of Molycorp property boundary**		**21 Sep 1988**	**N36º 41' 55" W105º 28' 55"**
16	1,275	10	63	--	H' = 2.82; even = 0.6 CTQ_a = 42 BCI = 119	
11			**Questa Ranger/ Gaging Station**		**21 Sep 1988**	**N36º 42' 5" W105º 33' 50"**
6	171	6	100	--	H' = 2.06; even = 0.8 CTQ_a = 32 BCI = 155	

* Estimated; accurate to ±5".

Smolka and Tague (1989) - Periphyton

Site (in report)		Reach	Date	Location*
Biomass (mg)	Taxa (relative abundance %)			
1		**Zwergle Gaging Station**	**20 Sep 1988**	**N36º 40' 25" W105º 22' 45"**
--	18 taxa; three dominant taxa are *Cocconeis pediculus pediculus* (23), *Fragilaria leptostauron leptostauron* (19), *Navicula tripunctata tripunctata* (10)			
6		**Elephant Rock Campground**	**20 Sep 1988**	**N36º 42' 25" W105º 26' 55"**
--	20 taxa; three dominant taxa are *Cocconeis minuta minuta* (19), *Achnanthes microcephala microcephala* (13), *Cocconeis pediculus pediculus* (10)			
7		**Upstream of Molycorp Boundary**	**20 Sep 1988**	**N36º 41' 55" W105º 28' 55"**
--	18 taxa; three most dominant are *Fragilaria vaucheriae vaucheriae* (12), *Achnanthes microcephala microcephala* (10), *Nitzschia linearis linearis* (10)			
11		**Questa Ranger/ Gaging Station**	**20 Sep 1988**	**N36º 42' 5" W105º33'50"**
--	9 taxa; three most dominant are *Achnanthes microcephala microcephala* (80), *Fragilaria vaucheriae vaucheriae* (11), *Navicula minima minima* (3)			

* Estimated; accurate to ±5".

Leiner, S. 1992. *Brown Trout (Salmo trutta) and Rainbow Trout (Oncorhynchus mykiss): Population Metrics and Biomass Prediction Models in New Mexico Streams*. Ph.D. Dissertation, New Mexico State University, Las Cruces, NM.

This document presents data for 32 sites on 15 streams in New Mexico, including two sites on the Red River. Only brown and rainbow trout are discussed and the focus of the document is modeling of population metrics and biomass. Sites are not identified by landmark but GPS coordinates are provided for each site, so reaches could be identified. The upper site was described as a campground in the National Forest with open and closed seasons. The lower site was described as the state hatchery, closed to public fishing.

Site Designations in Document		Elevation (m)	Flow (m^3/s)
RED14	21	2560	1.28
RED15	22	2158	1.32

Data were presented for number collected, density estimates by area, and mean weights. Number of passes was not identified, but was stated as generally 3-4 passes.

Leiner (1992) - Fish

Site (in report)		**Reach**			**Date**			**Location***	
Fish	Number Collected	#/km	kg/km	#/ha	kg/ha	Mean length (mm)	Mean weight (g)	# of passes (efficiency %)	Site length (ft.)
RED14								**N36º 42' 30"**	
Site 21		**Elephant Rock Campground**			**July 1989**			**W105º 27' 30"**	
BRN	6	120	5.4	182	8.2	--	45	3-4	164
RBT	1	20	7.9	30	12.1	--	400	3-4	164
RED15								**N36º 40' 56"**	
Site 22		**Downstream of Hatchery**			**July 1989**			**W105º 39' 29"**	
BRN	74	643	114.8	931	186	--	172	3-4	361
RBT	156	1,417	39.4	1,962	64.2	--	28	3-4	361

* GPS coordinates as presented in original document.

Smolka, L. R. 1993. Special water quality survey of the Red River, Taos County, New Mexico. February - December, 1992. Pp 107-138 IN New Mexico Environment Department. Intensive Water Quality Stream Surveys 1992. New Mexico Environment Department, Santa Fe, NM.

This report presents results of benthic invertebrate sampling conducted at six previously established sites and at three new sites on the Red River on 10 April 1992. Sites previously established correspond to sites in Smolka and Jacobi (1984, 1986, q.v.) and Smolka and Tague (1987, 1989, q.v.). EPA Rapid Bioassessment Protocol (RBP) III methods (Plafkin *et al.* 1989) were used, and population parameters appropriate to the RBP III were presented, including total number of taxa, density (number of organisms/m^2), the Hilsenhoff Biotic Index, the Community Tolerance Quotient, percent dominant taxon, EPT Index, Community Loss, EPT:(Chironomids + EPT) ratio, Scrapers:(collector - filterers + scrapers) ratio, percent shredders. The report also compared the above parameters to reference site conditions, producing a score and a final Biological Condition Rating for each site. Basic water quality parameters were collected at all sites, except the site above Bitter Creek, monthly between February and December 1992. Elevations were provided for new sites, except the site above Bitter Creek.

Site	Storet Code	Description	Elevation
1	HRG22	"Red River at Zwergle Dam site."	
Above Bitter Creek	n.a.	"Above Bitter Creek"	
2	URG120.028069	"Red River below Bitter Creek."	2577 m
3	HRG23.1	"Red River below the town of Red River and above the Red River WWTP."	
4	HRG23.3	"Red River below the Red River WWTP outfall at Elephant Rock campground."	
5	URG120.028045	"Red River at upper Molycorp boundary."	2490 m
6	HRG24	"Red River above Questa at the USGS gage near the USFS office."	
7	HRG25	"Red River at the highway 522 (3) bridge in Questa."	
8	HRG27	"Red River below the Red River fish hatchery."	

n.a. = not available

Smolka (1993) - Benthic Invertebrates

Site (in report)		Reach		Date	Location*
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
1		**Zwergle Gaging Station**		**10 Apr 1992**	**N36º 40' 25" W105º 22' 45"**
31	2,765	20	65	--	HBI = 2.55; % dom. = 26 CTQ_a = 46 EPT:(chiron+EPT) = 0.98 Scr:(C-F+Scr) = 0.98 % Shredders = 6
Above Bitter Creek		**Upstream of Bitter Creek**		**10 Apr 1992**	**N36° 40' 45" W105° 22' 50"**
29	3,090	17	59	--	HBI = 2.48; % dom. = 30 CTQ_a = 45 EPT:(chiron+EPT) = 0.98 Scr:(C-F+Scr) = 0.75 % Shredders = 2
2		**Downstream of Bitter Creek**		**10 Apr 1992**	**N36° 42' 35" W105° 24' 35"**
26	2,551	17	65	--	HBI = 2.61; % dom. = 30 CTQ_a = 47 EPT:(chiron+EPT) = 0.95 Scr:(C-F+Scr) = 0.75 % Shredders = 7
3		**June Bug Campground**		**10 Apr 1992**	**N36° 42' 25" W105° 26' 5"**
20	1,835	13	65	--	HBI = 2.14; % dom. = 28 CTQ_a = 49 EPT:(chiron+EPT) = 0.98 Scr:(C-F+Scr) = 0.38 % Shredders = 3
4		**Elephant Rock Campground**		**10 Apr 1992**	**N36º42'25" W105º26'55"**
18	1,407	13	72	--	HBI = 2.48; % dom. = 34 CTQ_a = 44 EPT:(chiron+EPT) = 0.95 Scr:(C-F+Scr) = 0.22 % Shredders = 4
5		**Upstream of Molycorp property boundary**		**10 Apr 1992**	**N36° 41' 55" W105° 28' 55"**
13	1,594	8	62	--	HBI = 2.59; % dom. = 40 CTQ_a = 52 EPT:(chiron+EPT) = 0.94 Scr:(C-F+Scr) = 0.48 % Shredders = 7
6		**Questa Ranger/Gaging Station**		**10 Apr 1992**	**N36° 42' 05" W105° 33' 50"**
10	490	6	60	--	HBI = 1.26; % dom. = 82 CTQ_a = 46 EPT:(chiron+EPT) = 0.99 Scr:(C-F+Scr) = 0.08 % Shredders = 4

Smolka (1993) - Benthic Invertebrates (cont.)

Site (in report)		**Reach**		**Date**	**Location***
No. of Taxa	Density (#/m^2)	No. of EPT Taxa	% EPT Taxa	Biomass (g/m^2)	Other Indices
7		**SH522 Bridge**		**10 Apr 1992**	**N36º 41' 35" W105º 36' 40"**
13	535	9	69	--	HBI = 2.60; % dom. = 42 CTQ_a = 50 EPT:(chiron+EPT) = 0.95 Scr:(C-F+Scr) = 0.02 % Shredders = 4
8		**Downstream of hatchery**		**10 Apr 1992**	**N36º 40' 55" W105º 39' 25"**
19	1,423	12	63	--	HBI = 3.30; % dom. = 28 CTQ_a = 54 EPT:(chiron+EPT) = 0.82 Scr:(C-F+Scr) = 0.07 % Shredders = 11

* Estimated; accurate to ±5".

SECTION 2.2.2

HISTORICAL (1959 - 1974)

CREEL CENSUS STUDIES

Navarre, R. J. 1960. Conservation Officer's Creel Census on Lakes and Streams. Federal Aid Project F-22-R-1, Job G-3. Job Completion Report.

This document presents results of a statewide creel census conducted between 1 April 1959 and 31 December 1959. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. The Red River was divided into two reaches (upper and lower), but the delineation of these two reaches was not indicated.

According to Table 7 of the document, of the 272 license checks conducted on the lower Red River, 262 were conducted in May (representing 936 hours) and ten were conducted in July (representing 13 hours.) Of the 83 license checks conducted on the upper Red River, four were conducted in May (representing nine hours), 71 were conducted in July (representing 235 hours), and eight were conducted in August (representing 25 hours.) Note that the number of license checks is 83 and 272 in the upper and lower reaches, respectively, but the sum of the hours fished does not equal 294 and 1,023, respectively. The missing hours are not accounted for in the original document. The total number of days spent conducting the census on the Red River was not indicated.

Navarre (1960) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-Hour
Upper Red River			**1 Apr 1959 - 31 Dec 1959**					
83	294	298	--	41	10	--	349	1.19
Lower Red River			**1 Apr 1959 - 31 Dec 1959**					
272	1,023	1,266	53	11	--	--	1,330	1.30

Harrison, J. S. 1960. Red River Creel Census. Federal Aid Project F-22-R-1, Work Plan 2, Job G-2. Job Completion Report.

This document presents results from an intensive creel survey conducted on the Red River near the hatchery from May to September 1959. Contacts were made on two days per week, (one on a weekday and the other on a Saturday or Sunday), for a total of 44 days. A car counter was situated so as to estimate total use through the entire census period. Individual fish species were not identified. In addition, some data were divided between weekends and week days. Data regarding type of bait and angler state and county of origin were summarized. Of the 3,270 fish recorded in the census, 92% were rainbow trout, 8% were brown trout, and one cutthroat trout were identified.

Harrison (1960) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Lower Red River			**1 May 1959 - 31 May 1959**					
450	1,643	--	--	--	--	--	1,238	0.75
Lower Red River			**1 Jun 1959 - 30 Jun 1959**					
396	996.24	--	--	--	--	--	639	0.64
Lower Red River			**1 Jul 1959 - 31 Jul 1959**					
436	1,310.75	--	--	--	--	--	553	0.42
Lower Red River			**1 Aug 1959 - 31 Aug 1959**					
380	1,001.25	--	--	--	--	--	506	0.51
Lower Red River			**1 Sep 1959 - 30 Sep 1959**					
178	482.42	--	--	--	--	--	334	0.69

Hatchery records indicate that 8,097 rainbow trout were planted in this reach of the Red River between the end of the 1958 trout season and 1 April 1959. During June, July, August, and September, 662, 518, 731, and 4,735 rainbow trout were planted, respectively.

Navarre, R. J. 1961. Conservation Officer's Creel Census on Lakes and Streams. Federal Aid Project F-22-R-2, Job G-3. Job Completion Report.

This document presents results of a statewide creel census conducted during 1960. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of the previous statewide census (Navarre 1960, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. The total number of days spent conducting the census on the Red River was not indicated.

Navarre (1961) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**1960**					
114	211	116	6	4	11	20*	207	0.98
Middle Red River			**1960**					
185	381	370	3	--	--	--	373	0.98
Lower Red River			**1960**					
231	697	980	46	--	--	20*	1,046	1.50

* Species not indicated.

Jester, D. B. 1962. Conservation Officer Creel Census on Lakes and Streams. Federal Aid Project F-22-R-3, Work Plan 5, Job No. G-3. Job Completion Report.

This document presents results of a statewide creel census conducted during the 1961 calendar year. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. Additionally, data are provided for each of the west, middle, and east forks. The total number of days spent conducting the census on the Red River was not indicated.

Jester (1962) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
West Fork Red River			**1961**					
103	336	266	60	1	2	--	329	0.98
Middle Fork Red River			**1961**					
2	33	10	--	--	--	--	10	0.30
East Fork Red River			**1961**					
2	2	--	--	--	--	--	0	1.50*
Upper Red River			**1961**					
441	654	540	1	--	3	57**	601	0.92
Middle Red River			**1961**					
194	401	169	1	--	--	--	170	0.42
Lower Red River			**1961**					
238	428	337	--	--	--	23	360	0.84

* As reported in the document.
** Species not indicated.

Regan, D. M. 1963. Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-4, Work Plan 5, Job G-3(4). Job Completion Report.

This document presents results of a statewide creel census conducted during the 1962 calendar year. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. The total number of days spent conducting the census on the Red River was not indicated.

Regan (1963) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**1962**					
75	157	149	1	--	2	--	152	0.97
Middle Red River			**1962**					
912	1,612	1,108	--	1	10	--	1,119	0.69
Lower Red River			**1962**					
96	195	160	3	3	18	--	184	0.94

Little, R. G. 1964. Conservation Officers' Creel Census of Lakes and Streams. Federal Aid Project F-22-R-5, Work Plan 5, Job G-3(5). Job Completion Report.

This document presents results of a statewide creel census conducted during the 1963 calendar year. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. The total number of days spent conducting the census on the Red River was not indicated.

Little (1964) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**1963**					
256	449	383	--	2	1	--	386	0.86
Middle Red River			**1963**					
862	1,500	1,317	3	3	4	--	1,327	0.88
Lower Red River			**1963**					
77	119	176	11	--	--	--	187	1.57

Harrison, J. S. 1965. Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-6, Work Plan 5, Job G-3(6). Job Completion Report.

This document presents results of a statewide creel census conducted during the 1964 calendar year. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. Additionally, data are provided for West and Middle Forks of the Red River. The total number of days spent conducting the census on the Red River was not indicated.

The catch/man-hour of effort for the lower Red River reach was incorrectly calculated as 0.70. We have recalculated the catch/man-hour as 1.18.

Harrison (1965) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
West Fork Red River			**1964**					
19	22	2	--	--	--	--	2	0.09
Middle Fork Red River			**1964**					
9	17	20	--	--	--	--	20	1.18
Upper Red River			**1964**					
194	342	365	3	1	--	--	369	1.08
Middle Red River			**1964**					
664	1,058	1,032	--	--	--	--	1,032	0.98
Lower Red River			**1964**					
125	209	234	13	--	--	--	247	1.18

Harrison, J. S. 1966. Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-7, Work Plan 2, Job K-1. Job Completion Report.

This document presents results of a statewide creel census conducted during the 1965 calendar year. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, Harrison 1965, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. The total number of days spent conducting the census on the Red River was not indicated.

Harrison (1966) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**1965**					
174	337	334	1	16	3	--	354	1.05
Middle Red River			**1965**					
789	1,256	1,024	5	5	7	1*	1,042	0.83
Lower Red River			**1965**					
107	152	77	1	--	--	--	78	0.51

* Sunfish.

Little, R. G. 1967. Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-8, Job K-1. Job Completion Report.

This document presents results of a statewide creel census conducted during the 1966 calendar year and on the first two days of the 1966 fishing season for each species. The dates for the opening days were not specified. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, Harrison 1965, 1966, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. Census data for the first two days of the season applied only to the middle reach of the Red River. The total number of days spent conducting the census on the Red River was not indicated.

Little (1967) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**1966**					
67	94	53	--	6	--	--	59	0.63
Middle Red River			**Opening 2 days, 1966**					
35	127	154	--	--	--	--	154	1.21
Middle Red River			**1966**					
469	855	632	2	--	--	--	634	0.75
Lower Red River			**1966**					
30	39	65	--	--	--	--	65	1.69

Little, R. G. 1968. Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-9, Job K-1. Job Completion Report.

This document presents results of a statewide creel census conducted during the 1967 calendar year and on the first two days of the 1967 fishing season for each species. It was not specified as to which dates were the opening dates for which species. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, 1967, Harrison 1965, 1966, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. Additionally, data are provided for the East and West Forks of the Red River. The total number of days spent conducting the census on the Red River was not indicated.

Little (1968) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
West Fork Red River			**1-2 Apr, 6-7 May 1967**					
2	2	3	--	--	--	--	3	1.50
West Fork Red River			**1967**					
16	18	5	--	--	--	--	5	0.28
East Fork Red River			**1-2 Apr, 6-7 May 1967**					
2	10	12	--	--	--	--	12	1.20
East Fork Red River			**1967**					
2	10	12	--	--	--	--	12	1.20
Upper Red River			**1-2 Apr, 6-7 May 1967**					
39	102	193	--	--	--	--	193	1.90
Upper Red River			**1967**					
126	240	275	--	--	--	--	275	1.15
Middle Red River			**1-2 Apr, 6-7 May 1967**					
41	89	208	--	--	--	--	208	2.33
Middle Red River			**1967**					
96	210	293	--	--	--	--	293	1.40
Lower Red River			**1-2 Apr, 6-7 May 1967**					
117	328	856	10	--	--	--	866	2.64
Lower Red River			**1967**					
161	394	934	10	--	--	--	944	2.40

Grasmick, J. 1971. Statewide Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-11, Job K-1. Job Progress Report.

This document presents results of a statewide creel census conducted on the first two days of the 1969 fishing season for each species. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, 1967, 1968, Harrison 1965, 1966, q.v.). The Red River was divided into three reaches, but the delineation of these three reaches was not indicated. The inclusion of Cabresto Creek between two of the Red River stations suggests that the reaches indicate upper, middle, and lower reaches as in previous documents in the same Federal Aid series (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, 1967, 1968, Harrison 1965, 1966, q.v.). The total number of days spent conducting the census on the Red River was not indicated.

Grasmick (1971) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**Opening 2 days 1969**					
34	66	142	9	--	--	--	151	2.29
Middle Red River			**Opening 2 days 1969**					
40	99	108	6	--	--	--	114	1.15
Lower Red River			**Opening 2 days 1969**					
40	142	122	--	--	--	--	122	0.86

Grasmick, J. 1973. Statewide Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-13, Job K-1. Job Progress Report.

This document presents results of a statewide creel census conducted 1 April 1971 to 31 March 1972 and on the first two days of the 1971 fishing season for each species. The dates of the opening day for each season were not specified. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, 1967, 1968, Harrison 1965, 1966, Grasmick 1971, q.v.). The Red River was divided into three reaches (upper, middle, and lower), but the delineation of these three reaches was not indicated. Data are also included for Fawn Lakes and Eagle Rock Lake. The lower reach of the Red River was not censussed during the two opening days of the 1971 fishing season. The total number of days spent conducting the census on the Red River was not indicated.

Grasmick (1973) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Upper Red River			**Opening 2 days 1971**					
28	65	35	--	2	1	--	38	0.58
Upper Red River			**1971**					
79	153	98	--	2	7	--	107	0.70
Middle Red River			**Opening 2 days 1971**					
17	40	45	1	--	--	--	46	1.15
Middle Red River			**1971**					
327	441	331	8	1	3	--	343	0.78
Fawn Lakes			**Opening 2 days 1971**					
10	19	8	--	--	--	--	8	0.42
Fawn Lakes			**1971**					
107	186	83	--	--	--	--	83	0.45
Eagle Rock Lake			**Opening 2 days 1971**					
72	128	88	--	1	--	--	89	0.69
Eagle Rock Lake			**1971**					
103	185	114	--	1	--	--	115	0.62
Lower Red River			**1971**					
57	106	159	12	--	1	--	172	1.62

Grasmick, J. H. 1974. Statewide Conservation Officers' Creel Census on Lakes and Streams. Federal Aid Project F-22-R-14, Job K-1. Job Progress Report.

This document presents results of a statewide creel census conducted 1 April 1972 to 31 March 1973 and on the first two days of the 1972 fishing season for each species. The dates of the opening day for each season were not specified. Anglers at trout streams, trout lakes, warmwater streams, and warmwater lakes were censussed during license checks. Information pertinent to the Red River was presented as number checked, hours fished, counts for each species caught and total fish caught, and the catch per man hour. Results are compared to those of previous statewide censuses (Navarre 1960, 1961, Jester 1962, Regan 1963, Little 1964, 1967, 1968, Harrison 1965, 1966, Grasmick 1971, 1973, q.v.). The Red River was divided into two reaches (middle and lower), but the delineation of these two reaches was not indicated. Data are also included for Fawn Lakes and Eagle Rock Lake. Only the middle reach of the Red River and Eagle Rock Lake were censussed during the two opening days of the 1972 fishing season. The total number of days spent conducting the census on the Red River was not indicated.

Grasmick (1974) - Creel Census

Reach		**Dates**						
		Fish Caught						
Number Checked	Hours	RBT	BRN	BRK	CUT	Other	Total	Catch / Man-hour
Middle Red River			**Opening 2 days 1972**					
42	76	24	--	--	--	--	24	0.32
Middle Red River			**1972**					
195	429	169	--	--	--	--	169	0.39
Fawn Lakes			**1972**					
68	144	36	--	--	--	--	36	0.25
Eagle Rock Lake			**Opening 2 days 1972**					
30	59	18	--	--	--	--	18	0.31
Eagle Rock Lake			**1972**					
83	224	61	--	--	--	--	61	0.27
Lower Red River			**1972**					
24	55	36	--	--	1	--	37	0.67

Pacific, R. D. 1979. Fishery resources in and fisherman use of the lower Red River, Taos County, New Mexico (BLM). Memorandum to Herb Garn dated, 11 September 1979.

This memo, in response to a request for information on water rights adjudication hearings, presents a summary of creel censuses taken of the lower Red River from 1959 to 1974. The lower Red River refers primarily to the canyon in which the fish hatchery is located, especially downstream of the hatchery to the confluence with the Rio Grande. A total of 23, 042 fish were harvested at an annual average of 714 angler-hours/mile. Rainbow trout (97.0%), brown trout (2.8%), brook trout (0.1%), and cutthroat trout (0.1%) were the fish species caught. Citing data from previous creel censuses (including Navarre 1960, 1961; Harrison 1960, 1965, 1966; Jester 1962; Regan 1963; Little 1964, 1967, 1968; Grasmick 1971, 1973, 1974, q.v.), this document also states that the mainstem of the Red River provides 26,285 angler-days of use and an annual harvest of 83,397 fish. In 1975-76, fishing success for the whole mainstem was 0.8 fish/hr, and the 15-year average for the lower Red River was 1.18 fish/hr. These statistics placed the Red River in the top six trout streams in New Mexico. Creel survey parameters are compared to statewide trout stream averages.

Although the memo does not present original fish population data, it cites data from the previously published creel censuses and two sets of NMDGF unpublished data from September 1973 and October 1974. The October 1974 data are found in Patterson (1974, q.v.), where the data are reported assuming 50% efficiency. Information presented in this memo which was not mentioned in Patterson (1974, q.v.) is that there was an accidental release from the hatchery of 18,000-20,000 legal-size trout during the summer of 1974, which probably inflated the rainbow trout population densities reported in September 1974.

The catch per man-hour of effort for 1964 is incorrectly given as 0.70, as it was in the original document (Harrison 1965, q.v.). Given the other data presented, we have recalculated the catch per man-hour as 1.18. The catch/man-hour for 1971 is incorrectly given as 0.79. We have recalculated the catch/man-hour as 1.62 as in the original document (Grasmick 1973, q.v.).

SECTION 2.2.3

OTHER HISTORICAL (1906 - 1994) STUDIES

(TAGGING, STOCKING, FISH KILLS)

Barker, R.E. 1950? *Summary and Comparison Report of Trout Tagging Studies*. Technical Report No. 9F. New Mexico Department of Game and Fish, Santa Fe, NM.

This report presents data from a tagging study conducted on legal-size rainbow trout planted in the Rio Grande, Red River, Pecos River, Weatherly Lake, and Blue Water Lake between 22 December 1949 and 31 October 1950. A sample of the total fish plant was tagged with metal mouth tags. Plants were conducted in the Red River in January, February, April, and May 1950. Data are presented as percentage returned to creel by month, with longevity, average migration distances, and monthly growth rates of returned trout. There is no indication as to the location of the plants within the Red River, except that they were in the "Red River lower."

New Mexico Department of Game and Fish. 1953b. Fish planting. Memorandum to Citizens of Red River, dated 24 August 1953.

This memo reports the total fish planted in Red River, several tributaries, and several ponds between 1 July 1952 and 30 June 1953. Tributaries included Pioneer Creek, Sawmill Creek, Goose Creek, Bitter Creek, and the West Fork Red River. Ponds included Hamilton's, Young's, Booker's, Hickman's, and Kershner's ponds. Fish species included legally catchable (≥8.5 inches [216 mm]) and non-legal (<8.5 inches [216 mm]) rainbow trout and native cutthroat fry (<1 inch). A total of 84,050 fish, weighing a total of 8,786 pounds were planted. Data are presented by species, date, and site. A summary is not included here, since the data do not represent population sampling.

New Mexico Department of Public Health. 1966. Record of incidents causing pollution of the Red River, Taos County, New Mexico.

This six page incident form chronicled observations made by various witnesses (Artie Grant, Roy E. Barker, Allen Vickrey, Ralph Little, Jim Pickumn, Warren McNall, Jim Harrison, Ted Burt, Bob Larsen, Patrick Davies, Bud Brashears, Elbert Graves, John Fair, Joe Harris, Jack Yaple, Carl Berghofer, the "hatchery crew", "members of Federal and State Health Agencies", and "various") on conditions in the Red River from August 1965 to March 1966. Most of the observations reported the turbidity and other water conditions or sampling conducted on particular dates. The following summarizes observations regarding biota [all spelling and grammar are *sic*.].

3 Nov 1965 "Included assisting in collecting bottom organism and water chemistry"

6 Dec 1965 "Mortality of catchable sized trout in hatchery pond south of access road."

7 Dec 1965 "Attempts to determine reason for trout mortality at Red River Hatchery. Conducted electro-fishing in Red River above hatchery. Several 3-5 brown trout were checked."

17 Jan 1966 "Notified Roy Barker of condition of river and loss of some fish in live boxes at Hatchery."

24 Jan 1966 "Picked dead fish out of Red River."

24 Jan 1966 "Distressed fish were observed at the bridge at noon and at 1:15 p.m." [A second note indicates that this is the bridge over the river at the hatchery.]

25 Jan 1966 "Hatchery personnel had picked 1 rainbow and two browns on screens across river."

26 Jan 1966 "Dead brown trout were observed in several sections electrofished during the survey of the Red River. This survey was conducted to determine loss of fish created by pollution."

26 Jan 1966 "Electrofishing in Red River to determine fish losses. Several dead Brown Trout were recovered. 85 recorded results."

16 Feb 1966 "Electro-fished several sections of Red River to determine the extent of fish loss."

16 Feb 1966 "Electrofishing in Red River. Set out 4 live car containing trout."

17 Feb 1966 "Checked live cars and replaced test fish - - icing conditions caused trout mortality."

28 Feb 1966 "Checked Rio Grande from Velarde to Taos Jct. Bridge for dead fish. Check was made to determine if fish were lost from tailings observed in the Rio Grande on 2/27/66."

11 Mar 1966 "Collected bottom samples (3 sq. surber at 6 different stations)"

17 Mar 1966 "Electrofishing in Red River 85 has results."

Duff, B. 1975. re: Molycorp Spill. Letter to Joseph G. Harris, dated 15 April 1975.

This letter reported investigative activities on 10 April 1975 of Bryan Duff, Maynard Chapman, Gerald Silva, John Quintana, and Jack Ellvinger in response to a tailings pipeline break on 9 April 1975. There was a description of the break and the team's observations along the river. Collection of water and sediment samples was noted. Secondhand information from Bob Patterson was relayed in this letter, indicating that the fish kill tally was 400 fish.

Corrections regarding this letter are found in Patterson (no date, 1975?, q.v.). Hatch (1975a, b, q.v.) presents more detailed information and data on this fish kill. The site of the pipeline break was erroneously reported to be at the Eagle Rock Campground, and not upstream of the Goat Hill Campground where the 9 April 1975 spill actually occurred. Additionally, the spill that these investigators were looking at had occurred approximately six weeks earlier and had not even reached the Red River.

Hatch, M. 1975a. Fish Kill at Red River. Memorandum to R. L. Brashears, dated 11 April 1975.

This memo reports results from a fish kill investigation by Jim Grasmick and Mike Hatch on 10 April 1975 in response to an effluent spill from a broken tailings pipe on 9 April 1975. Three 0.1 mile sections of the stream and half the shoreline of Eagle Rock Lake were surveyed by observation. There was a note that Red River in the vicinity of the spill and Eagle Rock Lake had been stocked on 8 April 1975 with approximately 260 fish and approximately 660 fish, respectively. This report indicated that 300-400 fish were killed and that this estimate was probably conservative due to the channelized streambed allowing dead fish to flush out of the area.

The exact location of the pipeline break is not given, and the first sampling site was located where the majority of the effluent was suspected to have entered the river. The GPS coordinates for this site represent a point half-way between Goathill Campground and the bridge near the 2002-03 RI/FS Site RR-11A1 and are extremely rough estimates. The latter point was used as the highest upstream point at which the break might have occurred because we assume it would have been identified if the break had occurred at a point near or upstream of the bridge.

Hatch (1975a) - Fish

Site	Reach	Date	Comments	Location*
"opposite the mine"	Upstream of Goathill Gulch	10 Apr 1975	5 dead fish	N36º 41' 5" W105º 31' 45"
"Goat Hill Campground"	Goat Hill Campground	10 Apr 1975	2 dead fish	N36º 41' 15" W105º 32' 25"
"where Highway 3 crosses Red River at Questa"	SH 522 Bridge	10 Apr 1975	1 dead fish	N36º 41' 35" W105º 36' 40"
Eagle Rock Lake	Eagle Rock Lake	10 Apr 1975	9 dead fish, 10 fish with signs of stress	N36º 42' 10" W105º 34' 25"

* Estimated; accurate to ± 5".

Hatch, M. 1975b. Fish Kill at Red River (Memo of April 11, 1975 revised). Memorandum to R. L. Brashears, dated 16 April 1975.

This memo reports revised results from a fish kill investigation by Jim Grasmick and Mike Hatch on 10 April 1975 (Hatch 1975a, q.v.) in response to an effluent spill from a broken tailings pipe on 9 April 1975. This report revised the fish kill estimate from 300-400 fish down to an estimate of 248 fish killed. The estimate includes 50 fish/mile killed in the first three miles downstream of the spill, 20 fish/mile killed in the next three miles, 10 fish/mile killed in the last two miles, and 18 fish killed in Eagle Rock Lake.

Approximately 0.2 miles of stream upstream of the spill was surveyed to check for possible stocking mortality since stocking had occurred on 8 April 1975. No dead fish were observed in the area upstream of the spill.

Patterson, R. R. no date (1975?). Report of Fish Kill in the Red River as the Result of the Break in Moly Corp Effluent Line April 9, 1975.

This report summarizes information from Duff (1975, q.v.) and Hatch (1975b, q.v.) on fish killed and water quality conditions after an effluent spill from a broken pipeline on 9 April 1975. A chronology of events after the spill was recorded, along with the Hatch (1975b, q.v.) estimate of 248 rainbow trout killed as a result of the spill.

Corrections are provided for Duff (1975, q.v.) which purportedly investigated the spill of 9 April 1975. The investigation by Environmental Improvement Agency personnel reported in that document actually occurred at Eagle Rock Campground instead of Goat Hill Campground, and the spill they were looking at had occurred approximately six weeks earlier and did not reach the Red River.

Anonymous. 1982. *Red River Water Quality Situation Report. Spring - 1982.*

This report summarizes data from an inspection of the Red River Sewage Treatment Plant (STP) on 29-30 December 1981. Several inadequacies of the facilities and NPDES permit violations are reported. Biotic data include fecal coliform bacteria sampling at six sites on the Red River conducted on 4 November 1981 and 16 February 1982 and report of a fish kill in Fawn Lakes during summer 1981. The size of the fish kill was not stated, but it was attributed to effluent from the STP increasing nutrient levels and producing a toxic algal bloom or to effluent from the STP elevating ammonia levels in the lake.

Anonymous (1982) - Fecal Coliform

Site (in report)	Reach	Date	Colonies/100 ml	Location*
"STP effluent outfall"	Upstream of Elephant Rock Campground	4 Nov 1981	47±3	N36º 42' 25" W105º 26' 30"
"RR 300 yds. below STP outfall"	Upstream of Elephant Rock Campground	4 Nov 1981	0±3	N36º 42' 25" W105º 26' 40"
"RR below Elephant Rock CG"	Elephant Rock Campground	4 Nov 1981	0±3	N36º 42' 25" W105º 26' 50"
"RR ½ mile below Elephant Rock CG"	Upstream of Hansen Creek	4 Nov 1981	1±1	N36º 42' 15" W105º 27' 20"
"RR 1 mile below Elephant Rock CG"	Downstream of Hansen Creek	4 Nov 1981	0±1	N36º 42' 5" W105º 27' 55"
"RR 1½ mile below Elephant Rock CG"	Upstream of Molycorp property boundary	4 Nov 1981	0±1	N36º 41' 55" W105º 28' 25"
"STP effluent outfall"	Upstream of Elephant Rock Campground	16 Feb 1982	200,000	N36º 42' 25" W105º 26' 30"
"RR 300 yds. below STP outfall"	Upstream of Elephant Rock Campground	16 Feb 1982	6,200	N36º 42' 25" W105º 26' 40"
"RR below Elephant Rock CG"	Elephant Rock Campground	16 Feb 1982	3,500	N36º 42' 25" W105º 26' 50"
"RR ½ mile below Elephant Rock CG"	Upstream of Hansen Creek	16 Feb 1982	1,400	N36º 42' 15" W105º 27' 20"
"RR 1 mile below Elephant Rock CG"	Downstream of Hansen Creek	16 Feb 1982	1,600	N36º 42' 5" W105º 27' 55"
"RR 1½ mile below Elephant Rock CG"	Upstream of Molycorp property boundary	16 Feb 1982	100	N36º 41' 55" W105º 28' 25"

* Estimated; accurate to ±5".

Patterson, B. 1983. Sewage Spill into Red River. Memorandum to Dick McCleskey, dated 20 September 1983.

This memo discusses some investigative activities into the effects of a sewage spill from the Red River sewage treatment plant (STP). Neither the date of the spill nor the date of the survey is given. Five sites were electrofished to estimate fish loss from the spill. A note is given that the hatchery had stocked 975 trout in the area (at a rate of approximately 120 trout/mile) prior to Labor Day of that year (September 5), and the assumption was made that most of those had already been harvested.

Patterson (1983) - Fish

Site	Reach	Length (ft)	Date	Comments	Location*
June Bug Campground	June Bug Campground	264	? Sep 1983	10 legal RBT 4 BRN < 127 mm	N36º 42' 25" W105º 26' 5"
upstream of STP outfall	June Bug Campground	264	? Sep 1983	2 legal RBT	N36º 42' 25" W105º 26' 30"
between Fawn Lakes and the STP outfall	Elephant Rock Campground	528	? Sep 1983	0 fish	N36º 42' 25" W105º 26' 40"
upstream of Columbine Creek	Upstream of Columbine Creek	264-528	? Sep 1983	0 live fish 1 dead RBT	N36º 40' 55" W105º 30' 50"
Goathill Campground	Goathill Campground	264	? Sep 1983	2 legal RBT	N36º 41' 15" W105º 32' 25"

* Estimated; accurate to ±5".

Jaquez, E. 1992. Investigations of Unpredictable Fishery Phenomena. Federal Aid Project F-22-R-33, Study 113. Final Report.

This document reports investigations made by NMDGF personnel to eight events statewide which were lethal or potentially lethal to fish. One of the events involved the Red River in the vicinity of Bitter Creek. The report states that, about 3:00 p.m. on 17 July 1991, "runoff from a heavy rain washed copious amounts of mud into Bitter Creek (tributary to the Red River) the same evening that trout were stocked. The suspended solids were apparently sufficiently thick to cause suffocation of the trout." A Fish Kill Report from R. F. Akroyd, Jr. and another typed message were appended to the document. The typed message is repeated here:

"On July 17, 1991 at about 3:00 pm, Jim Weller came by the hatchery and reported a fish kill in the town of Red River apparently from Bitter Creek down. We had stocked the RRMC on July 15th. That evening there was a heavy rain that washed a lot of yellow mud into Bitter Creek. Weller reported that the following day people were picking up fish along the river in trash bags. Since this time we had received three other reports with pretty much the same story. These people also said that fishing had been good up until that evening with a dramatic decrease after the rains."

NMDGF. 2000. Fish stocking records, 1906-1994.

This database provides trout stocking records for the Red River mainstem and forks for nearly every year from 1906 to 1993. Data include fish species, the number planted, and the reach of river in which they were planted. Starting in 1982, size of fish was recorded, although units were not provided and the size data are not summarized here. Fish species included rainbow trout, brown trout (also entered as loch leven trout), brook trout, and two subspecies of cutthroat trout (*Oncorhynchus clarki virginalis*, the Rio Grande cutthroat trout, entered as native black spotted trout or New Mexico cutthroat trout, and *O. c. bouvieri* entered as Yellowstone cutthroat trout). Stream reaches only referred to the individual west and east forks, and the upper, middle and lower Red River; records before 1926 only mentioned the Red River, not individual reaches.

Total figures for some years were double-checked against Thompson (1950), NMDGF (1953, q.v.), and published values in selected NMDGF Annual Reports (State of New Mexico 1915, 1917, 1919, 1921, 1925; NMDGF 1923, 1927, 1933, 1934, 1935, 1940, 1952, 1953a, 1954, 1955, 1956, 1957, 1959). Data for 1994 were supplied by Richard Hansen (NMDGF, personal communication, 31 October 2003). NMDGF (2004) suggests that cutthroat trout stocked in New Mexico streams from 1902-1939 were Yellowstone cutthroat trout from stock from Yellowstone Lake, Wyoming.

Trout Stocking in Red River (through 1994).

Name	First Stocked	Total Through 1994
"General" trout	1906	41,200
Rainbow trout	1910	4,635,569
Brook trout	1915	459,950
Rio Grande Cutthroat trout	1916	809,401
Brown trout	1928	2,207,655
Yellowstone Cutthroat	1949	6,000
Total Trout		**8,118,575**
Average # Trout/Year	93,317	

Rainbow Trout Stocking (by Reach), 1910-1994.

Stream Reach	# Planted
East Fork of Red River	72,540
West Fork Red River	162,943
Upper Red River	685,026
Middle Red River	1,540,701
Lower Red River	1,247,251
"Red River" (no distinction made until 1926)	927,108
Total Rainbow Trout	**4,635,569**

NMDGF (2000) - Fish Stocking Schedule

Year	Rainbow	Brown	Brook	RG cutthroat	YS cutthroat
1906	41,200 “general” trout		--	--	--
1910	1,500	--	--	--	--
1914	200	--	--	--	--
1915	750	--	30,000	--	--
1916	--	--	--	11,900	--
1917	--	--	--	38,500	--
1918	--	--	--	20,000	--
1919	--	--	--	3,600	--
1920	--	--	--	1,500	--
1921	60,000	--	60,000	--	--
1922	--	--	--	4,500	--
1923	--	--	--	63,000	--
1924	--	--	--	2,000	--
1926	20,000	--	--	--	--
1927	110,000	--	65,000	--	--
1928	199,000	37,000	74,000	--	--
1929	105,500	64,500	40,000	--	--
1930	18,800	--	--	--	--
1931	147,300	388,650	52,800	--	--
1932	41,000	--	17,750	--	--
1933	10,000	--	20,400	32,000	--
1934	16,500	--	--	144,628	--
1935	21,680	--	100,000	39,250	--
1936	35,399	--	--	45,000	--
1937	49,800	--	--	52,000	--
1938	56,750	--	--	55,000	--
1939	73,800	--	--	45,500	--
1940	8,434	704	--	--	--
1941	15,651	--	--	--	--
1942	32,520	51,539	--	--	--
1943	20,787	--	--	2,016	--
1944	77,627	--	--	--	--
1945	21,218	32,774	--	--	--
1946	31,301	37,601	--	--	--
1947	46,978	7,924	--	--	--
1948	34,245	107,533	--	--	--
1949	40,885	108,064	--	6,930	6,000
1950	102,587	139,092	--	--	--
1951	37,505	93,264	--	5,000	--
1952	30,322	129,560	--	42,624	--
1953	34,737	110,656	--	--	--
1954	49,618	117,940	--	6,625	--
1955	75,033	50,416	--	--	--
1956	57,477	43,932	--	10,000	--
1957	67,324	48,892	--	4,920	--
1958	58,707	22,000	--	--	--
1959	54,821	28,090	--	3,648	--
1960	113,814	30,000	--	--	--
1961	49,752	30,000	--	4,500	--

NMDGF (2000) - Fish Stocking Schedule (cont.)

Year	Rainbow	Brown	Brook	RG cutthroat	YS cutthroat
1962	52,376	29,400	--	--	--
1963	54,904	27,000	--	--	--
1964	110,088	31,500	--	10,000	--
1965	82,811	3,200	--	--	--
1966	70,291	31,500	--	22,000	--
1967	85,429	30,306	--	28,105	--
1968	43,608	20,000	--	--	--
1969	35,429	45,200	--	23,750	--
1970	35,153	34,560	--	8,800	--
1971	39,813	27,000	--	--	--
1972	36,639	30,000	--	300	--
1973	222,482	30,800	--	--	--
1974	125,885	30,000	--	--	--
1975	124,239	35,000	--	--	--
1976	169,040	33,300	--	--	--
1977	455,985	--	--	49,500	--
1978	64,387	--	--	22,305	--
1979	57,997	53,222	--	--	--
1980	63,831	--	--	--	--
1981	74,108	--	--	--	--
1982	66,345	--	--	--	--
1983	74,370	5,536	--	--	--
1984	49,601	--	--	--	--
1985	47,708	--	--	--	--
1986	28,798	--	--	--	--
1987	48,422	30,000	--	--	--
1988	49,903	--	--	--	--
1989	40,200	--	--	--	--
1990	40,601	--	--	--	--
1991	43,000	--	--	--	--
1992	43,004	--	--	--	--
1993	42,700	--	--	--	--
1994	27,100	--	--	--	--
Total	**4,635,569**	**2,207,655**	**459,950**	**809,401**	**6,000**
	+41,200				