A COMPENDIUM OF AQUATIC RESOURCE STUDIES IN THE CLARK FORK RIVER BASIN

MAY, 1987

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F O R E W O R D

This report is an updated version of the compendium of studies which was prepared and distributed in January, 1986. The compendium describes the objectives, current status and projected activities of fifty active or recently completed aquatic resources studies within the Clark Fork River Basin. Although the descriptions of each study are brief, the compendium should serve as a guide to sources of information.

Governor Schwinden established a Clark Fork River Basin Project to coordinate and integrate data from all aquatic studies within the basin and to encourage citizen and scientific involvement in understanding the aquatic resource problems of the river. This document represents one of several ongoing efforts of the Clark Fork Project to achieve that goal. For more information about the Project, contact Howard Johnson of the Governor's Office, Capitol Station, Helena, Montana 59620. Telephone (406) 444-3111.

TABLE OF CONTENTS

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

STUDY CONTACTS

NAME	ORGANIZATION	TELEPHONE	STUDY(S)
Andrews, Ned	USGS-Denver, CO.	(303)236-5004	9.1
Bahls, Loren	DHES, WQB-Helena	444-2406	4.1, 4.2, 6.2, 6.3, 6.4, 6.5, 12.1, 13.2
Bartschi, Don	USFS-Missoula	329-3511	5.1
Beckwith, Mike	IDHW,DOE-Coeur d'Alene ID.	(208)667-3524	8.1
Berg, Rod	MDFWP-Missoula	721-5808	2.2, 2.5, 2.6
Bishop, Mike	EPA-Helena	449-5414	6.1
Brook, Edward J.	UM, Geology Dept.	243-2141	10.6
Brooks, Rebekah	UM, Geology Dept.	542-0537	10.7
Brooks, Tom	USGS, MT Office-Helena	449-5263	9.2
Brown, Larry	MDHES,WQB-Helena	444-2406	3.3
Canton, Steve	Chadwick & Assoc.- Littleton, CO.	(303)798-7708	12.1
Coleman, Charles	MDHES, SHWB-Helena	444-2821	4.4
Cross, David	CSKT-Pablo, MT	675-4600	16.1
Crowley, Frank	MDHES-Helena	444-2630	4.5
Cunnane, Mark	MSU-Dept. of Civil Engr.	994-6132	11.1
Dodge, Ted	Headwaters RC&D-Butte	782-7333	17.1
Duaime, Ted	MBMG-Butte	496-4157	1.1, 1.2
Erskine, Terry	ASARCO-Troy, Montana	259-5882	2.10
Finke, Eric	EPA-Helena	449-5414	4.3, 6.1
Goggin, Mike	USFS-Missoula	329-3039	5.1
Graham, Pat	MDFWP-Helena	444-3186	2.3, 2.5, 2.6
Green, Joseph	EPA-Corvallis, OR	No Phone	6.4
Hadley, Wayne	MDFWP-Deer Lodge	846-3278	2.7
Higgins, Susan	MDNRC-Helena	444-6607	18.1
Horner, Ned	IDFG-Coeur d'Alene, ID.	(208)664-9236	7.1
Huston, Joe	MDFWP-Kalispell	755-5505	2.9, 15.1
Ingman, Gary	MDHES, WQB-Helena	444-2406	4.1, 13.2
Johns, Carolyn	UM, Geology Dept.-Missoula	243-2341	10.2
Johnson, Mike	USFS-Missoula	444-3516	5.1
Knapton, Roger	USGS, MT Office-Helena	449-5263	9.3
Knoy, Jim	EPA-Helena	449-5414	4.4
Knudsen, Gerhard	MDNRC-Helena	444-6601	2.1
Lambing, John	USGS, MT Office-Helena	449-5263	9.3, 9.4
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STUDY CONTACTS (Continued)

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Modroo, Elton	Sunshine Mining Co.	(208)345-0660	3.3
Montgomery, Dick	EPA-Helena	449-5486	6.2, 6.3 6.4, 6.5
Moreland, Joe	USGS, MT Office-Helena	449-5263	9.2, 9.3 9.4
Moore, Johnny	UM, Geology Dept.-Missoula	243-2341	10.2, 10.4, 10.6, 10.7, 10.8
Mundie, Ben	MDSL-Helena	444-2074	1.1
Munther, Greg	USFS-Missoula	329-3793	5.1
Paro, Jim	CSKT-Pablo, MT	675-4600	16.1
Peavey, Howard	MSU, WRC-Bozeman	994-6690	11.1
Peters, Don	MDFWP-Missoula	721-5808	2.5, 2.8
Phillips, Glenn	MDFWP-Helena	444-2406	2.4, 2.11
Pickett, Frank	MPC-Butte	723-5421	14.1
Pilcher, Steve	MDHES,WQB-Helena	444-2406	4.1, 4.2
Posewitz, Jim	MDFWP-Helena	444-2603	4.5
Ring, Tom	MDNRC, Helena	444-6785	18.1
Robertson, Duane	MDHES,SWMB-Helena	444-2821	4.3, 4.4
Rubich, Mike	MDHES, SWMB-Helena	444-2821	4.3
Schafer, William	Schafer & Assoc.-Bozeman	587-3478	17.1
Sonderegger, John	MBMG-Butte	496-4159	17.1
Spence, Liter	MDFWP-Helena	444-3888	2.1
Sprague, Don	MPC-Butte	723-5421	14.1
Smith, Dennis P.	MDSL-Helena	444-2074	3.3
Swant, Timothy	WWP-Noxon, MT.	874-2739	15.1
Tulloch, Ed	IDHW-DOE, Coeur-d'Alene, ID.	(208)667-3524	8.1
Udaloy, Anne	UM-Geology Dept.-Missoula	728-3495	10.8
Vashro, Jim	MDFWP-Kalispell	755-5505	2.9, 2.10 3.1
Walther, Kit	MDSL-Helena	444-2074	3.1, 3.2
Watson, Vicki	UM EVST-Missoula	243-5153	10.1, 10.5
Weber, Erich	MDHES, WQB-Helena	444-2406	4.2
Weeks, Larry	SCC-Missoula	626-4451	13.1, 13.2
Wells, Jerry	MDFWP-Bozeman	586-5419	3.2
Woessner, Bill	UM Geology Dept.-Missoula	243-2341	10.3
Woodworth, Roger	WWP-Spokane, WA	(509)489-0500	15.1
Workman, Dennis	MDFWP-Missoula	721-5808	2.1, 2.2, 2.3, 2.5, 2.6, 2.7 2.8

GLOSSARY

AMC	ANACONDA MINERALS COMPANY
BPA	BONNEVILLE POWER ADMINISTRATION
CIC	CHAMPION INTERNATIONAL CORPORATION
CSKT	CONFEDERATED SALISH AND KOOTENAI TRIBES
EPA	ENVIRONMENTAL PROTECTION AGENCY
EVST	ENVIRONMENTAL STUDIES PROGRAM
FERC	FEDERAL ENERGY REGULATORY COMMISSION
FS	FEASIBILITY STUDY
HRC&D	HEADWATERS RESOURCE CONSERVATION AND DEVELOPMENT
IDFG	IDAHO DEPARTMENT OF FISH AND GAME
IDHW	IDAHO DEPARTMENT OF HEALTH AND WELFARE
IDHW-DOE	IDAHO DEPARTMENT OF HEALTH AND WELFARE-DIVISION OF THE ENVIRONMENT
MBMG	MONTANA BUREAU OF MINES AND GEOLOGY
MDFWP	MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
MDHES	MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
MDNRC	MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
MDSL	MONTANA DEPARTMENT OF STATE LANDS
MPC	MONTANA POWER COMPANY
MPDES	MONTANA POLLUTION DISCHARGE ELIMINATION SYSTEM
MSU	MONTANA STATE UNIVERSITY
RI	REMEDIAL INVESTIGATION
RI/FS	REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SCC	STONE CONTAINER CORPORATION
SHWB	SOLID HAZARDOUS WASTE BUREAU
UM	UNIVERSITY OF MONTANA
USFS	U.S. FOREST SERVICE
USGS	U.S. GEOLOGICAL SURVEY
WQB	WATER QUALITY BUREAU
WWP	WASHINGTON WATER POWER COMPANY
WWTP	WASTE WATER TREATMENT PLANT

STUDY NUMBER: 1.1 (COMPLETED)

ORGANIZATION: Montana Bureau of Mines and Geology (MBMG)

TITLE OF STUDY: Hydrogeologic Monitoring of the Colorado Tailings Area, Butte, Montana (prepared for the Department of State Lands via contract).

CONTACT(S): Ted Duaime - Montana Bureau of Mines and Geology - 496-4157

Ben Mundie - Montana Department of State Lands - 444-2074

OBJECTIVE: Characterize the mobilization of heavy metals within the Colorado Tailings; determine the resulting impacts to surface and groundwater; prepare a rationale for reclamation needs and alternatives.

DURATION: 1982 - 1987

CURRENT STATUS: The Colorado Tailings are abandoned mine wastes, averaging about five feet in thickness and covering 30 acres of Silver Bow Creek and its floodplain. They are located just downstream from the Butte Metro Wastewater Treatment Plant.

Beginning in 1982, MBMG began collecting water quality and core samples near and within the tailings. Approximately 25 test wells were monitored monthly for numerous water quality parameters and static water levels from 1982 through early 1986. Comprehensive water quality sampling was less frequent in recent months, although specific conductivity, temperature and static water levels were routinely monitored. The above data and reports have provided a basis for reclamation designs.

Under the Silver Bow Creek Remedial Investigation/Feasibility Study, the Colorado Tailings will be considered as one of the many operable units within the National Priority List site. The remedial action and sequence of action on these operable units will be determined as the investigation is completed. A project summary will be prepared with distribution planned for spring 1987.

PUBLICATIONS AND REPORTS

Duaime, T., J. Sonderegger and M. Zaluski. 1985. Hydrogeology of the Colorado Tailings Area, Butte, Montana. Pages 4-20 In C.E. Carlson and L.L. Bahls (eds.), Proceedings of the Clark Fork Symposium. April 5, 1985. Montana Academy of Sciences, Montana College of Science and Technology.

STUDY NUMBER: 1.2

ORGANIZATION: Montana Bureau of Mines and Geology (MBMG)

TITLE OF STUDY: Intensive Butte Area Groundwater Monitoring

CONTACT(S): Ted Duaime - Montana Bureau of Mines and Geology, Butte--496-4157

OBJECTIVE: Assess the impacts to groundwater (quality and quantity) caused by shutdown of mining activities in Butte.

DURATION: 1984 - Indefinite

CURRENT STATUS: Pumping of the underground mine workings on Butte Hill ceased in April, 1982. Water is now flooding these areas and the Berkeley Pit at a rate of 3,000 to 10,000 gallons per minute.

Comprehensive water quality sampling for common ions and heavy metals was routinely conducted within the abandoned mine shafts and from several shallow groundwater stations during the first year of the study. The most recent comprehensive water quality sampling of the mine shafts was conducted in October, 1986. However, monthly specific conductivity, temperature and static water levels have been monitored for the last two years. All monitoring efforts have been closely coordinated with the Anaconda Minerals Company, the US Geological Survey and Montana Department of State Lands. Samples from the Berkeley Pit were collected in October, 1986.

FUTURE ACTIVITIES: This project was originally funded by a grant from the 1983 Montana Legislature. No additional funding for comprehensive water quality sampling has been received, except for a small grant from the Butte Silver Bow City-County government. Consequently, future investigations will be limited. One or two water quality sampling episodes will occur in the spring of 1987. Less expensive monitoring, like monthly specific conductivity, temperature and static water level measurements will continue.

PUBLICATIONS AND REPORTS

Data summaries are available from the Montana Bureau of Mines and Geology.

STUDY NUMBER: 2.1 (COMPLETED)

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Instream Flow Reservation Studies - Upper Clark Fork River

CONTACT(S): Liter Spence - Montana Department of Fish, Wildlife and Parks - 444-3888

Gerhard Knudsen - Montana Department of Natural Resources and Conservation - 444-6601

Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Quantify the year-round instream flow requirements for game fish in the upper Clark Fork River and prepare an application to the Board of Natural Resources to reserve these flows.

DURATION: January 1984 - November, 1986

CURRENT STATUS: An application for reservation of water in the upper Clark Fork River Basin has been submitted by the Department of Fish, Wildlife and Parks to the Board of Natural Resources and Conservation. The application describes the purpose and need of the reservation and the amount of water necessary. The application requests water to be applied instream for fish, wildlife, recreation and the maintenance of water quality. Recreation, fish, wildlife and wetted perimeter information has been collected on the upper Clark Fork and its tributaries. Minimum flows have been calculated for several stream reaches utilizing wetted perimeter/stream discharge curves.

Fish population monitoring has been conducted on all major tributary streams in the upper Clark Fork Basin. An assessment of water quality needs for trout populations in the mainstem has been prepared.

During the extremely low flows of the summer of 1985, photo stations were established for several stream segments. Channel appearance was photographed at various stream flows.

FUTURE ACTIVITIES: The completion of this application has triggered the Environmental Impact Statement (EIS) process, with the Montana Department of Natural Resources as the designated lead agency. See Study No. 18.1.

PUBLICATIONS AND REPORTS

Application for Reservations of Water in the Upper Clark Fork

River Basin. (November, 1986). Submitted by: Montana Department of Fish, Wildlife and Parks, Helena, Montana.

Subcontract reports available from Department of Fish, Wildlife and Parks in Helena, include:

"Irrigated Land Assessment of the Upper Clark Fork Drainage" (October, 1984),

"Refinement of Recreational Value Estimates on the Upper Clark Fork River" (June, 1984).

STUDY NUMBER: 2.2 (COMPLETED)

ORGANIZATION: Montana Department of Fish Wildlife and Parks (MDFWP)

TITLE OF STUDY: Evaluation of the Effects of Pulp and Paper Mill Effluents on the Fish Populations of the Middle Clark Fork River

CONTACT(S): Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Rod Berg - Project Biologist - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Obtain fishery and other baseline data on the Clark Fork River to determine if treated pulp mill waste from Stone Container Corporation's (Champion International) Frenchtown Mill has a detrimental effect on the river's trout populations.

DURATION: July, 1984 - July, 1986

CURRENT STATUS: Trout population estimates have been conducted at four sections in the middle Clark Fork River. The suitability of the intergravel environment for trout egg survival has been evaluated by water sampling (using standpipes) and on-site bioassays. The bioassays, using brown trout eggs, were conducted during the winter and early spring of 1984-85. Three sites were evaluated: near the Council Grove area, below Stone Container Corporation (Champion International) and near Cyr.

In the autumn of 1985, fish population estimates were conducted at Harper's Bridge, Superior and two sites near Huson. A saturation plant of 10,000 young-of-the-year brown trout was made in the Huson section on June 23, 1986, to evaluate the possibility that recruitment is a limiting factor for trout populations in the Clark Fork River.

FUTURE ACTIVITIES: Further evaluations of intergravel environment suitability will be conducted, along with measurement of physical parameters such as stream gradient, average channel width and development. The latter measurements will help identify differences between reaches which might, in part, explain anomalies in the fisheries (i.e., the almost complete absence of brown trout below Missoula).

PUBLICATIONS AND REPORTS

Two progress reports, available from the Department of Fish, Wildlife and Parks in Missoula, have been prepared:

"A Field Bioassay of Potential Effects of Champion

Pulp Mill Effluents on Brown Trout Egg and Sac Fry Survival in the Clark Fork River" (April 15, 1985)

"Middle Clark Fork River Fishery Monitoring Study: Evaluation of the Effects of Pulp and Paper Mill Effluents on the Fish Population" (October 15, 1985) and September 30, 1986.

STUDY NUMBER: 2.3 (COMPLETED)

ORGANIZATION: Montana Department of Fish Wildlife and Parks (MDFWP)

TITLE OF STUDY: Evaluation of Management of Water Releases for Fisheries from Painted Rocks Reservoir, Bitterroot River, Montana (BPA Project 83-463)

CONTACT(S): Pat Graham - Montana Department of Fish, Wildlife and Parks, Helena - 444-5686

Dennis Workman, Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Evaluate the effects of dewatering on trout populations. Develop a water management plan to optimize the use of limited water through timed discharges from Painted Rocks Reservoir.

DURATION: 1983 - 1987

CURRENT STATUS: Spring and autumn fish population estimates have been conducted on three sections of the river. The physical characteristics of several study sections have been measured. Water temperatures have been continuously recorded at four stations. Stream discharges have been measured on the river and at major irrigation diversions. Test releases of water from Painted Rocks Reservoir have been completed.

PUBLICATIONS AND REPORTS

Reports available from the Department of Fish, Wildlife and Parks in Missoula include:

"Draft Water Management Plan for the Proposed Purchase of Supplemental Water from Painted Rocks Reservoir, Bitterroot River, Montana" (June, 1984)

"Evaluation of Management of Water Releases for Fisheries from Painted Rocks Reservoir" Annual Report (November, 1984); Quarterly Report (April, 1985); Quarterly Report (July, 1985)

STUDY NUMBER: 2.4 (COMPLETED)

ORGANIZATION: Montana Department of Fish Wildlife and Parks (MDFWP)

TITLE OF STUDY: Evaluation of Copper Concentrations in Crayfish (*Pacifastacus trowbridgi*) from Various Segments of the Clark Fork River Drainage, Montana

CONTACT(S): Glenn Phillips - Montana Department of Fish, Wildlife and Parks, Helena - 444-2406

OBJECTIVE: To evaluate whether oxygen demanding waste material discharged by the pulp mill at Frenchtown was influencing the rate of copper accumulation by crayfish in the river.

DURATION: August 1984 - March 1985

CURRENT STATUS: The study has been completed and a final report is available.

FUTURE ACTIVITIES: No further activities are planned on this project.

PUBLICATIONS AND REPORTS

Phillips, G.R. 1985. Evaluation of Copper Concentrations in Crayfish (*Pacifastacus trowbridgi*) from Various Segments of the Clark Fork River Drainage, Montana. Pollution Control Information Series, Technical Report No. 3. Montana Department of Fish, Wildlife and Parks, Helena.

STUDY NUMBER: 2.5

ORGANIZATION: Montana Department of Fish Wildlife and Parks (MDFWP)

TITLE OF STUDY: Middle Clark Fork River Instream Flow and Fishery Study

CONTACT(S): Pat Graham - Montana Department of Fish, Wildlife and Parks, Helena - 444-5686

Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Rod Berg - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Don Peters - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Quantify the status of the trout fishery in the middle portion of the Clark Fork River (from the confluence of the Blackfoot River to the Flathead River) relative to present and projected water quality, habitat and instream flow conditions.

DURATION: 1983 - 1987

CURRENT STATUS: Trout population estimates have been conducted at sections below Milltown, above the Bitterroot River and near Superior. Brown trout spawning site surveys have been conducted in the autumn. Trout movement data has been generated using jaw tagging at the Superior section.

FUTURE ACTIVITIES: Fish population estimates will continue to be collected at all sections. Wetted perimeter transects will be established at several locations along the river to allow determination of instream flow requirements for game fish. Additional spawning and trout movement surveys will be conducted.

PUBLICATIONS AND REPORTS

Western Montana Fishery Investigation Project No. F-12-R-31 Job: Ib (July, 1985)

STUDY NUMBER: 2.6

ORGANIZATION: Montana Department of Fish Wildlife and Parks (MDFWP)

TITLE OF STUDY: Middle Clark Fork River Tributaries Study

CONTACT(S): Pat Graham - Montana Department of Fish, Wildlife and Parks, Helena - 444-5686

Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Rod Berg - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Determine the relative importance of tributaries as existing or potential sources of recruitment for trout populations of the middle Clark Fork River (between the Blackfoot and Flathead Rivers).

DURATION: July 1984 - July 1986

CURRENT STATUS: Fishery surveys are being conducted on all perennial tributaries (approximately 25 streams) to determine their potential importance for providing recruitment of rainbow, brown, cutthroat and bull trout to the mainstem of the Clark Fork River. Photographic stations have been established on several streams to record habitat changes with different flow volumes.

FUTURE ACTIVITIES: Instream flow requirements for migrant and resident fish will be determined. Factors which may be negatively affecting the fishery (barriers which may hinder or block migrant fish passage, water quality problems, etc.) will be assessed. A management plan will be formulated to maintain and improve the fishery values of tributary streams. A progress report on these activities will be prepared in July of 1986. However, to adequately meet the goals of this study, additional funding will be needed to continue work for a least two additional years beyond July, 1986.

STUDY NUMBER: 2.7

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Western Montana Fishery Investigation, Inventories and Surveys of the Upper Clark Fork River (above Drummond)

CONTACT(S): Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Wayne Hadley - Montana Department of Fish, Wildlife and Parks, Deer Lodge - 846-3270

OBJECTIVE: Evaluate the condition, distribution and abundance of trout in the upper Clark Fork drainage.

DURATION: 1969 - Indefinite

CURRENT STATUS: Trout population estimates have been conducted on the upper Clark Fork River at the following locations:

pH Shack (near Warm Springs)	1969 - present
Sager Lane (near Dempsey)	1981 - 1982
Williams-Tavener (below Deer Lodge)	1969 - present
Phosphate (below the Little Blackfoot River	1978 - present

Brown trout movement (numbered T-tag) and recruitment studies have also been conducted near these stations.

Trout populations have been estimated for several years on the following tributaries: Warm Springs Creek, Gold Creek, Flint Creek and the Little Blackfoot River. Fishery surveys have also been routinely conducted on Racetrack Creek, Lost Creek and Dempsey Creek to help determine their importance as sources of recruitment to the upper river. Trout populations in several other tributaries of the study area have also been recently monitored as part of the instream flow reservation studies.

FUTURE ACTIVITIES: During the 1987 field season, electrofishing surveys will be conducted from Warm Springs Ponds to the Milltown Reservoir. This extensive survey will provide an excellent description of the composition and distribution of fish populations and their relationship to habitat conditions.

PUBLICATIONS AND REPORTS

Annual progress reports, outlining the results of these studies, are available from Montana Department of Fish, Wildlife and Park's Missoula office.

STUDY NUMBER: 2.8

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Western Montana Fishery Investigation: Inventories and Surveys of the Upper Clark Fork River (Drummond to Milltown, Rock Creek and the Blackfoot River)

CONTACT(S): Dennis Workman - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

Don Peters - Montana Department of Fish, Wildlife and Parks, Missoula - 721-5808

OBJECTIVE: Evaluate the condition, distribution and abundance of game fish in waters of the study area.

DURATION: 1967 - Indefinite

CURRENT STATUS: Trout population estimates have been conducted at the following locations:

Clark Fork River

Bearmouth (below Drummond)	1979 & 1985
Bonita (above Rock Creek)	1979 - 1980
Turah (above Milltown)	1979 - Present
Milltown (below the dam)	1979 - Present

Blackfoot River

Johnsrud Park (near mouth)	1979 - Present
Lincoln	1972

Water temperatures have been periodically monitored (with recording thermographs) within the study section since 1976.

Three fish population study sections on Rock Creek have been periodically sampled since the early 1970's. Creel census data is available for Rock Creek since the mid-1950's. Fish movement (jaw tagging) and growth rate studies have also been conducted.

FUTURE ACTIVITIES: The Bearmouth, Turah, MIlltown and Johnsrud Park study sections will be monitored yearly. The Rock Creek sections will be periodically monitored. The monitoring stations at Lincoln and a new station on the Blackfoot River near Ovando may be added. The Bonita Station will probably be dropped. See also: Study 2.7, Future Activities.

PUBLICATIONS AND REPORTS

Annual progress reports, outlining the results of these studies, are available from Montana Department of Fish, Wildlife and Parks' Missoula office.

Job Progress Report. Western Montana Fisheries Investigation Inventory and Survey of the upper Clark Fork and Blackfoot Rivers. Project 7-12-R-32. July 1, 1985-June 30, 1986.

STUDY NUMBER: 2.9

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Fisheries Studies on Noxon Rapids and Cabinet Gorge Reservoirs

CONTACT(S): Jim Vashro - Montana Department of Fish, Wildlife and Parks, Kalispell - 755-5505

Joe Huston - Montana Department of Fish, Wildlife and Parks, Kalispell - 755-5505

OBJECTIVE: Evaluate the suitability of the reservoirs to support various species of game fish; document their distribution, abundance and reproductive success; develop and implement management programs to establish and enhance game fish populations.

DURATION: 1952 - Indefinite

CURRENT STATUS: Since the elimination of the free-flowing lower Clark Fork by dams in the 1950's, the Montana Department of Fish, Wildlife and Parks has continuously attempted to establish a sport fishery in the reservoirs. Several different fish species have been planted. The success (or mainly lack of success) of these plantings has been monitored within the reservoirs by gill net and creel census surveys. Several tributaries have been studied to estimate their value as sources of recruitment to the reservoirs.

Washington Water Power (WWP), which owns and operates Noxon and Cabinet Gorge dams, implemented a new reservoir operation plan in July, 1986. Past management called for drafting Noxon Rapids Reservoir up to 36 feet in the spring for flood control. The new management plan will call for limits on daily, seasonal and annual drawdowns that should benefit the reservoir fisheries.

FUTURE ACTIVITIES: Diversified fish plantings and monitoring will continue. Burbot (ling), brown trout, smallmouth bass and possibly Kamloops rainbow trout and bull trout will be planted. MDFWP is in the third year of a three-year program funded by Washington Water Power to establish fishable populations of brown trout and burbot (ling) in Noxon and Cabinet Gorge reservoirs.

MDFWP will be providing supervision for a two-year baseline fisheries study by WWP to evaluate the effects of a new reservoir management plan to minimize water level fluctuations in Noxon and Cabinet Gorge reservoirs.

PUBLICATIONS AND REPORTS

Huston, Joe E. 1985. Thirty-two Years of Fish Management-Noxon Rapids and Cabinet Gorge Reservoirs. Montana Department of Fish, Wildlife and Parks, Helena Montana. pp.30 (March, 1985).

Rumsey, S.S. and J.E. Huston. 1985. Past, Present and Future Fishery Management in Cabinet Gorge and Noxon Rapids Reservoirs. pp. 113-126 In C. E. Carlson and L. L. Bahls, (eds.). Proceedings of the Clark Fork River Symposium, April 19, 1985. Montana Academy of Sciences, Montana College of Mineral Science and Technology, Butte, Montana 59701.

Progress reports available from Montana Department of Fish, Wildlife and Parks' Kalispell office.

STUDY NUMBER: 2.10

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP) under contract by ASARCO, Incorporated

TITLE OF STUDY: Rock Creek (Sanders County) Baseline Fisheries Assessment

CONTACT(S): Jim Vashro - Montana Department of Fish, Wildlife and Parks, Kalispell - 755-5505

Terry Erskine - ASARCO, Troy - 295-5882

OBJECTIVE: Establish baseline information on the fisheries in Rock Creek, tributaries to Cabinet Gorge Reservoir, prior to development of a hardrock mine proposed by ASARCO, Inc. Parameters studied include fish species composition, abundance, distribution, movement, food habits, age and growth, tissue metal content analysis, and spawning.

DURATION: April, 1985 - February, 1987

CURRENT STATUS: Field studies have been completed and a final report should be published by March, 1987. The two annual reports will be used in preparation of an Environmental Impact Statement if ASARCO files for an operational permit on the proposed silver mine.

FUTURE ACTIVITIES: All project objectives have been satisfied. Future activity will depend on submission of an operating plan by ASARCO.

PUBLICATIONS AND REPORTS

ASARCO Rock Creek Project, Baseline Fisheries Assessment. Proposal. Jim Vashro, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana. December, 1984.

ASARCO Rock Creek Project, Baseline Fisheries Assessment. David Barnard and Jim Vashro, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana.
1986.

ASARCO Rock Creek Project, Baseline Fisheries Assessment, Terry Hightower and Jim Vashro, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana. 1987.

STUDY NUMBER: 2.11

ORGANIZATION: Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Evaluation of Toxicity of Clark Fork River Water to Fingerling Rainbow Trout at Various Locations in the Drainage

CONTACT(S): Glenn Phillips - Montana Department of Fish, Wildlife and Parks, Helena - 444-2406

OBJECTIVE: To evaluate the toxicity of Clark Fork River water during runoff season at various locations in the drainage.

DURATION: April, 1986 - completion of study

CURRENT STATUS: Fingerling rainbow trout were maintained for two months (beginning in late April) in floating holding containers at seven locations in the Clark Fork River drainage. Survival was monitored along with several chemical parameters including total recoverable cooper, total recoverable zinc, alkalinity hardness, and pH. Flow measurements were also recorded and loading of metals was estimated.

FUTURE ACTIVITIES: Spring runoff during 1986 was somewhat anomalous in that the river had experienced winter flooding in late February. Winter flooding probably reduced metals loading in the river during spring. Because of these unusual conditions, the bioassays will be repeated during 1987.

PUBLICATIONS AND REPORTS

Preliminary data are available from the Montana Department of Fish, Wildlife and Parks.

STUDY NUMBER: 3.1

ORGANIZATION: Montana Department of State Lands (MDSL)

TITLE OF STUDY: Aquatic Resource Studies Associated with ASARCO's Rock Creek Project

CONTACT(S): Kit Walther - Montana Department of State Lands, Helena - 444-2074

Jim Vashro - Montana Department of Fish, Wildlife and Parks, Kalispell - 755-5505

OBJECTIVE: Establish baseline water quality, water quantity, fishery and other biological conditions for Rock Creek, Sanders County, Montana.

DURATION: 1984 - 1987

CURRENT STATUS: ASARCO is proposing to develop a silver-copper deposit in the Cabinet Mountains, approximately five miles northeast of Noxon. The site is beneath the Cabinet Mountains Wilderness Area near St. Paul and Chicago Peaks. Mining, and most of the crushing and ore concentrating, would occur underground within a room-and-pillar excavation. Tailings would be slurried to a tailings dam, located one quarter mile from the Clark Fork River.

In April, 1985, WESTTECH, a consulting firm hired by ASARCO, finalized a study plan for the collection of baseline aquatic resource data within the Rock Creek Drainage. Sampling began in the spring of 1985. Ten surface water stations will be sampled seasonally (biweekly during spring) for the analysis of 33 major water quality parameters, including common ions, nutrients and heavy metals. (To achieve maximum detection limits, carbon furnace techniques will be utilized for the heavy metal analysis.)

At least eleven groundwater monitoring wells will be installed; several of these will be monitored quarterly for the same water quality parameters analyzed during the surface water collections. All presently existing wells and springs within the project area will be sampled for their water quality and water yield.

Seven aquatic invertebrate and periphyton stations will be sampled three times per year, during pre-runoff, summer low flow and autumn. Species present and their abundance will be reported. Diversity indices will be calculated.

The Montana Department of Fish, Wildlife and Parks will conduct baseline fishery resource investigations on Rock Creek and on the Clark Fork River above and below the confluence of Rock Creek. Fish population estimates will be conducted at five

stations on Rock Creek. Spawning migrations from the Clark Fork River will be monitored. The tissue from twenty-five game fish, collected from each of three locations on Rock Creek, will be analyzed for their heavy metal content. Gill net sampling and snorkeling observations will be conducted in the Clark Fork River near Rock Creek.

FUTURE ACTIVITIES: The data collected in these baseline studies has been submitted to the Montana Department of State Lands as part of the application for an operating permit. An Environmental Impact Statement will be prepared by the Department of State Lands and the U.S. Forest Service.

STUDY NUMBER: 3.2

ORGANIZATION: Montana Department of State Lands (MDSL) - Hard Rock Mining Bureau

TITLE OF STUDY: Studies Associated with Montoro's German Gulch Project

CONTACT(S): Kit Walther - Montana Department of State Lands - Environmental Impact Statement Team Leader - 444-2711

Jerry Wells - Montana Department of Fish, Wildlife and Parks, Bozeman - 586-5419

OBJECTIVE: Establish baseline water quality and biological conditions and determine instream flow needs for trout on German Gulch.

DURATION: May-September 1984 (plus additional studies, if needed, in the future)

CURRENT STATUS: The Montoro Gold Company of Reno, Nevada, has proposed to develop a surface mine and ore processing plant and tailings disposal facility in the German Gulch drainage (a tributary of Silver Bow Creek near Gregson). In anticipation of an Environmental Impact Statement, this study collected water quality, macroinvertebrate, periphyton and trout population data at three sites on the stream:

Below Edward Creek (Headwaters)
Below Beefstraight Creek
Near the mouth

Wetted perimeter/stream discharge relationships were plotted for each station, with minimum flows determined by inflection points on the curves (as per the wetted perimeter methodology).

The University of Montana genetics laboratory has determined that trout inhabiting German Gulch are a pure strain of westslope cutthroat trout.

FUTURE ACTIVITIES: Montoro has decided to reassess development of this project. Unless or until a decision is made by the company to reactivate their application for an operating permit, no further studies are planned.

PUBLICATIONS AND REPORTS

Aquatic Evaluation and Instream Flow Recommendations for Selected Reaches of German Gulch Creek, Silver Bow County, Montana (December, 1984). Montana Department of Fish, Wildlife and Parks.

STUDY NUMBER: 3.3

ORGANIZATION: Montana Department of State Lands--Hard Rock Mining Bureau (MDSL)

TITLE OF STUDY: Baseline Water Quality Monitoring for Big Blackfoot Project near Lincoln, Montana

CONTACT(S): P. Dennis Smith, Hard Rock Bureau - 444-2074

Larry Brown, Montana Department of Health and Environmental Sciences, Water Quality Bureau-444-2406

Elton Modroo, Sunshine Mining Co. - (208) 345-0660

OBJECTIVE: Chemical characterization and documentation of groundwater and surface water quality prior to constructing a gold mine and heap leach facility.

DURATION: October, 1986 - end of mine life (approximately 5 years)

CURRENT STATUS: The mine is currently in the design and feasibility stage. Water quality baseline information is being gathered in order to accommodate requests for such data from permitting agencies such as the Hard Rock Bureau and Water Quality Bureau. This information is incorporated into the company's application for an operating permit and compared with future monitoring results to assess impacts. Sunshine Mining Company has just initiated the data collection phase of the application process.

FUTURE ACTIVITIES: An operational and post-mining water quality monitoring program will be designed and implemented.

STUDY NUMBER: 4.1 (COMPLETED)

ORGANIZATION: Montana Department of Health and Environmental Sciences (MDHES) - Water Quality Bureau

TITLE OF STUDY: Lower Clark Fork River Monitoring

CONTACT(S): Loren Bahls - Water Quality Project Leader - 444-2406

Steve Pilcher - Water Quality Bureau Chief - 444-2406

Gary Ingman - Water Quality Specialist - 444-2406

OBJECTIVE: Establish a chemical, physical and biological water quality baseline for the Clark Fork River below Rock Creek; utilize this information, in part, during preparation of an Environmental Impact Statement for Stone Container Corporation's (Champion International) Wastewater Discharge Permit.

DURATION: 1984 - 1987

CURRENT STATUS: From March 1984 to August 1985, a total of twenty-five monitoring runs were conducted (an approximate frequency of once every three weeks) at the following sixteen sampling stations:

01 Clark Fork at Turah
02 Blackfoot River at mouth
03 Clark Fork below Milltown Dam
04 Clark Fork above Missoula WWTP
05 Missoula WWTP discharge
06 Clark Fork at Sheffield's
07 Bitterroot River near mouth
08 Clark Fork at Harper Bridge
09 Stone (Champion) discharge(s)
10 Clark Fork at Huson
11 Clark Fork near St. Regis
12 Flathead River near mouth
13 Clark Fork above Thompson Falls Reservoir
14 Clark Fork below Thompson Falls Dam
15 Clark Fork below Noxon Rapids Dam
16 Clark Fork below Cabinet Gorge Dam

Fifteen additional mainstem sites were sampled three to four times per year, including surface and bottom samples from deepwater pools and reservoirs.

Parameters that were routinely analyzed included: Heavy metals (total recoverable): Cu, Zn, Fe, Mn, As, Cd. Algal Nutrients: total phosphorus, orthophophorus, nitrate, kjeldahl

nitrogen. Other: Temperature, total suspended solids, volatile suspended solids. Several additional parameters were collected on a seasonal basis including: Hardness, specific conductance, BOD, COD, dissolved oxygen, color, and aquatic macroinvertebrates (kick-net composites). Seasonal algal bioassays have also been conducted. Thirty-day chronic bioassays of lower Clark Fork River water and Stone Container Corporation (Champion International) effluent using juvenile rainbow trout and Ceriodaphnia were completed (see Study 6.2).

This project will be joined with study number 4.2 during 1987-89.

FUTURE ACTIVITIES: Monthly sampling will continue at the selected stations with the following modifications: The "near St. Regis" station will be replaced by a station at Superior. Two additional stations will be established--at Alberton and above the Flathead River.

The "routinely analyzed" parameters listed above will continue to be monitored, along with the addition of alkalinity and hardness. The "additional" parameters and stations will no longer be monitored, except macroinvertebrates and periphyton once per year, in August, at all eighteen stations.

This monitoring program will continue through June, 1987, with funding provided by the 1985 Legislature. An application for funding the 1987-89 monitoring program has been approved by the 1987 Legislature.

PUBLICATIONS AND REPORTS

Draft Environmental Impact Statement, Champion International Frenchtown Mill, Missoula County, Discharge Permit MT-0000035 December 1985. 155p.

Addendum--Draft Environmental Impact Statement, Champion International Frenchtown Mill, Missoula County, March, 1986. 45 p.

Final Environmental Impact Statement, Champion International Frenchtown Mill (Stone Container Corporation) Missoula County. August, 1986. 23 p.

STUDY NUMBER: 4.2

ORGANIZATION: Montana Department of Health and Environmental Sciences (MDHES) - Water Quality Bureau

TITLE OF STUDY: Upper Clark Fork River Monitoring

CONTACT(S): Steve Pilcher - Water Quality Bureau Chief - 444-2406

Loren Bahls - Project Leader - 444-2406

Erich Weber - Water Quality Specialist - 444-2406

OBJECTIVE: Assess the effectiveness of the Warm Springs Ponds treatment system and evaluate water quality conditions through reaches of the Clark Fork River above confluence of Rock Creek.

DURATION: 1976 - Indefinite

CURRENT STATUS: The Clark Fork River station at Deer Lodge (STORET 1=2MTHDWQ 35260917) is the principal Montana Department of Health and Environmental Sciences ambient water quality station on the river and the only comprehensive long-term water quality station in Montana operated exclusively by the State. Parameters at this station include: discharge, TSS and turbidity, lab pH, alkalinity, hardness, field pH, temperature, specific conductance, common ions, algal nutrients, and selected metals (As, Cd, Cu, Fe, Mn, Pb, and Zn--"total recoverable"). Samples have been collected sporadically since March, 1976 and monthly since January, 1978.

The following five stations have been sampled monthly since December, 1982: Clark Fork River above the Little Blackfoot River; Clark Fork River below Warm Springs Creek; Anaconda Company Warm Springs Pond 2 discharge; Warm Springs Creek at mouth; Mill-Willow Creek Bypass at mouth. Parameters include turbidity, temperature, and pH, specific conductance, sulfate, Cd, Cu and Zn (total recoverable).

Silver Bow Creek at the Frontage Road above the Warm Springs Ponds has been sampled monthly since January, 1984, for the same parameters as the five stations in the paragraph above.

Monthly monitoring will continue at all of the above stations. Starting in August, 1985, five additional stations were sampled for a total of twelve stations:

01 Silver Bow Creek below Colorado Tailings
02 Silver Bow Creek at Ramsey
03 Silver Bow Creek at Frontage Road
04 Warm Springs Pond 2 Discharge

05 Mill-Willow Bypass near mouth
06 Warm Springs Creek near mouth
07 Clark Fork below Warm Springs Creek
08 Clark Fork near Dempsey
09 Clark Fork at Deer Lodge
10 Clark Fork above Little Blackfoot
11 Clark Fork at Gold Creek
12 Clark Fork at Bonita (just above Rock Creek)

Parameters to be analyzed at each station were expanded to include: Heavy metals (total recoverable): Cu, Zn, Fe, Mn, As, Cd. Algal nutrients: Total phosphorus, orthophosphorus, nitrate, kjeldahl nitrogen. Other: Total suspended solids, volatile suspended solids, hardness, alkalinity, pH, and stream discharge. Macroinvertebrate and qualitative periphyton composite samples were collected annually at each station.

FUTURE ACTIVITIES: The above stations and parameters will be monitored through June, 1987. During 1987-1989, this project will be combined with Project 4.1 to establish a water quality monitoring program over the entire length of the Clark Fork River.

PUBLICATIONS AND REPORTS

Progress reports and data summaries are available at the Department of Health and Environmental Sciences, Water Quality Bureau.

STUDY NUMBER: 4.3

ORGANIZATION: Montana Department of Health and Environmental Sciences (MDHES) - Solid Waste Management Bureau

TITLE OF STUDY: Butte-Silver Bow Creek Remedial Investigation (Superfund)

CONTACT(S): Mike Rubich - (Superfund) Project Manager - 444-2821

Duane Robertson - Bureau Chief - Solid and Hazardous Waste Management Bureau - 444-2821

Eric Finke - Environmental Protection Agency Montana Office - 449-5414

OBJECTIVE: Accurately identify surface water, groundwater, tailings and point source problem areas; evaluate potential remedial actions and, eventually select a preferred alternative to rectify contamination in the Silver Bow Creek/upper Clark Fork system.

DURATION: 1984 - Indefinite

CURRENT STATUS: With the designation of Silver Bow Creek as a Superfund site in 1982, the Anaconda Minerals Company and their consultants began collecting preliminary information on the extent and severity of contamination in the area. This information, in part, was used to develop a work plan for the Silver Bow Creek Remedial Investigation (RI), which began in September, 1984. Water quality, soils and biological data were intensely collected until December, 1985.

Subsequent to the completion of the Phase I RI, feasibility study efforts were begun. Detailed planning has been completed and feasibility studies for the various problems encountered at the site may be initiated as soon as funding becomes available.

Concurrent with the initiation of feasibility studies, additional RI efforts have been initiated to answer questions arising from the first phase, correct data deficiencies and provide specific information necessary to complete feasibility studies.

Extensive delay in CERCLA reauthorization has had a significant affect on site progress. Lack of funding has delayed this project by one year.

FUTURE ACTIVITIES: Site expansions both into the headwaters and downstream and an ongoing attempt to integrate CERCLA activities at all Clark Fork Superfund sites into a technically supportable and manageable sequence make it difficult to predict future action dates with any accuracy at this point. However,

the near term will involve completion of high priority feasibility studies on the "original" portion of the Silver Bow Creek site, screening evaluations followed by Remedial Investigation/Feasibility Study planning and implementation for new study areas of the site (Butte Addition, Clark Fork River, Warm Springs Ponds to Milltown) requiring detailed investigation. Screening activities will define immediate public health or environmental priorities which can be addressed via a fast track removal action. Additionally, an "operable unit" management approach is being utilized on the site which is intended to allow corrective action to proceed at site subunits without requiring all site investigations to be completed.

PUBLICATIONS AND REPORTS

Portions of the Phase I RI have been released for public review. These task specific appendices are listed below. Remaining documents are expected to be released in early 1987.

Silver Bow Creek Documents released for public review:

Appendix A Part 1 -- Surface Water and Point Source Investigation. Report
Appendix B -- Ground Water and Tailings Investigation
Part 1 -- Report
Part 2 -- Attachments I-IV Historic Data, Well Information and Sample Procedures
Part 3 -- Attachment V, Physical Data
Part 4 -- Attachment VI, Chemical Data
Appendix C -- Warm Springs Ponds Investigation
Part 1 -- Report
Appendix D Part 1 -- Algae Investigation
Appendix D Part 2 -- Vegetation Mapping
Appendix D Part 3 -- Agricultural Investigation
Appendix E Part 1 -- Macroinvertebrate Investigation
Appendix E Part 2 -- Bioassay Investigation
Appendix E Part 3 -- Fish Tissue Investigation
Appendix E Part 4 -- Waterfowl Investigation
Appendix F -- Laboratory Quality Assurance/Quality Control Program

STUDY NUMBER: 4.4

ORGANIZATION: Montana Department of Health and Environmental Sciences (MDHES) - Solid and Hazardous Waste Bureau

TITLE OF STUDY: Milltown Superfund Site Studies

CONTACT(S): Charles Coleman - Solid and Hazardous Waste Bureau - Montana Department of Health and Environmental Sciences - 444-2821

Jim Knoy - Environmental Protection Agency Montana Office - 449-5414

Duane Robertson - Solid and Hazardous Waste Bureau Chief - 444-2821

OBJECTIVE: Evaluate alternatives (and select a preferred alternative) to rectify impacts to human health, the aquatic environment and groundwater which have resulted from contamination of reservoir sediments by arsenic and heavy metals.

DURATION: 1983 - 1987

CURRENT STATUS: In May, 1981, four community wells in Milltown were tested by health officials and found to be contaminated by arsenic. Subsequent studies by the University of Montana suggested that the contamination source was heavy metal deposits within the reservoir's sediments. The reservoir was designated as a Superfund site and a Remedial Investigation (RI) was begun in July, 1983 to confirm the source and extent of groundwater contamination. The RI was completed in July, 1984: "Arsenic Source and Water Supply Remedial Action Study, Milltown Reservoir."

Concurrent with the RI, a focused Feasibility Study (FS) was conducted to determine the most efficient way to provide safe water for Milltown residents. Construction of a new central water system for Milltown was begun in the fall of 1984 and completed in June, 1985.

With the immediate, pressing problem of the Milltown water supply corrected, a more extensive Feasibility Study was initiated to address ways to:

- minimize down gradient/down stream release of contaminants originating at Milltown Reservoir, and
- minimize ingestion of contaminants originating at the Milltown site.

The FS, which is being conducted by Harding, Lawson Associates, is currently in progress. Additional groundwater monitoring

and limited groundwater modeling is being conducted below the reservoir. Thus far, the FS has narrowed the list of clean up options to six potential alternatives, ranging from no action to complete dam retirement (with stabilization of sediments and reestablishment of a freeflowing river). Other alternatives include excavation, "institutional controls," chemical stabilization of sediments and channel isolation (with the reservoir left in place). However, with the recent reauthorization of Superfund and subsequent requirements in the law, portions of the FS will need to be readdressed including a reevaluation of the potential alternatives.

FUTURE ACTIVITIES: The Data Report which addresses the recent monitoring and modeling will be completed by early 1987. The FS, including selection of a preferred alternative, will be completed in the summer of 1987 barring any major deficiencies in the data as a result of new requirements from the reauthorization of Superfund. After a 30 day review period, public hearings will be conducted to allow comment on the preferred alternative. Following selection of the preferred alternative, design and implementation of clean-up could begin sometime in 1987. The Superfund activities have a significant bearing on the Montana Power Company's application to the Federal Energy Regulatory Commission for relicensing the dam. (See Study 14.1.)

PUBLICATIONS AND REPORTS

Arsenic Source and Water Supply Remedial Action Study, Milltown, Montana. July, 1984.

STUDY NUMBER: 4.5

ORGANIZATION: Montana Department of Health and Environmental Sciences (MDHES) and Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Studies Associated with the Collection of Background Data for the Natural Resources Claims Lawsuit

CONTACT(S): Frank Crowley - Attorney - Montana Department of Health and Environmental Sciences - 444-2630

Jim Posewitz - Montana Department of Fish, Wildlife and Parks - 444-2603

OBJECTIVE: Assemble data to quantify damages caused by the Anaconda Minerals Company to the upper Clark Fork River Basin in preparation for a $50 million Natural Resource Claims lawsuit (as per Section 107 of CERCLA).

DURATION: November 1984 - settlement of lawsuit

CURRENT STATUS: In December, 1983, the Montana Department of Health and Environmental Sciences and the Montana Department of Fish, Wildlife and Parks filed suit against the Anaconda Minerals Co./Atlantic Richfield Company for damages to natural resources caused by past mining activities. In August, 1984, the parties agreed to a stay of proceedings pending the completion of the Silver Bow Remedial Investigation/Feasibility Study and the promulgation of rules by the Department of Interior.

The 1987 Legislature approved a request for $200,000 to fund the legal and technical staff needed to complete the assessment. Staff from the Department of Fish, Wildlife and Parks and the Department of Health and Environmental Sciences will be assigned to this effort.

Further data collection is occurring as part of several ongoing water resource investigations in the upper Clark Fork Basin. The U. S. Department of Interior has promulgated rules for Natural Resource Damage Assessments, 43 CFR Part II Final Rule. The procedures in the rule will assist authorized officials to perform natural resource damage assessments for use in court action or administrative proceedings when seeking compensation for injuries to natural resources.

FUTURE ACTIVITIES: The staff assigned to this unit will develop the law suit and the technical data needed to assess the natural resource damages. These assessments are not identical to response or remedial actions addressed by CERCLA (Superfund) and the Clean Water Act. The assessments are intended to supplement response actions taken under CERCLA to compensate the public for injury

to natural resources.

PUBLICATIONS AND REPORTS

"A Preliminary Assessment of Impacts to the Trout Fishery Upper Clark Fork River, Montana" Montana Department of Fish, Wildlife and Parks. (July, 1984)

STUDY NUMBER: 5.1

ORGANIZATION: United States Forest Service (USFS)

TITLE OF STUDY: Stream Sediment Monitoring on National Forest Lands

CONTACT(S): Mike Goggin, Region I US Forest Service, Missoula - 329-3039

Mike Johnson, Region I US Forest Service, Missoula - 329-3516

Don Bartschi, Region I US Forest Service, Missoula - 329-3511

Greg Munther, Lolo, Deer Lodge and Bitterroot National Forests, Missoula - 329-3793

OBJECTIVE: Monitor sediment deposition impacts to fish and other aquatic life resulting from National Forest construction and development activities.

DURATION: 1975 - Indefinite

CURRENT STATUS: All or a portion of seven national forests are within the Clark Fork River Basin. US Forest Service fishery biologists and hydrologists routinely collect bottom sediment and some suspended sediment samples from streams where forest-permitted activities like logging and road construction have occurred or are planned to occur. Various sediment deposition measurements are utilized, including core sampling, embeddedness, surface visual analysis and washed sediment buckets. The latter method involves placing washed gravel and cobbles in a sampling device of known surface area and volume; this method is particularly useful in evaluating upstream versus downstream impacts resulting from instream activity. Benthic macroinvertebrates are usually collected at the sediment sampling sites.

The largest amount of information, particularly regarding biological populations, has been gathered on streams in the Lolo, Deerlodge and Bitterroot National Forests.

FUTURE ACTIVITIES: According to the draft Forest Plans prepared by all seven national forests in the basin, the frequency of sediment and biological monitoring activities will increase over the next decade.

PUBLICATIONS AND REPORTS

1985 Fisheries Habitat and Aquatic Environment Monitoring Report, Bitterroot National Forest, Bitterroot National Forest in cooper-

ation with Montana Department of Fish, Wildlife and Parks, August, 1986. Prepared by Greg Munther and Gary Frank, US Forest Service.

Water Quality Monitoring Program, Lolo National Forest 1979-1985. Prepared by Margaret Hillhouse, Lolo National Forest. May 1986.

Progress Report--Rock Creek Watershed Monitoring, Deerlodge National Forest. Prepared by Tim Sullivan and Jim Seymour, January 21, 1986.

1985 Fisheries Habitat and Aquatic Environment Monitoring Report, Lolo National Forest, to implement monitoring item 2-2 of the Lolo Forest Plan. Prepared by Greg Munther and Gary Frank, US Forest Service. May, 1986.

1985 Fisheries Habitat and Aquatic Environment Monitoring Report, Rock Creek drainage of the Deer Lodge National Forest. Deer Lodge National Forest in cooperation with Montana Department of Fish, Wildlife and Parks. Prepared by Greg Munther and Gary Frank. June, 1986.

First Year Results of the Evaluation of the Effect of Forest Land Management on Tributaries in Rock Creek and the Bitterroot River Drainages. Prepared by Don Peters, Montana Department of Fish, Wildlife and Parks. (Not dated).

STUDY NUMBER: 6.1

ORGANIZATION: Environmental Protection Agency (EPA)

TITLE OF STUDY: Anaconda Smelter Superfund Studies

CONTACT(S): Mike Bishop - Project Manager - 449-5414

Eric Finke, Environmental Protection Agency, Helena - 449-5414

OBJECTIVE: Identify the nature and extent of heavy metal contamination in the Anaconda area, evaluate risks to public health and the environment and present alternatives to correct the problem.

DURATION: 1983 - Indefinite

CURRENT STATUS: The Anaconda Smelter and surrounding area, including the Opportunity Treatment Ponds, was designated as a Superfund site in December, 1982. Throughout 1983, the Anaconda Minerals Company (AMC) and their consultants conducted studies of contaminants at the site. In October, 1984, AMC agreed to carry out a complete Remedial Investigation/Feasibility Study (RI/FS) of the area with EPA. Sources, pathways and the extent of heavy metal contamination will be identified and alternative(s) for cleanup prescribed.

Due to the complexity of the site, the final work plan for the Anaconda Smelter RI/FS includes several "focused" remedial investigations within the overall plan, including studies of the beryllium disposal areas on Weather Hill and at the B2 portion of the Opportunity Ponds, the granulated slag pile, the flue dust disposal and/or storage areas, the Arbiter Plant, and the "Smelter Hill" investigation.

As part of the total Remedial Investigation, the Center for Disease Control conducted a urinary arsenic study in the Anaconda area. This study determined that children residing in the small community of Mill Creek had elevated urinary arsenic levels.

The Anaconda Minerals Company issued the Mill Creek Remedial Investigation/Feasibility Study in December, 1986. Twelve alternatives for solving the Mill Creek contamination problems were considered in the investigation. The EPA prepared an addendum to the RI/FS. Public comments were received until January, 1987.

PUBLICATIONS AND REPORTS

Mill Creek Remedial Investigation Report. Prepared by the Ana-

conda Minerals Company, December, 1986.

Assessment of Health Effects Associated with Airborne Transport of Hazardous Substances from the Anaconda Smelter Site. Final Report. Document No.: 228-TS1-RT-BTD2-2. Prepared by Camp, Dresser and McKee. Denver, Colorado. November, 1985.

Geochemistry Report, Anaconda Smelter RI/FS. Prepared by Tetra Tech, Inc. July, 1986.

Beryllium Disposal Areas Weather Hill Bunker. Final State I Remedial Investigation Report. Prepared by Tetra Tech, Inc. July, 1985.

Endangerment Assessment: Mill Creek, Montana, Anaconda Smelter Site. Revised Final Report. Prepared by Clement Associates, Inc. Arlington, Virginia. April 23, 1986.

STUDY NUMBER: 6.2 (COMPLETE)

ORGANIZATION: Environmental Protection Agency (EPA)

TITLE OF STUDY: Chronic Bioassays of Champion International (Stone Container) Effluent

CONTACT(S): Dick Montgomery - Environmental Protection Agency - 449-5486

Loren Bahls, Montana Department of Health and Environmental Sciences, Water Quality Bureau - 444-2406

OBJECTIVE: Determine the toxicity of the pulp mill effluent to juvenile rainbow trout and Ceriodaphnia.

DURATION: 1985

CURRENT STATUS: From May 13 to June 12, 1985, thirty-day flow-through bioassays were conducted using recently emerged (button-up stage) rainbow trout. Dilutions of Stone Container Corporation (Champion International) waste water that were tested ranged from 2.0% (1:50 dilution) to 0.2% (1:500 dilution), plus controls (0.0% effluent). Two separate dilution sources (river water and local well water) were used for the trout toxicity tests.

A seven-day Ceriodaphnia test was conducted using the same dilutions of Stone Container Corporation (Champion International) wastewater as with the trout bioassay, plus the addition of a 4.0% (1:25) dilution. Only river water was used in these bioassays.

An additional seven-day Ceriodaphnia test was conducted using the Clark Fork River water from nine locations--three above and six below Stone Container Corporation's (Champion International) discharge.

PUBLICATIONS AND REPORTS

Findings of Chronic Bioassays at Champion International paper Mill, Frenchtown, Montana. May 13 - June 12, 1985. Prepared by D. W. Nimmo, J. Lazorchak, D. Link, S. Potts and M. Kerr. US Environmental Protection Agency, Region VIII, Denver, Colorado, U.S. Environmental Protection Agency Montana Operations Office, Helena and Montana Department of Health and Environmental Sciences, Helena, Montana.

STUDY NUMBER: 6.3 (COMPLETE)

ORGANIZATION: Environmental Protection Agency (EPA)

TITLE OF STUDY: Chronic Bioassays of Upper Clark Fork River Water

CONTACT(S): Dick Montgomery - Environmental Protection Agency - 449-5486

Loren Bahls - Montana Department of Health and Environmental Sciences, Water Quality Bureau - 444-2406

OBJECTIVE: Evaluate the toxicity of upper Clark Fork River water to three life stages of rainbow trout.

DURATION: 1985

CURRENT STATUS: Flow-through bioassays were conducted with rainbow trout green eggs, eyed eggs and fingerlings. Test water was collected from the Clark Fork River near Deer Lodge. Dilution water was obtained from Taylor Creek, a nearby perennial stream. A two-bank dilution system was utilized. Tests were conducted from May 7 through June 6, 1985. All tests were conducted at 10 $\pm$ 2 C. The egg tests were conducted for the full thirty days. Fingerling tests were conducted for 13 days.

The tests were timed to coincide with spring runoff, when high concentrations of heavy metals are normally present in the upper Clark Fork River. Normal spring runoff did not occur during 1985 and significant mortalities did not occur in any of the tests.

Rain events during the last half of the study produced sharp, brief increases in metal concentrations. These increased concentrations exceeded calculated chronic and acute levels of copper that would protect aquatic life. However, the fluctuations in copper and zinc were neither high enough nor long enough in duration to produce significant mortalities during the test period.

PUBLICATIONS AND REPORTS

A Thirty-day Flow Through Bioassay Test on Copper and Zinc Toxicity in the Clark Fork River near Deer Lodge, Montana. May 7- June 6, 1985. Prepared by L. Parrish and Glenn Rodriquez, US EPA, Region VIII, Denver, Colorado.

STUDY NUMBER: 6.4 (COMPLETED)

ORGANIZATION: Environmental Protection Agency (EPA)

TITLE OF STUDY: Algal Assays Performed on Waters Collected from the Clark Fork River System

CONTACT(S): Dick Montgomery, Environmental Protection Agency, Montana Office - 499-5486

Loren Bahls, Montana Department of Health and Environmental Sciences, Water Quality Bureau- 444-2406

Joseph Greene, Environmental Protection Agency, Corvallis, Oregon

DURATION: 1984 - 1985

CURRENT STATUS: Algal assays, using Selenastrum capricornutum, were undertaken at the request of the Montana Water Quality Bureau. The tests are performed with water samples shipped to the Corvallis Environmental Research Laboratory. The assays are conducted according to methods outlined in the S. capricornutum Algal Assay Bottle Test (Miller, Greene and Shiroyama, 1978).

Water samples from nine stations on the Clark Fork River below Milltown Dam were collected and assayed on three dates: December 10-14, 1984; May 10-16, 1985; August 6-8, 1985.

A second set of algal assays were conducted with water obtained from 9 stations on Silver Bow Creek, Warm Springs Pond and the upper Clark Fork River downstream to Turah. The assays were part of the Remedial Investigation on the Silver Bow Superfund site. These tests were performed to define the effects of heavy metals, phosphorus and nitrogen on the potential growth of planktonic algae within the Silver Bow, Warm Springs and upper Clark Fork River systems.

PUBLICATIONS AND REPORTS:

Results of Algal Assays Performed on Water Collected from the Lower Clark Fork River System on Stations below Milltown Dam to below Noxon Dam:

Rept. I: December 10-14, 1984 Sampling; prepared by J. C. Greene et al. US EPA, Corvallis, Oregon.

Rept II: May 10-16, 1985 Sampling; prepared by J. C. Greene et al. US EPA, Corvallis, Oregon.

Rept III: August 6-8, 1985 Sampling; prepared by J. C. Greene et al. US EPA Corvallis, Oregon.

Results of Algal Assays Performed on Waters Collected from Silver Bow Creek, the Warm Springs Pond and the Upper Clark Fork River: May 10-16, 1985. Prepared by J. C. Greene et al. US EPA, Corvallis, Oregon.

STUDY NUMBER: 6.5

ORGANIZATION: Environmental Protection Agency (EPA)

TITLE OF STUDY: Toxicity Tests and Algal Assays of Missoula Wastewater Treatment Plant (WWTP)

CONTACT(S): Dick Montgomery, Environmental Protection Agency-449-5486

Loren Bahls, Montana Department of Health and Environmental Sciences, Water Quality Bureau-444-2406

OBJECTIVES: 1) Evaluate the potential toxicity of ammonia and chlorine in the Missoula WWTP effluent to aquatic organisms and determine if other potentially toxic substances are present in the discharge, 2) evaluate the algal growth potential of nutrients discharged to the Clark Fork River.

DURATION: 1987

CURRENT STATUS: The Missoula WWTP discharge permit is scheduled for renewal in September, 1987. Past operation problems at the plant led to plant modification and new construction designed to improve effluent quality. The toxicity and algal assay tests are designed to evaluate the quality of the effluent and its potential impact on the Clark Fork River. The data resulting from the tests will be used along with data developed by the Montana Water Quality Bureau to establish discharge permit limitations.

As a supplement to the tests with the waste water treatment plant, toxicity tests will be conducted with Ceriodaphnia to evaluate potential heavy metals toxicity associated with spring runoff induced increases in heavy metals to the Clark Fork River. Water samples collected at selected stations from Deer Lodge to Missoula will be collected and tested over a seven day period.

PUBLICATIONS AND REPORTS:

Preliminary planning documents only.

STUDY NUMBER: 7.1

ORGANIZATION: Idaho Department of Fish and Game (IDFG)

TITLE OF STUDY: Lake Pend Oreille Fisheries Investigations

CONTACT(S): Ned Horner - Regional Fishery Manager, Coeur-d'Alene - (208) 765-3111

OBJECTIVE: Evaluate the suitability and contribution of Lake Pend Oreille tributaries as spawning and rearing areas; monitor the success of juvenile fish (fry) releases from the Cabinet Gorge Fish Hatchery.

DURATION: 1982 - Indefinite

CURRENT STATUS: During the past four years, inventories have been conducted on the major spawning tributaries of Lake Pend Oreille. The primary purpose of this research has been to collect baseline information to better define fish management options. Another benefit has been to ascertain the value of the tributaries for perpetuating trout and char species within Lake Pend Oreille. Major species of concern are bull trout, Gerrard rainbow and westslope cutthroat trout. Population abundance and dynamics were estimated for juvenile rainbow trout in tributaries to the lake and data on the trophy fishery were complied to provide a historical perspective for current enhancement goals. Fishing effort in two major tributaries and harvest of juvenile adfluvial rainbow was estimated to determine whether stream angling significantly limits recruitment to the lake. Developing an estimate of juvenile rainbow trout production from tributaries and documenting age at migration were objectives of graduate student research begun in 1986. The IDFG now has important baseline fisheries data so the impacts of land use and fishing pressure can be monitored and if needed, regulated.

Another portion of this study, initiated in 1985, is to evaluate the success of kokanee fry releases from the Cabinet Gorge Fish Hatchery. This hatchery was constructed to mitigate losses to the once abundant kokanee from lake drawdown (Albeni Falls Dam), loss of Clark Fork River spawning areas (Cabinet Gorge Dam) and impacts from past introduction of Mysis shrimp. The hatchery was cooperatively funded by the Bonneville Power Administration, Washington Water Power Company, and Idaho Department of Fish and Game.

FUTURE ACTIVITIES: Graduate student research on production of juvenile fish from tributary streams will continue in 1987. Further quantification of wild trout and char production capability is needed to define future enhancement potential.

Major emphasis will be placed on development of a fisheries

management package for the Lake Pend Oreille drainage in 1987. The impact of regulation changes on the trophy trout and char fisheries will be modeled and alternatives will be developed for public comment. New regulations will be developed for the 1988-89 season. The IDFG is also participating in the development of a comprehensive management plan for the Pend Oreille system with other state, federal and private interest groups that will provide long term goals and direction.

STUDY NUMBER: 8.1

ORGANIZATION: Idaho Department of Health and Welfare (IDHW) - Division of Environment (DOE)

TITLE OF STUDY: Clark Fork River/Lake Pend Oreille Water Quality Study

CONTACT(S): Mike Beckwith, Idaho Division of Environment (IDHW-DOE), Coeur d' Alene - (208) 667-3524

Ed Tulloch, Idaho Division of Environment (IDHW-DOE), Coeur d' Alene - (208) 667-3524

OBJECTIVE: Define baseline flow, sediment, nutrient and heavy metal contributions to Lake Pend Oreille by the Clark Fork River; assess ambient limnological conditions within the lake.

DURATION: July 1984 - Indefinite

CURRENT STATUS: Sampling has been conducted at two river stations--the Clark Fork River near its mouth at Cabinet Gorge Dam (lake inlet) and the Pend Oreille River near Dover, Idaho. Five lake stations have been sampled off the Clark Fork River delta, at mid-point, in the southern and northern "arms," and at the head of the outlet "arm" (Pend Oreille River).

Sampling frequencies have been:

River station--weekly May-July and monthly during rest of year

Lake stations--late April, early June, mid July, late August, late September.

Parameters analyzed include:

Heavy metals (total recoverable): Cu, Zn, As, and Cd. River samples only (lake samples are below detection limits)

Nutrients: ammonia, nitrate, kjeldahl nitrogen, total phosphorus, orthophosphorus

Others: Ca, Mg, alkalinity, hardness silica, turbidity, total and fecal coliforms and phytoplankton.

Additional parameters for the lake samples include chlorophyll-a and secchi disk transparency and profiles (down to 50 meters) for temperature, dissolved oxygen, pH and specific conductivity. Algal assays have also been conducted on lake samples in 1985 and 1986.

Periphyton production in the near shore areas of Lake Pend Oreille was investigated during the summer of 1985. The study is helpful to identify areas of localized high productivity.

FUTURE ACTIVITIES: A Clean Lakes Phase I proposal has been submitted to the EPA. A primary objective of the investigation is to identify alternatives for reducing nutrient loads to the lake. It is anticipated that this investigation can be linked with the comprehensive evaluation of pollution problems in Lake Pend Oreille as required by the 1987 amendments to the Clean Water Act.

A comprehensive evaluation of nutrient sources and the trophic status of Lake Pend Oreille has been required by the Clean Water Act of 1987. The funding and extent of this program is to be determined.

PUBLICATIONS AND REPORTS

Falter, C. Michael and Jacob Kann. 1987. Attached Benthic Algae (periphyton) in Lake Pend Oreille, Idaho. Department of Fish and Wildlife Resources, College of Forestry, University of Idaho, Moscow, Idaho.

STUDY NUMBER: 9.1 (COMPLETED)

ORGANIZATION: U.S. Geological Survey (USGS)

TITLE OF STUDY: Analysis of Clark Fork River Bottom Sediment and Biota for Trace Metal Content

CONTACT(S): US Geological Survey Research Staff in Denver, Colorado

Ned Andrews - US Geological Survey, Denver - (303) 236-5004

Sam Luoma - US Geological Survey, Menlo Park, California - (415) 323-8111

OBJECTIVE: Determine the longitudinal distribution of trace metals in the sediment and macroinvertebrates of the Clark Fork River; develop field methods for collecting representative sediment samples and methods for processing samples which will ensure their chemical stability; investigate the relationship of fluvial mechanics to metal concentrations in the river.

DURATION: 1984

CURRENT STATUS: During 1984, bottom sediment samples were collected from 44 sites at 3 to 5 mile intervals between Warm Springs and St. Regis. Benthic macroinvertebrates were also collected at fifteen of these sites. During the normal runoff period of 1985, depth and width integrated samples were collected once every three days from three sites on the Clark Fork River (near Deer Lodge, Gold Creek and Missoula) as well as from major tributary streams. These large volume samples (30 to 40 liters) were centrifuged and preserved in the field. Particle size distribution and heavy metal analyses (for lead, zinc, copper, cadmium and arsenic) were performed on all sediment and water column samples. The benthic macroinvertebrates were analyzed for their heavy metal content.

PUBLICATIONS AND REPORTS

Data summary for 1985 sampling.

STUDY NUMBER: 9.2

ORGANIZATION: U.S. Geological Survey (USGS), Montana Office

TITLE OF STUDY: Hydrology and Water Quality of Shallow Aquifers along the Clark Fork from Warm Springs to Milltown, Western Montana

CONTACT(S): Tom Brooks - US Geological Survey, Helena Office - 449-5263

Joe Moreland - US Geological Survey, Helena Office - 449-5263

OBJECTIVE: To assess the occurrence of ground water in shallow aquifers along the Clark Fork from the headwaters to the confluence with the Blackfoot River near Missoula and to assess the occurrence and magnitude of chemical constituents, including toxic metals, in water in those aquifers. Specifically, the project will determine (1) characteristics of ground water flow systems, (2) seasonal changes in the systems, (3) quality of ground water in the systems, (4) basic mechanisms for evolution of ground water quality, and (5) relationships between ground water and surface water flow quality.

CURRENT STATUS: The study will obtain existing data from USGS files and other federal and state agencies. Existing data will be supplemented by: (1) selective field inventory of existing wells, (2) installation of test wells, (3) conducting seepage runs along the upper Clark Fork, (4) establishing a network of wells for periodic water level measurement, and (5) establishing a network of wells for annual water quality sampling.

Using data collected during this study and other existing data from state and federal agencies, geochemical models, such as WATEQF and WATEQ2, may be used to determine equilibrium relationships in water. Lithographic samples will be obtained for analysis of mineralogy and selected metal concentrations.

FUTURE ACTIVITIES: Installation of wells and sampling will continue through FY 88.

PUBLICATIONS AND REPORTS

A report will be available in 1989.

STUDY NUMBER: 9.3

ORGANIZATION: U.S. Geological Survey (USGS), Montana Office

TITLE OF STUDY: Historical and Current Streamflow and Water Quality Data for the Clark Fork and the Mouths of Major Tributaries

CONTACT(S): Joe Moreland - US Geological Survey, Helena - 449-5263

Roger Knapton - US Geological Survey, Helena - 449-5263

John Lambing - US Geological Survey, Helena - 449-5263

OBJECTIVE: Monitor stream discharge and water quality parameters at selected stations in the Clark Fork Basin.

DURATION: 1907 - Indefinite

CURRENT STATUS: The US Geological Survey is presently collecting continuous stream discharge measurements at twenty-four stations in the Clark Fork basin. Two of these stations, the Clark Fork River below Missoula and the Flathead River at Perma, are also being monitored for selected water quality parameters. Physical, chemical and biological samples are being collected at the Missoula station. Physical and chemical samples are being collected at Perma.

During the period from April, 1985 - July, 1986, daily suspended sediment samples were collected from the Clark Fork River at Deer Lodge and Turah. Heavy metal samples were also collected at these stations as well as from Rock Creek, Flint Creek, the Little Blackfoot River and the Blackfoot River during high stream discharge conditions and storm events. (Funding for that work was provided, in part, by the 1985 Montana Legislature through a Resource Indemnity Trust grant.) Daily sediment stations were operated above and below Milltown Dam in cooperation with the Federal Energy Regulatory Commission and Montana Power Company.

FUTURE ACTIVITIES: Most of the above outlined monitoring efforts will continue. The Montana Office has also prepared a proposal to monitor twenty-two stations in the basin for physical and chemical parameters. The earliest possible date for funding of all or part of this proposal appears to be FY '87.

PUBLICATIONS AND REPORTS

Historical Water Quality Data for the Clark Fork River and the

Mouths of Selected Tributaries, Western Montana" (April, 1985).

Streamflow and water quality data are published annually in U.S. Geological Survey Water Data Reports.

STUDY NUMBER: 9.4

ORGANIZATION: U.S. Geological Survey (USGS), Montana Office

TITLE OF STUDY: Suspended and Trace Metals in the Clark Fork and Major Tributaries from Deer Lodge to Milltown, Montana, March 1985 through June 1986.

CONTACT(S): Joe Moreland, US Geological Survey, Helena - 449-5263

John Lambing, US Geological Survey, Helena - 449-5263

OBJECTIVE: Identify the magnitude and variability of suspended sediment and trace metal concentrations in the upper Clark Fork basin. Determine the cumulative increase in suspended sediment loads between Deer Lodge and Turah. Examine statistical relationships between suspended sediment and metals concentrations for use in simulating metals loads transported at daily sediment sampling sites.

DURATION: March 1985 through September, 1987 or longer

CURRENT STATUS: Water quality data collection and analysis was completed in September, 1986. A data report summarizing the results of the study was completed and released in March, 1987.

FUTURE ACTIVITIES: The daily sediment sampling will be continued through joint efforts of the Montana Department of Health and Environmental Sciences and the US Geological Survey. This is a continuation of the joint effort previously conducted with the Governor's Office.

Daily sediment analyses will be collected at Deer Lodge and Turah. Periodically during high flow/high sediment periods and during low flow, specific metals will be analyzed by the US Geological Survey Central Lab. During the remainder of the runs, only total sediments will be determined. The data will be used as a long-term indicator of upstream disturbance and general condition of the river channel and adjacent flood plain.

PUBLICATION AND REPORTS:

Water Quality Data for the Clark Fork and Selected Tributaries from Deer Lodge to Milltown, Montana, March 1985 through June 1986. U.S. Geological Survey Open File Report 87-110. March, 1987, Helena, Montana.

STUDY NUMBER: 10.1

ORGANIZATION: University of Montana (UM)

TITLE OF STUDY: Development and Application of Synthetic/Predictive Water Quality Modeling for the Clark Fork River System

CONTACT(S): Vicki Watson - University of Montana, Botany/EVST Department, Missoula - 243-5153

OBJECTIVE: Utilize a suite of models to evaluate the impacts of organic loading, nutrients and heavy metals upon the water quality and the biological organisms of the Clark Fork River.

DURATION: 1985 - 1987

CURRENT STATUS: Most of the water quality information to be used in these modeling efforts has already been collected or is presently being collected by the Montana Water Quality Bureau or the U.S. Geological Survey. However, a survey of river morphometry and turbulence will be conducted during low flow and during the falling hydrograph (following high flow) to provide a better estimate of the physical reaeration potential of the river and to help select the range of models to be used.

A variation of the QUAL II model will be used to assess the impacts of organic loading upon the river's dissolved oxygen levels. Potential impacts of changing nutrient loads upon the trophic status of the lower river reservoirs and Lake Pend Oreille will be estimated using modifications of the Vollenweider input-output model. Metal species equilibria will be assessed using the MINEQL model developed, in part, by the Battelle Pacific Northwest Laboratory.

FUTURE ACTIVITIES: Water quality data for use in the various models will be compiled. Stream morphology measurements will continue. Actual modeling will be performed on the University of Montana's DEC 20 computer system.

STUDY NUMBER: 10.2 (COMPLETED)

ORGANIZATION: University of Montana (UM) - Department of Geology

TITLE OF STUDY: Determination of Heavy Metal Contamination in Reservoir Sediment Along the Clark Fork River, Missoula to Heron, Montana

CONTACT(S): Johnnie Moore - Department of Geology - University of Montana - 243-2341

Carolyn Johns - Department of Geology - University of Montana - 243-2341

OBJECTIVE: Determine the concentration of heavy metals-arsenic, copper, cadmium, iron, lead, manganese and zinc--in the lower river reservoir sediments and compare these to values found in Milltown Reservoir.

DURATION: 1984 - 1986

CURRENT STATUS: During the summer of 1984, grab samples of reservoir sediments were collected from Milltown (27 samples), Thompson Falls (7 samples), Noxon Rapids (14 samples) and Cabinet Gorge (7 samples). Additionally, core samples, averaging 25 cm in length were collected at Thompson Falls (3 cores) and Noxon Rapids (5 cores). Six cores, approximately 150 cm in length, were collected at Milltown. Two heavy metal extraction techniques were utilized: acetic acid (25% v/v) and total, which involves a four-hour digestion in hot aqua regia.

Preliminary results from the acetic acid extractions indicate that copper and zinc sediments concentrations in the lower river reservoirs are about ten times lower than those found in the Clark Fork arm at Milltown. However, sediment concentrations of copper and zinc are still elevated over background levels--four to eight times higher than the control stations in the Blackfoot arm of the Milltown Reservoir. Arsenic concentrations from the acetic acid extractions do not appear to be significantly elevated in sediments of the lower river reservoirs.

PUBLICATIONS AND REPORTS

Copper, Zinc and Arsenic in Bottom Sediments of Clark Fork River Reservoirs--Preliminary Findings. Pages 74-88 In C.E. Carlson and L. L. Bahls, (eds.), Proceedings of the Clark Fork Symposium, April 19, 1985. Montana College of Mineral Science and Technology, Butte, Montana.

Johns, Carolyn and Johnnie Moore, (not dated) Metals in Bottom Sediments of Lower Clark Fork River Reservoirs Final Report Sub-

mitted to Montana Water Resources Research Center, Montana State University.

STUDY NUMBER: 10.3

ORGANIZATION: University of Montana (UM)

TITLE OF STUDY: Groundwater Use and Management: A Sole Source Aquifer Study, Missoula Valley, Montana

CONTACT(S): William Woessner - University of Montana - Geology Department, Missoula - 243-2341

OBJECTIVE: Evaluate the long-term quantity, quality and availability of the natural groundwater system in the Missoula Valley; begin a long-term monitoring program and develop a predictive tool to evaluate the consequences of current and future groundwater management practices.

DURATION: 1985 - 1987

CURRENT STATUS: In the summer of 1983, the City of Missoula's Rattlesnake Creek water supply system was closed because of giardia contamination. The city now relies solely on groundwater for their drinking water. Approximately 7.6 billion gallons of water are withdrawn annually from the underlying aquifer.

The Missoula Valley Aquifer is directly connected to the land surface with only sporadic layers of silt and clay to protect it from downward infiltrating pollution. Improperly installed septic tanks and the "French Drain" system of storm water disposal utilized by the City of Missoula are major sources on contamination to the aquifer.

This study is monitoring withdrawals from and discharges into the Missoula Valley Aquifer by: 1) conducting surface water discharge rates on the Clark Fork and Bitterroot Rivers, 2) measuring water level changes at six monitoring wells, and 3) evaluating the discharge rates of two storm water drain systems and three septic tank disposal fields. Water quality parameters are also being collected at all monitoring sites.

FUTURE ACTIVITIES: The above monitoring program will continue for two years. At that time, a numerical groundwater model will be developed to predict the effects of existing and proposed development and disposal practices on the aquifer system.

STUDY NUMBER: 10.4

ORGANIZATION: University of Montana (UM), Geology Department

TITLE OF STUDY: Pathways of Metal Contaminant Transport in the Clark Fork River: Warm Springs Ponds to Garrison

CONTACT(S): Johnny Moore, University of Montana, Geology Department, Missoula - 243-2341

OBJECTIVE: 1) Determine metal partitioning and fractionation in bed sediments of the Clark Fork River. Specifically determine what proportion of metals are carried by sulfides, oxyhydroxides, organics and resistant crystalline compounds; 2) Establish the relationship of grain size on metal concentrations; 3) Establish the mechanisms of transport of metals in the river and the potential for distribution and concentration in particular river environments; 4) Determine the relative percentages of metals carried in the bedload and metals carried in the sediments.

DURATION: 1987 - Indefinite

CURRENT STATUS: This project has been approved for funding by the Water Resources Research Center. Field research is expected to begin in the 1987 field season.

STUDY NUMBER: 10.5

ORGANIZATION: University of Montana (UM), Department of Botany

TITLE OF STUDY: Improving Biotic Resources of the Upper Clark Fork River

CONTACT(S): Vicky Watson, University of Montana, Botany/EVST Department, Missoula - 243-5153

OBJECTIVE: 1) Assess the relationship between algae growth and fish production in the upper river and establish a baseline of algae growth for evaluating future changes in the river; 2) determine the relationship between macroinvertebrate populations, toxic metals and fish populations over the length of the upper river.

DURATION: 1986 - Indefinite

CURRENT STATUS: Funding for this project with Resource Indemnity Trust Funds was approved by the 1987 Legislature. The project will utilize aerial and on-ground measurements of algae growth and standing crops at various locations in the upper river for comparison with metal concentrations, river morphometry, nutrients and other factors. Diurnal oxygen concentration will be measured at 4-5 sites in the upper river biweekly from July to early September for comparison with the Department of Fish, Wildlife and Parks fishery studies.

Aquatic insect habitat will be inventoried at various locations in the upper river to determine if habitat is limiting aquatic insect populations. Insect populations will be quantified at selected stations over the annual cycle as a measure of available fish food and to establish a baseline for future measurements.

FUTURE ACTIVITIES: Some preliminary data have been gathered. The project is expected to be underway during the 1987 field season depending on funding arrangements.

STUDY NUMBER 10.6

ORGANIZATION: University of Montana, Geology Department

TITLE OF STUDY: Transport Phases and Grain Size Associations of Metals in Sediment of a Contaminated River System

CONTACT(S): Edward J. Brook, Department of Geology - 243-2141

Johnny Moore, Department of Geology - 243-2141

OBJECTIVES: 1) Determine the magnitude of contamination in the river sediments, 2) determine what chemical species are transporting metals in those sediments, 3) investigate the extent of any relationship between metal content and grain size distribution.

DURATION: 1986 - 1987

CURRENT STATUS: Samples of recently deposited sediments have been collected from selected locations on the river between Warm Springs Ponds and Milltown Reservoir and from the Blackfoot River, Little Blackfoot River and Flint Creek.

Samples are analyzed by induction coupled plasma spectrophometry or atomic absorption spectrophometry. Total sediment metal concentrations are determined for each site and total concentrations are determined in each of six size fractions. Each size fraction is subjected to four sequential chemical extractions designed to remove metals associated with various transport phases.

Data from the analyses will be compared and contrasted with published data to evaluate mechanisms of transport.

PUBLICATIONS AND REPORTS

The data will be used in the preparation of a thesis.

STUDY NUMBER: 10.7

ORGANIZATION: University of Montana (UM) - Department of Geology

TITLE OF STUDY: Distribution and Chemical Analyses of Metal Contamination in the Floodplain Sediments of the Upper Clark Fork River, Montana

CONTACT(S): Rebekah Brooks, Department of Geology - 542-0537

Johnny Moore, Department of Geology - 243-2141

OBJECTIVES: 1) Prepare a detailed map of sediments on the floodplain and determination of their mineralogic and chemical content, 2) determine distribution of tailings material in the floodplain deposits by detailed sampling, 3) chemical analysis of floodplain sediments to determine metal concentrations, and 4) analyze sediment underlying tailings to determine if contaminants have migrated vertically into the vadose zone or unlying alluvial aquifer.

DURATION: 1986 - 1987

CURRENT STATUS: Detailed sedimentologic maps are constructed using colored aerial photos and data obtained from cores, trenches and auguring. Soil samples at various distances from the river are used to determine mineralogy, grain size, and lateral distribution of metals concentration. Water movement into the vadose zone is measured at selected sites with a suction lysimeter. Sand point piezometers and augered wells are used to measure water levels and collect water samples in the alluvial aquifer. Groundwater samples are analyzed for metal concentrations.

PUBLICATIONS AND REPORTS: This investigation is being developed as a Master of Science thesis project.

STUDY NUMBER: 10.8

ORGANIZATION: University of Montana (UM), Department of Geology

TITLE OF STUDY: Geochemical Responses of Sediments and Groundwater to the Draining of the Reservoir at Milltown, Montana

CONTACT(S): Anne Udaloy, Department of Geology - 728-3495

Johnny Moore, Department of Geology - 243-2141

OBJECTIVES: 1) Determine how the chemical behavior of metals in reservoir sediments and groundwater are affected by changes in redox environments caused by draining and refilling the reservoir, 2) determine the factors affecting the mobilization of metals and where they migrate. The investigation is focused on arsenic, copper, iron, manganese, sulfur and zinc.

CURRENT STATUS: Existing wells and sandpoints from previous water quality studies are utilized, plus shallow wells at two additional sites, to establish a six-point sampling grid. The wells are constructed as piezometer nests or as multilevel samplers. A lysimeter is established at each site at the level of the June, 1986 water table.

A sediment core sample equal in length to the deepest well at that point is used to define the local stratigraphic sequence of the sediments. The water table is recorded on a biweekly schedule and at the same time samples for water quality analysis are taken from the study grid wells.

On a monthly schedule, 3 ten centimeter sediment cores are taken at each grid point from the same levels as the water quality samples. Sediment analysis includes separation of chemical components into crystalline particles, organic or metal hydroxide coatings and absorbed or exchangeable ions. Sediment extracts, ground water and pore water are analyzed using an inductively coupled plasma spectrophometer and atomic absorption spectorphotometer.

PUBLICATIONS AND REPORTS

The investigation is the basis of a Master of Science thesis investigation.

STUDY NUMBER: 11.1

ORGANIZATION: Montana State University (MSU)

TITLE OF STUDY: Statistical Evaluation and Design of Water Quality Monitoring for Upper Clark Fork River Basin

CONTACT(S): Mark Cunnane, Department of Civil Engineering-Montana State University - 994-6132

Howard Peavy, Water Resources Center - Montana State University - 994-6690

OBJECTIVES: 1) Design an efficient and effective water quality monitoring program for the upper Clark Fork River, 2) model metal speciation in the Clark Fork River.

DURATION: 1986 - 1987

CURRENT STATUS: Water quality data, collected by the Montana Water Quality Bureau are being statistically analyzed to evaluate future sampling needs. One product of this evaluation will be a proposed water quality monitoring protocol based on existing conditions.

The water quality data are evaluated to calculate metal speciation equilibria using MINTEQ, a metal speciation equilibrium model for surface and ground water. Water quality data are from samples collected at stations from Silver Bow Creek to Gold Creek.

FUTURE ACTIVITIES: This research is expected to be complete in July, 1987.

PUBLICATIONS AND REPORTS

A professional paper is being prepared in partial fulfillment of the requirements for of a Master of Science degree.

STUDY NUMBER: 12.1 (COMPLETED)

ORGANIZATION: Anaconda Minerals Company/Chadwick and Associates

TITLE OF STUDY: Benthic Invertebrate Studies on the Upper Clark Fork River

CONTACT(S): Steve Canton - Chadwick and Associates - (303) 794-5530

Loren Bahls - Montana Department of Health and Environmental Sciences, Water Quality Bureau - 444-2406

OBJECTIVE: Annually monitor the benthic invertebrate communities in Silver Bow Creek, Mill-Willow Creek and the upper Clark Fork River.

DURATION: 1972 - 1985

CURRENT STATUS: Benthic invertebrate samples were collected yearly during autumn at eleven stations. Five of these stations are on Silver Bow Creek (from Butte to Opportunity) two are on the Mill-Willow bypass channel (one above the Warm Springs Ponds and one below the confluence with the Pond 2 discharge) and three are on the Clark Fork River (at Warm Springs, Deer Lodge and Phosphate). Three separate quantitative samples were collected at each station using a modified Hess sampler. Organisms were identified to the lowest practical taxonomic level using available keys. Wet-weight biomass was determined for major groups (i.e., insect orders). Analysis of the invertebrate community includes calculation of the Shannon-Weaver Diversity Index.

PUBLICATIONS AND REPORTS

Annual progress reports entitled, "Aquatic Biological Survey of Silver Bow Creek and the Upper Clark Fork River" have been prepared by Chadwick and Associates.

Canton, Steven and James W. Chadwick, 1985. The Aquatic Invertebrates of the upper Clark Fork River, 1972 - 1984. In Carlson, C. E. and L.L. Bahls (eds.), Proceedings of the Clark Fork Symposium, April 19, 1985. Montana College of Mineral Sciences and Technology, Butte, Montana.

STUDY NUMBER: 13.1 (COMPLETED)

ORGANIZATION: Stone Container Corporation (Champion International Corporation)

TITLE OF STUDY: Alternative/Additional Methods of Treatment to Improve the Quality of Discharge from Stone Container Corporation's Frenchtown, Montana Kraft Paper Mill

CONTACT(S): Larry Weeks - Technical Director - Stone Container Corporation, Missoula - 626-4451

OBJECTIVE: Identify and evaluate alternative state-of-the-art waste treatment technologies available for pulp and paper mill effluents.

DURATION: 1984 - 1986

CURRENT STATUS: Stone Container Corporation (Champion International) hired WESTON, an engineering consulting firm, to review all available waste treatment technologies that could potentially reduce the color, BOD, TSS and nutrient content of their mill's effluent. Starting with 240 title and abstract citations, WESTON screened this list down to eleven potential methodologies. (Other treatment systems were eliminated primarily because they did not have proven records with full-scale application in the pulp and paper industry.) A detailed evaluation of these eleven technologies was then conducted as to their estimated installation, operation and maintenance costs and their ability to improve the quality of the mill's effluent, i.e., an estimate of the effluent quality expected from these technologies versus the present treatment system.

FUTURE ACTIVITIES: Stone Container Corporation is currently working to minimize nutrient concentrations in their effluent. This work is guided by conditions of the Montana Pollution Discharge Elimination System (MPDES) Permit issued to Stone in 1986.

An effluent color removal system is being investigated for use at the Missoula Mill. The process consists of treating the effluent with a coagulant (cationic polyamine) followed by a flocculent (acrylamide) to remove the color from the effluent. The sludge from the treated effluent can be separated and disposed of on land.

Stone Container Corporation is installing a pilot plant in May, 1987, to test the process with mill effluent. The Wyerhaeuser Company has been employed to conduct acute and chronic toxicity tests of the treated effluent with rainbow trout fry. A 45-day flow-through toxicity test with "button-up" fry will be conducted in June, 1987. A chemical analysis of the treated effluent will be conducted.

Stone Container Corporation will use the pilot plant test data to make decisions about the usefulness of the treatment system for the Missoula mill.

PUBLICATIONS AND REPORTS

Weston Consultants, October, 1985. Evaluation of Alternative Technologies for Wastewater Treatment. Prepared for Champion International Corporation, Missoula, Montana.

STUDY NUMBER: 13.2

ORGANIZATION: Institute of Paper Chemistry/Stone Container Corporation (Champion International Corporation)

TITLE OF STUDY: Benthic Invertebrate Studies on the Middle Clark Fork River

CONTACT(S): Larry Weeks - Stone Container Corporation - 626-4451

Loren Bahls - Montana Department of Health and Environmental Sciences, Water Quality Bureau - 444-2406

Gary Ingman - Montana Department of Health and Environmental Sciences, Water Quality Bureau - 444-2406

OBJECTIVE: Annually monitor the benthic invertebrate communities in the Clark Fork River above and below a major pulp and paper mill located at Frenchtown.

DURATION: 1956 - Indefinite

CURRENT STATUS: Benthic invertebrate samples are collected yearly during late summer at nine to eleven stations. The study area extends from the outskirts of Missoula to Lozeau (near the confluence of Nine Mile Creek) with the most intensive coverage given to a twenty mile river reach encompassing the Frenchtown Mill. At each station, four replicated Surber samples are collected in riffle areas less than twelve inches deep. All taxonomic work is conducted at the laboratories of the Institute of Paper Chemistry in Appleton, Wisconsin. Identification of specimens is carried out to the genus and species levels as feasible. Various diversity and biotic indices are calculated to ascertain changes in community composition between controls and areas influenced by the mill's effluent. Annual progress reports, which presently number thirty-three volumes, are available from the Institute of Paper Chemistry.

FUTURE ACTIVITIES: Yearly sampling is expected to continue.

PUBLICATIONS AND REPORTS

A Benthic Invertebrate Water Quality Survey of the Clark Fork River in the Vicinity of Missoula, Montana. Project 1980. A Progress Report to Champion Corporation, Frenchtown Mill. Prepared by the Institute of Paper Chemistry. This report consists of thirty-three volumes; a progress report has been issued each year since 1956.

STUDY NUMBER: 14.1 (COMPLETED)

ORGANIZATION: Montana Power Company (MPC)

TITLE OF STUDY: Study of Alternatives for Milltown Dam

CONTACT(S): Frank Pickett - Montana Power Company, Butte - 723-5421

Don Sprague - Montana Power Company, Butte - 723-5421

OBJECTIVE: Evaluate feasible alternatives for the reconstruction or retirement of the Milltown Dam structure.

DURATION: 1984 - 1986

CURRENT STATUS: On June 13, 1986, the Federal Energy Regulatory Commission (FERC) ordered the Montana Power Company to repair the spillway section of Milltown Dam subject to conditions on construction procedures, water quality monitoring and waste disposal control. An on-site observer was hired under contract to the state to assist government agencies and citizen groups in monitoring construction activities.

The Montana Power Company completed the spillway repair in April, 1986. Phase II of the operation will include repair and rebuilding of the power house and installing new turbines. This phase has not yet been authorized by FERC.

FUTURE ACTIVITIES: Future action at the dam will wait until FERC has acted on the proposed plans for Phase II.

PUBLICATIONS AND REPORTS

Environmental Assessment Milltown Hydroelectric Project FERC No. 2543-004 Montana Division of Environmental Analysis, Office of Hydropower Licensing, Federal Energy Regulatory Commission, 825 N. Capitol Street NE, Washington, D.C. 20466. June 30, 1986.

Milltown Hydroelectric Project Engineering Evaluation. FERC Project No. 2543. September 1984. The Montana Power Company, Butte, Montana.

Application for Amendment of License, Milltown. Project No. 2543. July 1985. The Montana Power Company, Butte, Montana.

Application for Amendment of License, Milltown. Project No. 2543. Appendix Exhibit E. July 1985. The Montana Power Company, Butte, Montana.

STUDY NUMBER: 15.1

ORGANIZATION: Washington Water Power Company (WWP) in cooperation with Montana Department of Fish, Wildlife and Parks (MDFWP)

TITLE OF STUDY: Assessing the Fisheries Benefits of Restricting Noxon Rapids Reservoir Drawdown

CONTACT(S): Joe Huston, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana - (406) 755-5505

Roger Woodworth, Washington Water Power, Spokane, Washington - (509) 482-4138

Timothy Swant, Washington Water Power, Noxon, Montana - (406) 847-2739

OBJECTIVE: Monitor and document near-term changes in the plankton, benthic, and fish populations which may result from new drawdown limitations on Noxon Rapids reservoir.

DURATION: 1986 - 1988

CURRENT STATUS: In 1986, WWP introduced a new reservoir operation plan which restricts large-scale drawdowns. These drawdowns were thought to be a major cause of the mostly unsuccessful sport fishery in Noxon Rapids Reservoir. With the relative stability of the reservoir, monitoring has begun with data collected on the 1986 fall brown trout spawning run and 1986 winter benthic sampling.

FUTURE ACTIVITIES: Benthic and plankton samples will be taken quarterly from five different locations. Brown trout spawning runs will be surveyed through redd counts, and where possible, stream trapping. Attempts will be made to document the occurrence, spawning and recruitment of burbot, largemouth bass and smallmouth bass. Gill netting will be performed several times a year to observe general trends in fish populations. Other aspects of both Cabinet Gorge and Noxon Rapids reservoirs fisheries, such as age and growth, food habits and habitat usage and availability will also be assessed, as applicable.

STUDY NUMBER: 16.1

ORGANIZATION: Confederated Salish and Kootenai Tribes (CSKT)

TITLE OF STUDY: Lower Flathead River Fisheries Study

CONTACT(S): David Cross - Confederated Salish and Kootenai Tribes, Pablo, Montana - 675-4600

Jim Paro - Confederated Salish and Kootenai Tribes, Pablo, Montana - 675-4600

OBJECTIVE: Assess the effects of Kerr Dam operations on the fisheries of the lower Flathead River by evaluating the aquatic habitat of the river and its tributaries, including the size, distribution and abundance of sport fish.

DURATION: 1983 - 1987

CURRENT STATUS: Fish population estimates and habitat evaluations are being conducted at five study sections on the mainstem: near Buffalo Rapids, near the Sloan Bridge, above Dixon (Agency section), below Dixon (weed section) and near Perma. Spawning, creel census and fish movement surveys are also being conducted at these sites. Water temperatures are being continuously monitored at the Sloan, Dixon and Perma bridges. Fish study sections have also been established on five major tributaries:

Jocko River (7 sections)
Mission Creek (5 sections)
Post Creek (4 sections)
Little Bitterroot River (4 sections)
Crow Creek (1 section)

Fish weirs have been established on the Jocko River and Mission Creek to assess spawning runs of trout from the main river. Annual progress reports for 1983, 1984 and 1985 are available from the Confederated Salish and Kootenai Tribes' office in Pablo.

FUTURE ACTIVITIES: Preliminary findings indicate a lack of successful spawning by trout species in the lower Flathead River. Field studies as outlined above will continue. Instream flow determinations were conducted on the mainstem during the autumn of 1985, utilizing the Instream Flow Incremental Methodology. In 1987, an array of fishery management options will be prepared to mitigate the impacts of present hydroelectric operations (demonstrating under each option how fish populations and hydroelectric generation capabilities would be modified).

STUDY NUMBER: 17.1

ORGANIZATION: Headwaters Resource Conservation and Development Project Area

TITLE OF STUDY: Reclamation Techniques for Heavy Metal Contaminated Pasturelands in Deer Lodge, Powell and Silver Bow Counties

CONTACT(S): Ted Dodge, Headwaters Resource Conservation and Development Area Coordinator, Butte - 782-7333

John Sonderegger, Montana Bureau of Mines and Geology - 496-4159

William M. Schafer, Schafer and Associates - 587-3478

OBJECTIVE: Develop reclamation techniques for heavy metal contaminated pasturelands, while ensuring that changes in land use do not negatively impact the surface and ground water resources of the area.

DURATION: August 1984 - October 1988

CURRENT STATUS: Test plots which will evaluate the success of various combinations of tillage techniques, liming rates and plant (forage) species, were established in 1985 at the Hazel Spangler Ranch near Gregson. Soil chemistry measurements, including extractable metal concentrations, were conducted prior to and after the lime applications. Procedures for monitoring impacts on ground water were evaluated. Emergence and survival of various plant species was determined, but severe drought conditions during the spring and summer of 1985 had a definite impact upon interpretation of the results. After the evaluation of plant survival the decision to maintain the original plots was made. New dryland plots are currently being developed which incorporates the findings of the original plots including establishment techniques, species, analyses, and ground water monitoring. These plots have been limed, tilled and monitoring equipment has been installed.

FUTURE ACTIVITIES: Seeding of new plots is scheduled to be competed in the spring of 1987.

PUBLICATIONS AND REPORTS

Lime and Tillage Effects on Soil Copper and Zinc Partitioning and Vegetable Response in Acid Contaminated Agricultural Soils in Southwestern Montana. A final project report submitted to Ted Dodge, Headwaters R.C. & D., Butte, Montana. Submitted by Schafer and Associates, Bozeman, Montana, December 31, 1986.

Schafer, William M. and Margaret Babits. 1987. Lime and Tillage Effects on Soil Copper and Zinc Partitioning and Vegetable Response in Acid Contaminated Agricultural Soils in Southwestern Montana. Presented at annual meeting of American Society of Surface Mining and Reclamation, Billings, Montana. March, 1987.

STUDY NUMBER: 18.1

ORGANIZATION: Montana Department of Natural Resources and Conservation (MDNRC)

TITLE OF STUDY: Environmental Impact Statement--Upper Clark Fork River Water Reservations

CONTACT(S): Tom Ring, Montana Department of Natural Resources and Conservation - 444-6785

Susan Higgins, Montana Department of Natural Resources and Conservation - 444-6607

OBJECTIVE: Prepare an evaluation of the environmental, social and economic impacts of allocating water resources in the upper Clark Fork River for instream flows and for irrigation storage reservoirs. The Environmental Impact Statement will analyze a series of alternatives and their relative impacts.

DURATION: 1987 - 1988

CURRENT STATUS: The Montana Department of Natural Resources and Conservation has received two applications to reserve water in the upper Clark Fork River basin. The Department of Fish, Wildlife and Parks wishes to reserve instream flows in the mainstem of the Clark Fork River and 17 of its tributaries. The Granite County Conservation District is seeking to reserve water for irrigation needs of the county by developing storage reservoirs in the Boulder and Willow Creek drainages between Drummond and Phillipsburg.

A third application is expected from the Mile High Conservation District for reservation of surface and groundwater in Silver Bow County for irrigation.

Public scoping meetings were held in March at Drummond, Anaconda and Bonner. Issues raised at the public scoping meetings will be considered in developing the alternatives and impact evaluations.

FUTURE ACTIVITIES: A tentative schedule for completion of the water reservation process follows:

June, 1987: Finalize Mile High Conservation District application

Fall, 1987: Publish and receive public comments on draft Environmental Impact Statement

Early winter, 1987: Publish final Environmental Impact Statement

Mid winter, 1987: Conduct contested case hearings on reservation application

Spring-early Summer, 1988: Decision by the Board of Natural Resources and Conservation

PUBLICATIONS AND REPORTS:

See Study No. 2.1.