W O R K   P L A N

CLARK FORK RIVER/LAKE PEND OREILLE BASIN PROJECT

JUNE, 1985

Prepared By:

Howard E. Johnson
Ken Knudson
Clark Fork River Basin Project
Governor's Office
Helena, Montana 59620

TABLE OF CONTENTS

List of Tables iii

List of Figures iv

Glossary. v

CHAPTER PAGE

I. Clark Fork River Basin Project

Background 1
Project Overview 2

Project Organization 3
Project Coordinator and Staff 3
Clark Fork Interagency Task Force 4
Citizen's Advisory Council 4
Steering Committee 5

Project Goals and Objectives 5
Primary Goal 5
Specific Goals and Objectives 6

Anticipated Funding Sources. 8

II. Clark Fork River Basin Environmental Impacts

General Description of the Clark Fork River Basin. 9
General Information about Environmental Impacts Affecting Fish and Other Aquatic Life in the Clark Fork River Basin 12

III. Analysis of Environmental Impacts and Studies by Project Area

Project Study Boundaries 16
Summary of Past and Ongoing Studies. 16
Segment-Specific Analysis of Impacts and Studies 17

Table of Contents (con't)

IV. Project Areas

Project Area 1
General Status of the Water Quality and Fishery. 18
Summary of Environmental Impacts 19
Present Information. 21
Information Needs. 25

Project Area 2

General Status of the Water Quality and Fishery 27
Summary of Environmental Impacts 27
Present Information 29
Information Needs 30

Project Area 3

General Status of the Water Quality and Fishery 31
Summary of Environmental Impacts 31
Present Information 33
Information Needs 34

Project Area 4

General Status of the Water Quality and Fishery 36
Summary of Environmental Impacts 36
Present Information 38
Information Needs 40

Project Area 5

General Status of the Water Quality and Fishery 42
Summary of Environmental Impacts 42
Present Information 44

Table of Contents (con't)

Project Area 6

General Status of the Water Quality and Fishery 46
Summary of Environmental Impacts 47
Present Information 49
Information Need 51

Project Area 7

General Status of the Water Quality and Fishery 52
Summary of Environmental Impacts 52
Present Information 53
Information Needs. 54

V. Preliminary Proposals for Additional Resource Evaluations

Basin-Wide Evaluations
Nutrient Source Assessment 57
Assessment of Non-Point Pollution Sources. . . 59
Regional Economic Analysis of Recreation . . . 61
in the Clark Fork/Lake Pend Oreille Basins

Project Area Evaluations
Project Area 1 62
Project Area 2 67
Project Area 3 69
Project Area 6 71
Project Area 7 73

VI. Scope of Work and Time Schedules

Project Tasks 74

T A B L E S

NUMBER		PAGE
1	Organization Chart-Clark Fork River Basin Project.	3-A
2	Summary of Recently Completed or Ongoing Water Resources Studies in the Clark Fork River Basin	16-1
3	Project Study Work Plan Schedule	78

FIGURES

NUMBER		PAGE
1	Columbia River Basin, highlighting the Clark Fork Basin.	1-A
2	Clark Fork River Basin.	9-A
3	Clark Fork River Basin Project Study Area	16-A
4	Project Area 1--Clark Fork River above the confluence of the Blackfoot River	18-A
5	Project Area 2--Blackfoot River	27-A
6	Project Area 3--Bitterroot River.	31-A
7	Project Area 4--Clark Fork River from the confluence of the Blackfoot River to the confluence of the Flathead River.	36-A
8	Project Area 5--Flathead River below Kerr Dam	42-A
9	Project Area 6--Clark Fork River from the confluence of the Flathead River to Lake Pend Oreille	46-A
10	Project Area 7--Lake Pend Oreille	52-A

GLOSSARY

AMC	Anaconda Minerals Company
BPA	Bonneville Power Administration
CHDW	Chadwick and Associates
CIC	Champion International
CSKT	Confederated Salish Kootenai Tribe
DFWP	Montana Department of Fish, Wildlife and Parks
DHES	Montana Department of Health & Environmental Science
DNRC	Montana Department of Natural Resources and Conservation
EPA	Environmental Protection Agency
HYDRM	Hydrometrics
IFG	Idaho Fish and Game
IDHW	Idaho Department of Health and Welfare
IPC	Institute of Paper Chemistry
MBMG	Montana Bureau of Mines and Geology
MDSL	Montana Department of State Lands
MSU	Montana State University
NPS	National Park Service
SWMB	Montana Solid Waste Management Bureau
SCS	Soil Conservation Service
TTRT	Tetratech
UM	University of Montana
USGS	U.S. Geological Survey
USDA	U.S. Department of Agriculture
UI	University of Idaho
WWP	Washington Water Power
WQB	Water Quality Bureau

I. CLARK FORK RIVER BASIN PROJECT

A Background

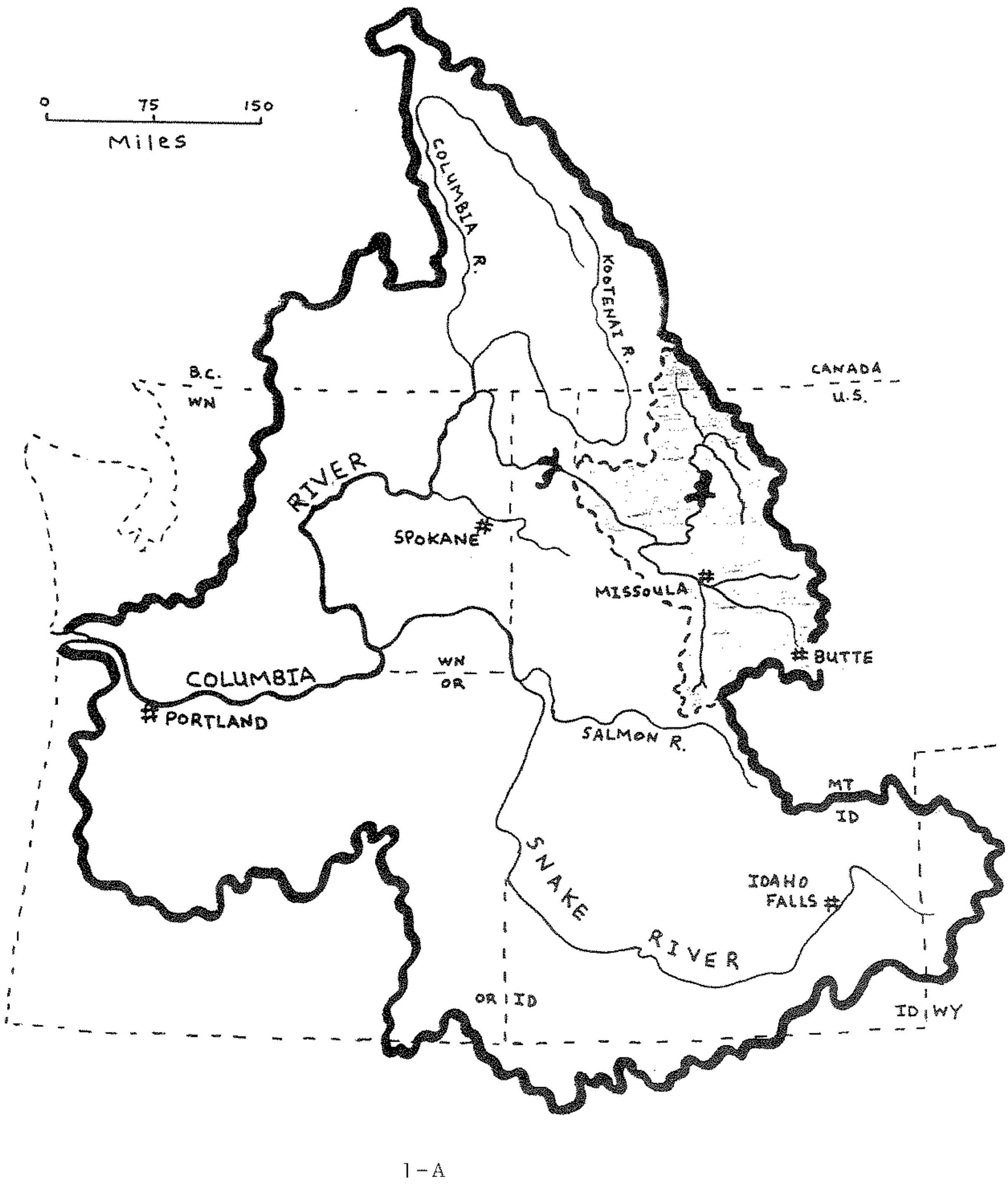
The Clark Fork River is a primary water resource for western Montana, northern Idaho and eastern Washington. From its origin in west central Montana, the river flows north and west to Lake Pend Oreille in northern Idaho. After leaving the lake, the river, now named the Pend Oreille, continues north through eastern Washington to the British Columbia border where it joins the Columbia River (Figure 1).

Much of the basin is mountainous and the river valley forms a narrow corridor that is the central focus for urban development, industrial activity and transportation in the region. But, despite its importance to the economy and quality of life in the basin, the Clark Fork River has been seriously abused and polluted.

Vast quantities of untreated mining and municipal wastes were discharged to the headwaters beginning in the late 1800's. As a result, fish and other aquatic resources of the upper 100 miles of stream were destroyed. In the lower river, major spawning migrations of trout and salmon from Lake Pend Oreille were eliminated by dams constructed in the early and mid-1900's.

Although wastewater treatment has improved the water quality, the upper river continues to suffer significant problems due to past mining activities, and the lower river

FIGURE 1. COLUMBIA RIVER BASIN, highlighting the Clark Fork River Basin (Shaded Portion)



is without a viable fishery. In the midsections of the river the potential impacts of wastes from a large sewage treatment plant and a pulp and paper mill are presently being evaluated. Throughout the basin, tributary streams and the mainstem river are affected by channel modifications, sediment and nutrients from logging and agricultural lands, rural subdivisions and dewatering. The cumulative impacts of these pollutants pose a threat to the Clark Fork River in Montana and to the water quality of Lake Pend Oreille.

Montana and Idaho and Washington citizens have become increasingly aware and concerned about the degraded status of the river. This public concern has caused management, enforcement and research agencies and organizations to direct more effort towards investigating, and wherever possible mitigating the causes of this degradation.

The Clark Fork River Basin is presently the subject of over 30 water or fishery-related studies, ranging from Superfund remedial investigations in the headwaters area near Butte to limnological studies on Lake Pend Oreille.

B. Project Overview

Montana, through its Governor`s Office, has recently initiated a project to coordinate past, on-going and proposed studies so as to establish a comprehensive data base for the Clark Fork River Basin.

The idea of the Clark Fork Project came from a variety of sources: Public interest groups, state and federal agencies, legislators, members of industry and private citizens in the states of Montana, Idaho and Washington. Spearheading the need for the project were the water quality and fishery data deficiencies that became apparent during the controversy surrounding Montana`s early 1984 decision to issue a revised discharge permit for Champion International Corporation`s pulp mill near Missoula. The decision resulted in intensive and extensive water quality and fishery studies being initiated in the Lower Clark Fork River. Given the large number of concurrent water-related studies in the Basin, a unique opportunity now exists to develop an integrated data base and a comprehensive water management plan for the future.

In addition to providing administrative continuity to existing or planned Clark Fork Studies, the project will identify what additional information is most urgently needed if the water quality and fishery problems facing the Basin are to be adequately understood. The ultimate goal of this project is to develop a master plan for the resolution of water-related resource problems within the Clark Fork River Basin. By taking this coordinated approach, duplication of effort can be minimized thus helping stretch the monies available for investigating the Clark Fork`s problems.

Inherent to the project's concept is the fact that there currently exists a window in time during which governmental agencies, industry and universities are able, via a diversity of potential and existing funding sources, to concentrate their efforts on studying the problems of the Clark Fork. This attention and interest is necessary if the Clark Fork River is ever to regain its full potential as a recreational, cultural and economic resource.

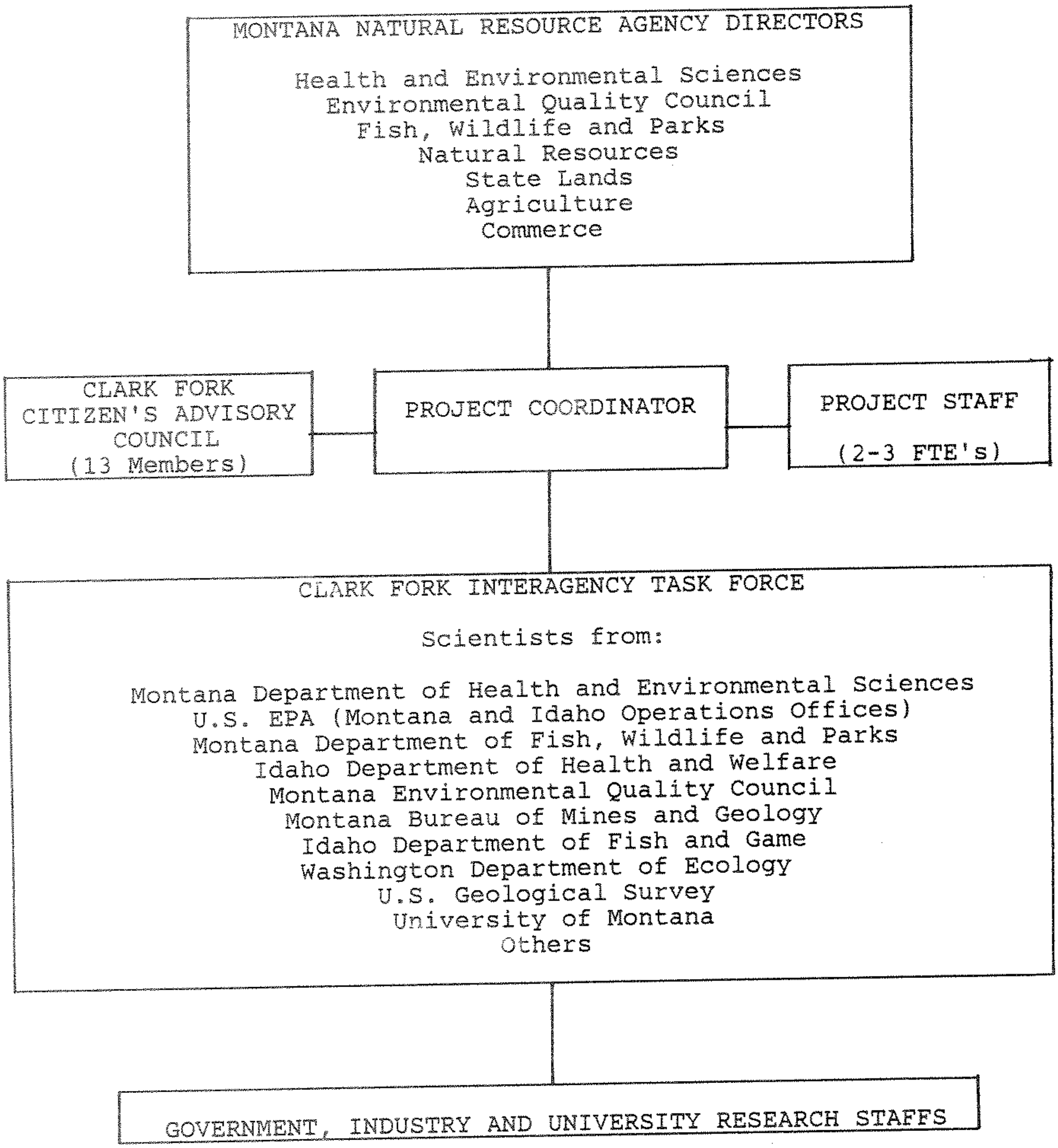
C. Project Organization

The project organization and flow of responsibility is shown in Table 1.

1. Project Coordinator and Staff

The Clark Fork River Basin Project is attached to the

TABLE 1
ORGANIZATION CHART
CLARK FORK RIVER BASIN PROJECT



Governor's Office in Helena. The Project Coordinator, appointed by the Governor is assisted by an aquatic biologist and a secretary. The Coordinator and staff are responsible for the development, organization and completion of the project goals and objectives.

2. Clark Fork Interagency Task Force

The Interagency Task Force is composed of scientists from state and federal resource agencies and the Montana University system who are charged with the oversight of fishery and water quality projects within the Clark Fork River Basin. In addition to Montana, the Task Force includes representatives from government resource agencies in Idaho and Washington.

Duties of the Task Force include:

a. Assist the project coordinator in compiling a comprehensive data base;

b. Identification and evaluation of information and study needs; and

c. Advise the project coordinator regarding the development of future management alternatives for the river.

The Task Force will meet at least quarterly for the duration of the project. Some of these meetings will occur via conference call.

3. Citizen's Advisory Council

The Citizen's Advisory Council is composed of individuals who live or work within the Basin and who have a first-hand knowledge of pending management decisions regarding the river and its tributaries. This committee is responsible for channeling the concerns and desires of the public into the projects goals and tasks. The Citizen's Advisory Council shall advise the Governor through the project coordinator on the following areas:

a. Identification of Clark Fork Basin issues;
b. Development of the project work plan;
c. Prioritization of data needs; and
d. Identification of water management alternatives.

Meetings of the Advisory Council shall occur at least four times a year. All interested members of the public are encouraged to attend these meetings.

4. Steering Committee

The seven state agency directors listed on Table 1 will serve as the Steering Committee for the Project. This group will collectively give final approval to the project study plan and the expenditure of project funds on additional water-related studies within the Basin. Meetings of the Steering Committee will occur bi-monthly or more frequently when requested by a steering committee member or the project director.

D. Project Goals and Objectives

1. Primary Goal

Recognizing the importance of the Clark Fork River to the economy and quality of life of western Montana, northern Idaho, and eastern Washington; and recognizing that because of human activities, portions of the Clark Fork River are today below their resource potential or are threatened with further degradation--

The primary goal of the Clark Fork River Basin Project is to provide a Master Plan for maintaining and in some areas improving the quality of the Clark Fork River Basin's aquatic resources.

2. Specific Goals and Objectives

Goal 1: Analysis of the Quality and Trends in Quality of the Clark Fork River's Aquatic Resources.

Objectives

1. Assess, for the entire length of the river, the condition of the Clark Fork`s flow volumes, water quality, fisheries and other aquatic parameters that are impacted by human activities.

2. Identify and prioritize water-related issues and problems for all reaches of the Clark Fork River.

3. Identify specific pollutants that exceed existing water quality standards and determine the reduction in pollutant loading necessary to mitigate water quality problems.

4. Define water quality conditions for each river segment that will optimize biological productivity and which will provide for cultural, social and economic uses of the river.

5. Determine the economic value of the river in its present condition compared with its economic value at various levels of environmental improvements.

Goal 2: Determine feasible methods to maintain or enhance the quality of the Clark Fork River's aquatic resources.

Objectives

1. Identify and evaluate opportunities and tech-

niques for reclamation of specific sites or sections of the river basin affected by environmental damage.

2. Prepare a plan for systematically improving fisheries and other aquatic resources of the Clark Fork via improvements in water quantity, water quality, channel integrity and other habitat considerations.

3. With the assistance and consensus of the Interagency Task Force and the Citizen's Advisory Council, identify those studies most urgently needed to understand the dynamics of the Clark Fork River system and that will provide for the long-term monitoring needs of the basin.

4. Seek and provide funding for the above studies.

Goal 3: Develop a course of action and comprehensive plan to maintain and enhance the quality of the Clark Fork River's aquatic resources that can be implemented by government and industry decision makers.

To accomplish the goals and objectives outlined above the project coordinator and staff will be required to:

1. Coordinate the efforts of all agencies and individuals currently studying the Clark Fork River Basin.

2. Develop a comprehensive, integrated aquatic data base for the river basin.

3. To encourage active public participation when determining what additional studies should be

initiated and when prescribing management options for protecting or improving the aquatic resources of the basin.

E. <u>Anticipated Funding Sources</u>

Potential sources of funding for the project include:

-- Resource Indemnity Trust Tax Fund

-- Grants from the U.S. Geological Survey, EPA, and other Federal Agencies.

-- Grants from industries working within the Basin including: timber products, mining and agriculture.

The overall project budget will be developed by the project coordinator with input from the Interagency Task Force and the Citizen's Advisory Council. Budget approval will be the responsibility of the seven state agency directors that function as the Project Steering Committee. No general fund monies are anticipated to be spent on this project.

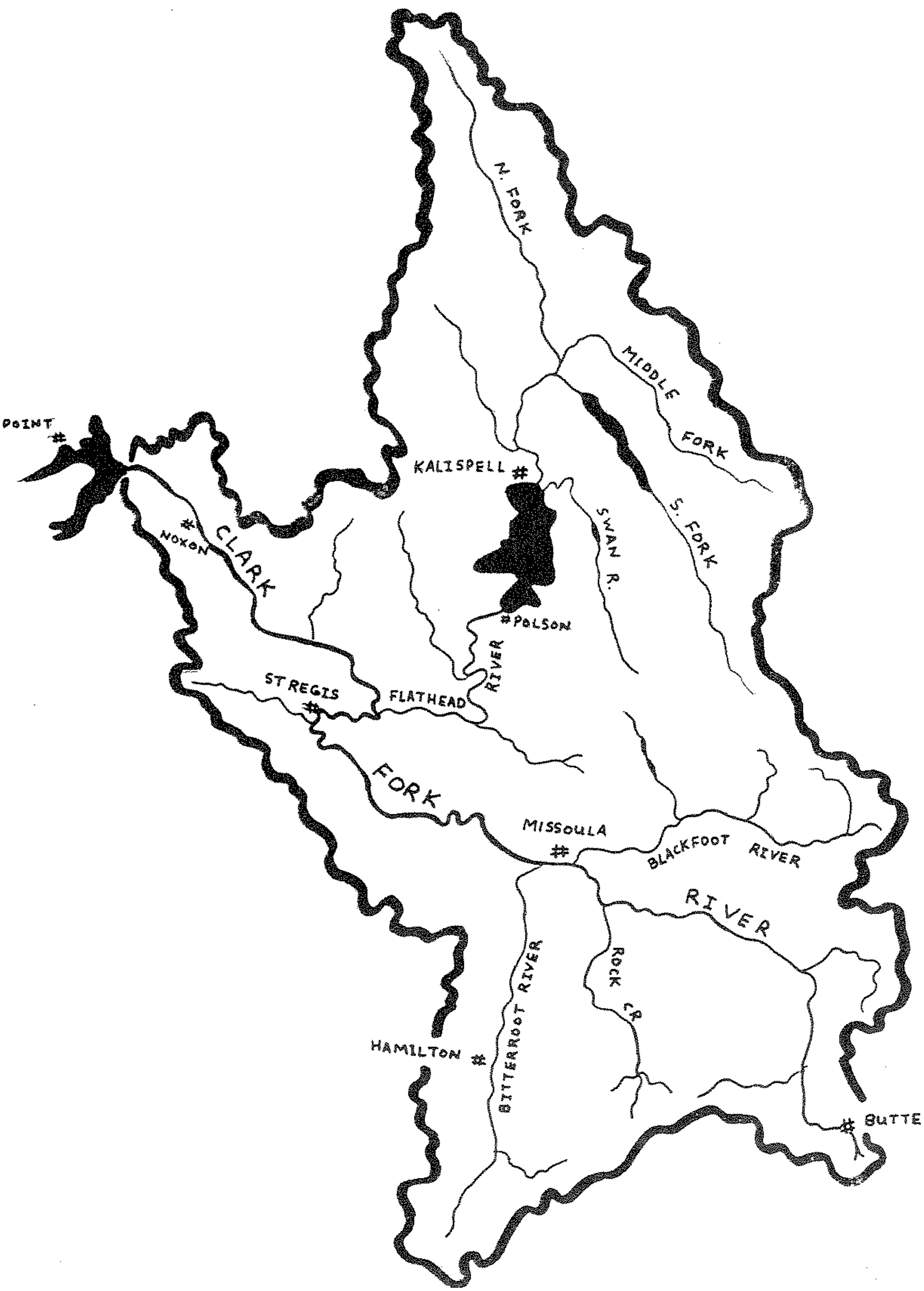
II. CLARK FOR RIVER BASIN
ENVIRONMENTAL IMPACTS AND EXISTING STUDIES

A. General Description of the Clark Fork River Basin

The Clark Fork River originates in the Deer Lodge Valley in west central Montana at the confluence of Silver Bow and Warm Springs Creeks. From its headwaters, the river flows north and west, draining most of Montana west of the Continental Divide as well as a small portion of northern Idaho--an area of more than 22,000 square miles. The Clark Fork River terminates at Lake Pend Oreille in northern Idaho, about seven miles west of the Montana-Idaho border (Figure 2). Major cities in the drainage include Butte, Anaconda, Deer Lodge, Missoula, Superior, Thompson Falls, Hamilton and Kalispell.

Near its origin, the river flows through broad, semi-arid valleys, but most of the basin consists of high mountain ranges and steep valleys. Dense coniferous forests occur throughout the basin ranging from alpine/subalpine stands in the higher elevations to fir, larch and pine stands along the lower ridges and valley bottoms. The latter are important sources of timber. The higher elevation forests, on the other hand, have important watershed values. Their canopies insure that snowmelt will occur over an extended period, which stabilizes the supply of clean water to the Clark Fork and its tributaries. The value of high country to the Basin's water supply is underscored by the fact that as much as 80 inches per year of precipitation falls (primarily as snow) here, compared to only 10-20 inches per year in the valley bottoms.

FIGURE 2. CLARK FORK RIVER BASIN



The Clark Fork is Montana's largest river with an average annual discharge rate of 22,380 cubic feet per second at the Montana-Idaho border. On the average, the Basin yields one cubic foot of water/second/acre (650,000 gallons/acre/day)--a rate five times greater than that of the Montana portions of the Missouri and Yellowstone Rivers.

More than 150 tributary streams join the Clark Fork including Rock Creek (near Missoula), Fish Creek, Flint Creek and the Little Blackfoot, Blackfoot, Bitterroot, St. Regis, Flathead, Thompson, Vermillion and Bull Rivers. The Flathead River, the largest tributary, contributes to more than half the total discharge at the Montana-Idaho border.

There are seven hydroelectric facilities within the Clark Fork River Basin:

> Flint Creek Dam is located at the outlet of Georgetown Lake,
>
> Milltown Dam is located on the Clark Fork immediately below its confluence with the Blackfoot River (just upstream from Missoula),
>
> Thompson Falls, Noxon Rapids and Cabinet Gorge Dams impound the lower sixty miles of the Clark Fork River in Montana,
>
> Kerr Dam is located four miles below the outlet of the Flathead River from Flathead Lake,
>
> Hungry Horse Dam is located near the mouth of the South Fork of the Flathead River.

With the exception of a small reservoir behind Milltown Dam, the Clark Fork is essentially free flowing for the first 250 miles of its length. Near Thompson Falls, however, the Clark Fork River changes in character from a river to a series of long narrow "lakes" as it runs its course through the Thompson Falls, Noxon Rapids and Cabinet Gorge Reservoirs. There are approximately seven miles of free flowing river between the Cabinet Gorge Dam and Lake Pend Oreille.

Pend Oreille is the largest lake in Idaho with a surface area of 148 square miles, The lake Basin is deep, averaging 538 feet with a maximum depth of 1,152 feet.

The forest products industry is presently the largest employer in the Basin. The public, whose lands are administered by the U.S. Forest Service, is the largest landowner. Private timber companies own substantial portions of the Blackfoot and Thompson River drainages. Many of the Basin`s lower elevation forests have been harvested. Plans to harvest steeper, higher elevation public lands raise serious questions about possible changes in water yield and increases in sediment loads to the river and its tributaries.

Hard rock mining has occurred extensively throughout the Basin. In addition to the past operations in the head waters at the "Richest Hill on Earth", two large mining ventures capable of employing 100-350 people are presently being planned. These are Montoro`s open-pit gold and silver mine on German Gulch near Butte and ASARCO`s underground copper and silver mine in the Rock Creek drainage near Noxon.

Hay and livestock are the primary agricultural products in the Basin. The Bitterroot Valley has historically been the Basin's most productive and diversified agricultural area. However, in the last two decades, the growth of rural subdivisions has drastically reduced the amount of land available for agriculture. This impact is not confined to the Bitterroot, since nearly all of the Clark Fork Basin's narrow valley bottoms have experienced an increase in the spread of "ranchettes" or second home developments.

Recreation, tourism and outfitting for big game hunting and fishing are among the fastest growing industries in the Clark Fork Basin. This is attributable to the attractions provided by the area's vast mountain panoramas, wildlife populations, clear mountain lakes and tributary streams, and unique outdoor recreation opportunities. But, degradation of water quality and fish habitat--especially in the mainstem of the Clark Fork River--limits the opportunity for growth in this industry. Fishing and other water-related recreation is far below its potential.

B. <u>General Information about Environmental Impacts Affecting Fish and Other Aquatic Life in the Clark Fork River Basin</u>.

Numerous human-related activities negatively impact fish and aquatic life in the Clark Fork River Basin. These activities also affect other beneficial water uses such as irrigation, stock watering and domestic water supplies. They may also affect the aesthetics or appearance of the water or stream channel.

In many instances, the human activities that impact the basin's water resources also affect the surrounding land. For example, mine tailings deposited upon flood plain pastures can reduce or eliminate hay or alfalfa production. Overgrazing by livestock or overharvesting of timber not only increase sediment yields to surface waters, but may also reduce total forage or timber production.

Trout and their associated "food chain" organisms are good indicators of the health of a stream. In fact, most of the water quality standards for the Clark Fork River system are based upon the needs of these sensitive species. Generally speaking, if viable trout populations are present, other beneficial uses of the river's water will also be protected. As such, when discussing categories of impacts to the Clark Fork River, special emphasis is given to the effects upon trout and other associated aquatic life.

There are eight major categories of impacts to these organisms in the Clark Fork River Basin:

1. Heavy metals (primarily copper, zinc, cadmium, iron and arsenic). Sources of these toxic elements are mine tailings, deposited by inactive ore extraction and smelting facilities in the headwaters of the basin.

2. Other Toxic Materials (ammonia, chloramines, organic acids, and pesticides). Ammonia and chloramines are found in sewage treatment plant effluents. Runoff from animal confinement facilities, irrigation return flows and Champion International's pulp mill effluent are also sources of ammonia. Pesticides are often found in runoff from agricultural lands or urban areas. Organic resin acids are components of Champion's effluent that are potentially toxic to organisms in the Clark Fork River.

3. Nutrients. The above sources of ammonia as well as runoff from areas disturbed by logging or grazing, are primary nutrient sources to the basin. Nutrients stimulate the growth of algae and other aquatic plants. If this growth becomes excessive, the night time respiration of these plants can lower the amount of oxygen available

for fish and other aquatic life. Human, animal and other organic wastes, when discharged into streams, can directly decrease the amount of available oxygen. Normal dissolved oxygen levels in pristine trout streams range from 7.0 mg/L (during summer nights) to 14.0 mg/L (in winter). The growth of trout is affected when dissolved oxygen levels drop below 7.0 mg/l. Exposure to levels below 3.0 mg/l can be lethal.

4. Stream channel modifications. Road construction or flood control activities (riprap and channel clearing) often remove overhanging vegetation, destroy undercut banks or displace midchannel boulders or logs, all of which provide hiding cover for trout. These modifications have led to a reduction in the amount of suitable fish habitat and accelerated erosion along portions of the Clark Fork and its tributaries.

5. Dams. Hydroelectric facilities and their associated reservoirs have impacted fish and other aquatic life in the Clark Fork Basin by:

-- blocking historical spawning runs,

-- inundating free-flowing stream channels, where trout were once able to naturally reproduce and trout food (aquatic insects) was produced in abundance,

-- altering natural stream discharge patterns, which causes periodic dewatering of spawning sites and affects sediment transport (the cleaning of bottom gravels), and

-- increasing dissolved nitrogen levels below spillways, which causes gas bubble disease or "popeye" in fish.

6. Insufficient streamflows (dewatering). Agricultural demands for water often approach or exceed the summer discharge rates of some streams or stream reaches in the basin. Fluctuating discharges from certain dams

may also dewater shallow "riffle" areas, desiccating developing trout eggs and aquatic insects.

Although dewatering may only be a seasonal or infrequent occurrence, its impact to a stream has year-round implications. If spawning or rearing areas for trout become dry for a few days or even hours, the resulting mortality to young-of-the-year individuals can remove an entire age class from the population. Dewatering can also increase the summer water temperature of streams and increase the concentration of pollutants.

7. Elevated water temperatures. Besides dewatering, another cause of increased water temperatures in tributaries of the Clark Fork is logging near or within riparian areas, which removes the shading canopy provided by trees. Instream temperatures above 66 degrees F. prevent the proper growth of trout and temperatures above 80 degrees F. are usually lethal.

8. Sedimentation. Sources of suspended silt to streams within the basin include improperly logged timber sales and their associated roads, poorly managed farms and ranches, irrigation return flows, placer mining and industrial and domestic waste discharges. When these small sediment particles settle onto the stream bottom, developing eggs, immature fish and vital food sources like aquatic insects can be suffocated.

III. ANALYSIS OF ENVIRONMENTAL IMPACTS AND STUDIES BY PROJECT AREA

A. Project Study Boundaries

The diverse characteristics and large geographical size of the area encompassed by the Clark Fork River Basin presents a variety of environmental problems. For the purposes of this project, seven distinct project areas or segments of the basin have been identified for special consideration. Although the project will consider basin-wide issues, the analysis of individual stream segments will focus on problems that are unique to those areas.

The seven project areas or stream segments that will be studied during the project are shown in Figure 3. The Flathead River Basin above Kerr Dam is not included in this study. The Flathead Lake and its drainage basin form a distinct aquatic ecosystem separate from the Clark Fork Basin. The area has been studied extensively and in 1983, the Flathead Basin Commission was established to coordinate water quality management programs in the basin.

B. Summary of Past and Ongoing Studies

The impacts just described in Chapter II have been or are being evaluated by numerous water resource investigations. Thus far, the Clark Fork River Basin Project has identified 50 studies that will provide useful information for the project's data base and reclamation Master Plan. These studies, numerically listed by study segment and arranged in approximate longitudinal distribution from the headwaters to Lake Pend Orielle, are summarized in Table 2.

FIGURE 3. CLARK FORK RIVER BASIN PROJECT STUDY AREA
Showing work segment boundaries

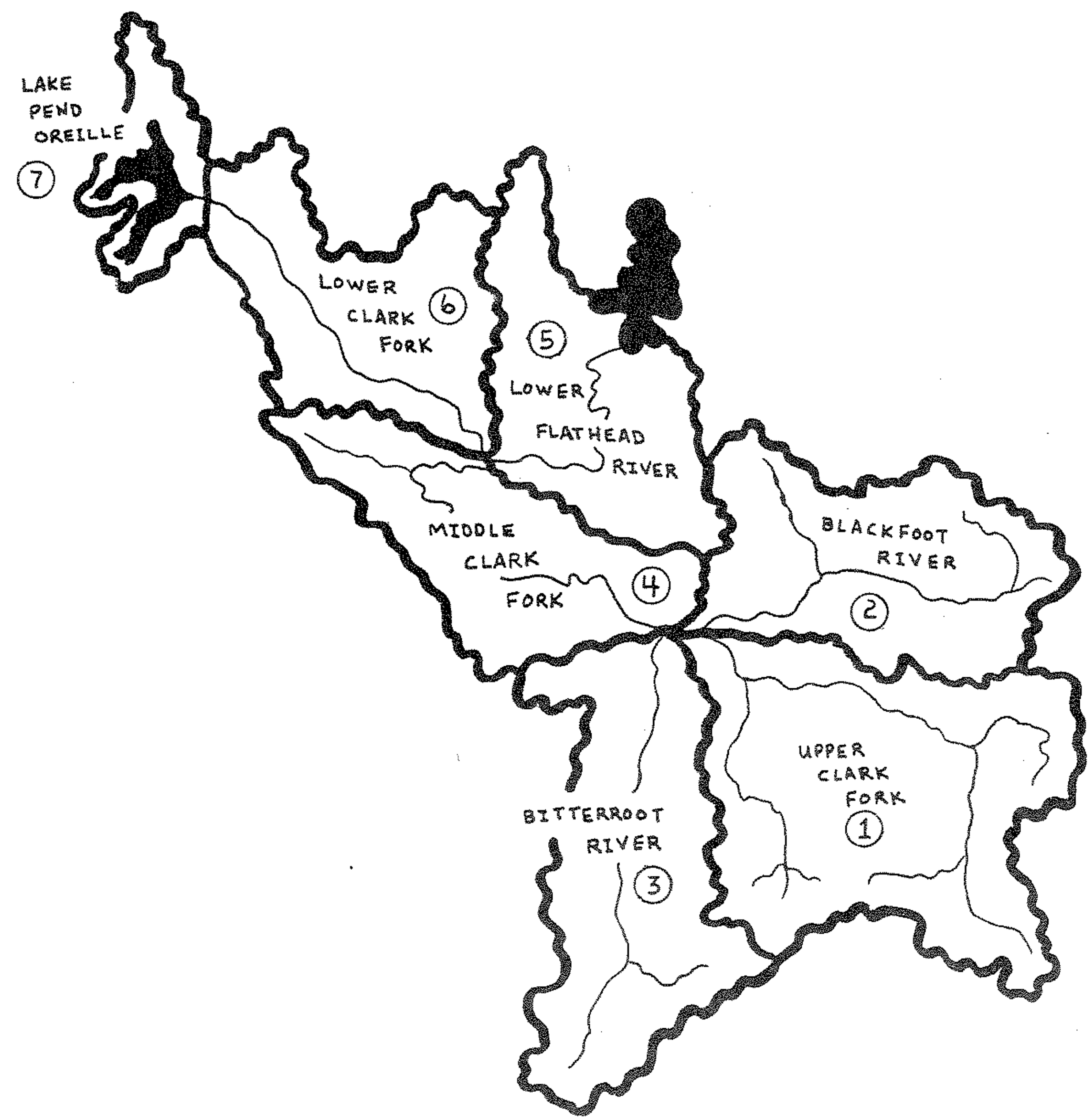


TABLE 2

SUMMARY OF RECENTLY COMPLETED OR ONGOING WATER RESOURCE STUDIES

IN THE

CLARK FORK RIVER BASIN

STUDY NUMBER	SEGMENT(S) STUDY SITE	PRIMARY GROUP	PRIMARY TOPIC/STUDY TITLE	OBJECTIVES	STATUS
1	1 Butte-Deer Lodge Watershed	AMC/ HYDRM	Rehabilitation of heavy metal impacts. "Summit and Deer Lodge Valley's Long-Term Environmental Study, Butte-Anaconda, Montana"	Determining the impact of mining and mineral processing operations on land and water resources in the upper Clark Fork River Basin	C 4/1983
2	1 Silver Bow Creek	MBMG	Reclamation of mine tailings. "Water Monitoring and Reclamation Construction Alternative for Colorado Tailings"	Characterize environmental problems (heavy metals mobilization) caused by the Colorado Tailings	O
3	1 Silver Bow Creek	MDSL	Reclamation of mine tailings. "Colorado Tailings Reclamation Design Studies"	Evaluate cleanup options and design reclamation plan for Colorado Tailings	O
4	1 Butte Area	MBMG	Contamination of ground water by heavy metals. "Intensive Butte Area Groundwater Monitoring"	Assess impacts to ground water caused by the shut down of Anaconda's Butte operations	O
5	1 Butte-Deer Lodge Watershed	MDHES SWMB	Remedial investigation of heavy metal contamination. "Butte-Silver Bow Creek Superfund Site Studies"	Describe the extent and severity of heavy metal contamination of Silver Bow Creek and the upper Clark Fork. Evaluate, select and design remedial action alternatives	O
6	1 Anaconda Opportunity Area	EPA/AMC TTRT	Remedial investigation of heavy metal contamination. "Anaconda Smelter Superfund Studies"	Describe the extent and severity of heavy metal contamination of both the smelter site and the Opportunity Tailings ponds	O
7	1 Butte-Walkerville Area	MDSL/ HYDRM	Reclamation of abandoned line lands. "Comprehensive Reclamation of Abandoned Hard Rock Mine Sites in the Urban Area of Butte and Walkerville, Montana	Phase I-Identify abandoned mine lands where clear threats to public health exist. Phase II-Prepare engineering plans for sites selected for reclamation.	C 3/1983 O

8	Silver Bow Creek, Upper CFR Gregson-Dempsey[1]	EPA	Evaluation of surface water and aquatic biology. "Site Specific Water Quality Assessment Silver Bow Creek and Clark Fork River, Montana"	Determine water quality and biological conditions of Gregson-Dempsey stream reach to determine conformance with existing water quality standards ("E" & "C-1" segments)	C 1983
9	German Gulch[1]	MDSL DFWP	Evaluation of fisheries and water quality. "Baseline Studies Associated with Montoro's German Gulch Mining Project"	Collect fisheries, aquatic insect and water quality data on German Gulch for use in EIS	O
10	CFR-Warm Springs Creek to Little Black-Foot River[1]	DHES/ WQB	Evaluation of surface water quality. "Upper Clark Fork River Monitoring"	Evalute treatment efficiency of Warm Springs ponds. Monitor changes in "C" reaches of river resulting from shutdown of Anaconda Mineral's operations.	O
11	Powell and Granite Counties[1]	USDA/ SCS	Location of soils contaminated by heavy metals.	Prepare maps that locate soils contaminated by heavy metals.	O
12	Deer Lodge Area[1]	USDA/ SCS MBMG	Reclamation of soils contaminated by heavy metals. "Reclamation Techniques for Heavy Metal Contaminated Pasture Lands in Deer Lodge, Powell and Silver Bow Counties"	Develop reclamation techniques that will not negatively impact surface and ground water resources of the area	O
13	CFR-Warm Springs to Garrison[1]	MSU	Evaluation of chemical changes and transport of copper. "Chemical Reactions Controlling Copper Transport in the Upper Clark Fork River, Montana"	Identify sources of copper currently found in the upper river, the mechanisms controlling their transport and evaluate the complexation capacity of the river waters	O

14	Deer Lodge Area[1]	NPS UM	Identification of heavy metal deposits. "Floral and Faunal Survey and Toxic Metal Contamination Study of the Grant Kohrs Ranch National Historic Site"	Describe the floral and faunal resources of the site. Identify the extent of severity of toxic metal contamination of soils and vegetation	C 5/1984
15	Headwaters to Drummond[1]	UM	Depostition of heavy metals in riparian areas. "Toxic Metal Enrichments from Mining and Smelting Operations in Riverside Sediments of the Upper Clark Fork"	Identify and evaluate heavy metal contamination of riparian sediments at four locations-Rocker, Racetrack, Garrison and Drummond	C 5/1984
16	CFR-Warm Springs to Drummond[1]	DFWP	Evaluation of heavy metal contamination of trout. "Liver Tissue Analysis of Metals in Fish from the Upper Clark Fork River"	Determine if heavy metals particularly copper and cadmium are accumulating in a major detoxifying organ	O
17	Silver Bow Creek,CFR Warm Springs to Phosphate[1]	AMC/ CHDW	Evaluation of macroinvertebrate populations. "Aquatic Biological Survey of Silver Bow Creek and Upper Clark Fork River"	Monitor changes in density and diversity of aquatic invertebrates. Yearly records, 1972-present.	O
18	Warm Springs Garrison[1]	AMC/ DFWP	Evaluation of heavy metals in fish tissue. "Heavy Metal Concentrations in Tissues of Brown Trout Collected from the Upper Clark Fork River"	Determine if trout in the Clark Fork above the Little Blackfoot River are safe for human consumption.	C 1983
19	Milltown Area[1]	UM	Contamination of ground water by heavy metals. "Hydrologic Survey of Milltown, Montana and Vicinity"	Determine groundwater flow patterns and identify the extent of apparent groundwater contamination	C 1982

20	1 Milltown Area	DHES/ SWMB UM	Remedial investigation of heavy metal contamination of reservoir sediments and associated groundwater. "Arsenic Source and Water Supply Remedial Action Study, Milltown, Montana" (Milltown Superfund Studies)	Determine extent and severity of heavy metal contamination. Evaluate alternative groundwater sources for contaminated drinking water supplies	C 7/1984
21	1 Milltown Area	DHES SWMB	Reclamation of heavy metals. "Feasibility Study of Heavy Metal Contamination of Reservoir Sediments and Ground Water"	Finalize endangerment assessment. Describe reclamation alternatives for sediment and ground water that are contaminated with heavy metals	O
22	1 Milltown Area	MPC	Rehabilitation/Reclamation of hydroelectric facility. "Milltown Hydroelectric Project Engineering Evaluation"	Evaluate reconstruction and retirement alternatives for a hydroelectric facility. The fact that the reservior's sediments are contaminated by heavy metals is a primary consideration	O
23	1 Entire Segment	DFWP	Evalutaion of fisheries resource and instream flow needs. "Instream Flow Reservation Studies-Upper Clark Fork River"	Determine instream flow needs for fish and wildlife. Correlate fishery, water quality data bases. Proceed with flow reservation application through DNRC Board.	O
24	1 Entire Segment	UM	Recreational use survey. "Recreational Use of the Upper Clark Fork River and Its Tributaries"	Provide baseline recreational user day information for the upper river.	C 6/1979
25	1 Entire Segment	DFWP	Economic evaluation of recreation. "A preliminary Estimate of the Value of Recreational Use of the Clark Fork and Its Tributaries"	Evaluate the economic value of the recreational industry for the upper Clark Fork River	C 1981

26	1 & 2 Entire Segments	DFWP	Investigation of fisheries resource. "Western Montana Fisheries Investigations, Upper Clark Fork River, Blackfoot River and Rock Creek" (Job Progress Reports)	Evaluate the status of fish populations, particularly trout, through fisheries surveys and population estimates. Also includes some water quality and temperature data.	O
27	1 & 2 Entire Segments	DHES/ WQB	Documentation of water quality conditions. "Water Quality Inventory and Management Plan, Upper Clark Fork River Basin, Montana"	Delineate water quality and water quality-related problems in the basin with particular emphasis on point sources of pollutants	C 7/1975
28	2 Entire Segment	DFWP	Documentation of baseline fishery and water quality. "Upper Blackfoot River Study-A Pre-mining Inventory of Aquatic and Wildife Resources"	Describe existing fish, wildlife and water quality resources of drainage in response to a proposed mining operation in the headwaters	C 1974
29	2 Headwater Streams	UM	Evalutaion of heavy metal impacts to aquatic community. "Impact on the Aquatic Ecosystem by Mining in the Mike Horse Area, Heddleston Mining District, Montana" (Upper Blackfoot River)	Determine the impacts to aquatic invertebrate and periphyton communities from acid mine drainage	C 6/1978
30	3 Entire Segment	BPA DFWP	Evaluations of dewatering impacts upon fishery. "Evaluation of Management of Water Releases for Fisheries from Painted Rocks Reservoir Bitterroot River, Montana"	Evaluate affect of dewatering on fish populations. Develop a water management plan to optimize use of limited water through timed discharges from Painted Rocks Reservior	O
31	4 CFR, from Bitterroot River to Nine-mile Creek	CIC/ IPC	Evaluation of macroinvertebrate populations. "A Benthic Invertebrate Water Quality Survey of the Clark Fork River in the Vicinity of Missoula"	Monitor changes in density and diversity of aquatic invertebrates yearly records 1956-present	O

32	4 Champion Internat-ional Mill Site	CIC/ Weston	Evaluation of waste treatment alternatives. "Alternative/Additional Methods of Treatment to Improve the Quality of Discharge from Champion International's Frenchtown, Montana, Kraft Paper Mill"	Identify and review applicable treatment technologies with respect to their cost effectiveness, environment benefits and current level of adaptation within the industry	O
33	4 Entire Segment	DFWP	Investigation of fisheries resource. "Evaluation of the Effects of Pulp and Paper Mill Effluent on the Fish Population of the Middle Clark Fork River"	Determine numbers, biomass and condition of trout populations monitor suitability of gravels for trout egg survival evaluate heavy metal accumulation in crayfish	O
34	1 & 4 Warm Springs to Alberton	SCS	Inventory of stream banks and channel. "Clark Fork of the Columbia River Natural Resource and Physical Features Inventory"	Determine the percentage of the river's channel and banks that have been altered by human activities	C 1983
35	1 & 4 Warm Springs to St. Regis	USGS	Investigation of heavy metals content of sediments and aquatic insects. "Analysis of Clark Fork River Sediment for Trace Metal Content"	Determine the longitudinal distribution of heavy metals in the sediment and macroinvertebrates of the Clark Fork River (Sta. established at 3-5 mile intervals from Warm Springs to St. Regis)	O
36	5 Entire Segment	BPA CSKT	Investigations of fisheries resource. "Lower Flatehad Fisheries Study"	Assess the effects of Kerr Dam on the trout and Northern Pike fisheries. Determine numbers, biomass and movements of fish populations. Evaluate suitability of mainstem and tributaries for spawning and recruitment	O
37	3-6 Entire Segments	DHES/ WQB	Documentation of water quality conditions. "Water Quality Inventory and Management Plan, Lower Clark Fork River Basin, Montana"	Delineate water quality-related problems in the basin with particular emphasis on point source or pollution	C 7/1976
38	6 Lower River Reserviors	UM	Investigation of heavy metal content of sediments. "Determination of Heavy Metal Contamination in Reservior Sediment Along the Clark Fork River"	Determine heavy metal concentrations in sediments of Thompson Falls, Noxon Rapids and Cabinet Gorge Reserviors	O

39	6 Noxon Area	MDSL	Evaluation of fisheries and water quality of Rock Creek. "Baseline Studies Associated with ASARCO's Rock Creek Project"	Collect fisheries, aquatic insect and water quality data on Rock Creek for use in EIS	O
40	6 Lower River Reservoirs	WWP UI	Investigation of fish and other aquatic life. "Fishery Studies on Noxon Rapids and Cabinet Gorge Reserviors"	Conduct biological surveys	O
41	6 Lower River Reserviors	DFWP	Investigation of fisheries resource. "Noxon Rapids-Cabinet Gorge Reservior Studies" (Job Progress Report)	Evaluate the status of fish populations through creel census and gill netting surveys	O
42	6 Lower River Reserviors	DFWP	Investigation of fisheries resource. "Northwest Montana Fisheries Investigations"	Evaluate the status of fish populations through fisheries surveys and population estimates	O
43	1-6 (Particu- larly 4 & 6)	DHES WQB	Evaluation of water quality bottom sediments and biota. "Lower Clark Fork River Monitoring"	Establish a water quality, periphytion, aquatic insect and bottom sediment baseline for the middle and lower river. (Also includes sampling of major tributaries at their mouths)	O
44	7 Pend Oreille Lake	IFG	Investigation of fisheries resource. "Pend Oreille Lake/Clark Fork River Fisheries Studies"	Estimate size and age specific survival of Kokanee populations. Describe relative distribution and abundance of juvenile salmonids. Estimate escapement of bull trout in key spawning areas.	O
45	7 Pend Oreille Lake	EPA	Evaluation of nutrient enrichment. "Algal Assays-Lake Pend Oreille"	Determine nutrient(s) limiting phytoplankton productivity	O

46	7 Pend Oreille Lake	IDHW WQB	Evaluation of water quality. "Lake Pend Oreille Water Quality Study"	Define baseline flow sediment, nutrient and heavy metal contributions for the lake by the Clark Fork River. Assess ambient limnological conditions of the lake.	O
47	1-7 Portions of all segments	USGS	Investigation of water quality and stream discharge conditions. "Historical Streamflow and Water Quality Data for the Clark Fork River Basin"	Monitor baseline water quality and stream discharge conditions	O
48	1 Upper CFR	USGS	"Quantification of Annual loads of trace metals and suspended Sediment in the Clark Fork River from Deer Lodge to Turah"	Monitor suspended sediment daily at Deer Lodge and Turah. Monitor heavy metals periodically at these stations and at four major tributaries.	O
49	3 Entire basin	UM	"Sediment, Channel Morphology and Streamflow Characteristics of the Bitterroot River Drainage Basin, Southwestern Montana"	Describe the fluvial processes and geomorphology of the basin	C 1984
50	3 Entire basin	DNRC	"A Feasibility Study for a Streambank Stabilization Program for the Bitterroot River, Montana"	Propose a generalized program to stabilize streambanks. (No specific or site-specific recommendations were made.)	C 1981

C. Segment-Specific Analysis of Impacts and Studies

Chapter IV will discuss the relationship of studies to impacts for each of the seven project areas. These project area descriptions will begin with a statement about the general status of the water quality and fishery, followed by a summary of environmental impacts. The relationship of the studies enumerated and listed in Table 2 to presently identified impacts will be discussed, along with an identification of any further information needs.

The information contained in the project area discussions was gathered from a variety of completed or ongoing studies. The primary sources of information on water quality and water quality related issues are the, "Water Quality Inventory and Management Plan" reports prepared by the Montana Water Quality Bureau (WQB) in 1975-1976. These basic data reports are supplemented by the WQB's biennial assessment of water quality (305-B) reports. Information has also been derived from university studies and other sources described in Table 2 and from consultations with researchers and citizens working or living in the basin.

IV. PROJECT AREAS

PROJECT AREA 1

Clark Fork River above the confluence of the Blackfoot River (Upper River Segment)

The discussion for this segment will focus on the Clark Fork mainstem and its tributaries below the confluence of Warm Springs and Silver Bow Creeks--the designated headwaters of the Clark Fork. The reclamation and monitoring efforts above Warm Springs Creek in the vicinity of Butte and Anaconda are primary objectives of Studies 1-9.

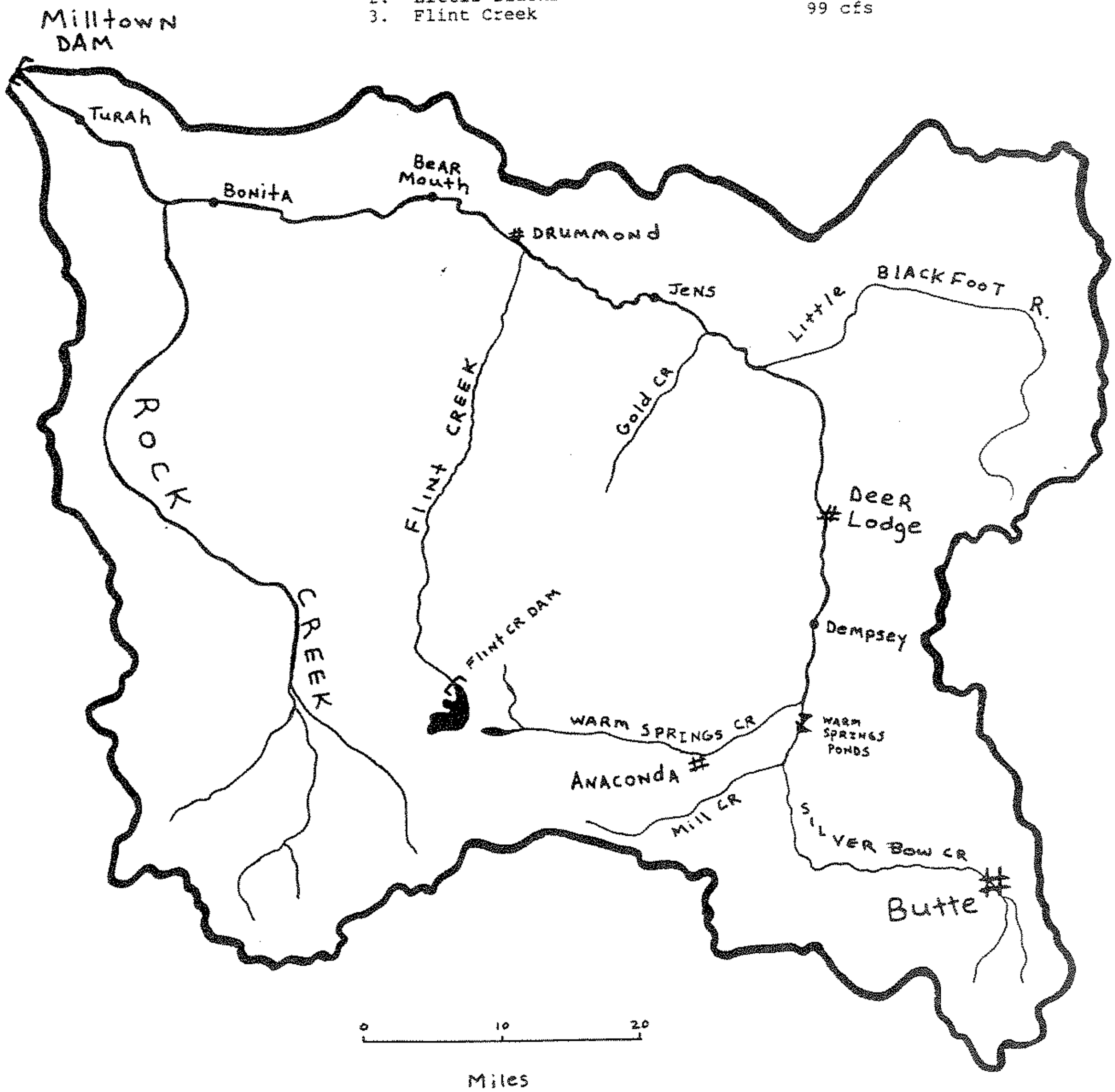
A. General Status of the Water Quality and Fishery

The upper Clark Fork River is a poor quality stream. Less than 400 trout/mile are found in most of this segment, with the exception of a small reach just below Warm Springs Creek. In the worst case--the 20 mile stream reach from Bearmouth to the confluence of Rock Creek-only about 50 trout/mile are found. Whitefish are also uncommon in the mainstem. Most tributaries are of high quality. Rock Creek is a "blue ribbon" trout stream with trout population estimates averaging over 1500 fish/mile.

The upper river is beset with a variety of impacts to fish and other aquatic resources. Heavy metal toxicity is the most significant problem, followed by stream channel modifications, nutrients and dewatering. Other impacts include elevated stream temperatures, toxic compounds (particulary ammonia) and dams.

SEGMENT 1 -- Clark Fork River above the confluence of the Blackfoot River (Upper River Segment)

A.	Drainage Area of Segment	3,700 Mi2
B.	Average Annual Discharge	1,397 cfs
C.	Major Tributaries and their Average Annual Discharge	
	1. Rock Creek	616 cfs
	2. Little Blackfoot River	190 cfs
	3. Flint Creek	99 cfs



B. Summary of Environmental Impacts

1. Heavy Metals. The headwaters of the Clark Fork River was the center for mining activities in Montana from the mid-1800`s until the cessation of the Anaconda Mineral Company's operations in the early 1980's. Due to the magnitude of the mining wastes generated by these activities, the upper river was essentially devoid of fish and other aquatic life for nearly a century. Today, despite nearly three decades of waste treatment efforts by the Anaconda Company, substantial portions of the river's floodplain are still contaminated by mine tailings. During high water, these tailings are eroded and re-suspended, causing heavy metal concentrations in the river to exceed water quality criteria for protection of aquatic life.

Besides the obvious impacts to fish and other aquatic life, several thousand acres of agricultural land have been taken out of production by these deposits. Heavy metals have also accumulated in the sediments of Milltown Reservoir. From here, they have leached into the ground water, causing the contamination of wells supplying drinking water to residents of the community of Milltown.

2. Stream Channel Modifications. The banks and channels of the upper river have been altered by the construction of two major highways and railroads. These impacts are most apparent in the reach from Garrison to Jens and from Drummond to Turah. The Little Blackfoot River has also been impacted by landowners attempting to alter the course of the stream within its narrow floodplain.

3. Nutrients. The primary point sources of nutrients to the upper river are domestic waste discharges from the cities of Butte, Anaconda and Deer Lodge. Non-point

sources from logged areas and agricultural lands also occur. The latter are more diffuse and are not confined to any particular reach of the mainstem or its tributaries. The effects of these wastes are most noticeable during summer, when dense concentrations of benthic algae, particularly filamentous mats of Cladophora, almost totally cover the stream bottom. Dissolved oxygen values as low as 5.2 mg/L have been measured during summer in the river immediately above Rock Creek.

4. Dewatering. Although presently not a significant problem in the mainstem, many of the upper river's tributaries are severely dewatered by agricultural withdrawals during summer. These include: Racetrack, Dempsey, Cottonwood, Tin Cup Joe, Warm Springs and Flint Creeks, as well as the lower portion of the Little Blackfoot River. The periodic dewatering of spawning areas in these tributaries has an effect on trout recruitment for the upper portion of this segment.

5. Elevated Water Temperatures. Irrigation water withdrawals in the Deer Lodge and Drummond Valleys increase summer water temperatures in the Clark Fork mainstem. Maximum daily water temperatures often exceed 66 degrees F. from June through August. However, maximum water temperatures on the Clark Fork are not as high as those recorded in other highly productive trout streams like the Madison and Big Hole Rivers. Elevated summer water temperatures, by themselves, are therefore not a likely cause of the depressed trout fishery of this segment. Rather, this condition contributes to the overall problem because the toxicity of heavy metals is directly proportional to increases in water temperature. Also, as water warms, its ability to hold oxygen in solution decreases.

6. Other Toxic Materials. Ammonia, originating primarily from the cities of Butte, Anaconda and Deer Lodge, at times approaches criteria levels in the upper portion of the river. Fish kills, related to the improper application of pesticides also have occurred in some tributary streams.

7. Dams. The Flint Creek Dam has an effect on the flow regime of Flint Creek. Irrigation dams along the east face of the Flint Creek Range alter the discharge rates of several upper river tributaries including Dempsey, Tin Cup Joe, Racetrack, Willow and Rock Creeks (the latter two streams enter the Clark Fork near Garrison).

On the mainstem, Milltown Dam blocks the upstream migration of fish, but its small, sediment-choked reservoir has little influence on the flow regime of the Clark Fork River.

8. Sediment. Runoff from overgrazed rangeland and improperly conducted timber harvests adds sediment to the upper Clark Fork and its tributaries. Past and ongoing placer mining operations on Gold Creek, Flint Creek, Bear Gulch and other small streams also add sediment to the drainage.

C. Present Information

1. Water Quality Monitoring. Many different studies and reports have provided water quality data and related information for the upper Clark Fork River Basin (Studies 5, 8, 10, 13, 23 , 35, 43 and 47). But, only a few (5, 10, 43 and 40) are presently collecting samples on a regular basis. Water samples for heavy metal analyses are being collected monthly from the mainstem at Warm Springs, just above the Little Blackfoot River, Deer Lodge and Turah. The latter two stations are also being sampled for ammonia and nutrients. Silver Bow Creek, Warm Springs Creek, Flint Creek, Rock

Creek, the Little Blackfoot River, the pond 2 discharge, and Mill-Willow by-pass are being sampled monthly (at their mouths) for heavy metals. The USGS is collecting daily suspended sediment samples at Deer Lodge and Turah (Study 48).

2. Other Heavy Metal Studies. Many studies in this project area address the distribution, transport and fate of heavy metals associated with sediments in the stream channel and floodplain (Studies 1, 5, 6, 11, 13, 14, 15, 19, 20, 21, 35 and 43). Most of these studies have collected samples on a scattered or localized basis. The exceptions are studies 1 and 5 which map tailing deposits throughout the floodplain from Warm Springs to Deer Lodge, and Study 35 which is analyzing bank and channel sediments at three-to-five mile intervals throughout the study segment. This latter study will provide a cursory evaluation of the longitudinal distribution of heavy metals in channel and streambank sediments, but not at the level of detail provided by studies 1 and 5.

The methods for reclaiming areas contaminated by heavy metals is addressed by Studies 1, 5, 12, 20, 21 and 22. These studies are primarily associated with the basin's three Superfund sites at Butte, Anaconda and Milltown. An exception is Study 12 which is investigating reclamation techniques for metal contaminated pastureland in the Deer Lodge Valley. There are no studies directly addressing the reclamation of streambanks that are contaminated by mine tailings below Warm Springs Creek.

Previous studies have demonstrated that trout in the Clark Fork near Warm Springs and Deer Lodge and in the lower portion of Little Blackfoot River are safe for human consumption (Study 18). Additional studies are now underway to evaluate the effect of heavy metals on the physiology of brown trout (Study 16). The heavy metal content of invertebrates collected from seven locations between Warm Springs and Milltown will be determined as a part of Study 35.

3. Stream Channel Modifications. Human impacts to the channel and banks of the mainstem are reported in Study 34. Aerial photographs (1"=250') of the entire segment were taken on April 15, 1981. Specific erosion sources and streambank alterations were verified by field investigations. This information was recorded on the aerial photographs, which are available for review at the Phillipsburg, Deer Lodge and Missoula Soil Conservation Service offices.

4. Dewatering. The impacts of dewatering to the trout fishery are discussed in Study 23. Included in this report are data on water surface profiles, stream gauging records, trout populations and water quality, all of which lead to a rationale for the instream flow needs of the fishery. Stream gauging records are available at four mainstem and four tributary sites (Study 47).

5. Stream Temperature Monitoring. Water temperatures have been continuously recorded at Deer Lodge and Bonita from 1979-1983 (Study 47). These data have also been collected at the following locations (Study 26):

a) Bearmouth and Bonita from July 1976 - March 1983
b) Gold Creek from July 1976 - May 1981
c) Turah, 1979-1980

Rock Creek is the only tributary in this project area with continuously recorded (1979-1983) water temperature information (Study 47). Some temperature data for this station was also collected by Study 26.

6. Fish Populations and Other Biota. Fish population estimates have been determined at the following sections on the mainstem (Study 26):

a) PH Shack (near Warm Springs)	1967-Present
b) Sager Lane (near Dempsey)	1981-1982
c) below Deer Lodge	1967-Present
d) Phosphate (near Gold Creek)	1978-Present
e) Bearmouth	1979
f) Bonita	1979-1980
g) Turah	1979-Present

Fish population estimates have also been conducted on the following tributaries:

Rock Creek (3 sections), Little Blackfoot River (2 sections), Flint Creek (2 sections) Warm Springs (2 sections), Gold Creek, Race Track Creek and Dempsey Creek.

The Anaconda Minerals Company has monitored aquatic invertebrate populations at Warm Springs, Deer Lodge and Phosphate once per year since 1972 (Study 17). The Water Quality Bureau is collecting aquatic invertebrates and periphyton at Turah three times per year (Study 43). Some additional biological samples were obtained for the Clark Fork River at Warm Springs and Dempsey in 1982 (Study 8). The EPA will be conducting a 30-day trout bioassay of the upper river's water near Deer Lodge in May, 1985. Algal assays (Study 43) and bioassays, using Ceriodaphnia as a test organism will be conducted at several stations between Butte and Milltown during the Spring and Summer of 1985.

7. <u>Economic Evaluations.</u> A survey of recreational uses of the upper Clark Fork River and tributaries was conducted by University of Montana in 1979 (Study 24). An economic analysis of the recreational use in this project area suggests that recreational related industries are below their potential due to degraded water quality and a limited sport fishery (Study 25).

D. <u>Information Needs</u>

1. There is a notable lack of water quality information both from past and ongoing studies in the mainstem from the Little Blackfoot River to Rock Creek. Since this reach contains the lowest density of trout in this project area, additional water quality data are needed to assess potential impacts on fish populations.

2. Given that streamside deposits of heavy metals are believed to contribute to violations of water quality criteria during high water, more detailed information on quantities and locations of sediment deposits are needed. The mapping efforts in studies 1 and 5 should be extended to include the entire mainstem to Milltown Dam.

3. Streambanks that are contaminated by tailing deposits are very unstable and largely unvegetated. As such, they are sources of metals to the river during high flow periods. Stabilization techniques for these areas need to be developed and their applicability for use in other parts of the river basin assessed.

4. In order to better understand the effects of heavy metals on trout populations, additional data is needed from two stream reaches on the mainstem:

a) Drummond to Rock Creek
Information collected in 1979 and 1980 from the Bearmouth and Bonita sections demonstrated that this portion of Segment 1 contains extremely low trout populations (less than 50 trout/mile). More data is needed to confirm and better quantify these results.

b) PH Shack to Sager Lane
The excellent trout populations at the PH Shack section (1500-2000 trout/mile) drop very rapidly to about 400 trout/mile at Sager Lane (near Dempsey). Additional fish population estimates are needed in the twelve-mile reach between these sites to determine if this population change is gradual or abrupt. Potential impacts to the fishery such as stream-side mine tailing deposits or lack of suitable habitat should be noted and correlated, if possible, to the trout population values.

5. Sampling efforts for aquatic insects should be expanded to include, as a minimum, those stations being sampled for trout populations. It is not presently known if the diversity or abundance of these food chain organisms is as depressed as the trout fishery, particularly in the Bearmouth to Rock Creek portion of the mainstem.

6. A regional model is needed to assess the recreational value of the entire Clark Fork River Basin. Ideally, this economic model should address not only the present condition of the recreational industry, but should also project how different levels of reclamation would affect the economy of the region.

PROJECT AREA 2
Blackfoot River

A. General Status of the Water Quality and Fishery

The Blackfoot River is generally a very high quality stream. It is the most heavily floated river in west-central Montana and is a class I trout stream downstream from the confluence of the Clearwater River. Approximately 2500 trout/mile are found in sections near Lincoln and Johnsrud Park. The latter section is about ten miles above the confluence with the Clark Fork River near Bonner. Rainbow trout are the dominant sport fish, but native populations of bull trout are found throughout the mainstem and in many tributaries. Whitefish are relatively uncommon when compared to the trout populations of the Blackfoot.

Increases in suspended and bedload sediments are believed to be having the greatest impact on fish and aquatic resources in the Blackfoot River drainage. This impact is most pronounced in the tributary streams that provide spawning and rearing areas for the river's trout populations. Other impacts include heavy metals, nutrients and dams.

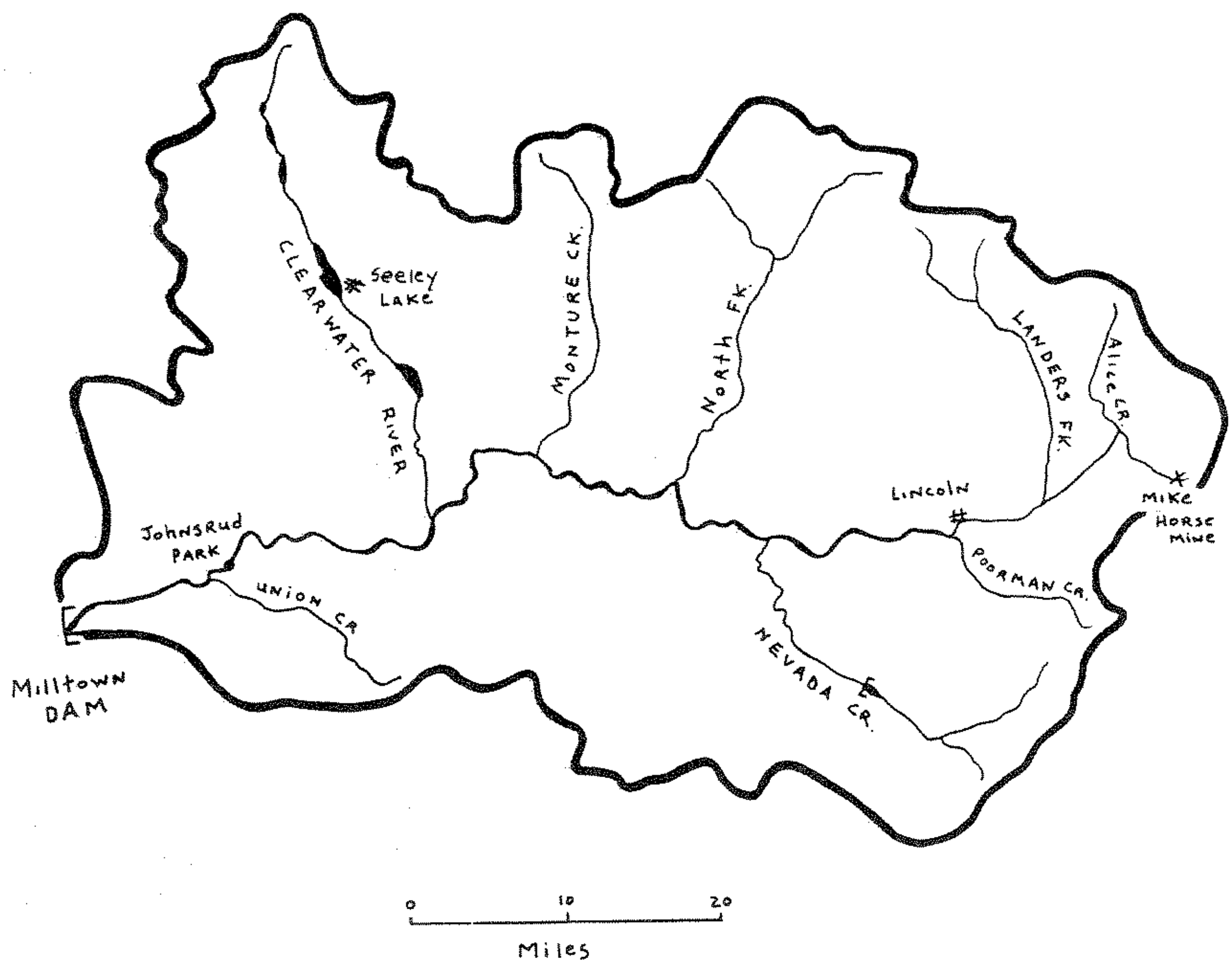
B. Summary of Environmental Impacts

1. Sedimentation. Diffuse runoff from agricultural croplands and overgrazed ranges adds excessive sediment to Union, Douglas and Camas Prairie Creeks (the Potomac Valley Area) and to Nevada Creek. Placer mining along Elk Creek contributes sediment to the Blackfoot River. Washington Creek, a tributary of Nevada Creek, has also been recently impacted by placer mining.

SEGMENT 2 -- Blackfoot River

A.	Drainage Area of Segment	2,300 Mi2
B.	Average Annual Discharge	1,658 cfs
C.	Major Tributaries and their Average Annual Discharges	

1.	Clearwater River	305 cfs
2.	Landers Fork	250 cfs (est)
3.	North Fork	150 cfs (est)



Sediment originating from past logging activities enters several of the river's tributaries, most notably the Landers Fork and two tributaries of Nevada Creek (Mc Elwain and Braziel Creeks). During runoff periods, a plume of muddy water is visible in the Blackfoot River for several miles below the confluence of the Landers Fork.

According to Forest Plans being prepared by the Lolo and Helena National Forests, timber harvesting and road construction on public lands in the Blackfoot River drainage will continue at present levels or increase over the next few decades. Grazing levels on U.S. Forest Service lands are also expected to be maintained at current levels or increased. The Forest Plans acknowledge that both of these activities, and particularly the timber harvests, will increase the amount of sediment that is discharged into some streams by 100 - 200 percent.

2. Heavy Metals. The headwaters of the Blackfoot River are impacted by acid-mine waste and tailings from the old Mike Horse Mine. The tailings problem was stabilized in 1975 when the Anaconda Company rebuilt the dam that impounds the mine's waste dump, but the mine's adit discharge into Bear Trap Creek remains unabated. Impacts to the river's biota from this abandoned operation are measurable until the confluence of Alice Creek, about ten miles downstream of the mine.

3. Nutrients. Agricultural runoff contributes nutrients to Union Creek, Camas Prairie Creek and Nevada Creek. Several thousand head of cattle are wintered along these streams. Domestic sources of nutrients are minor, since the human population density of the Blackfoot River Basin is the lowest of the seven project study areas.

4. Dams. The Nevada Creek irrigation dam blocks the upstream migration of trout from the Blackfoot River. It also regulates the discharge pattern of lower Nevada Creek.

C. Present Information

1. Suspended Sediment Monitoring. Very little suspended sediment information is available for the Blackfoot River drainage. One station near the mouth is being sampled monthly for total suspended solids (Study 43). A cursory evaluation of potential sediment sources in the basin has been conducted (Study 28), but the samples were analyzed for turbidity rather than suspended solids.

2. Other Water Quality Monitoring. Monthly samples for heavy metals, nutrients and other basic water quality parameters (hardness, alkalinity, pH, etc.) are being collected near the mouth of the river (Study 43). The USGS is also sampling this station monthly for heavy metals (Study 48). One study has examined the impact of heavy metal and acid-mine discharge on the biota of streams in the headwaters of the Blackfoot River (Study 29).

3. Fish Populations and Other Aquatic Biota. Annual estimates of fish populations on the Blackfoot River at Johnsrud Park have been conducted since 1980. A population estimate was also made on the river near Lincoln in 1972. Several tributary streams have also been surveyed for the presence or absence of trout species, but numerical estimates of density are not available.

Periphyton and aquatic insects were sampled at eight locations on Bear Trap and Anaconda Creeks and at one site on the Blackfoot River just below the confluence of these streams (Study 29). The Water Quality Bureau is presently sampling for these same organisms three times per year upstream from the mouth of the river (Study 43).

D. Information Needs

1. Present suspended sediment levels of streams within the Blackfoot River Drainage are largely unknown. Intensive surveys of suspended sediments in streams already affected by logging activities are lacking. These data are needed to assess actual and potential impacts to the trout fishery.

2. To complement the suspended sediment study proposed for this segment, fish population estimates should be conducted on several tributaries. The suitability of these streams as spawning and rearing areas for bull trout should also be assessed.

PROJECT AREA 3
Bitterroot River

A. General Status of the Water Quality and Fishery

The water quality of the Bitterroot River is good. Most of the tributary streams draining the west half of the basin originate within the Selway-Bitterroot Wilderness Area and the East Fork originates in the Anaconda Pintlar Wilderness. Estimates of trout populations in the mainstem near Darby average about 1000 trout/mile. Growth rates of Rainbow trout in the Bitterroot River area among the highest in Montana. Whitefish are common, although no estimate of their numbers has been made.

Dewatering is the most significant impact to the fish and aquatic resources of this segment, followed closely by streambank and channel modifications. Non-point sources of nutrients and sediment (particularly intergravel deposition of small diameter particles and bedload movement) are impacts that have not been quantified.

B. Summary of Environmental Impacts

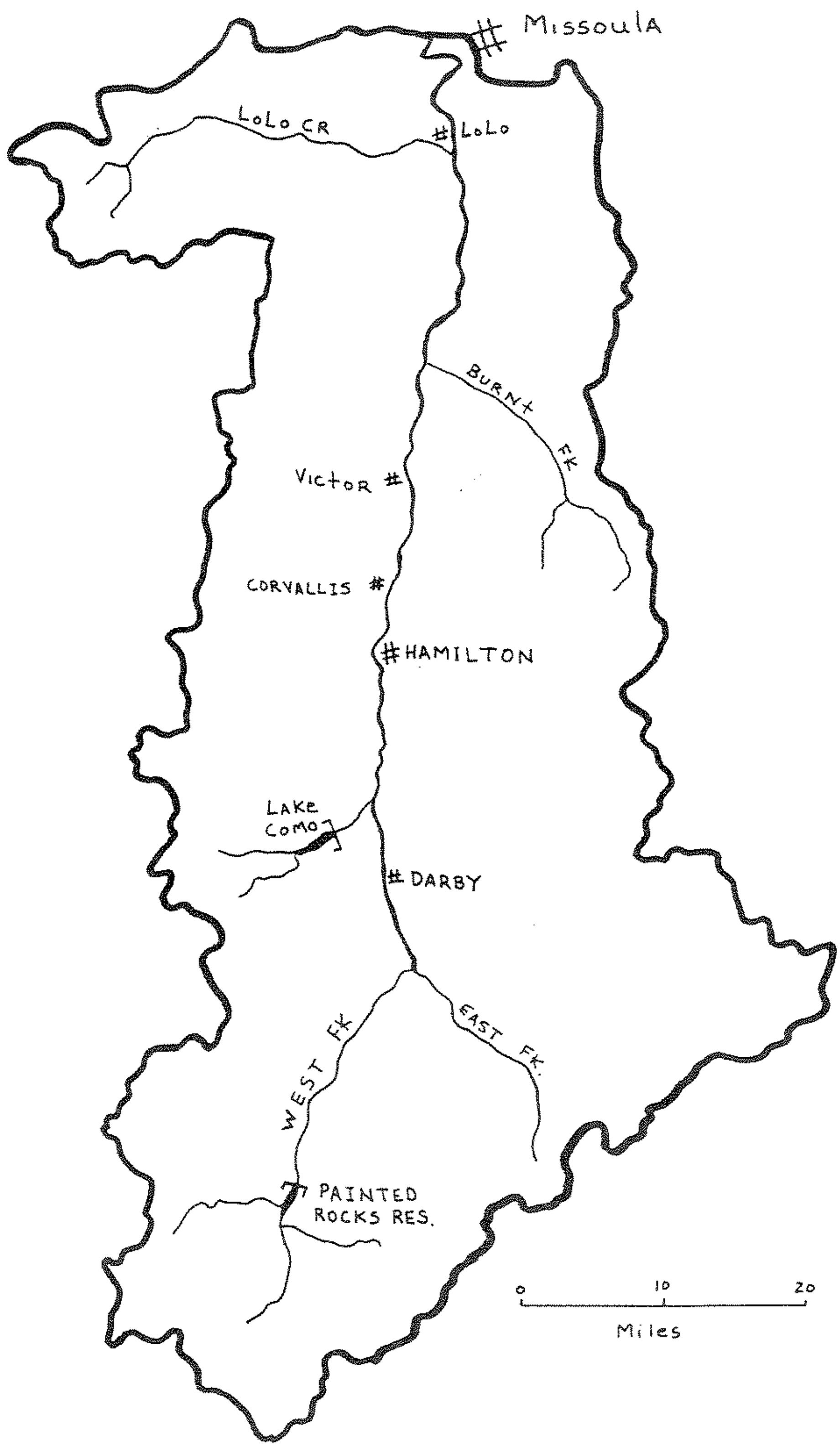
1. Dewatering/Dams. Irrigated agriculture is extensively practiced throughout the valley bottoms of the Bitterroot Basin. As a consequence, the natural summer discharge rates of many tributaries and portions of the mainstem are severely reduced. The river reach from Hamilton to Victor is almost completely dewatered during some summers.

Two major irrigation storage projects, Painted Rocks Reservoir and Lake Como, significantly alter the flow regime

SEGMENT 3 -- Bitterroot River

A.	Drainage Area of Segment	2,800 Mi2
B.	Average Annual Discharge	2,490 cfs
C.	Major Tributaries and thier Average Annual Discharges	

1. West Fork — 288 cfs
2. East Fork — 250 cfs
3. Lolo Creek — 150 cfs (est)



of the Bitterroot River. In an effort to mitigate the river's dewatering problem, two conservation groups--the Ravalli County Fish and Wildlife Association and the Western Department of Fish and Game Association, along with the Montana Department of Fish, Wildlife and Parks have jointly purchased 5,000 acre-feet per year of water from the Painted Rocks Reservoir. Efforts are also underway to secure an additional 10,000 acrefeet per year of Painted Rocks' water.

2. Stream Channel Modifications. Much of the farmland as well as houses and other buildings are located within the broad floodplain of the Bitterroot River. Landowners, in an attempt to protect these lands and buildings from spring flooding, have riprapped extensive portions of the mainstem and its tributaries.

Modifications to stream channels have also occurred in response to reduced summer streamflows. As available water becomes scarce in late summer, irrigators are forced to put headgates and other diversion structures further into or directly alongside the natural stream channel. In the Bitterroot Basin most of the material used for riprap and other structures is composed of uniformly-sized gravel or rock, which provides little or no habitat for trout.

3. Sedimentation. The Bitterroot mainstem and the lower portions of its major tributaries flow across extensive alluvial deposits. Activities in headwater streams that accelerate erosion eventually cause impacts to irrigation headgates and ditches, spawning areas and the stream channel stability of valley bottom areas. The Bitterroot Forest contains some of the largest clearcut areas in Montana. Runoff from these and other logged areas and their associated roads has added significant amounts of sediment to some of the river's tributaries like the West Fork.

Poor grazing practices, timber harvests, rural subdivisions and roads have combined to accelerate erosion in the northwest portion of the Sapphire Range. The Burnt Fork and adjacent tributaries have extensive bedload accumulation problems. An example of the severity of this problem is found at the Lee Metcalf Wildlife Refuge--to prevent the siltation of ponds and wetlands, settling basins had to be installed on streams supplying the Refuge.

4. Nutrients. Primary point sources of nutrients to the Bitterroot River are domestic wastes from the communities of Hamilton, Stevensville, Darby and Lolo. Agricultural runoff containing commercial fertilizers, animal wastes and sediment enters the river throughout the Bitterroot Valley. The proliferation of subdivisions within the basin has also led to a potential increase in nutrients to the river and its tributaries from the discharge of septic tank drainfields.

C. Present Information

1. Dewatering/Dams. The Montana Department of Fish, Wildlife and Parks is evaluating the effects of dewatering on the trout populations of the Bitterroot River (Study 30). A water management plan will be developed by this study that will utilize timed releases of Painted Rocks Reservoir water to augment summer flows. The Bonneville Power Administration is funding the study as partial mitigation for impacts caused to the trout fishery by construction of dams on the lower Clark Fork River.

The Department of Fish, Wildlife and Parks has collected water surface profile information for the Bitterroot and some tributaries (Study 26). This information will be valuable when an instream flow reservation is developed for the basin. The U. S. Geological Survey is operating (1938-

present) a stream gauging station for the Bitterroot River at Darby.

2. Stream Channel Modifications. An inventory of physical features along the Bitterroot River channel was conducted by the Soil Conservation Service in 1979. All eroding banks, irrigation diversions, riprap and other channel and bank alterations were located and measured. This preliminary inventory did not attempt to prioritize these problem sites or relate them to other impacts in the basin such as dewatering. Two studies have also addressed the fluvial processes and geomorphology of the Bitterroot River System--one conducted by the University of Montana (Study 49) and another by a consultant for the local Conservation District (Study 50).

3. Water Quality Monitoring. Monthly samples for heavy metal, nutrient and suspended solids analyses are being collected near the river's mouth (Study 43). The U.S.G.S. also analyzed for these parameters at this station from 1970-1973 (Study 47). This is the only station in this project area with continuous surface water quality records.

4. Fish Populations and Other Biota. Fish populations are being sampled at two locations on the mainstem river near Darby and Victor (Study 30). An additional study section may be established closer to the river's mouth in 1985. Periphyton and aquatic invertebrates are sampled three time per year at the river's mouth (Study 43).

D. Information Need

The preliminary inventory of physical features that has been conducted by the SCS should be expanded and combined with the dewatering information from Study 30 to develop a Corridor Management Plan for the Bitterroot River drainage.

The plan would prioritize problem sites in the basin as to their need for eventual reclamation, with special emphasis given to the relationship between channel alterations and dewatering.

PROJECT AREA 4

Clark Fork River from the confluence of the Blackfoot River to the confluence of the Flathead River (Middle River Segment)

A. General Status of the Water Quality and Fishery

With intensive water quality monitoring just beginning in this segment, it is difficult to make a generalized statement about its present status. However, some factor or combination of factors are definitely creating conditions that are less than desireable for trout production. Only about 200 trout per mile were found in a section just downstream of the Bitterroot in 1984. Similarly, in 1983, only 300 trout per mile were found in the river near Superior. Whitefish appear to be fairly abundant, but no estimates of their numbers have been made.

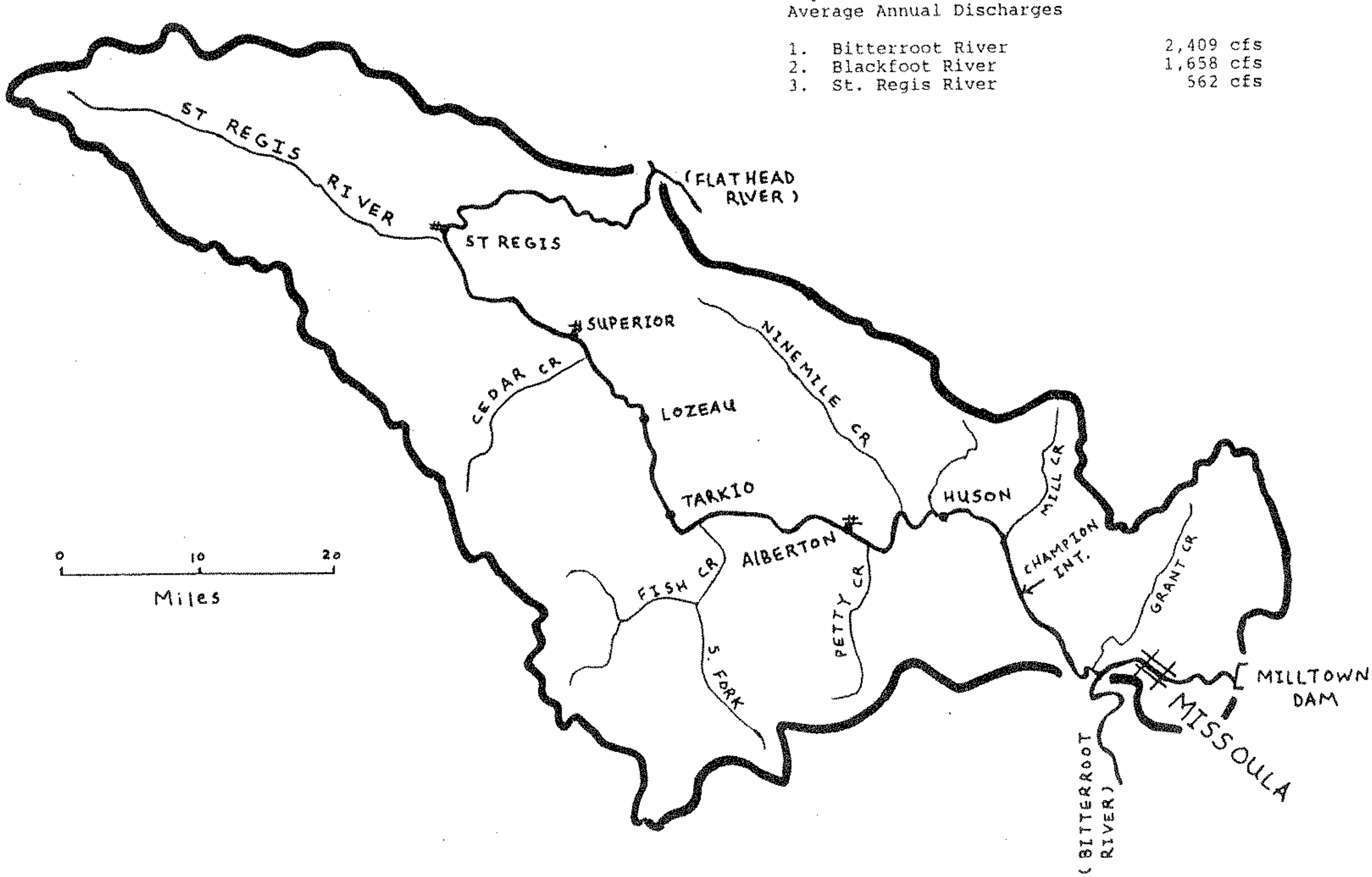
The most significant impacts presently identified for this segment are heavy metals, toxic compounds (ammonia and possibly organic resin acids) and nutrients. Other impacts include sedimentation, stream channel modifications and dewatering.

B. Summary of Environmental Impacts

1. Heavy Metals. Milltown Dam is located at the beginning of this segment just below the confluence of the Blackfoot River. Constructed in 1907, the reservoir for this dam became the first settling basin for mining wastes originating in the headwaters of the upper river. Operation of this dam has required periodic drawdowns of the reservoir, resulting in the downstream flushing of metal-laden sediments. Water

SEGMENT 4 -- Clark Fork River from the confluence of the Blackfoot River to the confluence of the Flathead River (Middle River Segment)

A.	Drainage Area of Segment	2,100 Mi2
	Total drainage area including upstream segments	10,900 Mi2
B.	Average Annual Discharge	7,562 cfs
C.	Major Tributaries and their Average Annual Discharges	
	1. Bitterroot River	2,409 cfs
	2. Blackfoot River	1,658 cfs
	3. St. Regis River	562 cfs



quality criteria for heavy metals have often been exceeded during these times, but the extent and magnitude of these impacts is yet to be thoroughly documented. In recent years, the Montana Power Company (the dam's owner) has attempted to modify the drawdowns in an effort to reduce impacts to the middle river. The company is presently reviewing feasible alternatives to retire or replace this facility.

Even without the Milltown Dam drawdowns, water quality criteria for copper and other heavy metals are sometimes exceeded in the middle river during runoff. During May of 1984, copper levels exceeding EPA acute toxicity criteria were found as far downstream as St. Regis (the farthest downstream monitoring station in this segment). The Milltown Reservoir was not being drawn down during this time.

2. Toxic Compounds. The two primary sources of toxic compounds are the City of Missoula's sewage treatment plant and Champion International's pulp and paper mill. The latter is located approximately ten miles below the confluence of the Bitterroot River. The principal toxicants in the city's waste are ammonia and chloramines, while organic resin acids are potential toxicants in Champion's discharge.

Fish kills, caused by herbicide spills, have recently occurred in Mill Creek near Frenchtown.

3. Nutrients. The City of Missoula's sewage treatment plant and the Champion mill are also the primary point sources of nutrients to the middle river. Tentative estimates made by the Water Quality Bureau indicate that these two sources may account for as much as fifteen percent of the total nutrient load to the Clark Fork River. Non-point sources of nutrients are widespread and diffuse.

4. Sedimentation. Significant quantities of suspended solids are present in the Champion International and City of Missoula effluents. Runoff from logging and associated roads has impacted some tributaries within this river segment. Placer mining in the Ninemile Creek Drainage adds sediment to this stream. Agricultural runoff is minimal.

5. Stream Channel Modifications. The Clark Fork River has been heavily riprapped within the Missoula city limits. Three irrigation diversion structures are also located here. Below Missoula, most of the agricultural lands are on benches above the floodplain, eliminating the need for flood control structures.

Transportation corridors have had very little impact on the mainstem's channel or banks, but the St. Regis River was subjected to numerous channel changes during the construction of Interstate 90.

6. Dewatering. Surface water withdrawals are minimal along the mainstem. The lower reaches of some small tributaries in the Missoula and Frenchtown areas, including O'Keefe, LaValle, Mill and Grant Creeks are dewatered by agriculture during summer.

C. Present Information

1. Water Quality Monitoring. Monthly samples for heavy metal, nutrient, common ion and total suspended solids analyses are presently being collected by the Water Quality Bureau on the Clark Fork River at the following locations:

a) below Milltown Dam
b) above the Missoula WWTP
c) above the Bitterroot (Sheffields)
d) below the Bitterroot (Harpers Bridge)

e) Huson

f) St. Regis

g) City of Missoula WWTP effluent

h) Champion International effluent

Ten other mainstem stations in this segment are also being sampled three to four times per year for these parameters (Study 43). Study 35 will be sampling at the U.S.G.S. gauging station below Missoula for heavy metal analyses approximately ten times per month from May-July, 1985.

Monthly water quality samples have been collected at the following locations and times (Study 47):

a) above Missoula 1969-1971

b) below Missoula 1979-1983

c) at Alberton 1969-1971

2. Other Heavy Metals Studies. The U.S.G.S. is annals the heavy metal content in stream bottom and channel sediments at three to five mile intervals from Milltown to St. Regis. In 1984, the Water Quality Bureau also collected bottom sediments for heavy metal analysis twice from five and once from eleven deep water pools between Huson and the confluence of the Flathead River (Study 43).

The DFWP is analyzing samples of crayfish exoskeltons for heavy metal content. Study 35 is collecting other aquatic invertebrates for heavy metal analysis from eight locations between Missoula and St. Regis.

3. Fish Populations and Other Biota. Fish populations are being sampled at five sections on the mainstem (Study 33):

a) below Milltown Dam

b) below the Bitterroot (to Harper's Bridge)

c) below the Champion International effluent (to Huson)
d) below Huson (to Petty Creek)
e) near Superior

Additionally, the Montana Department of Fish, Wildlife and Parks is examining 30 to 40 tributaries in this project area to determine their suitability as spawning and rearing areas for trout.

Since 1956, Study 31 has annually collected aquatic insect samples from eight mainstem stations near Champion International's mill from below the Bitterroot to just below Nine Mile Creek.

The Water Quality Bureau is collecting periphyton and aquatic insects three time per year from 11 stations; in addition to the six mainstem stations listed above for water quality monitoring, these stations are:

a) above Missoula
b) above the Missoula WWTP
c) Just below the Champion International effluent
d) 4 miles below the Champion International effluent
e) Lozeau (8 miles above Superior)

The EPA will be conducting a 30-day trout bioassay of the Champion International effluent in May of 1985. Algal assays (Study 43) and bioassays, using <u>Ceriodaphnia</u> as a test organism will be conducted at six stations between Missoula and St. Regis.

D. Information Need

The Clark Fork River from St. Regis to the confluence of the Flathead River is gaining in popularity as an area to fish and float. A proposed hydroelectric facility would potentially dewater most of this reach by diverting the river through a tunnel beneath Nine Mile Mountain Range. Two additional study sections are needed to assess the status of fish populations in the river from St. Regis to the Flathead River.

PROJECT AREA 5
Flathead River below Kerr Dam

A. <u>General Status of the Water Quality and Fishery</u>

The overall water quality of this segment is excellent. Its source, Flathead Lake, is nationally known for its thriving populations of trout and salmon. But the river below Kerr Dam is practically devoid of trout. Confederated Salish and Kootenai tribal biologists estimate that only 12 trout/mile are present in the lower Flathead River. The northern pike population is also sparse with estimates ranging from 30 to 165 fish/mile. Whitefish, however, are very abundant with population estimates ranging from 1000-6000 fish/mile.

The dewatering of trout and northern pike spawning areas, caused by flow fluctuations from Kerr Dam, appears to be the major impact to the fish and other aquatic resources of this segment. Other impacts include sedimentation (particularly in tributary streams), and pesticides. Elevated stream temperatures and nutrients are potential, yet unquantified, impacts.

B. <u>Summary of Environmental Impacts</u>

1. <u>Dams/Dewatering</u>. Kerr Dam is a baseload stabilizing or "peaking power" facility. Discharge rates from the dam fluctuate dramatically, sometimes on an hourly basis. Potential spawning sites for trout and northern pike in the lower Flathead River are periodically dewatered during the low ebb of these fluctuations. Consequently, recruitment of

SEGMENT 5 -- Flathead River below Kerr Dam

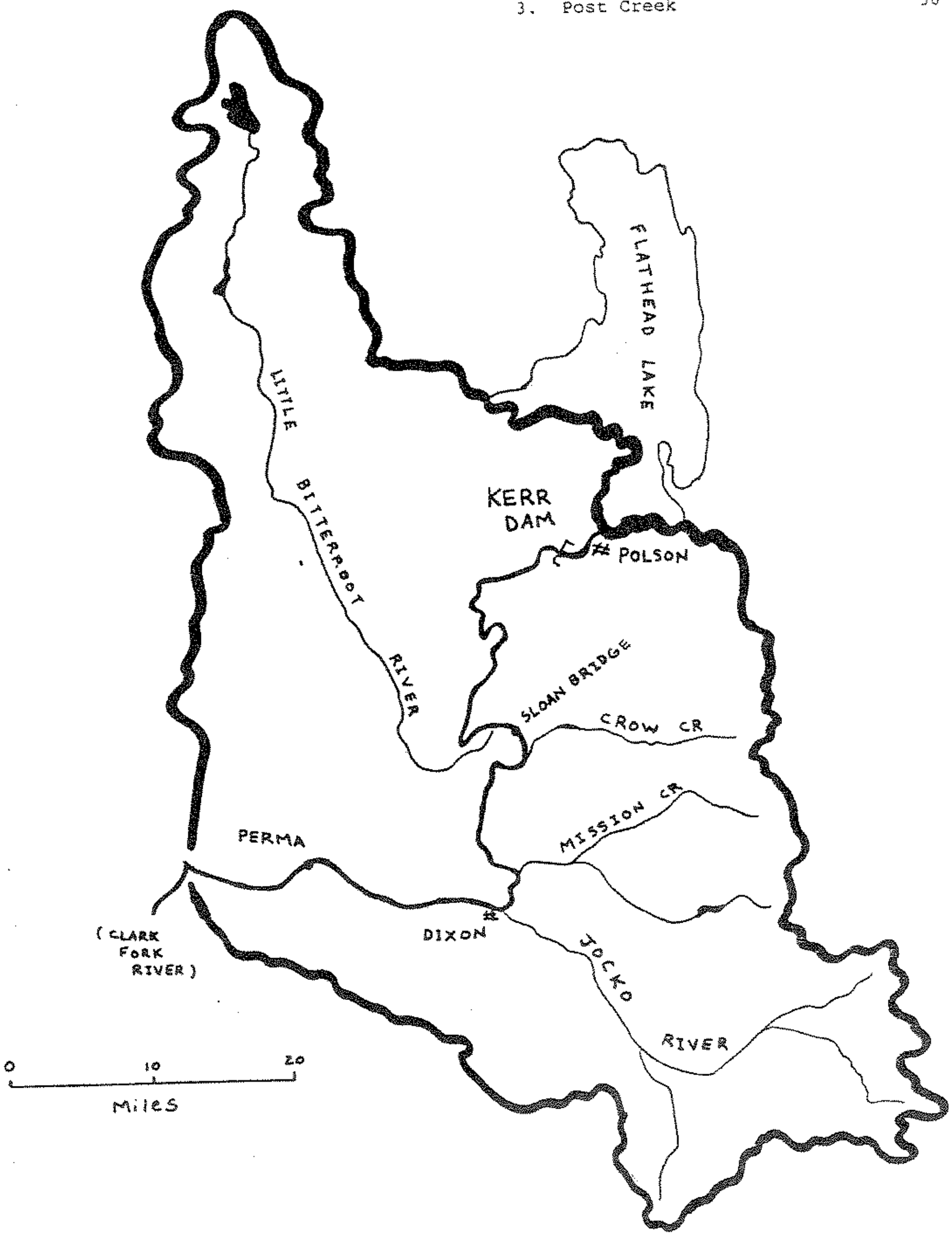
A. Drainage Area of Segment 2,100 Mi2

Total Drainage Area including Upstream Segments 9,200 Mi2

B. Average Annual Discharge 11,900 cfs

C. Major Tributaries and their Average Annual Discharges

1. Jocko River 250 cfs (est)
2. Little Bitterroot River 200 cfs (est)
3. Post Creek 50 cfs (est)



trout for this segment appears to be very dependent upon small tributary streams like Mission Creek, Post Creek, Crow Creek and the Jocko River which drain the west face of the Mission Mountains. The Little Bitterroot River, which flows through dry, unshaded rangeland, is a low-gradient, "warm water" stream that likely provides northern pike recruitment for the mainstem.

Irrigation dams regulate the discharge patterns of all of the above tributaries. The lower reaches of these streams, particularly the Little Bitterroot, are often dewatered during summer by agriculture.

2. Sedimentation. All of the "cold water" tributaries draining the Mission Mountains are impacted by sediment from irrigation return flows. Since these streams presently appear to be the primary spawning areas for trout in the lower Flathead, this impact may be having a significant effect on trout recruitment.

Erosion resulting from overgrazing causes the Little Bitterroot River to be the largest sediment producer in this segment. During runoff conditions, a plume of sediment from this tributary is very visible below its confluence with the Flathead River.

3. Nutrients. Although water quality measurements do not indicate the presence of excessive nutrient concentrations, relatively dense aquatic plant growth occurs throughout the lower 15 miles of the Flathead River. Water Quality Bureau personnel have recorded night time dissolved oxygen concentrations as low as 6.9 mg/L in this segment. They surmize that the very clear waters of the river allow sunlight to penetrate through the entire water column, promoting dense accumulations of aquatic plant growth. The lower Flathead

River is also slow-moving, which limits reaeration. The sources of nutrients to this segment are primarily non-point.

4. Toxic Compounds. Fish kills, believed to be related to the misuse or misapplication of pesticides, have been recently reported in the Jocko River.

5. Elevated Stream Temperatures. Water temperatures as high as 73 degrees F. have been measured at the mouth of the Flathead River by Water Quality Bureau biologists. If such temperatures are common rather than a chance occurrence, they could be affecting the growth and reproduction of trout.

C. Present Information

1. Dams/Dewatering. The effects of power peaking upon the fishery of the lower Flathead River is being evaluated by Study 36. The spawning and recruitment capabilities of the river and its tributaries are being assessed. An array of fisheries management options will be developed by this study to mitigate the impacts of present hydroelectric operations. Each option will demonstrate how fish population management or hydroelectric generation capabilities would need to be modified.

Two stream discharge gauging stations in this segment are operated by Study 47:

a) Flathead River at Polson (from 1907-present)

b) Flathead River at Perma (from 1983-present)

2. Water Quality Monitoring. The Water Quality Bureau is collecting monthly samples for heavy metal, nutrient and total suspended solids analyses at the river's mouth (Study 43). From 1971-1973, Study 47 also conducted monthly sampling for these parameters on the Flathead River at Perma (10 miles above the mouth).

3. <u>Stream Temperature Monitoring</u>. Continuously recording thermographs are being operated at Perma, Dixon and Sloan Bridge (Study 36). This study is also monitoring the stream temperatures of four tributaries--Jocko River, Mission Creek, Crow Creek and the Little Bitterroot River. The U.S.G.S. continuously recorded water temperatures for the Flathead River at Polson from 1977-1983 (Study 47).

4. <u>Fish Populations and Other Biota</u>. Study 36 is conducting fish population estimates on five sections of the mainstem. These sections are each approximately four miles in length and are evenly spaced along the river from just below Kerr Dam (Buffalo Section) to near the mouth (Perma Section). This study is also monitoring the fish populations in five major tributaries.

a) Little Bitterroot River (4 sections)
b) Jocko River (7 sections)
c) Mission Creek (5 sections)
d) Post Creek (4 sections)
e) Crow Creek (1 section)

The Water Quality Bureau is collecting periphyton and aquatic insect samples three times per year at the mouth of the Flathead River (Study 43).

PROJECT AREA 6

Clark Fork River from the confluence of the Flathead River to Pend Oreille Lake

A. General Status of the Water Quality and Fishery

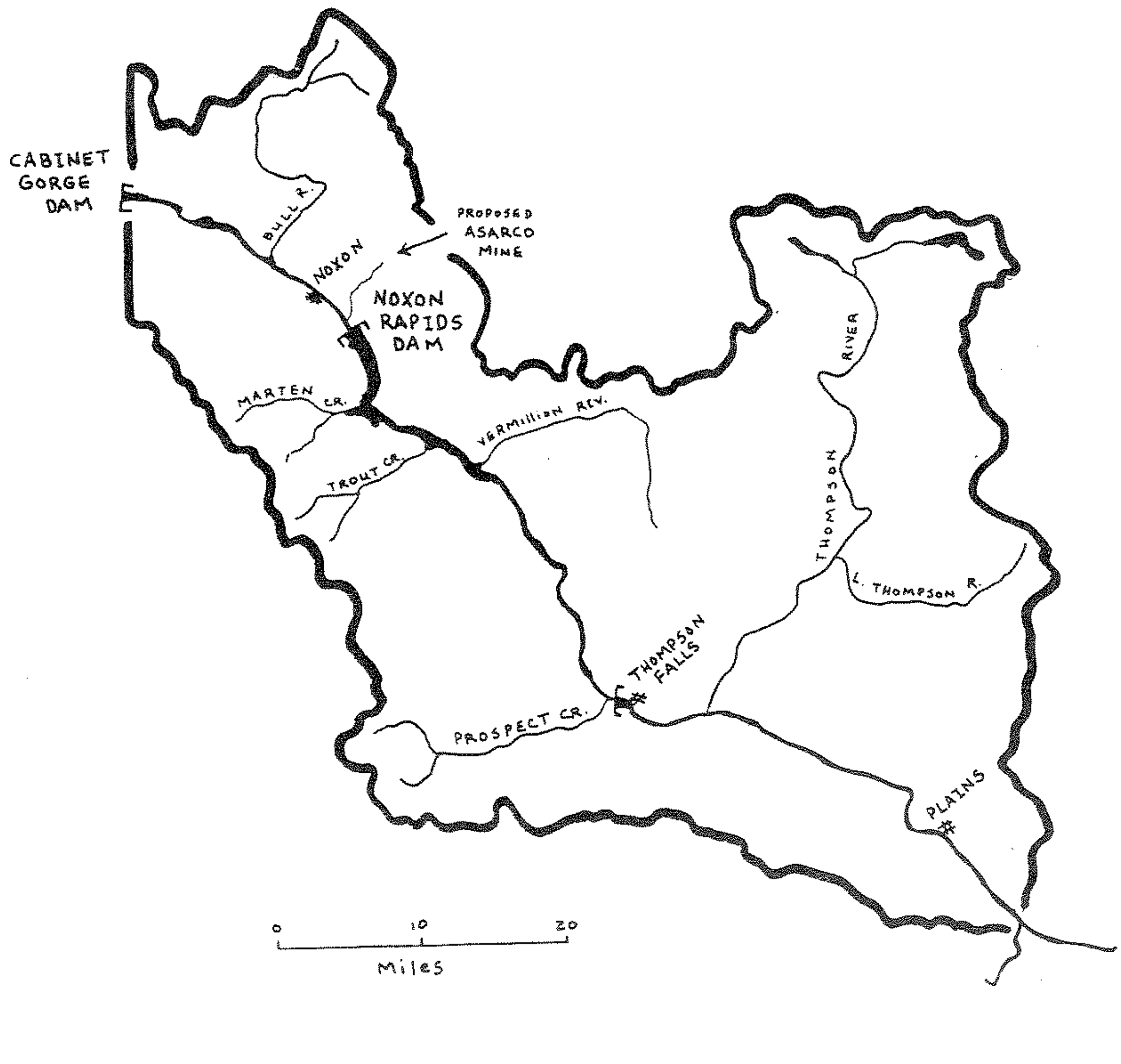
No major waste discharges enter the Clark Fork River within this segment. The cumulative or chronic impacts of discharges upstream of this segment have not yet been completely evaluated, although recent monitoring indicates variable water quality conditions. No fish population estimates have been conducted on the unimpounded mainstem, but local anglers report consistently poor success rates. Northern pike appear to be the most common sport fish. Tributaries like the Thompson River, Prospect Creek, Trout Creek, Marten Creek and the Bull River support good resident trout populations.

Dams appear to be the impact most significantly affecting this stream segment. Upstream migrations of fish from Pend Oreille Lake have been blocked by these facilities. The three reservoirs that impound over half of this river segment do not presently support a viable sport fishery. There was a "boom" in the rainbow trout fishery in the Noxon Rapids Reservoir just after the construction of the dam in the early 1960's, but this has since faded into an almost nonexistent fishery.

Other presently identified impacts to this segment include heavy metals and nutrients. Toxic organic compounds and elevated stream temperatures are potential impacts that have not as yet been quantified.

SEGMENT 6 -- Clark Fork River from the confluence of the Flathead River to Pend Oreille Lake

A.	Drainage Area of Segment	2,000 Mi2
	Total Drainage Area including Upstream Segments	22,073 Mi2
B.	Average Annual Discharge	22,380 cfs
C.	Major Tributaries and their Average Annual Discharges	
	1. Flathead River	11,900 cfs
	2. Thompson River	476 cfs
	3. Bull River	368 cfs



B. Summary of Environmental Impacts

1. Dams. Prior to the construction of the Thompson Falls Dam in 1916, Clark Fork River and many tributaries were spawning and rearing areas for bull trout and cutthroat trout from Pend Oreille Lake. This dam is located 70 miles upstream from the lake. The blockage of these runs into Montana was completed in 1952 with the construction of Cabinet Gorge Dam (7 miles upstream from the lake). In 1959 the free-flowing portion of the river between Noxon and Thompson Falls was impounded by Noxon Rapids Dam.

Water within these reservoirs is replaced very rapidly which inhibits the establishment of a food base typical of standing waters like ponds or lakes, e.g. zooplankton ("fresh water shrimp" and "water fleas" as they are commonly called). Occasional deep drawdowns of these reservoirs prevent the permanent establishment of shallow, near shoreline aquatic plant and animal communities that are typical of natural lakes and ponds. The clean gravel bottom of the former free-flowing river has long since been covered with silt, eliminating spawning areas for trout and most of the habitat for aquatic insects. The net result is that the lower river reservoirs are very unproductive, with practically no resident trout fisheries.

Since the Flathead River supplies over half of the total annual flow of the lower river, the power peaking activities at Kerr Dam could be impacting fish spawning in the free-flowing portion of the river between its confluence with the Clark Fork River and the Thompson Falls Reservoir.

2. Heavy Metals. Heavy metals, originating in the upper river are impacting the water quality of this segment. During runoff in May, 1984, acutely toxic concentrations of copper were found as far downstream as Thompson Falls.

This annual surge of heavy metals is the most significant water quality impact that has been documented thus far in the lower river.

Heavy metals, originating at the U.S. Antimony Mine, are also impacting Prospect Creek near Thompson Falls.

3. Toxic Compounds. The impact of organic compounds discharged by Champion International and the City of Missoula is not clearly known at this time. The trout bioassays of Champion's effluent, scheduled for the spring of 1985, will better define the impact level of these wastes. The origin and composition of the "scum" or foam that has been reported since the start-up of Champion International's pulp mill is still being investigated.

4. Elevated Stream Temperatures. Elevated water temperature may be a problem in the lower Clark Fork River. Temperature measurements as high as 71 degrees F. have been reported by Water Quality Bureau biologists.

5. Nutrients. Most of the nutrients found in this segment appear to be derived from upstream sources. Aquatic plant densities are fairly high during summer, causing night time dissolved oxygen concentrations to dip slightly below 7.0 mg/L on occasion.

C. Present Information

1. Dams. Fish passage facilities, which would have allowed the upstream migration of bull trout and other fish species from Pend Oreille Lake, were not installed during the construction of the lower river dams. In an attempt to mitigate the loss of this migratory fishery, the Department of Fish, Wildlife and Parks is evaluating ways to establish a self-sustaining fishery in the lower river reservoirs (Study 41). This will include increased study of stocking and reproduction success of fish populations. The study will evaluate habitat suitability, reproduction success and review the effects of the reservoir drawdowns and discharge rates.

2. Water Quality Monitoring. The Water Quality Bureau is collecting monthly heavy metal, nutrient, common ion and total suspended solids samples for analysis at four locations on the mainstem:

a) above Thompson Falls
b) below Thompson Falls Dam
c) below Noxon Rapids Dam
d) below Cabinet Gorge Dam

Samples are also being collected three to four times per year at four other locations on the Clark Fork for analysis of these parameters.

The U.S. Geological Survey (Study 47) collected monthly samples for analysis of the above parameters at:

a) Plains (from 1969-1970 and 1982-1983)
b) Thompson Falls (from 1969-1973)

They have also sampled the Bull River and the Thompson River. The Montana Water Quality Bureau is collecting water quality samples on Rock Creek (near Noxon).

3. Heavy Metals. The Water Quality Bureau is collecting bottom sediments for heavy metal analysis three times per year in the three lower river reservoirs (Study 43). The heavy metal contents of bottom sediments in these reservoirs is also being studied by the University of Montana (Study 38).

4. Stream Temperature Monitoring. The U. S. Geological Survey continuously recorded water temperature data on the Clark Fork River at Plains from 1969-1977 (Study 47).

5. Fish Populations and Other Biota. Gill net and creel census surveys have been conducted by Study 41 in the lower river reservoirs for over two decades. These surveys are planned to be intensified over the next few years in conjunction with diversifications in fish planting. In contrast, fish population estimates have never been conducted on the free-flowing portion of the river between the confluence of the Flathead River and Thompson Falls Reservoir. Fish population estimates are being conducted at two locations on the Thompson River (Study 42).

The Water Quality Bureau (Study 43) is collecting periphyton and aquatic insect samples three times per year at:

a) Plains
b) above Thompson River
c) below Thompson Falls Dam
d) below Noxon Rapids Dam
e) below Cabinet Gorge Dam

Algal assays are also being conducted at all of the above locations except (1). Seven-day toxicity bioassays, using *Ceriodaphnia* as a test organism, will also be conducted in the spring of 1985 at (2), (3) and (4).

D. Information Need

The combination of flow fluctuations from Kerr Dam and pollutants from upstream sources make conditions for the fishery less than optimal in the free-flowing portion of this segment. Fish population estimates should be conducted in the vicinity of Plains and in the 1 1/2 mile section of free-flowing river below Thompson Falls Dam. The data are necessary to assess the effect of the flow fluctuations on the fishery.

PROJECT AREA 7
Pend Oreille Lake

A. General status of the water quality and fishery

Pend Oreille is a high quality, nearly pristine lake. Algae blooms, which plague many other large lakes in the western United States, are not common here. But, dense, localized concentrations of algae have become more common in recent years, particularly along shoreline areas.

The lake supports thriving populations of Kamloops rainbow trout, kokanee salmon and bull trout. The sport fishing provided by these species is an important component of the area's economy.

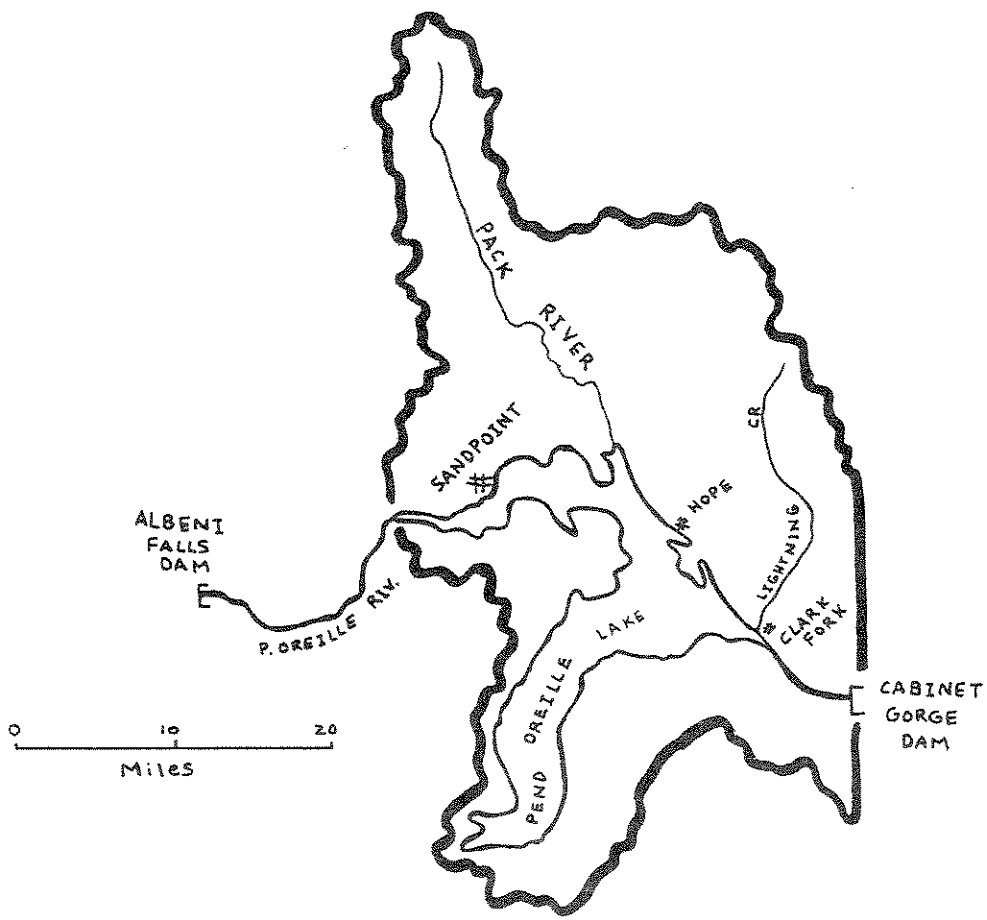
Impacts to Pend Oreille Lake are largely unquantified. Baseline monitoring efforts by the Idaho Water Quality Bureau are just underway. The blockage of trout and salmon spawning runs by the dams on the lower Clark Fork River has been somewhat mitigated by fish hatcheries. (No such facilities exist for bull trout, however). Nutrients represent the biggest potential impact to the lake, followed by heavy metals and sedimentation.

B. Summary of Environmental Impacts

1. Nutrients. The greatest single threat to the quality of Pend Oreille Lake is increased nutrient loading both from upstream and shoreline sources. The corresponding increase in algae populations would not only degrade the appearance of the lake, but would also eventually affect the fishery. Decisions made by the State of Montana regarding nutrient

SEGMENT 7 -- Pend Oreille Lake

A.	Drainage Area of Segment	600 Mi2
	Total Drainage Area including Upstream Segments	23,300 Mi2
B.	Average Annual Discharge	----
C.	Major Tributaries and their Average Annual Discharges	
	1. Clark Fork River	22,300 cfs
	2. Pack River	322 cfs



additions to the Clark Fork River must, therefore, be made with proper consideration of Pend Oreille Lake.

2. Heavy Metals. Although the upper portion of the Clark Fork River is severely degraded by heavy metals, preliminary evaluations by the Idaho and Montana Water Quality Bureaus indicate that this impact may dissipate by the time the river enters Pend Oreille. Heavy metal samples collected below Cabinet Gorge Dam in 1984, were almost all below laboratory detection limits. But, given the magnitude of the upstream problems associated with this impact, additional sampling should be continued.

3. Sedimentation. A plume of sediment from the Clark Fork River is highly visible in the northern arm of the lake during runoff conditions. This suspended sediment has an effect on the euphotic (light penetration) zone of this portion of the lake.

C. Present Information

1. Water Quality Monitoring. The Idaho Water Quality Bureau is presently collecting monthly samples for nutrient, heavy metal, common ion, total suspended solids and chlorophyll-a analysis at 4 locations on Pend Oreille Lake (Study 46). During July-September, the sampling frequency is increased to bi-weekly. This study is also collecting monthly samples in the Clark Fork River below Cabinet Gorge Dam. During May-July, this sampling will occur on a weekly basis. This latter station corresponds to the lower-most monitoring site by the Montana Water Quality Bureau (Study 43).

2. Heavy Metals Studies. No bottom sediment samples are being collected for heavy metal analysis. Pending the results of Study 38, which is evaluating bottom sediments of

the three lower Clark Fork River reservoirs, similar samplin-g may be necessary in the river delta area of the northern arm of Lake Pend Oreille.

3. Fish Populations and Other Biota. The Idaho Fish and Game Department is conducting spawning and recruitment studies for Kokanee and bull trout in certain tributary streams. They are also estimating the total population size and age-specific survival of Kokanee in the lake.

The U.S. Environmental ProtectiOn Agency (Study 45) is conducting algal assays on water from the four lake stations sampled by the Idaho Water Quality Bureau. These assays will determine which nutrient(s) limit(s) the growth of algae in the lake.

D. Information Needs

1. Since nutrients are the major potential impact to Pend Oreille Lake, and since the Clark Fork River is the largest potential contributor of nutrients to the lake, additional nutrient loading information is needed in the Clark Fork River Basin. Sampling frequency for these parameters needs to be increased at selected stations on the river.

2. As an addition to the EPA algal assay information, the trophic status or "biological age" of Lake Pend Oreille needs to be assessed. This, in part, would involve measuring primary productivity levels--the growth response rate of open-water algae (phytoplankton) to existing nutrient levels.

V. PRELIMINARY PROPOSALS FOR ADDITIONAL RESOURCE EVALUATIONS

Chapters III and IV have provided a review of the, numerous water resource investigations, funded by state, federal, university and industry dollars which are presently active in the Clark Fork and Lake Pend Oreille Basins. These investigations each address a portion of the total, basin-wide resource situation.

Part of the purpose of the Clark Fork River Basin Project is to identify where additional effort needs to be directed to compliment and coordinate existing work. After considerable discussion with technical and citizen representatives from throughout the basin, including the review of two draft study plans by the Interagency Task Force, Citizen's Advisory Council and other interested parties, eight additional resource evaluations have been identified. These proposals will augment work presently being conducted in the basin by filling the information needs identified in Chapter III. All the proposals are intended to broaden the information base that will be required to develop a course of action and comprehensive plan to maintain and enhance the quality of the Clark Fork River/Pend Oreille Basin's aquatic resources.

Of the eight proposed resource evaluations, three will require the collection and analysis of data from throughout the Clark Fork River Basin Project study area; the other five are specific to a given Project Area (stream segment). However, even the area-specific proposals have basin-wide implications, or at least are relative to other portions of the basin. For example, the reduction of heavy metals in the upper Clark Fork River (Project Area 1) will also benefit the rest of the Clark Fork mainstem; and the quantification of current recreational uses of the Blackfoot River (Project Area 2) will contribute to an understanding of the recreational potential of the upper Clark Fork River.

The eight proposed research evaluations to be discussed in this chapter include:

A. Basin-wide Evaluations:

1. Nutrient source assessment;
2. Assessment of non-point pollution sources;
3. Regional economic analysis of recreation in the Clark Fork/Lake Pend Oreille basins.

B. Project Area Evaluations:

1. Project Area 1--Assessment of the Potential for Heavy Metal Reclamation in the Upper Clark Fork River;
2. Project Area 2--Blackfoot River Recreational and Fishery survey;
3. Project Area 3--Bitterroot River Stream Corridor Management Plan;
4. Project Area 6--Limnological Evaluation of the Lower River Reservoirs;
5. Project Area 7--Trophic Evaluation of Lake Pend Oreille.

A. BASIN-WIDE EVALUATIONS

1. Nutrient Source Assessment

Lake Pend Oreille is the ultimate recipient for wastes generated in the Clark Fork/Lake Pend Oreille Basins. The largest single threat to the quality of this pristine lake is increased nutrient loading. Nutrients enter the lake not only from the Clark Fork River, but also from shoreline sources around the lake.

a. In the Clark Fork River Basin, more information is needed concerning loads of nutrients from major tributaries and the changes in nutrient loads along the mainstem. The Montana Water Quality Bureau "Lower Clark Fork River Monitoring Plan" (Study 43), has collected monthly nutrient samples at sixteen stations for more than a year. Samples have been collected from several stations along the mainstem, all of its major tributaries and from major point source effluents. These important nutrient loading data (nine of the station are located at or near USGS gauging stations), should to be supplemented by increasing the sampling frequency at eleven of Water Quality Bureau's stations:

i. Clark Fork River at Cabinet Gorge and below Plains--twice weekly sampling;

ii. Clark Fork River at St. Regis and the Flathead River at its mouth--weekly sampling;

iii. Clark Fork River at Turah, below Missoula (Harper's Bridge), below Champion International (Huson), the Blackfoot River at its mouth, the Bitterroot River at its mouth, the City of Missoula Waste Water Treatment Plant effluent and Champion International's effluent--twice monthly sampling.

Increased sampling at the first two stations will better determine if the lower river reservoirs are acting as nutrient "sinks", ie., do they remove nutrients that would otherwise enter Pend Oreille Lake. Weekly sampling at St. Regis and the Flathead River mouth will better quantify the relative nutrient contributions of the Flathead versus the Clark Fork River systems. The other stations will determine relative nutrient contributions from major tributaries and segments of the Clark Fork River.

b. In addition to increased monitoring in the Clark Fork Basin, all major shoreline sources of nutrients around Lake Pend Oreille need to be quantified. This will require testing and nutrient analysis of all major septic tank drainfields and other potential nutrient sources.

> [NOTE: The above evaluations should be closely coordinated with the nutrient loading information that will also be gathered by proposed resource evaluations 2, 7 and 8].

Study Duration

The resource evaluation described above should be conducted for one full year. Upon completion of this basin-wide nutrient source "screening", nutrient monitoring should be intensified for an additional year at those locations within the basin found to be contributing the largest percentage of nutrients.

2. Assessment of Non-point Pollution Sources

Lands disturbed by logging, irrigation return flows, placer mining, grazing and roads contribute significant amounts of sediments to streams throughout the Clark Fork River Basin. Depending upon the soils, geology and land use of the disturbed areas, significant amounts of nutrients may also be contributed to the receiving streams as well as to downstream reservoirs and Lake Pend Oreille. In an effort to understand present and potential impacts caused by diffuse pollution sources, the Clark Fork River Basin Project proposes the following:

a. Sediment Evaluations

The U.S. Forest Service is presently evaluating the impacts of sediment upon the spawning and rearing capacities of selected tributary streams in the Lolo, Bitterroot and Deer Lodge Forests. The following proposed resource evaluation would expand upon the USFS work:

i. Several streams will be selected within the basin that have differing soil types, geology, land use, vegetation cover, elevation and levels of development (i.e. for every developed or impacted tributary selected, an adjacent, undeveloped tributary would be evaluated as a control);

ii. Several sediment-related parameters will be evaluated in each stream including:

--Core sampling and embededness measurements to determine the amount of fine sediment that is deposited in the interstices between larger stream substrata particles;

--Total suspended solids and turbidity measurements to determine the amount of suspended sediment, especially during runoff (the latter measurement would also serve to relate sediment impacts to state water quality standards);

--Measurements of bedload movement to determine impacts and accumulation rates of non-suspended sediment. These measurements are particularly important in streams like the Bitterroot and its tributaries that are characterized by broad, alluvial deposition areas.

b. Nutrient Evaluations.

Each of the streams selected for sediment work will also be frequently monitored for nutrient concentrations. By comparing nutrient loads in adjacent developed stream versus undeveloped streams, increases in non-point nutrient levels caused by land disturbances can be estimated. This evaluation will help determine if land use practices need to be modified or limited within drainages of particular soil types or geology. This assessment will be extremely valuable if it is determined that waste load limitations are needed within the basin to protect downstream resources like Lake Pend Oreille.

<u>Study Duration</u>

This proposed resource evaluation will be conducted for two years. Ten to twenty streams from throughout the basin would be evaluated. Field work will be conducted primarily from mid-March through mid-September.

3. Regional Economic Analysis of Recreation in the Clark Fork/Lake Pend Oreille Basins.

The recreational opportunities and associated economic values within the Clark Fork River Basin extend over a wide range. The Lake Pend Oreille and Blackfoot River Project Areas are quite high, while the upper Clark Fork and lower river reservoirs are generally regarded as very good.

This proposed resource evaluation will quantify information concerning the present and potential value of the recreational industry throughout the Clark Fork River Basin. The preliminary economic evaluation that was conducted by the University of Montana in the upper river needs to be expanded to a regional analysis of the entire basin. This regional study should assess the present net value of this industry to the basin's economy. The benefits that would be derived from various reclamation schemes must also be projected and defined in monetary terms. Field interviews, mail surveys and various cost-substitution techniques should be utilized.

This proposed evaluation will augment and compliment the state-wide economic evaluation of hunting, fishing and recreation which is proposed by the Montana Department of Fish, Wildlife and Parks.

<u>Study Duration</u>

This proposed resource evaluation will be conducted for one year.

B. **PROJECT AREA EVALUATIONS**

1. Project Area 1--Assessment of the Potential for Heavy Metal Reclamation in the Upper Clark Fork River.

The most significant impact believed to be affecting the aquatic resources of the upper Clark Fork River is heavy metal contamination. Heavy metal levels in the upper river must be reduced before fishery and recreational opportunities can be improved. Two Superfund projects are presently addressing the feasibility of reclaiming heavy metal sources in the portion of this project area above the confluence of Warm Springs Creek. The present proposal is focused on the Clark Fork mainstem from Warm Springs Creek to Milltown Dam. Special attention will be given to the first twelve river miles. Here, trout populations decline from around 1500/mile at the pH shack section near Warm Springs to 400/mile at the Sager Lane section near Dempsey. The Clark Fork River Basin Project proposes the following actions to determine the feasibility of reclaiming heavy metal sources in this Project Area:

a. Surface Water Quality Monitoring

Three projects are presently collecting monthly samples for heavy metal analysis. These studies and their duration are:

i. USGS (March 1985-June 1986);
ii. Water Quality Bureau--upper river monitoring (January 1982-indefinite);
iii. Water Quality Bureau--lower river monitoring (March 1984-June 1987).

The location of sampling sites and parameters monitored by these studies are given in Chapter III. There are three monitoring gaps that will be filled by this proposed resource evaluation:

1. Routine collection of surface water quality samples on the mainstem between the Little Blackfoot River and Rock Creek;
2. Intensified water quality monitoring in the reach from Warm Springs to Dempsey, and;
3. Collection of dissolved and total metals, (presently only total recoverable metals are being collected) pH, alkalinity and hardness at selected sites.

This latter addition to surface water quality monitoring would allow for better prediction of metal speciation and would, therefore, be supportive of the work being conducted by the Chemistry Department at Montana State University.

b. Groundwater Monitoring

The Superfund studies in the vicinity of Butte and Anaconda are collecting some groundwater quality information This work needs to be expanded to include shallow groundwater monitoring in streamside areas contaminated by tailing deposits. The investigation should be concentrated in the stream reach from Warm Springs to Dempsey. This work will determine the contribution of shallow groundwater sources to the elevated metal levels found in the upper river during runoff conditions.

c. Floodplain Mapping of Heavy Metal Deposits.

The extent and magnitude of the streamside deposits of mine tailings or "slickens" in the upper Clark Fork River is presently unknown. These sources of heavy metals need to be located and quantified. The Clark Fork River Basin Project proposes that an initial screening of deposits that are potentially erodible under normal high water conditions be conducted throughout the upper river. In the area from Warm Springs to Dempsey the survey should be expanded to include the entire floodplain.

d. Fish Habitat Evaluation.

The impacts of stream channel modifications upon fish habitat is also considered to be a factor that is limiting trout populations in the upper river. Presently, the habitat suitability for trout in this project area is largely unknown. A physical features inventory conducted by the Soil Conservation Service (1983) addressed human impacts to the streambanks and channel, but did not specifically address fish habitat. The results of this proposed inventory should be expanded to include measurements of undercut banks, overhanging riparian vegetation and mid-channel cover (provided by boulders and logs). A cursory survey should be conducted throughout the entire project area. Intensified measurements should be made (1) in the reach from Warm Springs to Dempsey and (2) at all sections that are presently sampled for fish population estimates.

e. Biological Monitoring.

The changing characteristics of water quality in the upper Clark Fork River since the shutdown of the Anaconda Company operations and the uncertainty of the applicability of much of the past monitoring data (i.e., lack of dissolved metal collections and/or metals speciation work) suggests that a greater reliance upon biological monitoring may be needed. Excellent historical records of fish populations are available for the upper river. This data base should be expanded by:

i. Aquatic invertebrate monitoring

The present work conducted by Chadwick and Associates under contract by the Anaconda Company (yearly samples at

Warm Springs, Deer Lodge and Phosphate) and the Montana Water Quality Bureau (quarterly samples at Turah) should be expanded to include quarterly sampling of invertebrate populations at all fish population stations in the Clark Fork mainstem. Samples should also be collected at key fish population stations on Rock Creek, the Little Blackfoot River, Flint Creek and Warm Springs Creek. An intensified study should be conducted to characterize invertebrate populations in the reach from Warm Springs to Dempsey.

ii. Periphyton sampling

The same locations proposed to be sampled for aquatic insects should also be sampled for periphyton. Species diversity and accrual rates should be monitored seasonally. This monitoring is particularly important in the reach from Warm Springs to Dempsey. The productivity of the river immediately below the Warm Springs Ponds is likely increased by liming activities and nutrient additions from the cities of Butte and Anaconda. Careful monitoring of periphyton, aquatic invertebrates and fish populations will help determine how biological communities are affected within the Warm Springs to Dempsey reach.

iii. Fish population surveys

The fish population work presently being conducted by the Montana Department of Fish, Wildlife and Parks should be expanded to include intensified sampling in the Warm Springs to Dempsey reach of the river. Three or four stations within this twelve mile reach should be sampled both in the spring and fall. These sampling efforts are necessary to determine the downstream extent of benefits provided by the Warm Springs treatment ponds. The fishery crew assigned to this project should also be available to assist the Department of Fish, Wildlife and Parks biologists with population sampling at other stations on the upper river and its tributaries.

f. Streambank Stabilization Demonstration Project

All of the above resource evaluations will provide the baseline information needed to proceed with an actual reclamation demonstration project on the upper river. This project will be located within the reach of river between Warm Springs and Dempsey. If metal reductions are achieved by the demonstration project, concurrent changes in the biological community can be best monitored here (i.e., a definite gradient in trout numbers now exists; will this "slope of change" be demonstrably improved?).

Following the development of engineering designs and cost estimates, several bank stabilization treatments will be utilized. Part of the engineering designs must predict any stream instability that might occur downstream as a result of stabilizing the channel within the demonstration project area.

Wherever possible, eroding streambanks will be stabilized with treatments that concurrently provide fish habitat. Bank sloping, followed by willow plantings, flow defectors and subsurface log placements are examples of "soft" stabilization techniques that could be utilized.

Study Duration

The total resource evaluation package suggested for this Project Area should be conducted over two years.

2. Project Area 2

Blackfoot River Recreational and Fishery Survey

The Blackfoot River is the major fishing and floating tributary in the Clark Fork Basin study area. The recreation value of this sparsely populated, highly accessible river is increasing every year. Yet increased timber harvesting and road building threaten fish habitat and water quality of the Blackfoot River. Without proper assessment of present fishery and recreational conditions, much of the river's values may be lost before modification of use in surrounding public lands can be implemented. To gather the kind of baseline information needed to insure perpetuation of the values of the Blackfoot River, the following evaluations are proposed:

a. Recreational Survey

A 1979 recreational use survey that was conducted by the Montana Department of Fish, Wildlife and Parks should be updated. Comparing present recreational use figures with those generated in 1979 will provide the kind of "hard" data needed to quantify the growth of the recreation-based industry of this river system.

b. Fishery Evaluations

The spawning and rearing potential of all major tributaries of the Blackfoot River needs to be evaluated. The work presently being conducted by the Montana Department of Fish, Wildlife and Parks on tributaries of the middle Clark Fork River should be extended to the Blackfoot River. Netting, tagging, redd-counts, fry trapping and some fish population estimates should be conducted. Sediment impacts, in particular, should be measured on selected streams.

Study Duration

Both the recreational and fishery evaluation should be conducted over one full field season.

3. Project Area 3
Bitterroot River Stream Corridor Management Plan

Growth rates of rainbow trout in the Bitterroot River are among the highest in the state. But, the combined impacts of dewatering and stream channel modifications significantly reduce the trout populations of the river. The need exists for a coordinated and integrated approach to rectify these impacts.

The Clark Fork River Basin Project proposes to assist in the development of a Corridor Management Plan for the basin. Problem sites would be identified, rated and grouped into specific work projects. Reclamation techniques for each site (or work project areas) would be designed, and cost estimates provided. Sites would then be prioritized as to their need for actual reclamation. Consolidation of ditches, stabilization of significantly eroding streambanks and various water storage and conservation techniques would be examples of topics to be addressed in the plan.

This proposed evaluation would augment the dewatering investigations presently being conducted by the Montana Department of Fish, Wildlife and Parks. Past resource evaluation by the Montana Department of Natural Resources and Conservation and the University of Montana would also be utilized.

Implementation of such a basin-wide plan would not only benefit fish and other aquatic life, but would assist landowners. Problems that affect their operations such as loss of stream banks to erosion, flooding of bottom lands, sedimentation of irrigation ditches and unstable diversion structures would be addressed. Development of a Corridor Management Plan would insure that all future channel modifications and water withdrawals are conducted with proper consideration of impacts to adjacent landowners and to the river and fishery.

Study Duration

This proposed resource evaluation would be conducted for one year.

4. Project Area 6
Limnological Evaluations of the Lower River Reservoirs

Presently, Cabinet Gorge, Noxon Rapids and Thompson Falls Reservoirs do not support a viable sport fishery. Their ability to support a food base for the fishery is largely unknown. As well, the reservoirs' influence upon nutrient cycling, which ultimately effects their productivity and the water quality of Lake Pend Oreille, is presently unquantified. These distinct, but interrelated questions will be addressed by this proposed resource evaluation.

a. Food Base Evaluations

Phytoplankton biomass and/or primary productivity investigations need to be conducted on the reservoirs. Investigations into zooplankton productivity or standing crops also need to be undertaken. The latter evaluation should be concentrated in bays or side channels like Marten Creek, Trout Creek and Vermillion Bay, where the influence of river currents is minimal. Stomach content analyses of fish will also be an integral part of this investigation.

b. Nutrient Cycling Evaluations

This in-reservoir work would be complimented by the nutrient source assessment of the Clark Fork River Basin (proposed resource evaluation 1). To determine the effects of stratification, turnover and dam operations on nutrient cycling, assimilation and removal, the following actions are proposed:

i. Nutrient, dissolved oxygen and temperature profiles will be frequently collected at three stations on Noxon Rapids Reservoir and at one station on Cabinet Gorge Reservoir.

ii. Algal assays will be conducted seasonally on water collected from the surface and bottom of the reservoir stations, as well as from the below Plains and below Cabinet Gorge river stations. These assays would help determine changes in the biological availability of nutrients as water moves through, and is cycled within, the reservoir complex.

Study Duration

This resource evaluation would be conducted for one full year.

5. Project Area 7
Trophic Evaluation of Lake Pend Oreille

Since the largest threat to the water quality of Lake Pend Oreille is increased nutrient loading, the present trophic status of the lake needs to be determined. Predictive modeling of the effects of increased nutrient loading on Pend Oreille's quality should also be undertaken. The Idaho Water Quality Bureau is presently collecting baseline nutrient, Chlorophyll-a and algal assay information from three lake stations. This investigation should be expanded to include:

a. Determination of current flow patterns in the lake;

b. Profiles of nutrients, dissolved oxygen and temperature;

c. Better quantification of algal biomass and/or primary productivity rates;

d. Separation of the influences of shoreline nutrient additions versus those contributed by the Clark Fork River Basin. Part of this question will be addressed by the basin-wide nutrient source assessment. However, nutrient availability assessments (algal assays) as suggested for the lower river reservoirs should also be undertaken. Septic tank drainfield effluents should be compared to surface water contribution in these assays.

V. SCOPE OF WORK AND TIME SCHEDULES

The project study plan will be implemented through a series of tasks performed by the project staff working in conjunction with the project advisory councils and committees. The following tasks are proposed to be accomplished during the period of May, 1985 -- June, 1988 (Table 3).

A. Project Tasks

1.0 Prepare Project Work Study Plan. The work study plan describes (1) background information on current conditions and activities affecting the Clark Fork River Basin; (2) goals and objectives of the project, and (3) a proposed study plan and budget. The plan is developed in consultation with the project advisory committees.

2.0 Develop a comprehensive system to store, retrieve and analyze aquatic resource data. Identify existing data systems used by state and federal agencies; examine opportunities for improved interaction and access between existing systems. Select and implement a system that will provide for storage and retrieval of aquatic resource data and information for the Clark Fork River Basin.

2.1 Review, compile and analyze existing aquatic resource data.

--Develop a bibliography of reports and data files for the Clark Fork River Basin;

--Compile and summarize data from different sources according to project study areas, specific problem areas and for the entire basin. Develop a report that describes past and existing conditions affecting aquatic resources, trends in water quality and aquatic resources, identification of major environmental problems affecting water quality and aquatic resources.

2.2 Identify and prioritize environmental problems affecting water quality and aquatic resources in the river basin. The data and information identified in Task 2.1 will be systematically reviewed with the project advisory committees and general public to establish priorities for action's to mitigate identified problem areas.

3.0 Identify potential sites and feasible methods for reclamation and waste load reductions. (1) Existing data and ongoing studies will be analyzed to identify specific sites where reclamation of mine tailing deposits and stream banks will significantly reduce the movement of heavy metals and sediments into the upper river. Reclamation plans will be developed and implemented wherever possible. (2) Existing and new information will be analyzed to determine specific sites where water quality standards and criteria are exceeded. Waste load reductions and methods for resolving these problems will be proposed and implemented.

3.1 Prepare a plan to improve (optimize) and sustain desirable fish populations and other aquatic resources in the Clark Fork River Basin. Coordinate efforts between appropriate agencies to (1) identify water quality and habitat limitations, and actions necessary to improve these conditions; (2) identify measures to improve recreational opportunities including public access and facilities.

3.2 Identify additional study needs. Through a review of existing data, consultation with agencies, and the project advisory committees specific information needs will be identified. Wherever possible, existing studies will be expanded to provide the additional information; if necessary-, new studies will be proposed.

4.0 Coordinate research, reclamation and information dissemination activities.

4.1 Monitor activities, results and recommendations of Superfund programs at Silver Bow Creek, Milltown Dam and Anaconda Reduction Works. Summarize and transfer these data to appropriate agencies to minimize duplication of efforts and maximize the usefulness of the data. Quarterly status reports prepared for distribution.

4.2 Coordinate and monitor studies and activities by agencies and individuals. Routine meetings and communication with project leaders, agency representatives and individuals to assure new information is available to interested parties and to aid in joint efforts to minimize costs and duplication of efforts. Quarterly status reports will be prepared.

4.3 Organize and conduct meetings of advisory groups and committees and the general public. Project staff will announce meetings, prepare program materials and agendas to insure coordination, information dissemination and opportunities for public participation.

4.4 Provide information to public interest groups and individuals. The project staff will meet with public interest groups, industry, municipalities and other groups to hear concerns and to explain progress of existing studies. News releases, oral and written presentations and reports will be provided as necessary.

5.0 Develop a comprehensive action plan to maintain and enhance the quality of the aquatic resources of the Clark Fork River Basin. This final report will combine the information from interim reports to (1) identify basin wide water related issues and problems (2) describe an array of feasible management options for protecting aquatic resources that can be implemented by government and industry decision makers and (3) describe long-term monitoring and management plans that will serve future planning and regulatory decisions.

TABLE 3 PROJECT STUDY WORK PLAN SCHEDULE

TASK NO.	ACTIVITY	OUTPUT	TARGET COMPLETION DATE
1.0	Prepare project study plan	Study Plan	May, 1985
2.0	Develop comprehensive data base	Data system Status reports	January,1988 Quarterly
2.1	Review, compile & analyze existing data	Draft Report Final Report Status Reports	January, 1987 January, 1988 Quarterly
2.2	Identify & prioritize environmental problems	Included in Task 2.1	
3.0	Identify potential sites & feasible methods for reclamation and waste load reductions	Draft Report Final Interim Status Reports	June, 1987 January, 1988 Quarterly
3.1	Prepare fisheries and recreational improvement plan	Same as 3.0	
3.2	Identify additional information needs	Same as 2.1	
4.0	Coordinate research, reclamation and information dissemination	Status Reports	Quarterly
4.1	Monitor Superfund activities and results	Status Reports	Quarterly
4.2	Coordinate & monitor studies and activities and individuals	Status Reports	Quarterly
4.3	Organize & conduct meetings of advisory groups, committees and the general public	Status Reports	Quarterly
4.4	Provide information to public interest groups and citizens	News Releases, Presentations, Reports	January,1988
5.0	Develop a comprehensive action plan	Final Report	June, 1988