MONTANA DEPARTMENT OF FISH AND GAME

LONG-RANGE PLAN FOR INSTREAM FLOWS

MARCH 1979

OVERVIEW

Montana is one of the few western states which has the ability to allocate a portion of its surface waters to remain instream for fish and wildlife purposes. Section 85-2-316 of the Montana Water Use Act outlines a procedure for the reservation of waters of the state. The reservation process has just been completed for the Yellowstone River basin. The Department of Fish and Game took an active part in these proceedings in defense of instream flows for fish and wildlife. As a result, the department has been granted an instream allocation amounting to 5.5 million acre feet of water at Sidney.

The obvious question at this time pertains to the future direction of our efforts at securing instream flows. Where should we be headed during the next 5 years? Certainly, much remains to be done in regard to maintaining the integrity of the Yellowstone allocations. Legal challenges must be met, allocations must be substantiated and defended during the review period and additional biological and flow data obtained to comply with certain conditions of the order.

In addition, other basins have been identified which are: (1) particularly vulnerable to dewatering, (2) areas of high aquatic resource value, or (3) unique or contain features of special interest. The basins selected for further work on instream flows based on the above criteria are as follows:

(1) Upper Clark Fork (from the headwaters downstream to Bonner).
(2) Upper Missouri (from headwater tributaries downstream to Canyon Ferry Dam).
(3) Middle Missouri (from Fort Benton to Fort Peck Reservoir).
(4) Blue ribbon trout streams.

All items are scheduled to start during the summer of 1979 - the upper Clark Fork study is scheduled for completion in 2 years - the middle Missouri in 3 years, and the upper Missouri in 4 years. The Blue Ribbon streams will take 4-5 years to complete. A discussion of these specific items follows.

UPPER CLARK FORK

BACKGROUND

The Clark Fork of the Columbia River has its headwaters in Montana near the town of Butte and flows in a northwesterly direction, leaving the state near Thompson Falls. In the past, the Clark Fork has periodically suffered severe degradation from industrial pollution spills, often resulting in fish kills and bottom substrate damages. As a result, the aquatic populations have historically been maintained at levels well below the carrying capacity of the stream.

Recent efforts at industrial pollution abatement in upstream areas have considerably improved the quality of water. Fish populations have responded dramatically and, in some sections, rival those found in many of our Blue Ribbon streams. Even though the Clark Fork has recovered dramatically from past abuses, certain reaches are exhibiting signs of stress from chronic temperature, nutrient and dissolved oxygen problems. These problems are directly related to discharge and severity increases with a decrease in stream flow.

Certain segments of the Clark Fork appear to be in a borderline flow condition now during the low flow summer months. Additional dewatering could severely impact these segments. A major water source for the upper river is the discharge from Anaconda's waste treatment ponds. Certainly the 1983 zero discharge requirement imposed on Anaconda could significantly impact the entire upper Clark Fork.

The Clark Fork currently has no instream flow protection. In view of the vulnerable position of the upper Clark Fork, it is felt that a reservation of flow for this section of river should be the department's next priority.

STUDY AREA

The reach of Clark Fork considered for reserving flows is from the town of Bonner upstream to the headwaters. This does not include the Blackfoot or Bitterroot rivers. The Blackfoot currently enjoys a measure of protection from a 1971 instream flow filing under provisions of Section 89-801, R.C.M. 1947. The Bitterroot more properly comes under the category of a reclamation effort rather than a preservation effort.

METHODS

The methods for flow determination on the upper Clark Fork are relatively simple and straightforward. The Clark Fork is not a large river in the reach considered for a reservation and lends itself very well to adequate biological sampling and

standard surveying techniques. A brief summary of methods to be considered for the determination of instream flows on the Clark Fork and its tributaries is presented below.

MAIN STEM

BIOLOGICAL

The upper portion of the study area extends from its headwaters downstream to the town of Garrison. The Clark Fork in this reach is a river very similar to the Beaverhead below Clark Canyon Dam. The habitat conditions in this reach are excellent with good flows and an abundance of overhanging brush and undercut banks.

As a result of 12 years of research on the Beaverhead, a method has been developed to determine instream flows for that type of river. The approach taken to determine instream flows on the Clark Fork upstream from Garrison will be twofold. First, an intensive inventory of aquatic populations and habitat conditions will be conducted to determine the similarity in habitat conditions and fish populations between the upper portion of the Clark Fork and the Beaverhead.

After sufficient correlation has been documented between the two rivers, the method developed on the Beaverhead will be transferred and used on the upper Clark Fork. Basically this method consists of taking a number of cross-sectional stream profiles throughout the reach in question and plotting the wetted perimeter against discharge for the composite of the cross-sections. It has been demonstrated that the two major points of inflection on the wetted perimeter versus discharge curve correspond quite closely to the low and high level of aquatic habitat potential as defined in the department's Upper Missouri Level B Instream Flow Report.

The reach of the Clark Fork from Garrison to Bonner presents an altogether different set of aquatic conditions from the headwaters segment and offers the possibility of a direct determination of differing flows on fish populations and aquatic life.

From Garrison downstream to the mouth of Rock Creek, the Clark Fork commonly suffers from low flows during the summer months which stress the aquatic communities and prevent the attainment of a desirable level of productivity. In this reach, low flows aggravate an already undesirable nutrient problem and results in lowered dissolved oxygen levels. In addition, hot springs discharge in this reach and elevate water temperatures to undesirably high levels. The combination of high nutrient concentrations, high water temperatures, low D.O. levels and low flows tend to suppress fish and aquatic populations in this reach.

In contrast, the aquatic conditions in the Clark Fork below the mouth of Rock Creek improve significantly. The discharge from Rock Creek not only adds flow to the Clark Fork, but also serves to dilute the nutrient levels and cool water temperatures during the summer months.

An analysis of fish and aquatic insect populations above and below the mouth of Rock Creek should allow a determination of the effects of different flow levels on such population parameters as species composition, relative abundance, age structure, growth and condition. From this, desirable flow regimes can be determined.

WATER QUALITY

In addition, a study is currently in progress to establish the relationship between flow, nutrient levels, water temperatures and dissolved oxygen levels in this reach of river.

Throughout 1979 and 1980, the pollution control section of this department will continue the monthly water quality monitoring of the upper Clark Fork River that was begun in April 1978. Thirteen stations will be monitored for algal nutrients and common ions. Periodic surface discharge/water quality "runs," utilizing at least 20 stations, will also be conducted to determine nutrient loads and to identify potential groundwater sources of these nutrients.

Laboratory algal productivity tests (algal assays) will be conducted as well as instream artifical substrate (net productivity) determinations. Analyses of instream diurnal curves of dissolved oxygen will be conducted to (1) further predict primary productivity levels, (2) establish eutrophication indices, which will be a summation of the most extreme summer dissolved oxygen fluctuations plus water temperature maxima (these indices will be established at every mainstem station where estimates of fish populations will be determined by Fisheries Division biologists), (3) attempt to correlate levels of trout productivity to the eutrophication indices, and (4) identify flows needed to maintain desirable D.O. levels during summer low flow months.

It should be noted that a considerable amount of algal nutrient, common ion, temperature and dissolved oxygen data have been collected in the upper Clark Fork River by this department during the past 2 years. The upcoming 2 years of data collection, however, will be much more thorough and intense, particularly concerning the methodologies involved in diurnal dissolved oxygen sampling and the subsequent data interpretation and analyses. Modification and combination of the techniques of Odum (1956), Edwards, Owens and Gibbs (1961), Edwards (1962), Churchill, et al. (1962), and others will be employed. Correlations will also be made between such field determinations and data from artifical river experiments that were conducted by this department on the Yellowstone River during the past summer (data from this study will be published later in 1979).

AQUATIC INSECTS

The previously mentioned methods for instream flow determinations are based on maintaining fish populations and various water quality parameters at desirable levels. An additional consideration involves securing flows necessary to maintain existing aquatic insect populations. A technique has recently been developed (Gore 1978) for predicting instream flow requirements of benthic macroinvertebrates. With sufficient effort, this technique can be applied to the main stem of the Clark Fork.

TRIBUTARIES

The approach taken for reserving instream flows on the tributaries to the Clark Fork will stem from two basic considerations. First, tributary streams will be inventoried to determine the species composition and status of resident fish populations. Present plans are to use the Instream Flow Group's Incremental Flow Methodology to identify desirable flow levels for the tributary streams.

In addition, the lower portions of the tributaries will be regularly sampled to determine their importance to the main stem Clark Fork as spawning and nursery areas. Extensive fish tagging operations will be carried out to determine the relative importance of various tributaries to sections of the main river. During the spawning season, instream flow requests for the lower portions of important tributaries will be keyed to spawning and rearing requirements.

ADDITIONAL STUDIES

Several other factors in addition to determining instream flow numbers need to be addressed in preparing a reservation of flow under Montana law. One of the major requirements involves an economic assessment of the effects of the applicant's reservation. Since the Clark Fork supports industry and power generation as well as recreation and agriculture, the economic analysis is necessarily complex and will have to be addressed as a separate study.

An analysis of the present recreational situation on the Clark Fork is vital to support an instream reservation. A graduate student at the University of Montana, Missoula is currently conducting a recreational study on the Clark Fork and the report is expected to be completed in the near future.

ADDITIONAL FUNDING NEEDS

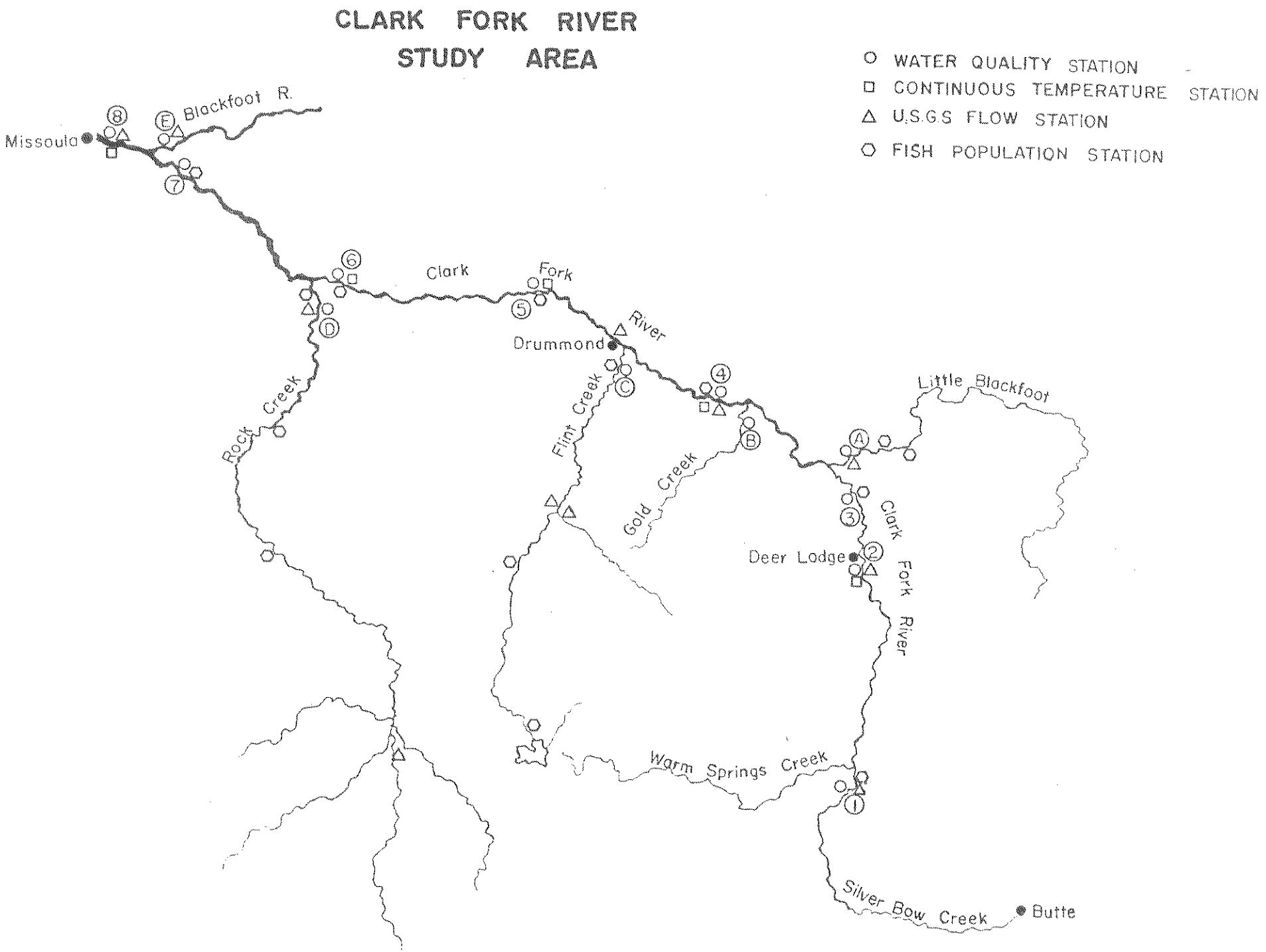
The Department of Fish and Game has been actively involved in instream flow work on the upper Clark Fork for more than a year. As a result, work on many of the items mentioned above has already been initiated.

The nutrient/dissolved oxygen study began in April 1978 and will be supplemented by 2 additional years of research. This study already has secured funding for its duration. The recreation study has also been funded and is due to be completed shortly.

The fisheries study has been initiated, however, it is seriously underfunded. All necessary equipment, supplies and material have either already been obtained or have otherwise been provided for. In addition, two fisheries field biologists have had most of their time and travel committed to this effort. The obvious deficiency in the fisheries study is the lack of adequate funding for fisheries aids. To successfully complete the fisheries study, three fisheries aids will have to be employed for a 6-month period during the first year and a 9-month period during the second year. Total cost for the first year would be approximately $18,000 (including travel expenses). Second year expenses would be approximately $24,000. This level of funding would allow adequate treatment of both main stem Clark Fork and tributary study areas.

The aquatic insect study approach is not funded. This study lends itself well to a graduate student project approach and would require a funding level of $8,000 per year for 2 years. Research would most likely be conducted out of the University of Montana at Missoula.

The economic study is not presently funded. While we have no firm proposals in hand at this time, we feel a funding level of $15,000 for 1 year should be sufficient.


CLARK FORK RIVER
STUDY AREA
WATER QUALITY STATION
CONTINUOUS TEMPERATURE STATION
U.S.G.S FLOW STATION
FISH POPULATION STATION
Missoula
Blackfoot R.
Clark Fork River
Drummond
Rock Creek
Flint Creek
Gold Creek
Little Blackfoot
Deer Lodge
Clark Fork River
Warm Springs Creek
Silver Bow Creek
Butte

UPPER MISSOURI

Background

Fisheries values in the Missouri River drainage above Canyon Ferry Dam are recognized as some of the best wild trout waters in the nation. Many of the smaller streams supply water flows necessary to maintain the fisheries values in the larger streams and rivers. These smaller streams also provide locally important fisheries.

A fishery is dependent on favorable water quality, water quantity, temperature and cover. Previous laws in Montana and by the federal government provide for protection of water quality and temperature. Some protection of cover is provided under the Stream Preservation Acts which cover essentially all projects potentially detrimental to streambank habitat.

Only recently has there been a mechanism to provide flows to maintain aquatic productivity. In 1973, under the Montana Water Use Act, a provision was made to allow agencies of government to reserve flows to protect fish and wildlife resources. The first use of this process took place in the Yellowstone drainage and culminated in the Board of Natural Resources and Conservation's decision of December 15, 1978, where 5.5 million acre feet per year were reserved instream for fish and wildlife preservation.

The Board of Natural Resources and Conservation is currently considering other basins for flow reservations. The two discussed in detail have been the Missouri above Canyon Ferry and the Clark Fork above Bonner.

There are considerable BLM and Forest Service lands which border on major trout rivers and tributary streams in these areas. The reservation process will directly affect management in many of these areas, and involvement of the agencies (BLM and Forest Service) will be an important part of the process.

Since the Upper Missouri drainage is being considered as a likely candidate for one of the next water allocation areas, it is imperative to assess the current situation and identify areas needing further work in the future.

Currently in the Missouri drainage above Canyon Ferry Dam, flow recommendations for the Upper Missouri River Basin Level B planning effort have been made for the Jefferson, Madison, Gallatin, East Gallatin, West Gallatin, Big Hole, Beaverhead and Ruby rivers. Several tributaries in the Gallatin Forest have had, or are in the process of having, the IFG-4 method completed to identify flow needs.

Additional Data Needs

There are approximately 70 other tributaries in the study area where either biological and/or instream flow studies are needed.

Goals of the investigations would be (1) to determine fish populations in approximately 50 tributaries where adequate data is not available and (2) to use the IFG-4 or wetted perimeter methodology to determine fishery flow needs in approximately 70 tributaries of the Missouri above Canyon Ferry.

Methods

To obtain data on the tributary streams sufficient for a request to reserve flows, the following procedure would be used:

1) Status of existing fish populations would be determined by estimating numbers and biomass in approximately 1000 foot sections on selected tributaries during the summer and fall months when flows are lowest.

2) The IFG-4 method would be employed on a section of selected tributaries. Cross-sectional measurements would be made during high, moderate and low flow stages. The data would be submitted for computer analyses and flow ranges determined which would maintain both the low and high level of aquatic habitat potential.

Approximately 18 tributaries should be completed each field season. The probable sequence of completion would be Bighole, Beaverhead, Ruby, Jefferson, Gallatin and Madison drainages. The proposed tributaries are included in Appendix 1.

Duration of Study

The study should be conducted over a 4 year period beginning May 1979 and terminating with a final report in February 1984.

Financial Needs

To accomplish the proposed work on the selected tributaries, a budget of approximately $37,000 per year will be required. An approximate budget breakdown is provided below.

Additional Finances Required		Annual Finances Provided by Fish and Game
(1) Salaries:		
1 Biologist-12 months	$15,131	1 Supervisor-1 month
2 Fisheries Fieldworkers- 6 months each	9,868	1 Biologist-3 months
Benefits	3,999	
(2) Supplies:		
Office	200	
(3) Equipment:		
Waders & Miscellaneous	400	All surveying, flow and electrofishing equipment provided by Fish and Game
(4) Travel:		
Per diem	4,500	Vehicle will be provided
12,000 miles @ 18¢/mile	2,160	by Fish and Game
(5) Other Services:		Electrofishing estimates run
Computer runs for IFG-4	1,000	by Fish and Game
Contracted secretarial services	200	Office space will be supplied Fish and Game
Total	$37,458	

Appendix 1. Potential streams for biological and instream flow needs studies.

Big Hole Drainage	
Willow Creek	4S 9W S26
Rock Creek	3S 10W S25
Trapper Creek	2S 9W S34
Camp Creek	2S 9W S26
Moose Creek	1S 9W S33
Canyon Creek	1S 9W S32
Divide Creek	1S 9W S08
Deep Creek	2N 12W S29
French Creek	2N 12W S16
Pintlar Creek	1N 15W S23
LaMarche Creek	2N 13W S34
Fishtrap Creek	1N 13W S04
Mussigbrod Creek	1S 16W S09
North Fork Big Hole	1S 15W S33
Trail Creek	2S 17W S23
Ruby Creek	3S 17W S15
Steel Creek	2S 15W S34
Big Lake Creek	4S 16W S32
Miner Creek	6S 16W S03
Governor Creek	5S 15W S26
Warm Springs Creek	5S 14W S16
Wise River	1S 12W S19
Pattengail	2S 12W S10
Beaverhead Drainage	
Blacktail Creek	9S 8W S14
East Fork Blacktail Creek	11S 6W S04
Grasshopper Creek	8S 10W S26
Horse Prairie Creek	10S 11W S11
Bloody Dick Creek	9S 15W S15
Red Rock River	12S 9W S20
Red Rock River	14S 1E S16
Big Sheep Creek	13S 10W S35
Odell Creek	
Tom Creek	
Ruby Drainage	
Ruby River	6S 4W S17
Ruby River	7S 4W S31
Warm Springs Creek	
Middle Fork Ruby	
West Fork Ruby	
East Fork Ruby	

Appendix 1 continued. Potential streams for biological and instream flow needs studies.

Jefferson Drainage	
Boulder River (above Little Boulder)	
Boulder River (above mouth Bison Creek)	
South Boulder River	1S 3W S22
Willow Creek	1N 1E S19
Whitetail Creek	2N 4W S09
East Gallatin Drainage	
Rocky Creek	2S 6E S6
Sourdough Creek	2S 6E S6
Sourdough Creek*	3S 5E S25
Bridger Creek	1S 6E S31
Hyalite Creek	1N 5E S32
Hyalite Creek*	3S 5E S25
West Gallatin Drainage	
Baker Creek	1N 3E S12
Spanish Creek	4S 4E S18
South Fork Spanish Creek*	4S 3E S32
Hell Roaring Creek*	4S 4E S4&5
Squaw Creek*	4S 4E S34
Swan Creek*	5S 5E S25
Moose Creek	6S 5E S6
Portal Creek	6S 4E S13
West Fork*	6S 4E S32
North Fork	6S 3E S35
Middle Fork	6S 3E S35
South Fork	6S 4E S31
Porcupine Creek	7S 4E S16
Beaver Creek	7S 4E S17
Buck Creek*	8S 4E S4
Taylor Fork*	9S 4E S11
Cache Creek*	9S 3E S4&9
South Cottonwood*	3S 5E S34
Madison Drainage	
Cherry Creek	2S 1E S36
Hot Springs Creek	3S 1E S9
North Meadow Creek	4S 1W S34
South Meadow Creek	4S 1W S34
Jack Creek	5S 1W S24
O'Dell Creek	5S 1W S26
Blaine Spring Creek	7S 1W S6
Indian Creek	8S 1E S30
Indian Creek	8S 1E S36

Appendix 1 continued. Potential streams for biological and instream flow needs studies.

Madison Drainage continued	
Ruby Creek	9S 1W S12
Squaw Creek	10S 1E S33
Standard Creek	10S 1E S33
Grayling Creek	12S 5E S8
Duck Creek	12S 5E S22
Cougar Creek	12S 5E S22
South Fork Madison*	13S 4E S24
West Fork Denny Creek*	13S 4E S17
Watring Creek*	12S 4E S7&18
Antelope Creek	12S 1E S36
Missouri Drainage	
Missouri River at Toston	5N 2E S15
Sixmile Creek**	
Crow Creek**	
Dry Creek**	
Deep Creek	7N 3E S36
Duck Creek**	
Confederate Creek**	
Antelope Creek**	
Beaver Creek**	

*IFG-4 completed by U.S. Forest Service
** Biological survey before determination of need for instream reservation

MIDDLE MISSOURI

Under legislation signed by President Ford in October 1976, a 149-mile reach of the Missouri River in northcentral Montana was incorporated into the National Wild and Scenic Rivers system. A portion of this legislation requires that the designated management agency, the Bureau of Land Management, determine instream flows required to maintain the river, commensurate with the purposes of the act. This determination will be based, in part, on instream flow requirements needed to maintain the fishery resource and its associated aquatic habitat.

The Montana Department of Fish and Game is currently conducting a fisheries inventory and planning study in the 149-mile reach of the Missouri River included in the aforementioned legislation. The department has expended considerable time and effort in becoming familiar with proven sampling methods on large rivers and in developing equipment and techniques adaptable to the Missouri River. The department's study efforts, initiated on October 1, 1975, parallel to some extent the effort to be made by the Bureau of Land Management on instream flow quantification. In view of the difficulty of quantifying instream flow needs for fisheries in a large river, such as the Missouri River, it was deemed beneficial for the Bureau of Land Management and the Montana Department of Fish and Game to cooperate in developing a suitable methodology.

There is little need to review the circumstances which make the proposed study particularly important at this time. It is sufficient to note that because of the increasing human demand for Montana's limited water supplies for industrial, agricultural and domestic uses, the prospect for water resource development plans on streams such as the middle Missouri River appears likely. Projects which remove or impound substantial amounts of water will undoubtedly alter the existing flow regimens and the associated aquatic communities. Unless streamflow levels necessary to maintain the aquatic resources of the Missouri River are determined, little can be done to evaluate conflicting resource demands and minimize adverse impacts on the aquatic resource.

The Bureau of Land Management and Department of Fish and Game have embarked on a cooperative instream flow study on the middle Missouri. The study is scheduled to begin during spring 1979 and is designed to run for 3 years, although funding is on an annual basis.

BLUE RIBBON STREAMS

Another long-range goal of our instream flow program is the determination of instream flow needs for the 12 Blue Ribbon streams. Under provisions of Section 89-801 passed by the 1969 Montana legislature (the so-called Murphy's Law), the Department of Fish and Game was able to file for instream water rights on our 12 best, or "Blue Ribbon" streams.

A list of the 12 streams and the Fish and Game filing dates follows:

Big Spring Creek - Fergus County, 12/21/70
Blackfoot River - Missoula County, 1/6/71; Powell County, 1/7/71
Flathead River including North Fork - Flathead County, 12/22/70
Gallatin River - Gallatin County, 12/21/70
West Gallatin River - Gallatin County, 12/21/70
Madison River - Madison County, 12/21/70; Gallatin County, 12/28/70
Missouri River - Lewis and Clark County, 12/21/70; Broadwater County, 12/17/70; Cascade County, 12/17/70
Rock Creek - Granite County, 1/7/71; Missoula County, 1/6/71
Smith River - Cascade County, 12/17/70; Meagher County, 12/22/70
Yellowstone River - Stillwater County, 12/14/70; Sweetgrass County, 12/14/70; Park County, 12/23/70
Middle Fork Flathead River - Flathead County, 12/22/70
South Fork Flathead River - Flathead County (not filed); Powell County, 1/7/70

As the result of a decision concerning a contested water right on the Smith River (one of our "Blue Ribbon" streams), it was determined that the Department of Fish and Game did indeed have an instream right, but it is unquantified at the present time. Consequently, the instream flow numbers must be quantified for all our "Blue Ribbon" streams before they can become effective.

The introduction of Senate Bill 76 in the 1979 Montana Legislature and its apparent success lends a certain urgency to the quantification of our filed rights on the 12 "Blue Ribbon" streams. Senate Bill 76 is entitled "An Act to Adjudicate Claims of Existing Water Rights in Montana."

Basically, this act establishes a procedure for a centralized filing of all water rights prior to enactment of the 1973 water use act. In addition, a system of water courts would be provided for the actual adjudication process.

As a result of the 1970 and 1971 filings, the department became an "existing water user on the 12 "Blue Ribbon" streams.

Under Senate Bill 76, failure to file a claim will result in the presumption that the water right or claimed water right has been abandoned. The department, therefore, is compelled to file on and substantiate the flows originally claimed on the 12 "Blue Ribbon" streams under Section 89-801, R.C.M. 1947.

The quantification of the department's existing instream rights on the 12 "Blue Ribbon" streams has been identified as a long-range priority requiring at least 5 years to complete. At the present time, a specific array of projects necessary to accomplish this goal and an estimate of cost is not available.