BEFORE THE MONTANA BOARD OF NATURAL

RESOURCES AND CONSERVATION

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IN THE MATTER OF WATER	)
RESERVATION APPLICATION NOS.	)
69903-41O 71895-41I 72578-41L	)
70115-41F 71966-41S 71579-41T	)
70117-41H 71997-41J 72580-41A	)
70118-41H 71998-41S 72581-41I	)
70119-41H 72153-41P 72582-41I	)
70270-41B 72154-41K 72583-41P	)
71537-41P 72155-41A 72584-41S	)
71688-41L 72256-41P 72585-41M	)
71889-41Q 72307-41Q 72586-41P	)
71890-41K 72574-41O 72587-41G	)
71891-41P 72575-41K 72588-40C	)
71892-41G 72576-40E 73198-41I	)
71893-41K 72577-41P 73199-41S	)
71894-41I IN THE UPPER	)
MISSOURI RIVER BASIN	)

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DEPARTMENT OF FISH, WILDLIFE AND PARKS' PREFILED DIRECT TESTIMONY

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Prefiled direct testimony submitted in support of the Department of Fish, Wildlife and Parks' application for instream flow reservations in the upper Missouri River Basin

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November 1, 1991

Volume 1

LIST OF WITNESSES FOR THE
DEPARTMENT OF FISH, WILDLIFE AND PARKS
PREFILED DIRECT TESTIMONY

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Patrick Graham

Liter Spence

Charles Parrett

Fred Nelson

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Dan Hook

Wade Fredenberg

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Mike Poore

Volume 2

Ron Spoon

Al Wipperman

Gary Olson

Bill Gardner

Bill Hill

Daniel Casey

Ken Knudson

Joe Eilliot

John Duffield

Q. What other programs are available to aid in the restoration of rivers and streams?

A. A pilot water leasing program was established by the 1989 legislature to explore the feasibility of leasing existing consumptive water rights to restore and enhance instream flows. This water leasing study program needs to be distinguished from the water reservation process. The water reservation process will allocate unused water in the Missouri River Basin and is an opportunity to preserve the status quo throughout the basin where fisheries values are significant. The water leasing program allows the Department to lease existing consumptive rights and temporarily convert them to instream flow rights in specific problem areas where the considerable cost of leasing water is justified.

The River Restoration Act, passed by the 1989 legislature, provides for the establishment of a fund to be used to restore damaged streams. The Water Quality Bureau of DHES administers a program (the 319 program) to address sediment and other pollution from disperse non-point sources. The Montana Association of Conservation Districts (MACD) is actively promoting the protection and enhancement of stream-side vegetative areas through proper riparian management practices. We cooperate with them on that effort. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or Superfund program is in the midst of a major clean-up effort in the headwaters of the Clark Fork River. The Electric Power Planning and Conservation Act of 1980 provides for the mitigation of damage to fish and wildlife resulting from development and operation of hydroelectric power facilities in the Columbia River basin including Western Montana.

Q. The requested instream flows in some cases are for more water than currently flows instream during the summer months. What is the rationale for asking for these instream flows?

A. The instream flows requested are those flows which would give us good fish populations. In many streams, consumptive water use has already lowered the natural summer streamflow levels below that which would sustain optimum numbers of fish. The requested instream flows are designed not to reflect the existing streamflow levels, but rather to reflect flow levels needed to maintain the desired wild fish populations.

An instream flow reservation would indicate at what level future or junior water users would no longer be able to divert water for consumptive use. It does not guarantee water will always be at that level because an instream flow reservation cannot reduce existing water rights.

From our perspective, the primary benefits of the reservation are two things - first, it should maintain the status quo or existing streamflow condition and prevent new consumptive water use from further dewatering or increasing the frequency of years when streamflows are the stream below a level which would be detrimental to the existing fisheries. Second, water availability and streamflows in some areas may change in the future and actually improve because of water conservation, improved irrigation methods, changing economic conditions, and changing land use patterns. The water reservation would be a mechanism to provide protection for additional water should it become available in the future.

Q. How will an instream flow reservation be implemented?

A. Implementation of an instream flow water reservation program is an evolutionary process. In the Missouri basin, the priority date of all reservations has been established by the legislature as July 1, 1985. It is important to note again that the water reservations in the Missouri basin cannot by law reduce any senior water right in existence prior to July 1, 1985. Only new (junior) water use permit holders will be affected. The timing and degree to which we monitor individual streams will depend on the extent of that junior water use. As time passes, streams with more junior users will be monitored more closely than those with fewer junior users.

The process the Department will follow in monitoring new applications for water use permits will be modeled after the process the Department has followed for its Yellowstone reservations. The first step is to monitor applications which will be junior to the reservations if the permit is granted. The Department will notify each applicant, either through a letter or the objection process, that an instream flow reservation exists in the source of supply and that, at some future time, he or she may be asked to cease water use because of low water conditions. All junior water use permits are conditioned to existing rights at the time the permit is issued. In most cases where the Department has objected based on its Yellowstone reservations, the permit has been specifically conditioned to the senior instream flow reservations. In only a few cases the requested permit would routinely interfere with our Yellowstone reservations, and the Department has objected and requested the permit be denied. Generally, when the Department has objected to the issuance of a permit, other senior consumptive users have also objected. The Department plans to continue this practice with any Missouri Basin reservations.

If a drought or low flow year is eminent, the Department will obtain a current listing of all water users who are junior to the reservations. An initial letter would be sent to them in June advising them of flow conditions and informing them that they might be subject to a "call" for their junior water. If flow conditions deteriorate and fall below the reservations, the Department would send a second letter to junior users that they must cease their diversions until flows again rise above the reservations. A stream gauge would be assigned for them to monitor flow levels, and they would be given phone numbers of the Department and the closest DNRC Water Rights Field Office so they can call for up-to-date flow information.

To date, Department has relied on voluntary compliance by junior users when calling for its water for the Yellowstone reservations. Eventually a more efficient system may be necessary, such as use of water commissioners to distribute water according to priority dates. With regard to the Missouri basin water reservations, a water commissioner may be needed to regulate the junior users. Other water users as well as the Department could benefit from a water commissioner.

Q. How will any instream flows granted to the Department compete for water with water rights established prior to July 1, 1985?

A. Any instream flows granted to the Department in this process will not and cannot compete for available water with historic, established water rights with priority dates prior to July 1, 1985, the priority date set by statute for Missouri River basin reservations. This is a clear and direct result of the prior appropriation doctrine that regulates the priority of use of available water. This reservation process allocates only that water available after depletions by consumptive senior users. Those senior rights with priority dates before any instream flow reservations are entitled to use their water right first and cannot be restricted by the later priority, junior instream flow reservations. The Department clearly understands this.

Instream flow reservations will restrict new junior consumptive users, those with priorities after July 1, 1985, when stream flow is physically not there to meet the instream flow reservation. Then junior users, but only junior users, can be restricted until the flows return to the minimum instream flows of the reservation.

There are only a couple of qualifications necessary. For permits granted after July 1, 1985, but prior to the granting of the instream reservation, the Board of Natural Resources and Conservation "may subordinate the reservation to the permit if it finds that the subordination does not interfere substantially with the purpose of any reservation." Section 85-2-331(4), MCA. The other important qualification is that a senior cannot expand the water consumed or diverted beyond his or her right by, for example, expanding irrigation to a new field or by changing the use to a more consumptive one. In such cases, all other impacted water users, including those with instream reservations and senior and junior water right holders, are entitled to take legal or administrative action to prevent expansions that would derive them of water that they would otherwise have. Existing water users would generally have a common interest with the Department in preventing these expansions.

Q. What value, if any, do minimum instream flows provide for established, senior water right users?

A. I believe that minimum instream flows provide a substantial, practical benefit to senior water right users. Consumptive users, such as irrigators or municipalities, must first be able to divert their water from the stream or river. If there is a base flow provided by minimum instream flows, the water can be more easily diverted through headgates or other diversions. On the other hand, if the stream or river is almost entirely diverted for consumptive uses, then consumptive users will have a much more difficult time withdrawing water. Bulldozing dams and channels in the streambed on an annual basis worsens the problem because the unstable streambed begins to cut deeper and deeper below the headgates. The cost and effort to divert the water continues to go up, as does the damage to the streambed environment.

Dewatering a stream through diversions for consumptive uses creates inherent conflicts among the users. As new junior consumptive users start diverting the remaining available water, downstream senior users who are harmed by new diversions have to personally take actions to stop the new junior. This is done either by a direct request or, if this fails, by more costly legal action usually culminating in the appointment of a water commissioner.

Thus, where new consumptive users are added to a stream that already has significant water diverted, the existing consumptive users can expect greater cost and expense in continuing to get their water. In contrast, if the available water or a portion of it is instead reserved for instream flows, there is no additional burden on the senior consumptive users. When the Department protects any instream water reservations from new junior users, the Department is also protecting the senior users from the impacts of new junior diversions in the ways I have described.

Another benefit of instream flows is maintaining water quality. Most beneficial water users require a minimum level of water quality. Lowered streamflows may affect water quality which, in turn, affects established water users.

The water that would satisfy minimum instream flow reservations applied for by the Department can also serve other purposes such as meeting senior downstream hydropower claims and even meeting the need of downstream consumptive users by, in effect, helping transport their water downstream.

Q. If minimum instream flows are beneficial to other water users in the ways you have just testified, why were minimum flows not adopted long ago?

A. I believe that the answer is in the history of development in the West and the accompanying uses of our water. Water was first put to use for mining and agriculture about 130 years ago. The laws regarding water use were established to protect one consumptive user's right from anothers. Water was seen only in terms of such development as mining, irrigation, municipal and power production. Water for fisheries, wildlife and water quality was either taken for granted or its value was not considered in the historic development of water use laws.

Today the value our society places on instream flows has increased and it is no longer taken for granted. Instream flows are recognized both for their inherent values and for their growing economic importance. If we were starting all over, it might be logical to allocate minimum instream flows along with allocations for consumptive uses. However, historically a different course was followed. Consumptive rights were allocated first and now we are trying to fit minimum instream flows in what remains of the allocation process. This makes accomplishing the goal of providing adequate stream flows for fish, wildlife and recreation more difficult. However, we are committed to work within the present process to assist the Board in making the best, most reasonable, and workable decisions to protect insteam flow values.

The development of water for irrigation, mining and many other consumptive uses has already been largely completed. Water has been allocated and perfected as water rights for almost all the irrigation and mining that is practicably possible. I view the reservation process as an opportunity to balance all competing, legitimate uses of water to the extent that this can be accomplished with the limited water still available in many streams.

Q. Is that why the Department's reservation seems large compared to those of the other reservants?

A. Yes. Our reservation does not look nearly as large when compared to the natural stream flows. It looks large because existing consumptive uses are not considered in this allocation process. They have been developed over the years and are protected by law.

Q. Will an instream reservation granted to the Department give the Department standing to object to water claims in the state-wide adjudication before the Water Court or to new permit applications and change of use applications by water right holders in administrative hearings before the Department of Natural Resources and Conservation?

A. Instream reservations granted to the Department would add little, if anything, to the standing that the Department already has in the Missouri River Basin above Fort Peck Dam. The Department has analyzed its present standing in the basin by considering each of the 28 sub-basins as designated by the Water Court. The Department has pre-1973 water right claims in 18 of the basins. For the remaining basins, 9 of them flow directly into basins in which the Department has pre-1973 water right claims. In addition, they are again tributary to basins further downstream within the Missouri River basin where the Department has pre-1973 water right claims. Therefore, the Department has standing by virtue of its pre-1973 water rights claims and their hydrological connection with every part of the Missouri River basin, except for one Water Court sub-basin. This exception is Dry Creek, Water Court sub-basin 40D, that is a tributary directly into Fort Peck Reservoir.

Based on this standing, the Department has participated fully in the state-wide adjudication throughout the state, including the Missouri River basin. The Department's has participated as an active objector in the Missouri River Basin where the Water Court has issued temporary preliminary decrees, which provide the first opportunity for water right claimants to object to the claims of others.

These same claims, in themselves, give the Department standing to object to applications for new permits and to requests for changes in use, such as a change in point of diversion, a change in place of use or a change in the use of the water. These requests are considered in administrative hearings before the Department of Natural Resources and Conservation. For these administrative proceedings, instream flow reservations would only give the Department additional grounds for objecting. Those grounds would be when the new permit or change in use would adversely impact the minimum instream flow reservation. This is the same right that all water right holders have for protecting their water rights. On at least the more highly appropriated streams, new requests for consumptive permits or for changes that would consume more water will most likely be and are often already being opposed by other consumptive water users, along with the Department. The Department's experience with our Yellowstone River reservations demonstrate that our need to object to the issuance of a permit or approval of a change to protect our instream flow reservations is infrequent.

Q. Why is the Department requesting instream flows in the Missouri River Basin?

A. The Missouri River and its tributaries are important fishing and recreational areas used by the people of Montana and the nation. Approximately one-half of the fishing pressure which occurs in the entire state occurs in the Missouri River basin upstream from Fort Peck Dam. This attests to the popularity and outstanding quality of the basin's fishery resources. Recreational use of the Missouri basin's water is important to the human experience, providing both enjoyment and relief from day-to-day pressures. The Montana Constitution and statutes recognize this resource as worthy of protection. The fish species that would be protected by instream flow reservations contribute to the well-being of the people of Montana and visitors who enjoy the outstanding fishing opportunities Montana has to offer. In addition, conservation of native fish species by sustaining this habitat reduces the potential for the species to become listed as threatened and endangered.

Q. What are the economic values of preserving instream flows?

A. The Missouri basin's nationally acclaimed sport fisheries provide a significant boost to Montana's economy. In 1989, Montana ranked fifth in the nation in the number of non-resident fishing licenses sold (USFWS 1990). Trout anglers on the state's lakes, reservoirs and streams spent, in 1985, an estimated $99.7 million while pursuing their sport (Duffield, et al. 1987). For reference to the work of others, I have attached a list of literature cited with complete citations. This list is incorporated as a part of my testimony. About $50 million of this was spent while fishing the waters of the Missouri basin.

The travel industry adds millions of dollars to the state's economy each year and provides jobs for thousands of Montanans (Stephens 1990 and McCool, et. al. 1991). Without the quality fishing opportunities provided by the Missouri River basin, Montana's tourist industry, a major contributor to the state's economy, would suffer. Angling-related revenues depend on the maintenance of sufficient flows to protect the abundant fish resources that characterize Montana. Continued flow depletions will degrade some of the very resources that draw tourists to Montana.

Fishing is unquestionably a highly-valued commodity in the Missouri River basin. Researchers also determine the economic value people place on trout fishing above what they actually had to spend to recreate. This value is called the net economic value and was estimated to be $122 million in 1985 (Duffield, et. al. 1987). Over $61.5 million, or 51% of the statewide total, was attributed to streams and rivers in the Missouri basin above Fort Peck Reservoir. Based on a fishing use of 2.5 million days per year in 1985, the annual value of Montana's lake and stream fisheries totaled $215 million. In the same way that the price of farmland is related to the value of production, the recreational value of Montana's stream and lake "fishing assets" is on the order of $5 billion (Duffield 1988).

The Duffield study cautioned that they did not quantify the total economic value of streams in Montana. Rather, the study addressed only the economic benefits attributed to fishing. In addition to fishing, streams provide many other recreational benefits - floating, camping, picnicking, swimming, bird watching, sightseeing and hunting are all popular recreational activities conducted along the Missouri River and its tributaries. It is apparent the recreational value of the upper Missouri basin streams would be significantly higher than the fishing value of $122 million per year if all other river-based recreational activities were evaluated.

Hydropower and water quality benefits of instream flows are also significant.

Q. What are the potential consequences of the Department not being granted instream reservations in the Missouri basin?

A. The natural flow of streams in the basin have been increasingly depleted over the past 130 years. If fisheries, and, consequently, fishing and other stream based recreation opportunities are to be maintained in the future, there must be some recognition of the value of instream flows and a means found to maintain those flows. If a means is not provided, we can expect streamflows to continue to be depleted, increasing the annual occurrence of critically low flows. Should that occur, we would find ourselves more often facing the consequences of years like 1988 when extreme reductions in streamflows occurred in parts of the basin due to drought conditions. Increasingly fish populations would not be able to recover, as has been the case in other chronically dewatered streams today. The loss in value to the people of Montana would be significant.

I, Patrick J. Graham, being first duly sworn, states that the foregoing testimony is true.

DATED this 30 day of October, 1991.

Patrick J. Graham

Subscribed and sworn to before me this 30th day of October, 1991.

(NOTARY SEAL)

Notary Public for the
State of Montana
Residing at Helena, Montana
My Commission Expires May 14, 1994

Literature Cited

U.S. Fish and Wildlife Service. 1990. National Survey of fishing, hunting and wildlife associated recreation.

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PRE-FILED DIRECT TESTIMONY OF
LITER E. SPENCE
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS (MDFWP)

Q. Please state your name and business address.

A. Liter E. Spence, MDFWP, 1420 E. 6th Avenue, Helena, MT 59620.

Q. By whom are you employed, and in what capacity?

A. I am employed by the Montana Department of Fish, Wildlife and Parks. My position is Water Resources Supervisor in the Fisheries Division. My primary responsibility is to implement the Department's instream flow program, which includes obtaining and protecting instream flow reservations and other instream flow water rights.

Q. What is your educational and employment experience that is pertinent to this testimony?

A. I have a Bachelor of Science Degree in Zoology and Chemistry from the University of Idaho and a Master of Science Degree in Wildlife Conservation and Management from the University of Wyoming. After graduating from the University of Wyoming, I worked for two years for the U.S. Fish and Wildlife Service's Missouri River Basin studies office in Billings, Montana. Following that, I became employed by the then Montana Fish and Game Department as a fisheries field biologist in Missoula, Montana. I have worked approximately 19 years for the Montana Department of Fish, Wildlife and Parks. During that period, I have served two different times as Water Resources Supervisor for a total of about 9 years.

I have had additional education and training through several special schools, workshops and symposia concerning streams, stream processes and instream flows for aquatic life. I have authored numerous fisheries reports and popular articles concerned with my professional field. These are stated more explicitly in the attached biography which is incorporated herein.

I am a member of the American Fisheries Society and the Montana Chapter of the American Fisheries Society. I was certified as a Fisheries Scientist by the American Fisheries Society in 1970.

Between 1978 and 1986 I had a break in employment with the Department while I was in private business.

I had previous experience with the water reservation process in Montana while serving as Water Resources Supervisor in the mid-1970s. I was primarily responsible for coordinating the assembly of the Department's instream flow reservation application in the Yellowstone River Basin submitted in November 1976. Instream reservations were granted in the Yellowstone Basin by the Board of Natural Resources and Conservation in December, 1978.

Q. What are your responsibilities in your present position?

A. I am responsible for most of the activities which involve obtaining and maintaining the quantity of water in streams. Such activities include monitoring and protecting instream flows obtained prior to 1973 (Murphy Rights), obtaining and protecting instream flow reservations and monitoring new water use permits which could affect those instream water rights.

Q. What is the purpose of your testimony in this proceeding?

A. My testimony relates to the content of the application for reservations of water in the Missouri River Basin above Fort Peck Dam submitted by the Department in June 1989. My testimony will relate to the various portions of the three-volume application and the persons responsible for completing or assisting in completing those portions. I will also provide testimony concerning the impacts of our reservation requests on other water use activities, both existing and future.

Q. Has any additional information become available since the Department's application was submitted that will be the subject of testimony in this proceeding?

A. Yes, some information such as fish population and angler use data, and recreation economics data has become available and will be the subject of the testimony of the individuals knowledgeable about the data.

Q. What was your role in the preparation of the Department's application?

A. My primary role was coordinating the preparation of the application, which includes three volumes. Part of this responsibility included coordination of the various individuals who participated in the development of data used to prepare the application. I was responsible for ensuring that the contents of the application met the requirements of the ARM rules for water reservations and that sufficient information was provided in the application to justify the instream flow requests for each of the streams. I also contributed information to certain sections of Volume 1 of the application.

Q. Were other individuals responsible for preparing portions of the application?

A. Yes. In addition to DFWP personnel, persons outside of the Department were contracted with to provide information for the Public Interest section of the application. These individuals were Dr. John Duffield, Ken Knudson, Dr. Joe Elliott and Charles Parrett. Dr. Duffield will testify to the economic values associated with instream flows and recreation. Ken Knudson and Dr. Elliott will testify to selected portions of the Public Interest section of the application. Charles Parrett, U.S. Geological Survey hydrologist, provided the Department with water availability information on each of the streams in the application as required under the ARM rules for Determination of the Amounts of the Reservations. This information is contained in Appendix A of the application.

Q. Will anyone else be testifying in support of the application?

A. Yes. Fred Nelson will testify to all of the information in Volume 2 which he prepared through the use of existing reports and data, discussions with individual Department field biologists, and personal experience. He will also testify as to the methods used in deriving instream flow requests as explained in Volume 1 beginning on page 1-11.

In addition, the following DFWP biologists will provide testimony on the individual streams and lakes in Volume 3 as follows:

Bill Gardner - Beaver Creek (Big Spring Creek), Belt Creek reaches 1 and 2, Big Otter Creek, Cottonwood Creek (Big Spring Creek), Cow Creek, Dry Fork Belt Creek, East Fork Big Spring Creek, Highwood Creek, Judith River reaches 1 and 2, Logging Creek, Lost Fork Judith River, Marias River reaches 1, 2 and 3, Middle Fork Judith River, Pilgrim Creek, Shonkin Creek, South Fork Judith River, Sun River reaches 1 and 2, Tillinghast Creek, and Yogo Creek.

Mike Poore - Big Spring Creek reaches 1 and 2, Warm Spring Creek, Collar Gulch.

Ken Frazer - Alabaugh Creek, Big Dry Creek, Checkerboard Creek, Cottonwood Creek (Musselshell River), Little Dry Creek, Little Prickly Pear Creek reaches 1 and 2, Lyons Creek, North Fork Musselshell River reaches 1 and 2, Prickly Pear Creek reaches 1 and 2, South Fork Musselshell River, Spring Creek (Musselshell River), Stickney Creek, Wegner Creek, and Wolf Creek.

Steve Leathe - Big Birch Creek, Dearborn River, Eagle Creek, Flat Creek, Hound Creek, Middle Fork Dearborn River, Newlan

Creek, North Fork Deep Creek (Smith River), North Fork Smith River, Rock Creek (Smith River), Sheep Creek (Missouri River), Sheep Creek (Smith River), South Fork Dearborn River, South Fork Smith River, Tenderfoot Creek.

Al Wipperman - Smith River reaches 1, 2 and 3 and Bean Lake.

Wade Fredenberg - American Fork Creek, Big Elk Creek, Careless Creek, Flat Willow Creek, Musselshell River reaches 1, 2 and 3, Swimming Woman Creek.

Bill Hill - Badger Creek, Birch Creek, Cut Bank Creek, Deep Creek (Teton River), DuPuyer Creek, Elk Creek, Ford Creek, McDonald Creek, North Badger Creek, North Fork Deep Creek (Teton River), North Fork DuPuyer Creek, North Fork Willow Creek, South Badger Creek, South Fork Deep Creek (Teton River), South Fork DuPuyer Creek, South Fork Two Medicine River, Spring Creek (Teton River), Teton River, and Willow Creek (Sun River).

Mark Lere - Beaver Creek (Missouri River), Silver Creek, Trout Creek, Canyon Creek, Cottonwood Creek (Missouri River), Seven Mile Creek, McGuire Creek, Spokane Creek, Ten Mile Creek, Virginia Creek and Willow Creek (Missouri River).

Ron Spoon - Missouri River reach 2.

Rod Berg - Missouri River reaches 3, 4, 5 and 6.

Dan Hook - Missouri River reaches 3, 4, 5 and 6 (Goose nesting only).

Gary Olson - Antelope Butte Swamp.

A complete listing of all the stream reaches contained in the reservation application and their flow requests is shown in Appendix A of this testimony. Vicinity maps locating each of the streams where flow requests have been made will be provided in the testimony of each of the above individuals.

Q. Why is the Department requesting instream flow reservations in the Missouri River Basin?

A. As an agency charged with management of the state's fish and wildlife resources, DFWP has a two-fold responsibility: (1) to protect and enhance the abundant and diverse fish, wildlife and recreational resources, and (2) to provide optimum opportunities for diverse outdoor recreation that are commensurate with resource preservation.

Fish and wildlife populations and their habitats are inseparable. Therefore, preservation of fish and wildlife populations is necessarily dependent upon preservation of their habitats. The habitat components for streams are: (1) the physical streambed and bank; (2) the quality of the water; and (3) the quantity of the water. Physical habitat characteristics and water quality of streams are protected under existing statutes, i.e., Stream Protection Act (87-5-501 through 509, MCA), the Natural Streambed and Land Preservation Act of 1975 (75-7-101 et. seq., MCA), and Water Pollution Control Act of Montana, Title 75, Chapter 5, MCA. The water quantity component of fish habitat can only be protected through the 1973 Water Use Act (85-2-316, MCA), which allows state agencies to reserve waters for existing or future beneficial uses or to maintain a minimum flow, level or quality of water. A water reservation obtained under this statute would serve to protect a vital component of the many stream fishery habitats in the Missouri River Basin. With the exception of the recently enacted water leasing statute (85-2-436-437, MCA) which allows DFWP the opportunity to improve instream flows through the leasing of existing diversionary water rights, the water reservation process is the only means available to preserve instream flows for the protection of fish, wildlife and recreation.

Fish inhabiting a stream occupy specific habitats which are comprised of many components, including a preferred range of water velocities and depths. Quantity and quality of this physical habitat is influenced by the magnitude of the flows. Through its impact on fish habitat, flow is believed to primarily regulate fish abundance. Simply stated, following long-term periods of low flows, fish numbers tend to decrease in response to the shrinking habitat. Conversely, long-term periods of higher flows allow for the expansion of the population. Sufficient instream flows are essential for maintaining viable game fish populations at levels of abundance that are commensurate with the stream's biological capabilities and that satisfy the expectations of the angling majority by providing them with a high quality fishing experience.

Streamflows also affect spawning and juvenile rearing areas of stream gamefish. Stream riffles and side channels are typically the prime sites chosen for spawning and the rearing of young. These sites are also the stream habitats that are most sensitive to flow reductions. Consequently, the production of the young recruits that are needed to sustain stream fisheries is strongly tied to the magnitude of the flows.

All aquatic organisms depend on some lower form of plant or animal for food. These lower forms also have specific water requirements necessary to sustain their growth and reproduction. Reduction in availability of these lower aquatic organisms ultimately reduces the abundance of those organisms which feed upon them. The primary food of Montana stream-dwelling gamefish is aquatic invertebrates which have their greatest production in stream riffles. Riffles are highly sensitive to flow reductions. The health and well being of the game fish populations and, in turn, the quality of the angling experience depend on the maintenance of sufficient riffle habitat to protect the fishes food base.

Reduced streamflows during normal low flow periods affect the quality of water that is necessary to sustain aquatic organisms. Possible consequences of lowered streamflows are higher water temperatures, increased amounts of dissolved solids, increased nutrient concentrations and lower dissolved oxygen levels, all of which are potentially harmful to aquatic life. Instream flow reservations are needed to prevent the further deterioration of water quality during low flow periods. Also, should existing pollution problems be corrected on those streams where poor water quality is presently limiting fish abundance, a reservation will help ensure that sufficient flow is available in the future to allow populations to expand and reach the stream's biological potential.

Q. Will the requested instream flow reservations improve fishery conditions in the Missouri River Basin and its tributary streams?

A. The reservations themselves cannot make any new water available for instream flows. The reservations will only maintain the status quo of flow conditions in the Missouri basin streams but will also provide a baseline and a priority date for any water that may become available in the future for use as instream flows.

Q. What methods were used by DFWP to recommend the requested instream flows?

A. The Wetted Perimeter Inflection Point Method was the primary instream flow method used. Four other methods were also used where the Wetted Perimeter Inflection Point Method could not be used or was not appropriate. These methods are described beginning on page 1-11 of Volume 1 of the application and will be addressed in the testimony of Fred Nelson.

Q. Will the requested instream reservations adversely affect existing water uses?

A. No.

Q. Why do you say that?

A. The priority date of all instream flow reservations, if they are granted, will be July 1, 1985. Therefore, under Montana water law, all water rights with a priority date before July 1, 1985 cannot be interfered with by the instream reservations. These senior water right holders may use their rights even when the flow in the river or stream is less than the instream flow reservations.

Q. What about individuals who wish to change their existing water rights for one reason or another?

A. Granting the reservations could allow the Department to become involved in any proceedings for a change in an existing right, such as changing a point of diversion, a place of use or the purpose of use. Priority date is not a factor in changes in appropriation rights. If a person believes that a proposed change in another person's existing right will adversely affect his own water rights, he or she may object to the change. If the reservations are granted, the Department would have the same right as other water right holders to object to that change if the changed use will adversely affect the instream flow reservation.

Q. The Department has had instream reservations in the Yellowstone Basin since December 1978. Has the Department objected to new water use permits and changes in that basin?

A. Yes. However, our objections have been infrequent. As of October 2, 1991, the DNRC had issued 1,014 new water use permits and 499 changes in appropriation rights in the Yellowstone basin since December 15, 1978. (DNRC water rights computer printout dated October 2, 1991. During that same period, DFWP objected to 83 new permits and to only two changes in existing rights. However, in most cases, we did not request that any of the new permits be denied or even changed. We simply requested they be specifically conditioned to recognize the Department's senior instream flow rights.

Q. Will the granting of instream reservations in the Missouri basin alter the standing of the Department in the current adjudication proceedings?

A. The Department has been an active participant in the adjudication process since its beginning. We already have standing to object to temporary preliminary decrees and preliminary decrees because we have our own existing diversionary water rights as well as some pre-1973 instream flow rights in many basins. We do not believe the granting of water reservations will alter what we are already doing in that process. Based on MDFWP and water court records of the 85 basins involved in the statewide adjudication process, the Department has some kind of pre-1973 water right claim in 49 of those individual basins. There are 28 individual basins in the Missouri Basin above Fort Peck Dam. The Department has pre-1973 water right claims in 18 of those basins. Further, nine of the 10 basins in which the Department does not have pre-1973 water right claims flow into basins where we have such claims. Thus, the Department already claims standing in every basin except one (Dry Creek, Basin 40D) within the boundaries of this reservation request.

Q. Would granting reservations provide the Department with any additional standing to participate in the issuance of new water use permits?

A. The Department of Natural Resources and Conservation has consistently denied our objections to new permit applications made on the basis of impacts to stream flows and the fishery resources where we did not have some type of instream flow water right such as our pre-1973 instream rights (Murphy Rights) or water reservations like those in the Yellowstone Basin. Granting instream reservations in the Missouri River Basin would allow the Department to fully participate in the water use permitting process administered by DNRC where there are adverse impacts to the fisheries protected by the reservations.

Q. Does the Department's application fairly represent the instream flow needs of streams in the Missouri River Basin?

A. Yes, it does. The application requests instream flow reservations on 249 streams (281 stream reaches) in the Missouri basin above Fort Peck Dam. The flows requested for each of the streams or stream reaches are specific to that stream reach and essential to maintaining the existing aquatic environment of that reach. There is a wide range of flows requested, varying from a few cubic feet per second (cfs) in small tributary streams to higher flow quantities requested in the lowermost reaches of the Missouri River mainstem.

Flow quantities requested in this application reflect the size and character of the existing stream channel of the stream reach specified as well as the existing fish and wildlife found there. The quantity of water requested in one stream reach is not necessarily adequate for another reach of the same stream. The quantity of water needed to sustain existing aquatic life in a stream reach must be independently determined. This has been done in the preparation of this application. At the same time, it must be kept in mind that retention of streamflows in one reach serves to provide flows to those reaches lying downstream, subject, however, to downstream diversions. For this reason, the water quantities requested in all the individual stream reaches should not be added together to determine the total quantity of water requested for the entire river basin. For example, the 4.8 million acre-feet of water requested in the reach of the Missouri River between the Judith River and Fort Peck Reservoir is not the sum of the quantities of water requested in individual upstream reaches. Rather, this quantity represents the amount of water needed to sustain existing aquatic life within that specific reach of the river.

Q. Does the instream flow request for a particular stream mean that the Department expects that flow to be maintained throughout the period of time requested?

A. No. The Department is quite aware that, because of prior appropriations or natural flow conditions, water in many streams will not always be available in the quantities we have requested. Under the "first in time, first in right" principle, the priority date of a water right is the key to the use of the water. The earlier the priority date, the greater the chance a person can use water at any given time. However, under this system, the right to use the water does not guarantee that the water will actually be there to use. Instream reservations would be granted under the same conditions. They would not guarantee the Department any use of water for instream flows if water was not physically available, but they would allow its use for this purpose when water <u>is</u> available. The lateness of our priority date compared to those of prior appropriators would not allow us to interfere with the majority of water uses on most streams. The only water uses which the instream flows could restrict would be those junior uses which have priority dates after July 1, 1985.

Q. Does this have anything to do with the "reach concept" discussed in the Management Plan section of your application?

A. Yes. The reach concept, as explained in the Management Plan is simply a term used to indicate how the Department would monitor and protect instream flows that may be granted. Except for some of the larger, longer rivers, most instream flow recommendations, particularly on tributaries, were derived at a site near the stream's mouth, with the designated reach extending from the mouth to the headwaters. A designated "reach" merely serves to identify a stretch of stream where junior water users would be subject to the instream reservation which was derived at, and will be monitored at, a site near the lower end of the stream reach. The reach, as we define it, does not represent a stream segment that has the same flow regime and instream flow requirement throughout its length. It is simply a means to identify the upper and lower boundaries of a stream within which junior water users would be contacted by DFWP if we wished to make a "call" for the water when the flow at the downstream monitoring site drops below the instream flow reservation.

Q. Is water available in all the streams requested in the Department's application to meet the instream flow requests?

A. First of all, I should say that the Department's requests are not based, for the most part, on the availability of water to meet those requests. The requests are, instead, based on biological needs of the fish.

Secondly, the amount of water that Mother Nature provides in most streams varies from year to year and in some years there is more water available than in other years. There are also different amounts of water available each month during the year. So, unless a stream is completely dry all year, there are some streamflows available at certain times. Our requests simply ask that a portion of this remaining flow be allowed to remain instream for fish and wildlife purposes. As previously mentioned, reservations would only protect existing flow conditions up to the amount of the instream flows granted. The existing condition begins when the reservation's priority date is established, which is July 1, 1985. All we are doing, therefore, is protecting flows from any junior water users who may be issued permits after that date. Senior water users are not affected and the reservations cannot control natural flow levels which may occur below the granted reservation amounts. Therefore, the only control we have over streamflows is the ability to restrict junior water users when the flow levels reach the requested amounts. The requested flows simply establish a trigger flow where this could occur.

Q. What is the effect of the 50% of average annual flow limitation (85-2-316(6) MCA) on the instream flows requested in the Department's reservation application.

A. The statute limits the amount of instream flow which the Board of Natural Resources and Conservation (Board) can grant to no more than 50% of the average annual flow on gauged streams. This limitation in many cases can result in the granting of an instream flow that is too low, thus potentially damaging the existing fishery and impacting future recreational opportunities. There are five conditions where the 50% limitation, when applied to gauged streams, can be too restrictive from a biological perspective. These are discussed in Volume I, pages 1-25 through the top of page 1-29. There are a total of 36 stream reaches in the application where the instream flow reservation request exceeds 50% of the average annual flow. Information on these 36 gauged stream reaches where this has occurred are contained in Volume I, Table 1-2 beginning on page 1-30.

Since the Department believes the flow levels requested for each stream in this application are the flows required to maintain the fisheries resource at a desired level, any flows granted that are less than requested levels will have some detrimental impacts on the resource. Therefore, to minimize the impacts of the 50% limitation, it is recommended that any reductions in the requested flows that may be made by the Board as a result of this law, be made during the high flow period of the year. This is preferable to making those reductions during the irrigation season months when flows are often already too low. As a guideline, any reductions should be made during the period from May 15 to July 1. Also, we believe the average annual flow can be interpreted by volume (acre feet) as well as by flow rate (cfs) and downward adjustments may be more effectively made on an acre feet basis. For example, all of the reduction could be made during one month simply by reducing the total acre feet requested in that month by the amount which is greater than 50% of the average annual flow. The reduced volume granted can then be converted to a flow rate in cfs.

Q. Many of the stream reaches contained in the Department's reservation application refer to fish "species of special concern" that should be provided protection through the granting of instream flows. What is a species of special concern?

A. Species of special concern which occur in the Missouri basin streams referred to in the Department's application and in the testimony of its witnesses include the following fish species:

Westslope cutthroat trout
Arctic grayling
Pallid sturgeon
Sturgeon chub
Paddlefish
Northern redbelly dace x finescale dace hybrid
Sickelfin chub

This is a DFWP and American Fisheries Society designation that reflects the limited numbers of these fish present in the state, their limited distribution, or the limited amount of preferred habitat still available to them. These fish have been eliminated or severely reduced in numbers over much of their former range. Some of the species, particularly the Arctic grayling and the westslope cutthroat trout depend on relatively pristine habitat and a low level of competition from non-native fishes for their survival. The pallid sturgeon occurs as only a relict population containing very few numbers in Montana and has recently been listed as a federal endangered species. A list and discussion of these species of special concern compiled by George Holton can be found in Montana Outdoors, Vol. 17(2), March/April, 1986.

Q. Some of the DFWP testimony refers to "Blue Ribbon" streams which should be protected by instream flow reservations. What is a Blue Ribbon stream?

A. The idea of Blue Ribbon streams originated in the late 1950's due to the efforts of biologists from DFWP, the U.S. Fish and Wildlife Service and Montana State University. A Stream Classification Committee from these agencies produced the first Stream Classification Map in 1959. Streams were placed in four classes ranging from those with national as well as statewide value (Class 1) to streams of restricted local value such as counties (Class 4). Streams were classified on the basis of availability (degree of access) aesthetics (natural beauty, clear water, etc.), use (angler use) and productivity (the ability to produce fish). Streams receiving a Class 1 rating were colored blue on the map and became known as "Blue Ribbon" streams. In the Missouri basin, portions of the Big Hole, Madison, Gallatin and Missouri rivers were classified as Blue Ribbon. The map was produced as a means to overcome one of the major obstacles to preserving Montana's fishing streams -- lack of a satisfactory method to measure their economic and social value. Unlike most other water uses, recreational fishing at that time did not lend itself to conventional means of value measurement and was often undersold at the bargaining table during resource planning. The stream classification system was a first attempt to overcome this obstacle. In 1965, the original map was updated using the same criteria but with additional information that increased the number of miles of classified streams. In the Missouri basin, a short section of the Missouri River between Hauser Dam and Holter Reservoir was upgraded from Class II (Red Ribbon) to Class 1 (Blue Ribbon).

The third and latest update of the map was completed in 1980. However, a broadened set of criteria was used to classify the streams, including wild and scenic river status and threatened and endangered species. The Class 1 Blue Ribbon streams designated on the 1965 map remained Class 1 on the 1980 map and in some cases additional reaches of those streams were added to Class I (Missouri River between Canyon Ferry Dam and Hauser Lake and the upper Big Hole River.

Since 1980, a computerized data base of streams and their resource values has evolved into the Montana Rivers Information System. Each stream is rated on a number of resource and other values and those streams which receive the highest values are rated as Class I streams. All the original Class 1 Blue Ribbon streams in the Missouri basin are still included in the Class I category and the term "Blue Ribbon" is still used today to designate those original Class 1 streams which continue to have the highest fishery and recreational values.

Q. Do you have any further testimony?

A. Yes. First, the Department has requested instream flows on 249 streams (281 stream reaches) in the Missouri River Basin. The Department maintains a list of streams in the State that have some type of existing fishery or the potential for a fishery. In the Missouri River Basin above Fort Peck Dam, the list contains 2,739 streams (2,765 stream reaches). Although the streams requested in the Department's application are those with the more significant fishery values, the number of streams requested in the application is only nine percent (9%) of the total number of streams in the Missouri River Basin above Fort Peck Dam that have some fishery value. It is apparent the Department has not blanketed the Missouri basin with instream flow requests. By selecting only streams with the most significant fisheries values, there remains some flexibility for future water uses while protecting the status quo of the most valuable fisheries in the basin.

Secondly, according to the draft EIS prepared by DNRC on the Missouri Basin reservations, there are no competing consumptive reservation requests for 233 stream reaches of the 281 reaches shown in our application and, therefore, there is no direct competition for water on those streams in the reservation proceedings. (See DEIS Table K-3 attached as Appendix B.) We have requested flows on most of the streams also during the non-irrigation season when there is little demand for consumptive irrigation water use.

Third, for about 130 years, many streams in Montana have gradually become dewatered due to the gradually increasing use of those waters for consumptive uses, primarily irrigation. During the 1988 drought, we saw what could be a future instream flow scenario if existing instream flows are not protected. We observed first-hand the effects of reduced streamflows on stream fisheries during the irrigation season. In 1988, an extremely low winter snowpack coupled with the existing levels of water use combined to produce streamflows that were at or near record lows in most streams in the state, causing critical conditions for stream fisheries. Some of the more serious conditions in the Missouri basin occurred as follows:

- Jefferson River. The entire 84 miles of stream had no flow for all practical purposes for a stream this size.

- Red Rock River. 35 miles severely dewatered, dry in some sections.

- Big Hole River. Practically dry at Wisdom and at the mouth. Near record low flows occurred at Melrose. The stream was not floatable most of the summer. (See Exhibit 3)

- Smith River. Unfloatable by July 4, about 2-3 weeks earlier than normal. Lowest flows on record (20 cfs) were measured at the USGS gage near Fort Logan.

- Missouri River above Canyon Ferry Reservoir. Set record low streamflow as measured at the USGS gauge at Toston.

- Fish kills occurred in Madison, Jefferson, Red Rock and Smith rivers due to low flows and warm water temperatures.

Continued appropriation of water for consumptive use will increase the frequency of such low flow events causing future "droughts" even in good water years. Instream reservations would help prevent such occurrences from becoming more frequent than they are today.

Lastly, in my professional opinion, state of the art procedures were used to compile the instream flow requests in this application. The state of the art provides no single methodology that should be used in the determination of instream flows for the protection of aquatic resources. The testimony of Fred Nelson describes the methods used and the circumstances where they were used. Further, it is my professional opinion that the flows requested are necessary to provide for the long-term perpetuation of the most significant and valuable fish and wildlife populations utilizing the waters of the Missouri basin.

Liter Spence, being first duly sworn, states that the foregoing testimony is true.

DATED this 31st day of October, 1991.

Liter E. Spence

Liter E. Spence

Subscribed and sworn to before me this 31st day of October, 1991.

Debra McRae

Notary Public for the State of Montana
Residing at Helena, Montana
My commission expires May 14, 1994

BIOGRAPHY

Liter E. Spence
October 16, 1991

Current position: Water Resources Supervisor, Montana Department of Fish, Wildlife and Parks, Helena, MT 59620

Education:

1954-1956 Boise Jr. College, Boise, Idaho. Received AA degree in General Science with emphasis in biology, chemistry and mathematics.

1959-1961 University of Idaho, Moscow, Idaho. Received BS degree in Zoology with minor in chemistry.

1961-1963 University of Wyoming, Laramie, Wyoming. Received MS in Wildlife Conservation and Management. Course work emphasized fisheries management.

Experience:

Summer 1962 - Fishery Aid, Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, Juneau, Alaska. Tagged sockeye salmon migrating from the Pacific Ocean to determine where they spawn in streams of Aleutian Peninsula and recovered tagged fish on their spawning grounds.

1963-1965 - Fishery Biologist, U.S. Fish and Wildlife Service, Missouri River Basin Studies, Billings, Montana. Investigated the effects of proposed federal water development projects on fisheries in Montana and Wyoming.

1965-1970 - Project Fishery Biologist, Montana Department of Fish and Game, Missoula, Montana. Conducted fisheries inventories and creel censuses on streams and lakes in western Montana fisheries region.

1970-1974 - Planning Ecologist, Montana Department of Fish and Game, Ovando, Montana. Conducted baseline inventory study of water quality, fisheries and wildlife in upper Blackfoot River in connection with a proposed industrial copper mining venture by the Anaconda Company.

1974-1978 - Water Resources Supervisor, Montana Department of Fish and Game, Helena, Montana. Coordinated efforts by Fish and Game Department to implement provisions of the Montana Water Use Act which provides for flow reservations for fish, wildlife and recreation. Responsible for assembly of Fish and Game Department application for water reservations in the Yellowstone River Basin submitted to the Board of Natural Resources in 1976.

1978-1985 - In private retail business in California and Nevada.

1986-present - Water Resources Supervisor, Montana Department Fish, Wildlife and Parks, Helena. Responsible for Department's instream flow program statewide, including preparation of Department's application for instream flow reservations in the Missouri River Basin above and below Fort Peck Dam, including the Little Missouri River Basin.

Additional Education and Training:

(1) July 12-23, 1970. Training school in water quality studies conducted by Environmental Protection Agency, Pacific Northwest Water Laboratory, Corvallis, Oregon.

(2) October 11-12, 1972. River mechanics seminar, Montana State University, Bozeman. Sponsored by Department of Fish and Game with participants from Corps of Engineers, Vicksburg, Mississippi and Civil Engineering Department at Colorado State University, Fort Collins.

(3) October 9-December 11, 1973. Hydrology course taught by Dr. Richard Bruskern, Civil Engineer, Montana State University, Bozeman through the Montana State University continuing education program.

(4) September 5-6, 1974. Instream flow needs problem analysis workshop, Sun Valley, Idaho. Sponsored by Washington Water Research Center, Washington State University, Pullman, WN.

(5) September 27, 1974. Stream gaging techniques field workshop, Yellowstone National Park, Mammoth, Wyoming. Conducted by Ron Shields, U.S. Geological Survey, Helena, Montana for Department of Fish and Game biologists to demonstrate proper techniques for streamflow measurement.

(6) January 22, 1975. Water Surface Profile Program (WSP) workshop, Billings, Montana. Conducted by U.S. Bureau of Reclamation hydraulic engineers for fishery biologists from Montana and Wyoming to explain how WSP can be used for instream flow determinations.

(7) September 17-19, 1975. Instream flow needs workshop, Utah State University, Logan, Utah. Conducted by Utah State University and Office of Biological Services, U.S. Fish and Wildlife Service, Washington, D.C. Workshop resulted in a state-of-the-art document describing methodologies currently used to recommend instream flows for fish, wildlife and recreation. The document is entitled Stalnaker, C.B. and J.L. Arnette. 1976. Methodologies for determination of stream resource flow requirements: an assessment. USFWS, OBS, West. Water Allocation. 199 p.

(8) May 3-6, 1976. Instream flow needs symposium and specialty conference, Boise, Idaho. Sponsored by Western Division American Fisheries Society and Power Division American Society of Civil Engineers. A series of papers discussing solutions to technical, legal and social problems caused by increasing competition for limited streamflow. Proceedings of the conference published by American Fisheries Society. I presented a paper and moderated a panel.

(9) June 29, 1976. Stillwater River near Absarokee. One day field workshop with Fish and Game and Bureau of Reclamation personnel for field instruction and demonstration of Water Surface Profile (WSP) program technique. Instruction by Mr. Richard DeVore, Hydraulic Engineer, U.S. Bureau of Reclamation, Billings.

(10) March 31 - April 1, 1988. Instream flow protection in the western United States - a practical symposium. Sponsored by University of Colorado, School of Law, Boulder, Colorado. Presented a paper on Department of Fish, Wildlife and Parks instream flow protection procedures.

(11) October 20-21, 1989. Western Regional Instream Flow Conference, Jackson Hole, Wyoming. Sponsored by Trout Unlimited.

<u>Professional Organizations:</u>

Member, American Fisheries Society and Montana Chapter, American Fisheries Society. Certified as a Fisheries Scientist by the American Fisheries Society in 1970.

<u>Articles and Publications:</u>

Spence, L.E. 1965-1970. Western Montana fishery study. Inventory of waters of the project area. Fed. Aid in Fish Restor. Proj. F-12-R, Mont. A series of annual progress reports. Mont. Fish and Game Dept., Helena. Mimeo.

Spence, L.E. 1971. Rock Creek creel census. Final report, summer census. Fed. Aid in Fish Restor. Proj. F-27-R, Job 1, Mont. Mont. Fish and Game Dept., Helena. 28 p. + appendix. Mimeo.

Spence, L.E. 1968. Georgetown Lake winter creel census. Fed. Aid in Fish Restor. Proj. F-12-R-13, Job 2. Mont. Mont. Fish and Game Dept., Helena. 18 p. Mimeo.

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Spence, L.E. 1970. Georgetown Lake winter creel census. Fed. Aid in Fish Restor. Proj. F-12-R-16 Job I-b, Mont. Mont. Fish and Game Dept., Helena. 12 p. + appendix. Mimeo.

Spence, L. 1970. Evaluation of random boulders for stream improvement in Rock Creek. Work conducted under Fed. Aid in Fish Restor. Proj. F-12-R, Mont. Mont. Fish and Game Dept., Helena. 9 p. Mimeo.

Spence, L.E. 1971. Georgetown Lake summer creel census. Fed. Aid in Fish Restor. Proj. F-12-R-17, Job I-b, Mont. Mont. Fish and Game Dept., Helena. 11 p. + appendix. Mimeo.

Spence, L.E. 1975. Upper Blackfoot River study. A preliminary inventory of aquatic and wildlife resources. Mont. Dept. of Fish and Game, Helena and the Anaconda Company, Butte, MT 87 p. + appendix.

Spence, Liter. 1970. Diversion tactics. Montana Outdoors Vol. V No. 2. Mont. Fish and Game Dept., Helena. February 1970.

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Spence, L.E. 1974. An inexpensive surface water dissolved oxygen sampler. Prog. Fish Cult. 36(1): p. 26.

Spence, Liter. 1975. "The new water law." Montana Outdoors column in The Independent Record, Helena, MT. Mont. Dept. Fish, and Game, Helena 59601.

Spence, Liter. 1976. "What has the 1973 Montana Water Use Act done for aquatic resources?" Paper presented at Montana Chapter, Amer. Fish. Soc. meeting, Missoula, MT January 22, 1976. Mont. Dept. Fish & Game, Helena 59601.

Spence, L.E. 1976. WSP - Will it do the job in Montana? In Proceedings of Instream Flow Needs Symposium & Specialty Conference, presented by Western Division American Fisheries Society & Power Division, Amer. Soc. Civil Engineers, Boise, Idaho May 3-6, 1975. Pub. by Amer. Fish. Soc., 5410 Grosvenor Lane, Bethesda, MD 20014. September 1976.

Spence, Liter. "Yellowstone reservation explained." Montana Outdoors column in the Independent Record, Helena, MT. Mont. Dept. Fish & Game, Helena 59601.

Spence, Liter. 1977. "Montana's new water law - is it working?" Montana Outdoors, Jan.-Feb. 1977. pg. 23. Mont. Dept. Fish & Game, Helena, MT 59601.

Spence, Liter. 1987. Clark Fork R_x - Prescription for Renewal? Montana Outdoors, Vol. 18(6) Nov./Dec. Mont. Dept. Fish, Wildlife and Parks, Helena, MT 59620. pg. 2.

Spence, Liter. 1990. Instream Flow on the Mighty Mo. Montana Outdoors. Vol 21(4), July/Aug. Mont. Dept. Fish, Wildlife and Parks, Helena, MT 59620. pg. 2.

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from DEIS, Table 3-2, Page 23

Table 3-2. DFWP instream flow requests

HEADWATERS SUBBASIN

BIG HOLE RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
American Creek	Headwaters to mouth	Jan 1 - Dec 31	2.8	2,027
Bear Creek	Headwaters to mouth	Jan 1 - Dec 31	2.8	2,027
Big Hole River #1	Warm Springs Creek to Pintlar Creek	Jan 1 - Dec 31	160	115,835
Big Hole River #2	Pintlar Creek to the old Divide Dam	Jan 1 - Dec 31	800	579,173
Big Hole River #3	Old Divide Dam to mouth	Jan 1 - Dec 31	650	470,578
Big Lake Creek	Twin Lakes outlet to mouth	Jan 1 - Dec 31	4.7	3,403
Birch Creek	Mule Creek to mouth	Jan 1 - Dec 31	10	7,240
Bryant Creek	Headwaters to mouth	Jan 1 - Dec 31	1.4	1,014
California Creek	Headwaters to mouth	Jan 1 - Dec 31	14	10,136
Camp Creek	Headwaters to mouth	Jan 1 - Dec 31	5	3,620
Canyon Creek	Canyon Lake to mouth	Jan 1 - Dec 31	5	3,620
Corral Creek	Headwaters to mouth	Jan 1 - Dec 31	1	724
Deep Creek	Sevenmile and Tenmile to mouth	Jan 1 - Dec 31	18	13,031
Delano Creek	Headwaters to mouth	Jan 1 - Dec 31	0.3	217
Divide Creek	North and East forks to mouth	Jan 1 - Dec 31	3	2,172
Fishtrap Creek	West and Middle forks to mouth	Jan 1 - Dec 31	10	7,240
Francis Creek	Sand Creek to mouth	Jan 1 - Dec 31	4	2,896
French Creek	Headwaters to mouth	Jan 1 - Dec 31	6	4,344
Governor Creek	Headwaters to mouth	Jan 1 - Dec 31	4	2,896
Jacobsen Creek	Tahepia Lake to mouth	Jan 1 - Dec 31	14	10,136
Jerry Creek	Headwaters to mouth	Jan 1 - Dec 31	7	5,068
Johnson Creek	Schultz Creek to Forest Service boundary	Jan 1 - Dec 31	13	9,412
Joseph Creek	Anderson Creek to mouth	Jan 1 - Dec 31	5	3,620
LaMarche Creek	West and Middle forks to mouth	Jan 1 - Dec 31	11	7,964
Miner Creek	Upper Miner Lakes to mouth	Jan 1 - Dec 31	9	6,516
Moose Creek	Headwaters to mouth	Jan 1 - Dec 31	9	6,516
Mussigbrod Creek	Hell Roaring Creek to Forest Service boundary	Jan 1 - Dec 31	10	7,240
NF Big Hole River	Ruby and Trail creeks to mouth	Jan 1 - Dec 31	30	21,719
Oregon Creek	Headwaters to mouth	Jan 1 - Dec 31	0.3	217
Pattengail Creek	Sand Lake to mouth	Jan 1 - Dec 31	12	8,688
Pintlar Creek	Oreamnos Lake to mouth	Jan 1 - Dec 31	10	7,240
Rock Creek	Beaverhead National Forest boundary to mouth	Jan 1 - Dec 31	5	3,620
Ruby Creek	Pioneer and WF Ruby creeks to mouth	Jan 1 - Dec 31	4	2,896
Sevenmile Creek	Headwaters to mouth	Jan 1 - Dec 31	1.8	1,303
Seymour Creek	Upper Seymour Lake to mouth	Jan 1 - Dec 31	13	9,412
Sixmile Creek	Headwaters to mouth	Jan 1 - Dec 31	1.6	1,158
SF Big Hole River	Skinner Lake to mouth	Jan 1 - Dec 31	22	15,927
Steel Creek	Headwaters to mouth	Jan 1 - Dec 31	6	4,344
Sullivan Creek	Headwaters to mouth	Jan 1 - Dec 31	4	2,896
Swamp Creek	Yank Swamp to mouth	Jan 1 - Dec 31	8	5,792
Tenmile Creek	Tenmile Lakes to mouth	Jan 1 - Dec 31	3.8	2,751
Trail Creek	Headwaters to mouth	Jan 1 - Dec 31	14	10,136
Trapper Creek	Trapper Lake to mouth	Jan 1 - Dec 31	3.2	2,317
Twelvemile Creek	Headwaters to mouth	Jan 1 - Dec 31	1.2	869
Warm Springs Creek	West and East forks to mouth	Jan 1 - Dec 31	20	14,479
Willow Creek	Tendoy Lake to mouth	Jan 1 - Dec 31	16	11,583
Wise River	Mono and Jacobson creeks to mouth	Jan 1 - Dec 31	35	25,339
Wyman Creek	Headwaters to mouth	Jan 1 - Dec 31	7	5,068

GALLATIN RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Baker Creek	Heeb Lane Bridge to mouth	Jan 1 - Dec 31	14	10,136
Ben Hart Creek	Headwaters to mouth	Jan 1 - Dec 31	29	20,995
Big Bear Creek	Headwaters to mouth	Jan 1 - Dec 31	2	1,448
Bridger Creek	Headwaters to mouth	Jan 1 - Dec 31	36.6	26,497
Cache Creek	Headwaters to mouth	Jan 1 - Dec 31	2.6	1,882
EF Hyalite Creek	Heather Lake to Hyalite Reservoir	Jan 1 - Dec 31	7	5,068
East Gallatin River #1	Rocky and Sourdough cks to Bozeman STP outlet	Jan 1 - Dec 31	121.3	87,817
East Gallatin River #2	Bozeman STP outlet to Thompson Spring Creek	Jan 1 - Dec 31	90	65,157
East Gallatin River #3	Thompson Spring Creek to mouth	Jan 1 - Dec 31	170	123,074

Ck - Creek EF - East Fork R - River SF - South Fork STP - sewage treatment plant WF - West Fork

Gallatin River Drainage (continued)

Gallatin River #1	Yellowstone NP boundary to WF Gallatin River	Jan 1 - Dec 31	170	123,074
Gallatin River #2	WF Gallatin River to East Gallatin River	Jan 1 - Dec 31	400	289,587
Gallatin River #3	East Gallatin River to mouth	Jan 1 - Dec 31	1,000	723,967
Hell Roaring Creek	NF Hell Roaring Creek to mouth	Jan 1 - Dec 31	16	11,583
Hyalite (Middle) Creek #1	Middle Creek Dam to Middle Creek Ditch intake	Jan 1 - Dec 31	28	20,271
Hyalite (Middle) Creek #2	I-90 bridge near Belgrade to mouth	Jan 1 - Dec 31	16	11,583
MF of the WF Gallatin R.	Headwaters to NF of the WF Gallatin River	Jan 1 - Dec 31	3	2,172
Porcupine Creek	NF Porcupine Creek to mouth	Jan 1 - Dec 31	4.5	3,258
Reese Creek	Bill Smith Creek to mouth	Jan 1 - Dec 31	5	3,620
Rocky Creek	Jackson Creek to Sourdough Creek	Jan 1 - Dec 31	51	36,922
Sourdough (Bozeman) Ck.	Mystic Reservoir to mouth	Jan 1 - Dec 31	35.9	25,990
South Cottonwood Creek	Jim Creek to Hart Ditch headgate	Jan 1 - Dec 31	14	10,136
SF Spanish Creek	Falls Creek to mouth	Jan 1 - Dec 31	15	10,859
SF of the WF Gallatin R.	Headwaters to mouth	Jan 1 - Dec 31	5	3,620
Spanish Creek	North and South forks to mouth	Jan 1 - Dec 31	70	50,678
Squaw Creek	Headwaters to mouth	Jan 1 - Dec 31	12	8,688
Taylor Fork	Tumbledown Creek to mouth ~~of Gallatin River~~	Jan 1 - Dec 31	36	26,063
Thompson Spring Creek	County road crossing in T1N R5E Sec 30 to mouth	Jan 1 - Dec 31	29	20,995
WF Gallatin River	Middle and North forks to mouth	Jan 1 - Dec 31	26	18,823
WF Hyalite Creek	Hyalite Lake to Hyalite Reservoir	Jan 1 - Dec 31	12	8,688

JEFFERSON AND BOULDER RIVER DRAINAGES

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Boulder River #1	West and South forks to High Ore Creek	Jan 1 - Dec 31	20	14,479
Boulder River #2	High Ore Creek to Cold Spring	Jan 1 - Dec 31	24	17,375
Boulder River #3	Cold Spring to mouth	Jan 1 - Dec 31	47	34,026
Halfway Creek	Headwaters to canyon	Jan 1 - Dec 31	1.9	1,376
Hells Canyon Creek	Headwaters to mouth	Jan 1 - Dec 31	3.6	2,606
Jefferson River	Headwaters to Madison River	Jan 1 - Dec 31	1,100	796,363
Little Boulder River	Moose Creek to mouth	Jan 1 - Dec 31	7	5,068
North Willow Creek	top Hollow ~~Top~~ Lake to mouth	Jan 1 - Dec 31	7	5,068
South Boulder River	Curly Creek to mouth	Jan 1 - Dec 31	12	8,688
South Willow Creek	Granite Lake to mouth	Jan 1 - Dec 31	14	10,136
Whitetail Creek	Whitetail Reservoir to mouth	Jan 1 - Dec 31	3	2,172
Willow Creek	North and South Willow creeks to mouth	Jan 1 - Dec 31	14	10,136
Willow Spring Creek	Headwaters to mouth	Jan 1 - Dec 31	9.2	6,660

MADISON RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Antelope Creek	Headwaters to mouth	Jan 1 - Dec 31	14	10,136
Beaver Creek	Wyethia Creek to Earthquake Lake	Jan 1 - Dec 31	937	42,280
Black Sand Spring Creek	Black Sand Spring to SF Madison River	Jan 1 - Dec 31	18.7	13,538
Blaine Spring Creek	Ennis National Fish Hatchery to mouth	Jan 1 - Dec 31	23	16,651
Cabin Creek	Gully Creek to Madison River	Jan 1 - Dec 31	585	28,741
Cherry Creek	Headwaters to mouth	Jan 1 - Dec 31	15	10,859
Cougar Creek	Yellowstone NP boundary to mouth	Jan 1 - Dec 31	24	17,375
Duck Creek	Yellowstone NP boundary to Hebgen Reservoir	Jan 1 - Dec 31	23	16,651
Elk River	Headwaters to mouth	Jan 1 - Dec 31	28	20,271
Grayling Creek	Yellowstone NP boundary to Hebgen Reservoir	Jan 1 - Dec 31	34	24,615
Hot Springs Creek	North and Middle forks to mouth	Jan 1 - Dec 31	5.5	3,982
Indian Creek	Raw Liver Creek to mouth	Jan 1 - Dec 31	48	34,750
Jack Creek	Lone Creek to mouth	Jan 1 - Dec 31	28	20,271
Madison River #1	Yellowstone NP boundary to Hebgen Reservoir	Jan 1 - Dec 31	500	361,983
Madison River #2	Hebgen Dam to West Fork	Jan 1 - Dec 31	800	579,173
Madison River #3	West Fork to Ennis Reservoir	Jan 1 - Dec 31	1,000	723,967
Madison River #4	Ennis Dam to mouth	Jan 1 - Dec 31	1,300	941,157
Moore Creek	Fletcher Creek to mouth	Jan 1 - Dec 31	1.4	1,014
North Meadow Creek	Headwaters to mouth	Jan 1 - Dec 31	18	13,031
O'Dell Creek	Headwaters to mouth	Jan 1 - Dec 31	98	70,949
Red Canyon Creek	Headwaters to Hebgen Reservoir	Jan 1 - Dec 31	2.9	2,100
Ruby Creek	Beartrap Canyon to mouth	Jan 1 - Dec 31	18	13,031
SF Madison River	Dry Canyon to Hebgen Reservoir	Jan 1 - Dec 31	92	66,605
Squaw Creek	North Fork to mouth	Jan 1 - Dec 31	14	10,136
Standard Creek	Headwaters to mouth	Jan 1 - Dec 31	10	7,240
Trapper Creek	Headwaters to Hebgen Reservoir	Jan 1 - Dec 31	3.2	2,317
Watkins Creek	Coffin Creek to Hebgen Reservoir	Jan 1 - Dec 31	5.5	3,982
WF Madison River	Fox Creek to mouth	Jan 1 - Dec 31	957	66,533

Ck - Creek MF - Middle Fork NF - North Fork NP - National Park R - River SF - South Fork WF - West Fork

RED ROCK-BEAVERHEAD DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Bear Creek	Headwaters to BLM boundary	Jan 1 - Dec 31	6.5	4,706
Beaverhead River #1	Clark Canyon to East Bench Div Dam at Barretts	Jan 1 - Dec 31	200	144,793
Beaverhead River #2	East Bench Diversion Dam at Barretts to mouth	Jan 1 - Dec 31	200	144,793
Big Sheep Creek	Cabin and Nicholia creeks to mouth	Jan 1 - Dec 31	48	34,750
Black Canyon Creek	Headwaters to mouth	Jan 1 - Dec 31	2.5	1,810
Blacktail Deer Creek	MF and WF to County Rd @ T8S R8W Secs 20 & 29	Jan 1 - Dec 31	42	30,407
Bloody Dick Creek	Swift Lake outlet to mouth	Jan 1 - Dec 31	20	14,479
Browns Canyon Creek	Headwaters to mouth	Jan 1 - Dec 31	2.3	1,665
Cabin Creek	Headwaters to mouth	Jan 1 - Dec 31	0.4	290
Corral Creek	Headwaters to mouth	Jan 1 - Dec 31	6	4,344
Deadman Creek	Deadman Lake to mouth	Jan 1 - Dec 31	4.5	3,258
EF Blacktail Deer Creek	Headwaters to mouth	Jan 1 - Dec 31	18	13,031
EF Clover Creek	Headwaters to mouth	Jan 1 - Dec 31	4.4	3,185
EF Dyce Creek	Headwaters to mouth	Jan 1 - Dec 31	1.4	1,014
Frying Pan Creek	Headwaters to mouth	Jan 1 - Dec 31	1.6	1,158
Grasshopper Creek	Blue Creek to mouth	Jan 1 - Dec 31	30	21,719
Hell Roaring Creek	Headwaters to mouth	Jan 1 - Dec 31	15	10,859
Horse Prairie Creek	Headwaters to mouth	Jan 1 - Dec 31	36	26,063
Indian Creek	Headwaters to mouth	Jan 1 - Dec 31	0.2	145
Jones Creek	Headwaters to Lakeview Road crossing	Jan 1 - Dec 31	1.9	1,376
Long Creek	Jones Creek to mouth	Jan 1 - Dec 31	3.4	2,461
Medicine Lodge Creek	Bear Canyon to mouth	Jan 1 - Dec 31	10	7,240
Narrows Creek	Spring in T13S R1E Sec18A to Elk Lake	May 1 - July 15	1.2	869
		July 16 - April 30	0.5	362
Odell Creek	Headwaters to Lower Red Rock Lake	Jan 1 - Dec 31	11	7,964
Peet Creek	Headwaters to reservoir in T14S R4W Sec34A	Jan 1 - Dec 31	0.9	652
Poindexter Slough	Springs & canal T8S R9W Sec3,SW to Beaverhead	Jan 1 - Dec 31	57.9	41,918
Rape Creek	Headwaters to reservoir in T10S R13W Sec4	Jan 1 - Dec 31	0.4	290
Red Rock Creek	Headwaters to Upper Red Rock Lake	Jan 1 - Dec 31	15	10,859
Red Rock River #1	Dam at Lower Red Rock Lake to Lima Reservoir	Jan 1 - Dec 31	55	39,818
Red Rock River #2	Lima Dam to Clark Canyon Reservoir	Jan 1 - Dec 31	60	43,438
Reservoir Creek	Headwaters to mouth	Jan 1 - Dec 31	1.5	1,086
Shenon Creek	Headwaters to BLM boundary in T10S R14W Sec25	Jan 1 - Dec 31	0.4	290
Simpson Creek	Headwaters to mouth	Jan 1 - Dec 31	0.7	507
Tom Creek	Headwaters to Upper Red Rock Lake	Jan 1 - Dec 31	1.4	1,014
Trapper Creek	Headwaters to mouth	Jan 1 - Dec 31	0.7	507
WF Blacktail Deer Creek	Grays and South forks to mouth	Jan 1 - Dec 31	3	2,172
WF Dyce Creek	Headwaters to mouth	Jan 1 - Dec 31	0.7	507

RUBY RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Coal Creek	Headwaters to mouth	Jan 1 - Dec 31	3.6	2,606
Cottonwood Creek	Geyser Creek to mouth	Jan 1 - Dec 31	4	2,896
EF Ruby River	Headwaters to mouth	Jan 1 - Dec 31	3	2,172
MF Ruby River	Divide Creek to mouth	Jan 1 - Dec 31	5	3,620
Mill Creek	Outlet of Branham Lake to mouth	Jan 1 - Dec 31	10	7,240
NF Greenhorn Creek	Headwaters to mouth	Jan 1 - Dec 31	3.5	2,534
Ruby River #1	East, Middle, and West forks to Ruby Reservoir	Jan 1 - Dec 31	102	73,845
Ruby River #2	Ruby Dam to mouth	Jan 1 - Dec 31	40	28,959
Warm Springs Creek	Romy ~~[illegible]~~ Lake outlet to mouth	Jan 1 - Dec 31	48.5	35,112
WF Ruby River	Headwaters to mouth	Jan 1 - Dec 31	3.0	2,172
Wisconsin Creek	Crystal Lake outlet to mouth	Jan 1 - Dec 31	12	8,688

UPPER MISSOURI SUBBASIN

UPPER MISSOURI RIVER AND TRIBUTARIES

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af/yr)
Avalanche Creek	Cooney Gulch to Canyon Ferry Reservoir	Jan 1 - Dec 31	5	3,620
Beaver Creek	Headwaters in Elkhorn Mts to Canyon Ferry Reservoir	Jan 1 - Dec 31	2.8	2,027
Beaver Creek	Headwaters in Big Belt Mts to mouth	Jan 1 - Dec 31	10.0	7,240
Canyon Creek	Headwaters to mouth	Jan 1 - Dec 31	10.0	7,240
Confederate Gulch	Debauch Gulch to mouth	Jan 1 - Dec 31	5	3,620
Cottonwood Creek	Headwaters to mouth	Jan 1 - Dec 31	1.0	724
Crow Creek	Tizer and Wilson Creeks to Williams Ditch intake	Jan 1 - Dec 31	11	7,964
Deep Creek	Castle Fork to Missouri River	Jan 1 - Dec 31	9	6,516

EF - East Fork MF - Middle Fork NF - North Fork WF - West Fork

Upper Missouri River and Tributaries (continued)

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Dry Creek	Headwaters to Broadwater Missouri Canal	Jan 1 - Dec 31	1.8	1,303	
Duck Creek	Headwaters to Canyon Ferry Res.	Jan 1 - Dec 31	8	5,792	
Little Prickly Pear Ck. #1	Canyon Creek to Clark Creek	Jan 1 - Dec 31	22	15,927	15,927
Little Prickly Pear Ck. #2	Clark Creek to mouth	Jan 1 - Dec 31	70	50,678	50,678
Lyons Creek	Headwaters to mouth	Jan 1 - Dec 31	10.0	7,240	7,240
McGuire Creek	Headwaters to mouth	May 1 - Nov 30	8.3	3,523	
		Dec 1 - Apr 30	4.7	1,408	4,931
Missouri River #1	Jefferson and Madison rivers to Canyon Ferry Res.	Jan 1 - Dec 31	2,400	1,737,520	1,737,520
Missouri River #2	Hauser Dam to Holter Reservoir	Oct 15 - Dec 15	4,878	599,873	
		Dec 16 - Mar 15	3,000	535,537	
		Mar 16 - Apr 30	5,316	485,030	
		May 1 - June 30	7,890	954,624	
		July 1 - Oct 14	3,500	735,867	3,310,931
Missouri River #3	Holter Dam to Great Falls	May 19 - July 5	6,398	609,132	
		July 6 - May 18	4,100	2,577,916	3,187,048
Prickly Pear Creek #1	Rabbit Gulch to Hwy 12 bridge in East Helena	Jan 1 - Dec 31	22	15,927	15,927
Prickly Pear Creek #2	Hwy 12 bridge in East Helena to Lake Helena	Jan 1 - Dec 31	30	21,719	21,719
Sevenmile Creek	Greenhorn Creek and Skelly Gulch to mouth	Jan 1 - Dec 31	1.0	724	724
Silver Creek	Helena Valley Irrigation Canal to mouth	May 1 - Nov 30	13.0	5,518	
		Dec 1 - Apr 30	5.4	1,617	7,135
Sixteenmile Creek	Billy Creek to mouth	Jan 1 - Dec 31	20	14,479	14,479
Spokane Creek	Helena Valley Irr. Canal to mouth	May 1 - Nov 30	4.0	1,698	
		Dec 1 - Apr 30	3.0	898	2,596
Stickney Creek	North and South forks to mouth	Apr 1 - Apr 30	7	417	
		May 1 - May 31	34	2,091	
		June 1 - June 30	35	2,083	
		July 1 - July 31	7	430	5,021
Tenmile Creek	Headwaters to mouth	Jan 1 - Dec 31	12.0	8,688	8,688
Trout Creek	Springs near Vigilante Campground to mouth	Jan 1 - Dec 31	15.0	10,860	10,860
Virginia Creek	Headwaters to mouth	Jan 1 - Dec 31	6.0	4,344	4,344
Wegner Creek	Headwaters to mouth	Apr 1 - Apr 30	8	476	
		May 1 - May 31	41	2,521	
		June 1 - June 30	38	2,261	
		July 1 - July 31	8	492	5,750
Willow Creek	Headwaters to mouth	Jan 1 - Dec 31	3.5	2,534	2,534
Wolf Creek	Headwaters to mouth	Jan 1 - Dec 31	7.0	5,068	5,068

DEARBORN RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Dearborn River	Headwaters to mouth	Jan 1 - Dec 31	110	79,636	79,636
Flat Creek	Headwaters to mouth	Jan 1 - Dec 31	7.5	5,430	5,430
MF Dearborn River	Headwaters to mouth	Jan 1 - Dec 31	9.5	6,878	6,878
Sheep Creek	Headwaters of South Fork to mouth	Jan 1 - Dec 31	22	15,927	15,927
SF Dearborn River	Headwaters to mouth	Jan 1 - Dec 31	11.5	8,326	8,326

SMITH RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Big Birch Creek	Headwaters to mouth	Jan 1 - Dec 31	11	7,964	7,964
Eagle Creek	Headwaters to mouth	Jan 1 - Dec 31	2.5	1,810	1,810
Hound Creek	EF Hound Creek and Middle Creek to mouth	Jan 1 - Dec 31	35	25,339	25,339
Newlan Creek	Headwaters to mouth	Jan 1 - Dec 31	3.8	2,751	2,751
NF Deep Creek	Headwaters to rock cascades	Jan 1 - Dec 31	1.0	724	724
NF Smith River	Headwaters to mouth	Jan 1 - Dec 31	9	6,516	6,516
Rock Creek	Headwaters to mouth	Jan 1 - Dec 31	11	7,964	7,964
Sheep Creek	Headwaters to mouth	Jan 1 - Dec 31	35	25,339	25,339
Smith River #1	North and South Forks Sheep Creek	Jan 1 - Dec 31	90	65,157	65,157

EF - East Fork Irr. - Irrigation MF - Middle Fork Res. - Reservoir SF - South Fork

Smith River Drainage (continued)

Smith River #2	Sheep Creek to Hound Creek	Jan 1 - Dec 31	150	108,595	108,595
Smith River #3	Hound Creek to mouth	Jan 1 - Dec 31	80	57,917	57,917
SF Smith River	Headwaters to mouth	Jan 1 - Dec 31	7	5,068	5,068
Tenderfoot Creek	Headwaters to mouth	Jan 1 - Dec 31	15	10,859	10,859

SUN RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Elk Creek	Headwaters to mouth	Jan 1 - Dec 31	16	11,583	11,583
Ford Creek	Headwaters to mouth	Jan 1 - Dec 31	12	8,688	8,688
NF Willow Creek	Headwaters to mouth	Jan 1 - Dec 31	3.0	2,172	2,172
Sun River #1	Diversion Dam to Elk Creek	Jan 1 - Dec 31	100	72,397	72,397
Sun River #2	Elk Creek to mouth	Jan 1 - Dec 31	130	94,116	94,116
Willow Creek	Headwaters to mouth	Jan 1 - Dec 31	3	2,172	2,172

BELT CREEK DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Belt Creek #1	Headwaters to Big Otter Creek	Jan 1 - Dec 31	90	65,157	65,157
Belt Creek #2	Big Otter Creek to Missouri River	Jan 1 - Dec 31	35	25,339	25,339
Big Otter Creek	Whiskey Spring Coulee to Belt Creek	Jan 1 - Dec 31	5	3,620	3,620
Dry Fork Belt Creek	Galena and Oti Park Creek to Belt Creek	Jan 1 - Dec 31	7	5,068	5,068
Logging Creek	Headwaters to Belt Creek	Jan 1 - Dec 31	6	4,344	4,344
Pilgrim Creek	Headwaters to Belt Creek	Jan 1 - Dec 31	8	5,792	5,792
Tillinghast Creek	Headwaters to Belt Creek	Jan 1 - Dec 31	5.5	3,982	3,982

MIDDLE MISSOURI SUBBASIN

MIDDLE MISSOURI RIVER AND TRIBUTARIES

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Cow Creek	NF and SF to County bridge	Jan 1 - Dec 31	4.5	3,258	3,258
Highwood Creek	Headwaters to Hwy 228 Bridge at Highwood	Jan 1 - Dec 31	10	7,240	7,240
Missouri River #4	Great Falls to Marias River	Mar 15 - May 18	4,887	630,059	
		May 19 - July 5	11,284	1,074,311	
		July 6 - Aug 31	4,500	508,760	
		Sep 1 - Mar 14	3,700	1,431,075	3,644,20~~5~~4
Missouri River #5	Marias River to Judith River	Mar 15 - May 18	5,571	718,244	
		May 19 - July 5	14,000	1,332,892	
		July 6 - Aug 31	5,400	610,512	
		Sep 1 - Mar 14	4,300	1,663,140	4,324,788
Missouri River #6	Judith River to upper end of Fort Peck Reservoir	Mar 15 - May 18	7,100	915,371	
		May 19 - July 5	15,302	1,456,851	
		July 6 - Aug 31	5,800	655,735	
		Sep 1 - Mar 14	4,700	1,817,850	4,845,807
Shonkin Creek	Forest boundary to town of Shonkin	Jan 1 - Dec 31	7	5,068	5,068

FORT PECK RESERVOIR TRIBUTARIES

Big Dry Creek	Hwy 200 bridge to mouth	Mar 15 - Mar 31	300	9,521	
		Apr 1 - Apr 30	100	5,950	
		May 1 - May 31	35	2,152	
		June 1 - Oct 31	5.5	1,669	19,292
Little Dry Creek	Whiteside ranch house to Big Dry Creek	Mar 15 - Mar 31	110	3,491	
		Apr 1 - Apr 30	42	2,499	
		May 1 - May 31	17	1,045	
		June 1 - Oct 31	3.5	1,062	8,097

JUDITH RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Beaver Creek	West Fork to Cottonwood Creek	Jan 1 - Dec 31	5	3,620	3,620
Big Spring Creek #1	Fish hatchery to Cottonwood Creek	Jan 1 - Dec 31	110	79,636	79,636
Big Spring Creek #2	Cottonwood Creek to mouth	Jan 1 - Dec 31	100	72,397	72,397
Cottonwood Creek	Spring Branch of Cottonwood Ck. to Big Spring Ck.	Jan 1 - Dec 31	4.5	3,258	3,258

Hwy - Highway   NF - North Fork   SF - South Fork

Judith River Drainage (continued)

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
East Fork Big Spring Ck.	Headwaters to Big Spring Creek	Jan 1 - Dec 31	7.5	5,430	5,430
Judith River #1	SF and MF to Big Spring Creek	Jan 1 - Dec 31	25	18,099	18,099
Judith River #2	Big Spring Creek to Missouri River	Jan 1 - Dec 31	160	115,835	115,835
Lost Fork Judith River	SF and WF to MF Judith River	Jan 1 - Dec 31	14	10,136	10,136
Middle Fork Judith River	Headwaters to South Fork	Jan 1 - Dec 31	22	15,928	15,928
South Fork Judith River	Headwaters to Middle Fork	Jan 1 - Dec 31	3.5	2,534	2,534
Warm Spring Creek	Springs to Judith River	Jan 1 - Dec 31	110	79,636	79,636
Yogo Creek	Headwaters to MF Judith River	Jan 1 - Dec 31	3	2,172	2,172

MUSSELSHELL RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Alabaugh Creek	Headwaters to mouth	Jan 1 - Dec 31	12	8,688	8,688
American Fork Creek	South Fork to mouth	Jan 1 - Dec 31	5.5	3,982	3,982
Big Elk Creek	Origin ~~of~~ at Lebo Fork to mouth	Jan 1 - Dec 31	9.5	6,878	6,878
Careless Creek	Headwaters to Roberts Creek	Jan 1 - Dec 31	2	1,448	1,448
Checkerboard Creek	East and West Forks to mouth	Jan 1 - Dec 31	6	4,344	4,344
Collar Gulch Creek	Headwaters to mouth	Jan 1 - Dec 31	0.6	434	434
Cottonwood Creek	WF, MF, and Loco Creek to mouth	Jan 1 - Dec 31	16	11,583	11,583
Flatwillow Creek	NF and SF to Petrolia Reservoir	Jan 1 - Dec 31	18	13,031	13,031
Musselshell River #1	NF and SF to Deadmans Basin Div	Jan 1 - Dec 31	80	57,917	57,917
Musselshell River #2	Deadmans Basin Div to Musselshell Div	Jan 1 - Dec 31	80	57,917	57,917
Musselshell River #3	Musselshell Diversion Dam at town of Musselshell to mouth	Jan 1 - Dec 31	70	50,678	50,678
NF Musselshell #1	Headwaters to Bair Reservoir	Jan 1 - Dec 31	3	2,172	2,172
NF Musselshell #2	Bair Reservoir to SF Musselshell R.	Jan 1 - Dec 31	16	11,583	11,583
SF Musselshell	Headwaters to North Fork	Jan 1 - Dec 31	30	21,719	21,719
Spring Creek	Headwaters to mouth	Jan 1 - Dec 31	8	5,792	5,792
Swimming Woman Ck.	Headwaters to Cty road crossing 8 linear miles upstream from mouth	Jan 1 - Dec 31	2.5	1,810	1,810

MARIAS/TETON SUBBASIN

MARIAS RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Badger Creek	N and S Badger creeks to Forest/ Blackfeet Reservation Boundary	Jan 1 - Dec 31	60	43,438	43,438
Birch Creek	Swift Reservoir to Hwy 358	Jan 1 - Dec 31	64	46,334	46,334
Cut Bank Creek	Blackfeet Reservation boundary to mouth	Jan 1 - Dec 31	75	54,297	54,297
Dupuyer Creek	Headwaters to mouth	Jan 1 - Dec 31	12	8,688	8,688
Marias River #1	Two Medicine River and Cut Bank Creek to head of Tiber Reservoir	Jan 1 - Dec 31	200	144,793	144,793
Marias River #2	Tiber Dam to Circle Bridge (Hwy 223)	Jan 1 - Dec 31	500	361,983	361,983
Marias River #3	Circle Bridge (Hwy 223) to mouth	Jan 1 - Dec 31	560	405,421	405,421
North Badger Creek	Headwaters to mouth	Jan 1 - Dec 31	14	10,136	10,136
NF Dupuyer Creek	Headwaters to mouth	Jan 1 - Dec 31	12	8,688	8,688
South Badger Creek	Headwaters to mouth	Jan 1 - Dec 31	40	28,959	28,959
SF Dupuyer Creek	Headwaters to mouth	Jan 1 - Dec 31	6	4,344	4,344
SF Two Medicine River	Headwaters to Forest/ Blackfeet Reservation Boundary	Jan 1 - Dec 31	16	11,583	11,583

TETON RIVER DRAINAGE

STREAM	REACH DESCRIPTION	DATES REQUESTED	AMOUNT REQUESTED (cfs)	(af)	(af/yr)
Deep Creek	Headwaters to mouth	Jan 1 - Dec 31	18	13,031	13,031
McDonald Creek	Headwaters to mouth	Jan 1 - Dec 31	10	7,240	7,240
NF Deep Creek	Headwaters to mouth	Jan 1 - Dec 31	7.2	5,212	5,212
SF Deep Creek	Headwaters to mouth	Jan 1 - Dec 31	6.9	4,995	4,995
Spring Creek	Headwaters to mouth	Jan 1 - Dec 31	4.5	3,258	3,258
Teton River	Headwaters to discharge from Priest Butte Lake	Jan 1 - Dec 31	35	25,339	25,339

LAKES AND SWAMPS

Bean Lake	Sec. 18C and 19B, T18N, R6W, Sec. 13D and 24A, T18N, R7W	Jan 1 - Dec 31	—	2648.6 ~~2,649~~	2648.6 ~~2,649~~
Antelope Butte Swamp	North 1/2 Sec. 28, T26N, R8W	Jan 1 - Dec 31	—	460	460

Ck. - Creek Cty - County Div - Diversion Hwy - Highway MF - Middle Fork NF - North Fork R - River SF - South Fork WF - West Fork

Table K-3. Reservation requests for instream flows on streams with no competing requests

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
GALLATIN RIVER DRAINAGE		
DFWP	Baker Creek	2
DFWP	Big Bear Creek	[a]
DFWP	Bridger Creek	4
DFWP	Cache Creek	4
DFWP	East Fork Hyalite Creek	2
DFWP	Gallatin River #1	2
DFWP	Hell Roaring Creek	[a]
DFWP	Hyalite Creek #1	3[b]
DFWP	Middle Fork West Fork Gallatin River	4
DFWP	Porcupine Creek	4
DFWP	Reese Creek	2
DFWP	Rocky Creek	2
DFWP	South Cottonwood Creek	6
DFWP	South Fork Spanish Creek	4
DFWP	South Fork West Fork Gallatin River	4
DFWP	Spanish Creek	1
DFWP	Squaw Creek	1
DFWP	Taylor Fork	3
DFWP	West Fork Gallatin River	1
DFWP	West Fork Hyalite Creek	2
MADISON RIVER DRAINAGE		
DFWP	Madison River #1	1
DFWP	Black Sand Spring Creek	2
DFWP	Cougar Creek	3
DFWP	Duck Creek	3
DFWP	Grayling Creek	[a]
DFWP	Red Canyon Creek	[a]
DFWP	Watkins Creek	[a]
DFWP	Trapper Creek	[a]
DFWP	Cabin Creek	4
DFWP	Beaver Creek	4
DFWP	Antelope Creek	2
DFWP	Elk River	4
DFWP	West Fork Madison River	3
DFWP	Standard Creek	4
DFWP	Squaw Creek	4
DFWP	Ruby Creek	3
DFWP	Indian Creek	4
DFWP	Blaine Spring Creek	2
DFWP	O'Dell Spring Creek	[a]
DFWP	Jack Creek	3
DFWP	Moore Creek	2[b]
DFWP	North Meadow Creek	3
DFWP	Hot Springs Creek	4
DFWP	Cherry Creek	4
JEFFERSON AND BOULDER RIVER DRAINAGES		
DFWP	Boulder River #1	4
DFWP	Hells Canyon Creek	2[b]
DFWP	Willow Spring Creek	2
DFWP	Halfway Creek	1[b]
DFWP	Whitetail Creek	4
DFWP	South Boulder River	3[b]
DFWP	South Willow Creek	3
DFWP	North Willow Creek	3
DFWP	Willow Creek	2
DFWP	Little Boulder River	4
BIG HOLE RIVER DRAINAGE		
DFWP	South Fork Big Hole River	[a]
DFWP	Big Hole River #1	1
DFWP	Big Hole River #2	1
DFWP	Big Hole River #3	1
DFWP	Warm Springs Creek	3
DFWP	Miner Creek	1
DFWP	Rock Creek	1
DFWP	Big Lake Creek	1
DFWP	Francis Creek	2
DFWP	Steel Creek	1
DFWP	Swamp Creek	1
DFWP	Joseph Creek	3
DFWP	Trail Creek	3
DFWP	Ruby Creek	3
DFWP	Johnson Creek	3
DFWP	Mussigbrod Creek	2
DFWP	North Fork Big Hole River	1
DFWP	Pintlar Creek	3[b]
DFWP	Fishtrap Creek	3[b]
DFWP	LaMarche Creek	3
DFWP	Seymour Creek	3
DFWP	Sullivan Creek	[a]
DFWP	Twelvemile Creek	[a]
DFWP	Corral Creek	3
DFWP	Tenmile Creek	[a]
DFWP	Sevenmile Creek	[a]
DFWP	Sixmile Creek	[a]
DFWP	Oregon Creek	[a]
DFWP	California Creek	[a]
DFWP	American Creek	[a]
DFWP	French Creek	4
DFWP	Governor Creek	1
DFWP	Deep Creek	3
DFWP	Bear Creek	3
DFWP	Bryant Creek	[a]
DFWP	Jacobsen Creek	[a]
DFWP	Wyman Creek	4
DFWP	Pattengail Creek	3
DFWP	Wise River	3
DFWP	Delano Creek	[a]
DFWP	Jerry Creek	4
DFWP	Divide Creek	3
DFWP	Canyon Creek	3
DFWP	Moose Creek	3
DFWP	Trapper Creek	4
DFWP	Camp Creek	4
DFWP	Willow Creek	3

Table K-3 (continued)

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Birch Creek	4
BLM	Deep Creek	3
BLM	Bear Creek	3
BLM	Canyon Creek	3
BLM	Moose Creek	3
BLM	Camp Creek	4
BLM	Willow Creek	3

RUBY RIVER DRAINAGE

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Ruby River #1	3[b]
DFWP	Ruby River #2	2
DFWP	Coal Creek	[a]
DFWP	Middle Fork Ruby River	[a]
DFWP	East Fork Ruby River	4
DFWP	West Fork Ruby River	4
DFWP	Cottonwood Creek	3[b]
DFWP	Warm Spring Creek	3[b]
DFWP	North Fork Greenhorn Creek	1
DFWP	Mill Creek	4
DFWP	Wisconsin Creek	5
BLM	North Fork Greenhorn Creek	1

BEAVERHEAD RIVER DRAINAGE

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Beaverhead River #1	1
DFWP	Red Rock River #1	2[b]
DFWP	Red Rock River #2	2[b]
DFWP	Red Rock Creek	1[b]
DFWP	Hell Roaring Creek	1[b]
DFWP	Corral Creek	2
DFWP	Tom Creek	3
DFWP	Narrows Creek	2
DFWP	Odell Creek	2
DFWP	Jones Creek	3
DFWP	Peet Creek	2
DFWP	Long Creek	3
DFWP	East Fork Clover Creek	4
DFWP	Indian Creek	2
DFWP	Cabin Creek	2
DFWP	Simpson Creek	2
DFWP	Deadman Creek	3
DFWP	Big Sheep Creek	2[b]
DFWP	Black Canyon Creek	[a]
DFWP	Shenon Creek	4
DFWP	Frying Pan Creek	[a]
DFWP	Trapper Creek	[a]
DFWP	Bear Creek	2
DFWP	Rape Creek	1
DFWP	Bloody Dick Creek	3
DFWP	Browns Canyon Creek	[a]
DFWP	Medicine Lodge Creek	3
DFWP	Horse Prairie Creek	3[b]
DFWP	East Fork Dyce Creek	[a]
DFWP	West Fork Dyce Creek	[a]
DFWP	Reservoir Creek	[a]
DFWP	Grasshopper Creek	4
DFWP	Poindexter Slough	1
DFWP	East Fork Blacktail Deer Creek	3[b]
DFWP	West Fork Blacktail Deer Creek	4
DFWP	Blacktail Deer Creek	3[b]
BLM	Hell Roaring Creek	1
BLM	Corral Creek	2
BLM	Tom Creek	3
BLM	Odell Creek	2
BLM	Jones Creek	3
BLM	Peet Creek	2
BLM	Long Creek	3
BLM	Indian Creek	2
BLM	Cabin Creek	2
BLM	Simpson Creek	2
BLM	Deadman Creek	2
BLM	Big Sheep Creek	2[b]
BLM	Black Canyon Creek	[a]
BLM	Frying Pan Creek	[a]
BLM	Trapper Creek	[a]
BLM	Bear Creek	2
BLM	Rape Creek	1
BLM	Bloody Dick Creek	3
BLM	Medicine Lodge Creek	3
BLM	East Fork Dyce Creek	[a]
BLM	West Fork Dyce Creek	[a]
BLM	East Fork Blacktail Deer Creek	3[b]
BLM	West Fork Blacktail Deer Creek	4[b]
BLM	Shenon Creek	4
BLM	Trapper Creek	[a]

MISSOURI RIVER DRAINAGE - THREE FORKS TO HOLTER DAM

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Avalanche Creek	4
DFWP	Beaver Creek	3
DFWP	Confederate Gulch	4
DFWP	Crow	
DFWP	Dry Creek	3[b]
DFWP	Duck Creek	4
DFWP	Sixteen Mile Creek	3
DFWP	Cottonwood Creek	4
DFWP	Willow Creek	3
DFWP	Beaver Creek	3[b]
DFWP	Prickly Pear Creek	2[b]
DFWP	Tenmile Creek	4[a]
DFWP	Sevenmile Creek	4
DFWP	Silver Creek	3
DFWP	Trout Creek	3
DFWP	McGuire Creek	[a]

MISSOURI RIVER DRAINAGE - HOLTER DAM TO BELT CREEK

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Sheep Creek	3
DFWP	Spokane Creek	3
DFWP	Virginia Creek	4
DFWP	Canyon Creek	4

Table K-3 (continued)

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
DFWP	Little Prickly Pear Creek #1	2
DFWP	Little Prickly Pear Creek #2	2
DFWP	Lyons Creek	2
DFWP	Wolf Creek	3
DFWP	Wegner Creek	a
DFWP	Stickney Creek	3
DEARBORN RIVER DRAINAGE		
DFWP	Middle Fork Dearborn River	4
DFWP	South Fork Dearborn River	4
DFWP	Flat Creek	4
DFWP	Bean Lake	NA
SMITH RIVER DRAINAGE		
DFWP	South Fork Smith River	a
DFWP	North Fork Smith River	a
DFWP	Newlan Creek	4
DFWP	Big Birch Creek	4
DFWP	Sheep Creek	2[b]
DFWP	Eagle Creek	4
DFWP	Rock Creek	3
DFWP	Tenderfoot Creek	3
DFWP	North Fork Deep Creek	a
SUN RIVER DRAINAGE		
DFWP	North Fork Willow Creek	a
DFWP	Willow Creek	4
DFWP	Ford Creek	4
DFWP	Elk Creek	3
BELT CREEK DRAINAGE		
DFWP	Belt Creek #1	3
DFWP	Dry Fork Belt Creek	3
DFWP	Tillinghast Creek	3
DFWP	Pilgrim Creek	2
DFWP	Logging Creek	4
MARIAS RIVER DRAINAGE		
DFWP	South Fork Dupuyer Creek	2
DFWP	North Fork Dupuyer Creek	3
DFWP	Dupuyer Creek	4
DFWP	South Badger Creek	3
DFWP	North Badger Creek	1[b]
DFWP	Badger Creek	3
DFWP	South Fork Two Medicine River	2

APPLICANT	STREAM	FISHERIES VALUE CLASS[c]
TETON RIVER DRAINAGE		
DFWP	McDonald Creek	4
DFWP	South Fork Deep Creek	4
DFWP	North Fork Deep Creek	2
DFWP	Deep Creek	4
DFWP	Spring Creek	3
DFWP	Antelope Butte Swamp	NA
MISSOURI RIVER DRAINAGE - BELT CREEK TO FORT PECK DAM		
DFWP	Cow Creek	6
JUDITH RIVER DRAINAGE		
DFWP	Middle Fork Judith River	a
DFWP	Beaver Creek	4
DFWP	Cottonwood Creek	4
DFWP	Lost Fork Judith River	6
DFWP	Yogo Creek	4
DFWP	South Fork Judith River	6
MUSSELSHELL RIVER DRAINAGE		
DFWP	Musselshell River #1	6
DFWP	South Fork Musselshell River	4
DFWP	Alabaugh Creek	4
DFWP	Cottonwood Creek	4
DFWP	North Fork Musselshell River #1	3
DFWP	North Fork Musselshell River #2	3
DFWP	Checkerboard Creek	4
DFWP	Spring Creek	4
DFWP	Big Elk Creek	4
DFWP	American Fork Creek	4
DFWP	Careless Creek	a
DFWP	Swimming Woman Creek	a
DFWP	Collar Gulch Creek	a
DFWP	Flatwillow Creek	4
FORT PECK RESERVOIR DRAINAGE		
DFWP	Big Dry Creek	3[b]
DFWP	Little Dry Creek	a

[a] some or all reaches unclassified
[b] some reaches have lower classification
[c] 1 = outstanding fisheries resource
2 = high value fisheries resource
3 = substantial fisheries resource
4 = moderate fisheries resource
5 = limited fisheries resource
6 = unrated

PREFILED TESTIMONY OF CHARLES PARRETT IN CONNECTION WITH THE MISSOURI RIVER RESERVATION APPLICATION

Q. Please state your name and address.

A. My name is Charles Parrett and my home address is 1523 Broadway, Helena, Montana.

Q. What is your present employment, and how long have you been employed in this position?

A. I am employed by the U.S. Geological Survey in Helena as a Supervisory Hydrologist. I have worked for the Survey as a Hydrologist from 1977 to 1988 and as a Supervisory Hydrologist from 1988 to the present.

Q. Please state your educational background and experience.

A. I graduated with honors from Montana Tech in 1967 with a B.S. degree in Engineering Science. After working as a Hydraulic Designer for 2 years with the Montana Department of Highways, I returned to Montana State University in 1969. I obtained an M.S. degree in Civil Engineering in 1970 and took additional course work toward a doctorate until 1971. I began employment with the Montana Water Resources Board (later the Department of Natural Resources and Conservation) as a Hydraulic Engineer in charge of the Floodway Management Program. I left the Department in 1977, and after a three-month stint as a Hydrologist/Engineer with the Morrison-Maierle engineering firm, began work with the U.S. Geological Survey as a Hydrologist in October 1977.

While employed with the Survey, I have been the project chief on numerous surface-water hydrological investigations, including various flood studies, studies that developed methods for estimating streamflow characteristics at ungaged sites, state-wide water-use project, and various streamflow modeling studies. I have been the sole or principal author of 18 formal U.S. Geological Survey technical reports, including one Professional Paper and three Water-Supply Papers. In addition, I have been a coauthor on 9 other U.S. Geological Survey reports.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to assist the Board of Natural Resources in determining the facts about my role in the preparation of estimates of monthly streamflow characteristics at selected sites in the upper Missouri River Basin, Montana, base period water years 1937-86, and to provide for the record the written report describing the estimates and the methodology.

Q. Please describe the monthly streamflow characteristics that were estimated.

A. Streamflow characteristics that were estimated were the monthly-mean discharges that are exceeded 90, 80, 50, and 20 percent of the years of extended record (1937-86) and the mean-monthly discharge for each month.

Q. Please describe your role in the preparation of the above-described estimates.

A. I served as project chief on a cooperative project with the Montana Department of Fish, Wildlife, and Parks to provide estimates of long-term (1937-86) monthly streamflow characteristics at selected sites in the Missouri River basin. Based on previous work, several methods for estimating streamflow at ungaged sites were used at most of the selected sites. I was responsible for determining which methods would be used at the sites and with the development of estimation equations required for application of two of the methods. I also directed the work of hydrologic technicians who (1) made streamflow measurements required for one of the methods, (2) assisted with measurements of channel geometry, (3) compiled data, and (4) helped develop computer programs for managing the extensive data base.

Q. Did you prepare a written report of your estimates?

A. Yes. The written report, U.S. Geological Survey Water-Resources Investigations Report 89-4083, entitled "Estimates of Monthly Streamflow Characteristics at Selected Sites in the Upper Missouri River Basin, Montana, Base Period Water Years 1937-86," describes the methodology and presents estimates for 312 sites.

Q. Is a true and correct copy of the report contained in the Department of Fish, Wildlife, and Parks' exhibits filed with its prefiled direct testimony?

A. Yes. A true and correct copy of the report is contained in the Department's exhibits as Exhibit 4.

Q. Were other estimates made that were not included in the written report?

A. Yes. Estimates were made for six sites not shown in the written report. These estimates were requested after the report process was well underway, and the estimates were subsequently furnished to the Department of Fish, Wildlife, and Parks in the form of a computer-generated table similar to tables 4-9 in the report. These estimates were made using the Basin-Characteristics Method described in the report. A copy of this additional table of estimates is attached and is part of this testimony.

Charles Parrett, being first duly sworn, states that the foregoing testimony is true.

Dated: October 29, 1991.

Charles Parrett

Subscribed and sworn to before me this 29 day of October, 1991.

Notary Public for the State of Montana
Residing at Helena, Montana
My commission expires: [illegible]

Table 4.-- Estimated monthly streamflow characteristics for October and November.

[Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second; QM, mean monthly streamflow for specified month, in cubic feet per second]

Stream name	October					November				
	Q.90	Q.80	Q.50	Q.20	QM	Q.90	Q.80	Q.50	Q.20	QM
ROCK CREEK AT MOUTH NEAR WISDOM	4	5	7	10	8	4	5	6	8	6
DELANO CREEK AT MOUTH NEAR WISE RIVER	0.1	0.2	0.3	0.5	0.4	0.1	0.1	0.2	0.3	0.3
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	1	2	2	3	3	1	1	2	3	2
N.F DEEP CREEK AT MOUTH NR MILLIGAN	0.8	1	2	3	2	0.7	1	1	2	2
COLLAR GULCH AT MOUTH NEAR MAIDEN	0.2	0.3	0.5	0.8	0.6	0.2	0.3	0.4	0.6	0.5
BADGER CREEK BEL FORKS NR BROWNING	19	24	33	50	37	18	21	31	43	32

Table 5.-- Estimated monthly streamflow characteristics for December and January.

[Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second; QM, mean monthly streamflow for specified month, in cubic feet per second]

Stream name	December					January				
	Q.90	Q.80	Q.50	Q.20	QM	Q.90	Q.80	Q.50	Q.20	QM
ROCK CREEK AT MOUTH NEAR WISDOM	3	4	5	6	5	3	3	5	6	5
DELANO CREEK AT MOUTH NEAR WISE RIVER	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	1	1	2	2	2	0.8	1	1	2	1
N.F DEEP CREEK AT MOUTH NR MILLIGAN	0.7	0.8	1	2	1	0.6	0.7	1	1	1
COLLAR GULCH AT MOUTH NEAR MAIDEN	0.2	0.2	0.3	0.4	0.4	0.2	0.2	0.3	0.4	0.3
BADGER CREEK BEL FORKS NR BROWNING	18	20	27	36	30	15	18	23	30	24

Table 6.-- Estimated monthly streamflow characteristics for February and March.

[Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second;
QM, mean monthly streamflow for specified month, in cubic feet per second]

Stream name	February					March				
	Q.90	Q.80	Q.50	Q.20	QM	Q.90	Q.80	Q.50	Q.20	QM
ROCK CREEK AT MOUTH NEAR WISDOM	3	4	5	6	5	3	4	6	8	7
DELANO CREEK AT MOUTH NEAR WISE RIVER	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.3	0.2
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	0.9	1	1	2	2	1	1	2	3	2
N.F DEEP CREEK AT MOUTH NR MILLIGAN	0.6	0.7	1	1	1	0.7	0.9	1	2	1
COLLAR GULCH AT MOUTH NEAR MAIDEN	0.2	0.2	0.3	0.4	0.3	0.2	0.3	0.4	0.6	0.4
BADGER CREEK BEL FORKS NR BROWNING	15	17	22	28	23	17	20	24	31	26

Table 7.-- Estimated montnly streamflow characteristics for April and May.

[Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second; QM, mean montnly streamflow for specified month, in cubic feet per second]

Stream name	April					May				
	Q.90	Q.80	Q.50	Q.20	QM	Q.90	Q.80	Q.50	Q.20	QM
ROCK CREEK AT MOUTH NEAR WISDOM	8	10	16	25	18	25	31	49	69	52
DELANO CREEK AT MOUTH NEAR WISE RIVER	0.4	0.5	1	1	1	2	2	4	5	4
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	3	3	6	9	6	9	12	18	25	19
N.F DEEP CREEK AT MOUTH NR MILLIGAN	2	3	4	7	5	9	11	16	21	17
COLLAR GULCH AT MOUTH NEAR MAIDEN	0.6	1	2	2	2	3	4	5	7	6
BADGER CREEK BEL FORKS NR BROWNING	35	46	72	110	81	250	280	370	460	370

Table 8.-- Estimated monthly streamflow characteristics for June and July.

Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second; QM, mean monthly streamflow for specified month, in cubic feet per second]

Stream name	June Q.90	June Q.80	June Q.50	June Q.20	June QM	July Q.90	July Q.80	July Q.50	July Q.20	July QM
ROCK CREEK AT MOUTH NEAR WISDOM	20	27	49	73	53	8	10	17	26	19
DELANO CREEK AT MOUTH NEAR WISE RIVER	1	2	3	4	3	0.5	0.6	0.9	1	1
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	7	9	17	25	18	3	3	6	8	6
N.F DEEP CREEK AT MOUTH NR MILLIGAN	6	8	15	21	16	2	3	5	7	5
COLLAR GULCH AT MOUTH NEAR MAIDEN	2	3	5	7	5	0.7	1	2	2	2
BADGER CREEK BEL FORKS NR BROWNING	200	250	370	540	410	54	77	120	180	130

Table 9.-- Estimated monthly streamflow characteristics for August and September.

[Q.XX, monthly mean streamflow for specified month exceeded XX percent of the years, in cubic feet per second; QM, mean monthly streamflow for specified month, in cubic feet per second]

Stream name	August					September				
	Q.90	Q.80	Q.50	Q.20	QM	Q.90	Q.80	Q.50	Q.20	QM
ROCK CREEK AT MOUTH NEAR WISDOM	5	6	9	13	10	4	5	7	10	8
DELANO CREEK AT MOUTH NEAR WISE RIVER	0.3	0.3	0.6	0.8	0.6	0.2	0.3	0.3	0.5	0.4
HALFWAY CREEK AT MOUTH NEAR WHITEHALL	2	2	3	5	4	1	2	2	4	3
N.F DEEP CREEK AT MOUTH NR MILLIGAN	2	2	3	4	3	1	1	2	3	2
COLLAR GULCH AT MOUTH NEAR MAIDEN	0.5	0.6	1	1	1	0.3	0.4	0.6	1	0.7
BADGER CREEK BEL FORKS NR BROWNING	31	36	48	64	49	24	27	33	42	36

PREFILED TESTIMONY OF
FREDERICK A. NELSON
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS (MDFWP)

Q. Please state your name and business address.

A. Fred Nelson, MDFWP, 1400 South 19th Ave., Bozeman, MT 59715

Q. What is your present employment?

A. I am a fisheries biologist employed by the Montana Department of Fish, Wildlife and Parks.

Q. Please state your educational background and experience.

A. I am a 1968 graduate of Cornell University, Ithaca, NY, with a B.S. degree in Fishery Science. I received a M.S. degree in Fish and Wildlife Management at Montana State University in 1976. I've been employed by the MDFWP since 1976.

Q. Briefly describe your instream flow-related training.

A. My instream flow-related training began in 1978 when I attended a week-long instream flow methods workshop, conducted by the U.S. Fish and Wildlife Service, in California. Since then, I've attended a number of other workshops and training sessions. These are listed in my vita, which is included with this prefiled testimony.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to: (1) briefly describe my role in the instream flow-related work that culminated with the MDFWP's reservation application, (2) provide information on the methods that are available for deriving instream flow recommendations, with special emphasis on the Wetted Perimeter Inflection Point Method (WPIPM), the primary method used in MDFWP's application, and (3) briefly describe the fishery values of the 175 stream reaches upstream from Canyon Ferry Dam where MDFWP has made instream flow requests.

For clarity, each of the above three elements of my testimony will be addressed under the following headings:

MY ROLE IN MDFWP'S INSTREAM FLOW RESERVATION PROGRAM

THE WETTED PERIMETER INFLECTION POINT METHOD AND OTHER INSTREAM FLOW METHODS

STREAM FISHERY VALUES UPSTREAM FROM CANYON FERRY DAM

MY ROLE IN MDFWP'S INSTREAM FLOW RESERVATION PROGRAM

Q. Briefly describe your role in the reservation process.

A. Since 1976, when I began work with MDFWP, my duties have focused on instream flow and other water-related issues. In regard to this reservation application, my main contributions are summarized as follows:

1) Based on my research and information provided by other professionals, the MDFWP adopted the WPIPM as the primary instream flow method in its instream flow program. This method, which originated in Idaho and Washington in the early 1970's, was, under my auspices, slightly modified from its original form for use in Montana.

2) I oversaw the development of MDFWP's wetted perimeter (WETP) predictive computer program, an integral part of the WPIPM. This program and later updates incorporated state-of-the-art simulation procedures that were developed by the Cooperative Instream Flow Service Group of the U.S. Fish and Wildlife Service, Fort Collins, Colorado.

3) In 1980, I researched and wrote the MDFWP's guidelines for applying the WPIPM and using the WETP program. I wrote guideline updates in 1984 and 1989. The 1989 revision is attached as Exhibit 1.

4) All WETP data that were collected by MDFWP personnel were sent to me for review. I checked each data set to ensure that program assumptions were met and no errors were present. Unacceptable data sets were returned to the investigators for correction. If corrections were not possible, the data sets were eliminated. Acceptable data were run through the WETP program, which is located at Montana State University and, in a mini-version, at MDFWP's regional office in Bozeman. The end product was then returned to the investigators, who determined the instream flow recommendations.

5) I conducted, often in conjunction with the USGS, Helena, workshops to train MDFWP personnel in the use of the WPIPM. Training included: theory, surveying and other field techniques, selection of study sites, data coding, and flow-measuring procedures.

6) I assisted, when called upon, other MDFWP biologists and team leaders who were conducting instream flow studies. I assisted with the selection of study sites, the

establishment of stream cross-sections, field data collection and data coding, and aided with problem solving.

7) I was responsible for preparing the MDFWP's reservation application for the Missouri Basin upstream from Canyon Ferry Dam (Volume 2 of the application). I coordinated MDFWP's efforts in identifying those streams of the upper basin having the highest fishery values. I coordinated and administered instream flow studies that determined the instream flow needs for many of the 175 high quality stream reaches ultimately selected for reservation applications. I personally led the team of workers that established study sites and collected WETP field data on 25 stream reaches, and I participated in the electrofishing (the method used to sample stream fish populations) of about 35 reaches.

Information I presented in Volume 2 for the 175 stream reaches (these reaches are located on maps in Appendix A of my testimony) was primarily extracted from published instream flow reports written by other MDFWP biologists. Other sources included annual federal aid completion reports prepared by MDFWP, progress reports and raw data in MDFWP files, and personal communications with MDFWP's field biologists. A portion also reflects studies that I personally conducted or directly supervised.

8) I wrote, along with Steve Leathe, MDFWP, Great Falls, the publication titled "A Literature Evaluation of Montana's Wetted Perimeter Inflection Point Method For Deriving Instream Flow Recommendations." This publication provides an up-to-date synopsis of the history of the WPIPM, examines its theoretical and experimental basis, identifies its strengths and weaknesses as compared to other available methods, and provides justification for its use in Montana. (See Exhibit 2.)

Q. What portions of MDFWP's reservation application were your direct responsibility?

A. I was responsible for preparing the following:

<u>Volume 1</u>

Page 1-6 last two paragraphs through page 1-8 first full paragraph.
Page 1-9 through end of paragraph top of page 1-10
Page 1-11 through page 1-31b except for water availability section on page 1-29.
Page 1-37 third paragraph through page 1-38, second paragraph.

Volume 2

Pages 2-1 through 2-620.

THE WETTED PERIMETER INFLECTION POINT METHOD AND OTHER INSTREAM FLOW METHODS

Q. What is the purpose of instream flows?

A. An adequate flow of water (an instream flow) is needed to sustain those stream fishes that provide for a sport fishery.

Q. How are instream flows determined?

A. The required instream flows are determined using instream flow methods. There are many different instream flow methods described in the literature.

Q. What methods are available for deriving instream flows in Montana?

A. By far, the best and most accurate means for deriving instream flow recommendations to protect fishery values in a selected waterway is to directly observe the response of the fish population to flow variations over a period of many years. The end product of this evaluation is the derivation of the actual relationship between fish abundance and flows. This relationship is the basis for deriving the instream recommendations. This empirical approach involves a long-term commitment of time, money and manpower, probably for 10 or more years. Other factors that can influence fish populations over time must also be accounted for in this long-term evaluation. Because of the intensive data requirements and long-term commitment, this approach is impractical and rarely used, forcing resource managers to rely on an array of less time-consuming and more practical alternatives when deriving flow recommendations. These alternatives, or shortcuts, are divided into three general groups of instream flow methods termed (1) non-field, (2) habitat retention, and (3) incremental.

Recommendations derived from <u>non-field methods</u> (Group #1) are typically based on a flow quantity derived from the historic flow record. These methods are usually performed in the office using existing flow information. Non-field methods are generally weak in establishing a biological basis for the recommended flows, and are normally confined to deriving preliminary or reconnaissance grade recommendations, thus limiting their suitability for use in Montana's water reservation program.

Habitat retention methods (Group #2) examine various components of a stream's hydraulic characteristics at various flows for the purpose of developing generalized habitat-flow relationships. The recommendation is not based on detailed evaluations of the habitat requirements of specific fish species or life stages. The simplified prediction techniques that this group uses in evaluating the condition of the stream environment reduces field data requirements to the point where dollar costs, manpower needs and time consumption are reasonable. The outcome of the analysis is a minimum flow recommendation that is intended to fully protect some aspect of the stream resource. These methods are most appropriate when instream protection is requested for a large number of streams, as occurs in state water reservation programs.

Incremental methods (Group #3) produce habitat-flow relationships for specific life stages of various fish species. These methods attempt to predict the actual amount of suitable fish habitat that is present as flow changes incrementally. Incremental methods are typically applied where planned water developments, such as dams, will drastically alter existing flows. The habitat-flow relationships generated by these methods are analyzed in combination with the site's historic flow records and predicted post-project flows to determine the magnitude of the habitat changes that will occur when the project is completed. This analysis is conducted for each fish species and life stage of importance. Through negotiation, flow releases are established based on the willingness of each party to absorb some acceptable level of loss -- the resource manager loses fish habitat and the dam operator loses revenue by having to release water to satisfy fishery needs. Consequently, these methods provide a means for measuring trade-offs as opposed to providing minimum flow recommendations. This is a costly, complex and time-consuming analysis that has limited application to the water reservation process.

Q. What instream flow methods are used by MDFWP?

A. The MDFWP employs a number of instream flow methods, depending on the needs of a particular situation. The nature of the water reservation process relegated the non-field and incremental groups of methods to a secondary role in deriving flow recommendations. Habitat retention methods (Group #2) were most suited to the process. The habitat retention method selected by the MDFWP was the wetted perimeter inflection point method (WPIPM). This method was judged most suited for use on Montana's waters.

Q. Did MDFWP originate the WPIPM?

A. No. The WPIPM has existed since the early-1970s. The MDFWP simply adopted this existing method, in a slightly modified form, for use in its instream flow program.

Q. Are other states and provinces using the WPIPM?

A. The WPIPM is widely accepted, particularly in the West. Most states and provinces having protective instream flow legislation employ a variety of instream flow methods, depending on the needs of a particular situation. Agencies in Colorado, Washington, Minnesota, Wyoming, Idaho and British Columbia presently use variations of the WPIPM in their instream flow programs.

Q. Does the WPIPM have a link with other habitat retention methods?

A. Wetted perimeter criteria are a component of many other habitat retention methods currently in use. Wetted perimeter analyses are not solely restricted to the WPIPM.

Q. What is wetted perimeter and what is an inflection point?

A. Wetted perimeter is the distance (in feet) along the bottom and sides of a channel cross-section that is in contact with water when the stream is viewed in cross-section (see Appendix B). As the flow in a stream channel increases, the wetted perimeter also increases, but the rate of gain of wetted perimeter is not constant throughout the entire range of flows. Starting at zero flow, wetted perimeter increases rapidly for small increases in flow up to the point where the stream channel nears its maximum width. Beyond this break or inflection point, the increase of wetted perimeter is less rapid as flow increases. Appendix C depicts the relationship between wetted perimeter and flow, showing an inflection point.

The wetted perimeter-flow relationship thus provides a measure of the amount of stream bottom that is covered by water at various flows.

Q. On what area of a stream is the WPIPM applied?

A. The relationship between wetted perimeter and flow is derived for stream riffles. A riffle is a section of stream in which the water flow is rapid and shallower than the sections above and below. Streams usually consist of a succession of pools and riffles.

Q. Why does the WPIPM focus on riffles?

A. Aquatic insects, such as caddis flies, stone flies and mayflies, and other aquatic invertebrates are the primary food of Montana's stream-dwelling gamefish. It is widely accepted that the production of these aquatic food items is greatest in riffles of streams. Thus, riffles are the primary fish food-producing area in streams.

Q. How is food production related to streamflows?

A. Aquatic invertebrates, the major food items in Montana's streams, inhabit the small spaces within the stream bottom. Flowing water supplies the oxygen that is needed to sustain these gill-breathing life forms. Without a cover of water, the bottom substrate becomes uninhabitable. The amount of riffle habitat covered with water will increase with flow, causing the food-producing potential to also increase. Streamflow controls the amount of riffle area that is wetted and, thus, controls the amount of habitat that is available for producing food.

Q. What is the connection between the wetted perimeter-flow relationship for riffles and food production?

A. The relationship between wetted perimeter and flow for stream riffles generally, but not always, shows two inflection points where the rate of increase of wetted perimeter changes. In the example (Appendix D), these inflection points occur at approximate flows of 8 and 12 cfs. Below the lower inflection point (8 cfs), the flow is spreading out horizontally across the stream bottom, causing the wetted perimeter to increase rapidly for very small increases in flow. A point is eventually reached (at the lower inflection point) where the water starts to move up the sides of the active channel and the rate of increase of wetted perimeter begins to decline. At the upper inflection point (12 cfs), the stream is approaching its maximum width and begins to move up the banks as flow increases. Large increases in flow beyond the upper inflection point cause only small increases in wetted perimeter.

The area available for food production is, in my judgement, near optimal at the upper inflection point because almost all of the available riffle, or food-producing, area is covered with water. At flows below the upper inflection point, the stream begins to pull away from the riffle bottom until, at the lower inflection point, the rate of loss of wetted bottom begins to rapidly accelerate. Once flows are reduced below the lower inflection point, the riffle bottom is being exposed at an even greater rate and the area available for food production greatly diminishes. The method is intended to establish a threshold below which a stream's food-producing capacity begins to decline (upper inflection point) and a threshold at which the loss is judged unacceptable (lower inflection point).

Q. Does the MDFWP have photographs that depict the change in wetted perimeter as flow decreases?

A. Yes. An example is shown in Exhibit 3. This site is the lower Big Hole River at High Road Bridge near Twin Bridges. The site is shown at flows of 1,450, 543, 55 and less than 10 cfs.

Q. What happens to the wetted perimeter at the various flows?

A. At 1,450 cfs, the river bottom is completely covered with water and, consequently, wetted perimeter is optimized. At 543 cfs, the water is beginning to pull away from the bottom, as indicated by the small area of exposed gravel at the river's edge. Wetted perimeter is beginning to decline. At 55 cfs, a vast area of the bottom is exposed and the flow is now confined to a narrow strip in the center of the channel. Wetted perimeter has been reduced to a low level. At less than 10 cfs, the flow is a mere trickle that barely covers a narrow band in the channel's center. Wetted perimeter is now approaching zero - the point at which the channel is completely dry.

Q. For this Big Hole site, at what flow does the upper inflection point occur?

A. For this Big Hole site, the upper inflection point occurs at about 650 cfs. Six hundred and fifty cfs is the point at which the river bottom becomes completely covered by water, causing the wetted perimeter to be near its maximum. Above 650 cfs, large increases in flow lead to only small increases in wetted perimeter.

Q. How is the recommended flow selected from the wetted perimeter-flow relationship?

A. The WPIPM provides a range of flows (between the lower and upper inflection points) from which a single instream flow recommendation is selected. Flows below the lower inflection point are judged undesirable based on their probable impacts on food production, while flows at or above the upper inflection point are considered to maximize the food-producing area.

The final flow recommendation is generally selected from the range of flows between the two inflection points by a consensus of the biologists who collected and analyzed all relevant field data for the stream of interest. The biologists' rating of the stream resource forms the basis for the flow selection process. Factors considered in the evaluation include: (1) the level of recreational use, (2) the existing level of environmental degradation, (3) water availability, and (4) the magnitude and composition of existing fish populations. Fish population information, which is essential for all streams, is a major consideration. A marginal or poor fishery would likely justify a flow recommendation at or near the lower inflection point unless other considerations, such as the presence of "Species of Special Concern" (Arctic grayling and cutthroat trout, for example) warrant a higher flow. In general, streams with significant resident fish populations, those providing crucial spawning and/or rearing habitats for migratory populations, and those supporting significant populations of "Species of Special Concern" were given consideration for flow recommendations at or near the upper inflection point.

Other candidates for upper inflection point recommendations are streams that have the capacity to provide outstanding fisheries, but are prevented from reaching their potential due to stream dewatering. The flow at the upper inflection point would provide a goal to strive for should the means become available to improve streamflows through such mechanisms as water storage projects, water conservation, or the lease of irrigation water for instream uses. Streams that are subjected to other forms of environmental degradation, such as mining pollution, and that have the potential to support significant fisheries if reclaimed, are additional candidates for upper inflection point recommendations.

Q. What are the field data requirements for the WPIPM and how are wetted perimeter-flow relationships derived?

A. The wetted perimeter-flow relationship for a stream of interest is derived using a wetted perimeter predictive (WETP) computer program developed in 1980 for the MDFWP.

Two pieces of information -- the cross-sectional profile and stage-discharge rating curve -- are required for each riffle cross-section as input to the WETP program. These data are obtained in the field using standard surveying procedures.

The stage-discharge rating curve describes the relationship between the height of the water surface (the stage) in the riffle cross-section and the magnitude of the flow (discharge) through the cross-section. This rating curve, when coupled with the cross-sectional profile, is all that is needed to compute the riffle wetted perimeter at most flows of interest.

The WETP program requires at least two sets of stage measurements taken at different known flows to develop the stage-discharge rating curve. However, the use of three sets of stage-discharge data collected at a high, intermediate and low flow is recommended. The three measurements are made when runoff is receding (high flow), near the end of runoff (intermediate flow) and during late summer-early fall (low flow).

The channel profile also has to be measured for each cross-section. Unlike the measurement of water surface elevations, this has to be done only once.

The WPIPM is applied solely to riffles. Cross-sections can be established in a single riffle or in a number of different riffles. Cross-sections should describe the typical riffle habitat within the stream segment being studied. For each riffle, no more than three cross-sections placed at the riffle's head, middle and bottom are needed. Fewer can be used if the riffle is fairly uniform. Typically, cross-sections were placed in more than one riffle in each reach. Three to five cross-sections were generally used to model the riffle habitat in each reach. For example, if the biologist-in-charge judged that three different riffles represented the typical riffle habitat within the reach being studied and also judged that riffle one could be adequately modelled using three cross-sections and riffles two and three could be modeled using one cross-section each, then a total of five riffle cross-sections would be available for the analysis.

When deriving the wetted perimeter-flow relationship for each reach, the computed wetted perimeters for all riffle cross-sections at each flow of interest are averaged. The flow request is derived from the wetted perimeter-flow relationship for the composite of all riffle cross-sections. For the above example, the composite would represent the average for five riffle cross-sections.

Q. Who collected the field data for MDFWP's reservation application?

A. Field data were collected by a team of MDFWP personnel, usually consisting of a team leader - typically a biologist - and two or more field workers. Approximately twelve teams collected the wetted perimeter data presented in MDFWP's application. Team leaders and some field workers were trained in the use of the WPIPM in special workshops conducted by the MDFWP, often in conjunction with the USGS. Duties of the team leaders mainly included the selection of study sites, the establishment of cross-sections, the operation of surveying gear, the recording of elevations in field survey books, the coding of data, the derivation of instream flow recommendations, and the preparation of instream flow write-ups.

Q. What role do assumptions play in the WPIPM?

A. Because there are wide gaps in our knowledge of how fish respond to environmental changes, fishery scientists must rely on broad, general assumptions when discussing how stream fish populations are regulated. These assumptions may not fully describe the means of regulation for a given stream of interest or apply to all streams in a particular region, and many have not been tested in definitive scientific studies. Despite these shortcomings, the assumptions are logical and defensible, but not immune to criticism. These biological assumptions are an essential part of all instream flow methods, including the WPIPM. Reliance on assumptions is the price to be paid for using alternatives (instream flow methods), rather than long-term biological studies, to derive instream flow recommendations for individual waterways.

Q. What are the major biological assumptions associated with the WPIPM and are they reasonable?

A. The five major assumptions associated with the WPIPM, along with a discussion of their reasonableness, follow:

Assumption 1. Food supply is a major factor influencing the abundance of gamefish in Montana's streams.

The reduction in physical habitat during late fall and winter when natural streamflows are at their annual lows is generally considered to be the primary factor that ultimately limits fish populations in Montana's unregulated (without dams or irrigation diversions) coldwater streams. However, food supply is considered the key regulator during the warmer months when higher water temperatures initiate fish growth and young fish are hatched and enter the population. The population increases over summer in both numbers and biomass, typically reaching its highest level in fall. The fact that fish populations in Montana's streams tend to increase over summer suggests that the amount of physical habitat needed for population expansion is in excess at this time when compared to winter. Vacant habitat would have to be available in order for this expansion to occur. This is consistent with the fact that streamflow in Montana's unregulated streams is typically highest in spring-summer, thus producing an abundance of physical habitat for fish. Food supply rather than habitat is considered to limit the magnitude of this summer population expansion. A number of studies support the importance of food supply as the key population regulator during the warmer months.

Assumption 2. The primary food of the gamefish inhabiting Montana's streams is aquatic invertebrates.

This assumption is well documented in the literature.

Assumption 3. Aquatic invertebrates are primarily produced in riffles of streams.

This is a widely accepted assumption that is well documented in the literature.

Assumption 4. Gamefish abundance is related to food production, which in turn is related to the wetted perimeter in riffles.

This assumption is alluded to in the literature, although no single study has directly investigated this series of relationships. A number of studies support the contention that food supply is often the key regulator of fish abundance in Western streams during the warmer months. Consequently, the first relationship within assumption #4 appears valid.

As discussed earlier, the amount of riffle habitat covered with water will increase with flow, causing the food-producing potential to also increase. The few studies that have examined this relationship between food production and riffle wetted perimeter show inconclusive results. However, such a relationship, although not documented in a definitive scientific study, appears both logical and defensible.

Assumption 5. Food-producing capacity is at or near the optimum at the upper inflection point on the wetted perimeter-flow relationship for riffles.

The area available for food production is considered near optimal at the upper inflection point because almost all of the available riffle, or food-producing, area is wetted. This is a logical assumption, although it has not been thoroughly tested in a definitive scientific study.

Q. What are some criticisms of the WPIPM and how do you respond to those criticisms?

A. 1. As discussed previously, the relationship between riffle wetted perimeter and food production is not well documented in the literature. The few studies that have tested this relationship show inconclusive results. While such a relationship appears logical, it has not been validated in a definitive, scientific study.

2. The WPIPM does not quantify the relationship between fish abundance and flows. However, all instream flow methods share this limitation. Instream flow methods should be viewed as shortcuts to obtaining instream flow recommendations. To accomplish their purpose, they must incorporate broad, general assumptions that greatly simplify the complex interaction of biological and environmental factors that regulate fish abundance in

nature. In essence, an incomplete and relatively simple population model (an instream flow method) is being applied to a biological system of great complexity. With the WPIPM, the focus is on food production, one of many variables that can influence fish abundance. Based on information reported in the literature, the targeting of food production is a reasonable approach for Montana's streams where the role of food supply appears paramount as a population regulator during the warmer months when fish grow and populations expand. Maximizing a stream's food producing area is expected to enhance the food supply and, in turn, benefit fish. However, the quantitative effects of flow variations on food production and, in turn, on fish abundance are not predicted by the WPIPM. The WPIPM merely provides an estimate of the flow (the upper inflection point flow) that will maximize the food-producing area. The wetted perimeter and flow relationship generated for each study stream by the WPIPM should not be construed as mimicking the relationships between food production and flows, or fish abundance and flows. The derivations of these relationships are not achievable with the current body of instream flow methods, but rather are the product of stream-specific, long-term biological studies.

3. The WPIPM looks only at riffles, ignoring pools and runs which also are important habitats for fish. By targeting only riffles, flow recommendations may shortchange other essential habitats, causing some species and life stages to suffer. This concern, however, may be unwarranted due to the fact that riffles are the area of a stream that is most sensitive to flow reductions. Pools and runs tend to be less affected. A recommendation that wets a large portion of the riffles will, at the same time, maintain the integrity of runs and pools, thus protecting these important habitats as well.

4. A common criticism of the WPIPM is that inflection points are sometimes poorly defined and difficult to identify. In Montana, the WPIPM has been primarily applied to fairly high gradient mountain streams that contain well-defined riffles having rectangular cross-sectional profiles. Due to this riffle configuration, inflection points, particularly upper ones, are readily discernible for the majority of streams. However, exceptions do occur and require some level of professional judgment in identifying inflection points. Professional judgment plays a role in other aspects of the WPIPM as well, and its role can vary by stream. Professional judgment, however, is not confined to just the WPIPM, but is a component of all instream flow methods. While some level of professional judgment may be required to select

inflection points with the WPIPM, other methods may rely on its use to define the habitat criteria that must be met by the recommendations. The involvement of professional judgment is one of the sacrifices that must be made for the convenience of using instream flow methods in place of long-term biological studies to derive instream recommendations.

5. The WPIPM is often criticized for generating a single, minimum flow recommendation that does not reflect the year-round flow needs of all fish species and life stages. Fish inhabiting Montana's streams do not live under stable, year-round flow regimes. To survive, fish must adapt to wide-ranging flows that can vary greatly by season and by year. Individual fish species and life stages are often affected differently by the naturally varying flows. Lower flows tend to be more beneficial to the younger life stages and smaller fish, while higher flows tend to favor the older life stages and larger fish. These relationships allow the total numbers of fish in some chronically dewatered streams to remain relatively high; however, the population will be dominated by small fish. The flow needs for other life functions, such as spawning and egg incubation, can also differ among species. The argument is made that recommendations must be species- and life stage-specific to have biological relevance. This philosophy leads to a complex array of recommendations that can vary by season and by year.

An opposing philosophy views the recommendations within the context of the prevailing instream flow laws, which in this case is Montana's water reservation process. Under the reservation process, the unappropriated waters in a basin are allocated among all competing uses, including municipal, agricultural and industrial as well as instream for the protection of fish, wildlife, and water quality. When granted, the instream reservation becomes a part of the priority date system, with some future uses subject to, or junior to, the instream reservation. When streamflows fall below the granted instream flow reservations, junior consumptive users will have to comply with the terms of the reservation and cease withdrawing water until flows again recover. Given this requirement, complex flow recommendations that vary by time period and by year are generally unsuitable because they confuse junior water users and exacerbate problems with compliance and policing. The problem is aggravated further by the large number of instream reservations, potentially in the hundreds, that must be monitored within a basin. A single, year-round recommendation tends to minimize these problems, but such a recommendation may fail to fully satisfy the instream flow needs of all fish species and all of their life stages and functions. However, keeping the recommendations simple appears, in the long run, to be in the best interest of the resource because compliance and policing problems are minimized.

The WPIPM assumes that a flow level intended to maximize a stream's food-producing area will benefit all fish species and life stages that feed on aquatic invertebrates. Although this approach does not focus on a particular gamefish species or life stage, adult trout are the main target. Focusing on adults appears to be the best strategy because this is the life stage that is most important to the sport fishery.

Q. Is the WPIPM applicable to all Montana streams?

A. The WPIPM is not applicable to all streams. The WPIPM is designed for use on streams in which the flow is confined to a single channel. When flow is distributed among many channels, cross-sections through these braided reaches are difficult to model hydraulically, making most computer models, including WETP, unworkable in this situation. Waters having little or no riffle development, such as cascading mountain streams that plunge from pool to pool and some low gradient, prairie streams, are another exception, as are spring creeks. The stable, year-round flows that characterize spring creeks prevent the collection of field data at a high, medium and low flow, which is information needed to calibrate the WETP computer program. Other methods must be applied to these streams.

Q. For what period of the year do the recommendations of the WPIPM apply?

A. The WPIPM is intended to quantify the instream flow needs during the non-winter period from approximately April through October. This is the period when fish grow and feed intensively. Availability of an adequate food supply during the non-winter period is essential to the health and well-being of the fish community. In winter, fish tend to confine their activities to limited areas, are less active and feed less, causing food availability to typically assume a secondary role as a population regulator.

Q. How does the MDFWP derive instream flow recommendations for the winter period?

A. The policy of the MDFWP when deriving flow recommendations for winter is to fully protect winter flows. The justification for this policy is primarily based on the fact that winter is the period most detrimental to fish survival in streams that are subjected to icing and other severe weather conditions. For these streams, the harsh winter environment ultimately limits the numbers and pounds of gamefish that can be maintained indefinitely by the aquatic habitat. Winter flow depletions would only serve to aggravate an already stressful situation, leading to even greater winter losses and the possible devastation of the fish community.

The fact that the flows in Montana's unregulated streams are generally lowest in the winter further justifies the policy of fully protecting winter flows. The widely held assumption that more water provides space for more fish has led to the conclusion that the period of lowest streamflows is most limiting to fish. The coupling of the low flow period with harsh winter weather conditions increases the severity of the stream environment in winter.

Q. How do winter flow depletions affect food production?

A. In winter, the primary concern in regard to food production is to maintain enough wetted habitat to overwinter the immature stages of the aquatic invertebrates that serve as the primary food of stream trout. Sufficient food must be available to allow the trout to recover from the rigors of winter and begin to grow when the water warms and fish metabolism increases. Trout survival will be affected if the spring rise in water temperature is not accompanied by an increase in food.

A less important function of the food-producing area in winter is to supply food for wintering trout. While the scarcity or unavailability of food is only considered a secondary cause of winter mortality, it can be important during those winters in which the physical condition of the environment is so degraded by ice as to be barely tolerable to trout.

The naturally occurring low flows of winter reduce the amount of riffle habitat (the food-producing area) to its lowest level of the year in unregulated streams. Due to the wide, shallow configuration of riffles, flow reductions affect this habitat type much more severely than the deeper pools and runs. Winter flow levels alone, particularly during below normal water years, can affect the food supply through its influence on the amount of riffle habitat that is available to overwinter the bottom organisms. Ice action can further deplete the food organisms by subjecting riffle sections to sudden scouring and partial drying and freezing during the anchor ice cycles. The combination of harsh weather conditions and the naturally occurring low flows can severely reduce the food supply in some years, potentially affecting trout survival during the winter and in subsequent months as well. Winter flow depletions have the potential to reduce the food supply even further.

Q. Will the recommendations of the WPIPM protect winter flows?

A. As discussed earlier, the protection of natural flows during the critical winter months is justified if the goal is to maintain fish populations at their existing levels. As a guideline, the winter recommendation should not be less than the base flow, which is defined as the lowest mean monthly flow during the winter months. Past work by the MDFWP has shown that the upper inflection point recommendations of the WPIPM typically exceed base flows. Winter flows would, therefore, be protected if upper inflection point recommendations were extended through the winter period. This is a common practice of the MDFWP when recommending flows and was applied in the Missouri Basin reservation application. Lower inflection point recommendations are normally inadequate for protecting winter base flows.

Q. Do the recommendations of the WPIPM exceed the available streamflows?

A. There will be time periods, especially in winter and during drought events, when the requested flows based on the WPIPM exceed the available flows. On streams where appropriations by consumptive water users have caused the existing flows to be far less than the virgin condition, recommendations of the WPIPM will often exceed the existing water availability during the summer irrigation season when major depletions occur.

The concept of the flow recommendations being available at all times is incompatible with the wide seasonal and annual flow variations that characterize Montana's streams. If streamflows were stable from season-to-season, exhibited no year-to-year variations, and were undepleted by consumptive water users, the available water supply would exceed the requested flows based on the WPIPM. Because streamflow is seasonally variable and subject to depletion, the single, year-round recommendations of the WPIPM will periodically exceed the available supply. Only when the requested flows equal the historic low flows would they never exceed the available streamflows. However, such flows would devastate a stream fishery if maintained for any length of time and are analogous to asking a farmer to produce his crops using only the amount of water available during the worst drought year on record.

The fact that the requested instream flows periodically exceed the available water supply should not be viewed as unreasonable. In many respects, the requests are comparable to a late, or junior, consumptive water right on a stream having many senior appropriators. Because of the late priority date, this junior right holder infrequently receives the full amount of his right. When water in excess of the needs of the senior users is available, the junior right holder can use this excess up to the amount of his right. The fact that a right is held for a specified flow rate, water volume and period of use does not guarantee that the full amount will always be available during the period of need. The unavailability of a full water supply does not prevent the junior user from exercising his right nor does it invalidate his legal claim to this excess water. The same reasoning applies to an instream flow reservation, which, like a junior consumptive water right, has a granted flow rate, volume and period of use and a late priority date, one later than the senior consumptive rights on the stream. In the case of the Missouri Basin instream reservations, the instream priority date will be 1985, about 120 years after the first consumptive water uses were established in this basin. On many streams, the needs of the senior consumptive water users will severely limit the supply of water that will be available to satisfy the instream reservations. The instream reservations, once granted, simply guarantee that any excess flows up to the amount of the granted instream flows are reserved for the needs of fish.

Q. Should the flow requests of the WPIPM be viewed as the flows that must be maintained continuously in a stream in order for fish populations to prosper?

A. Flows in individual Montana streams vary greatly from season-to-season and year-to-year. Flows will periodically fall below the recommendations of the WPIPM, even under undepleted, virgin conditions. Clearly, wild fish populations have prospered under these natural variations, even though the flows are periodically less than those needed to maximize the food-producing area. How these less than optimum flows affect food supply and, in turn, fish abundance in a particular stream is unknown. Like all instream flow methods, the WPIPM is incapable of quantifying these effects. The WPIPM simply assumes that a stream's maximum food-producing potential is achieved at the upper inflection point, which is the flow level being recommended for most streams. The recommendations should not be viewed as the flows that must be maintained continuously in order for fish populations to prosper.

Q. How should the flow requests based on the WPIPM be viewed?

A. The flow requests should be viewed within the context of the water reservation process. The WPIPM provides the recommended "trigger" flow at which <u>junior</u> water users must cease their withdrawals. Under the Doctrine of Prior Appropriation, the basis of Montana's water law, the users who are senior to the instream flow reservation can continue to withdraw water without being subject to the "trigger" flows. Consequently, senior users can continue to exercise their rights and to deplete streamflows, sometimes far below the "trigger" level.

Q. Did MDFWP use other methods in its reservation application?

A. Yes. For 61 stream reaches in its application, MDFWP relied on four additional approaches for deriving flow recommendations.

Q. What are these four approaches?

A. These are termed: (1) Fixed Percentage Technique, (2) Base Flow Approach, (3) Water Quality and Flow Management Maintenance, and (4) Biological-Flow Relationships.

Q. Briefly describe these approaches and why they were used.

A. 1. Fixed Percentage Technique. For 27 highly valued stream reaches, time constraints, access limitations and other considerations prevented the use of the WPIPM. The 27 are:

Beaverhead-Red Rock Sub-basin
Browns Canyon Creek
Red Rock River (Reach #1)
Reservoir Creek
West Fork Dyce Creek

Big Hole Sub-basin
Big Lake Creek
Delano Creek
Jacobson Creek
Rock Creek
Wyman Creek

Gallatin Sub-basin
Hell Roaring Creek

Jefferson Sub-basin
Halfway Creek

Madison Sub-basin
Cougar Creek
Duck Creek
Elk River
Moore Creek
Red Canyon Creek
Trapper Creek
Watkins Creek

Ruby Sub-basin
Coal Creek

Upper Missouri Sub-basin
Deep Creek

Smith Sub-basin
North Fork Deep Creek

Musselshell Sub-basin
Collar Gulch Creek

Marias Sub-basin
Badger Creek
Birch Creek
Cut Bank Creek
North Fork Deep Creek
South Fork Deep Creek

An alternative method (termed the fixed percentage method) that incorporated the results from the WPIPM was used to derive recommendations for these waters. For this derivation, the high inflection point flows that were derived for those streams in which the WPIPM was applied, were expressed as percentages of the average annual flow for each stream. Percentages were computed for only those tributaries in which a calculation of the average annual flow was available when this analysis was completed in November 1988. These percentages were then arrayed by sub-basin and the individual percentages in each sub-basin were averaged to derive a sub-basin mean (see table below). The mean percentages were then used to calculate flow requirements for the corresponding sub-basin tributary streams (the 27 in the previous table) in which flow requests from the WPIPM were unavailable. High inflection point flows, when averaged by sub-basin, ranged from 27-48% of the average annual flow.

Upper inflection point flows expressed as percentages of the average annual flow for selected streams in the Missouri River Basin.

Sub-basin Streams	No. Streams	Upper Inflection Point Mean Percentage (Range)[1]
Beaverhead-Red Rock River Tributaries	25	43 (16-70)
Big Hole River tributaries	21	32 (18-66)
Gallatin River tributaries (excludes East Gallatin River tributaries)	10	31 (25-39)
Jefferson River tributaries	7	36 (33-40)
Madison River tributaries	10	47 (29-61)
Ruby River tributaries	7	48 (37-54)
Upper Missouri River tributaries	7	34 (18-71)
Musselshell River tributaries	6	44 (39-58)
Smith River tributaries	9	27 (16-39)
Marias River tributaries	7	40 (24-68)

[1] Range excludes lowest and highest values to eliminate outliers which could skew the mean percentage.

2. Base Flow Approach. For some streams, often referred to as spring creeks, subsurface inflows are the major year-round water source. Subsurface inflows stabilize flow patterns from month-to-month and year-to-year, thus eliminating the extreme flow peaks that characterize those streams that rely heavily on snow-melt for their water supply. Because seasonal flows are relatively stable in spring creeks, the collection of cross-sectional field data at a high, medium and low flow, information needed to calibrate the WETP computer program and derive wetted perimeter-flow relationships, was unachievable. Another approach had to be used to derive recommendations for the 17 high quality spring creeks in this application.

Subsurface inflows not only stabilize annual flow patterns, but also moderate seasonal temperature fluctuations, causing peak temperatures in spring creeks to be cooler in summer and warmer in winter than in neighboring mountain streams. This creates temperatures more favorable for the year-round growth of trout. Warmer winter temperatures also reduce the potential for icing, thus lessening winter stress on trout. The dissolved mineral content of subsurface inflows, which is typically far greater than that of snow-melt, creates a fertile and highly productive aquatic environment. This combination of relatively stable flow and temperature regimes and high fertility gives spring creeks the potential to grow and sustain trout at levels that far exceed the biological capability of most other streams.

To protect the unique and highly valued spring creek resource, MDFWP requested that the base flow -- the lowest mean monthly flow for the year -- be reserved for the maintenance of year-round fish and wildlife habitat. Base flow typically occurs during the winter when subsurface inflows are generally lowest for the year and, thus, reflects a normal low flow event. This level of protection was deemed sufficient to maintain the outstanding fish and wildlife habitats of spring creeks.

Most of the base flow requests in MDFWP's application were derived from flow information provided by the USGS. For six spring creeks, however, base flow requests reflect flow information collected by the MDFWP. At the time flow requests were finalized for these six creeks, USGS derived base flows were unavailable.

For three spring creeks in MDFWP's application (Poindexter Slough, Willow Spring Creek and Black Sand Spring Creek), USGS flow quantifications were unavailable until the summer of 1990 and, consequently, were not included in Volume 1 of the MDFWP's application. These quantifications are shown in Appendix E of my testimony.

Two additional streams, Stickney and Wegner creeks, tributaries to the Missouri River near the town of Craig, also had their flows determined by an alternative method that is similar in concept to the base flow approach. These streams are intermittent in their lower reaches but are important in the Spring when runoff provides flows which allow rainbow trout to enter from the Missouri River to spawn. Requested flows were the mean monthly flows as determined by the USGS and were requested for only 4 months of the year.

3. Water Quality and Flow Management Maintenance. For three streams in the Madison sub-basin (Beaver and Cabin creeks and the West Fork Madison River) and four streams in the Gallatin sub-basin (East Gallatin River--Reach #1, Bridger, Rocky, and Sourdough creeks), all remaining, unappropriated water was requested to remain instream. The purpose of the request for the four Gallatin River tributaries is to protect the water quality component of fish habitat in the East Gallatin River, a stream with a history of pollution problems. For the three Madison River tributaries, the request is crucial for the continued success of the fishery-flow management plan for the Madison River. Tributaries are virtually the sole water supply to the upper Madison River when Hebgen Reservoir is filled each year and flow releases into the river are reduced. Without this crucial water source, the Madison River fishery would suffer.

4. Biological-Flow Relationships. Flow requests for the Gallatin River--Reach #2, Madison River--Reach #4, and Narrows Creek (Red Rock--Beaverhead River Sub-basin) are based on biological-flow relationships developed from data collected in past years. Flow requests for Missouri River mainstem Reaches #2 through #6 are based on biological studies, which relate goose nesting success and the seasonal biological needs of resident and migratory fishes to flows.

STREAM FISHERY VALUES UPSTREAM FROM CANYON FERRY DAM

Q. Briefly describe the fishery values that will be protected by the instream flow requests for the 175 stream reaches in Volume 2 of MDFWP's application.

A. Rather than repeat the voluminous body of information presented for the 175 stream reaches in Volume 2 of the application, I've chosen to summarize this material by lumping streams having similar characteristics and generalizing, in simple terms, on their importance as fisheries. My comments will be organized by drainage; Big Hole, Gallatin, Jefferson, Madison, Red Rock-Beaverhead, Ruby and the Missouri above Canyon Ferry Dam. If specific questions arise regarding individual waters, the reader is referred to the 620 pages of Volume 2 where each stream reach is addressed in detail.

Big Hole River Drainage

The Big Hole River is nationally recognized as one of the West's outstanding wild trout fisheries. The 56-mile "Blue Ribbon" stretch of river from Divide to the mouth (Reach #3 in the application) is one of southwest Montana's most heavily utilized river fisheries, having an estimated 22,400 angler-days of pressure in 1989 (from published angler-use data of the MDFWP). (The entire river -- Reaches 1, 2 and 3 -- supported nearly 40,000 angler-days.) The 31-mile section of Reach #3 from Divide to Glen supports robust populations of brown and rainbow trout. Below Glen, dewatering takes its toll and the trout population, now almost exclusively comprised of brown trout, declines to a low level as the river progresses to its mouth.

The canyon portion of Reach #2 is noted for its rainbow trout. Lesser numbers of brown trout, some of trophy-size, also inhabit the canyon. Upstream, trout numbers decline markedly and brook trout become more prevalent in the catch.

Reach #1 is essentially a brook trout fishery. Like the lower river, Reach #1 suffers from severe dewatering during the summer irrigation season, particularly in the vicinity of Wisdom where zero flows have recently occurred. While the fishery in Reach #1 is certainly not the caliber of that in Reach #3, the presence of a Montana fish species of "special concern" - the arctic grayling - gives it national significance.

The stream-dwelling grayling, which once thrived in the Missouri drainage above the Great Falls, is now reduced to a remnant population found in the upper Big Hole drainage. The Big Hole River near Wisdom -- a grayling stronghold -- supported, in 1989, an estimated 22 yearling and older grayling per river mile, down from over 100 per mile in 1983. Less than 1,500 grayling may remain river-wide. Many believe that the continuing decline of the presently low population warrants threatened or endangered status for the Big Hole grayling.

Along with the mainstem Big Hole River, grayling are found in 14 tributaries in MDFWP's application (Big Lake, Deep, Fishtrap, Francis, Governor, LaMarche, Miner, Mussigbrod, Pintlar, Rock, Steel, Swamp and Wyman creeks and N.F. Big Hole River). Big Lake, Governor, Rock, Steel and Swamp creeks are spawning and rearing sites for river grayling, while Deep and LaMarche creeks are probable spawning sites. Deep Creek is also an important wintering area for river grayling.

The westslope cutthroat trout, another dwindling species of "special concern" that currently occupies less than eight percent of its historic Montana range, is now restricted to headwater areas of mountain tributaries where it survives in isolated populations numbering from a few hundred to a few thousand individuals. Westslope cutthroat reside in low numbers in ten Big Hole tributaries (Camp, Delano, Jacobson, Jerry, Moose, Pattengail, Six mile, Trapper, and Wyman creeks and Wise River). Westslope cutthroat readily hybridize with rainbow and Yellowstone cutthroat trout, species introduced throughout western Montana. Only in one Big Hole tributary -- Delano Creek -- has the purity of the westslope cutthroat been verified through genetic testing. Genetically pure populations may occur in some of the other nine tributaries as well.

Except for Divide Creek, whose mainstem flows entirely through private lands, the tributaries to the lower Big Hole River below Wise River (Birch, Camp, Canyon, Jerry, Moose, Trapper and Willow Creeks) mainly pass through forested mountains within the public domain. Once reaching the valley floor, these streams flow through private ranching and grazing lands to their junctures with the Big Hole River. All of these streams provide notable fishing for pan-sized trout. Brook trout predominate in four tributaries (Birch, Camp, Divide and Trapper creeks) while rainbow and rainbow x cutthroat hybrid trout are most numerous in Canyon, Jerry, Moose and Willow creeks. A smattering of cutthroat trout and a very few brown trout are also present in some streams.

Twenty-seven of the requested reservation streams feed the middle Big Hole River between Wise River and Wisdom. Twelve of these (American, California, Corral, Deep, French, Oregon, Sevenmile, Seymour, Sixmile, Sullivan, Tenmile, and Twelvemile creeks) originate on, or flow through, the 56,138-acre Mt. Haggin Wildlife Management Area, owned by MDFWP. All 12 support high numbers of pan-sized trout. The brook trout, which is the most abundant and widely distributed species on Mt. Haggin, inhabits all 12 streams. Nine streams also contain rainbow trout, four support rainbow x cutthroat hybrids, and one (Sixmile Creek) has cutthroat trout of unknown genetic purity.

Among those 27 middle Big Hole River tributaries described in the application are the Wise River and three of its 50+ tributaries (Jacobson, Pattengail, and Wyman creeks). Virtually all of the Wise River drainage is within the confines of the Beaverhead National Forest. Here, the brook trout is the most numerous trout species. Lesser numbers of rainbow, cutthroat and rainbow x cutthroat hybrid trout intermingle with the brook trout. Jacobson Creek is the only known tributary where cutthroat trout dominate the population.

The North Fork Big Hole River and five of its tributaries (Johnson, Joseph, Mussigbrod, Ruby and Trail creeks) are other requested reservation streams feeding the middle river. Most of these waters meander through lush, willow-lined, riparian zones within steep, mountain terrain before entering the broad North Fork valley. The U.S.Forest Service is the majority land holder in the North Fork drainage, except for the North Fork itself which passes entirely through private lands. Brook trout are by far the most numerous trout species. A few of these streams also support low numbers of rainbow and rainbow x cutthroat hybrids.

The remaining five tributaries to the middle river (Bear, Bryant, Fishtrap, LaMarche and Pintlar creeks) are also locally noted for their brook trout fishing. These tributary drainages are primarily within mountain forest lands controlled by the USFS.

Privately-owned grassland-sagebrush hillsides are the major land feature along the upper Big Hole above Wisdom. Nine reservation tributaries (Big Lake, Francis, Governor, Miner, Rock, Steel, Swamp, and Warm Springs creeks and S.F. Big Hole River), all brook trout fisheries of local significance, feed the upper river.

Overall, the streams of the Big Hole drainage, including the Big Hole River, annually provide over 67,000 angler-days of recreation. Of the major drainages in southwest Montana, the Big Hole ranks third behind the Madison and Gallatin drainages in total angler use.

Gallatin River Drainage

The Gallatin River, one of Montana's "Blue Ribbon" trout waters, ranks nationally as an outstanding wild trout fishery. In 1989, fishermen accounted for over 65,000 angler-days of recreational use on the Gallatin River. A prolific rainbow trout population and lesser numbers of brown trout, noted for their occasional trophy size, inhabit Reach #1 and the canyon portion of Reach #2. Once the river leaves the narrow canyon and enters the broad Gallatin valley, irrigation diversions progressively drain the river channel, leaving little summer habitat for fish. The 15-miles of river below Cameron Bridge to the confluence of the East Gallatin are virtually ignored by anglers due to the severe dewatering.

The 12-miles of the Gallatin River below the mouth of the East Gallatin (Reach #3) are rejuvenated somewhat by the life sustaining summer flow contribution of the East Gallatin River. Here, populations of brown and rainbow trout, while never approaching the numbers in the upper river, are characterized by the presence of larger-size fish, some reaching trophy proportions.

Ten requested reservation streams (Cache, Hell Roaring, Porcupine, S.F. Spanish, Spanish, and Squaw creeks, the Taylor Fork, and the West Fork Gallatin River and its Middle and South forks) drain the high peaks of the Gallatin National Forest south of Bozeman and feed the canyon stretch of the Gallatin River. These ten are the most important stream fisheries in the Gallatin Canyon. Rainbow trout are the most abundant species in eight streams, brook trout dominate in one (S.F. Spanish Creek), while genetically impure cutthroat trout are most numerous in Cache Creek.

Downstream from the canyon mouth two tributaries (S. Cottonwood and Big Bear creeks), whose lower stretches are chronically dewatered during the irrigation season once reaching the valley floor, enter the river. In their mountain headwaters in the Gallatin National Forest, rainbow, brook and a few cutthroat trout reside. Upper S. Cottonwood Creek is one of the Gallatin's outstanding small stream fisheries.

Baker Creek is the lower-most tributary having an instream flow request. Baker Creek was originally a side-channel of the Gallatin River. A dike and headgate were constructed at the channel head nearly 100 years ago, creating what is now called Baker Creek. Because flows are regulated, Baker Creek has spring creek-like qualities. High numbers of larger-size brown trout inhabit the lower creek. During the fall spawning season, brown trout from the Gallatin River enter the creek to reproduce.

The East Gallatin River supports robust populations of rainbow and brown trout despite its proximity to the growing urban center of Bozeman. Recent upgrades in Bozeman's sewage treatment plant have greatly improved overall water quality, allowing the East Gallatin fishery to prosper once again. However, the rapid expansion of Bozeman continues to burden the river and periodic pollution problems persist. To help slow the further deterioration of water quality and thus preserve the East Gallatin's fishery, the MDFWP requested that all remaining, unappropriated flow in three headwater tributaries - Bridger, Rocky and Sourdough creeks, which are notable stream trout fisheries in their own right - remain instream to dilute the various urban pollutants that enter the river at Bozeman.

Instream flows were requested for six other East Gallatin tributaries. The East and West forks of Hyalite Creek, both within the boundaries of the Gallatin National Forest, provide crucial spawning and rearing habitats for the cutthroat and arctic grayling populations of Hyalite Reservoir, a popular lake fishery of regional importance. Among the six are three spring creeks (Ben Hart, Thompson and Reese creeks), which are highly valued for their outstanding fisheries for rainbow and brown trout. Hyalite Creek, a stream whose lower stretch has negligible fishery value due to chronic dewatering, supports an abundance of small rainbow trout in its headwaters in the Gallatin National Forest below Hyalite Reservoir.

Of the major river drainages in southwest Montana, the Gallatin drainage is second in importance, after the Madison drainage, for angling-related recreation. Anglers annually account for over 84,000 recreation-days while pursuing their sport on the Gallatin's flowing waters.

Jefferson River Drainage

The Jefferson River is plagued by many environmental problems, the most notable being the severe dewatering that occurs during most irrigation seasons throughout much of the 84 miles of river. The river's trout populations reflect this degradation. Trout densities in the Jefferson's best sections, even following a succession of "good" flow years, are, at best, about ¼ of those in the better stretches of the nearby Madison and Big Hole rivers. Rainbow trout, which inhabit the river in low numbers, comprise less than 10% of the trout population. The river's brown trout, which commonly reach weights of 1½-2 pounds, support a spring and fall sport fishery that is locally popular with residents of the Butte-Whitehall area. Use, however, is relatively low, amounting to only 15,260 angler-days in 1989.

In addition to the Jefferson River, instream flows were requested for ten Jefferson River tributaries. The largest and one of the relatively few tributaries that contribute flows to the Jefferson River during the summer irrigation season is the Boulder River. The upper Boulder (Reach #1) offers, by far, the best fishing opportunities. Here, rainbow and brook trout provide a locally important fishery in a small stream setting. Downstream in Reach #2, channel sedimentation, summer irrigation depletions, and metals pollution from the mines and old tailings surrounding Basin, take their toll. The trout population, now dominated by brown trout, plummets to a severely depressed level. Large downstream springs help to rejuvenate the lower river, allowing brown trout numbers in Reach #3 to rebound to a respectable density.

A substantial spawning run of brown trout from the Jefferson River enters Reach #3 each fall. Because the Boulder's spawning gravel is severely degraded, the capability of the river to produce young brown trout recruits for the Jefferson River fishery is limited. The fact that significant numbers of brown trout spawners annually ascend the Boulder - a stream having marginal spawning potential - is indicative of the overall poor state of other spawning sites for the Jefferson River trout population.

One tributary to the Boulder River, the Little Boulder River, has an instream flow request. The Little Boulder supports good numbers of brown, rainbow and brook trout in its lower segment and provides small stream fishing opportunities of local importance.

Two requested reservation streams, North and South Willow creeks, drain the forested slopes of the Tobacco Root Mountains and flow into Willow

Creek Reservoir, a popular lake fishery of regional significance. Both support notable fisheries for resident rainbow and brook trout. Off the forest, both provide important spawning and rearing habitats for the self-sustaining rainbow trout population of Willow Creek Reservoir. Downstream from the reservoir dam, Willow Creek, a locally renowned rainbow and brown trout fishery, flows for 11 miles through a narrow canyon and agricultural lands before discharging into the Jefferson River.

In addition to Willow Creek and the Boulder River, four other requested reservation streams directly feed the Jefferson River. The South Boulder River, a small stream draining the slopes of the Tobacco Root Mountains, supports a substantial trout population, comprised of rainbow, brook and brown trout. Whitetail Creek, which enters the Jefferson River at Whitehall, harbors exceptionally high numbers of brown trout for a small stream of its size. Hells Canyon Creek, which flows from the Highland Mountains, is one of only two known spawning sites for the highly depressed rainbow trout population of the Jefferson River. In addition to its spawning value, Hells Canyon Creek also supports fairly substantial numbers of resident rainbow trout and rainbow x cutthroat hybrids.

The Jefferson's other rainbow spawning tributary is Willow Spring Creek, a short spring-fed creek originating on the valley floor. In cooperation with the private land owner, the aquatic habitat of Willow Spring Creek was rehabilitated and young rainbow trout, raised from eggs taken from the Hells Canyon Creek spawning run, were planted in the hope that these fish would rear in Willow Spring Creek, move downstream to the Jefferson River to mature, then return to their "natal" stream in 3-5 years to spawn. In spring, 1991, the first spawners returned to Willow Spring Creek, indicating that the MDFWP's effort at developing additional spawning habitat is succeeding.

Madison River Drainage

The Madison River has long been recognized as Montana's premier wild trout river. Over 113,000 angler-days, the highest usage for the rivers in southwest Montana, are annually expended on the river. About 59% of these anglers are non-residents who vacation in bordering communities of Ennis and West Yellowstone to fish the famed Madison.

The river upstream from Hebgen Reservoir (Reach #1) is primarily noted for its fall fishing, when large brown trout leave Hebgen Reservoir for spawning sites in Yellowstone National Park. For unknown reasons, the Madison's run of brown trout spawners is accompanied by good numbers of reservoir rainbow trout, which also contribute to the highly touted fall fishery.

Downstream from Hebgen Reservoir to Ennis Reservoir (Reaches #2 and 3) the Madison provides nationally acclaimed fishing for rainbow and brown trout. This segment sustains the bulk of the fishing pressure and is most attractive to non-resident anglers. Surviving in the "channels" above Ennis Reservoir (the downstream-most portion of Reach #3) is a remnant population of arctic grayling that some consider to be a vestige of the stream-dwelling form that is currently in jeopardy basin-wide.

Below Ennis Dam (Reach #4) the river suffers in summer from thermal pollution. The thermally heated water of Ennis Reservoir is passed to the lower river, causing summer water temperatures to routinely exceed 66F, the upper limit for satisfactory catchability. Temperatures occasionally approach 83F, the lethal temperature for trout. (In 1988, lethal temperatures occurred, causing major fish kills.) Because summer water temperatures are elevated, the fishing slumps and few anglers use the river resource. Fishing on Reach #4 is thus restricted to the cooler months when few tourists visit Montana. Despite unfavorable water temperatures, trout, both rainbows and browns, endure in Reach #4, although numbers decrease markedly as the river progresses through the lower valley to its mouth.

Instream flows are requested for 24 Madison River tributaries. Eight of these (Black Sand Spring, Cougar, Duck, Grayling, Red Canyon, Trapper and Watkins creeks and S.F. Madison River) feed Hebgen Reservoir and provide crucial spawning and rearing habitats for the reservoir's brown, rainbow and cutthroat trout populations, which are now sustained entirely by fish naturally produced in the wild. Hebgen Reservoir was recently ranked as Montana's number one lake fishery for rainbow trout. These eight streams flow almost entirely within lands in the public domain.

Three requested reservation tributaries - Beaver and Cabin creeks and the W.F. Madison River - enter the upstream-most portion of Reach #2. Their prime fishery value lies with their flow contributions to the upper Madison River. When Hebgen Reservoir is filled each year and flow releases into the river are reduced, the flow of the three upper tributaries are relied upon to adequately water the upper Madison River channel and thus protect the river's fishery. For this reason, MDFWP requested that all remaining, unappropriated water in these three tributaries, all of which lie almost entirely on National Forest lands, be reserved for the maintenance of the Madison River fishery.

Other requested reservation tributaries downstream from Hebgen Dam are Antelope, Blaine Spring, Indian, Jack, Moore, North Meadow, O'Dell Spring, Ruby, Squaw and Standard creeks and the Elk River. Antelope Creek, which feeds Cliff Lake in the Beaverhead National Forest, is a crucial spawning and rearing site for the lake's self-sustaining rainbow trout and the newly introduced Bear Lake strain of cutthroat trout. Blaine Spring and O'Dell creeks are valley floor tributaries that, because of their spring creek nature, hold high numbers of brown and rainbow trout. Moore Creek, another valley floor tributary, is a potential spawning stream for the remnant grayling population of Ennis Reservoir and the Madison River "channels". The Elk River, a tributary to the West Fork Madison River, flows entirely within the Beaverhead National Forest. The Elk River provides a stream rainbow trout fishery in a wilderness setting.

The remaining six waters, which drain mountainous National Forest lands surrounding the Madison Valley, enter the Madison River on the valley floor. (North Meadow Creek discharges into Ennis Reservoir). All are excellent small stream fisheries. In four streams (Jack, Ruby, Indian, and Standard creeks), rainbow and rainbow x cutthroat hybrid trout predominate, while brown trout are most abundant in Squaw Creek and lower North Meadow Creek. The headwaters of North Meadow Creek hold an abundance of brook trout. Four of the six streams (Indian, Jack, North Meadow and Ruby creeks) are severely dewatered in their lower stretches during the summer irrigation season.

Below Ennis Reservoir in Reach #4, instream flows are requested for two tributaries (Cherry and Hot Springs creeks), both of which harbor resident populations of rainbow, brown and some brook trout. Both also support spawning runs of brown trout from the Madison River.

The flowing waters comprising the Madison drainage are southwest Montana's most heavily fished, having over 121,000 angler-days of use in 1985. Of this total pressure, visitors to Montana accounted for 68% or 82,350 angler-days.

Red Rock-Beaverhead Drainage

The Red Rock River is one of southwest Montana's lesser known sport fisheries. Only about 2,000 angler-days were expended on the river in 1989. While use is relatively light - a probable consequence of the limited public access to the river's best sections - the fishery has regional significance.

Above Lima Reservoir in Reach #1, the river supports brook and cutthroat trout. A few arctic grayling, which are probably drifters from the Red Rock Lakes, are also present. While not noted for an abundance of trout, this reach produces some larger-size fish of 3-4 pounds.

Reach #2, below Lima Reservoir, suffers from chronic dewatering, a result of dam regulation and irrigation depletions. Large springs toward the river's confluence with Clark Canyon Reservoir improve instream flows, allowing the resident brown and rainbow trout populations to attain respectable densities and reach sizes in excess of 20 inches. Of equal importance, Reach #2 provides important spawning and rearing habitats for the brown and rainbow trout of Clark Canyon Reservoir, a popular lake fishery of regional importance. The brown trout in the fall spawning run average near four pounds, while the spring-running rainbow trout average about three pounds.

Requested reservation tributaries feeding the waters of the Red Rock Lakes National Wildlife Refuge in the river's headwaters are Corral, Hell Roaring, Odell, Red Rock and Tom creeks. All contain good populations of brook trout and some cutthroat trout. Of greater importance are their contributions to the self-sustaining arctic grayling and cutthroat trout fisheries of the Red Rock Lakes. Both populations spawn in the spring in the lakes' tributaries, the most important being the above five streams.

Narrows Creek, a tiny tributary to Elk Lake in the Centennial Valley, is the sole spawning site for the lake's arctic grayling population. The creek also provides important spawning habitat for lake-dwelling cutthroat trout. Both species contribute to a popular lake fishery of regional significance.

Other requested reservation tributaries to Reach #1 of the Red Rock River are Jones, Peet, Long and E.F. Clover creeks. Jones and Peet creeks are populated exclusively with westslope cutthroat trout, a species of "special concern" in Montana. Long Creek holds good numbers of brook trout and hybridized cutthroat trout. Lower Long Creek is severely dewatered during the summer irrigation season. Above-average numbers of brook trout and lesser numbers of genetically impure cutthroat trout inhabit E.F. Clover Creek.

Fifteen requested reservation streams lie in the drainage surrounding Reach #2 and Clark Canyon Reservoir. Nine streams (Bear, Browns Canyon, Cabin, Frying Pan, Indian, Rape, Shenon, Simpson and Trapper creeks) are small, extreme headwater tributaries that support westslope cutthroat trout and flow primarily through public lands controlled by the BLM and USFS. The other six streams are locally important stream fisheries supporting few, if any, cutthroat. Big Sheep Creek, a large spring-fed stream flowing into the Red Rock River, is well known for its brown and rainbow trout, which consistently reach lengths in excess of 20 inches. Deadman Creek, a Big Sheep Creek tributary, is, considering its small size and high elevation, a productive fishery for pan-sized rainbow trout and rainbow x cutthroat hybrids. Black Canyon Creek contains excellent numbers of brook trout, while Bloody Dick and Medicine Lodge creeks, which hold both brook and rainbow trout, support some of the highest trout densities for streams in the Red Rock drainage. Horse Prairie Creek, the second largest tributary to Clark Canyon Reservoir, is populated with brown, brook and rainbow trout. While not noted for an abundance of trout, the creek's fish, particularly the brown trout, reach above-average sizes. The creek also provides spawning habitat for rainbow and brown trout from Clark Canyon Reservoir. Lower Horse Prairie Creek is severely dewatered during the summer irrigation season. In some years, total dewatering occurs.

The Beaverhead River originates at the outlet of Clark Canyon Reservoir. The "Blue Ribbon" , upper 12-miles of river support Montana's premier trophy trout fishery. Brown and rainbow trout in excess of four pounds are frequently taken by anglers. Above average numbers of smaller trout are also present. Trophy trout numbers have plummeted in recent years, a consequence of drought-related winter flow reductions at Clark Canyon Dam. However, numbers of smaller trout remain relatively high and the trophy population should eventually recover once the reservoir returns to normal operations.

Reach #2 of the Beaverhead supports lesser numbers of brown and rainbow trout and trophy fish are relatively uncommon. The fishery for 14-18 inch trout is considered good in the Dillon area and progressively worsens as the river nears its mouth. In-channel sedimentation, habitat alterations and dewatering all take their toll, causing the fishery of the lower river to suffer.

The Beaverhead River supports substantial fishing pressure, the bulk occurring on the better water above Dillon. In 1989, about 22,700 angler-days were expended on the Beaverhead, with 52% attributed to non-resident anglers.

Reservations are sought for Grasshopper and Blacktail Deer creeks, two of the larger tributaries to the Beaverhead River. Mine pollution and dewatering have severely damaged the fish community of lower Grasshopper Creek. Brown, rainbow, brook, and hybrid trout reside here in low numbers. Above Bannack, the source of the mine pollution, the creek is predominately a brook trout fishery, harboring excellent trout numbers.

Blacktail Deer Creek holds less than expected trout numbers for a stream of its size. Brook and a few rainbow trout inhabit this stream. Due to the extensive use of lower Blacktail Deer Creek for irrigation during the growing season, much of the channel is severely dewatered in late summer. The East and West forks are better fisheries than the mainstem and, overall, provide fair to good fishing for pan-sized brook trout and a few rainbows. The East Fork drainage is entirely within the public domain, mainly the 18,000-acre Blacktail Wildlife Management Area, owned by the MDFWP.

Three small tributaries in the Grasshopper Creek drainage have reservation requests. Reservoir Creek holds genetically pure westslope cutthroat trout. The East and West forks of Dyce Creek support relatively high numbers of rainbow x cutthroat hybrid and brook trout for streams of their size.

Poindexter Slough, the last of the reservation streams in the Beaverhead Drainage, is one of Montana's most productive spring creeks. The lower three miles are owned by the MDFWP and managed primarily for fishing access and waterfowl habitat. The slough's populations of brown and rainbow trout are comparable to those in Montana's better know spring creeks, all of which are in private ownership. Poindexter Slough, which supported an estimated 1,600 angler-days of pressure in 1989, provides a high quality angling experience in a spring creek setting that is freely accessible to the general public.

Ruby River Drainage

Reach #1 of the Ruby River, located upstream from Ruby Reservoir, is not noted as an exceptional fishery. Severe in-channel sedimentation, which plagues the upper river and its three forks, has undoubtedly impacted the river's capacity to sustain trout. Only below the confluence of Warm Springs Creek, can trout numbers be rated as good. Here, rainbow trout and lesser numbers of brown trout sustain a sport fishery of local importance. The populations again decrease to depressed levels as the river progresses past Warm Springs Creek to Ruby Reservoir.

Flows in Reach #2, below Ruby Reservoir, are subject to dam manipulations and severe irrigation depletions. Sedimentation is also a chronic problem. Despite these limitations, the river sport fishery, although far below its potential, is notable. Brown trout in the 10 - 14 inch class are the mainstay of the fishery. In the fall, large numbers of brown trout from the Jefferson River enter the Ruby River to spawn. The Ruby River supported over 11,000 angler-days of use in 1989, despite the severely limited public access to the river.

Instream flows were requested for nine Ruby River tributaries, which include the river's East, Middle, and West forks. The three forks, which harbor rainbow trout, rainbow x cutthroat hybrids and a smattering of cutthroats, support highly depressed trout populations, the consequence of a serious sedimentation problem which hopefully will be corrected in the future. Other requested reservation streams feeding Reach #1 are Cottonwood, Warm Springs, Coal and N.F. Greenhorn creeks. Coal and N.F. Greenhorn creeks are small headwater, mountain tributaries in the Beaverhead Forest that harbor westslope cutthroat trout, a species of "special concern" in Montana. While Warm Springs creek is, by far, the largest of the upper Ruby tributaries, its trout fishery is not noteworthy. Its importance lies with its flow contribution to the Ruby River. The warm, nutrient-laden water of the spring has a positive influence on the aquatic productivity of the river, allowing a 4-7 fold increase in the river's game fish population immediately below the spring's confluence. Cottonwood Creek is, like the three forks of the Ruby, another major tributary impacted by siltation. Its fish population, comprised of low numbers of rainbow and rainbow x cutthroat hybrid trout, reflects this degradation.

Two requested reservation tributaries, Mill and Wisconsin creeks, enter Reach #2 of the Ruby River. Both are severely dewatered in their lower segments after entering agricultural lands of the Ruby Valley. In their mountain origins on the Beaverhead National Forest, both provide noteworthy small stream fisheries for pan-sized brook trout.

Missouri River Drainage Above Canyon Ferry Dam

The thermally heated water of the lower Madison River and the summer dewatering that plagues the Jefferson and lower Gallatin rivers are passed onto Reach #1 of the Missouri River. Consequently, Reach #1 is not particularly noted for its sport fishery for resident trout. While brown and rainbow trout reside in the river yearlong, numbers are depressed, a consequence of the many environmental problems, most notably summer dewatering. Fishermen mainly target the migrant trout from Canyon Ferry Reservoir, which provide high quality fishing in the 21-mile stretch of "Blue Ribbon" water from Toston Dam to the reservoir. Brown trout spawners, some in the 6 - 10 pound trophy class, ascend the river from late August through mid-December. In the spring, reservoir rainbow trout, averaging about 17 inches and two pounds, enter the river to spawn. About 10,700 angler-days of fishing pressure were expended on Reach #1 in 1989.

The MDFWP is presently rebuilding Canyon Ferry's rainbow trout fishery, which collapsed in the 1980's, by planting wild stocks of fish. Unlike the domesticated stocks relied upon in the past, these wild fish are capable of reproducing in the wild and thus contribute to the maintenance of the reservoir's sport fishery. Present results are encouraging. Wild rainbow spawners are showing up in a number of tributaries, including the Missouri River where the magnitude of the spawning run increases each year.

Instream flows are requested for eight tributaries to Reach #1 of the Missouri River and Canyon Ferry Reservoir. All provide worthwhile fishing opportunities for resident trout. The largest, Sixteenmile Creek, is regionally recognized for its high numbers of rainbow and brown trout. The remaining seven are principally rainbow and brook trout fisheries of local importance. Rainbow and rainbow x cutthroat hybrid trout dominate four streams (Avalanche, Crow, Deep, and Dry Creeks) while brook trout are most numerous in Beaver, Confederate and Duck creeks. Once leaving the mountains of the National Forest and entering agricultural lands, all seven are severely dewatered in summer.

Five streams (Beaver, Confederate, Deep, Dry and Duck creeks) also support, in addition to resident fish populations, spring spawning runs of rainbow trout from Canyon Ferry Reservoir.

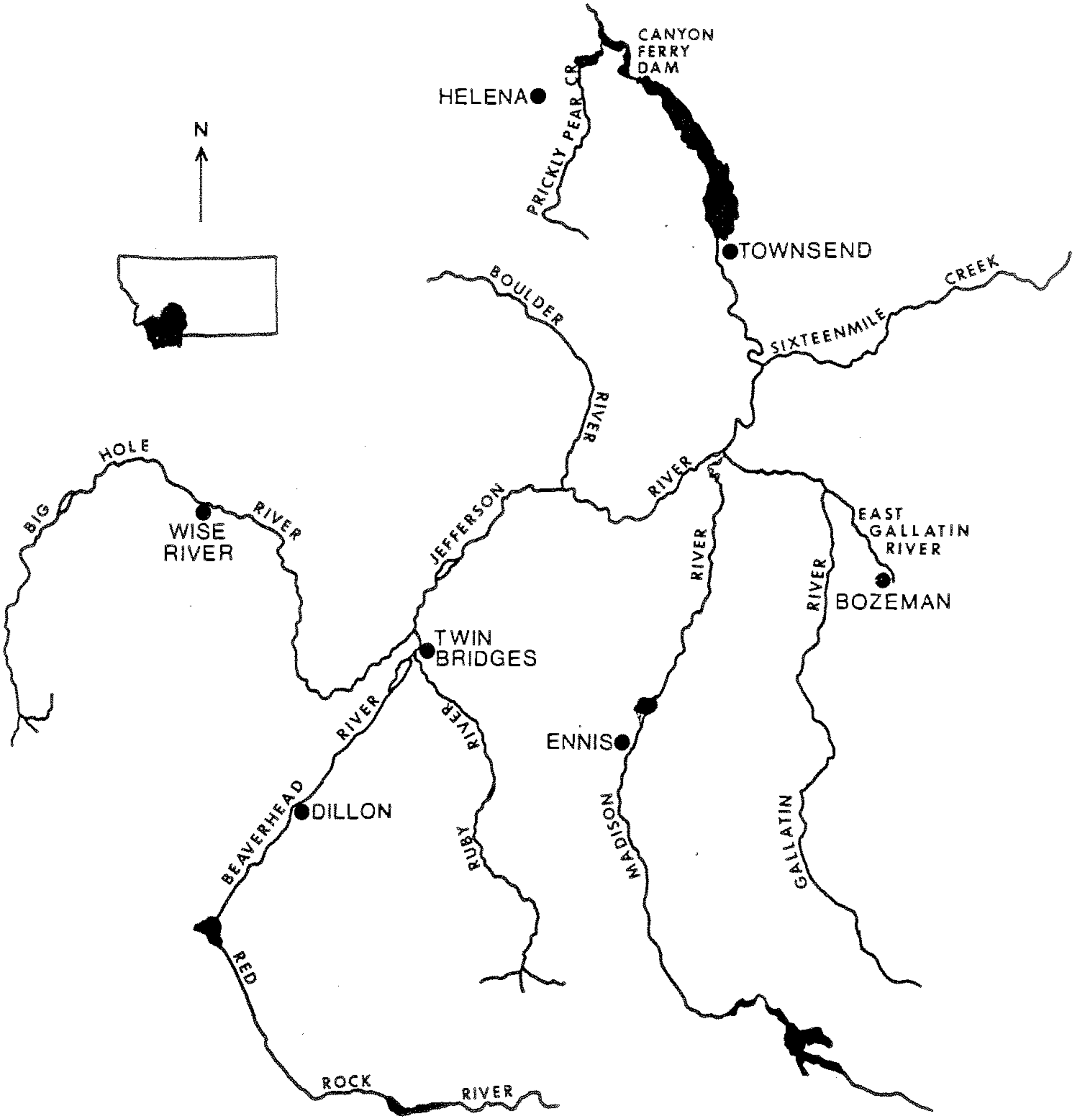
Frederick A. Nelson, being duly sworn, states that the foregoing testimony is true.

Dated this 30th day of October, 1991.

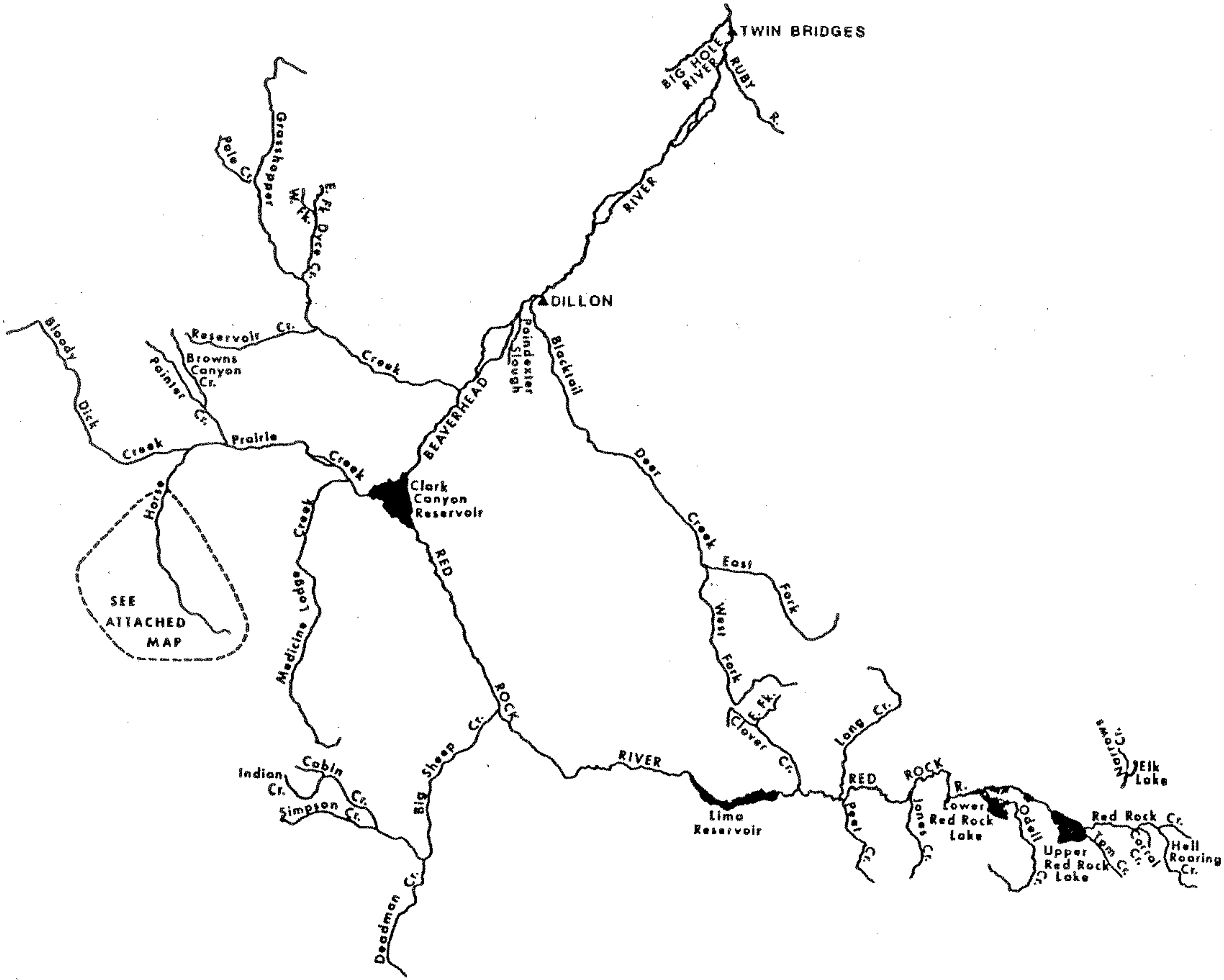
Frederick A. Nelson

Subscribed and sworn to before me this 30th day of October, 1991.

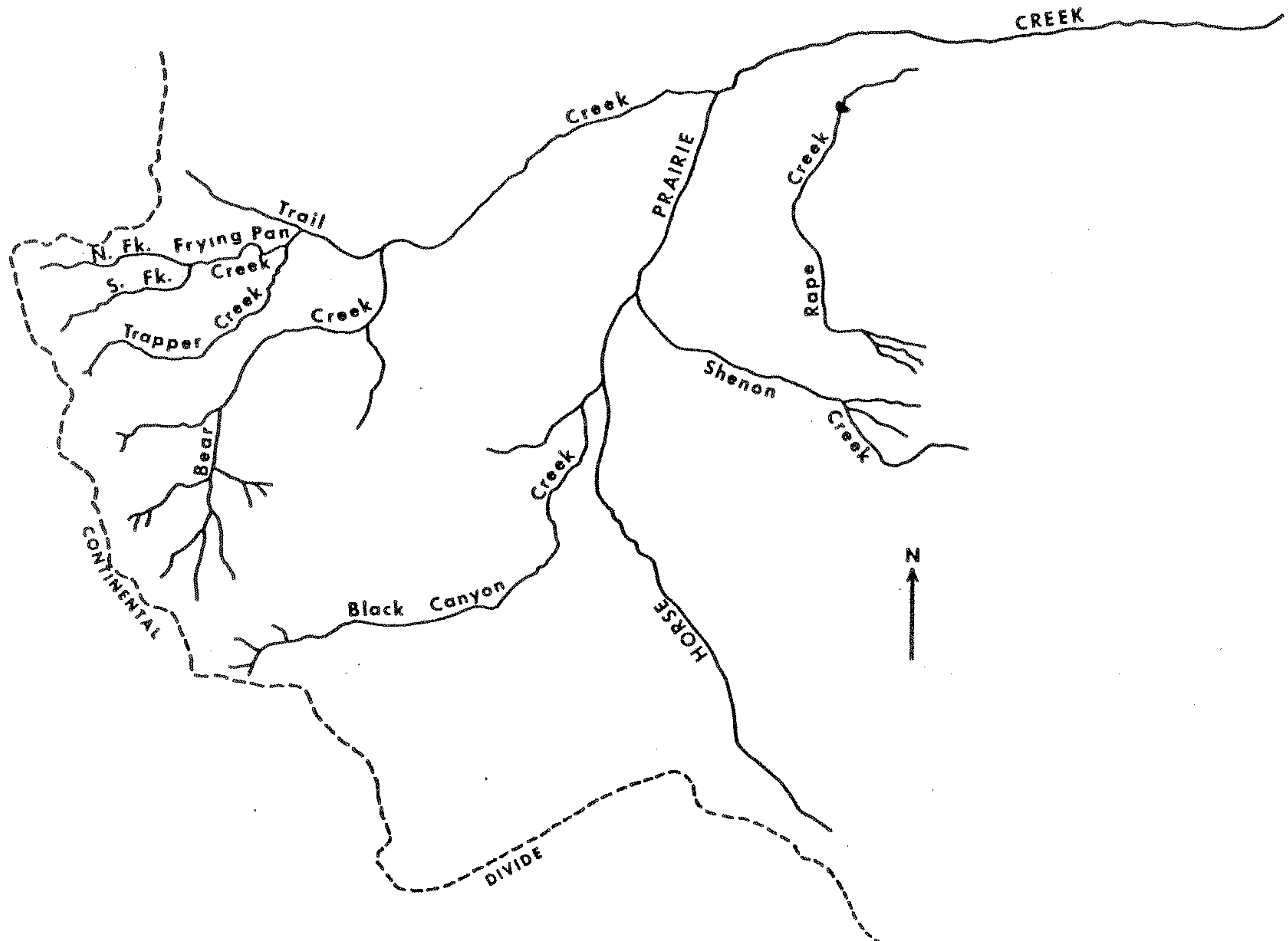
Notary Public for the State of Montana
Residing at Helena, Montana
My commission expires Nov 1-92



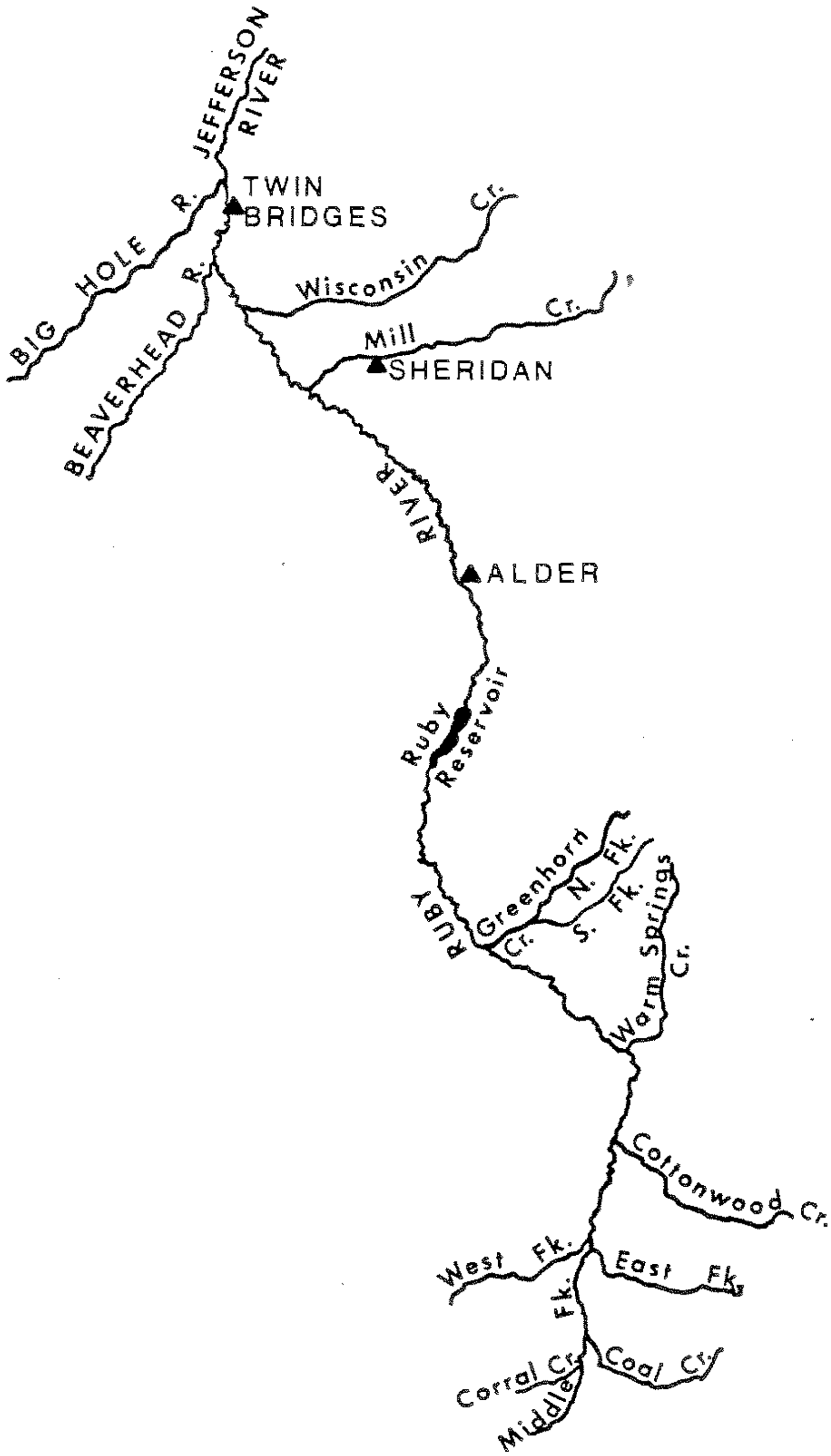
Map of the Missouri River Basin upstream from Canyon Ferry Dam.



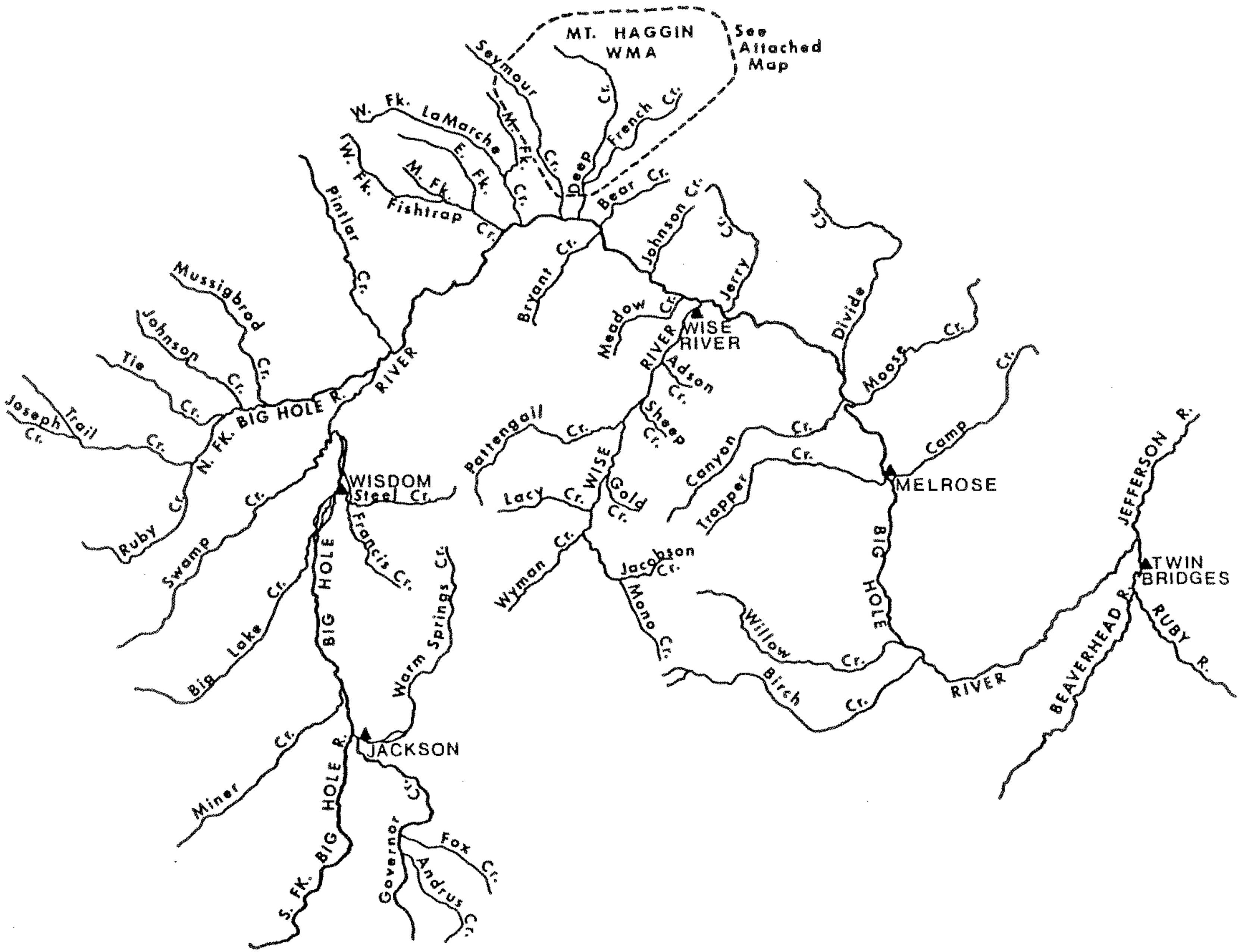
Map of the Red Rock-Beaverhead River Sub-Basin.



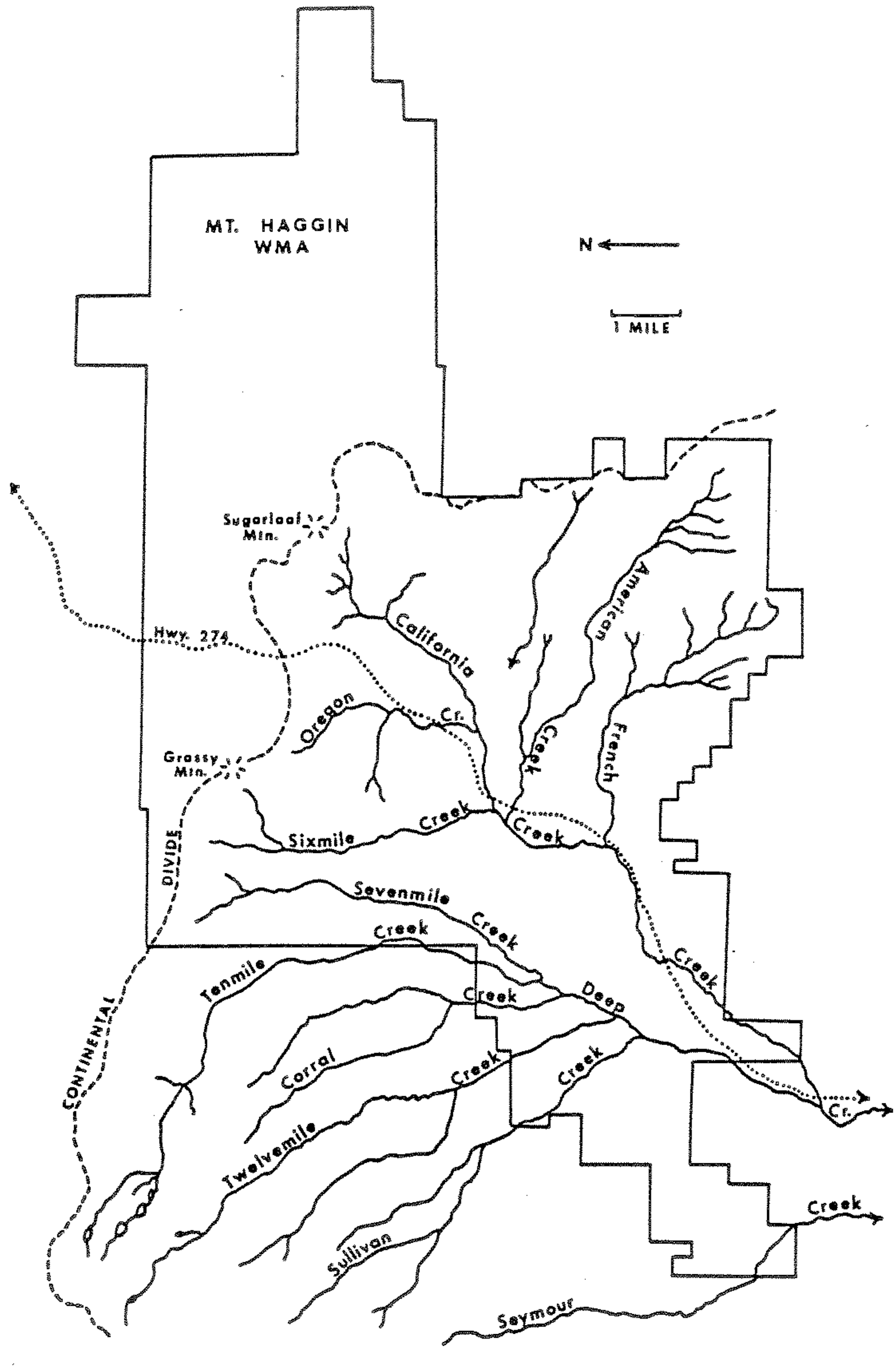
Map of a portion of the Horse Prairie Creek drainage.



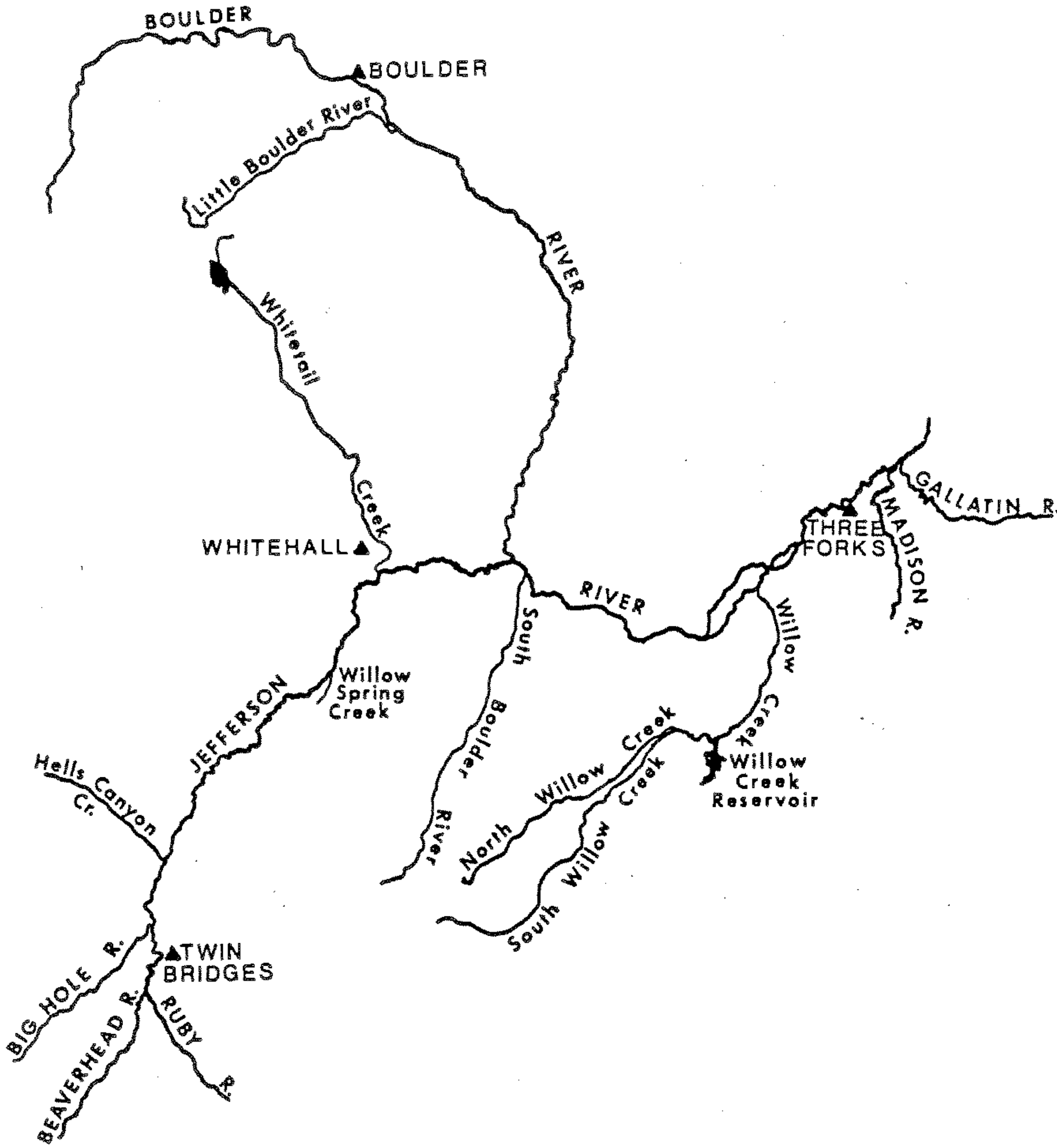
Map of the Ruby River Sub-Basin.



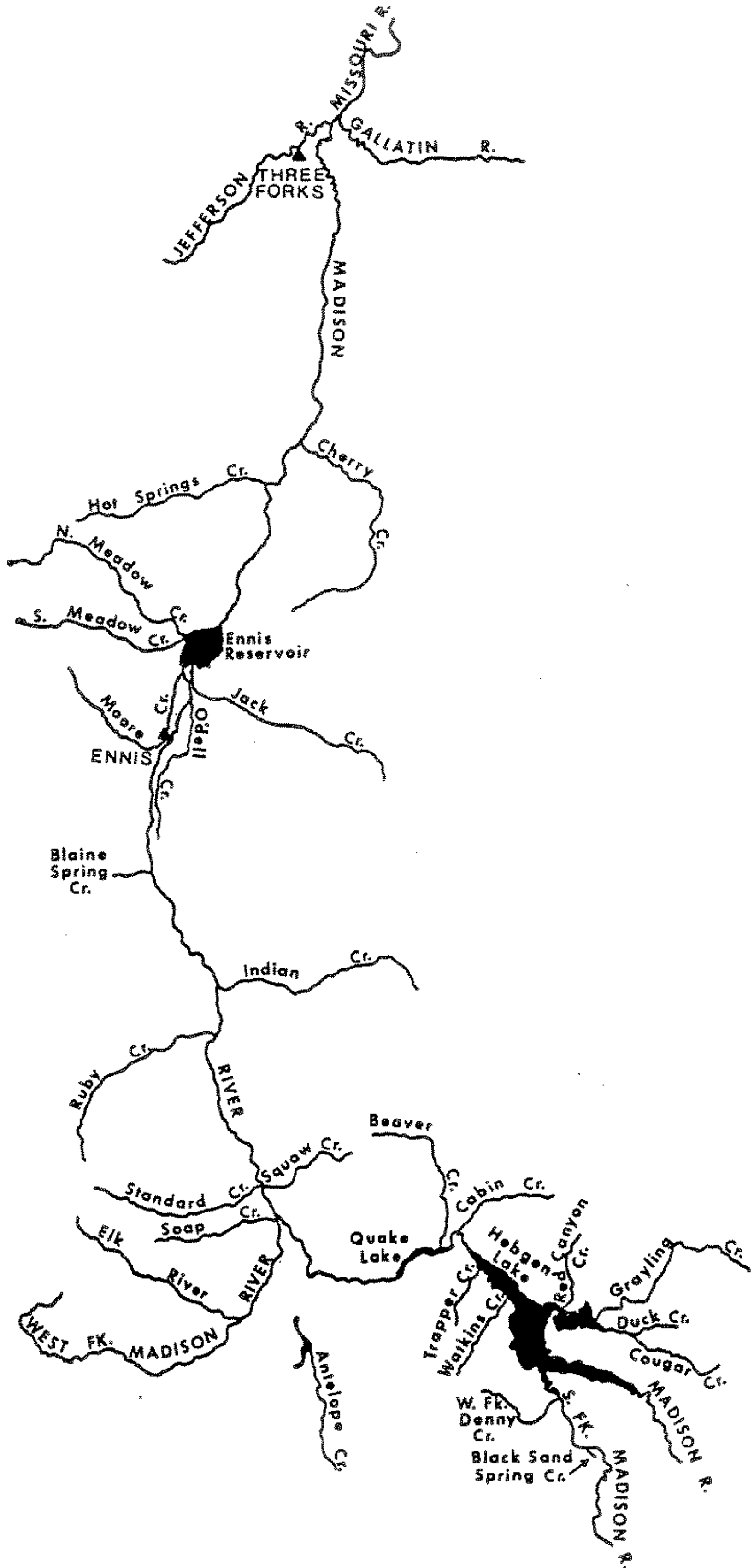
Map of the Big Hole River Sub-Basin.



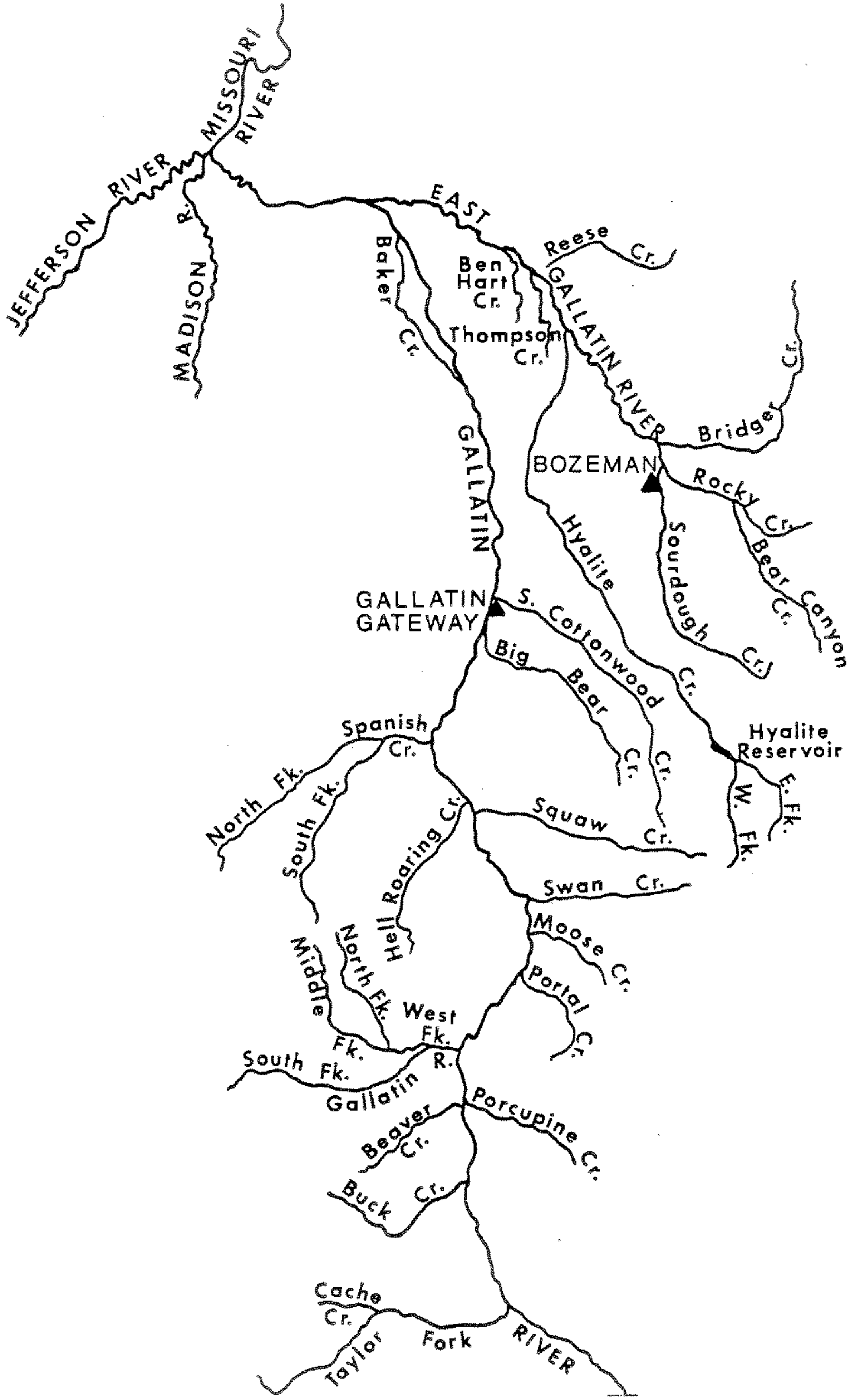
Map of the streams on the Mt. Haggin Wildlife Management Area.



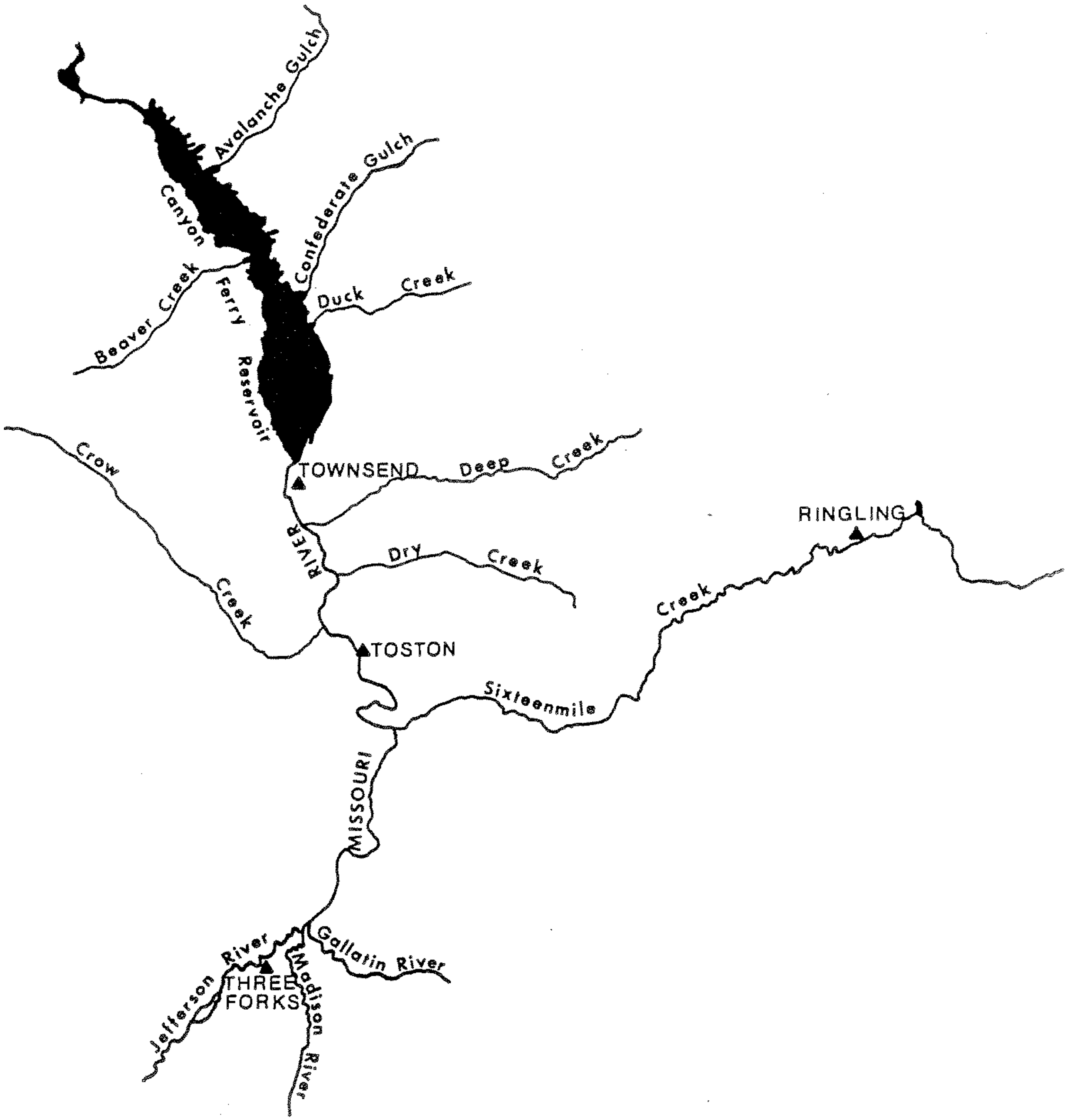
Map of the Jefferson River Sub-Basin.



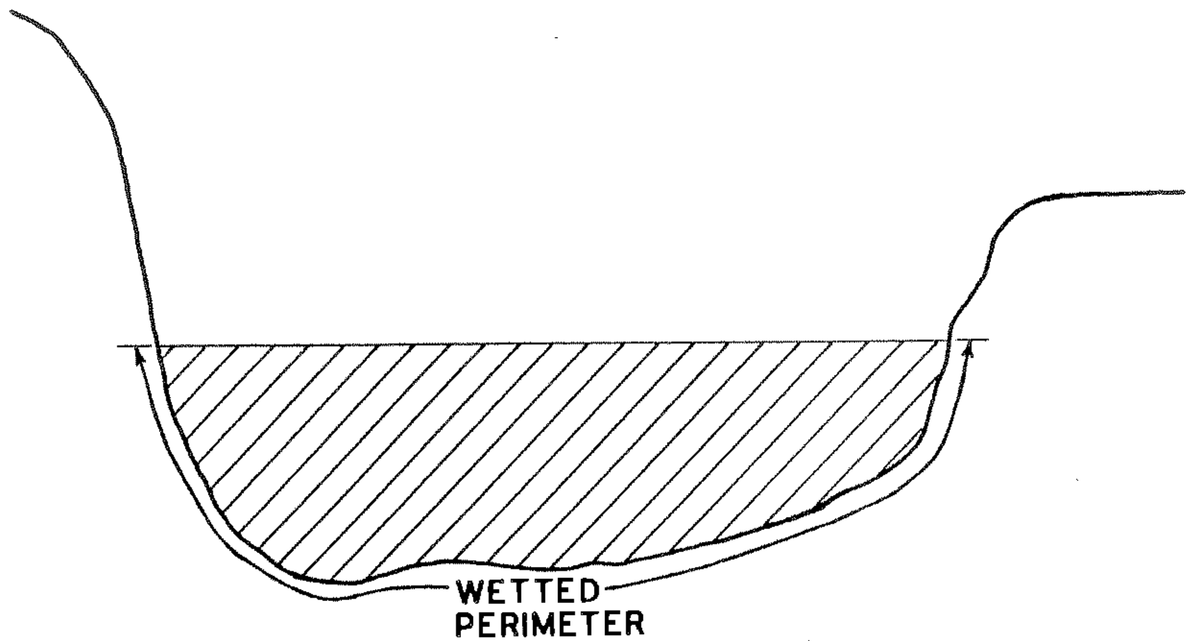
Map of the Madison River Sub-Basin.



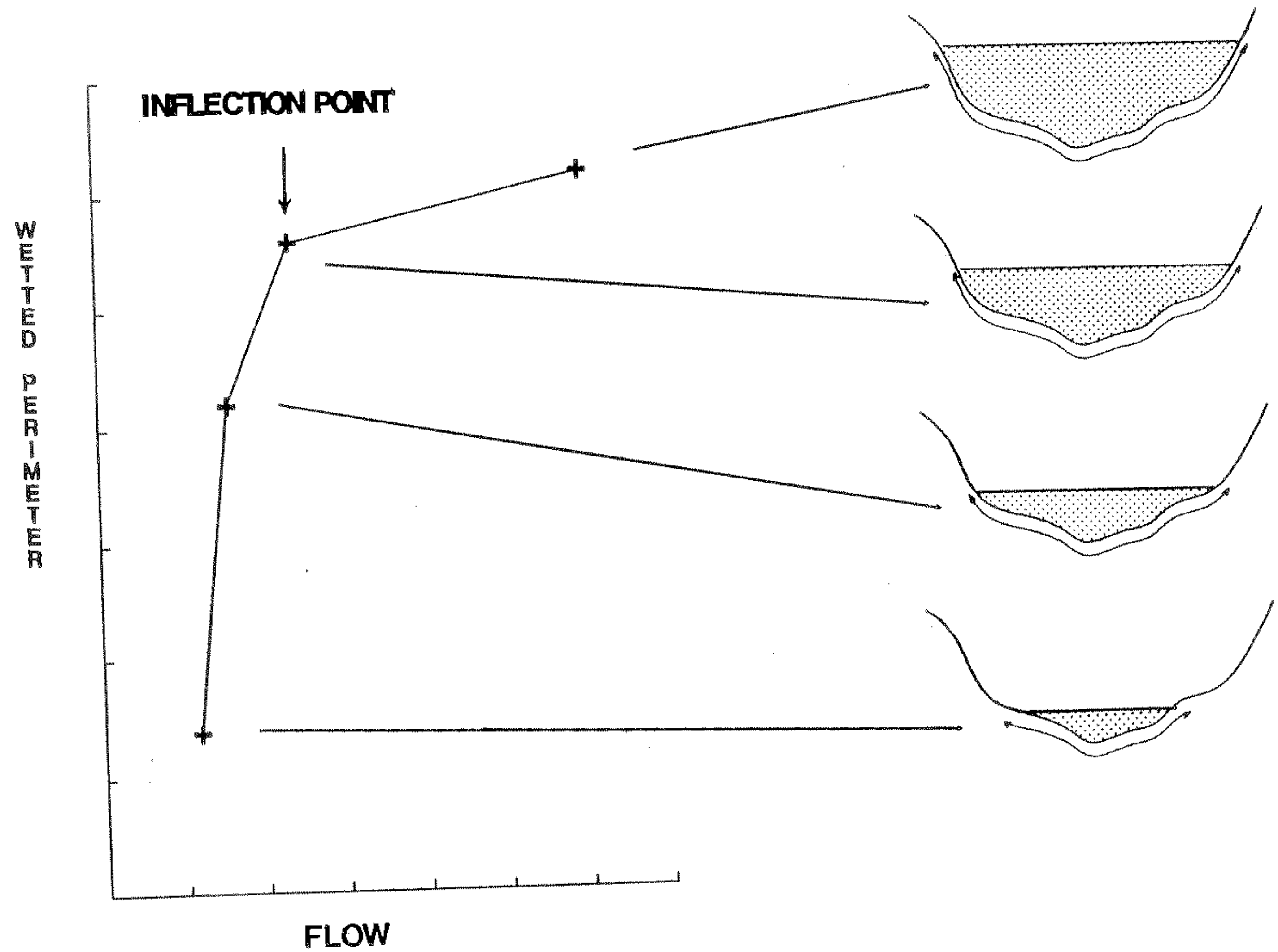
Map of the Gallatin River Sub-Basin.



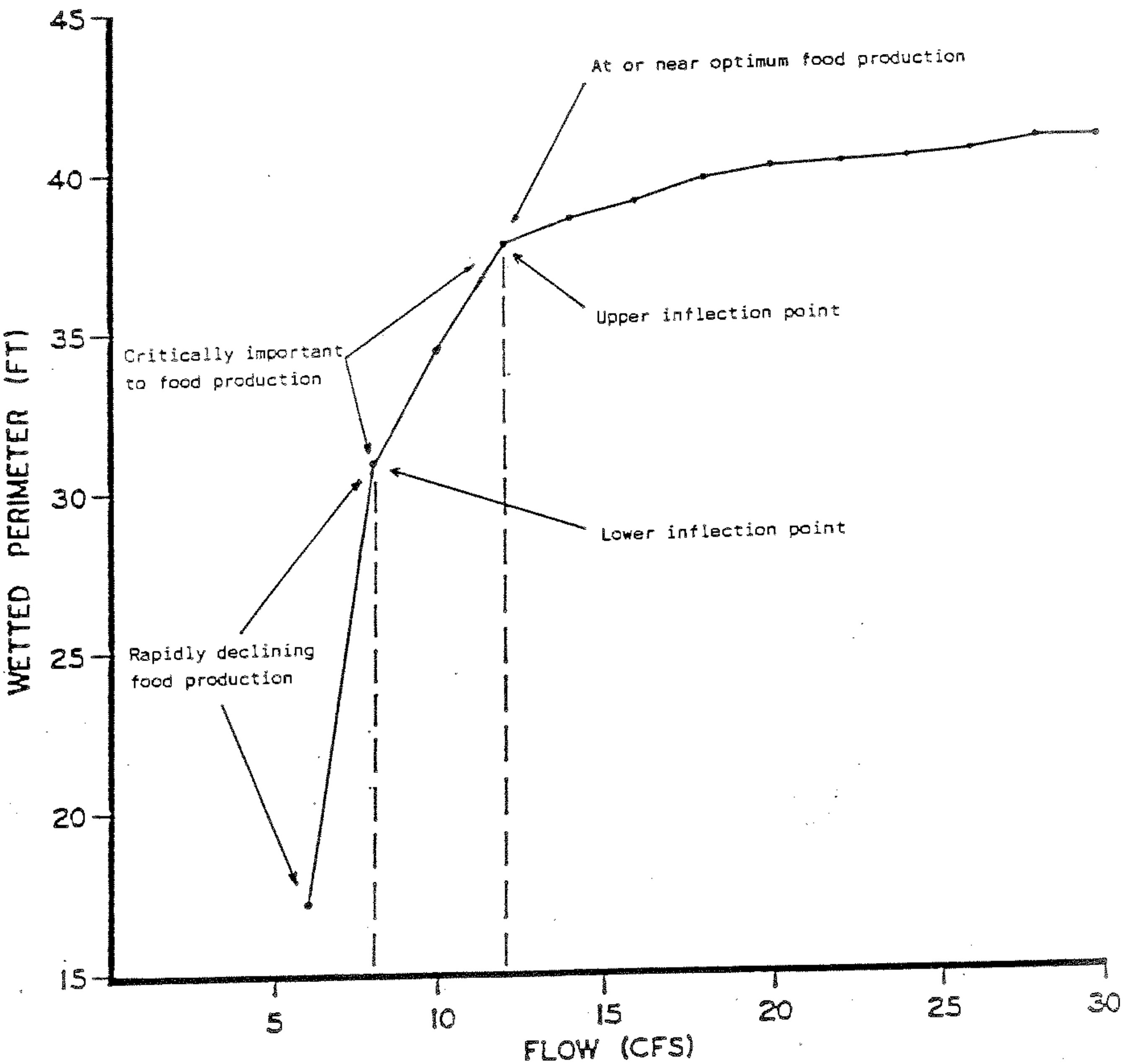
Map of the Upper Missouri River Sub-Basin (confluence of Jefferson and Madison rivers - Canyon Ferry Dam).



The wetted perimeter in a channel cross-section.



Relationship between wetted perimeter and flow, showing an inflection or break point.



An example of a relationship between wetted perimeter and flow for a stream riffle cross-section showing upper and lower inflection points.

Appendix E

Percentile flows, cubic feet per second

Stream name		Q.90	Q.80	Q.50	Q.20	QM
Poindexter Slough	Oct	39	41	49	55	50
	Nov	38	42	51	56	51
	Dec	37	41	49	52	48
	Jan	37	41	45	48	45
	Feb	37	41	46	49	46
	Mar	39	44	47	52	48
	Apr	40	44	50	59	52
	May	39	45	59	68	59
	June	48	55	69	76	68
	July	45	48	59	70	61
	Aug	41	45	53	65	57
	Sept	37	41	49	56	52
Willow Spring Creek	Oct	11	12	13	14	13
	Nov	12	12	13	14	13
	Dec	12	13	13	15	14
	Jan	16	18	20	23	21
	Feb	22	23	26	30	27
	Mar	21	25	29	33	29
	Apr	14	16	20	23	20
	May	11	13	14	16	14
	June	11	11	13	15	13
	July	12	13	14	16	15
	Aug	13	13	14	16	14
	Sept	12	12	13	14	13
Black Sand Spring Creek	Oct	21	23	25	27	25
	Nov	21	23	25	26	25
	Dec	21	22	25	26	24
	Jan	21	22	24	26	24
	Feb	21	22	24	25	24
	Mar	21	23	24	25	24
	Apr	24	25	26	29	27
	May	32	34	37	43	38
	June	28	32	39	44	39
	July	22	24	28	33	28
	Aug	21	23	25	28	25
	Sept	21	23	24	27	25

VITA -- Frederick A. Nelson

<u>Current Position</u> Fishery Biologist, Montana Department of Fish, Wildlife and Parks, Bozeman, MT 59715

<u>Place and Date of Birth</u> Pittsburgh, Pennsylvania; November 10, 1944

<u>Education</u>

1962-68 Cornell University, Ithaca, New York
Received BS degree in Fishery Science

1973-76 Montana State University, Bozeman, Montana
Received MS degree in Fish and Wildlife Management, with emphasis in fisheries

<u>Thesis -- The Effects of Metals on Trout Populations in the Upper Boulder River, Montana</u>

<u>Experience</u>

Summer 1966 -- Fishery Biologist Aide, New York State Department of Environmental Conservation, Stamford, New York. Surveyed lake fish populations and estimated fish numbers in various waterways of the Catskill Mountain region of New York.

Summer 1967 -- Fishery Biologist Aide, New York State Department of Environmental Conservation, Oakdale, New York. Surveyed the fish populations in the lakes and ponds of Long Island, New York.

Spring and Summer 1974 -- Fisheries Field Worker, Montana Department of Fish, Wildlife and Parks, Livingston, Montana. Participated in a comprehensive fisheries inventory of the waterways of the Shields and upper Yellowstone River drainages of southwest Montana.

1976 - Present -- Fishery Biologist, Montana Department of Fish, Wildlife and Parks, Bozeman, Montana. My responsibilities primarily involve instream flow and other water-related issues, including the preparation and filing of instream flow claims under Montana's water reservation and water right processes.

<u>Special Schools and Workshops</u>

1. March 1978. Attended a week-long training school in the use of the Instream Flow Incremental Method (IFIM) for deriving instream flow recommendations, conducted by the U.S. Fish and Wildlife Service in Santa Cruz and Sacramento, California.

2. June 7-11, 1982. Attended a short course in stream mechanics given through the Continuing Education Program of the Montana State University Civil Engineering and Engineering Mechanics Department, Bozeman, Montana.

3. November 29-December 1, 1983. Attended the Instream Flow Technology Section of the 1983 Hydropower Conference, Portland, Oregon.

4. June 25, 1985. Attended a workshop on streamflow measurements and the maintenance of current meters, conducted by Ron Shields of the U.S. Geological Survey, Helena, Montana.

5. February 24-26, 1987. Attended an instream flow methods workshop taught by E. Woody Trihey and sponsored by OEA Research, Helena, Montana.

6. September 12-13, 1989. Attended an instream flow methods workshop, sponsored by the U.S. Fish and Wildlife Service, Green Bay, Wisconsin, and gave a presentation on the Wetted Perimeter Inflection Point Method.

Professional Organizations

Member, American Fisheries Society and Montana Chapter, American Fisheries Society

Publications

Leathe, S.A. and F.A. Nelson. 1986. A literature evaluation of Montana's wetted perimeter inflection point method for deriving instream flow recommendations. Montana Department of Fish, Wildlife and Parks, Helena, Montana. Revised February 1989. 70 pp.

Nelson, F.A. 1977. Beaverhead River and Clark Canyon Reservoir fishery study. Montana Department of Fish, Wildlife and Parks, Helena, Montana. 118 pp.

Nelson, F.A. 1980. Evaluation of four instream flow methods applied to four trout rivers in southwest Montana. Montana Department of Fish, Wildlife and Parks, Bozeman, Montana. 105 pp.

Nelson, F.A. 1980. Supplement to evaluation of four instream flow methods applied to four trout rivers in southwest Montana. Montana Department of Fish, Wildlife and Parks, Bozeman, Montana. 55 pp.

Nelson, F.A. 1980. Evaluation of selected instream flow methods in Montana. Pp. 412-432 in Western Proceedings 60th Annual Conference of the Western Association of Fish and Wildlife Agencies. Western Division, American Fisheries Society.

Nelson, F.A. 1980. Guidelines for using the wetted perimeter (WETP) computer program of the Montana Department of Fish, Wildlife and Parks. Montana Department of Fish, Wildlife and Parks, Bozeman, Montana. Revised July 1984 and March 1989. 56 pp.

Nelson, F.A. 1984. Some trout-flow relationships in Montana. Pp. 122-126 in F. Richardson and R.H. Hamre (eds.), Proceedings of the Wild Trout III Symposium. Trout Unlimited, Vienna, Virginia.

Nelson, F.A. 1986. Effect of flow fluctuations on brown trout in the Beaverhead River, Montana. North American Journal of Fisheries Management 6:551-559.

Nelson, F. and L. Peterman. 1979. Determination of instream flows in Montana: An action plan. Montana Department of Fish, Wildlife and Parks, Helena, Montana. 64 pp.

PRE-FILED TESTIMONY OF STEPHEN A. LEATHE
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

Q. Please state your name and business address.

A. Stephen A. Leathe, Montana Department of Fish, Wildlife and Parks, Box 6610, Great Falls, MT 59406.

Q. Who is your employer and what is your position?

A. I am the Region Four Fisheries Manager for the Montana Department of Fish, Wildlife and Parks based in Great Falls.

Q. Please describe your educational and employment history.

A. I received a B.S. degree from the University of Maine at Orono in 1975 and majored in Wildlife Management. I spent two summers there assisting on a research project investigating the effects of water pollution on aquatic invertebrates in a large Maine river. Following graduation from Maine, I enrolled as a graduate student at Montana State University. I received my M.S. degree in 1980 after completing a research project on plankton populations in the Tongue River Reservoir in southeastern Montana. I was subsequently employed by MDFWP as a fisheries biologist for nearly six years in the Kalispell area and worked on three different fisheries research projects during that time. I subsequently worked as a fisheries research biologist for Montana State University for six months on the Bighorn River during 1985 before returning to MDFWP. I spent six months as a fisheries biologist in Helena before taking a position in Great Falls as a fisheries management biologist in March 1986. I have been the Regional Fisheries Manager in Great Falls since the summer of 1988.

Q. What is the purpose of your testimony?

A. My testimony is intended to describe the fishery resources and support MDFWP's instream water reservation requests for 14 streams and rivers in the Smith and Dearborn river drainages. I will also present testimony on Sheep Creek, which flows directly into the Missouri River near the town of Cascade. The streams in the Smith River drainage which I will discuss are:

- Big Birch Creek
- Eagle Creek
- Hound Creek
- Newlan Creek
- North Fork Deep Creek
- North Fork Smith River
- Rock Creek
- Sheep Creek
- South Fork Smith River
- Tenderfoot Creek

In the Dearborn drainage I will present testimony on the Dearborn River, Flat Creek, Middle Fork Dearborn River, and South Fork Dearborn River. Vicinity maps of these streams are contained in Appendix A of this testimony.

Q. What specific portions of the MDFWP application will you address in your testimony?

A. Volume 3, pages 3-117 through 3-137 and 3-151 through 3-186.

Q. Do you have any experience in dealing with instream flow issues in relation to fisheries resources?

A. Yes, a substantial amount. I spent nearly three years as a biologist evaluating the potential effects of proposed small hydro developments on tributaries of the Swan River in northwestern Montana. Determination of water availability, recommending minimum flows, and determination of possible effects of dewatering on fish populations were integral parts of the project. During portions of 1985 & 1986 I was employed as a fisheries biologist in Helena. One of my main responsibilities was to assist in organizing existing information and to identify and prioritize needs for additional information required for preparing this application.

Q. Do you have any other pertinent experience?

A. Yes. While employed in Helena, I worked on a comprehensive review of the literature on instream flow methods and critically evaluated the Wetted Perimeter Inflection Point method which MDFWP was using to derive minimum instream flow recommendations for fisheries. I thoroughly reviewed scientific literature on available instream flow techniques, examined their strengths and weaknesses, and interpreted the results of studies evaluating the effectiveness of various instream flow methods. A comprehensive summary of this investigation, co-authored by Fred Nelson, was published by MDFWP in 1986 with 95 references cited. It was revised in 1989 with 102 references cited.

Q. What was your involvement in the preparation of the Missouri River water reservation application?

A. I supervised and assisted in the collection of field data used to derive minimum flow recommendations on the 15 streams or rivers previously mentioned. I assisted in the analysis and interpretation of this information and conducted or supervised some of the fish population investigations.

Q. How would you describe the fishery resources of the 10 tributaries in the Smith River drainage for which the MDFWP has filed a reservation request?

A. I believe all these tributaries support significant trout populations and comprise an important fishery resource for the people of Montana. Most of these streams provide a few hundred days of fishing recreation each year and a few sustain more than 1000 angler-days of use in some years. Fishing pressure estimates were determined by a mail survey conducted statewide by MDFWP in 1982 through 1985 and in 1989. Rainbow trout and brook trout tend to predominate in these tributaries, with the largest fish typically ranging from 11 to 14 inches long. Brook trout populations are especially high in the South Fork of the Smith River (more than 400 per 1000 feet of stream), Big Birch Creek (at least 250 fish per 1000 feet), and in Newlan Creek. Sheep Creek has an exceptional rainbow trout population, with more than 900 fish per 1000 feet measured in a section above the confluence with Moose Creek. Rock Creek and Tenderfoot Creek also have outstanding rainbow and/or hybrid cutthroat trout populations. Eagle Creek supports populations of rainbow, cutthroat and brook trout.

Q. Are brown trout found in any of the Smith River tributaries included in the MDFWP application?

A. Brown trout are not as common as the other trout species in the Smith River tributaries but they grow to much larger sizes. Brown trout longer than 20 inches were collected during surveys on Hound Creek, Rock Creek and the North Fork of the Smith River. The best brown trout population was found in the latter stream (167 fish per 1000 feet of stream). Hound Creek is well known among knowledgeable anglers in the Great Falls area for providing excellent fishing opportunities for large brown trout in a semi-secluded, small stream setting.

Q. Much of the fish population survey work on the Smith River tributaries was done during the 1970's. Do you think it is relevant today?

A. Yes. The Department conducted a systematic basinwide survey of fish populations in the Smith River drainage during the early 1970's which provided an excellent database to work with. We have not identified any major changes in fish habitat since that time either via our own investigations in the area or through comments from the angling public. Moreover, statewide fishing use surveys in the 1980's show continued substantial use of these waters by anglers, suggesting that fish populations remain satisfactory. Surveys on the mainstem Smith River during the last five years indicate trout populations are similar to or perhaps higher than they were in the 1970's.

Q. Are any of the Smith River tributaries used for spawning by migratory fish?

A. We do not have much concrete information on this question. Lower Tenderfoot Creek appears to be heavily used by spawning brown trout in the fall but it is not certain whether these fish migrate from the Smith River. I personally observed large rainbow or cutthroat trout actively spawning in Newlan Creek above Newlan Creek Reservoir in the spring of 1987. I concluded these fish likely migrated from the reservoir based on their large size relative to the resident fish in the stream. A substantial rainbow trout population continues to exist in Newlan Creek Reservoir even though MDFWP stocked no rainbows in the reservoir after 1983. My observations coupled with the fact that rainbow are not commonly known to reproduce successfully in lake environments in Montana leads me to believe that rainbows are reproducing naturally in the creek above the reservoir. I believe it is reasonable to assume that some of the other tributaries discussed in this testimony are used for spawning by migratory fish from the Smith River. It simply has not been investigated thoroughly.

Q. Are there any remnant populations of genetically pure native cutthroat trout present in the Smith River tributaries for which MDFWP has filed for water reservations?

A. Yes, in the North Fork of Deep Creek. Cutthroat trout, arctic grayling and mountain whitefish are believed to have been the only native salmonids in the Smith River drainage prior to the arrival of white settlers. Cutthroat and grayling were almost totally eradicated by a combination of factors and have been replaced by introduced rainbow, brook and brown trout. Native cutthroat stocks have been reduced to the point where they are now considered a "species of special concern" in Montana. U.S. Forest Service biologists discovered a remnant population of native cutthroats in an isolated portion of the North Fork of Deep Creek. We believe this population warrants special protection and hence have requested a water reservation on this stream.

Q. What methods were used to derive the instream flow requests on the Smith River tributaries?

A. The Wetted Perimeter Inflection Point method was used on all streams except the Fixed Percentage method was used on the North Fork of Deep Creek.

Q. Why is an instream flow reservation needed for the Smith River tributaries?

A. To maintain existing fish populations and the recreational fishing activity dependent on these fish populations. These flows would also maintain spawning habitat in some streams believed to be used by migratory trout and would help protect the only documented population of genetically pure native cutthroat trout remaining in the Smith River drainage. Reserved minimum flows in these tributaries would provide water to the mainstem Smith River which is a "blue ribbon" trout stream and a very popular river for recreational floating.

Q. Do you feel there is sufficient water in the Smith River tributaries to meet MDFWP's flow requests?

A. This is a difficult question to answer without detailed long term, on-site water consumption and availability studies. My review of the water availability information presented in Volume 1 of the MDFWP application suggests that sufficient water is available during most months in most streams in at least five out of every 10 years. This seems to be true in spite of the fact that summer flows in many of the streams appear to be artificially low because of irrigation withdrawals.

Q. Please describe the fishery resource of the mainstem Dearborn River.

A. The Dearborn River is a tributary that flows into the Missouri River approximately 13 miles downstream from Holter Dam. It is one of the most important trout streams in Montana. The Dearborn provides up to 2500 angler-days of fishing use annually, according to MDFWP statewide mail surveys conducted during the years 1982 through 1985 and in 1989. It is known to have good fishing for resident trout (mostly rainbows) in the 8-12" range, particularly in its upper reaches. However, its importance largely stems from the spawning habitat it provides for migratory rainbow trout that reside in the Missouri River.

Q. Please tell us what you know about rainbow trout spawning runs in the Dearborn River.

A. During the spring of 1988 we placed a trap near the mouth to capture fish migrating upstream into the Dearborn from the Missouri River. We were surprised by the large number of trout we captured. We tagged 2361 mature rainbows averaging 14.9 inches long as they moved upstream between March 16 and May 5, 1988. Most of these fish were sexually mature and appeared to be preparing to spawn. Most rainbow trout spawning occurs in March, April and May.

Q. Do you know how many rainbow trout migrated from the Missouri into the Dearborn River to spawn?

A. We electrofished three river sections ranging from two to three miles in length upstream from the trap in late April. The purpose was to determine the percentage of the spawning run we handled through the trap by looking for previously tagged fish in each section. The sections were located 18, 28, and 43 river miles upstream from the trap and we captured significant numbers of tagged spawners in each of the three sections. Based on this work we concluded that we trapped around 12% of the spawning male population and approximately 20,000 rainbows from the Missouri used the Dearborn River for spawning.

Q. Did you observe rainbows spawning in the Dearborn River?

A. Yes. On April 28, 1988 I surveyed the lower 42 miles of the Dearborn from a helicopter to determine the extent and distribution of spawning use. I counted approximately 6000 spawning nests (redds) and observed rainbows on many redds. Most spawning use was concentrated in the lower 30 river miles and spawning was not complete at the time of the survey.

Q. Did you confirm that rainbow trout from the Missouri River spawn in the Dearborn River?

A. Yes. Anglers returned tags from more than 25 of the 1170 rainbow spawners that were tagged at the Dearborn trap. Most of these rainbows were caught in the Missouri River from six miles upstream to 12 miles downstream from the mouth of the Dearborn. No tagged rainbow were reported by anglers fishing on the Dearborn River itself or on any other streams or rivers in the area.

Q. What is the significance of these findings?

A. Spawning surveys on the Missouri River below Holter Dam during the mid to late 1980's indicated that about 90% of the rivers' rainbow trout reproduction occurred in tributaries. The majority of the spawning occurred in Sheep Creek, the Dearborn River, and the Little Prickly Pear Creek drainage. Run sizes were estimated to be about 4,000, 20,000 and 15,000 fish in each of these streams, respectively. Hence the Dearborn was the most heavily used of the three principal spawning areas.

Q. What is the importance of rainbow trout in the Missouri River downstream from Holter Dam?

A. The 35-mile stretch of the Missouri River between Holter Dam and Cascade is the second most heavily fished river in Montana. It is a "blue ribbon" trout stream of national importance that supports about 70,000 angler-days of recreation annually. Rainbow trout form the backbone of the fishery and numbers of rainbow larger than 10" average 2700 per mile near Craig and 900 per mile above Cascade. Few rivers support such high densities of large rainbow trout. Spawning habitat in the Dearborn River is critical to the perpetuation of the Missouri River fishery.

Q. Do other fish species from the Missouri use the Dearborn River for spawning?

A. Yes. A trap was installed near the mouth of the Dearborn in fall 1988. A total of 3,457 mountain whitefish were captured in only 10 nights of trapping. This indicates a very substantial whitefish spawning run.

Q. What method was used to derive the instream flow request for the mainstem Dearborn River?

A. The Wetted Perimeter Inflection Point method.

Q. Why is an instream flow reservation needed on the mainstem Dearborn River?

A. As I mentioned before, the Dearborn River provides critical spawning habitat for rainbow trout that reside in the "blue ribbon" section of the Missouri River below Holter Dam. The Dearborn River is the single most important spawning area for these fish. Reserved stream flows in the Dearborn would thus help maintain trout and whitefish populations in the second most heavily fished trout stream in Montana - the Missouri.

Reserved flows would also help sustain resident fish populations and associated fishing and floating use in the Dearborn River itself.

Q. Is there sufficient water in the Dearborn River to meet the MDFWP flow request?

A. In some months of the year there normally is, particularly in the critical rainbow trout spawning and rearing period of April through July. This is true despite the fact that a significant amount of water is removed from the river above the USGS gage site at river mile 19 to irrigate approximately 3300 acres.

Q. Please describe the fishery resources of the Middle and South Forks of the Dearborn River and Flat Creek.

A. The Middle and South forks of the Dearborn River both have very good rainbow trout populations. Numbers of rainbows longer than three inches range between 350 and 400 per 1000 feet of stream. Rainbows up to 16 inches long were electrofished during October, 1987 in the Middle Fork. This is a large rainbow for a relatively small stream. Flat Creek had relatively low trout populations but it is the most heavily fished of the three streams. Fishing use on Flat Creek averaged about 340 angler-days per year for the period 1982-1989 according to the MDFWP statewide mail survey. We believe that low trout populations in Flat Creek are at least partly due to sedimentation resulting from excessive bank erosion caused by the transport of irrigation water diverted from the upper Dearborn River.

Q. Are any of these three streams used for spawning by migratory fish?

A. We believe so. One of our biologists (Ken Frazer) surveyed the lower ends of the Middle and South Forks of the Dearborn in April, 1988 and observed recently constructed spawning beds (redds) and numerous 12-16 inch rainbows. The size of the fish and timing of the observation strongly suggests that these fish were migrants from the Missouri River. Fish of this size are rather uncommon in these streams during most of the year. The biologist noted that large beaver dams appeared to limit upstream fish migration to the lower one mile of the South Fork and lower 1/4 mile of the Middle Fork. The spawning beds and large rainbow were only observed downstream from these barriers. This suggests the fish were migrating from the Dearborn River into these streams to spawn and their upstream movement was halted by these natural barriers.

Q. What method was used to derive the instream flow requests for the three tributaries to the Dearborn River?

A. The Wetted Perimeter Inflection Point method.

Q. Why is an instream flow reservation needed on these three Dearborn River tributaries?

A. To maintain existing fish populations and recreational fishing use in these streams. Reserved flows would also help maintain spawning areas at the lower ends of the South and Middle forks of the Dearborn River which we believe are used by migratory fish from the Missouri River. Reserved flows in these streams also provide water for the mainstem Dearborn River which is a vitally important spawning stream for Missouri River rainbow trout.

Q. Do you believe there is sufficient water available to meet the MDFWP water reservation requests for these three tributaries to the Dearborn River?

A. This is a difficult question to answer without detailed long-term water consumption and availability studies. Based on the predicted flows presented in Volume I of our application plus my own observations, I believe that sufficient water exists in most months during average years to meet our requests for these three streams.

Q. Please describe the fishery resource of Sheep Creek.

A. Sheep Creek flows directly into the Missouri River about 24 miles downstream from Holter Dam, near the town of Cascade. It is a critically important spawning stream for rainbow trout that reside in the Missouri River. We placed fish traps near the mouth of this stream in the spring of 1986 and 1987 and estimated that 3500-4400 rainbow spawners averaging about 16 inches long migrate into Sheep Creek to spawn each year. This is a very sizeable spawning run for such a small stream. Surveys revealed most of the spawning occurred in the South Fork of Sheep Creek and in the mainstem below the confluence of the North and South forks. Annual surveys during the fall in 1980 through 1982 indicated that brown trout and mountain whitefish also migrated from the Missouri River to spawn in Sheep Creek.

Q. Where did the rainbows which spawned in Sheep Creek come from?

A. We tagged more than 600 spawning rainbows in Sheep Creek during 1986 and 1987. More than 40 of these tags were returned by anglers and all were caught in the Missouri River. Most of the tagged fish were caught in the Missouri four miles upstream to 15 miles downstream from the mouth of Sheep Creek. Several Sheep Creek spawners were caught by anglers fishing on the Missouri River near Great Falls, more than 50 miles downstream. Sheep Creek is the most important spawning area for rainbows residing in this portion of the Missouri River. Lack of sufficient spawning habitat may limit rainbow numbers in this river section.

Q. What method was used to derive the instream flow request for Sheep Creek?

A. The Wetted Perimeter Inflection Point method.

Q. Why is an instream flow reservation needed on Sheep Creek?

A. Sheep Creek, the Dearborn River, and the Little Prickly Pear Creek drainage have to be considered some of the most important trout streams in Montana. This is because they provide the spawning areas for around 90% of the rainbow trout that live in the 35-mile "blue ribbon" section of the Missouri River between Holter Dam and Cascade. As I mentioned previously, this section of the Missouri receives the second highest fishing use of all Montana rivers and has a trout fishery comprised primarily of rainbows that has national importance. It is very important to reserve as much of the remaining flow in Sheep Creek as is possible to insure the continued health of the trout population in the lower portion of the blue ribbon Missouri.

Q. What is the availability of water in Sheep Creek?

A. Available flows usually exceed the minimum flow request of 22 cfs during the spring high water period but are often less than 22 cfs in the low water period of late summer, fall and winter.

Stephen A. Leathe, being first duly sworn, states that the foregoing testimony is true.

Dated October ____, 1991.

____
Stephen A. Leathe

Subscribed and sworn to before me this 30 day of October, 1991.

Curtis E. Larsen
____
Notary Public for the State of Montana
Residing at Helena, Montana
My Commission Expires July 6, 1994

BIOGRAPHY
STEPHEN A. LEATHE
October, 1991

Montana Dept. of Fish,
Wildlife & Parks
P. O. Box 6610
Great Falls, Montana 59406

Birthdate: November 14, 1953
Office Phone: 454-3441
Home Phone: 727-0169

EDUCATION

M.S. Botany, 1980, Montana State University, Bozeman. Thesis entitled "Population dynamics and production of limnetic crustacean zooplankton in the Tongue River Reservoir, Montana." Supported by Research Assistantship from Montana Cooperative Fishery Research Unit and by Biology Department teaching assistantship. Objective of study to provide baseline data to facilitate evaluation of potential impacts of surface coal mining adjacent to reservoir.

B.S. Wildlife Management, with distinction, 1975, University of Maine at Orono.

PROFESSIONAL CERTIFICATION AND MEMBERSHIPS

Certified Fisheries Scientist, 1982, by the American Fisheries Society.

Member of the American Fisheries Society, Montana Chapter of the American Fisheries Society, and Montana Association of Fish & Wildlife Biologists.

PROFESSIONAL EXPERIENCE

FISHERIES

Central Montana: August 1988 to present. Regional Fisheries Manager for Montana Department of Fish, Wildlife & Parks based in Great Falls. Supervise fisheries management program in northcentral Montana (Region 4). Program elements include: survey, inventory and monitoring of fish populations and angler use in area waters; develop and evaluate fish stocking program; protection, restoration, and enhancement of aquatic habitat; develop and evaluate fishing regulations; conduct special studies and research projects; acquire and develop fishing access sites; prepare management plans for area waters; prepare environmental assessments of impacts of MDFW&P management actions; licensing of private fish ponds; prepare annual progress reports and completion reports; review of applications for fishing tournaments; coordinate with public and private agencies on reservoir operations and flow releases; participate in Federal licensing of hydroelectric dams; review land and water development plans of public and private agencies and provide input on fisheries impacts and mitigation. Region Four covers approximately 29,000 square miles and contains around 130 publicly managed fishing lakes and 3,700 miles of fishing streams. These waters provide an average of around 470,000 days of fishing recreation annually. Normally supervise a staff of three to four professional fisheries biologists with a supporting staff of up to 10-15 fisheries technicians.

<u>Central Montana:</u> March, 1988, to July, 1988. Fisheries Biologist III with Montana Department of Fish, Wildlife and Parks based in Great Falls. Responsible for fisheries management of lakes, rivers, streams and ponds in Missouri, Dearborn, Smith, Judith and Upper Musselshell drainages in northcentral Montana under supervision of Regional Fisheries Manager. Emphasis placed on designing and implementing field studies to determine trout population trends and angler use in Missouri River from Holter Dam to Great Falls, Smith River, and Big Spring Creek near Lewistown. Identified major sources of rainbow trout recruitment to Missouri River and initiated habitat enhancement efforts. Conducted ongoing hatchery trout species and strain evaluations in five major reservoirs. Directed and coordinated management of small warm and cold water reservoirs in Lewistown area. Supervised or conducted collection of instream flow reservation data on 15 streams in Smith and Dearborn drainages. Participated in habitat protection in area streams and rivers by implementing the Stream Protection Act and the Natural Streambed and Land Preservation Act (SB 310). Assisted Regional Fisheries Manager in developing and achieving management goals, objectives and strategies.

<u>Mid-Missouri Reservoirs and Instream Flow Projects:</u> September, 1985 to March, 1986. Fisheries Biologist III with Montana Department of Fish, Wildlife & Parks based in Helena. Designed and initiated special project to evaluate the influence of reservoir operations on the sport fisheries of Canyon Ferry, Hauser and Holter reservoirs and interconnecting river segments. Major study elements included limnology, lake and river fish population monitoring, extensive creel census, and devised a complex mass-marking scheme to evaluate movement and performance of hatchery rainbow trout strains. Assisted in organizing existing information and identifying data gaps for the upper Missouri water reservation application for instream flows and cooperatively developed a prioritized plan for gathering field information for the mid- and lower Missouri drainage portions of the water reservation application.

Big Horn River: March, 1985 to September, 1985. Fish and Wildlife Biologist III with Montana Cooperative Fishery Research Unit (Montana State University) based in Fort Smith, Montana. Field biologist in charge of a study funded by the U.S. Bureau of Reclamation to determine the effects of gas supersaturation on the aquatic ecosystem of the Big Horn River. Preliminary emphasis placed on monitoring the incidence and severity of gas bubble disease in brown and rainbow trout in three river sections, determining trout population size in relation to gas levels (cooperatively with the MDFW&P), monitoring gas levels and water quality via the installation of satellite relay systems, and the determination of rainbow and brown trout reproductive success and movement patterns in relation to ambient gas levels. Study results would be used to identify methods (i.e., changes in reservoir operations and/or installation of mitigation structures) to reduce or eliminate the gas supersaturation problem.

Swan River drainage: June, 1982 to February, 1985. Fisheries Biologist III for Montana Department of Fish, Wildlife and Parks based in Kalispell. Conducted study funded by Bonneville Power Administration to assess the potential cumulative impacts of 20 proposed small hydro projects on the fisheries resource of the Swan River drainage in northwest Montana. Study involved fish population, spawning, and habitat inventory (on 50 tributary streams, the Swan River, and Swan Lake); monitoring physical parameters (temperature, flow duration, water chemistry); and making instream flow measurements and recommendations on 17 tributaries. Intensive creel censuses were conducted on the Swan River, Swan Lake, and the tributary system. The economic values of these sport fisheries and the potential economic losses associated with the proposed hydro development were determined through a cooperative study with an economic consulting firm. Also cooperated with the U.S. Forest Service to develop fisheries and watershed models to predict the impacts of elevated sediment levels in streambeds resulting from land use activities. Co-authored the study proposal and handled much of the budgeting and project management. Supervised six to nine biological technicians during the summer and fall field seasons.

Flathead Lake: June, 1980 through June, 1982. Fisheries Biologist III with Montana Department of Fish, Wildlife and Parks based in Kalispell. Responsible for assessment of food habits of westslope cutthroat trout, bull trout, kokanee salmon, and three species of whitefish, funded by EPA as part of Flathead River Basin Study. This project also included analysis of age and growth and population fluctuations of cutthroat and bull trout and an evaluation of the potential effects of Mysis shrimp establishment. Sampling methods included the use of hydroacoustic gear, midwater trawl, purse seine, and various gill nets. Supervised two technical assistants.

Middle Fork Flathead River: June, 1979 to June, 1980. Fisheries Biologist II with Montana Department of Fish, Wildlife and Parks based in Kalispell. Responsible for baseline assessment of the Upper Flathead River Basin fishery resource, funded by EPA. Major study objective to identify critical spawning and rearing areas and habitat types utilized by adfluvial westslope cutthroat and bull trout. Supervised two field assistants. Most fieldwork was conducted in the Great Bear and Bob Marshall Wilderness areas.

Tongue River Reservoir and Tongue River: Spring, 1977. Field assistant to fellow graduate student studying population dynamics and life histories of walleye, sauger and crappie in Tongue River Reservoir - southeastern Montana. Sampling methods included trap netting, gill netting, and river electrofishing.

Limnology

Flathead Lake, Montana, 1980-1982. Physical parameters and crustacean zooplankton.

Tongue River Reservoir, Montana, 1976-1979. Detailed water chemistry, physical parameters, algal production, and zooplankton dynamics and production.

Benthic Invertebrates

Penobscot River, Maine, summers 1974 and 1975. Field collection (by SCUBA) and taxonomy. Also worked on pesticide - stream invertebrate study on northern Maine streams during 1975.

ORAL PRESENTATIONS

Great Plains Fishery Workers Association, "Fisheries resources and management of the upper Missouri River and Reservoirs." Co-presented with M. Lere and G. Liknes at annual meeting, February, 1991, Lethbridge, Alberta.

Symposium on Small Hydropower and Fisheries, "An evaluation of the potential cumulative bioeconomic impacts of proposed small-scale hydro development on the fisheries of the Swan River drainage, Montana." May 2, 1985, Denver, Colorado.

Montana Chapter of American Fisheries Society, "Cumulative impacts of micro-hydro development on the fisheries of the Swan River drainage, Montana." Annual meeting, spring, 1983, Missoula, Montana.

Montana Chapter of American Fisheries Society, "On the recent appearance of opossum shrimp in Flathead Lake .... Hello Mysis, Goodbye kokanee??" Annual meeting, spring, 1982, Lewistown, Montana.

Western Association of Fish and Wildlife Agencies, "Habitat utilization by westslope cutthroat and bull trout in the Upper Flathead River." Summer, 1980, Kalispell, Montana.

Great Plains Fisheries Workers Association, "Population dynamics of the limnetic crustacean zooplankton in the Tongue River Reservoir, Montana, with notes on the feeding habits of white crappie." Winter, 1979, Billings, Montana.

Also, numerous presentations to private, federal, international, local government, and environmental groups concerning progress and findings of research and management programs.

PUBLICATIONS

Leathe, S.A., 1991. The new Missouri. Montana Outdoors, 22(4):32-37.

Leathe, S.A. and F.A. Nelson, 1986. A literature evaluation of Montana's Wetted Perimeter Inflection Point Method for deriving instream flow recommendations. Montana Department of Fish, Wildlife and Parks, Helena, Montana. 69 pages.

Leathe, S.A., M.D. Enk, and P.J. Graham, 1985. An evaluation of the potential cumulative bioeconomic impacts of proposed small-scale hydro development on the fisheries of the Swan River Drainage, Montana. Proceedings of the Symposium on Small Hydropower and Fisheries, Denver, Colorado. 11 pages.

Leathe, S.A. and M.D. Enk, 1985. Cumulative effects of micro-hydro development on the fisheries of the Swan River Drainage, Montana. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Three volumes, 410 pages.

Shepard, B.B., S.A. Leathe, T.M. Weaver, and M.D. Enk, 1984. Monitoring levels of fine sediment within tributaries to Flathead Lake, and impacts of fine sediment on bull trout recruitment. Proceedings of the Third Wild Trout Symposium, Mammoth Hot Springs, Yellowstone National Park, Wyoming. 11 pages.

Leathe, S.A. 1984. Opossum shrimp: A controversial new resident of Flathead Lake. Western Wildlands 9(4):10-14.

Leathe, S. 1983. Shrimp and salmon in Flathead Lake: Time will tell. Montana Outdoors 14(4):8-10.

Montana Department of Fish, Wildlife and Parks, 1982. A review of the State II Environmental Assessment regarding a proposed coal mine in the Canadian portion of the North Fork Flathead River drainage: Fisheries concerns. Co-authored with B. Shepard and

included in the final document forwarded to the British Columbia Provincial Government by the Governor of Montana. 43 pages.

Whalen, S.C., S.A. Leathe, R.W. Gregory, and J.C. Wright, 1982. Physiochemical limnology of the Tongue River Reservoir, Montana Hydrobiologia 89:161-176.

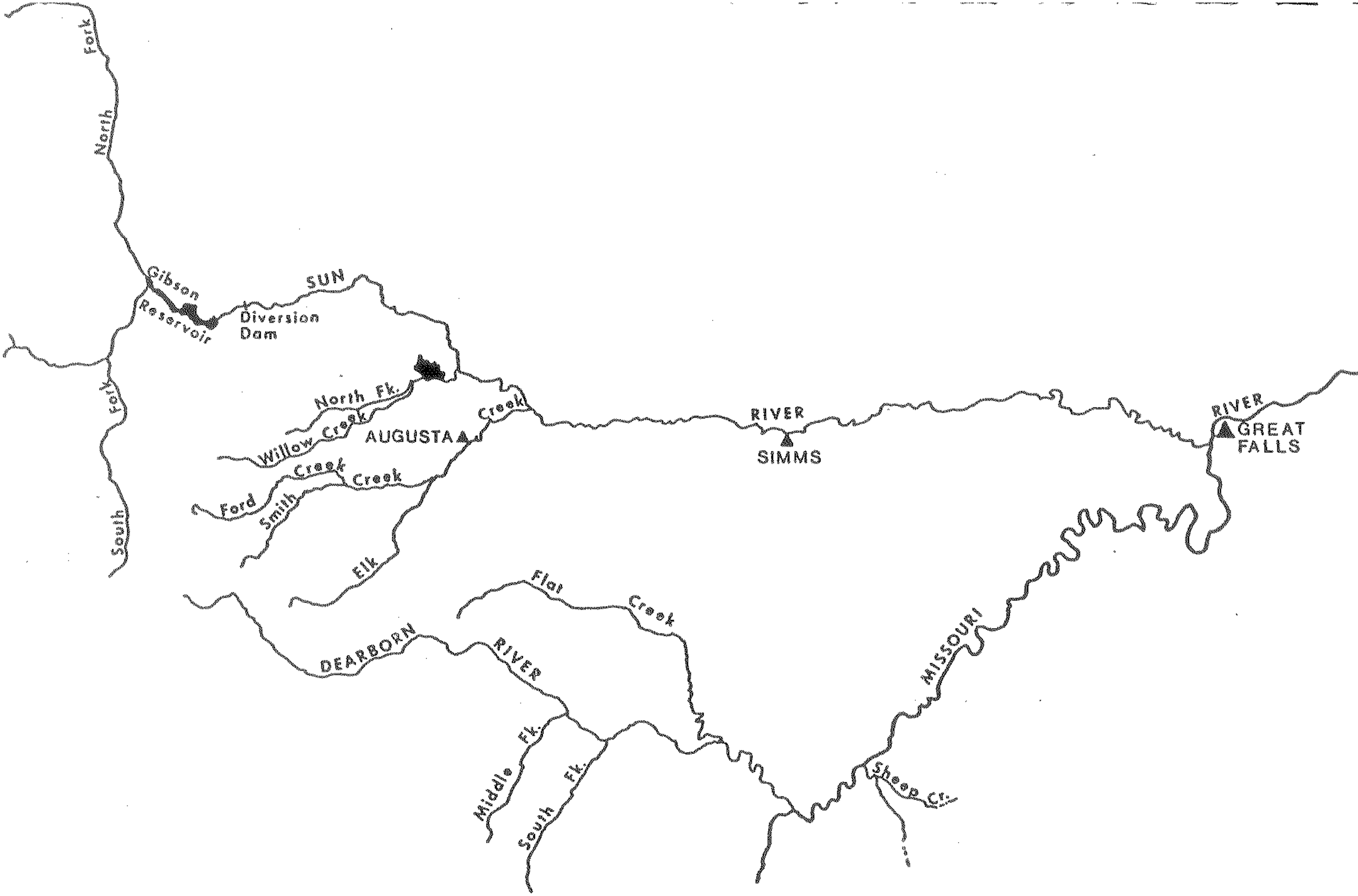
Leathe, S.A. and P. J. Graham, 1981. Flathead Lake fish food habits study, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana. 93 pages.

Leathe, S.A., 1980. Habitat utilization by westslope cutthroat and bull trout in the Upper Flathead River Basin, Montana. Proceedings of the Annual Conference of the Western Association of Fish and Wildlife Agencies 60:324-334.

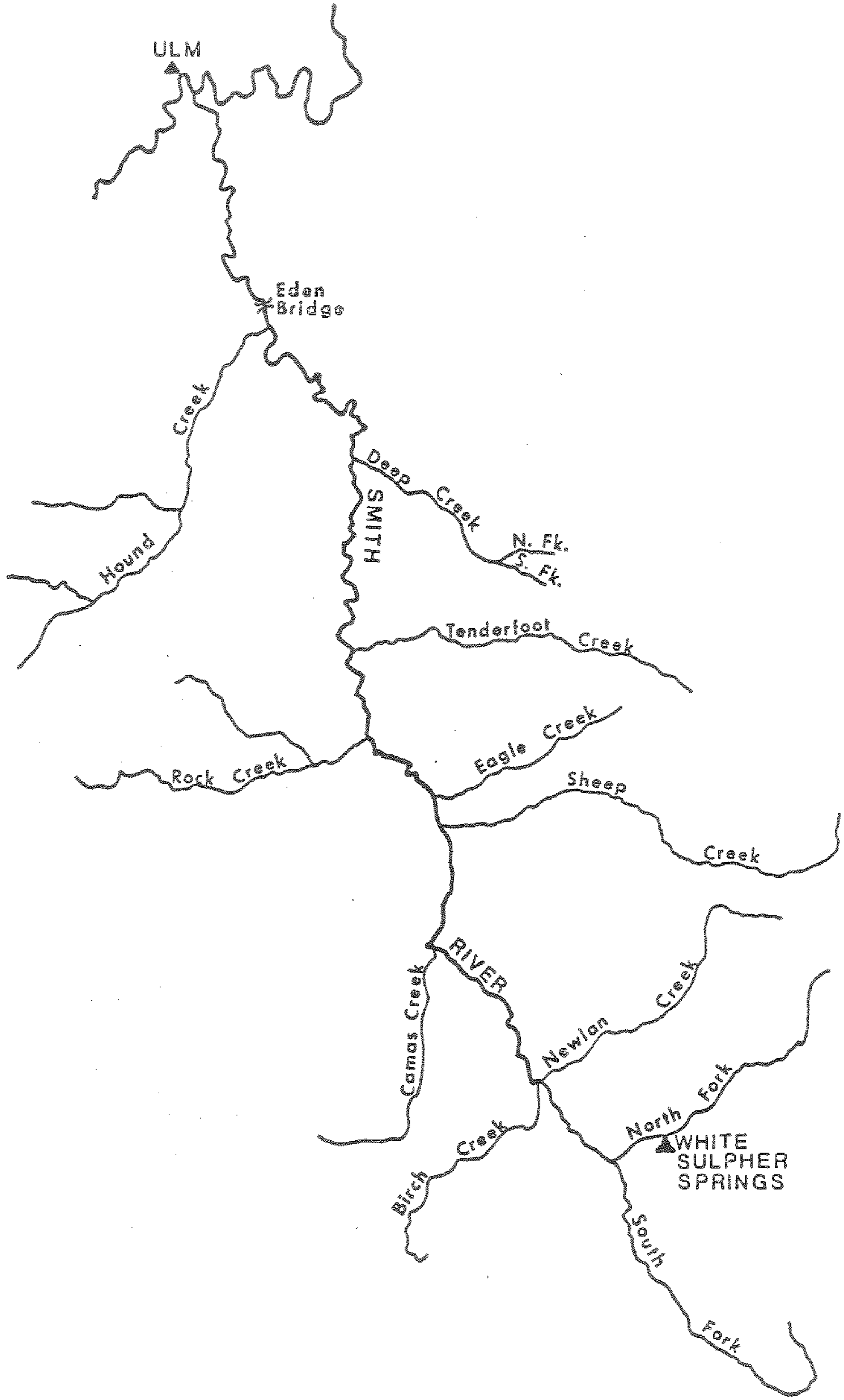
Leathe, S.A., 1980. The population dynamics and production of limnetic crustacean zooplankton in the Tongue River Reservoir, Montana. M.S. thesis, Montana State University, Bozeman, Montana. 148 pages.

Graham, P.J., D. Read, S.A. Leathe, J. Miller and K. Pratt, 1980. Flathead River Basin Fishery Study. Montana Department of Fish, Wildlife and Parks, Kalispell, Montana. 148 pages.

Also, authored and co-authored numerous progress reports concerning fisheries management projects in northcentral Montana.



Map locating the Dearborn River Drainage and Sheep Creek.



Map of the Smith River Drainage.

PRE-FILED DIRECT TESTIMONY
OF KEN FRAZER
ON BEHALF OF THE MONTANA DEPARTMENT OF
FISH, WILDLIFE AND PARKS

Q. Please state your name and business address?

A. Ken Frazer, Montana Department of Fish, Wildlife and Parks, 2300 Lake Elmo Rd., Billings, MT 59105

Q. What is your present employment?

A. I am a regional fisheries biologist with Montana Department of Fish, Wildlife and Parks, Region 5, in Billings, MT.

Q. Please state your educational background and experience.

A. I was educated in Montana public schools through high school. I received a B.A. in biology from Carroll College in 1974 and an M.S. in aquatic biology from Murray State University in Kentucky in 1981.

I began working for the department as a seasonal fisheries worker in the spring of 1974. I worked seasonally for three years assisting with field sampling on various projects throughout the Kalispell region. The majority of my work involved sampling on Flathead Lake.

I attended graduate school between 1977 and 1979 doing my thesis and working as a research assistant on a project to study trace metal contamination in fish.

I started full time with the department in June of 1980 and have been with them ever since. I worked on various projects in the Kalispell region between 1980 and 1983 with major emphasis on studying kokanee salmon in the Flathead Lake and River system and inventorying fisheries resources in the Bob Marshall/Great Bear Wilderness area. I helped set up and collect field data for a Wetted Perimeter Inflection Point (WEPT) analysis on the main Flathead River and its three forks, and was responsible for combining all instream flow requests for the Flathead River into a final report.

Between July 1983 and July 1987, I worked on a project funded by the Corps of Engineers at Fort Peck. The first part of this project was to evaluate the potential impacts to the fishery of building a re-regulating dam downstream of Fort Peck Dam. The second part of the project was to design, implement and evaluate a habitat improvement project to try and improve the rainbow trout fishery downstream from Fort Peck Dam. I used Wetted Perimeter Inflection Point analysis

Missouri River between Canyon Ferry Reservoir and Fort Peck Dam. I set up Wetted Perimeter Inflection Point transects and collected flow, water surface elevation, stream profile and fisheries data on streams in the Helena area and the upper Musselshell River Drainage. I also collected Wetted Perimeter Inflection Point data or fisheries data on other streams in cooperation with other biologists or worked as part of their crew when they needed extra help.

I completed reservation requests for all streams on which I did the major work, and did the write-ups for some stream reaches where older data was used. I reviewed, edited and organized all stream write-ups prepared for Volume 3 of the application and assembled the final draft of this volume. I prepared all drainage maps used in the application.

Q. Please describe your involvement in the collection of flow and/or fisheries data for each stream or stream reach covered in this testimony.

A. Prickly Pear Creek
Reach 1 - Summarized existing fisheries and flow data.
Prickly Pear Creek
Reach 2 - Collected Wetted Perimeter Inflection Point data and summarized existing data.
Little Prickly Pear Creek
Reach 1 - Summarized existing fisheries and flow data.
Little Prickly Pear Creek
Reach 2 - Collected Wetted Perimeter Inflection Point data, helped with some fisheries data collection.
Lyons Creek - Collected Wetted Perimeter Inflection Point and fisheries data.
Wolf Creek - Collected Wetted Perimeter Inflection Point and fisheries data.
Wegner Creek - Collected some fisheries data.
Stickney Creek - Summarized existing data.
South Fork Musselshell River - Collected Wetted Perimeter Inflection Point and fisheries data.
Alabaugh Creek - Collected Wetted Perimeter Inflection Point and fisheries data.
Cottonwood Creek (Musselshell River) - Collected Wetted Perimeter Inflection Point and fisheries data.
North Fork Musselshell River
Reach 1 - Collected Wetted Perimeter Inflection Point and fisheries data.
North Fork Musselshell River
Reach 2 - Collected Wetted Perimeter Inflection Point and fisheries data.
Checkerboard Creek - Collected Wetted Perimeter Inflection Point and fisheries data.
Spring Creek (Musselshell River) - Collected Wetted Perimeter Inflection Point and fisheries data.

Big Dry Creek - Helped collect Wetted Perimeter Inflection Point data.
Little Dry Creek - Helped collect Wetted Perimeter Inflection Point data.

Q. Please summarize in tabular form the Department's application for an instream flow reservation for each stream or stream reach covered in this testimony. Include a brief description of the reach, the amount of flow requested, the method used to determine the flow request, and the fisheries or other resource values the reservation is designed to protect.

A. I have summarized this information in Table 1 which is attached to, and is a part of this testimony.

Q. Please summarize the work you did on Alabaugh Creek as part of the reservation process.

A. Alabaugh Creek is a tributary to the South Fork Musselshell River which enters near Lennep, Montana. I helped established five Wetted Perimeter Inflection Point transects at the lower end of the reach and collected field data at each transect at three different flows. (Transects are imaginary lines across a stream channel perpendicular to the flow at which physical measurements are made of channel elevations and stream flows.) I helped conduct a two-pass estimate of the trout population in a 300-foot section of the stream during the fall of 1987. (The two-pass method is a scientific means of estimating the size of a fish population by electrofishing.)

Q. What method was used to determine the amount of flow requested for Alabaugh Creek?

A. The Wetted Perimeter Inflection Point Method

Q. Discuss any earlier work conducted on Alabaugh Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Alabaugh Creek through the reservation process.

A. Alabaugh Creek is a relatively small tributary to the South Fork of the Musselshell River. The headwaters of this stream are in the national forest. The riparian area along the entire stream is in pretty good condition. This stream supports an excellent mixed trout population of brook, rainbow and brown trout with brook trout being the dominant species. The estimated trout population in a 300-foot section sampled by electrofishing was very high at 297 trout for 300 feet of to maintain the walleye fishery. Any natural spawning that can be provided is extremely valuable. Walleye gather in the reservoir near the mouth of Big Dry Creek each spring and if spring flows allow, they will migrate up Big Dry Creek at least 30 to 35 miles and spawn. Walleye eggs, larvae and young-of-year fingerlings have all been collected from Big Dry Creek when high spring flows coincided with the normal walleye spawning period.

Q. Why is an instream flow reservation needed on Big Dry Creek?

A. Flow reservations are needed on Big Dry Creek to protect the high spring flows so that walleye from the reservoir will be able to migrate up the creek and spawn successfully during years when spring runoff coincides with the walleye spawning period. High spring flows also provide the opportunity for other fish like channel catfish to migrate upstream and spawn. This helps maintain the resident fishery as well as provide recruitment to the reservoir. Some flow must also be maintained in the stream throughout the summer to provide exchange of water between pools. This is necessary to provide oxygen and to help reduce water temperatures for resident fish and small migratory fish rearing in the stream.

Q. What flow is being requested for Big Dry Creek in the Department's application?

A. The requested flows are:

300 cfs	-- March 15 - March 31	(9,521 A.F.)
100 cfs	-- April 1 - April 30	(5,950 A.F.)
35 cfs	__ May 1 - May 31	(2,152 A.F.)
5.5 cfs	-- June 1 - October 31	(1,669 A.F.)

For a total request of 19,292 acre feet per year.

Q. What is the availability of water on Big Dry Creek?

A. The mean monthly flows as calculated by the USGS are being requested for the spring period from March 15 through May 31. These flows will normally be available less than 5 out of 10 years. The 50th percentile flow is being requested for the remainder of the summer and fall. This flow should be available 5 out of 10 years on average.

Q. Please summarize the work you did on Checkerboard Creek as part of the reservation process.

A. Checkerboard Creek is a tributary to the North Fork Musselshell River which enters near the town of Checkerboard. I helped establish four WEPT transects on Checkerboard Creek approximately one mile above the mouth, and collected field data at each transect at three different flows. I helped conduct a two-pass estimate of the trout population in a 450-

foot section of stream during the fall of 1987.

Q. What method was used to determine the amount of flow requested for Checkerboard Creek?

A. The Wetted Perimeter Inflection Point Method

Q. Discuss any earlier work conducted on Checkerboard Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Checkerboard Creek through the reservation process.

A. Checkerboard Creek supports an excellent trout fishery for a stream of its size. Both the number and size of trout present are very good. Brook trout are the predominant fish species present with lesser numbers of rainbow and brown trout. A combined population of 387 trout was estimated for a 450-foot section of stream. There were 113 trout 6 inches or longer in this section. Brook trout and rainbow over 12 inches long and brown trout over 16 inches long were collected. Approximately 50% of the Checkerboard Creek drainage is public land (Lewis and Clark National Forest) in the Castle Mountains, which is an important recreation area. Overall the stream channel is in good condition with deep holes and good instream cover. Beaver ponds provide refuge for fish and help hold water during periods when the stream is dewatered by irrigation.

Q. Why is an instream flow reservation needed on Checkerboard Creek?

A. The requested flow is necessary to maintain the existing resident trout fishery at its present level and to help prevent further dewatering of an already over-appropriated stream. Checkerboard Creek currently supports a good trout fishery despite some serious dewatering problems. It has fair public access in an important recreation area. The entire drainage is relatively undisturbed, with the lower end of the stream flowing through a scenic narrow canyon. Irrigation withdrawals already cause serious dewatering problems in the lower end of the stream. A large diversion project located near the middle of the reach in the area where the fish population work was conducted, looks like it could divert the entire summer flow to Bair Reservoir. This diversion did not look like it had been used for awhile which is probably why the fishery is in as good a shape as it is. Low flows of just over 3 cfs were measured at the WETP sight during field sampling. Any further water development on Checkerboard Creek would probably eliminate this unique fishery.

The riparian area along Checkerboard Creek provides important habitat for a number of wildlife species. Checkerboard Creek also helps maintain some flow in a seriously dewatered section of the North Fork of the Musselshell just downstream of Bair Reservoir.

Q. What flow is being requested for Checkerboard Creek in the Department's application?

A. The Department is requesting 6 cfs from January 1 through December 31. This amounts to 4,344 acre feet per year.

Q. What is the availability of water on Checkerboard Creek?

A. The fishery in Checkerboard Creek is adversely impacted by present irrigation withdrawals and the lower half of the stream could be totally dewatered if existing diversions were expanded to their capacity. The requested flow is only available during part of the year, but the requested flow should still be granted for the entire year to protect additional water if it becomes available in the future.

Q. Please summarize the work you did on Cottonwood Creek as part of the reservation process.

A. Cottonwood Creek is a tributary to the South Fork Musselshell River near the town of Martinsdale. I helped established five WEPT transects on Cottonwood Creek and collected field data at five different flows. I helped conduct a two-pass estimate of the trout population on a 500-foot section of stream.

Q. What method was used to determine the amount of flow requested for Cottonwood Creek?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on Cottonwood Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Cottonwood Creek through the reservation process.

A. Cottonwood Creek is a beautiful clear mountain stream draining the north side of the Crazy Mountains. It contains excellent fish habitat, and good clean spawning gravel. The riparian zone is in relatively good condition although livestock are grazed along most of the lower drainage. The entire drainage is privately owned so access is limited, but anglers can usually obtain access with permission.

Cottonwood Creek supports a good mixed trout fishery dominated by brown trout and rainbow trout. Brown trout over 19 inches long and rainbow over 16 inches long were collected from the electrofishing section. The creek also supports a small brook trout population and a few cutthroat trout. Large numbers of 2-4 inch rainbow and brown trout were collected in the sampling section indicating Cottonwood Creek is an important rearing stream and probably contributes fish to the Musselshell River. During years when there is flow in the lower end of Cottonwood Creek in the fall, it probably provides important spawning habitat for brown trout out of the South Fork Musselshell. The riparian zone along Cottonwood Creek provides important wildlife habitat for numerous species of wildlife, especially in the lower valley section.

Q. Why is an instream flow reservation needed on Cottonwood Creek?

A. Cottonwood Creek is already seriously dewatered by irrigation withdrawals. Three diversions withdraw water from the upper forks of the drainage and two large ditches withdraw water from the stream once it reaches the valley floor. The lower three miles of stream is totally dewatered during the irrigation season, preventing access of fish to the South Fork. An instream flow reservation is needed for Cottonwood Creek to protect the flow that still remains in the stream. Any additional diversion of water could dewater more of the stream and eliminate a valuable resident fishery as well as important spawning and rearing habitat for the South Fork. Instream flow from Cottonwood is also important for providing water to the seriously dewatered South Fork, at least during part of the year.

Q. What flow is being requested for Cottonwood Creek in the Department's application?

A. The Department is requesting 16 cfs from January 1 through December 31. This amounts to 11,583 acre feet per year.

Q. What is the availability of water on Cottonwood Creek?

A. Based on flows observed during the field investigations, it appears that the requested flows are only available during part of the year in part of the reach. A flow of 9.1 cfs was measured in the middle of the reach during field sampling, and at that time, the lower end of the stream was totally dewatered. Despite the limited availability of water, the reservation request should be granted for Cottonwood Creek to prevent further dewatering and to protect flows if additional water becomes available in the future.

Q. Please summarize the work you did on Little Dry Creek as part of the reservation process.

A. Little Dry Creek is a tributary to Big Dry Creek which flows into Fort Peck Reservoir. I helped established four WEPT transects on Little Dry Creek and collected field data at two flows, but we found that due to the stream's low gradient and shifting channel conditions during runoff events, the data were not usable.

Q. What method was used to determine the amount of flow requested for Little Dry Creek?

A. The flow requests for Little Dry Creek are the mean monthly flows or 50th percentile flows based on the Water Availability Study prepared by the USGS (Appendix A - Volume 1 of the application).

Q. Discuss any earlier work conducted on Little Dry Creek that was used as part of the reservation process.

A. Fisheries data utilized was based on sampling conducted by Jim Liebelt in Big and Little Dry creeks in 1979. Mr. Liebelt was a department fisheries biologist in Region 6 at the time.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Little Dry Creek through the reservation process.

A. Little Dry Creek is a low gradient prairie stream that flows into Big Dry Creek. Typical of many streams of this type, the flow pattern on Little Dry Creek is very irregular. Flash flood type flows can occur during spring runoff or at any time during major precipitation events. During the rest of the year, the stream is a series of interconnected pools with only limited flow between them. The resident fishery is limited to a few channel catfish and various sucker and minnow species that survive in the larger pools as long as there is some flow between pools to maintain oxygen levels.

The main fisheries value of Little Dry Creek is as a spawning and rearing stream for walleye, channel catfish and other species out of Fort Peck Reservoir. As stated above, walleye are one of the most popular game fish in Fort Peck Reservoir, but natural walleye spawning habitat is limited in the reservoir. The Department spends large amounts of money and effort trying to maintain the walleye fishery in the reservoir through an artificial stocking program. Any natural spawning that can be provided is extremely valuable. Walleye gather in the reservoir near the mouth of Big Dry Creek each spring and if spring flows allow, they will migrate up Big Dry Creek and then up Little Dry Creek to spawn. Walleye eggs, larvae and young-of-year fingerlings have all been collected from Little

Dry Creek when high spring flows coincided with the normal walleye spawning period. Young-of-year channel catfish, white and shorthead redhorse suckers, river carpsuckers and carp have also been captured in Little Dry Creek during these conditions.

Q. Why is an instream flow reservation needed on Little Dry Creek?

A. Flow reservations are needed on Little Dry Creek to protect the high spring flows so that walleye from the reservoir will be able to migrate up the creek and spawn successfully during years when spring runoff coincides with the walleye spawning period. High spring flows also provide the opportunity for other fish like channel catfish to migrate upstream and spawn. This helps maintain the resident fishery as well as provide recruitment to the reservoir. Some flow must also be maintained in the stream throughout the summer to provide exchange of water between pools. This is necessary to provide oxygen and to help reduce water temperatures for resident fish and small migratory fish rearing in the stream.

Q. What flow is being requested for Little Dry Creek in the Department's application?

A. The requested flows are:

110 cfs	-- March 15 - March 31	(3,491 A.F.)
42 cfs	-- April 1 - April 30	(2,499 A.F.)
17 cfs	-- May 1 - May 31	(1,045 A.F.)
3.5 cfs	-- June 1 - October 31	(1,062 A.F.)

For a total request of 8,097 acre feet per year.

Q. What is the availability of water on Little Dry Creek?

A. The mean monthly flows as calculated by the USGS are being requested for the spring period from March 15 through May 31. These flows will normally be available less than 5 out of 10 years. The 50th percentile flow is being requested for the remainder of the summer and fall. This flow should be available 5 out of 10 years on average.

Q. Please summarize the work you did on Little Prickly Pear Creek as part of the reservation process.

A. Little Prickly Pear Creek is a tributary to the Missouri River about two miles below Holter Dam. Reach #1 extends from the confluence of Canyon Creek to the confluence of Clark Creek 12.2 miles downstream. Reach #2 extends 13.4 miles from Clark Creek to the mouth. I helped established five WEPT transects near the lower end of Reach #2 and collected field data at each transect at four different flows. I also helped run a fish trap at the downstream end of Reach #2 to capture spawning fish migrating out of the Missouri River, and helped with spawning surveys and electrofishing in both Reaches #1 and #2 to look for fish tagged at this trap.

Q. What method was used to determine the amount of flow requested for Little Prickly Pear Creek?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on Little Prickly Pear Creek that was used as part of the reservation process.

A. The Wetted Perimeter Inflection Point work on Reach #1 was conducted by Bruce Rehwinkel, Montana Department of Fish, Wildlife and Parks, and analyzed by Fred Nelson. Fisheries data used in this application came from sampling conducted by Al Elser and Mark Lere as part of their Masters thesis work on Little Prickly Pear Creek, and from work conducted by the regional fisheries crew working out of the Region 4 office in Great Falls.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #1 of Little Prickly Pear Creek through the reservation process.

A. Reach #1 supports a good resident trout and whitefish population with brown trout being the dominant trout species. The lower end of this reach also provides important spawning and rearing habitat for rainbow and brown trout that migrate out of the Missouri River. Little Prickly Pear Creek is a very important spawning tributary for the extremely popular Blue Ribbon trout fishery in the Missouri River between Helena and Cascade.

Due to it's close proximity to Helena and the chances of catching a large trout during the spring and fall spawning runs, this reach provides an important local fishery. This entire reach flows through private land, but public access is generally allowed with permission. The riparian zone along this reach is in relatively good condition except where it was altered by railroad construction. The riparian area provides important habitat for numerous species of wildlife.

Q. Why is an instream flow reservation needed on Reach #1 of Little Prickly Pear Creek?

A. Reach #1 of Little Prickly Pear Creek currently suffers from serious dewatering problems due to irrigation demands. This is demonstrated by the fact that August is usually the lowest flow month of the year. Dewatering combined with unrecovered habitat loss that resulted from railroad construction along the stream in 1887 has resulted in a resident fishery that is below it's potential. A flow reservation is needed to at least maintain the resident fishery at its present level. Additional water withdrawal during critical times could seriously impact this resident fishery. A reservation is also needed to maintain flows to allow rainbow and brown trout spawners from the Missouri River to ascend Little Prickly Pear Creek, and to maintain rearing habitat for small fish in the stream once spawning has occurred. Many beaver dams in the drainage already inhibit spawning migrations of trout up the stream, especially in the fall. Any additional loss of flow during the spawning periods could seriously impact these spawning runs.

Q. What flow is being requested for Reach #1 of Little Prickly Pear Creek in the Department's application?

A. The Department is requesting 22 cfs from January 1 through December 31. This amounts to 15,927 acre feet per year.

Q. What is the availability of water on Reach #1 of Little Prickly Pear Creek?

A. Based on 13 years of gauge data, it appears the requested flow is below the base winter flow level for this reach. This indicates the requested flow should be available most of the time. However, due to current summer irrigation demands on this reach, flows drop well below these levels most years. Despite the limited availability of water at times, the entire reservation request should be granted for this reach to prevent any further dewatering and to provide flows if additional water becomes available in the future.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #2 of Little Prickly Pear Creek through the reservation process.

A. This reach constitutes an important recreation area between Helena and Great Falls and supports heavy public use. Public access is excellent due to the presence of a recreation road along a majority of the reach. Several picnic and parking areas are developed along the reach. This reach supports a resident trout fishery dominated by rainbow trout with lesser numbers of brown trout and brook trout. The riparian area along this reach has been extensively altered by the railroad and interstate highway that follow it. As a result, the resident fish population is well below what would be expected from this stream in it's natural state.

Little Prickly Pear Creek provides important spawning and rearing habitat for rainbow and brown trout that migrate out of the Missouri River. Based on recapture data for rainbow trout marked at a trap installed at the mouth of the Little Prickly Pear Creek in the spring of 1988, it was estimated there were 15,000 rainbow migrating up Little Prickly Pear Creek to spawn. The size of the brown trout spawning run has not been estimated, but is also large. A majority of the spawning and rearing occurs in this reach. Because of the importance of the trout fishery in the Missouri River near the confluence of Little Prickly Pear Creek, this spawning run is an extremely important resource in the area.

Q. Why is an instream flow reservation needed on Reach #2 of Little Prickly Pear Creek?

A. A flow reservation is needed to sustain the resident trout fishery at its present level and to provide water for future fishery improvement as the altered habitat along the stream slowly recovers. A reservation is also needed to maintain flows to allow rainbow and brown trout spawners from the Missouri River to ascend Little Prickly Pear Creek and spawn, and to maintain rearing habitat for small fish in the stream once spawning has occurred. Current irrigation practices totally dewater sections in the lower 2 miles of this reach during low water years. This has serious impacts on both the upstream migration of trout from the Missouri and the downstream recruitment of small trout back to the Missouri. Numerous beaver dams and a large irrigation diversion in this reach inhibit upstream movement of spawning trout during periods of low flow. This reservation would help maintain flows during critical periods and allow trout to get past these barriers to the upper sections of the stream for spawning. Flow reservations are also needed to help maintain the aesthetic value of this popular recreation area by maintaining a reasonable flow in the stream.

Q. What flow is being requested for Reach #2 of Little Prickly Pear Creek in the Department's application?

A. The Department is requesting 70 cfs from January 1 through December 31. This amounts to 50,678 cfs per year.

Q. What is the availability of water on Reach #2 of Little Prickly Pear Creek?

A. Based on limited gauge data and flows measured as part of the reservation process, it appears the requested flows are only available during part of the year. Flows as low as 18.3 cfs were measured near the mouth of the reach while collecting Wetted Perimeter Inflection Point data. One section near the lower end of the reach can be totally dewatered during extremely dry years. Despite the limited availability of water, the reservation request should be granted. This will help prevent further dewatering of the reach and will provide flows if additional water becomes available in the future.

Q. Please summarize the work you did on Lyons Creek as part of the reservation process.

A. Lyons Creek is a tributary to Little Prickly Pear Creek north of the city of Helena. I helped established five WEPT transects near the lower end of the reach and collected field data at each transect at three different flows. I helped conduct a two-pass estimate of the trout population in a 500-foot section of stream just above Interstate 15. I also conducted spawning surveys on the stream in the spring from the mouth to the first barrier, and shocked a short section or stream just downstream of this barrier to look for marked fish.

Q. What method was used to determine the amount of flow requested for Lyons Creek?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on Lyons Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Lyons Creek through the reservation process.

A. Lyons Creek is a small, clear mountain stream that flows down through a narrow valley. The riparian zone receives some grazing pressure, but is still in pretty good shape. A majority of the creek contains good instream fish habitat. Lyons Creek supports a good resident trout population of rainbow and brown trout as well as a few brook trout. A population of 243 3.0-inch and longer trout was estimated for one 500-foot section in the summer of 1987. Brown trout up to 16.0 inches long were collected. Probably the most important fishery value of Lyons Creek is as a spawning and rearing stream for rainbow and brown trout from the Missouri River and Little Prickly Pear Creek. A spawning survey conducted in the spring of 1988 found rainbow redds from the mouth up to the first beaver dam barrier located approximately 3 miles upstream. Several mature rainbow that had been marked at a trap at the mouth of Little Prickly Pear Creek were captured below this dam. No spawning survey for brown trout has been conducted in Lyons Creek, but the numerous young-of-year brown trout present in August indicated that brown trout spawning was quite heavy. Based on the large numbers of small rainbow and brown trout captured while electrofishing, Lyons Creek is a very important nursery stream for both species.

Q. Why is an instream flow reservation needed on Lyons Creek?

A. The requested flow is necessary to maintain the existing resident trout fishery, and to provide enough flow for the important spawning runs of rainbow and brown trout that migrate up Lyons Creeks out of the Missouri River. These flows will also help maintain good rearing conditions for the large number of small trout that depend on Lyons creek as a nursery area. The requested flows will also provide water for Little Prickly Pear Creek which suffers serious dewatering near it's lower end. This additional flow in Little Prickly Pear will help migrating trout get over beaver dams to reach the spawning areas in Lyons Creek. Diversion of water from Lyons Creek is limited at present. Any additional diversion would have serious impacts on this important fisheries resource.

Q. What flow is being requested for Lyons Creek in the Department's application?

A. The Department is requesting 10.0 cfs from January 1 through December 31. This amounts to 7,240 acre feet per year.

Q. What is the availability of water on Lyons Creek?

A. No gauge data are available on Lyons Creek, but based on field observations, it appears that the requested flow is only available during part of the year. A flow of 6.9 cfs was measured near the mouth during Wetted Perimeter Inflection Point analysis. Despite the limited availability of water, the entire flow request should be granted for Lyons Creek to prevent any further dewatering of this important stream and to provide flows if additional water becomes available in the future up to the amount of the reservation request.

Q. Please summarize the work you did on the North Fork of the Musselshell River as part of the reservation process.

A. The North Fork of the Musselshell River originates on the south side of the Little Belt Mountains and flows into Bair Reservoir about 15 miles east of White Sulphur Springs. Reach #1 extends from the headwaters to Bair Reservoir and Reach #2 extends from Bair Reservoir to the mouth. I helped established five WEPT transects in each reach of the North Fork, and collected field data at each transect at four flows in Reach #1 and three flows for Reach # 2. I helped conduct a two-pass estimate of the trout population in a 300-foot section of Reach #1 and a 500-foot section of Reach #2. I also helped electrofish a second 300-foot section near the middle of Reach #2.

Q. What method was used to determine the amount of flow requested for the North Fork of the Musselshell?

A. The Wetted Perimeter Inflection Point Method was used for both reaches.

Q. Discuss any earlier work conducted on the North Fork of the Musselshell that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #1 of the North Fork of the Musselshell River through the reservation process.

A. The stream in this reach is a small, clear stream flowing through a variety of habitat types. It originates in a narrow mountain valley, then flows out onto a rolling sagebrush plain. Instream fisheries habitat is good throughout this reach including an extensive complex of beaver dams and willows where the stream first reaches the valley floor. This reach supports an excellent brook trout population for a stream of its size and offers a variety of fishing opportunities in an area where stream fishing for trout is limited. A population estimate near the lower end of the reach showed over 200 brook trout in a 300-foot section of stream with brook trout up to 10.8 inches long being captured. A few rainbow trout were also collected. They were probably upstream migrants from plants made in Bair Reservoir. The riparian area along the upper part of the reach provides important habitat for a variety of wildlife species.

Q. Why is an instream flow reservation needed on Reach #1 of the North Fork?

A. This reach already suffers from serious dewatering due to irrigation. Water is diverted from the two headwater streams entering the reach as well as from the upper end of the reach itself. The average daily discharge for 36 years of record (1940 - 1976) recorded at a USGS gauge located near the lower end of the reach was 12.2 cfs. During the Wetted Perimeter Inflection Point analysis, the highest flow that was measured was only 9.6 cfs. The lowest flow measured was only 1.8 cfs. A flow reservation is needed on this reach to help sustain the existing resident trout population and to prevent any further dewatering of this reach. Flows already reach critically low levels in this reach. Any additional diversion of water would probably eliminate this fishery.

Q. What flow is being requested for Reach #1 of the North Fork in the Department's application?

A. The Department is requesting 3 cfs from January 1 through December 31. This amounts to 2,172 acre feet per year.

Q. What is the availability of water on Reach #1 of the North Fork?

A. Based on the gauge data that is available for this reach, it appears that the requested flow should be available most of the time. However, based on field observations during the Wetted Perimeter Inflection Point analysis, even the requested small amount of flow is not available during the irrigation season in dry years. Despite the limited availability of water at times, the reservation request should be granted for this reach to maintain a minimum flow in the stream and to provide flows if additional water becomes available in the future.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #2 of the North Fork of the Musselshell River through the reservation process.

A. This reach of the North Fork has the potential of being an excellent trout fishery, but due to numerous man caused problems it supports a very marginal fishery. The entire flow in this reach is controlled by Bair Reservoir. Flow patterns are totally unnatural, and extensive irrigation development causes serious dewatering problems as well as siltation and water quality problems as a result of irrigation returns. Brown trout were the only game fish species found in this reach which is probably a reflection of the observed water quality problems. A population estimate made near the lower end of the reach showed only 44 brown trout in a 500-foot section.

The riparian zone along most of this reach is in fair to good condition and the stream contains some excellent fisheries habitat with overhanging banks, deep holes and good instream cover. Despite the low fish populations, this reach receives considerable use by local anglers.

Q. Why is an instream flow reservation needed on Reach #2 of the North Fork?

A. This reach already suffers serious dewatering problems due to the unnatural release pattern from Bair Reservoir and the extensive irrigation withdrawals that occur along it's entire length. This reach has the potential of supporting an excellent trout fishery if flow conditions and irrigation practices along the stream were changed. The flow reservation is needed to provide some consistent flow downstream of Bair Reservoir, to help sustain the existing resident fishery, to prevent any further diversion of water in this already over-appropriated stream reach and to provide flows if additional water becomes available in the future.

Q. What flow is being requested for Reach #2 of the North Fork of the Musselshell in the Department's application?

A. The Department is requesting 16 cfs from January 1 through December 31. This amounts to 11,583 acre feet per year.

Q. What is the availability of water in Reach #2 of the North Fork?

A. Much of the flow in this reach is controlled by releases from Bair Reservoir, so water availability is dependent upon reservoir levels and how much of that water is already committed. Based on field observations and flows measured during the Wetted Perimeter Inflection Point analysis, the requested flow level is only available during part of the year. The flow request should be granted for this reach to establish a minimum flow level needed downstream of Bair Reservoir when water is available, and to protect flows if additional water becomes available in the future.

Q. Please summarize the work you did on Prickly Pear Creek as part of the reservation process.

A. Prickly Pear Creek originates in the Elkhorn Mountains south of Helena, and flows about 28 miles before it enters Lake Helena, an arm of Hauser Reservoir. Reach #1 extends from Rabbit Gulch to East Helena. Reach #2 extends from East Helena to the mouth. I helped establish three WEPT transects on Reach #2 near the confluence of Ten Mile Creek, and collected field data at each transect at four different flows.

Q. What method was used to determine the amount of flow requested for Prickly Pear Creek?

A. The Wetted Perimeter Inflection Point Method was used for both reaches.

Q. Discuss any earlier work conducted on Little Prickly Pear Creek that was used as part of the reservation process.

A. The Wetted Perimeter Inflection Point analysis for Reach #1 was conducted by Bruce Rehwinkel who was the department's regional fisheries biologist in Townsend at the time. He established five WEPT transects and collected field data at each transect at three different flows. Mr. Rehwinkel also collected the fisheries data that was used for Reach #1. He electrofished and conducted population estimates on several sections in this reach. Fisheries data for Reach #2 were collected by Rod Berg and Mark Lere. They conducted survey electrofishing on several sections of this reach in 1981 and 1982.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #1 of Prickly Pear Creek through the reservation process.

A. This reach originates within the Helena National Forest in a popular recreation area outside of Helena, and flows through some scenic mountain country before reaching the valley floor. Much of this reach has been seriously impacted by man's activities which have altered much of the natural stream channel. There have also been water quality problems from mining activities in this reach in the past. Despite these problems, this reach is still quite scenic and supports a relatively good resident trout population. A population estimate conducted in 1987 showed 298 rainbow, 3.5 inches and longer, and 79 brown trout 4.5 inches and longer in one 3,300 section in the middle of the reach. The upper section of this reach contains a good brook trout population. Due to past problems, the fishery in this reach is probably well below its potential. Many of the water quality problems have been cleaned up in recent years, and some habitat improvement work has been done to try and help the stream recover. Besides the resident fishery, this reach also provides spawning habitat for rainbow and brown trout that migrate out of the Lake Helena-Hauser Reservoir complex. This reach has an important recreational value due to it's close proximity to a relatively large population area, and the availability of public access across Forest Service property.

Q. Why is an instream flow reservation needed on Reach #1 of Prickly Pear Creek?

A. A flow reservation is needed on this reach to help sustain the existing resident fishery, and to provide necessary flows for the rainbow and brown trout spawning runs out of the Lake Helena-Hauser Reservoir complex. These flows will also be important in allowing improvement of the resident trout population, as water quality and habitat conditions are improved in the future. This reservation is also necessary to protect flows, while they are still available in this reach, from the water demands of an expanding human population in the Helena area.

Q. What flow is being requested for Reach #1 of Prickly Pear Creek in the Department's application?

A. The Department is requesting 22 cfs from January 1 through December 31. This amounts to 15,927 acre feet per year.

Q. What is the availability of water in Reach #1 of Prickly Pear

Creek?

A. Most major irrigation demands on Prickly Pear Creek occur in the lower reach. The requested flow of 22 cfs for Reach #1 should be available under normal water conditions.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Reach #2 of Prickly Pear Creek through the reservation process.

A. The resident fish population in this reach is well below it's potential due to serious dewatering and siltation problems. This reach supports a resident population of brown and rainbow trout. Population numbers have not been quantified. Brown and rainbow trout from the Lake Helena-Hauser Reservoir complex also migrate through this reach to spawn. This reach contains a lot of good fish habitat. With better flow conditions and improved irrigation practices to reduce sediment input, this reach has the potential to become an excellent trout fishery. The close proximity to a large population of people in the Helena valley puts a high recreational value on this reach.

Q. Why is an instream flow reservation needed on Reach #2 of Prickly Pear Creek?

A. This reach is already seriously dewatered due to irrigation demands in the lower Helena valley. Large sections of the reach are totally dewatered each year. The resident fish population is only a fraction of what it should be. An instream flow reservation will help sustain the resident trout population and prevent flows from worsening at critical times when rainbow and brown trout are trying to migrate upstream to spawn. A reservation would also protect flows up to the amount of the reservation request in case additional water becomes available in the future. Additional flows are needed if the fishery in this reach is ever to reach it's full potential.

Q. What flow is being requested for Reach #2 of Prickly Pear Creek in the Department's application?

A. The Department is requesting 30 cfs from January 1 through December 31. This amounts to 21,719 acre feet per year.

Q. What is the availability of water in Reach #2 of Prickly Pear Creek?

A. The requested flow is only available during part of the year in most of this reach. Some sections of the reach are totally dewatered every year during part of the irrigations season. Despite the limited availability of water, the reservation should be granted to protect flows if additional water becomes available in the future.

Q. Please summarize the work you did on the South Fork of the Musselshell River as part of the reservation process.

A. The South Fork of the Musselshell River is a headwaters tributary to the Musselshell near the town of Lennep. I helped establish five WEPT transects just upstream from the Martinsdale diversion, and helped collect field data at each transect at three different flows. I conducted a two-pass estimate of the trout population in a 650-foot section near the lower end of the reach, and helped with survey shocking on a 350-foot section near the upper end of the reach.

Q. What method was used to determine the amount of flow requested for the South Fork?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on the South Fork of the Musselshell that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on the South Fork of the Musselshell through the reservation process.

A. The South Fork is a nice stream that flows through a wide valley between two small mountain ranges. The riparian zone is in good shape along most of the stream, and fish habitat is generally good to excellent. Almost the entire South Fork is seriously impacted by dewatering. Serious dewatering occurs during the irrigation season in many sections of the stream. Low flows combined with warm irrigation return flows affect water temperatures. Irrigation return flows also cause serious siltation and water quality problems. These situations affect the resident fish population which is well below what it would be for this stream in its natural state. Shocking near the lower end of the reach captured only brown trout and suckers. The fish habitat was excellent in this section, but only 66 brown trout were estimated to occur in a 650-foot section of stream. The fish that were captured included brown trout up to 17.9 inches long being collected. Survey electrofishing in the upper end of the reach captured brown, rainbow and brook trout. Brown trout over 24 inches and rainbow over 15 inches long were captured, but again, numbers were low for the habitat that was available. The South Fork could provide spawning habitat for brown trout migrating out of the Musselshell river, but in most years the Martinsdale diversion and the dewatered stream section below act as a barrier to any upstream migration.

Q. Why is an instream flow reservation needed on the South Fork?

A. The South Fork already suffers from serious dewatering due to irrigation withdrawals. Flow reservations are needed to help maintain the resident trout fishery that does exist in this stream, and to protect flows that could be used to improve this fishery if any additional water up to the amount of the reservation request becomes available in the future. A flow reservation is also needed to help prevent any further water temperature increases in the South Fork so trout can survive.

Q. What flow is being requested for the South Fork of the Musselshell in the Department's application?

A. The Department is requesting 30 cfs from January 1 through December 31. This amounts to 21,719 acre feet per year.

Q. What is the availability of water on the South Fork of the Musselshell?

A. Based on USGS gauge data collected between 1941 and 1979, the requested flow should be available most of the time. However, based on field observations during the Wetted Perimeter Inflection Point analysis, the requested flow is only available during part of the year. A flow of only 8.3 cfs was measured near the lower end of the reach. Despite the limited availability of water, the reservation request should be granted for the South Fork to protect flows up to the amount of the reservation request if additional water becomes available in the future.

Q. Please summarize the work you did on Spring Creek as part of the reservation process.

A. I helped establish five Wetted Perimeter Inflection Point transects on Spring Creek and collected field data at each transect at three different flows. I conducted a two-pass estimate of the trout population on a 500-foot section of stream just downstream of Whitetail Creek.

Q. What method was used to determine the amount of flow requested for Spring Creek?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on Spring Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Spring Creek through the reservation process.

A. Spring Creek is a small mountain stream in the Little Belt Mountains with important recreational value. It is a tributary to the North Fork Musselshell River almost five miles below Bair Reservoir, which is located about 15 miles east of White Sulphur Springs. Much of the stream flows through national forest land and Forest Service roads provide good access to the drainage. The Forest Service maintains two designated recreation sites along the stream. The upper part of this stream contains good fish habitat and supports a good mixed brook trout-rainbow trout fishery. Spring Creek appears to provide an important fishery for local anglers and for recreationists using the Forest Service sites. A combined population of 274 trout was estimated for the 500-foot shocking section in the upper reach of Spring Creek. Flow in the lower 5 miles of stream is intermittent as the entire flow goes underground in some areas.

Q. Why is an instream flow reservation needed on Spring Creek?

A. The requested flow is necessary to maintain the existing resident trout fishery at it's present level and to protect the recreational quality of this stream. The upper end of Spring Creek does not appear to be impacted by irrigation at present.

Q. What flow is being requested for Spring Creek in the Department's application?

A. The Department is requesting 8 cfs from January 1 through December 31. This amounts to 5,792 acre feet per year.

Q. What is the availability of water on Spring Creek?

A. Based on the flows observed during the Wetted Perimeter Inflection Point analysis, the requested flow in the upper reach of the stream during a dry year is only available during part of the year. Large sections of stream go dry naturally during the summer in the lower five miles of the reach as flows go underground. Despite the limited availability of water during part of the year, the entire flow request for Spring Creek should be granted to maintain present flow levels and to protect flows if additional water becomes available in the future.

Q. Please summarize the work you did on Stickney Creek as part of the reservation process.

A. Stickney Creek is a tributary to the Missouri River about three miles downstream from the small community of Craig. My involvement with Stickney Creek was in writing up the available data for the application, and in helping analyze USGS flow data to determine the flow request.

Q. What method was used to determine the amount of flow requested for Stickney Creek?

A. The flows requested for Stickney Creek are the mean monthly flows as determined by the USGS. These flows are requested only for the 4-month spring runoff period.

Q. Discuss any earlier work conducted on Stickney Creek that was used as part of the reservation process.

A. A short section of stream near the mouth was sampled by electrofishing in 1981 to look for spawning rainbow. This work was conducted by Rod Berg and his field crew. Mr. Berg was a department fisheries biologist working on the Missouri drainage at the time.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Stickney Creek through the reservation process.

A. Stickney Creek is an important spawning tributary for rainbow trout migrating out of a very popular Blue Ribbon section of the Missouri River.

Q. Why is an instream flow reservation needed on Stickney Creek?

A. Flows normally go underground near the mouth of Stickney Creek during most of the year, but in wet years, spring runoff provides surface flow in this area during the rainbow spawning period. The flow reservation being requested for Stickney Creek is needed to maintain natural spring flows during good water years so spawning rainbow are able to migrate through the normally dewatered section and reach the perennial flow section upstream. These high spring flows are also important in maintaining the stream channel and the riparian zone along the stream.

Q. What flow is being requested for Stickney Creek in the Department's application?

A. The requested flows are:

April 1 - April 30 -- 7 cfs (417 A.F.)
May 1 - May 31 -- 34 cfs (2,091 A.F.)
June 1 - June 30 __ 35 cfs (2,083 A.F.)
July 1 - July 31 __ 7 cfs (430 A.F.)

This amounts to 5,021 acre feet per year.

Q. What is the availability of water on Stickney Creek?

A. Based on USGS calculations, the flows being requested will be available less than 5 years in 10, however it is essential that this reservation be granted to maintain spawning flows near the mouth of Stickney Creek during those good water years, and to help maintain the channel and riparian area along the lower section of stream.

Q. Please summarize the work you did on Wegner Creek as part of the reservation process.

A. Wegner Creek is a tributary to the Missouri River which enters just downstream from the town of Craig. I had a seasonal employee walk the lower three miles of Wegner Creek in the spring of 1988 to look for spawning rainbow. I wrote up the available data for the reservation and helping analyze the USGS data to determine the flow request.

Q. What method was used to determine the amount of flow requested for Wegner Creek?

A. The flows requested for Wegner Creek are the mean monthly flows as determined by the USGS. These flows are only requested for the 4-month spring runoff period.

Q. Discuss any earlier work conducted on Wegner Creek that was used as part of the reservation process.

A. Rod Berg and his crew electrofished a short section near the mouth of Wegner Creek in the spring of 1981 to look for mature rainbow. Steve Leathe reported a large concentration of rainbow redds in the Missouri River near the mouth of Wegner Creek while flying the river in the spring of 1988.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Wegner Creek through the reservation process.

A. Wegner Creek is an important spawning tributary for rainbow trout migrating out of a very popular Blue Ribbon section of the Missouri River.

Q. Why is an instream flow reservation needed on Wegner Creek?

A. Flows normally go underground in the lower 5 miles of Wegner Creek during most of the year, but in wet years, spring runoff provides surface flow in this area during the rainbow spawning period. The flow reservation being requested for Wegner Creek is needed to maintain natural spring flows during good water years so spawning rainbow are able to migrate through the normally dewatered section and reach the perennial flow section upstream. These high spring flows are also important in maintaining the stream channel and the riparian zone along the stream.

Q. What flow is being requested for Wegner Creek in the Department's application?

A. The requested flows are:

April 1 - April 30	--	7 cfs	(476 A.F.)
May 1 - May 31	--	41 cfs	(2,521 A.F.)
June 1 - June 30	__	38 cfs	(2,261 A.F.)
July 1 - July 31	__	8 cfs	(492 A.F.)

This amounts to 5,750 acre feet per year.

Q. What is the availability of water on Wegner Creek?

A. Based on USGS calculations, the flows being requested will be available less than 5 years in 10, however it is essential that this reservation be granted to maintain spawning flows near the mouth of Wegner Creek during good water years, and to help maintain the channel and riparian area along the lower section of stream.

Q. Please summarize the work you did on Wolf Creek as part of the reservation process.

A. Wolf Creek is a tributary to Little Prickly Pear Creek which enters at the town of Wolf Creek. I helped establish five Wetted Perimeter Inflection Point transects on Wolf Creek and helped collect field data at each transect at three different flow. I helped conduct a two-pass estimate of the trout population on a 500-foot section of stream in the fall of 1987 and conducted a spawning survey and did some survey electrofishing for spawning rainbow in the spring of 1988.

Q. What method was used to determine the amount of flow requested for Wolf Creek?

A. The Wetted Perimeter Inflection Point Method.

Q. Discuss any earlier work conducted on Wolf Creek that was used as part of the reservation process.

A. No other data were used.

Q. Please describe the fisheries values and any other resource values the Department is trying to protect on Wolf Creek through the reservation process.

A. Wolf Creek supports a good mixed resident trout population containing rainbow, brown and brook trout. There was an estimated combined population of 233 trout greater than 3.0 inches in length in a 500-foot section sampled in the fall of 1987. Wolf Creek is also an important spawning tributary for rainbow and probably brown trout out of the Missouri River and Little Prickly Pear Creek, and it provides important rearing habitat for small rainbow and brown trout.

Q. Why is an instream flow reservation needed on Wolf Creek?

A. The requested flow is needed to sustain the existing resident trout population at its present level, to maintain the important rainbow and brown trout rearing habitat in the stream and to maintain enough flow to allow spawning trout to migrate up Wolf Creek from Little Prickly Pear Creek. Irrigation water is already diverted from Wolf Creek at several points and the lower end of the stream is often seriously dewatered during the irrigation season. Many small trout were observed in an irrigation ditch that diverts water about a mile and a half upstream from the mouth. Many of these small trout were probably lost to the system in the irrigation ditch. This reservation is needed to prevent any further dewatering of Wolf Creek. Any additional dewatering could result in the loss of an important source of fish recruitment to the Missouri River fishery as well as the loss of a good resident small stream fishery.

Q. What flow is being requested for Wolf Creek in the Department's application?

A. The Department is requesting 7.0 cfs from January 1 through December 31. This amounts to 5,068 acre feet per year.

Q. What is the availability of water on Wolf Creek?

A. It appears that Wolf Creek is already over-appropriated and that the requested flow is only available during part of the year. A flow of 4.4 cfs was measured during the Wetted Perimeter Inflection Point analysis. Despite the limited availability of water, the reservation request should be granted for Wolf Creek to maintain the spawning and rearing that is occurring on the stream and to protect flows if additional water becomes available in the future up to the amount of the reservation request.

I, Ken Frazer, being first duly sworn, states that the foregoing testimony is true.

DATED this 30 day of October, 1991.

Ken Frazer
Ken Frazer

Subscribed and sworn to before me this 30th day of October, 1991.

(NOTARY SEAL)

Debra McRae
Notary Public for the
State of Montana
Residing at Helena, Montana
My Commission Expires May 14, 1994

BIOGRAPHY
KEN FRAZER

PERSONAL:

Born February 28 1952, Billings, MT

EDUCATION:

B.A. Biology, Carroll College, 1974
M.S. Aquatic Biology, 1981

EXPERIENCE:

4/1989 - Present: Montana Department of Fish, Wildlife and Parks (FWP). Regional Fisheries Biologist. Responsibilities include management of the fisheries on the Bighorn River, Bighorn Lake, the Musselshell River, the lower Yellowstone River, many of the smaller lakes and all the small warm water ponds in the region; directing the River Ranger position on the Bighorn River and walleye egg taking on Bighorn Lake; working with local conservation districts and conducting 310 and SBA inspections on regional waters.

7/87 - 4/89: Montana Department of Fish, Wildlife and Parks. Missouri River Instream Flow Coordinator. Responsibilities included coordinating the work efforts of all parties involved in the Department's application on the Missouri River between Canyon Ferry Reservoir and Fort Peck Dam; setting up Wetted Perimeter Inflection Point transects and collecting flow, water surface elevation, stream profile and fisheries data on numerous streams in the Helena area and the upper Musselshell River Drainage; collecting Wetted Perimeter Inflection Point data or fisheries data on other streams in cooperation with other biologists.

5/85 - 7/87: Montana Department of Fish, Wildlife and Parks. Regional Fisheries Biologist. Designed fisheries study for Fort Peck tailwater area based on problems determined during previous contract work. Prepared proposal and budget and obtained funding from Corps of Engineers (COE). Directed fisheries study working on improvement of both trout and warm water fisheries through improved water level management and habitat enhancement. Managed budget for study, worked with COE to obtain improved discharges from Fort Peck Dam, designed, implemented and evaluated habitat improvement projects, and wrote monthly and annual reports.

7/83 - 4/85: Montana Department of Fish, Wildlife and Parks. Regional Fisheries Biologist. Supervised study to evaluate the fishery in the Missouri River and dredge cuts below Fort Peck Dam and to identify potential impacts of a proposed reregulation dam on this fishery. Duties included: supervising temporary employees, developing research goals, directing and assisting in field sampling, analyzing data and writing monthly and final reports. Worked closely with the COE in evaluating several proposed plans for increasing power production at Fort Peck Dam, identified game and forage fish present, located important habitat areas, determined seasonal movement patterns and identified the effects that fluctuating water levels and habitat loss resulting from various rereg proposals would have on fish and plankton in the area. Major game species studied included: walleye, sauger, northern pike, paddlefish and rainbow trout. Also assisted in collection of channel profile data for a number of instream flow transects on the Missouri River below Fort Peck Dam.

9/81 - 7/83: Montana Department of Fish, Wildlife and Parks. Fisheries Fieldman. Assisted on study investigating factors effecting kokanee spawning along the shoreline of Flathead Lake. Duties included: designing and building sampling equipment, locating kokanee spawning areas using boats and SCUBA, marking and mapping spawning areas,monitoring egg survival and fry emergence from natural and experimental redds and evaluating groundwater and gravel movement, groundwater D.O. and lake levels in relation to embryo survival. Assisted in data analysis and figure preparation for annual reports. Was also responsible for collection, analysis and write-up of data for a zooplankton monitoring report as part of this study.

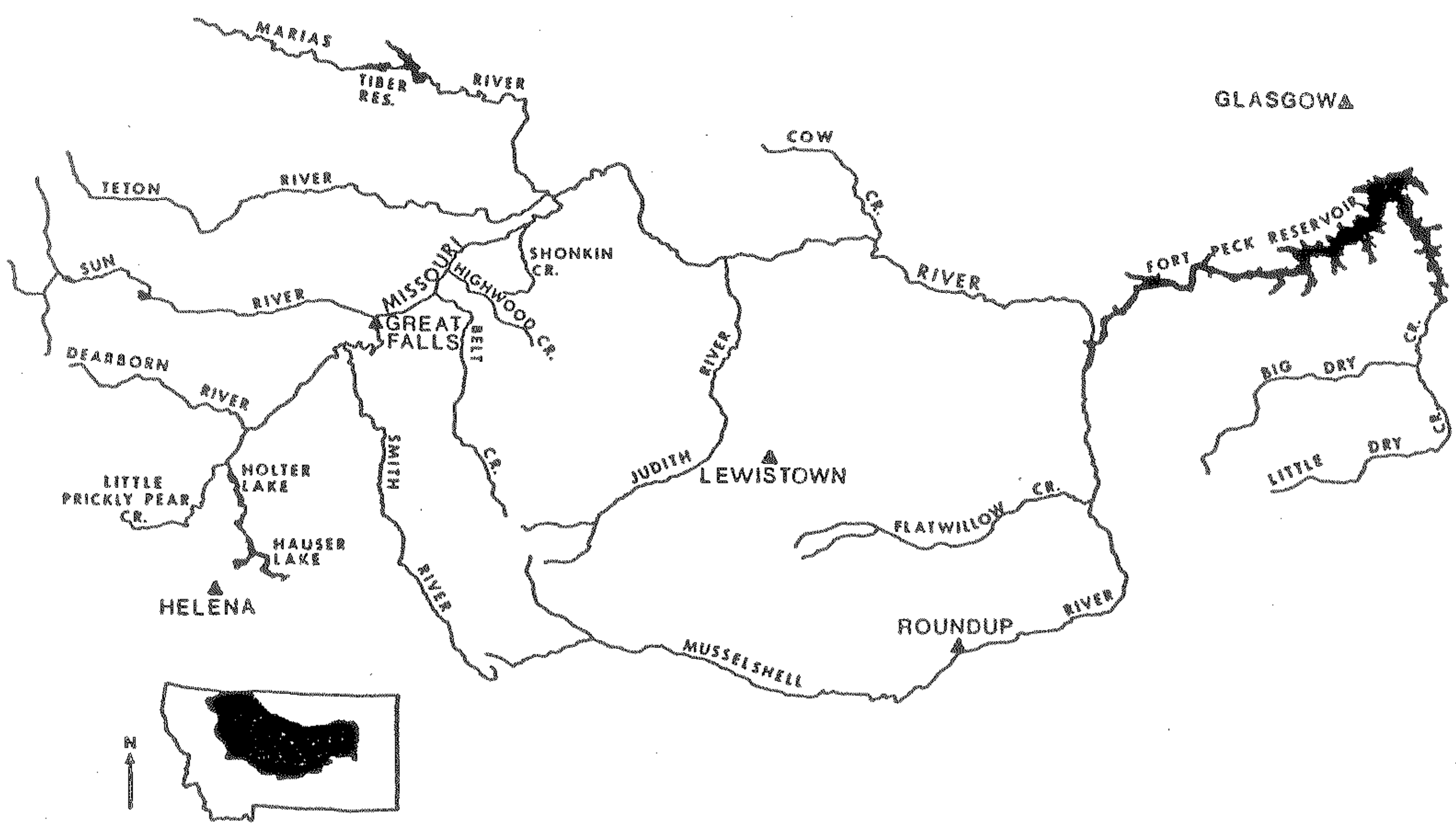
4/81 - 9/81: Montana Department of Fish, Wildlife and Parks. Fisheries Fieldman. Organized and updated all instream flow recommendations for the Flathead drainage and combined in a final report. Coordinated and ran a creel census and recreational use study on Flathead Lake and the Upper Flathead drainage. Duties included: directing and supervising field crews, developing random sampling schedule and coordinating work schedules for shoreline, boat, and aerial counting and interviewing crews, training crew members, maintaining car counters, assisting with counts and interviews and processing collected data.

6/80 - 4/81: Montana Department of Fish, Wildlife and Parks. Fisheries Fieldman. Worked as a crew leader on study to evaluate and inventory fisheries resources in the Middle Fork of the Flathead River drainage. Most work was in the Bob Marshall and Great Bear Wilderness areas requiring approximately 60 days of backpacking and wilderness camping. Duties included: measuring and recording habitat features on numerous stream reaches in the drainage, snorkeling sections of each reach to identify fish species present and to look at size and age structure, walking streams in the fall to count bull trout redds, and setting up and collecting necessary data on several transects along the river for use in establishing minimum instream flows using the Wetted Perimeter Inflection Point Method. Laboratory work included reading fish scales and otoliths, analyzing stomach samples, organizing habitat and snorkel data for entrance into a computer, analyzing data and working on figures for an annual report.

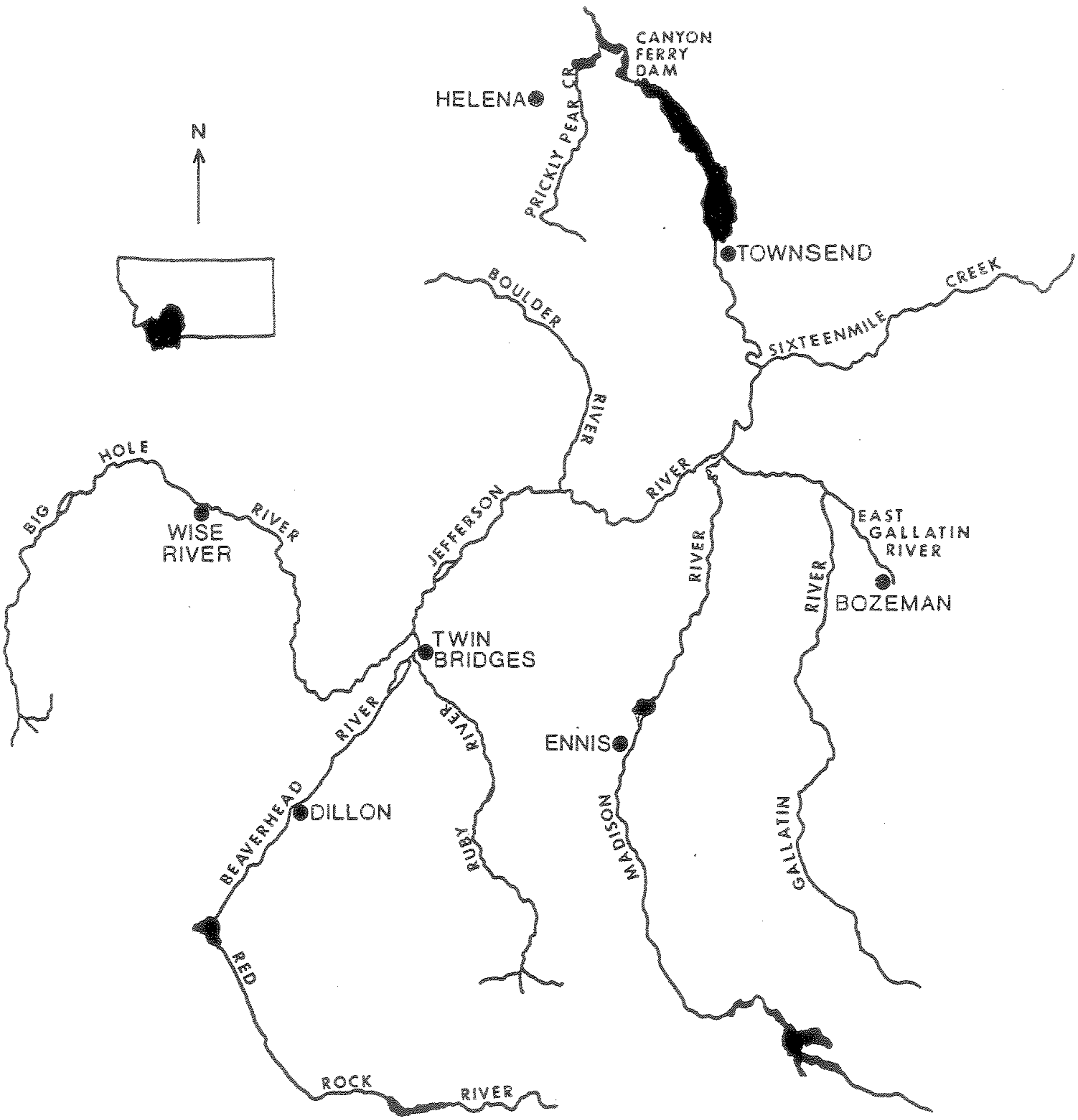
6/79 - 6/80: Montana Department of Fish, Wildlife and Parks. Fisheries Fieldman. Worked on study to evaluate the effects of Hungry Horse Dam on the fish and invertebrate fauna of the Flathead River. Duties included: designing and building necessary sampling equipment, monthly sampling of fish and invertebrates from various sites along the river, picking and identifying benthic samples and monitoring seasonal fish population trends in the river. Other work included: Identifying kokanee spawning areas in the river, studying kokanee spawning success and incubation mortality and trying to relate these findings to the flow records from Hungry Horse Dam, monitoring cutthroat migration in the river using tagging and biotelemetry, helping set up and collect field data on numerous transects in the Flathead drainage for establishing minimum flows using the Wetted Perimeter Inflection Point Method. Analyzed data and worked on tables and figures for annual progress report.

9/77 - 6/79: Murray State University. Graduate Research Assistant. Worked on project to study the origin, distribution and bioaccumulation of selenium in two large reservoir systems. Duties included: collection of fish, water and sediment samples on a monthly basis, preparing samples for analysis and assisting in laboratory analysis using atomic absorption spectroscopy. Also analyzed data and wrote reports for the project.

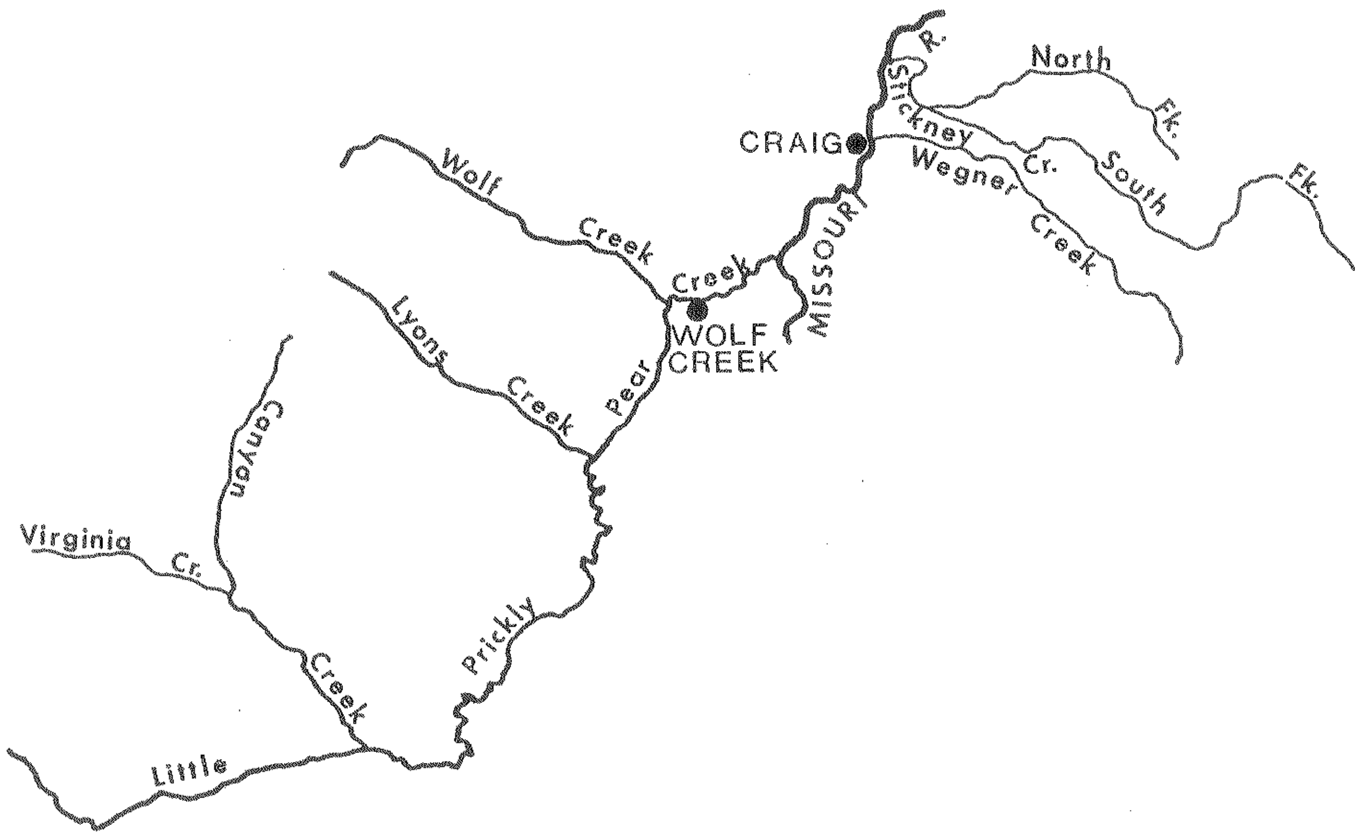
5/76 - 12/76, 6/75 - 12/75, 5/74 - 9/74: Montana Department of Fish, Wildlife and Parks. Fisheries Laborer. Primary commitment was to the Flathead Lake Fisheries Study on a 35-foot research boat. Duties included: preparing and launching wooden boat each spring, maintaining boat and all related equipment in good order, and assisting in all experimentation and research done on the boat. Used specialized nets and other sampling equipment to study the fish populations of Flathead Lake and to gather limnological data at standard stations around the lake. Worked with newly developed hydro-acoustic echo sounding and recording system, helped develop a midwater trawl to use in conjunction with this electronic gear, worked as member of a kokanee egg-taking crew, and assisted with other fisheries projects throughout the region.



Map of the Missouri River Basin from Canyon Ferry Dam to Fort Peck Dam.



Map of the Missouri River Basin upstream from Canyon Ferry Dam.



Location map for the Little Prickly Pear Creek drainage, Wegner and Stickney creeks.

Stickney Cr.	Confluence of N. & S. Forks to mouth (3.2 mi)	7 cfs (4/1-4/30) 34 cfs (5/1-5/31) 35 cfs (6/1-6/30) 7 cfs (7/1-7/31) (5,021 AF/yr)	mean monthly flows (4 months)	Spawning tributary for rainbow out of Missouri River.
Wegner Cr.	Headwaters to mouth (13.3 mi)	8 cfs (4/1-4/30) 41 CFS (5/1-5/31) 38 CFS (6/1-6/30) 8 CFS (7/1-7/31) (5,750 AF/yr)	mean monthly flows (4 months)	Spawning tributary for rainbow out of Missouri River.
Wolf Cr.	Headwaters to mouth (11.6 mi)	7 cfs (5,068 AF/yr)	wetted perimeter	Good mixed resident trout fishery with 233 trout > 3" long in 500' of stream. Important spawning & rearing tributary for rainbow & brown trout.

PREFILED TESTIMONY OF RODNEY BERG
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

Q. Please state your name, present employment and office address.

A. Rodney Berg. I am employed by the Montana Department of Fish, Wildlife and Parks as a fisheries biologist. My current office address is: 3201 Spurgin Road, Missoula, MT, 59801.

Q. What is your educational and employment experience?

A. I graduated in 1971 from the University of Wisconsin at Stevens Point with a B.S. degree in Fisheries Management. I received a M.S. degree in Fish and Wildlife Management from Montana State University in 1973. After graduating, I worked for Montana State University from March, 1973, through June, 1974, where I supervised a research project dealing with effects of highway construction on the St. Regis River in west central Montana. From July 1, 1974, to the present time I have been employed by the Montana Department of Fish, Wildlife and Parks. During this time, I have conducted fisheries investigations for the Department on the upper Yellowstone River between Gardiner and Reed Point, on the Missouri River between Canyon Ferry Dam and Fort Peck Reservoir and on the Clark Fork River between Butte and Plains. In each of these study areas, I conducted extensive fishery surveys using electrofishing, gill netting, trapping, or seining to determine species composition, relative abundance and size composition of fish populations. In addition, absolute abundance and biomass estimates were obtained for selected species using mark-recapture procedures. Selected species were also tagged with individually numbered tags to aid in evaluating fish movement patterns and angler harvest rates. Tributaries were surveyed in each of the three study areas to determine their importance in providing spawning and recruitment for key sport fish species in the main stems of the Yellowstone, Missouri and Clark Fork rivers. Migrant fish were sampled in the tributary streams using electrofishing or fish traps. Instream flow levels required to maintain existing fishery resources were determined on the Missouri River using the Wetted Perimeter Inflection Point Method in conjunction with the Biological Flow Relationships Method. In total, I have worked for 18 years as a professional biologist.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to support the Department's application for instream flows to protect fishery resources of the Missouri River between Holter Dam and Fort Peck Reservoir.

Q. Which portion of the Department's application is supported by your testimony?

A. I supervised collection of most of the data pertaining to Missouri River Reaches 3 through 6 of the application (Volume 3, pages 3-13 through 3-38). Maps showing the general location of these reaches are attached and made a part of this testimony.

Q. How would you describe the fishery in these reaches of the Missouri River?

A. Each of these four reaches of the Missouri River supports exceptional fisheries. The fisheries vary from highly productive trout waters in the upper reach to equally highly productive coolwater and warmwater fisheries in the lower reaches.

Q. Specifically, how would you describe the fishery in Reach 3 of the Missouri River?

A. Reach 3 of the Missouri, which extends from Holter Dam to Great Falls, supports an exceptional wild rainbow and brown trout fishery. In the fall of 1988, electrofishing estimates conducted by the DFWP for the river near Craig showed 4,150 rainbow trout and 466 brown trout 10 inches and larger per mile of river. At Cascade the population declined to 930 rainbow trout and 172 brown trout per mile. From Cascade to Great Falls, trout remain the dominant game fish along with some burbot and walleye. The upper 35 miles of this reach from Holter Dam to Cascade is designated a Class I sport fishery. This segment is considered one of Montana's premier river trout fisheries.

Q. What is the location of Reach 4, and what is the fishery value of this reach?

A. Reach 4 extends from Great Falls to the Marias River. This reach of the Missouri River supports a highly productive coolwater fishery with sauger being the predominant game fish. Coldwater game fish species found in this reach include brown and rainbow trout and mountain whitefish. Warmwater game fish species present in low numbers in this reach include burbot and shovelnose sturgeon. Fishing pressure on this reach is presently estimated at 7,692 angler-days of use annually (McFarland 1989).

Q. How would you characterize the fishery in Reach 5 of the Missouri, and where is it located?

A. Reach 5 of the Missouri River extends from the confluence of the Marias River to the confluence of the Judith River. This reach supports an exceptional warmwater fishery for sauger and shovelnose sturgeon along with some burbot, channel catfish and walleye. Shovelnose sturgeon in this reach attain the largest maximum size found anywhere within the geographical range of the species in the United States.

Paddlefish are found in this reach of the river during their spawning period from mid-May through early July. Four paddlefish spawning areas have been identified in this reach. These spawning areas are located in the vicinities of Three Islands, Virgelle Ferry, Little Sandy Creek and Deadmans Rapids.

Q. Are paddlefish considered an important species in the Missouri River?

A. Paddlefish are a very important species in the Missouri. Because of their limited distribution and the limited available habitat, the Department of Fish, Wildlife and Parks classifies the paddlefish as a "Species of Special Concern - Class A". Due to stream flow and habitat alterations, only six isolated, self-sustaining paddlefish populations remain in the United States today. Paddlefish receive light fishing pressure in Reach 5 because of limited access and lack of dense paddlefish concentrations. However, critical paddlefish spawning areas in this reach help sustain the sport fishery for paddlefish on the Charles M. Russell Game Range within Reach 6.

Q. Are there other "Species of Special Concern" in Reach 5?

A. Yes. In addition to the paddlefish, the pallid sturgeon and sturgeon chub are two other fish species residing in this reach of the Missouri with "Species of Special Concern" status. Each of these species has been sampled in this reach on less than five occasions and are considered rare throughout their entire geographic range. The pallid sturgeon was recently listed (October 1990) as an endangered species by the United States Fish and Wildlife Service.

Q. What is the location of Reach 6, and what is the fishery value of this reach?

A. Reach 6 extends from the confluence of the Judith River to Fort Peck Reservoir. An exceptional warmwater fishery is found in this reach. Paddlefish, sauger, shovelnose sturgeon and channel catfish are the predominant game fish species found throughout the reach.

Q. What is the status of paddlefish in this reach?

A. Paddlefish inhabit this reach during the spring spawning season from mid-May through early July. These paddlefish reside in Fort Peck Reservoir during most of their life. They migrate upstream from the reservoir into the Missouri River to spawn during the spring high flow period.

Q. Have any paddlefish spawning areas been identified in Reach 6?

A. Six paddlefish spawning areas have been identified in this reach. These spawning areas are located in the vicinities of Holmes Rapids, Dauphine Rapids, Bullwhacker Creek, Cow Island, Two Calf Islands and Robinson Bridge. Reproduction from these spawning areas is critical for recruitment into the sport fishery for paddlefish which occurs on the Charles M. Russell Game Range in the lower 20 miles of the reach.

Q. Is there a significant sport fishery for paddlefish on the CMR Game Range?

A. Yes, it is very significant. In 1977, an estimated 1,625 anglers fished 2,526 man-days and snagged 900 paddlefish. Most of the fishing pressure occurred over a 40-day period. These anglers spent an estimated 8,299 hours fishing for paddlefish.

Q. Is this a local fishery, or do these paddlefish anglers come from a wide geographic area?

A. The paddlefish anglers come from a wide geographic area. In 1977, paddlefish snaggers from 61 Montana cities and towns were interviewed during our creel survey. This is a sport fishery of statewide importance.

Q. If paddlefish are a "Species of Special Concern", why does the Department allow harvest of the species?

A. Paddlefish are listed by the Department as a "Species of Special Concern" due to their limited distribution and the limited available habitat and not because of their abundance in the areas where they are found in Montana. We have no evidence that paddlefish populations are being adversely affected by angler harvest. If over-exploitation by anglers occurs, declines in overall angler success rates and average size of paddlefish harvested would be expected. If this occurs, the Department will impose stricter restrictions on paddlefish harvest.

Q. Are there any other "Species of Special Concern" in Reach 6?

A. Yes. In addition to the paddlefish, the pallid sturgeon, sicklefin chub and sturgeon chub are three other "Species of

Special Concern" residing in this reach of the Missouri. All except the paddlefish are classified as rare throughout their entire geographical range and, as previously mentioned, the pallid sturgeon is a federally endangered species.

Q. How were instream flow requirements of the Missouri River fishery determined?

A. The Wetted Perimeter Inflection Point Method was used in conjunction with the Biological-Flow Relationships method. Details of the methods used are included in Volume 1 of the Department's application and are described in Fred Nelson's testimony.

Q. How were these methods used?

A. Riffle areas of the Missouri River are essential for food production during the entire year. For this reason, flows required to maintain wetted perimeter of riffles were determined in Reaches 3 through 6.

Studies conducted by the Department indicate side channels of the Missouri River are important year round for trout spawning and rearing in Reach 3 and for goldeye, bigmouth buffalo and smallmouth buffalo rearing and forage fish production in Reaches 4 through 6. Flows required to maintain these vital side channel habitat areas were determined for Reaches 3 through 6.

In Reach 3, flows required to maintain side channels were determined by direct observations of habitat conditions in the side channels at various Missouri River stage heights. From these direct observations it was determined a flow of 4100 cfs was required to provide adequate habitat in most of the side channels.

In Reaches 4 through 6 flows required to maintain side channels were determined by measuring physical characteristics of the side channels, including influent flow, average depth, maximum depth, and width, at various Missouri River stage heights. From these observations flows required to maintain side channels were determined in each of the three reaches based on Department developed criteria. Bill Gardner, a DFWP fishery biologist who currently resides in Fort Benton, Montana, was the principal investigator for side channel instream flow studies conducted in Reaches 4 through 6.

Studies conducted by the Department show paddlefish in Reach 5 of the Missouri River require 14,000 cfs in that reach to initiate their annual spawning migration to the spawning sites identified in the reach. This flow requirement was determined by electrofishing census counts made during the paddlefish spawning period. Most of the paddlefish did not migrate to identified spawning sites until flows in Reach 5 exceeded 14,000 cfs. Maintenance of the paddlefish spawning migration is dependent on a flow at or above 14,000 cfs during the 48-day period from May 19 through July 5. This time period was selected because it coincides with the spawning period of paddlefish.

It was determined from USGS stream flow records that flows in Reach 6 from May 19 through July 5 are 109.3% of the median flow in Reach 5. For this reason, a flow of 15,302 cfs (109.3% of 14,000 cfs) is recommended from May 19 through July 5 to maintain the paddlefish migration in Reach 6. In addition, it was determined that Reaches 3 and 4 contribute 45.7% and 80.6%, respectively, of the median flow of the Missouri River in Reach 5. Therefore, to maintain the annual spring paddlefish migration in Reaches 5 and 6, it was recommended that flows of the Missouri River in Reaches 3 and 4, respectively, be maintained at 45.7% and 80.6% of 14,000 cfs. This would amount to 6,398 cfs and 11,284 cfs in Reaches 3 and 4, respectively, during the paddlefish spawning period from May 19 through July 5.

Q. Did you determine instream flow requirements for goose nesting on the Missouri River?

A. No. These determinations were made by Dan Hook, a MDFWP wildlife biologist who currently resides in Anaconda, Montana and who will testify in this regard.

Q. Could you summarize the instream flow determinations which you made for fisheries on the Missouri River?

A. Yes. A comprehensive summary of the reaches which I worked on along with the amount of flow requested to maintain fishery values follows:

1. Missouri River - Reach 3. Holter Dam to Great Falls.
   May 19 - July 5. 6,398 cfs - to help meet the spawning flow requirement of paddlefish in Reaches 5 and 6. In addition this flow will maintain adequate wetted perimeter in food production areas in riffles, and adequate spawning, incubation and rearing habitats for trout in side channels.
   July 6 - May 18. 4,100 cfs - to maintain adequate spawning, incubation and rearing habitats for trout in side channels. In addition, this flow will maintain adequate wetted perimeter in food production areas in riffles.

2. Missouri River - Reach 4. Great Falls to the confluence

of the Marias River.

May 19 - July 5. 11,284 cfs - to help meet the spawning flow requirement of paddlefish in Reaches 5 and 6. This flow will also maintain adequate wetted perimeter in food production areas in riffles, forage fish production, and goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels.

July 6 - August 31. 4,500 cfs - to maintain forage fish production and goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels. This flow will also maintain adequate wetted perimeter in food production areas in riffles.

September 1 - May 18. 3,700 cfs - to maintain adequate wetted perimeter of food production areas in riffles.

3. Missouri River - Reach 5. Confluence of the Marias River to confluence of the Judith River.

May 19 - July 5. 14,000 cfs - to meet the spawning flow requirement of paddlefish. This flow will also maintain adequate wetted perimeter in food production areas in riffles and will maintain forage fish production and goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels.

July 6 - August 31. 5,400 cfs - to maintain forage fish production and goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels. This flow will also maintain adequate wetted perimeter in food production areas in riffles.

September 1 - May 18. 4,300 cfs - to maintain adequate wetted perimeter of food production areas in riffles.

4. Missouri River - Reach 6. Confluence of the Judith River to Fort Peck Reservoir.

May 19 - July 5. 15,302 cfs - to meet the spawning flow requirement of paddlefish. In addition, this flow will maintain adequate wetted perimeter in food production areas in riffles and will maintain forage fish production and sauger, goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels.

July 6 - August 31. 5,800 cfs - to maintain forage fish production and sauger, goldeye, bigmouth buffalo and smallmouth buffalo rearing habitats in side channels. This flow will also maintain adequate wetted perimeter in food production areas in riffles.

September 1 - May 18. 4,700 cfs - to maintain adequate wetted perimeter in food production areas in riffles.

Q. Is sufficient flow available in the Missouri River to meet the flows you have requested to maintain fisheries?

A. Yes. Sufficient flows are usually available to meet the flows we have requested in our application. I have reviewed U. S. Geological Survey flow duration hydrographs for the Missouri River at five stations on the Missouri River. In Reach 3, hydrographs were reviewed for stations located below Holter Dam near Wolf Creek and near Ulm. In Reach 4, the Fort Benton gaging station hydrograph was reviewed. The Virgelle gaging station hydrograph was reviewed for Reach 5 and, for Reach 6, the Landusky station hydrograph was reviewed.

In all reaches, flow requests made for fisheries by the Department were below the daily median flows (flows occurring 50% of the time) in the Missouri River for a 19-year period of record from 1960 through 1978. The 19-year period of record for these stations was selected because flows were recorded continuously by the USGS at all five of the stations during this time period. These findings indicated that Missouri River flows reached or exceeded Department flow requests for fisheries 50 percent or more of the time. In some cases, Department fisheries flow requests were lower than the lowest flow on record for the reach. In summary, Department fisheries flow requests on the Missouri River in reaches 3 through 6 were reached or exceeded 50 to 100 percent of the time during the 19-year period from 1960 through 1978.

I, Rodney Berg, being first duly sworn, states that the foregoing testimony is true.

DATED this 30th day of October, 1991.

Rodney K. Berg
Rodney Berg

Subscribed and sworn to before me this 30th day of [illegible], 1991.

(NOTARY SEAL)

[signature]
Notary Public for the
State of Montana
Residing at Helena, Montana
My Commission Expires [illegible]

BIOGRAPHY
RODNEY BERG
October, 1991

PERSONAL:

Born April 21, 1949, Waukon, Iowa
Social Security No. 482-62-3357

EDUCATION:

B.S. Fish Management, University of Wisconsin, 1971
M.S. Fish and Wildlife Management, Montana State University, 1973

EXPERIENCE:

1974 - Present: Montana Department of Fish, Wildlife and Parks. Fisheries Biologist. Responsibilities included conducting fisheries investigations on upper Yellowstone River from Gardiner to Reed Point, on the Missouri River from Canyon Ferry Dam to Fort Peck Reservoir and on the Clark Fork River from Butte to Plains. Worked on the upper Yellowstone River from July 1, 1974, through September 30, 1975, on the Missouri River from October 1, 1975, through September 30, 1984, and on the Clark Fork River from October 1, 1984, to the present.

1973 - 1974: Cooperative Fishery Unit, Biology Department, Montana State University. Supervised a research project dealing with effects of highway construction on the St. Regis River in west central Montana.

1971 - 1973: Cooperative Fishery Unit, Biology Department, Montana State University. Conducted a limnology study of Clark Canyon Reservoir in southwestern Montana.

DEPARTMENT RESEARCH REPORTS:

Berg, R. K. 1975. Fish and Game Planning, Upper Yellowstone and Shields River Drainages. Federal Aid to Fish and Wildlife Restoration Project FW-3-R.

Berg, R. K. 1981. Fish Populations of the Wild and Scenic Missouri River, Montana. Federal Aid to Fish and Wildlife Restoration Project FW-3-R, Job 1-A, Fisheries.

Berg, R. K. 1981 and 1982. Middle Missouri River Planning Project. Federal Aid to Fish and Wildlife Restoration Project FW-3-R, Job 1-A, Fisheries.

Gardner, W. and R. K. Berg. 1982. An analysis of instream flow requirements for selected fish in the wild and scenic portion of the Missouri River. Montana Department of Fish, Wildlife and Parks.

Berg, R. K. 1985 - 1991. Middle Clark Fork and Blackfoot River Fishery Investigations. Job Progress Reports. Montana Department of Fish, Wildlife and Parks.

POPULAR ARTICLES:

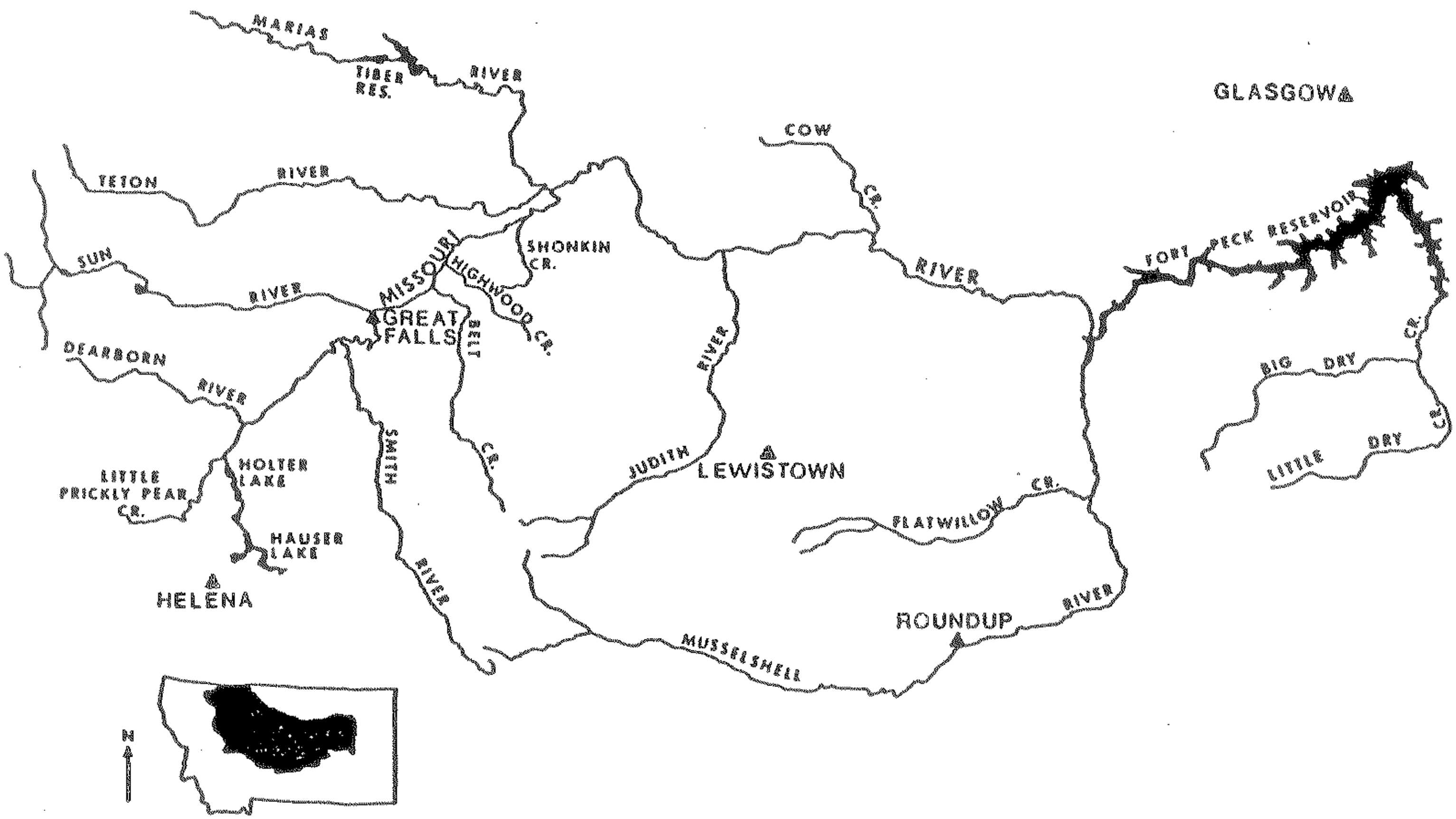
Berg, R. K. 1977. Upper Yellowstone Fishery. Montana Outdoors 8(2): 27-29.

Berg, R. K. 1980. Spoonbill. Montana Outdoors 11(3): 11-13 and 21-22.

Berg, R. K. 1984. Trout Heaven. Montana Outdoors 15(5): 27-30.

PROFESSIONAL SOCIETIES:

Member: American Fisheries Society, 1969 - present.
Montana Chapter, American Fisheries Society, 1973 - present.



Map of the Missouri River Basin from Canyon Ferry Dam to Fort Peck Dam.

PREFILED DIRECT TESTIMONY OF DANIEL L. HOOK
ON BEHALF OF MONTANA DEPARTMENT FISH WILDLIFE AND PARKS

Q: Please state your name and business address.

A: Daniel L. Hook, 13 Mountain View, Anaconda, Montana 59711

Q: What is your present employment?

A: I am a Wildlife biologist employed by the Department of Fish, Wildlife and Parks.

Q: Please state your educational background and experience.

A: I was educated in the Highland, Indiana public school system through high school. I am a 1970 graduate of Purdue University with a B.S. in Agriculture, Wildlife Ecology major. I received a M.S. in Fish and Wildlife Management from Montana State University in 1973. I have been employed by the Montana Department of Fish, Wildlife and Parks as a wildlife biologist since 1973.

Q: What is the purpose of your testimony in this proceeding?

A: The purpose of my testimony is to support that portion of the Department's instream flow reservation request that is based on the need to provide adequate instream flows for Canada Goose nesting in the Missouri River below Holter Dam.

Q: What portion of the Department's application covers material that is supported by your testimony?

A: Volume 3, Pages 3-13 through 3-37 which includes reaches 3-6 of the Missouri River.

Q: What work experience do you have which qualifies you to provide testimony on the relationship between instream flows and Canada goose nesting?

A: My Master's thesis centered on the relationship between Canada goose nest success and water depths surrounding island habitat. I have also conducted Canada goose nesting studies and instream flow work on the Missouri River.

Q: What waterfowl studies have you conducted in the Missouri River drainage?

A: From 1976-1981, I conducted Canada Goose nest surveys along the Missouri river. These surveys were conducted along the reach from Holter Dam to Great Falls and from Morony Dam to Fred Robinson Bridge. The section of river from Great Falls to Morony Dam was not surveyed due to the fact that this section is impounded by a series of dams and does not provide nesting habitat. In 1985, additional Canada goose surveys were conducted from Highwood Creek below Morony Dam to Fort Benton. During the course of these surveys, data were collected on Canada goose nests and instream flows required to maintain island security from mammalian predators (coyotes, raccoons, skunks).

Q: What is the importance of maintaining adequate side channel flows around the island nest sites?

A: The security of the island nest sites from mammalian predation is dependent on adequate side channel flows which is a function of depth, width, and velocity. Adequate flows inhibit and/or prevent mammalian predators from crossing onto the islands.

Q: Do instream flows have any other function in Canada goose nesting efforts?

A: Yes. Adequate flows are important in the initial nest site selection process. A 1979 survey of side channel depths from Carter Ferry to Robinson Bridge found that the geese were selecting islands with greater side channel depths for nest sites.

Q: Did you participate in collecting and analyzing the instream flow data used to determine minimum flows for Canada goose nesting needs?

A: Yes. During 1980-81, I participated in selecting and establishing the wetted perimeter cross-sections on island side channels for the reaches from Holter Dam to Great Falls and from Morony Dam to Fred Robinson Bridge. I assisted in measuring several of these cross-sections under varying flow conditions. Based on my knowledge of the system, Canada goose nesting data collected, wetted perimeter data, and first hand experience on the river as regards island security under different flows, I recommended minimum instream flows for Canada goose nest security.

Q: What type of information was collected during the Canada goose nest surveys?

A: Data on nest site selection, nest fate, egg success, habitat use, clutch size, and number of young produced was collected. A total of 674 nests were examined during the course of these surveys.

Q: Can you explain these terms?

A: Yes. Nest site selection refers to the actual location of the nest, ie. size of island, and location on the island. Nest fate refers to whether the eggs in the nest hatched or whether the nest was deserted, or destroyed. Egg success is the number of eggs actually hatched in a successful nest. Habitat use is the type of vegetation or other material at the site of the nest. Clutch size is the number of eggs in the nest.

Q: What was the preferred nesting habitat?

A: All the nests found during these surveys were on river islands. The preferred sites were the smaller, willow covered gravel bar type islands.

Q: When is the Canada goose nesting season?

A: During the course of these studies, a majority of the nests located were initiated about the first week of April. The peak of hatch occurred during the first week of May. The nesting season runs from mid- March to the first of June.

Q: What is the rate of nest success?

A: During the course of these investigations, the nest success rate was over 80% This is one of the highest recorded nest success rates for Canada geese reported in the literature. For man-made management areas, a 75% nest success rate is considered a management goal.

Q: Do you have any information that would indicate that flows below those recommended in the reservation application would have an adverse effect on Canada goose nest success?

A: Yes. During the spring of 1985, the Montana Power Company conducted a hydro-peaking test on the Missouri River at Morony Dam. Flows during this test reached a recorded low of 2800 cfs on a daily basis. The recommended flow for this reach is 4887 cfs.

Q: What studies were conducted during this test?

A: A Canada goose nest survey was conducted during this test from Highwood Creek to Fort Benton.

Q: What are the findings of that study?

A: From 1976-80, the Canada goose population on this reach experienced an average nest success of 85%. In 1985, 45 nests were located in this reach. During these low flows, nest success dropped to 38%. 47.6% of the nests were destroyed by mammalian predators as of May 1. In the section from Highwood Creek to Carter Ferry, a 48% decline in the number of nests observed between 1980 and 1985 data was noted. This would indicate an avoidance of this area due to the lower flows. There appeared to be two consequences to these reduced flows. First, a significant reduction in nesting effort and, secondly, a dramatic increase in nest predation by mammalian predators. From 1976-80 nest loss due to predation averaged 5.9%. In 1985, with the reduced flows, this loss increased to 42% due to predation. Based on my knowledge of this reach of the Missouri River, I would estimate that a loss of production of 200 goslings may have occurred due to these reduced flows.

Q: Can you relate this loss in production to other waterfowl areas?

A: Yes. This loss would be equal to the entire annual Canada goose production at the Department's Freezout Lake Waterfowl Management Area during the 1970's.

Q: Can Canada Geese adapt their nesting efforts to less preferred habitat due to reduced flows?

A: The geese may begin using larger islands as nest sites. This results in a colonial nesting situation. Typically, they will experience a lower nest success rate under these conditions. Problems that are encountered include increased nest desertion due to intraspecific competition, dump nesting (where more than one female lays eggs in the same nest and no nest attendance occurs), and smaller clutch sizes. Also, mammalian predation can become more critical. A coyote gaining access to a large island with ten or more nests can have a much more significant impact than on a smaller island with one nest.

Q. Why is an instream flow reservation needed for goose nesting in the Missouri River?

A. The reservation is needed to maintain the suitability of river islands as nest sites and to provide the nests minimum security from mammalian predators. The requested flows are the minimum flows required to maintain these conditions.

Daniel L. Hook, being duly sworn, states that the foregoing testimony is true.

Dated this 30 day of October, 1991.

Daniel L. Hook

Daniel L. Hook

Subscribed and sworn to before me this 30 day of October, 1991.

Vivian L. Milch

Notary Public for the State of Montana
residing at Missoula, Montana
My commission expires 13-3-91

BIOGRAPHY - DANIEL L. HOOK

PERSONAL:

Born June 8, 1948, Hammond, Indiana
Social Security No. 306-56-8199

EDUCATION:

B.S. Wildlife Ecology, Purdue University, 1970
M.S. Wildlife Management, Montana State Univ., 1973

EXPERIENCE:

1988 - Present: Wildlife Biologist, Montana Department Fish Wildlife and Parks, Region 2, Anaconda, Montana.
Responsibilities include conducting wildlife surveys and inventories, recommending hunting seasons, and reviewing and coordinating activities with other federal, state and private landowners in eleven hunting districts.

1980 - 1988: Rocky Mountain Front Wildlife Studies, MDFWP, Augusta, Montana. Primary responsibilites involved conducting elk, mule deer and bighorn sheep surveys in relationship to gas and oil development activities along the East Front of the Rocky Mountains. Extensive radio telemetry work was conducted to determine home ranges, movement patterns, crtical habitats, and response to gas and oil activites.

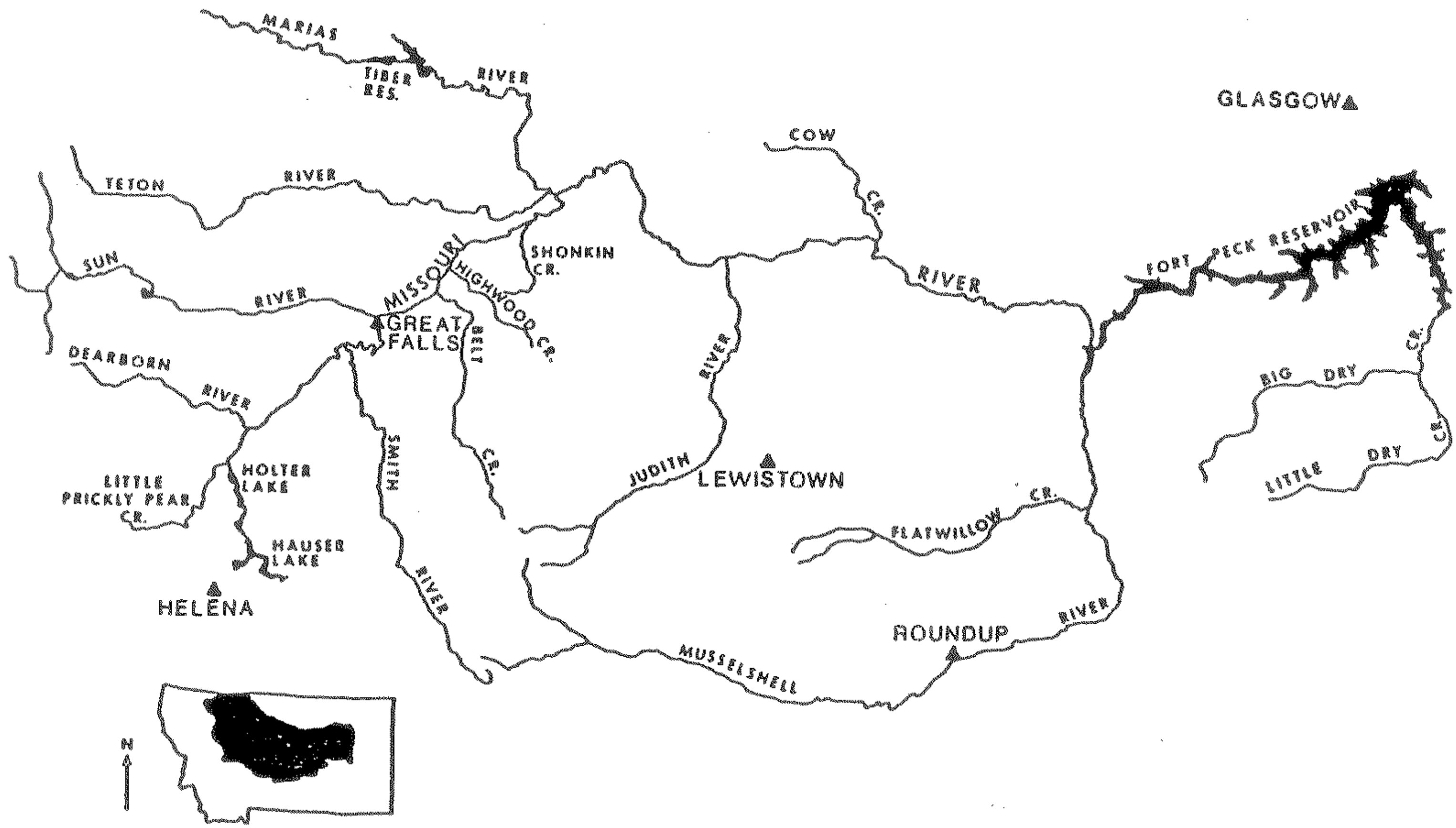
1980 -1981: Wildlife Biologist, MDFWP. Conducted Canada goose nest surveys along the Missouri River from Holter Dam to Great Falls and from Morony Dam to Carter Ferry. Worked on establishing minimum instream flow requirements for island security.

1975 - 1980: Middle Missouri River Wildlife Study, MDFWP, Fort Benton, Montana. Conducted big game, upland game bird, and waterfowl surveys and inventories along the Missouri River from Great Falls to the Judith River. Waterfowl work covered the river from Great Falls to Fred Robinson Bridge. Part of the activities on this project included complete Canada goose nest surveys. Data on nest success, habitat selection, and island security were collected.

1973 - 1975: Upper Yellowstone and Shields Rivers Project, MDFWP, Livingston, Montana. Rsponsibilities included upland game bird and waterfowl surveys and inventories for the Upper Yellowstone and Shields rivers drainages. Habitat evaluations of the proposed Allenspur Dam were conducted. Based on this work testimony was prepared and given regarding the Yellowstone River Instream Flow Reservation.

1970 - 1973: Graduate Student, Montana State University.
A Master Thesis research project on Canada goose nesting was conducted at Freezout Lake, Montana. The primary emphasis was on nest success in relation to water levels around island habitats.

Appendix A



Map of the Missouri River Basin from Canyon Ferry Dam to Fort Peck Dam.

PREFILED TESTIMONY OF WADE FREDENBERG
ON BEHALF OF
THE MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS (MDFWP)

Q. Please state your name and business address.

A. My name is Wade Fredenberg and I work at the Montana Department of Fish, Wildlife and Parks Region 3 Headquarters, 1400 So. 19th Street, Bozeman.

Q. What is your employment history with the Department of Fish, Wildlife and Parks?

A. I am currently employed as a fishery program specialist. In this position I am considered the regional biologist in charge of the fishery program in the Gallatin and Madison River drainages. In addition, I have statewide responsibility for overseeing certain aspects of the Department's electrofishing program. I have been in this position nearly three years. Prior to that time, I was a regional fishery biologist in the Billings office of DFWP. For six years there, I was in charge of the fishery program in the Bighorn and Upper Musselshell River drainages. My employment history, education, and other vita are attached.

Q. What is your educational background?

A. I am a native Montanan born and raised in Kalispell. I graduated from high school there in 1974 and spent two years at Flathead Valley Community College where I earned an Associate of Arts Degree. Upon completion, I transferred to Montana State University and in 1978 earned a Bachelor of Science Degree in Fish and Wildlife Management. I then continued on for two years and received a Master of Science Degree from MSU in 1980 in the Fish and Wildlife Management curriculum.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to provide supporting documentation for the Department of Fish, Wildlife and Parks' water reservation request, specifically in the Musselshell River Basin. I was the biologist who formulated the Department's recommendations for three reaches of the Musselshell River and five of its tributaries.

Q. Specifically, what were those requests?

A. In tabular form, they are:

Musselshell River -	Reach #1 (upper)	- 80 cfs
	Reach #2 (middle)	- 80 cfs
	Reach #3 (lower)	- 70 cfs

Big Elk Creek - 9.5 cfs
American Fork Creek - 5.5 cfs
Careless Creek - 2 cfs
Swimming Woman Creek - 2.5 cfs
Flatwillow Creek - 18 cfs

Maps showing the general location of each of the above streams are attached and are a part of this testimony. The specifics of these requests and supporting documentation can be found in the Department's application (Volume 3) on pages 3-371 through 3-388, 3-421 through 3-436, and 3-440 through 3-444. The information contained in the application is still accurate.

Q. Do you have work experience that qualifies you to conduct instream flow analysis?

A. Prior to the time that I worked on the Musselshell analysis, I had become familiar with instream flow techniques as part of my duties in my employment in Kalispell where I spent several weeks helping to assemble instream flow data for the Flathead River. As we began to work on the Musselshell, I received training and read literature I obtained through the Department instream flow coordinator, Fred Nelson, regarding the wetted perimeter inflection point method of instream flow determination. During my 15 years experience as a professional in the field of fishery biology, I have personally witnessed the relationship between stream flows and fish population changes in this state. This was particularly apparent during the drought cycle of the late 1980's. Thus, while I do not consider myself an expert in the field of instream flow, I do feel that I carefully followed the procedures set forth by the Department to conduct this analysis and I have high confidence in the results that were obtained. I consulted with Fred Nelson and others frequently during the course of developing these recommendations.

Q. Please describe the work you did in connection with DFWP's application for instream flow reservations in the Missouri River basin.

A. With the assistance of one or two fieldworkers operating under my direction, we conducted field surveys on the Musselshell River and its tributaries during 1986 and 1987. We set up WETP cross sections, collected flow, water surface elevation and fisheries data on the streams discussed in this testimony.

Q. What methods did you use to determine the Department's instream flow requests?

A. The wetted perimeter inflection point method as described in the application and the testimony of Fred Nelson was used on each stream and stream reach.

Q. Please describe the fishery of the Musselshell River?

A. The Musselshell River is one of Montana's longest rivers despite its relatively small size. It flows 364 miles across the semiarid hills and plains of central Montana before reaching its confluence with the Missouri at Fort Peck Reservoir. It is best characterized as flowing through three separate habitat types; coldwater in the upper 55 miles, a coldwater/warmwater transitional zone for 146 miles, and then a classic warmwater prairie stream for 163 miles. These habitat types are reflected in the three reaches in our flow request and they each have unique fisheries qualities.

Q. What type of fishery is found in the upper, coldwater reach (Reach #1) of the river?

A. Reach #1 of the Musselshell River, from the confluence of the North and South forks to the Deadmans Basin Diversion Dam is a classic brown trout stream with abundant bank cover, deep pools, and a dense riparian zone. Unfortunately, the combined effects of riparian abuse from railroad and highway channelization have caused major instability of the channel. Agricultural encroachment on the floodplain has contributed to the problem in many areas. In my judgment, these factors in combination with severe dewatering during the irrigation season have reduced the quality of the upper Musselshell River fishery substantially. Review of old newspaper accounts from the Harlowton paper and frequent discussions with individual sportsmen who have lived and fished in the area for many years lead me to the conclusion that this fishery used to be much better than it presently is.

Q. Is there documentation of the effects of dewatering on this fishery?

A. Yes, in 1985 we began annual monitoring of a 1.25 mile-long section of the river near the Selkirk Fishing Access Site near Two Dot. During the years 1985 through 1988, we witnessed a steady decline in the brown trout population from 89 fish per 1,000 feet of stream with a biomass of 66 pounds to only 21 fish per 1,000 feet with a biomass of only 22 pounds. This was, of course, during the peak of the drought cycle. At various times during the summer of 1988, I observed dry streambed and dead fish in the upper Musselshell River. We documented these dewatered conditions over most of the 364 miles of the Musselshell River with a series of photo points on county bridges.

Q. Would you expect these problems that you have described to have lasting impacts on this fishery?

A. Yes. Once a population is suppressed to the levels we saw on this stream, it takes more than one or two years for recovery. In addition, the upper Musselshell is a chronically dewatered stream. Even in good flow years, the fish population is subjected to critically low flow levels as a result of irrigation depletion. Thus, much of the quality cover and food-producing riffle habitat is dewatered virtually every summer. The stream fishery may never reach its potential under these conditions.

Q. Under optimum conditions, what trout population levels are achievable for this reach of the Musselshell River?

A. Without having the benefit of historic population data on this stream, we can only speculate. A stream that I presently work on which is very similar to the Musselshell in nearly every respect except for the dewatering problem is the East Gallatin River near Bozeman. In that stream, trout populations commonly achieve densities of around 400-500 trout per 1,000 feet with biomass (weight) levels of 200 pounds per 1,000 feet. We routinely capture brown trout up to 10 or 12 pounds on the East Gallatin. As I mentioned, newspaper stories and personal accounts indicate the Musselshell used to have a similar reputation for producing large fish but they are very seldom caught there today. I believe that the fishery of the upper Musselshell River is achieving much less than half of its potential.

Q. Given this situation, why is an instream flow reservation needed for Reach #1 of the Musselshell?

A. In the near term, the fishery would not likely benefit from the reservation. However, the Musselshell has the potential to become a unique, high-quality trout stream in an area where no other such resources exist. The reservation would protect the status quo and over time, if such factors as improved irrigation efficiency, land use changes, and changing resource values should occur, additional water may become available in the system. The reservation, with its 1985 priority date, could then play a role in the revitalization of this fishery.

Q. What is the fishery status of **Reach #2 of the Musselshell,** the 146-mile section from Deadmans Basin Diversion downstream to Musselshell Diversion?

A. This reach is what we characterize as the transitional zone between a coldwater fishery and a warmwater fishery. The trout fishery ends rather abruptly below the Deadmans diversion due to chronic dewatering. In most years, there are long periods when all of the flow of the Musselshell is diverted into the canal to fill Deadmans Basin Reservoir. In 1984, a study conducted on the fish population above and below the diversion showed about a 2/3 decline in the trout population immediately below the diversion (Vaughn and Fredenberg, 1984, "An evaluation of the Trout Population in Three Sections of the Musselshell River Near Deadmans Basin Reservoir", MDFWP, Helena). Thus, for all intents and purposes, trout are not a factor in the fishery of this reach. The Department of Fish, Wildlife and Parks stocked smallmouth bass throughout this reach in the late 1970's in an attempt to create a fishery. This introduction was at least partly successful and smallmouth bass are presently the most important game fish in this reach. The Musselshell Diversion, near the town of Musselshell, is a barrier to upstream migration of channel catfish and sauger from the lower river and Fort Peck Reservoir.

Q. Is it accurate to say, then, that there is a very poor fishery throughout Reach #2 of the Musselshell River?
A. Yes, that is accurate.

Q. What is the water quality like in Reach #2 of the Musselshell?
A. Very poor. Due to the degradation of the Careless Creek channel from the Deadmans Basin spill of irrigation water and other natural and manmade factors, the water is high in sodium-sulfate and is nutrient-enriched, in addition to transporting high sediment loads. Salinity is high enough to cause damage to some crops (Kaiser and Botz, 1976, "Water Quality Inventory and Management Plan, Musselshell Basin, Montana", Water Quality Bureau, Environmental Sciences Division, DHES, Helena).

Q. Why is an instream flow reservation needed for Reach #2 of the Musselshell?
A. A minimum stream flow would greatly benefit the overall future water quality in this reach of the Musselshell River by diluting pollutants and ensuring that the presently degraded conditions do not worsen. The entire Musselshell River supports a diverse and abundant array of wildlife dependent on the riparian zone for food, shelter, and water. The reservation will protect the existing status of the self-sustaining smallmouth bass population which would benefit local anglers who have few other fishery resources in this region of the state. In addition, collections of a peculiar minnow, the northern redbelly dace x finescale dace hybrid were taken from Reach #2 of the Musselshell in 1985. This fish is listed by MDFWP as a "Fish of Special Concern" due to its limited numbers and habitat. The hybrid dace is a parthenogenetic species, which means that all of the individuals are female and they produce exact clones of the mother through development of an unfertilized egg.

Q. The Department of Fish, Wildlife and Parks has requested an instream reservation of 70 cfs for the lower 163 miles of the **Musselshell River** below the Musselshell Diversion. Are there significant fishery values in this **Reach #3** of the river.
A. Definitely! The lower Musselshell River flows through a grassland/badlands type of habitat on its way to Fort Peck Reservoir and, in this reach, irrigation withdrawals are limited downstream from the Musselshell diversion and Korenko diversion, which is a few miles downstream from the Musselshell diversion. This is a classic warmwater prairie stream with a full complement of warmwater fish species, including channel catfish, smallmouth bass, sauger, and

northern pike. This stream is very remote and we have only limited fishery data on it. In 1981, tags from 31 channel catfish tagged in Fort Peck Reservoir were retrieved in the Musselshell River. This and other evidence demonstrate that the lower Musselshell is a very important spawning tributary for channel catfish, sauger, and smallmouth bass, all of which are becoming increasingly popular sport fish in Fort Peck Reservoir. There are no barriers to upstream migration in this 163 miles of river, making it an important spawning resource that needs to be protected. The Musselshell Diversion is a barrier to fish migration and thus, this reach of stream is functionally isolated from the rest of the system.

Q. Do fishermen use the lower Musselshell?

A. In 1989, our fisherman use surveys indicated that about 6,300 fisherman days were expended on the entire Musselshell River. Of this total, about 4,600 days, or nearly three-fourths of the total, occurred on the warmwater portion of the river. This is surprisingly high given the remote location of this stream. These figures were derived from a random mail survey sent to licensed anglers which is presently being conducted every other year by MDFWP.

Q. So, overall you feel the Musselshell River is a resource worth protecting with an instream flow reservation.

A. Yes. This stream is one of the longest undammed streams in the nation and provides a very unique example of the transition of a trout stream into a warmwater stream. This drainage has suffered problems associated with channelization, pollution, and dewatering, but these may eventually be rectified to provide this state with an unparalleled resource. It is imperative that the situation not be allowed to further decline and the flow reservation is the means toward that end.

Q. What fishery values justify the reservation request for 18 cfs on **Flatwillow Creek**?

A. Flatwillow Creek is the largest drainage emerging from the Snowy Mountains and, as such, is the best stream trout fishery in Petroleum County and the surrounding locale. A fish population estimate near Tyler in 1987 found a trout population of 54 fish per 1,000 feet of stream with a total weight of 47 pounds per 1,000 feet. Both of these values were higher than those for the upper Musselshell River, a considerably larger stream. In addition, the average size of fish was nearly one pound and brown trout up to 24 inches long were captured. Thus, Flatwillow Creek is a trout fishery of regional importance.

Q. Why is an instream flow reservation needed for Flatwillow Creek?

A. The entire drainage is heavily used for irrigation. An instream flow reservation will protect the fishery values of this stream by preventing further depletions of water, and allow for flow improvement if water use practices change.

Q. What are the significant values associated with the fishery of **Big Elk Creek**?

A. The brown trout population in the lower end of Big Elk Creek was surprisingly high during a 1987 survey. An estimated population of 150 fish per 1,000 feet was recorded, with brown trout ranging in size up to 14 inches. This is one of the best small stream trout fisheries in the upper Musselshell basin.

Q. Does dewatering occur on Big Elk Creek?

A. Yes. On one occasion in 1987, we recorded a flow of 4.8 cfs. On that occasion, I observed that the larger fish in the stream (10 - 20 inch brown trout) were forced to seek refuge in deep pools where they were schooled up and vulnerable to predation. It is my opinion that a flow of 4.8 cfs is inadequate to protect the fishery values of this stream.

Q. Why is an instream flow reservation needed on Big Elk Creek?

A. As one of the larger tributaries in the Upper Musselshell, Big Elk Creek provides supplemental flow to the critically-dewatered Musselshell. Big Elk Creek may be used by migratory brown trout out of the Musselshell River for spawning, rearing, and for refuge from low and warm water conditions in the mainstem Musselshell.

Q. Does **American Fork Creek** in the adjacent drainage to Big Elk Creek have fishery values similar to Big Elk Creek?

A. Potentially it does; however, the evidence indicates that the middle reaches of this stream go dry on an annual basis, and as a result, the quality of the fishery on American Fork is much poorer. In 1987, we found only 34 catchable size trout per 1,000 feet of stream; mostly brown trout up to about 14 inches.

Q. Do you feel American Fork Creek would be a better fishery with a water reservation for instream flow?

A. The reservation will not likely result in any immediate improvement. However, it will protect the streamflow status quo and, over time, we may see some flow improvement if water becomes available in the future. The quality of the fish habitat in the section we electrofished was high and, given sufficient flows, this fishery could improve markedly. As with Big Elk Creek, the flow contributions of the American Fork are important to the mainstem Musselshell River.

Q. DFWP has requested instream reservations on **Careless Creek** (2 cfs) and **Swimming Woman Creek** (2.5 cfs). What are the fishery values of these streams?

A. Careless Creek and its tributary, Swimming Woman Creek, are small streams which head in adjacent drainages of the Snowy Mountains. Both flow through densely-vegetated riparian bottoms before flowing out onto the open prairie and eventually becoming dewatered. In both cases, our flow reservation request is to protect brook trout fisheries in the upper ends of these drainages.

Q. Why is an instream flow reservation needed for Careless Creek and Swimming Woman Creek?

A. Both of these streams are important local fisheries and contain high densities of small brook trout. The future welfare of these fisheries is dependent on instream flow protection.

Q. Do you have any further comments?

A. The fishery of the entire Musselshell River system and its tributaries has fared poorly in competition with human uses for water in this semiarid region of the state. However, it is apparent that both man and wildlife species are drawn to the Musselshell for what it can provide; life-giving waters. It is imperative that instream flow be given a role in preserving and enhancing the biological and economic vitality of this region.

Wade Fredenberg, being first duly sworn, states the foregoing testimony is true.

DATED this 30th day of October 1991.

Wade A. Fredenberg
Wade Fredenberg

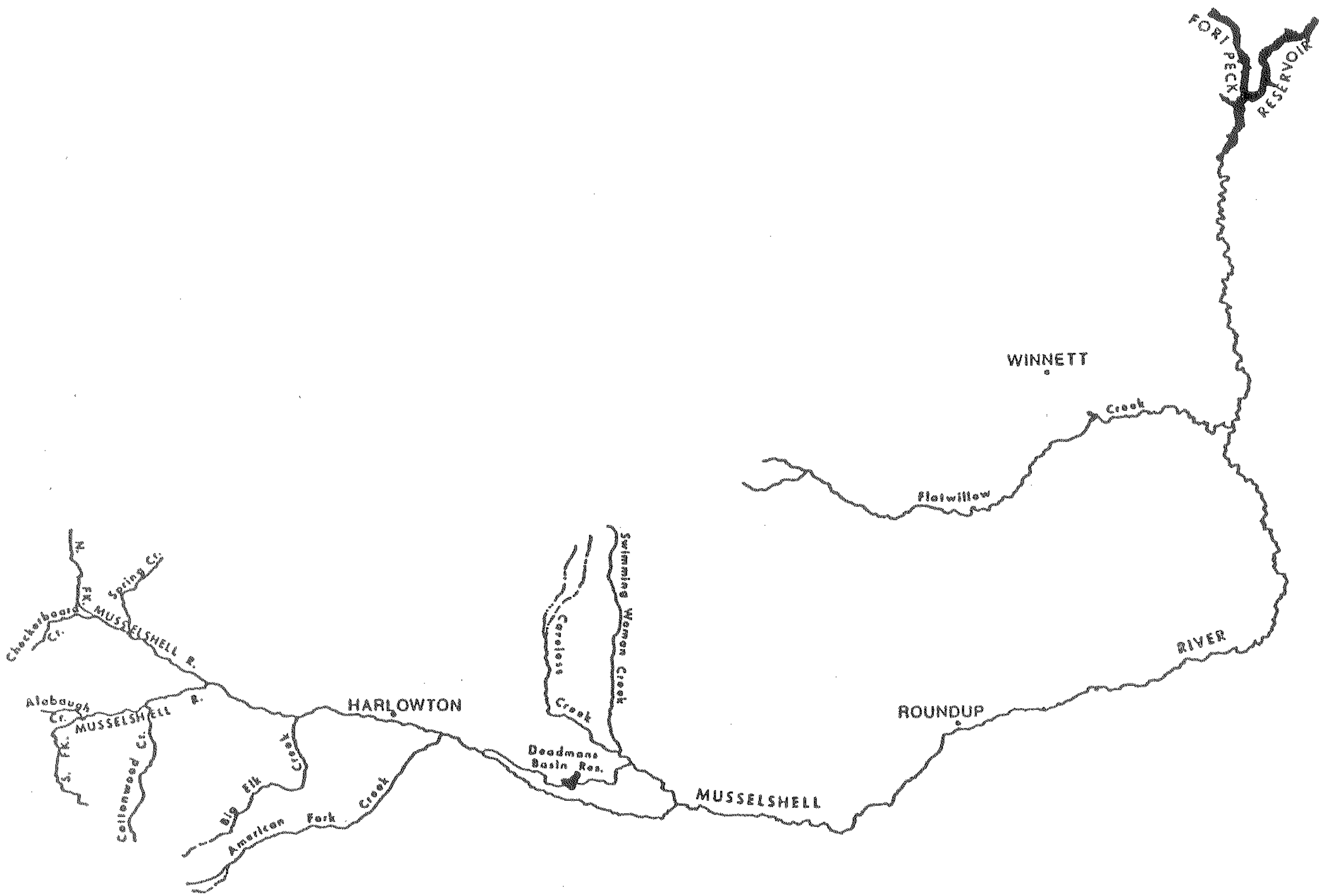
Subscribed and sworn to before me this 30th day of October 1991.

Joan Buhl
NOTARY PUBLIC for the State of Montana
Residing at Bozeman, MT
My Commission expires 8-21-92

(NOTARIAL SEAL)

11.1

Appendix A



Location map for the Musselshell River Drainage.

PRE-FILED TESTIMONY OF MARK LERE
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS (MDFWP)

Q. Please state your name and business address.

A. My name is Mark Lere and I work for the Montana Department of Fish, Wildlife and Parks at Region 8 Headquarters, 1404 East 8th Ave, Helena, MT 59601.

Q. What is your employment history with the Montana Department of Fish, Wildlife and Parks?

A. I am presently employed as a regional fisheries biologist. In this position, I am responsible for conducting fisheries research on Canyon Ferry, Hauser and Holter reservoirs. In addition, I am responsible for the fishery program for most of the waters found within the borders of Region 8. I have been in this position since February, 1986. Prior to my current employment, I was a research biologist for nearly three years in charge of developing and evaluating an implementable water management plan for the release of purchased water from Painted Rocks Reservoir into the Bitterroot River. Prior to that time I was a fisheries fieldworker for nearly two years and assisted in obtaining baseline fisheries data in the Missouri River below Holter Dam and in the tributaries to Hauser and Holter reservoirs. My employment history, education and other vitals are attached.

Q. What is your educational background?

A. I was educated in Montana public schools and graduated from Bozeman Senior High School in 1972. I earned a Bachelor of Science Degree in Fish and Wildlife Management from Montana State University in 1976. I then received a Masters of Science Degree in Fish and Wildlife Management from Montana State University in 1982.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to provide supporting documentation to the Montana Department of Fish, Wildlife and Parks water reservation request for nine Missouri River Basin tributaries located between Canyon Ferry and Holter dams and two tributaries located in the Little Prickly Pear Drainage. Maps showing the general location of these streams are attached. I was the biologist, in cooperation with Mr. Ken Frazer, who specifically developed the Department's recommendations for these eleven tributaries.

Q. Specifically, what are those water reservation requests?

A. The requests are:

Spokane Creek - 4.0 cfs for May 1 through November 30
3.0 cfs for December 1 through April 30

McGuire Creek - 8.3 cfs for May 1 through November 30
4.7 cfs for December 1 through April 30

Trout Creek - 15.0 cfs for January 1 through December 31

Sevenmile Creek - 1.0 cfs for January 1 through December 31

Tenmile Creek - 12.0 cfs for January 1 through December 31

Silver Creek - 13.0 cfs for May 1 through November 30
5.4 cfs for December 1 through April 30

Beaver Creek - 10.0 cfs for January 1 through December 31

Willow Creek - 3.5 cfs for January 1 through December 31

Cottonwood Creek - 1.0 cfs for January 1 through December 31

Virginia Creek - 6.0 cfs for January 1 through December 31

Canyon Creek - 10.0 cfs for January 1 through December 31

Additional supporting documentation for the specific requests is presented in the Department's application (Volume 3) on pages 3-41 through 3-49, 3-59 through 3-81 and 3-93 through 3-99.

Q. Do you have training and/or work experience related to conducting instream flow analysis?

A. Yes. From 1983 through 1986, I headed a research project on the Bitterroot River to develop and evaluate a water management plan for the release of supplemental water from Painted Rocks Reservoir. This research required the knowledge and ability to use standard techniques for measuring stream discharge as well as the use of the wetted perimeter/inflection point methodology to quantify instream flow recommendations. I also assisted with data collection for instream flow analysis as a fisheries fieldworker on the Missouri River below Holter Dam during 1981 and on the mid-Yellowstone Basin during 1976. Prior to conducting instream flow analysis on the eleven Missouri Basin tributaries, I attended a streamflow measurement workshop conducted by the U.S. Geological Survey and a wetted perimeter methodology workshop conducted by the Department instream flow

Q. What are the important fishery and wildlife values of **Spokane Creek** and **McGuire Creek**?

A. Spokane and McGuire creeks are important tributaries to Hauser Reservoir since they are two of only five tributaries available for spawning and rearing of salmonids that migrate to and from the reservoir. The lower one-third mile of Spokane Creek and lower one mile of McGuire Creek are used extensively by spawning kokanee, brown trout, rainbow trout and mountain whitefish that migrate from Hauser Reservoir. Brown trout spawners weighing up to 4 pounds have been sampled in both streams. In addition, both streams provide important rearing habitat for juvenile salmonids. The resident fisheries in these two streams are dominated by smaller rainbow trout and brown trout. In October 1990, a total of 55 brown trout and 7 rainbow trout were captured by electrofishing in a 500 foot section of McGuire Creek. In association with the recent increased use of Spokane and McGuire creeks by spawning kokanee, bald eagles have begun to congregate in the area during the fall to feed on dead and dying kokanee. In addition, bald eagles are over-wintering in the area to feed on waterfowl residing in the ice free waters of Spokane and McGuire bays.

Q. How would you characterize the availability of water in **Spokane Creek and McGuire Creek** for instream use?

A. From the headwaters to near the crossing of the Helena Valley Irrigation Canal, Spokane Creek tends to be intermittent as a result of both natural losses and irrigation dewatering. Downstream from the irrigation canal, Spokane Creek becomes a permanent stream due to gains from groundwater sources and it is on this section of the stream that the Department has requested a flow reservation. The lower two miles of stream display spring creek-like characteristics with fairly stable flows and constant water temperatures. McGuire Creek arises from springs and, as a result, sub-surface water sources provide fairly stable flows and constant water temperature.

Q. Why are the requested instream flow reservations needed in **Spokane** and **McGuire** creeks?

A. Spokane and McGuire creeks are important tributaries to Hauser Reservoir that provide spawning and rearing habitat for salmonids. Both the brown trout and kokanee populations found in Hauser Reservoir rely solely upon successful spawning in the tributaries and in the tailrace of Canyon Ferry Reservoir. The future welfare of migrant spawners, rearing juveniles, and resident fish populations in these two streams are dependent on instream flow protection.

Q. What are the important fishery values of **Silver Creek**?

A. Silver Creek is an important tributary to Lake Helena for migratory spawning brown trout, kokanee and rainbow trout. Spawning rainbow trout and brown trout up to 3.0 and 8.0 pounds in weight, respectively, have been sampled in Silver Creek and spawners have been found as far as 2.5 miles upstream from the mouth. Juvenile salmonids utilize Silver Creek extensively for rearing habitat. Silver Creek also supports good populations of resident rainbow trout, brown trout and brook trout. In October 1990, a total of 182 brown trout, 19 rainbow trout and 1 brook trout were collected by electrofishing in a 2,500-foot section of Silver Creek.

Q. How would you characterize the water availability in **Silver Creek** for instream use?

A. The lower five miles of Silver Creek have been converted to a channelized drainage canal for the Helena Valley. As a result, streamflow in this canal is almost entirely dependent upon ground water sources and irrigation returns. Due to the influence of sub-surface water, this canal displays spring creek-like characteristics with fairly stable streamflow and constant water temperature. This 5 miles of canal is the section of Silver Creek on which the Department has requested a flow reservation. At least one irrigation pump removes water from this canal during the irrigation season.

Q. Why is the requested instream flow reservation needed in **Silver Creek**?

A. Silver Creek is an important tributary to Lake Helena that provides spawning and rearing habitat for salmonids. Both the brown trout and kokanee populations found in Lake Helena and Hauser Reservoir rely upon successful spawning in the tributaries and in the tailrace of Canyon Ferry Reservoir. The future welfare of migrant spawners, rearing juveniles, and resident fish populations in Silver Creek are dependent on instream flow protection.

Q. What are the important fishery and wildlife values of **Trout Creek**?

A. In my opinion, Trout Creek is the most important tributary for spawning and rearing of salmonids that migrate to and from Hauser Reservoir. Kokanee, brown trout, mountain whitefish and rainbow trout migrate into Trout Creek to spawn. Spawning rainbow trout and brown trout up to 3.5 and 9.0 pounds in weight, respectively, have been sampled in Trout Creek and migrant spawners have been found as far as five miles upstream from the mouth. Juvenile salmonids utilize Trout Creek extensively for rearing habitat. Trout Creek also contains good populations of resident rainbow trout and brown trout. In October 1989, a total of 124 kokanee, 12 brown trout and 3 rainbow trout were captured by electrofishing in a 500-foot section of Trout Creek. Recent increases in the number of kokanee utilizing Trout Creek for spawning have resulted in bald eagles congregating in the area during the fall to feed on dead and dying fish. As a result, the mouth of Trout Creek has been designated by the Department as a public viewing area for the fall congregation of eagles.

Q. How would you characterize the water availability in **Trout Creek** for instream use?

A. Trout Creek arises from springs located approximately nine miles upstream from its mouth. Trout Creek, except during early spring run-off, more closely resembles a spring creek than a typical mountain stream. Sub-surface water sources provide fairly stable streamflows and water temperatures throughout most of the year. With the exception of small irrigation pumps used to water numerous yards and gardens, there is little irrigation withdrawal from Trout Creek.

Q. Why is the requested instream flow reservation needed in **Trout Creek**?

A. Trout Creek is an important tributary to Hauser Reservoir that provides spawning and rearing habitat for salmonids. Both the brown trout and kokanee populations found in Hauser Reservoir rely solely upon successful spawning in the tributaries and in the tailrace of Canyon Ferry Reservoir. Trout Creek also provides good angling opportunities for resident rainbow trout and brown trout. I feel that an instream flow of 15.0 cfs is necessary to protect the existing migrant and resident fishery, as well as the juvenile salmonids rearing in the stream.

Q. What are the important fishery values of **Beaver Creek**?

A. I feel Beaver Creek is the most important tributary to the Holter Reservoir complex for spawning and rearing of rainbow trout that migrate to and from both the 3.5-mile section of free flowing Missouri River below Hauser Dam and to Holter Reservoir. Rainbow trout from the Missouri River and Holter Reservoir spawn extensively in Beaver Creek during the spring high flow period. These migrant rainbow trout provide an excellent fishery in the stream. Brown trout of river or reservoir origin occasionally use Beaver Creek for spawning in the fall but their use is dependent upon the extent of beaver dam construction and flow levels at this low flow time of the year. Resident populations of rainbow trout, brown trout and cutthroat trout also provide a good fishery in Beaver Creek.

Q. What are the important fishery values in **Tenmile Creek** and **Sevenmile Creek**?

A. Tenmile and Sevenmile creeks provide moderate fisheries for rainbow trout and brook trout. Brown trout are also found in the lower portion of Tenmile Creek. The fisheries in both of these streams are considerably below their potential due to severe dewatering from irrigation withdrawals and, in the case of Tenmile Creek, municipal withdrawals. Gamefish populations in both streams are substantially greater in upstream sections where dewatering is less severe.

Q. How would you characterize the water availability in **Tenmile** and **Sevenmile** creeks for instream use?

A. Demands for water from Tenmile Creek are heavy. Both the small community of Rimini and the city of Helena use water from the Tenmile drainage for a municipal water supply. There are also heavy demands for irrigation water from Tenmile Creek. Due to these demands, a middle section of Tenmile Creek typically goes dry during the irrigation season. Groundwater sources and irrigation returns tend to re-water the stream near the mouth. Irrigation demands from Sevenmile Creek, a tributary to Tenmile Creek, are also great. Downstream of the Birdseye road crossing, Sevenmile Creek typically is dewatered to low levels during the irrigation season.

Q. Why are the requested instream flow reservations needed in **Tenmile Creek and Sevenmile Creek**?

A. Instream flow reservations would act to protect the existing resource values of these two streams. Although instream flow reservations would probably not improve the fisheries in Tenmile and Sevenmile creeks, Department requests would act to protect what remains there today. Should future water supply conditions improve through the use of more efficient irrigation practices and/or land use changes, instream flow reservations may enhance the fisheries in these two streams.

Q. What are the important fishery values of **Virginia Creek** and **Canyon Creek**?

A. Virginia Creek, a tributary to Canyon Creek, provides a moderate fishery for brook trout, rainbow trout and brown trout. Canyon Creek provides a good fishery for rainbow trout, brown trout and brook trout. The Canyon Creek fishery is very popular with local anglers.

Q. How would you characterize the water availability in **Virginia Creek** and **Canyon Creek** for instream use?

A. Withdrawals of water for irrigation and mining activities from Virginia Creek appear to be minimal. However, the stream channel of Virginia Creek has been altered by past dredging for mineral extraction and, to a lesser extent, road construction. On Canyon Creek, several diversions withdraw substantial quantities of water during the irrigation season resulting in dewatering in the lower reaches of the stream during the summer.

Q. Why are the requested instream flow reservations needed in **Virginia Creek and Canyon Creek**?

A. Instream flow reservations would act to protect the existing resource values found in these two streams. Although the Department's reservation request for Canyon Creek would likely not improve instream flow conditions, the reservation would act to maintain the status quo. Should future water supply conditions improve through the use of more efficient irrigation practices and/or land use changes, instream flow reservations may enhance the fisheries in Canyon Creek.

Mark Lere, being first duly sworn, states the foregoing testimony is true.

Dated: October 30, 1991.

Mark Lere

Subscribed and sworn to before me this 30th day of October, 1991.

Notary Public for the State of Montana
Residing at Helena, Montana
My Commission expires May 17, 1994

BIOGRAPHY -- MARK E. LERE

PERSONAL: Born June 29, 1954, Bozeman, MT

HIGHER EDUCATION: B.S. Degree in Fish and Wildlife Management
Montana State University, Bozeman, MT

M.S. Degree in Fish and Wildlife Management
Montana State University, Bozeman, MT

WORK EXPERIENCE:

February 1986 to Present - Fisheries Biologist III, Montana Department of Fish, Wildlife and Parks, Helena, MT. My present duties include conducting research to obtain a better understanding of the fish population dynamics in the mid-Missouri Reservoir complex and to obtain information necessary for developing fisheries management plans for Canyon Ferry, Hauser and Holter reservoirs. My duties also include acting as the management biologist for the waters found within the boundaries of Region 8. A portion of my duties during 1986 involved collecting and analyzing data on waters in the Helena area to support the Department's flow reservation requests.

July 1983 to February 1986 - Fisheries Biologist III, Montana Department of Fish, Wildlife and Parks, Missoula, MT. I was the project leader responsible for developing and evaluating an implementable water management plan for the release of purchased water from Painted Rocks Reservoir to provide optimum benefits to the Bitterroot River.

March 1982 to July 1983 - Fisheries Fieldworker I, Montana Department of Fish, Wildlife and Parks, Great Falls, MT. My duties involved gathering baseline fisheries data in the Missouri River downstream of Holter Dam, in Hauser and Holter reservoirs, and in associated tributaries.

June 1981 to December 1981 - Fisheries Fieldworker, Montana Department of Fish, Wildlife and Parks, Great Falls, MT. Assisted the regional biologist in collecting baseline fisheries data. A portion of my duties included assisting in the collection of data needed to determine the relationship between side channel habitat and river discharge.

March 1980 to June 1981 - Graduate Research Assistant at Montana State University, Bozeman, MT. I conducted independent research on evaluating the long term effectiveness of three types of improvement structures in Montana streams and authored a M.S. Thesis.

September 1978 to March 1980 - Graduate Teaching Assistant at Montana State University, Bozeman, MT. I instructed beginning biology laboratories with class sizes ranging from 10 to 40 students.

June 1976 to January 1977 - Fisheries Assistant, Red Lodge, MT. My duties included assisting the regional biologist in collecting data needed for the flow reservation process on the Yellowstone River and associated tributaries. Other duties included conducting stream and lake surveys in the Beartooth Mountains.

Summers 1974 and 1975 - Fisheries Assistant, Red Lodge, MT. Assisted regional biologist in conducting stream and lake surveys in the Beartooth Mountains.

TRAINING COURSES AND WORKSHOPS:

1. February 1991. Attended a negotiation seminar sponsored by the Montana Chapter of the American Fisheries Society, Missoula, MT.

2. February 1989. Attended a mark-recapture program workshop sponsored by DFWP fisheries division, Helena, MT.

3. February 1989. Attended a writing skills workshop sponsored by DFWP fisheries division, Helena, MT.

4. January 1989. Attended a short course on river mechanics presented by Dr. Donald Reichmuth, Geomax, Helena MT.

5. January 1989. Attended a course on the Introduction to Wordperfect 5.0 presented by the Information Services Division, Helena, MT.

6. December 1988. Attended an expert witness seminar sponsored by the Montana Chapter of the American Fisheries Society, Fairmont Hot Springs, MT.

7. June 1986. Attended a training workshop on the wetted perimeter methodology for instream flow analysis sponsored by the DFWP fisheries division, Helena, MT.

8. June 1986. Attended a training workshop on streamflow measurements and care of flow meters sponsored by the DFWP fisheries division, Helena, MT.

9. May 1986. Attended electrofishing theory workshop presented by the U.S. Fish and Wildlife Service, Bozeman, MT.

10. January 1983. Attended stream mechanics workshop presented by the Continuing Education Program at Montana State University, Bozeman, MT.

PROFESSIONAL ORGANIZATIONS:

Member, American Fisheries Society, National and Montana Chapter.
1988 to Present - Chairman of the Legislative Concerns Committee, Montana Chapter.

REPORTS AUTHORED:

Lere, M.E. 1991. Statewide Fisheries Investigations. Canyon Ferry, Hauser, Holter Reservoirs Study. Fed. Aid to Fish and Wild. Rest. Proj. No. F-46-R-1, Job II-f. 61 pp.

Lere, M.E. 1990. Statewide Fisheries Investigations. Mid-Missouri Reservoirs Study. Fed. Aid to Fish and Wild. Rest. Proj. No. F-46-R-1, Job II-f. 60 pp.

Lere, M. 1989. Statewide Fisheries Investigations. Mid-Missouri Reservoirs Study. Fed. Aid to Fish and Wild. Rest. Proj. No. F-46-R-1, Job II-f. 4 pp.

Montana Department of Fish, Wildlife and Parks. 1989. Hauser Reservoir Fisheries Management Plan, Sept. 1989 - Sept. 1994. 16 pp.

Lere, M.E. 1988. Statewide Fisheries Investigations. Mid-Missouri Reservoirs Study. Fed. Aid to Fish and Wild. Rest. Proj. No. F-46-R-1, Job II-f. 52 pp.

Lere, M.E. 1987. Statewide Fisheries Investigations. Mid-Missouri Reservoirs Study. Fed. Aid to Fish and Wild. Rest. Proj. No. F-36-R-2, Job II-f. 66 pp.

Lere, M.E. 1986. D-J Fisheries Restoration. Upper Missouri River System Fishery Improvement Project. Fed. Aid to Fish and Wild. Rest. Proj. No. F-36-R-1, Job 1-a. 7 pp.

Lere, M.E. 1986. D-J Fisheries Restoration. Water Reservations - Missouri River Basin. Fed. Aid to Fish and Wild. Rest. Proj. No. F-38-R-1, Job I-a. 2 pp.

Lere, M. 1985. Evaluation of management of water releases for Painted Rocks Reservoir, Bitterroot River, Montana. Annual report to the Bonneville Power Administration. Contract No. DE AI79-83BP13076. Project No. 83-463. Montana Department of Fish, Wildlife and Parks, Missoula, MT. 67 pp.

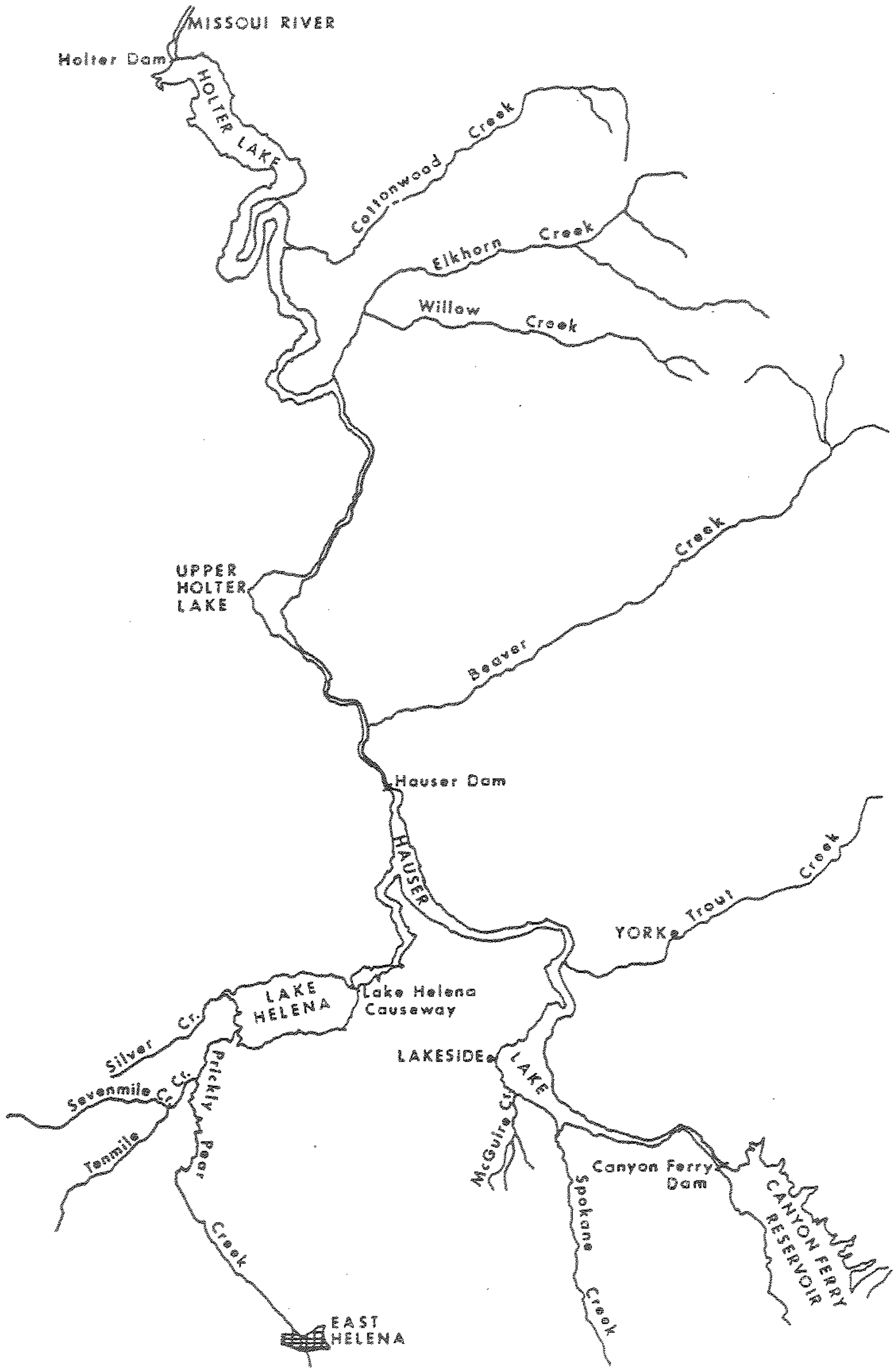
Lere, M. 1984. Evaluation of management of water releases for Painted Rocks Reservoir, Bitterroot River, Montana. Annual report to the Bonneville Power Administration. Contract No. DE AI79-83BP13076. Project No. 83-463. Montana Department of Fish, Wildlife and Parks, Missoula, MT. 65 pp.

Lere, M. 1984. Draft water management plan for the proposed purchase of supplemental water from Painted Rocks Reservoir, Bitterroot River, Montana. Montana Department of Fish, Wildlife and Parks. BPA project 83-463. 3201 Spurgin Road, Missoula, MT. 60 pp.

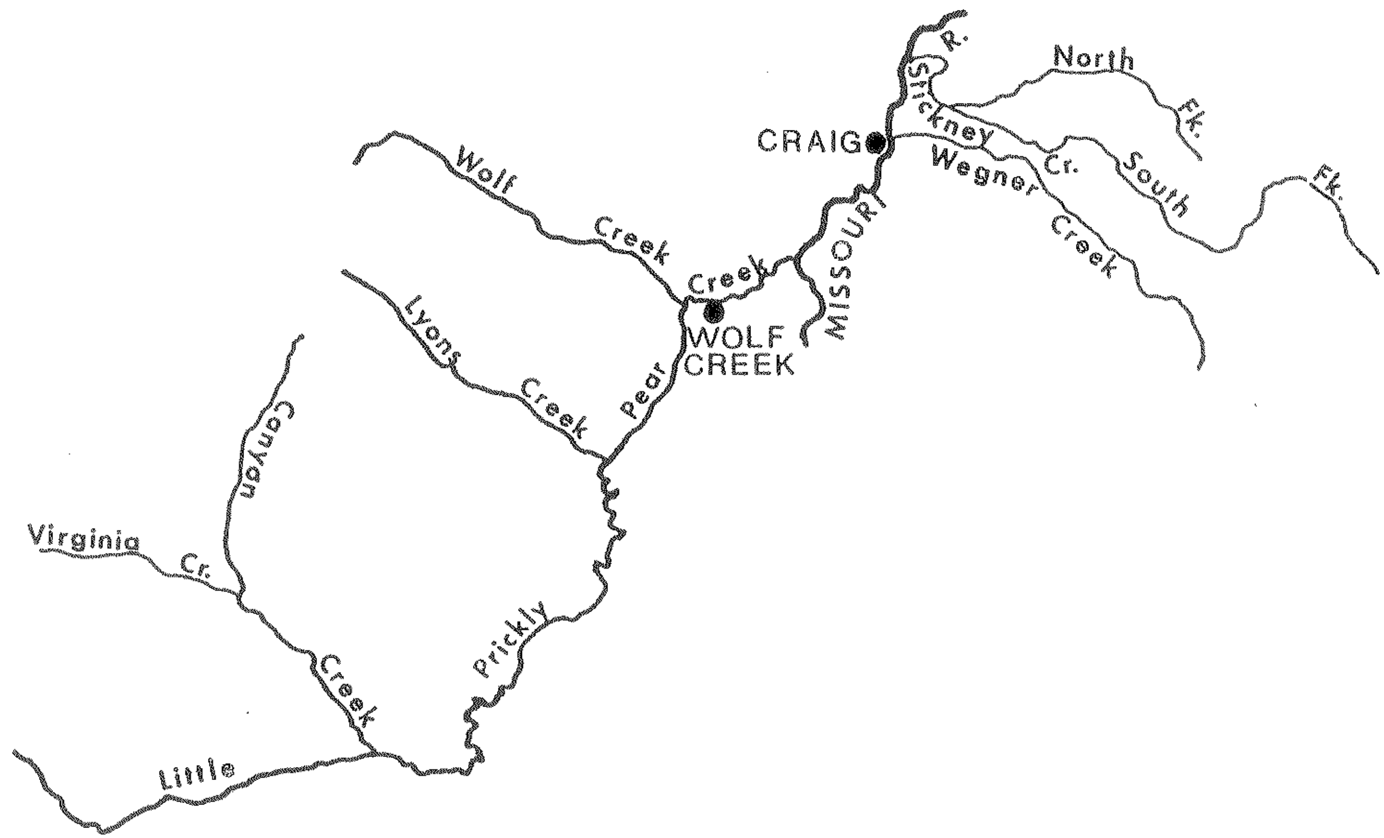
Berg, R.K. and M. Lere. 1983. Fish populations of Hauser and Holter Reservoirs, Montana with emphasis on tributary recruitment. Job Progress Report. Montana Department of Fish, Wildlife and Parks. Funded, in part, by U.S. Bureau of Reclamation. Purchase Order 2-01-60-02720. 40 pp.

Lere, M.E. 1982. The long term effectiveness of three types of stream improvement structures installed in Montana streams. M.S. Thesis, Montana State University, Bozeman, MT. 99 pp.

Appendix A



Map of the Missouri River Basin between Canyon Ferry Dam and Holter Dam.



Location map for the Little Prickly Pear Creek drainage, Wegner and Stickney creeks.

PRE-FILED DIRECT TESTIMONY OF MICHIEL POORE
ON BEHALF OF THE
MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS (MDFWP)

Q. Please state your name and business address.

A. Michiel Poore, MDFWP, Box 891, Columbus, Montana, 59019

Q. What is your present job?

A. I am a fisheries biologist employed by the MDFWP working in Region 5 out of Billings but based in Columbus, Montana.

Q. Please state your educational background and employment experience.

A. I was educated in public schools in Montana and Alaska. I attended high school in Anchorage, Alaska and spent two years at the University of Alaska in Fairbanks. In 1963, I transferred to the University of Montana where I received a B.S. in Wildlife Technology, Aquatic Option in 1968. I received a M.S. in Fish and Wildlife Management from Montana State University in 1973. I went to work for the MDFWP in 1973 as a fisheries biologist stationed in Lewistown, Montana. I worked as a biologist in Lewistown from 1973 to 1985 when I began working in Columbus.

Q. What is the purpose of your testimony in this proceedings?

A. The purpose of my testimony is to support that portion of the Department's instream flow requests on streams that I worked with for many years in the Lewistown area.

Q. What portion of the Department's application covers material that is supported by your testimony?

A. My testimony relates to information contained on pages 3-341 to 3-349, 3-362 to 3-366 and 3-437 to 3-439 (Big Spring Creek, Warm Spring Creek and Collar Gulch Creek). Maps showing the general location of these streams are attached as Appendix A and is a part of this testimony. All of these streams are tributaries of the Judith River.

Q. Is the information contained in these portions of the application accurate?

A. Yes.

Q. What training and experience do you have that qualifies you to do instream flow analysis?

A. I received training conducted by DFWP's instream flow coordinator, Fred Nelson, on the various instream methods, and particularly the Wetted Perimeter Inflection Point Method. I followed the procedures established by the Department to conduct this analysis. In addition to doing work on the streams described in my testimony, I helped do the wetted perimeter determinations for a number of streams in the Smith River drainage.

Q. What was your involvement in the Department's Missouri River Basin water reservation application process?

A. During the years I worked in Lewistown, much of my time was devoted to gathering the majority of the fisheries information for the streams just mentioned and much of that information is contained in the application. I was involved with collecting field information, conducting fish population estimates, measuring flows and determining the amount of water required to maintain the aquatic resources in these streams.

Q. What method was used to determine the amount of water requested for instream flows on Big Spring Creek and Warm Spring Creek?

A. Instream flow requests on Big Spring Creek and Warm Spring Creek are based on the wetted perimeter method which was applied at several locations to determine the necessary flows.

Q. Did you do the wetted perimeter determinations?

A. Yes. I was in charge of the wetted perimeter work. In addition to working on Big Spring Creek and Warm Spring Creek, I helped do the wetted perimeter determinations for a number of streams in the Smith River Drainage.

Q. Big Spring Creek is divided into two separate reaches for purposes of this reservation application. Why was the stream divided into two reaches?

A. Big Spring Creek in its lower 8.2 miles (Reach #2) is considerably different from the upper 23.7 miles of stream (Reach #1). Towards its lower end, the Big Spring Creek valley becomes narrower and the valley sides gradually steepen. Soils change to more erosive types and the stream channel is more unstable. Cottonwood Creek, which enters Big Spring Creek at the beginning of Reach #2, contributes major amounts of sediment and bedload to the watershed. Higher stream flows, which progressively increase down the watershed, tend to undercut unstable slopes causing bank sloughing and mass wasting in several areas. Increased bedload and flows contribute to channel migrations and moderate channel instability. In response to changes in the physical nature of the stream, fish populations also change. Reach #2 can be characterized as a transition zone from the coldwater trout fishery of Reach #1 to the warm water fishery more typical of the Judith River System. Trout populations decrease in a downstream direction and small trout are much less abundant. Trout reproduction is limited because of the sediment load and unstable channels.

Species not found in Reach #1 show up in Reach #2 including goldeyes, sauger, and shorthead redhorse suckers. Carp are more abundant. These species are all common in the lower Judith River and probably use lower Big Spring Creek for spawning, rearing and foraging. Dissolved solids and the organic load, which increase downstream within the watershed, are quite high in the lower reach of Big Spring Creek. This rich environment contributes to the production of an abundance of aquatic vegetation and a rich aquatic invertebrate community which are very important to the fish and wildlife resource. Wildlife and bird populations are more abundant within Reach #2 because the adjacent floodplain is less developed and fewer people live along the stream.

Q. What factors contribute to making the fishery in Big Spring Creek so outstanding?

A. Big Spring Creek has the characteristics of a spring creek. Spring creeks in general are very unique, and in a limestone area, are generally very productive. Many factors contribute to maintaining the outstanding fishery found in Big Spring Creek. Probably the most important factor is the stable year-round flow provided by the large spring. In spring-fed streams, fish populations are not forced to deal with the often quite severe water level fluctuations which affect many of Montana's streams. Stable flows produce stable fish populations. Stable water temperatures, in the mid-fifties at the spring, provide the optimum temperatures for trout growth during most of the year. Productive water rich in dissolved solids acquired by percolation through underground limestone formations provides a rich environment for fish growth and production of aquatic invertebrates and vegetation. The last factors important for maintaining the Big Spring Creek fishery are the relatively stable banks, stream channel, and well developed riparian zone which interact with the stable flows to provide a multitude of habitats for trout of all sizes.

Q. Beginning with Big Spring Creek stream Reach #1, how would you describe the fishery the Department is attempting to protect with the instream flow reservation?

A. Big Spring Creek Reach #1 is one of the finest wild trout streams in the state of Montana. In 1969, when the Montana Legislature authorized the MDFWP to file for instream water rights in the best blue ribbon trout streams in the state (Murphy rights), Big Spring Creek was selected as one of only six streams in the Missouri basin selected for filing under that bill. Trout populations in the better sections of this small stream are comparable in numbers to the better sections of the Missouri River, a stream with many times the size and flow. Big Spring Creek has a history of producing large trout and few streams in the state have ever produced the 20 pound class fish occasionally taken from this stream. With the exception of the Bighorn River, Big Spring Creek is the most easterly significant trout fishery in the state and local sportsmen and tourists consider it the most outstanding trout stream of Central Montana.

Q. Why is an instream flow reservation needed for this reach of Big Spring Creek?

A. Reductions from the stable flows would potentially impact various segments of the fish population. Normally, small flow reductions first impact small fish which tend to inhabit the shallow water and the cover along the edges of the stream. Any additional consumptive water withdrawals which might upset this delicate balance of interacting factors would adversely impact the high quality fishery and related aquatic ecosystem. Conditions for growing trout in Big Spring Creek are so perfect that the MDFWP maintains the state's largest trout hatchery there and the water is also used by three private hatcheries to raise trout for commercial purposes.

Q. Are there other public benefits that would be adversely impacted by additional consumptive water withdrawals from Big Spring Creek?

A. Yes. Based on my personal observations and experience and professional judgement, I believe that Big Spring Creek, which flows through the middle of the city of Lewistown, is almost synonymous with Lewistown and Central Montana. It is one of the jewels that make the area such an attractive place to live, raise families and recreate. Many Central Montana residents and tourists who visit the area spend quality time fishing, swimming, tubing, canoeing, hunting or just relaxing along the stream. Many species of wildlife live in and along the stream and its associated riparian zone. Great numbers of waterfowl, particularly mallards, winter along the stream because it remains ice-free year round. Further reductions in flow could affect this ice-free status. The Lewistown Sewage Treatment Plant discharges an average of about 2,000,000 gallons per day of treated water into Big Spring Creek. During storms and at normal spring runoff periods, the plant discharges up to 9,000,000 gallons per day. Both these figures are relatively high for a community the size of Lewistown. The dilution factor provided by maintaining the

MDFWP water reservation is important for helping to maintain water quality and to speed up recovery in the mixing/dilution zone downstream from the sewage treatment facility. The impacts and odors from this discharge have been noticeable for many years and extend downstream for miles. Polluted discharge from a local sawmill also enters the stream near Lewistown. Granting the MDFWP request for an instream flow reservation will not only help protect the high quality wild trout fishery and associated wildlife community which depends upon Big Spring Creek, but also many of the other values so important to the watershed and the people of Central Montana.

Q. Why is the instream flow request for Reach #2 slightly lower than that requested for Reach #1?

A. Reach #1 contains one of the highest quality trout fisheries in the state and more flow is needed to preserve it in its present condition. Although Reach #2 is also a high quality trout and warm water fishery which also needs protection, we feel the slightly reduced request will provide sufficient water to maintain the aquatic ecosystem. The flow of 100 cfs was derived using the standard wetted perimeter methodology and should be sufficient to protect the integrity of the stream channel and its dependent fish and wildlife community. A potential benefit from a slightly reduced flow would be to help stabilize the channel and reduce erosion problems common within Reach #2.

Q. Are there other values that would be protected by granting the MDFWP's request for an instream water reservation in Reach #2 of Big Spring Creek.

A. Yes. In varying degrees nearly all the other considerations discussed for Reach #1 also apply for Reach #2. Both reaches together function to constitute this very unique and valuable resource so important to the people of Central Montana. In addition, flows from Big Spring Creek contribute most of the flow for the Judith River at their confluence, except during the spring runoff period. Big Spring Creek flows are very important for maintaining the fish and wildlife community and other beneficial uses in the Judith River downstream from their confluence.

Q. This testimony also includes Warm Spring Creek. What was your involvement with this stream?

A. While in the Lewistown area, I lived for two years on a ranch north of town and Warm Spring Creek ran through the middle of the property. Fisheries related work I was involved with on Warm Spring Creek included fish population sampling, stocking of rainbow trout and smallmouth bass, wetted perimeter and flow measurements and evaluation of a proposed hydroelectric facility.

Q. Describe the fishery values the Department wishes to protect with the requested flow reservation of 110 cfs.

A. For many years the trout fishery in Warm Spring Creek has been maintained through annual stocking of catchable size rainbow trout. Stocked fish grow moderately well but are unable to reproduce because of the 68° water temperature. A few brook trout which migrate downstream from above where the large artesian spring emerges are also found in the stream. Brown trout probably enter the stream from Big Spring Creek via the Judith River. Water temperatures are also too high for reproduction of brown trout. Because temperatures in Warm Spring Creek are above optimum levels for trout, smallmouth bass were introduced in 1973 and are growing well and reproducing.

Warm Spring Creek has the potential to provide one of the best smallmouth bass fisheries in the state of Montana. Other game fish species found in the lower end of Warm Spring Creek including sauger and channel catfish originate from the Judith River. The warm productive water of Warm Spring Creek which provides such a rich environment for the diverse community of aquatic vegetation and aquatic insects also provides habitat for many other fish species. These other species include four species of suckers, carp, dace, perch, sculpins, goldeye and various minnow species. They provide a rich forage base for the various predatory game fish species.

In terms of productivity, diversity of fish species and diversity of the invertebrate community, Warm Spring Creek is one of the most unique streams in the entire state. Conductivity of the water in Warm Spring Creek, which is a rough measurement of dissolved solids, is so high that electrofishing efficiency is very low. This low electrofishing efficiency makes it very difficult to monitor fish populations in the stream. Therefore, most fish population work on Warm Spring Creek has been qualitative rather than quantitative.

Q. What factors contribute to making the fishery in Warm Spring Creek so unique?

A. To a varying degree, the same factors which make Big Spring Creek so productive and unique also apply to Warm Spring Creek. The most important factor is the constant stable flow of about 125 cfs provided by the spring. Flows in Warm Spring Creek over its entire 28 mile length are very stable since no other perennial streams of any significance enter the stream. Stable temperatures, which average 68°F at the spring, provide an ideal environment for a unique combination of warm-cool water fish and invertebrate species. A third factor is the highly productive water rich in dissolved solids which it picks up as it percolates through limestone layers deep within the Madison formation. These rich waters make possible the diverse aquatic community which supports the stream's unique fishery resource. The fourth important factor is the stability of the streams banks, channel and riparian zone. This is particularly true in the upper ten miles of stream. Bank and channel instability increase in a downstream direction as soils change to more erosive types and poor agricultural practices impact the streams banks and riparian zone. Stable banks and channel, stream flow, water temperature and productive water provide the ingredients necessary to provide the diversity of habitats so vital to the watershed's rich fish and wildlife community.

Q. What other public benefits would be protected by the granting of the MDFWP's instream flow request for Warm Spring Creek?

A. Because of its warm clear water, Warm Spring Creek is very popular for swimming floating and tubing. A large swimming hole located near the spring attracts hundreds of people during the hot days of summer and fall and on weekends parking spaces are limited. A private fish hatchery proposal for raising sturgeon near the spring has been proposed. Using water from Warm Spring Creek to raise channel catfish and walleyes for commercial purposes has also been suggested. Since these hatchery proposals are for non-consumptive water use, the MDFWP water request would probably be compatible with these uses. Because of the undeveloped nature of the watershed, the sparse population and well developed riparian zone, wildlife and bird populations are abundant. The warm ice-free water during winter months and abundance of aquatic invertebrates and aquatic vegetation attracts hundreds of waterfowl, particularly mallards. The abundant fish and wildlife species dependent upon Warm Spring Creek attract many hunters, fishermen and other recreationists, making it one of the more popular areas in Central Montana. Flow from Warm Spring Creek combined with flow from Big Spring Creek constitute the majority of flow within the Judith River system, except during spring runoff. Granting the MDFWP request for an instream flow reservation of 110 cfs year round for Warm Spring Creek will help maintain the fish and wildlife community and protect all the other public and private uses just discussed.

Q. What potential threats to the quantity and quality of water in Big Spring Creek and Warm Spring Creek may threaten the integrity of these streams in the future, making an instream flow reservation necessary?

A. Nearly every year new proposals are made to use water from one or both of these streams for various projects. More often than not these proposals are for consumptive uses. Renewed gold mining activity based on cyanide leach technology has already contaminated ground water along the East Fork of Big Spring Creek and several cyanide spills have also occurred at Kendal located in the Warm Spring Creek drainage. Small hydropower projects have been proposed on both streams. The proposed Warm Spring Creek hydropower project would result in reduced stream flows through several miles of the best habitat. Residential developments along both streams pose problems with sewage systems and additional water use. Granting the MDFWP instream flow requests on these two large unique spring creeks will help protect and maintain the existing values and ensure their use and enjoyment for generations yet to come. These two streams are indeed an integral part of the high quality of life in Central Montana.

Q. What was your involvement with the MDFWP request for instream flow reservation in Collar Gulch Creek?

A. During the time I was in Lewistown, I sampled the stream's fishery on several occasions. I collected cutthroat trout from the stream for genetic analysis and was part of a cooperative effort between the BLM and MDFWP to collect and transfer cutthroat upstream from a log crib fish barrier.

Q. Why were these fish moved upstream from the barrier?

A. To my knowledge these fish represent the only cutthroat trout population in the Judith Mountain Range. Statewide, they are classified as a "Species of Special Concern" because their original range and distribution has steadily declined. The Collar Gulch population has somehow managed to survive past mining activity and a mining-related water diversion of most of the stream's flow. Although approximately 3.5 miles of the stream has perennial flow only the lower 2 miles of stream was inhabited by fish. The upper 1.5 miles of stream, which appeared to contain some suitable trout habitat, was blocked by the log barrier. Fish were collected from below the barrier and transferred above the barrier to take advantage of the additional habitat.

Q. Why is an instream flow reservation needed in Colter Gulch Creek?

A. Although this pure cutthroat population has somehow managed to survive, the number of fish in the stream is small and they appear to be just "holding on". Any additional water use which consumes, degrades or otherwise affects this small perennial stream will undoubtedly lead to the disappearance of the species from this entire mountain range. In addition, this small stream is important to a number of wildlife and bird species which use the area. The Judith Mountains are quite arid and any perennial water supply is quite essential to the resident wildlife species.

Renewed interest in gold mining that has resulted from developing more efficient methods of gold extraction has already impacted ground water and stream flow in several areas around Lewistown. Renewal of mining activity in the Collar Gulch drainage would probably destroy the small stream's cutthroat population, due to changes in water quality or water quantity.

I, Michiel Poore, being first duly sworn, states that the foregoing testimony is true.

DATED this _____ day of ____________, 1991.

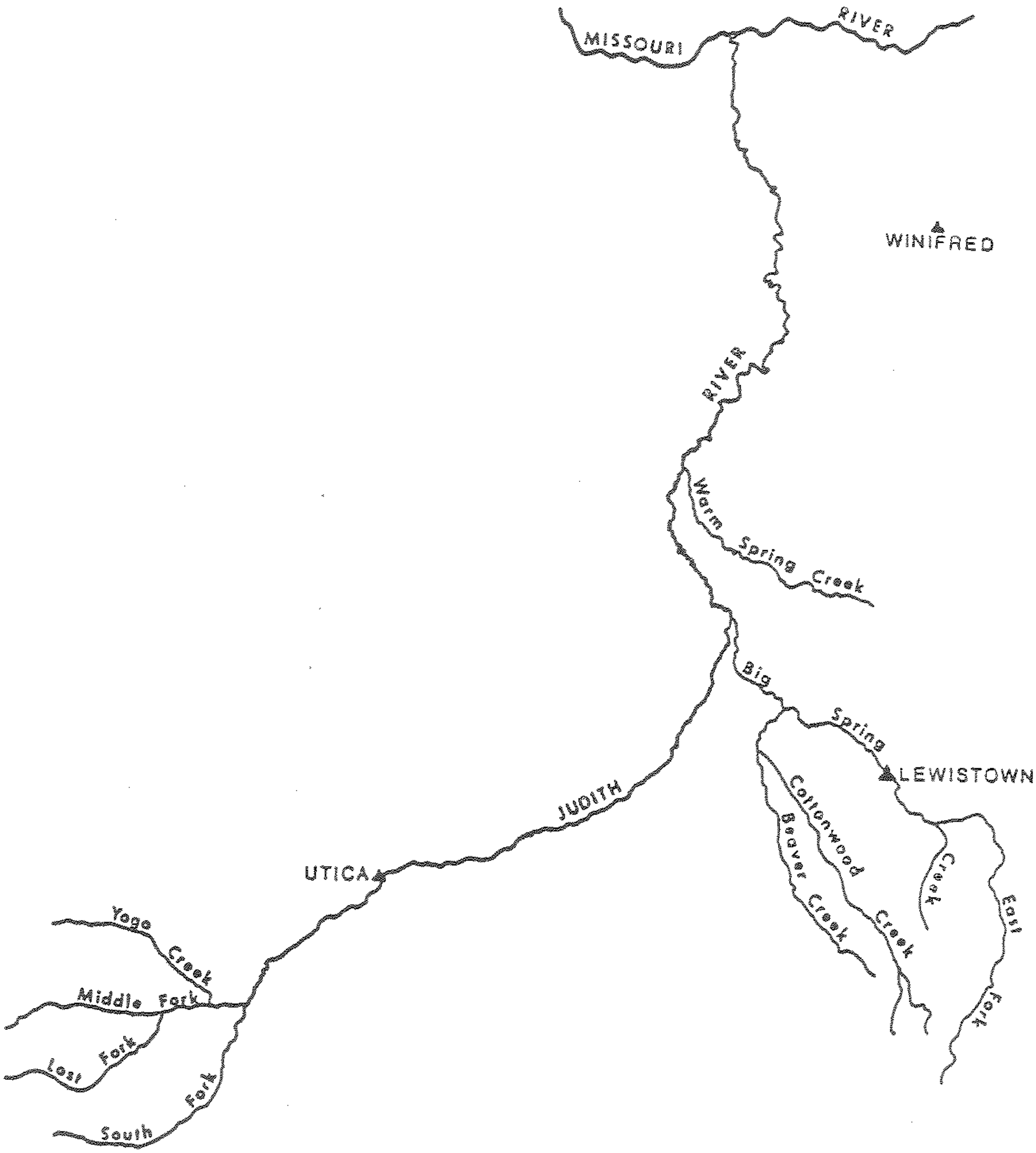
____
Michiel Poore

Subscribed and sworn to before me this ____ day of _________, 1991.

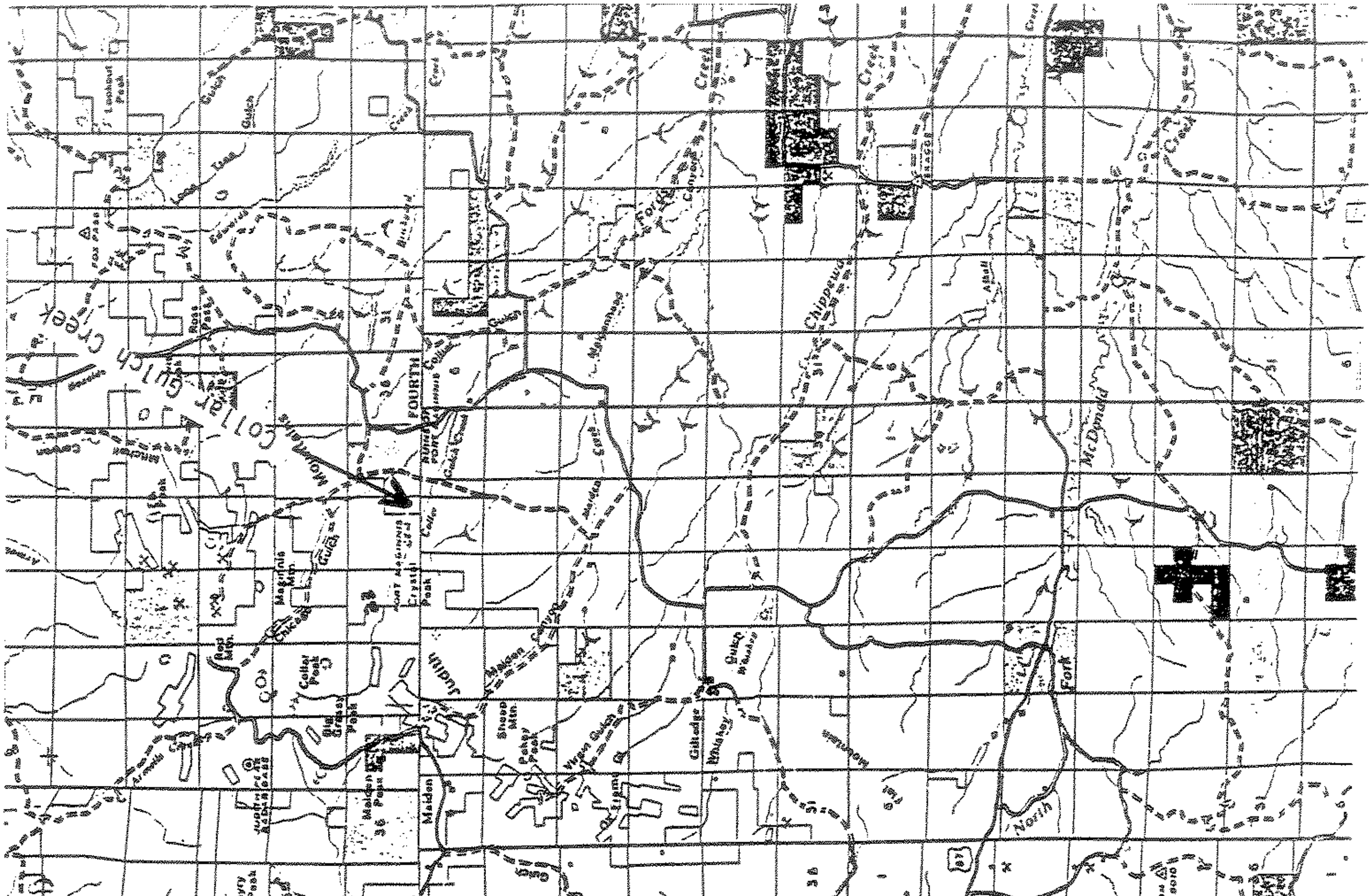
(NOTARY SEAL)

____
Notary Public for the
State of Montana
Residing at _______________________
My Commission Expires ______________

Appendix A



Location Map for the Judith River Drainage.



Judith
Maiden
Maiden Canyon
North
Fork
McDonald
Chippewa
Crystal Peak
FOURTH