F-02-7

BIG HOLE RIVER INSTREAM FLOW PROTECTION PROJECT

Environmental Contingency Grant Program Completion Report

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Submitted To:

Office of the Governor

Department of Natural Resources and Conservation

January 1995

PROJECT SUMMARY

The Big Hole River of southwestern Montana sustains the last remnant population of fluvial, or river-dwelling, Arctic grayling in the 48 contiguous United States. In the mid-1980's, this population underwent a serious decline in abundance. An interagency recovery program led by Montana Fish, Wildlife, and Parks (FWP) was instituted in 1988 to address the factors responsible for the decline and to devise a program to conserve this unique native salmonid. In October 1991, a petition was submitted to the U. S. Fish and Wildlife Service (USFWS) requesting fluvial Arctic grayling in Montana be classified as "Endangered" and be given full protection under the Endangered Species Act. The status review of the grayling resulted in a finding, published in the Federal Register, that "...listing...is warranted but precluded..." The rationale behind the finding included a lessening threat to the population "...primarily as a result of the cooperative efforts that have been initiated..."(Nordstrom 1994).

A predominant factor limiting Arctic grayling in the Big Hole River during the 1980's has been drought. Water yield in the Big Hole Basin was the lowest on record between 1988 and 1994 (USGS Files). During years of poor snowpack and scarce mid-summer precipitation, increased agricultural demand for water resulted in periodic dewatering of the upper Big Hole River, particularly between July and September. Diminished flows

contribute to high water temperatures, higher susceptibility to predators, decreased habitat volume, and increased mortality of very old and very young fish. Water temperatures lethal to grayling have been documented in 5 of the last 7 years in the upper Big Hole River (Byorth 1994).

It is well documented that fish abundance is regulated by food and space which are primarily determined by water volume (Chapman 1966). Limits of productivity in a riverine fish community are set by discharge during critical periods. Nelson (1980) described two minimum flow levels for salmonid populations: an "absolute minimum" below which standing crops of fish are reduced and a "most desirable minimum" which are necessary to maximize standing crops. In the Big Hole River the absolute minimum was determined to be 60 cfs in a reach near Wisdom (Mt. Dept. of Natural Resources and Conservation (DNRC) 1992). However, in 6 of the past 7 years, discharge in the upper Big Hole River at Wisdom has been under 60 cfs on a majority of days between June and October. During extremely dry years it is appropriate to define a third critical flow level. This "minimum survival" flow would merely maintain a wetted channel and facilitate survival of the fish population only in a short term. This level was estimated to be 20 cfs. Our goal during Summer 1994 was to maintain instream flows above this level to mitigate further declines in, or reduce the risk of extinction of the Arctic grayling population. Flows were monitored at a U. S. Geological Survey (USGS) gage located at Wisdom (Figure 1).

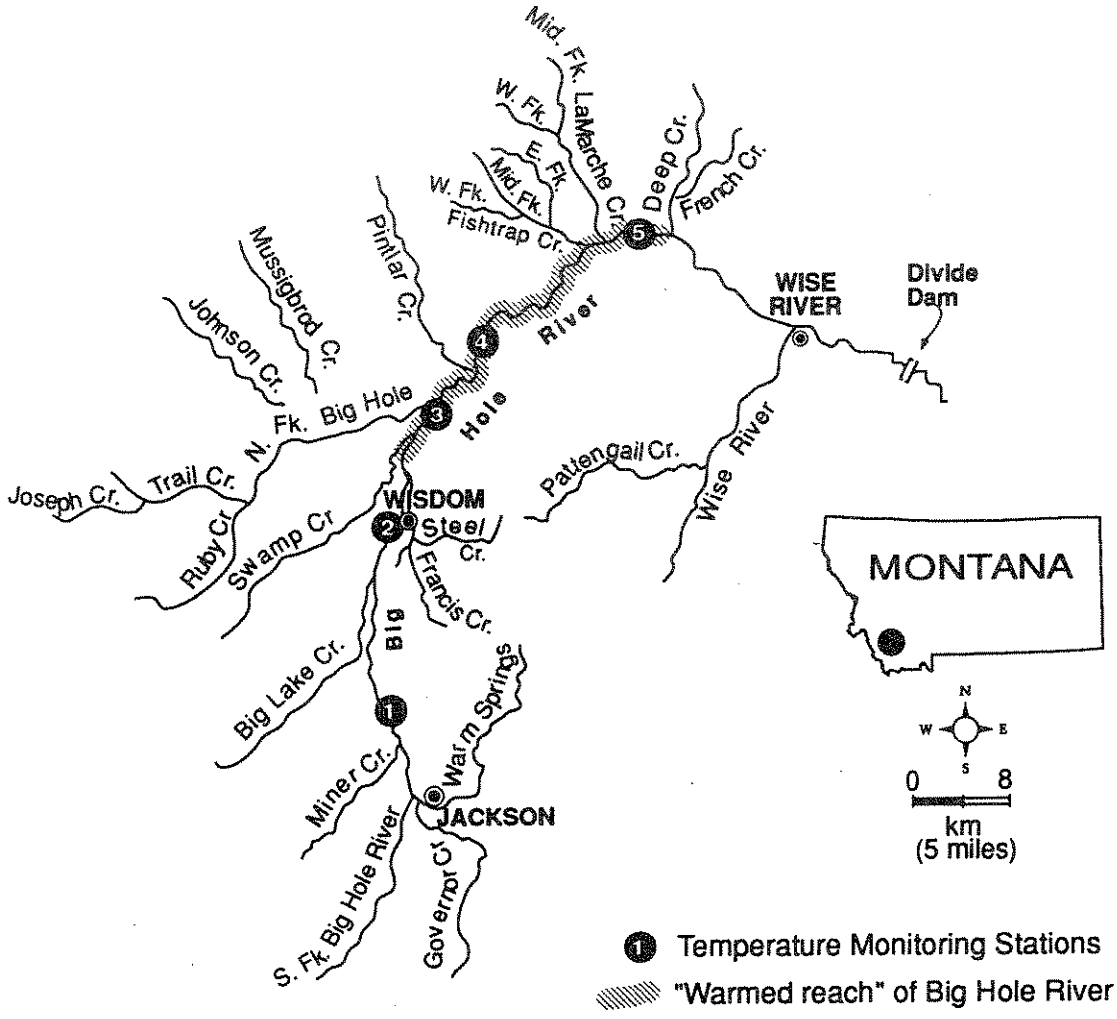

Figure 1. Map of the upper Big Hole River study area including thermograph stations, USGS gage station (2), and warmest reach of the Big Hole.

Due to early snow-melt and lack of rain, water withdrawals for agriculture were the primary regulator of instream flows in the Big Hole River and its tributaries. Therefore, to maintain minimum survival flows, it was necessary to seek cooperation from the agricultural community in conserving the limited available water. We contacted water-users, in person and by phone, requesting that they minimize their withdrawals. In spite of

efforts to conserve water, however, flows became critical in early August. By that time, irrigation season had ended but water was still being diverted for stock. It was apparent that the only way to maintain a minimum flow was to find alternative sources of stock water.

The upper Big Hole River has been dewatered most severely in the reach near Wisdom, which is among the most critical habitats for Arctic grayling. Several diversions and canals upstream of Wisdom are used to transport water over long distances to cattle. Evaporation and leakage renders this water delivery system extremely inefficient. To provide an alternative to diverting water, we contacted water-users on three ranches and offered to supply stock water in tanks. After a ranch owner expressed interest in cooperating, we requested financial support for the project from the Environmental Contingency Grant Program through the Governor's Office and DNRC. The grant was secured which enabled FWP to purchase ten 1,000 gallon stock tanks and to lease a tank truck and driver from the East Bench Irrigation District. Eight stock tanks were installed in several large pastures which were kept filled by water truck from September 7 through October 1, 1994. Water was pumped into the tanker from the Big Hole River at the ranchers' established points of diversion. Two additional stock tanks were placed at an existing well site, which we developed to constantly supply tanks with water.

RESULTS

Discharge in the upper Big Hole River declined to critical levels during two periods in 1994. Mean daily flows were below 20 cfs from June 25 through July 5 (Figure 2). The lowest flow during this period was 14 cfs. Diverting water to irrigate hay was a primary factor reducing stream flow. In the upper Big Hole Basin, the irrigation season traditionally extends from May to early July. After water users were contacted, on June 28 and July 6, the majority of irrigation diversions were closed. A rain storm also occurred as irrigation season ended and flows increased to 57 cfs by July 8 (Figure 2).

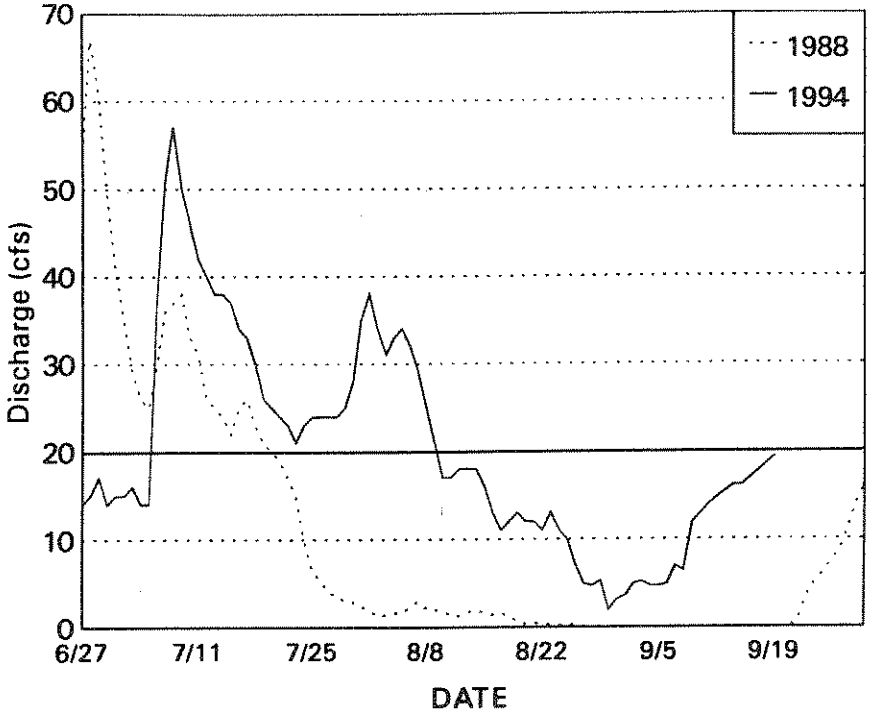

Figure 2. Mean daily discharge of the Big Hole River measured at the USGS gage near Wisdom, June 27 to September 30, 1988 and 1994.

A second critical flow period began in late July as hot, dry weather persisted. Between July 24 and 27, a fish kill due to lethal water temperatures was documented near the confluence of the Big Hole River and Pintler Creek. Several hundred fish of most resident species and age classes were found dead. The full extent of the fish kill was unknown, but mortalities were documented from the mouth of the North Fork of the Big Hole River to the Squaw Creek area, a distance of approximately 13 miles (the "warmest reach" in Figure 1). In response to critical conditions, Governor Racicot convened a public meeting in Butte to discuss strategies to address the drought, especially in the Big Hole and Clark Fork basins. He emphasized using cooperative efforts to alleviate water shortages. On July 30, the Fish, Wildlife, and Parks Commission closed the fishing season from the mouth of the North Fork to Dickie Bridge to protect the Arctic grayling population. FWP initiated a second round of water-user contacts requesting increased water conservation. FWP also hired a water commissioner to survey Big Lake and Big Swamp Creeks for surplus water. As a result of these efforts, flows increased to 38 cfs by August 1 (Figure 2). However, flows returned to critical levels by August 10.

While very little water was entering the Big Hole River from tributaries or precipitation, stock water was still being diverted in mid-August. By August 25, water users were contacted a third time to reduce consumption. In spite of those efforts, a water-user opened a diversion on August 30 in an unsuccessful

attempt to divert water to cattle. As a result, flows reached the low point of 1.9 cfs on that date. In response to FWP's calls for assistance, that diversion and eight others were closed or reduced to a minimum to keep the Big Hole River flowing.

After the Environmental Contingency Grant was secured, stock tanks were distributed and filled by September 7. As a result, the "Spokane" ditch was closed. Prior to its closing, approximately 5 cfs had been diverted and transported over 8 miles to water approximately 2,500 cattle. After the Spokane ditch and the other diversions were closed or withdrawals reduced, flows at Wisdom increased to near 20 cfs by September 16. Flows fluctuated between 15 and 20 cfs until early October, when fall precipitation provided relief from drought conditions.

The success of delivering water to stock tanks as an alternative to providing water through ditches is illustrated by Table 1. We delivered water to stock tanks for 25 days. Had the Spokane ditch remained open at a rate of 5 cfs, approximately 81 million gallons of water would have been diverted from the Big Hole River. We delivered approximately 227,375 gallons of water over the 25 day period in addition to approximately 150,000 gallons provided by a well. The volume of water required via the alternative means was approximately 0.5% of that required by ditch delivery.

The summer of 1988 provided a useful comparison to gauge the success of this summer's efforts. In 1988, the Big Hole River ceased to flow (i.e. 0 cfs) at Wisdom for 24 days in August and

September. In 1994, flows were as low as 1.9 cfs on one day, and were below 5.0 cfs on only 6 days.

Table 1. Comparison of efficiency of providing stock water via ditch at 5.0 cfs versus delivering water by stock tanks and a well between September 7 and October 1, 1994.

Water Volume	Ditch	Tanks	Well	Tank + Well
Flow (cfs)	5.0	0.014	0.005	0.019
Gallons per Day	3,231,580	9,095	3,000	12,095
Total Gallons	8.1×10^7	227,000	150,000	377,000
% of Ditch Volume	100	0.34	0.19	0.53

While substituting water delivery for stock water canals proved to be a successful way of maintaining a minimum instream flow, it was merely an emergency measure. The expense and limited scope would render water delivery ineffective in the long term. More permanent solutions to water allocation during drought years must be addressed. A positive step was made during 1994 as water-users made an effort to conserve water. An increased awareness of the status of the Arctic grayling population and a conscious effort to monitor water consumption will facilitate future efforts at preserving in-stream flow. The efficacy of providing water via wells and pipelines was tested and will be pursued further. Plans to drill wells and pump water to cattle served by the Spokane Ditch are in development. The concept of "conjunctive use", or tapping deep aquifers in drought years, is also being investigated.

The Arctic grayling population of the Big Hole River has

recently shown signs of increasing abundance (Byorth 1995). Fall 1994 sampling revealed an increase in grayling abundance to approximately 65 per mile in the Wisdom area, a level last observed in 1984. Continued recovery of the population depends on providing a satisfactory minimum instream flow. While 20 cfs may allow the grayling population to survive critical periods in a short-term crisis, the "absolute minimum" flow of 60 cfs should be our goal in the future. By seeking out alternatives for watering stock and through improved conservation in irrigation practices the last fluvial Arctic grayling population in the lower 48 United States will remain a testament to Montana's commitment to its natural heritage.

BUDGET SUMMARY

The Environmental Contingency Grant was $ 7,245.00. Total expenses for the project at completion were $ 8,970.52. We had estimated costs based on delivering water for two weeks. However, the drought persisted and we continued delivering water for two additional weeks. The major additional expense was providing wages for water truck drivers. While only 40 hours per week were allotted, drivers delivered water up to 19 hours per day. Additional driving time was provided by FWP fisheries personnel. FWP also provided additional funding for a water commissioner and rented high volume pumps to fill the water tank more efficiently.

Table 2. Summary of budget and expenses for the upper Big Hole River Flow Protection Project.

Item	$ Budgeted	$ Spent	
		E.C.G Grant	FWP
Stock Tanks (10)	2250.00	2269.00	
Delivery	150.00		
Truck Drivers	600.00	1623.08	1367.00
Water Truck	2800.00	3150.00	
Maintenance/Repair	500.00	200.94	270.50
Contingency	945.00		
Water Commissioner			90.00
TOTAL	**7245.00**	**7243.02**	**1727.50**

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