F-07/08-42

F-07/08 Flathead

ATTACHMENT

SUMMARY

The Montana Department of Fish, Wildlife and Parks (MDFWP) under provisions of an act passed by the 1969 Montana Legislature filed for instream water rights for purposes of preserving fish and wildlife habitat in the 45.7 mile reach of the Flathead River from Flathead Lake to the confluence of the South Fork. The MDFWP filed on December 22, 1970 for the amounts listed below:

Time Period	Amount (cfs)
October 1 - March 31	3,625
April 1 - September 30	8,125

This reach of the Flathead River supports a high quality westslope cutthroat trout, trophy bull trout, and kokanee salmon fishery. Fishing pressure on the Flathead River during the summer of 1975 was estimated at 46,193 man-days with over 73% of the pressure occurring in the vicinity of Kalispell. The estimated harvest was 217,610 fish which included 86% kokanee, 7.1% westslope cutthroat trout, 3.5% mountain whitefish and 2.4% bull trout.

This reach of the Flathead River is extremely popular with recreational floaters even though flows are partly regulated by releases from Hungry Horse Dam (on the South Fork) and subject to extreme fluctuations. Waterfowl hunting along the river is also a popular fall activity.

Recent advances in the development of instream flow methodologies have enabled the MDFWP to more accurately define the flows that are needed to maintain the high quality trout and salmon fishery of this reach of the Flathead River at the existing level. The recently derived flow recommendations are less than the original filing for the periods of July 16 - April 30 and exceed the original filing for the period of May 1 - July 15.

For adjudication purposes, the final claim submitted by the MDFWP can be less than, but not exceed, the original filing of December 22, 1970. Consequently, the flow recommendations must be adjusted to the constraints imposed by the original filing. The final claim of the MDFWP is as follows:

Time Period	Amount (cfs)
August 1 - April 15	3,500
April 16 - April 30	6,650
May 1 - July 15	8,125
July 16 - July 31	5,402

The final claim amounts to a net flow reduction of 872,408 acre-feet from the original filing, a reduction of 20.5%.

The final claim, when adjusted to fall within the constraints of water availability for a median or normal water year, equals 3,384,350 acre-

feet of water per year, which is about 52.4% of the annual volume of water that is normally available at the U.S.G.S. gauging site near the upper end of this reach (5.7 miles downstream from the South Fork).

The instream flow methodologies, flow recommendations and other background information are thoroughly discussed in the following sections.

1. RIVER

Flathead River (from the inlet to Flathead Lake up to the mouth of the South Fork Flathead River)

2. GENERAL DESCRIPTION

Origin

The Flathead River originates in the Rocky Mountains of British Columbia. The river is named the Flathead River in Canada until crossing the Canadian border. At this point it is known as the North Fork of the Flathead River down to the confluence of the Middle Fork where it is again named the Flathead River. From the confluence of the Middle Fork, the river flows approximately 13 miles through Badrock Canyon before entering the Flathead Valley.

The lower main stem Flathead River above Flathead Lake is a low gradient river flowing through agricultural land. There are numerous islands, side channels, and oxbow lakes. The riparian zone consists of cottonwood, willow, alder, and birch. The subdivision of agricultural land along the river is increasing.

Stream Length

Length of Flathead River (inlet to Flathead Lake up to the confluence of North and Middle Forks): 55.3 miles
Inlet to Flathead Lake up to the mouth of the South Fork: 45.7 miles
Mouth of the South Fork up to the mouth of the Middle Fork: 9.6 miles

Drainage Area

Total Flathead River (above Flathead Lake): 5571 square miles

Gradient

Total Flathead River (above Flathead Lake): 12.3 ft/mile (0.23%)
Middle Fork to South Fork: 8.6 ft/mile (0.16%)
South Fork to Flathead Lake Inlet: 2.8 ft/mile (0.05%)

Flows

A U.S.G.S. gauge is located 5.7 miles downstream from the mouth of the South Fork. The South Fork contributes approximately one third of the river's flow and has been regulated by Hungry Horse Dam since September 21, 1951. The average discharge of the Flathead River for the 52 year period of record (1928-1980) is 9724 cfs (7,045,000 acre-feet per year) with a maximum estimated discharge of 176,000 cfs and a minimum of 798 cfs.

Water Quality

The Flathead River above Flathead Lake has an A-1 water quality classification from the State Water Quality Standards. Waters classified A-1 are suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities. Water quality must be suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

The U.S.G.S. National Stream Quality Accounting Network has a site (12363000) at Columbia Falls (T30N, R20W, Sec. 17). During the water year October 1979 to September 1980 hardness as $CaCO_3$ (mg/1) ranged from 66 to 110, pH ranged from 7.4 to 8.3, D.O. ranged from 8.4 to 12.9, and total nitrogen ammonia (mg/1 as N) ranged from .00 to .04. Many other water quality parameters are monitored. For a listing of results consult the U.S.G.S.'s "Water Resources Data for Montana: Volume 2. Upper Columbia River Basin" reports.

Recreational Usage

The Flathead upstream from its confluence with the South Fork is classified a Recreational River under the National Wild and Scenic River Act of 1976. This section is extremely popular with recreational floaters. The Flathead below the South Fork is partially regulated by releases from Hungry Horse Dam, but is also a popular recreational floating stream. A creel census in 1975 estimated fishing pressure on the mainstem Flathead River at 46,193 man-days, or approximately 835 man-days per river mile. Over 73 percent of the fishing pressure occurred in the area of Kalispell. The estimated harvest was 217,610 fish, of which 86 percent were kokanee. Other important species were westslope cutthroat trout (15,557, 7.1%), mountain whitefish (7,717, 3.5%) and bull trout (5,300, 2.4%).

Waterfowl hunters frequently use this section of river and the sloughs along the lower reaches.

Potential Environmental Problems

A potential dam site is located near Coram, Montana. Classification of the river under the National Wild and Scenic River Act and the proximity of Glacier National Park should preclude construction of the dam at this time. Some irrigation withdrawals are made in the Flathead Valley but there is no threat of dewatering. Minimum flows in the river below the South Fork have been much lower than historical averages since impoundment of the South Fork by Hungry Horse Dam (1951).

Previous Instream Claim

An act passed by the 1969 Montana Legislature (Chapter 345, Laws of

1969) enabled the MDFWP to file for instream water rights for purposes of preserving fish and wildlife habitat in 12 high quality trout streams. For the 45.7 mile reach of the Flathead River from Flathead Lake up to the mouth of the South Fork, the MDFWP filed for the amounts listed below:

Time Period	Amount (cfs)
October 1 - March 31	3,625
April 1 - September 30	8,125

The filing was recorded in Flathead County on December 22, 1970.

3. FISH POPULATIONS (Flathead Lake - South Fork)

There are at least 22 fish species present in the Flathead River upstream from Flathead Lake (Table 1). The bull trout, westslope cutthroat trout and kokanee salmon are the most important game species found in the river. It is necessary to understand their life history to adequately assess habitat requirements that are necessary to maintain the fishery. A brief life history is therefore presented for the three species

Bull and Cutthroat Trout Life History

The bull trout population in the Flathead drainage is almost entirely adfluvial, living in a lake as subadults or adults and migrating into tributaries to spawn. The migratory pattern of bull trout is similar in the North and Middle Forks. These fish reside in Flathead Lake, begin moving up the lower Flathead River in early spring, and start to arrive in their spawning tributaries as early as late June. Many fish may hold in the North and Middle Forks until September before ascending the tributaries. Most spawning occurs during September and October after which spawners return rapidly to Flathead Lake.

Three basic life history patterns have been identified throughout the range of westslope cutthroat trout. These patterns are migratory between lakes and streams, migratory from small tributaries to main rivers, and nonmigratory stocks (Behnke 1971) which are referred to as adfluvial, fluvial, and resident, respectively.

Adfluvial westslope cutthroat spawners begin moving up the lower Flathead as early as February and probably move into tributaries sometime in April or May. They spend a varying amount of time on the spawning grounds and most return to the main river around the time of peak runoff. Block (1955) found spawners in North Fork streams June 17 and Johnson (1963) felt cutthroat spawning peaked in mid-June. Time spent in the river between the tributaries and Flathead Lake appears quite variable.

Juvenile cutthroat and bull trout spend from one to four growing

Table 1. A list of fish species in Flathead Lake and the Flathead River upstream from Flathead Lake and their relative abundance: C - common, U - uncommon, and R - rare.

Fish Species	Abundance: Flathead River	Abundance: Flathead Lake
Cutthroat trout	C	C
Westslope (*Salmo clarki lewisi*)	R	R
Yellowstone (*Salmo clarki bouvieri*)	C	C
Bull trout (*Salvelinus confluentus*)	C	R
Rainbow trout (*Salmo gairdneri*)	U	R
Brook trout (*Salvelinus fontinalis*)	R	R
Lake trout (*Salvelinus namaycush*)	R 1/	C
Kokanee (*Oncorhynchus nerka*)	C 1/	C
Lake whitefish (*Coregonus clupeaformis*)	U 1/	C
Pygmy whitefish (*Prosopium coulteri*)	U 1/	C
Mountain whitefish (*Prosopium williamsoni*	C	C
Arctic grayling (*Thymallus arcticus*)	R	-
Slimy sculpin (*Cottus cognatus*)	C	R
Shorthead sculpin (*Cottus confusus*)	?	-
Mottled sculpin (*Cottus bairdi*)	C	-
Longnose sucker (*Catostomus catostomus*)	U	C
Largescale sucker (*Catostomus macrocheilus*)	C	C
Peamouth (*Mylocheilus caurinus*)	C	C
Northern squawfish (*Ptychocheilus oregonensis*)	C	C
Northern pike (*Esox lucius*)	R 2/	R
Redside shiner (*Richardsonius balteatus*)	R 2/	C
Largemouth bass (*Micropterus salmoides*)	R 2/	U
Pumpkinseed (*Lepomis gibbosus*)	R 2/	R
Yellow perch (*Perca flavescens*)	R 2/	C
Black bullhead (*Ictalurus melas*)	R 2/	R

1/ Refers to seasonal abundance.

2/ Common in some sloughs along the lower river.

seasons in the tributaries before moving into the main river. The majority spend two to three seasons in the tributaries. Adfluvial juvenile trout migrate from streams in late spring and early summer. They may spend several months in the river before entering Flathead Lake.

The main stem Flathead River from Flathead Lake upriver to the mouth of the Middle Fork is used by adfluvial cutthroat and bull trout primarily as a migratory corridor and probably as an overwintering area for cutthroat and juvenile bull trout. There is also seasonal utilization by adfluvial cutthroat and bull trout in response to increased food abundance in the river. A fluvial (resident) population of rainbow and possibly cutthroat trout is also present in the main stem throughout the year.

Kokanee Salmon Life History

Large numbers of migrating kokanee normally first appear in the lower Flathead River during September. The timing of the initial appearance and subsequent migration rate of kokanee varies considerably from year to year. The mainstem Flathead River is used as a migration corridor as well as a kokanee spawning area.

Spawning of kokanee occurs between October 15th and December 15th in the Flathead River system. Following spawning, the adults die. Eggs deposited in the gravel develop over the winter and the fry emerge and move downstream during the spring, primarily in April, to Flathead Lake. After three to five growing seasons in the lake (four for the majority), the adult fish return to the spawning grounds to complete the life cycle.

Thus, even though kokanee are residents of the river during only about eight months of the year, adequate flows for migration, spawning, incubation and emigration are all vital to their existence and continued contribution to the fishery.

Fish Population and Movement Studies

Trout and Whitefish

McMullin and Graham (1981) completed a study in 1980 on the main stem Flathead River to document the relative abundance and movement of game species. During the study, three areas of the main stem between the mouth of the Middle Fork and Flathead Lake were sampled using a boat-mounted electrofishing unit and a direct observation snorkeling technique. Seasonal population trends, relative abundance, and movement patterns were assessed for cutthroat, rainbow and bull trout as well as mountain whitefish and kokanee salmon. The information presented below is based on the findings.

Spawning adult cutthroat trout enter the main stem in October and hold in the main river until water temperatures and increasing flows trigger upstream migration in the spring. Spawning occurs primarily in the tributaries to the upper drainage during May and June.

Juvenile cutthroat move downstream from the upper drainage to Flathead Lake beginning in April and continue throughout most of the year with the peak of migration to the upper main stem, above the mouth of the South Fork, occurring in July.

Adult bull trout appear to migrate upstream through the main stem in response to increasing spring flows and temperatures, moving into the lower main stem in April with peak migrations occurring in May and June. Adults spawn in the upper drainage during September and October.

Juvenile bull trout emigrate from upper drainage tributaries in late spring through the summer. The movement of juvenile bull trout after they leave the tributaries has not been well documented. Some juvenile bull trout are present in the main stem portion of the river throughout the year.

Rainbow trout are most abundant in the upper main stem with abundance decreasing progressively downstream.

Mountain whitefish are the most abundant species in the Flathead River. Mountain whitefish spawn in riffle areas of the main stem in the fall. Dense concentrations of whitefish overwinter in the main stem but movement patterns are complex and not well understood.

Kokanee Salmon

Unpublished data for 1981 show that in excess of 100,000 kokanee migrated through the lower Flathead River enroute to spawning grounds in the Middle Fork and McDonald Creek.

During 1981, the reach from Flathead Lake the South Fork was searched for redds. About 8,000 redds were located with 1,000 of these in spring-fed areas and the rest located in the river channels where water level fluctuations could potentially cause dewatering of eggs and stranding of fry. Redds were located in water depths ranging from 0.1 feet to 12 feet and were distributed along the entire reach with concentrations in the areas where the greatest amount of channel development occurs.

Large numbers of kokanee spawners were still entering the main river during November, 1981 and some spawning probably occurs from October 15th to December 15th.

Studies are currently being conducted to assess the effects of changing water levels on kokanee spawning, incubation and fry emergence. Preliminary results indicate that redd dewatering during cold winter months results in excessive mortality of incubating eggs.

4. WILDLIFE (Flathead Lake - South Fork)

The riparian area along this reach of the Flathead River is well developed with numerous habitat types accomodating a wide array of wildlife species and providing recreational opportunity for hunters and trappers as well as nonconsumptive users.

Waterfowl

Canada geese, mallards, pintails, lesser scaup, teal, wood ducks, widgeon, mergansers, goldeneyes, and buffleheads are all seasonal users of the river. Most of these species also nest and rear young in this reach.

Upland Game Birds

Ruffed grouse are present in wooded areas along this entire reach. Ring-necked pheasants are abundant in suitable habitat, particularly below Columbia Falls. Some local populations of Merriam's turkeys are also found in the lower parts of the reach, but no hunting season is presently held on them.

Bald Eagle and Osprey

Both bald eagles and ospreys nest and rear young along this reach of the Flathead. Ospreys migrate out of the area during winter months. Resident bald eagles are joined by large numbers of migrating birds that concentrate in the area during the fall to feed on dead and dying kokanee. During most years, some bald eagles are present along the river year-round.

Big Game

White-tailed deer are the primary big game species utilizing the riparian area on a year-round basis. In addition, there is some use by mule deer, moose, elk, mountain lion, and black bear.

Furbearers

Beaver, otter, muskrat, and mink are the primary furbearers associated with the river bottom. They provide a considerable amount of income during the trapping season to valley residents.

5. INSTREAM FLOW METHODOLOGIES (Flathead Lake - South Fork)

Recent advances in the development of instream flow methodologies have enabled the MDFWP to more accurately define the instream flow needs for the rivers of the state. The purpose of the following section is to discuss the instream flow methods the MDFWP has applied in recent years to the reach of the Flathead River between Flathead Lake and the confluence of the South Fork.

The method of the MDFWP divides the annual flow cycle for headwater rivers, such as the Flathead River, into two separate flow periods. They consist of a relatively brief snow runoff or high flow period, when a large percentage of the annual water yield is passed by the river, and a nonrunoff or low flow period which is characterized by relatively stable base flows. The high flow period generally occurs during the months of April, May, June and July while the remaining months encompass the low flow period. Separate flow recommendations are derived for each period.

A. Method for High Flow Period - Dominant Discharge/Channel Morphology Concept

It is generally accepted that the major force in the establishment and maintenance of a particular channel form in view of its bed and bank material is the annual high flow characteristics of the river. It is the high spring flows that determine the shape of the channel rather than the average or low flows.

The major functions of the high spring flows in the maintenance of channel form are bedload movement and sediment transport. It is the movement of the bed and bank material and subsequent deposition which are capable of covering already established bars with finer material which leads successively to vegetated islands. Increased discharge associated with spring runoff also results in a flushing action which removes deposited sediments and maintains suitable gravel conditions for aquatic insect production, fish spawning and egg incubation.

Reducing the high spring flows beyond the point where the major amount of bedload and sediment is transported would interrupt the ongoing channel processes and change the existing channel form and bottom substrates. A significantly altered channel would affect both the abundance and species composition of the present aquatic populations by altering the existing habitat types.

Several workers (Leopold, Wolman and Miller 1964, US Bureau of Reclamation 1973, and Emmett 1975) adhere to the concept that the form and configuration of river channels are shaped by and designed to accommodate a dominant discharge. The discharge which is most commonly referred to as a dominant discharge is the bankful discharge (Leopold, Wolman and Miller 1964, Emmett 1975). Bankful discharge is defined as that flow when water just beings to overflow onto the active flood plain.

Bankful discharge tends to have a constant frequency of occurrence among rivers (Emmett 1975). The recurrence interval for bankful discharge was determined by Emmett (1975) to be 1.5 years and is in close agreement with the frequency of bankful discharge reported by other studies (Leopold, Wolman and Miller 1964, Emmett 1972).

It is not presently known how long the bankful flow must be maintained to accomplish the necessary channel formation processes. Until studies further clarify the necessary duration of the bankful discharge, a duration period of 24 hours is chosen. For this reach of the Flathead River the bankful discharge is, at present, undefined.

A gradual rising and receding of flows should be associated with the dominant discharge and the shape of the spring hydrograph should resemble that which occurs naturally. U.S.G.S. flow records were used to determine the time when the high flow period and peak flow normally occurs. Flows are increased from a base flow level to the dominant discharge in two-week intervals at the 80th percentile flow level, corresponding to the natural timing of the high flow period. For the Flathead River, April 16 through July 31 encompasses much of the high flow period.

The 80th percentile is the flow that is exceeded in eight of 10 years or, in other terms, in eight years out of 10 there is more water than the 80th percentile flowing in the river. The 80th percentile was chosen in part because of its compatibility with irrigation development. To economically develop efficient, full-service irrigation systems, a good water supply is considered necessary in about eight years out of 10, on the average (MDNRC, 1976). It is also our belief that the high flow months can withstand substantial withdrawals and not alter the basic functions of channel maintenance. The 80th percentile flows were estimated from U.S.G.S. flow records for the gauge at Columbia Falls.

B. Methods for Low Flow Period

Wetted Perimeter/Inflection Point Method

The wetted perimeter/inflection point method, as applied to riffle areas, was chosen for deriving low flow recommendations for the trout rivers of Montana. Wetted perimeter is the distance along the bottom and sides of a channel cross-section in contact with water (Figure 1). As the flow in the stream channel decreases, the wetted perimeter also decreases, but the rate of loss of wetted perimeter is not constant throughout the entire range of flows. An example of a relationship between wetted perimeter and flow for a riffle cross-section is illustrated in Figure 2. There is a point, called an inflection point, on the plot of wetted perimeter versus flow at which the rate of loss of wetted perimeter is significantly changed.

In the example (Figure 2), this inflection point occurs at an approximate flow of 500 cfs. Beyond the inflection point, large changes in flow cause only very small changes in wetted perimeter. Below the inflection point, the river begins to pull away from the riffle bottom, exposing the bottom at an accelerated rate. The flow recommendation is selected at or beyond this inflection point.

The maintenance of suitable flows in riffles is essential for the well-being of trout populations since the production of aquatic invertebrates, the principle food of trout, primarily occurs in riffle areas

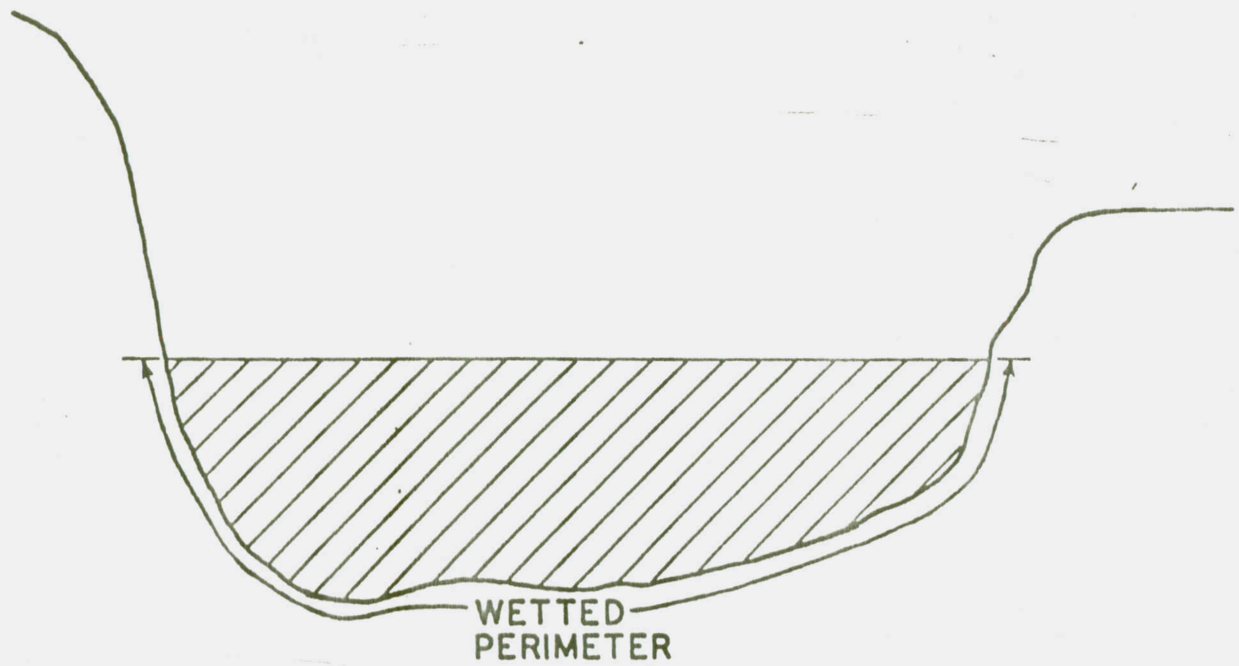

Figure 1 The wetted perimeter in a channel cross-section.

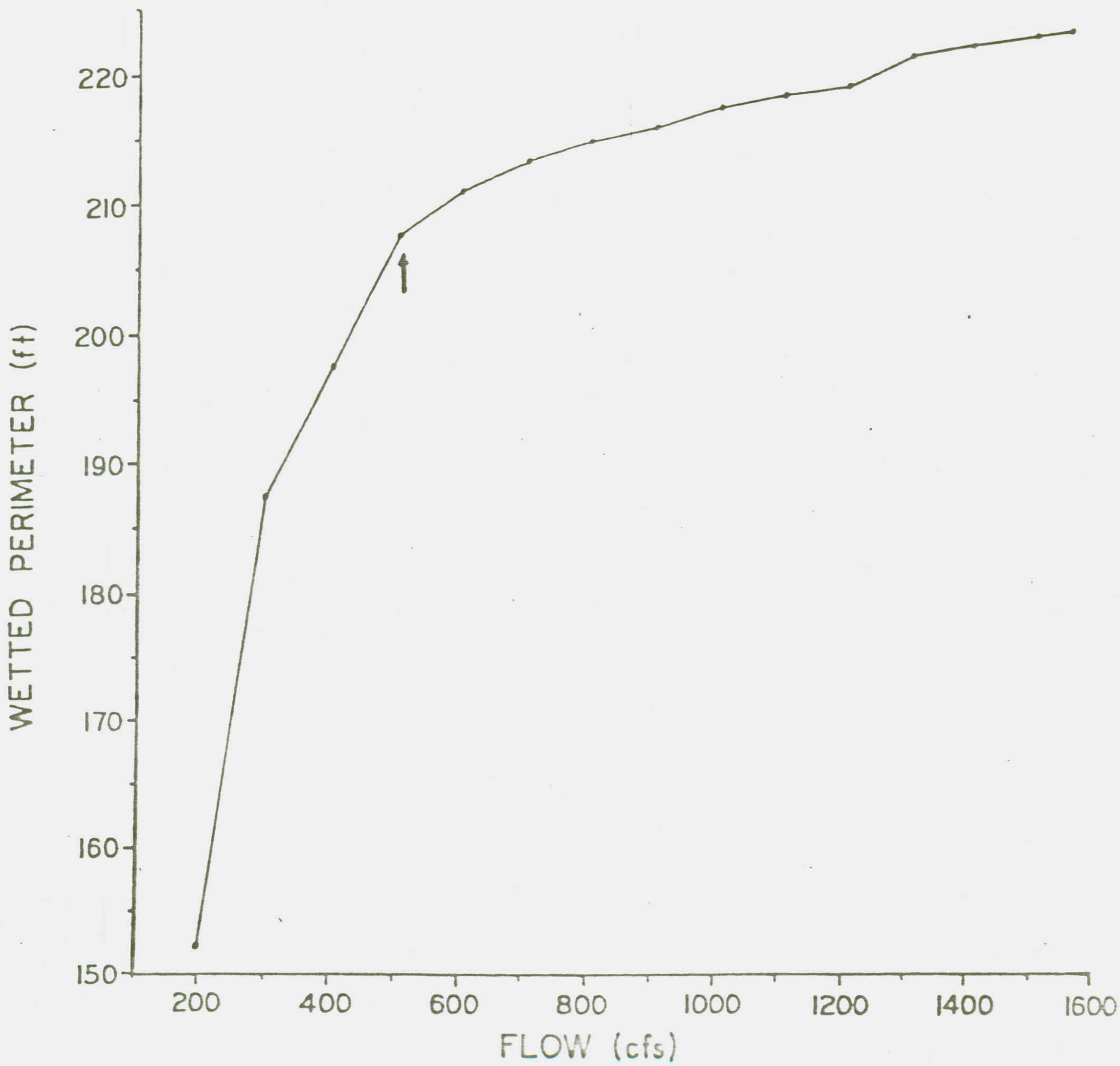

Figure 2 An example of a relationship between wetted perimeter and flow for a cross-section.

(Hynes, 1970). It has also been demonstrated that riffles are critical areas for spawning sites of trout and shallow inshore areas are required for the rearing of trout fry (Sando 1981). Once flows are reduced below the inflection point, the riffle bottom is being exposed at an accelerated rate and the area available for food production and trout spawning and rearing greatly diminishes. At flows beyond the inflection point, the area available for these essential life processes is considered to approach the optimum.

Riffles are also the area of a stream most affected by flow reductions (Bovee 1974 and Nelson 1977). Consequently, the maintenance of suitable riffle conditions for food production and trout spawning and rearing areas will also maintain suitable conditions in pools and runs, areas normally inhabited by adult trout. Because riffles are the habitat most affected by flow reductions and are essential for the well-being of trout populations, they should receive the highest priority for instream protection.

The Montana Department of Fish, Wildlife and Parks completed a study in 1980 that validated the wetted perimeter method as applied to the trout rivers of southwest Montana (Nelson 1980a, 1980b and 1980c). In this study, instream flow recommendations were derived from the actual trout standing crop (numbers and pounds) and flow relationship for five reaches of four nationally acclaimed wild trout rivers. These recommendations were compared to those derived from the wetted perimeter/inflection point method. The study results showed that flows less than the inflection point are undesirable as recommendations since they lead to substantial reductions of the standing crops of adult trout.

The flow at the inflection point is not necessarily the preferred recommendation for all trout rivers. The "Blue Ribbon" rivers would generally require a higher flow in order to maintain the sport fishery resource at the existing level. For those rivers having a lower resource rating, the flow at the inflection point may be a satisfactory recommendation. In general, flows less than the inflection point are undesirable as flow recommendations regardless of the existing state of the river resource.

The wetted perimeter-flow relationships for the riffle areas are derived using a wetted perimeter predictive (WETP) computer program developed in 1980 by the MDFWP (Nelson 1980d). The WETP program uses a minimum of two sets (three sets are recommended) of stage (water surface elevation) measurements taken at different known discharges (flows) to establish a least-squares fit of log-stage versus log-discharge. Once the stage-discharge rating curve for each cross-section is determined, the stage at a flow of interest can be predicted. This rating curve, when coupled with the cross-section profile, is all that is needed to predict the wetted perimeter at most flows of interest.

The wetted perimeter/inflection point method was applied to a riffle area located near the middle of the reach of the Flathead River between the inlet to Flathead Lake and the mouth of its South Fork (T28N, R21W, Sec. 10). The WETP program was calibrated to field data collected at flows of 1,910, 7,440 and 26,200 cfs. The inflection point on the wetted perimeter-discharge relationship (see Figure 3) occurs at a flow of about 3,500 cfs. For adjudication purposes a flow of 3,500 cfs will be recommended for the low flow period.

Kokanee Spawning/Incubation Requirements

Where time and budget constraints allow the best and most accurate method for determining the instream flow needs for fish and wildlife purposes is to derive the actual flow and biological relationships from long-term data collected in drought, normal and above normal water years. A study to determine these relationships on the regulated portion of the Flathead River below the mouth of the South Fork was begun in April, 1979 and will continue until April 1, 1986. The primary focus of the study is on the determination of flows necessary to produce a stable intermediate number of kokanee salmon in order to maintain and enhance the lake fishery while providing a suitable run of spawning adults.

At present, these investigations have yielded only preliminary conclusions which will be further refined during the next four years. These conclusions, however, represent the best available information on flows required to maintain and stabilize the kokanee fishery. Recommendations based on these conclusions follow:

1) The greatest potential damage to kokanee spawning success occurs in years when there is a large disparity between high flows at the time of spawning and lower mid-winter flows. Eggs deposited in redds in shallow water are subseqently dewatered. Examination of dewatered redds in 1981 showed almost complete mortality of eyed eggs deposited 0.2 feet above the water line after being dewatered for 40 hours at a minimum air temperature of 10°F.

The most desirable flow regime would be a constant flow from mid-October through mid-December for spawning followed by the same or greater flows until fry emergence during April. Such a constant flow regime would necessarily be based on the natural low-flow time of the incubation period which, during a median or normal water year, occurs during the months of February and March at a flow of about 3,300 cfs for the period of record.

2) Years during which natural flows from the North and Middle Forks are high in combination with high regulated discharge from Hungry Horse Dam during the spawning season will result in some egg dewatering during the later incubation period. During 1981, a drop from a 4,000 cfs spawning flow to a 2,300 cfs incubation flow resulted in 20% redd dewatering. This may or may not be an acceptable level of dewatering

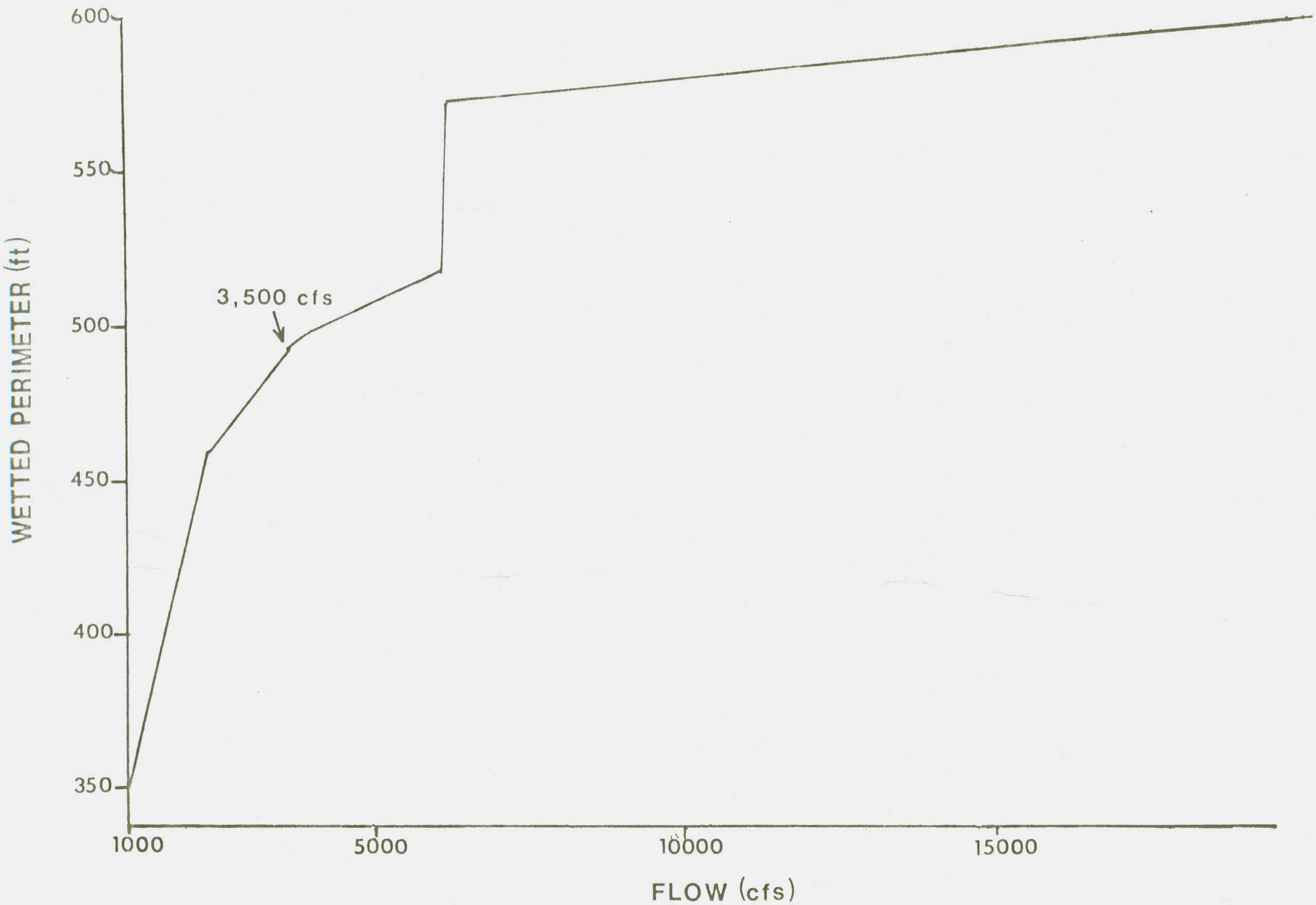

Figure 3. Relationship between wetted perimeter and flow for one riffle cross-section located in the Flathead River.

pending further investigation.

3) Higher naturally-occurring flows during the month of April are probably essential in transporting the fry downstream to Flathead Lake. It is thus recommended that the shift to a high flow methodology for determining instream flow requirements occur during this period.

Summary of Methods

For the high flow period of April 16 through July 31, the flow recommendations are based on the 80th percentile flows using the dominant discharge/channel morphology concept. For the low flow period of August 1 through April 15, the flow recommendations are based on the wetted perimeter/inflection point method.

Encompassed in this same period is the kokanee spawning incubation period of October 15-April 15. The requested flows under the wetted perimeter/inflection point methodology would adequately address the needs of kokanee in the river system.

6. FLOW RECOMMENDATIONS (Flathead Lake- South Fork)

The monthly flow recommendations derived from the combined kokanee spawning/incubation and wetted perimeter/inflection point method and the dominant discharge/channel morphology concept are listed in Table 2.

The flow recommendations, in addition to maintaining the resident cutthroat trout, rainbow trout, and mountain whitefish populations at the existing level, would also serve to:

1) Facilitate the upstream movement of adult adfluvial cutthroat trout in the spring and bull trout in the summer and fall to their spawning areas as well as their return to Flathead Lake;

2) Facilitate the upstream movement of kokanee salmon in September, October and November to their spawning areas;

3) Maintain favorable spawning and incubation habitat for kokanee salmon;

4) Maintain favorable habitat for the rearing of juvenile cutthroat and bull trout; and

5) Facilitate the migration of juvenile trout and kokanee fry to Flathead Lake.

For adjudication purposes, these recommendations must be adjusted to the constraints imposed by the original instream filing of December 22, 1970. This adjustment is necessary because the final claim can be less than, but not exceed, the original filing. The final claim

Table 2. Monthly flow recommendations for the Flathead River (from Flathead Lake upstream to the South Fork) compared to the original filing of December 22, 1970 and the final claim.

Time period	Flow Recommendations (cfs)[a]	Original Filing (cfs)[b]	Final Claim (cfs)[c]
January	3,500	3,625	3,500
February	3,500	3,625	3,500
March	3,500	3,625	3,500
April 1-15	3,500	8,125	3,500
April 16-30	6,650	8,125	6,650
May 1-15	13,784	8,125	8,125
May 16-31	20,944[d]	8,125	8,125
June 1-15	20,720	8,125	8,125
June 16-30	13,267	8,125	8,125
July 1-15	8,519	8,125	8,125
July 16-31	5,402	8,125	5,402
August	3,500	8,125	3,500
September	3,500	8,125	3,500
October	3,500	3,625	3,500
November	3,500	3,625	3,500
December	3,500	3,625	3,500

a/ Derived from the wetted perimeter/inflection point method and kokanee spawning and incubation requirements and the dominant discharge/channel morphology concept.

b/ Flows as originally filed on December 22, 1970.

c/ Derived by adjusting the flow recommendations to the constraints imposed by the original instream filing of December 22, 1970.

d/ The approximate bankful discharge (presently undefined) should be maintained for 24 hours during this period.

is listed along with the original filing in Table 2. The final claim is less than the original filing for the period of July 16-April 30 and amounts to a net flow reduction of 872,408 acre-feet from the original filing, a reduction of 20.5 percent.

The final claim is compared to the median monthly flows of record, as derived from U.S.G.S. flow records for the gauge at Columbia Falls in Table 3. The median provides a measure of water availability during a normal or typical water year. The median is the flow that is exceeded in five of 10 years or, in other terms, in five years out of 10 there is more water than the median flowing in the river. The final claim is less than the median flows for the periods of April 1 - August 31 and October 1 - January 31 and exceeds the medians for February 1 - March 31 and September 1-30.

The final claim equals 3,384,350 acre-feet of water per year, which is about 52.4 percent of the annual volume of water that is normally available at the U.S.G.S. gauging site on the Flathead River at Columbia Falls (5.7 miles downstream from the South Fork).

Table 3. Comparison of the final instream claim for the Flathead River (from Flathead Lake upstream to the South Fork) to the approximate median flows of record.

Time Period	Final Claim (cfs)	Approximate median flows[a/]	
		cfs	Acre-feet
January	3,500	4,270	262,490
February	3,500	3,360	186,561
March	3,500	3,280	201,631
April 1-15	3,500	6,790	201,969
April 16-30	6,650	14,587	433,890
May 1-15	8,125	21,347	634,967
May 16-31	8,125	30,412	964,912
June 1-15	8,125	29,300	871,529
June 16-30	8,125	23,067	686,128
July 1-15	8,125	13,980	415,835
July 16-31	5,402	7,537	239,134
August	3,500	4,490	276,014
September	3,500	3,170	188,583
October	3,500	4,850	298,144
November	3,500	4,420	262,946
December	3,500	5,500	338,102
			6,462,835[b/]

a/ Derived from a 49 year period of record (between 1931-1979 water years) for USGS gauge station at Columbia Falls (5.7 miles downstream from the South Fork).

b/ Approximate volume of water normally available on an annual basis.

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