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ANNUAL SUMMARY OF STATEWIDE INSTREAM FLOW RESERVATION APPLICATIONS[1]

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ABSTRACT

This report summarizes the principle activities performed during the fourth year of the Instream Flow program and the status of instream flow applications filed in previous years.

Between 1 July 1989 and 30 June 1990 (Fiscal Year 90), ten instream flow analyses were completed by the Alaska Department of Fish and Game. Reservation applications were completed for submittal to the Alaska Department of Natural Resources for the Delta Clearwater River, also known as Clearwater Creek, and two reaches of the Chatanika River (Fairbanks area); Talkeetna River (Talkeetna); South Fork of Campbell Creek (Anchorage); Anchor River and Ninilchik River (Kenai Peninsula); Buskin River (Kodiak Island); and Fish Creek and Montana Creek (Juneau).

Seven Alaska Department of Fish and Game instream flow reservation requests filed in previous years have been granted by the Alaska Department of Natural Resources: Terror River, Willow Creek, Rabbit Creek, Little Rabbit Creek, Little Survival Creek, upper Little Susitna River, and lower Campbell Creek.

Nine instream flow reservation applications from prior years are in the process of adjudication: Little Susitna River (middle reach), Chena River (two reaches), Cottonwood Creek, Fish Creek (two reaches), Meadow Creek, and Campbell Creek (Upper Reach) and Indian River.

Applications filed for Sawmill Creek, Ketchikan Creek, Salcha River, Buskin River, Buskin Lake, Monashka Creek, Pillar Creek, North Fork of Campbell Creek, Ship Creek, Anchor River, Kenai River (two reaches), and Ward Creek, are pending adjudication.

KEY WORDS: instream flow, flow reservation, Tennant Method, Montana Method, Willow Creek, Little Susitna River, Rabbit Creek, Little Rabbit Creek, Little Survival Creek, Terror River, Montana Creek, Chena River, Cottonwood Creek, Fish Creek, Meadow Creek, Campbell Creek, North Fork of Campbell Creek, South Fork of Campbell Creek, Chatanika River, Delta Clearwater River, Clearwater Creek, Ninilchik River, Talkeetna River, Fish Creek Sawmill Creek, Ketchikan Creek, Salcha River, Ship Creek, Kenai River, Anchor River, Buskin River, Buskin Lake, Pillar Creek, Monashka Creek, Indian River, Ward Creek, Anchorage, Fairbanks, Talkeetna, Juneau, Kenai Peninsula, Kodiak Island.

INTRODUCTION

This report summarizes Fiscal Year (FY) 1990 activities completed during the fourth year of operation of the Statewide Instream Flow program (1 July 1989 to 30 June 1990).

The State of Alaska has abundant and diversified sport fisheries which are of considerable recreational importance to fishermen. In 1988, for example, an estimated 377,000 anglers took 1.9 million household trips, fishing 2.3 million angler days to harvest 3.5 million fish (Mills 1989). These values represent significant increases over those noted in the late seventies and early eighties.

Private and commercial developments such as hydroelectric, recreational, mining, and agricultural projects; and residential and commercial construction, contribute to changes in both the riparian and instream habitat of sport fishing areas. These developments will negatively impact the production of fish unless sufficient instream flows are maintained and other important habitat characteristics are preserved.

An instream flow is defined as the quantity of water that flows past a given point within a stream channel during one second. In 1980, the Alaska State Legislature enacted the Instream Flow Bill (HB 118) which allows instream flows to be legally reserved (AS 46.15.03 and 46.15.145) for the protection of fish and wildlife habitat, migration, and propagation, or other specified uses. Regulations to implement the law were adopted by the Alaska Department of Natural Resources (ADNR) in September 1983, and forms required to file applications for instream flows were made available by the ADNR in November 1983.

To reserve instream flows, an application containing supporting data and analyses that substantiate the flows being requested must be submitted to the ADNR.

In 1986, the Alaska Department of Fish and Game (ADF&G) established a formal program to collect and/or synthesize and analyze data that are necessary to obtain instream flow reservations for the protection of sport fish resources. During the first three years, twenty-nine instream flow reservation applications have been submitted to and accepted by the ADNR.

The goal of this program is to protect the instream and related habitat of sport fish species by reserving sufficient instream flows.

The objective of the program for FY 90 was to apply for instream flow reservations for the protection of sport fishery resources in a minimum of seven rivers of the state.

To meet this objective ten candidate instream flow application stream reaches were selected: Anchor River, Buskin River, Chatanika River (two reaches), Delta Clearwater River (also known as Clearwater Creek), Fish Creek, Montana Creek, Ninilchik River, South Fork of Campbell Creek, and Talkeetna River. The general location of FY 90 instream reservation stream reaches and locations of reservations filed in previous years are illustrated in Figure 1.

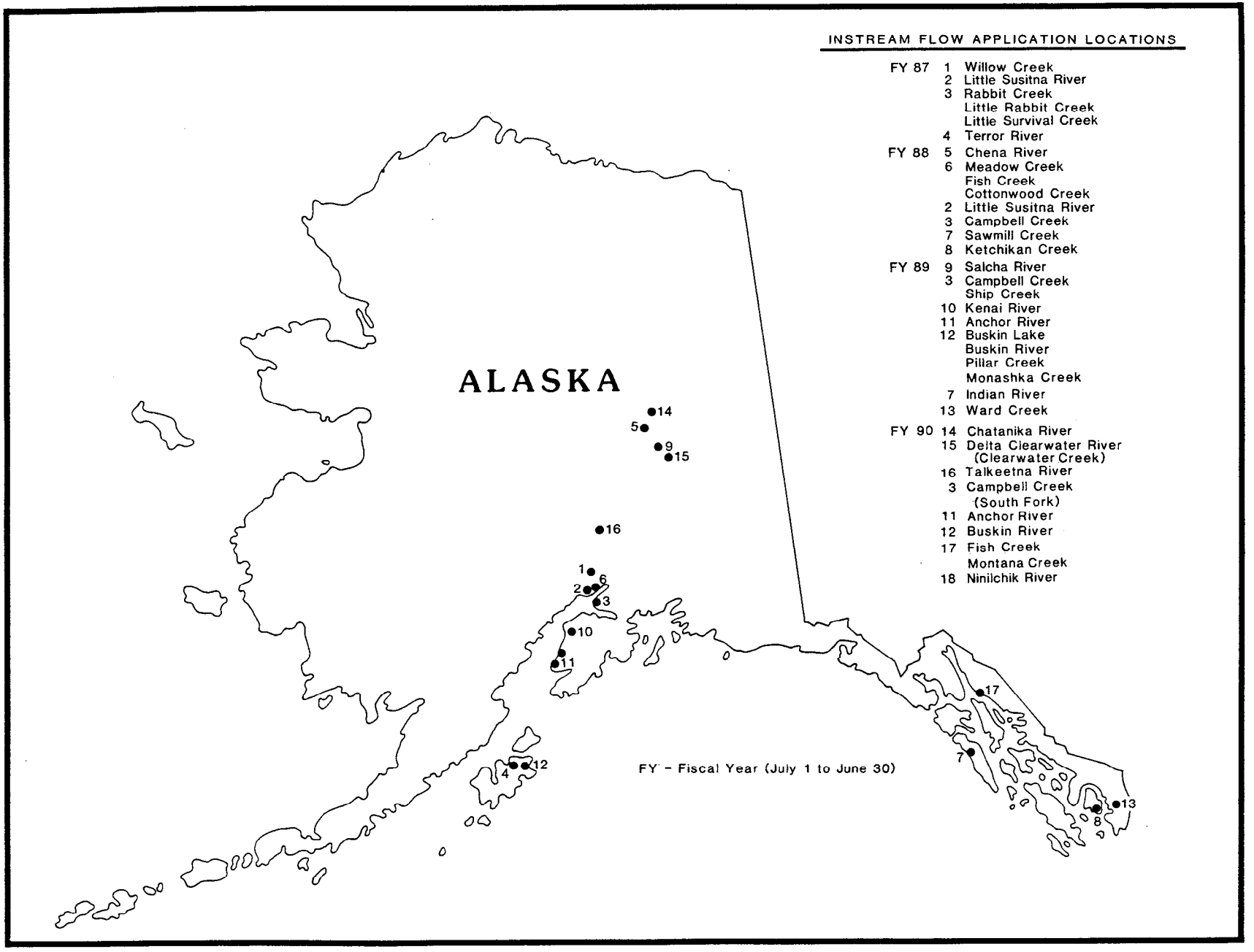

Figure 1. Alaska Department of Fish and Game instream flow reservation application locations, July 1, 1986 to June 30, 1990.

METHODS

Locations for reserving instream flows were nominated as described in the 1984 Instream Flow Work Plan (ADF&G 1984; Estes 1985), and as modified in 1986 (Instream Flow Committee 1986). The final selection of the sites was made by the Division of Sport Fish by evaluating the importance of the nominated streams to the sport fishery, the likelihood of competition for an out-of-stream appropriation, and review of the quantity and quality of existing data necessary for the submission of an application. The sites selected for FY 90 were: Anchor River, Buskin River, Chatanika River (two reaches), Delta Clearwater River (also known as Clearwater Creek), Fish Creek, Montana Creek, Ninilchik River, South Fork of Campbell Creek, and Talkeetna River (Figure 1).

To obtain an instream flow reservation for the protection of fishery resources, data must be provided that specifies the flow requirements of each species/life phase for which a reservation is requested.

In Alaska, specific methods are not designated or required for supporting an instream flow reservation. The burden of proof for selecting a method and providing hydrological and biological data required to support an instream flow reservation is placed on the applicant (ADNR 1985; Estes and Harle 1987).

The selection of a specific methodology will depend on the quantity and quality of hydrological and biological data available for each water body under study. In general, the simplest method is used such as a modification of the Tennant Method (1972)[1]. If legally required or specific increments of water must be evaluated, the resource intensive Instream Flow Incremental Methodology, IFIM (Bovee 1982) is selected. Regardless of the method chosen, an analysis of regional hydrological characteristics is incorporated into these analyses following procedures described in Estes (1984), Orsborn and Watts (1980), and Shaw (1988) to insure flow reservation recommendations mimic natural hydrological patterns.

The Tennant Method, combined with an evaluation of hydrological characteristics, was considered the most cost effective approach for recommending flow regimes for the applications prepared in FY 90. The choice of this approach was based on the philosophy that any valid application of an instream flow method or combination of them could be used to calculate instream flow requirements if two assumptions were met: hydrological data were calibrated to the site or area studied; and, fish habitat criteria represented the species/life phases of fish found in the vicinity of the targeted water body (Estes 1984; Estes and Orsborn 1986). Other considerations included the availability of data, previous analyses, and financial resources.

The Tennant Method was developed by Tennant (1972, 1976). It has been successfully tested in court, requires minimal expenditures of resources and

[1] Referred to as the Montana Method in earlier literature.

can be used with limited or extensive hydrological and fishery data bases. The Tennant Method is considered one of the simplest techniques for selecting or qualitatively evaluating instream flows for fish and wildlife. Eight flow classifications were established by Tennant by analyzing a series of field measurements and observations. Each is assigned a percentage or percentage range of the average annual flow (QAA). The QAA can be obtained from the U.S. Geological Survey (USGS) and is calculated by averaging the mean daily flow for the year (Orsborn and Watts 1980). It can also be estimated using regional hydrological models. Seven of the Tennant classifications characterize habitat quality for fish and wildlife and the eighth provides for a flushing flow. The percentages of QAA for habitat quality range from less than 10% (Severe Degradation) to 60%-100% (Optimum Range). The flushing flow classification equals 200% of the QAA.

Research by Estes (1984), however, suggests the flushing flow value should be increased to 400% or more of the QAA for a duration of three to seven days. Flushing flows are usually associated with a one in two year period peak flood flow; therefore, one cannot predict the exact timing of an event. Accordingly, flushing flows, although important to maintain fish habitat, cannot be formally reserved unless a stream system has a flow control structure. This is because an instream flow can only be reserved at a designated location for a specified time period. A statement was added to each application explaining that reserved flushing flows would be required if a control structure is planned for the future for a stream.

Flow recommendations for FY 90 were established by selecting the desired Tennant classification and multiplying the QAA by the percentage or percentage range for that classification as described above. When sufficient hydrological data were available, supplemental hydrological analyses of mean monthly flows, daily flows, and duration analyses were performed which described natural stream characteristics of the stream reach. This information was used to modify the flow recommendations to mimic natural hydrological patterns and insure that more water was not requested than could be expected to occur naturally within the stream.

Flows were only requested for those months when fish utilized the targeted stream reach for passage, spawning, incubation, or rearing. This fish distribution and timing information was provided by ADF&G biologists and illustrated by periodicity charts that were appended to the instream flow application.

The above information was incorporated into a formal instream flow application form with other required information following procedures defined by the ADNR (1985).

Additional descriptions of procedures for individual instream flow reservations are presented in each instream flow application (ADF&G 1990a, b, c, d, e, f, g, h, i, and j).

RESULTS

Analyses to provide instream flow protection for fish in ten stream reaches were completed and used to prepare instream flow reservation applications for

submittal to the ADNR: Anchor River, Buskin River, Chatanika River (two reaches), Delta Clearwater River (also known as Clearwater Creek), Fish Creek, Montana Creek, Ninilchik River, South Fork of Campbell Creek, and Talkeetna River. Each application is currently undergoing final approval by the permitting section of the ADF&G, the Habitat Division, prior to submittal to the ADNR. Submittal is anticipated to occur in October, 1990.

Instream flow reservation reach boundaries for each application are illustrated in Appendices A1 through A10. Figures illustrating fish periodicity for each reservation application are presented in Appendices A11 through A20. Instream flow regimes requested for each stream are preliminary because they may be modified during the adjudication process (administrative process to determine whether to approve, modify, or deny an instream flow reservation request). Accordingly, they are not presented in this report. Future reports are planned which will periodically summarize and provide a comparison of requested and granted instream flow regimes.

Additional information for each instream flow reservation reach can be obtained in individual reservation applications (ADF&G 1990 a, b, c, d, e, f, g, h, i, and j).

DISCUSSION

Alaskan law is unique because it provides the opportunity for private individuals, in addition to state, federal, and local government agencies, to apply to the ADNR for instream flow reservations for rivers, streams, and lakes. Applications can be filed for four types of uses:

1) protection of fish and wildlife habitat, migration, and propagation;

2) recreation and parks purposes;

3) navigation and transportation purposes; and

4) sanitary and water quality purposes.

To date, over 12,000 water bodies in Alaska have been identified as supporting anadromous and resident fish species (ADF&G 1985, 1989). Many others have yet to be investigated. Not including the ten ADF&G instream flow reservation applications completed for FY 90, the ADNR has received only thirty six applications to reserve instream flows following passage of the 1980 enabling legislation. Of them, twenty nine were prepared by the ADF&G, one by the Bureau of Land Management (BLM), four by the Anchorage Audubon Society, and two by private individuals (Estes 1987, 1988; Harle 1988). Table 1 summarizes the status of instream flow applications prepared by the ADF&G since the initiation of its instream flow program in 1986.

Only the applications filed by the ADF&G and the BLM have met all technical requirements. The others were rejected: two were filed before the regulations were adopted; documentation was insufficient to support the reservation request in three of the applications; and the instream flow reservation desired was not specified in one of them (Harle 1988).

Table 1. Status of Alaska Department of Fish and Game instream flow reservation applications, July 1, 1986 to June 30, 1990.

Instream Flow Application Location	Status
Willow Creek	Granted (July 8, 1988)
little Susitna River	Granted (February 19, 1988)
Rabbit Creek	Granted (February 19, 1988)
Little Rabbit Creek	Granted (February 19, 1988)
Little Survival Creek	Granted (November 1, 1988)
Terror River	Granted (May 20, 1987)
Chena River (Two Reaches)	In Process of Adjudication
Meadow Creek	In Process of Adjudication
Fish Creek (Two Reaches)	In Process of Adjudication
Cottonwood Creek	In Process of Adjudication
Little Susitna River (Upper Reach)	In Process of Adjudication
Campbell Creek (Middle Reach)	In Process of Adjudication
Sawmill Creek	Pending Adjudication
Ketchikan Creek	Pending Adjudication
Salcha River	Pending Adjudication
Campbell Creek (Lower Reach)	Granted (June 28, 1990)
Campbell Creek (North Fork)	Pending Adjudication
Ship Creek	Pending Adjudication
Kenai River (Two Reaches)	Pending Adjudication
Anchor River (Lower Reach)	Pending Adjudication
Buskin Lake	Pending Adjudication
Buskin River (Lower Reach)	Pending Adjudication
Pillar Creek	Pending Adjudication
Monashka Creek	Pending Adjudication
Indian River	In Process of Adjudication
Ward Creek	Pending Adjudication
Chatanika River-Reach A	In Preparation
Chatanika River-Reach B	In Preparation
Delta Clearwater River (Clearwater Creek)	In Preparation
Talkeetna River-Reach A	In Preparation
Campbell Creek (South Fork)	In Preparation
Buskin River-Reach B	In Preparation
Anchor River-Reach B	In Preparation
Fish Creek (near Juneau)	In Preparation
Montana Creek (near Juneau)	In Preparation
Ninilchik River-Reach A	In Preparation

As of July 1, 1990, instream flow water rights were granted for seven of the ADF&G applications. Nine of these applications are in the process of adjudication. The remainder of these applications are pending adjudication (Table 1).

The experience gained through the analysis and preparation of each application has continually improved our ability to complete the next application. Unfortunately, we are at a stage where data limitations or processes may limit or reduce the number of reservations submitted in the future unless additional resources are obtained to collect and analyze data from streams having little or no biological and hydrological data.

For example, the dearth of hydrological data for most streams in Alaska will govern the ability to evaluate naturally occurring hydrological patterns with confidence. It is also more time consuming to estimate flow characteristics for streams having a limited or non-existent data base as opposed to summarizing data for a stream having an adequate historical record. There are only 316 stream gaging sites in Alaska. Of them, only 171 have a continuous flow record of ten or more years, 55 have a record of five to nine years, and 90 have a record shorter than four years (Emery 1989). The U.S. Geological Survey (USGS) considers a ten year record as the minimum data base required to support a statistically reliable regional flow analysis. Alaska has an average of one stream gage per 7,000 square miles, whereas there is an average of one gage per 400 square miles in the lower forty-eight states (Emery 1987). Flows must be estimated for the numerous ungaged stream reaches in Alaska using regional hydrological models. Reliability of the flow estimates calculated by using the equations in these models is usually best for models developed for regions having a greater concentration of gaging stations. Therefore, it is obvious that additional gaging stations are required to improve the accuracy of the data base used to develop instream flow recommendations.

Competition for water in some systems and the associated adjudication process, if lengthy (see Estes 1987), could further hamper the ability of the ADF&G to apply for reservations because of limited personnel and financial resources. Additionally, after an instream flow reservation is granted it must be reviewed by the ADNR every ten years to determine whether it should be modified. This requires the applicant to maintain a storage system for the original data and analyses used to determine and defend the reservation. Documentation must be sufficient to enable the applicant or a representative of the applicant, who is unfamiliar with the original work, to defend the reservation each time it is reviewed. This data storage requirement is costly in terms of space and is a burden to the applicant. It is also unclear as to who bears the burden for determining whether an instream flow should be revised after ten years has lapsed.

The ADNR adjudicates water rights applications for out-of-stream appropriations in addition to instream flow reservation applications. Therefore, due to limited personnel resources, the ADNR has a backlog and usually is often unable to adjudicate applications immediately after an applicant files. However, a priority date is assigned to all water rights applications by the ADNR on the day an application for instream flows is accepted. This date protects the applicant by establishing the order of

priority for the allocation of water, regardless of when the adjudication occurs.

Another constraint to reserving water is the lack of equality afforded an applicant for an instream flow reservation as opposed to applicants for out-of-stream appropriations with respect to obtaining a priority date (Estes 1987). Presently, an instream flow applicant must quantify and substantiate the flow regime requested in order to file an application and receive a priority date. An out-of-stream applicant, however, is only required to estimate the amount of water needed in order to receive a priority date.

Many of these shortcomings may be corrected by proposed changes to the ADNR water management regulations (Alaska Administrative Code 1990) which were recently approved by the Commissioner of the ADNR and submitted to the state Attorney General and Lieutenant Governor for review and final approval. Among the changes proposed is one that would allow instream flow applicants to receive a priority date by estimating the quantity of water they want to reserve. Additional time would then be granted to collect and analyze data to substantiate requests for instream flows. Another proposal would improve the existing regulations by eliminating the provision allowing the Commissioner of the ADNR to require an instream flow certificate holder to collect and analyze additional data when a certificate is automatically reviewed every ten years. One of the proposals would require out-of-stream applicants to quantify the naturally occurring seasonal amounts of water within a water source as part of the application process for water rights exceeding a 100,000 gallons per day threshold.

In summary, although the existing instream flow reservation process is among the most progressive in the country, the data and analysis requirements are presently much greater than those required to support out-of-stream applications. These requirements could be interpreted to limit the base level of instream flow protection which is implied in the Alaska Constitution. Article VIII, Section 13 of the Alaska Constitution (Harrison 1982) grants a general reservation of water to fish and wildlife. These and other concerns are being addressed by the proposed regulation changes referenced above and by proposed legislation that was introduced in 1989 by Representative Cliff Davidson (1989) of the State House of Representatives.

HB 210, if it had been enacted, would have provided a guaranteed base level of instream flow protection to all streams and river reaches that support fish (Davidson 1989). The bill was amended (House Finance Committee 1990) and supported by the Governor's office. Although technical support was provided for the bill by the ADF&G and ADNR, HB 210 died in the final weeks of the 1990 legislative session. It is anticipated a similar version of the bill will be reintroduced in 1991.

Based on our experiences, the following seven recommendations to improve the instream flow reservation process are provided:

1) Additional staff and financial resources should be allocated to the instream flow program to allow for a greater number of applications to be processed.

2) Additional USGS gaging stations should be funded to improve flow projection estimates and to determine the availability of water for out-of-stream and instream uses.

3) A program should be initiated and funded to update and improve the precision and accuracy of hydrological models used to estimate flow characteristics for ungaged sites in Alaska. This information derived from these models is essential for determining the availability of water for out-of-stream and instream uses for the majority of rivers and streams in the state.

4) ADNR Water Use Act regulation modifications should be approved that improve the instream flow reservation process and provide instream flow applicants treatment more equivalent to that granted applications for out-of-stream water appropriations.

5) Out-of-stream appropriation certificates should be automatically reviewed by the ADNR once every ten years, similar to the instream flow reservation review.

6) Legislation similar to HB 210 should be enacted or regulations established that will guarantee a base level of instream flow protection for stream reaches that are classified as supporting fish.

7) An instream flow methods and application handbook should be prepared by the ADF&G to provide sufficient guidance for the public and other interested parties to file for instream flow reservations.

ACKNOWLEDGEMENTS

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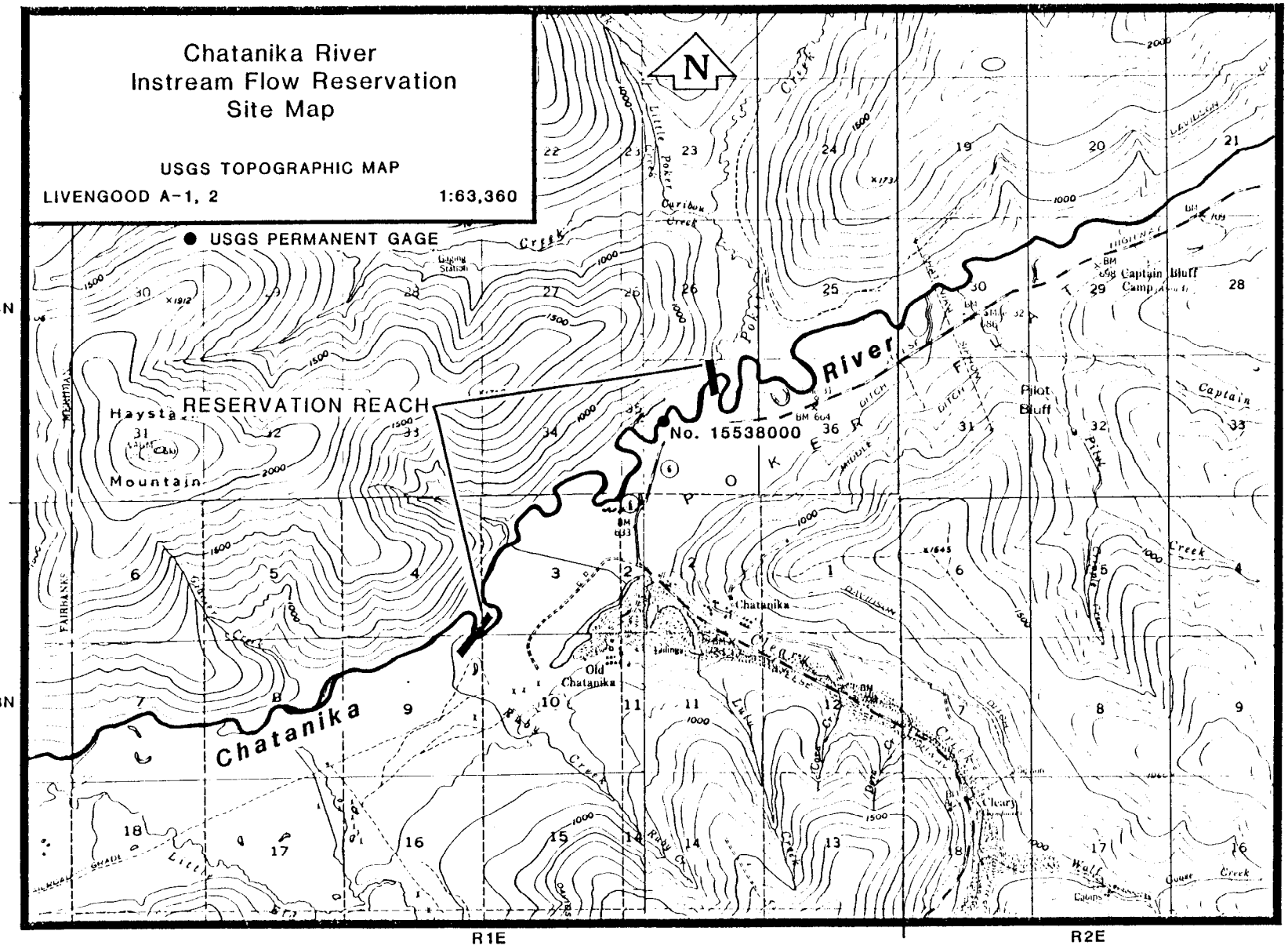
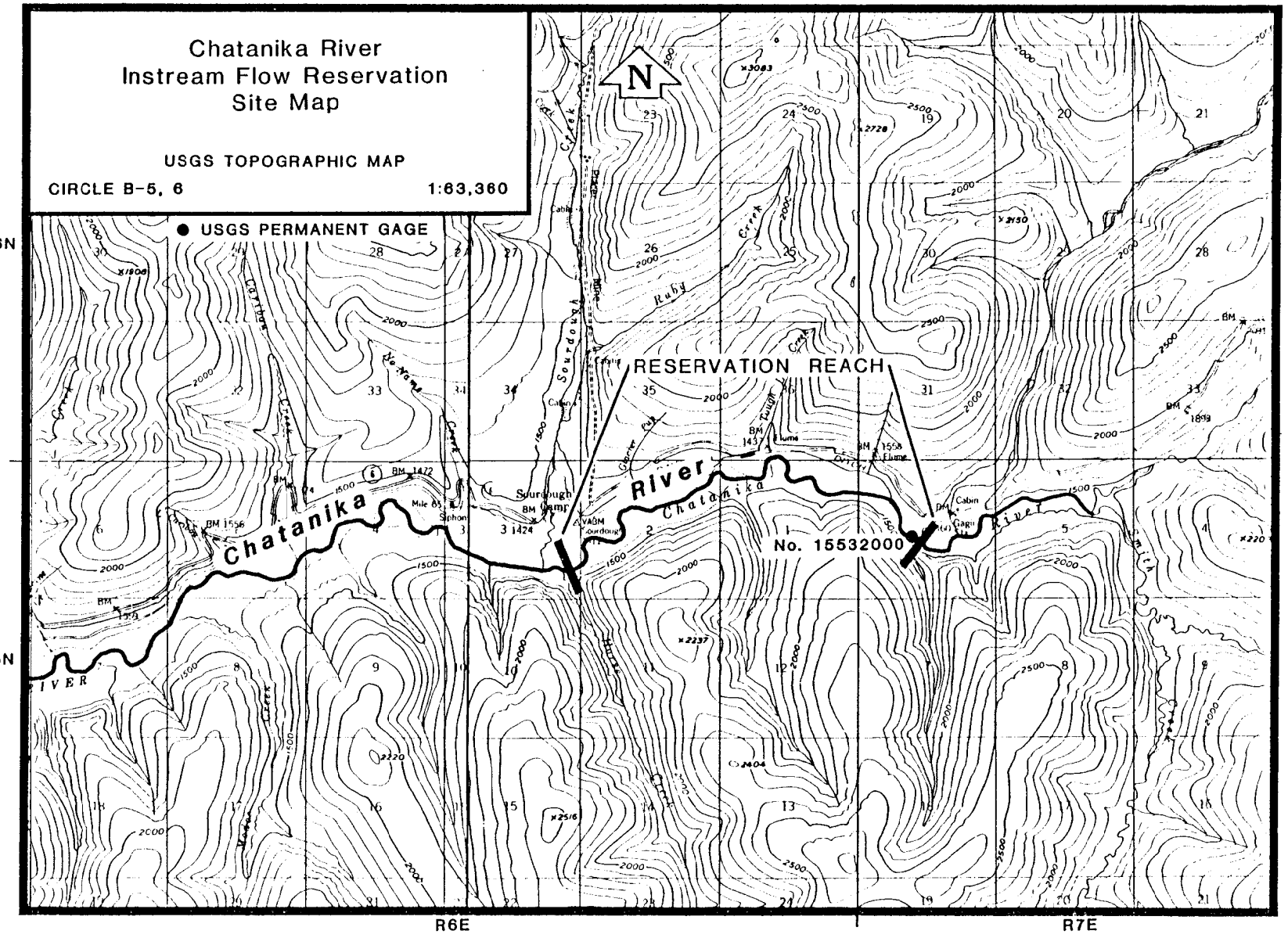
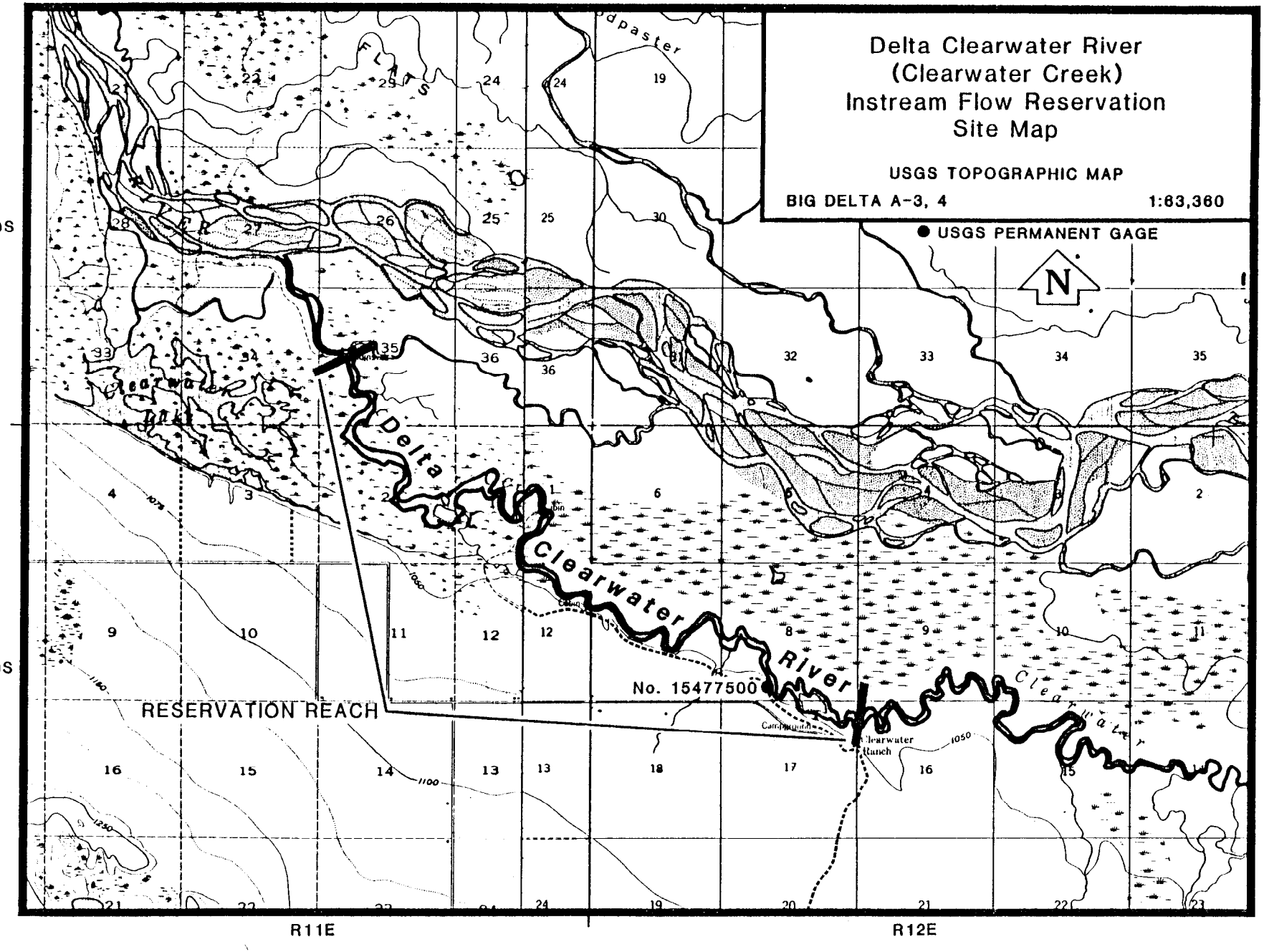
APPENDIX A



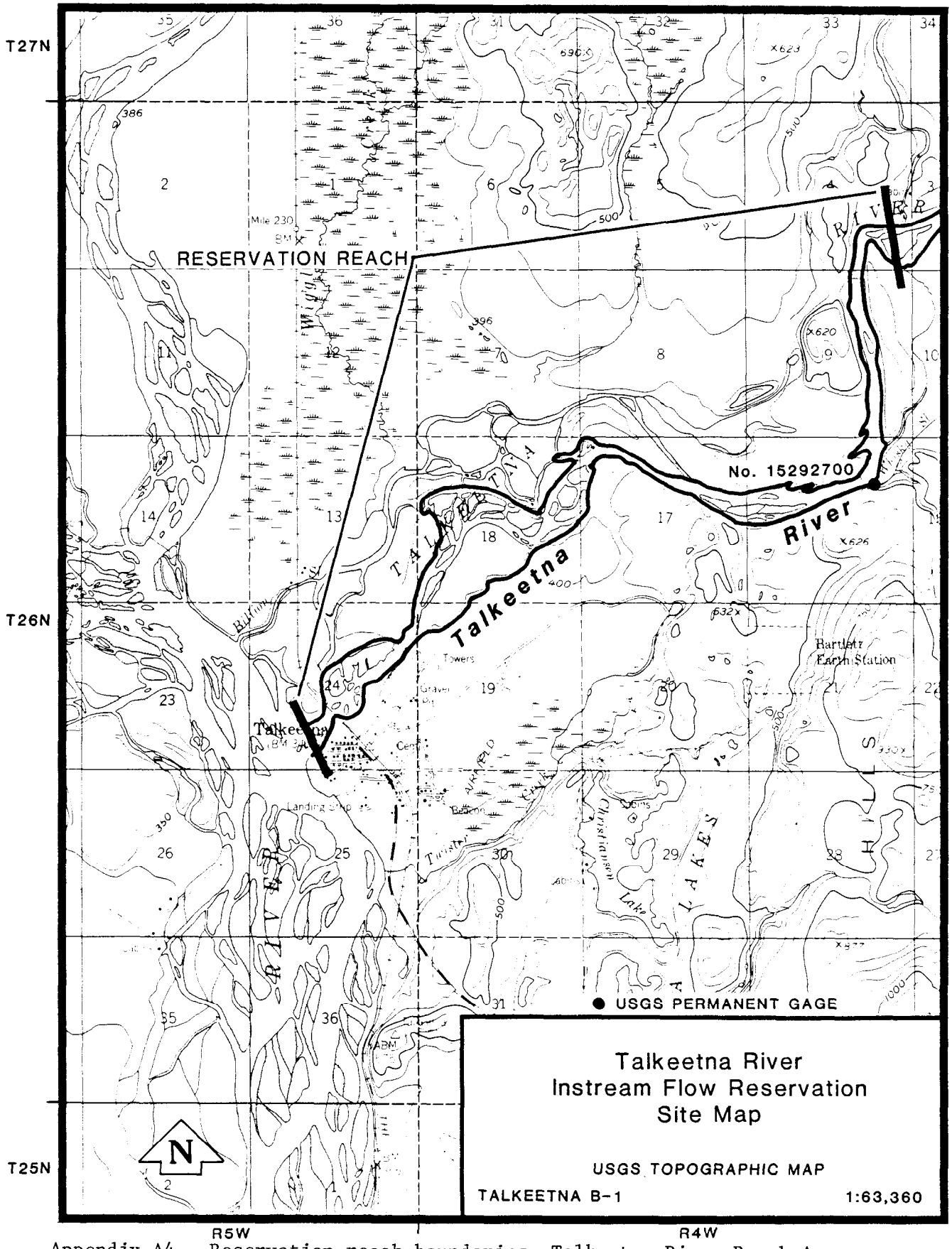
Appendix A1. Reservation reach boundaries, Chatanika River-Reach A.



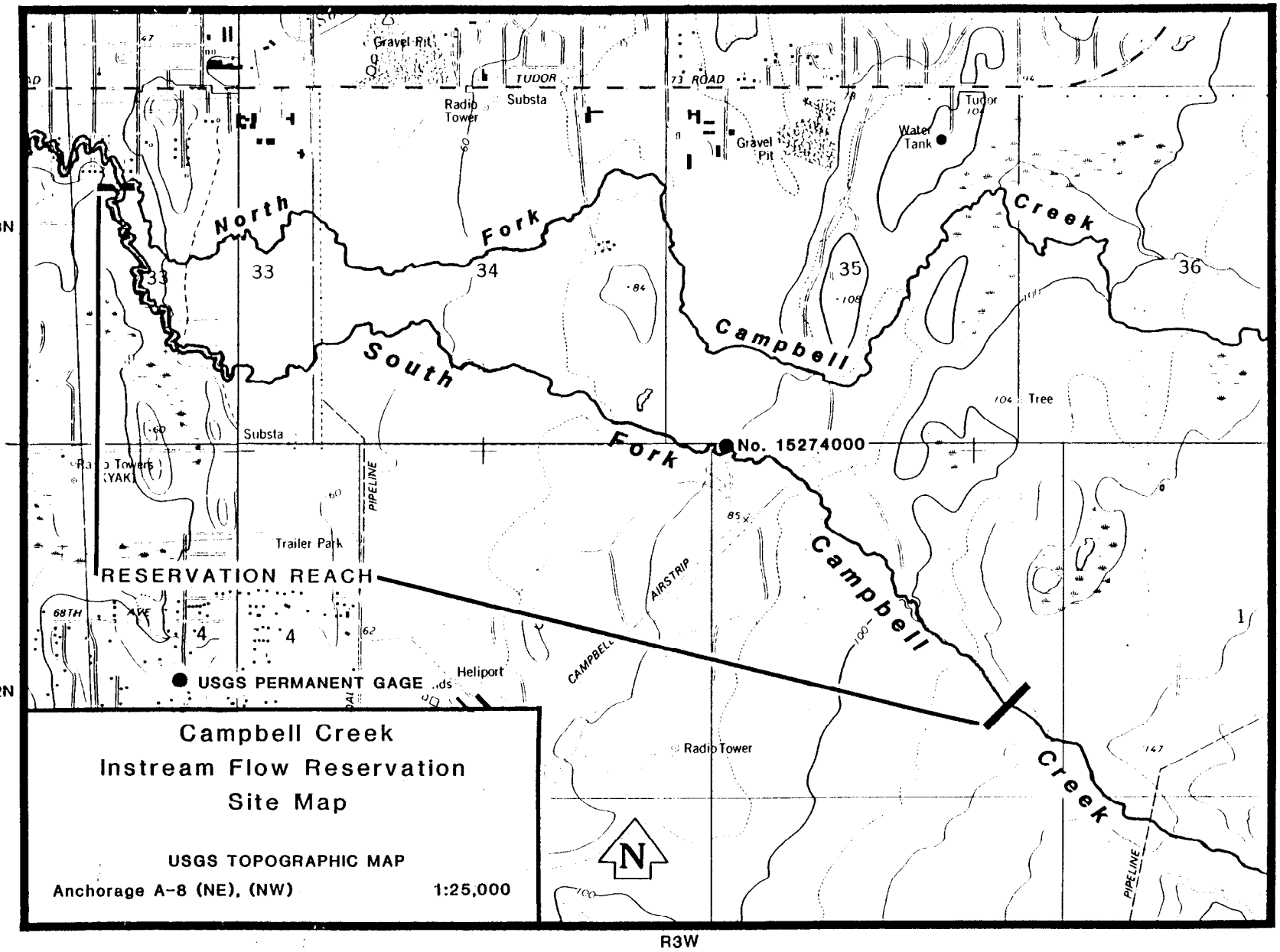
Appendix A2. Reservation reach boundaries, Chatanika River-Reach B.



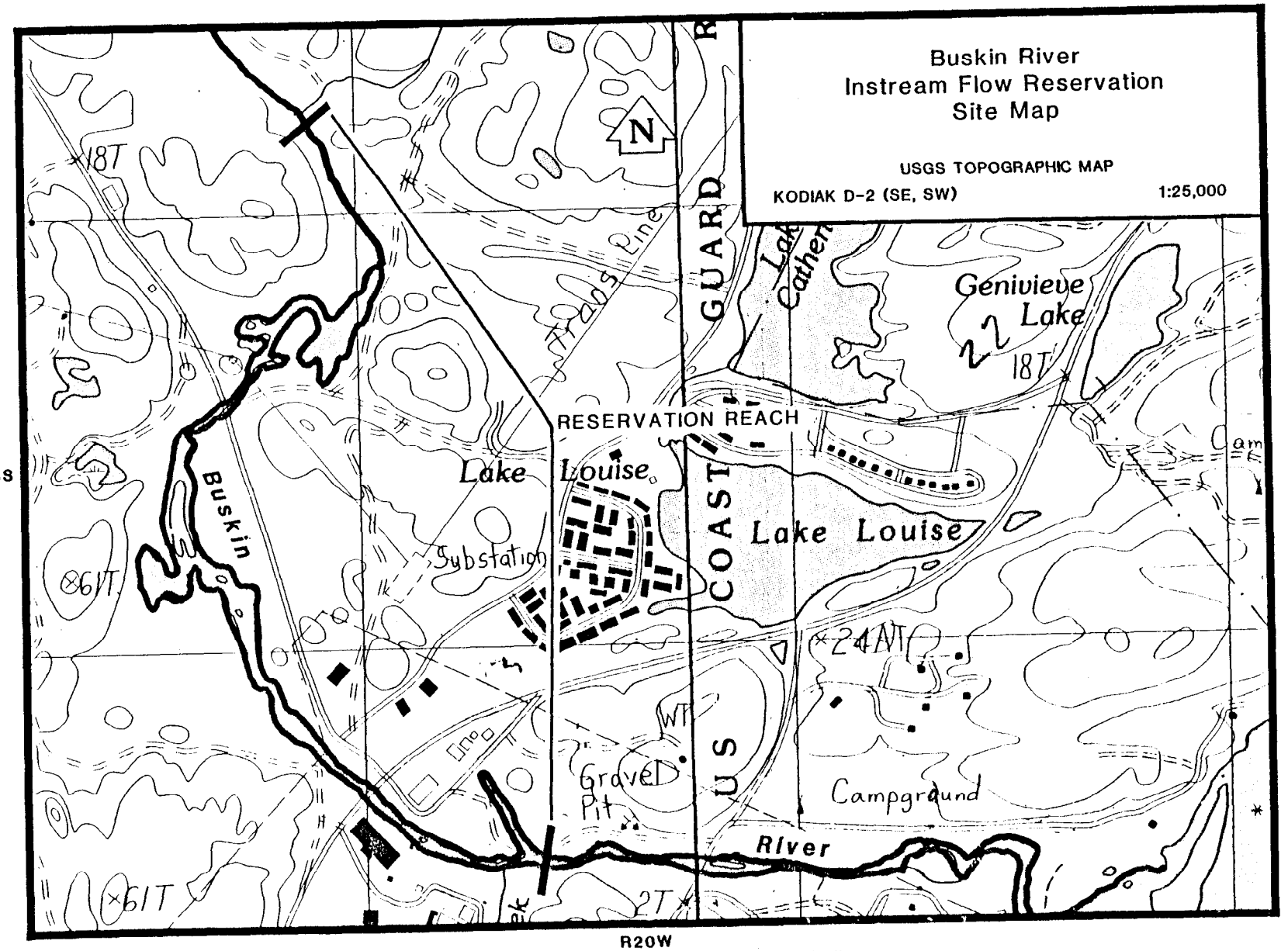
Appendix A3. Reservation reach boundaries, Delta Clearwater River (Clearwater Creek).



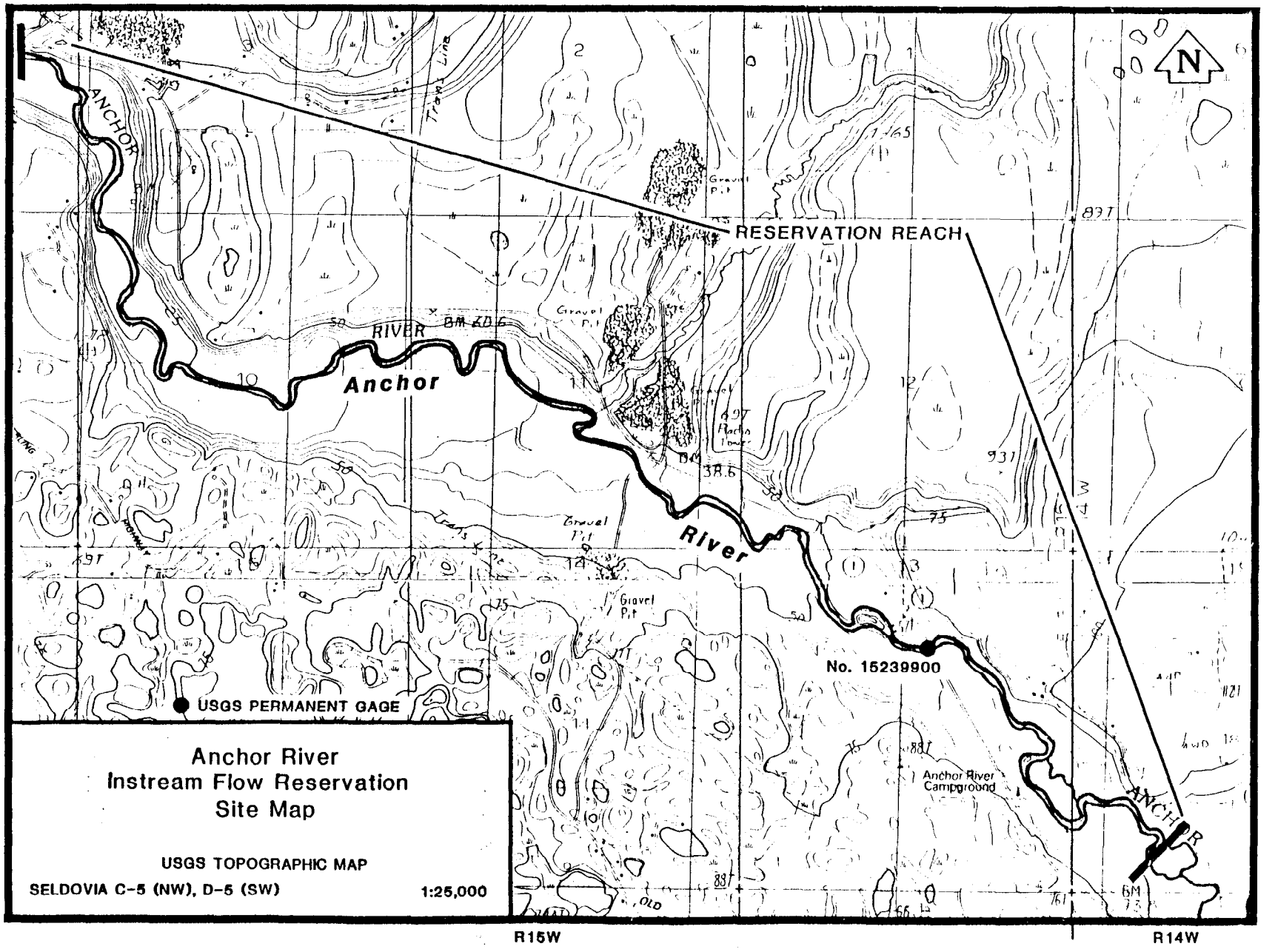
Appendix A4. Reservation reach boundaries, Talkeetna River-Reach A.



Appendix A5. Reservation reach boundaries, Campbell Creek (South Fork).

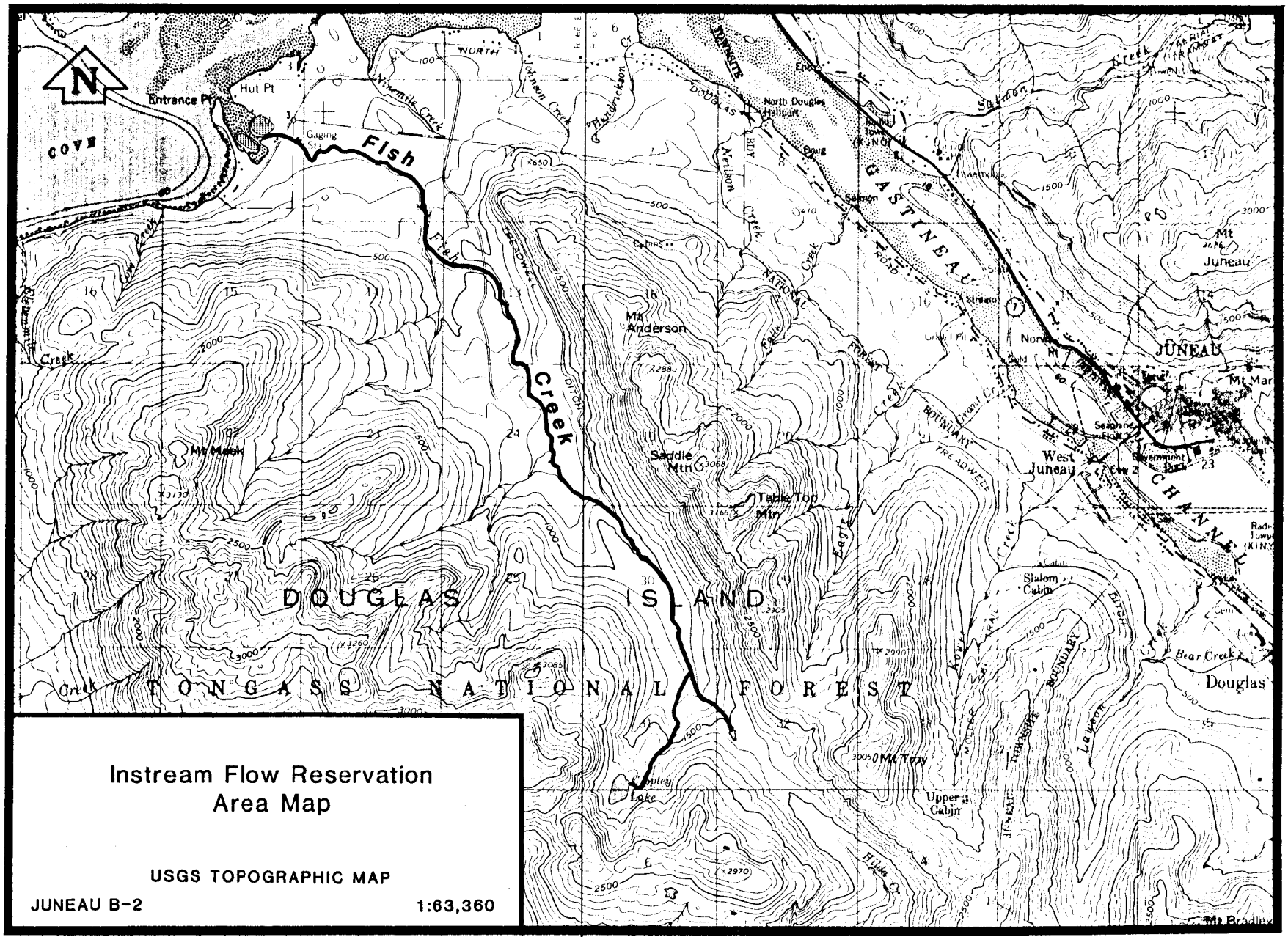


Appendix A6. Reservation reach boundaries Buskin River-Reach B.

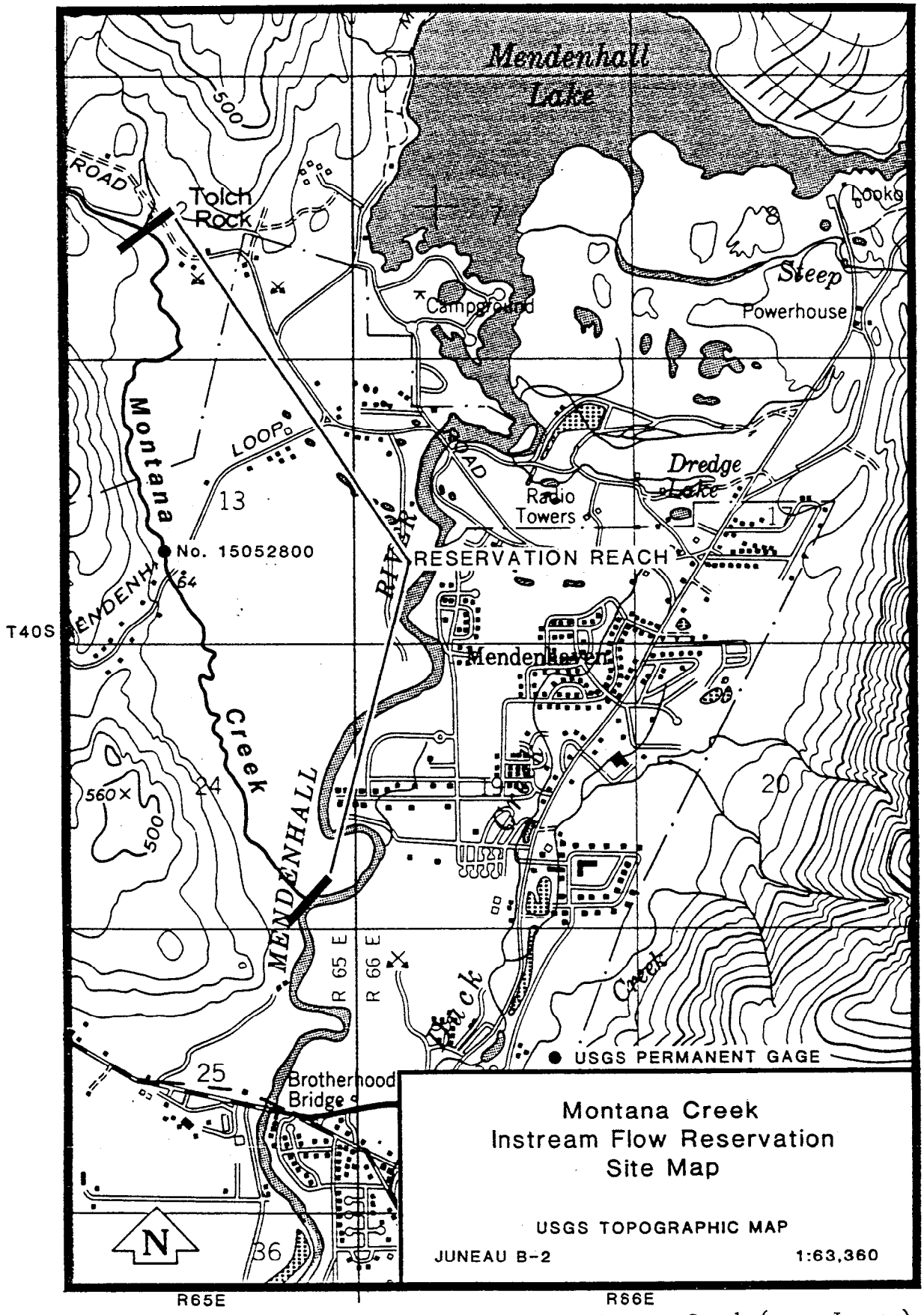


Appendix A7. Reservation reach boundaries, Anchor River-Reach B.

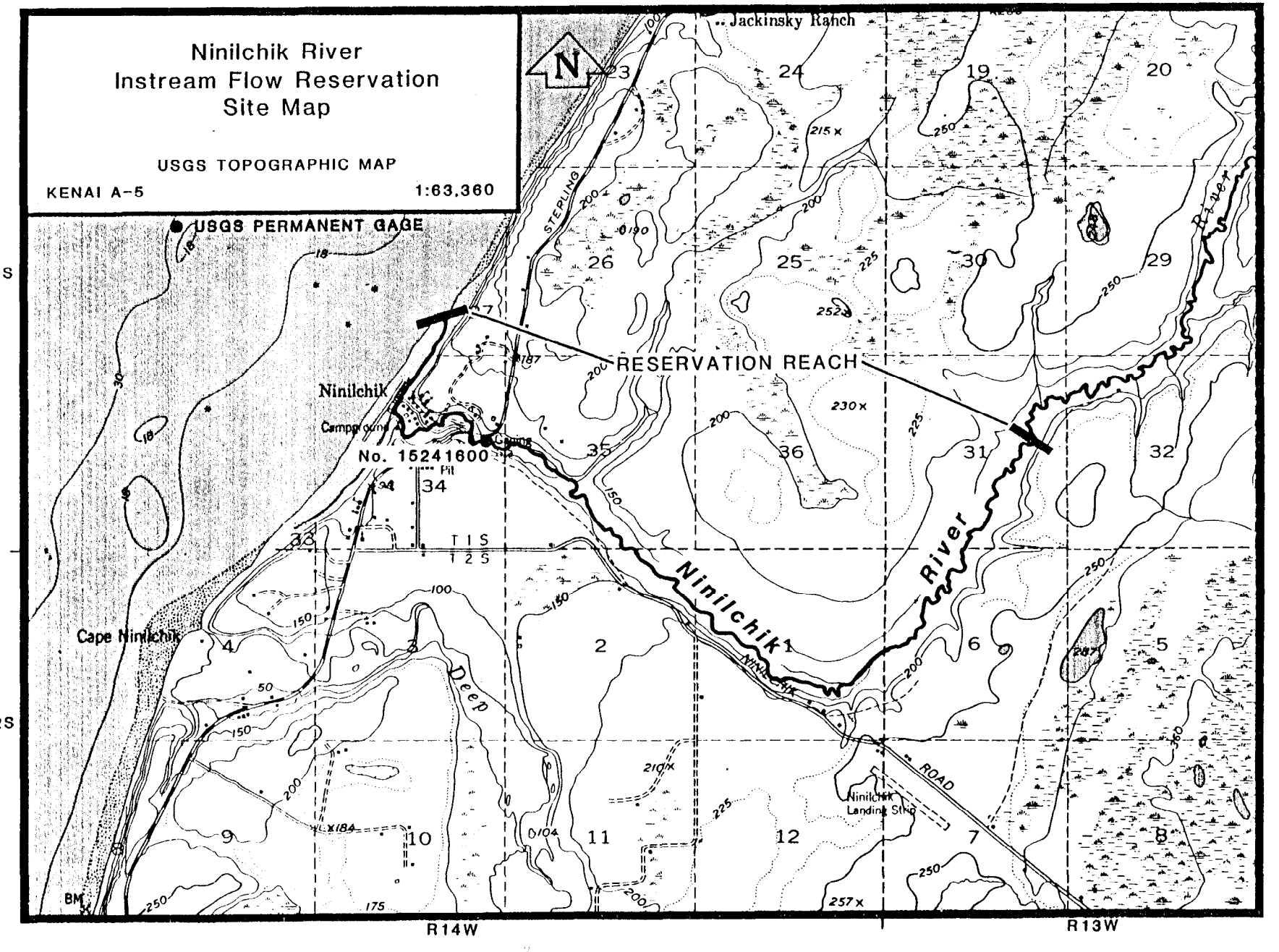
T41S



Appendix A8. Reservation reach boundaries, Fish Creek (near Juneau).



Appendix A9. Reservation reach boundaries, Montana Creek (near Juneau).



Appendix A10. Reservation reach boundaries, Ninilchik River-Reach A.

Appendix A11. Species periodicity chart for: Chatanika River-Reach A.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage						XXX	XXXX	XX				
Spawning							XXX	XXXX	X			
Incubation	XXXX	XXXX	XXXX	XXX			XXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
CHUM SALMON												
Passage						XXX	XXXX	XXXX				
Spawning							XXX	XXXX	XX			
Incubation	XXXX	XXXX	XXXX	XXXX			XXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XXXX	XXXX	XXX					
LONGNOSE SUCKER												
Passage ?												
Spawning				XX	XXXX	XXX						
Incubation				XX	XXXX	XXXX	XXXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ROUND WHITEFISH												
Passage							XXXX	XXXX	XXXX	XXXX	XXX	
Spawning								XX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
HUMPBACK WHITEFISH												
Passage							XXXX	XXXX	XXXX	XXXX	XXX	
Spawning								XX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
SHEEFISH												
Passage							XXXX	XXXX	XXXX	XXXX	XXX	
Spawning								XX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ARCTIC GRAYLING												
Passage ?												
Spawning				XX	XXXX	XX						
Incubation				XX	XXXX	XXXX	XXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A11. (Page 2 of 2).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
COHO SALMON												
Passage									XXXX	XXXX	XXXX	
Spawning									XXXX	XXXX	XXXX	
Incubation	XXXX	XXXX	XXXX	XXXX					XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
SLIMY SCULPIN												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
BURBOT												
Passage ?												
Spawning	XXXX	XXXX										XXXX
Incubation	XXXX	XXXX	XXXX	XXXX	XXXX							XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
NORTHERN PIKE												
Passage ?												
Spawning				XXX	XXXX	XX						
Incubation				XXX	XXXX	XXXX	XXXX	XXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A12. Species periodicity chart for: Chatanika River-Reach B.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
LONGNOSE SUCKER												
Passage ?												
Spawning				XX	XXXX	XXX						
Incubation				XX	XXXX	XXXX	XXXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ROUND WHITEFISH												
Passage							XXXX	XXXX	XXXX	XXXX	XXX	
Spawning								XX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ARCTIC GRAYLING												
Passage ?												
Spawning				XX	XXXX	XX						
Incubation				XX	XXXX	XXXX	XXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
SLIMY SCULPIN												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
BURBOT												
Passage ?												
Spawning	XXXX	XXXX										XXXX
Incubation	XXXX	XXXX	XXXX	XXXX	XXXX							XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A13. Species periodicity chart for: Delta Clearwater River (Clearwater Creek).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
COHO SALMON												
Passage									XXXX	XXXX	XXXX	
Spawning									XXXX	XXXX	XXXX	
Incubation	XXXX	XXXX	XXXX	XXX			XXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
CHUM SALMON												
Passage						XXX	XXXX	XXXX				
Spawning							XXX	XXXX	XX			
Incubation	XXXX	XXXX	XXXX	XXXX			XXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XXXX	XXXX	XXX					
LONGNOSE SUCKER												
Passage ?												
Spawning				XX	XXXX	XXX						
Incubation				XX	XXXX	XXXX	XXXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ROUND WHITEFISH												
Passage							XXXX	XXXX	XXXX	XXXX	XXX	
Spawning								XX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX				XX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ARCTIC GRAYLING												
Passage ?												
Spawning				XX	XXXX	XX						
Incubation				XX	XXXX	XXXX	XXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
BURBOT												
Passage ?												
Spawning	XXXX	XXXX										XXXX
Incubation	XXXX	XXXX	XXXX	XXXX	XXXX							XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
SLIMY SCULPIN												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A14. Species periodicity chart for: Talkeetna River-Reach A.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage						XX	XXXX	X				
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
COHO SALMON												
Passage							XX	XXXX	XXXX	X		
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage ?												
Spawning ?												
Incubation ?												
Rearing ?												
SOCKEYE SALMON												
Passage						X	XXXX	XXXX	X			
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
CHUM SALMON												
Passage							XX	XXXX	X			
Spawning								XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX	XX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			X	XXXX	XXXX	XXXX							
RAINBOW TROUT												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage ?												
Spawning ?												
Incubation ?												
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
BURBOT												
Passage ?												
Spawning	XXXX	XX										XXXX
Incubation	XXXX	XXXX	????	?								XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
ARCTIC GRAYLING												
Passage ?												
Spawning ?												
Incubation ?												
Rearing ?												

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A15. Species periodicity chart for: Campbell Creek (South Fork).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage					XX	XXXX	XXXX					
Spawning							XXXX	XXXX				
Incubation	XXXX	XXXX	XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
COHO SALMON												
Passage							XXXX	XXXX	XXXX	XX		
Spawning								XXXX	XXXX	XXXX		
Incubation	XXXX	XXXX	XXXX	XXXX	XX			XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage							XXXX	XXXX	X			
Spawning							XXXX	XXXX	X			
Incubation	XXXX	XXXX	XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XXXX	XXXX							
SOCKEYE SALMON												
Passage							XXXX	XXXX				
Spawning							XXX	XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX	XXXX	XXXX		XXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage ?												
Spawning									XX	XXXX	XX	
Incubation	XXXX	XXXX	XXXX	XXXX	XX				XX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
RAINBOW TROUT												
Passage ?												
Spawning				XX	XXXX	XX						
Incubation				XX	XXXX	XXXX	XXXX	XX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A16. Species periodicity chart for: Buskin River-Reach B.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
COHO SALMON												
Passage							X	XXXX	XXXX	XXXX		
Spawning										XX	XXXX	XX
Incubation	XXXX	XXXX	XXXX	XX							XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage						XX	XXXX	XXXX	XXXX			
Spawning							XX	XXXX	XXXX	X		
Incubation	XXXX	XXXX	XXXX	XX			XX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing				XX	XXXX	XX						
SOCKEYE SALMON												
Passage					XXXX	XXXX	XXXX	XXXX	XXXX			
Spawning							X	XXXX	XXXX	XX		
Incubation	XXXX	XXXX	XXXX	XXXX				XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
CHUM SALMON												
Passage								XXXX	XXXX	X		
Spawning								X	XXXX	XX		
Incubation	XXXX	XXXX	XXXX	XX					XXXX	XXXX	XXXX	XXXX
Rearing				XX	XXXX	XXXX	XX					
STEELHEAD TROUT												
Passage-immg.									XX	XXXX	XXXX	XX
Passage-emig.					X	XXXX	X					
Spawning				XX	XXXX	X						
Incubation					XXXX	XXXX	XXXX	XXXX	XX			
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
RAINBOW TROUT												
Passage ?												
Spawning				XXXX	XXXX	XX						
Incubation				XXXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage-immg.							XXXX	XXXX	XXXX	XXXX		
Passage-emig.				XX	XXXX	XX						
Spawning										XXX	XXXX	XXXX
Incubation	XXXX	XXXX	XXXX	XX							XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A17. Species periodicity chart for: Anchor River-Reach B.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON												
Passage					XX	XXXX	XXXX	XX				
Spawning							XXXX	XXX				
Incubation	XXXX	XXXX	XXXX	XXX			X	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
COHO SALMON												
Passage								XXXX	XXXX	X		
Spawning									XXX	XXX		
Incubation	XXXX	XXXX	XXXX	XXX					X	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage							XXXX	XXXX	XXX			
Spawning							X	XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX	XXX					XXXX	XXXX	XXXX	XXXX
Rearing			X	XXXX								
SOCKEYE SALMON												
Passage							XXXX	XX				
Spawning ?												
Incubation ?												
Rearing ?												
CHUM SALMON												
Passage								XXX	XXX			
Spawning ?												
Incubation ?												
Rearing ?												
STEELHEAD TROUT												
Passage-immg.								XXXX	XXXX	XX		
Passage-emig.					XXXX	X						
Spawning				XXXX								
Incubation					XXXX	XXXX	XXXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage-immg.							XXXX	XXXX	XXXX			
Passage-emig.				XXXX	XXXX							
Spawning									XX	XXXX	XXX	
Incubation	XXXX	XXXX	XXXX	X						X	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A18. Species periodicity chart for: Fish Creek (near Juneau).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COHO SALMON												
Passage	XXXX							XX	XXXX	XXXX	XXXX	XXXX
Spawning	XXXX									XXXX	XXXX	XXXX
Incubation	XXXX	XXXX	XXXX							XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage						XX	XXXX	XXXX	XXX			
Spawning							XXXX	XXXX	XXXX			
Incubation	XXXX	XXXX	XX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			XXXX									
CHUM SALMON												
Passage						XX	XXXX	XXXX	XXX			
Spawning							XXXX	XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			XXXX									
CUTTHROAT TROUT												
Passage							XXXX	XXXX	XXXX	XXXX	XXXX	
Spawning			XXXX	XXXX	XXXX							
Incubation			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage						XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	
Spawning									XX	XXXX	XXXX	XXXX
Incubation	XXXX	XXXX	XXXX	XXXX					XX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A19. Species periodicity chart for: Montana Creek (near Juneau).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COHO SALMON												
Passage	XXXX							XX	XXXX	XXXX	XXXX	XXXX
Spawning	XXXX									XXXX	XXXX	XXXX
Incubation	XXXX	XXXX	XXXX							XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON												
Passage						XX	XXXX	XXXX	XXX			
Spawning							XXXX	XXXX	XXXX			
Incubation	XXXX	XXXX	XX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			XXXX									
CHUM SALMON												
Passage						XX	XXXX	XXXX	XXX			
Spawning							XXXX	XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			XXXX									
CUTTHROAT TROUT												
Passage							XXXX	XXXX	XXXX	XXXX	XXXX	
Spawning			XXXX	XXXX	XXXX							
Incubation			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
STEELHEAD TROUT												
Passage	XXXX	XXXX	XXXX	XXXX	XXXX	XX		XX	XXXX	XXXX	XXXX	
Spawning			XXXX	XXXX	XXXX	XXXX						
Incubation				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX			
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN												
Passage						XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XX
Spawning									XX	XXXX	XXXX	XXXX
Incubation	XXXX	XXXX	XXXX	XXXX					XX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.

Appendix A20. Species periodicity chart for: Ninilchik River-Reach A.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON													
Passage						XXXX	XXXX	XXXX	X				
Spawning								XX	XXXX				
Incubation		XXXX	XXXX	XXXX	XX			XX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
COHO SALMON													
Passage								XX	XXXX	XXXX	X		
Spawning										XXXX	XXXX		
Incubation		XXXX	XXXX	XXXX	XX					XXXX	XXXX	XXXX	XXXX
Rearing		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
PINK SALMON													
Passage	?												
Spawning	?												
Incubation	?												
Rearing	?												
SOCKEYE SALMON													
Passage	?							XX	XXX				
Spawning	?												
Incubation	?												
Rearing	?												
CHUM SALMON													
Passage	?												
Spawning	?												
Incubation	?												
Rearing	?												
RAINBOW TROUT													
Passage		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Spawning						XXXX	XX						
Incubation	?					XXXX	XXXX	XXXX					
Rearing		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
STEELHEAD TROUT													
Passage		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		XXXX	XXXX	XXXX	XXXX	XXXX
Spawning					X	XXXX	XX						
Incubation	?				X	XXXX	XXXX	XXXX					
Rearing		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
DOLLY VARDEN													
Passage	?						XX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Spawning									XX	XXXX	XXXX	XX	
Incubation		XXXX	XXXX	XXXX	XX				XX	XXXX	XXXX	XXXX	XXXX
Rearing		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Based on professional judgement of ADF&G biologists.
Passage life phase presented for anadromous fish is immigration.
Passage life phase presented for resident fish includes immigration and outmigration.
Incubation life phase includes period from egg deposition to fry emergence.
? = Data not available.