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INSTREAM FLOW

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This report summarizes the activities performed during the first year of the Instream Flow program.

Between 1 July 1986 and 30 June 1987, six instream flow analyses were completed. Instream flow reservation applications were submitted to and accepted by the Alaska Department of Natural Resources for the Little Susitna River, Willow Creek, Rabbit Creek, Little Rabbit Creek, Terror River, and Little Survival Creek. To date, the Terror River application has been adjudicated and was granted the requested instream flow reservation, the first in the State. The other applications will probably be adjudicated during FY 88.

KEY WORDS: instream flow, flow reservation, Montana Method, Instream Flow Incremental Methodology, Willow Creek, Little Susitna River, Rabbit Creek, Little Rabbit Creek, Little Survival Creek, Terror River.

INTRODUCTION

This report summarizes Fiscal Year (FY) 1987 activities completed during the first year of the newly formed Instream Flow program (1 July 1986 to 30 June 1987).

The State of Alaska has abundant and diversified sport fisheries which are of considerable value to fishermen. In 1986, for example, an estimated 360,000 anglers took 1.7 million trips, fishing 2.1 million angler days to harvest 3.2 million fish (Mills 1987). These values represent significant increases over those noted in previous years (Mills 1979-1986).

Increases in private and commercial developments such as hydroelectric, recreational, mining, and agricultural projects, and residential and commercial construction, have contributed to changes in both the riparian and instream habitat of important sport fishing areas. These developments will negatively impact the production of fish which utilize these areas unless sufficient instream flows and other important habitat characteristics are maintained.

An instream flow is defined as the quantity of water that occurs within a stream channel at a specific location during a given time period. 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, 46.15.145) for the protection of fish and wildlife habitat, migration and propagation or other specified uses.

To reserve instream flows, an application containing supporting data and analyses that substantiate the flows being requested must be submitted to the Alaska Department of Natural Resources (ADNR).

Prior to July 1986, the Alaska Department of Fish and Game (ADF&G) had insufficient personnel and financial resources to establish 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 or other resources. However, a portion of supplemental funding received by the ADF&G in FY 87 under the recently passed Wallop-Breaux federal legislation allowed for the initiation of an instream flow program in the Statewide Research and Technical Services Unit of the Division of Sport Fish.

Accordingly, the goal of this new 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 87 was to apply for instream flow reservations for the protection of sport fishery resources in six specific rivers of the state.

The six streams selected during FY 87 were the Little Susitna River, Willow Creek, Rabbit Creek, Little Rabbit Creek, Little Survival Creek, and Terror River (Figures 1 to 7).

METHODS

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 application for an instream flow reservation is placed upon the applicant (ADNR 1985; Estes and Harle 1987). Two methods were employed in FY 87 to apply for instream flows: the Instream Flow Incremental Methodology (IFIM), Physical Habitat Simulation (PHABSIM), system modeling approach (Bovee 1982), and the Montana Method (Tennant 1972). The selection of these methods was premised on the philosophy that any valid instream flow method or a combination of methods could be used to generate instream flow recommendations if hydrological data were calibrated to the site or area studied, and fish habitat criteria were adjusted to the species/life phases of fish found in the vicinity of the targeted water body (Estes 1984).

The choice of these methods was also based on the availability of data, previous analyses, and financial resources. The Montana Method was considered the most cost effective approach for recommending a flow regime for four of the streams. However, the more sophisticated and usually more costly IFIM analyses were used to support applications for Willow Creek and the Terror River because IFIM analyses had been performed on these streams in the past for other purposes (Estes 1984; Wilson et al. 1981).

The Montana Method was developed by Tennant (1972, 1976). It has been successfully tested in court, requires minimal expenditures of resources and can be used with limited or extensive hydrological and fishery data bases. The Montana Method is considered one of the simplest techniques for selecting or qualitatively evaluating instream

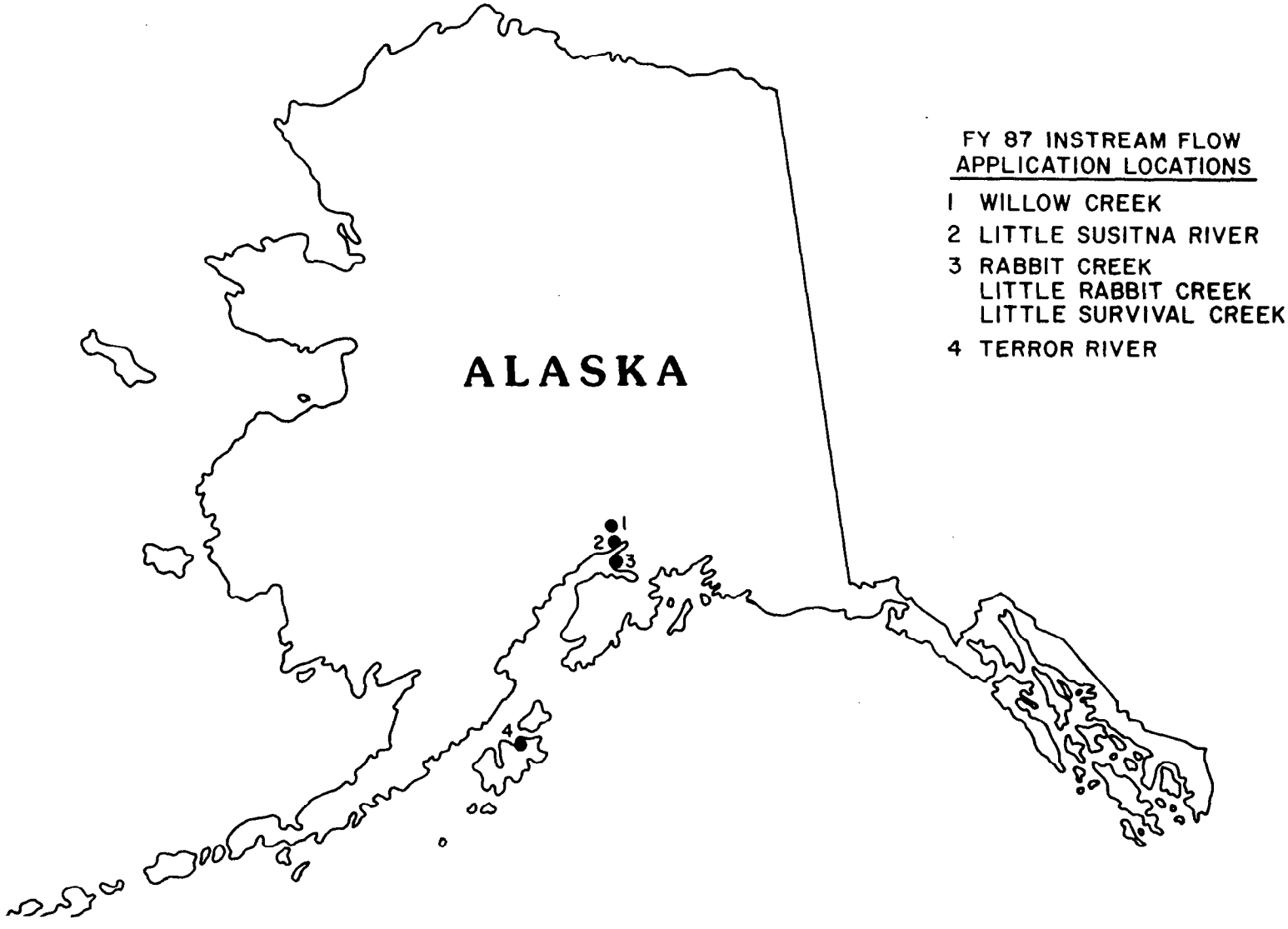

Figure 1. FY 87 instream flow application locations.

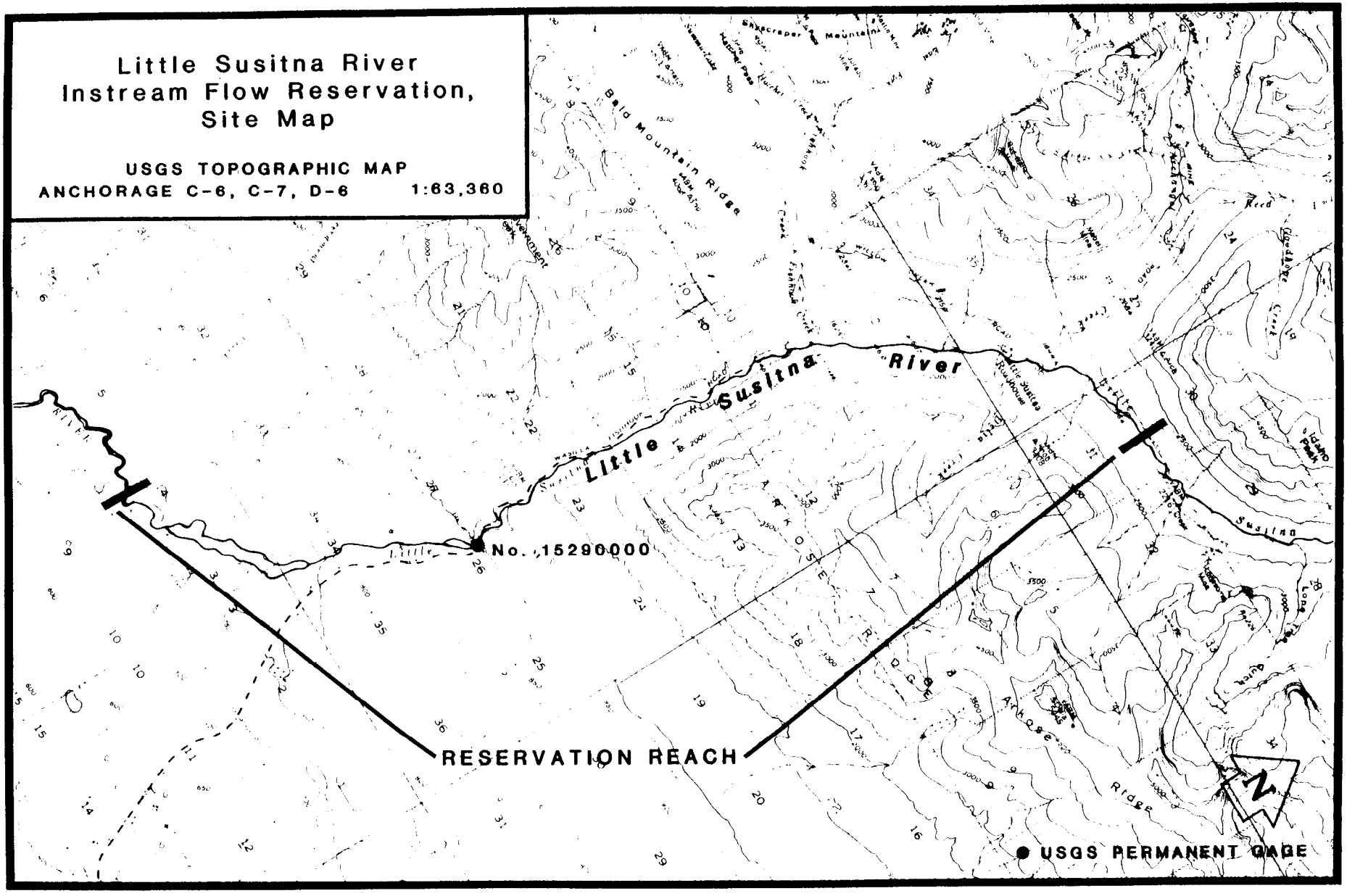

Figure 2. Little Susitna River reservation reach.

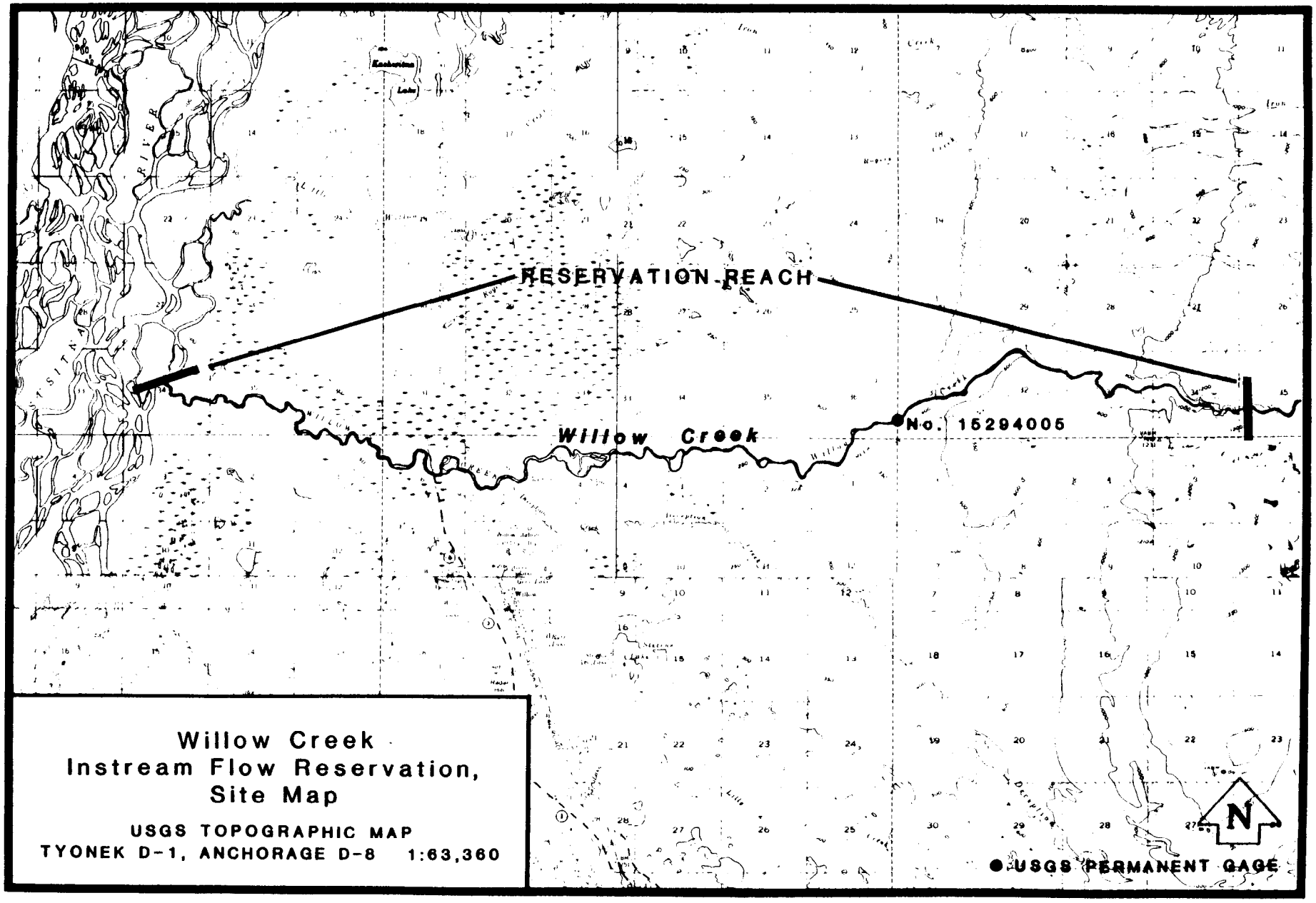

Figure 3. Willow Creek reservation reach.

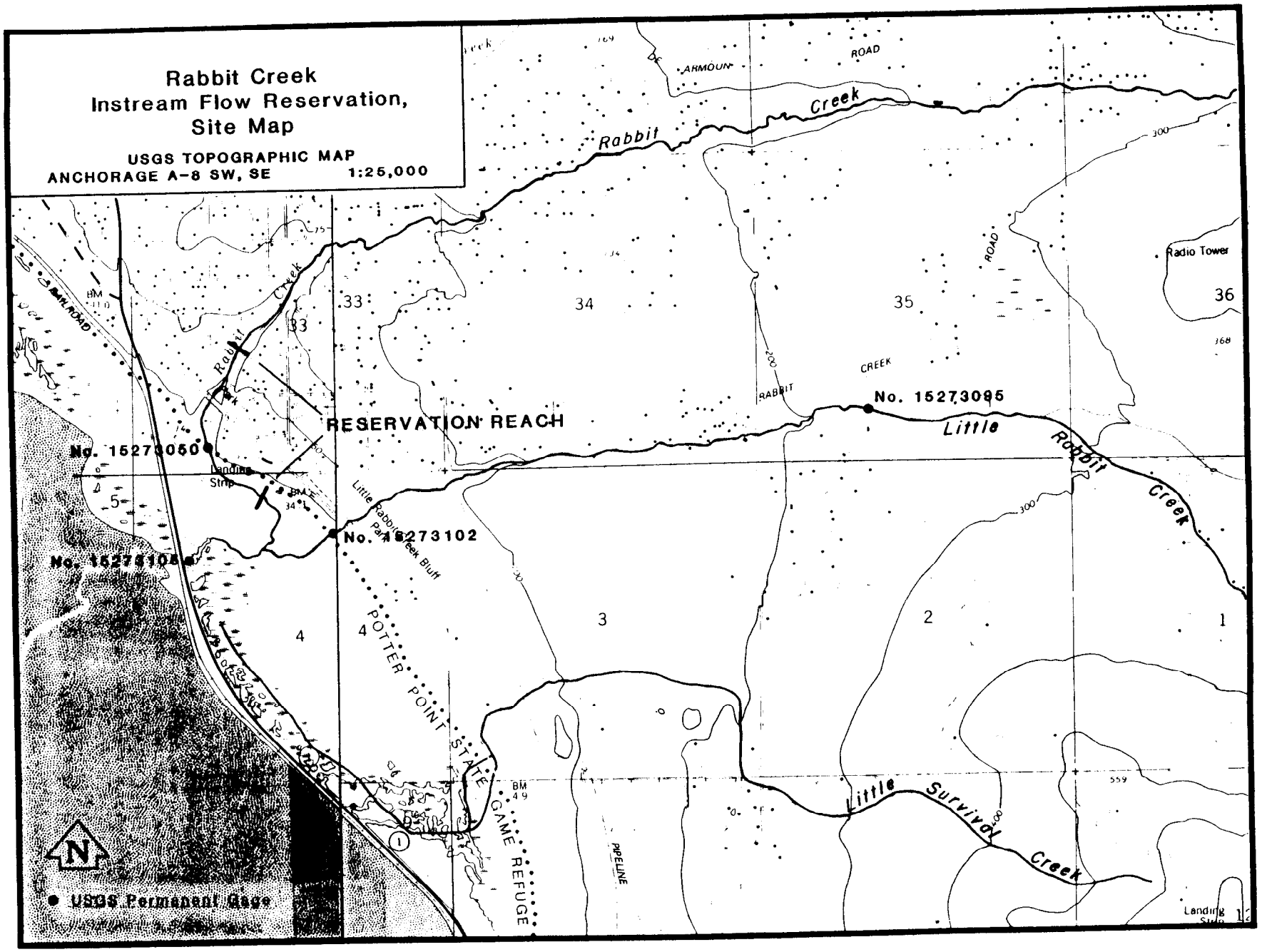

Figure 4. Rabbit Creek reservation reach.

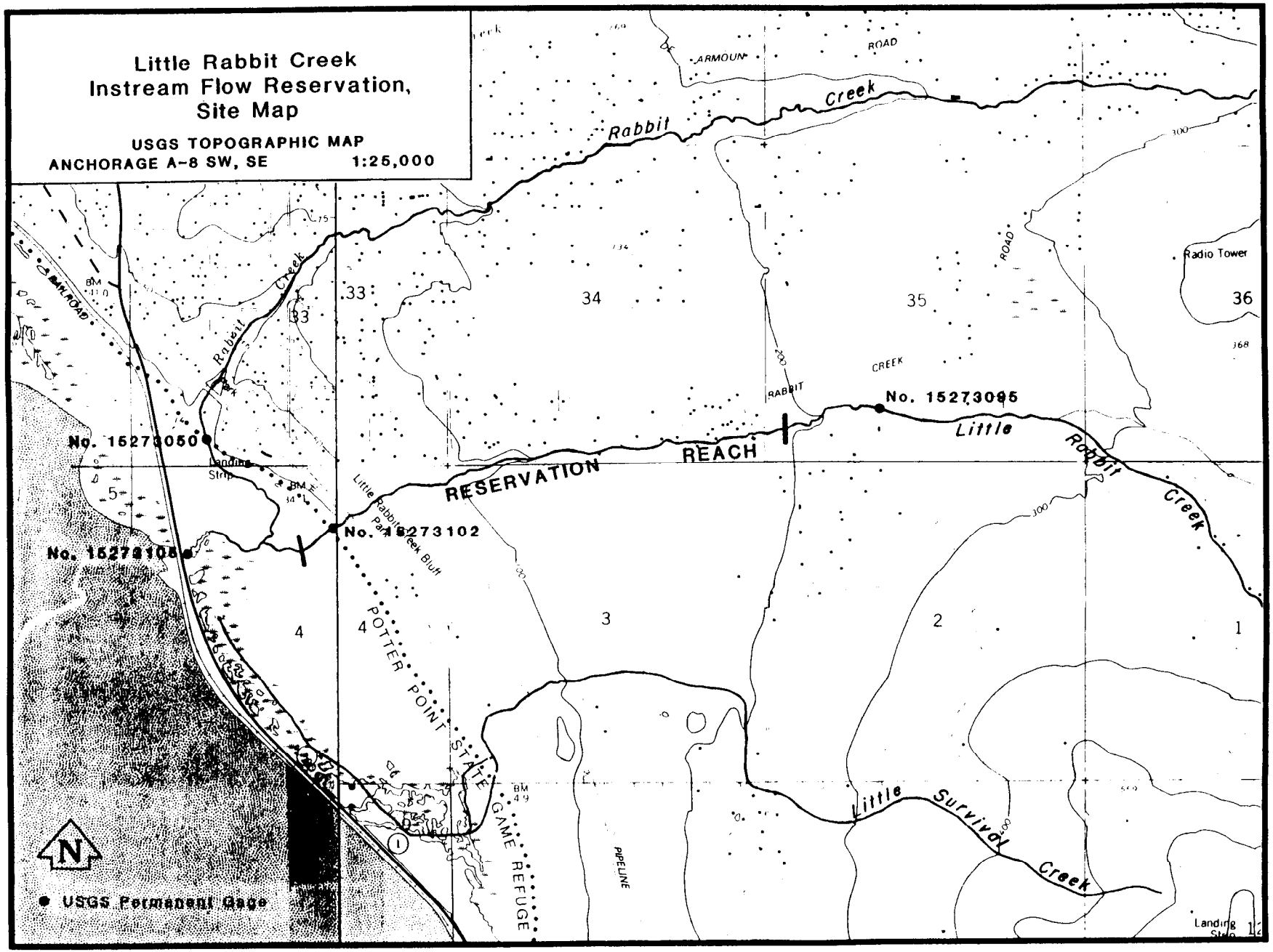

Figure 5. Little Rabbit Creek reservation reach.

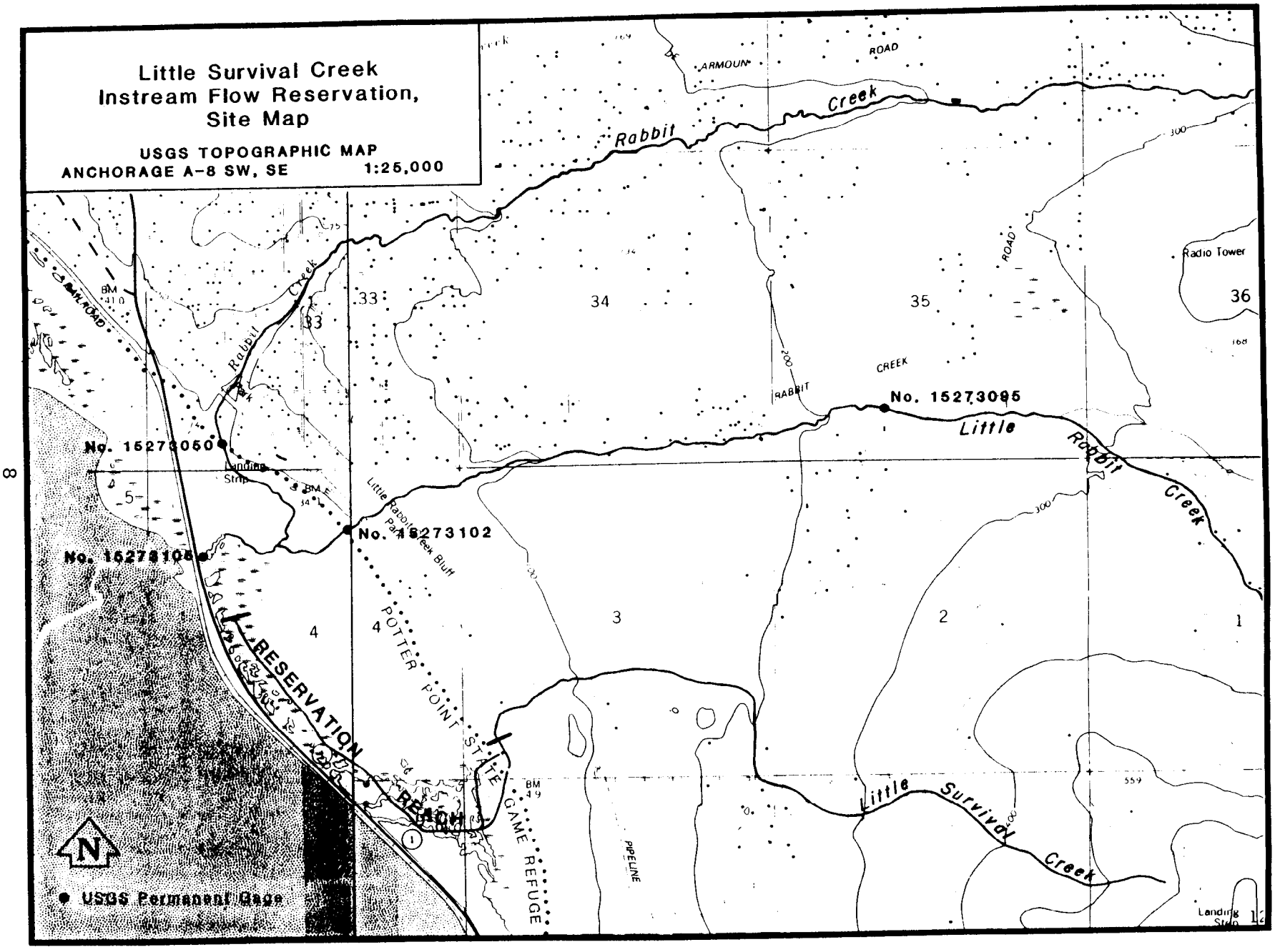

Figure 6. Little Survival Creek reservation reach.

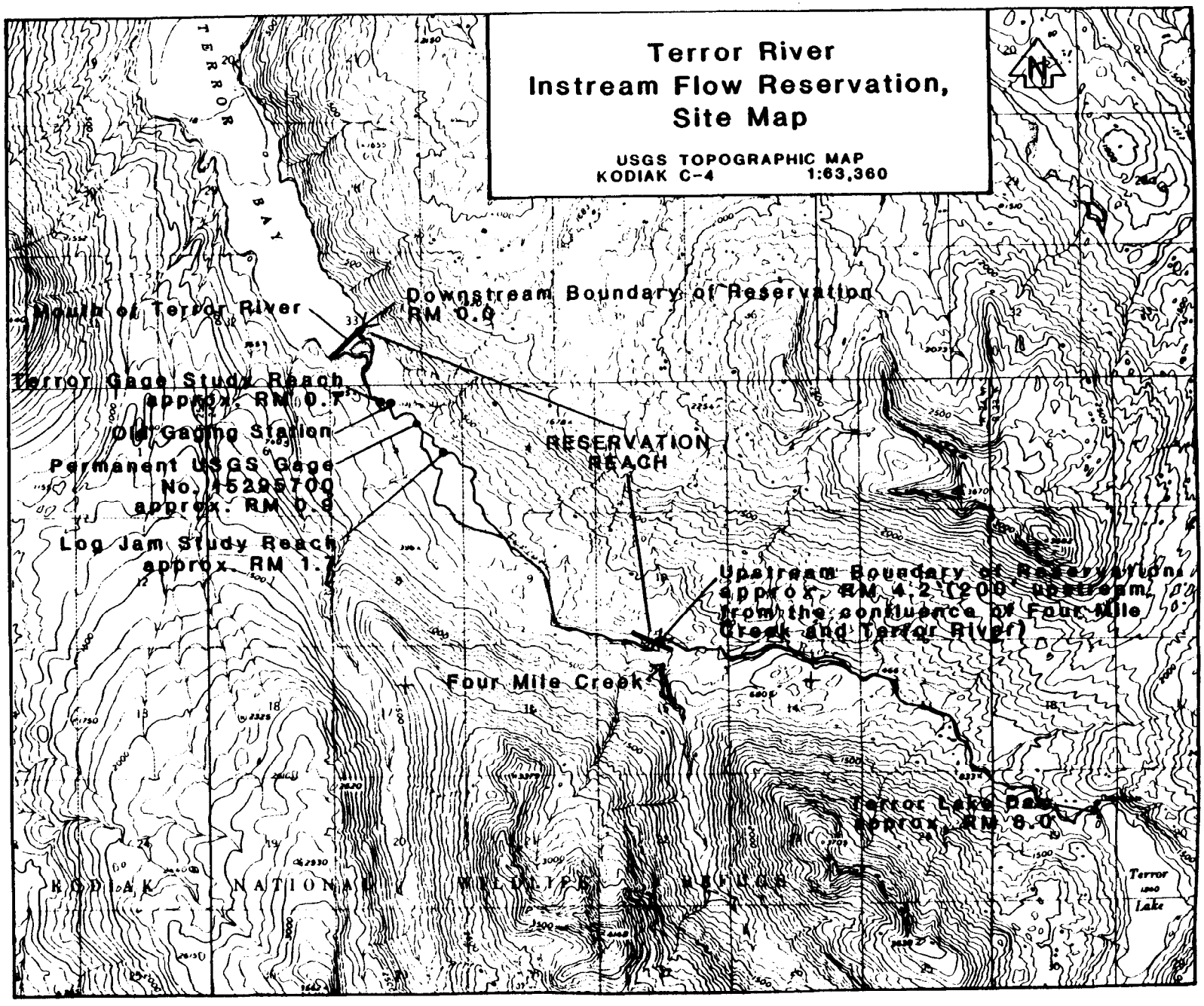

Figure 7. Terror River reservation reach.

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). Seven of the 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 <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 3 to 7 days.

The Montana Method requires that the QAA be calculated from an existing or synthesized data base. A flow recommendation is established by selecting the desired classification and multiplying the QAA by the corresponding percentage or percentage range.

The IFIM PHABSIM system was developed by the Instream Flow Group of the U.S. Fish and Wildlife Service. It is one of the most resource intensive methodologies and has also been tested successfully in court. The PHABSIM system is a collection of computer programs that combine open channel hydraulics and behavioral responses of fish to hydraulic characteristics (Milhous, et al. 1984). The combination of these programs translates flow variations into the availability of fish habitat (weighted usable area, WUA). The PHABSIM models require extensive hydraulic data (e.g., water velocity and depth) collection and analyses to simulate available physical (hydraulic) conditions (a physical model). Fish habitat criteria (e.g., water velocity and depth, and substrate characteristics associated with the water column utilized by fish) are required to develop fish habitat criteria files. The fish habitat criteria files are used to determine, through weighting, the percentage of total wetted surface area at a given flow which provides fish habitat based on physical characteristics simulated by the physical model. The resulting product is designated as WUA and is an index of the capacity of a site to support the species and life stage being considered (spawning habitat for chinook salmon in this study). WUA is expressed as square feet (ft^2) or percentage (%) of wetted surface habitat area estimated to be available per 1,000 linear feet of stream reach at a given flow. The range of flows for which WUA can be calculated is determined by the calibration range of the hydraulic models. WUA is not a measure of the number of fish at a site.

The IFIM allows for the quantification of habitat that is capable of supporting a targeted species/life phase or combination of species/life phases as a function of selected flows. The ability to evaluate a series of specified flows with this method makes it the most versatile method of those examined for making water allocation decisions.

Rivers and streams were nominated for analysis as described in the 1984 Departmental Instream Flow Work Plan; (ADF&G 1984; Estes 1985), and as modified in 1986 (Instream Flow Committee 1986). The final selection of the streams evaluated was made by the Sport Fish Division by evaluating the importance of the nominated streams to the

sport fishery and reviewing the quantity and quality of existing data that are necessary for the submission of an application.

The Montana Method in combination with an evaluation of hydrological patterns (Estes and Orsborn 1986) was used to derive instream flow recommendations for the Little Susitna River, Rabbit Creek, Little Rabbit Creek, Little Survival Creek, and for a portion of the year for Willow Creek (September to June) as described in ADF&G (1987a, b, c, d, e). The IFIM was applied to the Terror River and Willow Creek (July and August) as described in ADF&G (1986a, 1987e).

The results of these analyses were used to complete instream flow applications following procedures described in ADNR (1985). The completed applications were submitted to the ADNR for adjudication (administrative process to determine whether to approve, modify, or deny an instream flow reservation request).

RESULTS

Six analyses were completed and used to submit applications to the ADNR to reserve instream flows in the Little Susitna River, Willow Creek, Rabbit Creek, Little Rabbit Creek, Little Survival Creek and Terror River (ADF&G 1986a, 1987a, b, c, d, e). A summary of the reservation flows requested for each stream is presented in Table 1.

Following five months of adjudication, an instream flow reservation was granted for the Terror River, the first since enactment of enabling legislation in 1980. The adjudication process for the remaining five applications is expected to be completed by the end of FY 88 (30 June 1988).

DISCUSSION

Although the capability to execute the various processes required to complete an instream flow application improved with experience gained from the analysis and preparation for each application, other data limitations or processes may limit the number of reservations submitted in the future to the present level unless additional resources are obtained.

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 nonexistent data base as opposed to summarizing data for a stream having an adequate historical record. The defense of an instream flow regime as part of the adjudication process proved to be more time consuming than anticipated. Competition for water in some systems and the associated adjudication process could conceivably hamper the ability of the ADF&G to apply for reservations. 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

Table 1. Summary of instream flow reservation requests, FY 87.

Month	Flow (cfs)					
	Little Susitna River	Willow Creek	Rabbit Creek	Little Rabbit Creek	Little Survival Creek	Terror River
Jan	29.4	80.6	10.7	2.6	0.7	60.0
Feb	23.3	67.2	7.8	2.0	0.7	60.0
Mar	19.2	57.7	7.1	1.8	0.7	60.0
Apr	22.0	67.1	9.7	2.6	0.7	100.0
May	207.6	338.8	16.2	5.4	1.2	150.0
Jun	212.0	338.8	19.8	5.4	1.2	150.0
Jul	240.4	700.0	19.8	5.4	1.2	150.0
Aug	212.0	550.0	19.8	5.4	1.2	150.0
Sep	212.0	338.8	19.8	5.4	1.2	150.0
Oct	130.3	263.5	19.8	5.4	1.2	150.0
Nov 1-15	60.4	141.5	18.3	5.3	1.2	100.0
Nov 16-30	60.4	141.5	18.3	5.3	1.2	60.0
Dec	38.0	97.7	13.3	3.2	1.2	60.0

stream appropriations with respect to obtaining a priority date. Instream flow data and analysis requirements must be met before a priority date will be granted. Out of stream applicants do not have to provide this information to obtain a priority date. A hypothetical situation may occur in which all of the water from a stream would be appropriated for out of stream use while a potential instream flow applicant was still in the process of collecting and analyzing data.

There are over 15,000 streams in Alaska classified as an anadromous fish stream (ADF&G 1986b) not including the thousands of unclassified or resident fish streams. At the present rate of reserving six streams a year, it would take at least 2,500 years to protect these streams. These and other concerns should be addressed in order to provide adequate protection for instream flow requirements of sport fish.

Based on these concerns, the following four recommendations to improve the instream flow program 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 U.S. Geological Survey (USGS) gaging stations should be funded. Alaska has an average of one stream gage per 5,000 square miles, whereas there is an average one gage per 400 square miles in the lower forty-eight states. These data are required to improve flow projection estimates.

3) The instream flow regulations should be amended to provide equal treatment regarding priority dates for instream flow applications that is equivalent to treatment presently granted applications for out of stream water appropriations.

4) Legislation should be enacted which will automatically provide a base level of instream flow protection for stream reaches that are classified as supporting anadromous fish species.

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