KETCHIKAN LAKES HYDROELECTRIC PROJECT

FERC Project No. 420-000-Alaska
(State Review No. AK9608-09J)

VOLUME II

DRAFT APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT FOR HYDROPOWER LICENSE

City of Ketchikan, Alaska

Acting By and Through
Ketchikan Public Utilities

June 30, 1998

PRELIMINARY DRAFT
ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE

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Federal Energy Regulatory Commission
Office of Hydropower Licensing
Division of Project Review

Ketchikan Lakes Hydroelectric Project
FERC No. 420-000-Alaska

I. APPLICATION

The City of Ketchikan, Alaska under the name of Ketchikan Public Utilities (KPU) applies to the Federal Energy Regulatory Commission (FERC or Commission) for a new license for the Ketchikan Lakes Hydroelectric Project (Project), FERC Project No. 420, as described in the attached exhibits. The Ketchikan Lakes Hydroelectric Project is located on Ketchikan Creek in Southeast Alaska (**Figure 1**), within and adjacent to the City of Ketchikan, Alaska. The location of Project facilities is shown on **Figure 2**. Project facilities extend north from the city, across state lands, and into National Forest lands administered by the U.S. Forest Service, Tongass National Forest (Forest Service), and lands managed by the Bureau of Land Management (BLM). The portion of the Tongass National Forest occupied by the Project is reserved by the federal government for power development.

The Project is an existing combined- purpose facility operated by KPU. The Project utilizes the runoff to Ketchikan Lakes and storage in Ketchikan Lakes, together with run-of-river flow diverted from Granite Basin Creek, to generate electricity and to provide a water source for the Ketchikan municipal water system. By an Act of Congress dated July 27, 1939, the municipal water supply is protected jointly by the City of Ketchikan and the Forest Service. The Act states that this land is *"...reserved from all forms of location , entry, or appropriation, under the mineral or nonmineral land laws of the United States, and set aside as municipal water-supply reserves for the use and benefit of the people of the city of Ketchikan, a municipal corporation of the Territory of Alaska..."*.

Figure 1 Regional Site Map

The Project is owned and operated by the City of Ketchikan, Alaska under the name of Ketchikan Public Utilities (KPU). KPU has elected to file an applicant-prepared environmental assessment (APEA) with their application. The Commission and Forest Service have agreed to participate through a Letter of Understanding (LOU) that was executed for this Project.

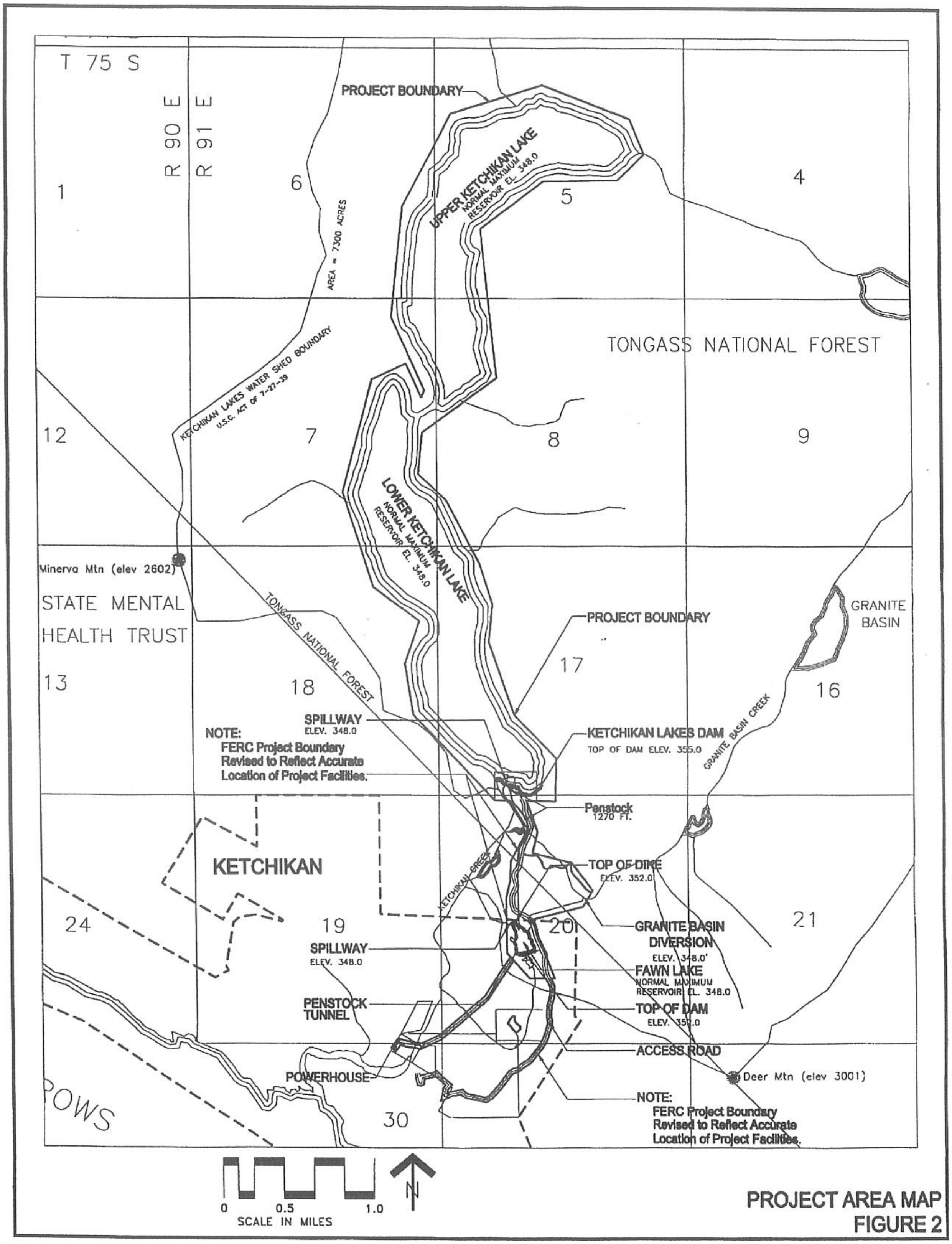


Figure 2 Project Area Map

II. PURPOSE OF ACTION AND NEED FOR POWER

A. Purpose of Action

The Commission must decide whether to relicense the Project, and what conditions should be placed on any license issued. The Forest Service must decide what license conditions are needed for the adequate protection of National Forest System lands if the Commission grants a new license.

In this EA, we assess the environmental and economic effects of: 1) operating the Project as proposed by KPU and 2) the No Action Alternative. We also assess alternative generating capacities, decommissioning the Project, federal government takeover, and non-power license.

B. Need For Power

Hydroelectric energy is critical to the Ketchikan community due to its relatively low cost. The only other electric energy available is from diesel generation, which is much more expensive due to fuel and operating costs. KPU strives to generate as much electricity as possible with hydropower, and as little as possible with diesel.

C. Background

The Ketchikan Lakes Hydroelectric Project is the modern product of numerous improvements to the first hydroelectric public utility in Alaska. The early workings were first constructed at Ketchikan in 1903, as noted in *Water Powers of Southeast Alaska*, a report prepared in 1947 by the Federal Power Commission and the Forest Service. This same document notes that there have been eight distinct stages of hydroelectric development of Ketchikan Creek, the first beginning in 1903. The initial application for a permit to cover the existing and expanding plant was made to the Forest Service on August 26, 1911, by the Citizens' Light, Power, and Water Company. This application and an amended application dated January 5, 1912 were incomplete. Application No. 420 was filed with the Commission by the Citizens' Light, Power, and Water Company on May 21, 1923. This application was amended several times, and a license was issued May 15, 1928, effective July 1, 1928. The City of Ketchikan purchased the Project in 1935 and the transfer was dated November 13, 1936. The original license for the Project expired on June 30, 1970. The Project continued operating under annual licenses until June 30, 1982 at which time a new license was issued. The term of the current license is 30 years, so the license will expire on June 30, 2000.

Subsequent to the 1947 Water Powers report, there have been modifications to the Project. However, the basic arrangement remains the same as it was in 1947; key Project components include Ketchikan Lakes, the Granite Basin Diversion, the Fawn Lake forebay and power tunnel, and the powerhouse (**Figure 2**). The Project was the first central station power supply for the City of Ketchikan, and has continued to be a key resource since its inception. Enhancements made since the original construction have been made to optimize use of the water resource, to provide for reliable municipal water supply, to provide for a minimum flow in Ketchikan Creek, and to comply with basic needs for modernization.

The total annual energy available from the Project ranges from 16 to 23 million kilowatt hours (kWh) on an annual basis. Additional generation resources have been added to the KPU system to accommodate load growth. The total electric energy generated at all of the plants owned or operated by KPU in 1995 was 160 million kWh and of this amount 17.4 million kWh was generated at the Ketchikan Lakes powerhouse. KPU owns or operates additional hydroelectric power facilities at Beaver Falls, Silvis Lake, and Swan Lake. The total amount of hydroelectric power generated by KPU in 1995 was 122 million kWh, with Ketchikan Lakes providing about 14 percent of this amount. KPU also operates three diesel generator sets at the Bailey powerhouse to supplement the hydroelectric generation as required.

The other hydropower operations are not restricted by the domestic supply constraints that influence operation of Ketchikan Lakes. Therefore, KPU's the other hydropower facilities (Silvis Lake and Beaver Falls) and Swan Lake (operated by KPU) are utilized for load following and Ketchikan Lakes is operated to produce energy while maintaining relatively stable water level in Fawn Lake.

Diesel generation is significantly more expensive than hydropower due primarily to the fuel costs. Therefore, it is desirable to generate as much electricity as possible with hydroelectric power and to minimize diesel generation. However, the operators must take precautions not to deplete water storage too severely before running the diesels because there is not enough diesel capacity to cover the full load. There is presently 12,500 kW of diesel capacity. System load peaks at 30,000 kW. The operational adjustments are determined by evaluation of all the data available to the operators including reservoir levels, time of day, precipitation in progress, and time of year.

The total hydroelectric capacity owned or operated by KPU is 45,700 kW but generation at this level cannot be sustained. The amount of hydroelectric capacity available to KPU is dependent on precipitation and reservoir levels. The plant factor (percentage of power generated versus rated capacity of the plants) for all hydroelectric power combined in 1995 was 41 percent. This was with very little water spilled and produced a total of 122 million kWh. Total KPU generation in 1995 was 160 million kWh, with 38 million kWh from diesel. The overall operating mode is to generate as much as possible with hydroelectric sources (avoiding spills) while taking care to preserve enough water in storage to always have enough hydroelectric energy available to meet total load by the combination of hydropower and diesel generation. This overall objective, together with the need to provide reliable municipal water, prescribe the operation of the Project.

III. PROPOSED ACTION AND ALTERNATIVES

A. KPU's Proposal

1. Project Description

The Ketchikan Lakes Hydroelectric Project is an existing combined-purpose facility operated by KPU. The Project utilizes the runoff to Ketchikan Lakes and storage in Ketchikan Lakes, together with run-of-river flow diverted from Granite Basin Creek, to generate electricity and to provide a water source for the Ketchikan municipal water system. Ketchikan Lakes are natural lakes which have been increased in capacity by construction of a dam at the outlet of the lower lake.

KPU proposes no changes to current operations. No new facilities are planned; no additional environmental mitigation measures are proposed. Specific existing facilities which together comprise the Project are listed and subsequently described below.

- Ketchikan Lakes, Dam, and Spillway
- Fawn Lake
- Ketchikan Lake to Fawn Lake Conveyance
- Granite Basin Diversion
- Granite Basin Diversion to Fawn Lake Conveyance
- Power Tunnel
- Powerhouse
- Access Roads

Ketchikan Lakes, Dam and Spillway: The Ketchikan Lakes are now interconnected by a channel which has been deepened between the two lakes to expedite flow from the upper to the lower lake. The upper and lower lakes are about equal in surface area, with a total combined surface area of 632 acres. The dam is a rockfill embankment with a wooden core wall. The total crest length is 1,163 feet; the maximum height is 30 feet. The spillway crest elevation is 348 feet; the crest height of the dam is 355 feet. The spillway was reconstructed in 1978, to pass the probable maximum flood. The spillway is a concrete crest weir, 103 feet in width. The spillway chute beyond the concrete apron is excavated in bedrock and discharges to Ketchikan Creek (**Figure 2**).

Fawn Lake: Fawn Lake is contained between two rockfill dams (**Figure 2**). The main dam is approximately 385 feet long and 22 feet high. The smaller dam is approximately 200 feet long and 15 feet high. The top of both dams is at elevation 352 feet. Both dams are rockfill with wooden cores. There is a spillway cut in rock at the west end of the smaller (north) dam, discharging overflow back to Ketchikan Creek. The spillway crest is at elevation 348 feet, which is the same as the Ketchikan Lakes spillway.

Ketchikan Lake to Fawn Lake Conveyance: The conveyance from Ketchikan Lake to Fawn Lake consists of a combination of penstocks (pipelines) and a tunnel (**Figure 2**). There are two parallel penstocks from Ketchikan Lake to the upstream tunnel portal. One of the pipelines was a 54-inch wood stave pipe that was recently replaced with a 54-inch ductile steel penstock. The other is a 54-inch concrete cylinder pipe. Each of the two penstocks can be isolated by valves at the tunnel portal and the dam. The pipelines connect through a concrete vault to a tunnel which is 7 feet by 8 feet in cross section and 1,127 feet long, terminating in Fawn Lake below the normal low water level. The capacity of this conveyance is dependant on the relative water levels in Ketchikan Lakes and Fawn Lake. The system is designed to convey an average flow of 120 cfs during low water conditions.

Granite Basin Diversion: The Granite Basin Diversion structure is a concrete dam approximately 30 feet long and 6 feet high, with three roller gates which can be used to sluice out the forebay to the diversion, to control the amount of flow entering the diversion, or to pass the flow by the diversion gate. The top of the roller gates is at elevation 464 feet. The tunnel inlet invert is at elevation 457 feet. The maximum capacity of this diversion and the conveyance to Fawn Lake is about 160 cfs but it seldom reaches capacity.

Granite Basin Diversion to Fawn Lake Conveyance: The conveyance from Granite Basin to Fawn Lake is a tunnel, 5 feet by 7 feet in cross section and 1,170 feet long (**Figure 2**). There is a concrete flume at about the middle of the tunnel, crossing an unnamed channel. This flume was previously a wooden structure but was recently replaced with concrete. The tunnel terminates above Fawn Lake at a natural drainage into Fawn Lake, about 150 feet from the Fawn Lake forebay. The tunnel inlet is at elevation 457 feet and the outlet is at elevation 442 feet. The capacity of the conveyance is 160 cfs.

Power Tunnel: Water from the Fawn Lake forebay is conveyed to the powerhouse through a tunnel, 7 feet by 8 feet in cross section and 3,473 feet long (**Figure 2**). There are two sections of tunnel on a shallow grade, 0.5 percent and 1.0 percent, with a 427-foot section in the middle at 42 percent grade. About 360 feet ahead of the powerhouse, the tunnel is terminated with a concrete plug. The plug is penetrated by three 36-inch diameter penstocks running to the powerhouse, and two 12-inch diameter lines which run to the chlorination facility ahead of the municipal water tank. There is a tower inlet structure with a slide gate at the forebay. The invert of the tunnel is 305 feet at the inlet and 95 feet at the concrete bulkhead.

Powerhouse: The powerhouse is located on the west side of Ketchikan Creek just north of Fair Street in the City of Ketchikan (**Figure 2**). There are three turbine generator sets in the powerhouse, of similar design. The turbines are horizontal Francis type directly connected to the generators. Each unit is rated 1,400 kW, giving a total installed capacity of 4,200 kW. The plant is remotely controlled from KPU's Control and Dispatch Center at the Bailey Power Plant in Ketchikan. The flow rate through each unit at full capacity is calculated to be about 75 cfs.

Access Roads: There is an access road from the City of Ketchikan to Fawn Lake and then to Ketchikan Lake (**Figure 2**). Recently, the lower portion of this road was relocated to remove it from private land. As a result, a new survey was conducted. This survey reflects the new location of the access road and resulting revised FERC Project Boundary up to the Ketchikan Lakes (**Figure 2 and Exhibit G of Application**). The access road is controlled by a gate, which is locked to prevent public access. There is a branch from the access road going up to the Granite Basin Diversion between Fawn and Ketchikan Lakes. The total length of the access road is about 2 miles.

There is a substation on Fair Street, adjacent to the powerhouse (**Figure 2**); however, this facility is not a part of the power plant, and therefore, not under the Commission's jurisdiction. The generator bus voltage is 4.16 kilovolt (kV). There is a 5,000 kilovolt amperes (kVA) transformation, stepping the generator voltage up from 4.16 kV to 12.47 kV, which is the distribution voltage.

The substation includes bus work and feeder positions which serve five 12.47-kV distribution feeders. There is also a 20,000-kVA transformation from 34.5-kV to 12.47-kV at the substation. This transformation allows interconnection with the 34.5-kV transmission grid, which passes through the Ketchikan substation. The 34.5-kV transformation and circuit breakers, as well as the 12.47-kV bus work and distribution breakers are a part of the overall KPU electrical distribution system which is necessary to provide electric service, regardless of the Ketchikan powerhouse. Only the generator leads to the substation are considered a part of the Project and under the Commission's jurisdiction.

Components of the Project involve approximately 863 acres. Lands of the United States total approximately 826 acres. The northern portion of the Project, approximately one-half way between Fawn Lake and Ketchikan Lakes, is located on approximately 778 acres of federal lands administered by the Forest Service (Tongass National Forest), and this land is included in the power withdrawal. There are also approximately 48 acres administered by the BLM. Non-federal lands (Ketchikan and private ownership) make up approximately 37 acres (**Figure 2** and **Table 1**).

2. Project Operation

To maintain the Project's combined mission to generate electricity and to provide water to the Ketchikan municipal water system, water from Ketchikan Lakes and the Granite Basin Diversion are conveyed to Fawn Lake, which is a small manmade lake. Fawn Lake is the forebay to the tunnel and penstock system of the hydroelectric plant (powerhouse).

Table 1
Project Land Ownership

PARCEL	FEDERAL		NON-FEDERAL		TOTAL (Acres)
	Tongass National Forest (Acres)	BLM (Acres)	Private (Acres)	Ketchikan (Acres)	
Ketchikan Lakes	744.94 (1)	--	--	26.86 (1)	771.80
Forebay-Diversion	33.00 (1)	37.96 (1)	—	—	70.96
Power Tunnel	—	5.18 (2)	1.27 (3)	0.10	6.55
Powerhouse	—	—	—	4.70	4.70
Access Road	—	5.08	3.75 (4)	0.08	8.91
Total	777.94	48.22	5.02	31.74	862.92

(1) Wholly within and covered by U.S.C. Act of 7/22/39.
(2) 0.92 acres within and covered by U.S.C. Act of 7/22/39.
(3) Wholly within U.S. Survey No. 2635.
(4) 2.64 acres within U.S. Survey No. 2635.

About 360 feet above the powerhouse, three 36-inch OD steel penstocks (pipes) tap the water behind a concrete plug in the tunnel. In addition to the three penstocks, two 12-inch water lines from the tunnel plug to the municipal water supply. The municipal water does not pass through the power plant. The tailrace from the powerhouse discharges back to Ketchikan Creek just north of the bridge on Fair Street. Part of the tailrace flow is diverted directly to City Park and the Deer Mountain Fish Hatchery on the south side of Fair Street. This flow returns to Ketchikan Creek south of the bridge on Fair Street.

The Ketchikan Lakes power plant is remotely operated by the Central Control and Dispatch Center at the Bailey Power Plant in downtown Ketchikan. The Ketchikan Lakes operating criteria is based upon domestic water supply requirements together with optimizing electrical energy production. This results in the plant being utilized primarily for energy production and very little load following. The power supply objective is to utilize all available water for electric energy production. The water supply objective is to maintain constant supply pressure and good water quality, which is achieved by maintaining a stable water level in Fawn Lake (**Figure 2**). The operating criteria which satisfies both of these criteria is to maintain the water level in Fawn Lake at or above 325 feet elevation; and to avoid rapidly changing the water level in Fawn Lake. This can be accomplished by discharging from Fawn Lake at the same rate at which water comes in from both Granite Basin Creek and Ketchikan Lakes, with the water level at an elevation of 325 feet or more. Inflow from Granite Basin Creek is run-of-river. Inflow from Ketchikan Lakes varies with the relative water levels in Ketchikan Lakes and Fawn Lake. The Ketchikan Lakes plant is normally operated so that the water level in Fawn Lake is near 325 feet; with the allowance that it can range up to the spillway elevation of 348 feet. The rate of change is held down to a rate which avoids turbidity introduced from turbulence in the reservoir.

The water level at Fawn Lake (**Figure 2**), and resulting pressure in the penstocks, is significant to the operation of the municipal water system. From the water supply viewpoint, it is preferable to maintain constant pressure in the penstocks. This influences the operation of the hydropower facility. The system operators have achieved a high degree of success in utilizing all of the water, which means avoiding spills from the reservoir, in conjunction with meeting the municipal water supply requirements. KPU has alternative generation resources which are capable and preferable to Ketchikan Lakes for peaking capacity and Automatic Generation Control (AGC). Therefore, predominantly operating the Ketchikan Lakes power plant as an energy production unit in conjunction with the municipal water supply is compatible with the overall needs of KPU.

In addition to providing hydroelectric energy and municipal water, the Project is operated to assure that there is a minimum flow of at least 35 cfs returned to Ketchikan Creek. This includes flow diverted to the City Park and Deer Mountain Fish Hatchery in addition to flow returned directly to Ketchikan Creek from the tailrace of the powerhouse.

The bypassed reach of stream between Ketchikan Lakes and the return flow from the powerhouse to Ketchikan Creek is 8,100 feet of stream. This reach of stream is rugged, with minimal access, and a number of physical barriers that prevent upstream fish movement. There is about 2,100 feet of Granite Basin Creek bypassed between the diversion and the confluence with Ketchikan Creek. This section is also rugged with many small waterfalls.

3. Proposed Environmental Measures

KPU has incorporated several environmental measures into the Project. These measures are summarized below.

- KPU will install weirs below both the Ketchikan Lakes Dam and the Granite Basin Diversion to monitor the seepage that currently occurs from the Ketchikan Lakes Dam and the Granite Creek Diversion and will maintain these levels of flows into the Ketchikan Creek by-pass reach even if future maintenance activities would reduce seepage.

- In the event KPU plans to make repairs to either the dam or diversion structure that could result in a reduction of the current seepage flows, KPU commits to maintain through some other means an amount of flow in the by-pass reaches of Ketchikan and/or Granite Creeks equal to the amount of the seepage flows measured during the first two years of seepage monitoring.
- If KPU ever plans to improve the Ketchikan Lakes dam, they will monitor the temperature of the seepage flows over a one-year period prior to making any improvements.
- KPU will maintain the 35 cfs minimum flow at the tailrace.
- KPU will continue to provide 4.5 cfs flow to the Ketchikan Indian Corporation Deer Mountain Fish Hatchery.
- KPU will continue to manage the watershed to protect the water quality and will continue to operate Fawn Lake to minimize turbidity to protect the water quality. In addition to the municipal water supply, this water quality also benefits the water quality released into Ketchikan Creek at the tailrace.
- Use of the Deer Mountain Trail within the Ketchikan Lakes watershed would continue.
- In 1997, KPU completed the installation of an oily water separator and a plumbing refit in the powerhouse to remove all oil from water before it is discharged into the Project tailrace.
- KPU will conduct flow monitoring for one year just upstream of the tailrace to measure seasonal variability of flows in the by-pass reach of Ketchikan Creek. The gaging will not be conducted to USGS specifications, but will obtain similar results.
- KPU will donate $15,000 to ADF&G to remove the five-foot barrier on Ketchikan Creek downstream of Rainbow Falls, and as mitigation for impacts to spawning and rearing trout and salmon in the by-pass reach and below the Project tailrace to develop and implement a plan for improving fish rearing habitat in Ketchikan Creek between the tailrace and the existing fish ladder, and/or habitat/passage improvements in Schoenbar Creek.
- If KPU constructs a water treatment facility, KPU will consult with the Forest Service about reopening the Ketchikan Lakes watershed to public recreation.
- If public recreation access is opened to Ketchikan Lakes, KPU will consult with ADF&G about conducting fish studies in Ketchikan Lakes.
- KPU will calculate hourly flows through the turbines by statistically correlating power output (kW) to flow rates (cfs). This will allow determination of ramping rates. This will allow KPU to consider alternate ramping options that do not negatively affect Project operations but would be more beneficial to the fishery downstream of the tailrace.
- KPU will install remote water level monitoring equipment at Fawn Lake to allow greater lead times for making flow ramping decisions which will in turn enable a decrease ramping rates.

B. No Action Alternative

Under the no action alternative, the Project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish the baseline environmental condition for comparison with other alternatives.

C. Alternatives Considered But Eliminated from Further Consideration

1. Federal Government Takeover

Public Law 278, enacted in 1953, 67 Stat. 587, made the provisions of the Federal Power Act pertaining to federal takeover inapplicable to projects owned by municipalities. Therefore, federal takeover is not a reasonable alternative.

2. Non-power License

A non-power license is a temporary license which the Commission would terminate whenever it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license and we have no basis for concluding that the Project should no longer be used to produce power. Thus, we do not consider non-power licensing a realistic alternative to relicensing in this circumstance.

IV. CONSULTATION AND COMPLIANCE

A. Agency Consultation

The Commission's regulations require prospective applicants to consult with state and federal environmental resource agencies and the public before filing a license application. This consultation is also the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act, the National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented in accordance with the Commission's regulations.

To this point in the process, public notification and requests for comments for the Project were made by: 1) the Notice of Intent of file a relicense application filed with the Commission on June 1, 1995 and being published in the Federal Register; 2) the scoping process described in the following Section; 3) the preparation and submittal of study plans; 4) the submittal of draft study reports; and 5) the filing of this Preliminary Draft EA and application.

Additional opportunities to comment will occur when the Draft EA and final application are filed with FERC.

B. Scoping

The scoping process for the Project was initiated on April 3, 1996. On this date, KPU sent a letter to interested parties providing notice that they had initiated the process with the Commission to relicense the Ketchikan Lakes Hydroelectric Project. KPU indicated it was their intent to prepare a preliminary draft environmental assessment (PDEA) for this Project pursuant to section 2403(b) of the Energy Policy Act of 1992. To facilitate this consolidated process, KPU established a Collaborative Team composed of KPU, Greystone (the EA contractor), Commission staff, state, federal and municipal agencies, Indian tribes, and non-governmental organizations. KPU requested that certain of the Commission's post-filing requirements for scoping, and requests for agency and public comments be moved to the pre-filing stages. This would allow for a coordinated process whereby preparation of the application occurs along with preparation of the PDEA. KPU advised that under this process, opportunities for commenting would not decrease, but the timing would change. In addition, some of the information that is traditionally found in the license application would instead be found in the PDEA.

On August 15, 1996, KPU issued an invitation to Consultation/Scoping. Attached to this invitation was the Initial Consultation Package/Scoping Document 1 (ICP/SD1) which included a written description of the operations and the resource areas associated with the Project. In addition to written comments solicited by the ICP/SD1, two consultation/scoping meetings were held on September 18, 1996, at 1:00 p.m. and 7:00 p.m. at KPU's office in Ketchikan, Alaska. Additionally, a site visit of the Project was conducted on September 19, 1996. The meeting invitation (via the ICP/SD1) was sent to the agencies and Indian tribes on the Project contact list attached as **Appendix F**.

Besides KPU, FERC, and Greystone representatives, only representatives of the Forest Service and the Alaska Department of Fish & Game (ADF&G) attended the two meetings. A transcript of the meetings was recorded to document attendants comments. Written comments were received from the following agencies in date order:

Entity	Date
Alaska Division of Governmental Coordination (ADGC)	August 20, 1996
US Army Corps of Engineers (COE)	September 23, 1996
Alaska State Historic Preservation Officer (ASHPO)	September 24, 1996
Alaska Department of Fish and Game (ADF&G)	November 19, 1996
Tongass National Forest(Forest Service)	December 4, 1996
US Fish and Wildlife Service (FWS)	December 5, 1996

Following the initial consultation/scoping meeting and a comment period, the issues raised were reviewed and a summary of the comments was developed and presented in Scoping Document 2 (SD2). Based on the results of the scoping process, SD2 was prepared and distributed in April 1997. The identified environmental concerns are addressed in appropriate sections of this EA. Those issues include the following:

Wetlands
- Potential effects of the Project's flow modifications on wetlands should be assessed in the by-pass reaches of Granite and Ketchikan Creeks, and in Ketchikan Creek below the tailrace.

Fish
- Potential effects of the Project's flow modifications on aquatic habitat in the bypassed reaches of Ketchikan and Granite Creeks. Specifically, there is concern regarding the potential elimination of instream flows throughout the Ketchikan Creek bypassed reach (there is concern about the lack of a Project flow regime for the bypassed reach).
- Potential effects of Project facilities and operations on aquatic habitat and fish migration below the powerhouse. There is concern that the current flow regime (volume, variability and timing) is inadequate and is affecting fish resources and spawning habitat of Ketchikan Creek below the powerhouse. There is specific concern about the potential for stranding of fry due to flow being reduced during critical times.
- Potential Project-related modification of stream temperatures and effects on the fishery in Ketchikan Creek and adjacent fish hatchery.
- Potential effects of flow and lake level fluctuations on the fishery in Ketchikan Lakes, particularly the effects on brook trout spawning.

Wildlife
- Potential mortality to birds via bird collisions with the powerline running from the powerhouse to the city (Note: the powerline is not part of this Project, but is included here because it was brought up as an issue.).

Rare, Threatened or Endangered Species
- Potential effects of continued Project operations on any threatened, endangered, and sensitive plant and animal species.

Water Resources
- Potential effects of Project operation and maintenance activities on turbidity and water temperature downstream of the hydroelectric plant.
- Effects of Project operations on water quality for municipal water supply purposes.

Recreation

- Potential effects of restricting access and use of the Ketchikan Lakes (as required by EPA to protect water supply) on recreational opportunities in the area - (Note: This issue is not directly related to the hydropower Project - The same restrictions would apply whether or not hydropower operation continues.).

Cultural and Historic Sites

- Potential for Project facilities to be eligible for inclusion in the National Register of Historic Places.

As part of defining the scope of this EA, we considered the boundaries of the potentially affected area for each resource or environmental issue. For physical and biological resources, the study area was limited to the Ketchikan Lakes watershed. Socioeconomic resources included the Ketchikan borough.

C. Water Quality Certification

KPU requested 401 certification from the Alaska Department of Environmental Conservation (ADEC) on May 30, 1997. A description of the Ketchikan Lakes Hydroelectric Project operations and a summary of water quality data derived from the inlet to the municipal water supply was attached to that request.

V. ENVIRONMENTAL ANALYSIS

In this section we describe the general environmental setting of the Project Area for each resource. We then discuss the site-specific and any cumulative effects of the resources affected by the Project including the effects of the Proposed Project, modifications to the proposed Project recommended by staff, and the No Action alternatives.

A. General Description of the Project Locale

Ketchikan is located in southeast Alaska on the south side of Revillagigedo Island (**Figure 1**). Revillagigedo Island has a surface area of 1,168 square miles. The Project is located on Ketchikan Creek, which drains from north to south into the East Channel of Tongass Narrows, just northwest of the Revillagigedo Channel. The Revillagigedo Channel drains into the Clarence Strait and west into the Pacific Ocean. The watershed for the Lower and Upper Ketchikan Lakes is approximately 8.15 square miles (11.2 square miles if one includes Fawn Lake and Granite Basin)(**Figure 2**). The drainage basin is elongated in shape and is approximately 4 miles long and 2.5 miles wide. The topography of the Ketchikan Creek watershed is typical of southeast Alaska, with steep side slopes rising from sea level. Slopes are typically heavily forested with muskeg occurring in low, stream-bottom areas.

During the Pleistocene Epoch, glaciers advanced over the entire Revillagigedo Island region at least once, and probably several times. The last glacial period ended approximately 13,000 years ago. Combined glaciation and fluvial erosion resulted in the formation of present landforms as U-shaped valleys; elevated terraces; elongated lakes; and deeply scoured embankments, inlets, and passages.

B. Cumulative Effects

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR § 1508.7), an action may cause cumulative impacts on the environment if its impacts overlap in space and/or time with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

During the scoping process, the scope of analysis for this Project was defined as the Ketchikan Creek watershed and Ketchikan area. Scoping identified water quality, fisheries, and recreation as potential resources for which cumulative impacts could occur.

There are no current plans for other activities within the Ketchikan Creek watershed that would affect water quality, fisheries, or recreation as the watershed is a designated municipal water-supply source and use of the watershed for other resource development or for recreation is restricted. Likewise, current KPU plans do not propose any modification of the Project or the facilities and operations within the Project Area. Cumulative effects related to water quality would be limited because the Project is managed in part to maintain water quality and because of the continued restrictions on other uses of the municipal water supply watershed above Ketchikan. The Project does impact anadromous fish habitat in portions of the by-pass reach. However, this amount of impact is very small relative to the large amount of available habitat throughout the region and would not affect the relative health of the regional anadromous fish populations nor the fishing industry that depends on them.

While not with the Ketchikan Creek watershed, recreation use within the Ketchikan area would be expected to grow as both population and tourism increase.

Growth in Ketchikan is anticipated, and this Project is an important component of the regional supply of electricity. Depending on the amount and timing of this growth, other hydropower and diesel generation facilities could be required to meet demand or changes could be required to meet increasing water supply demands.

The absence of new construction and any change in current operations as proposed by KPU would result in minimal, if any, impacts on the natural and human environment from the continued operation of the Project. Also, no other projects are currently anticipated within the watershed. Therefore, these impacts in combination with other projects in the region would not add significant cumulative effects on local resources.

C. KPU's Proposed Action

1. Geology and Soil Resources

Affected Environment

<u>Physiography/Topography</u>

The Project Area is situated in the southwestern portion of Revillagegedo Island, one of the larger islands (1168 square miles) of the Alexander Archipelago of southeastern Alaska. Revillagegedo Island is located within the Southeast Alaskan section of the Pacific Coast Mountains Physiographic Province (Williams, 1958). This section is characterized by rugged, glacially scoured peaks, lakes, and fjords. During the Pleistocene Epoch, glaciers advanced over Revillagegedo Island at least once, if not several times. The last glacial period ended about 13,000 years ago. Combined glaciation and fluvial erosion has resulted in the U-shaped valleys; elevated terraces; elongated lakes; and deeply scoured embankments, inlets, and passages.

Elevations in the Project Area range from approximately 100 feet above sea level at the lower (southwestern) end of the penstock tunnel to approximately 500 feet along the Project Area boundary around Ketchikan Lakes. Below the dam, land within the Project Area is moderately sloping while it is steeply to very steeply sloping around the lakes.

<u>Geology</u>

Base rock within the Project Area formed when a plutonic body intruded into pre-existing, metamorphosed sedimentary rock. This metasedimentary bedrock dates from Paleozoic or Mesozoic time. It outcrops from the southern end of the Project area to the southern end of Lower Ketchikan Lake. The plutonic body is described as a stock comprised of gabbro, a dark, coarse-grained igneous rock. This gabbro stock dates from Tertiary time. Near the south end of the Project Area, the metasedimentary bedrock grades into metamorphosed volcanic rock (Berg et al., 1988).

The steep slopes surrounding the valley are mantled by colluvium, a mixture of unsorted, glacially-deposited rock material and post-glacial fragments of decomposing bedrock. These colluvial deposits reach several feet in thickness on the lower slopes. The valley of Ketchikan Creek is covered with deposits of Quaternary (Pleistocene and post-Pleistocene) alluvium. These poorly sorted stream deposits of sand, gravel, cobbles, and boulders rest on metasedimentary and metavolcanic bedrock and are up to 15 feet thick. A small area of Quaternary elevated marine deposits is found at the lower end of the access road corridor. These deposits consist mostly of sand and fine gravel (Lemke, 1975).

Minerals

Metallic mineral deposits have been identified in the Ketchikan area, and some resource development (including gold mining) has occurred in the past. However, there are no active mines or significant known deposits within the Project Area (Bundtzen et al., 1982 & 1996). Two claims and one prospect have been identified in the area below the Ketchikan Lakes dam (Berg et al., 1981).

Geologic Hazards

The Ketchikan area has been placed in seismic zone 2 on a scale of 0 to 3 (with 3 being the highest risk zone). Moderate earthquake-related damage to man-made structures is possible. The magnitudes of the largest expected events would register in the 4.5 to 6.0 range (Richter Scale) in Ketchikan. However, the possibility of larger events can not be ruled out.

Steep terrain, significant precipitation, and shallow soil depths accompanied by limited infiltration capacities could result in instability, particularly during a seismic event; however, the area surrounding the lakes do not exhibit fractured or loose rock poised to fall.

Avalanches are not uncommon in winter. There is an avalanche chute on the western shore of the lower lake which stops just short of the water, and several on the eastern shore which reach the water (R&M Engineering, 1995). The Forest Service has identified recurrent rock slide zones both east and west of the southern half of the Upper Ketchikan Lake on GIS vegetation mapping (USDA, Tongass National Forest, 1996).

Soils

Soils within the Tongass National Forest have been mapped in the Ketchikan area (USFS, undated). This mapping is stored in the Forest's GIS data base. Mapping unit descriptions for these soils are also available. Descriptions of the soil mapping units which occur in the National Forest portion of the Project Area are as follows:

Vixen-Traitors complex, 75-100 percent slopes. Vixen soils consist of fine sandy loam and silt loam which becomes gravelly with depth. They are deep, moderately well drained and well drained soils which have developed in residual and colluvial material derived from metamorphic bedrock. Traitors soils consist of silt loam and fine sandy loam. They are shallow, moderately well drained and well drained soils which have derived from metamorphic bedrock. This soil complex is found on the east side of the southern half of Lower Ketchikan Lake.

Tonowek and Tuxekan soils, 0-15 percent slopes. Tonowek soils consist of very fine sandy loam near the surface and very gravelly sand at depth. Tuxekan soils consist of silt loam and loam near the surface and extremely gravelly loamy sand at depth. Both are very deep, well drained soils which have developed in alluvium. These soils are found in the alluvial valleys above upper Ketchikan Lake and below Lower Ketchikan Lake.

Kaikli mucky peat, 35-60 percent slopes. This soil consists of peat and muck with a thin layer of silt loam at depth. It is a moderately deep, very poorly drained soil which has developed primarily in organic material. This soil is found to the south and east of the south end of Lower Ketchikan Lake.

Shakan-McGilvery association, 60-150 percent slopes. Shakan soil predominantly consists of gravelly and very gravelly sandy loam. It is a moderately deep and moderately rapidly drained soil which has developed in colluvium. McGilvery soil consists of peat overlying a thin layer of very gravelly silt loam. This soil is shallow and well drained and has developed in organic material. This association is found on the west side of the southern half of Upper Ketchikan Lake.

Tokeen gravelly sandy loam, 35-60 percent slopes; Tokeen gravelly sandy loam, 60-75 percent slopes; and Tokeen gravelly sandy loam, 75-100 percent slopes. These soils consist of gravelly sandy loam and gravelly loam. They are moderately deep, well drained, and have formed in colluvium derived from granitic bedrock. They comprise about half of the shoreline soils around Ketchikan Lakes.

Rock outcrop, 75-150 percent slopes. Areas of rock outcrop are characterized by an absence of soil development. In addition to metamorphic and granitic bedrock, these areas include unconsolidated talus deposits. Scattered soils of varying types are present in these areas including those of the Traitors, Helm and Shakan series. Rock outcrop is present in several areas along the shoreline of both Upper and Lower Ketchikan Lakes.

Soils in the portion of the Project area which is to the south of the Tongass National Forest have not been mapped. This area has been examined on stereo pairs of natural color aerial photography for the area (USFS, 1973). Most of this area appears similar in slope, geomorphology, and vegetation to the adjoining area within the Forest south of Lower Ketchikan Lake. Those areas within the Forest are mapped as Kaikli mucky peat, 35-60 percent slopes and Tonowek and Tuxekan soils, 0-15 percent slopes. Therefore, the study area south of the Forest boundary has been tentatively mapped as a complex of these two soil mapping unit

Environmental Impacts and Recommendations

Continued operations of the hydroelectric facilities would likely result in both long- and short-term effects on both the geologic and soil resources. Future excavation of rock in the Project Area for use in road construction and/or maintenance would alter the local physiographic and geologic conditions; however, impacts, although long-term, would be limited to approved quarry sites that would be selected based on minimizing effects to other resources. No additional new road construction is planned. Road maintenance would infrequently require minimal quantities of rock.

For the duration of the Project and continued use of the Ketchikan Creek watershed as the primary source of municipal water supply, mineral exploration and development will be prohibited in the Project area and watershed. Therefore, anticipated impacts from mineral development in the watershed would not occur.

Although possible, the likelihood of a seismic event in combination with high slope-instability conditions that could affect the Project is minimal. An earthquake larger than 6.0 on the Richter Scale would be required to result in a significant mass wasting event or events, which could directly impact the Project's dams or produce an over-topping of a dam by displacement of impounded water from slope failures. None of the recorded seismic events that have been recorded within about 120 miles of the Project area have exceeded a magnitude of 5.0 (KPU, 1992).

Impacts to soils from continued operations of the Project would likely be limited to short-term accelerated soil erosion and soil loss events. Road and ditch maintenance could leave loosened soil materials on the surface. The exposed soil materials would subsequently be subject to entrainment by runoff from precipitation events. However, rock is used in most road and ditch maintenance activities which limits the exposure of soil materials to the forces of water erosion. Maintenance of buried penstocks, if necessary, would likely expose excavated soil materials to accelerated erosion conditions; however, exposed soil materials would be replaced and stabilized shortly after cessation of repair or maintenance activities. Accelerated soil loss conditions would limited by minimizing the extent and duration of soil exposure.

2. Climate, Meteorology, And Air Quality

Affected Environmental

The Project lies at elevations ranging from sea level at the Tongass Narrows to 3014 feet on Diana Mountain at the upper end of the watershed above Upper Ketchikan Lake. The Project is located at latitude 55° 21' N and longitude 131° 39' W. The climate is classified as marine, and is characterized by relatively narrow temperature ranges and relatively heavy precipitation amounts. Ketchikan's average monthly temperature is 45.9°F. August is the hottest month with an average temperature of 58.7° and January is the coldest month with an average temperature of 34.2°F. Precipitation amounts in the Ketchikan area are extremely variable within short distances, due to the rugged topography and close proximity to the ocean. Ketchikan averages 155.22 inches of precipitation per year, including an average of 37.4 inches of annual snowfall. The wettest month is October with an average monthly precipitation of 22.55 inches, and the driest month is June with an average monthly precipitation of 7.36 inches. (Values derived from the period 1922 to 1987, University of Alaska Arctic Environmental Information Center, from City of Ketchikan, 1992, Beaver Falls Hydroelectric Project).

Environmental Impacts and Recommendations

The Project will have no affect on climate/meteorology. However, the loss of this hydroelectric power generation capacity would require replacement with an equal amount of new hydroelectric power generation, that would have environmental impacts elsewhere, or with additional diesel generation which would result in increased air emission impacts.

3. Water Resources

Affected Environment

Ketchikan Lakes System

The Project Area for Ketchikan Lakes hydroelectric Project consists of the 8.5 square mile contributing watershed above the Ketchikan Lakes, the 3.0 square mile watershed above the Granite Basin Diversion, Fawn Lake, Ketchikan Creek from the Lakes to the Fair Street Powerhouse, Granite Basin Creek Diversion and supporting conduits, tunnels and roads. The two Ketchikan Lakes run north to south and extend across 580 acres. Granite Creek starts in a lake at the base of a cirque and descends southwest 2.5 miles through two other lakes reaching the Granite Basin Diversion. The by-pass reach for Granite Creek extends 0.45 miles to the confluence with Ketchikan Creek. The Granite Basin Diversion runs 0.22 miles west to the 3.84 acre Fawn Lake. The Ketchikan Creek by-pass descends 1.34 miles from Ketchikan Lakes to the tailrace of the Fair Street Powerhouse. Only the lowest 0.24 miles of the by-pass reach is accessible to anadromous fish due to a migration barrier.

The Ketchikan Lakes consist of two adjacent natural lakes 1.15 air miles north of seaside Ketchikan. Ketchikan Lakes serve as the Ketchikan municipal water supply as well as providing hydroelectric power to KPU. The useable volume of the two lakes was increased to 13,600 acre feet by construction of a dam at the outlet of the lower lake. Development of this site began in 1903. There have been a number of stages in the development of the site's hydroelectric power since that time, including diversion of Granite Basin Creek flow into the water supply and hydropower system. The present system has been nearly the same for approximately 30 years.

There are numerous, small, unnamed streams flowing into Ketchikan Lakes within the 8.5 - square mile watershed above Ketchikan Lakes Dam. The upper inlet is fed by a small, unnamed, alpine lake south of John Mountain, 2,000 feet upstream and 770 feet higher in elevation. Water from Ketchikan Lakes is conveyed by pipelines and a tunnel to Fawn Lake, which is at the same elevation as Ketchikan Lakes (**Figure 3**). Granite Basin Creek flow is also diverted to Fawn Lake. Ketchikan Creek extends 7,400 feet (1.4 miles) from the embankment on Lower Ketchikan Lake to the tailrace of the Power Plant in the city of Ketchikan. There are small pools, 340 - 750 feet in length located above the three falls in the by-pass reach. Scout Lake is a small lake on the west flank of Deer Mountain at elevation 280 feet which feeds the Ketchikan Creek by-pass reach. There are no other significant drainages within the study area.

The community of Ketchikan receives an average of 155.2 inches of precipitation per year, with average monthly rainfall ranging from 7.36 inches for June to 22.55 inches for October (City of Ketchikan, 1989). This substantial variation in precipitation results in a wide range in reservoir levels within the KPU hydroelectric system. In 1994, monthly precipitation at Ketchikan Lakes mirrored the averages but was offset slightly. Monthly precipitation ranged from a low of 4.5 inches in August to a high of 23 inches in September (**Figure 4**) (KPU, 1996a). Periods without measurable precipitation (0.01 inch) are short; at Ketchikan the longest period was 21 days in July through August of 1924.

The hydrologic conditions of the Project are defined by information acquired from several sources. Some of the information which has been developed has been derived directly from the power plant operation. This information is supplemented by several hydrologic studies conducted since 1923, which include elevation-precipitation relationships, precipitation records, and some stream gaging records.

Basic hydrologic data for the Ketchikan Creek watershed are presented in **Table 2**. The average annual runoff for Ketchikan Creek is 155,800 acre feet, and the maximum historic annual runoff occurred during the 1917-1918 water year was 178,000 acre feet (**Figure 5**) (USGS, 1996) at USGS Site 1506400, located 0.4 miles upstream of the mouth of Ketchikan Creek, in the center of Ketchikan.

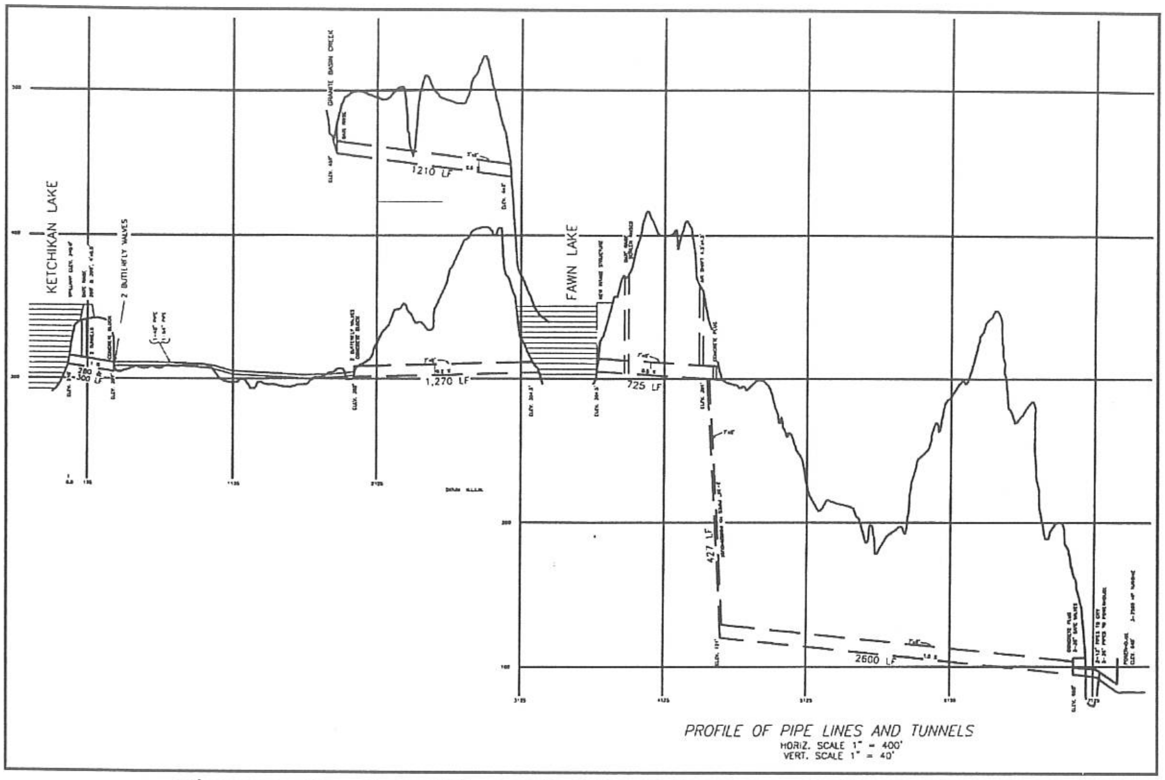


Figure 3 Profile of Pipelines and Tunnels

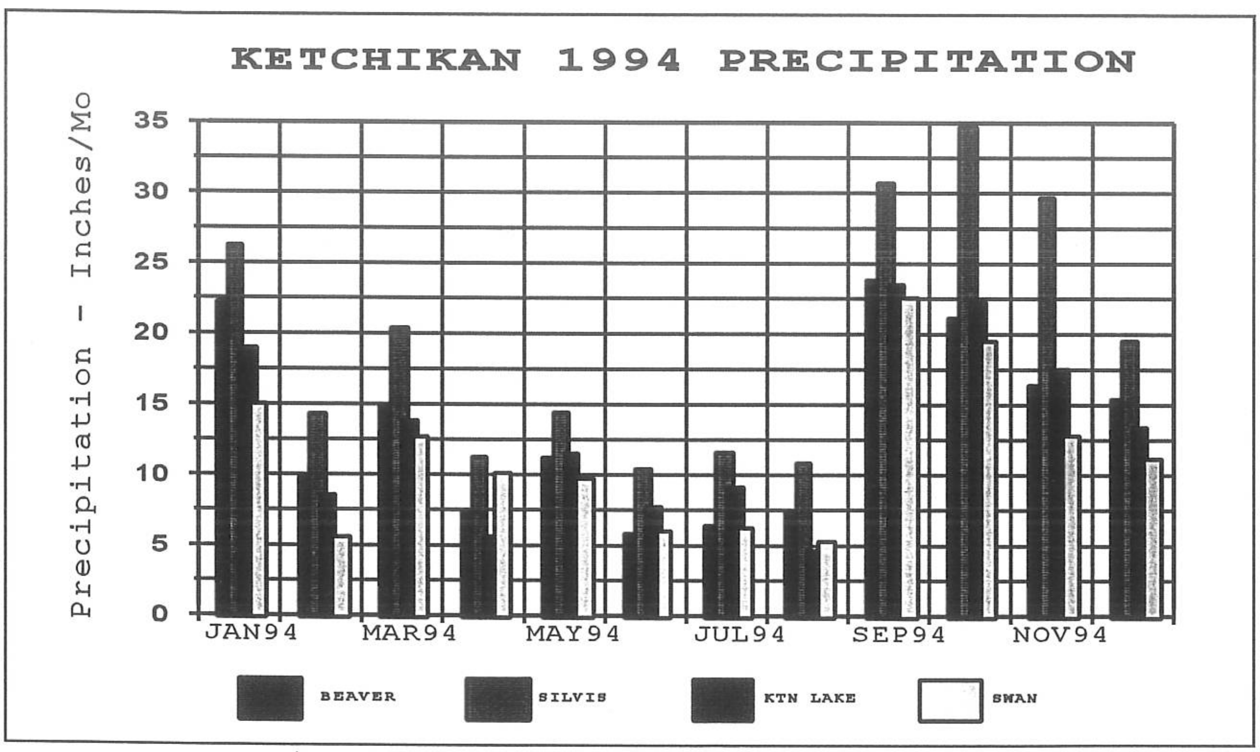


Figure 4 Ketchikan 1994 Precipitation

Table 2 Basic Hydrologic Data	
Drainage area of Ketchikan Creek[1,3]	13.5 sq. mi.
Drainage area above Ketchikan Lake[2]	8.5 sq. mi.
Drainage area above Granite Basin Diversion[2]	3.0 sq. mi.
Maximum Discharge - Ketchikan Creek, November 18, 1917[1,4]	4,400 CFS
Minimum Discharge - Ketchikan Creek, June 24, 1967[1,4]	3.6 CFS
Average Annual Discharge - Ketchikan Creek[1,4]	205 CFS
Average Annual Discharge - Ketchikan Creek per square mile[2]	15.2
Average Annual Runoff -Ketchikan Creek[1,4,5]	155,800 AF
Maximum Historical Annual Runoff Ketchikan Creek (1917-18)[1]	178,000 AF

Source: USGS Water Resources Division, 1996.

[1]USGS Water Resources Diversion - Flow Data from USGS Site 1506400
[2]Federal Power Commission and the USDA Forest Service, 1947
[3]Area above the gage site just below the confluence of Schoenbar Creek
[4]Discharge at gage site below confluence of Schoenbar Creek
[5]Average of 7 years with complete USGS gaging record, 1910-11, 1915-19, 1965-67

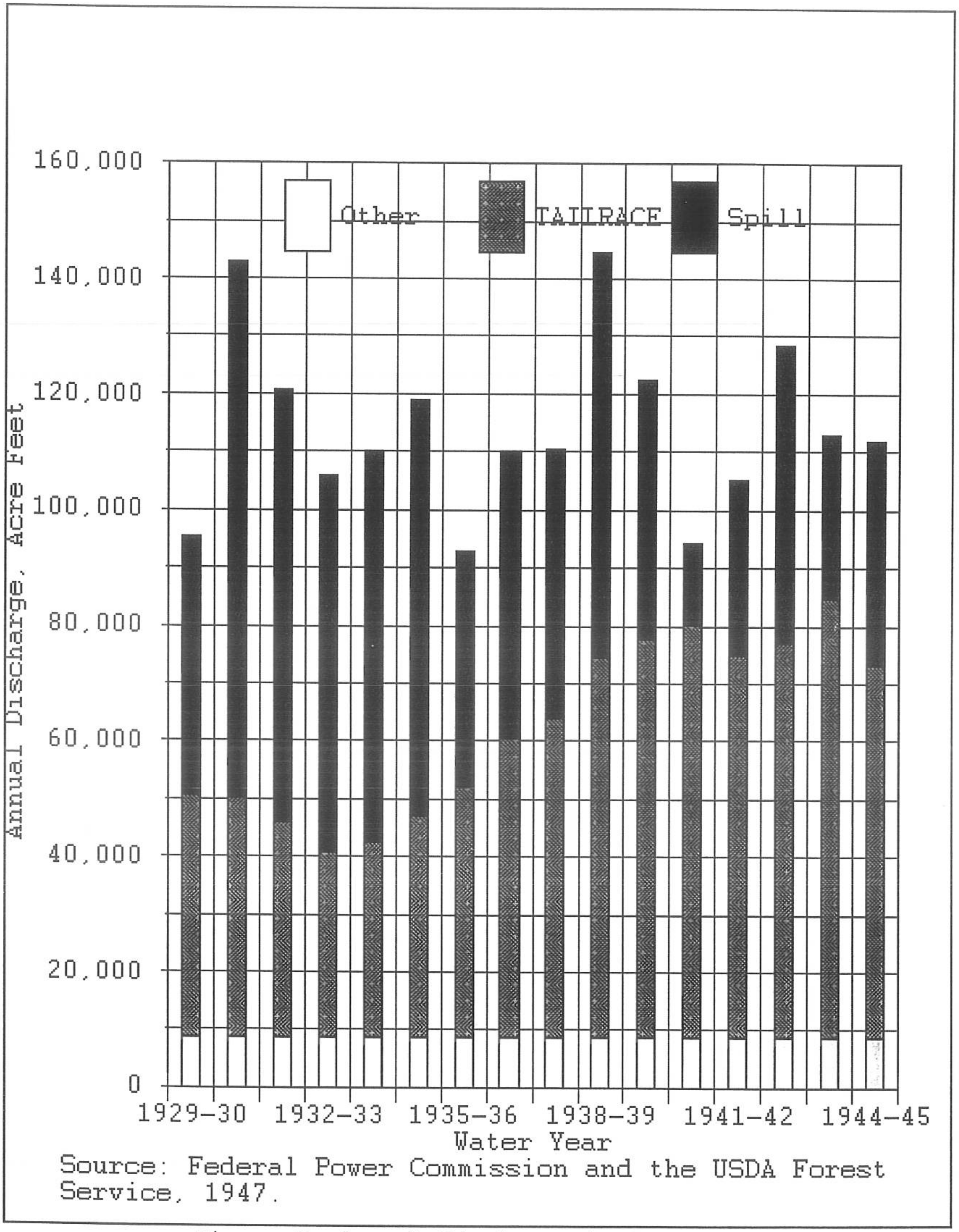
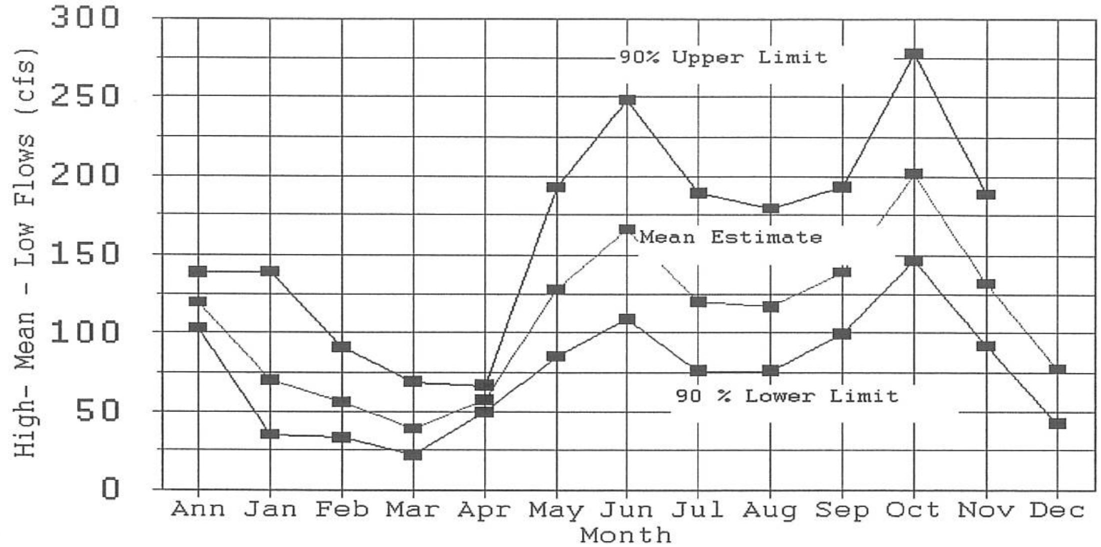


Figure 5 Annual Discharge in Acre-Feet

Table 3
Ketchikan Creek Flow Statistics
Annual and Monthly Flow, cfs

	90% Lower Limit	Mean Estimate	90% Upper Limit
Annual	102.9	119.4	138.4
January	34.9	69.6	138.7
February	33.0	55.8	90.7
March	22.1	38.9	68.6
April	49.5	57.3	66.3
May	84.9	127.9	192.7
June	108.8	166.2	248.2
July	75.7	119.7	189.5
August	75.8	116.6	179.4
September	99.6	138.8	193.4
October	146.3	201.6	277.9
November	92.0	131.8	188.9
December	42.1	77.0	141.0
Peak Flow, cfs			
Recurrence Interval			
2 years	1.4	2.1	3.2
5 years	1.8	2.7	4.1
10 years	2.0	3.0	4.7
25 years	2.2	3.4	5.4
50 years	2.3	3.7	5.9
100 years	2.4	3.9	6.4
Winter Flow, cfs			
Recurrence Level (7-day Mean)			
2 years	8.1	14.5	25.9
5 years	4.7	9.2	18.2
10 years	3.0	7.0	16.3
Recurrence Level (30-day Mean)			
2 years	12.5	22.4	40.1
5 years	8.1	14.0	24.0
10 years	7.2	9.7	13.0
Summer Low Flow, cfs			
Recurrence Level (7-day Mean)			
2 years	16.3	24.9	38.0
5 years	5.9	15.7	42.1
10 years	4.2	12.3	35.6
Recurrence Level (30-day Mean)			
2 years	33.5	61.4	112.6
5 years	19.2	39.4	81.1
10 years	12.3	28.6	66.5
Exceedance Flow, cfs			
Exceedance Level			
5 Percent	NA	NA	NA
15 Percent	170.4	201.1	NA
50 Percent	76.9	95.4	118.3
85 Percent	22.5	43.8	851.7
95 Percent	11.5	23.4	47.5



Source: Kleinegger, 1996

Figure 6 Ketchikan Creek Stream Flow - Flow at Inlet of Ketchikan Lakes

The majority of the water supply comes from Ketchikan Lakes. There is no stream gaging record for inflow to Ketchikan Lakes, because of the unique physical setting. There are numerous small streams flowing into Ketchikan Lakes rather than one main stream. The number of these small streams and the topography preclude stream gaging. The U.S. Forest Service (unknown) predicted monthly inflows to Ketchikan Lakes (**Table 3 and Figure 6**)

This estimate projected a 119 cfs mean annual monthly flow, a 7-day, 10-year mean winter low flow of 7.01 cfs and a 7-day, 10-year mean summer low flow of 12.27 cfs. Monthly average flows range from 40 cfs in March to 200 cfs in October. Typically, high flows are observed in June and October and low flows are observed from January through March.

Figure 7 shows a stage volume curve for Ketchikan Lakes, and **Figure 8** shows the recent historical variation in elevation of the reservoir. The water level in the 13,600 acre-foot Ketchikan Lakes is gaged on a continual

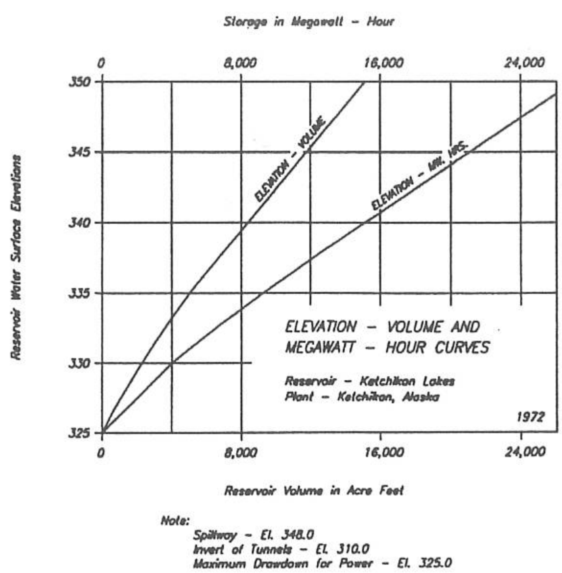


Figure 7 Stage Volume Curve

basis, with the data transmitted to the Bailey Power Plant. The spillway elevation is 348 feet, and between January of 1990 and December of 1995, the elevation ranged from an elevation of 328 feet up to the spillway or higher. There were only four very brief

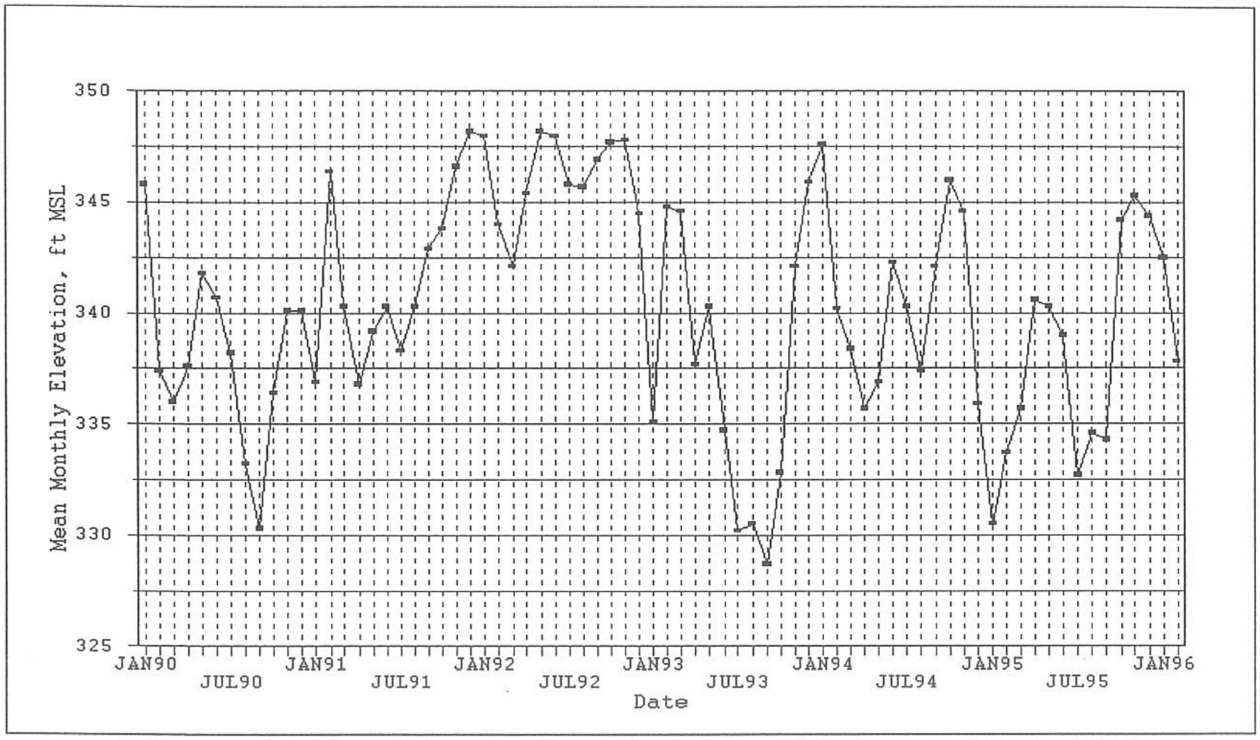


Figure 8 Ketchikan Lake Elevation History, 1990-1996

periods in the four-year interval when the lake level was at or above the spillway (**Figure 8**).

The average daily discharge from Ketchikan Lakes and Granite Basin Creek is about 150 cfs as estimated by hydrologic techniques. Based upon the amount of power generated at the powerhouse during a typical year, this appears to be a realistic value. For example, the average daily flow through the powerhouse in 1995 was about 120 cfs. Adding 12 cfs for domestic water and 10 cfs for losses would give an average of 142 cfs for 1995.

Granite Basin Creek. The average monthly discharge of Granite Basin Creek above the diversion is estimated to be about 45 cfs (USFS, unknown). This value is based upon a number of analytical studies. Granite Basin Creek has not been gaged. The capacity of the diversion tunnel at Granite Basin Creek is large relative to the average daily flow and therefore diverts a high percentage of the flow. It is estimated that the flow exceeds the tunnel capacity less than 5 percent of the time, meaning that spills occur only 5 percent of the time or less.

Table 4 and **Figure 9** show the predicted mean flow of Granite Basin Creek, with upper and lower deviations, on a monthly basis.

Peak monthly flows occur in October and June, with mean average flows during those months of 74 cfs and 90 percent of the upper limit of flows in June of 117 cfs. Low monthly flows occur from January through March, with average flows of approximately 16 cfs.

Representative channel data was collected from 0.45 mile by-pass reach of Granite Basin Creek between the diversion and the confluence with Ketchikan Creek during the summer of 1997 in the G-1 Reach. The channel bank width was 40.1 feet, with an average depth of 5 feet. The thalweg depth was 6.1 feet on a channel with a 2.5 percent grade. The channel substrate consisted of 4.8 percent sand and silt, 30.2 percent gravels and 65 percent cobble sized materials, with the maximum population being large cobbles at 28.6 percent of the total. Non-native eastern brooktrout were only observed in the lower 0.26 miles of this reach due to a migration barrier.

Table 4
Stream Flow Data for Granite Creek *
Annual and Monthly Flow, cfs

	90% LOWER LIMIT	MEAN ESTIMATE	90% UPPER LIMIT
Annual	38.76	45.12	52.53
January	8.14	16.35	32.85
February	10.82	17.99	29.93
March	7.09	12.85	23.26
April	15.99	18.63	21.70
May	40.68	62.02	94.54
June	48.30	75.35	117.54
July	36.33	58.79	95.13
August	31.96	49.76	77.48
September	39.15	55.03	77.35
October	53.38	74.22	103.19
November	33.00	47.77	69.17
December	12.65	23.83	44.90
	EXCEEDENCE FLOW, CFS *		
EXCEEDENCE LEVEL			
5 percent	108.74	134.34	165.96
15 percent	66.16	78.42	92.95
50 percent	26.00	32.32	40.17
85 percent	7.46	14.62	28.66
95 percent	2.83	5.81	11.92

* Source: USFS Water Resources Atlas

Fawn Lake. Fawn Lake is a very small reservoir, built to serve as a forebay for the powerhouse penstock, as well as a common collection point for the flows from both Ketchikan Lakes and Granite Basin Creek. Since the reservoir is small relative to the capacity of the penstock, the water level can be drawn down rapidly by opening the gates to the power turbines. Depending upon the amount of flow coming into Fawn Lake from Granite Basin Creek, and other factors, it may be possible to draw the level in Fawn Lake down so rapidly that turbidity is created. Since this water is the source of the domestic water supply, it is important to avoid turbidity. Also, the domestic water supply system works best when the water level in Fawn Lake is held at a nearly constant level. These factors, together with avoiding spills or extreme draw down in Ketchikan Lakes, present complex management criteria for the power plant operators. The rate at which water moves from Ketchikan Lakes to Fawn Lake is limited by the capacity of the pipeline/tunnel and the water level in Fawn Lake. Average capacity is about 120 cfs at low water conditions. The system operators have been able to obtain nearly total utilization of all the inflow to Ketchikan Lakes, by conveyance to Fawn Lake. This is evidenced by the avoidance of spills from Ketchikan Lakes.

The flow from the Granite Basin Diversion combines with the flows from Ketchikan Lakes at Fawn Lake. The flow through the powerhouse less the flow removed for municipal use, is the sum of the flow from Ketchikan Lakes plus Granite Basin. For the most part, all of the flow from Ketchikan Lakes and Granite Basin is routed through the power tunnel to the powerhouse and the municipal water supply. There are occasional spills from the system at Ketchikan Lake and at the Granite Basin Diversion. There are records of these spills, which allows adding these flows to the hydrologic record created from the power generation and municipal water use data.

Ketchikan Creek - By-pass Reach. Ketchikan Lakes has operated as a hydroelectric Project of 95 years. The by-pass reach of Ketchikan Creek consists of 1.34 miles of stream above the powerhouse tailrace up to Ketchikan Lakes Dam, and 0.45 miles of Granite Creek up to the Granite Basin Diversion. Anadromous fish migration can only occur in the lowest 0.25 miles of the Ketchikan Creek by-pass reach due to a migration barrier. Non-native eastern brooktrout have only been observed in the lowest 0.26 miles of the Granite Basin Diversion due to a barrier. Flows in the by-pass reach are very minimal because as much water as possible is diverted for generation and domestic supply. Flow in the by-pass reach is comprised of runoff from precipitation, under seepage from Ketchikan Lakes Dam, and leakage around Granite Basin Diversion. The monthly average flow has been estimated to be about 10 cfs. The minimum historic instantaneous recorded flow at the USGS gage in Ketchikan is 3.6 cfs. This occurred briefly on June 26, 1967 when the power plant was not releasing water. The daily flow for that day was 42 cfs (USGS 1996). A daily flow duration curve was developed using precipitation data collected between January 1994 and November 1997 (KPU 1998b) that showed daily flows greater than 3.6 cfs would occur more than 99 percent of the time and daily flows of 4.8 cfs would occur more than 50 percent of the time. These flows are not gaged.

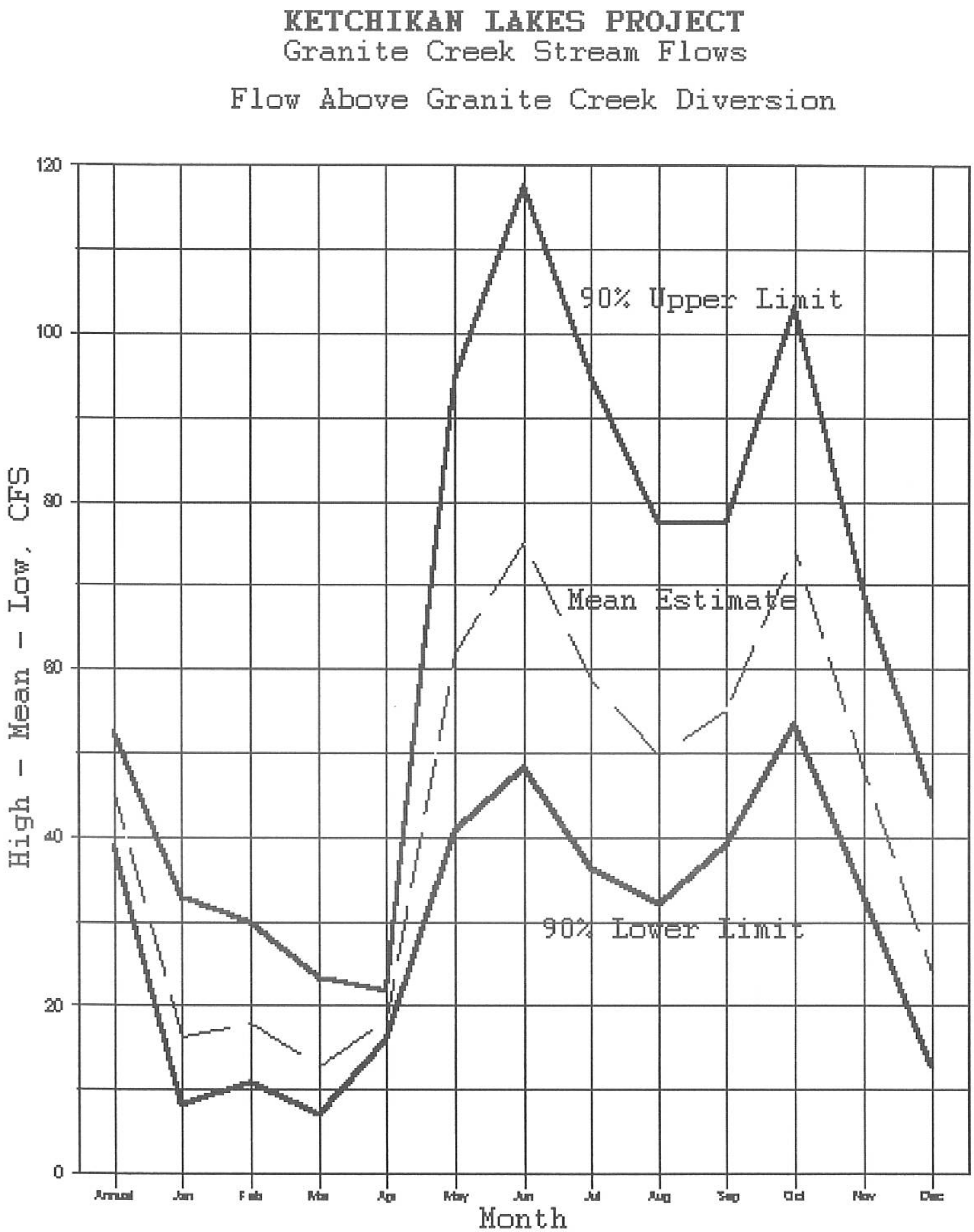


Figure 9 Granite Creek Stream Flows

Representative channel information was acquired during the fishery study (Greystone 1998) and was acquired from a location midway between the tailrace and the embankment of Lower Ketchikan Lake in Reach K4. This straight channel segment had a slope of 2 percent, a bank channel width of 67.5 feet, an average depth of 3.26 feet and a maximum depth of 4.1 feet. The channel substrate consisted of 74.5 percent cobbles greater than 128 mm, and 25.5 percent medium to very coarse gravel.

Ketchikan Creek - Below the Powerhouse. Ketchikan Creek flows 0.75 miles downstream from the tailrace to its inlet in Tongass Narrows. This reach is 75 percent of the Ketchikan Creek reach available for anadromous fish migration, due to migration barriers upstream. The average annual daily flow below the powerhouse was measured at the USGS site 15064000 as 205 cfs based on eight years of data (1910 - 1911, 1915 - 1919 and 1964 - 1967). This gage reflects runoff from the 1.1 square mile watershed of Schoenbar Creek. Schoenbar Creek is 8.1 percent of the contributing watershed for this gage. Extrapolating a reduction of flow to Schoenbar the average daily flow below the powerhouse is 191 cfs. The minimum instantaneous flow below the Powerhouse is 35 cfs, a minimum decreed within the last FERC permit. The minimum is divided below the turbines to provide 2.5 cfs to the adjacent fish hatchery and 32.5 cfs or more to the tailrace. Discharge from the fish hatchery and the City Park rejoin Ketchikan Creek 684 feet downstream of the tailrace. The tailrace discharge joins a minimum flow of 3.6 cfs from the by-pass reach resulting in 36.1 cfs of flow around City Park, and 38.6 cfs below the fish hatchery outfall. Flows in Ketchikan Creek are the same as would occur without the powerhouse with the exception of the 10 cfs of water removed for the water supply. There are no significant losses that occur as a result of the hydroelectric power generation operations.

The 0.26 mile Ketchikan Creek channel between the tailrace and Schoenbar Creek was characterized during the 1997 fishery study (KPU 1998a). The channel is a riffle and is approximately rectangular in shape and dominated by a small cobble substrate. A representative width of 86 feet was observed for 0.24 miles, but a short distance, 0.02 miles, was narrower with a 59-foot width. The Manning's equation was utilized to examine flow depths at representative flows assuming an ideal rectangular channel, a 2.4 percent channel grade and a Manning's `n' of 0.040 as shown in **Table 5**.

The minimum flows through the tailrace of 32.5 cfs, plus the 3.6 cfs minimum flow from the Ketchikan Creek by-pass reach provide 2 inches of water in the 86-foot wide channel. Approximately 500 cfs is required to raise the depth of an ideal rectangular channel to one-foot. The presence of gravel bars and a developed thalweg or a decrease in slope would modify the channel depths in this reach.

There are hourly fluctuations in flows below the powerhouse in response to demands on the utility. Hourly generation records acquired for fifteen days in 1995 show a maximum normal ramping rate of 900 KW in thirty minutes, which is the equivalent of 50 cfs. This could generate a decrease of flow from 85 cfs to 35 cfs. More dramatic ramping could occur briefly in the event of an upset condition (two to six times per year) when a turbine and generator trip offline, but this would not reflect ordinary operating conditions.

Table 5
Estimated Flow Depths in Ketchikan Creek Below the Tailrace

Flow (cfs)	Rectangular Channel 59'	Bottom Width 86'
36.1	0.26	0.21
50	0.32	0.25
100	0.48	0.38
125	0.55	0.44
150	0.62	0.49
175	0.68	0.54
200	0.73	0.58
250	0.84	0.67
300	0.94	0.74
500	1.28	1.01

Water Supply. The domestic water supply is taken from the penstock just before the water enters the powerhouse. The flow rate into the domestic water system is not metered. Based upon the daily consumption, the flow of domestic water is estimated to vary from 4 to 10 cfs. Monthly water flow, observed in the chlorination process, in August, 1994 averaged 8.45 cfs, while flow in January, 1995 was also 6.33 cfs (KPU 1995). This flow is not controlled by the powerhouse operation. The domestic water supply, drawn from the penstock near the powerhouse elevation, is boosted under penstock pressure up to the water supply storage tank. The elevation of the storage tank is sufficient to provide distribution pressure in the municipal system. Chlorine is injected in the domestic water supply pipeline just after the water is drawn from the penstock. Mixing and exposure occurs in the 6,000 foot transmission line up to the storage tank. Additional contact time occurs in the storage tank. Maintaining a relatively constant reservoir level in Fawn Lake, and thereby a fairly constant pressure at the tap point of the domestic water supply, is significant to operation of the domestic water system.

No other water treatment is required for the water supply because KPU, as a condition of their ADEQ permit PWS #120232 for the drinking water system, has agreed to limit human access to the water source (Ketchikan Lakes and Fawn Lake).

The domestic water use has been estimated to range from a minimum of 2.5 million gallons to a maximum of 6.5 million gallons per day (4 to 10 cfs). Absent an alternative domestic water supply, this flow is considered an absolute necessity. It is assumed that this amount will increase with population growth. If this flow were not diverted for domestic use, it would be available for hydroelectric power generation. The unavailability of domestic water for power generation is considered unavoidable.

Tailrace and Fish Hatchery. The tailrace is that part of a hydroelectric Project between the point where water is discharged from the turbine and where it is returned to a natural channel. Water in the tailrace at the Ketchikan powerhouse is divided before it is returned to Ketchikan Creek. In a diversion box beneath the powerhouse, 2.5 cfs is diverted to the fish hatchery located just southwest of the powerhouse. Part of the flow to the fish hatchery is discharged to open channels flowing through the City Park. Depending on hatchery needs, part of this flow returns to Ketchikan Creek about 200 feet downstream of the Fair Street bridge. The balance of the flow returns to Ketchikan Creek after flowing through the hatchery, about 600 feet downstream from the Fair Street bridge. The amount of flow to the hatchery is relatively constant, and is fixed by weirs in the division box at the powerhouse. The amount of flow directed to the hatchery is controlled by the hatchery personnel.

Minimum Flow. The discharge from the powerhouse is maintained at or above the minimum flow requirement of 35 cfs. This coincides with the present FERC license which requires that a minimum flow of 35 cfs be maintained. This is a factor in the hydro plant operation. Review of historical data indicates that 35 cfs is about the highest minimum flow that could be sustained over the summer months during a low rainfall summer. The operating personnel have achieved a high degree of reliability in achieving this flow. There is a by-pass valve on the penstock which automatically releases 35 cfs directly from the penstock to the tailrace chamber in the event that the turbines are shutdown.

ADF&G Instream Flow Reservation Request. In July, 1988, the ADF&G applied to the State of Alaska Department of Natural Resources, for an instream flow reservation (IFR) on Ketchikan Creek. Instream flow reservations are a rate, or volume of flow in a river which is filed with the Alaska Department of State Lands for one of four uses: protection of fish and wildlife habitat, migration and propagation; recreation and parks purposes; navigation and transportation purposes; or sanitary and water quality purposes. The objective of this filing was promotion of the fishery. The application is for flow from the outlet of Ketchikan Lakes to the confluence with Tongass Narrows. The flow request varies with time of year, as shown in **Table 6**. The Ketchikan Creek instream flow reservation is pending before Alaska Department of State Lands. A pending IFR application does not create a situation that challenges an existing water right unless the water covered by the existing right is no longer in use, in whole or in part, and is thus subject to revocation for abandonment or forfeiture. The filing of the IFR application merely results in a priority order being established for future allocation of any water that might become unappropriated (Alaska DNR 1998). KPU plan to continue using all of their water rights for municipal water supply and hydro power generation.

Table 6
Comparison of ADF&G Request and Average Unregulated Monthly Flows, 1993 - 1995

		Estimated Unregulated Flows		
MONTH	**ADF&G Request**	**1993**	**1994**	**1995**
January	74	109	179	54
February	70	257	28	115
March	67	103	162	111
April	122	108	131	147
May	200	166	193	137
June	200	58	149	102
July	170	39	94	63
August	134	29	35	75
September	134	39	274	79
October	219	171	214	297
November	200	210	106	192
December	105	237	85	191
Average	141	127	137	130

Water Rights. Water rights for this Project were assigned by the State of Alaska Certificate of Appropriation No. 537 for 81,395,500 gallons per day (gpd) (126 cfs) for electric power generation and for 6,725,100 gpd (10.4 cfs) for the public water supply. The point of diversion is the Lower Ketchikan Lake rockfill dam and water intake structures located in the protracted SE 1/4 of SW 1/4 of Section 17, T75S, R91E, Copper River Meridian. The Deer Mountain Fish Hatchery has an appropriation of 1,615,790 gpd (2.5 cfs) from the KPU tailrace below the powerhouse (NE 1/4 NE 1/4 of Section 30, T75S, R91E, Copper River Meridian) through the State of Alaska Certificate of Appropriation No. 472 amended. Article 33 of the present FERC license for the Project requires a continuous minimum flow of 35 cfs below the powerhouse. This 35 cfs flow requirement is not a serious impediment to operation of the powerhouse. This flow does pass through the powerhouse before being discharged and generates about 800 kW of electricity on an annual basis which is used in the system. Downstream of the Project area, ADF&G filed for a minimum flow of 5 cfs through the fish ladder. This filing has a priority date of 12/31/64 and was certified by the Alaska Department of State Lands on 7/23/70.

Water Quality. The water derived from Ketchikan Lakes is a calcium bicarbonate water of low hardness (5.7-42.7 mg/L $CaCO_3$) and low salinity (25 umhos/cm). The mean pH for the lakes was 6.0 Standard Units (S.U.) in testing done approximately 15 times per year from 1993 - 1994 (KPU, 1996b). This is considered to be slightly acidic, but within the range of EPA recommended pH levels for freshwater drinking supplies. The results showed maximum daily turbidity values in August of 1993, 1994 and 1995 ranged from 0.59 NTU to 0.88 NTU. Turbidity of the water supply increases when water levels within the Fawn Lake forebay are depressed. Operations is aware of the problem and every effort is expended to minimize it. A minimum of 14 total and fecal coliform samples were taken from Ketchikan Lakes during the 1993-1995 studies (KPU, 1996b). All samples met EPA's surface water treatment guidelines of less than 100 total coliforms per 100 milliliters.

Nutrient values are low. Nitrate-nitrogen has been at detection limit in sampling performed between 2/20/90 and 2/1/94, ranging from <0.03 - <0.5 mg/L. Nitrites were also at detection limit with values of <0.1 mg/L. Total phosphorus was typically at the detection limit but ranged from <0.03 to 0.38 mg/L.

Metals sampling has been performed periodically at the site between 2/20/90 and 2/1/94. Alaska has use based standards found in 18 AAC 70 (ADEC, 1996). The water has the potential to pose limitations for sensitive salmonids with regard to copper and zinc concentrations (**Table 7**). Additionally the detection limits for cadmium, mercury and total cyanide were higher than water quality criteria for aquatic organisms, so it is not clear whether these parameters pose limitations.

Testing of volatile organics shows most compounds at levels below detection limits, and those that do register are lower than recommended water quality criteria (**Table 8**).

Monthly temperatures have been acquired at the Deer Mountain Hatchery over a nineteen-year period which show a range from 1.1°C to 16.15°C. Monthly temperatures average 7.34°C with the monthly average range over the period ranging from 3.16°C to 13.93°C (Denton, 1996).

Water is derived from the intake pipe which is located in the lower levels of Lower Ketchikan Lake, which is a shallow lake. Water temperatures are strongly influenced by seasonal air temperatures.

KPU sent a letter to ADEC on May 31, 1997 requesting Section 401 Certification.

Table 7
Results from Water Quality Sampling, Ketchikan Municipal Water Supply

		18 AAC70	02/20/90	6/08/90 a*	6/08/90 b*	6/08/90 c*	6/29/90 a	6/29/90 b	6/29/90 c	02-05-91	4/08/91 **	05/01/91	1/25/93 *	04-28-93	12-22-93
Aluminum	ug/l		94												
Antimony	ug/l														
Arsenic	ug/l	50(D);100(I)	<2							<1		<1	1		
Barium	ug/l	1000(D)	3							<1		<2	3		
Beryllium	ug/l	11(A);100(I)													
Cadmium	ug/l	10(D);0.4(S)	<2							<0.1		<0.1	<0.1		
Chromium	ug/l	50(D);100(A)	<3							<1		<1	<1		
Copper	ug/l	1000(D);1.8(S)		753	1410	198	1760	272	1150						
Fluoride	mg/l		0.06							<0.5		<0.5	<0.4		
Iron	ug/l	300(D);1000(A)		88	36	36	89	45	48					<100	
Lead	ug/l	50(D);52(S)	<2	<25	<25	<25	<25	<25	<25	<1	33.3	<1	2		
Mercury	ug/l	2(D);0.5(A)	<0.2							0.6		<0.6	<0.2		
Nickel	ug/l														
Nitrate-N	mg/l	10(D)	<0.03							<0.5		<0.5	<0.1		
Nitrite	mg/l												<0.1		
Total Phosphorus-P	mg/l			<0.03	<0.03	0.38	<0.03	<0.03	<0.03					0.14	
Selenium	ug/l	10(D)	<2							<2		<2	<2		
Silver	ug/l	50(D)	<7							<0.2		<0.2	<0.2		
Thallium	ug/l														
Zinc	ug/l	5000(D);9(S)		48	594	31	53	14	39						
Hardness	mg/l			27.6	42.7	36.9	10.3	5.7	12.3					12	
Calcium	mg/l			0.798	0.924	0.858	0.863	0.902	0.923					3.2	
Magnesium	mg/l													0.97	
Silica as SiO_2	mg/l													0.648	
Alkalinity as $CaCO_3$	mg/l	>20												6	
Chloride	mg/l	250(D)												5.2	
Nitrates	mg/l											0.5		0	<0.1
Sulfate	mg/l	250(D)												1	
Total Cyanide	mg/l	0.005													
pH	S.U.	6-8.5(Ai)												4.91***	
		6.5-8.5 (Aiii and Bi)													
Conductivity	umhos/cm													25	

EPA Quality Criteria for Water 1976

D - Domestic
I - Irrigation
*Treated Water
**Bailey Powerhouse
A - Aquatic Organisms
S - Salmonids
***Sampling Error Suspected

Table 8
Comparison of Organic Sampling of Ketchikan Municipal Water Supply with Water Quality Standards
Water Quality Standards ($\mu g/l$)
40 CFR 131.36(12)
Freshwater

	18AAC 70														
	Acute	Domestic	MCL		05-24-89		12-22-89		1-25-93		2-13-95	Samples	Min	Max	Average
Dichlorodifluoromethane				<	3	<	0	<	2	<	0.5	4	<0.1	<2.5	<1.27
Fluorotrichloromethane					1			<	1			2	<0.5	0.5	<0.5
Chloromethane		20		<	1	<	0	<	2	<	0.5	4	<0.1	<2	<0.77
Vinyl Chloride			2	<	1	<	0	<	2			3	<0.1	<2	<0.86
Bromomethane				<	1	<	0	<	2	<	0.5	4	<0.1	<2	<0.77
Chloroethane				<	1	<	0	<	2	<	0.5	5	<0.1	<2	<0.77
Trichlorofluoromethane				<	1	<	0	<	1			2	<0.1	0.5	<0.3
1,1-Dichloroethene			7	<	1	<	0			<	0.2	3	<0.1	<0.5	<0.26
Methylene chloride				<	1	<	0	<	1	<	0.5	4	<0.1	<1	<0.52
trans-1,2-Dichloroethene				<	1	<	0					2	<0.1	<0.5	<0.3
1,1-Dichloroethane				<	1	<	0	<	0			3	<0.1	<0.5	<0.26
2,2-Dichloropropane				<	1			<	1			2	<0.5	<1	<0.75
cis-1,2 Dichloroethene		57		<	1	<	0					2	<0.1	<0.5	<0.3
Chloroform					3	<	0		4		13.8	4	<0.1	13.8	<5.1
Bromochloromethane				<	1	<	0	<	0	<	0.3	4	<0.1	<0.5	<0.3
n1,1,1-Trichloroethane			200	<	1	<	0	<	0			3	<0.1	<0.5	<0.26
1,1-dichloropropene		0.25		<	1			<	1			2	<0.5	<0.5	<0.5
Carbon Tetrachloride		12	5	<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
Benzene			5	<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
1,2-Dichloroethane			5	<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
Trichloroethene			5	<	1	<	0					2	<0.1	<0.5	<0.3
1,2-Dichloropropane				<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
Bromodichloromethane				<	1	<	0		0		0.39	4	<0.1	<0.5	<0.3
Dibromomethane		68000		<	1			<	0	<	0.2	3	<0.2	<0.5	<0.37
Toluene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
o-Chlorotoluene								<	0	<	0.2	2	<0.2	<0.3	<0.25
p-Chlorotoluene								<	0	<	0.2	2	<0.2	<0.2	<0.2
cis-1,3-Dichloropropene				<	1	<	0					2	<0.1	<0.5	<0.3
trans-1,3-Dichloropropene		6		<	1	<	0					2	<0.1	<0.5	<0.3
1,3-Dichloropropene								<	0			1	NA	NA	<0.2
1,3-Dichloropropane				<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
Dibromochloropropane				<	1							1	NA	NA	<0.5
1,2-Dibromoethane		6800		<	1	<	0	<	1			3	<0.1	<1	<0.53
Chlorobenzene				<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
Ethylbenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.26

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Freshwater

	18AAC 70														
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1,1,1,2-Tetrachloroethane				<	1	<	0	<	0			3	<0.1	<0.5	<0.26
m & p Xylenes				<	1	<	0	<	0			3	<0.1	<0.5	<0.33
o-xylene				<	1	<	0	<	0			3	<0.1	<0.5	<0.26
Styrene				<	1	<	0	<	0			3	<0.1	<0.5	<0.26
Bromoform		43		<	1	<	0	<	1	<	0.5	4	<0.1	<1	<0.52
1,1,2,2-Tetrachloroethane		1.7		<	1	<	0	<	0			3	<0.3	<0.5	<0.3
1,2,3-Trichloropropane				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
Isopropylbenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
n-Propylbenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
Bromobenzene				<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.27
1,3,5-Trimethylbenzene				<	1							1	NA	NA	<0.5
& 2-Chlorotoluene															
1,3,5-Trimethylbenzene						<	0	<	0			2	<0.1	<0.2	<0.15
4-Chlorotoluene				<	1	<	0					2	<0.1	<0.5	<0.3
tert-Butylbenzene				<	1	<	0	<	1			3	<0.1	<0.5	<0.36
1,2,4-Trimethylbenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.26
sec -Butylbenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
p-Isopropyltoluene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
sec-Isopropyltoluene						<	0					1	NA	NA	<0.1
m-dichlorobenzene								<	0			1	NA	NA	<0.2
o-dichlorobenzene		4000						<	0	<	0.2	2	<0.2	<0.2	<0.2
1,3-dichlorobenzene		4000		<	1	<	0			<	0.2	3	<0.1	<0.5	<0.26
1,4-Dichlorobenzene			75	<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.25
n-Butylbenzene		27000		<	1	<	0	<	0	<	0.2	4	<0.1	<0.5	<0.27
1,2-Dichlorobenzene				<	1	<	0					2	<0.1	<0.5	<0.3
1,2 Dibromo-3-chloropropane				<	1	<	0	<	2	<	0.5	3	<0.1	<2	<0.77
1,2,4-Trichlorobenzene		4.4		<	1	<	0	<	0			3	<0.1	<0.5	<0.3
Hexachlorobutadiene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
Napthalene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
1,2,3-Trichlorobenzene				<	1	<	0	<	0			3	<0.1	<0.5	<0.3
a,a,a-Trifluorotoluene					100							1	NA	NA	100
cis-1,2-Dichloroethylene								<	0	<	0.2	2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethylene		27						<	0	<	0.2	2	<0.2	<0.2	<0.2
Trichloroethylene		8						<	0			1	NA	NA	<0.2
Tetrachloroethylene								<	0			1	NA	NA	<0.2

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Freshwater

	18AAC 70														
	Acute	Domestic	MCL		05-24-89		12-22-89		1-25-93		2-13-95	Samples	Min	Max	Average
Vinyl acetate						<	0					1	NA	NA	<0.1
Acetone				<	0							1	NA	NA	<0.1
Carbon Disulfide				<	0							1	NA	NA	<0.1
2-Butanone				<	0							1	NA	NA	<0.1
4-methyl-2-Pentanone				<	0							1	NA	NA	<0.1
2-Hexanone				<	0							1	NA	NA	<0.1
Total Trihalomethanes		19					100	<	4			2	<4	100	<52
Gamma BHC (Lindane)	2	0.0073						<	0			1	NA	NA	<0.025
Toxaphene	0.73	7.6						<	1			1	NA	NA	<0.5
Endrin	0.18							<	0			1	NA	NA	<0.025
Methoxychlor								<	0			1	NA	NA	<0.1
2,4-D								<	1			1	NA	NA	<0.5
2,4,5-TP								<	1			1	NA	NA	<1

*Treated Water

Summary. Unique features of the Ketchikan Lakes system are:

- Two water sources are diverted to a single small reservoir (forebay), Fawn Lake, which is off-stream of either source.
- The penstock (tunnel) from Fawn Lake to the powerhouse is also used to convey domestic water to supply the City of Ketchikan.
- Water levels in the supply system are managed to maintain water quality and pressure for the domestic supply, as well as to prevent spills.
- The Ketchikan municipal water supply is drawn from the penstock just above the powerhouse.
- There is a minimum flow requirement below the discharge of the powerhouse.
- Discharge from the powerhouse is divided before it reaches Ketchikan Creek, with part of the water diverted to the fish hatchery before it returns to Ketchikan Creek.

Ground Water. There is no information on any wells within the study area. The Ketchikan Lakes are surrounded by steep-sided slopes, and no alluvial deposits are present except near the inlet of the Upper Lake on the northeast corner. The Ketchikan by-pass reach passes through some meadows, which undoubtedly have an alluvial base, but have not been developed, given the ownership.

Environmental Impacts and Recommendations

Operations of the Project facilities will continue to affect the natural hydrologic regime of the lakes, the Ketchikan Creek by-pass reach, Ketchikan Creek below the powerhouse tailrace, and Granite Basin Creek below the diversion.

Ketchikan Lakes. Water levels in Ketchikan Lakes are directly influenced by precipitation and by releases to the penstocks supplying the turbines. The lakes' water levels have greater fluctuations than anticipated under natural conditions. Water levels are managed and depend on the status of other hydroelectric facilities in the KPU grid, precipitation at the other hydroelectric facilities within the grid, and water quality considerations at the forebay area at Fawn Lake.

Water quality within the lake reflects the headwater conditions of a mountainous coastal old-growth forest of western hemlock, Sitka spruce, and cedar. Human access is limited due to a closure imposed to protect the municipal water supply, and rugged terrain. There is limited disturbance beside the lakes and virtually none in the overlying watershed. Sedimentation is not an issue. KPU anticipates no construction under the Proposed Action beyond standard maintenance of the site.

Ketchikan Creek By-pass Reach. The 1.34 miles of Ketchikan Creek between the lakes and the tailrace of the power plant has been a by-pass reach for the last ninety-five years. The lowest 0.25 miles of the by-pass reach is the only reach accessible to anadromous fish. Flows in the by-pass reach average 10 cfs, and have a minimum low flow of 3.6 cfs. These are much less than they would be under natural conditions, and reflect a contributing watershed of less than two square miles, rather than a watershed of approximately 12.5 square miles. However, the hydrograph, or the seasonal sequencing of flows, parallels a natural hydrograph in an area that receives an average of 155.22 inches of precipitation per year; e.g., higher flows are observed from September through May, and lower flows are observed from June through August. Prior to construction of the hydroelectric facility flows similar to those observed below the tailrace would have passed through this reach.

Ketchikan Creek Below the Tailrace. The flow pattern is affected by the power plant operation, as the operators have the ability to release water from Ketchikan Lakes at a rate either faster or slower than the natural inflow. However, the natural inflow is not known and cannot be determined on an instantaneous basis, because the inflow sources are not concentrated and amendable to gaging. Therefore, it is not precisely known how much the hydro plant affects the stream flows which would naturally occur on an instantaneous basis. From a review of all the available data on lake elevations, precipitation, and generation, it appears that the following can be said of the influence of the Project on stream regulation.

- The minimum monthly flows below the powerhouse are increased above the flows that would naturally occur during dry periods.
- During periods of high natural flow, the average monthly flow is frequently reduced.
- Average daily flows are not greatly affected.

The operation of the hydroelectric project actually modulates flows in the reach below the by-pass reach, decreasing the peak flows and increasing the low flows, as Ketchikan Creek flows through town. **Table 6** shows flows from the powerhouse tailrace for the years 1993 through 1995. The average of the flows requested is 142 cfs throughout the year. This is approximately all of the flow during an average year, after domestic water is taken out. **Figure 10** shows the relation of the ADF&G request with the estimated unregulated flows that would have occurred in Ketchikan Creek in 1993, 1994, and 1995 (if flows were not affected by the power plant). **Figure 11** shows the actual regulated flows from the tailrace relative to the ADF&G flow requests. Comparison of the figures indicates the regulated flows more closely approximate the ADF&G request than would unregulated flow. The ADF&G flow request would provide more flow in the summer months and less flow in the winter months relative to natural flow. The power plant operation does provide some improvement in this direction. The calculated unregulated flows were arrived at by assuming that all changes in monthly storage are reduced to zero, with the change in storage converted to a change in flow.

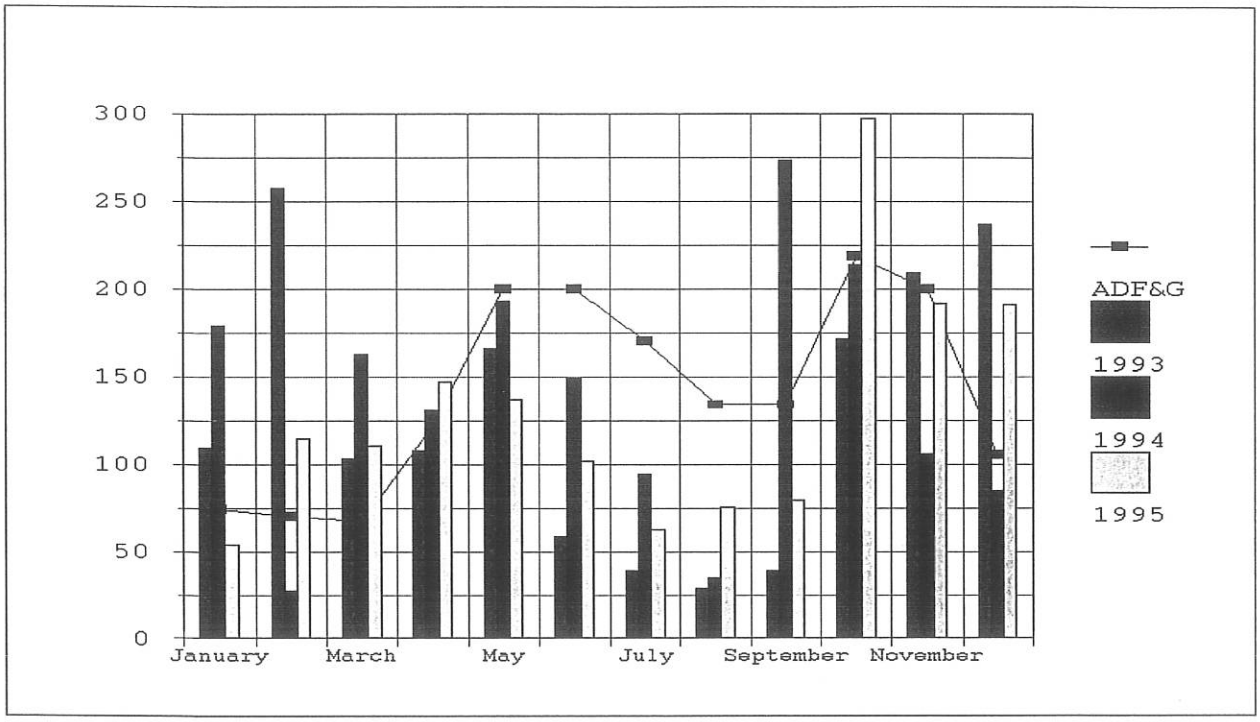

Figure 10 Unregulated (Calc) Flows and ADF&G Request

If Ketchikan Lakes and Granite Basin Creek flows were released to attempt to meet the ADF&G flow request in the by-pass reach of Ketchikan Creek, the powerhouse could not be operated. Essentially 100 percent of the available water is now used for domestic supply and power.

On a daily basis, flow fluctuations may be more severe than under normal conditions, due to ramping up to meet peak loads, and ramping down off-peak to conserve water at this particular site. Ramping does not exceed 50 cfs per hour, although the chance in flow may occur in a thirty minute period. It is not unusual for the flow to vary from 125-175 cfs, down to 35 - 40 cfs, and back up to 125 - 175 cfs, within a 24-hour period.

The management of flows provides a higher average summer flow in the reach during a season that typically is a sensitive period for the fishery. Moderate reductions in flow during the high precipitation period may influence the overall size of the fishery in this reach, but support a more stable population from one year to the next.

Ketchikan Lakes is the only source of water for the municipal water supply. The penstocks for the hydroelectric Project transfer water for the water supply prior to the turbine inlet. KPU's management of the community water supply is fully integrated with

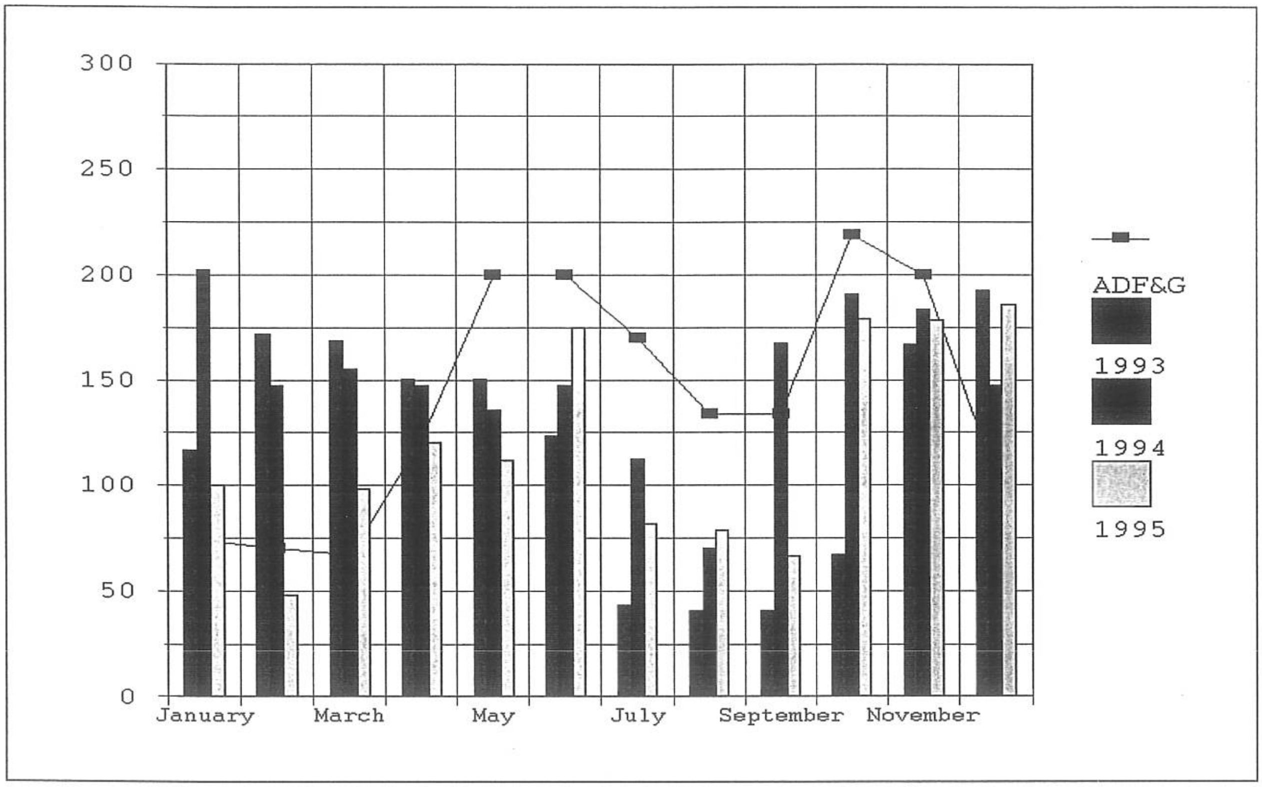

Figure 11 Actual Regulated Flows and ADF&G Request

the operation of the hydroelectric facility. KPU manages the water supply to meet drinking water quality standards by restricting access to the Ketchikan Lakes and Fawn Lake.

<u>Granite Basin Diversion By-pass</u>. The Ketchikan Lake hydroelectric Project also derives water from Granite Basin, an upper tributary of Ketchikan Creek. The diversion transfers runoff from a three-square mile watershed through a five-foot by seven-foot diversion tunnel with a capacity of 160 cfs. The tunnel is considerably oversized for mean flows of 32 cfs, and thus results in little backwater upstream. However, the reach below the diversion, or the Granite Basin by-pass consists of approximately 2400 feet (0.45 miles) of channel sustained by a contributing watershed of 146 acres. This reach receives flow from 7 percent of the Granite Basin watershed, and any leakage from the diversion dam. Flows are reduced ninety percent from natural conditions. The Granite Basin by-pass reach supports subsurface flow but does not have sustained channel flow throughout periods of low precipitation. The reach does support a small year-round fishery in the lower half of the reach.

4. Vegetation and Wetland/Riparian Resources

Affected Environment

Numerous vegetation communities have been identified and mapped by the Forest Service in the Project Area and in the surrounding watershed. Tongass National Forest resource information was the primary source used to describe and map the vegetation communities within the Project Area. Community characterization is based on altitude and proximity to water. Mapped locations of vegetation communities within the Project Area and the Tongass National Forest were provided on the Forest Service GIS layer TIMTYP. Communities within the Project Area but outside of the Tongass National Forest were mapped using aerial photos, National Wetlands Inventory (NWI) information and Forest Service CLUS.MAT-soil type relations. Descriptions for forested communities were developed from the Forest Plant Association Management Guide (DeMeo et al, 1992) and the Tongass Land Management Plan (USDA Forest Service 1997b). Non-forested community descriptions were developed from the Identification, Classification and Delineation of Wetlands Using Soils and Vegetation Data (DeMeo et al, 1989) and the Alaska Vegetation Classification (Viereck et al, 1992).

The watershed, in which the Project Area is situated, is mostly covered by upland forest. The forest is classified as a coastal old-growth rain forest. Western hemlock and Sitka spruce predominate, interspersed with western red cedar, Alaska yellow cedar, and red alder. Descriptions of the mapped vegetation communities are given below.

<u>Cedar</u>. Red cedar (*Thuja plicata*) stands make up a small portion of the Tongass National Forest in the Ketchikan area and have a similarly small distribution within the Project area. These communities are typically restricted to elevations below 800 msl, however their distribution has been documented to occur on a variety of landforms--from drumlin fields to mountain hillsides. The structure of these forests varies in complexity, largely related to disturbance as well as factors such as soil drainage, temperature, light, and seeding characteristics. Devil's club (*Oplopanax horridus*), blueberry/huckleberry (*Vaccinium spp.*), and salmonberry (*Rubus spectabilis*) are common components of the understory. Plant associations with Red cedar components have canopy covers which are relatively closed, ranging from 50-64 percent.

A single stand of cedar occurs in an area adjacent to and southeast of the Ketchikan Lakes dam. A portion of this stand occurs within the Project boundary.

<u>Spruce</u>. Sitka spruce (*Picea sitchensis*) are typically found to occupy disturbed sites in southeastern Alaska, primarily alluvial floodplains. While most forested areas within the Ketchikan area are dominated by hemlock or a mixture of

conifers, a few locations support predominantly pure stands of Sitka spruce. This occurrence may be indicative of disturbances such as those caused by water movement, windthrow, and soil mass movement.

Devil's club, yellow skunk cabbage (*Lysichitum spp.*), reedgrass (*Calamagrostis spp.*), blueberry/huckleberry, and salmonberry are common components of the understory. The latter two components represent a transition to upland habitats. Plant associations within the Sitka spruce vegetation type have variable canopy covers ranging from 46 (open) to 69 (relatively closed) percent.

Two stands of spruce occur on the east side of lower Ketchikan Lake in separate tributary drainages. Neither stand occurs within the Project boundary.

Hemlock. Two species of hemlock are widespread over the forested southeastern Alaskan landscape: Mountain Hemlock (*Tsuga mertensiana*), common at elevations greater than 2000 msl; and Western Hemlock (*Tsuga heterophylla*), which dominates below elevations of 2000 msl. Within the Ketchikan area and the Project area, Western Hemlock typically dominates the hemlock communities.

Plant associations within this vegetation type are based primarily upon variations in the understory, of which Devil's club, blueberry/huckleberry, and salmonberry are common components. Plant associations within the Hemlock vegetation type have canopy covers ranging from 58-66 percent.

The hemlock community types occupy much of the slopes to the east of Ketchikan Lake, including those slopes within the Project Area. Slopes above the southern half of lower Ketchikan Lake are also occupied by the hemlock community type.

Hemlock-Spruce. In close association with purer stands of hemlock is the Hemlock-Spruce vegetation type. Here, Sitka spruce (*Picea sitchensis*) shares dominance with western hemlock. The understory is commonly found to be devil's club, blueberry/huckleberry, salmonberry, yellow skunk cabbage, and shield fern (*Dryopteris ssp.*).

This community type dominates the slopes around Upper Ketchikan Lake, west of the northern part of upper Ketchikan Lake, and on uplands within and adjacent to the southern part of the Project Area.

Red Alder. Red alder (*Alnus rubra*) represents the only broadleaf forest community type within the Project Area. Often considered an early successional community, red alder communities in southeastern Alaska typically occupy moist and disturbed sites, such as those created by river channel. Canopy coverage is predominantly closed, ranging from 60-100 percent. Plants common to the understory of this community are salmonberry, Devil's club, trifoliate foamflower (*Tiarella trifoliata*) and enchanter's nightshade (*Circaea alpina*).

The alder community type occupies the less steep valley and alluvial bottoms within and adjacent to the southern part of the Project Area.

Alder Brush. The Alder Brush community is common throughout Alaska on steep slopes, floodplains and streambanks. It can occur in the form of a closed, tall scrub community, with canopy of 75-100 percent, or as an open tall scrub community, with canopy of 25-75 percent. Species common to this community are alder (*Alnus crispa, Alnus sinuata*), willow (*Salix spp.*), sedge (*Carex spp.*), reedgrass (*Calamagrostis ssp.*), horsetail (*Equisetum ssp.*), and fescue (*Festuca ssp.*). This community type does not occur within the Project Area.

Wetlands. Wetland communities are common in the Project Area, reflecting the abundance of surface and groundwater within the region. Wetlands can be broadly defined as being either lacustrine systems, associated with Ketchikan, Scout and Fawn Lakes, or palustrine systems, supporting forested, emergent or shrubby vegetation. NWI maps identified five major wetland types within the Project area on the basis of Cowardin et al. (1979), corresponding to six wetland complexes as described in DeMeo et al. (1989)(**Table 9**).

Of those listed, the types listed in the first two rows of **Table 9** are typically designated as open muskeg. These communities are likely to contain a variety of bog related plant life, such as sphagnum moss (*Sphagnum ssp.*), bog cranberry (*Vaccinium oxycoccus*), sedge (*Carex ssp.*), and marsh violet (*Viola palustris*). Shore pine (*Pinus contorta*), lodgepole pine (*Pinus contorta*), and yellow cedar (*Chamaccyparis nootkatensis*) are common trees of the forested wetlands, while burrweed (*Sparganium hyperboreum*), pondweed (*Potamogeton ssp.*) and aquatic buttercup (*Ranunculus trichophyllus*) are likely along the shores of unconsolidated palustrine areas, lakes and ponds.

Larger lacustrine areas are located along the southern shores of both upper Ketchikan and lower Ketchikan Lakes; a third area is located on the south-eastern shore of Ketchikan Lake. Palustrine areas are situated in and adjacent to the southern part of the Project Area. Most of these wetlands are associated with the alder forest community type present in lowland valley and alluvial bottoms.

Table 9 Wetland Types Within Project Area	
per Cowardin et al. (1979)	**per DeMeo et al. (1989)**
Palustrine Scrub/Shrub (PSS4B, PSS1)	Scrub-Shrub Evergreen/Muskeg
Palustrine Emergent (PEM1B)	Emergent Short and Tall Sedge Muskeg
Palustrine Forested (PFO4, PFO4, PFO5H)	Forested Wetland
Palustrine Unconsolidated (PUSC, PUBh, PUBH)	Not Listed
Lacustrine	Lakes and Ponds

Plant Species of Special Concern and Unique Communities. Twenty-two (22) plant species are listed as sensitive by the Forest Service for the Alaska Region. Two (2) of these, *Carex lenticularis var. dolia* (goose grass sedge) and *Platanthera gracilis* (bog orchid) are known to occur within the Ketchikan area. Nine (9) others are suspected to occur within the Project Area, based on the presence of associated vegetation communities for each species. Refer to **Table 10**, Sensitive Plant Species of the Ketchikan Area, for a list of sensitive species which may occur in the Project Area. There are no identified Unique Communities within the Project Area.

There is no alteration or disturbance of the landscape proposed. Therefore, the plant inventories currently found in the Tongass Land Management Plan (USDA Forest Service 1997b) adequately address the issue of possible or suspected occurrence of sensitive plant species. Potential impacts are discussed below. Avoidance and minimization of impacts to sensitive species within the Project Area would occur because no additional disturbance to vegetation is planned.

Environmental Impacts and Recommendations

Continued operation of the Project facilities would result in minimal impacts to forest and other vegetation types. The absence of planned new construction would result in no additional removal of vegetation. Repairs or maintenance of existing facilities could result in the disturbance or removal of re-established vegetation from limited areas in the immediate vicinity of the facility. When repairs and maintenance activities are completed, soil materials would be replaced, and vegetation would be encouraged to re-establish quickly.

Table 10 Sensitive Plant Species of the Ketchikan Area			
Scientific Name	**Common Name**	**Presence**	**Habitat**
Carex lenticularis var. dolia	Goose grass Sedge	known	lake margins, heath, wet meadows, alpine/subalpine and open forest.
Cirsium edule	Edible thistle	suspected	meadows, forest edges, along glacial streams
Glyceria leptostachya	Davy mannagras	suspected	shallow freshwater, stream and lake margins
Hymenophyllum wrightii	Wright Filmy Fern	suspected	grows in dense, humid coastal forests near saltwater. Shaded cliff faces, bases of trees, decaying wood, rootwads.
Isoletes truncata	Truncate quillwort	suspected	shallow freshwater pools or ponds
Ligusticum calderi	Calder lovage	suspected	alpine-subalpine meadows, boggy slopes and rocky areas
Platanthera chorisiana	Choris bog orchid	suspected	heaths, muskegs, mossy upper beach meadows
Platanthera gracilis	Bog orchid	known	wet meadows, expected in muskeg
Poa laxiflora	Loose-flowered bluegrass	suspected	moist lowland forests, upper beach meadows
Ranunculus orthorhynchus var. alaschensis	Straight-beak buttercup	suspected	wet meadows
Senecio moresbiensis	Queen Charlotte butterweed	suspected	alpine-subalpine meadows, shady wet boggy areas, boggy/rocky slopes, open rocky heaths or grassy areas

As no additional construction and associated disturbance is proposed, no additional impacts to wetlands are anticipated. No changes to water management or controls are proposed; therefore, hydrologic conditions of existing wetlands should not change.

An issue was raised about the extent that wetlands at the headwaters of Upper Ketchikan Lake could have been impacted by the original development and continued operation of the Project. It is unlikely that wetlands at Upper Ketchikan Lake have been negatively affected by either original development or operation. When the Project was originally developed, both Upper and Lower Ketchikan Lakes were naturally occurring and water did not freely flow between the two because Upper Ketchikan Lake was perched above Lower Ketchikan lake by a physical barrier. This barrier continued to cause a small elevational difference even after the dam on Lower Ketchikan Lake was constructed. This obstruction was later removed to connect the two lakes and allow flow between them. This would have had a very minor effect on the elevation of Upper Ketchikan Lake, resulting in a slight decrease in the lake level. The small lake level decrease could have slightly increased the area at the headwaters that would be inundated sufficiently to create wetland habitat.

The absence of new construction and the limiting of repair/maintenance activities to previously disturbed areas would prevent impacts to sensitive plant species and potential habitat.

5. Aquatic Resources

Affected Environment

Information for the fisheries resource was acquired from three primary sources:

- Resource management agencies
- Published and unpublished literature
- Field stream inventory

The resource management agencies provided information on the status, occurrence, and use of habitats for fish in the Project area. Literature included general literature on the key fish species and reports on site-specific surveys conducted in the Project area.

During August 1997, an aquatic habitat survey was conducted of the Ketchikan Creek system. During August 1997, September 1997, and April 1998 fish surveys were conducted. Ketchikan and Granite Basin creeks were separated into approximately ½ mile long or less reaches (**Figure 12**). The reaches were delineated based primarily on significant hydrologic or physical aquatic habitat changes. Attributes of selected reaches were collected using the *Draft Fish Habitat Monitoring Protocol for the Tongass National Forest* (USFS 1997). Additional detail on methods, collected data, and analysis are provided in the *Aquatic Resources Study for the Ketchikan Lakes Hydroelectric Project* (KPU, 1998).

The fisheries resource of the Project Area includes both anadromous and resident species of the Ketchikan Creek system or watershed. Significant aquatic habitats within this system consist of Ketchikan Creek, Granite Basin Creek, Schoenbar Creek, Scout Creek, and a tributary to Granite Basin Creek (**Figure 12**). Fish species present in the Ketchikan Creek system are listed in **Table 11**. None of the species of fish occurring in Ketchikan Creek system are listed by the state or U.S. Fish and Wildlife Service (USFWS) as threatened or endangered species.

Based on the accessibility for anadromous fish in combination with key parts of the system, the aquatic habitat can be divided into four groups of stream reaches or lakes. The groupings of aquatic habitat are: 1) the anadromous section of Ketchikan Creek (K1, K2, K3); 2) the non-anadromous section of Ketchikan Creek (K4, K5, K6); 3) Granite Basin Creek (G1, G2, GT1); and, 4) Ketchikan Lakes. The specific stream reaches are identified on **Figure 12**. The source of the break between the anadromous and non-anadromous sections of Ketchikan Creek is a five-foot high falls at the upstream end of the canyon area of Ketchikan Creek. The height of the falls creates a barrier to the migratory movement of anadromous fish past this point in Ketchikan Creek.

Anadromous Section - Ketchikan Creek. The anadromous section of Ketchikan Creek (approximately one mile in length) supports a variety of salmonid fish species. Coho salmon, chinook salmon, sockeye salmon, pink salmon, chum salmon, Dolly Varden char, cutthroat trout, steelhead trout, rainbow trout, and brook trout all use portions of Ketchikan Creek below the barrier falls for spawning and rearing (ADF&G 1987; Greystone 1997). Chinook salmon and the summer coho run are not native to the system, but are maintained by the Deer Mountain Hatchery. Brook trout are also not native to the system. The remaining species (including the fall run coho) are native, with supplemental stocking of some species.

ADF&G's escapement surveys conducted from 1978 to 1995 document significant salmon uses of Ketchikan Creek (**Table 12**). The surveys indicate that there is a substantial amount of wild pink salmon production in Ketchikan Creek, with maximum yearly counts ranging from 850 to 40,000. Additionally, there are relatively small amounts of chinook, sockeye, chum, and coho salmon production. Total numbers of salmon produced in Ketchikan Creek are large enough to make Ketchikan Creek a regionally important base for commercial and sport salmon fisheries.

In addition to the salmon in Ketchikan Creek, there are wild populations of steelhead, rainbow, cutthroat, and brook trout, and Dolly Varden char (**Table 13**). ADF&G foot and snorkel surveys have been conducted from the mouth of Ketchikan Creek to the Project's tailrace from 1995 to present. Greystone also conducted steelhead surveys in 1998.

The average of 541 anglers recorded for the years 1990 to 1994 indicates Ketchikan Creek is an import recreational fishery. Because of this stream's importance as a fishery, the ADF&G has specified it for protection under AS16.05.870(a) as important to anadromous fish and is an ADF&G cataloged anadromous fish stream (stream #101-47-10250) (ADF&G, 1987).

Chinook, coho, and sockeye salmon rear year-round in this segment of Ketchikan Creek and the other species of salmon rear for short durations of the year following emergence (**Table 14**). Steelhead/rainbow trout and Dolly Varden char also use this stream segment for spawning, incubation and rearing year-round.

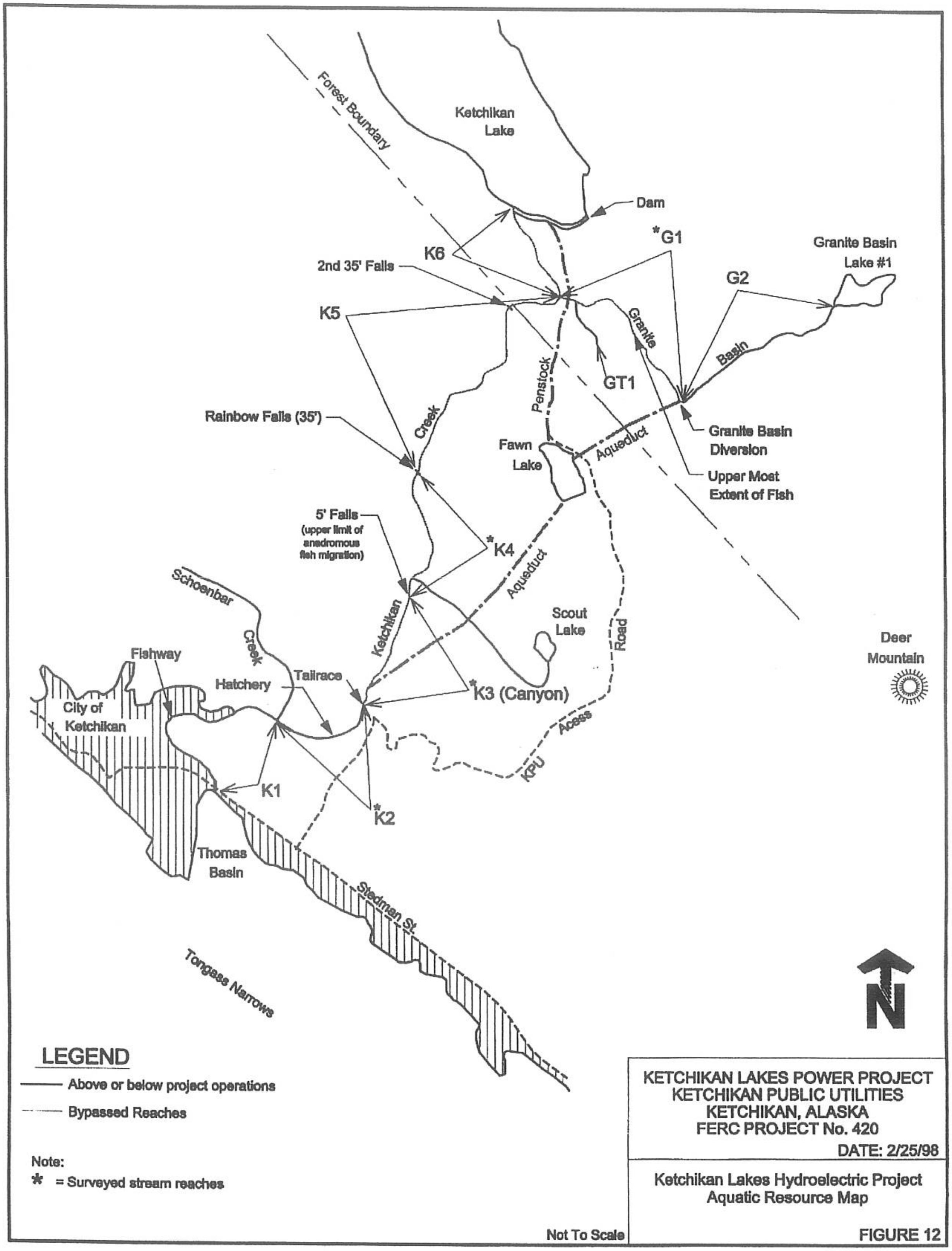

Figure 12 Aquatic Resources Map

Table 11 Species List and Codes For Fish Occurring Within the Ketchikan Creek Watershed		
Common Name	**Species Code**	**Scientific Name**
Chinook salmon (= king salmon)	KS	*Oncorhynchus tshawytscha*
Coho salmon (= silver salmon)	CO	*Oncorhynchus kisutch*
Sockeye salmon (= red salmon)	RS	*Oncorhynchus nerka*
Pink salmon (= humpback salmon)	PK	*Oncorhynchus gorbuscha*
Chum salmon (= dog salmon)	CH	*Oncorhynchus keta*
Steelhead, rainbow trout	SH	*Oncorhynchus mykiss*
Dolly Varden char	DV	*Salvelinus malma*
Cutthroat trout	CT	*Oncorhynchus clarki*
Eastern brook trout	BT	*Salvelinus fontinalis*
Stickleback	SB	*Gasterosteus aculatus*
Sculpin	SC	*Cottus* spp.

The Deer Mountain Fish Hatchery is located next to Ketchikan Creek (**Figures 2** and **12**). ADF&G began operation of the hatchery in the mid-1970s and the Ketchikan Indian Corporation is the current operator (Denton, 1996). Chinook salmon culture (Unuk River ancestral stock) began with the 1977 brood. Annual smolt releases into Ketchikan Creek have been around 100,000 for most of the years. Native-strain Ketchikan Creek coho stock was cultured until 1982. However, from 1986 to present, a non-native strain Reflection Lake summer coho stock has been cultured and released into Ketchikan Creek. Enhancement of the Ketchikan Creek steelhead stock has been intermittent, with small numbers released in some years.

The hatchery has a water appropriation of approximately 4.5 cfs from KPU's diversion water. It is withdrawn just after being released through the turbines but before the tailrace and routed directly to the hatchery via a 4-inch pipeline. The hatchery receives all of its water from this source.

Temperature. Because the hatchery's water supply comes directly from KPU's diversion waters just prior to the tailrace outlet, the hatchery's water temperature records provide data on tailrace water temperatures. Monthly averages at the hatchery ranged from 1.1°C (34°F) to 16.1°C (61.0°F), with maximum temperatures sometimes reaching 18.0°C (64.4°F), especially in August (Denton 1996). This

Table 12 Salmon Escapement Surveys						
Year	Date	Chinook	Coho	Sockeye	Pink	Chum
1978	9/15/97			21	850	
1979	8/10/97			9	9200	
	8/20/97			15	13300	
	8/29/97				13000	
	10/4/97		60			
	11/5/97		130			
1980	9/10/97	1	10	23	4267	
1982	8/17/97			15	936	
1982	8/13/97	80				
	9/23/97		2	6	9272	1
1983	9/2/97	1353				
	9/23/97		1400			
	9/28/97	1	494	2	13230	1
1984	7/25/97	500				
	9/11/97	5				
	9/27/97				11187	1
	10/30/97				6880	6
1985	9/20/97		58			
1985	8/27/97				2076	3
	9/12/97	130			7830	
1989	8/5/97	300				
	9/7/97	7		1	27600	
1990	8/21/97	160	1000		11500	
1992	8/27/97	16	20		40000	1
1994	9/8/97		40		22960	
1995	9/6/97	7	25	2	19250	
Total*		2560	3239	94	216410	13
Average*		213	294	10	11390	2
Maximum		1353	1400	23	40000	6

Source: ADF&G 1996

Notes:

The ADF&G times these escapement surveys to detect peak pink salmon escapement and, while other species are noted and counted, their run timing differs and the numbers seen here should not be used in any other format.

* Because of the note above and that dates and frequency of surveys varied from year to year, the totals and averages per species are only given for general information.

Table 13
Sport Fish Harvest and Effort by Species
Ketchikan Creek, 1990 to 1994

Year	Anglers	Trips	Days Fished	Fish Species									
				Chinook	Coho	Sockeye	Pink	Chum	Dolly Varden	Steelhead	Rainbow	Cutthroat	Brook
1990	926	2187	1978	197	292	10	470	11	479	96	80	16	16
1991	239	529	579	0	13	28	0	32	139	135	84	0	0
1992	436	835	1014	0	16	8	82	0	0	93	0	0	0
1993	352	1091	1212	0	82	9	9	0	214	0	0	0	0
1994	751	1936	2625	57	831	52	74	0	134	0	28	0	26
Avg	541	1316	1482	51	247	21	127	9	193	65	38	3	8
Min	239	529	579	0	13	8	0	0	0	0	0	0	0
Max	926	2187	2625	197	831	52	470	32	479	135	84	16	26

Source: (ADF&G 1996)

is the upper limit for chinook salmon culture (Denton 1996) and the upper limit for 50 percent egg mortality (Alderdice and Velsen 1978; Groot and Margolis 1991). Detrimental effects have been seen in gamete viability, resulting in lowered survival of fertilized eggs (Denton 1996).

In conversations with KPU employees, hatchery staff have learned that the occasionally high water temperature is a consequence of the intake pipe being on the bottom of Lower Ketchikan Lake, which is relatively shallow (Denton 1996). It would not be possible to access cooler water in the summer from the lower Ketchikan Lake where the outlet is located. Therefore, the hatchery staff has learned to work around the high temperatures by using refrigeration techniques (Denton 1996). Because the hatchery was constructed after the hydro-project, it has designed its operation with KPU's operation requirements as an existing condition.

KPU installed hourly continuous temperature monitors just above and just below the tailrace on July 25, 1997. A heavy flow event, occurring sometime between August 20 and October 4, washed out the loggers. They were both retrieved downstream of the tailrace on October 5, 1997. For this reason, only limited temperature data above and below the tailrace has been obtained. However, information from the limited data set is as follows.

Ketchikan Creek reached a maximum temperature of 19.4°C (67.0°F) below the tailrace during the sample period (with an average of 13.1°C (55.6°F). Additionally, the data indicate that the average stream temperature was at least 1.3°C (2.2°F) higher downstream of the tailrace than upstream of the tailrace during the sample period. Furthermore, the maximum temperature was at least 3.4°C (6.1°F) higher downstream than upstream of the tailrace. It is not known how much of this is Project-related as described below. As discussed above, the warmer tailrace waters are taken from lower Ketchikan Lake that is exposed to sunlight during retention time. The cooler water above the tailrace comes primarily from runoff within the by-pass reach that is cooled by stream shading.

Although the hatchery and 1997 temperature data indicate temperature occasionally reaches higher than preferable for salmonids, lack of suitable rearing habitat is the most likely limiting factor to natural fish production (Denton 1996; Greystone 1997b).

<u>Instream Flows</u>. KPU has been operating at a required minimum flow (35 cfs) below the powerhouse since 1982. Prior to this 35 cfs requirement, the Project was operated to maximize power production with no attempt to maintain instream flows below the tailrace. This minimum flow is required by FERC. Review of historical data indicates that 35 cfs is about the highest minimum flow that could be sustained over the summer months during a low rainfall summer.

Table 14
Ketchikan Creek Fish Species Periodicity Chart

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook Salmon													
	Passage					XXX	XXXX	XXXX	XXXX	XX			
	Spawning							XXXX	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	XXXX	
	Spawning	XX							XX	XXXX	XXXX	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
Pink Salmon													
	Passage							XXXX	XXXX	XXXX			
	Spawning							XX	XXXX	XXXX			
	Incubation	XXXX	XXXX	XXXX	XXXX			XX	XXXX	XXXX	XXXX	XXXX	XXXX
	Rearing			XX	XXXX	XXX							
Sockeye Salmon													
	Passage						XX	XXXX	XXXX	XXXX			
	Spawning							XXXX	XXXX	XXXX	XXXX		
	Incubation	XXXX	XXXX	XXXX				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
	Rearing			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Chum Salmon													
	Passage							XX	XXXX	XXXX			
	Spawning								XXXX	XXXX			
	Incubation	XXXX	XXXX	XXXX	XXX				XXXX	XXXX	XXXX	XXXX	XXXX
	Rearing		XX	XXXX	XXXX	XXXX							
Dolly Varden													
	Passage												
	Spawning						XXXX	XXXX	XXXX	XXXX			
	Incubation	XXXX	XXXX	XXXX	XXXX		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
	Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rainbow Trout													
	Passage												
	Spawning		XX	XXXX	XXXX	XXXX							
	Incubation		XX	XXXX	XXXX	XXXX	XXXX	XXX					
	Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Steelhead Trout													
	Passage	XX	XXXX	XXXX	XXXX	XXXX	XXXX						
	Spawning		XX	XXXX	XXXX	XXXX							
	Incubation		XX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX				
	Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Source: (ADF&G 1988)
Notes:
Each 'X' represents a quarter of the month
Periodicity based upon professional judgment of ADF&G biologists
Incubation life phase includes period from egg deposition to fry emergence

KPU's operating personnel have achieved a high degree of reliability in providing this minimum flow by installing a by-pass gate that assures the 35 cfs flow even if a power failure occurs. This 35 cfs flow includes flows provided to the hatchery (maximum 4.5 cfs) and to a stream in the City Park.

There is no required instream flow above the tailrace in the bypassed reaches. Any flow in this reach is provided by seepage from the dams and direct runoff into these reaches. Flows have been documented to be as low as 3.6 cfs in the by-pass reach just above the tailrace.

In 1988, the ADF&G filed an instream flow reservation to protect and maintain fish production within Ketchikan Creek from its mouth (river mile 0.0) upstream to approximately river mile 2.1 (ADF&G 1988). River mile 2.1 is approximately at the Ketchikan Lakes outlet (**Figure 12**). The rational for the instream flow request was an instream flow analysis conducted by the ADF&G using the Tennant Method. This analysis determined the hydrological characteristics of Ketchikan Creek and evaluated the effects that changes in those characteristics had on the fish species that depend on them (Tennant 1976; ADF&G 1988).

The ADF&G requested reservation of 74 cubic feet per second (cfs) in January, 70 cfs in February, 67 cfs in March, 122 cfs in April, 200 cfs in May and June, 70 cfs in July, 134 cfs in August and September, 219 cfs in October, 200 cfs in November, and 105 cfs in December. (Refer to the EA and hydrology technical report for more detailed discussion of this request.) KPU's operation of the Project is not consistent with these requests. They currently run operations to maximize power output while maintaining the guaranteed minimum flow requirement of 35 cfs below the powerhouse and the water quality and quantity demands of the municipal water supply and hatchery water supply. The hydrology data indicates that these flow requests could not be maintained during the summer months where flows are often continuously at 35 cfs for weeks and even months.

These ADF&G states that these requested flows are not a request for water from KPU's operation, but is requested as the desired water in Ketchikan Creek if KPU's Project is ever abandoned or modified which would allow additional instream flow water rights (ADF&G 1997).

<u>Anadromous Section - Reach-Specific Information</u>. Reaches K1, K2, and K3 comprise the anadromous section of Ketchikan Creek:

Reach K1. This reach extends from the mouth of Ketchikan Creek (the Stedman street bridge) upstream to the confluence with Schoenbar Creek (**Figure 12**). K1 is 2,659 feet long.

This reach was not surveyed for fish during the 1997 and 1998 field effort. However, ADF&G surveys (**Table 12**) document the presence of all five species of salmon and adult steelhead throughout this reach. Additionally, Greystone incidentally observed one adult steelhead in this reach on April 19, 1998.

This reach was not surveyed for habitat during the 1997 field effort. However, general observations of spawning activities and substrate composition indicate that a portion of this reach is an important salmon spawning area for the Ketchikan Creek fishery. Additionally, the spawning and migration activities in this reach are important for the city of Ketchikan's tourism; providing an important part of the city's tours.

Historically, there was a substantial pink salmon fishery that spawned in the estuarian gravels at the mouth of Ketchikan Creek. Numbers probably exceeded 100,000 adults. However, removal of these gravels for roads and to deepen the harbor has eliminated this fishery (ADF&G 1998). Additionally, the Ketchikan Creek fishery was subjected to extensive overharvesting in the early 1900s from the now illegal fish trapping in the mouth of Ketchikan Creek.

A fishway was built in 1957 near the upper end of this reach to assist salmon escapement past a falls/cascade (**Figure 12**) for hatchery purposes. It is maintained by both the ADF&G and Ketchikan Indian Corporation, (the current operators of the Deer Mountain Hatchery). Although no documentation exists, it is thought that the fishway has greatly improved the pink salmon fishery above the fishway. The ADF&G has filed for a 5 cfs instream flow reservation at the fishway to maintain fish migration ability through the fishway. The top of the fishway is 1,355 feet downstream of Schoenbar Creek.

This reach ends at the confluence with Schoenbar Creek, historically an important salmon spawning area. However, communications with local residents indicate that alteration of habitat in upper areas of the creek have reduced its capabilities. Additionally, the 1997 survey crew observed a significant pooling of salmon at the mouth of Schoenbar Creek, unable to migrate past a poorly installed culvert at its mouth. Although heavy rains later made this passable, the poor culvert installation may significantly delay and disrupt migrations and, if low flows persist, may block migration. During worst-case conditions the culvert is perched, but even during best case conditions the length of the culvert creates difficult passage.

Snorkel observations in August and September of 1997 recorded adults of all five salmon species. Pink salmon was by far the most abundant adult salmon, while coho was the most abundant juvenile salmon (**Table 16**). The trapping and snorkeling surveys documented the presence of juvenile chinook, coho, Dolly Varden, steelhead/rainbow, and cutthroat in the reach. Snorkel observations in April of 1998 found no adult steelhead; however, ADF&G Snorkel surveys in April and May of 1997 and 1998 document the occurrence of adult steelhead in this reach.

The Deer Mountain Hatchery is located 663 feet upstream from the start of this reach (**Figure 12**). This hatchery diverts migrating salmon into the hatchery by installing a diversion (bar screen) across Ketchikan Creek during the Coho and Chinook spawning period in the fall. While installed, this barrier appears to almost completely restrict all but smaller-bodied pink salmon from

Reach K3. This reach extends from the tailrace to an anadromous fish migration barrier located 1284 feet upstream of the tailrace (**Figure 12**). Observations in April, August, and September 1997 and April 1998, indicate that a falls at the upstream end of the canyon area of Ketchikan Creek creates a migration barrier to anadromous species. This barrier consists of a cascade that hits bedrock wall, angles 90 degrees, and then drops approximately 5 feet. Additionally, there is not an adequate takeoff pool to allow salmon to maneuver the falls. The barrier may best be described as semi-permanent. It is not quite permanent because it is partially created by an old growth timber that will, after many years, deteriorate. However, it is essentially permanent because it does not appear to be a typical large woody debris barrier that could be washed out by a high flow event. As described below, there is anecdotal evidence that steelhead migrated past this point many years ago.

This section is significantly different from the rest of Ketchikan Creek for several reasons. First, this reach has extremely steep bedrock walls. Accordingly, it has a relatively narrow channel (20 ft compared with 73 ft for K2 and 36 ft for K4) and complete lack of floodplain. It has relatively steep gradient (approximately 5 percent) with primarily bedrock substrates (**Table 15**). Also, because this section is above the tailrace, flows taken from Ketchikan Lakes and Granite Basin Diversion bypasses this reach. Therefore, it has significantly less flow than the downstream reaches.

Unlike K1, K2, and K4, spawning habitat in this reach is extremely limited, primarily due to the bedrock-dominated substrate. The lower instream flows may also reduce available spawning habitat in this reach, but increasing flows in this reach would only slightly increase its spawning habitat. The bedrock substrate in this reach limits its spawning habitat potential to such a degree that even historic flow levels would not appreciably increase habitat. Furthermore, the narrow channel width, complete lack of floodplain, and field observations indicate that high flows (e.g., ADF&G requested flows) in this reach would actually reduce available habitat, not increase it.

Adult pink, sockeye, chum, and coho salmon were all found up to the migration barrier at the end of this reach with pink salmon most abundant (**Table 16**). Additionally, juvenile chinook and coho were recorded, although almost exclusively near the downstream end of the reach.

During a reconnaissance survey in April 1997, an adult steelhead trout was observed trying to jump the migration barrier falls, documenting its presence up to the migration barrier. Accordingly, steelhead/rainbow juveniles were found throughout reach K3 during the snorkeling and trapping surveys in August and September 1997 and April 1998. No steelhead were seen past the migration barrier at the end of K3 during ocular observations in April of 1997 or during the adult steelhead survey conducted in April 1998.

Resident species recorded during the survey included rainbow, brook trout, and Dolly Varden. This was the farthest upstream reach where Dolly Varden char were found.

<u>Non-anadromous Section - Ketchikan Creek</u>. Reaches K4, K5, and K6 comprise the non-anadromous section of Ketchikan Creek:

Reach K4. This reach extends from the 5-foot falls at the upstream end of the canyon to a 35-foot falls (Rainbow Falls) (**Figure 12**).

This reach is much different from K3. This reach has a much broader flood plain and wider stream channel than K3. The 2 percent gradient is much more gradual than the 5 percent found within K3. Additionally, the substrates are comprised primarily of large cobbles instead of bedrock (**Table 15**). Because of these differences, this reach has much better spawning and rearing habitat.

The by-pass of flows in this reach appears to reduce its available aquatic habitat. More flow in this reach would increase the aquatic habitat, especially spawning habitat. However, field surveys in 1997 indicate that this reach cannot be accessed by anadromous fish. As a result, it is only inhabited by a small population of resident trout. This reach likely had much more aquatic habitat available for these resident fish species (and possibly anadromous species prior to the barrier) when natural instream flows were present.

The snorkel and trapping surveys indicate that resident rainbow, cutthroat, and brook trout are the only fish species occurring in this reach (**Table 16**). The data collected indicate that the fish populations within reach K4, while not abundant, are reproducing successfully.

Table 15
Summary of Key Aquatic Habitat Parameters in the Ketchikan Creek System
August and September 1997

Reach ID	Reach Channel Type	Reach Length (ft)	Approx. Gradient (%)	Pool/FW Number Ratio	Pool/FW Lengths Ratio	Dominant Substrate	Fastwater			Pool		Dominant Vegetation Type	LWD (#/mile)
							Avg Length (ft)	Avg Width (ft)	Avg Depth (ft)	Avg Length (ft)	Avg Res. Depth (ft)		
K2	LC1	1378	1	0.0	0.0	SC	689	73	2.2	--	--	NFA/NHO	23
K3*	MC3	1284	5	0.8	0.5	BR	172	20	0.9	71	1.2	CFC	350
K4*	MC2	1855	2	1.0	0.5	LC	183	36	0.6	82	1.2	NFA	413
G1*	MC1	2400	2	1.1	0.3	BR	170	17	0.5	53	1.4	NFA	290
Avg	--	1729	3	0.7	0.3	--	303	36	1.0	69	1.3	--	269
Min	--	1284	1	0.0	0.0	--	170	17	0.5	53	1.2	--	23
Max	--	2400	5	1.1	0.5	--	689	73	2.2	82	1.4	--	413

Notes:

Reach Channel Type determinations were made using (Paustian 1992); MC1 = Moderate gradient, narrow shallow contained channel; MC2=Moderate gradient, moderate width and incision, contained channel; MC3=Moderate gradient, deeply incised, contained channel; LC1=Low gradient, contained channel.

2,659 feet total length of K1 (from Stedman Street bridge to Schoenbar Creek); upstream end of fishway to end of K1 (Schoenbar Creek) is 1,355 feet; 1,980 feet from start of estuarian influence to Schoenbar Creek.

* Flows in the bypassed reaches were higher than typical because no water was being diverted at Granite Basin Diversion so flow-related parameters should be viewed accordingly.

Table 16
Summary of Snorkeling and Fish Trapping Results in the Ketchikan Creek System August and September 1997 and April 1998

Reach ID	Species	Snorkel Data (fish/acre)				Fish Trapping Data (Total for 6 Traps)
		Fastwater		Pool		
		<300 mm	>300 mm	<300 mm	>300 mm	<300 mm
K2	Chinook Salmon	66	18	--	--	6
	Coho salmon	931	30	--	--	14
	Sockeye salmon	0	18	--	--	0
	Pink salmon	0	2283	--	--	0
	Chum salmon	0	24	--	--	0
	Dolly Varden	48	12	--	--	0
	Steelhead/rainbow	240	0	--	--	24
	Cutthroat trout	12	0	--	--	1
	TOTAL	1298	2385	--	--	46
K3	Chinook salmon	0	0	42 (0)[1]	0	6 (1)[1]
	Coho salmon	114	0	354 (0)	71	28 (1)
	Sockeye salmon	0	0	0 (0)	35	0 (0)
	Pink salmon	0	2083	0 (0)	4243	0 (0)
	Chum salmon	0	0	0 (0)	71	0 (0)
	Dolly Varden	152	0	389 (35)	71	0 (0)
	Steelhead/rainbow	417	0	636 (813)	0	34 (5)
	Cutthroat trout	0	0	0 (0)	0	6 (0)
	Brook trout	0	0	24 (0)	0	0 (0)
	TOTAL	682	2083	1445 (848)	4490	74 (7)
K4	Steelhead/rainbow[2]	0	0	82	0	19
	Cutthroat trout[2]	0	0	37	0	22
	Brook trout	0	0	74	0	1
	TOTAL	0	0	193	0	42
G1a[3]	Brook trout	34	0	453	0	46
G1b[3]	Brook trout	0	0	0	0	0
GT1[4]	*Brook trout*	--	--	--	--	*48*
G2[4]	*no fish*	--	--	*0*	*0*	*0*
K5[4]	*Brook Trout*	--	--	*67*	*0*	--
K6[4]	*Brook trout*	--	--	*3*	*0*	*2*

Notes:

[1] Numbers in parentheses indicate snorkel and trap data collected on April 19, 1998. Additionally, a snorkel survey for adult steelhead was conducted in K2 and K4. No adult steelhead were found during the survey; however, one >36-inch steelhead was incidentally observed in reach K1.

[2] Because most, if not all, of these two species showed evidence of hybridization, identification was based on dominant phenotype.

[3] To more accurately describe the fisheries in this reach, the reach was split into two sections, G1a is the section below the migration barrier and G1b is upstream.

[4] Although not part of the survey, data was obtained to provide additional information. K5 was sampled just below confluence with G1, and K6 was sampled just above G1. This was qualitative data only, no estimate of fish/acre or fish/trap should be assumed.

Snorkel observations and trapping in the reach document that fish sizes are very small. This could be caused by: 1) slow growth caused by marginal food availability due to the extremely unproductive, oligotrophic water; 2) fishing pressure; or, 3) a combination of the two. Fishing pressure on the small fish population found here could easily remove the larger fish. Survey crews during 1997 observed active fishing and camping within this reach of Ketchikan Creek.

Most rainbow and cutthroat showed evidence of hybridization with each other. This is not surprising given the limited population sizes in this reach and the tendency of these two species to readily hybridize.

Three hundred and thirty-four feet upstream from the start of the reach is where Scout Creek enters Ketchikan Creek (**Figure 12**). This creek is important because it contributes more than half of the flows to the by-pass reach during low-flow periods (i.e., the flow in K4 above this point is half of the flow below). A qualitative fish snorkel survey in April 1998 found cutthroat/rainbow hybrids in Scout Creek and what appeared to be pure cutthroat in Scout Lake and upper portions of the stream. This finding suggests that this is the recruitment source for the cutthroat remaining in Ketchikan Creek.

There are unconfirmed reports from local fisherman that historically (possibly 35 years ago or more) steelhead made it upstream to Rainbow Falls. This was likely before the old growth timber created the migration barrier at the top of the canyon.

3139 feet upstream from the tailrace is Rainbow Falls, and is the end of Reach K4. Rainbow Falls has a vertical drop of approximately 35 feet. As its height suggests, it definitely is (and historically was) a migration barrier to all fish species.

Reach K5. This reach extends from Rainbow Falls to the confluence with Granite Basin Creek (**Figure 12**).

A second 35-foot falls occurs near the upper end of this reach (**Figure 12**). It is very similar to Rainbow Falls. As its height suggests, this falls is a definite permanent migration barrier, and was so historically.

No aquatic habitat and no formal fisheries data were collected in this reach during the 1997 survey. However, qualitative fisheries data were collected at the upper end of the reach (between the second 35-foot falls and Granite Basin Creek). The data were obtained by snorkeling and trapping optimum habitats. Both snorkeling and trapping found only eastern brook trout (**Table 16**). Although not sampled, the section of the reach between Rainbow Falls and the 2nd 35-foot falls likely contains brook trout and possibly rainbow and cutthroat as found in K4.

Reach K6. This reach extends from Granite Basin Creek to the outlet of Ketchikan Lakes (**Figure 12**).

This reach was not formally surveyed; however, qualitative snorkeling and trapping were conducted in optimum habitats to determine species occurrence (**Table 16**). As was noted for upper K5, only brook trout were found.

Granite Basin Creek. Reaches G1 and G2 comprise the Granite Basin Creek segment of the Ketchikan Creek System that was surveyed. Also included in the Granite Basin Creek segment is GT1, which is a tributary to Granite Basin Creek:

Reach G1. This reach starts at the mouth of Granite Basin Creek and ends at KPU's Granite Basin Diversion. This is the reach where flows from upstream are bypassed to Fawn Lake (**Figure 12**).

This reach has relatively good aquatic habitat with the exception of its reduced flows as explained below. It had the best pool-to-fastwater ratio of any of the reaches and, although dominated by bedrock, had several sections with suitable spawning substrates (**Table 15**). It also has a relatively low (2 percent) gradient.

The only species of fish found in Granite Basin Creek was the nonnative eastern brook trout. Furthermore, they were only found up to a migration barrier in reach G1 (1352 feet upstream). Therefore, for fisheries discussions, reach G1 is divided into two sections. G1a is the fish-bearing section (below the migration barrier) and G1b in the remaining section (**Table 16**).

During low flow periods, reach G1 (the bypassed reach of Granite Basin) has some sections of stream flowing subsurface (beneath the substrate). These sections have a few permanent pools that provide some habitat to support the limited brook trout population.

Reach G2. This reach extends from KPU's Granite Basin Diversion to the first lake on Granite Basin Creek (**Figure 12**).

This was not a formally surveyed stream reach. However, trapping and qualitative snorkeling of optimum habitat was conducted to provide information on presence/absence of fish species above the diversion. No fish were found in this reach.

Reach GT1. This reach consists of a small tributary stream just upstream of where the penstocks cross Granite Basin Creek (**Figure 12**).

This reach was not surveyed for aquatic habitat. However, fish traps were set to document the large numbers of brook trout fry observed. Its size is limited (<0.5 cfs flow, <0.1 ft average depth, and <3 ft. average width during the 1997 survey). Despite its limited size, hundreds of fry were seen throughout this tributary, indicating its importance as a spawning tributary and probable recruitment source for lower Granite Basin Creek (G1a). Two fish older than a year were recorded in this reach (**Table 16**).

Ketchikan Lakes. According to an ADF&G survey of Ketchikan Lakes, fish species within Ketchikan Lakes include cutthroat trout, sticklebacks, cottids, and nonnative eastern brook trout (ADF&G 1995). ADF&G records show that the brook trout population originated from a U.S. Forest Service stocking of 5,000 fingerlings in 1931 from Yes Bay Hatchery.

The ADF&G survey reports that the Lakes substrates generally consist of bedrock and talus, with some muck in the depths. However, there are good spawning grounds at the primary inlet to the Lakes. The Lakes are approximately 640 acres in size with an estimated maximum depth of 200+ feet in the upper lake. The Lakes are oligotrophic, probably resulting in a fishery with slow growth rates.

All of Ketchikan Lakes water, except infrequent spills, is diverted from its historic course of Ketchikan Creek (**Figure 11**). The intake pipe for this diversion is located in the lower levels of Lower Ketchikan Lake. Because this is a shallow lake, water temperatures are strongly influenced by seasonal air temperatures.

Fish were observed rising in Fawn Lake during the 1997 survey. Conversations with KPU staff indicated that the fish migrate to and from Ketchikan Lakes via the penstock. Fawn Lake is a manmade lake created for this Project to route water to the powerhouse.

Environmental Impacts and Recommendations

Reduction of Flows in Bypassed Reaches. Flows in the bypassed reaches (K3-K6, G1) will continue to be bypassed. Accordingly, this will result in continuation of reduced aquatic habitat in the bypassed section (except potentially for K3 as discussed above). This reduces available resident fish spawning and rearing habitat and reduces habitat for periphyton and macroinvertebrates, lowering productivity and the fishery's food supply.

Reduction of flows will primarily affect resident fish species. This is because anadromous fish only occur in the lower 1284 feet of the bypassed section (reach K3) and this reach has very poor spawning habitat. Good potential spawning habitat only occurs upstream of a falls impassible by anadromous fish.

Upper parts of the bypassed section (K5, K6, G1) were documented to be dry (except subsurface flow) during low rain periods, leaving only residual pools to sustain fish. This likely reduces the fish populations by increasing stress, competition, and predation.

KPU will continue to restrict fishing in the Project area. Because the bypassed section appears to be unproductive and may not be able to support fishing pressure, these restrictions will help maintain current population levels.

Modification of Instream Flow Below the Tailrace. The ADF&G reports that abrupt decreases in water discharge into the creek from the Project have, in the past, resulted in high mortality to rearing juveniles (Denton 1996). This and other ADF&G information on fry strandings suggests that some level of impact occurs. The effect on the fishery resulting from potentially abrupt decreases in flow is currently unquantified.

KPU's ramping rates are conducted to maximize power production (taking into account the Project's other operational needs) and protect's the fishery below the tailrace by maintenance of 35 cfs flow. Accurate ramping rate information is currently not known. Therefore KPU is currently conducting studies to collect the necessary streamflow data to enable the calculation of ramping rates.

While the effect of the minimum flow level on the fishery has not been quantified, the current flow regime supports a significant wild pink salmon fishery with spawning occurring throughout the reaches of Ketchikan Creek below the tailrace. Furthermore, KPU's ability to store water and guarantee at least 35 cfs below the tailrace may benefit the fishery during no-rain periods compared to pre-Project flows. This is because it is likely that pre-Project (unregulated) flows were less than 35 cfs during some of these no-rain periods. Additionally, the 35 cfs minimum flow requirement has increased minimum instream flows substantially, with flows recorded as low as 3.6 cfs prior to the requirement.

Because the Project started modifying flows in 1903, no true data on the unregulated flows exist. However, estimates of unregulated flows have been synthesized and indicate that the current regulated flows more closely approximate the ADF&G's requested flows than would unregulated flows. This indicates that the Project has improved the instream flows over natural unregulated flows. Furthermore, the hydrologic analysis indicates that operation of the Project has significantly reduced peak flows compared to unregulated flows.

The ADF&G's instream flow study (ADF&G 1988) indicates that their seasonal flow requests would improve the fishery over the current regulated flows. However, further manipulation of flows to achieve the ADF&G's requests would reduce power production and disrupt how KPU operates their entire hydroelectric system on the island.

Temperatures Below the Tailrace and at the Hatchery. Stream temperatures in Ketchikan Creek below the tailrace (during the limited data set of the fall temperature monitoring) was found to reach a maximum of 19.4°C, and that the tailrace waters average at least 1.3°C higher than the water upstream (with a maximum of 3.4°C higher). Additionally, the hatchery's temperature data recorded a maximum average monthly temperature of 16.1°C (in August) and an instantaneous maximum of 18.0°C.

While the limited data collected in the Fall of 1997 indicate that the tailrace water is warmer than the by-pass reach, it is not known if it is Project-related. This is because there is no pre-Project temperature data and it is very likely that temperatures in the by-pass reach were warmer than what occurs now. For example, during pre-Project conditions, the warmer Ketchikan Lakes water was a major portion of the water in the by-pass reach. This likely resulted in warmer water at the above tailrace sample location than occurs currently.

Any Project-created water temperature increases would likely be relatively insignificant compared to the temperature increases resulting from water retention time/solar radiation in Ketchikan Lakes. However, possible Project-related temperature increases could be the result of heat transfer from the turbines, heat friction from water passing through the penstocks, and solar warming of water in above ground penstocks and Fawn Lake. (The latter is unlikely due to the lack of retention time in the penstocks and Fawn Lake.)

Regardless of whether the warm water temperature is natural or Project-induced, these data indicate temperature could be affecting the survival rates of salmon during incubation. Alderdice and Velsen (1978) determined that the upper limit for 50 percent egg mortality of Chinook salmon was 16°C when incubation temperature was constant. However, the data indicate that temperatures probably do not stay at or above 16°C throughout the incubation period. Additionally, temperatures typically are lower during September and much lower during October, potentially reducing the adverse effects to the eggs.

Continuation of the Project has not adversely affect temperature problems at the Deer Mountain hatchery for the following reasons. The hatchery was built when the Project's operations were already in place. Therefore, any temperature problems experienced at the hatchery were present from the beginning of hatchery operations. Furthermore, the hatchery uses refrigeration techniques to remedy the temperature problem.

<u>Other Impacts</u>. KPU will continue to restrict fishing of the predominate non-native brook trout within Ketchikan Lakes. Because the lakes appear to be unproductive and may not be able to support fishing pressure, these restrictions will help maintain current population levels. Furthermore, KPU has committed to conducting a lake fishery study if the lakes are opened to fishing in the future.

It is unlikely that the Project's fluctuations of lake levels adversely affect brook trout populations within Ketchikan Lakes. This is because the brook trout population was not established until after the Projects operation was already in place; therefore, the population has developed under any operational flow fluctuations. Furthermore, there is protection afforded to the Ketchikan Lakes fish habitat due to KPU's filtration avoidance program (required for the City's water supply which also comes from this Project). Under this program, KPU is restricted by the EPA from drawing down the water levels in Ketchikan Lakes to a great extent. This restriction would not likely allow the reduction of brook trout spawning habitat to the level where it would affect the existing population. Based on water-level drawdown restrictions at Ketchikan Lakes, continuation of existing operations would probably have negligible effects on the lakes' current fish populations.

Because the Ketchikan Lakes intake is located away from shoreline fisheries habitat and the water supply requirements limit water-level drawdowns, entrainment affects on the fishery is expected to be low. Additionally, there is no entrainment potential at the intake tunnel entrance on Granite Basin Diversion because surveys conducted in 1997 document the absence of fish populations in this segment of Granite Basin.

Adult salmonids were observed to be falsely attracted to the Project's higher-velocity tailrace during their upstream spawning migrations. This false attraction can result in delaying the upstream migration of these fish (FERC 1995). Although this delay is occurring, true impacts from this are most likely minimal because the amount of spawning habitat (accessible to salmon) above the tailrace is limited.

Installation of the dam at the outlet of Ketchikan Lakes and installation of the Granite Basin Creek diversion have most likely resulted in some loss of alluvial material recruitment to Ketchikan Creek and lower Granite Creek. However, aquatic habitat surveys conducted in 1997 indicate good quality and quantity of spawning substrates in the system, especially in reaches K2, K4, and G1.

6. Wildlife Resources

Affected Environment

Wildlife habitat in the vicinity of the Project spans numerous ecosystems, based on altitude and proximity to water. Important species which characterize the area include wolf, black bear, bald eagle, Sitka black-tailed deer, river otter, beaver, squirrels, ducks, swans, seagulls, and ptarmigan.

Information for wildlife resources was obtained from previous mammal monitoring reports, Forest Service, USFWS, and ADF&G. The wildlife resource is upland in nature and is comprised of these basic groups big game, furbearers/predators, small mammals, raptors, songbirds, reptiles and amphibians. In addition, Forest Service sensitive and federally listed threatened and endangered species occur or may occur within the Project Area. Habitat types within the Project area include the following:

<u>Big Game</u>. The Project area is contained within ADF&G Management Unit 1A. This Unit encompasses all of Revillagigedo Island as well as inland areas. Numerous big game species are known to occur within the Project area. These species include Sitka black-tailed deer (*Odocoileus hemionus-sitkensis*), black bear (*Ursus americanus*), and mountain goat (*Oreamnos americanus*). Sitka black-tailed deer are the most common big game species within the area and are expected to use all habitat types within the Project Area (CH_2M Hill 1994).

<u>Furbearers/Predators</u>. Furbearers/predators are also very common within the Project Area. Typical species include the wolves (*Canis lupus*), mink (*Martes vison*), weasel (*Mustela nivalis*), marten (*Martes americana*), and river otter (*Lutra canadensis*). In general, these species occur in relatively low numbers (CH2M Hill 1993). Although expected to occur, no beavers have been documented to occur within the Project Area (CH2M Hill 1995).

<u>Small Mammals</u>. Numerous small mammal species are known to occur within the Project Area. These species include deer mice (*Peromyscus maniculatus*), meadow vole (*Microtus* sp.), red-backed vole (*Clethrionomys rutilis*), masked shrew (*Sorex cinereus*), northern water shrew (*Sorex palustris*), red squirrel (*Tamiasciurus nudsonicus*), and northern flying squirrel (*Glaucomys sabrinus*). Although these species are found within all habitat types within the area, the recent three-year study of the area determined that the local small mammal populations are relatively low (CH2M Hill 1995).

<u>Raptors</u>. Several raptor species are expected to occur within the Project Area. The most common species include the bald eagle (*Haliaeetus leucocephalus*), great-horned owl (*Bubo virginianus*), and sharp shinned hawk (*Accipter striatus*) (KPU, 1992). These species are expected to occur within suitable habitats throughout the Project Area.

<u>Waterfowl and Shorebirds</u>. Numerous waterfowl and shorebirds are anticipated to potentially occur within the Project Area. However, their numbers and diversity are expected to vary by season. Common species may include harlequin ducks (*Histrionics histrionics*), surf scoter (*Melanitta perspicillata*), Canada goose (*Branta canadensis*), great blue heron (*Ardea herodias*), and greater yellowlegs (*Tringa melanoleuca*). These species are anticipated to occur on both Fawn and Ketchikan lakes or any other open water habitats within the Project Area.

<u>Songbirds</u>. The number and variety of songbirds varies by season and habitat type. Some of the more common species include rufus

hummingbird (*Selasphorus sasin*), American dipper (*Cinclus mexicanus*), varied thrush (*Ixoreus naevius*), belted kingfisher (*Ceryle alcyon*), pine siskin (*Carduelis pinus*), raven (*Corvus corax*), crow (*Corvus brachyrhynchos*), gray catbird (*Dumetella carolinensis*), chickadee (*Parus* sp.).

Reptiles and Amphibians. Reptile and amphibian species are not common within the Project Area. However, species identified within the area include rough-skinned newt (*Taricha granulosa*), boreal toad (*Bufo boreas boreas*), and wood frog (*Rana sylvatica*). These species are expected to inhabit the wetter areas within the Project Area.

Wildlife of Special Concern. The Forest Service has identified six Forest Sensitive species as occurring or potentially occurring within the Project Area. **Table 17** identifies these species, potential habitat, and potential for occurrence within the Project Area.

Environmental Impacts and Recommendations

No additional impacts to wildlife beyond those that occurred during initial construction activities are anticipated. Habitat use by species has likely stabilized in response to long-term Project operations. As no changes to Project operations are proposed, there would be no changes to habitat conditions and access.

7. Endangered, Threatened, and Sensitive Species

Affected Environment

The USFWS has not identified any threatened or endangered species as occurring within the Project Area. However, they have indicated that the arctic peregrine falcon may occur in the area as a seasonal migrant. This species may forage throughout the Project Area. While the Queen Charlotte goshawk has not been listed by the USFWS as a threatened or endangered species, it may be listed in the near future. Therefore it is also addressed in this section (as well as being included in **Table 17**.

Queen Charlotte Goshawk. The Queen Charlotte goshawk occurs in the temperate rain forests of coastal Alaska and British Columbia. On the Tongass National Forest, goshawks appear to select closed, multi-storied canopy forests for nesting. The typical tree species selected for nest sites is the hemlock. In addition, nesting sites are located in hoomogenous habitats with few openings. Prey species for the goshawk varies by availability. The most common species taken is Steller's jay (*Cyanocitta stelleri*), grouse (*Dendragapus spp.*), varied thrush (*Ixoreus naevius*), red squirrel (*Tamiasciurus hudsonicus*), and woodpeckers (*Picedes spp.*). However, sharp-shinned

Table 17 Forest Sensitive Species		
Common Name/ Scientific Name	**Potential Habitat**	**Potential for Occurrence within the Project area**
Montague Island tundra vole (*Microtus oeconomus elymocetes*)	Moist and wet tundra habitats. Is only known from Montague Island (USDA Forest Service 1990).	Low, Based on a three-year small mammal study within the Project area which did not locate this species.
Trumpeter swan (*Cygnus buccinator*)	Nests within marshes, lakes, beaver ponds, oxbows, and backwaters of rivers (Sphar 1991). Wetlands on the northern portion of the Tongass National Forest (USDA Forest Service 1997b).	Low, typically not found on this portion of the Forest; some may stop at local lakes during migration.
Dusky Canadian goose (*Branta canadensis occidentalis*)	Nests in close proximity to lakes, reservoirs, streams, rivers, of various sizes. Populations are only known from the Copper River Delta in south central Alaska (USDA Forest Service 1990).	Low, populations are not known from the Project Area.
Queen Charlotte goshawk (*Accipiter gentilis laingi*)	Dense coniferous forests, particularly productive old-growth stands. This subspecies is non-migratory (USDA Forest Service 1997b).	Moderate, based on suitable habitat within the Project Area.
Osprey (*Pandion haliaetus*)	Nests within hemlock/ spruce forests near streams or coastal beach (USDA Forest Service 1997b).	Moderate, based on suitable habitat within the Project Area.
Peale's peregrine falcon (*Falco peregrinus pealei*)	Associated with large sea bird colonies located on the outer coasts or nearby islands. Nests occur on cliffs ranging in height from 20 to 275 meter high (USDA Forest Service 1997b).	Moderate, based on suitable habitat within the Project Area.

hawks (*Accipiter striatus*), alcids (Aldidae) yellowlegs (*Tringa spp.*), ptarmigan (*Lagopus spp.*), and northwestern crow (*Corvus caurinus*) also may be taken (FWS 1997).

Environmental Impacts and Recommendations

With the exception of potential seasonal use of the Project Area by the arctic peregrine falcon, the absence of threatened and endangered species in the Project Area would result in no additional impact from the proposed continuation of Project operations. Although operations could reduce the effectiveness of habitat for peregrine in residence, the limits on human use of the Ketchikan Creek watershed may provide some overall benefits for a transient seeking short-term foraging opportunities. The Project is not likely to affect the arctic peregrine falcon.

Impacts to the Queen Charlotte goshawk are not anticipated. This conclusion is based on the following considerations. Any goshawks that already occur I the area would be accustomed to existing and ongoing activities in the area. Also, the limits on human use of the Ketchikan Creek watershed, may provide some overall benefit to goshawks occurring in the area. Finally, since no new facilities are proposed as a part of this Project, no loss of potential goshawk habitat is anticipated. Therefore, the Project is not likely to affect the Queen Charlotte goshawk.

8. Aesthetics

Affected Environment

The Ketchikan Creek watershed provides the major vertical visual backdrop to the City of Ketchikan. Forest-covered Minerva Mountain at 2602 feet rises north of town. The southern peak of the Deer Mountains is directly east of Ketchikan. The 3001-foot peak summits above timberline. The tundra-covered ridge line runs north, paralleling the Ketchikan Lakes, with Roy Jones Mountain, Northbird Peak, and John Mountain all peaking at elevations above 3000 feet. Small, high elevation alpine lakes, including Granite Basin, lie in cirques in the subalpine zone. Dude, Brown and Diana Mountains delineate the northern border of the Ketchikan Lakes watershed. They range in elevation from 2848 feet to 3014 feet and are all above timberline. The northern peaks are not visible from Ketchikan, but may be seen from the waterways surrounding Ketchikan.

Principle locations from which a significant number of people would view Project facilities are from the City of Ketchikan and from the Deer Mountain Trail. The facilities that are visible from the City include the powerhouse and substation at the south end of the penstocks within city limits. No other facilities are visible from the City. The penstocks are obscured from view by heavy vegetation. All other facilities are screened by the rugged topography and vegetation.

Ketchikan Creek flows through the western half of the City of Ketchikan. The creek provides a scenic landscape that enhances the visual quality of the city's setting.

The Deer Mountain summit is a popular destination hike for area residents and visitors. The trail switchbacks up the southern slope of Deer Mountain southeast of the Project's power facilities, and provides scenic views overlooking Ketchikan, Tongass Narrows, and Ketchikan Lakes. The Ketchikan Lakes add visual variety to the uniformly forested and mountainous landscape for hikers who have attained the ridgeline on the Deer Mountain Trail. Project pipelines and penstocks are screened by vegetation, topography, and distance to views from the trail. The other facilities attract little viewer attention and do not dominate the landscape as viewed from the trail.

Tongass National Forest Visual Resource Management. The Tongass NF has developed management directives for visual resources in enacted municipal watersheds. The visual resources of the Ketchikan District of the Tongass National Forest have been assessed and inventoried by the Forest Service using the Visual Management System (VMS) guidelines (Forest Service, 1974). Visual Quality Objectives (VQOs) have been established for the area and are based on the management activities authorized in the watershed. VQOs are designed to provide objectives for visual management of the land and define the acceptable level of change that an action may introduce into the landscape. The Ketchikan Lakes watershed has been inventoried by the Forest Service and two VQOs have been assigned in this area: Retention (R) and Partial Retention (PR). Retention is the predominate VQO on Forest Service lands within the Ketchikan Creek watershed. Upper Ketchikan Lake and surrounding slopes and slopes above the eastern shore of Lower Ketchikan Lake are a PR VQO area. Use of Ketchikan Lakes as part of the Project did not change the pre-Project character of the water, as it is a modification of a natural lake.

Environmental Impacts and Recommendations

Impacts to visual resources from the continued operation of the Project facilities would be minimal and limited to short-term effects caused by clearing of vegetation above buried conduits needing repair or maintenance. Significant contrasts in color and texture would be addressed by the re-establishment of vegetative cover shortly after the completion of repair/maintenance activities.

9. Cultural Resources

Affected Environment

A cultural resource inventory and literature review was completed by Campbell (1997). A brief summary of the findings of that report is presented here. The Project is located on Revillagigedo Island in the State of Alaska within traditional territory of the Tlingit. Few archaeological investigations have been conducted previously in the Project vicinity, but prehistoric and historic sites are known to exist in the area. Prehistoric and Native American sites that have been documented in the area include villages, camps, fish weirs, rock art, middens, culturally modified trees, totem poles and burial sites. The terrain around the Project area is rugged, and most substantial settlements were probably located along narrow coastal strips or at the mouths of inlets.

Improvements to the water supply system and power plant began in the early 1900s. Notable improvements included a water tunnel in 1903, a flume in 1906, a dam and a tramway in 1911, a new powerhouse in 1912, four dams in the early 1920s, and a vehicle road in 1957. Cultural resource surveys were conducted of the road, and of the tramway corridor following Ketchikan Creek. Five cultural features were identified and recorded by these surveys (KET-519 through KET-523). The first four are related to the Ketchikan water control and power facilities. The fifth feature (KET-523) is a stone fish trap of unknown age across Ketchikan Creek. The historic features were the ruins of the tramway (KET-519), the abandoned power lines (KET-520), a wooden stave penstock (KET-521), and a storage alcove blasted out of the bedrock (KET-522).

Environmental Impacts and Recommendations

The documented sites retain poor physical integrity, and do not have the potential to yield information important in history. However, the Project Area exhibits the potential to contain buried cultural deposits that may not be visible to surface inspection. The currently proposed relicensing will not involve any ground disturbance, and will not affect any significant historic properties. If future developments will involve ground disturbance, intensive surveys of these areas of potential effect should be completed to insure that no undocumented cultural resources are impacted.

Development of the water and power supply systems for Ketchikan began in 1902, and improvements have continued periodically over the intervening years. The principal dam at Ketchikan Lake built in 1911 retains its log core, but is superficially a fairly typical earth and rubble structure. The rock-filled crib dams at the south of Ketchikan Lake are also comparatively nondescript. The fact that the combined capacity of the hydroelectric generation was among the largest in the region in the 1920s does not make these features historically significant. Little remains of the tramway but traces of its location. The powerhouse has been upgraded and replaced several times and does not retain any historic character. Similarly, the penstocks have been upgraded and replaced over the years and do not retain historic character. These features have played an important role in local history, and retain an integrity and continuity of function within the community. However, no unique or outstanding historic or engineering features remain, and the system as a whole retains little of the character of earlier episodes of historic importance. No aspect or feature of the water and power systems stands out as a property that should be considered for listing on the National Register, and improvements to the current and historic uses would be consistent with the integrity and continuity of function of these facilities.

10. Recreational Resources

Affected Environment

Recreation opportunities in the Ketchikan area are plentiful and occur on public and private lands. State-owned lands surround the coastal City of Ketchikan and separate the city from the Forest

Service land located further inland. Traditional recreational uses of the local area have included hunting, hiking and fishing.

Ketchikan is a popular vacation destination in southeast Alaska. In 1995, over 600 cruise ships docked at Ketchikan, bringing over 300,000 annual passengers. Sport fishing is a popular activity in southeast Alaska. Charter fishing sales have grown at the rate of 29 percent annually since 1988 in the Ketchikan Borough.

The Project's study area for recreation resources includes the Ketchikan Creek watershed, which surrounds the Project Area. Most of the watershed and the Project facilities are in the Ketchikan District of the Tongass National Forest. Although recreation opportunities on Forest Service-administered lands typically include hunting, fishing, hiking, backpacking, wildlife viewing, kayaking and boating; the Project area, including Ketchikan Lakes and Fawn Lake, are closed to public access due to their use as the Ketchikan municipal water supply. By an Act of Congress dated July 27, 1939, the municipal water supply is protected jointly by the City of Ketchikan and the Forest Service. The Act states that this land is ... *reserved from all forms of location, entry, or appropriation, under the mineral or nonmineral land laws of the United States, and set aside as municipal water-supply reserves for the use and benefit of the people of the city of Ketchikan, a municipal corporation of the Territory of Alaska....* Section 3 of this Act states that *The Secretary of the Interior and the Secretary of Agriculture are hereby authorized to prescribe and enforce such regulations as may be found necessary to carry out the purpose of this Act, including the right to forbid persons other than those authorized by them and the municipal authorities of said municipal corporation from entering or otherwise trespassing upon these lands, and any violation of this Act or of regulations issued thereunder shall be a misdemeanor and shall be punishable as is provided for in section 5050, Compiled Laws of Alaska, 1933.*

To open this watershed to general use, including public recreation, would threaten the City's ability to continue to meet the Surface Water Treatment Rule of the Safe Drinking Water Act. Increased use of the watershed, lakes, and streams could reduce water quality of the municipal water supply below standards set by the EPA. Substandard water quality would require the construction of a water treatment facility at a cost of approximately $20 million. Also, open access to the watershed would require additional manpower by KPU and the Forest Service to patrol and maintain this area.

The Tongass National Forest has developed objectives for recreation resources under the Municipal Watershed (MW) Land Use Designation. Under the MW land use, recreation uses will be authorized by the Forest Service officer with delegated authority, in consultation with the municipality and will be limited to those uses that will protect water quality and flow.

Developed Recreation. The Deer Mountain Trail is a National Recreation Trail in Tongass National Forest. The trail begins at the junction of Granite Basin and Ketchikan Dump roads, near the south end of the aqueduct. The trail switchbacks up the southern slope of Deer Mountain southeast of the power Project facilities, and provides scenic views overlooking Ketchikan and Tongass Narrows. The Deer Mountain summit and the nearby Deer Mountain Cabin are popular destinations for locals and visitors. North of the summit, the trail is on public lands in the Tongass National Forest and for short segments, crosses portions of the Ketchikan Creek watershed.

There are no other developed recreation sites within the watershed area. The Deer Mountain Cabin is located on the eastern boundary of the watershed between the Deer Mountain summit and the next summit to the northeast. The cabin is maintained by the Forest Service.

At one time several years ago, a tramway connected the city with a boat ramp, lodging and camping facilities at the south end of Lower Ketchikan Lake. The tramway and the facilities have been removed, and are no longer available for public recreational uses.

The proposed Carlanna Lake Recreation Area is about 1.25 miles west of Minerva Mountain on the western watershed boundary. Carlanna Lake was operated by KPU as part of the city water system until 1982. Currently, KPU owns a one acre parcel occupied by the dam, and the surrounding watershed is managed by the Bureau of Land Management (BLM). The lake provides fishing and boating opportunities.

Wilderness. There are several wilderness areas in southeast Alaska. The area nearest to the Ketchikan Lakes Power Project is the Misty Fiords National Monument Wilderness, located about eighteen miles to the east.

Recreation Activities. Hikers occasionally trespass on the road between town and the lakes, and Forest Service trails traverse the watershed. Fishing use along Ketchikan Creek below the fish hatchery increased between 1991 and 1994, with use of the creek ranging from 8 to 25 percent of the freshwater fishing in the Ketchikan area (an area including tributaries into waters stretching between Portland Canal and Ernest Sound, including drainages on Duke, Annette and Gravina Islands).

Ketchikan Creek is a hatchery and wild freshwater fishery. The creek provides fishing for several varieties of salmon and trout. The Deer Mountain Hatchery is located downstream of the hydroelectric plant, and is currently operated by the Ketchikan Indian Corporation.

The Project area is within State Game Management Unit 1. Various species of big game, fur animals, and small game and migratory birds are hunted in the unit. Big game includes black bear, brown bear, deer, goat, moose, and wolf.

The Outdoor Recreation Activity Demand, from the Ketchikan Community Survey, has identified a demand for roaded recreation opportunities. Most recreation opportunities in the region consist of activities in remote areas which are accessible primarily by boat or plane. The Forest Service and the Alaska Division of Parks and Outdoor Recreation currently provide some limited opportunities for roaded recreation.

Recreation Opportunity Spectrum. National Forest lands are inventoried and mapped by Recreation Opportunity Spectrum (ROS) class to identify the type of recreation opportunities available on public lands. The ROS system categorizes Forest lands in six classes, each of which is defined by its setting and by the possible recreation experiences and activities it affords. Tongass National Forest lands in the Ketchikan Lakes watershed have been inventoried and mapped with three ROS classes; Roaded Natural, Semi-Primitive Non-Motorized and Primitive (USDA Forest Service 1996).

The Roaded Natural (RN) class is characterized by a predominantly natural-appearing environment with evidence of moderate permanent resource alternation and utilization. Evidence of the sights and sounds of people is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from the sights and sounds of people. Lands of this ROS class include the penstock corridor, most of Fawn Lake, and southern third of the lower Ketchikan Lake northeast of the coastal, urban lands of the City of Ketchikan.

Semi-Primitive Non-Motorized (SPNM) class is characterized by few or subtle changes by people, with a high probability of isolation from the sights and sounds of people. Lands of this ROS class include portions of the Project area east of Fawn Lake and areas east and west of the northern two-thirds of the lower Ketchikan Lake.

The Primitive (P1) class is characterized by an essentially unmodified environment, where trails may be present but structures are rare, and where probability of isolation from the sights and sounds of people are extremely high. The upper Ketchikan Lake is surrounded by lands with the P1 ROS classification.

Environmental Impacts and Recommendations

Recreation opportunities in the Project Area and surrounding watershed would remain unchanged under the proposed action. Public access to Project facilities, including Ketchikan and Fawn lakes is currently prohibited, primarily because EPA regulations prohibit recreational access in municipal watershed districts that do not operate a water treatment facility. It is anticipated that Ketchikan will need to construct a treatment facility at some time in the future. When this occurs, recreational opportunities will be re-established in the watershed. The continued use of upper reaches of the watershed by hikers using existing Forest Service trails would continue to be allowed.

11. Land Use

Affected Environment

Physical and environmental factors have played a significant role in affecting the course of land use development in the region. The mountainous terrain has effectively restricted settlement in Ketchikan to the narrow strip of land about 30 miles long bordering the Tongass Narrows. Residential, community, and industrial development extend less than one mile inland from the coast. Ketchikan's commercial and industrial land uses are concentrated within the borough limits, as are the majority of residents.

Land ownership within and adjacent to the Project Area consists of federal lands in the Tongass National Forest, state lands, and municipal lands within the Borough of Ketchikan. The Project Area consists of Ketchikan Lakes, Fawn Lake, and narrow corridors surrounding the tunnels and the access road. There are a total of about 863 acres within the Project Area, of which about 778 are managed by the Tongass National Forest, 50 are controlled by the Alaska State Mental Health Trust, 32 acres are within the Borough of Ketchikan, and 5 acres are private (**Table 1**).

More than 90 percent of the land adjoining Ketchikan is under the jurisdiction of the Tongass National Forest. Despite the predominance of federal lands, a shift in land ownership has occurred in and around the borough over the last 25 years. Federal lands have changed to state ownership as a consequence of the Alaska Statehood Act and to Native ownership pursuant to the Alaska Native Claims Settlement Act (Public Law 92-203, 92nd Congress, H.R. 10367, December 18, 1971). Public lands surrounding the city were designated as State Mental Health Land by the U.S. Congress in 1956. Currently, the status and management of Mental Health Trust lands is being investigated to determine future management and uses.

The Ketchikan Borough lies within the coastal zone of southeast Alaska. Land and water uses have been identified by the Alaska Coastal Management Program (ACMP), and standards were developed for each use or activity. The nine major uses or activities are coastal development, geophysical hazards (developments in such areas), recreation, energy facilities, transportation and utilities, fish and seafood processing, timber harvest and processing, mining and mineral processing, and subsistence. Federal lands in Alaska are excluded from the coastal zone, pursuant to sec. 304(1) of the Coastal Zone Management Act of 1972.

Approximately 10 percent of the Project Area is located within the coastal zone on non-federal lands. The only land use in the Project Area is the operation of the existing Project, which is a major energy facility under ACMP guidelines. Both the Forest Service and the Native American Corporations actively harvest timber on their lands. Fishing and hiking comprise most recreational use in the area; motorized transportation is limited mostly to water craft, snowmobiles, and aircraft. There are few roads in the area. Subsistence uses consist of hunting, fishing and the use of other resources.

Access to the Ketchikan Lakes and to much of the Ketchikan Creek watershed is restricted for recreational use due to minimum water quality requirements placed on KPU by the EPA as part of the recertification of the municipal water supply system.

Tongass National Forest Land Management. The Ketchikan Lakes Municipal Watershed is reserved as a municipal water-supply by the Ketchikan Townsite Exclusion Act of July 27, 1939. The Tongass National Forest designates municipal watersheds with the land use designation MW (Enacted Municipal Watersheds). The Forest provides management directives for municipal watersheds. For the primary land uses within the watershed area, the land use designation standards and guidelines are:

Facilities

A. Construct no Forest Service Administrative facilities. Facilities such as dams, reservoirs, and pipelines are consistent with Land Use Designation objectives.

Fish

A. Plan the construction and maintenance of fish improvement projects only if they are compatible with the municipal watershed objectives.
   1. Restrict fish habitat improvements which result in reduced water quality for a municipality using the water from the affected stream.
   2. When planning fish habitat improvement projects, consider the effects of anticipated municipal water withdrawals.

Recreation

A. Provide only for those activities and recreation use levels that can be accommodated without detriment to water quality and flow.
B. Issue appropriate orders for regulating public use within the watershed, in cooperation with the municipality.

Subsistence

A. Permit subsistence activities in accordance with the federal, state, and local laws.

Timber

A. Forested land is classified as unsuitable for timber production.
B. No timber harvest is scheduled. Salvage may be considered on a case-by-case basis in consultation with the municipality.
C. Personal use wood and Christmas tree cutting activities are usually incompatible with Land Use Designation objectives.

Environmental Impacts and Recommendations

Continued operation of the Project facilities would not cause any change in land use in the Project Area. As no change in operations is proposed, no changes in adjoining land use due to the Project are anticipated.

12. Socioeconomics

Affected Environmental

The Ketchikan Gateway Borough had a population of 14,728 in 1996, an increase of 6.5 percent from the 1990 population of 13,828. In the City of Ketchikan, there were 8,729 people in 1996, an increase of 6.6 percent from the 1990 population of 8,263 (State of Alaska 1996c).

Ketchikan's per capita household income was $16,920 in 1990. The average household income for Ketchikan Gateway Borough was $46,114 in 1990, compared to $45,160 for the State of Alaska. The southeastern Alaska economy is based primarily on forestry, fishing, tourism and government services.

Ketchikan is a major port of entry in southeast Alaska. The primary industries are timber and wood products manufacturing, fishing and tourism. Harvests of Western hemlock and Sitka spruce from southeastern Alaska yielded 810 million board feet in 1992 (Cheshire, 1993). The annual timber harvest includes 430 million board feet derived from the Ketchikan Gateway Borough and Prince of Wales Island. Timber is derived from the Tongass National Forest, whose southern portions surround the Borough of Ketchikan, and from private land managed by Native American Corporations. The lumber and wood products industry employed between 1,000 to 1,200 workers in the Ketchikan Gateway Borough during 1990, with total earnings amounting to $12 million (KPU, 1992). In 1991, timber industry employment accounted for 15.2 percent of the area's total employment and 18.6 percent of the wages earned in the area (Cheshire, 1993).

The Ketchikan commercial fishery is based on salmon and halibut. Pink salmon is the major product, but runs of chum, king, coho and sockeye salmon are also harvested. Cod, dungeness crab and shrimp are also caught commercially. There are two canneries in Ketchikan. The value of the Ketchikan fishery is more than $90 million annually while providing more than 1,500 full time jobs (KPU, 1992). The average annual fishery salary in 1992 was $17,332.

Active marketing of southeastern Alaska as a vacation destination has resulted in substantial increases in tourists. Cruise ship activity tripled between 1982 and 1992, resulting in an estimated 236,700 passengers in 1992. By 1995, over 600 cruise ships docked at Ketchikan, bringing over 300,000 annual passengers. Charter fishing sales have grown at the rate of 29 percent annually since 1988. Gross annual hotel/lodge business sales in 1992 was $5,176,713 (Cheshire, 1993). Retail and hotel and lodging employed 1295 people in 1992 with average annual wages of $15,910.

Federal, state and local government services supported approximately 1860 employees in 1992, with an average annual income of $35,508. The federal government employed between 293 and 350 workers in the Ketchikan Borough depending on the season in 1992, predominantly in the U.S. Forest Service, the U.S. Coast Guard and the U.S. Post Office. The State Government employed between 521 and 612 individuals and the local government employed 817 to 1046 workers in 1992 (Cheshire, 1993).

Future economic growth in the borough is expected to occur in the tourism, construction and mining industries. U.S. Borax is currently evaluating the feasibility of developing a molybdenum mine at Quartz Hill. Most commercial construction is tied to the tourism industry. Current Projects include the Spruce Mill Development, a retail/office/lodging complex that will be completed by 2000. The timber and seafood processing industries face uncertain futures in Ketchikan (Tromble, 1996).

Water is piped to businesses and residences in Ketchikan by KPU from Ketchikan Lakes and Fawn Lake. Power is provided by three hydroelectric plants owned by KPU (Ketchikan Lakes, Beaver Falls, and Silvis Lake), the state-owned Swan Lake Hydro Facility, and KPU's diesel-fueled Bailey Power Plant. Currently, all of the water available in Ketchikan Lakes and at the Granite Basin Diversion is utilized for municipal water supply and electric generation.

The domestic water supply in Ketchikan currently ranges from a minimum of 2.5 million gallons to a maximum of 6.5 million gallons per day. This is equivalent to an average flow of 4 to 10 cfs. The water supply is taken from the penstock from Fawn Lake just before the water enters the powerhouse.

The city landfill has recently been improved with a bale fill system, recycling and resource reuse. Refuse is also shipped out-of-state. There are seven public schools in Ketchikan Gateway Borough. Medical services are provided by Ketchikan General Hospital, Ketchikan Medical Clinic and the Southeast Surgical Clinic (State of Alaska; 1996a, 1996b).

Environmental Impacts and Recommendations

As operations of the Project would continue unchanged, the Project would continue to provide electricity to the KPU system and its customers. Services to residents of the Ketchikan area would remain mostly unchanged.

D. No Action Alternative

Under the No Action Alternative, KPU would continue to operate the Project as a source of both electricity and drinking water supply within the limits of its facilities and regulatory requirements. No changes in current use and management would occur. Both short- and long-term changes in water flow and use would be the same as for the Proposed Action Alternative. As described for the Proposed Action, additional impacts to resources under the No Action Alternative would be minimal to none.

VI. Developmental Analysis

In this section, the effects that alternatives for continued Project operation and decommissioning would have on the Project's potential power benefits are compared. In the following section, it is attempted to balance the environmental benefits and developmental costs of any alternatives developed for the Project.

A. Continued Project Operation

To calculate the economic benefits of continuing to operate a utility-owned Project, the staff compares the Project costs for each alternative -- the Project as proposed and the Project with staff-recommended enhancements -- to the power `benefits', as represented by the cost of obtaining the same amount of capacity and energy using other resources. Consistent with the Commission's new approach to economic analysis (72 FERC ¶ 61,027), the staff equate the power benefits to the current (1997) cost the utility would have to pay; the staff does not consider any future inflation effects in their analysis.

1. Proposed Action

There are no new developments proposed in this application, and therefore no anticipated costs for new development. An economic assessment was conducted for the Project to analyze the gross economics of the proposed action. This assessment is provided in Volume I of this application. The gross capital cost of the Project to KPU is $6,069,366 as of December 31, 1995. The accumulated depreciation on the plant as of the same date was $1,853,050, leaving the net plant in service cost at $4,216,316. The actual construction cost of the Project is unknown. Initial development was started by others, in 1903. Several improvements were made by the previous owner, Citizens' Light, Power and Water Company, prior to purchase of the Project by KPU in 1935 for $760,000. Following purchase of the Project by KPU, a number of capital improvements have been made, resulting in the above noted book values.

2. Mitigation

Mitigation and enhancement measures have been included as part of the Applicant's proposal as shown in **Section III.A.3**. The agencies have recommended a number of mitigative measures that, along with the proposed measures, would affect the Project economics by adding directly to the Project costs by conducting studies or mitigating impacts. The relative costs and benefits of these measures are presented in **Table 18**.

B. Project Decommissioning

As discussed in Section III, the Project serves the dual purpose of providing a municipal water supply in addition to hydroelectric generation. Therefore, retirement of the hydroelectric facilities would be limited to those facilities not involved in water collection, storage, and conveyance for the municipal water system.

Retiring the Project would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. During the application consultation process, including scoping, no agency commented or recommended Project retirement.

Under this alternative, the Project would discontinue generating electricity by hydropower. Given the demand for electricity, the loss in energy would require compensation from additional diesel engine powered generation or new hydropower. The powerhouse and associated electric facilities would be removed or converted for other approved uses. In summary, the effects of retiring the Project and maintaining the dams and reservoirs for the municipal water supply are:

- The energy the Project generates would be lost. The Project currently generates between 16 and 23 kWh of electricity annually. Replacing this energy with diesel generation would adversely affect air quality and the cost of electricity.

- Retiring the powerhouse and other appurtenant facilities would have a significant cost.

Dam removal is not a viable alternative because this Project is also used as the primary drinking water supply source for the community.

Table 18 Costs and Benefits of Proposed and Recommended Mitigation and Enhancement		
Enhancements, Mitigation	**Benefits**	**Present Worth**
Install Weirs Below Ketchikan Lakes Dam and Granite Basin Diversion to Monitor Seepage and Maintain Flows in By-pass Reach	Habitat Enhancement	$20,000
Continue to Maintain 35 cfs at Tailrace	Habitat Enhancement	No Cost
Continue to Provide 4.5 cfs to Deer Mountain Fish Hatchery	Stock Enhancement	No Cost
Continue to Manage Watershed to Protect Water Quality	Maintain Water Quality	$50,000
Continued Use of Deer Mountain Trail Within Watershed	Recreation	No Cost
Monitor Temperature of Seepage Flows Below Ketchikan Lakes Dam for One Year If KPU Proposes Improvements	Habitat Enhancement	$5,000
Donation to ADF&G for removing the five-foot Fish Barrier on Ketchikan Creek Below Rainbow Falls, and for Improving Fish Rearing Habitat in Ketchikan Creek Between the Tailrace and Existing Fish Ladder, and/or Passage Improvements in Schoenbar Creek	Habitat Enhancement	$15,000
Conduct Flow Monitoring for One Year Upstream of the Tailrace to Measure Seasonal Variability of Flows in the By-pass Reach	Ramping - Habitat Enhancement	$28,000
Reopening Ketchikan Lakes Watershed to Public Recreation if Water Treatment Facility is Constructed (Develop Recreation Plan/Management by Forest Service)	Recreation	$30,000
If Public Recreation Access is Opened to Ketchikan Lakes, Conduct Fish Studies in Ketchikan Lakes	Recreation, Study	$50,000
Install Remote Water Level Monitoring Equipment at Fawn Lake to Allow Greater Lead Times for Making Flow Ramping Decisions	Habitat Enhancement	$8,000
Install Oily Water Separator to Remove Oils from Tailrace Waters	Water Quality Habitat Enhancement	$40,000
	Total Present Worth	**$246,000**

VII. Comprehensive Development and Recommended Alternative

Section 4(e) of the Federal Power Act (FPA), 16 U.S.C. 797(e) and 803(a)(1), requires the Commission, in acting on applications for license, to give equal consideration to the power and developmental purposes and to the purpose of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality. Section 10(a)(1) of the FPA requires that any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. When FERC reviews a project, the recreational, fish and wildlife, and other non-developmental values of the involved waterway are considered equally with its electric energy and other developmental values.

In this section, the benefits and costs of the alternatives are weighed. These include (1) KPU's Proposed Action with environmental enhancement measures; (2) the Proposed Action with additional environmental enhance measures recommended by the agencies; and (3) the No Action Alternative. The environmental enhancement measures proposed by KPU are presented in **Section III.A.3**.

Based on the review and evaluation of the Project alternatives and the No Action Alternative, we have selected the Proposed Action with KPU's recommended enhancement measures as the preferred option. These measures are discussed below.

By-pass Flows - By-pass flows in Ketchikan Creek would continue to be provided through a combination of seepage flows from the Ketchikan Lake dam and Granite Basin Diversion and inflows from tributaries. KPU would monitor the seepage and agrees to maintain minimum flows at the monitored levels even if future maintenance were to reduce or eliminate seepage. If KPU ever plans to improve the Ketchikan Lakes dam, they will monitor the temperature of the seepage flows over a one-year period prior to making any improvements.

Tailrace Minimum Flow - KPU would continue to maintain a 35 cfs minimum flow at the tailrace. A flow by-pass valve on one of the 36-inch penstock lines is already in place to maintain the required 35 cfs minimum flow from the penstock to the large tailrace chamber in the event that all three turbines are shutdown.

Fish Hatchery Flow - KPU would continue to provide 4.5 cfs flow to the Deer Mountain Fish Hatchery.

Habitat Improvements - KPU will donate $15,000 to ADF&G for removing the five-foot barrier on Ketchikan Creek downstream of Rainbow Falls, and to mitigate impacts to resident fish in the by-pass reach to develop and implement a plan for improving fish rearing habitat in Ketchikan Creek between the tailrace and the existing fish ladder, and/or passage improvements in Schoenbar Creek. Removal of the barrier is intended to allow the passage of anadromous fish. Neither the agencies nor KPU can commit to the effectiveness of this measure

Ramping Rates - KPU will calculate hourly flows through the turbines by statistically correlating power output (kW) to flow rates (cfs). This will allow determination of ramping rates. KPU will then consider alternate ramping options that do not negatively affect Project operations but would be more beneficial to the fishery downstream of the tailrace. KPU will also install remote water level monitoring equipment (SCADA) at Fawn Lake to allow greater lead times for making flow ramping decisions which will in turn enable a decrease in ramping rates.

Recreation - KPU would continue to restrict access to the Project area as required to maintain water quality. Use of the Deer Mountain Trail in the upper portions of the watershed would continue. If KPU constructs a water treatment facility, KPU will consult with the Forest Service about reopening the Ketchikan Lakes watershed to public recreation. If public recreation access is opened to Ketchikan Lakes, KPU will consult with ADF&G about conducting fish studies in Ketchikan Lakes.

VIII. Consistency with Comprehensive Plans

Section 10(j)(2) of the Federal Power Act requires the Commission to consider the extent to which a Project is a consistent with federal and state comprehensive plans for improving, developing, and conserving waterways affected by the Project. Twenty-two plans are currently on the Commission list of comprehensive plans for the state of Alaska. Three of these plans and two additional local plans address resources relevant to this Project, and are discussed below.

A. Tongass National Forest Land and Resource Management Plan (LRMP)

The LRMP divides the Tongass National Forest into management areas through Land Use Designations (LUDs) and it provides direction for managing activities in those areas. Approximately 90 percent of the Project Area occupies National Forest system lands. The LUD for the Ketchikan Creek watershed, which includes 90 percent of the Project area, is designated as Municipal Watershed (MW). Goals for this MW are to maintain the watershed as municipal water supply reserves, in a manner that meets State of Alaska Drinking Water Regulations and Water Quality Standards for water supply. Objectives to meet the goals for this LUD are to:

1. Limit most management activities to the protection and maintenance of natural resources; fish habitat enhancements, and watershed and wildlife improvements, may occur if they are compatible with the municipality's watershed management objectives.

2. Classify forested land as unsuitable for timber production; salvage logging will only occur after consultation with the municipality.

3. Recreation uses will be authorized by the Forest Service officer with delegated authority, in consultation with the municipality, and will be limited to those uses that will protect water quality and flow.

The setting should generally be natural; however, facilities or structures to provide municipal water supplies may be present.

Based on the analysis presented in this EA, the continued operation of the hydroelectric generation facilities and the diversion facilities for the municipal water supply would be consistent with the goals and objectives of the LRMP. Changes in water management and recreational access and use are not proposed. No new construction or facilities with accompanying disturbance are proposed. Use would be consistent with the Municipal Watershed LUD.

B. North American Waterfowl Management Plan (NAWMP)

The NAWMP sets goals for conserving North American waterfowl through cooperative planning and management. The plan provides the framework for a waterfowl conservation effort by describing population and habitat goals and suggesting recommendations to resolve problems of international concern through the year 2000. The plan's intent is to set the stage for the development of national, flyway, provincial, territorial, and state plans that contain specific management measures for waterfowl conservation in the United States and Canada. The plan recognizes that habitat loss and degradation is the major waterfowl problem in North America and sets habitat conservation as a top priority.

Anticipated minimal impacts from the continued operation of the Project would be limited to the temporary displacement of waterfowl from the Project's lakes due to the other human activity involved in Project maintenance. Due to the limited and minimal impacts likely to result from continued operations, the Project would be consistent with the NAWMP.

C. Alaska Outdoor Recreation Plan (AORP)

Based on a survey of 2,865 residents, the AORP identifies citizen preferences and suggested actions to address outdoor recreation issues in the state. The plan identified the following issues:

- The state needs to maintain its recreational land base.
- The outdoor recreation needs of urban Alaskans must be met with sites near people's homes.
- Cooperation among agencies is essential to successfully meet state recreation needs.
- Preserving and protecting Alaska's culture and history is critical in maintaining the state's distinct identity.
- High quality outdoor recreation experiences must be perpetuated and enhanced.

The Project would have minimal affect on outdoor recreation. The relicensing of the Project and the continuation of operations with no changes, including the continued restrictions for recreational use of the watershed along with continued use of existing recreational trails would result in no change to outdoor recreational opportunities in the Ketchikan area. Known and yet undiscovered cultural resources in the Project Area and surrounding watershed would likely remain undisturbed due to the limitations on access and activity posed by the federal designation of the watershed as a protected, municipal watershed.

IX. Finding of No Significant Impact

This DEA for the Ketchikan Lakes Hydroelectric Project has been prepared in accordance with the National Environmental Policy Act of 1969. The Proposed Action includes enhancements and some unavoidable impacts.

Unavoidable impacts are those associated with the continued flow modifications associated with the Project. Several environmental enhancements would be provided by KPU to mitigate these impacts and improve on existing conditions. These are summarized in **Table 18**.

On the basis of this independent environmental analysis, issuance of a license for the Project with our recommended environmental measures would not constitute a major federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not required.

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Appendix A Forest Service Section 4(e) Conditions

The Forest Service indicated in their letter dated June 3, 1998 that they are not prepared to submit draft 4(e) conditions at this time. This section is reserved for insertion of 4(e) conditions by FERC staff once they are received.

Appendix B Fish and Wildlife Service Recommendations

Under the provisions of the Federal Power Act (FPA), as amended by the Electric Consumers Protection Act of 1986, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the Project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Preliminary Terms and Conditions

Based on the information available to date, the FWS recommends that the concerns discussed above be addressed by the conditions listed below. In some cases (e.g., habitat improvements, temperature impacts, etc.), FWS has recommended that the applicant conduct additional analyses or propose a specific plan of action. Dependent upon the result of such analyses, these preliminary conditions are subject to change. In the case of condition number one, once a plan is developed, a date can be inserted into the conditions where indicated.

KPU's responses to these recommendations are indented and *italicized.*

1. As mitigation for impacts to spawning and rearing trout and salmon in the by-pass reach and below the Project tailrace, salmonid rearing habitat shall be improved in Ketchikan Creek below the tailrace and anadromous fish passage shall be improved at the mouth of Schoenbar Creek and the 5-feet high falls above the tailrace, according to a Habitat Improvement Plan approved by the U.S. Fish and Wildlife Services Alaska Department of Fish and Game, and National Marine Fisheries Service, dated (to be developed). Quarterly construction progress reports and annual post-construction effectiveness-monitoring reports shall be submitted to the resource agencies named above and the Federal Energy Regulatory Commission. Should the proposed actions not achieve the quantitative goals specified in the Plan, the contingency actions described in the Plan shall be taken.

    KPU will donate $15,000 to ADF&G for removing the five-foot barrier on Ketchikan Creek downstream of Rainbow Falls, and as mitigation for impacts to spawning and rearing trout and salmon in the by-pass reach and below the

Project tailrace to develop and implement a plan for improving fish rearing habitat in Ketchikan Creek between the tailrace and the existing fish ladder, and/or passage improvements in Schoenbar Creek. Removal of this barrier is intended to allow the passage of anadromous fish. Neither the agencies nor KPU can commit to the effectiveness of this measure.

2. Flows through the tailrace shall not be reduced by more than 30 cfs per hour, at a rate not to exceed ½ cfs in any 1-minute period when flows in Ketchikan Creek immediately below the tailrace are less than 100 cfs. When flows in Ketchikan Creek immediately below the tailrace are greater than 100 cfs, flows through the tailrace shall not be reduced by more than 60 cfs per hour, at a rate not to exceed 1 cfs in any 1-minute period.

   KPU will calculate hourly flows through the turbines by statistically correlating power output (kW) to flow rates (cfs). This will allow determination of ramping rates. KPU will then consider alternate ramping options that do not negatively affect Project operations but would be more beneficial to the fishery downstream of the tailrace. KPU will also install remote water level monitoring equipment (SCADA) at Fawn Lake to allow greater lead times for making flow ramping decisions which will in turn enable a decrease in ramping rates.

3. Turbines shall be equipped with by-pass valving and/or deflector plates to ensure flow continuation in the event of load rejection. The ramping rates described in condition 2 shall not be exceeded during such events.

   A flow by-pass valve on one of the 36-inch penstock lines is already in place to maintain the required 35 cfs minimum flow from the penstock to the large tailrace chamber in the event that all three turbines are shutdown.

4. Flows may be increased by a maximum of 60 cfs in any 24-hour period, and may be decreased by a maximum of 30 cfs in any 24-hour period.

   KPU will use the SCADA system at Fawn Lake to provide alternate ramping options that do not negatively affect Project operations.

5. Condensate and leakage from turbines and other equipment shall be collected and treated to remove oil or other contaminants before being discharged.

In 1997, KPU completed the installation of an oily water separator and a plumbing refit in the powerhouse to remove all oil from water before it is discharged into the Project tailrace.

There is currently a spill prevention containment control (SPCC) plan in place for KPU's operations at the powerhouse. KPU will investigate the quality of the discharged water to determine if contaminants are present.

6. Water temperature shall be continuously monitored at the tailrace and in Ketchikan Creek immediately above the tailrace. Temperature probes shall be permanently installed in a manner to shield them from direct warming by the sun.

KPU is currently monitoring temperature for one full year. The recorders are shielded from the sun and continuously record temperatures every hour.

7. Water discharged through the tailrace shall be within 1 degree Celsius of the water in the creek above the tailrace.

KPU is currently investigating seasonal variations in water temperatures by conducting one year of hourly temperature data above and below the tailrace. While the limited data collected last fall indicate the tailrace water is warmer than the by-pass reach water, it is not known if this is Project-related. There is no historical temperature data available. Furthermore, without the hydro project, Ketchikan Lakes would warm the water before being spilled into the by-pass reach potentially making the pre-hydro project Ketchikan Creek water warmer than what occurs presently at the "above tailrace" sample location. KPU does not believe that requiring tailrace water to be within 1 degree of water at this sample location is valid given the uncertainty of this temperature representing a natural temperature condition.

For water temperatures, KPU has committed to monitor the temperatures of seepage flows. This was the only temperature issue raised at the interagency meeting held in Ketchikan to discuss these issues.

8. The licensee shall propose and fund a study to evaluate the status of fisheries in Ketchikan Lakes, and shall implement measures deemed necessary to correct impacts caused by the hydropower project when public access and fishing opportunities are restored to Ketchikan Lakes. The study

proposal shall be submitted to the Federal Energy Regulatory Commission, U. S. Fish and Wildlife Service, and Alaska Department of Fish and Game within 6 months of access restoration and shall be approved by the Federal Energy Regulatory Commission prior to implementation.

If KPU constructs a water treatment facility, KPU will consult with the Forest Service about reopening the Ketchikan Lakes watershed to public recreation. If public recreation access is opened to Ketchikan Lakes, KPU will consult with ADF&G about conducting fish studies in Ketchikan Lakes.

Appendix C National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)

Under the provisions of the Federal Power Act (FPA), as amended by the Electric Consumers Protection Act of 1986, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the Project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Preliminary Recommendations

The NMFS recommendations include the following. KPU's responses to these concerns are indented and italicized.

1. Ramping rates should not exceed a change of more than about 1 inch/hour in variously configured channels. This would be equivalent to a change in the range of 30 to 50 cfs/hour depending on streambed configuration and total discharge. Down ramping is of greater concern due to potential fish entrapment in isolated pools. Daily limits on ramping rates, based on synthetic data derived from Fish Creek, should be 60 cfs/day for rising water and 30 cfs/day for falling water at total flows of less than 100 cfs. At higher discharge rates of over 100 cfs, the drainage can accommodate greater unit cfs changes (which constitute a lesser percentage of total discharge over a greater area of streambed). NMFS recommends reductions of no more than 60 cfs at total flows exceeding 100 cfs.

    KPU will calculate hourly flows through the turbines by statistically correlating power output (kW) to flow rates (cfs). This will allow determination of ramping rates. KPU will then consider alternate ramping options that do not negatively affect Project operations but would be more beneficial to the fishery downstream of the tailrace. KPU will install remote water level monitoring equipment (SCADA) at Fawn Lake to allow greater lead times for making flow ramping decisions which will in turn enable a decrease in ramping rates.

2. Instream flows below the powerhouse must be maintained at a minimum of 35 cfs. If discharge drops below that level, the

ADF&G, FWS, and NMFS shall immediately be notified to allow for assessment of damages to fishery resources.

KPU does currently and will maintain a minimum flow of 35 cfs below the powerhouse. Furthermore, *a flow by-pass valve on one of the 36-inch penstock lines is already in place to maintain the required 35 cfs minimum flow from the penstock to the large tailrace chamber in the event that all three turbines are shutdown. KPU currently notifies FERC of any license condition breaches.*

3. Tailrace water temperatures shall not exceed 16°C over an 8-hour period. If this is a recurrent problem, the operator shall investigate and operational changes to reduce discharge temperatures.

For water temperatures, KPU has committed to monitor the temperatures of seepage flows if such flows are to be replaced in the future. This was the only temperature issue raised at the interagency meeting held in Ketchikan to discuss these issues. KPU cannot commit to limitations of tailwater temperatures because there are no opportunities to change them. A suggestion was made that a potential way to change the temperature of waters existing the tailrace would be to relocate the inlet at Ketchikan Lakes. This would not only be prohibitively expensive but would also not significantly alter temperatures. This is because the available data shows only a 1.3°C difference between tailrace and by-pass reach flows. The tailrace water is likely to be most affected thermally by traveling through penstocks and tunnels as well as its retention time in Fawn Lake. This would account for the small temperature difference. No other changes to the system to modify temperature would be possible. Also, because the hatchery was built after the hydro-project, they have incorporated refrigeration in their system to handle water temperatures outside their optimal range.

4. An assessment shall be made of alluvial deposits below the powerhouse to determine if sufficient alluvium is being provided to maintain spawning habitats.

The aquatic study conducted for this Project indicates that there are sufficient spawning substrates below the powerhouse (reach K-2). If additional habitat is suggested, *it could be provided from the funds made available by KPU for fisheries mitigation.*

5. Mitigation for impacted fisheries shall be provided by engineering improvements to the perched Schoenbar Creek culvert. Improvements should include a fish ladder or other structural modifications to assure fish access into the culvert at all water levels. Velocities inside the culvert should be examined to determine the benefit of including rocks or baffles within the culvert to reduce velocities or provide resting spots for up-migrating fish. Furthermore, the "Five-Foot Falls" on Ketchikan Creek shall be examined to determine the feasibility of removing this barrier to enhance anadromous fish passage to spawning and rearing habitats in section K4. A report shall be provided to the ADF&G, FWS, and NMFS. If such modifications are determined to have benefit, they shall be implemented by KPU in consultation with ADF&G, FWS, and NMFS.

KPU did not engineer or install the culvert in question and the fish passage problems are a result of poor design/installation and not the hydro project operation. As a result, this would be considered off-site mitigation.

KPU will donate $15,000 to ADF&G for removing the five-foot barrier on Ketchikan Creek downstream of Rainbow Falls, and as mitigation for impacts to spawning and rearing trout and salmon in the by-pass reach and below the Project tailrace to develop and implement a plan for improving fish rearing habitat in Ketchikan Creek between the tailrace and the existing fish ladder, and/or passage improvements in Schoenbar Creek. Removal of this barrier is intended to allow the passage of anadromous fish. Neither the agencies nor KPU can commit to the effectiveness of this measure.

Appendix D Alaska Department of Fish and Game Recommendations

Under the provisions of the Federal Power Act (FPA), as amended by the Electric Consumers Protection Act of 1986, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the Project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Preliminary Comments

The ADF&G concerns include the following. KPU's responses to these concerns are indented and italicized.

1. Water flow in Ketchikan Creek above the powerhouse must be maintained at a minimum equal to the leakage water currently present from the Ketchikan Lakes dam, and all other downstream sources. Monitoring of these flows must be an ongoing program to allow ADF&G staff to evaluate those flows in relation to resident and anadromous species needs above the powerhouse.

   KPU will conduct flow monitoring for one year just upstream of the tailrace to measure seasonal variability of flows in the by-pass reach of Ketchikan Creek. The gaging will not be conducted to USGS specifications, but will obtain similar information.

2. A minimum of 35 cfs instream flow must be maintained at all times as currently permitted. Ramping rates need to be adjusted to meet current information on impacts on rearing and spawning fish, stranding and migration impedance.

   KPU will continue to maintain the 35 cfs instream flow below the tailrace. KPU will calculate hourly flows through the turbines by statistically correlating power output (kW) to flow rates (cfs). This will allow determination of ramping rates. KPU will then consider alternate ramping options that do not negatively affect Project operations but would be more beneficial to the fishery downstream of the tailrace. KPU will install remote water level monitoring equipment (SCADA) at Fawn Lake to allow greater *lead times for making flow ramping decisions which will in turn enable a decrease in ramping rates.*

3. Currently, public access to Ketchikan Lakes is prohibited but upon a change in this limitation, KPU will fund at a minimum a one year study of the resident species located in these lakes.

   If KPU constructs a water treatment facility, KPU will consult with the Forest Service about reopening the Ketchikan Lakes watershed to public recreation. If public recreation access is opened to Ketchikan Lakes, KPU will consult with ADF&G about conducting fish studies in Ketchikan Lakes.

4. Mitigation for spawning and rearing loss by rapidly changing stream flows will include barrier modifications in Schoenbar Creek, spawning habitat improvements, and modification of the 5 ft. Barrier falls located above the powerhouse. These programs will be developed in coordination with ADF&G and may be expanded to include contributions to operation of the Deer Mountain Hatchery.

   KPU will donate $15,000 to ADF&G for removing the five-foot barrier on Ketchikan Creek downstream of Rainbow Falls, and as mitigation for impacts to spawning and rearing trout and salmon in the by-pass reach and below the Project tailrace to develop and implement a plan for improving fish rearing habitat in Ketchikan Creek between the tailrace and the existing fish ladder, and/or habitat/passage improvements in Schoenbar Creek. Removal is intended to allow the passage of anadromous fish. Neither the agencies nor KPU can commit to the effectiveness of this measure.

   The Ketchikan Lakes Hydro facilities predate the Deer Mountain Hatchery. As in the past, KPU will continue to provide a source of water for the hatchery. KPU does not propose to provide any monetary contributions to the operation of the hatchery.

5. KPU should explore methodology to correct high water temperatures occurring during summer months in water provided to the Deer Mountain Hatchery.

   KPU is currently investigating seasonal variations in water temperatures by conducting one year of hourly temperature data above and below the tailrace. While the *limited data collected last fall indicate the tailrace water is warmer than the by-pass reach water, it is not known if this is Project-related. There is no historical temperature data available. Furthermore, during pre-Project conditions, Ketchikan Lakes would warm the water before entering the by-pass reach potentially making the pre-hydro Project Ketchikan Creek water warmer than what is indicated at the "above tailrace" sample location. As stated above, the Ketchikan Lakes Hydro facilities predate the hatchery. The hatchery has been developed and operated with full knowledge of the existing conditions. It is KPU's understanding that this condition has been addressed in the past by refrigeration at the hatchery.*

For water temperatures, KPU has committed to monitor the temperatures of seepage flows. This was the only temperature issue raised at the interagency meeting held in Ketchikan to discuss these issues.

Appendix E Relationship of License Process to Laws and Policies

Federal Power Act: The Project is currently operating under a license issued by the Commission on June 30, 1982 (¶62,569 Federal Energy Guidelines).

Clean Water Act: An Application for 401 certification was submitted to the Alaska Department of Environmental Conservation (ADEC) on May 30, 1997. A description of the Ketchikan Lakes Hydroelectric Project operations and a summary of water quality data derived from the inlet to the municipal water supply was attached to that request. The ADEC has indicated they will review and act on KPU's request after FERC issues the pubic notice on the final EA.

Alaska Historic Preservation Act: "*An Archeological Survey of Ketchikan Creek and the Ketchikan Lake Area, Ketchikan, Alaska for the Federal Energy Regulatory Commission Relicensing Project No. 420*" was prepared in 1997. Five cultural features were identified. The documented sites retain poor physical integrity, and do not have the potential to yield information important in history. However, the Project Area exhibits the potential to contain buried cultural deposits that may not be visible to surface inspection. The currently proposed relicensing will not involve any ground disturbance, and will not affect any significant historic properties. Development of the water and power supply systems for Ketchikan began in 1902, and improvements have continued periodically over the intervening years. The principal dam at Ketchikan Lake built in 1911 retains its log core, but is superficially a fairly typical earth and rubble structure. The rock-filled crib dams at the south of Ketchikan Lake are also comparatively nondescript. The fact that the combined capacity of the hydroelectric generation was among the largest in the region in the 1920s does not make these features historically significant. Little remains of the tramway but traces of its location. The powerhouse has been upgraded and replaced several times and does not retain any historic character. Similarly, the penstocks have been upgraded and replaced over the years and do not retain historic character. These features have played an important role in local history, and retain an integrity and continuity of function within the community. However, no unique or outstanding historic or engineering features remain, and the system as a whole retains little of the character of earlier episodes of historic importance. No aspect or feature of the water and power systems stands out as a property that should be considered for listing on the National Register, and improvements to the current and historic uses would be consistent with the integrity and continuity of function of these facilities.

The Alaska Office of History & Archaeology was provided a copy of the preliminary draft environmental assessment and draft application for this project on February 27, 1998. A letter was sent to the Alaska Office of History & Archaeology on June 8, 1998 along with a copy of the archaeological survey requesting concurrence with the recommendation that the project will not adversely affect significant cultural resources.

Coastal Zone Management Act: A Coastal Project Questionnaire was completed and submitted to the Alaska Department of Governmental Coordination (ADGC) on June 18, 1997. ADGC has indicated that they will coordinate a State of Alaska review for consistency with the Coastal Zone Management Program when they receive public notice from FERC asking for comments, terms and conditions as well as sufficient information to allow analysis of impacts, and all required State and federal permit applications are submitted. In a letter dated June 8, 1998, the Ketchikan Gateway Borough has found that the Project is generally consistent with the Ketchikan District Coastal Zone Management Program base on: D.3. To preserve Ketchikan's opportunities to develop hydroelectric resources in an economical and environmentally sound manner.

Appendix F Project Contact List

Alaska Department of Environmental Conservation
Mr. Dave Sturdevant
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Industrial Operations
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Juneau AK 99801-1795

Alaska Division of Governmental Coordination
Alaska Office of Management and Budget
Ms. Lorraine Marshall
Project Review Coordinator
PO Box 110030
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Alaska Department of Fish and Game
Mr. Jack Gustafson
Habitat Division
2030 Sea Level Drive
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Alaska Department of Fish and Game
Mr. Christopher Estes
333 Raspberry Road
Anchorage, AK 99518-1599

Cape Fox Corporation
Mr. Doug Campbell
Box 8558
Ketchikan, AK 99901

FERC
Mr. Charles R. Hall
Office of Hydropower Licensing
888 First St., NE
Room 52-67
Washington DC 20426

FERC
Mr. Mike Henry
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Portland, OR 97204

Ketchikan Indian Corporation Fish Hatchery
Mr. George Carnes, Manager
429 Deermount
Ketchikan, Alaska 99901

Ketchikan Indian Corporation
Ms. Corrine Garza, General Manager
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Ketchikan, Alaska 99901

Ketchikan Public Utilities
Mr. Ron Settje, Administrative Manager
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Ketchikan, AK 99901

Ketchikan City Administrator
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Ketchikan, AK 99901

Tongass Tribe
Ms. Beatrice Watson
Chairman, Tongass Tribe
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U.S. Geological Survey
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Supervisory Hydrologist
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U.S. Forest Service
Tongass National Forest
Ms. Theresa Trulock, Recreation, Key Contact
3031 Tongass Avenue
Ketchikan, AK 99901

U.S. Forest Service, Tongass National Forest
Ketchikan Ranger District
Mr. Jimmy J. DeHerrera, District Ranger
3031 Tongass Avenue
Ketchikan, AK 99901

U.S. Fish and Wildlife Service
Mr. Steve Brockman
P.O. Box 3193
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Ketchikan, AK 99901

U.S. Department of Commerce
National Marine Fisheries Service
Mr. Andy Grossman
Fisheries Biologist Protected Resources Management Division
PO Box 21668
Juneau, AK 99802-1668

Appendix G Consultation and Comment Letters Received

MEMORANDUM

State of Alaska Department of Natural Resources
Division of Mining & Water Management

Date: 29 May '98

To: Lorraine Marshall, DGC PRC

CC: See list

From: John Dunker, Water Resource Officer, Southeast Region

Subject: Ketchikan Lakes Hydro Draft FERC Relicense Apln. and PDEA

The Department of Natural Resources, Division of Mining & Water Management, Water Management Section has completed our review of Ketchikan's Draft FERC Relicense Application and PDEA for the Ketchikan Lakes Hydro Project. Following are our comments:

PDEA:

pp. 33 & 34, ADF&G Instream Flow Reservation Request:

This section could be improved by clarifying the legal effect of ADF&G's Instream Flow Reservation (IFR) application. As written, this section seems to imply that the pending IFR application creates an administrative context for reallocation of water under state law. A pending IFR application does not create a situation that challenges an existing water right, unless the water covered by the existing water right is no longer in use, in whole or in part, and is thus subject to revocation for abandonment or forfeiture. The filing of the IFR application merely results in a priority order being established for future allocation of any water that might become unappropriated, as in the case of the project's decommissioning.

pp. 34, Water Rights:

In this section, the description of the Deer Mountain Fish Hatchery water rights repeats an error in the ADNR water right certificate; the water is taken from the tailrace, not from the penstock, as stated.

Cc: Gary Prokosch, ADNR/DM&WM/Water

Christopher Estes, ADF&G/SportFish/RTS

Jack Gustafson, ADF&G/H&R

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

AES/ESO/KTN

JUN 1 1998

Mr. Larry Keith
Greystone
5231 South Quebec Street
Greenwood Village, Colorado 80111

Re: Ketchikan Lakes Hydroelectric Project
FERC Project No. 420

Dear Mr. Keith:

The U.S. Fish and Wildlife Service has reviewed your draft license application and preliminary draft environmental assessment (application and EA, respectively) for relicense of the Ketchikan Lakes Hydroelectric Project. We appreciate your efforts to keep the Service apprised of progress on this project. The recent meetings and site tours which you hosted helped us to understand your operational objectives and limitations.

Project Facilities: The existing system, as described in the application, includes a dam, intake structure, and penstock at Lower Ketchikan Lake (elevation 348 feet), which diverts water to Fawn Lake (a 3 acre, artificial reservoir at approximately the same elevation as Lower Ketchikan Lake). Upper and Lower Ketchikan Lakes were effectively combined into one lake by damming the outlet of the lower lake, and raising it to the level of the upper lake. Water from Granite Basin Creek, a tributary joining Ketchikan Creek downstream of Ketchikan Lakes, is also diverted to Fawn Lake. An intake structure at Fawn Lake supplies a 7-foot by 8-foot by 3,473-foot-long tunnel, which conveys a total of up to 280 cubic feet of water per second to three 36-inch-diameter by 360-foot long penstocks. These penstocks supply water to three horizontal axis, 1.4kW reaction turbines at the 88-foot-elevation powerhouse. An unspecified volume of water is simultaneously conveyed through the tunnel to two 12-inch diameter penstocks, to supply a nearby municipal water chlorination plant.

Water is discharged to a concrete chamber from which some water is diverted to the Deer Mountain Hatchery and some is diverted to small streams in the adjacent City Park. The balance is returned, through a 72-inch diameter corrugated metal pipe, to Ketchikan Creek.

Project Operation: The project is operated primarily to supply base load for the Ketchikan community. The project is also used to restore service when other units in the system are tripped off line. Although other projects in Ketchikan Public Utilities' system are used to follow peak loads, the EA states that "[t]here are hourly fluctuations in flows below the powerhouse in response to demands on the utility." Because the project supplies the least expensive power of any of KPU's facilities, a high priority is placed on generating the greatest possible amount of electricity from the available water. This is accomplished by avoiding spills from the Ketchikan Lakes dam, to the extent possible. Power output, and therefore water releases, are scheduled daily to balance various needs, including: 1) maintaining a sufficiently stable water level in Fawn Lake to provide low-turbidity water to the municipal water system; 2) maintaining adequate storage in Ketchikan Lakes to meet peak load demands (in concert with other facilities in the KPU system); 3) providing a minimum flow of 35 cfs below the powerhouse, as specified in the current Federal Energy Regulatory Commission license; and 4) avoiding spills from the Ketchikan Lakes dam. Adjustments in power and water outputs are made up to several times per day to balance these needs.

There is currently no regulatory restriction on the rate of downstream flow modification (ramping rates). Past ramping rates are not well described in the application and EA, beyond stating that reductions in flow from 125-175 cfs to 35-50 cfs occur regularly and may happen nearly instantaneously (EA, page 43 and Aquatic Resources Study[1], page 4-2).

Fishery: Ketchikan Creek supports anadromous runs of pink (*Oncorhynchus gorbuscha*), coho (*O. kisutch*), chinook (*O. tshawytscha*), sockeye (*O. nerka*) and chum salmon (*O. keta*), steelhead trout (*O. mykiss*), and resident populations of Dolly Varden char (*Salvelinus malma*), eastern brook trout (*S. fontinalis*), cutthroat trout (*O. clarki*), rainbow trout (*O. mykiss*), stickleback (*Gasterosteus aculatus*), and sculpin (*Cottus* spp.). Some of the Dolly Varden and cutthroat may also be anadromous. Chinook salmon and the summer coho run are not native to the system, but are maintained by the Deer Mountain Hatchery, a few hundred yards below the power plant. A fall run of coho salmon is native to the system. Because the stream flows through the city of Ketchikan, it supports an important recreational fishery. Fish produced in the stream and hatchery provide opportunity for a large regional sport and commercial salmon fishery in marine waters. A more complete analysis of the Ketchikan Creek fishery is found in the Aquatic Resources Study.

Preliminary Comments

Bypass Reach Flows: The application would be strengthened with additional information on water management within the Ketchikan Lakes/Ketchikan Creek system. For example, the effect of water diversions on flows and fish habitat in the bypass reach should be evaluated by describing the flows above and below the tailrace in terms of monthly exceedance flows and daily fluctuations.

Mitigation for spawning and rearing habitat lost by the dramatically reduced flows in this reach should be proposed. We suggest that habitat improvements, such as boulder clusters, wing deflectors, or other structural modifications downstream of the tailrace could be an effective mitigation strategy. Any such structures must be carefully designed to withstand seasonal high

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[1]Ketchikan Public Utilities. 1998. Aquatic resources study for the Ketchikan Lakes hydroelectric project. Feb., 1998.

flows over a long term (e.g., designed to withstand a 50- or 100-year flood event). It is particularly important to anchor or bed any such structures below the layer of cobbles or other bedload in the stream, and to ensure that flow is not directed into an unarmored bank.

Flow Fluctuation Rates: Flow fluctuations below the tailrace may occur several times in a 24-hour period, for the reasons discussed above, under "Project Operation." Another source of flow fluctuation are "upset conditions," during which the electrical load is rejected and the generators are tripped off line. In such circumstances, flows are ramped down as quickly as possible to the mandated minimum flow of 35 cfs. Apparently, this occurs approximately two to six times per year (EA, p. 32).

Work in the Pacific Northwest[2] has shown that flow reductions that result in water level ("stage") changes exceeding 1 inch per hour in the narrowest portion of a stream channel ("control reach") can result in stranding steelhead trout fry downstream. For salmon, this rate appears to be approximately 2 inches per hour in the control reach. Such events appear to be most harmful at low flows and less damaging at high flows. The rate of flow increase appears to be of less concern, as most of the observed impacts associated with such increases seem to be associated with the peak flows ultimately reached rather than the rate at which flow is increased.

Median flow for Ketchikan Creek, as defined by the 50 percent exceedance flow, is estimated at 95.4 cfs (EA, page 25). When flows are at or below this median, reductions of 50 cfs produce a stage change of approximately 1.9 inches (0.16 feet) in the control reach (EA, Table 1, page 32). To reduce the incidence of steelhead fry stranding, such changes should be spread over 2 hours, not within 30 minutes as reported in the EA (page 32) or "nearly instantaneous" as reported in the Aquatic Resources Study (page 4-2).

Better documentation of ramping rates would strengthen the EA. We recommend that hourly flow changes be calculated from power production records for 1 or more complete years. An analysis of down-ramping events should be presented in tables and graphs of exceedance values for the range of ramping rates documented. Additionally, a statistically reliable (e.g., 90 percent confidence level) sample of down-ramping events should be examined by 1-minute intervals, to document the true rate of change that fish in the system experience.

Daily Range of Flows: Reductions in flow of approximately 100 cfs over a 24-hour period occur at "a frequency of one out of three months" (Aquatic Resources Study, page 4-2), although it is not clear if this analysis relied on daily average flows or daily extreme (maximum and minimum) flows. Nor is it clear how many times in a given month such events may have occurred. For example, if these extreme flow reductions occurred from 1 to 30 times in 1 month but not in either the preceding or following month, the frequency could be termed "one out of three months." We recommend that the 24-hour flow range (maximum minus minimum) be presented

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[2]Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: a review of the biological effects, mechanical causes, and options for mitigation. State of Washington Dept. of Fisheries, Tech. Report No. 119. 46 pp.

for a period of 1 or more complete years, indicating all days with a net flow reduction. These data should be presented in exceedance curves and tables to allow a comparison to expected frequencies under natural conditions.

To model expected natural conditions in Ketchikan Creek, the Service[3] used data from nearby Fish Creek (in Thorne Arm), which has more than 50 years of daily discharge data. Daily flows were converted to cfs per square mile of drainage, and adjusted for the size of the Ketchikan Creek drainage. The number of days with declining flows outnumbered days with increasing flows, but daily flow increases were of greater magnitude, on average, than daily flow declines. This pattern is typical of natural streams, as runoff and flooding events are often sudden, while flow subsidence is normally spread over a longer period.

An exceedance analysis for days with declining flows indicates that half of the 24-hour flow reductions were declines of 10 cfs or less, and 75 percent of the daily declines were changes of 31 cfs or less. There were no instances of flow reductions greater than 96 cfs (Table 1). The Service recommends that daily flow reductions and increases caused by the project be limited to approximately the natural 25 percent exceedance level (i.e., 30 cfs for flow decreases and 60 cfs for flow increases).

Table 1. Percent of days that changes in flow equal or exceed specific magnitudes (cfs) in a 24-hour period for Ketchikan Creek under natural (unregulated) conditions. Data synthesized from Fish Creek USGS gage, adjusted for drainage area[3].

Percent Exceedance	24-hr Flow Reductions (cfs)	24-hr Flow Increases (cfs)
75	6.3	5.0
70	6.9	9.0
65	7.3	12
60	7.7	14
55	8.5	17
50	10	20
45	12	24
40	15	29
35	19	36
30	24	46
25	31	58
20	40	74
15	50	94
10	63	119
5	78	148
1	93	175
0	96	183

[3]Lyons, S. 1998. Memorandum of May 11, 1998, from Steve Lyons, Regional Hydrologist, U.S. Fish and Wildlife Service, to Steve Brockmann, Ketchikan Ecological Services. 5 pp.

Water Quality: Several chemical and physical characteristics of water in Ketchikan Lakes are quantified in the EA, but there is no discussion of how the project affects any of the parameters measured. We note that several instances of oily residue have been documented in the water at the Deer Mountain Hatchery. The potential for the project to result in discharge of oils to the hatchery and to Ketchikan Creek below the project tailrace, should be discussed as a project impact. Measures should be proposed to ensure that oil or other contaminants are not released into the water leaving the powerhouse. We understand that some or all of the lubricants used are non-toxic, vegetable-based oils, but we are nonetheless concerned that a large release could suffocate aquatic invertebrates or fish fry using margins of the stream, and could have dramatic impacts on hatchery operations. Coolants or other chemicals could similarly impact aquatic organisms if released to the stream and hatchery.

Temperature Elevation: Water temperature impacts are also a concern. The EA briefly summarizes the range of average monthly temperatures recorded at the Deer Mountain Hatchery (page 35 and 51), and notes that water from the power plant sometimes reaches temperatures warm enough to kill salmon eggs. These sections of the EA should also include a thorough discussion of temperature records from above and below the tailrace which, according to the Aquatic Resource Study, document tailrace water warming the stream by up to 3.4°C (6.1°F). The limited data in the report should be supplemented in the EA by additional data from temperature monitoring that we understand is currently being conducted.

An additional impact caused by artificially warm water that should be discussed in the EA is the resultant early emergence of fry, which likely does not coincide with availability of microscopic food organisms (which may be determined more often by photoperiod than temperature). Under natural conditions salmon incubation and emergence typically coincide with suitable food availability.

The EA should evaluate the causes of the warming. Among the possibilities are the artificially shallow forebays of Ketchikan and Fawn Lake. Solar radiation typically warms the bottom of such shallows, and the heat is transferred to the ponded water. Other possibilities include solar heating of the penstock between Ketchikan and Fawn Lakes, and transfer of heat from the powerhouse turbines.

Following an evaluation of the causes, KPU should evaluate potential corrective measures in the EA and propose a plan to correct the temperature problem in the application. Depending on the cause(s), actions such as deepening the forebays or cooling the tailrace water may be required. If ponding and warming in Fawn Lake is the primary cause of the warming, it may be most effective to simply eliminate this artificial lake and replace it with a valve arrangement linking Ketchikan Lakes and Granite Basin directly to the power tunnel. We note that deepening or eliminating Fawn Lake may provide additional benefits; improving water clarity for the municipal water supply thereby reducing or eliminating the need for sudden down-ramping events in Ketchikan Creek below the tailrace.

Wetland Impacts: Emergent wetlands are typically found near the inlets of many lakes in the region. These sedge-dominated communities are frequently important to many wildlife species, particularly nesting waterfowl. The EA should describe any such wetlands in the project area (e.g., at the upper end of Upper Ketchikan Lake), evaluate their use by wildlife, and the discuss the effects of project operation (e.g., lake stage fluctuations) on these wetlands.

Anadromous Fish Passage: Low flows in Ketchikan Creek below the tailrace appear to limit anadromous fish passage into and through the culvert at the mouth of Schoenbar Creek. At higher flows, passage is allowed (Aquatic Resources Report, page 3-9 to 3-10). To help ensure that project operation does not block access to Schoenbar Creek, a series of pools could be constructed below the culvert. Installation of notched baffles inside the culvert may also be necessary, to channel low flows and provide small resting pools.

Another anadromous fish barrier that appears to be caused at least partially by project flows is the 5-foot falls upstream of the project tailrace, in the bypass reach. Evaluation by Service and Alaska Department of Fish and Game biologists suggests that much greater obstacles are passed by salmon and steelhead on nearby streams with somewhat greater flows (e.g., Mahoney Creek). While restoring flows to the bypass reach may be the best way to restore natural fish passage, such an approach is not consistent with continued operation of the Ketchikan Lakes Hydroelectric project. Physical modification or removal of this barrier would open (or reopen) approximately ½ mile of good spawning and rearing habitat to anadromous fish. The effects of such an action on the resident fish population, bedload gravels, and fish habitat would require further consideration by the resource agencies and a plan for implementing and monitoring the project would be necessary. Improving passage to these spawning areas, which are not subject to the temperature elevation of the tailrace water as noted above, could help mitigate for loss of egg viability due to temperature impacts.

Any proposed modification of either migration barrier should be reviewed and approved by the Service, Alaska Department of Fish and Game, and the National Marine Fisheries Service prior to submission to Federal Energy Regulatory Commision as a mitigation proposal. Ultimately, approval of the Alaska Department of Fish and Game would be necessary to obtain a Title 16 permit to conduct the work.

Resident Lake Fishery: Ketchikan Lakes support populations of cutthroat trout, eastern brook trout, sticklebacks, and sculpins. No analysis of these populations has been done for the relicensing effort, and the effects of project operation on the populations are unknown. No fishing is allowed in the lakes because the lakes are a source of municipal drinking water, which currently meets standards for treatment by chlorination without filtration. Should filtration become necessary in the future, it is likely that the public access and fishing closures could be removed. At an April 16, 1998, meeting in Ketchikan, Ketchikan Public Utilities agreed to fund an analysis of the lake fishery, and any measures deemed necessary to correct impacts caused by the hydropower project if and when public access and fishing opportunities are restored to Ketchikan Lakes.

Preliminary Terms and Conditions

Based on the information available to date, the Service recommends that the concerns discussed above be addressed by the conditions listed below. In some cases (e.g., habitat improvements, temperature impacts, etc.), we have recommended that the applicant conduct additional analyses or propose a specific plan of action. Dependent upon the result of such analyses, these preliminary conditions are subject to change. In the case of condition number one, once a plan is developed, a date can be inserted into the conditions where indicated.

1. As mitigation for impacts to spawning and rearing trout and salmon in the bypass reach and below the project tailrace, salmonid rearing habitat shall be improved in Ketchikan Creek below the tailrace and anadromous fish passage shall be improved at the mouth of Schoenbar Creek and the 5-feet high falls above the tailrace, according to a Habitat Improvement Plan approved by the U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, and National Marine Fisheries Service, dated <u>(to be developed)</u>. Quarterly construction progress reports and annual post-construction effectiveness-monitoring reports shall be submitted to the resource agencies named above and the Federal Energy Regulatory Commission. Should the proposed actions not achieve the quantitative goals specified in the Plan, the contingency actions described in the Plan shall be taken.

2. Flows through the tailrace shall not be reduced by more than 30 cfs per hour, at a rate not to exceed ½ cfs in any 1-minute period when flows in Ketchikan Creek immediately below the tailrace are less than 100 cfs. When flows in Ketchikan Creek immediately below the tailrace are greater than 100 cfs, flows through the tailrace shall not be reduced by more than 60 cfs per hour, at a rate not to exceed 1 cfs in any 1-minute period.

3. Turbines shall be equipped with bypass valving and/or deflector plates to ensure flow continuation in the event of load rejection. The ramping rates described in condition 2 shall not be exceeded during such events.

4. Flows may be increased by a maximum of 60 cfs in any 24-hour period, and may be decreased by a maximum of 30 cfs in any 24-hour period.

5. Condensate and leakage from turbines and other equipment shall be collected and treated to remove oil or other contaminants before being discharged.

6. Water temperature shall be continuously monitored at the tailrace and in Ketchikan Creek immediately above the tailrace. Temperature probes shall be permanently installed in a manner to shield them from direct warming by the sun.

7. Water discharged through the tailrace shall be within 1 degree Celsius of the water in the creek above the tailrace.

8. The licensee shall propose and fund a study to evaluate the status of fisheries in Ketchikan Lakes, and shall implement measures deemed necessary to correct impacts caused by the hydropower project when public access and fishing opportunities are restored to Ketchikan Lakes. The study proposal shall be submitted to the Federal Energy Regulatory Commission, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game within 6 months of access restoration and shall be approved by the Federal Energy Regulatory Commission prior to implementation.

Thank you for your continued coordination with the Service. I anticipate that additional coordination will be necessary and my staff remains available to discuss any aspect of the project. I am confident that, with some modification, the Ketchikan Lakes Hydroelectric Project will continue to provide power for the community while reducing impacts on the important fishery that Ketchikan Creek sustains. If you have any questions, please contact Steve Brockmann in the Ketchikan Suboffice at (907) 225-9691.

Sincerely,

David B. Allen
Regional Director

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

June 1, 1998

Mr. Ron Settje
Ketchikan Public Utilities
2930 Tongass Avenue
Ketchikan, Alaska 99901

RE: Ketchikan Lakes Project, Preliminary Terms and Conditions, FERC 420-000

Dear Mr. Settje:

Thank you for the opportunity for my staff to meet with you and and other resource agency representatives to discuss the Ketchikan Lakes Hydroelectric Project. Pursuant to that meeting, and the report, "Aquatic Resources Study for the Ketchikan Lakes Hydroelectric Project," we offer the following comments and preliminary terms and conditions.

General Comments:

This project consists of diversions from two impounded lake systems, Ketchikan Lakes and Granite Basin Lake. Diverted water is impounded in an artificial reservoir, Fawn Lake. Final diversion from Fawn Lake takes water to a powerhouse bypassing the natural streambed from Ketchikan Lakes. Dam Seepage and other runoff continue to supply enough water through the bypass section to support some anadromous and resident fish populations above the powerhouse. Below the powerhouse, a minimum discharge of 35 cubic feet per second (cfs) is required. This lower section supports chinook, coho, sockeye, pink, and chum salmon, steelhead trout, and Dolly Varden char. Resident fish include eastern brook trout and cutthroat trout. A fish hatchery operates below the powerhouse.

There is debate regarding optimal and even adequate instream flows in the creek above the powerhouse in bypass reaches K3, K4, K5, and K6. Below the powerhouse, ramping appears to be a problem. Destruction of habitat, stranding of fish, and impacts to fish during sensitive life stages may result with excessive ramping rates. Temperatures of tailrace waters may at times be too high to ensure survival and vigor of salmonids during sensitive life stages. Finally, opportunities to improve fish access along the drainage system are available.

Anadromous fish do migrate above the powerhouse. More information on instream flows within reaches K3 to K6 should be obtained to improve capabilities for enhancement and management of these populations.

Preliminary Recommendations:

1. Ramping rates should not exceed a change of more than about 1 inch/hour in variously configured channels. This would be equivalent to a change in the range of 30 to 50 cfs/hour depending on streambed configuration and total discharge. Down ramping is of greater concern due to potential fish entrapment in isolated pools. Daily limits on ramping rates, based on synthetic data derived from Fish Creek, should be 60 cfs/day for rising water and 30 cfs/day for falling water at total flows of less than 100 cfs. At higher discharge rates of over 100 cfs, the drainage can accommodate greater unit cfs changes (which constitute a lesser percentage of total discharge over a greater area of streambed). We recommend reductions of no more than 60 cfs at total flows exceeding 100 cfs (See attached memorandum: Lyons to Brockman).

2. Instream flows below the powerhouse must be maintained at a minimum of 35 cfs. If discharge drops below that level, the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service shall immediately be notified to allow for assessment of damages to fishery resources.

2. Tailrace water temperatures shall not exceed 16°C over an 8-hour period. If this is a recurrent problem, the operator shall investigate and operational changes to reduce discharge temperatures.

4. An assessment shall be made of alluvial deposits below the powerhouse to determine if sufficient alluvium is being provided to maintain spawning habitats.

5. Mitigation for impacted fisheries shall be provided by engineering improvements to the perched Schoenbar Creek culvert. Improvements should include a fish ladder or other structural modifications to assure fish access into the culvert at all water levels. Velocities inside the culvert should be examined to determine the benefit of including rocks or baffles within the culvert to reduce velocities or provide resting spots for up-migrating fish. Furthermore, the "Five-Foot Falls" on Ketchikan Creek shall be examined to determine the feasibility of removing this barrier to enhance anadromous fish passage to spawning and rearing habitats in section K4. A report shall be provided to the Alaska Department of Fish and Game (ADFG), the U.S. Fish and Wildlife Service (USFWS), and the NMFS. If such modifications are determined to have benefit, they shall be implemented by Ketchikan Public Utilities in consultation with ADFG, USFWS, and NMFS.

If you wish to further discuss these preliminary terms and conditions or provide additional information or mitigation options, please contact Andrew Grossman, Habitat Conservation, (907) 586-7358.

Sincerely,

Steven T. Zimmerman, Ph.D
Assistant Administrator
Habitat Conservation

cc: ADFG, Ketchikan
Estes, ADFG, Anchorage
USFWS, Ketchikan
FERC, Washington, D.C.
Babson, GCAK, Juneau

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

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June 2, 1998

Mr. Larry Keith
Project Manager
Greystone
5231 South Quebec Street
Greenwood Village, CO 80111

Dear Mr. Keith:

SUBJECT: KETCHIKAN LAKES HYDROELECTRIC PROJECT, RELICENSE
SECOND STAGE CONSULTATION AND PDEA
STATE I.D. NO. AK9804-06JJ

The Division of Governmental Coordination has completed coordinating the State's review of the draft application dated February 1998 and applicant-prepared Preliminary Draft Environmental Assessment per the Federal Energy Regulatory Commission (FERC) consultation requirements under the Federal Power Act (FPA) and the National Environmental Policy Act (NEPA). This constitutes the second consultation stage per FPA, and an applicant-prepared environmental assessment process, under which the NEPA compliance actions are prepared at the front of the FERC process, along with the development of the license application.

The project is a hydroelectric project located at Ketchikan Creek, within and adjacent to the City of Ketchikan, which requires re-licensing by FERC. The project faiclities extend north from the city, across State lands, and into U.S. Forest Service lands. The project is owned and operated by the City of Ketchikan under the name of Ketchikan Public Utilities. The current license expires on 6/30/2000.

The project has been previously reviewed at the initial consultation and scoping document stages (State review No. AK9608-09JJ). During the prior first consultation stage, agencies were to provide resource information about the project area and request studies. Also, under NEPA, the reviewers were to identify environmental and socioeconomic issues, identifying issues that do not require detailed analysis, comment on cumulative impacts concerning this project, and identify reasonable alternatives that should be evaluated. According to DGC's record, the DEC comment was the only substantive technical comment received in the initial consultation review.

Also, a related project review was conducted for the Ketchikan Lakes road, State review No. AK9801-08JJ, Tongass Narrows 511.

At the second-stage consultation, the applicant provides a draft application, showing responses to comments made in the initial consultation stage, and the results of all studies and information gathering required by reviewers. At this stage, the reviewers are to provide written comments, preliminary terms and conditions, prescriptions, or recommendations. The input will be analyzed and incorporated into the final license application and PDEA. Under NEPA, the State is to continue identification of significant environmental and socioeconomic issues related to the project.

I distributed a reminder to agencies on 5/26 regarding the comment deadline. Our record shows comments by the Department of Natural Resources (DNR) Division of Mining and Water (Dunker, 5/29), DNR Division of Lands (Shadura, 4/20/98), Department of Fish and Game (DFG) Division of Sport Fish (Hoffman, 4/7/98). DNR commented on the DFG instream flow reservation request, an error about point where water is taken for the Deer Mountain Fish Hatchery, and no permits are required from the Division of Land (though the project facilities are across State lands (this should be checked). DFG commented about water level drops in Ketchikan Creek and impacts to rearing salmonids, impacts of lake drawdown on brook trout in Ketchikan Lakes, studies to document the impacts of changes in flows and velocities on fish in Ketchikan Creek, and DFG's request for additional water for fisheries.

Following the second stage of consultation, the applicant begins finalizing the application in preparation for filing with FERC. Filing and providing copies of the filed application to reviewers constitutes the third stage of consultation, followed by a FERC review for adequacy. When FERC issues a public notice that application is ready for environmental analysis; this notice establishes a comment period for reviewers to file comments, recommendations, terms and conditions. The FERC license is subject to ACMP review, and thus must receive a consistency finding prior to issuing a license. The DEC Certificate of Reasonable Assurance is also subject to ACMP review. The Division of Governmental Coordination will coordinate a State of Alaska review for consistency with the Alaska Coastal Management Program (ACMP) when we receive public notice from FERC asking for comments, terms and conditions, as well as sufficient information to allow analysis of impacts, and all required State and federal permit applications are submitted. At that time, the review will analyze the project against the standards of the ACMP and the enforceable policies of the Ketchikan Coastal Management Program, which is incorporated into the State program.

Copies of brochures about the ACMP and a Coastal Project Questionnaire were provided to you with the 1996 letter. We received the filled out CPQ on 6/18/97. We have one revised brochure enclosed with this letter for your information about the ACMP. Also, for your information, we are currently working on revising the CPQ.

The State would conduct a 50-day review of this project for ACMP purposes. Some procedural points are noted here, in advance: (1) After any project has been reviewed and a

State consistency finding has been issued, if changes to the approved project are proposed prior to or during its siting, construction, or operation, the applicant is required to contact this office immediately to determine if further review and approval of the revised project is necessary. If the actual use differs from the approved use contained in the project description, the State may amend the State approvals. (2) While State and Federal agencies, before issuing permits, are required to receive a finding from the State concurring the project is consistent, the consistency determination does not obligate agencies to issue authorization under their laws.

If you have any questions, please contact me at 465-8790 or email lorraine_marshall@gov.state.ak.us.

Sincerely,

Lorraine Marshall
Project Review Coordinator

Enclosures

cc: Dave Sturdevant, DEC, Juneau
Steve Hoffman, DFG, Ketchikan
Christopher Estes, DFG, Anchorage
Jack Gustafson, DFG, Ketchikan
Elizaveta Shadura, DNR, Juneau
Jim Anderson, DNR, Juneau
John Dunker, DNR, Juneau
Judith Bittner, DNR/SHPO, Anchorage
John Hill, Coastal District, Ketchikan
Brad Powell, USFS, Ketchikan

ferccons2.fnl

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF SPORT FISH

2030 Sea Level Drive, Suite 215
KETCHIKAN, AK 99901
PHONE: (907) 225-2859
FAX: (907) 225-0497

June 3, 1998

Larry Keith
Greystone
5231 S. Quebec Street
Greenwood Village, CO 80111

Dear Mr. Keith:

The following list summarizes concerns from ADF&G Sport Fish Division on the Ketchikan Lakes Hydroelectric Project, FERC Project number 420.

1. Water flow in Ketchikan creek above the powerhouse must be maintained at a minimum equal to the leakage water currently present from the Ketchikan Lakes dam, and all other downstream sources. Monitoring of these flows must be and ongoing program to allow ADF&G staff to evaluate those flows in relation to resident and anadromous species needs above the powerhouse.

2. A minimum of 35 cfs instream flow must be maintained at all times as currently permitted. Ramping rates need to be adjusted to meet current information on impacts on rearing and spawning fish, stranding and migration impedance.

3. Currently, public access to Ketchikan Lakes is prohibited but upon a change in this limitation, KPU will fund at a minimum a one year study of the resident species located in these lakes.

4. Mitigation for spawning and rearing loss by rapidly changing stream flows will include barrier modifications in Schoenbar Creek, spawning and rearing habitat improvements, and modification of the 5 ft barrier falls located above the powerhouse. These programs will be developed in coordination with ADF&G and may be expanded to include contributions to operation of the Deer Mountain Hatchery.

5. KPU should explore methodology to correct high water temperatures occurring during summer months in water provided to the Deer Mountain Hatchery.

Sincerely,

Stephen Hoffman

Stephen Hoffman

United States Department of Agriculture
Forest Service
Alaska Region
TT/TDD (907) 225-0414
Ketchikan Ranger DistrictMisty Fiords National Monument
3031 Tongass Avenue
Ketchikan, Alaska 99901
(907) 225-2148

File Code: 2770

Date: June 3, 1998

Mr. Larry Keith
Greystone
5231 South Qubec St.
Greenwood Village, CO 80111

Dear Mr. Keith:

Enclosed are our Preliminary Comments to the Preliminary Draft Environmental Assessment (PDEA) for the Ketchikan Public Utility Ketchikan Lakes Hydroelectric Project #420.

Approximately a month ago we forwarded to your office a complete box of the current Tongass Land Management Plan (TLMP 1997). All references in the PDEA to the " revised Tongass Land Management Plan" need to be checked for accuracy and references need to be changed to "Tongass Land Management Plan 1997. "

Attached are photocopy pages from the PDEA that have minor changes or corrections.

Please send me a review copy of the cultural resource inventory and literature review completed by Campbell (1997) refered to on page 69 of the PDEA.

At this time I am not prepared to submit draft 4(e) conditions.

Under the Vegetation and Wetland/Riparian Resources chapter, there is a section titled "Plant Species of Special Concern and Unique Communities." This section is inadequate. An inventory of the 11 species should have been conducted IF their associated habitats are within the project area. Just listing the species is not enough. If an inventroy was not possible, then a listing of which species that MAY occur within the project area is needed. The effects section should outline the risk of affecting sensitive species if they occur.

I have several concerns regarding the Recreation Resources chapter. The first full paragraph on page 72 discusses the fact that the City of Ketchikan's policy to not allow recreation use in the watershed is consistent with Forest management directive. I believe this is in reference to the old revised TLMP that is no longer accurate. TLMP 1997 states the following under Municipal Watershed Objectives: "Recreation uses will be authorized by the Forest Service officer with delegated authority, in consultation with the municipality and will be limited to those that will protect water quality and flow." I would like the recreation section to reflect that at such time that the municipality is required to build a filtration plant, that the watershed will be opened again for recreation access.

I also found that the Environmental Impacts and Recommendations section of the Recreation Resources chapter is confusing. I want to clarity that the Forest Service may develop recreation facilities adjacent to the watershed, outside the project area.

Thank you for the opportunity to comment. If you have any questions, please contact Teresa Trulock at this office.

Sincerely,

JIMMY J. DEHERRERA
District/Monument Ranger

Enclosures

cc:
Ron Settje, KPU
Tom Somrak, SO
David P. Boergers, FERC

KETCHIKAN GATEWAY BOROUGH

Department of Planning & Community Development • 344 Front Street • Ketchikan, Alaska 99901

Susan Dickinson
Director

(907) 228-6610
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ktnczm@ktn.net

June 8, 1998

Post-it® Fax Note 7671	Date	# of pages ▶ 1
To Larry Keith	From Lo Marshall	
Co./Dept. KPU	Co. DGC	
Phone #	Phone # 907 465 8790	
Fax # 3037219298	Fax #	

Ms. Lorraine Marshall
Project Review Coordinator
Division of Governmental Coordination
240 Main Street, Suite 500
Juneau, Alaska 99811-0300

CZM Consistency Review

Project: Ketchikan Lakes Hydro Draft App & PDEA (second consult)
Applicant: Ketchikan Public Utilities
State ID #: AK 9804-06JJ

Project Description:

As described in DGC correspondence dated June 2, 1998, "The project is a hydroelectric project located at Ketchikan Creek, within and adjacent to the City of Ketchikan, which requires re-licensing by FERC. The project facilities extend north from the city, across State lands, and into U.S. Forest Service lands. The project is owned and operated by the City of Ketchikan under the name of Ketchikan Public Utilities. The current license expires on 6/30/2000.

Findings:

The Ketchikan District has reviewed the above referenced application. The District finds that the project is generally consistent with the Ketchikan District Coastal Zone Management Program based on the following policy:

D.3. To preserve Ketchikan's opportunities to develop hydroelectric resources in an economical and environmentally sound manner.

Reviewed by:

[signature]
John W. Hill
Coastal District Coordinator