Aquatic & Biological Assessment of the South Fork to Black Bear Creek, Prince of Wales Island, Alaska

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Executive Summary

This report summarizes results of fish distribution, fish habitat, groundwater, and bald eagle nest investigations conducted during May, July, and August 2000 for use in the evaluation of the proposed Alaska Power and Telephone South Fork Hydroelectric Project in the Black Bear Creek watershed, near Klawock, Alaska.

Fish distribution surveys were completed in the South Fork of Black Bear Creek to supplement past surveys and further characterize the presence, distribution, and seasonality of use by fish downstream from the existing migration barrier near the site of the proposed powerhouse. Our survey conducted during late May peaks of salmonid abundance corroborated results of previous studies. Only Dolly Varden char were observed in the upper portion of the reach downstream from the powerhouse site. Coho and rainbow/steelhead distribution was limited to the lower reach of the South Fork of Black Bear Creek.

Fish habitat surveys were conducted downstream of the proposed powerhouse using U.S. Forest Service Region 10 protocols to develop a detailed baseline of conditions prior to construction of the South Fork Hydroelectric Project. Detailed habitat surveys were conducted in west channel and mainstem of the South Fork of Black Bear Creek from the Lake Fork of Black Bear Creek, up to the cascade on the South Fork of Black Bear Creek. The South Fork is primarily riffle with substrate dominated by gravel and cobble. Pools are most common in the upstream reach section. Fine sediments generally increased in the downstream reach section. Additional surveys in the Lake Fork between the South Fork confluence and Black Bear Lake noted some redistribution of woody debris since detailed surveys were completed in 1982, but the fundamental habitat character of this reach was unchanged.

Dye tracing studies were conducted to examine the groundwater connection between the infiltration zone near the proposed tailrace below the barrier cascade and the seepage zone in the anadromous reaches of South Fork and Spring Fork. Charcoal packets placed in upwelling sites of the South Fork and Spring Fork were used to sample for dye injected directly into the streambed just downstream from the proposed

hydro facility tailrace in the South Fork. Separate tests from July 24 to August 27 and from August 27 to 29 under high and low flow conditions detected no dye from the South Fork in any Spring Fork upwelling site. Our results corroborate 1990 studies which also observed no dye movement from the South Fork to Spring Fork upwelling sites.

No bald eagle nests, young eagles, or adults were observed on a July 27 helicopter survey of the project-affected areas of remaining timber, including the impoundment site, penstock route, powerhouse site, and the road and transmission line alignments.

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1.0 INTRODUCTION

Alaska Power and Telephone (AP&T) intends to construct a 2 MW “run-of-river” hydroelectric facility on the South fork of Black Bear Creek near Klawock, Prince of Wales Island, Alaska (Figure 1). When the South Fork Hydroelectric project is brought on line, it will supply additional power to the Black Bear Lake Hydroelectric system (BBL), which is already experiencing peak demand.

The proposed South Fork project is located on Sealaska Corporation land, and lies within a subwatershed of the Black Bear Creek drainage. The South Fork basin is confined to a glaciated valley, which descends to the north from a cirque surrounded by a serrated headwall ridge with peaks up to 3996 feet. Within the headward segment of the valley, and above the proposed hydro project area, there is a high basin which may have formerly contained a tarn lake (Forbes 1998).

The diversion site for this project will be situated at an approximate elevation of 750 feet where the creek begins a rapid descent down a bedrock channel. The proposed powerhouse is situated at an elevation of approximately 180 feet, which is at the foot of a small cascade, and at the top of an alluvial fan. From the base of the cascade, the stream then flows down the alluvial fan and out into the flood plain of the Black Bear Creek Valley where it joins with Black Bear Creek. The stream, from the base of the alluvial fan to the confluence with Black Bear Creek, is a meandering flood plain channel with multiple braiding and side channels.

Upstream of the diversion site, the creek traverses a meadow basin consisting of a marshy wetland, due in part to beaver activity. A series of at least four beaver ponds have been observed in the past interspersed along the creek in this upper basin reach (Bonar 1999).

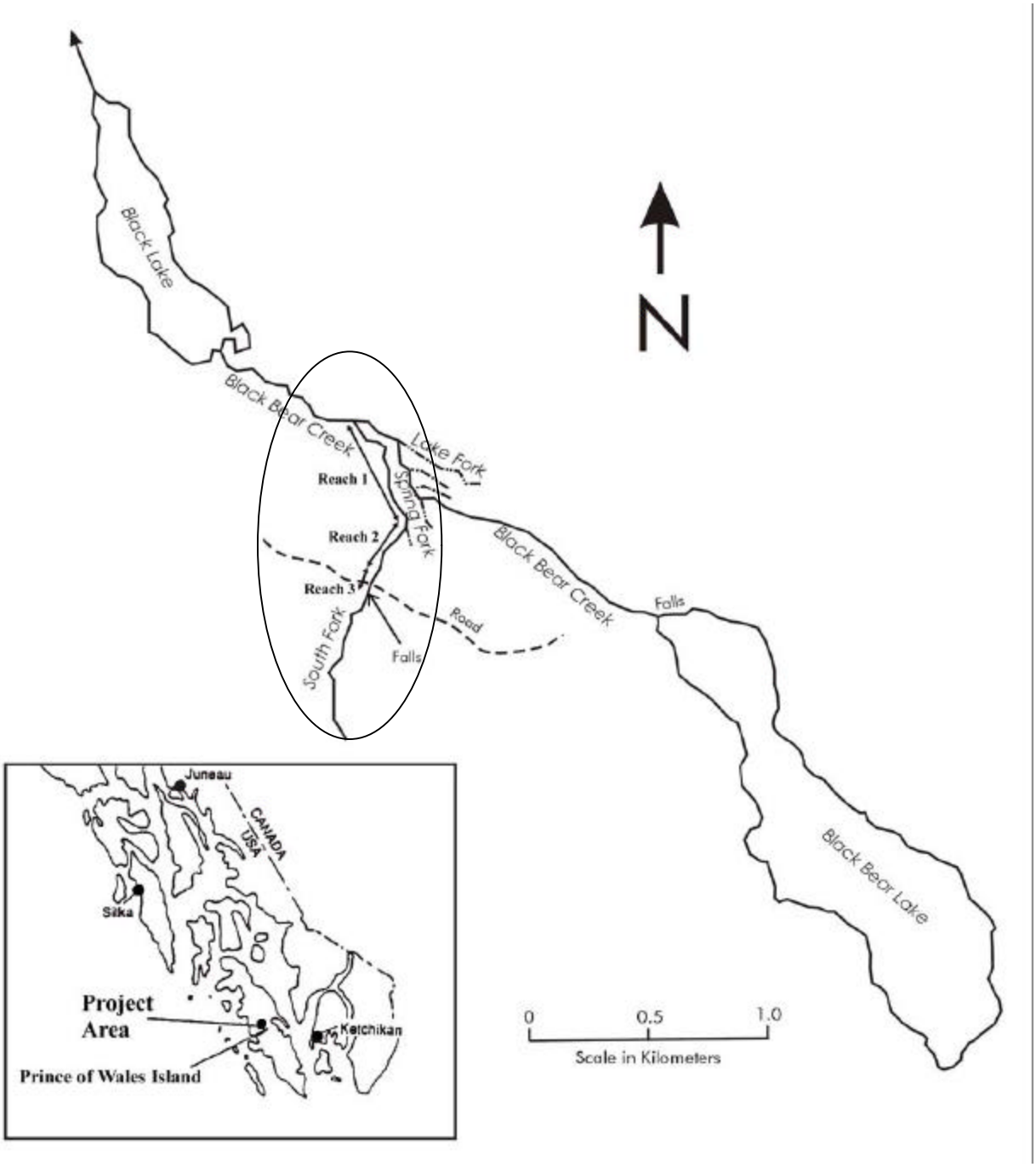

Figure 1. Approximate area surveyed during studies associated with the South Fork Hydroelectric Project, on Black Bear Creek, near Klawock, southeast Alaska, 2000.

During late May to early August of 2000 we conducted four separate field studies in the South Fork Project area at the request of AP&T with the following objectives:

1. Supplement past surveys with additional sampling to further characterize the presence, distribution, and seasonality of fish use downstream of the existing migration barrier (small cascade) in the South Fork of Black Bear Creek.

2. Develop a detailed baseline of fish habitat information for the South Fork of Black Bear Creek prior to construction of the South Fork Hydroelectric Project.

3. Investigate the groundwater connection between the infiltration zone near the proposed tailrace below the barrier cascade and the seepage zone in the anadromous reaches of South Fork and Spring Fork.

4. Conduct a survey of the project-affected area for bald eagle nesting trees.

2.0 FISH DISTRIBUTION

We Surveyd fish presence, distribution, and seasonality of use downstream from the existing migration barrier (small cascade) in the South Fork of Black Bear Creek in 2000 for comparison with the results of past surveys. Our survey was conducted during late May when peak salmonid fry migration typically occurs within this system.

2.1 Fish Methods

Fish surveys in the South Fork of Black Bear Creek were conducted with the assistance of Randy Otos (AP&T) and Bob Chadwick (ADF&G). All fieldwork was conducted under ADF&G Fish Resource Permit SF-2000-047, issued April 14, 2000.

Fish were surveyed using minnow traps and snorkeling to gather information on fish distribution and temporal use within the proposed study area, downstream of the cascade barrier (Figure 2). Methods were similar to those used in past sampling by ADF&G, AP&T, and Aquatic Environmental Services (AES).

Minnow traps were used throughout the length of the alluvial fan (Reaches 2 and 3). Traps were baited with betadine-treated salmon eggs, immersed in a pool habitat, left immersed for 24 hours, and then checked the next day. A total of 20 traps were fished at 20 sites, with a total immersion time just under 24 hours.

We used spot snorkeling to see if larger fish, or other species, were not effectively sampled using minnow traps. Snorkel observations were conducted in the large pool at the base of the cascade barrier and in a few pools below the minnow trapping study reach (downstream from base of alluvial fan, reach 1).

All fish collected were identified, measured for length, and released live at the site of capture.

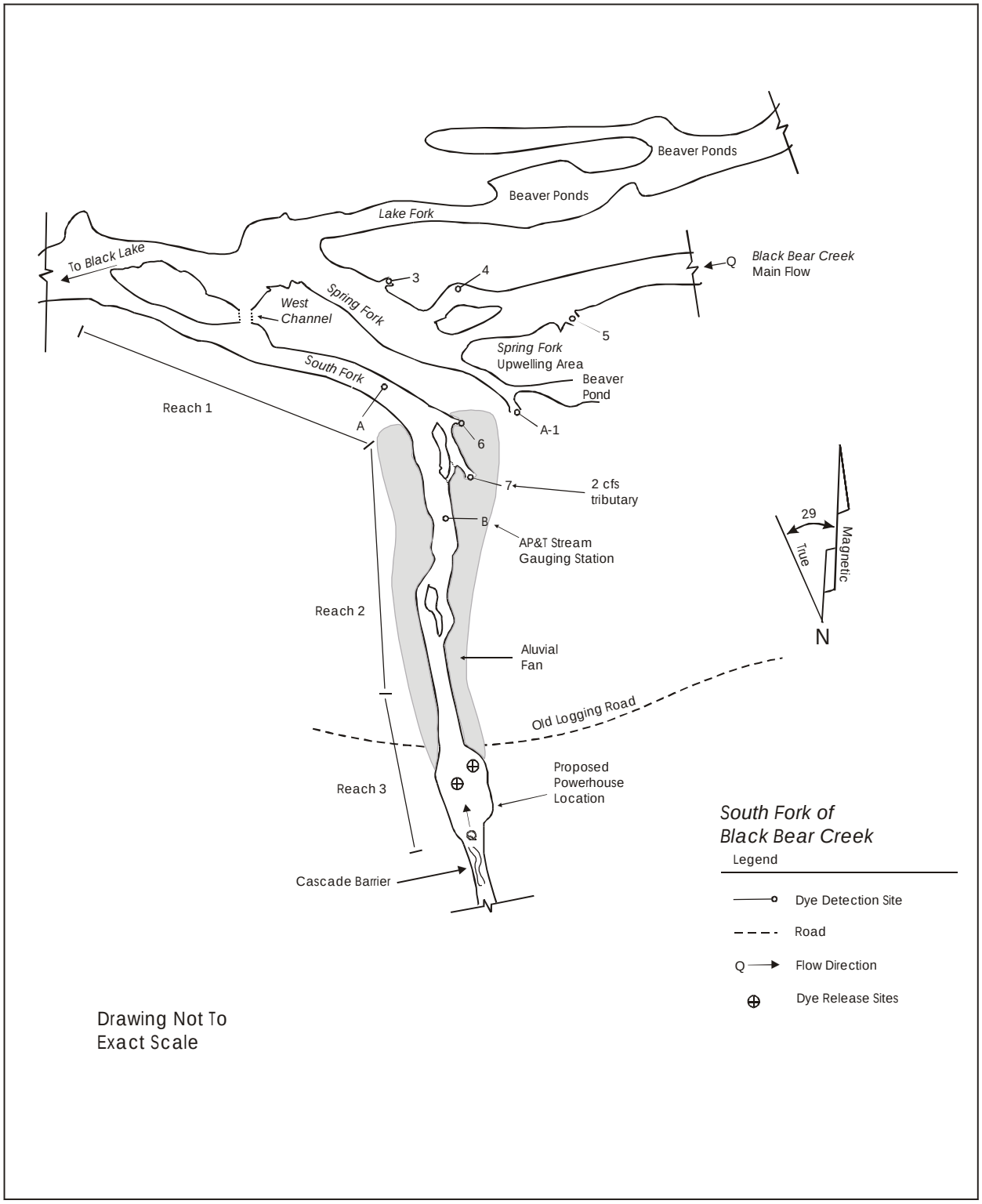

Figure 2. South Fork hydroelectric project study area from the cascade down to Black Bear Creek, Prince of Wales Island, southeast Alaska.

2.2 Fish Results

Dolly Varden, rainbow trout, and coho fry were observed in the study area. A total of 176 Dolly Varden char and eight rainbow trout were trapped starting at the barrier falls (0 feet) and continuing downstream 950 feet (figure 3). No coho were collected in traps, although a few fry were observed downstream (reach 1) from the base of the alluvial fan during spot snorkeling in selected pools.

Dolly Varden lengths ranged from 2.2 inches to 6.0 inches, and 4.4 inches to 6.0 inches for rainbow trout (figure 4). The size distribution of Dolly Varden was not similar in the upper and lower reaches of the South Fork. Dolly Varden observed while snorkeling in the large pool at the base of the cascade were larger than those observed in the minnow traps (N=24, 3 to 9 inches). The observed mean length for Dolly Varden captured in minnow traps was greater for fish captured in traps located in reach 3 (Figure 5). This area has a greater number, and size of pools than that observed in the lower portion of reach, which would explain the larger size (Appendix 1).

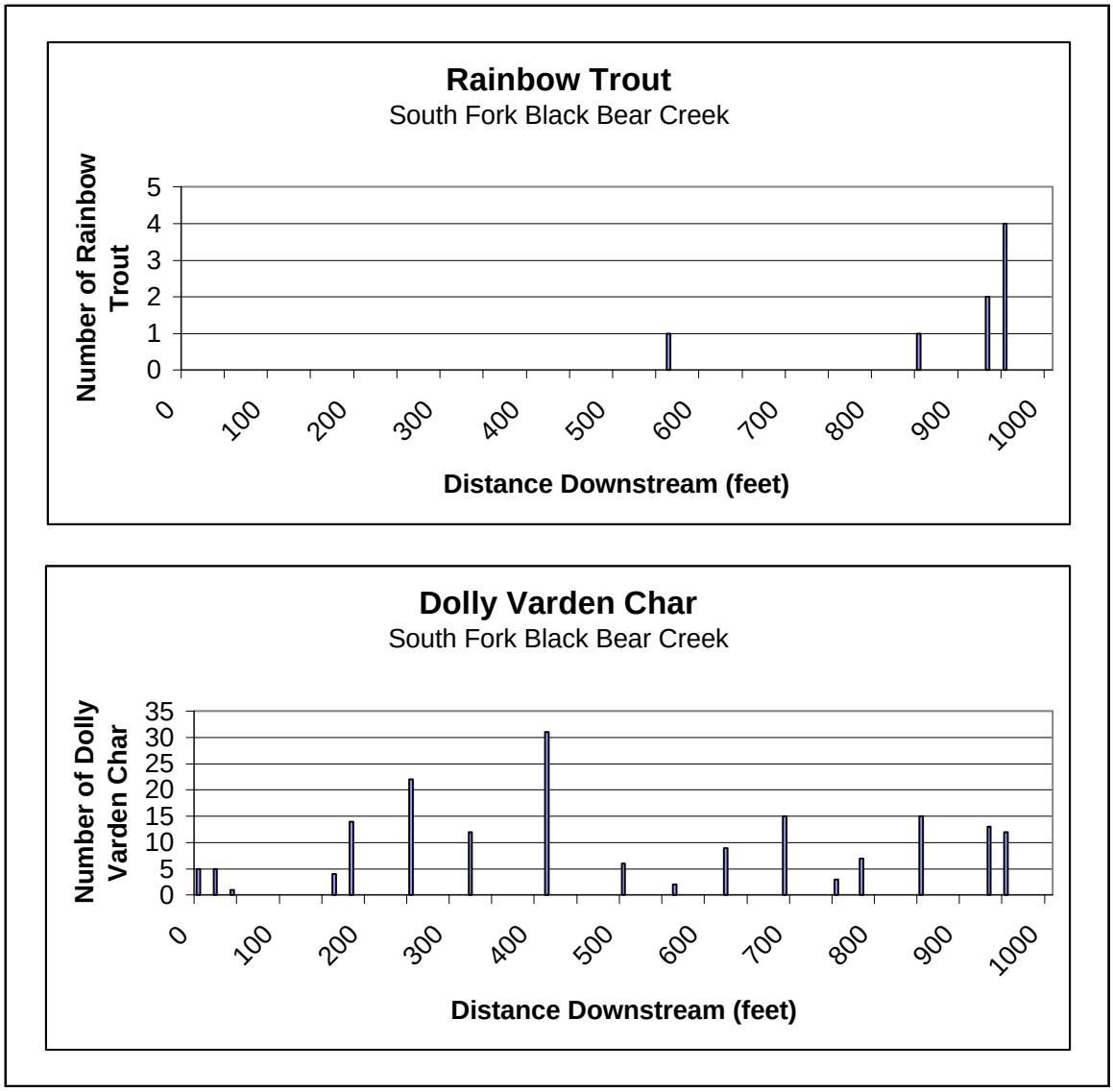

Figure 3. Minnow trap counts of Dolly Varden char (N=176) and rainbow trout (N=8) downstream from the small cascade, South Fork Black Bear Creek, Prince of Wales Island, Alaska during Summer 2000.

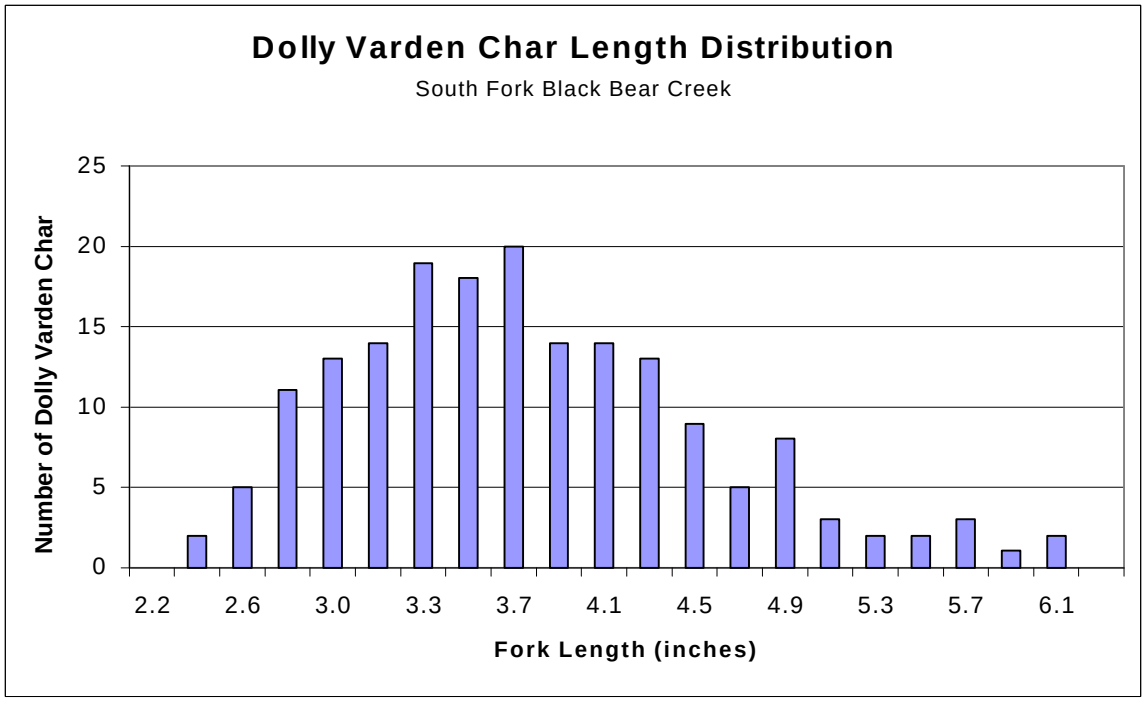

Figure 4. Length-frequency distribution of Dolly Varden char (N=176) collected from the South Fork of Black Bear Creek during summer 2000.

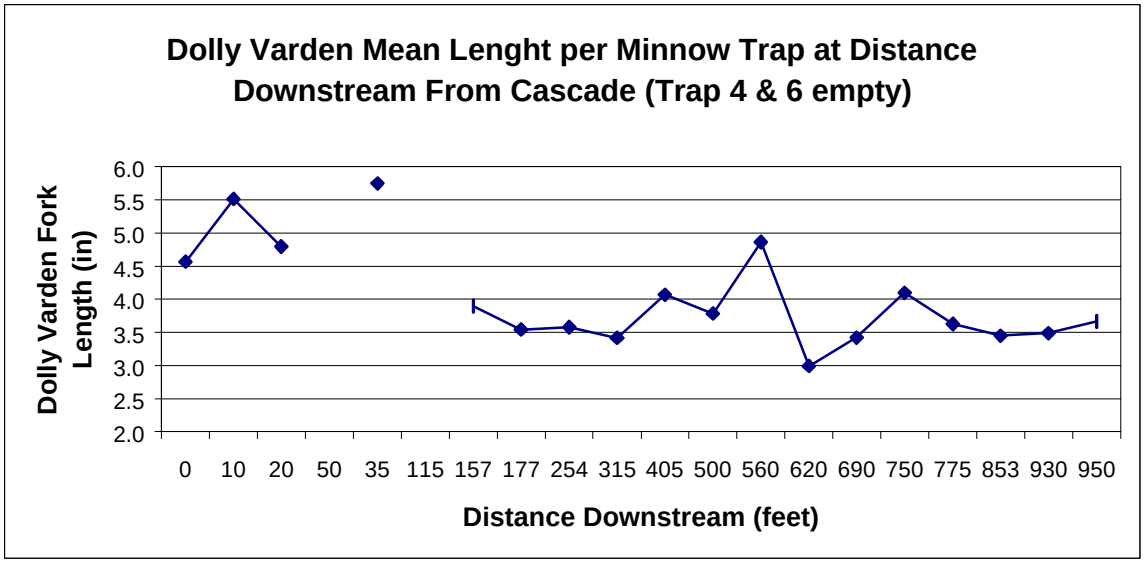

Figure 5. Dolly varden size distribution from the cascade (0 ft) down to the last trap site at 940 feet, South Fork, Black Bear Creek, Southeast Alaska, July 25, 2000.

2.3 Fish Discussion

Previous surveys between October 31 and November 2, 1998 by Aquatic Environmental Services (AES) observed no fish in the bypass reach or in the upper portion of the reach downstream from the barrier cascade. Similarly, no fish were captured during September 2-3, 1997 in minnow traps set by AP&T upstream from the proposed diversion site. AES captured juvenile Dolly Varden char and coho salmon in the lower reach downstream of the proposed powerhouse, and also observed adult coho salmon in the lower reach. ADF&G sampling in April and July 1999 observed no fish upstream of the proposed diversion site, Dolly Varden char between the barrier cascade and the logging road crossing, and juvenile coho salmon, rainbow/steelhead trout, and Dolly Varden char in the lower reach downstream from the logging road crossing.

ADFG (2000b) concluded that existing information appears adequate to determine with reasonable confidence that salmonids do not occur in the upstream and proposed bypass reaches but noted some uncertainty about the upstream extent of fish use in proximity to the cascade and proposed powerhouse site. ADFG noted that the upstream limit of salmonid distribution was extended during every new sampling event and that previous surveys during April, July, and September did not occur during the period of peak salmonid fry abundance in this system. Our survey conducted during late May peaks of salmonid abundance corroborated results of previous studies. Only Dolly Varden char were observed in the upper portion of the reach downstream from the powerhouse site. Coho and rainbow/steelhead distribution was limited to the lower reach of the South Fork of Black Bear Creek.

3.0 FISH HABITAT

Habitat surveys were conducted downstream of the proposed powerhouse to develop a detailed baseline of conditions prior to construction of the South Fork Hydroelectric Project. Detailed habitat surveys were conducted in the west channel and the mainstem of the South Fork of Black Bear Creek from the Lake Fork of Black Bear Creek, up to the cascade on the South Fork of Black Bear Creek. Additional surveys

were conducted in the Lake Fork between the South Fork confluence and Black Bear Lake to identify changes since detailed surveys of that area by Environaid in 1982. Habitat surveys were designed to characterize the type and quantity of stream habitat available to fish. Surveys were performed in late May of 2000 to reflect stream conditions during time of peak fry outmigration from the system.

3.1 Habitat Methods

The habitat survey quantified physical habitat characteristics that could influence fish densities in the South Fork of Black Bear Creek. We used survey methods based on protocols described by the U.S. Forest Service Region 10 for a tier 2 stream survey (R-10 Amendment 2090-98-1). The tier 2 survey was designed to provide consistent, quantitative estimates of habitat parameters necessary to evaluate the conditions of stream relative to basic Riparian Habitat Management Objectives (RHMO's). Consistent with the fish habitat and fish distribution and abundance focus of this study, we also included several more detailed survey parameters similar to those of a tier 3 survey. Stream survey parameters included stream class, channel morphology, fish habitat, large wood, riparian vegetation, beaver dams, undercut banks, side channel habitat, and migration barriers as prescribed by the described protocols.

We started the detailed habitat survey where the South Fork enters Black Bear Creek and proceeded up the South Fork Drainage classifying habitat types. During the first step, we classified and mapped individual habitat units by habitat type and recorded all visual observations of habitat characteristics. Habitat units were classified as riffle, pool, glide, step pool, and cascade. Observations included water surface area by habitat type, gradient, depth, pieces of large woody debris (LWD), percent undercut bank, and percent substrate composition. Active channel width, valley form, and any unusual channel features were also recorded.

A metric hip-chain was used to obtain quick and precise distance measurements for both habitat and reach length. Stream gradient was measured for riffles with a hand-held clinometer. Habitat units in side channels were measured separately, and a channel-type code was employed to distinguish main (00) and side (01) channels.

Water depth was measured with a wading rod, and recorded as averages for riffle and glides, and maximums for pools. Pool residual depth was also measured with the wading rod. Substrate for each habitat was classified by sight into the percentage composed by each of five categories that include fines/silt, gravel, cobble, boulder, and bedrock.

We took detailed measurements of stream substrate composition (Wolman 1954). Particle size measurements were made at representative riffle sites for each reach surveyed (Figure 2). At each site, we measured the diameter of 50 substrate particles chosen along transects across the stream channel. We used a sample size of 50 particles instead of the normal 100 due to cold water temperature numbing the hand and making small particles indistinguishable from larger ones. Substrate particles were chosen systematically by a biologist who placed one foot forward, closed their eyes, reached down at the end of their foot, and measured the first particle touched. The sampling biologist then moved ahead one more foot length and repeated the procedure. If the channel width was crossed before 50 particles were measured, the biologist returned on a parallel transect from the first transect. Particles were measured along the B-axis (intermediate) diameter in millimeters. This is the diameter on the particle that would prevent it from passing through a square sieve opening. All three sample sites were hand mapped for future reference (Appendix 3).

Spawning gravel surveys in the South Fork were conducted from the confluence with Black Bear Creek (Lake Fork) up to the cascade. These observations were performed as part of the overall habitat survey.

Supplemental surveys in the Lake Fork between the South Fork confluence and Black Bear Lake included downstream distance and counts of active LWD. No other habitat changes were observed in this reach.

3.2 Habitat Results

Habitat surveys began on May 24 and concluded on May 25, 2000 during which time water temperatures ranged from 6.1^{o}C to 8.0^{o}C. The daily flows below the cascade (proposed powerhouse site) fluctuated from about 21cfs to 33cfs, with a mean

flow of 27 cfs for the study duration. Reach one is a flood plain channel that extends upstream to the base of the alluvial fan (413m). Reach 2 is a high gradient alluvial fan channel that extends upstream of reach one approximately 255m. Reach 3 ends at the base of the cascade and is the upper extent of the alluvial fan (129m).

Our survey showed channel configuration (high sinuosity and high flood plain) within survey reach 1 is determined by riffle habitat (Figure 6) with a pool-to-riffle ratio (P:R) of 0.5:1. This reach is unconstrained along 100% of its length. There were a few short side channels in this reach of river, and the total length of all side channels was 82 meters (Appendix 2), or 10 percent of the total survey length. Reach one also had the highest amount of undercut bank on both the left and right side, at 72 and 64 percent respectively when compared to reaches 2 and 3 (Appendix 2). In addition, this reach of stream had the highest number of both LWD (N=142) and key LWD (N=47).

Channel configuration for reach two (low sinuosity and no flood plain) is determined by geomorphic features. This reach is unconstrained by either the hillslope or bedrock along 100% of its length. The mean wetted channel width for late May was 5.2 m with riffle as the dominant habitat type (P:R=0.63:1). There were two side channels in reach 2, and their total length was 57meters (7% of total survey length). Gradient was consistent within each reach with reach 2 having the highest gradient (3.0%) and reach one the lowest (1.1%).

Reach 3 is dominated by pool habitat (P:R=1.7:1), and has the second largest amount of LWD (N=137) and key LWD (N=44). Most of this LWD is in the form of debris jams located throughout the reach. Reach 3 has a low sinuosity channel type and is confined on both sides by both hillslope and bedrock. The mean wetted width and average slope for this reach during our survey was 5.9 meters and 1.5 percent respectively. The reach ends at the top of the alluvial fan at the base of the cascade.

Figure 6. Representative low and high gradient riffle habitat found in the South Fork of reach one (top) and two (bottom) respectively. Note the abundant amount of spawning substrate in reach 1 (top).

Table 1. Reach summary information for habitat survey in the South Fork of Black Bear Creek during July 2000, Prince of Wales Island, southeast Alaska.

Reach	Habitat	Average % slope	Sum of length (m)	Average width (m)	Average depth (m)	Max depth (m)
1	p	0.0	50	8.3	1.0	1.2
	r	1.6	363	12.1	0.4	0.6
1 Total		1.1	413	10.8	0.6	1.2
2	hgr	5.2	192	4.8	0.9	3.5
	p	0.0	34	5.3	1.1	1.3
	r	4.0	29	6.3	0.5	0.6
2 Total		3.0	255	5.2	0.9	3.5
3	p	0.0	36	6.7	1.6	3.0
	pp	4.0	17	3.1	0.5	0.5
	r	2.7	76	5.8	0.3	0.3
3 Total		1.5	129	5.9	1.0	3.0
Grand Total		1.9	797	7.4	0.8	3.5

During our habitat survey we visually observed the dominant and subdominant riparian vegetation for each reach. Stream riparian buffers were not measured because they do not exist on this system. The only large trees still standing are those that were left from the last timber harvest because of low harvest quality (Figure 6). Tree stumps can be observed next to the stream bank where timber harvesting has occurred within a few meters of the stream. A mixture of young growth conifers (yellow cedar, hemlock, spruce) and deciduous trees (alder) are the dominant riparian for all reaches (Figure 6). Shrubs (i.e. salmon berry, blueberry, devils club) are the subdominant vegetation for all reaches.

During 23 May, our supplemental surveys in the Lake Fork, between the South Fork outlet and Black Bear Lake, revealed little change since habitat surveys conducted by Environaid in 1982. At 235 meters upstream from Black Bear Lake, we observed a recent downed hemlock on the right bank that has one end submerged into the river while the other is still on the bank. At 257 meters upstream from the lake we noticed another newly downed hemlock on the right bank, and this piece of LWD overhang the water by approximately two meters. We observed that the habitat quality and quantity

in this section of river is very similar to that found by Envionaid with the exception of the before mentioned minor changes.

We identified relative amounts of suitable spawning habitat within each habitat unit surveyed (Appendix 1) for all three reaches. The highest concentration of spawning gravel was observed in reach 1 (2,623 m^2) and the lowest in reach 2 (36 m^2). We also conducted a pebble count (Wolmen 1954) to characterize the substrate conditions within each survey reach. Reach 1 had the greatest frequency of particles between 8 and 128 mm in diameter (Figure 7). This corresponds to the abundant amount of spawning area observed in reach 1. Reach 2 and 3 had similar substrate size with the majority between 16 and 512 mm in diameter. The large particle size frequency observed in these two reaches is influenced by steep gradient, frequent high flows that transport smaller particles to the flood plain (reach1), and deposition of larger material that took place when the alluvial fan was formed.

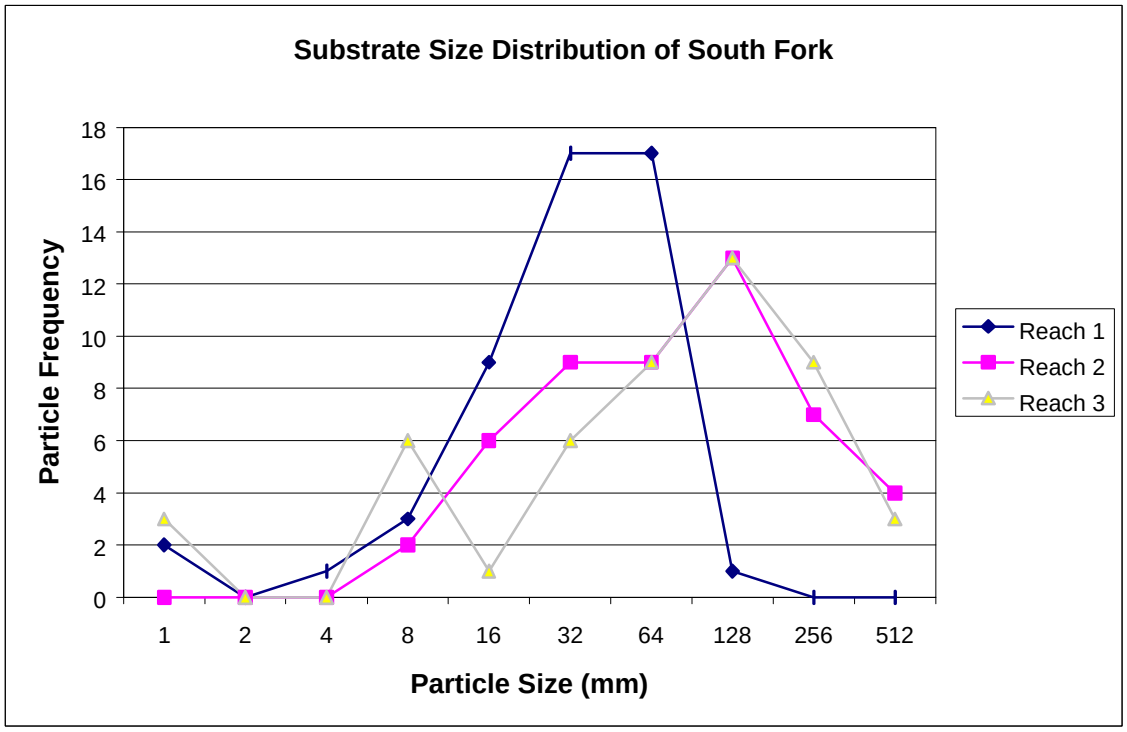

Figure 7. Particle size frequency distribution for representative riffles substrate (N=50) in reach 1, 2, and 3 of the South Fork to Black Bear Creek, Prince of Wales Island, southeast Alaska, 25 July, 2000.

Through the course of the survey three barriers to fish migration were identified. The first barrier, located 549 meters upstream from the mouth of the South Fork (reach 2, Figure 8), was a 2-m high log and debris dam providing blockage to adult pink, chum, sockeye, steelhead and coho (Reiser 1985). A second and larger barrier was located at 691 meters upstream (reach 2). This 3-m high log is tall enough to block all anadromous fish species present in the South Fork drainage. All migration is finally cut off at a 20-m cascade found at the end of the survey 797 meters upstream. Identification of these barriers in the South Fork Drainage does not necessarily mean that the indicated species cannot pass upstream in this system. There are many small channels of water that flow around these barrier structures at times of high flowing water. This may be how a few rainbow trout have managed to find their way above barrier 1. Neither barrier 1 nor barrier 2 had a plunge pool depth greater than 1.25 times the height of the barrier, or more than 2.5-meters deep, that would allow some species such as sockeye, coho, and steelhead to migrate upstream of the barriers (Reiser and Peacock 1985). During our survey of these barriers we found other variables that would also affect barrier potential. Turbulent water below the structure (Figure 8, barrier1) can disorient fish and reduce jumping height. Also, most migratory fish tire as they migrate, and these barriers are at the upper limits of migration making it unlikely that they will be able to pass these barriers. Adult escapement surveys conducted in the South Fork drainage since the early 1980 show that the upper extent of pink, chum, coho, and sockeye salmon spawning is at the base of the alluvial fan (bottom of reach 2). The high gradient and low amount of spawning gravel in reach 2 is most likely deterrent for adult spawner migration into this reach. Adult steelhead have not been observed in the South Fork during any surveys conducted since the early 1980s.

Figure 8. Anadromous fish barrier 1 (bottom) and 2 (top) located within reach 2 of the South Fork of Black Bear Creek.

3.3 Habitat Discussion

No previous habitat survey data was available for the South Fork of Black Bear Creek from the mouth to the barrier cascade. The quantitative estimates of stream condition parameters and channel morphology collected during the detailed habitat survey in this area establishes baseline conditions which can be used as a point of comparison for any future studies deemed necessary to determine if conditions have been changed by construction and operation of the hydroelectric project. Such comparisons could help identify any effects, should they occur, of construction site runoff, flow interruptions, changes in bed load and large wood transport, shifts in temperature regime, or changes in groundwater infiltration and seepage. Detailed habitat assessments also provide the flexibility to evaluate the varied habitat use and life history strategies of fish species in the Black Bear Creek system.

Habitat quantity and quality in the Lake Fork of Black Bear Creek from the South Fork Mouth to Black Bear Lake were described during 1982 surveys by Environaid to establish baseline aquatic habitat conditions prior to construction of the South Fork Project. Rather than repeating a detailed survey of this area, we conducted a supplemental survey to identify any significant changes from previous results. Because of the dynamic nature of this watershed, the concern was whether channels in this area were different than those described during the previous survey. We observed some redistribution of woody debris in this area but found the fundamental character of the habitat unchanged.

4.0 GROUNDWATER DYE TRACING STUDY

The groundwater connection between the infiltration zone near the proposed tailrace below the barrier cascade and the seepage zone in the anadromous reaches of South Fork and Spring Fork was examined to provide a basis for assessing whether South Fork development might be expected to affect anadromous areas of the Spring Fork to Black Bear Creek. Our work was a follow-up to groundwater tracing studies in the Spring and South Forks conducted in 1989 and 1990 in conjunction with assessments of Black Bear Creek hydro development.

4.1 Dye Trace Methods

We performed groundwater studies during the later part of July to the end of August. Our study generally followed the procedures used in 1989 Environaid and 1990 HDR studies in the same area. Groundwater movement was identified based on the absorption dye in active charcoal filters placed downstream from dye introduction sites. Two separate sampling periods were used to evaluate groundwater transport at different flows.

We first reconnoitered the area to locate detection sites that were used in past studies. We were able to find all sites with the aid of maps showing general site locations, and direction from Randy Otos who helped with past studies. We placed downstream detection sites (stations) near previous sites number 6 and 7 in lower South Fork and sites 3, 4, and 5 in Spring Fork (Figure 1 of the Black Bear Lake Tailrace Studies). Sets of 3 active charcoal filters were hung on wires in the emerging groundwater flows found at stations 3, 4, 5, 6 and 7. Sets were also placed in the mainstream South Fork channel (station A, and B) as controls to verify that the dye was detectable in the system. See map for detailed locations (Figure 3). Before a set of active charcoal filters was installed, water samples for use as controls were taken at each station. Flagging and a metal surveyors tag were hung near the detection station for future revisits.

Dye was injected directly into the streambed just downstream from the proposed hydro facility tailrace in the South Fork. Two pits were dug to facilitate injection directly into the streambed rather than into the surface flow (Figure 9).

Figure 9. View of dye injection (Rhodomine W.T) to streambed and pit depth (2 ft.) located at the base of the cascade barrier on the South Fork of Black Bear Creek.

The first test was initiated on July 24, 2000 at approximately 1200 hrs with the release of two pounds of fluorescein dye into groundwater in a section of stream bed about 65 feet upstream of the former road crossing, and just below the cascade on the South Fork of Black Bear Creek (Figure 2). For the first test, we used Fluorescein dye because it is detectable at lower concentrations and is less adherent to soil particles than Rhodomine W.T. Sampling at detection stations for this test continued until the morning of August 27.

Spring through fall was a fairly wet year during 2000 as indicated by flow reading from the AP&T gauging station in the South Fork Drainage (Figure 10). Before the start

of our sampling in July, the South Fork experienced a large increase in flow due to heavy rain (Figure 11). Continual fluctuations in stream flows also made it difficult to predict a low flow period for our sampling. We chose to conduct a second groundwater test during late August 2000 because of a high flow event during our first groundwater test, and because we wanted to test the groundwater connectivity at different flows. Our second test ran from the 27th to 29th of August. Sampling methods for the second test were similar to the first except we used Rhodomine W.T. dye so that there would be no overlap in dye detection if Fluorescein was still present in the groundwater. An additional detection station was also added for the second test in an upwelling area observed at the head of Spring Fork (A-1, Figure 2). Station A-1 was measured at a distance of 60 meters from South Fork and approximately 200 meters upstream of detection site 4.

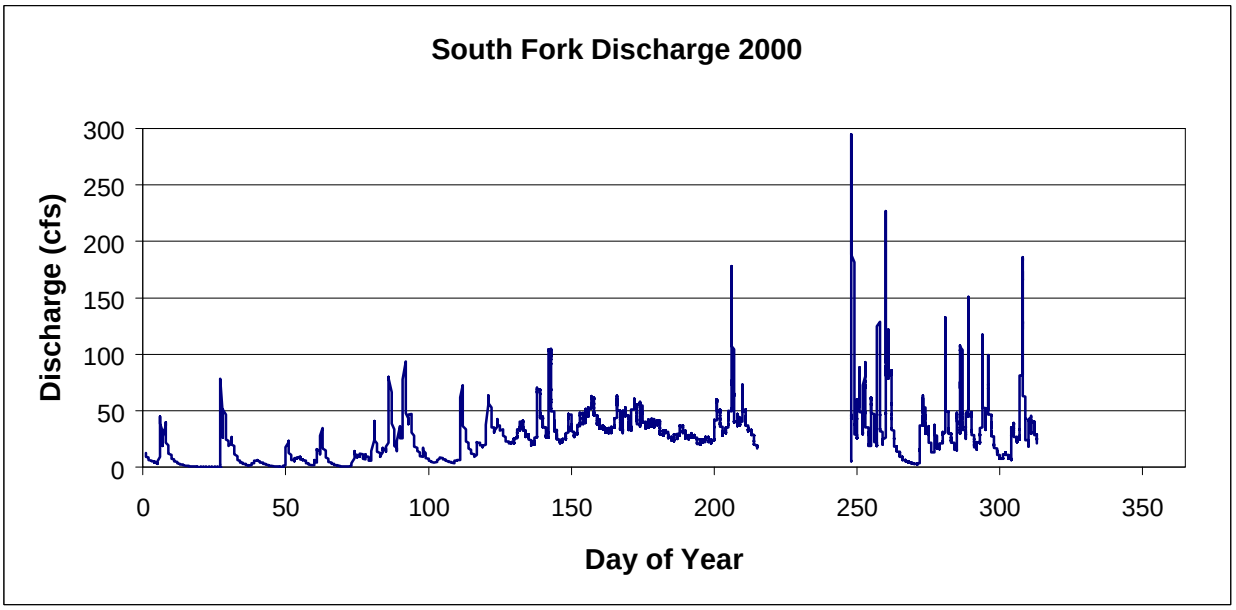

Figure 10. Daily flows (recorded every 15 min.) in the South Fork of Black Bear Creek, Prince of Wales Island, Alaska during 2000. Flow reading for the periods Aug. 3 to Sept. 3 and Nov. 9 to Dec. 31 were not available at time of report.

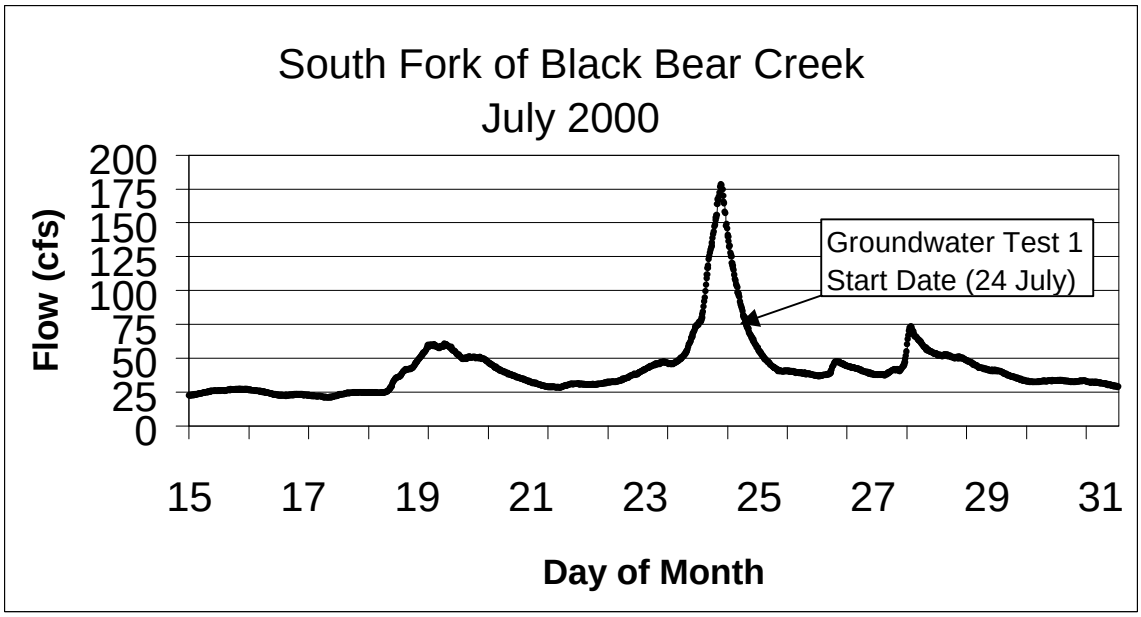

Figure 11. Daily water flows (recorded every 15 min.) below the cascade from July 15 to 31, 2000 in the South Fork of Black Bear Creek, Prince of Wales Island, southeast Alaska.

Charcoal filters were removed on August 27 for the first test and August 29 for the second test and sent to a lab for analysis. The charcoal packets were analyzed at the same lab (Ozark Underground Laboratory) as that of all earlier groundwater dye trace work done on the system. Both dyes were washed out of the active charcoal packets in the laboratory with NH^4OH – alcohol elutant and analyzed under a fluorimeter to detect level of dye concentrations at each station.

4.2 Dye Trace Results

The results of our first test revealed that dye concentrations were highest in the mainstem flow stations A and B at 170 and 136 parts per billion (ppb) respectively (Table 2). The only other detection observed was at station 6, which had a lower concentration (27ppb) than stations A and B. The results of our second test also showed similar results as our first test (Table 2). Detection stations A (859 ppb) and B (252 ppb) again showed the highest concentrations of die detection. Station 6 had slightly less die detected on the second test (5 ppb) as that detected on the first test.

No dye from the South Fork was detected at any Spring Fork upwelling site during tests one or two, nor was dye detected at site 7 in the mouth of a small tributary to the South Fork.

Table 2. Comparison of 2000 dye tracing results (parts per billion) with prior study results for the Black Bear system.

Detection site	South Fork dye release				Black Bear Crk. dye release	
	1990 #1[a]	1990 #2[a]	2000 #1[a]	2000 #2[b]	1990 #1[b]	1990 #2[b]
1 (Lake Fk.)	ND	ND	--	--	201	28.5
2 (Spring Fk.)	ND	ND	--	--	520	41.1
3 (Spring Fk.)	ND	ND	ND	ND	372	32.2
4 (Spring Fk.)	ND	ND	ND	ND	263	25.2
5 (Spring Fk.)	ND	ND	ND	ND	305	23.4
A-1 (Spring Fk.)	--	--	--	ND	--	--
6 (South Fk.)	199	72.2	27	5	6.3	ND
7 (South Fk.)	457	126	ND	ND	ND	ND
A (South Fk.)	--	--	170	252	--	--
B (South Fk.)	--	--	136	859	--	--

a Fluorescein dye
b Rhodamin WT dye

4.3 Dye Trace Discussion

Studies of groundwater interchange between the South Fork and Spring Fork were conducted in 2000 to verify conclusions by HDR (1990) that the South Fork provides significant water for spring flows in the upwelling area of Spring Fork. This conclusion was based primarily on observations of the proximity of the South Fork channel and upwelling areas of the Spring Fork. HDR reported that the southern-most spring on the Spring Fork is only 75 feet from the South Fork but 300 feet from Black Bear Creek. Further, an abandoned channel which could facilitate subsurface flow leads from a 90 degree bend in the South Fork to the channel of the southern-most spring at a point approximately 40 feet below the first point of upwelling.

Dye tracing studies by HDR did not support the conclusion that the South Fork was contributing significant flow to the Spring Fork, but this result was thought to be compromised by the introduction of dye into flowing water of the South Fork rather than into the substrate. HDR concluded that it was not surprising that dye from the South Fork was not found in any of the Spring Fork locations since the dye had a limited time to infiltrate. Dye tracing studies by HDR indicated that Black Bear Creek and the South Fork contributed water to springs on the South Fork. Dye from Black Bear Creek was detected by HDR in one South Fork site.

HDR's suggestion of a linkage contributed to concerns that development of the South Fork could affect spring flow in anadromous fish areas of the Spring Fork. We repeated dye tracing studies from the South Fork to the Spring Fork but introduced dye directly into the substrate rather than into the flowing South Fork so that the dye could enter the groundwater in concentrations sufficient for detection if significant interchange was occurring. However, we still did not detect dye from the South Fork in Spring Creek upwelling sites including our new upwelling station (A-1) established even closer to the South Fork than the pre-established sites.

This result could suggest that previous assumptions regarding the strength of the South Fork contribution to springs in the Spring Fork are overestimates. Based on the topography and geology of the alluvial areas through which these streams flow, we do

not discount the possibility that subsurface flows in the South Fork and the Spring Fork interact but the strength of this interaction is not corroborated by dye tracing studies conducted to date. As indicated by Environaid 1989 the alluvial fans of Black Bear Creek and South Fork are closely intermingled in the Spring Fork area. The Spring Creek upwelling areas appear to be near the groundwater interface between the two systems.

We note that results of dye tracing studies depend heavily on the flow conditions under which they are conducted. Low stream flows provide conservative conditions for tests because the sphere of influence from any given site would be at a minimum during dry conditions (HDR 1990). Flows during 1990 tests were lower than average because of drought conditions. Flows during tests conducted in 2000 encompassed a wider range of conditions including high flows corresponding to storm runoff (test #1) and base flows more like long term summer averages (test #2).

Groundwater contribution patterns to the upwelling areas of both the Black Bear Creek and South Fork alluvial fans may have been affected by changing flow patterns in Black Bear Creek. Base flow requirements for the Spring Fork from the Black Bear Lake Project (BBL) could have altered the groundwater contribution from Black Bear Creek. Stations 3, 4, and 5 may now be continually supplied with surface water from the BBL project such that upwelling of water from South Fork sources has been reduced or eliminated due to groundwater recharge that raised the water table in these areas.

5.0 EAGLE NEST TREE SURVEY

We conducted Bald Eagle nest surveys by helicopter within the project are during the last week of July.

5.1 Nest Survey Methods

On July 27, we conducted a bald eagle nest survey of the project-affected area in areas of remaining timber, including the impoundment site, penstock route, powerhouse site, and the road and transmission line alignments. Our survey protocol followed that used by USFW and USFS for area reconnaissance and identification of eagle nesting sites.

With the use of a helicopter, we hovered just above the tree canopy and slowly proceeded through the project area looking for eagle nesting trees. The beginning of our survey was conducted up the East side of the South Fork drainage, starting at the confluence of the South Fork and ending at the cirque at the head of the South Fork Valley. We then returned on a downstream heading on the opposite side of the stream (West bank). We also surveyed the old logging road and proposed transmission line alignment corridor heading toward Black Bear Powerhouse.

5.2 Nest Survey Results

Air flight time over the project area was approximately half an hour and we did not observe any bald eagle nests, young eagles, or adults during our survey.

5.3 Nest Survey Discussion

It is unlikely that the South Fork Project will effect any eagle nesting habitat. The area has been heavily timber harvested throughout the entire project area and there are few trees standing that would be adequate for bald eagle nesting. Bald eagle nest sites are typically located near saltwater or near a large river system at an opportunistic distance from an abundant food supply. Also, the proposed AP&T hydroelectric project is located in an upstream area of the South Fork Creek, and beyond areas accessible to anadromy. These factors decrease the likelihood of bald eagles utilizing this area.

6.0 CONCLUSIONS

Results of surveys conducted in the South Fork of Black Bear Creek during 2000 corroborated results of past studies of fish distribution, provided new baseline information on habitat conditions, and confirmed the absence of bald eagle nest trees in the project area. Results of groundwater studies also corroborated previous dye tracing results which did not detect groundwater of South Fork origin in Spring Fork upwelling sites. Dye studies do not corroborate suspicions that the South Fork contributes a significant amount of the upwelling in Spring Fork anadromous areas.

In addition to providing baseline information, fish distribution and habitat surveys can also be used to identify site-specific best management practices for minimizing potential impacts to fish and fish habitat. There are few fish in the upper portion of the South Fork that could be impacted by project development. Construction activities and future operations should be conducted in a manner that habitat area and fish use downstream of the alluvial fan are not significantly affected. Habitat surveys suggest that increased sedimentation associated with site preparation and road building would be the primary risk to downstream fish habitats. This can be minimized as long as the project does not produce large quantities of sediment and substantially disrupt typical stream flow patterns.

The potential for downstream effects of project construction near the river can be reduced by concentrating construction during low mean flow periods to reduce the amount of sediment that could be contributed by construction. Construction activities coinciding with periods of the least amount of fish use in the basin (June to August) would also reduce the potential for impacts. Sedimentation risks of road construction can be limited by stabilizing exposed slopes and fill, especially in the area of an existing sediment slide approximately 50 m east of South Fork. Any access roads built next to the stream should have an appropriate particle size and culvert dimensions sufficient to withstand flood conditions.

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8.0 APPENDIX

Appendix 1. Data recorded for each habitat unit identified during our survey of the South Fork from Black Bear Creek up to the cascade near the proposed powerhouse site. Unit type codes are: P=Pool, R=Riffle, HGR=High Gradient Riffle, PP=Plunge Pool(s). Bank Class, Channel Pattern, and Riparian Dominant and subdominant codes are: VS=Vegitated Stabalized, S=Single, M=Multiple, M=Mixed connifer disidguous, S=Schrubs respectively.

Data Order	Reach	Habitat	Habitat #	Photo	% Slope	Distance upstream	(m) Length	(m) Width	(m) Depth	Channel Type	Stream Class	ACW (m)	ACH (m)	Bank Class (L/R)	Channel Pattern	D/S Riparian
1	1	r	1	20	1	38	38	8	0.4	fp3f	1	45	1	vs/vs	s	m/s
2	1	p	1	--	0	52	14	8	1.2	fp3f	1	45	1	vs/vs	s	m/s
3	1	r	2	--	1	101	49	11	0.6	fp3f	1	45	1	vs/vs	m	m/s
4	1	r	3	--	1	118	17	17	0.4	fp3f	1	45	1	vs/vs	m	m/s
5	1	p	2	--	0	130	12	10	0.9	fp3f	1	45	1	vs/vs	m	m/s
6	1	r	4	--	1	155	25	20	0.4	fp3f	1	45	1	vs/vs	m	m/s
7	1	p	3	--	0	170	15	8	1	fp3f	1	45	1	vs/vs	m	m/s
8	1	r	5	22	1	218	48	16	0.3	fp3f	1	45	1	vs/vs	m	m/s
9	1	r	6	23	2	289	71	8	0.4	fp3f	1	45	1	vs/vs	m	m/s
10	1	r	7	--	3	337	48	9	0.2	af1	1	45	1	vs/vs	s	m/s
11	1	p	4	--	0	346	9	7	1	af1	1	45	1	vs/vs	s	m/s
12	1	r	8	--	3	413	67	8	0.4	af1	1	45	1	vs/vs	s	m/s
1	2	hgr	1	--	4	438	25	5	0.4	af1	1	13	2.5	vs/vs	s	m/s
2	2	p	1	--	0	445	7	6	1.1	af1	1	13	2.5	vs/vs	s	m/s
3	2	hgr	2	--	5	473	28	4.5	0.4	af1	1	13	2.5	vs/vs	s	m/s
4	2	p	2	--	0	483	10	6.5	1.2	af1	1	13	2.5	vs/vs	s	m/s
5	2	hgr	3	--	6	530	47	4.4	0.45	af1	1	13	2.5	vs/vs	s	m/s
6	2	r	4	--	6	544	14	8.5	0.35	af1	1	13	2.5	vs/vs	m	m/s
7	2	p	3	24	0	549	5	4	1	af1	1	13	2.5	vs/vs	m	m/s
8	2	hgr	5	--	5	599	50	5	0.4	af1	1	13	2.5	vs/vs	m	m/s
9	2	p	4	--	0	604	5	5	1	af1	1	13	2.5	vs/vs	m	m/s
10	2	hgr	6	--	5	625	21	6	3.5	af1	1	13	2.5	vs/vs	s	m/s
11	2	r	7	--	2	640	15	4	0.6	af1	1	13	2.5	vs/vs	s	m/s
12	2	hgr	8	--	6	661	21	3.7	0.4	af1	1	13	2.5	vs/vs	m	m/s
13	2	p	5	--	0	668	7	5	1.3	af1	1	13	2.5	vs/vs	s	m/s
1	3	r	1	--	3	683	15	2.3	0.25	a5	2	16	2	vs/vs	s	m/s
2	3	p	1	--	0	691	8	3	1.4	a5	2	16	2	vs/vs	s	m/s
3	3	r	2	25	2	712	21	5.5	0.3	a5	2	16	2	vs/vs	s	m/s
4	3	pp	1	--	4	729	17	3.1	0.45	a5	2	16	2	vs/vs	s	m/s
5	3	P	2	--	0	737	8	5.3	1.1	a5	2	16	2	vs/vs	s	m/s
6	3	R	3	--	3	777	40	9.5	0.25	a5	2	16	2	vs/vs	s	m/s
7	3	P	3	--	0	784	6.5	6	0.9	a5	2	16	2	vs/vs	s	m/s
8	3	P	4	--	0	797	13	12.5	3	a5	2	16	2	vs/vs	S	m/s

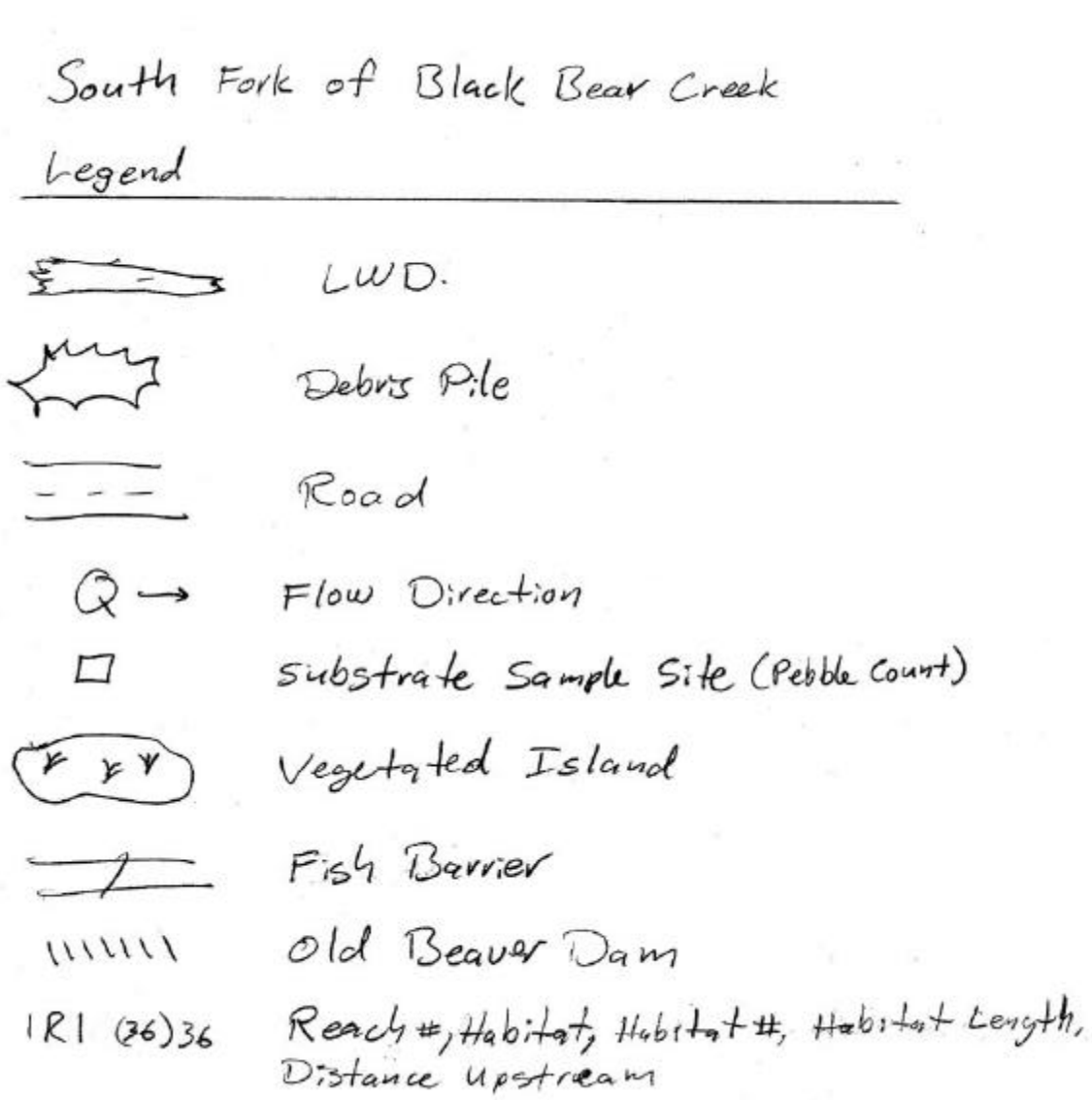
Data				% Substrate					Spawner	Habitat Cover	% Cut bank		Key	Pool	Pool
Order	Reach	Habitat	Habitat #	Fines	Gravel	Cobble	Boulder	Bedrock	area (m^2)	vert./hor.	L/R	LWD	LWD	Crest Depth	Resid. Depth
1	1	r	1	15	75	10	--	--	228	m/h	75/100	12	2	--	--
2	1	p	1	30	45	25	--	--	50.4	h/h	100/100	5	1	0.35	0.9
3	1	r	2	10	80	10	--	--	431.2	h/m	95/95	18	1	--	--
4	1	r	3	15	85	--	--	--	245.65	m/l	75/60	9	8	--	--
5	1	p	2	25	70	5	--	--	84	h/h	50/100	7	4	0.20	0.7
6	1	r	4	20	65	15	--	--	325	--	--	13	2	--	--
7	1	p	3	--	--	--	--	--	5	--	--	9	1	0.30	0.7
8	1	r	5	5	85	10	--	--	652.8	m/m	--	17	2	--	--
9	1	r	6	5	80	15	--	--	454.4	h/h	85/100	27	19	--	--
10	1	r	7	10	20	70	--	--	86.4	l/l	70/20	8	3	--	--
11	1	p	4	5	10	80	5	--	6.3	m/m	95/0	3	1	0.20	0.8
12	1	r	8	--	10	80	10	--	53.6	m/m	5/5	14	3	--	--
1	2	hgr	1	--	5	70	25	--	0	m/m	90/0	4	3	--	--
2	2	p	1	--	10	50	40	--	1	h/m	0/0	4	2	0.30	0.8
3	2	hgr	2	--	5	25	70	--	0	l/l	5/5	5	2	--	--
4	2	p	2	--	15	45	40	--	1	m/m	0/5	5	2	0.25	1.0
5	2	hgr	3	--	5	10	85	--	0	l/m	0/0	10	3	--	--
6	2	r	4	--	5	10	85	--	15	l/l	0/0	2	0	--	--
7	2	p	3	--	5	70	25	--	1	h/m	0/0	6	2	0.30	0.7
8	2	hgr	5	--	--	10	90	--	0	l/l	20/0	7	1	--	--
9	2	p	4	--	5	10	85	--	1	m/m	0/0	5	0	0.25	0.8
10	2	hgr	6	--	--	20	80	--	0	m/l	0/0	6	1	--	--
11	2	r	7	--	--	30	70	--	15	l/l	0/0	4	1	--	--
12	2	hgr	8	--	--	35	75	--	0	m/h	0/20	3	1	--	--
13	2	p	5	--	5	45	55	--	1.75	h/h	0/0	9	4	0.30	1.0
1	3	r	1	--	35	40	10	5	12.075	h/h	0/0	5	1	--	--
2	3	p	1	--	15	50	20	15	3.6	h/h	0/0	18	4	0.30	1.1
3	3	r	2	--	20	75	5	--	23.1	l/l	0/0	4	0	--	--
4	3	pp	1	--	10	50	40	--	15	h/h	0/0	33	14	--	--
5	3	p	2	--	--	50	50	--	1	h/h	0/0	12	6	0.35	0.8
6	3	r	3	--	10	50	40	--	30	l/l	0/0	22	7	--	--
7	3	p	3	5	30	40	30	--	3	m/h	0/0	5	1	0.35	0.6
8	3	p	4	--	--	20	40	45	1	h/h	0/0	38	11	0.50	2.5

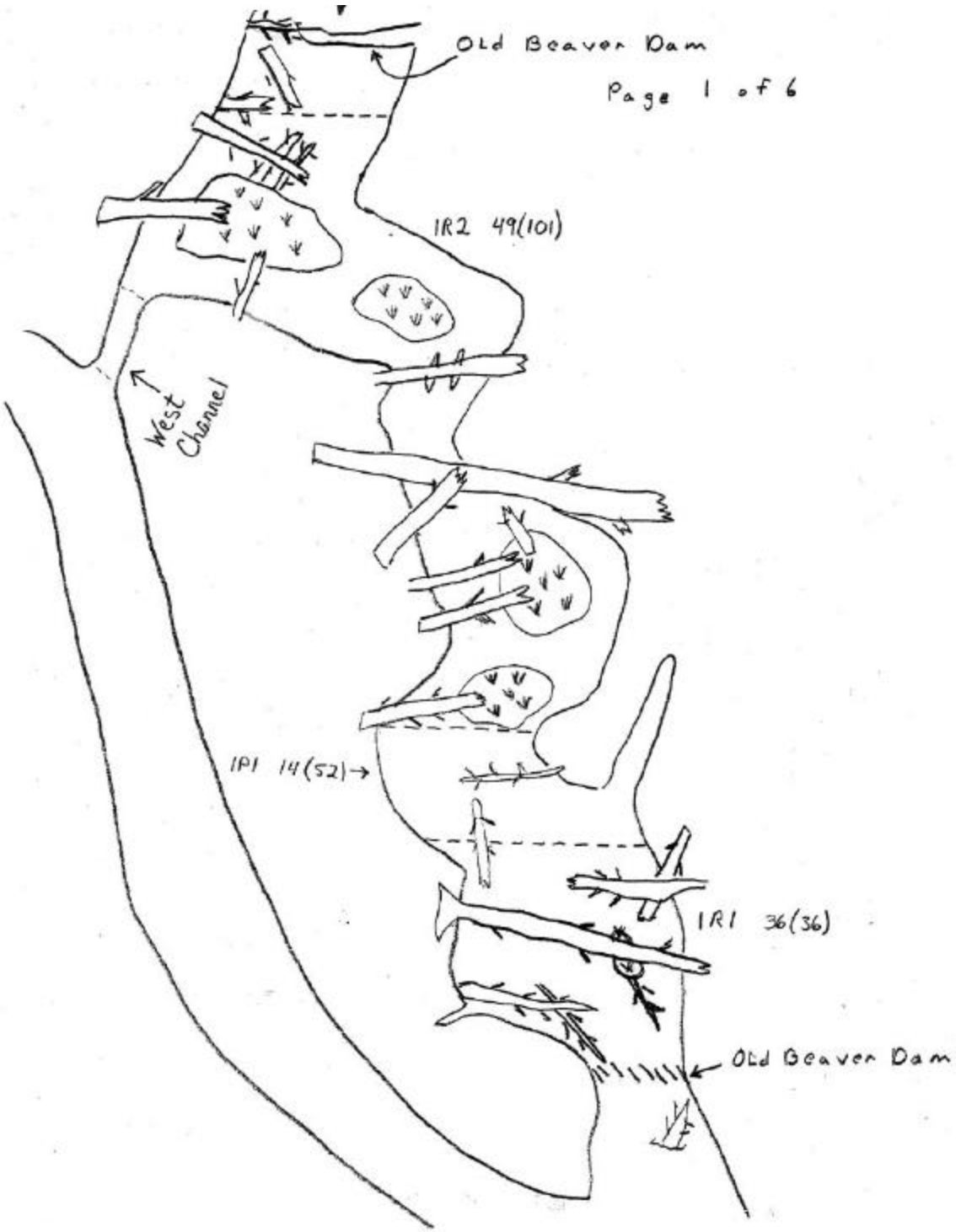
	Side								
Stream	Channel	Habitat	habitat #	% slope	length	width	depth	LWD	key LWD
South Fork	01l	r	1	1	19	5	0.3	5	5
South Fork	02l	r	3	1	63	6.5	0.25	13	4
South Fork	01l	p	3	0	6	8	1	--	--
South Fork	01l	r	1	2	23	3	0.15	9	4
South Fork	02r	r	2	6	28	2	0.2	--	--
West Channel	00	r	1	1	34	8	0.25	6	3

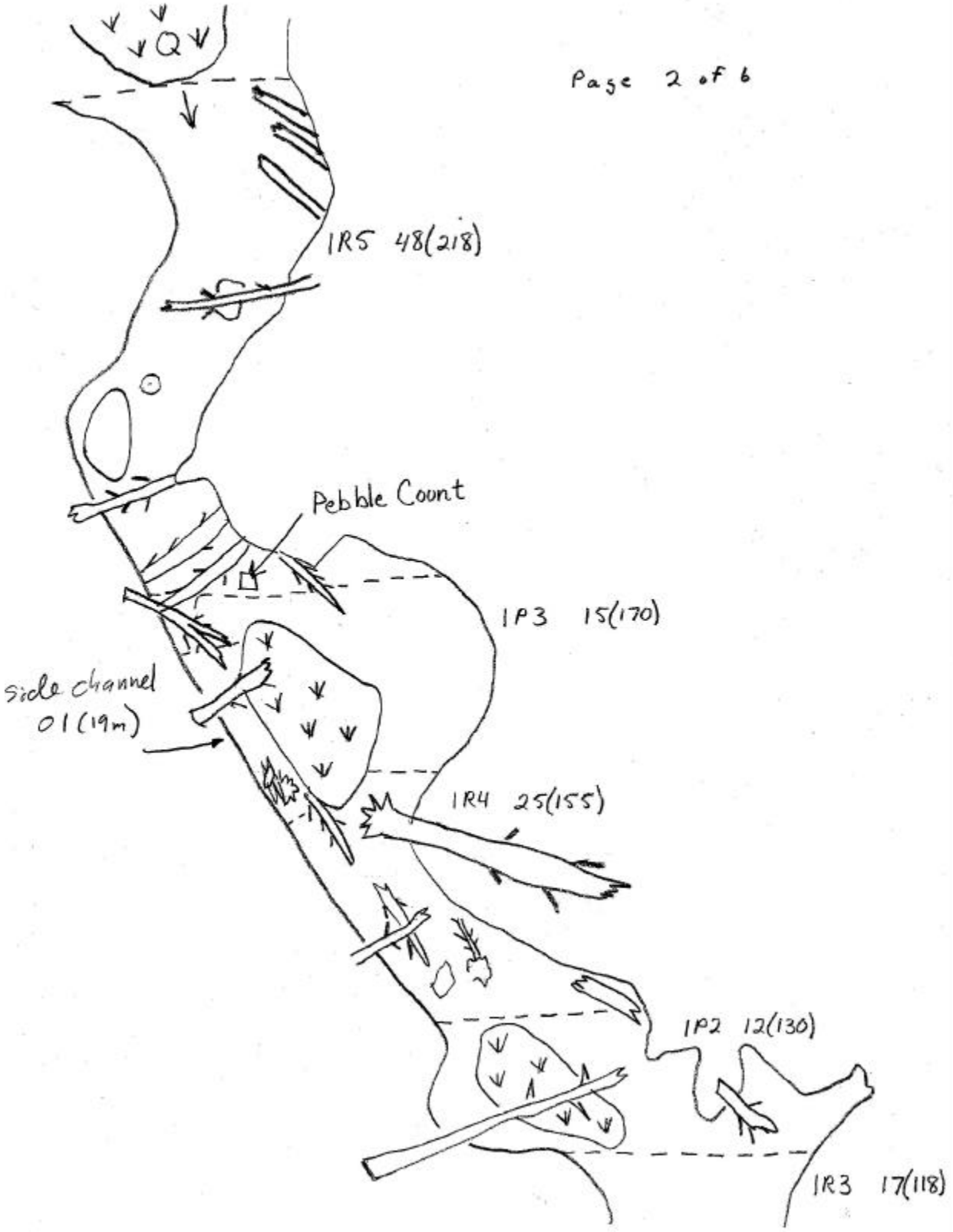
Appendix 2. Field maps drawn by the survey crew of habitat units sequences for the entire length of the survey.

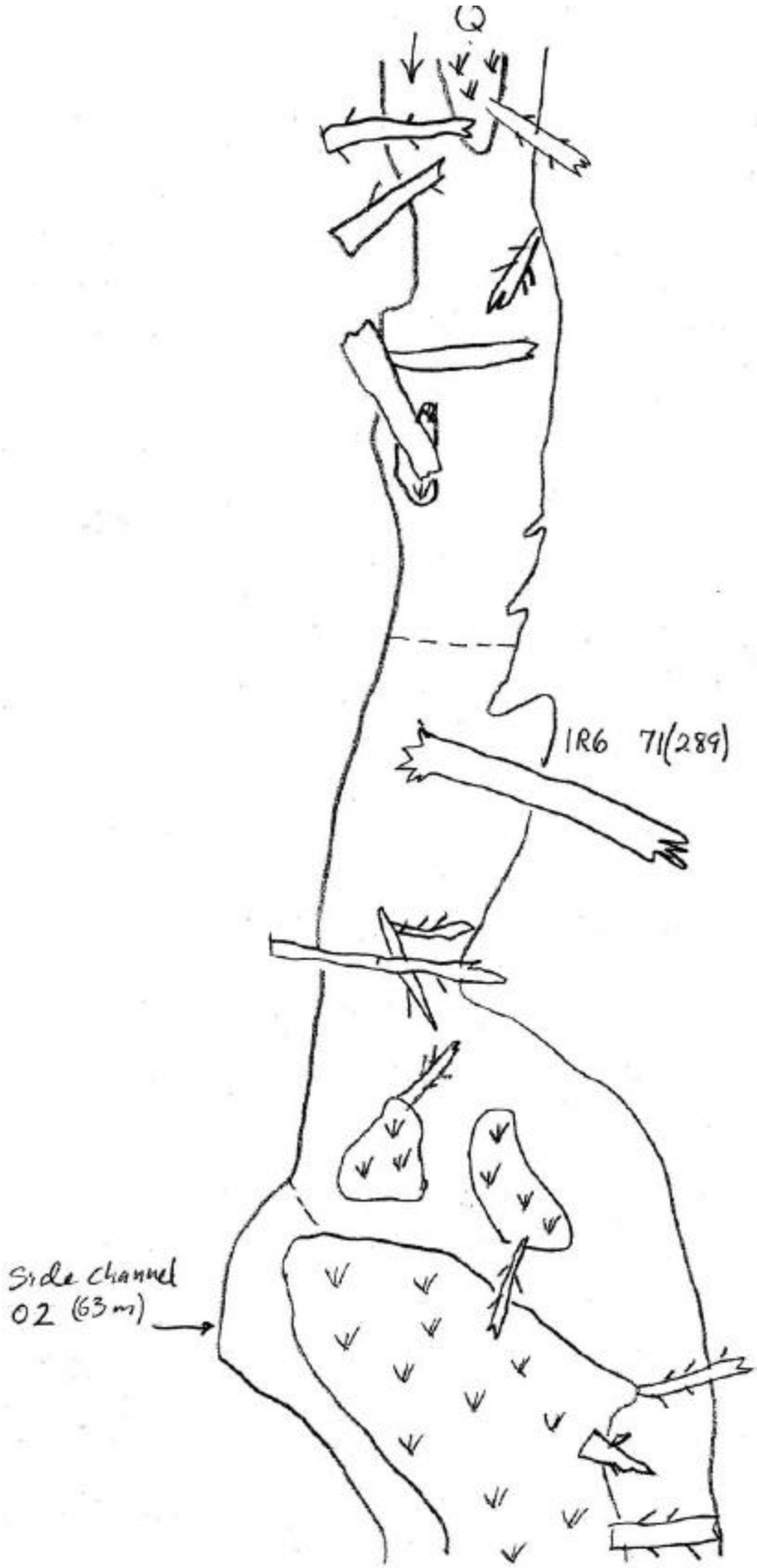
South Fork of Black Bear Creek

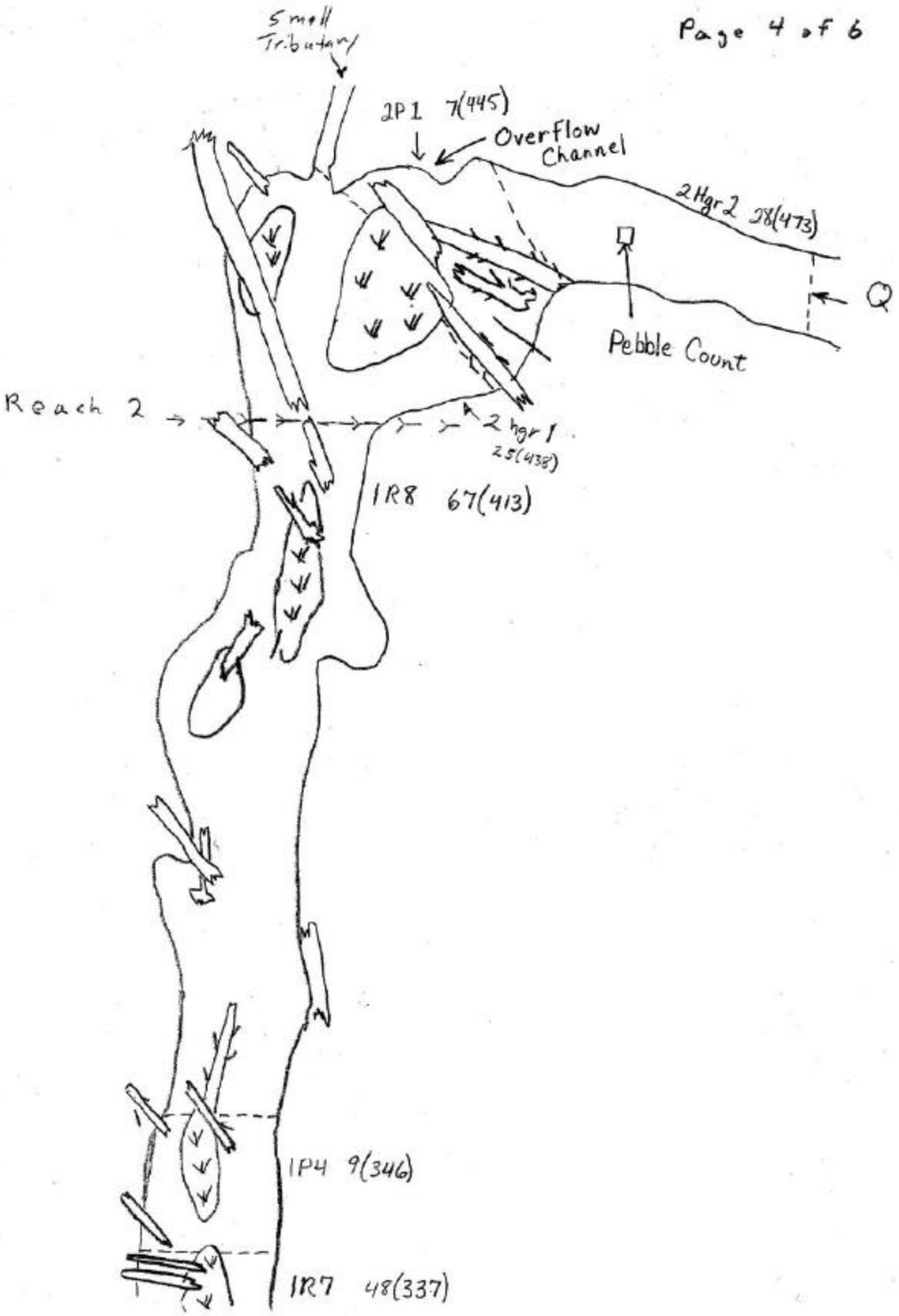
Legend

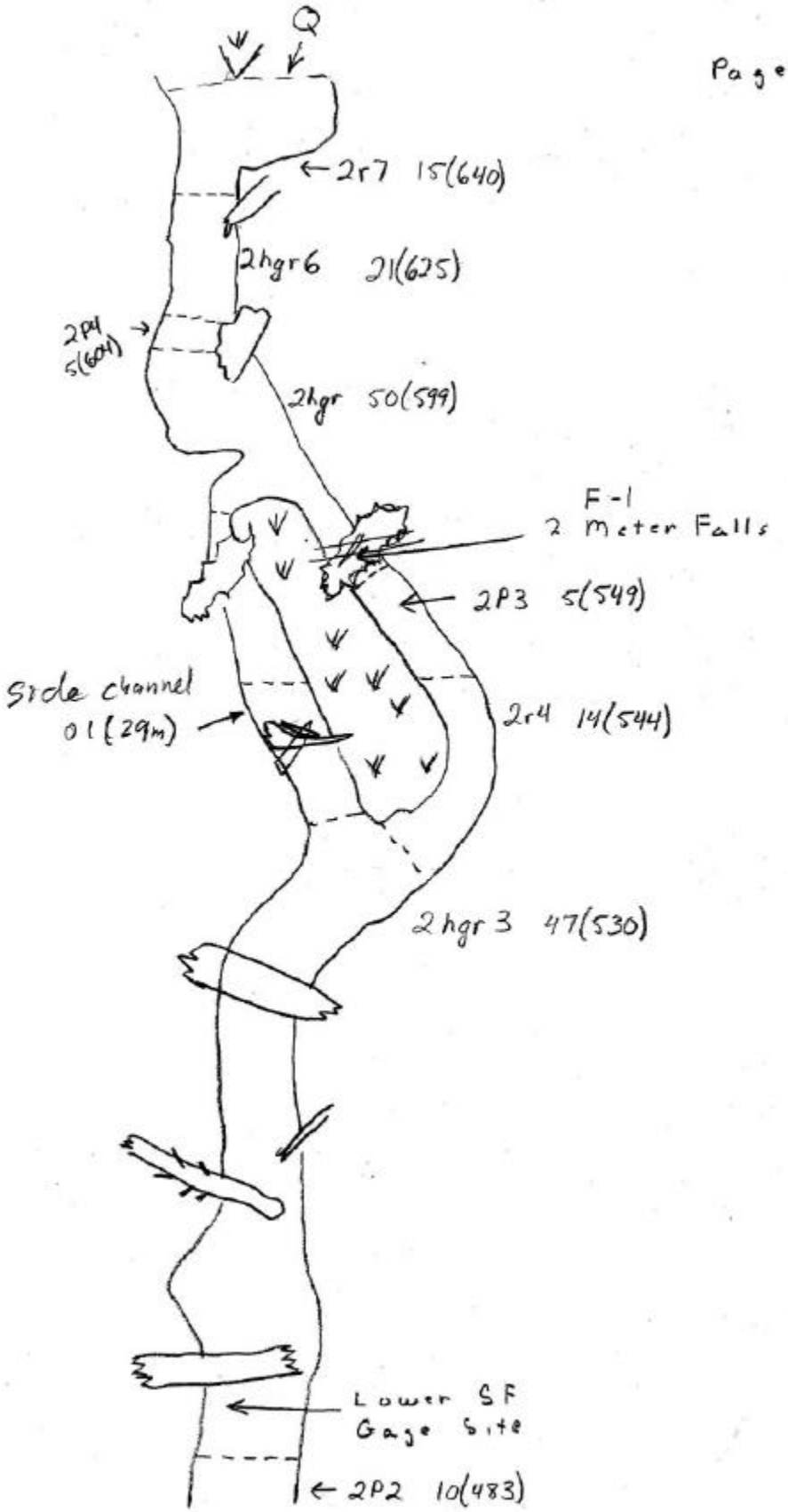


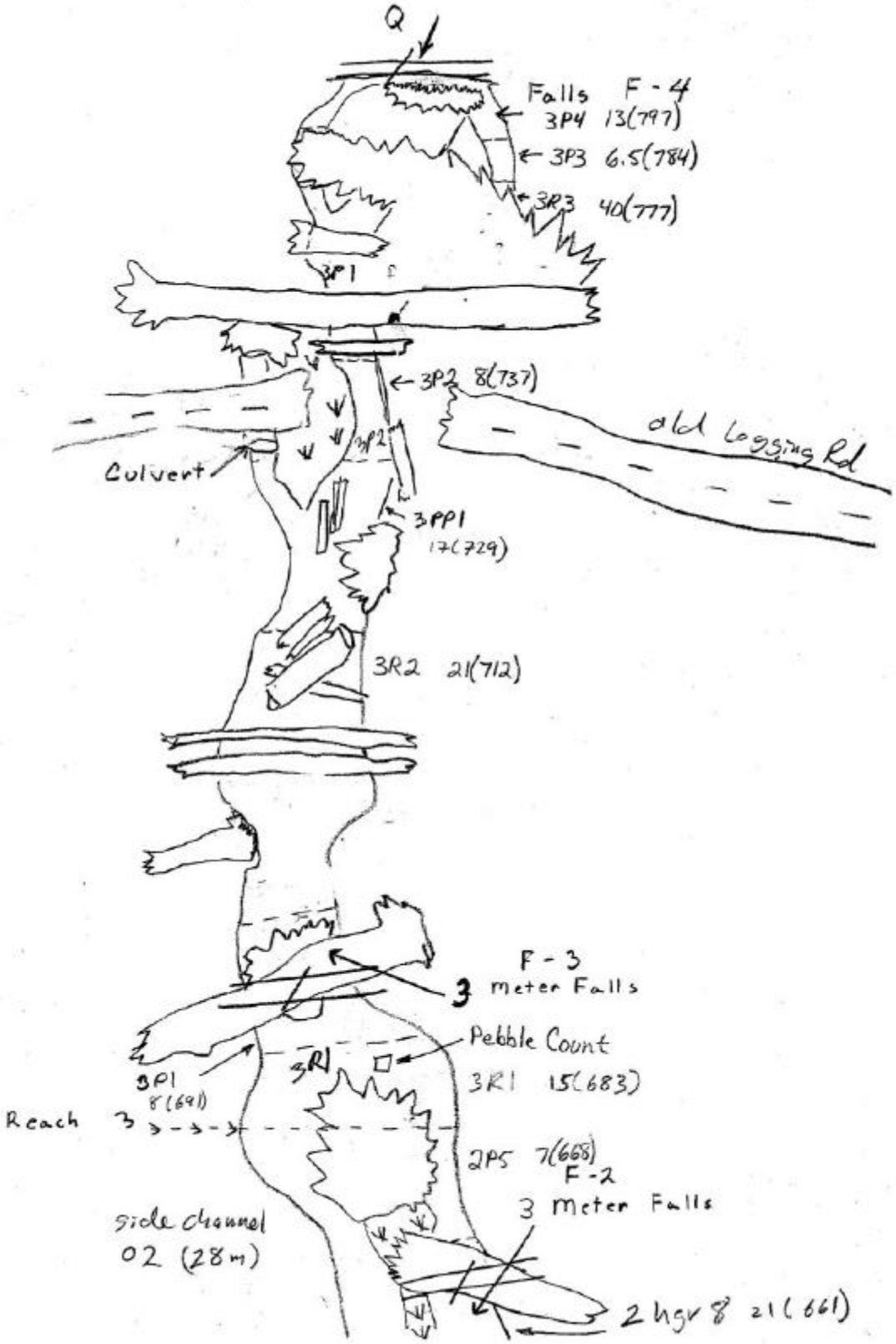

Old Beaver Dam
Page 1 of 6
IR2 49(101)
West Channel
IP1 14(52)→
IR1 36(36)
Old Beaver Dam


Q
Page 2 of 6
1R5 48(218)
Pebble Count
1P3 15(170)
side channel
01(19m)
1R4 25(155)
1P2 12(130)
1R3 17(118)


Q
IR6 71(289)
Side channel
02 (63 m)


Small Tributary
2P1 7(445)
Overflow Channel
2Hgr2 38(473)
Q
Pebble Count
Reach 2
2 hgr 1
25(438)
1R8 67(413)
1P4 9(346)
1R7 48(337)


Q
2r7 15(640)
2hgr6 21(625)
2P4 5(604)
2hgr 50(599)
F-1
2 meter Falls
2P3 5(549)
Side channel
01(29m)
2r4 14(544)
2hgr3 47(530)
Lower SF
Gage Site
2P2 10(483)


Q
Falls F-4
3P4 13(797)
3P3 6.5(784)
3R3 40(777)
3P1
3P2 8(737)
old Logging Rd
Culvert
3P2
3PP1
17(729)
3R2 21(712)
F-3
3 meter Falls
Pebble Count
3P1
8(691)
3R1
3R1 15(683)
Reach 3
2P5 7(668)
F-2
3 meter Falls
side channel
02 (28m)
2 hgr 8 21(661)

Appendix 3. ADF&G fish collection permit

Sep.19. 2000 9:59AM No.2989 P. 2/3

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
P.O. Box 25526
JUNEAU, ALASKA 99802-5526

Permit No. SF-2000-047

Expires 10/1/2000

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes Glen Martin **of** Alaska Power & Telephone Co.
person, agency or organization
at PO Box 3222, Port Townsend, WA 98368 to conduct the following activities
address
from April 15, 2000 **to** September 30, 2000 in accordance with AS 16.05.930.

Purpose: To: 1) collect more data on seasonal and spatial fish composition by species downstream of a migration barrier on the South Fork of Black Bear Creek; 2) survey to determine baseline habitat conditions downstream of tailrace; 3) survey Lake Fork downstream to Black Lake to document habitat quality and quantity.

Location: South Fork of Black Bear Creek on Prince of Wales Island, Alaska, and Black Bear Creek from the Black Bear Lake Hydro project tailrace to Black Lake.

Species Collected and Final Disposition: Any species and number of fish may be captured, identified, measured for length, and released live at the site of capture (see **Contingencies** section).

Method of Capture: Fish may be captured by use of minnow traps, dip nets, hoop nets, and electroshocking equipment (see **Contingencies** section).

Authorized Personnel: The following personnel may participate in collecting activities under terms of this permit: Glen Martin; Randy Otos; Bernie Romey.

-Continued on Back-

REPORT DUE November 1, 2000. The report shall include species, numbers, dates, and locations of collection and disposition, and if applicable, sex, age, and breeding condition, and lengths and weights of fish. The report shall also include other information as may be required under the contingencies section.

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.
2. No specimens taken under authority hereof may be sold or bartered. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.
3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until detailed reports, as specified above, have been received by the department.
5. UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

Fish Resource Permit Coordinator
Division of Sport Fish

Director
Division of Sport Fish

4/14/00
Date

Contingencies:

1) **Bob Chadwick** (755-8802; Home:826-5364; bob_chadwick@fishgame.state.ak.us) Craig (POW) Sport Fish Division Area Management Biologist, must be notified within a few days **prior** to engaging in collecting activities within his management area. These biologists have the right to specify methods for collecting, as well as limiting the collections of any species, and the number of specimens collected by time and area.
2) No fish may be possessed live or transported without a valid Fish Transport Permit (FTP) obtained from the Alaska Department of Fish and Game.
3) Salmon eggs used as bait in traps must be disinfected prior to use. A 10 minute soak in 1/100 Betadyne solution or some other iodophor disinfectant is adequate.
4) All unattended collecting gear must be labeled with the permittee's name, telephone number, and permit number.
5) Electroshocking is currently discouraged, but not prohibited by the department. Electroshockers may not be used in the presence of spawning salmonids or adult trout.
6) A Title 16 Permit is required from Alaska Department of Fish and Game, Division of Habitat and Restoration, to place structures (weir, etc.) in streams.
7) *A copy of this permit, including any amendments, must be made available at all field collection sites and project sites for inspection upon request by a representative of the department or a law enforcement officer.*
8) Issuance of this permit does not absolve the permittee from compliance in full with any and all other applicable federal, state, or local laws regulations, or ordinances.
9) A report of collecting activities, referenced to this fish resource permit number, must be submitted to the Alaska Department of Fish and Game, Division of Sport Fish, PO Box 25526, Juneau, AK 99802-5526, attention Al Havens (465-6183; alan_havens@fishgame.state.ak.us), within 30 days after the expiration of this permit. This report must summarize, by species, the fish captured and incidental mortalities. A report is required whether or not collecting activities were undertaken. A report should also be sent to the Biologist(s) listed under number 1 in this Contingencies section.

cc: Bob Chadwick, Division of Sport Fish, Craig
Division of Commercial Fisheries, Douglas
Division of Habitat and Restoration, Douglas
Fish and Wildlife Protection, Juneau