18736

Alaska Coastal Zone Management Program

ANNETTE ISLANDS STREAM INVENTORY

Potential Salmon Production Summary

EVELYN BIGGS, FISHERIES MANAGEMENT BIOLOGIST

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Alaska Coastal Zone Management Program
GB425.A4B55 1981

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Potential Salmon Production Summary

Prepared for the

Metlakatla Indian Community

by

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"This project was supported, in part, by Federal Coastal Zone Management Program Implementation Funds (P.L. 92583, Sec. 306) granted to the State of Alaska by the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce."

ACKNOWLEDGEMENTS

I would like to express my thanks and appreciation to the following people:

Joe Yuska and Chuck Huntington, two Oregon State University graduate students, for their long, hard hours in the field, for their assistance with the data interpretation and for their invaluable advice concerning stream inventories.

The Annette Island U.S. Weather Bureau staff for the helium, the use of tools, regulators, and muscle-power, and for their instructions concerning balloon handling.

Dale Williams, for his assistance in interpreting and providing additional insight to the U.S. Fish and Wildlife Service data. Also thanks to many of the Metlakatla Indian community members who provided me with additional historic information concerning Annette Island streams and the salmon resource.

The Metlakatla Indian Community, Annette Natural Resource Center staff for their assistance in keeping this project rolling and for the use of their offices and equipment.

Pacific Rim Planner, Inc., for providing me with office space and for their advice and assistance concerning this project.

Finally, to June Hanley who put in long hours and did an excellent job typing this report.

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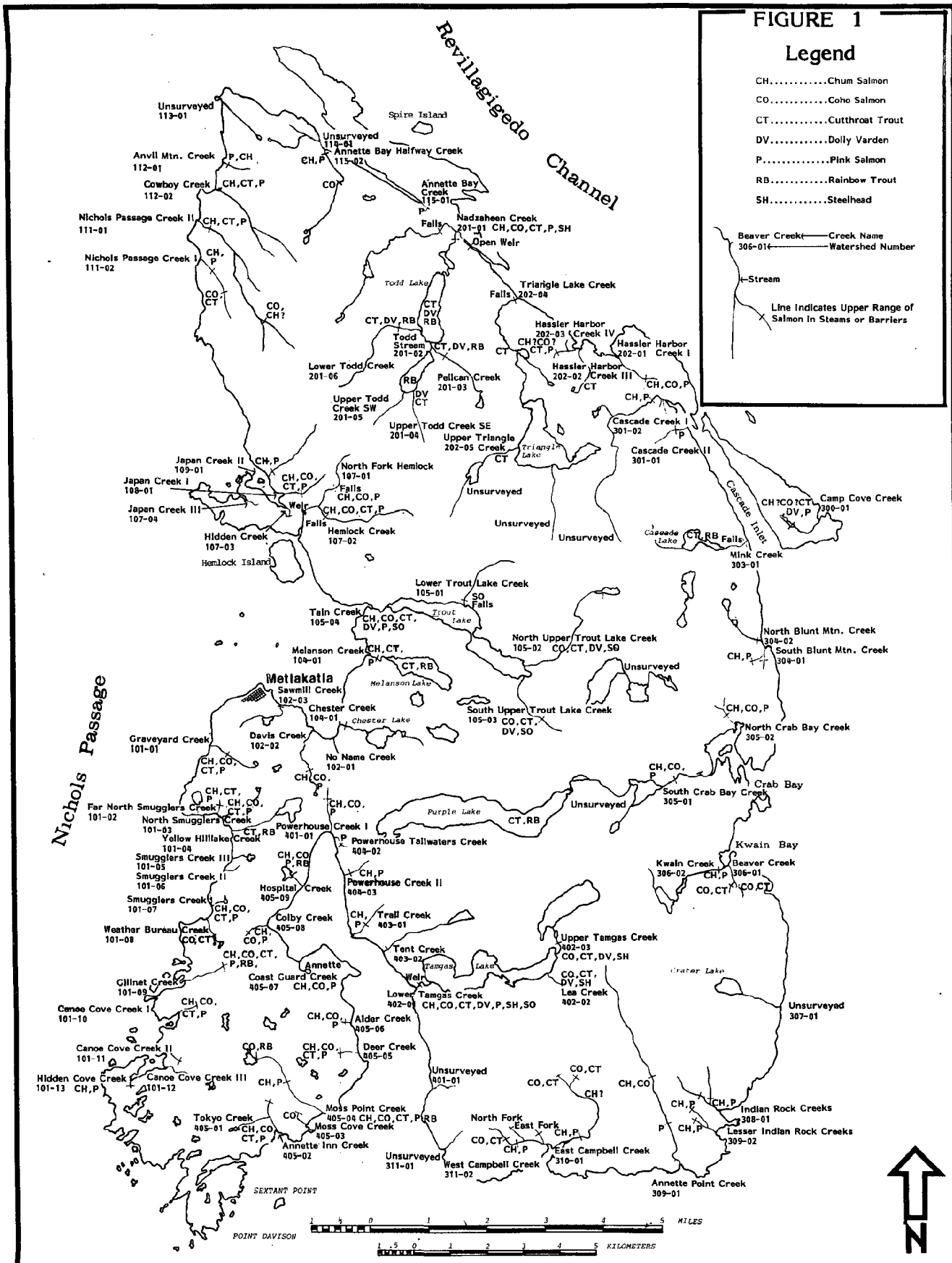
STREAM LISTING

Stream Name	Watershed Number	Statistical Number	Individual Stream Survey Page Number
1. Anvil Mountain Creek	112-01	101-28-001	27
2. Cowboy Creek	112-02	101-28-002	31
3. Nichols Passage Creek II	111-01	101-28-003	35
4. Nichols Passage Creek I	111-02	101-28-004	41
5. Japan Creek II	109-01	101-28-005	45
6. Japan Creek I	108-01	101-28-006	49
7. Hidden Creek	107-03	101-28-007	53
8. Japan Creek III	107-04	101-28-008	55
9. North Fork Hemlock Creek	107-01	--	57
10. Hemlock Creek	107-02	101-28-009	59
11. Tain Creek	105-04	101-28-010	63
12. Lower Trout Lake Creek	105-01	101-28-011	67
13. North Upper Trout Lake Creek	105-02	101-28-012	71
14. South Upper Trout Lake Crek	105-03	101-28-013	77
15. Melansin Creek	104-01	101-28-014	83
16. Chester Creek	104-01	--	87
17. No Name Creek	102-01	101-28-015	88
18. Davis Creek	102-02	101-28-016	89
19. Sawmill Creek	102-03	101-28-017	93
20. Graveyard Creek	101-01	101-28-018	97
21. Far North Smugglers Creek	101-02	101-28-020	101
22. North Smugglers Creek	101-03	101-28-021	103
23. Yellow Hill Lake Creek	104-04	101-28-022	107
24. Smugglers Creek III	101-05	101-28-024	111
25. Smugglers Creek II	101-06	101-28-025	113
26. Smugglers Creek I	101-07	101-28-026	115
27. Weather Bureau Creek	101-08	101-28-027	119
28. Gillnet Creek	101-09	101-28-028	123
29. Canoe Cove Creek I	101-10	101-28-029	127
30. Canoe Cove Creek II	101-11	101-28-030	131
31. Canoe Cove Creek III	101-12	101-28-031	135
32. Hidden Cove Creek	101-13	101-28-032	137
33. Tokyo Creek	405-01	101-26-002	141
34. Annette Inn Creek	405-02	101-26-001	145
35. Moss Cove Creek	405-03	101-26-003A	149
36. Moss Point Creek	405-04	101-26-003	151
37. Deer Creek	405-05	101-26-004	155
38. Alder Creek	405-06	101-26-005	159
39. Coast Guard Creek	405-07	101-26-006	161
40. Colby Creek	405-08	101-26-007	165
41. Hospital Creek	405-09	101-26-008	169
42. Powerhouse Creek I	404-01	101-26-015	173
43. Powerhouse Tailwaters Creek	404-02	101-26-016	177
44. Powerhouse Creek II	404-03	101-26-017	181
45. Trail Creek	403-01	101-26-018	183

STREAM LISTING Continued

Stream Name	Watershed Number	Statistical Number	Individual Stream Survey Page Number
46. Tent Creek	403-02	101-26-019	187
47. Lower Tamgas Creek	402-01	101-26-025	189
48. Upper Tamgas Creek	402-03	101-26-027	193
49. Lea Creek	402-02	101-26-026	199
50. Unsurveyed Creek	401-01	--	
51. Unsurveyed Creek	311-01	--	
52. West Campbell Creek	311-02	101-24-030	201
53. East Campbell Creek	310-01	101-24-032	205
54. Annette Point Creek	309-01	101-24-079	209
55. Lesser Indian Rock Creeks	309-02	101-24-081	213
56. Indian Rock Creeks	308-01	101-24-083	217
57. Unsurveyed (Crater Lake Creek)	307-01	--	
58. Beaver Creek	306-01	101-24-086	221
59. Kwain Creek	306-02	101-24-087	225
60. South Crab Bay Creek	305-01	101-24-094	229
61. North Crab Bay Creek	305-02	101-24-095	235
62. South Blunt Mountain Creek	304-01	101-24-096	239
63. North Blunt Mountain Creek	304-02	101-24-097	243
64. Camp Cove Creek (Ham Island)	300-01	101-24-098	245
65. Mink Creek	303-01	101-24-099	249
66. Cascade Creek II	301-01	101-42-056	250
67. Cascade Creek I	301-02	101-42-057	251
68. Hassler Harbor Creek I	202-01	101-42-058	255
69. Hassler Harbor Creek III	202-02	101-42-059	259
70. Hassler Harbor Creek IV	202-03	101-42-060	261
71. Triangle Lake Creek	202-04	101-42-061	265
72. Upper Triangle Lake Creek	202-05	101-42-063	269
73. Pelican Creek	201-03	101-42-064	273
74. Upper Tood Creek SE	201-04	101-42-070	275
75. Upper Todd Creek SW	201-05	101-42-062	276
76. Todd Stream	201-02	101-42-065	277
77. Lower Todd Creek	201-06	101-42-066	281
78. Nadzaheen Creek	201-01	101-42-067	285
79. Annette Bay Creek	115-01	101-42-068	289
80. Annette Bay Halfway Creek	115-02	101-42-069	293
81. Unsurveyed	114-01	--	
82. Unsurveyed	113-01	--	



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Annette Islands
Stream Survey

Evelyn Biggs, Fisheries Management Biologist

Introduction

The Metlakatla Indian Community (MIC), because of its unique right to manage the Annette Island resources, compiles a Salmon Management Plan every year. In the course of salmon fisheries management, since salmon have a freshwater life-cycle phase and since much of what happens in the streams (escapement, spawning, incubation of eggs, rearing of fry, smoltification and outmigration) determines the future magnitude of salmon stocks originating in those streams, there arises the need for a freshwater habitat evaluation. This evaluation provides baseline data for monitoring and manipulating potential and current salmon production from streams. This study was devised and compiled to provide MIC resource planners with baseline data to aid in wise management and potential enhancement of Annette Islands' valuable salmon resource.

This inventory was compiled from several previous and recent studies conducted on Annette Island. In 1971-1976, the U.S. Fish and Wildlife Service conducted stream and lake surveys on Annette Island; however, no formal report was ever published revealing these findings. In 1979, a watersheds study was completed examining water quality, water flow characteristics of some streams, lakes, and estuaries surrounding the Annette Islands (Pacific Rim Planners, Inc., 1979A). Data from both of these studies was combined with data collected in streams during 1980 and 1981 and evaluated in terms of how various physical and biological parameters affect salmon production in the streams and recommendations regarding management and enhancement of the streams were made. In addition, stream conditions and salmon production realized on the Annette Islands were related to conditions and production found in other Pacific Northwest locations through a literature review.

There are approximately 82 streams that drain the Annette Islands (a few other small creeks exist, but were not counted). More detailed descriptions of the major watersheds and their sub-basins is available in the Annette Island Watershed Study and Annette Islands Coastal Management Program (Pacific Rim Planners, Inc., 1979A and 1979B). The streams range in size considerably, but are of three general types:

1. those streams draining muskeg ponds, lakes or originating from muskeg run-off (e.g. Canoe Cove Creeks, Graveyard Creek), characterized by lower pH and high Tannic Acid concentration

2. those streams draining higher elevation lakes (eg. Tain Creek, Tamgas Creek) characterized by high temperatures in the summer and less variable streamflow.

3. and those streams originating from mountain run-off (e.g. Annette Point Creek, Anvil Mountain Creek) characterized by low year round temperatures and flashiness (variable flows)

Specific characteristics of each of the creek types affect salmon production as well as physical and biological factors that occur in all three creek types. The various factors that affect salmon production in streams, including factors characteristic of the stream types, fall into two general categories:

I. Physical Factors (12)

A. Hydrogeographic

1. stream bed gradient
2. bottom composition and gravel types
3. meander (sinuosity)
4. origin
5. pool:riffle ratios and pool size
6. water velocity
7. water flow (can be related to rainfall, 32,36)
8. stream depth and width
9. stream bank composition and stability
10. presence or absence of barriers to migration

B. Chemical

1. pH and cause of acidity or basicity
2. water temperature
3. clarity/turbidity
4. dissolved oxygen
5. dissolved carbon dioxide
6. total alkalinity
7. total hardness
8. dissolved and suspended solids (related to B.3)
9. conductivity
10. pollutants or toxins

C. Other

1. large organic debris presence
2. small organic matter presence
3. presence of beaver dams or other physical obstructions (including man-made ones)

II. Biological Factors

A. Extrapensatory (independent of population density - all physical factors are considered extrapensatory)

1. stream primary productivity
2. stream invertebrate abundance
3. terrestrial insect abundance (as a potential salmonid food source)
4. aquatic and terrestrial vegetation present

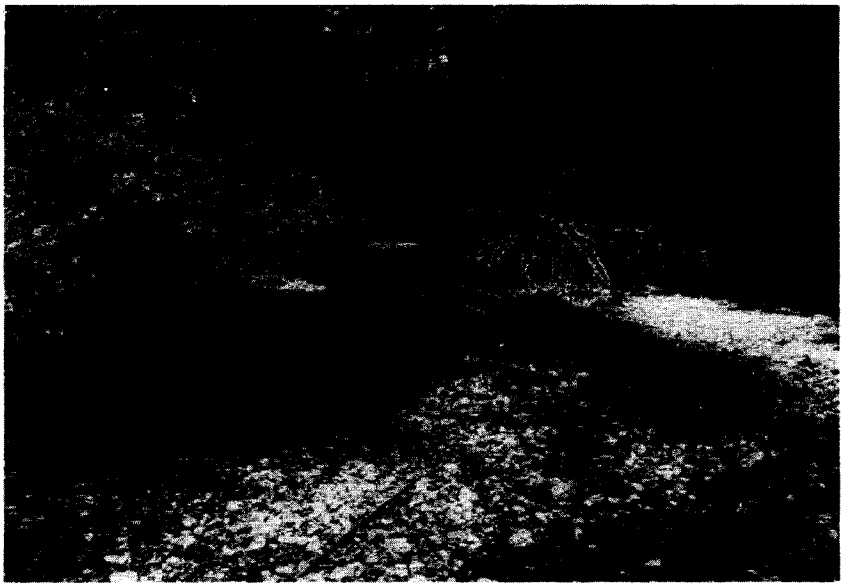
B. Compensatory (freshwater survival is generally related inversely with factor, usually over a threshold number)

1. escapement magnitude
2. density of eggs and alevins in gravel and of fry and fingerlings in the stream

C. Depensatory (freshwater mortality due to factor generally related inversely with population density)

1. predation (although this can be compensatory also)

Many of these factors are interdependent and a complex model involving all of them has never been compiled, even though many stream models have been drawn up. Since many of these factors were examined in the Annette Islands streams, a production model could be constructed if only for each of the three stream types. However, for the purposes of estimated potential salmon production, a very simple model was drawn up utilizing survival rates realized in streams similar to those on Annette, optimal escapements based on available spawning bed magnitude and historical escapement, and relating survival and salmon migration (of both adults and smolts) to individual stream conditions. It is recommended that for future estimates of actual stream production projections, a more precise model be constructed based on weather conditions (and relating those to stream flow, changes in available rearing and spawning habitat, stream temperature, other water quality factors and miscellaneous other physical and biological factors), actual escapements, fry counts, hatchery releases, and salmon catch (commercial); in addition, changes made affecting creeks, such as logging practices, road construction, and pollution, should be taken into account prior to stream production modelling. At this point in time, there is sufficient baseline data present or currently being collected, to compose a rudimentary model similar to that suggested.



Literature Review

A thorough review of current literature is valuable in relating stream conditions and habitat characteristics found on Annette Island to similar streams and factors affecting production in the Pacific Northwest that have been well documented. Production statistics found in these other streams may provide a clearer picture of what could be expected in terms of potential production out of Annette Island streams. Factors affecting production and production statistics will be examined in each phase of salmon life history, beginning with the migration of the adults to their home streams (only factors and species that could or do occur on Annette will be covered in detail).

Adult Return Migration

Many of the migration patterns and timing of salmon are genetically determined (4); however, physical factors do affect and change run timing and success. First of all, a stream must be physically large enough to accommodate salmon. Table 1 summarizes preferred and/or acceptable habitat conditions and includes acceptable stream depths that will allow salmon passage. Temperature can also affect salmon migration, but generally, detrimental affects occur only above a certain tolerable level (see Table 1 for ranges). Burgner (4) found that earlier warmer water temperatures induced earlier sockeye migrations. Adequate dissolved oxygen levels are required for sustained swimming of salmon (high temperature during the fall can lead to decreased oxygen levels), and it has been determined that levels should not fall below 5 mg/l oxygen during migration (28). Turbidity should not exceed 400 mg/l as it abrades salmon gills and acts as a thermal barrier (28). Barriers that impede migration should be identified, whether they are falls, debris jams, or excessive water velocities, removable or stationary. Table 1 lists acceptable velocities for salmon migration. Bryant (14) states that large organic debris (LOD) does not, in most cases, block fish passage. In fact, LOD can actually aid in migration by providing "stepped falls" in places that would normally be a velocity barrier (32). Adequate streamflow are critical to migration by providing acceptable depths and oxygen levels for passage. Thompson (9) stated that stream flow required for passage was found to be generally 67% of that required for spawning. Delayed stream flows increases over the summer was shown to delay the timing of the upstream migration of pink and chum salmon (12).

Spawning

The most obvious factor affecting spawning is the amount of suitable area available. Creek size, the percentage of suitable gravels present, and stream flow generally determine the amount of area that will be available. Table 1 summarizes preferred or acceptable water depths, velocities and temperatures for the different species of salmon. Successful spawning has occurred in temperatures ranging from 2.2 to 20C; however, a sudden drop in temperature can cause all spawning to cease (28). Gravel size is important as each species has a particular range of sizes it can use. Table 1 summarizes gravel sizes acceptable

TABLE 1. HABITAT PREFERENCES AND SALMON PRODUCTION STATISTICS

PINKS	Life History Phase	Preferred/Acceptable (P/A) Depth (m)	P/A Velocity (fps)	Temperature Preference/ Tolerance (°C)	Substrate Size Preference	For Spawning: Redd Size/ Area Recommended per Spawning Pair For Incubation and Rearing: Densities Observed, Area/Fish/ Fish/Area
Fecundity: 1300-1800 (12,70) 1500*	Adult Migration	≥ .18m - Oregon (34) .09-1.1m- Kodiak (2)	≤ 7.0 (34) .1-4.0-Kodiak (2)	6.2 - 15.6 (28)	--	--
	Spawning	≥.18m - Oregon (34) .15-.53m (28)	.7-3.33 (28)	7.2 - 12.8 (28)	1.3-10.2cm (28)	$.6m^2$ /$.6m^2$ (28)
	Incubation	--	Apparent (in gravel) >.0033 (20cm/h) < scour vel.	4.4 - 13.3	25% volume of fines (fine ≤ 6.4mm) (28)	$.002m^2/1000/m^2$ (28) Alaska
	Fry-Fingerling	--	--	5.6-14.6, optimum=10.1 Upper leathal=25.8 (28)	--	2cm fish: $.002m^2/1000m^2$ (28) Alaska
CHUM						
Fecundity: 2100-3100 (12,20) 2500*	Adult Migration	≥.18m - Oregon (34)	≤ 8.0 (34)	8.3-15.6 (28)	--	--
	Spawning	≥.18m - Oregon (34)	1.5-3.3 (34) .7-3.3 (28)	7.2-12.8 (28)	1.3-10.2cm (28)	$2.3m^2/9.2m^2$ (28)
	Incubation	--	Apparent (in gravel) >.003 (20cm/h) < scour vel.	4.4-13.3 (28)	< 25% volume of fines (fines ≤ 6.4mm) (28)	$.001m^2/1000/m^2$ (28) in B.C.
	Fry Fingerling	--	--	11.2-14.6 optimum=13.5 Upper lethal=25.8 (28)	---	$.03m^2/33.3/m^2$ (28) in B.C.
COHO						
Fecundity: 2850*	Adult Migration	≥.18m - Oregon (34)	≤ 8.0 (34)	7.2-15.6 (28)	--	--
	Spawning	≥.18m - Oregon (34)	1-3 (34) .7-2.3 (28)	4.4-9.4 (28)	1.3-10.2cm (28)	$2.8m^2/11.7m^2$ (28)
	Incubation	--	Apparent (in gravel) >.0033 (20cm/h) < scour vel.	4.4-13.3 (28)	< 25% volume of fines fines ≤6.4mm (28)	$.33m^2/31m^2$ (28) in B.C.
	Fry-Fingerling	.3-1.2 (9,34)	.2-.8 (9,34) .3-.7 (9)	11.8-14.6 optimum=20.0 Upper lethal=25.8 (28)	--	$3.7-5.5m^2/.2-.3/m^2$ (28) in B.C.

* Annette Island - 1981 Tamgas Hatchery Brood Stock Statistics

CONTINUED

ABLE 1. HABITAT PREFERENCES AND SALMON PRODUCTION STATISTICS CONTINUED

CKEYE	Life History Phase	Preferred (P/A) Depth (m)	P/A Velocity (fps)	Temperature Preference/ Tolerance (°C)	Substrate Size Preference	For Spawning: Redd Size/ Area Recommended per Spawning Pair For Incubation and Rearing: Densities Observed, Area/Fish/ Fish/Area
cundity: 00*	Adult Migration	≥.18m - Oregon (34)	≤ 7.0	7.2 - 15.6 (28)	--	--
	Spawning	≥.18m - Oregon (34) .3-.46m -Wash (34)	Around 1.75 (28) Washington	10.6-12.2 (28)	1.3-10.2cm (28)	$1.8m^2/6.7m^2$
	Incubation	--	Apparent (in gravel) >.0033 (20cm/h) < scour vel.	4.4-13.3 (28)	< 25% volume of fines (fines ≤ 6.4mm) (28)	--
	Fry-Fingerling	--	--	11.2-14.6 optimum=15.0 Upper lethal=24.6 (28)	--	--
EELHEAD						
	Adult Migration	≥ .18 - Oregon (34)	≤8.0 (34)	--		--
	Spawning	≥ .18 - Oregon (34)	2.0-2.3 (28) Oregon	3.9-9.4 (28)	.6-10.2cm (28)	$5.4m^2$/--
	Incubation	--	Apparent (in gravel) >.0033 (20cm/h) <scour vel.	--	< 25% volume of fines (fines≤ 6.4mm) (28)	--
	Fry-Fingerling	.18-.70m (34) Age 0+: < .15m (9) Age 1+: .60-.75m (9)	Age 0+ (32mm): <.5 Age 1+: 2-1.6 (9,34)	7.3-14.6 optimum=10.1 Upper lethal=24.1 (28)	Age 0+: Rubble (10-30cm) Age 1+: Rubble (10-30cm) (28)	--

* Annette Island - 1981 Tamgas Hatchery Brood Stock Statistics

to each species. One researcher stated that, in general, optimal gravel composition for salmon is 80% 1.3-3.8cm gravels with the balance being material up to 10.2cm.(28). Cover ability (produced by overhanging vegetation, LOD submerged and above water, undercut banks, and pools) can be essential to fish waiting to spawn and nearness of cover may be a factor in spawning site selection (28). Stream flow is important during spawning as salmon not only prefer and choose water depths and velocities that are physically suited for redd building activity and that are affected by stream flow (28), but also because stream flow strongly influences the magnitude of the spawning area available. There is an optimum flow range for each creek maximizing spawning area (14). For major creeks, this stream flow - spawning area relationship can be established by measuring usable widths (remembering acceptable velocities) as a function of stream flow (34). Thompson (34) found that, in general, the optimum flow for spawning was 1.67 times that of the minimum flow, in creeks with gravel bars and uniform sections of spawning area (minimum flows were established for each creek based on presence of minimum depth and size of the gravel bars). Gallagher (8) found that 90 % of the variation in the even-year return of chum salmon and 10% of the variation in the pink salmon run was explained by variations in stream flows from September 15 - November 14 in the Puget Sound region of Washington.

Different salmon species utilize different sections of the creek, with pinks generally using lower creek stretches and chum and coho using upper reaches (12). Only pink and chum utilize intertidal spawning areas. Many salmonids prefer spawning in pool-riffle interchanges as a downwelling current is created there that penetrates gravel (good for incubation) and that may assist the fish in maintaining its position with a minimum of effort (28). Average redd areas (size of area salmon need to cover eggs laid) and area recommended for each spawning pair by species have been defined by various individuals (see Table 1).

Among the biological factors occuring during spawning that affect production is fecundity. Table 1 lists fecundity ranges found with the various species as well as fecundities observed in 1981 in returning Annette Island salmon (1981 Tamgas Creek Hatchery Egg Take Statistics). Sex ratios found were generally 50:50 and seemed to have a minor affect on production (12,37,20,28). Unsuitable stream conditions, such as low flow, can not only cause stress and increasing mortality in returning adults, but can also increase predation if fish are easier to catch. It is an obvious fact that production is directly related to the number of spawners, however, in addition, many researchers have noted the affect of spawner density on production (compensatory factor). Wickett (37) states excessive density of spawners can cause redds from early spawners to be dug up by preceeding spawners. Miller (14) found that survival rates of resulting eggs was constant up to a "threshold" spawner density, above which survival began to drop off. Ricker (30) has also defined a compensatory, logarithmic, relationship between number of spawners and recuits, in which recruit production begins to fall off and even decrease with the number of spawners.

Merrell (13) also observed a spawner density - fry survival relationship along with an affect on ocean survival by the run timing in a S.E. Alaskan creek. Survival of pink and chum fry was greatest in upper reaches of the stream, which may have been partially related to increased stream gradient and spawning area quality, and where spawner densities were lowest; during years of low spawner densities, the fish tended to use lower reaches of the creek, where the gradient was lower and possibly where the spawning area was of a poorer quality (13). Gallagher (8) also observed a wider distribution of spawners over the grounds with increasing run densities (with sufficent flows, redd super-imposition actually decreased even with the large runs). In addition, offspring from odd-year run spawners showed higher survival rates than those from even-year runs that generally spawned later; the odd-year offspring may be getting a "head-start" on growth with the warmer spring temperatures (13). Taylor (33) also observed a run timing effect; early pink spawners (peaking in late July to August) were smaller and offspring resulting had lower survival rates than late spawners (peaking in September). Neave (20) mentions that not only the size and timing of the run affect survival spring, but also the "compactness" of the run, there being negative effects occurring if the salmon all return instantaneously versus a staggered return. To establish optimal spawner density, without relating it to changes in spawning area and quality due to physical factors, one must keep track of fry and spawner densities over a number of years and try to maintain the spawner number that results in the highest fry densities; in many Canadian streams, the actual escapements rarely reached the optimum spawner number (37). Wickett (37) found a large variation between creeks in optimal spawner densities which ranged from .35 up to 1.4 spawner pair/yard^2 in three creeks.

Species interaction has been observed to affect production, Gallagher (8) finding that the magnitude of chum spawners had a negative effect on the pink runs resulting two years later. He suggests that odd-even year run phenomona may have resulted from pink-chum interactions, with an equilibrium between pink and chum runs having been reached. Pink and chum may have evolved distinct life history strategies permitting their co-existence.

Incubation

Gravel quality strongly influences egg-alevin survival, Table 1 summarizing desirable gravel sizes. The potential of spawning bed material to produce fry is directly related to permeability, with increasing percentages of fines in gravels (less than .833mm in diameter) decreasing permeability (16,37). Sediments from .1-3.3mm were found to have the most disruptive effects on stream communities. Generally, increasing percentages of fines are found with decreasing stream gradients (25), however, logging can increase the amount of fines in gravels due to siltation (16). LOD formed by logging can also trap fine sediments and then during periods of flooding, the sediment can be washed down into lower reaches and the LOD movement can scour out gravels where eggs are incubating. On the other

hand, LOD from logging can help stabilize a channel and prevent the scouring effect (logging LOD must be examined individually in each creek to determine positive and negative affects, (5,32). Fines in the gravel prevent water flow which in turn prevents dissolved oxygen (D.O.) from reaching the eggs. Thompson (34) states that a .8 mg/l intergravel D.O. is required before the eggs hatch and .5 mg/l required after hatching to the emergence of the fry from the gravel. However, Reiser and Bjornn (28) list higher critical levels for chum at 1.67 mg/l during the pre-eyed stage and 3.70 mg/l after the eyed stage. High fall temperatures (sometimes caused indirectly by logging if no buffer strip is left) can also cause a decrease in D.O. levels and low temperatures can, if stream flows are also low, cause egg freezing in the gravel (10,36,37). Gravel bed depth and the irregularity of the stream bed surface can also affect water flow through gravel (28). Adequate stream flow both carrying oxygen to the eggs and alevin and preventing eggs from freezing during periods of low temperature, is essential to early life survival. Many researchers have shown, however, the detrimental scouring effect too much stream flow or flooding can result in, causing heavy egg mortality (8,10,14,15,36,37). Wickett (37) recorded an 8-fold variation in stock resulting from an area due to gravel scouring and overriding all other factors affecting run size; also a scoured creek does not regain its former stock as quickly as a creek not affected by flooding because some permanent habitat damange has occurred. Gallagher (8) found that deviation from the lowest stream flows in the Puget Sound region had a negative affect on chum returns (causing 10% of the variation during even-year runs) and high January precipitations had a negative effect on pink returns (causing 65% of the variation in run size). Fringe areas that were covered by high flows during spawning are often left to desiccation and freezing during the winter low flows (12); since rainfall is often lower in January in southeast Alaska, loss of fringe area is probably a common occurrence on Annette Island. Thompson (34) found that optimum incubation stream flows were approximately equal to minimum spawning stream flows established, and successful incubation and fry emergence occured at 2/3 of the required flow for spawning.

Density of eggs in the gravel can profoundly affect survival. Hunter (12) found that numbers of fry emerging gradually falls off to a maximum with increasing numbers of pink and chum eggs deposited and that similarly, percentage of eggs surviving to fry decreases with increasing numbers of eggs deposited. Wickett (37) obtained similar results stating that stream velocity and temperature is what limits the density of eggs that will maximize survival. Predation of eggs in the gravel occurs, but is not covered well in the literature; the magnitude or extent of the predation and its resultant affect on production is not known.

Juvenile Rearing and the Freshwater Environment

Defining acceptable and preferred habitat and stream size for juvenile salmon is much more complicated than for any other phase in a salmon's life history, because not only are habitat preferences different between species, but the habitat itself is hard to define. In general, the lower the channel elevation, the higher the fish biomass found (25). Pink and chum fry generally depart for the estuary soon after emerging from the gravel, and freshwater habitat requirements for them are not well defined; however, chum fry generally do spend a longer period of time in freshwater and migrate out at a larger relative size than do pinks (8,12). Canadian researchers found that pink and chum fry outmigrations generally peak between mid-April to mid-May (12). Because pink and chum migrate out at such an early stage in their life, early marine environmental factors versus freshwater factors are what affect resulting production most profoundly. Morrill (18) stated that indeed, marine survey indices of chum fry abundance were a much more accurate base for production prediction, than were pre-emergent fry indices. The early marine environment will be covered later.

Coho, sockeye, steelhead, Dolly Varden, and cutthroat remain in the freshwater habitat for at least one growing season and are therefore much more affected by freshwater production factors (physical and biological). In general, coho fry prefer pools and backwater areas and generally spend one year in freshwater, steelhead (spending two years in freshwater) and trout prefer riffles, and Dolly Varden prefer similar habitat to coho, but are much less aggressive (10,28); therefore, species composition and production is strongly affected by quantity of each habitat type. With coho production, pool abundance is extremely important and Platts (25) found that the highest abundance of fish occurred in streams with 30-50% of the area in pools (versus riffles). One study showed that in an artificial stream, when cover was quadrupled and number of pools tripled, the fish biomass tripled (10). On the other hand, it has been shown that creeks with lower pool-riffle (p:r) ratios may be more conducive to increase fish productivity in areas where the water is infertile (25), probably a more important consideration where management will be aimed at steelhead, chinook salmon, or trout.

Streamflow has a profound affect on the amount of habitat available and can change the p:r ratio. Many researchers have found strong correlations between streamflow and coho production in Washington and Oregon (10,31). Unfortunately, the flow requirements are least known for salmon in the fry-emergence to adult period even though during the rearing, flow is probably the most critical factor determing survival because of its interactive affect on many other physical and biological factors (34). However, Thompson (34) has recommended guidelines for optimal rearing flows: he suggests adequate depths over riffles, a p:r near 50:50, with 60% of the riffle area being covered by flow, riffle velocities of 1-1.5 fps and pool velocities of .3-.8 fps, and with most of the stream cover being available as a shelter for young fish. Giger (9) recommends an optimum rearing flow at which increases in wetted perimeter of the stream with streamflow begin to fall off and amount of shelter available per stream mile is maximized; he stresses

the interaction of stream flow to other factors affecting production lists acceptable stream depths and velocities for various species (see Table 1).

Amount of available cover can be a critical factor (sometimes a determining factor - 21) affecting fish biomass and changes in stream flow can change the amount of cover considerably (28). Cover is created by overhanging stream-side vegetation and root wads, undercut banks, pools, LOD and other obstructions. A lowered stream flow can "pull" water away from the banks, decreasing the amount of stream-side cover available and uncovering some of the submerged cover available(9). A decrease in the amount of stream-side cover can also indirectly decrease food availability if salmon are depending on food from terrestrial sources, as many insects available "drop" into the stream from overhanging riparian vegetation (28). Large variations in flow causing stream flashiness can also be detrimental to production (as with incubating eggs) by "washing out" or destroying cover. Logging can also affect the amount of cover available in the stream; blowdown and LOD created by logging can initially increase the amount of cover available, but if no buffer strip is left and the LOD washes out, a resulting decrease in cover and increase in stream riffle area will occur (4). A buffer strip allows a future source of LOD and stabilizes the streambank, having a net positive affect on available cover and rearing habitat (5,32). On the other hand, it was found that in small second or third order Cascade Range streams, logging that left sections of stream open, with no buffer strip increased stream primary productivity and insect productivity resulting in increased fish biomass; however, this was not the case for larger, lower gradient streams (19).

Food availability is a primary factor determining the stream production potential and may regulate fry density and distribution (28). Water quality, depth, velocity, and substrate composition all profoundly affect food abundance. Even stream size affects biological productivity, wider streams being less productive per unit area than narrower ones, depending primarily on water depth and velocity (9). Primary productivity is the base of the food chain in swift water areas and detritus forms the base in depositional areas, both affecting the numbers of aquatic invertebrates present. Riffle areas were found to be the most productive in terms of aquatic insects, which move and become "drift" (especially at night - 9), and food for salmonids. Therefore, stream velocities can affect the amounts of "drift" available with low velocities reducing drift; in general, Giger (9) states that stream velocities under 15 fps and over 3 fps (the optimum occuring at 1-2 fps, 1.4-3.5 fps according to Reiser and Bjornn, 28) have a detrimental affect on drift abundance. Water depth must be adequate for insect production, with highest productivities reported between .15-.9m (28), the optimum range being .46-.91m (28).

Substrate composition regulates benthic insect distribution, the highest productivity occuring with rubble (6.6-17.8cm in diameter) and a general decrease in the number of insects in the progression rubble-bedrock-gravel-sand (9,28); predominately coarse gravel (3.2-7.6cm) and rubble (7.6-30.4cm) areas generally produce the most number of insects. Salmon utilize mayflies (Ephemeroptera) and stoneflies (Plecoptera) more heavily than caddis-flies (Trichoptera) (28) and if low numbers of aquatic insects occur, salmon will switch to depending mainly on terrestrial sources for food. Nickelson and Hafele (21) found that a 75% flow reduction decreased aquatic insect numbers and drift; however, salmon food type simply shifted to terrestrial and adult aquatic insects.

Water quality also influences food availability, as well as directly influencing juvenile salmonid growth and survival. Low pH and a lack of Calcium (associated with low water hardness) can be a cause of low stream productivity, a neutral pH and hardwater being desirable (10,28). Low pH and low water hardness often occurs in Annette Island streams and may be limiting factors in production. Water temperatures influence fry growth rates (warmer temperatures increase metabolic rates), swimming ability, dissolved oxygen concentrations (above 15C, D.O. regulates the active metabolism rate of young sockeye) ability to capture and use food (in higher temperatures, stream salmonids require more food) and ability to withstand disease outbreaks (28). Table 1 lists preferred temperature ranges and optimal temperatures (maximizing growth under other optimal conditions) and lethal temperatures; with warmer temperatures versus those on the lower end, having the most deliterious affects on survival. Dissolved oxygen concentration is important to growth, with amount of food consumed, weight gain rate and food conversion falling off below about 3.5 mg/l D.O. with coho (age 0+) (28). High turbidities (levels of suspended solids) can abrade and clog fish gills, reduce feeding and cause fish to avoid some areas (28); therefore, during flooding, streams with a high amount of deposited silt and mud can be undesirable to juvenile salmonids. High turbidities are generally not a problem on Annette Island. Pollution and siltation from logging often negatively affects juvenile salmon growth and survival.

Density dependent factors also come into play in stream fry production potentials. Coho fry are very aggressive and territorial and will defend a rearing "space" or "focal point" to which they will repeatedly return ferociously (28). In contrast to pink and chum, whose production is largely determined by available spawning area and gravel quality, coho production is often limited by the total amount of rearing space available in a stream. High densities often result in a decrease in the average size of the fish migrating out, for all species, which could be the result of competition for limited amounts of food and having to rear in a non-preferable microhabitat (9). Increases in flow can increase rearing space available and indirectly cause visual isolation (important to coho) which in turn increases the stream's production potential (9).

Table 1 lists densities of salmon eggs and fry observed and gives an idea of what a creek can produce knowing area available. Predation can also affect fry survival, but has a more profound affect on production during smolt migration and in the estuary.

In general, good rearing habitat for anadromous salmonids consists of a mixture of pools and riffles (riffles less than 20%) adequate cover, water temperatures averaging between 10 and 15C during the summer, dissolved oxygen at near saturation levels, suspended solids less than 25 mg/l, and riffles with less than 20% fine sediment (less than 6.4mm in diameter) (28). Many of Annette Islands streams possess most of these characteristics. It has been shown that variation in freshwater conditions are the dominating factors controlling the general population level and stock size; ocean factors impose some additional variation but only affect production after the general population level has been set by freshwater factors (27). Freshwater physical factors are much more variable than ocean physical factors (20). In modelling stream production it is recommended that a habitat rating system be devised that utilizes multiple regressions and takes into account factor interaction and the percentage of variable caused by each factor (10). Gallagher (8) and Nickelson and Hafele (21) have constructed such models.

Smolt Migration and the Early Marine Life

Several physical and biological factors that affect production occur during the downstream migration of smolt. Temperature not only affects creek productivity, but it also affects the timing of smolt migration. Foerster (7) found that sockeye smolt migration commencement coincides with a vernal rise in lake temperature, in the spring the threshold occurring at about 4.4C, and that migration ceases once a summer thermocline has formed (at below 10C); those smolt that did not migrate before the water stratification occurred, stayed and migrated the next spring. Also, bright, calm days accelerated migration and rain and overcast slowed it (7). Run timing itself has an affect on survival. Taylor (33) found that early migrating pink hatchery fry (departing between February 27th and March 19th) showed lowered ocean survival than hatchery fry migrating later (april 10th-April 22nd); however, the early fry were smaller which in itself may have affected the differential survival. Wild Alaskan pink fry were found to migrate from early March, peaking in mid-April, to mid-May from the Taku River (east of Juneau, Alaska). Chum fry migration peaked in early May, coho and sockeye smolt migration peaked in May and June (6). Increased stream flows have been correlated to peaks in juvenile migration; increased flow and turbidities may assist juveniles in swimming downstream and avoiding predators (6). Juvenile mortality increases with the distance the young fish must travel to get to saltwater and decreases with increasing numbers of migrants exiting (20), a depensatory process possibly related to predation. Size at migration has been shown to affect survival, in general, larger fry and smolt experience increased ocean survival (6,26); in addition, larger

coho smolt seem to migrate out earlier than smaller ones (6), which may also affect production. Sockeye smolts migrating (yearlings) varied from 8-20cm in length (6), and averaged 10cm long in another study (11); chinook and coho smolts varied from 15-27 cm when migrating. Increasing the rearing time for chum resulted in the release of larger fry, can also increase ocean survival (6). Size at time of migration may be related to predation, which has been recorded as being an important factor in decreasing fry output (12). Neave (20) recorded a predation efficiency that ranged from 5-8.6% of the migrating pink fry in British Columbia streams; predator efficiency decreased with increasing numbers of migrating fry (exhibiting the depensatory effect). Sculpins were found to be efficient predators of pink and chum fry, consuming 15 fry a day; coho smolts were even more efficient, consuming 20 fry per day (12). Sculpins are commonly found at Annette Island creek mouths and predation mortality should be considered in any production model.

Ocean survival is largely determined by survival rates in the estuary and early marine life of salmon (26). The summer sea water temperature was found to be inversely correlated with total subsequent pink salmon abundance, lower temperatures enhancing numbers (36). Gallagher (36) found that pinks were enhanced by cooler sea surface temperature whereas warmer sea water temperatures enhanced chum and salinity was found to be directly related to chum brood returns, increasing salinities in Puget Sound having a positive affect on chum fry survival (this salinity affect occurs with both pink and chum fry - 36,37). Late summer rainfalls enhance pink and chum stocks (37). Increased winter precipitation also had a positive affect on chum brood in Puget Sound (8). Upwelling can profoundly influence growth and survival of juvenile salmonids by affecting plankton blooms, the food source (6). Upwelling effects decrease as you go offshore and this is consistent with the fact that the most abundant and diverse micro and macro plankton items occur in-shore (6). Pink and chum fry prey in shallow near-shore waters in Puget Sound, consisted of epibethic (just off the bottom) prey items with a change to zooplanktivourous items occurring at the May (8). Pink seemed to prefer invertebrate eggs as food, whereas chum preferred smaller gammarid amphipods and harpacticoids, although they do eat alot of the same things. Coho exhibit a flexibility in choice of food items, both in freshwater and in saltwater; this explains why it has been difficult to tie changes in coho abundance with herring population changes (6). In Alaska, food was not found to be a limiting factor in production of pink and Bristol Bay sockeye (26). Peterman (26) demonstrated that predation during the early marine life was a significant factor affecting survival of Alaskan pinks and sockeye; parasitism and disease also took their toll and all these three factors together seem to have a more significant affect on survival than did competition and density-dependent factors. In general, it was found that when pink, chum, sockeye, chinook, and coho fry and smolt go out to sea, they stay in coastal and inside waters, whereas

steelhead seem to go directly out to sea (11). Pink, chum and sockeye were found together in the estuary and near the coast and although coho and chinook were alot fewer in abundance and were more wide ranging than the others, all five species remained near the coast for their first summer; no evidence of food competition among smolts was recorded (11). In contrast Gallagher (8) found that large numbers of pink fry had a negative affect on growth of chinook and sockeye smolt and a pro-profound affect on chum brood returns, partly causing the odd-even affect on pink and chum runs in Puget Sound. Age class ratios also varied in odd and even years. Chum return as 4 or 3 year olds and usually 3 year olds make up only 1/3 of the run (8). Gallagher found that in odd years (corresponding to strong pink runs), the 3:4 year old ratio is 50:50 (which would shift alot of chum over to becoming even year spawners) versus in even years when it is 35:65. Similarly in B.C. where strong pink runs occur in even years, the same effect occurs with a shift to a high percentage of 4 and 5 year old chum during odd years (weak pink runs) suggesting again, the presence of an equilibrium between pink and chum runs allowing their co-existence (8). Peterman (26) did not find a competitive effect between pink and sockeye fry in Alaska and did compare survival rates realized. Table 2 summarizes various survival rates realized in life history phases of Pacific salmon, many of which include efects on survival during the early marine life.

Marine Survival and the Ocean Environment

Less is known about factors affecting survival in this phase of the salmon's life history than in any other phase. As was stated earlier, freshwater factors and factors affecting the early marine life of salmon generally determine production resulting, however, ocean factors are important nevertheless.

Fishing mortality is probably the single most important ocean factor affecting production. It has been observed that return rates of salmon realized in Alaska and British Columbia are generally higher than those realized in Washington and Oregon; this may have to do with the fact that Washington and Oregon smolts more north and may migrate a farther distance in coastal areas during their ocean lives than do Alaskan smolts (11). This increased distance may subject them to more inshore and offshore fisheries and inshore predators, having to traverse Canadian and Alaskan waters. Therefore, ocean survivals realized in Washington, Oregon and Southern B.C. may not be representative of rates realized in Southeast Alaska. It has been noted that pink and sockeye smolts, as well as adults sometimes migrate together (22), however, competition has not been demonstrated. Compensatory responses to fishing pressure does occur, but it mainly occurs in the freshwater environment. Pinks have generally higher fishing mortalities than do chum, chum fishing mortality was recorded to vary from 47-82% (20). Neave (20) stresses the fact that increased fishing pressure can only be compensated for with increased freshwater survival,

TABLE 2. REALIZED SURVIVAL RATES IN BRITISH COLUMBIA AND ALASKA

FRESHWATER SURVIVAL

Egg-Emergent Fry*:	Pink	10% - Average for 5 Alaska and B.C. creeks (17) 5-20% - B.C. (26) .88-16.47%, B.C. creek averages (12)
	Chum	.99-19.41% - B.C. creek averages (12)
	Pink and Chum Combined:	1-22.8%, average 9.6% - S.E. Alaska (13) 1.16%, S.E. Alaska average (20) 5-13.2% B.C. average (20) Egg Lost - 8-98% mortality, of remainder, 5.7-31.1% survival in B.C. (12)
Egg-Fingerling (Migrating) -		
	Pink and Chum	.08-15.09% B.C. (20) 5-20%, actual measured - 11% - B.C. (3)
Fry-Smolt:	Sockeye	21-70% in B.C. (26)

* Generally, chum, coho, sockeye and steelhead utilize better overall quality gravel than pinks and may experience higher average survival rates (especially within a creek).

MARINE SURVIVAL

Fry-Returning Adult:		
	Pinks	2-9% - B.C. (26) .7-5.2%- B.C. (12) 2-22%, average 3.4% - For 5 Alaska and B.C. creeks (17) 11% (95% exploitation rate) - B.C. (27)
	Chum	.85-2.6% - B.C. (12)
	Pink and Chum Combined	.29-6.75% - B.C. (12) .5-3.5%, average 2% - Alaska Fish and Game Statistic (1)
	Sockeye:	.5-4.1% - B.C. (26) .5-2.5%, average 1.5% - Alaska Fish and Game Statistic (1)
Smolt-Returning Adult		
	Coho	6-16%, average 10% - Alaska Fish and Game Statistic (1)
	Sockeye (Age 1+)	2-87% - Bristol Bay, Alaska (26)
	Sockeye (Age 2+)	4-70% - Bristol Bay, Alaska (26)
	Sockeye	2-10% - B.C. (26)

Pink Salmon

Marine Survival Estimation

Model (17):

$$Sm = \frac{R}{E \times Sf}$$

R = Return per spawner, average 3.06 for Alaska
E = Fecundity ÷ 2
Sf= Freshwater survival
Sm= Marine survival

and using an assumed ocean mortality of 5%, he predicted required freshwater survivals to maintain stocks given different fishing mortalities: at little to no fishing pressure, freshwater survival could fall below 10%, however, with fishing mortalities at 80 and 90%, freshwater survival had to be 12 and 23% respectively. McNeil (17) has devised a simple model to estimate pink salmon marine survival rates:

$$Sm = \frac{R}{E \times Sf} \quad \text{where}$$

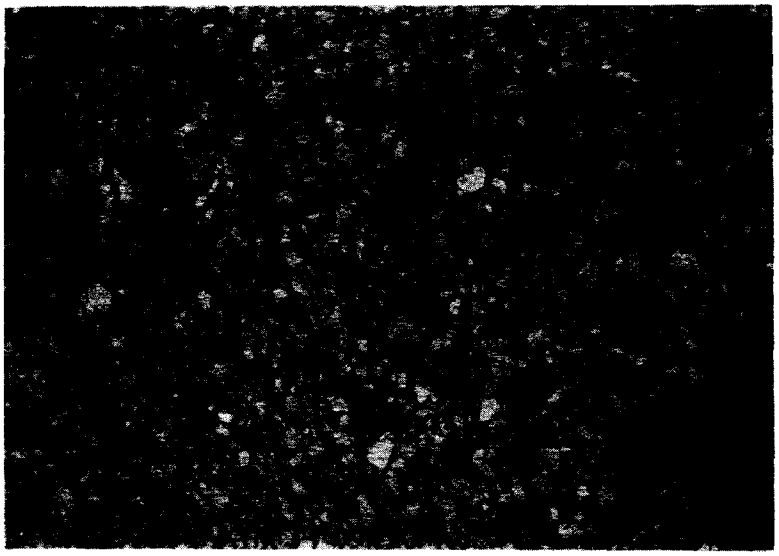
R = Return per spawner (averaging 3.06 in Alaska)

E = Fecundity ÷ 2 (since it takes two spawners)

Sf = Freshwater survival (%)

Sm = Marine survival (%)

This model could be applied to Annette Island pink salmon stocks as well. McNeil (17) stresses that natural populations of salmonids are more severely affected by increased fishing pressure since freshwater survival cannot be manipulated as it can with hatchery reared fish. Wright (38) recommends maintaining natural runs of coho stocks on a sustained yield basis with average catch:escapement ratios of 3:1 (overall fishing rate of 75%); hatchery stocks can withstand 19:1 ratios (overall fishing rates of 95%) due to the increased egg to smolt survival. Ricker (29) made an observation that has to do with ocean growth versus survival (that has been stressed so far). He observed that the average instantaneous rate of growth per month in the final year is .28 for pinks and .12 for chum and that early-opening fisheries do not allow fish caught to grow to potential; therefore, the yield-in weight is lower for early fisheries than for later ones. The overall average ocean mortality for salmon over 30cm long was found to be .2 per month (29). Many of the other causes of changes in production due to ocean factors are unknown; however, at this point, a model using average ocean survivals found on Annette Island or adjacent areas should be sufficient for predicting production given an estimate of the outmigrating fry or smolts present.



Summary of Production Potentials & Conclusions

Utilizing some of the survival rates and production statistics listed in Tables 1 and 2, a simple production model was constructed. Table 3 outlines the statistics and model used to calculate potential production statistics. Fecudities listed are those estimated from salmon returning to Annette Island in 1981 (to the Tamgas Creek Hatchery) and survival rates are those that are used by the state of Alaska in their estimates and include survival realized here in Southeast Alaska. The marine survival rates used are quite conservative and in reality, ocean survival rates often surpass those listed. As a result production potential estimates are conservative and production can in reality far exceed (doubling and tripling in some cases) the potential as well as fall below when underescapement occurs. Tables 4 and 5 summarize the recommended escapements and potential productions estimated for all the creeks currently producing salmon or with potential production abilities without any enhancement. It should be emphasized that often, when historical escapement counts were listed and when much of the available spawning area available was of marginal quality, recommended escapements listed were not strictly calculated by the equation given in Table 3, but were adjusted considering the additional information available. Also, spawning areas were split up into areas utilized only by pinks and chum (e.g. intertidal areas) and those utilized only by coho and sockeye (e.g. upper lake tributaries), as well as areas pinks, chum and coho utilize. In general, coho as well as chum tend to spawn father up the creek, in larger and generally better quality gravels than do pinks; sockeye utilize only those tributaries that empty into an alpine lake. Therefore, production potentials were often not uniformly calculated (except that similar rates were used in the estimates) and individual stream characteristics, geometry and historical escapement data were employed to hopefully increase the accuracy of the estimates.

Water quality factors were not generally considered in the estimates calculated, except those that excluded salmon production entirely. Comments were made in the individual stream survey forms and in general, low pH (usually resulting from high tannic acid concentrations) and low water hardness were water quality factors found that could have a limiting affect on production, affecting only coho and sockeye fry that have freshwater rearing periods. Pollution was not found, except in Sawmill Creek, to be a limiting factor.

The other physical factors that probably affect production most profoundly in Annette Island streams are poor gravel quality and streamflow flashiness. Moderate to heavy gravel compaction due to fines mixed in the gravel is quite common, especially in low gradient streams draining muskeg, and can cause heavy mortality of incubating salmon eggs. In streams with a highly variable streamflow, especially those draining steep slopes, gravel scouring and changes in the gravel areas submerged probably reduces survival

TABLE 3. PRODUCTION STATISTICS AND MODEL

Recommended Redd Areas per Spawning Pair (28)		Fecundities (Average Number of Eggs Per Female)
Pink	$.6m^2$	1500
Chum	$9.2m^2$	2500
Coho	$11.7m^2$	2850
Sockeye	$6.7m^2$	2400

I. Spawning area available (estimate) ÷ recommended area per spawning pair = <u>recommended escapement of spawning pairs</u>.

II. A. Recommended spawning pairs (= number of females) X fecundity X egg loss rate (1%) = <u>potential number of eggs buried in in the gravel</u>.

B. Potential number of eggs buried X survival rate (egg to emergent fry) = <u>potential number of emerging fry</u>.

Survival rates used in calculations:

Gravel Quality	Marginal - Poor	Fair - Good	Excellent
For all Species:	1.2% (1)	10%	20%

C. Potential number of emerging fry X marine survival rate (includes fry to smolt survival rate for coho and sockeye)= <u>potential production</u>

Marine survival rates utilized

2% for pink, chum and coho (1)

1.5% for sockeye (1)

TABLE 4. SUMMARY OF RECOMMENDED ESCAPEMENTS IN SPAWNING PAIRS

STREAM TYPE:	Major Creeks: Watershed Number	Pinks	Chum	Coho	Sockeye	Minor Creeks: Watershed Number	Pinks	Chum	Coho	Sockeye
Type 1. creeks draining muskeg and muskeg ponds or lakes.	102-02	600	40	10	--	300-01	390	25	5	--
	101-09	1300	85	10	--	115-01	100	--	--	--
	405-01	830	54	20	--	202-03	380	25	--	--
	405-02	275	18	10	--	101-01	75	5	4	--
	405-04	2625	100	45	--	101-02	50	--	--	--
	405-08	200	6	5	--	101-03	520	34	4	--
	405-09	500	33	5	--	101-05	32	--	--	--
	306-02	5420	355	--	--	101-07	540	35	28	--
						101-08	--	--	2	--
						202-01	1200	80	5	--
						101-10	142	9	2	--
						101-11	233	--	--	--
						101-13	408	--	--	--
						405-03	--	--	2	--
						405-05	225	15	4	--
						405-06	15	1	--	--
						405-07	188	12	7	--
						404-01	90	6	2	--
						309-02	812	--	--	--
SUBTOTALS:	8	11,750	691	105	--	19	5400	247	65	--
Type 2 Creeks Draining Alpine Lakes	105-02	--	--	168	295	105-04	170	10	--	--
	306-01	375	25	18	--	104-01	90	6	--	--
	305-01	12,500	630	25	--	--	--	--	--	--
	201-01	27,100	500	20	--	--	--	--	--	--
SUBTOTALS:	4	39,975	1155	231	295	2	260	16	--	--
Type 3 Creeks draining forested and exposed rock mountain slopes.	107-02	3000	170	--	--	115-02	--	--	10	--
	107-01	--	7	10	--	112-01	325	5	--	--
	105-03	--	--	440	770	112-02	60	3	--	--
	402-03	--	--	94	--	111-01	1400	35	12	--
	311-02	2200	145	10	--	111-02	--	--	5	--
	310-01	4300	235	150	--	109-01	85	--	--	--
	309-01	2670	175	25	--	108-01	130	8	--	--
	301-02	2100	137	5	--	105-01	--	--	27	47
						403-01	400	20	--	--
						402-02	--	--	6	--
						308-01	175	--	--	--
						304-01	510	45	10	--
SUBTOTALS:	8	14,270	869	734	770	12	3085	116	70	47
TOTALS:	20	65,995	2715	1070	1065	33	8745	379	135	47

OVERALL TOTAL:	Number of Creeks	Pinks	Chum	Coho	Sockeye
	53	74,740	3094	1205	1112

TABLE 5. STREAM PRODUCTION POTENTIAL SUMMARY

(Does not include potential production from stream enhancements.)

STREAM TYPE:	Major Creeks: Watershed Number	Pinks	Chum	Coho	Sockeye	Minor Creeks: Watershed Number	Pinks	Chum	Coho	Sockeye
Type 1 Creeks draining muskeg, muskeg ponds or lakes.	102-02	1780	200	56	--	300-01	1160	124	28	--
	101-09	3861	421	56	--	115-01	36	--	--	--
	405-01	2465	267	113	--	202-03	135	15	--	--
	405-02	817	89	56	--	101-01	223	25	23	--
	405-04	7796	495	254	--	101-02	18	--	--	--
	405-08	594	30	28	--	101-03	1544	170	23	--
	405-09	1500	164	28	--	101-05	11	--	--	--
	306-02	16,100	1750	--	--	101-07	200	21	20	--
						101-08	--	--	2	--
						202-01	430	50	4	--
						101-10	422	45	11	--
						101-11	83	--	--	--
						101-13	146	--	--	--
						405-03	--	--	11	--
						405-05	80	10	3	--
						405-06	15	1	--	--
						405-07	560	60	40	--
						404-01	270	30	11	--
						309-02	290	--	--	--
SUBTOTALS:	8	34,913	3416	591	--	19	5623	551	176	0
Type 2 Creeks draining alpine lakes	105-02	--	--	1900	2100	105-04	60	50	--	--
	306-01	1115	125	102	--	104-01	32	4	--	--
	305-01	37,125	3120	141	--					
	201-01	80,490	2475	113	--					
SUBTOTALS	4	118,730	5720	2256	2100	2	92	54	--	--
Type 3 Creeks draining forested or exposed rock mountain slopes.	107-02	8900	840	--	--	115-02	--	--	56	--
	107-01	--	35	56	--	112-01	965	25	--	--
	105-03	--	--	2480	2750	112-02	21	2	--	--
	402-03	--	--	530	--	111-01	500	21	40	--
	311-02	785	86	7	--	111-02	--	--	28	--
	310-01	13,000	1200	850	--	109-01	30	--	--	--
	309-01	15,860	1760	280	--	108-01	3860	40	--	--
	301-01	6240	680	30	--	105-01	--	--	152	168
						403-01	142	12	--	--
						402-02	--	--	44	--
						308-01	62	--	--	--
						304-01	182	28	8	--
SUBTOTALS:	8	44,785	4601	4233	2750	12	5762	128	328	168
TOTALS:	20	198,428	13,737	7080	4850	33	11,477	733	504	168

OVERALL TOTAL:	Number of Creeks	Pinks	Chum	Coho	Sockeye
	53	209,905	14,470	7584	5018

of eggs and alevins incubating in the gravel. Wherever applicable, if either of these factors occurred, the lowest freshwater survival rate (1.2%) was utilized in calculating the estimate.

In a few cases, namely the creeks along the eastern border of and emptying into Tamgas Harbor, man-made obstructions may limit production. The B.I.A. road was constructed with culverts, but often these culverts looked to be impassable and the slash and debris in the creek resulting from the construction strongly affected and changed the stream channel. Two creeks surveyed and one unsurveyed were affected by this construction (see the individual stream survey forms).

Most of the streams surveyed did possess physical characteristcs falling into the preferred or acceptable ranges listed in Table 1. Temperature, LOD present, water depths and velocities were found to be generally acceptable for salmon production except for the problem factors listed above; characteristics that affect production are stressed within the individual stream survey forms.

As outlined in the introduction, Annette Islands' creeks generally fall into one of three types: muskeg drainage, alpine lake drainage, and mountain slope drainage. Tables 4 and 5 split the streams into these types and watershed numbers are listed for identification of individual streams. Only 53 creeks of the 77 surveyed currently have salmon producing potential, of these, 51% were found to drain muskeg (type 1), 11% drain alpine lakes (type 2) and 38% drain mountain slopes (type 3). However, type 1 creeks only potentially produce 19% of the salmon returning to Annette Island. Type 2 creeks produce 54.5% of the salmon and type 3 creeks, some of which drain into alpine lake systems (conducive to salmon rearing and smolt survival), produce 26.5% of the salmon potential production. These mountain drainage streams also produce 60% and 59% of the potential production of coho and sockeye respectively. Alpine drainage lakes, such as Nadzaheen, South Crab Bay Creek and Kwain Creek , potentially produce the bulk of the pink and chum salmon (57% and 40% respectively). Creeks were also split in major or minor streams based on their quality of spawning and rearing area and potential production; 38% of the creeks are considered major creeks and yet these potentially produce 95% of Annette Islands' salmon resource. In constrast the minor creeks (62% of the total) potentially produce only 5% of the salmon (see Table 6).

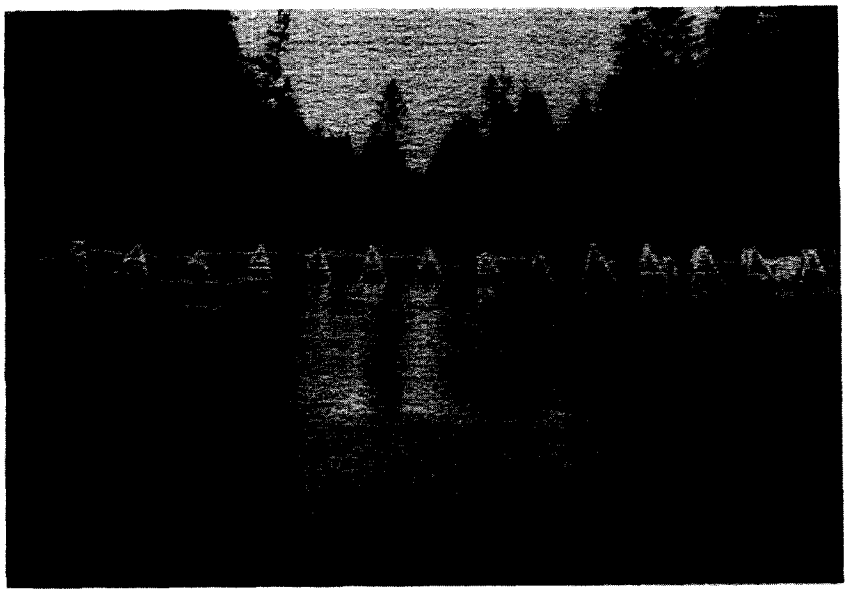
Tables 4 and 5 do not include creeks surveyed that possess salmon producing potential, but that currently do not, due to barriers preventing migration. Many of these streams have suitable spawning and often excellent rearing areas, but unless enhanced by the construction of a fish passage device, they will not produce anything but trout and Dolly Varden. Kwain Creek, the Triangle Lake System (including tributaries) and the Todd Lake System (including tributaries) currently possess the greatest potential salmon production with enhancement. See individual stream survey forms for estimates of potential production, that could occur if fish passages were constructed, based on the model give in Table 3.

TABLE 6. POTENTIAL PRODUCTION OF SALMON ACCORDING TO STREAM SIZE AND TYPE IN PERCENTAGE OF THE TOTAL

	Major	Minor	Type 1	Type 2	Type 3
Of Total Creeks With Potential Production	38%	62%	51%	11%	38%
Pink	94.5	5.5	19	57	24
Chum	95	5	27	40	33
Coho	93	7	10	30	60
Sockeye	97	3	0	42	58
All Species	95%	5%	19%	54.5%	26.5%

Finally, it should be emphasized that the estimates calculated in this study are rough and may not be what is experienced in reality in terms of salmon production. However, they do give resource planners a general idea of potential production on Annette Island. Marine survival rates used refer to survival expected from the time that fry emerge to the time that adult salmon return to the Annette Island vicinity. This means that many salmon produced on Annette Island are caught in other fisheries and most likely do contribute to the general salmon catch in the state of Alaska. Therefore, those potential production figures do not include catch realized by fishermen not fishing in the vicinty of Annette Island (non-Community members or Community members fishing in adjacent state waters). The total benefits the Annette Island fishermen, Annette Island Packing Company, and other fishermen fishing state waters derive from salmon production originating on Annette Island are not represented by the potential production estimates calculated.

A more precise production model can be constructed utilizing much of the data included in this study. However, it is recommended that escapement counts, water quality testing, and streamflow measurements be conducted in as many streams as possible on a yearly, scheduled basis to increase the data base available for wise salmon resource management. Many of the streams on Annette Island have adequate salmon escapements, however, a few face under-escapement and salmon production could be enhanced with proper harvest regulations that are enforced (see individual stream survey forms for identification of those streams).



Individual Stream Surveys

INTERPRETATION OF STREAM SURVEY FORMS

To assist in interpretating the Annette Islands Stream Survey Summary, the following information is provided:

There are two numbering systems used on these forms. Under the space entitled number are the statistical numbers. These are devised from the state fishing district numbers (the same system utilized by A.D.F.G.), the first three digits being the major district, the second two being the subdistrict number and the last three being the individual stream number; streams are designated by determining which subdistrict the creek empties into. The second number, under the space entitled geocode is the watershed number referring to the three digit code for each individual watershed and a two digit code for individual streams (see page 18 of the Annette Coastal Management Program).

The space entitled stage refers to the particular level of flow occurring on the date surveyed and flood height refers to how high above the stage flow the creek flows when flooding (generally this is at maximum flow).

See the Appendix I for an explanation of some of the units of measure and terminology used on these forms.

The data included on each form is given only for the section of the creek surveyed (see section surveyed); therefore, it may not be representative of the entire creek if a large portion was left unsurveyed. Also, unless stated otherwise, data given was taken only on the date listed in the "date surveyed" space. If the data included was taken on a different day, that date will be listed next to the data of concern.

Ranges of stream data given (e.g. streamflow and velocity) are only ones that have been measured or observed; the parameters could in reality go under or over the ranges given, they simply were not measured.

Water quality measurement abbreviations include D.O. which means dissolved oxygen concentration and CO_2 means dissolved carbon dioxide concentration. In general, unless streamflow is sluggish or the creek has alot of "dead" areas in it, D.O. will most likely be at saturation level due to the aeration effect of water flowing over rocks and dropping over distances through airspace.

Finally, it should be stressed again that measured distances and areas and estimated spawning areas, escapement recommendations and production potentials are estimates and should not be taken as exact parameters. Actual production realized can and does vary over 100% of the estimates given and the figures are only meant to give an idea of what the creek can produce potentially under certain conditions.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Anvil Mountain Creek Stream	101-28-001 Number	112-01 Geocode
Flows N.W., .5 mi long, into Nichols Pass Location	Mountain run-off and springs Origin	Steep, Timbered Mountain Slopes Watershed Type
6/17/81 Date Surveyed	375m from High Tide Mark (HTM) Section Surveyed	Possible beach log pile and cascades Barriers
Moderate flow Stage	-- Flood Height	

2% Ave. Gradient	.5 cfs Flow / Range	Moderate -- Ave. Velocity/Range	1.2m -- Ave. Width/Range	.15 .1-.2 Ave. Depth/Range

Bedrock channel Streambank Composition	Stable / Stability	None - fork at 375m Tributaries

Water Quality

10m above HTM Sample Site	11.7 C Temp.-Air	11C Temp.-Water	-- Ph	Clear None Clarity/Turbidity	Light Amber Color	Saturated -- D.O. CO_2	

-- Total Alkalinity	-- Total Hardness	-- Dissolved Solids	Good water quality. Other/Overall

Spawning Area

35% gravels, 10% bedrock, 20% cobble, 15% boulders, 10% sand, 10% mud and silt.
Overall Stream Bottom Composition

Some - generally high quality gravels.
Gravel Compaction

$245m^2$ in lower section - good for Pink and Chums.
Spawning Area Available Above High Tide Mark (HTM)

None
Intertidal Spawning Area

Rearing Area

-- Few pools Pool/Riffle Frequency (P:R Ratio)	-- Ave. Pool Depth/Range	-- Ave. Pool Size/Range

Mainly from overhanging vegetation; some undercut banks
Available Cover

Scarce Mainly terristrial insects.
Aquatic Invertebrates/Available Food Source

Algae and moss in areas.
Aquatic Vegetation

Alder and scrubs in forested area - mainly hemlock and spruce.
Terrestrial Vegetation

80% canopy from alders; steep, bedrock banks provide some additionally.
Shading

Very little rearing area.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Used by Pink and Chum mainly if utilized at all.
Use by Fish

No fishing.
Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Check creek during migrationary periods, when flow is high to see if salmon can get over beach log barrier.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/17/81	None Seen				

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, 6/17/81

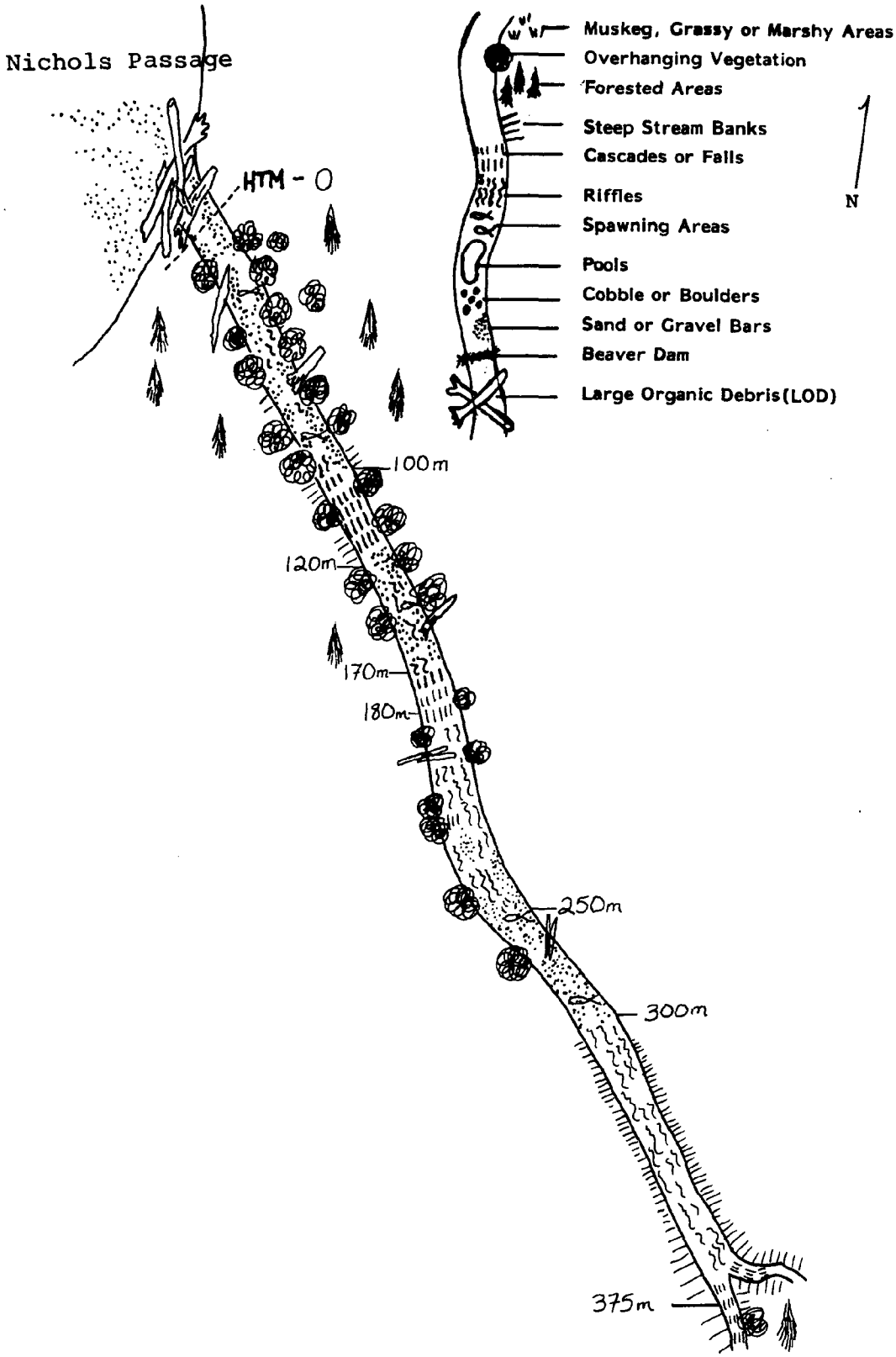
Recommended Escapement

Due to limited rearing area, coho probably do not use this creek, therefore, recommendations are made for pink and chum only. Pink probably use lower reaches and there is sufficnet ground for 325 spawning pairs. Chum probably utilize the upper reaches and only 5 spawning pairs are recommended for escapement.

Potential Production Summary

Anvil Mountain Creek potentially produces approximately 165 pinks, and 25 chum that will return to Annette Island vicinity, using an emergent fry survival rate of 10% egg-fry due to the fair to good quality gravels present.

Figure 2. ANVIL MOUNTAIN CREEK



Not In Scale

ANVIL MOUNTAIN CREEK

Watershed No. 112-01
Stat. No. 101-28-001

0m	High Tide Mark (HTM); below HTM a pile of beach logs create a possible barrier at low flow, low tide.
0-100m	Stream looks like a spawning channel; average stream width (ASW) = 2.0m, with 80% gravels (mixed with some fine sediment) and 80% shading (alders mainly); no rearing area.
100-120m	Bedrock Cascade; it may be a velocity barrier at high flow.
120-170m	ASW = 1.0, 70% gravels (spawnable).
170-180m	Bedrock riffle; moderate gradient.
180-250m	ASW - 1m, 10% spawning gravels.
250-300m	ASW = 1m, 70% spawning gravels.
300-375m	ASW - 1m, 10% spawning gravels.
Above 375m	Stream splits, gradient increases, and tributaries are too small for use by salmon.

Spawning Area (all in fresh water):

0-100m	(below Cascades)	$160m^2$
120-170		35
180-250		7
250-300		35
300-375		7.5
	Total	$245m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Cowboy Creek	101-28-002	112-02

Location	Origin	Watershed Type
Flows N.W., about 2 mi. long, into Nichols Pass.	Mountain runn-off, ponds and springs	Timbered mountain slopes and muskeg (67.5 acres in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/17/81	To 600m, above High Tide Mark (HTM)	Falls at 45m	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2%	--	--	--	--

Streambank Composition / Stability	Tributaries
Mainly bedrock and large boulder / Stable below falls, stable to unstable above.	One, stream forks above survey distance.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/8/72:	12C	10C	5.8	Clear			
Base of falls	11.7C	9 C	5.5	Clear	None	Light Amber	

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
25.0 ppm	100 ppm	Total= 8.56 ppm	T.A., T.H., D.S., taken 8/8/72

Spawning Area

Overall Stream Bottom Composition

Below falls: 40% gravel, 11% rubble, 12% cobble, 12% pebbles, 15% sand, 10% silt. Above falls: 45% bedrock and boulders, 15% rubble, 15% cobble, 15% gravel, 5% pebble, 5% sand.

Gravel Compaction

Compacted a little below falls, more above falls.

--

Spawning Area Available Above High Tide Mark (HTM)

Below barrier, limited - 35m^2 of marginal quality gravels; 25m^2 available above falls, limited - 10m^2 of mainly boulders and cobble mixed with gravels.

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Above falls, p:r = 1:2	Pools formed by Falls, rocks, bends and LOD, .30m above falls/to 1m	Largest is - 30 x 40 feet

Available Cover

Below falls: Some LOD and one plunge pool; Above Falls: from topography (banks) overhanging vegetation and LOD.

Aquatic Invertebrates/Available Food Source

A few (non abundant) salt tolerant glossosmona (trichoptera), ephemeroptera, and diptera.

Aquatic Vegetation

No rooted plants; periphyton on rocks, some filamentous algae, cedar like moss on rocks.

Terrestrial Vegetation

Influence of vegetation and woody debris on channel stability limited. Skunk cabbage, currant, chocolate lilies, some sedges and grasses, salmonberry and alder - timer is mainly cedar, hemlock and spruce.

Shading

Below falls: 35% due to some topography, forest and a little riparian vegetation; above falls: 50-85%.

Extent and Quality of Rearing Area

None below falls except the pool for pink and chum fry. Some potential rearing area for coho above falls only.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

Pink, chum, and trout only, could use this creek.

Use by Fishermen

None except some deer hunters (they use cabin). Little, if any, subsistence fishing

Wildlife Present

--

Comments and Recommendations

There is some potential rearing and spawning area above the falls, but the magnitude of production increase may not justify the cost of a ladder. No other improvements recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/8/72	None seen	--	--	--	--
6/17/81	Chum	Fry	1	--	Probably a straggler.
	Trout	Fry	15	--	Seen above falls - not abundant.

Survey(s) and Dates Conducted

E. Biggs and C. Huntingon, 6/17/81. USFWS surveyed creek on 8/8/72.

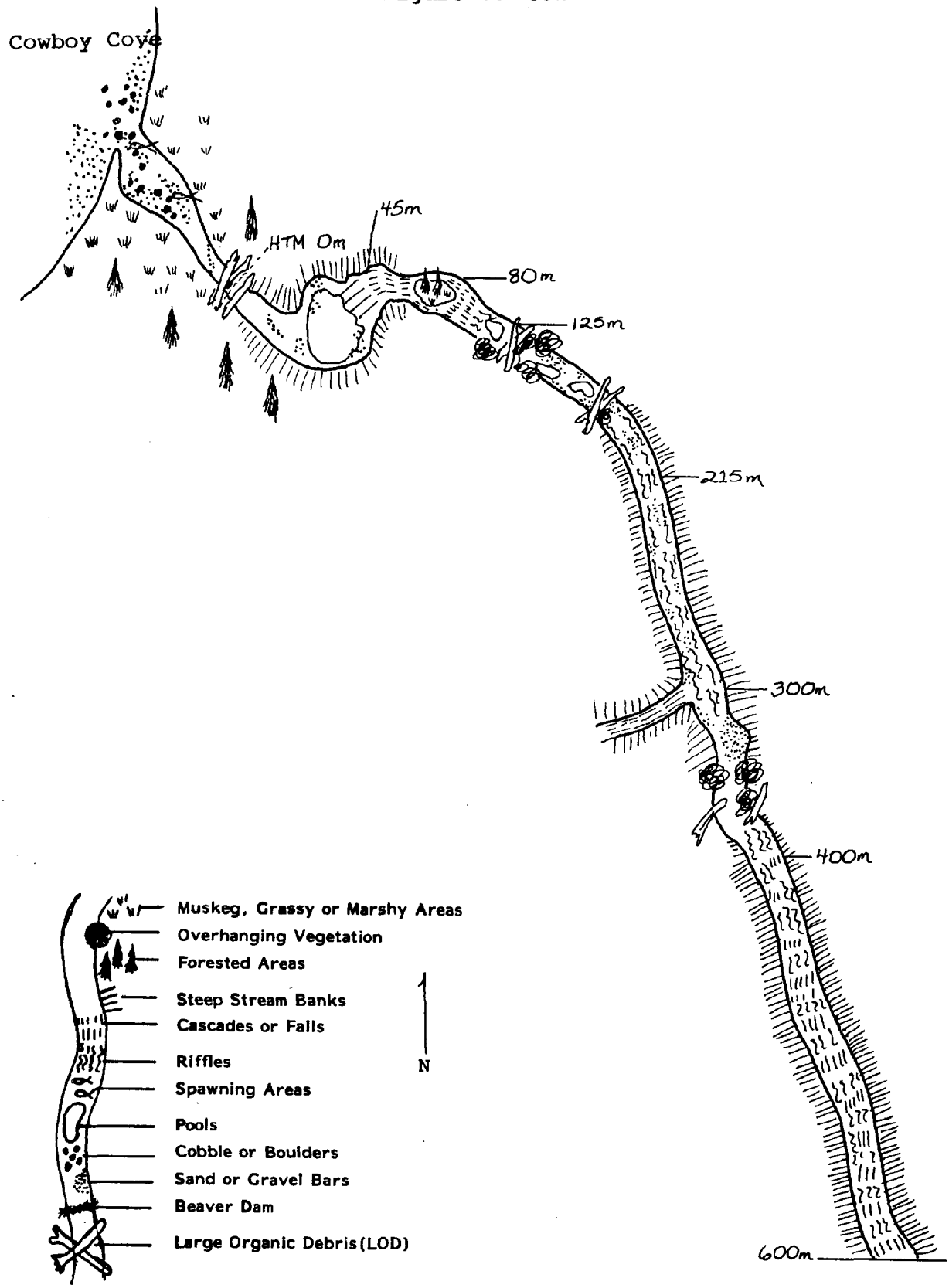
Recommended Escapement

Very limited spawning area exists in this creek. Only 60 pink spawning pairs and 3 chum spawning pairs are recommended for escapement.

Potential Production Summary

Due to poor gravel quality, only a 1.2% egg-fry survival rate is assumed: only 21 pinks, and 2 chums are expected to return given the recommended escapement numbers.

Figure 3. COWBOY CREEK



Not In Scale

COWBOY CREEK

Watershed No. 112-02
Stat. No. 101-28-002

Intertidal	Mostly cobble and boulder; only about $10m^2$ total is available for spawning.
0m	High Tide Mark (HTM); log pile.
45m	3.5m barrier falls over bedrock; large, deep pool created by it.
45-80m	Bedrock
80-125m	Gradient decreases, bedrock to 125m with a large pool formed by LOD and good coho rearing habitat starting at 125m.
125-215m	Good rearing habitat with a few riffles.
300m	Tributary with .3 cfs flow over a 10m high barrier cascade.
325m	Alluvial Deposit, may be part of a caved-in bank.
400-600m (End of Survey)	Boulders and bedrock bottom with steep bedrock banks; increased gradient creating a possible velocity barrier (moss appears on rocks).

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Nichols Passage Creek II	101-28-003	111-01

Location: Flows N.W., over 3 mi. long into Nichols Pass.

Origin: Timbered mountain slope and muskeg flat run-off.

Watershed Type: Timbered muskeg flats and mountain slopes. (280 acres in area.)

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/17/81	2700m above High Tide Mark (HTM)	Falls on each fork, 2700m up	Low-Moderate flood	+1.5 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Less than, equal to 2°	3-4 cfs / up to 12 cfs	2 fps --	6m to 4.5m	.7m to .3m

Streambank Composition / Stability: Steep of bedrock and heavily vegetated dirt banks / Stablized by bedrock and vegetation

Tributaries: 3 with a stream fork at 2460m

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/8/72:	10C	12C	6.5	Clear	None	11.0 ppm	
10m Above HTM	12C	9C	--	Clear	None	Light Amber	-- --

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
25.0 ppm (8/8/72)	70.0 ppm (8/8/72)	--	Resistivity = 6734 ohm/cm^3 (8/8/72)

Spawning Area

Overall Stream Bottom Composition: Some foliated bedrock - shales and some clay deposit; bottom is about 60% bedrock, 10% sand and fines, and about 30% gravels.

Gravel Compaction: Moderate - most gravels are flat and angular - of marginal quality.

Spawning Area Available Above High Tide Mark (HTM): Gravel bars present - some areas up to 50% spawning area - 1260m^2 area available, mostly below 1300m and due to gravel bars.

Intertidal Spawning Area: Limited - approximately 40m^2 of marginal quality gravels mixed with cobble and boulders.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools, mostly riffle and runs	--	--

From LOD controlled pools, undercut banks, riparian vegetation and root wads.

Available Cover: Scarce - a few are present.

Aquatic Invertebrates/Available Food Source: Some algae, pennate moss - common on rocks.

Aquatic Vegetation: Devils club, salmonberry, currant and huckleberry - forest is hemlock, spruce and cedar.

Terrestrial Vegetation: 80-90% shading, 70% due to vegetation and 10% due to canopy (trees).

Shading: Not extensive - some good areas exist around LOD, channel braids (side channels), and undercut banks and pools.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and cutthroat use creek.

Use by Fish: Limited use by fishermen - may be some commercial fishing outside cove.

Use by Fishermen

Wildlife Present

Deer tracks abundant.

Comments and Recommendations

Little could be done to enhance stream.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/8/72	None seen	--	--	--	--
6/17/81	Cutthroat	Adult 4.5 inches	1		

Survey(s) and Dates Conducted

E. Biggs and J. Yuska, 6/17/81 and by USFWS, 8/8/72.

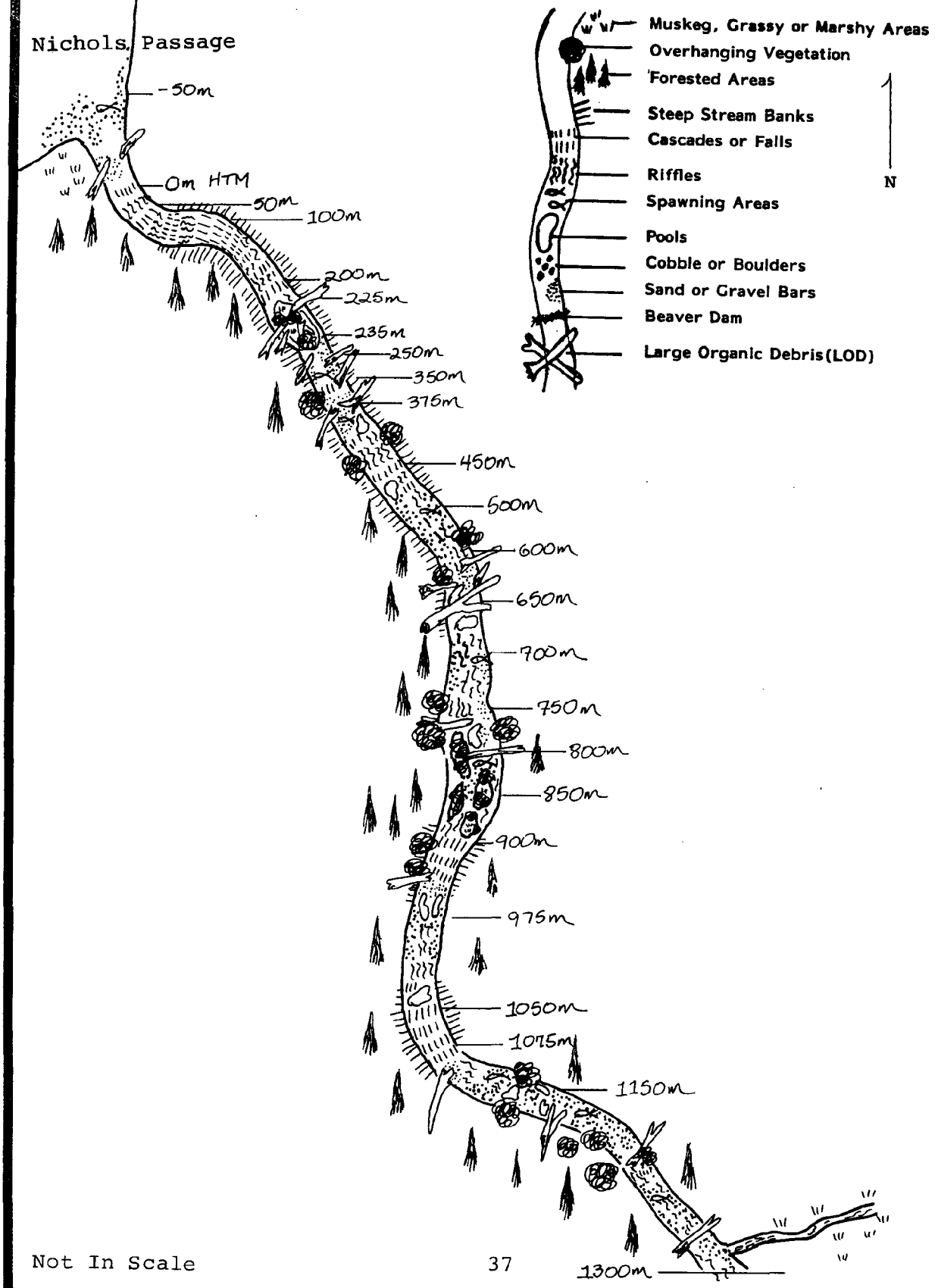
Recommended Escapement

12 spawning pairs of coho, 35 spawning pairs of chum, and 1400 spawning pairs of pinks (they probably all spawn below 900m, due to cascades).

Potential Production Summary

With the poor gravel quality, a 1.2% egg-fry survival rate is assumed. With the recommended escapements, approximately 500 pinks, 21 chums, and 8 coho could return to Annette Island from this creek.

Figure 4. NICHOLS PASSAGE CREEK II - Section 1

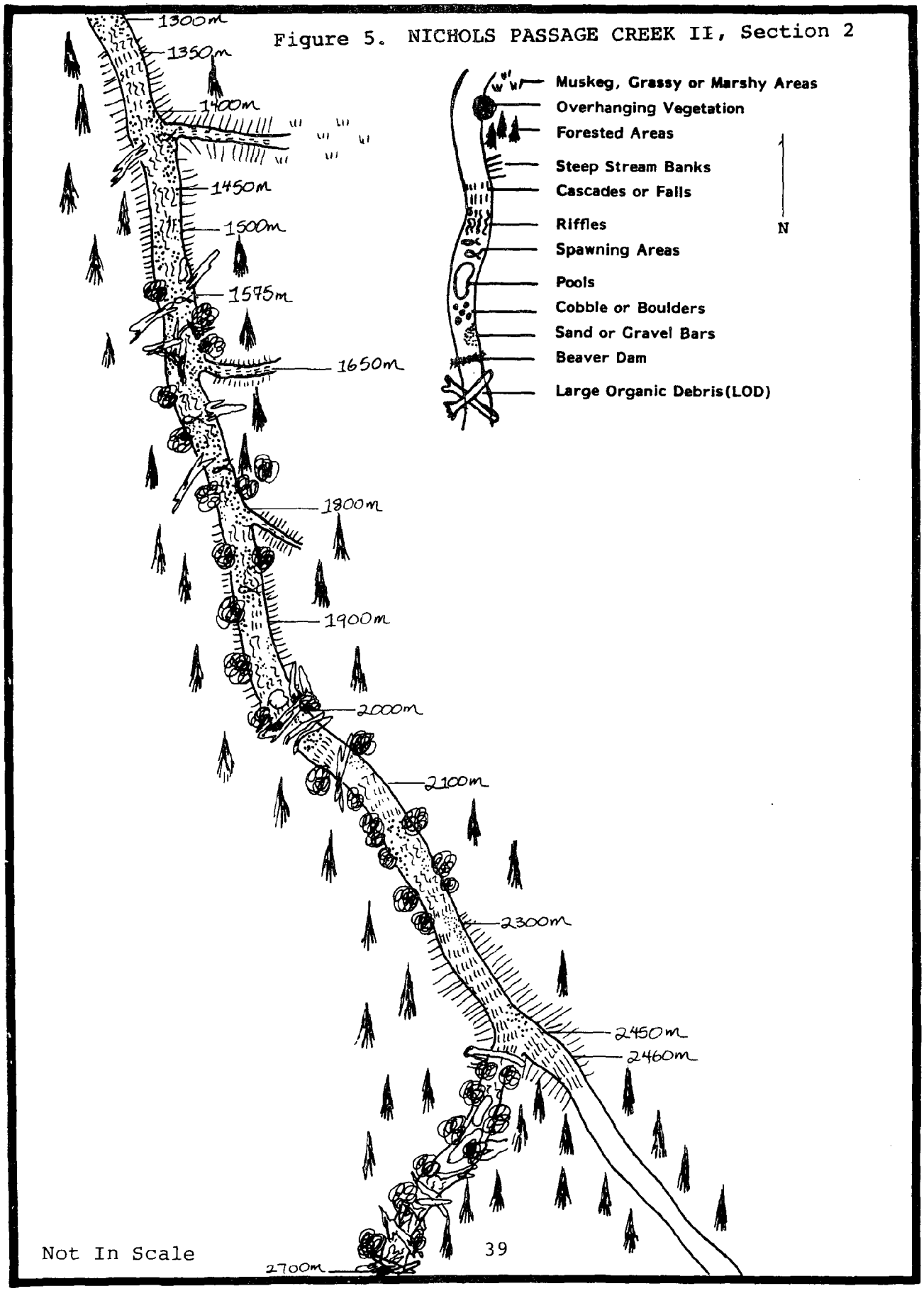


Not In Scale

-50m	End of intertidal spawning area.
-50-0m	Average Stream Width (ASW) = 4m, Average Stream Depth (ASD) = 0.7m, with 20% spawning gravels, 50% boulder, 30% large cobble; High Tide Mark (HTM) at 0m.
0-50m	100% bedrock; at 50m, 1m high falls (not a barrier).
50-100m	100% bedrock, moderate gradient, ASW =2m, ASD = .22m; at 100m, 1 m high bedrock cascades.
100-200m	100% bedrock; 1.5m high bedrock cascade.
225m	LOD blockage, 7m long pool created by it; ASW = 3m, ASD = .5m.
235m	Gravels in bottom return (20% spawning area).
250-350m	Good rearing habitat here, low gradient with LOD and gravel bars 5m long and 4m wide; bottom composition is 30% gravels, 10% clay with fines being prevalent, ASW = 3.5m.
350-375m	Bottom composition, 60% small boulders, 30% cobble, 5% bedrock, less than 5% spawning area.
375-450m	ASW = 3m, ASD = .15m, bottom is 75% spawning gravels.
450-500m	Bedrock and boulders mainly, less than 5% spawning gravels.
500-650m	ASW = 3.2m, ASD = .08m, 50% spawning gravels; deer tracks numerous here; 4.5 inch cut-throat trout seen at 600m.
650m	Alot of LOD and pools here.
700m	Pockets of gravel bars 5m long and 3m wide; however; gravel is flat and angular (poor quality).
750m	Flood plain widens; creek runs through a gorge up to this point; alot of rearing habitat here.
800m	Side channel.
850m	Braids and flashy channels (not a well-defined channel); ASW = 2.5m, 50% spawning gravels.
500-900m	Good rearing habitat, much area is available; at 900m, is a 1m falls, ASW = 2m and less than 5% gravels occur.
975-1050m	ASW = 1.5m, increases to 30% gravels.
1050-1075m	Rock cascades (not a barrier).
1075-1150m	ASW = 2.0m, 70% spawning gravels.
1150-1300m	ASW = 1.5m, 50% spawning gravels.
1300-1350m	ASW = 1.5m, 20% spawning gravels; at 300m, a small tributary (.25 cfs flow) enters from muskeg.
	Upper half of creek is bordered by old growth timber with little to no understory.

(CONTINUED, SECOND SECTION)

Figure 5. NICHOLS PASSAGE CREEK II, Section 2



Not In Scale

NICHOL PASSAGE CREEK II (CONTINUED)

1350m	Bedrock riffle
1400m	ASW = 1.5m, ASD = .07m, 30% spawning gravels above 1400m, a tributary enters draining muskeg with a bedrock bottom.
1450m	Gravels less than 5% of bottom below 1450m, and 10% above.
1575m	ASW = 1.5m, 50% spawning gravels.
1650-1800m	ASW = 1.0m, 50% spawning gravels including some gravel bars, at 1650m, a .25 cfs tributary enters draining muskeg over bedrock.
1800-1900m	At 1800m, .25 cfs tributary enters; 30% spawning gravels to 1900m.
1900m	ASW = 1.5m, ASD = .06m, less than 5% gravels here.
2000m	1.5m diameter log and additional LOD straddles creek (not a barrier at higher flow), less than 5% gravels.
2000-2300m	Less than 5% to 0% gravels, at 2300m, a gorge begins (not a barrier).
2450m	Stream forks.
2460m	North Fork, barrier falls - end of survey.
2450-2700m	South Fork, choked with debris and bottom is mud and silt, no good spawning or rearing habitat here; at 2700m, debris barrier across creek.

Spawning Area:

Intertidal, Above HTM	-50-0m	$40m^2$	1300-1350m	$15m^2$
	235-250m	9	1400-1425m	11
	250-350m	105	1500-1575m	11
	375-450m	169	1575-1650m	56
	500-850m	525	1650-1800m	75
	975-1050m	34	1800-1900m	30
	1075-1150m	105	1900-2700m	<10
	1150-1300m	112.5		

Total Area Above HTM $1260m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Nichols Passage Creek I	101-28-004	111-02

Location	Origin	Watershed Type
Flows N.W., about 1.2 mi. long, into Nichols Pass.	A small lake, mountain slope run-off and springs	Timbered mountain and bedrock slopes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/17/81	1850m abofe High Tide Mark (HTM)	Possibly at 1075m and 1475m	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1-2%, up to 30% in cascade	6 cfs --	1.5 fps / 1-2 fps	2.5m --	.15m --

Streambank Composition	/ Stability	Tributaries
Bedrock and heavily vegetated of dirt and rock banks	/ gravel deposits indicate instability.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
10 Above HTM	11.7 C	14C	--	Clear	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

40% bedrock, 10% boulders, 10% rubble, 10% cobble, 20% gravel, 5% pebble, 5% sand with trace silt.

Overall Stream Bottom Composition

Beaches are mostly gravel with some cobble, pebbles, sand and silt.

Gravel Compaction

Relatively clean gravel - limited compaction.

Spawning Area Available Above High Tide Mark (HTM)

Some available on gravel bars - approximately $55m^2$ area available.

Intertidal Spawning Area

None

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	--	--

Available Cover

--

Aquatic Invertebrates/Available Food Source

--

Aquatic Vegetation

Devil's club, salmonberry, currant with skunk cabbage and ferns occasionally; timber is hemlock, spruce, and cedar.

Terrestrial Vegetation

65% from topography and some riparian vegetation.

Shading

Good coho rearing habitat of moderate abundance.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Limited production of salmon, coho, and cutthroat use creek and possibly pink and chum if they can get over cascades.

Use by Fish

Very little, if any, commercial fishing outside mouth, trap is nearby.

Use by Fishermen

Wildlife Present

--

Comments and Recommendations

In general, the creek has little accessible spawning and rearing area for anadromous salmonids and because of the channel instability, spawning and rearing area present is questionable; okay for trout.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/17/81	Cutthroat	Fry 50-180mm	Over 50	--	

Survey(s) and Dates Conducted

C. Huntington, 6/17/81

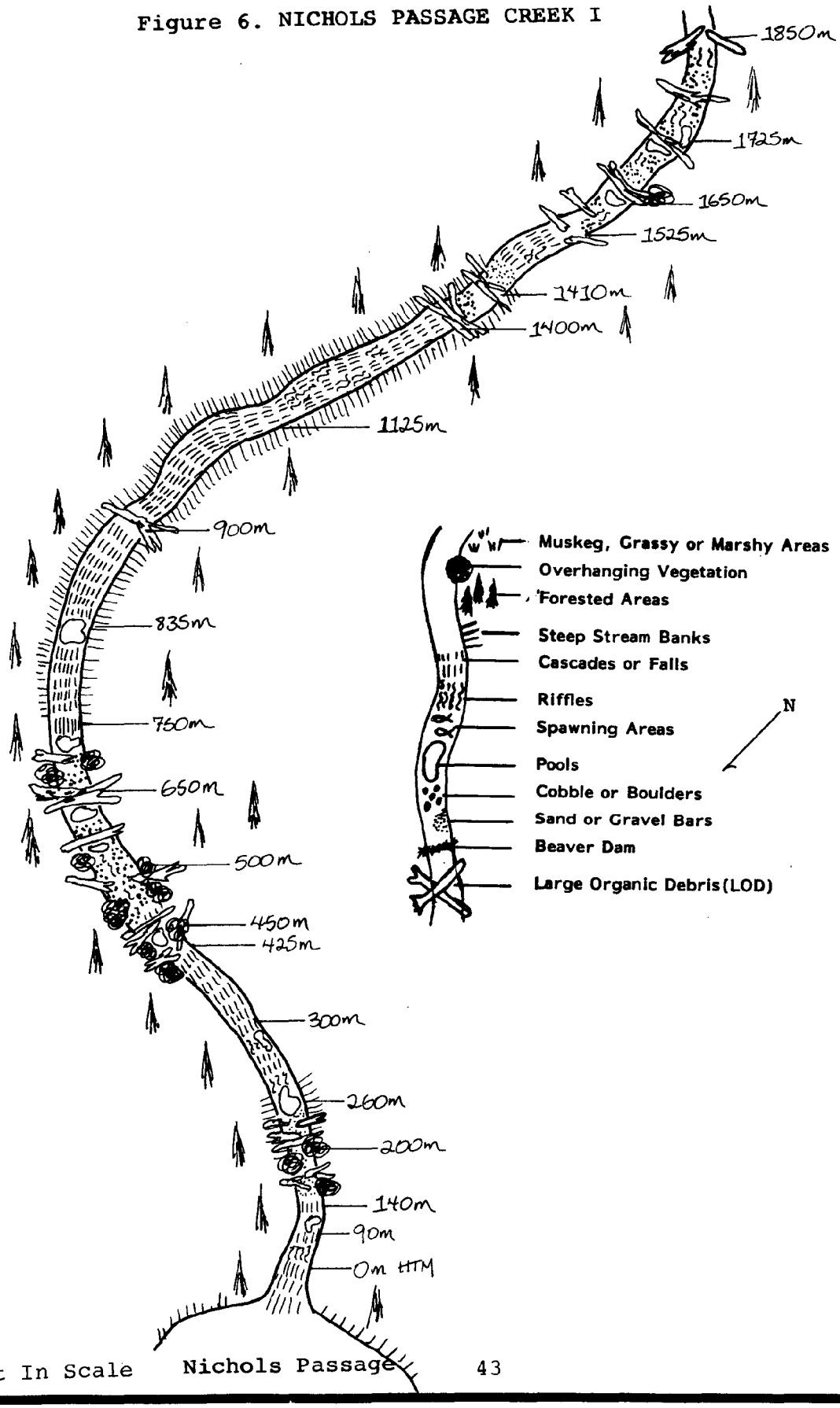
Recommended Escapement

Due to the cascades and inaccesibility, pinks and chum probably cannot or do not utilize this creek. There is only enough gravels for about 5 coho spawning pairs, with a moderate amoun of rearing area available.

Potential Production Summary

Due to the fair quality gravels, a 10% egg-fry survival rate is assumed and approximately 28 adult coho could be expected to return to Annette Island from this creek.

Figure 6. NICHOLS PASSAGE CREEK I



Not In Scale

Nichols Passage

NICHOLS PASSAGE CREEK I

Watershed No. 111-02
Stat. No. 101-28-004

0m	High Tide Mark (HTM); creek flows over a 10m long 1.2m passable cascade.
90m	5m Cascade (30° gradient).
140-260m	1.3m Cascade with a .7m deep plunge pool; above 140m, gradient drops and good rearing habitat (alot of LOD and overhanging vegetation); at 200m is a large 2m deep pool; at 260m is an 8m long pool with bedrock walls.
270-280m	Cascading channel over bedrock.
300-330m	Cascading channel with possible barrier; above 330m, cascades may become a velocity barrier.
425m	Gradient drops again to 1-2%.
450m	Good coho rearing area, alot of LOD and side channels.
500m	Wide gravel bars and flood plain here with undercut banks and root tangles.
650m	Debris jam with gravel above.
750-825m	.8m falls at 750 m with bedrock and cascades to 825m.
835m	Huge pool averaging 1.5m (2m at deepest point), 4 x 6m in area.
900m	Debris jam.
875-1400m	Bedrock and boulders with a possible barrier cascade in a gorge at 1075m.
1400m	Small debris jam with gravels piled up behind it.
1410-1450m	Behind debris jam is $35m^2$ spawning area.
1450-1525m	Bedrock and boulders with a 3m high possible barrier cascade at 1475m.
1525-1650m	Gradient lowers to 2%; debris jam and LOD at 1650m.
1725m	LOD moderate; undercut banks and root tangles here; some fines piled behind debris jams - little to no spawning area.
1850m	End of survey; it is unlikely that salmon even get up here.
Spawning Area:	Limited. Approximately $50m^2$ is available and is of marginal quality.
	No intertidal area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Japan Creek II	101-28-005	109-01

Location	Origin	Watershed Type
Flows S.W. into Japan Bay - .5 mi long.	Run -off from Round Mountain	Timbered mountain slopes - (84 acres in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/7/81	150m from estuary	100 ft barrier falls at 150m	Moderate	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3° to 6° in places	-- --	3 fps (6/8/72) --	2m / up to 6m	.15m/ up to .20m

Streambank Composition	/ Stability	Tributaries
Bedrock and boulders - steep.	Stable, but evidence of flashiness (creek increases to 9m wide).	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/8/72: --	13.9 C	7.2 C	6.8	Clear	None	8.0 ppm	
	9.5C	9.0C	6.0	Clear	None	Light Amber	

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (6/8/72)	10/5 ppm (6/8/72)	89.8 ppm (6/8/72)	Resistivity = 4810 ohm/cm^3 (6/8/72)

Spawning Area

Mainly boulder, bedrock, and gravels (50% bedrock, 30% cobble and boulder, 20% gravels (poor quality).

Overall Stream Bottom Composition

Lots of angular gravels.

Gravel Compaction

Limited - None from 100-150m (bedrock); less than $50m^2$ total available.

Spawning Area Available Above High Tide Mark (HTM)

Gravels mixed with too many fines - no spawning area.

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Mainly riffle - a couple pools due to LOD and falls.	--	--

Limited - banks are steep (10 ft high average), but some LOD is present.

Available Cover

Moderately abundant - ephemeroptera and Odonata observed.

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Sparse - some ferns, salmonberry, currant, and skunk cabbage.

Terrestrial Vegetation

90% - 80% from canopy and 10% from banks and overhanging vegetation.

Shading

None to speak of.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pinks are known to spawn below falls.

Use by Fish

No known use by fishermen.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Minor stream - limited production - no improvements recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/7/72	None Seen	--	--	--	--
6/7/81	None Seen	--	--	--	--

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, 6/7/81, and USFWS, 6/8/72

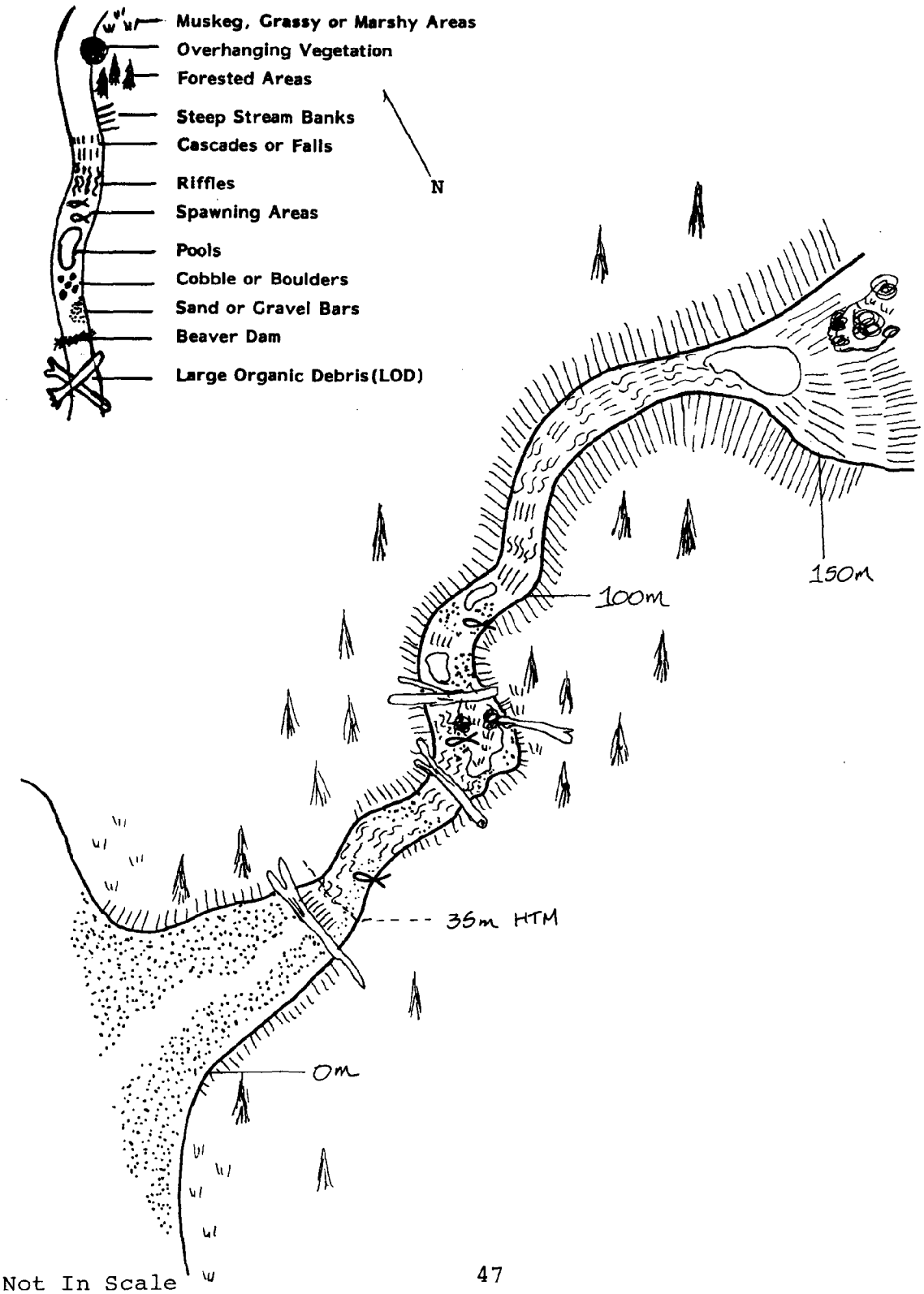
Recommended Escapement

Probably only pinks utilize this creek if any salmon utilize it at all, and only 83 spawning pairs are recommended.

Potential Production Summary

The gravels are angular, and the creek flashy, therefore, only a 1.2% egg-fry survival rate is assumed. Therefore, approximately 30 pinks would return to Annette Island from this creek.

Figure 7. JAPAN CREEK II



Not In Scale

JAPAN CREEK II

Watershed No. 109-01
Stat. No. 101-28-005

0m	Intertidal area is mostly sand and fines mixed with gravel and pebbles, not usable for spawning.
10m	High Tide Mark (HTM), Average Stream Width = 2m, Average Stream Depth = .15m.
100m	Bedrock and boulder to falls, below 100m, some LOD and pools occur.
150m	30m barrier falls.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Japan Creek I	101-28-006	108-01

Location	Origin	Watershed Type
Flows W. in Japan Bay - about .5 mi long.	Mountain runn-off and seepage	Timbered mountain slopes (39 acres in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/7/81	475m Above High Tide Mark (HTM)	Beaver dam and pond at 475m	Low flow	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	1.5 cfs (1.4 cfs - 6/8/72) to 1	1 fps Slow	1.8m --	.08m --

Streambank Composition	/ Stability	Tributaries
--	--	--

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/8/72:	13.9 C	9.4 C	6.9	Brown Slight	Amber	--	--
--	9.5C	9.0C	5.5	Clear None	Amber	--	--

Total Alkalinity: Trace (6/8/72)
Total Hardness: 15.0 ppm (6/8/72)
Dissolved Solids: Total = 11.0 ppm (6/8/72)
Other/Overall: Resistivity = 585,122 ohm/cm^3 (6/8/72)
Alot of organic matter near beaver dams.

Spawning Area

Overall Stream Bottom Composition: 20% bedrock, 20% rubble and boulders, 30% gravels, 30% fine gravels, sand and silt.

Gravel Compaction: Some angular shales and fines mixed with gravel.

Spawning Area Available Above High Tide Mark (HTM): Limited to about $39m^2$ - marginal quality gravels.

Intertidal Spawning Area: Limited to about $37.5m^2$ - marginal quality gravels.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pool in 40% of creek, riffles in 20%.	--	Large pond at 475m is 1.5 x 15m

Undercut banks and root wads, pools behind alot of debris jams with LOD (old beaver dams in upper section of logs).

Available Cover: Scarce - diptera

Aquatic Invertebrates/Available Food Source: Scarce - some moss on rocks.

Aquatic Vegetation: Moss, salmonberry, currant, fern, alder - timber is mainly hemlock.

Terrestrial Vegetation: Up to 90% in some areas; 70% average - 60% due to timber, 10% due to riparian vegetation.

Shading: Some coho rearing habitat is available, but is limited due to small size of stream.

Extent and Quality of Rearing Area:

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink and chum use creek.

Use by Fishermen: Deer hunting and some subsistance fishing, low fishing pressure.

Wildlife Present

Alot of beaver activity.

Comments and Recommendations

The creek has gone through some changes, a couple of beaver dams have been washed out (beavers trapped out?)

An okay stream for pink and chum; although coho could rear here also - limited by size of creek.
No improvements are recommended, since it is a nursery stream and does have some spawning area, logging could have detrimental affects on stream.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/8/72	Unidentifed salmonid	Fry	--	--	Below second beaver dam.
8/15/80	Mostly pinks with chum	Adults	1500	--	Aerial count, fish at creek mouth.
6/7/81	None observed	--	--	--	--
9/1/81	Pink	Adults	100	--	Aerial count, fish at creek mouth.

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, 6/7/81 and USFWS, 6/8/72

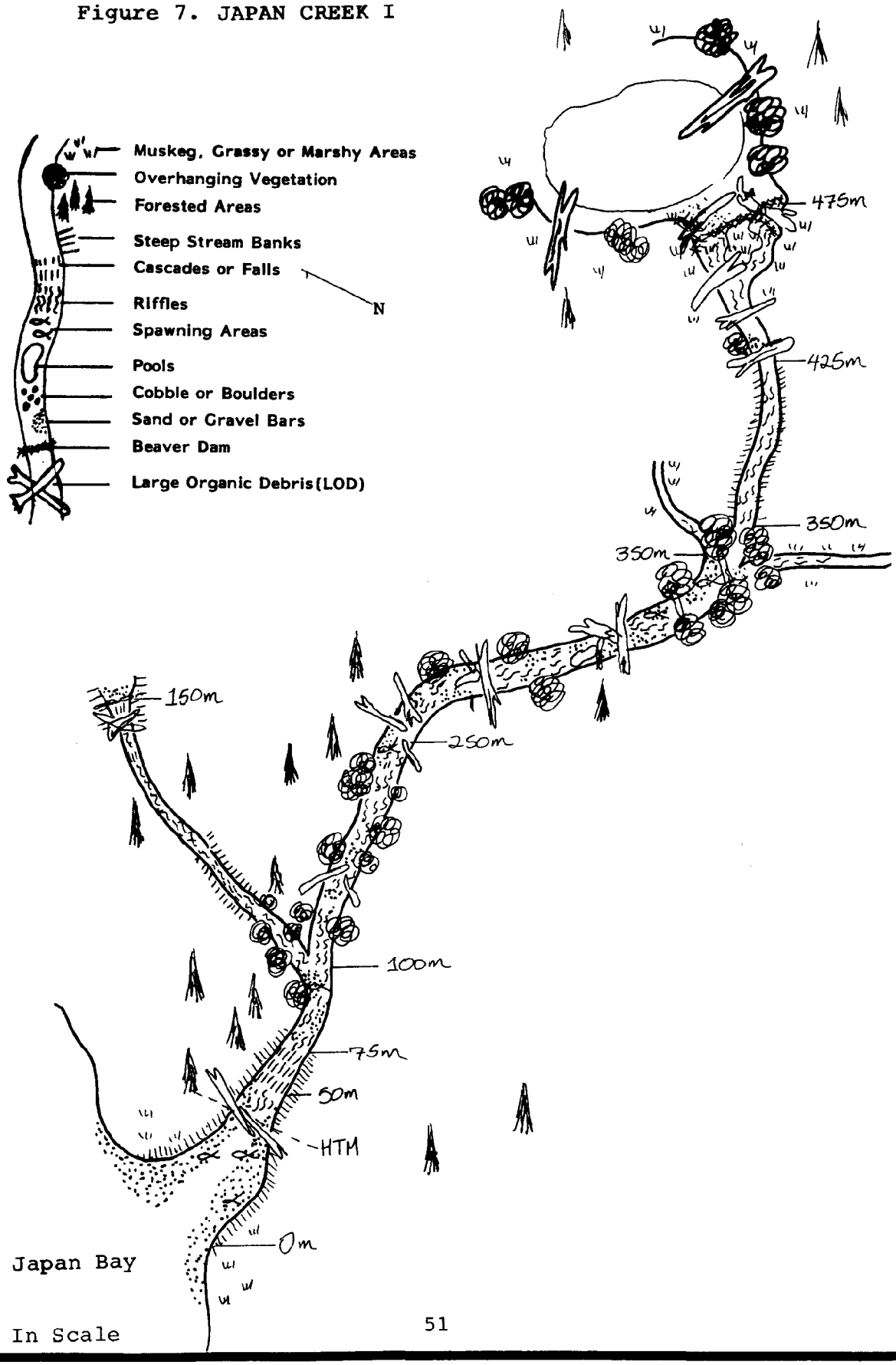
Recommended Escapement

Probably only pink and chum utilize this creek. Recommended escapement is only about 130 pinks spawning pairs and 8 chum spawning pairs.

Potential Production Summary

Potential production from this creek, assuming a 10% egg-fry survival rate (fair quality gravels), is 3860 pinks and 40 chum returning to Annette Island.

Figure 7. JAPAN CREEK I



Not In Scale

JAPAN CREEK I

Watershed No. 108-01
Stat. No. 1010-28-006

0m	Beginning of a small Estuary, Average Stream Width (ASW) = 1.5m, Average Stream Depth (ASD) = .08m, about 50% good spawning gravels (37.5m^2 total area).
30m	High Tide Mark (HTM), LOD here, few gravels mixed with boulders to 50m.
50-75m	Bedrock Cascade
75-100m	At 75m, gravels begin again, tributary centers at 100m, tributary has ASW = 1.0m, ASD = .05m, .4 cfs flow - okay coho rearing habitat, except gradient is moderate to 150m in tributary where stream is clogged with debris and gradient increases.
75-250m	ASW = 1.2m, 10% spawning gravels (21m^2 area)
250-350m	Above 250m bottom has alot of fine sand mixed with gravels, alot of LOD in channel, a lower stream velocity and gradient with good rearing habitat.
350m	Two tributaries come in, main channel flow is reduced by one-half; stream banks are clay, and there is a thick alder canopy; gravels here are smaller, but still usable for spawning - during high flow more gravel on banks is available.
350-425m	Large debris jam blocks fish except during high flow at 425m, ASW = .8m, ASD = .05m, 10% spawning gravels (6m^2 area).
475m	Abandoned beaver dam, a fish barrier - flow is a trickle and dam is wide, 1.5m high, heavy LOD influence from 425m.
Spawning Area:	Limited. Intertidal area is 37.5m^2. Freshwater area is approximately 39m^2.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hidden Creek	101-28-007	107-03

Flows N.W. into Japan Bay, .25 mi long — Location

Run-off from muskeg and timbered flats. — Origin

Muskeg and timbered flats. — Watershed Type

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/7/81	40m from High Tide Mark (HTM)	Log and debris blockage at 40m	Low Flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1%	.5 cfs --	1-2 fps --	1m --	.1m --

Rock and bedrock in beach sand and mud. Unstable — Streambank Composition / Stability

None — Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	9.5C	10C	--	Clear	None	Amber	-- --

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	-- Some organic matter from muskeg.

Spawning Area

Bedrock and boulder mixed with gravels mixed with silt and mud.

Overall Stream Bottom Composition

Alot of fines in gravel - angular gravel.

Gravel Compaction

None available.

Spawning Area Available Above High Tide Mark (HTM)

None available - too many fines.

Intertidal Spawning Area

Rearing Area

No pools - 100% riffle.

Pool/Riffle Frequency (P:R Ratio)

Very limited - some under large rocks.

Ave. Pool Depth/Range: --

Ave. Pool Size/Range: --

Available Cover

Scarce

Aquatic Invertebrates/Available Food Source

None

Aquatic Vegetation

Skunk cabbage, grasses and sedges and stunted trees.

Terrestrial Vegetation

50% from overhead canopy.

Shading

None below muskeg ponds.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

None

Use by Fish

None

Use by Fishermen

NOTE: Sculpins were only fish seen.

Wildlife Present

None seen

Comments and Recommendations

A muskeg drainage stream not utilized by salmonids.

Survey(s) and Dates Conducted E. Biggs, 6/7/81

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/7/81	Sculpins only				

Survey(s) and Dates Conducted

E. Biggs, 6/7/81

Recommended Escapement

Pinks may try to use this creek, but probably unsuccessfully.

Potential Production Summary

--

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Japan Creek III		101-28-008	107-04	
Stream		Number	Geocode	
Flow N.W. into Sylburn Harbor, .1 mi. long.		Muskeg run-off		Muskeg and timbered flats
Location		Origin		Watershed Type
6/7/81	40m Above High Tide Mark (HTM)	Muskeg marsh at 40m	--	--
Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
Less than 1%	Less than .5 cfs	Slow	1-2m	.1m
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Heavily vegetated dirt and rock.		Relatively unstable	None	
Streambank Composition		/ Stability	Tributaries	

Water Quality

--	--	--	--	Clear	--	Amber	--	--
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity		Color	D.O.	CO_2
--	--	--	-- Muskeg water (low Ph probably).					
Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall					

Spawning Area

In estuary - fine, flaky state, pebbles and mud.

Overall Stream Bottom Composition

Extreme - no gravels.

Gravel Compaction

Stray pinks may try to spawn in pebbles, but probably are not successful.

Spawning Area Available Above High Tide Mark (HTM)

Long estuarine area, but no gravels.

Intertidal Spawning Area

Rearing Area

--	--	--	--	--
Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range		Ave. Pool Size/Range	

Stunted overhead trees.

Available Cover

Scarce

Aquatic Invertebrates/Available Food Source

None

Aquatic Vegetation

Skunk cabbage, grasses and sedges, and stunted timber.

Terrestrial Vegetation

50% - due to canopy.

Shading

None in freshwater - good estuarine area for pink and chum fry.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

No known use.

Use by Fish

No known use.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Pinks may try to spawn here, but probably unsuccessfully - no salmon production.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/7/81	None seen	--	--	--	--

Survey(s) and Dates Conducted

C. Huntington, 6/7/81

Recommended Escapement

Pinks may try to utilize this creek, but probably unsuccessfully.

Potential Production Summary

--

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hemlock Creek - North Fork	101-28-009	107-01

Location	Origin	Watershed Type
Fork of Hemlock Creek	Same as Hemlock	Same as Hemlock

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/5/81	700m from Fork	Falls at end (1310m)	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	25 cfs (6/23/76)	1 fps --	2m --	.20m

Streambank Composition / Stability	Tributaries
Soil and dirt stabilized by heavy vegetation. Stable	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above Fork	11.1 C	11 C	6.8 (6/23/76)	Clear	None	Light Amber	-- --

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Same as Hemlock.

Spawning Area

15% spawning gravels.

Overall Stream Bottom Composition

Limited - good gravels.

Gravel Compaction

$183m^2$ area - good quality gravels.

Spawning Area Available Above High Tide Mark (HTM)

Not applicable.

Intertidal Spawning Area

Rearing Area

A few pools (small) - mostly riffles and runs .75m -- -- --

Pool/Riffle Frequency (P:R Ratio) Ave. Pool Depth/Range Ave. Pool Size/Range

LOD (some clue to logging) and overhanging riparian vegetation.

Available Cover

Scarce

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Thick riparian vegetation, salmonberry, devil's club, currant under spruce - hemlock timber.

Terrestrial Vegetation

80-90% due to overhanging vegetation.

Shading

Extensive in fork - good steelhead , trout, and coho spawning and rearing habitat; good cover available.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Coho, trout, pink and chum use it for spawning and rearing.

Use by Fish

None known.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

The Fork is where most of the good rearing area available in Hemlock Creek exists. A significant amount of spawning area exists also - logging has added LOD and cover, increasing the rearing area in creek - detrimental affects are minimal.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments

(See form on Hemlock Main Channel.)

Survey(s) and Dates Conducted

C. Huntington. 6/5/81 and USFWS, 6/23/76

Recommended Escapement

Coho and chum probably utilize the north fork and due to the limited coho rearing area, only 10 coho spawning pairs and 7 chum pairs are recommended for escapement.

Potential Production Summary

Given the above escapements with an assumed 10% egg-fry survival rate, 56 coho and 35 chum can be expected to return as a result of production from this fork.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hemlock Creek	101-28-009	Main Channel, 107-02; North Fork, 107-01

Location	Origin	Watershed Type
Flow S.W. into N. Pt. Chester, 2 mi. long to 1310m (above creek mouth) in North Fork	Timbered mountain run-off (Chenango Mountain)	Forested and logged mountain terrain, 1225 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/5/81		Barrier falls on both forks	Moderate	+2.5 ft.

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5°	35 cfs 20-150 cfs	2.5 fps	7.5m --	.5 m to 1m

Streambank Composition / Stability	Tributaries
Lower end: soils, upper end: rock mixed/ with soils (heavily vegetated)	Stable - lower creek has a flood plain.
	None - stream forks 610m above mouth.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
50m Above Mouth	11.9C	11 C (below falls)	5.5	Clear None	Light Amber	(5/8/72) 10.0ppm	(5/8/72) 4.0ppm

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
5/8/72: 11C	5C	7.3	
Trace (5/8/72	20.0 ppm (5/8/72)	--	Resistivity 23,584 ohm/cm^3/ There does not seem to any negative effects from logging.

Spawning Area

Overall Stream Bottom Composition: Main channel - 15% spawnable gravels, 10% boulders, 10% sand, 5% bedrock, 60% cobble, rubble and unspawnable gravels.

Gravel Compaction: Minimal - high quality gravels

Spawning Area Available Above High Tide Mark (HTM): Approximately 300m^2 area - most of which occurs just above the weir.

Intertidal Spawning Area: 1650m^2 - excellent quality spawning channel.

Rearing Area

Pool/Riffle Frequency (P:R Ratio): Some deep pools formed by LOD, mainly riffles and runs.

Ave. Pool Depth/Range: .65m

Ave. Pool Size/Range: One pool was 60m long.

Available Cover: Much LOD - some due to logging; no undercuts because of rock banks.

Aquatic Invertebrates/Available Food Source: Scarce - some intertidally.

Aquatic Vegetation: Some algae and moss covered boulders.

Terrestrial Vegetation: Grass and sedges intertidally with canopy of hemlock and spruce - thick riparian vegetation begins at 610m. Intertidal area - 5% due to banks and some canopy; above HTM 60% due to banks, overhanging vegetation, and canopy.

Shading: Some rearing area exists under and around LOD, otherwise, limited. (Channel is mainly riffles and runs.)

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Chum, coho, pink and cutthroat use creek and possibly steelhead.

Use by Fishermen: Subsistence fishing (especially when logging camp was operating) and egg take for hatchery - closed to commercial fishing.

Wildlife Present

--

Comments and Recommendations

Excellent pink and chum spawning areas (they mainly use the lower areas); logging affects have improved stream production quality if anything, due to increase in LOD - detrimental affects are minimal. Hemlock is a major salmon producing stream on Annette Island. The lack of coho fry is unsettling, the adults may have been fished out, so stream should be checked in the fall for presence of coho spawners.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/11/67	Pinks	Adults	2200		USFWS Escapement Estimate
9/11/67	Chum	Adults	200		USWFS Escapement Estimate
5/8/72	None Seen	--	--		--
1974	Pink	Adults	5290		USFWS Escapement Estimate
1975	Pink	Adults	18,874		USFWS Escapement Estimate
1976	Pink	Adults	21,919		USFWS Escapement Estimate
8/15/80	Pink	Adults	1000		Weir Count
	Chum	Adults	20		Weir Count
8/18/80	Pinks mainly (mixed with chum)	Adults	20		Approximately 1% chums; salmon count in creek above and below weir.
9/1/81	Pink	Adults	100		Outside creek mouth (aerial count)
9/5-10/4-1981	Pinks	Adults	2700 (2000 put above Weir)		Weir Count Hatchery egg take (2000 pinks and 100 chum were allowed to spawn naturally.
	Chums	Adults	420 (100 put above Weir)		
	Coho	Adults	10		

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, C. Huntington, 6/5/81, and USFWS, 5/8/72

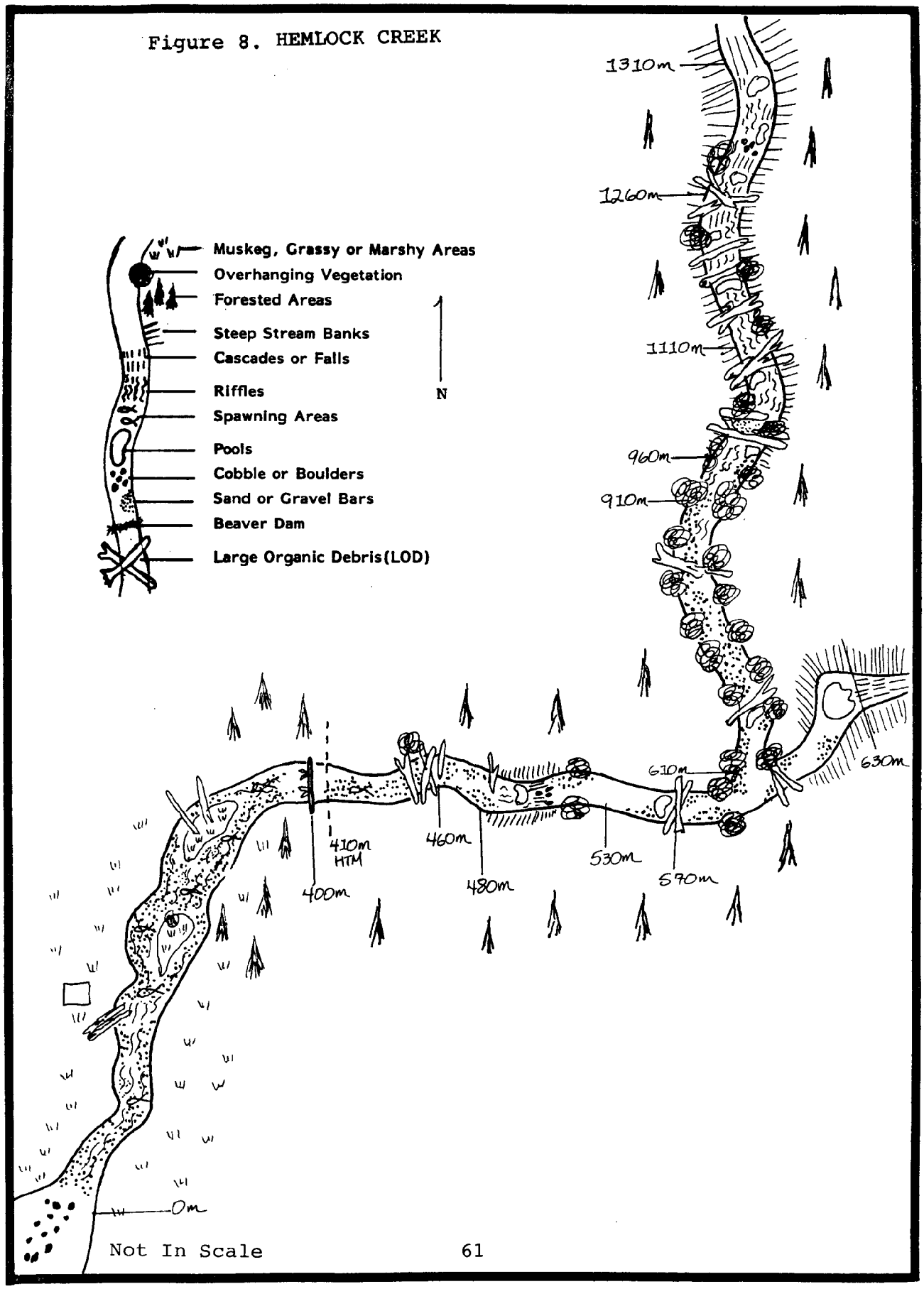
Recommended Escapement

Only pinks and chum utilize the intertidal area, which is extensive, coho probably only utilize the North Fork (see previous stream form). It is recommended that approximately 3000 pink spawning pairs and 170 chum spawning pairs be allowed to escape and spawn in this creek.

Potential Production Summary

Approximatley 8900 pinks and 849 chum could be expected to return to Annette Island resulting from production in this main channel of Hemlock Creek (gravels are good quality so a 10% egg-fry survival rate is assumed).

Figure 8. HEMLOCK CREEK



Not In Scale

HEMLOCK CREEK

Watershed No. 107-01 (North Fork)
107-02 (Main Channel)
Stat. No. 101-28-009

0m	Creek mouth, bottom is boulders and bedrock.
0-410m	20% spawning gravels, Weir at 400m, High Tide Mark (HTM) at 410m.
410-460m	20% spawning gravels, large log pile at 460m (not a barrier).
0-460m	From 0m, Average Stream Width (ASW) = 20m, Average Stream Depth (ASD) =.25m.
460-530m	Heavy LOD influence, Average Stream Velocity = .08 fps, ASW = 5m, 10% spawning gravels, evidence of gravel bars spawnable at high flows. At 480m, gravel is smaller, but better quality than at 460m.
530-570m	ASW = 5.5m, 5% spawning gravels.
570-610m	LOD pile with 6m long pool at 570m. ASW = 5.5m, 20% spawning gravels.
610-630m	In South Fork, ASW = 5.5m, ASD = .3m, bottom is large gravels and cobbles with 10% spawning gravels. Barrier falls at 630m.
610-910m	In North Fork, ASW = 2.5-3m, ASD = .15m, with 20% spawning gravels, rearing habitat is okay, not excellent - stream is more like a spawning channel.
910-960m	Less gravels, some pools and riffles here.
960-1110	ASW = 1.75m, ASD = .25m, many boulders in channels with 5% spawning gravel. Good rearing habitat with alot of LOD, pools and riffles. Creek begins to run through a gorge.
1110-1260m	Gorge becomes steeper, stream gradient increases and stream bottom is filled with moss covered boulders. No spawning or rearing area.
1310m	Barrier Falls.

Spawning Area:

Intertidal, Above HTM,	0-410m	$1650m^2$
	410-460m	200m
	460-530m	35m
	530-570m	11m
	570-610m	44m
South Fork	610-Falls	11m
	Sub-total	$300m^2$

North Fork	610-910m	$165m^2$
	910-1110m	18m
	Sub-total	$183m^2$
Total Above HTM		$483m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Tain Creek	101-28-010	105-04

Location	Origin	Watershed Type
Flows W. into Pt. Chester, 700m long.	Trout Lake	Forested mountain drainage, 25 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/6/81	Entire length, 700m above High Tide Mark (HTM)	None	Moderate	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	65 cfs / 19-130 cfs	over 3 fps/down to 1 fps	20m/ to 4.8m	.4m --

Streambank Composition / Stability	Tributaries
Banks are bedrock or fragmented rock with root mats - no under cuts. Stable.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/8/72:	14.4C	8.9C	6.8				
8/7/73:	17.8C	16.7C	6.5			(See next page)	
Just below lake.	10.6C	12C	--	Clear	None	Amber 8.6-10.0	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (6/8/72)	8.0ppm (6/8/72)	6.85ppm (6/8/72)	Tannic Acide - 5.6 mg/l (7/19/79) Additional data on next sheet.

Spawning Area

Mainly boulders, cobble, rubble and bedrock.

Overall Stream Bottom Composition

Minimal

Gravel Compaction

Less than 2% of creek is spawnable; $90m^2$ total available at best.

Spawning Area Available Above High Tide Mark (HTM)

At best $100m^2$ is available - mainly mixed in with cobble and boulders.

Intertidal Spawning Area

Rearing Area

Pools formed by falls and boulders - they are small and sparse.

Pool/Riffle Frequency (P:R Ratio) -- -- Ave. Pool Depth/Range -- -- Ave. Pool Size/Range

Very little - little overhanging vegetation or undercut banks, limited LOD.

Available Cover

Sparse - a few caddisflies, mayflies.

Aquatic Invertebrates/Available Food Source

Alot of algal growth on rocks.

Aquatic Vegetation

Not much overhanging vegetation - but shrubs and stunted trees are numerous.

Terrestrial Vegetation

Channel relatively open - 10% shading due to canopy.

Shading

Limited - probably not utilized by salmonids for rearing.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pinks, chum, coho, sockeye and dolly varden migrate through the creek.

Use by Fish

Heavy subsistence fishing (dipnetting and beach seining) and fly fishing.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Recommend strict regulations regarding subsistence fishing - escapements are much lower than they could be (for potential area). Salmon probably only use creek for migration to lake.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/10/65	Unidentifed	Adult	1700	--	Ball of fish outside mouth of creek (aerial creek).
8/26/75	Sockeye	Adult	1	--	In upper creeks.
10/6/75	Sockeye	Adult	49	--	In upper creeks.
7/30-8/15/80	Sockeye	Adults	40	--	In main creek.
6/6/81	None	--	--	--	--
9/19/81	Sockeye	Adults	19	3	In upper creeks.

Additional Water Quality Data:

Flow: 7/19/79 - 2.74 cfs (questionable), 8/21/79 - 7.20 cfs (questionable), 9/21/79 - 129.62 cfs (questionable), 8/7/73 - 19 cfs.

Water Temp: 7/19/79 - 19.5C, 8/20/79 - 20.5C 8/21/79 - 19.0C, 9/21/79 - 14.0C, 8/17/80, 16C - stream, 17C lake.

D.O.: 7/19/79 - 10.0 ppm, 8/20/79 - 8.6 ppm, 9/21/79 - 9.7 ppm.

Conductivity: 7/19/79 - 16.5 ohm/cm^2, 8/20/79 - 18.0 ohm/cm^2, 9/21/79 - 32.0 ohm/cm^2

Survey(s) and Dates Conducted

C. Huntington, J. Yuska, E. Biggs, 6/6/81; USFWS, 6/8/72 and 8/7/73; Pacific Rim Planners, Inc., 7-9/79

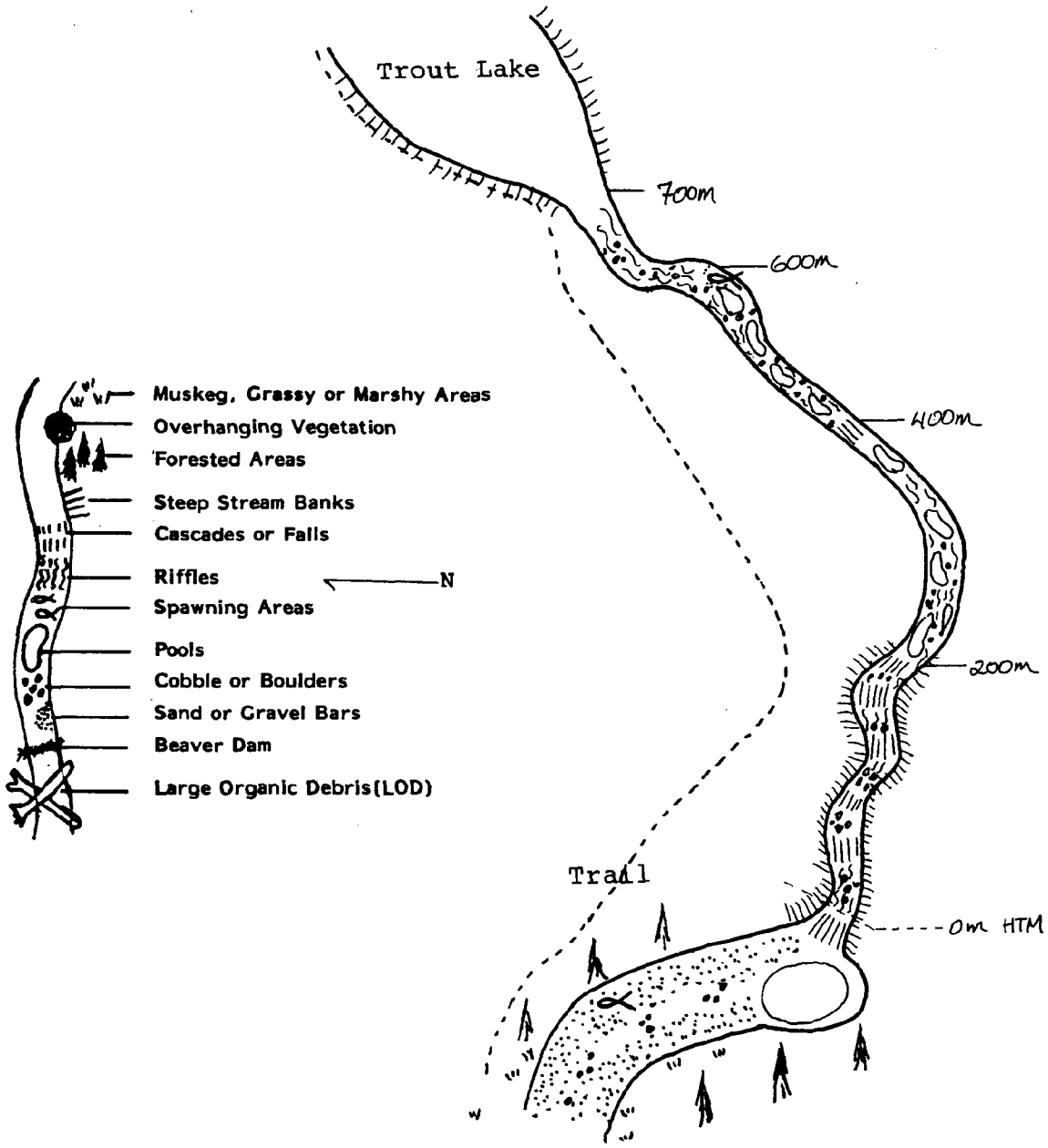
Recommended Escapement

Mainly salmonids traverse this creek on their way to Trout Lake tributary creeks, however, they will not be included on this form (only on the individual tributary forms). Only approximately 170 pink spawning pairs and 10 chum pairs are recommended for escapement in this creek.

Potential Production Summary

Due to the poor gravel quality intertidally, (1.2% egg-fry survival) probably only approximately 60 pinks return to Annette Island, however, in the upper reaches that chum utilize, 50 chum could return resulting from production in this creek (assuming a 10% egg-fry survival).

Figure 9. TAIN CREEK



Not In Scale

TAIN CREEK

Watershed No. 105-04
Stat. No. 101-28-010

Below 0m	Intertidal area is mostly cobble and boulder, less than 5% available spawning area; large intertidal pool below 0m.
0m	High Tide Mark (HTM), 1m Falls, not a barrier.
0-200m	Cobble, boulder and bedrock substrate, high velocity flow.
200-400m	Lower gradient, slower flow, Average Stream Depth (ASD) = .3m (shallower than lower section); riffle here; however, limited spawning area - gravels sparse and angular; at 400m, 25 ft. cascade chute (not a barrier).
400-600m	Lower gradient, riffle area, mostly cobble/boulder bottom, $70m^2$ spawning area at head of riffle at 600m (only spawning area seen so far).
600-700m	Slow flow, low gradient, cobble/boulder bottom, Trout Lake at 700m.

Spawning Area: Limited

Above HTM $70m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Lower Trout Lake Creek	101-28-011	105-01

Location: Flows S.W. into Lower Trout Lake- about 1.5 mi long.

Origin: Run-off from mountain slopes. /draining with granite outcroppings.

Watershed Type: Forested and lotted mtn. $2mi^2$ in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	110m	Cascade barrier at 110m.	low flow	+2 ft (flashy)

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2%	10-12 cfs --	3 fps --	7m --	-- --

Streambank Composition / Stability: Gravel - dirt and rock, heavily vegetated with root wads and shrubs. Relatively stable.

Tributaries: None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
10m Above Mouth	16 C	9 C	--	Clear --	None	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: Large gravels, cobble rubble.

Gravel Compaction: Gravels rounded at mouth and become angular toward falls.

Spawning Area Available Above High Tide Mark (HTM): Approximately $315m^2$ available spawning area in fair qualities - some on a gravel bar - large gravel bar near mouth - not counted (probably not used).

Intertidal Spawning Area: Not Available

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
One pond exists below the falls. Mainly a run and riffle.	1m	about 3m diameter

Available Cover: Limited - some LOD and a side channel with a few undercut banks.

Aquatic Invertebrates/Available Food Source: Scarce - none seen.

Aquatic Vegetation: Scarce - some brown mosses and periphyton near the mouth.

Terrestrial Vegetation: A few shrubs (blueberry and huckleberry), mainly cedar and hemlock with a few alder, (fairly open understory).

Shading: 70% from canopy (not riparian vegetation).

Extent and Quality of Rearing Area: Limited - a little available inside channel - if fish use the creek to spawn, fry probably go directly to the lake.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Probably sockeye, coho and trout only use the creek.

Use by Fishermen: Occasionally hunting (campsite near creek mouth).

Wildlife Present

None seen.

Comments and Recommendations

This is a minor production creek (limited spawning area) with a little area available to sockeye, coho, and/or cutthroat. No improvements recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
None Seen					

Survey(s) and Dates Conducted

E. Biggs, 6/21/81

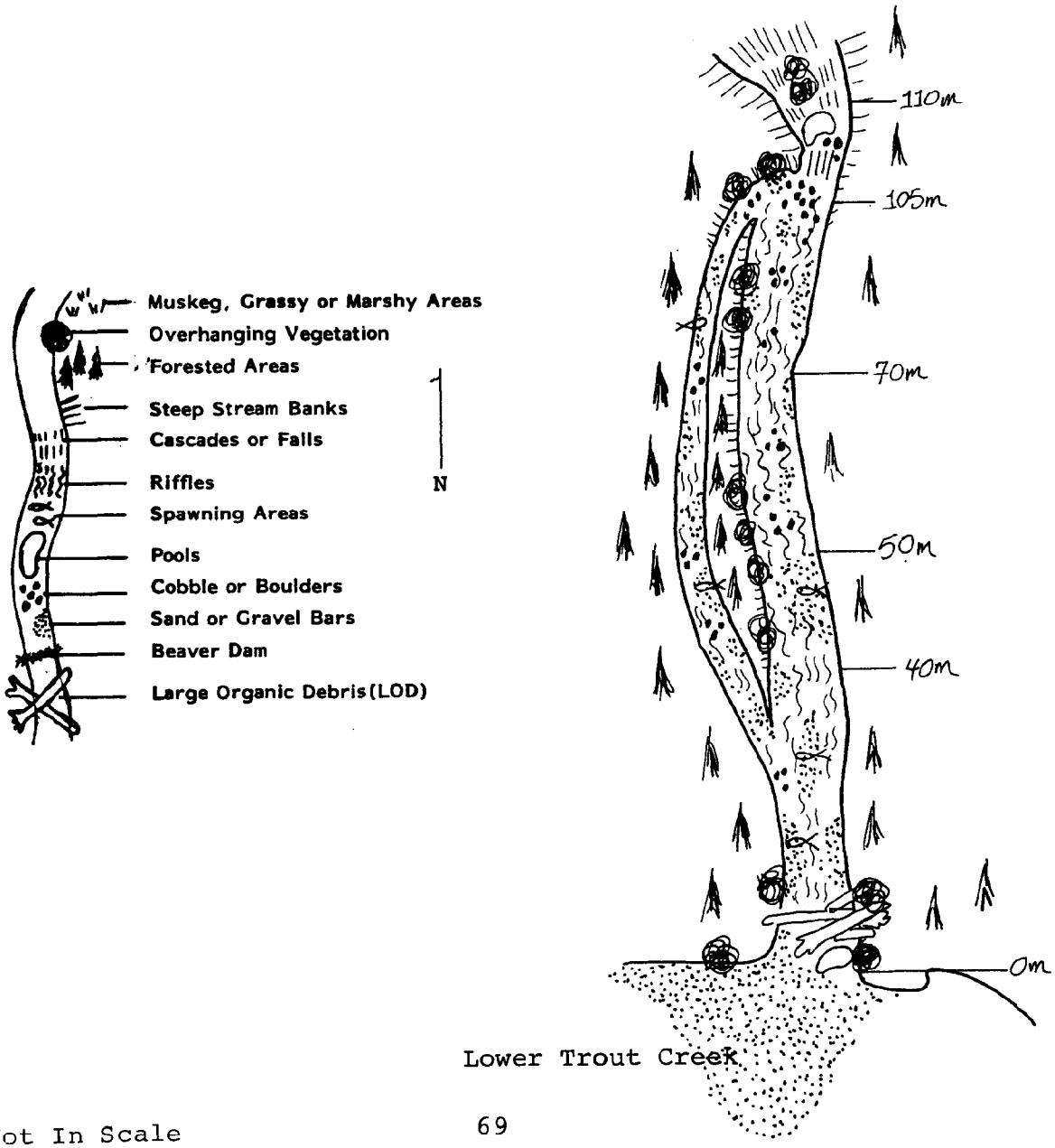
Recommended Escapement

Recommendations are made for sockeye and coho only. 47 sockeye spawning pairs and 27 coho spawning pairs could utilize this creek, however, due to the difference in timing, coho may disturb sockeye redds.

Potential Production Summary

Given the above escapements and a 10% egg-fry survival rate (good quality gravels present), it is estimated that 168 sockeye and 152 coho could return to Annette Island resulting from production in this creek.

Figure 10. LOWER TROUT LAKE CREEK



Not In Scale

LOWER TROUT LAKE CREEK

Watershed No. 105-01
Stat. No. 101-28-011

At Mouth - 0m	Large gravel bar, extends into lake, gravels high quality (rounded), but with fines mixed in.
0-40m	Average Stream Width (ASW) = 7m, 50% spawning gravels; side channel splits off to the west.
40-50m	ASW = 5m, 90% spawning gravels.
50-70m	ASW = 5m, gravels interspaced with boulders, 10-20% spawning gravels available during high flow.
70-105	ASW = 5m, gravels between boulders, 10% spawning gravels, side channel enters at 105m.
105-110m	Bedrock and boulder cascade with a barrier falls/ cascade at 110m.
30-105m (Side Channel)	ASW = 3m from 30-70m, with a low gradient and about 80% available spawning area during high flows - some rearing area, but its limited; above 70m, ASW = 1m, and spawning gravel decreases to 10% - interspaced in boulders.

Spawning Area:	0-40m	$140m^2$
	40-50m	45m
	50-70m	15m
	70-105m	18m
Side Channel		97m
Total	Approximately	$320m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
North Upper Trout Lake Creek	101-28-012	105-02

Location	Origin	Watershed Type
Flows S.W. into Upper Trout Lake, 1.2 mi. long	19 acre lake, springs and mountain run-off.	Timbered mountain slope and alpine valley, 2 mi^2 area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	3300m - entire section	None	Moderate	+ 2-3 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Variable 1-10%	12 cfs / up to 25 cfs	Rapid 1 fps --	8m / 4.5-21m	.20m /up to .25m

Streambank Composition / Stability	Tributaries
Relatively steep upper banks of mud and rock (2-30 ft high) - some fallen logs. Relatively stable.	One tributary enters creek.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/26/72: --	6.1C 12.2C	6.1C 10C	6.8 --	Clear	None	Amber	-- (9/26/72) Trace

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (9/26/72)	9ppm- NaCl (9/26/71)	7.70ppm Free $CaCo_3$ (9/26/71)	Okay

Spawning Area

Overall Stream Bottom Composition

Bedrock, boulders, and cobble interspaced with gravel spawning areas (see stream map description); there would be more spawning area with less cobble and rubble intermixed.

Gravel Compaction

Minimal excellent gravels.

Spawning Area Available Above High Tide Mark (HTM)

Extensive area - probably critical to size of run in Trout Lake - 1972m^2 of excellent quality spawning gravels - with only a few "fines"

Intertidal Spawning Area

Not applicable.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)

Many large pools throughout creek - high p:r

Ave. Pool Depth/Range

Main pools, .9m /up side pools .7m /to 1.5m

Ave. Pool Size/Range

6m diameter/up to 120m.

Available Cover

Provided mainly by side pools with root wads and cobble bottoms.

Aquatic Invertebrates/Available Food Source

Sparse - a few diptera, mayflies, caddisflies and stoneflies.

Aquatic Vegetation

Moss and algae relatively abundant.

Terrestrial Vegetation

Riparian vegetation sparse - azaleas, skunk cabbage, currant and alder; timber is spruce, hemlock and cedar.

Shading

40% from canopy (forest) and topographic (steep banks).

Extent and Quality of Rearing Area

Extensive rearing area in both upper lake (origin) and throughout creek. Many coho salmon are produced.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

Sockeye, coho and cutthroat utilize creek.

Use by Fishermen

No known use by sports fishermen or otherwise.

Wildlife Present

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Comments and Recommendations

This is the major creek for spawning sockeye on Annette. It should be strictly protected and escapement counts should be conducted yearly. No major habitat improvement recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/29/71	Sockeye	Fry	12		Young of the year = 0+
6/21/81	Coho	Fry	300		No sockeye!
9/19/81	Sockeye	Adult	19	3	Creek could hold alot more spawners.

Survey(s) and Dates Conducted

C. Huntington, 6/21/81 and USFWS, 9/29/71 and 9/26/72

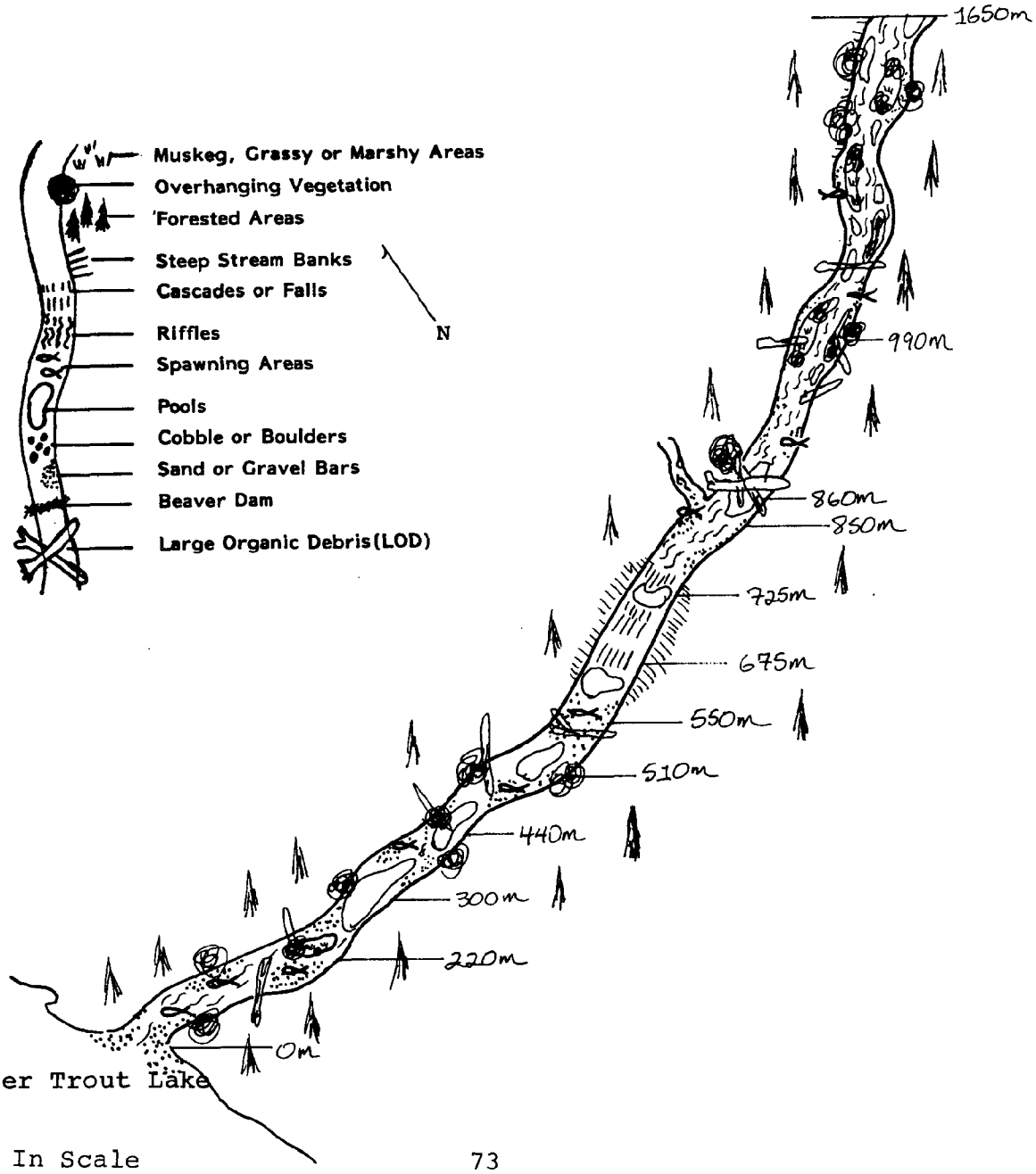
Recommended Escapement

Recommendations will be made for sockeye and coho only. 295 sockeye and 168 coho spawning pairs could utilize this creek successfully.

Potential Production Summary

With the excellent quality spawning gravels present and good water supply, a 20% egg-fry survival rate is assumed. Potential production given the above escapements would be 2100 sockeye and 1900 coho returning to Annette Island resulting from production in this creek.

Figure 11. NORTH UPPER TROUT LAKE CREEK - Section 1



Not In Scale

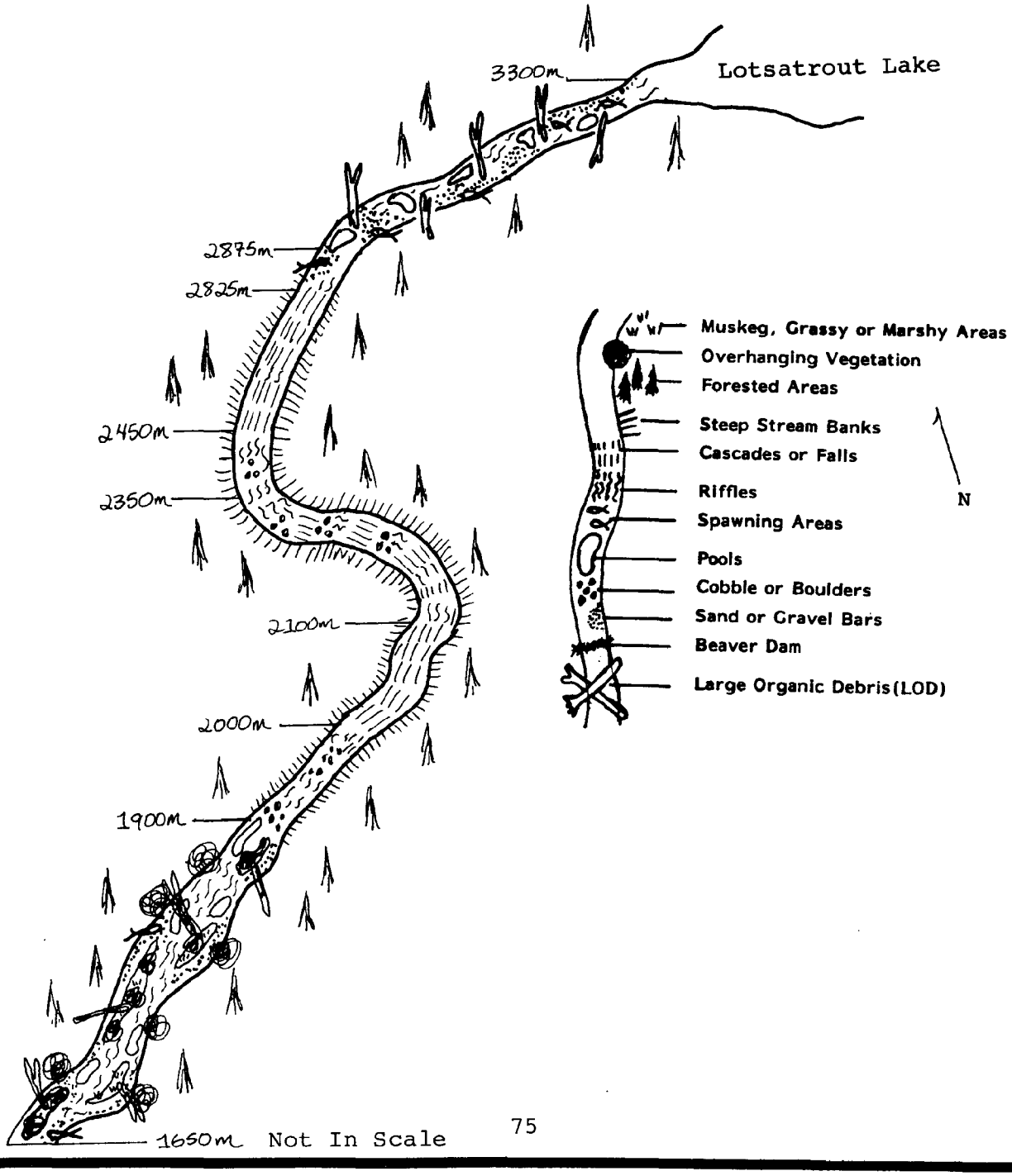
NORTH UPPER TROUT LAKE CREEK

Watershed No. 105-02
Stat. No. 101-28-012

0-550m	Average Stream Width (ASW) = 12m, Average Stream Depth (ASD) = .45m, good spawning area, alot of rearing area available with large, deep side pools, much LOD and root wads, and large, deep pools in the channel. Island at 220m, 20 x 125m pool at 300m, 12 x 45m pool at 440m, 8 x 20m pool at 510m, and 110m long riffle at 550m.
550-725m	Spawning area decreases; at 675m, there is a 2m high, stepped falls with a 30m diameter, 5m deep pool below it (not a barrier). At 725m, 2.5m stepped falls with a deep plunge pool.
0-725m	Bottom composition: 5% pebble, 25% rubble, 30% cobble, 40% gravel.
725-1900m	Bottom composition: 5% pebble, 10% gravel, 45% rubble, 35% cobble, 5% boulder. Good "off channel" rearing area with some LOD and root wads in side channels, ASW = 7m, ASD = .30m, gradient is less than 1% with slow water velocity; main channel is cobble and rubble with some boulders, with patchy spawning areas ($< 50m^2$) in side pools ("tailout"). At 850m, a tributary enters that has some spawning and rearing area, but gravels are angular. LOD with pool at 860m and channel braiding with abundant side pools and good rearing habitat begins at 990m.

(CONTINUED,
SECOND SECTION)

Figure 12. NORTH UPPER TROUT LAKE CREEK - Section 2



Not In Scale

NORTH UPPER TROUT LAKE CREEK (CONTINUED)

1650-1900m	Braided channel and slow flow continues. At 1900m is end of good rearing habitat.
1900-2825m	Bottom composition: 5% gravel, 20% cobble, 20% rubble, 25% boulder, 30% bedrock. Generally a steep gradient channel with little to no LOD, few large pools and swift velocity - little or no spawning or rearing area. ASW = 8m, ASD = .20m. At 2000m, relatively steep bedrock channel with passable cascades, which ends at 2100m. From 2350-2450m, gently sloping gradient bedrock channel with lots of moss and algae and at 2825m, the bedrock channel ends.
2825-3300m	Bottom composition: 5% sand, 5% pebble, 75% gravel, 15% cobble. Low gradient (less than 1%) with moderate amount of LOD and pool formations; good spawning and rearing area with 2 old redds, at 2875m and coho fry observed.
3300m	Lotsatrout Lake - rearing area for coho fry.

Spawning Area: Total Available $1972m^2$
($760m^2$ of which is in upper section)

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
South Upper Trout Lake Creek	101-28-013	105-03

Location	Origin	Watershed Type
Flows N.W. into Upper Trout Lake	Mountain slope run-off and springs	Timbered slopes - alpine valley with granite outcroppings (2 mi^2 area)

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	2200m from creek mouth	Barrier falls at 2200m	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5°	4.5 cfs / .5 cfs (8/1/74), 10 cfs (9/29/71)	1 fps / --	1.5m / 3-12m	.15m --

Streambank Composition	Stability	Tributaries
Mud and rock with vegetation.	Fairly stable - some undercutting.	One

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Just Above Mouth	16C	9C	6.8	Clear Good	None	None	-- --

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

Overall Stream Bottom Composition

Alot of good gravels (90% of bottom in areas), but gravels become more and more angular above 800m - about 50% gravels, 30% rubble, 10% boulder, 10% sand.

Gravel Compaction

Some - angular gravels

Spawning Area Available Above High Tide Mark (HTM)

Excellent quality spawning area, especially in lower half of creek; 5180m^2 available area total.

Intertidal Spawning Area

Not applicable.

Rearing Area

Pool substrates are mainly cobble and rubble. Pools and riffle interspaced throughout, 40-60% riffles (.2m deep)

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.9m .6-1.2m	6m to 15m

Available Cover

Mainly provided by some LOD in braided channel and influencing the main channel - a little overhanging vegetation.

Aquatic Invertebrates/Available Food Source

Moderate density - stonefly, mayfly and caddisfly larvae observed.

Aquatic Vegetation

--

Terrestrial Vegetation

Some huckleberry, salmonberry, azalea, devil's club, terrestrial grasses - timbered areas are hemlock, cedar, shorepine and alder.

Shading

In general, 0-40%; 90% shading in a couple of areas (overhanging vegetation and LOD).

Extent and Quality of Rearing Area

A fair amount - not as much as North Upper Trout Lake Creek, but still provides alot of coho fry.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

Sockeye, coho and cutthroat use the creek.

Use by Fishermen

No use known by sportmen.

Wildlife Present

None seen.

Comments and Recommendations

This is a major spawning area for sockeye - underescapement is obvious - recommend strict fishing regulations on lower creek to boost production. Coho fry growth may be limited in creek by low water temperature.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/29/71	Sockeye	Adult	59	13	(mostly found in first large pool.
	Cutthroat	Adult - 6 inch	1		
	Sockeye	Fingering	a few sited		
8/1/74	Cutthroat	4-6 inch	6		
	Coho	2-3 inch (fry)	21		
	Three spine sticklebacks				
		1.5-3 inch	12		
	Sculpin	Adult	a few spotted		
1971	Sockeye	Adult	72		Escapement Peak Count
1972	Sockeye	Adult	66		Escapement Peak Count
1974	Sockeye	Adult	125		Escapement Peak Count
6/21/81	Coho	Fry	20		More were seen, but uncounted.
9/19/81	None seen (sockeye adults expected).				

Survey(s) and Dates Conducted

J. Yuska, 6/21/81 and USFWS, 9/29/71 and 8/1/74

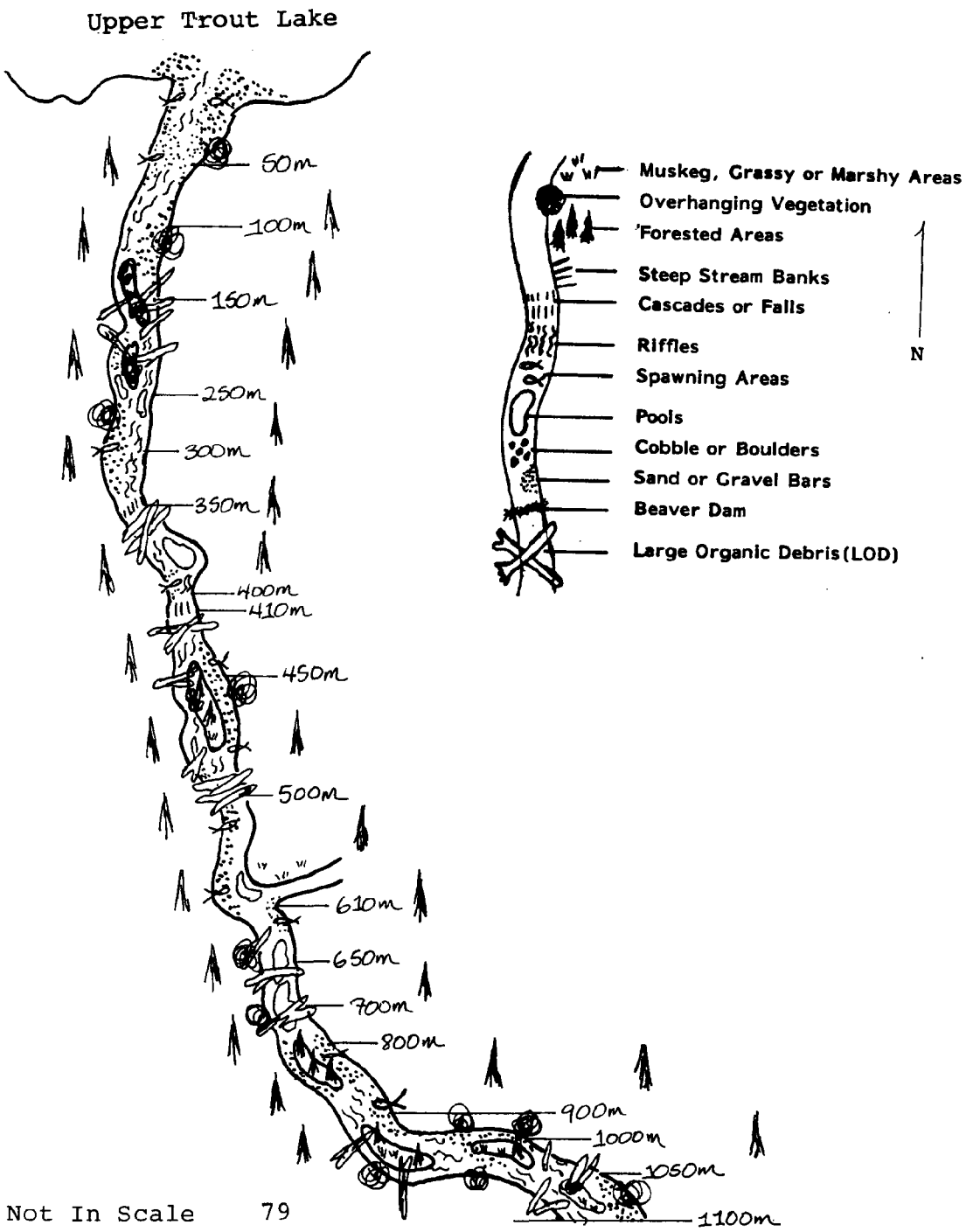
Recommended Escapement

There is an immense amount of spawning area available in this creek, 770 sockeye spawning pairs and 440 coho spawning pairs could utilize this creek.

Potential Production Summary

Because of the excellent quality gravels, but expected creek flashiness, a 10% egg-fry survival rate is assumed. Potential production with the above escapements, 2750 sockeye and 2480 coho could return to Annette Island

Figure 13. SOUTH UPPER TROUT LAKE CREEK - Section 1



Not In Scale

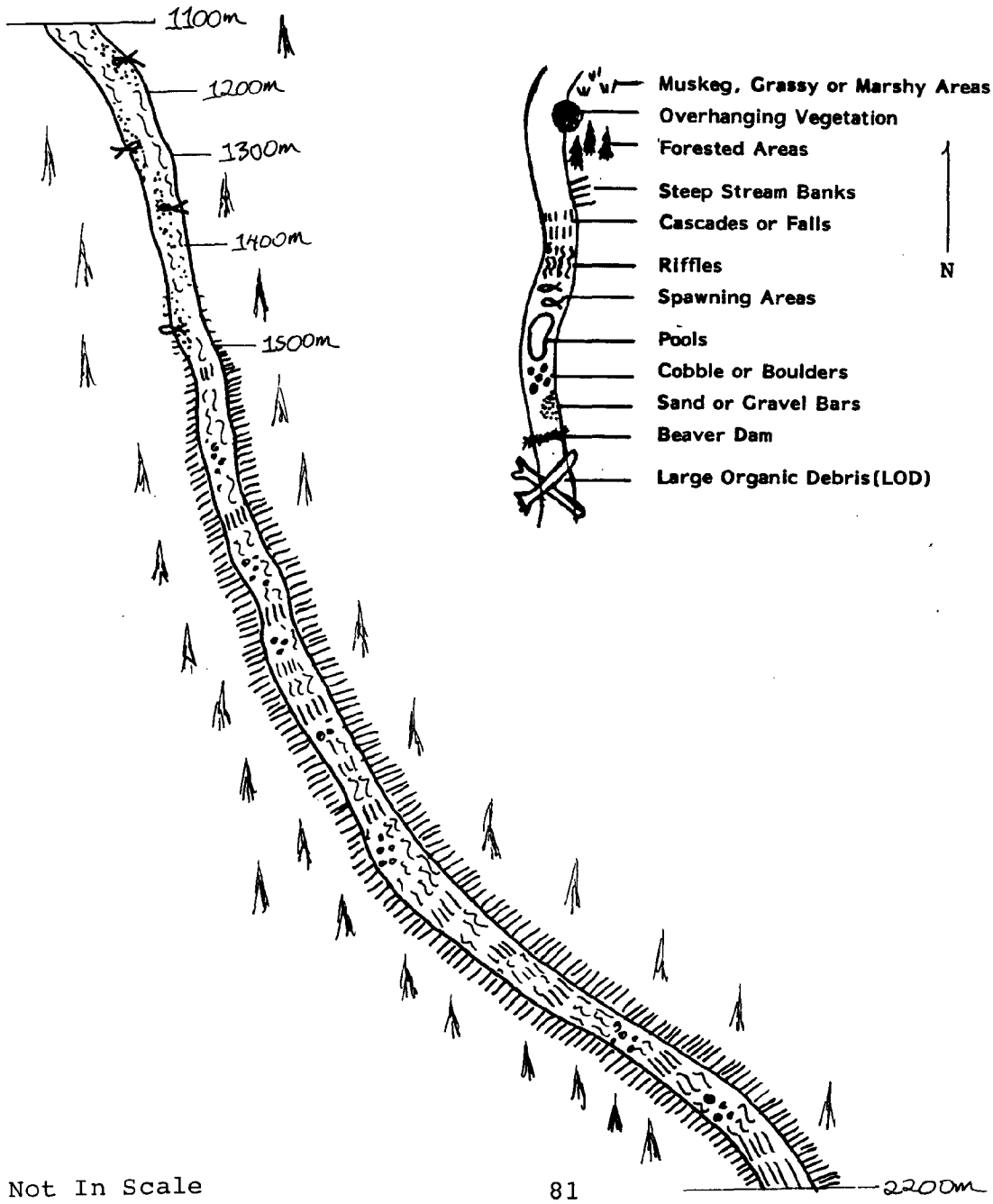
SOUTH UPPER TROUT LAKE CREEK

Watershed No. 105-03
Stat. No. 101-28-013

0-50m	Upper Trout Lake at 0m, Average Stream Width (ASW) = 10m, Average Stream Depth (ASD) = .45m, low gradient, low velocity, 90% spawning gravels.
50-150m	ASW = 7m, ASD = .4m, at 100m stream is 3m wide, but including gravel bars at high flow, 9m wide; 60% usable gravels and gravel size increases.
150-250m	Stream braids, alot of LOD in channel, gravels are larger, but clean, at 250m moderate amount of rearing habitat including root wads and backwater areas (still 60% gravels).
250-300m	60% spawning gravels; at 300m, channel is 3m wide with 5m gravel bars that are covered at high flows.
300-400m	Still 60% gravels; at 350m, LOD forms falls .5m high.
400-450m	Gravels increase in size, bottom is 30% gravels, 60% cobble, 10% boulder, at 410m is a LOD induced falls .5m high.
450-500m	Braided channel begins at 450m with LOD piles and good rearing habitat; bottom is 90% gravels, 5% cobble, 5% boulder; a side channel has 100% gravel ($100m^2$ total spawning area in it).
500-800m	ASW = 6m, with 50% spawning gravels over a low gradient, at 610m, a tributary with good off-channel rearing area enters - tributary ASW = 3m, ASD = .08m with $180m^2$ of available spawning area during high flows. At 650m, good off-channel rearing areas, low gradient, with undercut banks and 40% shading from 0m.
800-900m	Braiding occurs at 800m, ASW = 6m with 100% spawning gravel.
900-1000m	ASW = 6m, with 50% spawning gravel.
1000-1100m	ASW = 7m, 60% spawning gravel, at 1050m, a moderate amount of LOD and channel braiding ends at 1100m.
0-1100m	Gravels are fairly rounded and clean.

(CONTINUED
SECOND SECTION)

Figure 14. SOUTH UPPER TROUT LAKE CREEK - Section 2



Not In Scale

SOUTH UPPER TROUT LAKE CREEK (CONTINUED)

1100-1200m	ASW = 5m, 60% gravels, no more channel braiding.
1200-1300m	ASW = 5m, 15% gravels.
1300-1400m	ASW = 4m, 10% gravels - size of gravel has increased.
1400-1500m	ASW = 3m, stream gradient has increased with the bottom having less than 5% gravels, being mostly large cobble, small boulders, and bedrock; very little rearing habitat here or above 1500m.
1500-2200m	Stream increases in gradient; no coho fry up this far; barrier falls at 2200m.

Spawning Area:

	0-50m	$450m^2$
	50-150m	315
	150-250m	1080
	250-300m	240
	350-410m	120
	410-450m	360
Side Channel		100
Tributary		180
	500-700m	600
	700-800m	300
	800-900m	600
	900-1000m	300
	1000-1100m	420
	1100-1200m	300
	1200-1300m	75
	1300-1400m	40
	Total Area	$5480m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Melansin Creek	101-28-014	104-01

Forested mountain slopes and granite outcroppings.

Location	Origin	Watershed Type
Flows W. into Pt. Chester, 800m long	Melansin Lake	--

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/6/81	800m - entire creek (9/21/71)	Barrier falls at 200m.	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3.5%	15 cfs /up to 70 cfs/	3 fps / up to 3.5 fps/	4m / up to 6m	.15m --

Streambank Composition	/ Stability	Tributaries
Channel fairly open with rock (vegetated banks).	/ Stable	--

Water Quality

Sample Site	Temp.-Air	Temp.-Water (9/21/71)	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/21/71:	15.5 C	13.3C	6.5				
50m mark - stream flow station	10.6C	12C	--	Clear / None	Clear		

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1 ppm (9/21/71)	--	5.5 ppm due to $CaCO_3$	Good water quality.

Spawning Area

Overall Stream Bottom Composition: Cobble/boulder/bedrock channel.

Gravel Compaction: Angular gravel.

Spawning Area Available Above High Tide Mark (HTM): Less than 1% available spawning area above 4 ft falls at High Tide Mark (HTM), $10m^2$ total, approximately.

Intertidal Spawning Area: $56m^2$ at the most (14m wide, .2m deep average).

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Alot of deep pools.	--	--

Available Cover: --

Aquatic Invertebrates/Available Food Source: Many aquatic dipterans.

Aquatic Vegetation: Scarce

Terrestrial Vegetation: Mainly of stunted cedar and shorepine with a few alders - few shrubs.

Shading: 15% or less due to canopy and riparian vegetation.

Extent and Quality of Rearing Area: Poor and limited rearing habitat for coho; marginal to okay for steelhead.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Limited use (if any) by salmonids, pink and chum probably spawn intertidally.

Use by Fishermen: Not much subsistence or sport fishing.

Wildlife Present

None seen.

Comments and Recommendations

This creek has very limited spawning gravels and almost no available rearing (due to falls and cascades above). Lake is on a base of grandiorite, so lake tributaries probably have little good spawning gravels - not recommended for trout or salmon planting. A minor producer of salmon on Annette Island.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1973	Rainbow	Fry	6100		Lake stocked with trout by USFWS
9/21/71	Pink	Adults (4.5 lbs. average)	53		
	Chum	Adults (10 lbs. average)	59		
6/6/81	None Seen	--	--		--

Survey(s) and Dates Conducted

C. Huntington, J. Yuska, E. Biggs, 6/6/81 and USFWS, 9/21/71

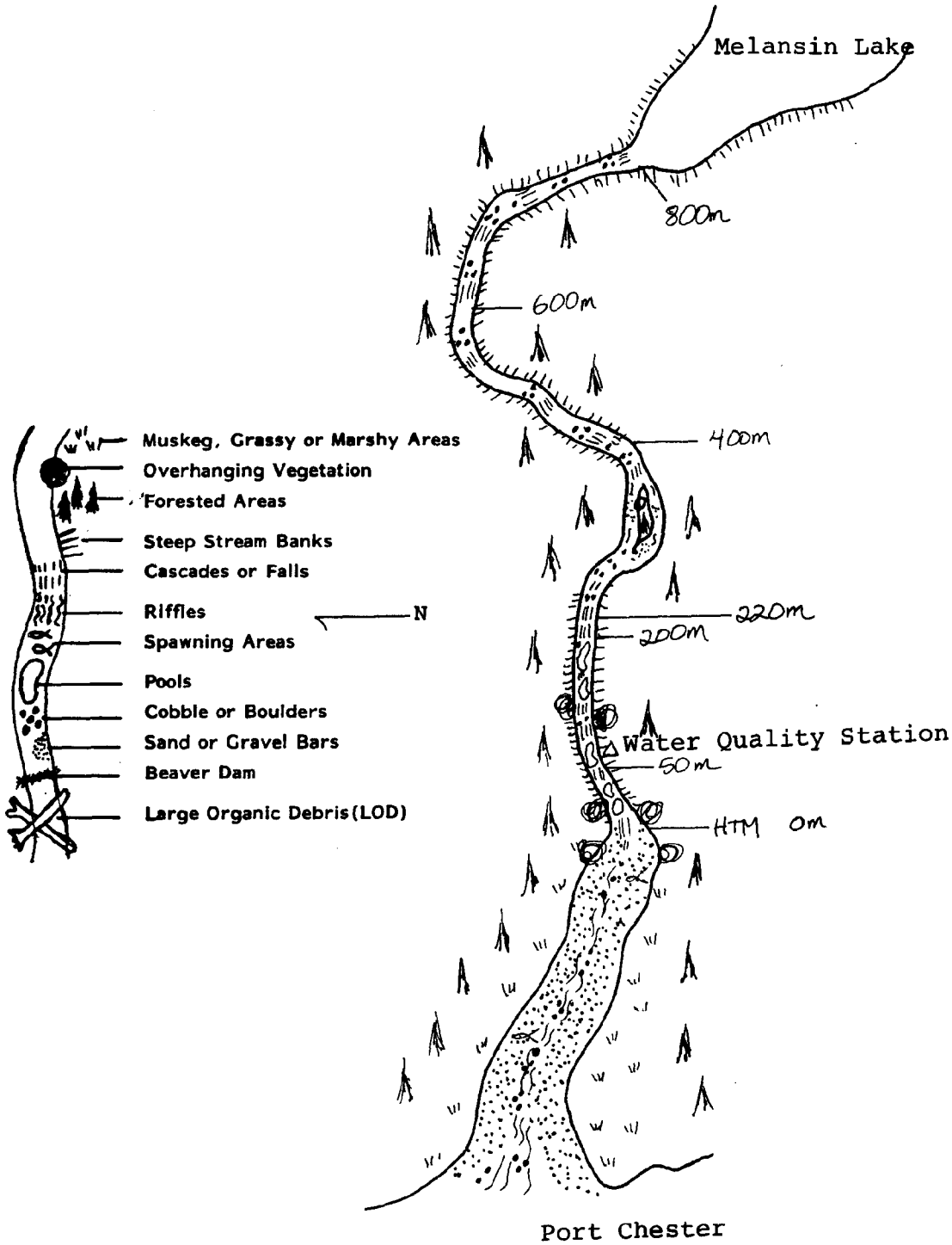
Recommended Escapement

This creek is of marginal value in production at present and only intertidal area is available and usable. At the most, 90 pink and 6 chum spawning pairs could utilize the area present.

Potential Production Summary

The gravel quality is poor, so a 1.2% egg-fry survival rate is assumed. Potentially, only 32 pinks and 4 chum would be expected to return as a result of production here.

Figure 15. MELANSIN CREEK



Not In Scale

MELANSIN CREEK

Watershed No. 104-01
Stat. No. 101-28-014

Intertidal Area to 0m

Gravels interspaced with cobble and boulders; less than 2% spawning area.

0m	High Tide Mark (HTM) 2m high stepped falls.
0-50m	Bottom mainly large cobble to small boulders with 5% spawning gravels. Streamflow gaging station at 50m.
50-220m	Bedrock/boulder cascades, no spawning area. 25 ft barrier falls at 200m.
220-400m	Low gradient area with one side channel; 5% spawning gravels.
400-800m	Mostly bedrock and boulder; too difficult for fry passage; Melansin Lake at 800m.

Spawning Area: Limited

Approximately $50m^2$ is available.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Chester Creek	--	104-01

Location	Origin	Watershed Type
Flows W. into Pt. Chester	Chester Lake	Steep, granite mountain slope.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
7/9/79	base	Whole creek is a falls.	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	7/28/79 - 6.5 cfs	--	--	--

-- (Flow Continued - 8/20/79 - 5.07 cfs, 9/19/79 - 33.42 cfs)

Streambank Composition / Stability	Tributaries
	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Base of falls	--	--	--	-- --	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	-- --

Spawning Area

Bedrock

Overall Stream Bottom Composition

--

Gravel Compaction

Not applicable.

Spawning Area Available Above High Tide Mark (HTM)

Not applicable.

Intertidal Spawning Area

Rearing Area

Not applicable.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	-- --	-- --

Available Cover

--

Aquatic Invertebrates/Available Food Source

--

Aquatic Vegetation

--

Terrestrial Vegetation

--

Shading

--

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

No fishing - Used as water supply (old powerhouse at base).

Use by Fish

No fish

Use by Fishermen

Wildlife Present

--

Comments and Recommendations

Sampled for water quality only - no use by fish or fishermen.

Survey(s) and Dates Conducted: Pacific Rim Planners, Inc., 7-9/79

ANNETTE ISLANDS STREAM SURVEY SUMMARY

No Name Creek	101-28-015	102-01
Stream	Number	Geocode
Flows N. into Pt. Chester, .5 mi long.	Mountain and muskeg slopes run-off.	Mountain slopes and muskeg run-off.
Location	Origin	Watershed Type
6/21/81	300m above High Tide Mark (HTM)	Culvert at HTM, may be one. Low	--
Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
3%	-- --	-- --	-- --	-- --
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Rock colonized with vegetation.	Stable	None
Streambank Composition	/ Stability	Tributaries

Water Quality

--	--	--	--	-- --	--	--	--
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	-- --				
Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall				

Spawning Area

Predominantly cobble/rubble/boulders.
Overall Stream Bottom Composition

Angular sparse gravels.
Gravel Compaction

Little to none - rocks are too large.
Spawning Area Available Above High Tide Mark (HTM)

None
Intertidal Spawning Area

Rearing Area

Limited pools (few and very shallow).	--	--
Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range

--
Available Cover

Sparse
Aquatic Invertebrates/Available Food Source

Some mosses.
Aquatic Vegetation

Some salmonberry and skunk cabbage - timber is spruce and hemlock.
Terrestrial Vegetation

--
Shading

Limited because of lack of cover and shallow pool depth.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

None known.
Use by Fish

None known.
Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Creek probably not utilized by salmonids - no available gravels - no fish seen or expected.

Survey(s) and Dates Conducted: E. Biggs, C. Huntington, 6/21/81

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Davis Creek	101-28-016	102-02

Location	Origin	Watershed Type
Flows N into Pt. Chester, 1.5 mi long	Small lake and muskeg run-off.	Muskeg marsh and forested foothills.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/4/81	1500m above High Tide Mark (HTM)	Muskeg area at 1500m	Low flow	+1.5 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3%	2 cfs --	rapid over 1 fps --	3.6m 3-4.5m	.45m --

Streambank Composition / Stability	Tributaries
Moderately steep banks to the muskeg of bedrock and fragmented rock. /Stabilized by roots and LOD.	Two and stream splits at 1500m.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/7/71: Above culvert.	12.3C 10.0C	11.7C 10.5C	6.0 5.5	Clear	None	Amber	-- --

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1 ppm (9/7/71)	48.2 ppm (9/7/71)	--	Satisfactory - not great.

Spawning Area

Overall Stream Bottom Composition: Gravels interspaced in boulders with lots of bedrock in the channel (some bottom material is angular); there are a couple of sand bars, but fines are minimal.

Gravel Compaction: No fines or compaction, clean excellent quality gravels.

Spawning Area Available Above High Tide Mark (HTM): Definite redds found - suitable gravels are present to the 1400m mark. Approximately 700m^2 of total area exists.

Intertidal Spawning Area: None (cobble/boulder substrate mixed with some fines).

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Mainly riffles in creek - a few pools.	Shallow/ one to 1m deep	Small/ One to 7.5m diameter

Available Cover: Some available, with a few undercut banks and slack water areas, some LOD in the channel and root tangles.

Aquatic Invertebrates/Available Food Source: Sparse - a few trichoptera, ephemeroptera and diptera (sparse probably because of low Ph).

Aquatic Vegetation: Some filametous algae growth, alot of mosses present.

Terrestrial Vegetation: Thick and tight riparian vegetation to muskeg areas made up mainly of skunk cabbage, salal, salmonberry and alder; timber is spruce, cedar and hemlock.

Shading: Intense - 90% mainly due to riparian vegetation.

Extent and Quality of Rearing Area: There is a moderate amount of coho rearing area, but low Ph and low abundance of insects are probably limiting factors to production. Much rearing area is physically good for steelhead.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Chum, coho and pinks use the creek.

Use by Fishermen: Subsistence fishing and egg take for hatchery (Fall, 1980).

Wildlife Present

--

Comments and Recommendations

Many pink and chum use this creek along with coho; so subsistence fishing should be regulated and controlled; a gravel pile under the culvert may help fish get through it (there is a 3 ft drop at HTM). Water quality and food abundance may be limiting factors to production.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/7/71	Coho	Fry (55mm)	30	--	
9/1/71	Pink	Adult	30	--	
9/15/71	Pink	Adult	--	30	These were found speared - not natural mortality.
9/20/71	Pink	Adult	--	32	Found ½ mile up the creek.
1972	Pink	Adult	270	--	USFWS Escapement Estimate
1973	Pink	Adult	100	--	USFWS Escapement Estimate
1974	Pink	Adult	712	--	USFWS Escapement Estimate
1975	Pink	Adult	750	--	USFWS Escapement Estimate
1076	Pink	Adult	1165	--	USFWS Escapement Estimate
9/1/81	Pink	Adult	60	--	Aerial count - fish ball seen at creek mouth.

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/4/81, and USFWS, 9/7/71

Recommended Escapement

Recommended escapements according to available spawning area are 600 pinks, 40 chum and 10 coho (according to rearing area) spawning pairs.

Potential Production Summary

With good-excellent quality gravels, a 10% egg-fry survival rate is assumed. Give the above escapements, production potential is 1780 pinks, 200 chum and 56 coho returning to Annette Island.

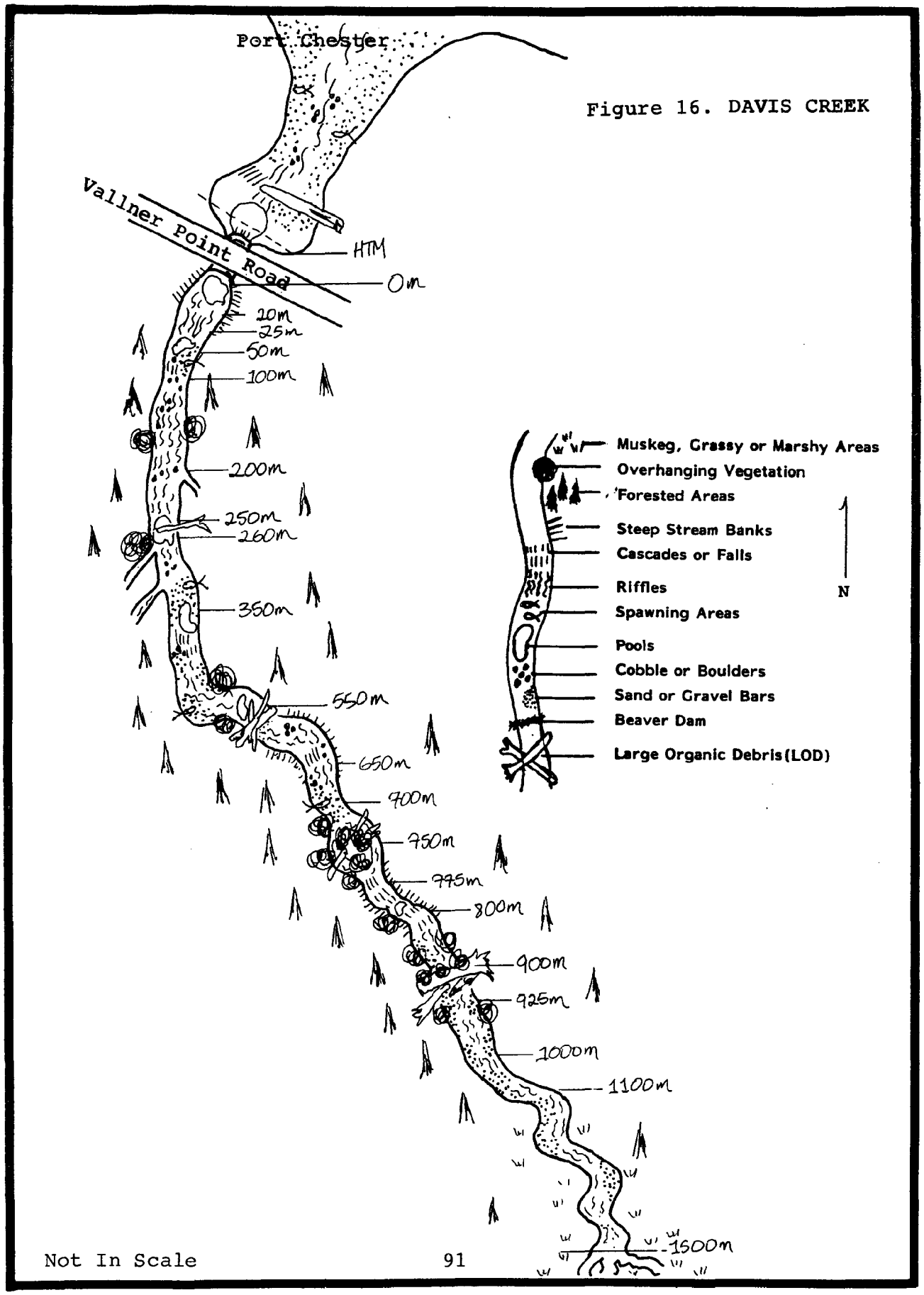


Figure 16. DAVIS CREEK

Not In Scale

DAVIS CREEK

Watershed No. 102-02
Stat. No. 101-28-016

Intertidal Area (Below Road Culvert)

Mainly cobble and boulder and gravels with fine sediment mixed in.

0m	Upstream side of road culvert, High Tide Mark (HTM).
0-100m	$120m^2$ spawning area just above the culvert, then an .08m deep spawning riffle at 25m. At 50m is a pool .8m deep with high, overhanging stream banks 6-7m long. At 100m is a long glide over bedrock.
100-200m	70% spawning area with a decrease in gradient and 50% overhead canopy shading, gravel are good size, but angular and a first order tributary enters at 200m.
200-350m	Fewer gravels, but good rearing area; at 250m is a large pool and two first order tributaries enter, one at 260m and one at 300m. At 350m, gradient increases again and 20% good spawning gravels occur at the "tailout" of a plunge pool.
350-550m	Most gravels too large for spawning; alot of LOD and debris jam potential.
650m	Very little spawning area available.
700m	25m section with spawning gravels. Average Stream Width (ASW) = 1-1.5m.
750m	Island
775m	Scores of steep cascades with large angular boulders.
800m	Series of falls (steep), blockage to pinks with a 2 cfs flow.
900m	1 diameter live cedar log across creek.
925m	Gradient drops and 25% available spawning area occurs; moss and filamentous algae are present.
1000m	Gradient low, gravels are small with alot of fines; ASW = 1m, Average Stream Depth (ASD) = .35m, alot of aquatic moss and algae occur.
1100m	Above here, channel narrows considerably with a U-shaped cross section and fine sediment bottom (no spawning area).
1500m	Stream breaks into muskeg.

Spawning Area:	0-100m	$225m^2$	
	100-200m	100m	
	350m	20m	
	350-1400	350m	- approximately
	Total	$700m^2$	approximately

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Sawmill Creek	101-28-017	102-03

Location	Origin	Watershed Type
Flows N into Pt. Chester, .25 mi. long, near L.P. Mill	Skater Lake - run-off from trailor court area	Muskeg and developed land, 10 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	Entire length - to Skaters Lake	Possibly at second culvert.	Low flow	+1.5 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Low - 3%	-- --	1 fps / to slow	1.2m --	.1 --

Streambank Composition / Stability	Tributaries
Soils stabilized by roots and heavy vegetation - LOD may add organic load to creek./ Stabilized by vegetation.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/9/72:	15.0C	13.3C	6.8				
Above second culvert.	12.2C	14.0C	5.0	Cloudy/ Some	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (6/9/72)	12.0ppm (6/9/72)	9.1ppm-$CaCo_3$ (6/9/72)	Pollution problems- sewage and industrial sources. Resistivity = 461,698 ohms/cm^3

Spawning Area

Overall Stream Bottom Composition: Mud and silt in gravel and rubble - some sand; much of bottom is mucky with high amount of organic matter.

Gravel Compaction: Siltation of gravels has occurred.

Spawning Area Available Above High Tide Mark (HTM): None- too many fines in gravel - former report (in 1972) states that 80% good spawning was available.

Intertidal Spawning Area: None- creek flows under lumber yard - through two culverts, culvert under Vallner Point Road could be a barrier (two foot drop).

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools in 20% of stream, riffles in 50%.	.15m --	1.2 x 3m --

Available Cover: Undercut banks, some LOD and Skater's Lake.

Aquatic Invertebrates/Available Food Source: Sparse - a few Odonata and ephemeroptera.

Aquatic Vegetation: Scarce - primarily composed of microforms.

Terrestrial Vegetation: Heavy shrubs and alder and near lake is tall grasses and shrubs.

Shading: 90-100% to trailors (due to heavy riparian vegetation); 30% past trailor court to lake.

Extent and Quality of Rearing Area: Rearing area is okay - moderate amount of area available, as long as pollution does not interfere with the physiology.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Creek not utilized by salmonids any more (may have been coho at one time). Pinks and chum used to use creek

Use by Fishermen: No fishing.

Wildlife Present

--

Comments and Recommendations

Pollution problems and siltation seems to have destroyed the production potential of the creek. An updated, full water quality test (BOD, COD, pH, coliform counts, etc) should be conducted. Siltation problem may be hard to deal with because of road run-off and sewage seepage; it may help to reduce flow impedences and make second culvert passable.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1971	Pink & Chum	Adult	Not counted		Residents reported these fish in the creek this year.
1972	Pink	Adult	100		USFWS Escapement Estimate
1973	Pink	Adult	100		USFWS Escapement Estimate

Survey(s) and Dates Conducted

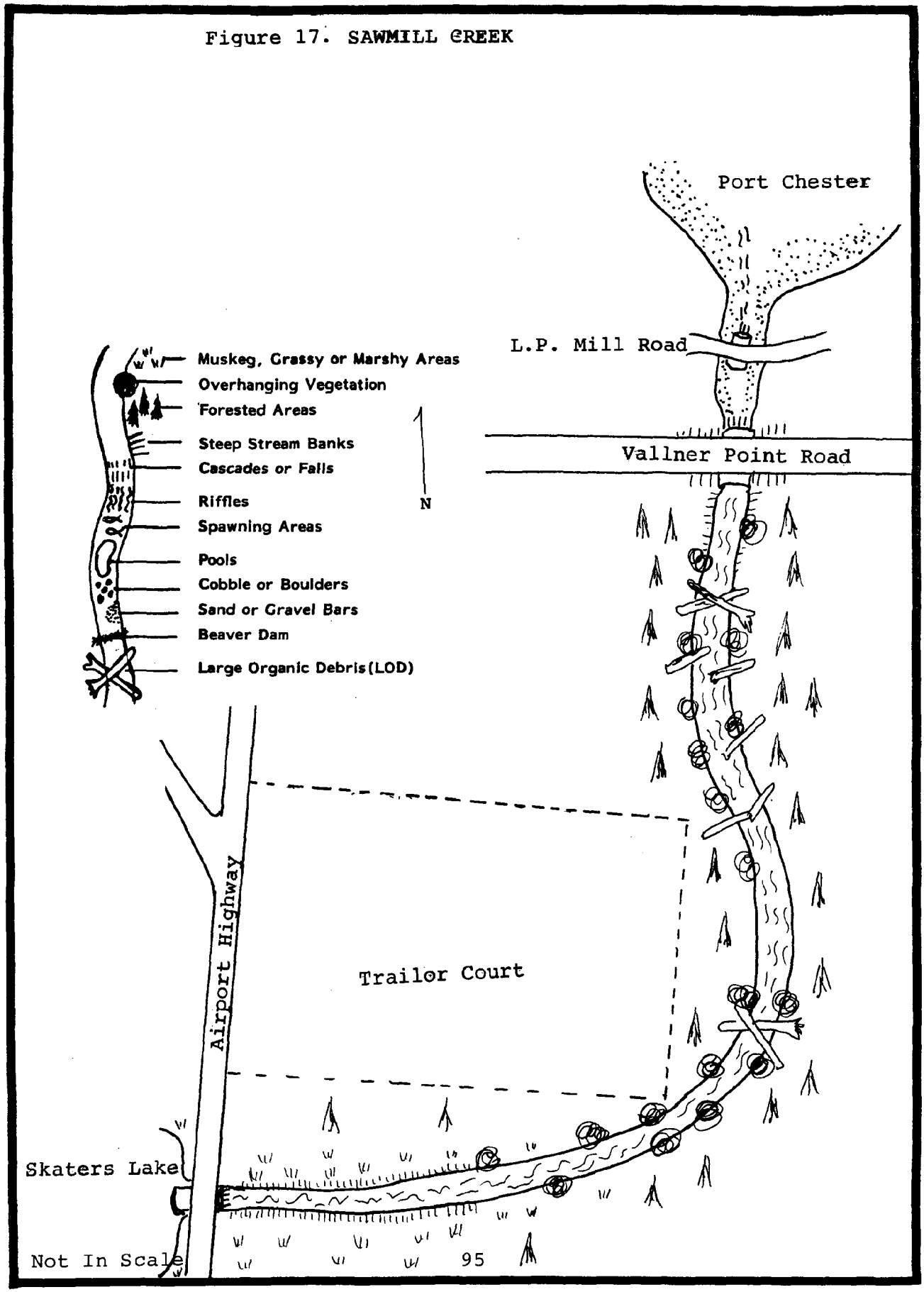
E. Biggs, C. Huntingtom, 6/21/81 and USFWS, 6/9/72

Recommended Escapement

No recommended escapements should be made until this creek is rehabilitated.

Potential Production Summary

Figure 17. SAWMILL CREEK



SAWMILL CREEK

Watershed No. 102-03
Stat. No. 101-28-017

Sawmill Road

Stream flows through passable culvert over intertidal largely consisting of sand and small gravel and debis from the lumber mill.

Vallner Point Road

High Tide Mark (HTM) below culvert, stream drops 2 ft from culvert; hard for fish to maneuver.

To Skaters Lake

Creek flows through well-defined channel with alot of LOD; however, bottom has alot of fine sediment, muck and generally not suited for use by salmonids.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Graveyard Creek — Stream
101-28-018 — Number
101-01 — Geocode

Flows NW into Nichols Passage, about 1.0m long. — Location
Small muskeg lakes and run-off. — Origin
Muskeg marshes and timbered, gently rolling hills $1mi^2$ area — Watershed Type

6/6/81 — Date Surveyed
650m up to end of spawning areas. — Section Surveyed
None — Barriers
Low flow — Stage
+1.5 ft — Flood Height

1.5% - gentle — Ave. Gradient
1.5 cfs / to 11 cfs — Flow / Range
(9/7/71) 2fps/moderate-swift — Ave. Velocity/Range
2.0m / to 6m — Ave. Width/Range
-- -- — Ave. Depth/Range

Mud and rock stabilized by root wads and vegetation - alot of LOD and "drowned logs". — Streambank Composition / Stability
None - stream forks at 610m — Tributaries

Water Quality

9/7/71:	12.2C	11.1C	5.5	Clear /	None	Amber	
10m	10.6C	9.5C	5.5	Clear /	None	Amber	-- --
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity		Color	D.O. CO_2

17.1ppm (9/7/71) — Total Alkalinity
34.2ppm (9/7/71) — Total Hardness
28.44ppm (9/7/71) — Dissolved Solids
Okay - siltation is a problem in areas. — Other/Overall

Spawning Area

Mainly small gravels, pebbles, sand and some silt and organic matter - larger rock occurs above second culvert. — Overall Stream Bottom Composition
Some with fines mixed in gravels. — Gravel Compaction

Redds found - 2.5% spawning area overall in creek of fair quality spawning gravels; $45m^2$ total area available. — Spawning Area Available Above High Tide Mark (HTM)

None - creek flows over sand/rubble beach. — Intertidal Spawning Area

Rearing Area

Pools are numerous throughout creek, (some organic debris in pools), 6:1 ratio. — Pool/Riffle Frequency (P:R Ratio)
.25m / to .6m — Ave. Pool Depth/Range
2.5 x 3.5m / -- — Ave. Pool Size/Range

Abundant cover available under overhanging vegetation, intense shading, alot of root wads, undercut banks and heavy amount of LOD (with pool formations). — Available Cover

Sparse - some diptera and trichoptera - but more here than in other muskeg creeks on Island. — Aquatic Invertebrates/Available Food Source

Sparse. — Aquatic Vegetation

Extremely developed stream margin of salmonberry, currant, skunk cabbage, ferns and root tangles under cedar, hemlock, spruce and alder. — Terrestrial Vegetation

90% intense shading up to 100% in areas - due to heavy riparian vegetation and canopy. — Shading

Excellent coho rearing areas throughout creek in undercut banks, LOD, deep pools and backwater areas, under root wads - many fry observed. — Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho, and cutthroat utilize creek. — Use by Fish

Reported heavy subsistence fishing in the fall (but no known sport fishing). — Use by Fishermen

Wildlife Present

Beaver, mink, and land otter observed in previous years.

Comments and Recommendations

This creek, because of the limited spawning area, but extensive rearing area, is significant in production of coho versus pinks and chum (although they utilize the creek). Manage and protect as an important nursery area and especially restrict fishing during escapement of coho (looks like there may be underescapement problem). No habitat improvements are recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/17/71	Pink	Adults	4	1	
	Coho	Adults	1	--	
	Chum	Adults	3	--	
9/14/71	Pinks	Adults	23	3	Found from mouth to 90m up.
9/15/71	Pinks	Adults	11	1	Found from mouth to 24m up.
9/20/71	Pinks	Adults	0	9	Found from mouth to 90m up.
10/12/71	Pinks	Adults	21	28	Found from mouth to 90m up.
1972	Pinks	Adults	125	--	USFWS Escapement Estimate
1973	Pinks	Adults	551	--	USFWS Escapement Estimate
1974	Pinks	Adults	574	--	USFWS Escapement Estimate
1975	Pinks	Adults	769	--	USFWS Escapement Estimate
1976	Pinks	Adults	626	--	USFWS Escapement Estimate
6/6/81	Coho	Fry	200	--	More seen, but uncounted.
	Cutthroat	Fry (0+ age)	About 50	--	
9/1/81	Pinks (mixed)	Adults	100	--	Fished balled up at mouth - aerial survey.

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/6/81 and USFWS, 9/7/81

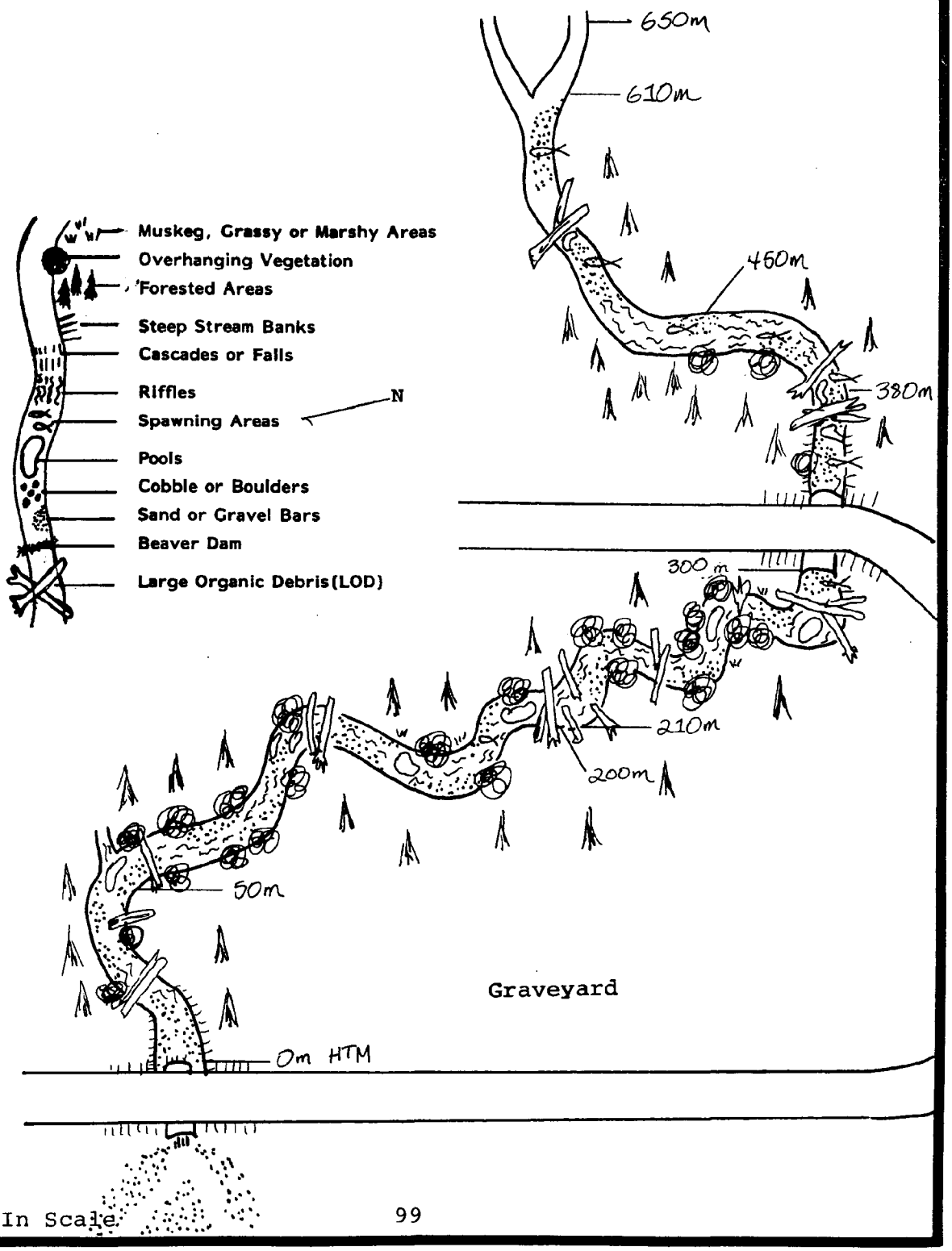
Recommended Escapement

Limited spawning area is available, only 75 pinks, 5 chum and 4 coho spawning pairs are needed to utilize all the available area.

Potential Production Summary

Gravel quality is fair, a 10% egg-fry survival rate is assumed. 223 pinks, 25 chum and 23 coho could return to Annette Island assuming the above escapement rates occurred.

Figure 18. GRAVEYARD CREEK



Not In Scale

GRAVEYARD CREEK

Watershed No. 101-01
Stat. No. 101-28-018

Intertidal	Creek flows over sand and pebble beach, no spawning area.
0m	High Tide Mark (HTM) at passable road culvert.
0-50m	Average Stream Width (ASW) = 2m with alot of sand bars and LOD; spring seepage at 50m.
50-200m	Alot of deep, undercut banks with excellent cover, steep banks and choked with woody debris; excellent rearing habitat and many coho fry observed.
200-300m	LOD, undercut banks, and cover continues, and size of gravel increases. At 210m, spring seepage occurs and at 300m, 5% gravels occur (although they are angular); second road culvert here.
300-380m	ASW = 1.75m, Average Stream Depth (ASD) = .15m, bottom is mainly mossy cobble and small boulders with 5% spawning area, many pools occur; amount of overhanging shrubs decrease, canopy mainly of trees.
380-450m	Crumbly rock banks that are a good source of gravel and fine sand; more mature trees occur here.
450-650m	Same as above, still only 5% gravels. Stream forks at 610m, north fork is 1m wide, .1m deep with fine gravels too small for spawning and south fork is also poor spawning area; mainly muskeg "land bridges" (creek flows under vegetation). Survey ended at 650m - creek flows into muskeg.

Spawning Area: Limited

Approximately $45m^2$ available spawning area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Far North Smuggler Creek	101-28-020	101-02
Stream	Number	Geocode
Flows S into Smuggler Cove, about .5 mi. long.	Muskeg and small lake drainings.	Muskeg and timbered flats.
Location	Origin	Watershed Type
450m above High Tide Mark (HTM)	Possibly log jam at HTM and muskeg areas at 250m.	--
6/15/81	Moderate Flow	
Date Surveyed	Barriers	Stage

Section Surveyed	Flood Height
.35cfs / --	.15m / --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Low - about 1-3%	.35cfs / --	Slow - .5 fps/ --	1.5m / --	.15m / --

Banks high in places - muskeg and rocks with root tangles. / Stable - extensive LOD influence on channel. None

Streambank Composition / Stability Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
10m above HTM	10.6C	10.0C	--	Clear / None	Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Strong muskeg influence.

Spawning Area

10% silt, 15% sand, 30% pebble, 40% gravels (less than or equal to 2cm in diameter).

Overall Stream Bottom Composition

Moderate - most gravel too fine for salmon.

Gravel Compaction

3% available spawning area - about $20m^2$ area, but gravels are marginal, too many fines mixed in.

Spawning Area Available Above High Tide Mark (HTM)

Limited - less than $10m^2$ area available.

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
p:r = 4:1	-- --	-- --

Lots of LOD, slash, undercuts and root wads - extensive cover.

Available Cover

Sparse

Aquatic Invertebrates/Available Food Source

Sparse.

Aquatic Vegetation

Stunted trees and muskeg vegetation.

Terrestrial Vegetation

50% banks and riparian vegetation.

Shading

Good coho rearing area - limited by small size of creek.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Probably only pinks and trout could use gravel.

Use by Fish

No fishing or hunting activity - known.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Creek of minor importance in production (limited) - most gravels are too fine for use by salmon. An old shack was found at 25m and a trash collector dam at 100m; log jam at mouth may act as a barrier during low flows.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/15/71	Unidentified Salmonid	Fry	1		At 200m above creek mouth.

Survey(s) and Dates Conducted

C. Huntington, 6/15/81

Recommended Escapement

Due to the small gravel size, only pinks would be expected to utilize this creek and due to the limited spawning area, the escapement recommendation is only 50 pink spawning pairs.

Potential Production Summary

Due to the marginal gravel quality, a 1.2% egg-fry survival rate is assumed with a production potential of 18 pinks returning to Annette Island.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
North Smuggler Creek	101-28-021	101-03

Location	Origin	Watershed Type
Flows SW into Suggler Cove, about 1 mi long.	Drains small lake NW of Yellow Hill Lake and muskeg run-off.	Muskeg and timbered flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81	1400m above High Tide Mark (HTM)	Possibly by beach log jam.	Low to moderate.	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5% upper end, 3% upper reach	1.25 cfs / --	1 fps / --	1.5m / --	.15m / --

Streambank Composition / Stability	Tributaries
Fragmented rock, root tangles and some organic matter. / Fairly stable, but creek channel moves a bit at high flow - moderate LOD influence.	One - consisting of 35% of total flow.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	10.6C	12.0C	--	Clear/ None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Muskeg water

Spawning Area

Overall Stream Bottom Composition: 5% silt, 15% sand, 10% pebble, 35% gravel, 15% rubble, 5% boulder and a trace amount of bedrock.

Gravel Compaction: Not bad - some fines.

Spawning Area Available Above High Tide Mark (HTM): Some gravels are packed in behind LOD - $300m^2$ total area available; $275m^2$ occurs in first 600m, $25m^2$ occurs in 1000-1400m of creek.

Intertidal Spawning Area: Limited to approximatley $10m^2$.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
p:r = 1:1 - riffles occur at higher flow.	-- --	-- --

Moderate LOD influence creating some pools and overhanging root wads.

Available Cover: Sparse - some ephemeroptera, trichoptera, and diptera.

Aquatic Invertebrates/Available Food Source: Heavy filamentous algae in small pools.

Aquatic Vegetation: Alot of currant, salmonberry and ferns under a hemlock, cedar and spruce canopy.

Terrestrial Vegetation: 95% due to a heavy riparian understory, canopy and some topography (banks).

Shading: A fair amount is available in the summer (for coho); however, in the winter, most of creek is probably riffles, runs and swift water.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Coho, pink, chums and cutthroat trout probably utilize creek.

Use by Fishermen: No fishing or hunting known.

Wildlife Present

None seen.

Comments and Recommendations

Beach log jam at mouth is passable at high tide and high flow, otherwise, it is a barrier. This is a pretty good coho creek, but does not produce large numbers; due to fair amount of spawning area in lower reach, this creek probably produces alot of pink and chum.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/15/81	Coho	Fry	a few		
	Cutthroat	Adults (8 inch & 7 inch)	2		

Survey(s) and Dates Conducted

C. Huntington, 6/15/81

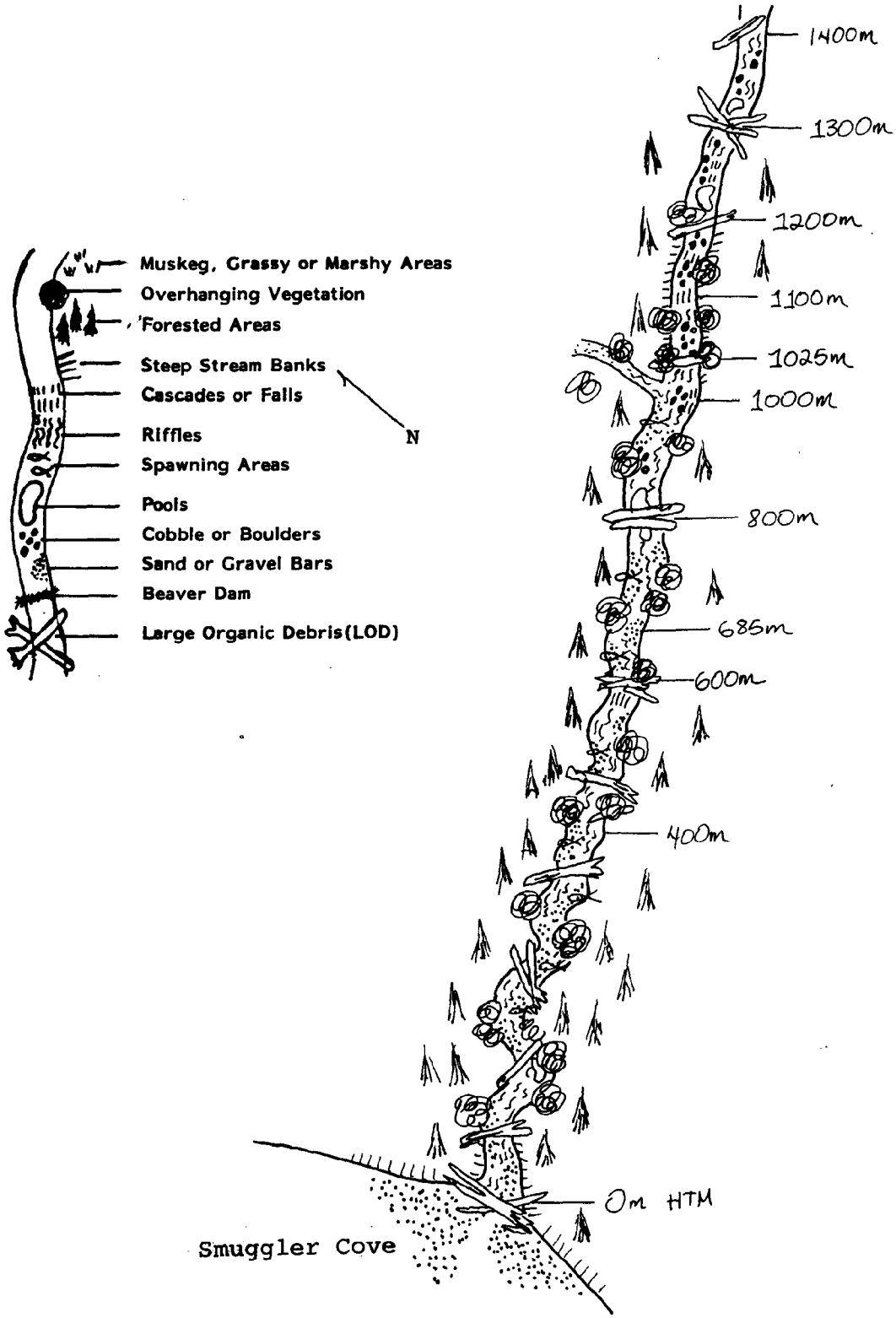
Recommended Escapement

A moderate amount of spawning area is available, and rearing area, so recommended escapements are 520 pinks, 34 chum, and 4 coho spawning pairs.

Potential Production Summary

Production potential, assuming a 10% egg-fry survival rate, is 1544 pinks, 170 chum and 23 coho returning to Annette Island.

Figure 19. NORTH SMUGGLER CREEK



Not In Scale

NORTH SMUGGLER CREEK

Watershed No. 101-03
Stat. No. 101-28-021

0m	High Tide Mark (HTM), beach log jam.
0-400m	Good spawning and rearing habitat, low gradient LOD and overhanging cover.
600m	.5m high passable debris jam with old redd just above it.
685m	Another old redd observed.
800m	Log fall in creek; coho fry and adult trout here; heavy algae growth occurs in side pools.
1000m	Amount of rubble and boulder in channel increases here. Tributary making up 35% of the total stream flow enters here.
1025m	Passable debris jam with coho fry below it.
1100m	Passable bedrock chute.
1200m	Passable slash and debris jam.
1300m	LOD pile.
1400m	Good rearing area continues (from 0m) but spawning area is patchy. End of survey.

Spawning Area:

Intertidal	Limited to about $10m^2$		
Above HTM	0-1000m	$275m^2$	(mostly below 600m)
	1000-1400m	25m	
	Total	$300m^2$	

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Yellow Hill Lake Creek	101-28-022	101-04

Location: Flow SW into Smuggler Lake, about .5 mi long.

Origin: Yellow Hill Lake and muskeg run-off.

Watershed Type: Muskeg and timbered flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81	(Entire section) 850m to culvert in airport road	Probable cascade barrier at 250m.	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Moderate	1 cfs / --	moderately swift - 1-2 fps	1.5m / to 3m	.10m / to .2m

Streambank Composition / Stability: Banks steep in areas (up to 10m) - mainly of bedrock./ Stabilized by bedrock and vegetation, some LOD influence in lower reach.

Tributaries: None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	--	--	7.5 (5/11/72)	Clear/None	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Better than other creeks in this area because it drains a large lake.

Spawning Area

Overall Stream Bottom Composition: 95% boulders and cobble, 5% gravels with some fines in the lower section.

Gravel Compaction: --

Spawning Area Available Above High Tide Mark (HTM): Less than $10m^2$ area - bottom is mostly cobble and boulder, too large to use.

Intertidal Spawning Area: None - intertidal channel is indiscernable.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools - mainly riffles and runs.	-- --	-- --

Available Cover: Limited - mainly occurs in braided channel in lower reach.

Aquatic Invertebrates/Available Food Source: Abundant - mayflies, caddisflies and diptera observed.

Aquatic Vegetation: Scarce

Terrestrial Vegetation: Mainly of muskeg and stunted timber - scarse.

Shading: 60% in lower section, 30% due to banks, 30% due to brush; 30% shading near lake.

Extent and Quality of Rearing Area: Limited - velocity is too high and creek is too steep in many areas; however, some is available in the braided channels.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Trout only use creek.

Use by Fishermen: No known fishing activity.

Wildlife Present

None seen.

Comments and Recommendations

Not a salmon stream - manage for cutthroat only; USFWS recommended stocking with rainbow - in 1973, they did stock.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
5/11/72	Cutthroat	Adult and Fry	A few	--	
1973	Rainbow	Fry	1000	--	Stocked in Yellow Hill Lake
6/15/81	Cutthroat	Fry	Several	--	

Survey(s) and Dates Conducted

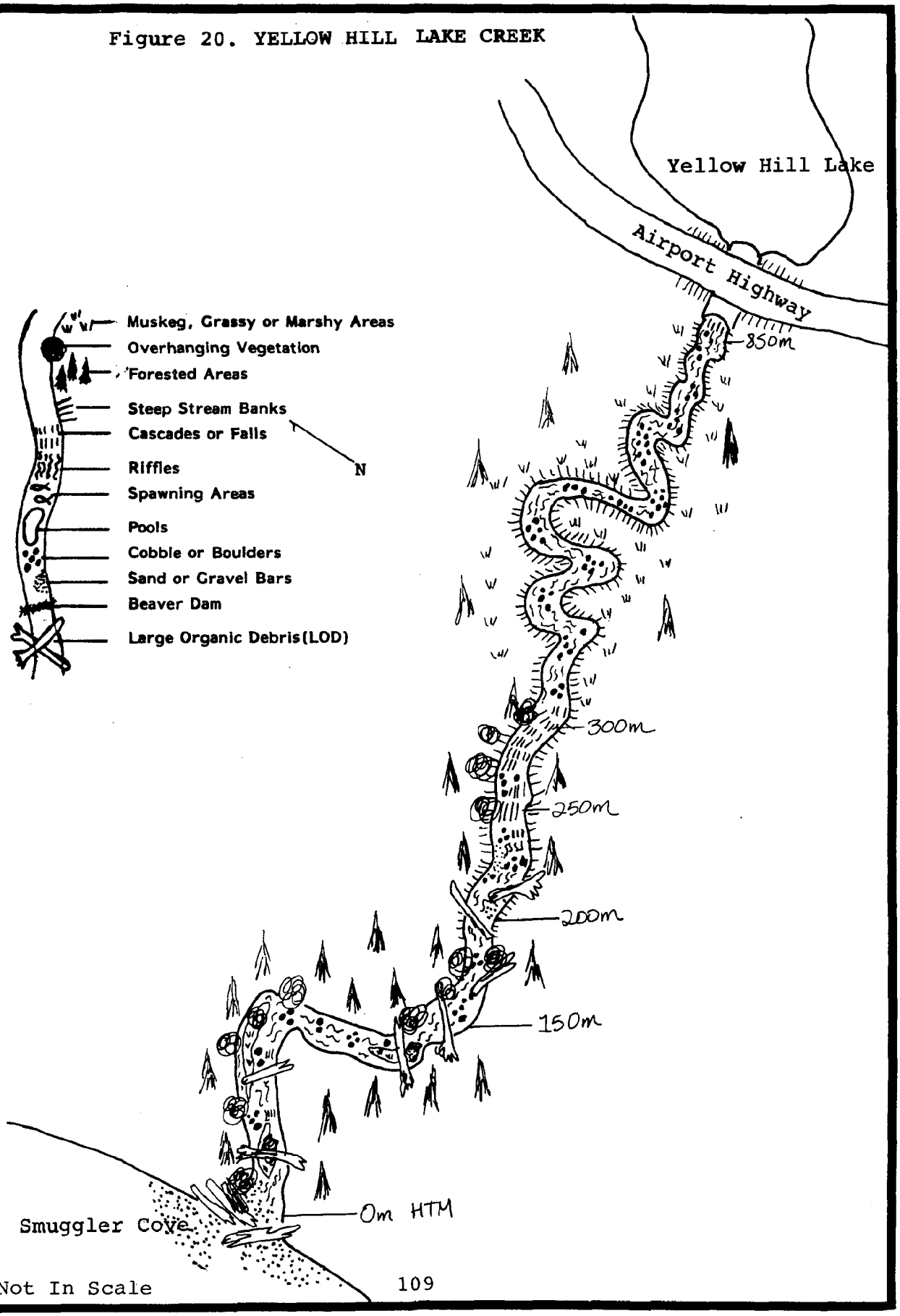
C. Huntington and J. Yuska, 6/15/81 and USFWS, 5/11/72

Recommended Escapement

No salmon production is expected, however, trout utilize this creek.

Potential Production Summary

Figure 20. YELLOW HILL LAKE CREEK



Not In Scale

YELLOW HILL LAKE CREEK

Watershed No. 101-04
Stat. No. 101-28-022

0m	High Tide Mark (HTM), no intertidal gravels.
0-150m	Average Stream Width (ASW) = 3m, stream braids with large cobble substrate (no gravel), some LOD in channel.
200-250m	Bottom composition: 30% cobble, 60% boulders, 5% gravels, 5% fines. Stream has good cover and LOD, 60% shading, but moderate gradient (too steep for coho fry). ASW = 1.75m, Average Stream Depth (ASD) = .06m, at 250m, is an 8m cascade and probably barrier.
300-850m	Creek meanders through muskeg, ASW = 1.0m, ASD = .08m, gradient is low to moderate and shading is 30% (20% by stream banks and 10% by vegetation). Bottom composition: 60% large cobble, 35% boulders, and less than 5% gravel. Cutthroat fry were observed in this stretch. Fish passage may be blocked by partially plugged road culvert at 850m.

Spawning Area: Limited, less than $10m^2$ total area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Smuggler Creek III	101-28-024	101-05

Location	Origin	Watershed Type
Flows W into Smuggler Cove, .3 mi long	Drains eutrophied lake and muskeg run-off.	Muskeg area and timbered flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81	450m above High Tide Mark, (HTM)	At 450m, creek runs into muskeg.	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1-1.59. - moderate	.5 cfs / --	1 fps / --	1m / .5-1.25m	.18m / .1-.35m

Streambank Composition	/ Stability	Tributaries
Rock and mud with muskeg vegetation (some bedrock banks and LOD defined channels - steep in areas)	/ Stable	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	16C	14C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Muskeg water - some LOD influence in lower areas.

Spawning Area

Overall Stream Bottom Composition

Lower stretch: 5% gravels, 35% cobble, 60% rubble. Above 300m: less than 5% gravels, all muck and fines.

Gravel Compaction

Some fines mixed in gravels.

Spawning Area Available Above High Tide Mark(HTM)

Onely 18.75m^2 (limited areas) in the 0-300m stretch, above 300m, the gradient is low and the creek runs through overhanging muskeg vegetation.

Intertidal Spawning Area

None - creek channel is indiscernable and creek mouth is choked with LOD and debris.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools.	-- --	-- --

Available Cover

Some under LOD, overhanging vegetation and undercut banks.

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

None seen.

Terrestrial Vegetation

Muskeg vegetation and stunted timber.

Shading

Some

Extent and Quality of Rearing Area

Limited

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

No known use by fish.

Use by Fishermen

No known use by fishermen.

Wildlife Present

--

Comments and Recommendations

1m wide log at mouth may be a barrier except at extremely high tides and high flow flows. A minor creek used probably only by pinks if used at all.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments

No salmonids seen and no evidence of redds.

Survey(s) and Dates Conducted

J. Yuska, 6/15/81

Recommended Escapement

Due to the creek and gravel sizes, probably only pinks utilize this creek and recommended escapement is 32 pink spawning pairs.

Potential Production Summary

Due to poor gravel quality, 1.2% egg-fry survival rate assumed, production potential is only estimated at 11 pinks.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Smuggler Creek II	101-28-025	101-06

Location	Origin	Watershed Type
Flows W into Smuggler Cove, 300m long	Muskeg run-off	Forested muskeg flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81	300m - entire creek from High Tide Mark (HTM)	15 300m it runs into muskeg. Low	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	.25 cfs / --	-- --	1m / --	.1m / --

Streambank Composition	/ Stability	Tributaries
Steep - mud and rock banks with vegetation.	/ Stable	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
None taken	--	--	--	-- --	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Muskeg water

Spawning Area

Overall Stream Bottom Composition

10% spawning gravel in a 50m stretch, otherwise, creek bottom is all fines (muskeg muck and silt) and some bedrock.

Gravel Compaction

Moderate with fines.

Spawning Area Available Above High Tide Mark (HTM)

At most $3m^2$ available - minor production if any.

Intertidal Spawning Area

None - mouth choked with LOD.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)

Few pools

Ave. Pool Depth/Range

-- --

Ave. Pool Size/Range

-- --

Available Cover

Some composed of LOD, muskeg land bridges and some off channel areas.

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Some moss and algae.

Terrestrial Vegetation

Moss, salmonberry, currant, azalea, cedar, hemlock and shorepines.

Shading

Over 75% due to stream bank vegetation and canopy.

Extent and Quality of Rearing Area

Limited - there is some good cover, but the creek is very small.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

No known use by fish.

Use by Fishermen

No known use by fishermen.

Wildlife Present

None seen.

Comments and Recommendations

There is a possible barrier at 120m from the mouth at a 2m falls; also at a bedrock cascade at 100m.

In addition, LOD and debris blockage at mouth acts as a barrier except at high tides and high flow. Pinks only, would probably use this creek, although production is probably minor.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments

Survey(s) and Dates Conducted

J. Yuska, 6/15/81

Recommended Escapement

None are made due to the limited creek and spawning area size.

Potential Production Summary

Some may occur, but is not included in the total estimate at this time.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Smuggler Creek I	101-28-026	101-07

Flows W into Smuggler Cove, .4 mi long — Smuggler Lake — Forested muskeg flats.

Location	Origin	Watershed Type
Entire length - 675m High Tide Mark (HTM) to Lake	None	

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81		(6/9/72)	Low	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3%	.65cfs / to 1.4 cfs	(6/9/72) 1 fps/to .5 cfs	1.25m / --	.1m / to .25m

Streambank Composition / Stability: Mud, rock and sand with muskeg vegetation and root tangles - some LOD created channels. / Stable except at mouth where erosion has occurred.

Tributaries: Two - no forks.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/9/72:	17.8C	13.9C	6.0	Clear / Slight			
25m Above HTM	10.6C	13.5C	--	Clear / None	Brown	--	--

Trace (6/9/72) 10.0ppm (6/9/72) 8.63ppm $CaCO_3$ (6/9/72) Resistivity = 4716 ohms/cm^3 (6/9/72)

Total Alkalinity | Total Hardness | Dissolved Solids | Other/Overall

Spawning Area

Trace rubble, trace cobble, 40% gravel, 25% pebbles, 25% sand, 10% silt and muck.

Overall Stream Bottom Composition

Some fines mixed in gravels.

Gravel Compaction

$325m^2$ available mainly on gravel bars - 5 old redds observed.

Spawning Area Available Above High Tide Mark (HTM)

None - indistinct channel clogged with LOD.

Intertidal Spawning Area

Rearing Area As flow increases, more riffle occurs, p:r = 1:2 pools occur at bends and behind beaver dams.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.15m / to .55m	One is 1.8 x 7.5m in area/--

Undercut banks, LOD and pools provide alot of cover.

Available Cover

Abundant - ephemeroptera, diptera, and trichoptera observed.

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Much of riparian vegetation is just thick forest understory of alders, berries, some muskeg plants, spruce and hemlock.

Terrestrial Vegetation

98% (70% from thick and tight riparian vegetation, the rest is from canopy and topography).

Shading

Extensive rearing area is available in LOD, pools, beaver ponds and in lake.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pinks, coho are known to use creek, chum may use it also.

Use by Fish

Some subsistence fishing occurs.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Stream is probably inaccessible to fish except during periods of high flow, because of a sand/silt and LOD bar at the mouth (creek seeps through it). Gravel not too good for anything but Pinks, but coho obviously use creek - although their production is probably limited because of the small gravels.

Escapement counts are recommended, and fishing regulations also, if the creek proves to be underescaped.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/9/72	Coho	Fry	A few		Observed in lake (not counted).
	Pink	Adults			Not counted
6/15/81	Coho	Fry	Numerous		

Survey(s) and Dates Conducted

C. Huntington, 6/15/81 and USFWS, 6/9/72

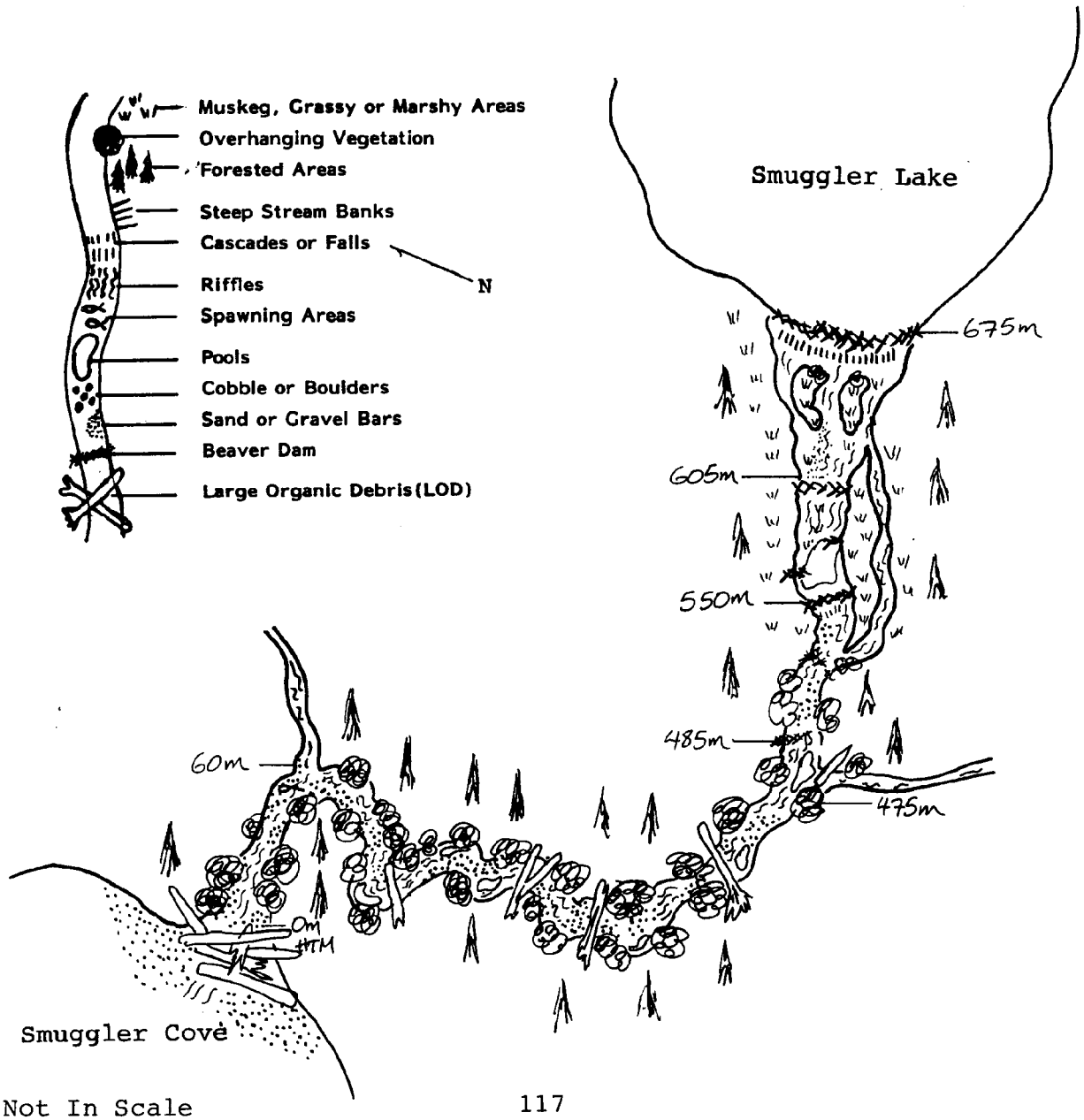
Recommended Escapement

According to the spawning area available and rearing area for coho, recommended escapements are: 540 pinks, 35 chum and 28 coho spawning pairs.

Potential Production Summary

The gravel is of poor quality, so a 1.2% egg-fry survival rate will be assumed. Potential production based on the above escapements are 200 pinks, 21 chum, and 20 coho returning to Annette Island.

Figure 21. SMUGGLER CREEK I



Not In Scale

SMUGGLER CREEK I

Watershed No. 101-07
Stat. No. 101-28-026

0m	High Tide Mark (HTM), entrance choked with logs and debris.
0-475m	Channel has alot of LOD and overhanging, thick riparian vegetation, at 60m a tributary enters in, at 475m, a tributary enters that has little good rearing area.
485-550m	Numerous washed out beaver dams, many coho fry observed here and above here, at 550m, is a 1.3m high beaver dam with 55 x 8m pond behind it.
605-675m	At 605m is a beaver dam with a 70 x 20m pond behind it, grasses occur throughout area; at 675m is Smuggler Lake.

Spawning Area: No intertidal area.

Above HTM, $325m^2$ is gravel bars.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Weather Bureau Creek	101-28-027	101-08

Flows NW into Smuggler Cove, .3 mi long — Weather Bureau Lake II — Muskeg with some forested areas.

Location	Origin	Watershed Type
375m from High Tide Mark (HTM) to Lake	Upper Beaver Dam (1.7m high) may be one.	Moderate

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/15/81		(6/12/73)		+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3%	.3 cfs /to 1 cfs (6/12/73)	1 fps / down to .5 fps	.5m / to .9m	.05m / to.1m

Soils with muskeg vegetation - channel defined by LOD in places./ Stable considering low flows.

Streambank Composition / Stability

None

Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/12/73:	12.2C	11.7C	6.0	Slightly turbid	Brown	8ppm	
25m above HTM	16.0C	12.5C	--	Clear / None	Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (6/12/73)	--	6ppm (6/12/73)	--

Spawning Area

Mud, a few gravels and some boulders and rock.

Overall Stream Bottom Composition

Some with fines mixed in gravel.

Gravel Compaction

Limited to about $15m^2$.

Spawning Area Available Above High Tide Mark (HTM)

None

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	--	--

Provided by LOD, root tangles, beaver ponds and Lake (if salmonids use it).

Available Cover

Some blackflies and mayflies.

Aquatic Invertebrates/Available Food Source

Periphyton and filamentous algae abundant on rocks.

Aquatic Vegetation

Muskeg vegetation, stunted trees mainly and heavy riparian vegetation (berries and shrubs).

Terrestrial Vegetation

95%, (60% due to overhanging vegetation and 30% due to canopy).

Shading

Fair coho habitat exists, but creek is so small, production is probably limited to low numbers.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Coho utilize and perhaps a few pinks - trout also.

Use by Fish

No fishing known.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Creek of minor importance - limited spawning area available, but it does produce a few fish.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/12/73	None observed				
6/15/81	Coho	Fry	5		In small pond near mouth.

Survey(s) and Dates Conducted

C. Huntington, 6/15/81 abd USFWS, 6/12/73

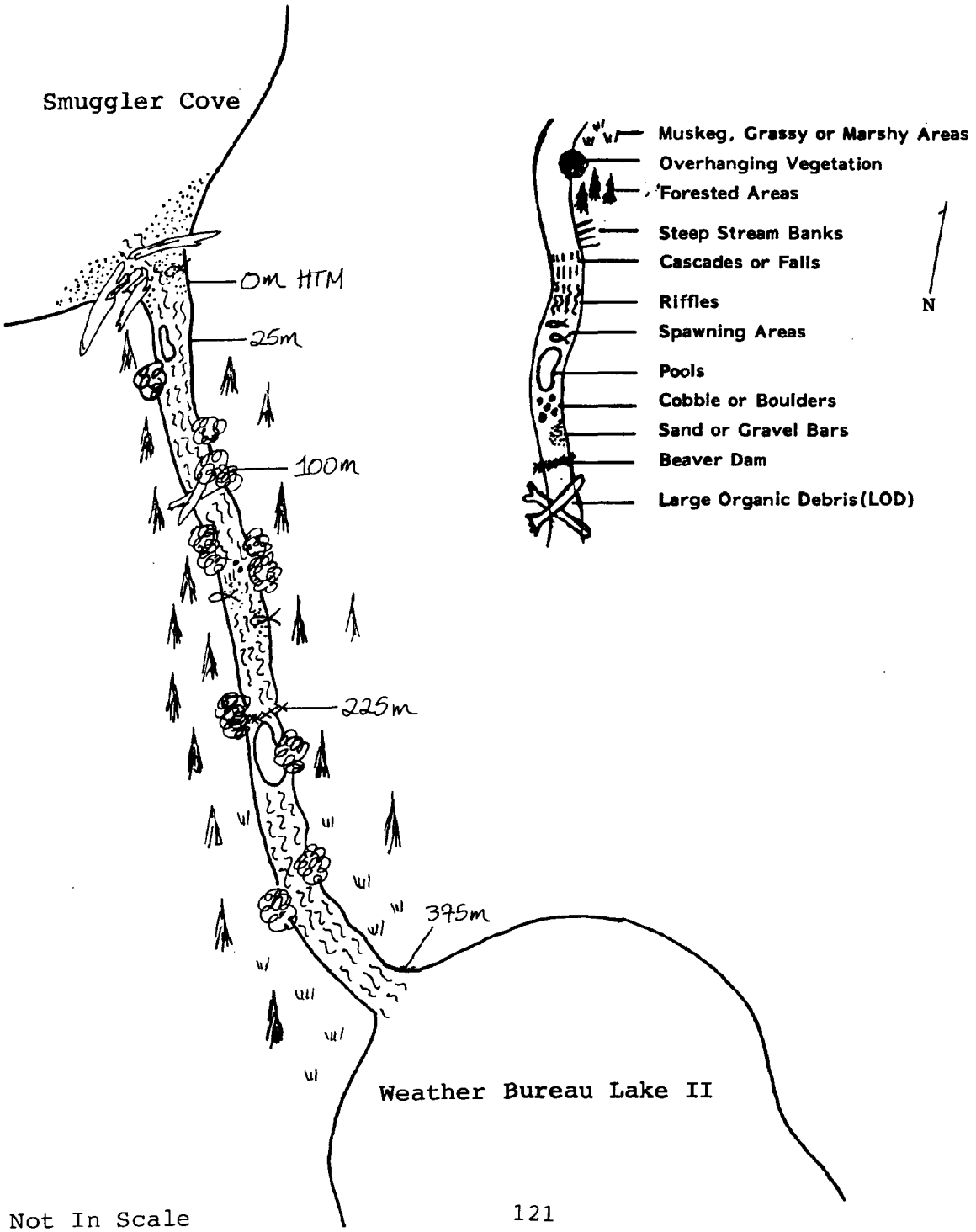
Recommended Escapement

Due to the limited spawning area available, but abundant rearing area, 2 coho spawning pairs could utilize this creek.

Potential Production Summary

Potential production, based on the poor quality of gravels is only a couple coho returning.

Figure 22. WEATHER BUREAU CREEK



Not In Scale

WEATHER BUREAU CREEK

Watershed No. 101-08
Stat. No. 101-28-027

0m	High Tide Mark (HTM), logs piled up here; no available intertidal spawning area.
25m	5 coho fry observed in a small pond; lots of algae on rocks.
100m	Stream goes under a root tangle of a live tree and the channel above here is not well-defined.
225m	.8m high beaver dam here, may be a barrier.
375m	Weather Bureau Lake II

Spawning Area: Limited, no intertidal area.

Above HTM is only about $15m^2$ spawning area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Gillnet Creek	101-28-028	101-09

Flows NW into Nichols Passage, 1.5 mi long. — Location

Muskeg ponds and run-off. — Origin

Gently rolling muskeg and forested hills. — Watershed Type

Date Surveyed	Section Surveyed		Barriers	Stage		Flood Height	
6/15/81	1675m from road to High Tide Mark (HTM)		Blocked culvert 1675m above HTM	Low flow		--	
--	--	--	Variable .5-1.5 fps	4m	--	.15m	--

Ave. Gradient	Flow	/ Range	Ave. Velocity/Range	Ave. Width/Range		Ave. Depth/Range	

Rock and mud with vegetation and some LOD influence in areas./ Some active undercutting, but stabilized by vegetation. — Streambank Composition / Stability

None — Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	16.0C	14.0C	--	Clear / None	Very Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Lower reach: 50% gravel, 15% pebble, 15% cobble, 10% sand, 5% silt, 5% rubble, 30% of creek is beaver pond with muck/silt/organic matter substrate. — Overall Stream Bottom Composition

Bed material is very angular in places - not great quality. — Gravel Compaction

LOD provides some trapped gravels and excellent spawning below 1150m (first 500m of creek) - 625m^2 area total is available abobe HTM (fair quality gravels). — Spawning Area Available Above High Tide Mark (HTM)

150m^2 is available near very large estuarine rearing area. — Intertidal Spawning Area

Rearing Area

Many pools - produced by LOD and beaver dams. — Pool/Riffle Frequency (P:R Ratio)

.30m / to 1m — Ave. Pool Depth/Range

-- -- — Ave. Pool Size/Range

LOD influence strong in areas forming pools; along with LOD, undercut banks, root wads and deep ponds provide abundant cover.

Available Cover

Abundant in areas - caddisflies and diptera observed.

Aquatic Invertebrates/Available Food Source

Filamentous algae, periphyton and mosses are abundant.

Aquatic Vegetation

Muskeg vegetation (berries and shrubs) and old growth timber (cedar, hemlock, spruce).

Terrestrial Vegetation

95% in lower reach; 30% of creek is an open beaver pond area.

Shading

Excellent coho habitat in lower reaches with abundant LOD, beaver ponds and a large estuarine rearing area is available in addition. — Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Coho, cutthroat, and rainbow utilize creek; pink and chum may also.

Use by Fish

No known use by fishing except possibly some commercial fishing (gillnetting) near the mouth.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Escapement counts are recommended. No habitat improvement is recommended; the creek probably already produces adequate numbers (a moderate amount of production).

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/15/81	Cutthroat	Fry	Abundant		
	Rainbow	Fry	Abundant		
	Coho	Fry	Abundant		

No escapement counts ever conducted.

Survey(s) and Dates Conducted

C. Huntington, 6/15/81

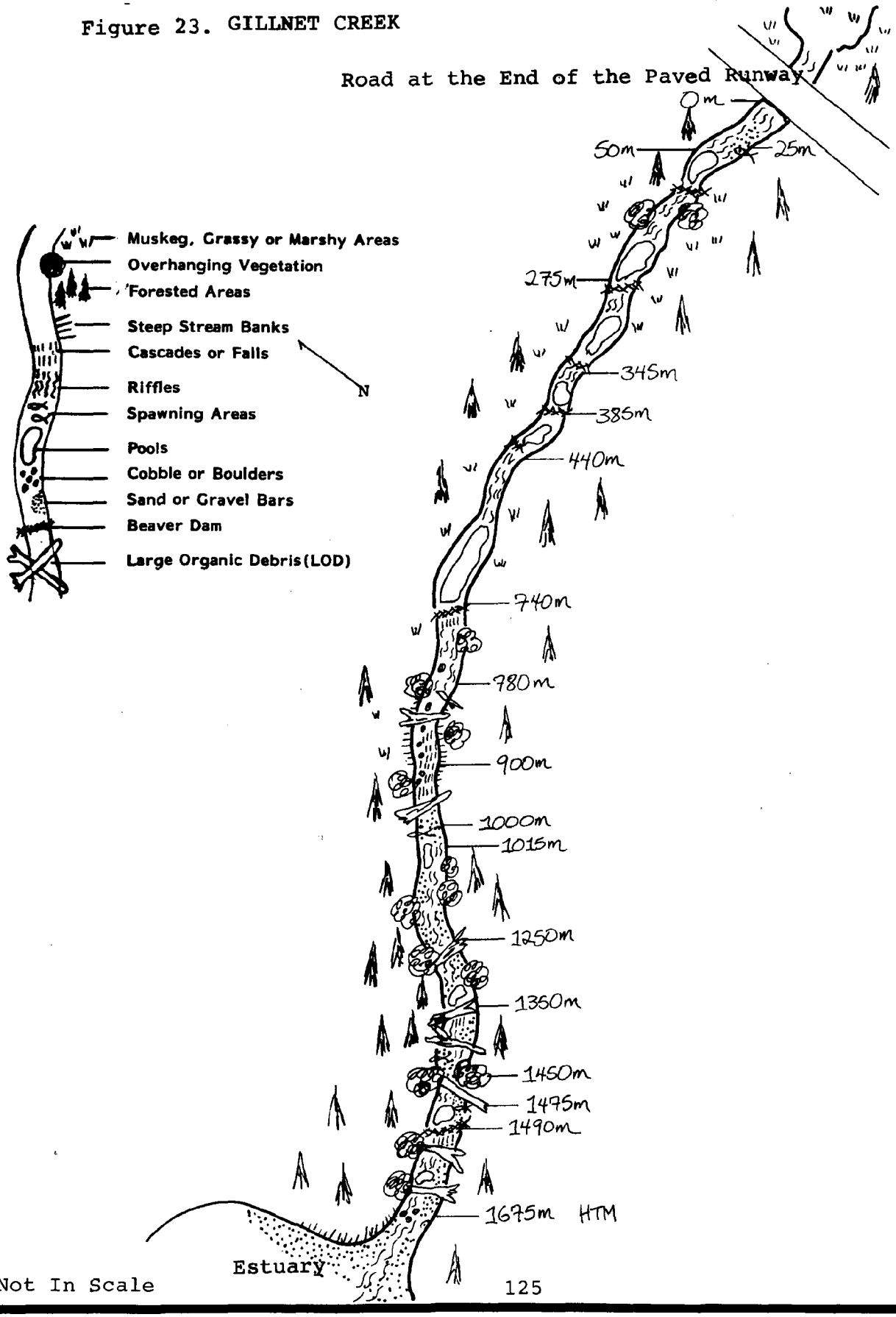
Recommended Escapement

Due to the extensive intertidal and freshwater spawning areas available, the following recommendations can be made: 1300 pink, 85 chum and 10 coho spawning pairs could utilize this creek.

Potential Production Summary

Gravel is of fair quality so a 10% egg-fry survival rate will be assumed. 3861 pinks, 421 chum and 56 coho could return to Annette Island as a result of production from this creek.

Figure 23. GILLNET CREEK



Not In Scale

GILLNET CREEK

Watershed No. 101-09
Stat. No. 101-28-028

0m	Blocked culvert (creek runs under dirt road at the end of the paved runway).
25m	$5m^2$ patchy spawning area, angular gravels and low velocity flow; juvenile salmonid observed here.
50m	Upstream end of beaver dam.
275m	.4m high beaver dam with 225 x 5m pond.
345m	.35m high beaver dam with 70 x 4m pond.
740m	1m high beaver dam (passable at high flow) with 300 x 5m pond.
780m	Two washed out beaver dams, creek begins to flow more freely. Bottom composition is bedrock, boulders, rubble and some cobble with alot of algae and moss occurring.
900m	Bedrock banks predominate from 780m.
1000m	First spawning gravel patch since below culvert, $8m^2$ area, angular gravels with cobbles and pebbles.
1015m	Coho fry in side pools, pools average .25m deep with a .5m maximum depth.
1250m	Suspected old redd found, Average Stream Width (ASW) = 3m, Average Stream Depth (ASD) = .15m.
1350m	LOD influence strong forming pools and providing cover - forest surrounding area is old growth.
1450m	Cutthroat rainbow, and coho fry seen here in abundance.
1475m	Suspected old redd here.
1490m	Beaver dam, .35m high, with a small pond.
1675m	High Tide Mark (HTM). Intertidal spawning area opens up into a large estuarine rearing area.

Spawning Area:

Intertidal	$150m^2$ total area
Above HTM	$625m^2$ (Excellent spawning areas below 1150m, in first 500m of stream.)

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Canoe Cove Creek I	101-28-029	101-10

Location Flows SW in N. Canoe Cove, about 1.5 mi long.

Origin Everetts Lake and muskeg run-off.

Watershed Type 71 acres in area - Gently rolling hills with muskeg and forested areas.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/22/81	500m above High Tide Mark (HTM) (5/25/72)	None	Low flow	+3 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5%	3 cfs / up to 5 cfs	Moderate - 1 fps up to 2 fps.	1m / to 3m	.1m / to .15m

Streambank Composition / Stability Vegetated soil banks and rocks (some steep banks)/ Fairly stable

Tributaries --

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
5/25/72:	11.1C	9.4C	7.0	Turbid water	Brown	--	3.6ppm
--	20.0C	14.0C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness (5/25/72)	Dissolved Solids	Other/Overall
Trace (5/25/72)	12.5ppm (NaCl)	106.98ppm (5/25/72)	Dissolved Solids - $CaCO_3$ = 10.7ppm (5/25/72)

Spawning Area

In first 500m: 20% gravels, 35% pebbles, 20% sand, 10% cobble and boulders, 5% bedrock.

Overall Stream Bottom Composition

Some occurs, gravels are of fair quality.

Gravel Compaction

Approximately $33m^2$ is available - spawning area may be limited due to the narrowness of the stream.

Spawning Area Available Above High Tide Mark (HTM)

$75m^2$ total area available (again may be limited because of creek narrowness).

Intertidal Spawning Area

Rearing Area Pools occur in 60% of the entire creek area (many due to beaver activity).

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.3m / ---	3 x 3.6m / --

Provided by undercut banks, some LOD, overhanging vegetation - a moderate amount.

Available Cover

Sparse - but diverse: mayflies, midges, stoneflies, caddisflies, ephemeroptera, diptera.

Aquatic Invertebrates/Available Food Source

Moderately abundant moss on rocks and abundant filamentous algae.

Aquatic Vegetation

Huckleberry, salal, mosses, terrestrial grasses, chocolate lilies, skunk cabbage and a few alders; cedar and hemlock canopy.

Terrestrial Vegetation

From 0-200m: 50% shading (40% due to vegetation, 10% due to banks). 200-500m: 75% shading, all due to shrubs and herbaceous vegetation.

Shading

Moderate amount is available in LOD, under banks and pools (some formed by old beaver dams).

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and cuthtroat are known to use creek.

Use by Fish

No know use by subsistence or sport fishermen.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

No habitat improvements are recommended. Stream produces a moderate amount of salmonids.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
5/25/72	Coho	Fry	710		
	Pink, chum and coho adults have been observed in the past.				
6/22/81	Cutthroat	8 cm	1		Seen near creek mouth.

Survey(s) and Dates Conducted

J. Yuska, 6/22/81, and USFWS, 5/25/72

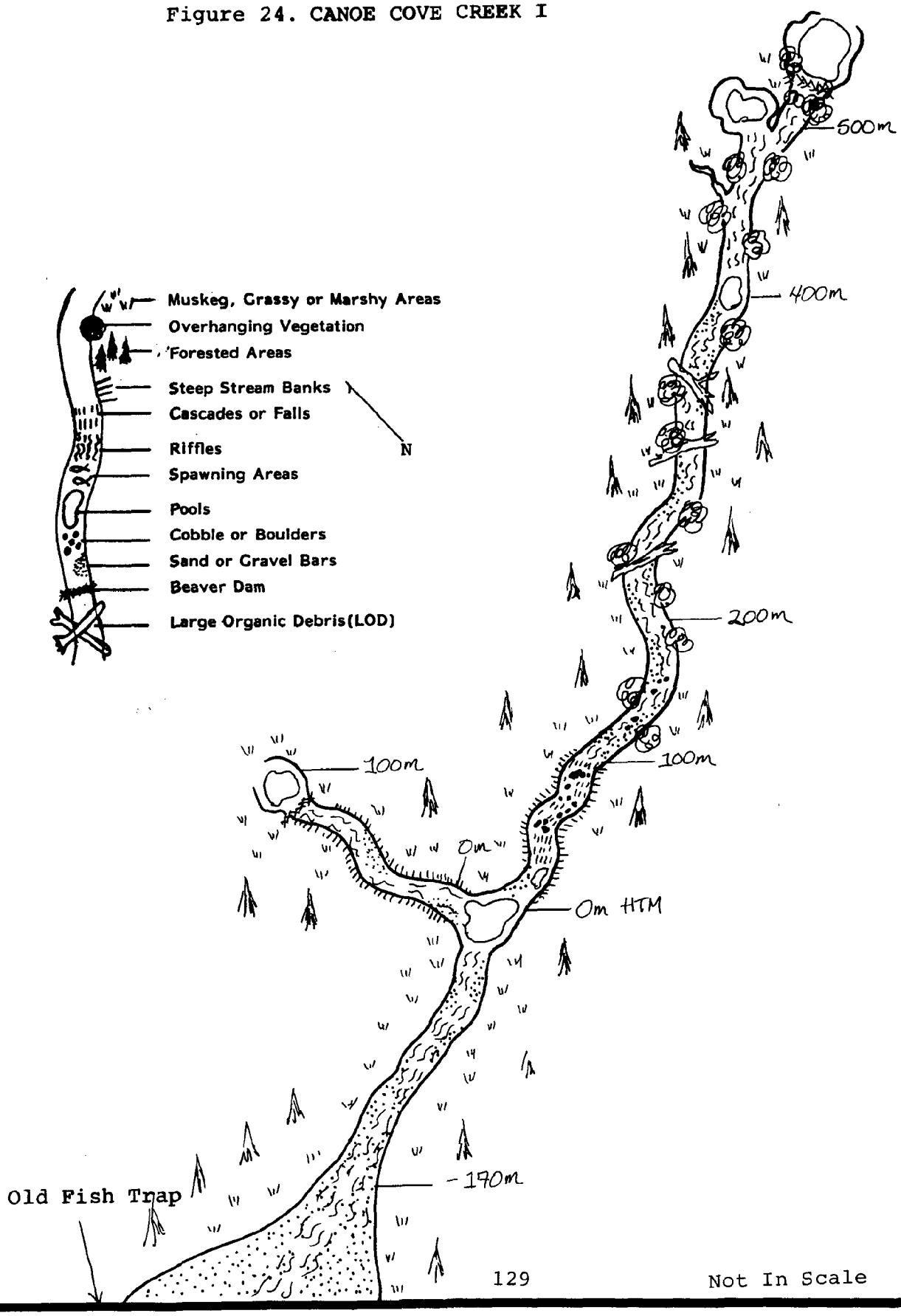
Recommended Escapement

According to spawning area available, the following recommendations can be made: 142 pinks, 9 chum and 2 coho spawning pairs.

Potential Production Summary

Gravels are of fair quality so a 10% egg-fry survival rate will be assumed. 422 pinks, 45 chum, and 11 coho could return to Annette Island as a result of production from this creek.

Figure 24. CANOE COVE CREEK I



Not In Scale

CANOE COVE CREEK I

Watershed No. 101-10
Stat. No. 101-28-029

-170-0m	Average Stream Width (ASW) = 5m, 10% usable gravels ($75m^2$ spawning area total). High Tide Mark (HTM) at 0m.
0m	At HTM, a large 100m tributary, ASW = .5m with a bottom of 20% gravels, 40% pebbles and 40% sand, enters; it flows over a beaver dam at 100m up and ends in a large intertidal pool 25m in diameter; there is a $10m^2$ available spawning area in the tributary.
5m	Adult cutthroat trout observed.
0-100m	Cascades over bedrock (less than 5% gravel) possible velocity barrier for pinks and chum, with 1m high steep banks.
100-200m	ASW = .75m, ASD =.05m. Bottom composition: 20% gravels, 40% pebbles, 20% sand and 10% cobble, $15m^2$ available spawning area.
200-400m	ASW =.75m, less gravels - 10% gravels ($7.5m^2$ available spawning area); moss and algae abundant in this section with some LOD; at 400m is a pool 4 x 1.5m.
400-500m	ASW = .5m, ASD = .15m, with less than 5% gravels; 75% shading from 200m; water becomes stagnant at 500m - it is flowing out of muskeg ponds. (End of Survey)

Spawning Area:

Intertidal	$75m^2$ area total
Above HTM	$33m^2$ approximate total area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Canoe Cove Creek II	101-28-030	101-11

Flows W into Canoe Cove, 400m long. Muskeg ponds and run-off. Muskeg flats with scattered stands of stunted trees.

Location	Origin	Watershed Type
400m - High Tide Mark (HTM) to muskeg origins.	At 15m, debris barrier and land bridges form possible	-- $\frac{1}{2}mi^2$ area

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/19/81	-- --	barriers.	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Moderate - 6%	Moderate - 1 fps/ -	1.8m / --	.2m / --	

Muskeg vegetation in mud - "land bridges" and muskeg vegetation influence channel which is not well defined./Unstable. One - stream forks at 70m.

Streambank Composition / Stability Tributaries

Water Quality

	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/8/71:	17.8C	15.0C	6.0				
Above HTM	15.0C	13.5C	--	Clear / None	Brown	--	--
Sample Site							
17.1ppm (9/8/71)	--	--		Muskeg water			

Total Alkalinity Total Hardness Dissolved Solids Other/Overall

Spawning Area

--

Overall Stream Bottom Composition

Poor gravels quite a bit due to fines in gravel.

Gravel Compaction

$60m^2$ of marginal quality spawning area.

Spawning Area Available Above High Tide Mark (HTM)

Substrate too fine below -25m to use, $75m^2$ marginal quality area from 0 to -25m.

Intertidal Spawning Area

Rearing Area

Few pools or riffles. -- -- -- --

Pool/Riffle Frequency (P:R Ratio) Ave. Pool Depth/Range Ave. Pool Size/Range

Some available due to overhanging vegetation, but it is limited.

Available Cover

Scarce - diptera observed.

Aquatic Invertebrates/Available Food Source

Some moss and filamentous algae - sparse.

Aquatic Vegetation

Salal, skunk cabbage, ferns, vanilla leaf, azalea, mosses; canopy is cedar and shorepines.

Terrestrial Vegetation

Intense due to brush and trees (80%).

Shading

Limited - poor gravels and a fast velocity - not alot of cover is available.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

No known use of stream by fish.

Use by Fish

No known use of stream by fishermen.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Limited use, if any, by pinks only due to fines in gravels and low pH. Any fish entering creek are probably strays; no improvements are recommended. Also possible debris and topographic barriers exist.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/19/81	None seen.				

Survey(s) and Dates Conducted

J. Yuska, 6/19/81 and USFWS, 9/8/71

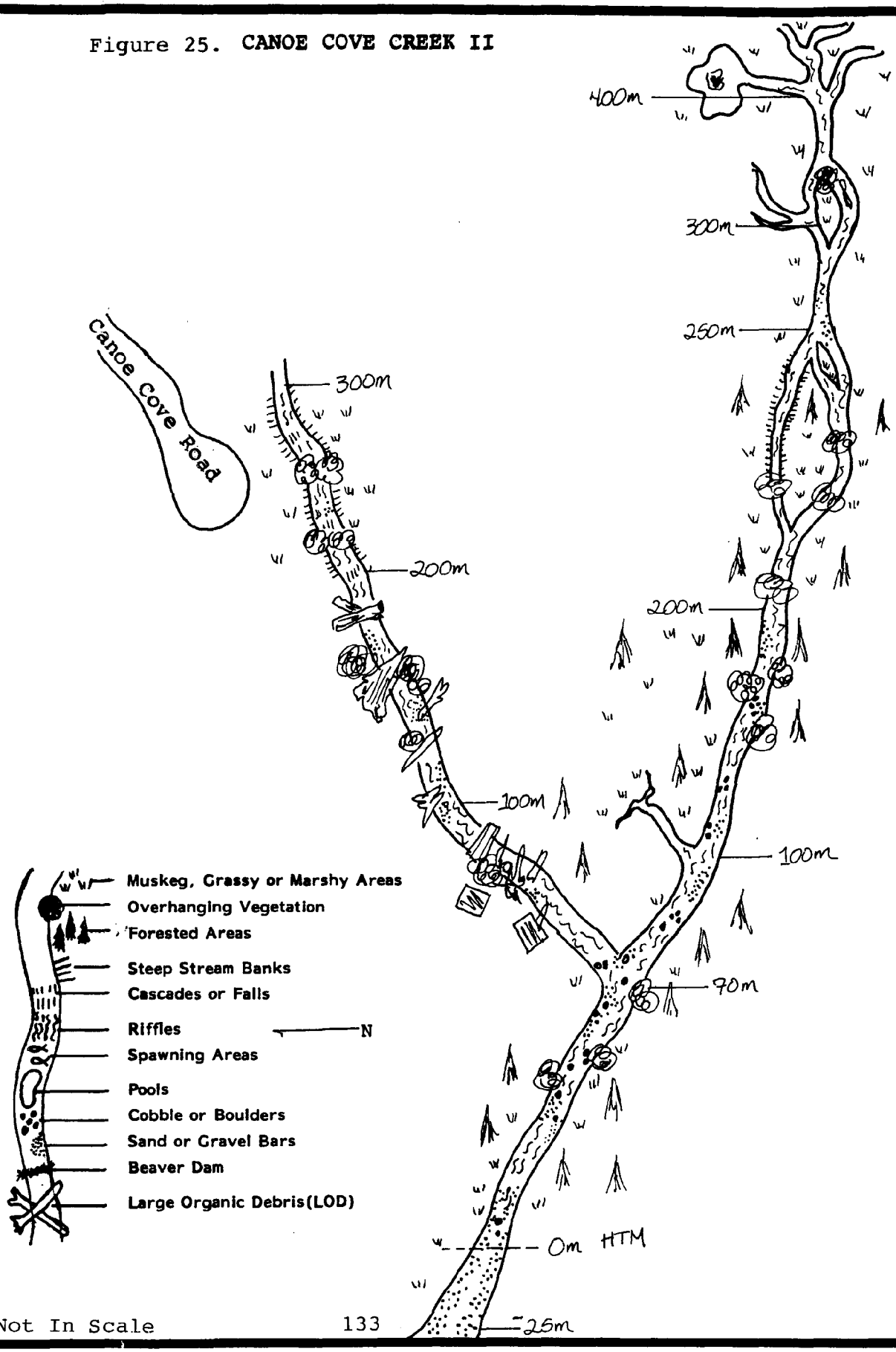
Recommended Escapement

Due to the fine gravels, probably only pinks would utilize this creek, with a recommended escapement of 233 spawning pairs based on available area.

Potential Production Summary

Due to the poor gravels, a 1.2% egg-fry survival rate is assumed, and only 83 pinks are estimated to return given the above escapement.

Figure 25. **CANOE COVE CREEK II**



Not In Scale

CANOE COVE CREEK II

Watershed No. 101-11
Stat. No. 101-28-030

-25-0m Average Stream Width (ASW) = 6m, 60% usable gravels (approximately $75m^2$ spawning area).

-70m Creek flows over boulder and cobble; tributary enters at 70m.

0-300m (Tributary)

ASW = .5m, spawning gravel is approximately 10% ($10m^2$ available area); debris jams scattered from 0-200m, caused by old World War II structures fallen into creek - may be okay coho rearing habitat. Above 200m, stream gradient increases and creek becomes narrow with no gravels, at 300m, creek flows under and into the muskeg and is within 100m of the end of the Canoe Cove dirt road.

0-100m (Main Channel)

ASW = 2.5m, ASD = .06m, bottom is 20% gravels, 40% fines and 40% boulder and cobble, (approximately $45m^2$ of spawning area is available).

100-200m ASW = 1m, 10% gravels are present ($10m^2$ spawning area). At 200m, stream splits into several channels with less than 5% gravels and alot of fine sediment, creek flows under muskeg "land bridges" that may be barriers to migration.

200-300m Many undercut banks, with a possible old redd at 250m in one small gravel bar. Stream splits again at 300m with less than 5% gravels.

300-400m Gradient is increasing and stream is still splitting into muskeg.

Spawning Area:

Intertidal $75m^2$ area total

Above HTM Approximately $65m^2$ of marginal quality spawning area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Canoe Cove Creek III (S.E. Creek)	101-28-031	101-12

Location	Origin	Watershed Type
Flows NW into So Canoe Cove, 1 mile long. Muskeg pond and run-off.		Muskeg flats with stunted timber stand. 60 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/19/81	Entire length from low tide to ponds. (6/19/81)	--	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3%	Less than 1 cfs up to 1 cfs	.5 fps / --	1.5m / --	.25m / --

Streambank Composition / Stability	Tributaries
Channel poorly defined in places and heavily influenced by LOD./Unstable.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
W.Q. taken 8/24/72	- 15.5C	13.3C	5.0	Turbid	Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (8/24/72)	--	--	Additional water quality taken - next page.

Spawning Area

Overall Stream Bottom Composition: 50% rubble, 30% sand, 20% boulder.

Gravel Compaction: Some due to sand.

Spawning Area Available Above High Tide Mark (HTM): Very little - salmon probably cannot reach the pond because of low flow and beaver dams.

Intertidal Spawning Area: None

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools in 40% of the stream.	.35m / .6m	3.6 x 1.2m / --

Available Cover: Some in pools.

Aquatic Invertebrates/Available Food Source: Moderately abundant. Odonata and ephemeroptera observed.

Aquatic Vegetation: Scarce.

Terrestrial Vegetation: Muskeg vegetation; stunted trees and heavy riparian vegetation.

Shading: Intense - about 40% due to riparian vegetation and 60% due to canopy.

Extent and Quality of Rearing Area: Very little is available.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Probably no fish use this creek.

Use by Fishermen: No fishing known.

Wildlife Present

None seen.

Comments and Recommendations

Low acidity, poorly defined channel, low flow and lack of gravels make this creek unusable by salmon.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
7/17/79	Unidentified Salmonids	Fry	Not counted		Observed; however, station station was intertidal - so they could be from another creek.

None seen or expected above HTM.

Additional Water Quality Data:

Flow:	7/17/79 - .09cfs	8/23/79 - .07cfs	9/20/79 - .59cfs
Temp (Water):	7/17/79 - 9.0C	8/23/79 - 14.8C	9/20/79 - 11.0C
D.O.:	7/17/79 - 11.5ppm	8/23/79 - 8.4ppm	9/20/79 - 10.4ppm
Conductivity (ohms/cm^2)	7/17/79 -	8/23/79 - 7000	9/20/79 - 55

Other - Water color was dark brown and sampling station was found to be intertidal.

Survey(s) and Dates Conducted

C. Huntington, 6/19/81, USFWS, 8/24/72, and Pacific Rim Planners, Inc., 7-9/1979

Recommended Escapement

No recommendations for escapement are made due to the lack of spawning areas.

Potential Production Summary

None made.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hidden Cove Creek	101-28-032	101-13

Flows N into S Canoe Cove, .2 miles long./ Muskeg ponds, springs and run-off. Partially forested muskeg.

Location	Origin	Watershed Type
300m from High Tide Mark (HTM) to muskeg.	Muskeg ponds at 300m.	Low flow

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
7/19/81	.25cfs / --	Less than 1 fps - slow	4m / --	.15 / .1-.2m

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1%				

Streambank Composition / Stability: Muskeg vegetation in mud and rock - well-defined channel stabilized by vegetation.

Tributaries: None - stream splits into muskeg at 300m.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	22.2C	23.0C	6.0	Clear / None	Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: 40% gravels, 40% fines and pebbles, 20% cobble and boulders.

Gravel Compaction: Alot of fines mixed in - marginal quality gravels.

Spawning Area Available Above High Tide Mark (HTM): $75m^2$ of marginal quality gravels available.

Intertidal Spawning Area: Some available - $170m^2$ area of marginal quality gravels.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools and rifffles.	-- --	-- --

Available Cover: Limited

Aquatic Invertebrates/Available Food Source: Scarce

Aquatic Vegetation: Some algae, but not abundant.

Terrestrial Vegetation: Skung cabble, grasses and sedges, some herbs and stunted trees.

Shading: 0-10% due to topography (banks).

Extent and Quality of Rearing Area: Very little due to lack of cover and small size of stream.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: No previous record of use by fish.

Use by Fishermen: No fishing.

Wildlife Present

None seen.

Comments and Recommendations

Pink salmon may use this creek, but their success is questionable. No improvements are recommended - this creek produces low numbers, if any, of salmonids.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
7/19/81	None seen				

Survey(s) and Dates Conducted

E. Biggs, 7/17/81

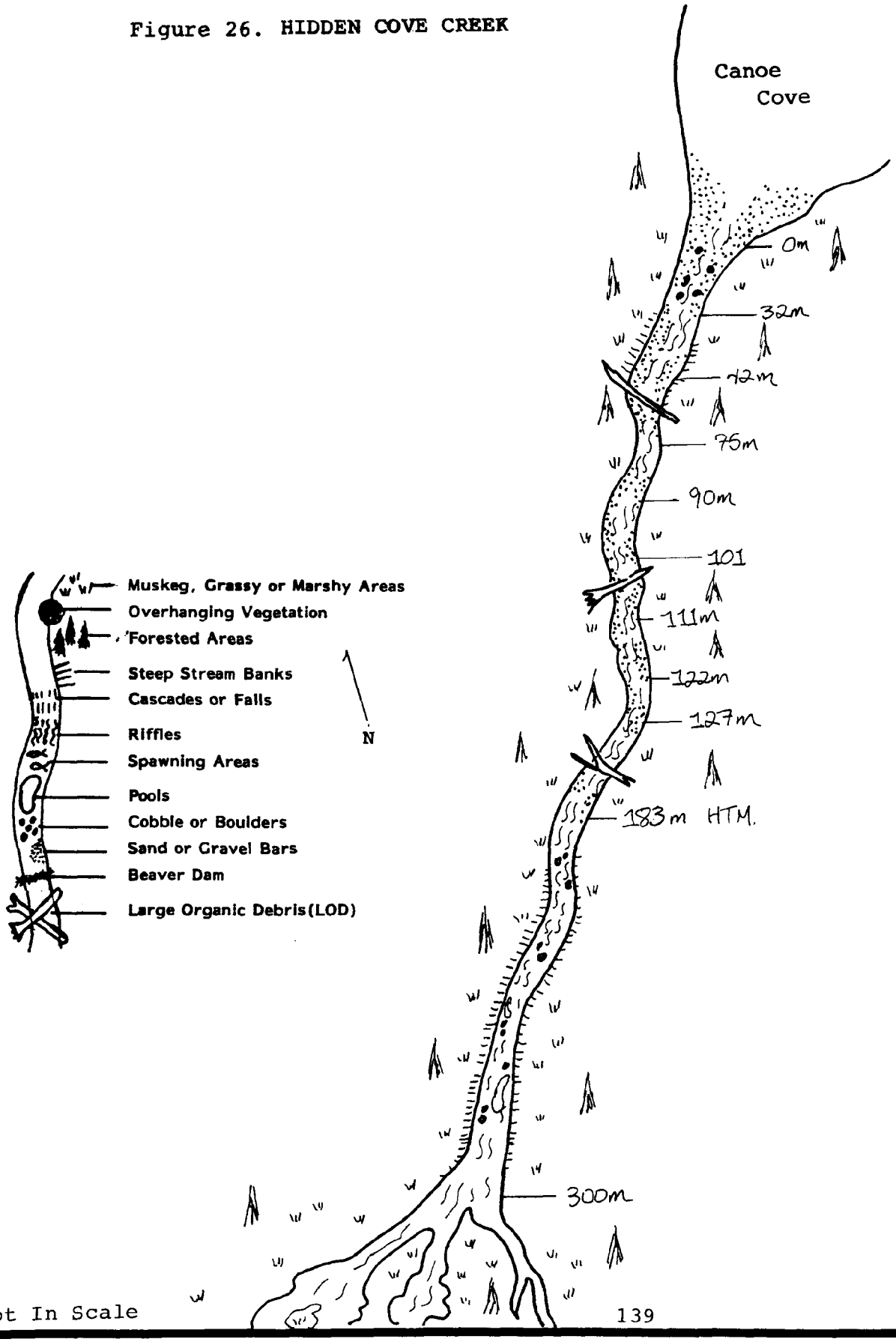
Recommended Escapement

Because of the fine gravels, only pinks could probably utilize this creek. Recommended escapement is 408 pink spawning pairs.

Potential Production Summary

Based on a 1.2% egg-fry survival rate (poor quality gravels) and the above escapement, only about 146 pinks would be expected to return to Annette Island from this creek.

Figure 26. HIDDEN COVE CREEK



Not In Scale

HIDDEN COVE CREEK

Watershed No. 101-13
Stat. No. 101-28-032

0-32m	Average Stream Width (ASW) = 2m, intertidal gravels are about 50%.
32-42m	Fine sediment mixed with gravel and pebbles, ASW = 9m with very slow flow ($40m^2$ marginal quality spawning area available).
42-75m	ASW = 2m, mainly a pebble bottom with mud.
75-90m	ASW - 2m, 75% spawning area ($23m^2$ area available).
90-101m	Stream widens to ASW = 4 m, (has alot of mud bottom) 25% spawning gravels ($10m^2$ area available).
101-111m	ASW = 2m, 50% spawning gravels ($10m^2$ area available).
111-122m	ASW = 3m, 75% spawning gravels ($23m^2$ area available).
122-127m	ASW = 2m, 25% spawning gravels ($2m^2$ area available).
127-183m	ASW = 5-6m, 10% spawning gravels, mostly a mud bottom ($30m^2$ area available). High Tide Mark (HTM) at 183m.
183-300m	ASW = 1.5-2m, bottom is mostly pebble and boulders with areas of slow flow widened into pools (alot of of sedges and rushes on banks); some gravels available. At 300m, stream splits into muskeg.

Spawning Area:

Intertidal	$170m^2$ of marginal quality, but usable spawning area.
Above HTM	$75m^2$ total area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Tokyo Creek	101-26-002	405-01

Flow SE into Tamgas Harbor, .6 mi long. Tokyo Lake and muskeg run-off./ Gently rolled forested muskeg area. $1m^2$ in area.

Location	Origin	Watershed Type
Entire length 950m from fork to Lake.	None	Moderate

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/19/81	(11/24/71)			+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2%	2.5 cfs to 4 cfs	2 fps / moderate-swift	1.5m / .9-1.8m	.17m / to .4m

Mud (vegetated) and rock banks - some channelization and undercut banks occur./ Fairly stable due to vegetation and timber.

Streambank Composition / Stability

One tributary (creek itself is a fork Tributaries of Annette Inn Creek).

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
5/24/72:	15.0C	10.6C	6.5	--	--	--	Trace
--	16.0C	14.0C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (5/24/72)	10.8ppm NaCl (5/24/72)	9.25ppm free $CaCO^3$ (5/24/72)	/ Resistance = 33,000 ohms/cm^3 (5/24/72)

Spawning Area

35% gravels, 35% fines, 30% cobbles and small boulders.

Overall Stream Bottom Composition

Some fines - fair quality gravels.

Gravel Compaction

$500m^2$ spawning area in creek sections with 20-40% gravels.

Spawning Area Available Above High Tide Mark (HTM)

Not Applicable

Intertidal Spawning Area

Rearing Area Pools - some large pools created by beaver activity and small pools by LOD.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range	
Some LOD, undercut banks, beaver ponds and lake.	--	--	--

Available Cover

Some - diptera and trichoptera observed.

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Salal, terrestrial grasses, huckleberry, ferns, azalea, mosses, devil's club, skunk cabbage; cedar dominant near creek, hemlock found away from stream.

Terrestrial Vegetation

75% due to canopy.

Shading

Limited because of moderate-fast velocity and very little LOD in channel; however, there are numerous undercut banks.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and cuthtroat utilize creek.

Use by Fish

Little to no fishing pressure known.

Use by Fishermen

Wildlife Present

None seen - evidence of beaver, mink and land otter.

Comments and Recommendations

No habitat improvements recommended. This creek does support a significant amount of coho fry and chum and pink do use creek for spawning - an important production creek on Annette (combined with Annette Inn Creek).

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
11/24/71	Chum	Adult	2	-	(Probably too late to spot pinks).
	Coho	Adult	1	-	
6/19/81	Coho	Fry	1	-	

Escapement count combined with Annette Inn Creek Count

Survey(s) and Dates Conducted

J. Yuska, 6/19/81 and USFWS, 11/24/71 and 5/24/72

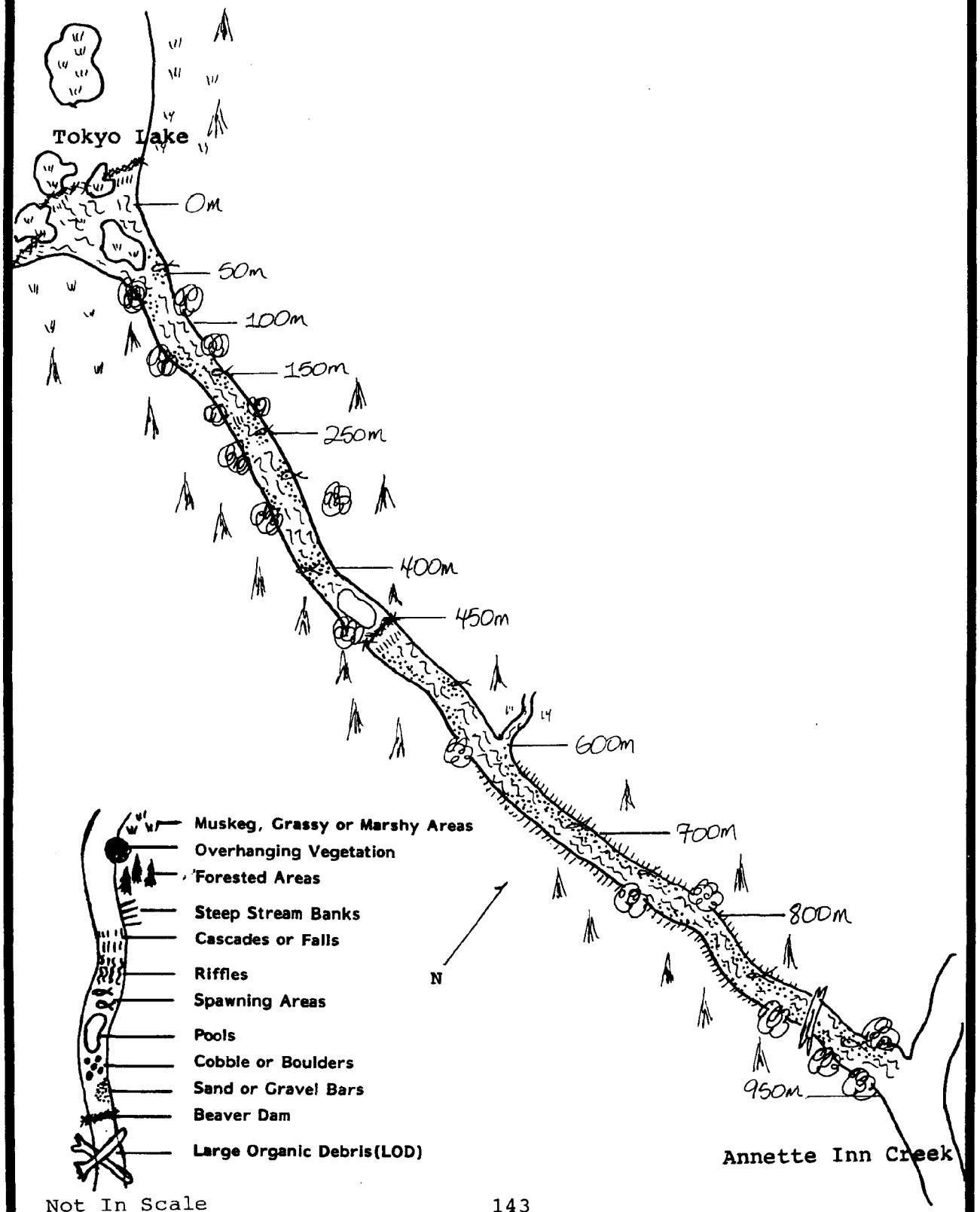
Recommended Escapement

Based on the spawning area available in Tokyo Creek, recommended escapements are 830 pinks, 54 chum and 20 coho spawning pairs.

Potential Production Summary

Potential production based on the above escapements and an assumed 10% egg-fry survival: 2465 pinks, 267 chum and 113 coho could return to Annette Island.

Figure 27. TOKYO CREEK



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TOKYO CREEK

Watershed No. 405-01
Stat. No. 101-26-002

0m	Tokyo Lake, swampy area (freshwater clams abundant here) with beaver activity.
50-100m	First spawning gravels here, 20% gravels, Average Stream Width (ASW) = 1m; moderate gradient and good rearing area.
100-250m	ASW = 1m, velocity moderate to fast, bottom is 20% gravels, 60% fines, 20% cobble; old redd observed at 150m.
250-400m	ASW = 1.5m, 40% spawning gravels.
400-450m	ASW = 2m, bottom is 40% spawning gravels, 30% fines, 30% cobble and small boulders; beaver dam at 450m, with 25m long pool - coho fry seen here.
450-600m	ASW = 1.5m, 40% spawning gravels.
600-700m	ASW = 1.75m, .75 cfs tributary enters at 600m.
700-800m	ASW = 1.75m, 40% gravels.
800-950m	ASW = 1.5m, ASD = .17m, with a moderate to fast velocity and 40% gravels. At 950m, Tokyo Creek joins Annette Inn Creek.

Spawning Area: No intertidal spawning area.

Above HTM, $500m^2$ (with 20-40% gravels)

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Annette Inn Creek — Stream
101-26-001 — Number
405-02 — Geocode
130 acres in area.

Flow SW into Tamgas Bay, about 1 mi long. Muskeg ponds, springs and run-off. Flat forested muskeg area.

Location: 1350m above High Tide Mark (HTM) (.84 mi).
Origin: None
Watershed Type: --

Date Surveyed: 6/19/81
Section Surveyed: (11/24/71)
Barriers: +3 ft above fork 1 fps/moderate below fork 2 fps/to rapid
Stage: above fork 1.75m/-- below 2.50m/--
Flood Height: above and below .25m/--

Ave. Gradient: 1.0% (over 1.0% below fork) / 5.5 cfs (below fork) to
Flow / Range: 12 cfs
Ave. Velocity/Range
Ave. Width/Range
Ave. Depth/Range

Streambank Composition: Mud and rock with vegetation./ Fair stable channel due to vegetation and trees.
Stability
Tributaries: Tokyo Creek is only tributary (fork at 475m).

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
5/24/72:	15.0C	11.1C	6.8	Clear / None	--	--	Trace
--	16.0C	11.0C	--	Clear / None	Brown	--	--

Total Alkalinity: Trace (5/24/72)/ 15ppm NaCl (5/24/72)
Total Hardness: free $CaCO_3$ (5/24/72)
Dissolved Solids: 12.84ppm
Other/Overall: Resistance = 38,284 ohm/cm^3 (5/24/72) Pretty good water quality.

Spawning Area

Overall Stream Bottom Composition: Above fork: trace rubble, 15% cobble, 40% gravel, 20% pebble, 20% sand, 5% silt, trace muck. Below fork: 10% rubble, 20% cobble, 40% gravel, 10% pebble, 15% sand, 5% silt, trace muck.
Gravel Compaction: Some - fair quality gravels.

Spawning Area Available Above High Tide Mark (HTM): Patchy - 70m^2 above fork and 95m^2 below Tokyo Creek.

Intertidal Spawning Area: None available.

Rearing Area

Pool/Riffle Frequency (P:R Ratio): p:r-3-4:1/ Small pools are scattered throughout - in reach near Inn - riffles dominate elsewhere.
Ave. Pool Depth/Range: .4m / to 1.2m
Ave. Pool Size/Range: -- --

Available Cover: LOD and debris from old Inn provide excellent cover - also, overhanging vegetation and undercut banks.

Aquatic Invertebrates/Available Food Source: Sparse - diptera, larvae, ephemeroptera and trichoptera observed, though.

Aquatic Vegetation: Very little; however, some algal growth occurs, especially near the Old Inn.

Terrestrial Vegetation: Skunk cabbage, ferns, currant and other berries with predominately spruce, hemlock, alder and some cedar.

Shading: Intense - 90% above Fork and 90-95% below Tokyo Creek Fork.

Extent and Quality of Rearing Area: Very little off channel development - so areas with no LOD and a steep gradient are poor rearing habitat areas, however, areas with abundant LOD (like around the Inn) are good for rearing.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink, chum, cutthroat and coho use creek.

Use by Fishermen: Little to no known fishing pressure (used to be when Inn was operating).

Wildlife Present

None seen, evidence of beaver, mink, and land otter though (11/24/71).

Comments and Recommendations

No habitat improvements recommended; manage creek mainly as a coho nursery area (due to limited spawning area), although pink, chum, and cutthroat do use the creek also.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1972	Pinks	Adults	380	-	USFWS Escapement Estimate
1973	Pinks	Adults	406	-	USFWS Escapement Estimate
1975	Pinks	Adults	20	-	USFWS Escapement Estimate
1976	Pinks	Adults	2410	-	USFWS Escapement Estimate
6/19/81	Coho	Fry	Over 100	-	Thick near old Inn.

Survey(s) and Dates Conducted

J. Yuska, C. Huntington, 6/19/81 and USFWS, 11/2/71 and 5/24/72

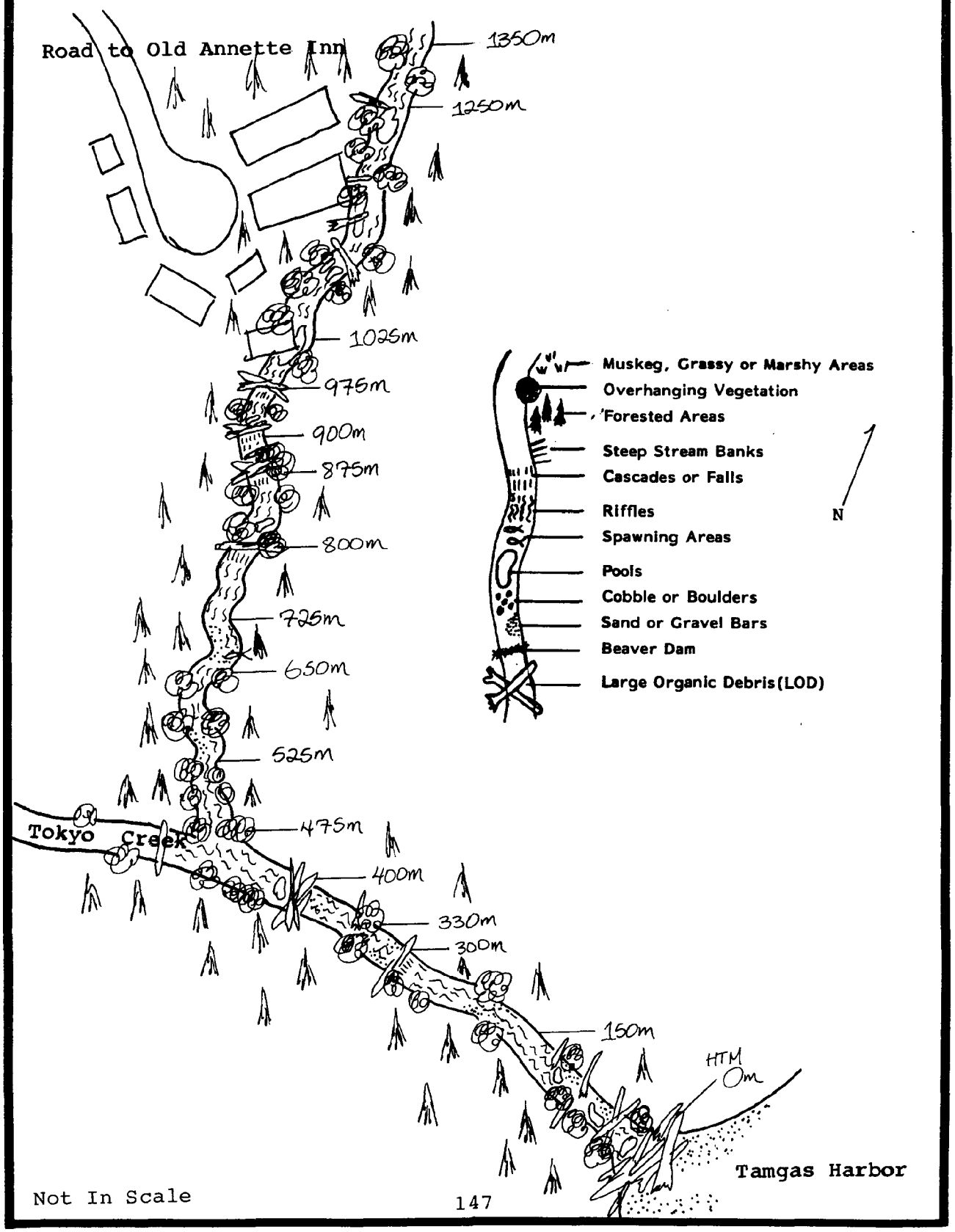
Recommended Escapement

According to spawning area available and rearing area for coho, recommended spawning is 275 pink, 18 chum and 10 coho spawning pairs.

Potential Production Summary

Given the above escapement level and an assumed 10% egg-fry survival rate, potential production from Annette Inn Creek is 817 pinks, 89 chum, and 56 coho.

Figure 28. **ANNETTE INN CREEK**



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ANNETTE INN CREEK

Watershed No. 405-02
Stat. No. 101-26-001

0m	Beach log pile.
0-150m	Alot of LOD with a few large pools and fair rearing area.
300m	.3m falls over log.
330m	Creek runs under roots and muskeg.
400m	LOD (4 logs piled up).
150-475m	Fairly swift flow of predominantly riffles and runs with marginal coho rearing habitat (another "muskeg land bridge" where creek flows under roots and muskeg). Tokyo Creek comes in at 475m.
525m	Lots of deep, slow runs with undercut banks with depth to .7m.
650m	Banks are undercut, consisting of muskeg and root tangles with some rock.
725-790m	Runs and riffles.
800m	LOD influence increases here, .5m high passable debris jam.
875m	Passable debris jam.
900m	Passable debris jam.
975m	Passable debris jam with .4m falls.
1025m	Lower end of debris jam from abandoned Inn.
1025-1250m	Alot of rearing area here due to debris jams from old Inn that ends at 1250m.
1350m	Very little spawning area here or above, with some rearing area, no barriers to here. Channel hard to follow and splits into muskeg and heavy muskeg forest understory.

Spawning Area:

No intertidal spawning area.

Above HTM	0-475m	$95m^2$	patchy spawning area
	475-1250m	$70m^2$	patchy spawning area
		$165m^2$	Total Area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Moss Cove Creek	101-26-003A	405-03

Location Flow SE into Tamgas Harbor (west of Moss Pt. Creek)

Origin Muskeg ponds and run-off. / Thickly forested muskeg area - flat.

Watershed Type

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/3/81	200m - Entre section from High Tide Mark (HTM).	Culvertless road at 200m.	Moderate	+1.5 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2%	1.75 cfs / --	Slow -less than 1 fps	-- --	-- --

Streambank Composition / **Stability**: Mud with vegetation - heavy LOD and organic matter on channel./ Stabilized by vegetation and timber.

Tributaries: None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM.	10.6C	11.5C	5.5	Clear / None	Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Muskeg water.

Spawning Area

Overall Stream Bottom Composition: Mainly mud, sand, and organic matter (twigs, branches, bark and leaves).

Gravel Compaction: Alot of fines.

Spawning Area Available Above High Tide Mark (HTM): Hard to see where coho spawn - less than 1% area is available; only 2 or 3 spawning areas exist with room for 1 or 2 redds (coho may be spawning in Moss Pt. Creek and excess fry migrating over to this creek).

Intertidal Spawning Area: None - intertidal area heavily clogged with logs.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Mostly pools - p:r = 10:1 - poorly defined, shallow (.05m) riffles.	.15m / to .40m	Small / --

Available Cover: Alot of undercut banks, LOD and pools - extensive cover under heavy vegetation also.

Aquatic Invertebrates/Available Food Source: Scarce - diversity low / terrestrial food sources.

Aquatic Vegetation: Very little primary productivity.

Terrestrial Vegetation: Tight and dense - salt tolerant sedges, Cinquefoil, skunk cabbage, alder, trees are cedar, hemlock and spruce.

Shading: Dense - 90%.

Extent and Quality of Rearing Area: Whole creek is rearing area - limited only by small creek size.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Probably utilized by coho only if utilized at all.

Use by Fishermen: No known fishing.

Wildlife Present

None seen.

Comments and Recommendations

Coho only, probably utilize creek - the fry present may be excess fry (pushed out of Moss Pt. Creek by competition for space) that immigrated over to Moss Cove Creek and that were not yet smolts.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/3/81	Coho	Fry	Over 20		

Survey(s) and Dates Conducted

C. Huntington, E. Biggs, and J. Yuska, 6/3/81

Recommended Escapement

Only coho seem to utilize this creek and there is space for only 1 or 2 redds, therefore, escapement recommended is 2 coho spawning pairs.

Potential Production Summary

11 coho could return to Annette Island if 2 spawning pairs were successful.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Moss Point Creek | 101-26-003 | 405-04

Stream | **Number** | **Geocode**

Flow SE into Tamgas Harbor, 1.7 miles long. | Muskeg run-off and, lake next to Annette Natural Resoure Center. / 2 mi^2 area. Forested and open muskeg.

Location | **Origin** | **Watershed Type**

6/4/81 | Entire length (2700m) | None to coho, possible debris barrier (1625m) for/ pink and chum. | Moderate - low | --

Date Surveyed | **Section Surveyed** | **Barriers** | **Stage** | **Flood Height**

5% | 8.5 cfs to 12 cfs / 1 fps to 2.5 fps/ | Slow to Moderate/ | 4.5m to 1.5m above runway | .3m to .5m above runway

Ave. Gradient | **Flow / Range** | **Ave. Velocity/Range** | **Ave. Width/Range** | **Ave. Depth/Range**

Mostly fine material with vegetation, heavy LOD and some OM (organic matter) influence./ Stabilized by vegetation and root wads. None.

Streambank Composition / Stability | **Tributaries**

Water Quality 11/24/71:

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	--	--	7.0				
	11.5C	12.5C	5.5	Clear / None	Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Below runway (0-1500m): 10% rubble and cobble, 50% gravel, 20% pebbles , 20% sand. Above runway and in beaver ponds mainly pebbles, mud, sand, silt and muck.

Overall Stream Bottom Composition

In some areas, compaction is a problem with fines mixed in gravel.

Gravel Compaction

All spawning area occurs below runways from 50-1500m; 7 suspected redds observed. 35% of 50-1500m is spawnable with fair to good quality gravels = 1575m^2 fair quality area.

Spawning Area Available Above High Tide Mark (HTM)

None

Intertidal Spawning Area

Rearing Area Most pools are small pockets behind snags and LOD, a few large pools and beaver ponds.

p:r = 1:4 | .35m to 1.5m above runway | 6 x 12m / --

Pool/Riffle Frequency (P:R Ratio) | **Ave. Pool Depth/Range** | **Ave. Pool Size/Range**

Relatively abundant provided by deep undercut banks, beaver pond, root wads, overhanging vegetation and LOD.

Available Cover

Sparse near runway - below runway organic matter on creek bottom is good for chironomid larvae, (they are present).

Aquatic Invertebrates/Available Food Source

Sparse - some algae on rocks.

Aquatic Vegetation

Thick and tight riparian vegetation of mainly alder and berries; canopy is spruce, hemlock and cedar.

Terrestrial Vegetation

Intesne below 1500m - 90%, open above 1500m - 10% due to topography only.

Shading

Some excellent physical rearing habitat exists especially around runways and in beaver ponds below the dirt airstrip.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho, and cutthroat utilize creek extensively; rainbow have been caught in lake.

Use by Fish

Heavy subsistence use occurs, as well as intense sport fishing (not limiting), around the airstrips.

Use by Fishermen

Wildlife Present

Heavy beaver use and land otter have been spotted.

Comments and Recommendations No habitat improvements recommended.

Moss Point Creek is a major salmon producing creek on Annette Island. Alot of fair quality spawning area and rearing area is available. Beaver dam at 1625m with a 1.25 ft drop may be a barrier to pink and chum, but they would not utilize the creek above this point anyway. Entire creek section is used by salmonids. Escapement counts are recommended on an annual basis.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
11/24/71	Chum	Adult	1	Several	USFWS On-foot Count
	Cutthroat	6 inch	1	-	USFWS On-foot Count
	Pink	Adult	0	Several	USFWS On-foot Count
1972	Pinks	Adult	3670	-	USFWS Escapement Estimate
1973	Pinks	Adult	4895	-	USFWS Escapement Estimate
1974	Pinks	Adult	4914	-	USFWS Escapement Estimate
9/11/74	Pinks	Adult	163	1	USFWS On-foot Count
9/18/74	Pinks	Adult	1612	15	USFWS On-foot Count
	Chum	Adult	16	0	USFWS On-foot Count
	Coho	Adult	4	0	USFWS On-foot Count
9/19/74	Pinks	Adult	2178	0	USFWS On-foot Count
	Chum	Adult	16	0	USFWS On-foot Count
	Coho	Adult	6	0	USFWS On-foot Count
9/26/74	Pinks	Adult	2457	410	USFWS On-foot Count
	Chum	Adult	21	5	USFWS On-foot Count
	Coho	Adult	7	0	USFWS On-foot Count
10/3/74	Pinks	Adult	1052	0	USFWS On-foot Count
	Chum	Adult	36	0	USFWS On-foot Count
	Coho	Adult	4	0	USFWS On-foot Count
10/10/74	Pinks	Adult	597	0	USFWS On-foot Count
	Chum	Adult	34	0	USFWS On-foot Count
	Coho	Adult	2	0	USFWS On-foot Count
10/17/74	Pinks	Adult	122	0	USFWS On-foot Count
	Coho	Adult	16	0	USFWS On-foot Count
1974	Pinks	Adult	2900	0	USFWS Peak Counts
	Chum	Adult	40		
	Coho	Adult	16		
1975	Pinks	Adult	8910	0	USFWS Escapement Estimate
8/29/75	Pinks	Adults	154	24	USFWS On-foot Count
9/8/75	Pinks	Adult	2456	17	USFWS On-foot Count
9/19/75	Pinks	Adult	3286	357	USFWS On-foot Count
	Chum	Adult	0	3	USFWS On-foot Count
10/3/75	Pinks	Adult	1981	1201	USFWS On-foot Count
10/17/75	Chum	Adult	0	26	
1975	Pinks	Adult	3650	--	USFWS Peak Counts
	Chum	Adult	30	--	USFWS Peak Counts
1976	Pinks	Adult	5063	--	USFWS Escapement Estimate
9/7/80	Pink (mixed with chum)	Adults	400	--	Fish in a ball outside the creek mouth (aerial).
6/4/81	Coho & trout	0+ Fingerling	1 each	-	650m above mouth
8/31/81	Pinks	Adult	50	-	Counted in lower creek.
9/1/81	None seen outisde creek mouth.				
9/7/81	Pinks	Adult	40	-	Counted up to ¼ mile up the creek.
9/17/81	Pinks	Adult	1083	4	Foot count - peak count 1981.

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, C. Huntington, 6/4/81 and USFWS, 11/24/71, 5/2/72, 7/23/75 plus escapement counts.

Recommended Escapement

2625 pinks, 100 chum and 45 coho spawning pairs could utilize this creek successfully.

Potential Production Summary

Potential production resulting from this creek given the escapement above could be: 7796 pinks, 495 chum and 254 coho returning to Annette Island assuming a 10% egg-fry survival rate.

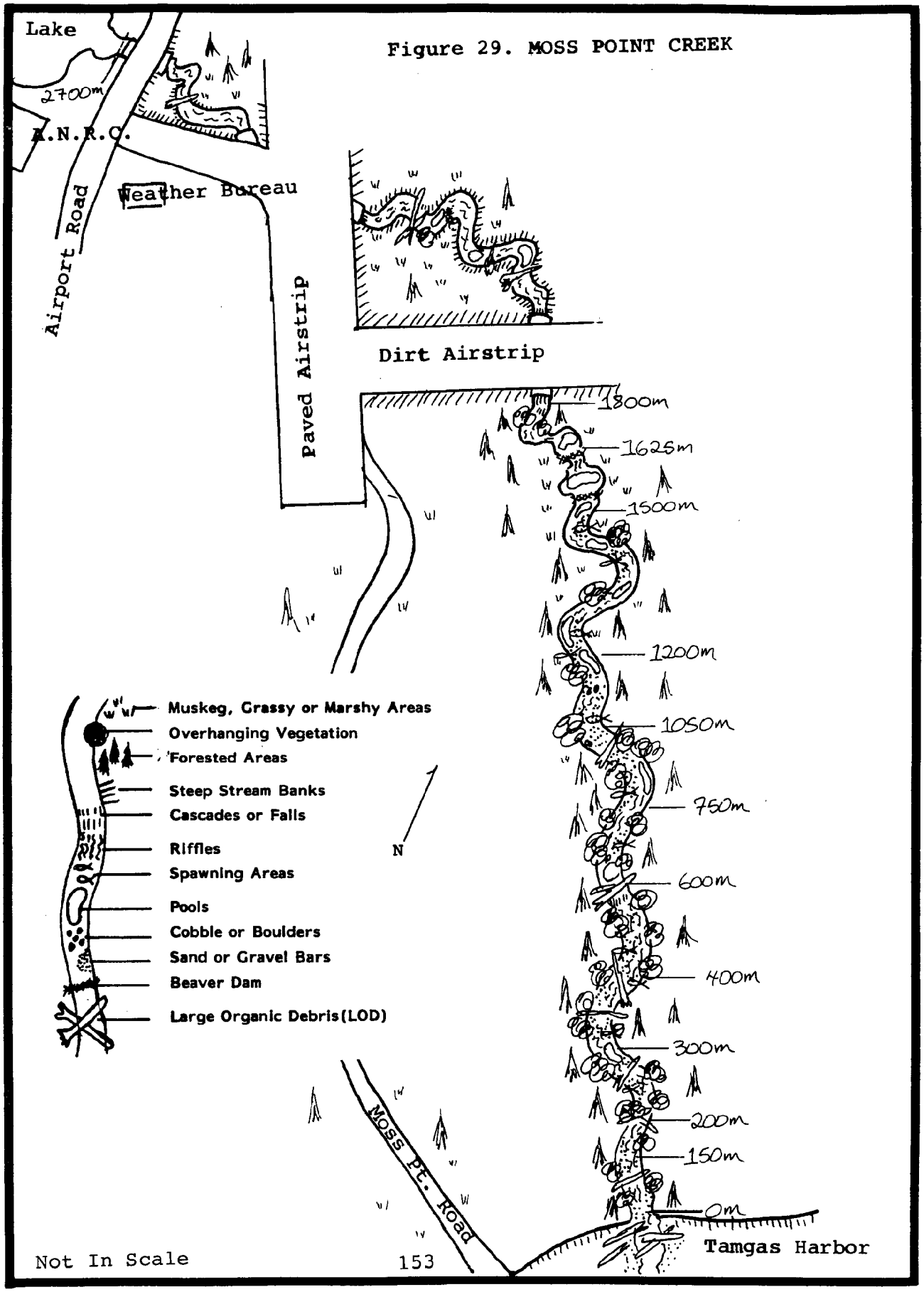


Figure 29. MOSS POINT CREEK

Not In Scale

MOSS POINT CREEK

Watershed No. 405-04
Stat. No. 101-26-003

0-150m	Creek mouth at 0m, High Tide Mark (HTM), Average Stream Width (ASW) = 4m, Average Stream Depth (ASD) = .10m; creek is a riffle/glide with spawning area beginning at 50m.
150-200m	ASW = 2-3m, ASD = .35-.40m - gravels are angular and coarse. At 200m, canopy increases to 70% with good rearing area and alot of undercuts.
200-300m	Alot of fines mixed in with the gravels; there is a pool at 300m that is 10-12m long, 5m wide and .05m deep.
300-400m	Good spawning areas here, but gravels are angular.
400-600m	Still is some good spawning areas; at 600m there is a 2 ft drop over LOD with pool built up behind logs.
750m	4.0 cm 0+ (age - less than a year old) trout seen.
1050m	Canopy opens up a little and bottom material increases in size.
1200m	Wide pools with shallow, undercut banks - spawning material is of best quality since 0m, but still not excellent.
1500m	Stream opens up into muskeg, grasses and ponds. 35% spawning area from 0-1500m.
1625m	Beaver dam with a 1.25 ft drop.
1625-1800m	ASW = 1m, creek flows out of passable culvert under dirt airstrip.
1800+m	Creek above dirt strip flows out of a passable culvert under the paved airstrip: ASW = 1.5m, ASD = .5m (deep), the flow is slow with alot of organic matter and fines in the sediment (no spawning areas); excellent rearing habitat with pools to 1.5m, steep banks with undercut banks and overhanging grasses and shrubs, and some "blown-out" abandoned beaver dams (some LOD in channel, but not abundant). Above beginning of culvert of paved airstrip, creek flows from a third culvert under the airport and through a section similar to the section described above.
2700m	At .5m above third culvert, is a lake situated next to the old B.O.Q. building (which is the Annette Natural Resource Center), a screen over the culvert mouth is broken, but may partially block adult fish passage. Coho jacks (precocious male salmon) and trout caught in lake.

Spawning Area: No intertidal spawning area.

Above HTM, 0-1500m $1575m^2$ spawning area of fair quality available.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Deer Creek	101-26-004	405-05

Flow E into Tamgas Harbor, .5 mi long./ Muskeg run-Off, Muskeg pond created by beaver dam./ Forested muskeg flats.

Location	Origin	Watershed Type
755m from mouth to beaver dam.	None, except possibly at last beaver dam.	Moderate

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81				

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1%	.8 cfs up to 2-5 cfs down to .5 cfs (7/10/75)	.5-1 fps/--	1.75m / --	.15m / --

Fragmented rock and muskeg banks with root tangles for support./ Relatively stable

Streambank Composition / Stability

None

Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
20m above mouth	12.2C	13.0C	7.0 (7/10/75)	Clear/None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: 5% cobble and rubble (trace bedrock and boulders), 50% gravel, 25% pebbles, 15% sand, 5% silt.

Gravel Compaction: Some fines mixed with gravels - many small gravels.

Spawning Area Available Above High Tide Mark (HTM): Most available gravel is too small for chum and coho - okay for pinks, but some is available for chum and coho (probably no spawning area is avaiable above the beaver dams), 135m^2 total areas available.

Intertidal Spawning Area: None

Rearing Area

Pool/Riffle Frequency (P:R Ratio): Most of the stream is riffles, runs, and glides - pools occur in bends and behind beaver dams.

Ave. Pool Depth/Range: .20m/ to .45m

Ave. Pool Size/Range: Relatively small / --

Available Cover: Abundant cover is provided by undercut banks, root tangles, pools and ponds, and overhanging vegetation.

Aquatic Invertebrates/Available Food Source: Scarce - some caddisflies, mayflies and diptera observed however.

Aquatic Vegetation: Some moss and algae occurs on the rocks.

Terrestrial Vegetation: Skunk cabbage, ferns, currant, salmonberry and alder - canopy is hemlock and spruce.

Shading: 98% due to riparian vegetation and canopy, decreases to 75% above 175m, mainly due to riparian vegetation.

Extent and Quality of Rearing Area: A moderate amount is available - coho probably do not utilize the beaver ponds because no spawning occurs behind them and fry cannot traverse dams. However, habitat is fair below dams, but it lacks large deep pools.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pinks and coho mainly use creek, although chum probably utilize it also.

Use by Fishermen: No fishing known.

Wildlife Present

None seen.

Comments and Recommendations

This stream is small, but does produce some salmon - escapement count in 1981 is impressive.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/21/81	Coho	Fry	6	-	
9/1/81	Pinks (mixed)	Adults	1200	-	Ball counted outside mouth (aerial count) - peak count, 1981.

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, 6/21/81 and USFWS, 7/10/75

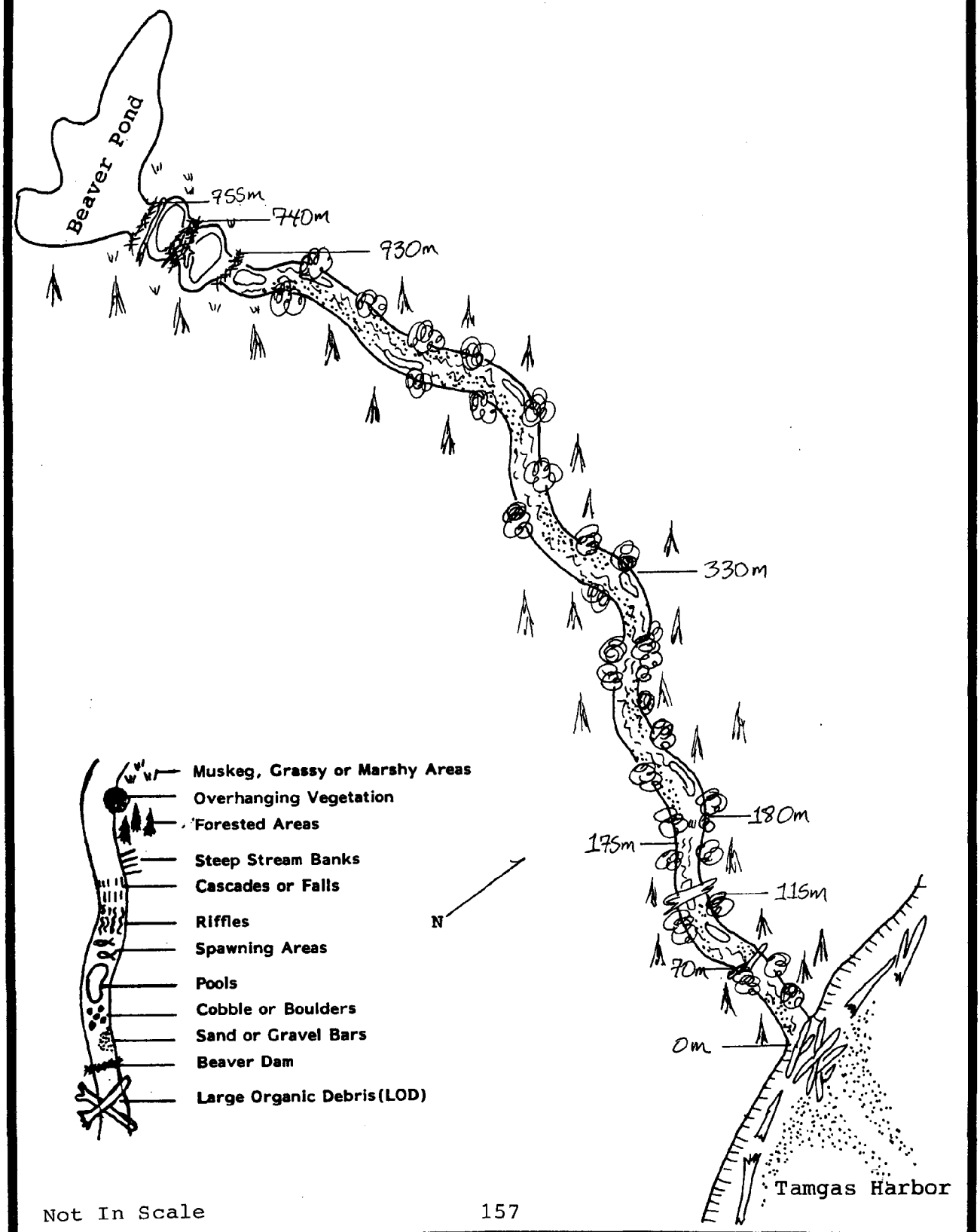
Recommended Escapement

225 pinks, 15 chum and 4 coho spawning pairs could probably utilize this creek.

Potential Production Summary

Due to the number of fines in the gravel, a 1.2% egg-fry survival rate will be assumed. Given the above escapement, production potential is estimated at 90 pinks, 10 chum and 3 coho returning to Annette Island.

Figure 30. DEER CREEK



Not In Scale

DEER CREEK

Watershed No. 405-05
Stat. No. 101-26-004

0m	Beach log jam (passable) with 98% shading. Below log jam at -5m, 5 coho fry were observed in pool just below High Tide Mark (HTM) at 0m.
70m	Small debris jam with gravels in behind jam.
115m	Log in channel.
175m	Shading drops to 75% (mainly from riparian-stream-side vegetation) above this point.
180m	35m long cascade over a root tangle.
330m	Coho fry observed here.
730m	1m high passable beaver dam with a 2 x 10m beaver pond.
740m	.6m passable beaver dam.
755m	.8 beaver dam - passable barrier, with large pond behind it (origin of stream). Survey ends.

Spawning Area: No intertidal spawning area.

Above HTM, 135m^2 spawning area available.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Alder Creek	101-26-005	405-06

Location	Origin	Watershed Type
Flow W into Tamgas Harbor, .1 mi long.	Muskeg ponds and run-off.	Forested muskeg flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	160m above mouth to muskeg ponds.	None	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Low	.5 cfs / --	1 fps / --	1.5m / --	.1m / --

Streambank Composition / Stability	Tributaries
High banks of vegetation and rock and alot of LOD./ Stabilized by vegetation and rock.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
20m above HTM	12.2C	12.0C	--	Clear / None	Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: 50% gravels, 18% pebble, 17% sand, 10% silt, 5% cobble.

Gravel Compaction: Somewhat angular gravels with alot of fines mixed in.

Spawning Area Available Above High Tide Mark (HTM): Gravel (granitic) is small with some fines, but is okay for pinks, $25m^2$ is available (includes intertidal area) - okay for a few pinks although chum and coho could use also.

Intertidal Spawning Area: See above.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools small	-- --	-- --

Available Cover: Alot of LOD covers creek, along with root wads, provide a moderate amount of cover.

Aquatic Invertebrates/Available Food Source: Sparse - predominately caddisfly and diptera larvae.

Aquatic Vegetation: Some non-filamentous algae on rocks.

Terrestrial Vegetation: Currant, other berries and shrubs, and alder create a very thick riparian vegetation margin. Forest is hemlock and spruce.

Shading: 99% due to riparian vegetation, canopy and topography (high banks).

Extent and Quality of Rearing Area: Coho do utilize the creek.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pinks, coho, and probably chum utilize the creek.

Use by Fishermen: No known fishing occurs.

Wildlife Present

None seen.

Comments and Recommendations

A small creek producing small numbers of salmon. No habitat improvements recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/21/81	Coho	Fry	4	--	Seen in lower 30m of creek.
9/1/81	Pinks (mixed)	Adult	About 200	--	In a ball outside creek mouth (aerial count).

Survey(s) and Dates Conducted

E. Biggs, C. Huntingon, 6/21/81

Recommended Escapement

Since the available spawning area is intertidal, only pinks and chum probably utilize this creek. Recommended escapement is 42 pink and 1 chum spawning pairs.

Potential Production Summary

Gravels are of marginal quality, so a 1.2% egg-fry survival rate is assumed. Potential production is estimated at 15 pinks and 1 chum.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Coast Guard Creek — Stream
101-26-006 — Number
405-07 — Geocode

Flows NE into Tamgas Harbor, .3 mi long./ and small lake next to Hatchery — Location
Muskeg run-off — Origin
.5mi^2 in area. Forested muskeg flats. — Annex. Watershed Type

6/21/81 — Date Surveyed
Entire section - 320m mouth to lake. — Section Surveyed (8/24/71)
-- — Barriers
-- — Stage
+1.5 ft — Flood Height

1% — Ave. Gradient
.5 cfs to 5.0 cfs / Range — Flow
1 fps/slow to rapid — Ave. Velocity/Range
1.8m / -- — Ave. Width/Range
.25m / -- — Ave. Depth/Range

Banks soil and heavily vegetated with alot of LOD./ Stable — Streambank Composition / Stability
One small tributary — Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/24/71:	15.6C	14.4C	6.5	--	--	--	11.5ppm
--	16.0C	14.0C	--	Clear / None	Brown	--	--

17.1ppm (8/24/71) — Total Alkalinity
-- — Total Hardness
63.5ppm (8/24/71) — Dissolved Solids
Little flooding occurs. — Other/Overall

Spawning Area

Spawning gravel is present throughout stream witha small amount of fines. Old redds were observed and alot more spawning area is available than in Colby Creek. — Overall Stream Bottom Composition

Good quality - a little bit of fines. — Gravel Compaction

83m^2 is available, which is quite a bit for this small creek. — Spawning Area Available Above High Tide Mark (HTM)

30m^2 available of marginal quality gravels. — Intertidal Spawning Area

Rearing Area

Several pools occcur and one large pool by road (3.6m deep) created by road fill. — Pool/Riffle Frequency (P:R Ratio)
-- — Ave. Pool Depth/Range
-- — Ave. Pool Size/Range

Abundant due to LOD, overhanging vegetation, beaver ponds and deep pool. — Available Cover

Relatively abundant - caddisflies and mayflies observed on rocks. — Aquatic Invertebrates/Available Food Source

Alot of filamentous green algae. — Aquatic Vegetation

Thick riparian vegetation mainly composed of berries and alder, canopy is spruce and hemlock. — Terrestrial Vegetation

Intense much of creek stretch - overall 50% (20% due to banks and 30% to vegetation). — Shading

Abundant good rearing habitat is available (many fry spotted); however, it is doubtful that fry get into origin lake due to high beaver dam. — Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pinks, chum, and coho utilize creek. — Use by Fish

Fishing used to be heavy, but light pressure now (probably) - kids swim in pond in summer. — Use by Fishermen

Wildlife Present

Heavy beaver activity.

Comments and Recommendations

Culverts on Tamgas Apt. Road are barriers to salmon at low tide; beaver dam barrier, 1.8m high, occurs at 520m, preventing adults and fry from entering lake. This stream could produce a significant number of salmon, however, underescapement may be occurring. Escapement counts in the creek are recommended.

Improving culvert for fish movement is recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1971	Low escapement recorded due to heavy subsistence fishing.				
1972	Low relative abundance of pinks was recoreded.				
6/21/81	Coho	Fry	750	-	Very numerous in creek.
9/1/81	Pinks	Adults	300	-	Two balls of fish were seen near mouth; however, 200 in in one ball may be returning from hatchery release out culvert near creek culvert.

Survey(s) and Dates Conducted

J. Yuska, 6/21/81 and USFWS, 9/24/71

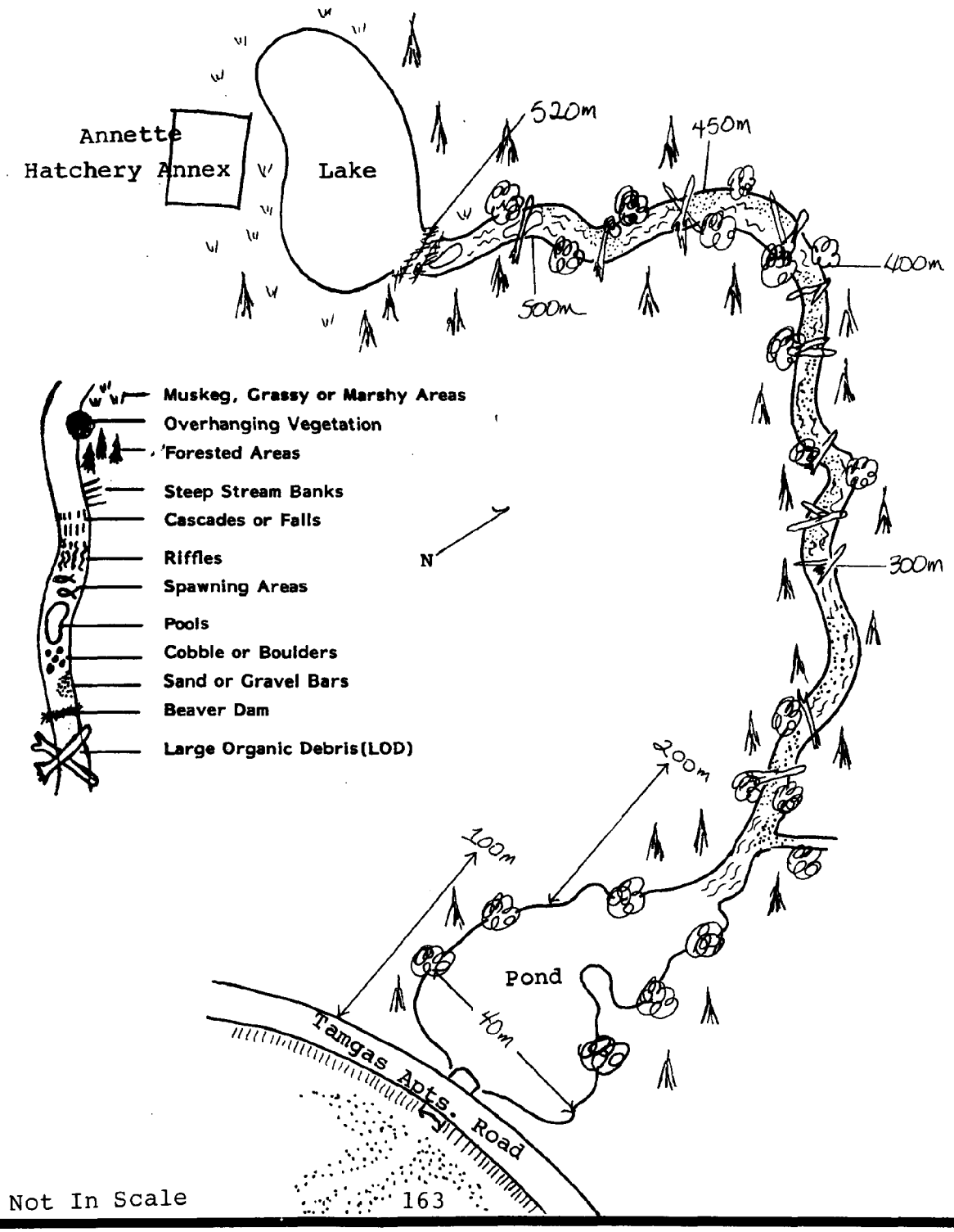
Recommended Escapement

Recommended escapement is 188 pinks, 12 chum and 7 coho spawning pairs based on available spawning area.

Potential Production Summary

Gravel is generally of good quality so a 10% egg-fry survival rate will be assumed. Based on the above escapements, potential production is 560 pinks, 60 chum and 40 coho returning to Annette Island.

Figure 31. COAST GUARD CREEK



Not In Scale

COAST GUARD CREEK

Watershed No. 405-07
Stat. No. 101-26-006

-50m	12m wide x 50m long intertidal spawning area with 5% gravels ($30m^2$ total area available) of marginal quality.
0m	Upper end of culvert (passable) that goes under the gravel Tamgas Apartment Road. High Tide Mark (HTM) at culvert.
0-100m	A large pond here 40m wide (used as swimming hole in summer).
100-200m	Stream narrows from pond to stream. A tributary with .125 cfs flow and $10m^2$ spawning area enters at 200m.
200-300m	Average Stream Width (ASW) = 1m, Average Stream Depth (ASD) = .07m, with 20% gravels ($20m^2$ spawning area); 14 coho fry observed.
300-400m	ASW = 1.5m; bottom composition: 30% gravels, 30% sand, 40% pebbles ($45m^2$ spawning area); 15 coho fry seen and rearing habitat is good in this stretch.
400-500m	Alot of algae and insects in bottom with alot of LOD in the stream; canopy shading 50% (20% due to banks and 30% vegetation). At 450m is an old redd and $7.5m^2$ spawning area (only area in stretch).
500m	2 coho fry seen in pool.
520m	Beaver dam behind which is the creek origin, small lake next to the Annette Island Hatchery Annex.

Spawning Area:

Intertidal	$30m^2$
Above HTM, approximately	$83m^2$

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Colby Creek	101-26-007	405-08

Location: Flows E into Tamgas Harbor, .7 mi long.
Origin: Muskeg pools and run-off. / Forested muskeg flats, .5mi^2 in area.
Watershed Type

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/3/81	875m to barrier from High Tide Mark (HTM)	Culvertless road at .5 mi.	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2% in lower stretch, 3% near road.	3.5 cfs up to 40 cfs with rain	1.5 - 1.9 fps to 3.5 fps (8/25/71)	1.5m to 2m	.15m / --

Streambank Composition: High banks (10 ft) stabilized by root wads and logs (heavy LOD influence). / Stability
Tributaries: One tributary enters creek.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/25/71:	12.8C	15.0C	6.5	--	--	9.7ppm	11.5ppm
--	11.0C	11.5C	5.5	Clear / None	Brown	(7/31/79)	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (8/25/71)	--	20.0ppm (8/25/71)	Flashy creek, influenced by rainfall easily.

Spawning Area

Overall Stream Bottom Composition: Overall creek bottom is 80% gravels (mostly small, 2.5-3 inches in diameter), the rest is pebbles, sand, mud, and silt.

Gravel Compaction: Gravels "dirty" - moderate compaction.

Spawning Area Available Above High Tide Mark (HTM): Two probable redds observed - 5% spawning area in section surveyed. Total available area is approximately 55m^2.

Intertidal Spawning Area: Limited - marginal quality gravels.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
p:r = 4:1; riffles are light and average depth = .08m	.20m / to .60m	-- --

Available Cover: Excellent cover provided by tight and thick riparian vegetation, 40-50cm undercut banks, and some LOD.

Aquatic Invertebrates/Available Food Source: None seen / Food source is primarily terrestrial insects.

Aquatic Vegetation: Scarce

Terrestrial Vegetation: Muskeg vegetation; grasses, apple, alder in cedar, hemlock, spruce canopy.

Shading: 30-50% shading, mainly due to canopy - creek open to just above HTM.

Extent and Quality of Rearing Area: Alot of rearing area is available in small pools, under LOD and undercut banks.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink, chum, and coho utilize the creek.

Use by Fishermen: Some subsistence fishing occurs.

Wildlife Present

None seen.

Comments and Recommendations

This creek produces a moderate amount of salmon and is limited by the small creek size and marginal quality of the gravels. More creek area could be opened by placing a culvert in the road; however, it is doubtful that the increase in production realized would justify the cost.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
10/12/71	Pinks	Adult	204	126	
1972	Pinks	Adult	746	--	USFWS Estimated Escapement
1973	Pinks	Adult	2655	--	USFWS Estimated Escapement
9/10/74	Pinks	Adult	257	7	
9/19/74	Pinks	Adult	546	32	
	Chum	Adult	1	0	
9/26/74	Pinks	Adult	192	62	
	Chum	Adult	2	0	
10/11/74	Pinks	Adult	175	0	
	Chum	Adult	3	0	
	Coho	Adult	5	0	
1974	Pinks	Adult	600	--	Peak Count - USFWS
	Chum	Adult	3	--	Peak Count - USFWS
	Coho	Adult	5	--	Peak Count - USFWS
1974	Pinks	Adult	1092		USFWS Estimated Escapement
8/29/75	Pinks	Adult	19	1	
9/8/75	Pinks	Adult	957	46	
9/21/75	Pinks	Adult	235	618	
10/1/75	Pinks	Adult	88	215	
1975	Pinks	Adult	1000	--	Peak Count - USFWS
1975	Pinks	Adult	1380	--	USFWS Estimated Escapement
1976	Pinks	Adult	189	--	USFWS Estimated Escapement
9/7/80	Pinks (mixed)		1000	--	Estimated ball of fish at mouth (aerial count).
6/3/81	Coho	55mm fingerling (0+)	2		Very dark fish (due to water quality?).
9/1/81	Pinks	Adult	150-200	--	Estimate - ball of fish at mouth (aerial count).
9/13/81	Pinks	Adult	50	--	Foot count - seen in creek.

Addition Water Quality Data:

7/31/79 - Flow - .01 cfs (questionable), Temp. (Water) - 14.0C, Tannic Acid - 54 mg/l
8/25/79 - Flow - 12 cfs, 9/26/74 Temp. (Water) - 12.2C, 10/11/74 Temp. (Water) - 13.9C.

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/3/81 and USFWS, 8/25/71 and Pacific Rim Planners, Inc., 7/31/79

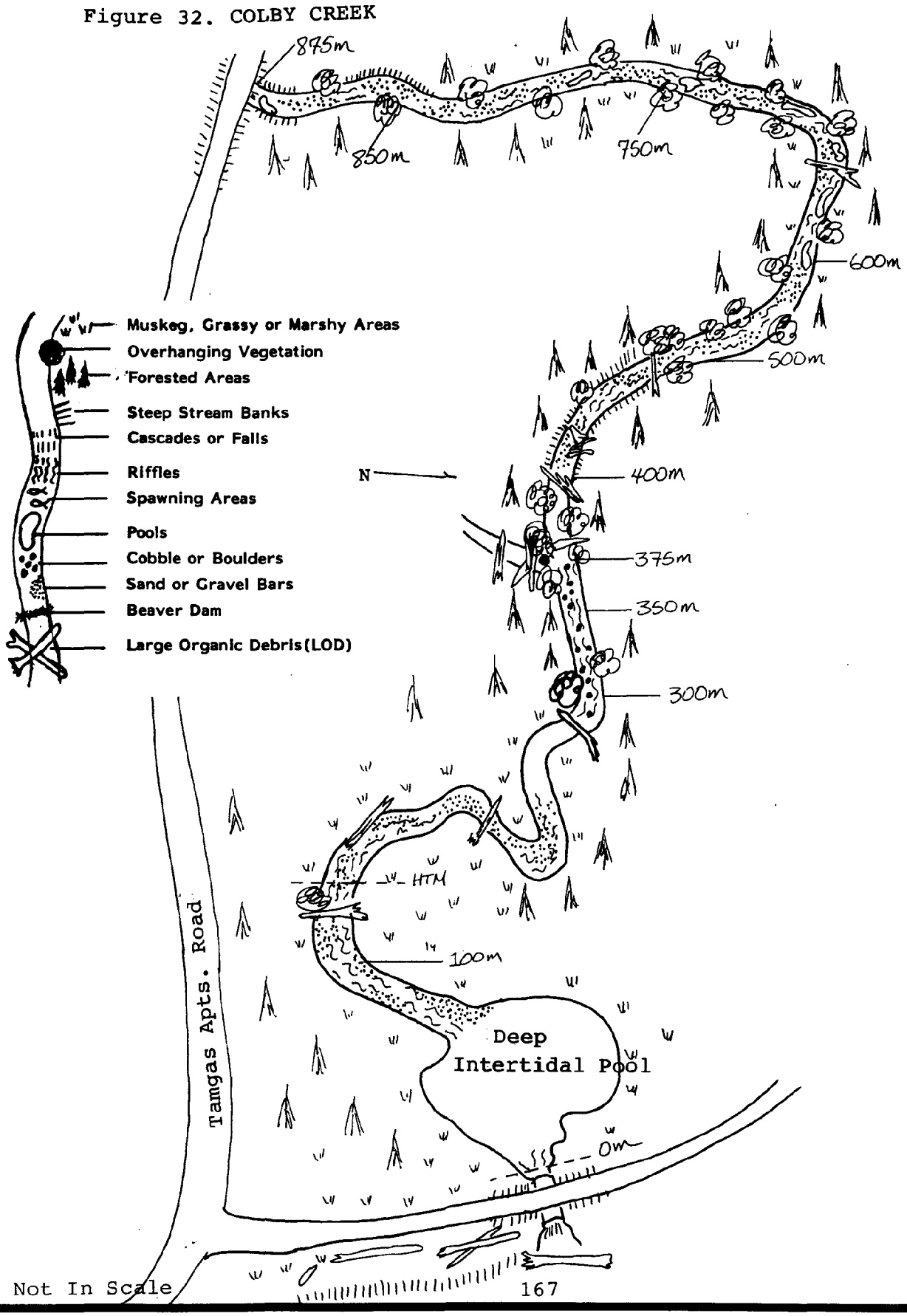
Recommended Escapement

According to available spawning area and historical escapements, recommended escapement is 200 pink, 6 chum, and 5 coho spawning pairs be allowed to spawn in this creek. Historical escapements are higher, this is probably a harvestable surplus from the creek and strays attracted to the creek culvert.

Potential Production Summary

Assuming a 10% egg-fry survival rate (assuming gravels experience a certain amount of flushing and based on previous production), potential production based on the above escapements is: 594 pinks, 30 chum and 28 coho. These figures are lower than realized production during several years exhibiting the conservativeness of the estimate. In those years, marine survival was probably much higher than 2%.

Figure 32. COLBY CREEK



Not In Scale

COLBY CREEK

Watershed No. 405-08
Stat. No. 101-26-007

0m	Upper end of culvert (passable) flowing under small dirt road. Above 0m is a large, deep intertidal pool.
100m	Adverage Stream Depth (ASD) = .30m, banks are undercut to .4-5m, gravels "dirty" mixed with alot of fines.
150m	High Tide Mark (HTM) above a large log across the channel.
300m	Gradient increases and canopy increases to 30% cover, bottom has cobble, gravel and angular boulders. Below 300m, creek flows through a grassy meadow.
350m	ASW = 1.7m
375m	Stream forks under dense LOD.
400m	Stream still choked with LOD, riparian vegetation is very thick and stream velocity is moderate to fairly high.
500m	Low canopy, LOD chokes heavily undercut banks; stream gradient moderate to high with cutthroat and coho fry observed here and above.
600m	Gradient low, better quality pools and rearing area here; many fry spotted.
750m	Canopy 30-50%, gravels are ½ inch with alot of fines mixed in; undercut banks.
850m	Old redds observed.
875m	Rock barrier at Tamgas Apartment Road (no culvert). From 600m, trees are stunted as area is generally muskeg.

Spawning Area: Limited, Above HTM only about $55m^2$ of patchy spawning area is available.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode	Watershed Type
Hospital Creek	101-26-008	405-09	Forested muskeg - gently rolling hills. 2mi^2 in area.

Location: Flows SE into Tamgas Harbor, .3mi long./ Hospital Lake and muskeg run-off./

Origin

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/13/81	Entire section, 550m - mouth of Lake.	Log in creek is a possible barrier at low flow.	Moderate flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5 - 2%	3.5 cfs/ at flodding up to 10-15 cfs.	1.5 fps / to 2 fps	4m /1.8-6.3m	.1-.2m / --

Streambank Composition / Stability: Steep, heavily vegetated banks with some LOD influence./Stable banks

Tributaries: None

Water Quality 8/25/71:

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	14.4C	13.3C	7.0	--	--	7.8-9.6 (1979)	3.5ppm (8/25/71)
	11.0C	13.0C	5.5	Clear / None	Dark Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (8/25/71)	36.0ppm (8/25/71)	30.0ppm $CaCO_3$ (8/25/71)	- See next sheet for additional data.

Spawning Area

Overall Stream Bottom Composition: Large rubble/boulder (of less than 12 inch size) predominates bottom with angular gravels mixed in.

Gravel Compaction: Alot of organic floc occurs in the upper gravels and they are angular.

Spawning Area Available Above High Tide Mark (HTM): Limited; little spawning area is available for coho and steelhead (gravels are small -1.5 inch diameter size predominating). Much more occurs in the lower end. Only about 50m^2 occurs above HTM.

Intertidal Spawning Area: Some available, but it is limited - actually the best gravels occur intertidally, approximately 250m^2 is available.

Rearing Area

Pool/Riffle Frequency (P:R Ratio): p:r = 4:1, pools are located evently throughout stream as well as the four riffles./

Ave. Pool Depth/Range: .30m / to .70m

Ave. Pool Size/Range: 3m diameter / --

Available Cover: Limited except in lake area.

Aquatic Invertebrates/Available Food Source: Sparse - however, diptera and trichoptera were observed.

Aquatic Vegetation: Sparse - the thickest occur next to the lake where moss covers 10% of the bottom.

Terrestrial Vegetation: A tight canopy occurs near the mouth of alder, sitka, spruce, and hemlock mainly.

Shading: 60-90% due to canopy in lower end of creek; it opens up near lake.

Extent and Quality of Rearing Area: Extensive, good quality rearing occurs in the lake, however, it is limited in the stream itself.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink, chum, and coho utilized the creek.

Use by Fishermen: Some subsistence fishing occurs.

Wildlife Present

Beaver activity at Hospital Lake; some land otter predation reported in 1971.

Comments and Recommendations

USFWS removed a log barrier, 165m up the creek on 9/15/71. At 300m, another large log that may be a barrier should also be removed. There may be additional, unsurveyed spawning area above the lake to allow so many spawning fish in the creek, because only a couple redd sites occur suitable for coho. This creek is mainly a pink and chum producing stream with much of the spawning occurring intertidally.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/10/71	Pinks	Adult	460	1	USFWS Peak Counts
	Chum	Adult	1	1	USFWS Peak Counts
	Coho	Adult	2	1	USFWS Peak Counts
1972	Pinks	Adult	3942	--	USFWS Estimated Total Escapement
1973	Pinks	Adult	3515	--	USFWS Estimated Total Escapement
9/10/74	Pinks	Adult	710	7	USFWS On-foot Count
	Coho	Adult	0	1	USFWS On-foot Count
9/11/74	Pinks	Adult	648	9	USFWS On-foot Count
9/18/74	Pinks	Adult	1835	152	USFWS On-foot Count
	Chum	Adult	8	0	USFWS On-foot Count
	Coho	Adult	2	0	USFWS On-foot Count
9/19/74	Pinks	Adult	1105	257	USFWS On-foot Count
	Chum	Adult	4	1	USFWS On-foot Count
9/24/74	Pinks	Adult	974	925	USFWS On-foot Count
	Chum	Adult	2	2	USFWS On-foot Count
	Coho	Adult	1	1	USFWS On-foot Count
10/4/74	Pinks	Adult	2292	0	USFWS On-foot Count
	Chum	Adult	70	0	USFWS On-foot Count
	Coho	Adult	8	0	USFWS On-foot Count
10/10/74	Pinks	Adult	402	0	USFWS On-foot Count
	Chum	Adult	3	0	USFWS On-foot Count
	Coho	Adult	3	0	USFWS On-foot Count
10/17/74	Pinks	Adult	26	0	
	Chum	Adult	1	0	
	Coho	Adult	11	0	
1974	Pink	Adult	3200	--	USFWS Peak Counts
	Chum	Adult	72	--	
	Coho	Adult	11	--	
1974	Pink	Adult	4584	--	USFWS Estimated Total Escapement
8/29/75	Pink	Adult	34	--	USFWS On-foot Count
9/5/75	Pink	Adult	586	1	USFWS On-foot Count
9/21/75	Pink	Adult	193	3147	USFWS On-foot Count
10/3/75	Pink	Adult	2357	411	USFWS On-foot Count
	Chum	Adult	21	46	USFWS On-foot Count
10/16/75	Coho	Adult	4	0	USFWS On-foot Count
1975	Pink	Adult	5504	--	USFWS Peak Count
	Chum	Adult	67	---	USFWS Peak Count
	Coho	Adult	4	--	USFWS Peak Count
1975	Pink	Adult	3482		USFWS Estimated Total Escapement
1976	Pink	Adult	1275		USFWS EStimated Total Escapement
7/18/79	Unidentified Salmonids - Fry		Several	--	Seen in pools.
9/20/79	Pink	Adult	600	--	P.R.P.I. On-foot Count
	Chum	Adult	10	--	P.R.P.I. On-foot Count

CONTINUED ON SECOND SHEET

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/13/81 and USFWS, 8/25/71 and Pacific Rim Planners, Inc., 7-9/79

Recommended Escapement

In 1975, USFWS concluded that spawning area was available for approximately 3200 fish (mainly pinks). According to the spawning area available and historical escapements, recommended escapements are 500 pink, 33 chum, and 5 coho spawning pairs.

Potential Production Summary

Assuming a 10% egg-fry survival because of fair gravel quality and the previous production record, potential production estimates are 1500 pink, 164 chum and 28 coho returning to Annette Island. As with Colby Creek, it can be seen that in many years, this potential is exceeded and shows how conservative the estimate is. Marine survival probably exceeded 2% in those years.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/7/80	Pinks (mainly - mixed)	Adult	3800	--	Ball of fish at mouth (aerial count).
6/3/81	No fish seen				
9/1/81	Pinks (mainly - mixed)	Adult	100-200	--	Ball of fish at mouth (aerial count).

Additional Water Quality Data:

USFWS: 8/25/71 - 5.0 cfs flow

P.R.P.I.: 7/18/79, Temp (Water)- 16.0C
7/29/79, Flow -.09cfs Temp. Water- 14.5C D.O.- 8.2ppm Conductivity -130 ohms/cm^2
Tannic Acid - 5.8 mg/1
7/31/79, Flow- 2.72cfs Temp. Water- 16.5C D.O.-8.8ppm
8/22/79, Flow- .04cfs Temp. Water- 15.5C D.O.-7.8ppm Conductivity- 165 ohms/cm^2
9/20/79, Flow - 1.26cfs Temp. Water - 12.0C (Air= 10.5) Tannic Acid - 42 mg/1
D.O.-9.6ppm Conductivity- 130 ohms/cm^2,
9/24/79, Tannic Acid - 47 mg/1

Other: 7/25/79 - N(NO3) = 1.1mg/1, N (NO_2) = .09 mg/1, PO_4 = Near 0 mg/1

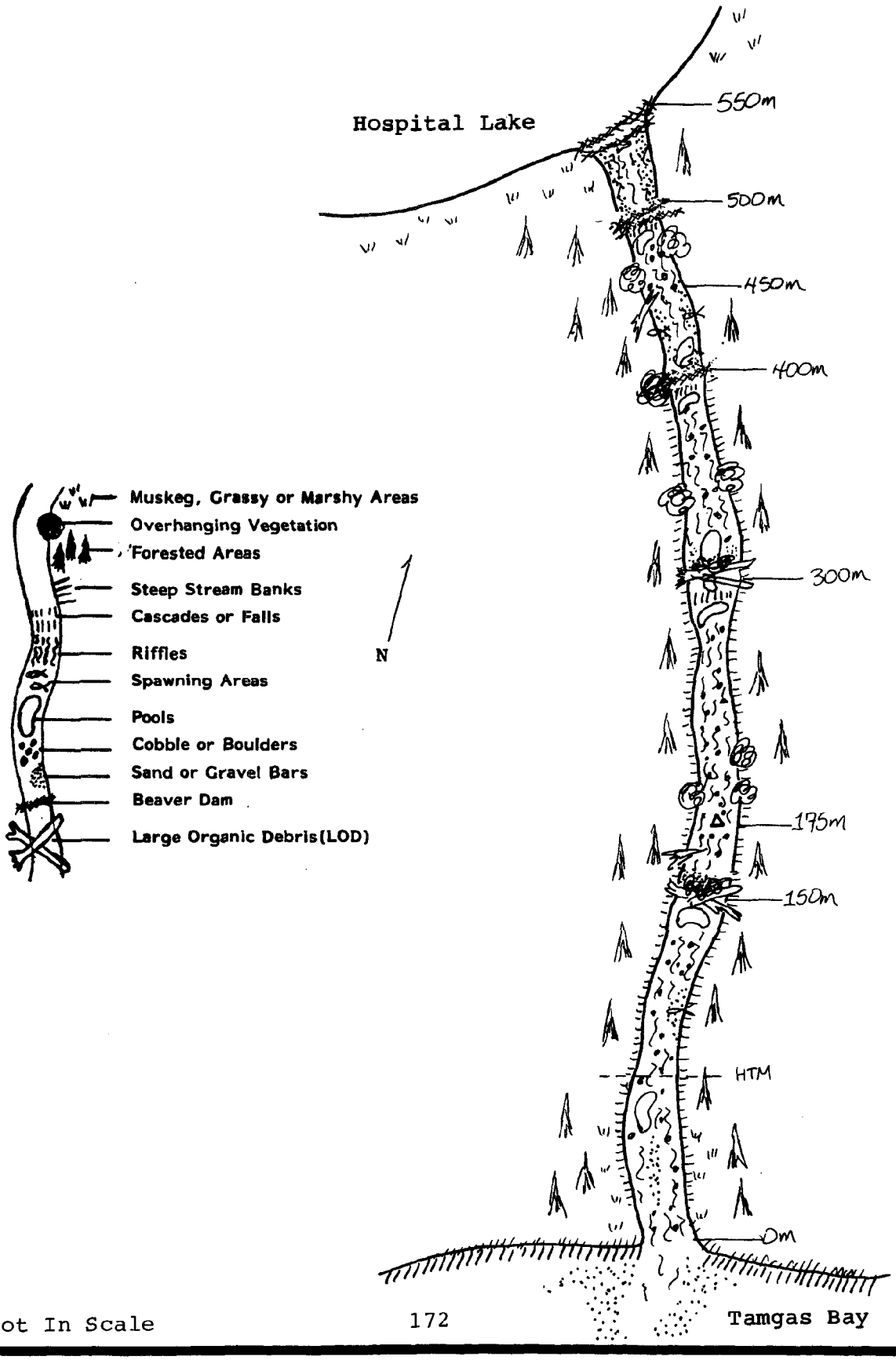
HOSPITAL CREEK

Watershed No. 405-09
Stat. No. 101-26-008

0m	Stream mouth.
75m	High Tide Mark (HTM).
150m	Passable debris jam, Average Stream Width (ASW) = 5m, Average Stream Depth (ASD) = .1m, canopy is fairly dense.
175m	Stream Survey Station, velocity is 1.5 fps.
300m	1m high log across creek (a possible barrier) with a pool .5m deep, 3m wide; canopy shading 60% here.
400m	2 x 20 feet debris dam - probably an old beaver dam, with good spawning area to 450m.
450m	Cobble and large boulder substrate begins here.
500m	Beaver dam; 10% of bottom covered with moss.
550m	Lake and beaver dam; from 500m, some good gravels and spawning area exists. Lake is good rearing habitat.

Spawning Area: Limited, only about $50m^2$ above HTM.

Figure 33. HOSPITAL CREEK



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ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Powerhouse Creek I	101-26-015	404-01

Flows S into Tamgas Harbor, 1.0 mi long./ Muskeg ponds, springs, and run-off./ Muskeg flats and some mountain foothills.

Location	Origin	Watershed Type
900m above High Tide Mark (HTM)	Above 400m, steepness may be velocity barrier.	

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/7/81			Moderate Flow	+ 2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Variable: 1.5-6%	1 cfs to 3 cfs (9/14/71)	1 fps/ Rapid in upper section.	1.5m to 2.5m	.10m / --

Sloped rock and vegetation in soils banks./
Fairly stable with a little active bank cutting.

Streambank Composition / Stability	Tributaries
	Two - small ones.

Water Quality

Water quality taken 9/14/71 -

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
	12.8C	10.5C	6.0	Clear / None	Brown	-	36ppm

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm	12.0ppm	10.4ppm $CaCO_3$	--

Spawning Area

15% boulder, 20% rubble, 25% cobble, 15% gravel, 15% pebble, 10% sand - trace silt and organic matter.
Overall Stream Bottom Composition

Good quality - granitic gravels are rounded - minimal.
Gravel Compaction

Only about 1.5% area is available - approximately $20m^2$ area total.
Spawning Area Available Above High Tide Mark (HTM)

$40m^2$ good quality area occurs just above the culvert under the B.I.A. road.
Intertidal Spawning Area

Rearing Area Generally pools are shallow, caused by LOD, pools in 30% of bottom, riffles in 10%.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.20m to .30m	-- --

Pools do not provide alot of cover and banks are steep; however, root tangles provide a bit.
Available Cover

A few observed - not dense - diptera, trichoptera and ephemerotera observed.
Aquatic Invertebrates/Available Food Source

Scarce - there is a little algal growth on submerged rocks.
Aquatic Vegetation

Mosses and ferns, alot of currant, salmonberry, under a hemlock, cedar and spruce canopy.
Terrestrial Vegetation

Intense - 95% due to both thick riparian vegetation and steep banks (topographical).
Shading

Some coho rearing areas are available in the lower end of the creek - but it is not extensive - steep gradient and sparse cover limits the rearing area available.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum and coho utilize the creek.
Use by Fish

Some reported subsistence fishing occurs.
Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Spawning area is limited, but of good quality, management of stream should be geared toward pink and chum, due to limited rearing area available for coho, although they do utilize the creek. The powerhouse tailwaters may attract more pinks than can utilize this creek, creating an overescapement. No habitat improvement is recommended at this time.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/14/71	Pinks	Observed in creek - not counted.			
1973	Pinks	Adults	100		USFWS Estimated Total Escapement
1975	Pinks	Adults	81	--	USFWS Estimated Total Escapement
1976	Pinks	Adults	42	--	USFWS Estimated Total Escapement
9/7/80	Pinks mainly (mixed)	Adult	1000	--	Seen at creek mouth, an additional were attracted to the power-house tailwaters.
6/7/81	Coho	0+ Fry	3	--	Intertidally (above culvert) and 1 at 150m.
9/1/81	Pinks mainly (mixed)		300-400	-	A ball of fish was outside mouth, some of which may have been attracted by the tailwaters (aerial count).

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/7/81 and USFWS, 9/14/71

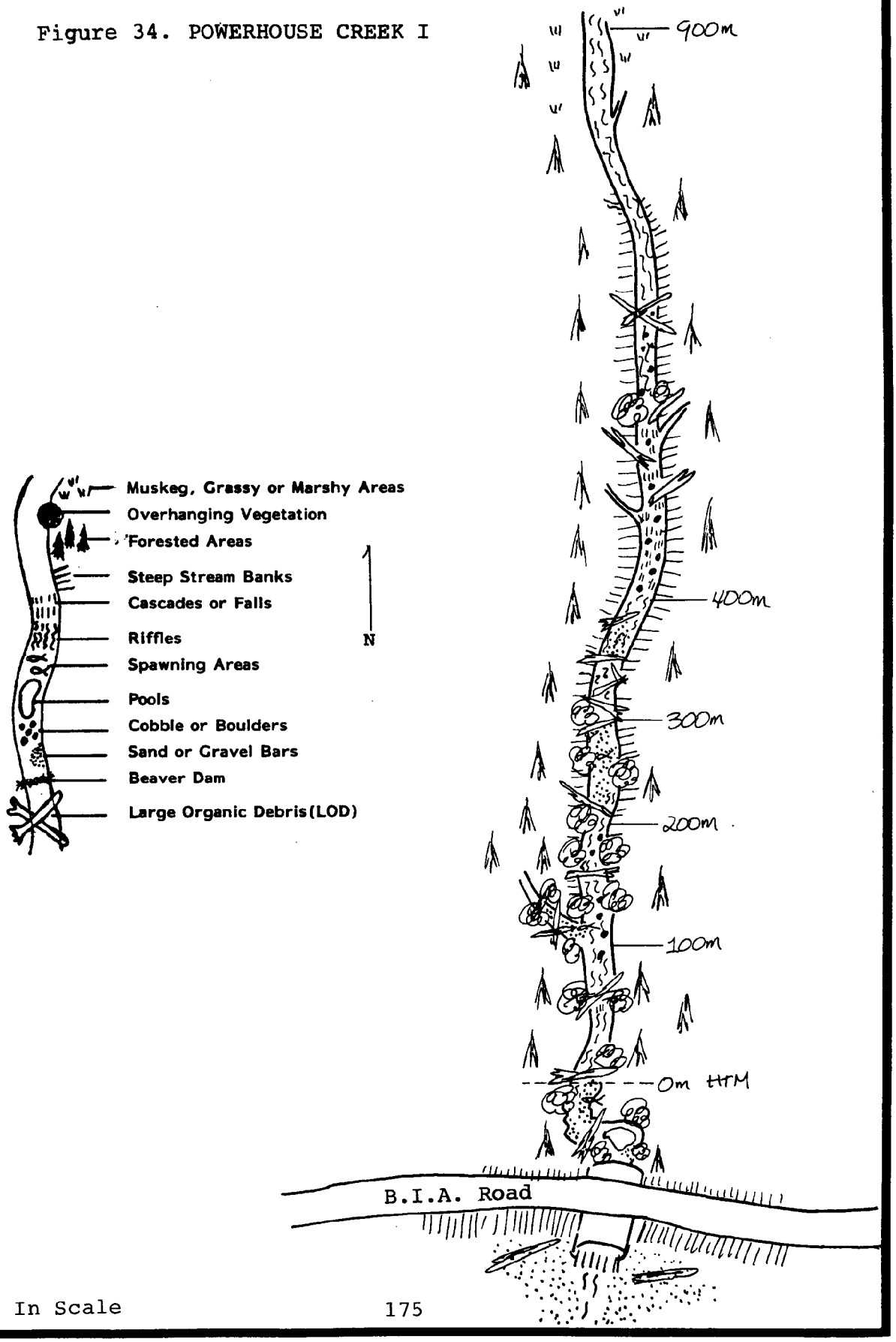
Recommended Escapement

According to available spawning area, recommended escapements are 90 pink, 6 chum and 2 coho spawning pairs (even though historical escapement counts are higher).

Potential Production Summary

Potential production, assuming a 10% egg-fry survival rate, is estimated at 270 pinks, 30 chum, and 11 coho returning to Annette Island. The powerhouse tailwaters may be attracting an artifically high number of pinks to this creek and/or marine survival may have exceeded 2% in a few years resulting in the large escapement figures in past years.

Figure 34. POWERHOUSE CREEK I



Not In Scale

POWERHOUSE CREEK I

Watershed No. 404-01
Stat. No. 101-26-015

0m	High Tide Mark (HTM). Below 0m is large pool above culvert (under BIA road) and about $40m^2$ of good quality spawning gravels.
100m	Moderate gradient, bottom is cobbles mixed in with small gravels (too small for spawning).
110m	Stream splits, tributary has an Average Stream Width (ASW) = 1m, Average Stream Depth (ASD) = 0.5m - spawning areas in tributary could be used during high flows, whole channel is defined by LOD.
100-200m (Main Channel)	ASW = .75m, ASD = .08m (more flow and cleaner gravels than in the tributary), large cobble and boulders predominate in the bottom above the tributary, lots of salmonberry on banks of creek.
200-300m	Better spawning gravels occur, but are still of marginal quality, 80% shading.
300-400m	Lots of LOD from blowdown (no stumps or logging here). From 110m; banks have gotten steeper.
400m	At 400m and above, gradient increases; bottom is all cobble and boulder and stream is a sloping cascade (too steep for juvenile salmon migration).
900m	Stream gets steadily smaller, fed by springs.

Spawning Area:

Intertidal, $40m^2$ of good quality spawning area.

Above HTM, limited to about $20m^2$ area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Powerhouse Tailwaters Creek	101-26-016 Mountain slope	404-02

Flows W into Tamgas Harbor, .12 mi long./ run-off and powerhouse tailwaters. Forested mountain slopes.

Location	Origin	Watershed Type
175m from High Tide Mark (HTM) to road.	Culvert at B.I.A. Road	Moderate

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/11/81	.125 cfs / --	sluggish	1.5m / --	.05m / --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Low				

Flashy creek - unstable channel.
Streambank Composition / Stability

None
Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	--	-- Turbid	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	None taken - probably it is okay due to origin.

Spawning Area

Mainly fines - mud, sand and organic debris.
Overall Stream Bottom Composition

Heavy - due to fines.
Gravel Compaction

None
Spawning Area Available Above High Tide Mark (HTM)

Of marginal quality, many fines are mixed in, however, 12.5m^2 area exists.
Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
3 pools in 175m length.	2.m / --	2 x 3.5m /--

Alot of LOD occurs due to construction.
Available Cover
None seen.

Aquatic Invertebrates/Available Food Source
Abundant - green filamentous algae covers 50% of the rocks and periphyton occurs on creek bottom.

Aquatic Vegetation
Skunk cabbage, ferns, mosses, salmonberry, and cedar and hemlock.

Terrestrial Vegetation
Up to 50% due to riparian vegetation and canopy.

Shading
Pools and LOD are abundant, but rearing is limited due to small size of creek and flashiness.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Probably pinks only, could use this creek if they use it at all.

Use by Fish
None known.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

The creek itself is of marginal value in salmon production (although before the road was constructed it may have been better), but the tailwaters attract alot of fish.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments

None seen or expected.

Survey(s) and Dates Conducted

J. Yuska, 6/11/81

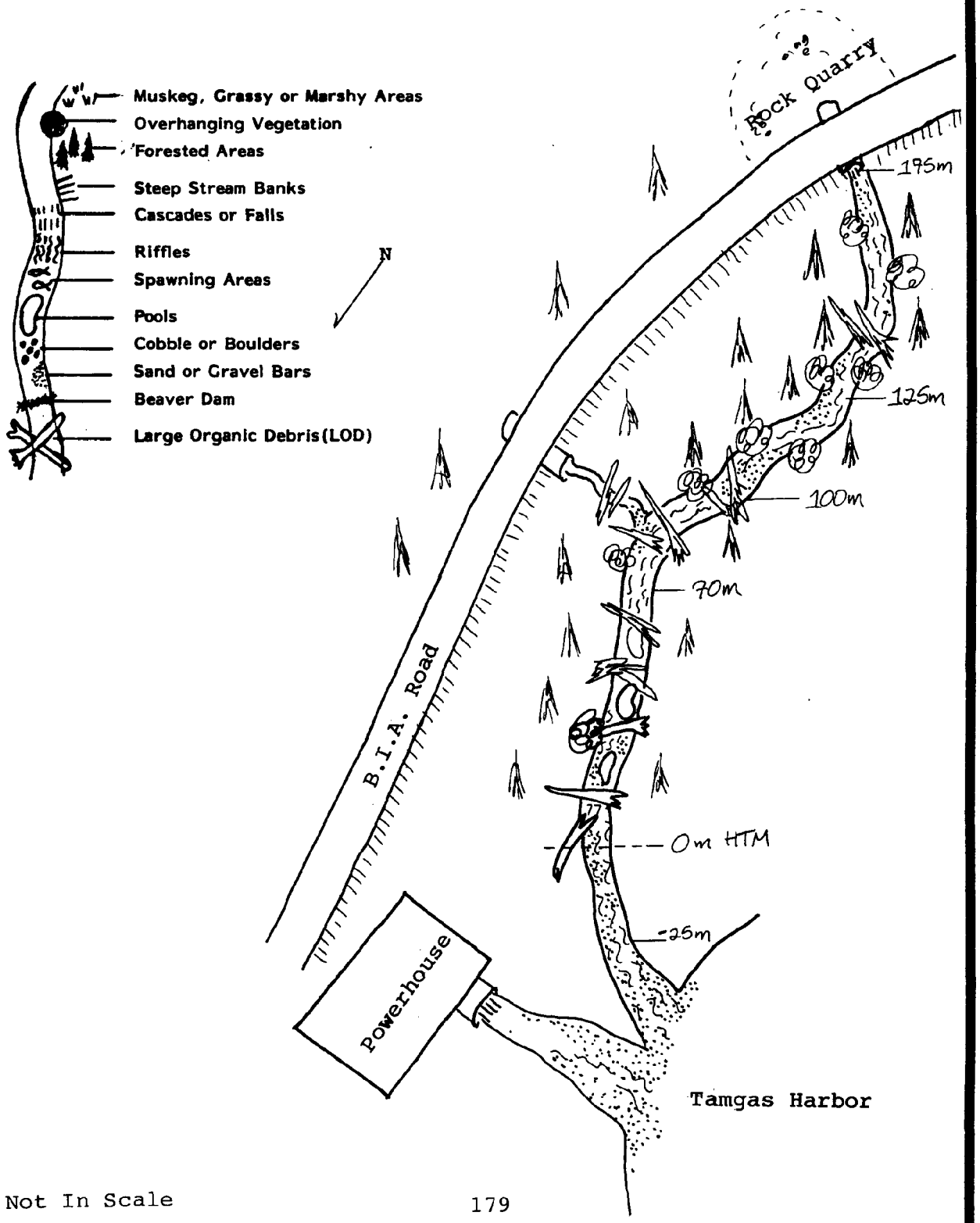
Recommended Escapement

None made.

Potential Production Summary

No production potential is calculated due to the marginal qravel quality and questionable use of the creek by salmon (even though they may be present due to the tailwaters attractive to stray pinks).

Figure 35. POWERHOUSE TAILWATERS CREEK



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POWERHOUSE TAILWATERS CREEK

Watershed No. 404-02
Stat. No. 101-26-016

-25-0m	Average Stream Width (ASW) = 2m; bottom composition: 25% usable gravels (marginal intertidal gravels) 30% sand, 45% angular cobble, about 12.5m^2 spawning area available. High Tide Mark (HTM) at 0m.
0-70m	Three pools in this stretch 2m wide, 3-4m long, .1-.3m deep; organic detritus abundant with very fine anaerobic muds area choked with LOD from road construction.
70-100m	ASW = 1m, slow flow over 100% sand.
125-175m	50% canopy shading with alot of periphyton on the bottom. At 175m, blocked culvert is barrier to fish (creek flows under the road and comes immediately from the rock quarry).

Spawning Area:

Limited, intertidal area is about 12.5m^2

Above HTM, there is none.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Powerhouse Creek II	101-26-017	404-03

Location	Origin	Watershed Type
Flow W into Tamgas Harbor, 1.2 mi long.	Mountain slope run-off.	Forested mountain slope.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/12/73	Unknown	Road and slash	--	--
--	.5 cfs / --	.5 fps / --	.9m / --	.1m / --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Unkown			None	

Streambank Composition / Stability	Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	6.0	Clear / Slight	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

Overall Stream Bottom Composition: Unkown

Gravel Compaction: --

Spawning Area Available Above High Tide Mark (HTM): Unknown

Intertidal Spawning Area: Unknown

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Unknown		

Available Cover: Abundant LOD.

Aquatic Invertebrates/Available Food Source: Unknown

Aquatic Vegetation: None known.

Terrestrial Vegetation: Berries, ferns and timber.

Shading: Intense

Extent and Quality of Rearing Area: Unknown

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Historically, pink, chum and coho utilized creek.

Use by Fishermen: No fishing known.

Wildlife Present

--

Comments and Recommendations

Creek not even noticed in 1981 - the creek may have been blocked and partially destroyed and dispersed by the road construction. At one time it had a good sized run. In 1973, USFWS recommends removing log barriers. In 1981, improvements that could be conducted are rebuilding culvert allowing fish passage, and clearing slash and perhaps trenching to encourage channelization. Benefit:cost estimate (based on production) is recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1972	Pinks	Adults	837	--	USFWS Estimated Total Escapement
1973	Pinks	Adults	1432	--	USFWS Estimated Total Escapement
9/5/74	Chum	Adults	8	--	USFWS On-foot Count
9/10/74	Pinks	Adults	21	15	USFWS On-foot Count
9/19/74	Pinks	Adults	124	32	USFWS On-foot Count
10/3/74	Pinks	Adults	606	--	USFWS On-foot Count
	Chum	Adults	17	--	USFWS On-foot Count
10/11/74	Pinks	Adults	208	--	USFWS On-foot Count
	Chum	Adults	14	--	USFWS On-foot Count
10/17/74	Pinks	Adults	13	--	USFWS On-foot Count
	Chum	Adults	1	--	USFWS On-foot Count
1974	Pinks	Adults	638	--	USFWS Peak Count
	Chum	Adults	17	--	USFWS Peak Count
1974	Pinks	Adults	1248	--	USFWS Estimated Total Escapement
8/26/75	Pinks	Adults	8	--	USFWS On-foot Count
8/29/75	Pinks	Adults	3	2	USFWS On-foot Count
9/5/75	Pinks	Adults	652	2	USFWS On-foot Count
9/19/75	Pinks	Adults	95	913	USFWS On-foot Count
10/1/75	Pinks	Adults	422	264	USFWS On-foot Count
	Chum	Adults	13	16	USFWS On-foot Count
10/17/75	None seen				
1975	Pinks	Adults	1335	--	USFWS Peak Count
	Chum	Adults	29	--	USFWS Peak Count
1975	Pinks	Adults	1301	--	USFWS Estimated Total Escapement
1976	Pinks	Adults	524	--	USFWS Estimated Total Escapement

Survey(s) and Dates Conducted

USFWS, 6/12/73

Recommended Escapement

In previous years, this creek may have produced salmon, however, no escapement recommendations can be made since no spawning area was measured.

Potential Production Summary

This creek may have been damanged and its production potential lessened by the construction of the B.I.A. road (it does seem to have been a moderate producer of pink and chum salmon in previous years). No potential production can be estimated without additional surveys and escapement counts.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Trail Creek	101-26-018	403-01

Location	Origin	Watershed Type
Flows SW into Tamgas Harbor, 1.0 mi long. Mountain slope run-off.		Timbered mountain slope.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/11/81	350m from mouth to 20m falls	Culvert at times and 20m barrier falls.	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Low-moderate	2 cfs / --	Rapid / --	1.75m / --	.1m / --

Streambank Composition / Stability	Tributaries
Flashy creek with unstable banks - alot of hedload transfer occurs during storms - heavy LOD influence.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	--	Clear / None	Clear	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Turbidity probably occurs during storms.

Spawning Area

Overall Stream Bottom Composition
Cobble and gravels mainly - gravel bars 5-15m wide in areas. Porous gravels swallows flow entirely at times.

Gravel Compaction
Some occurs- most gravel is okay.

Spawning Area Available Above High Tide Mark (HTM)
25% usable gravels occur, but low egg survival is expected due to stream flashiness - $80m^2$ area total occurs below culvert.

Intertidal Spawning Area
$120m^2$ area available of marginal quality area - channel is indefinite.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Some pools - a few are deep.	-- --	-- --

Available Cover
LOD and the pools - a moderate amount available.

Aquatic Invertebrates/Available Food Source
Unknown

Aquatic Vegetation
Unknown

Terrestrial Vegetation
Berries, ferns, moss and timber.

Shading
Intense

Extent and Quality of Rearing Area
Limited due to the flashiness of creek and swift velocity, creek channel disappars entirely during low flows.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish
Only pinks and chum could use the creek.

Use by Fishermen
None known.

Wildlife Present

None seen.

Comments and Recommendations

LOD and slash from road construction influences channel heavily and road culvert is a probable fish fish barrier during low flows. This stream dies up completely at times, and is of minor importance at present in terms of production. Gravels are a bit large for spawning, but usable. This creek would make a good interpretive and scenic trail upstream of road because of falls.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
None seen					

Survey(s) and Dates Conducted

J. Yuska, 6/11/81

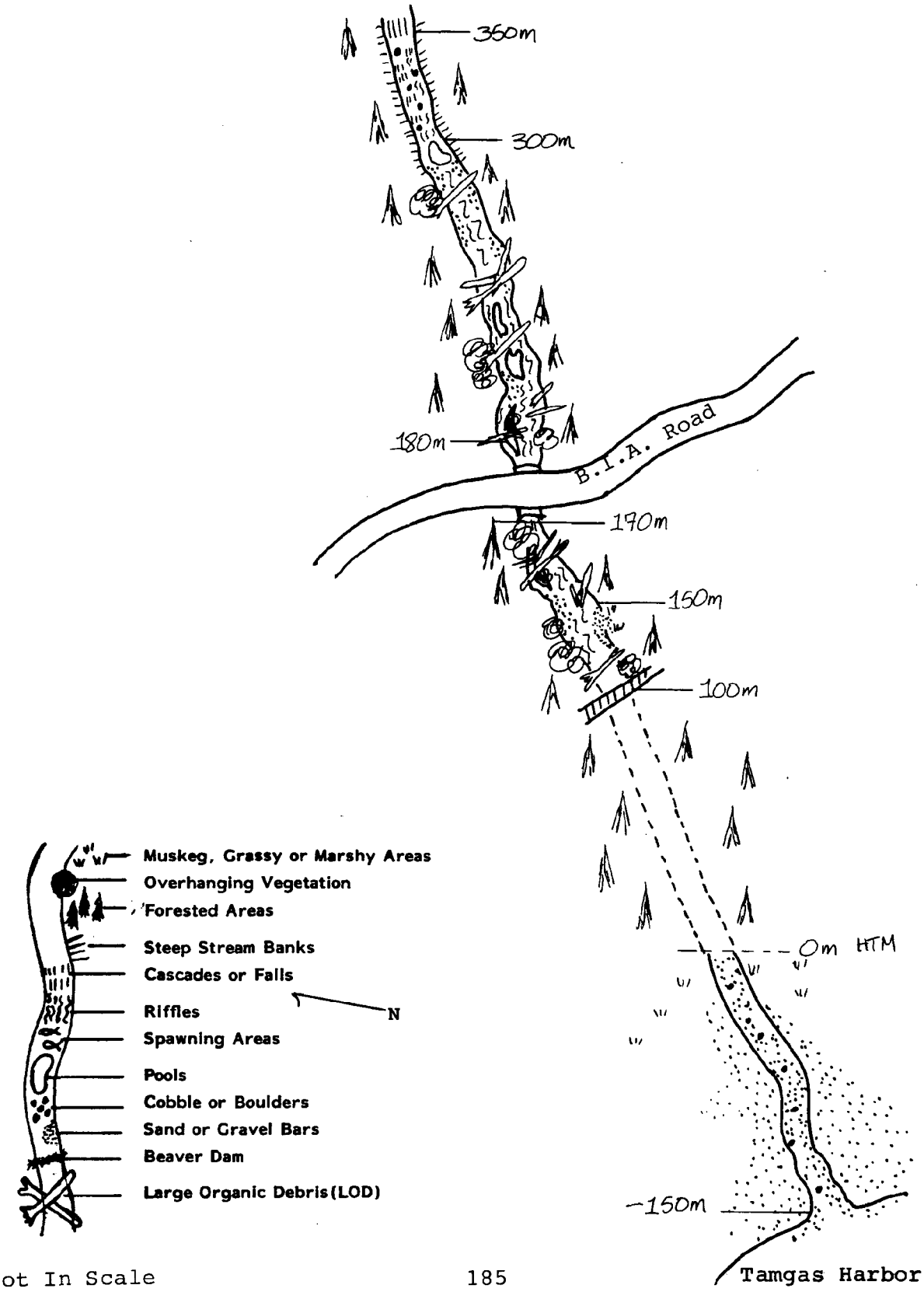
Recommended Escapement

Because of the creeks flashiness, probably only pink and chum salmon make use of it. Recommended escapement based on usable spawning area is 400 pink and 20 chum spawning pairs.

Potential Production Summary

Because of the creeks flashiness, egg survival is low and a 1.2% egg-fry survival rate will be assumed. Potential production is estimated at 142 pinks and 12 chum returning to Annette Island.

Figure 36. TRAIL CREEK



Not In Scale

TRAIL CREEK

Watershed No. 403-01
Stat. No. 101-26-018

-150-0m	High Tide Mark (HTM) at 0m, Average Stream Width (ASW) = 4.m; bottom composition: 40% large cobble, 20% usable gravels and 40% small boulders ($120m^2$ spawning area).
0-100m	Stream completely sinks into cobbles (no flow on the surface). Old bridge at 100m.
100-170m	ASW = 1.75m, ASD = .1m, 5m wide gravel bar mixed with cobble. At 160m begins heavy LOD due to road construction and off channel areas. At 170m is a road culvert (under Tamgas Hatchery Road) that is a possible barrier at low flows.
180m	Braided stream channel with evidence of flashiness.
180-300m	Lots of heavy LOD and porous gravels (probably alot of flow is lost to subsurface flow).
300m	Pool in bedrock is 2 x 3m and .75m deep with granodiorite banks and a bedrock stream bottom.
350m	20m high barrier falls. From 300m, gradient is steep and bottom is all large cobble and small boulders.

Spawning Area:

Intertidal approximately $120m^2$ area.

Above HTM, approximately $70m^2$ is available that is probably usable only at high flows.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Tent Creek	101-26-019	403-02

Location	Origin	Watershed Type
Flows W into Tamgas Harbor, 1 mi long.	Tent Lake and mountain run-off./ Several barrier falls - one near mouth.	Alpine lake and forested mountain slope.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	From mouth to road culvert.	one near mouth.	Low flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	3.5 cfs to 20 cfs (7/1/74)/	Swift / --	3.6m to 1.5-10.5m	.35m / --

Streambank Composition / Stability	Tributaries
Flashy creek acts to make creek unstable - some undercutting occurs.	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	6.8 (7/1/74)	Clear/Slight	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (7/1/74)	--	--	--

Spawning Area

Overall Stream Bottom Composition
Below culvert: 85% bedrock, 5% boulder, 4% rubble, 3% cobble, 2% gravel, 1% pebble, trace sand.

Gravel Compaction
Minimal

Spawning Area Available Above High Tide Mark (HTM)
Limited - large rock and boulder dominate substrate.

Intertidal Spawning Area
None

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools occur in 15% of creek.	to .9m / --	3m diameter or smaller

Available Cover
Heavy LOD and overhanging vegetation, a few undercut banks.

Aquatic Invertebrates/Available Food Source
Sparse - some diptera and ephemeroptera observed.

Aquatic Vegetation
Moderately abundant - periphyton and some aquatic mosses on rocks.

Terrestrial Vegetation
Berries and alder with a spruce, hemlock, cedar canopy.

Shading
Intense - 99% due to canopy, thick overhanging vegetation, and topography.

Extent and Quality of Rearing Area
Some available due to heavy LOD and overhanging vegetation; however, flashiness of creek limits rearing.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish
No known use of creek by fish.

Use by Fishermen
None known - area was used during World War II (old pipeline and campsite are present).

Wildlife Present

None seen.

Comments and Recommendations

Many creek barriers (3m one at HTM - 11 barriers total recorded by USFWS) prevent use of creek by salmon and the great expense to put in a fish passage could probably not be justified due to the small amount of spawning area. No improvements or enhancement is recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments

Survey(s) and Dates Conducted

C. Huntington, 6/20/81 and USFWS, 7/1/74

Recommended Escapement

None made.

Potential Production Summary

No production potential was conducted because no accessible salmon spawning area exists. Trout utilize this creek.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Lower Tamgas Creek	101-26-025	402-01

Flow W into Tamgas Harbor, .3 mi long. Tamgas Lake — Alpine lake and mountain slopes.

Location — Origin — Watershed Type

6/11/81 — Date Surveyed

440m from bay to lake. — Section Surveyed

Weir - beyond that, cascades may block pink and chum. — Barriers

Moderate — Stage

-- — Flood Height

Moderate to steep — Ave. Gradient

40 cfs / 100 cfs (7/26/71) — Flow / Range

Rapid - 2-4 fps — Ave. Velocity/Range

10.5m / -- — Ave. Width/Range

.3m / -- — Ave. Depth/Range

Banks stable - bedrock, boulders and fragmented rocks - stabilized in places by root tangles. — Streambank Composition / Stability

None — Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	10.6C (11/10/81)	7.0 (7/26/71)	-- --	--	--	--

Hatchery keeps track of water quality.

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

50% bedrock, 20% boulders, 15% rubble, 10% cobble, 5% gravel, trace pebbles and sand.
Overall Stream Bottom Composition

None - although gravels are somewhat angular.
Gravel Compaction

Limited because of predominately cobble and boulder substrate - $25m^2$ maximum, area is available.
Spawning Area Available Above High Tide Mark (HTM)

None
Intertidal Spawning Area

Rearing Area

Some deep plunge pools (below cascades) occur. — Pool/Riffle Frequency (P:R Ratio)

-- -- — Ave. Pool Depth/Range

-- -- — Ave. Pool Size/Range

Limited
Available Cover

A few - mayflies and diptera observed.
Aquatic Invertebrates/Available Food Source

Periphyton and moss on rocks are relatively abundant .
Aquatic Vegetation

Some riparian vegetation - mainly is timber (hemlock, spruce and cedar).
Terrestrial Vegetation

45% - due mainly to topography.
Shading

None for coho (plenty available in lake above). Some available for steelhead and trout in riffles.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Weir across creek prevents salmon migration; however, some coho and steelhead are allowed over the barrier. Cutthroat and Dolly Varden utilize creek and lake.
Use by Fish

Limited creek - used mainly by Tamgas Creek Hatchery (some dipnetting and beach seining is allowed).
Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Use of creek is restricted and controlled by the hatchery and it is recommended that in future years, coho and steelhead are allowed to pass in numbers recommended for escapement to spawning creeks above. Rearing area in lake is abundant.

Historical Escapement/Fish Observed

	Date	Species	Size	Numbers-Live	Dead	Comments
	8/6/80	Sockeye	Adults	60	--	Seen in creek and above in Lake.
	6/11/81	None Seen				
	9/1/81	Pinks mainly (mixed)-	Adults	100	--	Ball of pinks noticed outside creek.
As of	11/10/81	Pinks	Adults	2322 (males)	--	
				2626 (females)	--	Tamgas Hatchery Weir Count
		Chum	Adults	143 (males)	--	Most of pinks, chum and many of
				130 (females)	--	the coho were hatchery reared.
		Sockeye	Adults	800	--	Sockeye and steelhead number is
		Coho	Adults	1134	--	from natural production. (More
		Coho	Jacks	333	--	coho are still coming in.)
		Steelhead	Adults	13	--	
		Dolly Varden	Adults	Hundreds	--	

Survey(s) and Dates Conducted

C. Huntington and E. Biggs, 6/11/80 and USFWS, 7/26/71

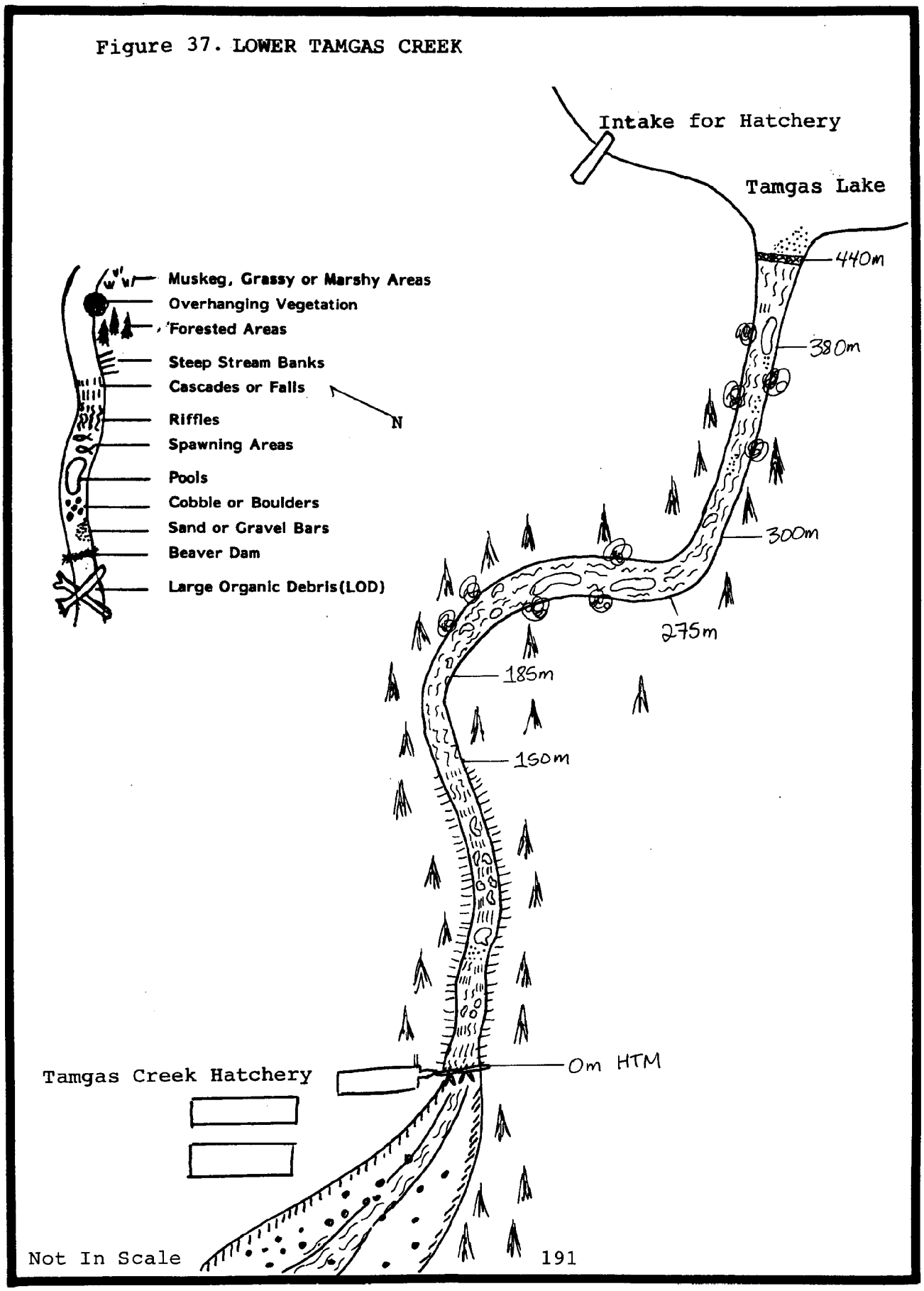
Recommended Escapement

Sockeye are not allowed in the lake anymore due to hatchery disease control procedures, so no escapement recommendations will be made for them. Other salmonids namely coho, utilize this creek only as a migration passage on their way to upper lake tributaries. No recommendations will be made.

Potential Production Summary

Limited to trout, Dolly Varden and steelhead from the creek itself. Other production comes from upper tributaries, Tamgas Lake and Tamgas Creek Hatchery.

Figure 37. LOWER TAMGAS CREEK



LOWER TAMGAS CREEK

Watershed No. 402-01
Stat. No. 101-26-025

0m	High Tide Mark (HTM), fish weir is here. Below, intertidal area is predominately cobble and boulders, no spawning area.
0-150m	Cascades and falls (passable) with a few deep plunge pools (one pool has a gravel tailout available for spawning.
150-185m	Deep run.
185-275m	Two large pools occur between a deep run.
275-300m	Riffles and pools.
300-380m	Riffles and runs with a small amount of angular spawning gravels of fair quality. A bedrock pool occurs at 380m.
380-440m	Riffles and runs. Gabion dam opening to lake at 440m; there is a small patch of gravel at the head of the Gabion. Hatchery water supply intake is approximately 100m to the north of the creek head.

Spawning Area:

Limited, approximately $25m^2$ maximum (bottom is mainly cobble and boulder).

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Upper Tamgas River	101-26-027	402-03

Location	Origin	Watershed Type (10mi² area)
Connects Upper and Lower Tamgas Lakes, .5 mi long.	Upper Tamgas Lake	Timbered mountain slopes and a little muskeg area

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
8/19/72	Entire stream	At 225m, 9m falls	-(Flood plain 12-30m)	+1.5 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
3.0%	3.0 cfs / --	2.5 fps / Rapid	10m / 4.5-22.5m	.35m / --

Streambank Composition / Stability	Tributaries
Steep banks (2.5m high) - heavily vegetated - no erosion./ Stable (some flooding occurs	None

Water Quality Date sampled 8/19/72

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	13.3C	17.1C	6.8	Clear / None	--	--	Trace

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace	60ppm NaCl	5.14ppm free $CaCO_3$	--

Spawning Area

Overall Stream Bottom Composition: 10% boulder, 20% rubble, 40% cobble, 25% gravel, 5% pebble, trace sand, trace organic matter.

Gravel Compaction: --

Spawning Area Available Above High Tide Mark (HTM): Excellent spawning area, approximately 1100m² area is currently available (USFWS recommended allowing 1500 sockeye spawners escapement).

Intertidal Spawning Area: Not applicable.

Rearing Area p:r = 25-75%, riffles are less than .45m deep, few pools (they occur behind LOD and near banks). -- / to 1.2m Small to moderate in size

Pool/Riffle Frequency (P:R Ratio) | Ave. Pool Depth/Range | Ave. Pool Size/Range

Available Cover: Little overhanging vegetation - some pools available, some undercut banks and side channels.

Aquatic Invertebrates/Available Food Source: A few - diptera and trichoptera larvae seen.

Aquatic Vegetation: None

Terrestrial Vegetation: Muskeg grasses; spruce and hemlock.

Shading: 70% shading due to brush and timber.

Extent and Quality of Rearing Area: Some cover is available, but rapid creek velocity and bouldery cascades limit area - plenty is available in lake below.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Coho, cutthroat and Dolly Varden use stream; sockeye used to use it (before Weir was put in).

Use by Fishermen: Possible light subsistence fishing, but doubtful that fishing still occurs.

Wildlife Present

None seen.

Comments and Recommendations

No habitat improvement is recommended (a fish passage over the falls would not increase production that much). They stated that the creek was definitely underutilized (recommended 1500 sockeye escapement).

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/20/71	Sockeye	Adult (average 6 lbs.)	1204	--	In creek
	Sockeye	Adult	100		At creek mouth
8/19/72	Sockeye	Adult	450	--	
8/73	Sockeye	Adult	35	--	
8/1/74	Sockeye	Adult	194	--	
	Coho	Fry	Few	--	Seen below lower falls.
8/6/80	Sockeye	Adults	60	--	Probably utilized this creek and Lea Creek (observed in Lower Tamgas Creek).
Fall '81	See Weir Count for Lower Tamgas Creek				

Survey(s) and Dates Conducted

USFWS, 9/20/71, 8/19/72, and 8/1/74

Recommended Escapement

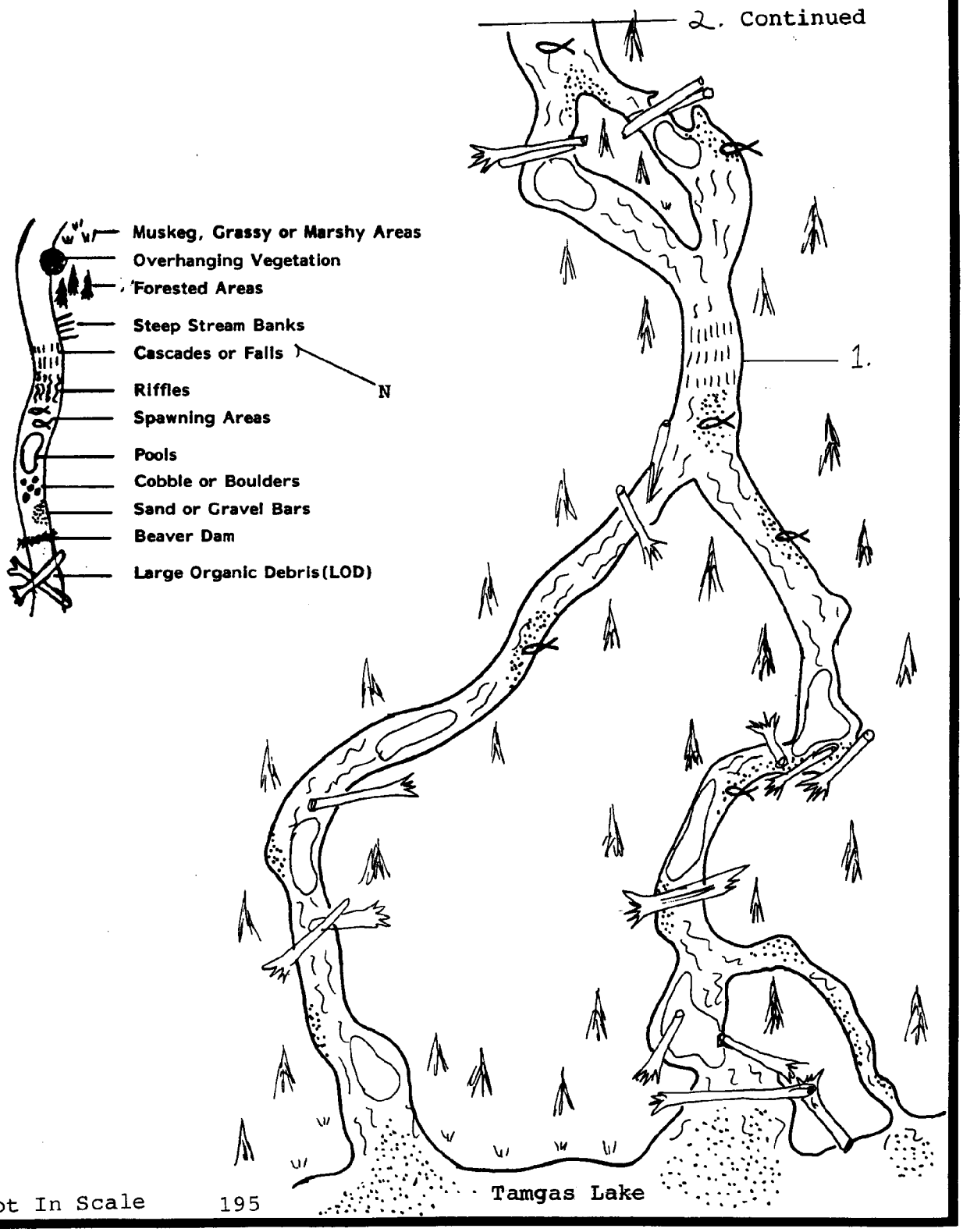
Based on the USFWS surveys, 94 coho spawning pairs could utilize this creek (however, that estimate is probably high). Sockeye are not allowed to utilize Tamgas Lake anymore.

Potential Production Summary

(Combined with Lea Creek)

530 coho could potentially return to Tamgas Creek resulting from production in this creek (assuming a 10% egg-fry survival rate since gravel quality is unknown).

Figure 38. UPPER TAMGAS RIVER - Section 1



Not In Scale

UPPER TAMGAS RIVER

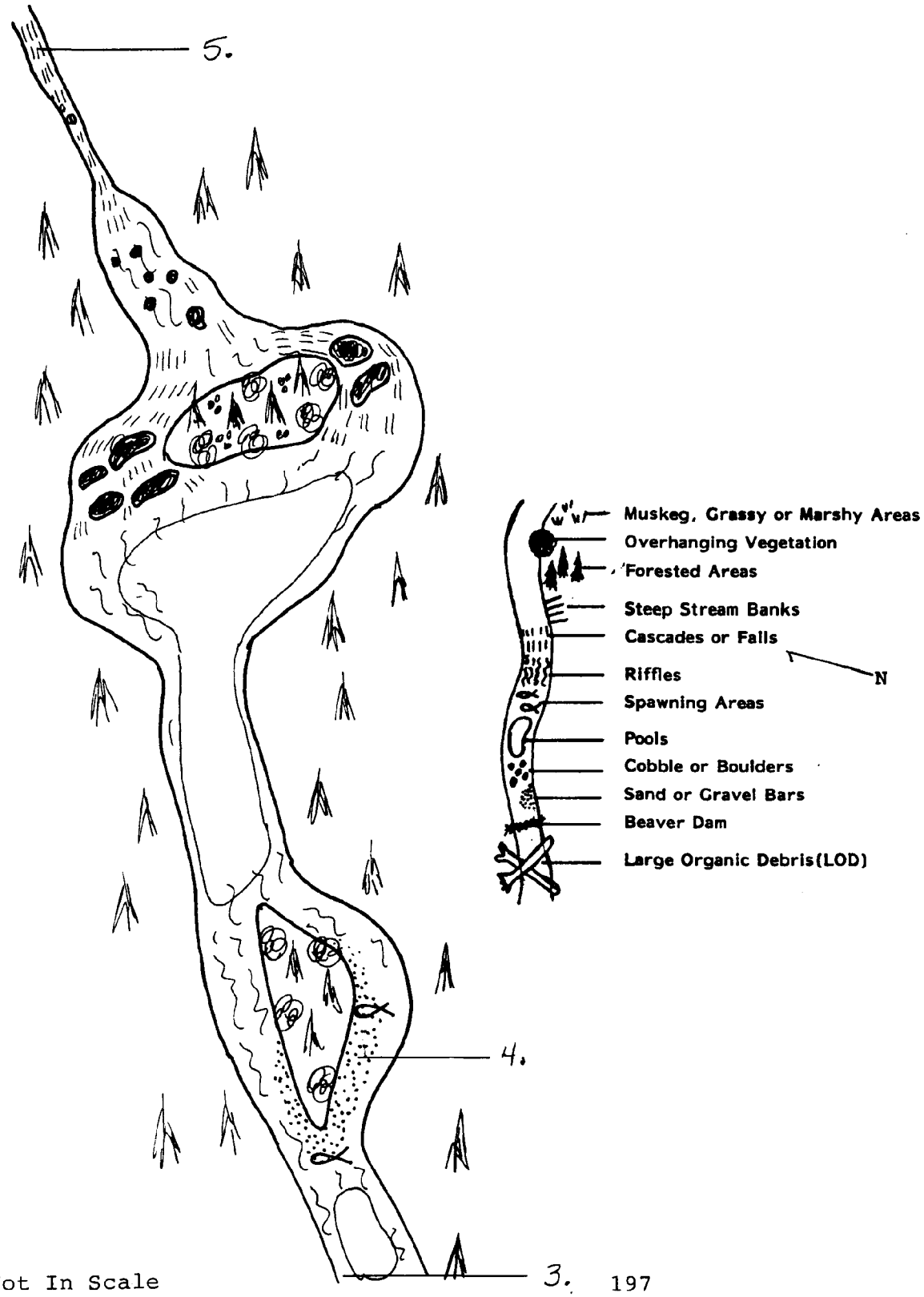
Watershed No. 402-03
Stat. No. 101-26-027

1. Barrier to fish passage.

2. Continued in second section.

*NOTE: Survey and map completed by the U.S. Fish and Wildlife Service in 1974.

Figure 39. UPPER TAMGAS RIVER - Section 2



Not In Scale

UPPER TAMGAS RIVER (CONTINUED)

3. Continued from previous map.

4. Gravel bars, spawning area.

5. Thirty foot barrier falls.

*NOTE: Survey and map completed by the U.S. Fish and Wildlife Service in 1974.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Lea Creek	101-26-026	402-02	
Stream	Number	Geocode	(66 acres in area)
Flows NW into Lower Tamgas Lake, .5 mi long.	Mountain slope run-off.	Steep, timbered mountain slopes.	
Location	Origin	Watershed Type	
72m from mouth to barrier.	12m falls 72m up creek.	--	+2 ft
Date Surveyed / Section Surveyed	Barriers	Stage	Flood Height
9/12/73			
50%	3.2 cfs/ --	.5 - 1 fps	2.4m / --	.3m / --
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--		None		
Streambank Composition / Stability		Tributaries		

Water Quality

Above Mouth	11.0C	7.5C	7.0	Clear / None	--	--	--
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
17.7ppm	--	--	--				
Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall				

Spawning Area

50% rubble, 30% boulders, 20% gravel.

Overall Stream Bottom Composition

--

Gravel Compaction

40$ spawning area - $70m^2$ total available area.

Spawning Area Available Above High Tide Mark(HTM)

Not applicable.

Intertidal Spawning Area

Rearing Area Very few pools (one .6m deep pool at base of falls).

--	--	--
Pool/Riffle Frequency(P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range

--

Available Cover

--

Aquatic Invertebrates/Available Food Source

Scarce

Aquatic Vegetation

Thick riparian vegetation with timber.

Terrestrial Vegetation

30% shade due to vegetation, with an addition 50% due to canopy.

Shading

Limited

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Not known/ none observed.

Use by Fish

Not known.

Use by Fishermen

Wildlife Present

--

Comments and Recommendations

No fishing in stream - no recommendations for habitat improvement. Prod. Summary included with Upper Tamgas River form.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/12/73	None Seen				

Survey(s) and Dates Conducted

USFWS, 9/12/73

Recommended Escapement

Based on the USFWS estimate of available spawning area, 6 coho spawning pairs is the recommended escapement. Sockeye are not allowed to utilize Tamgas Lake anymore.

Potential Production Summary

Assuming a 10% egg-fry survival rate since gravel quality is unknown, the production potential estimate is 44 coho returning to Tamgas Harbor orginally from this creek.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

West Campbell Creek	101-24-030	311-02
Stream	Number	Geocode
Flows SE into Campbell Slough	Mountain run-off and springs.	Forested mountain slopes and forested muskeg areas. (110 acres in area).
Location	Origin	Watershed Type
3100m to end of good habitat.	Barrier cascades at 750m.	

6/9/81	Low flow	+1.2 ft		
Date Surveyed	Section Surveyed (8/10/73)	Barriers	Stage	Flood Height
2.5% below 750m, 2-10% range	4.5 cfs/ up to 9 cfs	1 fps variable/.5-2.5 fps/	Below 750m =4.5m Above = 2.75m	.15m / --
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range

Sloped banks with brush (steep above 750m)/ Stable — Streambank Composition / Stability

Two major forks, two minor tributaries. — Tributaries

Water Quality Water sampled 8/10/73

--	14.4C	12.2C	7.0	Clear / None	Brown	--	--
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
17.1ppm	--	--		--			
Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall				

Spawning Area

Below 750m: (bottom copmposition is slightly different in the major forks) - 1% sand, 4% pebbles, 20%

Overall Stream Bottom Composition

gravel, 20% cobble, 15% rubble, 15% boulders, 25% bedrock. Above 750m: 1% sand,/ 1% pebble, 13% gravel, 15% cobble, 20% rubble, 20% boulders, 30% bedrock. / Angular gravels and some compaction.

Gravel Compaction

$675m^2$ of fair quality area currently available (plus $70m^2$ in tributaries), $605m^2$ potential area occurs above barrier falls (above 750m, creek has steep reaches of bedrock and boulder with "benches" of good good quality gravels and rearing area).

Spawning Area Available Above High Tide Mark (HTM)

$650m^2$ marginal quality gravels.

Intertidal Spawning Area

Rearing Area

Fairly abundant pools.

In forks = .30m/to 1.2m		
1m / to 1.75m		In tributary - 2 x 3m/ --
Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range

A fair amount of LOD exists along with some undercut banks and root tangle.

Available Cover

Abundant below 750m, sparse above 750m: trichoptera (especially Glossosoma), ephemeroptera and diptera observed.

Aquatic Invertebrates/Available Food Source

Abundant algae and moss on rocks and filamentous algae.

Aquatic Vegetation

Muskeg vegetation and forest.

Terrestrial Vegetation

60% due to topography, a little riparian vegetation and canopy (up to 95% in tributaries).

Shading

Some LOD, overhanging vegetation, undercut banks and pools create a fair amount of rearing area, the

Extent and Quality of Rearing Area

best occurring from 400-575m; however, rearing area is a limiting factor to coho production, not spawning area. More rearing and spawning area is available in tributaries.

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and cutthroat currently utilize this creek.

Use by Fish

Light subsistence fishing with some hunting in the fall occurring.

Use by Fishermen

Wildlife Present

Deer sign abundant - Canada Geese roost in slough.

Comments and Recommendations

Good quality spawning and rearing area occurs in both the main channel and in the forks. A fish passage at 750m could open up more spawning and rearing areas, a benefit: cost study would be recommended. As it is, the creek produces some, but not alot of pinks and chum and can only accommodate a few coho spawning pairs.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/10/73	Coho	Fry	A few	--	USFWS Foot Count
8/24/74	Pinks	Adult	71	--	USFWS Foot Count
9/11/74	Pinks	Adult	720	--	USFWS Foot Count
	Chum	Adult	6	--	USFWS Foot Count
9/20/74	Pinks	Adult	734	111	USFWS Foot Count
	Chum	Adult	25	5	USFWS Foot Count
9/30/74	Pinks	Adult	235	--	USFWS Foot Count
	Chum	Adult	41	--	USFWS Foot Count
1974	Pink	Adult	1468	--	USFWS Estimated Total Escapement
6/9/81	Coho	Fry	100	--	Spotted in East Fork Tributary
	Trout	Adult (over 5 in.)	1	--	Spotted in East Fork Tributary
	Coho	Fry	Few	--	Spoted at mouth of North Fork Tributary
9/1/81	None seen outside creek or in slough.				Aerial count
9/25/81	Pink	Adult	56	--	
	Chum	Adult	0	--	

Survey(s) and Dates Conducted

C. Huntington, 6/9/81 and USFWS, 8/10/73

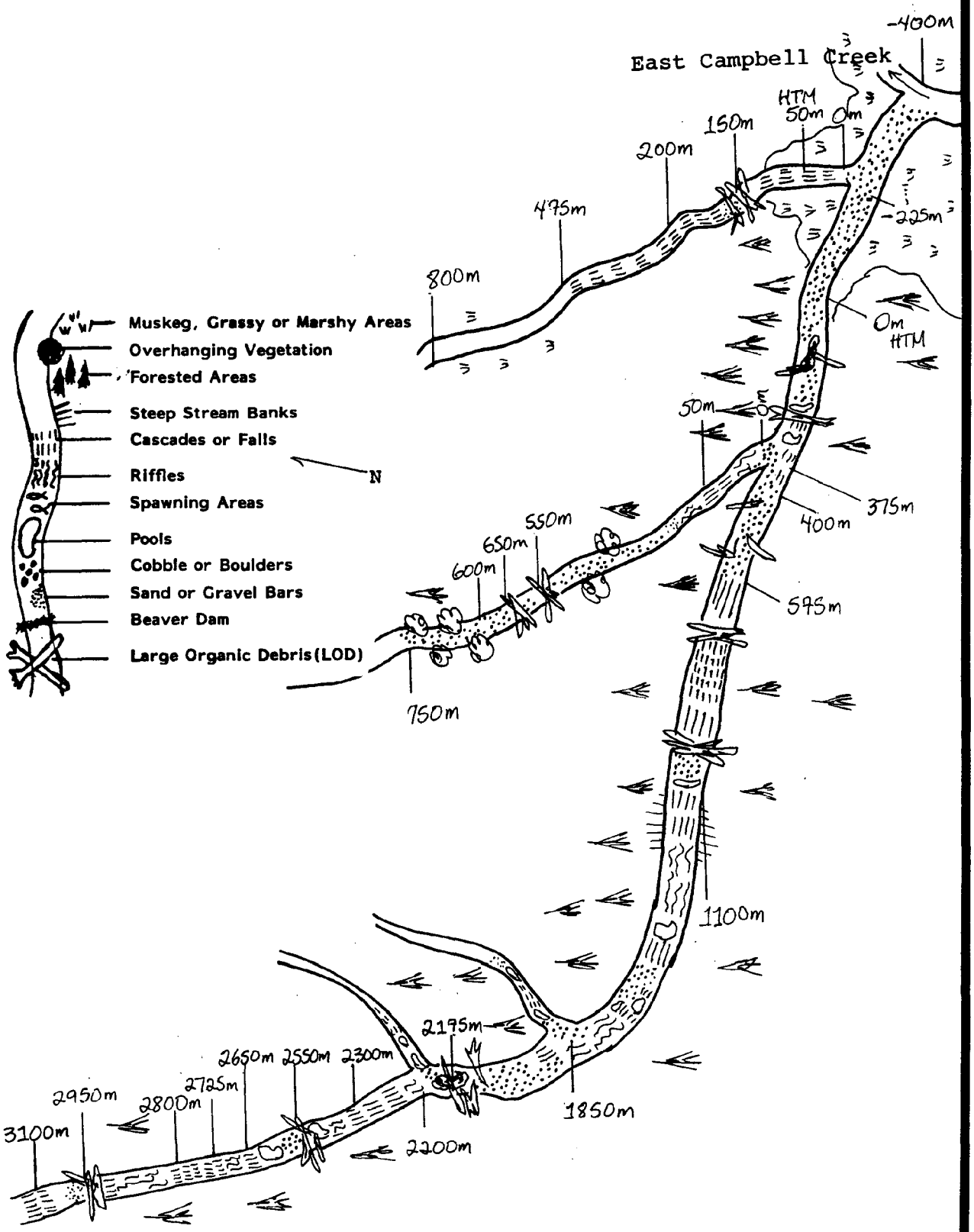
Recommended Escapement

Recommended escapement based on currently available spawning area is 2200 pinks, 145 chum and 10 coho spawning pairs. Historical escapements indicate a low survival of offspring, whether due to poor gravel quality and other detrimental freshwater factors, or low marine survival.

Potential Production Summary

Based on the above escapements and assuming a low egg-fry survival rate of 1.2% due to the poor gravel quality, production potential estimates are: 785 pinks, 86 chum and 7 coho returning to Annette Island. Obviously, this is a conservate estimate, as escapements have exceeded that in previous years.

Figure 40. WEST CAMPBELL CREEK



Not In Scale

WEST CAMPBELL CREEK

Watershed No. 311-02
Stat. No. 101-24-030

-400m	Point at which West Campbell Creek joins East Campbell Creek in Campbell Slough.
-225m	Creek forks, tributary is the East Fork of West Campbell Creek, 80% spawning area intertidally to 0m.
0-50m (East Fork)	High Tide Mark (HTM) at 50m, creek flows through small cascades.
150m (East Fork)	Passable debris jam.
160m (East Fork)	Debris pile.
200m (East Fork)	Probable barrier, 40° rise in 5m, over bedrock cascades.
0-475m (East Fork)	Mainly bedrock cascades, 4-10% gradient, .6 cfs flow; creek is 85% shaded.
475-800m	Lower stream gradient and good spawning (less than 1.5%) and rearing habitat (muskeg area); 8 inch trout spotted near 800m. (End of survey.)
0m (Main Channel)	HTM.
0-750m	Average Stream Width (ASW) = 4.5m, 20% gravels overall, some areas, 300-325m and 350-385m are 90% bedrock; tributary (North Fork West Campbell Creek enters at 375m); best rearing and spawning area (over 75% spawning gravels) is from 400-575m. Log jam with .3m drop at 650m. At 750m is a 2m high probable barrier cascade with a 4% gradient above it; probably no coho get above this.
0-50m (North Fork)	2m falls without plunge pool at 50m, fork begins at 375m, main channel.
550m (North Fork)	Debris jam, probable barrier.
600m (North Fork)	Debris jam barrier.
50-750m (North Fork)	Gradient lowers, good rearing and fair spawning areas.
750-850m (Main Channel)	90% bedrock.
1100-1160m	90% bedrock, a 2m high and 10m wide bedrock cascade occurs at 1100m with a 60m of bedrock channel to 1160m.
1450m	.5m falls with 2.5m plunge pool.
1850m	Tributary comes in, no spawning area, but some rearing area.
2200m	Tributary comes in, no spawning area, but some rearing area.
2300m	Series of cascades.
2550m	Debris jam with deep plunge pool.
2650m	1m falls with deep plunge pool.
2725-2800m	Passable falls with cascades.
2950m	3.3m high debris jam with gravels and a definite barrier.
750-2950m	13% gravels overall, ASW = 2.75m.
3100m	Alot of boulders and bedrock, no more good spawning or rearing habitat here or above.

Spawning Area: Intertidal Area 650m^2 spawning area available.
Above HTM, 0-750m 675m^2 spawning area available.
750-2950m 605m^2 potential area above present barrier.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

East Campbell Creek — Stream
101-24-032 — Number
310-01 — Geocode

Flows SW into Campbell Slough, 2.7 mi long. — Location
4300m from mouth to above fork.
Mountain run-off./ hillsides and forested muskeg areas. (195 acres in area). — Watershed Type
Origin None to coho - at 600m falls may block pink and chum./Moderate to low. +2.5 ft

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/8/81	(8/15/73)			

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
4°	3.5 cfs / up to 19 cfs/	1 fps / --	4.8m / --	.45m / --

Dirt and rock heavily vegetated, some undercutting/Relatively stable./ Three with a fork at 3600m
Streambank Composition / Stability — Tributaries

Water Quality

	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/15/73:	11.1C	13.4C	7.0	Slight / Turbidity --		--	--
150m above mouth	11.1C	9C	5.5	Clear / None	Amber	--	--

Sample Site — 17.1ppm (8/15/73)

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

20% spawning gravels (much of which is angular - slate), 20% cobble, 20% boulders, 30% bedrock, 10% rubble, and trace fines - many gravel bars occur.
Overall Stream Bottom Composition

Some fines and some angular gravels, but relatively clean in general.
Gravel Compaction

781$1m^2$ area total is available.
Spawning Area Available Above High Tide Mark (HTM)

An excellent intertidal spawning channel exists - $650m^2$ total area.
Intertidal Spawning Area

Rearing Area

Pools frequent and caused by bends in stream, boulders, and fallen timber.
Pool/Riffle Frequency (P:R Ratio)

.9m / up to 1.5m
Ave. Pool Depth/Range

4.5 x 4.5m / --
Ave. Pool Size/Range

Some LOD occurs, upstream, overhanging vegetation gets thicker.
Available Cover

Abundant
Aquatic Invertebrates/Available Food Source

Some algae
Aquatic Vegetation

Thick riparian vegetation (thick alders) - in a cedar and spruce canopy.
Terrestrial Vegetation

75% shading mainly from the riparian vegetation; the rest is from canopy.
Shading

Upstream (upper end) alot exists, especially in off channel areas under LOD, thick vegetation and in side pools.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and probably cutthroat utilize this creek.
Use by Fish

Little to no subsistence fishing occurs. Hunters use creek and slough.
Use by Fishermen

Wildlife Present

Many deer tracks (3 spotted) - Canada Geese roost in slough.

Comments and Recommendations

This creek could be a major producer on Annette Island. Alot of good to excellent quality spawning and rearing area occurs. No habitat improvements are recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/15/73	Pink and Chum	Adults	--	--	Spotted, not counted.
1974	Pinks	Adults	4556	--	USFWS Estimated Total Escapement
1975	Pinks	Adults	22,319	--	USFWS Estimated Total Escapement
1975	Pinks	Adults	9319		USFWS Estimated Total Escapement
6/8/81	Coho	Fry	Numerous		
9/1/81	No fish seen in creek mouth or slough.				(aerial count)
9/25/81	Pink		25	6	(underescapement - why? - possibly
	Chum		--	--	due to commercial fishing at mouth?)

Survey(s) and Dates Conducted

E. Biggs, J. Yuska, 6/9/81 and USFWS, 8/15/73

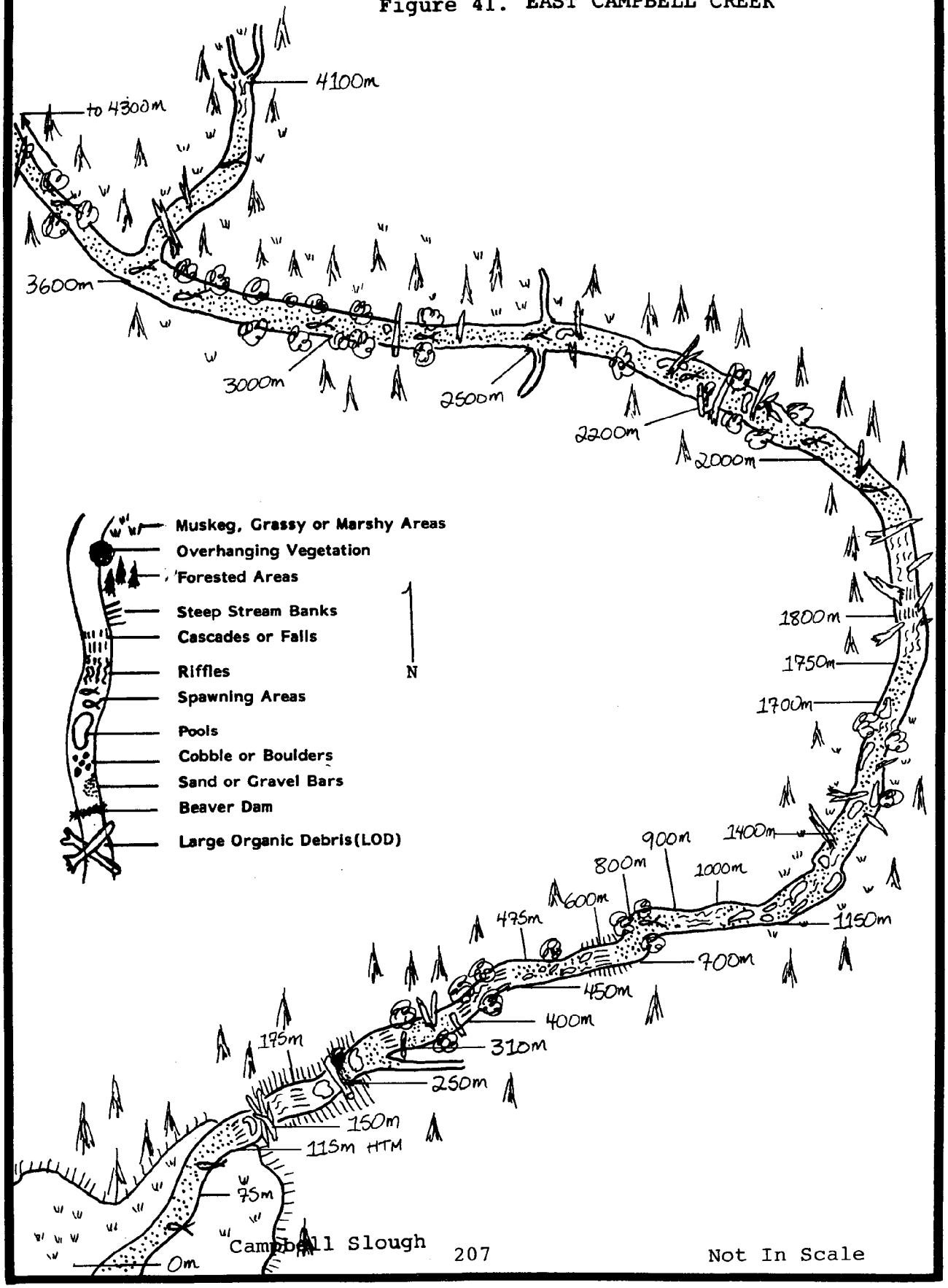
Recommended Escapement

Recommended escapements for this creek based on available and accessible spawning area and coho rearing area are 4300 pinks, 235 chum and 150 coho spawning pairs.

Potential Production Summary

An overall survival rate of 10% egg-fry will be assumed to the fair-good quality gravels occurring. Production potential for this creek is estimated at 13,000 pinks, 1200 chum and 850 coho returning to Annette Island. Obviously this potential can be exceeded in good years; however, it seems that creek production has been much lower than potential in recent years.

Figure 41. EAST CAMPBELL CREEK



Campbell Slough

Not In Scale

EAST CAMPBELL CREEK

Watershed No. 310-01
Stat. No. 101-24-032

-600m	Campbell Slough mouth.
0m	Beginning of excellent intertidal spawning area.
0-75m	Average Stream Width (ASW) = 8m, Average Stream Depth (ASD) = .08m, 90% usable gravels (540m^2 spawning area).
75-115m	ASW = 5.5m, 50% usable gravels (110m^2 spawning area), High Tide Mark (HTM) at 115m.
115-150m	Heavy LOD, less than 5% usable gravels.
150-250m	Bedrock cascades (low gradient) and pools, Heavy LOD at 150m with less than 5% gravels above. ASW = 5m, ASD = .3m. At 250m tree across creek may be a barrier at low flows - creek has steep stream banks; 6m wide pool, 1m deep above log.
250-310m	5% spawning gravels above pool at 250m, first order tributary enters (very steep gradient, flows over bedrock). At 310m, top of bedrock cascade with alot of gravel bars, LOD, root wads, generally good rearing area.
310-400m	ASW = 4m, ASD = .2m, with 7m long gravel bars, 35% spawning gravels.
450m	1.5m falls here may be a barrier to pink and chums.
475m	ASW = 3m, ASD = .25m, alot of pools here with less than 5% usable gravels (poor quality gravels, too flat and angular).
600m	Cascading falls over bedrock (not a barrier).
700m	ASW = 3.5m, 5% gravels; coho fry observed here.
800-900m	ASW = 4.5m, low gradient, 30% spawning gravels with gravel bars.
900m	ASW = 4.5m, gravels decrease to 5%, numerous "backwater" areas available for rearing.
1150m	ASW = 3.5m, ASD = .3m, less than 5% spawning gravels.
1400m	Low gradient, 5% spawning gravels in pockets.
1400-1700m	Muskeg area (much skunk cabbage in and around creek).
1700-1750m	ASW = 3.5m, 30% spawning gravels.
1800m	1.25m cascade through a fair amount of LOD.
2000m	ASW = 3m, ASD = .08m, 90% usable round gravels including 3m gravel bars.
2200m	Excellent spawning and rearing area with alot of off channel areas with 6m wide pools, 1m deep; 75% shading.
2500m	Muskeg tributary enters, with 50% usable spawning gravels.
3000m	Stream banks flat in muskeg with a narrow band of riparian vegetation, alders, cedars, and spruce. There are still 50% usable gravels, but they have some fines mixed in.
3600m	Stream splits into two 2m wide tributaries, each .08m deep; 50% usable gravels, cedar dominate with riparian vegetation.
4100m (East Fork)	Gravel gone as creek flows into muskeg and fine sediments; 50% gravels from 3600-4100m.
4300m (West Fork)	Gravel gone, bottom all fines; 50% gravels from 3600-4300m.

Spawning Area:	Intertidal area	650m^2	Total Area
	Above HTM	7811m^2	Total Area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Annette Point Creek	101-24-079	309-01

Location: Flows straight into Felice Strait, 3 mi long.

Origin: Mountain run-off, springs./ Forested mountain slopes with reaches of exposed granite outcroppings.

Watershed Type: 1525 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/9/81	4300m above mouth	Falls at 4300m	Low to moderate	+ 2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1.5% (increases in upper end).	14 cfs / to 18 cfs (9/25/72)	2 fps to rapid	5-6m / 3-9m	.15m / --

Streambank Composition / Stability: Gravel, bedrock and boulder heavily vegetated./Well defined, stable channel./

Tributaries: None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/28/72:	7.2C	6.7C	6.8			probably	
Above HTM	18.5C	7.5C	6.0	Clear / None	Slight Amber	high	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	9.5ppm (9/25/72)	8.13ppm (9/25/72)	Water quality looked good.

Spawning Area

Overall Stream Bottom Composition: 40-60% gravel, 10% cobble, 10% boulder, 20% bedrock (foliated - high in quartz), some sand.

Gravel Compaction: Minimal - good, clean gravels here.

Spawning Area Available Above High Tide Mark (HTM): Some excellent quality spawning channels exist with some occurrences of gravel bars, approximately $3222m^2$ area is available.

Intertidal Spawning Area: 80% gravels intertidally, $720m^2$ available area good quality.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Some deep pool exist from 36-3800m p:r = 1.5-2 in lower reaches.	.55m / up to 1.5m	10m in diameter / --

LOD increases as you go upstream with a few undercut banks and deep pools; a moderate mount occurs.

Available Cover: Relatively abundant, especially upstream; diptera, heptagenids and mayflies observed.

Aquatic Invertebrates/Available Food Source: Sparse

Aquatic Vegetation: Currant, salmonberry, devil's club and alder under a spruce, cedar and a few hemlock canopy.

Terrestrial Vegetation: 40% at 350m, average overall is about 50%, much of it due to overhanging vegetation.

Shading: Some, but not alot, of good rearing exists in the main channel - alot of the available area exists in the tributaries and in a few braided channels.

Extent and Quality of Rearing Area:

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink, chum and coho utilize this creek.

Use by Fishermen: Some light subsistence fishing occurs.

Wildlife Present

Some beaver activity is evident.

Comments and Recommendations

Annette Point Creek is one of the major salmon producing creek on Annette Island due to the magnitude and quality of the spawning and rearing areas and due to its large size. No improvements are recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/25/72	Pink	Adults	2400	--	USFWS On-foot Counts
	Chum	Adults	350	--	USFWS On-foot Counts
9/11/74	Pink	Adults	1420	--	USFWS On-foot Counts
	Chum	Adults	38	--	USFWS On-foot Counts
9/20/74	Pink	Adults	2278	104	USFWS On-foot Counts
	Chum	Adults	224	29	USFWS On-foot Counts
10/3/74	Pink	Adults	1055	--	USFWS On-foot Counts
	Chum	Adults	521	--	USFWS On-foot Counts
8/24/74	Pink	Adults	64	--	USFWS On-foot Counts
	Chum	Adults	4	--	USFWS On-foot Counts
1974	Pink	Adults	2382	--	USFWS Peak Count
	Chum	Adults	550	--	USFWS Peak Count
8/21/75	None seen				
8/28/75	Pink	Adults	5600	57	
1975	Pink	Adults	5657	--	USWFS Peak Count
6/9/81	Coho	Fry (some up 45mm)	Over 100	seen	Very abundant
9/1/81	Pinks mainly (mixed)	Adult	300-400	--	Ball of fish outside creek mouth (aerial count)
9/24/81	Pink	Adults	3236	310	This years escapement looks good.
	Chum	Adults	93	92	
	Coho	Adults	2	--	

Survey(s) and Dates Conducted

E. Biggs and J. Yuska, 6/9/81 and USFWS, 9/25/72

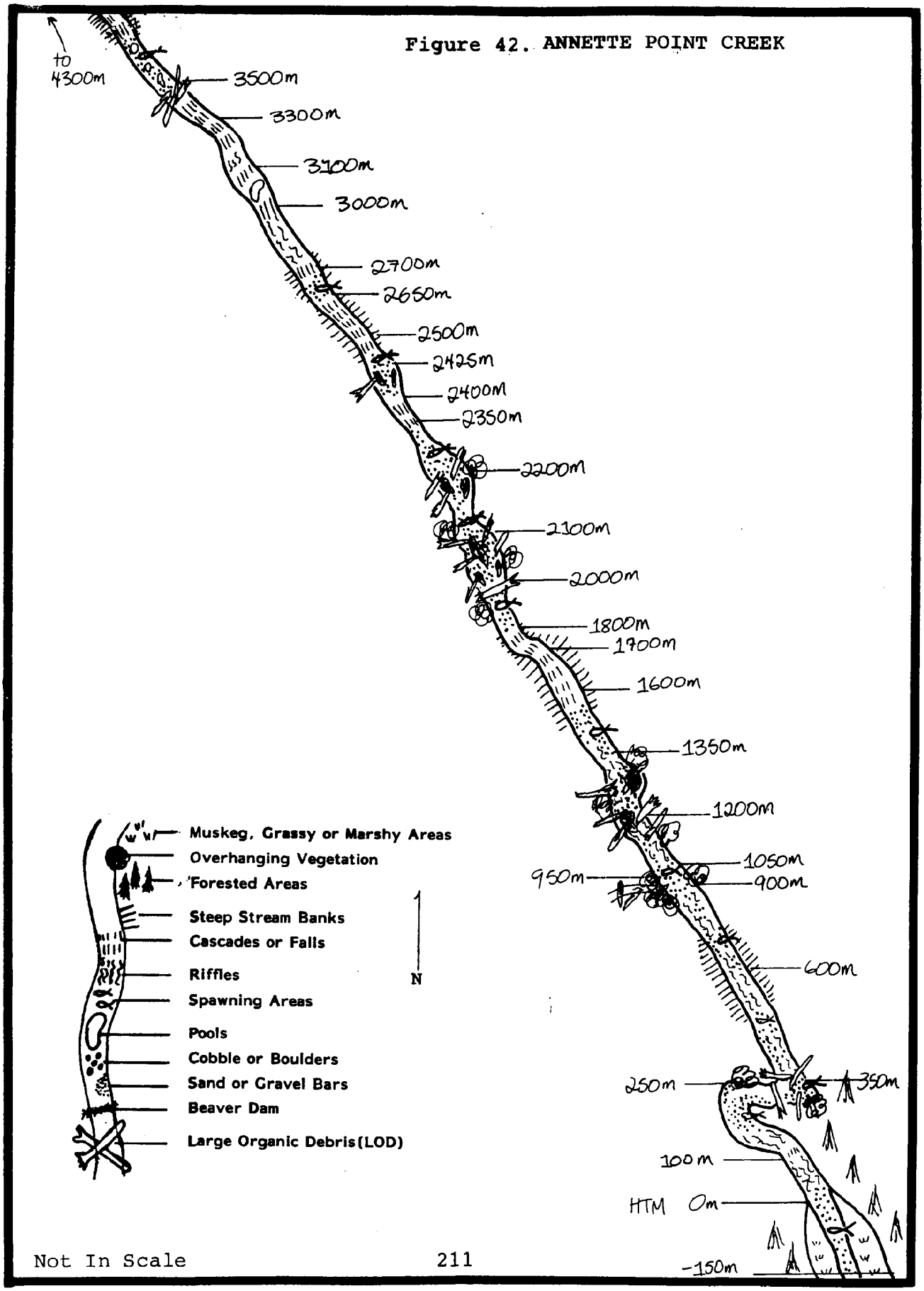
Recommended Escapement

Recommended escapement based on available spawning area and rearing area is 2670 pink, 175 chum and 25 coho spawning pairs.

Potential Production Summary

With the excellent quality gravels occuring a 20% egg-fry survival rate can be assumed. 15,860 pinks, 1730 chum, 280 coho could potentially return to Annette Island based on the above escapements.

Figure 42. ANNETTE POINT CREEK



Not In Scale

ANNETTE POINT CREEK

Watershed No. 309-01
Stat. No. 101-24-079

-150-0m	80% spawning gravel (720m^2 of spawning area) High Tide Mark (HTM) at 0m.
0-100m	Bedrock riffle.
100-250m	Spawning gravels on bars (8 x 4m = 32m^2 area), with 10m wide pools.
350m	Average Stream Depth (ASD) = .2m; side channels have excellent gravels and cover (from LOD and banks). Gravel bar area, 14 x 4m = 56m^2 spawning area.
600m	Steep banks (40 ft high).
650-900m	Average Stream Width (ASW) = 11m, ASD = .1m, bottom composition: 10% gravel, 50% large cobble, 20% bedrock, 20% boulder, (1275m^2 available spawning area). Tributary at 900m (second order) with a .5 cfs flow, good rearing habitat and a 30m^2 spawning area.
900-950m	11m^2 gravel bar, with 15% usable gravel bottom (52m^2 area total).
1050m	5% spawning area; 20m^2 area.
1050-1200m	Alot of LOD, 15% usable gravels (90m^2 spwaning area).
1200-1350m	Braiding occurs with excellent rearing habitat, ASW = 4m, ASD = .2m (192m^2 spawning area).
1350-1600m	ASW = 6m, ASD = .15m, 15% gravels (225m^2 spawning area); braiding ends.
1600-1700m	Bouldery cascade flowing through a gorge; 1.3m falls at 1700m, but it is not a barrier to coho (but could be to pinks and chums).
1800m	Gorge ends, 1.5m fall above.
1850-2000m	ASW = 4.5m, ASD = .2m, 20% gravels (135m^2 spawning area).
2000-2100m	Channel braids under LOD with alot of rearing habitat (coho fry seen); ASW = 11m, ASD = .09m; 80% spawning gravels including 11m wide gravel bars (880m^2 spawning area).
2100-2200m	ASW = 5m, ASD = .2m - no braiding (50m^2 spawning area).
2200-2350m	More braiding occurs, ASW = 11m, ASD = .09m, 80% spawning gravels (880m^2 spawning area).
2350-2400m	Braids end, 10% usable gravels (120m^2 spawning area).
2400m	Bedrock cascade.
2425m	Braiding begins, ASW = 5m, ASD = .15m, 80% gravels (200m^2 spawning area).
2500m	Bedrock cascade.
2650m	Bedrock ends, ASW = 5m, ASD = .2m, 10% gravels (25m^2 spawning area).
2700m	1.3m cascade.
3000m	1m bedrock cascade.
3100m	2m high, 10m long (very shallow) bedrock cascade.
3300m	Cascades continue.
3500m	LOD, less than 5% gravels.
3600-3800m	Pockets of gravel (less than 5% total) between cascades and deep pools (50m^2 area total).
3800m	Steep gradient; gorge begins above this point.
4300m	10m falls barrier.

Spawning Area: Intertidal 720m^2 spawning area.
Above HTM 3222m^2 spawning area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Lesser Indian Rock Creeks	101-24-081	309-02

Flows SE into Felice Strait, .5 mi long. Steep timbered and exposed Mountain slope and muskeg run-off./ rock slopes and muskeg areas.

Location	Origin	Watershed Type
700m from mouth (up both forks).	Stream flows into muskeg at 700m.	35 acres in area.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	1.0 cfs South Fork/ - 1.5 cfs North Fork/-	Moderate	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Slow - moderate	1.5m / --	.2-.4m / --		

Muskeg soils with some undercutting - not much LOD influences. / Stable, well-defined channel.
Streambank Composition / Stability

Stream forks at 20m, one tributary in North Fork.
Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	10.5C	11.5C	5.5	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	This water is mainly muskeg drainage.

Spawning Area

About 20% gravels, 30% pebbles, 10% boulders, and cobble, 20% sand, 20% silt.
Overall Stream Bottom Composition

Some, especially near where fines occur.
Gravel Compaction

$60m^2$ area exists in the South Fork and $125m^2$ in the North; $187m^2$ area exist total.
Spawning Area Available Above High Tide Mark (HTM)

50% spawning gravels, $300m^2$ total area available.
Intertidal Spawning Area

Rearing Area Pools are sparse, but some deep pools are created in muskeg areas.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range		Ave. Pool Size/Range	
	--	--	--	--

By undercut banks and muskeg "land bridges" not much there.
Available Cover

Sparse
Aquatic Invertebrates/Available Food Source

Alot of moss occurs on rocks in the lower reach.
Aquatic Vegetation

Huckleberry, azalea, skunk cabbage, and grasses in a cedar, spruce canopy.
Terrestrial Vegetation

40% overall, 10% due to banks, and 30% due to vegetation.
Shading

Not much is available due to lack of cover and pools, and small size of creek.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Probably only utilized by pink and chum.
Use by Fish

No fishing is known on this creek.
Use by Fishermen

Wildlife Present

None

Comments and Recommendations

This creek probably produces mainly pinks and does not produce large numbers. No improvements are recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/20/81	None seen				

Survey(s) and Dates Conducted

J. Yuska, 6/20/81

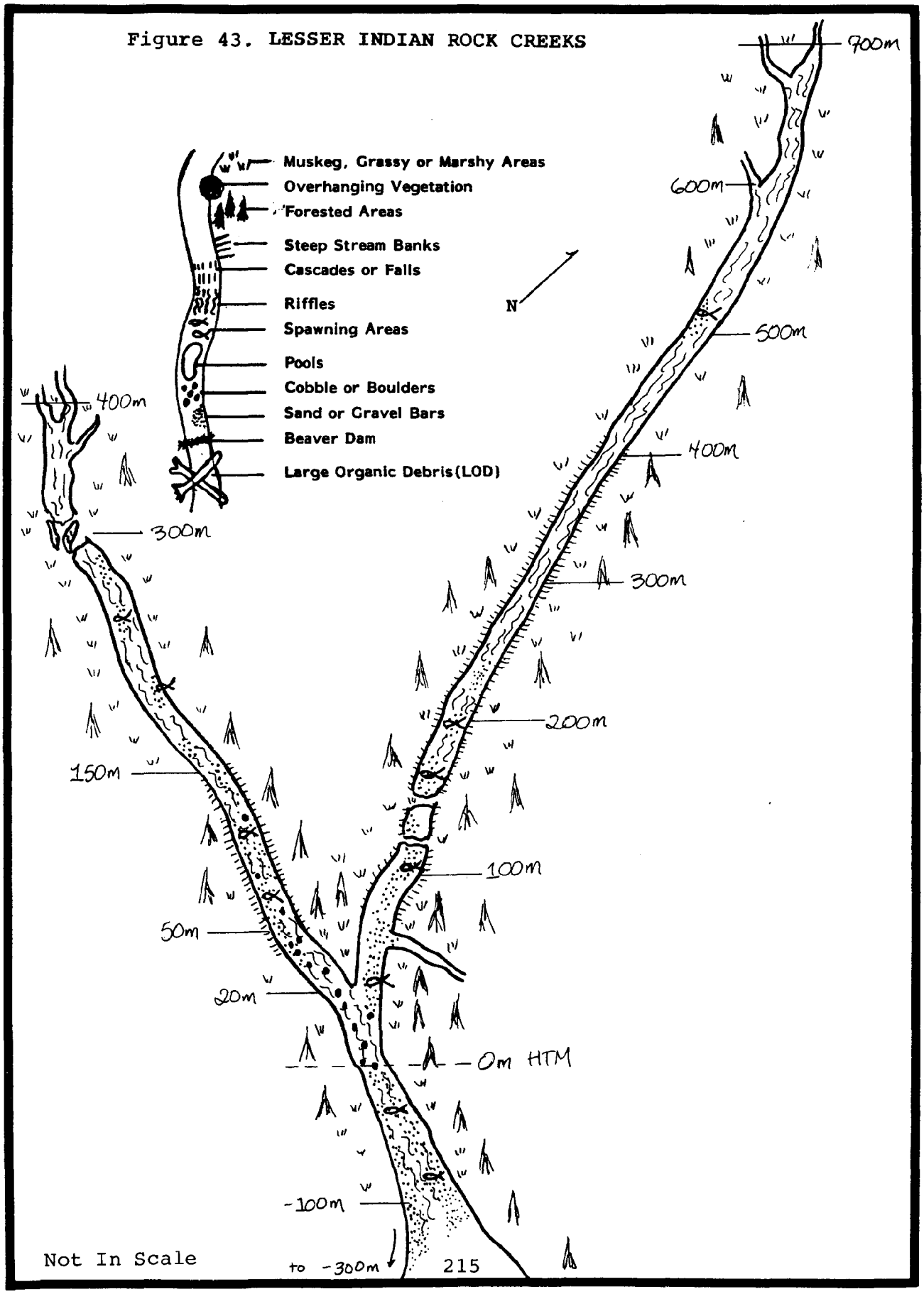
Recommended Escapement

Based on available spawning area, and gravel quality, recommended escapement is 812 spawning pairs of pinks only.

Potential Production Summary

Due to the compacted gravels, a 1.2% egg-fry survival rate will be assumed. 290 pinks could return to Annette Island originating from this creek.

Figure 43. LESSER INDIAN ROCK CREEKS



LESSER INDIAN ROCKS CREEK

Watershed No. 309-02
Stat. No. 101-24-081

-300m Cabin

-100-0m Intertidal area, Average Stream Width (ASW) = 6m, 50% spawning gravels. High Tide Mark (HTM) at 0m.

0-20m ASW = 5m, 80% boulders and 20% cobble; stream splits at 20m.

20-50m (South Fork)
ASW = 2.5m; bottom composition: 50% boulders, 50% cobble, less than 5% gravels.

50-150m (South Fork)
ASW = 1.5m, 30% gravels ($45m^2$ spawning area).

150-300m (South Fork)
ASW = 1m; bottom composition: 10% gravels, 40% pebbles, 10% cobble, 40% sand ($15m^2$ spawning area). At 300m, stream is covered with muskeg "land bridges" (roots and vegetation).

400m (South Fork)
Stream splits into muskeg.

20-100m (North Fork)
ASW = 3m, stream incised in muskeg like soils, with deep pools and a moderate gradient; bottom composition: 30% sand, 30% gravel, 40% pebbles ($72m^2$ spawning area).

100-200m (north Fork)
ASW = 1.5m, moderate gradient, pools deep, stream flows through muskeg and under "land bridges"; 30% gravels, old redd observed at 150m, ($45m^2$ spawning area).

200-300m (North Fork)
ASW = 1m, ASD = .4m, stream deep and narrow, less than 5% gravels.

300-400m (North Fork)
ASW = .5m, ASD = .4m; less than 5% gravels.

400-500m (North Fork)
ASW = 1m, all mud/silt/sand substrate, no gravels; low gradient. At 500m, 70% pebbles in pockets, 10% gravels ($10m^2$ spawning area).

600m (North Fork) Less than 5% gravels.

700m (North Fork) Stream splits into muskeg.

Spawning Area:	Intertidal	$300m^2$ spawning area
	Above HTM	$187m^2$ spawning area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Indian Rock Creeks (North & South Forks)	101-24-083	308-01

Location	Origin	Watershed Type
Flows SE into Felice Strait, .5 mi long.	Steep mountain slope run-off./	Timbered and exposed rock mountain slope with some areas of muskeg. (35 acres in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	to 550m above mouth	Barrier falls up both forks. Moderate Flow	+1.5 ft	

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
5° North Fork/ 3° South Fork/2-7°	5.5 cfs North Fork 6.5 cfs South Fork/-	Moderate / up to 2.5 fps/ 1 fps / in North Fork	4m North Fork/-- 3m South Fork/--	.35m North Fork .15m South Fork/-

Streambank Composition / Stability: Steep banks in areas, some undercut banks and moderate LOD influence in lower 250m./ Relatively stable overall.

Tributaries: Stream forks at HTM; 4 tributaries in South Fork.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/24/73:	13.3C	11.1C	6.5	Turbid	Brown	--	--
-	10.5C	11.5C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
17.1ppm (8/24/73)	--	--	--

Spawning Area

Overall Stream Bottom Composition: South Fork: 10% bedrock, 5% boulders, 20% rubble, 35% cobble, 20% gravels, 5% pebbles, 5% sand, trace silt. North Fork: 30% bedrock, 35% boulders, 20% rubble, 15% cobble.

Gravel Compaction: Moderate due to fines.

Spawning Area Available Above High Tide Mark (HTM): $25m^2$ patchy and of marginal quality in both forks.

Intertidal Spawning Area: 5% spawning intertidally; approximately $80m^2$ of marginal quality area is available.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools occur around bends and under/ LOD, p:r = 2:3 (below clay banks- South Fork).	.5m North Fork up to 1m .25m South Fork up to .5m	-- --

Available Cover: A little LOD and a few undercut banks in lower end - limited.

Aquatic Invertebrates/Available Food Source: Sparse in both forks.

Aquatic Vegetation: Sparse: a little algal growth (filamentous) in the lower end to 50m in the South Fork.

Terrestrial Vegetation: Some skunk cabbage, devil's club, currant under a spruce, cedar and hemlock canopy.

Shading: 5% in lower end (due to banks); above 50m, 85% (both forks) due to forest and banks and a little riparian vegetation.

Extent and Quality of Rearing Area: In North Fork, rearing is limited due to swift velocity and lack of cover. In South Fork, fair habitat occurs in lower 250m due to LOD and undercuts, but swift velocity is limiting - poor above 250m.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Probably only pinks and chum utilize creek if at all.

Use by Fishermen: Even though there is a cabin present, no known fishing occurs.

Wildlife Present

None seen.

Comments and Recommendations

This creek is of marginal value for salmon production - no improvements are recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/24/73	None seen				
6/20/81	None seen				

Survey(s) and Dates Conducted

C. Huntington, 6/20/81 and USFWS, 8/24/73

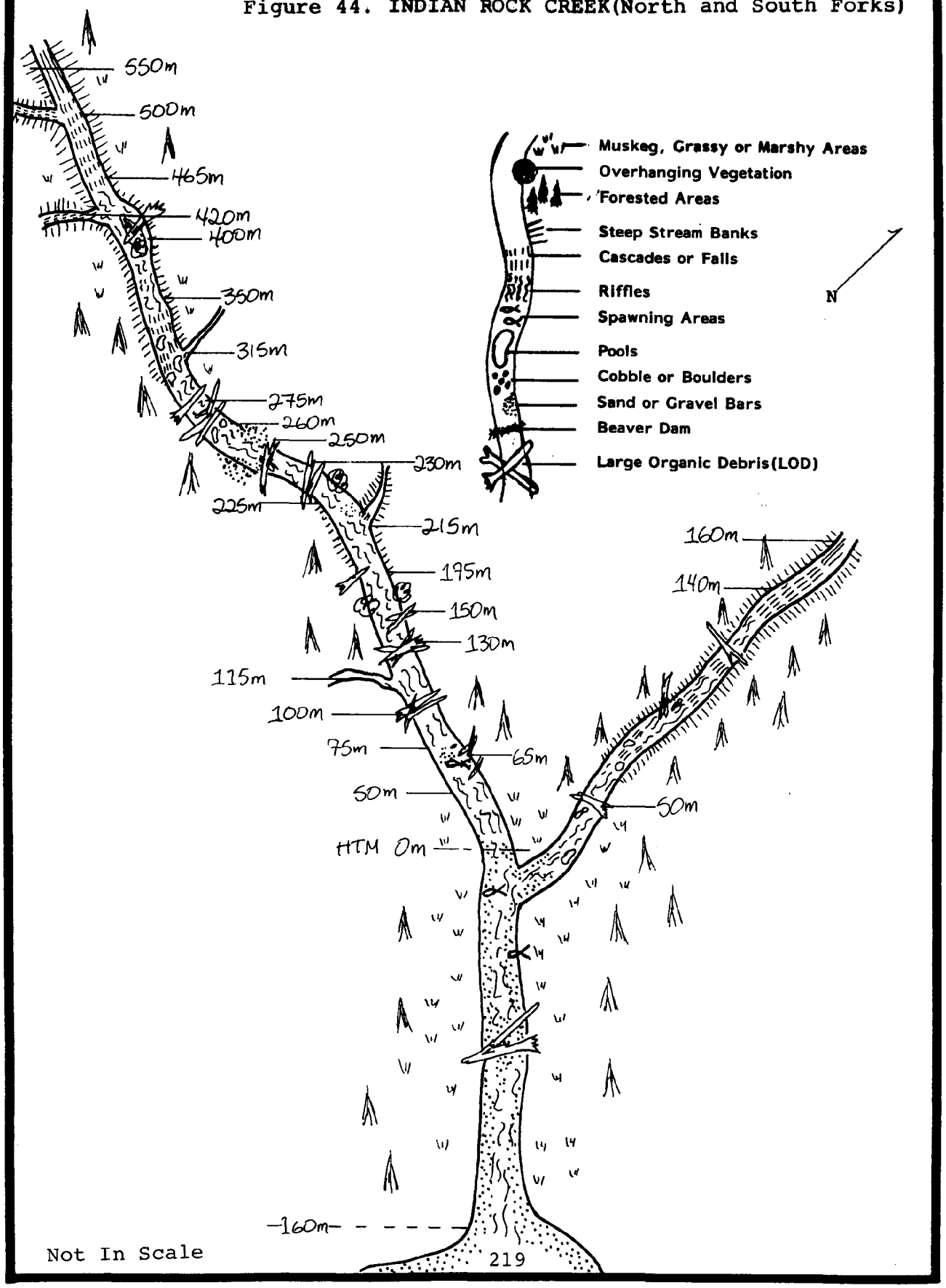
Recommended Escapement

Based on spawning area available and gravel quality, only 175 spawning pairs of pinks could probably utilize this creek.

Potential Production Summary

Due to the marginal gravel quality, only approximately 62 pinks could be expected to return based on a 1.2% egg-fry survival rate and a 2% ocean survival.

Figure 44. INDIAN ROCK CREEK(North and South Forks)



Not In Scale

INDIAN ROCK CREEK (North and South Forks) Watershed No. 308-01
Stat. No. 101-24-083

-160-0m		5% spawning area intertidally ($80m^2$ area); bottom is mostly gravel and clay at mouth, with gravel and rubble prevailing toward High Tide Mark (HTM) at 0m. Stream forks intertidally at 0m.
0-50m	(North Fork)	Riffles
140m	(North Fork)	Series of steep cascades.
160m	(North Fork)	3.5m falls, a probable barrier.
0-50m	(South Fork)	Salt tolerant sedges and flat banks here.
65m	(South Fork)	Undercut spruce roots with a bottom of mostly cobble.
75m	(South Fork)	$7m^2$ spawning area at pool "tail-out".
100m	(South Fork)	Two logs over channel.
115m	(South Fork)	Trickle tributary comes in.
130m	(South Fork)	LOD jam.
150m	(South Fork)	Small LOD pile.
175m	(South Fork)	$12m^2$ area good spawning riffle.
215m	(South Fork)	Steep tributary enters channel.
225m	(South Fork)	Small south bank slump.
230m	(South Fork)	Two logs across creek.
250m	(South Fork)	Debris jam - clay banks to 260m.
275m	(South Fork)	Stream stepped over LOD and rock; predominately cobble and rubble bottom, banks are rocky with root tangles.
315m	(South Fork)	Bedrock and boulders at a 5% gradient to 350m; small tributary trickles in.
350m	(South Fork)	Begin cobble and rubble bottom; rocky banks with some muskeg; below 350m, banks are heavily overgrown with moss and ferns.
400m	(South Fork)	Root tangles from large live trees in channel (creek moves around a bit).
420m	(South Fork)	Tributary cascades in (steep) - no spawning or rearing habitat.
465m-500m	(South Fork)	Cascades, 5% gradient bedrock channel.
500m	(South Fork)	1.5 cfs flow tributary with impassable falls. 40m above mouth (no spawning or rearing).
550m	(South Fork)	10m barrier falls.

Spawning Area: Limited

Intertidal	Approximately $80m^2$ area
Above HTM	Approximately $20m^2$ area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Beaver Creek	101-24-086	306-01

Location	Origin	Watershed Type
Flow NW into Kwain Slough, .5 mi long./	Timbered slopes/ and muskeg run-off./	Timbered and open muskeg flats and gently sloping hilsides. (3.4mi² in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/13/81	620m above mouth	Falls up East Fork - none in East Fork.	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2% above dams 5% in forks	1.25 cfs / --	.5 fps above dams	1.5m (above dams)/-	.20m (above dams)

Streambank Composition / Stability: Extensive LOD influence with grassy and woody banks - flooding due to beaver dams - otherwise stable channel.

Tributaries: This creek is a fork of Kwain Creek. it forks at 530m above mouth.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
At mouth	15.0C	12.0C	--	Clear / None	Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: Above beaver dams: 35% gravel, 15% rubble, 5% boulder, 20% cobble, 10% pebble, 10% sand, 5% silt, 5% organic matter (OM). In beaver ponds, mainly mud and OM.

Gravel Compaction: Some occurs, but not bad.

Spawning Area Available Above High Tide Mark (HTM): 14 obvious redds were spotted, 250m² total area is available; 225m² of it below the lowest beaver dam. (More may be available in unsurveyed section of West Fork).

Intertidal Spawning Area: Not applicable (covered in Kwain Creek Survey).

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Beaver ponds and LOD pools abundant. p:r = 3:1 - excellent for coho.	See stream maps.	--

Available Cover: Extensive cover available from heavy LOD load, undercut banks, deep pools and debris from beaver activity.

Aquatic Invertebrates/Available Food Source: Abundant: Dipterans, trichopterans, and some ephemeropterans (ponds full of tadpoles).

Aquatic Vegetation: Moderate amount of algae occurs on rocks.

Terrestrial Vegetation: Lower creek - grasses and sedges, in upper creek, dense currant, berries, devil's club under alder, cedar, hemlock and spruce canopy.

Shading: 80% from topography, some riparian vegetation and forest vegetation.

Extent and Quality of Rearing Area: Excellent, this creek probably has the most extensive (considering creek size) and best quality rearing area of any creek on the Island - due to heavy cover, low gradient and channel braiding (alot is available above and below the dams).

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Coho utilize entire creek, pink and chum use mainly the lower end.

Use by Fishermen: No known fishing occurs.

Wildlife Present

Heaviest beaver influence on creek observed on Annette.

Comments and Recommendations

This creek produces 2000+ coho smolts annually and should be protected and managed as a major coho stream. Do not disturb beaver dams and check dams for passability annually.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/13/81	Coho	Fry	Over 150 below first dam!		
					Two or three thousand could rear in this creek.
9/21/81	Pink	Adults	-	6	On-foot Count

Survey(s) and Dates Conducted

C. Huntington, 6/13/81

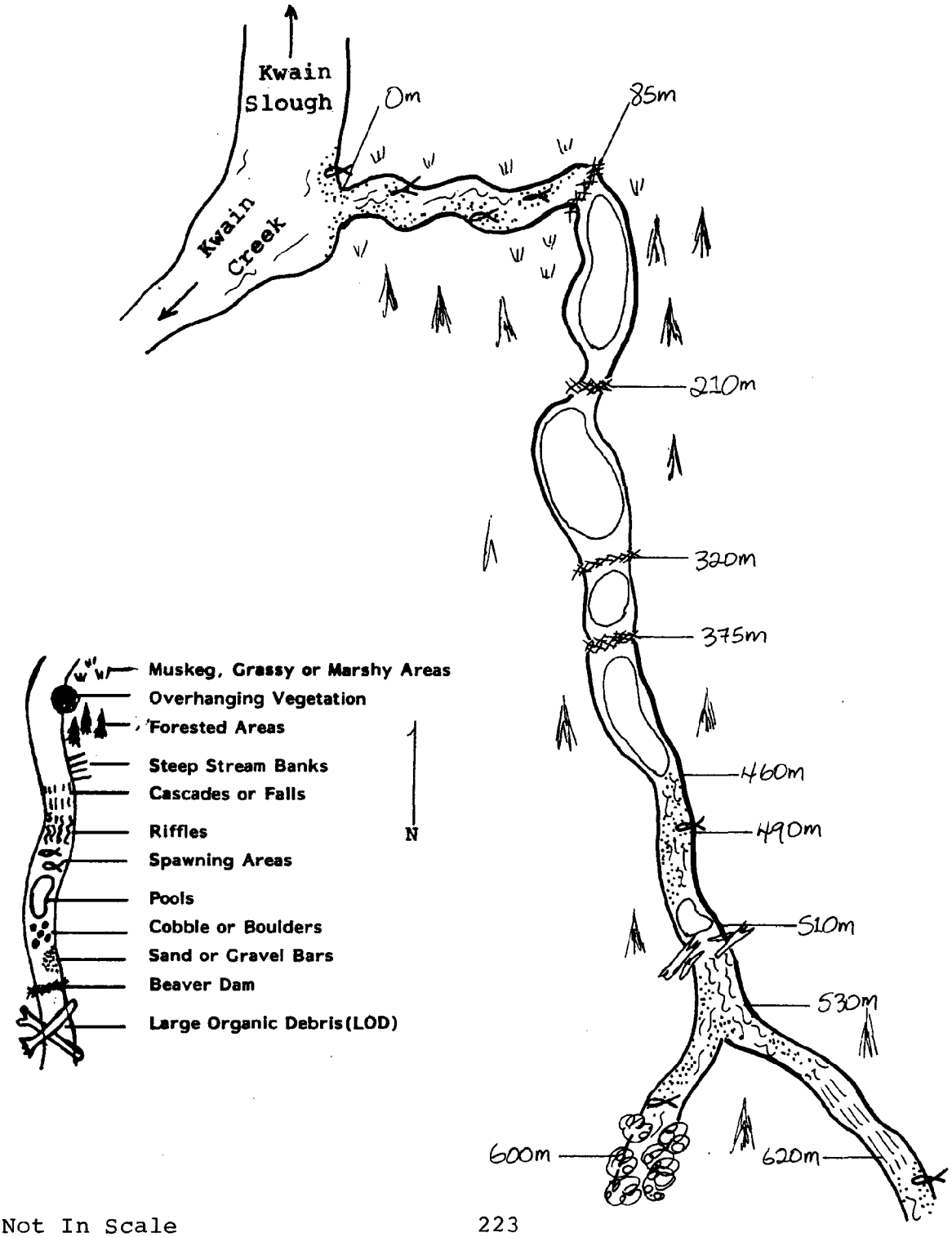
Recommended Escapement

Based on the available spawning area (including unsurveyed area in the upper west fork) and extensive rearing area, recommended escapements are 375 pink, 25 chum, and 18 coho spawning pairs.

Potential Production Summary

Gravel quality is fair, so a 10% egg-fry survival rate will be assumed. Production potential from Beaver Creek is 1115 pinks, 125 chums and 102 coho returning to Annette Island.

Figure 45. BEAVER CREEK



Not In Scale

BEAVER CREEK

Watershed No. 306-01
Stat. No. 101-24-086

0m	Mouth, where Beaver Creek flows into Kwain Bay Slough.
0-85m	$225m^2$ spawning area below first beaver dam at 85m; .2m high beaver dam passable at high flow, 30 x 110m pond about 2.5m maximum depth ($3600m^2$ rearing area).
210m	Second beaver dam passable at high flow, 20 x 110m pond, 2m maximum depth ($2200m^2$ rearing area).
320m	Third dam passable at high flow, 55 x 30m pond, 2m maximum depth ($1650m^2$ rearing area).
375m	Fourth dam passable at high flow, 30 x 85m pond, 1.5m maximum depth ($2550m^2$ rearing area).
460m	Uppermost end of beaver dams and ponds.
490m	Two old redds here.
510m	20 x 10m pool formed by old dam.
460-530m	Average Stream Width (ASW) = 1.5m, Average Stream Depth (ASD) = .20m, 35% gravels ($26m^2$ spawning area); stream forks at 530m.
530-600m (West Fork)	Channel is extremely choked with riparian vegetation, although spawning could occur above thicket (it is passable).
530-620m (East Fork)	Barrier at long, steep cascade in bedrock - some good gravels above this, but no fry observed.
Spawning Area:	Total area is approximately $250m^2$, mainly above HTM, however, in lower $225m^2$, there may be some salt water influence.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Kwain Creek	101-24-087	306-02

Flows NE into Kwain Bay, 1.4 mi long./off and Kwain Lakes below Tamgas Peak./ Mountain run- Steep timbered mountain slopes. (3.4 mi^2 in area)

Location	Origin	Watershed Type

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/13/81	1200m from mouth (6/21/72)	Falls at 675m	Low flow	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Intertidal: less than 1% Above HTM 2%	7.5 cfs up to 8.1 cfs/	Variable/1-3 fps	5m above falls/Below HTM/ 4m below falls/4-30m/	.25m above falls .20m below falls to .6m

Streambank Composition / Stability: Soils, mud and clay (rock upper end) heavily vegetated - minor LOD Influence above HTM./ Vegetation stabilizes channel.

Tributaries: Beaver Creek Forks intertidally, Creek forks again at 1100m.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
6/21/72:	13.0C	7.0C	8.1	Turbid (10.0ppm)	--	--	--
--	15.0C	12.0C	--	Clear / None	Very slight Amber	10.0ppm	-

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	10.0ppm (6/21/72)	8.56 ppm (6/21/72)	Resistivity = 47,169 ohms/cm^3

Spawning Area

Intertidally: 10% silt, 20% sand, 10% pebbles, 55% gravels, 5% cobbles. Below Falls: 5% bedrock, 20% boulders, 25% rubble, 30% cobble, 10% gravel, 5% pebbles, 5% sand and fines. Falls to 350m: 2% cobble, 55% gravel, 8% pebbles, 20% sand, 10% silt. Above 350m: 25% rubble, 55% cobble, 15% gravel, 5% pebbles.

Overall Stream Bottom Composition

Gravel Compaction: Some occurs with presence of fines.

Spawning Area Available Above High Tide Mark (HTM): $10m^2$ - limited area below falls; above falls - extensive spawning habitat occurs between 150-300m; $500m^2$ fair quality, $200m^2$ good quality and $100m^2$ excellent quality - totalling $800m^2$ potential area.

Intertidal Spawning Area: By low-level aerial photography: $3250m^2$ area available ($3450m^2$ fair quality area estimated by conventional survey technique).

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Overall p:r = 1:2, pools created by LOD, bends in creek and root tangles./	Above falls .30m/ up to Below falls .25m/ .75m	-- --

Intertidally - Some undercut banks are available. Above HTM, overhanging vegetation, LOD and root tangles provide a moderate amount.

Available Cover: Abundant intertidally: amphipods and isopods. Above HTM: fairly abundant; predominately ephemeroptera.

Aquatic Invertebrates/Available Food Source: Sparse - some filamentous algae occurs.

Aquatic Vegetation: Devil's club, salmonberry, and timber (spruce and hemlock) above HTM. Sedges, grasses, and herbs intertidally.

Terrestrial Vegetation: Less than 5% below HTM. 90% to barrier, 25% above barrier to forks, 90% above forks.

Shading: Some exists intertidally for pink and chum fry; limited coho habitat except above the barrier falls

Extent and Quality of Rearing Area: where a moderate amount occurs. Most area is suited best for pink and chum.

Reported and Suspected Use of Stream by Fish and Fishermen

Pink, chum, coho and cutthroat currently utilize this creek.

Use by Fish: Some subsistence fishing and hunting occurs.

Use by Fishermen

Wildlife Present

Beaver activity and mink observed.

Comments and Recommendations

Currently there is extensive spawning area available for pink and chum, the creek being one of the major producers of salmon. However, more area could be opened by putting in a fish passage (modifying the barrier cascades at 125m) - the rearing area above the falls may be the limiting factor to coho production.

A benefit:cost analysis would be desirable.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
Escapement records sine 1955: ADF&G and USFWS Report that up to 25-50,000 fish have been observed in this creek.					
6/12/72	Pink	Fry	Not counted		
1974	Pink	Adults	1522	--	USFWS Estimated Total Escapement
1975	Pink	Adults	12,486	--	USFWS Estimated Total Escapement
1976	Pink	Adults	5888	--	USFWS Estimated Total Escapement
8/5/80	Coho	Fry	50	--	Water temperature recorded at 20C!
	Cutthrat	Fry	25	--	
9/4/80	Pinks with 1% Chum	Adults	3500	--	Spawning in creek slough below falls - On foot Count
9/7/80	Pinks mainly (mixed)	Adults	6000	--	Aerial count - seen in slough.
9/1/81	Pinks mainly (mixed)	Adults	300-400	In slough	Aerial count
			100-200	- In ball below creek mouth	
9/26/81	Pink		1279	358	On-foot Count
	Chum		0	1	On-foot Count

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/13/81 and USFWS, 6/21/72

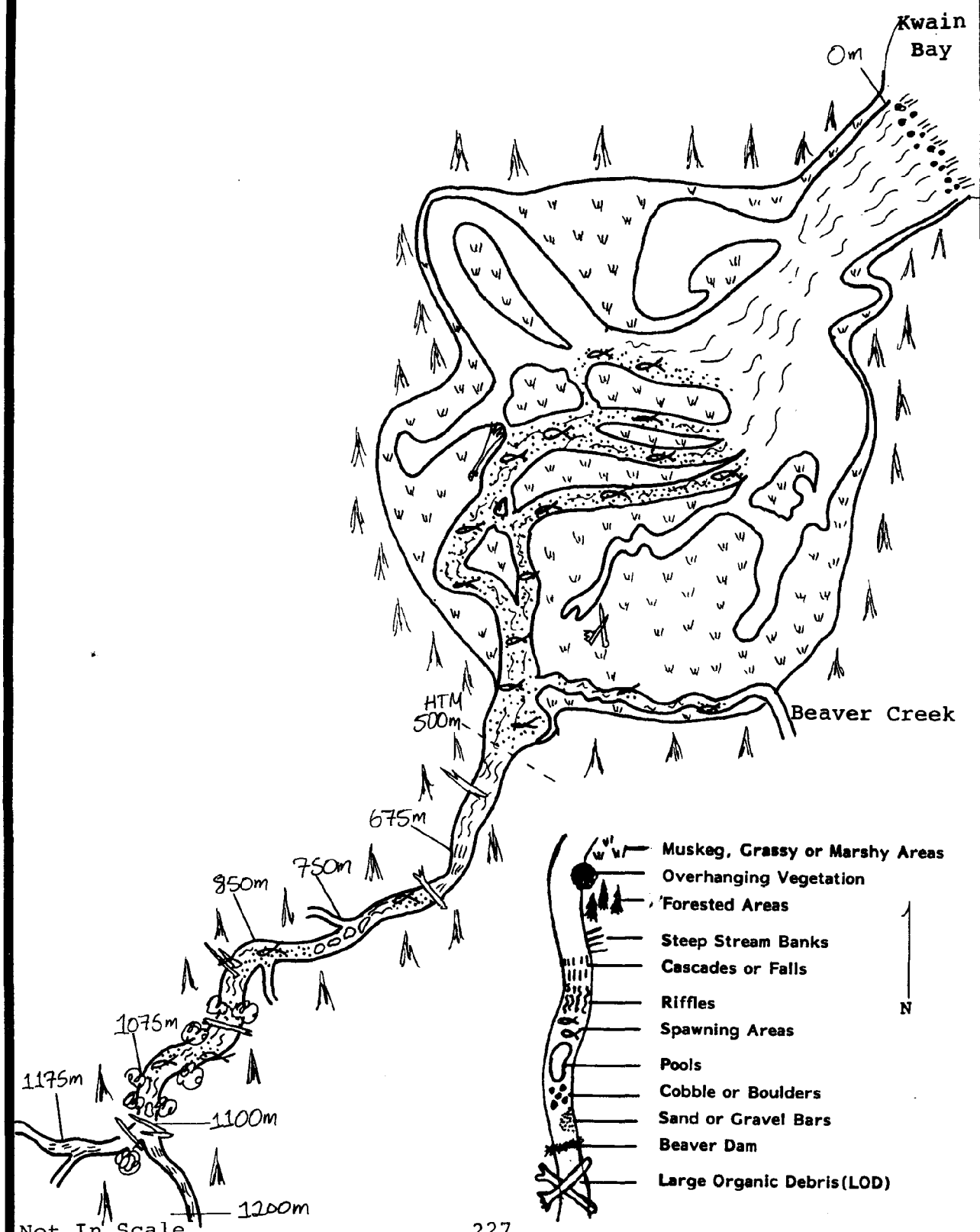
Recommended Escapement

Using the estimate of spawning area estimated by low-level aerial photography and computed spawning area available recommended escapements are 5420 pink and 355 chum spawning pairs. Coho probably do not utilize this fork.

Potential Production Summary

Based on a 10% egg-fry survival rate due to the fair gravel quality, potential returns to Annette Island from Kwain Creek are 16,100 pinks and 1750 chum. Coho fry spotted in this creek are probably overflows from Beaver Creek. However, much potential coho spawning and rearing habitat occurs above the barrier falls with a 68 coho spawning pair and 400 coho adult return production potential.

Figure 46. KWAIN SLOUGH AND CREEK



KWAIN BAY SLOUGH AND KWAIN CREEK

Watershed No. 306-02
Stat. No. 101-24-087

0m	Mouth of creek is bedrock, boulder cascade flowing into Kwain Bay. Just above 0m, creek is very wide and slow flowing (too slow for spawning). Spawning area begins where creek narrows into channels.
500m	High Tide Mark (HTM), intertidal spawning area flows through an open, grassy (sedges, forbes, and rushes) slough.
500-675m	Cobble, boulder riffle ($10m^2$ spawning area); at 675m is a 1.5m steep (40° rise) falls over bedrock, a probable barrier to salmon.
750m	Tributary enters with good coho rearing area to 60m (.5 cfs flow).
850m	.5 cfs flow tributary enters in; the best spawning area in creek occurs from this point, downstream to the upper end of the falls at 675m.
1075m	Upper limit of good spawning area.
1100m	Heavy LOD and overhanging vegetation - stream bottom mostly rubble and cobble; stream forks.
1200m (East Fork)	3m chute and cascades (barrier). End of survey.
1175m (West Fork)	Stream splits again - one tributary has a 2m falls with no plunge pool, and a cascade on the main channel poses a definite barrier. End of survey.

Spawning Area:

Intertidal (majority of area available)

	0-500m	$3450m^2$	Total Area
Above HTM	500-675m	$10m^2$	Current Available
Above barrier at	675m	$800m^2$	Potential Area

($3520m^2$ Area Available Intertidally, Estimated by Low-Level Aerial Photography)

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
South Crab Creek and Slough	101-24-094	305-01

Location	Origin	Watershed Type
Flows NE into Crab Bay, 2 mi long.	Purple Lakes - mountain run-off./	Steep forested and exposed rock slopes and alpine valleys and lakes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/13-14/81	2800m above Nork Crab Creek Fork	8m falls at 2800m	Relatively low	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
.5° in slough 1-2° in creek	20 cfs/up to 70 cfs	1.5 fps/ 1-3 fps	Below HTM 30m/-- Above 16.5m / --	.1 / up to .08-.6.

Streambank Composition / Stability	Tributaries
Grassy banks in slough, heavily vegetated soils and rocks above/ stabilized by vegetation - low LOD influence - some flashiness.	One intertidally (besides N. Crab Creek Fork) None above HTM.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
8/1/72:	19.0C	12.15C	7.5-7.7	--	--	12.0ppm	--
In slough	13.3C	18.5 C	5.5	Clear / None	Slight Amber	--	--

Trace (8/1/72) 10.0ppm (8/1/72) 8.56ppm (8/1/72) Resistivity = 46,169 ohms/cm^3

Total Alkalinity Total Hardness Dissolved Solids Other/Overall

Spawning Area

Overall Stream Bottom Composition

Intertidally: boulders, cobble and sand in lower end of slough, in channels, pebbles and small gravels (increasing in size up slough) prevail. Above HTM: gravels mixed in/ with cobble, cobble, boulder and eventually bedrock.

Gravel Compaction

Some due to silt and sand intertidally - none above HTM.

Spawning Area Available Above High Tide Mark (HTM)

Gravel size increases with cobble, but is still good. Most gravels occur below 2000m, 9610m^2 total available. (Many gravel bars occur and may indicate flashiness).

Intertidal Spawning Area

An immense amount of area is available. By low-level aerial photography: 12,000m^2 area (approximately 15,000m^2 estimated by conventional survey techniques).

Rearing Area

Pool/Riffle Frequency (P:R Ratio) -- Ave. Pool Depth/Range -- Ave. Pool Size/Range --

Some pools intertidally; however, they are sparse.

Available Cover

Undercut banks are only cover intertidally. LOD and undercut banks occur above HTM.

Aquatic Invertebrates/Available Food Source

Abundant intertidally: isopods and amphipods are common. Moderately abundant above HTM: simulids (blackflies) are common.

Aquatic Vegetation

Algae (brown periphyton) common and some marine algae intertidally. Moss occurs on rocks above HTM.

Terrestrial Vegetation

Sedge, grasses and herbs intertidally. Above HTM is berries, alder and hemlock, spruce and cedar canopy.

Shading

0% intertidally. 40% above HTM mainly due to canopy.

Extent and Quality of Rearing Area

Many coho fry seen in a moderate amount of rearing area. Intertidally - some occurs in undercut banks for pink and chum fry (abundant food exists).

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

Pink, chum, coho and cutthroat utilize creek (rainbow in Purple Lake).

Use by Fishermen

Light subsistence fishing recorded and some hunting.

Wildlife Present

Deer, wolves, mink and marten have been observed. Canada Geese feed in the slough.

Comments and Recommendations

Excellent pink and chum spawning grounds and extensive freshwater rearing and spawning habitat for coho make this creek one of the top two producers of salmon on Annette Island. No habitat improvement is recommended; trying to make lower or upper Purple Lake available would require more than one fish passage, although it could be stocked with excess fry for rearing and a benefit cost study would be desirable.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
10/14/71	Pink and Chum	Adult	30,000	approximately	Varies from 25-50,000 - USFWS Estimate
	Coho	Adult	100 or less every year		
1974	Pink	Adult	4348		USFWS Estimated total Escapement
1975	Pink	Adult	21,309	--	USFWS Estimated total Escapement
1976	Pink	Adult	15,672	--	USFWS Estimated total Escapement
1973	Rainbow	Fry	12,000	--	Stocked in Purple Lake
1974	Rainbow	Fry	36,000	--	Stocked in Purple Lake
1975	Rainbow	Fry	50,000	--	Stocked in Purple Lake
9/7/80	Pinks	Adults	4000	--	Aerial count - estimated from fish in slough.
	Chum	Adults	500	--	Aerial count - estimated from fish in slough.
6/13/81	Coho	Fry	Over 50	--	Many more uncounted ones observed.
9/1/81	Pinks Mainly (mixed) - Adults		300-400	--	Aerial Count - fish counted in slough - many uncounted carcasses seeen.
9/21/81	Pinks	Adults	12,800	134	On-foot Count Peak
	Chum	Adults	42	65	On-foot Count Peak

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, J. Yuska, 6/13-14/81 and USFWS, 10/14/71, 8/1/72

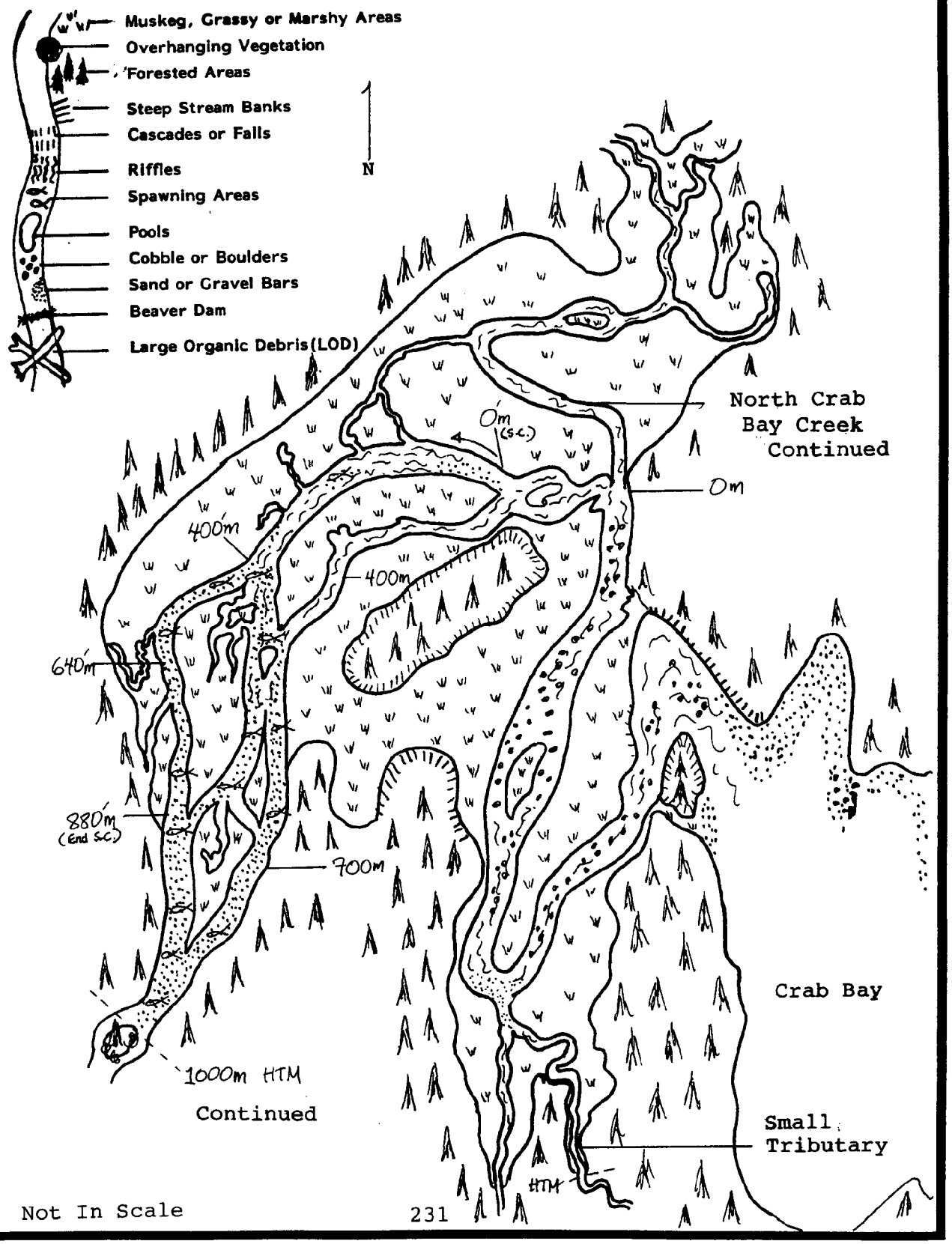
Recommended Escapement

Based on the spawning area estimated by low-level aerial photography and conventional survey technique and on historical escapements, recommended escapements are: 6500 pink (that will be very site-selective) and 390 chum spawning pairs intertidally. In the freshwater section of the creek, spawning area is available for another 6000 pink, 240 chum and rearing area for 25 coho spawning pairs.

Potential Production Summary

Assuming an overall egg-fry survival rate of 10%, potential production is 37,125 pinks, 3120 chums and 141 coho returning to Annette Island. Most of these fish are probably intercepted in Seine and Gillnet fisheries around the Island.

Figure 47. CRAB BAY SLOUGH AND SOUTH CRAB CREEK



Not In Scale

SOUTH CRAB CREEK

Watershed No. 305-01
Stat. No. 101-24-094

0m — Point at which North Crab Creek splits off; no spawning areas below this point intertidally (channel below 0m is mainly boulder and cobble). Small tributary entering main channel on south end of the slough is 200m long from High Tide Mark (HTM), has a .5 cfs flow and about 3-10m^2 spawning area.

0-400m (South Channel)
No usable gravel here.

400-700m — Average Stream Width (ASW) = 18m, Average Stream Depth (ASD) = .3m, 30% spawning gravels (1620m^2 spawning area.

700-100m — ASW = 36m, ASD = .1m, 90% spawning gravels (9720m^2 spawning area). HTM at 1000m. (Continued, second section.)

0-400m (North Channel)
ASW = 11-12m; bottom composition 70% spawning gravel, mixed with pebbles and some mud (3080m^2 spawning area).

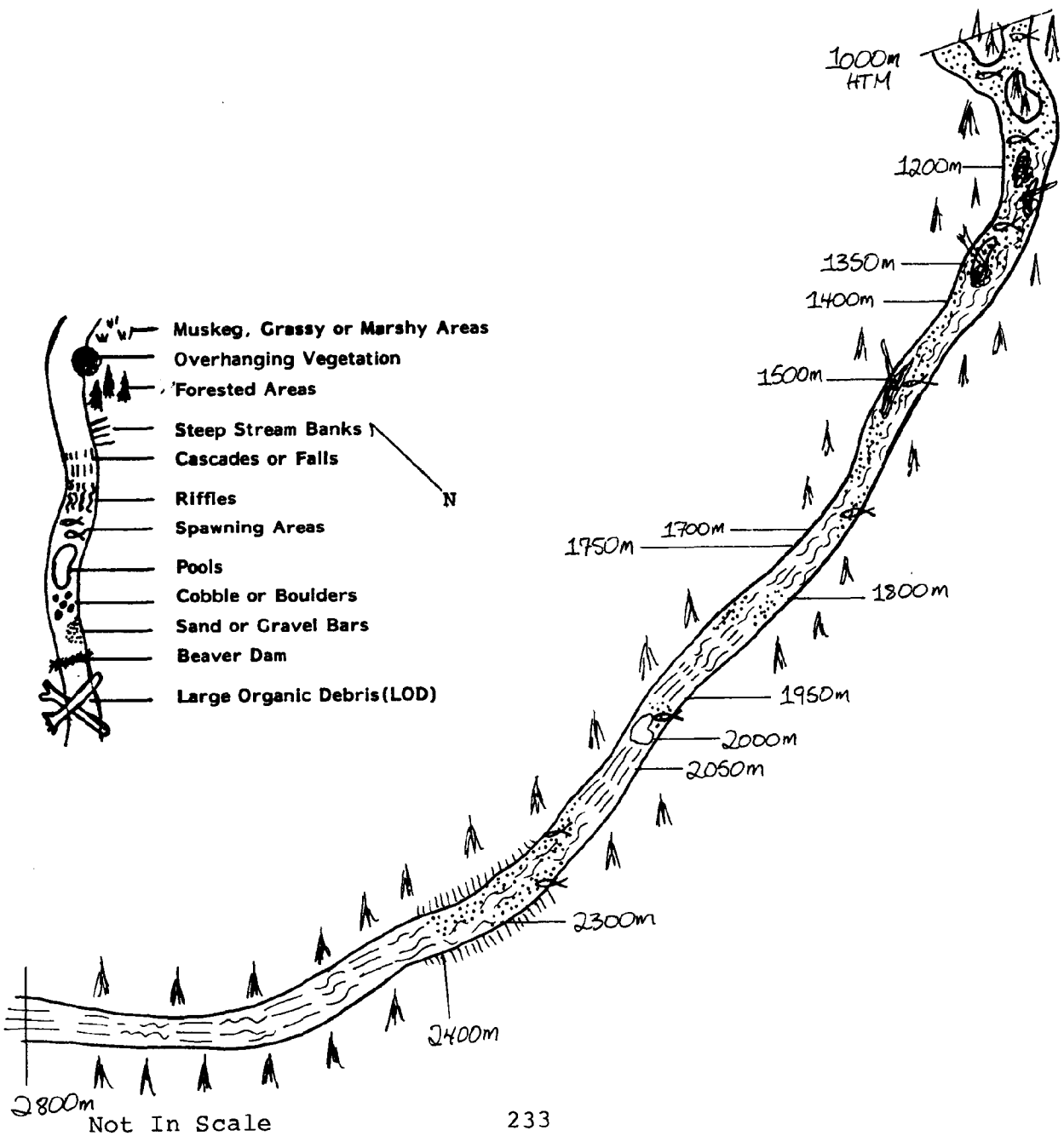
400-600m — Gravels become finer with sand, mud and shell, and is no longer good for spawning.

400-880m — 10% spawning gravels (624m^2 spawning area).

Spawning Area: Intertidal area is 15,044m^2 spawning area in slough, 3-10m^2 in small tributary.
12,000m^2 area available
Estimated by Low-Level Aerial Photography

(CONTINUED, SECOND SECTION)

Figure 48. SOUTH CRAB CREEK



Not In Scale

SOUTH CRAB CREEK (CONTINUED)

1000-1200m	HTM, ASW = 40m, ASD = .08m, 90% spawning gravels ($7200m^2$ spawning area).
1200-1350m	ASW = 15m, ASD = .1m, large cobble present, but still 50% spawning gravels ($1125m^2$ spawning area).
1350-1400m	ASW = 15m, bottom composition: 30% gravels, 50% cobbles, 30% small boulders ($150m^2$ spawning area).
1400-1500m	ASW = 17m, ASD = .1m, 20% spawning gravels ($170m^2$ spawning area), some undercut banks.
1500-1700m	ASW = 8m, ASD = 6m, bottom has alot of boulders with 20% spawning gravels ($560m^2$ spawning area).
1750-1800m	Bedrock riffle; trees make up majority of riparian vegetation.
1950-2000m	Bedrock riffle with a spawning area at 2000m.
2050m	Waterfall 1.5m high, all bedrock, but not a barrier.
2300m	40 ft high banks (like a gorge) over creek; bottom has 4 and 5m gravel bars, making bottom 20% spawning gravels ($180m^2$ spawning area).
2400-2800m	Less than 1% usable spawning gravels, bottom all bedrock with an 8m barrier falls at 2800m.

Spawning Area: Above HTM $9610m^2$ spawning area total

ANNETTE ISLANDS STREAM SURVEY SUMMARY

North Crab Bay Creek Stream	101-24-095 Number	305-02 Geocode Forested and exposed granite / slopes and alpines valleys.
Flows SE into Crab Bay, .8 mi long. Location	Mountain slope run-off and springs. Origin	Watershed Type 70mi^2 in area.

6/13/81 Date Surveyed	1250m from mouth to barrier. Section Surveyed	Falls and flows in sandstone at 1250m. Barriers	Low flow Stage	+2 ft Flood Height
Low (1-2%) Ave. Gradient	1.5 cfs / -- Flow / Range	.2-1 fps / -- Ave. Velocity/Range	9m / -- Ave. Width/Range	.08m / -- Ave. Depth/Range

Sand, mud and clay with grasses and sandstone upper end./ Some active undercutting but generally stable.
Streambank Composition / Stability

This creek is a fork of South Crab Creek - it has one tributary.
Tributaries

Water Quality

(12.0C in upper end)

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Intertidally	13.3C	17.0C	5.5	Clear / Slight	Light Amber	--	--

Water probably gets very silty during heavy rains.

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

In lower sections: silt, clay and sand predominate. Some small gravel occur farther up - gravels of marginal quality for spawning.
Overall Stream Bottom Composition

Moderate compaction due to heavy accumulation of fines.
Gravel Compaction

Only 50m^2 occurs above HTM and this is of marginal quality.
Spawning Area Available Above High Tide Mark (HTM)

Approximately 560m^2 of poor - marginal quality area, only suitable for pinks, occurs.
Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Very few pools.	-- --	-- --

Some cover available in undercut banks and LOD over 1100m - limited.
Available Cover

Amphipods and isopods are numerous intertidally. Scarce above HTM.
Aquatic Invertebrates/Available Food Source

Some brown periphyton, marine algaes and mosses.
Aquatic Vegetation

Mainly estuarine - sedges, grasses and herbs. Wooded area begins above 1100m.
Terrestrial Vegetation

0% in lower section, 10-20% above 1100m.
Shading

Some rearing area occurs intertidally because of undercuts, LOD and low velocity and gradient. Limited above 1100m.
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink and chum utilize creek if at all (and these are probably overflow from South Crab Creek). Coho may use, but not extensively.
Use by Fish

No fishing known.
Use by Fishermen

Wildlife Present

See South Crab Bay Slough.

Comments and Recommendations

This is mainly a pink and chum stream; however, coho may use some of the upper gravels (or fry may just wind up here after flooding or competition for space occurs in South Crab Creek). This creek produces small numbers of salmon because of marginal quality spawning areas and limited rearing areas.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
Most counts previously were combined with South Crab Bay Creek's counts.					
6/13/81	Coho	Fry	A few		
9/21/81	Pinks	Adults	None seen		

Survey(s) and Dates Conducted

J. Yuska, E. Biggs, 6/13/81

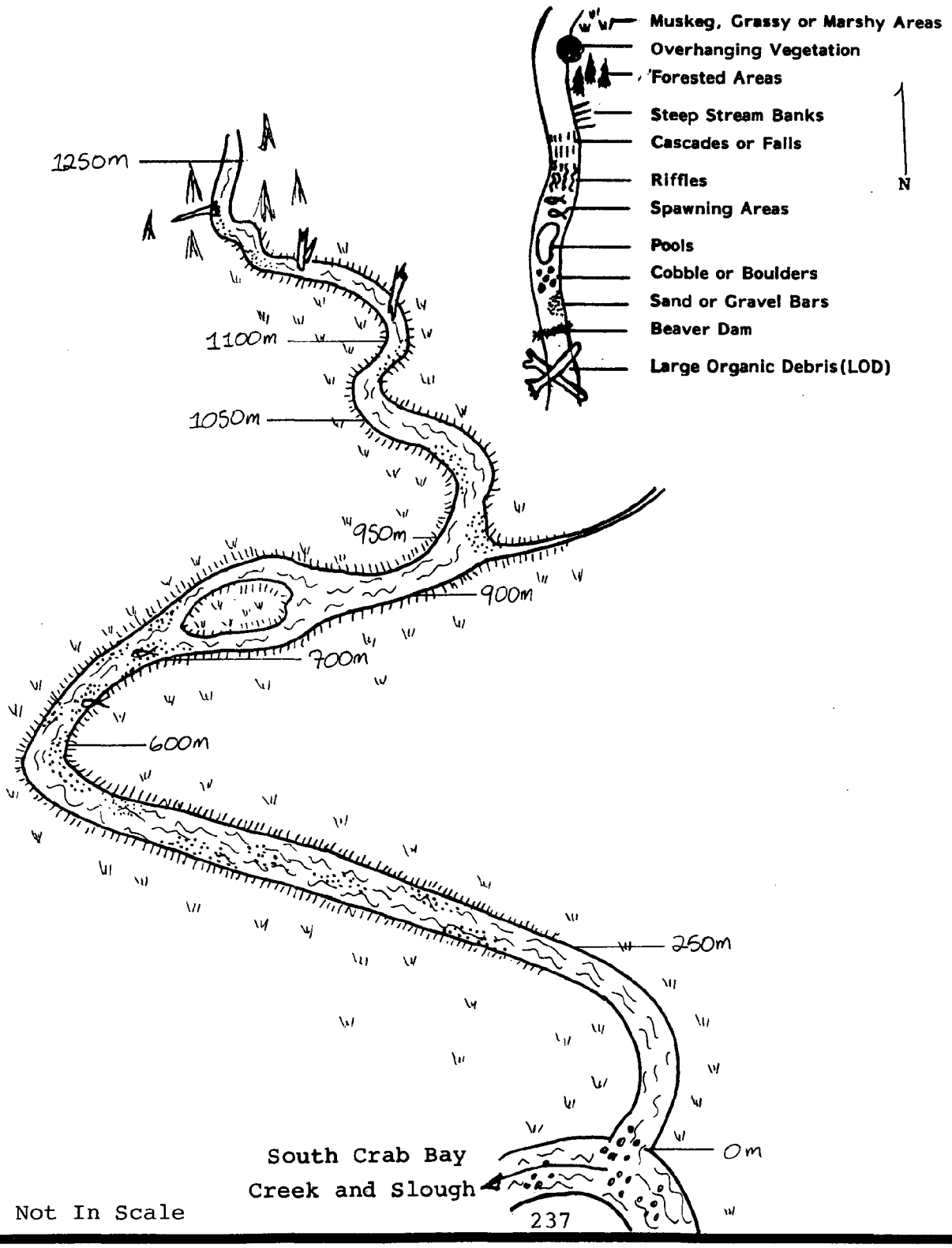
Recommended Escapement

Pink and chum probably only utilize this creek if Crab Bay slough overflows, and even if they did, survival would be low due to the poor gravel quality.

Potential Production Summary

None calculated, too many fines occur in the bottom.

Figure 49. NORTH CRAB BAY CREEK



Not In Scale

NORTH CRAB CREEK

Watershed No. 305-02
Stat. No. 101-24-095

0m	Point where North Crab Creek forks off from Crab Slough.
0-250m	Average Stream Width (ASW) = 9m; marginal gravels, compact and small.
600m	Gravels increase in size, but a compact and fine gravels are still present, 10% usable spawning area; ASW = 9m ($180m^2$ spawning area).
700m	Silt covers 30% clay, deposits present, with 20% gravels ($180m^2$ spawning area).
900m	Gravels form a thin layer covering clay, less than 5% usable.
950m	Tributary enters with $5m^2$ spawning area at mouth.
950-1050m	Pronounced bank instability.
1100m	ASW = 7m, ASD =.08m, bank instability increases; still is a high percentage of fine sediment in bottom.
1100-1250m	Some LOD present; at 1250m, stream ends in a narrow high cascade through a sandstone cave ($200m^2$ spawning area).

Spawning Area:

Intertidal	$360m^2$	approximately spawning area
Above HTM	$200m^2$	spawning area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
South Blunt Mountain Creek	101-24-096	304-01

Location	Origin	Watershed Type
Flows NE into Revilla Channel, .4 mi. long.	Mountain slope run-off.	Steep forested and exposed granite slopes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	450m above mouth to barrier.	Falls at 450m.	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Moderate to steep.	9 cfs (7/6/76)/to flashy/	1 fps / variable	4.5 m / --	.25m / --

Streambank Composition / Stability	Tributaries
--	One main fork at 60m.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	12.3C	9.0C	7.0 (7/6/76)	Clear / None	Slight Amber	--	--
--	--	--		--			

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall

Spawning Area

Overall Stream Bottom Composition

Above 250m - all bedrock and boulders. Mainly cobble and boulders with less than 10% gravels.

Intertidally, gravels increase to 50% in areas.

Gravel Compaction

Minimal - no fines.

Spawning Area Available Above High Tide Mark (HTM)

Stream's flashiness may limit egg survival although some gravel bars exist. $133m^2$ area available - fair quality.

Intertidal Spawning Area

$250m^2$ area available of fair quality spawning gravels.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools	-- --	-- --

Available Cover

Some LOD occurs and channel braiding.

Aquatic Invertebrates/Available Food Source

Sparse

Aquatic Vegetation

Sparse

Terrestrial Vegetation

Blueberries, salmonberry, devil's club, ferns under a hemlock, spruce and cedar canopy.

Shading

Shading is moderate from banks, overhanging shrubs, and canopy.

Extent and Quality of Rearing Area

Limited due to flashiness of creek and limited amount of area. Some is available, however.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish

Pinks and chum are known to spawn here.

Use by Fishermen

No fishing known.

Wildlife Present

None seen.

Comments and Recommendations

Not much could be done to enhance this stream for salmon production. The stream's flashiness may limit production by disturbing gravels during incubation.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
7/6/76	None Seen				
6/20/81	None Seen				

Survey(s) and Dates Conducted

J. Yuska, 6/20/81 and USFWS, 7/6/76

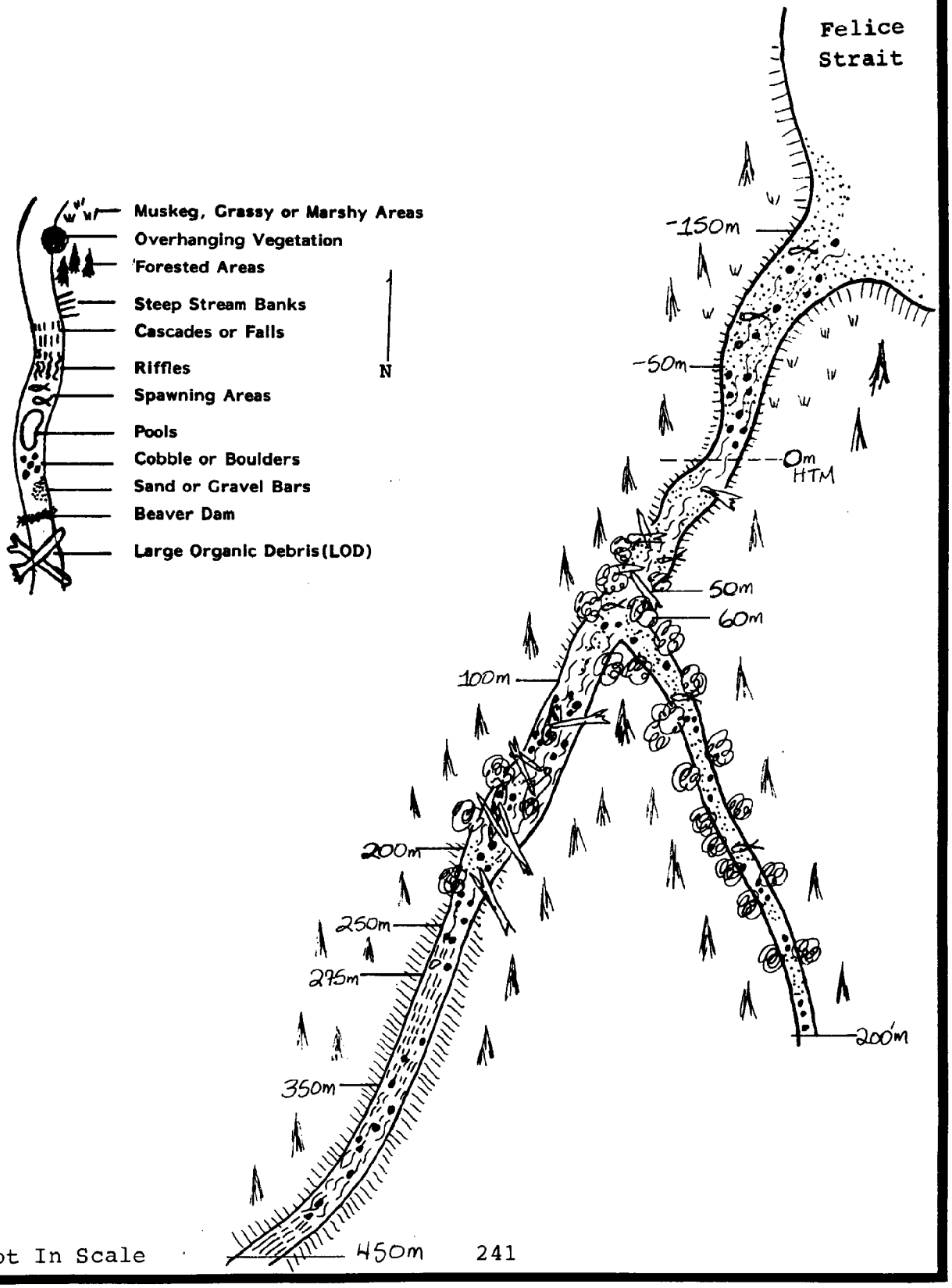
Recommended Escapement

Based on available spawning area, recommended escapement is 510 pink, 45 chum and 10 coho spawning pairs.

Potential Production Summary

Due to creek flashiness, a low in-gravel survival rate 1.2% is assumed. Potential return of adults from this creek is 182 pinks, 28 chum and 8 coho.

Figure 50. SOUTH BLUNT MOUNTAIN CREEK



Not In Scale

SOUTH BLUNT MOUNTAIN CREEK

Watershed No. 304-01
Stat. No. 101-24-096

-150 to -50m	Average Stream Width (ASW) = 5m, 50% spawning gravels ($250m^2$ spawning area).
-50-0m	No gravels, bottom is all cobbles and boulders. At 0m High Tide Mark (HTM) and here there are 10% gravels, 50% cobble, and 40% small boulders.
0-50m	ASW = 5m, with 6m wide gravel bars, 10% gravels ($55m^2$ spawning area).
50-100m	ASW = 4m, 10% gravels ($20m^2$ spawning area), with alot of LOD in the stream. At 60m, a tributary enters, ASW = 1.5m, with 20% gravels, 50% cobble, 30% boulders; tributary is 200m long at which point gravels become insignificant ($60m^2$ spawning area total in tributary).
100-200m	Gravels are less than 5% of the area, stream banks are unstable, LOD is common and channel braids; bottom is mainly cobble and boulders.
200-250m	ASW = 3.5m, 10% gravels, 60% boulder, 30% cobble with a moderate gradient ($17.5m^2$ spawning area). At 250m, stream enters a steep bedrock and boulder gorge.
275m	1.5m falls - may be a barrier to pinks and chums, but coho may be able to traverse it.
350m	Cascades end, but channel is still moderately steep with less than 5% gravels.
450m	Gorge ends with a 3m falls, a definite barrier to salmon, little or no spawning gravels above 250m.

Spawning Area:	Intertidal	$250m^2$ spawning area
	Above HTM	$133m^2$ approximately spawning area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

North Blunt Mountain Creek Stream	101-24-097 Number	304-02 Geocode
Flows SE into Revilla. Channel, .7 mi long. Location	A small lake and mountain slope run-off. Origin	Steep forested and exposed granite slopes. Watershed Type
6/20/81 Date Surveyed	To falls at High Tide Mark (HTM) Section Surveyed	10m falls at High Tide Mark Barriers
Moderate Stage	-- Intertidally = Flood Height	
Steep Ave. Gradient	3 cfs (7/6/76) -- Flow / Range	Fast / -- Ave. Velocity/Range
2.4m/ 6m Ave. Width/Range	.2m / -- Ave. Depth/Range	
Rock / Stable Streambank Composition / Stability	-- Tributaries	

Water Quality

At HTM	12.3C	11.0C	6.5 (7/6/76) -- --	--	--	--
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2

--	--	--	--
Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall

Spawning Area

Intertidally - 50% gravels, 30% cobble, 20% boulder - subject of heavy wave action.
Overall Stream Bottom Composition

--
Gravel Compaction

Very little spawning potential.
Spawning Area Available Above High Tide Mark (HTM)

Some gravels occur, but wave action destroys potential productivity.
Intertidal Spawning Area

Rearing Area

--	-- --	-- --
Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range

--
Available Cover

--
Aquatic Invertebrates/Available Food Source

--
Aquatic Vegetation

--
Terrestrial Vegetation

--
Shading

--
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Only trout would use this creek.
Use by Fish

No fishing.
Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

Not much could be done to enhance this creek - little spawning or rearing occurs above falls (USFWS).

Intertidal spawning area is of marginal quality. No fish seen or expected.

Survey(s) and Dates Conducted J. Yuska, 6/20/81, and USFWS 7/6/76

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Camp Cove Creek - Ham Island	101-24-098	300-01

Flows NE into Revilla Channel, .5 mi long. Beaver ponds - muskeg run-off. Forested muskeg area.

Location	Origin	Watershed Type
6/20/81	Beaver ponds at 960m.	Low - moderate +1.5 ft

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
1%	4-5 cfs / 2 cfs (5/4/76)	1 fps / to 2 fps	2m / to 1.5m	.2m / up to .5m
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range

Mainly of soil and rock heavily vegetated with grass and shrubs - some flashiness, but stable channel due to vegetation. Some LOD influence./ 3 small ones (muskeg drainage).

Streambank Composition / Stability Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	10.5C	13.0C	--	Clear / None	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

10% bedrock and boulders, 10% cobble and rubble, 30% gravels, 20% pebbles, 20% sand, 10% mud and silt.

Overall Stream Bottom Composition

Some organic matter occurs, mixed in with other sediments. Moderate due to fines present.

Gravel Compaction

Evidence of redds was observed - gravels are patchy mainly occurring in gravel bars - approximately $186m^2$

Spawning Area Available Above High Tide Mark (HTM)

area exists, however.

30% gravels in a 64m usable stretch - creats $50m^2$ available area.

Intertidal Spawning Area

Rearing Area Many pools of variable size occur formed by boulders, LOD and root wads.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.25m / .5m	1m diameter/ up to 3m

Abundant cover under overhanging vegetation, LOD, root wads, and undercut banks (deep in places).

Available Cover

Scarce

Aquatic Invertebrates/Available Food Source

Alot of aquatic moss occurs.

Aquatic Vegetation

Upper and lower ends - grasses and sedges under trees predominates. In the mid-section, berries and alder are common.

Terrestrial Vegetation

20% in lower and upper end due to canopy. 90% in the middle due to riparian vegetation, topography and canopy.

Shading

Extensive rearing area occurs in this creek because of extensive cover, low velocity and low gradient.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pinks utilize creek; chum, coho, cutthroat and Dolly Varden possibly use it also.

Use by Fish

No fishing or hunting known.

Use by Fishermen

Wildlife Present

Beaver activity.

Comments and Recommendations

This creek does not produce alot of salmon, but it has good quality spawning and rearing areas. It could produce alot of trout. Some flashiness may occur - affecting egg and alevin survival; however, affect is unknown at this time.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
5/4/76	Pink	Fry	Not counted		Cutthroat and Dolly Varden could utilize creek also.
6/20/81	None seen				

Survey(s) and Dates Conducted

E. Biggs 6/20/81 and USFWS 7/4/76

Recommended Escapement

Based on available spawning area, and rearing area recommended escapements are 390 pink, 25 chum, and 5 coho spawning pairs.

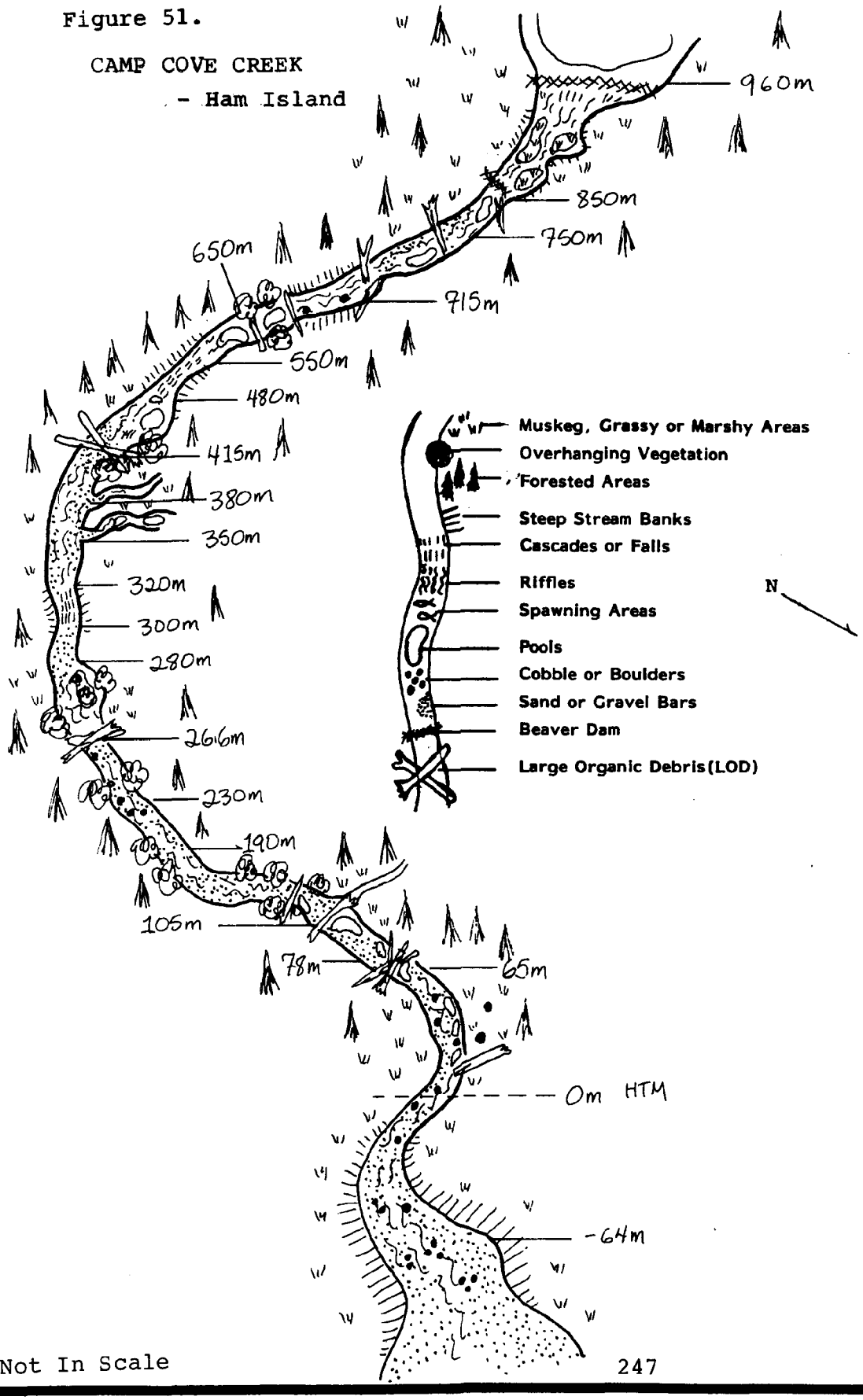
Potential Production Summary

Based on the above escapements, and assuming an overall 10% egg-fry survival rate (fair gravels), production potential is 1160 pinks, 124 chum and 28 coho returning to Annette Island.

Figure 51.

CAMP COVE CREEK

- Ham Island



Not In Scale

CAMP COVE CREEK (HAM ISLAND)

Watershed No. 300-01
Stat. No. 101-24-098

-64m	Average Stream Width (ASW) = 2.5m, 30% gravels (.50m^2 available spawning area).
0m	High Tide Mark (HTM).
65m	Canopy closes in to 90% shading; ASW = 2.5m, bottom is 40% boulders and cobble, 10% gravels (16m^2 spawning area).
78m	LOD pile.
105m	ASW = 2.5m, ASD = .2m, a large pool here provides excellent rearing habitat next to a gravel bar (5m^2 spawning area); a tributary with .25 cfs flow enters here and also provides some excellent rearing habitat.
190-230m	ASW = 2.0m, 80% spawning gravels (64m^2 area).
230-266m	ASW = 2.0m, 20% spawning gravels - large size (14m^2 area). At 266m is an old root tangle, LOD and mainly fine sediment on the bottom.
280-300m	ASW = 1m, 90% spawning gravels (18m^2 area).
300-320m	Creek flows over a bedrock channel.
320-415m	ASW = 3m, ASD = .2-.3m, gradient lowers and gravels begin again - 10% spawning gravels in bottom (29m^2 area available). At 380m is a tributary (less than .25 cfs flow) with some rearing area and evidence of redds. At 380m is another .25 cfs flow tributary. At 415m is a root tangle, a possible barrier at low flow and a pool above.
480-550m	Creek flowing across bedrock, at 550m and above, gravels are sparse.
650m	Root tangles and LOD form good sized pools.
715m^2	ASW = 2m, a deep, slow flowing channel here with too many fine sediments mixed with cobble for spawning.
715-780m	Some gravel bars occur, ASW = 1.5m, with about 40m^2 total spawning area.
850-960m	Old beaver dam at 850m, and creek above is channellized and the bottom is all fines. At 960m, is a beaver dam with a huge pond (creek origin). End of spawning habitat here and survey.

Spawning Area:

Intertidal	50m^2 area
Above HTM	186m^2 area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Mink Creek	101-24-099	303-01

Flow E into Cascade Inlet, .7 mi long. Cascade Lake — Forested mountain slopes and alpine valley and lake.

Location	Origin	Watershed Type
6/15/76 Lake and lower end of creek.	30m falls at HTM	-- --

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
Steep	89 cfs / --	2.4 fps / --	6m / --	.15m / --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
Rock and heavily vegetated soils / Stable			None	

Streambank Composition / Stability — Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	5.5	-- --	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

--

Overall Stream Bottom Composition

--

Gravel Compaction

--

Spawning Area Available Above High Tide Mark (HTM)

--

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	-- --	-- --

Available Cover
--

Aquatic Invertebrates/Available Food Source
--

Aquatic Vegetation
--

Terrestrial Vegetation
--

Shading
--

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Currently only Dolly Varden and trout use lake and stream.

Use by Fish

No known fishing, although some hunting occurs.

Use by Fishermen

NOTE: 3600 rainbow fry were stocked in Cascade Lake in 1973.

Wildlife Present

--

Comments and Recommendations

No salmon currently utilize this creek and a benefit: cost analysis plus a more thorough stream survey is recommended before considering installing a fish passage (potential production increase is unknwon at this time). Rainbow were stocked in lake and it should be managed for trout and Dolly Varden at this time.

Survey(s) and Dates Conducted USFWS, 6/15/76

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Cascade Creek II	101-42-056	301-01

Location: Flows NE into Cascade Inlet, .2 mi long.
Origin: Mountain and forested flats run-off./ Forested slopes and muskeg flats.
Watershed Type

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
5/23/72	.2 mi from mouth.	None - short creek	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	1 cfs / --	.5 fps / --	1.5m / --	.18m / --

Streambank Composition / Stability: --
Tributaries: --

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	6.6	-- --	--	--	--

Possible intermittent flow.

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

Overall Stream Bottom Composition: --

Gravel Compaction: --

Spawning Area Available Above High Tide Mark (HTM): --

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	-- --	-- --

Available Cover: --

Aquatic Invertebrates/Available Food Source: --

Aquatic Vegetation: --

Terrestrial Vegetation: --

Shading: --

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pinks only utilize creek.

Use by Fishermen: No fishing known.

Wildlife Present

--

Comments and Recommendations

A more detailed survey is needed to give a production potential figure; however, this is a minor creek that produces small, if any, numbers of salmon. Survival if eggs and alevins may be low anyways due to possible intermittent flow.

Survey(s) and Dates Conducted: USFWS, 5/23/72

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Cascade Creek I	101-42-057	301-02

Flow SE into Cascade Inlet, 3.4 mi long./ Small lakes, beaver ponds, and mountain run-off./ Alpine, muskeg, meadows and forested and exposed rock

Location	Origin	Watershed Type
To Beaver Pond in 1980. 1600m from HTM to Beaver Pond.	12m stepped falls at 105m	mountain slopes. --

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	(5/5/72)		Moderate flow	

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1%	30 cfs / up to 75 cfs	.5 fps / up to 1 fps	14m / --	.5m / --

Steep, rocky banks (bedrock or vegetated fragmented rock) with limited LOD influence./ Stable

Streambank Composition / Stability

Four tributaries

Tributaries

Water Quality 8/12/80:

17.0C at mouth, 15.5C up stream

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	15.3C	10.0C	--	Clear / None	Slight Amber	--	--

Red tide is obvious and common at mouth.

Total Alkalinity | Total Hardness | Dissolved Solids | Other/Overall

Spawning Area

In intertidal, 170m glide (-70 to 80m): 5% cobble, 55% gravel, 20% pebble, 15% sand, 5% silt, trace rubble. Overall below barrier: 15% rubble, 15% cobble, 45% gravel, 10% pebble, 10% sand, 5% silt. Above barrier is mainly bedrock and boulder.

Overall Stream Bottom Composition

Minimal

Gravel Compaction

Nearly all of the available spawning area, $700m^2$ is situated just below the first cascade barrier.

Spawning Area Available Above High Tide Mark (HTM)

Excellent spawning channel exists, but velocity may be too slow for the entire area to be productive: $560m^2$ of fair to good quality area and $350m^2$ of marginal quality area exists.

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools below falls - beaver pond above at 1600m./	-- / --	-- / --

Limited, some undercuts and LOD below barriers, above barrier

Available Cover

Sparse - caddisflies, mayflies and diptera.

Aquatic Invertebrates/Available Food Source

Sparse - some algae.

Aquatic Vegetation

Blueberry, alder, skunk cabbage, devil's clube, under a spruce and hemlock canopy.

Terrestrial Vegetation

25% to first barrier - due to canopy and topography. 75% above barrier due to riparian vegetation, canopy and topography.

Shading

Limited - very little below the first barrier. Moderately abundant above the barrier in beaver ponds and under LOD - could rear coho above barriers.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Pink and chum utilize this creek.

Use by Fish

Subsistence fishing rare.

Use by Fishermen

Wildlife Present

Beaver activity and wolves observed.

Comments and Recommendations

This creek is a major producer of pink and chum salmon due to the extensive high quality spawning areas; however, low creek velocity could reduce the potential production expected with the area present. There is potential coho rearing and spawning area above the falls, but the production increase may not justify the cost of a fish passage (need benefit:cost analysis and a more detailed stream survey above the barriers).

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
5/5/72	None Seen				
1974	Pinks	Adult	100	--	USFWS Estimated Total Escapement
1975	Pinks	Adult	1768	--	USFWS Estimated Total Escapement
1976	Pinks	Adult	2094	--	USFWS Estimated Total Escapement
9/7/80	Pinks mainly (mixed) - Adult		1000	--	Fish counted outside mouth - aerial count.

Survey(s) and Dates Conducted

C. Huntington, 6/20/81, E. Biggs, 8/12/80, and USFWS, 5/5/72

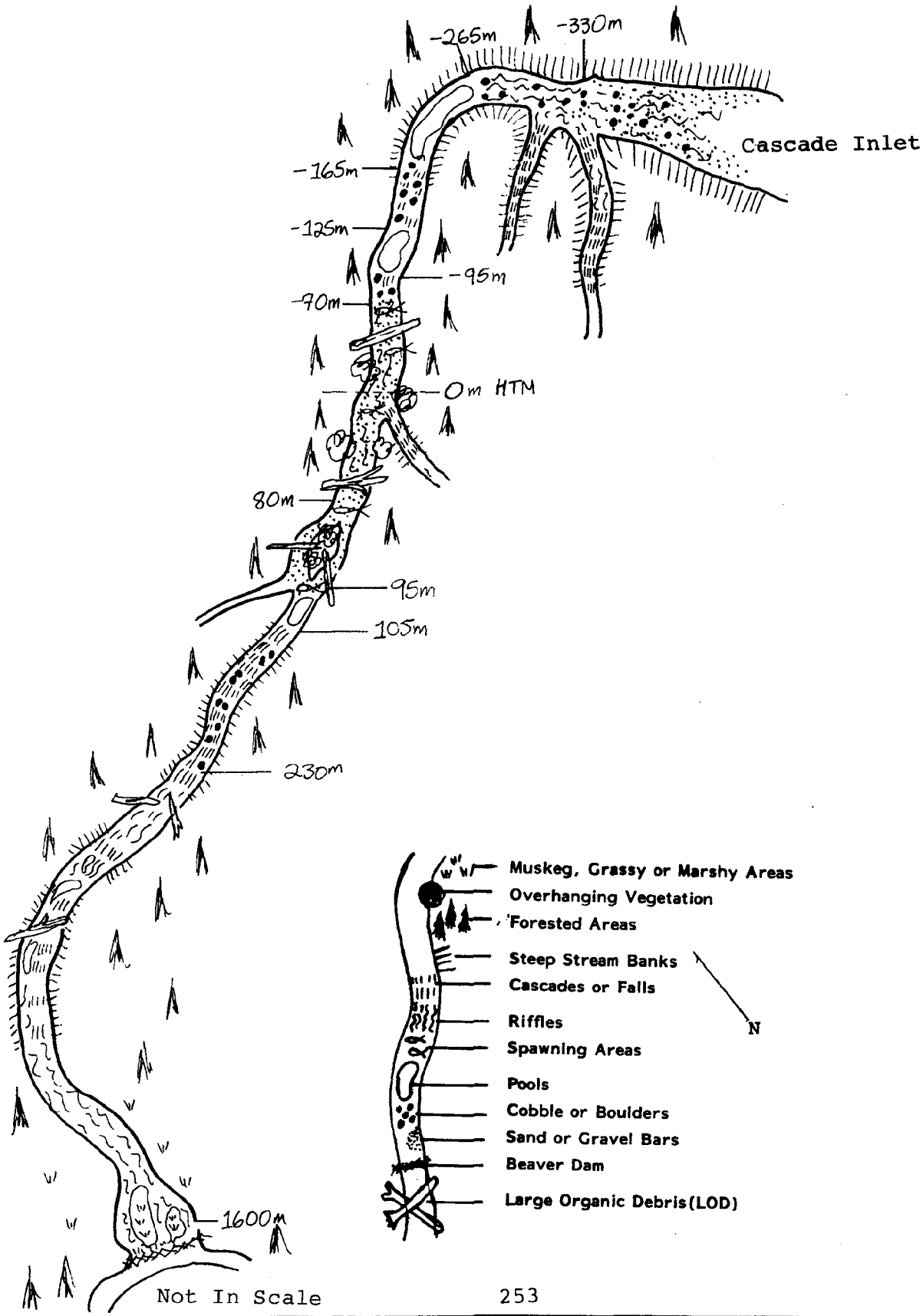
Recommended Escapement

Recommended escapements based on the available fair-good quality spawning areas (not including any of the marginal areas that fish could spawn in, but survival would be limited) are 2100 pink, 137 chum and 5 coho spawning pairs.

Potential Production Summary

Based on the above escapements and an assumed egg-fry survival rate of 10%, a production potential estimate is 6240 pinks, 680 chum, and 30 coho returning to Annette Island. Potential coho rearing and spawning remains above the barrier falls remains unsurveyed at this time.

Figure 52. CASCADE CREEK I



CASCADE CREEK I

Watershed No. 301-02
Stat. No. 101-42-057

-330m	Six cfs flow tributary enters, with possible bedrock cascade barrier at mouth - at 45m up is a 2.5m high stepped falls and possible barrier, no spawning or rearing in tributary. In main channel here and below are steep stream banks. Just above -330m is a .3 cfs flow tributary with a possible cascade barrier at the mouth - no spawning or rearing area is available.
-265m	No good spawning gravels below this point.
-265 to -165m	Average Stream Width (ASW) = 1.5m, Average Stream Depth (ASD) = 2m, looks like one large pool over 1m deep average, gravels are fine.
-165 to -125m	Boulder run (no gravels).
-125 to -95m	Pool 12m wide and average 1m deep, maximum depth is 2m - some fine gravels in the bottom.
-95 to -70m	Boulder run.
-70-0m	ASW = 16m, ASD = .5m, average velocity is .5 fps; best spawning area so far ($560m^2$ available spawning area). At 0m is High Tide Mark (HTM). Just above 0m is a 1.5 cfs flow tributary with a 2.5m barrier falls at the mouth.
0-80m	ASW = 16m, ASD = .5m, average velocity is .5 fps, "Fair" gravels in glide (some fines mixed in - $640m^2$ spawning area available).
80-95m	Channel braids around island; good quality spawning gravel in northern side channel ($50m^2$ area), some spawning gravels occur just above braiding ($10m^2$ area). At 95m, a .1 cfs flow tributary enters with no available spawning or rearing area.
105m	Stepped cascade and falls (probable barrier) with a plunge pool.
105-230m	Bedrock, boulder channel; 5m stepped falls (probable second barrier) at 230m.
230-1600m	Gradient decreases gradually; bottom is mainly bedrock and boulders. At 1600m, is a beaver dam and a large pond (small lake). End of survey.
Spawning Area:	Intertidal $560m^2$ Fair to good quality spawning gravels. $350m^2$ marginal quality gravels. Above HTM $700m^2$ of fair to good quality spawning gravels to the barrier cascade.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hassler Harbor Creek I	101-42-058	202-01

Flows NW into Hassler Harbor, .5 mi long./ Muskeg run-off and small ponds. Muskeg flats with some forested areas (195 acres in area).

Location	Origin	Watershed Type
1200m above High Tide Mark (HTM)	At 1200m stream is too small for salmon use.	

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/18/81	(9/18/72)		Low flow	+2 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
.5%	1 cfs/ up to 4 intermittent/ --	/ --	-- / --	-- / --

Steep, 45° banks, heavily covered with brush and timber, some LOD influence./ Unstable channel due to shale flaking in lower 300m./ 3 small feeder tributaries all under .25 cfs.

Streambank Composition / Stability / Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/18/72:	11.7C	10.0C	6.4	--	--	12.0ppm	--
--	18.3C	14.0C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (9/18/72)	6.6ppm (9/18/72)	5.65ppm (9/18/72)	Resistivity = 69,000 ohms/cm^3

Spawning Area

Overall Stream Bottom Composition: 30% gravels, 10% cobble, 5% bedrock, 10% small boulders, 45% fines (sand and silt).

Gravel Compaction: Angular gravel and some fines present; marginal quality gravels.

Spawning Area Available Above High Tide Mark (HTM): Gravels become less abundant (increasing fines) above 850m and stream splits after that. 714.5m^2 area available.

Intertidal Spawning Area: 340m^2 of marginal quality gravels - survival of eggs is questionable due to low gravel quality, stream flashiness and channel instability.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Numerous pools.	-- --	Some up to 15m long.

LOD abundant, undercut banks, and root wads provide a fair amount of cover.

Available Cover: Sparse

Aquatic Invertebrates/Available Food Source: Sparse - some marine algae in lower end.

Aquatic Vegetation: Vanilla leaf, skunk cabbage, ferns, mosses, alder with some stunted hemlock (predominately) canopy.

Terrestrial Vegetation: Intense in upper creek - 85% due mainly to bank vegetation.

Shading: There is abundant coho rearing habitat in upper half of the creek, however, the low flow in summer may limit numbers produced.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink, chum, and coho utilize creek.

Use by Fishermen: No known fishing.

Wildlife Present

--

Comments and Recommendations

This is the major creek producing salmon of the Hassler Harbor Creeks; however, it produces low numbers. The possible intermittent flow may reduce survival of eggs, alevin and fry and it is surprising no spawners have been seen. The creek does have some good coho habitat.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/18/72	None seen - spawners were expected!				
6/18/81	Coho	Fry	Over 100		In abundance above 400m.

Survey(s) and Dates Conducted

J. Yuska, 6/18/81 and USFWS, 9/18/72

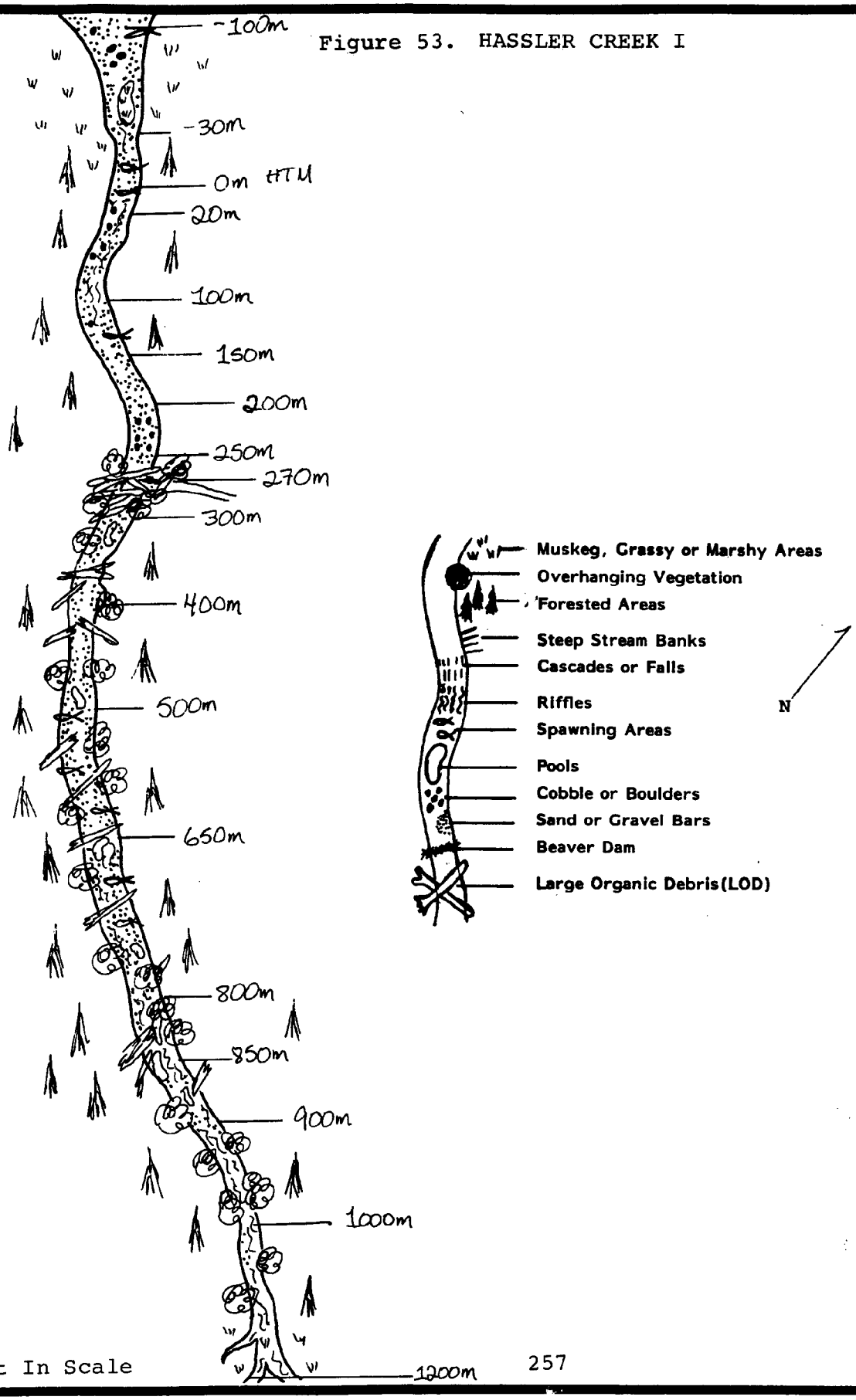
Recommended Escapement

The intertidal spawning area was not included in the estimate of recommended spawners because of the marginal gravel quality and abundance of habitat above it (although pinks could utilize it). Therefore, recommended escapements are 1200 pink, 80 chum, and 5 coho spawning pairs.

Potential Production Summary

A 1.2% egg-fry survival rate will be assumed due to the poor gravel quality. Production potential is estimated at 430 pinks 50 chum and 4 coho returning to Annette Island originating from this creek.

Figure 53. HASSLER CREEK I



Not In Scale

HASSLER HARBOR CREEK I

Watershed No. 202-01
Stat. No. 101-42-058

-100 to -30m	Average Stream Width (ASW) = 6m; bottom composition: 60% spawning gravels, 30% pebbles and fines, 10% boulders.
-30 to 0m	ASW = 6m, 50% gravels. At 0m is High Tide Mark (HTM).
0-20m	$70m^2$ spawning area available.
20-100m	ASW = 4m; bottom composition: 5% gravels, 40% cobble, 60% small boulder ($16m^2$ spawning area).
100-150m	ASW = 6m, 50% gravels ($150m^2$ spawning area).
150-200m	ASW = 6.5m, 20% gravels ($65m^2$ spawning area).
200-250m	ASW = 2.5m; steep banks (45°); bottom composition: 75% boulder, 20% bedrock, less than 5% gravels. At 250m, bottom is 30% gravels, 25% fines, 20% boulders, and 20% cobble ($15m^2$ spawning area).
270m	Tributary comes in under 10 logs across the main channel (less than 5% gravels).
300-400m	Excellent rearing habitat with LOD and undercuts; LOD may be a barrier to adults at low flow. ASW = 3m, Average Stream Depth (ASD) = .15m.
400-650m	ASW = 3m, 20% gravels ($150m^2$ spawning area). Low gradient with excellent rearing areas (undercut banks).
650-800m	ASW = 3m, bottom has 50% gravels ($225m^2$ spawning area).
800-850m	ASW = 2m, 20% gravels ($20m^2$ spawning area).
850-900m	Less than 5% gravels, but excellent rearing habitat, many coho fry observed.
900-1000m	ASW = .7m; less than 5% gravels. Moderate gradient, and fry are still numerous.
1000-1200m	ASW = .5m, moderate gradient with less than 5% gravels, no more coho fry seen. End of survey at 1200m where creek splits up into the muskeg.

Spawning Area:

Intertidal	$342m^2$ area available
Above HTM	$715m^2$ approximate area available

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hassler Harbor Creek III	101-42-059	202-02

Location	Origin	Watershed Type
Flows NE into Hassler Harbor, 1 mi long./ 300m Avove High Tide Mark (HTM)	Small lake and mountain muskeg run-off. Possible 1.5m high barrier falls at 125m.	Steep, forested slopes, lakes and some muskeg flats. (25 acres in area)

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/18/81	2° and up.	Variable/ slow to rapid	Low	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2° and up.	.25 cfs / --	Variable/ slow to rapid	1m / --	.2m / --

Streambank Composition	/ Stability	Tributaries
Bedrock and boulders - a few soft banks.	/ Stable	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	18.3C	12.0C	--	Clear / None	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: 40% bedrock, 30% boulders, 20% rubble, 5% cobble, 3% gravel, 1% pebble, 1% sand.

Gravel Compaction: Angular gravels - sparse.

Spawning Area Available Above High Tide Mark (HTM): Stream channel is mainly bedrock and boulders with no large patches of spawnable gravels with a possible barrier at 125m.

Intertidal Spawning Area: None available.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Some bedrock pools formed.	-- / up to 1.5m deep	-- / --

Available Cover: Limited: some LOD, no undercuts, no root wads, little overhanging vegetation.

Aquatic Invertebrates/Available Food Source: Sparse.

Aquatic Vegetation: Moss and periphyton occurs on creek bottom.

Terrestrial Vegetation: A few berries and ferns under spruce/hemlock canopy.

Shading: 85% mainly due to topography and canopy.

Extent and Quality of Rearing Area: Limited: poor quality rearing area in section surveyed.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Cutthroat currently utilize this creek and it is too marginal for use by coho (only they of all the salmon could use this creek).

Use by Fishermen: No fishing known.

Wildlife Present

None seen.

Comments and Recommendations

No imrpovements are recommended due to limited spawning area available.

Survey(s) and Dates Conducted: C. Huntington, 6/18/81

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Hassler Harbor Creek IV	101-42-060	202-03

Location: Flows NE into Hassler Harbor, .25 mi long./ forested hills run-off.

Origin: Muskeg flats and forested hills run-off.

Watershed Type: Gently sloping forested hills and muskeg flats.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/18/81	(9/25/72)	A possible cascade barrier at 175m.	Low flow	(25 acres in area) --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
.5°	.2 cfs/ up to .5 cfs	.25 fps / sluggish	4.5m up to 6m	.25m/ down to below .1m

Streambank Composition / Stability: --

Tributaries: 400m Above High Tide Mark (HTM)

Stream forks just above HTM.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
9/25/72: --	12.2C 10.5C	7.2C 15.0C	6.8 --	-- Clear / None	-- Brown	-- --	5.8ppm --

Resistivity = 47,169 ohm/cm^3 (9/25/72)

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
11.0ppm (9/25/72)	9.416ppm (9/25/72)		

Spawning Area

Overall Stream Bottom Composition: Below falls: 55% gravel, 15% pebble, 15% sand, 7% silt, 2% cobble, 2% rubble, 2% boulder, 2% bedrock.

Gravel Compaction: Extensive - many fines in gravel.

Spawning Area Available Above High Tide Mark (HTM): Limited - 30m^2 below falls and only about 4m^2 potential area above falls. Survival of eggs is probably low due to fines in gravel and low velocity.

Intertidal Spawning Area: 200m^2 of marginal quality area is available; poor due to low velocity and fines in gravel.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Pools are mainly caused by beaver activity and falls. p:r = 5:1 at low flow.	Pool under falls is .35m/	One pool (below falls) is 15 x 10m / --

Available Cover: Fair amount due to beaver ponds, overhanging vegetation and pools.

Aquatic Invertebrates/Available Food Source: Sparse - diptera and trichoptera observed.

Aquatic Vegetation: Cedar-like moss is abundant as well as filamentous algae.

Terrestrial Vegetation: Skunk cabbage - grasses and sedges under a canopy of spruce, hemlock and cedar.

Shading: 50% above falls, 30% below.

Extent and Quality of Rearing Area: Fair coho habitat exists above the cascade; however it is limited due to small size of creek.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pinks, chums and coho may use this creek.

Use by Fishermen: No fishing know.

Wildlife Present

Heavy beaver activity and influence on stream.

Comments and Recommendations

This creek produces low numbers of any salmonid, however, it is utilized. Because of low velocities, flows and compacted gravel, survival of eggs and alevins is probably low.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/25/72	None seen - pinks were expected.				
6/18/81	Coho	Fry (50mm)	2		In tributary

Survey(s) and Dates Conducted

C. Huntington, 6/18/81 and USFWS, 9/25/72

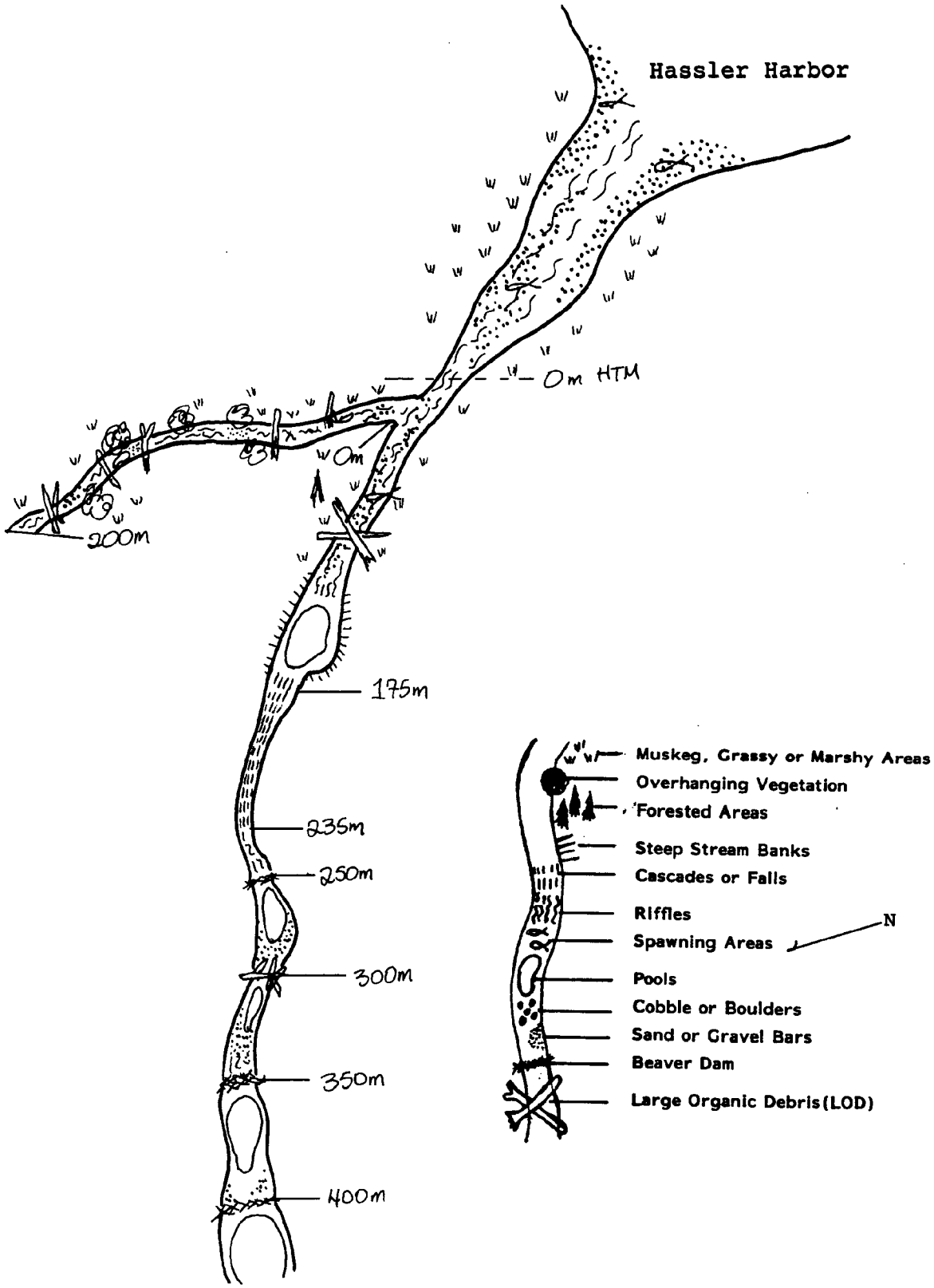
Recommended Escapement

Based on current available spawning area, 380 pink and 25 chum spawning pairs could utilize this creek. Coho could not because of the limited rearing area available.

Potential Production Summary

Based on the above escapements and a 1.2% egg-fry survival rate (marginal gravels), potential production is estimated at 135 pinks and 15 chum returning to Annette Island.

Figure 54. HASSLER HARBOR CREEK IV



Not In Scale

HASSLER HARBOR CREEK IV

Watershed No. 202-03
Stat. No. 101-42-060

Intertidal	$200m^2$ available spawning area.
0m	High Tide Mark (HTM). Tributary enters just above 0m with less than .1 fps velocity, but approximately $5m^2$ spawning area available; good rearing habitat here with pools to .7m deep, root tangles, undercut banks, and LOD, also abandoned beaver dams and 40% shading - tributary surveyed to 200m.
0-175m	$30m^2$ available spawning area, although gravels have alot of fines mixed in; just below 175m is a large pool 15 x 10m, .35m deep. At 175m is a small, bedrock falls that may be a barrier to pink salmon; above falls is $4m^2$ of marginal quality spawning gravels.
175-235m	Bedrock channel.
250m	Beaver dam, with pond behind it.
300m	Old beaver dam, with small pond.
350m	Beaver dam 1m high, a probable barrier because of a root tangle at the base.
400m	Additional dam, end of survey (no more spawning habitat).

Spawning Area:

Intertidal	$200m^2$ of marginal to fair quality spawning area
Above HTM	$39m^2$ of marginal quality spawning area.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Triangle Lake Creek	101-42-061	202-04	
Stream	Number	Geocode	Alpine lake, alpine meadows in steep forested terrain (1123 acres in area)
--	Triangle Lake		
Location	Origin	Watershed Type	
540m from High Tide Mark (HTM) to alpine meadow			

6/18/81	Falls at HTM	Moderate flow	+2-3 ft	
Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
2-6°	15 cfs / --	2-4 fps / moderate to rapid.	7m / --	.2m / --
Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range

Bedrock and soil and rock heavily vegetated, limited LOD influence / Stable/ --

Streambank Composition / Stability Tributaries

Water Quality

9/20/73:	16.7C	11.7C	6.8	--	--		11ppm
Above Falls	18.3C	15.5C	6.0	Clear/None	Clear	10.2-10.7ppm -- (1979)	(9/20/73)
Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2

34ppm (9/20/73) 15ppm NaCl (9/20/73)/12.8ppm Free $CaCo_3$ (9/20/73) - See next sheet for additional water quality information.

Total Alkalinity Total Hardness Dissolved Solids Other/Overall

Spawning Area

Up to meadow: mainly bedrock, boulders with a few scattered patches of large gravels.

Overall Stream Bottom Composition

Minimal.

Gravel Compaction

There is some potential spawning area available just below the beaver dam and more may exist above the meadow, but remains unsurveyed.

Spawning Area Available Above High Tide Mark (HTM)

None

Intertidal Spawning Area

Rearing Area Pools frequent, caused by cascades, falls and beaver activity.

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
	.5m / 2m	1 x 2m/ up to 12 x 40m

Abundant; some braiding occurs, with some bank undercutting; LOD and organic matter behind beaver dam.

Available Cover

Abundant and diverse / mayflies, caddisflies, ephemeroptera and stoneflies observed.

Aquatic Invertebrates/Available Food Source

Some microalgae and some mosses; alot of green filamentous algae in riffles

Aquatic Vegetation

Stunted trees in muskeg below meadow - grasses and herbs in meadow.

Terrestrial Vegetation

30% due to topography and canopy below meadow. 10% in meadow due to steep banks.

Shading

Extensive above and near beaver dam.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Currently, only cutthroat utilize this stream and lake.

Use by Fish

No fishing.

Use by Fishermen

Wildlife Present

Active beaver dam and lodge in alpine meadow. Deer seen in meadow.

Comments and Recommendations

A fish ladder over the falls could turn this system into a major coho producer as well as open area to pink and chum. A more thorough stream survey to lake is recommended along with a benefit:cost study prior to enhancement. However, stocking this lake with excess fry for rearing could prove fruitful.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/20/73	Cutthroat	Adult	1	--	In Triangle Lake
9/21/79	Cutthroat	Adult (13-15 cm.)	1	--	In Upper Triangle Creek
6/7/81	None Seen				

Additional Water Quality Data:

7/18/79 - Above Falls: Flow - * Temp (Water) - 21.3C; D.O. 10.3ppm (10.4ppm riffle)
7/19/79 - Above Falls: Flow - 6.47 cfs;
Below Falls: Flow -25.47 cfs?; Temp (Water) - 18.5C; D.O. 10.4ppm, Conductivity-140 ohms/cm^2
8/21/79 - Above Falls: Flow - 7.20 cfs?; Temp (Water) - 18.0C; D.O. 10.7ppm
Below Falls: Flow - 2.76 cfs?; Temp (Water) - 16.5C; D.O. 7.5ppm
9/21/79 - Above Falls: Flow -39.85 cfs?; Temp (Water) - 13.0C; D.O. 10.2ppm; Conductivity-175 ohms/cm^2
Below Falls: Flow -35.11 cfs?; Temp (Water) - 12.0C; D.O. 10.8ppm; Conductivity-170 ohms/cm^2

*Flow measurements are questionable.

Survey(s) and Dates Conducted

E. Biggs, 6/18/81 and USFWS, 9/20/73 and Pacific Rim Planner, Inc., 7-9/79

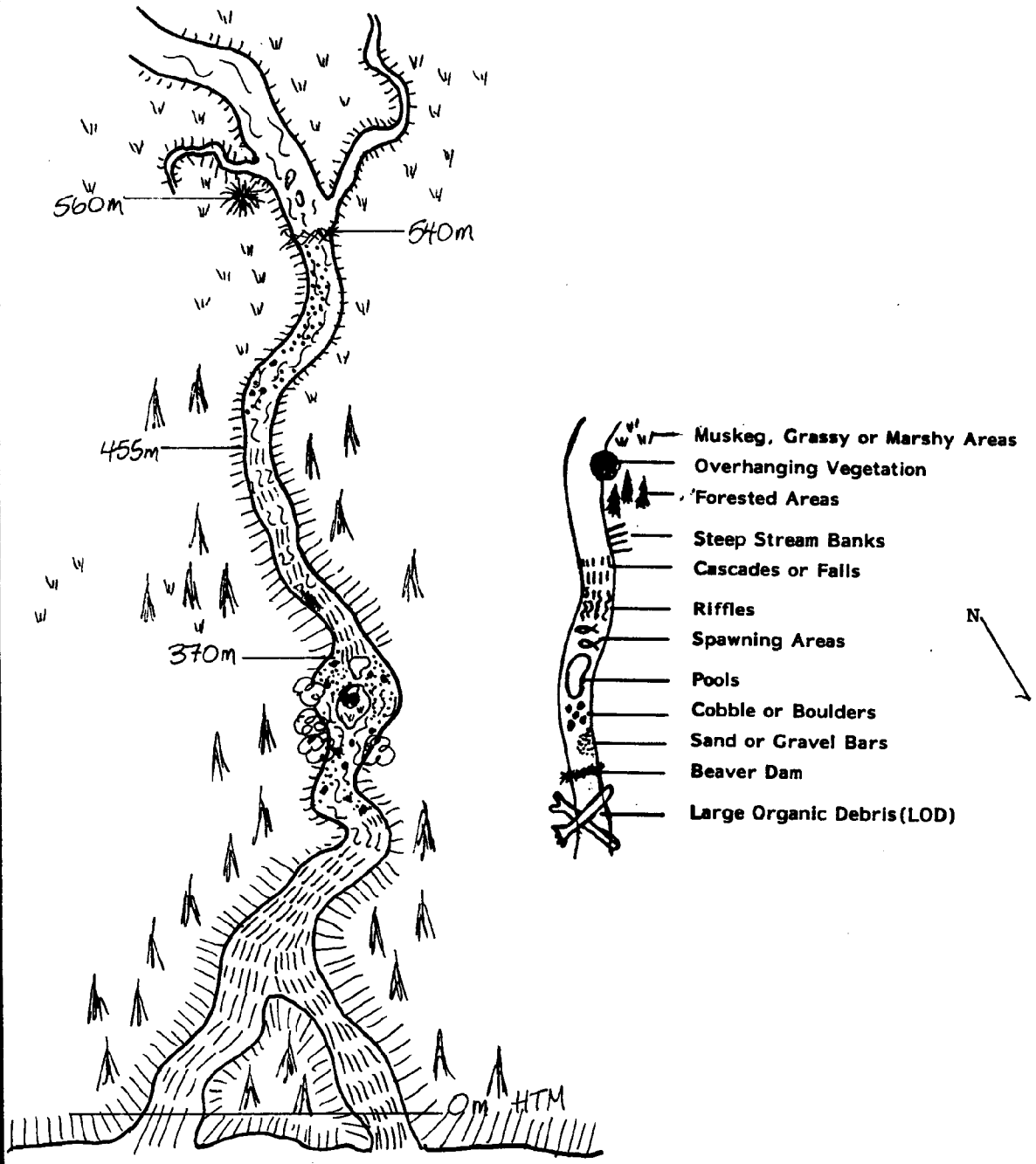
Recommended Escapement

None currently.

Potential Production Summary

Much unsurveyed spawning area probably exists above the falls, and since there is alot of potential rearing area, a closer scrutiny of this system may prove productive.

Figure 55. **TRIANGLE CREEK**



Not In Scale

TRIANGLE LAKE CREEK

Watershed No. 202-04
Stat. No. 101-42-061

0m	High Tide Mark (HTM), creek flows over impassable intertidal barrier falls. Limited spawning area above falls, probably unusable at high flows.
370m	Second set of cascade falls (may be a velocity barrier). Creek begins flowing through a muskeg meadow with a wooded margin next to the channel.
370-455m	Cascade, bedrock riffle.
455-540m	Gradient lowers; at 540m is a beaver dam at the margin of an upland meadow, through which the creek meanders; below dam are some gravels, but they are mixed with fines; good habitat probably exists above the upland meadow toward Triangle Lake. Beaver lodge occurs just above dam at 540m. End of survey.

Spawning Area: Limited. Currently none available due to barrier falls.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Upper Triangle Lake Creek	101-42-063	202-05

Flows NE into Triangle Lake, 1 mi long. Mountain run-off and small lake. Forested and exposed granite rock slopes.

Location	Origin	Watershed Type
9/20/73 to barrier falls	7.5m falls .2 mi up creek --	--

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
--	8 cfs / --	Rapid / --	4.5m / --	.15m / --

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range

Unknown.
Streambank Composition / Stability

--
Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	6.8	--	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	

Spawning Area

Unknown
Overall Stream Bottom Composition

--
Gravel Compaction

Unknown
Spawning Area Available Above High Tide Mark (HTM)

Not applicable.
Intertidal Spawning Area

Rearing Area

Unknown
Pool/Riffle Frequency (P:R Ratio)

Ave. Pool Depth/Range

Ave. Pool Size/Range

Unknown
Available Cover

Unknown
Aquatic Invertebrates/Available Food Source

Unknown
Aquatic Vegetation

Unknown
Terrestrial Vegetation

Unknown
Shading

--
Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Cutthroat utilize this creek.
Use by Fish

No known fishing.
Use by Fishermen

Wildlife Present

None reported.

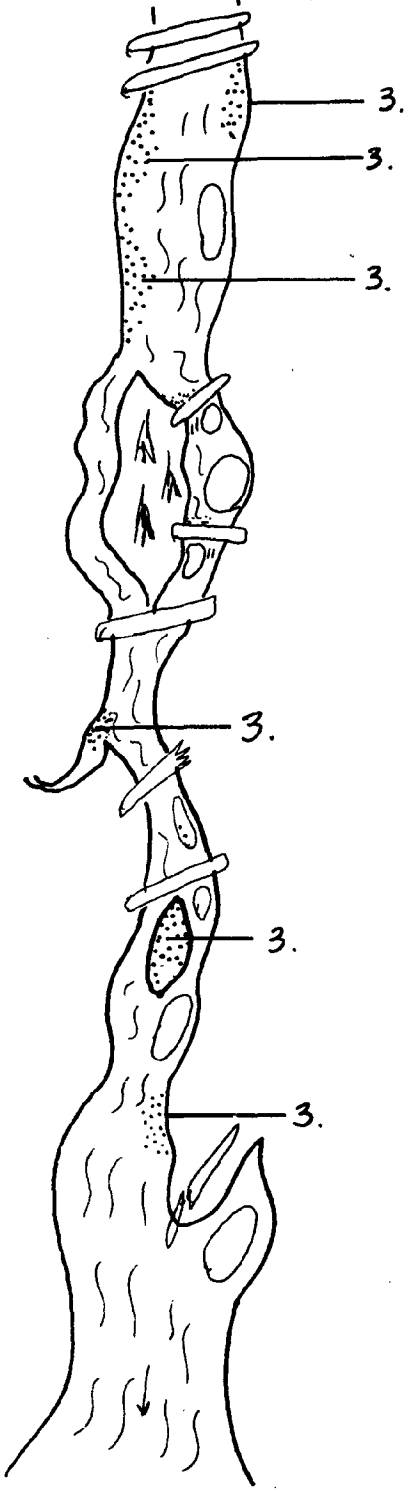
Comments and Recommendations

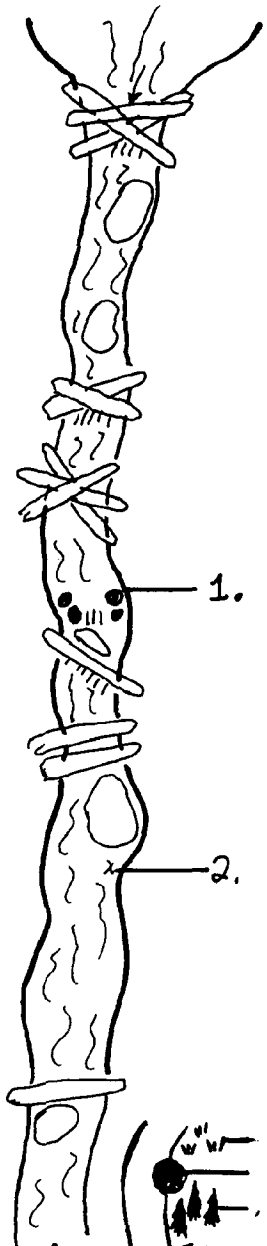
USFWS recommended managing creek as a trout nursery area and protecting against logging. Creek needs additional survey to determine potential spawning area available to salmon if enhanced.

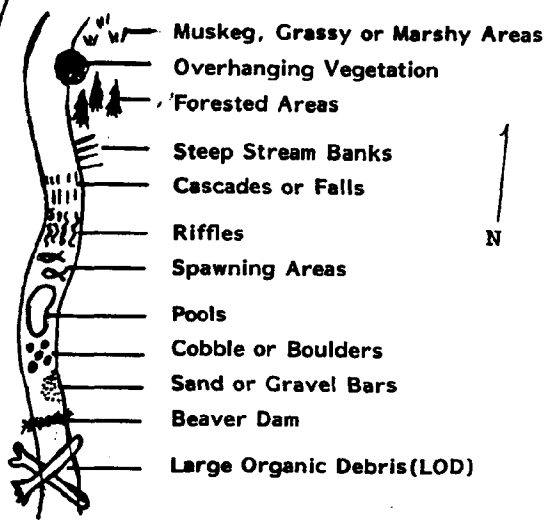
Survey(s) and Dates Conducted USFWS, 9/20/72

A Continued

Figure 56. UPPER TRIANGLE CREEK







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UPPER TRIANGLE CREEK

Watershed No. 202-05
Stat. No. 101-42-063

1. Bedrock cascade

2. Caddisfly Larvae

A. Continued

4. Sandbars

NOTE: Stream survey and map completed by the U.S. Fish and Wildlife Service in 1972.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Pelican Creek	101-42-064	201-03

Location	Origin	Watershed Type
Flows NW into Todd Stream, 1.5 mi long.	Mountain slope run-off.	Forested and exposed rock slope run-off.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	250m from mouth to bedrock.	Possibly by bedrock cascades at 210m	Low Flow	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2% - increases above 210m	42 cfs (8/11/76)	4 fps (8/11/76)-moderate	3.5m / to 1.8m	.06m / to .3m

Streambank Composition	/ Stability	Tributaries
Soil colonized by thick plant growth - grasses and shrubs.	Stable	None

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	17.5C	10.0C	--	Clear / None	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Lower End: 45% gravels (large size), 20% large cobbles, 20% small boulders. Above 210m: Almost 100% bedrock, less than 5% gravels.

Overall Stream Bottom Composition

Not a problem.

Gravel Compaction

Limited; however, some is available: 0-100m, 70% gravels, 100-200m, 20% gravels resulting in approximately $315m^2$ available area.

Spawning Area Available Above High Tide Mark (HTM)

Not applicable.

Intertidal Spawning Area

Rearing Area

Some pools and riffles exist (1 riffle at 50m).

Pool/Riffle Frequency (P:R Ratio)

Ave. Pool Depth/Range: --

Ave. Pool Size/Range: --

Some LOD and undercut banks. Cover not abundant.

Available Cover

None observed.

Aquatic Invertebrates/Available Food Source

None observed.

Aquatic Vegetation

Some grasses, shrubs and a few trees.

Terrestrial Vegetation

30% due to canopy, 25% due to riparian vegetation and 5% due to banks.

Shading

Limited. Salmonids would use lake.

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

No fish reported - unknown use.

Use by Fish

No fishing reported - unknown use.

Use by Fishermen

Wildlife Present

None seen.

Comments and Recommendations

A possible barrier occurs at 210m, with no spawning or rearing available above it. Spawning area is limited, therefore this creek does or would produce small numbers of salmonids.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/11/76	None Seen				
6/21/81	None Seen				

Survey(s) and Dates Conducted

J. Yuska, 6/21/91 and USFWS, 9/11/76

Recommended Escapement

None made due to the barrier falls in Nadzaheen Creek.

Potential Production Summary

Twenty-seven coho and/or 47 sockeye spawning pairs could utilize this creek resulting in a production potential of (assuming 10% egg-fry survival) 153 coho and 223 sockeye returning to Annette Island.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Upper Todd Creek S.E.	101-42-070	201-04

Location	Origin	Watershed Type
Flows N into Upper Todd Lake, 1.2 mi long./	Mountain run-off and springs.	Forested mountain slopes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
9/25/75	--	Possible log and beaver dams./ --		--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	16 cfs / --	.8 fps / --	3.3m / --	.15m / --

Streambank Composition	/ Stability	Tributaries
--		

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	--	--	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Overall Stream Bottom Composition: Unknown

Gravel Compaction: --

Spawning Area Available Above High Tide Mark (HTM): Unknown

Intertidal Spawning Area: Not applicable.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	-- --	-- --

Available Cover: --

Aquatic Invertebrates/Available Food Source: --

Aquatic Vegetation: --

Terrestrial Vegetation: --

Shading: --

Extent and Quality of Rearing Area:

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Cutthroat and Dolly Varden utilize creek; rainbow may also use creek.

Use by Fishermen: No known fishing.

NOTE: 4850 rainbow fry stocked in Upper Todd Lake in 1973.

Wildlife Present

--

Comments and Recommendations

USFWS recommends leaving creek in present state. The creek needs an additional, more detailed survey to determine production potential for future enhancement possibilities.

Survey(s) and Dates Conducted: USFWS, 9/25/75

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Upper Todd Creek S.W.	101-42-062	201-05

Location	Origin	Watershed Type
Flows NE into Upper Todd Lake, 1.2 mi long.	Mountain slope run-off.	Forested mountain slopes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
9/25/75	--	None	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	18 cfs / --	.9 fps / --	2.7m / --	.42m / --

Streambank Composition / Stability	Tributaries
--	--

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	--	--	6.3	--	--	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	--

Spawning Area

Unknown

Overall Stream Bottom Composition

--

Gravel Compaction

Unknown

Spawning Area Available Above High Tide Mark (HTM)

Not applicable

Intertidal Spawning Area

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
--	--	-- --

Available Cover

--

Aquatic Invertebrates/Available Food Source

--

Aquatic Vegetation

--

Terrestrial Vegetation

--

Shading

--

Extent and Quality of Rearing Area

Reported and Suspected Use of Stream by Fish and Fishermen

Cutthroat and Dolly Varden utilize creek - rainbow were stocked and may use creek also.

Use by Fish

No known fishing.

Use by Fishermen

NOTE: 4850 rainbow fry stocked in Upper Todd Lake in 1973.

Wildlife Present

--

Comments and Recommendations

USFWS recommends leaving creek in present stated. Additional surveys are needed to map spawning areas and determining production potential for benefit:cost analysis to enhancing creek system (putting in fish passage in above Nadzaheen).

Survey(s) and Dates Conducted USFWS, 9/25/75

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Todd Stream	101-42-065	201-02

Location	Origin	Watershed Type
Flows from Upper to Lower Todd Lake	Upper Todd Lake	Apline Lake (15.6 acres in area)

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	Entire section - .25 mi.	None	Low	+1 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
2%	12 cfs / 13 cfs (8/2/73)	Under 1 fps/ 1fps (8/2/73)	4.5m / --	.3m / --

Streambank Composition / Stability: Soils with grasses - some channelization and bank erosion occurs, but relatively stable.

Tributaries: Three muskeg drainages enter stream.

Water Quality 8/2/73:

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
--	19.5C	18.9C	7.0	--	--	--	--
--	17.5C	14.0C	--	-- --	Brown	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
Trace (8/2/73)	--	--	--

Spawning Area

Overall Stream Bottom Composition: 80% usable spawning gravels - mixed with some mud.

Gravel Compaction: Some mud in gravels.

Spawning Area Available Above High Tide Mark (HTM): Approximately 1990,^{2} of marginal to poor quality gravels - but usable - survival of eggs may be low if velocity is low and because of fines.

Intertidal Spawning Area: Not applicable.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Some pools - pools in 40% of creek and riffles in 30%.	-- --	-- --

Available Cover: Some available; root wads and undercut banks - provide it.

Aquatic Invertebrates/Available Food Source: Some present - mayflies observed.

Aquatic Vegetation: Not abundant, but some mosses and filamentous algae occur.

Terrestrial Vegetation: Few trees - mainly sedges, grasses, and some bog orchids, columbine, bunchberry, dogwood and thimbleberry.

Shading: 10% due to banks and vegetation.

Extent and Quality of Rearing Area: Some off channel areas and root wads, with a slow velocity provide rearing habitat.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Currently only cutthroat and Dolly Varden utilize stream.

Use by Fishermen: No known historic use.

Wildlife Present

None seen.

Comments and Recommendations

Moderately abundant spawning and rearing areas are available for trout or landlocked salmon. It could support sea-run salmon if a fish passage were constructed. Lake system deserves a benefit:cost study and production potentials should be examined. The lake looks productive and may provide alot of rearing area.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
Spring, 1973	Rainbow	Fry	4850	--	Stocked in Upper Lake - none seen in 1981.
8/2/73	Dolly Varden	49-178mm fork length	24	--	Caught in gillnet USFWS claims to have caught a coho smolt, however, this is questionable as barrier prevents salmon migration into Todd Lake.
6/21/81	Cutthroat	Fry	10	--	No salmon fry observed.

Survey(s) and Dates Conducted

J. Yuska, 6/21/81 and USFWS, 8/2/73

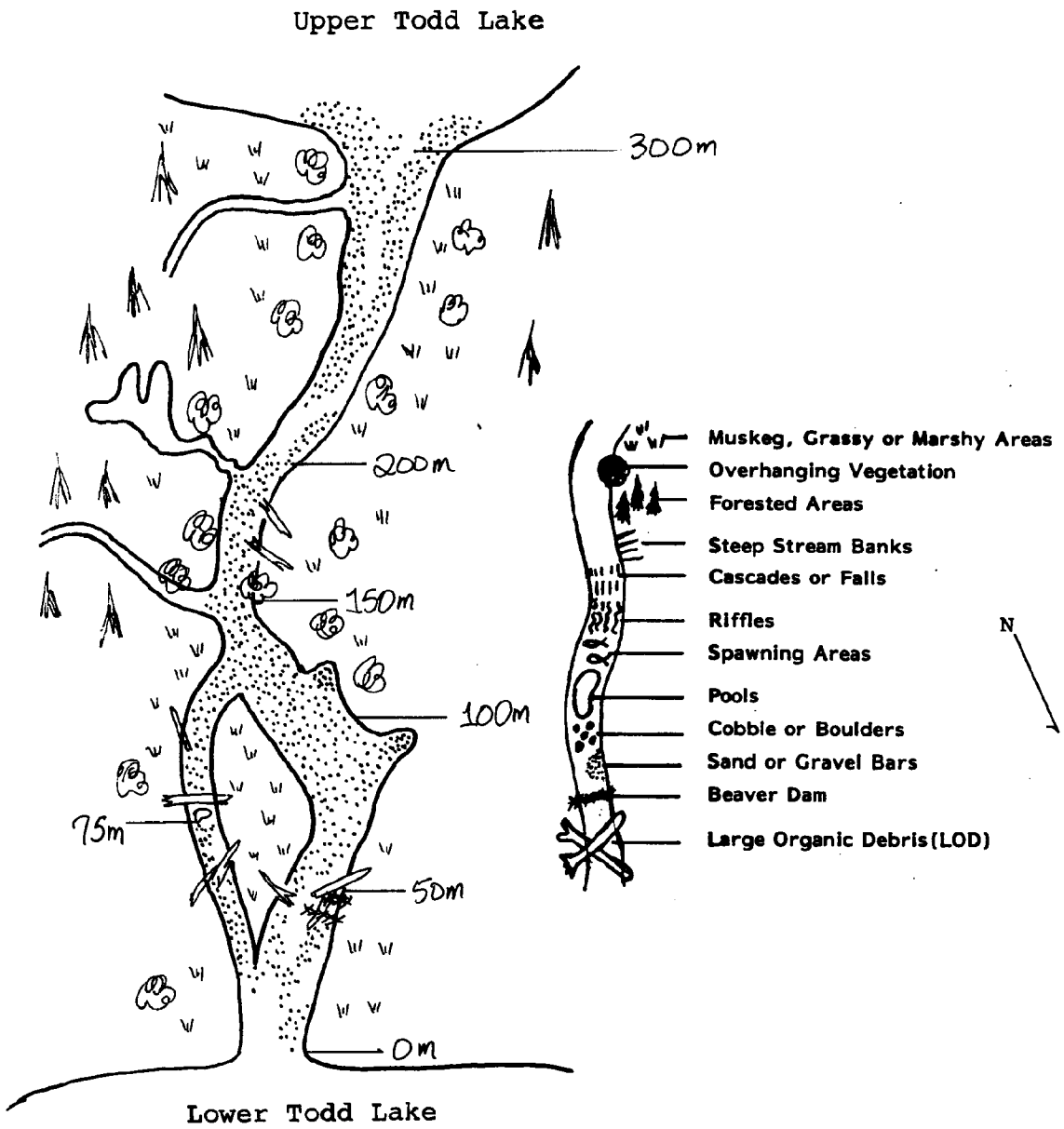
Recommended Escapement

None made due to barrier falls in Nadzaheen Creek.

Potential Production Summary

Because of the fine gravels, sockeye and coho would probably not utilize this stream and because of its distance from the estuary, pink and chum could not successfuly utilize it.

Figure 57. TODD STREAM



Not In Scale

TODD STREAM

Watershed No. 201-02
Stat. No. 101-42-065

0m	Lower Todd Lake. Just above 0m, a 75m long side channel flows off to the east side of the main channel with a bottom composed mainly of gravel and mud.
0-100m	Average Stream Width (ASW) = 8m, Average Stream Depth (ASD) = .5m, 80% spawning gravels; low velocity flow. At 50m, beaver dam was started.
100-200m	ASW = 6m, ASD = .25m, 100% usable spawning gravels - large channel with a few root wads. At 150m is a 75m long tributary with .125 cfs flow - no gravels. At 200m is a 50m tributary draining muskeg - no spawning area.
200-300m	ASW = 10m, ASD = .15m, 75% spawning gravels. At 300m is Upper Todd Lake with a muskeg drainage tributary entering just below.

Spawning Area:

All Freshwater - 1990m^2 area available, at present, to cutthroat and rainbow trout only.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Lower Todd Lake Creek	101-42-066	201-06

Location	Origin	Watershed Type
Flows NE into Lower Todd Lake, 2 mi long./	Mainly mountain slope run-off, some muskeg run-off./	Alpine Lake - mountain slopes and a few muskeg flats (15.6 acres in area)

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	610m from mouth to barrier.	Cascades at 610m	Moderate Flow	+1 ft

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1-2%	10 cfs/4.6 cfs (9/27/75)	1 fps / --	7m / 6-8m	.2m / down to .13m

Streambank Composition / Stability	Tributaries
Steep banks of fragmented rock colonized by vegetation/ Stable, little LOD influence.	Two small tributaries enter creek.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
240m above mouth	17.5C	12.0C	7.5 (9/27/75)	Clear / None	Light Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Water looks like mainly mountain run-off, may be flashy.

Spawning Area

Overall Stream Bottom Composition: 70% gravels, variable in size, 15% boulders and cobble, 10% bedrock, 5% fines and organic matter.

Gravel Compaction: Flat, angular gravels (slate)

Spawning Area Available Above High Tide Mark (HTM): Approximately 1960m^2 of poor to good quality spawning area is available.

Intertidal Spawning Area: Not applicable.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools - mainly riffles and runs.	-- --	-- --

Available Cover: Limited - some LOD, undercut banks and a few root wads.

Aquatic Invertebrates/Available Food Source: Sparse

Aquatic Vegetation: Scarce - except some moss on submerged rocks.

Terrestrial Vegetation: Near mouth, sedges, grasses and herbs are common. Above some blueberries, thimbleberries, skunk cabbage occurs under spruce, hemlock and cedar.

Shading: 0-50% - mainly due to topography and canopy.

Extent and Quality of Rearing Area: Near mouth, beaver dam provides good rearing area and in Lake. Creek, has limited rearing area (few pools, LOD, or undercut banks).

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Cutthroat and Dolly Varden currently utilize creek.

Use by Fishermen: No known fishing occurs.

Wildlife Present

Beaver dam just inside mouth of creek.

Comments and Recommendations

Some spawning channels and patchy gravel beds occur of poor to good quality gravels. Rearing is available also. It could support sea-run salmon is passage were installed.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
9/27/75	Dolly Varden	Adults	A few	--	
6/21/81	No salmonids - sticklebacks observed. Numerous tadpoles in creek mouth and lake.				

Survey(s) and Dates Conducted

E. Biggs, 6/21/81 and USFWS, 9/27/75

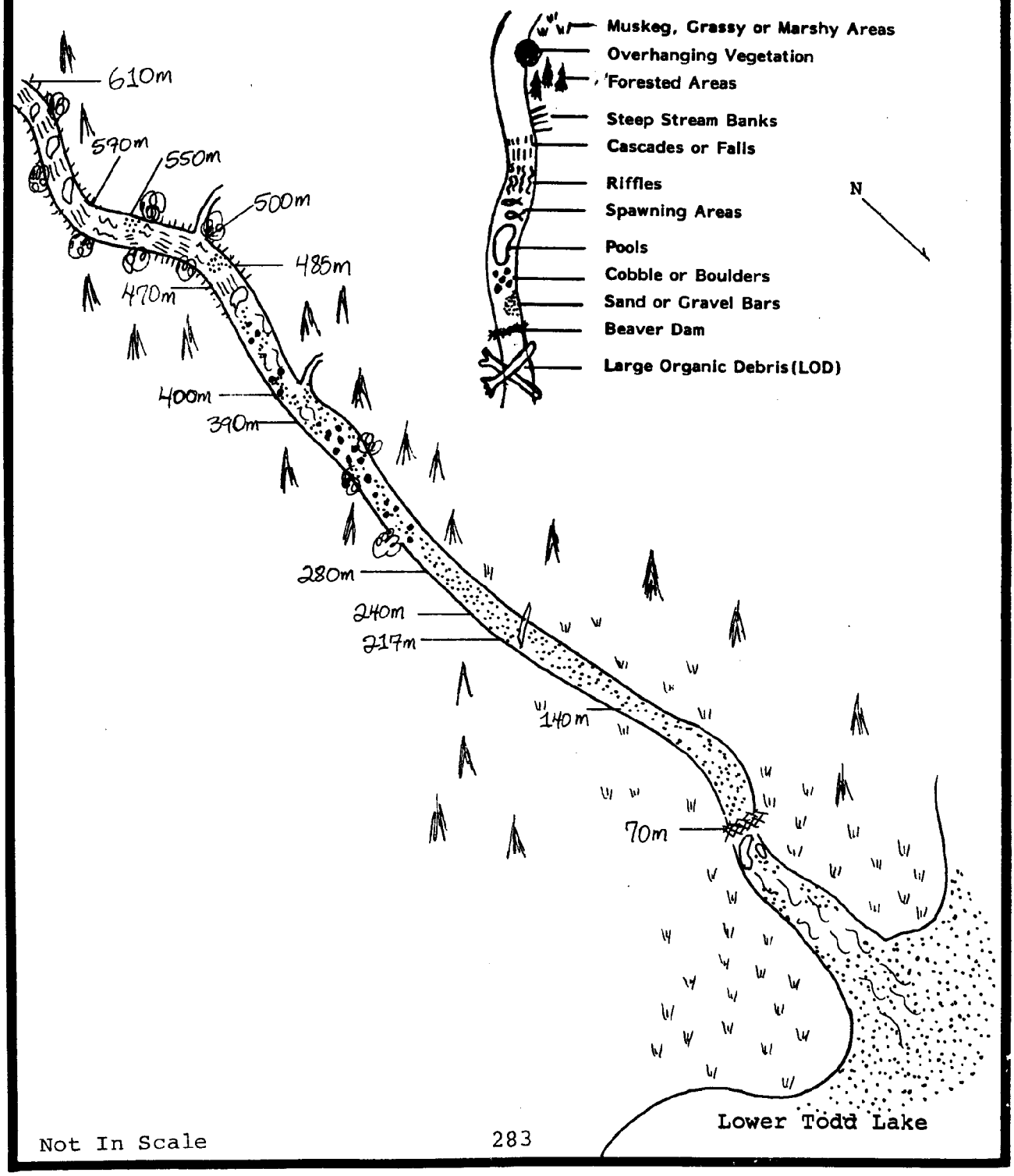
Recommended Escapement

None made.

Potential Production Summary

Because of the extensive spawning area available, 167 coho and 292 sockeye spawning pairs could utilize this creek with a potential production (assuming 10% egg-fry survival) of 942 coho and 1390 sockeye returning to Annette Island.

Figure 58. LOWER TODD CREEK



Not In Scale

LOWER TODD CREEK

Watershed No. 201-06
Stat. No. 101-42-066

0m	Creek mouth with large, shallow gravel bar extending out into Lower Todd Lake.
70m	Active beaver dam with sediment below that is gravel mixed with mud; 50% usable, but marginal gravels ($200m^2$ area).
70-240m	Slow velocity flow is a wide channel. Average Stream Width (ASW) = 9m, 70% usable with some marginal gravels ($1000m^2$ area). At 140m, creek narrows and bottom is hard gravels and mud. At 217m, gravel is cleaner and better quality for spawning.
240-280m	Velocity increases, ASW = 7m, gravels increase to 90% of bottom ($252m^2$ spawning area).
280-390m	ASW = 5.5m, gravel interspaced with boulders, but is still 75% usable ($454m^2$ spawning area).
400-470m	ASW = 5.5m, rocks become large and flat with gravel interspaced (10% gravels and $44m^2$ spawning area). At 400m, a .25 cfs flow tributary draining muskeg. A pebble bar occurs just above 470m.
500m	Channel over bedrock; a .5 cfs flow tributary enters in - water is clear, so it is probably mountain run-off.
550m	$10m^2$ spawning bed, the rest is all bedrock; gradient increases.
570m	Mineral leaching from rocks here (may be iron oxides).
610m	Bedrock cascade, probably a velocity barrier.
Spawning Area:	All Freshwater, $1960m^2$ spawning area total. Available only to cutthroat and rainbow trout.

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Nadzaheen	101-42-067	201-01

Location: Flows SE into Nadzaheen Cove

Origin: The Todd Lakes, other small lakes and run-off.

Watershed Type: Alpine lakes, forested / mountain slopes and some muskeg slopes.

Date Surveyed: 6/14/81

Section Surveyed: 1450m from mouth to falls on both forks.

Barriers: Barrier falls in each creek.

Stage: Low Flow

Flood Height: +2-3 ft

Ave. Gradient: 1%

Flow / Range: 15 cfs/ up to 75 cfs 40 cfs on 5/11/71

Ave. Velocity/Range: 1.5 fps/ up to 2 fps/

Ave. Width/Range: 14m / 9-50m/ Lower end - .15m/at times up to .45m

Ave. Depth/Range: Dirt and rock stabilized by vegetation - well defined channel - little LOD influence except in braided channel (flooding occurs after rains)/ A major fork (splitting flow in half) occurs at 1100m.

Streambank Composition / Stability

Tributaries

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
5/11/71	15.6C	15.3C	6.8	--	--	--	--
Above 1100m	16.2C	17.0C	--	Clear / None	Light Amber	--	--

Total Alkalinity: 17.1ppm (5/11/71)

Total Hardness: --

Dissolved Solids: 230ppm (5/11/71)

Other/Overall: Additional water quality information on next sheet. Some flooding occurs after heavy rains.

Spawning Area

Overall Stream Bottom Composition: Intertidally: 70% gravels, 15% cobble, 5% pebbles, 10% sand. South Fork: 50% angular cobble, 50% angular boulders. North Fork: finer sediment occurs mixed with large gravel, cobble, boulders and bedrock.

Gravel Compaction: Some in lower end - not a problem.

Spawning Area Available Above High Tide Mark (HTM): Hundreds of redds observed. Good to excellent quality spawning areas available, some gravels are large, but chum and coho utilize them; by low-level aerial photography: 4622m^2 area available (3690m^2 estimated by conventional stream survey methods).

Intertidal Spawning Area: Excellent and abundant area exists: by low-level aerial photography technique; 12054m^2 total (by conventional stream survey techniques, 18,450m^2 was estimated).

Rearing Area Few pools in lower end of creek (mainly riffle). In No. Fork, p:r = 2:1 in braided section.

Pool/Riffle Frequency (P:R Ratio): --

Ave. Pool Depth/Range: --

Ave. Pool Size/Range: --

Available Cover: Limited in lower section. Increases near and above fork due to LOD, overhanging vegetation, undercut banks and root wads.

Aquatic Invertebrates/Available Food Source: Abundant: diptera larvae, hydropsychids (in North Fork), mayflies, caddisflies and Isopods (intertidally) observed.

Aquatic Vegetation: Intertidally: filamentous algae is abundant. Rivularia occurs on rocks above fork.

Terrestrial Vegetation: Grasses and sedges in lower end. Salmonberry, currant, skunk cabbage, blueberries, mosses, apple in a cedar, hemlock and spruce canopy occur.

Shading: Up to 20% below weir due to canopy. 60% above weir due to riparian vegetation, canopy and some topography.

Extent and Quality of Rearing Area: Abundant only near and above forks (in braided channel) - limited to under LOD and undercut banks near weir. However, it is of excellent quality. A fish passage could open up extensive rearing area in the Todd Lake system.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pinks, chum, coho, cutthroat, Dolly Varden and steelhead utilize this creek.

Use by Fishermen: Subsistence fishing, hunting, and hatchery egg takes have occurred in Nadzabeen.

Wildlife Present

Ducks, marten, and minks observed.

Comments and Recommendations The highest recorded escapements on Annette have occurred in this major system. Excellent spawning channels, good water quality, high temperature and year-round flow help give the stream its production characteristics (the 0+ coho fry are larger here than anywhere else). A detailed benefit: cost analysis regarding installation of fish passage over the barrier falls on the south Fork (including a more detailed stream survey above the falls) is strongly recommended.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
1959	All species	Adults	150,000	--	Largest single recorded count.
9/21/71	Pink and Chum	Adults	75,000	--	75% pinks, 25% chum
1974	Pink	Adults	5,142	--	USFWS Estimated Total Escapement
1975	Pink	Adults	40,677	--	USFWS Estimated Total Escapement
1976	Pink	Adults	42,313	--	USFWS Estimated Total Escapement
8/19/80	Pink	Adults	6,300	--	Above Weir (Weir operating for egg take)
9/7/80	Pink	Adults	42,000	--	Combined Weir, foot and aerial peaks count.
	Chum	Adults	1,100	--	
	Coho	Adults	500	--	
6/14/81	Coho	Fry	Abundant	(over 1000)	In lower creek, there are hundreds in the only cover available there - the weir!
	Trout	Fry	Abundant	--	Could have been rainbow and cutthroat there.
9/1/81	Pinks	mainly (mixed)	20-30,000	--	In creek (aerial survey)
9/23/81	Pinks -	below weir	2,760	--	On foot count - E. Biggs and T. Frame
		under weir (provides cover)	3,675	--	
		above weir	40,871	--	
		TOTAL	47,306	3,549	
	Chum		77	373	

Additional Water Quality Data:

	Air Temp	Water Temp	pH	T.A.	T.H.	D.S.	D CO_2	Turbidity
5/22/71	7.0C	6.0C	7.5	17.1ppm	120ppm	102.7ppm	--	--
9/1/72	17.8C	16.1C	7.0	Trace	15ppm NaCl	12.84ppm Free $CaCO_3$	Trace	5.0ppm due to logging activity
8/17/80		14.0C Above weir 17.0C Below weir						

Survey(s) and Dates Conducted

E. Biggs, C. Huntington, and J. Yuska, 6/14/81, E. Biggs, 8/19/80, and USFWS, 5/11/71.

Also examined by Tamgas Creek Hatchery Personel and others.

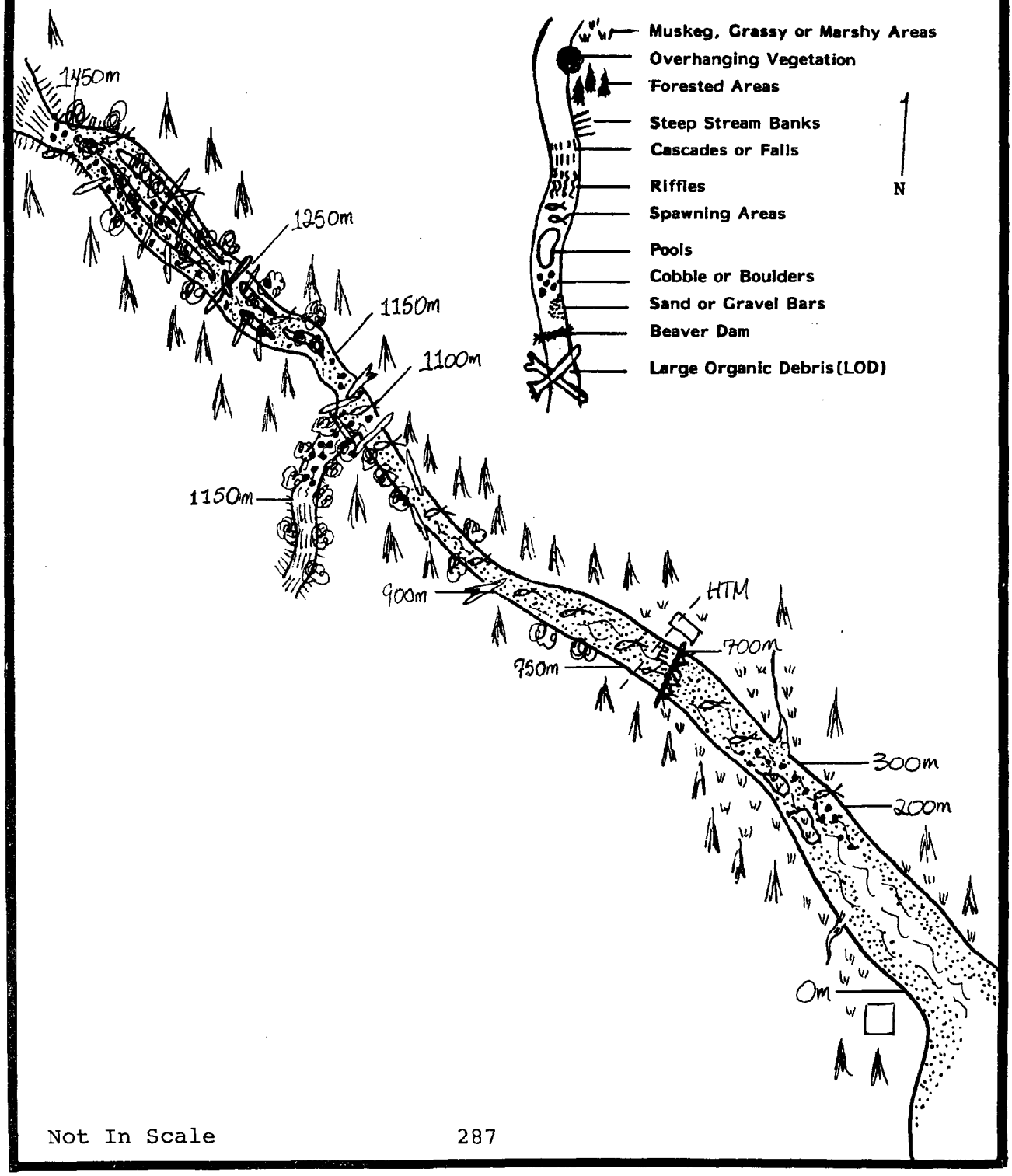
Recommended Escapement

Based on an estimate of spawning area from low-level aerial photography technique, historical escapements, and available rearing area, recommended escapements are 27,100 pink (mainly using the intertidal area), 500 chum (mainly utilizing the area above high tide) and 20 coho spawning pairs.

Potential Production Summary

A 10% overall egg-fry survival rate is used in the estimate, even though some excellent quality gravels exist. Production potential is estimated at 80,480 pinks, 2475 chum and 113 coho returning to Annette Island. Production has exceeded this in previous years and is probably due to variations in both the freshwater and marine survival rates. An enhancement study is recommended (see production potentials of tributaries to Todd Lakes).

Figure 59. NADZAHEEN CREEK (North and South Forks)



Not In Scale

NADZAHEEN CREEK (NORTH AND SOUTH FORKS)

Watershed No. 201-01
Stat. No. 101-41-067

0m	Stream watchers cabin; insignificant tributary with a bedrock barrier flows in above cabin.
0-200m	Bedrock, boulder and cobble riffle.
200-300m	Average Stream Width (ASW) = 20m; spawning gravels begin at 200m, 90% usable gravels (1800m^2 spawning area).
300-700m	From 0m to 700m creek flows through grassy flats: ASW = 40m, with 90% usable gravels (14,400m^2 spawning area). At 700m is a weir and trailer (old egg take station) with abundant coho fry in pools created by the weir.
700-750m	ASW = 50m, 90% spawning gravels (2250m^2 area). Estimated High Tide Mark (HTM) at 745m.
750-900m	ASW = 21m, ASD = .11m, 90% gravels (2835m^2 spawning area). Old weir occurs at 900m.
900-1100m	ASW = 21m, 10% spawning gravels, 80% cobble, (420m^2 spawning area); abundant coho and trout fry observed here (trout in riffles, coho in backwater areas). Creek splits into two forks.
1100m-1150m (South Fork)	Boulder, cobble riffle with heavy LOD pile at mouth of fork and a set of three impassable falls at the head (1150m).
1100-1150m (North Fork)	ASW = 9m, ASD = .08m (5.5 cfs flow) with 50% usable gravels (160m^2 spawning area).
1150-1250m (North Fork)	Channel becomes braided with gravel bars interspaced, 10% spawning gravels.
1150-1450m (North Fork)	Alot of good rearing habitat available in side channels and under frequent LOD piles.
1450m (North Fork)	25m cascade falls over bedrock, definite barrier.

Spawning Area:

Intertidal	200-300m	1,800m^2	area	12,054m^2 by Low-Level Aerial Photography
	300-700m	14,400m^2	area	
	700-750m	2,250m^2	area	
	Total	18,450m^2		
Above HTM	750-900m	2,835m^2	area	4622m^2 by Low-Level Aerial Photography
	900-1100m	420m^2	area	
	1100-1150m	225m^2	area	
	1150-1450m	210m^2	area	
	Total	3,690m^2		

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Annette Bay Creek	102-42-068	115-01

Location	Origin	Watershed Type
Flows NW into Annette Bay, 600m long.	Muskeg run-off	Open muskeg flats (121 acres in area).

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/20/81	600m to end of creek in muskeg.	debris blockage at 75m	Moderate	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
--	.33 cfs / --	.5 fps sluggish/--	1.25m / --	-- --

Streambank Composition / Stability: Very unstable - heavy LOD influence near beaver dam, logging and construction have caused some erosion and stream blockage - rechannelization./

Tributaries: None

Water Quality 8/31/72: 17.8C 14.4C 6.0 -- -- 10.0ppm 35.0ppm

Sample Site	Temp.-Air	Temp.-Water	Ph (8/31/72)	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	10.5C	12.0C	6.0	Clear / Slight	Brown	--	--

Total Alkalinity: 17.1ppm (8/31/72)
Total Hardness: Resistivity=16.60 ohm/cm^3/
Dissolved Solids: 4.28ppm
Other/Overall: $CaCO_3$/ Siltation has occured from logging and debris blockage has occurred.

Spawning Area

Overall Stream Bottom Composition: Below dam: 45% gravels, 25% pebbles, 20% sand, 10% silt, organic matter - trace. Muck is on bottom above dams.

Gravel Compaction: Moderate compaction with some fines and angular gravels.

Spawning Area Available Above High Tide Mark (HTM): Limited: Only about $20m^2$ is available under the bridge and road (no area available above dams) of marginal quality - survival of eggs would be low.

Intertidal Spawning Area: Limited: only about $35m^2$ of marginal quality area is availablle.

Rearing Area

Pool/Riffle Frequency (P:R Ratio)	Ave. Pool Depth/Range	Ave. Pool Size/Range
Few pools - a beaver pond occurs.	-- --	beaver pond is 55 x 25m

Available Cover: In beaver pond, behind debris jam, under bridge and in a few undercut banks.

Aquatic Invertebrates/Available Food Source: Sparse - caddisflies and diptera observed though.

Aquatic Vegetation: Scarce

Terrestrial Vegetation: Muskeg vegetation dominates.

Shading: 5% topographical (was more before logging).

Extent and Quality of Rearing Area: Limited rearing area due to small creek size and channel instability (good cover is available).

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Only pinks could utilize creek if at all, in its present state.

Use by Fishermen: No fishing now - logging camp may have used creek.

Wildlife Present

Beaver activity.

Comments and Recommendations

The channel is slowly recovering from a major disturbance. Even before disturbance, this stream (due to small size) probably did not produce large numbers of salmon. However, estuary area may be important rearing area - protect area for further development and disturbance to allow it to recover.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
8/31/72	None Seen				
6/20/81	None Seen				

Survey(s) and Dates Conducted

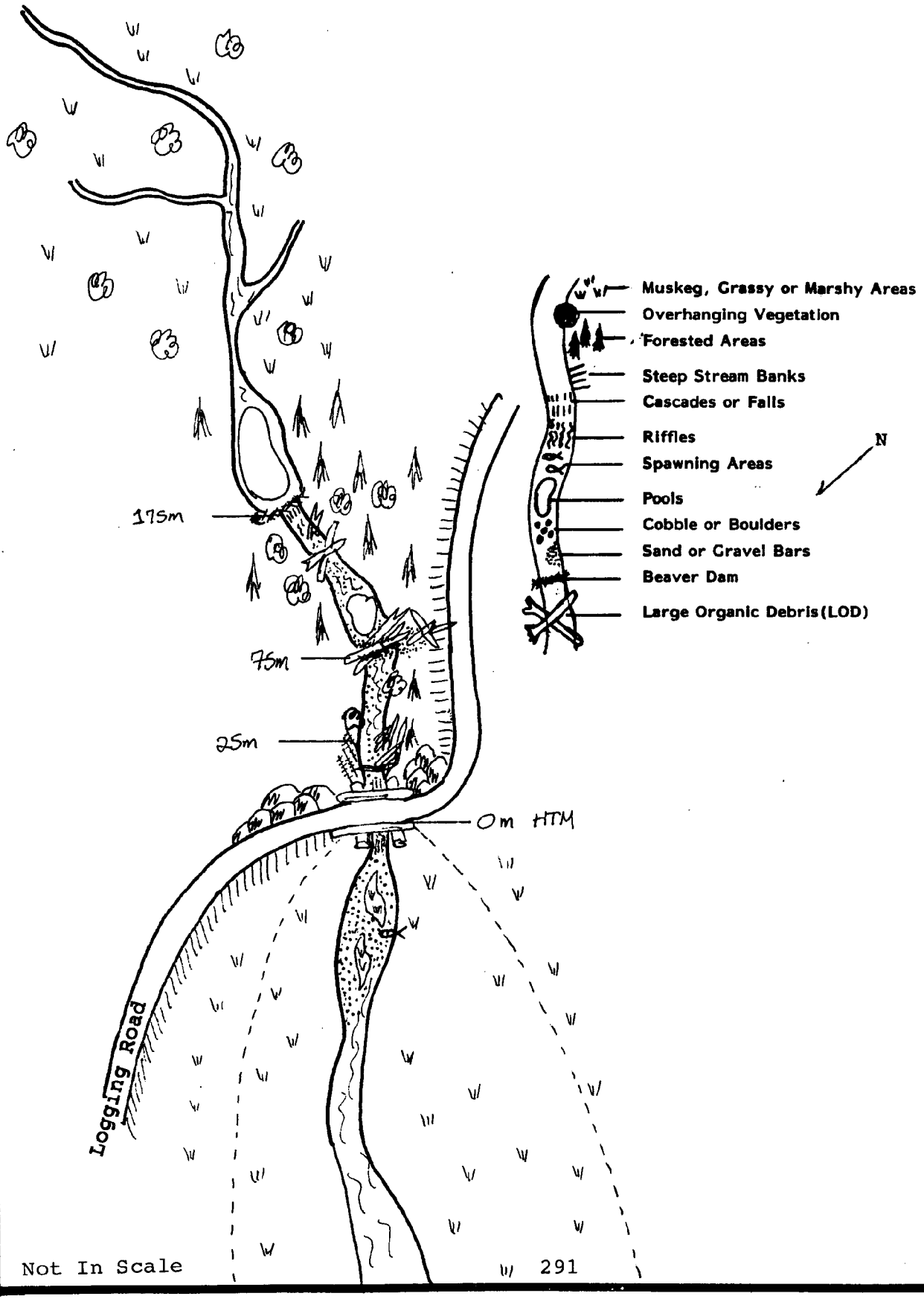
Recommended Escapement

Only 100 pink spawning pairs could utilize this creek and their success is questionable due to the fines in the gravel.

Potential Production Summary

Due to the marginal gravel quality, only about a 1.2% egg-fry survival rate is expected resulting in a production potential estimate at 36 pinks returning to Annette Island.

Figure 60. ANNETTE BAY CREEK



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ANNETTE BAY CREEK

Watershed No. 115-01
Stat. No. 101-42-068

Intertidal	$35m^2$ spawning area available.
0m	High Tide Mark (HTM), creek flows under log bridge with $8m^2$ available spawning area under road.
0-25m	$12m^2$ spawning area; cat tracks run into and disturb creek channel - the heavy machinery movements did cause siltation of gravels.
75m	Slash and roadside debris blocking channel, no more available spawning area above 25m.
175m	Beaver dam with 55 x 25m pond behind it. Above beaver dam, stream flows into muskeg flats.

Spawning Area: Limited and of marginal quality.

Intertidal	$35m^2$ area
Above HTM	$20m^2$ area

ANNETTE ISLANDS STREAM SURVEY SUMMARY

Stream	Number	Geocode
Annette Bay Halfway Creek	101-42-069	115-02

Location: Flows NE into Annette Bay, 1.8 mi long./ run-off and small lakes.

Origin: Mountain slope

Watershed Type: Forested steep mountain slopes.

Date Surveyed	Section Surveyed	Barriers	Stage	Flood Height
6/21/81	1500m above High Tide Mark (HTM) to barrier	Possible barrier at 0m definite barrier at 1500m.	--	--

Ave. Gradient	Flow / Range	Ave. Velocity/Range	Ave. Width/Range	Ave. Depth/Range
1-10%	4 cfs / --	2-4 fps / --	3-3.5m / --	.2-.3m / --

Streambank Composition / Stability: Rocks and soils with heavy riparian growth and bedrock./ Fragmentation of rock indicates some instability.

Tributaries: One in section surveyed.

Water Quality

Sample Site	Temp.-Air	Temp.-Water	Ph	Clarity/Turbidity	Color	D.O.	CO_2
Above HTM	12.2C	10.0C	--	Clear / None	Slight Amber	--	--

Total Alkalinity	Total Hardness	Dissolved Solids	Other/Overall
--	--	--	Looks good

Spawning Area

Overall Stream Bottom Composition: Some gravels - up to 40% in stretches; otherwise, channel is boulders, cobble, bedrock.

Gravel Compaction: Angular with some compaction.

Spawning Area Available Above High Tide Mark (HTM): $710m^2$ area is available all above the bedrock run (a possible barrier - especially for pink and chum) at 150m and below 1100m in the braided channels.

Intertidal Spawning Area: None available - area is less than 5% gravels (mainly boulders and cobble).

Rearing Area

Pool/Riffle Frequency (P:R Ratio): Some pools occur in braided channels and below falls. Few riffles occur except bedrock riffles./

Ave. Pool Depth/Range: -- --

Ave. Pool Size/Range: -- --

Available Cover: *From some overhanging vegetation and LOD - not extensive.*

Aquatic Invertebrates/Available Food Source: Scarce

Aquatic Vegetation: Some filamentous algae.

Terrestrial Vegetation: Azalea, grasses, skunk cabbage, a few alder, huckleberry, queens cup in cedar, hemlock and spruce.

Shading: 80%, 30% due to steep banks and 40% due to vegetation, 10% due to canopy.

Extent and Quality of Rearing Area: Not alot, but some is available in braided channels with slow flow and pools.

Reported and Suspected Use of Stream by Fish and Fishermen

Use by Fish: Pink and chum are probably blocked by the initial cascades, coho may be blocked also - none were seen.

Use by Fishermen: No known fishing occurs.

Wildlife Present

None seen.

Comments and Recommendations

This stream shows potential if the fish can traverse the first 150m of the creek. A fish ladder may be a consideration, but the increase in production realized may not justify the cost.

Historical Escapement/Fish Observed

Date	Species	Size	Numbers-Live	Dead	Comments
6/21/81	None seen				

Survey(s) and Dates Conducted

J. Yuska, 6/21/81

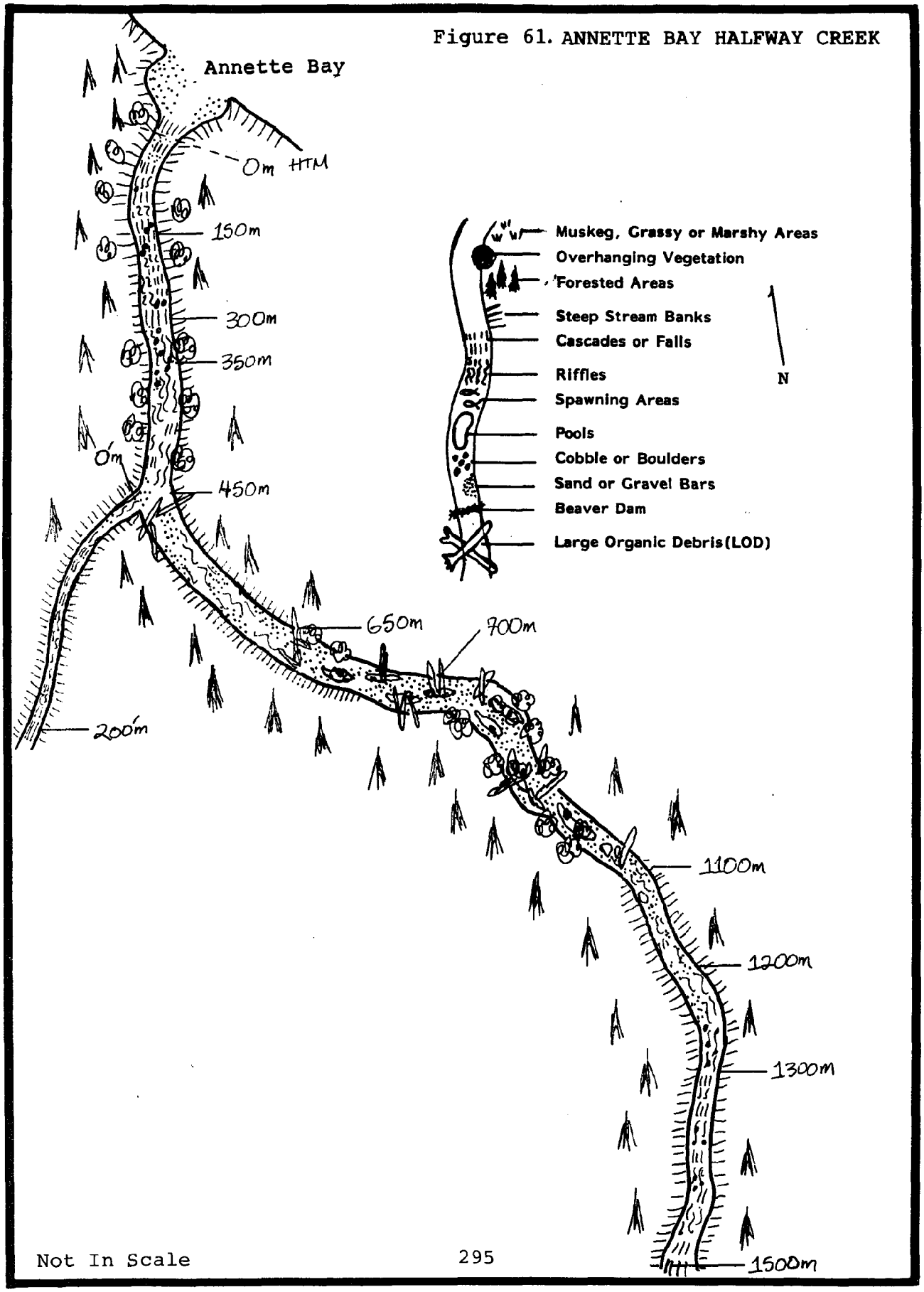
Recommended Escapement

There is enough suitable spawning area above the falls for about 1180 pink and 77 chum spawning pairs, however, it is doubtful they traverse the falls. Therefore, recommended escapement is limited to about 10 coho spawning pairs (limited by rearing area, not spawning area).

Potential Production Summary

At the above escapement, potential production is about 56 coho (assuming a 10% egg-fry survival rate).

Figure 61. ANNETTE BAY HALFWAY CREEK



Not In Scale

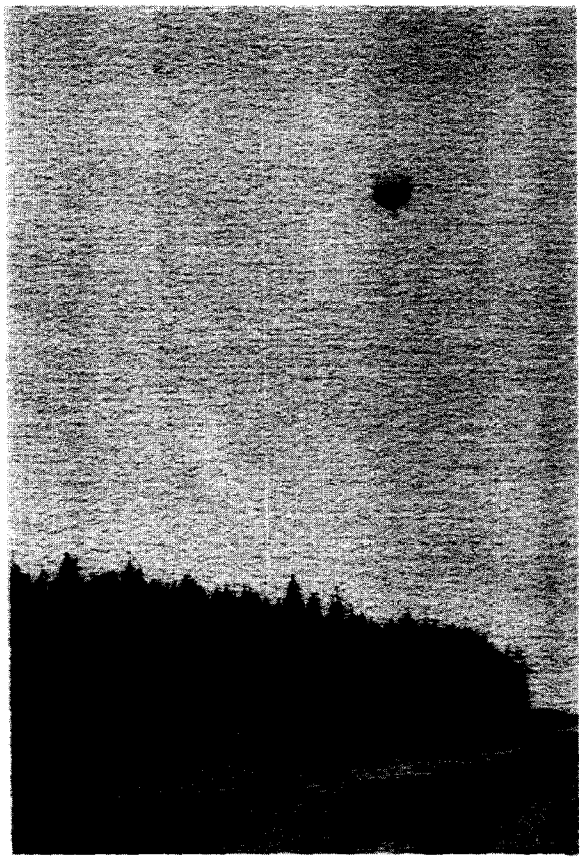
ANNETTE BAY HALFWAY CREEK

Watershed No. 115-02
Stat. No. 101-42-069

0m	High Tide Mark (HTM) 2m falls into bay, probable barrier to pinks and chum.
0-150m	All cascades and falls, probably velocity barrier, but coho may still make it.
150-300m	Average Stream Width (ASW) = 3.5m, Average Stream Depth (ASD) = .25m; bottom composition is 30% cobble, 40% boulder, and 30% bedrock, gradient is lower and at 300m is a sloping falls.
350m	Gradient decreases, but less than 5% gravels in bottom.
450m	No rearing or spawning areas from 0m to here; tributary enters, 1.5 cfs flow and high gradient, with less than 1% gravels and a barrier falls at 200m.
450-650m	ASW = 3.5m, 20% angular gravels of marginal quality ($140m^2$ spawning area).
650-1100m	ASW = 3.0m, 50% gravels ($540m^2$ spawning area) with a low gradient and algae present on rocks; shading is 50% and beginning at 650m; channel braiding occurs with off-channel rearing areas and frequent LOD.
1100-1200m	ASW = 3.0m, 10% gravels ($30m^2$ spawning areas); channel braiding ends and gradient increases.
1200-1300m	Mainly a boulder bottom with less than 5% gravels ($7m^2$ spawning area).
1300-1500m	Gradient increases, bottom is all bedrock and boulders with no gravels.
1500m	Cascades - no more available spawning or rearing habitat here or above.

Spawning Area:

Intertidal	None
Above HTM	May be available to coho is they can traverse initial cascades.



Appendices

APPENDIX I. GLOSSARY OF STREAM SURVEY TERMS

Angular gravels - gravels that are not rounded, but instead are irregularly shaped.

A.S.D. - average stream depth in the section surveyed or described.

A.S.W. - average stream width in the section surveyed or described.

c.f.s. - cubic feed per second; a common unit measure of streamflow.

Fork Length - the shortest measurable length of the fish, including the tail (from the tip of the snout to the middle of the tail).

f.p.s.- Feet per second; a common unit measure of stream velocity.

HTM - High Tide Mark; the level which the highest high tide reaches or high level of salt water influence.

LOD - large organic debris, e.g. dead or living logs or root wads in, over, or bordering a stream channel.

Pools - a deeper section of the creek formed by LOD, boulders, obstructions, falls, and stream currents.

Redds - a fish "nest", or the area in the gravel utilized by a salmonid in which she buries her eggs.

Riffles - a shallow section of the creek where a laminar stream flow pattern occurs.

Riparian - streamside or bordering; e.g. vegetation that borders a stream and that would not occur there if there were no stream (trees are generally not riparian).

Smolts - a juvenile salmonid that is physiologically ready for and which tends to migrate toward the ocean.

Stream Bottom Classification (USFWS)

Bedrock - solid rock
Boulder - Over 30cm in diameter
Rubble - 15-30 cm
Cobble - 10-15 cm.
Gravel - 1.25-10 cm.
Pebble - .3-1.25 cm (fines are less than .65 cm.)
Sand - less than .3 cm.
Silt - very fine - includes mud.
Organic matter - leaves, bark, wood chips (can be microscopic).

Tailout - a gravel or debris substrate pile that accumulates downstream from a pool or depression in the stream bottom, deposited by current.

APPENDIX II. METHODS AND DATA SOURCES

For a complete description of water quality measurements and sampling methods, refer to the Annette Islands Watershed Study (Pacific Rim Planners, Inc., 1979).

Most of the data measured was done so with standard equipment and by simple methods. Gradients were measured using a hand-held Sunto clinometer and distances measured by pacing them off (depths were measured with meter sticks). Streamflows were estimated by measuring cross-sectional area and multiplying by water velocity (measured using a floating object and a stop watch). Stream bottom compositions were estimated by pacing off areas of particular composition and by physically examining substrates (sampling and sifting).

Much of the other data included on the forms are straight observations and need no explanation.

Spawning area was estimated in the following ways:

1. Stream length (meters) X stream width (meters) X percentage of spawnable gravels (submerged) in that section = spawning area (square meters).

2. If spawning area is a gravel bar, the individual bars were paced off and individual areas added up for a particular stream section.

Production potential estimates were obtained by methods explained in Part 2. of this survey.

APPENDIX III. LOW LEVEL AERIAL PHOTOGRAPHY TECHNIQUE

For four of the major streams surveyed, an innovative and relatively new survey technique was utilized to measure spawning areas, rearing areas, and creek dimensions with much more accuracy and detail than the conventional mapping procedures. This method is called low level aerial photography and is carried out by use of a weather balloon with a tetrahedron frame housing a camera suspended underneath (see the Appendices cover sheet photo).

Rutzler (1979) has developed methodology for low level aerial photography of coral reefs using a 35mm camera suspended under a weather balloon. The equipment utilized in this study was an adaptation of Rutzler's system and modified to fit the requirements of stream survey work on the Olympic Peninsula in Washington and on Annette Island in Southeast Alaska by Joseph Yuska and Charles Huntington of the Department of Fisheries, Oregon State University in Corvallis, Oregon.

The 35mm camera utilized was a lightweight Olympus, OM-1 with an autowinder (motor drive) mounted on a gimballed tetrahedron (constructed of balsa wood and styrofoam) suspended from a neoprene weather balloon. The balloon was surrounded by a jacket made of extra-lightweight rip-stop nylon to protect it from protruding branches and obstructions it might have hit. Two positioning or tether lines (up to 150 feet in length), one tied to the balloon base, and one tied to the frame, were extended to the ground. A triggering cable (composed of fine telephone line wire) was extended down one of the tether lines and hooked up to the autowinder. In addition, a radio controlled shutter release was employed before the triggering cable, but found to be more difficult and less dependable to use than the wire release. A third person stood directly underneath or to one side of the balloon dragging a meter long P.V.C. pipe floating on the stream surface (to give each photo scale). The people controlling the tether lines control the height at which the balloon flies and therefore the camera focal length. The person dragging the meter pipe ensures that the camera is centered over the stream correctly.

By varying the height of the balloon over the stream which varies the camera lens focal length, and by turning the camera so that the picture frame either runs lengthwise with the stream or crosswise (to photograph the widest area possible), a wide range of stream sizes could be surveyed. To ensure that the photographs overlapped, the focal length at different heights was measured prior to flying the balloon, then the creek distance was paced off between each picture taken (the appropriate paced distance depending on balloon height). Measurements could include substrate composition of the stream, location of salmon redds, as well as detailed stream geometry and could be examined in detail in the office once the film was developed. A wide variety of films and filters could be employed to elucidate specific components of the stream system which the researcher is interested in measuring.

Low level aerial photography does not rely on cloud-free conditions and in fact, contrast in black and white photographs and detail in stream bottoms is increased on overcast days. However, the breeze must be very slight and no breeze preferable, a rare incidence and limiting factor to the use of this method in Southeast Alaska. These low level photographs could be taken below the tree canopy and could reveal much more detail than photographs taken from aircraft. In addition, this method can be done for a fraction of the cost of what aerial photographs from aircraft would cost.

Four streams were surveyed by this technique and only one set of the pictures was not utilized in spawning area estimates. The Hemlock Creek series were shot on a clear day when the reflection from the sun was so intense that the reflection off the creek surface covered up the meter-stick and prevented the interpreter from seeing the creek bottom. The other creeks shot were Kwain Creek Slough, Crab Creek Slough, and Nadzaheen and the estimates obtained from those photos are included in the individual stream survey forms.

After the photographs were developed, an enlarger was employed to standardize the size of the meter stick in each picture, compensating for the variation in the height that the balloon was flown. The photographs were then made into one composite for each creek, with sufficient overlap. The areas to be calculated could then be measured in one of three ways:

1. one could use a planimeter to measure each area of concern (a difficult task on overlapping photos)

2. one could overlay transparent graph paper, trace the creek areas of concern and then count squares or

3. one could break each creek area of concern into geometric shapes and estimate the area of each shape individually by trigonometry.

Methods 2 and 3 were utilized as 1 proved too difficult to do uniformly and accurately. By knowing the percent of spawnable gravels in each of the areas photographed, one could estimate the size of the potential spawning areas using the area estimate derived from low level aerial photography. This was done for Crab Creek Slough, Kwain Creek Slough and Nadzaheen.

The individual composites are on file at the Annette Natural Resource Center, and it is recommended that low-level aerial photography be employed in other resource inventory or environmental impact studies because of its accuracy and flexibility (in data obtained) and because of the ease at which data can be examined in the office and out of the weather.

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