

LEMON CREEK REPORT
BASELINE AQUATIC HABITAT CHARACTERIZATION

ATTACHMENT 18

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SPORT FISH DIVISION

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Introduction:

The Alaska Department of Fish and Game (ADF&G) designated Lemon Creek as an anadromous fish stream that supports stocks of coho, chum, and pink salmon, and Dolly Varden char (ADF&G# 111-40-01-10100). Knowledge of fisheries resources in Lemon Creek is largely lacking, with most of the known information compiled in ADFG's Juneau Fish Habitat Assessment (Bethers, et al 1995). Limited escapement data derived from periodic stream counts in the lower reaches from 1975-1994 indicate that chum (1-1210 fish) were most frequently observed, followed by coho salmon (0-15), and pink salmon (11-80) (Bethers, et al 1995). Juvenile coho (4-250) and Dolly Varden (up to 300) have been trapped or visually observed in the lower reaches of Lemon Creek.

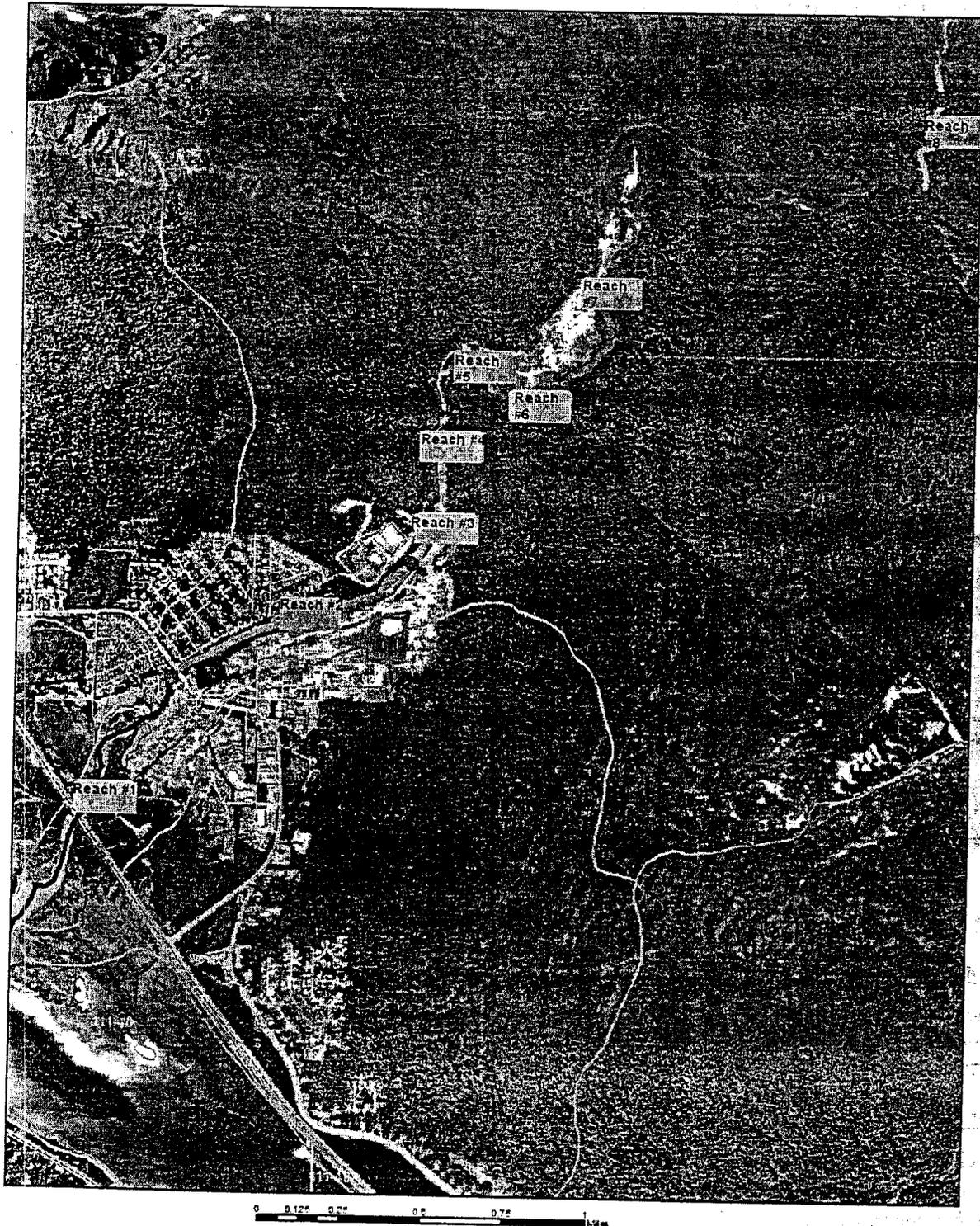
Little is known about use of the stream or estuary by non-game fish. Anecdotal observations of piscivorous birds by biologists in early spring suggest the presence of eulachon or capelin at the mouth of Lemon Creek, and three-spine stickleback are likely present in the stream margins and associated wetlands. Lemon Creek's fish populations have yet to be fully evaluated (Brian Glynn, 2004; Bethers et al., 1995), and even less information on the past and current aquatic habitat conditions have been collected.

Given the high level of human disturbance of the lower Lemon Creek watershed since the 1970's, fish population evaluation efforts have likely been a low relative priority to ADF&G fish management biologists. However, in-channel gravel extraction in lower Lemon Creek has been strongly regulated since 1984 due to its negative effects to fish habitat and water quality. The mined reaches upstream of the Glacier highway bridge have since reclaimed some of the pre-disturbance riparian and in-stream habitat features of the original channel. Thus, the purpose of the ADFG 2004 reconnaissance survey was to roughly characterize the aquatic habitat throughout the Lemon Creek study area, and relate these relative values to potential sediment management alternatives identified in the Lemon Creek Geomorphic Assessment and Sediment Management Alternatives Analysis (Geomorphic Assessment).

2004 Baseline Habitat Survey

ADF&G conducted reconnaissance level fish habitat surveys of Lemon Creek in May 2004. The study area extended from tidewater at the Egan Drive bridge upstream approximately 4.5 miles to the fish barrier at the end of the study area (Figure 1). Field observers used habitat survey protocols developed by U.S. Forest Service, Alaska Region (USFS, 2001) and adapted into the Sport Fish Region 1 Stream Survey User Guide (ADF&G, draft) as a method to measure select habitat parameters related to salmonid presence and abundance. Data collected include channel type, average gradient, bank full width, pool and large wood frequency; this is summarized below in Table 1. This survey segmented Lemon Creek into eight reaches defined by channel types as described by the Geomorphic Process Groups in the USFS Channel Type User Guide (USFS, 1992). The narrative below summarizes habitat values based on observations by ADF&G biologists as well as data collected in each reach starting at Reach 1 working upstream. These observations were then compared to the hydrologic and habitat characteristics presented Channel User Type Guide to help define the habitat potential in each reach. Since the habitat survey stream reaches were defined by the criteria in the User Guide, they differ slightly from the reach definitions in the Geomorphic Assessment (Figure 1).

Figure 1. Habitat Survey Reach Delineations



Reach Descriptions:

Reach 1 – Large Estuarine Channel (ES4)

Fish Use:

This intertidal reach provides rearing habitat for outmigrating juvenile fish, especially chum salmon, as well as some spawning habitat for pink and chum salmon. It is likely that many of the adult chum salmon found in Lemon Creek are strays from nearby Macaulay Hatchery, however the proportion of this component of the chum salmon escapement is not known.

Existing Habitat Condition:

This reach also contains the Redi-Mix Bridge and the adjacent commercial operation that is impacting fish habitat. A failing riprap revetment has the potential to further degrade this reach. The extensive amounts of disturbed banks are a significant source of fine sediment in this reach, in addition to the fines that are transported from upstream reaches. Fine-grained sediment deposited in this reach potentially buries salmon redds to an extent that it may limit egg viability.



Reach 2 – Wide Low Gradient Floodplain Channel (FP5)

Fish Use:

This reach is also influenced by tidal fluctuation for a short distance above the Glacier Hwy Bridge, and is known to provide spawning and rearing habitat for salmonids (Kirkpatrick 2004 and ADF&G 1990). This includes overwintering by juvenile coho salmon.

Existing Habitat Condition:

This reach would be expected to have high habitat values, especially for rearing juvenile salmonids such as coho salmon and Dolly Varden char. However, there is little cover in the limited number of pools in this reach available to fish during low flow periods such as winter. The high sediment load fills in pools that do form during high water events. The primary source of these fines is likely disturbed banks in this reach and in Hidden Valley, stabilizing these banks will likely improve the value of this reach sediments as spawning habitat.

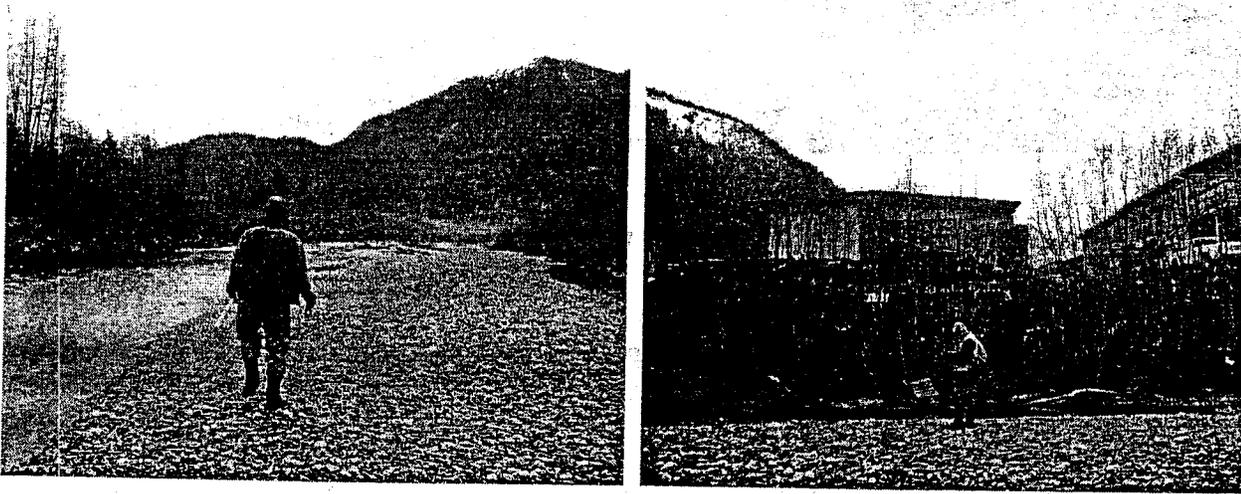
This reach has been disconnected from the floodplain and channeled by instream mining and urbanization. Prior to urban development this reach likely had high habitat values. The habitat values will not return to historic levels unless Lemon Creek is reconnected to the floodplain. A

significant portion of the existing riparian area is being encroached on by commercial and industrial development. This continues to degrade fish habitat throughout this reach.

This reach has the highest density of large wood in the surveyed area, congregated in several large logjams. Most of this wood was outside of the active channel during the survey, but would be accessible to fish during the summer/fall high flow periods. Most of the pools in this reach were associated with the large wood.

This reach contains significant amounts of gravel and cobble sediment, which should be suitable for spawning habitat. There appears to be a high amount of fines that reduces the suitability of this sediment for spawning habitat. The high sediment load will also likely bury any incubating salmonids eggs rendering them unviable.

This is the reach that will be most effected by any instream mining. This survey will serve as a benchmark on which to base fish habitat improvements that would be included in future mining plans.



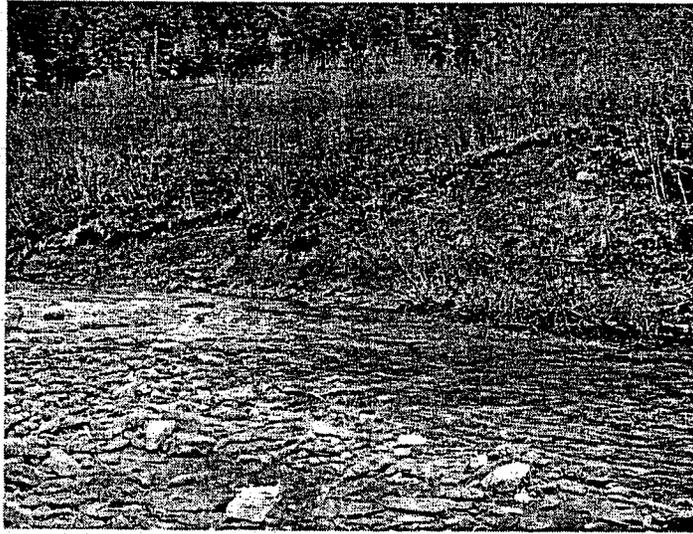
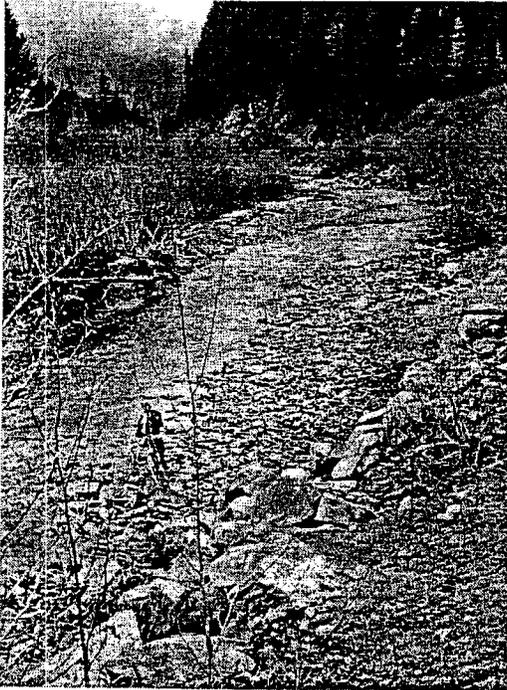
Reach 3 – Moderate-Width Mixed Control Channel (MM2)

Fish Use:

This is a transition reach to the narrow gorge upstream. There are limited habitat values in this reach due to the large volume of sediment that is deposited from upstream reaches. Currently, it mostly serves as a migration corridor to upstream habitat.

Existing Habitat Condition:

The banks are predominantly disturbed and this reach is a significant source of sediment to the stream during rain events. This reach will likely be affected by instream mining. Habitat improvements should be incorporated into any mining plan for this reach.



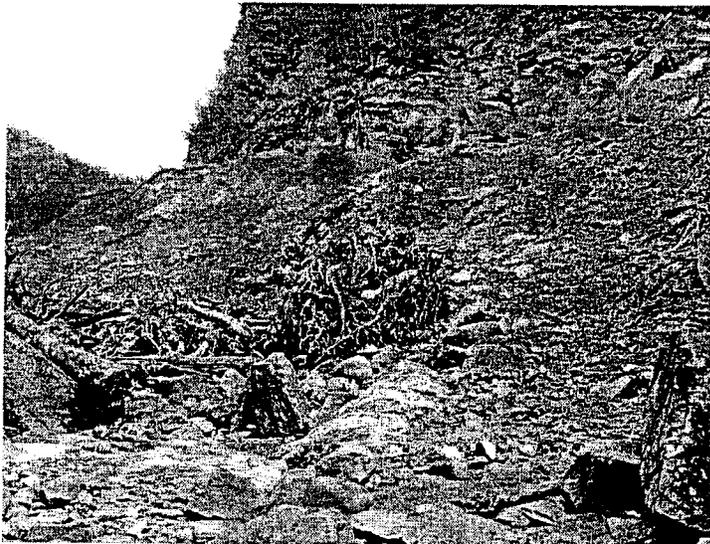
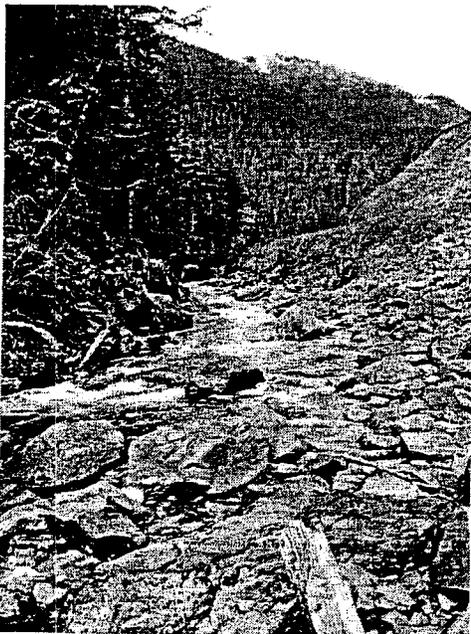
Reach 4 – Moderate Gradient Contained Narrow Valley (LC2)

Fish Use:

This reach is known as the “gorge” locally. There are adequate holding pools and large wood that provide cover. This reach predominantly serves as a migration corridor.

Existing Habitat Condition:

Similar to Reach 3, this may provide a significant source of sediment to the stream during rain events. The west bank is relatively undisturbed, but an access road is adjacent to the east bank through this reach and is a significant source of surficial sediment from the roadbed and cut-and fill slopes. Stabilizing this bank should be incorporated with any planned road upgrades.



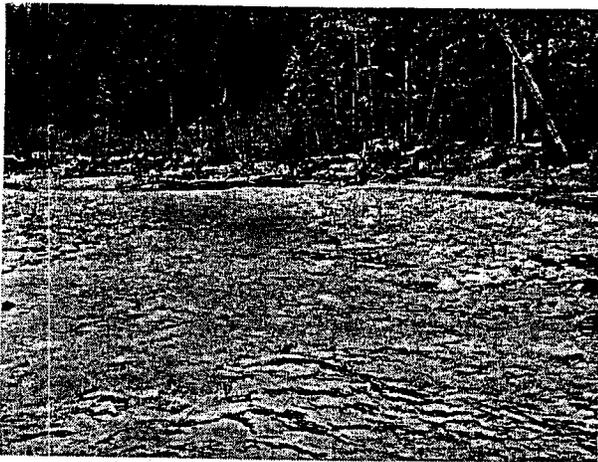
Reach 5 – Wide Low Gradient Floodplain Channel (FP5)

Fish Use:

This reach is similar to Reach 2 and Reach 3 in that it should provide high habitat values but has been degraded by excessive sediment input from upstream. Even with a relatively high wood count there are only 8 pools. Rearing coho salmon and Dolly Varden char were noted in small clearwater side channels during the habitat survey.

Existing Habitat Condition:

Excessive sediment input is likely filling pools faster than they can be formed. Reducing the sediment input would improve this habitat significantly. The streambanks of this reach are relatively stable.



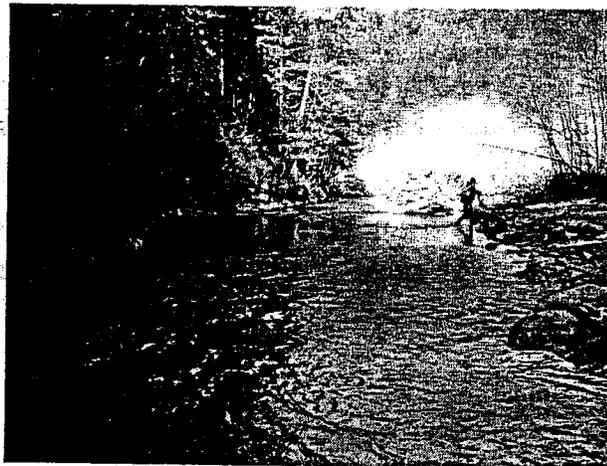
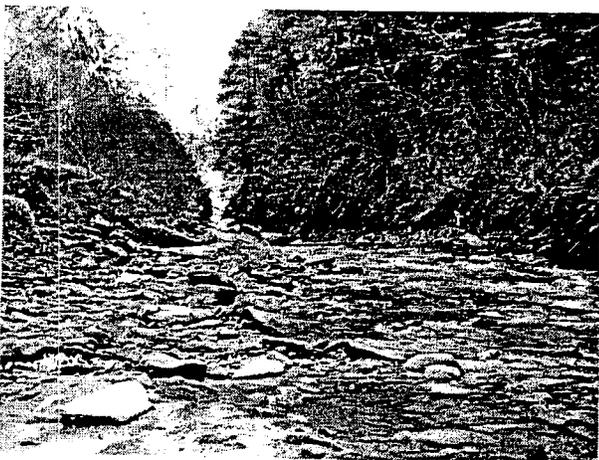
Reach 6 – Moderate Gradient Contained Narrow Valley (LC2)

Fish Use:

This contained reach is a migration corridor to upstream fish habitat. There are sufficient holding pools to accommodate this purpose.

Existing Habitat Condition:

The riparian corridor and streambanks are relatively intact in this reach.



Reach 7 – Wide Low Gradient Floodplain Channel (FP5)

Fish Use:

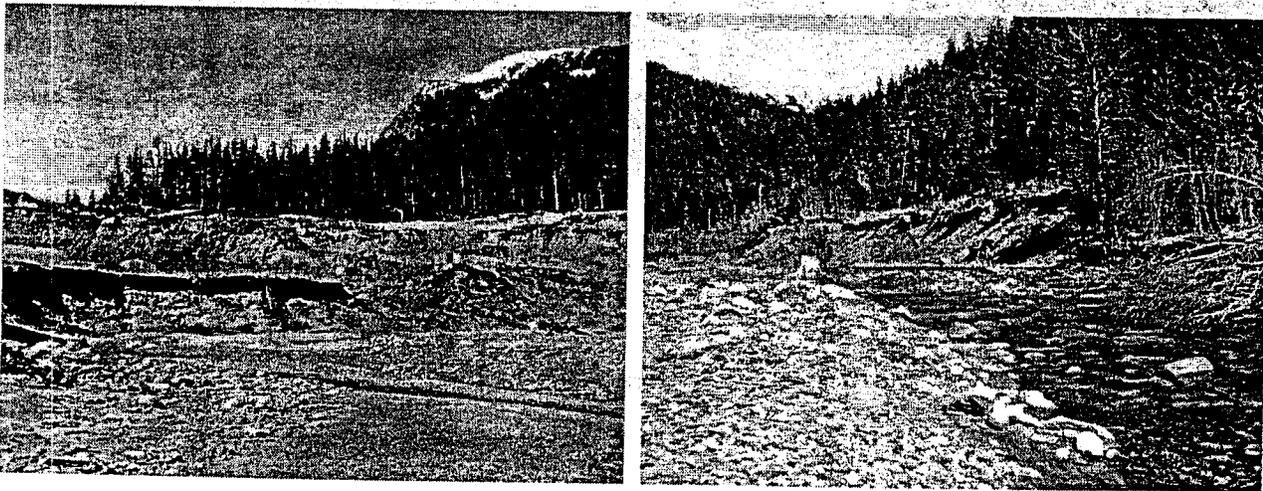
This reach extends the length of Hidden Valley and is the longest reach surveyed. It has the highest large wood count, but low pool density. Much of the large wood is stranded on the extensive gravel bars except during high flows.

This reach would be expected to provide rearing habitat for juvenile salmonids. Several small side channels did contain rearing fish, which were noted during the habitat survey. Overwintering habitat for juveniles would be a critical function for this reach. Any spawning activity that occurs in this reach is likely disturbed by the unstable nature of this reach.

Existing Habitat Condition:

Land management activities has led to this reach becoming very unstable, which has encouraged the mass wasting that has occurred in recent years. This reach has been the primary source of the excessive sedimentation that is occurring downstream. This has also degraded fish habitat values significantly in this reach.

Stabilizing the banks of this reach would not only improve fish habitat within this reach but also contribute significantly to improvements downstream by eliminating much of the excessive sedimentation that occurs throughout lower Lemon Creek.



Reach 8 – Moderate Gradient Contained Narrow Valley (LC2)

Fish Use:

This reach provides some rearing habitat and possibly some spawning habitat, but both are limited.

Existing Habitat Condition:

This habitat appears stable and relatively not impacted by human activities. It is not expected that any mining or habitat enhancement activities would take place in this reach.

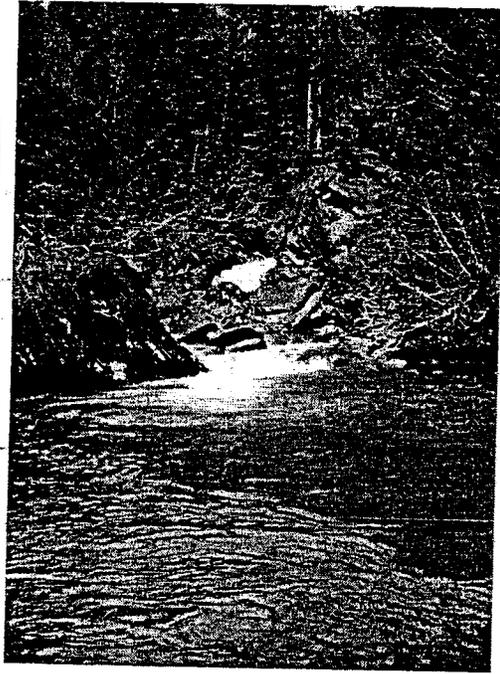


Table 1. Data Summary.

Habitat Feature Data Summary, May 2004								
	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8
CBJ Geomorphic Assessment Reach Identifier	A-B	C-D	E	F	G-H	Between H&I	I-K	Above K
Channel Type	ES4	FP5	MM2	LC2	FP5	LC2	FP5	LC2
Surveyed Distance (km)	1.6	1.35	0.356	0.365	0.654	0.189	3.40	0.676
Average Gradient (%)	1.1	1.1	2.9	4.2	1.2	2	1.5	2.6
Bankfull Width (m)	38	60	20	20	25	12	45	17
Incision Depth (m)	2	1.5	2.5	50	3	50	2.8	8
Pools (count)	0*	10	4	18	8	6	23	5
Pool Density (p/m)	0*	0.007	0.011	0.049	0.012	0.032	0.007	0.007
Large Wood (count)	0	560	20	71	237	2	980	31
LW Density (pieces/m²)	0	4.15	0.056	0.195	0.362	0.011	0.288	0.046
Key Piece (count)	0	3	0	2	7	0	52	2
Key Piece Density (pieces/m²)	0	0.022	0	0.005	0.011	0	0.015	0.003
Riparian Disturbance (m, both banks)	980	791	585	437	196	0	2146	0

* Pools not counted in estuarine reaches due to tidal influences.

Literature Cited:

ADF&G 1999. Lemon Valley Access Corridor Project, Final Project Report for ADOT/PF. Alaska Department of Fish and Game, Division of Habitat and Restoration. Juneau, Alaska.

Bethers, M., K. Munk, and C. Seifert. 1995. Juneau Fish Habitat Assessment. Alaska Department of Fish and Game, Division of Sport Fish. Juneau, Alaska.

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U. S. Department of Agriculture, Forest Service. 2001. Fish and aquatic stream habitat assessment. U.S.D.A. Forest Service, Region 10 (Alaska). Report Chapter 20 FSH 2090-Aquatic Ecosystem Management Handbook, R-10 amendment 2090-2001-1.

Glossary

The following Channel Type Definitions and Management Considerations are excerpted from the USFS Channel Type User Guide (USFS 1992) and are provided as a reference to represent the range four of channel type characteristics found throughout Southeast Alaska. Although channel type characteristics are relatively consistent, a degree of variability is inherent in these geomorphic units.

ES4 Channel Type (Large Estuarine Channel):

The ES4 streams are depositional channels subject to tidal influences. Stream energy is low, due to wide, low gradient channels. Gravel and sand bars tend to be stable bed features, except during extreme flow events. Large woody debris can significantly influence channel structure. Debris accumulations are important in forming pool habitat in ES4 channels.

These channels are always accessible to anadromous species. Generally, high quality substrate provides high available spawning area (Available Spawning Area, ASA 22%). Spawning pink and chum salmon will frequent ES4 channels in high densities. Although pool development is minimal (3% off water surface area), rearing coho salmon will move downstream from the mainstem in the summer to rear here (Available Rearing Areas, ARA 7%). Pink and chum salmon fry may temporarily remain in the ES4 system prior to moving seaward.

Sediment deposition is a dominant process in estuarine deltas; therefore, sediment retention in ES4 channels is high. These channels are very sensitive to intrusion of fine sediments into spawning beds. The effect of cumulative sediment impacts from upstream watershed disturbance is a major management concern. Erosion control, control of road drainage, and road maintenance are mitigation measures that should be emphasized in areas near these streams.

Stream bank sensitivity is high due to high amounts of fine unconsolidated alluvium in ES4 stream banks. Bank erosion can be a significant source of fine sediment in these channels. Channel protection and bridge design and implementation should be emphasized.

Protection of estuarine wetland and flood plain habitat is an important management consideration for ES4 channels and associated riparian areas. These intertidal wetlands provide extremely important habitat for waterfowl, furbearers, and a wide variety of aquatic species.

FP5 Channel Type (Wide Low Gradient Flood Plain Channel):

The FP5 channels function as sediment deposition systems. Low gradient, poor flow containment, and fine sized substrate are indicative of low stream power. Substrate consists mainly of sand to small cobble size particles. Short-term storage of fine sediment is characteristic of FP5 channels. These fine sediment deposits are typically mobilized during high flow events. Small side channels dissecting the FP5 flood plain are a common feature.

FP5 channels are heavily used by spawning chinook, chum, and pink salmon, and steelhead trout because of the abundance of high quality spawning gravels. These channels get only moderate use by spawning coho salmon, which prefer smaller channels. All freshwater rearing species make frequent use of these channels because rearing habitat is readily available, primarily in association with side channels, off-channel pools, and stream segments having large woody debris accumulations. Overwintering habitat in these channels is provided in off-channel slough areas and pools associated with large woody debris.

Maintaining future sources of woody debris is an important consideration in FP5 channels. Natural large woody debris volumes are moderately high, but generally, in channel wood accumulations are less stable than in smaller FP4 channels due to higher flood flows in P5 channel types.

Retention of fine sediment (sand, gravel) is often high in FP5 channels; therefore, these channels may be sensitive to cumulative sediment inputs from headwater sources. Excessive sediment loads can degrade spawning gravel quality and, in extreme cases, can disrupt sediment transport equilibrium and channel stability. Removal or disturbance of stream bank vegetation can accelerate bank erosion and the subsequent loss of undercut bank rearing habitat. Riparian management should emphasize stream bank protection and erosion control measures to minimize potential sediment sources.

Flood plain protection is a very important management consideration for FP5 channels because of off-channel features that contribute to juvenile fish rearing habitat. These off-channel flood plain features include small spring fed tributaries, sloughs, beaver pond complexes, and side channels.

The location and design of stream crossing structures is an important consideration due to the large size and natural instability of the channels and associated flood plains. Large multi-span bridges are often required to cross these channels. Roadways traversing flood plain tributaries must provide for juvenile fish migration through culverts.

MM2 Channel Type MM2 (Moderate Width Mixed Control Channel):

MM2 channels are generally accessible to anadromous species, with several species of spawners using the moderate amounts of available spawning area (ASA). These channels have moderate amounts of rearing area that are used by coho salmon, Dolly Varden char, and steelhead trout juveniles. Pools are relatively deep (mean pool depth = 0.41 meters [1.34 feet]), and are highly dependent on large woody debris. Overwintering habitat is primarily associated with these pools. When located next to accessible lakes, these channels provide good quality spawning for sockeye salmon and steelhead trout.

Large woody debris significantly influences channel morphology and fish habitat quality. Large wood volume is generally high. Large wood accumulations form pool and stream bank rearing habitat, as well as stabilize spawning substrate behind log steps. Maintenance of large woody debris sources is an important management concern.

Banks are composed primarily of unconsolidated cobble and gravel size materials, therefore, stream bank sensitivity is rated high. The volume and energy of flood discharge in MM2 channels are the major factors affecting bank erosion. Disturbance of streamside vegetation root mats may contribute to accelerated channel scour and lateral channel migration.

Flood plains associated with MM2 channel types are generally narrow, however, side channels and flood overflow channels are commonly found along MM2 reaches. Flood plain stability can be a concern in these uncontained channel segments.

There is a high level of concern for providing fish passage through road crossing structures. Bridges are generally the appropriate stream crossing structures for MM2 channels. Culvert installations on these streams will not generally meet anadromous fish passage requirements. In addition, heavy woody debris loading and bedload sediment transport in MM2 channels pose a serious risk to culvert and bridge maintenance.

LC2 Channel Type (Moderate Gradient Contained Narrow Valley):

LC2 channels are sediment transport systems. Moderate gradients, well-contained stream flow, and large class substrate are indicative of high stream energy. Sediment inputs from upstream mountain slope channels are rapidly transported through these channels. Mass wasting along channel side slopes is a major on-site contributor of sediment. Sediment contributions from stream banks are of minor significance because they are largely composed of bedrock or large rock fragments. Cobble and coarse gravel deposits are common substrate components around boulder clusters or large woody debris. Fine sediments are readily flushed through these streams.

LC2 channels are frequently accessible to anadromous species, but often contain barriers that block upstream fish movement. Typically these streams get occasional use by spawning salmonids, however, Dolly Varden and steelhead show the most frequent use of spawning areas. These channels do have some good rearing areas, especially in reaches with stable large woody debris. Chinook salmon, Dolly Varden, and steelhead tend to favor rearing in LC2 channels more than coho due to availability of boulder-pool habitats.

Large wood accumulations have limited influence on LC2 channel morphology. Relatively high stream energy in LC2 channel types tends to displace in channel debris to bank areas. Total woody debris loading is moderate and is composed of large diameter (45.7-76.2 cm [18-30 inch]) pieces longer than 15.2 meters (50 feet) in length. Large wood incorporated into the stream bed can have an important function trapping gravel and cobble substrate used for spawning habitat.

Stream banks in LC2 channels are relatively stable due to the high amounts of bedrock and boulders incorporated into them. However, channel side slopes are steep (75%) and susceptible to mass erosion if disturbed by road cuts, blowdown, or timber yarding. Riparian management should emphasize protection of unstable side slopes.

Due to long, steep side slopes adjacent to the channel, road crossing are generally not practical along LC2 channel types. Suitable crossing sites generally require multi-span bridges. Special road location and design, and slope stabilization measures should be considered for these streams.