United States
Department of
Agriculture

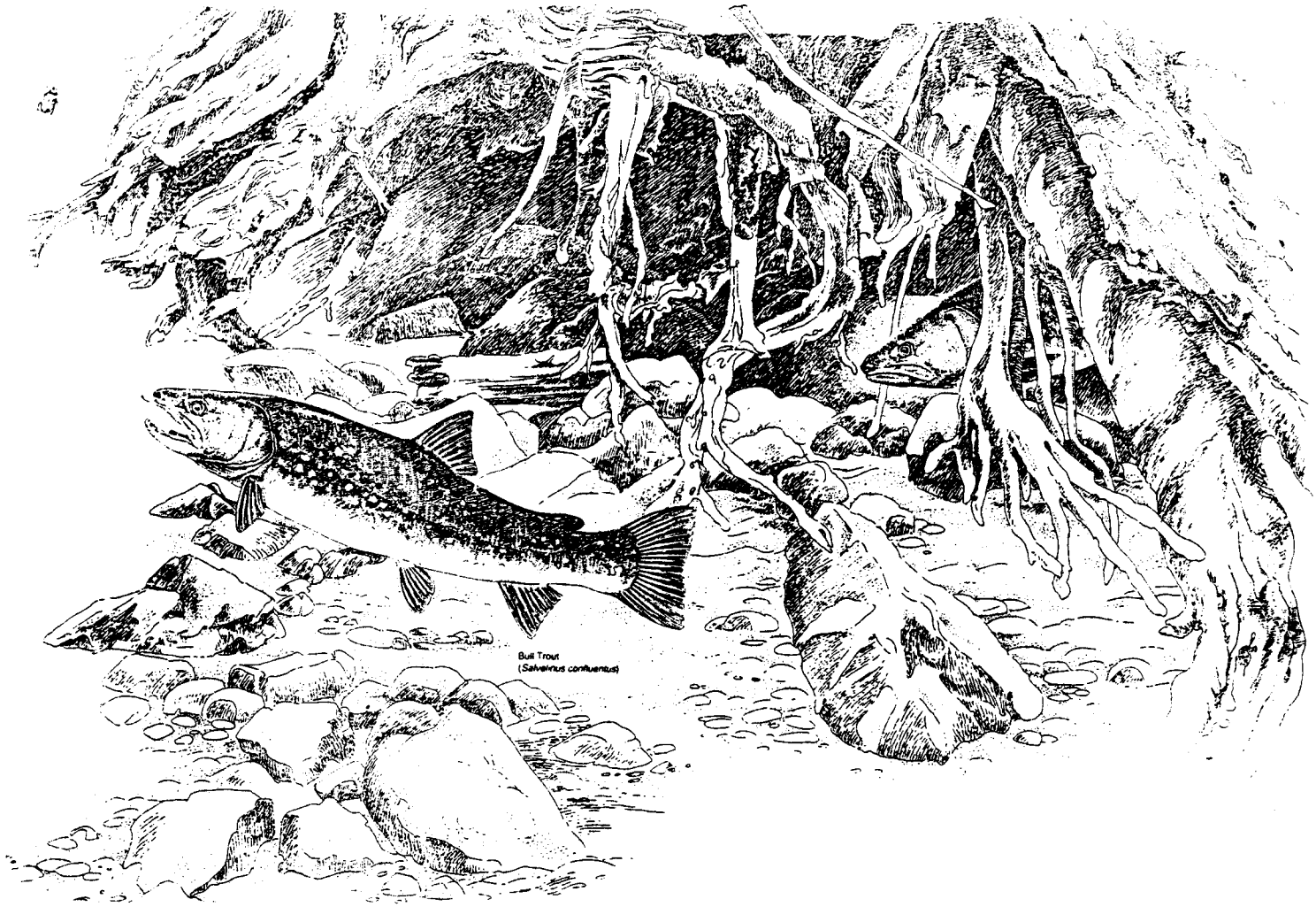
Forest Service

Pacific
Northwest
Region

UPPER SKAGIT RIVER WATERSHED NATIVE CHAR PROJECT

UPPER CANYON CREEK HABITAT SURVEYS
UPPER CANYON CREEK SNORKEL SURVEYS
CANYON AND RUBY CREEK BULL TROUT SPAWNING SURVEYS

2001



Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Report Prepared April 2002

INTRODUCTION
UPPER SKAGIT RIVER STREAM SURVEYS, SNORKEL SURVEYS, AND BULL TROUT REDD SURVEYS: 2001
Methow Valley District of the Okanogan-Wenatchee National Forest

Project: Little is currently known about the char population in the upper Skagit River watershed. Bull trout in the upper Skagit watershed were recently listed as threatened under the Endangered Species Act by the U.S. Fish and Wildlife Service. The surveys in this report are part of a multi-year study of char in the upper Skagit River watershed by a multi-agency team including the U. S. Forest Service, U. S. National Park Service, B. C. Parks and Ecological Reserves, B.C. Ministry of Fisheries and Seattle City Light. The team is investigating the distribution, genetics, and migration of native char in the upper Skagit River watershed. The results of the study will be used to develop a monitoring plan for native char and to evaluate the potential effects of land, lake and dam management activities on native char and their habitat.

Objectives: The objective of the surveys in this report is to identify and describe key spawning areas and rearing areas of native char (bull trout and/or Dolly Varden) in several stream segments of Ruby Creek, a major tributary to Ross Lake in the upper Skagit River watershed.

Scope of Work:

1. Habitat Surveys: The Methow Valley Ranger District of the Okanogan-Wenatchee National Forest conducted fish habitat surveys on about 2 ½ miles of stream in the upper Canyon Creek watershed in 2001. Canyon Creek is one of three large tributaries to Ruby Creek. Surveys were conducted on two stream segments; a 1.8 mile stream segment in the main stem of Canyon Creek between the confluence with the North Fork of Canyon Creek and an 80 foot high waterfall fish barrier at river mile (RM) 9.9, and a 0.6 mile stream segment between the mouth of the North Fork of Canyon Creek and a 30 foot high waterfall fish barrier at RM 0.6. These two stream segments were identified as potential bull trout spawning areas based on data derived from the *1997 Canyon Creek Stream Survey Report*, which covered the mouth of Canyon Creek to the confluence with the North Fork of Canyon Creek.
2. Fish Snorkeling Surveys: Fish snorkeling surveys were conducted in Canyon Creek from Cedar Crossing (RM 5.8) to just above the confluence with the North Fork (RM 8.1), and in the entire surveyed segment of the North Fork of Canyon Creek (RM 0 to 0.6).
3. Bull Trout Redd Surveys: Bull trout redd surveys were conducted in Canyon Creek (6 miles of habitat), in Ruby Creek (3 miles of habitat) and in the lower mile of Panther Creek (a major tributary to Ruby Creek).

Survey Protocols:

Stream Habitat Survey Protocol: Stream habitat surveys were conducted using the Region 6 Hankin-Reeves Level II survey protocol (*USFS Stream Inventory Handbook, Pacific Northwest Region* 6, *2001 – Version 2.1*). Data collected under the survey protocol is listed below:

• Habitat types, dimensions, and maximum depths. Habitat types are pools, riffles, side channels, dry channels, tributaries, culverts, and special cases (waterfalls, chutes, dams, marshes,

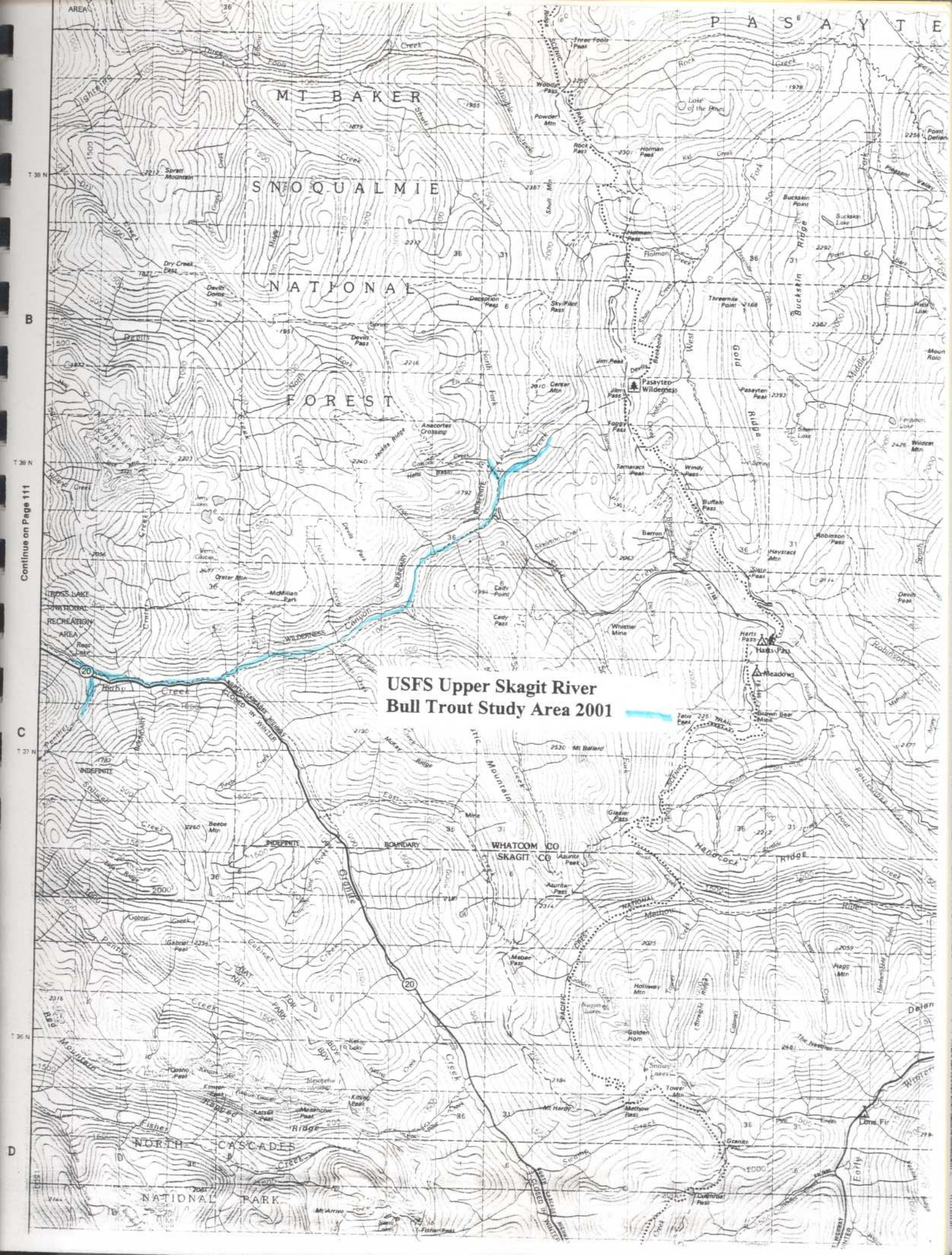
and braided channels). The pool tail crest is measured in each pool to determine pool residual depth.

- Large woody debris: A count of the number of pieces of wood that are within the bankfull channel width in three size categories:
  - -Small: > 25 feet long with a diameter of at least 12" at the small end.
  - -Medium: > 50 feet long with a diameter between 24" and 36".
  - -Large: > 50 feet long with a diameter greater than 36".
- Substrate: Two Wolman pebble counts are conducted in each reach as well as an ocular estimate of substrate in five size categories in each habitat unit.
- Bankfull widths and depths: Measured every 10th riffle, with a minimum of 10 in the survey.
- Floodprone width: Measured every 10th riffle.
- Riparian vegetation: Dominant and subdominant vegetation type and size class in two riparian zones; the inner zone (0 to 25 feet from the streambank) and the outer zone (25 to 100 feet from the streambank), every 10th pool and riffle.
- Stream temperature: Temperature monitors were installed at the mouth of each stream during the summer. Stream temperatures were taken with a hand-held thermometer every 10th pool and riffle, and in all tributaries and side channels.
- The length and height of all bank erosion is recorded.
- A determination of substrate embeddedness in pools (coarse gravel/small cobbles greater than 35% covered by fine sediments).

All habitat lengths in the main channel were measured. Habitat widths and the lengths of the side channels were estimated.

Fish Snorkeling Protocol: All pools and deeper riffle habitat were snorkeled within the snorkel project area. Shallow riffles were viewed from above. A total of 2.9 miles of habitat was snorkeled during the summer and fall of 2001.

Redd Survey Protocol: Due to time and access constraints only one visit was made to each redd survey transect. The size, substrate type and habitat of each bull trout redd was recorded, as well as a size estimate of all bull trout seen during the survey. The location of each redd was mapped. Stream temperatures were taken throughout the survey.


USFS Upper Skagit River
Bull Trout Study Area 2001
MT BAKER
SNOQUALMIE
NATIONAL
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PASAYTEN
WILDERNESS
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I. HABITAT SURVEY REPORT:

Canyon Creek and North Fork Canyon Creek

I. HABITAT SURVEY REPORT: UPPER CANYON CREEK (MAIN STEM) AND NORTH FORK CANYON CREEK

A. Threatened, Endangered and Species of Concern:

Canyon Creek is an important stream for bull trout in the upper Skagit River watershed. Bull trout in the upper Skagit River watershed are listed as threatened under the Endangered Species Act by the U. S. Fish and Wildlife Service. Adfluvial bull trout and resident bull trout spawning and rearing was observed by surveyors in 2001 throughout the lower 10 miles of Canyon Creek.

Anadromous fish passage to Ross Lake and its tributaries is blocked by three dams on the upper Skagit River between the town of Newhalem and Ross Lake. One of the dams may have been a natural fish barrier.

Redband rainbow trout and westslope cutthroat trout are species of concern of the U.S. Fish and Wildlife Service. Rainbow trout, which are abundant in upper Canyon Creek, are probably coastal rainbow trout, as the upper Skagit watershed is not within the natural range of redband rainbow trout (Behnke, 1992). The small population of cutthroat trout in upper Canyon Creek could be planted westslope cutthroat trout. Although the upper Skagit River is not within the natural range of westslope cutthroat trout, several lakes in the Ruby Creek watershed have been planted in the past with westslope cutthroat trout (K. Williams).

B. Summary of Existing Conditions

Fish habitat in upper Canyon Creek is in near pristine condition due to the lack of past management activities. The entire main stem of Canyon Creek is unroaded. Habitat components important to salmonids include clean spawning gravel, large amounts of large woody material in the stream channel, deep pool habitat, cool water temperatures and adequate stream flow. This segment of the report will briefly describe the existing conditions of these important habitat components in the two surveyed stream segments in upper Canyon Creek.

1. Stream Flow: The stream flow in Canyon Creek and in the entire watershed was extremely low in 2001 due to an unusually low snow year. Both surveyed streams were flowing subsurface near the mouth at the time of the survey (late August), resulting in passage barriers for potential migrating bull trout (about 4,000 feet of stream in upper Canyon Creek and about 30 feet of stream in the North Fork were flowing subsurface). The main stem of Canyon Creek above the confluence with the North Fork was slightly larger than the North Fork. Both streams were contributing less than 6 cfs of flow during the survey (flow estimate based on wetted channel cross section dimensions and estimated water velocity). No water is diverted from either stream.

2. Sedimentation: Salmonids, especially bull trout, are sensitive to accumulations of sediment in spawning grounds. Fine sediments in the interstitial spaces among the gravel depletes the oxygen supply, smothering the eggs and newly hatched fry.

Amounts of fine sediments are very low in upper Canyon Creek based on visual observation and from data collected from pebble counts. The amount of surface fines less than 8.5 millimeters in size was less than 6% in both surveyed stream segments, far below the guideline of 12% established by the U. S. Fish and Wildlife Service in their "Matrix of Diagnostic/Pathways and

Indicators", developed to standardize the determinations of effects on bull trout. Very little bank erosion was seen in the 1.8 mile segment of the main stem of Canyon Creek (less than 1% of the banks were actively eroding). Although nearly 20% of the banks were actively eroding in the 0.6 mile segment of the North Fork (mostly avalanche chutes), much of the eroding banks consists of gravels, not fine sediment. Fine sediment was entering the stream from bank erosion along the left bank of the North Fork in the 1,200 foot long alluvial fan at the confluence with the main stem. The channel was very wide and braided in the alluvial fan with nearly the entire left bank eroding. Cobble embeddedness was not a problem in the surveyed stream segments, with no pools judged by surveyors to be embedded (small cobble/coarse gravel substrate greater than 35% covered by fines). Spawning gravel was abundant in many segments of the surveyed stream area despite the high gradient channel. Avalanche chutes in the upper Canyon Creek drainage are likely an important source of gravel to adfluvial bull trout spawning areas downstream.

Although the amount of fine sediments is higher in the lower gradient 8.1 mile segment of Canyon Creek between the mouth and the North Fork, sedimentation is not excessive and likely not a problem (*Canyon Creek Stream Survey Report, USFS, 1997).* No pools in any stream segment of Canyon Creek were judged by surveyors to be embedded. The table below compares substrate and fine sediment data by reach in Canyon Creek, generated from pebble count data.

Table 1: Summary of Substrate, Fine Sediment and Bank Erosion Data by Reach Canyon Creek

		Substrate %							
Stream Segment	**# Miles**	**Sa**	**Gr**	**Co**	**Bo**	**Be**	**Fines < 8.5 mm**	**D50**	**% Bank Erosion**
Canyon Cr. Mouth to Boulder Creek	2.7	6	23	45	23	3	10.5%	148	2.9%
Canyon Cr. Boulder Cr. to Mill Creek.	1.6	9	26	36	27	2	12.0%	114	1.2%
Canyon Cr. Mill Creek to Slate Creek	3.0	11	18	48	22	1	13.5%	134	1.9%
Canyon Cr. Slate Cr. to North Fork	0.8	10	32	50	8	0	14.0%	81	7.3%
Canyon Cr. North Fork to Barrier*	1.8	1	41	47	11	0	5.5%	80	1.0%
North Fork Canyon: Mouth to Barrier	0.6	0	32	34	33	1	2.0%	148	18.8%

*Both pebble counts were taken in the lower gradient alluvial fan. Substrate is larger above the fan.

3. Large Woody Debris: Large pieces of wood in the channel are important to fish as they provide good fish hiding cover, slow water velocities, cause side channel and floodplain development, create pools, and help with sediment and water storage. Large woody debris is an important food source to many species of macroinvertebrates.

Large woody debris may be at near natural levels in the two stream segments surveyed in 2001. Large wood is abundant in the moderate gradient (2% to 4%) alluvial fan of the two surveyed streams, more scarce in the more constricted, higher gradient segments above the fan. Most of the wood in the lower 10 miles of Canyon Creek is between the upper end of the alluvial fans of the two surveyed streams and the confluence with Canyon Creek and Slate Creek (Canyon Creek RM 7.3). Very little large wood is found in the lower 7.3 miles of Canyon Creek, with less than 15 pieces per mile counted during the 1997 survey. The following table compares the amount of large woody debris counted in the two surveyed stream segments in 2001 with the lower 8 miles of Canyon Creek surveyed in 1997:

Table 2: Large Woody Debris per Mile by Reach – Canyon Creek

		Large Woody Debris by Size Class			
Stream Segment	# Miles	Large[1]	Medium[2]	Small[3]	Total
Canyon Cr. Mouth to Boulder Creek	2.7	0.4	0.8	10.1	11.3
Canyon Cr. Boulder Cr. to Mill Creek	1.6	0.6	3.0	12.7	16.3
Canyon Cr. Mill Creek to Slate Creek	3.0	0.7	2.0	13.2	15.9
Canyon Cr. Slate Creek to North Fork	0.8	1.3	8.8	67.8	77.9
Canyon Cr. North Fork to Barrier	1.8	3.3	14.2	53.6	71.1
North Fork Canyon: Mouth to Barrier	0.6	6.7	20.0	56.7	83.4

[1]Pieces of wood at least 25 feet long with a diameter of at least 12" at the small end.
[2]Pieces of wood at least 50 feet long with a diameter of at between 24" and 36".
[3]Pieces of wood at least 50 feet long with a diameter of greater than 36" at the small end.

The recruitment potential for large woody debris is excellent throughout most of Canyon Creek and its tributaries due to well-forested stream banks.

Large woody debris is an important component of bull trout habitat in upper Canyon Creek (above the confluence with Slate Creek). Resident and juvenile bull trout are abundant in the jams in upper Canyon Creek (2001 snorkel data). The two adult adfluvial bull trout seen during snorkel surveys conducted in upper Canyon Creek in 2001 were seen in deep pools formed by log jams. The one bull trout redd seen in upper Canyon Creek was in a pool tail-out under a log jam. Large wood plays a less important role in lower Canyon Creek, where the increased amount of flow and constricted bedrock channel form the deep pools used by bull trout for rearing and spawning.

4. Pool Habitat: Fish use pools for resting and holding areas during migration and spawning. Pool depth provides cover from predators, buffers against wide fluctuations in water temperatures, and acts as a refuge during fire, drought and cold winter temperatures.

Pool habitat is abundant with good hiding cover in the two stream segments surveyed in 2001. About 30% of the total habitat area in the two stream segments consists of pool habitat. Most of the pools in the alluvial fan of the two streams are formed by log jams. Pool habitat in the higher gradient stream segments above the alluvial fan are either step pools formed by boulder substrate or pools formed by bedrock at the bends in the stream. Good spawning gravel exists in many of the pools.

The following table compares pool habitat in the two surveyed stream segments in upper Canyon Creek with data from the 1997 Canyon Creek survey below the confluence with the North Fork:

Table 3: Pool Habitat by Reach – Canyon Creek

Stream Segment	# Miles	Pool Habitat Data			
		% Pool Habitat	Pools per Mile	Pools > 3' deep/mile	Residual Depth
Canyon Cr. Mouth to Boulder Creek	2.7	14.9%	13.8	13.8	3.8'
Canyon Cr. Boulder Cr. to Mill Creek	1.6	17.8%	12.2	12.2	3.4'
Canyon Cr. Mill Creek to Slate Creek	3.0	15.4%	14.6	14.6	2.9'
Canyon Cr. Slate Creek to North Fork	0.8	14.6%	16.3	8.8	2.5'
Canyon Cr. North Fork to Barrier	1.8	32.2%	38.3	10.4	2.0'
North Fork Canyon: Mouth to Barrier	0.6	29.7%	90.0	16.7	1.7'

Each stream segment meets or exceeds the parameters for a properly functioning system under the U. S. Fish and Wildlife Service "Matrix of Diagnostics/Pathways and Indicators", developed to standardize the determinations of effect on bull trout (see pages 7 and 8).

5. Water Temperature: Most salmonids have a low tolerance for extreme temperature fluctuations. High water temperatures have been shown to reduce growth and survival, and influence behavior and metabolism. State (DOE) water quality standards call for the 7 day maximum water temperature to stay below 16°C. Guidelines issued by the U. S. Fish and Wildlife Service to facilitate and standardize determinations of effects on bull trout require water temperatures no higher than 57°F (about 14°C) to maintain a properly functioning rating.

Water temperatures in upper Canyon Creek are cold, with little temperature fluctuation. The maximum water temperature measured by a thermograph at the mouth of upper Canyon Creek (elevation 2,950 feet) during the summer of 2001 was 11.8°C on August 27. The highest 7 day maximum water temperature recorded at the same site in 2001 was 10.0°C on August 14.

Water temperatures at the mouth of Canyon Creek (elevation of 1,850 feet) are slightly higher than the guidelines issued by the U. S. Fish and Wildlife Service for a properly functioning rating. The maximum water temperature measured at the mouth of Canyon Creek (elevation 1,850 feet) was 14.8°C on August 14. The water temperature at the mouth exceeded 14°C on 8 days during the summer of 2001. The highest 7 day maximum water temperature recorded at the mouth was 14.6°C on August 11. The 7 day maximum temperature at the mouth exceeded 14°C on 8 days during the summer of 2001.

6. Off-Channel Habitat: Beaver dams create fish habitat, store sediment, reduce stream velocities and store water. Wetland habitat provides off-channel rearing habitat for fish, and stores water.

Off-channel wetland habitat and side channel habitat is scarce in the Canyon Creek watershed due to the constricted channel and narrow floodplain. Some side channel habitat exists in the alluvial fan of the two surveyed stream segments in upper Canyon Creek. Less than 3% of the total habitat in the 10 miles of Canyon Creek surveyed in 1997 and 2001 is side channels.

Evidence of past beaver activity was seen in Canyon Creek during the 1997 stream survey (beaver chewed tree at river mile 4.8).

C. Management Implications and Enhancement Opportunities

1. Management Implications: Although management activities are restricted in Canyon Creek due to its designation as wilderness and Late-Successional Reserve, mining and fish poaching are management concerns. Current recreational mining and the potential of future large-scale mining operations occur below the surveyed stream segments and are discussed in the 1997 Canyon Creek and Slate Creek Stream Survey Reports (Methow Valley Ranger District, 1997). Conversations with suction dredge miners in 2001 at the Chancellor Campground (at the confluence of Canyon and Slate Creeks) indicate that fisherman could be impacting the bull trout population in upper Canyon Creek (the fishermen kept a large amount of fish; it is unknown if any of the fish taken were bull trout).

2. Enhancement Opportunities:

a. Monitoring: Monitoring projects are a vital part of managing fish habitat. An objective of the surveys is to develop a monitoring plan for native char in the upper Skagit River watershed. Monitoring will likely include bull trout redd surveys, fish habitat surveys, fish snorkeling surveys, water temperature monitoring, and sediment monitoring. Recreational use needs to be monitored to help determine fishing and mining effects. Dispersed campgrounds need to be monitored to help assess trends on effects on riparian areas.

b. Restoration Projects: Little, if any, stream restoration work is needed in the main stem of Canyon Creek due to the lack of roads and large-scale mining activity. Restoration work would benefit fish habitat in the Slate Creek and Mill Creek subdrainages, the two largest tributaries to Canyon Creek. The road system in the Slate Creek and South Fork Slate Creek drainages need to be inventoried to identify sediment sources (slope failures) and sites with high erosion potential. The eroding bank failures need to be stabilized by installing sediment traps (boulder or biologs) and replanting the banks. The effects of current and past mining in the Slate Creek and Mill Creek subdrainages need to be monitored. The settling ponds at the Barron mine site in the Slate Creek drainage should be tested for toxic chemicals. State designation of the Azurite Mine (Mill Creek subdrainage) as a Superfund Hazmat Site could aid in cleaning up the contaminated tailings. The site has not been listed as a Superfund Hazmat Site due to its remote location (G. Knott).

c. Consultation: Recreational use in the Canyon Creek watershed has the potential to impact bull trout and bull trout habitat. Forest service involvement with other government agencies and private user groups such as fisherman and recreational miners could help protect bull trout. Although current State fishing regulations prevent fishing for bull trout in Canyon Creek, fish poaching may be a problem. Suction dredging occurs in Canyon Creek near the campground at Chancellor, and in Slate Creek (below and above the waterfall barrier at RM 0.6). Although the areas currently dredged are probably not used by bull trout for spawning, use of suction dredgers should not be allowed in identified bull trout spawning areas.

D. Land Management Plan Standards and Guidelines

1. Land Ownership and Management

Over 98% of the land in the Canyon Creek drainage is managed by the Forest Service. The remaining land is privately owned mining land, including the mines at Barron in the Slate Creek drainage, and the Whistler Mine, on the ridge between Slate Creek and the South Fork of Slate Creek. About 35% of the land in the Canyon Creek drainage has been designated as a wilderness area. The non-wilderness portion of the drainage has been designated as Late-Successional Reserve (LSR non-key watershed) under the Northwest Forest Plan (Record of Decision, 1994). Land designated as Late-Successional Reserve is managed to enhance habitat for late-successional and old-growth related species. The Aquatic Conservation Strategy (1994) establishes riparian reserves to protect and restore riparian and aquatic habitat (see Appendix 4 for a list of standards and guidelines under the Aquatic Conservation Strategy). The Canyon Creek watershed is designated as a non-key watershed. The majority of the land managed by the Forest Service in the watershed is in a designated roadless area (Liberty Bell Roadless Area). The only roaded portions of the watershed are found in Slate Creek (USFS Road 200 and spur roads leading to the Barron mine) and the road to the Azurite Mine (Slate Creek to Mill Creek).

2. Okanogan-Wenatchee National Forest Plan Standards and Guidelines

Management activities on land managed by the Forest Service in the Canyon Creek drainage follow standards and guidelines of the 1989 Land and Resource Management Plan for the Okanogan National Forest, as amended by the Record of Decision, 1994 (Northwest Forest Plan). See Appendix 4 for a list of standards and guidelines of the Okanogan National Forest Plan. The Plan is scheduled to be updated in 2002 or 2003.

3. Desired Future Conditions

Land management activities on the Okanogan-Wenatchee National Forest are designed to meet objectives of the Aquatic Conservation Strategy, which are to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. Streams within Late-Successional Reserves will offer high quality stream habitat that will act as refugia for the recovery of native fish stocks.

The Okanogan Forest Plan mandates improved fish habitat for rearing, spawning and migration. The Plan calls for stabilizing stream banks, large quantities of large woody debris, high numbers of quality pools, good water quality, low water temperatures, and low sediment inputs. The Forest Plan includes scheduled habitat enhancement projects such as pool and hiding cover development, maintenance of fish structures and habitat monitoring.

4. Critical Habitat Parameters: Matrix of Diagnostics/Pathways and Indicators

The following table "Matrix of Pathways and Indicators" was developed by the U. S. Forest Service (adapted from the U.S.F.W.S.) to standardize the determinations of effects on listed fish. The matrix is designed to summarize important environmental parameters and levels of conditions for each pathway and indicator.

Table: Matrix of Diagnostics/Pathways & Indicators for Bull Trout in Canyon Cr.

Pathways *Indicators*	Properly Functioning	Canyon Creek Existing Condition
1. SPECIES		
Subpopulation Characteristics:		
Subpopulation Size	Subpopulation > several thousand, all life stages	No data exists on the size of the bull trout population. All life stages exist.
Growth/Survival	Resiliency to recovery from disturbance.	Populations of bull trout appear to be stable. More data is needed.
Diversity/Isolation	Migratory form is present/exists near other groups.	Adfluvial bull trout rear in Ross Lake and spawn in Canyon Creek & other tributaries to Ross Lake.
Genetic Integrity	Connectivity high among subpopulations, hybridi-zation is low	Possible hybridization with Dolly Varden. Connectivity may be poor due to the dam below Ross Lake (population disconnected from lower Skagit River). May be at risk.
2. HABITAT		
Water Quality:		
Temperature	7 day maximum temp. < 2 to 5°C (incubation) 4 to 12°C (rearing) 4 to 9oC (Spawning) 15°C (Migration)	Lower Canyon Creek may be functioning at risk for bull trout rearing (natural condition). The 7 day maximum temperature at the mouth of Canyon Creek > 12°C on 46 days in 2001. Canyon Creek is properly function for migration (did not exceed 15°C in 2001). The water temperatures did not exceed 12°C at RM 8.1 in 2001.
Sediment	< 12% fine (< 8.5mm) in gravel	Fine sediments are < 12% in the lower 4 miles and upper 2 miles of Canyon Creek, and slightly exceed 12% from RM 4 to 8. Canyon Creek is properly functioning.
Chemical Contamination	Low levels	Unknown, but possible chemical contamination from past mining activity in Mill Creek and Slate Creek.
Habitat Access:		
Man-made physical barriers	Barriers should allow fish passage at all flows	No man-made barriers exist in Canyon Creek.
Habitat Elements:		
Substrate Embeddedness	Embeddedness less than 20% in a reach.	None of the habitat in Canyon Creek was judged by surveyors to be embedded.

Large woody debris	80 pieces per mile > 50 feet long with diameter > 24 inches. Good recruitment potential.	Every reach in Canyon Creek is well below standards for numbers of pieces of large wood. Possible reasons for lack of wood are the high-energy channel and past fire history (fires were started to uncover ore deposits). Good recruitment potential exists in much of Canyon Creek.
Pool Frequency and Quality	Pool frequency: Chart based on channel width	All reaches exceed or are just below the standards for numbers of pools.
Large Pools	Many pools > 3' deep	Canyon Creek has an abundance of deep pool habitat, and is properly functioning.
Off-channel habitat	Backwater with cover. Low energy side channel	Little off-channel habitat exists due to the constricted channel (natural condition).
Refugia	Refugia with intact riparian areas.	Most riparian areas are intact throughout Canyon Creek. Functioning properly.
Channel conditions:		
Wetted Width/Depth Ratio	Width/depth ratio < 10	No data on wetted width/depth. Canyon Creek is properly functioning for bankfull width/depth ratio.
Bank Stability	>80% of reach is > 90% stable	Properly functioning in entire main stem. Only 80% of the banks are stable in the North Fork due to an abundance of avalanche chutes (natural condition).
Floodplain Connectivity	Off-channel areas linked to main channel	The few side channels that exist in Canyon Creek are connected to the main channel.
Flow/Hydrology		
Changes in Peak/Base Flows	Comparable to undisturbed watershed	Little disturbance history in Canyon Creek. Functioning properly.
Increase in Drainage Network	Minimum increase due to roads	Canyon Creek is unroaded, although a road network exists in Slate Creek. Probably functioning properly.
Watershed condition		
Road Density/location	< 2 mi/mi^2. No roads in valley bottom.	Few roads exist in the entire watershed. Canyon Creek is functioning properly.
Disturbance History	<15% ECA, with no disturbance in unstable areas	Little timber has been harvested in the Canyon Creek watershed. Canyon Creek is functioning properly.
Riparian Reserves	Provides adequate shade and LWD recruitment	Stream shading is good in Canyon Creek from vegetation and topography. Recruitment potential for LWD is good in most of the watershed.

E. UPPER CANYON CREEK STREAM SURVEY REPORT SUMMARY PAGE

LOCATION:	**County:**	Whatcom
	Forest:	Mt. Banker/Snoqualmie (managed by the Okanogan-Wenatchee NF).
	District:	Managed by the Methow Valley District
	Drainage:	Canyon Creek
	Tributary to:	Ruby Creek
	Mouth Location:	T37N, R15E, Section 12 (sw ¼ of ne ¼).
WATERSHED:	**NFS Watershed No.**	17 11 00 05 NFS 19 A
	Watershed Area:	About 54,500 acres.
	Stream Order:	2 (North Fork and Canyon Creek above the North Fork)
	Stream Class:	1
	Stream Length:	Total length of Canyon Creek: About 16 miles. Canyon Creek above North Fork: About 8 miles. North Fork of Canyon Creek About 5 miles.
SURVEY:	**Surveyors:**	Hopkins, Farmer, Jakubowski, Mines.
	Survey Dates:	August 28-30, October 4.
	Flow during survey:	Less than 6 cfs in both streams (10 to 12 cfs total).
	Survey Length:	-Upper Canyon Creek 1.8 miles (confluence with North Fork to an 80' high waterfall fish barrier). -North Fork 0.6 miles (mouth to 30' waterfall barrier at the confluence with Cascade Creek.
FISH SPECIES:	**Bull Trout:**	From the beginning to end of the survey. Unknown above.
	Rainbow Trout:	From the beginning to end of the survey. Unknown above.
	Cutthroat Trout:	Small population in upper Canyon Creek and North Fork.
AMPHIBIANS:	**Tailed Frogs:**	Tailed frogs have been seen in Ruby Creek and in lower Granite Creek, and could be present in Canyon Creek.

F. CANYON CREEK & NORTH FORK CANYON CREEK SURVEY DATA SUMMARY

	Upper Canyon Cr (Mainstem)	North Fork Canyon Creek
Reach Length – Miles (Measured)	1.83	0.60
Large Woody Debris per Mile*		
-Small (>25' long, > 12" diameter)	53.6	56.7
-Medium (>50' long, 24 to 36" diameter)	14.2	20.0
-Large (>50' long, > 36" diameter)	3.3	6.7
-Total	71.1	83.4
Pool Data		
-Stream Survey Pools per Mile	38.3	90.0
-Plan (Quality) Pools per Mile	18.0	20.0
-Stream Survey Pools > 3' deep per Mile	10.4	16.7
-Average Pool Residual Depth	2.02'	1.71'
% Habitat Area		
-% Pool	32.2%	29.7%
-% Riffle	64.7%	61.5%
-% Side Channel	3.1%	8.6%
Sedimentation/Erosion		
-Linear Feet of Bank Erosion per Mile	90	1,980
-% Eroding Banks (Total both banks)	1%	18.8%
-% Pools Embedded	0%	0%
Channel Morphology		
-Average Bankfull Width in Feet	29.1'	31.4
-Width/Depth Ratio	12.6	20.1
-Floodprone Width in Feet	55.0'	43.3
-Entrenchment Ratio	1.91	1.38
-Sinuosity	1.05	1.05
-Gradient	7%	8%
-Rosgen Channel Type	B3, some A2	A3, some B3
Substrate Data (from pebble counts)		
-D-50	79.7	147.9
-% Sand	1%	0%
-% Gravel	41%	32%
-% Cobble	47%	34%
-% Boulder	11%	33%
-% Bedrock	-	1%

G. Reach Summaries

Upper Canyon Creek Reach Summary: (River Mile 8.1 to 9.9).

1. Geomorphology and Hydrology Data Summary:

Reach Boundaries:	From the confluence with the North Fork of Canyon Creek to an 80' waterfall barrier at RM 9.9.
# of Miles in Reach:	1.83.
Elevation:	2,920' to 3,600'.
Orientation:	Flows southwesterly.
Valley Form:	V-shaped valley.
Valley Width:	50' to 100'.
Sinuosity:	1.05.
Gradient:	7% (average).
Average Bankfull Width:	29.1'.
Width/Depth Ratio:	12.6.
Floodprone Width:	55.0'.
Entrenchment Ratio:	1.91.
Rosgen Channel Types:	B3 and $B3_a$ in lower 1.5 miles, A2 in upper 1/3 mile.
Flow:	Estimated at 5 to 6 cfs at the time of the survey.
Max. Recorded Temp:	11.8°C on 8-27-01
Max. 7-Day Max. Temp:	10.0°C on 8-14--01

2. Substrate Data Summary:

Pebble Count #1:	D50 = 85.4. SA 1%, GR 40%, CO 50%, BO 9%, BR 0%.
Pebble Count #2:	D50 = 74.1. SA 0%, GR 44%, CO 43%, BO 13%, BR 0%.
Average D50	79.7.
Average D84	205.1.
Note:	Both pebble counts were in the lower segment of the reach, in the lower gradient alluvial fan.

Table: Ocular Estimate by Habitat Type:

Habitat Type	Sand	Gravel	Cobble	Boulder	Bedrock
Riffle	-	16%	39%	44%	1%
Pool	-	31%	34%	31%	4%
Side Channels	-	30%	30%	40%	-
All Habitats	-	21%	37%	40%	2%

3. Tributary Data Summary:

Tributary # and Name	River Mile	Bank	Est. % of Flow	Water Temperature		
				Trib.	Canyon	Date/Time
No perennial tribs.						

4. **Large Woody Debris Data Summary (per mile):**

Size Class	Total LWD in Main Channel	LWD in Side Channels	Total LWD (OWNF)
Large: > 50' long, > 24" diameter	3.3	0	3.3
Medium: > 50' long, 24" –36" diameter	14.2	0	14.2
Subtotal: > 50' long, > 24" diameter	**17.5**	**0**	**17.5**
Small: > 25' long, > 12" diameter	53.6	0	53.6
Total LWD:	**71.1**	**0**	**71.1**

5. **Pool Data Summary:**

Hankin/Reeves Survey Pools per Mile:	38.3
Hankin/Reeves Survey Pools > 3' deep per Mile:	10.4
Forest Plan Pools per Mile (Quality Pools):	18.0
Average Residual Depth of Survey Pools:	2.02
% Habitat Area Pools:	32.2%

6. **Sedimentation & Erosion:**

% of Pools Embedded	0%
Linear Feet of Bank Erosion per Mile	90'
% Eroding Banks (Total of Both Banks)	1%

7. **Habitat Summary:**

% Riffle	64.7%
% Pool	32.2%
% Side Channel	3.1%

8. **Reach Characterization:**

The lower quarter mile of the reach flowed through a moderate gradient (3% to 4%) alluvial fan (confluence with the North Fork). Excellent spawning gravels exist in this short stream segment, captured by log jams. The stream was flowing subsurface for a distance of over 4,000 feet about 300 feet above the confluence with the North Fork at the time of the survey. Several large side channels (dry at the time of the survey) created by the log jams are found in the alluvial fan. The floodplain is over 100 feet wide in the lower quarter mile segment of the stream.

The channel becomes more confined and higher gradient above the alluvial fan, although some side channel habitat still exists in the narrow floodplain above the streambanks (no side channels were seen above the alluvial fan in the North Fork). The channel is very narrow and

constricted by bedrock in the upper 1/3 mile of the reach. A 15 foot high waterfall (boulders caught in a narrow bedrock channel) is at least temporarily a barrier to upstream migration (RM 1.7). There is a permanent fish barrier at RM 1.8 (an 80 foot high bedrock waterfall).

Very little bank erosion was seen in the surveyed segment of the stream (only 1% of the streambanks were actively eroding). Numerous talus slopes and bedrock outcroppings are found above the right streambank. There are only a couple of small avalanche chutes in the surveyed stream segment.

The streambanks were lined with sapling sized alder and small to large size cedar, spruce and Douglas-fir trees. The outer riparian zone consisted of small to large size spruce, cedar, Pacific yew, and Douglas-fir trees. The recruitment potential for large wood is very good. Stream shading is excellent throughout the reach.

9. Land Use:

Management:	The entire reach is managed by the U. S. Forest Service. The Pasayten Wilderness boundary crosses the stream at about RM 3.
Agricultural Use:	None.
Livestock Grazing:	None.
Mining:	Historic mining at the headwaters of Barron Creek, a tributary entering Canyon Creek on the left bank about a mile above the end of the survey.
Timber Harvests:	No evidence of past timber harvesting in this reach.
Irrigation:	Free-flowing.
Recreation:	Limited fishing and hunting. This area receives very little use due to poor access (no trail).
Road Density:	Unroaded.

10. Management Concerns:

- The poaching of bull trout is a management concern.

11. Restoration and Protection Opportunities:

- This stream segment is in near pristine condition. No habitat restoration projects are needed.

North Fork Canyon Creek Reach Summary: (River Mile 0.0 to 0.60).

1. Geomorphology and Hydrology Data Summary:

Reach Boundaries:	From the confluence with the Canyon Creek to a 30' high waterfall barrier at the confluence with Cascade Creek..
# of Miles in Reach:	0.60.
Elevation:	2,950' to 3,200'.
Orientation:	Flows southeasterly.
Valley Form:	V-shaped valley.
Valley Width:	25' in the bedrock gorge to over 150' in the alluvial fan.
Sinuosity:	1.05.
Gradient:	8% (average).
Average Bankfull Width:	31.4'.
Width/Depth Ratio:	20.1.
Floodprone Width:	43.3'.
Entrenchment Ratio:	1.38.
Rosgen Channel Types:	A3 channel above alluvial fan, B3 channel in alluvial fan.
Flow:	Estimated at 5 cfs at the time of the survey.
Max. Recorded Temp:	The temperature monitor was not recovered.

2. Substrate Data Summary:

Pebble Count #1:	D50 = 147.9. SA 0%, GR 37%, CO 23%, BO 40%, BR 0%.
Pebble Count #2:	D50 = 146.7 SA 0%, GR 37%, CO 44%, BO 28%, BR 1%.
Average D50	147.3.
Average D84	580.0.

Table: Ocular Estimate by Habitat Type:

Habitat Type	Sand	Gravel	Cobble	Boulder	Bedrock
Riffle	-	19%	41%	38%	2%
Pool	-	23%	40%	33%	4%
Side Channels	-	32%	48%	20%	-
All Habitats	-	21%	42%	35%	22%

3. Tributary Data Summary:

Tributary # and Name	River Mile	Bank	Est. % of Flow	Water Temperature		
				Trib.	N. Fork	Date/Time
Cascade Creek	0.6	R	33%	13°C	13°C	08- /15:00

4. **Large Woody Debris Data Summary (per mile):**

Size Class	Total LWD in Main Channel	LWD in Side Channels	Total LWD (OWNF)
Large: > 50' long, > 24" diameter	6.7	0	6.7
Medium: > 50' long, 24" –36" diameter	20.0	0	20.0
Subtotal: > 50' long, > 24" diameter	**26.7**	**0**	**26.7**
Small: > 25' long, > 12" diameter	56.7	0	56.7
Total LWD	**83.4**	**00**	**83.4**

5. **Pool Data Summary:**

Hankin/Reeves Survey Pools per Mile:	90.0
Hankin/Reeves Survey Pools > 3' deep per Mile:	16.7
Forest Plan Pools per Mile (Quality Pools):	20.0
Average Residual Depth of Survey Pools:	1.71'
% Habitat Area Pools:	29.7%

6. **Sedimentation & Erosion:**

% of Pools Embedded	0%
Linear Feet of Bank Erosion per Mile	1,980'
% Eroding Banks (Total of Both Banks)	18.8%

7. **Habitat Summary:**

% Riffle	61.5%
% Pool	29.7%
% Side Channel	8.6%

8. **Reach Characterization:**

The lower quarter mile of the reach flowed through a moderate gradient (3% to 4%) alluvial fan (confluence with Canyon Creek). Excellent spawning gravels exist in this short stream segment, captured by large amounts of large woody debris. Most of the large wood in the channel is in the alluvial fan (few pieces upstream). The channel is very wide in the alluvial fan, with a large gravel bars on the right side and middle of the channel (braided channel at high flows). Most of the left bank in this quarter mile segment of the creek was eroding. Large wood along the bank is falling into the stream as the bank continues to erode. Two side channels greater than 200 feet long are created by log jams in the fan. The creek was dry for a distance of about 40 feet just above the mouth (barrier to fish migration). Pools in the alluvial fan were formed by large wood.

The stream becomes confined and high gradient (10%) above the alluvial fan. The creek flows through a bedrock constricted gorge in the upper 500 feet of the reach. A 30 foot high waterfall is a barrier to upstream fish migration at the confluence with Cascade Creek (end of survey). A waterfall barrier prevents upstream migration into Cascade Creek. No side channels exist in the constricted segment above the alluvial fan. Although substrate is largely large cobble and boulder above the alluvial fan, excellent spawning gravels exist in the pools and along the channel margins (some wide gravel bars are found along the right bank in the middle of the reach). Numerous large avalanche chutes on the left slope of the stream are the source for gravels in the North Fork and downstream into Canyon Creek. Little fine sediment is entering the stream from the chutes (material in the slope consists of angular small to medium size gravels). Pools above the alluvial fan were formed by substrate (plunge pools) and from bedrock constrictions at the bend in the stream.

The banks were well-forested with conifers in the lower quarter mile of the stream, (mainly large cedar, Douglas-fir, hemlock and fir trees). Much of the left bank above the alluvial fan consisted of sparsely vegetated avalanche chutes and bedrock outcroppings, with a mixed conifer forest along the right bank. Stream shading was generally good, provided by trees and the steep topography.

9. Land Use:

Management:	The entire stream is on land managed by the U. S. Forest Service. The Pasayten Wilderness boundary crosses the stream about mid-way through the reach.
Agricultural Use:	None.
Livestock Grazing:	None.
Mining:	None.
Timber Harvests:	No evidence of past timber harvesting in this reach.
Irrigation:	Free-flowing.
Recreation:	A trail alongside Canyon Creek below the confluence with the North Fork and in the alluvial fan of the North Fork allows access for fishing and hunting. The area above the alluvial fan receives minimal use due to the lack of trail.
Road Density:	Unroaded.

10. Management Concerns:

- The poaching of bull trout is a management concern.

11. Restoration and Protection Opportunities:

- This stream segment is in near pristine condition. No habitat restoration projects are needed.

II. SNORKEL SURVEY REPORT:

Canyon Creek & North Fork Canyon Creek

II. SNORKEL SURVEY REPORT: Canyon Creek and North Fork Canyon Creek

Objectives and Scope of Work: A total of about 2.2 miles of the main stem of upper Canyon Creek (between the end of the gorge at RM 5.8 and the confluence with the North Fork at RM 8.1) and 0.6 miles of the North Fork of Canyon Creek were snorkeled during the summer and fall of 2001. A 0.7 mile stream segment in upper Canyon Creek between the Chancellor Campground and the confluence with the North Fork was snorkeled twice, in late August and early October. The objectives of the snorkel surveys were:

1. To gather current fish distribution data in upper Canyon Creek.
2. To determine if adfluvial bull trout from Ross Lake are spawning in upper Canyon Creek.
3. To determine the timing of adfluvial bull trout migration in upper Canyon Creek.

Protocol: All pool and deeper riffle habitat in the stream segments were snorkeled (moving upstream). Shallower riffle habitat was viewed from above.

Observations: The following observations were made from data gathered from the snorkel surveys:

1. Fish Distribution: Rainbow trout is the most abundant species in upper Canyon Creek. Approximately 86% of the 1,383 fish observed in the 2.9 miles of stream snorkeled between August 28 and August 30 were rainbow trout. All life stages of rainbow trout were observed, from 1" young-of-the-year juveniles to 14" adults. About two-thirds of the rainbow trout were in the 4" to 8" size category. A total of 185 bull trout were observed, ranging in size from 2" to close to two feet in length, most between 6" and 9" long. About 13% of the total fish observed in upper Canyon Creek were bull trout. A very small population of cutthroat trout exists in upper Canyon Creek. About 1% of the fish observed in upper Canyon Creek were cutthroat trout. The population of cutthroat trout in Canyon Creek may be from stock planted in lakes in the Ruby Creek watershed. The tables on pages 18 to 22 summarize fish distribution data gathered during snorkeling surveys conducted during 2001 in upper Canyon Creek.

2. Adfluvial Bull Trout: Two adfluvial bull trout between 20" and 24" were seen in upper Canyon Creek on August 30, about 500 feet below the confluence with the North Fork. Both fish were seen in deep pools created by large log jams. No adfluvial bull trout were seen in a repeat survey on October 5. A bull trout redd was seen at the pool tail crest under the log jam in one of the pools where the adfluvial bull trout was holding. The unusually low flow year could have affected the timing, duration and number of adfluvial bull trout migrating to upper Canyon Creek. Upstream migration of bull trout in Canyon Creek above the confluence with the North Fork and in the North Fork was not possible in 2001 due to subsurface flow in the alluvial fan of each stream. Good spawning habitat exists in both streams below waterfall barriers.

3. Resident Bull Trout: It is likely that a resident bull trout (or Dolly Varden, which are thought to be possibly present) population exists in upper Canyon Creek. The resident char seen in upper Canyon Creek were different in appearance from bull trout observed in streams east of the Cascade Crest. Most of the char have two sets of parr marks (parr marks along both the sides and the tops of the body). The lower third of the dorsal fin is spotted with cream colored spots on most of the fish, while the top two-thirds of the dorsal fin is clear. The bull trout appeared to be slightly lighter in color than bull trout I have observed east of the Crest. A small redd, possibly

from resident bull trout (1' x 2') was seen just below the waterfall barrier at river mile 9.9 in upper Canyon Creek during a habitat survey conducted on October 4.

4. Spawning Habitat in Snorkeled Area: Very little spawning habitat exists between the top of the gorge (RM 5.8) and the confluence with Slate Creek (RM 7.3) in Canyon Creek. Most of this stream segment consists of riffle habitat, with pools formed mainly by boulders and gradient breaks. The stream segment is fairly straight, with few bends or bedrock constrictions to form deep pools, and very little large woody debris exists in this stream segment to capture gravels or create pools. Substrate is very coarse in this 1.5 mile stream segment, consisting almost entirely of large cobbles and small boulders. Bull trout were more scarce in this stream segment, comprising only 8% of the total fish observed. No adfluvial bull trout were observed in this area. Spawning habitat is excellent from just above the campground at Chancellor to the confluence with the North Fork, a distance of just over half a mile. The stream channel is more sinuous in this stream segment within a wider floodplain. Amounts of large woody debris were much higher than downstream, with numerous log jams capturing large amounts of spawning gravels. About 30% of the fish observed in this stream segment were bull trout, including the two adfluvials. Most of the bull trout were rearing in the deep pools created by log jams. Good spawning habitat exists in upper Canyon Creek above the confluence with the North Fork and in the North Fork of Canyon Creek.

CANYON CREEK 2001 SNORKEL SUMMARIES

Table 1: Canyon Creek Snorkel Summary – August 28 - 30, 2001 Transects
Total Fish Counted by Transect and Species

Snorkel Transect	# of Miles	# of Rain-bow	% Rain-bow	# of Bull Trout	% Bull Trout	# of Cut-throat	% Cut-throat	Total Fish Seen
North Fork Canyon Cr – mouth to Cascade Creek	**0.6**	**269**	89%	**29**	10%	**2**	1%	**300**
Canyon Creek from Chancellor to North Fork	**0.7**	**221**	69%	**98**	30%	**3**	1%	**322**
Canyon Creek – From Cedar Crossing to confluence with Slate Cr.	**1.5**	**694**	91%	**58**	8%	**9**	1%	**761**
Total of three transects	**2.8**	**1,184**	86%	**185**	13%	**14**	1%	**1,383**

Table 2: Canyon Creek Snorkel Summary – October 5, 2001

Snorkel Transect	# of Miles	# of Rain-bow	% Rain-bow	# of Bull Trout	% Bull Trout	# of Cut-throat	% Cut-throat	Total Fish
Resurvey of Transect #2: Canyon Creek from Chancellor to the N. Fork	**0.7**	**166**	59%	**112**	40%	**2**	1%	**280**

NORTH FORK CANYON CREEK SNORKEL SURVEY: RM 0 to 0.6
August 28, 2001

Transect Length: 0.6 miles
Transect Area: From the mouth to the confluence with Cascade Creek
Habitat Snorkeled: Most of the pools and deep riffle habitat was snorkeled
Surveyors: D. Hopkins
Water Temperature: 12 to 14°C (10:00 to 18:00)

Table 3: Snorkel Data Table N. Fork Canyon Cr. RM 0 to 0.6

			Rainbow Trout			Bull Trout			Cutthroat		
NSO*	Habitat	Length	1-4"	4-8"	8-12"	1-4"	4-8"	8-12"	1-4"	4-8"	8-12"
1	Riffle above mouth	100'	4								
5	Pool below dry channel	60'	1		1		1				
8	Pool near end of alluvial fan	70'	2	5		1					
15	First pool above alluvial fan	22'	2	4		1					
17	2.4' deep pool	17'	2		1	3					
18	1.8' deep pool	30'		1	4						
20	1.7' deep pool	38'	1	4	1						
22	2.2' deep pool, wood cover	20'	1	3	1						
23	2.5' deep pool, wood cover	26'		4	2		1				
25	2' deep pool	30'	3	6	1						
26	1' deep riffle with boulders	63'		1							
29	3' deep pool	16'	3	5							
30	2' deep pool	30'		3							
31	3.8' deep pool with boulders	36'	3	6	1		3				
34	1' deep riffle	120'	1	2	1						
35	3.6' deep pool	27'	5	5	3	1					
36	Riffle	172'	4	3							
39	1.9' deep pool	26'	1	1							
40	1.9' deep pool	24'		5	2						
42	2.2' deep pool	25'	4	2	1						
44	2.2' deep pool	26'	3	7		1					
46	3.3' deep pool	27'		4	2		1	1			
47	2.7' deep pool	28'	2	3							
49	2.1' deep pool	18'	2	1	1						
51	2' deep pool	30'	2	4	3						
55	2.7' deep pool	32'		6	2			1			
60	3.8' deep pool	37'	2	5	2						
67	2.4' deep pool	41'	1	4	3						
72	2.9' deep pool	44'	1	8	1	2	1				
77	2.3' deep pool	47'	2	1				2			
85	5' deep pool below chute	51'		7	2						
87	5' deep bedrock pool	52'		10	2		3				
91	6' deep pool below waterfall	34'		51	9		4	2		1	1
	Total	**1,419'**	**52**	**171**	**46**	**9**	**14**	**6**		**1**	**1**

*NSO = Natural Sequence Order (habitat unit number in stream survey).

CANYON CREEK SNORKEL SURVEY: RM 5.8 to RM 7.3
August 29, 2001

Transect Length: 1.5 miles
Transect Area: From Cedar Crossing to the confluence with Slate Creek (River Mile 5.8 to River Mile 7.3)
Habitat Snorkeled: All of the pools and deep riffle habitat was snorkeled
Surveyors: D. Hopkins, S. Farmer, J. Jakubowski, A. Mines
Water Temperature: 11°C @ 12:00, 12°C @ 14:00, 13°C @ 15:00, 12°C @17:00

Table 4: Snorkel Data Table Canyon Creek RM 5.8 to RM 7.3

	Rainbow Trout			Bull Trout				Cutthroat	
Habitat	1-4"	4-8"	8-14"	1-4"	4-8"	8-12"	>12"	4-8"	8-12"
Deep bedrock pool #1below Crossing	2	24			1				
80' riffle above bedrock pool	2	3	1		1				
Pool #2 under Cedar Crossing Bridge	2	4	4						
Pocket pools in riffle above bridge	0	4	0						
Deep pool #3 above Cedar Crossing	5	24	5	2	3	2			2
Channel spanning pool #4 above bridge	1	22	3						
Channel spanning pool #5 above bridge		4	1						
Riffle with pocket pool	3	7	3		1				
Bedrock pool on half channel	1	13	2		1				
>150' of riffle with pocket pools	3	8	4						
Spanning pool #6 – deep bedrock pool	2	18	5	1	1				
Deep part of riffle above pool #6		2	2		1				
Channel spanning pool #7 – bedrock pool	1	15	3	1	2				
Deep part of riffle above pool #7		7	3			1			
Channel spanning pool #8 – boulders		8	2						
Pocket pools and riffle above pool #8		17	5						
100' long bedrock pool #9		25	3		8				
Riffle and pocket pools above pool #9	4	28	8		1				
Pool #10 created by large boulders	2	22	3	1	4	1			
Pool # 11 (small but channel spanning)	3	5	1		1				
>250' of riffle above pool #11	3	27	7						1
Pool #12 – bedrock and boulder		2	1						
Riffle between Pools #12 and #13		2	1						
Pool #13 – bedrock and boulder	1	8	2						
50' long pool on half the channel	1	10		1		1			
150' of deep riffle below pool #14	9	44	7	1	4	1		2	
Channel spanning pool #14		16	1		2	1			1
>100' of riffle with good pocket pools	3	14	14			1			1
Channel spanning pool #15	2	7	3						
Pocket pool in riffle		2	3						
Pools #16 to #19 (channel spanning)	2	11	9	1	1				
Pocket pools in riffle above pool #19		4	3			1			
Pools # 20 to #22 (channel spanning)	5	20	3	2	1				1
Pocket pools & riffle below Slate Creek	5	32	6						
Pools #23 to #25	8	32	15	2	3	1		1	
Total	**70**	**491**	**133**	**12**	**36**	**10**	**0**	**3**	**6**

CANYON CREEK SNORKEL SURVEY RM 7.4 to RM 8.1
August 30, 2001

Transect Length: 0.7 miles
Transect Area: From Chancellor C.G. to just above the confluence with the N. Fork (River Mile 7.4 to River Mile 8.1)
Habitat Snorkeled: All of the pools and deep riffle habitat was snorkeled
Surveyors: D. Hopkins
Water Temperature: 10°C (10:00)

Table 5 : Snorkel Data Table Canyon Creek RM 7.4 to RM 8.1

	Rainbow Trout			Bull Trout				Cutthroat	
Habitat	**1-4"**	**4-8"**	**8-12"**	**1-4"**	**4-8"**	**8-12"**	**>12"**	**4-8"**	**8-12"**
Deep bedrock pool above campground	5	17	1	1	4			1	
Deep riffle with overhanging vegetation	4	2	2						
Small pool under log in riffle	1	2	1						
Thirty feet of riffle/good cover	1	5	1						
Shallow pool at bend – slope eroding	1	3							
Shallow pool – log jam on bank	1	1							
Pool with good gravel below log jam	1	3							
Pool with wood cover below large log jam	4	5	2		4	1			
Shallow pool below jam	1	2			1				
Deep pool created by log jam. Plentiful spawning gravel.		6	1	1	4	0	1 (20")		
Pool with overhanging wood	5	5	1	1	2	1			
Deep pool created by log jam. Excellent cover. Plentiful spawning gravel.		3	1		8	1	1 (22")		
Three pocket pools in riffle	1	4	1		1				
Deep pool with huge log jam	9	17	7	4	19	1			2
Pool created by roots of cottonwood		19	4	1	15	1			
Deep riffle with small scour pool	1	5							
35' riffle with wood		2				1			
Pool created by roots of cottonwood	5	25	5	2	18				
Pocket pool in riffle									
Small pool created by boulder		1							
Pocket pool in riffle created by wood		1	1						
Pocket pool created by root wad		3							
Pool below confluence with North Fork		1							
Pool above confluence with North Fork	2	1	1						
Pool below dry channel above N. Fork		4	3		3				
2.9' deep pool	1	8	1	2	1				
Total	**43**	**145**	**33**	**12**	**80**	**6**	**2**	**1**	**2**

October 5, 2001 Survey
Same Transect: All primary pools snorkeled

	Rainbow Trout			Bull Trout				Cutthroat	
Habitat	**1-4"**	**4-8"**	**8-12"**	**1-4"**	**4-8"**	**8-12"**	**>12"**	**4-8"**	**8-12"**
All major pools – see next page for table	**21**	**121**	**24**	**20**	**82**	**10**	**0**	**1**	**1**

CANYON CREEK SNORKEL SURVEY: RM 7.4 to RM 8.1
October 5, 2001

Transect Length: 0.7 miles
Transect Area: From Chancellor C.G. to just above the confluence with the N. Fork (River Mile 7.4 to River Mile 8.1)
Habitat Snorkeled: All of the primary pool habitat was snorkeled
Surveyors: D. Hopkins
Water Temperature: 6°C (10:30)

Table 6: Snorkel Data Table Canyon Creek RM 7.4 to 8.1 (2nd Survey)

	Rainbow Trout			Bull Trout				Cutthroat	
Habitat	**1-4"**	**4-8"**	**8-12"**	**1-4"**	**4-8"**	**8-12"**	**>12"**	**4-8"**	**8-12"**
Deep bedrock pool above campground P1		9	4		3	1		1	
Pool 2: Pool at bend with eroding bank									
Pool 3: 150 feet above pool at bend	3	3	1						
Pool 4: LWD complex on bend	1	12	3	2	6	4			
Pool 5: Under overhanging root wad					1				
Pool 6: LWD complex. Adfluvial in Aug.	2	8	2	6	15	4			
Pool 7: Small pool 120 feet above pool 6		1							
Pool 8: 15 feet above pool 7		1							
Pool 9: BT redd at crest (6' x 3' under log). Adfluvial was seen here in August	2	15	3	3	12				
Pool 10: LWD in pool, 300' above pool 9	2	10	1	3	10	1			
Pool 11:LWD complex in pool.	3	17	1	1	2	0			1
Pool 12: At bend, good cover.	5	20	2	2	17				
Pool 13: Possible redd at top of pool 7' x 4'). Clean, but no apparent pit	3	25	7	3	15	0			
Pool 14: Just below North Fork									
Total	**21**	**121**	**24**	**20**	**82**	**10**		**1**	**1**

Total Rainbow	166	(59%)
Total Bull Trout	112	(40%)
Total Cutthroat	2	(1%)
Total Fish Observed	280	

III. BULL TROUT REDD SURVEY REPORT:
Ruby Creek, Canyon Creek and Panther Creek

III. BULL TROUT REDD SURVEY REPORT: Ruby Creek and Tributaries

Objectives and Scope of Work: A total of about 9 ½ miles of habitat was surveyed in the Ruby Creek drainage. About 6 miles of habitat in Canyon Creek was surveyed (between the mouth and RM 5.1, and between the confluence with Slate Creek (RM 7.3) and the confluence with the North Fork (RM 8.1). About 2 ½ miles of Ruby Creek was surveyed, from just below the confluence with Panther Creek to the end of the stream (confluence with Granite and Canyon Creeks). The lower mile of Panther creek was surveyed. The objectives of the redd surveys were:

1. To locate adfluvial bull trout spawning areas in the Ruby Creek watershed.
2. To determine the timing of adfluvial bull trout spawning.

Protocol: Only one survey visit was made to each transect site due to time constraints (onset of winter). The size, substrate type and habitat of each bull trout redd was recorded, as well as a size estimate of all bull trout seen during the survey. The location of each redd was mapped. Stream temperatures were taken throughout the survey.

Observations: The following observations were made from data gathered from bull trout redd surveys in the Ruby Creek watershed in 2001:

1. Canyon Creek:
    a. Both adfluvial bull trout from Ross Lake and resident bull trout are spawning in Canyon Creek. A total of 26 bull trout redds and eleven bull trout were counted in the 5.8 surveyed stream miles. Ten of the redds were greater than 15 square feet in size, eight of the redds were between 5 and 15 square feet in size, and eight of the redds were less than 5 square feet in size. Three of the eleven bull trout seen were adfluvial bull trout between 24" and 26" (a 26" diameter bull trout was dead and measured with a ruler). Adfluvial bull trout were seen on two of the redds (both redds were greater than 25 square feet). A 13" bull trout was seen sitting on a redd which was 21 square feet (7' x 3') in size. Seven bull between 7" and 10" were observed sitting on redds ranging in size from 3 square feet to 6 square feet.
    b. Nearly all the bull trout redds were seen in deep pools in areas where the channel was constricted by bedrock. Few resident redds and no adfluvial redds were seen in the less constricted alluvial fans found at the confluences with the major tributaries (Boulder Creek, Mill Creek and Slate Creek). Redds dug by resident fish consisted of gravel and sand. Most of the larger redds consisted of gravel and small cobble substrate. The larger adfluvial size redds were in water depths of between 1.5 and 2.5 feet deep, with good boulder or bedrock cover nearby. Redds were found in all parts of a pool (pool crest, sides and top).
    c. Adfluvial bull trout redds were seen in the following areas of Canyon Creek in 2001: between RM 0.8 and RM 2.0, between RM 3.5 and RM 3.9, between RM 4.5 and RM 5.1, and at RM 8.0.
2. Ruby Creek: Two small resident redds were seen at RM 2.2 and RM 2.7 in Ruby Creek. Two bull trout about 8" in length were on one of the redds. A redd 4' x 3' was seen in a pool in a side channel near Ruby Arm during snorkeling surveys conducted in 2000.
3. Panther Creek: No bull trout or redds were seen in the lower mile of Panther Creek in 2001. Poor spawning habitat exists in the very high energy bedrock channel. Redd surveys need to be conducted further upstream in the lower gradient stream segments.

2001 RUBY CREEK WATERSHED BULL TROUT REDD SURVEYS

SUMMARY TABLE

		# of Redds Observed				# of Bull Trout Observed				
Stream Segment	**Miles**	**Size of < 5 sq ft**	**5 to 15 sq. ft.**	**> 15 sq. ft.**	**Total # Redds**	**Less than 8"**	**8" to 12"**	**12" to 16"**	**> 16"**	**Total Bull Trout**
Canyon Creek										
Mouth to Boulder Creek	2.7	4	5	5	14	4	3	1	2 (24,26")	10
Boulder Cr. to Mill Creek	1.6	2	3	1	6	-	-	-	-	0
Above Mill Creek[a]	0.8	2	0	3	5	-	-	-	1 (24")	1
Slate Creek to North Fork[b]	0.8	0	0	1	1	[b]	[b]	[b]	[b]	[b]
Total Canyon Creek	**5.9**	**8**	**8**	**10**	**26**	**4**	**3**	**1**	**3**	**11**
Ruby Cr RM 0.6 to 3.2[c]	**2.6**	**2**	**0**	**0**	**2**	**2**	-	-	-	**2**
Panther Cr RM 0 to 1.0	**1.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total 2001 Surveys	**9.5**	**10**	**8**	**10**	**28**	**6**	**3**	**1**	**3**	**13**

[a]Note: A 2.2 mile stream segment of Canyon Creek between RM 5.1 to RM 7.3 (below Slate Creek) was not surveyed. About 1.5 miles of the 2.2 mile unsurveyed stream segment is poor bull trout spawning habitat (from Cedar Crossing to Slate Creek (RM 5.8 to 7.3). The channel is less constricted in this 1.5 mile stream segment, with few pools and low amounts of gravel. The 0.7 mile segment below Cedar Crossing (RM 5.1 to 5.8 has good spawning habitat, but was not surveyed).

[b]This segment was snorkeled at the time of the redd survey and on August 30 – see snorkel data on pages 21-22.

[c]The lower 0.6 mile stream segment of Ruby Creek (between Ruby Arm and Panther Creek) was not surveyed in 2001. A 4' x 3' bull trout redd was seen at RM 0.1 during a fish snorkeling/bull trout redd survey on October 18, 2000.

CANYON CREEK BULL TROUT REDD SURVEYS – FALL 2001

Transect #1: Mouth to Confluence with Boulder Creek (RM 2.7)

Date: 10-17-01
Surveyor: Hopkins
Water Temp: 6°C
Length: 2.7 Miles
 # Redds Seen: 14
 # Bull Trout Seen: 10

Data Table: Canyon Creek - Mouth to Confluence with Boulder Creek

Redd #	Approximate Location	Size of Redd	Substrate % sa	gr	co	Bull Trout	Habitat
1	1,500' above mouth	3' x 2'	60	40		2 (<8")	Cleaned gravel with pit, R side of channel next to log.
2	1,500' above mouth	3' x 3'		100		2 (<8")	15' from redd #1.
2	3,300' above mouth	3' x 2'	80	20		1 (10")	Clean, mounded gravel on L side of channel behind alder. Photo
3	3,300' above mouth	2' x 1'	40	60		-	Next to redd #2 (photo)
4	4,000' above mouth	2' x 1'		100		1 (8")	At pool tail crest.
5	4,000' above mouth	5' x 4'	30	70		-	In same pool as redd #4. Cleaned are under huge boulder – 1.5'.
6	6,200' above mouth	2.5' x 1.5'	20	80		1 (9")	At beginning of gorge, next to bedrock outcropping on right side
7	6,600' above mouth.	6' x 4'	10	70	20	-	Redd in >2' water on R side of pool, next to bedrock.
8	6,900' above mouth	7' x 3'	15	85		1 (13")	In > 2' water depth in pool, in front of boulder (see photo).
	7,800' above mouth	-				1 (26")	Dead bull trout in pool. Fork length measured at 25".
9	7,800' above mouth	3' x 2'		100		-	Very clean gravel on R side of pool.
10	8,500' above mouth	9' x 3'		50	50	1 (24")	Adfluvial bull trout on redd in pool in front of boulder (>2' deep
11	10,600' above mouth	10' x 3.5'	25	55	20	-	Left side of pool next to large boulders in 2.5' of water.
12	12,000' above mouth	3' x 2'	10	30	60	-	Very clean gravel with nice pit (algae in pool). At pool crest.
13	12,500' above mouth	3' x 2'		35	65	-	In same pool as #14, at pool tail crest in 1.5' deep water.
14	12,500' above mouth	2.5' x 1.5'		75	25	-	About 15' from #13, at pool tail crest. Lots of algae in pool.

Notes: -Redds are easy to see due to the abundance of algae in the stream (lack of flow in 2001?).
-JUD placer mining claim is at RM 1.7 (9,000' above mouth). An adfluvial on a redd was seen 500' downstream of the claim.
-No redds were seen in the 0.3 mile unconfined stream segment just below the confluence with Boulder Creek.

CANYON CREEK BULL TROUT REDD SURVEYS – FALL 2001

Transect #2: Confluence of Boulder Creek (RM 2.7) to Confluence with Mill Creek (RM 4.3)

Date: 10-24-01
Surveyor: D. Hopkins
Water Temp: 5°C @12:45
Weather: Raining, temperatures in mid 40s
Length: 1.6 Miles
 # Redds Seen: 6
 # Bull Trout Seen: 0

Data Table: Canyon Creek - Confluence with Boulder Creek to Confluence with Mill Creek

Redd #	Location	Size of Redd	Substrate % sa	gr	co	Bull Trout	Habitat & Notes
1	500' above Boulder Creek	2' x 2'	-	100	-	-	Redd very bright, cleaned of algae. On left side of riffle in pocket pool.
2	4,000' above Boulder Creek	5' x 3.5'	25	65	10	-	On left side of pool in 2 to 2.5' of water. Boulders next to redd
3	5,500' above Boulder Creek	3.5' x 2'	10	80	10	-	Just below pool crest in 1.8' of water. Very clean – no algae.
4	Next to redd #3	3' x 1.5'	10	80	10	-	10' below redd #3. Very clean gravel, pit.
5	5,650' above Boulder Creek	5' x 2'	-	100	-	-	In pool above redds 3 & 4, in 2 ½ feet of water. Very clean.
6	6,550' above Boulder Creek	3' x 3'	-	100	-	-	On left side of pool near bedrock ledge in 2 ½ feet of water.

Notes on Transect #2:

1. The first 1000 feet of the transect is riffle with some small pocket pool habitat. The channel is wide and unconfined.
2. The channel is confined from RM 2.9 to RM 3.9, with numerous deep pools formed by the bedrock outcroppings.
3. The upper 2100 feet of the transect widens (alluvial fan with Mill Creek). Nearly all habitat in this 0.4 mile segment is riffle.

CANYON CREEK BULL TROUT REDD SURVEYS – FALL 2001

Transect #3: Above Confluence with Mill Creek (RM 4.3) to about RM 5.1

Date: 10-24-01
Surveyor: J. Jakubowski
Water Temp: 5°C @12:45
Weather: Raining, temperatures in mid 40s
Length: 0.8 Miles
 # Redds Seen: 6
 # Bull Trout Seen: 0

Data Table: Canyon Creek - Confluence with Mill Creek to RM 5.1

Redd #	Location	Size of Redd*	Substrate % sa gr co	Bull Trout	Habitat & Notes
1	900' above Mill Creek	6' x 3'	100	-	On right bank of riffle.
2	1,200' above Mill Creek	6' x 4'	30 70 -	-	On right side of pool near bedrock.
3	2,400' above Mill Creek	3' x 1.5'	100	-	Left side of pool below bedrock outcropping.
4	2,700' above Mill Creek	10' x 2.5'	90 -	1 (20-24")	On right side of large, deep pool near pool tail crest.
5	4,150' above Mill Creek	2' x 2'	100	-	Left side of channel in pocket pool behind boulder.

RUBY CREEK BULL TROUT REDD SURVEYS – FALL 2001

Transect: Confluence of Panther Creek to Confluence of Granite and Canyon Creeks (RM 0.6 to 3.2)

Date: 10-16-01
Surveyor: J. Jakubowski, S. Farmer
Water Temp: @12:45
Weather:
Transect Length: 2.6 Miles
 # Redds Seen: 2
 # Bull Trout Seen: 2

Data Table: Ruby Creek – Confluence with Panther Creek to Canyon/Granite Confluence

Redd #	Location	Size of Redd	Substrate % sa gr co	Bull Trout	Habitat & Notes
1	About RM 2.2	2' x 1'	100	2 (<8")	In riffle in slow backwater area behind small log.
2	About RM 2.7	1' x 1'	80 20 0	-	On left side of channel in braided riffle.

Notes: 1. River mile 0.0 to 0.6 was not surveyed to high amount of flow. A 4' x 3' redd was seen at RM 0.1 in October 2000.

2. Although some large patches of spawning gravel are found in the deep pools in the lower gorge, substrate is generally too coarse for bull trout spawning in Ruby Creek (due to the high energy, constricted channel and lack of large woody material).

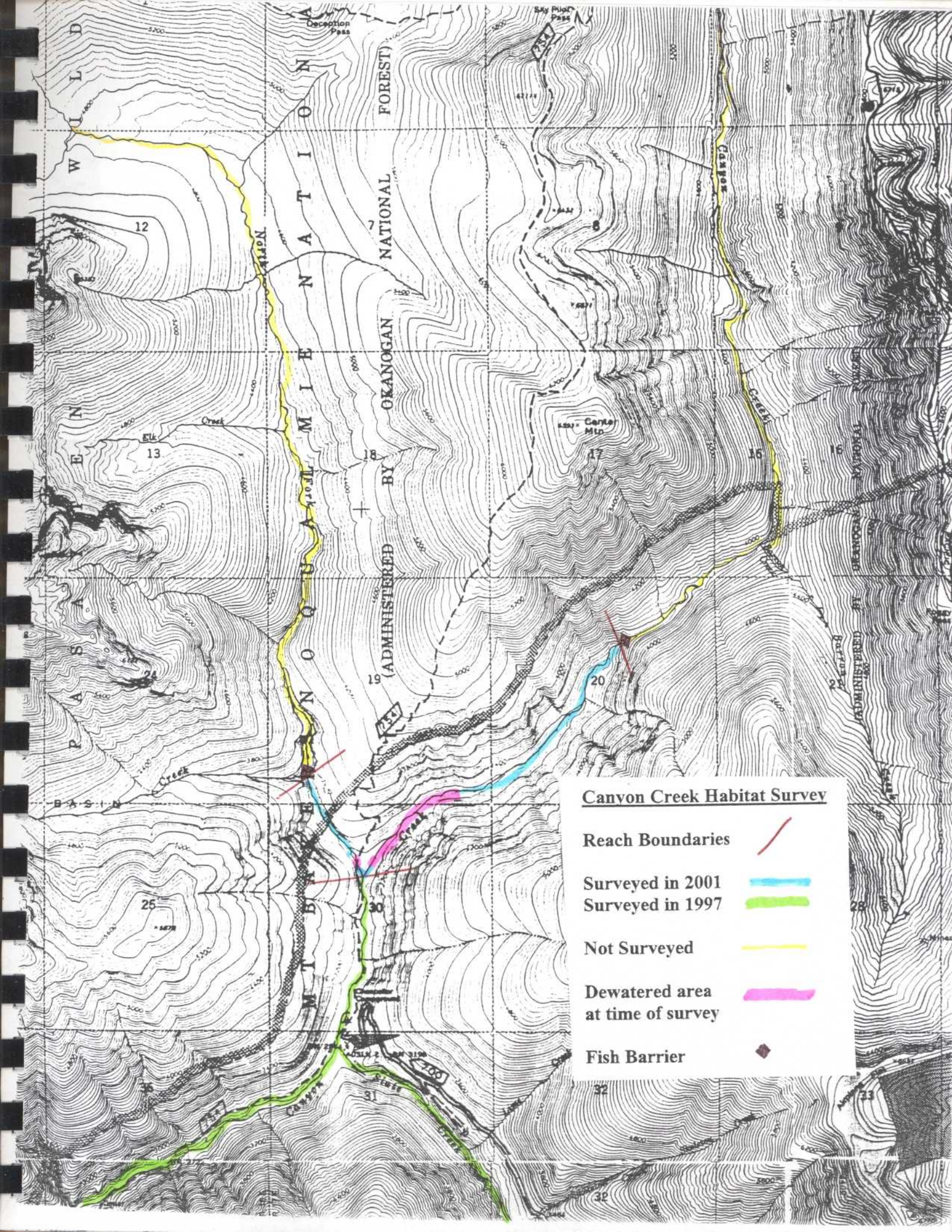
PANTHER CREEK REDD SURVEY – FALL 2001

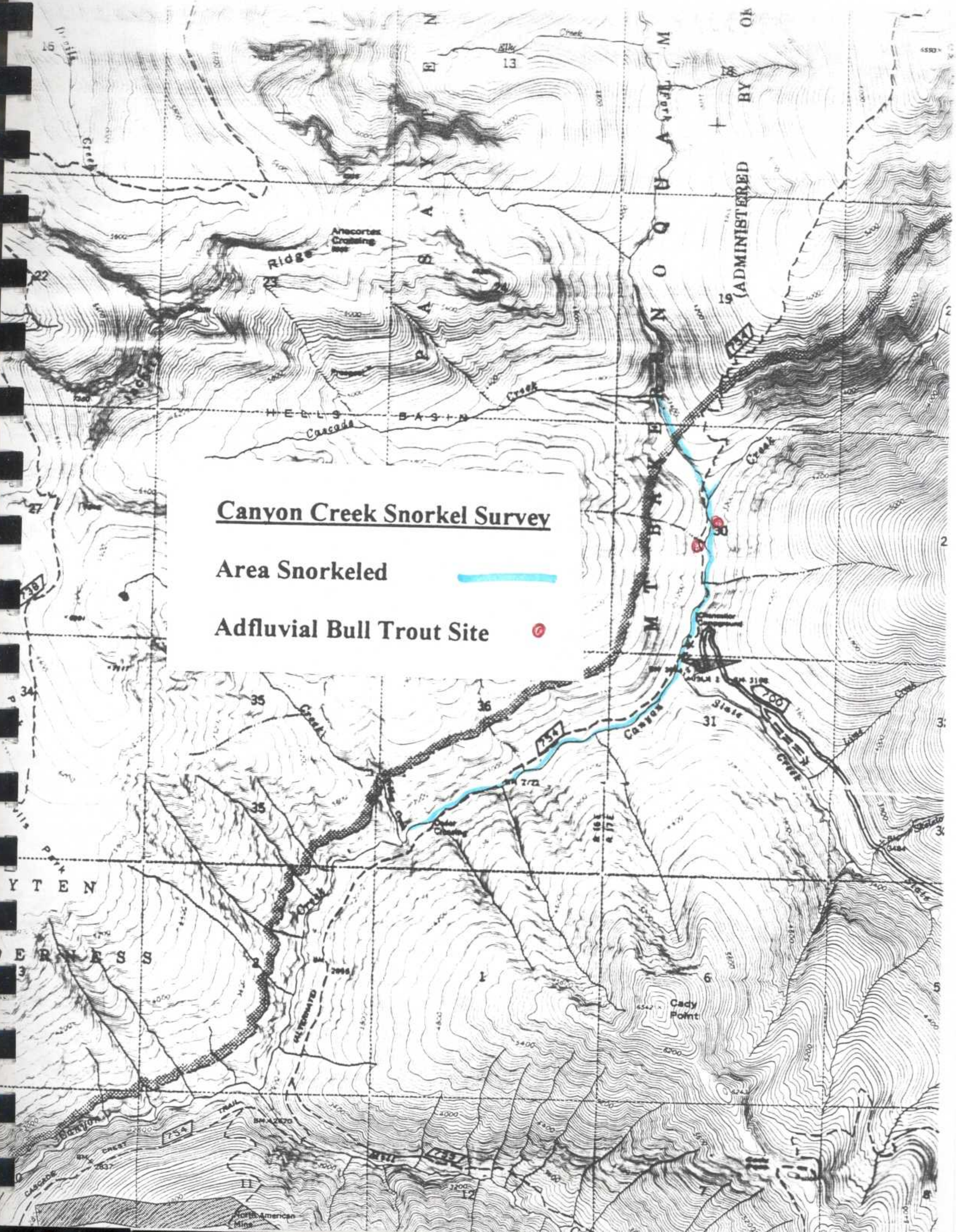
Date:	10-29-01
Surveyor:	Hopkins
Water Temp:	3.5°C at 11:30
Weather:	Overcast, temperatures in the 40s.
Transect Length:	About 1 mile
# Bull Trout Redds:	0
# of Bull Trout Seen:	0

Habitat Notes: The lower mile of Panther Creek is generally poor spawning habitat for bull trout. The channel is incised and very narrow (20 to 35 feet wide) for the amount of flow in this high gradient segment of the stream. Substrate consists mainly of cobble, boulders and bedrock, with some small pockets of gravel in the quieter water. Much of the channel could not be seen due to whitewater. A large log jam exists about 500 feet above the Route 20 bridge crossing. The jam is holding back a fair amount of gravel, but no redds or bull trout were seen in the pool. Pool habitat was not as deep as in Canyon or Ruby Creeks, despite similar flow. The channel in the first stream mile is basically a "chute", scoured to bedrock in some segments.

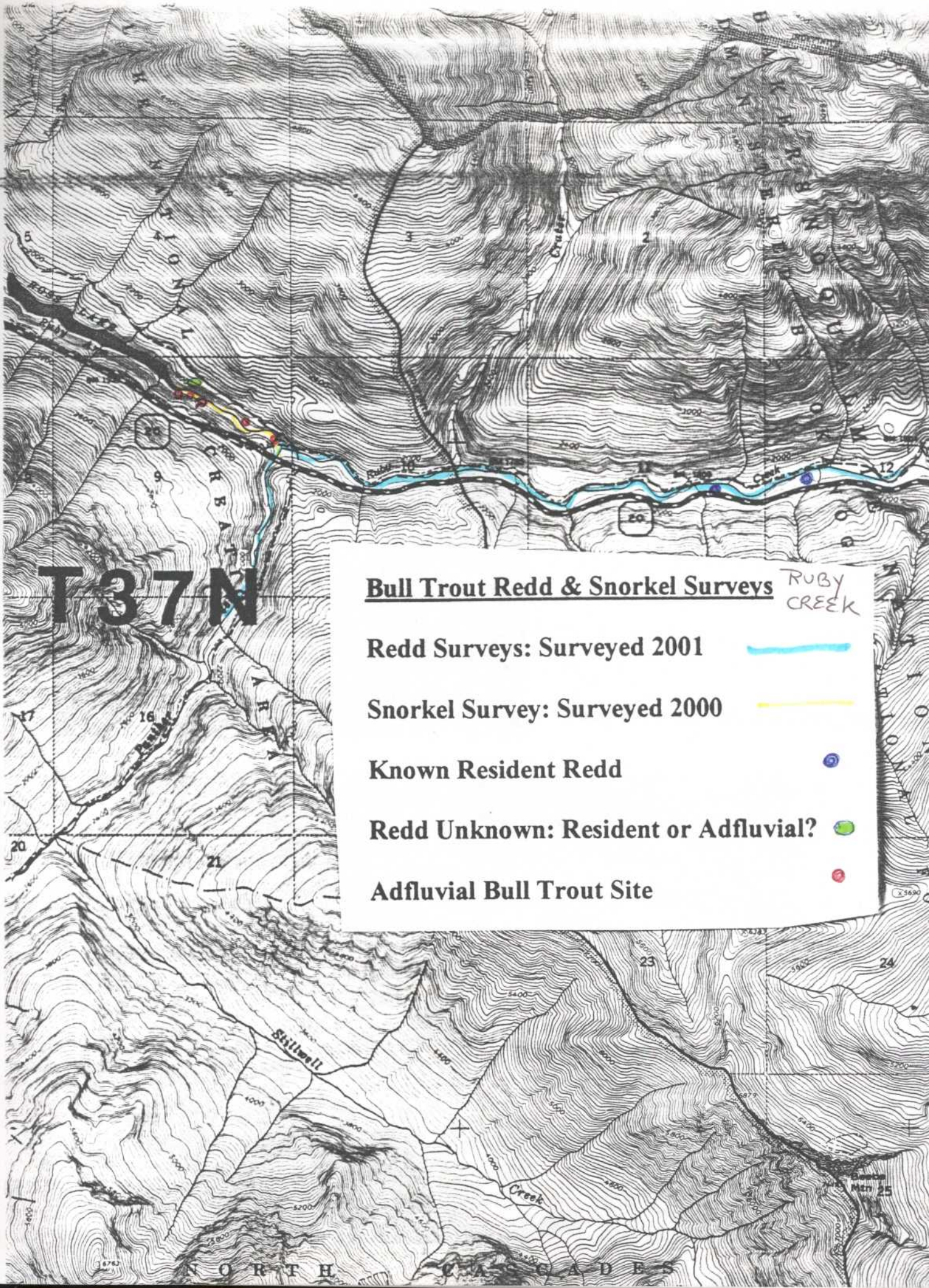
Recommend: Survey for bull trout redds higher in the drainage, where the channel is lower gradient and less confined.

IV. MAPS AND PHOTOGRAPHS


Canyon Creek Habitat Survey
Reach Boundaries
Surveyed in 2001
Surveyed in 1997
Not Surveyed
Dewatered area at time of survey
Fish Barrier

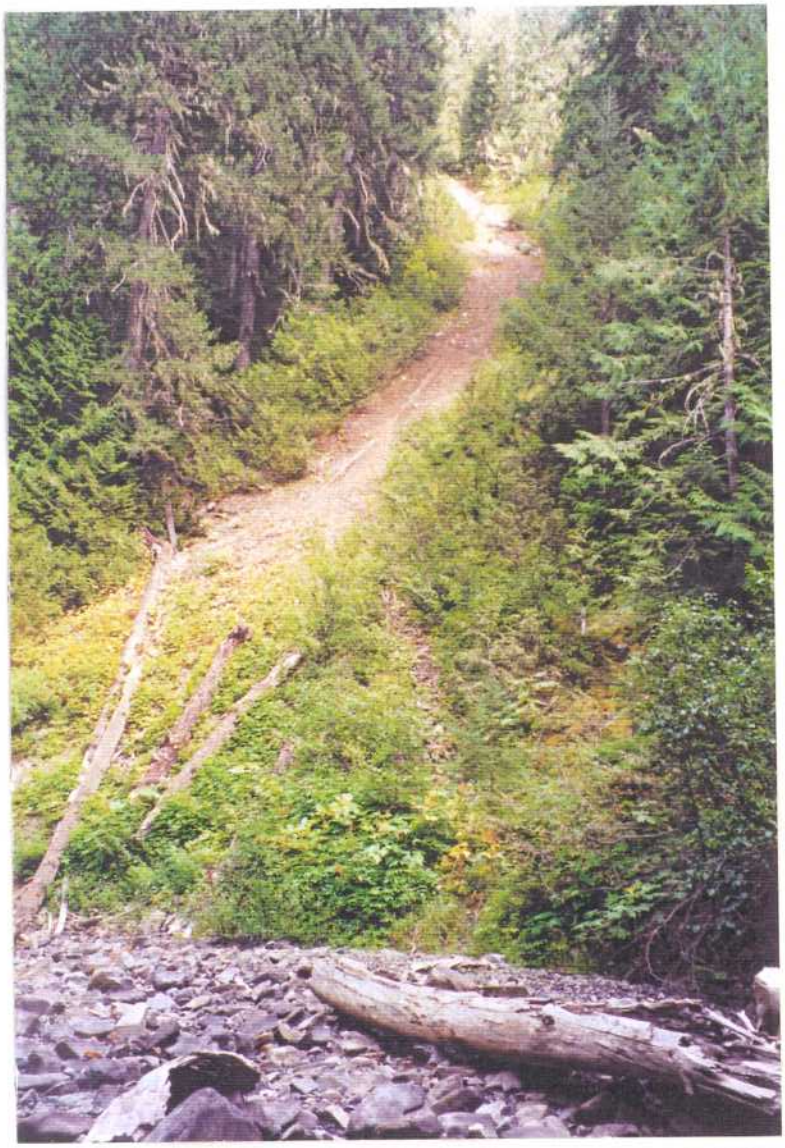

Canyon Creek Snorkel Survey
Area Snorkeled
Adfluvial Bull Trout Site

t Redd Surveys
veyed
Surveyed
robable Resident Redd
robable Adfluvial Redd
known: Resident or Adfluvial?
Bull Trout Sighting
Devils Park
McMillan Park
Cady Point
Creek
Mill
Creek
Holmes
Friday
Cascade


T37N
Bull Trout Redd & Snorkel Surveys
RUBY CREEK
Redd Surveys: Surveyed 2001
Snorkel Survey: Surveyed 2000
Known Resident Redd
Redd Unknown: Resident or Adfluvial?
Adfluvial Bull Trout Site
Ruby Creek
Stillwell
Creek
NORTH CASCADES

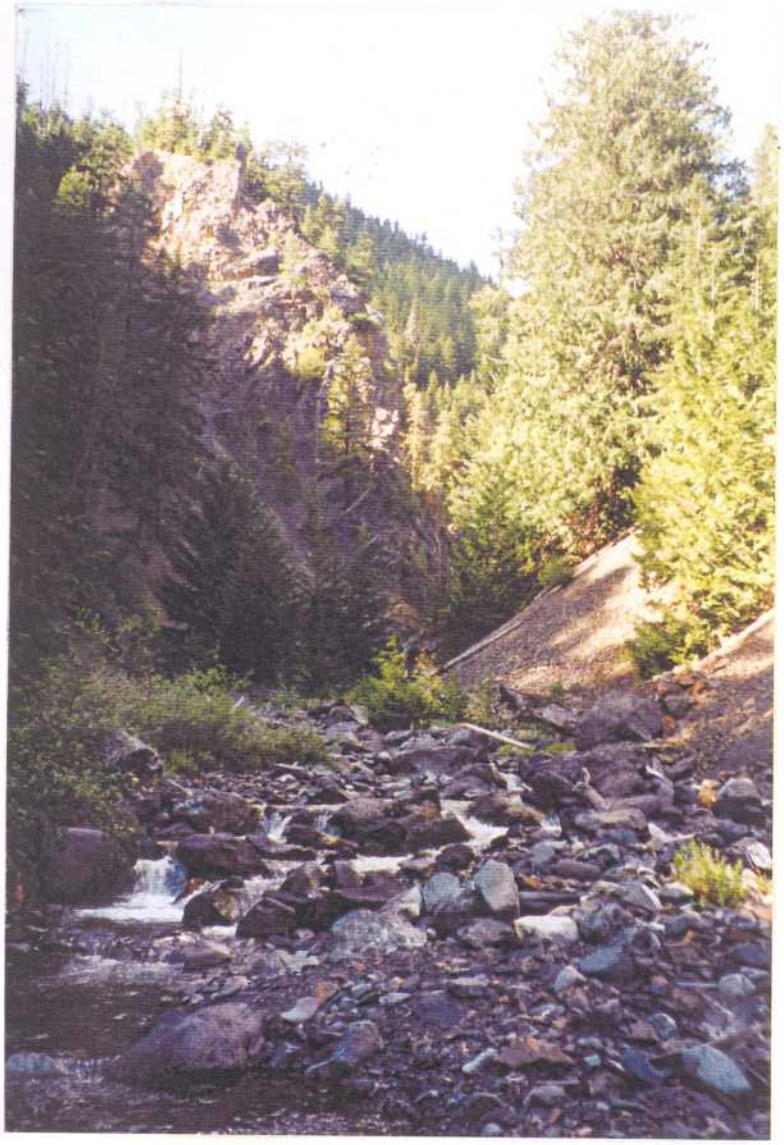
Waterfall barrier at RM 0.6 in North Fork

Wood in the alluvial fan in the North Fork

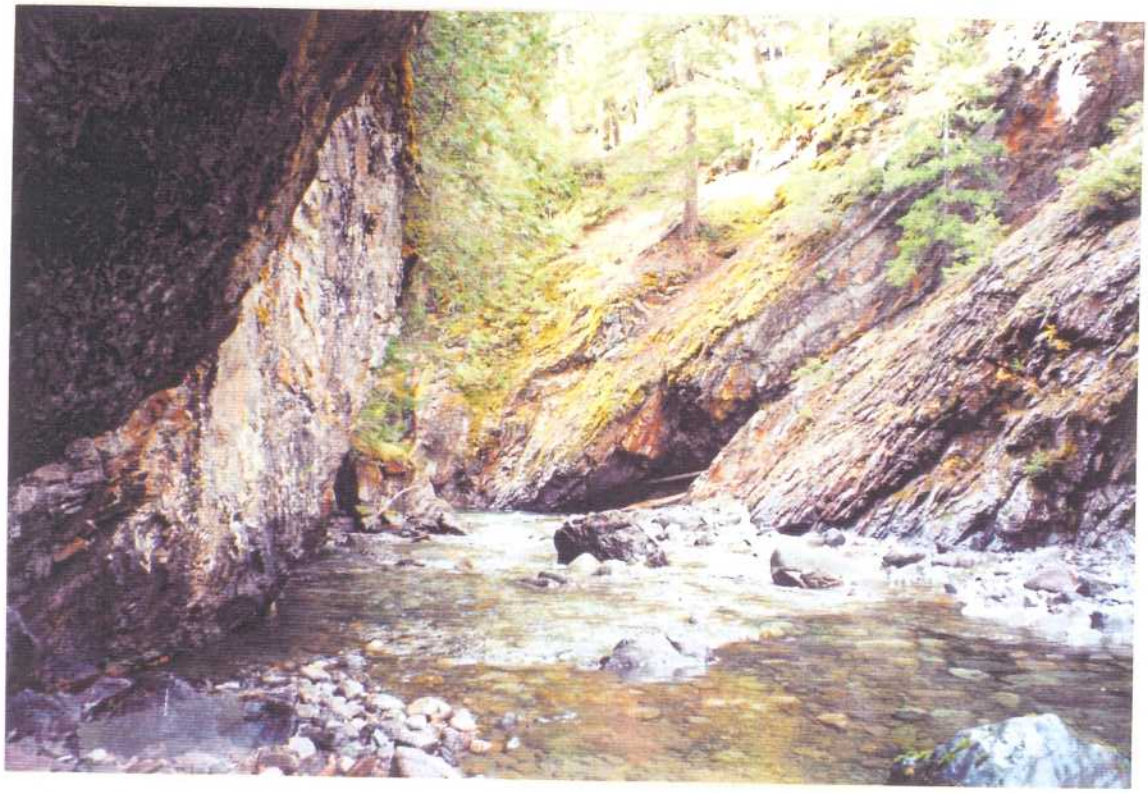


Chute in upper Canyon Creek

Dry channel in upper Canyon Creek



Bedrock outcropping in the North Fork



Adfluvial bull trout spawning area in lower Canyon Creek

Bull trout redd in lower Canyon Creek (in front of boulder)
A 13" bull trout was seen on the redd.

Resident bull trout redds in lower Canyon Creek