

Cumulative Effects of Micro-hydro Development on the Fisheries of the Swan River Drainage, Montana, Volume III

Fish and Habitat Inventory of Tributary Streams

Final Report
1983 - 1984



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CUMULATIVE EFFECTS OF MICRO-HYDRO
DEVELOPMENT ON THE FISHERIES OF THE
SWAN RIVER DRAINAGE, MONTANA

III: FISH AND HABITAT INVENTORY OF
TRIBUTARY STREAMS

Final Report

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INTRODUCTION

This report is part of a three-volume set of publications that summarizes the information gathered during a two and one-half year study of the fisheries of the Swan River drainage in relation to potential small hydro development. During the course of this study MDFW&P personnel conducted aerial and ground surveys of almost every tributary stream in the Swan River drainage between Swan and Lindbergh lakes (Figure 1). This information was collected in order to obtain a reliable basin-wide database which was used to evaluate the potential cumulative effects of a number of proposed small hydro developments on the fisheries of the drainage (see Leathe and Enk 1985). The fish population, fish spawning, and habitat inventory information presented herein will hopefully be useful to fisheries management personnel and land managers involved in evaluating the potential on-site and downstream impacts of such activities as small hydro development, road and bridge construction, and timber harvesting.

Each named tributary stream is treated as a "chapter" in this report and the streams (chapters) are ordered alphabetically. The first part of each chapter is a table that specifies the locations of all sampling sites as well as the date(s) when the surveys or measurements were performed. All locations are expressed in stream kilometers, which are measured beginning at the mouth of the stream (i.e. the point where it joins a larger stream, the Swan River, or a lake). Following the table of locations there is a reach-by-reach narrative summary of general habitat characteristics, outstanding features of the stream, and fish populations and spawning use. An attempt was made to rank many of the measured parameters relative to other surveyed stream reaches in the drainage. The methods used to collect this information are described elsewhere (Leathe and Graham 1983, Leathe and Enk 1985, Leathe 1985).

At the end of the reach-by-reach description of each stream, a biophysical inventory map has been included that displays reach boundaries, bridges, and other key features described in the legend (Figure 2). Stream kilometer marks have been placed on each map to facilitate the location of measurement sites presented at the beginning of each stream summary. Township, range, and section lines were also placed on the maps to assist in the relocation of sampling sites and also to aid in the determination of property ownership since a substantial amount of "checkerboard" land ownership occurs in the Swan. A set of standard U.S. Geological Survey 7.5 minute topographic quadrangle base maps (with kilometer markings) used for this study will be kept at MDFW&P headquarters in Kalispell.

Finally, fish population information and some of the more important chemical and physical parameters for each stream reach are tabulated in Appendix A. Detailed information on the distribution and intensity of bull trout spawning in the principal spawning

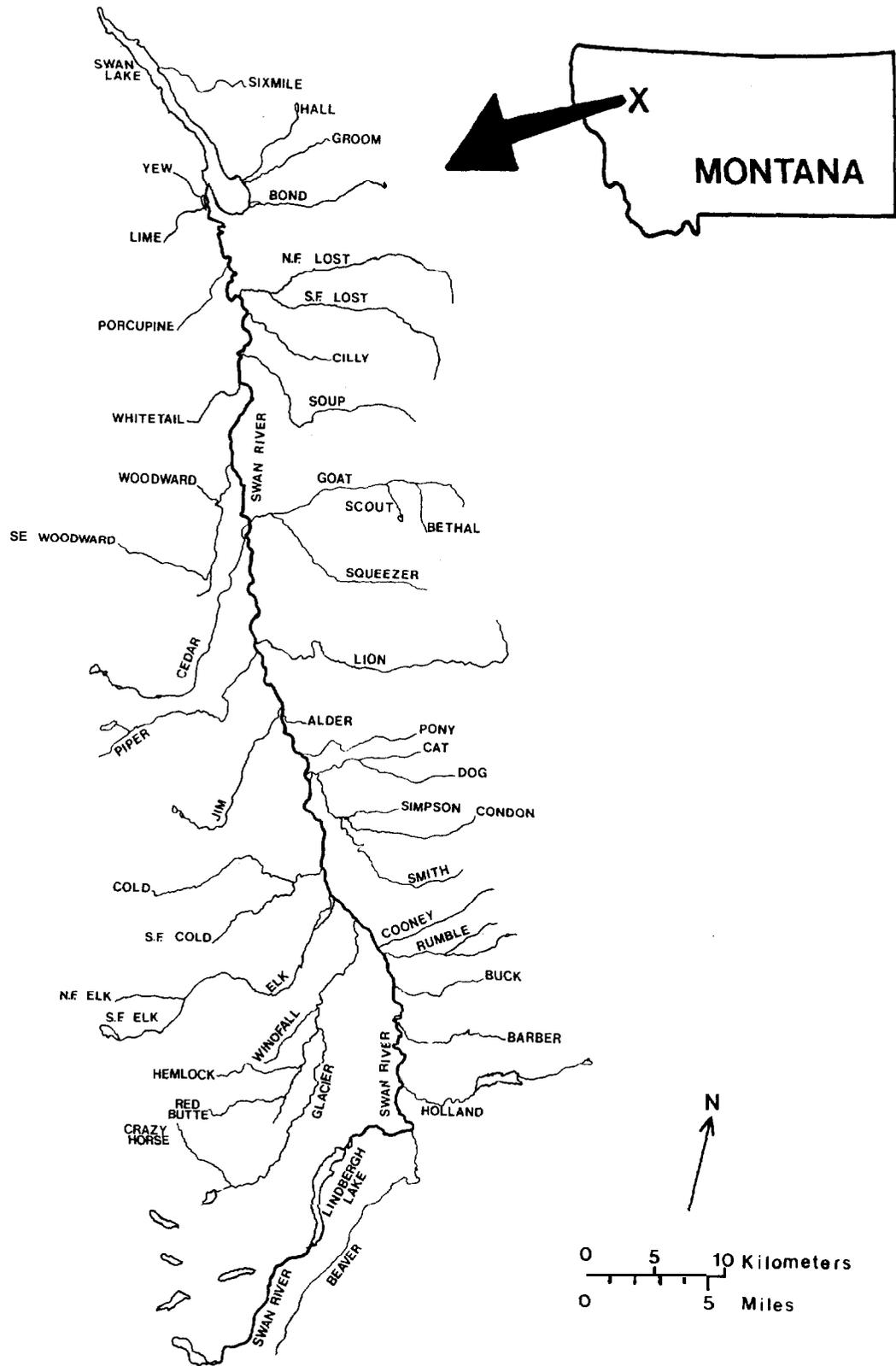
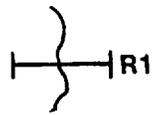
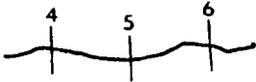


FIGURE 1. Map of the Swan River drainage, Montana.

LEGEND



Upper boundary of reach (i.e. R1 = Reach 1)



Stream kilometers (beginning at mouth)



Bridge



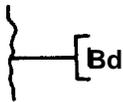
Intermittent flow during late summer or fall

X

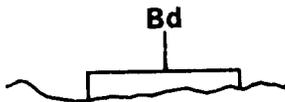
Debris accumulation in stream channel



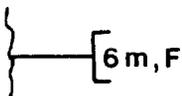
Marsh



Single beaver dam



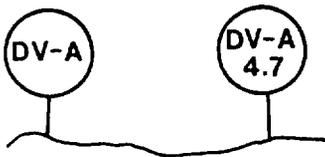
Series of beaver dams



Potential obstacles to migrating fish:

Height: (i.e. 6 meters)

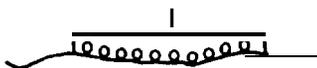
**Type: L (logs), C (chute or cascade),
Bd (beaver dams), BR (bedrock),
F (waterfall)**



Bull trout (DV) spawning areas:

**Spawning area boundary (i.e. A-A, B-B, etc.)
Redds per kilometer (i.e. 4.7 redds per km)**

DV



High density bull trout spawning area

Figure 2. Legend for biophysical inventory maps.

streams during the years 1982 through 1984 is graphically depicted in Appendix B. Raw field data collected during the study is on file at the Montana Department of Fish, Wildlife and Parks headquarters in Kalispell. Also, raw stream habitat data, fish collection data, and summarized habitat and fish population data were entered and stored into the Discovery computer system at the MDFW&P office in Kalispell.

BARBER CREEK

Locations of physical and chemical measurement stations
and other installations in Barber Creek,
atributarytothe Swan River.

<u>Beach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4.5	Location of reach	
2	km 4.5-8	Location of reach	
	km 5-7	Habitat survey section	7/27/83
	km 6.5	Electrofishingsection	7/25/83
	km 4.5	Discharge measurement	7/21/83
	km 4.6	Water chemistry	9/22/83
	km6	Max/min thermometer	8/3/83-8/10/83

Reach 1

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1982. Beach I of Barber Creek is a third order stream having a relatively small drainage area (16.5 square kilometers) and a low average channel gradient (2.0%). The channel width was estimated to be 2-3 meters. The streambed material was composed mostly of sand and silt. The D-90 was estimated to be low. The channel debris was low and there were no fish barriers observed. Marshes were cannon throughout the reach and the stream braided frequently.

Beach 2

Beach 2 of Barber Creek is a third order stream having a relatively samll drainage area (8.9 square kilometers) and a moderate average channel gradient (4.7%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (50°F or 10.0°C) and conductivity during the low water period was high (342 micranhos). The discharge during the habitat survey was 2.3 cfs and the estimated late summer flow was 0.7 cfs. The stream had an average wetted width of 2.4 meters and was comprised of 2% pool, 25% riffle, 60% run, and 13% pocketwater-cascade. There were no high quality (class I, II, and III) pools in the survey section. The streambed was comprised mainly of large gravel (35%) and sand (26%) with lesser amounts of small gravel (25%), cobble (8%), silt (4%), and boulder-bedrock (2%). D-90 was 11 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (40%) and channel stability was good (rating score = 72). There was a moderate amount of instream cover (31%) which was mostly canprised of debris and boulders. Total overhead cover was abundant (82%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (36%).

Stream Features

Within the reach boundaries there were no observed barriers to fish migration or prominent features. Streamflow was intermittent

in late Summer at km 8.0, the designated upper boundary.

Fish Populations and Spawning Use

A two-pass population estimate ~~was~~ obtained by electrofishing a 100 m section of this reach on 25 July 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was low (39/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) ~~was~~ also low (18/300 m).

BARBER CREEK

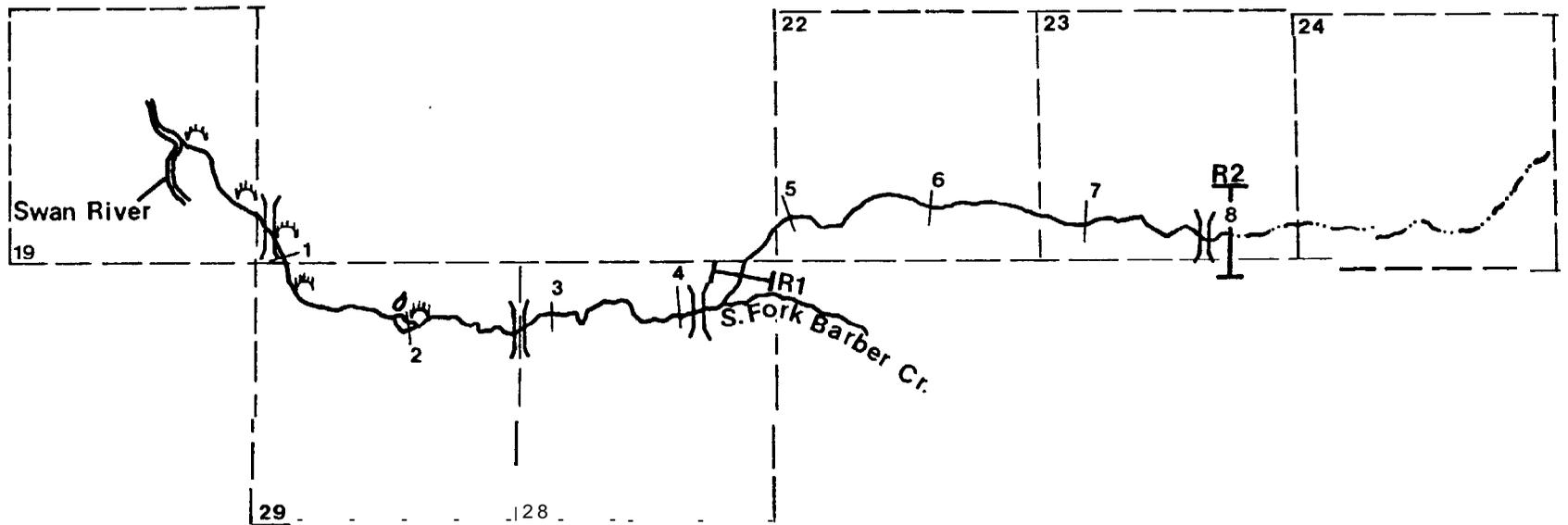


Figure 3 . Biophysical inventory map of Barber Creek, a tributary to the Swan River.

BEAVER CREEK

Locations of physical and chemical measurement stations
and other installations in Beaver Creek,
a tributary to the Swan River.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-7	Location of reach	
2	km 7-12.5	Location of reach	
3	km 12.5-19	Location of reach	
	km 16.5-18.5	Habitat survey section	9/14/83
	km 16.5	Electrofishing section	9/20/83
	km 17	Discharge measurement	9/14/83
	km 13.5	Water chemistry	9/22/83
	km 16.6	Max/min thermometer	8/18/83-9/20/83

Peach 1

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1982. Peach 1 of Beaver Creek is a fourth order stream having a relatively large drainage area (62.1 square kilometers) and a low average channel gradient (1.0%). The channel width was estimated to be 3-5 meters. Channel debris was low and there were no fish barriers observed. The streambed material was composed mostly of gravel. The D-90 was estimated to be low. Some marsh sections were observed in the reach. The entire reach was surveyed for bull trout redds in 1982 but no redds were found. This reach was not surveyed for bull trout redds in 1983. A one-pass population estimate was obtained by other Montana Department of Fish, Wildlife and Park's personnel who electrofished 183 m, 122 m, and 122 m sections of this reach (at km 1.5) on 12 August 1971, 18 August 1965, and 12 August 1965, respectively. Average densities of fish 75 mm and longer were low for cutthroat trout (48/300 m), and moderate for brook trout (129/300 m).

Peach 2

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1982. Peach 2 of Beaver Creek is a fourth order stream having a medium-sized drainage area (36.0 square kilometers) and a moderate average channel gradient (4.9%). The channel width was estimated to be 4-5 meters. Channel debris was moderate. A log jam at km 11.0 was considered to be a possible barrier to upstream fish movement. The streambed material was composed of gravel and cobble. The D-90 was estimated to be moderate. A few log jams and short cascade sections were present. The entire reach was surveyed for bull trout redds in 1982 but no redds were found. This reach was ~~not~~ surveyed for bull trout redds in 1983.

Reach 3

Reach 3 of Beaver Creek is a second order stream having a relatively small drainage area (15.0 square kilometers) and a moderate average channel gradient (5.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (55°F or 12.8°C) and conductivity during the low water period was low (102 micromhos). The late summer flow was 2.9 cfs. The stream had an average wetted width of 4.0 meters and was composed of 5% pool, 12% riffle, 80% run, and 3% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (11.0 per kilometer of stream). The streambed was comprised mainly of large gravel (49%) and cobble (19%) with lesser amounts of small gravel (16%), silt (11%), sand (3%), and boulder-bedrock (2%). D-90 was 18 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (88%) and channel stability was good (rating score = 64). There was a moderate amount of instream cover (37%) which was mostly comprised of logs and debris, Total overhead cover was abundant (72%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (67%).

Stream Features

Beaver dams were common in a 0.3 km length of stream in the vicinity of km 13.5.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 97 m section of this reach on 20 September 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was very high (285/300 m). The density of "cat-size" cutthroat trout (150 mm and longer) was low (18/300 m). A 4.5 km section (km 17.0-12.5) of the reach was surveyed for bull trout redds in 1982 but no redds were found. This reach was not surveyed for bull trout redds in 1983.

BEAVER CREEK

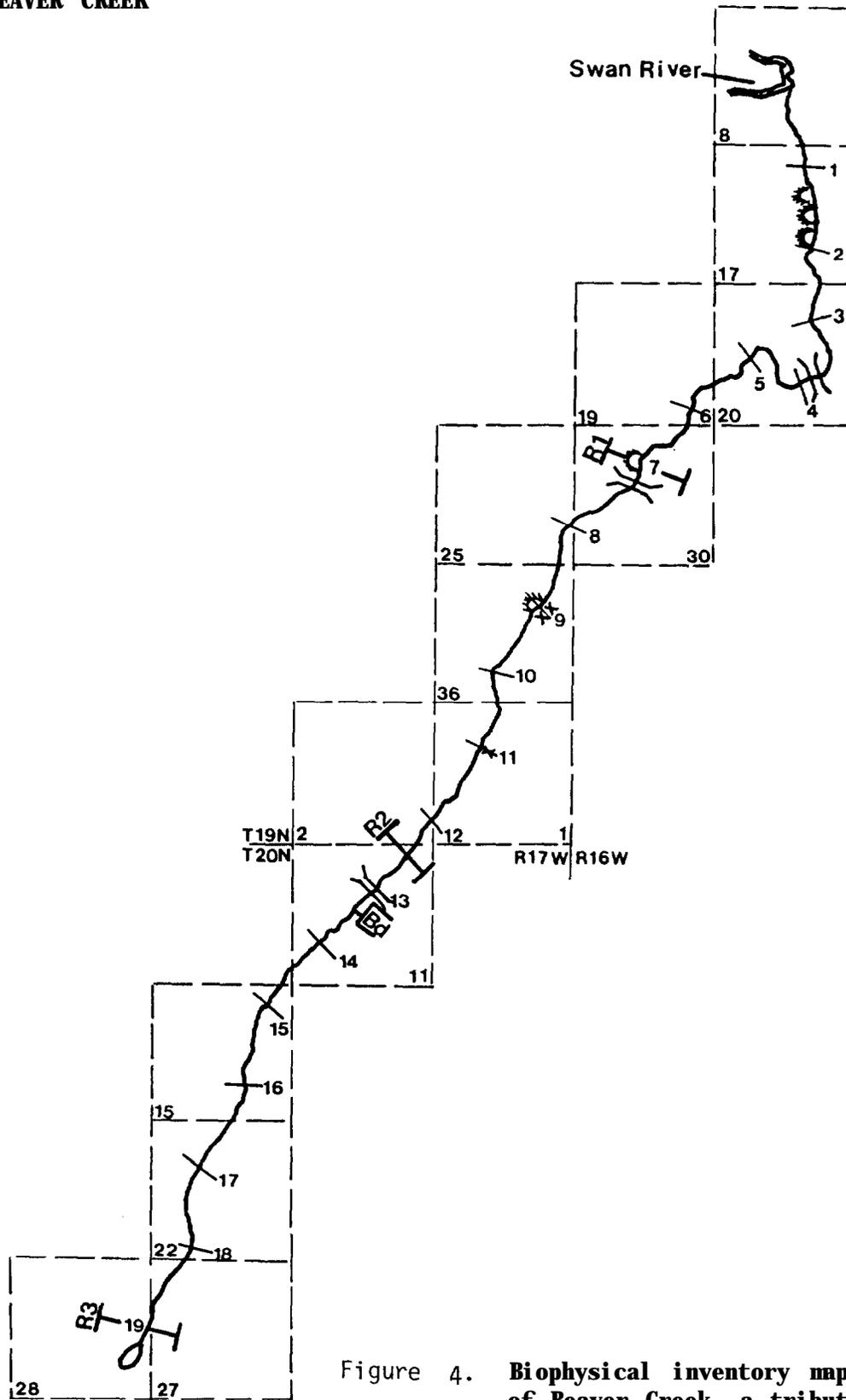


Figure 4. **Biophysical inventory map of Beaver Creek, a tributary to the Swan River.**

BETHAL CREEK

Locations of physical and chemical measurement stations
and other installations in Bethal Creek,
a tributary to Coat Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3	location of reach	
	km 0-2	Habitat survey section	8/13/82
	km 0.3-0.5	Electrofishing section	8/25/82;8/15/82
	km 0.2	Discharge measurement	8/16/82;10/19/83
	km 0.2	Water chemistry	9/21/83
	km 0.5	Max/min thermometer	8/26/82-11/8/82
	km 2.8	Proposed hydro diversion	
	km 0.0	Proposed hydro powerhouse	

Reach 1

Reach 1 of Bethal Creek is a third order stream having a relatively small drainage area (9.7 square kilometers) and a high average channel gradient (9.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was high (254 micromhos). The late summer flow was 3.8 cfs. The stream had an average wetted width of 3.5 meters and was comprised of 15% riffle, 52% run, and 33% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (4.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (34%) and large gravel (27%) with lesser amounts of cobble (25%), small gravel (12%), and sand (2%). D-90 was 39 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (35%) and channel stability was good (rating score = 70). There was a low amount of instream cover (11%) which was mostly comprised of debris and turbulence. Total overhead cover was low (40%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (19%).

Stream Features

There were numerous cascades from km 0.5 to km 1.0 which would likely prevent upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing an 84 m section of this reach on 26 August 1982. The density of 75 mm and longer bull trout (the only species captured) was low (75/300 m). The density of "catchable-sized" bull trout (150 mm and longer) was moderate (56/300 m). Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production.

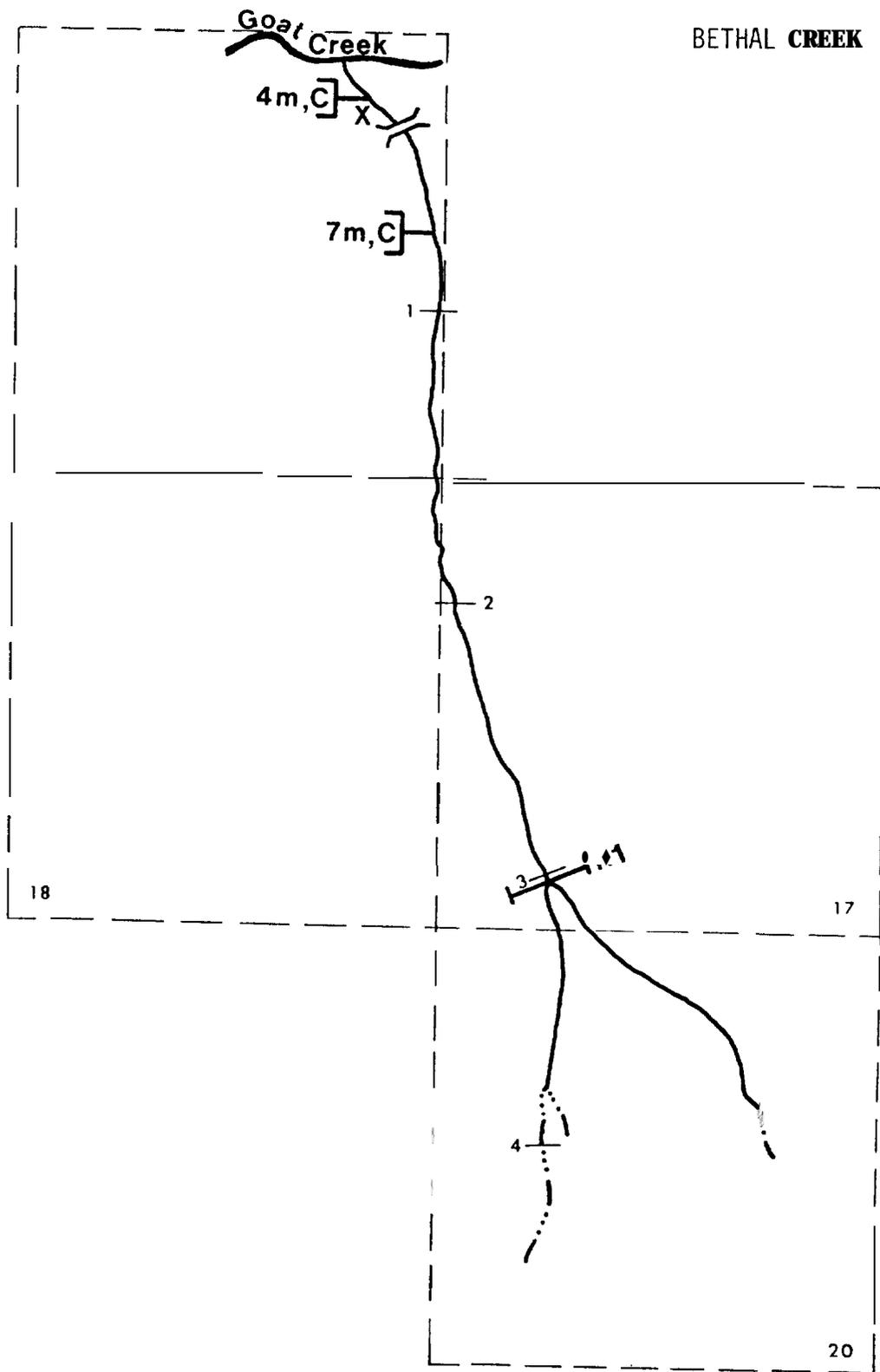


Figure 5. Biophysical inventory map of Bethal Creek, a tributary of Goat Creek.

BOND CREEK

Locations of physical and chemical measurement stations
and other installations in Bond Creek,
a tributary to Swan Lake.

<u>Reach</u>	<u>location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4.3	Location of reach	
	km 2.5-3.5	Habitat survey section	7/20/83
	km 2.7	Electrofishing section	8/13/82
	km 2.5	Discharge measurement	7/20/83
	km 0.8	Water chemistry	9/27/83
	km 2.7	Max/min thermometer	8/4/83-8/11/83
	km 0.5	Fish trap	4/22/83-7/18/83
2	km 4.3-8.5	location of reach	
	km 4.5-4.9	Instream flow transects	7/28/82-11/19/82
	km 5.3	(WETP) Proposed hydro diversion	

Reach 1

Reach 1 of Bond Creek is a third order stream having a relatively small drainage area (20.0 square kilometers) and a moderate average channel gradient (4.1%). The estimated maximum summer water temperature for this reach during 1983 was relatively cold (54°F or 12.2°C) and conductivity during the low water period was high (286 micranhos). The discharge during the habitat survey was 25.4 cfs and the estimated late summer flow was 6.0 cfs. The stream had an average wetted width of 6.0 meters and was comprised of 3% pool, 47% riffle, 40% run, and 10% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (3.0 per kilometer of stream). The streambed was comprised mainly of large gravel (39%) and cobble (33%) with lesser amounts of small gravel (10%), boulder-bedrock (10%), sand (7%), and silt (1%). D-90 was 33 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (33%) and channel stability was good (rating score = 68). There was a moderate amount of instream cover (23%) which was mostly comprised of debris and boulders. Total overhead cover was moderate (60%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (29%).

Stream Features

A few wasting banks were observed within the survey section. The creek splits into two channels at km 0.5. The north branch empties into Swan Lake while the south branch empties into a large marsh which lies at the southern end of Swan Lake.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 132 m section of this reach on 13 August 1982. Densities of fish 75 mm and longer were moderate for cutthroat trout (84/300 m), and moderate for brook trout (99/300 m). Moderate numbers of sculpins were also captured. Densities of "catchable-sized" trout (150 mm and longer) were low for cutthroat trout (18/300 m), and moderate for brook trout (43/300 m). A 3.8 km section (km 3.8 to km 0) of the reach was surveyed for bull trout redds in 1982, but no redds were found. This reach ~~was~~ not surveyed for bull trout redds in 1983. A limited amount of brook trout spawning was observed. A fish trap was installed in the lower end of the reach to monitor potential spawning ~~movements~~ and rates of juvenile emigration of cutthroat trout from 22 April to 18 July 1983. Only one adult cutthroat trout and very ~~few~~ juveniles were captured, indicating very low use by migratory fish.

Peach 2

This reach was not ground surveyed but was surveyed by helicopter on 16 September 1982. Peach 2 of Bond Creek is a third order stream having a relatively small drainage area (14.3 square kilometers) and a high average channel gradient (12.5%). The channel width was estimated to be 5 meters. Channel debris was low. The streambed material was composed of cobble and bedrock. The D-90 was estimated to be large. The stream cut through bedrock with numerous falls throughout the reach forming some extremely deep pools and complete barriers to ~~upstream~~ fish movement. The creek dries up for a length of 0.3 km in the vicinity of km 5.8.

BOND CREEK

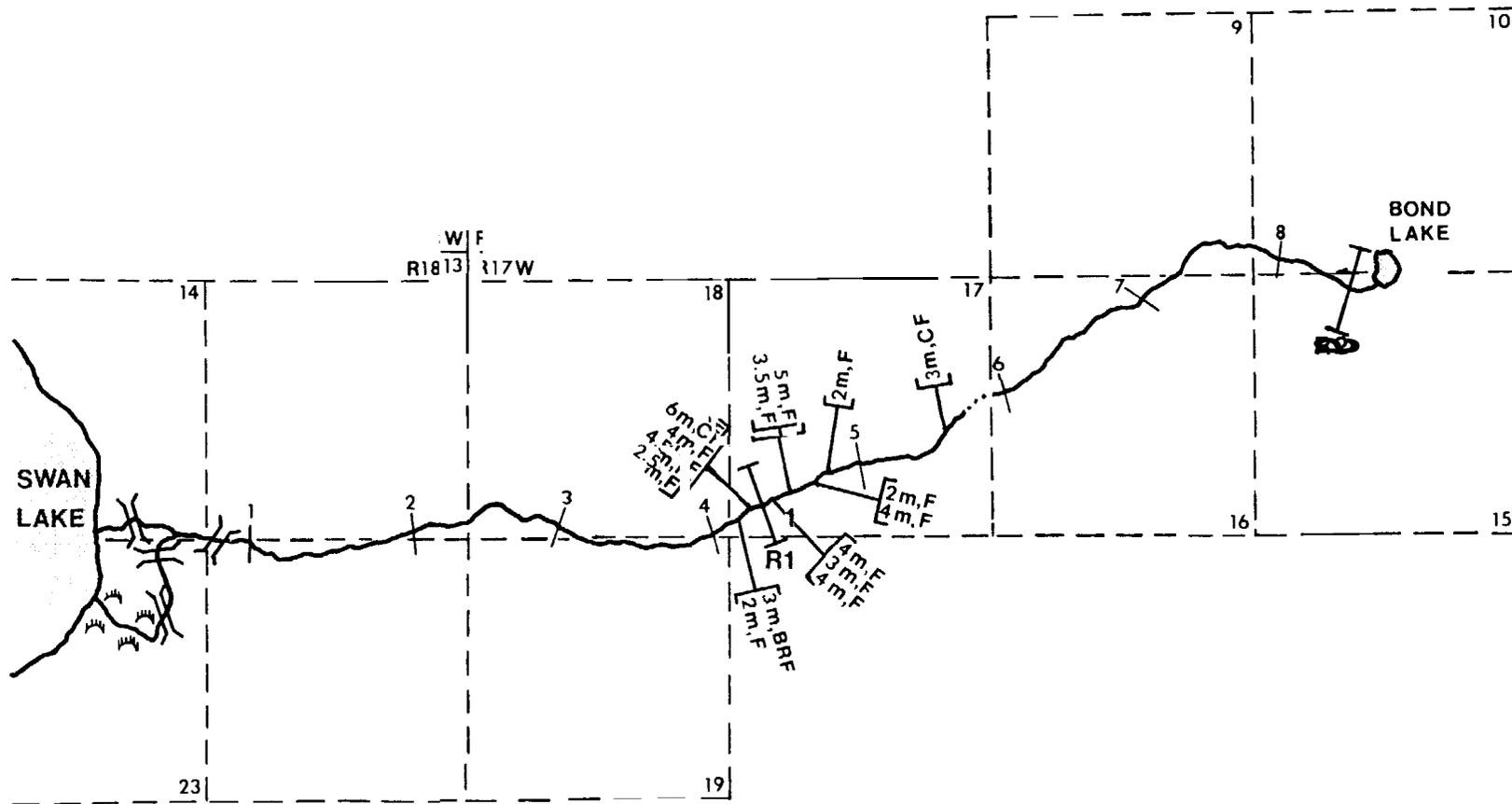


Figure 6. Biophysical inventory map of Bond Creek, a tributary to Swan Lake.

BUCK CREEK

Locations of physical and chemical measurement stations
and other installations in Buck Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0-2	Habitat survey section	8/17/83
	km 1	Electrofishing section	8/22/83
	km 0.7	Dischargemeasurement	8/22/83
	km 0.6	Water chemistry	9/22/83
2	km 2-5	Location of reach	
	km 2-4	Habitat survey section	8/15/83
	km 3.5	Electrofishing section	8/16/83
	km4	Discharge measurement	8/15/83
	km 3.5	Max/min thermometer	8/17/83-9/1/83
3	km 5-6	Location of reach	
	km 5-6	Habitat survey section	8/10/83
	km 5.9	Electrofishing section	8/11/83
	km6	Discharge measurement	8/10/83
	km5	Water chemistry	9/22/83
	km6	Max/min thermometer	8/10/83-8/17/83

Reach 1

Reach 1 of Buck Creek is a fourth order stream having a relatively small drainage area (26.2 square kilometers) and a low average channel gradient (2.3%). The conductivity during the low water period was high (323 micranhos). The discharge during the habitat survey was 2.8 cfs and the estimated late summer flow was 1.5 cfs. The stream had an average wettedwidth of 4.0 meters and was comprised of 3% pool, 32% riffle, 62% run, and 3% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (6.5 per kilometer of stream). The streambed was comprised mainly of large gravel (46%) and small gravel (22%) with lesser amounts of silt (11%), sand (10%) cobble (10%), and boulder-bedrock (1%). D-90 was 16 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was good (rating score = 75). There was a low amount of instream cover (18%) which was mostly comprised of logs and debris. Total overhead cover was low (29%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (22%).

Stream Features

Marshy areas were created by the numerous beaver dams located from km 1.5 to km 1.9.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 132 m section of this reach on 22 August 1983. Densities of fish 75 mm and longer were high for brook trout (294/300 m) and low for both bull trout (6/300 m) and rainbow trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were high for brook trout (66/300 m) and low for bull trout (3/300 m). There were no "catchable-sized" rainbow trout in the section. Based on electrofishing estimates, the reach was considered to be marginal for migratory bull trout production.

Reach 2

Reach 2 of Buck Creek is a fourth order stream having a relatively small drainage area (21.4 square kilometers) and a moderate average channel gradient (4.8%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (62°F or 16.7°C). The discharge during the habitat survey was 3.9 cfs and the estimated late summer flow was 2.1 cfs. The stream had an average wetted width of 4.4 meters and was comprised of 7% pool, 15% riffle, 75% run, and 3% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (3.5 per kilometer of stream). The streambed was comprised mainly of large gravel (42%) and silt (20%) with lesser amounts of small gravel (19%), cobble (12%), boulder-bedrock (4%), and sand (3%). D-90 was 16 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (43%) and channel stability was good (rating score = 71). There was a low amount of instream cover (14%) which was mostly comprised of aquatic vegetation and logs. Total overhead cover was moderate (46%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (36%).

Stream Features

From km 3.6 to km 3.7 the stream flowed through a marshy area and a shallow pond 75 m wide. The channel braided throughout this section.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 99 m section of this reach on 16 August 1983. Densities of fish 75 mm and longer were high for brook trout (183/300 m), and low for cutthroat (33/300 m). The density of "catchable-sized" trout (150 mm and longer) was high for brook trout (64/300 m), and low for cutthroat trout (7/300 m).

Peach 3

Reach 3 of Buck Creek is a third order stream having a relatively small drainage area (6.3 square kilometers) and a high average channel gradient (6.7%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was moderate (235 micromhos). The discharge during the habitat survey was 3.0 cfs and the estimated late summer flow was 1.4 cfs. The stream had an average wetted width of 2.9 meters and was comprised of 32% riffle, 40% run, and 28% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (14.0 per kilometer of stream). The streambed was comprised mainly of large gravel (47%) and cobble (29%) with lesser amounts of small gravel (12%) and boulder-bedrock (12%). D-90 was 30 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (40%) and channel stability was good (rating score = 66). There was a low amount of instream cover (18%) which was mostly comprised of debris and boulders. Total overhead cover was high (82%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (33%).

Stream Features

Log jams were numerous throughout the reach. Three of the log jams (located at km 5.4, km 5.5, and km 5.8) were barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 123 m section of this reach on 11 August 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was low (33/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was also low (5/300 m).

BUCK CREEK

19

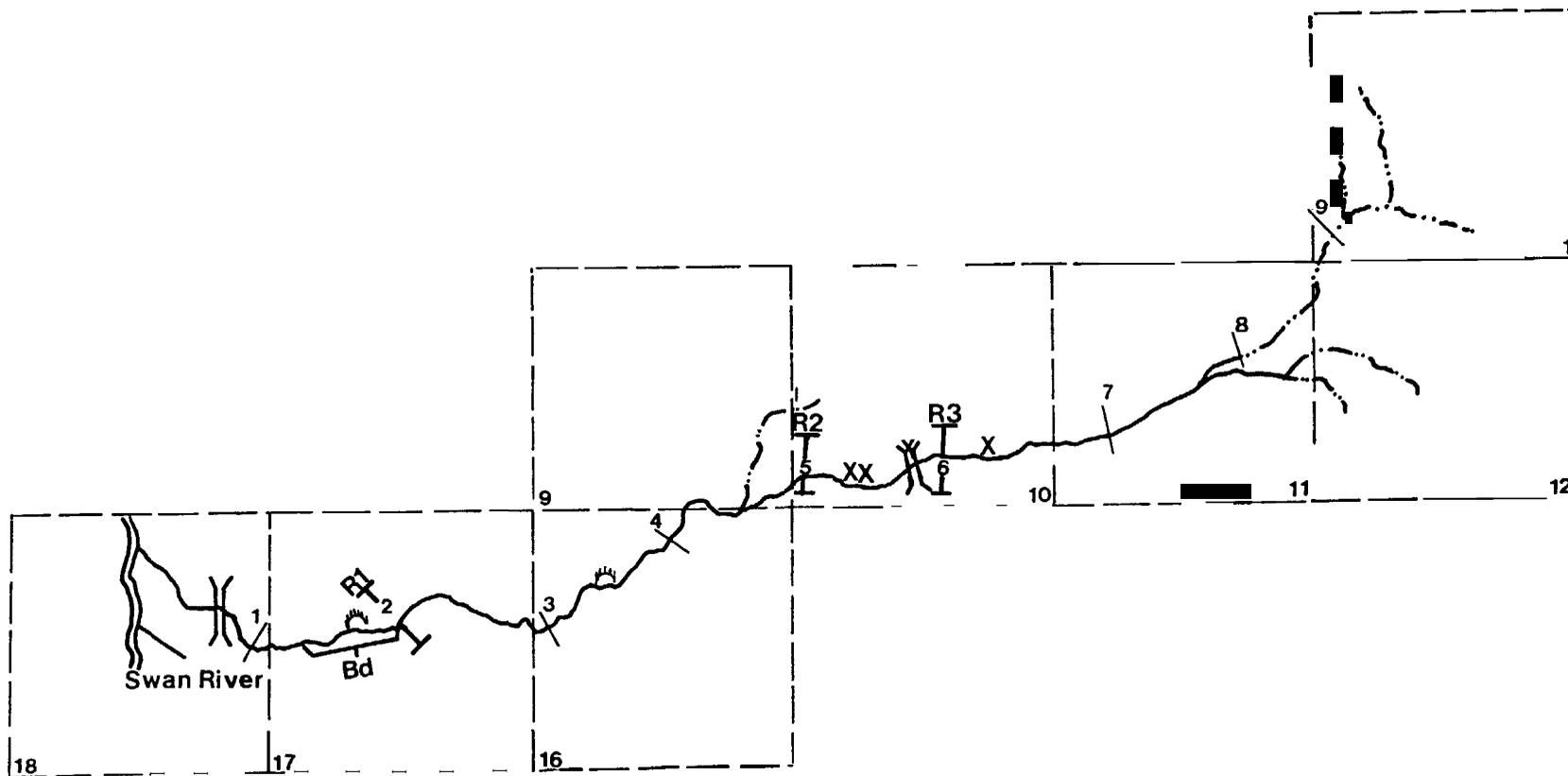


Figure 7. Biophysical inventory map of Buck Creek, a tributary of the Swan River.

CAT CREEK

locations of physical and chemical measurement stations
and other installations in Cat Creek,
a tributary to Dog Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Dat(s)</u>
1	km 0-2.5	location of reach	
	km2	Water chemistry	9/27/83
2	km 2.5-4.5	Location of reach	
	km 3-4	Habitat survey section	8/25/83
	km 3.5	Electrofishing section	8/29/83
	km 3.5	Discharge measurement	8/29/83
	km 2.5	Max/min thermometer	8/22/83-9/7/83

Reach 1

This reach was not ground surveyed but was surveyed by helicopter on 17 September 1982. Reach 1 of Cat Creek is a second order stream having a relatively small drainage area (7.4 square kilometers) and a high average channel gradient (8.8%). The channel width was estimated to be 1-2 meters. The streambed was composed of cobble and large gravel. The D-90 was estimated to be moderate.

Reach 2

Reach 2 of Cat Creek is a first order stream having a relatively small drainage area (4.5 square kilometers) and a high average channel gradient (22.6%). The estimated maximum summer water temperature for this reach during 1983 was moderate (59°F or 15.0°C) and conductivity during the low water period was low (140 micromhos). The discharge during the habitat survey was 1.6 cfs and the estimated late summer flow was 1.1 cfs. The stream had an average wetted width of 3.6 meters and was comprised of 20% riffle, 22% run, and 58% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (10.0 per kilometer of stream). The streambed was comprised mainly of large gravel (37%) and cobble (26%) with lesser amounts of boulder-bedrock (26%), silt (6%), small gravel (4%), and sand (1%). D-90 was 46 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (43%) and channel stability was good (rating score = 50). There was a moderate amount of instream cover (21%) which was mostly comprised of debris and boulders. Total overhead cover was abundant (76%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (74%).

Stream Features

Numerous log jams were present throughout the reach. A major log jam was located at km3.8. Cascade barriers were present at

km 3.7 and km 3.6. The flow was intermittent upstream of km 4.5.

Fish Populations and Spawning Use

A three-pass population estimate was obtained by electrofishing a 92 m section of this reach on 29 August 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was low (69/300 m). The density of "cat&able-sized" cutthroat trout (150 mm and longer) was also low (28/300 m).

CAT CREEK

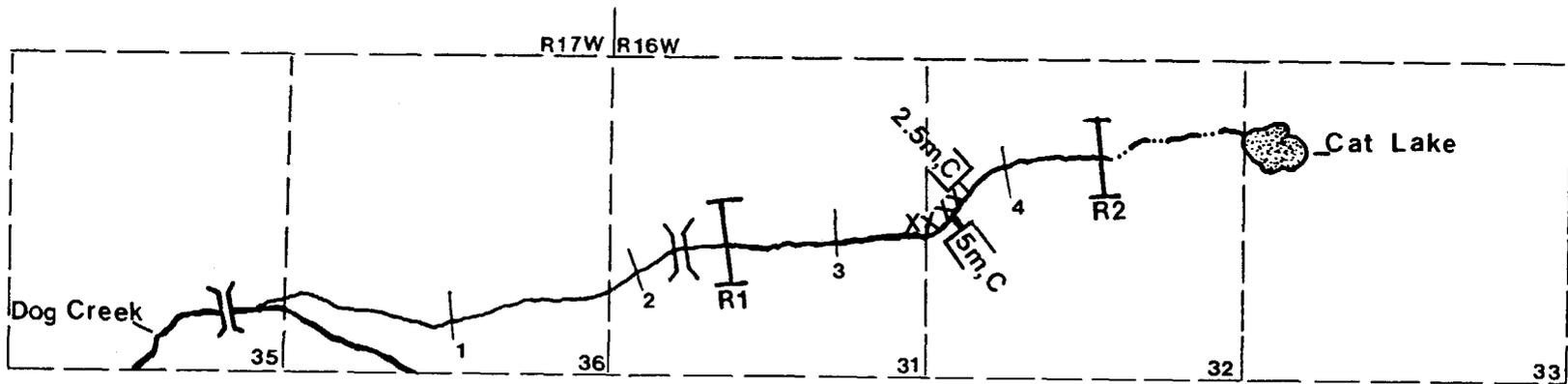


Figure 8. Biophysical inventory map of Cat Creek, a tributary of Dog Creek.

CEDAR CREEK

Locations of physical and chemical measurement stations
and other installations in Cedar Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-9.5	Location of reach	
	km 3-5	Habitat survey section	10/25/83
	km 4.7	Electrofishing section (survey)	9/30/83
	km 9.0	Electrofishing section (monitoring)	9/11/84-9/19/84
	km 3.1	Discharge measurement	10/26/83
	km 0.3	Water chemistry	9/27/83
	km 4.5	Max/min thermometer	8/16/83-9/1/83
	2	km 9.5-14.6	Location of reach
km 13-14		Habitat survey section	10/27/83
km 13.2		Electrofishing section (survey)	9/2/82
km 10.5		Electrofishing section (monitoring)	9/10/84-9/17/84
km 13.4		Electrofishing section (monitoring)	9/12/84-9/18/84
km 13.2		Discharge measurement	10/27/83
km 13.2		Water chemistry	9/27/83
km 13.2		Max/min thermometer	8/11/83-8/18/83
km 12.5		Instream flow transects (WEIP)	8/11/83-8/30/83
km 13.1		Proposed hydro diversion	
km 9.6		Proposed hydro powerhouse	

Reach 1

Reach 1 of Cedar Creek is a fourth order stream having a relatively large drainage area (63.0 square kilometers) and a low average channel gradient (1.4%). The estimated maximum summer water temperature for this reach during 1983 was moderate (**59°F** or **15.0°C**) and conductivity during the low water period was moderate (220 micromhos). The late summer flow was 14.9 cfs. The stream had an average wetted width of 7.1 meters and was comprised of 15% riffle, 80% run, and 5% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (9.0 per kilometer of stream). The streambed was comprised mainly of large gravel (45%) and small gravel (22%) with lesser amounts of cobble (15%), silt (10%), boulder-bedrock (5%), and sand (3%). D-90 was 25 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches

in the drainage. The reach had a high amount of channel debris (83%) and channel stability was good (rating score = 62). There was a high amount of instream cover (45%) which was mostly comprised of logs and debris. Total overhead cover was moderate (69%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (46%).

Stream Features

Beaver dams were numerous throughout this reach. At km 2.2 the stream channel braided for 300-500 meters. A beaver dam meadow occurred at km 9.5.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 90 m section of this reach on 30 September 1982. Densities of fish 75 mm and longer were high for brook trout (207/300 m), and low for cutthroat trout, bull trout, and rainbow trout (33, 3, and 9 fish/300 m, respectively). Densities of "catchable-sized" trout (150 mm and longer) were low for cutthroat, bull, brook, and rainbow trout (11, 3, 12, and 5 fish/300 m, respectively).

In addition, a 1,000 foot-long section of this reach was electrofished during the period 11 September through 19 September, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, densities of fish 75 mm and longer were extremely high for brook trout (442/300 m), and moderate for cutthroat trout (130/300 m). Densities of "catchable-sized" trout (150 mm and longer) were moderate for brook trout (40/300 m), and low for cutthroat trout (21/300 m).

The entire reach was surveyed for bull trout redds in 1982 and one redd was found. The stream was not surveyed for bull trout redds in 1983 or 1984. A substantial amount of brook trout spawning was observed. Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production.

Reach2

Reach 2 of Cedar Creek is a second order stream having a relatively small drainage area (28.8 square kilometers) and a high average channel gradient (9.0%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (**64°F** or **17.8°C**) and conductivity during the low water period was low (88 micromhos). The late summer flow was 4.2 cfs. The stream had an average wetted width of 5.3 meters and was comprised of 3% pool, 3% riffle, 57% run, and 37% pocketwater-cascade. There was a

moderate density of highquality (class I, II, and III) pools (8.0 per kilometer of stream). The streambed was comprised mainly of cobble (34%) and boulder-bedrock (30%) with lesser amounts of large gravel (19%), silt (11%), small gravel (4%), and sand (2%). D-90 was 41 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (45%) and channel stability was good (rating score = 60). There was a high amount of instream cover (52%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (63%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (16%).

Stream Features

There were numerous falls, cascades, and bedrock chutes between km 9.5 and 12.5 that were complete barriers to upstream fish movement. Streamflow diminished in marshy areas in the vicinity of km 16.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 118 m section of this reach on 2 September 1982. The density of 75 mm and longer cutthroat trout (the only species captured) was high (267/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was moderate (56/300 m).

In addition, two 1000 foot-long sections of this reach were electrofished during September, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, the density of 75 mm and longer cutthroat trout (the only species captured) at km 10.5 was high (236/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) at km 10.5 was moderate (40/300 m). The density of 75 mm and longer cutthroat trout (the only species captured) at km 13.4 was very high (302/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) at km 13.4 was high (97/300 m).

CEDAR CREEK

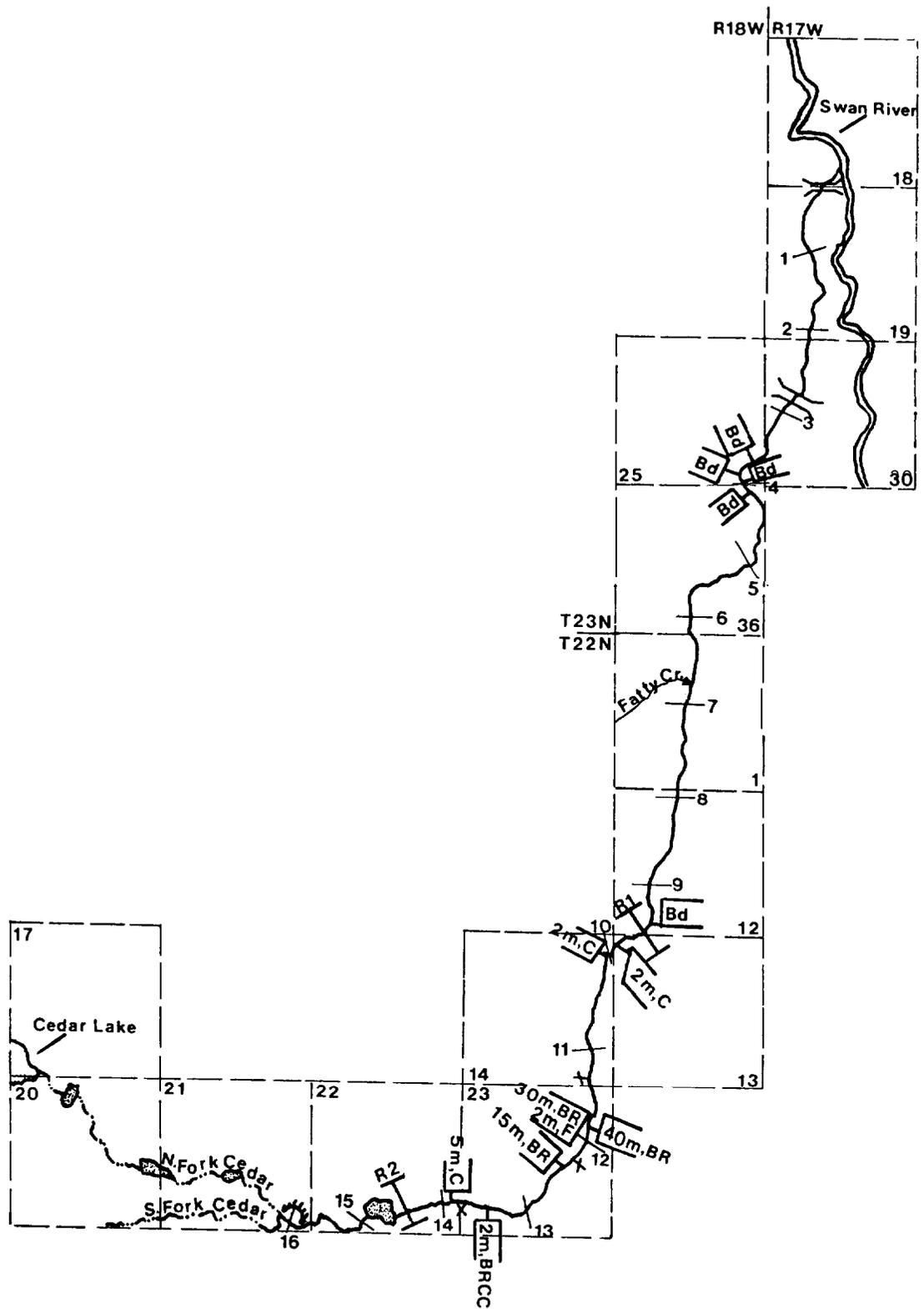


Figure 9. Biophysical inventory map of Cedar Creek, a tributary of the Swan River.

CILLY CREEK

Locations of physical and chemical measurement stations
and other installations in Cilly Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date (s)</u>
1	km 0-2	Location of reach	
	km 1-2	Habitat survey section	7/21/83
	km 1.3	Electrofishing section	7/25/83
	km 2	Discharge measurement	7/21/83
	km 0.9	Water chemistry	9/27/83
	km 1	Max/min thermometer	8/4/83-8/11/83
2	km 2-7	Location of reach	

Reach 1

Reach 1 of Cilly Creek is a third order stream having a relatively small drainage area (20.5 square kilometers) and a low average channel gradient (1.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (64°F or 17.8°C) and conductivity during the low water period was high (392 micromhos). The discharge during the habitat survey was 4.3 cfs and the estimated late summer flow was 1.0 cfs. The stream had an average wetted width of 3.5 meters and was comprised of 8% riffle, and 92% run. There was a low density of high quality (class I, II, and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of small gravel (34%) and silt (26%) with lesser amounts of sand (20%), large gravel (17%), cobble (2%), and boulder-bedrock (1%). D-90 was 7 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (73%) and channel stability was good (rating score = 75). There was a high amount of instream cover (58%) which was mostly comprised of debris and logs. Total overhead cover was abundant (88%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (76%).

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 111 m section of this reach on 25 July 1983. The density of 75 mm and longer brook trout (the only species captured) was high (252/300 m). The density of "catfish-sized" brook trout (150 mm and longer) was also high (75/300 m). A 2.2 km section (km 2.7 to 0.5) of the reach was surveyed for bull trout redds in 1982, but no redds were found. This reach was not surveyed for bull trout redds in 1983. A substantial amount of brook trout spawning was observed.

Reach 2

This reach was not ground surveyed, but was surveyed by helicopter on 17 September 1982. Reach 2 of Cilly Creek is a second order stream having a relatively small drainage area (18.4 square kilometers) and a moderate average channel gradient (4.0%). The channel width was estimated to be 1-2 meters. A road culvert at km 7.5 was considered to be a possible barrier to upstream fish movement. The streambed material was composed mostly of gravel. A .7 km section (km 2.7 to 2.0) was surveyed for bull trout redds in 1982 but no redds were found.

CILLY CREEK

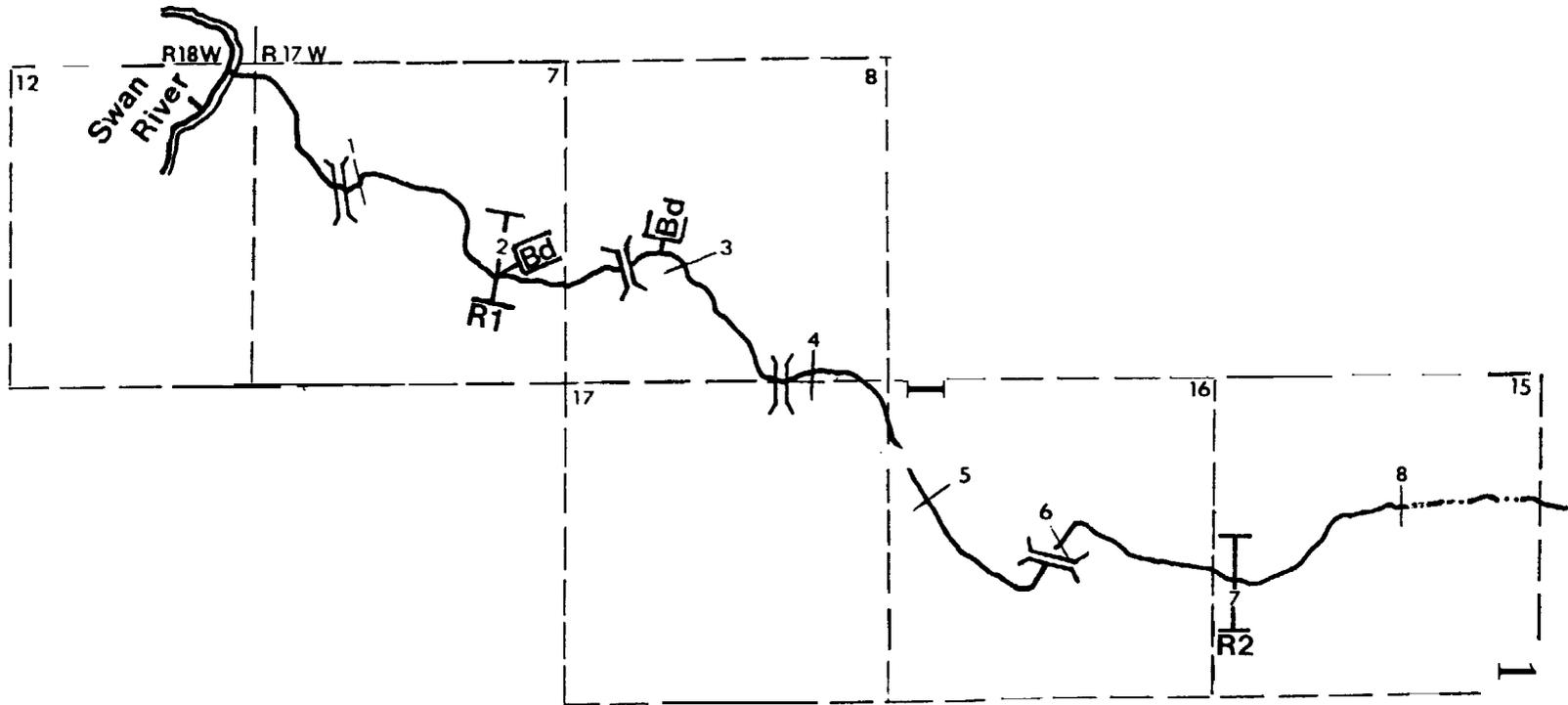


Figure 10. Biophysical inventory map of Cilly Creek, a tributary of the Swan River.

COLD CREEK

Locations of physical and chemical measurement stations
and other installations in Cold Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-8	Location of reach	
	km 4-6	Habitat survey section	10/24/83
	km 6	Electrofishing section	09/22/82
	km 6.5	Discharge measurement	10/24/83
	km 0.1	Water chemistry	09/27/83
2	km 8-17	Location of reach	
	km 9.7-11.7	Habitat survey section	11/09/83
	km 10.7	Electrofishing section (survey)	09/09/82
	km 8.4	Electrofishing section (monitoring)	08/29/84 - 09/06/84
	km 10.8	Electrofishing section (monitoring)	08/23/84 - 08/28/84
	km 14.0	Electrofishing section (monitoring)	08/22/84 - 08/27/84
	km 8.1	Water chemistry	09/27/83
	km 10.7	Max/Min thermometer	08/04/83 - 08/10/83
	km 8	Fish trap	09/01/83 - 10/14/83
	km 10.8	Instream flow transects (WETP)	08/03/83 - 11/16/83
	km 8	Thermograph	04/08/83 - 10/30/84
	km 8	Water level recorder	11/23/82 - 10/30/84
	km 13.4	Proposed hydro diversion	
	km 8.5	Proposed hydro powerhouse	

Reach 1

Reach 1 of Cold Creek is a fourth order stream having a relatively large drainage area (85.9 square kilometers) and a low average channel gradient (0.6%). The conductivity during the low water period was moderate (189 micromhos). The late summer flow was 27.4 cfs. The stream had an average wetted width of 8.8 meters and was comprised of 10% pool, 5% riffle, and 85% run. There was a moderate density of high quality (class I, II, and III) pools (8.0 per kilometer of stream). The streambed was comprised mainly of large gravel (47%) and small gravel (26%) with lesser amounts of silt (16%), sand (7%), and cobble (4%). D-90 was 16 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other

stream reaches in the drainage. The reach had a moderate amount of channel debris (45%) and channel stability was good (rating score = 69). There was a moderate amount of instream cover (27%) which was mostly comprised of logs and debris. Total overhead cover was low (23%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (21%).

Stream Features

Beaver dams were located at km 4.2 and km 4.3.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 131 m section of this reach on 22 September 1982. Densities of fish 75 mm and longer were low for both brook trout (57/300 m), and bull trout (9/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both brook trout (12/300 m), and bull trout (3/300 m). Moderate numbers of sculpins were also captured. Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production. The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984 and 0, 1, and 2 redds were found respectively.

Reach 2

Reach 2 of Cold Creek is a second order stream having a medium-sized drainage area (35.2 square kilometers) and a moderate average channel gradient (5.0%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (53°F or 11.7°C) and conductivity during the low water period was moderate (168 micromhos). The estimated late summer flow was 24.0 cfs. The stream had an average wetted width of 7.3 meters and was comprised of 10% pool, 2% riffle, 30% run, and 58% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (24 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (43%) and cobble (42%) with lesser amounts of large gravel (9%), sand (3%), silt (2%), and small gravel (1%). D-90 was 96 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (33%) and channel stability was good (rating score = 56). There was a high amount of instream cover (46%) which was mostly comprised of debris and boulders. Total overhead cover was abundant (71%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (41%).

Stream Features

This reach contained numerous small log jams and cascades which limited the ability of spawning migratory adult bull trout to negotiate this reach. Bull trout redds were not observed above km 13.7.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 115 m section of this reach on 9 September 1982. Densities of fish 75 mm and longer were high for bull trout (270/300 m), low for brook trout (6/300 m), and low for cutthroat trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were high for bull trout (71/300 m), low for brook trout (3/300 m), and low for cutthroat trout (3/300 m).

In addition, three 1,000 foot-long sections of this reach (at kilometers 8.4, 10.8, and 14.0) were electrofished during August and September of 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, densities of fish 75 mm and longer at km 8.4 were high for brook trout (253/300 m), moderate for bull trout (93/300 m), and low for cutthroat trout (10/300 m). Densities of "catchable-sized" trout (150 mm and longer) were high for brook trout (65/300 m), and low for both bull trout (11/300 m), and cutthroat trout (6/300 m).

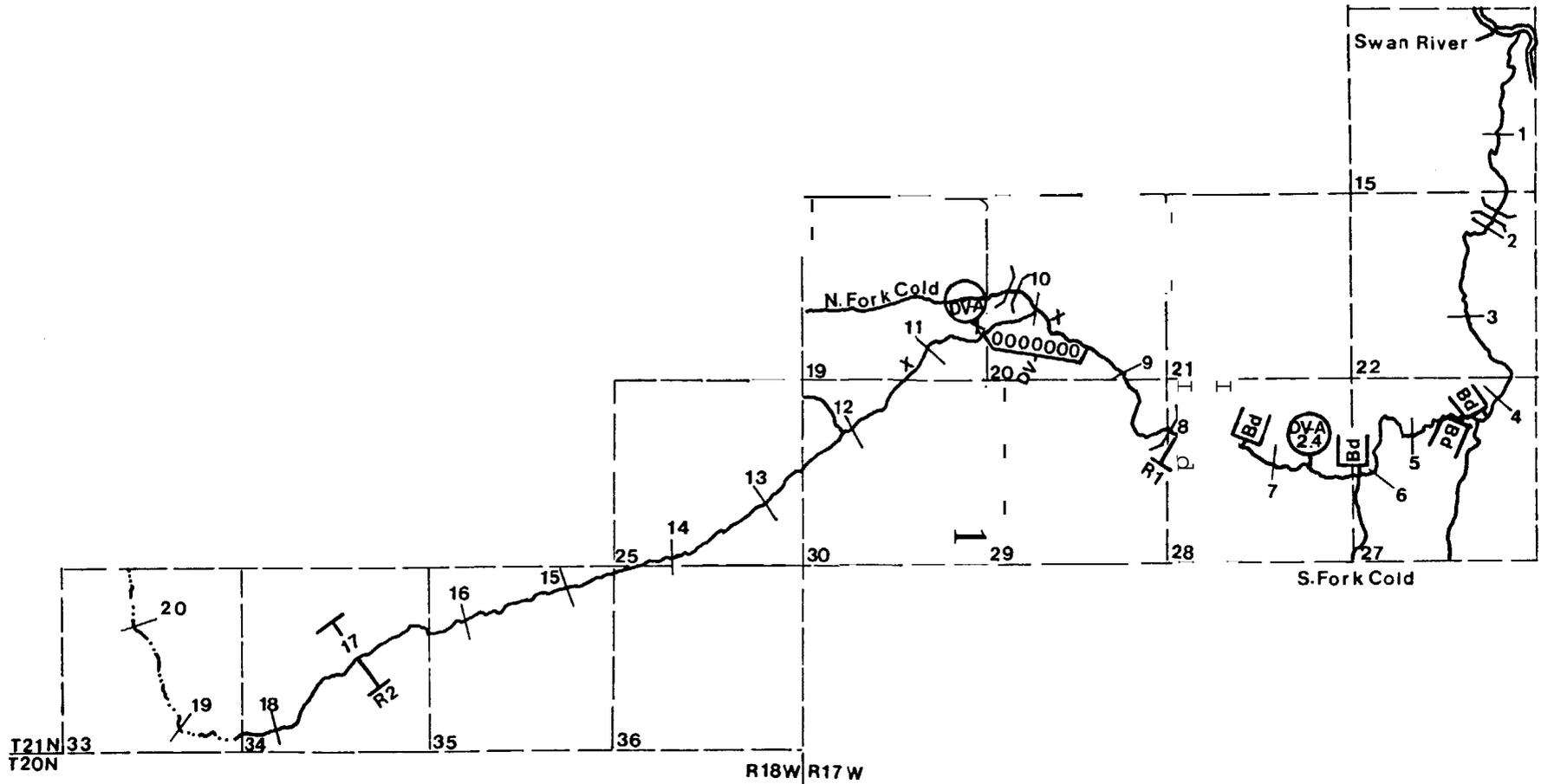
At km 10.8, the density of bull trout 75 mm and longer was high (170/300 m). Three cutthroat trout were captured at km 10.8, but an accurate population estimate could not be calculated. The density of "catchable-sized" bull trout (150 mm and longer) was high (71/300 m).

At km 14.0, the density of bull trout (the only species captured) that were 75 mm and longer was low (49/300 m). The density of "catchable-sized" bull trout (150 mm and longer) was moderate (35/300 m).

The entire reach was surveyed for bull trout redds in 1982 and one possible redd was found. A 6.5 km section (km 8.0 - km 14.5) of the reach was surveyed for bull trout redds in 1983 and eight redds were found. A 6.5 km section (km 8.0 - km 14.5) of the reach was again surveyed for bull trout redds in 1984 and four redds were found. A fish trap was installed in the lower end of the reach to monitor potential spawning movements of bull trout during the period 1 September to 14 October 1983. A total of five adult bull trout (478 to 616 mm) were tagged and released. Based on electrofishing estimates and redd counts, the reach was considered to be important for migratory bull trout production.

COLD CREEK

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11. Biophysical inventory map of Cold Creek, a tributary of the Swan River.

CONDON CREEK

Locations of physical and chemical measurement stations
and other installations in Condon Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-6	location of reach	
	km 2.5-4.5	Habitat survey section	9/20/83
	km 4.2	Electrofishing section	9/21/83
	km 4.5	Discharge measurement	9/20/83
	km 1.1	Water chemistry	9/27/83
	km 4.5	Max/min thermometer	8/11/83-8/18/83
2	km 6-9	Location of reach	
	km 6.5-8.5	Habitat survey section	7/27/83
	km 8.3	Electrofishing section	7/28/83
	km 8.5	Discharge measurement	7/27/83
	km 6.7	Water chemistry	9/27/83
3	km 9-13	Location of reach	

Peach 1

Reach 1 of Condon Creek is a fourth order stream having a relatively large drainage area (74.5 square kilometers) and a low average channel gradient (0.5%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (64°F or 17.8°C) and conductivity during the low water period was moderate (222 micromhos). The late summer flow was 2.7 cfs. The stream had an average wetted width of 5.5 meters and was comprised of 42% pool, 3% riffle, and 55% run. There was a moderate density of high quality (class I, II, and III) pools (8.5 per kilometer of stream). The streambed was comprised mainly of silt (78%) with lesser amounts of large gravel (11%), small gravel (7%), and sand (4%). D-90 was 4 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (15%) and channel stability was fair (rating = 81). There was a high amount of instream cover (71%) which was mostly comprised of aquatic vegetation and debris. Total overhead cover was moderate (42%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (36%).

Stream Features

Beaver dams were numerous from km 3.0 to km 4.2. The stream flows through a marshy area from km 2.0 to 1.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 107 m section of this reach on 21 September 1983. Densities of

fish 75 mm and longer were high for brook trout (399/300 m) and low for bull trout (3/300 m) and rainbow trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were very high for brook trout (120/300 m) and low for rainbow trout (1/300 m). Based on electrofishing estimates, the reach was considered to be marginal for migratory bull trout production. The stream was not surveyed for bull trout redds.

Reach 2

Reach 2 of Condon Creek is a second order stream having a relatively small drainage area (8.3 square kilometers) and a moderate average channel gradient (5.1%). The conductivity during the low water period was low (146 micromhos). The discharge during the habitat survey was 7.0 cfs and the estimated late summer flow was 2.1 cfs. The stream had an average wetted width of 3.7 meters and was comprised of 3% pool, 15% riffle, 52% run, and 30% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (11.0 per kilometer of stream). The streambed was comprised mainly of large gravel (47%) and small gravel (17%) with lesser amounts of cobble (14%), sand (9%), boulder-bedrock (7%), and silt (6%). D-90 was 30 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (58%) and channel stability was good (rating score = 68). There was a moderate amount of instream cover (29%) which was mostly comprised of logs and debris. Total overhead cover was abundant (80%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (43%).

Stream Features

A large log jam was located at km 8.0 and channel braiding occurred at km 7.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 97 m section of this reach on 28 July 1983. Densities of fish 75 mm and longer were low for cutthroat trout (75/300 m), and moderate for brook trout (144/300 m). Densities of "catchable-sized" trout (150 mm and longer) were moderate for both cutthroat trout (49/300 m), and brook trout (50/300 m).

Reach 3

This reach was not ground surveyed but was surveyed by helicopter on 18 September 1982. Reach 3 of Condon Creek is a second order stream having a relatively small drainage area (7.1 square kilometers) and a high average channel gradient (21.3%). The channel width was estimated to be 3 meters. Channel debris was moderate. The streambed

material was composed of cobble and boulders. The D-90 was estimated to be large. The reach was characterized by cascades, some of which possibly form barriers to upstream fish movement.

CONDON CREEK

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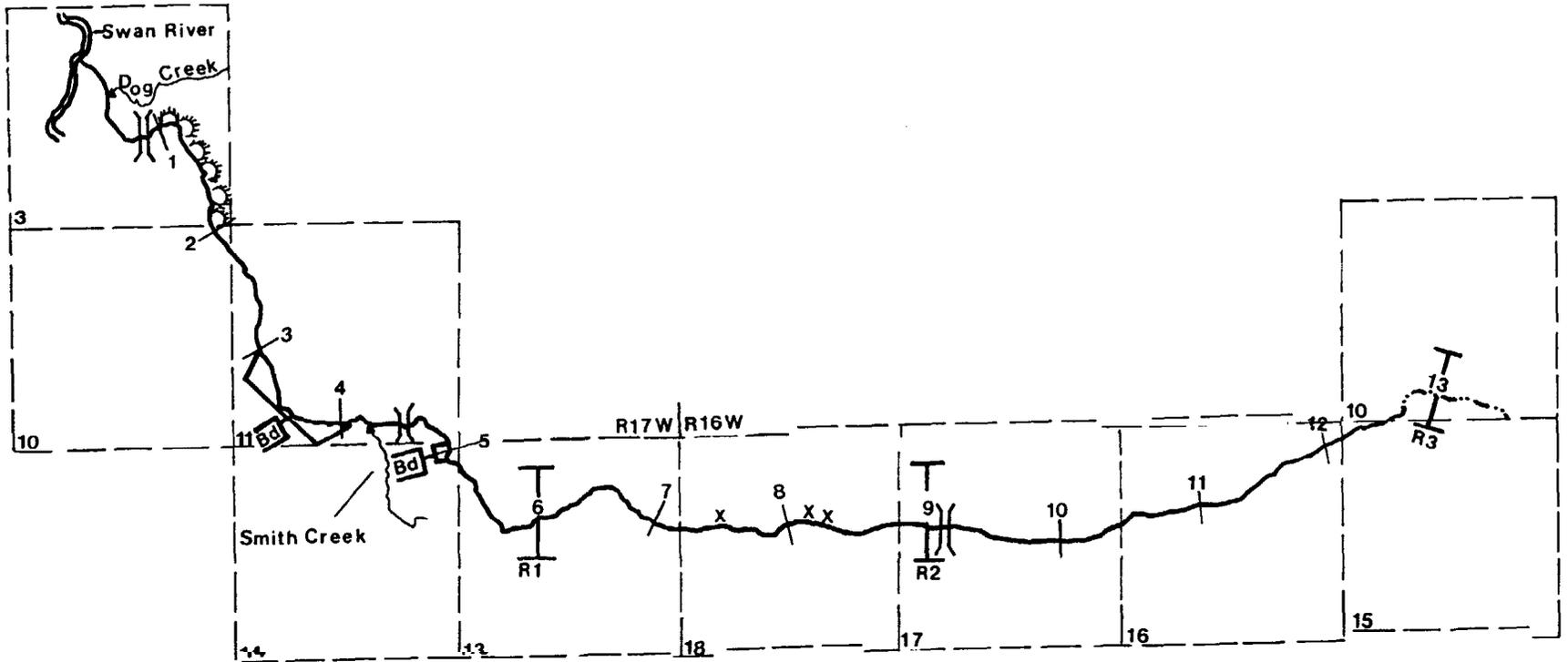


Figure 12. Biophysical inventory map of Condon Creek, a tributary of the Swan River.

COONEY CREEK

Locations of physical and chemical measurement stations
and other installations in Cooney Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4.5	Location of reach	
	km 2.5-4.5	Habitat survey section	7/26/83
	km4	Electrofishing section	7/27/83
	km 4.5	Discharge measurement	7/26/83
	km 0.3	Water chemistry	9/22/83
	km4	Max/min thermometer	8/11/83-8/18/83
	km 4.5-8	Location of reach	
	km 5-6	Habitat survey section	7/21/83
	km 5.1	Electrofishing section	7/26/83
	km 5.1	Discharge measurement	7/25/83
	km 4.8	Water chemistry	9/22/83
	km 5.1	Max/min thermometer	8/11/83-9/15/83

Reach 1

Reach 1 of Cooney Creek is a third order stream having a relatively small drainage area (18.7 square kilometers) and a moderate average channel gradient (4.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (55°F or 12.8°C) and conductivity during the low water period was moderate (249 micromhos). The discharge during the habitat survey was 17.3 cfs and the estimated late summer flow was 5.2 cfs. The stream had an average wetted width of 5.4 meters and was comprised of 40% riffle, 20% run, and 40% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (4.0 per kilometer of stream). The streambed was comprised mainly of cobble (42%) and large gravel (42%) with lesser amounts of small gravel (7%), boulder-bedrock (7%), sand (1%), and silt (1%). D-90 was 41 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (45%) and channel stability was fair (rating score = 82). There was a low amount of intream cover (19%) which was mostly comprised of debris and boulders. Total overhead cover was moderate (67%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (38%).

Stream Features

From km 1.0 to km 1.5 the stream channel was braided. A beaver dam and 0.5 km long pond were located at km 2.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 112 m section of this reach on 27 July 1983. Densities of fish 75 mm and longer were moderate for cutthroat trout (93/300 m) , and

low for bull trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both cutthroat trout (25/300 m), and bull trout (3/300 m). The entire reach was surveyed for bull trout redds in 1982 and no redds were found. This reach was not surveyed for bull trout redds in 1983.

Reach 2

Reach 2 of Cooney Creek is a second order stream having a relatively small drainage area (11.8 square kilometers) and a high average channel gradient (12.4%). The estimated maximum summer water temperature for this reach during 1983 was moderate (57°F or 13.9°C) and conductivity during the low water period was moderate (208 micranhos). The discharge during the habitat survey was 24.7 cfs and the estimated late summer flow was 5.9 cfs. The stream had an average wetted width of 5.5 meters and was comprised of 8% riffle, 27% run, and 65% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (9.5 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (41%) and large gravel (31%) with lesser amounts of cobble (24%), small gravel (3%), and silt (1%). D-90 was 68 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (20%) and channel stability was good (rating score = 58). There was a moderate amount of instream cover (29%) which was mostly comprised of debris and boulders. Total overhead cover was moderate (48%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (24%).

Stream Features

An 8 m bedrock cascade at km 8.5 forms a definite barrier to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 111 m section of this reach on 26 July 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was moderate (135/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was low (28/300 m).

COONEY CREEK

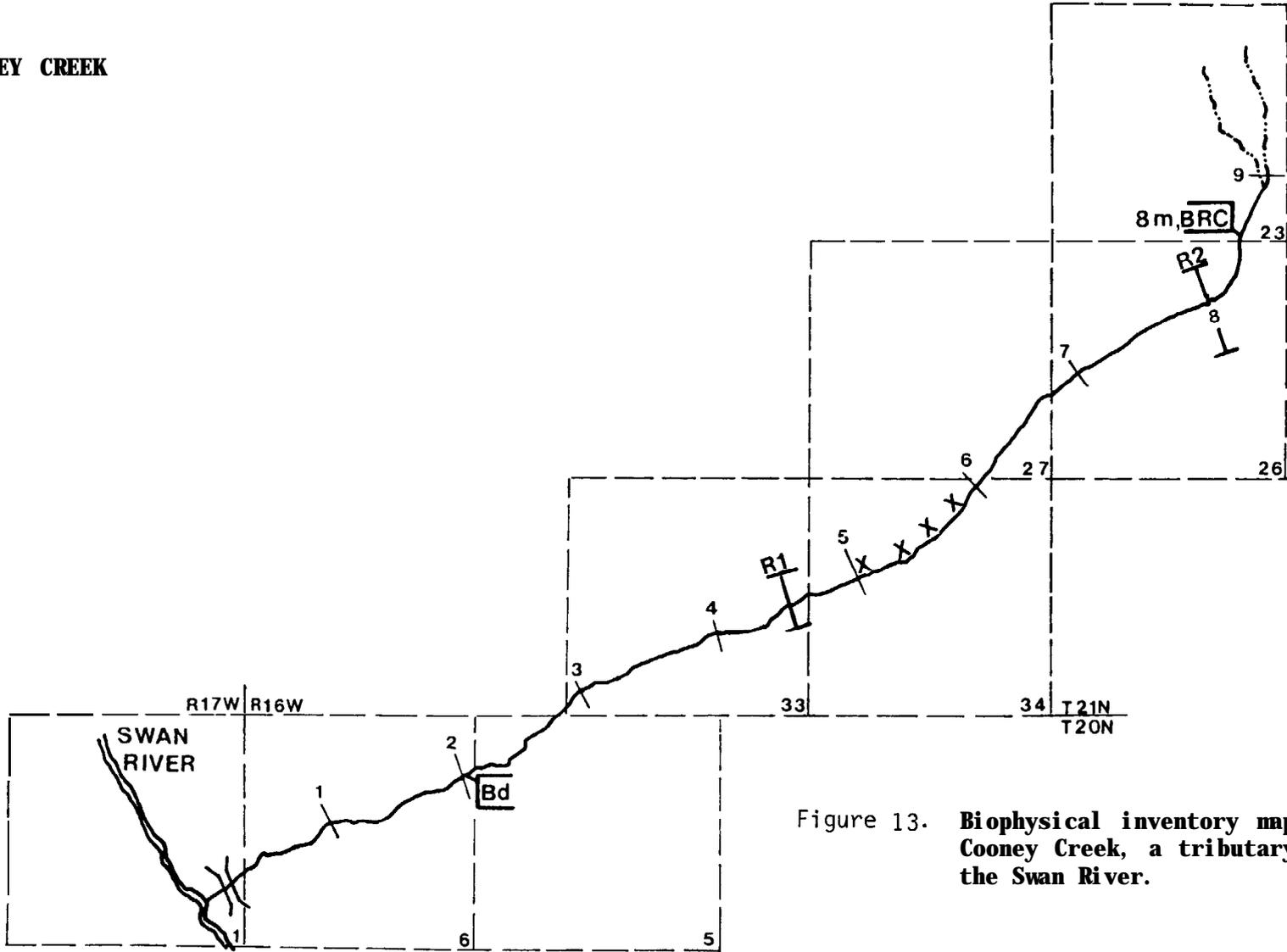


Figure 13. **Biophysical inventory map of Cooney Creek, a tributary of the Swan River.**

CRAZY HORSE CREEK

Locations of physical and chemical measurement stations and other installations in Crazy Horse Creek, a tributary to Glacier Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-1.5 km 0.5	Location of reach Water chemistry	9/22/83
2	km 1.5-6 km 3.7-1.7 km 2.2 km 0.1 km 3.1	Location of reach Habitat section survey Electrofishing section Discharge measurement Max/min thermometer	8/24/83 10/5/83 8/24/83 8/24/83-10/5/83

Reach 1

Reach 1 was not ground surveyed but was surveyed by helicopter on 19 September 1982. Reach 1 of Crazy Horse Creek is a third order stream having a relatively small drainage area (17.2 square kilometers) and a high average channel gradient (10.0%). The channel width was estimated to be 4 meters. Channel debris was moderate. The substrate consisted of boulder and cobble. D-90 was high. Numerous cascades throughout the reach form definite barriers to upstream fish movement.

Reach 2

Reach 2 of Crazy Horse Creek is a third order stream having a relatively small drainage area (16.4 square Kilometers) and a moderate average channel gradient (4.3%). The estimated maximum summer water temperature for this reach during 1983 was moderate (58°F or 14.4°C) and conductivity during the low water period was low (90 micranhos). The discharge during the habitat survey was 8.2 cfs and the estimated late summer flow was 5.5 cfs. The stream had an average wetted width of 6.3 meters and was comprised of 10% pool, 8% riffle, 65% run, and 17% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (5.0 per Kilometer of stream). The streambed was comprised mainly of boulder-bedrock (49%) and cobble (26%) with lesser amounts of large gravel (21%), and small gravel (4%). D-90 was 51 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (18%) and channel stability was good (rating score = 58). There was a low amount of instream cover (9%) which was mostly comprised of boulders and debris. Total overhead cover was low (31%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (23%).

Stream Features

Numbrous bedrock falls, chutes and cascades form definite barriers to upstream fish movement in this reach. The stream becomes intermittent at km 6.0.

Fish Populations and Spawning Use

A 110 m section of this reach was electrofished on 5 October 1983, however no fish were captured.

CRAZY HORSE CREEK

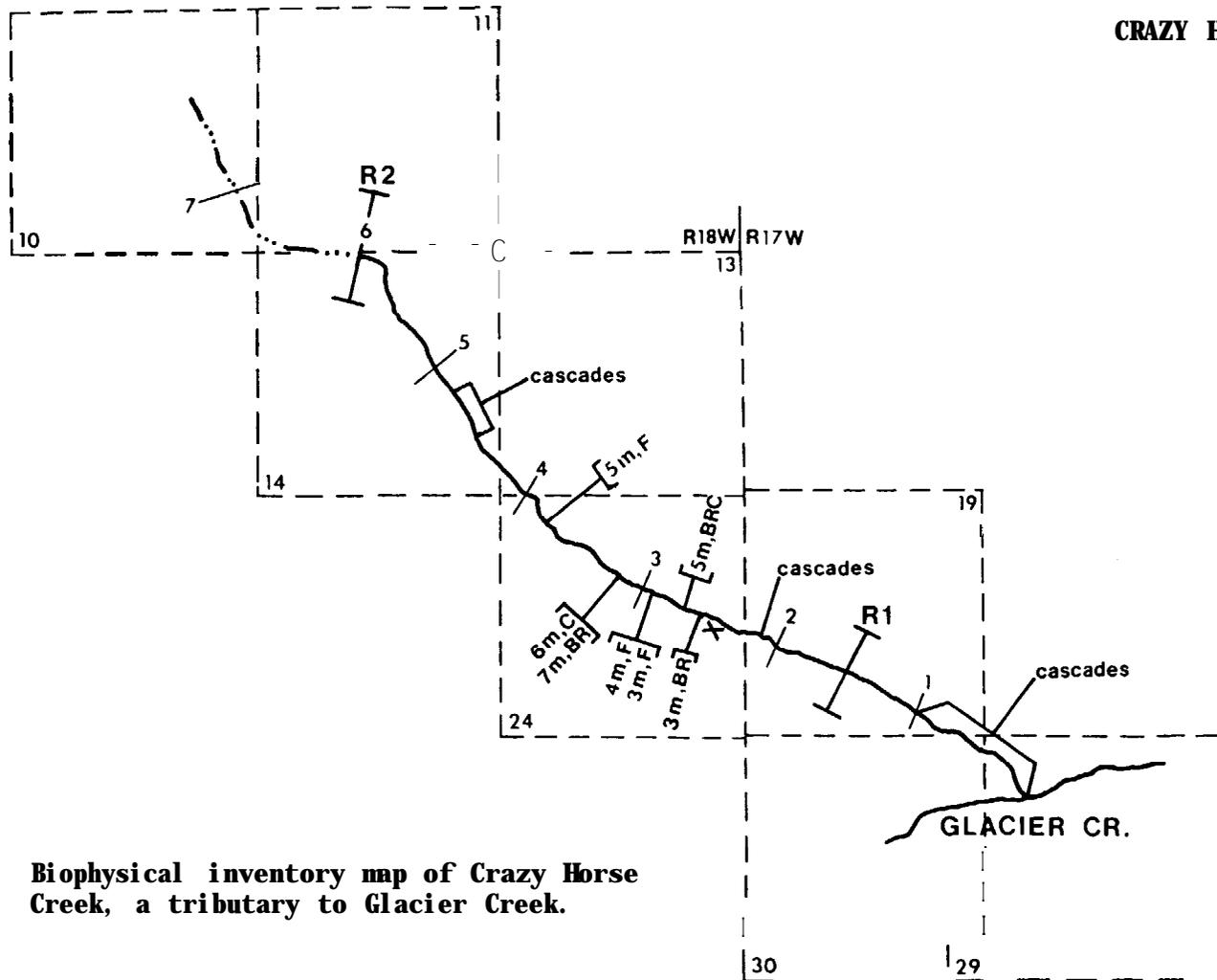


Figure 14- Biophysical inventory map of Crazy Horse Creek, a tributary to Glacier Creek.

DOG CREEK

Locations of physical and chemical measurement stations
and other installations in Dog Creek,
a tributary to Condon Creek.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-5.5	Location of reach	
2	km 5.5-9.5	Location of reach	
	km 5.5-7.5	Habitat survey section	9/7/83
	km 6.5	Electrofishing section	9/8/83
	km 7	Discharge measurement	9/7/83
	km 5.6	Water chemistry	9/27/83
	km 5.6	Max/min thermometer	8/10/83-8/18/83

Reach 1

This reach was not ground surveyed but was surveyed by helicopter on 17 September 1982. Peach 1 of Dog Creek is a third order stream having a relatively small drainage area (11.0 square kilometers) and a moderate average channel gradient (3.7%). The channel width was estimated to be 4 meters. Channel debris was moderate and no fish barriers were observed. The streambed material was composed mostly of gravel.

Fish Populations and Spawning Use

A one-pass population estimate was obtained by other Montana Department of Fish, Wildlife and Park's personnel who electrofished a 183 m section of this reach (at km 2.6) on 10 August 1971. Densities of fish 75 mm and longer were low for cutthroat trout (17/300 m) and bull trout (3/300 m), and moderate for brook trout (123/300 m). The entire reach was surveyed for bull trout redds in 1982. No bull trout redds were found although a substantial amount of brook trout spawning was observed. This reach was not surveyed for bull trout redds in 1983.

Peach 2

Peach 2 of Dog Creek is a third order stream having a relatively small drainage area (11.0 square kilometers) and a high average channel gradient (16.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (55°F or 12.8°C) and conductivity during the low water period was low (135 micranhos). The late summer flow was 6.6 cfs. The stream had an average wetted width of 5.0 meters and was comprised of 5% pool, 5% riffle, 27% run, and 63% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (13.5 per kilometer of stream). The streambed was comprised mainly of cobble (39%) and boulder-bedrock (38%) with lesser amounts of large gravel (19%), small gravel (3%), sand (1%). D-90 was 102 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison

to other stream reaches in the drainage. The reach had a low amount of channel debris (30%) and channel stability was good (rating score = 62). There was a moderate amount of instream cover (22%) which was mostly comprised of boulders and debris. Total overhead cover was abundant (79%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (40%).

Stream Features

This reach contains numerous falls, chutes, and cascades which form barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 101 m section of this reach on 8 September 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was moderate (84/300 m). The density of "cat&able-sized" cutthroat trout (150 mm and longer) was high (78/300 m). A 1.5 km section (km 7.0-5.5) of the reach was surveyed for bull trout redds in 1982 but no redds were found. The reach was not surveyed for bull trout redds in 1983.

DOG CREEK

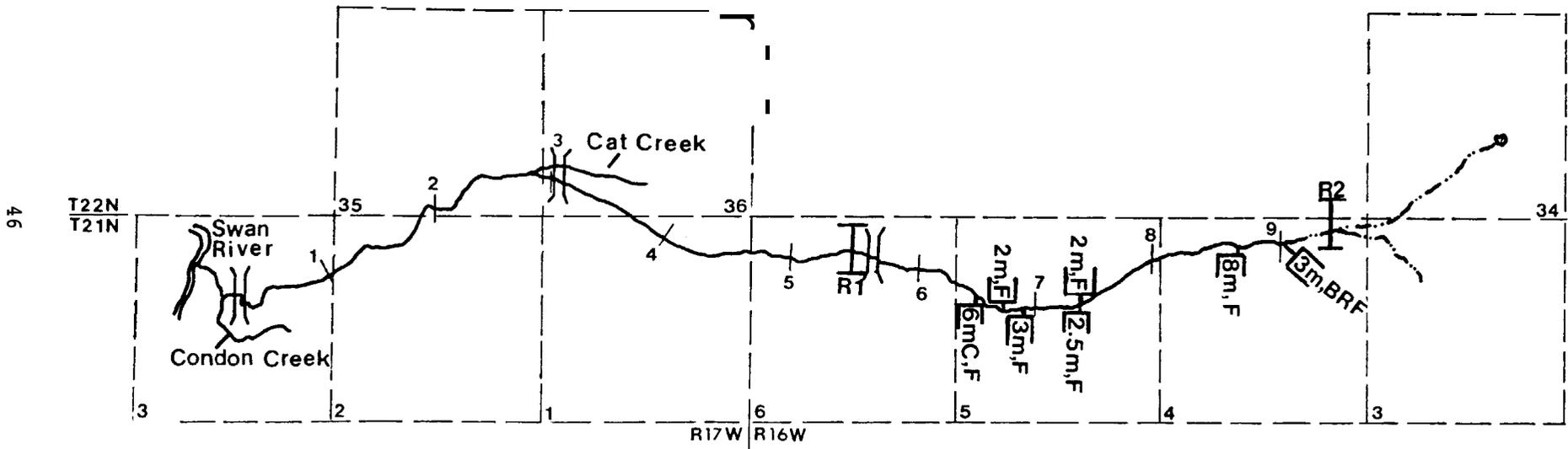


Figure 15 Biophysical inventory map of Dog Creek, a tributary of Condon Creek.

ELK CREEK

Locations of physical and chemical measurement stations
and other installations in Elk Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-9	Location of reach	
	km 3-5	Habitat survey section	10/06/83
	km5	Electrofishing section	10/14/83 - 10/18/83
	km5	Discharge measurement	10/06/83
	km 0.6	Water chemistry	09/29/83
	km5	Max/min thermometer	08/03/83 -
	km 6.6	Instream flow transects (WEIP)	07/20/84 - 09/07/84
2	km 9-16.2	Location of reach	

Reach 1

Reach 1 of Elk Creek is a fourth order stream having a relatively large drainage area (71.9 square kilometers) and a low average channel gradient (1.7%). The estimated maximum summer water temperature for this reach during 1983 was moderate (**58°F** or **14.4°C**) and conductivity during the low water period was moderate (167 micromhos). The late summer flow was 31.4 cfs. The stream had an average wetted width of 11.7 meters and was comprised of 8% pool, 17% riffle, 55% run, and 20% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (6.0 per kilometer of stream). The streambed was comprised mainly of large gravel (30%) and cobble (29%) with lesser amounts of boulder-bedrock (15%), sand (13%), small gravel (8%), and silt (5%). D-90 was 41 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (23%) and channel stability was good (rating score = 62). There was a moderate amount of instream cover (26%) which was mostly comprised of boulders and debris. Total overhead cover was low (24%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (15%).

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 305 m section of this reach on 14 October and 18 October 1982. Densities of fish 75 mm and longer were high for

bull trout (255/300 m) and low both brook trout (21/300 m) and rainbow trout (12/300 m). Small numbers of mountain whitefish and sculpins were also captured. Densities of "cat&able-sized" trout (150 mm and longer) were moderate for bull trout (36/300 m) and low for both brook trout (7/300 m) and rainbow trout (7/300 m).

The entire reach was surveyed for bull trout redds in 1982, but no redds were found. A 2.3 km section (km 6.7-9) of the reach was surveyed for bull trout redds in 1983 and 1984 and 2 redds were found each year. Based on electrofishing estimates and redd counts, the reach was considered to be critical for migratory bull trout production.

Reach 2

A habitat survey of this reach was not completed, however, the reach was flown by helicopter on 18 September 1982, and walked for bull trout redds in three consecutive years, 1982-1984. Reach 2 of Elk Creek is a fourth order stream having a medium-sized drainage area (58.7 square kilometers) and a low average channel gradient (1.8%). The channel width was estimated to be 12 meters and channel debris was low. The substrate consisted of large and small gravel and the D-90 was relatively small.

Stream Features

An extremely large log jam located at km 13.0 was a complete barrier to upstream movement of migratory adult spawning bull trout in 1982. The jam was modified by U.S. Forest Service personnel during the summer of 1983 to insure long-term accessibility of upstream spawning habitat. Numerous redds were observed above the log jam in the fall of 1983 whereas none were found in this section in 1982. Although not barriers, the stream passes over a 1.8 m falls and a bedrock chute at km 13.0, and a 20 m long bedrock chute at km 13.6. High gradient subsections in the vicinity of km 10.5 to 10.7 and around km 8.5 should be periodically inspected for fish passage improvement. Also, a large log jam was present at km 7.0.

Fish Populations and Spawning Use

The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984 and 56, 89, and 91 redds were found, respectively: The most concentrated bull trout spawning use in the entire Swan River drainage occurred in this reach of Elk Creek and it is considered to be critical for migratory bull trout production.

ELK CREEK

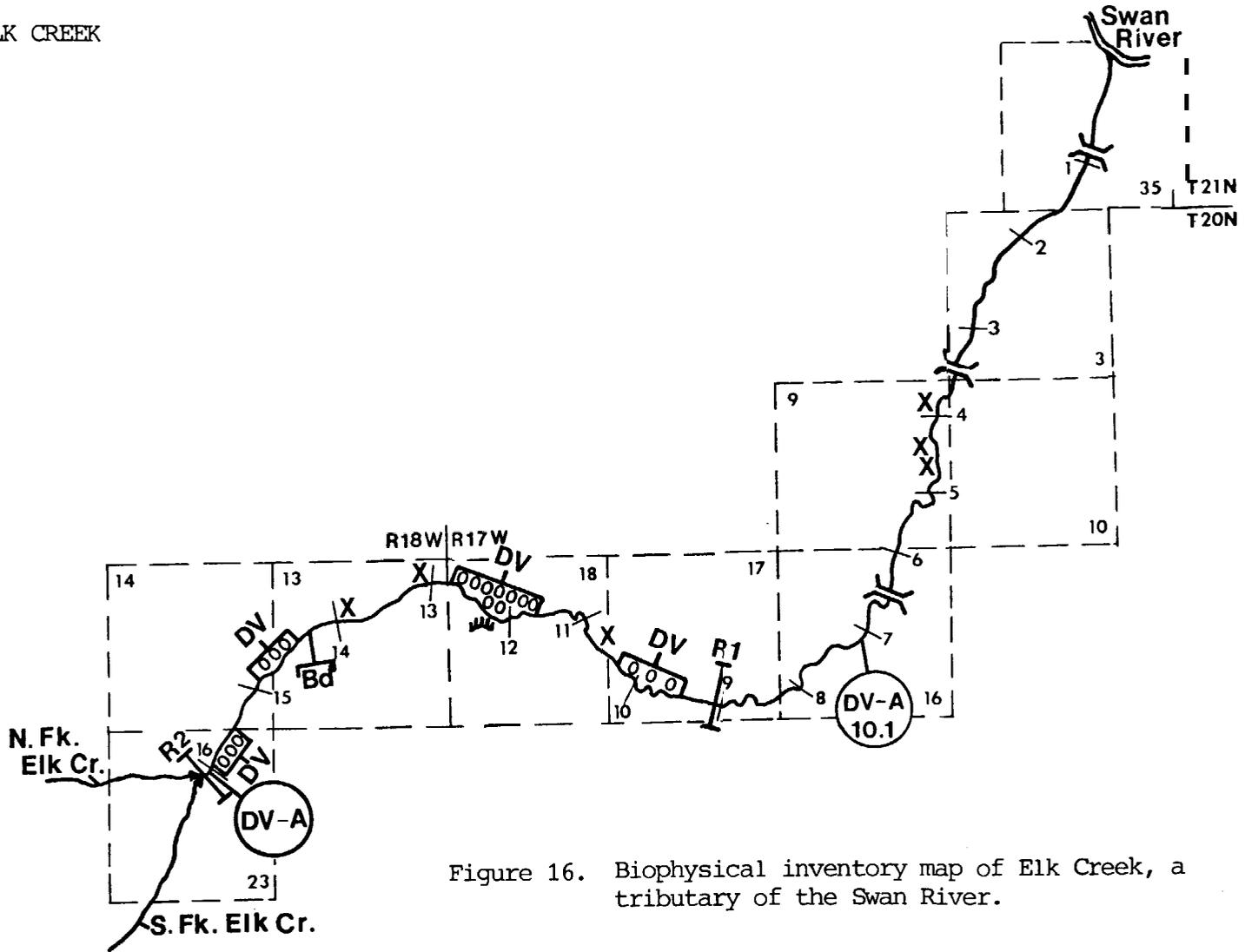


Figure 16. Biophysical inventory map of Elk Creek, a tributary of the Swan River.

GLACIER CREEK

Locations of physical and chemical measurement stations
and other installations in Glacier Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-11	Locatoin of reach	
	km 8-10	Habitat survey section	10/25/83
	km 9.8	Electrofishing section	9/28/82
	km 10.7	Discharge measurement	10/25/83
	km 0.4	Water chemistry	9/22/83
	km 9.9	Max/min thermometer	8/3/83-8/10/83
2	km 11-15.3	Location of reach	
3	km 15.3-22.5	Location of reach	
4	km 22.5-24	Location of reach	
	km 22.5-23.5	Habitat survey section	9/14/83
	km 22.5	Electrofishing section	9/15/83
	km 22.5	Discharge measurement	9/15/83
	km 22.7	Water chemistry	9/22/83
	km 23	Max/min thermometer	8/10/83-8/24/83

Reach 1

Reach 1 of Glacier Creek is a fifth order stream having a relatively large drainage area (155.0 square kilometers) and a low average channel gradient (1.3%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (70°F or 21.1°C) and conductivity during the low water period was low (76 micromhos). The late summer flow was 30 cfs. The stream had an average wetted width of 10.2 meters and was comprised of 32% riffle, 65% run, and 3% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (2.5 per kilometer of stream). The streambed was comprised mainly of cobble (46%) and large gravel (38%) with lesser amounts of boulder-bedrock (9%), small gravel (6%), and sand (1%). D-90 was 33 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (15%) and channel stability was good (rating score = 70). There was a low amount of instream cover (4%) which was mostly comprised of logs and debris. Total overhead cover was low (15%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (9%).

Stream Features

Numerous wasting banks were observed throughout the survey section. The stream is quite braided from km 2 to 1.0. From km 1.5 to 2.5 the channel splits into two channels. The stream flow diminished from km 6 to 4.5 during the summer apparently due to subsurface flow.

Fish Population and Spawning Use

A two-pass population estimate was obtained by electrofishing a 120 m section of this reach on 28 September 1982. Densities of fish 75 mm and longer were moderate for brook trout (84/300 m), and low for rainbow trout (18/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both brook trout (8/300 m) and rainbow trout (3/300 m). Small numbers of sculpins, suckers, and mountain whitefish were also captured. The entire reach was surveyed for bull trout redds in both 1982 and 1983, but no redds were found.

Reach 2

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1982. Reach 2 of Glacier Creek is a fourth order stream having a relatively large drainage area (67.7 square kilometers) and a moderate average channel gradient (3.1%). The channel width was estimated to be 8 meters. Channel debris was low and no fish barriers were observed. The streambed material was composed mostly of cobble and boulders, and the D-90 was estimated to be moderate. The entire reach was surveyed for bull trout redds in both 1982 and 1983, but no redds were found. A very limited amount of brook trout spawning was observed.

Reach 3

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1983. Reach 3 of Glacier Creek is a fourth order stream having a relatively large drainage area (64.7 square kilometers) and a low average channel gradient (1.5%). The channel width was estimated to be 8-12 meters. No fish barriers were observed in this reach. The streambed material was composed mostly of gravel.

Stream Features

A marshy area known as Glacier Sloughs extends from km 17-15.3. This area has a very low gradient and the channel becomes very wide (30-50 m) and flows very slowly. The streambed consists primarily of sand and silt, and aquatic vegetation and beaver activity are common throughout this section.

Glacier Creek braids very heavily in the one kilometer long section (km 17-18) immediately upstream from Glacier Sloughs. Another swampy area is located between km 19.5 and 19.8. A 4 m falls at km 20.4 was probably a barrier to all upstream fish movement.

Fish Populations and Spawning Use

A one-pass population estimate was obtained by other Montana Department of Fish, Wildlife and Parks personnel who electrofished a 183 m section of this reach (at km 22.5) on 22 August 1972. Densities of fish 75 mm and longer were low for cutthroat, bull,

and brook trout (16, 23 and 8 fish/300 m, respectively). The entire reach was surveyed for bull trout redds in 1982 but no redds were found. A 3.8 km section (km 20.6-16.8) was surveyed for bull trout redds in 1983 and one redd was found.

Peach 4

Reach 4 of Glacier Creek is a third order stream having a medium sized drainage area (51.3 square kilometers) and a high average channel gradient (6.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (67°F or 19.4°C) and conductivity during the low water period was low (58 micrcxnhos). The late summer flow was 26 cfs. The stream had an average wetted width of 10.1 meters and was comprised of 10% pool, 3% riffle, 30% run and 57% pocektwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (10.0 per kilometer of stream). The streambed was comprised mainly of cobble (39%) and boulder-bedrock (38%) with lesser amounts of large gravel (20%), and small gravel (3%). D-90 was 104 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was good (rating score = 45). There was a moderate amount of instream cover (33%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (41%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (31%).

Stream Features

Numerous cascades, falls, and bedrock chutes throughout the reach form definite barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 127 m section of this reach on 15 September 1983. Densities of fish 75 mm and longer were moderate for brook trout (129/300 m), and low for both cutthroat trout (39/300 m) and bull trout (39/300 m). Densities of "cat&able-sized" trout (150 mm and longer) were moderate for brook trout (53/300 m), and low for both cutthroat (20/300 m) and bull trout (28/300 m). Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production.

GLACIER CREEK

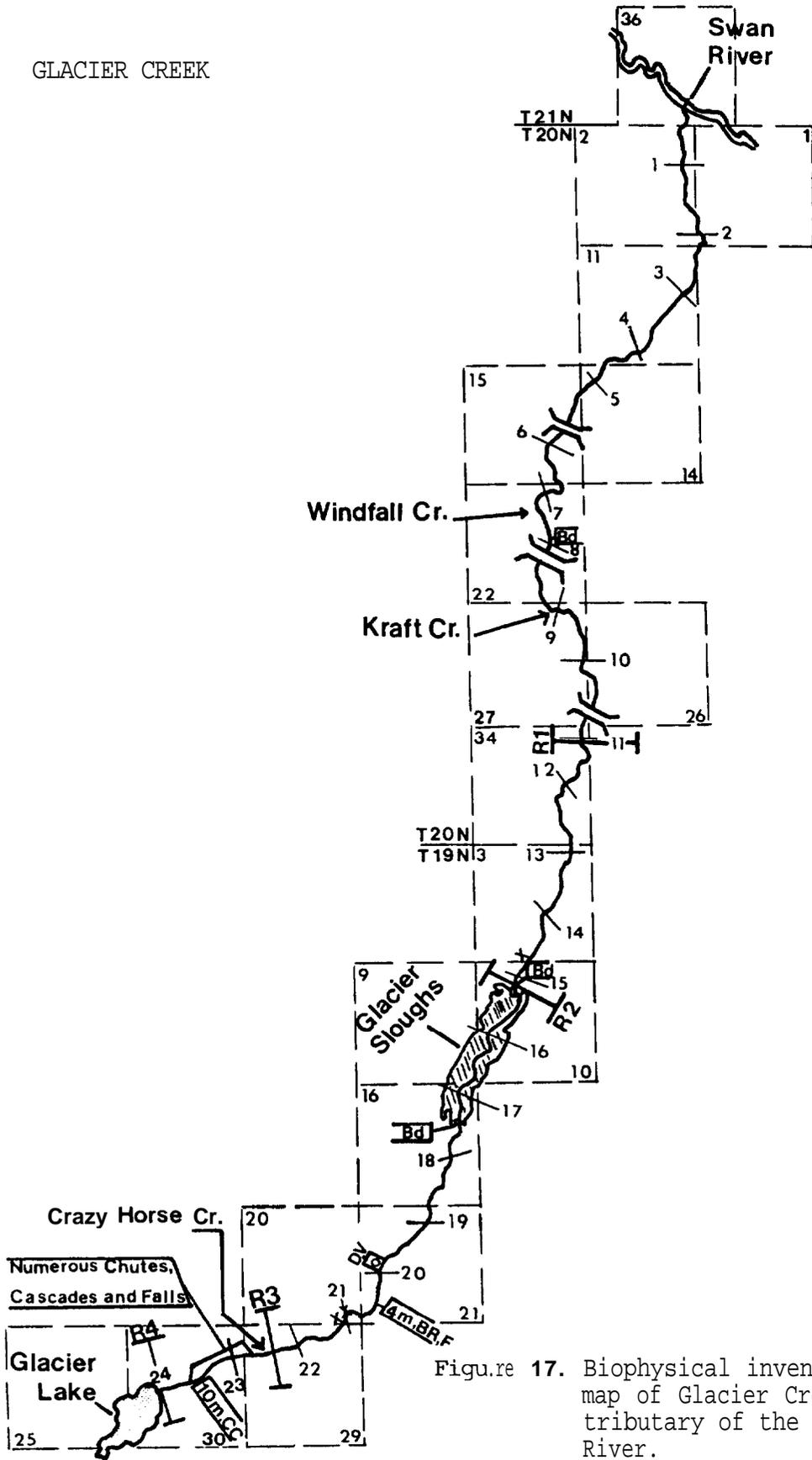


Figure 17. Biophysical inventory map of Glacier Creek, a tributary of the Swan River.

GOAT CREEK

Locations of physical and chemical measurement stations
and other installations in Coat Creek,
a tributary to the Swan River

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-1.3	Location of reach	
	km 0.2-1.2	Habitat survey section	10/04/83
	km 1.2	Electrofishing section	10/14/83
	km 0.5	Discharge measurement	10/05/83
	km 0.5	Water chemistry	09/29/83
	km 0.5	Max/min thermometer	10/04/82
	km 0.4	Fish trap	09/01/83 - 10/27/83
	km 0.4	Fish trap	09/05/84 - 10/18/84
2	km 1.3-5	Location of reach	
	km 2.5-4.5	Habitat survey section	10/04/83
	km 3.2	Electrofishing section	09/30/82
	km 3.2	Discharge measurement	10/04/83
	km 3.3	Water chemistry	09/29/83
	km 3.2	Max/min thermometer	08/04/83 - 08/10/83
	km 4.4-4.5	Streambed monitoring site	10/01/84
3	km 5-10.4	Location of reach	
	km 7.4-9.4	Habitat survey section	10/06/83
	km 8.9	Electrofishing section	08/09/82
	km 9.2	Discharge measurement	10/06/83
	km 9	Water chemistry	08/04/82 - 11/10/82
	km 8.9	Max/min thermometer	08/10/83 - 09/12/83
	km 9	Instream flow transects (WEIP)	07/20/82; 08/12/82; 11/17/82
	km 9.4	Proposed hydro diversion	
	km 5.7	Proposed hydro powerhouse	
4	km 10.4-11.6	Location of reach	
	km 10.5-11.5	Habitat survey section	08/01/83
	km 10.8	Electrofishing section	08/02/83
	km 11.5	Discharge measurement	08/01/83
	km 10.8	Max/min thermometer	08/04/83 - 08/10/83
5	km 11.6-15.6	Location of reach	
	km 12.4-13.4	Habitat survey section	09/28/82 - 09/29/82
	km 12.1	Electrofishing section	09/29/82
	km 11.7	Discharge measurement	09/28/82

Reach 1

Reach 1 of Goat Creek is a third order stream having a relatively large drainage area (86.4 square kilometers) and a low average channel gradient (0.9%). The conductivity during the low water period was high (272 micromhos) and the late summer flow was 15.4 cfs. The stream had an average wetted width of 7.8 meters and was comprised of 3% pool, 7% riffle, 83% run, and 7% pocket water-cascade. There was a moderate density of high quality (class I, II, and III) pools (8.0 per kilometer of stream). The streambed was comprised mainly of large gravel (45%) and cobble (30%) with lesser amounts of small gravel (10%), sand (7%), silt (6%), and boulder-bedrock (2%). D-90 was 28 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (43%) and channel stability was fair (rating score = 80). There was a moderate amount of instream cover (23%) which was mostly comprised of debris and logs. Total overhead cover was moderate (45%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (34%).

Stream Features

A large log jam was located at km 0.4.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 305 m section of this reach on 14 November and 18 November 1983. Densities of fish 75 mm and longer were low for all three species; bull trout (57/300 m), brook trout (45/300 m), and rainbow trout (9/300 m). Densities of "catchable-sized" trout (150 mm and longer) were also low for all three species; bull trout (7/300 m), brook trout (20/300 m), and rainbow trout (6/300 m).

The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984 and 1, 3, and 0 redds were found, respectively. A substantial amount of brook trout spawning was observed. A fish trap was installed in the lower end of the reach to monitor potential spawning movements of bull trout from 9 September to 27 October 1983. A total of 158 adult bull trout (400 to 808 mm) were tagged and released. The trap was installed again in 1984 in the same location and 154 adult bull trout (400 to 823 mm) were tagged and released, indicating heavy use of the Goat/Squeezer Creek drainages for migratory bull trout spawning and rearing. Based on electrofishing estimates and redd counts, the reach was considered to be important for migratory bull trout production.

Reach 2

Reach 2 of Goat Creek is a third order stream having a medium-sized drainage area (50.8 square kilometers) and a low average channel gradient (1.6%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2°C) and conductivity during the low water period was high (291 micromhos). The late summer flow was 9.1 cfs. The stream had an average wetted width of 7.2 meters and was comprised of 8% pool, 27% riffle, and 65% run. There was a moderate density of high quality (class I, II, and III) pools (8.5 per kilometer of stream). The streambed was comprised mainly of large gravel (44%) and cobble (20%) with lesser amounts of small gravel (15%), silt (13%), sand (7%), and boulder-bedrock (1%). D-90 was 21 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (68%) and channel stability was fair (rating score = 81). There was a moderate amount of instream cover (30%) which was mostly comprised of debris and logs. Total overhead cover was moderate (45%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (34%).

Stream Features

A large beaver dam was located at km 4.3.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 30 September 1982. Densities of fish 75 mm and longer were low for cutthroat, bull, and brook trout (12, 48, and 33 fish/300 m, respectively). Densities of "catchable-sized" trout (150 mm and longer) were also low for cutthroat, bull, and brook trout (5, 5, and 10 fish/300 m, respectively).

The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984 and 14, 17, and 11 redds were found, respectively. A substantial amount of brook trout spawning was observed. Based on electrofishing estimates and redd counts, the reach was considered to be critical for migratory bull trout production.

Reach 3

Reach 3 of Goat Creek is a third order stream having a medium-sized drainage area (38.6 square kilometers) and a moderate average channel gradient (4.6%). The estimated maximum summer water temperature for this reach during 1983 was average (59°F or 15.0°C) and conductivity during the low water period was high (273 micromhos). The late summer flow was 6.4 cfs. The stream had an average wetted width of 6.1 meters and was comprised of 8% pool, 15% riffle, 32% run, and 46% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (17 per

kilometer of stream). The streambed was comprised mainly of boulder-bedrock (35%) and large gravel (31%) with lesser amounts of cobble (27%), small gravel (4%), and silt (3%). D-90 was 85 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (43%) and channel stability was good (rating score = 68). There was a moderate amount of instream cover (26%) which was mostly comprised of boulders and debris. Total overhead cover was abundant (78%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (26%).

Stream Features

A 3 m falls at km 8.5 forms a barrier to upstream fish movement. A large log jam is located at km 7.8.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 132 m section of this reach on 9 August 1982. The density of 75 mm and longer bull trout (the only species captured) was low (48/300 m). The density of "catchable-sized" bull trout (150 mm and longer) was moderate (38/300 m).

The entire reach was surveyed for bull trout redds in 1982 and 1983, where 18 and 19 redds were found respectively. A 4.3 km section (km 9.3-5) of the reach was surveyed for bull trout redds in 1984 and 20 redds were found. Based on electrofishing estimates and redd counts, the reach was considered to be critical for migratory bull trout production.

Reach 4

Reach 4 of Goat Creek is a third order stream having a relatively small drainage area (21.2 square kilometers) and a moderate average channel gradient (3.6%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2 C). The discharge during the habitat survey was 14.2 cfs and the estimated late summer flow was 5.2 cfs. The stream had an average wetted width of 4.5 meters and was comprised of 2% pool, 35% riffle, and 63% run. There was a high density of high quality (class I, II, and III) pools (16.0 per kilometer of stream). The streambed was comprised mainly of large gravel (48%) and small gravel (29%) with lesser amounts of cobble (14%), sand (8%), and silt (1%). D-90 was 13 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (45%) and channel stability was good (rating score = 57). There was a moderate amount of instream cover (21%) which was mostly comprised of debris and logs. Total overhead cover was moderate (62%) and overhead cover due to over-

hanging vegetation (within one meter of the water surface) and undercut banks was moderate (34%).

Stream Features

The creek goes dry from km 10.9 to km 10.4 during late summer.

Fish Populations and Spawning Use

A 131 m section of this reach was electrofished on 2 August 1983, however only two juvenile bull trout were captured, indicating a very sparse fish population. The entire reach was surveyed for bull trout redds in 1982, but no redds were found. A 1.2 km section (km 11.6 to 10.4) of the reach was surveyed for bull trout redds in 1983 but no redds were found.

Reach 5

Reach 5 of Goat Creek is a second order stream having a relatively small drainage area (6.6 square kilometers) and a high average channel gradient (13.7%). The late summer flow was 2.1 cfs. The stream had an average wetted width of 3.2 meters and was comprised of 21% pool, 24% riffle, 18% run, and 37% pocketwater-cascade. The streambed was comprised mainly of cobble (37%) and boulder-bedrock (32%) with lesser amounts of large gravel (19%), small gravel (8%), and sand (4%). D-90 was 33 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 55). There was a moderate amount of instream cover (25%) which was mostly comprised of boulders and logs. Total overhead cover was low (33%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (33%).

Stream Features

Falls and cascades which formed barriers to fish movement included a 2 m cascade, 4 m cascade and 3 m falls at km 12.7, and a 12 m falls at km 13.1. A debris jam was located at km 12.4.

Fish Populations and Spawning Use

A 93 m section of this reach was electrofished on 29 September 1982 but no fish were captured.

GOAT CREEK

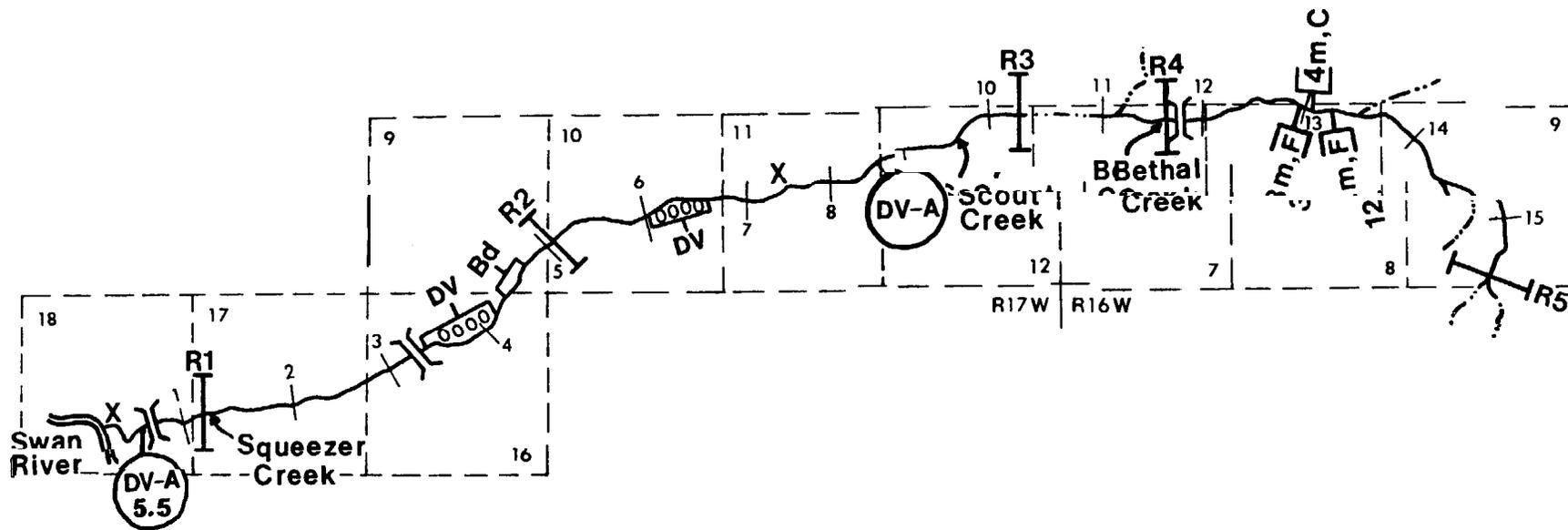


Figure 18. Biophysical inventory map of Goat Creek, a tributary of the Swan River.

GROOM CREEK

Locations of physical and chemical measurement stations
and other installations in Groom Creek,
a tributary to Swan Lake.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3	Location of reach	
	km 1.5-2.5	Habitat survey section	7/20/83
	km 2.2	Electrofishing section	8/18/82
	km 2.5	Discharge measurement	7/20/83
	km 1.5	Water chemistry	9/29/83
	km 2.2	Max/min thermometer	8/4/83-8/11/83
	km 0.2	Fish trap	4/27/83-7/18/83
	km 2.8	Instream flow transects (WEIP)	6/24/83-10/17/83
	km 1.5	Proposed hydro powerhouse	
2	km 3-6	Location of reach	
	km 4.1-5.1	Habitat survey section	9/22/83
	km 4.2	Electrofishing section	9/23/83
	km 4.1	Discharge measurement	9/22/83
	km 3.8	Proposed hydro diversion	

Reach 1

Reach 1 of Groom Creek is a second order stream having a relatively small drainage area (11.4 square kilometers) and a high average channel gradient (7.1%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2°C) and conductivity during the low water period was moderate (250 micromhos). The discharge during the habitat survey was 12.5 cfs and the estimated late summer flow was 0.6 cfs. The stream had an average wetted width of 3.8 meters and was comprised of 2% pool, 42% riffle, 23% run, and 33% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (6.0 per kilometer of stream). The streambed was composed mainly of cobble (38%) and large gravel (34%) with lesser amounts of boulder-bedrock (24%), small gravel (3%), and silt (1%). D-90 was 54 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (40%) and channel stability was good (rating score = 67). There was a moderate amount of instream cover (31%) which was mostly comprised of debris and boulders. Total overhead cover was abundant (85%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (37%).

Stream Features

Numerous small debris jams were present throughout the reach. The stream goes dry from 0.2 to the mouth during late summer.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 18 August 1982. The density of cutthroat trout 75 mm and longer was high (192/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was moderate (39/300 m). A 2.0 km section (km 2.0 to 0.0) of the reach was surveyed for bull trout redds in 1982 but no redds were found and a limited amount of brook trout spawning was observed. This reach was not surveyed for bull trout redds in 1983.

A fish trap was installed in the lower end of the reach to monitor potential spawning movements and rates of juvenile emigration of cutthroat trout during the period 27 April to 18 July 1983. No adult cutthroat trout and no juveniles were captured, indicating very low use by migratory fish.

Reach 2

Reach 2 of Groom Creek is a second order stream having a relatively small drainage area (5.4 square kilometers), a high channel gradient (17.3%) and a late summer flow of 2.1 cfs. The stream had an average wetted width of 3.9 meters and was comprised of 12% riffle, 33% run, and 55% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (3.0 per kilometers of stream). The streambed was comprised mainly of boulder-bedrock (34%) and large gravel (30%) with lesser amounts of cobble (22%) and small gravel (14%). D-90 was 43 centimeters, indicating that the largest particles of substrate in the streambed were about average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was good (rating score = 57). There was a high amount of instream cover (42%) which was mostly comprised of boulders and turbulence. Total overhead cover was moderate (62%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (28%).

Stream Features

Several cascades and falls throughout the reach formed definite barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 98 m section of this reach on 23 September 1983. The density of cutthroat trout 75 mm and longer was low (42/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was also low (23/300 m).

GROOM CREEK

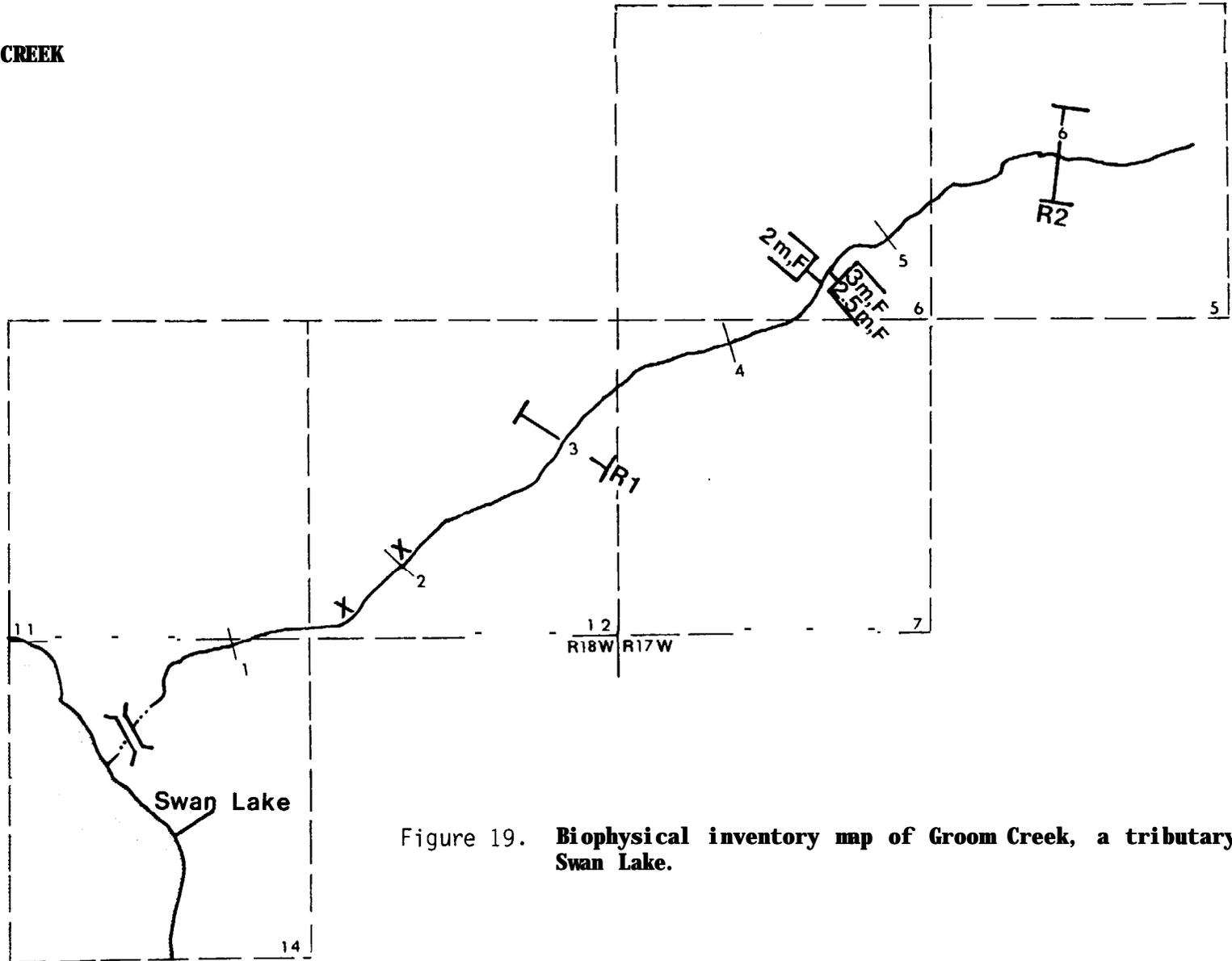


Figure 19. **Biophysical inventory map of Groom Creek, a tributary of Swan Lake.**

HALL CREEK

Locations of physical and chemical measurement stations
and other installations in Hall Creek,
atributaryto Swan Lake.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0.5-1.5	Habitat survey section	9/28/83
	km 1	Electrofishing section	9/30/83-10/5/83
	km 1	Discharge measurement	9/28/83
	km 0.2	Max/min thermometer	8/19/82-10/21/82
	km 1	Fish trap	4/27/83-7/18/83
	km2	Instream flow transects (WEIP)	6/23/83-10/19/83
	km 1.8	Proposed hydro powerhouse	
2	km 2-6	Location of reach	
	km2.8-3.8	Habitat section survey	10/19/83
	km 2.3	Electrofishingsection	9/18/82
	km 3.7	Discharge measurement	10/19/83
	km 2.3	Water chemistry	9/21/83
	km 2.3	Max/min thermometer	8/4/83-8/11/83
	km 3.4	Proposed hydro diversion	

Reach 1

Reach 1 of Hall Creek is a second order stream having a relatively small drainage area (12.8 square kilometers) and a moderate average channel gradient (4.0%). The estimated maximum summer water temperature for this reach during 1983 was average (57°F or 13.9°C). The late summer flow was 2.8 cfs. The stream had an average wetted width of 3.5 meters and was comprised of 2% pool, 15% riffle, 45% run, and 38% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (5.0 per kilometer of stream). The streambed was comprised mainly of large gravel (44%) and cobble (41%) with lesser amounts of small gravel (8%), boulder-bedrock (3%), silt (3%), and sand (1%). D-90 was 26 centimeters, indicating that the largest particles of substrate in the streambed were **small** in comparison to other stream reaches in the drainage. The reach had a moderate **amount** of channel debris (35%) and channel stability was good (rating score = 57). There was a **low** amount of instreamcover (18%) which was mostly comprised of debris and boulders. Total overhead cover was abundant (92%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (33%).

Stream Features

The stream goes dry from km0.2 to the mouth during late **summer**.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electro-fishing a 185 m section of this reach on 30 September and 5 October 1983. Densities of fish 75 mm and longer were high for cutthroat trout (153/300 m), and moderate for brook trout (147/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both cutthroat trout (11/300 m) and brook trout (4/300 m). The entire reach was surveyed for bull trout redds in 1982 but no redds were found and a limited amount of brook trout spawning observed.

A fish trap was installed in the middle portion of the reach to monitor potential spawning movement and rates of juvenile emigration for cutthroat trout from 27 April to 18 July 1983. Three adult cutthroat trout and very few juveniles were captured, indicating a low amount of use by migratory fish.

Peach 2

Peach 2 of Hall Creek is a second order stream having a relatively small drainage area (11.4 square kilometers) and a high average channel gradient (14.6%). The estimated maximum summer water temperature for this reach during 1983 was average (58°F or 14.4°C) and conductivity during the low water period was low (110 micromhos). The late summer flow was 2.9 cfs. The stream had an average wetted width of 3.3 meters and was comprised of 3% pool, 27% run, and 70% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (7.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (38%) and large gravel (30%) with lesser amounts of cobble (21%), small gravel (6%), silt (4%), and sand (1%). D-90 was 80 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 66). There was a high amount of instream cover (42%) which was mostly comprised of logs and boulders. Total overhead cover was moderate (70%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (33%).

Stream Features

A 0.4 km long cascade section (km 2.8 to 2.4) was a complete barrier to upstream fish movement.

Fish Movement and Spawning Use

A two-pass population estimate was obtained by electrofishing a 126 m section of this reach on 19 August 1982. Densities of fish 75 mm and longer were moderate for cutthroat trout (138/300 m) and low for brook trout (24/300 m). Densities of "catchable-sized" trout (150 mm and longer) were moderate for cutthroat trout (58/300 m) and low for brook trout (14/300 m).

HALL CREEK

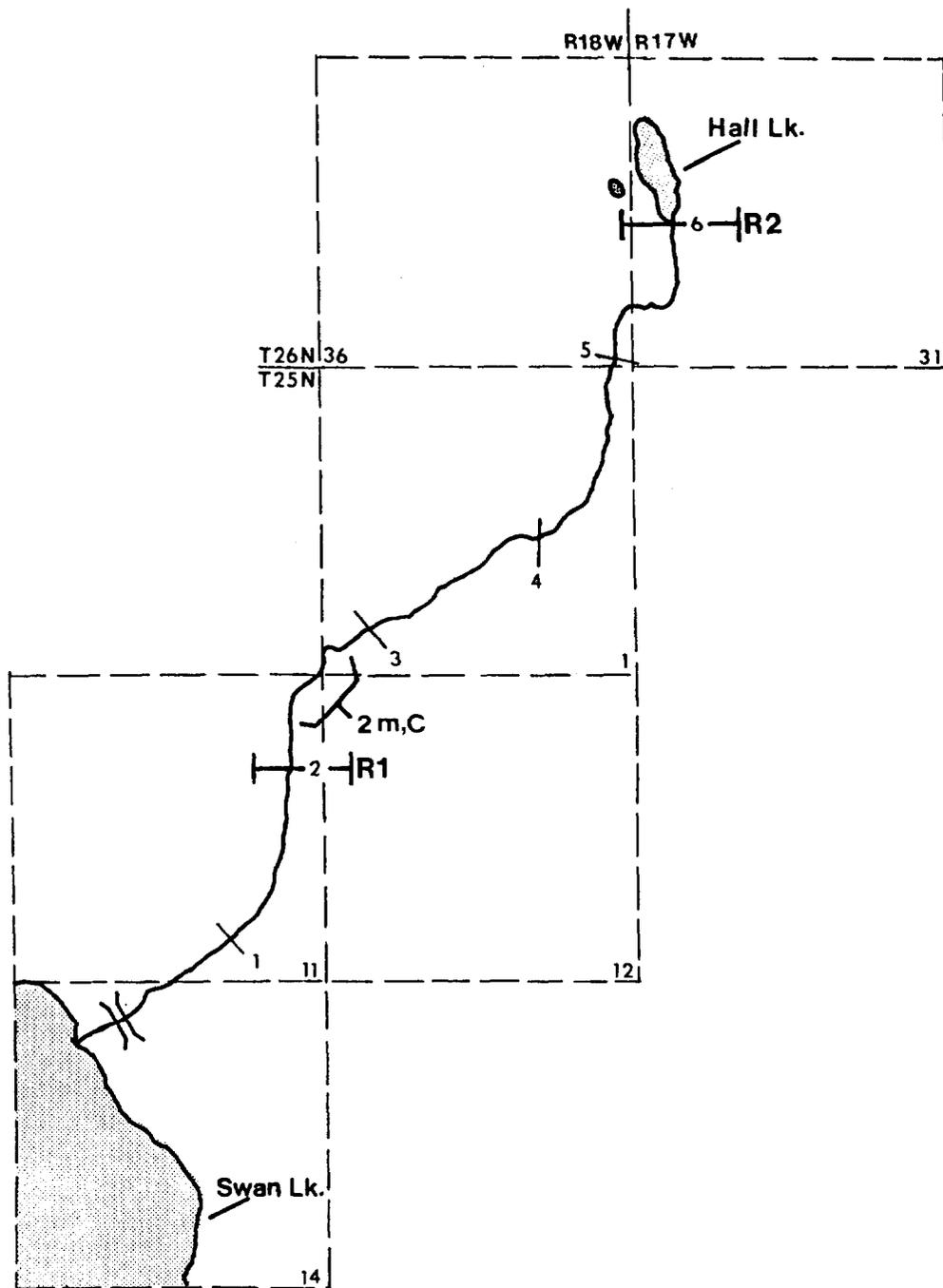


Figure 20. Biophysical inventory map of Hall Creek, a tributary of Swan Lake.

HOLLAND CREEK

Locations of physical and chemical measurement stations
and other installations in lower Holland Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4.5	Location of reach	
2	km 4.5-6.5	location of reach	
	km 4.7-5.7	Habitat survey section	9/6/83
	km 4.9	Electrofishing section	9/12/83
	km 4.5	Discharge measurement	9/5/83
	km 4.9	Water chemistry	9/22/83
	km 5	Max/min thermometer	8/11/83-9/1/83

Reach 1

This reach ~~was~~ not ground surveyed but was surveyed by helicopter on 19 September 1982. Reach 1 of lower Holland Creek is a fourth order stream having a medium-sized drainage area (58.3 square kilometers) and a low average channel gradient (0.5%). The channel width was estimated to be 4-6 meters. Channel debris was low and no fish barriers were observed. The streambed material was comprised mostly of gravel and the D-90 was very small. Several marsh sections occurred throughout the reach in which some channel braiding was observed. A one-pass population estimate was obtained by other Montana Department of Fish, Wildlife and Park's personnel who electrofished a 183 m section of this reach (at km 0.5) on 12 August 1971. The density of 75 mm and longer brook trout (the only species captured) was low (13/300 m).

Reach 2

Reach 2 of lower Holland Creek is a fourth order stream having a **medium sized** drainage area (44.3 square kilometers) and a low average channel gradient (0.3%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (77°F or 25.0°C) and conductivity during the low water period was low (150 micromhos). The late summer flow was 1.2 cfs. The stream had an average wetted width of 9.1 meters and was comprised of 20% riffle, and 80% run. There were no high quality (class I, II, and III) pools in the survey section. The streambed was comprised mainly of large gravel (37%) and small gravel (36%) with lesser amounts of silt (9%), sand (9%), and cobble (9%). D-90 was 27 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (53%) and channel stability was good (rating score = 65). There was a moderate amount of instream cover (31%) which was mostly comprised of aquatic vegetation and debris. Total overhead cover was low (27%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (24%).

Stream Features

A moderate number of small debris jams were present throughout the reach.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 112 m section of this reach on 12 September 1983. Densities of fish 75 mm and longer were low for both brook trout (9/300 m), and rainbow trout (51/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both brook trout (3/300 m) and rainbow trout (24/300 m). Large numbers of mountain whitefish, redbreast shiners, sculpins, northern squawfish, and largescale suckers were also captured.

HOLLAND CREEK

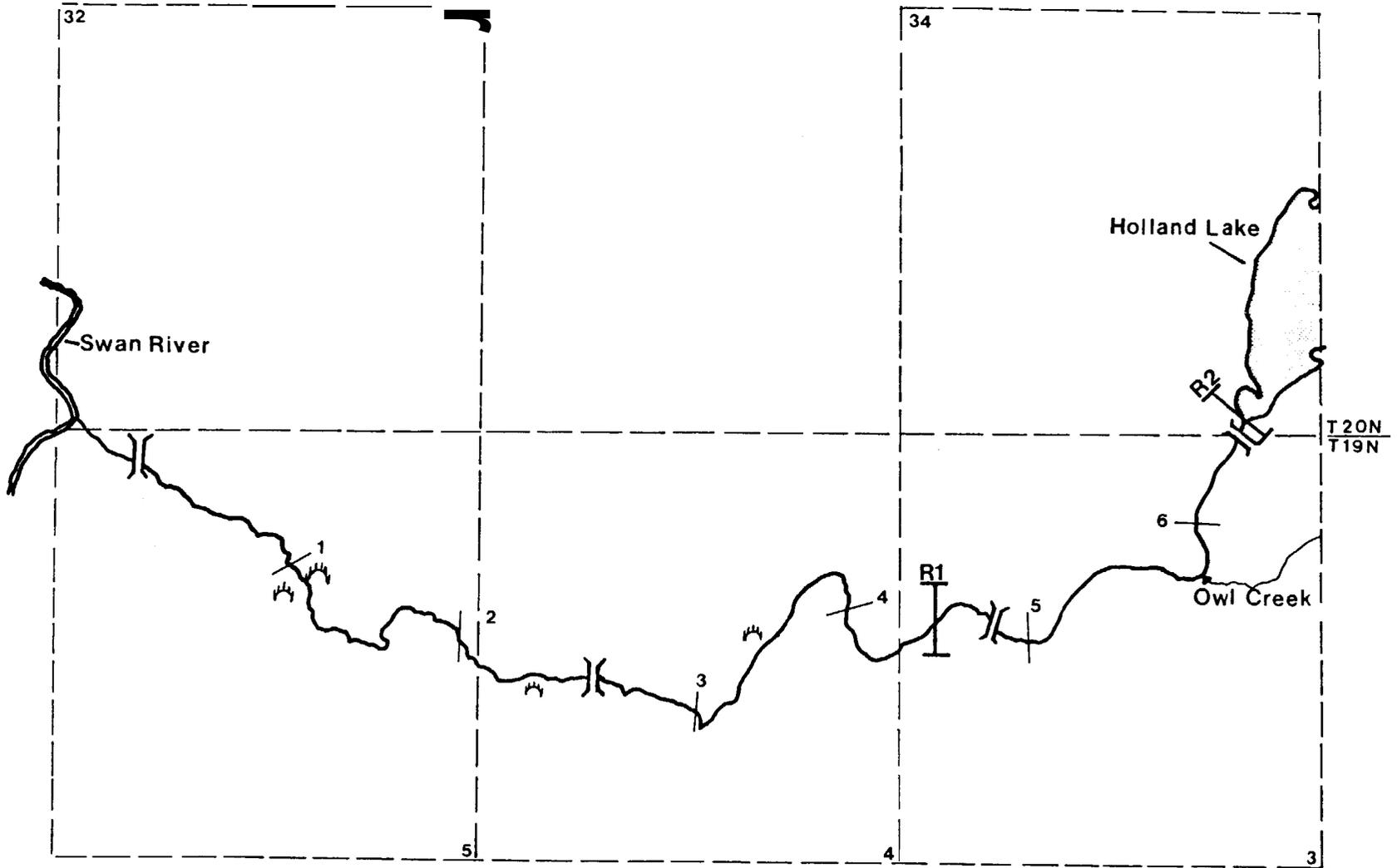


Figure 21. Biophysical inventory map of Lower Holland Creek, a tributary of the Swan River.

JIM CREEK

Locations of physical and chemical measurement stations
and other installations in Jim Creek,
a tributary to the Swan River

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0.5-1.5	Habitat survey section	08/01/83
	km 1.5	Electrofishing section	08/02/83; 08/09/83; 08/24/83
	km 1.9	Discharge measurement	08/02/83
	km 1.5	Max/min thermometer	08/04/83 - 08/10/83
2	km 2-5.5	Location of reach	
	km 3-5	Habitat survey section	08/03/83
	km 3.7	Electrofishing section	08/23/83
	km 3.5	Discharge measurement	08/04/83
	km 3.5	Water chemistry	09/27/83
	km 3.3	Max/min thermometer	08/04/83 - 08/11/83
3	km 5.5-9.5	Location of reach	

Reach 1

Reach 1 of Jim Creek is a third order stream having a medium-sized drainage area (53.2 square kilometers) and a low average channel gradient (0.3%). The estimated maximum summer water temperature for this reach during 1983 was average (**56°F** or **13.3°C**). The discharge during the habitat survey was 53.1 cfs and the estimated late summer flow was 19.6 cfs. The stream had an average wetted width of 14.0 meters and was comprised of 5% pool, 20% riffle, and 75% run. There was a low density of high quality (class I, II, and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of silt (40%) and large gravel (33%) with lesser amounts of sand (14%), small gravel (12%), and cobble (1%). D-90 was 10 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (58%) and channel stability was fair (rating score = 88). There was a high amount of instream cover (56%) which was mostly comprised of debris and logs. Total overhead cover was moderate (41%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (27%).

Stream Features

This reach is heavily braided from km 2 to the mouth, partially as a result of extensive beaver activity.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 308 m section of this reach on 2, 9, and 24 August 1983. Densities of fish 75 mm and longer were high for brook trout (243/300 m) and low for bull trout (39/300 m). Densities of "Catchable-sized" trout (150 mm and longer) were high for brook trout (80/300 m) and low for bull trout (10/300 m). Based on electrofishing estimates and upstream redd counts, the reach was considered to be important for migratory bull trout production. A 0.6 km section (km 2-1.4) of the reach was surveyed for bull trout redds in 1983 and no redds were found.

Reach 2

Reach 2 of Jim Creek is a third order stream having a medium-sized drainage area (41.0 square kilometers) and a low average channel gradient (1.7%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (**53°F** or **11.7°C**) and conductivity during the low water period was moderate (189 micromhos). The discharge during the habitat survey was 49.9 cfs and the estimated late summer flow was 18 cfs. The stream had an average wetted width of 7.7 meters and was comprised of 8% pool, 25% riffle, 62% run, and 5% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (8.0 per kilometer of stream). The streambed was comprised mainly of large gravel (37%) and small gravel (21%) with lesser amounts of cobble (19%), silt (14%), sand (4%), and boulder-bedrock (3%). D-90 was 29 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 69). There was a high amount of instream cover (43%) which was mostly comprised of logs and debris. Total overhead cover was moderate (52%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (32%).

Stream Features

Beaver activity was observed from km 4.5 to km 5.5.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 92 m section of this reach on 23 August 1983. Densities of fish 75 mm and longer were low for both bull trout (9/300 m) and brook trout (30/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both bull trout (12/300 m) and brook trout (11/300 m).

A 2.7 km section (km 4.7-2.0) of the reach was surveyed for bull trout redds in 1983 and 7 redds were found. The entire reach was surveyed for bull trout redds in 1984 and 6 redds were found. Based on electrofishing estimates and redd counts, the reach was considered to be important for migratory bull trout production.

Reach 3

This reach was not ground surveyed but was surveyed by helicopter on 18 September 1982. Reach 3 of Jim Creek is a third order stream having a medium-sized drainage area (37.3 square kilometers) and a high average channel gradient (6.8%). The channel width was estimated to be 2-5 meters. Channel debris was moderate. The substrate consisted of boulders and large gravel. D-90 was moderate. The stream was dry at km 9.5. A 1.5 km section (km 7-5.5) of the reach was surveyed for bull trout redds in 1984 but no redds were found.

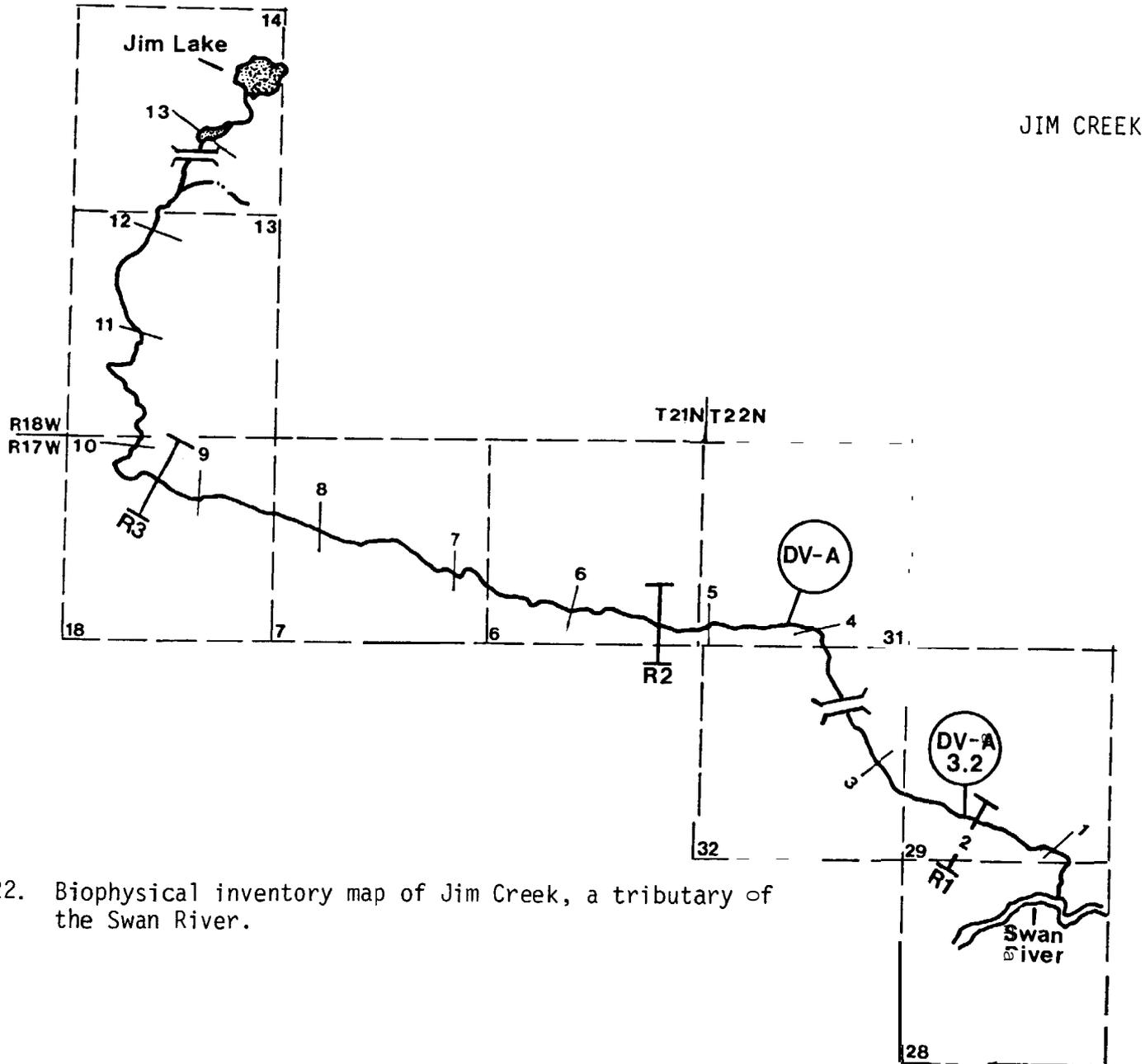


Figure 22. Biophysical inventory map of Jim Creek, a tributary of the Swan River.

KRAFT CREEK

Locations of physical and chemical measurement stations
and other installations in Kraft Creek,
a tributary to Glacier Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3	Location of reach	
2	km 3-7	Location of reach	
	km 4-6	Habitat survey section	8/2/83
	km 5.2	Electrofishing section	8/3/83
	km 3.2	Dischare measurement	8/2/83
	km 3.2	Waterchemistry	9/22/83
	km5	Max/min thermometer	8/3/83-8/11/83

Reach 1

This reach was not ground surveyed but was surveyed by helicopter on 19 September 1982. Reach 1 of Kraft Creek is a fourth order stream having a meduim-sized drainage area (42.4 square kilometers and a low average channel gradient (2.4%). The wetted width ~~was~~ estimated to be 2-4 meters. Channel debris was low and no fish barriers were observed. The streambed material was canprised of gravel and the D-90 was low.

Reach 2

Reach 2 of Kraft Creek is a fourth order stream having a relatively ~~small~~ drainage area (25.8 square kilometers) and a moderate average channel gradient (5.5%). The estimated maximum summer water temperature for this reach during 1983 was average (60°F or 15.6°C) and conductivity during the low water period was low (103 micromhos). The discharge during the habitat survey was 6.5 cfs and the estimated late summer flow was 2.4 cfs. The stream had an average wetted width of 5.0 meters and was ~~comprised~~ of 10% riffle, 38% run, and 52% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (8.0 per kilometer of stream). The streambed was comprised mainly of cobble (36%) and large gravel (32%) with lesser amounts of boulder-bedrock (22%), small gravel (6%), sand (2%), and silt (2%). D-90 was 78 centimeters, indicating that the largest particles of substrate in the ~~streambed~~ were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (43%) and channel stability was good (rating score = 69). There was a moderate amount of instream cover (33%) which was mostly comprised of boulders and debris. Total overhead cover was abundant (79%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (57%).

Stream Features

Numerous small log jams were present throughout the survey section. Much of the drainage was heavily logged, especially the upper end.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 107 m section of this reach on 3 August 1983. Densities of trout 75 mm and longer were high for cutthroat trout (156/300 m) and low for brook trout (6/300 m). Densities of "catchable-sized" trout (150 mm and longer) were moderate for cutthroat trout (54/300 m), and low for brook trout (3/300 m).

KRAFT CREEK

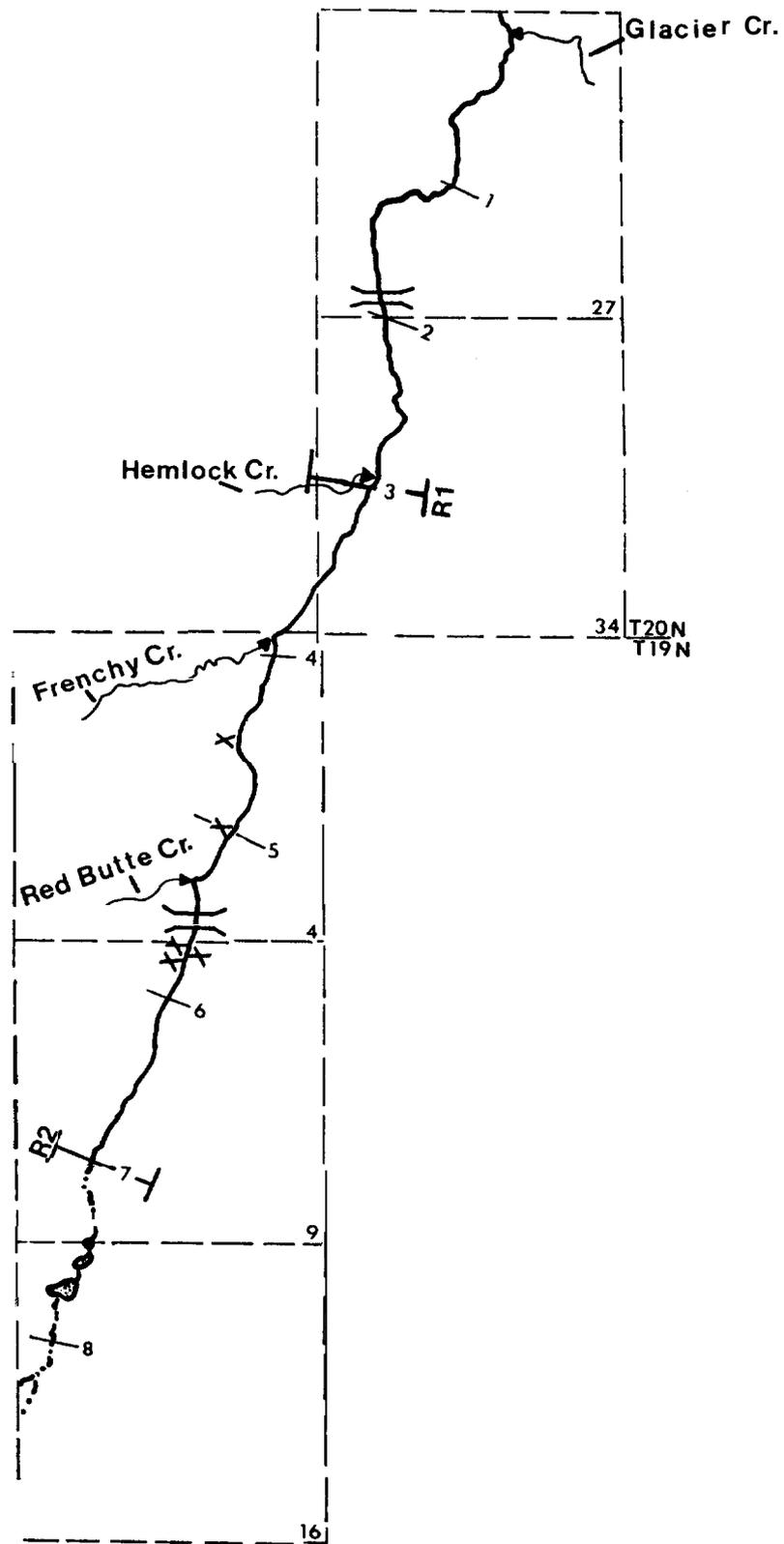


Figure 23. Biophysical inventory map of Kraft Creek, a tributary of Glacier Creek.

LION CREEK

Locations of physical and chemical measurement stations
and other installations in Lion Creek,
a tributary to the Swan River

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-10	Location of reach	
	km 6.7-8.7	Habitat survey section	10/06/83
	km 7.5	Electrofishing section	09/20/82
	km 8.7	Discharge measurement	10/06/83
	km 0.5	Water chemistry	09/21/83
	km 7.5	Max/min thermometer	08/11/83-08/17/83
	km 5.5	Streambed monitoring site	10/31/84
2	km 10-19.5	Location of reach	
	km 10.5-12.5	Habitat survey section	10/17/83
	km 10.5;11.7	Electrofishing section	09/15/82, 09/14/82
	km 10.3	Discharge measurement	10/17/83
	km 10	Water chemistry	09/21/83
	km 10.5	Max/min thermometer	08/11/83 - 08/31/83
	km 10.6 - 10.9	Instream flow transects (WETP)	06/22/83 - 10/18/83
	km 10.5	Thermograph	04/11/83 - 10/30/84
	km 10.5	Water level recorder	11/17/82 - 10/30/84
	km 12.6	Proposed hydro diversion	
km 10	Proposed hydro powerhouse		
3	km 19.5-22	Location of reach	

Reach 1

Reach 1 of Lion Creek is a third order stream having a relatively large drainage area (81.6 square kilometers) and a small average channel gradient (0.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (**54°F** or **12.2°C**) and conductivity during the low water period was moderate (210 micromhos). The late summer flow was 14.4 cfs. The stream had an average wetted width of 10.7 meters and was comprised of 3% pool, 10% riffle, 52% run, and 35% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (2.5 per kilometer of stream). The streambed was comprised mainly of large gravel (37%) and cobble (32%) with lesser amounts of boulder-bedrock (13%), small gravel (8%), silt (8%), and sand (2%). D-90 was 63 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was fair (rating score = 83). There was a moderate amount of instream cover (28%) which was mostly comprised of debris and boulders. Total

overhead cover was moderate (51%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (29%).

Stream Features

A man-made wooden dam is present at km 3.0. This dam could be a barrier to spawning adult migratory bull trout but a side channel is present providing fish passage.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 149 m section of this reach on 20 September 1983. Densities of fish 75 mm and longer were low for both cutthroat trout (2/300 m) and brook trout (39/300 m), and moderate for bull trout (99/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both bull trout (12/300 m) and brook trout (12/300 m). There were no "catchable-sized" cutthroat trout and moderate numbers of sculpins were captured.

The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984 and 60, 38, and 77 redds were found, respectively. Based on electrofishing estimates and redd counts, this reach was considered to be critical for migratory bull trout production.

Reach 2

Reach 2 of Lion Creek is a third order stream having a medium-sized drainage area (56.2 square kilometers) and a moderate average channel gradient (5.7%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (52°F or 11.1°C) and conductivity during the low water period was moderate (194 micromhos). The late summer flow was 18 cfs. The stream had an average wetted width of 7.3 meters and was comprised of 15% pool, 12% riffle, 40% run, and 33% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (12.5 per kilometer of stream). The streambed was comprised mainly of large gravel (36%) and cobble (31%) with lesser amounts of boulder-bedrock (21%), small gravel (10%), sand (1%), and silt (1%). D-90 was 61 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 56). There was a moderate amount of instream cover (39%) which was mostly comprised of boulders and logs. Total overhead cover was abundant (87%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (15%).

Stream Features

An 8.0 m falls located in a bedrock canyon at km 11.1 was a complete barrier to upstream fish movement. Cascades and falls, up to 6.0 m high, were present from km 10.4-10.9, km 12.3-12.6, and km 16.2-17.

Fish Populations and Spawning Use

A three-pass population estimate was obtained by electrofishing a 133 m section of this reach on 15 September 1982. The density of 75 mm and longer bull trout (the only species captured) was moderate (108/300 m). The density of "catchable-sized" bull trout (150 mm and longer) was high (71/300 m).

A 1.0 km section (km 11-10) of the reach was surveyed for bull trout redds in 1982 and 3 redds were found. A 0.5 km section (km 10.5-10) of the reach was surveyed for bull trout redds in 1983 and 1984 and 4, and 11 redds were found, respectively. Based on electrofishing estimates and redd counts, the lower portion of this reach was considered to be critical for migratory bull trout production.

Reach 3

This reach was not ground surveyed but was surveyed by helicopter on 12 July 1982. Reach 3 of Lion Creek is a third order stream having a relatively small drainage area (13.7 square kilometers) and a moderate average channel gradient (4.4%). The channel width was estimated to be 6-8 meters. Channel debris was moderate and no fish barriers were observed. The streambed material was comprised mostly of cobble and gravel. D-90 was estimated to be small. Some channel braiding was observed.

LION CREEK

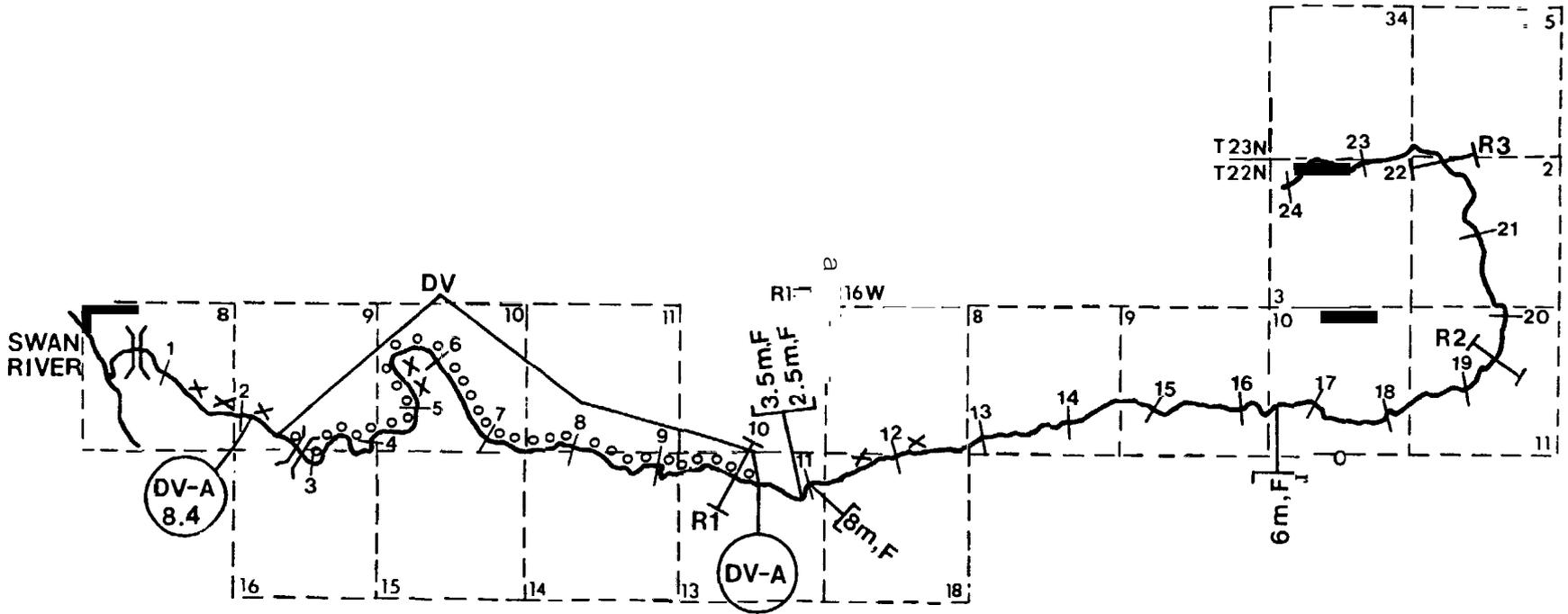


Figure 24 Biophysical inventory map of Lion Creek, a tributary of the Swan River.

LOST CREEK

Locations of physical and chemical measurement stations
and other installations in Lost Creek,
a tributary to the Swan River

Reach	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2.3	Location of reach	
	km 1-2	Habitat survey section	08/23/83
	km 1.8	Electrofishing section	11/10/83 - 11/16/83
	km 1.7	Discharge measurement	08/23/83
	km 1.8	Water chemistry	09/29/83
	km 1.6	Max/min thermometer	08/04/83 - 08/11/83
	km 1.7	Fish trap	05/07/83 - 05/26/83

Reach

Reach 1 of Lost Creek is a fourth order stream having a relatively large drainage area (82.0 square kilometers) and a low average channel gradient (0.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (59°F or 15.0°C) and conductivity during the low water period was high (277 micromhos). The discharge during the habitat survey was 18.7 cfs and the estimated late summer flow was 12.6 cfs. The stream had an average wetted width of 8.8 meters and was comprised of 25% riffle, 65% run, and 10% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (3.0 per kilometer of stream). The streambed was comprised mainly of large gravel (43%) and cobble (36%) with lesser amounts of small gravel (9%), silt (6%), sand (3%), and boulder-bedrock (3%). D-90 was 30 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (25%) and channel stability was fair (rating score = 79). There was a low amount of instream cover (19%) which was mostly comprised of debris and boulders. Total overhead cover was low (28%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (20%).

Stream Features

The stream was intermittent in late summer from the mouth to km 0.5.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 305 m section of this reach on 10 and 16 November 1983. Densities of fish 75 mm and longer were moderate for brook trout (111/300 m) and low for bull trout (48/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both brook

trout (8/300 m) and bull trout (6/300 m). Large numbers of sculpins were also captured. Based on electrofishing and redd surveys, the reach was considered to be marginal for migratory bull trout production. The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984, but no redds were found. A limited amount of brook trout spawning was observed. A fish trap was installed in the middle portion of the reach to monitor potential spawning movements and rates of juvenile emigration of cutthroat trout during May 1983. However, high streamflows during this period prevented effective trap operation.

LOST CREEK

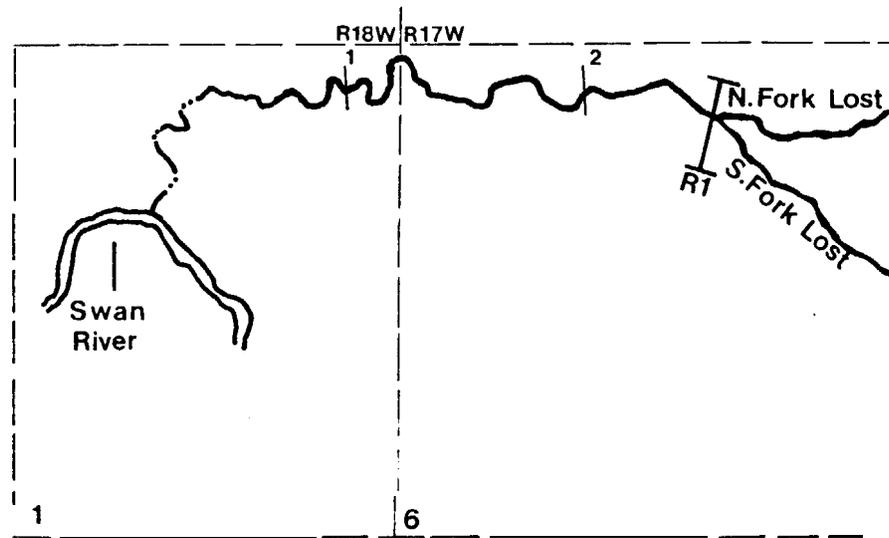


Figure 25. Biophysical inventory map of Lost Creek, a tributary of the Swan River

NORTH FORK ELK CREEK

Locations of physical and chemical measurement stations
and other installations in the North Fork of Elk Creek,
a tributary to Elk Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-1.5	Location of reach	
	km 0-1	Habitat survey section	9/13/83
	km 0.4	Electrofishing section	9/22/83
	km 0.2	Discharge measurement	9/22/83
	km 0.1	Water chemistry	9/29/83
	km 0.1	Max/min thermometer	8/18/83-9/13/83
2	km 1.5-4.5	Location of reach	
	km 2.5-3.5	Habitat survey section	9/20/83
	km 2.5	Electrofishing section	9/27/83
	km 3.5	Discharge measurement	9/20/83
	km 1.5	Max/min thermometer	8/18/83-9/13/83

Reach 1

Reach 1 of North Fork Elk Creek is a third order stream having a relatively small drainage area (18.2 square kilometers) and a high average channel gradient (9.8%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (**54°F** or **12.2°C**) and conductivity during the low water period was moderate (152 micromhos). The late summer flow was 14.1 cfs. The stream had an average wetted width of 7.8 meters and was comprised of 5% pool, 18% run, and 77% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (19.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (63%) with lesser amounts of large gravel (18%), cobble (17%), small gravel (1%), and sand (1%). D-90 was 103 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (23%) and channel stability was good (rating score = 44). There was a moderate amount of instream cover (31%) which was mostly comprised of boulders and logs. Total overhead cover was low (29%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (29%).

Stream Features

The stream flows over bedrock through portions of the reach, particularly km 0.3 to km 0.6. Numerous falls, chutes and cascades in this section form barriers to upstream movement of migratory adult bull trout. A 2 m high log jam was located at km 0.9.

Fish Populations and Spawning Use

A three-pass population estimate was obtained by electrofishing a 99 m section of this reach on 22 September 1983. Densities of

fish 75 mm and longer were low for both cutthroat trout (9/300 m) and bull trout (30/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both cutthroat trout (9/300 m) and bull trout (30/300 m). Based on electrofishing estimates, redd counts on Elk Creek, and the presence of significant fish barriers, the reach was considered to be marginal for migratory bull trout production. As a result, it was not surveyed for bull trout redds.

Reach 2

Reach 2 of North Fork Elk Creek is a second order stream having a relatively small drainage area (15.6 square kilometers) and a high average channel gradient (6.1%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2°C). The late summer flow was 7.5 cfs. The stream had an average wetted width of 8.2 meters and was comprised of 10% pool, 10% riffle, 20% run, and 60% pocketwater-cascade. There was a high density of high quality (class I, II, and m) pools (24.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (49%) and large gravel (26%) with lesser amounts of cobble (20%), small gravel (3%), and sand (2%). D-90 was 107 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (25%) and channel stability was good (rating score = 58). There was a moderate amount of instream cover (34%) which was mostly comprised of boulders and logs. Total overhead cover was low (36%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (29%).

Stream Features

This reach contains numerous bedrock chutes, falls, and cascades, many of which form barriers to upstream fish movement.

Fish Populations and Spawning Use

A 92 m section of this reach was electrofished on 27 September 1983, however only four cutthroat trout were captured indicating a very sparse fish population.

NORTH FORK OF ELK CREEK

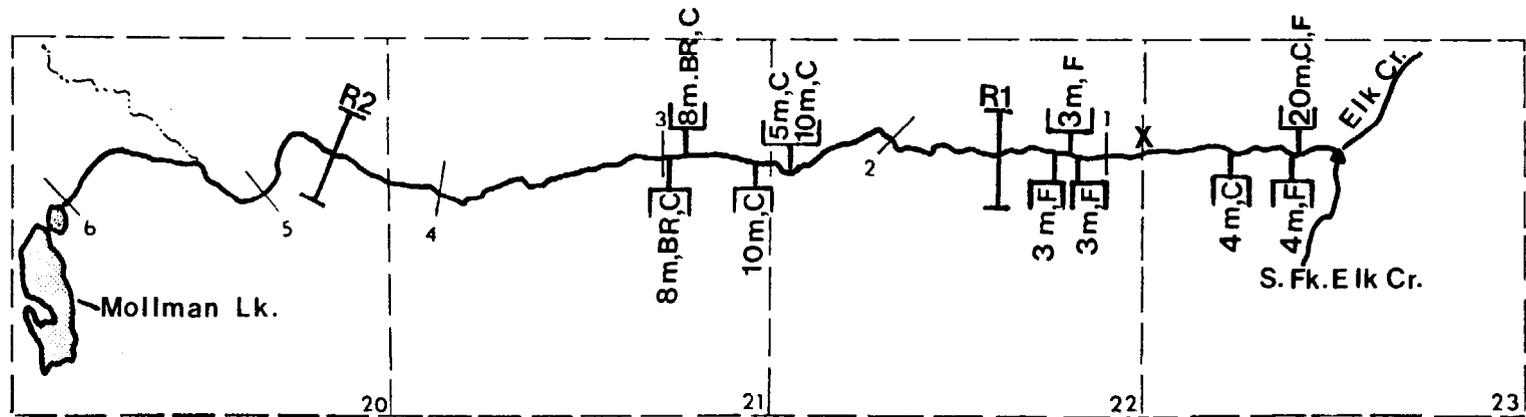


Figure 26. Biophysical inventory map of North Fork of Elk Creek, a tributary of Elk Creek.

NORTH FORK LOST CREEK

Locations of physical and chemical measurement stations
and other installations in the North Fork Lost Creek,
a tributary to the Swan River

Reach	<u>Location (s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-7.3	Location of reach	
	km 4-6	Habitat survey section	10/12/83
	km 4.9	Electrofishing section	08/31/82
	km 4.9	Discharge measurement	10/12/83
	km 2.5	Water chemistry	09/21/83
	km 4.7	Max/min thermometer	08/04/83 - 08/11/83
	km 6.1	Instream flow transects (WETP)	07/29/82 - 11/16/82
	km 6.8 km 2.8	Proposed hydro diversion Proposed hydro powerhouse	
2	km 7.3-11.5	Location of reach	
	km 8.8-10.8	Habitat survey section	10/01/83
	km 10	Electrofishing section	10/04/83
	km 10	Discharge measurement	10/03/83
	km 9	Water chemistry	09/29/83
3	km 11.5-14	Location of reach	

Reach 1

Reach 1 of North Fork Lost Creek is a fourth order stream having a medium sized drainage area (37.8 square kilometers) and a moderate average channel gradient (3.6%). The estimated maximum summer water temperature for this reach during 1983 was moderate (56°F or 13.3°C) and conductivity during the low water period was high (258 micromhos). The late summer flow was 6.4 cfs. The stream had an average wetted width of 6.3 meters and was comprised of 3% pool, 5% riffle, 20% run, and 72% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (13.0 per kilometer of stream). The streambed was comprised mainly of cobble (35%) and large gravel (28%) with lesser amounts of boulder-bedrock (22%), sand (9%), small gravel (4%), and silt (2%). D-90 was 103 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was fair (rating score = 85). There was a moderate amount of instream cover (22%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (45%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (26%).

Stream Features

A canyon section, from km 6-7, contains a falls at km 5.9 that is a barrier to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 31 August 1982. Densities of fish 75 mm and longer were moderate for cutthroat trout (102/300 m), moderate for bull trout (99/300 m), and low for brook trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were moderate for cutthroat trout (39/300 m), and low for both bull trout (17/300 m) and brook trout (3/300 m).

The entire reach was surveyed for bull trout redds in 1982 and 1983, with 9 and 6 redds found respectively. A 5.9 km section (km 5.9-0) was surveyed for bull trout redds in 1984 and 7 redds were found. A limited amount of brook trout spawning was observed. Based on electrofishing estimates and redd counts, the reach was considered to be important to migratory bull trout production.

Reach 2

Reach 2 of North Fork Lost Creek is a third order stream having a relatively small drainage area (23.9 square kilometers) and a moderate average channel gradient (4.9%). The conductivity during the low water period was moderate (219 micromhos) and the late summer flow was 3.1 cfs. The stream had an average wetted width of 4.0 meters and was comprised of 12% riffle, 33% run, and 55% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (6.5 per kilometer of stream). The streambed was comprised mainly of large gravel (32%) and cobble (28%) with lesser amounts of boulder-bedrock (25%), small gravel (12%), sand (2%), and silt (1%). D-90 was 61 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 75). There was a moderate amount of instream cover (31%) which was mostly created by boulders and debris. Total overhead cover was moderate (46%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (44%).

Stream Features

The stream goes dry from km 7.9 to km 7.5 and from km 10.8 upstream for an undetermined distance during late summer. There were several falls in this reach which are complete barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 116 m section of this reach on 4 October 1983. The density of 75 mm and longer cutthroat trout (the only species captured) was low (**63/300** m). **The** density of "catchable-sized" cutthroat trout (150 mm and longer) was also low (11/300 m). A 3.7 km section (km 11.0-7.3) of the reach was surveyed for bull trout redds in 1982 but no redds were found. A 0.7 km section (km 8.0-7.3) was surveyed for bull trout redds in 1983 but no redds were found.

Reach 3

This reach was not ground surveyed but was surveyed by helicopter on 17 September 1982. Reach 3 of the North Fork of Lost Creek is a first order stream having a relatively small drainage area (4.8 square kilometers) and high average channel gradient (19.5%). The channel width was estimated to be 1-2 meters. Channel debris was low and there were several cascades and chutes which were barriers to upstream fish movement. The streambed material was composed mostly of large gravel and boulders. The D-90 was estimated to be high. A high gradient cascade section was observed from km 11.5-12.5.

NORTH FORK OF LOST CREEK

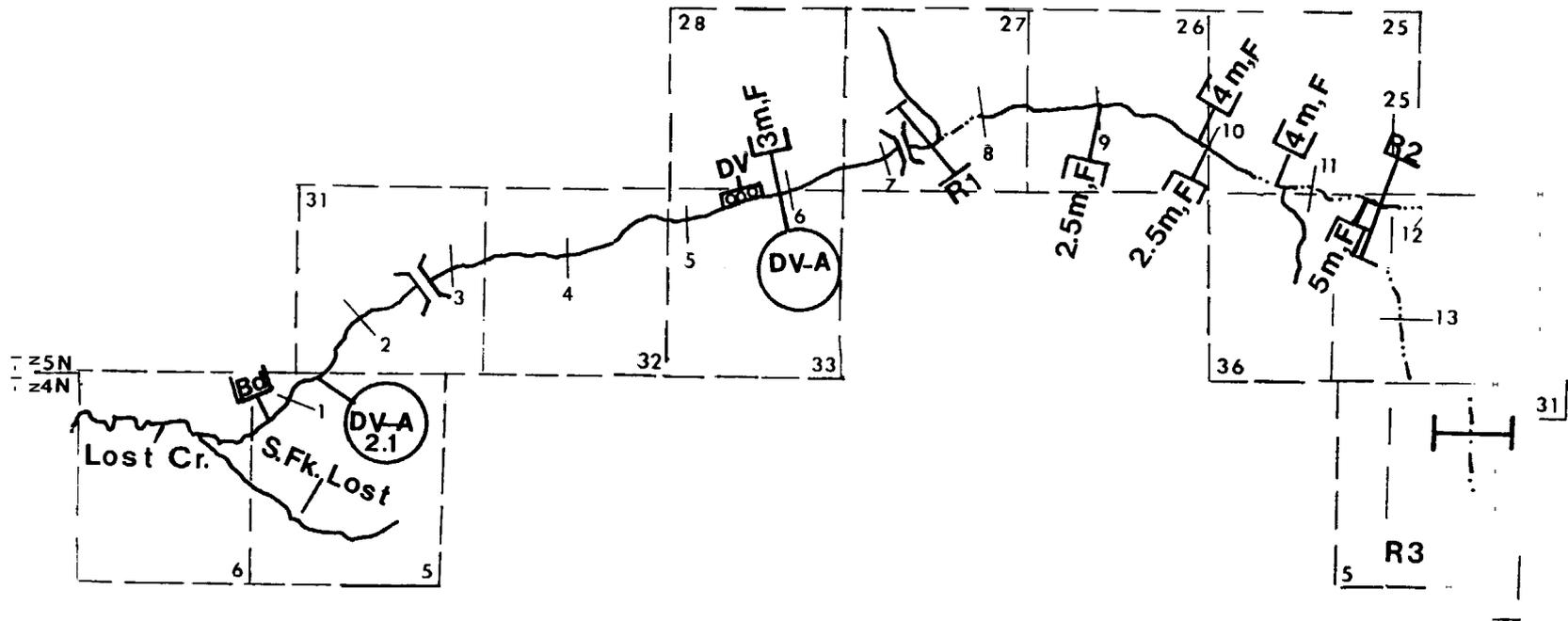


Figure 27. Biophysical inventory map of North Fork of Lost Creek, a tributary of Lost Creek.

PIPER CREEK

Locations of physical and chemical measurement stations
and other installations in Piper Creek,
a tributary to the Swan River

<u>Reached</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0.5-1.5	Habitat survey section	10/12/83
	km 0.6	Electrofishing section (survey)	09/20/82
	km 1.5	Electrofishing section (monitoring)	08/01/84 - 08/09/84
	km 1.7	Discharge measurement	10/12/83
	km 0.4	Water chemistry	09/27/83
	km 0.6	Max/min thermometer	08/04/83 - 08/11/83
	km 1.8	Proposed hydro powerhouse	
2	km 2-12	Location of reach	
	km 2.3-4.3	Habitat survey section	11/15/83
	km 4.3	Electrofishing section (survey)	08/26/82
	km 5.4	Electrofishing section (monitoring)	07/27/84 - 08/13/84
	km 8.8	Electrofishing section (monitoring)	08/14/84 - 08/21/84
	km 6.3	Water chemistry	09/27/83
	km 2.7	Max/min thermometer	08/11/83 - 09/01/83
	km 6.4	Instream flow transects (WEIP)	07/27/82 - 11/19/82
	km 6.4	Thermograph	06/15/83 - 10/29/84
	km 6.4	Water level recorder	11/24/82 - 10/29/84
	km 8.2	Proposed hydro diversion	
3	km 12-14	Location of reach	

Reach 1

Reach 1 of Piper Creek is a third order stream having a relatively small drainage area (24.1 square kilometers) and a low average channel gradient (1.8%). The estimated maximum summer water temperature for this reach during 1983 was average (58°F or 14.4°C) and conductivity during the low water period was low (141 micromhos). The late summer flow was 7.9 cfs. The stream had an average wetted width of 5.8 meters and was comprised of 33% riffle, and 67% run. There was a moderate density of high quality (class I, II, and III) pools (9.0 per kilometer of stream). The streambed was comprised mainly of large gravel (39%) and small gravel (24%) with lesser amounts of cobble (23%), sand (8%), silt (4%), and boulder-bedrock (2%). D-90 was 46 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had

a moderate amount of channel debris (45%) and channel stability was fair (rating score = 81). There was a moderate amount of instream cover (32%) which was mostly comprised of debris and logs. Total overhead cover was abundant (77%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (39%).

Fish Populations and Spawning Use

A three-pass population estimate was obtained by electrofishing a 97 m section of this reach on 20 September, 1982. Densities of fish 75 mm and longer were high for brook trout (183/300 m) and low for cutthroat, bull, and rainbow trout (24, 48, and 12 fish/300 m, respectively). Densities of "catchable-sized" trout (150 mm and longer) were moderate for brook trout (57/300 m) and low for cutthroat, bull, and rainbow trout (4, 16, and 6 fish/300 m, respectively).

In addition, a 1,000 foot-long section of this reach was electrofished during the period 1 August through 9 August, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, densities of fish 75 mm and longer were low for bull, cutthroat, and brook trout (67, 62, and 57 fish/300 m, respectively). Densities of "catchable-sized" trout (150 mm and longer) were low for bull, cutthroat, and brook trout (7, 20, and 28/300 m, respectively).

The entire reach was surveyed for bull trout redds in 1982 and again in 1984, but no redds were found. A 1.7 km section (km 1.7 to km 0.0) of the reach was surveyed for bull trout redds in 1983, but no redds were found. Based on electrofishing estimates and redd counts, the reach was considered marginal for migratory bull trout production. A limited amount of brook trout spawning was observed.

Reach 2

Reach 2 of Piper Creek is a second order stream having a relatively small drainage area (22.6 square kilometers) and a high average channel gradient (6.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (55°F or 12.8°C) and conductivity during the low water period was low (137 micromhos). The late summer flow was 11.0 cfs. The stream had an average wetted width of 6.8 meters and was comprised of 18% riffle, 67% run, and 15% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (6.0 per kilometer of stream). The streambed was comprised mainly of large gravel (32%) and cobble (29%) with lesser amounts of boulder-bedrock (18%), small gravel (14%), silt (6%), and sand (1%). D-90 was 23 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream

reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 69). There was a low amount of instream cover (11%) which was mostly comprised of debris and logs. Total overhead cover was moderate (59%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (25%).

Stream Features

Numerous log jams were present in the reach. A log jam at km 3.0 may possibly be a barrier to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 116 m section of this reach on 26 August 1982. Densities of fish 75 mm and longer were moderate for brook trout (78/300 m) and low for cutthroat trout (66/400 m). Densities of "catchable-sized" trout (150 mm and longer) were low for brook trout (21/300 m) and moderate for cutthroat trout (35/300 m).

In addition, two 1,000 foot-long sections of this reach were electrofished during July and August, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, densities of fish 75 mm and longer at km 5.4 were high for bull trout (210/300 m), and low for both cutthroat trout (60/300 m), and brook trout (43/300 m). Densities of "catchable-sized" trout (150 mm and longer) at km 5.4 were low for bull, cutthroat, and brook trout (6, 20, and 12/300 m respectively). The density of cutthroat trout 75 mm and longer (the only species captured) at km 8.8 was high (272/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) at km 8.8 was also high (82/300 m).

A 4.3 kilometer long section (km 6.3 - km 2.0) of this reach was surveyed for bull trout redds in 1982 but no redds were found. The reach was not surveyed for bull trout redds in 1983. A six kilometer long section (km 8.0 - km 2.0) was again surveyed for bull trout redds in 1984 and 1 redd was found.

The conflicting evidence that indicates high juvenile bull trout density in Reach 2, but a low amount of spawning activity at any point in Piper Creek suggests that Reach 2 either supports a resident bull trout population or serves as a rearing area for juveniles that hatched elsewhere. Consequently the importance of this reach for migratory bull trout production is undetermined.

Reach 3

This reach was not ground surveyed; however, it was helicopter surveyed on 13 July 1982. Reach 3 of Piper Creek is a second order

stream having a relatively small drainage area (7.0 square kilometers) and a moderate average channel gradient (3.3%). The channel width was estimated to be 2-3 meters. Channel debris was moderate to low. The substrate consisted of cobble and boulder with some fines and D-90 was high. Marshy areas where the stream was backed up were present from km 12.0-12.2. The fish habitat ended at km 14.0 due to steep gradient.

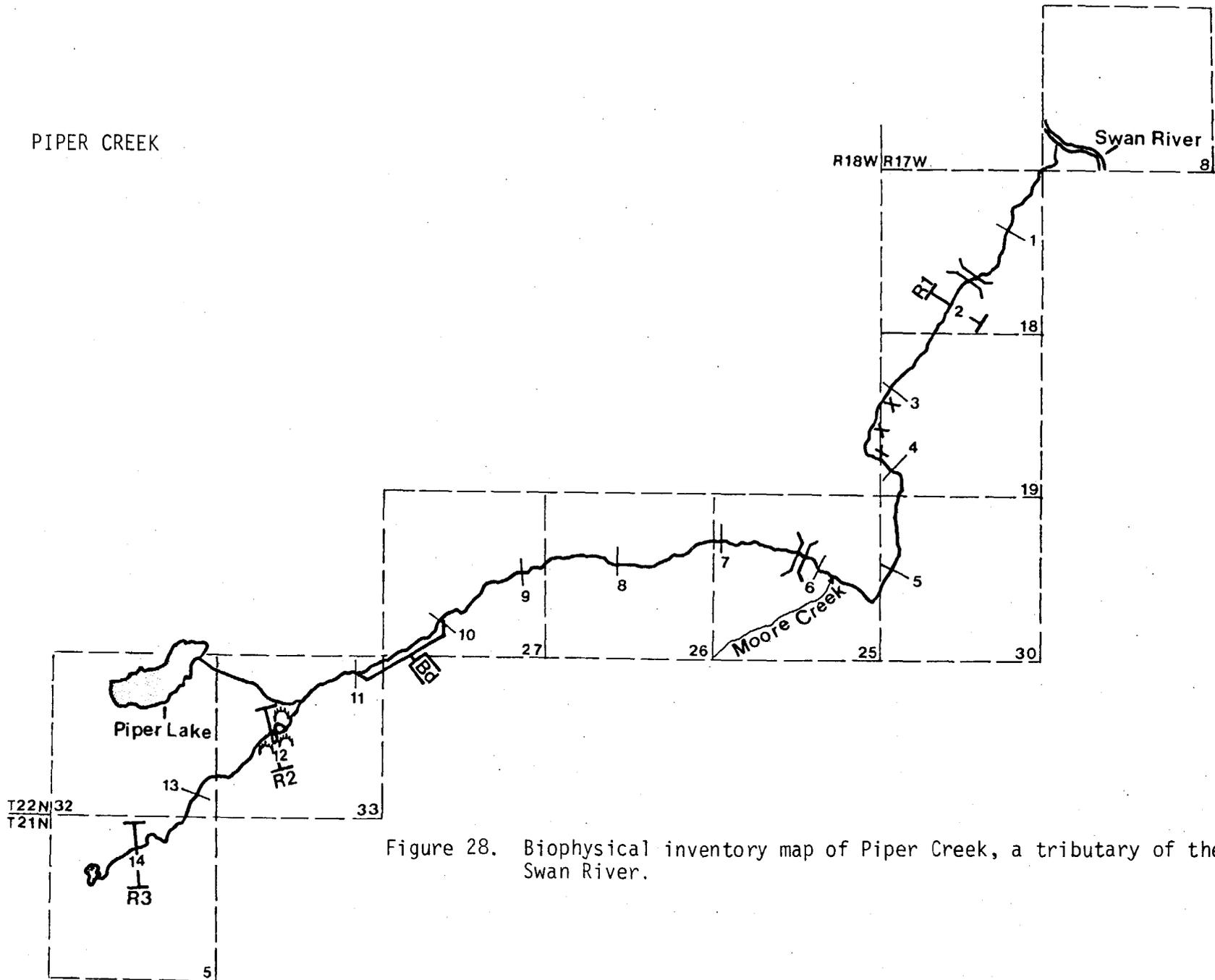


Figure 28. Biophysical inventory map of Piper Creek, a tributary of the Swan River.

PONY CREEK

Locations of physical and chemical measurement stations
and other installations in Pony Creek,
atributarytothe Swan River.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2.9	Location of reach	
	km 0.9-2.9	Habitat survey section	8/4/83
	km 2.9	Electrofishing section	8/8/83
	km 2.9	Discharge measurement	8/7/83
		Max/min thermometer	8/4/83-8/10/83
2	km 2.9-6.8	Location of reach	
	km 6	Water chemistry	9/27/83
3	km 6.8-9.1	Location of reach	
	km 7.5-8.5	Habitat survey section	8/25/83
	km 7.9	Electrofishing section	8/29/83
	km 8.2	Discharge measurement	8/29/83
	km 8.2	Max/min thermometer	8/18/83-8/29/83

Reach 1

Peach 1 of Pony Creek is a second order stream having a relatively small drainage area (13.3 square kilaneters) and a low average channel gradient (1.1%). The estimated maximum ~~summer~~ water temperature for this reach during 1983 was relatively high (62°F or 16.7°C). The discharge during the habitat survey was 4.1 cfs and the estimated late ~~summer~~ flow was 1.5 cfs. The stream had an average wetted width of 3.7 meters and was comprised of 5% pool, 8% riffle, 80% run, and 7% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (11.0 per kilaneter of stream). The streambed was comprised mainly of silt (59%) with lesser amounts of large gravel (19%), small gravel (14%), sand (5%), cobble (2%), and boulder-bedrock (1%). D-90 was 9 centimeters, indicating that the largest particles of substrate in the streambed were small in canparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (55%) and channel stability was fair (rating score = 82). There was a moderate amount of instream cover (25%) which was mostly comprised of debris and logs. Total overhead cover was moderate (55%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (43%).

Stream Features

Numerous beaver dams were present in this reach. A large marshy area was located at km 2.3.

Fish Populations and Spawning Use

Atwo-pass population estimate was obtained by electrofishing a 92 m section of this reach on 8 August 1983. Densities of fish

75 mm and longer were high for brook trout (429/300 m) and low for cutthroat trout (9/300 m). One longnose sucker was also captured. Densities of "catchable-sized" trout (150 mm and longer) was moderate for brook trout (42/300 m) and low for cutthroat trout (3/300 m). The entire reach ~~was~~ surveyed for bull trout redds in 1982 but no redds were found. This reach ~~was~~ not surveyed for bull trout redds in 1983.

Reach 2

This reach was not ground surveyed but was helicopter surveyed on 17 September 1982. Reach 2 of Pony Creek is a second order stream having a relatively ~~small~~ drainage area (11.5 square kilometers) and a high average channel gradient (6.3%). The channel width was estimated to be 1-2 meters. Channel debris was low. The substrate consisted of large gravel and cobble, and D-90 was moderate to low. A road culvert at km 6.0 may be a barrier to upstream fish movement. The entire reach was surveyed for bull trout redds in 1982 but no redds were found. This reach was not surveyed for bull trout redds in 1983.

Reach 3

Reach 3 of Pony Creek is a second order stream having a relatively ~~small~~ drainage area (5.8 square kilometers) and a high average channel gradient (22.3%). The estimated maximum summer water temperature for this reach during 1983 was average (57°F or 13.9°C) and conductivity during the low water period was moderate (165 micromhos). The discharge during the habitat survey was 2.5 cfs and the estimated late summer flow was 1.7 cfs. The stream had an average wetted width of 3.5 meters and was comprised of 2% pool, 3% riffle, 12% run, and 83% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (5.0 per kilometer of stream). The stream-bed was comprised mainly of cobble (42%) and large gravel (28%) with lesser amounts of boulder-bedrock (26%), small gravel (3%), and silt (1%). D-90 was 116 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was good (rating score = 65). There was a moderate amount of instream cover (38%) which was mostly comprised of boulders and debris. Total overhead cover was abundant (91%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (27%).

Stream Features

Numerous cascades and falls were observed throughout the reach.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 98 m section of this reach on 29 August 1983. The density of

75 mm and longer cutthroat trout (the only species captured) was high (153/300 m). The density of "catchable-sized" cutthroat trout (150 mm and longer) was low (19/300 m).

PONY CREEK

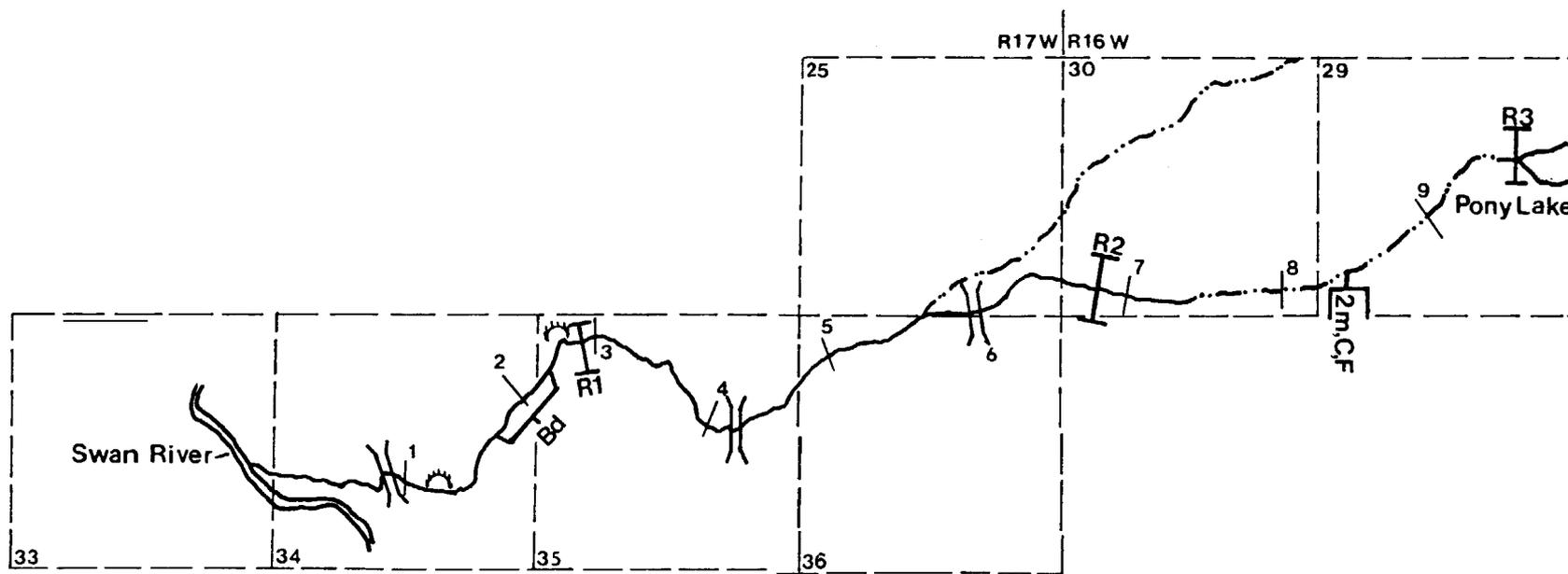


Figure 29. Biophysical inventory map of Pony Creek, a tributary of the Swan River.

PORCUPINE CREEK

Locations of physical and chemical measurement stations
and other installations in Porcupine Creek,
a tributary to Gildart Creek.

Reach	<u>Location(s)</u>	<u>Item</u>	Date(s)
1	km 0-3	Location of reach	
	km 0-1	Habitat survey section	10/18/83
	km 1	Electrofishing section	8/23/82
	km 1	Discharge measurement	10/18/83
	km 1	Water chemistry	9/26/83
	km 1	Max/min thermometer	8/11/83-9/1/83

Reach 1

Reach 1 of Porcupine Creek is a fourth order stream having a relatively small drainage area (25.7 square kilometers) and a high average channel gradient (8.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was moderate (240 micromhos). The late summer flow was 2.2 cfs. The stream had an average wetted width of 2.8 meters and was comprised of 12% riffle, 70% run, and 18% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (3.0 per kilometer of stream). The streambed was comprised mainly of large gravel (41%) and small gravel (32%) with lesser amounts of cobble (12%), boulder-bedrock (7%), silt (5%), and sand (3%). D-90 was 26 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (53%) and channel stability was good (rating score = 73). There was a high amount of instream cover (46%) which was mostly comprised of logs and debris. Total overhead cover was abundant (89%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (59%).

Streamt u r e s

The stream flow dissipates to a negligible level at km 3.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 23 August 1982. The density of brook trout (the only species captured) was moderate (144/300 m). The density of "catchable-sized" brook trout was also moderate (32/300 m).

PORCUPINE CREEK

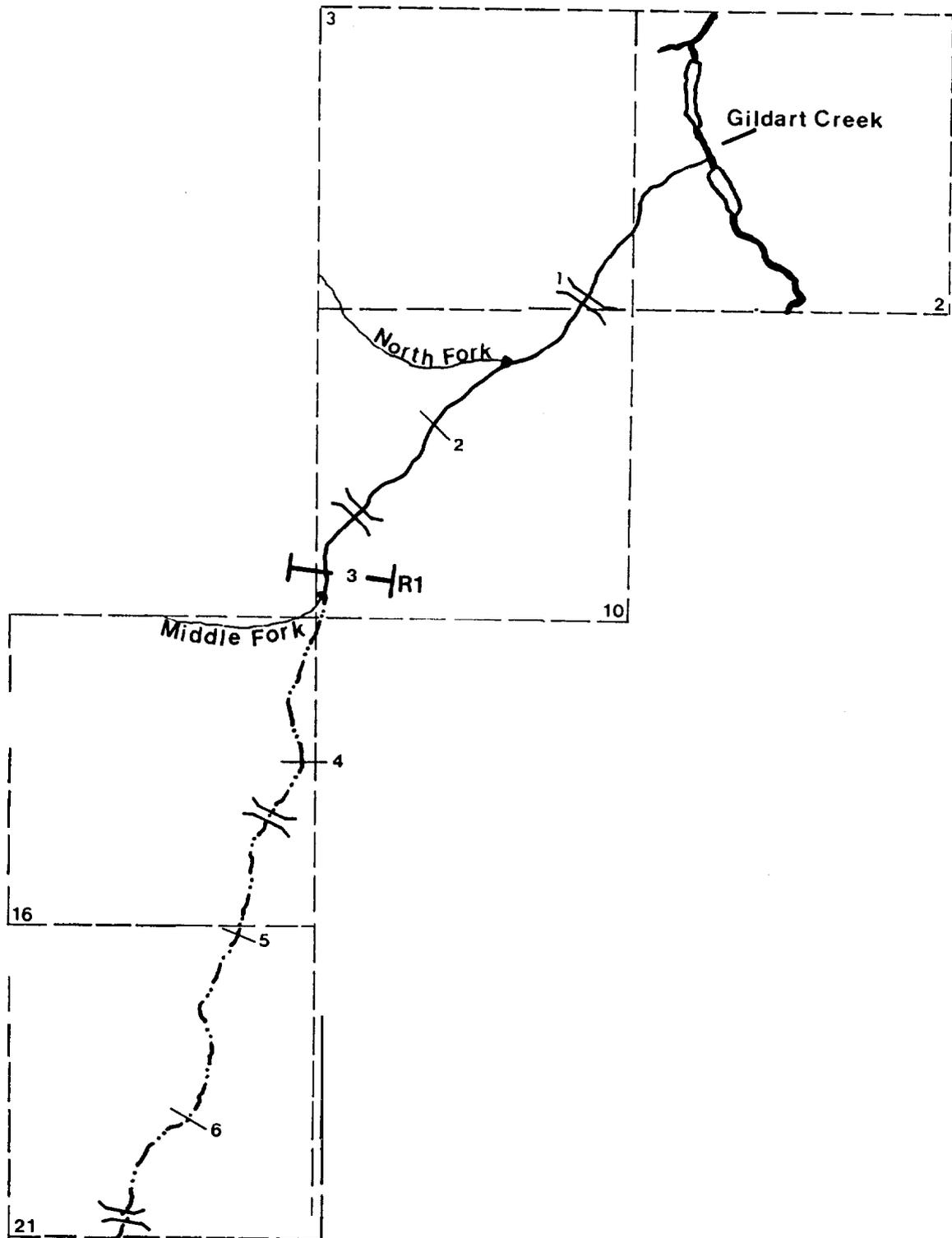


Figure 30. Biophysical inventory map of Porcupine Creek, a tributary of Gildart Creek.

RED BUTTE CREEK

Locations of physical and chemical measurement stations
and other installations in Red Butte Creek,
a tributary to Kraft Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4	Location of reach	
	km 1-3	Habitat survey section	8/9/83
	km2	Electrofishing section	8/10/83
	km 1.2	Discharge measurement	8/9/83
	km 0.3	Water chemistry	9/22/83
	km2	Max/min thermometer	8/22/83-9/1/83

Reach 1

Reach 1 of Red Butte Creek is a third order stream having a relatively small drainage area (9.8 square kilometers) and a high average channel gradient (7.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (52°F or 11.1°C) and conductivity during the low water period was low (82 micromhos). The discharge during the habitat survey was 2.4 cfs and the estimated late summer flow was 1.1 cfs. The stream had an average wetted width of 5.4 meters and was comprised of 10% pool, 25% riffle, 35% run, and 30% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (12.5 per kilometer of stream). The streambed was comprised mainly of large gravel (38%) and cobble (37%) with lesser amounts of boulder-bedrock (17%), small gravel (7%), and sand (1%). D-90 was 98 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 52). There was a moderate amount of instream cover (33%) which was mostly comprised of debris and boulders. Total overhead cover was moderate (59%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (51%).

Stream Features

Numerous small cascades and debris jams were present throughout the reach.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 100 m section of this reach on 10 August 1983. The density of 75 mm and longer cutthroat trout was high (174/300 m). The density of "catchable-sized" cutthroat trout (150mm and longer) was moderate (43/300 m).

RED BUTTE CREEK

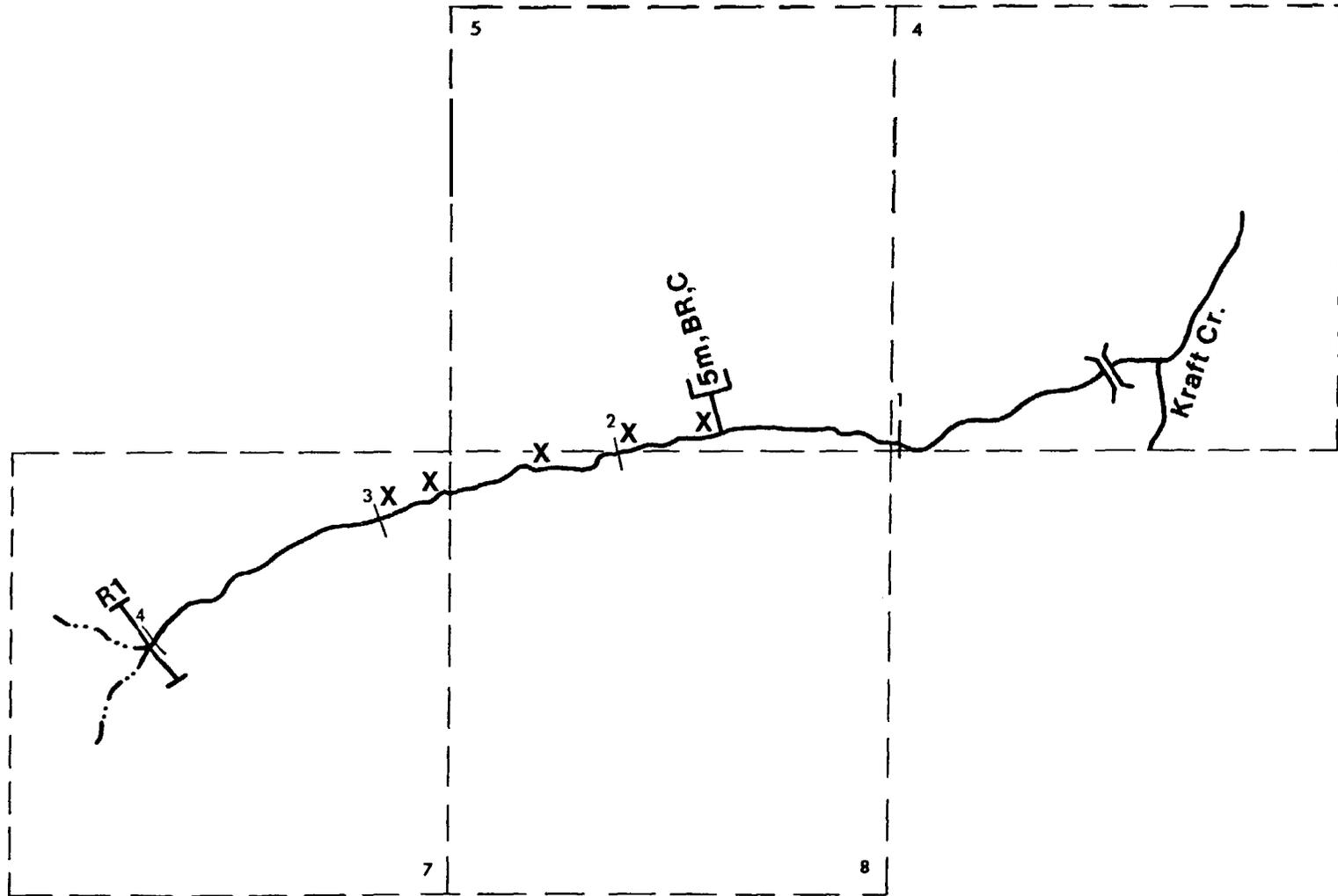


Figure 31. Biophysical inventory map of Red Butte Creek, a tributary of Kraft Creek.

RUMBLE CREEK

Locations of physical and chemical measurement stations
and other installations in Rumble Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0.5-1.5	Habitat survey section	9/1/83
	km 1.7	Electrofishing section	9/6, 9/7, 9/16/83
	km 0.7	Discharge measurement	9/1/83
	km 0.4	Water chemistry	9/22/83
	km 0.8	Max/min thermometer	8/11/83-8/18/83
2	km 2-4.8	Location of reach	
3	km 4.8-8	Location of reach	

Reach 1

Reach 1 of Rumble Creek is a third order stream having a relatively small drainage area (14.6 square kilometers) and a low average channel gradient (2.1%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (64°F or 17.8°C) and conductivity during the low water period was moderate (1% micromhos). The late summer flow was 1.8 cfs. The stream had an average wetted width of 5.3 meters and was comprised of 10% pool, 28% riffle, 35% run, and 27% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (11.0 per kilometer of stream). The streambed was comprised mainly of silt (32%) and large gravel (30%) with lesser amounts of small gravel (18%), sand (16%), cobble (3%), and boulder-bedrock (1%). D-90 was 7 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other streamreaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was fair (rating score = 82). There was a moderate amount of instream cover (22%) which was mostly comprised of debris and logs. Total overhead cover was low (32%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (23%).

Stream Features

Beaver dams and channel braiding were common throughout the reach. A marshy area was located at km 0.5.

Fish Populations and Spawning Use

A n-ark-recapture population estimate was obtained by electrofishing a 354 m section of the stream on 6, 7, and 16 September 1983. Densities of fish 75 mm and longer were high for brook trout (606/300 m) and low for cutthroat trout (27/300 m). Densities of "catchable-

sized" trout (150 mm and longer) were extremely high for brook trout (266/300 m) and low for cutthroat trout (18/300 m). The entire reach was surveyed for bull trout redds in 1982 but no redds were found. The reach was not surveyed for bull trout redds in 1983.

Reach 2

The reach was not ground surveyed, however it was helicopter surveyed on 18 September 1982. Reach 2 of Rumble Creek is a third order stream having a relatively small drainage area (11.6 square kilometers) and a moderate average channel gradient (4.8%). The channel width was estimated to be 4 meters. Channel debris was low. The substrate consisted mainly of ~~small~~ and large gravel with some rubble. D-90 was relatively small. No fish barriers were observed. A 2.3 km section (km 4.3 to km 2.0) was surveyed for bull trout redds in 1982 but no redds were found. The reach was not surveyed for bull trout redds in 1983.

Reach 3

This reach was not ground surveyed, however it was helicopter surveyed on 18 September 1982. Reach 3 of Rumble Creek is a first order stream having a relatively small drainage area (4.6 square kilometers) and a high average channel gradient (21.5%). Channel width was estimated to be 3 meters. Channel debris was low. The substrate consisted of boulders. D-90 was high. Cascades at km 6.0 and km 8.0 may form barriers to migratory fish.

RUMBLE CREEK

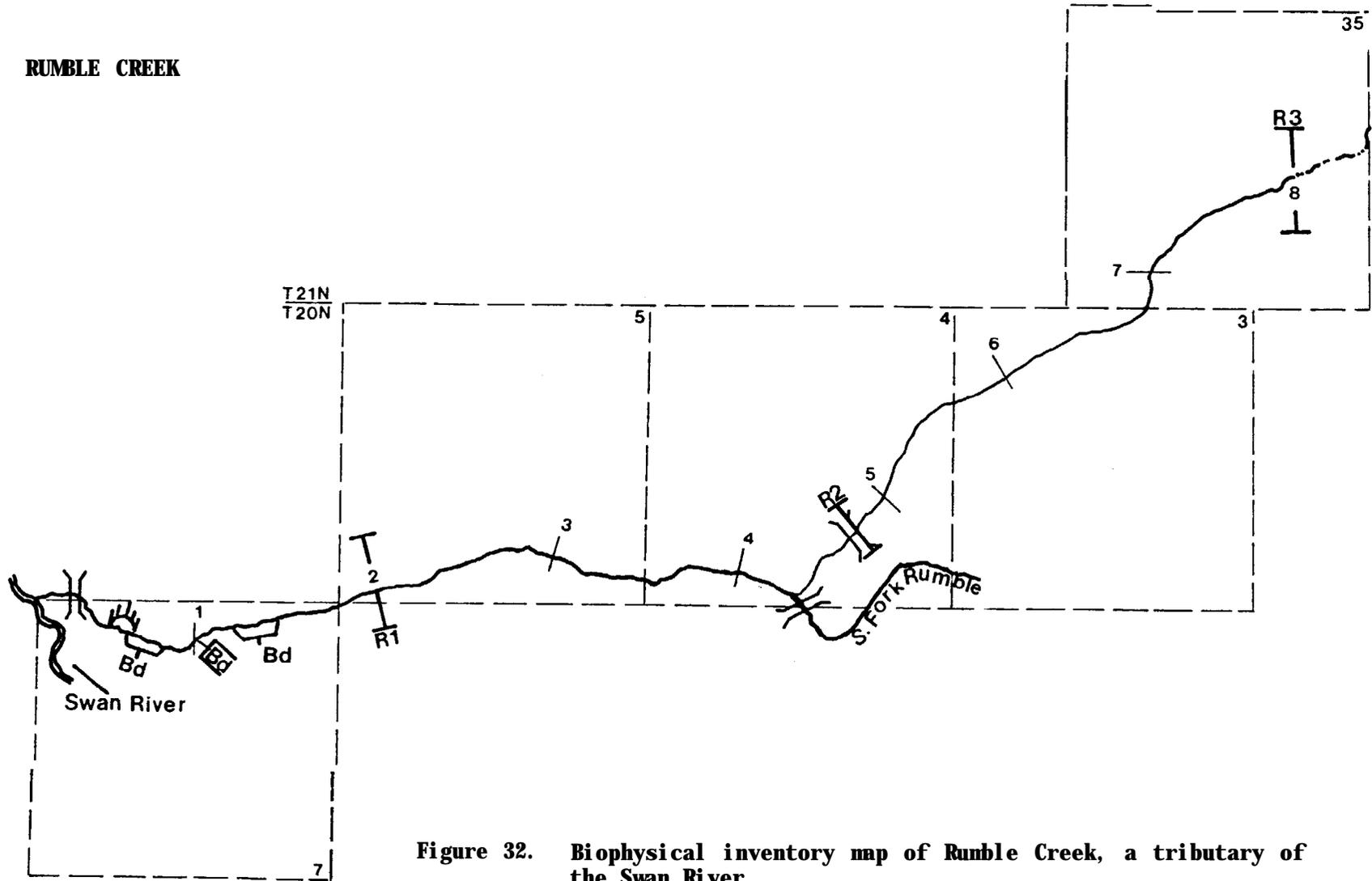


Figure 32. Biophysical inventory map of Rumble Creek, a tributary of the Swan River.

SCOUT CREEK

Locations of physical and chemical measurement stations
and other installations in Scout Creek,
a tributary to Coat Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-1.5	Location of reach	
	km 0-1	Habitat survey section	9/3/82
	km 1	Electrofishing section	9/13/82
	km 1.1	Discharge measurement	9/13/82
	km .5-1.5	Max/min thermometer	8/6/82-11/8/82
	km 1.5	Instream flow transects (WEIP)	
	km 1.7	Proposed hydro diversion	
	km 0	Proposed hydro powerhouse	

Reach 1

Reach 1 of Scout Creek is a second order stream having a relatively small drainage area (7.4 square kilometers) and a high average channel gradient (20.3%). The late summer flow was 2.7 cfs. The stream had an average wetted width of 4.1 meters and was comprised of 28% riffle, 13% run, and 59% pocketwater-cascade. There were no quality (class I, II, and III) pools. The streambed was comprised mainly of cobble (42%) and boulder-bedrock (29%) with lesser amounts of large gravel (24%), small gravel (3%), and sand (2%). D-90 was 74 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other streamreaches in the drainage. The reach had a high amount of channel debris (86%) and channel stability was good (rating score = 64). There was a moderate amount of instream cover (36%) which was mostly comprised of boulders and logs. Total overhead cover was moderate (69%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (69%).

Stream Features

The reach was a series of cascades. The creek was dry from km 1.5 to Scout Lake.

Fish Populations and Spawning Use

A 125 m section of this reach was electrofished on 13 September 1982, however no fish were captured.

SCOUT CREEK

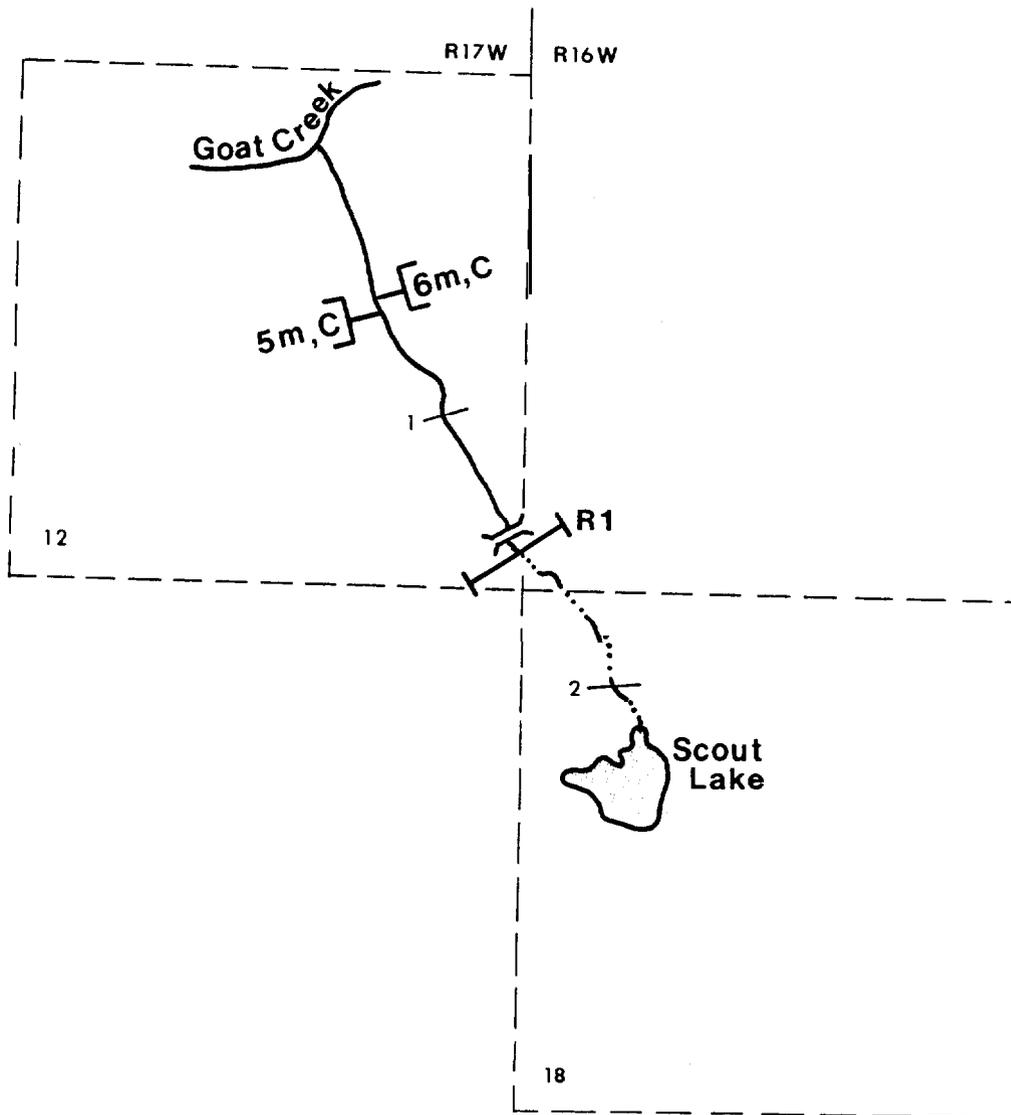


Figure 33. Biophysical inventory map of Scout Creek, a tributary of Goat Creek.

SIMPSON CREEK

Locations of physical and chemical measurement stations
and other installations in Simpson Creek,
a tributary to Condon Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-4	Location of reach	
	km 2-4	Habitat survey section	7/28/83
	km 2.4	Electrofishing section	8/1/83
	km 2.4	Discharge measurement	7/28/83
	km 0.2	Water chemistry	9/27/83
	km 2.4	Max/min thermometer	8/10/83-8/17/83

Reach 1

Reach 1 of Simpson Creek is a third order stream having a relatively small drainage area (13.9 square kilometers) and a moderate average channel gradient (3.4%). The estimated maximum summer water temperature for this reach during 1983 was average (58°F or 14.4°C) and conductivity during the low water period was low (148 micranhos). The discharge during the habitat survey was 0.6 cfs and the estimated late summer flow was 0.2 cfs. The stream had an average wetted width of 1.4 meters and was comprised of 10% riffle, 75% run, and 15% pocket water-cascade. There were no high quality (class I, II, and III) pools. The streambed was comprised mainly of silt (75%) with lesser amounts of sand (7%), small gravel (7%), large gravel (5%), boulder-bedrock (4%), and cobble (2%). D-90 was 6 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (65%) and channel stability was good (rating score = 70). There was a high amount of instream cover (52%) which was mostly comprised of debris and logs. Total overhead cover was abundant (99%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (79%).

Stream Features

The stream was intermittent from km 3.7 to 3.4 during the habitat survey. A large beaver pond was observed at km 2.1. This was an extremely small stream.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 92 m section of this reach on 1 August 1982. The density of 75 mm and longer cutthroat trout (the only species captured) was moderate (102/300 m). No "catchable-sized" cutthroat trout (150 mm and larger) were captured.

SIMPSON CREEK

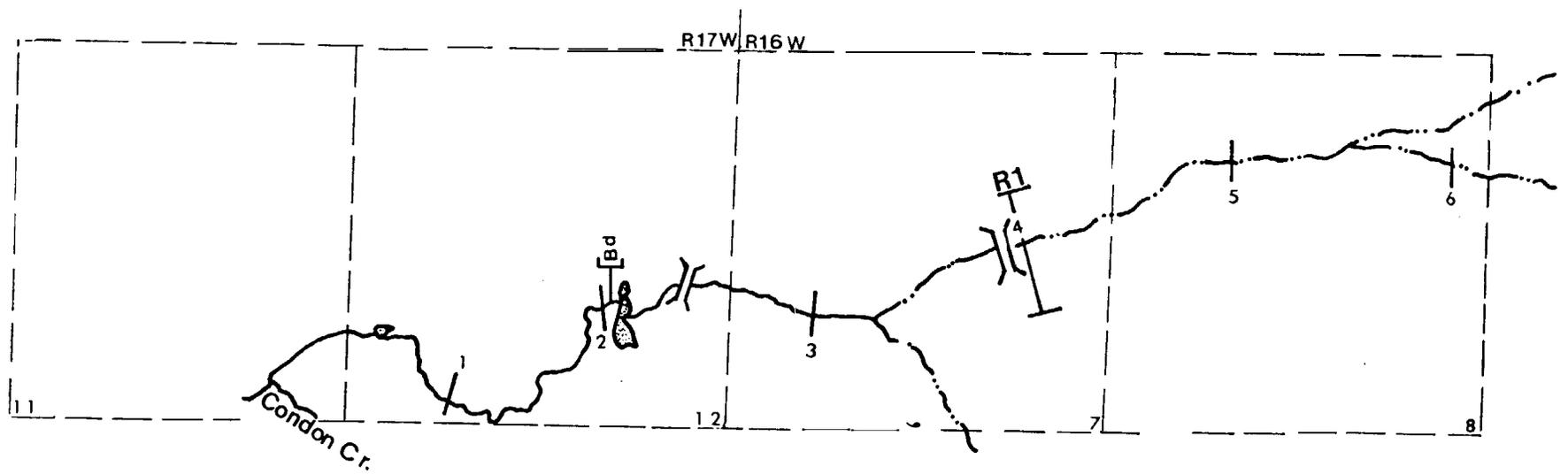


Figure 34. Biophysical inventory map of Simpson Creek, a tributary of Condon Creek.

SIXMILE CREEK

Locations of physical and chemical measurement stations
and other installations in Sixmile Creek,
a tributary to Swan Lake.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-6	Location of reach	
	km 2-4	Habitat survey section	10/26/83
	km 1.9	Electrofishing section	8/17/82
	km 4.1	Discharge measurement	10/26/83
	km 0.2	Water chemistry	9/21/83
	km 1.9	Max/min thermometer	8/4/83-8/11/83
	km 2.0	Instream flow transects (WETP)	6/27/83-10/17/83
	km 2.9	Proposed hydro diversion	
	km 1.7	Proposed hydro powerhouse	

Reach 1

Peach 1 of Sixmile Creek is a second order stream having a relatively ~~small~~ drainage area (8.0 square kilometers) and a high average channel gradient (10.2%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was low (84 micromhos). The late summer flow was 2.1 cfs. The stream had an average wetted width of 2.4 meters and was ~~comprised~~ of 17% riffle, 55% run, and 28% pocketwater-cascade. There were no high quality (class I, II, and III) pools. The streambed was comprised mainly of large gravel (47%) and cobble (27%) with lesser amounts of boulder-bedrock (18%), ~~small~~ gravel (4%), silt (3%), and sand (1%). D-90 was 33 centimeters indicating that the largest particles of substrate in the ~~streambed~~ were average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (48%) and channel stability was good (rating score = 73). There was a moderate amount of instream cover (22%) which was mostly comprised of logs and debris. Total overhead cover was abundant (90%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (42%).

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 134 m section of this reach on 17 August 1982. The density of 75 mm and longer cutthroat trout (the only species captured) was moderate (123/300 m). The density of "cat-sized" cutthroat trout (150 mm and longer) was low (10/300 m).

SIXMILE CREEK

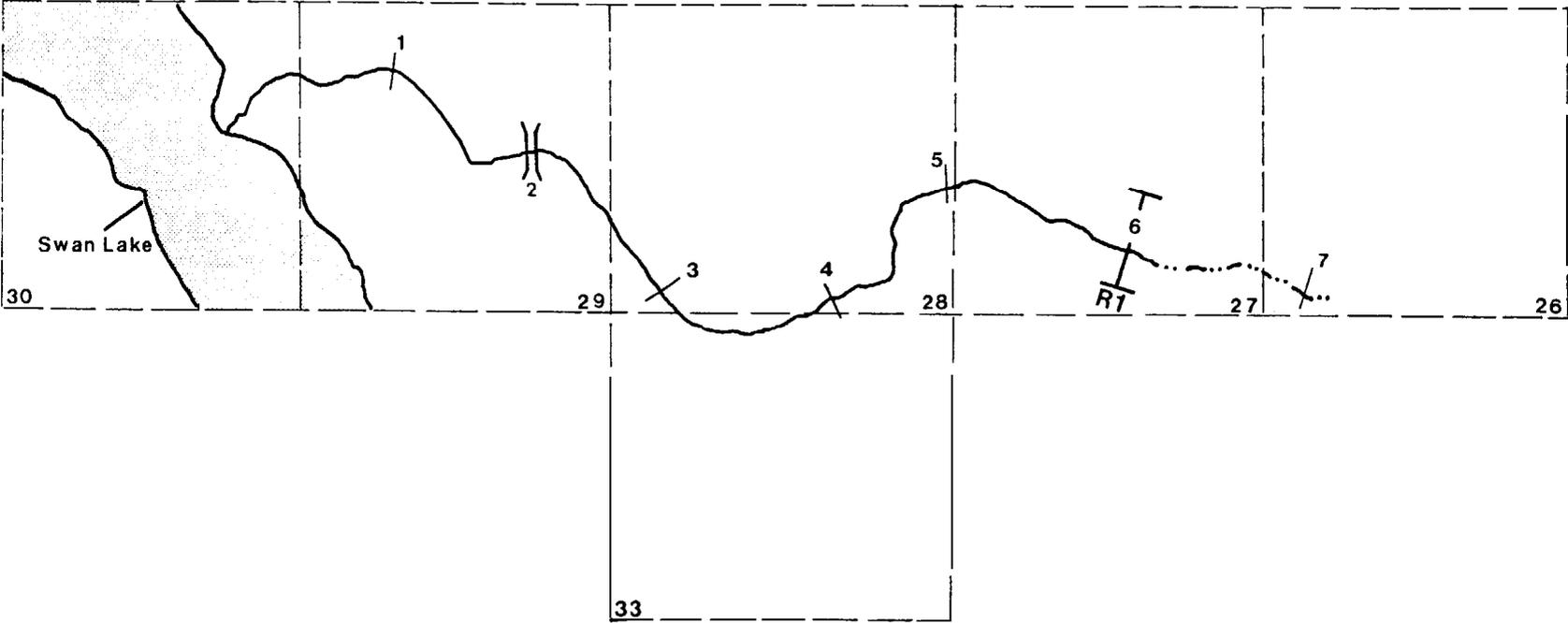


Figure 35. Biophysical inventory map of Sixmile Creek, a tributary of Swan Lake.

SMITH CREEK

Locations of physical and chemical measurement stations
and other installations in Smith Creek,
a tributary to Condon Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-5.5	Location of reach	
	km 0.2-1.2	Habitat survey section	9/15/83
	km 0.7	Electrofishing section	9/19/83
	km 1	Discharge measurement	9/19/83
	km 0.2	Water chemistry	9/27/83
	km 4.3	Max/min thermometer	8/18/83-9/1/83
2	km 5.5-9	Location of reach	
3	km 9-11	Location of reach	
	km 9.2-10.2	Habitat survey section	8/29/83
	km 9.2	Electrofishing section	8/30/83
	km 8.5	Discharge measurement	8/29/83
	km 8.5	Water chemistry	9/27/83
	km 9	Max/min thermometer	8/18/83-8/30/83

Reach 1

Reach 1 of Smith Creek is a third order stream having a relatively small drainage area (24.8 square kilometers) and a low average channel gradient (0.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (75°F or 23.9°C) and conductivity during the low water period was high (278 micromhos). The late summer flow was 0.3 cfs. The stream had an average wetted width of 2.7 meters and was comprised of 100% run. There was a low density of high quality (class I, II, and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of silt (63%) with lesser amounts of large gravel (17%), sand (12%), small gravel (7%) and cobble (1%). D-90 was 4 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (20%) and channel stability was fair (rating score = 87). There was a high amount of instream cover (56%) which was mostly comprised of aquatic vegetation and debris. Total overhead cover was moderate (58%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (56%).

Stream Features

A beaver dam was present at km 1.1. A marshy area was located at km 0.2.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 92 m section of this reach on 19 ~~September~~ 1983. The density of 75 mm and longer brook trout (the only species captured) was moderate (108/300 m). The density of "catchable-sized" brook trout (150 mm and longer) was also moderate (43/300 m). A small number of northern squawfish and long-nose suckers were also captured.

Reach 2

This reach was not ground surveyed, however it was helicopter surveyed on 18 September 1982. Reach 2 of Smith Creek is a second order stream having a relatively small drainage area (8.3 square Kilometers) and a high average channel gradient (6.7%). The channel width was estimated to be 3-4 meters. Channel debris was low. The substrate material consisted of large gravel and D-90 was relatively small. No barriers were observed.

Reach 3

Reach 3 of Smith Creek is a second order stream having a relatively small drainage area (7.1 square kilometers and a high average channel gradient (21.3%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2°C) and conductivity during the low water period was moderate (170 micromhos). The discharge during the habitat survey was 3.4 cfs and the estimated late summer flow was 2.8 cfs. The stream had an average wetted width of 4.4 meters and was comprised of 17% riffle, 60% run, and 23% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (6.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (48%) and cobble (21%) with lesser amount of large gravel (17%), small gravel (9%), sand (4%), and silt (1%). D-90 was 54 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (23%) and channel stability was good (rating score = 53). There was a moderate amount of instream cover (25%) which was mostly comprised of turbulence and boulder. Total overhead cover was moderate (44%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (21%).

Stream Features

Falls and bedrock chutes were numerous throughout the reach. At km 9.9, a 3 m falls and two 3m bedrock chutes formed fish barriers. A 4m falls at km 10.0 was a barrier. At km 10.1 there was a 3 m and a 4 m falls which also were barriers.

Fish Populations and Spawning Use

A 107 m section of this reach was electrofished on 30 August 1983, however only 5 cutthroat trout were captured, indicating a very sparse fish population.

SMITH CREEK

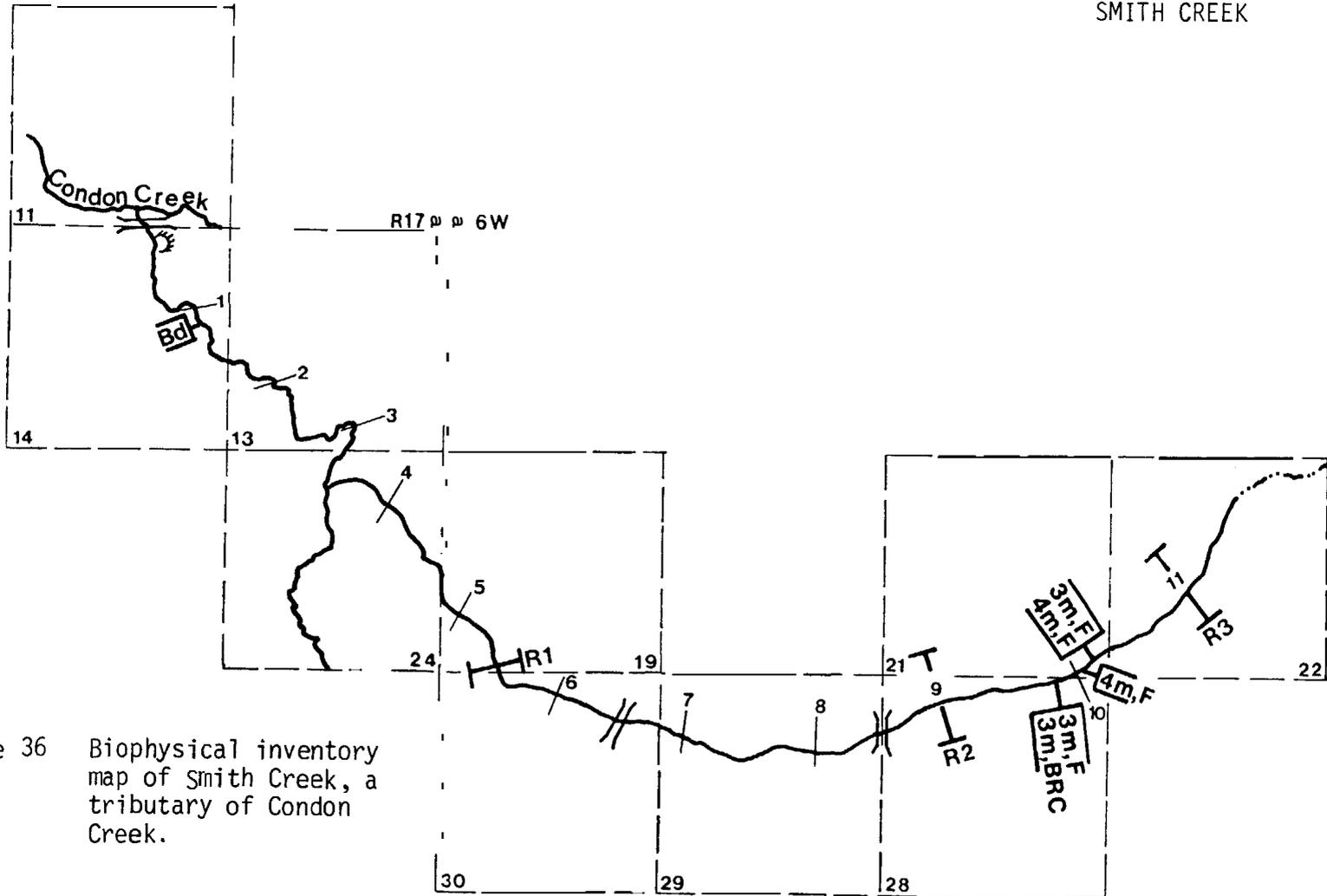


Figure 36 Biophysical inventory map of Smith Creek, a tributary of Condon Creek.

SOUP CREEK

Locations of physical and chemical measurement stations
and other installations in Soup Creek,
a tributary to the Swan River

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-10.2	Location of reach	
	km 2-4	Habitat survey section	07/11/83
	km 3.4	Electrofishing section	08/16/83
	km 4	Discharge measurement	07/11/83
	km 1.4	Water chemistry	09/27/83
	km 3.1	Max/min thermometer	08/04/83 - 08/11/83
	km 1.5; 9.3	Fish trap	04/22/83 - 07/18/83
	km 9.6	Proposed hydro powerhouse	
2	km 10.2-12.3	Location of reach	
	km 10.4-12.4	Habitat survey section	11/09/83
	km 10.9	Electrofishing section	08/11/82
	km 12.1	Discharge measurement	11/09/83
	km 11.3	Water chemistry	09/21/83
	km 11.2	Max/min thermometer	08/04/83 - 08/10/83
	km 11	Instream flow transects (WEIP)	07/26/83 - 11/18/83
	km 9.5	Thermograph	04/13/83 - 10/30/84
	km 11	Water level recorder	11/24/82 - 10/30/84
	km 12.1	Proposed hydro diversion	
3	km 12.3-15	Location of reach	
	km 13-15	Habitat survey section	08/08/83
	km 14	Electrofishing section	08/23/83
	km 13	Discharge measurement	08/09/83
	km 13.6	Max/min thermometer	08/10/83 - 09/12/83

Reach 1

Reach 1 of Soup Creek is a third order stream having a medium-sized drainage area (38.1 square kilometers) and a low average channel gradient (2.1%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (**61°F** or **16.1°C**) and conductivity during the low water period was high (328 micromhos). The discharge during the habitat survey was 23.8 cfs and the estimated late summer flow was about 10.0 cfs. The stream had an average wetted width of 6.8 meters and was comprised of 6% pool, 14% riffle, 75% run, and 5% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (7.0 per kilometer of stream). The streambed was comprised mainly of large gravel (30%) and silt (25%) with lesser amounts of sand (22%), small gravel (19%), and cobble (4%). D-90 was 13 centimeters, indicating that the largest particles of substrate in

the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (85%) and channel stability was fair (rating score = 85). There was a high amount of instream cover (42%) which was mostly comprised of debris and logs. Total overhead cover was moderate (61%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (43%).

Stream Features

The stream is very marshy near the mouth with no main channel. Beaver dams were located at km 2.4 and 3.4.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 107 m section of this reach on 16 August 1983. Densities of fish 75 mm and longer were high for brook trout (279/300 m) and low for bull trout (3/300 m). The density of "catchable-sized" brook trout (150 mm and longer) was moderate (48/300 m). No "catchable-sized" bull trout were captured. Small numbers of longnose suckers were also observed. Based on electrofishing estimates and redd counts, the reach was considered marginal for migratory bull trout production. A 9.5 km section (km 9.5 to 0.0) of the reach was surveyed for bull trout redds in 1982 but no redds were found. This reach was not surveyed for bull trout redds in 1983. A substantial amount of brook trout spawning was observed.

Fish traps were installed in the upper and lower ends of this reach to monitor potential spawning movements and rates of juvenile emigration of cutthroat trout during the time period of 22 April to 18 July 1983. No adult cutthroat trout and very few juveniles were captured, indicating very low use by migratory fish.

Reach 2

Reach 2 of Soup Creek is a second order stream having a relatively small drainage area (13.7 square kilometers) and a high average channel gradient (11.6%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (53°F or 11.7°C) and conductivity during the low water period was high (270 micromhos). The late summer flow was 8.5 cfs. The stream had an average wetted width of 4.8 meters and was comprised of 7% pool, 2% riffle, 50% run, and 41% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (13.5 per kilometer of stream). The streambed was comprised mainly of cobble (37%) and boulder-bedrock (36%) with lesser amounts of large gravel (23%), and small gravel (4%). D-90 was 69 centimeters, indicating that the largest particles of substrate in the streambed are large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (38%) and channel stability was good (rating score = 66). There

was a moderate amount of instream cover (27%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (59%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (43%).

Stream Features

Numerous cascades, falls, chutes, and debris jams were present throughout the reach, some forming complete barriers to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 160 m section of this reach on 11 August 1982. The density of 75 mm and longer cutthroat trout was high (240/300 m). The density of "catchable-sized" cutthroat trout was moderate (46/300 m).

Reach 3

Reach 3 of Soup Creek is a second order stream having a relatively small drainage area (10.5 square kilometers) and a high average channel gradient (6.7%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (55°F or 12.8°C). The discharge during the habitat survey was .3 cfs and the estimated late summer flow was 0.2 cfs. The stream had an average wetted width of 3.2 meters and was comprised of 45% riffle, 47% run, and 8% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (4.0 per kilometer of stream). The streambed was comprised mainly of large gravel (41%) and small gravel (28%) with lesser amounts of cobble (19%), sand (7%), boulder-bedrock (4%), and silt (1%). D-90 was 20 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (38%) and channel stability was good (rating score = 58). There was a low amount of instream cover (15%) which was mostly comprised of debris and logs. Total overhead cover was moderate (51%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (36%).

Stream Features

A moderate number of falls, cascades, and debris jams were present in this reach. The stream goes dry for approximately 100 m around km 13.7.

Fish Populations and Spawning Use

A 103 m section of this reach was electrofished on 23 August 1983, however no fish were captured.

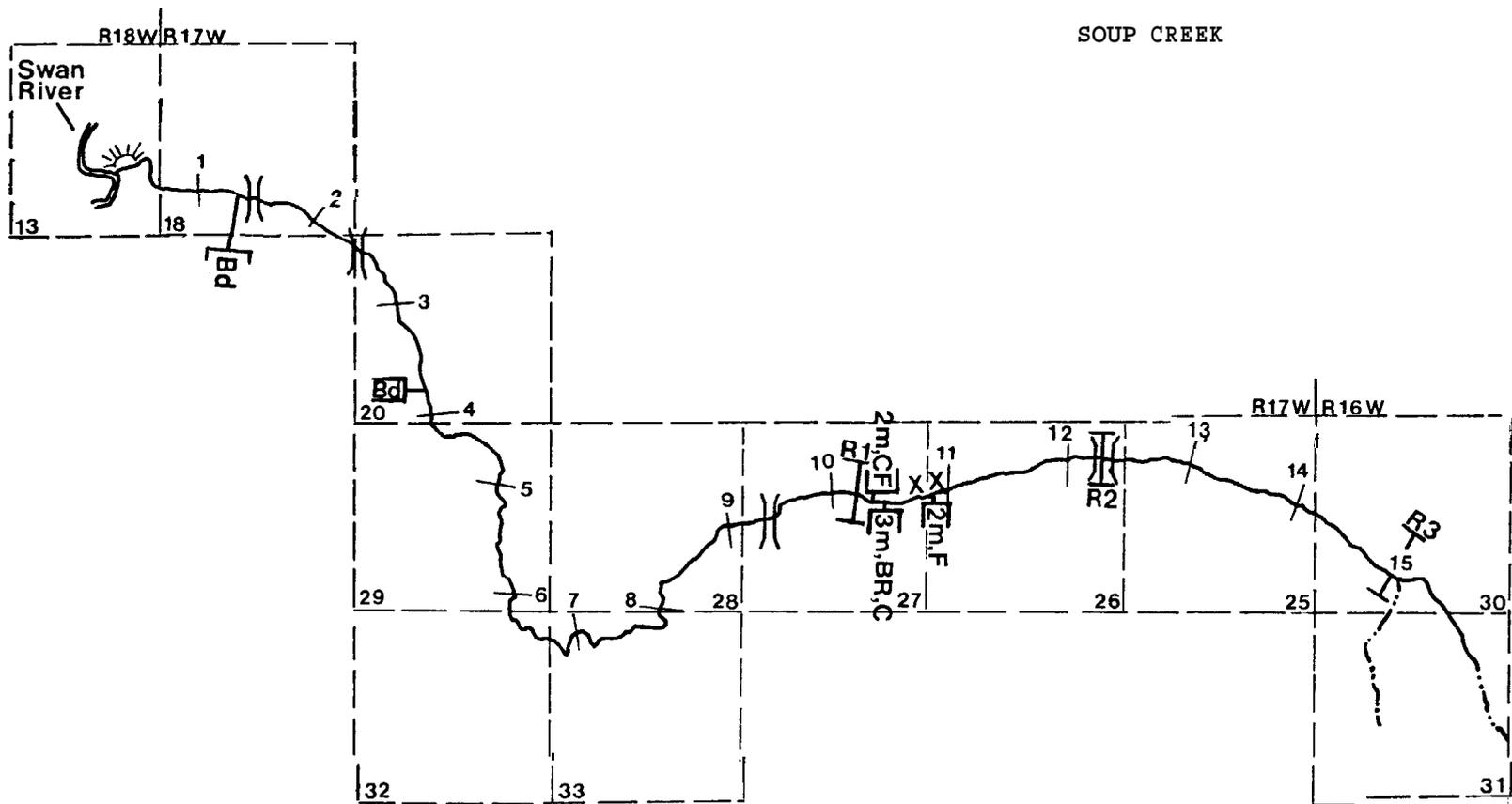


Figure 37. Biophysical inventory map of Soup Creek, a tributary of the Swan River.

SOUTH FORK OF COLD CREEK

Locations of physical and chemical measurement stations
and other installations in the South Fork of Cold Creek,
a tributary to Cold Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3.5	Location of reach	
	km 1-3	Habitat survey section	10/11/83
	km 3	Electrofishing section	9/21/82
	km 2.3	Discharge measurement	10/11/83
	km 0.6	Water chemistry	9/27/83
	km 3	Max/min thermometer	8/4/83-8/10/83
2	km 3.5-7	Location of reach	
	km 4.3-6.3	Habitat section survey	10/13/83
	km 6.3	Electrofishing section	9/15/82
	km 6.3	Discharge measurement	10/13/83
	km 6.7	Water chemistry	9/27/83
	km 6.1	Max/min thermometer	8/4/83-8/10/83

Peach 1

Peach 1 of South Fork Cold Creek is a third order stream having a relatively small drainage area (28.9 square kilometers) and a low average channel gradient (1.6%). The estimated maximum summer water temperature for this reach during 1983 was average (57°F or 13.9°C) and conductivity during the low water period was high (252 micromhos). The late summer flow was 4.1 cfs. The stream had an average wetted width of 5.2 meters and was comprised of 5% pool, 15% riffle, 77% run, and 3% pocket water-cascade. There was a high density of high quality (class I, II, and III) pools (14.5 per kilometer of stream). The streambed was comprised mainly of silt (32%) and large gravel (30%) with lesser amounts of small gravel (25%), sand (6%), cobble (6%), and boulder-bedrock (1%). D-90 was 12 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (65%) and channel stability was fair (rating score = 96). There was a moderate amount of in-stream cover (37%) which was mostly comprised of debris and logs. Total overhead cover was moderate (60%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (53%).

Stream Features

A series of beaver dams from km 1.5 to 1.0 created slow, deep runs.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 21 September 1982. Densities of

fish 75 mm and longer were high for brook trout (153/300 m) and low for both cutthroat trout (12/300 m) and bull trout (3/300 m). Densities of "catchable-sized" (150 mm and longer) brook, bull, and cutthroat trout were low (29, 3, and 6 fish/300 m, respectively). Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production. The entire reach was surveyed for bull trout redds in 1982, but no redds were found. This reach was not surveyed for bull trout redds in 1983.

Reach 2

Reach 2 of South Fork Cold Creek is a third order stream having a relatively small drainage area (16.7 square kilometers) and a high average channel gradient (8.9%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (54°F or 12.2°C) and conductivity during the low water period was moderate (248 micranhos). The late summer flow was 3.3 cfs. The stream had an average wetted width of 4.8 meters and was comprised of 10% pool, 2% riffle, 20% run, and 68% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (17.0 per kilometer of stream). The streambed was comprised mainly of large gravel (34%) and cobble (26%) with lesser amounts of boulder-bedrock (25%), silt (8%), small gravel (5%), and sand (2%). D-90 was 49 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (55%) and channel stability was good (rating score = 61). There was a moderate amount of instream cover (40%) which was mostly comprised of logs and boulders. Total overhead cover was moderate (68%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (63%).

Stream Features

The stream became intermittent at km 7.0.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 122 m section of this reach on 15 September 1982. The density of 75 mm and longer cutthroat trout (the only species captured) was moderate (150/300 m). The density of "catchable-sized" cutthroat trout was also moderate (56/300 m). The entire reach was surveyed for bull trout redds in 1982, but none were found. The reach was not surveyed for bull trout redds in 1983.

SOUTH FORK OF COLD CREEK

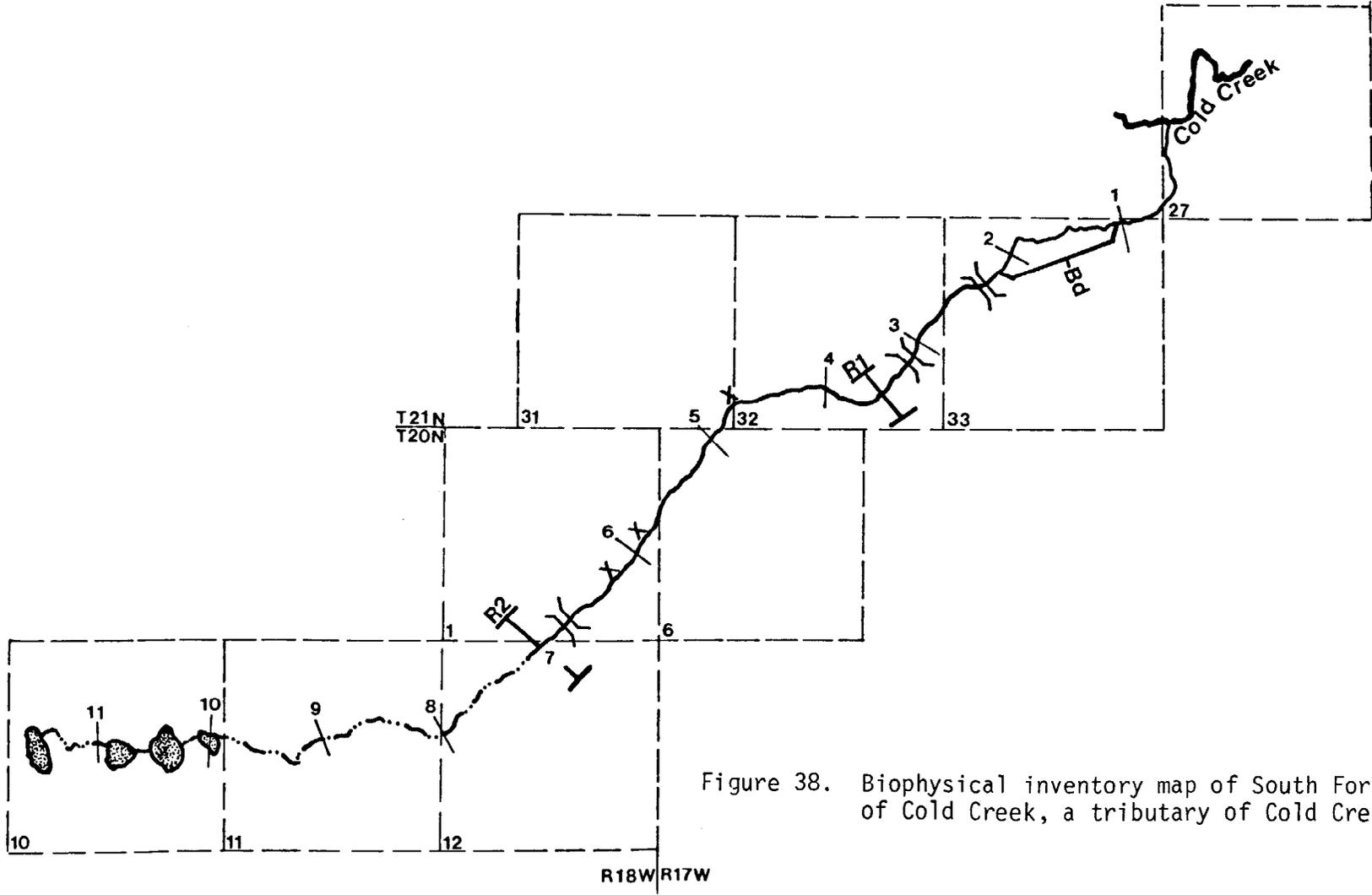


Figure 38. Biophysical inventory map of South Fork of Cold Creek, a tributary of Cold Creek.

SOUTH FORK ELK CREEK

Locations of physical and chemical measurement stations and other installations in the South Fork of Elk Creek, a tributary to Elk Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3	Location of reach	
	km 1-2	Habitat survey section	9/13/83
	km 0.7	Electrofishing section	9/29/83
	km 0	Discharge measurement	9/13/83
	km 0.1	Water chemistry	9/29/83
	km 0.1	Max/min thermometer	8/18/83-9/13/83

Reach 1

Reach 1 of South Fork Elk Creek is a third order stream having a relatively small drainage area (22.1 square kilometers) and a moderate average channel gradient (5.3%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was moderate (175 micranhos). The late summer flow was 13.4 cfs. The stream had an average wetted width of 8.0 meters and was comprised of 5% riffle, 50% run, and 45% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (5.0 per kilometer of stream). The streambed was comprised mainly of cobble (32%) and boulder-bedrock (31%) with lesser amounts of large gravel (16%), silt (10%), sand (6%), and small gravel (5%). D-90 was 91 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (50%) and channel stability was good (rating score = 58). There was a moderate amount of instream cover (39%) which was mostly comprised of debris and boulders. Total overhead cover was low (30%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (23%).

Stream Features

A 2.5 km falls located at km 0.5 was a complete barrier to upstream fish movement. Numerous small cascades were present from km 1.0 to 0.0.

Fish Populations and Spawning Use

A 109 m section of this reach was electrofished on 29 September 1983, however only 3 juvenile bull trout were captured, indicating a very sparse fish population. Based on electrofishing estimates and redd counts, the reach was considered to be marginal for migratory bull trout production.

SOUTH FORK OF ELK CREEK

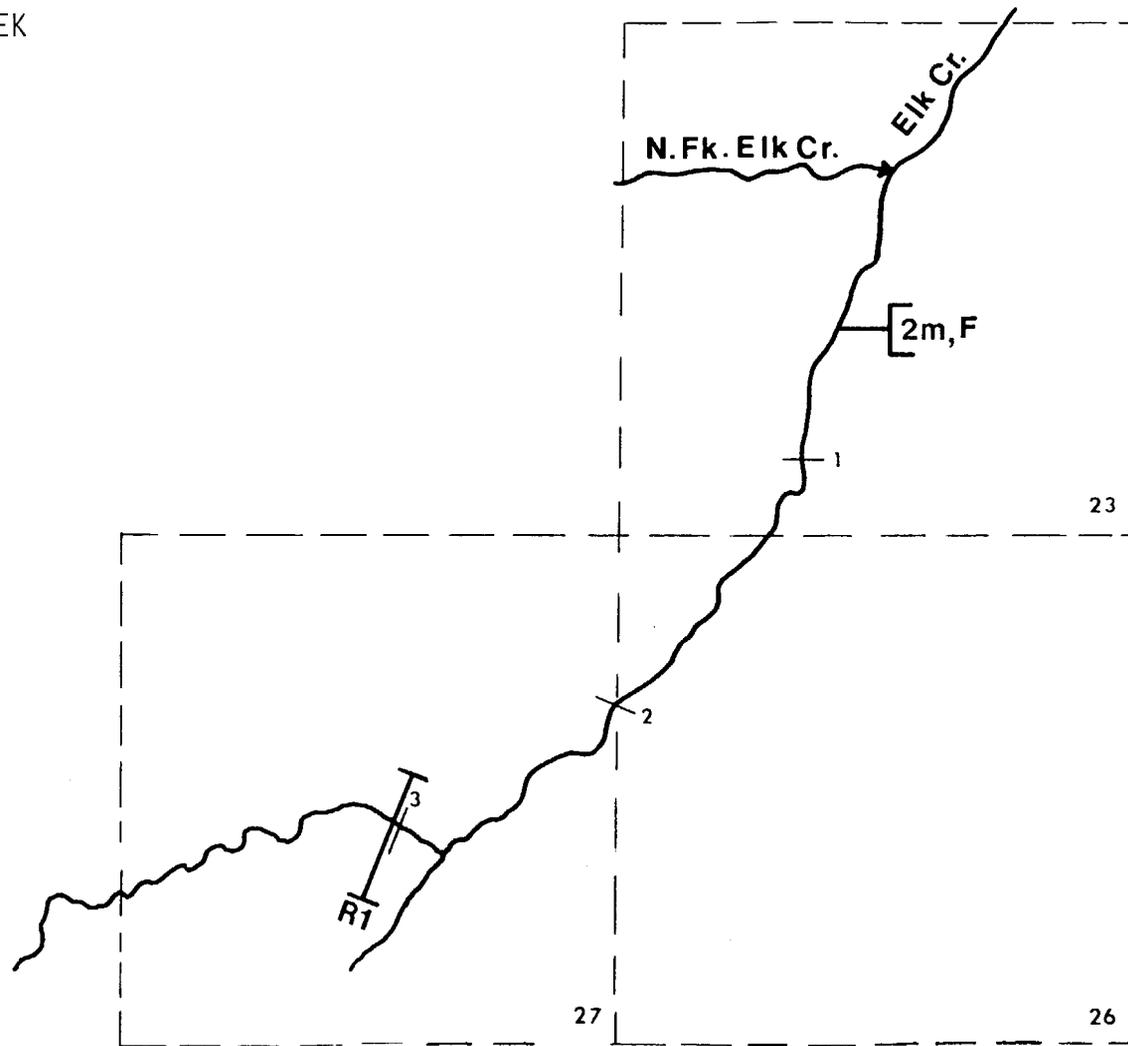


Figure 39. Biophysical inventory map of South Fork of Elk Creek, a tributary of Elk Creek.

SOUTH FORK OF LOST CREEK

Locations of physical and chemical measurement stations
and other installations in the South Fork of Lost Creek,
a tributary to Lost Creek

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3	Location of reach	
	km 0.5-2.5	Habitat survey section	08/11/83
	km 1.5	Electrofishing section	11/03/83, 11/08/83
	km 2.6	Discharge measurement	08/11/83
	km 0.7	Water chemistry	09/29/83
	km 2.5	Max/min thermometer	08/18/83 - 09/01/83
2	km 3-10	Location of reach	
	km 3.6 - 5.6	Habitat survey section	10/25/83
	km 4.5 - 5.3	Electrofishing section	08/25/82, 08/24/82
	km 4.5	Discharge measurement	10/26/83
	km 5	Water chemistry	09/29/83
	km 4.5	Max/min thermometer	08/06/82 - 11/10/82
	km 4.6	Instream flow transects (WETP)	07/29/82 - 10/31/82
	km 5.5	Thermograph	04/12/83 - 10/30/84
	km 5.5	Water level recorder	11/10/82 - 10/30/84
km 5.9	Proposed hydro diversion		
3	km 10-14	Location of reach	
	km 11-12	Habitat survey section	07/26/83
	km 11.6	Electrofishing section	07/28/83
	km 10.6	Discharge measurement	07/26/83

Reach 1

Reach 1 of South Fork Lost Creek is a third order stream having a medium-sized drainage area (43.6 square kilometers) and a moderate average channel gradient (3.6%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (**54°F** or **12.2°C**) and conductivity during the low water period was high (282 micromhcs). The discharge during the habitat survey was 23 cfs and the estimated late summer flow was 10.1 cfs. The stream had an average wetted width of 8.9 meters and was comprised of 3% pool, 15% riffle, 42% run, and 40% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (4.0 per kilometer of stream). The streambed was comprised mainly of cobble (43%) and large gravel (37%) with lesser amounts of boulder-bedrock (11%), small gravel (6%), sand (2%), and silt (1%). D-90 was 56 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (28%) and channel stability was good

(rating score = 74). There was a moderate amount of instream cover (21%) which was mostly comprised of debris and boulders. Total overhead cover was moderate (62%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (34%).

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained on a 305 m section of this reach on 3 and 8 November 1983. Densities of fish 75 mm and longer were low for both bull trout (24/300 m) and cutthroat trout (36/300 m), and moderate for brook trout (93/300 m). Densities of "catchable-sized" (150 mm and longer) bull, cutthroat, and brook trout were low (5, 16, and 11 fish/300 m, respectively).

The entire reach was surveyed for bull trout redds in 1982, 1983, and 1984. The first two surveys revealed no redds while four redds were found in 1984. A limited amount of brook trout spawning was observed. Based on electrofishing estimates and redd counts, the reach was considered to be important to migratory bull trout production.

Reach 2

Reach 2 of South Fork Lost Creek is a third order stream having a medium-sized drainage area (37.6 square kilometers) and a moderate average channel gradient (4.9%). The conductivity during the low water period was high (260 micromhos). The late summer flow was 14.4 cfs. The stream had an average wetted width of 6.0 meters and was comprised of 3% pool, 12% riffle, 50% run, and 35% pocket water-cascade. There was a moderate density of high quality (class I, II, and III) pools (7.0 per kilometer of stream). The streambed was comprised mainly of large gravel (36%) and boulder-bedrock (28%) with lesser amounts of cobble (25%), and small gravel (11%). D-90 was 63 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (33%) and channel stability was good (rating score = 76). There was a moderate amount of instream cover (25%) which was mostly comprised of boulders and debris. Total overhead cover was abundant (73%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (24%).

Stream Features

A moderate number of debris jams (mostly small) and falls were present throughout the reach. A 4 m falls at km 7.3 is a complete barrier to upstream fish movement.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 132 m section of this reach on 24 August 1982. Densities of fish 75 mm and longer were moderate for bull trout (99/300 m) and low for cutthroat trout (23/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both bull trout (12/300 m) and cutthroat trout (12/300 m).

The entire reach was surveyed for bull trout redds in 1982 and 1983 and 2, and 1 redds were found, respectively. A 4.3 km section (km 7.3 to 3) of the reach was surveyed for bull trout redds in 1984 and 8 redds were found. Based on electrofishing estimates and redd counts, the reach was considered important for migratory bull trout production.

Reach 3

Reach 3 of South Fork Lost Creek is a first order stream having a relatively small drainage area (12.2 square kilometers) and a high average channel gradient (19.5%). The discharge during the habitat survey was 14.4 cfs and the estimated late summer flow was 5.3 cfs. The stream had an average wetted width of 5.4 meters and was comprised of 3% pool, 42% riffle, 27% run, and 28% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (16.0 per kilometer of stream). The streambed was comprised mainly of large gravel (34%) and cobble (29%) with lesser amounts of boulder-bedrock (26%), small gravel (7%), sand (2%), and silt (2%). D-90 was 56 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (33%) and channel stability was good (rating score = 51). There was a moderate amount of instream cover (38%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (47%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (29%).

Stream Features

Two 3.0 m falls and an 8.0 m falls were complete barriers to upstream fish movement and were located at km 11.9 and km 11.0, respectively.

Fish Populations and Spawning Use

A 130 m section of this reach was electrofished on 28 July 1983, however no fish were captured.

SOUTH FORK OF LOST CREEK

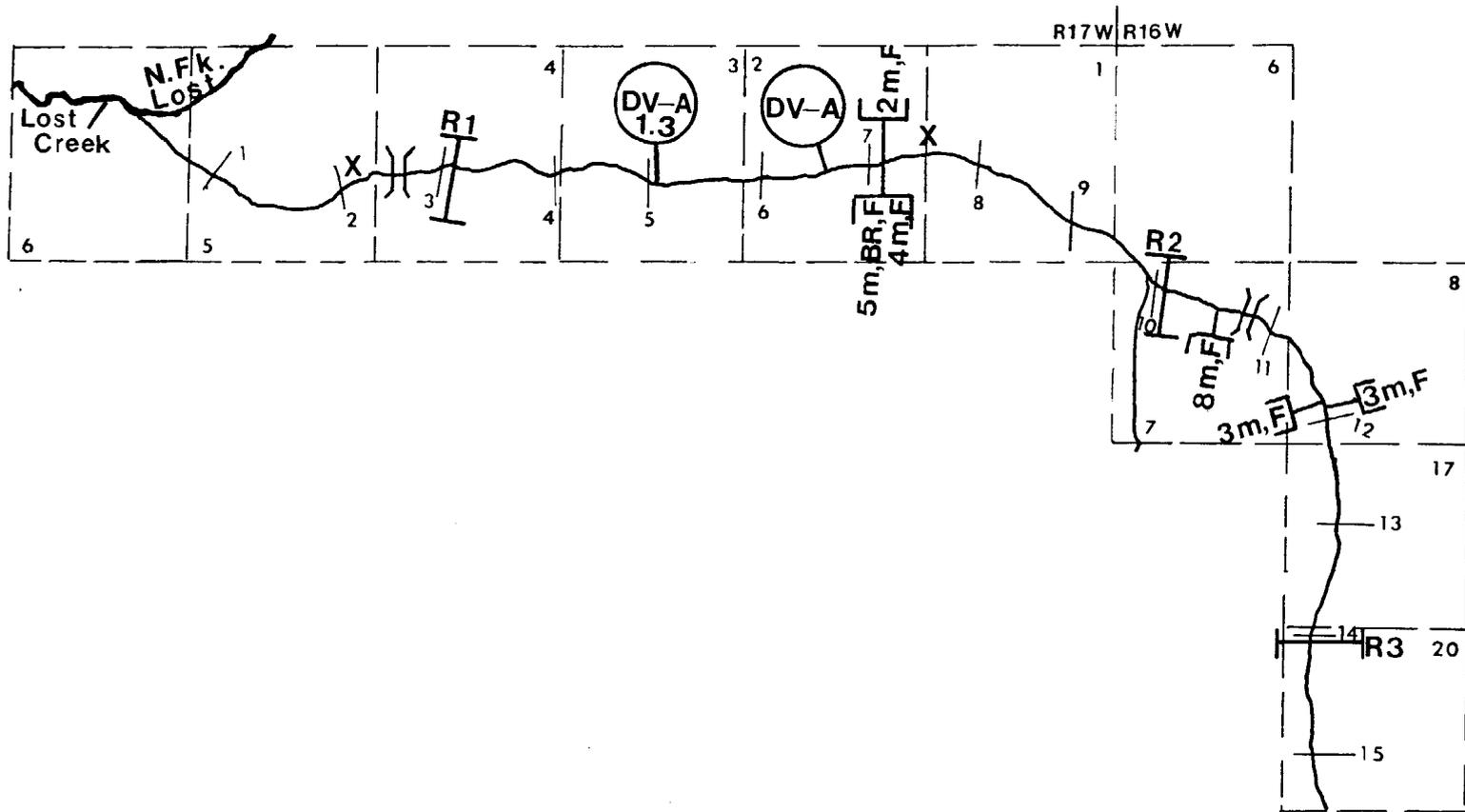


Figure 40. Biophysical inventory map of South Fork of Lost Creek, a tributary of Lost Creek.

SOUTH FORK OF RUMBLE CREEK

Locations of physical and chemical measurement stations and other installations in the South Fork of Rumble Creek, a tributary to Rumble Creek.

<u>Reach</u>	<u>location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2 km 0.4	Location of reach Water chemistry	9/22/83
2	km 2-5 km 2.3-3.3 km 2.3 km 2.3	Location of reach Habitat survey section Electrofishing section Discharge measurement	9/6/83 9/7/83 9/6/83

Reach 1

This reach was not ground surveyed, however it was helicopter surveyed on 18 September 1982. Reach 1 of South Fork Rumble Creek is a second order stream having a relatively small drainage area (5.0 square kilometers) and a high average channel gradient (10.4%). The channel width was estimated to be 3 meters. Channel debris was low. The substrate material consisted of large and small gravel and the D-90 was relatively small. No fish barriers were observed.

Reach 2

Reach 2 of South Fork Rumble Creek is a first order stream having a relatively small drainage area (3.8 square kilometers) and a high average channel gradient (26.8%). The estimated maximum summer water temperature for this reach during 1983 was average (56°F or 13.3°C) and conductivity during the low water period was moderate (158 micromhos). The late summer flow was 1.1 cfs. The stream had an average wetted width of 2.8 meters and was comprised of 8% pool, 15% riffle, 13% run, and 64% pocketwater-cascade. There was a high density of high quality (class I, II, and III) pools (17.0 per kilometer of stream). The streambed was comprised mainly of boulder-bedrock (33%) and large gravel (29%) with lesser amounts of cobble (26%), small gravel (9%), silt (2%), and sand (1%). D-90 was 64 centimeters, indicating that the largest particles of substrate in the streambed were large in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (45%) and channel stability was good (rating score = 46). There was a low amount of instream cover (15%) which was mostly comprised of boulders and debris. Total overhead cover was moderate (58%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (23%).

Stream Features

Bedrock falls and cascades were abundant throughout the reach. Some of the larger barriers included a 6 m and a 5 m bedrock falls at km 2.5, a 5 m and two 10 m bedrock falls at km 2.6, a 20 m

bedrock chute-cascade at km 2.8, and an 8 m cascade at km 3.5.

Fish Populations and Spawning Use

A 94 m section of this reach was electrofished on 7 September 1983, however, only five cutthroat trout were captured, indicating a very sparse fish population.

SOUTH FORK OF RUMBLE CREEK

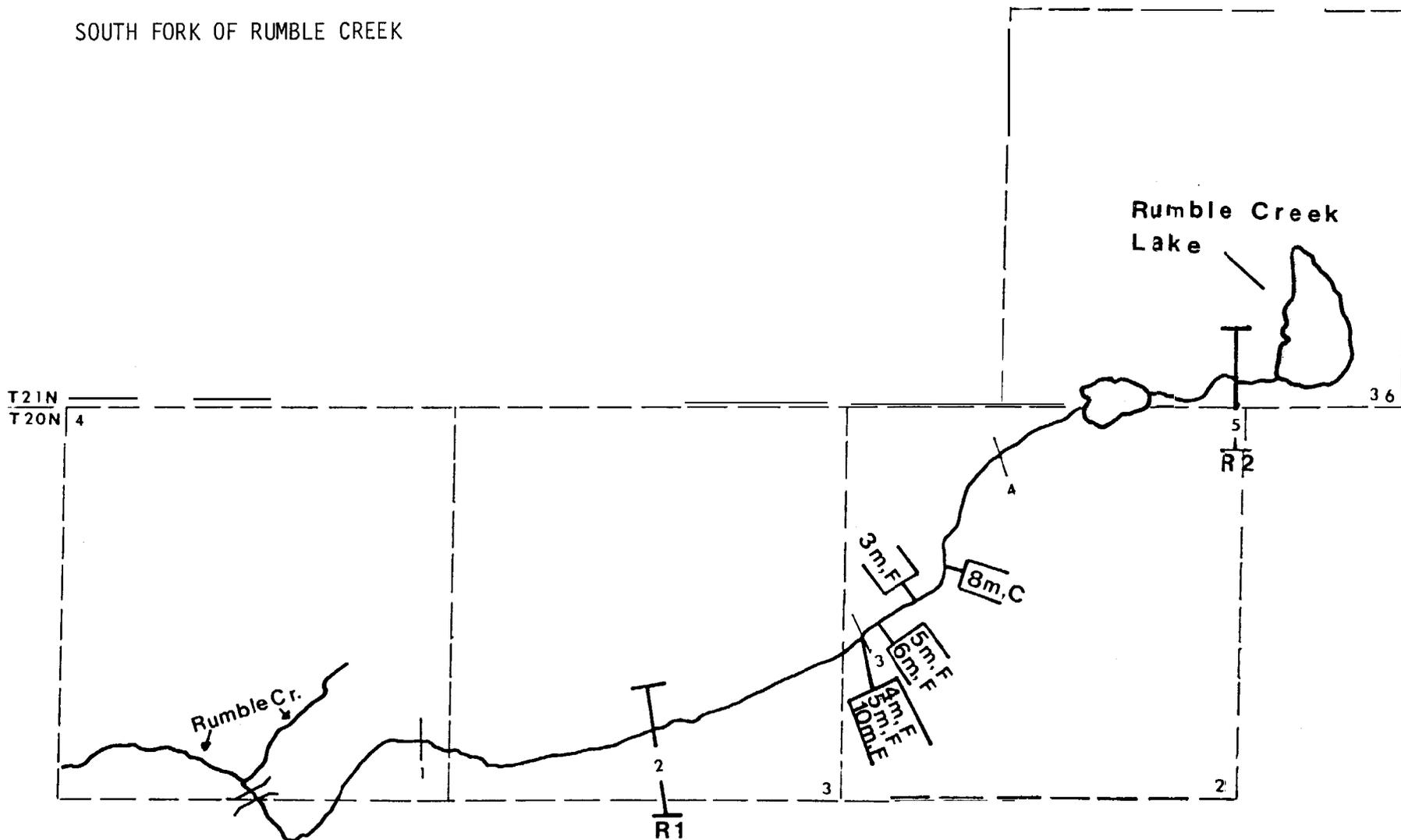


Figure 41. Biophysical inventory map of South Fork of Rumble Creek, a tributary of Rumble Creek.

SOUTH WOODWARD CREEK

Locations of physical and chemical measurement stations
and other installations in South Woodward Creek,
a tributary to Woodward Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2	Location of reach	
	km 0-2	Habitat survey section	9/28/83
	km 1	Electrofishing section	9/29/83, 10/5,20/83
	km2	Discharge measurement	9/29/83
2	km 2-5	Location of reach	
	km 2.5-4.5	Habitat survey section	9/28/83
	km 3.1	Electrofishing section	10/3/83, 10/12/83
	km 4	Discharge measurement	9/28/83
	km2	Water chemistry	9/29/83
	km 4.7	Proposed hydro powerhouse	
3	km 5-11	Location of reach	
	km 5-7	Habitat survey section	10/17/83
	km 7	Electrofishing section	9/1/82
	km 6.7	Discharge measurement	10/18/83
	km 9.3	Water chemistry	9/29/83
	km 6.6	Max/min thermometer	8/11/83-9/1/83
	km 6.7	Instream flow transects (WETP)	6/23/83-10/18/83
	km 10.2	Proposed hydro diversion	

Reach 1

Reach 1 of South Woodward Creek is a second order stream having a medium-sized drainage area (40.5 square kilometers) and a low average channel gradient (1.2%). The late summer flow was 37 cfs. The stream had an average wetted width of 15.7 meters and was comprised of 100% run. There was a low density of high quality (class I, II, and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of silt (80%) with lesser amounts of sand (7%), large gravel (6%), small gravel (5%), cobble (1%), and boulder-bedrock (1%). D-90 was 13 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (23%) and channel stability was good (rating score = 74). There was a moderate amount of instream cover (25%) which was mostly comprised of logs and aquatic vegetation. Total overhead cover was low (12%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (12%).

Stream Features

Woodward meadows extends from near the mouth of South Woodward Creek to km 1.7. One beaver dam was located at km 1.4.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 539 m section of this reach on 29 September, 5 and 20 October 1983. Densities of fish 75 mm and longer was moderate for brook trout (111/300 m) and low for bull trout (9/300 m). The density of "catchable-sized" (150 mm and longer) brook trout was moderate (54/300 m). There were no "catchable-sized" bull trout. Based on electrofishing estimates the reach was considered to be marginal for migratory bull trout production. In 1983, 0.3 km (km 1.7 to km 2.0) of this reach was surveyed for bull trout redds and one redd was found. This reach was not surveyed for bull trout redds during 1982.

Reach 2

Reach 2 of South Woodward Creek is a second order stream having a medium-sized drainage area (33.5 square kilometer) and a low average channel gradient (1.9%). The conductivity during the low water period was moderate (181 micromhos). The late summer flow was 36 cfs. The stream had an average wetted width of 7.3 meters and was comprised of 10% riffle and 90% run. There were no high quality (class I, II, and III) pools. The streambed was comprised mainly of large gravel (30%) and sand (22%) with lesser amounts of silt (19%), small gravel (14%), cobble (12%), and boulder-bedrock (3%). D-90 was 16 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (75%) and channel stability was fair (rating score = 81). There was a high amount of instream cover (63%) which was mostly comprised of debris and logs. Total overhead cover was abundant (78%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (40%).

Stream Features

A beaver dam at km 3.8 backed the stream up for 50 meters. This reach apparently receives large quantities of groundwater.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 308 m section of this reach on 3 and 12 October 1983. Densities of fish 75 mm and longer were high for brook trout (210/300 m) and moderate for bull trout (111/300 m). Densities of "catchable-sized" trout (150 mm and longer) were very high for brook trout (108/300 m) and low for bull trout (6/300 m). Based on electrofishing estimates and redd counts, the reach was considered to be important for migratory bull trout production. The entire reach was surveyed for bull trout redds in 1982 but no redds were found. The reach was again surveyed for bull trout redds in 1983 and two redds were found. The effectiveness of visually locating bull trout

redds may have been limited by high ~~late-summer~~ streamflow (normal for this creek), and the deep channel and abundant instream cover in this reach.

Reach 3

Reach 3 of South Woodward Creek is a second order stream having a relatively ~~small~~ drainage area (26.4 square kilometers) and a high average channel gradient (10.0%). The estimated maximum ~~summer~~ water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was low (137 micranhos). The late summer flow was 9.6 cfs. The stream had an average wetted width of 3.7 meters and was comprised of 5% pool, 55% run, and 40% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (6.0 per kilometer of stream). The streambed was comprised mainly of large gravel (38%) and boulder-bedrock (25%) with lesser amounts of small gravel (18%), cobble (10%) silt (5%), and sand (4%). D-90 was 50 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a moderate amount of channel debris (38%) and channel stability was good (rating score = 67). There was a moderate ~~amount~~ of instream cover (33%) which was mostly comprised of logs and boulders. Total overhead cover was abundant (89%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (50%).

Stream Features

A beaver dam was located at km 7.1.

Fish Populations and Spawning Use

A 122 m section of this reach was electrofished on 1 September 1982, however only 4 cutthroat trout ~~were~~ captured, indicating a sparse fish population. A 5.0 km section (10.0 km to 5.0 km) of the reach was surveyed for bull trout redds in 1982 but no redds were found. A 0.7 km section (5.7 km to 5.0) was surveyed in 1983 but no redds were found.

SOUTH WOODWARD CREEK

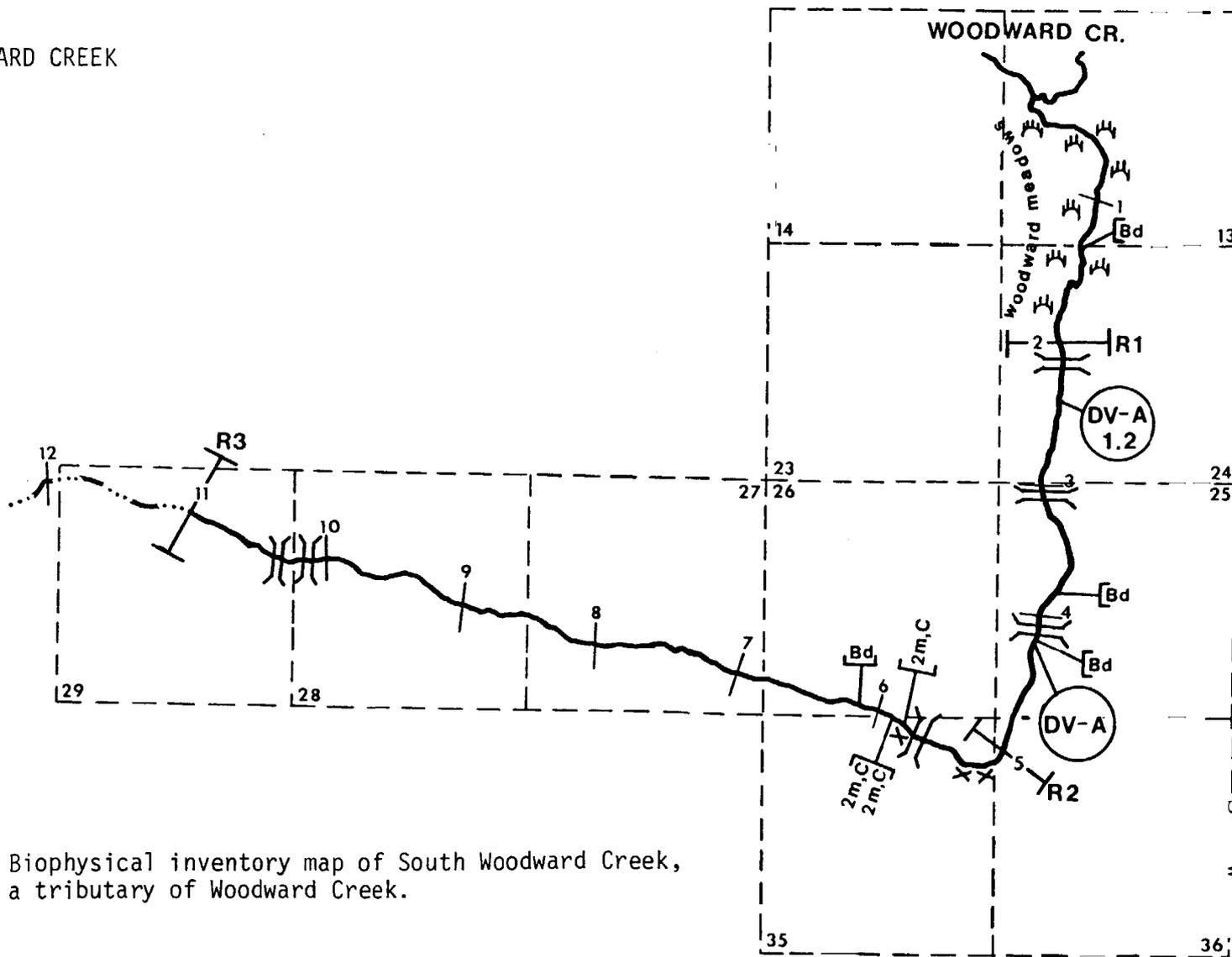


Figure 42. Biophysical inventory map of South Woodward Creek, a tributary of Woodward Creek.

UNNAMED TRIBUTARY TO SOUTH WOODWARD CREEK

Locations of physical and chemical measurement stations
and other installations in an unnamed
tributary to South Woodward Creek.

<u>Reach</u>	<u>location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-1	Location of reach	
	km 0-1	Habitat survey section	11/2/83
	km 0.3	Electrofishing section	9/7/83
	km 0.5	Dishcharge measurement	11/8/83
	km 0.7	Water chemistry	9/29/83
	km 0.5	Max/min thermometer	3/11/83-8/18/83
		Fish trap	
	km 0.3	Instream flow transects (WETP)	8/3/82-11/20/82
	km 0.8	Proposed hydro diversion	

Reach 1

Reach 1 of tributary to South Woodward Creek is a first order stream having a relatively small drainage area (0.6 square kilometers) and a high average channel gradient (10.1%). The estimated maximum ~~summer~~ water temperature for this reach during 1983 was relatively low (51°F or 10.6°C) and conductivity during the low water period was moderate (190 micromhos). The late ~~summer~~ flow was 8.5 cfs. The stream had an average wetted width of 3.5 meters and was comprised of 32% riffle, 35% run, and 33% pocketwater-cascade. There was a low density of high quality (class I, II, and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of cobble (37%) and large gravel (24%) with lesser amounts of boulder-bedrock (16%), silt (15%), small gravel (6%), and sand (2%). D-90 was 35 centimeters, indicating that the largest particles of substrate in the streambed were average in ~~comparison~~ to other stream reaches in the drainage. The reach had a moderate amount of channel debris (59%) and channel stability was good (rating score = 46). There was a moderate amount of instream cover (25%) which was mostly comprised of debris and logs. Total overhead cover was abundant (94%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (57%).

Stream Features

Numerous cascades, falls, and small debris jams were present throughout the reach. A beaver dam with a very large pond was located at the head of the drainage.

Fish Populations and Spawning Use

A 116 m section of this reach was electrofished on 7 September 1983, however only one cutthroat trout and one brook trout were captured, indicating a very sparse fish population.

TRIBUTARY TO SOUTH WOODWARD CREEK

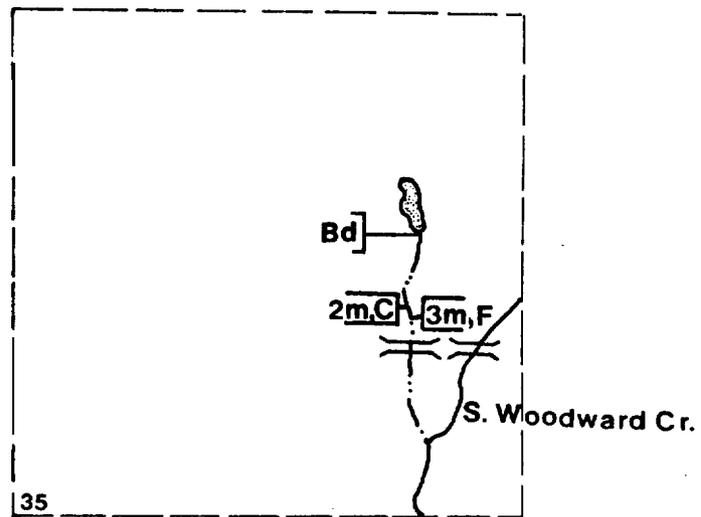


Figure 43. Biophysical inventory map of tributary to South Woodward Creek, a tributary to South Woodward Creek.

SQUEEZER CREEK

Locations of physical and chemical measurement stations
and other installations in Squeezer Creek,
a tributary to the Coat Creek

Reach	Location(s)	<u>Item</u>	<u>Date(s)</u>
1	km 0-6.5	Location of reach	
	km 2-4	Habitat survey section	10/04/84
	km 2.5	Electrofishing section (survey)	09/09/82
	km 2.5	Electrofishing section (monitoring)	09/27/84 - 10/10/84
	km 5.5	Electrofishing section (monitoring)	09/24/84 - 10/09/84
	km 2.5	Streambed monitoring site	11/05/84
	km 2	Discharge measurement	10/04/83
	km 0.1	Water chemistry	09/29/83
	km 6.1	Proposed hydro powerhouse	
	2	km 6.5-12	Location of reach
km 6.3-7.3		Habitat survey section	10/13/83
km 6.4		Electrofishing section (survey)	08/11/82
km 7.0		Electrofishing section (monitoring)	09/20/84 - 10/01/84
km 6.4		Discharge measurement	10/14/83
km 6.5		Water chemistry	09/21/83
km 6.5		Max/min thermometer	08/05/82 - 11/10/82
km 6.5		Instream flow transects (WEIP)	08/05/82 - 11/18/82
km 6.5		Thermograph	04/13/83 - 10/30/84
km 6.5		Water level recorder	11/23/82 - 10/30/84
km 8.2		Proposed hydro diversion	
km 8.2		Electrofishing section	09/27/84

Reach 1

Reach 1 of Squeezer Creek is a third order stream having a medium-sized drainage area (35.4 square kilometers) and a low average channel gradient (2.5%). The conductivity during the low water period was moderate (248 micromhos). The late summer flow was 9.0 cfs. The stream had an average wetted width of 6.7 meters and was comprised of 5% pool, 28% riffle, and 67% run. There was a moderate density of high quality (class I, II, and III) pools (9.0 per kilometer of stream). The streambed was comprised mainly of small gravel (37%) and large gravel (34%) with lesser amounts of sand (17%), silt (9%), and cobble (3%). D-90 was 10 centimeters indicating that the largest particles of substrate in the streambed

were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (63%) and channel stability was fair (rating score = 80). There was a low amount of instream cover (14%) which was mostly comprised of debris and logs. Total overhead cover was low (24%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (17%).

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 100 m section of this reach on 9 September 1982. Densities of fish 75 mm and longer were high for brook trout (174/300 m) and moderate for bull trout (81/300 m). Densities of "catchable-sized" trout (150 mm and longer) were high for brook trout (78/300 m) and low for bull trout (16/300 m).

In addition, two 1,000 foot-long sections of this reach (at kilometers 2.5 and 5.5) were electrofished during September and October, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, densities of fish 75 mm and longer at km 2.5 were moderate for both bull trout (142/300 m) and brook trout (101/300 m). Densities of "catchable-sized" trout (150 mm and longer) at km 2.5 were high for brook trout (61/300 m) and low for bull trout (7/300 m).

At km 5.5, the density of 75 mm and longer bull trout was moderate (129/300 m). One brook trout and three cutthroat trout were captured, but an accurate population estimate could not be calculated. The density of "catchable-sized" bull trout (150 mm and longer) at km 5.5 was low (12/300 m).

The entire reach was surveyed for bull trout redds in 1982, 1983 and 1984 and 41, 57, and 80 redds were found respectively. A substantial amount of brook trout spawning was observed. Based on electrofishing estimates and redd counts this reach was considered to be critical for migratory bull trout production.

Reach 2

Reach 2 of Squeezer Creek is a third order stream having a relatively small drainage area (21.4 square kilometers) and a high average channel gradient (7.6%). The estimated maximum summer water temperature for this reach during 1983 was relatively low (50°F or 10.0°C) and conductivity during the low water period was moderate (230 micromhos). The late summer flow was 6.3 cfs. The stream had an average wetted width of 5.6 meters and was comprised of 5% pool, 2% riffle, 55% run, and 38% pocketwater-cascade. There was a moderate density of high quality (class I, II, and III) pools (7.0 per kilometer of stream). The streambed was comprised mainly of large gravel (34%), cobble (24%), and boulder-bedrock (24%) with

lesser amounts of small gravel (12%), sand (5%), and silt (1%). D-90 was 44 centimeters, indicating that the largest particles of substrate in the streambed were average in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (28%) and channel stability was good (rating score = 71). There was a high amount of instream cover (43%) which was mostly comprised of boulder and debris. Total overhead cover was abundant (86%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (26%).

Stream Features

A large cascade section located from km 8.1 to km 7.8 is a complete barrier to upstream fish movement. Numerous cascades, falls, and chutes were present throughout the reach. The absence of fish in upper Squeezer Creek was verified by electrofishing a 1,000 foot long section at km 8.2 - upstream from the steep section. No fish were captured although available habitat was judged to be good.

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 131 m section of this reach on 11 August 1982. Densities of fish 75 mm and longer were moderate for bull trout (129/300 m) and low for cutthroat trout (12/300 m). Densities of "catchable-sized" trout (150 mm and longer) were low for both bull trout (10/300 m) and cutthroat trout (12/300 m).

In addition, a 1,000 foot-long section of this reach was electrofished during the period 20 September through 1 October, 1984 to obtain more accurate fish population information for the purpose of long-term monitoring. Using a mark-recapture estimation technique, the density of 75 mm and longer bull trout (the only species captured) was low (45/300 m). The density of "catchable-sized" bull trout was low (28/300 m).

The entire reach was surveyed for bull trout redds in 1982, but no redds were found. A 1.3 km section (km 7.8 to km 6.5) was surveyed for bull trout redds in 1983 and three redds were found. A 0.2 km section (km 6.7 to km 6.5) of this reach was surveyed for bull trout redds in 1984 and 3 redds were found. Based on electrofishing estimates and redd counts, the lower portion of this reach was considered to be critical for migratory bull trout production. A substantial amount of brook trout spawning was also observed.

SQUEEZER CREEK

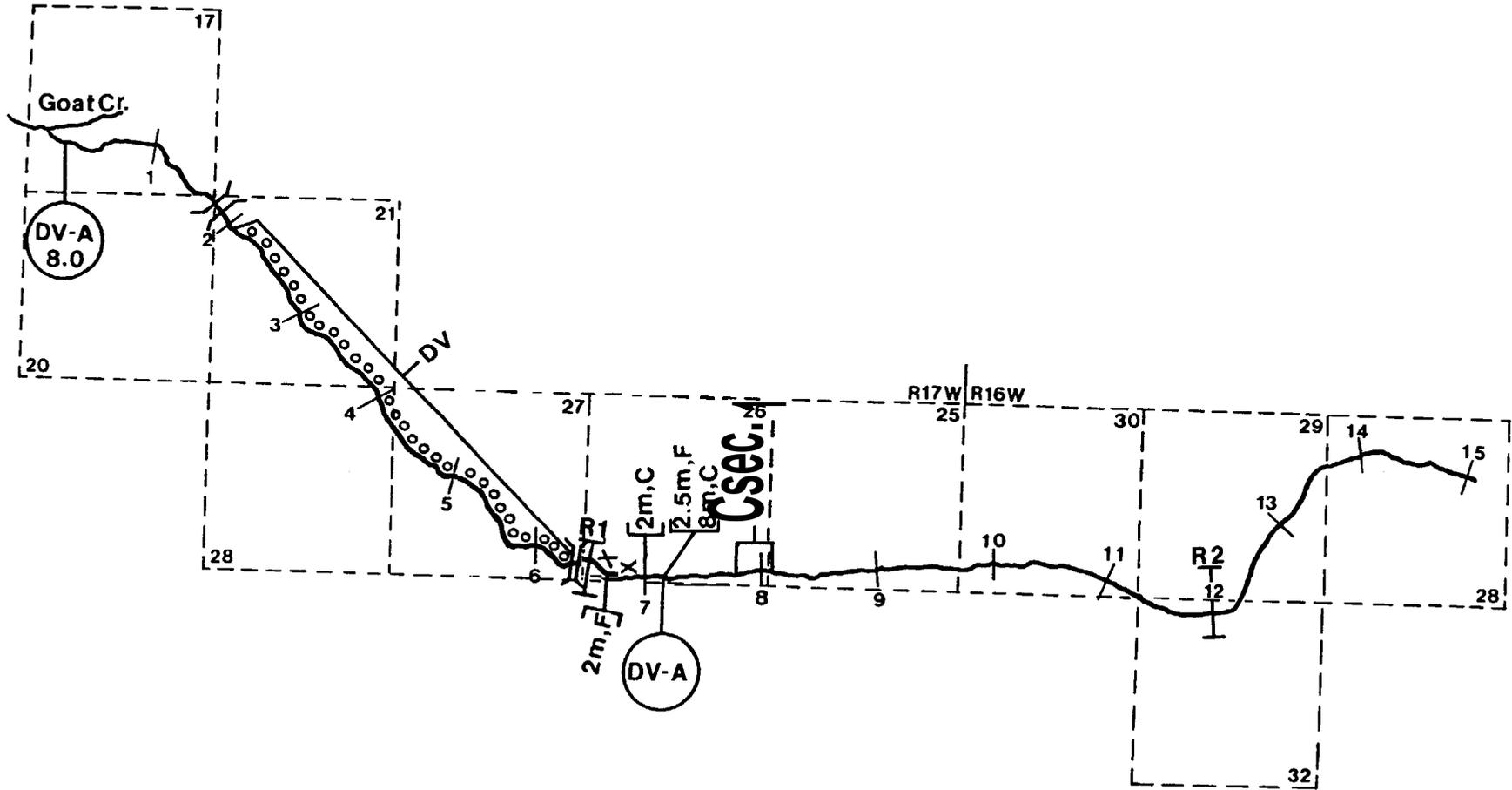


Figure 44. Biophysical inventory map of Squeezer Creek, a tributary of Goat Creek.

WHITETAIL CREEK

Locations of physical and chemical measurement stations
and other installations in Whitetail Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2.3	Location of reach	
	km 1-2	Habitat survey section	8/4/83
	km 1.7	Electrofishing section	8/8/83, 8/15/83
	km 1.7	Discharge measurement	8/4/83
	km 1.7	Water chemistry	9/29/83
	km 1.7	Max/min thermometer	8/4/83-8/11/83
2	Jan 2.3-5	Location of reach	

Reach 1

Reach 1 of Whitetail Creek is a third order stream having a relatively small drainage area (22.5 square kilometers) and a low average channel gradient (0.3%). The estimated maximum summer water temperature for this reach during 1983 was relatively high (66°F or 18.9°C) and conductivity during the low water period was moderate (242 micrcsnhos). The discharge during the habitat survey was 9.5 cfs and the estimated late summer flow was 3.5 cfs. The stream had an average wetted width of 7.7 meters and was comprised of 3% riffle, and 97% run. There were no high quality (class I, II, and III) pools. The streambed was comprised entirely of silt and detritus (100%). D-90 was <1 centimeter, indicating that the substrate in the streambed was very small in comparison to other stream reaches in the drainage. The reach had a low amount of channel debris (30%) and channel stability was fair (rating score = 87). There was a moderate amount of instream cover (38%) which was mostly comprised of debris and aquatic vegetation. Total overhead cover was low (26%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was low (26%).

Stream Features

A braided marsh section was located at km 1.2.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 305 m section of this reach on 8 and 15 August 1983. The density of 75 mm and longer brook trout was moderate (111/300 m). The density of "catchable-sized" brook trout (150 mm and longer) was also moderate (50/300 m). Moderate numbers of suckers and one redbside shiner were also captured.

Reach 2

This reach was not ground surveyed but was surveyed by helicopter on 17 ~~September~~ 1982. Reach 2 of Whitetail Creek is a second order stream having a relatively small drainage area (16.5 square kilometers) and a high average channel gradient (6.1%). The channel width was estimated to be 1-3 meters. Aerial observation of this reach was very difficult due to thick vegetative cover.

WHITETAIL CREEK

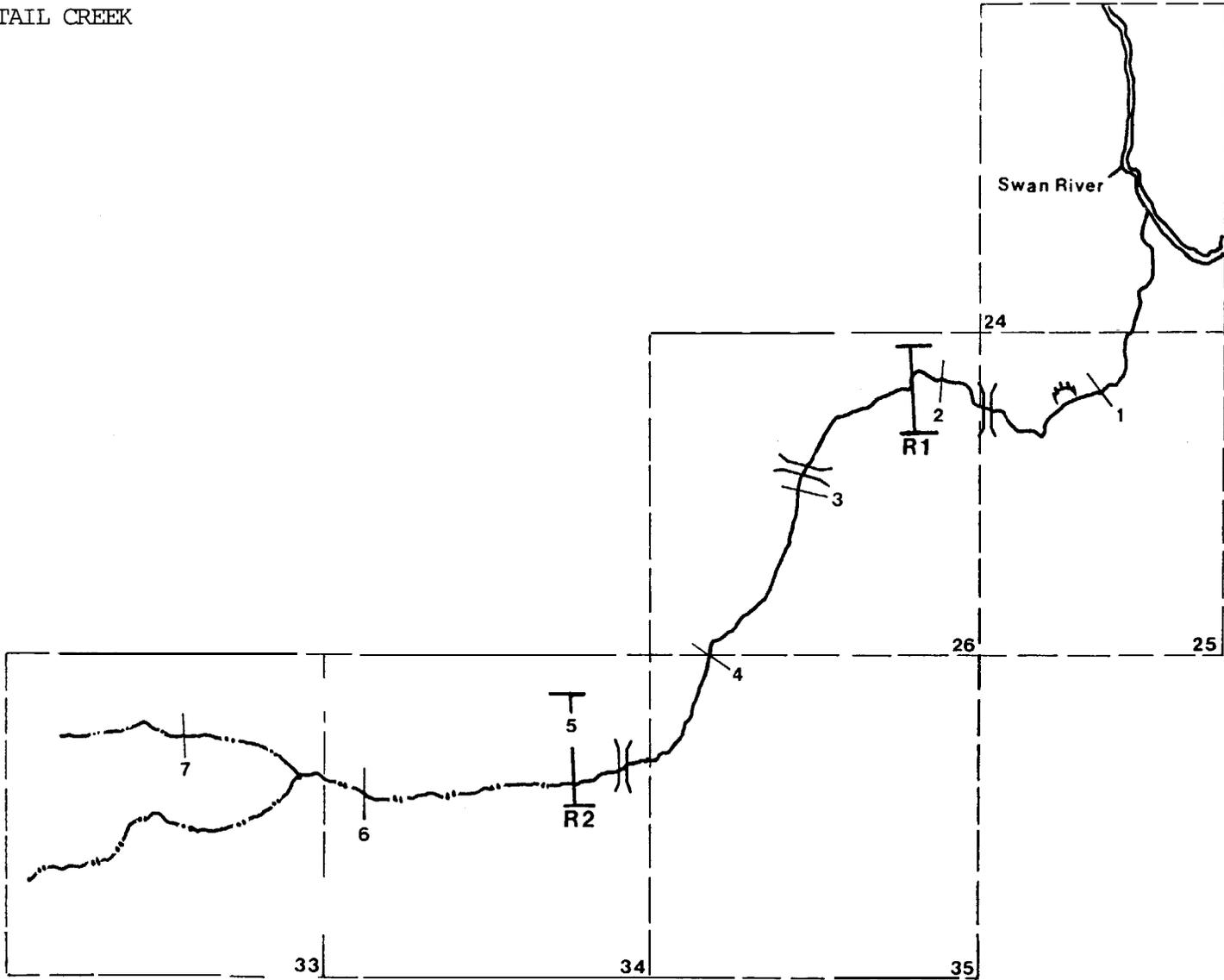


Figure 45- Biophysical inventory map of Whitetail Creek, a tributary of the Swan River

WINDFALL CREEK

Locations of physical and chemical measurement stations
and other installations in Windfall Creek,
a tributary to Glacier Creek.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3.5	Location of reach	
	km 0.5-1.5	Habitat survey section	9/14/83
	km 1.6	Electrofishing section	9/17/83
	km 1.6	Discharge measurement	9/17/83
	km 2	Water chemistry	9/22/83
	km 1.5	Max/min thermometer	8/22/83-9/1/83

Reach 1

Reach 1 of Windfall Creek is a third order stream having a relatively small drainage area (13.2 square kilometers) and a low average channel gradient (2.4%). The estimated maximum summer water temperature for this reach during 1983 was average (61°F or 16.1°C) and conductivity during the low water period was low (69 micranhos). The late summer flow was 1.1 cfs. The stream had an average wetted width of 2.6 meter and was comprised of 3% pool, 22% riffle, and 75% run. There was a low density of high quality (class I, II, and III) pools (5.0 per kilometer of stream). The streambed was comprised mainly of sand (31%) and small gravel (29%) with lesser amounts of large gravel (26%), silt (13%), and cobble (1%). D-90 was 5 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (68%) and channel stability was good (rating score = 76). There was a high amount of instream cover (81%) which was mostly comprised of aquatic vegetation and debris. Total overhead cover was moderate (52%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (26%).

Fish Populations and Spawning Use

A three-pass population estimate was obtained by electrofishing a 103 m section of this reach on 17 September 1983. The density of 75 mm and longer brook trout (the only fish captured) was high (432/300 m). The density of "cat&able-sized" brook trout was low (28/300 m).

WINDFALL CREEK

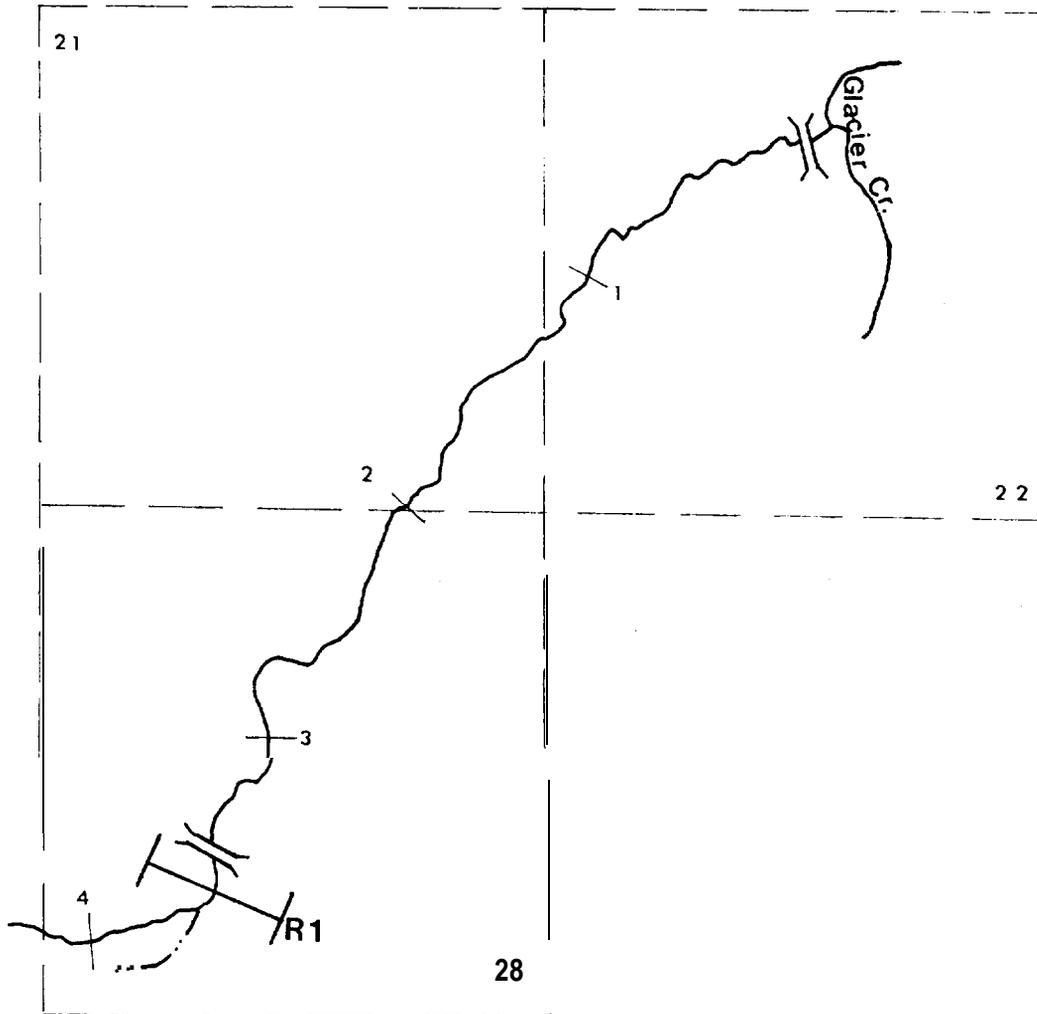


Figure 46. Biophysical inventory map of Windfall Creek, a tributary of Glacier Creek.

WOODWARD CREEK

Locations of physical and chemical measurement stations
and other installations in Woodward Creek,
a tributary to the Swan River.

<u>Reach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-3.5	Location of reach	
	km 1-3	Habitat survey section	11/4/83
	km 2.3	Electrofishing section	9/23/83, 9/27/83
	km 2.2	Discharge measurement	11/4/83
	km 2.4	Water chemistry	9/29/83
	km 2.3	Max/min thermometer	8/4/83-8/11/83
2	km 3.5-5	Location of reach	

Reach 1

Reach 1 of Woodward Creek is a fourth order stream having a relatively large drainage area (66.3 square kilometers) and a low average channel gradient (1.0%). The estimated maximum summer water temperature for this reach during 1983 was average (57°F or 13.9°C) and conductivity during the low water period was moderate (200 micromhos). The late summer flow was 97 cfs. The stream had an average wetted width of 11.6 meters and was comprised of 3% riffle and 97% run. There were no high quality (class I, II, and III) pools. The streambed was comprised mainly of large gravel (29%) and silt (25%) with lesser amounts of small gravel (22%), cobble (13%), sand (10%) and boulder-bedrock (1%). D-90 was 20 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (73%) and channel stability was good (rating score = 66). There was a high amount of instream cover (47%) which was mostly comprised of debris and logs. Total overhead cover was low (32%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was moderate (26%). This stream apparently receives large quantities of groundwater as was evidenced by exceptionally large late summer streamflows and a relatively stable hydrograph.

Fish Populations and Spawning Use

A mark-recapture population estimate was obtained by electrofishing a 307 m section of this reach on 23 and 27 September 1982. Densities of fish 75 mm and longer were high for brook trout (570/300 m), moderate for bull trout (90/300 m), and low for both rainbow trout (9/300 m) and cutthroat trout (3/300 m). Densities of "catchable-sized" trout (150 mm and longer) were very high for brook trout (134/300 m) and low for both bull trout (1/300 m) and rainbow trout (14/300 m). Based on electrofishing estimates and redd counts, the reach was considered to be important for migratory bull trout production. The entire reach was surveyed for bull trout redds in 1983 and one redd was found. The ability to visually locate potential bull trout

redds in this reach was hampered by very high late summer streamflow (normal for this creek), the deep channel, and abundant instream cover.

Reach 2

This reach was not ground surveyed but was surveyed by helicopter on 13 July 1982. Reach 2 of Woodward Creek is a third order stream having a relatively small drainage area (22.5 square kilometers) and a moderate average channel gradient (3.9%). The channel width was estimated to be 2-3 meters. Channel debris was low and no fish barriers were observed. The streambed material was comprised mostly of gravel and the D-90 was estimated to be small. Several beaver dams and multiple channels occur from km 4.4 to km 5.0. The stream was intermittent above km 5.0.

WOODWARD CREEK

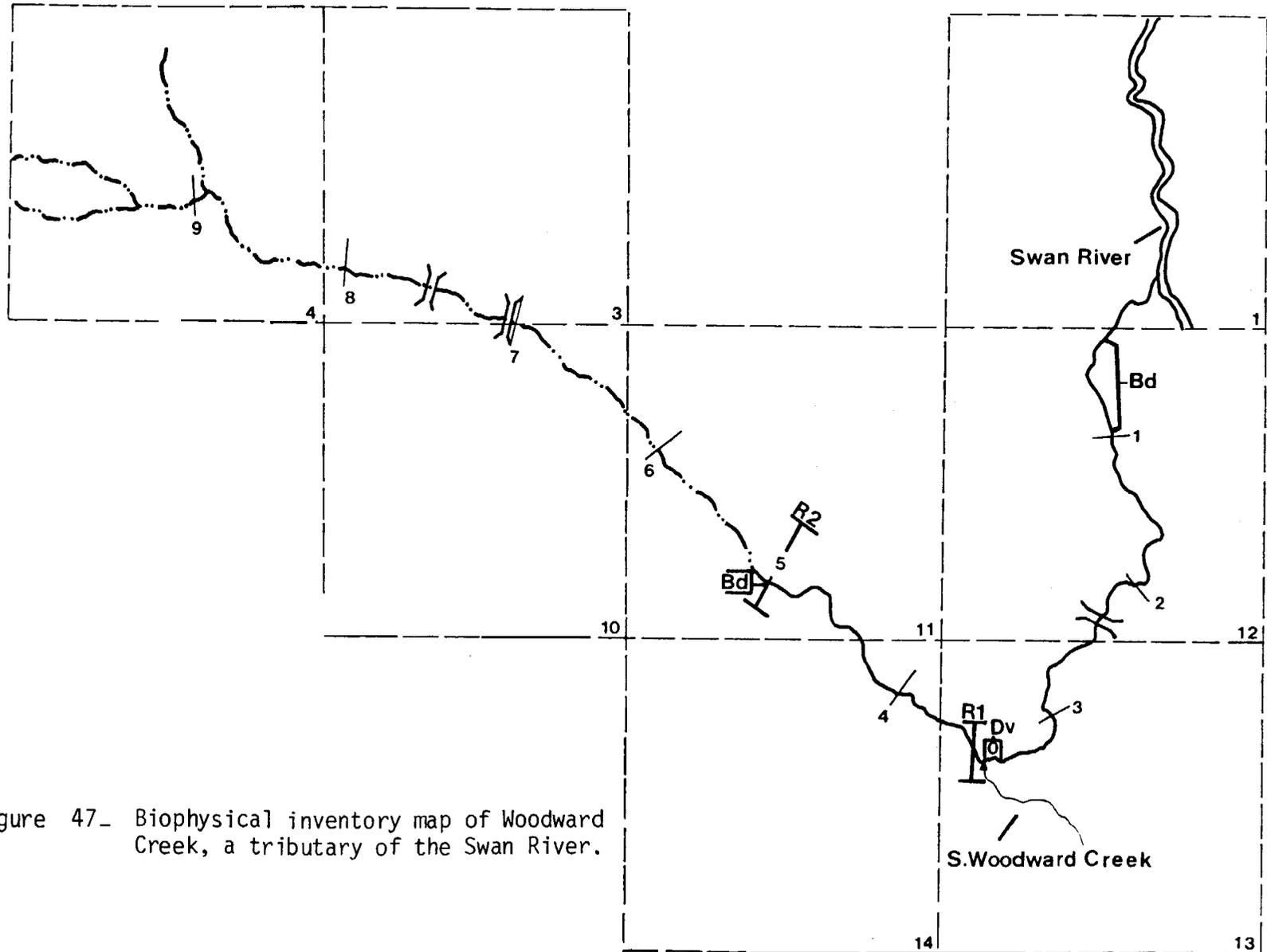


Figure 47_ Biophysical inventory map of Woodward Creek, a tributary of the Swan River.

YEW CREEK

Locations of physical and chemical measurement stations
and other installations in Yew Creek,
a tributary to the Swan River.

<u>Peach</u>	<u>Location(s)</u>	<u>Item</u>	<u>Date(s)</u>
1	km 0-2.2	Location of reach	
	km 0.3-1.3	Habitat survey section	11/7/83
	km 0.3	Electrofishing section	8/24/82
	km 0.3	Discharge measurement	11/7/83
	km 0.3	Water chemistry	9/29/83
	km 0.4	Max/min thermometer	8/11/83-9/1/83

Reach 1

Peach 1 of Yew Creek is a third order stream having a relatively small drainage area (7.3 square kilometers) and a high average channel gradient (8.9%). The estimated maximum summer water temperature for this reach during 1983 was average (58°F or 14.4°C) and conductivity during the low water period was high (298 micranhos). The late summer flow was 1.1 cfs. The stream had an average wetted width of 2.8 meters and was comprised of 3% riffle, 72% run, and 25% pocketwater-cascade. There was a low density of high quality (class I, II and III) pools (1.0 per kilometer of stream). The streambed was comprised mainly of large gravel (27%), cobble (21%) and silt (21%), with lesser amounts of small gravel (13%), boulder-bedrock (11%), and sand (7%). D-90 was 29 centimeters, indicating that the largest particles of substrate in the streambed were small in comparison to other stream reaches in the drainage. The reach had a high amount of channel debris (63%) and channel stability was good (rating score = 55). There was a moderate amount of instream cover (30%) which was mostly comprised of debris and boulders. Total overhead cover was abundant (92%) and overhead cover due to overhanging vegetation (within one meter of the water surface) and undercut banks was abundant (71%).

Fish Populations and Spawning Use

A two-pass population estimate was obtained by electrofishing a 113 m section of this reach on 24 August 1982. Densities of fish 75 mm and longer were low for both cutthroat trout (63/300 m) and brook trout (6/300 m). Densities of "catchable-sized" trout was also low for both cutthroat trout (25/300 m) and brook trout (6/300 m).

YEW CREEK

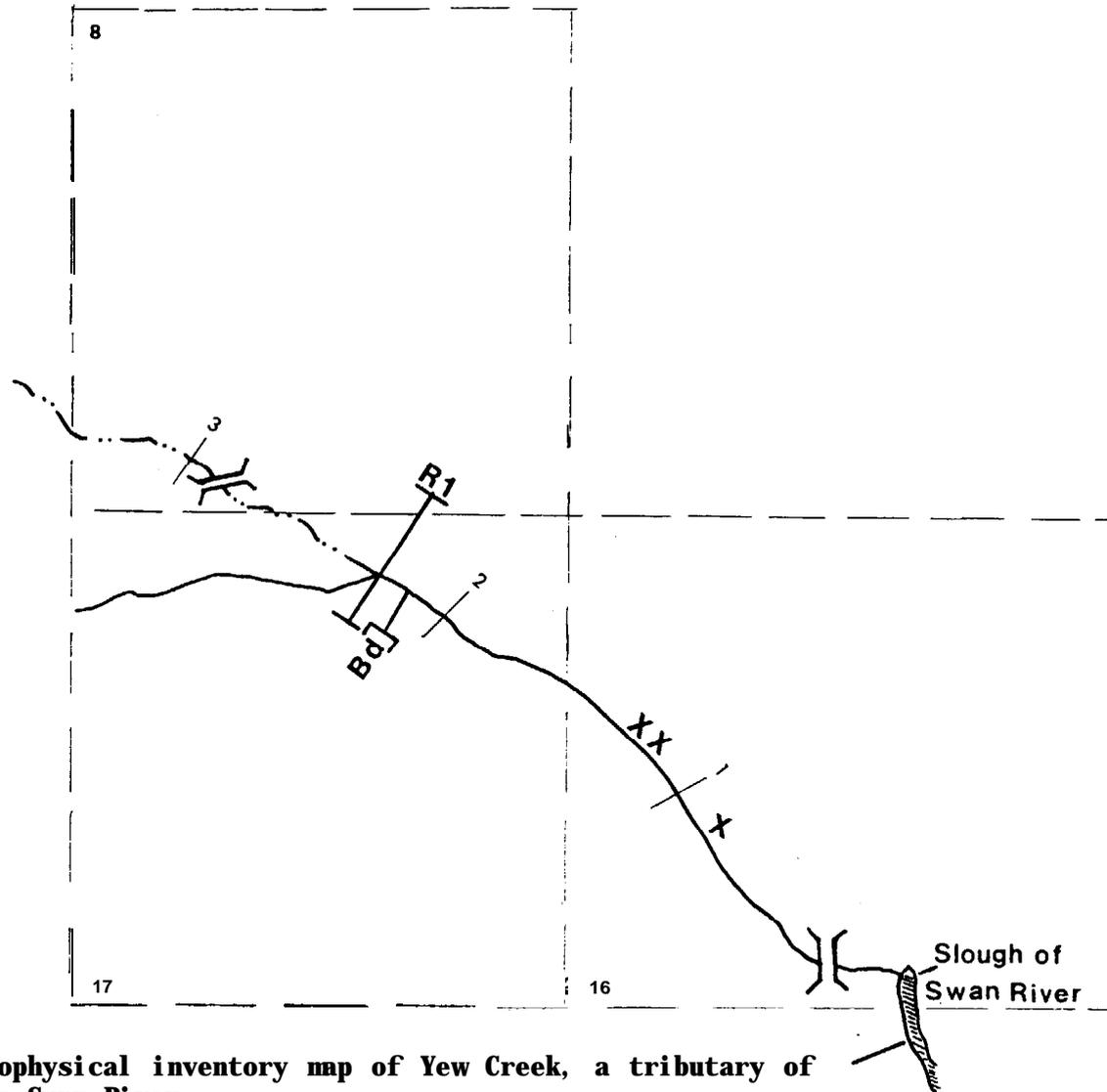


Figure 48. Biophysical inventory map of Yew Creek, a tributary of the Swan River.

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APPENDIX A

Tabulated Fish Population and **Habitat**
Measurement Data

Table A1. Summary of fish population information gathered during 1982 and 1983 on tributaries to the Swan River.

Creek	Reach	Date(s) shocked	Length of section (m)	Method	Number of fish ≥ 75 mm (3") per 300 m					Number of fish ≥ 150 mm (6") per 300 m				
					WCT	DV	EB	RB	MF	WCT	DV	EB	RB	MF
Barber	2	7/25/83	100	2-Pass	39	---	---	---	---	18	---	---	---	---
Beaver	3	9/20/83	97	Z-Pass	285	---	---	---	---	77	---	---	---	---
Bethal	1	8/26/82	84	Z-Pass	---	75	---	---	---	---	56	---	---	---
Bond	1	8/13/82	132	Z-Pass	84	---	99	---	---	18	---	43	---	---
Buck	1	8/22/83	132	Z-Pass	---	6	294	3	---	---	3	66	---	---
Buck	2	8/16/83	99	Z-Pass	33	---	183	---	---	7	---	64	---	---
Buck	3	8/11/83	123	2-Pass	33	---	---	---	---	5	---	---	---	---
Cat	2	8/29/83	92	3-Pass	69	---	---	---	---	28	---	---	---	---
Cedar	1	9/30/82	90	2-Pass	33	3	207	9	---	11	3	12	5	---
Cedar	2	9/2/82	118	Z-Pass	276	---	---	---	---	56	---	---	---	---
Cilly	1	7/25/83	111	2-Pass	---	---	252	---	---	---	---	75	---	---
Cold	1	9/22/82	131	2-Pass	---	9	57	---	---	---	3	12	---	---
Cold	2	9/9/82	115	Z-Pass	3	270	6	---	---	3	71	3	---	---
Condon	1	9/21/83	107	2-Pass	---	3	399	---	---	---	---	120	1	---
Condon	2	7/28/83	97	Z-Pass	75	---	144	---	---	49	---	50	---	---
Cooney	1	7/27/83	112	Z-Pass	93	3	---	---	---	25	3	---	---	---
Cooney	2	7/26/83	111	Z-Pass	135	---	---	---	---	28	---	---	---	---
Crazy Horse	2	10/5/83	110	---	---	---	---	---	NO FISH	---	---	---	---	---
Dog	2	9/8/83	101	2-Pass	84	---	---	---	---	78	---	---	---	---
Elk	1	10/14/82	305	M R	---	255	21	12	1	---	36	7	1	1
		10/18/82												
Glacier	1	9/28/82	120	Z-Pass	---	---	84	18	9	---	---	8	3	3
Glacier	4	9/15/83	127	2-Pass	39	39	129	---	---	20	28	53	---	---
Goat	1	11/14/83	305	M R	---	57	45	9	---	---	7	20	6	---
		11/18/83												
Goat	2	9/30/82	122	Z-Pass	12	48	33	---	---	5	---	10	---	---
Goat	3	8/9/82	132	Z-Pass	---	48	---	---	---	---	3;	---	---	---
Goat	4	8/2/83	131	2-Pass	---	6	---	---	---	---	6	---	---	---
Goat	5	9/29/82	93	2-Pass	---	---	---	---	---	---	---	---	---	---

Table A1 . (Cont.).

Creek	Reach	Date(s) shocked	Length of section (m)	Method	Number of fish ≥ 75 mm (3") per 300 m					Number of fish ≥ 150 mm (6") per 300 m				
					WCT ^{a/}	DV	EB	RB	MF	WCT	DV	EB	RB	MF
Groom	1	8/18/82	122	2-Pass	192	---	---	---	---	39	---	---	---	---
Groom	2	9/23/83	185	2-Pass	42	---	---	---	---	23	---	---	---	---
Hall	1	9/30/83	185	MR	153	---	147	---	---	11	---	4	---	---
		10/5/83												
Hall	2	8/19/82	126	2-Pass	138	---	24	---	---	58	---	14	---	---
Lower Holland	2	9/12/83	112	2-Pass	---	---	9	51	---	---	---	3	24	---
Jim	1	8/2/83	308	MR	---	39	243	---	---	---	10	80	---	---
		8/9/83												
		8/24/83												
Jim	2	8/23/83	92	2-Pass	---	3	30	---	---	---	12	11	---	---
Kraft	2	8/3/83	107	2-Pass	156	---	6	---	---	54	---	3	---	---
Lion	1	9/20/82	149	2-Pass	2	gg	39	---	---	---	12	12	---	---
Lion	2	9/15/82	133	3-Pass	---	108	---	---	---	---	71	---	---	---
Lost	1	11/10/83	305	MR	---	48	111	---	---	---	6	8	---	---
		11/16/83												
N. F. Elk	1	9/22/83	99	3-Pass	9	30	---	---	---	g	30	---	---	---
N. F. Elk	2	9/27/83	92	2-Pass	12	---	---	---	---	12	---	---	---	---
N. F. Lost	1	8/31/82	122	2-Pass	102	99	3	---	---	39	17	3	---	---
N. F. Lost	2	10/4/83	116	2-Pass	63	---	---	---	---	11	---	-57	6	---
Piper	1	9/20/82	97	3-Pass	25	48	183	12	---	4	16	21	---	---
Piper	2	8/26/82	116	2-Pass	66	---	78	---	---	35	---	---	---	---
Pony	1	8/8/83	92	2-Pass	6	---	429	---	---	3	---	42	---	---
Pony	3	8/29/83	98	2-Pass	153	---	---	---	---	19	---	---	---	---
Porcupine	1	8/23/82	122	2-Pass	---	---	144	---	---	---	---	32	---	---
Red Butte	1	8/10/83	100	2-Pass	174	---	---	---	---	43	---	---	---	---
Rumble	1	9/6/83	354	MR	27	---	609	---	---	18	---	266	---	---
		9/7/83												
		9/16/83												
Scout	1	9/13/82	125											
Simpson	1	8/1/83	92	2-Pass	102	---	---	---	---	---	---	---	---	---
Sixmile	1	8/17/82	134	2-Pass	123	---	---	---	---	10	---	---	---	---

A1

Table A1 . (Cont.).

Creek	Reach	Date(s) shocked	Length of section (m)	Method	Number of fish >75 mm (3") per 300-m					Number of fish >150 mm (6") per 300 m				
					WCT ^{a/}	DV	EB	RB	MF	WCT	DV	EB	RB	MF
Smith	1	9/19/83	92	2-Pass	---	---	108	---	---	---	---	43	---	---
Smith	3	8/30/83	107	2-Pass	15	---	---	---	---	g	---	---	---	---
soup	1	8/16/83	107	2-Pass	---	3	279	---	---	---	---	48	---	---
soup	2	8/11/82	160	2-Pass	240	---	---	---	---	46	---	---	---	---
soup	3	8/23/83	103							NO FISH				
S. F. Cold	1	9/21/82	122	2-Pass	12	3	153	---	---	6	3	29	---	---
S. F. Cold	2	9/15/82	122	2-Pass	150	---	---	---	---	56	---	---	---	---
S. F. Elk	1	9/29/83	109	2-Pass	---	15	---	---	---	---	15	---	---	---
S. F. Lost	1	11/3/83	305	MR	36	24	93	---	---	16	5	11	---	---
		11/8/83												
S. F. Lost	2	8/24/83	132	2-Pass	23	gg	---	---	---	13	g	---	---	---
S. F. Lost	3	7/28/83	130							NO FISH				
S. F. Rumble	2	9/7/83	94	2-Pass	15	---	---	---	---	15	---	---	---	---
S. Woodward	1	9/29/83	539	MR	---	g	111	---	---	---	---	54	---	---
		10/5/83												
		10/20/83												
S. Woodward	2	10/3/83	308	MR	---	111	210	---	---	---	6	108	---	---
		10/12/83												
S. Woodward	3	9/1/82	122	2-Pass	12	---	---	---	---	10	---	---	---	---
Trib to S. Woodward	1	9/7/82	116	3-Pass	6	---	6	---	---	6	---	6	---	---
Squeezer	1	9/9/82	100	2-Pass	---	81	174	---	---	---	16	78	---	---
Squeezer	2	8/11/82	131	2-Pass	12	120	---	---	---	12	10	---	---	---
Whitetail	1	8/8/83	305	MR	---	---	111	---	---	---	---	50	---	---
		8/15/83												
Windfall	1	9/17/83	103	3-Pass	---	---	432	---	---	---	---	28	---	---
Woodward	1	9/23/82	307	MR	3	90	567	9	3	---	1	134	14	---
		9/27/82												
Yew	1	8/24/82	113	2-Pass	63	6	---	---	---	25	---	6	---	---

a/ Abbreviations: WCT - westslope cutthroat trout; DV - bull trout; EB - brook trout; RB - rainbow trout; MF - mountain whitefish.

A1

Table A2. Summary (Part I) of physical and chemical characteristics of tributary streams in the Swan River drainage.

Stream	Reach	Date surveyed	Reach length	Drainage^a/ area (km²)	Stream order	Average reach gradient (%)	Late summer flow (cfs)	Average wetted width (m)	Maximum temp. (°F)	Conductivity (micromhos)
Barber	2	7/27/83	3.5	8.9	3	4.7	0.7	2.4	50	342
Beaver	3	9/14/83	6.5	15.0	2	5.2	2.9	4.0	55	102
Bethal	1	10/19/83	3.0	9.7	3	9.9	3.8	3.5	51	254
Bond	1	7/20/83	4.3	20.0	3	4.1	6.0	6.0	54	286
Buck	1	8/17/83	2.0	26.2	4	2.3	1.5	4.0	--	323
Buck	2	8/15/83	3.0	21.4	4	4.8	2.1	4.4	62	---
Buck	3	8/10/83	1.0	6.3	3	6.7	1.4	2.9	51	235
Cat	2	8/25/83	2.0	4.5	1	22.6	1.1	3.6	59	140
Cedar	1	10/25/83	9.5	63.0	4	1.4	14.9	7.1	59	220
Cedar	2	10/27/83	5.1	28.8	2	9.0	4.2	5.3	64	88
Cilly	1	7/21/83	2.0	20.5	3	1.2	1.0	3.5	64	392
Cold	1	10/24/83	8.0	85.9	4	0.6	27.4	8.8	--	189
Cold	2	11/9/83	9.0	35.2	2	5.0	24.0	7.3	53	168
Condon	1	9/20/83	6.0	74.5	4	0.5	2.7	5.5	64	222
Condon	2	7/27/83	3.0	8.3	2	5.1	2.1	3.7	--	146
Cooney	1	7/26/83	4.5	18.7	3	4.2	5.2	5.4	55	249
Cooney	2	7/21/83	3.5	11.8	2	12.4	5.9	5.5	57	208
Crazy Horse	2	8/24/83	4.5	16.4	3	4.3	5.5	6.3	58	90
Dog	2	9/7/83	4.0	11.0	3	16.2	6.6	5.0	55	135
Elk	1	10/6/83	9.0	71.9	4	1.7	31.4	11.7	58	167
Glacier	1	10/25/83	11.0	155.0	5	1.3	30.3	10.2	70	76
Glacier	4	9/14/83	1.5	51.3	3	6.9	26.3	10.1	67	58
Goat	1	10/4/83	1.3	86.4	3	0.9	15.4	7.8	--	272
Goat	2	10/4/83	3.7	50.8	3	1.6	9.1	7.2	54	291
Goat	3	10/6/83	5.4	38.6	3	4.6	6.4	6.1	59	278
Goat	4	8/1/83	1.2	21.2	3	3.6	5.2	4.5	54	---
Goat	5	9/28/82	4.0	6.6	2	13.7	2.1	3.2	--	---
Groom	1	7/20/83	3.0	11.4	2	7.1	0.6	3.8	54	250
Groom	2	9/22/83	3.0	5.4	2	17.3	2.1	3.9	--	---

Table A2. (Cont.)

Stream	Reach	Date surveyed	Reach length	Drainage area (km ²)	Stream order	Average reach gradient (%)	Late summer flow (cfs)	Average wetted width (m)	Maximum temp. (°F)	Conductivity (micromhos)
Hall	1	9/28/83	2.0	12.8	2	4.0	2.8	3.5	---	---
Hall	2	10/18/83	4.0	11.4	2	14.6	2.9	3.3	58	110
Lower Holland	2	9/6/83	2.0	44.3	4	0.3	1.2	9.1	77	150
Jim	1	8/1/83	2.0	53.2	3	0.3	19.6	14.0	56	---
Jim	2	8/3/83	3.5	41.0	3	1.7	18.4	7.7	53	189
Kraft	2	8/2/83	4.0	25.8	4	5.5	2.4	5.0	60	103
Lion	1	10/6/83	10.0	81.6	3	0.9	14.4	10.7	54	210
Lion	2	10/17/83	9.5	56.2	3	5.7	17.8	7.3	52	194
Lost	1	8/23/83	2.3	82.0	4	0.9	12.6	8.8	59	277
N.F. Elk	1	9/13/83	1.5	18.2	3	9.8	14.1	7.8	54	152
N.F. Elk	2	9/20/83	3.0	15.6	2	6.1	7.5	8.2	54	---
N.F. Lost	1	10/12/83	7.3	37.8	4	3.6	6.4	6.3	56	258
N.F. Lost	2	10/1/83	4.2	23.9	3	4.9	3.1	4.0	--	219
Piper	1	10/12/83	2.0	24.1	3	1.8	7.9	5.8	58	141
Piper	2	11/15/83	10.0	22.6	2	6.2	11.0	6.8	55	137
Pony	1	8/4/83	2.9	13.3	2	1.1	1.5	3.7	62	---
Pony	3	8/25/83	2.3	5.8	2	22.3	1.7	3.5	57	165
Porcupine	1	10/18/83	3.0	25.7	4	8.2	2.2	2.8	51	240
Red Butte	1	8/9/83	4.0	9.8	3	7.9	1.1	5.4	52	82
Rumble	1	9/1/83	2.0	14.6	3	2.1	1.8	5.3	64	196
Scout	1	9/3/82	1.5	12.9	2	20.3	2.7	4.1	--	---
Simpson	1	7/28/83	4.0	13.9	3	3.4	0.2	1.4	58	148
Sixmile	1	10/26/83	6.0	8.0	2	10.2	2.1	2.4	51	84
Smith	1	9/15/83	5.5	24.8	3	0.9	0.3	2.7	75	278
Smith	3	8/29/83	2.0	7.1	2	21.3	2.8	4.4	54	170
Soup	1	7/11/83	10.2	38.1	3	2.1	10.0	6.8	61	328
Soup	2	11/9/83	2.1	13.7	2	11.6	8.5	4.8	53	270
Soup	3	8/8/83	2.7	10.5	2	6.7	0.2	3.2	55	---
S.F. Cold	1	10/11/83	3.5	28.9	3	1.6	4.1	5.2	57	252
S.F. Cold	2	10/13/83	3.5	16.7	3	8.9	3.3	4.8	54	248

Table A2. (Cont.).

Stream	Reach	Date surveyed	Reach length	Drainage ^{a/} area (km ²)	Stream order	Average reach gradient (%)	Late summer flow (cfs)	Average wetted width (m)	Maximum temp. (°F)	Conductivity (micromhos)
S.F. Elk	1	9/13/83	3.0	22.1	3	5.3	13.4	8.0	51	175
S.F. Lost	1	8/11/83	3.0	43.6	3	2.9	10.1	8.9	54	282
S.F. Lost	2	10/25/83	7.0	37.6	3	4.4	14.4	6.0	--	260
S.F. Lost	3	7/26/83	4.0	12.2	1	8.5	5.3	5.4	--	---
S.F. Rumble	2	9/6/83	3.0	3.8	1	26.8	1.1	2.8	56	158
S. Woodward	1	9/28/83	2.0	40.5	2	1.2	37.0	15.7	--	---
S. Woodward	2	9/28/83	3.0	33.5	2	1.9	36.0	7.3	--	181
S. Woodward	3	10/17/83	6.0	26.4	2	10.0	9.6	3.7	51	137
Trib to S. Woodward	1	11/2/83	1.0	0.6	1	10.1	8.5	3.5	51	190
Squeezer	1	10/4/83	6.5	35.4	3	2.5	9.0	6.7	--	248
Squeezer	2	10/13/83	5.5	21.4	3	7.6	6.3	5.6	50	230
Whitetail	1	8/4/83	2.3	22.5	3	0.3	3.5	7.7	66	242
Windfall	1	9/14/83	3.5	13.2	3	2.4	1.1	2.6	61	69
Woodward	1	11/4/83	3.5	66.3	4	1.0	97.0	11.6	57	200
Yew	1	11/7/83	2.2	7.3	3	8.9	1.1	2.8	58	298

a/ Measured as total land area drained at lower reach boundary (includes all upstream reaches).

Table A3. Summary (Part I) of physical and chemical characteristics of tributary streams in the Swan River drainage.

Creek	Reach	Date surveyed	I, II & III		Channel		Instream cover (%)	Total ^{a/}	
			pools (#/km)	D-90 (cm)	stability score	debris (%)		overhead cover (%)	Overhead ^{b/} cover (%)
Barber	2	7/27/83	0.0	11	72	40	31	82	19
Beaver	3	9/14/83	11.0	18	64	88	37	72	64
Bethal	1	10/19/83	4.0	39	70	35	11	40	15
Bond	1	7/20/83	3.0	33	68	33	23	60	27
Buck	1	8/17/83	6.5	16	75	50	18	29	16
Buck	2	8/15/83	3.5	16	71	43	14	46	32
Buck	3	8/10/83	14.0	30	66	40	18	82	21
Cat	2	8/25/83	10.0	46	50	43	21	76	58
Cedar	1	10/25/83	9.0	25	62	83	45	69	36
Cedar	2	10/27/83	8.0	41	60	45	52	63	15
Cilly	1	7/21/83	1.0	7	75	73	58	88	69
Cold	1	10/24/83	8.0	16	69	45	27	23	10
Cold	2	11/9/83	24.0	96	56	33	46	71	38
Condon	1	9/20/83	8.5	4	81	15	71	42	32
Condon	2	7/27/83	11.0	30	68	58	29	80	30
Cooney	1	7/26/83	4.0	41	82	45	19	67	31
Cooney	2	7/21/83	9.5	68	58	20	29	48	23
Crazy Horse	2	8/24/83	5.0	51	58	18	9	31	18
Dog	2	9/7/83	13.5	102	62	30	23	79	32
Elk	1	10/6/83	6.0	41	62	23	26	24	14
Glacier	1	10/25/83	2.5	33	70	15	4	15	8
Glacier	4	9/14/83	10.0	104	45	50	33	41	29
Goat	1	10/4/83	8.0	28	80	43	23	45	31
Goat	2	10/4/83	8.5	21	81	68	30	45	33
Goat	3	10/6/83	17.0	85	66	43	26	78	16
Goat	4	8/1/83	16.0	13	57	45	21	62	31
Goat	5	9/28/82	--	33	55	48	25	33	30
Groom	1	7/20/83	6.0	54	67	40	31	85	22
Groom	2	9/22/83	3.0	43	57	50	42	62	26
Hall	1	9/28/83	5.0	26	57	35	18	92	28
Hall	2	10/18/83	7.0	80	66	48	42	70	28

Table A3. (Cont.)

Creek	Reach	Date surveyed	I, II & III pools (#/km)	D-90 (cm)	Channel stability score	Channel debris (%)	Instream cover (%)	Total overhead cover (%)	Overhead cover (%)
Lower Holland	2	9/6/83	0.0	27	65	53	31	27	18
Jim	1	8/1/83	1.0	10	88	58	56	41	14
Jim	2	8/3/83	8.0	29	69	48	43	52	20
Kraft	2	8/2/83	8.0	78	69	43	33	79	50
Lion	1	10/6/83	2.5	63	83	48	28	52	24
Lion	2	10/17/83	12.5	61	56	48	40	86	11
Lost	1	8/23/83	3.0	30	79	25	19	28	19
N. F. Elk	1	9/13/83	19.0	103	44	23	31	29	15
N. F. Elk	2	9/20/83	24.0	107	58	25	34	36	28
N. F. Lost	1	10/12/83	13.0	103	85	50	22	45	22
N. F. Lost	2	10/1/83	6.5	61	75	48	31	46	20
Piper	1	10/12/83	9.0	23	81	48	11	59	15
Piper	2	11/15/83	6.0	46	69	45	32	77	28
Pony	1	8/4/83	11.0	9	82	55	25	55	29
Pony	3	8/25/83	5.0	116	65	50	38	91	24
Porcupine	1	10/18/83	3.0	26	73	53	46	90	32
Red Butte	1	8/9/83	12.5	98	52	48	33	59	48
Rumble	1	9/1/83	11.0	7	82	50	22	42	17
scout	1	9/3/82	--	74	64	86	36	69	63
Simpson	1	7/28/83	0.0	6	70	65	52	100	71
Sixmile	1	10/26/83	0.0	33	73	48	23	90	25
Sni th	1	9/15/83	1.0	4	87	20	56	58	43
Sni th	3	8/29/83	6.0	54	53	23	25	45	20
soup	1	7/11/83	6.8	13	83	85	42	62	35
soup	2	11/9/83	13.5	69	69	38	27	59	34
soup	3	8/8/83	4.0	20	58	38	15	51	33
S. F. Cold	1	10/11/83	14.5	12	96	65	37	60	46
S. F. Cold	2	10/13/83	17.0	49	61	55	40	68	55
S. F. Elk	1	9/13/83	5.0	91	58	50	39	30	22
S. F. Lost	1	8/11/83	4.0	56	74	28	21	62	31
S. F. Lost	2	10.25/83	7.0	63	76	33	25	73	22
S. F. Lost	3	7/26/83	16.0	56	51	33	38	47	27

Table A3. (Cont.)

		Date	I, II & III pools (#/km)	D-90 (cm)	Channel stability score	Channel debris (%)	Instream cover (%)	Total^{a/} overhead cover (%)	Overhead^{b/} cover (%)
S. F. Rumble	2	9/6/83	17.0	64	46	45	15	58	21
S. Woodward	1	9/28/83	1.0	13	74	23	25	12	
S. Woodward	2	9/28/83	0.0	16	81	75	63	78	2:
S. Woodward	3	10/17/83	6.0	50	67	38	33	89	33
Trib to S. Woodward	1	11/2/83	1.0	35	46	59	25	94	24
Squeezer	1	10/4/83	9.0	10	80	63	14	24	9
Squeezer	2	10/13/83	7.0	44	71	28	43	86	13
Whitetail	1	8/4/83	0.0	0	87	30	38	26	22
Windfall	1	9/14/83	5.0	5	76	68	81	52	10
Woodward	1	11/4/83	0.0	20	66	73	47	32	13
Yew	1	11/7/83	1.0	29	55	63	30	92	54

a/ Includes undercut banks, overhang (within 1 m of water surface), understory (1 to 5 m above water surface), and overstory (more than 5 m above water surface).

b/ Includes only overhang (within 1 m of water surface) and undercut banks.

APPENDIX B

Bull Trout Redd Distribution in Swan
Tributaries - 1982 through 1984

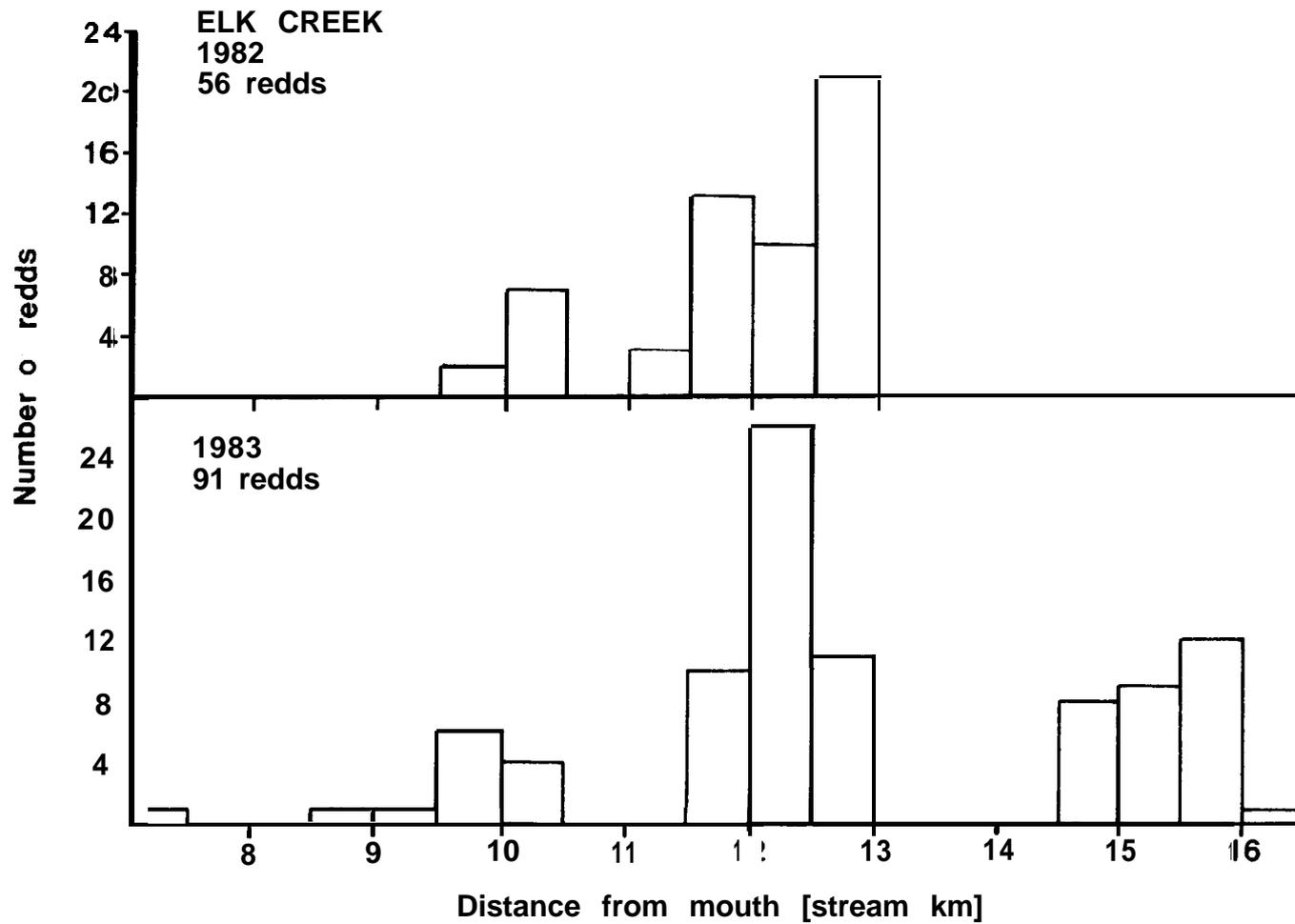


Figure B1. Distribution of bull trout redds in Elk Creek during 1982 and 1983.

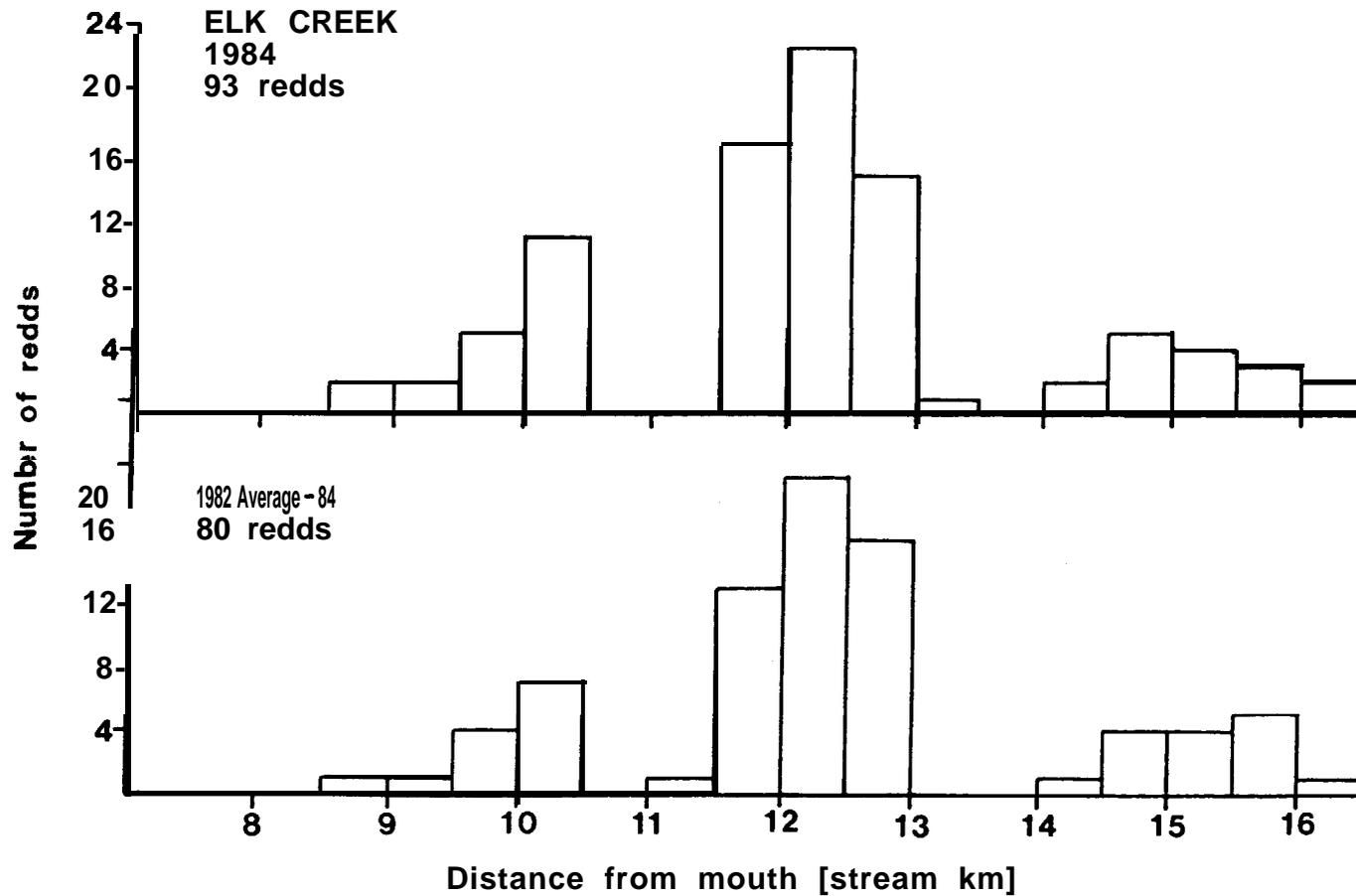


Figure B2. Distribution of bull trout redds in Elk Creek during 1984 (upper graph) and average redd distribution during the years 1982 through 1984 (lower graph).

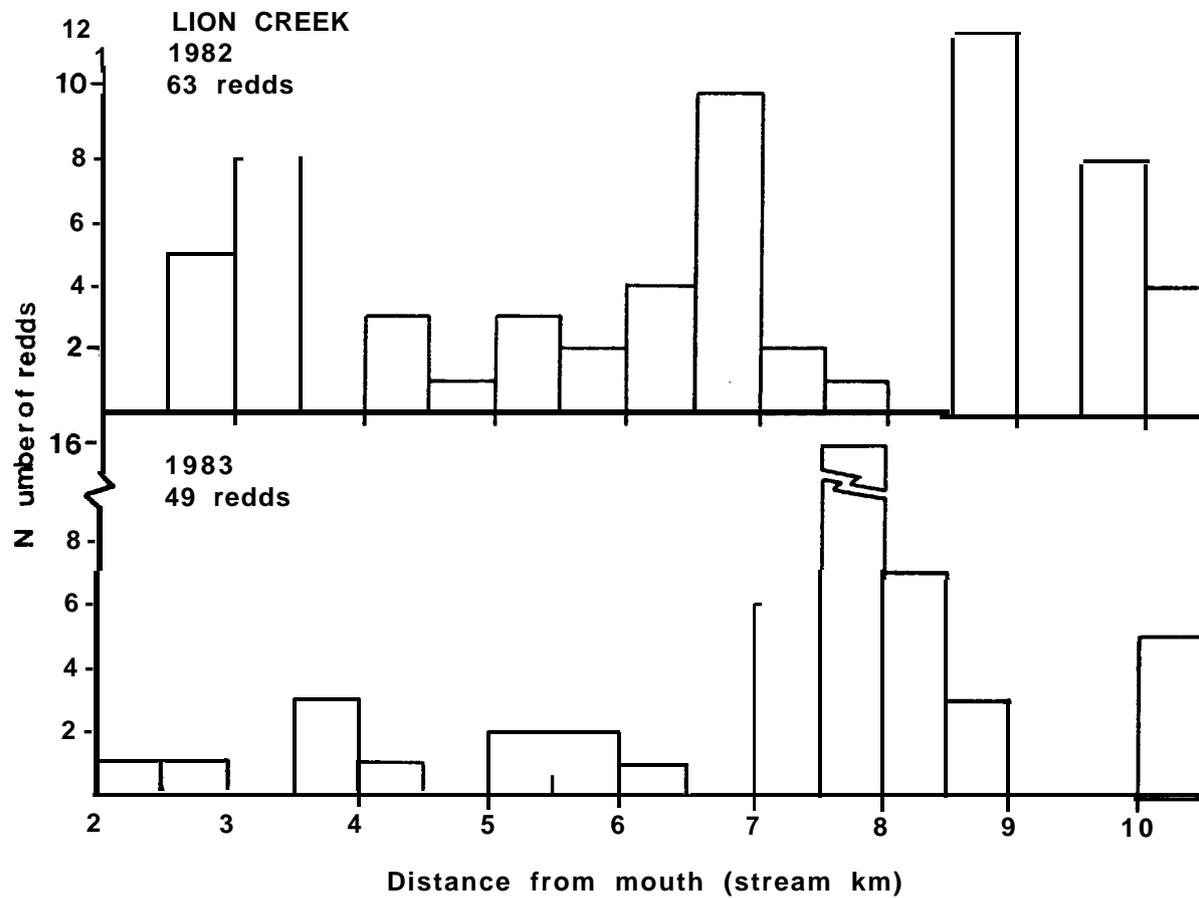


Figure B3. Distribution of bull trout redds in Lion Creek during 1982 and 1983.

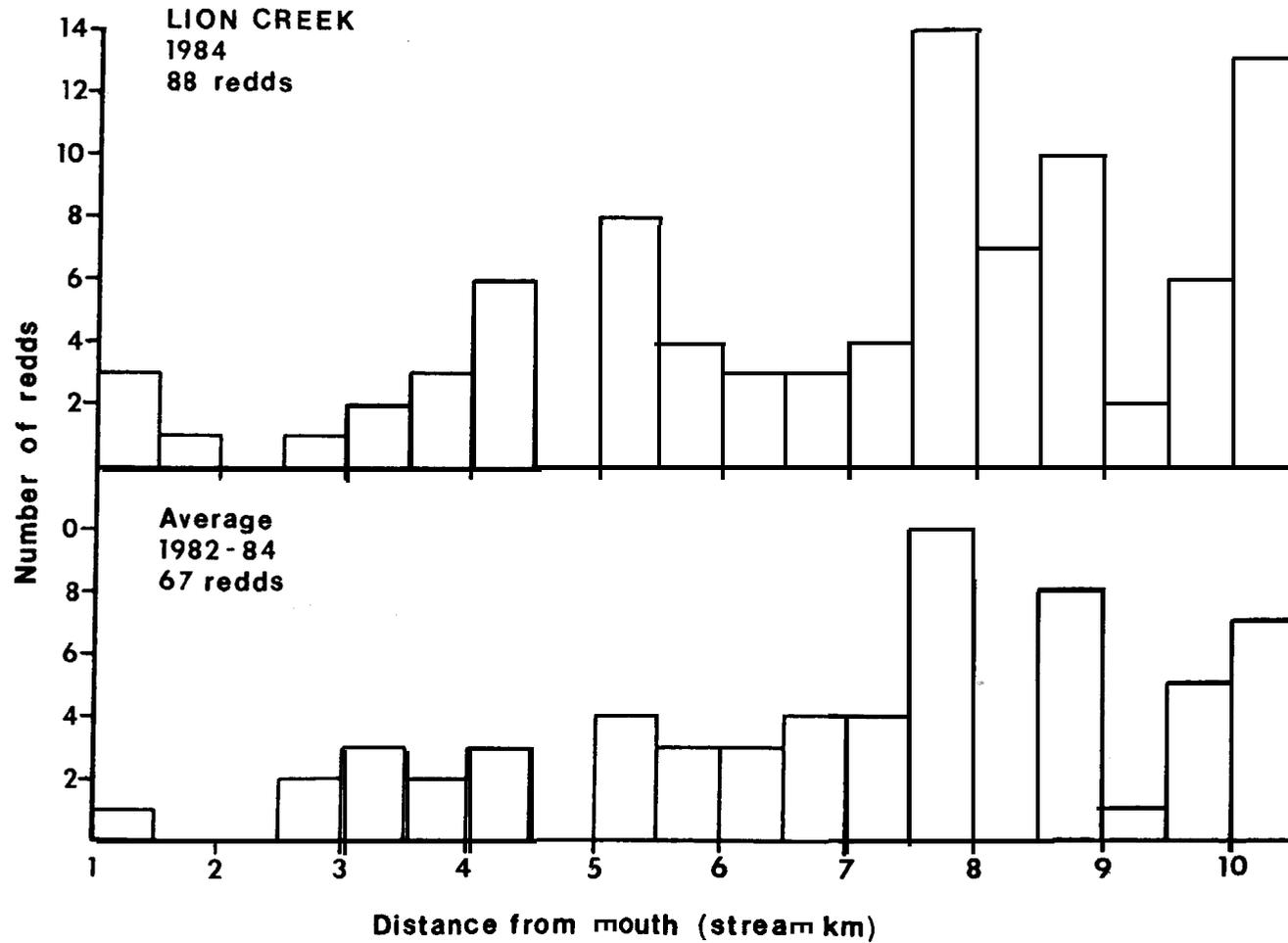


Figure B4. Distribution of bull trout redds in Lion Creek during 1984 (upper graph) and average redd distribution during the years 1982 through 1984 (lower graph).

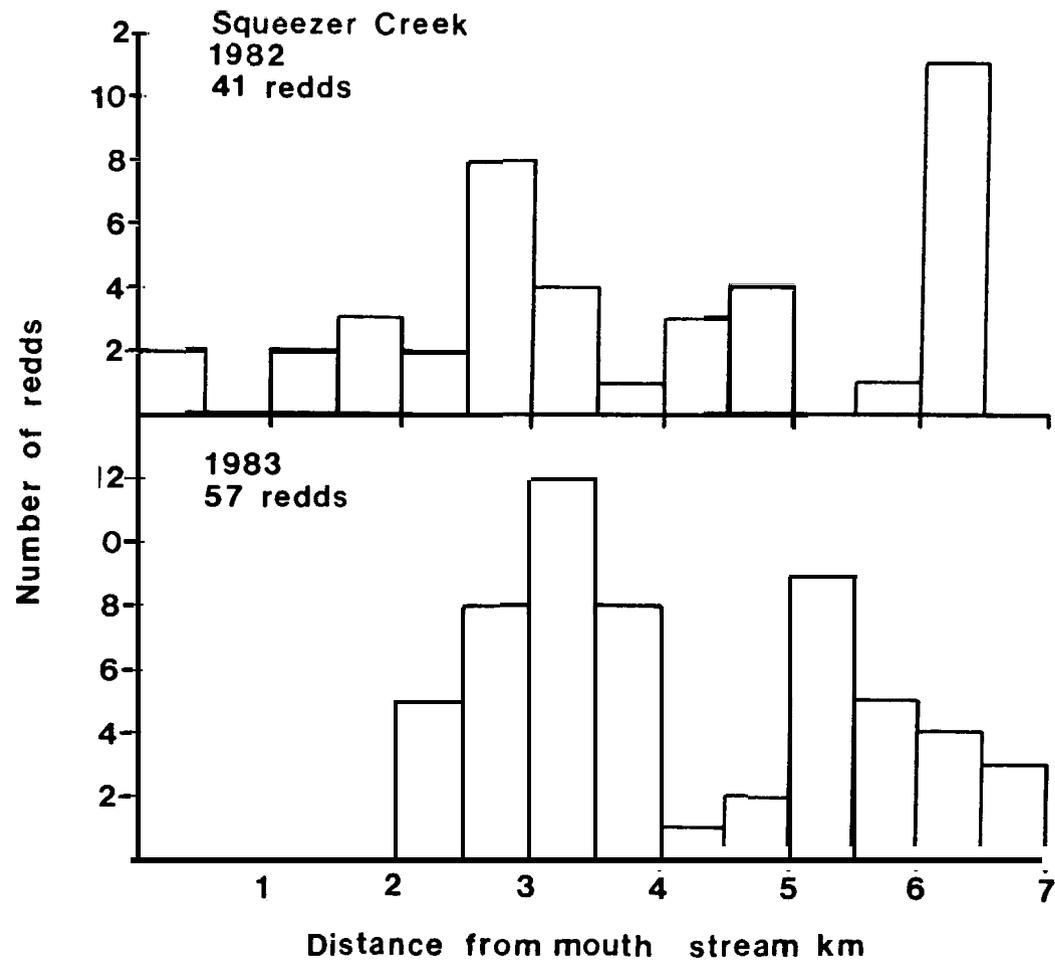


Figure B5. Distribution of bull trout redds in Squeezer Creek during 1982 and 1983.

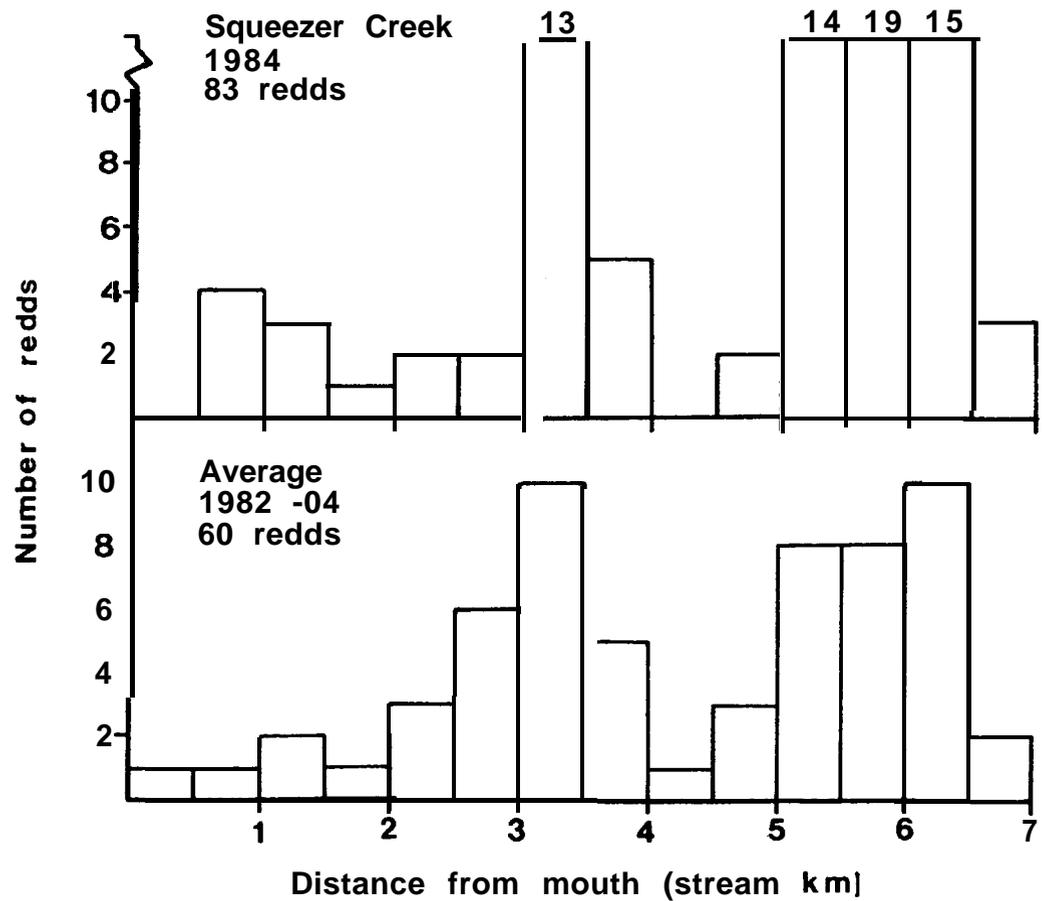


Figure B6. Distribution of bull trout redds in Squeezer Creek during 1984 (upper graph) and average redd distribution during the years 1982 through 1984 (lower graph).

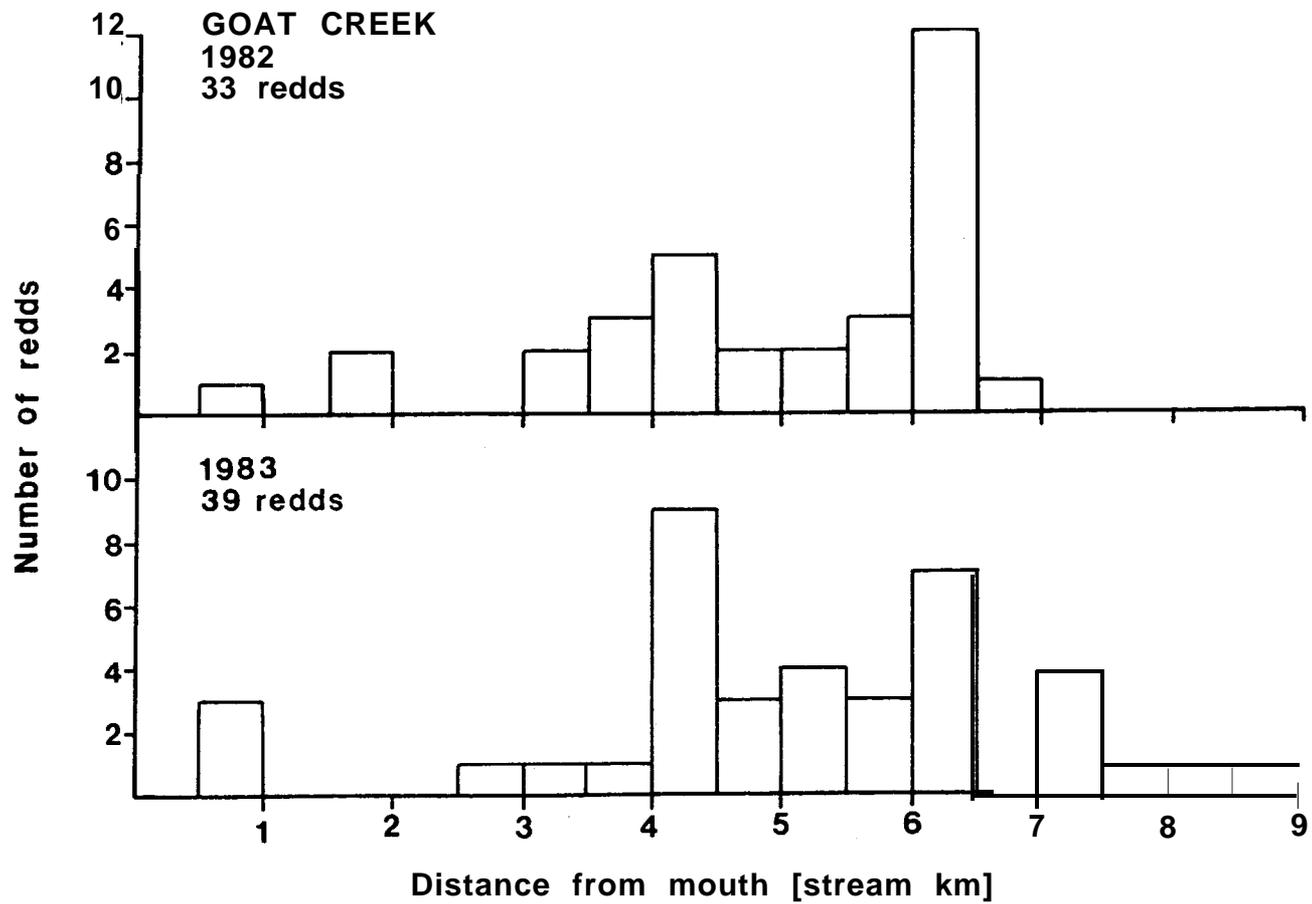


Figure B7. Distribution of bull trout redds in Goat Creek during 1982 and 1983.

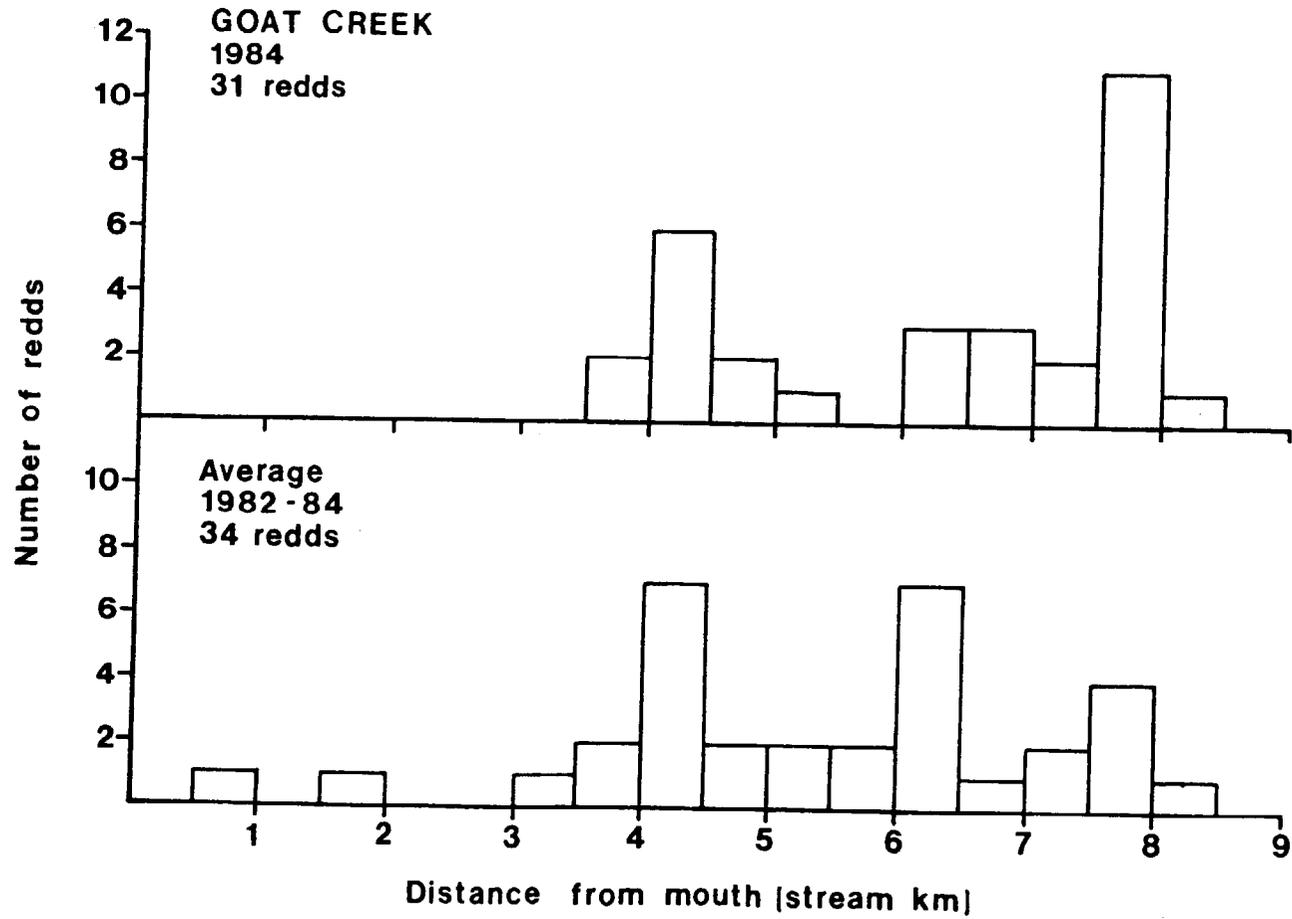


Figure B8. Distribution of bull trout redds in Goat Creek during 1984 (upper graph) and average redd distribution during the years 1982 through 1984 (lower graph).

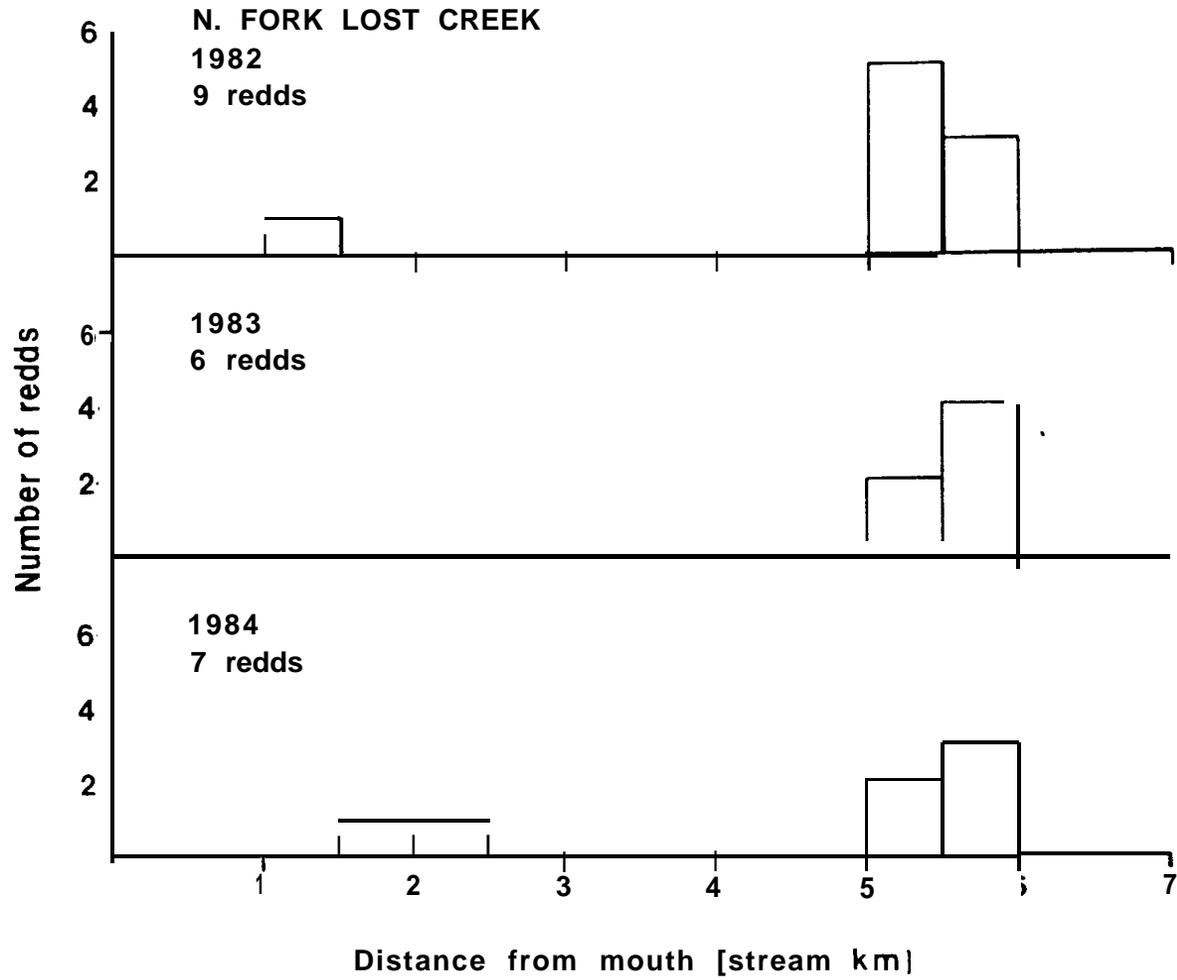


Figure B9. Distribution of bull trout redds in North Fork Lost Creek during 1982 - 1984.

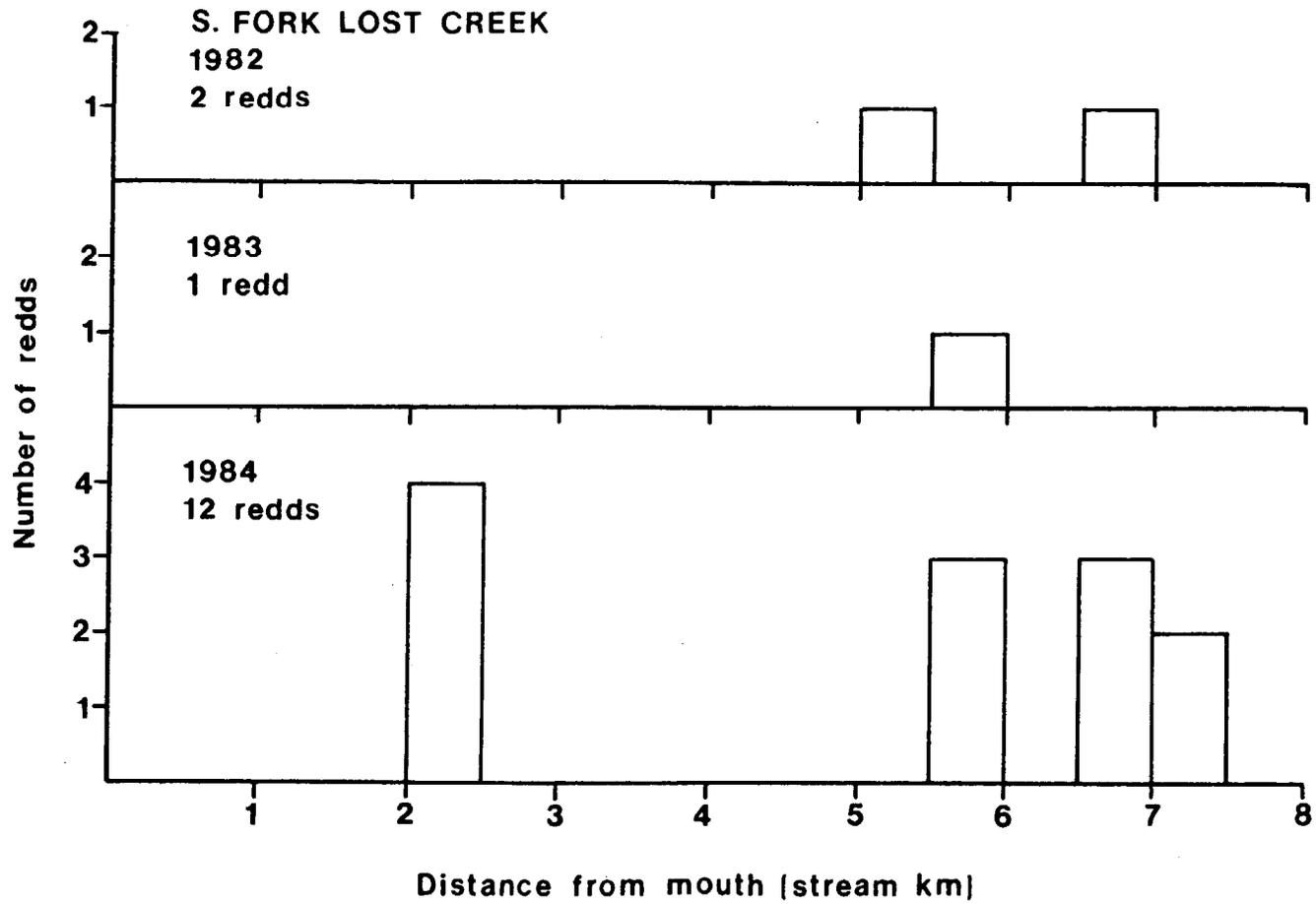


Figure B10. Distribution of bull trout redds in South Fork Lost Creek during 1982 - 1984.

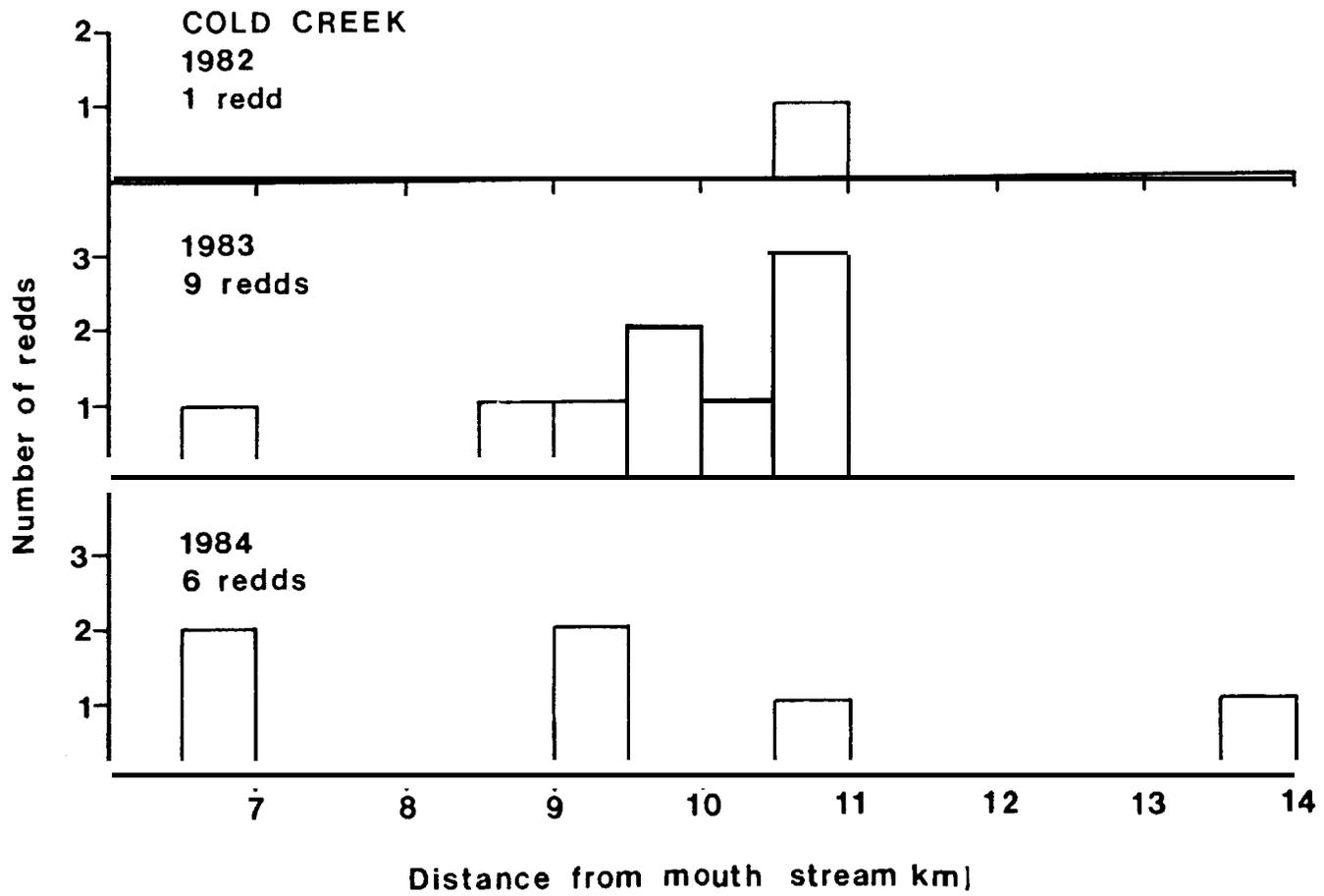


Figure B11. Distribution of bull trout redds in Cold Creek during 1982 - 1984.

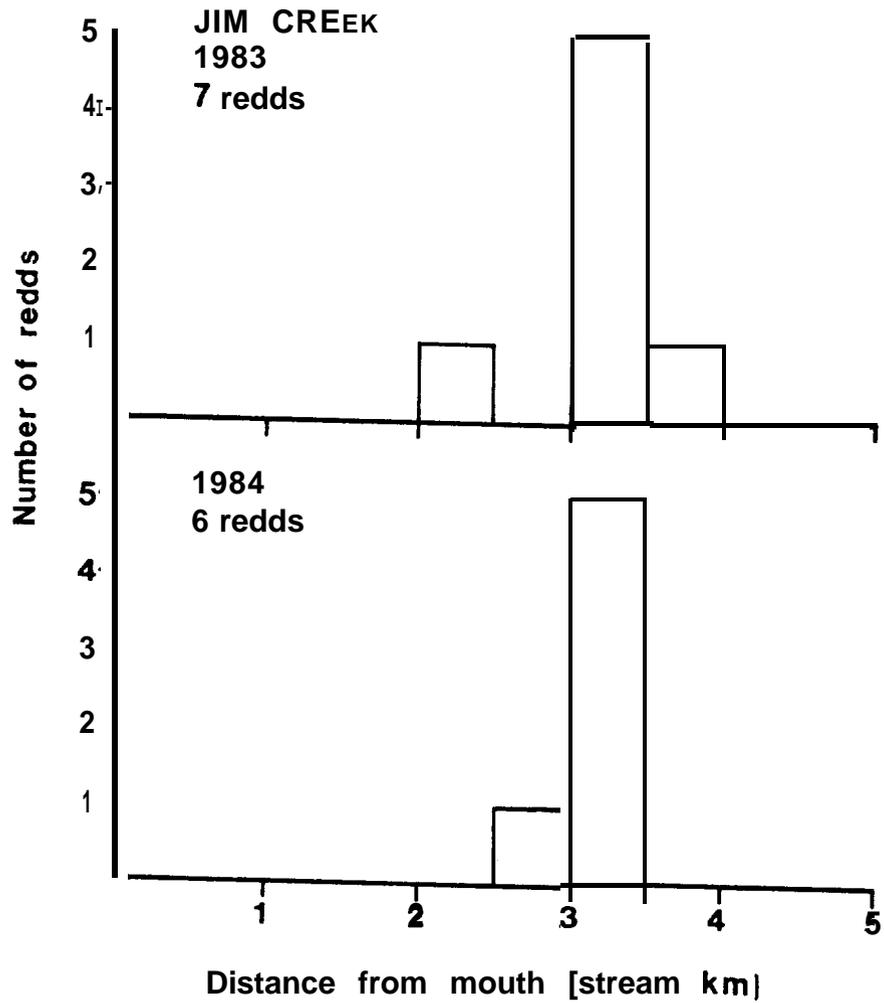


Figure B12. Distribution of bull trout redds in Jim Creek during 1983 and 1984.