FINAL REPORT

HOSPITAL CREEK FISH AND FISH HABITAT ASSESSMENT

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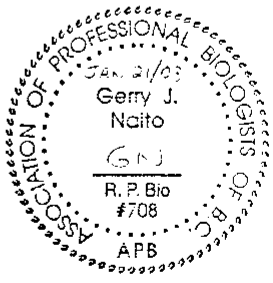

Project No. #153-01-01

January 2003

EXECUTIVE SUMMARY

Hospital Creek flows from its headwaters in the Rocky Mountains to join the Columbia River at Golden, BC, and has been subject to land development impacts including channelization and riparian disturbance. The Golden District Rod & Gun Club has taken the lead in investigating options for rehabilitating this stream, with the overall goal to increase public awareness about the creek's sensitivity and improve conditions through restoration and protection efforts. To this end, the Rod and Gun Club hired Naito Environmental to assess current fish utilization and habitat deficiencies in summer 2002 to identify potential habitat rehabilitation opportunities.

The focus of investigations was the approximately 4 km section of stream from the Columbia River up to an impassable falls. This includes the most heavily impacted sections of Hospital Creek that are accessible to fish from the Columbia River and which provide an ideal opportunity to undertake habitat rehabilitation work. Two smaller streams, Edelweiss and Limekiln Creeks, were also fish sampled.

Field investigations were conducted during August 29-September 2, 2002. Habitat assessment methods followed those of the Fish Habitat Assessment Procedures (FHAP) developed by the Watershed Restoration Program of British Columbia. Fish sampling methods consisted of electrofishing and minnow trapping.

Overall habitat composition by area in the 4 km study section downstream of the falls was 37% pool, 37% riffle, 24% glide, and 2% cascade. However, the pool percentage is skewed upward by extensive beaver pond development in the lower reach. Upstream of Reach 1, the maximum pool percentage is only 10% in impacted reaches and 12% in a relatively undisturbed reach. Average bankfull width was 7.9 m and wetted width was 4.6 m. Discharge ranged widely from 0.03 to 0.14 m^3/s due to subsurface flow in some reaches. Gradient was 0 to 5%, and cobble and gravel were the dominant substrates.

Water temperature ranged from 8.0 °C to 18.4 °C in Hospital Creek. Analysis of Hospital and Edelweiss Creek water showed relatively high levels of nitrogen (85 and 30 µg/L nitrate) but low phosphorous (<3 µg/L ortho-phosphorous), indicating that phosphorous may be a limiting factor for fish production.

A total of 13 sites were sampled by electrofishing in Hospital Creek, as well as one site in Edelweiss Creek and two in Limekiln Creek. Twenty minnow traps were also set. The six fish species captured or observed using both methods were eastern brook trout (306), bull trout (11), redside shiner (77), longnose sucker (27), slimy sculpin (28), and torrent sculpin (1). In addition, kokanee are known to use the stream, and northern pikeminnow have been reported. Maximum brook trout (mainly fry) densities were 49 fish/100 m^2 in Hospital Creek and 441 fish/100 m^2 in Edelweiss Creek. Brook trout fork length ranged from 37-99 mm for fry and 115-260 mm for juvenile/adults. Brook trout condition factor was around 1.1, with bull trout slightly lower. Maximum bull trout density was low at 12 fish/100 m^2, and no fry were captured. Only brook and bull trout were captured upstream of the lowermost rock weir along the CP Rail line, and no fry were captured upstream of Highway 1. Both Edelweiss

and Limekiln Creeks have significant brook trout spawning areas immediately downstream of the highway culverts.

Hospital Creek downstream of the falls offers excellent opportunities for habitat rehabilitation. The presence of bull trout immediately elevates the importance of stream restoration efforts, as this is a blue-listed species in BC. The main habitat issues to be addressed are as follows:

- assessment and possible removal of the large debris jam in the canyon;
- finding a solution that will allow fish passage past the beaver dams in Reach 1;
- increasing the amount of instream habitat complexity to improve conditions for spawning, holding, and rearing;
- improvement of fish passage at the Highway 1 culvert; and
- bank stabilization and riparian zone improvement.

The present study has focused on the fish and fish habitat aspects of the Hospital Creek Stewardship Project. However, there is another whole side to the Project dealing with public awareness, education, and involvement that should also be addressed.

The fish and fish habitat assessment reported on here is the first of three steps in the stream rehabilitation process. Further funding will be required for prescriptions and implementation, as well as future monitoring.

Very preliminary cost estimates for developing prescriptions and doing the construction are $15-20K for prescriptions (including surveying and mapping) and $20-30K for construction (logistics, supervision, equipment rentals, miscellaneous materials), not including heavy equipment and materials (logs, rock) that would hopefully be donated. However, this cost might be reduced to $10-14K for prescriptions and $14-20K for construction by limiting restoration work to the section of stream between Brookside Motel and the upstream end of the Trailer Park. A typical monitoring schedule for instream habitat restoration work might be Years 1, 2, 3, 5, and 10, with a cost of about $2,000-3,000 in each monitoring year, plus a potential additional requirement for maintenance of instream works.

The three potential funding sources for stream restoration and stewardship projects are as follows:

- Columbia Basin Fish & Wildlife Compensation Program;
- Habitat Conservation Trust Fund; and
- Pacific Salmon Foundation.

Recommendations for actions to move the Hospital Creek Stewardship Project forward include deciding which restoration measures to pursue, developing preliminary cost estimates, garnering community support, and applying for funding. The recommended schedule is as follows:

1) solicit community support and contributions and make funding applications in 2003;

2) develop habitat restoration prescriptions during 2004; and

3) implement the first round of restoration work in summer 2005.

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1 INTRODUCTION

1.1 BACKGROUND

Hospital Creek is a third order stream that flows through the Town of Golden, BC to join the Columbia River. Much of the lower 3 km of this stream have been subject to land development impacts such as channelization, loss of riparian vegetation, and littering that have reduced fish production capability and aesthetic qualities.

Visibility of the stream and returns of kokanee spawners have generated public interest in the condition of Hospital Creek. The Golden District Rod & Gun Club has taken the lead in investigating options for rehabilitating this stream and, in 2001-2002, received funding from the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) to install temporary fish passage at the Highway 1 culvert to determine if kokanee would use upstream spawning habitat. Overall, the Hospital Creek Stewardship Project aims to increase public awareness about the creek's sensitivity and improve conditions through restoration and protection efforts.

In a CKFRP summary report titled "Hospital Creek Stewardship Project" (Appendix 1), the stated project objectives are as follows:

- Increase awareness of the importance of small streams for fish habitat and promote human uses that minimize impacts on these streams;
- Increase knowledge of this watershed and develop skills to begin similar stewardship initiatives in other local watersheds;
- Develop partnerships between interested community groups to protect and restore local watersheds; and
- Test whether improving passage at the Highway #1 culvert will be effective in providing kokanee access to upstream spawning habitat.

A stream evaluation of Hospital Creek conducted by CKFRP staff in 2001 resulted in the aforementioned summary report (attached as Appendix 1) that identified suitable restoration options. The Golden District Rod & Gun Club approached Naito Environmental of Vernon, BC to develop a restoration plan that would build on the initial evaluation by CKFRP. However, fish presence, distribution, and habitat utilization data that would guide restoration locations and priorities were lacking. Therefore, as a first step in development of the restoration plan, an assessment of current fish utilization and habitat quality was conducted by Naito Environmental in summer 2002.

1.2 PURPOSE AND OBJECTIVES

The following report presents methods and results of the fish and fish habitat assessment study conducted by Naito Environmental in summer 2002. The study purpose was to provide the Golden District Rod & Gun Club with sufficient information to decide which stream restoration options it wants to pursue based on the Club's goals and objectives. This included the collection of data on habitat condition and fish presence, distribution, and habitat utilization that would guide restoration locations and priorities. The report also provides recommendations for future

organizational and funding application activities for the Golden District Rod & Gun Club to pursue to move the Hospital Creek Project forward.

2 STUDY AREA

2.1.1 PHYSICAL

Hospital Creek is located in southeastern BC at Golden (Figure 1),originating in the Van Horne Range of the Rocky Mountains at an elevation of 2300 m and flowing west to its confluence with the Columbia River at an elevation of 800 m. The stream headwaters in the Engelmann Spruce-Subalpine fir biogeoclimatic zone, dry cool subzone (ESSFdkp) and passes through Montane Spruce, dry cool (MSdk) before entering Interior Douglas-fir , dry mild (IDFdm) in the valley bottom of the Columbia River.

The main study area (Figure 2) consisted of approximately 4 km of Hospital Creek from the Columbia River up to a 10 m impassable falls (referred to in this report as Hospital Creek Falls). However, fish sampling was also conducted upstream of the falls to test for fish presence.

Hospital Creek enters the Golden City Limits about 650 m upstream of Highway 1 and passes under the highway through a 140 m long culvert that originates between the Visitor Information Centre and Ponderosa Motel and exits at the Chevron Gas Station. It then passes under 11th Avenue North and through the Brookside Motel property before flowing northwest along the east side of the CP Railway for about 800 m to a bridge at Anderson Road. Downstream of Anderson Road, Hospital Creek wanders toward and then roughly follows the highway until the stream passes under the CP Railway to join the Columbia River. The stream course is shown in Figure 2.

The main tributary of Hospital Creek is South Hospital Creek that enters upstream of the falls. Below Hospital Creek Falls, the main tributary is Edelweiss Creek, which joins Hospital Creek downstream of Anderson Road. Various map sources (NTS, TRIM, backroad mapbook (Mussio Ventures Ltd. 1996)) do not correctly show the present course of Hospital Creek downstream from Highway 1, and a map received by CKFRP from the Town of Golden (refer to Appendix 1) is also not in agreement with the present course of Edelweiss Creek. The map sources incorrectly show Hospital Creek passing under the CP Rail line before reaching Anderson Road and joining the Columbia River 1.5-2 km upstream of where it presently enters. The map from Town of Golden shows Edelweiss Creek flowing south then west after crossing the highway, whereas it presently drains north to join Hospital Creek downstream of Anderson Road (Figure 2).

To add to the confusion, Edelweiss Creek has a tributary referred to as Limekiln Creek that also crosses the highway only 250 m away from Edelweiss Creek. One local resident (Mr. Gondek) suggested that, whereas the northernmost stream crossing the highway is labeled as Edelweiss Creek on some maps (e.g., that supplied by Town of Golden), the lime works are situated closer to this stream so that perhaps it is more aptly named Limekiln Creek.

However, this report refers to the northernmost stream as Edelweiss Creek and the southern stream as Limekiln Creek.

2.1.2 FISH SPECIES

Pacific salmon historically ascended the Columbia River to Golden and beyond, but these runs were extirpated with building of impassable dams on the lower Columbia River in the USA. However, Hospital Creek now supports a run of kokanee, the non-anadromous form of sockeye salmon (*Oncorhynchus nerka*), which originate from Kinbasket Reservoir created by the Mica Dam. Previous studies by Coast River Environmental Services Ltd. (1999) found sculpins (*Cottus* sp.), eastern brook trout (*Salvelinus fontinalis*), northern pikeminnow (*Ptychocheilus oregonensis*), and redside shiner (*Richardsonius balteatus*). Other potential fish species were expected to be westslope cutthroat trout (*O. clarki lewisi*) and possibly bull trout (*S. confluentus*). The Columbia River mainstem supports approximately 18 fish species, including four trout and char, kokanee, and two whitefish species.

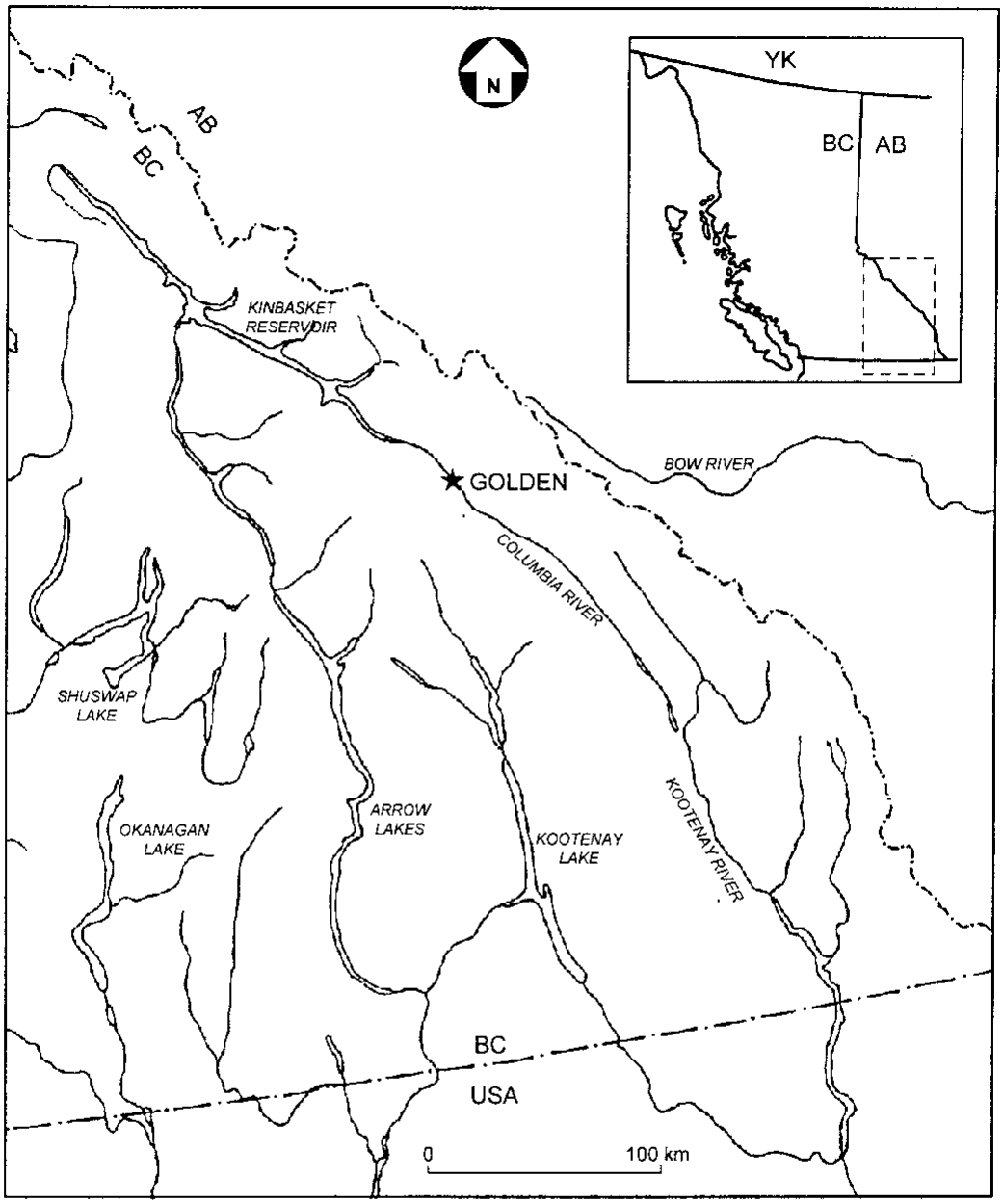
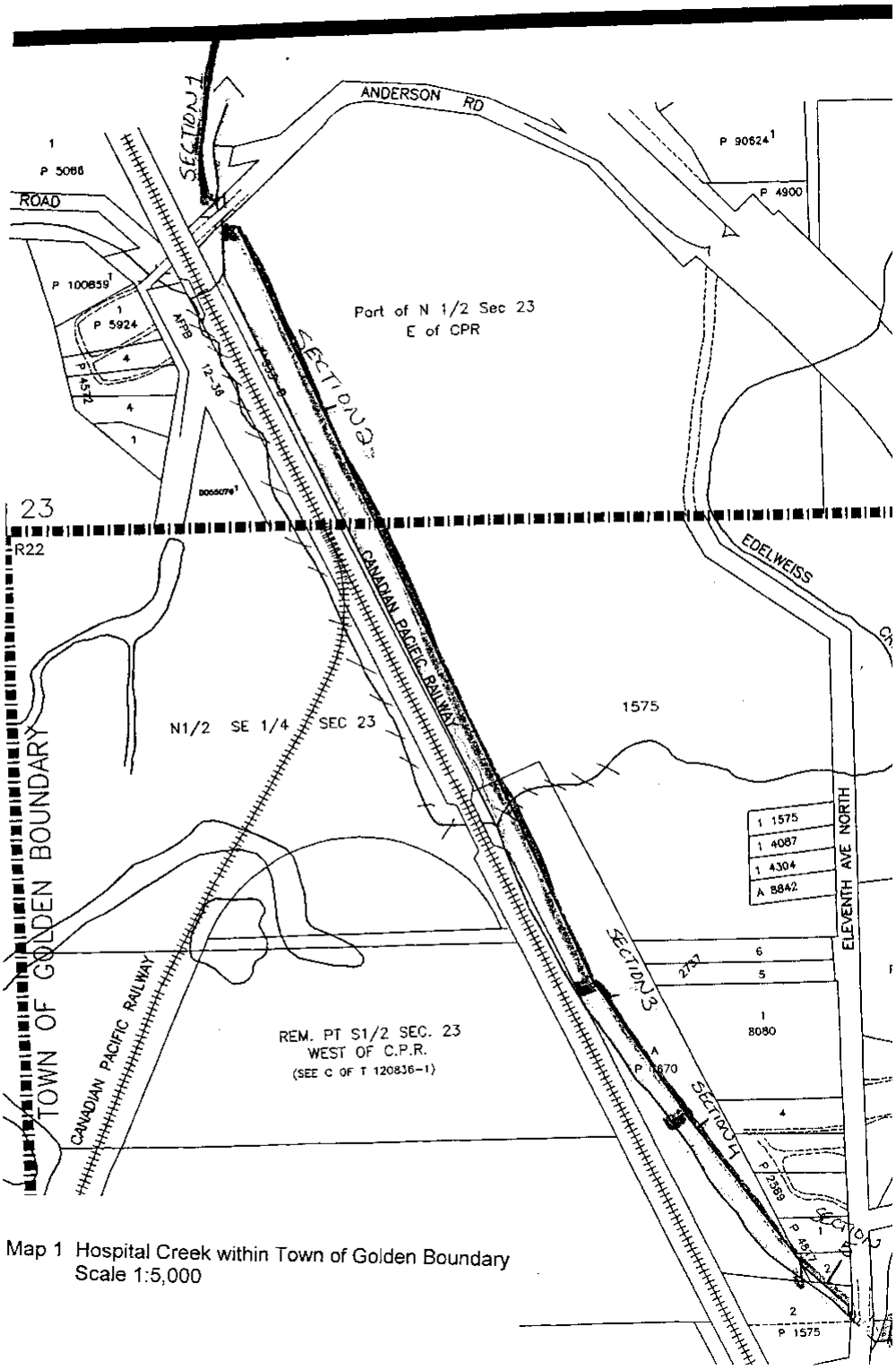
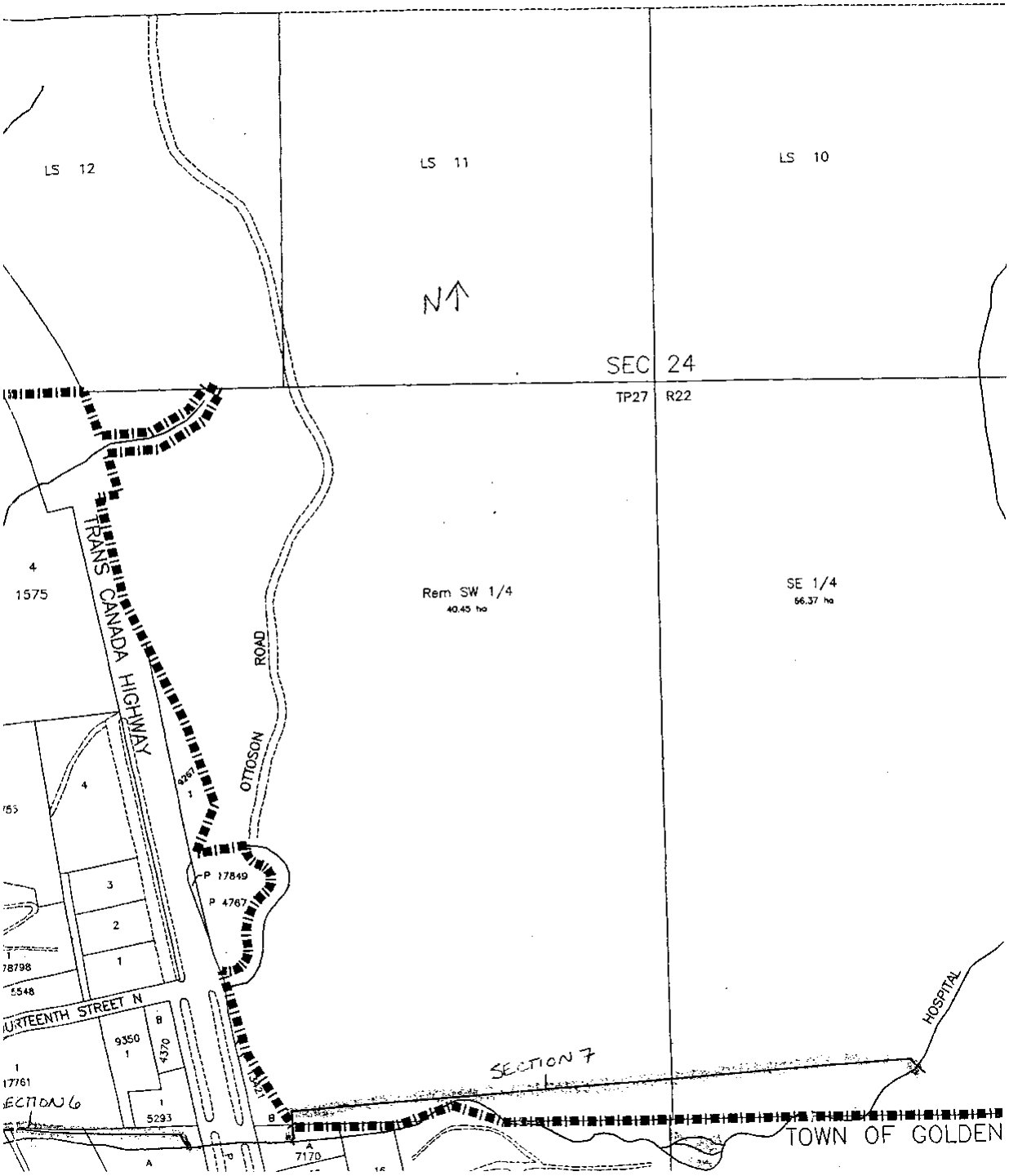


FIGURE 1. Location map for Hospital Creek at Golden, British Columbia.



Map 1 Hospital Creek within Town of Golden Boundary
Scale 1:5,000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3 METHODS

3.1 HABITAT ASSESSMENT

Detailed habitat assessment was conducted on Hospital Creek up to the 10 m falls near Km 4, as this is the stream section where rehabilitation efforts would be focused because it is accessible to fish from the Columbia River mainstem. Less detailed habitat assessment was conducted upstream of the falls at fish sampling locations.

Physical data collected at Edelweiss and Limekiln Creeks was limited to a few depth and wetted width measurements plus notes on riparian vegetation.

3.1.1 PHYSICAL HABITAT

3.1.1.1 Downstream of Hospital Creek Falls

Methods from the Fish Habitat Assessment Procedures (FHAP) (Johnston and Slaney 1996) were used for the assessment of physical habitat. The FHAP is used to identify limitations to salmonid production by characterizing physical habitat and comparing this against standards for similar, undisturbed streams. Data were recorded on the Level 1 – Habitat Survey Data Form (Figure 3), which has fields for the various physical habitat characteristics used to interpret habitat impacts and/or limitations.

The first step was to mark habitat units from the mouth all the way to Hospital Creek Falls. This procedure consisted of walking upstream using a hip chain to measure the distance to each habitat unit (pool, riffle, glide, cascade, etc.) boundary. Along the way, reach boundaries were also noted. A stream reach "is a relatively homogenous section of stream having a sequence of repeating structural characteristics (or processes) and fish habitat types" (Forest Practices Code of British Columbia 1995). In each reach, successive units of each habitat type were given a sequential number (e.g., Riffle 1, Riffle 2, etc.) and marked at the downstream boundary with a piece of labeled flagging.

Once all habitat units were marked, an attempt was made to fish sample at least one of each habitat type in each reach in the available time.

Physical habitat data were obtained after completion of fish sampling at each selected habitat unit (refer to Section **Error! Reference source not found.** for fish sampling methods). UTM coordinates of selected locations and features were obtained using a Garmin 12XL Global Positioning System (GPS) receiver. Habitat data were also obtained from some habitat units that were not fish sampled. Water depth and velocity measurements were taken along a representative transect using a Swoffer Model 2100 velocity meter with topset wading rod. A 50 m fiberglass measuring tape was used to define the transect line and identify depth/velocity measurement locations at 0.5 or 1.0 m intervals. A 1.2 m wood dowel marked in centimeters was used to measure bankfull height plus maximum depth in pools where detailed assessment was not conducted. An Abney hand level was used to measure gradient of selected longer habitat units such as riffles, but pools and glides were too short

and flat for gradient to be determined. Refer to the FHAP data (Appendix 3) for a list of physical characteristics recorded in the field.

Wetted and bankfull widths for each habitat type were averaged to yield reach-specific values. The mean wetted width values were multiplied by total length of each respective habitat type to calculate wetted area of each habitat type and each reach, from which pool percentage by area could be calculated. Reach-specific mean bankfull width weighted by length of each habitat type was used to calculate number of bankfull widths per pool (pool frequency).

Using stream inventory convention, stream banks are referred to as left and right looking in a downstream direction.

3.1.1.2 Upstream of Falls

Collection of habitat data upstream of Hospital Creek Falls was of less concern due to apparent absence of fish and a low priority for restoration. Therefore, data collection did not commence at the start of the reach (Hospital Creek Falls) and, consequently, habitat composition was not determined. However, most of the other basic FHAP data were collected at the one fish sample site.

3.2 WATER QUALITY

Grab samples of water were collected from Hospital and Edelweiss Creeks on September 2, 2002. The water samples were delivered to Caro Environmental Services in Kelowna for laboratory analysis of nutrients, alkalinity, and pH.

Water temperature and electrical conductivity were measured at fish sample sites using a Hanna Instruments HI 98311 tester with resolution of 1 µS/cm for electrical conductivity and 0.1 °C for temperature.

3.3 FISH SAMPLING AND DATA ANALYSES

Fish sampling was conducted during August 29-September 2, 2002 by Gerry Naito and Kelli Giest. The primary sampling method was electrofishing using a Smith-Root Model 12B backpack electrofisher within stopnet (9.5 mm stretched mesh) enclosures. Two removals were conducted to allow calculation of population estimates, except that no second pass was conducted if there were no fish captured on the first pass. Minnow traps (3.2 mm wire mesh) baited with salted salmon roe were used to sample wetland habitats and deep, low velocity stream sections such as the lower reaches of Hospital and Edelweiss Creeks.

An effort was made to fish sample at least one of each habitat type in each reach of Hospital Creek. Exploratory electrofishing without stopnets was also conducted in the upper part of Reach 6 and in Reach 7 (upstream of falls) where no fish appeared to be present. Edelweiss and Limekiln Creek each had one electrofishing site.

Level 1 - Habitat Survey Data Form

Forest District: _____ Watershed: _____ Sub-Basin: _____

NTS map sheet: _____ Weather: _____ Discharge ($m^3 \cdot s^{-1}$): _____

Survey Date: ____ / ____ / ____ Survey Crew: _____ Subsampling Fractions: ____ / ____ / ____ / ____

(d / m / y) (R / P / G / C / O)

	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Bed Material Type Spawning Gravel?
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

	Total LWD Tally	Functional LWD Tally 10 - 20 cm	Functional LWD Tally 20 - 50 cm	Functional LWD Tally > 50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Offchannel Habitat Type	Offchannel Habitat Access	Offchannel Habitat Length (m)	Disturbance Indicators			Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers	Comments
1																			
2																			
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4																			
5																			
6																			
7																			
8																			
9																			
10																			

Figure 3. Fish habitat assessment procedures Level 1 – Habitat Survey Data Form.

	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient (%)	Mean Depth Bankfull (m)	Mean Depth Water (m)	Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max. Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Type Dom.	Bed Material Type Sub-Dom.	Bed Material Type Spawning Gravel?
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12																	
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	Total LWD Tally	Functional LWD Tally 10 - 20 cm	Functional LWD Tally 20 - 50 cm	Functional LWD Tally > 50 cm	Cover Cover Type	Cover %	Cover Cover Type	Cover %	Offchannel Habitat Type	Offchannel Habitat Access	Offchannel Habitat Length (m)	Disturbance Indicators	Riparian Vegetation Type	Riparian Vegetation Structure	Riparian Vegetation Canopy Closure	Barriers	Comments
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At each enclosed electrofishing site, captured fish from the first pass were held in a bucket until the second pass was complete. This holding bucket was set in the stream outside the sample area and had screened cutouts to allow continual water circulation. Following the second pass, fish were anaesthetized in a CO_2 bath created by dissolving one or two tablets of Alka Seltzer™ in 3-4 L of water. The anaesthetized fish were measured for fork or total length (depending on species) to the nearest millimeter, weighed to the nearest 0.1 gram on an AccuLab VI-1200 electronic balance, transferred to a bucket of fresh water, and released back to the sample site when recovered.

The numbers of fish captured were converted to densities by first calculating sample site population estimates for each species using MicroFish (Van Deventer and Platts 1989), a software package that calculates maximum likelihood population estimates based on the decline in catch between successive removals. Each sample site population estimate was then divided by the sampled area to yield fish/100 m^2.

Condition is an indicator of fish health that relates a fish's weight to its length. A fatter fish is heavier for a given length and therefore has a higher condition factor. Condition factor was calculated for each fish using the following formula:

$$\text{Condition} = W/L^3 \times 100{,}000$$

where W = mass in grams and L = fork length in millimeters.

4 RESULTS

Results of the fish and fish habitat assessment are presented below. Reach descriptions are presented first, followed by a flow and water quality summary, fish sampling data, and a reach summary. The reaches identified in this study closely correspond to the sections identified previously by CKFRP (2001) and that report (refer to Appendix 1) provides detailed descriptions of stream conditions that in some cases augment the descriptions below. Photographs are provided in Appendix 3.

4.1 REACH DESCRIPTIONS

4.1.1 REACH 1

Reach 1 of Hospital Creek (Section 1 in CKFRP report) extends approximately 1200 m upstream from the Columbia River to Anderson Road through property owned by Dave Wachna. A main feature of this low gradient reach is the presence of three beaver dams (e.g., Photo 1) that cause the stream to form a series of linear ponds with near zero velocity. The first dam was under the CP Rail bridge and was not a major fish passage barrier due to a low height of 30 cm. The second dam 154 m upstream from the Columbia River was about 0.8 m high and a barrier to fish passage except that fish could potentially bypass the dam via overland flow around the edges. The third dam (Photo 1) was 228 m upstream from the mouth, close to 1 m high, and a probable fish passage barrier. Fresh cuttings indicated that

this dam was active. A fourth dam 351 m upstream from the mouth had been mostly dismantled by the landowner, leaving a low dam. Another beaver dam had been removed at 520 m upstream.

Banks and bottom in Reach 1 are composed of silt and sand, with scattered cobbles. Most of the reach is pool-like due to impoundment by the beaver dams, and average depth is greater than 1 m. Widths are 7 m bankfull and 6.2 m wetted. Riparian vegetation consists of shrub willow, mountain alder, red-osier dogwood, cottonwood, and Carex sp.

Reach 1 provides good salmonid rearing habitat but has no spawning potential. A total of 8 minnow traps captured eastern brook trout fry, longnose sucker, and a torrent sculpin. Adult brook trout in the 200 mm size range (too large to capture in minnow traps) were also observed.

4.1.2 REACH 2

Reach 2 of Hospital Creek (Section 2 in CKFRP report) is a straight, channelized section of stream (Photo 2) that extends 700 m along the CP Rail line upstream from Anderson Road. The entire reach is one long, very shallow glide. Gradient is less than 0.5% and the dominant bed material is gravel. Widths are 6.4 m bankfull and 5.1 m wetted. The right bank (looking downstream) is well-vegetated with alder (pole-sapling stage) but the left bank has been trimmed for railway maintenance. This reach reportedly goes dry every year and measured discharge was only 0.0.04 m^3/s compared with up to 0.14 m^3/s in reaches further upstream, indicating subsurface flow.

Electrofishing at one site in Reach 2 yielded eastern brook trout fry (7 fish/100 m^2), redside shiner, and slimy sculpin. Most fish were associated with accumulations of small, woody debris along the right bank. Mayfly nymphs were very abundant. The heavy algal growth observed in 2001 (CKFRP 2001) was not observed.

4.1.3 REACH 3

Reach 3 of Hospital Creek (Sections 3 and 4 in CKFRP report) is about 530 m long and contains five rock weirs (Photo 3) and an extensive area of gravel accumulation (Photo 4). The lower two weirs are intact and create plunge pools that provide good rearing and holding habitat for fish. The upper three weirs have fallen apart and provide limited boulder cover but no pool habitat. Gradient is around 0.5%. The dominant bed material is gravel, providing extensive salmonid spawning habitat, with cobble becoming more common near the upstream end. The stream channel is very wide, with bankfull width of 10-12 m in the lower 230 m and increasing to more than 20 m in the upper 300 m of the reach upstream of the boulder weirs. Habitat composition was 7% pool, 74% riffle, 7% glide, and 12% cascade, although most of the "cascade" habitat was bouldery riffle or glide created by rock weirs that had fallen apart.

In the lower part of this reach, riparian vegetation is deciduous pole-sapling (similar to Reach 2) but the upper part has the banks formed into gravel berms and vegetation is sparse. The low flow channel follows a sinuous path through the upper section and some willow and cottonwood are re-establishing on the floodplain. Measured discharge was 0.14 m^3/s in the

lower weir pool but only 0.03 to 0.05 m^3/s in two riffle sample sites, indicating probable subsurface flow that is intercepted in pool habitats.

Electrofishing at three sites in Reach 3 yielded eastern brook trout fry and slimy sculpin. The highest brook trout density of 49 fish/100 m^2 was in a weir pool but a shallow gravel riffle still produced 31 brook trout/100 m^2. A small amount of filamentous green algae was present in isolated pools (Photo 4).

4.1.4 REACH 4

Reach 4 of Hospital Creek (Sections 5 and 6 in CKFRP report) is 350 m long and includes a 100 m section confined by gabion walls through the Brookside Motel (Photo 5), a bottomless arch culvert at 11th Avenue North (Photo 6), and 250 m (Photos 7, 8) up to the outlet of the Highway 1 culvert at the Chevron Gas Station (Photos 11 and 12). The section upstream of 11th Avenue appears in good health due to its relatively natural appearance and excellent riparian zone.

Gradient is higher than previous reaches at around 3.5%. Bankfull and wetted widths are around 7.2 m and 3.6 m, respectively. The dominant bed material is cobble, with gravel subdominant, and isolated patches of gravel suitable for spawning by resident fish. Riffle is the dominant habitat type in this reach at 90%, with the remainder consisting of pool. Riparian vegetation is young to mature deciduous forest. Measured discharge was 0.06 m^3/s in the riffle at Brookside Motel but 0.13 m^3/s in the culvert pool at Chevron, indicating subsurface flow that is intercepted in pool habitats the same as in Reach 3.

There is a 10 m section of eroding right bank (looking downstream) where streamflow is adjacent to the bank just upstream of the rip rap armour at 11th Avenue. Further upstream is a longer section of eroding right bank farther back from the stream along a cobble-gravel bar (Photos 9 and 10).

The culvert outlet at the Chevron Station did not look like a serious fish migration barrier, as the drop was only about 30 cm and water velocity inside the culvert looked easily passable to fish 20-40 cm long (larger fish might be limited by shallow water depth). However, the culvert bottom at the outlet is corroded, allowing water to drop through the culvert bottom, which may create difficult passage conditions if fish try to swim over this hole. This may also "fool" fish into thinking they should be jumping underneath the culvert where the water is dropping through rather than jumping at the lip of the culvert.

Eastern brook trout (average 15 fish/100 m^2) were captured in the two fish sample sites in Reach 4, and a single juvenile bull trout was also captured in the culvert pool at the Chevron.

4.1.5 REACH 5

Reach 5 includes the Highway 1 culvert and the cobble riffle habitat (Photos 13, 14) upstream for a total reach length of 740 m. Gradient is 3.7%. The dominant bed material is cobble, with boulder subdominant, but there are isolated patches of spawning gravel suitable for resident fish. Average bankfull and wetted widths are 5.4 and 3.6 m, respectively. The first 500 m upstream of the Highway 1 culvert flows past a trailer park and gravel pit. This

section appears to have been channelized, with consequent impacts to riparian vegetation. The vegetation that is present consists of deciduous forest at a pole-sapling stage. Measured discharge was 0.12 m^3/s.

4.1.6 REACH 6

Reach 6 consists of a series of boulder riffles, cascades, and pools formed by boulders and bedrock (Photos 15, 16) in the canyon section of Hospital Creek up to the falls (Photo 22). Despite the large substrate (boulder dominant), there are isolated pockets of gravel suitable for spawning by resident fish. Stream gradient is 4.9%. Average widths are 9.1 m bankfull and 4.0 m wetted. The riparian zone consists of young forest of mixed coniferous and deciduous trees that provide moderate canopy closure. Measured discharges were 0.10 m^3/s and 0.11 m^3/s.

Around 950 m upstream of the Highway 1 culvert (275 m downstream of the falls) there is a very large debris jam about 3 m high (Photos 17, 18, 19). The debris jam forms an impassable fish barrier and is holding back a sediment wedge (Photo 20) with estimated volume of approximately 600 m^3, the equivalent of about 60 tandem dump truck loads. There is another smaller debris jam 70 m downstream of the falls that forms a 1.2 m drop (Photo 21) that is likely a fish passage barrier at low flows. No UTM coordinates could be obtained using GPS for the large debris jam due to the canyon walls but estimated coordinates measured from 1:20,000 TRIM mapping are Zone 11 502750E 5685000N (NAD 83).

Juvenile eastern brook trout and bull trout were captured downstream of the debris jam but no fish were captured upstream of the debris jam. Sample site fish densities were 10 to 12 fish/100 m^2. No fry were captured.

4.1.7 REACH 7

Reach 7 extends upstream from Hospital Creek Falls and was accessed from the wood bridge on a spur road off the Upper Donald Road (Photo 23). There is an overwidened section (Photo 24) for about 100 m upstream of the bridge but the typical widths for this reach are around 5.3 m bankfull and 4.0 m wetted. The dominant substrate is cobble, with boulder subdominant, but there are isolated pockets of gravel suitable for spawning by resident fish. Gradient is 4.9%, similar to Reach 6. The riparian zone consists of young forest of mixed coniferous and deciduous trees that provide moderate canopy closure. Measured discharge was 0.12 m^3/s.

No fish were captured in Reach 7.

4.1.8 EDELWEISS CREEK

As indicated on a map provided to CKFRP by the Town of Golden, the northern of two creeks crossing Highway 1 on the north edge of Town is referred to as Edelweiss Creek. Upstream of the highway, the streambed is encrusted with mineral deposits (Photo 25). Flow looks very stable based on a low bankfull height of 15 cm. The mineral deposits and stable flow are indicative of a springfed stream. This stream passes under the highway through a

round concrete culvert located about 200 m south of Anderson Road. The culvert is easily passable to larger resident fish but there is no useable habitat upstream of the highway due to high gradient and the encrusted streambed.

Habitat downstream of the highway consists mainly of glide (Photo 26) down to where the stream enters a large, beaver-dammed wetland (Edelweiss Wetland) (Photos 27, 32). The substrate is small (1-2 cm) gravel and fines. The stream is overwidened at one point due to an ATV crossing, but otherwise the widths are 2.1 m bankfull and 1.4 m wetted. Average depth is 0.13 m. Riparian vegetation consists of deciduous trees and shrubs at a pole-sapling seral stage. Plant species include water birch (to 4 m), spruce, cottonwood, willow, and kinnikinnick.

Contrary to the map supplied by Town of Golden but consistent with 1:20,000 scale TRIM mapping, Edelweiss Creek drains north, passing under Anderson Road near the highway and following the north side of Anderson Road to its mouth on the Gondek property (Photo 28).

Electrofishing between the highway and wetland yielded an extremely high density of 441 brook trout fry/100 m^2 from a total catch of 130 fish. A single slimy sculpin was also captured. Coast River Environmental Services Ltd. (2000) reported seeing numerous adult brook trout in spawning colouration in this area in 1998, and that observation plus the high brook trout fry catch indicate that this appears to be a significant spawning area.

Minnow traps set in Edelweiss Wetland captured redside shiners. Downstream of the beaver dam at the wetland outlet, minnow trapping captured longnose suckers and redside shiners. Water temperatures in the wetland and downstream were 15°C to 18°C versus 7.8°C where Edelweiss Creek enters the wetland, indicating that summer temperatures in the wetland are higher than optimum for salmonid fish species.

4.1.9 LIMEKILN CREEK

Limekiln Creek crosses Highway 1 about 275 m south of Edelweiss Creek just north of where the highway reduces to two lanes. As with Edelweiss Creek, the streambed upstream of the highway is encrusted with mineral deposits (Photo 29). This stream passes under the highway through a round concrete culvert that is not passable to fish due to a weir at the inlet (Photo 30). However, except for the pool dammed up by the inlet weir, there is no useable habitat upstream of the highway due to high gradient and the encrusted streambed.

Downstream of the highway, a deep culvert outlet pool (Photo 31) (maximum depth 0.65 m) provides excellent fish habitat. The stream continues on for about 50 m to drain into Edelweiss Wetland that is visible from the highway at this point (Photo 32). Flow looks very stable based on the low bankfull height of 10 cm. The mineral deposits and stable flow are indicative of a springfed stream. The substrate is gravel dominant and cobble subdominant. Stream widths are 3.4 m bankfull and 3.2 m wetted. Average depth is 0.25 m. Riparian vegetation consists of deciduous trees and shrubs at a shrub stage. Plant species include water birch (to 4 m), spruce, cottonwood, willow, kinnikinnick, and red-osier dogwood.

Electrofishing the culvert outlet pool and a few meters downstream yielded a very high density of 329 brook trout/100 m^2 from a total catch of 72 fish. All but one fish captured were fry. Coast River Environmental Services Ltd. (2000) reported seeing numerous adult brook trout in spawning colouration in this area in 1998, and that observation plus the high brook trout fry catch indicate that, like Edelweiss Creek, this appears to be a significant spawning area.

4.1.10 REACH SUMMARY

Dimensions, gradient, and habitat composition for Reaches 1 to 7 of Hospital Creek are summarized below in Table 1. FHAP data are provided in Appendix 3, and depth/velocity transect data are provided in Appendix 4.

Fish distribution is summarized by reach in Table 2.

Table 1. Summary of Hospital Creek reach dimensions and habitat composition.

Reach	Length	Wetted Area	W_B	W_W	Gradient	Habitat Percentage by Area				No. of
	(m)	(m^2)	(m)	(m)	(%)	Pool	Riffle	Glide	Cascade	Pools
1	1220	7564	7.0	6.2	<0.5	89	0	11	0	2
2	694	3539	6.4	5.1	<0.5	0	0	100	0	0
3	534	1906	15.2	3.6	0.5	7	74	7	12	2
4	349	1336	7.3	3.8	3.5	10	90	0	0	2
5	739	2660	5.4	3.6	3.7	0	100	0	0	0
6	630	2209	8.1	3.5	4.9	12	85	0	3	7
7	???	???	5.3	4.2	4.9	---	---	---	---	>1
1-6	4166	19,215	7.9	4.6		37	37	24	2	

W_B = bankfull width: W_W = wetted width.

Table 2. Fish species distribution summarized by reach and stream.

Reach	Fish Species Captured or Reported Present						
	KO	EB	BT	CCG	CRH	RSC	LSU
1	■	■	?	---[a]	■	---[a]	■
2	■	■	?	■	---	■	---[a]
3	■	■	?	■	---	---	---
4	■	■	■	---	---	---	---
5	---[a]	■	■	---	---	---	---
6	---[a]	■	■	---	---	---	---
7	---	---	---	---	---	---	---
Edelweiss Creek	---	■	---	■	---	---	---
Limekiln Creek	---	■	---	---	---	---	---
Edelweiss Wetland and downstream	■	---	---	---	---	■	■

[a] – Presence suspected.

Northern pikeminnow (NSC) may be present in Edelweiss Creek or Wetland (Coast River Environmental Consulting Services Ltd. 2000)

4.2 FLOW AND WATER QUALITY

Discharge during the August-September 2002 sampling period ranged from approximately 0.04 m^3/s to 0.06 m^3/s in Reaches 2, 3, and 4 where substantial subsurface flow appears to occur, and 0.10 m^3/s to 0.14 m^3/s elsewhere. The water was clear during the survey.

Results of laboratory analysis of the two water samples collected on September 2, 2002 are provided in Table 3 and Table 4.

Table 3. Results of laboratory analysis of Hospital Creek water sample collected on September 2, 2002.

Parameter	Reading	Units	Detection Limit
pH	8.3	pH units	
Alkalinity	168	mg/L	
Conductivity @25° C	344	µmhos/cm	
Ammonia	<0.01	mg/L as N	<0.01
Nitrite	<0.005	mg/L as N	<0.005
Nitrate	0.085	mg/L as N	<0.005
Ortho phosphorous	<0.003	mg/L as P	<0.003

Table 4. Results of laboratory analysis of Edelweiss Creek water sample collected on September 2, 2002.

Parameter	Reading	Units	Detection Limit
pH	8.3	pH units	
Alkalinity	198	mg/L	
Conductivity @25° C	438	µmhos/cm	
Ammonia	<0.01	mg/L as N	<0.01
Nitrite	<0.005	mg/L as N	<0.005
Nitrate	0.30	mg/L as N	<0.005
Ortho phosphorous	<0.003	mg/L as P	<0.003

4.3 FISH SAMPLING

Fish sampling by electrofishing and minnow trapping in Hospital, Edelweiss, and Limekiln Creeks during August-September 2002 resulted in capture of six fish species (Table 5). In addition, kokanee are known to be present and northern pikeminnow have been reported (Coast River Environmental Consulting Services Ltd. 2000). Photographs of the fish species captured are provided in Appendix 2, Photos 33 to 40.

Catch and density data are summarized in the following sections. Further details are provided in Appendices 5a, 5b, 5c, and 6.

4.3.1 CATCH AND DENSITY

4.3.1.1 Hospital Creek

A total of 11 individual habitat units in Hospital Creek were fish sampled by electrofishing within stopnet enclosures. In addition, exploratory electrofishing without stopnets was conducted to test for fish presence in Reach 6 upstream of the debris jam and in Reach 7 (upstream of Hospital Creek Falls). Sample site locations are shown on Figure 2. The total catch was 158 fish consisting of 101 eastern brook trout (Photos 35, 35, 36), 11 bull trout (Photo 33), 27 slimy sculpin (Photo 37), and 19 redside shiner (Photo 40). One brook trout observed but not captured at one site was included to calculate the population estimate for that site.

The highest catches, consisting mainly of brook trout fry and all of the sculpins and shiners, were in Reaches 2 and 3 between Anderson Road and Brookside Motel. Bull trout were only captured at the Chevron culvert pool and upstream, and no fry of either brook or bull trout were captured upstream of the culvert. A summary of fish catches by site is provided in Appendix 5. A list of fish species codes used in tables and appendices in this report is provided in Table 5.

Corresponding with catches, the highest Hospital Creek fish densities were for eastern brook trout (mainly fry) of 20-49 fish/100 m^2 in Reaches 2, 3, and 4 (downstream of highway). Fish densities at electrofishing sites are provided in Appendix 6.

Table 5. List of fish species codes used in tables and appendices in this report.

Code	Common Name	Scientific name	Captured in This Study?
KO	kokanee	*Oncorhynchus nerka*	no
EB	eastern brook trout	*Salvelinus fontinalis*	yes
BT	bull trout	*S. confluentus*	yes
CCG	slimy sculpin	*Cottus cognatus*	yes
CRH	torrent sculpin	*C. rhotheus*	yes
NSC	northern pikeminnow (formerly n. squawfish)	*Ptychocheilus oregonensis*	no
RSC	redside shiner	*Richarsonius balteatus*	yes
LSU	longnose sucker	*Catostomus catostomus*	yes

Reach 1 of Hospital Creek was fish sampled using minnow traps, as electrofishing was not feasible in the deep water of the beaver dam impoundments. Out of 8 traps in total, one trap set near the mouth (CP Rail Bridge) captured one torrent sculpin (Photo 38) and 2 longnose sucker (Photo 39), and one trap at Anderson Road Bridge captured 3 brook trout fry (Photo 34). No other fish were captured in the minnow traps although numerous small fish

(suspected shiners and suckers) were observed. Some brook trout in the 200 mm size range that were too large to be captured in minnow traps were observed in Reach 1.

4.3.1.2 Edelweiss and Limekiln Creeks

Electrofishing in Edelweiss Creek immediately downstream of Highway 1 captured 130 eastern brook trout fry, yielding a density of 441 fish/100m^2, although the population estimate was inflated by a poor decline in catch between passes. A single slimy sculpin yielded a density of 3 sculpin/100 m^2.

Five minnow traps set in Edelweiss Wetland captured 54 redside shiners. Six traps recovered from Edelweiss Creek downstream of the wetland yielded 25 longnose sucker and 4 redside shiner. One other trap was not recovered due to suspected theft or vandalism, and another had been opened allowing any captured fish to escape.

Electrofishing in Limekiln Creek immediately downstream of Highway 1 captured 71 brook trout fry and one juvenile/adult, for an overall brook trout density of 329 fish/100 m^2. No fish were captured in the culvert inlet pool upstream of the highway (Photo 30).

4.3.2 FISH SIZE AND CONDITION

Mean fork length of eastern brook trout captured in Hospital, Edelweiss, and Limekiln Creeks was 62 mm for fry and 173 mm for juvenile/adult fish (Table 6). Corresponding mean weights were 2.9 g for fry and 53.2 g for juvenile/adult fish. A length frequency histogram for all brook trout captured for this study is shown in Figure 4. The high proportion of fry is due in part to the sampling of two suspected spawning areas in Edelweiss and Limekiln Creeks. Individual fish data are provided in Appendix 6.

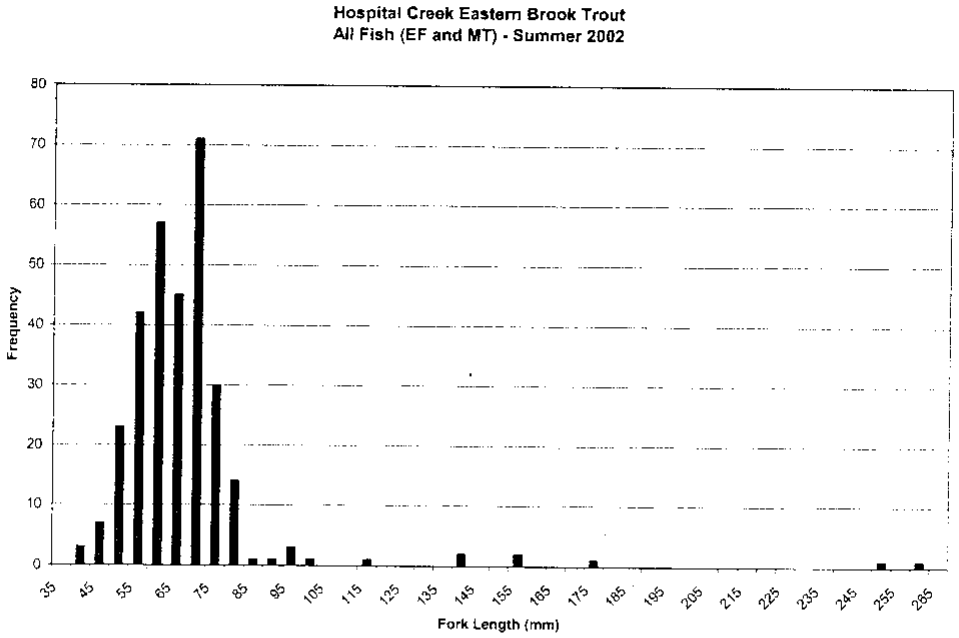
Table 6. Length, weight, and condition statistics for eastern brook trout captured in Hospital, Edelweiss, and Limekiln Creeks during August-September 2002.

Factor	Fry			Juvenile/Adult		
	Mean	Range	n	Mean	Range	n
Fork Length (mm)	62	37-99	298	173	115-260	8
Weight (g)	2.9	0.5-10.4	298	53.2	15.8-164	7
Condition	1.094	0.770-1.494	7	1.090	0.999-1.243	7

Table 7. Length, weight, and condition statistics for bull trout captured in Hospital Creek during August-September 2002.

Factor	Fry			Juvenile/Adult		
	Mean	Range	n	Mean	Range	n
Fork Length (mm)	---	na	0	114	92-145	11
Weight (g)	---	na	0	16.0	8.2-31.1	11
Condition	---	na	0	1.025	0.977-1.073	11

Figure 4. Length frequency histogram for eastern brook trout captured in Hospital, Edelweiss, and Limekiln Creeks, August 29-September 2, 2002.



5 DISCUSSION

5.1 FISH PRESENCE AND DISTRIBUTION

The previous study by CKFRP (2001) has already identified restoration options with which this author generally concurs. Therefore, one of the main purposes of the present study was to determine fish presence and distribution in the study area, as these can indicate types and/or locations of potential problems. For example, a difference in fish species present upstream and downstream of a suspected fish barrier (e.g., the Highway 1 culvert) can indicate the barrier's significance.

One interesting finding was confirmation that bull trout were present in Hospital Creek. This immediately elevates the importance of stream restoration efforts, as the bull trout is a blue-listed species in BC. Species on the Conservation Data Centre blue-list are elements considered to be vulnerable or particularly sensitive to human activities or natural events. The presence of bull trout may enhance the chances of acquiring outside funding for stream restoration work.

Bull trout were captured in the Chevron culvert pool and upstream in Reaches 5 and 6. However, no bull trout fry were found. This may mean that adult spawners from the Columbia River were unable to migrate up in 2001 due to the beaver dams in Reach 1, but that they were successful in a previous year. Alternatively, the bull trout captured in Hospital Creek are stream-resident fish rather than offspring of migrant adults. However, the absence of fry is still a mystery.

It is understood that no kokance were observed in fall 2002. This is suspected to be due to inability of fish to pass the beaver dams in Reach 1. It may also have been a low-return year for Upper Columbia River kokanee.

No fish were captured upstream of the large debris jam in the Hospital Creek Canyon despite fairly extensive sampling. This suggests two things. First, the debris jam is a total barrier to fish passage. Second, a debris flow event, perhaps the one that formed the debris jam, may have flushed out all fish from the section upstream of the debris jam, and re-colonization has been prevented by the impassable debris jam barrier. Such a debris flow may also explain the extensive gravel accumulation in Reach 3.

No fish were captured upstream of Hospital Creek Falls, and it is unknown whether fish were ever present in this section of stream or whether a catastrophic debris flow event eliminated a previous fish population.

Only brook and bull trout were captured upstream of Reach 3, and it is possible that the rock weirs at the downstream end of Reach 3 are presently limiting upstream movement of non-salmonids such as redside shiner and slimy sculpin.

No brook or bull trout fry were captured upstream of the Highway 1 culvert, despite the fact that mature brook trout (Photo 36) were found in Reach 6. This finding is a mystery, as there appears to be spawning habitat available in Reaches 5 and 6, and the abundance of shallow riffle provides suitable fry habitat.

5.2 HABITAT DEFICIENCIES

There are several habitat deficiencies that correspond with potential restoration options. In approximate order of priority, these deficiencies are debris jams, channelization, fish passage, spawning habitat, and cover. Other minor concerns relate to eroding banks and car body bank armour.

5.2.1 DEBRIS JAM

The large debris jam in the Hospital Creek Canyon is holding back a substantial amount of material and also prevents fish from accessing approximately 250 m of stream up to the falls. If the jam breaks loose in a high flow event, the resulting debris flow could pose a threat to downstream property as well as damage any downstream instream restoration work that is undertaken and cause fish mortality.

5.2.2 CHANNELIZATION AND POOL FREQUENCY

One of the primary disturbance indicators in Reaches 2, 3, 4, and 5 is extensive riffle (or glide) and a consequent lack of pool habitat, which is important for fish holding, rearing, and cover. Streams in erodible materials develop a natural pool and riffle pattern that can be related to the bankfull stream width (Newbury and Gaboury 1993). Roy and Abrahams (1980, cited in Newbury and Gaboury 1993) measured a mean pool spacing of 5.6 times the bankfull width for alluvial (i.e., non-bedrock) channels. Due in part to channel straightening and diking, the current mean pool spacing is almost 18 bankfull widths in Reach 3, 24 bankfull widths in Reach 4, and infinity (i.e., no pools) in Reach 5. In comparison, the relatively undisturbed Reach 6 has a pool spacing of around 11 bankfull widths. Therefore, pool frequency in Reaches 2 to 5 appears to be far less than ideal.

The FHAP salmonid habitat condition diagnostics table (Johnston and Slaney 1996) suggests that for streams less than 15 m wide and gradient of 2-5%, pool frequency is poor if percentage of pool area is less than 30% or if mean pool spacing is more than 4 channel widths. Pool area percentages in Reaches 2-5 of Hospital Creek range from 0 to 7%, again indicating that the amount of pool habitat appears to be far less than ideal.

5.2.3 FISH PASSAGE

As mentioned previously in Section 4.1.4, the culvert outlet at the Chevron Station did not look like a serious fish migration barrier, as the drop was only about 30 cm and water velocity inside the culvert looked easily passable to fish 20-40 cm long (larger fish might be limited by shallow water depth). However, the culvert bottom at the outlet is corroded, allowing water to drop through the culvert bottom, which may create difficult passage conditions if fish try to swim over this hole. This may also "fool" fish into thinking they

should be jumping underneath the culvert where the water is dropping through rather than jumping at the lip of the culvert.

The more significant fish passage problem on Hospital Creek is probably the beaver dams in Reach 1. CKFRP (2001) indicates that this reach presents an opportunity to test methods for passing fish over or through beaver dams. The finding of bull trout in Hospital Creek adds further complexity to the fish passage situation because, if bull trout are migrating up from the Columbia River, the fish may be substantially larger than kokanee and may migrate earlier (e.g., July). This means that fish passage measures should be able to accommodate fish up to at least 650 mm long and should be operational during July through October. No mountain whitefish were captured in 2002 but this is another species that could potentially utilize Hospital Creek and would extend the need for fish passage into November.

As mentioned above in Section 5.2.1, the large debris jam in Reach 6 appears to be a fish passage barrier that blocks access to about 250 m of stream. There is also another small debris jam that forms a migration obstacle nearer to the falls.

5.2.4 SPAWNING HABITAT

Spawning gravel quality in Hospital Creek is good in that sand or fines are never a dominant substrate except in Reach 1, although sand is subdominant in some habitat units. However, gravel quantity is only fair due to the limited amount of gravel available and its unsorted nature. The lack of habitat complexity does not provide the varying flow conditions that allow gravel to settle out in patches of uniform size material to provide ideal spawning habitat. The only area of extensive gravel deposits of uniform particle size is in Reaches 2 and 3 are where lower gradient and wider channel (in Reach 3) reduce water velocity and allow gravel bedload to settle out.

5.2.5 COVER AND LWD

There is a virtual absence of large woody debris (LWD) and general instream cover in Hospital Creek. Number of LWD pieces per bankfull width is less than 1 and the amount of wood cover in pools is less than 5%, placing these habitat parameters in the poor quality category based on FHAP diagnostics (Johnston and Slaney 1996). The lack of LWD corresponds with a lack of habitat complexity.

5.3 WATER QUALITY

Water quality, especially nutrients, and temperature affect stream productivity. Temperature may also affect species composition because fish species differ in their temperature preferences, and a certain temperature range or extreme may favour one species over another.

5.3.1 TEMPERATURE

Golder Associates Ltd. (1997) conducted a review of temperature tolerance ranges for brook trout and cutthroat trout and selected 9-13° C and 12-16° C as the optimal summer temperatures for cutthroat and brook trout, respectively, while temperatures greater than approximately 15.0°C are thought to limit bull trout distribution (Rieman and McIntyre,

1993). Temperatures in Reach 1 of Hospital Creek were 16-18° C, which is higher than optimal for all three salmonid species. Even upstream of Reach 1, a maximum water temperature of 12.8° C was measured upstream of Highway 1. Therefore, if summer temperatures typically exceed 13° C, brook trout may have a competitive advantage over cutthroat and bull trout.

In contrast, Edelweiss and Limekiln Creek temperatures were 8.7° C and 7.8° C before entering Edelweiss Wetland, reflecting their groundwater origins. These temperatures are favourable to salmonids. On the other hand, water temperatures in Edelweiss Wetland and in Edelweiss Creek downstream of the wetland were in the 15° C to 18° C range, explaining the dominance of non-salmonid species (sucker and shiner) in these habitats.

5.3.2 CHEMICAL COMPOSITION

Relative concentrations of nitrogen and phosphorus during the summer growing season can be indicative of nutrient limitation in stream ecosystems. Laboratory analysis of a Hospital Creek water sample collected on September 2, 2002 showed values of approximately 85 µg/L for dissolved inorganic nitrogen (DIN: nitrate + nitrite +ammonia (latter two typically present at low levels compared with nitrate)) and less than 3 µg/L for ortho-phosphorus (surrogate for soluble reactive phosphorus - SRP) (Table 3). The resulting weight:weight N:P ratio is greater than 85/3 = 26:1. Weight:weight N:P ratios (e.g., µg/L versus atomic weight ratios) of >9:1 are indicative that P is limiting production, while N:P ratios <4.5:1 suggest that N is limiting (Ashley and Slaney 1997). Therefore, if the water sample is representative of water quality in the summer growing season, it appears that P concentration may be a limitation to productivity in Hospital Creek. The FHAP salmonid habitat condition diagnostics table (Johnston and Slaney 1996) indicates that inorganic nutrient levels are good (highest quality level) if nitrate N >60 µg/L and SRP >3 µg/L. The DIN value of 85 µg/L is in the range of 50-100 µg/L DIN commonly found in BC coastal and interior streams (Ashley and Slaney 1997).

The nitrogen and phosphorus values for Edelweiss Creek (Table 4) result in a weight:weight N:P ratio of greater than 30/3 = 10:1, indicating that P concentration may also be a limitation to productivity in Edelweiss Creek.

The pH of 8.3 in both streams is on the high side and indicative of the limestone in the area that neutralizes acidity.

5.4 HABITAT REHABILITATION OPPORTUNITIES

The habitat deficiencies identified in Section 5.2 and in the Reach descriptions in Section 4.1 lead to several habitat rehabilitation options for the 4 km of stream from the mouth up to Hospital Creek Falls. These include the following:

1. debris jam removal
2. instream habitat complexing;
3. fish passage improvement; and

4. bank stabilization and riparian zone improvement.

In addition, the groundwater-fed Edelweiss and Limekiln Creeks may provide opportunities for habitat creation upstream of Highway 1.

5.4.1 DEBRIS JAM REMOVAL

The large debris jam in the canyon is holding back a large amount of material as well as blocking fish passage. The risk and consequences to human life and property of catastrophic failure of this jam, as well as feasibility of removing or dismantling the jam, should be assessed by a fluvial geomorphologist or water resources engineer. Catastrophic jam failure resulting in a debris flow could also have serious impacts on fish and fish habitat, including any instream restoration work that is undertaken.

The Town of Golden and the Province of British Columbia have interests in natural disaster prevention and may provide funding or expertise in this matter.

There may be some urgency to investigation of the debris jam. If risk and consequence of failure are high, it may be desirable to dismantle the debris jam in spring prior to freshet to utilize high flows to distribute the stored material to downstream areas. A work crew equipped with chainsaws and chainsaw winches would probably be able to strategically weaken the debris jam so that it will be gradually removed by freshet flows.

5.4.2 INSTREAM HABITAT COMPLEXING

Production of both migratory (kokanee, possibly bull trout and whitefish) and stream-resident fish species is likely being limited in Hospital Creek by the present lack of habitat complexity. Instream habitat complexing could create spawning habitat, fry habitat, holding pools, and fish cover.

Reach 1 could benefit from installation of large woody debris to provide cover for fish. Low wing deflectors or weirs would benefit Reach 2 and are described in CKFRP (2001). The building of several weirs to backwater the Highway 1 culvert (refer to Section 5.4.3.2 and CKFRP (2001)) could also create a series of scour pools downstream of the weirs that would improve habitat. Downstream from there, the long riffle down to 11th Avenue North could use further habitat complexing in the form of more weirs or else anchored LWD structures. Reach 5 (upstream of Highway 1) is one long riffle that looks very suitable for installing rock weirs to create a series of scour pools.

5.4.3 FISH PASSAGE IMPROVEMENT

Fish passage improvement would be beneficial at beaver dams in Reach 1 and at the Highway 1 culvert.

5.4.3.1 Beaver Dams

This is one of the main issues that stands in the way of the Hospital Creek Stewardship Project. If kokanee and other fish species cannot pass through Reach 1 to spawn in areas

where they are visible to the public, the public awareness and knowledge objectives will be difficult to achieve.

As mentioned in CKFRP (2001), this is a good area for testing different types of fish passage solution. Ideally, the solution would provide July-through-November passage for fish up to 650 mm long to allow kokanee, whitefish, and adult bull trout to move up from the Columbia River.

While it may be true that attempts to control beaver in this area are unlikely to have long term success due to continual recruitment from the Columbia River (CKFRP 2001), a continual program of trapping and dam dismantling may yet be a viable option. Perhaps the land owner could be provided with relatively inexpensive equipment such as a portable spar and winch system to make dam removal easier to undertake on a regular basis.

5.4.3.2 Highway 1 Culvert

The main problems for fish passage at the Highway 1 culvert appear to be the 30 cm drop and the perforated culvert bottom near the outlet. Both problems will be addressed by backwatering the culvert by building up the streambed downstream with a series of weirs.

5.4.4 Bank Stabilization and Riparian Zone Improvement

Bank stabilization could be conducted in Reach 4 of Hospital Creek on the right bank between 11th Avenue North and the Highway 1 culvert. The problem is not severe, and a solution might be as simple as placing a few boulders or pieces of anchored LWD along the toe of bank at strategic locations. Also in this section, the car body bank armour on the left bank could be removed and the bank graded back and planted with trees and shrubs. Riparian planting would also be beneficial in Reach 3 where gravel accumulation and berm construction has occurred, and in Reach 5 along the trailer park. Riparian zone improvements could also be made in Reach 1 by moving fences farther back from the streambank and planting trees and shrubs to increase width of the riparian zone.

5.4.5 Habitat Creation

It appears that both Edelweiss and Limekiln Creeks provide a stable source of cool groundwater that is heavily utilized for spawning by eastern brook trout downstream of Highway 1. While habitat utilization upstream of the highway is currently precluded by high gradient, both streams may have potential to excavate cross-slope channels roughly parallel to the highway that would have gradients suitable for fish use. The local topography already appears to indicate rough channel alignments.

6 CONCLUSIONS

Hospital Creek downstream of the falls offers excellent opportunities for habitat rehabilitation. The presence of bull trout immediately elevates the importance of stream restoration efforts, as this is a blue-listed species in BC. The main habitat issues to be addressed are as follows:

- assessment and possible removal of the large debris jam in the canyon;
- finding a solution that will allow fish passage past the beaver dams in Reach 1;
- increasing the amount of instream habitat complexity to improve conditions for spawning, holding, and rearing;
- improvement of fish passage at the Highway 1 culvert; and
- bank stabilization and riparian zone improvement.

The present study has focused on the fish and fish habitat aspects of the Hospital Creek Stewardship Project. However, there is another whole side to the Project dealing with public awareness, education, and involvement that should also be addressed.

7 FUTURE DIRECTIONS

The fish and fish habitat assessment reported on above is the first of three steps in the stream rehabilitation process. The second is development of habitat rehabilitation prescriptions followed by the final step, implementation. Associated with the implementation phase will be a monitoring program to assess success of the habitat restoration efforts.

Further funding will be required for the prescriptions, implementation, and future monitoring. Estimated cost requirements are provided below in Section 7.1. Following that, possible funding sources and application deadlines are provided. Finally, recommendations for future actions are made.

7.1 ESTIMATED COSTS

Very preliminary cost estimates for developing prescriptions and doing the construction are $15-20K for prescriptions (including surveying and mapping) and $20-30K for construction (logistics, supervision, equipment rentals, miscellaneous materials), not including heavy equipment and materials (logs, rock) that would hopefully be donated. However, this cost could be reduced as described below.

The best opportunities for stream restoration work are probably between Brookside Motel and the upstream end of the Trailer Park. If restoration efforts are confined to this relatively short section of stream, costs (surveying, mapping, prescription development, etc.) will be less. Work could still include some fish and water passage solutions at the beaver dams along Dave Wachna's property in Reach 1. The estimated cost reduction might be around 30-40%. That would mean a requirement for $10-14K for prescriptions and $14-20K for construction (plus material and equipment donations).

Monitoring costs will depend on how often monitoring activities take place, at what level, and by whom. The ideal would be to design a monitoring program that utilizes volunteers from the local community while being effective in meeting the monitoring objectives. Costs would be related mainly to consultants' fees for advice and analysis of data. A typical monitoring schedule for instream habitat restoration work might be Years 1, 2, 3, 5, and 10, with a cost of about $2,000-3,000 in each monitoring year.

Some money should also be allotted for maintenance activities that are recommended as a result of monitoring.

7.2 FUNDING SOURCES AND DEADLINES

A quick internet search revealed the following information about deadlines in applying for funding for stream restoration and stewardship work on Hospital Creek. The three potential funding sources of which this author is aware are as follows:

- Columbia Basin Fish & Wildlife Compensation Program;
- Habitat Conservation Trust Fund; and
- Pacific Salmon Foundation.

A fourth source used to be Fisheries Renewal BC but that program has now ended.

7.2.1 COLUMBIA BASIN FISH & WILDLIFE COMPENSATION PROGRAM

The Columbia Basin Fish & Wildlife Compensation Program (CBFWCP) funding application date for major projects (>$10,000) is August 1. However, applications for smaller projects (<$10,000) are accepted throughout the year. The earlier you apply for small project funding, the better your chances because the money will run out as time goes on in each fiscal year. Further project funding information is available at the CBFWCP website: http://www.cbfishwildlife.org/partners/index.php.

7.2.2 HABITAT CONSERVATION TRUST FUND

The Habitat Conservation Trust Fund (HCTF) funding application deadline has passed for 2003-2004 projects. To apply for 2004-2005 funding, it is likely that a letter of intent will have to be submitted by October 1, 2003. The letter requires budget information such as projected total project cost and amount requested from HCTF. More information is available at the HCTF website: http://www.hctf.ca/app/index.html. Following submission of the Letter of Intent, the actual funding application for 2004-2005 will likely be due by November 1, 2003.

At the present time, HCTF has only been accepting one (1) year new project proposals. No new multi-year projects will be accepted. We will have to see if this is still the case next year.

7.2.3 PACIFIC SALMON FOUNDATION

The Pacific Salmon Foundation (PSF) is currently accepting applications for the Spring 2003 Funding Cycle. The deadline for submission of applications is February 15, 2003. The next application deadline is likely to be in fall of 2003. Further project funding information is available at the PSF website: http://www.psf.ca/04programs/index.html. PSF is providing $10,000 for prescriptions and implementation of the Sinclair Creek Project at Radium Hot Springs.

7.2.4 ANCILLARY ITEMS

To be successful in funding applications, the Golden District Rod & Gun Club will probably have to show that there is considerable support from the local community as demonstrated by Letters of Support and (especially) cash or in-kind donations. Alternatively, the Rod and Gun Club may be successful if it proposes to contribute a substantial portion of the money itself. Recall that there was approximately $60,000 in cash and in-kind donations for the Sinclair Creek project, including logs & rock and truck & excavator time.

7.3 RECOMMENDATIONS AND SCHEDULE

Recommendations for actions to move the Hospital Creek Stewardship Project forward are listed below in Table 8. The recommended schedule is as follows:

4) solicit community support and contributions and make funding applications in 2003;
5) develop habitat restoration prescriptions during 2004; and
6) implement the first round of restoration work in summer 2005.

Table 8. Recommended actions to be taken for the Hospital Creek Stewardship Project.

No.	By When?	Action	Task Items
1	ASAP	• investigate debris jam in canyon; plan to attempt removal in spring 2003	• contact Town of Golden and MWLAP re actions to be taken
2	Feb/03	• review Fish and Fish Habitat Assessment report and decide which habitat restoration efforts the Club would like to pursue	• discuss and decide
3	Mar/03	• develop preliminary cost, equipment, and materials requirement estimates to use for funding applications	• have Naito Environmental develop estimates
4	after No. 3 Apr/03	• solicit community support and contributions	• brainstorm to identify potential project partners; decide who will contact each
5	after No. 4 May/03	• apply for up to $10,000 of CBFWCP small project funding to use for development of restoration prescriptions	• download and fill out application form
6	Jul/03	• prepare CBFWCP major project application if small project application is unsuccessful	• download and fill out application form
7	Sep/03	• prepare PSF and HCTF funding applications	• download and fill out application form

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APPENDIX 1

Hospital Creek Stewardship Project

Summary Report

Columbia-Kootenay Fisheries Renewal Partnership

Introduction

Hospital Creek is a small third order stream draining from the Rocky Mountians through the town of Golden to join the Columbia River. The stream has been documented to support kokanee, brook trout, northern pikeminnow, redside shiner and unidentified sculpin species (FISS). In addition, any species from the Columbia River may enter Hospital Creek and use it intermittently or for specific life history stages. These species include bull trout, rainbow trout and mountain whitefish (FISS, FishWizard).

The stream has had multiple human impacts, including channelization, development within the riparian area, litter and the crossing at Highway #1 impedes upstream fish movement. Visibility of the stream and spawning kokanee has resulted in public concern about conditions in Hospital Creek. Golden District Rod and Gun Club are taking the lead in increasing protection and looking at restoration options for the lower four kilometers of Hospital Creek, from the mouth to a set of falls.

The objectives of the Hospital Creek Stewardship Project are to:

- Increase awareness of the importance of small streams for fish habitat and promote human uses that minimize impacts on these streams;
- Increase knowledge of this watershed and develop skills to begin similar stewardship initiatives in other local watersheds; .
- Develop partnerships between interested community groups to protect and restore local watersheds; and
- Test whether improving passage at the Highway #1 culvert will be effective in providing kokanee access to upstream spawning habitat.

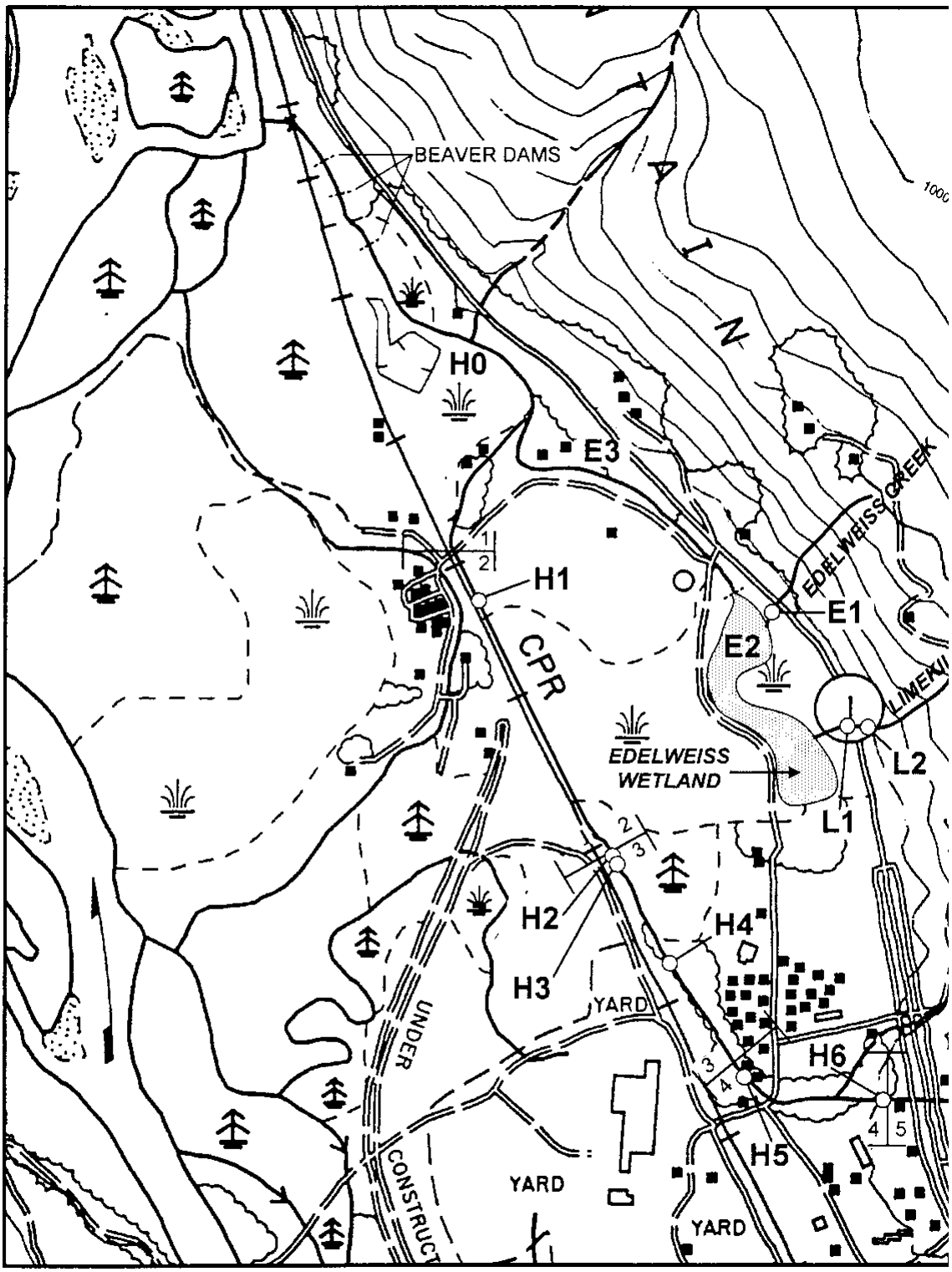
This report focuses on site visits conducted in 2001 to evaluate the stream and identify suitable restoration options. The partnership development and increasing awareness will be long term (i.e., greater than 1 year) objectives of the project.

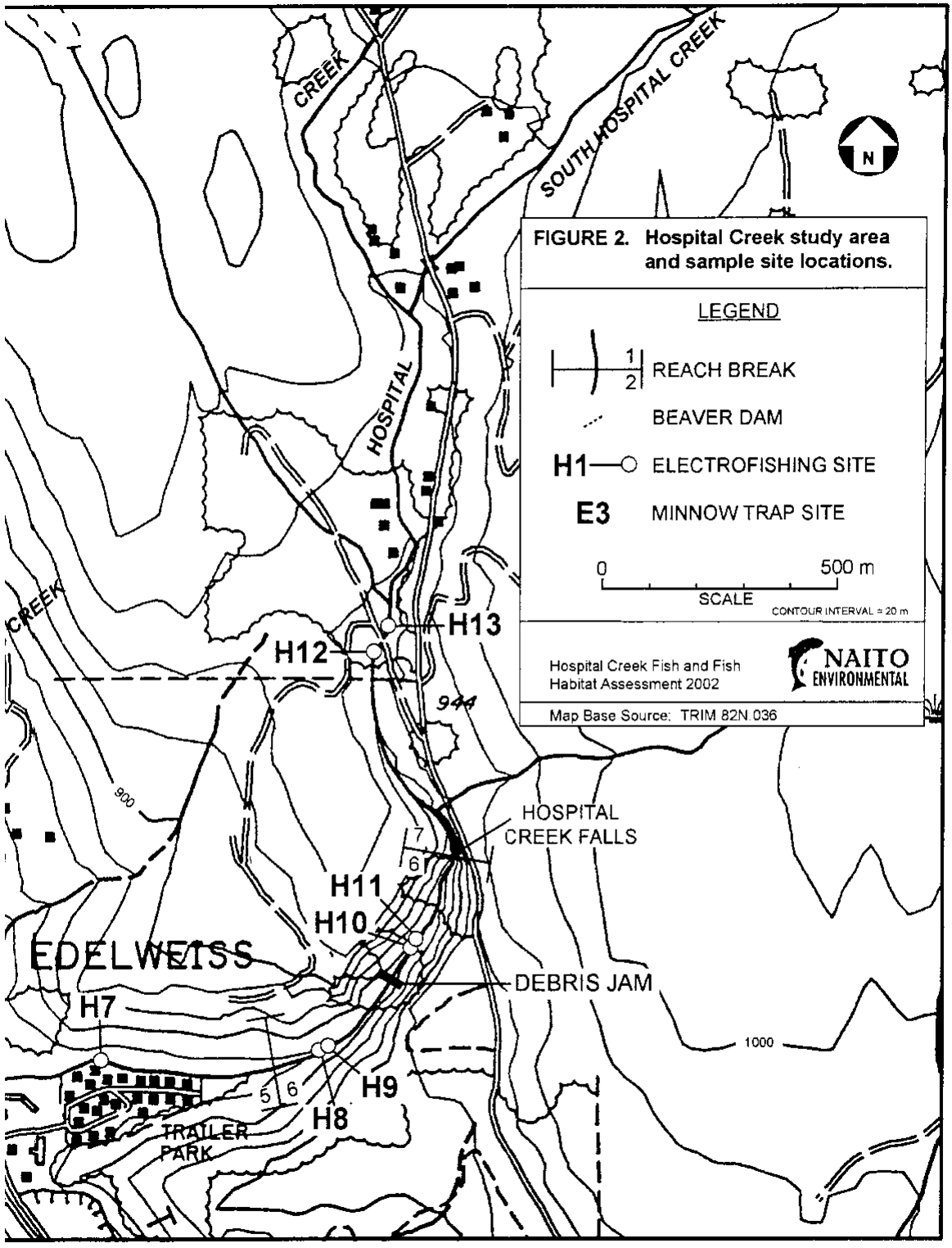
Methods

Two site visits were undertaken, one on August 14, 2001 with Grant Arlt (Golden District Rod and Gun Club) and Jen Rosewarne (CKFRP and East Kootenay Environment Society) and on November 24, 2001 with Grant Arlt, Barry Nagle (Golden District Rod and Gun Club) and David Walkna (landowner). On August 14th the stream was evaluated from Anderson Road to approximately 750 m upstream of Highway #1. Measurements collected included bankfull and wetted width, depth, dominant substrate size and riparian vegetation. Notes were made on other features observed. On November 24th, the lower approximately 1000 m of stream was walked and condition of beaver dams examined. Ice cover prevented measurement of in-stream parameters.

Results

The lower part of Hospital Creek was split into sections, as this part of the stream appeared to have had similar channel morphology and size, though the various impacts on the stream alter it's appearance. Approximate locations of sections are indicated on Map 1. The map was provided by the Town of Golden, but doesn't include much of Section 1, and has the stream located incorrectly for part of Section 2. Edelweiss Creek is identified joining Hospital Creek in Section 2, while the current channel joins Hospital Creek downstream of Anderson Road, in Section 1.


BEAVER DAMS
H0
E3
H1
CPR
E1
E2
EDELWEISS CREEK
EDELWEISS WETLAND
L2
L1
H2
H3
H4
YARD
H6
H5
YARD
YARD
1000


CREEK
SOUTH HOSPITAL CREEK
N
HOSPITAL
CREEK
H13
H12
944
900
HOSPITAL
CREEK FALLS
7
6
H11
H10
EDELWEISS
DEBRIS JAM
H7
1000
5
6
H9
H8
TRAILER
PARK
FIGURE 2. Hospital Creek study area and sample site locations.
LEGEND
1
2
REACH BREAK
BEAVER DAM
H1
ELECTROFISHING SITE
E3
MINNOW TRAP SITE
0
500 m
SCALE
CONTOUR INTERVAL = 20 m
Hospital Creek Fish and Fish Habitat Assessment 2002
NAITO ENVIRONMENTAL
Map Base Source: TRIM 82N.036

Section 1 0 – 1000m

The first section flows through private land between the CPR rail line and Highway #1. The stream is low gradient, contains abundant vegetation and three beaver dams were identified. The site visit focused on opportunities to reduce water levels in the beaver dams, in particular the upper dam, which is directing flow overland, and improve fish passage over these dams, particularly during kokanee migration in the fall. The ponds behind the upper two dams likely provide good habitat for Westslope cutthroat trout and all participants in the site visit agreed it is desirable to maintain this habitat. The dam closest to the mouth of Hospital Creek appeared to be recently constructed and is situated underneath the railway bridge (Photograph 1). It was less than 30 cm high in November and would not have prevented upstream migration of kokanee in fall 2001, though it would have presented an obstacle. The middle dam was about 150 m upstream of the railway bridge and flow was returning to Hospital Creek over the dam crest (Photograph 2). Flow was not concentrated and this dam is an obstacle, but not a barrier to upstream migration of adult salmonids. The upper most dam appears to be degenerating water was directed from the channel via overland flow, rather than over the dam crest (Photograph 3). It was not possible to assess how much flow percolates through the dam because of ice cover and the lack of a defined channel used by the overland component. In 2000, the landowner lowered the level of this dam (and several others that the beavers did not repair) to allow kokanee to move upstream. There did not appear to be much suitable forage close to the channel near the upstream dam and this site may not be active at present. The map provided for this project does not extend to this section.

Section 2 1000 – 2000 m

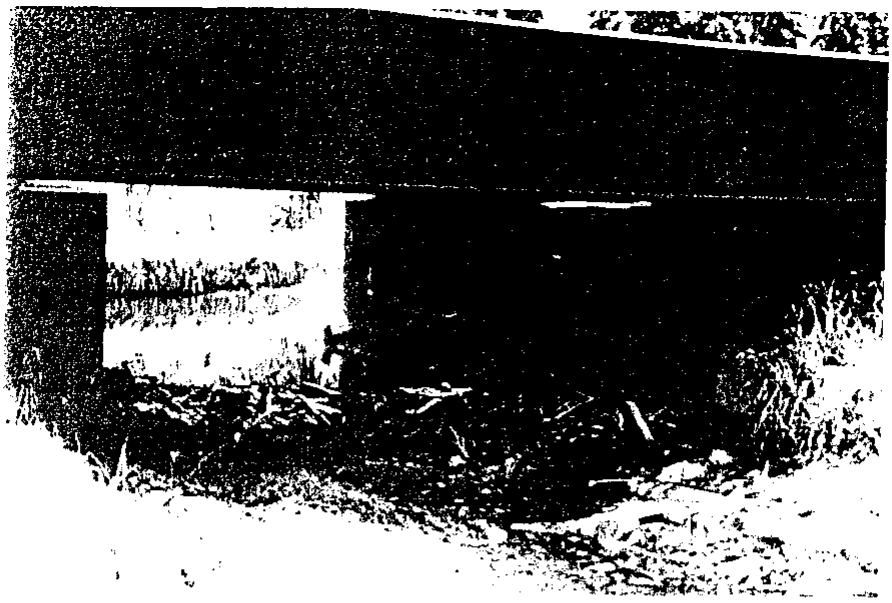
Upstream of Anderson Road the stream is low gradient (estimated slope 0.5 – 1%) and channelized for approximately 80% of this area. The right upstream bank (RUB) is formed by the CPR rail line for much of the first 500 m. This bank is steep and vegetation has been controlled with mechanical brushing. After ~500 m the RUB had well established deciduous tree and shrub cover for >50% of the next approximately 500 m. The left upstream bank (LUB) has been formed into a dyke, with well established riparian vegetation of deciduous trees and shrubs, with some sedges, grasses and forbes. The channel is straight with no meandering and no pools (Photograph 4). Substrate was composed almost entirely of small gravels, with a few large cobbles or small boulders, likely ones that have fallen in from upstream bank stabilizing rip rap. Much of the substrate was covered with algae, probably diatoms and 10 – 20% filamentous green algae. In places the filamentous algae growth was thick enough that night time oxygen depletion is probable (Photograph 5).

Mean wetted width = 5.24 m +/- 1.08 (Standard Deviation) n = 6
Mean bankfull width = 5.9 m +/- 0.87 (Standard Deviation) n = 6
Mean depth ≒ 12.2 cm +/- 3.47 (Standard Deviation) n = 30

We observed several small fish, some likely juvenile suckers (mottled colouring, shape) and some mayflies and caddis flies. There were a variety of species (not identified) of these invertebrates, but low numbers.

Section 3 2000 – 2150 m

Approximately 1000 m upstream of Anderson Road, the stream had several constructed rock weirs with a total length of about 150 m (Photograph 6). Below the weirs were some of the only pools identified in Hospital Creek. The lowest pool, and the largest, was 95 cm deep and contained several juvenile salmonids – three appeared to be mountain whitefish and one likely a rainbow trout. The substrate was silty and the lower part of the pool had collected some woody debris, of both natural and manufactured origin.



Photograph 1. Beaver dam near the mouth of Hospital Creek.

Photograph 2. Second beaver dam upstream of mouth of Hospital Creek.

Photograph 3. Third beaver dam upstream of the mouth of Hospital Creek.

Photograph 4. Hospital Creek upstream of Anderson Road (Section 2).

Photograph 5. Filamentous algae mat in Section 2 of Hospital Creek.

Photograph 6. Weir in Hospital Creek Section 3

Section 4 2150 – 2350 m

The next approximately 200 m is aggraded (i.e., accumulating gravel) appeared to have been bulldozed or used for gravel extraction. The channel was over widened with two or more wetted channels running through it (Photograph 7). All instream habitat was riffle. Gradient increased at this point – estimated slope 1.5 – 3%. Substrate was entirely small gravel and banks were both formed into dykes. Vegetation was sparse, some young cottonwoods and willows were beginning to establish. The disturbance – flooding or gravel extraction – appears to have taken place quite recently – such as within the past 5 years. Flow through this area appeared less than elsewhere, so subsurface flow is suspected.

Section 5 2350 – 2400 m

The next ~50 m flow through private property owned by the Brookside Motel. The channel is constricted between gabion walls and the substrate is entirely large cobble to small boulder (Photograph 8). The entire channel was riffle. The road crossing at the upstream end was an open pipe arch culvert that has retained natural substrate.

Section 6 2400 – 2600 m

The remaining ~200 m between the open pipe arch culvert (Photograph 9) and the Highway #1 culvert appears to be somewhat natural stream. The substrate was primarily large cobble to small boulder size with pockets of gravel suitable for spawning making up 10-20%. The channel was semi-confined meandering within about a 15 – 20 m width. Riparian vegetation was present, mainly deciduous trees. The RUB had bodies of several cars incorporated, either as part of an old landfill or to provide armouring (Photograph 10). One section, about 7 m long, of the LUB had substantial sloughing.

Mean wetted width = 3.8 m +/- 0.7 (Standard Deviation) n = 3
Mean bankfull width = 6.1 m +/- 1.0 (Standard Deviation) n = 3
Mean depth = 11.9 cm +/- 3.28 (Standard Deviation) n = 14

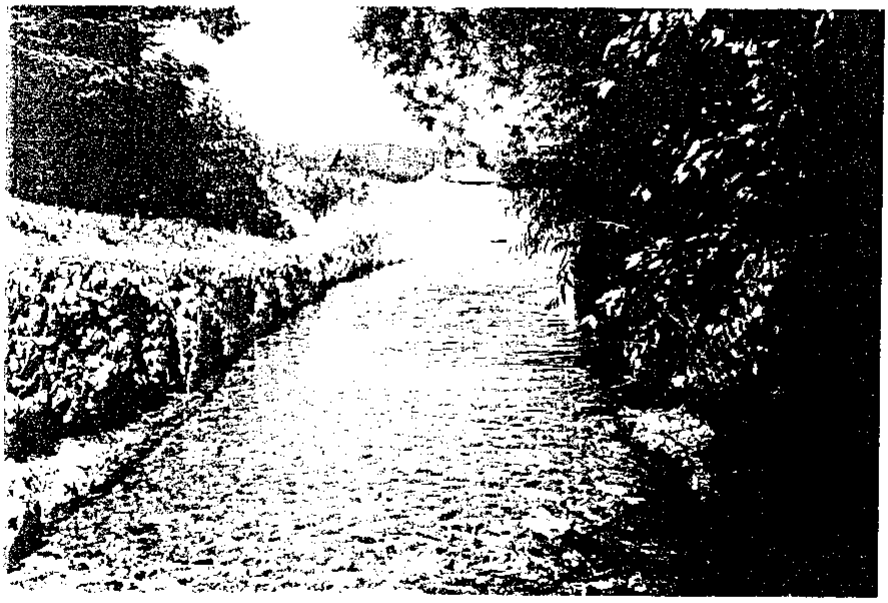
Highway #1 Culvert Outfall

Pool is 1.1 m deep at the culvert outfall and appears deeper in the middle. The culvert outfall drop is 40 cm. The tailout of the pool has excellent gravels for kokanee.

Section 7 2700 – 3400 m

Upstream of Highway #1 we walked about 750 m of stream. The section is relatively uniform, with the gradient estimated about 3%, substrate primarily large cobble to small boulder with pockets of spawning gravel composing 10-20% of the total. The first 200 m flows past a trailer park and gravel pit. This section appeared to be somewhat straightened and the riparian vegetation has been disturbed or removed in much of this section. Otherwise, the channel was very similar to upstream where there appears to have been minimal human disturbance. The upper section had well established riparian vegetation, including coniferous trees. There were no pools observed through this section, though the larger rocks would provide cover for smaller fish (probably up to 200 mm).

Photograph 7. Gravel accumulation in Section 4 of Hospital Creek.



Photograph 8. Gabion walls in Hospital Creek Section 5.

Photograph 9. Pipe arch culvert in Section 6 of Hospital Creek.

Photograph 10. Old car bodies in Hospital Creek Section 6.

Recommendations

Section 1

This section would be a good area to test methods for providing fish passage through or over beaver dams. The landowner is supportive of attempting to lower the water level in the stream to retain flows within the defined channel. He recognizes the value of pool habitat formed behind the dams. Attempts to control beaver in this area are unlikely to have long term success because the proximity to the Columbia River provides a source of new recruits.

Craig Dodds (Ministry of Water, Land and Air Protection) has provided some designs for water level control and fish passage through beaver dams. One or two of these designs should be tested, based on suitability for the site, construction and installation by volunteers.

Section 2

It is unlikely that CPR will agree to establish a natural meander pattern on this section. Therefore, any restoration activities will have to work with the existing straightened channel. This section reportedly has subsurface flows during the lower flow periods of the year. Narrowing the channel may help retain surface flows. This section lacked habitat complexity and cover. Adding pool forming structures (such as small weirs) or clusters of small boulders, or coarse woody debris would improve instream habitat for juvenile fish in this area.

Low level wing deflectors or small weirs may help constrict flows and help form pools. The total height of material added should not exceed 50 cm to allow passage of higher flows. The approximate dimensions of these weirs would include a maximum slope of 2:1 (i.e., the base will extend a minimum of 1 metre upstream and 1 metre downstream of the crest), extend 1.5 – 1.9 metres into the channel and spacing should be approximately six to seven channel widths, or 36 – 42 metres. The largest rocks would be approximately 75-80 cm diameter to allow at least a third of the rock to be buried beneath the natural stream bed.

Prior to developing these structures, it may be desirable to have a hydrologist or engineer with experience in hydrology assess the upstream impacts (particularly from accumulated gravels in Section 4). In addition, CPR may request detailed prescription design from an engineer or hydrologist if they are concerned about the effects of in-stream work on existing dykes.

Section 3

This section appears to have had some enhancement completed. The weirs were producing some of the best habitat observed within Hospital Creek. However, the weirs may be impounding gravel upstream. Some riparian planting would provide additional cover.

Section 4

This area was heavily disturbed and would benefit from the stream being forced into one channel and allowed to meander between the dykes. However, to excavate a channel would be quite expensive and if the observed channel resulted from aggradation, this type of constructed channel likely will not survive the next high flow event that results in substantial bedload movement – frequency is unknown at present. Adding vegetation may help stabilize one channel, and may help. If this section remains passable for fish it is not a high priority. Further investigation that determines whether the disturbance resulted from aggradation of bedload, gravel extraction or other human activities may alter the level of risk associated with restoration of this area. This area may require assessment by a hydrologist to determine options for dealing with the aggraded sediments and risks to downstream habitat from aggrading sediments.

Section 5

The constricted channel here limits options for restoration. This section would be best left alone.

Section 6

This area had some of the better habitat observed downstream of Highway #1. Removing the car bodies would benefit this section. There did not appear to be leakage of fluids from this material, so this would be a lower priority. However, it may be efficient to undertake this restoration at the same time as constructing weirs to improve passage at the highway culvert.

Highway #1 Culvert Outfall

Improving passage at this culvert is likely best achieved by placing small weirs downstream of the culvert to raise the outlet pool level. It would be desirable to raise this level by 60 cm to backflood the culvert. This would require 4 weirs of 15 cm height. Weirs should be spaced 15 to 20 metres. The land adjacent to the stream is privately owned and landowner support needs to be developed before proceeding. In addition, the Golden District Rod and Gun Club have constructed a temporary fish ladder. Installation of this ladder an monitoring upstream use by kokanee would be useful in assessing the ability of fish to migrate upstream of Highway #1 and use of habitat for spawning. The Highway #1 Culvert is between 50 and 100 metres long and may pose problems for fish migration in addition to the perched outfall. Access to the mouth of the structure is being negotiated with Chevron Canada with the intent of installing the ladder in the fall of 2002 and monitoring kokanee use of upstream habitat.

Section 7

This section of Hospital Creek would benefit from riparian restoration in the lower 200 m. The upper section is within a confined valley and appears to be in a fairly natural state.

Conclusions

The priorities for Hospital Creek are:

- Educate public on value of small streams to prevent further degradation;
- Improve passage at beaver dams in Section 1;
- Install temporary fish ladder at Highway #1 culvert and monitor kokanee use of upstream habitat;
- Identify cause of sediment accumulation in Section 4; and
- Contact landowners to identify those supportive of restoration initiatives.

Future restoration of Hospital Creek will be highly dependent on support of landowners.

APPENDIX 2. Hospital Creek Fish Habitat Assessment Procedures (FHAP) Data and Analyses - August-September 2002.

Habitat Unit							Depth (m)				Width (m)		Pools Only				Bed Material		Gravel		LWD
No.	Dist	Type	Length (m)	Type	Site	Grad. (%)	Bank Full	water 1	water 2	water 3	Bank Full	Wetted	Max. Depth	Crest Depth	Residual Depth	Pool Type	Dominant	Subdom.	Type	Amt.	Total
R1P1	50	P	14	R1 Pools									1.50		1.50	SC	S	S		N	0
R1P2	50	P	1066	R1 Pools							7.0	6.2	2.00		2.00	D	S	C		N	some
			1080	**R1 Pools**							7.0	6.2									
R1G1	0	G	50				1.40	1.10			7.0	6.2					S	C		N	3
R1G2	64	G	90								7.0	6.2									?
			140	**R1 Glides**					1.10		7.0	6.2									
R2G1	1220	G	694	**R2 Glide**	H1		0.71		0.06		6.4	5.1					G	C	AR	H	3
R3P1	1914	P	13		H2		0.79		0.39			5.5	0.62	0.19	0.43	SC	G	C	AR	H	0
R3P2	1972	P	3				0.61				12.6	10.2	0.65	0.15	0.50	SC	G	S	AR	H	0
			16	**R3 Pools**					0.39		12.6	7.9	0.64								0
R3C1	1927	C	3																		0
R3C2	1975	C	4								10.0	4.4					B	G	R	L	0
R3C3	2018	C	6				0.31	0.21	0.13	0.28	11.6	7.9					B	G	AR	L	0
R3C4	2073	C	12																		0
R3C5	2138	C	7					0.06	0.26	0.10	12.6	8.7					G	B	AR	H	2
			32	**R3 Cascades**					0.17		11.4	7.0									2
R3R1	1930	R	42		H3		0.51		0.06			2.2					G	S	AR	H	0
R3R2	1979	R	39				0.31				12.2	4.3									0
R3R3	2024	R	49								13.4	4.4									0
R3R4	2085	R	53								12.9	1.4									0
R3R5	2145	R	89																		0
R3R6	2234	R	108		H4	0.5		0.05	0.08	0.08	23.6	3.6					C	G	AR	L	3
R3R7	2368	R	64																		0
			444	**R3 Riffles**					0.07		15.5	3.2									3
R3G1	2342	G	26																		0
R3G2	2432	G	16																		0
			42	**R3 Glides**					0.07		15.5	3.2									0
R4P1	2565	P	6																		0
R4P2	2789	P	8		H6		1.11		0.71		10.0	9.3	1.24	0.15	1.09	SC	G	C	AR	L	0
			14	**R4 Pools**					0.71		10.0	9.3	1.24								0
R4R1	2479	R	117		H5				0.13			2.9									0
R4R2	2571	R	30																		0
R4R3	2601	R	188			3.5	0.63	0.10	0.10	0.12	7.2	4.3					C	G	R	L	2
			335	**R4 Riffles**					0.11		7.2	3.6									2
R5R1	2797	R	142																		0

APPENDIX 2. Hospital Creek Fish Habitat Assessment Procedures (FHAP) Data and Analyses - August-September 2002.

Habitat Unit							Depth (m)				Width (m)		Pools Only				Bed Material		Gravel		LWD
No.	Dist	Type	Length (m)	Type	Site	Grad. (%)	Bank Full	water 1	water 2	water 3	Bank Full	Wetted	Max. Depth	Crest Depth	Residual Depth	Pool Type	Dominant	Subdom.	Type	Amt.	Total
R5R2	2939	R	597		H7	3.7			0.13		5.4	3.6					C	B	R	L	0
			739	**R5 Riffles**					0.13		5.4	3.6									0
R6P1	3692	P	6		H9			0.37	0.48	0.32	9.7	3.7	0.48	0.18	0.30	SC	G	B	R	L	(jam)
R6P2	3863	P	25																		?
R6P3	3943	P	5		H10		0.66	0.54	0.75	0.50	10.9	5.3	0.75	0.11	0.64	SC	G	C	AR	L	?
R6P4	3951	P	4		H11																?
R6P5	3977	P	5		H11																?
R6P6	3990	P	6		H11																?
R6P7	4156	P	10																		0
			61	**R6 Pools**					0.49		10.3	4.5	0.62								
R6C1	3888	C	20	**R6 Cascades**					0.22		7.9	3.4									
R6R1	3536	R	156		H8	4.9	0.39	0.24	0.21	0.22	7.9	3.4					B	G	R	L	(a few)
R6R2	3698	R	165																		some
R6R3	3908	R	35																		some
R6R4	3948	R	3		H11																some
R6R5	3955	R	22		H11																some
R6R6	3982	R	8		H11																some
R6R7	3996	R	97		H11																some
R6R8	4093	R	63																		some
			549	**R6 Riffles**					0.22		7.9	3.4									
R7PX		P			H12							3.8	0.39								jam
R7XX		R			H13	4.9	0.47	0.18	0.20	0.14	5.3	4.2					C	B	R	L	some
R1P1		P	8		L1		0.35	0.20	0.29	0.25	3.4	3.2									
R1G1		G	29		E1		0.28	0.10	0.16	0.14	2.1	1.4									

R1P1 = Reach 1 Pool 1, etc. Pool Type: SC = scour; D = dammed Bed Material: S = sands, silt, clay, organics; G = gravel; C = cobble; B = boulder
Gravel Type: A = suitable for anadromous fish; R = suitable for resident fish; AR = suitable for both
Gravel Amount: N = none; L = isolated pockers; H = extensive amounts
Cover Type: B = boulder; DP = deep pool; OV = overhanging vegetation; LWD = large woody debris; SWD = small woody debri Cover %: TR = trace
Disturbance Indicators: EB = eroding bank
Riparian Vegetation Type: S = shrub/herb; D = deciduous forest; M = mixed coniferous-deciduous forest
Riparian Vegetation Structure: SHR = shrub/herb stage; PS = pole-sapling; YF = young forest; MF = mature forest
Canopy Closure: 1 = 0-20% covered; 2 = 20-40% covered
Barriers: N = none; CV = culvert

APPENDIX 2. Hospital Creek Fish Habitat Assessment Procedures (FHAP) Data and Analyses - August-September 2002.

	Functional LWD			Cover				Off-Channel Habitat			Indicators			Riparian Vegetation				
No.	10 to 20 cm	20 to 50 cm	>50 cm	Cover Type	%	Cover Type	%	Type	Access	Length	1	2	3	Type	Struc	Canopy	Barriers	Comments
R1P1																		under rail bridge
R1P2																		beaver dam impoundments
R1G1	2													S	SHR	1	N	
R1G2																		R25 F10 u/s; several beaver dams
R2G1	2	1		SWD	TR	B	TR				LR	FP		D	PS	1	N	d/s side of Anderson Road Bridge
R3P1				DP	20	B	10							S	SHR	1	N	pool d/s of first rock weir
R3P2				DP	20	B	5							D	PS	1	N	weir pool
R3C1																		rock weir cascade
R3C2				B	85	SWD	5							D	PS	1	N	rock weir cascade, R28 F11 u/s
R3C3				B	70	SWD	TR							D	PS	1	N	boulder weir fallen apart, R28 F10 u/s
R3C4																		boulder weir fallen apart, R28 F12 u/s
R3C5	2			B	30	SWD	5							D	PS	1	N	boulder weir fallen apart, R28 F13 u/s
R3R1				OV	20	B	TR				LR	MC		D	PS	1	N	gravel riffle
R3R2											LR	MC						gravel riffle
R3R3											LR	MC	FP					gravel riffle, R25 F23 u/s
R3R4											LR	MC	FP					gravel riffle
R3R5											LR	MC	FP					gravel riffle
R3R6											LR	MC	FP	S	SHR	1	N	cobble riffle
R3R7											LR	MC	FP					R26 F2 u/s
R3G1											MC							R26 F1 u/s marked w/ orange ribbon
R3G2																		R26 F3 u/s, glide due to hand-built weir
R4P1																		inside arch culvert, R26 F7
R4P2				DP	70	B	TR							D	YF	1	N	culvert pool at Chevron, R26 F12
R4R1																		w/i gabion walls
R4R2																		u/s of arch culvert
R4R3	1			B	5	OV	TR				EB			D	MF	1	N	cobble riffle w/o rip rap
R5R1																	CV	culvert

APPENDIX 2. Hospital Creek Fish Habitat Assessment Procedures (FHAP) Data and Analyses - August-September 2002.

	Functional LWD			Cover				Off-Channel Habitat			Indicators			Riparian Vegetation				
No.	10 to 20 cm	20 to 50 cm	>50 cm	Cover Type	%	Cover Type	%	Type	Access	Length	1	2	3	Type	Struc	Canopy	Barriers	Comments
R5R2				B	10						LR			D	PS	1	N	cobble riffle, R26 F13 u/s
R6P1				LWD	15	DP	20							M	PS	1	N	R26 F18 u/s
R6P2																		
R6P3				DP	70	B	5							M	YF	1	N	R26 F25, R27 F1 u/s
R6P4																		R27 F2 u/s
R6P5																		R27 F3 u/s
R6P6																		R27 F6 u/s
R6P7																		waterfall pool R27 F10,11,12
R6C1																		massive debris jam
R6R1				B	30	OV	5							M	YF	2	N	boulder riffle, R26 F16 u/s
R6R2																		R26 F19 u/s
R6R3																		sediment wedge
R6R4																		R27 F2 u/s
R6R5																		
R6R6											JM							R27 F4 u/s
R6R7											JM							R27 F7,F8 u/s of debris jam @4083 m
R6R8																		high gradient riffle, R27 F9
R7PX				B	10	OV	TR							M	YF	2	N	
R7XX				B	10	OV	TR				MB	MC		M	YF	2	N	
R1P1																		
R1G1																		

APPENDIX 3. Photographs

No.	Subject	
1	Hospital Creek - Reach 1.	Beaver dam @228 m from mouth.
2	Hospital Creek - Reach 2.	Channelized section along CPR.
3	Hospital Creek - Reach 3.	First (d/s) rock weir.
4	Hospital Creek - Reach 3.	Gravel aggradation.
5	Hospital Creek - Reach 4.	Gabion walls at Brookside Motel.
6	Hospital Creek - Reach 4.	Arch culvert at 11th Avenue N..
7	Hospital Creek - Reach 4.	Looking u/s from 11th Avenue N.
8	Hospital Creek - Reach 4.	Car bodies on south side.
9	Hospital Creek - Reach 4.	Eroding right bank.
10	Hospital Creek - Reach 4.	Eroding right bank.
11	Hospital Creek - Reach 4.	Pool at Chevron culvert outlet.
12	Hospital Creek - Reach 4.	Rock and plywood dam at outlet.
13	Hospital Creek - Reach 5.	Looking u/s from Highway 1 culvert.
14	Hospital Creek - Reach 5.	Fish sample site along trailer park.
15	Hospital Creek - Reach 6.	Pool formed by natural rock/log weir.
16	Hospital Creek - Reach 6.	Boulder riffle habitat with bedrock.
17	Hospital Creek - Reach 6.	Major debris jam looking u/s.
18	Hospital Creek - Reach 6.	Major debris jam looking u/s.
19	Hospital Creek - Reach 6.	Major debris jam looking across.
20	Hospital Creek - Reach 6.	Sediment wedge u/s of debris jam.
21	Hospital Creek - Reach 6.	Small debris jam.
22	Hospital Creek - Reach 6.	Hospital Creek Falls.
23	Hospital Creek - Reach 7.	Fish sample site H12.
24	Hospital Creek - Reach 7.	Looking u/s from wood bridge.
25	Edelweiss Creek.	Looking u/s from Highway 1.
26	Edelweiss Creek.	Looking d/s from Highway 1.
27	Edelweiss Creek.	Looking u/s from Anderson Road.
28	Edelweiss Creek.	Looking d/s near mouth.
29	Limekiln Creek.	Looking u/s from Highway 1.
30	Limekiln Creek.	Looking d/s to Highway 1 culvert.
31	Limekiln Creek.	Looking u/s to Highway 1 culvert.
32	Limekiln Creek.	Looking d/s to beaver pond wetland.
33	Bull trout.	Hospital Creek Site H6.
34	Brook trout fry.	Hospital Creek Site H0.
35	Brook trout juvenile/adult.	Hospital Creek Site H7.
36	Brook trout - mature adult.	Hospital Creek Site H8.
37	Slimy sculpin.	Hospital Creek Site H1.
38	Torrent sculpin	Hospital Creek Site H0.
39	Longnose sucker.	Hospital Creek Site H0.
*40	Redside shiner.	Edelweiss Creek Site E3.

*Note: RE Photo 40 Photo label incorrectly says E4.

Photo 1 Hospital Creek
Reach 1.
Beaver Dam @228 m.

Photo 2 Hospital Creek
Reach 2. Channelized section along CPR looking u/s.

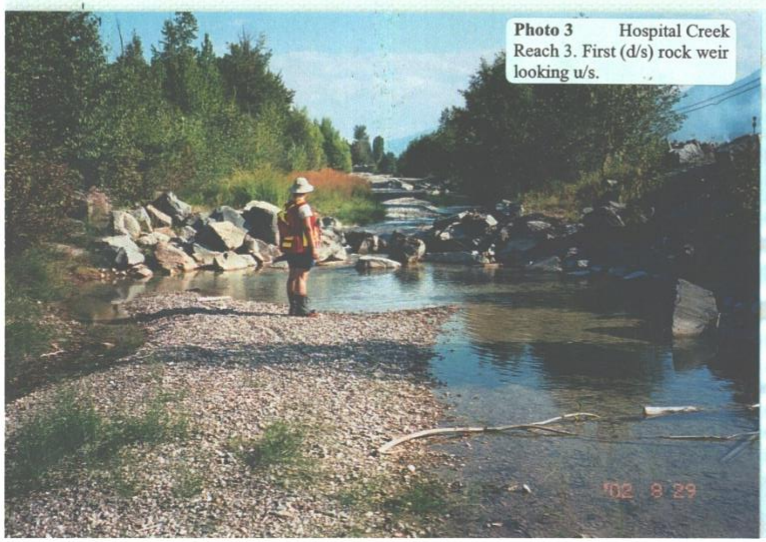


Photo 3 Hospital Creek
Reach 3. First (d/s) rock weir looking u/s.

Photo 4 Hospital Creek
Reach 3. Gravel aggradation looking u/s.

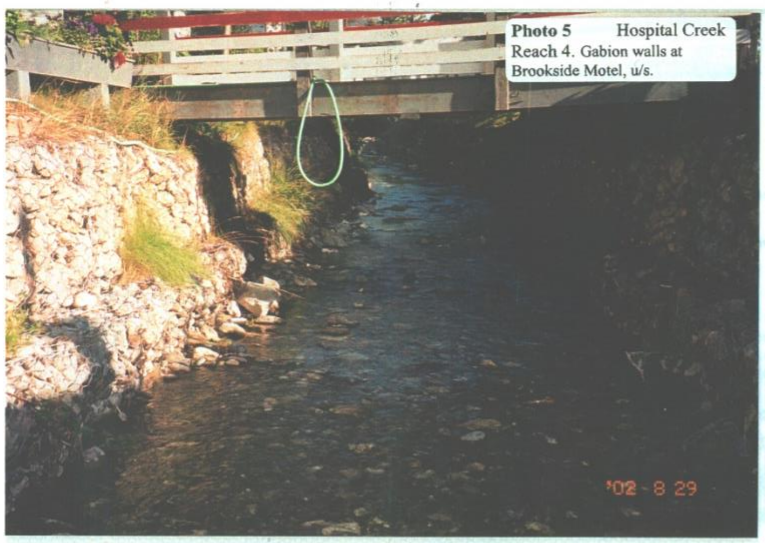


Photo 5 Hospital Creek
Reach 4. Gabion walls at Brookside Motel, u/s.

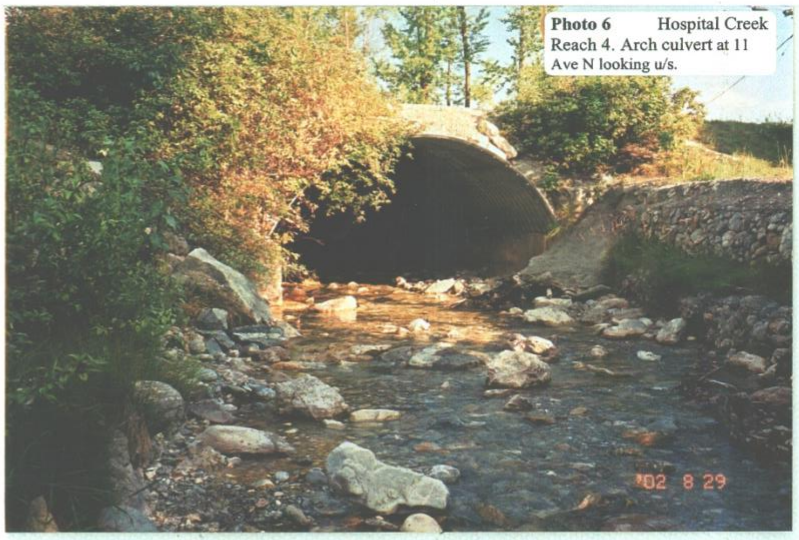


Photo 6 Hospital Creek
Reach 4. Arch culvert at 11 Ave N looking u/s.

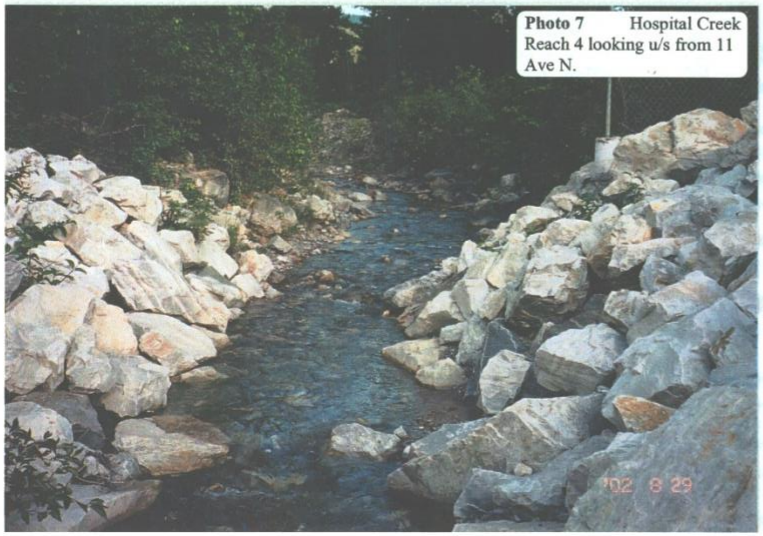


Photo 7 Hospital Creek
Reach 4 looking u/s from 11 Ave N.

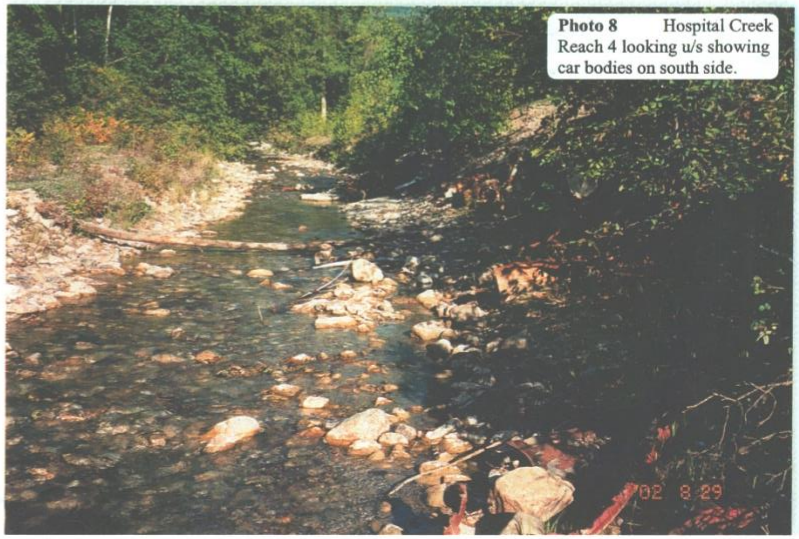


Photo 8 Hospital Creek
Reach 4 looking u/s showing car bodies on south side.

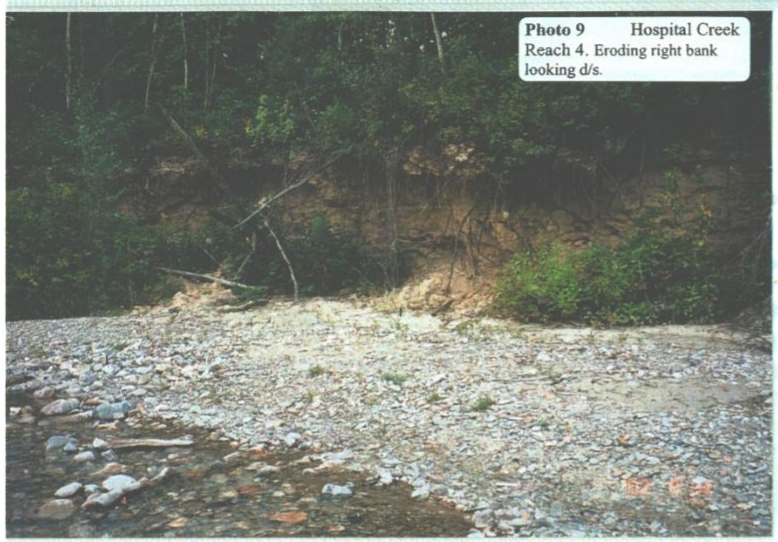


Photo 9 Hospital Creek Reach 4. Eroding right bank looking d/s.

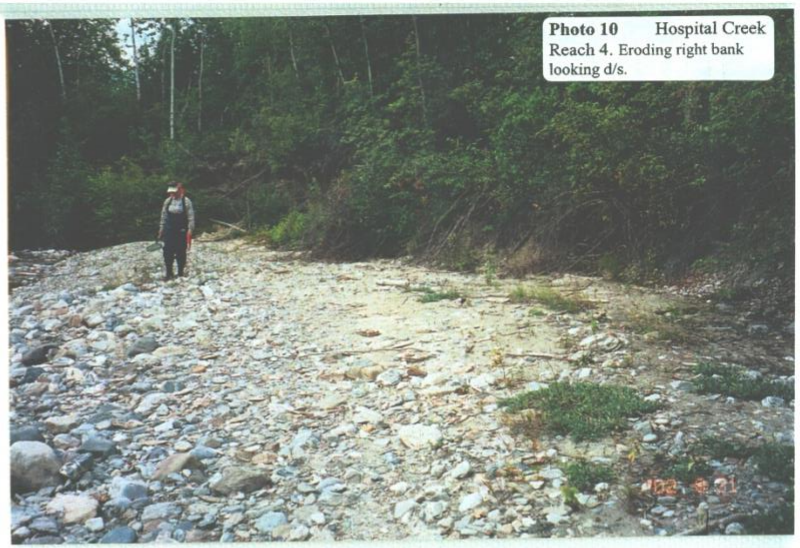


Photo 10 Hospital Creek Reach 4. Eroding right bank looking d/s.

Photo 11 Hospital Creek Reach 4. Pool at Chevron culvert outlet.

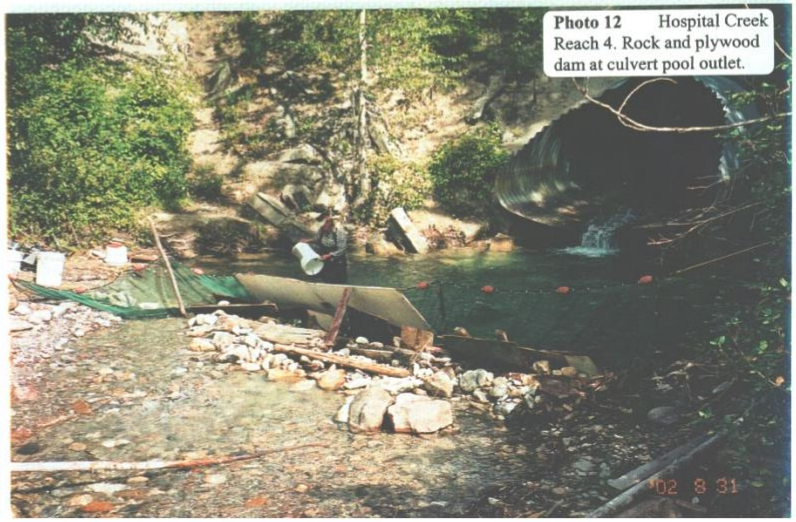


Photo 12 Hospital Creek Reach 4. Rock and plywood dam at culvert pool outlet.

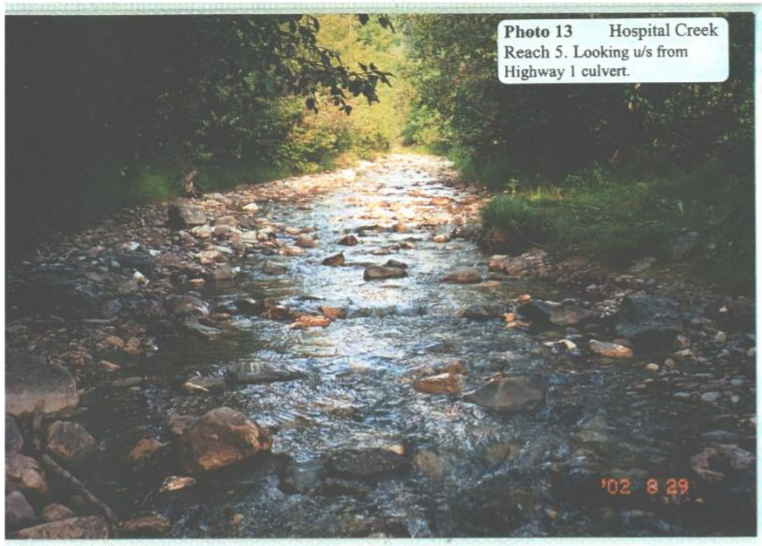


Photo 13 Hospital Creek
Reach 5. Looking u/s from Highway 1 culvert.

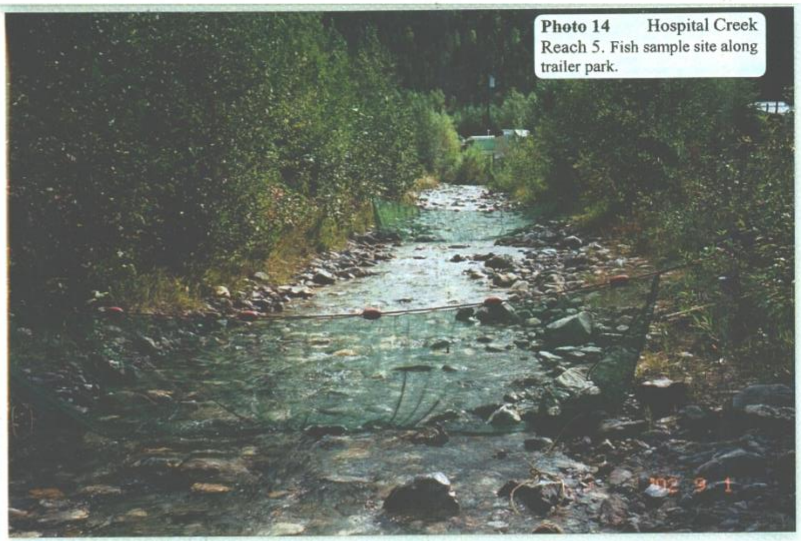


Photo 14 Hospital Creek
Reach 5. Fish sample site along trailer park.

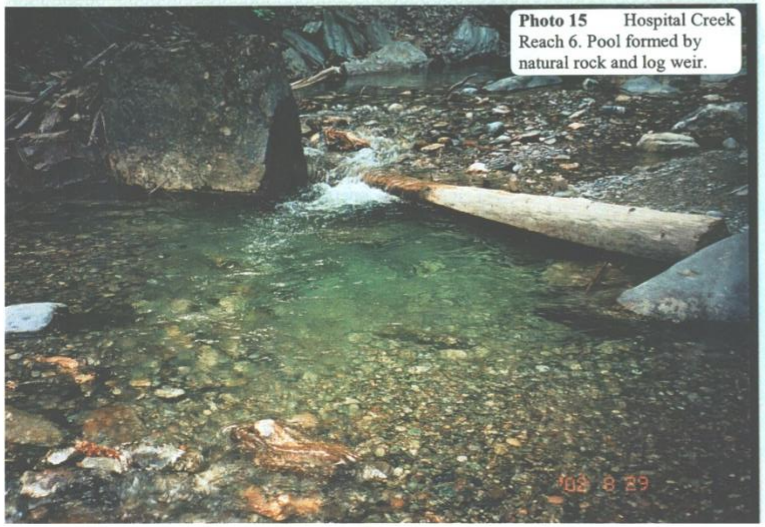


Photo 15 Hospital Creek
Reach 6. Pool formed by natural rock and log weir.

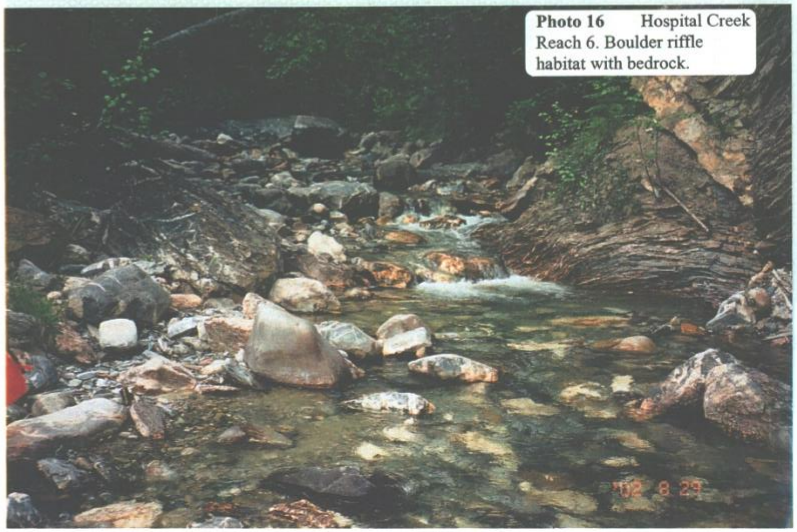


Photo 16 Hospital Creek
Reach 6. Boulder riffle habitat with bedrock.

Photo 17 Hospital Creek
Reach 6. Major debris jam looking u/s.

Photo 18 Hospital Creek
Reach 6. Major debris jam looking u/s.

Photo 19 Hospital Creek
Reach 6. Major debris jam looking across from left bank

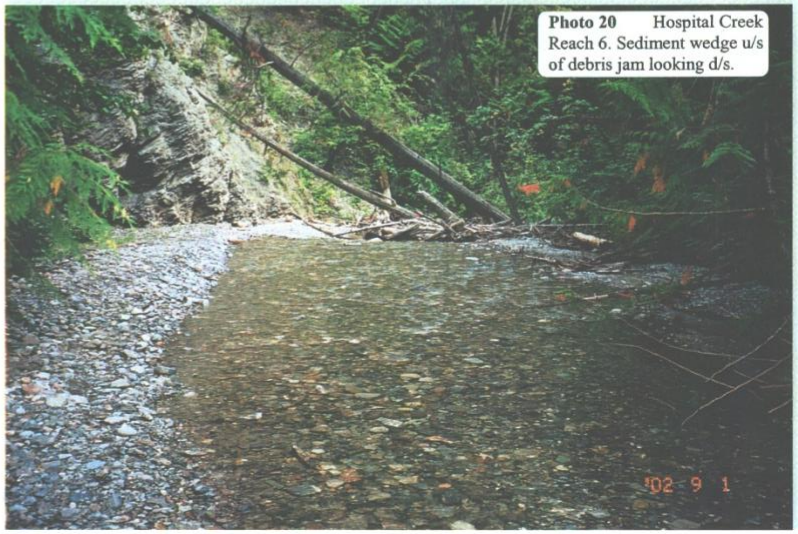


Photo 20 Hospital Creek
Reach 6. Sediment wedge u/s of debris jam looking d/s.

Photo 21 Hospital Creek
Reach 6. Small debris jam ~70 m d/s of falls, u/s.

Photo 22 Hospital Creek
Reach 6. Falls (~10 m high) at us/ end of Reach 6.

Photo 23 Hospital Creek
Reach 7. Fish sample site looking u/s.

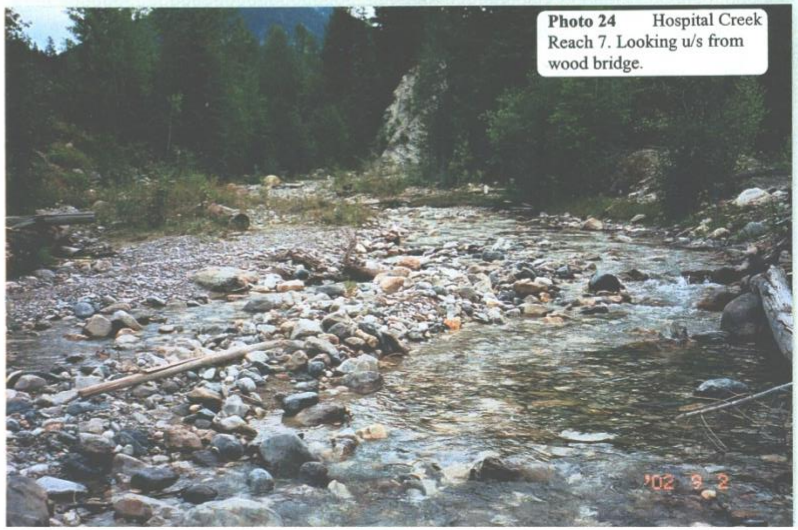


Photo 24 Hospital Creek
Reach 7. Looking u/s from wood bridge.

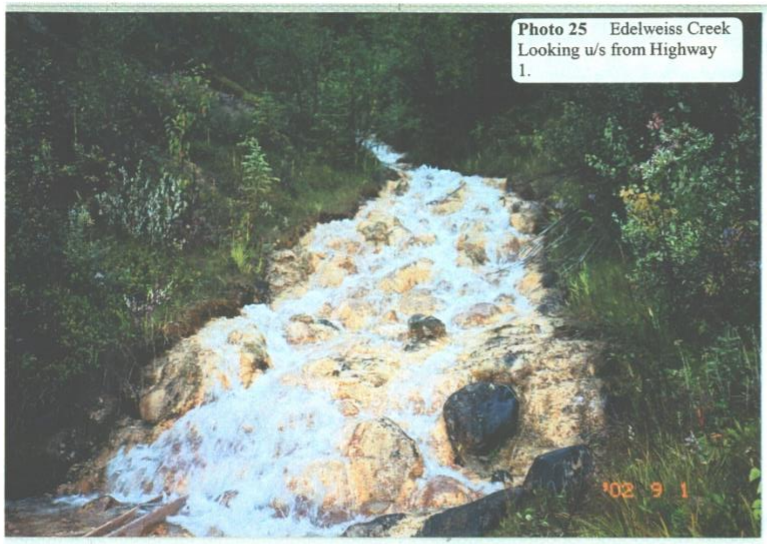


Photo 25 Edelweiss Creek Looking u/s from Highway 1.

Photo 26 Edelweiss Creek Looking d/s from Highway 1.

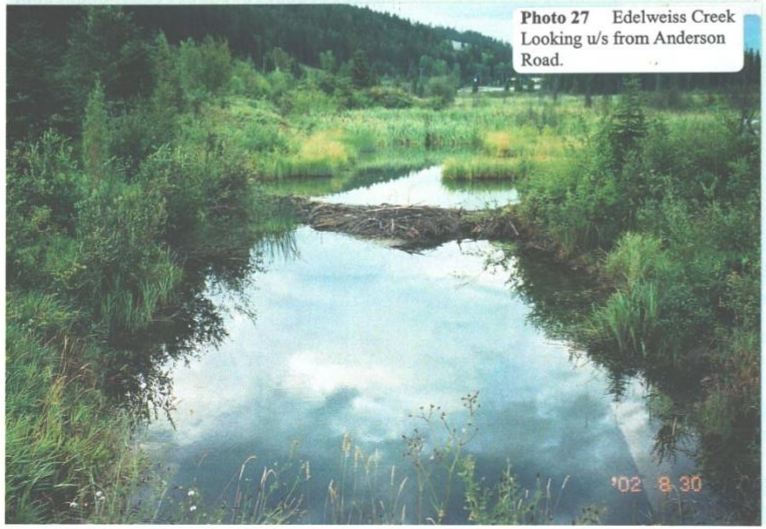


Photo 27 Edelweiss Creek Looking u/s from Anderson Road.

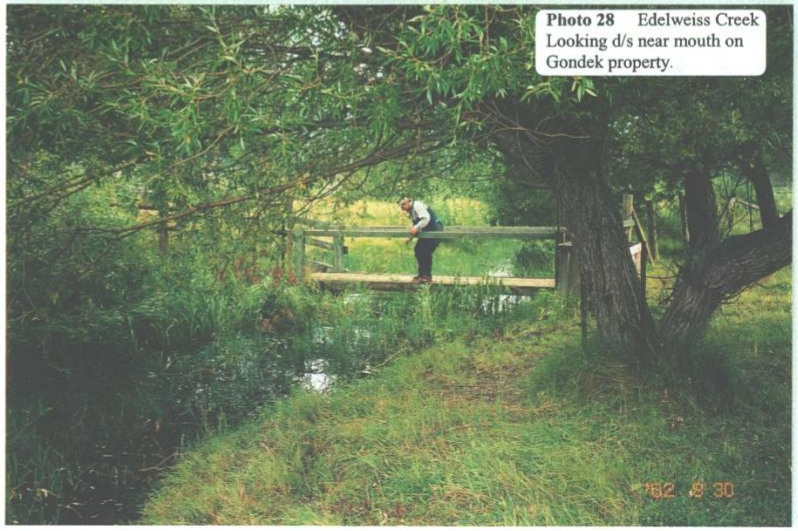


Photo 28 Edelweiss Creek Looking d/s near mouth on Gondek property.

Photo 29 Limekiln Creek
Looking u/s from Highway 1.

Photo 30 Limekiln Creek
Looking d/s to Highway 1 culvert inlet.

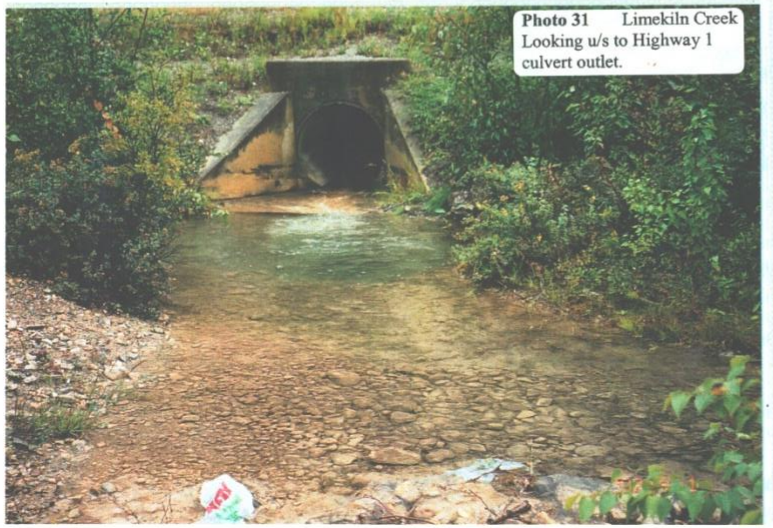


Photo 31 Limekiln Creek
Looking u/s to Highway 1 culvert outlet.

Photo 32 Limekiln Creek
Looking d/s to beaver pond wetland.

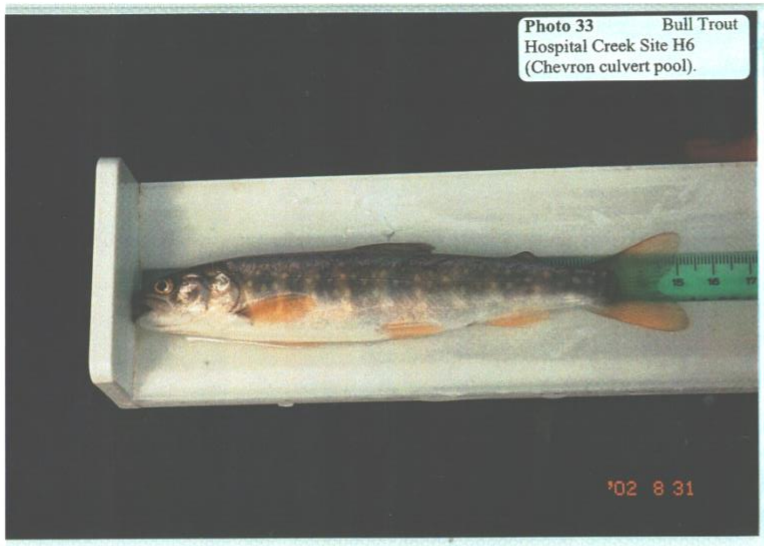


Photo 33 Bull Trout
Hospital Creek Site H6 (Chevron culvert pool).

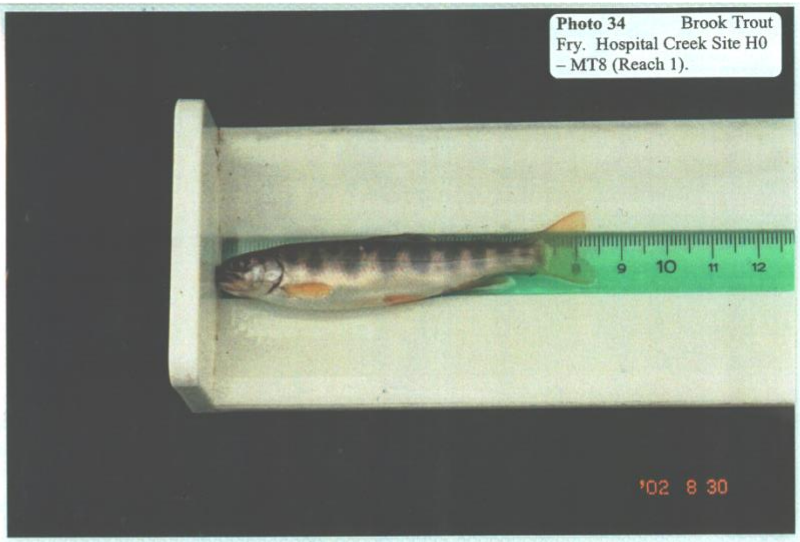


Photo 34 Brook Trout
Fry. Hospital Creek Site H0 – MT8 (Reach 1).

Photo 35 Brook Trout
Juvenile/Adult. Hospital Creek Site H7 (Reach 5).

Photo 36 Brook Trout
Mature adult. Hospital Creek Site H8 (Reach 6).

Photo 37 Slimy Sculpin
Hospital Creek Site H1
(Reach 2).

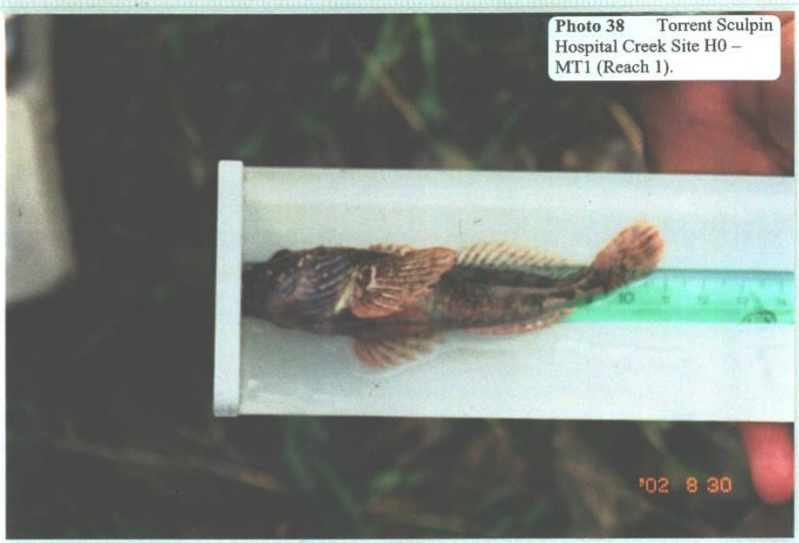


Photo 38 Torrent Sculpin
Hospital Creek Site H0 –
MT1 (Reach 1).

Photo 39 Longnose Sucker
Hospital Creek Site H0 –
MT1 (Reach 1).

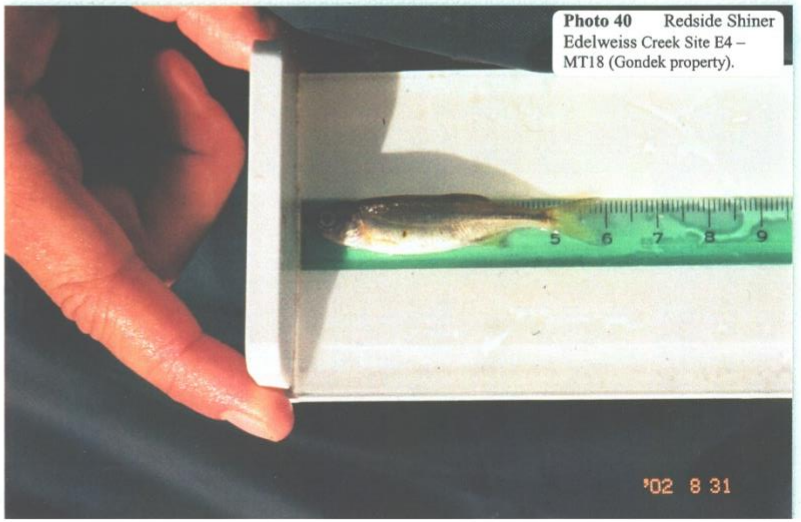


Photo 40 Redside Shiner
Edelweiss Creek Site E4 –
MT18 (Gondek property).

APPENDIX 4. Depth/Velocity Transect Data.
Hospital Creek Fish and Fish Habitat Assessment 2002

Site: **H1**
Habitat Type: GLIDE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0	0
1.0	0.03	0.15
2.0	0.04	0.16
3.0	0.1	0.17
4.0	0.09	0.1
5.0	0.1	0.03
5.4	0	0

Site: **H2**
Habitat Type: POOL

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0	0
1.0	0.2	-0.02
2.0	0.5	-0.01
3.0	0.55	-0.01
4.0	0.61	0.01
4.5	0.59	0.05
5.0	0.54	0.2
6.0	0.36	-0.01
7.0	0.27	-0.08
8.0	0	0

Site: **H3**
Habitat Type: RIFFLE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0	0
0.5	0.02	0.19
1.0	0.04	0.27
1.5	0.16	0.24
2.0	0.03	0.27
2.2	0	0

Site: **H4**
Habitat Type: RIFFLE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0	0
0.5	0.04	0.16
1.0	0.09	0.41
1.5	0.07	0.32
2.0	0.07	0.38
2.5	0.06	0.18
3.0	0.03	0.01
3.3	0	0

Site: **H5**
Habitat Type: RIFFLE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0	0
0.5	0.13	0.06
1.0	0.12	0.15
1.5	0.16	0.26
2.0	0.15	0.27
2.5	0.15	0.14
2.9	0	0

Site: **H6**
Habitat Type: POOL

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0.00	0.00
1.0	0.31	-0.02
2.0	0.62	-0.04
3.0	0.80	0.02
4.0	1.12	0.00
5.0	1.24	0.01
6.0	1.15	0.00
7.0	0.87	0.00
8.0	0.50	0.14
9.0	0.24	-0.03
9.8	0.00	0.00

Site: **H7**
Habitat Type: RIFFLE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0.00	0.00
0.5	0.10	-0.07
1.0	0.17	0.24
1.5	0.17	0.30
2.0	0.19	0.47
2.5	0.08	0.55
3.0	0.09	0.20
3.2	0.00	0.00

Site: **H8**
Habitat Type: RIFFLE

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0.00	0.00
0.5	0.09	0.21
1.0	0.15	0.00
1.5	0.19	0.25
2.0	0.15	0.51
2.5	0.05	0.34
3.0	0.01	0.76
3.5	0.10	0.62
4.0	0.02	0.05
4.4	0.00	0.00

Site: **H9**
Habitat Type: POOL

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0.00	0.00
0.5	0.35	-0.01
1.0	0.36	-0.01
1.5	0.37	0.06
2.0	0.27	0.34
2.5	0.34	0.19
3.0	0.20	0.03
3.5	0.02	0.29
3.8	0.00	0.00

Site: **H12**
Habitat Type: POOL

Distance (m)	Depth (m)	Velocity (m/s)
0.0	0.00	0.00
0.5	0.10	0.00
1.0	0.25	-0.01
1.5	0.36	0.13
2.0	0.39	0.25
2.5	0.34	0.22
3.0	0.19	0.12
3.5	0.10	0.02
3.8	0.00	0.00

APPENDIX 5a. Fish Collection Form Data for Hospital Creek Sites
Hospital Creek Fish and Fish Habitat Assessment 2002

Fish Permit: #02-04-0890
Agency: C201 (Naito Environmental)
Crew: GN/KG (Gerry Naito, Keili Geist)

Gazetted Name: **Hospital Creek**
Watershed Code: 300-910100
Waterbody ID: 00000KHOR
No Site Card Completed

SITE/METHOD

Site #	Date	Map #	Site UTM			Method	Stream Condition		
			Zone	Easting	Northing		Temp	Cond	Turb
H0	2002/08/30	82N.036	11	500525	5686810	MT	17.5	420	L
H0	2002/08/30	82N.036	11	500525	5686810	MT	17.9	436	C
H0	2002/08/30	82N.036	11	500525	5686810	MT	14.8	396	C
H1	2002/08/30	82N.036	11	500970	5685820	EF	16.1	391	C
H2	2002/08/30	82N.036	11	501220	5685308	EF	18.4	389	C
H3	2002/08/30	82N.036	11	501260	5685270	EF			
H4	2002/08/30	82N.036	11	501365	5685061	EF	10.4	405	C
H5	2002/08/30	82N.036	11	510515	5684840	EF			
H6	2002/08/30	82N.036	11	501810	5684795	EF			
H7	2002/08/30	82N.036	11	502177	5684827	EF	12.8	390	C
H8	2002/08/30	82N.036	11	502633	5684866	EF			
H9	2002/08/30	82N.036	11	502645	5684875	EF			
H10	2002/08/30	82N.036	11	502775	5685040	EF	12.2	394	C
H11	2002/08/30	82N.036	11	502780	5685045	EF			
H12	2002/08/30	82N.036	11	502735	5685685	EF	8.0	409	C
H13	2002/08/30	82N.036	11	502740	5685690	EF			

FISH SUMMARY

Site #	Date	Method/#	Pass	Species	Stage	Age	Total #	Length (mm)	
								Min	Max
H0		MT/1	1	LSU	J/A		2	63	96
				CRH	J/A		1	110	110
		MT/2	1	NFC	---		---	---	---
		MT/3	1	NFC	---		---	---	---
		MT/4	1	NFC	---		---	---	---
		MT/5	1	NFC	---		---	---	---
		MT/6	1	NFC	---		---	---	---
		MT/7	1	NFC	---		---	---	---
		MT/8	1	EB	F		3	68	80

Site #	Date	Method/#	Pass	Species	Stage	Age	Total #	Length (mm)	
								Min	Max
H1		EF	1	EB	F		10	66	80
				CCG	F		4	38	45
				CCG	J/A		2	77	80
				RSC	J/A		15	22	83
			2	EB	F		1	64	64
				CCG	F		5	39	45
				CCG	J/A		2	79	80
				RSC	J/A		4	34	34
H2		EF	1	EB	F		28	52	76
				CCG	F		4	40	46
				CCG	J/A		8	70	117
			2	EB	F		7	61	72
				CCG	F		2	30	41
H3		EF	1	EB	F		16	56	76
				EB	J/A		1	115	115
			2	EB	J/A		5	59	70
H4		EF	1	EB	F		9	57	75
			2	NFC	---		---	---	---
H5		EF	1	EB	F		4	64	79
			2	EB	F		1	57	57
H6		EF	1	BT	J/A		1	145	145
				EB	F		8	62	73
				EB	J/A		1	171	171
			2	EB	F		5	56	77
H7		EF	1	BT	J/A		2	130	144
				EB	J/A		2	136	155
			2	NFC	---		---	---	---
H8		EF	1	BT	J/A		6	92	115
				EB	J/A		1	248	248
			2	NFC	---		---	---	---
H9		EF	1	BT	J/A		2	95	99
				EB	J/A		2	155	260
			2	NFC	---		---	---	---
H10		EF	1	NFC	---		---	---	---
H11		EF	1	NFC	---		---	---	---
H12		EF	1	NFC	---		---	---	---
H13		EF	1	NFC	---		---	---	---

GEAR SPECIFICATIONS

Site	Method/#	Haul	Date In	Time In	Date Out	Time Out
H0	MT/1	1	08/29	1440	08/30	0911
H0	MT/2	1	08/29	1503	08/30	0944
H0	MT/3	1	08/29	1509	08/30	0949
H0	MT/4	1	08/29	1520	08/30	1003
H0	MT/5	1	08/29	1537	08/30	1026
H0	MT/6	1	08/29	1550	08/30	1050
H0	MT/7	1	08/29	1606	08/30	1104
H0	MT/8	1	08/29	1617	08/30	1120

ELECTROFISHER SPECIFICATIONS

Make: Smith-Root Model: 12B (battery-powered, backpack)

Site H1

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1246	1304	639	32.0	5.1	C	300	70	6
2	1350	1403	588	32.0	5.1	C	300	70	6

Site H2

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1512	1530	590	13.4	5.5	C	400	70	6
2	1553	1607	450	13.4	5.5	C	400	70	6

Site H3

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1655	1703	365	33.6	2.2	C	400	70	6
2	1718	1725	303	33.6	2.2	C	400	70	6

Site H4

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1024	1035	445	31.1	3.6	C	400	70	6
2	1056	1107	464	31.1	3.6	C	400	70	6

Site H5

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1143	1152	377	21.4	2.9	C	400	70	6
2	1210	1218	361	21.4	2.9	C	400	70	6

Site H6

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1341	1357	386	8.0	9.8	C	400	70	6
2	1425	1436	346	8.0	9.8	C	400	70	6

Site H7

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1206	1212	264	14.8	3.6	C	400	70	6
2	1230	1236	300	14.8	3.6	C	400	70	6

Site H8

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1658	1706	265	11.8	4.4	C	400	50	8
2	1735	1740	233	11.8	4.4	C	400	50	8

Site H9

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1707	1715	173	5.3	3.8	C	400	50	8
2	1741	1744	86	5.3	3.8	C	400	50	8

Site H10

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1830	1834	135	4.7	5.1	PE	400	50	8
2	(no second pass)								

Site H11

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1835	1845	438	73.0	4.0	PE	400	50	8
2	(no second pass)								

Site H12

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	0811	0814	136	6.9	3.4	PE	400	70	6
2	(no second pass)								

Site H13

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	0816	0836	968	103.0	5.3	O	400	70	6
2	(no second pass)								

APPENDIX 5b. Fish Collection Form Data for Edelweiss Creek Sites
Hospital Creek Fish and Fish Habitat Assessment 2002

Fish Permit: #02-04-0890
Agency: C201 (Naito Environmental)
Crew: GN/KG (Gerry Naito, Kelli Geist)

Gazetted Name: **Edelweiss Creek**
Watershed Code:
Waterbody ID:
No Site Card Completed

SITE/METHOD

Site #	Date	Map #	Site UTM			Method	Stream Condition		
			Zone	Easting	Northing		Temp	Cond	Turb
E1	2002/09/01	82N.036	11	501578	5685798	EF	7.8	458	C
E2	2002/08/31	82N.036	11	501461	5685888	MT	17.8	473	C
E2	2002/08/31	82N.036	11	501461	5685888	MT	16.5	476	C
E3	2002/08/31	82N.036	11	501060	5686180	MT	16.4	459	C
E3	2002/08/31	82N.036	11	501060	5686180	MT	15.4	464	C
E3	2002/08/31	82N.036	11	501060	5686180	MT	15.3	465	C

FISH SUMMARY

Site #	Date	Method	Pass	Species	Stage	Age	Total #	Length (mm)	
								Min	Max
E1	2002/09/01	EF	1	EB	F		85	40	99
				CCG	J/A		1	65	65
	2002/09/01	EF	2	EB	F		45	37	95
E2	2002/08/31	MT/9	1	RSC	J/A		36	45	75
		MT/10	1	NFC	---		---	---	---
		MT/11	1	RSC	J/A		18	49	62
		MT/12	1	NFC	---		---	---	---
		MT/14	1	NFC	---		---	---	---
E3	2002/08/31	MT/13	1	---[a]	---		---	---	---
		MT/15	1	---[b]	---		---	---	---
		MT/16	1	LSU	J/A		23	45	66
		MT/16	1	RSC	J/A		2	40	49
		MT/17	1	RSC	J/A		1	89	89
		MT/18	1	RSC	J/A		1	53	53
		MT/19	1	LSU	J/A		1	59	59
		MT/20	1	LSU	J/A		1	53	53

[a] Trap missing - presumed stolen and/or vandalized.

[b] Trap tampered with - unclipped and left open.

GEAR SPECIFICATIONS

Site	Method/#	Haul	Date In	Time In	Date Out	Time Out
E2	MT/9	1	8/30	0830	8/31	0730
	MT/10	1	8/30	0750	8/31	0715
	MT/11	1	8/30	0755	8/31	0720
	MT/12	1	8/30	0800	8/31	0730
	MT/14	1	8/30	0805	8/31	0800
E3	MT/13	1	8/30	0810	8/31	---[a]
	MT/15	1	8/30	0815	8/31	---[b]
	MT/16	1	8/30	0823	8/31	0810
	MT/17	1	8/30	0830	8/31	0823
	MT/18	1	8/30	0835	8/31	0830
	MT/19	1	8/30	0840	8/31	0835
	MT/20	1	8/30	0842	8/31	0843

[a] Trap missing - presumed stolen and/or vandalized.

[b] Trap tampered with - unclipped and left open.

ELECTROFISHER SPECIFICATIONS

Make: Smith-Root Model: 12B (battery-powered, backpack)

Site E1

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	0803	0820	417	28.5	1.4	PE	400	70	6
2	0856	0913	443	28.5	1.4	C	400	70	6

APPENDIX 5c. Fish Collection Form Data for Limekiln Creek Sites
Hospital Creek Fish and Fish Habitat Assessment 2002

Fish Permit: #02-04-0890
Agency: C201 (Naito Environmental)
Crew: GN/KG (Gerry Naito, Kelli Geist)

Gazetted Name: **Limekiln Creek**
Watershed Code:
Waterbody ID:
No Site Card Completed

SITE/METHOD

Site #	Date	Map #	Site UTM			Method	Stream Condition		
			Zone	Easting	Northing		Temp	Cond	Turb
L1	2002/09/01	82N.036	11	501733	5685548	EF	8.7	507	C
L2	2002/09/01	82N.036	11	501753	5685553	EF			

FISH SUMMARY

Site #	Date	Method/#	Pass	Species	Stage	Age	Total #	Length (mm)	
								Min	Max
L1	2002/09/01	EF	1	EB	F		52	48	76
			1	EB	J/A		1	140	140
		EF	2	EB	F		19	47	93
			2	EB	J/A		0	---	---
L2	2002/09/01	EF	1	NFC	---				

ELECTROFISHER SPECIFICATIONS
Make: Smith-Root Model: 12B (battery-powered, backpack)

Site L1

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1031	1041	322	7.6	3.2	PE	400	70	6
2	1108	1119	406	7.6	3.2	PE	400	70	6

Site L2

Pass	Time In	Time Out	EF Sec.	Length	Width	Encl.	Voltage	Freq	Pulse
1	1133	1134	54	3.3	2.3	PE	400	70	6
2	(no second pass)								

APPENDIX 6. Sample Site Fish Densities at Electrofishing Sites.
Hospital Creek Fish and Fish Habitat Assessment 2002

(population estimates calculated using MicroFish software (Van Deventer and Platts 1989))

Site	Length (m)	Width (m)	Area (m^2)	Species	All (F + J/A) 1	2	Total	Pop. Est.	Density no./100 m	Density no./100 m^2	Fry Catch 1	2	Total	Pop. Est.	Density no./100 m	Density no./100 m^2	J/A Catch 1	2	Total	Pop. Est.	Density no./100 m	Density no./100 m^2
H1	32.0	5.1	163	EB	10	1	11	11	34	7	10	1	11	11	34	7	0	0	0	0	0	0
H1	32.0	5.1	163	RSC	15	4	19	19	59	12	0	0	0	0	0	0	15	4	19	19	59	12
H1	32.0	5.1	163	CCG	6	7	13	20	63	12	4	5	9	14	44	9	2	2	4	5	16	3
H2	13.4	5.5	74	EB	28	7	35	36	269	49	28	7	35	36	269	49	0	0	0	0	0	0
H2	13.4	5.5	74	CCG	12	2	14	14	104	19	4	2	6	6	45	8	8	0	8	8	60	11
H3	33.6	2.2	74	EB	17	5	22	23	68	31	16	5	21	22	65	30	1	0	1	1	3	1
H4	31.1	3.6	112	EB	9	0	9	9	29	8	9	0	9	9	29	8	0	0	0	0	0	0
H5	21.4	2.9	62	EB	4	1	5	5	23	8	4	1	5	5	23	8	0	0	0	0	0	0
H6	8.0	9.8	78	BT	1	0	1	1	13	1	0	0	0	0	0	0	1	0	1	1	13	1
H6	8.0	9.8	78	EB	9	5	14	16	200	20	8	5	13	16	200	20	1	0	1	1	13	1
H7	14.8	3.6	53	BT	2	0	2	2	14	4	0	0	0	0	0	0	2	0	2	2	14	4
H7	14.8	3.6	53	EB	2	0	2	2	14	4	0	0	0	0	0	0	2	0	2	2	14	4
H8	11.8	4.4	52	BT	6	0	6	6	51	12	0	0	0	0	0	0	6	0	6	6	51	12
H8	11.8	4.4	52	EB	1	0	1	1	8	2	0	0	0	0	0	0	1	0	1	1	8	2
H9	5.3	3.8	20	BT	2	0	2	2	38	10	0	0	0	0	0	0	2	0	2	2	38	10
H9	5.3	3.8	20	EB	2	0	2	2	38	10	0	0	0	0	0	0	2	0	2	2	38	10
H10	4.7	5.1	24	NFC			0		0	0			0		0	0			0		0	0
H11	73.0	4.0	292	NFC			0		0	0			0		0	0			0		0	0
H12	6.9	3.4	23	NFC			0		0	0			0		0	0			0		0	0
H13	103.0	5.3	546	NFC			0		0	0			0		0	0			0		0	0
E1	28.5	1.4	40	EB	85	45	130	176	618	441	85	45	130	176	618	441	0	0	0	0	0	0
E1	28.5	1.4	40	CCG	1	0	1	1	4	3	0	0	0	0	0	0	1	0	1	1	4	3
L1	7.6	3.2	24	EB	53	19	72	80	1053	329	52	19	71	80	1053	329	1	0	1	1	13	4
L2	3.3	2.3	8	NFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species: BT = bull trout; EB = brook trout; RSC = redside shiner; CCG = slimy sculpin
Stage: F = fry; J/A = juvenile/adult; All = fry and juvenile/adult

APPENDIX 7. Individual Fish Data, August-September 2002
Hospital Creek Fish and Fish Habitat Assessment 2002

Site #	Location/Description
H0	Hospital Creek - Reach 1
H1	Hospital Creek - Reach 2 glide upstream from Anderson Road Bridge
H02	Hospital Creek -weir pool at d/s end of Reach 3
H03	Hospital Creek - gravel riffle in Reach 3 aggraded section
H04	Hospital Creek - cobble riffle in Reach 3 aggraded section
H05	Hospital Creek - cobble riffle/glide in gabion section, Brookside Motel
H06	Hospital Creek - outlet pool at Chevron culvert
H07	Hospital Creek - cobble riffle along trailer park
H08	Hospital Creek - boulder riffle in Reach 6
H09	Hospital Creek - pool immediately u/s of H08
H10	Hospital Creek - log weir/boulder pool u/s of debris jam in canyon
H11	Hospital Creek - continued fish presence sampling u/s of H10
H12	Hospital Creek - pool d/s of bridge on Upper Donald Road
H13	Hospital Creek - continued fish presence sampling u/s of H12
E1	Edelweiss Creek immediately d/s of highway
E2	Edelweiss Creek beaver pond wetland
E3	Edelweiss Creek d/s of beaver pond wetland
L1	Limekiln Creek immediately d/s of highway
L2	Limekiln Creek immediately u/s of highway

Life Stage: F = fry; J/A = juvenile/adult.

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
1	E1	EF/1	1	EB	65	2.5	F	0.9103			
2	E1	EF/1	1	EB	76	4.4	F	1.0023			
3	E1	EF/1	1	EB	59	2.5	F	1.2173			
4	E1	EF/1	1	EB	47	1.1	F	1.0595			
5	E1	EF/1	1	EB	53	1.5	F	1.0075			
6	E1	EF/1	1	EB	52	1.5	F	1.0668			
7	E1	EF/1	1	EB	54	1.5	F	0.9526			
8	E1	EF/1	1	EB	72	4.0	F	1.0717			
9	E1	EF/1	1	EB	76	5.2	F	1.1846			
10	E1	EF/1	1	EB	59	2.4	F	1.1686			
11	E1	EF/1	1	EB	65	2.8	F	1.0196			
12	E1	EF/1	1	EB	57	1.9	F	1.0260			
13	E1	EF/1	1	EB	57	1.9	F	1.0260			
14	E1	EF/1	1	EB	56	1.7	F	0.9680			
15	E1	EF/1	1	EB	50	1.4	F	1.1200			
16	E1	EF/1	1	EB	67	3.2	F	1.0640			
17	E1	EF/1	1	EB	52	1.5	F	1.0668			
18	E1	EF/1	1	EB	88	7.2	F	1.0565			
19	E1	EF/1	1	EB	58	2.0	F	1.0251			
20	E1	EF/1	1	EB	67	3.8	F	1.2635			
21	E1	EF/1	1	EB	60	2.6	F	1.2037			
22	E1	EF/1	1	EB	51	1.9	F	1.4323			
23	E1	EF/1	1	EB	54	1.7	F	1.0796			
24	E1	EF/1	1	EB	54	1.6	F	1.0161			
25	E1	EF/1	1	EB	65	2.7	F	0.9832			
26	E1	EF/1	1	EB	51	1.3	F	0.9800			
27	E1	EF/1	1	EB	48	1.2	F	1.0851			
28	E1	EF/1	1	EB	52	1.5	F	1.0668			
29	E1	EF/1	1	EB	50	1.5	F	1.2000			
30	E1	EF/1	1	EB	57	1.9	F	1.0260			
31	E1	EF/1	1	EB	48	1.0	F	0.9042			
32	E1	EF/1	1	EB	51	1.4	F	1.0554			
33	E1	EF/1	1	EB	53	1.4	F	0.9404			
34	E1	EF/1	1	EB	54	1.6	F	1.0161			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
35	E1	EF/1	1	EB	55	1.6	F	0.9617			
36	E1	EF/1	1	EB	54	1.7	F	1.0796			
37	E1	EF/1	1	EB	40	0.6	F	0.9375			
38	E1	EF/1	1	EB	46	1.1	F	1.1301			
39	E1	EF/1	1	EB	46	0.9	F	0.9246			
40	E1	EF/1	1	EB	93	9.1	F	1.1313			
41	E1	EF/1	1	EB	99	10.4	F	1.0718			
42	E1	EF/1	1	EB	70	3.1	F	0.9038			
43	E1	EF/1	1	EB	55	1.8	F	1.0819			
44	E1	EF/1	1	EB	57	1.9	F	1.0260			
45	E1	EF/1	1	EB	62	2.8	F	1.1749			
46	E1	EF/1	1	EB	77	5.4	F	1.1828			
47	E1	EF/1	1	EB	72	4.5	F	1.2056			
48	E1	EF/1	1	EB	60	2.3	F	1.0648			
49	E1	EF/1	1	EB	52	1.5	F	1.0668			
50	E1	EF/1	1	EB	52	1.5	F	1.0668			
51	E1	EF/1	1	EB	54	1.6	F	1.0161			
52	E1	EF/1	1	EB	67	3.3	F	1.0972			
53	E1	EF/1	1	EB	56	2.0	F	1.1388			
54	E1	EF/1	1	EB	45	1.1	F	1.2071			
55	E1	EF/1	1	EB	45	0.9	F	0.9877			
56	E1	EF/1	1	EB	53	1.8	F	1.2091			
57	E1	EF/1	1	EB	48	1.1	F	0.9946			
58	E1	EF/1	1	EB	75	4.5	F	1.0667			
59	E1	EF/1	1	EB	58	1.9	F	0.9738			
60	E1	EF/1	1	EB	74	5.0	F	1.2339			
61	E1	EF/1	1	EB	51	1.3	F	0.9800			
62	E1	EF/1	1	EB	50	1.4	F	1.1200			
63	E1	EF/1	1	EB	63	2.8	F	1.1198			
64	E1	EF/1	1	EB	57	1.8	F	0.9720			
65	E1	EF/1	1	EB	73	3.7	F	0.9511			
66	E1	EF/1	1	EB	70	4.6	F	1.3411			
67	E1	EF/1	1	EB	54	1.7	F	1.0796			
68	E1	EF/1	1	EB	55	1.8	F	1.0819			
69	E1	EF/1	1	EB	52	1.4	F	0.9957			
70	E1	EF/1	1	EB	58	2.4	F	1.2301			
71	E1	EF/1	1	EB	62	2.7	F	1.1329			
72	E1	EF/1	1	EB	70	3.4	F	0.9913			
73	E1	EF/1	1	EB	75	4.8	F	1.1378			
74	E1	EF/1	1	EB	78	5.9	F	1.2433			
75	E1	EF/1	1	EB	70	3.7	F	1.0787			
76	E1	EF/1	1	EB	66	3.1	F	1.0783			
77	E1	EF/1	1	EB	50	1.2	F	0.9600			
78	E1	EF/1	1	EB	49	1.2	F	1.0200			
79	E1	EF/1	1	EB	56	1.7	F	0.9680			
80	E1	EF/1	1	EB	54	1.7	F	1.0796			
81	E1	EF/1	1	EB	49	1.4	F	1.1900			
82	E1	EF/1	1	EB	58	2.1	F	1.0763			
83	E1	EF/1	1	EB	58	1.9	F	0.9738			
84	E1	EF/1	1	EB	51	1.3	F	0.9800			
85	E1	EF/1	1	EB	49	1.1	F	0.9350			
86	E1	EF/1	1	CCG	65	2.8	J/A	1.0196			
87	E1	EF/1	2	EB	57	1.7	F	0.9180			
88	E1	EF/1	2	EB	95	9.6	F	1.1197			
89	E1	EF/1	2	EB	84	7.4	F	1.2485			
90	E1	EF/1	2	EB	56	2.1	F	1.1958			
91	E1	EF/1	2	EB	78	5.3	F	1.1168			
92	E1	EF/1	2	EB	58	1.8	F	0.9225			
93	E1	EF/1	2	EB	51	1.4	F	1.0554			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
94	E1	EF/1	2	EB	50	1.4	F	1.1200			
95	E1	EF/1	2	EB	60	2.5	F	1.1574			
96	E1	EF/1	2	EB	48	1.1	F	0.9946			
97	E1	EF/1	2	EB	60	2.9	F	1.3426			
98	E1	EF/1	2	EB	50	1.7	F	1.3600			
99	E1	EF/1	2	EB	52	1.6	F	1.1379			
100	E1	EF/1	2	EB	44	0.8	F	0.9391			
101	E1	EF/1	2	EB	37	0.5	F	0.9871			
102	E1	EF/1	2	EB	40	0.8	F	1.2500			
103	E1	EF/1	2	EB	44	0.9	F	1.0565			
104	E1	EF/1	2	EB	53	1.4	F	0.9404			
105	E1	EF/1	2	EB	58	2.0	F	1.0251			
106	E1	EF/1	2	EB	53	1.7	F	1.1419			
107	E1	EF/1	2	EB	70	3.4	F	0.9913			
108	E1	EF/1	2	EB	74	4.0	F	0.9871			
109	E1	EF/1	2	EB	75	5.3	F	1.2563			
110	E1	EF/1	2	EB	47	0.8	F	0.7705			
111	E1	EF/1	2	EB	50	1.6	F	1.2800			
112	E1	EF/1	2	EB	50	1.3	F	1.0400			
113	E1	EF/1	2	EB	52	1.3	F	0.9246			
114	E1	EF/1	2	EB	45	1.2	F	1.3169			
115	E1	EF/1	2	EB	49	1.5	F	1.2750			
116	E1	EF/1	2	EB	46	0.9	F	0.9246			
117	E1	EF/1	2	EB	76	4.9	F	1.1162			
118	E1	EF/1	2	EB	54	1.6	F	1.0161			
119	E1	EF/1	2	EB	52	2.1	F	1.4935			
120	E1	EF/1	2	EB	79	4.7	F	0.9533			
121	E1	EF/1	2	EB	56	2.0	F	1.1388			
122	E1	EF/1	2	EB	54	1.5	F	0.9526			
123	E1	EF/1	2	EB	60	2.5	F	1.1574			
124	E1	EF/1	2	EB	42	0.8	F	1.0798			
125	E1	EF/1	2	EB	53	1.6	F	1.0747			
126	E1	EF/1	2	EB	58	1.9	F	0.9738			
127	E1	EF/1	2	EB	56	1.8	F	1.0250			
128	E1	EF/1	2	EB	56	2.1	F	1.1958			
129	E1	EF/1	2	EB	62	2.4	F	1.0070			
130	E1	EF/1	2	EB	44	0.9	F	1.0565			
131	E1	EF/1	2	EB	57	1.7	F	0.9180			
1	E2	MT/10	1	NFC				#DIV/0!			1 leech
1	E2	MT/11	1	RSC	50	1.5	J/A	1.2000			3 leech, 1 dragonfly nymph
1	E2	MT/12	1	NFC				#DIV/0!			leech, beetles
1	E2	MT/14	1	NFC				#DIV/0!			no record in notes
1	E2	MT/9	1	RSC	54	1.6	J/A	1.0161			
2	E2	MT/11	1	RSC	58	2.3	J/A	1.1788			
2	E2	MT/9	1	RSC	56	2.1	J/A	1.1958			
3	E2	MT/11	1	RSC	55	1.7	J/A	1.0218			
3	E2	MT/9	1	RSC	64	2.8	J/A	1.0681			
4	E2	MT/11	1	RSC	56	2.2	J/A	1.2527			
4	E2	MT/9	1	RSC	60	2.3	J/A	1.0648			
5	E2	MT/11	1	RSC	55	2.0	J/A	1.2021			
5	E2	MT/9	1	RSC	64	3.1	J/A	1.1826			
6	E2	MT/11	1	RSC	62	2.8	J/A	1.1749			
6	E2	MT/9	1	RSC	61	2.6	J/A	1.1455			
7	E2	MT/11	1	RSC	62	3.1	J/A	1.3007			
7	E2	MT/9	1	RSC	64	3.1	J/A	1.1826			
8	E2	MT/11	1	RSC	54	1.6	J/A	1.0161			
8	E2	MT/9	1	RSC	69	3.4	J/A	1.0350			
9	E2	MT/11	1	RSC	50	1.2	J/A	0.9600			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
9	E2	MT/9	1	RSC	69	3.3	J/A	1.0045			
10	E2	MT/11	1	RSC	60	2.2	J/A	1.0185			
10	E2	MT/9	1	RSC	60	2.4	J/A	1.1111			
11	E2	MT/11	1	RSC	50	1.3	J/A	1.0400			
11	E2	MT/9	1	RSC	55	1.8	J/A	1.0819			
12	E2	MT/11	1	RSC	58	1.9	J/A	0.9738			
12	E2	MT/9	1	RSC	51	1.6	J/A	1.2062			
13	E2	MT/11	1	RSC	56	1.8	J/A	1.0250			
13	E2	MT/9	1	RSC	75	5.1	J/A	1.2089			
14	E2	MT/11	1	RSC	52	1.8	J/A	1.2802			
14	E2	MT/9	1	RSC	45	1.4	J/A	1.5364			
15	E2	MT/11	1	RSC	56	2.0	J/A	1.1388			
15	E2	MT/9	1	RSC	57	2.3	J/A	1.2419			
16	E2	MT/11	1	RSC	52	1.6	J/A	1.1379			
16	E2	MT/9	1	RSC	54	1.5	J/A	0.9526			
17	E2	MT/11	1	RSC	54	1.7	J/A	1.0796			
17	E2	MT/9	1	RSC	55	1.9	J/A	1.1420			
18	E2	MT/11	1	RSC	49	1.2	J/A	1.0200			
18	E2	MT/9	1	RSC	60	2.4	J/A	1.1111			
19	E2	MT/9	1	RSC	62	2.6	J/A	1.0909			
20	E2	MT/9	1	RSC	52	1.5	J/A	1.0668			
21	E2	MT/9	1	RSC	56	1.9	J/A	1.0819			
22	E2	MT/9	1	RSC	56	2.0	J/A	1.1388			
23	E2	MT/9	1	RSC	54	1.8	J/A	1.1431			
24	E2	MT/9	1	RSC	56	2.1	J/A	1.1958			
25	E2	MT/9	1	RSC	66	3.2	J/A	1.1131			
26	E2	MT/9	1	RSC	62	2.6	J/A	1.0909			
27	E2	MT/9	1	RSC	57	2.2	J/A	1.1879			
28	E2	MT/9	1	RSC	55	1.9	J/A	1.1420			
29	E2	MT/9	1	RSC	54	1.7	J/A	1.0796			
30	E2	MT/9	1	RSC	56	2.1	J/A	1.1958			
31	E2	MT/9	1	RSC	60	2.1	J/A	0.9722			
32	E2	MT/9	1	RSC	60	2.4	J/A	1.1111			
33	E2	MT/9	1	RSC	58	2.1	J/A	1.0763			
34	E2	MT/9	1	RSC	52	1.6	J/A	1.1379			
35	E2	MT/9	1	RSC	64	2.9	J/A	1.1063			
36	E2	MT/9	1	RSC	45	0.8	J/A	0.8779			
1	E3	MT/16	1	LSU	63	2.5	J/A	0.9998			1 scud
1	E3	MT/17	1	RSC	89	8.5	J/A	1.2057			snails
1	E3	MT/18	1	RSC	53	1.7	J/A	1.1419	R28 F7		
1	E3	MT/19	1	LSU	59	2.1	J/A	1.0225	R28 F8		
1	E3	MT/20	1	LSU	53	1.5	J/A	1.0075			
2	E3	MT/16	1	LSU	60	2.4	J/A	1.1111			
3	E3	MT/16	1	LSU	66	3.4	J/A	1.1826			
4	E3	MT/16	1	LSU	59	2.1	J/A	1.0225			
5	E3	MT/16	1	LSU	56	1.8	J/A	1.0250			
6	E3	MT/16	1	LSU	49	1.3	J/A	1.1050			
7	E3	MT/16	1	LSU	56	1.8	J/A	1.0250			
8	E3	MT/16	1	LSU	56	2.0	J/A	1.1388			
9	E3	MT/16	1	LSU	57	2.2	J/A	1.1879			
10	E3	MT/16	1	LSU	52	1.6	J/A	1.1379			
11	E3	MT/16	1	LSU	53	1.7	J/A	1.1419			
12	E3	MT/16	1	LSU	51	1.5	J/A	1.1308			
13	E3	MT/16	1	LSU	45	1.1	J/A	1.2071			
14	E3	MT/16	1	LSU	54	1.7	J/A	1.0796			
15	E3	MT/16	1	LSU	49	1.3	J/A	1.1050			
16	E3	MT/16	1	LSU	54	1.6	J/A	1.0161			
17	E3	MT/16	1	LSU	54	1.7	J/A	1.0796			
18	E3	MT/16	1	LSU	54	1.8	J/A	1.1431			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
19	E3	MT/16	1	LSU	54	1.7	J/A	1.0796			
20	E3	MT/16	1	LSU	48	1.2	J/A	1.0851			
21	E3	MT/16	1	LSU	49	1.2	J/A	1.0200			
22	E3	MT/16	1	LSU	52	1.3	J/A	0.9246			
23	E3	MT/16	1	LSU	51	1.3	J/A	0.9800			
24	E3	MT/16	1	RSC	40	0.7	J/A	1.0938			
25	E3	MT/16	1	RSC	49	1.3	J/A	1.1050			
1	H00	MT/1	1	LSU	63	2.4	J/A	0.9598			
2	H00	MT/1	1	LSU	96	10.0	J/A	1.1303			
3	H00	MT/1	1	CRH	110	20.4	J/A	1.5327			
4	H00	MT/2	1	NFC				#DIV/0!			
5	H00	MT/3	1	NFC				#DIV/0!			
6	H00	MT/4	1	NFC				#DIV/0!			
7	H00	MT/5	1	NFC				#DIV/0!			
8	H00	MT/6	1	NFC				#DIV/0!			
9	H00	MT/7	1	NFC				#DIV/0!			
10	H00	MT/8	1	EB	68	3.4	F	1.0813			
11	H00	MT/8	1	EB	73	3.8	F	0.9768			
12	H00	MT/8	1	EB	80	5.4	F	1.0547			
1	H01	EF/1	1	RSC	28	0.2	J/A	0.9111			
2	H01	EF/1	1	RSC	22	0.1	J/A	0.9391			
3	H01	EF/1	1	RSC	39	0.6	J/A	1.0115		R28 F1	
4	H01	EF/1	1	RSC	35	0.5	J/A	1.1662			
5	H01	EF/1	1	RSC	83	6.5	J/A	1.1368			
6	H01	EF/1	1	RSC	61	2.4	J/A	1.0574			
7	H01	EF/1	1	RSC	39	0.4	J/A	0.6743			
8	H01	EF/1	1	RSC	32	0.4	J/A	1.2207			
9	H01	EF/1	1	RSC	30	0.2	J/A	0.7407			
10	H01	EF/1	1	RSC	29	0.3	J/A	1.2301			
11	H01	EF/1	1	RSC	30	0.2	J/A	0.7407			
12	H01	EF/1	1	RSC	28	0.1	J/A	0.4555			
13	H01	EF/1	1	RSC	34	0.5	J/A	1.2721			
14	H01	EF/1	1	EB	71	4.0	F	1.1176			
15	H01	EF/1	1	EB	70	3.6	F	1.0496			
16	H01	EF/1	1	EB	70	3.9	F	1.1370			
17	H01	EF/1	1	EB	68	3.4	F	1.0813			
18	H01	EF/1	1	EB	66	2.9	F	1.0087			
19	H01	EF/1	1	EB	71	3.9	F	1.0897			
20	H01	EF/1	1	EB	71	4.3	F	1.2014			
21	H01	EF/1	1	EB	69	4.0	F	1.2176			
22	H01	EF/1	1	EB	70	3.5	F	1.0204			
23	H01	EF/1	1	EB	80	6.0	F	1.1719			
24	H01	EF/1	1	RSC	38	0.7	J/A	1.2757			
25	H01	EF/1	1	CCG	80	6.5	J/A	1.2695		R28 F2	
26	H01	EF/1	1	CCG	77	5.7	J/A	1.2485			
27	H01	EF/1	1	CCG	45	1.0	F	1.0974			
28	H01	EF/1	1	CCG	38	0.6	F	1.0935			
29	H01	EF/1	1	CCG	40	0.7	F	1.0938			
30	H01	EF/1	1	CCG	40	0.5	F	0.7813			
31	H01	EF/1	1	RSC	32	0.3	J/A	0.9155			
32	H01	EF/1	2	CCG	80	7.2	J/A	1.4063			
33	H01	EF/1	2	EB	64	2.8	F	1.0681			
34	H01	EF/1	2	RSC	34	0.5	J/A	1.2721			
35	H01	EF/1	2	RSC	34	0.5	J/A	1.2721			
36	H01	EF/1	2	RSC	34	0.4	J/A	1.0177			
37	H01	EF/1	2	CCG	45	1.0	F	1.0974			
38	H01	EF/1	2	CCG	41	0.8	F	1.1607			
39	H01	EF/1	2	CCG	42	0.7	F	0.9448			
40	H01	EF/1	2	CCG	40	0.7	F	1.0938			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
41	H01	EF/1	2	RSC	34	0.5	J/A	1.2721			
42	H01	EF/1	2	CCG	39	0.8	F	1.3486			
43	H01	EF/1	2	CCG	79	6.1	J/A	1.2372			
1	H02	EF/1	1	EB	69	3.7	F	1.1263			
2	H02	EF/1	1	EB	71	3.8	F	1.0617			
3	H02	EF/1	1	EB	70	4.1	F	1.1953			
4	H02	EF/1	1	EB	56	2.3	F	1.3097			
5	H02	EF/1	1	EB	68	2.9	F	0.9223			
6	H02	EF/1	1	EB	63	3.2	F	1.2798			
7	H02	EF/1	1	EB	66	3.2	F	1.1131			
8	H02	EF/1	1	EB	57	2.4	F	1.2959			
9	H02	EF/1	1	EB	63	2.8	F	1.1198			
10	H02	EF/1	1	CCG	75	5.9	J/A	1.3985			
11	H02	EF/1	1	CCG	75	5.2	J/A	1.2326			
12	H02	EF/1	1	CCG	71	4.2	J/A	1.1735			
13	H02	EF/1	1	EB	76	4.5	F	1.0251			
14	H02	EF/1	1	EB	59	2.3	F	1.1199			
15	H02	EF/1	1	CCG	44	1.0	F	1.1739			
16	H02	EF/1	1	CCG	46	1.1	F	1.1301			
17	H02	EF/1	1	CCG	90	10.4	J/A	1.4266			
18	H02	EF/1	1	EB	63	3.3	F	1.3198			
19	H02	EF/1	1	EB	68	4.0	F	1.2721			
20	H02	EF/1	1	EB	60	2.2	F	1.0185			
21	H02	EF/1	1	EB	71	3.9	F	1.0897			
22	H02	EF/1	1	EB	67	3.9	F	1.2967			
23	H02	EF/1	1	EB	62	2.5	F	1.0490			
24	H02	EF/1	1	EB	61	2.8	F	1.2336			
25	H02	EF/1	1	EB	67	4.0	F	1.3300			
26	H02	EF/1	1	EB	58	2.9	F	1.4863			
27	H02	EF/1	1	EB	55	1.6	F	0.9617			
28	H02	EF/1	1	EB	52	1.8	F	1.2802			
29	H02	EF/1	1	CCG	40	1.0	F	1.5625			
30	H02	EF/1	1	CCG	117	20.3	J/A	1.2675			
31	H02	EF/1	1	CCG	46	1.2	F	1.2328			
32	H02	EF/1	1	CCG	70	4.7	J/A	1.3703			
33	H02	EF/1	1	CCG	80	6.6	J/A	1.2891			
34	H02	EF/1	1	EB	74	4.6	F	1.1352			
35	H02	EF/1	1	EB	60	2.3	F	1.0648			
36	H02	EF/1	1	EB	67	3.3	F	1.0972			
37	H02	EF/1	1	EB	58	2.1	F	1.0763			
38	H02	EF/1	1	EB	71	3.7	F	1.0338			
39	H02	EF/1	1	EB	62	2.8	F	1.1749			
40	H02	EF/1	1	CCG	72	5.1	J/A	1.3664			
41	H02	EF/1	2	EB	66	3.1	F	1.0783			
42	H02	EF/1	2	CCG	41	1.2	F	1.7411			
43	H02	EF/1	2	EB	68	2.9	F	0.9223			
44	H02	EF/1	2	EB	61	2.7	F	1.1895			
45	H02	EF/1	2	EB	68	3.2	F	1.0177			
46	H02	EF/1	2	EB	64	2.9	F	1.1063			
47	H02	EF/1	2	EB	67	2.8	F	0.9310			
48	H02	EF/1	2	EB	72	4.3	F	1.1520			
49	H02	EF/1	2	CCG	30	0.6	F	2.2222			
1	H03	EF/1	1	EB	70	4.0	F	1.1662			
2	H03	EF/1	1	EB	65	3.0	F	1.0924			
3	H03	EF/1	1	EB	60	2.9	F	1.3426			
4	H03	EF/1	1	EB	67	3.7	F	1.2302			
5	H03	EF/1	1	EB	75	4.7	F	1.1141			
6	H03	EF/1	1	EB	56	2.1	F	1.1958			
7	H03	EF/1	1	EB	58	2.3	F	1.1788			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
8	H03	EF/1	1	EB	76	5.0	F	1.1390			
9	H03	EF/1	1	EB	59	2.2	F	1.0712			
10	H03	EF/1	1	EB	70	3.8	F	1.1079			
11	H03	EF/1	1	EB	65	3.1	F	1.1288			
12	H03	EF/1	1	EB	60	2.7	F	1.2500			
13	H03	EF/1	1	EB	71	4.0	F	1.1176			
14	H03	EF/1	1	EB	70	4.2	F	1.2245			
15	H03	EF/1	1	EB	70	4.3	F	1.2536			
16	H03	EF/1	1	EB	115	15.8	J/A	1.0389			
17	H03	EF/1	1	EB	65	3.1	F	1.1288			
18	H03	EF/1	2	EB	65	3.6	F	1.3109			
19	H03	EF/1	2	EB	70	3.5	F	1.0204			
20	H03	EF/1	2	EB	59	2.6	F	1.2660			
21	H03	EF/1	2	EB	63	2.9	F	1.1598			
22	H03	EF/1	2	EB	64	2.7	F	1.0300			
1	H04	EF/1	1	EB	66	2.8	F	0.9739			
2	H04	EF/1	1	EB	66	3.1	F	1.0783			
3	H04	EF/1	1	EB	57	2.4	F	1.2959			
4	H04	EF/1	1	EB	75	4.8	F	1.1378			
5	H04	EF/1	1	EB	67	3.6	F	1.1970			
6	H04	EF/1	1	EB	69	3.8	F	1.1567			
7	H04	EF/1	1	EB	70	3.8	F	1.1079			
8	H04	EF/1	1	EB	63	3.0	F	1.1998			
9	H04	EF/1	1	EB	66	3.2	F	1.1131			
1	H05	EF/1	1	EB	79	4.9	F	0.9938			
2	H05	EF/1	1	EB	64	3.1	F	1.1826			
3	H05	EF/1	1	EB	68	3.8	F	1.2085			
4	H05	EF/1	1	EB	64	2.7	F	1.0300			
5	H05	EF/1	2	EB	57	2.3	F	1.2419			
1	H06	EF/1	1	EB	71	3.8	F	1.0617			
2	H06	EF/1	1	EB	62	2.5	F	1.0490			
3	H06	EF/1	1	EB	70	3.3	F	0.9621			
4	H06	EF/1	1	EB	70	3.8	F	1.1079			
5	H06	EF/1	1	EB	66	2.6	F	0.9044			
6	H06	EF/1	1	EB	70	3.3	F	0.9621			
7	H06	EF/1	1	EB	73	4.1	F	1.0539			
8	H06	EF/1	1	EB	71	3.5	F	0.9779			
9	H06	EF/1	1	EB	171	53.6	J/A	1.0720			
10	H06	EF/1	1	BT	145	30.5	J/A	1.0005			
11	H06	EF/1	2	EB	56	2.4	F	1.3666			
12	H06	EF/1	2	EB	68	3.3	F	1.0495			
13	H06	EF/1	2	EB	70	3.8	F	1.1079			
14	H06	EF/1	2	EB	61	2.1	F	0.9252			
15	H06	EF/1	2	EB	77	4.9	F	1.0733			
1	H07	EF/1	1	EB	155	38.7	J/A	1.0392			
2	H07	EF/1	1	EB	136	29.3	J/A	1.1648			
3	H07	EF/1	1	BT	130	22.7	J/A	1.0332			
4	H07	EF/1	1	BT	144	31.1	J/A	1.0415			
5	H07	EF/1	2	NFC				#DIV/0!			
1	H08	EF/1	1	BT	104	11.5	J/A	1.0223			
2	H08	EF/1	1	BT	115	15.5	J/A	1.0192			
3	H08	EF/1	1	BT	110	13.0	J/A	0.9767			
4	H08	EF/1	1	BT	108	12.8	J/A	1.0161			
5	H08	EF/1	1	BT	106	11.8	J/A	0.9908			
6	H08	EF/1	1	BT	92	8.2	J/A	1.0531			
7	H08	EF/1	1	EB	248	164.0	J/A	1.0752			
8	H08	EF/1	2	NFC				#DIV/0!			
1	H09	EF/1	1	BT	99	10.2	J/A	1.0512			
2	H09	EF/1	1	BT	95	9.2	J/A	1.0730			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
3	H09	EF/1	1	EB	155	37.2	J/A	0.9990			
4	H09	EF/1	1	EB	260		J/A				escaped
1	H10	EF/1	1	NFC				#DIV/0!			
1	H11	EF/1	1	NFC				#DIV/0!			
1	H12	EF/1	1	NFC				#DIV/0!			
1	H13	EF/1	1	NFC				#DIV/0!			
1	L1	EF/1	1	EB	61	2.3	F	1.0133			
2	L1	EF/1	1	EB	60	2.2	F	1.0185			
3	L1	EF/1	1	EB	58	2.5	F	1.2813			
4	L1	EF/1	1	EB	67	3.2	F	1.0640			
5	L1	EF/1	1	EB	65	3.1	F	1.1288			
6	L1	EF/1	1	EB	48	1.2	F	1.0851			
7	L1	EF/1	1	EB	67	3.1	F	1.0307			
8	L1	EF/1	1	EB	60	2.5	F	1.1574			
9	L1	EF/1	1	EB	61	2.6	F	1.1455			
10	L1	EF/1	1	EB	67	3.7	F	1.2302			
11	L1	EF/1	1	EB	66	3.2	F	1.1131			
12	L1	EF/1	1	EB	68	3.5	F	1.1131			
13	L1	EF/1	1	EB	60	2.5	F	1.1574			
14	L1	EF/1	1	EB	69	3.4	F	1.0350			
15	L1	EF/1	1	EB	71	4.5	F	1.2573			
16	L1	EF/1	1	EB	68	3.6	F	1.1449			
17	L1	EF/1	1	EB	60	2.1	F	0.9722			
18	L1	EF/1	1	EB	75	4.5	F	1.0667			
19	L1	EF/1	1	EB	70	3.4	F	0.9913			
20	L1	EF/1	1	EB	65	2.9	F	1.0560			
21	L1	EF/1	1	EB	61	2.5	F	1.1014			
22	L1	EF/1	1	EB	71	4.4	F	1.2294			
23	L1	EF/1	1	EB	75	4.7	F	1.1141			
24	L1	EF/1	1	EB	69	3.2	F	0.9741			
25	L1	EF/1	1	EB	66	3.1	F	1.0783			
26	L1	EF/1	1	EB	68	3.1	F	0.9859			
27	L1	EF/1	1	EB	61	2.3	F	1.0133			
28	L1	EF/1	1	EB	62	2.8	F	1.1749			
29	L1	EF/1	1	EB	61	2.7	F	1.1895			
30	L1	EF/1	1	EB	76	4.7	F	1.0707			
31	L1	EF/1	1	EB	75	4.8	F	1.1378			
32	L1	EF/1	1	EB	68	3.3	F	1.0495			
33	L1	EF/1	1	EB	68	3.4	F	1.0813			
34	L1	EF/1	1	EB	140	34.1	J/A	1.2427			
35	L1	EF/1	1	EB	69	3.5	F	1.0654			
36	L1	EF/1	1	EB	70	3.8	F	1.1079			
37	L1	EF/1	1	EB	65	2.7	F	0.9832			
38	L1	EF/1	1	EB	70	3.1	F	0.9038			
39	L1	EF/1	1	EB	60	2.2	F	1.0185			
40	L1	EF/1	1	EB	69	4.0	F	1.2176			
41	L1	EF/1	1	EB	59	2.2	F	1.0712			
42	L1	EF/1	1	EB	59	2.2	F	1.0712			
43	L1	EF/1	1	EB	64	2.9	F	1.1063			
44	L1	EF/1	1	EB	70	3.3	F	0.9621			
45	L1	EF/1	1	EB	65	3.1	F	1.1288			
46	L1	EF/1	1	EB	73	4.2	F	1.0796			
47	L1	EF/1	1	EB	65	3.2	F	1.1652			
48	L1	EF/1	1	EB	73	4.4	F	1.1311			
49	L1	EF/1	1	EB	57	2.0	F	1.0800			
50	L1	EF/1	1	EB	70	3.6	F	1.0496			
51	L1	EF/1	1	EB	56	1.7	F	0.9680			
52	L1	EF/1	1	EB	55	1.7	F	1.0218			
53	L1	EF/1	1	EB	62	2.6	F	1.0909			

Fish	Site #	Method/#	H/P	Species	Len (mm)	Weight (g)	Life Stage	Condition	Voucher	Photo	Comments
54	L1	EF/1	2	EB	67	3.0	F	0.9975			
55	L1	EF/1	2	EB	62	2.6	F	1.0909			
56	L1	EF/1	2	EB	62	2.6	F	1.0909			
57	L1	EF/1	2	EB	69	3.2	F	0.9741			
58	L1	EF/1	2	EB	59	2.2	F	1.0712			
59	L1	EF/1	2	EB	69	3.5	F	1.0654			
60	L1	EF/1	2	EB	67	2.9	F	0.9642			
61	L1	EF/1	2	EB	55	1.7	F	1.0218			
62	L1	EF/1	2	EB	93	10.1	F	1.2557			
63	L1	EF/1	2	EB	54	1.7	F	1.0796			
64	L1	EF/1	2	EB	55	1.8	F	1.0819			
65	L1	EF/1	2	EB	65	2.7	F	0.9832			
66	L1	EF/1	2	EB	61	2.6	F	1.1455			
67	L1	EF/1	2	EB	70	3.5	F	1.0204			
68	L1	EF/1	2	EB	63	2.3	F	0.9198			
69	L1	EF/1	2	EB	53	1.5	F	1.0075			
70	L1	EF/1	2	EB	52	1.7	F	1.2090			
71	L1	EF/1	2	EB	47	1.3	F	1.2521			
72	L1	EF/1	2	EB	57	2.0	F	1.0800			
1	L2	EF/1	1	NFC				#DIV/0!			