1997 TULAMEEN RIVER WATERSHED STREAM RESTORATION

FINAL REPORT

Prepared for:

MINISTRY OF ENVIRONMENT, LANDS AND PARKS, PENTICTON, B.C.

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Reference: **1997 Tulameen River Watershed Stream Enhancement Final Report.**
File No.: 1080-20 FRBC 98-29

Attention: **Mr. Steve Matthews, Fisheries Biologist**
Fisheries Management Program

Dear Mr. Matthews;

IRC Integrated Resource Consultants Inc. are pleased to present four hardcopies (including one unbound copy) and one electronic version of our final report of the 1997 Tulameen River Watershed Stream Restoration Project. The electronic version of our report is in Microsoft Word version 6.0 and the tables and relative appendices are in Microsoft Excel version 5.0. The electronic version of the T.R.I.M. maps which were included in the 1996 Tulameen River Watershed Stream Assessment project will be updated with information including the location of sample sites, restoration sites, and fish migration barriers as soon as the maps are forwarded to us.

Please call me at your convenience if you have any questions or would like to discuss the contents of this submission.

Yours truly,

Len Fanning, R.P. Bio.
Senior Biologist, Principal

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1.0 INTRODUCTION

Forest Renewal B.C. (FRBC) encompasses a number of interests which have the ultimate intention of renewing forest resources and achieving environmental sustainability for B.C. FRBC is a unique corporation which relies upon a positive working partnership between government agencies, forest companies, forest workers, environmental groups, First Nations, and local communities. FRBC's strategic investment priorities are to renew, restore and protect the forests, invest in forest worker training and create more jobs, as well as strengthening local forest communities.

The funding priorities encompassed by FRBC include Land and Resources, Value Added, Workforce, Communities, and Environment. The Watershed Restoration Program (WRP) included under the Environment category was responsible for funding the 1997 Tulameen River Watershed Stream Restoration Project. The Ministry of Environment, Lands and Parks (MOELP) was the lead proponent for the project.

In 1996, IRC Integrated Resource Consultants Inc. (IRC) conducted a stream assessment of the Tulameen River watershed under the auspices of MOELP as part of WRP. The stream assessment project which included a fish inventory of the Tulameen River and eleven tributaries was intended to assess the impacts from forest harvesting in the watershed, as well as the effect of an extreme flood event which had occurred in November 1995. The 1996 Tulameen River Watershed Stream Assessment report included prioritized recommendations for stream restoration by reach of the Tulameen River and eleven tributaries.

IRC was contracted on 21 July 1997 by the MOELP, Penticton to design and implement stream restoration strategies in the Tulameen River watershed as per the recommended strategies put forth in the 1996 Tulameen River Watershed Stream Assessment (IRC 1997). The restoration portion of the project was comprised of two main components: Granite Creek stream enhancement and Granite Creek headwaters native riparian planting. Granite Creek which was given a priority rating of 'Moderate' in the 1996 Tulameen River Watershed Stream Assessment was chosen for stream restoration due to a number of factors: the need for stream restoration and bank stabilization; a limited budget; and the importance of establishing a test restoration site. Indicators of stream disturbance present in this reach of Granite Creek included extensive riffle zones, unvegetated mid and side channel bars, and bank erosion. Restoration costs involving large equipment were minimized at this site due to easy access from Arrastra Creek Road. The site can also be easily relocated and monitored for success in the future.

As well as conducting the aforementioned stream restoration components, additional data was collected on some watercourses in the Tulameen River watershed. A fish inventory and habitat assessment was conducted at two sites in Spearing Creek to complete the data set which was collected in 1996. Presence/ absence surveys were

conducted on Jim Kelly Creek and Olivine Creek upstream of the fish migration barriers and water quality analyses were conducted on the Tulameen River and ten of the eleven tributaries which were assessed the previous year.

The Granite Creek headwaters native riparian tree and shrub planting program was intended to provide improved cover for Rainbow trout (*Oncorhynchus mykiss*) which were documented during the 1996 survey. The Granite Creek headwaters had previously been logged and in some areas clearcuts extended to the banks of the stream leaving little or no vegetation to provide cover. The logged areas in the Granite Creek headwaters had been replanted with deciduous pine saplings which would not be capable of providing adequate cover for a number of years.

Fish habitat enhancement and bank stabilization was conducted in a portion of Granite Creek as an informal demonstration project to evaluate the effectiveness of various enhancement treatments. A total of four eroding banks were stabilized with logs, rootwads and woody debris anchored with galvanized steel cable. Fish habitat enhancement included stabilizing additional woody debris instream and planting nursetrees in barren sand, gravel and cobble bars to promote vegetation growth. Nursetrees are those, in this case, juvenile trees which are thinned from flourishing stands to be replanted or 'buried' horizontally in a trough approximately 0.50 m deep with the intention of stimulation growth of sapling trees.

2.0 METHODS

2.1 Spearing Creek Fish Inventory and Habitat Assessment

The Spearing Creek fish inventory and habitat assessment which was conducted on 9 August 1997 was analogous to the fish inventory and habitat assessment conducted during the 1996 Tulameen River Watershed Stream Assessment. Two sites were chosen on Spearing Creek for the 1997 fish inventory and habitat assessment as one site (Site 1) had previously been sampled during 1996 on Spearing Creek. Site 1 represented the lowest reach of Spearing Creek. Site 2 was chosen to represent the middle reaches of Spearing Creek and Site 3 was chosen to represent the upper reaches.

2.1.1 Field Survey

The fish inventory included two passes with a 24 volt Smith-Root backpack electroshocker which were made over the two 100 m sites isolated by 25 m beach seine nets. The lead line of the net was anchored with cobble and the float line was propped out of the water with forked poles. Captured fish were anesthetized with MS-222, weighed with an Ohaus portable electronic scale, model number S200-02U ($\pm$ 0.001 gram) and measured with a standard ruler ($\pm$ 0.001 metres). GPS coordinates,

accurate to within 1 m post corrected, were determined with a Trimble Pathfinder for each site.
The habitat assessment, in association with the fish inventory, was conducted on 9 August 1997 at Site 2 and Site 3 on Spearing Creek. Detailed measurements of habitat characteristics for 100 metres of stream were made at intervals of 10 metres. A cross section of habitat was described at the 10 metres intervals from 0 metres (downstream) to 100 m (upstream) for a total of 11 cross section descriptions for each site. Data collected from each cross section was comparable to that of the Department of Fisheries and Oceans (DFO) /MOELP Stream Summary Forms.

Bankfull and wetted widths were measured with a hand held 100 metre tape (± 0.01 metres) and bankfull depth was measured with a metre stick (± 0.001 metres). Wetted depth was measured at approximately ¼, ½, and ¾ of the total wetted width with a standard ruler (± 0.001 metres). Pool depths were measured with a metre stick when too deep for the ruler. Percent canopy and riparian vegetation cover was estimated for the 10 metre interval below each cross section. Percent cover was estimated to represent cover provided by foliage during the summer months. The predominant canopy and riparian species were recorded for the 10 metre segments associated with each cross section. Large woody debris (LWD) within the bankfull width was quantified in the 10 metres downstream of each cross section. Percent cover of LWD referred to the percent of wetted width covered by the LWD in the 10 metres downstream of each cross section. LWD present but outside the bankfull width were noted. The percent composition of substrate type within the bankfull width was estimated for the 10 metres downstream of each cross section. Substrate type was determined visually using the following estimates extracted from FRBC Fish-stream Identification Guidebook (1995):

Symbol	Substrate Type	Substrate Description
br	bedrock	
bd	boulder	> 256 millimetres
cb	cobble	64- 256 millimetres
gr	gravel	2- 64 millimetres
sd	sand	0.0625- 2 millimetres
fn	fines (silt, clay)	< 0.0625 millimeters

Bank descriptions are associated with the 10 metres downstream of each cross-section for which they were recorded. Banks were designated right or left while facing downstream. Biological and physical characteristics such as riparian vegetation, mammal evidence, banks, floodplains, and side channels were described.

Habitat types within each 100 metre site were described. Percent gradient (slope) of each site was measured with a Suunto clinometer (PM-5/360 PC). Where vegetation was too dense or the stream meandered so as to prevent the gradient from being measured in one reading, a number of readings were recorded.

2.1.2 Preliminary Analysis

The analysis of fish data included the determination of mean fork lengths and weights as well as the associated standard deviations for each species captured at each site. Fish density (Number of individuals/ area) was calculated for all species in each of the sample sites using species population numbers and average area (m^2). The average area was calculated from measurements recorded during the habitat assessment. Fishing efficiency, a value defining the number of fish captured relative to the actual number of fish located in the specific area, was estimated at 1.0 for all sites (a value of 0.5 indicates that for every one fish captured, two fish would actually be present in that area).

A Condition Factor value which measured the plumpness or condition of Rainbow trout was calculated from length and weight measurements as follows:

$$CF = (W \times 100) / L^b$$

where: CF = Condition Factor
W = Weight in grams
L = Length in centimetres
100 = A constant placing the CF value closer to unity

(Ricker, 1975; Klak, 1942).

2.2 Fish Presence/ Absence Survey

2.2.1 Jim Kelly Creek

Jim Kelly Creek was surveyed on 7 August 1997 for fish presence/ absence. A 6.5 m falls was located 750 m upstream from the confluence with the Tulameen River. A 15 m falls was located 280 m upstream from the 6.5 m falls. Both falls present an upstream migration barrier to all fish. A GPS coordinate for a reference point (dry creek) accurate to within 1 m post corrected, was determined with a Trimble Pathfinder in order to accurately map and relocate the migration barriers.

The creek was electrofished with a 24 volt Smith-Root backpack electroshocker for a distance of 720 m upstream from the 15 m falls capturing no fish. Fish absence in Jim Kelly Creek upstream of the 6.5 m falls is likely (MoF, MoELP 1995).

2.2.2 Olivine Creek

Olivine Creek was surveyed on 8 August 1997 for fish presence/ absence. A 10 m falls located 400 m upstream from the mouth of the creek which was identified in the 1996 Tulameen River Watershed Stream Assessment was located in the field. GPS

coordinates, accurate to within 1 m post corrected were determined for the falls with Trimble Pathfinder.
Olivine Creek was electrofished for a distance of 1 km upstream from the falls with a 24 volt Smith-root backpack electroshocker. Fish absence in Olivine Creek upstream of the 10 m falls is likely (MoF, MOELP 1995).

2.3 Water Quality

Water samples were collected from two sites in the Tulameen River and Otter Creek for a total of four samples. These sites were strategically chosen so as to accumulate water quality data with respect to the surrounding environment. Water samples from the nine remaining tributaries were collected on 10 August 1997 from easily accessible sites located as close to the mouth of the creek as possible.

At each water sample site data which included temperature, pH, specific conductance, salinity, dissolved oxygen, redox and turbidity was collected with a Hydrolab DataSonde 3. The water samples were stored on ice packs in coolers and transported on 11 August 1997 to CanTest Analytical Laboratory Ltd. in Vancouver. Each water sample was analyzed for inorganic nutrient concentrations including soluble reactive phosphorus (SRP) and Nitrate-nitrogen (N). Additional analyses for biological oxygen demand (BOD), fecal coliform and *Escherichia coli* (E. coli) were conducted on the two samples collected from Otter Creek.

2.4 Native Riparian Vegetation Planting In Granite Creek

Native riparian tree and shrub species were planted in the headwaters of Granite Creek in areas which had suffered significant disturbance or loss of riparian vegetation due to improper logging practices. Twenty six planting sites were established along the banks of Granite Creek upstream from Granite Creek Road and one planting site was established in a separate clearcut beyond a forested area downstream from Granite Creek Road.

Tree and shrub species which were planted at each site were dependent upon aspect, existing cover, bank stability, substrate, width of stream and flow characteristics. The number of specimens planted depended upon habitat characteristics such as stream sinuosity, amount and type of existing vegetation, existing stream cover and potential stream cover. Vegetation was not planted in areas with signs of prolonged and/ or frequent disturbance by cattle as survival in these areas was expected to be low.

The trees and shrubs, which were purchased as plugs, bare-root bands, and in one gallon pots, were planted approximately 0.5- 1.0 m apart in clusters of 8 to 32 specimens per site. The sites ranged from 8 to 15 m in length and extended a maximum distance of 2.0 m inland from the top of each bank. Soil was added to areas of the bank which had suffered erosion, consisted mainly of sand, or where soil was

unavailable due to dense roots (mainly *Carex* sp.). Rootwads were moistened prior to planting and all vegetation planted was watered at the end of each day. Slow release fertilizer briquettes which provide nutrients for a period of six to eight months were inserted into the soil adjacent to the plants.

2.5 Fish Habitat Enhancement and Bank Stabilization in Granite Creek

Fish habitat enhancement in Granite Creek included a variety of enhancement techniques including logjam manipulation, LWD placement and stabilization and the planting of Red alder and Black Cottonwood nursetrees into cobble/ gravel bars. A Mitsubishi 250 excavator was utilized to carry out the majority of the works during the period of 25-26 September 1997. Anchoring of the features with 3/4 inch galvanized steel cable was conducted on 20 October 1997. The location of the fish habitat enhancement and bank stabilization efforts was located 8800 m upstream from the confluence with Tulameen River. Access to this location from Coalmont included traveling south for distance of 6 km on the Blakeburn Creek logging road and 8.2 km on the Arrastra Creek logging road. Stream restoration techniques and/ or combinations of techniques were implemented at six 'sections' in Granite Creek. The entire site including the six sections extended for a distance of approximately 400 m.

In order to minimize the detrimental effects to fish during this project, the entire work site which extended for approximately 400 m, was electroshocked and the fish salvaged. Fish barrier nets were secured upstream and downstream of the work site to ensure the fish would not re-enter the site. The salvaged fish were relocated downstream of the work site.

Section 1 which consisted of 40 m of eroding bank located on the east bank opposite the access road was protected with dry logs purchased from Weyerhauser Canada Ltd. On 25 September 1997, two logs at a time were positioned by the excavator, hand drilled at two points, and secured together with 5/8" rebar. The average diameter of the logs was approximately 0.30 m and the average length was approximately 10 m. Additional logs and two rootwads were placed along the bank and braced with boulders at the outlet of a dry side channel. The logs placed at the side channel had a slightly larger diameter and were somewhat shorter than those placed along the east bank. The logs were anchored on 20 October 1997 to trees atop the bank with 3/4" galvanized steel cable.

Section 2 consisted of a cobble/ gravel bar located at the access road to the river bed from kilometer 6.5 of the Arrastra Creek logging road. Three rootwads were placed on the cobble/ gravel bar with the rootwad end facing upstream so as to trap woody debris, promote sediment deposition, and cause accretion of the west bank with the ultimate goal of stabilizing the creek channel and enhancing fish habitat. The partial trunk of the rootwad was embedded into the bar at an angle of approximately 45^{o}. To assure stability, the rootwads were anchored to 'deadmen' also embedded into the bank

at an upstream angle of 45° and at a distance of 2 m upstream of the rootwads. The deadmen consisted of logs cut to a length of 2 m and buried to a depth of 1.3 m. The LWD was placed on 26 September 1997 and was anchored on 20 October 1997 with ¾ inch galvanized steel cable.

Black cottonwood and Red alder nursetrees were buried in the gravel/ cobble bar on the west bank to a depth of 0.50 m. A trench of approximately 4 m in length and 1 m in width was excavated and the nursetrees were inserted.

Section 3 which is located downstream of the access road consisted of an eroding bank and the entrance to a dry side channel. Five large rootwads were placed on 25 September 1997 by the excavator along the toe of the eroding bank with the rootwads facing instream. Logs which were placed on top of the rootwads and additional logs purchased from Weyerhauser Canada extended across the entrance to the dry channel immediately downstream of the eroding bank. These logs were intended to deflect flow away from the entrance to the side channel and logging road at the west bank. The rootwads placed at the toe of the bank and logs placed across the mouth of the dry side channel were secured together by ¾ inch galvanized steel cable. Boulders and cobble were placed on top of the trunks of the rootwads on 20 October 1997 for stabilization as large rooted trees were not available to provide a sufficient anchor.

Section 4 which is located 100 m downstream of the access road consisted of a gravel bar and a logjam. Dry logs which were purchased from Weyerhauser Canada Ltd. were added to the logjam so as to prevent the flow from diverting into two channels. The logs were placed horizontally and were angled to deflect the flow, which would otherwise flow directly north, to flow northwest under the logjam. The logs which were placed at the logjam extended to protect the east bank at the site of, as well as upstream of the logjam. The logs were placed on 25 September 1997 at the logjam and were anchored to two large conifers on 20 October 1997 with ¾ inch galvanized steel cable.

One Red alder and two Black cottonwood nursetree cuttings were planted so as to encourage foliage growth on the gravel bar. A trough, 4 m in length and 1 m wide was excavated to a depth of 0.5 m and the nursetrees were inserted and buried.

Section 5 was located approximately 200 m downstream of the access road. A logjam in Section 5 consisted primarily of a large deciduous tree and intact rootwad. The tree was cut 2 m above the rootwad by the excavator and was relocated with other logs in the logjam to stabilize the adjacent west bank. The large (3 m dia.) rootwad cut from the log was anchored into the creek bed at its original location by partially burying the trunk of the tree at an upstream angle of approximately 45°. The logs were placed on 26 September 1997 along the west bank and anchored 20 October 1997 with ¾ inch galvanized steel cable to trees on top of the bank.

Section 6 consisted of small logs and woody debris from the logjam in Section 5 as well as woody debris on the dry stream bed in the proximity of the eroding east bank was pushed with the excavator to the base of the bank. The woody debris relocated to the east bank was intended to protect the bank and possibly provide fish habitat at higher flows.

A large coniferous tree which had previously fallen into the wetted width was located approximately 20 m downstream of Section 6. Although not officially included as part of the fish habitat enhancement project, the tree was anchored on 20 October 1997 to a large conifer atop the west bank with ¾ inch galvanized steel cable.

3.0 RESULTS AND DISCUSSION

3.1 Spearing Creek Fish Inventory and Habitat Assessment

A fish inventory and habitat assessment was conducted on 9 August 1997 at two sites in Spearing Creek (Figure 1- Sites 1 and 2). Tables 1 and 2 summarize the fish data collected in the field and the raw fish data is presented in Appendix B. A combined total of 211 Rainbow trout and 71 sculpins (*Cottus* spp.) were captured at the two sites.

Site 2, which was intended to represent the middle reaches of Spearing Creek, yielded 99 Rainbow trout and 22 sculpins. The mean fork length and mean weight for Rainbow trout captured in Site 2 were 80.7 mm and 10.88 g, respectively. These values fall within the range of values determined by IRC during the 1996 Tulameen River watershed stream assessment for all sites sampled. In 1996, Rainbow trout mean lengths ranged from 56 mm (Site 1, Olivine Creek) to 137 mm (Site 5, Otter Creek) and mean weights ranged from 3.72 g (Site 1, Olivine Creek) to 41.20 g (Site 5, Otter Creek). An exception was observed in Site 1, Spearing Creek in 1996 with a sample size of one Rainbow trout, fork length of 178 mm, and weight of 60.00 g. The mean condition factor for Rainbow trout captured in Site 2 was 1.05 g/cm^3. This condition factor value falls within the range of values reported by IRC during the 1996 Tulameen River watershed stream survey of which the lowest condition factor value for Rainbow trout was 0.96 g/cm^3 (Site 3, Otter Creek) and the highest value was 1.18 g/cm^3 (Site 3, Tulameen River).

Site 3, which was intended to represent the upper reaches of Spearing Creek, yielded 112 Rainbow trout and 49 sculpins. The mean fork length and mean weight for Rainbow trout captured in Site 3 were 74.8 mm and 11.55 g, respectively. These values fall within the range of mean fork length (56 mm- 137 mm) and mean weight values (3.72 g- 41.20 g) for Rainbow trout for all sites determined during the 1996 Tulameen River watershed stream assessment and were lower than values determined for Site 2, Spearing Creek. The mean condition factor for Rainbow trout captured in Site 3 is 1.12 g/cm^3. This condition factor value which falls within the range of values

reported in the 1996 Tulameen River Watershed Stream Survey (0.96 g/cm^3 and 1.18 g/cm^3) is higher than Site 2, Spearing Creek (1.05 g/cm^3).

In conjunction with the fish inventory, a habitat assessment was conducted on 9 August 1997 at Site 2 and Site 3. The habitat assessment was comparable to that conducted by IRC in the 1996 Tulameen River watershed stream survey. The data collected during the habitat survey is also included in Appendix B. Fish habitat at Site 2 was primarily characterized by riffle-glide habitat with pooling associated with the cutbanks. The substrate was dominated by cobble and gravel with some sand. Cover was provided to the creek by LWD instream and riparian vegetation including Red alder, Red-osier dogwood and Thimbleberry. The surrounding riparian vegetation provided fair cover during low flows (Photographs 1 and 2). Fish habitat at Site 3 was characterized by riffle-pool habitat. The substrate was dominated by cobble with some fines and few boulders. Riparian vegetation, primarily Red-osier dogwood, provided ample cover to the creek however LWD was sparse (Photographs 3 and 4).

3.2 Fish Presence/ Absence Survey

3.2.1 Jim Kelly Creek

A 6.5 m falls was located 750 m upstream from the mouth of Jim Kelly (Figure 1). The falls represented a complete barrier to upstream migration of all fish (Photograph 5). A second set of falls located 1030 m upstream from the mouth of the creek also represented a barrier to upstream migration to all fish. This set of falls had a height of 15 m. Although the 280 m length of creek between the two falls was not fished due to limited access and unsafe terrain, 'no fish' were expected to exist between the two falls due to the migration barriers. A total of 720 m upstream of the second set of falls were electroshocked and yielded 'no fish" confirming fish absence above the 15 m falls. Rainbow trout were present in Jim Kelly Creek from the mouth upstream to the 6.5 m falls, a distance of 750 m (IRC, 1996).

3.2.2 Olivine Creek

Olivine Creek was electrofished for a distance of 1 km upstream of a 10 m falls which was located approximately 1500 m upstream from its confluence with the Tulameen River (Figure 1). 'No fish' were captured during the survey which confirms fish absence above the falls (Photograph 6). Rainbow trout presence was confirmed below the falls during the 1996 Tulameen River Watershed Stream Assessment.

3.3 Water Quality

CanTest Analytical Laboratories in Vancouver received the water samples on 11 August 1997 and initiated analytical testing. Table 3 presents the results of the analysis for each parameter tested. In addition, in-situ data was collected with the Hydrolab

DataSonde 3 during the field survey and is included in Appendix C and summarized in Table 4.

The analytical work conducted by CanTest Analytical Laboratories included tests for nitrate and soluble reactive phosphorus (SRP) concentrations for all 13 sampling stations, and total BOD, fecal coliforms and E. coli. concentrations for the sampling locations on Otter Creek. As indicated in Table 3, all of the recorded nitrate levels were either non detectable or well below the limits for protection of aquatic life presented in the B.C. Environment Approved and Working Criteria for Water Quality - 1995, while the SRP concentrations were all below the analytical detection limits and the protection of aquatic life criteria. Of the two samples collected from Otter Creek, the sampling station near the confluence of Tulameen River registered levels in excess of the acceptable protection of aquatic life criteria for both fecal coliforms (100 MPN/100mL) and E. coli (78 MPN/100mL). These elevated levels are most likely due to cattle farming activities and residential land usage in and about Frembd and Otter lakes located upstream from this sampling location.

Data including temperature, pH, specific conductance, salinity, dissolved oxygen, redox, and turbidity was collected with a Hydrolab DataSonde 3. The data collection locations which correspond with the water sample collection sites are illustrated in Figure 1. The data collected is outlined in Table 4 and illustrated graphically in Figure 2 for all 13 of the sampling stations.

Water temperatures varied considerably during the study period depending on the watercourse and the sampling location. The lowest temperature recorded from the 13 sampling locations was 7.89° C at Site 2 on Otter Creek (OT-02). In contrast, the highest temperature was 17.45° C also recorded in Otter Creek at the confluence of the Tulameen River (OT-01). Within this region, the creek bed consisted primarily of rip-rap and the riparian cover was negligible. These factors, in addition to the fact that the water is slower moving near the mouth or confluence with the Tulameen River likely contributed to the elevated water temperature.

The temperature at TU-02 was 14.36° C while at TU-01 the temperature was 16.59°C. This 2.23°C increase in water temperature between the two sampling sites on the Tulameen River is likely due to the fact that there is relatively little riparian cover between the two sites which allows direct exposure to the sun.

The average pH value for the surveyed creeks was 7.82, which also represents the mean pH obtained at the Otter Creek sampling location near the confluence of the Tulameen River (OT-01). The lowest pH recording of 7.11 also occurred in Otter Creek at the upstream location (OT-02). The two highest pH values of 8.29 and 8.24 occurred in Asp Creek and Granite Creek respectively near their confluences with the Tulameen River.

Dissolved oxygen was also measured as part of the sampling program. As shown in the summary table, the mean dissolved oxygen concentration for all of the sampling locations was 9.83 mg/L which falls between the "slight" (9.0 mg/L) and "no production impairment" (11.0 mg/L) effects on salmonids in their embryo and larval stages as determined in the MOELP Approved and Working Criteria for Water Quality - 1995. The lowest dissolved oxygen concentrations of 8.47 mg/L (Tulameen River - TU-01), 8.86 mg/L (Otter Creek OT-02) and 8.95 mg/L (Otter Creek OT-01) fall between the "slight" (9.0 mg/L) and "moderate production impairment" (8.0 mg/L) effects towards salmonids in their embryo and larval stages, while all other recordings falls between the "slight" (9.0 mg/L) and "no production impairment" (11.0 mg/L) effects towards salmonids in their embryo and larval stages. In contrast, all of the recorded dissolved oxygen concentrations are well above the "no production impairment" value of 8 mg/L for salmonids in all other life stages.

Dissolved oxygen percentage saturation values were measured and indicated that the majority of sampling locations were well above 90% saturation with an average of 92.7%. The highest dissolved oxygen percentage saturation recording of 98.8% was obtained at Site 2 on the Tulameen River (TU-02), while the second highest recording was obtained from the nearby Granite Creek site (GR-01) located near the confluence of the Tulameen River. The lowest percentage saturation measurement of 74.5% occurred at Site 2 on Otter Creek (OT-02).

3.4 Native Riparian Vegetation Planting in Granite Creek

In the headwaters of Granite Creek, a large area was logged in 1986 by Weyerhauser Canada Ltd. The clearcut area extended to each bank of Granite Creek leaving no riparian vegetation to provide cover to the creek. Although Lodgepole pine (*Pinus contorta* var. *latifolia*) saplings were planted in 1988 by Weyerhauser Canada Ltd., little cover to the creek was provided. The riparian vegetation which existed in August 1997 consisted of sparse shrub vegetation, primarily of Willow species (*Salix* spp.), (Photograph 7). In some areas cover was provided by dry cut logs which remained after the clearcut was burned (Photograph 8). Disturbance to the creek bed and to the banks caused by grazing cattle, although insignificant in comparison to that resulting from logging, was evident in these reaches of Granite Creek.

Native tree and shrub species were planted along Granite Creek within the riparian zone of the clearcut area to restore and enhance fish habitat (Figure 3). Rainbow trout were captured in Granite Creek within this clearcut during the field survey portion of the 1996 Tulameen River watershed stream assessment.

The specimens which were obtained from PRT Reid Collins and Robert Glenn Native Plant Nurseries were selected for their ability to survive at this altitude and climatic zone. Native riparian tree and shrub species which were selected for planting on the banks of Granite Creek included Black cottonwood (*Populus balsamifera* spp.

trichocarpa), Douglas maple (*Acer glabrum*), Dwarf birch (*Betula glandulosa*), Pacific willow (*Salix lucida* ssp. *lasiandra*), Sitka willow (*Salix sitchensis*), Scouler's willow (*Salix scouleriana*), Pussy willow (*Salix discolor*), Red elderberry (*Sambucus racemosa*), Flat-topped Spiraea (*Spiraea betulofolia*), Red-osier dogwood (*Cornus stolonifera*), Saskatoon (*Amelanchier alnifolia*), Blackgooseberry (*Ribes lacustre*), and Thimbleberry (*Rubus parviflorus*).

An total of 670 specimens representing 13 tree and shrub species were planted. Five of the 13 tree and shrub species planted were berry producing. Approximately 370 of the total 670 specimens were planted as relatively larger bare-root "bands" or one gallon pots. The remaining 300 specimens which were relatively smaller plugs were planted within the 26 planting sites as well as randomly between sites where it appeared they may be beneficial but not necessarily crucial. The approximate number of tree and shrub species planted at each site as well as between sites is listed in Appendix D. Larger specimens were planted within sites where vegetation was most lacking. Photographs 9 to 12 demonstrate post planting conditions in the headwaters of Granite Creek.

3.5 Fish Habitat Enhancement and Bank Stabilization in Granite Creek

Fish habitat enhancement and bank stabilization was conducted on Granite Creek at a site located 8800 m upstream from its confluence with the Tulameen River. The site which is illustrated in Figure 4, extends for a distance of approximately 400 m and includes 6 sections. The sections were divided based upon location and enhancement or stabilization technique which was undertaken.

Section 1 included 40 m of an eroding bank which was stabilized with dry logs anchored to rooted trees on top of the east bank with ¾ inch galvanized steel cable. The success of bank stabilization at Section 1 cannot be fully determined until peak flows have been experienced. The deflector logs placed at the east bank provided some additional fish cover for shade and protection as well as a source of food organisms, and are expected to continue to do so at higher flows. Photographs 13 to 16 demonstrate pre-construction and post construction conditions at Section 1.

Section 2 included rootwad and deadman installation as well as nursetree planting on the gravel/ cobble bar located at the access road. The rootwads were intended to promote sediment deposition and collect woody debris transported down the creek so as to build up the west bank over time. A more stable bank will function to protect the eroding bank immediately downstream (Section 3) by maintaining flow along the east bank. The rootwads will also provide cover to fish during the higher flows.

Success of the rootwad and deadman installations and of the nursetree plantings at Section 2 cannot be determined until 1998 after peak flows have been experienced.

Photographs 17 to 19 demonstrate pre-rootwad installation and post rootwad installation conditions of the gravel/ cobble bar at Section 2.

Section 3 included stabilization of the west bank with rootwads and logs and the placement of deflector logs at the entrance to a side channel immediately downstream of the eroding bank. The logs and rootwads were anchored with ¾ inch galvanized steel cable. The eroding west bank currently supports the Arrastra Creek Logging Road and the side channel at higher flows would direct flow precariously close to the road.

The success of bank stabilization at Section 3 cannot be fully determined until all seasonal flows have been experienced. Although not contributing to fish cover during low flows, the rootwads installed to stabilize the bank at Section 3 are expected to provide cover during higher flows as well as bank protection. Photographs 20 to 25 illustrate the rootwad and log installations and their stabilization with ¾ inch galvanized steel cable.

Section 4 included a logjam which split Granite Creek into two channels (Photograph 26), an eroding east bank immediately upstream of the logjam, and an unvegetated gravel/ sand bar (Photograph 27). Previously, one channel flowed in a northerly direction bypassing the logjam (Photograph 28) and the other channel flowed under the logjam in a northwesterly direction at a slightly lower elevation (Photograph 29). Downstream of the logjam, the northerly channel flowed at an elevation of approximately 1 m above the other causing some of the water to wash over the gravel/ cobble substrate and enter the northwesterly channel.

The results of stabilization of the logjam in Section 4 with dry logs acquired from Weyerhauser Canada Ltd., woody debris and boulders succeeded in diverting the majority of flow under the logjam and to the west bank (Photograph 30). The majority of water flowing in the northerly channel was diverted to the northwesterly channel under the logjam. The volume of water associated with the logjam increased and the logs placed to stabilize the bank immediately upstream of the logjam contributed to fish habitat by providing additional cover (Photograph 31).

Photographs 32 and 33 illustrate the modified flows in the two channels as a result of logjam stabilization. The Black cottonwood and Red alder nursetrees planted in the gravel bar are illustrated in Photograph 34.

Section 5 included separation of a large rootwad from its trunk, relocation of this log as well as the placement of additional logs and woody debris to the west bank for stabilization, and anchoring the large rootwad into the bank.

The rootwad which remained atop the gravel bar at Section 5 was intended to provide stability to the gravel bar by promoting substrate deposition and to provide fish cover at high flows. During high flows, woody debris is expected to accumulate at the

rootwad and provide additional fish cover and stream complexing. Success of the treatments to this section cannot be fully determined until peak flows have been experienced. The log deflectors placed at Section 5 appeared to achieve the desired effect of protecting the eroding west bank at low flows as well as providing additional fish cover (Photographs 35 to 37).
Section 6 consisted of the stabilization of the east bank with logs and woody debris which was pushed against the bank with the excavator. The debris was also intended to divert flow away from the unstable east bank. The success of the bank stabilization efforts in Section 6 cannot be determined until 1998 after peak flows have been experienced. Logs and woody debris placed at the foot of this bank are expected to provide cover at higher flows (Photograph 38).

The fallen coniferous tree located within the wetted width adjacent to the west bank approximately 20 m downstream of Section 6 was secured to a rooted tree upon the bank with ¾ inch galvanized steel cable. This LWD is expected to provide fish cover during all flow conditions.

The success of the fish habitat enhancement and bank stabilization portion of this project is difficult to quantify at this time as the project was undertaken during low summer flows. Success should be assessed in 1998 once the instream features have experienced peak.

4.0 RECOMMENDATIONS

IRC recommends annual monitoring of the Granite Creek riparian tree and shrub planting success for a period of 3 years. The monitoring program should determine the survival rate of the trees and shrubs, the survival rate of each species relative to the other species planted, and the overall success of the planting scheme in restoring riparian zone cover. Each monitoring program should include plant measurements and extensive photo-documentation so as to compare to preceding and succeeding years.

IRC recommends the annual monitoring of the fish habitat enhancement features and the bank stabilization efforts in Granite Creek for two years. We also recommend that an assessment be conducted after a period of five and ten years to determine the long term effect as well as the long term success of the project. The fish habitat enhancement and bank stabilization monitoring program should include extensive photo-documentation so as to compare to preceding and succeeding years. The success and failure of specific treatments should be documented.

5.0 REFERENCES

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6.0 ACKNOWLEDGEMENTS

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Table 1: Fish Inventory Summary

Stream Name	Site[1]	Sample Date	SP[2]	1st Pass[3]	2nd Pass[4]	Mean Fork Length (mm)	S.D. (mm)	Mean Weight	S.D (mm)	Mean CF[5] (g/cm^3)
Spearing Creek	2	9-Aug-97	CC	15	7	71.0	21.51	6.22	6.17	
Spearing Creek	2	9-Aug-97	RB	80	19	80.7	43.51	10.88	19.38	1.05
Spearing Creek	3	9-Aug-97	CC	33	16	56.2	15.49	2.66	2.35	
Spearing Creek	3	9-Aug-97	RB	86	26	74.8	47.98	11.50	21.80	1.12

1 - Sample Site Number

2 - Species Abbreviations: RB Rainbow trout (*Oncorhynchus mykiss*)
CC sculpin species (*Cottus* spp.)

3 - First pass through site with electroshocker

4 - Second pass through site with electroshocker

5 - Condition Factor: (Weight (g) x 100)/(Length (cm))^3

Table 2: Fish Inventory Summary - Population Density

Stream Name	Site[1]	Sample Date	Sample Area (m^2)	Species	Total Catch (No.)	Density (No./m^2)
Spearing Creek	2	9-Aug-97	629.09	CC	22	0.03
	2	9-Aug-97	629.09	RB	99	0.16
	3	9-Aug-97	310.00	CC	49	0.16
	3	9-Aug-97	310.00	RB	112	0.36

Table 3: Conventional Parameters in Water

Stream Name	Sample Site[1]	Nitrate (mg/L)	Nitrate Detection Limit (mg/L)	Protection to Aquatic Life (mg/L)	SRP[2] (mg/L)	SRP Detection Limit (mg/L)	Protection to Aquatic Life (mg/L)	Total BOD (mg/L)	Total BOD Detection Limit (mg/L)	F. Coliform Fecal Coliform (MPN/100mL)	F. Coliform Detection Limit (MPN/100mL)	Protection to Aquatic Life (mg/L)	E. Coli E. Coli (MPN/100mL)	E. Coli Detection Limit (MPN/100mL)	Protection to Aquatic Life (mg/L)
Tulameen Rv.	TU01	0.013	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Tulameen Rv.	TU02	<	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Arrastra Cr.	AR01	<	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Asp Cr.	AS01	0.20	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Champion Cr.	CH01	<	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Granite Cr.	GR01	<	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Jim Kelly Cr.	JK01	0.030	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Olivine Cr.	OL01	<	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Otter Cr.	OT01	0.029	0.01	<or=40[3], or 200[4]	<	0.02		<	10	100	2	<or= 14	78	2	<or= 14
Otter Cr.	OT02	0.021	0.01	<or=40[3], or 200[4]	<	0.02		<	10	2	2	<or= 14	2	2	<or= 14
Podunk Cr.	PO01	0.016	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Spearing Cr.	SP01	0.011	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14
Vuich Cr.	VU01	0.024	0.01	<or=40[3], or 200[4]	<	0.02		-	-	-	-	<or= 14	-	-	<or= 14

1: Samples collected 10 August 1997
2: SRP = Soluble Reactive Phosphorus
3. The average vaule is calculated from at least 5 weekly samples taken in a period of 30 days. Taken from Table 17 of Approved and Working Criteria for Water Quality - 1995
4. Represents a maximum value for nitrate concentrations. Taken from Table 17 of Approved and Working Criteria for Water Quality - 1995
5. Taken from Table 9 of Approved and Working Criteria for Water Quality - 1995

Table 4: Tulameen River Watershed Water Quality Data Summary

Sampling Location	Mean Temp (^{0}C)	Mean pH	Mean D.O. (% Sat.)	Mean D.O. (mg/L)
Arrastra Creek (AR-01)	15.86	8.08	94.8	9.40
Asp Creek (AS-01)	14.73	8.29	97.0	9.85
Champion Creek (CH-01)	11.14	7.62	91.5	10.05
Granite Creek (GR-01)	14.14	8.24	98.4	10.13
Jim Kelly Creek (JK-01)	10.96	7.65	94.8	10.48
Olivine Creek (OL-01)	11.83	8.16	96.4	10.45
Otter Creek (OT-01)	17.25	7.82	92.9	8.95
Otter Creek (OT-02)	7.89	7.11	74.5	8.86
Podunk Creek (PO-01)	10.35	7.44	91.0	10.21
Spearing Creek (SP-01)	11.78	7.90	97.2	10.55
Tulameen Creek (TU-01)	16.59	7.91	86.7	8.47
Tulameen Creek (TU-02)	14.36	7.95	98.8	10.12
Vuich Creek (VU-01)	10.47	7.47	91.6	10.25
Mean	12.87	7.82	92.7	9.83
Minimum	7.89	7.11	74.5	8.47
Maximum	17.25	8.29	98.8	10.55

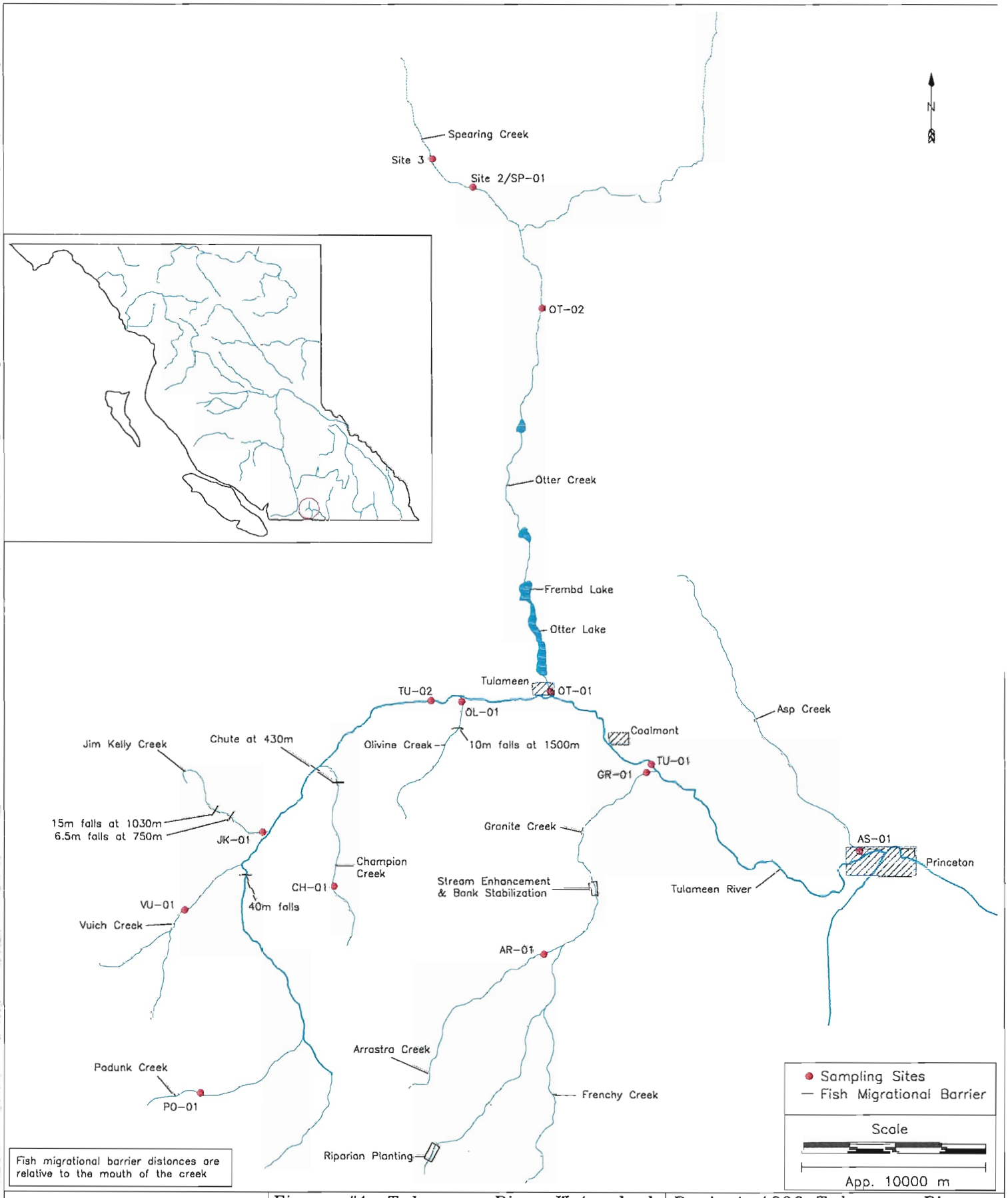

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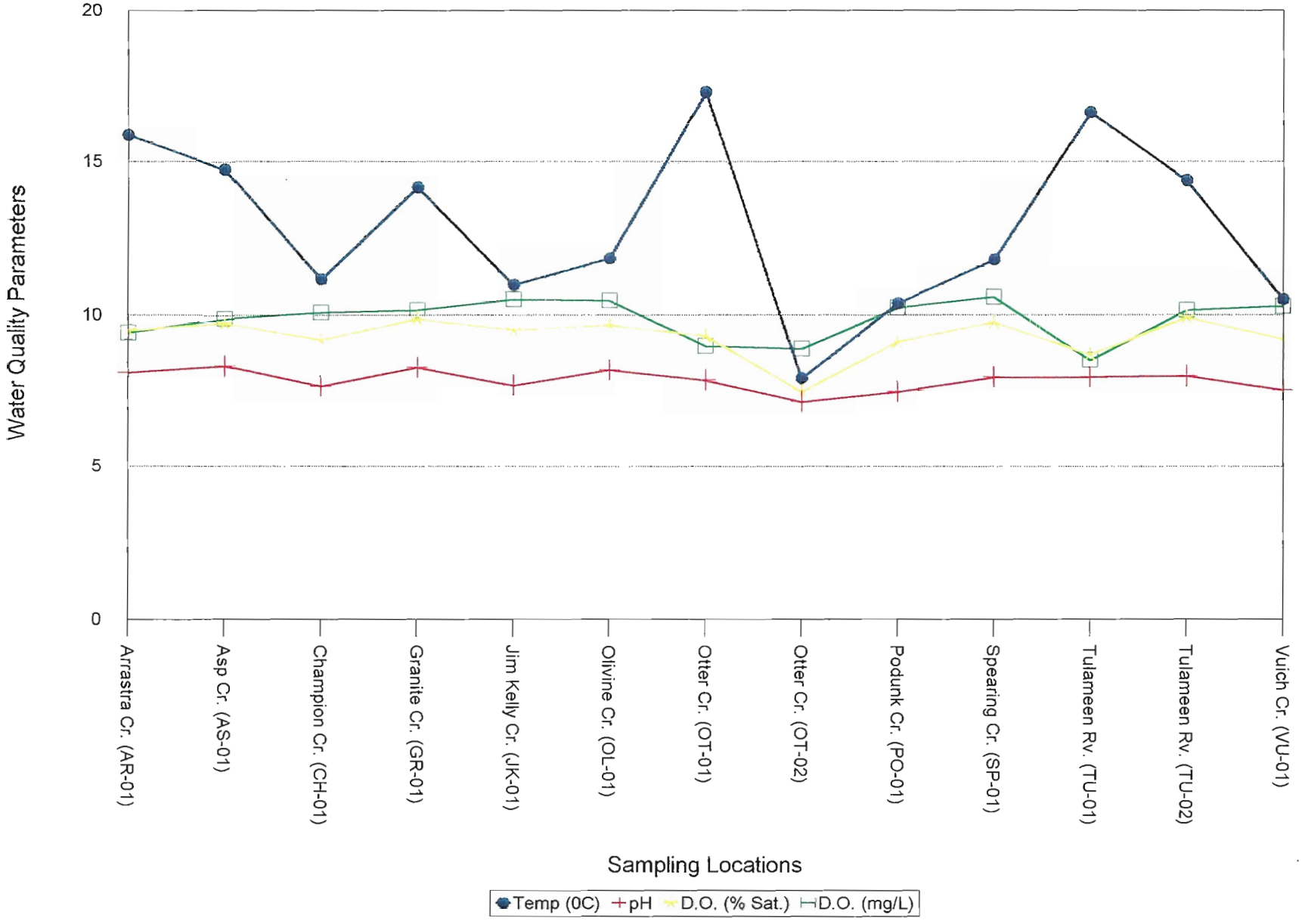
Figure #1: Tulameen River Watershed Study Area, Sampling Sites and Fish Migrational Barriers

Project: 1996 Tulameen River Watershed Stream Assessment

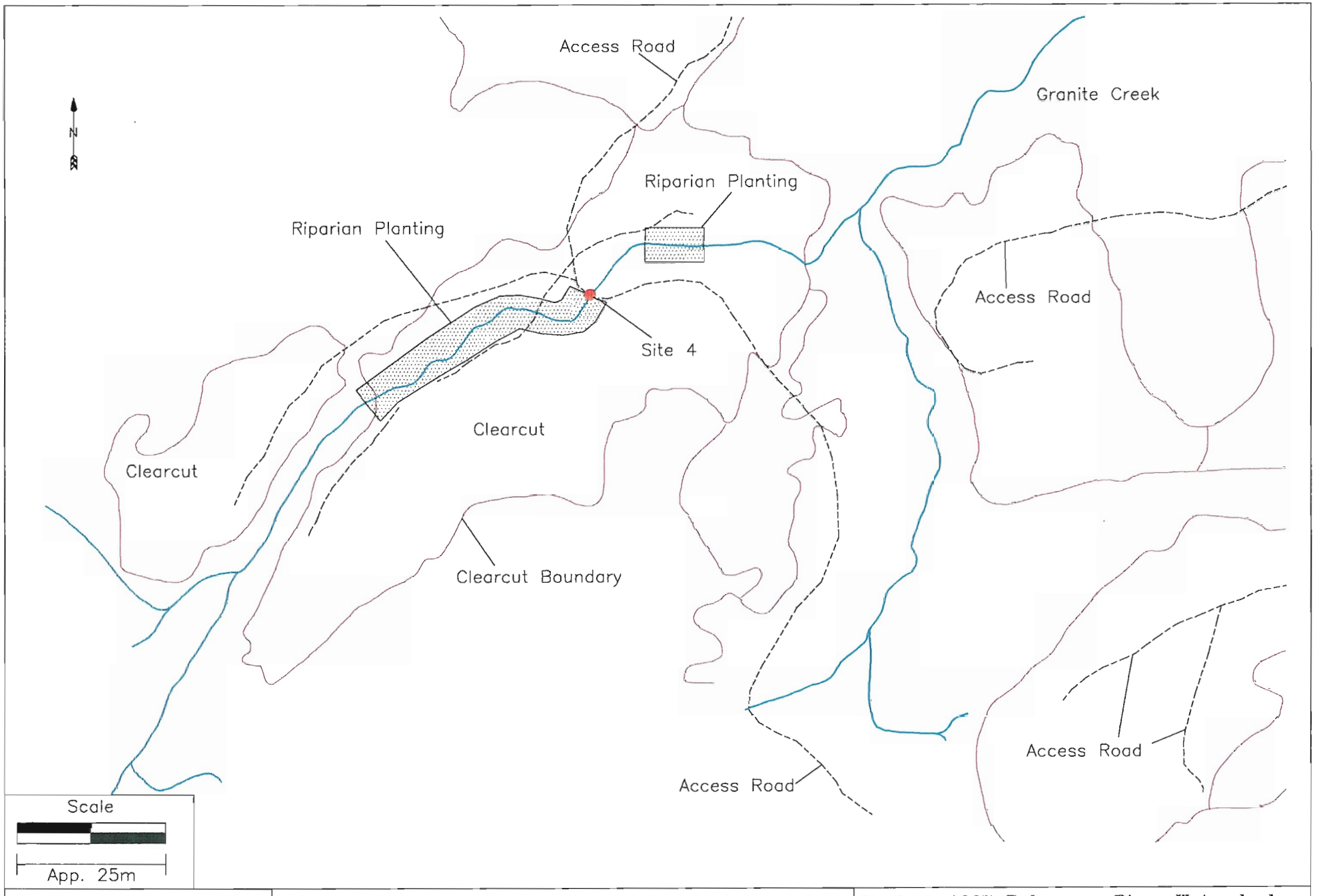
Client: Ministry of Environment, Lands and Parks, Penticton

Date: 28 January 1998

Figure 2: Mean Water Quality Data Collected from the Tulameen Watershed



Note: D.O. % Saturation have been multiplied by 0.1 for enhanced graphics



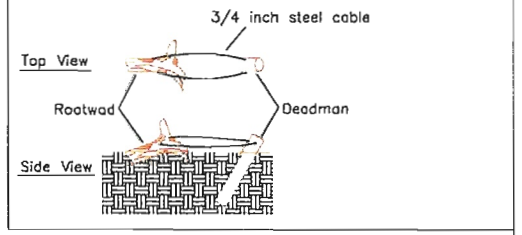
IRC Integrated Resource Consultants Inc.	Figure #3: Riparian Planting Zone on Granite Creek	Project: 1997 Tulameen River Watershed Stream Restoration
	Client: Ministry of Environment, Lands and Parks	Date: 28 January 1998

Section 1

Within Section 1 a 40 metre section of the eastern bank of the creek was stabilized with numerous logs bound together with root wads, boulders, logs and logs with rootwads. In the southeastern portion of this section, numerous logs were placed in a swampy region for further stabilization.
All logs, rootwads, logs and logs with rootwads were anchored with 3/4 inch steel cables to nearby trees.

Section 2

Within Section 2, rootwads were anchored with 3/4 inch steel cables to deadmen partially buried and immediately upstream. The cross-section displays the anchoring method. Also in this section, 2 juvenile Black cottonwood trees and 1 juvenile Red alder tree measuring approximately 4 metres in length were buried approximately 50 cm under the gravel/cobble substrate to act as nurse trees from which new vegetation is expected to develop.



Section 3

Within Section 3, numerous rootwads and logs were placed at the eroding toe of a western bank to prevent further erosion and promote debris collection and stabilization along the toe. In addition, numerous logs, logs with attached rootwads, and boulders were strategically placed to encourage higher flows to travel along the eastern bank.
All logs, rootwads and logs with rootwads were anchored with 3/4 inch steel cables to nearby trees.

Section 4

Within Section 4 numerous logs, rootwads and logs with rootwads were placed along the eastern bank for stabilization purposes. In addition, a large number of logs, rootwads, boulders and logs with rootwads were placed in an east-west direction to divert the majority of the flow towards the western bank. A portion of the substrate was excavated to promote the flow of water towards the western bank.
Also in this section, 2 juvenile Black cottonwood trees and 1 juvenile Red alder tree approximately 4 metres in length were buried approximately 50 cm under the sand/gravel substrate to act as nurse trees from which new vegetation is expected to develop.
All logs, rootwads and logs with rootwads were anchored in placed with 3/4 inch steel cables to nearby trees.

Section 5

Within Section 5 numerous logs, rootwads, and logs with rootwads were placed along the western creek bank for stabilization purposes and protection from the anticipated higher flows along the western creek bank.
All logs, rootwads and logs with rootwads were anchored with 3/4 inch steel cables to nearby trees.

Section 6

Within Section 6 numerous boulders, logs, rootwads and logs with rootwads were placed along the eastern bank to provide fish habitat and stabilize the eastern bank.

A deciduous tree was anchored with 3/4 inch cable to a rooted tree on the west bank

Scale
App. 25m

Legend
- Main Flow
- Black cottonwood Nursetree
- Red alder Nursetree
- Minor Flow
- Boulders
- Rootwad
- Log
- Log with Rootwad

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Figure 4: Fish Habitat Enhancement and Bank Stabilization in Granite Creek

Project: 1997 Tulameen Watershed Stream Restoration

Client: Ministry of Environment, Lands and Parks, Penticton, B.C.

Date: 26 January 1998

APPENDIX A: PHOTOGRAPHS

SPEARING CREEK

Photo 1: Spearing Creek. View of Site 2 facing upstream from 10 m.
Note: Overhanging vegetation and pooling. (9 August 1997).

Photo 2: Spearing Creek. View of Site 3 facing upstream from 80 m.
(9 August 1997).

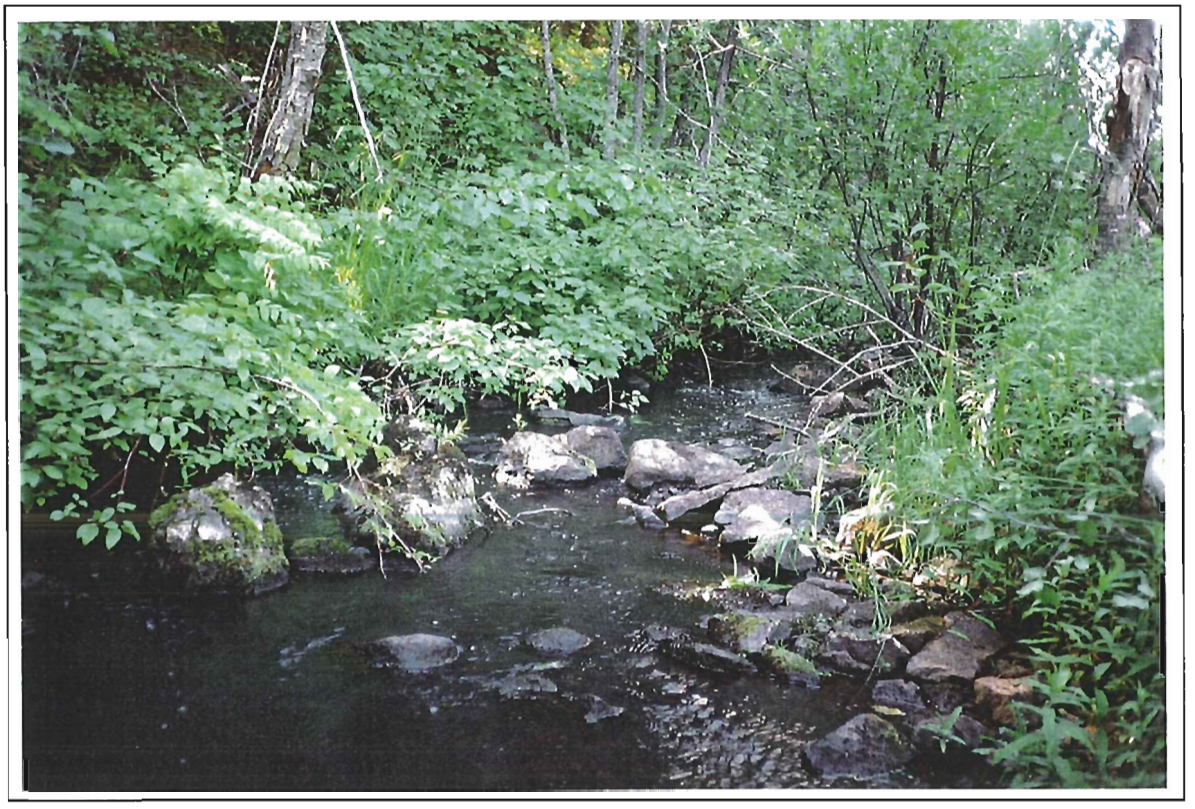

Photo 3: Spearing Creek. View of Site 3 facing upstream from 60 m.
Note: Riparian vegetation. (9 August 1997).

Photo 4: Spearing Creek. View of Site 3 facing downstream from 100 m.
Note: Riparian vegetation. (9 Agust 1997).

FISH BARRIERS ON JIM KELLY CREEK AND OLIVINE CREEK

Photo 5: Jim Kelly Creek. View of falls presenting an upstream migration barrier to all fish. (7August 1997).

Photo 6: Olivine Creek. View facing downstream of falls presenting an upstream migration barrier to all fish. Note: Abandoned miner's shack. (8 August 1997).

HABITAT ENHANCEMENT ON GRANITE CREEK

Photo 7: Granite Creek headwaters. View of Site 1 from road. Post planting.
Note: Clearcut to stream banks. (25 September 1997).

Photo 8: Granite Creek headwaters. View of Site 1. Post planting.
(26 September 1997).

Photo 9: Granite Creek headwaters. View of Site 6. Post planting.
Note: Burned stumps in background. (25 September 1997).

Photo 10: Granite Creek headwaters. View of Site 7. Pre-planting.
Note: Rainbow trout present in pool. (25 September 1997).

Photo 11: Granite Creek headwaters. View of Site 7. Post planting.
(25 September 1997).

Photo 12: Granite Creek headwaters. View of Site 15. Post planting.
(25 September 1997).

Photo 13: Granite Creek. View of Section 1 facing upstream. Pre-construction.
Note: Eroding east bank and fish barrier net. (25 September 1997).

Photo 14: Granite Creek. View of Section 1 facing east bank. Pre-construction.
Note: Dry side channel. (25 September 1997).

Photo 15: Granite Creek. View of Section 1 facing east bank. Post construction. (26 September 1997).

Photo 16: Granite Creek. View of Section 1 facing east bank. Post-construction. Note: Galvanized steel cable. (20 October 1997).

Photo 17: Granite Creek. View of Section 2. Pre-construction.
Note: Gravel/ cobble bar. (25 September 1997).

Photo 18: Granite Creek. View of Section 2 facing upstream. Post construction.
Note: Rootwads and planted nursetrees. (26 September 1997).

Photo 19: Granite Creek. View of Section 2. Post construction.
Note: Rootwad cabled to deadman. (20 October 1997).

Photo 20: Granite Creek. View of Section 3. Pre-construction.
Note: Eroding west bank and excavator. (25 September 1997).

Photo 21: Granite Creek. View of Section 3. Pre-construction.

Note: Dry side channel downstream of eroding west bank. (25 September 1997).

Photo 22: Granite Creek. View of Section 3. Mid construction.

Note: Excavator placing rootwads at toe of eroding west bank. (25 September 1997).

Photo 23: Granite Creek. View Section 3 facing downstream. Post construction. Note: Placed logs extend across dry side channel entrance. (25 September 1997).

Photo 24: Granite Creek. View of Section 3 facing upstream at entrance to dry side channel. Post construction. (25 September 1997).

Photo 25: Granite Creek. View of Section 3 facing stabilized west bank.
Note: Galvanized steel cable. (20 October 1997).

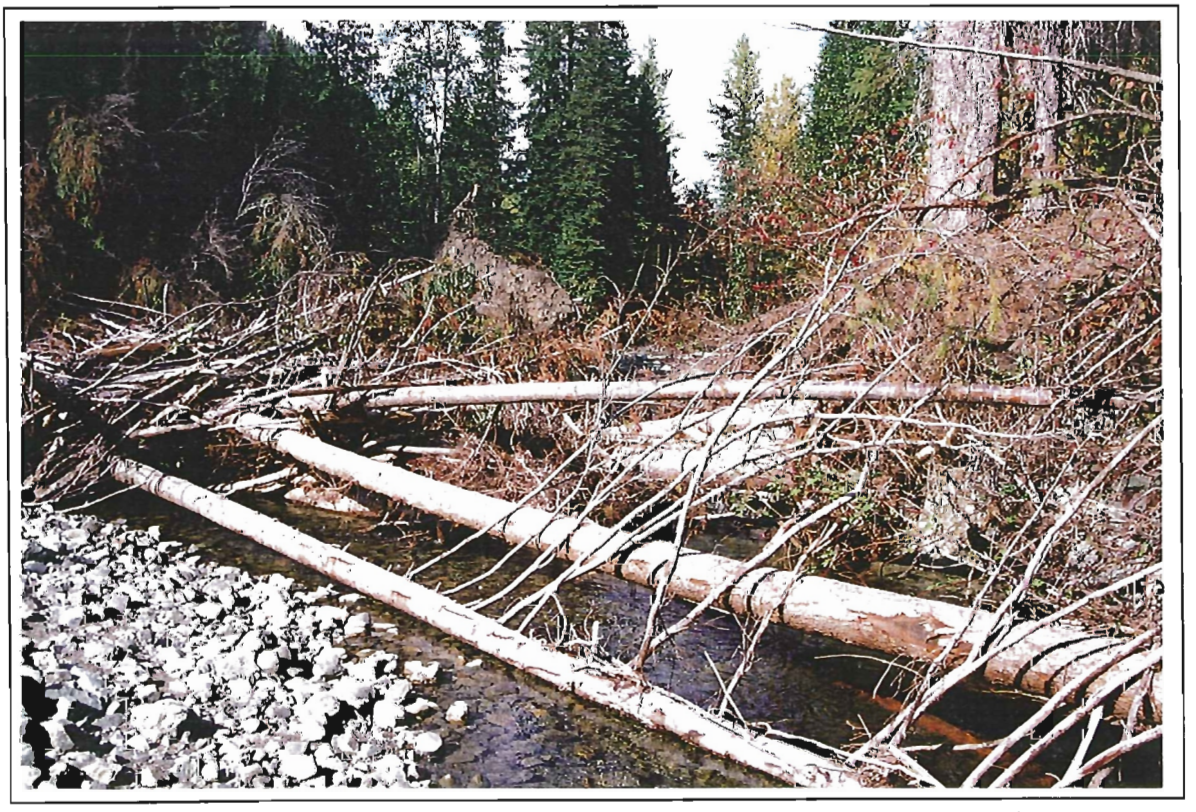

Photo 26: Granite Creek. View of Section 4 facing downstream. Pre-construction.
Note: Logjam. (25 September 1997).

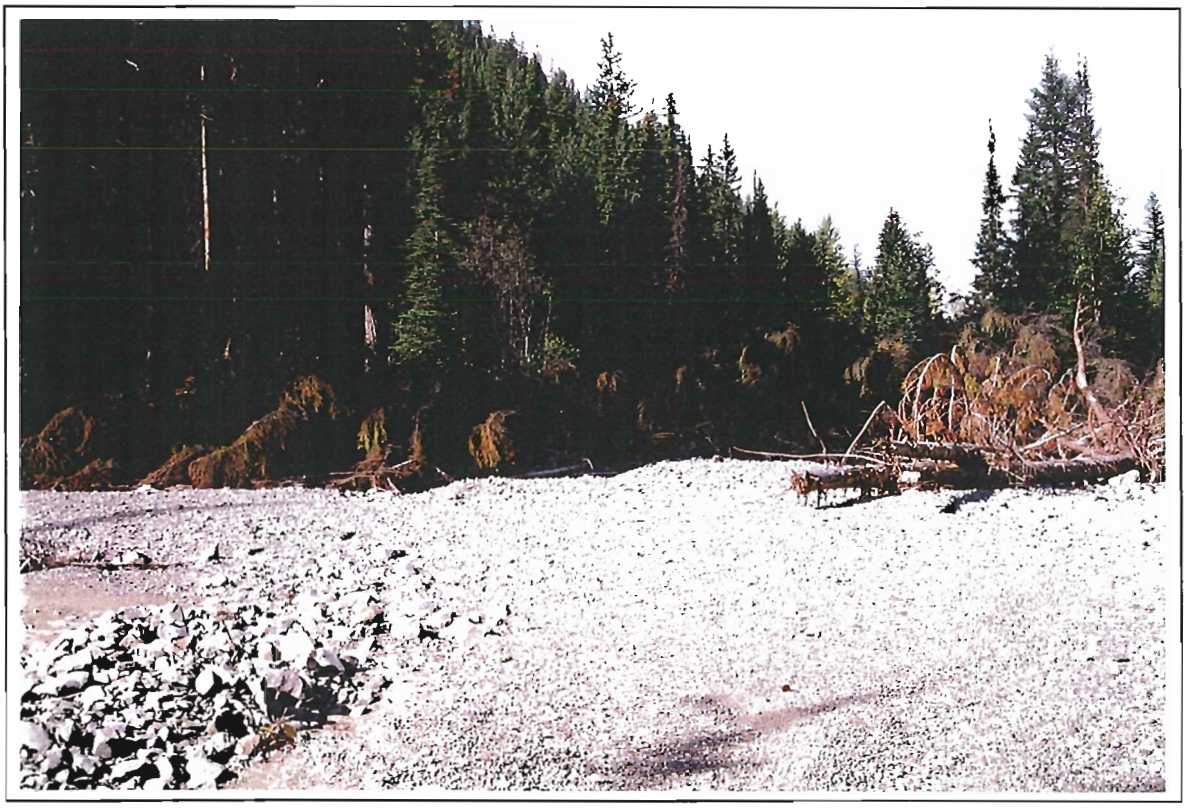

Photo 27: Granite Creek. View of Section 4. Pre-construction.
Note: Gravel/ sand bar. (25 September 1997).

Photo 28: Granite Creek. View of Section 4 downstream from logjam. Pre-construction.
Note: Channel flows in a northerly direction bypassing logjam. (25 September 1997).

Photo 29: Granite Creek. View of Section 4 facing upstream. Pre-construction.
Note: Channel flowing in a northwesterly direction under logjam. (25 September 1997).

Photo 30: Granite Creek. View of Section 4. Post construction.
Note: Logjam has been fortified with logs. (25 September 1997).

Photo 31: Granite Creek. View of Section 4 facing east bank immediately upstream of logjam. Post construction. Note: Galvanized steel cable. (20 October 1997).

Photo 32: Granite Creek. View of Section 4. Channel flowing north. Post construction. Note: Flow decrease compared to pre-construction. (25 September 1997).

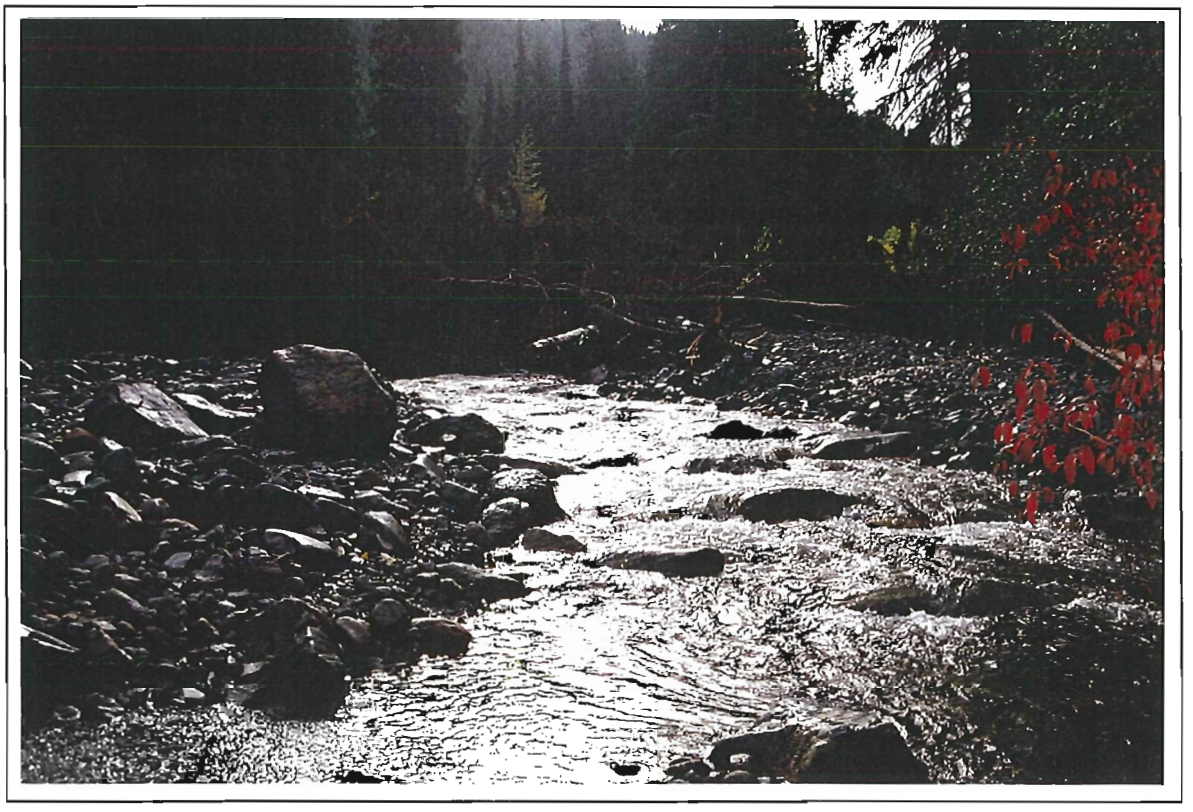

Photo 33: Granite Creek. View of Section 4 at channel flowing northwest. Post construction. Note: Flow increase compared to pre-construction. (25 September 1997).

Photo 34: Granite Creek. View of Section 4. Post construction. Note: Nursetrees planted in gravel/ sand bar. (26 September 1997).

Photo 35: Granite Creek. View of Section 5 facing downstream. Pre-construction. Note: Rootwad instream and large rootwad with log across channel. (25 September 1997).

Photo 36: Granite Creek. View of Section 5 facing downstream. Post construction. Note: Rootwad instream, logs at west bank, debris at east bank. (26 September 1997).

Photo 37: Granite Creek. View of Section 5 facing upstream. Post construction. Note: Large rootwad east bank, rootwad instream, stabilized west bank. (26 September 1997).

Photo 38: Granite Creek. View of Section 6 facing downstream. Post construction. Note: East bank stabilized with logs and debris. (26 September 1997).

APPENDIX B: SPEARING CREEK FISH INVENTORY

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	2	2		9-Aug	1		CC	114	21.52	
					1		CC	111	22.64	
					1		CC	89	9.20	
					1		CC	75	5.86	
					1		CC	56	2.52	
					1		CC	50	1.53	
					1		CC	92	9.86	
					1		CC	58	2.28	
					1		CC	55	2.10	
					1		CC	78	5.62	
					1		CC	98	12.01	
					1		CC	58	2.30	
					1		CC	48	1.30	
					1		CC	72	4.13	
					1		CC	56	2.08	
					2		CC	90	9.46	
					2		CC	41	0.99	
					2		CC	51	1.84	
					2		CC	93	10.59	
					2		CC	66	4.33	
					2		CC	51	1.70	
					2		CC	60	2.94	
					1		RB	142	29.56	1.03
					1		RB	76	5.17	1.18
					1		RB	80	5.50	1.07
					1		RB	81	5.50	1.03
					1		RB	90	7.37	1.01
					1		RB	77	5.03	1.10
					1		RB	45	0.84	0.92
					1		RB	43	0.79	0.99
					1		RB	38	0.58	1.06
					1		RB	42	0.94	1.27
					1		RB	43	0.94	1.18
					1		RB	42	0.72	0.97
					1		RB	44	0.86	1.01
					1		RB	63	2.91	1.16
					1		RB	43	0.81	1.02

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	2	2		9-Aug	1		RB	46	1.10	1.13
					1		RB	40	0.73	1.14
					1		RB	34	0.52	1.32
					1		RB	36	0.58	1.24
					1		RB	40	0.61	0.95
					1		RB	45	0.84	0.92
					1		RB	45	0.98	1.08
					1		RB	42	0.68	0.92
					1		RB	36	0.47	1.01
					1		RB	206	87.35	1.00
					1		RB	180	60.84	1.04
					1		RB	139	26.92	1.00
					1		RB	205	76.24	0.88
					1		RB	201	86.79	1.07
					1		RB	223	103.95	0.94
					1		RB	128	22.69	1.08
					1		RB	78	5.47	1.15
					1		RB	48	1.09	0.99
					1		RB	39	0.65	1.10
					1		RB	77	5.08	1.11
					1		RB	142	29.60	1.03
					1		RB	180	57.93	0.99
					1		RB	135	25.02	1.02
					1		RB	151	31.45	0.91
					1		RB	72	3.94	1.06
					1		RB	117	15.94	1.00
					1		RB	90	6.80	0.93
					1		RB	126	20.53	1.03
					1		RB	89	7.85	1.11
					1		RB	94	8.00	0.96
					1		RB	134	23.69	0.98
					1		RB	105	13.04	1.13
					1		RB	83	5.96	1.04
					1		RB	85	7.69	1.25
					1		RB	113	15.32	1.06
					1		RB	81	6.03	1.13
					1		RB	101	9.99	0.97

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	2	2		9-Aug	1		RB	85	6.46	1.05
					1		RB	46	0.97	1.00
					1		RB	46	1.03	1.06
					1		RB	82	5.20	0.94
					1		RB	117	15.55	0.97
					1		RB	128	21.48	1.02
					1		RB	80	4.82	0.94
					1		RB	70	3.12	0.91
					1		RB	113	15.53	1.08
					1		RB	110	13.51	1.02
					1		RB	140	28.10	1.02
					1		RB	35	0.62	1.45
					1		RB	96	9.27	1.05
					1		RB	104	12.25	1.09
					1		RB	79	1.68	0.34
					1		RB	83	7.75	1.36
					1		RB	42	0.95	1.28
					1		RB	67	3.41	1.13
					1		RB	80	5.61	1.10
					1		RB	84	6.22	1.05
					1		RB	73	3.75	0.96
					1		RB	38	0.50	0.91
					1		RB	86	6.61	1.04
					1		RB	71	3.18	0.89
					1		RB	42	0.73	0.99
					1		RB	36	0.46	0.99
					1		RB	43	0.80	1.01
					1		RB	43	0.82	1.03
					2		RB	73	3.88	1.00
					2		RB	46	0.94	0.97
					2		RB	42	0.76	1.03
					2		RB	86	6.97	1.10
					2		RB	42	1.25	1.69
					2		RB	87	7.30	1.11
					2		RB	86	6.41	1.01
					2		RB	88	6.84	1.00
					2		RB	93	7.36	0.92

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	2	2		9-Aug	2		RB	45	0.96	1.05
					2		RB	71	4.32	1.21
					2		RB	45	1.01	1.11
					2		RB	45	0.95	1.04
					2		RB	43	0.87	1.09
					2		RB	36	0.38	0.81
					2		RB	46	1.04	1.07
					2		RB	75	4.46	1.06
					2		RB	41	0.70	1.02
					2		RB	44	0.82	0.96
	3	4		9-Aug	1		CC	91	9.68	
					1		CC	65	3.71	
					1		CC	71	4.10	
					1		CC	52	2.00	
					1		CC	48	1.07	
					1		CC	43	0.98	
					1		CC	51	1.40	
					1		CC	49	1.28	
					1		CC	52	1.49	
					1		CC	45	1.02	
					1		CC	61	2.70	
					1		CC	75	4.55	
					1		CC	45	0.97	
					1		CC	95	9.12	
					1		CC	45	1.12	
					1		CC	88	7.27	
					1		CC	80	5.86	
					1		CC	50	1.38	
					1		CC	68	9.01	
					1		CC	49	1.76	
					1		CC	52	1.74	
					1		CC	64	3.20	
					1		CC	63	2.93	
					1		CC	66	3.91	
					1		CC	53	1.88	
					1		CC	45	1.11	
					1		CC	80	6.17	

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	3	4		9-Aug	1		CC	64	2.90	
					1		CC	43	0.95	
					1		CC	50	1.42	
					1		CC	50	1.21	
					1		CC	45	0.92	
					1		CC	52	1.55	
					2		CC	74	5.63	
					2		CC	19	0.12	
					2		CC	19	0.11	
					2		CC	63	3.14	
					2		CC	48	1.23	
					2		CC	51	1.53	
					2		CC	76	4.99	
					2		CC	51	1.47	
					2		CC	46	1.09	
					2		CC	46	1.23	
					2		CC	55	1.94	
					2		CC	60	2.40	
					2		CC	58	1.90	
					2		CC	43	0.93	
					2		CC	48	1.20	
					2		CC	46	1.22	
					1		RB	194	79.18	1.08
					1		RB	103	11.82	1.08
					1		RB	32	0.31	0.95
					1		RB	41	0.85	1.23
					1		RB	38	0.58	1.06
					1		RB	41	0.76	1.10
					1		RB	39	0.63	1.06
					1		RB	30	0.26	0.96
					1		RB	32	0.34	1.04
					1		RB	36	0.50	1.07
					1		RB	40	0.69	1.08
					1		RB	45	1.06	1.16
					1		RB	45	1.13	1.24
					1		RB	40	0.63	0.98
					1		RB	165	41.99	0.93

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	3	4		9-Aug	1		RB	112	15.10	1.07
					1		RB	149	32.07	0.97
					1		RB	79	5.27	1.07
					1		RB	41	0.76	1.10
					1		RB	38	0.57	1.04
					1		RB	48	1.27	1.15
					1		RB	41	0.78	1.13
					1		RB	39	0.58	0.98
					1		RB	37	0.53	1.05
					1		RB	41	0.82	1.19
					1		RB	32	0.42	1.28
					1		RB	44	1.02	1.20
					1		RB	38	1.69	3.08
					1		RB	46	0.70	0.72
					1		RB	46	0.69	0.71
					1		RB	42	0.85	1.15
					1		RB	35	0.53	1.24
					1		RB	103	11.57	1.06
					1		RB	39	0.59	0.99
					1		RB	39	0.65	1.10
					1		RB	82	7.46	1.35
					1		RB	206	89.66	1.03
					1		RB	150	35.73	1.06
					1		RB	160	42.10	1.03
					1		RB	155	41.48	1.11
					1		RB	116	15.78	1.01
					1		RB	93	9.30	1.16
					1		RB	105	11.34	0.98
					1		RB	111	14.24	1.04
					1		RB	92	9.28	1.19
					1		RB	45	1.20	1.32
					1		RB	41	0.73	1.06
					1		RB	40	0.92	1.44
					1		RB	35	0.55	1.28
					1		RB	220	120.55	1.13
					1		RB	208	106.13	1.18
					1		RB	184	67.50	1.08

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	3	4		9-Aug	1		RB	150	34.44	1.02
					1		RB	161	41.00	0.98
					1		RB	120	20.11	1.16
					1		RB	120	20.34	1.18
					1		RB	98	9.25	0.98
					1		RB	39	0.72	1.21
					1		RB	105	12.27	1.06
					1		RB	100	10.23	1.02
					1		RB	120	18.16	1.05
					1		RB	110	15.57	1.17
					1		RB	96	15.55	1.76
					1		RB	90	8.46	1.16
					1		RB	91	9.00	1.19
					1		RB	92	8.74	1.12
					1		RB	92	8.82	1.13
					1		RB	78	5.73	1.21
					1		RB	81	6.66	1.25
					1		RB	78	4.99	1.05
					1		RB	73	4.07	1.05
					1		RB	72	4.60	1.23
					1		RB	30	0.29	1.07
					1		RB	51	1.48	1.12
					1		RB	40	0.70	1.09
					1		RB	38	0.62	1.13
					1		RB	68	2.97	0.94
					1		RB	42	0.96	1.30
					1		RB	39	0.61	1.03
					1		RB	40	0.59	0.92
					1		RB	40	0.73	1.14
					1		RB	36	0.48	1.03
					1		RB	38	0.60	1.09
					1		RB	48	1.10	0.99
					1		RB	41	0.74	1.07
					1		RB	40	0.85	1.33
					2		RB	46	1.04	1.07
					2		RB	185	71.88	1.14
					2		RB	96	8.36	0.94

Appendix B: Tulameen River Watershed Fish Inventory

Stream Name	Sample Site No.	Reach Number	Section Number	Date (1997)	Pass Number[1]	Total Catch	Species[2] Catch	Fork Length (mm)	Weight (g)	Condition Factor[3] (g/cm^3)
Spearing Creek	3	4		9-Aug	2		RB	80	5.44	1.06
					2		RB	91	8.34	1.11
					2		RB	94	9.85	1.19
					2		RB	145	30.70	1.01
					2		RB	155	37.70	1.01
					2		RB	115	15.99	1.05
					2		RB	134	24.57	1.02
					2		RB	35	0.51	1.19
					2		RB	39	0.67	1.13
					2		RB	40	0.79	1.23
					2		RB	32	0.33	1.01
					2		RB	40	0.68	1.06
					2		RB	35	0.53	1.24
					2		RB	43	0.90	1.13
					2		RB	41	0.73	1.06
					2		RB	43	0.82	1.03
					2		RB	45	0.98	1.08
					2		RB	43	0.92	1.16
					2		RB	43	0.80	1.01
					2		RB	37	0.66	1.30
					2		RB	33	0.38	1.06
					2		RB	45	1.05	1.15
					2		RB	34	0.37	0.94

1 - Pass Number: number of passes made by electroshocker

2 - Species Abbreviations

RB	Rainbow trout
CC	Sculpin sp.

3 - Condition Factor (g/cm^2): As described by IEC Beak Consultants - A value used to incorporate length and weight measurements of the Rainbow trout. It has been determined as: (Weight (g) x 100)/ (Length (cm))^3. (Klak, 1941; Ricker, 1975)

SPEARING CREEK HABITAT DESCRIPTION

STREAM NAME	SITE	CROSS SECTION (m)	DATE	BANKFUL WIDTH (m)	BANKFUL DEPTH (m)	WETTED WIDTH (m)	WETTED DEPTHS (cm)			AVERAGE DEPTH (cm)
Spearing Creek	2	0	9-Aug-96	12.8	2.0	1.9	14.0	15.0	16.0	15.0
Spearing Creek	2	10	9-Aug-96	14.0	2.2	6.8	11.0	15.0	47.0	24.3
Spearing Creek	2	20	9-Aug-96	11.9	2.5	5.7	35.0	71.0	100.0	68.7
Spearing Creek	2	30	9-Aug-96	12.4	2.0	4.3	38.0	23.0	38.0	33.0
Spearing Creek	2	40	9-Aug-96	11.6	2.0	6.5	18.0	11.0	7.0	12.0
Spearing Creek	2	50	9-Aug-96	9.8	2.0	7.6	8.0	18.0	11.0	12.3
Spearing Creek	2	60	9-Aug-96	11.2	1.0	8.4	10.0	12.0	8.0	10.0
Spearing Creek	2	70	9-Aug-96	9.5	1.5	8.2	5.0	12.0	45.0	20.7
Spearing Creek	2	80	9-Aug-96	11.0	1.5	9.3	15.0	8.0	9.0	10.7
Spearing Creek	2	90	9-Aug-96	11.6	1.5	4.9	11.0	21.0	15.0	15.7
Spearing Creek	2	100	9-Aug-96	10.5	1.5	5.6	33.0	45.0	21.0	33.0
Spearing Creek	3	0	9-Aug-96	4.1	1.2	3.2	32.0	33.0	14.0	26.3
Spearing Creek	3	10	9-Aug-96	5.2	1.0	4.7	22.0	60.0	33.0	38.3
Spearing Creek	3	20	9-Aug-96	5.0	1.0	4.6	44.0	38.0	33.0	38.3
Spearing Creek	3	30	9-Aug-96	3.2	0.7	2.9	40.0	32.0	14.0	28.7
Spearing Creek	3	40	9-Aug-96	3.9	0.2	3.6	14.0	14.0	4.0	10.7
Spearing Creek	3	50	9-Aug-96	2.3	1.0	2.3	64.0	67.0	52.0	61.0
Spearing Creek	3	60	9-Aug-96	2.5	0.5	2.5	6.0	11.0	12.0	9.7
Spearing Creek	3	70	9-Aug-96	4.5	0.3	4.1	19.0	18.0	3.0	13.3
Spearing Creek	3	80	9-Aug-96	3.6	0.4	3.2	6.0	16.0	12.0	11.3
Spearing Creek	3	90	9-Aug-96	3.1	1.1	2.7	15.0	32.0	9.0	18.7
Spearing Creek	3	100	9-Aug-96	2.3	1.9	0.3	14.0	25.0	10.0	16.3

STREAM NAME	SITE	CROSS SECTION (m)	DATE	CANOPY COVER (%ww)	CANOPY SPECIES	RIPARIAN COVER (%ww)	DOMINANT RIPARIAN SPECIES
Spearing Creek	2	0	9-Aug-96	2	*P. menziesii*	10	*Cornus stolonifera* *Salix sp.*
Spearing Creek	2	10	9-Aug-96	10	*P. menziesii* *Picea sitchensis*	10	*Rubus parviflorus* *Cornus stolonifera*
Spearing Creek	2	20	9-Aug-96	0		10	*Cornus stolonifera* *Salix sp.*
Spearing Creek	2	30	9-Aug-96	0		5	*Cornus stolonifera*
Spearing Creek	2	40	9-Aug-96	2	*P. menziesii*	10	*Alnus rubra* *Cornus stolonifera*
Spearing Creek	2	50	9-Aug-96	1	*P. menziesii*	10	*Cornus stolonifera* *Alnus rubra*
Spearing Creek	2	60	9-Aug-96	2	*P. menziesii*	10	*Cornus stolonifera*
Spearing Creek	2	70	9-Aug-96	15	*Alnus rubra* *P. menziesii*	10	*Alnus rubra* *Rubus parviflorus*
Spearing Creek	2	80	9-Aug-96	5	*Populus trichocarpa* *Picea sitchensis*	5	*Alnus rubra* *Rubra parviflorus*
Spearing Creek	2	90	9-Aug-96	2	*Populus trichocarpa*	0	
Spearing Creek	2	100	9-Aug-96	5	*Populus trichocarpa* *P. menziesii*	2	*Alnus rubra*
Spearing Creek	3	0	9-Aug-96	5	*Picea sitchensis*	5	grass
Spearing Creek	3	10	9-Aug-96	1	*Picea sitchensis*	10	*Cornus stolonifera*
Spearing Creek	3	20	9-Aug-96	10	*Picea sitchensis*	20	*Cornus stolonifera* *Salix sp.*
Spearing Creek	3	30	9-Aug-96	0		25	*Cornus stolonifera*
Spearing Creek	3	40	9-Aug-96	0		15	*Cornus stolonifera* *Salix sp.*
Spearing Creek	3	50	9-Aug-96	2	*Picea sitchensis*	80	*Cornus stolonifera*
Spearing Creek	3	60	9-Aug-96	10	*Alnus rubra*	40	*Cornus stolonifera*
Spearing Creek	3	70	9-Aug-96	0		35	*Alnus rubra* *Cornus stolonifera*
Spearing Creek	3	80	9-Aug-96	5	*Alnus rubra*	0	
Spearing Creek	3	90	9-Aug-96	5	*Alnus rubra*	0	
Spearing Creek	3	100	9-Aug-96	1	*Picea sitchensis*	80	*Alnus rubra* *Cornus stolonifera*

STREAM NAME	SITE	CROSS SECTION (m)	DATE	LWD		SUBSTRATE: % COMPOSITION					
				TOTAL	% WW COVER	BR	BD	CB	GR	SD	FN
Spearing Creek	2	0	9-Aug-96	0	0			15	60	25	
Spearing Creek	2	10	9-Aug-96	4	10			10	70	20	
Spearing Creek	2	20	9-Aug-96	1	0			10	70	20	
Spearing Creek	2	30	9-Aug-96	3	0			50	40	10	
Spearing Creek	2	40	9-Aug-96	0	0			70	25	5	
Spearing Creek	2	50	9-Aug-96	0	0		2	68	25	5	
Spearing Creek	2	60	9-Aug-96	1	2			60	30	10	
Spearing Creek	2	70	9-Aug-96	0	0		1	60	30	9	
Spearing Creek	2	80	9-Aug-96	2	0			50	30	20	
Spearing Creek	2	90	9-Aug-96	0	0			50	30	20	
Spearing Creek	2	100	9-Aug-96	1	2			50	40	10	
Spearing Creek	3	0	9-Aug-96	0	0			30	75		20
Spearing Creek	3	10	9-Aug-96	1	2			5	75	20	
Spearing Creek	3	20	9-Aug-96	0	0				20		80
Spearing Creek	3	30	9-Aug-96	0	0			10	80	5	5
Spearing Creek	3	40	9-Aug-96	2	1			10	80	5	5
Spearing Creek	3	50	9-Aug-96	0	0		25	60			15
Spearing Creek	3	60	9-Aug-96	0	0			40	50		10
Spearing Creek	3	70	9-Aug-96	1	10		5	40	40	10	5
Spearing Creek	3	80	9-Aug-96	1	2		5	60	15	5	15
Spearing Creek	3	90	9-Aug-96	0	0		10	70		10	10
Spearing Creek	3	100	9-Aug-96	0	0		5	40	40		15

Appendix B: Tulameen River Watershed Habitat

STREAM NAME	SITE	CROSS SECTION (m)	DATE	BANK DESCRIPTION
Spearing Creek	2	0	9-Aug-96	L: Undercut. R: Cobble/ gravel slope to vegetation: *Cornus stolonifera*, *Salix* sp. and *Rubus parviflorus*.
Spearing Creek	2	10	9-Aug-96	L: Cutbank with veg. OH. Pooling at logjam. R: Cobble/ gravel/ sand slope with *Salix* sp. and *Alnus rubra*.
Spearing Creek	2	20	9-Aug-96	L: Cutbank with *Cornus stolonifera* OH. R: Point bar, slope to *Salix* sp.
Spearing Creek	2	30	9-Aug-96	L: Pool at undercut banks with dense*Cornus stolonifera* OH. R: Cobble/ gravel slope to *Cornus stolonifera* OH.
Spearing Creek	2	40	9-Aug-96	L: Slope to grass, small woody debris on bank. R: Cobble slope to vegetation.
Spearing Creek	2	50	9-Aug-96	L: Slightly cut bank with woody debris in wetted width and *C. stolonifera* and *A. rubra* OH. R: Slope cobble/ gravel to *Cornus stolonifera* OH.
Spearing Creek	2	60	9-Aug-96	L: Slope cobble to root OH and slightly cut bank. R: Gravel/ sand slope to *Cornus stolonifera* OH.
Spearing Creek	2	70	9-Aug-96	L: Slope cobble to *P. trichocarpa*, *Alnus rubra* and *Salix* sp. R: Cut bank with root OH. Few *Salix* sp.
Spearing Creek	2	80	9-Aug-96	L: Cobble/ gravel slope R: Cut bank with root and veg. OH.
Spearing Creek	2	90	9-Aug-96	L: Slope to road with *Alnus rubra* and *Populus trichocarpa*. R: Slope to *Rosa* sp. and *Symphoricarpos albus*.
Spearing Creek	2	100	9-Aug-96	L: Sloping cobble to flood plane, *Alnus rubra* and to Railroad. R: Slope cobble to veg. OH. *E. angustifolium, Rosa sp., A. rubra* and *C. stolonifera*.
Spearing Creek	3	0	9-Aug-96	L: Sloped gravel - silty. R: Sloped gravel - silty.
Spearing Creek	3	10	9-Aug-96	L: Undercut with pooling and veg. OH: Cornus stolonifera (excellent fish habitat) R: Slope, grass to wetted width.
Spearing Creek	3	20	9-Aug-96	L: Slope to road with veg. OH. R: Under cut with veg. OH. Grass in wetted width.
Spearing Creek	3	30	9-Aug-96	L: Slope to under cut bank. At 25 m *C. stolonifera* OH and grass. R: Slope to flood plane. Grass in wetted width.
Spearing Creek	3	40	9-Aug-96	L: Slope. Loose gravel from RR. Grass OH. R: Cut bank with *C. stolonifera* and *Salix* sp. OH.
Spearing Creek	3	50	9-Aug-96	L: Undercut slightly to OH veg. Slope to road. R: Cut bank with *Cornus stolonifera* OH.
Spearing Creek	3	60	9-Aug-96	L: Undercut bank with grass OH. One snag present. R: Undercut bank to veg. OH.
Spearing Creek	3	70	9-Aug-96	L: Undercut to slope to *Rubus parviflorus*, *Alnus rubra* and *C. stoloniferaolonifera*. R: Undercut to *Cornus stolonifera* and *Alnus rubra*.
Spearing Creek	3	80	9-Aug-96	L: Slope to flood plane (3m) then slope to road. R: Cut bank with C*ornus stolonifera*.
Spearing Creek	3	90	9-Aug-96	L: Slope to grass and *Epilobium angustifolium*. R: Cut bank with *Cornus stolonifera* OH.
Spearing Creek	3	100	9-Aug-96	L: Under cut bank with large cobble to grass. R: Under cut with veg. OH.

APPENDIX C: WATER QUALITY DATA

ANALYTICAL RESULTS

Analysis Report

CANTEST

CanTest Ltd

Professional
Analytical
Services

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Fax: 604 731 2386

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REPORT ON: Analysis of Water Samples

REPORTED TO: IRC Integrated Resource Consultants Inc.
Suite 160
14480 River Road
Richmond, B.C.
V6V 1L4

Att'n: Ms. Christina Annand

CHAIN OF CUSTODY: 20886, 20887
PROJECT NAME: Tulameen
PROJECT NUMBER: FR-BC-98-29

NUMBER OF SAMPLES: 13

REPORT DATE: August 18, 1997

DATE SUBMITTED: August 11, 1997

GROUP NUMBER: 7081124

SAMPLE TYPE: Water

TEST METHODS:

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 19th Edition, (1995) and 17th Edition (1989), published by the American Public Health Association.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CAN TEST ID	Nitrate N	Soluble Reactive Phosphorus
AS01	Aug 10/97	708110088	0.20	<
GR01	Aug 10/97	708110089	<	<
TU01	Aug 10/97	708110090	<	<
TU02	Aug 10/97	708110091	<	<
CH01	Aug 10/97	708110092	<	<
PO01	Aug 10/97	708110093	<	<
OL01	Aug 10/97	708110094	<	<
AR01	Aug 10/97	708110095	<	<
SP01	Aug 10/97	708110096	<	<
JK01	Aug 10/97	708110098	<	<
VU01	Aug 10/97	708110099	<	<
OT01	Aug 10/97	708110101	<	<
OT02	Aug 10/97	708110102	<	<
DETECTION LIMIT			0.05	0.02
UNITS			mg/L	mg/L

mg/L = milligrams per liter
< = Less than detection limit

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

BOD and Microbiologicals in Water

CLIENT SAMPLE IDENTIFICATION:	CAN TEST ID	Total BOD	Fecal Coliform	E. Coli
OT01	708110101	<	100	78
OT02	708110102	<	2	2
DETECTION LIMIT		10	2	2
UNITS		mg/L	MPN/100mL	MPN/100mL

mg/L = milligrams per liter
< = Less than detection limit

MPN/100mL = Most Probable Number / 100 mL

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Batch Quality Control for Conventional Parameters in Water

Parameter	QC Type	QC Result	Units	Lower Limit	Upper Limit
Nitrate N	Blank	< 0.05	mg/L	0	0.05
	Dionex Certified Standard	98.3	% Recovery	90	110
	Duplicate	2.8	R.P.D.	0	20
	Duplicate	NC	R.P.D.	0	20
Total BOD	Blank	< 10	mg/L	0	0.5
	Calibration Verification	101.5	% Recovery	81.5	118.5
	Duplicate	NC	R.P.D.	0	15
Soluble Reactive Phosphorus	Blank	< 0.02	mg/L	0	0.05
	Spike	98.0	% Recovery	80	120
	Calibration Verification	100.4	% Recovery	92	108
	Duplicate	NC	R.P.D.	0	16

mg/L = milligrams per liter
< = Less than detection limit
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Batch Quality Control Frequency Summary

Water Lab Ion Chromatography (Batch# 3902)

QC Type	No. Samples
Blank	1
Duplicate	3
Batch Size	31

Analysis Report

CANTEST

CanTest Ltd

Professional Analytical Services

1523 West 3rd Ave
Vancouver, BC
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Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Results of Testing

REPORTED TO: IRC Integrated Resource Consultants Inc.
Suite 160
14480 River Road
Richmond, B.C.
V6V 1L4

Att'n: Ms. Christina Annand

CHAIN OF CUSTODY: 20886, 20887
PROJECT NAME: Tulameen
PROJECT NUMBER: FR-BC-98-29

NUMBER OF SAMPLES: 13

REPORT DATE: August 18, 1997

DATE SUBMITTED: August 11, 1997

GROUP NUMBER: 7081124

SAMPLE TYPE: Water

TEST METHODS:

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 19th Edition, (1995) and 17th Edition (1989), published by the American Public Health Association.

COMMENTS:

Please note! Results for nitrate (NO3) have been reintegrated to calculate values to a lower detection limit.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	AS01	GR01	TU01	TU02	
DATE SAMPLED:	Aug 10/97	Aug 10/97	Aug 10/97	Aug 10/97	DETECTION LIMIT
CAN TEST ID:	708110088	708110089	708110090	708110091	
Nitrate N	0.20	<	0.013	<	0.01
Soluble Reactive Phosphorus	<	<	<	<	0.02

Results expressed as milligrams per liter (mg/L)
< = Less than detection limit

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	CH01	PO01	OL01	AR01	
DATE SAMPLED:	Aug 10/97	Aug 10/97	Aug 10/97	Aug 10/97	DETECTION LIMIT
CAN TEST ID:	708110092	708110093	708110094	708110095	
Nitrate N	<	0.016	<	<	0.01
Soluble Reactive Phosphorus	<	<	<	<	0.02

Results expressed as milligrams per liter (mg/L)
< = Less than detection limit

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	SP01	JK01	VU01	OT01		
DATE SAMPLED:	Aug 10/97	Aug 10/97	Aug 10/97	Aug 10/97	DETECTION LIMIT	UNITS
CAN TEST ID:	708110096	708110098	708110099	708110101		
Nitrate N	0.011	0.030	0.024	0.029	0.01	mg/L
Total BOD	-	-	-	<	10	mg/L
Soluble Reactive Phosphorus	<	<	<	<	0.02	mg/L
Fecal Coliform	-	-	-	100	2	MPN/100mL
E. Coli	-	-	-	78	2	MPN/100mL

mg/L = milligrams per liter
< = Less than detection limit

MPN/100mL = Most Probable Number / 100 mL

REPORTED TO: IRC Integrated Resource Consultants Inc.

REPORT DATE: August 18, 1997

GROUP NUMBER: 7081124

CANTEST

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	OT02		
DATE SAMPLED:	Aug 10/97	DETECTION LIMIT	UNITS
CAN TEST ID:	708110102		
Nitrate N	0.021	0.01	mg/L
Total BOD	<	10	mg/L
Soluble Reactive Phosphorus	<	0.02	mg/L
Fecal Coliform	2	2	MPN/100mL
E. Coli	2	2	MPN/100mL

mg/L = milligrams per liter
< = Less than detection limit

MPN/100mL = Most Probable Number / 100 mL

HYDROLAB DATASONDE 3 RESULTS

Table C1: Water Quality Data Collected on 10 August 1997 at Arrastra Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	152800	15.75	8.07	207	0.1	95.2	9.47	98	0.3	0
81097	152806	15.86	8.07	207	0.1	94.9	9.42	97	0.3	0
81097	152812	15.89	8.07	207	0.1	94.9	9.4	97	0.3	0
81097	152818	15.88	8.07	207	0.1	95	9.42	97	0.3	0
81097	152824	15.88	8.07	206	0.1	95.1	9.43	96	0.3	0
81097	152830	15.88	8.07	206	0.1	95.1	9.43	96	0.3	0
81097	152836	15.87	8.08	206	0.1	94.9	9.41	96	0.3	0
81097	152842	15.86	8.08	206	0.1	94.9	9.41	95	0.3	0
81097	152848	15.87	8.08	206	0.1	94.7	9.39	95	0.3	0
81097	152854	15.86	8.08	206	0.1	94.7	9.39	95	0.3	0
81097	152900	15.86	8.08	206	0.1	94.7	9.39	95	0.3	0
81097	152906	15.86	8.08	206	0.1	94.7	9.4	94	0.3	0
81097	152912	15.86	8.08	206	0.1	94.7	9.39	94	0.3	0
81097	152918	15.87	8.08	206	0.1	94.7	9.39	94	0.3	0
81097	152924	15.87	8.08	206	0.1	94.7	9.39	94	0.3	0
81097	152930	15.86	8.09	206	0.1	94.7	9.39	93	0.3	0
81097	152936	15.87	8.08	206	0.1	94.6	9.38	93	0.3	0
81097	152942	15.87	8.09	206	0.1	94.7	9.39	93	0.3	0
81097	152948	15.88	8.09	206	0.1	94.7	9.39	93	0.3	0
81097	152954	15.87	8.09	206	0.1	94.6	9.39	93	0.3	0
81097	153000	15.87	8.09	206	0.1	94.6	9.39	93	0.3	0
Mean		15.86	8.08	206	0.1	94.8	9.40	95	0.3	0
St. Dev.		0.03	0.01	0	0.0	0.2	0.02	2	0.0	0

Recovery finished at 081097 161940

Table C2: Water Quality Data Collected on 10 August 1997 at Asp Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	162500	14.76	8.3	451	0.2	97.1	9.85	98	0.3	8.8
81097	162506	14.7	8.3	451	0.2	97.4	9.9	98	0.3	9.4
81097	162512	14.84	8.3	448	0.2	97	9.83	98	0.3	9.5
81097	162518	14.7	8.3	449	0.2	97.5	9.91	98	0.3	9.6
81097	162524	14.7	8.3	449	0.2	97.3	9.88	97	0.3	8.7
81097	162530	14.68	8.3	449	0.2	97.5	9.91	97	0.3	7.9
81097	162536	14.69	8.3	450	0.2	97.3	9.89	97	0.3	7.1
81097	162542	14.75	8.29	448	0.2	97	9.85	97	0.3	6.7
81097	162548	14.79	8.29	448	0.2	96.8	9.82	96	0.3	7.3
81097	162554	14.72	8.29	449	0.2	97.1	9.86	96	0.3	8.5
81097	162600	14.77	8.29	448	0.2	96.8	9.82	96	0.3	9.5
81097	162606	14.78	8.29	448	0.2	96.8	9.82	96	0.3	10.6
81097	162612	14.69	8.29	448	0.2	97.3	9.89	96	0.3	11.8
81097	162618	14.77	8.29	447	0.2	96.8	9.82	95	0.3	11.4
81097	162624	14.74	8.29	447	0.2	96.9	9.84	95	0.3	11
81097	162630	14.69	8.29	448	0.2	96.9	9.85	95	0.3	9.7
81097	162636	14.68	8.29	448	0.2	96.9	9.85	95	0.3	8.5
81097	162642	14.7	8.29	448	0.2	96.9	9.84	95	0.3	6.9
81097	162648	14.69	8.29	448	0.2	96.9	9.85	94	0.3	6
81097	162654	14.74	8.28	448	0.2	96.7	9.81	94	0.3	4.6
81097	162700	14.79	8.28	447	0.2	96.6	9.79	94	0.3	4.5
Mean		14.73	8.29	448	0.2	97.0	9.85	96	0.3	8
St. Dev.		0.05	0.01	1	0.0	0.3	0.03	1	0.0	2

Recovery finished at 081097 181407

Table C3: Water Quality Data Collected on 10 August 1997 at Champion Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	124500	11.13	7.61	73	0	91.7	10.11	103	0.3	0
81097	124506	11.13	7.61	73	0	91.7	10.11	103	0.3	0
81097	124512	11.14	7.61	73	0	91.7	10.1	103	0.3	0
81097	124518	11.14	7.62	73	0	91.7	10.1	102	0.3	0
81097	124524	11.14	7.62	73	0	91.6	10.09	102	0.3	0
81097	124530	11.14	7.62	73	0	91.6	10.09	102	0.3	0
81097	124536	11.14	7.62	73	0	91.5	10.08	102	0.3	0
81097	124542	11.14	7.62	73	0	91.4	10.07	101	0.3	0
81097	124548	11.14	7.62	73	0	91.4	10.07	101	0.3	0
81097	124554	11.14	7.62	73	0	91.4	10.07	101	0.3	0
81097	124600	11.14	7.62	73	0	91.4	10.07	101	0.3	0
81097	124606	11.14	7.62	73	0	91.4	10.07	101	0.3	0
81097	124612	11.15	7.62	73	0	91.4	10.07	100	0.3	0
81097	124618	11.15	7.62	73	0	91.4	10.07	100	0.3	0
81097	124624	11.15	7.62	73	0	91.4	10.07	100	0.3	0
81097	124630	11.14	7.62	73	0	91.4	10.07	100	0.3	0
81097	124636	11.15	7.62	73	0	91.4	10.07	100	0.3	0
81097	124642	11.15	7.61	73	0	91.3	10.06	100	0.3	0
81097	124648	11.15	7.61	73	0	91.3	10.06	100	0.3	0
81097	124654	11.15	7.62	73	0	91.4	10.07	99	0.3	0
81097	124700	11.15	7.62	73	0	91.4	10.07	99	0.3	0
Mean		11.14	7.62	73	0.0	91.5	10.08	101	0.3	0
St. Dev.		0.01	0.00	0	0.0	0.1	0.02	1	0.0	0

Recovery finished at 081097 133203

Table C4: Water Quality Data Collected on 10 August 1997 at Granite Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	144300	14.12	8.24	246	0.1	98.5	10.14	96	0.3	0
81097	144306	14.11	8.24	247	0.1	98.4	10.13	96	0.3	0
81097	144312	14.13	8.24	246	0.1	98.4	10.13	96	0.3	0
81097	144318	14.13	8.24	246	0.1	98.4	10.13	96	0.3	0
81097	144324	14.13	8.24	247	0.1	98.4	10.13	96	0.3	0
81097	144330	14.12	8.24	247	0.1	98.4	10.13	95	0.3	0
81097	144336	14.13	8.24	247	0.1	98.3	10.12	96	0.3	0
81097	144342	14.13	8.24	247	0.1	98.4	10.13	95	0.3	0
81097	144348	14.14	8.24	247	0.1	98.4	10.13	95	0.3	0
81097	144354	14.13	8.24	246	0.1	98.4	10.13	95	0.3	0
81097	144400	14.13	8.24	246	0.1	98.4	10.13	95	0.3	0
81097	144406	14.13	8.24	246	0.1	98.3	10.12	95	0.3	0
81097	144412	14.14	8.24	246	0.1	98.4	10.13	95	0.3	0
81097	144418	14.14	8.24	247	0.1	98.4	10.13	95	0.3	0
81097	144424	14.16	8.24	246	0.1	98.3	10.12	95	0.3	0
81097	144430	14.15	8.24	247	0.1	98.5	10.14	94	0.3	0
81097	144436	14.14	8.24	247	0.1	98.5	10.13	94	0.3	0
81097	144442	14.15	8.24	247	0.1	98.5	10.13	94	0.3	7.9
81097	144448	14.15	8.24	247	0.1	98.4	10.13	94	0.3	16.7
81097	144454	14.15	8.24	247	0.1	98.5	10.13	94	0.3	22
81097	144500	14.15	8.24	247	0.1	98.5	10.13	94	0.3	26.7
Mean		14.14	8.24	247	0.1	98.4	10.13	95	0.3	3
St. Dev.		0.01	0.00	0	0.0	0.1	0.00	1	0.0	8

Recovery finished at 081097 152410

Table C5: Water Quality Data Collected on 10 August 1997 at Jim Kelly Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	121900	10.94	7.64	90	0	94.7	10.48	109	0.3	2.7
81097	121906	10.94	7.64	90	0	94.6	10.47	108	0.3	2.9
81097	121912	11	7.62	84	0	94.7	10.47	108	0.3	3.8
81097	121918	10.92	7.65	89	0	94.9	10.5	108	0.3	5.4
81097	121924	10.92	7.65	89	0	95	10.52	108	0.3	7.1
81097	121930	10.92	7.65	89	0	95.1	10.53	108	0.3	8.6
81097	121936	10.95	7.65	89	0	95	10.51	107	0.3	9.7
81097	121942	10.95	7.65	89	0	95.1	10.53	107	0.3	9.5
81097	121948	10.95	7.65	89	0	95.1	10.52	107	0.3	7.7
81097	121954	10.97	7.65	89	0	95	10.51	107	0.3	5.9
81097	122000	11	7.65	89	0	94.9	10.49	107	0.3	4.1
81097	122006	10.98	7.65	89	0	95.1	10.51	107	0.3	2.5
81097	122012	10.99	7.65	89	0	94.8	10.48	107	0.3	2.1
81097	122018	10.98	7.65	89	0	94.4	10.44	107	0.3	2.5
81097	122024	10.97	7.65	89	0	94.5	10.45	107	0.3	2.9
81097	122030	10.95	7.65	89	0	94.6	10.47	107	0.3	3.3
81097	122036	10.96	7.65	89	0	94.4	10.45	106	0.3	3.7
81097	122042	10.97	7.65	89	0	94.5	10.45	106	0.3	3.6
81097	122048	10.98	7.65	89	0	94.4	10.44	106	0.3	3.4
81097	122054	10.96	7.65	89	0	94.6	10.46	106	0.3	3.4
81097	122100	10.96	7.65	89	0	94.6	10.47	106	0.3	3.5
Mean		10.96	7.65	89	0.0	94.8	10.48	107	0.3	5
St. Dev.		0.02	0.01	1	0.0	0.3	0.03	1	0.0	2

Recovery finished at 081097 123930

Table C6: Water Quality Data Collected on 10 August 1997 at Olivine Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	134300	11.82	8.17	262	0.1	96.5	10.46	101	0.3	0
81097	134306	11.82	8.17	262	0.1	96.4	10.45	101	0.3	0
81097	134312	11.82	8.17	262	0.1	96.5	10.46	101	0.3	0
81097	134318	11.82	8.16	262	0.1	96.4	10.45	101	0.3	0
81097	134324	11.82	8.16	262	0.1	96.4	10.45	100	0.3	0
81097	134330	11.82	8.16	262	0.1	96.5	10.46	100	0.3	0
81097	134336	11.82	8.16	262	0.1	96.5	10.46	100	0.3	0
81097	134342	11.82	8.16	262	0.1	96.5	10.46	100	0.3	0
81097	134348	11.83	8.16	262	0.1	96.4	10.45	100	0.3	0
81097	134354	11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134400	11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134406	11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134412	11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134418	11.82	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134424	11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
81097	134430	11.83	8.16	262	0.1	96.5	10.45	98	0.3	0
81097	134436	11.83	8.16	262	0.1	96.4	10.45	98	0.3	0
81097	134442	11.83	8.16	262	0.1	96.5	10.45	98	0.3	0
81097	134448	11.84	8.16	262	0.1	96.4	10.45	98	0.3	0
81097	134454	11.83	8.16	262	0.1	96.5	10.45	98	0.3	0
81097	134500	11.84	8.16	262	0.1	96.5	10.45	98	0.3	0
Mean		11.83	8.16	262	0.1	96.4	10.45	99	0.3	0
St. Dev.		0.01	0.00	0	0.0	0.1	0.00	1	0.0	0

Recovery finished at 081097 143000

Table C7: Water Quality Data Collected on 10 August 1997 at Otter Creek (Site 1)

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	101700	17.26	7.8	192	0.1	93	8.96	96	0.3	0
81097	101706	17.24	7.8	191	0.1	92.9	8.96	95	0.3	0
81097	101712	17.22	7.81	191	0.1	92.9	8.95	95	0.3	0
81097	101718	17.23	7.81	191	0.1	92.7	8.94	94	0.3	0
81097	101724	17.23	7.81	191	0.1	92.8	8.95	94	0.3	0
81097	101730	17.23	7.81	191	0.1	92.9	8.95	93	0.3	0
81097	101736	17.2	7.81	191	0.1	92.9	8.96	93	0.3	0
81097	101742	17.22	7.81	191	0.1	92.8	8.95	92	0.3	0
81097	101748	17.22	7.82	191	0.1	92.8	8.94	92	0.3	0
81097	101754	17.21	7.82	191	0.1	92.8	8.95	91	0.3	0
81097	101800	17.27	7.82	191	0.1	92.7	8.93	91	0.3	0
81097	101806	17.24	7.82	191	0.1	92.9	8.95	90	0.3	0
81097	101812	17.22	7.83	191	0.1	92.8	8.95	90	0.3	0
81097	101818	17.28	7.83	191	0.1	92.8	8.93	90	0.3	0
81097	101824	17.29	7.83	191	0.1	92.9	8.94	89	0.3	0
81097	101830	17.3	7.83	191	0.1	92.9	8.94	89	0.3	0
81097	101836	17.28	7.83	191	0.1	92.9	8.95	88	0.3	0
81097	101842	17.27	7.84	192	0.1	93	8.96	88	0.3	0
81097	101848	17.29	7.84	191	0.1	92.9	8.95	88	0.3	0
81097	101854	17.3	7.84	191	0.1	93	8.95	87	0.3	0
81097	101900	17.29	7.84	191	0.1	92.9	8.94	87	0.3	0
Mean		17.25	7.82	191	0.1	92.9	8.95	91	0.3	0
St. Dev.		0.03	0.01	0	0.0	0.1	0.01	3	0.0	0

Recovery finished at 081097 113143

Table C8: Water Quality Data Collected on 10 August 1997 at Otter Creek (Site 2)

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	94100	7.81	7.13	269	0.1	79.2	9.43	137	0.3	1.1
81097	94106	7.83	7.12	269	0.1	77.4	9.21	137	0.3	1.1
81097	94112	7.88	7.12	267	0.1	75.7	9	137	0.3	1.1
81097	94118	7.9	7.12	267	0.1	74.6	8.87	137	0.3	1.1
81097	94124	7.9	7.12	267	0.1	74.1	8.8	137	0.3	1.2
81097	94130	7.95	7.12	266	0.1	73.2	8.69	137	0.3	1.2
81097	94136	7.86	7.12	267	0.1	73.5	8.75	136	0.3	1.2
81097	94142	7.86	7.12	267	0.1	73	8.69	136	0.3	1.2
81097	94148	7.88	7.12	266	0.1	72.9	8.67	136	0.3	1.2
81097	94154	7.86	7.12	266	0.1	72.8	8.67	136	0.3	1.2
81097	94200	7.83	7.12	266	0.1	73.1	8.71	136	0.3	1.2
81097	94206	7.81	7.11	266	0.1	74	8.82	136	0.3	1.1
81097	94212	7.83	7.11	266	0.1	76.3	9.09	136	0.3	1.1
81097	94218	7.82	7.11	266	0.1	77.5	9.23	136	0.3	1
81097	94224	7.87	7.11	266	0.1	76.3	9.08	136	0.3	1
81097	94230	7.9	7.11	265	0.1	75	8.92	136	0.3	1
81097	94236	7.92	7.11	265	0.1	74	8.79	136	0.3	1
81097	94242	7.96	7.11	265	0.1	73.3	8.7	135	0.3	0.9
81097	94248	7.99	7.11	264	0.1	72.8	8.64	135	0.3	0.9
81097	94254	7.96	7.1	264	0.1	72.5	8.61	135	0.3	0.9
81097	94300	7.97	7.1	264	0.1	72.3	8.59	135	0.3	0.9
Mean		7.89	7.11	266	0.1	74.5	8.86	136	0.3	1
St. Dev.		0.06	0.01	1	0.0	1.9	0.23	1	0.0	0

Recovery finished at 081097 101244

Table C9: Water Quality Data Collected on 10 August 1997 at Podunk Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	113600	10.42	7.5	75	0	91.3	10.23	106	0.3	0
81097	113606	10.36	7.49	74	0	91.5	10.26	106	0.3	0
81097	113612	10.38	7.48	74	0	91.5	10.26	106	0.3	0
81097	113618	10.35	7.48	73	0	91.7	10.29	106	0.3	0
81097	113624	10.3	7.47	73	0	91.7	10.3	106	0.3	0
81097	113630	10.27	7.47	73	0	91.7	10.31	106	0.3	0
81097	113636	10.32	7.46	72	0	91.5	10.28	106	0.3	0
81097	113642	10.39	7.45	72	0	91.3	10.23	106	0.3	0
81097	113648	10.36	7.42	72	0	91.4	10.25	106	0.3	0
81097	113654	10.41	7.44	71	0	91	10.2	106	0.3	0
81097	113700	10.35	7.43	71	0	91	10.21	106	0.3	0
81097	113706	10.33	7.43	71	0	90.9	10.21	106	0.3	0
81097	113712	10.35	7.43	70	0	90.9	10.2	106	0.3	0
81097	113718	10.34	7.43	70	0	90.6	10.17	106	0.3	0
81097	113724	10.37	7.42	70	0	90.4	10.14	106	0.3	0
81097	113730	10.34	7.42	70	0	90.3	10.13	106	0.3	0
81097	113736	10.31	7.41	70	0	90.2	10.14	105	0.3	0
81097	113742	10.3	7.41	70	0	90.4	10.16	106	0.3	0
81097	113748	10.32	7.4	70	0	90.5	10.16	106	0.3	0
81097	113754	10.34	7.4	69	0	90.6	10.17	105	0.3	0
81097	113800	10.36	7.4	69	0	90.5	10.16	106	0.3	0
Mean		10.35	7.44	71	0.0	91.0	10.21	106	0.3	0
St. Dev.		0.04	0.03	2	0.0	0.5	0.06	0	0.0	0

Recovery finished at 081097 115205

Table C10: Water Quality Data Collected on 10 August 1997 at Spearing Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	91500	11.77	7.87	193	0.1	97.7	10.6	132	0.3	0
81097	91506	11.77	7.88	193	0.1	97.6	10.59	132	0.3	0
81097	91512	11.77	7.88	193	0.1	97.6	10.59	132	0.3	0
81097	91518	11.76	7.88	193	0.1	97.9	10.63	131	0.3	0
81097	91524	11.77	7.89	192	0.1	98.1	10.65	131	0.3	0
81097	91530	11.77	7.89	192	0.1	97.9	10.63	131	0.3	0
81097	91536	11.76	7.89	193	0.1	97.8	10.62	130	0.3	0
81097	91542	11.77	7.89	193	0.1	97.7	10.61	130	0.3	0
81097	91548	11.77	7.89	193	0.1	97.5	10.58	130	0.3	0.8
81097	91554	11.78	7.89	193	0.1	97.5	10.58	129	0.3	2.1
81097	91600	11.78	7.9	192	0.1	97.6	10.59	129	0.3	3.5
81097	91606	11.77	7.9	193	0.1	97.3	10.56	129	0.3	3.8
81097	91612	11.77	7.9	193	0.1	97.3	10.56	129	0.3	3.4
81097	91618	11.78	7.9	193	0.1	97.3	10.56	129	0.3	3.2
81097	91624	11.78	7.9	192	0.1	97.3	10.56	128	0.3	2.9
81097	91630	11.78	7.9	193	0.1	97.4	10.57	128	0.3	2.5
81097	91636	11.78	7.91	192	0.1	97.2	10.54	128	0.3	2.8
81097	91642	11.78	7.9	193	0.1	97.1	10.54	128	0.3	3.2
81097	91648	11.77	7.9	193	0.1	97.1	10.54	128	0.3	3.1
81097	91654	11.78	7.91	193	0.1	96.9	10.51	127	0.3	3.1
81097	91700	11.78	7.9	193	0.1	96.7	10.49	127	0.3	3
81097	91706	11.79	7.91	192	0.1	96.5	10.48	127	0.3	2.8
81097	91712	11.79	7.91	192	0.1	96.4	10.46	127	0.3	2.8
81097	91718	11.8	7.91	192	0.1	96.5	10.47	127	0.3	3.1
81097	91724	11.79	7.91	192	0.1	96.7	10.49	126	0.3	3.6
81097	91730	11.79	7.91	192	0.1	96.8	10.5	126	0.3	4.6
81097	91736	11.79	7.91	192	0.1	96.6	10.48	126	0.3	6
81097	91742	11.8	7.91	192	0.1	96.5	10.47	126	0.3	7
Mean		11.78	7.90	193	0.1	97.2	10.55	129	0.3	2.4
St. Dev.		0.01	0.01	1	0.0	0.5	0.06	2	0	1.9

Recovery finished at 081097 092109

Table C11: Water Quality Data Collected on 10 August 1997 at Tulameen River (Site 1)

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	143800	16.41	7.89	185	0.1	86.1	8.44	107	0.3	27.2
81097	143806	16.46	7.89	185	0.1	86.3	8.45	107	0.3	36.1
81097	143812	16.58	7.9	185	0.1	86.4	8.44	106	0.3	39.8
81097	143818	16.54	7.9	185	0.1	86.7	8.48	106	0.3	37.4
81097	143824	16.36	7.9	189	0.1	87.1	8.55	106	0.3	35.9
81097	143830	16.58	7.9	184	0.1	86.4	8.44	105	0.3	35.4
81097	143836	16.75	7.9	183	0.1	86.9	8.46	105	0.3	31.5
81097	143842	16.75	7.91	182	0.1	86.7	8.44	104	0.3	22
81097	143848	16.78	7.91	183	0.1	87	8.47	104	0.3	16.8
81097	143854	16.58	7.92	184	0.1	86.6	8.46	104	0.3	13.3
81097	143900	16.52	7.92	185	0.1	86.9	8.5	104	0.3	10.6
81097	143906	16.58	7.92	184	0.1	87	8.5	104	0.3	11
81097	143912	16.73	7.92	183	0.1	86.9	8.47	103	0.3	13.6
81097	143918	16.73	7.92	183	0.1	86.8	8.45	103	0.3	15.3
81097	143924	16.6	7.93	185	0.1	87.3	8.52	103	0.3	17.2
81097	143930	16.55	7.92	184	0.1	85.9	8.4	103	0.3	21.9
81097	143936	16.71	7.92	183	0.1	86.7	8.45	102	0.3	22.6
81097	143942	16.54	7.92	185	0.1	86.7	8.48	102	0.3	25.1
81097	143948	16.64	7.92	184	0.1	86.7	8.46	102	0.3	25.8
81097	143954	16.52	7.92	184	0.1	86.6	8.47	102	0.3	17.2
81097	144000	16.52	7.93	185	0.1	86.5	8.46	102	0.3	0
Mean		16.59	7.91	184	0.1	86.7	8.47	104	0.3	23
St. Dev.		0.12	0.01	1	0.0	0.3	0.03	2	0.0	11

Recovery finished at 081097 152341

Table C12: Water Quality Data Collected on 10 August 1997 at Tulameen River (Site 2)

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	133800	14.36	7.95	125	0.1	98.9	10.14	102	0.3	12.1
81097	133806	14.35	7.95	126	0.1	98.9	10.13	101	0.3	8.5
81097	133812	14.36	7.94	125	0.1	98.8	10.13	101	0.3	3.5
81097	133818	14.37	7.95	126	0.1	98.8	10.13	101	0.3	3.1
81097	133824	14.36	7.95	126	0.1	98.8	10.12	101	0.3	6.2
81097	133830	14.36	7.95	125	0.1	98.8	10.12	100	0.3	11.9
81097	133836	14.35	7.95	126	0.1	98.9	10.13	100	0.3	12.5
81097	133842	14.36	7.95	126	0.1	98.8	10.12	100	0.3	15.4
81097	133848	14.35	7.95	126	0.1	98.8	10.12	100	0.3	19
81097	133854	14.37	7.95	126	0.1	98.8	10.12	99	0.3	17.9
81097	133900	14.36	7.95	126	0.1	98.8	10.12	99	0.3	19
81097	133906	14.37	7.95	125	0.1	98.8	10.12	99	0.3	26.1
81097	133912	14.36	7.95	126	0.1	98.8	10.12	99	0.3	25.8
81097	133918	14.37	7.95	126	0.1	98.8	10.12	99	0.3	22.9
81097	133924	14.36	7.95	126	0.1	98.8	10.12	98	0.3	22.1
81097	133930	14.35	7.95	126	0.1	98.8	10.12	98	0.3	12.6
81097	133936	14.37	7.95	126	0.1	98.9	10.13	98	0.3	0
81097	133942	14.36	7.96	126	0.1	98.8	10.12	98	0.3	0
81097	133948	14.37	7.95	125	0.1	98.7	10.12	98	0.3	0
81097	133954	14.36	7.95	126	0.1	98.7	10.12	98	0.3	0
81097	134000	14.37	7.95	126	0.1	98.8	10.12	98	0.3	0
Mean		14.36	7.95	126	0.1	98.8	10.12	99	0.3	11
St. Dev.		0.01	0.00	0	0.0	0.1	0.01	1	0.0	9

Recovery finished at 081097 142925

Table C13: Water Quality Data Collected on 10 August 1997 at Vuich Creek

Date (MMDDYY)	Time (HHMMSS)	Temp (degC)	pH (pH units)	SpCond (uS/cm)	Salinity (ppt)	D.O. (%Sat)	D.O. (mg/L)	Redox (mV)	Depth (m)	Turbidity (NTU)
81097	115600	10.45	7.47	86	0	91.9	10.29	104	0.3	16.1
81097	115606	10.45	7.47	86	0	91.8	10.28	104	0.3	16.6
81097	115612	10.45	7.47	86	0	91.8	10.27	104	0.3	17.2
81097	115618	10.46	7.47	86	0	91.8	10.27	104	0.3	17.7
81097	115624	10.45	7.46	86	0	91.7	10.27	104	0.3	18.1
81097	115630	10.45	7.46	86	0	91.7	10.26	103	0.3	18.3
81097	115636	10.46	7.46	86	0	91.7	10.26	103	0.3	18.5
81097	115642	10.46	7.46	86	0	91.7	10.26	103	0.3	18.7
81097	115648	10.47	7.46	86	0	91.7	10.26	103	0.3	18.7
81097	115654	10.46	7.46	86	0	91.7	10.26	103	0.3	18.7
81097	115700	10.47	7.46	86	0	91.6	10.25	103	0.3	18.7
81097	115706	10.47	7.46	86	0	91.6	10.25	102	0.3	18.8
81097	115712	10.47	7.46	86	0	91.6	10.25	102	0.3	18.7
81097	115718	10.47	7.45	86	0	91.5	10.24	102	0.3	18.3
81097	115724	10.47	7.45	86	0	91.5	10.24	102	0.3	17.6
81097	115730	10.47	7.45	86	0	91.5	10.24	102	0.3	16.9
81097	115736	10.48	7.45	86	0	91.5	10.24	102	0.3	15.5
81097	115742	10.48	7.45	86	0	91.5	10.23	102	0.3	14
81097	115748	10.48	7.45	86	0	91.6	10.24	101	0.3	13.3
81097	115754	10.48	7.45	86	0	91.5	10.24	101	0.3	12.7
81097	115800	10.48	7.45	86	0	91.5	10.24	101	0.3	11.8
Mean		10.47	7.46	86	0.0	91.6	10.25	103	0.3	17
St. Dev.		0.01	0.01	0	0.0	0.1	0.02	1	0.0	2

Recovery finished at 081097 121426

APPENDIX D: GRANITE CREEK NATIVE RIPARIAN PLANTING SCHEME

Table D1: Native Trees and Shrubs Planted at Granite Creek

Common Names	Scientific Names	Site Number																								
		0.5*	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13
Trees[1]																											
Black cottonwood	*Populus balsamifera* ssp. *trichocarpa*	6	2	1	2		3		2		1		1				2		1		1						
Shrubs[2]																											
Douglas maple	*Acer glabrum*	6	2		2	4	1		7		1	3	7	10			4		2	1	2	3	3		3	2	1
Dwarf birch	*Betula glandulosa*					3							4									5	1				
Pacific willow	*Salix lucida* ssp. *lasiandra*	1	2	3	1						2		2	1	2		1		1		1						
Salix spp.		3	2		3		6				4		5		7		7		6		4		5		5		6
Sitka willow	*Salix sitchensis*																										
Scouler's willow	*Salix scouleriana*																										
Pussy willow	*Salix discolor*																										
Red elderberry	*Sambucus racemosa*		3		2		3				5		5		7		4		7		3		7		6		3
Flat-topped Spiraea	*Spiraea betulofolia*					3							1									5	1				
Red-osier dogwood	*Cornus stolonifera*	5					2						2				1		1								
Saskatoon	*Amelanchier alnifolia*					3			1			2					1		1	1	1	2	3		1	1	1
Black gooseberry	*Ribes lacustre*		3		2	3	4		2	3		2	3	4	2	3	5		4		2	5	2		3		2
Thimbleberry	*Rubus parviflorus*		8		3	6	5	4		2		5		7	14	6	1	7		1	1	7				1	
Total Number per Site		21	22	4	15	22	24	4	12	5	13	12	30	22	32	9	26	7	23	3	15	27	22	0	18	4	13

* decimal values denote areas between planting sites

1 one gallon pots and bands

2 plugs

Table D2: Native Trees and Shrubs Planted at Granite Creek (Cont.)

Common Names	Scientific Names	Site Number																										Total
		13.5*	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5	25	25.5	26	
Trees[1]																												
Black cottonwood	*Populus balsamifera* ssp. *trichocarpa*						2		1		2		3		3		3		3		4				2		5	50
Shrubs[2]																												
Douglas maple	*Acer glabrum*		2			1	1		1		2	8			1	2	4	1			4	2	3		2		3	101
Dwarf birch	*Betula glandulosa*			1		1																						15
Pacific willow	*Salix lucida* ssp. *lasiandra*														2						2		1					22
Salix spp.			4		6		6		4		4		2				5		2		10		4		6		2	118
Sitka willow	*Salix sitchensis*																											
Scouler's willow	*Salix scouleriana*																											
Pussy willow	*Salix discolor*																											
Red elderberry	*Sambucus racemosa*		4		6																							65
Flat-topped Spiraea	*Spiraea betulofolia*						1		1				2						2		2		1					19
Red-osier dogwood	*Cornus stolonifera*						2		1				1				2		3									20
Saskatoon	*Amelanchier alnifolia*		2			1	3		2		4	3		3	2	2		1				1						42
Black gooseberry	*Ribes lacustre*		2			2	2		1		2	5			4				1			2						75
Thimbleberry	*Rubus parviflorus*																			2								80
Total Number per Site		0	14	1	12	5	17	0	11	0	14	16	8	3	12	4	14	2	11	2	22	5	9	0	10	0	10	607

* Decimal values denote areas between planting sites

1 one gallon pots and bands

2 plugs

APPENDIX E: GOVERNMENT PERMITS

BRITISH COLUMBIA

July 17, 1997

File: 34770-20
(IRC)

Integrated Resource Consultants Inc.
160 14480 River Road
Richmond BC V6V 1L4

Dear Len Fanning:

Re: **Letter of Authorization for Sampling of Fish (Tulameen Watershed)**

On behalf of the Ministry of Environment, Lands and Parks, you are hereby authorized to undertake the following sampling -

Permitted Waters: Tulameen River and tributaries (as specified in contract 98-29).

Permitted Times: July 28, 1997 to December 31, 1997

Permitted Species: All species

Permitted Gear: Dipnets, Seine nets, Electroshocker, Minnow traps.

.Permitted Personnel: Len Fanning, Neville Rising, Brian Widmer, Christina Annand, Phil Henderson.

Expiry Date: January 1, 1998.

Conditions: All fish to be returned to creek after capture except voucher specimens required for identification purposes. That all members of electrofishing crews must have a valid electrofishing certificate. Conduct fish sampling as specified in Contract 98-29. All sampled fish must be released at the capture site immediately following completion of sampling procedures to ensure maximum survival.

Your assistance on this project is very much appreciated.

S. Matthews, RPBio
Fisheries Biologist
Fish, Wildlife and Habitat Protection
Southern Interior Region

SM/smc

cc: B. Voth
M. Collett
B. Shepherd

Ministry of Environment, Lands and Parks

BC Environment

Mailing Address:
201 - 3547 Skaha Lake Road
Penticton BC V2A 7K2

Telephone: (250) 490-8200
Facsimile: (250) 492-1314

GENERAL CONDITIONS

1. This collecting permit is not valid

   (a) in national parks,
   (b) in provincial parks unless approved by regional staff of BC Parks,
   (c) for salmon other than kokanee, or
   (d) for collecting fish by angling **unless the permittee and crew** members possesses **a valid angling licence.**

2. This permit is valid only for the activities approved on the application form and in accordance with any restrictions set out therein.

3. The project supervisor named on the application for a scientific collection permit will carry a copy of this permit while engaged in fish collecting and produce it upon request of a conservation officer, fishery officer or constable.

4. This permit is valid only for trained, qualified staff named in the Application. The permittee will comply with all Worker's Compensation Board requirements and other regulatory requirements.

5. Any specimens surplus to scientific requirements and any species not authorized for collection shall be immediately and carefully released alive at the point of capture.

6. No fish collected under authority of this permit shall be used for food or any purpose other than the objectives set out in the approved application for a scientific collection permit. The permittee shall not sell, barter, trade, or give away, or offer to sell, barter, trade, or give away fish collected under authority of this permit. Dead fish shall be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.

7. No fish collected under authority of this permit shall be transported alive or transplanted to another body of water unless separately authorized by the Federal/Provincial Fish Transplant Committee on a live fish permit.

8. The permittee shall submit to the Regional Fisheries Section Head for the area under consideration a summary report of collecting activities within 90 days of completion of the collecting activity. Interim reports will be provided upon request to the requesting office.

9. This collection permit may be cancelled at any time and shall be surrendered to a Conservation Officer on demand or to the issuer immediately upon receipt of written notice of its cancellation.

BRITISH COLUMBIA

September 22, 1997

File: R802401

Ministry of Environment, Lands & Parks
201 - 3547 Skaha Lake Road
Penticton, B.C.
V2A 7K2

Attention: Steve Matthews, Fisheries Program

Dear Steve Matthews:

Re: Authorization -
Fish Habitat Restoration - Granite Creek

In regard to the above, the Fish, Wildlife and Habitat Protection Programs provide the following comments.

Your application has been reviewed and authorized under Section 9 of the Water Act, subject to the following conditions.

This letter does not relieve the person carrying out the proposed works from the requirement to comply with all other applicable federal, provincial or municipal enactments.

If the proposed works occur on Crown land or land owned by another person it will be necessary to obtain the approval of the owner before proceeding.

The proposed work must be designed, constructed and maintained in such a manner that the change does not pose a significant danger to life, property or the environment.

Work authorized is described as follows:

September 24: Site preparation (diversion of Granite Creek, rerouting of flow on site, LWD delivery, access preparation and fish salvage).

Ministry of Environment, Lands and Parks

BC Environment

Mailing Address:
201 - 3547 Skaha Lake Road
Penticton BC V2A 7K2

Telephone: (250) 490-8200
Facsimile: (250) 492-1314

September 25: LWD placement/bank stabilization: Five pieces of LWD are to be placed at the toe of the eroding east bank. The pieces of LWD will be placed parallel to the bank with rootwads upstream and the trunk of each LWD embedded into the bank. Each piece will be anchored to boulders (> 1 m dia.) along the toe of the bank with at least 1" galvanized steel cable. The rootwad of each LWD will be anchored to the streambed with rebar (through the trunk of the tree, the top 0.20 m angled to 90 deg. and driven to a depth of 3 m).

Logjam manipulation: LWD will be placed at the logjam so as to prevent the creek from flowing along the east bank and to encourage redirection of the concentrated flow along the west bank. LWD placed at the logjam will be anchored to the streambed with rebar(through the trunk of the tree, the top 0.20 m angled to 90 deg. and driven to a depth of 3 m).

Placement of cottonwood (Populus trichocarpa): Whole or partial pieces of cottonwood trees will be embedded in the gravel bars to a total depth of 0.10 m in the gravel/cobble bar on the west bank.

All work must be carried out during favourable weather and low water conditions.

Upon commencement of the project, the work must be pursued to completion as quickly as possible.

The channel, upon completion of the work, must have a cross-sectional area and gradient approximately equal to the existing conditions. Furthermore, the side slopes of the channel must not exceed 2:1 (horizontal:vertical).

All disturbed areas within 15 meters of the top of bank/high water mark are to be graded and stabilized upon completion of the work. Furthermore, these areas must be revegetated to prevent surface erosion and subsequent siltation of the watercourse.

Any machinery operated in the stream shall be free of excess oil and grease.

All work within the wetted perimeter of the stream must be undertaken and completed by September 30 and all other works about the stream must be completed by December 31, 1997.

A copy of this letter must be forwarded to the contractor/crew supervisor and must be present on the site while the work is proceeding.

Yours truly,

Mike Ladd
Habitat Officer
Fisheries & Wildlife
Management Programs
Southern Interior Region

ML/ls

c.c. Dan Bella, Water Management, Penticton
Al Lay, C.O. Service, Princeton
Frank Heller, FRBC Watershed Restoration Technician, Ministry of Forests, Merritt
Len Fanning, IRC, Suite 160, 14480 River Road, Richmond, B.C. V6V 1L4

APPENDIX F: FIELD NOTES AND CHAIN OF CUSTODY FORMS

Aug 7 /97

Site 2 on Jim Kelly

@ 40 m site 2
1 cutt. throat. & 168 mm
& 100m site 2
1 cutt @ 165 mm

@ 300 m from 0 m 20 ft falls
presumed to be barrier

@ 471 hiked up from falls, divert from creek.
walk through bush
511 from J. Kelley to trail

once on trail 517 m to dry creek
bed

173 m from trail down dry creek
to J. Kelly

@ 250 m down from dry creek on J. Kelly
1 large pool 20 ft x 30 ft x 5 ft deep

ds from dry creek
@ 270 m 15 m falls
@ 550 m ds from dry creek large falls to be seen
from below

72
146
471

Aug 8/97

Olavine, 50 m D/s from falls near cabin GPS co-ordinate
657637E
5488939N
file # R080815A

T° 13°

GPS co-ordinate for J. Kelley
50m upstream of dry creek
646139E
5482237N
file R080716A

walked 450 m u/s from dry creek bed on J. Kelly

∴ No fish found above barrier

Aug 9/97 Upper Spearing

Species	L	W	
Rainbow	19	79.18	
sculp	48	107	Archive
Rainbow	103	11.82	
"	75	6099	
	32	0 31	
	41	0 85	
	38	0.58	
	41	0.76	
	39	0.63	
	30	0.26	
	32	0.34	
	36	0.50	
	40	0.69	
	45	~~#~~ 1.06	
	45	1.13	
R. trout	40	0.63	
sculpin	13	098	Archive
"	51	1.40	"
"	49	1.28	"
"	52	1.49	"
"	45	1.02	"
R. trout	165	~~#~~ 41.99	

Upper Spearing 9 Aug 97

Species	L	W	
Sculpin	88	7.27	Archive
	80	5.86	
	50	1.38	
Rainbow	39	0.65	
	82	7.46	
	206	89.66	
	150	35.73	first
	160	42.10	
	155	41.48	
	116	15.78	
	93	9.30	
	105	11.34	
	111	14.24	
	92	9.28	
	45	1.20	
	41	0.73	
	40	0.92	
	35	0.55	
Sculpin (Pricklys)	91	9.68	
	65	3.71	
	71	4.10	
	52	2.00	

Aug 9/97 Upper spearing

Species	L	W	
Rainbow	112	15.10	
	149	32.07	
	79	5.27	
	41	0.76	
	38	0.57	
	48	1.27	
	41	0.78	
	39	0.58	
	37	0.53	
	41	0.82	
	32	0.42	
	44	1.02	
	38	0.69	
	46	0.76	
	40	0.69	
	42	0.95	
	35	0.53	
	103	11.57	
Rainbow	39	0.59	
Sculpin	61	2.70	
"	75	4.55	Archive
"	45	0.97	
"	95	9.12	
"	45	1.12	

Upper Spearing 9 Aug 97

Species	L	W	
Sculpin	88	7.27	Archive
	80	5.86	
	50	1.38	
Rainbow	39	0.65	
	82	7.46	
	206	89.66	
	150	35.73	First
	160	42.10	
	155	41.48	
	116	15.78	
	93	9.30	
	105	11.34	
	111	14.24	
	92	9.28	
	45	1.20	
	41	0.73	
	40	0.92	
	35	0.55	
Sculpin (Prickly)	91	9.68	
	65	3.71	
	71	4.10	
	52	2.00	

Aug 9/97 Upper spearing

Species	L	W	
Rainbow	112	15.10	
	149	32.07	
	79	5.27	
	41	0.76	
	38	0.57	
	48	1.27	
	41	0.78	
	39	0.58	
	37	0.53	
	41	0.82	
	32	0.42	
	44	1.02	
	~~38~~	0.69	
	46	0.76	
	40	0.69	
	42	0.95	
	35	0.53	
	103	11.57	
Rainbow	39	0.59	
Sculpin	61	2.70	
"	75	4.58	Archive
"	45	0.97	
"	95	9.12	
"	45	1.12	

9 Aug 97 Upper Spearing

Species	L	W	
Rainbow	30	0.29	
	51	1.48	
	40	0.70	
	38	0.62	
	68	2.97	
Sculpin	68	9.01	
Rainbow	42	0.96	
Sculpin	49	1.76	
	52	1.74	
	64	3.20	
	63	2.93	Archive
	66	3.91	
	53	1.88	
	45	1.11	
	80	6.17	
Rainbow	39	0.61	
	40	0.59	
	40	0.73	
	36	0.48	
	38	0.60	
Sculpin	64	2.90	
Rainbow	48	1.10	
Sculpin	43	0.95	

9 Aug 97 Upper Spearing

Species	L	W
Rainbow	220	120.25
	208	106.13
	184	67.50
	150	34.44
	161	41.00
	120	20.11
	120	20.34
	98	9.25
	39	0.72
	105	12.27
	100	10.23
	120	18.16
	110	15.57
	96	15.55
	90	8.46
	91	9.00
	92	8.74
	92	8.82
	78	5.73
	81	6.66
	78	4.99
	73	4.07
	72	4.60

9 Aug 97 Upper Spearing

Species	L	W
Rainbow	32	0.33
	40	0.68
	35	0.53
	43	0.90
	41	0.73
	43	0.82
	45	0.98
	43	0.92
	43	0.80
	37	0.66
	33	0.38
	45	1.05
	34	0.37
Sculpin	19	0.12
	19	0.11
	63	3.14
	48	1.23
	51	1.53
	76	4.99
	51	1.47
	46	1.09
	46	1.23
	55	1.94

9 Aug 97 Upper Spearing

Species	L	W
Sculpin	50	1.42
	50	1.21
	45	0.92
Rainbow	41	0.74
	40	0.85
Sculpin	52	1.55

Pass # 2

Species	L	W
Rainbow	46	1.04
Sculpin	74	5.63
Rainbow	185	71.88
	96	8.36
	80	5.44
	91	8.34
	94	9.85
	145	30.70
	155	37.70
	115	15.99
	134	24.57
	35	0.51
	39	0.67
	40	0.79

9 AUG 97 Mid Spearing

Species	L	W
Rainbow	142	29.56
	76	5.17
	80	5.50
	81	5.60
	90	7.37
	77	5.03
	45	0.84
	43	0.79
	38	0.58
	42	0.94
	43	0.94
	42	0.72
	44	0.81
	63	2.91
	43	0.81
	46	1.10
	40	0.73
	34	0.52
	36	0.58
	40	0.61
	45	0.84
	45	0.98
	42	0.68
	36	0.47

9 Aug 97 Upper Spearing

Species	L	W
Sculpin	60	2.40
	58	1.90
	43	0.93
	48	1.20
	46	1.22

Species	L	W	
Rainbow	85	7.69	
	113	15.32	
	81	6.03	
	101	9.99	fin rot
	85	6.46	
	46	0.97	
	46	1.03	
Sculpin	114	21.52	Archive
	111	22.64	"
	89	9.20	"
	75	5.86	"
Rainbow	82	5.20	
	117	15.55	
	128	21.48	
	80	4.82	
	70	3.12	
	113	15.53	
	110	13.51	
	140	28.10	
Sculpin	56	2.52	
Rainbow	35	0.62	
	96	9.27	
	104	12.25	

9 Aug 97 Mid Spearing site

Species	L	W
RAINBOW	206	87.35
	180	60.84
	139	26.92
	205	76.24
	201	86.79
	223	103.95
	128	22.69
	93	5.47
	48	1.09
	39	0.65
	77	5.08
	142	29.60
	180	57.93
	135	25.02
	151	31.45
	72	3.94
	117	15.94
	90	6.80
	126	20.53
	89	7.85
	94	8.00
	134	23.69
	105	13.04
	83	5.96

Pass 2 - 9 Aug 97, Mid Spearing

Species	L	W	
Sculpin	56	2.08	Archive

Pass II 2

Rainbow	L	W
	73	3.88
	46	0.94
	42	0.76
	85	6.97
	42	1.25
	87	7.30
	86	6.41
	88	6.84
	93	7.36
	45	0.96
	71	4.32
	45	1.01
	45	0.95
	43	0.87
	36	0.38
	46	1.04
	75	4.46
	41	0.70
	44	0.82

Species	L	W	
Rainbow	79	6.68	
	83	7.75	
	42	0.95	
	67	3.41	
	80	5.61	
	84	6.22	
	73	3.75	
	38	0.50	
	86	6.61	
	71	3.18	
	42	0.73	
	36	0.46	
	43	0.80	
	43	0.82	
Sculpin	50	1.53	
	92	9.86	
	58	2.28	
	55	2.10	Archive
	78	5.62	"
	98	12.01	"
	58	2.30	"
	48	1.30	"
	72	4.13	"

end

"For 10 Aug 97"
Envir, Canada 1-250-491-1501

→ 101.6 kPa Barometric Pres.

30 inches of Hg.
⇒ 762 mm Hg

Hydrolab Calibration 9 Aug 97
Cond = 1418 -> 1413
pH = 6.99 -> 7.00
pH = 10.04 -> 10.00

D.O. % SAT calibrated
at 762 mm Hg!

Species	L	W
Sculpin	90	9.46
	41	0.99
	51	1.84
	93	10.59
	66	4.33
	51	1.70
	60	2.94

10 AUG 1997

SPEARING SITE 3
@ 100m u/s — 655991 E, 5517689 N
FILE# R081009A

SPEARING SITE 2
@ 100m u/s — 655988E, 5516608 N
FILE# R091014A

~~WATER~~
QUALITY

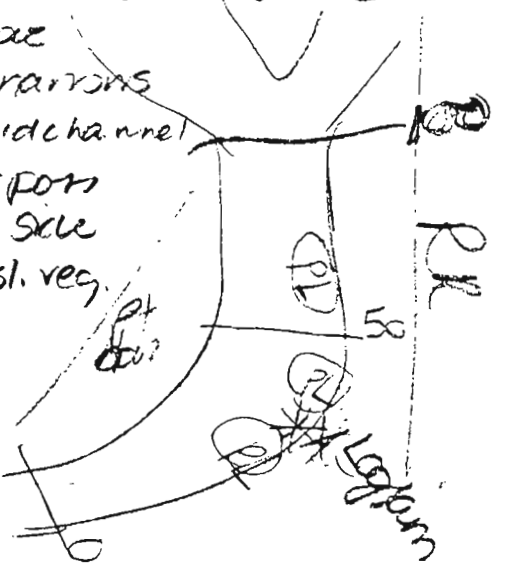
SQ1 SPEARING CR @ SITE 2 100m
OTQ2 @ SITE 3 @ 0m
OTQ1 @ SITE 1 @ 0m
PO Q1 @ SITE 3 @ 0m
VU Q1 @ 0m
JK Q1 SITE 1 @ 0m
CH Q1 @ 0m
OL Q1 SITE 1 @ 0m
TU Q2 SITE 3 @ 0m
TU Q1 SITE 2 @ 0m
AR Q1
~~FR Q1~~
AS Q1 SITE 1 @ -20 m.

9 AUG 1997
SPEARING CR SITE 2.

JUST DS OF WASHED OUT BR
↑ CB DEPOSITN IN STREAM.

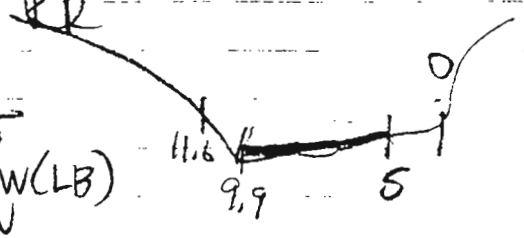
0-5 rif/ru
5-9 pool
9-12 rif/ru
12-20 pool-glide
20-25 rif/ru
25-100 riffle-pool

some algae
a-↑ deposits appears to be
w/o from br. - wide
bar above
reach, narrows
below - midchannel
bar above - pool
consider side
channel sl. veg.



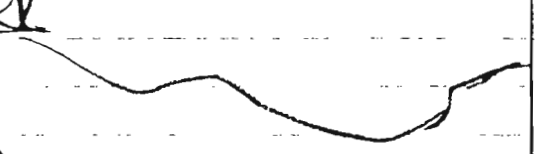
@90

bfw 11.6
bfd 1.5
ww 4.9
wd 11, 21, 15
CC 2% CW(LB)
RC 0 ww
SB 60 cb 30 gr 20 S
LWD 0
RB slope to veg; rosacaea, snowberry
LB alder\cw - slope to road.



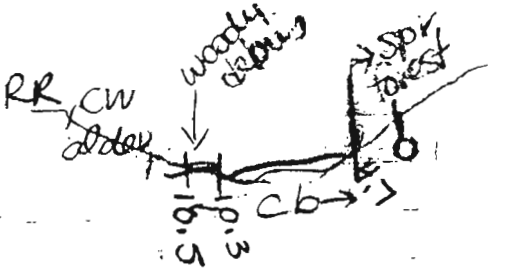
@80

bfw 11
bfd 1.5
ww 9.3
wd 15, 8, 9
CC 5% CW(LB), SPR(RB)
RC 5% alder - thimbleberry RB
SB
LWD 2pc 0% wwc LB - dep
uks of alder tree @ bar - no
use to fish at this time -
prob be washed down
during ↑ fl
RB - cut w root OH & veg
LB cobble/gr slope

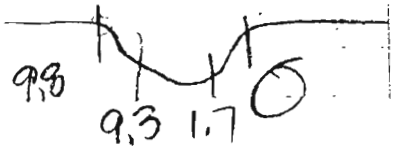


@100 m

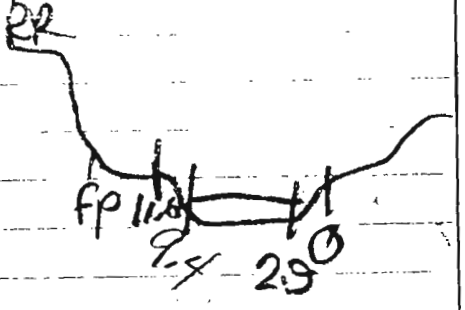
bfw 10.5 m
bfd 1.5 m bkfp
ww 5.6 m
wd 33 45 21
CC 5% CW LB SPR/df RB
RC 2% ww alder
LWD - 2% wwc - sm waterpost
LB
SB 50 cb 40 gr 10 S
LB sloping cb to fp - alder -
then to RR - road ↑CW.
RB slope cb to veg OH - alder
spr - fireweed, rosacaea
stinging nettle
R 03 dw



@50

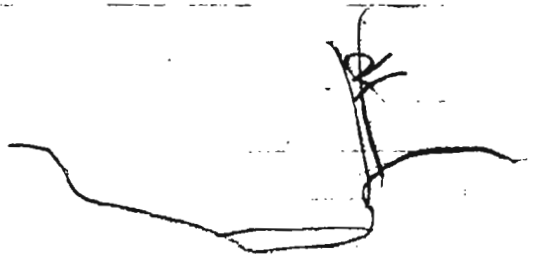


bfd 2
bfw 9.8
ww 7.6
wd 8, 18, 11
CC 1% df
RC Rosdw alder
SB 2% bd 68% cb 25 gr 5S
LWD 0
RB slope cb/gr to Rosdw OH
LB Rosdw/alder OH - slightly cut bnk w/ woody debris dep in ww



at 40
bfw 11.6
bfd 2
ww 6.5
wd 18, 11, 7
CC 2% df
RC 10 alder Rosdw
SB 70cb 25gr 5S
LWD 8m deb LB
RB cobble slope to veg
LB slope to grass

@70

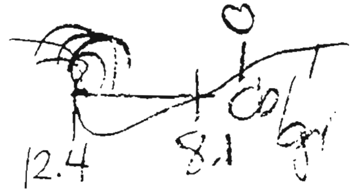


bfd 1.5
bfw 9.5
ww 8.2
wd 5 12 45
CC 15% df - alder
RC 10% alder - thimble - snowberry
LWD 8m debris RB
SB 1% bd, 60 cb 30 gr 9 S
RB cut w/ road (df) OH, some veg - willow
LB slope cb to veg - CW, alder willow

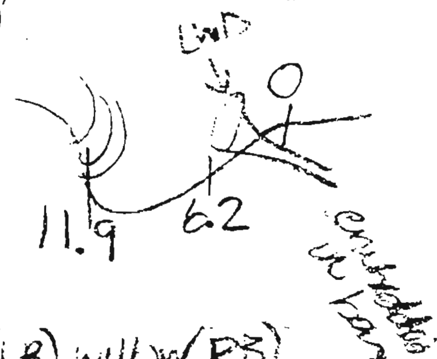
@ 60

bfd 1
bfw 11.2
ww 8.4
wd 10, 12, 8
CC 2% df
RC Rosdw, alder
LWD 12% mmc - 3m length
.3m width
SB 60 cb 30 gr 10 S
LB slope cb to root OH - Slightly diffbank
RB gravel slope w/sand to veg
Ros dw OH.

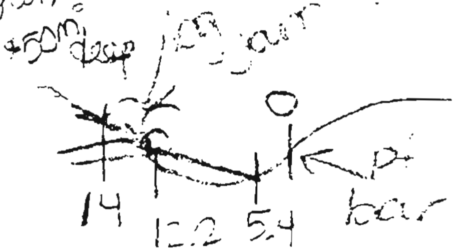
@30
bfd 2
bfw 12.4
ww 4.3
wd 38 23 38
CC 0
RC 5 Rozdw (LB)
SB 50 cb 40 gr 10 S
LWD - 3 - OWNC - high on RB
RB - Slope cb/gr to Rozdw
LB - under cut (pool) w/ Rozdw
(dense OH)



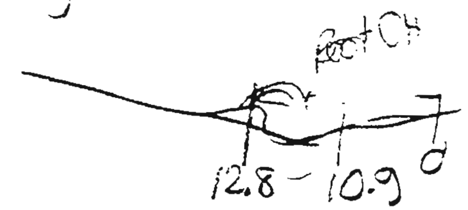
@20
bfd 2.5
bfw 11.9
ww 5.7
wd 35, 71, 100
CC 0
RC 10 Rozdw (LB) willow (RB)
SB 10% Cb 20% S 70% gr
LWD No cover but imbedded in RB.
RB Point bar slope to veg willow
LB Rozdw OH - cut bank outside of bend



pool below logjam:
5m org, 2m w +50m deep log jam
@10
bfd 22m
bfw 14.0
ww 6.8
wd 11, 15, 47
CC 10 spr + of ... SB: 10CB, 20S, 70Gr
RC 10 ... / Rozdw / ...
LWD 4 lg, some smaller debris ... LB @ ...
RB Slope CB/gr LB w/ willow growth + alder
LB - log jam (not barrier) - pooling cut bank w/ veg OH.



@0 m
bfw 12.8
bfd 2
ww 11.9
wd 14, 15, 16
CC 2 - df LB
RC Rozdw - willow - thimbleberry 10
Sb 15 Cb 25 S 60 GR
LWD Sm debris deposits LB
RB - Slope Cb/gr



9 Aug 97

Spearing Creek Site 3-Upper

algae - brk

OH - alder grass

Reach is along rd-RR.

100-95 riffle

95-80 glide

80-60 riffle

60-50 pool-glide

50-40 pool

40-30 riffle

30-0 glide/pool

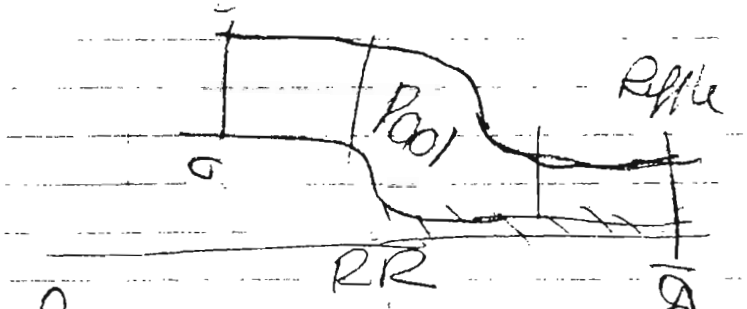
19-16 riffle (spawn)

15-0 glide/pool

(at 15 m/82 m of riffle)

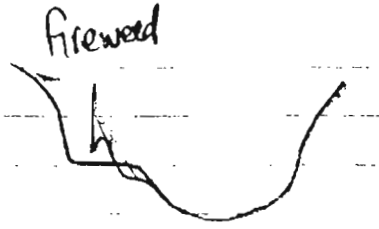
water is cloudy - silt clay deposition rocks + algae.

T = 12°



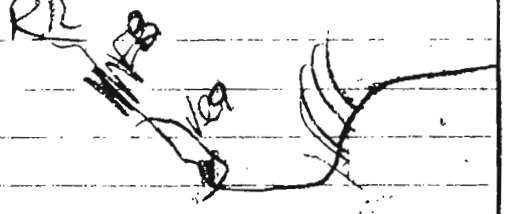
Rosacea along roadside

@ 80m



bfw 3.6
bfd 40 cm
WW 3.2
wd 6 16 12
LWD 18m 2% cover
Sb 5 bd 60 cb 20 Slt 15 gr
CC 5 (alder low) - spr orgs
RB RO3 OH - cutbank
LB fireweed - slope to floodplain (~3m) then slope to road,

@ 70m



bfd 30
bfw 4.5
ww 4.1
wd 19, 18, 3 cm
CC 0
RC 35%
SB 5 bd 5 cb 40 gr 50 Slt/clay 5
LWD 8m + branches, deposit 10%
LB sloping w/ thimbleberry (fireweed) alder + RO3 dw
RB RO3 dw - alder

@ 100m

bfw 2.3
ww 1.9
bfd 32 cm
wd 14 25 10 cm
Sb 5 bd 45 gr 40 cb 15 Slt/clay
CC 1% spr
RC 50% alder RO3
RB u/c w/ch mostly shrub
LB u/c - some lg CD to grass OH
LWD 0

@ 90

bfw 3.1
bfd 11
ww 2.7
wd 15 32 9
Sb cb 70 sd 10 bd 10 Slt
LWD 0
CC ~5 alder low
RC RO3 RB
RB cut OH RO3
LB Slope grass (↑ fireweed

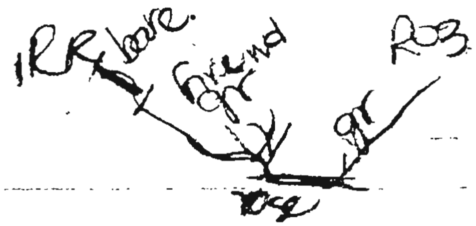
d 40
bfw 3.9
bfd 20
ww 3.6
Wd 14, 14, 4
CC 0
RC 15% RR rock grass Rosdw
SB 10 cb 80 gr 10 s/s/c
LWD 2 sm - 1% corer
LB slope - loose gr from RR
some gr OH
RB cut w/ Ros OH + Willow

@ 30 (frog)
bfw 3.2
bfd 0.7
Ww 2.9
Wd 40 32 14
CC 0
RC 25% Rosdw
LWD 0
LB slope to u/c @ 25m
OH Ros dw + grass
RB slope to fp - grass in ww

@ 60m
bfw 2.5
bfd 50cm
ww 2.5
Wd 6, 11, 12
CC 10% Alder
RC 40% Ros dw
Sb 40 cb 50 gr 10 silt/clay
LWD 3m - along RB.
RB OH veg shrub - u/c bank
LB undercut bnk - OH grass 1 snag (dbh 10cm)
- cut rainbows - riffle lg fish (RB) - 5cm
- Willow/fish

d 50
bfw 2.3
bfd 1m
Ww 2.3
Wd 64 67 52
CC 0 (2% spr RB)
RC 80 Ros from RB
LWD 0
Sb 25 bd 60 cb 15 silt/cl
RB cut w Ros OH
LB undercut slightly TO OH veg - slope to road (RR)
RR Rock Ros dw fine weed

@0

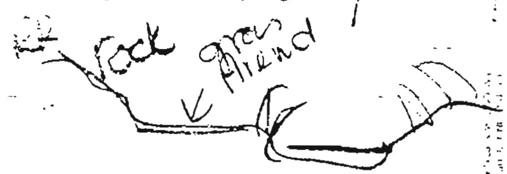


bfw 4.1
bfd 1.2
ww 3.2
wd 32 33 14
CC 5% spr * RB no OH cover
RC 5 grass
LWD 0
RB sloped gr * so very
LB sloped gr silty

@20

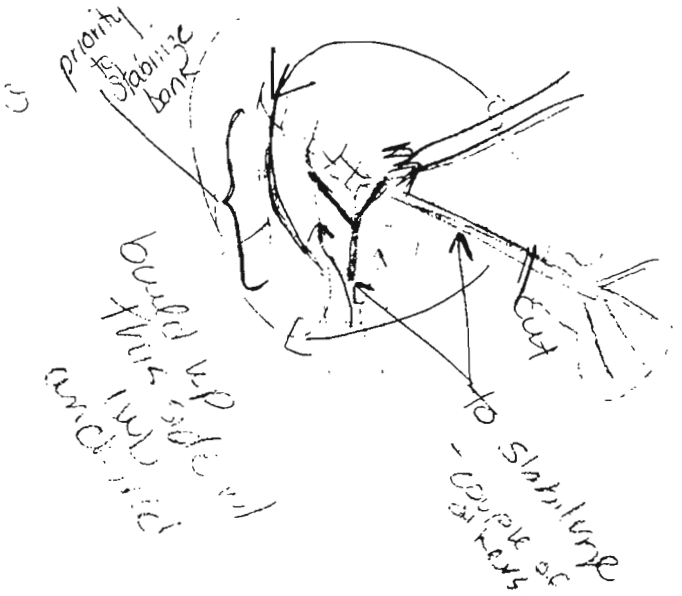
bfw 5m
bfd 1
ww 4.6
wd 44 38 33
Sb - SILT(80). gr
CC 10 spr
LWD 0 - some w/debris
RC 20 RO3/w - willow
RB w/c w/ veg OH grass to WW
LB slope to road w/ veg OH

@10

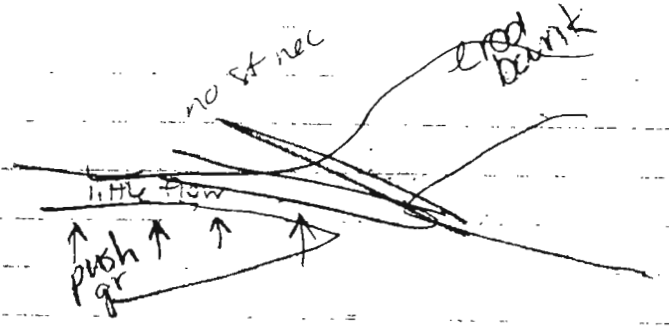


bfw 5.2
bfd 1m
ww 4.7
wd 22 60 33
Sb 5 cb 75 gr 20 silt
LWD 1 2% 8cm dia
CC 1% spr
RC 10% RO3/w
RB slope grass to ww little cover
LB OH - RO3 - exc fish hab.

pool



cable log to L bank



25 Sept 9

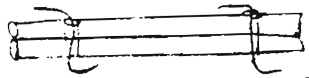
Site ② Bank stabilization east of access road - farthest u/s Site 1 - place rootwads out w/ butt end in 2m depression in bank.)
- place 2-3 logs atop rootwads for stabilization - anchor w/ 1" cable to live/standing trees atop bank (between flagging tape)

Site ① gravel bar place deadmen (4) w/ rootwads facing u/s (with butt end into bar) - root wads are to be anchored to dead men with 1" cable - along bar 4m from wetted width.

~~Also~~ place deflector logs anchored to ~~rootwads~~ deadmen w/ gravel - build up behind to divert H2O back to channel.

14 logs from Gravel / N [illegible]

Site ② - logs are placed along banks. Two logs are attached by rebar to each other: drilled 1" hole - through the 2 logs



5/8" rebar

lined bank

- logs used to stabilize these banks were sourced from the lot at 10.5 km (4). total area of bank stabil : 30 m

Site ③ this will be one of the last things to be done as it is the pathway to the lower area. logs were placed across opening & stabilized from behind w/ boulders i.e. cobble.

Site ④ - huge log jam - block / divert flow to west bank so that rather than flow going through log jam - flow is [illegible] through middle. Block flow with few logs / root wads & some gravel placed downstream. [illegible] rootwad & [illegible] were used to fill this [illegible]. [illegible] removed (the one blocking flow) + was placed behind the new log jam area -

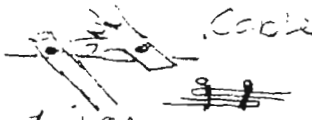
Site ⑤

- this area is to be opened up - Spruce ~30 m w/ rootwad was cut - rootwad was not moved but was anchored to ground - buried butt end into grd - rootwad facing U/S. The left bank was stabilized here by swinging some of the logs over. The channel was opened up as well.

20 Oct 97

Granite Creek - caching HMC Services

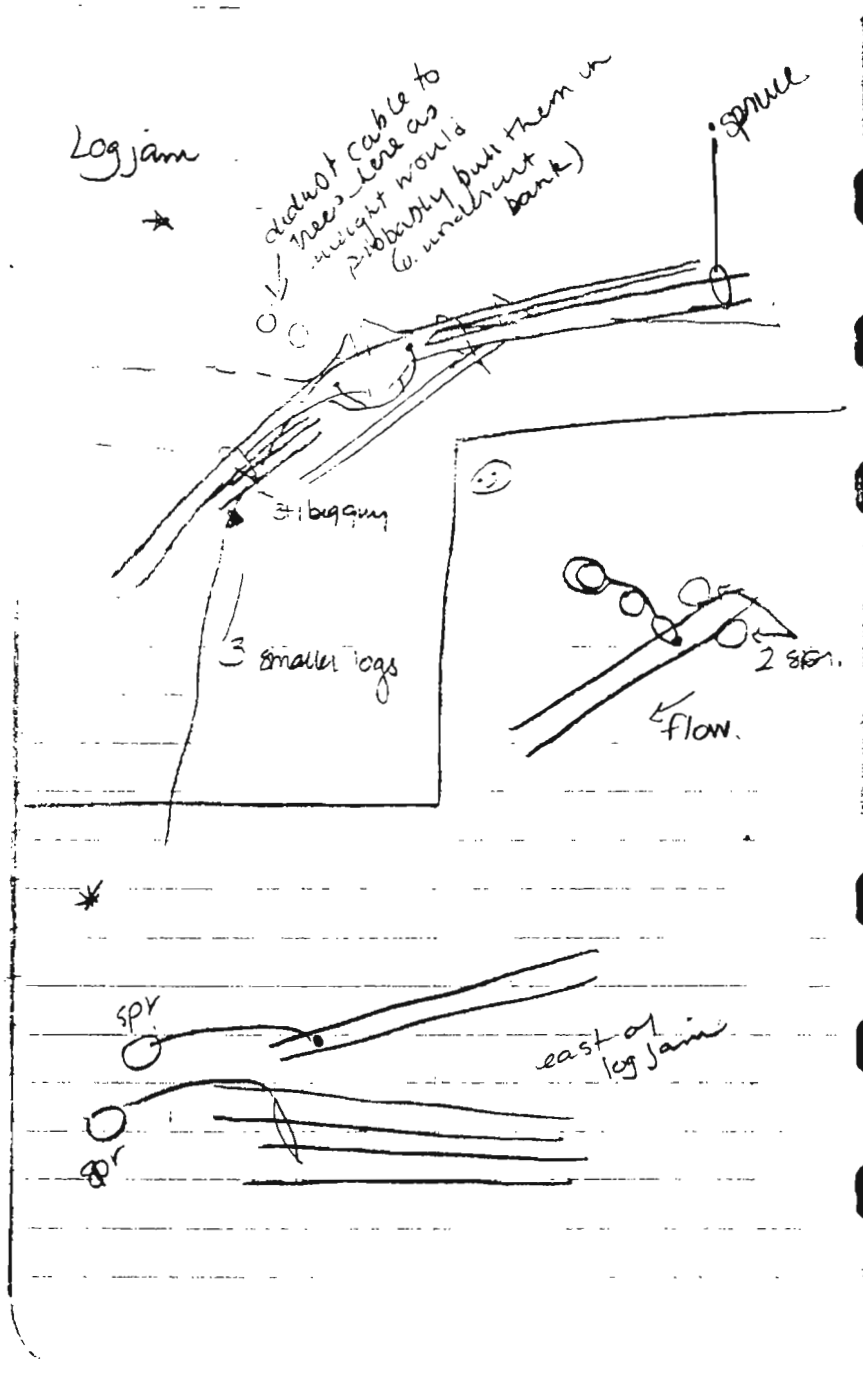
Rootwads - 1" holes drilled with gas powered drill + drill bit extension - through deadman ~ 3" from waterline (some variable lower) + thru rootwads at base of trunk thru each + top overlapped + clamped twice.



Some allowance for + water but preference is to maintain stability

Right bank stabilization - 1" holes drilled thru each log + stabilized to conifer on bank - see dia

Lbank - Rootwads drilled + cabled together - mostly thru roots as base of drunk too hard (to drill thro - cable (embedded) & top cabled to rootwads at upper end.



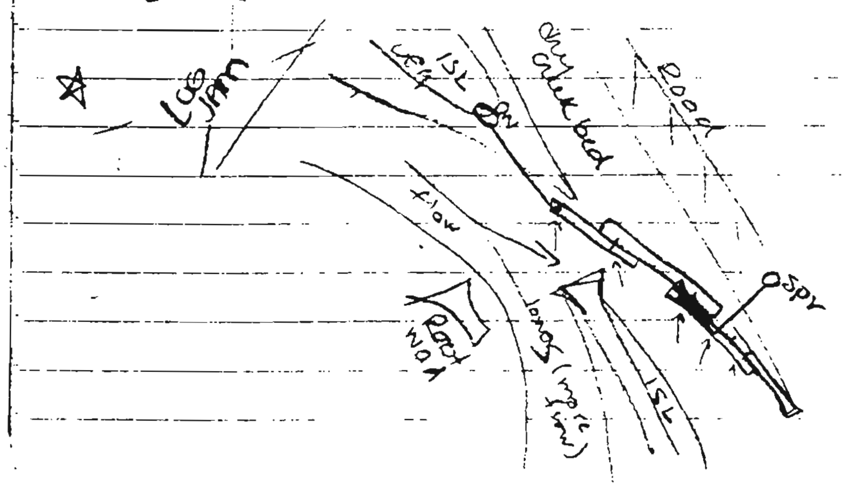
Log jam E. see *

The two main trees w/ root wads which were stacked were cabled together + the 4th log anchored to large spruce set back ~ 3 m - another large spr which stands between the additional log + other spr. will act as anchors if flows (see ⊙). 2 smaller logs across old flow channel were cabled to SW (+ one over large log).

~~cg jam~~ W see * three lg spr. cabled to live spruce - 2 smaller ones cabled together + largest one cabled to tree on bank.

- the logs were not cabled mid jam - if flows are extreme (sim to 1:500 flood - 1995 NOV) the logs will be moved to each bank by the flow (theoretically) + water will wash thru center + not undermine bank upon which is the road

d/s of jams where sonic was cut & rootwad was left mid stream - no anchoring - if it should be anchored - recommend rebar thru base of trunk & into substrate so cable would back up rootwad / jam & eventually send flow to far bank. The logs which were cut (from rootwad) & moved to LB were cabled to girder & anchored to CW u/s. CW was the only avail anchor but large enough! A second cable was



NO FISH OBSERVED
-Am. dipper

fed thru one of the logs and cabled to conifer on bank for added stability. See dia ☆

Conifer in mid - was cabled thru - rootwad to [illegible] on bank.

Debris which was pushed to RB was not cabled - not sufficient flow & not enough cable left.

CHAIN OF CUSTODY RECORD

20886

CANTEST

1523 West 3rd Ave
Vancouver, BC
V6J 1J8
Tel: 604 734 7276
Fax: 604 731 2386
1 800 665 8566

Client Name: Inc-Integrated Resource Consultants Inc

Page 1 of 1

Address: #160-14880 River Rd. Richmond, BC.

Telephone: 278-7714 | Fax: 278-7741 | Postal Code: V6V 1L4

Contact: CHRISTINA ANNAND

Project Name: TULAMEEN | Project Number: FR-BC-98-29 | P.O. Number:

RESULTS DUE: (D) (M) (Y)

(Surcharges May Apply)

Sampler's Name: Christina Annand.

FOR LABORATORY USE ONLY Laboratory Number	Sample Identification	Sample Location	Date Sampled (D/M/Y)	Sample Type	Water Source G or S	Tests Required: (SRP) Soluble Reactive Phosphorus	Nitrate Nitrogen	B.O.D.	Fecal Coliform	E. coli	Number of Containers	Remarks
	AS01	Asp	10/6/97	Fl-O		X	X				2	
	GR01	Granite				X	X				2	
	TU01	Tulameen				X	X				2	
	TU02	Tulameen				X	X				2	
	CH01	Champion				X	X				2	
	PO01	~~Fish~~ Podunk				X	X				2	
	OL01	Olivine				X	X				2	
	AR01	Arrastra				X	X				2	
	SP01	Spearing				X	X				2	
	JK01	Jim Kelly	↓	↓		X	X				2	
										Total No. of Containers	20	

G = Ground S = Surface

Relinquished by:	Date	Time	Received by:
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Method of Shipment:	Waybill No.:	Received for Lab by:	Date	Time
			Apr. 14/97	9:20
Shipped by:	Shipment Condition:	Cooler opened by:	Date	Time

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CHAIN OF CUSTODY RECORD

20887

CANTEST

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Tel: 604 734 7276

Fax: 604 731 2386

1 800 665 8566

Client Name: [illegible]

Address: #160-14480 River Rd, Richmond, BC.

Telephone: 278-7714 | Fax: 278-7741 | Postal Code: V6V 1L4

Contact: Christina Annand

Project Name: TULAMEEN | Project Number: FR-BC-98-29 | P.O. Number:

Sampler's Name: Christina Annand

Page ___ of ___

RESULTS DUE: ___ (D) ___ (M) ___ (Y)

(Surcharges May Apply)

Tests Required

FOR LABORATORY USE ONLY Laboratory Number	Sample Identification	Sample Location	Date Sampled (D/M/Y)	Sample Type	Water Source G or S	Soluble Reactive Phosphorus (SRP)	Nitrate-Nitrogen	B.O.D.	Fecal Coliform	E. Coli		Number of Containers	Remarks
	VU01	Vuich	10/8/98	H2O	S	X	X					2	
	OT01	Otter	↓	↓		X	X	X	X	X		3	
	OT02	Otter	↓	↓		X	X	X	X	X		3	
											Total No. of Containers	8	

G = Ground S = Surface

Relinquished by:	Date:	Time:	Received by:
R. Bury			
Relinquished by:	Date:	Time:	Received by:

Method of Shipment:	Waybill No.:	Received at Lab by:	Date	Time
		BS	Aug 11	9:20
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