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# WATERSHED RESTORATION PROGRAM COMPLETION REPORT
## Book 2

Prepared for:
**Pacific Inland Resources**
(A Division of West Fraser Mills Ltd.)

Prepared by :

**Ed Withers, Watershed Restoration Supervisor**
**Silvicon Services Inc.**
February 2000

## 2.3 Telkwa Road Rehabilitation

The Telkwa Road Rehabilitation Project is situated in the Telkwa River Chart area on the Telkwa River FSR (1000 FSR). The project objectives are to replace previously identified culverts with bridge structures that will provide for fish passage and enhance overall Coho habitat availability. One of three site plans of culvert stream crossings that were created during the 1998/1999 fiscal year, was selected for improvement for the 1999 field season. The stream that passes through this culvert was previously tested for fish presence and found to be a stream that had the potential for Coho habitat if the barrier was removed. Utilizing the site plan created by Silvicon Services Inc. a bridge structure was designed to replace the culvert. Formula Pile and Bridge Contractors Ltd. of Prince George BC were contracted to remove the culvert at 19.3km and construct the designed bridge in it's place. The bridge consists of a superstructure composed of three precast concrete slabs spanning 9m, founded on a precast concrete cap beam and driven steel pipe piles. The bridge design drawings were provided by Associated Engineering Ltd. of Burnaby BC.

Kent Coish

For your records

Ministry of Forests

SCHEDULE A

# WATERSHED RESTORATION PROGRAM STANDARDS AGREEMENT

# BRIDGE REPLACEMENT

| Initials | Initials |
|---|---|
| (Contractors) | (Province) |

19.3 Km. Bridge, Design and Construction

Schedule B (attached)

FRBC MYA Standards Agreement No. SBM - 98112
Dated: April 21,1998
Activity No: 112989
Pacific Inland Resources, Division of West Fraser Mills Ltd.
Smithers, B.C.

D. M. John, P.Eng.
Ministry Representative

K. Coish, P.Eng.
Recipient Representative

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# 1. INTRODUCTION

This document and all references within form Schedule A of the Watershed Restoration Program Standards Agreement for Bridge Replacement.

The Recipient shall conform to the requirements of the Forest Practices Code of British Columbia Act and Regulations, and the conformance will be used to measure compliance with this agreement.

Any reference in this document to the **Bridge Manual** means the most current edition of the "Forest Service Bridge Design and Construction Manual". This document can be obtained from the nearest Ministry of Forest District or Regional office. Except where modified below, the contents of Bridge Manual are considered mandatory requirements for the purposes of this agreement.

# 2. DESIGN

Bridge designs shall be prepared in accordance with the Bridge Manual.

## 2.1 Conceptual Design Review

The Recipient shall submit a **Conceptual Design Report** prepared by a professional engineer to the Ministry Representative for review and approval prior to commencing detailed bridge design.

The professional engineer who submits the Conceptual Design Report shall preferably also be the **Engineer of Record** for the project and shall take responsibility for the project from conceptual design through to completion of construction. The Engineer of Record may also be the engineer responsible for detailed design or another engineer with a vested interest in the engineering portion of the project The Engineer of Record shall be responsible to ensure the completed structure in its entirety meets the objectives and requirements detailed in the Conceptual Design Report and this Standards Agreement.

The Conceptual Design Report shall include the following information:

i) Site Plan,

ii) Site Reports,

iii) Conceptual Bridge Design drawings,

iv) Preliminary Work Progress Schedule.

The **Site Plan** shall be prepared and submitted in accordance with Appendix I, "Bridge and Major Culvert Site Plan Specifications".

The **Site Reports** shall include the site specific hydrologic, hydraulic, geotechnical and site reports where required as noted in the Bridge Manual.

The Site Report shall also include the:

i) rationale for proposed conceptual design noting any particular circumstances or significant design criteria such as debris or installation considerations,

ii) design water level, flow and velocity and methodology used for development of design flood hydrology and who developed the design flood flow rate,

iii) methods and extent of geotechnical assessment, rationale for any recommendations and assumptions, and who prepared the geotechnical assessment and recommendations.

The **Conceptual Bridge Design drawings** shall at a minimum include a plan view and elevation view of the new bridge. These conceptual drawings shall be overlain on the site plan and cross sections, and shall include the following information:

i) Design vehicle for loading and side tracking (if applicable)

ii) length, width and grade of the bridge deck,

iii) location of the superstructure and substructure components relative to the stream and road approaches,

iv) stream flow direction, design water elevation and design flow rate,

v) proposed configuration/arrangement and estimated depth of superstructure and reference to any MOF standard drawings if applicable for Class A bridges, or site-specific geometry, erection, environmental or other limitations/constraints that a designer must work within in preparing the final design,

vi) proposed realignment of the existing road approaches or stream if applicable,

vii) proposed approach road grades

viii) location and elevation of all other critical geometric points such as wingwall length and fill spill lines for Class A bridges, or site-specific geometric, erection, environmental or other limitations/constraints that a designer must work within in preparing the final design,

ix) proposed arrangement of riprap placement for Class A bridges, or site-specific geometric, erection, environmental or other limitations/constraints that a designer must work within in preparing the final design,

x) proposed sources of riprap, where available

xi) proposed details of approach fenders, if applicable,

xii) notes detailing any unusual construction requirements such as a temporary bridge, ford or detour etc.

The **Preliminary Work Progress Schedule** shall consist of an estimated schedule of the start time and duration of the project including and the estimated timing of any proposed work in the stream.

### 2.2 Final Design Review

The Recipient shall submit 3 hard copies of the final bridge design to the District Manager for approval and shall not commence any work until such approval is received.

## *3. CONSTRUCTION SPECIFICATIONS*

### 3.1 General

Bridge construction, fabrication of all bridge components and supply of all materials incorporated into bridge structures shall be in accordance with the Bridge Manual.

In addition to the above, prestressed concrete members shall be fabricated in accordance with Appendix II, "Manufacture of Prestressed Concrete Members".

Tendering requirements detailed in the Bridge Manual do not apply to projects under this Standards Agreement.

### 3.2 Independent In-Plant Inspection

All bridge components prefabricated in a plant shall be inspected by an independent Ministry of Forests appointed inspector in accordance with the Bridge Manual. The Recipient shall give written notice of the approximate fabrication schedule to the Ministry Representative 2 weeks prior to the inspection being required so the Ministry Representative can coordinate the in-plant inspection.

### 3.3 Short Term Work Structures and Falsework

Any short term structures and falsework required to implement the bridge replacement project are the sole responsibility of the Recipient. Short term structures and falsework must be capable of safely supporting the expected users and loads, and be in conformance with all applicable codes and regulations.

### 3.4 Road Closures and Traffic Control

The Recipient shall obtain approval from the District Manager before closing any Forest Service Road. Implementation of road closures including posting notification in the media are the sole responsibility of the Recipient.

Traffic control measures around the construction site are the responsibility of the Recipient. Measures shall include adequate signing around the work site to ensure road user safety about the work site and adequate signing on all approach roads to the site. Upon temporary abandonment of construction works, any hazards shall be clearly signed and marked.

## 3.5 Construction Schedule

The Recipient shall submit a written construction schedule of the work to the Ministry Representative a minimum of **2 weeks** prior to commencement of the work at the site. This schedule shall include the start time and duration of each main phase of the work. During the progress of the work, the Recipient shall advise the Ministry Representative of any significant changes to the construction schedule which may effect the Ministry Representative's (or his agent's) ability to schedule site inspections detailed in 3.7.

## 3.6 Professional Certification and As-Built Information

All bridges shall be certified by a professional engineer in accordance with the Bridge Manual. The Recipient shall be responsible to engage a professional engineer for this purpose. The certifying engineer shall work independently and at arms length to the bridge contractor, except in the following 2 cases:

i) for bridges where there are no piles or embedded posts, and where all structural components are substantially visible and above ground on completion (ie. Bridges on shallow sills and retaining walls), the bridge contractor's engineer may certify the bridge,

ii) for bridges constructed by the Recipients own employees (ie. where the Recipient is the bridge contractor).

**NOTE**: It is not acceptable for the certifying engineer to rely upon data or information provided during construction by the bridge contractor. In addition, the certifying engineer must carry out the final inspection as a minimum. One of the following scenarios may be selected:

i) the certifying engineer carries out all site inspections;

ii) the certifying engineer directs/supervises an individual (who may work for the same firm as the certifying engineer, or for an independent sub-consultant) to carry out some or all of the site inspections, other than the final inspection.

The Recipient shall submit the form FS137 (Assurance of Field Reviews) to the Ministry Representative **3 weeks** (or less at the option of the Ministry) prior to commencement of the work at the site. This form must be completed and signed by the professional engineer who will be providing certification. The engineer shall indicate on the form FS137, the field reviews which will be undertaken by the engineer to ensure that all aspects of the work substantially conform to the approved design.

On completion of the project, the Recipient shall submit the form FS138 (Certification of Construction of Bridges and Major Culverts) signed and sealed by the certifying engineer to the Ministry Representative. The engineer shall also submit other as-built documentation and forms FS1051ABC (Bridge As-Built Record) in accordance with the Bridge Manual.

## 3.7 Ministry Site Inspections

In addition to the field reviews by the certifying engineer, the Ministry Representative or an authorized independent agent, **may** choose to inspect the work. These inspections may be required at the following stages:

i) substructure excavations prior to placement of geotextile and riprap,

ii) foundation excavations prior to placement of footings,

iii) piles, prior to demobilization of pile driving equipment,

iv) cast-in-place concrete elements just prior to concrete pour, (ie. after rebar placement and formwork is complete),

v) prior to grouting of shear keys and deck panels,

vi) After demobilization and site clean up.

Such inspections by the Ministry or its agents do not relieve the certifying engineer of any responsibility, unless the Ministry elects to be the certifying engineer, and so advises the Recipient. For any of the above stages, the Ministry may request verification of schedule or timetable prior to the inspection.

## 3.8 Construction Tolerances

Where construction tolerances are **not** shown on the drawings, the bridge elements below shall be laid out and constructed so final locations shall not differ from the positions shown on the drawings by the following tolerances:

i) Horizontal location of bridge superstructure:

| | |
|---|---|
| longitudinal direction | ± 150 mm |
| transverse direction | ± 50 mm |

ii) Horizontal location of Substructure elements relative to superstructure:

| | |
|---|---|
| pile heads, posts, footings, retaining walls | ± 50 mm |

iii) Maximum deviation from plumb or specified batter for:

| | |
|---|---|
| piles | 20 mm per meter |
| posts | 5 mm per meter |

iv) Horizontal location of Anchor bolt groups ± 15 mm

v) Vertical location of bridge seats ± 10 mm

Any deviation from the final drawings beyond the above tolerances shall be satisfactorily corrected by the Recipient at his own expense.

## 3.9 Component Handling

Structural components shall be handled with reasonable care so as not to impact against other components or any objects and so as not to over-stress the components. Any inadvertent impact or mishandling resulting in damage of structural components shall be immediately reported to the Ministry Representative. If required by the Ministry Representative, any such damage shall be rectified at the Recipient's expense to the satisfaction of the Ministry Representative.

## 3.10 Design Changes

Any significant design changes proposed during construction shall require **prior** approval from the Ministry Representative. The Recipient may proceed on a verbal approval from the Ministry Representative under the understanding written approval will follow. The Ministry Representative shall be informed of any proposed changes from the approved drawings or specifications as soon as the need for changes arises. Some examples of significant design changes are (but are not limited to): substitution of materials or component types (i.e. spread footings for piles), changes in footing elevations greater than 100 mm and horizontal and vertical realignment of the bridge beyond the construction tolerances shown in 3.8 (i).

## 3.11 Riprap and Granular Material

Riprap shall be supplied and placed in accordance with the Bridge Manual. Sources for gravel and riprap shall be approved by the Ministry of Forest **prior** to source development. If requested by the Ministry of Forests, the Recipient shall be responsible to obtain required permits from other regulatory agencies. Following the removal of material from an approved site, side slopes must be dressed back to the natural angle of repose of the material and left in a state which will not pose any safety hazard to future users.

## 3.12 Footing Excavations

Excavations for all footings, shall be kept free of water during construction. If a pump is used to de-water the excavation, sufficient length of hose shall be available to discharge water well away

from the stream. For excavation in material other than rock, care shall be taken not to disturb or de-compact the bottom of the excavation.

Where foundation materials encountered do not meet the design requirements shown on the drawings or in the construction specifications, the certifying professional engineer shall be consulted prior to installation of foundations. The certifying professional engineer shall be responsible to stipulate measures to meet design requirements and consult the bridge design engineer as required. Notes and drawings (if necessary) detailing the prescribed measures shall be made and included with certification documentation.

### 3.13 Water Quality and Instream Work

Approvals from the regulatory agencies (Department of Fisheries and Oceans and The Ministry of Environment Lands and Parks) shall be obtained for works in and about streams. In addition to the above approvals, the following guidelines shall be followed.

Construction shall be carried out in such a manner as to ensure water quality is maintained by keeping soil erosion and run-off to a minimum during inclement weather and by taking measures to prevent .sediment, leachate, fresh concrete and demolition and construction debris from entering the wetted perimeter, including the following:

i) machines that enter the water must not have fluid leaks;

ii) bridge girders and deck components shall be cleaned just prior to launching or erection;

iii) excavations shall be isolated from running water using temporary sediment containment methods; sediment laden water shall be pumped out of the containment areas to the bush where sediment will settle and filter prior to entering any watercourse, prior to backfilling or removal of containment measures.. If necessary a settling area shall be constructed to prevent sediment laden water returning to the stream;

iv) no unnecessary crossings or encroachment by equipment on the wetted perimeter shall occur;

v) any undue disturbance to the stream channel or banks as a result of construction activities shall be corrected to the satisfaction of the Ministry Representative.

### 3.14 Salvageable Materials and Disposal Sites

All salvageable materials removed from the project site shall be delivered to the locations specified on Schedule B, or where requested by the Ministry Representative. The Recipient shall be responsible for any damage to salvageable materials incurred during removal and transportation from the bridge site. Waste materials and debris shall be disposed of at the approved sites identified in Schedule B. Alternative disposal sites on crown land shall be approved by the Ministry Representative.

### 3.15 Site Cleanup

Clean up of the site must be completed immediately following construction. This shall include the pickup and removal of all equipment, materials, trash, equipment refuse and construction debris, and cleaning the bridge girders, decks and bearings to the satisfaction of the Ministry Representative.

## *4. WARRANTY*

Notwithstanding any other provision of this Agreement, or the expiration or sooner termination of this Agreement, the Recipient agrees to correct promptly, at the Recipient's expense, defects or deficiencies in the work which appear prior to and during the period of one year from the date of Professional Certification of the completed work, or such longer periods as may be specified for certain products or work.

The Ministry Representative shall promptly give the Recipient written notice of observed defects and deficiencies that occur during the warranty period.

The Recipient shall correct or pay for damage resulting from corrections made under the above requirements.

# APPENDIX I

## BRIDGE AND MAJOR CULVERT

## SITE PLAN SPECIFICATIONS

## Bridge and Major Culvert Site Plan Specifications

### 1. Site Conditions

Site conditions should be such that the ground surfaces and any existing structures within the limits of survey are clearly visible (i.e. snow free).

### 2. Survey Accuracy

The site survey(s) will be conducted with a theodolite/transit or total station with a relative precision not less than 1:1000 horizontally and 1:300 vertically.

Field referencing and bench marks will be established with a relative precision not less than 1:1000 horizontally and 1:300 vertically.

### 3. Limits of Survey

Extend the site plan in the following directions:

3.1 upstream to show any bend which may influence the current pattern at the site, either at normal stage or in flood (generally, assume a distance up to seven (7) stream widths or to the second bend, minimum of 20 meters);

3.2 downstream three (3) stream widths, or to the limit of possible location changes; or to show all creek cross-sections, minimum 20 meters;

3.3 back from each bank to cover potential overflow channels, or to well above the high water mark;

3.4 along the existing or proposed road location a minimum of 50 m back from each existing or proposed abutment, or far enough to show approach problems. The surveyed area must be large enough to cover possible bridge and road location changes.

Establish a control traverse to gather site information and tie to the road P-line.

### 4. Field Referencing

4.1 References Points

Establish two (2) reference points at each site to allow for relocation and control surveys. The references will consist of a ground hub and a reference back site in a tree or a reference ground hub back site, on tangent with a transit hub, on each side to the stream crossing. Both reference hub and backsite will be placed out of the right-of-way to avoid disturbance.

4.2 Bench Marks

Establish at least two (2) bench marks, away from any potential disturbance, to be placed on firm fixed objects which will not be disturbed, one on each stream bank. Preferably place the bench marks where they will be visible from both proposed bridge abutments and within 1500 mm above high water level. Where elevations have not been established, use reference elevation datum of 100.000 m and note as "assumed datum of 100 m". Generally install 200 mm spikes in the side of a blazed, live tree (greater than 50 mm diameter), using the head as a bench mark.

4.3 Construction Reference Stakes

Establish a minimum of two (2) pairs of offset construction reference stakes to the existing center line or P-line at each site; to allow for establishment of the location of the proposed bridge center line with horizontal measurement. One (1) pair on each side of the crossing, right and left of the center line, away from potential disturbance and preferably outside the right-of-way. Where possible, stakes should be placed at approximately the same elevation as the road surface to allow for level, tape measurement.

### 5.

## 6. Data Collection

6.1 Present Water Level (PWL): Collect spot elevations every 15 m along both sides of stream to an accuracy sufficient to determine stream surface slopes.

6.2 High Water Level (HWL): Collect spot elevations where evidence is clear; note evidence.

6.3 Stream flow pattern: use floats dropped at several points across the stream to collect relative flow velocities. Note measured velocities; signs of bank erosion (overhanging trees and roots, vertical banks, areas where present channel differs from that in older air photos).

6.4 Site features: note sloughs, abandoned channels, overflow channels, sand or gravel bars, bed rock, boulder areas, log jams, debris accumulations, fords, vegetation boundaries, trails, ice-jam areas or other significant features.

6.5 Note descriptions and boundaries of soil and rock types as seen on the surface, including stream bed substrate, particularly where exposed rock may affect bridge structure or abutment location. Note any test hole locations and their logs.

For existing bridge structures within the limits of survey obtain:

a) spot elevations for each corner of the existing deck and/or edges of existing traveled road surface;

b) spot elevations for the upper corners of the existing abutments;

c) spot elevations showing the perimeter of the abutments where they contact the ground surface and outline the edges of the existing bridge;

d) outline of the outside perimeter of the existing structure.

6.6 Other existing:

a) structures such as: buildings, fences, roads, driveways and gates;

b) utilities such as: power poles with numbers of , height of, and direction of wires; gas lines with any surface markings and structures;

c) right-of-way markings such as: Forest Service Road, pipe line, gas line, easement, railway and power line R/W pins.

6.7 Descriptive photographs shall be taken to show the bridge crossing site. At minimum, photographs of each streambank from the opposite streambank and from the upstream and downstream of the proposed or existing bridge site shall be taken. Where difficult and convoluted ground or soil conditions occur, additional photographs shall be taken at the time of the data collection detailing conditions.

6.8 In addition to collecting sufficient data points for production of the site plan drawing, carry out the following profiles and cross-sections:

a) For proposed crossings, take a center line profile, including soundings where appropriate, of the expected crossing line to include approach alignment (a minimum of 50 m each side or adequate distance to resolve any approach or alignment problems), high water line, present water line, wetted perimeter, top of banks and other topographic features.

b) If the downstream reach is uniform, take one other section about three to five stream widths (minimum 15 meters) below center line and the same upstream. If flow is non-uniform, take two or more sections below center line at points of change, and do the same upstream.

c) Where a bridge structure exists, cross sections shall be taken, parallel to the center line, along the upstream and downstream edge of the bridge to show stream bed and ground lines adjacent to the abutments.

## 7.

## 8. Plan Details

Using a preferred scale of 1:200, plot the following information on the plan drawing:

8.1 The designation, location, and description of reference points and the bench marks, including elevation and datum;

8.2 Contours: the contour interval shall be 0.5 m; this may have to change on rock cliffs; make a conspicuous warning note if two intervals are used on the same plan; show all cross-sections and points read; extend contours across the stream bed where possible particularly at the proposed crossing location and at possible sites for a work bridge or ford; accuracy should permit interpolation to a 0.3 m error on rock, around existing bridge structure components and along the stream banks;

8.3 PWL and date of data collection; show spot elevations every 15 m along both sides of stream to an accuracy sufficient to determine stream surface slopes;

8.4 HWL; show spot elevations where evidence is clear and if possible join with a dashed line; describe evidence;

8.5 Stream flow patterns; use floats dropped at several points across the stream to collect relative flow velocities; note measured velocities; indicate signs of bank erosion (overhanging trees and roots, vertical banks, areas where present channel differs from that in older air photos);

8.6 Existing bridge structures show:

a) spot elevations for each corner of the existing deck (indicate "deck");

b) spot elevations for the upper corners of the existing abutments (indicate as "top abut" or "top crib");

c) spot elevations showing the perimeter of the abutments where they contact the ground surface; and

d) outline of the perimeter of the existing structure;

8.7 Show and label significant features from data collection such as sloughs, abandoned channels, overflow channels, sand or gravel bars, boulder areas, log jams, debris accumulations, fords, vegetation boundaries, cabins, trails, ice-jam areas or other significant features. Provide descriptive notes to describe such features;

8.8 Show and describe boundaries of soil and rock types as seen on the surface, including the streambed, particularly where exposed rock may affect bridge structure or abutment location. Show test hole locations and their logs;

8.9 Other existing structures, utilities and rights-of way;

8.10 Vegetation boundaries and types;

8.11 Location of stream cross-sections taken;

8.12 Land status and right-of-way boundaries, where known;

8.13 Control traverse;

8.14 North Arrow and magnetic declination;

8.15 Key map showing location of bridge site, direction and distance to town, ;

8.16 Legend of symbols and lines;

8.17 Scales;

8.18 Title Block showing: bridge structure number, FSR or forest road name, kilometer location, stream name, who completed the survey, who completed the drawing, date of survey, and drawing number.

**9.**

## 10. Profile/Cross Section Drawings

Show the following information:

10.1 Profile/Cross Sections

a) Scales:

Creek Cross Sections: 1:200 Horizontal and Vertical

Road Center Line Profile: 1:200 Horizontal and Vertical on existing/proposed bridge center line.

Detail Bridge Center Line Profile: 1:100 Horizontal and Vertical (detail of previous extending 10m each side of bridge).

Creek Center Line Profile: 1:200 Horizontal and Vertical.

b) Show the ground and stream bed elevations along the existing or proposed road and bridge center line.

c) Extend the center line ground profile at least 50 m beyond either end of existing or proposed bridge along the existing or proposed road center line. A stationing of 0+000 used at the beginning of and at the town side of the survey.

d) Where a bridge structure exists, on the same drawing, using distinct line types, show the stream bed and banks along the upstream and downstream edge of the bridge (where possible), show ground lines adjacent to the abutments.

e) Show the present water level and right bank/left bank.

f) Show high water level.

10.2 Stream bed/surface water profile - using a scale of 1:200 horizontal and 1:200 vertical.

a) Show the profile of the stream bed and water surface for the length of the site plan including stream bed gradient.

10.3 Title Block showing: bridge structure number, FSR or forest road name, kilometer location, stream name, who completed the survey, who completed the drawing, date of survey, and drawing number.

# APPENDIX II

## MANUFACTURE OF PRESTRESSED

## CONCRETE MEMBERS

## Manufacture of Prestressed Concrete Members

### 1. TENDON STRESSING

The dials of gauges shall be at least 200 mm in diameter. Gauges shall be calibrated, with the hoses and jacks with which they are to be used, by an approved testing agency. The calibration must have been performed within the previous six months of use or 12 months maximum. Before stressing commences, certified calibration curves shall be furnished to the Ministry.

If during the work any gauges give erratic results, the tension system or tension device shall be recalibrated.

The Contractor shall schedule the work so that placement of concrete follows tensioning of strands within 24 hours. In cases of unavoidable delay, a maximum period of 80 hours will be allowed, provided that the strands do not show unacceptable corrosion (see PCI Manual for Quality Control, Section 2.2.2).

Before tensioning, an initial force shall be applied to each strand to equalize stresses and eliminate slack. This force shall not exceed 22 kN. After the initial tension forces have been applied, each strand shall be marked at the outer end of each chuck as a reference line from which the elongation of the strand can be measured.

The method of tensioning shall be such that the specified tension is maintained in the strands until the forces in the strands are transferred to the concrete member(s). The maximum jacking load in each strand shall be 85% of the ultimate strength of the strand.

A tensioning force shall be determined both by reading the jacking load on the calibrated gauge and by measuring the elongation of the strand. When the difference between the two methods is greater than 5%, the cause of the discrepancy shall be ascertained and corrected.

Elongations of strands shall be calculated and shown on the working drawings. Calculations for elongations shall include appropriate allowances for possible slippage or relaxation of the anchorages, friction at hold down points, temperature difference, and strand relaxation.

### 2. FORMS

All exterior forms shall be of steel and shall be mortar-tight and of sufficient rigidity to prevent distortion due to incidental loadings during construction. Forms for skewed ends may be of rigid steel-reinforced plywood.

Forms shall produce 20 mm chamfers and fillets as shown on the Drawings.

The design of the forms shall take into account the effect of vibration of concrete as it is placed.

All exterior forms shall be set and maintained true to the designated lines until the concrete has hardened. When forms are unsatisfactory in any way, either before or during the placing of concrete, the Ministry may order the work stopped until the defects have been corrected.

The shape, strength, rigidity, mortar-tightness and surface smoothness of re-used forms shall be maintained at all times. Any warped or bulged formwork must be realigned before being re-used. Forms which are unsatisfactory in any respect shall not be re-used.

Void forms shall be of an approved product and shall be anchored firmly by a means acceptable to the Ministry, to prevent displacement during the placing of the concrete. Any member with a void out of position in excess of the specified tolerance will be rejected.

Exterior forms shall be treated in moderation with form oil before placing the concrete. Any material which will adhere to or discolour the concrete shall not be used.

Side forms and any attachments which would obstruct strain of the members shall be removed before transfer of stress.

### 3. ADMIXTURES

The Contractor shall add sufficient air-entraining agent to entrain 5%±1% air as determined by an air-meter used in accordance with the current CSA-A23.2.

The use of other admixtures, such as water-reducing agent or super plasticizer, shall be subject to the consent of the Ministry.

## 4. MEASUREMENT OF MATERIALS

Measurement of materials shall conform to the current CSA-A23.1. The Contractor shall produce a certificate of accuracy for the batching equipment from the Dominion Government Weights and Measures Division which is not over 6 months old. Cement in standard packages need not be weighed.

The surface moisture shall be determined in accordance with the current CSA-A23.2 and the batch weights of aggregates and water adjusted accordingly.

## 5. MIX REQUIREMENTS

Minimum compressive strength at time of transfer of stress to the concrete and at 28 days as determined by the current CSA-A23.2 shall be as called for on the Drawings.

Slump as determined by the current CSA-A23.2 shall be 50 mm ± 10 mm for concrete without super plasticizer and a maximum of 100 mm for concrete with super plasticizer.

In order to minimize shrinkage and creep the cement/aggregate ratio shall be kept as low as is consistent with strength requirements.

## 6. BATCHING AND MIXING

The batching plant and mixing of concrete shall conform to the current CSA-A23.1.

Mixing shall begin within 15 minutes after the cement has been added either to the water or aggregate.

Within 30 minutes after the introduction of the mixing water to the cement and aggregate, or the cement to the aggregate, the concrete shall be placed in its final position in the forms. In hot weather or under other conditions contributing to quick stiffening of the concrete, the maximum allowable time may be reduced by the Ministry.

Concrete mixing and transporting equipment shall be capable of placing concrete in the forms at the rate of 20 cubic meters per hour. Batch delivery shall be uniform and at a maximum interval of 10 minutes.

The maximum size of each batch shall not exceed the maximum rated capacity of the mixer as stated by the manufacturer of the mixer.

Concrete when placed in the form shall have a temperature not less than 10°C nor greater than 30°C .

## 7. HANDLING AND PLACING CONCRETE

In preparation for the placing of concrete, all construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces inside the forms shall be kept to a minimum and entirely removed when the concrete placing has reached an elevation rendering their service unnecessary.

Concrete shall be handled and placed in accordance with the requirements of the current CSA-A23.1 and shall be placed in the shortest possible time after mixing is completed. When rectangular void forms are used, concrete under voids shall be placed and compacted before void forms are in position.

Concrete may be deposited a maximum of 2 meters without the use of pipes, provided, when required, suitable measures are taken to prevent segregation and premature coating of upper reinforcing steel. When pipes are used they shall, as far as practicable, be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete.

After initial set of the concrete the forms shall not be jarred and no stress shall be placed on reinforcing bars which project.

## 8. VIBRATION OF CONCRETE

Concrete, during and immediately after depositing, shall be thoroughly compacted. The compaction shall be accomplished by mechanical vibration subject to the following provisions:

Vibration shall be internal for all accessible parts and shall be external for inaccessible parts.

Vibrators shall be of a type and design approved by the Ministry. They shall be capable of transmitting vibration to the concrete at frequencies recommended in the current CSA-A23.1.

The intensity of vibration shall be such as to visibly affect a mass of concrete of 50 mm slump over a radius of at least 500 mm.

The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.

Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcing and embedded fixtures and into the corners and angles of the forms. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted into and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed. Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

Vibration shall be supplemented by such spading as is necessary to ensure a smooth surface and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators.

Vibrator heads shall be smaller than the minimum clear distance between prestressing strands.

## 1. TEST CYLINDERS

The Contractor shall make available, as may be required by the Ministry, samples of the concrete to be used in casting the members.

Further, the Contractor shall take samples and make test cylinders in the presence of the Ministry Representative and in accordance with the current CSA-A23.2-1C, -3C and -9C. At least 8 cylinders per casting bed shall be made for testing:

Release Strength

Two cylinders from each end of the casting bed shall be cured in the same manner as the members and tested by the Contractor under the discretionary observation of the Ministry Representative at the Contractor's plant to assess the strength of the concrete at the time of transfer of force to the concrete. Only one cylinder from each end need be tested if the average strength of the two cylinders is equal to or greater than the required release strength at transfer and no test cylinder is more than 1.4 MPa below the release strength. No transfer of force shall occur until authorized by the Ministry.

If all release cylinders are tested and the release strength has not been attained, further testing with an impact hammer shall be allowed, provided a written procedure acceptable to the Ministry is provided by the Contractor. The procedure shall correlate readings from areas of a prestressed girder where the release strengths has been determined by concrete test cylinders with similar areas on the girder in question. If this situation occurs, extra pairs of release cylinders shall be made on future casts until confidence in determining the release strength is re-established.

28 Day Strength

Two cylinders from each end of the casting bed shall be identified as "acceptance cylinders" and shall be cured in the Contractor's curing tanks. These cylinders shall be tested by the Contractor under the discretionary observation of the Ministry Representative to determine the twenty-eight day strengths. The strength of the concrete in the member shall be taken as the average of the compressive strength of the "acceptance cylinders", however, no individual cylinder shall be more than 3.5 MPa below the specified strength and the average strength shall equal or exceed the 28 day strength.

For special cases, extra cylinders shall be made and tested if required by the Ministry. In the case of ready mix, and plant mixed concrete with no established records, extra cylinders, in addition to the release strength or 28 day strength cylinders, shall be made from each load.

## 2. SURFACE FINISH

Throughout the work special precautions shall be employed in formwork and concrete placing to produce a smooth and dense concrete. Exposed surfaces shall be as free as possible from form marks, fins, honey-combing and pock marking. Only a minimum amount of pointing will be allowed. Poor surface finish upon the removal of the forms shall be sufficient cause for the rejection of any member. All exposed edges shall be chamfered unless otherwise noted on the Drawings.

Roadway and walkway surfaces and surfaces to be bonded to shall be rough screeded by wood floating following initial strike off. Roadway and walkway surfaces shall be given a coarse transverse broomed finish. Surfaces to be bonded to shall be sand blasted to remove all laitance and foreign matter and partially expose the coarse aggregate. Loose sand and debris shall be washed or blown off.

The outer surfaces of the outside stringers and any other surfaces indicated on the drawings shall be given a Class 2 finish in accordance with MOTH Standard Specifications, Section 211.16.

## 3. CURING

Members may be cured by steam or heat as outlined herein.

Steam Curing: The concrete shall be allowed to attain its initial set before application of steam: generally 2 to 4 hours after the final placement of concrete or as justified by previous experience and permitted by the Ministry.

After the placement of concrete, sufficient steam shall be applied during initial curing to hold the air surrounding the member at a temperature not less than 13°C.

Steam curing shall be done within a suitable enclosure to contain the steam and minimize moisture and heat losses. The enclosure shall allow free circulation of steam around the sides and tops of members and shall not be in contact with the member.

Steam at the outlets shall be at 100% relative humidity and low pressure. Application of the steam shall not be directly on the concrete or test cylinders and shall be from outlets distributed uniformly along the whole length of the member.

During application of the steam the ambient air temperature shall increase at a rate not to exceed 22°C per hour until an optimum temperature of 55°C is reached. In no case shall the ambient curing temperature exceed 80°C. The maximum temperature shall be held until the concrete has reached the transfer strength. In discontinuing the steam, the ambient air temperature shall not decrease at a rate to exceed 33°C per hour until a temperature has been reached about 11°C above the temperature of the air to which the concrete will be exposed. The forms shall not be stripped until the completion of this cooling off period.

Provision shall be made for checking the ambient air temperature either by placing minimum-maximum thermometers under the enclosure or periodically checking with hand thermometers.

Curing With Radiant Heat and Moisture - Curing with radiant heat and moisture shall be done by heating the casting area in combination with the continuous application of moisture.

Heat shall be applied by means of pipes circulating steam, hot oil or hot water or by electric heating elements. Pipes shall not be in contact with concrete, form surfaces or test cylinders.

Moisture shall be applied by a continuous sprinkling to a cover of burlap or cotton matting or any other approved method for keeping the members continuously moist.

An auxiliary cover in addition to the moisture retaining cover shall be used above the entire bed to retain the heat. This cover shall be supported at a sufficient distance above the member to allow circulation of the heat.

The cycle of application of heat, temperature limitations, reduction of temperatures and use of recording thermometers shall be similar to the cycle specified for steam curing.

## 4. DRAPED STRANDS

Where called for on the Drawings strands shall be draped in accordance with the current CSA-A23.4.

BRITISH COLUMBIA

Ministry of Forests

# Work Progress Plan

For Outlining Scope of Project, Scheduling of Work Completion, and Inspecting Work Areas as requested by the Ministry of Forest Representative

| ACTIVITY DESCRIPTOR (Name / Short Description) | ACTIVITY NUMBER (From On-Line Plan) | STANDARDS AGREEMENT # (Cross Reference to Applicable SA) |
|---|---|---|
| Road Rehabilitation | 112989 | SBM 98112 |

| LICENSEE / PROPONENT (Name of Recipient) | MULTI-YR PLAN # (From On-Line Plan) | DISTRICT / LOCATION (Name / Short Description) |
|---|---|---|
| Pacific Inland Resources (a division of West Fraser Mills) | SBM 98112 | Bulkley Forest District/ Telkwa River Chart |

| Work Unit | Project Objectives | Requirements | Start Dates and End Dates | Inspection Requirements / Comments |
|---|---|---|---|---|
| Telkwa River Chart | Replace Culverts with Bridges to provide for fish passage | - Bridge design<br>- Construction | Start July 3, 1999<br>End July 17, 1999 | - field review by certifying engineer<br>- optional inspection by ministry representative |
| | | | | |
| | | | | |

| Special Requirements, Additional Notes, Scheduling, Comments, etc.... |
|---|
| - Construction was sceduled for June 18 but has been delayed due to high water levels<br>- Scheduling will depend heavily on weather and water levels |

| Recipient (Proponent) Representative | Telephone | Ministry Representative | Telephone |
|---|---|---|---|
| Kent Coish | 847-2656 | Grant Marleau | 847-6310 |

This Work Progress Plan forms part of the Standards Agreement and Work must be carried out and completed in accordance with this Work Progress Plan.

Signed: _____ Date: 6/06/99 Signed: _____ Date: 99 07 15

FOR KENT COISH

# SCHEDULE B

## Special Provisions for Design and Construction

1. Design Specifications
   Design loading: L-75; Hydrology: 100 year return period;

2. Contrary to 2.2, the recipient shall submit 2 copies of the final design to the Ministry Representative.

3. If the bridge(s) are to be tendered or subcontracted, the recipient (or representative) shall review the construction specifications contained within this document and the Bridge Manual and prepare Special Provisions for tendering. The Special Provisions shall fully describe the scope of work and provide additional specifications and requirements that are not fully described on the drawings. One copy of the tender document, without final drawings, shall be provide to the Ministry Representative.

4. For clarification of 3.13. It is the responsibility of the recipient to obtain approvals from regulatory agencies.

5. Supplemental information for preparation of As Built Records;
   (a) Pile driving records must be included, and shall include blow counts and length of each pile installed.
   (b) If benchmarks are disturbed during constructions, re-establish permanent benchmarks and show the location and a description of all permanent benchmarks.
   (c) For open bottom arch culverts, show the elevation at top of concrete footing at each corner (4) on the drawings.

| Initials | Initials |
|---|---|
| (Contractors) | (Province) |

## 5. TRANSFER

The transfer of the forces in the strands to the concrete member(s) shall be in accordance with the current CSA-A23.4 (section on Detensioning).

## 6. STRAND ENDS

After completion of concrete curing the ends of tensile strands shall be ground flush with the concrete surface. Where the ends of the members are to be embedded in concrete, the ends of the strands shall be painted with two coats of Ministry approved organic zinc rich paint. Where the ends of the members are not to be embedded in concrete, the ends of the members shall be covered with thixotropic epoxy to provide at least 3 mm cover. This material is to be applied in accordance with the manufacturer's recommendations.

## 7. TOLERANCES

For bridge stringers, the tolerances specified in the PCI Manual for Quality Control shall be modified so that the length of each member, measured parallel to the longitudinal axis, to extreme corners, at 20°C, does not exceed the specified length by more than 10 mm per 10 meter length (25 mm maximum).

The Contractor shall employ an adequate method of checking tolerances both before and after placement of concrete. Review of the method of checking tolerances by the Ministry will not limit the Contractor's responsibility for the accuracy of the members.

## 8. REPAIRS TO MEMBERS

Defective areas should be repaired immediately following removal of forms and before detensioning of strands. Holes, honeycomb spots, etc., shall be treated as for Class 2 finish in accordance with MOTH Standard Specifications, Section 211.16. The method of repair for cracks, broken corners and edges, bulges and other defects shall be submitted to the Ministry Representative for review.

## 9. HANDLING

Stringers shall at all times be kept in their normal upright position during handling, storage and transportation. They shall be picked up by means of vertical forces or forces inclined towards the opposite ends of the members by no more than 30 degrees from the vertical, applied to lifting devices near the ends of the stringers. I-beams shall be adequately stiffened during lifting and transportation.

Stored stringers shall rest on unyielding level supports near the ends of the stringers.

When loaded for transportation, members shall be supported so that they will not be overstressed. In general, beams with straight strands may be supported up to one-tenth of their lengths from each end, whereas beams with draped strands should be supported at their bearings. If the Contractor believes that it is possible to safely support members further from their ends, the Contractor shall submit to the Ministry, sketch(es), sealed by a registered professional engineer, showing the proposed support arrangement. Adequacy of support shall be based on the following assumptions:

- 100% impact on cantilevering ends, when checking stresses at supports,
- 50% negative impact on the whole member, when checking stress near midspan,
- 50% of prestress losses at time of shipping (unless circumstances dictate otherwise),
- allowable tensile stress = $0.5\sqrt{f_c}$
- allowable compressive stress = $0.6f_c$
- where $f_c$ = estimated strength of concrete at time of shipping.

Such sketch(es) shall be submitted at the time of submittal of the working drawings (see Section 3). Members transported on supports further from their ends than outlined above, without the submittal of sketch(es) acceptable to the Ministry, will be rejected.

Piles shall be lifted in the horizontal position at the pick-up positions shown on the drawings and at no other points. When stacking for storage or for delivery, piles shall be supported at the pick up points. They shall be handled carefully, avoiding dropping and jarring and avoiding surface abrasions or other damage.

Any member damaged so as to be, in the opinion of the Ministry Representative, unfit for the use for which it is intended shall be replaced at the Contractor's own expense.

## 2.4 Telkwa Monitoring

This project is located in the Telkwa River Chart area at roughly 10 and 11km on the Telkwa River Road (1000FSR). The Telkwa Monitoring Project is part of an ongoing effort by Pacific Inland Resources (PIR) and the Department of Fisheries and Oceans (DFO) and the Watershed Restoration Program (WRP) to restore and enhance fish habitat in the Telkwa drainage since 1994. The monitoring project involves the maintenance, monitoring and recording of data at two previously constructed off channel rearing ponds that were developed by PIR for the overwintering of Coho Salmon Fry. This project will provide information, and direction on how to proceed with projects of a similar nature on other interior watersheds in the Skeena Region and throughout the province. The monitoring information will also be used to assist in identifying cost/benefits of WRP funded projects of this nature.

Juvenile movements and timing is monitored, population estimates of the rearing ponds have been completed and reported. Environmental factors related to the immigration and emigration of juveniles to the rearing ponds has been completed and reported. Data about the juveniles is recorded and the fish are then released into the pond or the river.

BRITISH COLUMBIA

Ministry of
Environment,
Lands and Parks

# Standards Agreement

| | |
|---|---|
| MULTI-YR AGMT NUMBER: **0000101**<br>ANNUAL AGMT NUMBER: **NA**<br>ACTIVITY NUMBER: **708824** | THIS AGREEMENT DATED FOR REFERENCE **AUGUST 16, 1999** |
| FOR: **MES/ JUVENILE FISH MONITORING PROJECT FOR TWO PREVIOUSLY CONSTRUCTED OFF CHANNEL REARING PONDS (1010 AND 1011) ON THE TELKWA RIVER** | |

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**BETWEEN:**

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, (the "Province") as represented by the Minister of Environment, Lands and Parks

Smithers BC
3726 Alfred Ave.
Box 5000, Smithers BC V0J 2N0
Phone Number: (250) 847-7260
Fax Number: (250) 847-7556

**AND:**

Pacific Inland Resources , (the "Recipient")

[2378 Tatlow Road]
[PO Box 3130 Smithers BC V0J 2N0]
Phone Number: (604]) [847 2656]
Fax Number: (604) (847 5520)

both of whom are sometimes referred to as "the Parties" and each of whom is a "Party" to this Agreement.

**WHEREAS:**

A. The Province wishes the Work described in this Agreement to be carried out for the benefit of Forest Renewal BC.

B. The Recipient seeks to carry out and complete the Work described in the attached Schedule(s).

C. The Recipient has entered or intends to enter into an Annual or Multi-Year Agreement with Forest Renewal BC for the purpose of funding the Work.

**THE PARTIES AGREE AS FOLLOWS:**

## ARTICLE 1 DEFINITIONS

1.01 In this document, the following words have the following meanings:

(a) **"Agreement"** means this agreement including any Schedules;

(b) **"Changed Condition"** means a materially changed physical condition at the Work Area which

i) was not foreseen by the Recipient; and

ii) would not have been reasonably foreseen by a reasonable Recipient who, before submitting its tender, conducted a thorough investigation of the work to be done to complete the Work, including a thorough inspection of the Work and a review of all information available from the Province to persons wishing to submit tenders , but does not include any generally recurring weather conditions ;

(c) **"Contractor"** means the Recipient;

damage to the environment" have the meanings, where appropriate, given to them in the Forest Practices Code.

(e) "**Forest Practices Code**" means the Forest Practices Code of British Columbia Act and Regulations and Standards to that Act;

(f) **"Ministry Representative"** means a person appointed pursuant to section 5.01;

(g) **"Occupied Area"** means any Work Area, camp or rest area, or any other area occupied by the Recipient for the purposes of this Agreement;

(h) **"Recipient Representative"** means a person designated pursuant to Article 5.04;

(i) **"Schedule"** means a schedule of this Agreement;

(j) **"Subcontractor"** means a person, firm or corporation contracting with the Recipient to perform a part or parts of the Work, or to supply products worked to a special design according to the Agreement, but does not include one who merely supplies products not so worked;

(k) **"Term"** means the period of time this Agreement is in force pursuant to Article 3;

(l) **"Work"** means all

i) labour, supervision, and administration;

ii) provision of materials, transportation, supplies, tools, and equipment; and

iii) other services and provision of materials

necessary or desirable to perform the services described in each Schedule, and includes any services which are not expressly described which are nevertheless necessary for the proper execution of the work.

(m) **"Work Area"** means individual location, forest stands, or other particular areas or locations where work is to be undertaken and any areas of Crown Land occupied by the Recipient for purposes of the Work;

(n) **"Work Day"** means every day of the week except Saturday, Sunday and statutory holidays.

1.02 If a word defined in section 1.01 is used in a Schedule, it has the same meaning as in this document unless the context dictates otherwise.

1.03 A word or abbreviation which has a well known technical or trade meanings is used in the Schedule(s) in accordance with that recognized meaning.

1.04 The headings in this Agreement have been inserted for reference only. They do not define, limit, alter or enlarge the meaning of any provision of this Agreement.

## ARTICLE 2 SCHEDULES AND CHANGES

**Schedules**

2.01 The Schedules, listed below, apply to and form part of this Agreement

☒ Schedule "A" Title of Schedule A

**Changes**

2.02 No change to this Agreement is effective unless it is in writing and signed by the Parties.

**Interpretation**

2.03 Any reference in a Schedule to a manual or a form is a reference to a manual or form published by or for the Province and includes every amendment to it and any manual or form published from time to time in substitution for it or replacement of it.

2.04 The Forest Practices Code, if applicable, takes precedence over an approved prescription. An approved prescription, if applicable, outlining work covered by this Agreement takes precedence over this document. This document takes precedence over any of its attachments. In the event of a conflict between alike Schedules or other attachments of different dates, the Schedule or other attachments of later date prevails.

## ARTICLE 3 TERM OF AGREEMENT AND START OF WORK

3.01 The Term of this Agreement is to start May 1, 1999 and end March 31, 1999 unless otherwise provided in the Schedule(s).

3.02 The Parties may agree to extend the term of this Agreement.

3.03 The Recipient must not conduct any Work under this Agreement until:

(a) the Recipient has entered into a Multi-Year Agreement or Annual Agreement with Forest Renewal BC to fund the Work covered under this Agreement; and,

(b) the Recipient Representative has met with the Ministry Representative to review the Work.

3.04 Time is of the essence in this Agreement.

**Schedule of Work**

3.05 The Recipient must complete the Work according to the work completion timing schedule of the Work Progress Report(s). The actual date the Province notifies the Recipient to start Work and the continuity of the Work depend on the presence of suitable field conditions to allow the Work to be completed as outlined in the Schedule(s).

## ARTICLE 4 STANDARDS AGREEMENT AND MULTI-YEAR/ANNUAL AGREEMENT LINKAGE

4.01 This Agreement constitutes a Standards Agreement as defined in the Multi-Year Agreement or Annual Agreement between the Recipient and Forest Renewal BC dated for reference [INSERT MONTH AND DAY AND YEAR].

## ARTICLE 5 PARTY REPRESENTATIVES

**Ministry Representative**

5.01 The Province must appoint a Ministry Representative who has full authority to act on behalf of the Province to ensure compliance with all terms of this Agreement.

5.02 Upon entering into this Agreement, the Province must notify the Recipient of the name of the Ministry Representative.

5.03 The Province may substitute a Ministry Representative at any time, but must immediately notify the Recipient of the change.

**Recipient Representative**

5.04 The Recipient must designate a Recipient Representative, who has full authority to act on behalf of the Recipient in connection with the Work and this Agreement;

5.05 Upon entering into this Agreement, the Recipient must notify the Province of the name, address and telephone number of the Recipient Representative designated pursuant to section 5.04.

5.06 The Recipient must not substitute a Recipient Representative without written notice to the Ministry Representative.

5.07 If, in the reasonable opinion of the Ministry Representative, the Recipient Representative is not suitably experienced or is unable to properly supervise the Work or communicate with the Ministry Representative, then the Recipient must, upon receipt of written notice from the Ministry Representative, replace that representative and immediately notify the Province of that change.

## ARTICLE 6 PERMITS, AUTHORIZATIONS AND PRESCRIPTIONS

6.01 Where the Recipient is carrying out Work which relates to a statutory obligation of the Province under the Forest Practices Code, then the Recipient is carrying out that work as a contractor to the Province.

6.02 Without limiting the generality of section 6.01, where the Work is work that the Province is required to carry out under the Forest Practices Code, including work referred to in section 23.1 and 24.1, then the Province will provide any necessary prescriptions or other Forest

Practices Code approval documents and the Recipient will ensure that the Work complies with the prescription and other Forest Practices Code approval documents.

## ARTICLE 7 WORK PROGRESS PLAN AND STANDARDS OF PERFORMANCE

**Work Progress Plan**

7.01 The Recipient Representative must meet with the Ministry Representative before starting Work to:

(a) review the Schedule(s) and work performance requirements;

(b) jointly develop a Work Progress Plan(s) outlining the project scope, goals, work completion timing schedule, location and any special requirements of the Work; and

(c) inspect any Work Area, if requested by the Ministry Representative.

7.02 The Work Progress Plan must provide for the orderly completion of all Work, comply with all provisions of this Agreement, and be satisfactory to the Province.

7.03 The Work Progress Plan may divide the Work into separate phases or completion zones.

7.04 The Work Progress Plan forms part of this Agreement. Work must be carried out and completed in accordance with the Work Progress Plan.

**Standards of Performance**

7.05 The Recipient must, before starting any Work, satisfy itself as to:

(a) the nature and magnitude of the Work;

(b) the general character, quality and quantity of the equipment and materials required to carry out and complete the Work; and

(c) the qualifications, skills and abilities of its personnel and personnel of Sub-Contractors or other parties engaged in carrying out the Work in order to ensure the Work is carried out in accordance with this Agreement.

7.06 The Recipient must at all times exercise the standard of care, skill and diligence ordinarily exercised and observed by persons engaged in the performance of activities similar to the Work.

7.07 The Work must be carried out under the direct and continuous supervision of the Recipient or a qualified authorized agent of the Recipient who:

(a) speaks English and understands spoken and written English, or has access to a translator, to the reasonable satisfaction of the Ministry Representative; and

(b) is present at the Work Area when the Work is carried out.

**Subcontractor Work**

7.08 If the Recipient engages a Subcontractor, the Recipient is not relieved from the subcontracted obligations or any obligations under this Agreement.

7.09 The Recipient must not assign this Agreement, or subcontract any obligations under this Agreement, without prior written notification to the Province.

7.10 The Recipient must notify the Province of the name, office address and office telephone number of the Recipient's Subcontractor(s).

7.11 The actions of any Subcontractor engaged to carry out any of the Work are deemed the actions of the Recipient.

7.12 Nothing in this Agreement creates any direct or indirect contractual relationship between the Province and any Subcontractor.

## ARTICLE 8 INDEMNIFICATION AND INSURANCE

**Indemnity**

8.01 The Recipient must indemnify and save harmless the Province, its employees, agents and authorized representatives, and each of them from and against losses, claims, damages, actions, and causes of action (collectively referred to as "Claims"), that the Province may sustain, incur, suffer or be put to at any time either before or after the expiration or termination of this Agreement, that arises out of errors, omissions or negligent acts of the Recipient or its subcontractor(s), servant(s), agent(s) or employee(s) under this Agreement, excepting always that this indemnity does not apply to the extent, if any, to which the Claims are caused by errors, omissions or negligent acts of the Province, its other Recipient(s), authorized representatives, or any other person.

8.02 None of the Minister of Environment, Lands and Parks or the Ministry Representative in charge, their agents or employees are personally liable for any act performed in the discharge of any duty imposed or in the exercise of any power or authority conferred upon them by, or within the scope of, the Agreement if it can be demonstrated that all reasonable care was exercised in the conduct of the operations; in all such matters these persons act solely as agents and representatives of the Province.

8.03 Neither the Province nor any of its employees or agents are liable to the Recipient or the Recipient's employees or agents for any injury, loss, or damage however occasioned to any of them or their property while being transported or conveyed in any vessel, boat, aircraft owned or operated by the Province The Recipient must not make claims against the Province, its employees or agents to recover any such injury, loss or damage either on its own behalf or on behalf of its employees or agents. The Recipient must indemnify and save harmless the Province, its employees or agents from any such claims initiated by the Recipient's employees or agents.

**Insurance**

8.04 During the Term the Recipient must carry and maintain insurance coverage as specified in the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC and, if applicable, as specified in writing by the Province.

## ARTICLE 9 PROTECTION OF WORK AND PROPERTY

**General**

9.01 The Recipient must protect the Work area and property adjacent to any Work Area, from damage and is responsible for damage which may arise as the result of the Recipient's operations under the Agreement, except damage which occurs as a result of:

(a) an error in a Schedule; or

(b) an act or omission of the Province, third parties, or other Recipients, its agent or employees.

**Protection of the Environment**

9.02 The Recipient must not cause Environmental Damage in carrying out the Work under this Agreement.

9.03 Subject to 9.04, The Recipient is not in breach of 9.02 if:

(a) performing the Work according to an operational plan, or permit issued under the Forest Practices Code; or

(b) the Work performed by the Recipient has been exempted from a requirement to have an operational plan or prescription and the Recipient is carrying out the Work in accordance with the Forest Practices Code.

9.04 If the Recipient encounters circumstances where the Recipient knows or should reasonably know that, due to weather conditions or site factors, proceeding with the Work may, directly or indirectly, cause Environmental Damage, the Recipient must:

(a) immediately suspend the Work that may cause Environmental Damage;

(b) immediately advise the Province of the suspension and circumstances;

(c) not proceed with the Work until the Province so instructs; and

(d) upon the Province's instruction to proceed with the Work, do so in accordance with the Province's instructions.

9.05 The Recipient is not in breach of this Agreement for suspending Work pursuant to Section 9.04.

9.06 If the Recipient causes Environmental Damage while performing Work under this Agreement, the Recipient must:

(a) immediately stop the Work in the area affected;

(b) prevent any further damage to the environment;

(c) immediately notify the Province to the attention of the Ministry Representative; and

(d) take any remedial measures that the Ministry Representative requires.

9.07 The Recipient may resume Work that has been stopped under 9.06 when:

(a) Work can be resumed without violating sections 9.02 and 9.04; and

(b) All remedial measures required under section 9.06 have been carried out to the satisfaction of the Ministry Representative.

## ARTICLE 10 GOVERNING LAW

10.01 This Agreement is governed by and is to be construed in accordance with the laws of the Province of British Columbia.

10.02 The Parties will comply with the laws of Canada and British Columbia applicable to the Work and the Work Area.

## ARTICLE 11 CHANGES IN CONDITIONS

11.01 If a Changed Condition occurs during the course of the Work, the following applies:

(a) The Parties must immediately advise each other of particulars of the Changed Condition and the Recipient Representative and the Ministry Representative who each have authority to act in respect of that Schedule must meet to attempt to deal with the condition.

(b) If in the opinion of either Party, that Changed Condition is so substantial that amending this Agreement to deal with the change would change the essential nature of the Work, then the Parties must not proceed with the Work in respect of that Schedule any further and that Work must be brought to an end.

## ARTICLE 12 WORK COMPLETION AND ACCEPTABILITY OF WORK

**Notification of Completion**

12.01 The Recipient must, upon completing a phase of the Work, and the entire Work, promptly notify the Province of that completion. The notification must be in writing, and must be delivered to the Province during the Province's normal business hours.

**Inspection by the Province**

12.02 The Province may, following receipt of the Recipient's notification in 12.01, inspect and determine the acceptability of the Work performed in accordance with a Schedule.

12.03 The Recipient is encouraged, but not required, to observe each inspection while it is being conducted.

12.04 The Province must provide the Recipient with a copy of inspection results.

12.05 The Province reserves the right to inspect at any time, any Work performed.

12.06 Inspections are conducted by the Province in order to determine compliance with the provisions of this Agreement. These inspections are conducted for the sole benefit of the Province, and do not release the Recipient from the responsibility of providing quality control measures to assure that the Work strictly complies with this Agreement.

12.07 The Province and the Recipient may agree on a schedule for the Province to make its determination on the acceptability of the Work and to provide its notification to Forest Renewal BC.

12.08 Notwithstanding 12.07, The Province will make its determination on the acceptability of the Work and notify Forest Renewal BC of their decision within one year of the notification in 12.01.

12.09 The Province is not obliged to make any determination of acceptability before receiving the Recipient's written notification in 12.01.

## ARTICLE 13 MEASUREMENT

**Method of Measurement**

13.01 All linear and area measurements under this Agreement are measured on the horizontal plane.

## ARTICLE 14 NON-COMPLIANCE AND TERMINATION

**Termination by the Province**

14.01 The Province may, in its sole discretion, terminate this Agreement at any time. The Province is not liable for any losses occasioned by that termination if the termination:

(a) occurs before the Ministry Representative receives the written notification of the Recipient that they will commence Work;

(b) is caused by the Recipient's failure to perform or comply with this Agreement;

(c) results from the termination of the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC; or

(d) is caused by an Act of God, unsuitable weather, natural disaster, withdrawal of labour in labour disputes, or any other unforeseeable cause over which the Province has no direct control.

**Termination by the Recipient**

14.02 The Recipient may terminate this Agreement if the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC is terminated, and no claim may be made by the Province against the Recipient for any losses occasioned by that termination.

**Mutual Termination**

14.03 This Agreement may be terminated at any time by the mutual consent of the Parties.

14.04 If a party is unable to perform any obligation under this Agreement because of an Event of Force Majeure (as that term is defined in the Recipient's Multi-Year Agreement with Forest Renewal BC), that inability shall not be a default under this Agreement.

**Non-Compliance with Agreement Provisions**

14.05 If, in the opinion of the Province, the Recipient fails to perform or fails to comply with any of its obligations under this Agreement, the Province may, in its discretion do one or more of the following:

(a) require the Recipient to re-work the area or phase of work;

(b) permit the Work to continue, giving the Recipient a time limit for compliance, rectification or both;

(c) order the Recipient to stop the Work until the alleged failure of compliance is dealt with according to the Province's requirements;

(d) specify on Quality Certificate(s) that the Recipient failed to perform or comply with one or more of its obligations;

(e) terminate all or part of this Agreement.

These remedies are in addition to any other remedies available to the Province.

14.06 The Province may inspect any re-worked area or phase of the work. The results of that inspection supersede any previous inspection results.

## ARTICLE 15 DISPUTE RESOLUTION

15.01 If a dispute occurs between the Parties concerning any matter governed by this Agreement, the disputing Party must promptly advise the other Party and the Parties together must use all reasonable efforts to resolve the dispute.

15.02 Despite section 15.01, the Ministry Representative may give the Recipient instructions that, in the reasonable opinion of the Ministry Representative, are necessary to provide for the proper performance of the Work. The Recipient must act immediately to carry out the instructions, but any work performed by the Recipient in this respect is without prejudice to any claim the Recipient may have concerning the dispute.

15.03 If the Parties are unable to resolve the dispute informally within five Work Days, then the Recipient must give to the Ministry Representative written particulars of the complaint, which must include the following:

(a) a detailed description of the nature of the complaint;

(b) a list of the relevant provisions of the Schedule(s); and

(c) an evaluation by the Recipient of the matters in dispute.

15.04 The Province must, within 20 Work Days of receipt by the Ministry Representative of the written particulars, advise the Recipient, in writing, of any one of the following:

(a) that the Province accepts the position of the Recipient; or

(b) that the Province rejects the position of the Recipient.

15.05 If the Province accepts the position of the Recipient, the Parties will amend this Agreement if necessary and the Province will advise Forest Renewal BC .

15.06 If the Province rejects the Recipient's position, the Parties must retain a mutually agreed upon person to make a written recommendation to resolve the dispute. Any costs associated with retaining that person must be jointly paid by the Parties.

15.07 If after a review of the written recommendation, the Parties agree on a resolution of the dispute, the Parties must amend this Agreement if necessary and the Recipient must provide Forest Renewal BC with a copy.

15.08 If after a review of the written recommendation, the Parties are unable to resolve the dispute and the dispute is with respect to payment only, this dispute is deemed to be between the Recipient and Forest Renewal BC, and the Recipient's position and the written recommendation must be forwarded to Forest Renewal BC. Despite the foregoing, the resolution of a dispute under a Multi-Year Agreement or Annual Agreement does not prejudice any claim the Province may have against Forest Renewal BC in respect of the Work.

15.09 A copy of the written recommendation and the Province's position may be forwarded by the Province to the appropriate professional association.

## ARTICLE 16 MISCELLANEOUS

**Confidentiality**

16.01 The Recipient must treat as confidential all material that has been produced or received by it or any Subcontractor as a result of this Agreement (collectively the "Material") and not permit its disclosure without the Province's prior written consent except as required by applicable law, including the *Freedom of Information and Protection of Privacy Act*.

**Ownership**

16.02 The Material and any equipment provided by the Province to the Recipient or a Subcontractor as a result of this Agreement is the exclusive property of the Province. The Recipient must deliver it to the Province immediately following expiration of this Agreement, or sooner upon the Province's request, in the same condition it was supplied to the Recipient, excepting always loss or damage attributable to reasonable wear or tear.

**Copyright**

16.03 The copyright in the Material belongs exclusively to the Province. Upon the Province's request, the Recipient must deliver to the Province documents satisfactory to it waiving in the Province's favour any moral rights which the Recipient or Subcontractors or their employees may have in the Material and confirming the vesting of the copyright in the Province.

**Recipient Status**

16.04 Except as otherwise provided in this Agreement, the Recipient is not subject to the control of the Province in respect of the manner in which the Work is carried out.

16.05 The Recipient must not purport to commit the Province to the payment of any money to any person.

16.06 The Recipient must ensure all personnel hired by the Recipient to perform the Work are at all times employees of the Recipient and not of the Province.

**Notices**

16.07 Any notice or document required to be given under this Agreement is conclusively deemed validly given or delivered to and received by the Parties

(a) if hand delivered personally, on the date of that personal delivery;

(b) if mailed, on the fifth business day after the mailing of the same in British Columbia by prepaid post to the addresses set out in this Agreement (or at such other address as either Party may from time to time designate by notice in writing to the other); or

(c) if sent by facsimile transmission, when transmitted, only if transmitted to the facsimile machine numbers first above written. The onus of proving transmission and receipt lies with the transmitting Party.

**Non-Waiver**

16.08 A waiver of any provision of this Agreement or a waiver of a breach by a Party of any provision of this Agreement is effective only if it is in writing and signed by the other Party.

16.09 A written waiver by either Party of any provision of this Agreement or of any breach by the other Party of any provision of this Agreement is not a waiver of any subsequent breach of the same or any other provision of this Agreement.

**Recipient Provisions**

16.10 Except as specified in the Schedule(s), the Recipient must undertake all Work and furnish all labour, equipment, supervision, transportation, supplies and incidentals necessary to perform the Work.

**Unsuitable Workers**

16.11 The Recipient must ensure all persons employed to perform the Work are competent, adequately trained , fully instructed and supervised, and legally entitled to work in Canada.

16.12 The Recipient must, upon request of the Ministry Representative, remove any person it employs for purposes of the Agreement who, in the reasonable opinion of the Ministry Representative, is incompetent or has conducted himself or herself improperly, and the Recipient must not permit a person who has been so removed to perform any further Work.

**Survival of Terms**

16.13 Sections 7.01, 7.02, 8.01, 8.02, 15,01, 15.02 and 15.03 will, despite the expiration or earlier termination of the Term of this Agreement, remain and continue in full force and effect.

**Site Clean Up**

16.14 The Recipient must maintain the Work Area free from accumulations of waste products or debris, other than that caused by the Province, other recipients or third parties.

16.15 Upon the Recipient vacating the Work Area, the Ministry Representative may determine , at his or her sole discretion, whether or not the area was left in an acceptable condition.

16.16 If the Ministry Representative determines the Recipient left the Occupied Area in an unacceptable condition, the Province may repair the area or remove waste products or debris and recommend to Forest Renewal BC a deduction in payment to the Recipient equal to the cost of repairs or removal

**Camping and Parking**

16.17 Use of Provincial Crown forest land, including any roads, landings or Ministry of Forests recreational sites, by the Recipient, the Recipient's employees or agents for the purposes of lodgings, camping, vehicle parking or trailer parking in connection with Work under this Agreement, is permitted only with prior written approval of the Ministry Representative. That use, if approved, must be without charge to the Recipient; but, the approval may be revised or revoked at any time by the Province.

16.18 **Powers Cumulative**

The powers set out in the Schedule(s) for the Province to enforce the Recipient's compliance with this Agreement may be exercised separately, concurrently, or cumulatively.

**IN WITNESS OF WHICH** the Parties have duly executed this Agreement as of the date first above written.

**SIGNED AND DELIVERED**
on behalf of the Province by an authorized representative of the Province

Authorized Signatory
Ministry of Environment, Lands and Parks

**SIGNED AND DELIVERED**
by or on behalf of the Recipient (or by an authorized signatory of the Recipient)

Recipient or Authorized Signatory

# SCHEDULE "A" - SERVICES

## 1.0 SCOPE OF WORK

The Telkwa drainage has been the focus of fish habitat restoration and enhancement efforts by Pacific Inland Resources (PIR) and the Department of Fisheries and Oceans (DFO) and the Watershed Restoration Program (WRP) since 1994. The goal of the WRP is to maintain and monitor the projects that have been constructed in the Telkwa Watershed that will provide information, and ultimately direction, on how to proceed with projects of a similar nature on other interior watersheds in the Skeena Region and throughout the province. The monitoring information will also be used to assist in identifying cost/benefits of WRP funded of projects of this nature.

This contract facilitates the continuations of monitoring two fish habitat rehabilitation projects previously constructed in the Telkwa Watershed.

Specifically, two projects have been identified. They are:

1. Rearing Pond Monitoring km1010, Telkwa FSR;
2. Rearing Pond Monitoring at km 1011 Telkwa FSR;

## 2.0 CONTRACT TERM:

The term of this contract will be from **May 1, 1999** to ***March 31, 1999.***

## 3.0 CONTRACT MONITOR(S):

The principal technical monitor will be:

WRP Fisheries Specialist
BC Environment, Skeena Region
Box 5000
Smithers, BC V0J 2N0

Phone: (604) 847-7337
Fax: (604) 847-7556

## 4.0 PROJECT TASKS AND DELIVERABLES

### 4.1 Rearing Pond Monitoring - km 1010 and km 1011, Telkwa FSR

#### 4.1.1 Scope

Juvenile movements and timing will be monitored, population estimates of the rearing ponds will be completed and reported. Environmental factors related to immigration and emigration of juveniles to the rearing ponds will be investigated, reported. From the investigations, recommendations will be given for maintenance and or improvements to the project sites.

#### 4.1.2 Tasks

The Contractor will:

**a.** Repeat mark recapture population estimation similar to those completed from 1994 to 1997 at the km 1010 and km 1011 ponds also described in Juvenile Coho studies at the Telkwa River km 1011 Ponds (Bustard, 1996), and ;

**b.** Install a fence at the outlet of the km 1011 rearing ponds to capture all fish moving in or out during juvenile migrations in the spring and compare fence results to mark recapture estimate.

**c.** Relate movement patterns to water temperatures and flow regime of the Telkwa River.

*Note: The Contractor must remove all fencing material upon completion of the trapping operations that will ensure free migration of aquatic animals*

### 4.1.3 Deliverables

Based on the Tasks in Paragraph 4.1.2 of this Schedule "A", the Contractor will provide the Province with the following deliverables:

**a.** Three (3) copies of a report summarizing the findings from the spring fence monitoring. The report format will follow the format presented in *Juvenile Coho studies at the Telkwa River km 1011 Ponds* (Bustard, 1996). This report will be presented to the Technical Monitor and the WRP Fisheries Specialist by **September *15, 1999***

# SCHEDULE "B" - SERVICES

## 1.0 SCOPE OF WORK

The Telkwa drainage has been the focus of fish habitat restoration and enhancement efforts by Pacific Inland Resources (PIR) and the Department of Fisheries and Oceans (DFO) and the Watershed Restoration Program (WRP) since 1994. The goal of the WRP is to maintain and monitor the projects that have been constructed in the Telkwa Watershed that will provide information, and ultimately direction, on how to proceed with projects of a similar nature on other interior watersheds in the Skeena Region and throughout the province.

This contract is for the improvement and modification design of the rearing pond at km 1010 of the Telkwa FSR. Specifically, the project will result in an engineered design to improve the water flow though the ponds and the pond entrance stream.

## 2.0 CONTRACT TERM:

The term of this contract will be from **November 1999** to ***March 31, 1999.***

## 3.0 CONTRACT MONITOR(S):

The principal technical monitor will be:

WRP Fisheries Specialist
BC Environment, Skeena Region
Box 5000
Smithers, BC V0J 2N0

Phone: (604) 847-7337
Fax: (604) 847-7556

Alan Baxter
Pacific Inland Resources
Tatlow Road
Smithers BC V0J 2N0
Phone: (250) 847 2656
Fax: (250) 847 5520

## 4.0 PROJECT TASKS AND DELIVERABLES

### 4.1 Rearing Pond Monitoring - km 1010 and km 1011, Telkwa FSR

#### 4.1.1 Scope

Water flow at the pond inlet over the past two years has limited the immigration and emigration of juveniles to the rearing ponds. In order that these ponds can be used, by juvenile Coho, to their maximum productivity a detailed site review and engineered plan for improvement must be completed. Based on the engineered plan and recommendations a detailed improvement work plan will be developed for the 1010 Km ponds.

#### 4.1.2 Tasks

The Contractor will:

(a) Conduct a detailed engineered site survey of the 1010 rearing ponds to outline the existing conditions of the pond and an elevational profile.

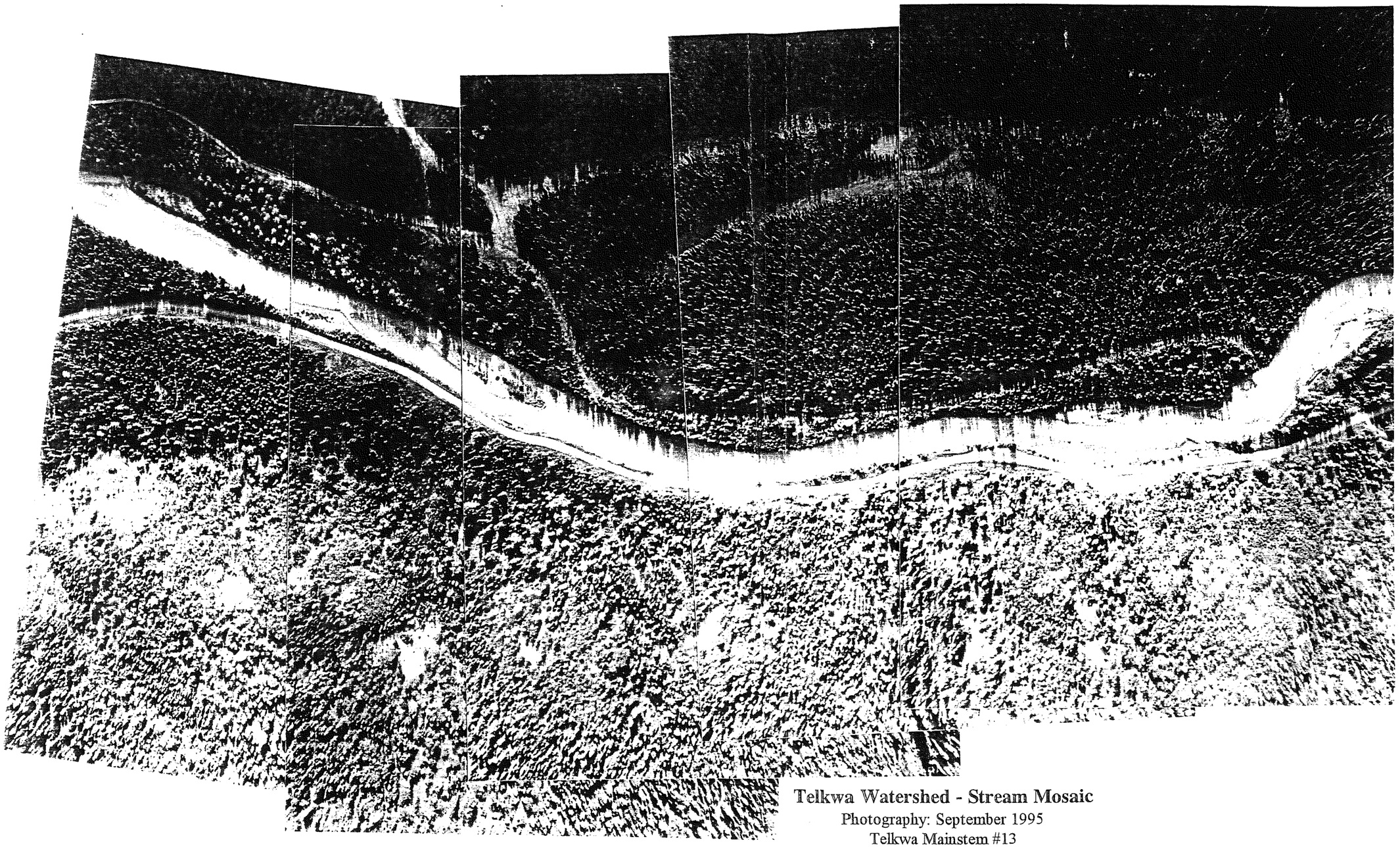
(b) Develop a conceptual design and report on how the pond entrance can be improved to allow fish passage through out the year, and how the ponds water holding capacity can be improved.

(c) After review by Pacific Inland Resources and Ministry of Environment produce a final detailed design and report for improvement works to be conducted in the 2000/01 fiscal year.

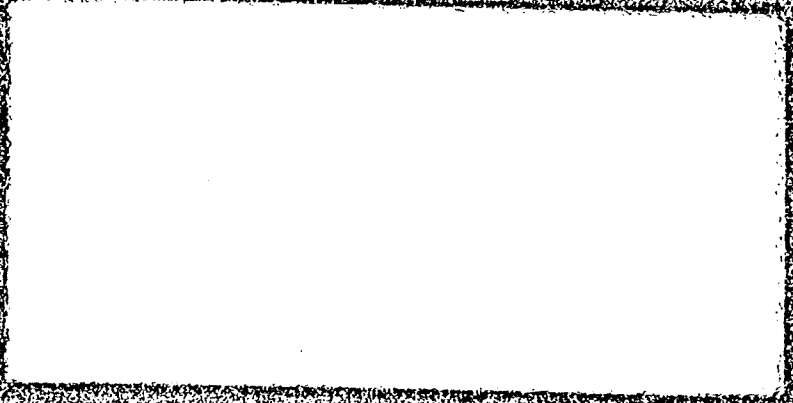
#### 4.1.3 Deliverables

Based on the Tasks in Paragraph 4.1.2 of this Schedule "B", the Contractor will provide the Province with the following deliverables:

**a.** Three (3) copies of a report summarizing the findings from the initial site survey, and the final detailed design for the pond improvements. This report will be presented to the Technical Monitor and the WRP Fisheries Specialist by **March 31, 2000**



**Telkwa Watershed - Stream Mosaic**
Photography: September 1995
Telkwa Mainstem #13



David Bustard & Associates

# JUVENILE COHO STUDIES AT THE

# TELKWA RIVER KM 1010

# AND KM 1011 PONDS 1999

Prepared by

**DAVID BUSTARD AND ASSOCIATES LTD.**

for

**WATERSHED RESTORATION PROGRAM**

PROVINCE OF B.C.

PACIFIC INLAND RESOURCES

**NOVEMBER 1999**

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# 1.0 INTRODUCTION

## 1.1 Background

Studies were conducted at two off-channel ponds located on the Telkwa River floodplain approximately 17 and 18 kms southwest of Smithers. The main pond complex is located at Km 1011 on the Telkwa Forest Road while a second area is located across the Telkwa River from Km 1010.

### 1.1.1 Km 1011 Ponds

The Km 1011 Ponds were constructed in 1993 by the Department of Fisheries and Oceans (DFO) as a pilot juvenile coho enhancement project. A special feature of the ponds was the development of culvert design features to prevent beavers from blocking outlet culverts and restricting fry recruitment into the ponds (Finnegan and Marshall 1997). The inlet channels were extended in 1995 as compensation for impacts of Pacific Northern Gas Ltd.'s pipeline crossing of the Telkwa River at this location. The total wetted area of the pond complex is 8700 $m^2$.

Further modifications of Km 1011 were undertaken in 1997, with the development of a connection between Channels 1 and 2 to increase the overwinter groundwater flows into Channel 2 (Figure 1). This connection was made to attempt to increase overwinter dissolved oxygen concentrations to more suitable levels for fish survival.

Coho populations have been monitored at Km 1011 for the past six years using a mark-and-recapture estimate for population estimates. The results to date indicate that the pond development has successfully created coho habitat. Estimates of pre-smolt coho numbers conducted in early May just prior to the outmigration period indicate that production in the ponds has increased from just over 200 coho pre-smolts prior to development to between 1100 and 2800 pre-smolts post-development (Bustard 1998).

Monitoring of the actual smolt out-migration as well as fry and yearling immigration has been undertaken since 1996. The smolt migration estimates have only been close to the pre-smolt mark-and-recapture estimates in one year. Problems with the pond outlet culvert during 1996 and the possibility the many of the smaller pre-smolts remained in the ponds for an extra year in 1998 may account for some of the differences observed.

Results from the upstream trapping indicated that newly-emerged coho fry and yearlings move upstream into the pond complex from mid-may through July. Results in 1998 indicated that both coho fry and yearling upstream migrant numbers were down sharply from past year, corresponding with poor coho spawner escapements in the upper Skeena tributaries for the previous two years.

### 1.1.2 Km 1010 Pond

The Km 1010 Pond complex was developed late in the fall of 1997. Trapping during early May 1998 indicated little use of the Km 1010 Ponds presumably due to poor access for upstream migrants past the outlet culvert (Bustard 1998). An upstream fry and yearling trap box as well as a downstream smolt trap box were installed in 1999 to determine timing and extent of fish movements in and out of this pond. These studies were conducted in conjunction with a proposal to improve access into the pond complex past the problem culvert.

## 1.2 Study Objectives

The study objectives for the 1999 work were as follows:

1.) To undertake a third year of measuring coho smolt out-migration from Km 1011 Ponds and a first year of assessing movements out of Km 1010 Pond.

2.) To compare mark-and-recapture population estimates to the actual number of coho smolts leaving the two systems.

3.) To measure the extent and timing of fish movements into the two pond complexes.

Funding for the project was provided by the Watershed Restoration Program (Province of B.C.) through Pacific Inland Resources Ltd,.

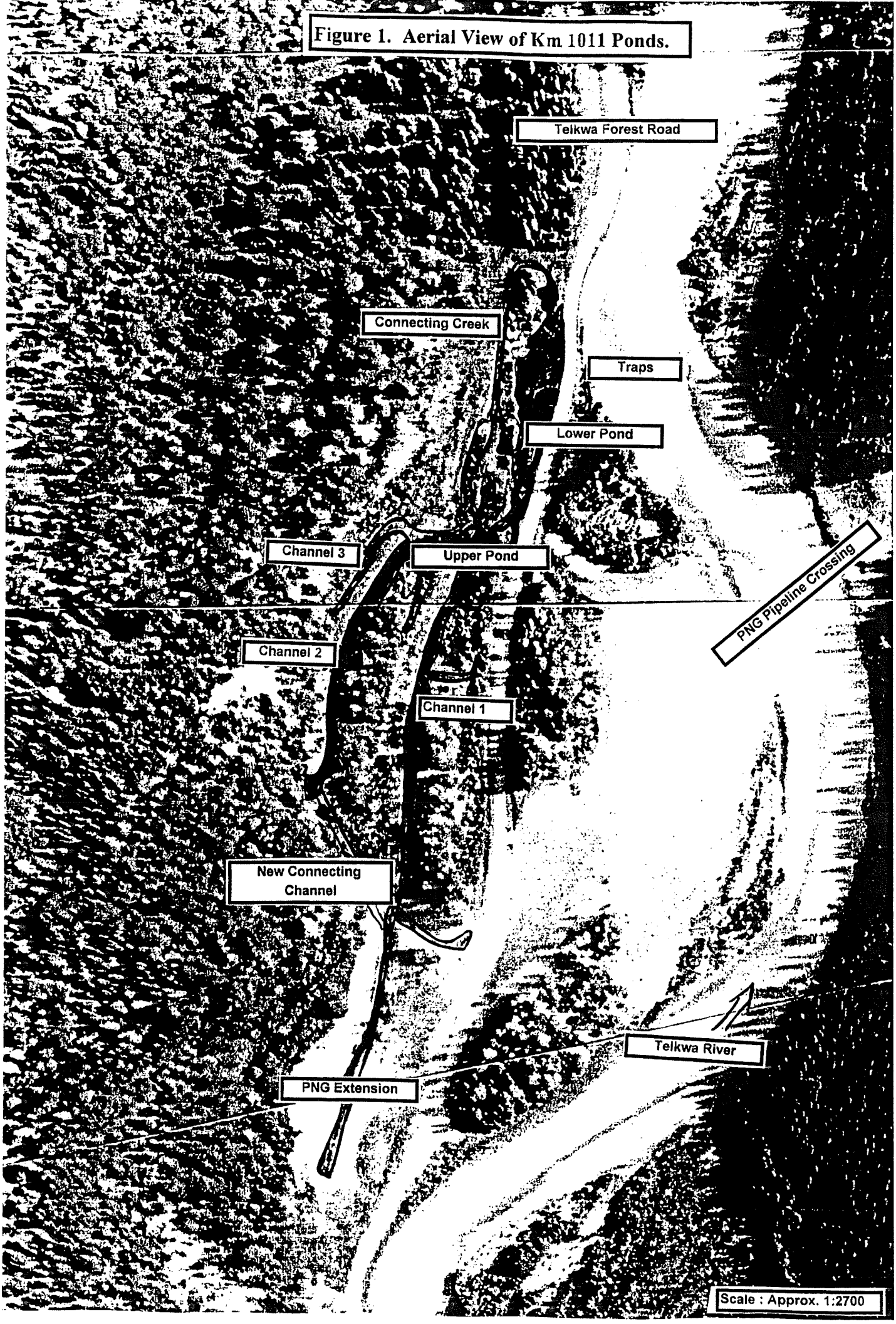
Figure 1. Aerial View of Km 1011 Ponds.
Telkwa Forest Road
Connecting Creek
Traps
Lower Pond
Channel 3
Upper Pond
PNG Pipeline Crossing
Channel 2
Channel 1
New Connecting Channel
Telkwa River
PNG Extension
Scale : Approx. 1:2700

# 2.0 METHODS

## 2.1 Timing

Field studies were initiated on May 2 and continued at both locations until June 16th. A short intense rain associated with a very warm period of rapid snowmelt resulted in the a sharp rise in the Telkwa River flow level to the highest level in at least four years. Although these high flows only occurred for several days, they flooded out the Km 1011 fence. As well, high flows washed into the Km 1010 Ponds from upstream. No further measurements were conducted due to the incomplete data and unknown movements that would have occurred during the high flows around the fences at both locations.

## 2.2 Water Temperature and Discharge

Methods for recording water temperature and discharge at Km 1011 were identical to those used for the past three years and described in Bustard (1996). The staff gauge on the Telkwa River was left in place over-winter, so levels since 1997 correspond directly to each other.

Water temperatures were taken at the outlet to Km 1010 pond and water levels were recorded at a staff gauge installed at the culvert box at Km 1010. Discharge from Km 1010 Pond was too high to run all flows through the trap box installation similar to Km 1011. Instead some flows were passed through the outlet culvert, and suitable flow conditions through the downstream trap box were adjusted using a cover on the culvert.

Thermographs were installed at 0.5 m depth in the Km 1011 lower pond and near the outlet box on Km 1010 Pond from the beginning of May to October 15th at both locations.

A series of dissolved oxygen and temperature profiles were conducted at seven locations in Km 1011 Ponds on May 5. Similar measurements were made at Km 1010 Pond and inlet creek on May 10, just as the ponds were free of ice cover.

## 2.3 Mark-and-Recapture Estimates

### 2.3.1 Km 1011

Methods used to conduct population estimates were identical to those used in past years. The markings were conducted on May 3-4th and the recaptures were undertaken on May 10-11th, prior to the main smolt outmigration (based on observations at the downstream traps). All fish captured during this portion of the surveys were marked with an upper caudal clip.

A total of 75 minnow traps baited with roe were used for both the mark and the recapture phases.

Population estimates were conducted using the Chapman modification to the Peterson formula (Chapman 1951), and the 95% confidence intervals were calculated using the standard error of the estimate (Robson and Regier 1971).* The estimates were separated by pond section and for coho less than and larger than 75 mm fork length[1]. This is the size break-off that has been used for the past five years to separate those coho probably remaining in the ponds for an additional year versus those expected to leave as smolts within the next six weeks.

### 2.3.2 Km 1010

Five minnow traps were set in Km 1010 on May 13th and again on May 20th to determine whether sufficient numbers of coho could be caught to make a mark-and-recapture estimate feasible. On both dates, no fish were captured, so we determined that a large trapping effort to obtain marked fish would not be worthwhile based on the low fish numbers present in the pond at Km 1010 in 1999.

## 2.4 Upstream and Downstream Traps

### 2.4.1 Km 1011

The same upstream and downstream trap box that was used for the past three years was installed in the short section of the outlet stream located between the road and the mainstem Telkwa River (Figure 1). A description of the trap configuration is given in Bustard (1996).

Trap boxes were operational by May 3, and were checked daily until June 16th when Telkwa River flows over-topped the downstream fence. The upstream box was also over-topped and not effectively fishing on May 24 and 25th.

The downstream box was operational until June 16th. However, we had a problem on May 23 and 24th when the screening in the downstream trap box was damaged by what we suspect was a mink. This was during the key smolt movement period, and we suspect that significant numbers of smolts were lost during this two-day period, affecting the final estimates of smolt numbers in 1999.

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[1] No fish less than 75 mm fork length were actually captured in the 1999 mark-and-recapture. Also, the large smolt size measured in 1998 suggested that some coho larger than 75 mm may remain in the ponds for an additional year.

The wire screening on the downstream box was reinforced with heavier gauge wire and a live trap was set for the remainder of the project. No mink was ever captured, and there were no further problems at the downstream trap.

All fish captured were sorted by species, counted, examined for marks (upper caudal clips from 1999 and right ventral clips from 1998 upstream yearlings) and released in the direction of capture. Fork lengths from a sample of fry (to a maximum of 30) were measured daily. All coho yearlings and smolts were measured to the nearest mm.

Representative weights were retained from 169 coho smolts and scales were retained from 46 coho smolts for aging. The results of the 1999 aging analysis are not available to date[2] . However, the age summaries from 56 coho smolts sampled in 1998 have been included in this report. Aging information for these fish was not available for the 1998 report.

### 2.4.2 Km 1010

Upstream and downstream trap boxes were installed adjacent to the culvert outlet at Km 1010. The trap designs were the same as those used at Km 1011 including a siphon from the pond to provide attraction water for the upstream box. The inlet trough to the downstream box was installed in a trench cut through the pond berm. The trap dimensions are the same as those outlined in Bustard (1996) for Km 1011.

Fine-meshed seine netting was installed across the pond inlet to collect conifer needles before they entered the downstream trap and plugged the screening. As well, wire fencing was installed around the trough inlet and trap box to prevent beavers from plugging the inlet. A wire fence was installed around the traps part way through the project to reduce porcupine damage.

All fish moving upstream and downstream in Km 1010 were handled similarly to the methods outlined for Km 1011. Weights were obtained from 44 coho smolts and scales were retained from 39 coho smolts. Age data is not available at the time of this report preparation.

## 2.5 Other Observations

Observations of wildlife species (including amphibians) associated with the pond complexes were collected at the sites and are summarized in Appendix 5 Tables 1 and 2.

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[2] Submitted to Greg Bonnell, Dept. of Fisheries and Oceans, Vancouver.

# 3.0 RESULTS

## 3.1 Water Temperature and Streamflow Summaries

Water temperatures collected during the studies are summarized in Figure 2 with a more complete record in Appendix 1 Tables 1 and 2.

Water temperatures in Km 1011 Pond rose from 8°C in early May to 18°C during late July and early August (Figure 2). Mean monthly water temperatures in Km 1011 were comparable to those recorded in the lower pond during 1996 and 1997, and emphasize that the summer of 1998 was unusually warm (Table 1). The Km 1011 Ponds have consistently been 5-7°C warmer than water temperatures in the mainstem Telkwa River.

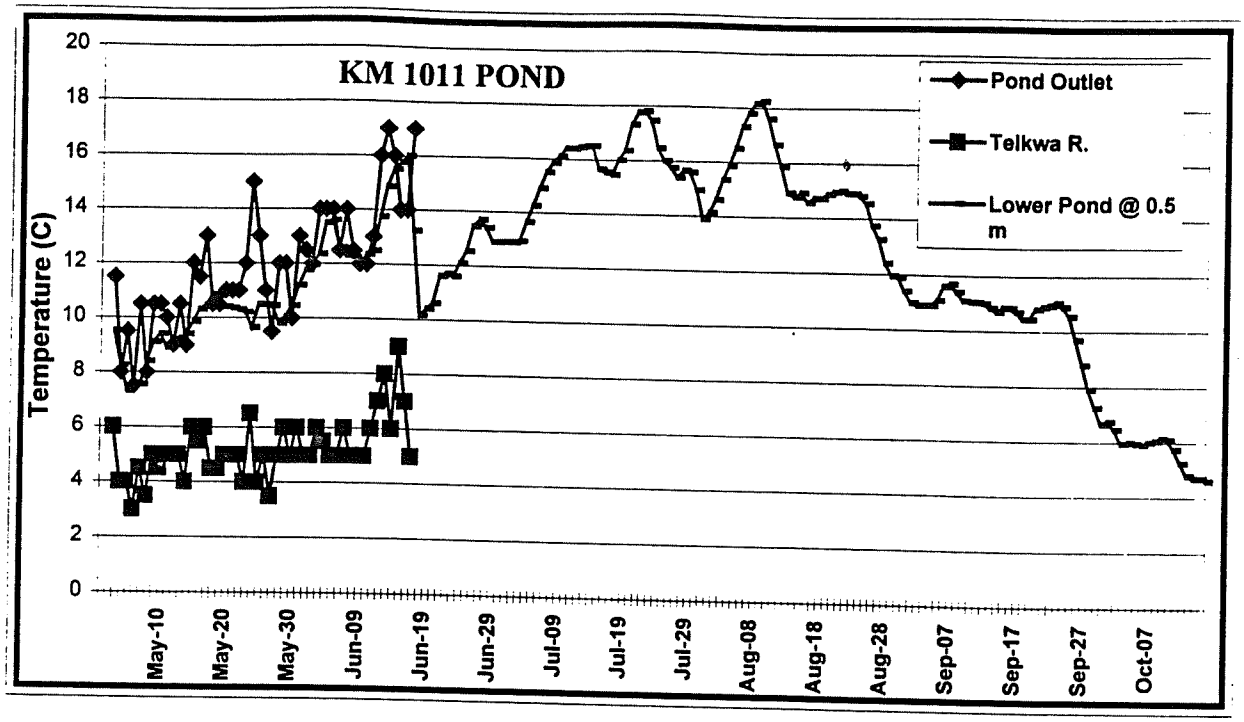
**Table 1. Mean Monthly Water Temperatures in Km 1011 and Km 1010 Ponds Compared to the Mainstem Telkwa River for the Period of Record.**

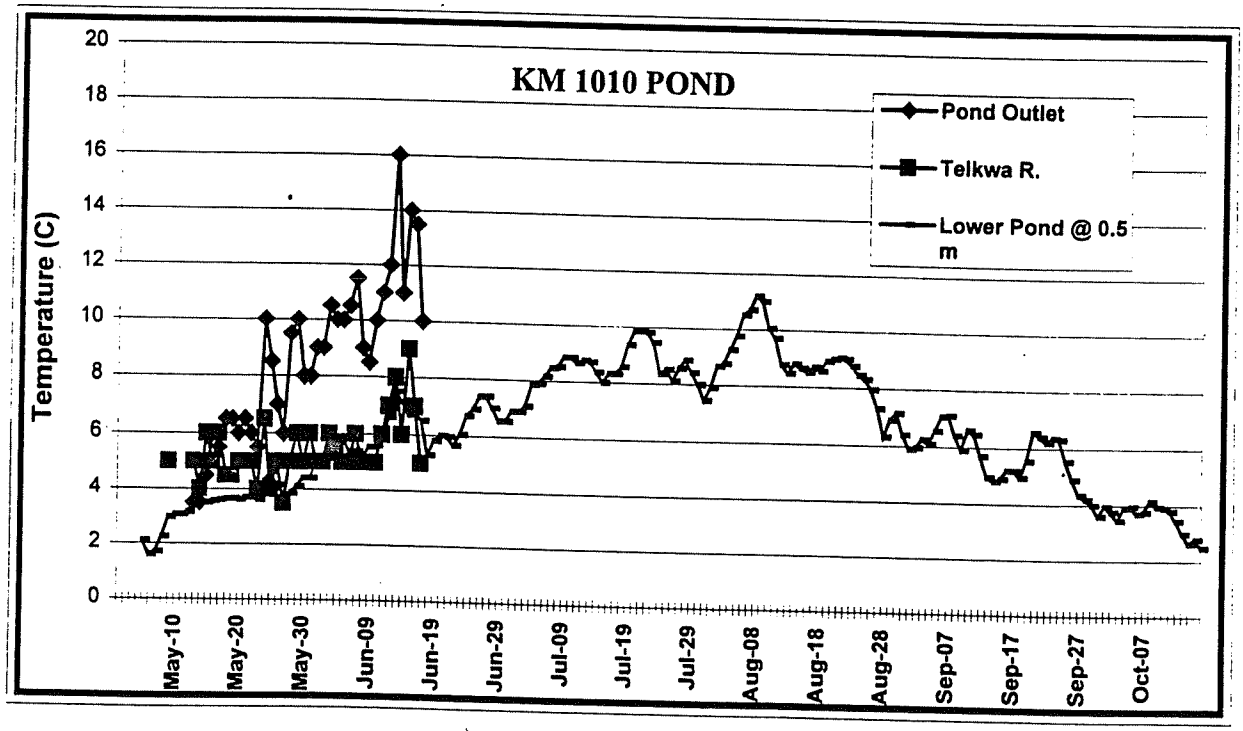
| Month | Telkwa Ponds | | | | | Telkwa River | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Km 1011 | | | | Km 1010 | | | | |
| | 1996 | 1997 | 1998 | 1999 | 1999 | 1996 | 1997 | 1998 | 1999 |
| May | 10.2 | 10.6 | 13.4 | 9.7 | 3.5 | 6.3 | 5.6 | 6.0 | 4.8 |
| June | 12.5 | 13.0 | 16.3 | 12.8 | 6.2 | 6.5 | 7.9 | 9.7 | 6.0 |
| July | 14.7 | 14.8 | 17.3 | 15.7 | 8.5 | 8.5 | 10.4 | 11.2 | nm[3] |
| Aug | 13.8 | 14.6 | 15.3 | 14.9 | 8.7 | nm | nm | nm | nm |
| Sept | 11.1 | 10.8 | 11.6 | 10.3 | 5.6 | | | | |
| Oct (to 15th) | | | | 5.6 | 3.5 | | | | |

Km 1010 still had ice cover during the first week of May. Mean monthly water temperatures rose from a cool 3.5°C during May to between 8 and 9°C in July and August (Table 1). The maximum daily temperature in the ponds was just over 11°C during early August. Water temperatures in the outlet creek were considerably warmer than in Km 1010 Pond with a maximum of 16°C recorded in mid-June prior to the end of the study (Figure 2).

[3] Not measured. The 1999 studies ended in mid-June due to flooding. All other years continued through July.

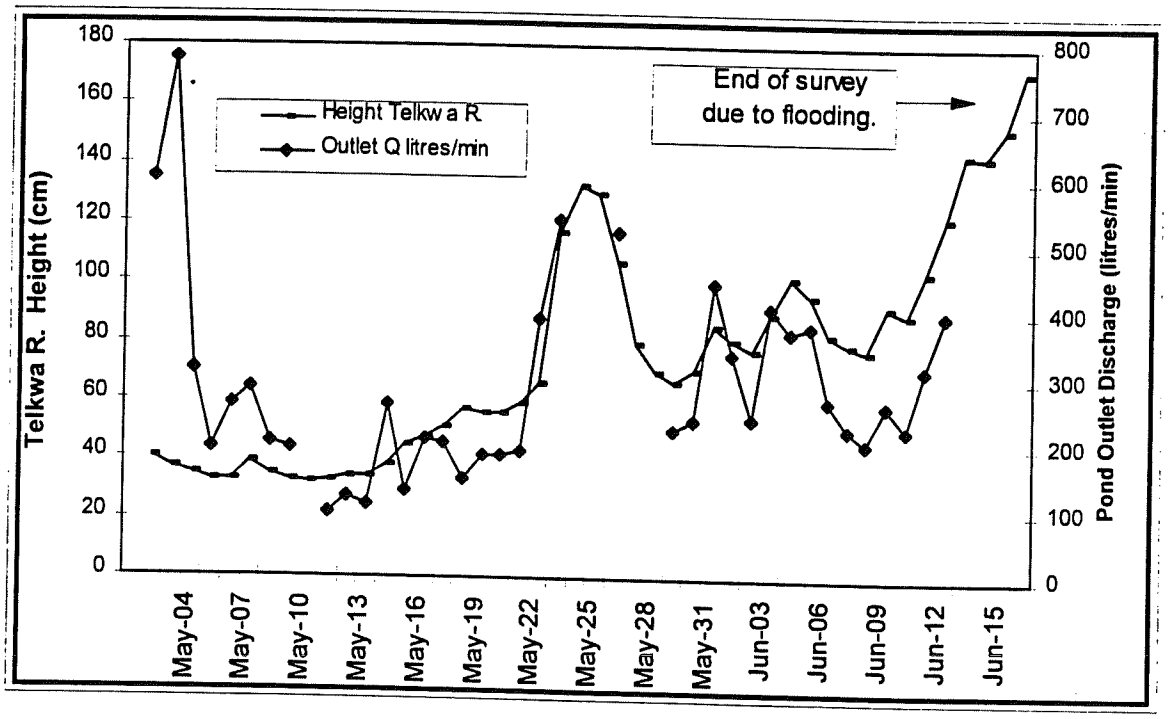
**Figure 2. Water Temperatures in Km 1011 and Km 1010 Ponds and the Telkwa River 1999.**



Km 1011 discharge estimates are summarized in Figure 3, with more detailed information provided in Appendix 1 Table 1. The outlet flows from Km 1011 Ponds were highest at the initiation of the project in early May, reflecting local run-off from the immediate pond area. After that date, outlet flows tended to track Telkwa River flows. The Telkwa River flows exceeded 180 cm on the gauge, the highest recorded since pond monitoring has been undertaken in the Telkwa.

**Figure 3. Telkwa River Water Levels Versus Km 1011 Outlet Flows.**




Discharge estimates at Km 1010 were not conducted since the streamflows were split between the downstream trap and the outlet culvert. The pond level was adjusted on a daily basis, with the excess flow directed through the culvert.

Dissolved oxygen measurements were conducted throughout both pond complexes during early May (Appendix 2 Tables 1 and 2). The results indicate that suitable dissolved oxygen levels were present in both pond complexes during this period (6-12 ppm range). Data from past years during early March indicates that low dissolved oxygen conditions can occur during the late winter in sections within both pond areas (Bustard 1998).

### 3.2 Fish Sampling Results

#### 3.2.1 Pond Mark-and-Recapture Population Estimates

#### 3.2.1 1 Km 1011 Population Estimates

Relatively small numbers of coho were captured throughout Km 1011 Pond complex during the mark-and-recapture population estimates in 1999 (Table 2). In total, only 205 coho were captured in the 150 traps set throughout the complex. This is less than one-half of the lowest number captured during past sampling at the same locations with the same or less effort (range from 547 to 1253 fish).

The catch per unit effort (CPUE) of 1.4 coho per trap is very low given the quality of the habitat and past sampling results. CPUE was highest in the lower pond and very low in the PNG extension channel where only a single coho was captured in 20 traps. Catches in this channel have been very low since the old channel was blocked and a new connecting channel was added off Channel 2, suggesting that coho are not recruiting into this section through the new channel.

Only a single peamouth chub was captured during the mark-and-recapture sampling. In the past a small number of rainbow trout and occasionally mountain whitefish and Dolly Varden have been sampled during the mark-and-recapture estimates. Together, these other species generally comprise less than 1% of the overall sample.

Table 3 summarizes the results of the population estimates by section. The total population estimate for all sections was 961 fish (95% confidence intervals of 448 to 1474). No fish smaller than 75 mm were sampled during the mark-and-recapture, and it assumed that most of the fish sampled would be leaving the ponds as smolts within six weeks of the early May estimates[4].

The total estimated population of coho in the ponds compared to previous sample results since 1993 is presented in Table 4. The results indicate that the overall estimate of coho was the lowest for all years since first estimates were made in 1993. The total absence of fish smaller than 75 mm was very unusual, and reflects the exceptionally low fry recruitment into the ponds during the summer of 1998. The estimate of 961 potential smolts for 1999 was the lowest since the pond construction (1994 onward). This estimate does fall within the lower end of the confidence interval range of the 1997 estimates.

The mean fork length of coho sampled in the mark-and-recapture estimates is shown in Table 5. The mean size of the >74 mm category was 116 mm. This indicates that the sample of coho present in the Km 1011 Ponds was comprised of much larger fish than in

[4] Based on large smolt sizes noted in 1998, this assumption that all fish >74 mm leave as smolts probably results in an over-estimate of the number of smolts leaving the ponds.

**Table 2. Summary of Coho Captured in Minnow Traps in Sections 1 to 8 of Km 1011 Ponds, May 1994 to 1999.**

| | Number of Traps | | | | | | Coho Captured | | | | | | Coho CPUE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| 1 Lower Pond | 30 | 30 | 30 | 30 | 30 | 30 | 160 | 180 | 284 | 152 | 207 | 107 | 5.3 | 6.0 | 9.5 | 5.1 | 6.9 | 3.6 |
| 2 Creek-Debris | 10 | 10 | 10 | 10 | 10 | 10 | 102 | 74 | 201 | 56 | 116 | 17 | 10.2 | 7.4 | 20.1 | 5.6 | 11.6 | 1.7 |
| 3 Creek-Rock | 10 | 10 | 10 | 10 | 10 | 10 | 61 | 55 | 137 | 29 | 78 | 8 | 6.1 | 5.5 | 13.7 | 2.9 | 7.8 | 0.8 |
| 4 Upper Pond | 20 | 20 | 20 | 20 | 20 | 20 | 99 | 92 | 234 | 56 | 73 | 30 | 5.0 | 4.6 | 11.7 | 2.8 | 3.7 | 1.5 |
| 5 Channel 1 | 20 | 20 | 20 | 20 | 20 | 20 | 98 | 54 | 141 | 36 | 76 | 14 | 4.9 | 2.7 | 7.1 | 1.8 | 3.8 | 0.7 |
| 6 Channel 2 | 20 | 20 | 18 | 20 | 20 | 20 | 115 | 92 | 84 | 55 | 84 | 11 | 5.8 | 4.6 | 4.7 | 2.8 | 4.2 | 0.6 |
| 7 Channel 3 | 20 | 18 | 10 | 20 | 20 | 20 | 130 | 110 | 84 | 63 | 77 | 17 | 6.5 | 6.1 | 8.4 | 3.2 | 3.9 | 0.9 |
| 8 PNG Extension | | | 8 | 20 | 20 | 20 | | | 88 | 100 | 31 | 1 | | | 11.0 | 5.0 | 1.6 | 0.1 |
| TOTAL | 130 | 128 | 126 | 150 | 150 | 150 | 765 | 657 | 1253 | 547 | 742 | 205 | 5.9 | 5.1 | 9.9 | 3.6 | 4.9 | 1.4 |

**Table 3. Juvenile Coho Population Estimates in Km 1011 Ponds, May 1999.**

| SECTION | SIZE CATEGORY[10] | M[5] | C[6] | R[7] | N[8] | SE (N) | 95% C.I[9] |
|---|---|---|---|---|---|---|---|
| 1 | >74 mm | 33 | 74 | 5 | 424 | 154.3 | 302 |
| 2 | >74 mm | 14 | 3 | 2 | 19 | 6.2 | 12 |
| 3 | >74 mm | 6 | 2 | 0 | 20 | 21.0 | 41 |
| 4 | >74 mm | 16 | 14 | 3 | 63 | 25.5 | 50 |
| 5 | >74 mm | 10 | 4 | 0 | 54 | 55.0 | 108 |
| 6 | >74 mm | 9 | 2 | 0 | 29 | 30.0 | 59 |
| 7 | >74 mm | 9 | 8 | 0 | 89 | 90.0 | 176 |
| PNG EXTENSION | >74 mm | 1 | 0 | 0 | 1 | 0.0 | 0 |
| **TOTAL** | **>74 mm** | **97** | **107** | **10** | **961** | **261.6** | **513** |

**Table 4. Juvenile Coho Population Estimates in Km 1011 Ponds, May 1993 to 1999.**

| Year | Juvenile Coho Estimates | | |
|---|---|---|---|
| | >74 mm (95% CI) | <75 mm | Combined |
| 1993 | 222 (179-263) | 964 | 1186 |
| 1994 | 2304 (1777-2832) | 336 | 2640 |
| 1995 | 1549 (1223-1875) | 296 | 1845 |
| 1996 | 2820 (2163-3477) | 1484 | 4304 |
| 1997 | 1124 (845-1403) | 271 | 1395 |
| 1998 | 1806 (1452-2160) | 107 | 1913 |
| 1999 | 961 (448-1474) | 0 | 961 |

[5] M refers to the number of coho initially marked.
[6] C refers to the total number of coho recaptured.
[7] R refers to the number of recaptured coho with marks.
[8] N refers to the estimates population.
[9] C.I. refers to confidence intervals.
[10] Note: no coho with fork lengths less than 75 mm were caught during the 1999 mark-and-recapture.

**Table 5. Mean Fork Lengths of Coho Sampled During Mark-and-Recapture Population Estimates in the Km 1011 Ponds May 1993 to 1999.**

| | <75 mm | | >74 mm (pre-smolts) | |
|---|---|---|---|---|
| | fl (mm) | n | fl (mm) | n |
| 1993 | Pre-construction | | | |
| 1994 | 66.3 | 63 | 100.6 | 648 |
| 1995 | 70.2 | 47 | 99.6 | 533 |
| 1996 | 65.9 | 472 | 89.9 | 752 |
| 1997 | 68.6 | 91 | 93.8 | 411 |
| 1998 | 68.4 | 40 | 100.9 | 692 |
| 1999 | na | 0 | 116.3 | 205 |

any past year. We noted in the 1998 studies that many of the larger coho that we assumed were going to leave as smolts in 1998 remained in the pond, leading to a discrepancy between the mark-and-recapture estimates and the smolt migration numbers in the downstream trap. This may account for the much larger fish present in the ponds in 1999 compared to past years.

### 3.2.1.2 Km 1010 Population Estimates

A mark-and-recapture estimate was not conducted in Km 1010 Pond in 1999 due to the lack of fish captured during two trials in early May to determine whether sufficient coho were present to warrant a population estimate.

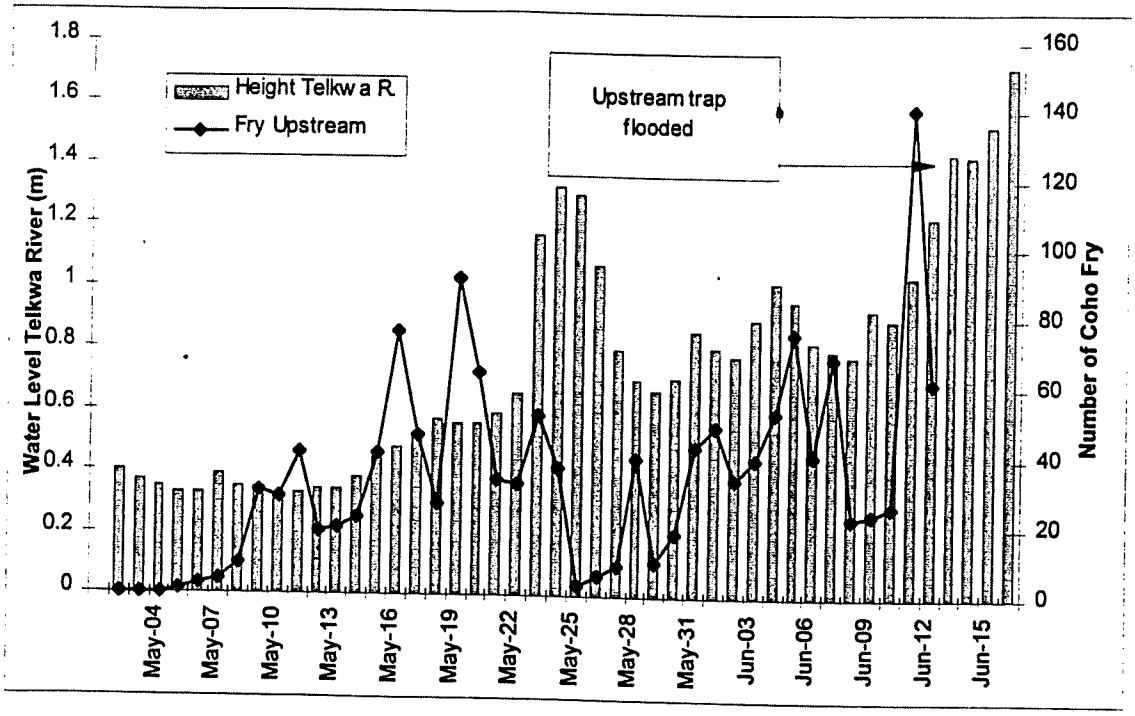
## 3.2.2. Fish Upstream Movements

### 3.2.2.1 Km 1011 Upstream Migrants

In total, 1487 fish moved upstream in Km 1011 Ponds during the May to mid-June period (Table 6). Newly-emerged coho fry comprised 97% of the fish moving upstream. A small number of coho yearlings (43) and rainbow trout (7) were also passed upstream into the ponds. The detailed results outlining daily movements are summarized in Appendix 3 Table 1.

The number of age 0+ coho moving upstream in May (799) was the highest recorded to date. The fry migration was continuing through June until the traps were washed out mid-month. The number of coho yearling upstream migrants (30) was well down from earlier years (Table 6).

**Figure 4. Coho Fry Upstream Movements in Km 1011 Ponds Versus Telkwa River Levels, May to Mid-June 1999.**




Coho fry were first captured in the upstream trap on May 5 (Figure 4 and Appendix 3 Table 1). This is very close to the first fry recorded in 1998 and approximately a week earlier than 1996 and 1997. Steady numbers of fry moved upstream on a daily basis from approximately May 9 onward, with a drop during a high-flow period in late May when the upstream trap was submerged. In the past, most coho fry upstream migration into the ponds occurred during June and July. The 1437 coho fry passed upstream prior to June 16th exceeds the next highest fry migration year (1996) when 978 fry were passed upstream by that date. The small number of coho yearlings entered the ponds throughout the period of trap operation.

The high recruitment of coho fry into Km 1011 during the period of trap operation is indicative of improved spawner recruitment into the Telkwa River during the fall of 1998 compared to the previous two years. The very low yearling numbers recorded moving into the ponds is further evidence of poor coho recruitment in the Telkwa in 1997. Coho fry recruitment in 1997 was the lowest to date (Table 6).

Similar to the previous two years, increased fry migration into the ponds was not directly related to rising flows in the Telkwa River. However, the highest daily migration occurred during a period of increasing streamflows just prior to the traps flooding out.

**Table 6. Summary of Km 1011 Upstream and Downstream Fish Movements by Month and Year (1996 to 1999).**

**UPSTREAM MOVEMENTS**

| Month | Coho 0+ | | | | Coho 1+ | | | | Rainbow | | | | Whitefish | | | | Dolly Varden | | | | CT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1997 |
| May | 553 | 170 | 112 | 799 | 233 | 253 | 119 | 30 | 0 | 8 | 2 | 6 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 |
| June | 980 | 351 | 158 | 638 | 440 | 349 | 121 | 13 | 2 | 2 | 1 | 1 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| July | 861 | 308 | 105 | na | 76 | 136 | 23 | na | 0 | 2 | 1 | na | 0 | 0 | 0 | na | 0 | 0 | 0 | na | 1 |
| Aug (1-9) | 37 | dry | dry | na | 9 | dry | dry | na | 0 | dry | dry | na | 0 | dry | dry | na | 0 | dry | dry | na | dry |
| Total | 2431 | 829 | 375 | 1437 | 758 | 738 | 263 | 43 | 2 | 12 | 4 | 7 | 8 | 5 | 1 | 0 | 0 | 0 | 2 | 0 | 2 |

**DOWNSTREAM MOVEMENTS**

| Month | Coho Smolts | | | | Coho Pre-smolts* | | | | Coho Fry | | | | Rainbow | | | | Whitefish | | | | DV | Chub | BT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999** | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1998 | 1999 | 1999 |
| May | 21 | 730 | 539 | 204 | 1 | 2 | 2 | 2 | 2 | 0 | 1 | 6 | 7 | 2 | 3 | 2 | 2 | 1 | 0 | 0 | 2 | 0 | 1 |
| June | 205 | 650 | 282 | 87 | 9 | 18 | 0 | 0 | 51 | 4 | 0 | 16 | 18 | 8 | 6 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| July | 9 | 2 | 1 | na | 9 | 14 | 2 | na | 238 | 8 | 0 | na | 0 | 0 | 0 | na | 1 | 0 | 0 | na | 0 | na | na |
| Aug (1-9) | 0 | dry | dry | na | 2 | dry | dry | na | 4 | dry | dry | na | 0 | dry | dry | na | 0 | dry | dry | na | dry | na | na |
| Total | 235 | 1382 | 822 | 291 | 21 | 34 | 4 | 2 | 295 | 12 | 1 | 22 | 25 | 10 | 9 | 3 | 4 | 2 | 0 | 1 | 2 | 1 | 1 |

*These fish were larger juveniles not exhibiting smolt characteristics (loss of parr marks, silver colouration and black tip on caudal fin).

**Evidence of a mink interfering with the d/s trap box on May 23 and 24, 1999, a peak period of migration.

No data was collected after June 16th in 1999 due to high Telkwa River flows flooding the outlet of the ponds.

A summary of upstream coho migrant fish length is presented in Appendix 3 Table 3 and Appendix 3 Figure 1. Coho fry sizes in 1999 are comparable to those measured in previous years. As in past years, most yearlings entering the pond complex were less than 80 mm fork length (Appendix 3 Figure 1).

### 3.2.2.2 Km 1010 Upstream Migrants

A total of 194 fish migrated upstream into the Km 1010 Pond during the May to mid-June period (Table 7). Newly-emerged coho fry comprised 96% of the total. A small number of coho yearlings, rainbow trout and a single Dolly Varden comprised the remainder of the total. After June 15, the Telkwa River overflowed into channels entering the top end of the Km 1010 Pond, and we assume coho fry entered the complex area above the trap box during this flooding. The culvert at the outlet of the Km 1010 Pond is presently a barrier to juvenile fish upstream migration at all flows.

**Table 7. Summary of Coho Migrants at Km 1010 from May 8 to June 15, 1999.**

| UPSTREAM MOVEMENTS | | | | | |
|---|---|---|---|---|---|
| **Month** | **Coho 0+** | **Coho 1+** | **Rainbow** | **Whitefish** | **Dolly Varden** |
| | | | | | |
| **May** | 6 | 2 | 1 | 0 | 0 |
| **June** | 180 | 3 | 1 | 0 | 1 |
| | | | | | |
| **Total** | 186 | 5 | 2 | 0 | 1 |

| DOWNSTREAM MOVEMENTS | | | | | |
|---|---|---|---|---|---|
| **Month** | **Coho Smolts** | **Coho Fry** | **Rainbow** | **Whitefish** | **Dolly Varden** |
| | | | | | |
| **May** | 35 | 0 | 1 | 0 | 4 |
| **June** | 42 | 0 | 4 | 0 | 3 |
| | | | | | |
| **Total** | 77 | 0 | 5 | 0 | 7 |

The first coho fry migrants appeared in the outlet stream during late May coinciding with high flow conditions in the Telkwa River and increasing water temperatures in the outlet creek. Only six coho fry moved up into Km 1010 Pond during May (Table 7). A steady upstream migration of coho fry really didn't start until the first week of June in Km 1010, approximately one month later than in Km 1011. In total, 180 coho fry moved into Km 1010 Pond, mainly during the middle of June just prior to the high-flow period that ended the trapping. Daily summaries of fish movements are presented in Appendix 3 Table 2.

### 3.2.3 Fish Downstream Movements

#### 3.2.3.1 Km 1011 Downstream Migrants

A total of 321 fish were captured in the downstream traps during the study period (Table 6). This included 291 coho smolts, two coho pre-smolts, 22 coho fry, three rainbow parr, one mountain whitefish, one bull trout juvenile, and one peamouth chub.

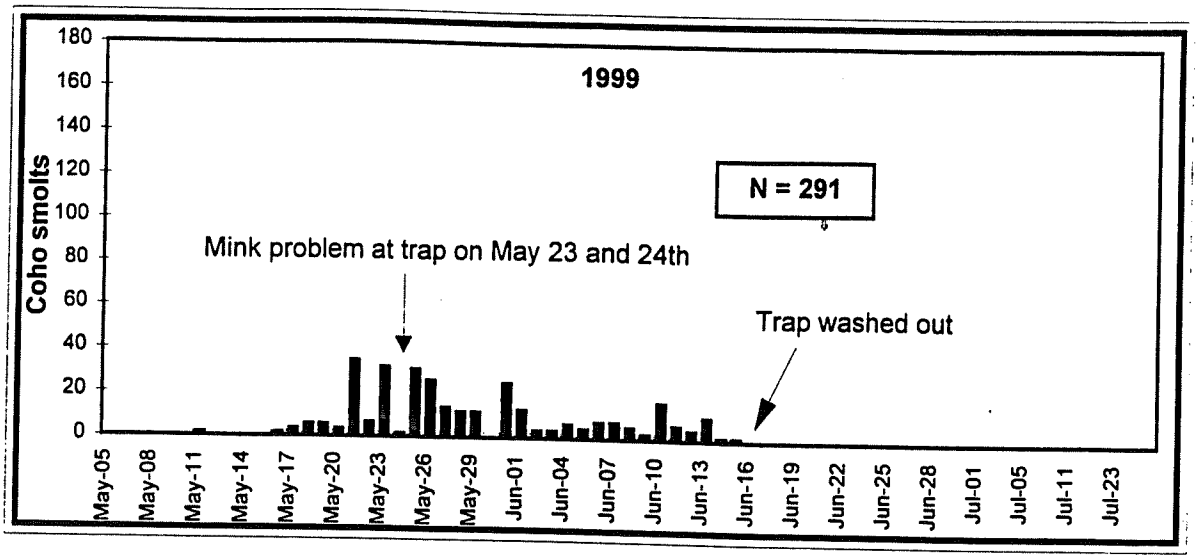
By the time the downstream trap box was flooded out, 291 coho smolts had left Km 1011 Pond (Figure 5). Timing data from other years suggests that the smolt migration from Km 1011 is typically declining by mid-June. In the previous two years, over 95% of the smolt movement occurred prior to June 18$^{th}$ with the peak of movements occurring during the last week of May and into the first week of June (Figure 5).

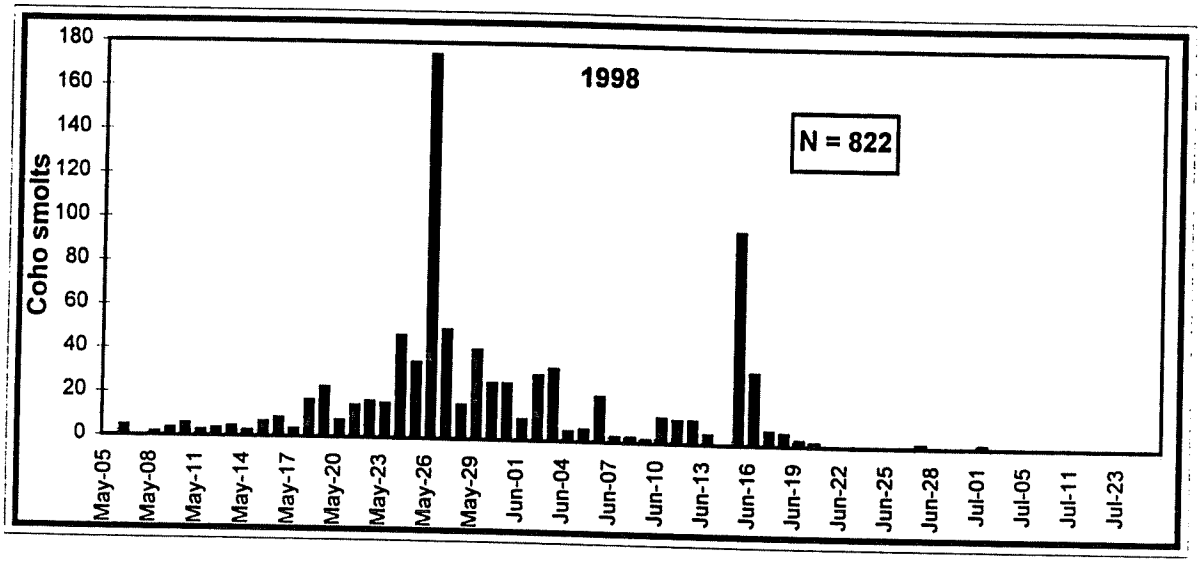
A number of factors compromised the coho smolt data in 1999. The late snowmelt freshet ending with the traps washing out prior to the expected end of the smolt migration, as well as mink problems at the traps for two days during what is normally the peak period for smolt movements resulted in unreliable smolt numbers.

However, we conclude that the smolt outmigration in 1999 was going to be relatively low compared to past years based on the generally low smolt numbers leaving on a daily basis when the traps were functioning well compared to similar periods in other years. Whether the total number of smolts actually leaving the ponds falls within the estimated range based on the mark-and-recapture estimates (between 448 and 1474 based on 95% confidence intervals) is unknown.

Coho smolts leaving Km 1011 in 1999 averaged 123 mm fork length. These smolts were between 13 and 24 mm larger than the mean size measured in past years (Figure 6 and Table 8). Since 1996, the mean size of smolts leaving Km 1011 Ponds has been increasing. Presumably this reflects a higher proportion of older age class smolts in the migration.

**Figure 5. Timing of Coho Smolt Downstream Migration at Km 1011 from 1997 to 1999.**



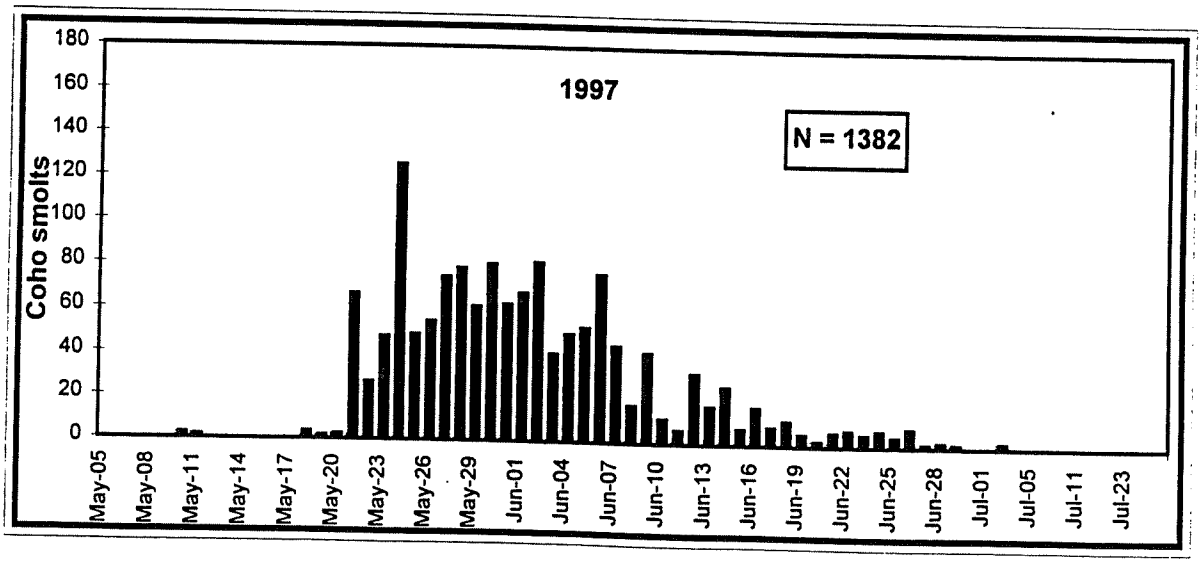



**Figure 6. Length-Frequency of Coho Smolts Leaving Km 1011 Ponds from 1996 to 1999.**

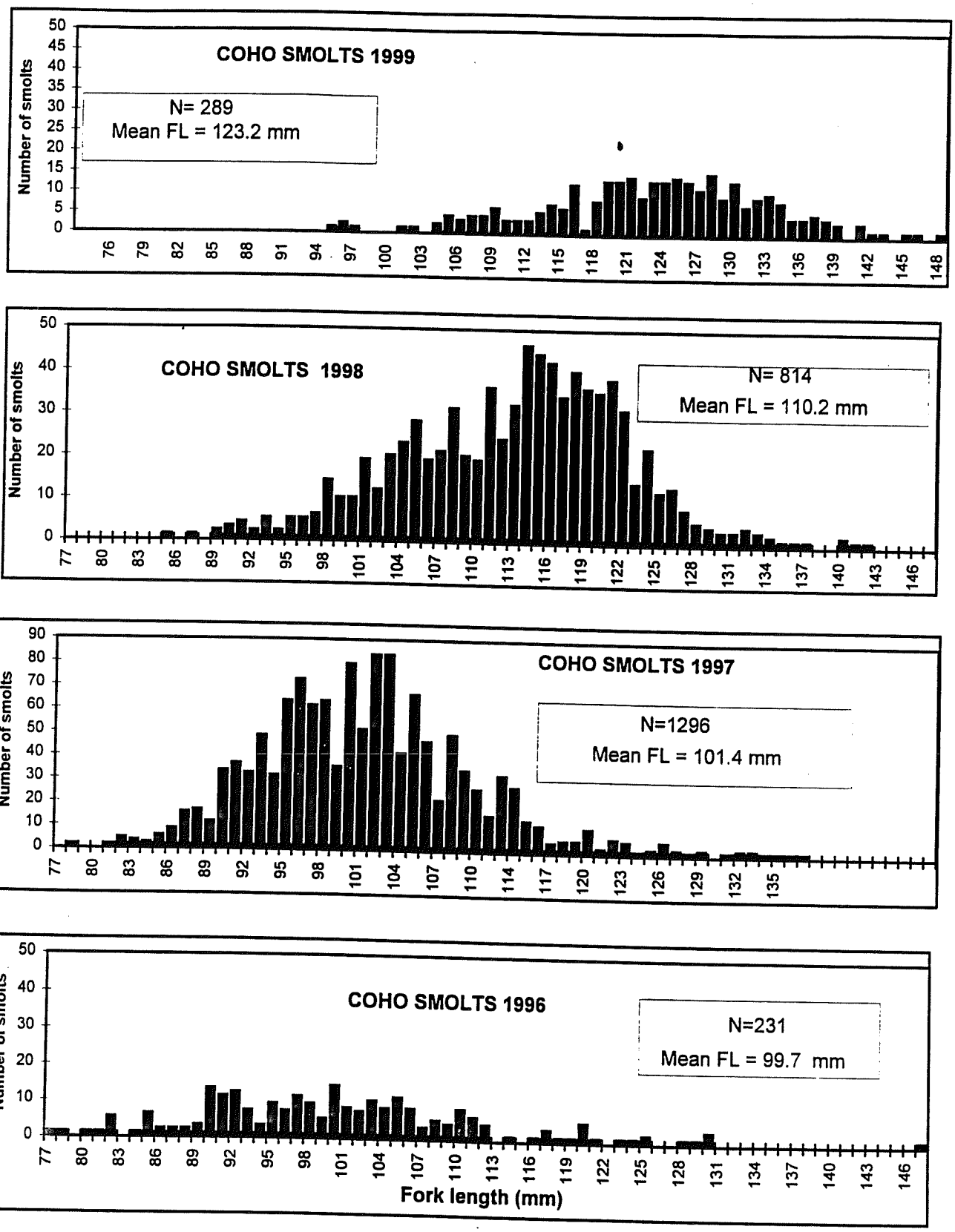


**Table 8. Summary of Mean Length and Weight of Coho Smolts at Km 1011 Ponds for the Period 1996 to 1999.**

| | Length (mm) | | | | Weight (g) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 |
| Mean | 99.7 | 101.4 | 110.2 | 123.2 | 10.0 | 10.8 | 13.4 | 19.1 |
| Number | 144 | 1296 | 814 | 289 | 144 | 127 | 415 | 162 |
| Range | 77-147 | 78-150 | 82-151 | 95-148 | 4.7-35.2 | 5.3-24.5 | 5.9-24.9 | 9.4-28.4 |
| Std | 11.5 | 8.5 | 9.0 | 9.5 | 3.9 | 2.9 | 3.2 | 3.9 |

Age information derived from scales for coho smolts sampled at the downstream trap in 1999 is not available at the time of this report preparation. However aging data for smolts collected in 1997 and 1998 indicates that there is a wide overlap in the age structure of coho smolts captured during the May-June period mainly ranging from age 1+ to age 3+ (Appendix 4 Table 1). This presumably reflects the range of life history strategies evident in coho using the ponds, including immigration at both the fry and yearling stages. A single age 4+ coho smolt was reported in the 1998 sample.

Although the age information collected from coho smolts suggests that smolt size tends to increase with age, there is so much overlap in the sizes, particularly in the 1998 sample, that size is not a reliable predictor of age for the Km 1011 coho smolts (Appendix 4 Table 1).

Table 9 summarizes the frequency of occurrence of the different age classes in the smolt samples for 1997 and 1998. This summary suggests that a higher proportion of the smolts leaving Km 1011 Ponds in 1998 were age 2+ and age 3+ fish. The high percentage of large smolts in 1999 may reflect the strong fry recruitment into Km 1011 Ponds during 1996 and the strong yearling recruitment the following year. At the same time, the poor fry recruitment observed in the ponds in 1998 has probably led to a lower proportion of age 1+ smolts in the 1999 migration. It should be emphasized that the results presented in Table 9 are not from a randomly collected sample of smolts. Instead, samples were collected to represent a range of size classes of smolts moving through the downstream traps.

### 3.2.3.2 Km 1010 Downstream Migrants

Table 7 summarizes the number of fish moving downstream from Km 1010 Pond during the May and June period of operation. A total of 76 coho smolts, five rainbow and seven Dolly Varden moved downstream from May 11$^{th}$ to June 16$^{th}$. The daily summaries are presented in Figure 7 and Appendix 3 Table 2. The summaries indicate that smolt movements occurred throughout the period of trap operation in small numbers.

**Table 9. Percentage of Smolts by Different Age Classes from 1997 to 1999.**

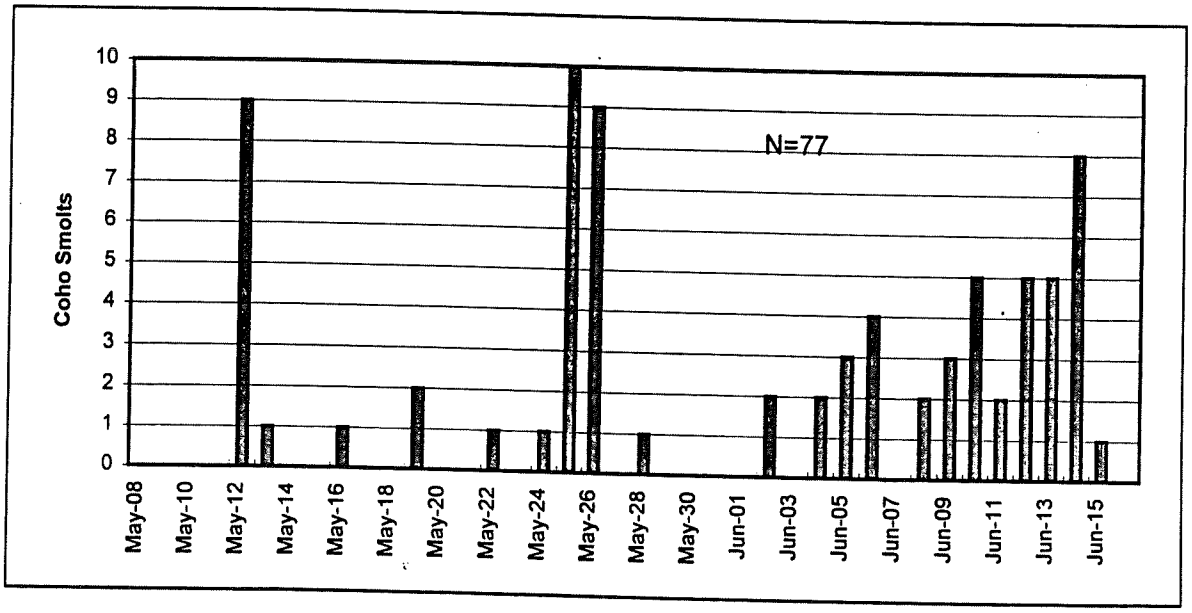
| | N | Age 1 | Age 2 | Age 3 | Age 4 |
|---|---|---|---|---|---|
| **1997** | 113 | 51.3 | 46.0 | 1.8 | 0 |
| **1998** | 53 | 37.7 | 41.5 | 18.9 | 1.9 |
| **1999** | 46 | na[11] | na | na | na |

Coho smolts leaving Km 1010 Pond ranged from 84 to 148 mm fork length, with a mean length of 112 mm (Figure 8).

A summary of fork lengths of the rainbow trout and Dolly Varden leaving Km 1010 pond is presented in Appendix 3 Table 4. Rainbow trout migrants were parr ranging from 50 to 111 mm fork length while Dolly Varden up to 196 mm were captured in the downstream trap. Dolly Varden may spawn in the small inlet tributary draining near the old Pacific Northern Gas right-of-way.

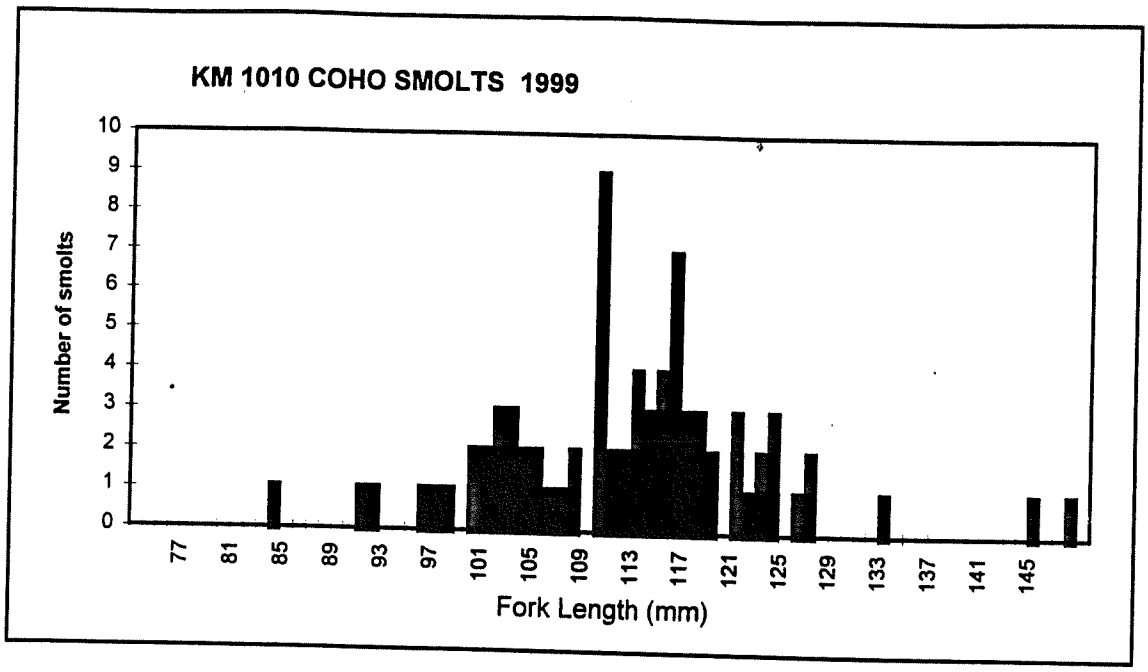
We did not expect to capture 76 coho smolts from the Km 1010 Pond given that no fish were captured in the two minnow trap trials to determine whether there were enough fish to conduct a mark-and-recapture estimate.

**Figure 7. Timing of Coho Smolt Downstream Migration in Km 1010 Pond, 1999.**




[11] Scale information for 1999 samples in not yet available.

**Figure 8. Length-Frequency of Coho Smolts Captured in Km 1010 Pond in 1999.**




# 4.0 DISCUSSION AND RECOMMENDATIONS

## 4.1 Population Estimate and Coho Smolt Migration

The mark-and-recapture population estimate conducted in Km 1011 Ponds in May 1999 resulted in an estimate of 961 coho pre-smolts in the ponds prior to the smolt outmigration (Table 3). This is the lowest number for all years since the first estimate was made in 1993 (Table 4). The total absence of coho smaller than 75 mm in the sample was very unusual and presumably reflects the exceptionally low fry recruitment into the ponds during the summer of 1998.

A total of 291 coho smolts were captured in the downstream traps prior to high-flow conditions in mid-June bringing the study to an end. The high flow conditions flooded over the traps, and along with mink problems at the trap for two days during the peak period of migration, resulted in an incomplete coho smolt count for 1999. Despite the trap problems, it is apparent that the 1999 smolt migration was going to be low compared to the previous two years.

The 1999 coho smolts were large, with the mean smolt size more than 20 mm larger than smolts captured in 1996 and 1997 (Table 8). The high proportion of large smolts leaving the ponds in 1999 may reflect the strong fry recruitment into Km 1011 during 1996 and the strong yearling recruitment the following year. Although there is a wide overlap in smolt sizes at different ages, we suspect that the very large average smolt size in the

1999 sample relfects a high proportion of older smolts (typically age 2+ and 3+) reflecting the very poor coho fry recruitment into Km 1011 in 1998.

Only 19 of the 291 coho smolts leaving Km 1011 Ponds had caudal clip marks from the mark-and-recapture estimates (Table 10). This suggests that just over 19% of the marked pre-smolts were actually captured in the downstream traps, similar to 1998 results, and significantly lower than 1997 estimates.

In the past, we have suggested that the low percentage of marked fish actually leaving the ponds may have been a result of more coho remaining in the ponds for an extra year to achieve a larger size. This explanation does not fit the situation in 1999, since the mean size of the pre-smolt fish during the mark-and-recapture in early May was already a very large 116 mm, and we suspect that most of these pre-smolts would leave the ponds in 1999. The incomplete smolts counts in 1999 may partly account for the low proportion of marked pre-smolts actually leaving the ponds. However, since 1997 we have had between 20 and 56% of the marked pre-smolts recaptured at the trap box. The low proportion of marked fish recaptured is puzzling.

**Table 10. Ratio of Marked to Unmarked Coho in the Km 1011 Pond Studies.**

| | Number of Smolts | Number of Marked Pre-smolts[12] | Number of Smolts With Marks | % of Smolts With Marks | % of Marked Pre-smolts Leaving Ponds | % of Recaptured Fish Marked[13] |
|---|---|---|---|---|---|---|
| 1996 | 233 | 402 | 27 | 11.6 | 6.7 | 14.1 |
| 1997 | 1382 | 301 | 168 | 12.2 | 55.8 | 26.4 |
| 1998 | 822 | 287 | 61 | 7.4 | 21.2 | 15.9 |
| 1999 | 291 | 98 | 19 | 6.5 | 19.4 | 9.4 |

Table 10 also shows that the proportion of marked fish recaptured during the mark-and-recapture estimates was the lowest to date (9.4%). The generally low numbers of coho captured during the population estimate, along with the low recapture rate suggests that the very cool conditions prevalent during the early May period may have not been conducive for effective minnow trapping. The low numbers of fish recaptured resulted in a wide confidence interval range associated with the population estimate in 1999.

[12] Marked during population estimate in early May.
[13] Recaptured during mark-and-recapture estimates.

It is interesting to note that only nine coho smolts with right ventral clips were captured in 1999 from a total of 250 coho yearlings clipped in 1998 resulting in a return of 3.1%. However, we observed that some injury to fish had resulted from these clips. There may have been some mortality of the yearlings clipped last year, so no further pelvic clips will be conducted on coho migrants.

The 77 coho smolts leaving Km 1010 Pond during 1999 was a higher number than expected since the culvert at the outlet of the pond has presented a barrier to coho fry moving upstream for most of the previous year. However, efforts to elevate the outlet pool to assist fry passage at the culvert during the summer of 1998 may have assisted some coho migration into the pond. As well, some fry may have moved in from the top end during high water conditions in the previous two years.

## 4.2 Upstream Coho Migrants

The trapping studies indicated that coho migrant upstream movements into the Km 1011 Pond reflected an overall stronger fry recruitment in the Telkwa River in 1999. This presumably resulted from improved coho spawner escapements into the Telkwa River in 1998 compared to the two previous years. The 1437 coho fry passed upstream by mid-June was the highest number recorded by this date since the traps were first installed in 1996. We suspect that upstream fry movements continued through much of the early summer of 1999. Newly-emerged coho fry appeared in the outlet to Km 1011 Pond in early May within one week of previous first fry observations at this site.

The upstream trapping results from Km 1010 yielded some interesting comparisons to those obtained in Km 1011. Coho fry movements into the Km 1010 Pond started approximately one month later than in Km 1011. The later migration of coho fry into Km 1010 Pond compared to Km 1011 may reflect several factors. Firstly, water temperatures in this pond were cool through May, and were similar to the mainstem Telkwa River water temperatures (Figure 2). Warm water temperature is probably an important factor drawing mainstem Telkwa River coho fry migrants into off-channel habitats such as Km 1010.

Secondly, during lower flow conditions in the Telkwa River, there is little slow water habitat at the confluence of the inflows from Km 1010 Pond. We suspect that coho fry move right past this small tributary without recognizing that it is present. As flows increase, the Telkwa backs up into the lower section of the outlet stream from Km 1010 Pond, providing a slack water area for fry to hold.

It is interesting to note that during a site visit on October 15 to Km 1011, large numbers of coho fry were noted in the stream channel below the impassable pond outlet culvert. We suspect that coho migrants might continue to move into Km 1010 Pond if it was accessible through the late summer and fall, since streamflows remain suitable through

this period. Km 1011 outlet flows tend to disappear in late July or early August in most years and we suspect this is the end of the fry upstream migration during most years.

### 4.3 Productivity Estimates

Based on the mark-and-recapture estimates, the Km 1011 Ponds have produced between 961 and 2820 coho pre-smolts annually (Table 11). The pre-smolt estimates correspond to production ranging from 11 to 32 smolts/100 $m^2$ during the past six years (Table 11).

A comparison of actual smolt output in 1999 to other years is not very meaningful since the study was ended early due to flooding, and we had predation problems during the peak of migration.

Although pre-smolt numbers were lower in 1999, the average size of coho smolts was larger than in the past. The mean smolt weight of 19 grams is almost twice the mean weight of the 1996 and 1997 coho smolts (Table 8). The very large difference in smolt size may be the result of a higher proportion of older age class fish due to poor recruitment of fry in the past two years. As well, the low numbers of fish present in the ponds in 1998 may have resulted in less competition for food and faster growth rates for those fish present. The large variation in mean smolt size has important survival implications, as larger smolts typically have higher survival rates than their smaller counterparts.

Bustard (1998) compared Km 1011 Pond coho smolt production estimates to those obtained in other studies. For example, a relationship derived by Koning and Keeley (1997), suggests a potential capability of the 0.87 ha of ponded habitat at Km 1011 to produce 2750 smolts.

Smolt yields measured at Km 1011 Ponds to date of approximately 10 smolts/100 $m^2$ (Table 11) are lower than estimates for coastal systems ranging from 14 to 51 smolts/100 $m^2$ (Foy and Decker, 1997; Picard et al. 1998; and Marshall and Britton 1990). These other studies were conducted on coastal watersheds with longer growing seasons and a high proportion of age 1+ smolts[14]. The Km 1011 Pond data suggest that 50% or more of the Km 1011 coho are remaining two and three years in the pond prior to smolting. One large coho smolt captured in 1998 was four years old.

[14] Typically up to 95% of smolts in coastal ponds leave as age 1+ fish (Matt Foy, DFO, pers. comm).

**Table 11. Coho Production Estimates in Km 1011 Ponds from 1993 to 1999.**

| Year | >74 mm | All Coho Combined | Pre-smolts/ 100 $m^2$ | Total Coho/ 100 $m^2$ | Smolts/ 100 $m^2$ | Kgs/100 $m^2$ All Coho[15] |
|---|---|---|---|---|---|---|
| 1993 | 222 | 1186 | na | | | |
| 1994 | 2304 | 2640 | 26.4 | 30.2 | | 0.28 |
| 1995 | 1549 | 1845 | 17.7 | 21.1 | | 0.19 |
| 1996 | 2820 | 4304 | 32.3 | 49.3 | | 0.30 |
| 1997 | 1124 | 1395 | 12.9 | 16.0 | 15.9 | 0.12 |
| 1998 | 1806 | 1913 | 20.7 | 21.9 | 9.4 | 0.22 |
| 1999 | 971 | 971 | 11.1 | 11.1 | 3.3[16] | 0.17 |
| Mean (94-99) | 1762 | 2178 | 20.2 | 24.9 | 9.6 | 0.22 |

Based on these observations, potential production benefits from off-channel pond developments in northern interior populations of coho such as in the Telkwa Watershed should take into account that potential productivity may be lower than reported in the literature where information has been largely derived from studies in coastal systems.

Marshall and Britton (1990) suggest that biomass may be superior to fish numbers as an expression of coho carrying capacity. Coho biomass has ranged from 0.12 to 0.30 kgs/100 $m^2$ in the Km 1011 Ponds since 1994. This is at the lower end of biomass estimates reported for coastal overwintering ponds in the Marshall and Britton (1990) review.

It should be stressed that adult coho escapements to the Telkwa Watershed, as well as other Bulkley River tributaries, has been severely depressed during most years in the past several decades (DFO 1998). We suspect that the ponds have been underseeded by coho fry and yearlings during the past several years, and that smolt production from the ponds has been limited by this poor recruitment. The 1999 coho escapement to the Telkwa River appears excellent, and this combined with good fry recruitment from the 1998 escapement should help to better test the capability of Telkwa 1011 Ponds to produce coho smolts.

[15] Based on mark-recapture population estimates. See Appendix 4 Table 2 for detailed summary.
[16] This represents a minimum estimate due to predation and trap flooding problems in 1999.

### 4.4 Recommendations

Specific recommendations are mainly directed at improvements to the Km 1010 Pond. Planning for some of this work is presently underway with the modifications scheduled for next season. Recommendations include the following:

- We recommend that the outlet channel to Km 1010 Pond be modified to result in no drop at the outlet culvert to ensure that coho fry are able to move into the pond.

- Improvements to the actual confluence site of the Km 1010 outlet stream and the Telkwa River to create more slow water habitat, especially during lower flow conditions should be considered.

- We also suggest excavating the channel along the old PNG right-of-way at Km 1010 in an effort to collect more subsurface flows from the Telkwa River floodplain. This would probably add a greater groundwater component to this system that tends to be dominated by surface flows. Km 1010 Pond water temperatures were much colder than at the Km 1011 Ponds.

- Consideration should be given to constructing a deflection berm at the top end of the pond/inlet creek complex to re-direct overflows from the Telkwa River back into the river rather than the ponds. Otherwise, we suspect that the culvert outlet or berm will be washed out due to too much water entering the pond during extreme flow events.

- The total area of pond and stream habitat contributing to coho production at Km 1010 needs to be calculated to assess smolt production on a unit area basis.

- The PNG extension channels in Km 1011 should be carefully monitored in the next year to determine whether they are utilized during a year of good coho fry recruitment. If poor utilization of these channels continues, some consideration should be given to re-establishing flows into Channel 1.

- Coho smolt aging should be done randomly with the objective of providing frequency of occurrence of age classes. To date sampling has been conducted to spread sampling uniformly amongst all size classes.

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## Appendix 1 Table 1. Summary of Water Temperature and Streamflow Information 1999. in Km 1011 Ponds.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Outlet Q | Q | Fry | Telkwa |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | (litres/sec) | cfs | Upstream | gauge ht |
| May 2 | 8.5 | 10.5 | 9.5 | 11.5 | 6 | 10.0 | 0.35 | 0 | 0.4 |
| May 3 | 7.8 | 8.7 | 8.3 | 8 | 4 | 13.0 | 0.46 | 0 | 0.37 |
| May 4 | 6.8 | 7.8 | 7.3 | 9.5 | 4 | 5.2 | 0.18 | 0 | 0.35 |
| May 5 | 7.4 | 7.8 | 7.6 | 7.5 | 3 | 3.3 | 0.11 | 1 | 0.33 |
| May 6 | 7.3 | 7.8 | 7.6 | 10.5 | 4.5 | 4.3 | 0.15 | 3 | 0.33 |
| 7 | 7.8 | 9.0 | 8.4 | 8.0 | 3.5 | 4.7 | 0.17 | 4 | 0.39 |
| 8 | 8.2 | 10.0 | 9.1 | 10.5 | 5.0 | 3.4 | 0.12 | 9 | 0.35 |
| 9 | 8.9 | 9.9 | 9.4 | 10.5 | 4.5 | 3.3 | 0.11 | 30 | 0.33 |
| 10 | 8.5 | 9.3 | 8.9 | 10.0 | 5.0 | 2.7 | 0.10 | 28 | 0.32 |
| 11 | 9.0 | 9.4 | 9.2 | 9.0 | 5.0 | 1.6 | 0.06 | 41 | 0.33 |
| 12 | 8.7 | 9.8 | 9.3 | 10.5 | 5.0 | 2.0 | 0.07 | 18 | 0.34 |
| 13 | 9.0 | 9.8 | 9.4 | 9.0 | 4.0 | 1.8 | 0.06 | 19 | 0.34 |
| 14 | 9.5 | 10.2 | 9.9 | 12.0 | 6.0 | 4.3 | 0.15 | 22 | 0.38 |
| 15 | 10.1 | 10.5 | 10.3 | 11.5 | 5.5 | 2.2 | 0.08 | 41 | 0.45 |
| 16 | 10.2 | 10.7 | 10.5 | 13.0 | 6.0 | 3.5 | 0.12 | 76 | 0.48 |
| 17 | 10.7 | 11.0 | 10.9 | 10.5 | 4.5 | 3.4 | 0.12 | 46 | 0.51 |
| 18 | 10.7 | 11.1 | 10.9 | 10.5 | 4.5 | 2.5 | 0.09 | 26 | 0.57 |
| 19 | 10.0 | 10.8 | 10.4 | 11.0 | 5.0 | 3.1 | 0.11 | 91 | 0.56 |
| 20 | 10.1 | 10.6 | 10.4 | 11.0 | 5.0 | 3.1 | 0.11 | 64 | 0.56 |
| 21 | 10.0 | 10.6 | 10.3 | 11.0 | 5.0 | 3.2 | 0.11 | 33 | 0.59 |
| 22 | 9.8 | 10.6 | 10.2 | 12.0 | 4.0 | 6.5 | 0.23 | 32 | 0.66 |
| 23 | 9.1 | 10.2 | 9.7 | 15.0 | 6.5 | 9.0 | 0.32 | 52 | 1.17 |
| 24 | 10.2 | 10.8 | 10.5 | 13.0 | 4.0 | | | 37 | 1.33 |
| 25 | 10.0 | 11.0 | 10.5 | 11.0 | 5.0 | | | 3 | 1.30 |
| 26 | 10.0 | 10.9 | 10.5 | 9.5 | 3.5 | 8.7 | 0.31 | 6 | 1.07 |
| 27 | 9.5 | 10.1 | 9.8 | 12.0 | 5.0 | 6.3 | 0.22 | 9 | 0.80 |
| 28 | 9.5 | 10.6 | 10.1 | 12.0 | 6.0 | 5.3 | 0.19 | 40 | 0.70 |
| 29 | 10.0 | 10.9 | 10.5 | 10.0 | 5.0 | 3.7 | 0.13 | 10 | 0.67 |
| 30 | 10.9 | 11.5 | 11.2 | 13.0 | 6.0 | 4.0 | 0.14 | 18 | 0.71 |
| 31 | 11.0 | 12.5 | 11.8 | 12.5 | 5.0 | 7.4 | 0.26 | 43 | 0.86 |
| **Avg** | | | **9.7** | **10.8** | **4.8** | | | | |
| Jun-01 | 11.5 | 12.4 | 12.0 | 12.0 | 5.0 | 5.7 | 0.20 | 49 | 0.81 |
| 2 | 11.9 | 12.8 | 12.4 | 14.0 | 6.0 | 4.1 | 0.14 | 34 | 0.78 |
| 3 | 12.9 | 14.1 | 13.5 | 14.0 | 5.5 | 6.8 | 0.24 | 40 | 0.90 |
| 4 | 14.1 | 13.1 | 13.6 | 14.0 | 5.0 | 6.2 | 0.22 | 53 | 1.02 |
| 5 | 12.0 | 13.2 | 12.6 | 12.5 | 5.0 | 6.3 | 0.00 | 76 | 0.96 |
| 6 | 11.9 | 12.7 | 12.3 | 14.0 | 6.0 | 4.5 | 0.16 | 41 | 0.83 |
| 7 | 12.1 | 12.4 | 12.3 | 12.5 | 5.0 | 3.8 | 0.13 | 69 | 0.80 |
| 8 | 11.6 | 12.3 | 12.0 | 12.0 | 5.0 | 3.4 | 0.12 | 23 | 0.78 |
| 9 | 12.3 | 12.4 | 12.4 | 12.0 | 5.0 | 4.4 | 0.16 | 24 | 0.93 |
| 10 | 12.0 | 13.0 | 12.5 | 13.0 | 6.0 | 3.8 | 0.13 | 26 | 0.90 |
| 11 | 13.0 | 14.5 | 13.8 | 16.0 | 7.0 | 5.3 | 0.19 | 141 | 1.04 |
| 12 | 14.3 | 15.4 | 14.9 | 17.0 | 8.0 | 6.7 | 0.24 | 62 | 1.23 |
| 13 | 15.1 | 15.9 | 15.5 | 16.0 | 6.0 | | | 0 | 1.44 |
| 14 | 15.5 | 16.0 | 15.8 | 14.0 | 9.0 | | | 0 | 1.43 |
| 15 | 15.4 | 16.6 | 16.0 | 14.0 | 7.0 | | | 0 | 1.53 |
| 16 | 10.1 | 16.4 | 13.3 | 17.0 | 5.0 | | | 0 | 1.72 |
| 17 | 10.1 | 10.2 | 10.2 | | | | | | |
| 18 | 10.1 | 10.7 | 10.4 | | | | | | |
| 19 | 9.6 | 11.6 | 10.6 | | | | | | |
| 20 | 11.2 | 12.0 | 11.6 | | | | | | |
| 21 | 11.4 | 12.0 | 11.7 | | | | | | |
| 22 | 11.2 | 12.0 | 11.6 | | | | | | |
| 23 | 11.8 | 12.4 | 12.1 | | | | | | |
| 24 | 12.0 | 13.1 | 12.6 | | | | | | |
| 25 | 13.0 | 13.9 | 13.5 | | | | | | |

## Appendix 1 Table 1. Summary of Water Temperature and Streamflow Information 1999. in Km 1011 Ponds.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Outlet Q | Q | Fry | Telkwa |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | (litres/sec) | cfs | Upstream | gauge ht |
| 26 | 13.5 | 13.9 | 13.7 | | | | | | |
| 27 | 13.0 | 13.8 | 13.4 | | | | | | |
| 28 | 12.5 | 13.3 | 12.9 | | | | | | |
| 29 | 12.8 | 13.0 | 12.9 | | | | | | |
| 30 | 12.8 | 13.0 | 12.9 | | | | | | |
| Avg | | | 12.8 | 14.0 | 6.0 | | | | |
| Jul-01 | 12.8 | 13.0 | 12.9 | | | | | | |
| 2 | 12.5 | 13.4 | 13.0 | | | | | | |
| 3 | 13.0 | 14.3 | 13.7 | | | | | | |
| 4 | 14.0 | 14.5 | 14.3 | | | | | | |
| 5 | 14.2 | 15.6 | 14.9 | | | | | | |
| 6 | 15.0 | 16.0 | 15.5 | | | | | | |
| 7 | 15.7 | 16.0 | 15.9 | | | | | | |
| 8 | 15.5 | 16.7 | 16.1 | | | | | | |
| 9 | 16.0 | 16.8 | 16.4 | | | | | | |
| 10 | 16.2 | 16.6 | 16.4 | | | | | | |
| 11 | 16.1 | 16.8 | 16.5 | | | | | | |
| 12 | 16.0 | 17.0 | 16.5 | | | | | | |
| 13 | 16.0 | 17.0 | 16.5 | | | | | | |
| 14 | 15.2 | 16.1 | 15.7 | | | | | | |
| 15 | 15.2 | 15.9 | 15.6 | | | | | | |
| 16 | 15.0 | 15.9 | 15.5 | | | | | | |
| 17 | 15.9 | 16.1 | 16.0 | | | | | | |
| 18 | 15.8 | 16.9 | 16.4 | | | | | | |
| 19 | 16.9 | 17.7 | 17.3 | | | | | | |
| 20 | 17.4 | 18.1 | 17.8 | | | | | | |
| 21 | 17.5 | 18.1 | 17.8 | | | | | | |
| 22 | 17.0 | 17.9 | 17.5 | | | | | | |
| 23 | 15.9 | 17.0 | 16.5 | | | | | | |
| 24 | 15.5 | 16.5 | 16.0 | | | | | | |
| 25 | 15.5 | 16.0 | 15.8 | | | | | | |
| 26 | 15.0 | 15.8 | 15.4 | | | | | | |
| 27 | 15.5 | 15.8 | 15.7 | | | | | | |
| 28 | 15.4 | 15.8 | 15.6 | | | | | | |
| 29 | 14.4 | 15.5 | 15.0 | | | | | | |
| 30 | 13.3 | 14.5 | 13.9 | | | | | | |
| 31 | 13.8 | 14.5 | 14.2 | | | | | | |
| Avg | | | 15.7 | | | | | | |
| Aug-01 | 14.2 | 15.0 | 14.6 | | | | | | |
| 2 | 15.0 | 15.7 | 15.4 | | | | | | |
| 3 | 15.5 | 16.2 | 15.9 | | | | | | |
| 4 | 16.2 | 16.8 | 16.5 | | | | | | |
| 5 | 16.8 | 17.8 | 17.3 | | | | | | |
| 6 | 17.6 | 18.0 | 17.8 | | | | | | |
| 7 | 17.8 | 18.5 | 18.2 | | | | | | |
| 8 | 18.0 | 18.5 | 18.3 | | | | | | |
| 9 | 17.2 | 18.0 | 17.6 | | | | | | |
| 10 | 16.1 | 17.2 | 16.7 | | | | | | |
| 11 | 15.5 | 16.2 | 15.9 | | | | | | |
| 12 | 14.3 | 15.5 | 14.9 | | | | | | |
| 13 | 14.5 | 15.0 | 14.8 | | | | | | |
| 14 | 14.8 | 15.0 | 14.9 | | | | | | |
| 15 | 14.4 | 14.7 | 14.6 | | | | | | |
| 16 | 14.6 | 14.8 | 14.7 | | | | | | |
| 17 | 14.6 | 14.8 | 14.7 | | | | | | |
| 18 | 14.8 | 14.9 | 14.9 | | | | | | |

## Appendix 1 Table 1. Summary of Water Temperature and Streamflow Information 1999. in Km 1011 Ponds.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Outlet Q | Q | Fry | Telkwa |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | (litres/sec) | cfs | Upstream | gauge ht |
| 19 | 14.8 | 15.1 | 15.0 | | | | | | |
| 20 | 14.8 | 15.2 | 15.0 | | | | | | |
| 21 | 14.8 | 15.0 | 14.9 | | | | | | |
| 22 | 14.8 | 15.0 | 14.9 | | | | | | |
| 23 | 14.6 | 15.0 | 14.8 | | | | | | |
| 24 | 14.3 | 14.8 | 14.6 | | | | | | |
| 25 | 13.2 | 14.3 | 13.8 | | | | | | |
| 26 | 12.9 | 13.6 | 13.3 | | | | | | |
| 27 | 11.9 | 12.9 | 12.4 | | | | | | |
| 28 | 11.9 | 12.0 | 12.0 | | | | | | |
| 29 | 11.8 | 12.0 | 11.9 | | | | | | |
| 30 | 11.0 | 11.8 | 11.4 | | | | | | |
| 31 | 10.8 | 11.2 | 11.0 | | | | | | |
| Avg | | | 14.9 | | | | | | |
| Sep-01 | 10.8 | 11.0 | 10.9 | | | | | | |
| 2 | 10.8 | 11.0 | 10.9 | | | | | | |
| 3 | 10.8 | 11.0 | 10.9 | | | | | | |
| 4 | 10.9 | 11.3 | 11.1 | | | | | | |
| 5 | 11.3 | 11.9 | 11.6 | | | | | | |
| 6 | 11.5 | 11.9 | 11.7 | | | | | | |
| 7 | 11.0 | 11.8 | 11.4 | | | | | | |
| 8 | 11.1 | 11.1 | 11.1 | | | | | | |
| 9 | 11.0 | 11.1 | 11.1 | | | | | | |
| 10 | 11.0 | 11.1 | 11.1 | | | | | | |
| 11 | 10.9 | 11.1 | 11.0 | | | | | | |
| 12 | 10.7 | 11.0 | 10.9 | | | | | | |
| 13 | 10.5 | 10.9 | 10.7 | | | | | | |
| 14 | 10.8 | 10.9 | 10.9 | | | | | | |
| 15 | 10.8 | 10.9 | 10.9 | | | | | | |
| 16 | 10.5 | 10.9 | 10.7 | | | | | | |
| 17 | 10.3 | 10.6 | 10.5 | | | | | | |
| 18 | 10.3 | 10.6 | 10.5 | | | | | | |
| 19 | 10.6 | 11.0 | 10.8 | | | | | | |
| 20 | 10.8 | 11.0 | 10.9 | | | | | | |
| 21 | 10.8 | 11.1 | 11.0 | | | | | | |
| 22 | 11.0 | 11.1 | 11.1 | | | | | | |
| 23 | 10.8 | 11.0 | 10.9 | | | | | | |
| 24 | 10.1 | 11.0 | 10.6 | | | | | | |
| 25 | 9.4 | 10.0 | 9.7 | | | | | | |
| 26 | 8.3 | 9.3 | 8.8 | | | | | | |
| 27 | 7.5 | 8.3 | 7.9 | | | | | | |
| 28 | 6.7 | 7.8 | 7.3 | | | | | | |
| 29 | 6.5 | 6.8 | 6.7 | | | | | | |
| 30 | 6.6 | 6.9 | 6.8 | | | | | | |
| Avg | | | 10.3 | | | | | | |
| Oct-01 | 6.1 | 6.8 | 6.5 | | | | | | |
| 2 | 5.8 | 6.1 | 6.0 | | | | | | |
| 3 | 6.0 | 6.0 | 6.0 | | | | | | |
| 4 | 5.9 | 6.0 | 6.0 | | | | | | |
| 5 | 5.8 | 6.0 | 5.9 | | | | | | |
| 6 | 5.9 | 6.1 | 6.0 | | | | | | |
| 7 | 6.0 | 6.1 | 6.1 | | | | | | |
| 8 | 6.1 | 6.2 | 6.2 | | | | | | |
| 9 | 6.0 | 6.2 | 6.1 | | | | | | |

## Appendix 1 Table 1. Summary of Water Temperature and Streamflow Information 1999. in Km 1011 Ponds.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Outlet Q | Q | Fry | Telkwa |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | (litres/sec) | cfs | Upstream | gauge ht |
| 10 | 5.5 | 6.0 | 5.8 | | | | | | |
| 11 | 5.0 | 5.5 | 5.3 | | | | | | |
| 12 | 4.6 | 5.0 | 4.8 | | | | | | |
| 13 | 4.6 | 4.8 | 4.7 | | | | | | |
| 14 | 4.5 | 4.9 | 4.7 | | | | | | |
| 15 | 4.6 | 4.6 | 4.6 | | | dry | | | dry |
| Avg | | | 5.6 | | | | | | |

## Appendix 1 Table 2. Summary of Water Temperature and Streamflow Information in Km 1010 Ponds 1999.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Fry | Telkwa |
|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | Upstream | gauge ht |
| May-04 | 2.0 | 2.2 | 2.1 | | | | 0.35 |
| May-05 | 1.1 | 2.1 | 1.6 | | | | 0.33 |
| May-06 | 1.3 | 2.1 | 1.7 | | | | 0.33 |
| May-07 | 1.7 | 2.8 | 2.3 | | | | 0.39 |
| May-08 | 2.8 | 3.1 | 3.0 | 5.0 | 5.0 | 0 | 0.35 |
| May-09 | 3.0 | 3.1 | 3.1 | | | | 0.33 |
| May-10 | 3.0 | 3.1 | 3.1 | | | | 0.32 |
| 11 | 2.8 | 3.5 | 3.2 | | | | 0.33 |
| 12 | 3.1 | 3.8 | 3.5 | 3.5 | 5.0 | 0 | 0.34 |
| 13 | 3.2 | 3.8 | 3.5 | 3.5 | 4.0 | 0 | 0.34 |
| 14 | 3.0 | 4.0 | 3.5 | 4.5 | 6.0 | 0 | 0.38 |
| 15 | 3.2 | 3.9 | 3.6 | 6.0 | 5.0 | 0 | 0.45 |
| 16 | 3.2 | 4.0 | 3.6 | 5.5 | 6.0 | 0 | 0.48 |
| 17 | 3.2 | 4.1 | 3.7 | 6.5 | 4.5 | 0 | 0.51 |
| 18 | 3.2 | 4.1 | 3.7 | 6.5 | 4.5 | 0 | 0.57 |
| 19 | 3.2 | 4.0 | 3.6 | 6.0 | 5.0 | 0 | 0.56 |
| 20 | 3.3 | 4.1 | 3.7 | 6.5 | 5.0 | 0 | 0.56 |
| 21 | 3.3 | 4.1 | 3.7 | 6.0 | 5.0 | 0 | 0.59 |
| 22 | 3.1 | 4.1 | 3.6 | 5.5 | 4.0 | 0 | 0.66 |
| 23 | 3.4 | 5.2 | 4.3 | 10.0 | 6.5 | 0 | 1.17 |
| 24 | 4.0 | 5.2 | 4.6 | nr | 4.0 | 2 | 1.33 |
| 25 | 3.2 | 5.1 | 4.2 | 7.0 | 5.0 | 0 | 1.30 |
| 26 | 3.0 | 4.6 | 3.8 | 6.0 | 3.5 | 2 | 1.07 |
| 27 | 3.1 | 4.6 | 3.9 | 9.5 | 5.0 | 0 | 0.80 |
| 28 | 3.4 | 4.8 | 4.1 | 10.0 | 6.0 | 0 | 0.70 |
| 29 | 4.0 | 4.8 | 4.4 | 8.0 | 5.0 | 0 | 0.67 |
| 30 | 4.2 | 4.6 | 4.4 | 8.0 | 6.0 | 0 | 0.71 |
| 31 | 4.2 | 5.7 | 5.0 | 9.0 | 5.0 | 2 | 0.86 |
| Avg | | | 3.5 | 6.6 | 5.0 | | |
| Jun-01 | 4.2 | 5.7 | 5.0 | 9.0 | 5.0 | 4 | 0.81 |
| 2 | 4.7 | 5.5 | 5.1 | 10.5 | 6.0 | 1 | 0.78 |
| 3 | 5.2 | 6.6 | 5.9 | 10.0 | 5.5 | 0 | 0.90 |
| 4 | 5.3 | 6.5 | 5.9 | 10.0 | 5.0 | 11 | 1.02 |
| 5 | 5.0 | 5.8 | 5.4 | 10.5 | 5.0 | 2 | 0.96 |
| 6 | 5.0 | 5.8 | 5.4 | 11.5 | 6.0 | 5 | 0.83 |
| 7 | 5.0 | 5.2 | 5.1 | 9.0 | 5.0 | 9 | 0.80 |
| 8 | 5.2 | 5.9 | 5.6 | 8.5 | 5.0 | 3 | 0.78 |
| 9 | 5.2 | 6.0 | 5.6 | 10.0 | 5.0 | 9 | 0.93 |
| 10 | 5.5 | 6.1 | 5.8 | 11.0 | 6.0 | 9 | 0.90 |
| 11 | 6.1 | 7.1 | 6.6 | 12.0 | 7.0 | 0 | 1.04 |
| 12 | 7.1 | 7.9 | 7.5 | 16.0 | 8.0 | 26 | 1.23 |
| 13 | 6.4 | 7.9 | 7.2 | 11.0 | 6.0 | 27 | 1.44 |
| 14 | 5.9 | 7.5 | 6.7 | 14.0 | 9.0 | 18 | 1.43 |
| 15 | 6.0 | 7.6 | 6.8 | 13.5 | 7.0 | 44 | 1.53 |
| 16 | 5.8 | 7.2 | 6.5 | 10.0 | 5.0 | 12 | 1.72 |
| 17 | 4.8 | 5.8 | 5.3 | | | | |
| 18 | 5.1 | 6.5 | 5.8 | | | | |
| 19 | 5.5 | 6.5 | 6.0 | | | | |
| 20 | 5.4 | 6.5 | 6.0 | | | | |
| 21 | 5.2 | 6.1 | 5.7 | | | | |
| 22 | 5.1 | 7.0 | 6.1 | | | | |
| 23 | 6.0 | 7.4 | 6.7 | | | | |
| 24 | 6.2 | 7.7 | 7.0 | | | | |
| 25 | 6.8 | 8.0 | 7.4 | | | | |
| 26 | 6.8 | 8.0 | 7.4 | | | | |

## Appendix 1 Table 2. Summary of Water Temperature and Streamflow Information in Km 1010 Ponds 1999.

| Date | Lower Pond @ 0.5 m | | | Outlet @ Trap | Telkwa R. | Fry Upstream | Telkwa gauge ht |
|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | | | | |
| 27 | 6.4 | 7.6 | 7.0 | | | | |
| 28 | 6.1 | 7.0 | 6.6 | | | | |
| 29 | 6.2 | 6.9 | 6.6 | | | | |
| 30 | 6.5 | 7.3 | 6.9 | | | | |
| Avg | | | 6.9 | 11.0 | 6.0 | | |
| Jul-01 | 6.5 | 7.3 | 6.9 | | | | |
| 2 | 6.0 | 8.2 | 7.1 | | | | |
| 3 | 7.0 | 8.7 | 7.9 | | | | |
| 4 | 7.1 | 8.7 | 7.9 | | | | |
| 5 | 7.2 | 9.1 | 8.2 | | | | |
| 6 | 7.8 | 9.1 | 8.5 | | | | |
| 7 | 8.0 | 9.0 | 8.5 | | | | |
| 8 | 8.2 | 9.5 | 8.9 | | | | |
| 9 | 8.2 | 9.5 | 8.9 | | | | |
| 10 | 8.3 | 9.0 | 8.7 | | | | |
| 11 | 8.4 | 9.1 | 8.8 | | | | |
| 12 | 8.2 | 9.2 | 8.7 | | | | |
| 13 | 7.6 | 9.1 | 8.4 | | | | |
| 14 | 7.8 | 8.2 | 8.0 | | | | |
| 15 | 7.8 | 8.8 | 8.3 | | | | |
| 16 | 7.8 | 8.8 | 8.3 | | | | |
| 17 | 8.1 | 9.0 | 8.6 | | | | |
| 18 | 8.8 | 9.9 | 9.4 | | | | |
| 19 | 9.5 | 10.2 | 9.9 | | | | |
| 20 | 9.5 | 10.2 | 9.9 | | | | |
| 21 | 9.4 | 10.2 | 9.8 | | | | |
| 22 | 8.9 | 10.0 | 9.5 | | | | |
| 23 | 7.8 | 8.9 | 8.4 | | | | |
| 24 | 8.1 | 8.9 | 8.5 | | | | |
| 25 | 7.8 | 8.4 | 8.1 | | | | |
| 26 | 8.0 | 9.1 | 8.6 | | | | |
| 27 | 8.6 | 9.1 | 8.9 | | | | |
| 28 | 8.0 | 8.8 | 8.4 | | | | |
| 29 | 7.5 | 8.5 | 8.0 | | | | |
| 30 | 7.0 | 7.9 | 7.5 | | | | |
| 31 | 7.6 | 8.2 | 7.9 | | | | |
| Avg | | | 8.5 | | | | |
| Aug-01 | 8.3 | 9.0 | 8.7 | | | | |
| 2 | 8.5 | 9.0 | 8.8 | | | | |
| 3 | 9.0 | 9.5 | 9.3 | 14.0 | | | |
| 4 | 9.5 | 10.0 | 9.8 | | | | |
| 5 | 10.0 | 11.0 | 10.5 | | | | |
| 6 | 10.4 | 11.0 | 10.7 | | | | |
| 7 | 10.6 | 11.8 | 11.2 | | | | |
| 8 | 10.2 | 11.8 | 11.0 | | | | |
| 9 | 9.9 | 10.2 | 10.1 | | | | |
| 10 | 9.4 | 10.0 | 9.7 | | | | |
| 11 | 8.1 | 9.4 | 8.8 | | | | |
| 12 | 7.9 | 9.0 | 8.5 | | | | |
| 13 | 8.6 | 9.0 | 8.8 | | | | |
| 14 | 8.3 | 9.0 | 8.7 | | | | |
| 15 | 8.0 | 9.0 | 8.5 | | | | |
| 16 | 8.4 | 9.0 | 8.7 | | | | |
| 17 | 8.2 | 8.9 | 8.6 | | | | |
| 18 | 8.8 | 9.0 | 8.9 | | | | |
| 19 | 8.8 | 9.2 | 9.0 | | | | |

## Appendix 1 Table 2. Summary of Water Temperature and Streamflow Information in Km 1010 Ponds 1999.

| Date | Lower Pond @ 0.5 m | | | Outlet @ | Telkwa R. | Fry | Telkwa |
|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Trap | | Upstream | gauge ht |
| 20 | 8.9 | 9.2 | 9.1 | | | | |
| 21 | 8.9 | 9.1 | 9.0 | | | | |
| 22 | 8.5 | 9.0 | 8.8 | | | | |
| 23 | 8.3 | 8.6 | 8.5 | | | | |
| 24 | 8.0 | 8.6 | 8.3 | | | | |
| 25 | 7.7 | 8.2 | 8.0 | | | | |
| 26 | 6.5 | 8.1 | 7.3 | | | | |
| 27 | 6.0 | 6.6 | 6.3 | | | | |
| 28 | 6.3 | 7.5 | 6.9 | | | | |
| 29 | 6.8 | 7.5 | 7.2 | | | | |
| 30 | 6.0 | 6.8 | 6.4 | | | | |
| 31 | 5.5 | 6.3 | 5.9 | | | | |
| Avg | | | 8.7 | | | | |
| | | | | | | | |
| Sep-01 | 5.5 | 6.4 | 6.0 | | | | |
| 2 | 6.0 | 6.5 | 6.3 | | | | |
| 3 | 6.0 | 6.2 | 6.1 | | | | |
| 4 | 6.0 | 7.1 | 6.6 | | | | |
| 5 | 7.0 | 7.1 | 7.1 | | | | |
| 6 | 6.9 | 7.3 | 7.1 | | | | |
| 7 | 5.5 | 7.3 | 6.4 | | | | |
| 8 | 5.6 | 6.2 | 5.9 | | | | |
| 9 | 6.2 | 7.0 | 6.6 | | | | |
| 10 | 6.0 | 6.9 | 6.5 | | | | |
| 11 | 5.4 | 6.0 | 5.7 | | | | |
| 12 | 4.8 | 5.1 | 5.0 | | | | |
| 13 | 4.6 | 5.0 | 4.8 | | | | |
| 14 | 4.7 | 5.1 | 4.9 | | | | |
| 15 | 5.0 | 5.4 | 5.2 | | | | |
| 16 | 5.0 | 5.4 | 5.2 | | | | |
| 17 | 4.9 | 5.0 | 5.0 | | | | |
| 18 | 5.0 | 6.1 | 5.6 | | | | |
| 19 | 6.1 | 7.0 | 6.6 | | | | |
| 20 | 5.9 | 6.9 | 6.4 | | | | |
| 21 | 5.9 | 6.5 | 6.2 | | | | |
| 22 | 6.2 | 6.5 | 6.4 | | | | |
| 23 | 6.1 | 6.5 | 6.3 | | | | |
| 24 | 5.1 | 6.0 | 5.6 | | | | |
| 25 | 4.7 | 5.1 | 4.9 | | | | |
| 26 | 4.0 | 4.7 | 4.4 | | | | |
| 27 | 4.0 | 4.4 | 4.2 | | | | |
| 28 | 3.8 | 4.2 | 4.0 | | | | |
| 29 | 3.2 | 4.0 | 3.6 | | | | |
| 30 | 3.8 | 4.1 | 4.0 | | | | |
| Avg | | | 5.6 | | | | |
| | | | | | | | |
| Oct-01 | 3.5 | 4.0 | 3.8 | | | | |
| 2 | 3.0 | 3.9 | 3.5 | | | | |
| 3 | 3.8 | 4.0 | 3.9 | | | | |
| 4 | 3.8 | 4.1 | 4.0 | | | | |
| 5 | 3.5 | 3.9 | 3.7 | | | | |
| 6 | 3.5 | 4.0 | 3.8 | | | | |
| 7 | 4.0 | 4.3 | 4.2 | | | | |
| 8 | 3.8 | 4.1 | 4.0 | | | | |
| 9 | 3.8 | 4.0 | 3.9 | | | | |
| 10 | 3.7 | 3.9 | 3.8 | | | | |

## Appendix 1 Table 2. Summary of Water Temperature and Streamflow Information in Km 1010 Ponds 1999.

| Date | Lower Pond @ 0.5 m | | | Outlet @ Trap | Telkwa R. | Fry Upstream | Telkwa gauge ht |
|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | | | | |
| 11 | 3.2 | 3.7 | 3.5 | | | | |
| 12 | 2.8 | 3.2 | 3.0 | | | | |
| 13 | 2.5 | 2.8 | 2.7 | | | | |
| 14 | 2.8 | 2.8 | 2.8 | | | | |
| 15 | 2.5 | 2.5 | 2.5 | 1 cm of ice on pond | | | |
| Avg | | | 3.5 | | | | |

**Appendix 2 Table 1.** **Summary of Dissolved Oxygen and Temperature Measurements Taken in the Telkwa River Km 1011 Ponds on March 2, 1997, March 5, 1998, and May 5, 1999.**

| Pond Section | Depth (m) | Dissolved Oxygen (ppm) | | | Temperature (C) | | | Snow Depth (m) | | | Ice Depth (m) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1997 | 1998 | 1999 | 1997 | 1998 | 1999 | 1997 | 1998 | 1999 | 1997 | 1998 | 1999 |
| **Lower Pond** | 0.0 | 7.5 | 7.5 | 9.8 | 0.9 | 0.8 | 6.9 | 0.3-0.9 | 0.3 | open | 0.5 | 0.3 | open |
| | 0.5 | 7.3 | 6.8 | 9.9 | 1.2 | 1.0 | 6.1 | | | | | | |
| | 1.0. | 7.2 | 6.8 | 9.8 | 1.5 | 1.0 | 6.1 | | | | | | |
| | 1.1 | 7.2 | | 9.5 | 1.6 | | 6.1 | | | | | | |
| **Upper Pond** | 0.0 | 9.6 | 6.3 | 10.9 | 1.2 | 1.0 | 5.0 | <0.1 | 0.2 | open | 0.2-0.5 | 0.2 | open |
| | 0.5 | 8.4 | 6.2 | 10.8 | 3.2 | 2.0 | 5.1 | | | | | | |
| | 1.0 | 7.9 | 2.2 | 10.8 | 3.5 | 2.1 | 5.1 | | | | | | |
| | 1.2 | 7.7 | 0.8 | 10.5 | 3.5 | 3.0 | 5.2 | | | | | | |
| **Channel 1** | 0.0 | 9.8 | 7.2 | 8.5 | 1.0 | 2.0 | 3.0 | none | <0.1 | open | * | 0.2 | open |
| | 0.5 | 8.0 | 4.4 | 7.1 | 4.0 | 3.0 | 5.0 | | | | | | |
| **Channel 2** | 0.0 | 2.2 | 8.0 | 11.2 | 2.0 | 0.8 | 6.5 | 0.0-0.6 | 0.3 | open | 0.4 | 0.2 | open |
| | 0.5 | 1.9 | 2.0 | 11.2 | 3.5 | 2.0 | 6.5 | | | | | | |
| | 1.0 | 1.8 | 0.3 | 12.4 | 3.8 | 4.2 | 7.3 | | | | | | |
| **Channel 3** | 0.0 | 0.5 | 1.5 | 10.5 | 1.4 | 0.0 | 5.0 | 0.3-1.0 | 0.4 | open | 0.5 | 0.7 | open |
| | 0.5 | 0.2 | 0.9 | 10.2 | 1.5 | 0.3 | 4.0 | | | | | | |
| | 0.9 | 0.2 | 1.3 | 10.0 | 1.5 | 0.9 | 4.0 | | | | | | |
| **PNG extension** | 0.0 | 11.7 | 7.8 | 9.9 | 4.5 | 3.0 | 5.1 | open | 0.3 | open | | 0.8 | open |
| | 0.5 | 10.3 | 4.1 | 9.9 | 4.5 | 4.0 | 6.0 | | | | | | |
| **Sidechannel** | 0.0 | 10.9 | 7.5 | 7.4 | 4.0 | 3.0 | 4.0 | none | none | open | <0.1 | ** | open |
| | 0.5 | 10.2 | 4.7 | 6.8 | 4.0 | 3.0 | 5.2 | | | | | | |

* 50% open with some slush ice.

** 80% open - some slush.

Note: A beaver dam was still present in the sidechannel. The PNG extension channel has been re-routed and now enters the upper portion of Channel 2.

The new channel is shallow and ice-free for 30 m.

**Appendix 2 Table 2. Summary of Dissolved Oxygen and Temperature Measurements Taken in the Telkwa River Km 1010 Ponds on March 14, 1996, March 5, 1998, and May 10, 1999.**

| Pond Section | Depth (m) | Dissolved Oxygen (ppm) | | | Temperature (C) | | | Snow Depth (m) | | | Ice Depth (m) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1996 | 1998 | 1999 | 1996 | 1998 | 1999 | 1996 | 1998 | 1999 | 1996 | 1998 | 1999 |
| **Site 1** | 0.0 | ice | 6.1 | 10.9 | 0.0 | 0.1 | 4.0 | 0.6 | * | none | 0.4 | | clear |
| **Outlet channel** | 0.5 | 2.1 | 6.1 | | 0.1 | 0.1 | | | | | | | |
| **Site 2** | 0.0 | ns | ice | 11.5 | ns | 0.0 | 4.0 | | 0.6 | none | | 0.6 | clear |
| **Lower pond-** | 0.5 | | 4.8 | 11.5 | | 0.1 | 3.5 | | | | | | |
| **near outlet** | 0.8 | | 4.8 | | | 0.1 | | | | | | | |
| | 1.0 | | | 11.0 | | | 3.5 | | | | | | |
| | 1.5 | | 4.8 | 9.6 | | 0.1 | 4.0 | | | | | | |
| **Site 3** | 0.0 | ns | ice | 7.2 | ns | 0.0 | 1.8 | | 0.6 | none | | 0.4 | ** |
| **Lower pond-** | 0.4 | | 0.8 | 7.7 | | 0.1 | 3.8 | | | | | | |
| **left corner** | | | | | | | | | | | | | |
| **Site 4** | 0.0 | ice | 5.2 | 10.1 | 0.0 | 0.1 | 3.0 | 0.2 | 0.3 | none | 0.7 | 0.4 | ** |
| **Lower pond-** | 0.5 | ice | 5.2 | 8.3 | 0.0 | 0.1 | 3.0 | | | | | | |
| **mid section** | 1.0 | 11.9 | | 7.4 | 0.9 | | 3.9 | | | | | | |
| **Site 5** | 0.0 | ns | 5.9 | 7.2 | ns | 0.1 | 2.5 | | 0.3 | *** | | 0.3 | clear |
| **Lower pond-** | 0.5 | | 5.3 | 7.1 | | 0.1 | 3.5 | | | | | | |
| **at inlet creek** | | | | | | | | | | | | | |

ns = No sample taken

* Short section of open water at shallow riffle with a trickle discharge.

** Pockets of ice covering pond.

*** Trickle flow in inlet creek. Snow still present in the forest.

## Appendix 3 Table 1. Summary of Upstream and Downstream Trapping Results at the Outlet to the Telkwa Ponds at Km 1011, 1999.

| DATE | UPSTREAM | | | | DOWNSTREAM | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | COHO | | | | COHO | PRE | COHO | | | |
| | AGE 0 | AGE 1+ | RBT | MW | SMOLTS | SMOLTS | FRY | RBT | R VENTI | MARKS |
| May-02 | | | | | | | | | | |
| May-03 | 0 | | | | | | | | | |
| May-04 | 0 | 1 | | | | | | | | |
| 5 | 1 | | | | | | | | | |
| 6 | 3 | | | | | | | | | |
| 7 | 4 | | | | | | | | | |
| 8 | 9 | | | | | | | | | |
| 9 | 30 | | | | | | | | | |
| 10 | 28 | 1 | | | | | | | | |
| 11 | 41 | | | | 1 | | | | | |
| 12 | 18 | 4 | | | | | | | | |
| 13 | 19 | 1 | | | | | | | | |
| 14 | 22 | 1 | | | | | | RBT-58 | | |
| 15 | 41 | 3 | RBT-57 | | | | | | | |
| 16 | 76 | 1 | | | 1 | | | | | |
| 17 | 46 | | | | 3 | | | | 1 | |
| 18 | 26 | 0 | | | 5 | | | | | |
| 19 | 91 | | | | 5 | | | | | |
| 20 | 64 | | | | 3 | | | | | |
| 21 | 33 | 0 | | | 34 | | | | 2 | 2 |
| 22 | 32 | | | | 6 | | | | 1 | |
| 23 | 52 | 4 | | | 31 | 1 | 2 | BT-85 | | 1 |
| 24 | 37 | 1 | RBT-62 | | 1 | 1 | | | | |
| 25 | 0 | 3 | | | 30 | | | | | |
| 26 | 6 | 3 | | | 25 | | | | 1 | 1 |
| 27 | 9 | 4 | RBT-4 | | 13 | | | | 1 | 1 |
| 28 | 40 | | | | 11 | | | | | 2 |
| 29 | 10 | | | | 11 | | 1 | | | 2 |
| 30 | 18 | 3 | | | 0 | | 3 | | | |
| 31 | 43 | | | | 24 | | | RBT-1 | 2 | 2 |
| Jun-01 | 49 | 1 | | | 12 | | 1 | CHUB-1 | | |
| 2 | 34 | | | | 3 | | 4 | RBT-1 | | |
| 3 | 40 | 1 | | | 3 | | 2 | | | |
| 4 | 53 | 1 | | | 6 | | 3 | | | 1 |
| 5 | 76 | 4 | | | 4 | | 3 | | | 1 |
| 6 | 41 | | | | 7 | | | | | 1 |
| 7 | 69 | | RBT-1 | | 7 | | 2 | MW-65 | | 1 |
| 8 | 23 | 1 | | | 5 | | | | | 1 |
| 9 | 24 | | | | 2 | | 1 | | | |
| 10 | 26 | | | | 16 | | | | 1 | |
| 11 | 141 | 4 | | | 6 | | | | | 1 |
| 12 | 62 | 1 | | | 4 | | | | | 1 |
| 13 | 0 | | | | 10 | | | | | 1 |
| 14 | washed out | | | | 1 | | | | | |
| 15 | | | | | 1 | | | | | |
| 16 | WASHED OUT | | WASHED OUT | | WASHED OUT | | | WASHED OUT | | |
| 17 | | | | | | | | | | |
| TOTAL | 1437 | 43 | 4 | 1 | 291 | 2 | 22 | 9 | 9 | 19 |
| | | | | | | | | | 3.1 | 6.5 |

**Appendix 3 Table 2. Summary of Upstream and Downstream Trapping Results at the Outlet to the Telkwa Ponds at Km 1010 in 1999.**

| DATE | UPSTREAM | | | | DOWNSTREAM | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | COHO | | | | COHO | PRE | COHO | RBT | OTHER |
| | AGE 0+ | AGE 1+ | RBT | MW | SMOLTS | SMOLTS | FRY | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | Traps fully operational as of this date | | | | | | | | |
| 12 | 0 | | | | 9 | | | | DV-2 |
| 13 | 0 | | | | 1 | | | | DV-1 |
| 14 | 0 | | | | 0 | | | | |
| 15 | 0 | | | | 0 | | | | |
| 16 | 0 | | | | 1 | | | | |
| 17 | 0 | | | | 0 | | | | |
| 18 | 0 | | | | 0 | | | | |
| 19 | 0 | | | | 2 | | | | |
| 20 | 0 | | | | 0 | | | | |
| 21 | 0 | | | | 0 | | | | |
| 22 | 0 | | | | 1 | | | | |
| 23 | 0 | | | | 0 | | | | |
| 24 | 2 | | | | 1 | | | | |
| 25 | 0 | | | | 10 | | | | |
| 26 | 2 | | | | 9 | | | | |
| 27 | 0 | | | | 0 | | | | |
| 28 | 0 | 1 | RBT -1 | | 1 | | | | |
| 29 | 0 | | | | 0 | | | | |
| 30 | 0 | 1 | | | 0 | | | | DV-1 |
| 31 | 2 | | | | 0 | | | RBT-1 | |
| Jun-01 | 4 | | RBT-1 | | 0 | | | | |
| 2 | 1 | | | | 2 | | | RBT-2 | |
| 3 | 0 | | | | 0 | | | | |
| 4 | 11 | | | | 2 | | | | |
| 5 | 2 | | | | 3 | | | | |
| 6 | 5 | | | | 4 | | | | DV-1 |
| 7 | 9 | | | | 0 | | | RBT-1 | |
| 8 | 3 | | | | 2 | | | | DV-1 |
| 9 | 9 | | | | 3 | | | | |
| 10 | 9 | | | | 5 | | 1 | | |
| 11 | 0 | 1 | DV-1 | | 2 | | | | |
| 12 | 26 | | | | 5 | | | | |
| 13 | 27 | | | | 5 | | | RBT-1 | |
| 14 | 18 | 1 | | | 8 | | | | DV-1 |
| 15 | 44 | 1 | | | 1 | | | | |
| 16 | 12 | | | | Washed out due to Telkwa R inflows at top end | | | | |
| 17 | | | | | | | | | |
| 18 | | | | | | | | | |
| TOTAL | 186 | 5 | 4 | 1 | 77 | 0 | 1 | | |

**Appendix 3 Table 3. Summary of Fork Length Measurements of Upstream Coho Migrants in Km 1011 Ponds from 1996 to 1999.**

**Age 0+**

| | May | | | | June | | | | July | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 |
| Number | 343 | 151 | 108 | 598 | 542 | 325 | 161 | 343 | 416 | 303 | 104 | end of |
| Size Range (mm) | 30-43 | 29-42 | 29-43 | 30-45 | 30-47 | 28-50 | 28-51 | 30-45 | 30-49 | 28-57 | 29-55 | study |
| Mean Fork Length | 35.1 | 32.8 | 33.2 | 35.4 | 35.9 | 37.6 | 36.0 | 34.7 | 38.4 | 44.4 | 41.3 | washed |
| Std | 2.4 | 2.2 | 1.7 | 2.5 | 2.9 | 4.8 | 4.5 | 2.3 | 4.3 | 7.6 | 6.8 | out |

**Age 1+**

| | May | | | | June | | | | July | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 | 1996 | 1997 | 1998 | 1999 |
| Number | 192 | 256 | 119 | 32 | 347 | 350 | 119 | 13 | 95 | 132 | 24 | end of |
| Size Range (mm) | 44-81 | 45-108 | 50-82 | 56-90 | 48-96 | 51-100 | 55-88 | 56-75 | 50-72 | 58-92 | 58-80 | study |
| Mean Fork Length | 56.1 | 64.1 | 64.1 | 69.0 | 61.8 | 69.2 | 69.4 | 63.2 | 59.0 | 73.9 | 77.2 | washed |
| Std | 7.2 | 10.4 | 7.3 | 9.6 | 6.8 | 8.8 | 7.3 | 5.1 | 5.4 | 8.6 | 8.5 | out |

**Appendix 3 Table 4. Summary of Fork Lengths of Fish Species Other than Coho in Km 1011 and Km 1010 Pond Outlets, 1999.**

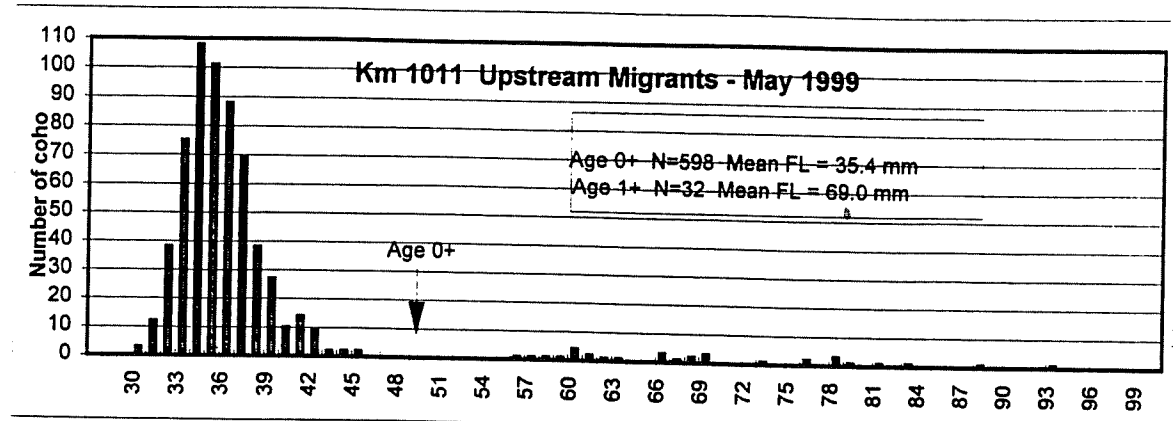
**Km 1011**

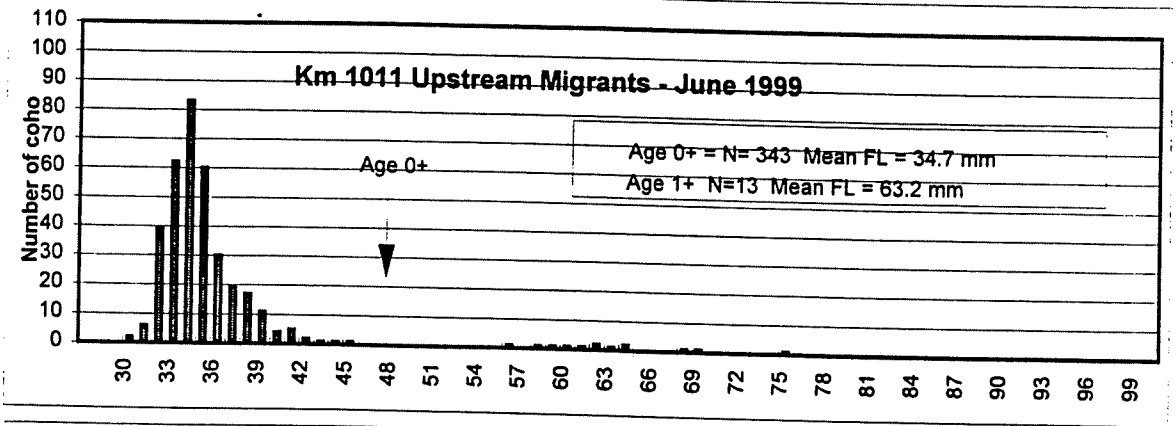
| Species | Rainbow Trout | | Mountain Whitefish | | Bull Trout | | Peamouth chub | |
|---|---|---|---|---|---|---|---|---|
| | Outlet traps | | | | | | | |
| | Up | Down | Up | Down | Up | Down | Down | Mark-recapture |
| | 33 | 58 | | 65 | | 85 | 73 | 92 |
| | 50 | 61 | | | | | | |
| | 52 | 65 | | | | | | |
| | 52 | 82 | | | | | | |
| | 56 | | | | | | | |
| | 57 | | | | | | | |
| | 62 | | | | | | | |
| count | 7 | 4 | | 1 | | 1 | 1 | 1 |
| max | 62 | 82 | | 65 | | 85 | 73 | 92 |
| min | 33 | 58 | | 65 | | 85 | 73 | 92 |
| avg | 51.7 | 66.5 | | 65.0 | | 85.0 | 73.0 | 92.0 |
| std | 9.2 | 10.7 | | | | | | |

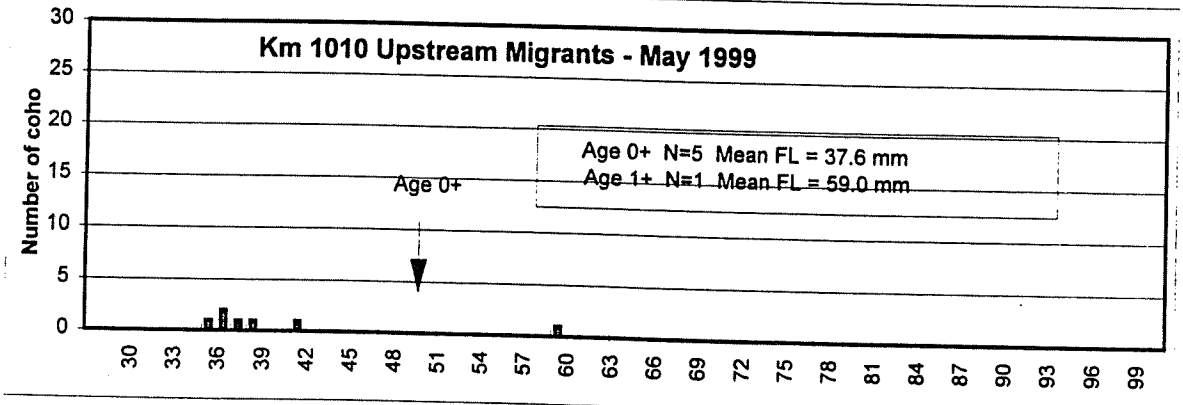
**Km 1010**

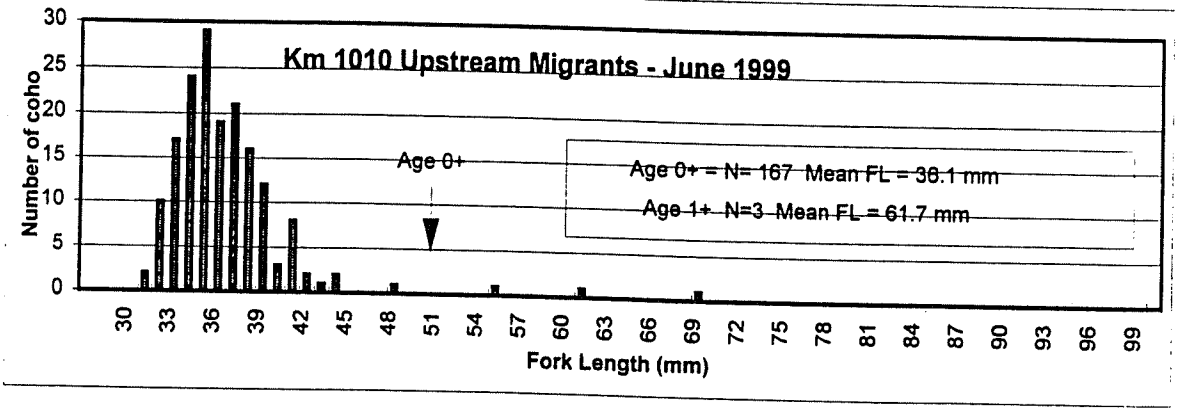
| | Rainbow Trout | | Dolly Varden | |
|---|---|---|---|---|
| | Up | Down | Up | Down |
| | 53 | 50 | 77 | 91 |
| | 51 | 61 | | 94 |
| | | 92 | | 98 |
| | | 101 | | 99 |
| | | 111 | | 100 |
| | | | | 155 |
| | | | | 196 |
| count | 2 | 5 | 1 | 7 |
| max | 53 | 111 | 77 | 196 |
| min | 51 | 50 | 77 | 91 |
| avg | 52.0 | 83.0 | 77.0 | 119.0 |
| std | 1.4 | 26.3 | | 40.5 |

**Appendix 3 Figure 1. Summary of Fork Lengths of Upstream Coho Migrants in Km 1011 and Km 1010 Ponds, 1999.**



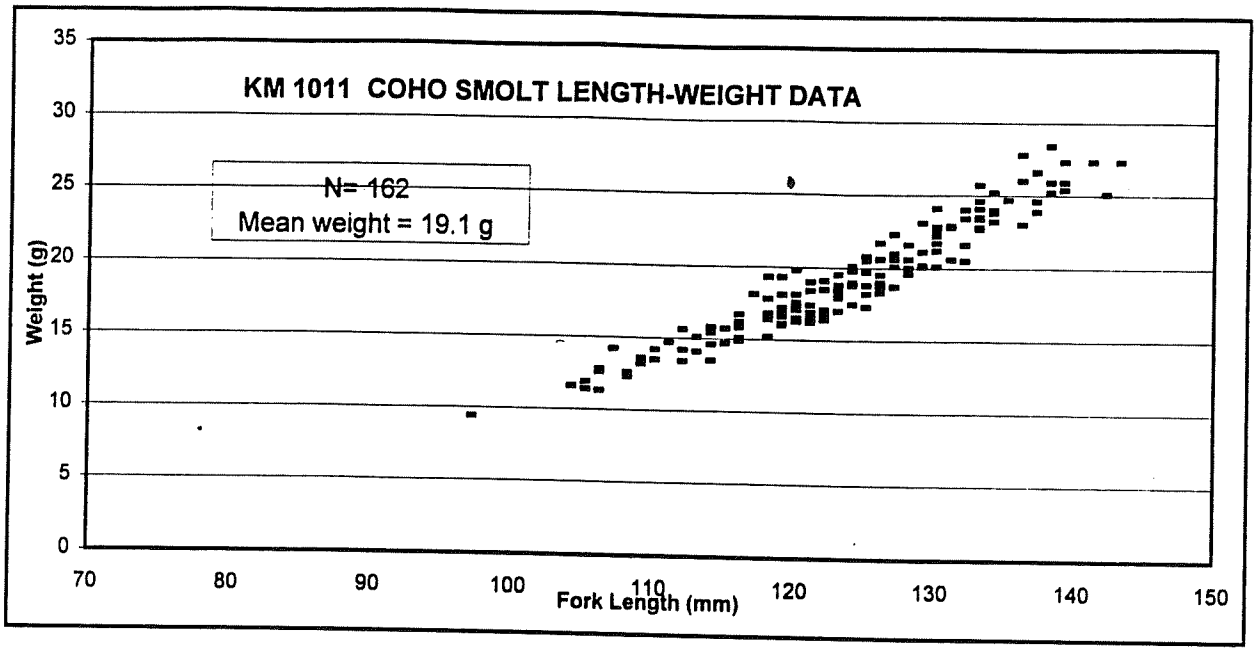
**Appendix 4 Table 1. Summary of Age-Length Determinations for Coho Captured in Mark-Recapture and Downstream Smolt Trap, 1995 to 1998.**

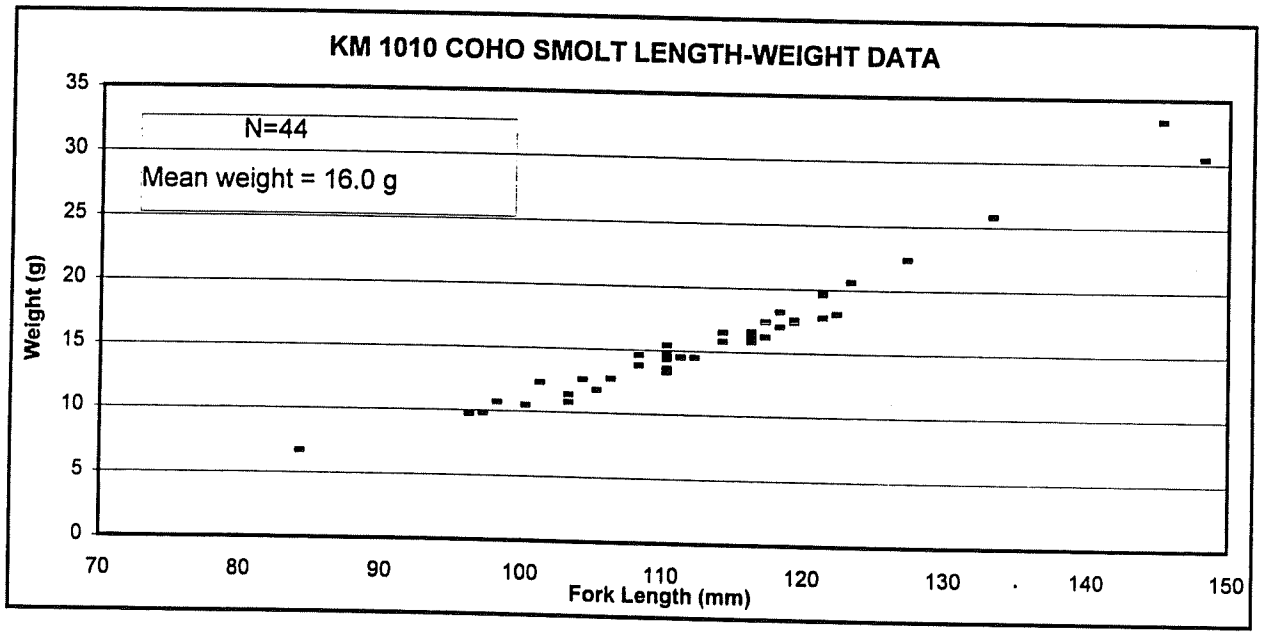
| | 1998 smolts | | | |
|---|---|---|---|---|
| Age | 1+ | 2+ | 3+ | 4+ |
| FL Range (mm) | 78-138 | 87-134 | 82-137 | 151 |
| FL Average | 105.1 | 109.4 | 116.6 | 151 |
| n | 20 | 22 | 10 | 1 |
| | **1997 smolts** | | | |
| Age | 1+ | 2+ | 3+ | |
| FL Range (mm) | 82-132 | 87-150 | 121-129 | |
| FL Average | 98.1 | 114.9 | 125.0 | |
| n | 20 | 26 | 2 | |
| | **1997 mark-recapture** | | | |
| Age | 1+ | 2+ | 3+ | |
| FL Range (mm) | 51-120 | 68-131 | na | |
| FL Average | 81.6 | 105.6 | na | |
| n | 38 | 26 | 0 | |
| | **1995 mark-recapture** | | | |
| Age | 1+ | 2+ | 3+ | |
| FL Range (mm) | 77-111 | 92-118 | 115-124 | |
| FL Average | 88.3 | 106.3 | 119.8 | |
| n | 24 | 16 | 9 | |

**Appendix 4 Table 2. Coho Biomass Estimates Based on Mark-and-Recapture Population Estimates in Km 1011 Ponds in Early May 1994 to 1999.**

| Year | Mean length <75 mm | Mean wt (g) | n | Total Biomass | Mean length >75 mm | Mean wt (g) | n | Total Biomass | Combined All Coho | Grams/m^2 All Coho |
|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 66.3 | 3.24 | 336 | 1087 | 100.6 | 10.40 | 2304 | 23955 | 25042 | 2.88 |
| 1995 | 70.2 | 3.80 | 296 | 1124 | 99.6 | 10.11 | 1549 | 15661 | 16785 | 1.93 |
| 1996 | 65.9 | 3.18 | 1484 | 4720 | 89.9 | 7.59 | 2820 | 21400 | 26120 | 3.00 |
| 1997 | 68.6 | 3.56 | 271 | 965 | 93.8 | 8.55 | 1124 | 9607 | 10571 | 1.22 |
| 1998 | 68.4 | 3.53 | 107 | 378 | 100.9 | 10.48 | 1806 | 18934 | 19312 | 2.22 |
| 1999 | 0.0 | | 0 | 0 | 116.3 | 15.60 | 961 | 14996 | 14996 | 1.72 |

**Appendix 4 Figure 1. Coho Smolt Length-Weight Information for Km 1011 and Km 1010 Ponds, 1999.**



**Appendix 5 Table 1. Wildlife Observations in the Vicinity of Km 1011 Pond 1999.**

| Date | Birds | Amphibians | Other |
|---|---|---|---|
| May-02 | kingfisher, 2 uid ducks | 1 w, toad - upper pool | |
| May-03 | 1 male mallard - upper pond | | |
| | bufflehead duck - lower pond | | |
| May-04 | 2 kingfishers | | |
| May-05 | 1 male mallard | | |
| May-07 | 5 uid ducks, 1 kingfisher | 2 w. toads in d/s trap | |
| May-08 | | 1 w. toad in d/s trap | |
| May-09 | kingfisher | | |
| | 6 yellow-rumped warblers | | |
| May-10 | 4 uid ducks | | |
| May-15 | 2 uid ducks | | |
| May-16 | | 1 w. toad | |
| May-17 | kingfisher | 1 w. toad in d/s trap | |
| | red-winged blackbird | | |
| May-18 | kingfisher, uid duck | 2 w. toads in d/s trap | |
| May-19 | 2 uid ducks | | |
| May-22 | kingfisher | | |
| | male merganser on river @ trap | | |
| May-23 | kingfisher | | mink interfering with d/s trap |
| May-24 | | | mink interfering with d/s trap |
| May-27 | kingfisher, Stellar jay | 1 w. toad in d/s trap | deer mouse caught in mink trap |
| May-29 | | | deer mouse caught in mink trap |
| May-30 | kingfisher | 1 w toad in d/s trap | deer mouse caught in mink trap |
| May-31 | 1 male mallard | | |
| | yellow-rumped warblers in brush near pond outlet | | deer mouse caught in mink trap |
| Jun-01 | | 2 w. toads in d/s trap | deer mouse caught in mink trap |
| Jun-02 | kingfisher | | |
| Jun-03 | goldeneye duck - lower pond | | deer mouse caught in mink trap |
| Jun-06 | | 2 w. toads in d/s trap | |
| Jun-07 | kingfisher | 1 w. toad in d/s trap | weasel caught in mink trap |
| Jun-08 | goldeneye duck - lower pond | | |
| Jun-09 | | 3 w. toads in d/s trap | |
| Jun-11 | | 1 w toad in d/s trap | |
| Jun-12 | | 3 w. toads in d/s trap | |
| Jun-13 | | 1 w. toad | |
| Jun-14 | | 1 w. spotted frog | |
| | | several toads in outlet pond | |
| Jun-15 | | 1 w. spotted frog | |
| | | several toads in outlet pond | |
| Jun-18 | kibgfisher | major hatch of tadpoles below | abundance of monarch butterflies |
| | | lower pond. | in groups for the past week. |

**Appendix 5 Table 1. Wildlife Observations in the Vicinity of Km 1010 Pond 1999.**

| Date | Birds | Amphibians | Other |
|---|---|---|---|
| | | | |
| May-08 | kingfisher | | |
| May-12 | kingfisher | | |
| | goldeneye duck | | |
| May-13 | kingfisher | | |
| May-14 | kingfisher | | |
| May-16 | | 1 w. toads in d/s trap | |
| May-18 | kingfisher | 2 w. toads in d/s trap | |
| May-20 | kingfisher | | |
| May-24 | kingfisher | long-toed salamander | |
| | dipper at mouth | | |
| May-25 | 1 male goldeneye | | |
| May-27 | woodpecker heard | | |
| May-29 | 2 gray jays & 1 stellar jay obs. on the way in | | |
| Jun-08 | | | porcupine chewing on wood of trap boxes |
| Jun-13 | | 2 w. toads in d/s trap | |
| | | | |

## 2.5 Telkwa Instream

The Telkwa Instream Project, related to the Telkwa Monitoring Project was overseen by PIR staff and is located in the Telkwa River Chart area at roughly 10km on the Telkwa River Road (1000FSR). The Telkwa Instream Project is part of an ongoing effort by Pacific Inland Resources (PIR) and the Department of Fisheries and Oceans (DFO) and the Watershed Restoration Program (WRP) to restore and enhance fish habitat in the Telkwa drainage since 1994. The monitoring project involves the improvement and modification design of the previously constructed off channel rearing pond at 1010km on the Telkwa FSR. Specifically the project resulted in an engineered site plan design to improve the water flow through the ponds and the pond entrance stream.

Water flow at the pond over the last two years has limited the immigration and emigration of juvenile Coho to the rearing ponds. In order to for these ponds to be used, by juvenile Coho, to their maximum productivity a detailed site review and engineered plan for improvement has been completed. Based on the engineered plan and recommendations a detailed improvement work plan will be developed for the ponds. McElhanney Consulting Services Ltd. of Smithers BC was contracted to perform the work on this project.

McElhanney

3rd May, 2000

Our File: 2321-00490-0
Your Contract: 99-FRBC-100

Pacific Inland Resources
P.O. Box 3130
Smithers BC V0J 2N0

Attention: Mr. Alan Baxter, FIT

Dear Mr. Baxter:

**Re: Conceptual Design – for fish passage channel and culvert upgrades for Km 1010 pond**

As requested, McElhanney has prepared a conceptual design to provide juvenile fish passage from the Telkwa River to Km 1010 pond. Enclosed, please find four copies of this letter, drawings and site photographs.

**Existing Conditions**
The pond is located across the Telkwa River from Km 1010 Telkwa FSR, near 8km on Telkwa River Road. There is a perched 500mm diameter culvert that acts as the main outlet for the Km 1010 pond and is, at least, a partial barrier to juvenile fish migration during all flows. A constructed channel then connects the culvert outlet with the Telkwa River. The confluence of this channel with the Telkwa River presently provides little slow water habitat during lower flow conditions. This, combined with similar water temperature in the channels, likely results in few fry entering the tributary. The Telkwa River has overflowed into the top end of the pond in the previous two years, enabling coho fry to enter the pond (*Juvenile Coho Studies at Telkwa River Km 1010 and Km 1011 Ponds', 1999 by David Bustard and Associates Ltd.).*

**Conceptual Design**
McElhanney has prepared a Conceptual Design for review, based on the Site Plan report '*Juvenile Coho Studies at Telkwa River Km 1010 and Km 1011 Ponds*', 1999 by David Bustard and Associates Ltd. This Conceptual Design will be modified once there has been an opportunity to visit and confirm the site features. As David Bustard and Assoc. have previously been involved with this site it would be beneficial if they could visit the site at the same time, as previously discussed.

The proposed work presently includes:

- Replacing the existing 500mm diameter culvert with a 1000mm or larger culvert and adjusting the culvert invert elevation and water level at the culvert outlet to create a backwater effect in the culvert. This would remove the existing drop at the culvert outlet and reduce flow velocities in the culvert to allow coho fry to move into the pond.

...2

1 - 5008 Pohle Avenue
Terrace BC
Canada V8G 4S8

Tel 250 635 7163
Fax 250 635 9586

- Creating and complexing a new channel with a gentler gradient and improved juvenile fish access at the confluence with the Telkwa River, total length of 60m @ an average gradient of 2.6%. The new channel will consist of a series of complexed riffles/ponds improving fish habitat and providing 'easier' fish passage. This channel would also collect more groundwater than the existing channel, providing relatively higher water temperatures. By also increasing the slack water area at the confluence, coho migration into the channel should be improved.

- Retaining the old constructed channel to act as an overflow channel during flood events.

- Construction of a rock spillway (or equivalent e.g. log spillway structure) to pass floodwater to the old channel and provide backwater effects in the culvert.

- Consideration given to constructing a deflection berm at the top end of the pond to limit the flow of Telkwa River water into the pond and prevent the culvert and berm from being washed out, as recommended in the Bustard report.

This work will improve fish passage in and out of the ponds by:

- Removing the perched condition of the culvert, which will allow juvenile passage
- Providing sustained depth and low velocity in the culvert
- Reducing the stream gradient from an average of 6% to an average of 2.6%, which will reduce stream velocity and improve water depth.
- Improve water depth by constricting and shaping the channel's invert. Presently, the channel flow is poorly contained.
- Improve standing water depth in the channel, through the creation of a pool-riffle complex. The pools are not expected to be fish barriers during low flow conditions, based on the profile model. Tail water depths are designed to key in with the riffles.

Access to the site will have to be upgraded if heavy materials (eg. rip rap) are to be imported. There is one stream crossing with steep approaches that would limit rock truck access. A temporary Squamish ford will have to be constructed to provide access. Approval from DFO and MOELP will be required.

Alternatives to rock armouring on the channel and berm potentially include geogrid and impermeable geotextile covered native soil and screened $D_{90}$ cobble. Variations may be explored during the final design. Alternatives to rock in the riffles include fabricating LWD step pools. However, wood will have to imported, as suitable material was not observed at the pond site.

A preliminary site visit was conducted by Shawn Zettler and Claude Rioux (of McElhanney) as they were in the 'neighborhood'. They observed that during low flow conditions, the channel drains on to a point bar, with the Telkwa River thalweg 50-100m north of the river bank. Water fans out across the point bar down stream. Fish access to

the site under low flow conditions may be poor, and should be confirmed with Dave Bustard. Potential alternatives to the conceptual design that may involve less material were also observed. The first alternative involves utilizing the existing channel and extending the channel towards the overflow culvert to the west. The channel would extend across the berm without a culvert. If flow control is required to allow for fish counting, a wood weir can be constructed on the outlet. Approximately 100m of channel would be constructed with an average gradient of 1% to 1.5%.

The second option involves creating a new channel with the confluence located downstream of the point bar. This would improve fish access as the channel outlet would be closer to the thalweg under low flow conditions. Similar to the above alternative, the existing culvert and counting box would be abandoned.

These options may provide a better and cheaper alternative to the conceptual design. However, a final site visit with yourself and Dave Bustard is required to discuss these alternatives.

At the present time, we do not recommend preparing a cost estimate, as the design is uncertain. Following the site visit, a final cost estimate for the concept can be generated if you require it.

Additionally, we will require the following to complete the project:

1. A final site visit under clear ground conditions and during juvenile migration (probably second half of April).
2. Additional survey pickup to include all of the proposed channel and surrounding area (currently the proposed channel is partially outside the surveyed area so we have assumed and extended the elevation contours).
3. Clarification of the location of PNG's old ROW as mentioned in the David Bustard Ltd. report recommendations and approval from PNG if any works are inside their ROW.

On development of the final concept, a review by DFO and MOELP will be required. Should you have any questions, please do not hesitate to contact either of the undersigned.

Sincerely,

McElhanney Consulting Services Ltd.

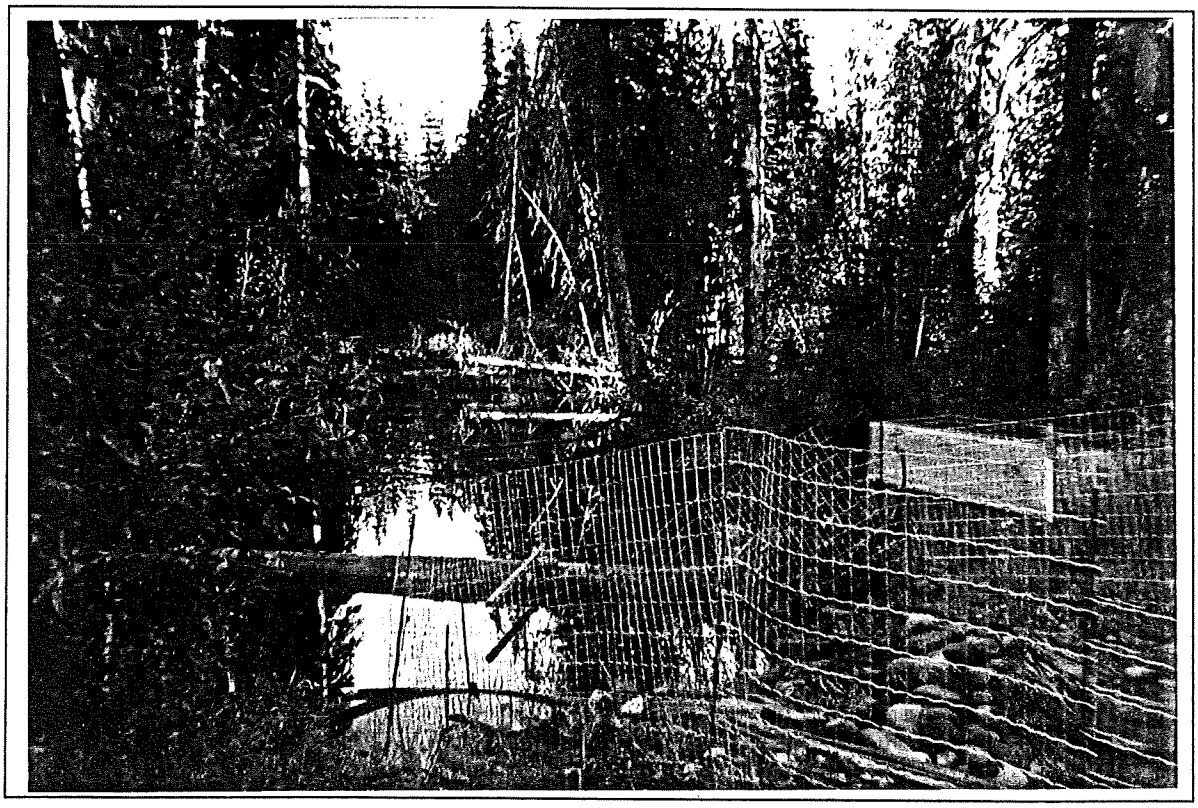
ALAN HAMPSHIRE

Alan F. Hampshire, P.Eng.
Project Manager

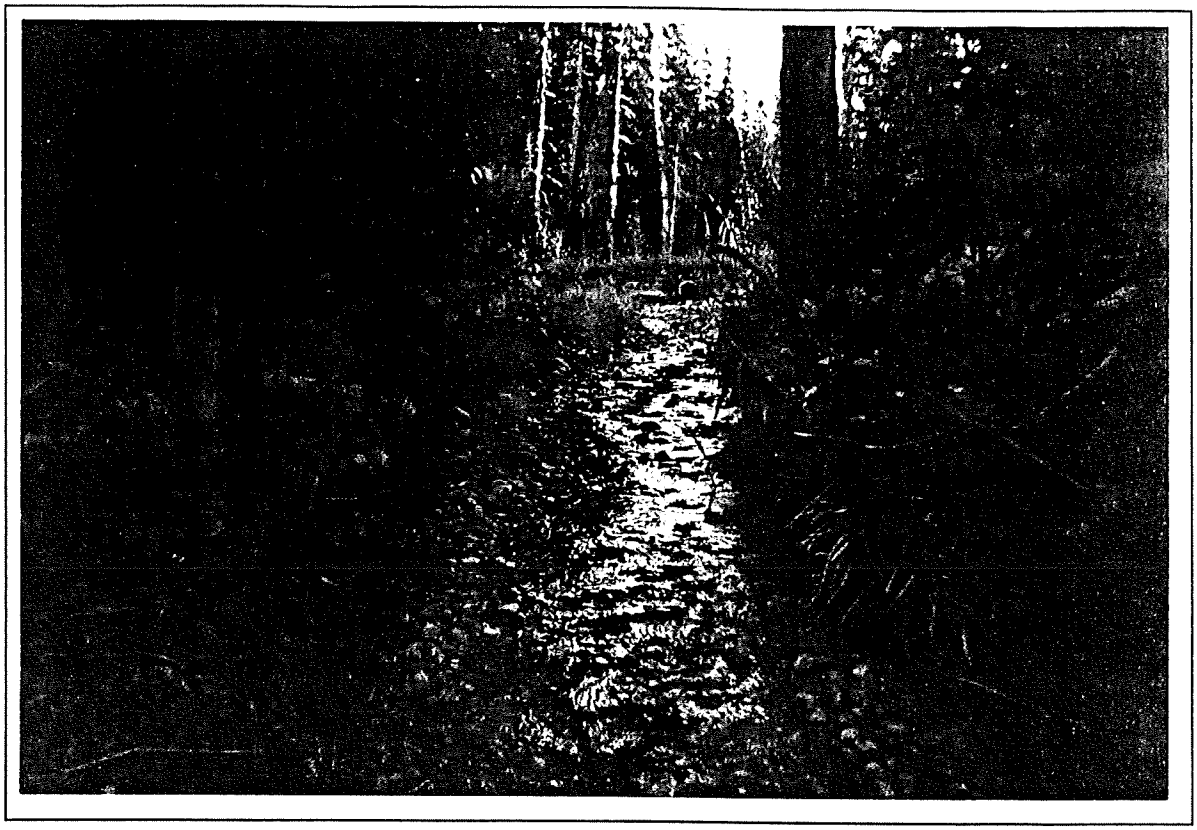
Shawn Zettler, E.I.T.
Project Engineer (Environmental)

AFH:ah
Enclosures

Sept. 99 Culvert outlet and fish trap box



Sept. 99 Wooden box on culvert inlet and fish trap box



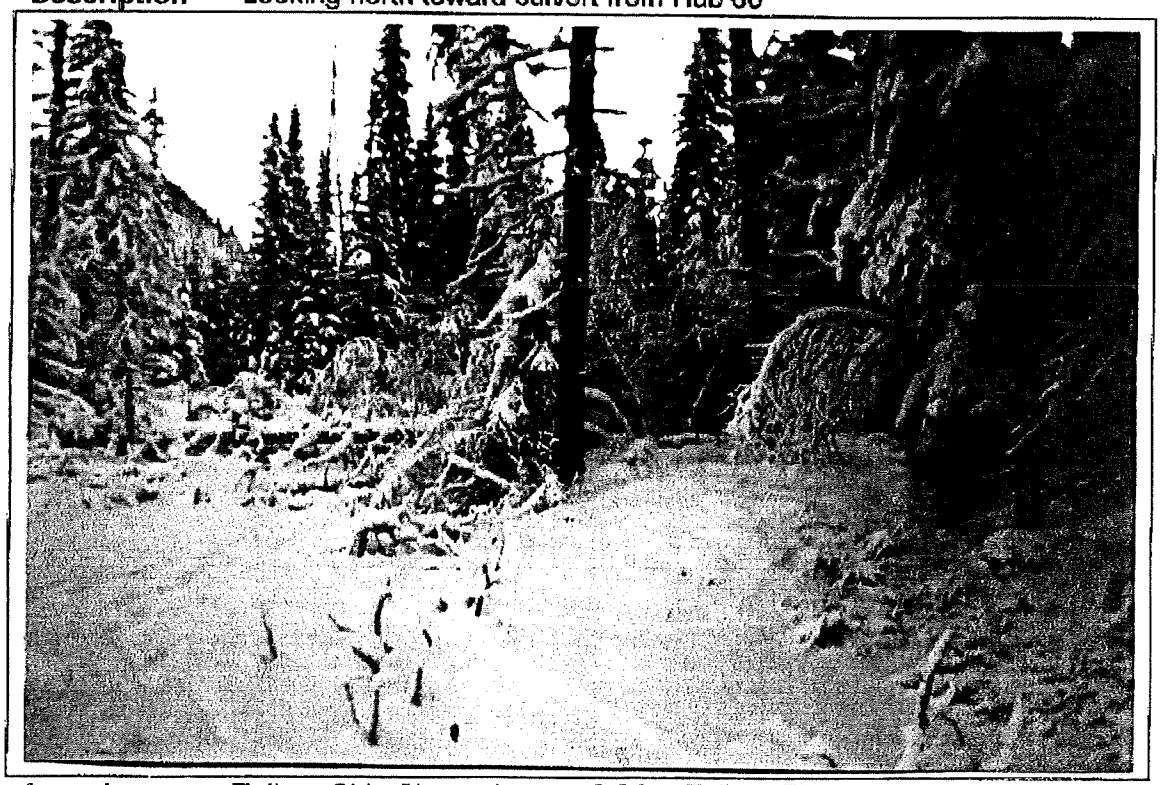
Sept. 99 Looking upstream to the culvert outlet

Sept. 99 Looking downstream from the culvert

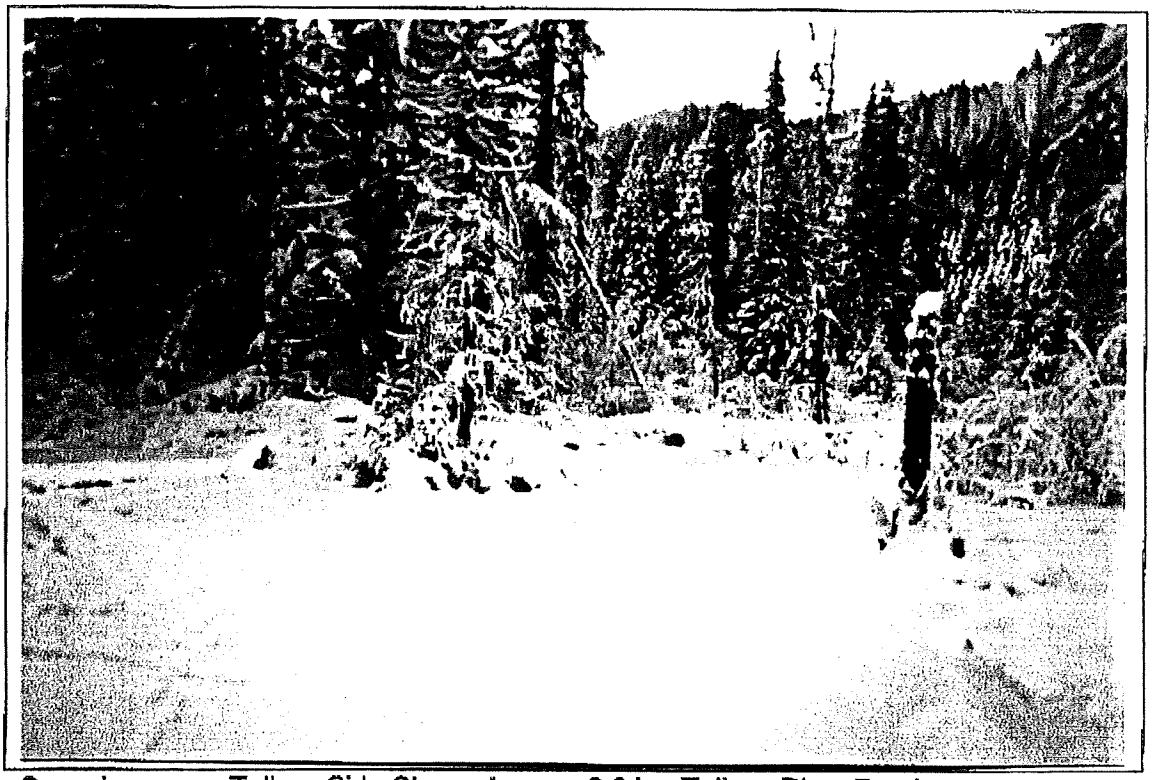
Sept. 99 Looking downstream at confluence with the Telkwa River

Sept. 99 Looking toward area of new channel

**Crossing** Telkwa Side Channel - near 8.0 km Telkwa River Road
**Description** Looking north toward culvert from Hub 60



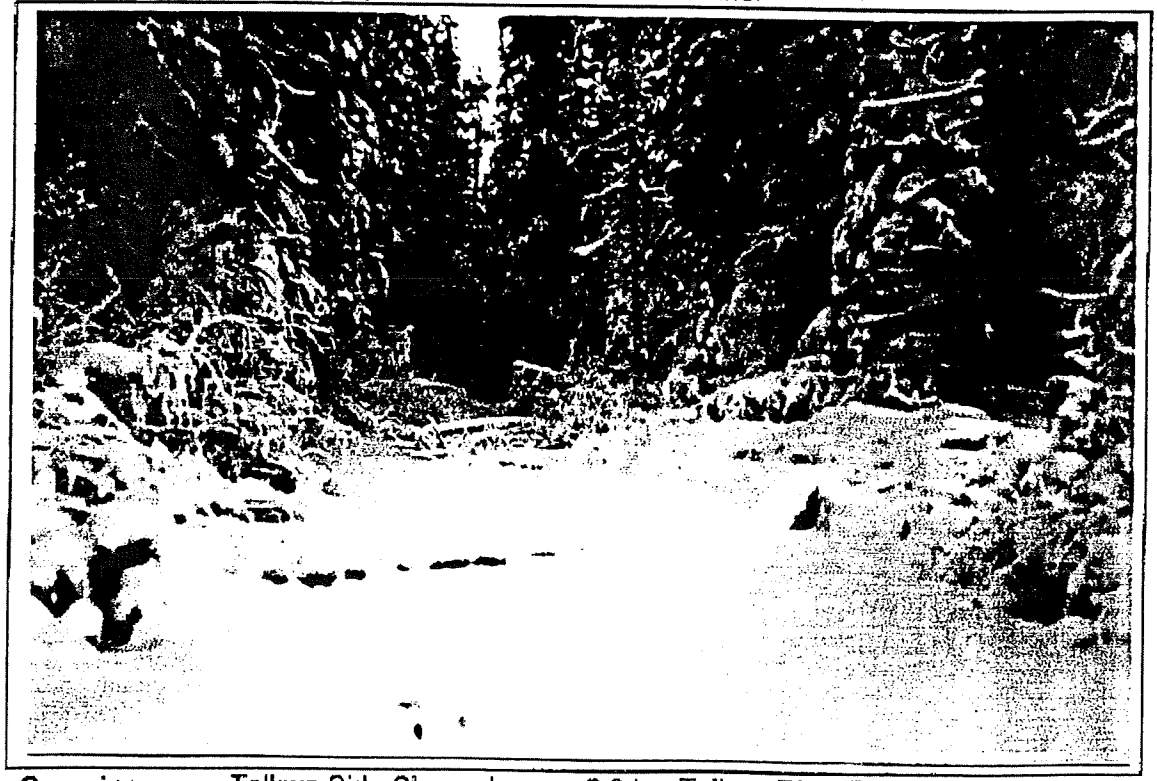
**Crossing** Telkwa Side Channel - near 8.0 km Telkwa River Road
**Description** Looking toward Hub 50 from Hub 60



**Crossing** Telkwa Side Channel - near 8.0 km Telkwa River Road
**Description** Looking toward northwest corner of pond & culvert inlet from Hub 60

**Crossing** Telkwa Side Channel - near 8.0 km Telkwa River Road
**Description** Looking northwest, inflow side channel

**Crossing Description** Telkwa Side Channel - near 8.0 km Telkwa River Road
Looking up southwest inflow side channel



**Crossing Description** Telkwa Side Channel - near 8.0 km Telkwa River Road
Looking up northwest inflow side channel

# PACIFIC INLAND RESOURCES

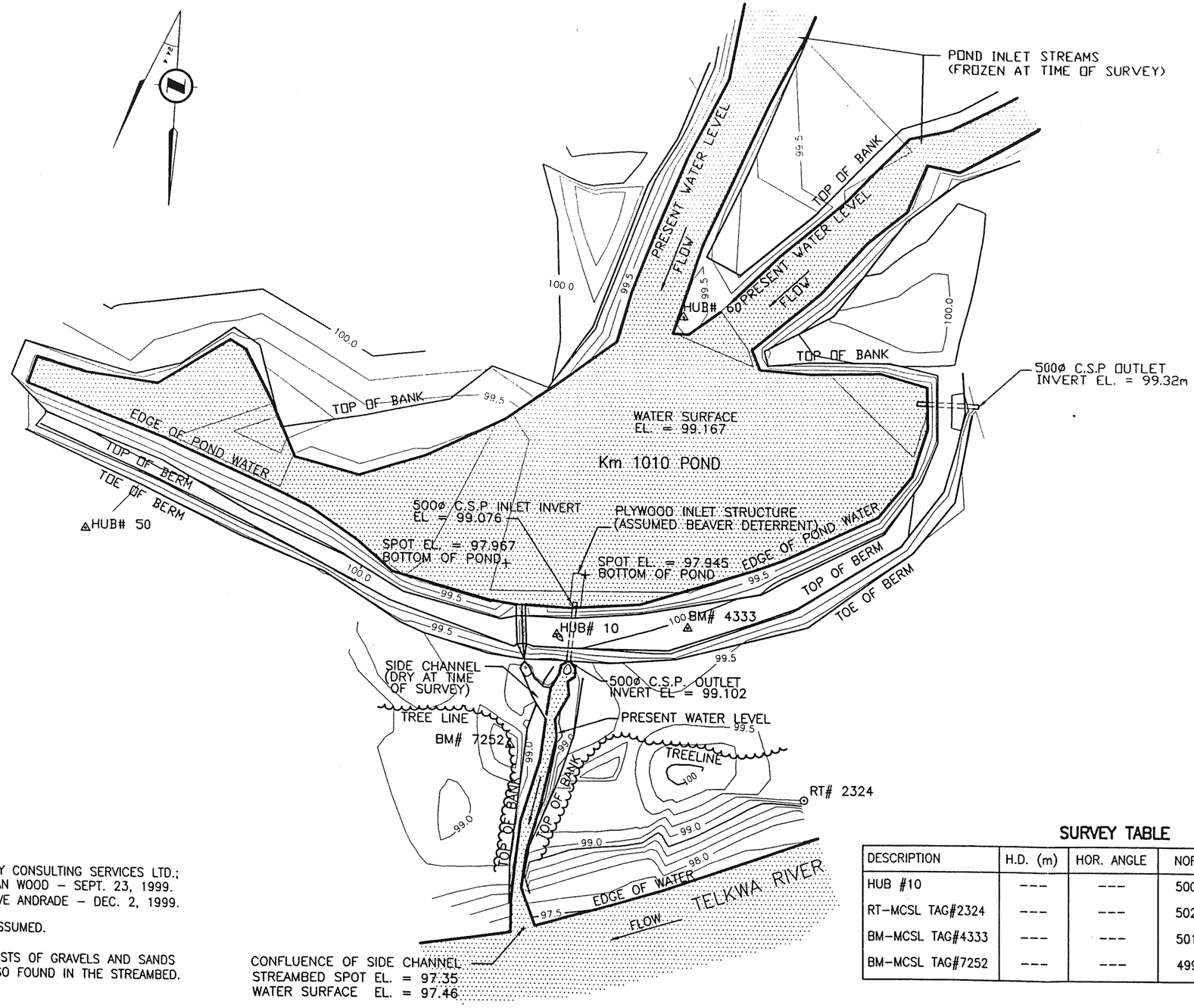
# TELKWA SIDE CHANNEL
# NEAR 8.0 km - TELKWA RIVER ROAD
# EXISTING CONDITIONS

| DRAWING No. | DESCRIPTION | REV. |
|---|---|---|
| 256-00-01 | PLAN - EXISTING CONDITION (1:250) | |
| 256-00-02 | PROFILES - EXISTING CONDITION | |
| 256-00-03 | PLAN - EXISTING CONDITIONS (1:500) | |

CANCEL PRINTS BEARING PREVIOUS NUMBER

McElhanney

**McELHANNEY CONSULTING SERVICES LTD.**
PO BOX 787, 3578 Victoria Drive, Smithers, BC, Canada V0J 2N0
Telephone (250) 847-4040 Fax (250) 847-4160




## NOTES–

1) SURVEYED BY McELHANNEY CONSULTING SERVICES LTD.;
   JESSICA TREMBLAY / BRIAN WOOD – SEPT. 23, 1999.
   JESSICA TREMBLAY / STEVE ANDRADE – DEC. 2, 1999.

2) COORDINATE SYSTEM IS ASSUMED.

3) STREAM SUBSTRATE CONSISTS OF GRAVELS AND SANDS WITH SMALL COBBLES ALSO FOUND IN THE STREAMBED.

## SURVEY TABLE

| DESCRIPTION | H.D. (m) | HOR. ANGLE | NORTHING | EASTING | ELEVATION |
|---|---|---|---|---|---|
| HUB #10 | --- | --- | 5000.000 | 2000.000 | 100.00 |
| RT–MCSL TAG#2324 | --- | --- | 5023.426 | 2025.612 | 99.57 |
| BM–MCSL TAG#4333 | --- | --- | 5015.226 | 2003.024 | 100.05 |
| BM–MCSL TAG#7252 | --- | --- | 4991.478 | 2011.208 | 99.71 |

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| 1 | 03MAY00 | NORTH ARROW | KDL | AH |

Designed SZ
Drawn JT
Checked AH

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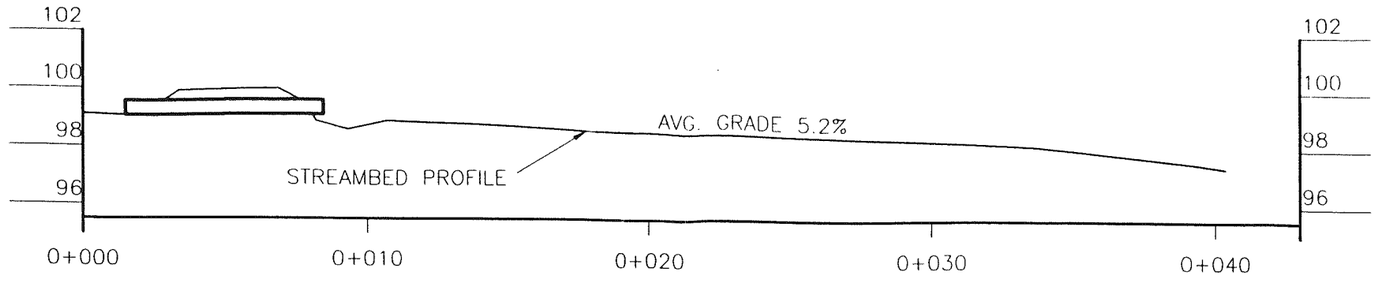
Suite #1 – 5008 Pohle Avenue, Terrace, B.C., Canada, V8G–4S8
Telephone (250) 635 – 7163 Fax (250) 635 – 9586

PACIFIC INLAND RESOURCES LTD.

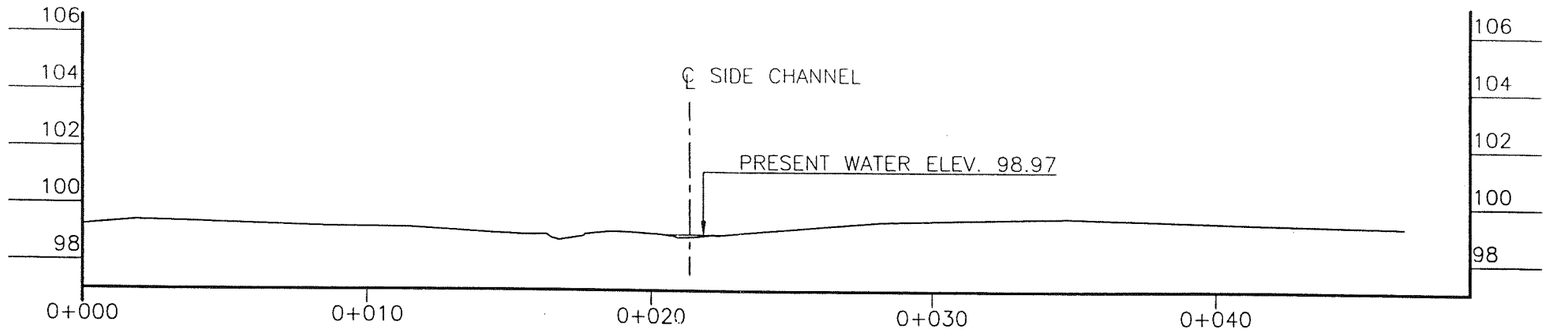
# Km 1010 POND
(NEAR 8.0km - TELKWA RIVER ROAD)
# EXISTING SITE CONDITIONS

Job No. 2321–00480–0
Scale 1:500
Approved
Drawing No. 490–01
Date MAR. 2000
1

CANCEL PRINTS BEARING PREVIOUS NUMBER

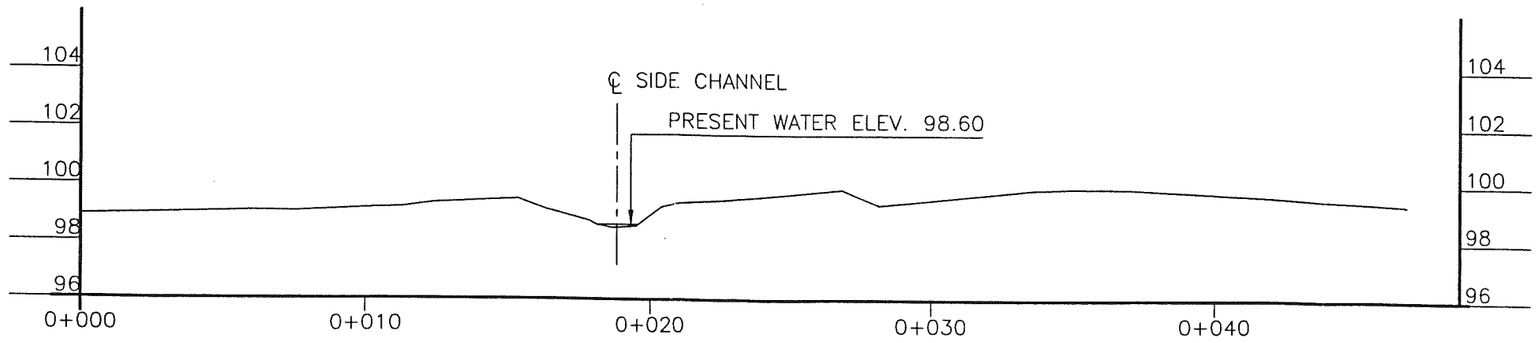



## PROFILE – STREAMBED




## SECTION 1

LOOKING UPSTREAM




## SECTION 2

LOOKING UPSTREAM

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| 1 | 03MAY00 | TITLE BLOCK | KDL | AH |

Designed AH
Drawn SNA
Checked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McElhanney

**PACIFIC INLAND RESOURCES LTD.**

**TELKWA SIDE CHANNEL**
(NEAR 8.0km - TELKWA RIVER ROAD)

**PROFILES - EXISTING CONDITIONS**

Job No. 2321-00490-0
Scale 1:100
Approved
Date OCT. 1999
Drawing No. 490-03 / 1


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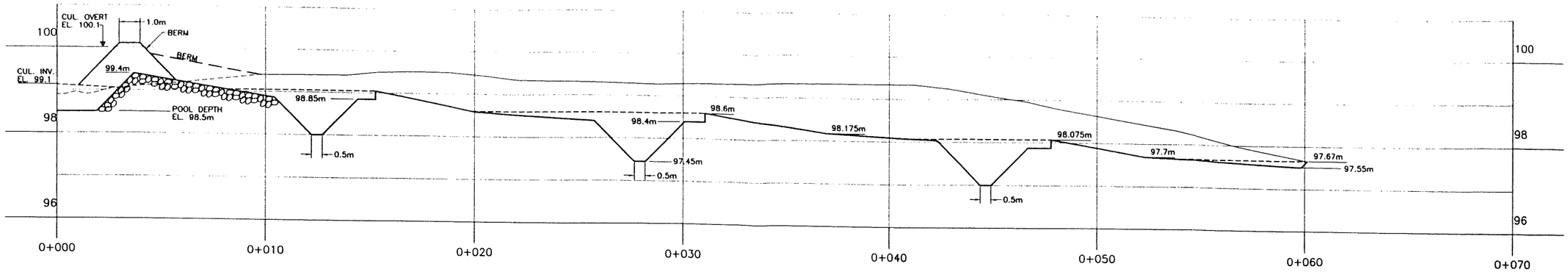
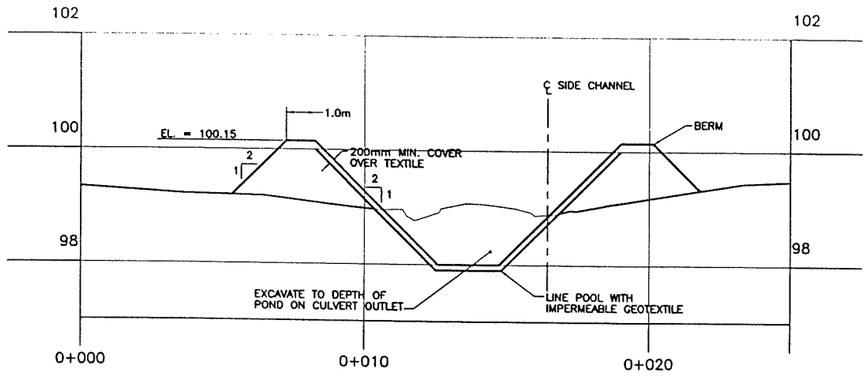
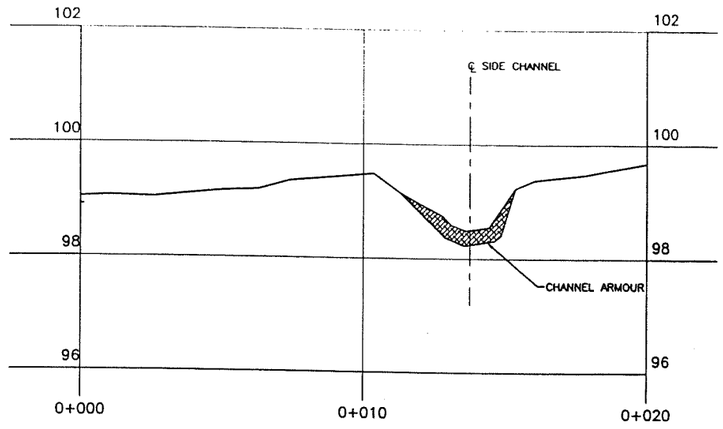
CANCEL PRINTS BEARING PREVIOUS NUMBER



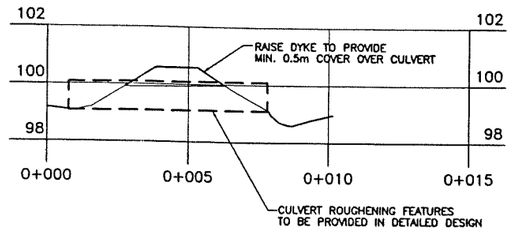

PROFILE – PROPOSED CHANNEL




SECTION A2
LOOKING UPSTREAM




SECTION B2
LOOKING UPSTREAM




SECTION C2
CULVERT CROSS SECTION

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| 1 | 25APR00 | REVISED AS PER COMMENTS | KDL | AH |

| | |
|---|---|
| Designed | SZ |
| Drawn | KDL |
| Checked | AH |

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Telephone (250) 635 – 7163 Fax (250) 635 – 9586

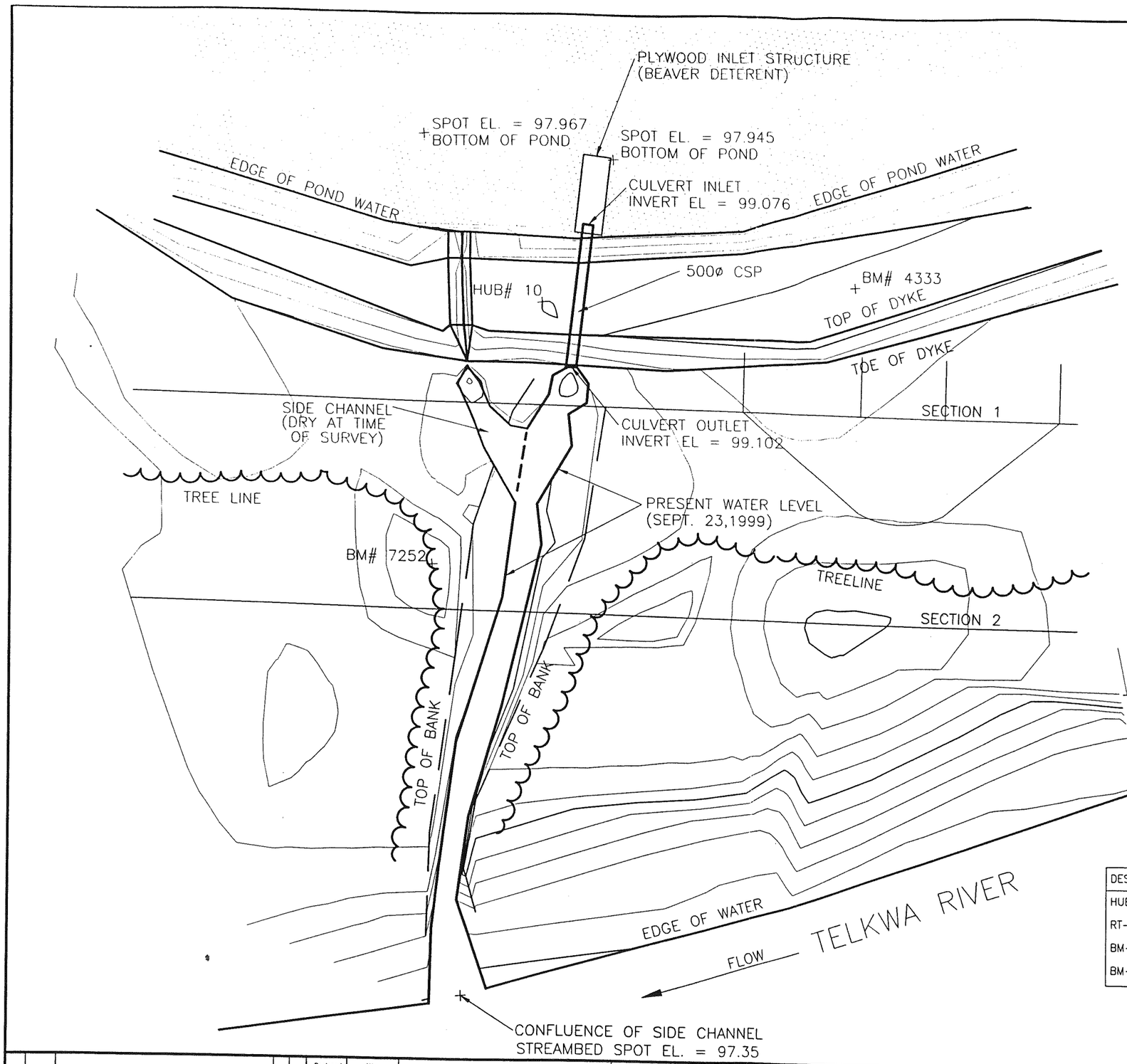
McElhanney

PACIFIC INLAND RESOURCES LTD.

FISH PASSAGE CHANNEL DESIGN
FOR Km 1010 POND
**CONCEPTUAL PROFILES**

| | |
|---|---|
| Job No. | 2321-00490-0 |
| Scale | 1:100 |
| Approved | |
| Date | MAR. 2000 |
| Drawing No. | 490-05 |
| | 1 |

CANCEL PRINTS BEARING PREVIOUS NUMBER




**NOTES–**

1) SURVEYED BY McELHANNEY CONSULTING SERVICES LTD.; JESSICA TREMBLAY / BRIAN WOOD – SEPT. 23, 1999.
2) COORDINATE SYSTEM IS ASSUMED.
3) CREEK HYDROLOGY:
   - –Q50 FLOW ESTIMATED AT _____ cu.m/sec.
   - –BOTTOM OF CREEK APPROX. ELEV. _____ (@ P–LINE)
   - –ESTIMATED MAX. STREAM VELOCITY = _____ m/sec.
   - –ESTIMATED H.W.L. ELEVATION = _____ m (@ P–LINE)
4) STREAM SUBSTRATE CONSISTS OF GRAVELS AND SANDS WITH SMALL COBBLES ALSO FOUND IN THE STREAMBED
5) STREAM CLASS = _____

**SURVEY TABLE**

| DESCRIPTION | H.D. (m) | HOR. ANGLE | NORTHING | EASTING | ELEVATION |
|---|---|---|---|---|---|
| HUB #10 | --- | --- | 5000.000 | 2000.000 | 100.00 |
| RT–MCSL TAG#2324 | --- | --- | 5023.426 | 2025.612 | 99.57 |
| BM–MCSL TAG#4333 | --- | --- | 5015.226 | 2003.024 | 100.05 |
| BM–MCSL TAG#7252 | --- | --- | 4991.478 | 2011.208 | 99.71 |

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| 1 | 03MAY00 | TITLE BLOCK | KOL | AH |

Designed: AH
Drawn: SNA
Checked:

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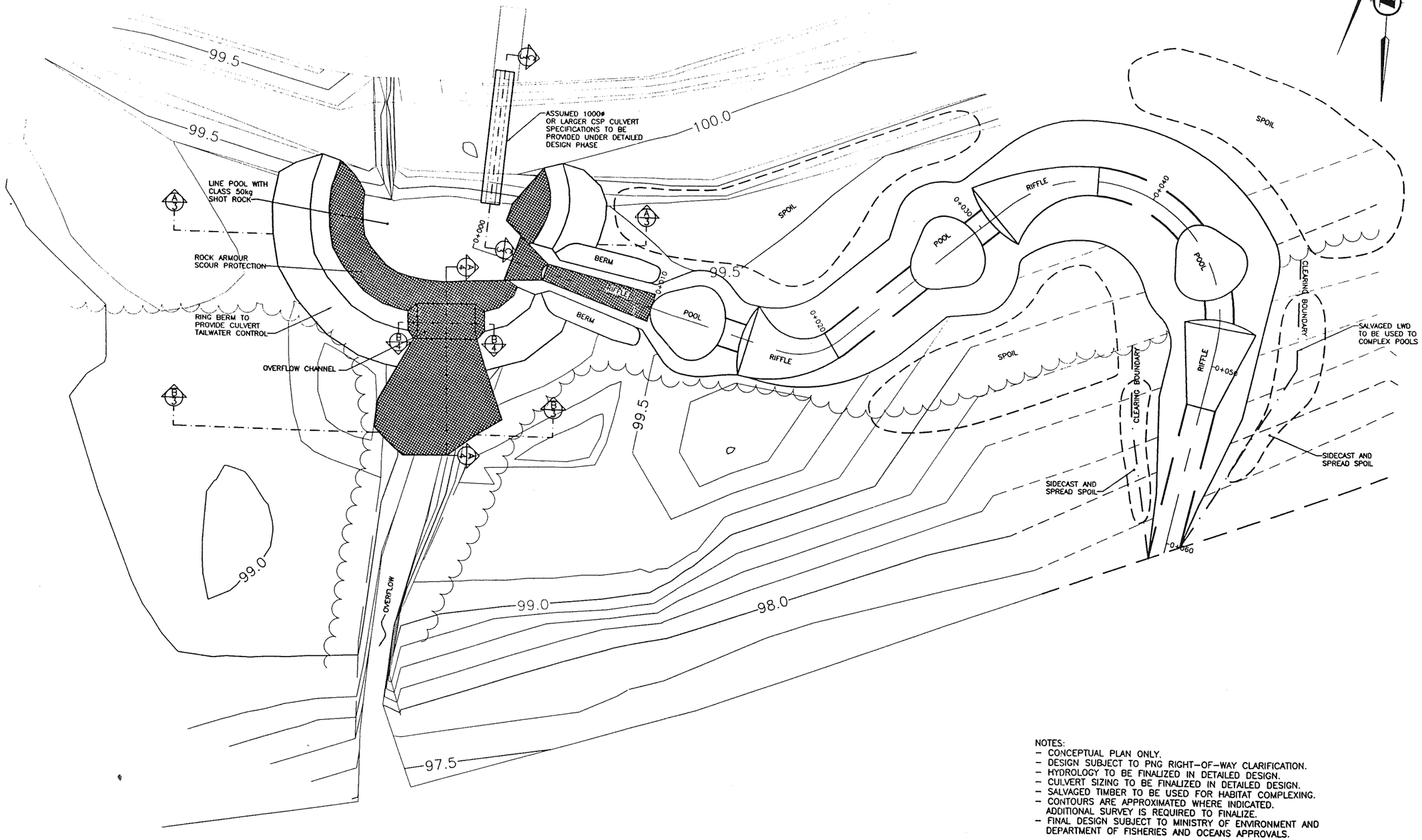
PACIFIC INLAND RESOURCES LTD.

TELKWA SIDE CHANNEL
(NEAR 8.0km - TELKWA RIVER ROAD)

PLAN - EXISTING CONDITIONS

Job No. 2321-00490-0
Scale 1:100
Approved
Date OCT. 1999
Drawing No. 490–02
1

# Km 1010 POND




NOTES:
- CONCEPTUAL PLAN ONLY.
- DESIGN SUBJECT TO PNG RIGHT-OF-WAY CLARIFICATION.
- HYDROLOGY TO BE FINALIZED IN DETAILED DESIGN.
- CULVERT SIZING TO BE FINALIZED IN DETAILED DESIGN.
- SALVAGED TIMBER TO BE USED FOR HABITAT COMPLEXING.
- CONTOURS ARE APPROXIMATED WHERE INDICATED. ADDITIONAL SURVEY IS REQUIRED TO FINALIZE.
- FINAL DESIGN SUBJECT TO MINISTRY OF ENVIRONMENT AND DEPARTMENT OF FISHERIES AND OCEANS APPROVALS.

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| 1 | 03MAY00 | NORTH ARROW | KDL | AH |

| | |
|---|---|
| Designed | SZ |
| Drawn | KDL |
| Checked | AH |

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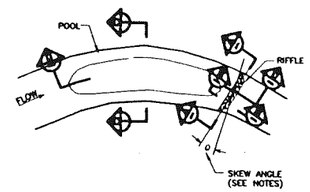
Telephone (250) 635 - 7163 Fax (250) 635 - 9586

PACIFIC INLAND RESOURCES LTD.

# FISH PASSAGE CHANNEL DESIGN FOR Km 1010 POND
# CONCEPT PLAN

| | |
|---|---|
| Job No. | 2321-00490-0 |
| Scale | 1:100 |
| Approved | Drawing No. 490-04 |
| Date | MAR. 2000 |

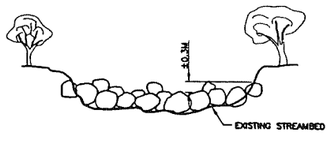
CANCEL PRINTS BEARING PREVIOUS NUMBER



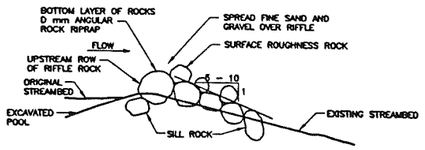

NOTES:

1. UPSTREAM ROCK TO BE OF MINIMUM SIZE 'D' SPECIFIED IN DETAILED DESIGN AND SET INTO OR ON COMPETENT SUBSTRATE.
2. DOWNSTREAM ROCKS CAN BE OF SMALLER SIZE THAN D OR SET INTO SUBSTRATE TO PROVIDE MAXIMUM 5 HORIZ. : TO 1 VERT. DOWNSTREAM SLOPE.
3. A SECOND LAYER OF ROCK WILL BE PLACED ON THE RIFFLE'S DOWNSTREAM SLOPE TO PROVIDE SURFACE ROUGHNESS.
4. SKEW ANGLE θ BETWEEN 0° AND 15° FROM PLANE PERPENDICULAR TO CHANNEL CENTERLINE.
5. POOL EXCAVATION SHOULD BE LIMITED TO OUTSIDE HALF OF MEANDER BEND.
6. WHERE POSSIBLE EXCAVATED MATERIAL SHOULD BE USED TO ARMOUR RIFFLE.
7. PLACEMENT OF SMALL WOODEN DEBRIS INTO POOL TO BE EVALUATED DURING CONSTRUCTION.
8. LOCATION OF LARGE WOODEN DEBRIS TO BE SHOWN ON DETAILED DESIGN.

## TYPICAL POOL/RIFFLE – PLAN

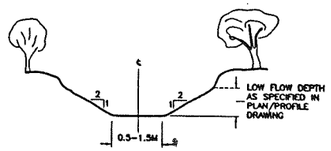



SECTION A



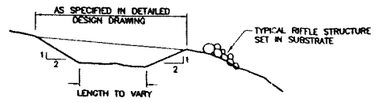

SECTION B

## TYPICAL RIFFLE STRUCTURE




SECTION C

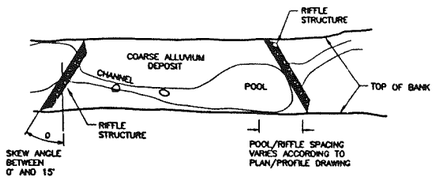
## TYPICAL POOL




POOL PROFILE

SECTION D

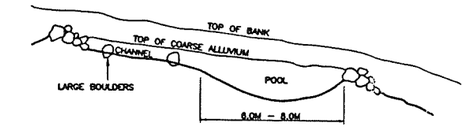
## TYPICAL EXCAVATED POOL



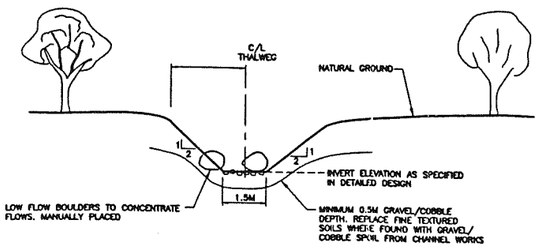

NOTES:

1. LOW FLOW CHANNEL PROVIDED TO ENSURE ADEQUATE FLOW DEPTH BETWEEN POOLS. REQUIRED IN AREAS AS SPECIFIED DURING CONSTRUCTION.
2. LARGE BOULDERS PLACED IN CHANNEL TO FURTHER CONCENTRATE LOW FLOWS.
3. RIFFLE AND POOL GEOMETRY AS PER TYPICAL DETAILS.

## PLAN

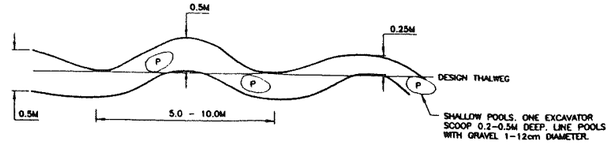



## PROFILE

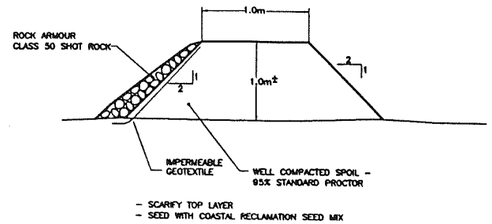



## CHANNEL CROSS–SECTION

## LOW FLOW CHANNEL CONCEPTUAL DETAILS

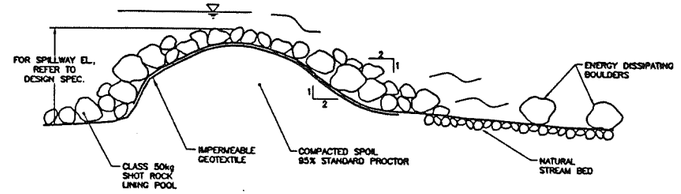



## THALWEG – FINAL SHAPING AND TEXTURING



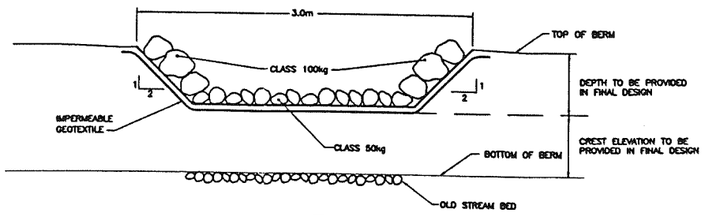

– SCARIFY TOP LAYER
– SEED WITH COASTAL RECLAMATION SEED MIX

## TYPICAL BERM DETAIL




SECTION A/2

## TYPICAL DETAIL OF OVERFLOW CHANNEL




SECTION B/2

## TYPICAL CROSS SECTION OF OVERFLOW CHANNEL

| No. | Date | Revision | Dr. | Ch. |
|---|---|---|---|---|
| | | | | |

Designed SZ
Drawn KDL
Checked AH

McElhanney Consulting Services Ltd.
Suite #1 – 5008 Pohle Avenue, Terrace, B.C., Canada, V8G–4S8
Telephone (250) 635 – 7163 Fax (250) 635 – 9586

McElhanney

PACIFIC INLAND RESOURCES LTD.

FISH PASSAGE CHANNEL DESIGN
FOR Km 1010 POND
**DESIGN TEMPLATE**

Job No. 2321–00490–0
Scale N.T.S.
Approved
Drawing No. 490–06 0
Date MAR. 2000

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CANCEL PRINTS BEARING PREVIOUS NUMBER

CONTRACT NO. 99-FRBC-100
DATE: November 15, 1999

# FOREST RENEWAL SERVICES CONTRACT

Pacific Inland Resources ( a Division of West fraser Sawmills Ltd.) of Smithers B.C. (the "Company") And McElhanney Consulting Services of Smithers B.C. (the "Contractor") agree as follows:

1. The Company has entered into a Multi-Year Agreement (the "FRBC Agreement") with Forest Renewal British Columbia ("FRBC") and has entered into this Contract for the purpose of engaging the Contractor to perform some of the Company's obligations under the FRBC Agreement.

2. The term of this Contract is 5 months beginning on Noveber 15, 1999 and ending on March 31, 2000 unless earlier terminated in accordance with this Contract or extended by agreement in writing between the parties.

3. The Contractor will develop a presription for the modification of the juvenile coho salmon rearing ponds located at 1010km on the Telkwa River Mainline. Prescription is to adress the problems of fish passage into the ponds during peak flow periods.

(the "Contract Services") at the Operating Areas (the "Operating Areas") designated by the Company in the Term Sheets agreed to by the Company and the Contractor from time to time, according to the terms of this Contract and the terms agreed to by the Contractor and the Company from time to time as set out in the Term Sheet for each Operating Area. The Term Sheet for each Operating Area will include, but is not limited to, the terms contained in Schedule A.

4. The Contractor's Federal Goods and Services Tax Registration is: 899 514 889

5. The Contractor's Workers' Compensation Board number is: 512 468 142

6. The Contractor's insurance agent is: Jardine Insurance Services of Canada Inc. of Vancouver B.C.

7. Other Terms and Conditions: As per the attached schedules.

IFI

8. This Contract, which includes the attached Conditions and the Term Sheet for each Operating Area, constitutes the entire agreement between the Company and the Contractor with respect to the Contract Services.

9. The Contractor hereby confirms receipt of a copy of this Contract.

PACIFIC INLAND RESOURCES
(A DIV.) WEST FRASER MILLS LTD.

Company:
Pacific Inland Resources
(A Division of West Fraser Mills Ltd.

Alan Hampshire

Contractor:
McElhanney Consulting Services Ltd.

By: _____
(Authorized Signatory)

By: _____
(Authorized Signatory)

CONTRACT NO. 99-FRBC-100

# FOREST RENEWAL SERVICES CONTRACT CONDITIONS

## PART 1
## OPERATING PROVISIONS

1.1 The Contract Services. The Contractor will at all times during the term of this Contract

(a) perform, as directed by the Company from time to time, all work and services required to perform the Contract Services within the time periods specified by the Company in an environmentally safe and a good workmanlike manner and in compliance with the applicable terms, conditions, and operating standards of any plan, prescription, or other permit applicable to this Contract and any other contract, agreement or other obligation binding on the Company which the Company has disclosed to the Contactor, including, but without limitation, any requirements of the *Forest Practices Code of British Columbia Act* and relevant regulations, standards and guidebooks (collectively referred to as the "Forest Practices Code"),

(b) provide all labour, supervision and, except as otherwise set out in this Contract or agreed in writing by the parties, all materials, equipment and supplies required for the performance of the Contract Services,

(c) exercise the standard of care, skill and diligence normally exercised and observed by competent persons engaged in the performance of activities similar to the Contract Services,

(d) be responsible for the health and safety of all workers, including sub-contractors, performing Contract Services at the Operating Areas and will comply with all legislation which governs any aspect of the employment relationship between the Contractor and its employees, sub-contractors, servants and agents and it is understood that the Company will not be in any way liable for any failure by the Contractor to comply with any such legislation, and

(e) immediately report to the Company if a worker is killed or seriously injured at the Operating Areas.

1.2 Project Signs. The Contractor will erect and maintain a project sign to be supplied by the Company at the Operating Areas as direct by the Company.

1.3 First Priority Hiring Directives and Jobs and Timber Accord. The Company may require the Contractor to comply with directives from the Company or FRBC, to give first priority hiring for work to local displaced forest workers, increase jobs for First Nations people in forest work, and hire qualified local workers, in accordance with eligibility criteria established by the Company or FRBC.

1.4 Payment by the Contractor. The Contractor will at all times

not apply if such fire is caused by the clear and deliberate failure of the Contractor to perform its obligations under this Contract,

(b) the Contractor's responsibility for Firefighting Costs other than those incurred directly by this Contract in respect of any such fire will be limited to the amount by which $500,000 exceeds the lessor of

(i) $100,000, and

(ii) the Firefighting Costs incurred directly by the Contractor in respect of such fire,

(c) provided that such limit will not apply if such fire is caused by the clear and deliberate failure of the Contractor to perform its obligations under this Contract or to the extent that such Firefighting Costs are attributable to the clear and deliberate failure of the Contractor to perform its obligations under this Contract, and

(d) the Contractor will not be responsible for Firefighting Costs for any such fire caused by lightning or by the acts of third parties or the Company, except to the extent that such Firefighting Costs are attributable to the clear and deliberate failure of the Contractor to perform its obligations under this Contract.

2.4 The Company's Responsibility for Firefighting Cost. The Company will

(a) be responsible for Firefighting Costs for fires that occur on or spread onto the Operating Areas to the extent that the Contractor is not responsible for such Firefighting Costs under this Contract, and

(b) reimburse the Contractor for Firefighting Costs for any fire over which the Ministry of Forests assumes jurisdiction and control, but only to the extent that the Company receives payment from the Ministry of Forests for those Firefighting Costs incurred by the Contractor.

2.5 Firefighting Equipment. The Contractor will provide and maintain at its own cost and expense, in good operating condition, firefighting equipment as required by this Contract and in accordance with the requirements of the Company, the Ministry of Forests and any other applicable authority.

## PART 3
## TERMINATION AND SUSPENSION

3.1 Force Majeure. For the purpose of this section "Event of Force Majeure" means any act or event that has had or may reasonably be expected to have an effect on the rights or obligations of either party under this Contract (excepting, however, any obligation of either party to make payments when due, unless timely payment is prevented by the Event of Force Majeure) if such act or event is beyond the reasonable control or responsibility of the party relying thereon as justification for not performing an obligation or complying with any condition required of such party under this Contract and which such party has been unable to overcome by the exercise of due diligence. Such acts or events shall include, but not be limited to, the following:

(a) an act of God, hurricane, tornado, epidemic, landslide, lightning, earthquake, fire or explosion (if such fire or explosion is not caused by the negligence of either party), flood or similar occurrence, and act of public enemy, war (declared or undeclared), blockade, insurrection, riot, embargo, general unrest or restraint of government and people, civil disturbance (including, without limitation, in relation to any aboriginal land claim) or similar occurrence,

(b) a decree, injunction, order, filing, assessment or writ of a court of competent jurisdiction or of a Ministry, government, or governmental authority ("Order") if such Order is not also the result of negligent or wilful action or failure to act of the party relying thereon; provided that the contesting in good faith of any such Order shall not constitute or be construed as a wilful or negligent action of such party,

(c) a change in any laws or enactments applicable to this Contract or the parties, or

(d) a strike, lockout, stoppage, slowdown of work or other labour disturbance against either party, or a sub-contractor or supplier of either party , so long as such party is unable to obtain, after due diligence, a sub-contractor or supplier to replace the affected sub-contractor or supplier and such party has not caused or maintained the strike, lockout, stoppage, slowdown of work or other labour disturbance for the purpose of avoiding its obligations hereunder. An Event of Force Majeure does not include a strike, lockout, work stoppage or other industrial or labour action not specified in this clause.

3.2 Result of Force Majeure. If either party is rendered wholly or partially unable to perform its obligations under this Contract as a result of an Event of Force Majeure, that party will be excused from whatever performance is affected by the Event of Force Majeure, to the extent so affected, provided that

(a) the non-performing party promptly, after the occurrence of the Event of Force Majeure (or becoming aware of the adverse impact of an Event of Force Majeure), gives the other party notice describing the particulars of the occurrence,

(b) the suspension of performance is of no greater scope and of no longer duration that

is required by the Event of Force Majeure,

(c) the non-performing party uses reasonable commercial efforts to remedy its inability to perform, and

(d) when the non-performing party is able to resume performance of its obligations hereunder, the party shall give the other party written notice thereof.

3.3 Curtailment of Operations. The Company may, from time to time during the term of this Contract, direct the Contractor to curtail or temporarily suspend performance of Contract Services for a specified or indefinite period if, in the opinion of the Company, such curtailment or suspension is required due to the effect on the Company's operations of market conditions, over supply of log inventory, failure of carriers to transport or provide transportation or any order, requisition or regulations of any court or governmental or regulatory authority whatsoever, for the lack of any permit approval or authorization from the applicable governmental or regulatory authorities required for the Contract Services under this Contract, and on or before the date on which the Contractor is permitted to resume performance of Contract Services, the Company will notify the Contractor of any extensions of time for the performance of the Contract Services, such extensions to allow a reasonable time for the Contractor to perform the Contract Services.

3.4 Termination by Contractor. If a suspension pursuant to section 3.3 continues for more than 60 consecutive days, the Contractor will have the right to terminate this Contract at any time after the 60th day of such suspension and while such suspension is continuing, by written notice delivered to the Company and on such termination will be entitled to receive payment of any amount due to the Contractor under the Terms of this Contract to the date of such termination.

3.5 Termination by Forest Renewal B.C. If the FRBC Agreement with FRBC expires or is cancelled or terminated, or if FRBC notifies the Company of substantial changes to the services to be provided under the FRBC Agreement or of any change in the funding to be provided by FRBC for such services, the Company may terminate this Contract by written notice delivered to the Contractor.

3.6 Limitation. If this Contract is terminated pursuant to section 3.4 or 3.5, neither party will be liable to compensate the other for loss of profits or increased costs resulting from such early termination, but otherwise all terms and conditions of this Contract will apply in settling the final payment for Contract Services performed to the date of such termination.

3.7 Removal of Equipment and Material. Within 30 days after the expiration or termination of this Contract or such shorter period required by the Company for safety reasons or protection of the environment, the Contractor will remove from the Operating Areas all its structures, vehicles, machinery, tools, equipment, supplies and all waste parts, supplies, materials and containers used in or resulting from the performance of the Contract Services.

3.8 Event of Default. The occurrence of any one or more of the following will constitute an "Event of Default" under this Contract:

(a) the Contractor fails to perform or comply with any of the terms of this Contract or breaches any of its obligations under this Contract and such failure is not remedied within thirty days after written notice specifying the default is given by the Company to the Contractor,

(b) where the Contractor has failed to comply with the Forest Practices Code, *Fisheries Act* or other environmental regulation relevant to the Contractor's operations under this Contract, and the Contractor has not promptly taken all reasonable steps to correct that non-compliance,

(c) the Contractor fails to either commence, make satisfactory progress, or substantially complete the Contract Services,

(d) if any representation or warranty made by the Contractor in this Contract is or becomes untrue or incorrect,

(e) if any information, statement, certificate, report or other document given by or on behalf of the Contractor pursuant to or as a result of this Contract is untrue or incorrect,

(f) an order is made or a resolution is passed or a petition is filed for the liquidation or winding up of the Contractor,

(g) the Contractor becomes insolvent, commits an at of bankruptcy, makes an assignment for the benefit of its creditors or otherwise acknowledges its insolvency,

(h) a bankruptcy petition is filed or presented against, or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,

(i) a receiver or receiver-manager is appointed for any property of the Contractor,

(j) an order is made or other remedy is sought against the Contractor, under the *Companies Creditors Arrangement Act* (Canada),

(k) the Contractor does not pay undisputed bills it owes, after legal proceedings have been started to make the Contractor pay those bills,

(l) the Contractor is, in the opinion of the Company, unable to meet its obligations as the become due, or

(m) the occurrence of a change in the effective management control or voting control of the Contractor.

3.9 Remedies in Default. In addition to the remedies the Company may have available to it, if, in the opinion of the Company, an Event of Default occurs, then the Company may, at its sole discretion and at its

materials, substances, chemicals or waste in the Operating Areas, the lands and waters adjacent to the Operating Areas and the lands and waters over which access is provided to the Operating Areas and perform this Contract in strict compliance with the Company's policies and procedures, and all lawful instructions of any government agency and of the Company, with respect to environmental protection generally, as disclosed to the Contractor, and with respect to the Forest Practices Code and *Fisheries Act* in particular.

4.5 Environmental Compliance. Without limiting the generality of any other provision of this Contract, the Contractor will

(a) comply with the Forest Practices Code, *Fisheries Act* and all other relevant environmental legislation,

(b) comply with the Company□s policies and operating procedures with respect to the Forest Practices Code and other environmental legislation,

(c) provide adequate supervision and training for its employees and keep accurate records of such training,

(d) immediately notify the Company of any possible contravention of the Forest Practices Code, *Fisheries Act* or other environmental legislation arising from or related to the Contractor□s operations under this Contract,

(e) immediately notify the Company of any communication with government authorities in respect of the Contractor□s operations under this Contract that is reasonably expected to affect the Company□s interests,

(f) notify the Company of any charges or penalties levied against the Contractor under the Forest Practices Code, *Fisheries Act* or other environmental legislation, and

(g) participate in any training arranged or required by the Company in respect of compliance with the Forest Practices Code.

4.6 Skills Development and Fair Wage Act. Where applicable, the Contractor will comply with and be subject to all terms and conditions of the *Skills Development and Fair Wage Act* (B.C.) ("*Fair Wage Act*") and its regulations. Where the *Fair Wage Act* applies, the Contractor will ensure that

(a) wages paid under this Contract will be subject to the *Fair Wage Act* and any regulations promulgated under the *Fair Wage Act*, and shall not be less than the rates set out in the *Fair Wage Act* for each trade classification,

(b) that neither it nor any sub-contractor enter into an agreement for the Contract Services with a contractor named on the "List of Non-Complying Contractors", as provided, created and maintained by the Employment Standards Branch, and

(c) regardless of any other term in this Contract, non-compliance with the *Fair Wage Act* by the Contractor, where it applies, whether voluntary or involuntary, gives the Company the right to do one or more of the following:

(i) terminate this Contract,

(ii) suspend any payment until compliance with the *Fair Wage Act* has been met,

(iii) hold back sufficient funds to cover the claims for unpaid fair wages, and

(iv) make such wage payments directly to tradespeople, if so directed by the Director of Employment Standards Branch.

## PART 5
## INDEMNITY AND INSURANCE

5.1 Indemnity. The Contractor will indemnify and hold harmless the Company, its employees and agents from and against any and all losses, claims, damages, actions, causes of action, costs and expenses of whatsoever kind or nature that the Company, its employees and agents may incur, suffer or be put to either before or after the expiration or termination of this Contract, by reason of any act or omission of the Contractor, its employees, officers, directors, shareholders or agents, or any sub-contractors or supplier of materials or services or any of their employees, officers, directors, shareholders or agents, as a result of or in any way arising out of this Contract. Such indemnification survives the termination or expiration of this Contract and any sub-contract.

5.2 Insurance. During the term of this Contract, the Contractor will ensure that specific insurance is purchased and maintained, as acting prudently the Contractor considers appropriate in the circumstances, including but not limited to:

(a) comprehensive liability coverage for not less than $2,000,000 per occurrence against bodily injury, personal injury and property damage,

(b) comprehensive "Forest Fire Fighting Expense" liability coverage in an amount not less than $1,000,000,

(c) liability insurance in an amount not less than $500,000, covering any losses, damages or claims that may arise out of the aerial drift of chemicals including fertilizer, where the Contractor carries out aerial herbicide, pesticide or fertilization activities under this Contract, and

(d) automobile liability insurance on all vehicles owned, operated, or licensed in the

## PART 7
## RESOLUTION OF DISPUTES

7.1 Arbitration. All disputes that arise between the Contractor and the Company under or in connection with this Contract will be referred to arbitration before a single arbitrator appointed in accordance with this Part.

7.2 Demand for Arbitration. Either party (the "Claimant") may at any time during the term of this Contract or within three months of the termination of this Contract give notice to the other party (the "Respondent") demanding arbitration of a dispute under this Contract and setting out a description of the dispute and a statement of the Claimant's claim against the Respondent.

7.3 Appointment of Arbitrator. An arbitrator will be appointed by agreement of the parties, or if they do not so agree within 14 days after the date of delivery of the demand for arbitration, either party may request the appointment of an arbitrator (other than a person who is a registered arbitrator under the Timber Harvesting Contract and Subcontract Regulation) by the British Columbia International Commercial Arbitration Centre ("BCICAC").

7.4 Procedure. All arbitrations under this Contract will be conducted in accordance with the *Commercial Arbitration Act* (British Columbia) and the rules of BCICAC governing arbitrations of commercial disputes.

7.5 Location of Arbitration. Each arbitration under this Contract will take place at a location agreed to by the parties or, if they do not so agree before the appointment of the arbitrator, at a location determined by the arbitrator.

7.6 Binding Effect. The parties irrevocably submit to arbitration pursuant to this Part and agree that decisions of an arbitrator will be final and binding on them.

7.7 Costs of Arbitration. Each party will be responsible for fees and expenses incurred by it in connection with an arbitration pursuant to this Part and the fees and expenses of the arbitrator will be borne by the parties equally.

## PART 8
## REPRESENTATIONS AND WARRANTIES

8.1 Representations and Warranties. The Contractor represents and warrants to the Company, with the intention that the Company will rely on it in entering into this Contract that

(a) the Contractor does not know of any fact that materially adversely affects, or could materially adversely affect, its properties, assets, condition (financial or otherwise), business or operations or its ability to fulfil its obligations under this Contract,

(b) the Contractor is not in breach of, or in default under, any law, statute, enactment or regulation of Canada or of the Province of British Columbia, that applies to or is binding on it, that materially affects or could affect its ability to fulfil its obligations under this Contract,

(c) the Contractor has the power, capacity and authority to accept, execute, deliver and perform this Contract, and

(d) this Contract is binding upon and enforceable against the Contractor.

## PART 9
## GENERAL PROVISIONS

9.1 Relationship. The Contractor is an independent contractor and not the servant, employee, agent or partner of the Company. No partnership, joint venture, agency or other legal entity is created by or will be deemed to be created by this Contract or any actions of the parties under this Contract.

9.2 No Authority to Bind the Company. The Contractor has no authority to, and will not, commit the Company to pay any person, firm or corporation, except as set out in this Contract.

9.3 Liens. The Contractor will not, by reason of this Contract or anything done by it pursuant hereto, acquire any rights, interest or title in or to any property of the Company, other than payments made to and received by the Contractor pursuant to this Contract, and will not purport to mortgage, charge, pledge or otherwise encumber such property.

9.4 Notices. Every notice, consent, request, demand or direction (each, for the purposes of this section, a "notice") to be given pursuant to this Contract by either party to the other will be in writing and will be delivered or sent by registered or certified mail postage prepaid and mailed in any government post office in British Columbia to the address of the applicable recipient set out on the first page of this Contract or to such other address in British Columbia as is specified by the particular party by notice to the other and a notice delivered or so sent will be deemed to have been given and received

(a) if delivered, on the day of delivery, or

(b) if mailed, on the earlier of the day of receipt and the fifth day after the day of mailing.

9.5 Interruption in Mail Service. If a notice is sent by mail and mail service between the point of mailing and the destination is interrupted by strike, slowdown, Event of Force Majeure or other cause within seven days before or after the time of mailing, the notice will not be deemed to be received until actually received, and the party sending the notice will use another service which has not been so interrupted or will deliver the notice in order to ensure prompt receipt.

9.6 Time. Time will be of the essence of this Contract.

waived, except with the written consent of the Company. Written waiver in one instance by the Company of any term or breach by the Contractor of this Agreement is not waiver in any other instance.

END OF TERMS AND CONDITIONS

# Schedule B
# Project Timelines

| Task | Completion Date |
|---|---|
| Site Survey | December 31, 1999 |
| Draft Conceptual Design and Report | ~~February 15, 2000~~ March 7, 2000 AFH 1st Feb 2000 |
| Final Detailed Design and Report | March 31, 2000 Aspenfeed w/ Alan Baxter telecon 1st Feb 2000 |

# Schedule C
# Project Costs

| | Rate | Site Visit | Hyraulics | Design | Drafting | Reports | Cost |
|---|---|---|---|---|---|---|---|
| | $/hr | hrs | hrs | hrs | hrs | hrs | $ |
| **Site Survey & Additional Site Survey** | | | | | | | |
| Engineer | $75 | 10 | - | - | - | - | $750 |
| Survey Assistant | $50 | 10 | - | - | - | - | $500 |
| Survey equipment | LS | - | - | - | - | - | $130 |
| Vehicle | LS | - | - | - | - | - | $240 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$1,620** |
| **Site Plan & Updated Site Plan** | | | | | | | |
| Engineer | $75 | - | - | - | - | 2 | $150 |
| Technician | $50 | - | - | - | 8 | - | $400 |
| Draftsperson | $40 | - | - | - | 12 | - | $480 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$1,030** |
| **Proj Man / Admin / Disbursements** | | | | | | | |
| Senior Engineer | $80 | - | - | - | - | 2 | $160 |
| Clerical | $40 | - | - | - | - | 2 | $80 |
| Design Check | $75 | - | - | - | - | - | $0 |
| Computer | | - | - | - | - | - | $200 |
| Disbursements | | | | | | | $50 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$490** |
| **Total for Site Plan (Smithers) (Original & Additional Information)** | | | | | | | **$3,140** |
| **Site Visit** | | | | | | | |
| Engineer | $65 | 7 | 0 | - | 0 | - | $455 |
| Vehicle | LS | - | - | - | - | - | $120 |
| Disbursements | | | | | | | $35 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$610** |
| **Conceptual Design & Report** | | | | | | | |
| Sr Engineer | $75 | - | - | 2 | - | - | $150 |
| Engineer | $65 | - | 8 | 16 | - | - | $1,560 |
| Draftsperson | $50 | - | - | - | 24 | - | $1,200 |
| Secreterial | $38 | | | | | 4 | $152 |
| Disbursements | | | | | | | $200 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$3,262** |
| **Detailed Design & Report** | | | | | | | |
| Sr. Engineer | $75 | - | - | 2 | 0 | 0 | $150 |
| Engineer | $65 | - | - | 16 | - | 6 | $1,430 |
| Draftsperson | $50 | - | - | - | 16 | - | $800 |
| Clerical | $38 | | | | | 4 | $152 |
| Disbursements | | | | | | | $110 |
| | | | | | | | |
| **Sub-Total** | | | | | | | **$2,642** |
| **Total for Design (Terrace)** | | | | | | | **$6,514** |

**OVERALL TOTAL** **$9,654**

# SCHEDULE "A-1" - SERVICES

## 1.0 SCOPE OF WORK

The Telkwa drainage has been the focus of fish habitat restoration and enhancement efforts by Pacific Inland Resources (PIR) and the Department of Fisheries and Oceans (DFO) and the Watershed Restoration Program (WRP) since 1994. The goal of the WRP is to maintain and monitor the projects that have been constructed in the Telkwa Watershed that will provide information, and ultimately direction, on how to proceed with projects of a similar nature on other interior watersheds in the Skeena Region and throughout the province.

These technical specifications are for the improvement and modification design of the rearing pond at km 1010 of the Telkwa FSR. Specifically, the project will result in an engineered design to improve the water flow though the ponds and the pond entrance stream.

## 2.0 CONTRACT TERM:

The term of this contract will be from **November 1999** to ***March 31, 2000.***

## 3.0 CONTRACT MONITOR(S):

The principal technical monitor will be:

WRP Fisheries Specialist
BC Environment, Skeena Region
Box 5000
Smithers, BC V0J 2N0

Phone: (604) 847-7337
Fax: (604) 847-7556

Alan Baxter
Pacific Inland Resources
Tatlow Road
Smithers BC V0J 2N0
Phone: (250) 847 2656
Fax: (250) 847 5520

## 4.0 PROJECT TASKS AND DELIVERABLES

### 4.1 Rearing Pond Modifications for km 1010 Ponds on Telkwa FSR

#### 4.1.1 Scope

Water flow at the pond inlet over the past two years has limited the immigration and emigration of juveniles to the rearing ponds. In order that these ponds can be used, by juvenile Coho, to their maximum productivity a detailed site review and engineered plan for improvement must be completed. Based on the engineered plan and recommendations a detailed improvement work plan will be developed for the 1010 Km ponds.

#### 4.1.2 Tasks

The Contractor will:

(a) Conduct a detailed engineered site survey of the 1010 rearing ponds to outline the existing conditions of the pond and an elevational profile.

(b) Develop a conceptual design and report on how the pond entrance can be improved to allow fish passage through out the year, and how the ponds water holding capacity can be improved.

(c) After review by Pacific Inland Resources and Ministry of Environment produce a final detailed design and report for improvement works to be conducted in the 2000/01 fiscal year.

#### 4.1.3 Deliverables

Based on the Tasks in Paragraph 4.1.2 of this Schedule "B", the Contractor will provide the Province with the following deliverables:

**a.** Two (2) copies of a report summarizing the findings from the initial site survey, and the final detailed design for the pond improvements. One copy of the report will be bound and the other will be electronic (Word 7.0 format on CD ROM)This report will be presented to the Technical Monitor and the WRP Fisheries Specialist by **March 31, 2000.**

## 2.6 Gitsegucla Band Survey, Design and Assessment

The Survey, Design and Assessment project began with a contract partnership between PIR and the Gitsegucla Band Counsel of South Hazelton BC. A tributary of the Kitseguecla River (Tributary 11) was the site of the project. It was found that fish passage was likely impeded from a beaver damn complex. The objective of this project was to provide a prescription for the development of fish passage past the beaver damns to allow fish access to roughly 3000 square metres of rearing habitat.

CONTRACT NO. 99-FRBC-27
DATE: February,16 2000

# FOREST RENEWAL SERVICES CONTRACT

**Gitsegukla Band Council**

of **South Hazelton, British Columbia, 36 Cascade Avenue VOJ 2R0**

(the "Contractor") agree as follows:

1. The Company has entered into a Multi-Year Agreement (the "FRBC Agreement") with Forest Renewal British Columbia ("FRBC") and has entered into this Contract for the purpose of engaging the Contractor to perform some of the Company's obligations under the FRBC Agreement.

2. The term of this Contract is 7 months beginning on Sept1, 1999 and ending on March 31, 2000 unless earlier terminated in accordance with this Contract or extended by agreement in writing between the parties.

3. The Contractor will perform Detailed Assessment of streams/survey and design as per the attached standards agreement and schedules

(the "Contract Services") at the Operating Areas (the "Operating Areas") designated by the Company in the Term Sheets agreed to by the Company and the Contractor from time to time, according to the terms of this Contract and the terms agreed to by the Contractor and the Company from time to time as set out in the Term Sheet for each Operating Area. The Term Sheet for each Operating Area will include, but is not limited to, the terms contained in Schedule A.

**[NOTE: This Contract should be used only for Contract Services that DO NOT constitute "a phase of a timber harvesting operation" as defined in the Timber Harvest Contract and Sub-Contract Regulation.]**

4. The Contractor's Federal Goods and Services Tax Registration is: Not Applicable

5. The Contractor's Workers' Compensation Board number is: 1931631

6. The Contractor's insurance agent is: North Country Insurance, Smithers B.C.

7. Other Terms and Conditions: This contract requires that the contractor ensure that all aspects of the Ministry of Environment, Lands, and Parks Standards Agreement are met

8. This Contract, which includes the attached Conditions and the Term Sheet for each Operating Area, constitutes the entire agreement between the Company and the Contractor with respect to the Contract Services.

9. The Contractor hereby confirms receipt of a copy of this Contract.

**PACIFIC INLAND RESOURCES**
(A DIV.) WEST FRASER MILLS LTD.

Company:
Pacific Inland Resources
(A Division of West Fraser Mills Ltd.

By: _____
(Authorized Signatory)

Contractor:
Gitsegukla Band Council.

By: _____
(Authorized Signatory)

CONTRACT NO. 99-FRBC-27

# FOREST RENEWAL SERVICES CONTRACT CONDITIONS

## PART 1
## OPERATING PROVISIONS

1.1 The Contract Services. The Contractor will at all times during the term of this Contract

(a) perform, as directed by the Company from time to time, all work and services required to perform the Contract Services within the time periods specified by the Company in an environmentally safe and a good workmanlike manner and in compliance with the applicable terms, conditions; and operating standards of any plan, prescription, or other permit applicable to this Contract and any other contract, agreement or other obligation binding on the Company which the Company has disclosed to the Contactor, including, but without limitation, any requirements of the *Forest Practices Code of British Columbia Act* and relevant regulations, standards and guidebooks (collectively referred to as the "Forest Practices Code"),

(b) provide all labour, supervision and, except as otherwise set out in this Contract or agreed in writing by the parties, all materials, equipment and supplies required for the performance of the Contract Services,

(c) exercise the standard of care, skill and diligence normally exercised and observed by competent persons engaged in the performance of activities similar to the Contract Services,

(d) be responsible for the health and safety of all workers, including sub-contractors, performing Contract Services at the Operating Areas and will comply with all legislation which governs any aspect of the employment relationship between the Contractor and its employees, sub-contractors, servants and agents and it is understood that the Company will not be in any way liable for any failure by the Contractor to comply with any such legislation, and

(e) immediately report to the Company if a worker is killed or seriously injured at the Operating Areas.

1.2 Project Signs. The Contractor will erect and maintain a project sign to be supplied by the Company at the Operating Areas as direct by the Company.

1.3 First Priority Hiring Directives and Jobs and Timber Accord. The Company may require the Contractor to comply with directives from the Company or FRBC, to give first priority hiring for work to local displaced forest workers, increase jobs for First Nations people in forest work, and hire qualified local workers, in accordance with eligibility criteria established by the Company or FRBC.

1.4 Payment by the Contractor. The Contractor will at all times

(a) pay promptly as they become due all charges for and with respect to labour, materials, equipment, supplies, services and sub-contractors used or contracted for in the performance of the Contract Services, including, without limitation, all wages, salaries and other remuneration due to employees, and all assessments and employee deductions under the *Woodworker Lien Act of British Columbia*, the *Employment Standards Act of British Columbia*, the *Workers Compensation Act of British Columbia*, the *Unemployment Insurance Act of Canada*, the *Income Tax Act of Canada*, the *Income Tax Act of British Columbia* and the *Canada Pension Plan Act of Canada*,

(b) on request, deliver to the Company evidence to the Company's satisfaction, of the payment of the charges, assessments and deductions referred to in paragraph a, including receipted payrolls under *the Woodworker Lien Act of British Columbia*, and

(c) pay as they become due all applicable income, sales, commodity and service taxes payable by the Contractor in respect of the performance of the Contract Services.

1.5 Builder's Lien Act. Where the *Builders Lien Act* (B.C.) applies to the Contract Services under this Contract, the Contractor shall comply with the provisions of the *Builders Lien Act* and if the Contractor receives legal advice that it is or may be a person primarily liable on a contract within the provisions of the *Builders Lien Act*, the Contractor will holdback monies pursuant to the provisions of the *Builders Lien Act* and otherwise comply with the provisions of that Act as it deems necessary or desirable.

## PART 2
## FIREFIGHTING

2.1 Firefighting. The Contractor will use all reasonable efforts to prevent, control, contain and extinguish all fires, however caused, that occur on or spread onto the Operating Areas, and ensure at all times during the performance of this Contract that a person who has been trained to a level acceptable to the Company in the areas of fire suppression techniques, fire behaviour and fireline safety is present on the site where this Contract is being performed,

2.2 Firefighting Cost. For the purposes of section 2.3 and 2.4, "Firefighting Costs" means all costs and expenses reasonably incurred by the Contractor or the Company, or by third parties whose costs and expenses the Contractor or the Company is liable for, in connection with the containment, control or extinguishment of fires that occur on, spread onto, or could reasonably be expected to spread onto the Operating Areas.

2.3 The Contractor's Responsibilities for Firefighting Costs. Subject to section 2.4, the Contractor will be responsible for all Firefighting Costs for fires that occur on or spread onto the Operating Areas, or can reasonably be expected to spread onto the Operating Areas, except that

(a) the Contractor's responsibility for Firefighting Costs incurred directly by the Contractor in respect of any such fire will be limited to $100,000, provided that such limit will

not apply if such fire is caused by the clear and deliberate failure of the Contractor to perform its obligations under this Contract,

(b) the Contractor's responsibility for Firefighting Costs other than those incurred directly by this Contract in respect of any such fire will be limited to the amount by which $500,000 exceeds the lessor of

(i) $100,000, and

(ii) the Firefighting Costs incurred directly by the Contractor in respect of such fire,

(c) provided that such limit will not apply if such fire is caused by the clear and deliberate failure of the Contractor to perform its obligations under this Contract or to the extent that such Firefighting Costs are attributable to the clear and deliberate failure of the Contractor to perform its obligations under this Contract, and

(d) the Contractor will not be responsible for Firefighting Costs for any such fire caused by lightning or by the acts of third parties or the Company, except to the extent that such Firefighting Costs are attributable to the clear and deliberate failure of the Contractor to perform its obligations under this Contract.

2.4 The Company's Responsibility for Firefighting Cost. The Company will

(a) be responsible for Firefighting Costs for fires that occur on or spread onto the Operating Areas to the extent that the Contractor is not responsible for such Firefighting Costs under this Contract, and

(b) reimburse the Contractor for Firefighting Costs for any fire over which the Ministry of Forests assumes jurisdiction and control, but only to the extent that the Company receives payment from the Ministry of Forests for those Firefighting Costs incurred by the Contractor.

2.5 Firefighting Equipment. The Contractor will provide and maintain at its own cost and expense, in good operating condition, firefighting equipment as required by this Contract and in accordance with the requirements of the Company, the Ministry of Forests and any other applicable authority.

## PART 3
## TERMINATION AND SUSPENSION

3.1 Force Majeure. For the purpose of this section "Event of Force Majeure" means any act or event that has had or may reasonably be expected to have an effect on the rights or obligations of either party under this Contract (excepting, however, any obligation of either party to make payments when due, unless timely payment is prevented by the Event of Force Majeure) if such act or event is beyond the reasonable control or responsibility of the party relying thereon as justification for not performing an obligation or complying with any condition required of such party under this Contract and which such party has been unable to overcome by the exercise of due diligence. Such acts or events shall include, but not be limited to, the following:

(a) an act of God, hurricane, tornado, epidemic, landslide, lightning, earthquake, fire or explosion (if such fire or explosion is not caused by the negligence of either party), flood or similar occurrence, and act of public enemy, war (declared or undeclared), blockade, insurrection, riot, embargo, general unrest or restraint of government and people, civil disturbance (including, without limitation, in relation to any aboriginal land claim) or similar occurrence,

(b) a decree, injunction, order, filing, assessment or writ of a court of competent jurisdiction or of a Ministry, government, or governmental authority ("Order") if such Order is not also the result of negligent or wilful action or failure to act of the party relying thereon; provided that the contesting in good faith of any such Order shall not constitute or be construed as a wilful or negligent action of such party,

(c) a change in any laws or enactments applicable to this Contract or the parties, or

(d) a strike, lockout, stoppage, slowdown of work or other labour disturbance against either party, or a sub-contractor or supplier of either party , so long as such party is unable to obtain, after due diligence, a sub-contractor or supplier to replace the affected sub-contractor or supplier and such party has not caused or maintained the strike, lockout, stoppage, slowdown of work or other labour disturbance for the purpose of avoiding its obligations hereunder. An Event of Force Majeure does not include a strike, lockout, work stoppage or other industrial or labour action not specified in this clause.

3.2 Result of Force Majeure. If either party is rendered wholly or partially unable to perform its obligations under this Contract as a result of an Event of Force Majeure, that party will be excused from whatever performance is affected by the Event of Force Majeure, to the extent so affected, provided that

(a) the non-performing party promptly, after the occurrence of the Event of Force Majeure (or becoming aware of the adverse impact of an Event of Force Majeure), gives the other party notice describing the particulars of the occurrence,

(b) the suspension of performance is of no greater scope and of no longer duration that

is required by the Event of Force Majeure,

(c) the non-performing party uses reasonable commercial efforts to remedy its inability to perform, and

(d) when the non-performing party is able to resume performance of its obligations hereunder, the party shall give the other party written notice thereof.

3.3 Curtailment of Operations. The Company may, from time to time during the term of this Contract, direct the Contractor to curtail or temporarily suspend performance of Contract Services for a specified or indefinite period if, in the opinion of the Company, such curtailment or suspension is required due to the effect on the Company's operations of market conditions, over supply of log inventory, failure of carriers to transport or provide transportation or any order, requisition or regulations of any court or governmental or regulatory authority whatsoever, for the lack of any permit approval or authorization from the applicable governmental or regulatory authorities required for the Contract Services under this Contract, and on or before the date on which the Contractor is permitted to resume performance of Contract Services, the Company will notify the Contractor of any extensions of time for the performance of the Contract Services, such extensions to allow a reasonable time for the Contractor to perform the Contract Services.

3.4 Termination by Contractor. If a suspension pursuant to section 3.3 continues for more than 60 consecutive days, the Contractor will have the right to terminate this Contract at any time after the 60th day of such suspension and while such suspension is continuing, by written notice delivered to the Company and on such termination will be entitled to receive payment of any amount due to the Contractor under the Terms of this Contract to the date of such termination.

3.5 Termination by Forest Renewal B.C. If the FRBC Agreement with FRBC expires or is cancelled or terminated, or if FRBC notifies the Company of substantial changes to the services to be provided under the FRBC Agreement or of any change in the funding to be provided by FRBC for such services, the Company may terminate this Contract by written notice delivered to the Contractor.

3.6 Limitation. If this Contract is terminated pursuant to section 3.4 or 3.5, neither party will be liable to compensate the other for loss of profits or increased costs resulting from such early termination, but otherwise all terms and conditions of this Contract will apply in settling the final payment for Contract Services performed to the date of such termination.

3.7 Removal of Equipment and Material. Within 30 days after the expiration or termination of this Contract or such shorter period required by the Company for safety reasons or protection of the environment, the Contractor will remove from the Operating Areas all its structures, vehicles, machinery, tools, equipment, supplies and all waste parts, supplies, materials and containers used in or resulting from the performance of the Contract Services.

3.8 Event of Default. The occurrence of any one or more of the following will constitute an "Event of Default" under this Contract:

(a) the Contractor fails to perform or comply with any of the terms of this Contract or breaches any of its obligations under this Contract and such failure is not remedied within thirty days after written notice specifying the default is given by the Company to the Contractor,

(b) where the Contractor has failed to comply with the Forest Practices Code, *Fisheries Act* or other environmental regulation relevant to the Contractor□s operations under this Contract, and the Contractor has not promptly taken all reasonable steps to correct that non-compliance,

(c) the Contractor fails to either commence, make satisfactory progress, or substantially complete the Contract Services,

(d) if any representation or warranty made by the Contractor in this Contract is or becomes untrue or incorrect,

(e) if any information, statement, certificate, report or other document given by or on behalf of the Contractor pursuant to or as a result of this Contract is untrue or incorrect,

(f) an order is made or a resolution is passed or a petition is filed for the liquidation or winding up of the Contractor,

(g) the Contractor becomes insolvent, commits an at of bankruptcy, makes an assignment for the benefit of its creditors or otherwise acknowledges its insolvency,

(h) a bankruptcy petition is filed or presented against, or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,

(i) a receiver or receiver-manager is appointed for any property of the Contractor,

(j) an order is made or other remedy is sought against the Contractor, under the *Companies Creditors Arrangement Act* (Canada),

(k) the Contractor does not pay undisputed bills it owes, after legal proceedings have been started to make the Contractor pay those bills,

(l) the Contractor is, in the opinion of the Company, unable to meet its obligations as the become due, or

(m) the occurrence of a change in the effective management control or voting control of the Contractor.

3.9 Remedies in Default. In addition to the remedies the Company may have available to it, if, in the opinion of the Company, an Event of Default occurs, then the Company may, at its sole discretion and at its

option, do either or both of the following:

(a) terminate the Contract, and/or

(b) take any other action the Company considers appropriate.

## PART 4
## REGULATORY COMPLIANCE

4.1 Compliance with the Law. The Contractor will comply with all applicable laws, statutes, enactments and regulations of Canada and the Province of British Columbia, including federal, provincial, regional and municipal laws, by-laws, rules and regulations. Specifically, the Contractor will

(a) comply with all laws affecting the Contract Services including the *Workers' Compensation Act* ("*WC Act*") and its regulations, the *Employment Standards Act* and its regulations and the *Human Rights Code*, including:

(i) ensuring that the required Workers Compensation Board of British Columbia ("WCB") coverage is provided for itself, all workers employed or engaged in carrying out the Contract Services,

(ii) ensuring that all sub-contractors and other individuals employed or engaged in carrying out the Contract Services have the required WCB coverage,

(iii) complying with requirements of the *WC Act* and regulations, pay for all assessments and levies associated with the Contract Services and upon request provide the Company with proof of such compliance, and

(b) obtain all authorities, licences, permits and approvals required by law to carry out the work and provide proof of having obtained these documents upon request by the Company.

4.2 Permits and Licences. The Contractor will obtain and pay for all permits and licences (other than permits and licences held from time to time by the Company or available only to the Company) required for the performance of the Contract Services, including the licensing and certification of equipment and operators.

4.3 Hazardous and Toxic Materials. Except as expressly authorized by the Company and in compliance with all applicable laws, the Contractor will not discharge, deposit, store or transport any pollutant, contaminant or hazardous or toxic material, substance, chemical or waste, and will not permit any person under its direction or control to do so.

4.4 Environmental Clean Up. The Contractor will use all reasonable efforts to contain, clean up, and minimize damage resulting from spills or discharge of pollutants, contaminants or hazardous or toxic

materials, substances, chemicals or waste in the Operating Areas, the lands and waters adjacent to the Operating Areas and the lands and waters over which access is provided to the Operating Areas and perform this Contract in strict compliance with the Company's policies and procedures, and all lawful instructions of any government agency and of the Company, with respect to environmental protection generally, as disclosed to the Contractor, and with respect to the Forest Practices Code and *Fisheries Act* in particular.

4.5 Environmental Compliance. Without limiting the generality of any other provision of this Contract, the Contractor will

(a) comply with the Forest Practices Code, *Fisheries Act* and all other relevant environmental legislation,

(b) comply with the Company□s policies and operating procedures with respect to the Forest Practices Code and other environmental legislation,

(c) provide adequate supervision and training for its employees and keep accurate records of such training,

(d) immediately notify the Company of any possible contravention of the Forest Practices Code, *Fisheries Act* or other environmental legislation arising from or related to the Contractor□s operations under this Contract,

(e) immediately notify the Company of any communication with government authorities in respect of the Contractor□s operations under this Contract that is reasonably expected to affect the Company□s interests,

(f) notify the Company of any charges or penalties levied against the Contractor under the Forest Practices Code, *Fisheries Act* or other environmental legislation, and

(g) participate in any training arranged or required by the Company in respect of compliance with the Forest Practices Code.

4.6 Skills Development and Fair Wage Act. Where applicable, the Contractor will comply with and be subject to all terms and conditions of the *Skills Development and Fair Wage Act* (B.C.) ("*Fair Wage Act*") and its regulations. Where the *Fair Wage Act* applies, the Contractor will ensure that

(a) wages paid under this Contract will be subject to the *Fair Wage Act* and any regulations promulgated under the *Fair Wage Act*, and shall not be less than the rates set out in the *Fair Wage Act* for each trade classification,

(b) that neither it nor any sub-contractor enter into an agreement for the Contract Services with a contractor named on the "List of Non-Complying Contractors", as provided, created and maintained by the Employment Standards Branch, and

(c) regardless of any other term in this Contract, non-compliance with the *Fair Wage Act* by the Contractor, where it applies, whether voluntary or involuntary, gives the Company the right to do one or more of the following:

(i) terminate this Contract,

(ii) suspend any payment until compliance with the *Fair Wage Act* has been met,

(iii) hold back sufficient funds to cover the claims for unpaid fair wages, and

(iv) make such wage payments directly to tradespeople, if so directed by the Director of Employment Standards Branch.

## PART 5
## INDEMNITY AND INSURANCE

5.1 Indemnity. The Contractor will indemnify and hold harmless the Company, its employees and agents from and against any and all losses, claims, damages, actions, causes of action, costs and expenses of whatsoever kind or nature that the Company, its employees and agents may incur, suffer or be put to either before or after the expiration or termination of this Contract, by reason of any act or omission of the Contractor, its employees, officers, directors, shareholders or agents, or any sub-contractors or supplier of materials or services or any of their employees, officers, directors, shareholders or agents, as a result of or in any way arising out of this Contract. Such indemnification survives the termination or expiration of this Contract and any sub-contract.

5.2 Insurance. During the term of this Contract, the Contractor will ensure that specific insurance is purchased and maintained, as acting prudently the Contractor considers appropriate in the circumstances, including but not limited to:

(a) comprehensive liability coverage for not less than $2,000,000 per occurrence against bodily injury, personal injury and property damage,

(b) comprehensive "Forest Fire Fighting Expense" liability coverage in an amount not less than $1,000,000,

(c) liability insurance in an amount not less than $500,000, covering any losses, damages or claims that may arise out of the aerial drift of chemicals including fertilizer, where the Contractor carries out aerial herbicide, pesticide or fertilization activities under this Contract, and

(d) automobile liability insurance on all vehicles owned, operated, or licensed in the

Contractor's name, in an amount not less than $2,000,000 per vehicle.

5.3 Additional Insurance. In addition to the indemnification and insurance required under this Part, the Company may, from time to time, require the Contractor to maintain and pay for such additional specific insurance related to the Contract Services, as the Company acting reasonably determines is necessary or desirable.

5.4 Nature of Insurance. The Contractor's insurance will be primary and not require the sharing of any loss by an insurer of the Company's and the Contractor will add the Company as an additional insured.

5.5 Proof of Insurance. The Contractor will, upon a request from the Company, provide the Company with evidence that the Contractor has obtained all required insurance, by providing the Company with a completed Province of British Columbia Certificate of Insurance.

## PART 6
## DUTY TO REPORT AND RECORDS

6.1 Reporting Variances. If the Contractor becomes aware of, or expects that the Contract Services to be completed or the outputs to be achieved under this Contract will vary from those originally contemplated in this Contract, the Contractor will immediately report this fact, in a written report, to the Company.

6.2 Books of Accounts. The Contractor will permit the Company, or its agent with written authorization from the Company, during normal business hours, to examine and copy and take away copies of any or all of the books of account and records (including supporting documents) that may be necessary or desirable in the Company's or its agent's opinion to verify the Contractor's compliance with this Contract.

6.3 Documents not Directly in the Contract's Control. The Contractor will ensure that the person who has control of such information or documents described in section 6.2 freely permits access to them.

6.4 Records to be retained. The Contractor will maintain accurate books of accounts and records (including supporting documents) in accordance with Generally Accepted Accounting Principles and keep the books of account and records (including supporting documents) for a period of three years after the later of:

(a) the completion of the Contract Services, or

(b) the term of the FRBC Agreement.

## PART 7
## RESOLUTION OF DISPUTES

7.1 Arbitration. All disputes that arise between the Contractor and the Company under or in connection with this Contract will be referred to arbitration before a single arbitrator appointed in accordance with this Part.

7.2 Demand for Arbitration. Either party (the "Claimant") may at any time during the term of this Contract or within three months of the termination of this Contract give notice to the other party (the "Respondent") demanding arbitration of a dispute under this Contract and setting out a description of the dispute and a statement of the Claimant's claim against the Respondent.

7.3 Appointment of Arbitrator. An arbitrator will be appointed by agreement of the parties, or if they do not so agree within 14 days after the date of delivery of the demand for arbitration, either party may request the appointment of an arbitrator (other than a person who is a registered arbitrator under the Timber Harvesting Contract and Subcontract Regulation) by the British Columbia International Commercial Arbitration Centre ("BCICAC").

7.4 Procedure: All arbitrations under this Contract will be conducted in accordance with the *Commercial Arbitration Act* (British Columbia) and the rules of BCICAC governing arbitrations of commercial disputes.

7.5 Location of Arbitration. Each arbitration under this Contract will take place at a location agreed to by the parties or, if they do not so agree before the appointment of the arbitrator, at a location determined by the arbitrator.

7.6 Binding Effect. The parties irrevocably submit to arbitration pursuant to this Part and agree that decisions of an arbitrator will be final and binding on them.

7.7 Costs of Arbitration. Each party will be responsible for fees and expenses incurred by it in connection with an arbitration pursuant to this Part and the fees and expenses of the arbitrator will be borne by the parties equally.

## PART 8
## REPRESENTATIONS AND WARRANTIES

8.1 Representations and Warranties. The Contractor represents and warrants to the Company, with the intention that the Company will rely on it in entering into this Contract that

(a) the Contractor does not know of any fact that materially adversely affects, or could materially adversely affect, its properties, assets, condition (financial or otherwise), business or operations or its ability to fulfil its obligations under this Contract,

(b) the Contractor is not in breach of, or in default under, any law, statute, enactment or regulation of Canada or of the Province of British Columbia, that applies to or is binding on it, that materially affects or could affect its ability to fulfil its obligations under this Contract,

(c) the Contractor has the power, capacity and authority to accept, execute, deliver and perform this Contract, and

(d) this Contract is binding upon and enforceable against the Contractor.

## PART 9
## GENERAL PROVISIONS

9.1 Relationship. The Contractor is an independent contractor and not the servant, employee, agent or partner of the Company. No partnership, joint venture, agency or other legal entity is created by or will be deemed to be created by this Contract or any actions of the parties under this Contract.

9.2 No Authority to Bind the Company. The Contractor has no authority to, and will not, commit the Company to pay any person, firm or corporation, except as set out in this Contract.

9.3 Liens. The Contractor will not, by reason of this Contract or anything done by it pursuant hereto, acquire any rights, interest or title in or to any property of the Company, other than payments made to and received by the Contractor pursuant to this Contract, and will not purport to mortgage, charge, pledge or otherwise encumber such property.

9.4 Notices. Every notice, consent, request, demand or direction (each, for the purposes of this section, a "notice") to be given pursuant to this Contract by either party to the other will be in writing and will be delivered or sent by registered or certified mail postage prepaid and mailed in any government post office in British Columbia to the address of the applicable recipient set out on the first page of this Contract or to such other address in British Columbia as is specified by the particular party by notice to the other and a notice delivered or so sent will be deemed to have been given and received

(a) if delivered, on the day of delivery, or

(b) if mailed, on the earlier of the day of receipt and the fifth day after the day of mailing.

9.5 Interruption in Mail Service. If a notice is sent by mail and mail service between the point of mailing and the destination is interrupted by strike, slowdown, Event of Force Majeure or other cause within seven days before or after the time of mailing, the notice will not be deemed to be received until actually received, and the party sending the notice will use another service which has not been so interrupted or will deliver the notice in order to ensure prompt receipt.

9.6 Time. Time will be of the essence of this Contract.

9.7 Right of Set-Off. The Company may at any time deduct and set-off any amount payable to the Contractor under this Contract against any amount payable by the Contractor under this Contract or otherwise.

9.8 Deduction and Holdbacks. The Company may deduct and holdback the following amounts from amounts otherwise payable to the Contractor pursuant to this Contract and may remit such amounts to the applicable authority on the Contractor's behalf or pay such amount to the Contractor when permissible:

(a) statutory deductions and holdbacks as required by applicable legislation, and

(b) Workers Compensation remittances at the applicable labour percentage, unless the Contractor delivers evidence of payment of such amounts to the Company.

9.9 Interpretation. For the purposes of this Contract, except as otherwise expressly provided

(a) a reference to a corporation includes, and is also a reference to, a corporation that is its successor, and

(b) a word referring to a corporation includes an individual and a word in the singular includes the plural and vice versa.

9.10 Assignment and Sub-Contracting. Except with the prior written consent of the Company, the Contractor will not at any time

(a) assign, mortgage, pledge, transfer or encumber any of its rights under this Contract except the right to receive payments for completed Contract Services in accordance with the provisions of this Contract, or

(b) permit by way of sub-contract or otherwise the performance of any part of this Contract Services by any person other than the Contractor or the Contractor's employees.

9.11 Successors and Assigns. This Contract will operate to the benefit of and be binding upon the Contractor and its successors and permitted assigns and the Company and its assigns.

9.12 Change in Control. If the Contractor is a corporation or partnership, any event or transaction by which effective management control or voting control of the Contractor changes or will change from one person or group of persons to another person or group of persons will be deemed to be an assignment for the purposes of this Contract.

9.13 Non-Corporate Contractors. The heirs, executors and administrators of a deceased Contractor will be entitled to the benefit of this Contract only to the extent of receiving payment of amounts, after all applicable deductions, to which the Contractor would have been entitled under this Contract.

9.14 Non-Waiver. No term of this Agreement and no breach by the Contractor of any such term may be

waived, except with the written consent of the Company. Written waiver in one instance by the Company of any term or breach by the Contractor of this Agreement is not waiver in any other instance.

END OF TERMS AND CONDITIONS

# SCHEDULE A

# (STANDARDS AGREEMENT)

BRITISH COLUMBIA

Ministry of
Environment,
Lands and Parks

# Standards Agreement

| | |
|---|---|
| MULTI-YR AGMT NUMBER: 0000101<br>ANNUAL AGMT NUMBER: NA<br>ACTIVITY NUMBER: 708824 | THIS AGREEMENT DATED FOR REFERENCE FEBUARY 14, 2000 |
| FOR: DAS- SURVEY, DESIGN AND ASSESSMENT AT SITE #14 ON TRIBUTARY 11 OF THE KITSEGUCLA RIVER SOUTH . | |

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**BETWEEN:**

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, (the "Province") as represented by the Minister of Environment, Lands and Parks

Smithers FLNRO
3726 Alfred Ave.
Box 5000, Smithers BC V0J 2N0
Phone Number: (250) 847-7260
Fax Number: (250) 847-7556

**AND:**

Pacific Inland Resources . (the "Recipient")

Box 3130
Smithers BC, V0J 2N0
Phone Number: (250) 847-2656
Fax Number: (250) 847-5520

both of whom are sometimes referred to as "the Parties" and each of whom is a "Party" to this Agreement.

**WHEREAS:**

A. The Province wishes the Work described in this Agreement to be carried out for the benefit of Forest Renewal BC.

B. The Recipient seeks to carry out and complete the Work described in the attached Schedule(s).

C. The Recipient has entered or intends to enter into an Annual or Multi-Year Agreement with Forest Renewal BC for the purpose of funding the Work.

**THE PARTIES AGREE AS FOLLOWS:**

## ARTICLE 1 DEFINITIONS

1.01 In this document, the following words have the following meanings:

(a) "**Agreement**" means this agreement including any Schedules;

(b) **"Changed Condition"** means a materially changed physical condition at the Work Area which

i) was not foreseen by the Recipient; and

ii) would not have been reasonably foreseen by a reasonable Recipient who, before submitting its tender, conducted a thorough investigation of the work to be done to complete the Work, including a thorough inspection of the Work and a review of all information available from the Province to persons wishing to submit tenders , but does not include any generally recurring weather conditions ;

(c) **"Contractor"** means the Recipient;

(d) **"Environmental Damage"** means slumping or sliding of land; inordinate soil disturbance; significant deterioration of water quality or other significant damage to the environment; and for the purposes of this definition, "inordinate soil disturbance" and "other significant

damage to the environment" have the meanings, where appropriate, given to them in the Forest Practices Code.

(e) **"Forest Practices Code"** means the Forest Practices Code of British Columbia Act and Regulations and Standards to that Act;

(f) **"Ministry Representative"** means a person appointed pursuant to section 5.01;

(g) **"Occupied Area"** means any Work Area, camp or rest area, or any other area occupied by the Recipient for the purposes of this Agreement;

(h) **"Recipient Representative"** means a person designated pursuant to Article 5.04;

(i) **"Schedule"** means a schedule of this Agreement;

(j) **"Subcontractor"** means a person, firm or corporation contracting with the Recipient to perform a part or parts of the Work, or to supply products worked to a special design according to the Agreement, but does not include one who merely supplies products not so worked;

(k) **"Term"** means the period of time this Agreement is in force pursuant to Article 3;

(l) **"Work"** means all

i) labour, supervision, and administration;

ii) provision of materials, transportation, supplies, tools, and equipment; and

iii) other services and provision of materials

necessary or desirable to perform the services described in each Schedule, and includes any services which are not expressly described which are nevertheless necessary for the proper execution of the work.

(m) **"Work Area"** means individual location, forest stands, or other particular areas or locations where work is to be undertaken and any areas of Crown Land occupied by the Recipient for purposes of the Work;

(n) **"Work Day"** means every day of the week except Saturday, Sunday and statutory holidays.

1.02 If a word defined in section 1.01 is used in a Schedule, it has the same meaning as in this document unless the context dictates otherwise.

1.03 A word or abbreviation which has a well known technical or trade meanings is used in the Schedule(s) in accordance with that recognized meaning.

1.04 The headings in this Agreement have been inserted for reference only. They do not define, limit, alter or enlarge the meaning of any provision of this Agreement.

## ARTICLE 2 SCHEDULES AND CHANGES

**Schedules**

2.01 The Schedules, listed below, apply to and form part of this Agreement

| | | |
|---|---|---|
| ☒ | Schedule "A" | Survey and Design Submissions for Tributary 11 of Kitseguela South |
| ☒ | Appendix "A" | Work Plan as outlined by the Implementing Partner the Gitsegukla Band council |

**Changes**

2.02 No change to this Agreement is effective unless it is in writing and signed by the Parties.

**Interpretation**

2.03 Any reference in a Schedule to a manual or a form is a reference to a manual or form published by or for the Province and includes every amendment to it and any manual or form published from time to time in substitution for it or replacement of it.

2.04 The Forest Practices Code, if applicable, takes precedence over an approved prescription. An approved prescription, if applicable, outlining work covered by this Agreement takes precedence over this document. This document takes precedence over any of its attachments. In the event of a conflict between alike Schedules or other attachments of different dates, the Schedule or other attachments of later date prevails.

## ARTICLE 3 TERM OF AGREEMENT AND START OF WORK

3.01 The Term of this Agreement is to start June 1, 1999 and end March 31, 2000 unless otherwise provided in the Schedule(s).

3.02 The Parties may agree to extend the term of this Agreement.

3.03 The Recipient must not conduct any Work under this Agreement until:

(a) the Recipient has entered into a Multi-Year Agreement or Annual Agreement with Forest Renewal BC to fund the Work covered under this Agreement; and,

(b) the Recipient Representative has met with the Ministry Representative to review the Work.

3.04 Time is of the essence in this Agreement.

**Schedule of Work**

3.05 The Recipient must complete the Work according to the work completion timing schedule of the Work Progress Report(s). The actual date the Province notifies the Recipient to start Work and the continuity of the Work depend on the presence of suitable field conditions to allow the Work to be completed as outlined in the Schedule(s).

## ARTICLE 4 STANDARDS AGREEMENT AND MULTI-YEAR/ANNUAL AGREEMENT LINKAGE

4.01 This Agreement constitutes a Standards Agreement as defined in the Multi-Year Agreement or Annual Agreement between the Recipient and Forest Renewal BC dated for reference

## ARTICLE 5 PARTY REPRESENTATIVES

**Ministry Representative**

5.01 The Province must appoint a Ministry Representative who has full authority to act on behalf of the Province to ensure compliance with all terms of this Agreement.

5.02 Upon entering into this Agreement, the Province must notify the Recipient of the name of the Ministry Representative.

5.03 The Province may substitute a Ministry Representative at any time, but must immediately notify the Recipient of the change.

**Recipient Representative**

5.04 The Recipient must designate a Recipient Representative, who has full authority to act on behalf of the Recipient in connection with the Work and this Agreement;

5.05 Upon entering into this Agreement, the Recipient must notify the Province of the name, address and telephone number of the Recipient Representative designated pursuant to section 5.04.

5.06 The Recipient must not substitute a Recipient Representative without written notice to the Ministry Representative.

5.07 If, in the reasonable opinion of the Ministry Representative, the Recipient Representative is not suitably experienced or is unable to properly supervise the Work or communicate with the Ministry Representative, then the Recipient must, upon receipt of written notice from the Ministry Representative, replace that representative and immediately notify the Province of that change.

## ARTICLE 6 PERMITS, AUTHORIZATIONS AND PRESCRIPTIONS

6.01 Where the Recipient is carrying out Work which relates to a statutory obligation of the Province under the Forest Practices Code, then the Recipient is carrying out that work as a contractor to the Province.

6.02 Without limiting the generality of section 6.01, where the Work is work that the Province is required to carry out under the Forest Practices Code, including work referred to in section 23.1 and 24.1, then the Province will provide any necessary prescriptions or other Forest Practices Code approval documents and the Recipient will ensure that the Work complies with the prescription and other Forest Practices Code approval documents.

## ARTICLE 7 WORK PROGRESS PLAN AND STANDARDS OF PERFORMANCE

**Work Progress Plan**

7.01 The Recipient Representative must meet with the Ministry Representative before starting Work to:

(a) review the Schedule(s) and work performance requirements;

(b) jointly develop a Work Progress Plan(s) outlining the project scope, goals, work completion timing schedule, location and any special requirements of the Work; and

(c) inspect any Work Area, if requested by the Ministry Representative.

7.02 The Work Progress Plan must provide for the orderly completion of all Work, comply with all provisions of this Agreement, and be satisfactory to the Province.

7.03 The Work Progress Plan may divide the Work into separate phases or completion zones.

7.04 The Work Progress Plan forms part of this Agreement. Work must be carried out and completed in accordance with the Work Progress Plan.

**Standards of Performance**

7.05 The Recipient must, before starting any Work, satisfy itself as to:

(a) the nature and magnitude of the Work;

(b) the general character, quality and quantity of the equipment and materials required to carry out and complete the Work; and

(c) the qualifications, skills and abilities of its personnel and personnel of Sub-Contractors or other parties engaged in carrying out the Work in order to ensure the Work is carried out in accordance with this Agreement.

7.06 The Recipient must at all times exercise the standard of care, skill and diligence ordinarily exercised and observed by persons engaged in the performance of activities similar to the Work.

7.07 The Work must be carried out under the direct and continuous supervision of the Recipient or a qualified authorized agent of the Recipient who:

(a) speaks English and understands spoken and written English, or has access to a translator, to the reasonable satisfaction of the Ministry Representative; and

(b) is present at the Work Area when the Work is carried out.

**Subcontractor Work**

7.08 If the Recipient engages a Subcontractor, the Recipient is not relieved from the subcontracted obligations or any obligations under this Agreement.

7.09 The Recipient must not assign this Agreement, or subcontract any obligations under this Agreement, without prior written notification to the Province.

7.10 The Recipient must notify the Province of the name, office address and office telephone number of the Recipient's Subcontractor(s).

7.11 The actions of any Subcontractor engaged to carry out any of the Work are deemed the actions of the Recipient.

7.12 Nothing in this Agreement creates any direct or indirect contractual relationship between the Province and any Subcontractor.

## ARTICLE 8 INDEMNIFICATION AND INSURANCE

**Indemnity**

8.01 The Recipient must indemnify and save harmless the Province, its employees, agents and authorized representatives, and each of them from and against losses, claims, damages, actions, and causes of action (collectively referred to as "Claims"), that the Province may sustain, incur, suffer or be put to at any time either before or after the expiration or termination of this Agreement, that arises out of errors, omissions or negligent acts of the Recipient or its subcontractor(s), servant(s), agent(s) or employee(s) under this Agreement, excepting always that this indemnity does not apply to the extent, if any, to which the Claims are caused by errors, omissions or negligent acts of the Province, its other Recipient(s), authorized representatives, or any other person.

8.02 None of the Minister of Environment, Lands and Parks or the Ministry Representative in charge, their agents or employees are personally liable for any act performed in the discharge of any duty imposed or in the exercise of any power or authority conferred upon them by, or within the scope of, the Agreement if it can be demonstrated that all reasonable care was exercised in the conduct of the operations; in all such matters these persons act solely as agents and representatives of the Province.

8.03 Neither the Province nor any of its employees or agents are liable to the Recipient or the Recipient's employees or agents for any injury, loss, or damage however occasioned to any of them or their property while being transported or conveyed in any vessel, boat, aircraft owned or operated by the Province The Recipient must not make claims against the Province, its employees or agents to recover any such injury, loss or damage either on its own behalf or on behalf of its employees or agents. The Recipient must indemnify and save harmless the Province, its employees or agents from any such claims initiated by the Recipient's employees or agents.

**Insurance**

8.04 During the Term the Recipient must carry and maintain insurance coverage as specified in the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC and, if applicable, as specified in writing by the Province.

## ARTICLE 9 PROTECTION OF WORK AND PROPERTY

**General**

9.01 The Recipient must protect the Work area and property adjacent to any Work Area, from damage and is responsible for damage which may arise as the result of the Recipient's operations under the Agreement, except damage which occurs as a result of:

(a) an error in a Schedule; or

(b) an act or omission of the Province, third parties, or other Recipients, its agent or employees.

**Protection of the Environment**

9.02 The Recipient must not cause Environmental Damage in carrying out the Work under this Agreement.

9.03 Subject to 9.04, The Recipient is not in breach of 9.02 if:

(a) performing the Work according to an operational plan, or permit issued under the Forest Practices Code; or

(b) the Work performed by the Recipient has been exempted from a requirement to have an operational plan or prescription and the Recipient is carrying out the Work in accordance with the Forest Practices Code.

9.04 If the Recipient encounters circumstances where the Recipient knows or should reasonably know that, due to weather conditions or site factors, proceeding with the Work may, directly or indirectly, cause Environmental Damage, the Recipient must:

(a) immediately suspend the Work that may cause Environmental Damage;

(b) immediately advise the Province of the suspension and circumstances;

(c) not proceed with the Work until the Province so instructs; and

(d) upon the Province's instruction to proceed with the Work, do so in accordance with the Province's instructions.

9.05 The Recipient is not in breach of this Agreement for suspending Work pursuant to Section 9.04.

9.06 If the Recipient causes Environmental Damage while performing Work under this Agreement, the Recipient must:

(a) immediately stop the Work in the area affected;

(b) prevent any further damage to the environment;

(c) immediately notify the Province to the attention of the Ministry Representative; and

(d) take any remedial measures that the Ministry Representative requires.

9.07 The Recipient may resume Work that has been stopped under 9.06 when:

(a) Work can be resumed without violating sections 9.02 and 9.04; and

(b) All remedial measures required under section 9.06 have been carried out to the satisfaction of the Ministry Representative.

## ARTICLE 10 GOVERNING LAW

10.01 This Agreement is governed by and is to be construed in accordance with the laws of the Province of British Columbia.

10.02 The Parties will comply with the laws of Canada and British Columbia applicable to the Work and the Work Area.

## ARTICLE 11 CHANGES IN CONDITIONS

11.01 If a Changed Condition occurs during the course of the Work, the following applies:

(a) The Parties must immediately advise each other of particulars of the Changed Condition and the Recipient Representative and the Ministry Representative who each have authority to act in respect of that Schedule must meet to attempt to deal with the condition.

(b) If in the opinion of either Party, that Changed Condition is so substantial that amending this Agreement to deal with the change would change the essential nature of the Work, then the Parties must not proceed with the Work in respect of that Schedule any further and that Work must be brought to an end.

## ARTICLE 12 WORK COMPLETION AND ACCEPTABILITY OF WORK

**Notification of Completion**

12.01 The Recipient must, upon completing a phase of the Work, and the entire Work, promptly notify the Province of that completion. The notification must be in writing, and must be delivered to the Province during the Province's normal business hours.

**Inspection by the Province**

12.02 The Province may, following receipt of the Recipient's notification in 12.01, inspect and determine the acceptability of the Work performed in accordance with a Schedule.

12.03 The Recipient is encouraged, but not required, to observe each inspection while it is being conducted.

12.04 The Province must provide the Recipient with a copy of inspection results.

12.05 The Province reserves the right to inspect at any time, any Work performed.

12.06 Inspections are conducted by the Province in order to determine compliance with the provisions of this Agreement. These inspections are conducted for the sole benefit of the Province, and do not release the Recipient from the responsibility of providing quality control measures to assure that the Work strictly complies with this Agreement.

12.07 The Province and the Recipient may agree on a schedule for the Province to make its determination on the acceptability of the Work and to provide its notification to Forest Renewal BC.

12.08 Notwithstanding 12.07, The Province will make its determination on the acceptability of the Work and notify Forest Renewal BC of their decision within one year of the notification in 12.01.

12.09 The Province is not obliged to make any determination of acceptability before receiving the Recipient's written notification in 12.01.

## ARTICLE 13 MEASUREMENT

**Method of Measurement**

13.01 All linear and area measurements under this Agreement are measured on the horizontal plane.

## ARTICLE 14 NON-COMPLIANCE AND TERMINATION

**Termination by the Province**

14.01 The Province may, in its sole discretion, terminate this Agreement at any time. The Province is not liable for any losses occasioned by that termination if the termination:

(a) occurs before the Ministry Representative receives the written notification of the Recipient that they will commence Work;

(b) is caused by the Recipient's failure to perform or comply with this Agreement;

(c) results from the termination of the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC; or

(d) is caused by an Act of God, unsuitable weather, natural disaster, withdrawal of labour in labour disputes, or any other unforeseeable cause over which the Province has no direct control.

**Termination by the Recipient**

14.02 The Recipient may terminate this Agreement if the Recipient's Multi-Year Agreement or Annual Agreement with Forest Renewal BC is terminated, and no claim may be made by the Province against the Recipient for any losses occasioned by that termination.

**Mutual Termination**

14.03 This Agreement may be terminated at any time by the mutual consent of the Parties.

14.04 If a party is unable to perform any obligation under this Agreement because of an Event of Force Majeure (as that term is defined in the Recipient's Multi-Year Agreement with Forest Renewal BC), that inability shall not be a default under this Agreement.

**Non-Compliance with Agreement Provisions**

14.05 If, in the opinion of the Province, the Recipient fails to perform or fails to comply with any of its obligations under this Agreement, the Province may, in its discretion do one or more of the following:

(a) require the Recipient to re-work the area or phase of work;

(b) permit the Work to continue, giving the Recipient a time limit for compliance, rectification or both;

(c) order the Recipient to stop the Work until the alleged failure of compliance is dealt with according to the Province's requirements;

(d) specify on Quality Certificate(s) that the Recipient failed to perform or comply with one or more of its obligations;

(e) terminate all or part of this Agreement.

These remedies are in addition to any other remedies available to the Province.

14.06 The Province may inspect any re-worked area or phase of the work. The results of that inspection supersede any previous inspection results.

## ARTICLE 15 DISPUTE RESOLUTION

15.01 If a dispute occurs between the Parties concerning any matter governed by this Agreement, the disputing Party must promptly advise the other Party and the Parties together must use all reasonable efforts to resolve the dispute.

15.02 Despite section 15.01, the Ministry Representative may give the Recipient instructions that, in the reasonable opinion of the Ministry Representative, are necessary to provide for the proper performance of the Work. The Recipient must act immediately to carry out the instructions, but any work performed by the Recipient in this respect is without prejudice to any claim the Recipient may have concerning the dispute.

15.03 If the Parties are unable to resolve the dispute informally within five Work Days, then the Recipient must give to the Ministry Representative written particulars of the complaint, which must include the following:

(a) a detailed description of the nature of the complaint;

(b) a list of the relevant provisions of the Schedule(s); and

(c) an evaluation by the Recipient of the matters in dispute.

15.04 The Province must, within 20 Work Days of receipt by the Ministry Representative of the written particulars, advise the Recipient, in writing, of any one of the following:

(a) that the Province accepts the position of the Recipient; or

(b) that the Province rejects the position of the Recipient.

15.05 If the Province accepts the position of the Recipient, the Parties will amend this Agreement if necessary and the Province will advise Forest Renewal BC .

15.06 If the Province rejects the Recipient's position, the Parties must retain a mutually agreed upon person to make a written recommendation to resolve the dispute. Any costs associated with retaining that person must be jointly paid by the Parties.

15.07 If after a review of the written recommendation, the Parties agree on a resolution of the dispute, the Parties must amend this Agreement if necessary and the Recipient must provide Forest Renewal BC with a copy.

15.08 If after a review of the written recommendation, the Parties are unable to resolve the dispute and the dispute is with respect to payment only, this dispute is deemed to be between the Recipient and Forest Renewal BC, and the Recipient's position and the written recommendation must be forwarded to Forest Renewal BC. Despite the foregoing, the resolution of a dispute under a Multi-Year Agreement or Annual Agreement does not prejudice any claim the Province may have against Forest Renewal BC in respect of the Work.

15.09 A copy of the written recommendation and the Province's position may be forwarded by the Province to the appropriate professional association.

## ARTICLE 16 MISCELLANEOUS

**Confidentiality**

16.01 The Recipient must treat as confidential all material that has been produced or received by it or any Subcontractor as a result of this Agreement (collectively the "Material") and not permit its disclosure without the Province's prior written consent except as required by applicable law, including the *Freedom of Information and Protection of Privacy Act*.

**Ownership**

16.02 The Material and any equipment provided by the Province to the Recipient or a Subcontractor as a result of this Agreement is the exclusive property of the Province. The Recipient must deliver it to the Province immediately following expiration of this Agreement, or sooner upon the Province's request, in the same condition it was supplied to the Recipient, excepting always loss or damage attributable to reasonable wear or tear.

**Copyright**

16.03 The copyright in the Material belongs exclusively to the Province. Upon the Province's request, the Recipient must deliver to the Province documents satisfactory to it waiving in the Province's favour any moral rights which the Recipient or Subcontractors or their employees may have in the Material and confirming the vesting of the copyright in the Province.

**Recipient Status**

16.04 Except as otherwise provided in this Agreement, the Recipient is not subject to the control of the Province in respect of the manner in which the Work is carried out.

16.05 The Recipient must not purport to commit the Province to the payment of any money to any person.

16.06 The Recipient must ensure all personnel hired by the Recipient to perform the Work are at all times employees of the Recipient and not of the Province.

**Notices**

16.07 Any notice or document required to be given under this Agreement is conclusively deemed validly given or delivered to and received by the Parties

(a) if hand delivered personally, on the date of that personal delivery;

(b) if mailed, on the fifth business day after the mailing of the same in British Columbia by prepaid post to the addresses set out in this Agreement (or at such other address as either Party may from time to time designate by notice in writing to the other); or

(c) if sent by facsimile transmission, when transmitted, only if transmitted to the facsimile machine numbers first above written. The onus of proving transmission and receipt lies with the transmitting Party.

**Non-Waiver**

16.08 A waiver of any provision of this Agreement or a waiver of a breach by a Party of any provision of this Agreement is effective only if it is in writing and signed by the other Party.

16.09 A written waiver by either Party of any provision of this Agreement or of any breach by the other Party of any provision of this Agreement is not a waiver of any subsequent breach of the same or any other provision of this Agreement.

**Recipient Provisions**

16.10 Except as specified in the Schedule(s), the Recipient must undertake all Work and furnish all labour, equipment, supervision, transportation, supplies and incidentals necessary to perform the Work.

**Unsuitable Workers**

16.11 The Recipient must ensure all persons employed to perform the Work are competent, adequately trained , fully instructed and supervised, and legally entitled to work in Canada.

16.12 The Recipient must, upon request of the Ministry Representative, remove any person it employs for purposes of the Agreement who, in the reasonable opinion of the Ministry Representative, is incompetent or has conducted himself or herself improperly, and the Recipient must not permit a person who has been so removed to perform any further Work.

**Survival of Terms**

16.13 Sections 7.01, 7.02, 8.01, 8.02, 15,01, 15.02 and 15.03 will, despite the expiration or earlier termination of the Term of this Agreement, remain and continue in full force and effect.

**Site Clean Up**

16.14 The Recipient must maintain the Work Area free from accumulations of waste products or debris, other than that caused by the Province, other recipients or third parties.

16.15 Upon the Recipient vacating the Work Area, the Ministry Representative may determine , at his or her sole discretion, whether or not the area was left in an acceptable condition.

16.16 If the Ministry Representative determines the Recipient left the Occupied Area in an unacceptable condition, the Province may repair the area or remove waste products or debris and recommend to Forest Renewal BC a deduction in payment to the Recipient equal to the cost of repairs or removal

**Camping and Parking**

16.17 Use of Provincial Crown forest land, including any roads, landings or Ministry of Forests recreational sites, by the Recipient, the Recipient's employees or agents for the purposes of lodgings, camping, vehicle parking or trailer parking in connection with Work under this Agreement, is permitted only with prior written approval of the Ministry Representative. That use, if approved, must be without charge to the Recipient; but, the approval may be revised or revoked at any time by the Province.

16.18 **Powers Cumulative**

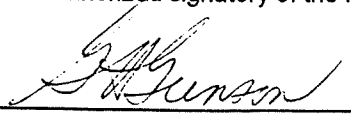
The powers set out in the Schedule(s) for the Province to enforce the Recipient's compliance with this Agreement may be exercised separately, concurrently, or cumulatively.

**IN WITNESS OF WHICH** the Parties have duly executed this Agreement as of the date first above written.

**SIGNED AND DELIVERED**
on behalf of the Province by an authorized representative of the Province

Authorized Signatory
Ministry of Environment, Lands and Parks

**SIGNED AND DELIVERED**
by or on behalf of the Recipient (or by an authorized signatory of the Recipient)



Recipient or Authorized Signatory

## 1. PURPOSE AND SCOPE OF WORK

The aquatic habitat restoration site survey and design work encompassed in these technical specifications, is the third stage of habitat restoration, as it is a part of the Watershed Restoration Program. An overview assessment of the fish, fish habitat and riparian zone was conducted and, based on existing information and photography, priorized the watershed's sub-basins for the future rehabilitation work based on resource priority and severity of impacts on the resource. A Level 1 detailed field aquatic and riparian habitat assessment was conducted in the high priority sub-basins. It involved detailed field surveys of the aquatic and riparian habitat and the impacts to that habitat. Habitat attributes are identified and where appropriate, conceptual rehabilitation options are developed. After survey an design work is completed and approved, the designs will be implemented in the works phase and then rehabilitation project will be monitored and evaluated to assess its effectiveness and recommend changes to the design, if necessary.

The Recipient shall complete works as per the conceptual prescription outlined by BioLith in "Level 1 FHAP of Kitseguecla River South", 1998, for site #14 on Tributary 11 of Kitseguecla River South.

1. The Recipient is to perform a fish presence assessment, report the fish presence, rough map the location of the fish access problem(s) within the site if any, and discuss the workplan proposal for survey.

2. Upon approval of the workplan, as required, the recipient will proceed with survey of the site, and prescribe remedy with alternatives as appropriate. The site is to be surveyed to the extent required for Type 1 design.

## 2. DEFINITIONS

In this document, the following terms have the following meanings:

**GIS** means Geographic Information Systems
**RIC** means Resource Inventory Committee
**FHAP** means Fish Habitat Assessment Procedure
**RAPP** means Riparian Assessment and Prescription Procedures
**MoF** means Ministry of Forests
**MoELP** means Ministry of Environment, Lands and Parks
**TRIM** means Terrain Resources Information Management
**WRTC** means Watershed Restoration Technical Circular
**LWD** means Large Woody Debris (also referred to as LOD - Large Organic Debris)
**LLD** means Large Lithic Debris (i.e. rocks, boulders, rip-rap, etc.)
**Project Types** means Type I-IV (further defined below), based on the work that is being surveyed and designed.

**Instream Project Types:**

**TYPE I** involves work where there would be alteration of the channel bottom and/or where streambed profiles are modified/impacted for a longitudinal distance of less than 50m, including:

- placement and anchoring of LWD for cover
- Anchoring of existing log jams
- Placement and anchoring of LWD and boulder clusters to induce scour
- Pool construction
- Gravel cleaning

and/or work involving Bank Stabilisation using:

- LLD
- LWD
- Re-vegetation of bank areas

**TYPE II** involves work where there would be alteration of the channel bottom, where streambed profiles are modified/impacted for a longitudinal distance of more than 50m, including:

- construction of pool riffle sequences using boulders;
- channel/gravel excavation;
- gravel placement;
- deflector groin installation;
- weir development;
- berm development;
- dike development.

**TYPE III** involves work in off-channel and or side-channel development.

**TYPE IV** involves work concentrating on woody debris removal.

3. **TECHNICAL REFERENCES:**

The Contractor will be familiar with the following technical references (Note: One or more may be referred to in the Services section of these Technical Specifications):

_____,**Draft, March 1998**. Riparian Assessment and Prescription Procedures. Watershed Restoration Technical Circular No. 6. MELP, Victoria.

**Johnston, N.T. and P.A. Slaney, 1996**. Fish Habitat Assessment Procedure. Watershed Restoration Technical Circular No. 8. MELP, Victoria.

**Newbury, R.W. and M.N. Gaboury. 1993**. Stream analysis and fish habitat design. Manitoba Department of Natural Resources, Winnipeg.

**Slaney, P.A. and D. Zaldokas [ed.] 1997**. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. MELP, Victoria.

_____, **Draft, April 1998**. Habitat Restoration Prescription Guidebook. MELP (Vancouver Island Region 1), Nanaimo.

4. **SURVEY AND DESIGN WORK AND ASSOCIATED STANDARDS**

4.1. The Recipient will conduct the appropriate site survey and detailed design at the location specified by BioLith in the document "Level 1 FHAP, Kitseguecla River South", 1998, as site #14, on Tributary 11 of Kitseguecla River South. The site survey in design will be conducted in such a manner to enable all appropriate deliverables outlined in **Section 5** of this Schedule "A". The survey and design work will be performed to the following standards:

4.1.1. Final maps must be 1:20,000 TRIM and all locations must be identified with an accuracy of ± 50m. If Autocad is to be used, all designs must be keyed to specific points on the TRIM map.

4.1.2. Type II and Type III projects will be designed to withstand a **1 in 50** year flood event. Type I and Type IV projects, upon approval of the MoELP technical monitor, may be developed to lesser standards.

4.1.3. **Engineer sealed designs** (sealed by a P.Eng. in good standing with the APEGBC) will be provided for all projects requiring a water rights licence, as well as for those projects which have been evaluated to have a high risk to life or property upstream or downstream, or if required to ensure the stability of the structure.

4.2. The Recipient is to organize an office and/or field based review of the draft designs, presented as per **Section 7.1** of this Schedule "A", with the Technical Monitor. The Technical Monitor may require, based on their availability, additional personnel to attend (e.g. WRP Fisheries Specialist, DFO, MoF).

## 5. DELIVERABLES

The Recipient will deliver the following for **all project types**:

5.1. **Index TRIM map (1:20,000)** referencing:

- stream reaches and associated sites within the stream channel that the work is proposed;
- legal boundaries;
- access roads;
- dumpsites; and
- as applicable - local sources of LWD, gravel, and boulders.

5.2. **A description** of the physical/biological objectives of each of the proposed restoration projects.

5.3. **Photographs** of each project site:

5.3.1. 35mm photos, labelled with: D/M/Y, approximate location, point of view, and description of prescription planned for the site;
5.3.2. photos must be electronically scanned and placed into in the report;
5.3.3. original copies and negatives of the photos described in 5.3.1 must also be submitted and mounted in plastic photo sleeves

5.4. **Work Plan**

A work plan for each restoration site including:

- a schedule of work with anticipated start-up and completion dates for each project area;
- supervision and environmental monitoring plans (include who will do what activity, when);
- number of crews and number of workers that will be maintained on site;
- timing of equipment requirements;
- access plans;
- quantities of materials required;
- material (e.g., boulders, LWD) source and placement locations;
- debris disposal details, including identification of disposal sites. All hazardous waste must be handled according to BC Waste Management regulations and with the approval of MELP.

5.5. Estimated costs produced in the previous assessment and prescription reports for restoration activities are to be revisited and expanded upon, based on the results of this Level 2 Assessment, and discussions/field inspections with MoELP representatives.

5.6. **Secure approvals** from regulatory agencies for the restoration works proposed. This includes:

5.6.1. Prior to developing prescriptions in full, the Recipient is to contact potential permit holders (i.e. , MoF, MoTH, and private forest companies) who may be affected by restoration plans, to address any concerns they may have regarding the conceptual prescriptions.

5.6.2. Prior to developing restoration prescriptions, the Recipient is to ensure that restoration plans are not developed on sites for which tenure holders have mandatory obligations to carry out such work.

5.7. Preparation of application(s) for submission under the Section 9 Regulation of the *Water Act* and for water licence approvals. This application should be submitted to the nearest MoELP regional office Water Management Branch and include the following:

- site map;
- North arrow
- large scale map of the reaches to be rehabilitated with the project sites identified;
- description for each individual project, including:
  - Representative cross sections at the site
  - Logitundinal profile of the project site
  - Contour survey and plan view of the site
  - Drawings of the proposed project at the site
- methodology to minimise restoration prescription impacts;
- letters from all affected permit holders (e.g., water licensees) and agencies (e.g., MoF, DFO, MoELP habitat officer) stating the terms and conditions of approval for each project;
- Level 2 Assessment results; and,
- payment of permit fees (if applicable).

- The application must reach MoELP at least 45 days before the proposed works can be constructed. Note that the more detailed and accurate the information initially submitted, the faster the application will be processed.

## 6. SITE SPECIFIC REQUIREMENTS FOR PROJECT TYPES I-IV:

The Contractor will deliver the following:

### 6.1. TYPE I PROJECTS

6.1.1. **A detailed drawing** of the position of the structures over the restoration reach, including chainage. This will include either a hand drawn sketch, or an enlarged aerial photograph or ground photograph, with an overlain sketch of the structure. (Scale is to be depicted).

6.1.2. **Level survey cross section plots** are to be produced at typical project site locations (See Newbury and Gaboury (1993), pg. 171, Fig. 4-53). Cross sections are to encompass the floodplain height, extending beyond top of bank. Restoration project details are to be overlain on the cross sectional plot.

6.1.3. **Methods for design** including design criteria, assumptions and calculations. Specifications for development of structures to a 1 in 50 year flood event are to be incorporated into the final design package.

6.1.4. **Methods and specifications for construction** including a detailed description of the methods to be used to construct each structure. This information should be provided to all operators and workers involved in the actual restoration work. Estimate of quantities of all materials required for restoration structures, for cost estimate purposes. This will include the number and sizes of boulders, trees and other construction materials, as well as the proposed source of these materials.

## 6.2. TYPE II PROJECTS

In addition to Type I project requirements, the following are required:

6.2.1. **A level survey to obtain a streambed and water surface profile** plot over the restoration reach plus a minimum distance of 200m above and 200m below the reach (See Newbury and Gaboury (1993), pg. 170, Fig. 4-52). This plot will also include design water surface elevations for the 7 day low flow, bankfull discharge and 1:50 year flood event for the existing channel and with the proposed channel controls.

6.2.2. **Location and elevations** of restoration structures are to be depicted on the profile (See Newbury and Gaboury (1993), pg. 176, Fig. 4-57).

## 6.3. TYPE III PROJECTS

In addition to Type I and II projects requirements, the following items are required:

6.3.1. Detailed construction drawings of the inlet and outlet structures, including elevations, construction materials, design flow, and corresponding inlet and outlet water surface elevations for the 7 day low flow, bankfull discharge and 1:50 year flood event.

6.3.2. Side channel cross sections relative to a specified design flow.

6.3.3. Considerations on design of inlet/outlet structures and side channel to accommodate or be protected during periods of high river discharge.

6.3.4. If groundwater fed pond, a description of the expected average discharge volumes over a one year period.

6.3.5. Details as described in Type I and II above, for in-channel complexing that may occur in the side channel

## 6.4. TYPE IV PROJECTS

In addition to Type I and Type II projects, the following will be required:

6.4.1. A long profile analysis to be conducted on a representative area requiring woody debris removal. Typically the analysis will be conducted for a representative meander of a pool-riffle -sequence.

6.4.2. **Woody Debris Tagging**: From analysis of information collected, woody debris for which removal has been proposed is to be tagged or marked for the assessed areas.

6.4.3. **Low elevation air photos** and /or ground photos are to be taken of the tagged sites (1:5,000 scale or greater). Scale of photos (suggest using an item of known dimensions laid on the ground), width of stream, day/month/year, and point of view are to be depicted on the photos.

## 7. REPORT SPECIFICATIONS AND DATES

7.1. **Two ( 2)** draft copies of the report (one must be electronic) will be presented to the Technical Monitor by March 13, 2000.

7.2. Comments on the draft report will be supplied back to the Recipient no later than March 20, 2000.

7.3. A final report, incorporating all comments of the draft report and minutes of the review meeting outlined in **Section 4.2** of this Schedule "A" will be submitted no later than March 24, 2000.

7.4. Four (4) copies of the final report will be submitted: three (3) will be bound, one (1) will be electronic (including the scanned photos as in 5.2.3 of this Schedule "A"). The Recipient is responsible for distributing these reports as follows:

- Two (2) (one bound and one electronic) to WRP Regional Fisheries Specialist (MELP);
- One (1) to the Department of Fisheries and Oceans, District Habitat Protection Officer; and
- One (1) retained by the Contractor for submission with the anticipated application for a Section 9 Approval to the Water Branch of MoELP.

7.5. A letter of introduction will accompany the report, introducing the project and will show a report distribution list.

# SCHEDULE B

# (ORIGINAL GITSEGUKLA BAND COUNCIL PROPOSAL)

**Skeena Region**
**Watershed Restoration Program (WRP)**
**Proposed Work Plans**

## Project Background

Proponent Name: Pacific Inland Resources

Implementing Partner: Gitsegukla Band Council

Watershed: Kitseguecla River

Project Name: Kitseguecla River South, Tributary 11, Site 14 Survey and Design

Workplan Number,
Activity Code: DAS (Detailed Assessment of Streams)/Survey and Design
Activity Number

## Project Description

**For Stream Survey and Design** – Habitat Restoration, type 2, fish access development assessment and design.

Background: Survey and Design work, in 1998, prescribed Category 1 impacts, the input of logging related sediment sources. The stream is considered stable and suitable for restoration works (Hydroglyphics 1998). Tributary 11 site visits in 1999, conducted under Scientific License, and Fish Collection Permit 34770-20, determined fish access is likely impeded. Fish Assessment work completed in 1999 determined the presence and extent of fish within the beaver complex in the logged area of Site 14, located on Tributary 11 of Kitseguecla river South, through 6 one-day visits to the site. It was determined that coho, chinook and cutthroat will benefit from 3 km and 3,000 square meters of rearing habitat (Habitat assessment by BioLith Scientific, 1998). 1998 reports recommend fish passage above the dams be designed to allow fish access to spawning and rearing habitat.

The Survey and Design work for 1999 is for Category 2 impacts, to prescribe and design access past beaver dams. Site Survey and Design is type 2 works, for fish access in reach 1 of Tributary 11, Kitseguecla River South sub-basin, Site 14, from station 0+637 to 1+390 (Point of commencement at the apex of the alluvial fan) as flagged in the field. The fish habitat impacts at site 14 beaver dams are site specific, rather than systemic, for a logging related impact. Passage around beaver dams is the prescription deliverable. We are not entertaining the option removal of dams at this point. Hydrological Assessment in 1998 by Dr. Gilchrist (Hydroglyphics) also states the channel averages less than 2%, has a stable stream morphology, and is a good candidate for restoration works.

**Project Specifics**

Bill Fell, Resource Technologist, is project manager.
Brad Pollard of ARC is our R. P. Biologist
Dr. Alan Gilchrist of Hydroglyphics is R. P. Geo-morphologist, Lead.
Dr. Allen Gottesfeld is the planning and strategy Resource Scientist

Proposed schedule for WRP
Dated for reference, field work commencement September 13, 1999.
Field work ending when snow on ground, or December 15 1999.
Report dates are January 25, 2000 for draft submission and March 31 for final report. The deliverables will include Fish presence report, and site design for fish passage above two beaver dams, including: machine access, materials, cost estimates, workplan/ contract ready description of works, and list of permits required. Permit requests will be forwarded to DFO and MoELP at the draft report stage. Works will be signed by an R. P. Geo. or P Eng..

Map of watershed and map of works location attached.

**Regulatory Review and Referral**

Has the project been previously reviewed in detail with MELP WRP staff.
Yes.

Water Act Approval Status. Not applicable.

Water Act Notification Status Not applicable.

Ministry of Forests Referral Status Not applicable.

Other Referral Status Not applicable

Name _____Bill Fell_____ Submission Date __10/12/99___

Reviewed _____

# SCHEDULE C

# (RATE SCHEDULE)

# SCHEDULE C

# RATE SCHEDULE

The following rate schedule will apply for contract 99-FRBC 27:

DAS Site Survey and Design,
PIR Contract Particulars
WRP Fisheries, Detailed Design,
Level 2
Type 1 Project, beaver dam access issues

| Category | Unit | Rate ($/unit) | Total Units | Days | Total Costs |
|---|---|---|---|---|---|
| | | | | | |
| Professional Fees | | | | | |
| Biologist | hr | $ 65 | 16 | 2 | $ 1,040 |
| Env. Monitor | hr | $ 65 | 0 | 0 | $ - |
| Project manager | hr | $ 50 | 24 | 3 | $ 1,200 |
| Technician | hr | $ 40 | 72 | 9 | $ 2,880 |
| Labourers | hr | $ 30 | 24 | 3 | $ 720 |
| Subtotal Fees | | | | | $ 5,840 |
| Expenses | | | | | |
| Crew Vehicle Rental | day | $ 51 | 6 | | $ 306 |
| Mileage | km | $ 0.40 | 200 | 8 | $ 640 |
| Safety and Fire Equipment | | $ 25 | 4 | | $ 100 |
| Total Station Rental | day | $ 50 | | 6 | $ 300 |
| Film/Processing | roll | $ 35 | 5 | | $ 175 |
| Subtotal Expenses | | | | | $ 1,521 |
| **Sub-totals** | | | | | **$ 7,361** |
| Administration @ 7.5% | | | | | $ 552 |
| **Total** | | | | | **$ 7,913** |

Total invoices for this project (excluding GST) are not to exceed $ **7913.00** , without prior written authorization from PIR's representative.

Payment will not occur until PIR receives quality certificates from the Ministry of Environment, Lands and Parks Standards Agreement Officer. The Final deliverables and invoice must be received by March 31, 2000. If this deadline is not met, PIR will reduce the final payment by $100.00 for each calendar day they are late.

# SCHEDULE D

# ( OTHER TERMS AND CONDITIONS)

# SCHEDULE D

# (OTHER TERMS AND CONDITIONS)

***Report Specifications and Dates***

In addition to section 7.4 of the Schedule A within the Standards Agreement, a bound copy of the final report will be sent to PIR.

***Survey and Design Work and Associated Standards***

PIR Requests an invite to the office and/or field based review of the draft designs, as outlined in section 4.2 within Schedule A of the Standards Agreement.

Due to planning timelines required for FRBC funded projects, PIR will not commit FRBC funding to any subsequent works resulting from the survey and design to be provided under this contract.

# Gitsegukla Band Council

36 Cascade Avenue, South Hazelton, B.C. V0J 2R0

Ph. (250) 849-5490 Fax (250) 849-5492


Ministry of Environment, Lands and Parks, c/o Ms. Alan Baxter, P/R
Regional fisheries Specialist Jeff Lough,
Box 5000,
Smithers, British Columbia, V0J2N0

Dear Jeff, Allen

Enclosed is the final report for the Survey and Design of Site 14 of Kitseguecla River South Tributary 11, meeting the requirements of the Activity Number 708824. Attached are four copies of the report, three bound and one electronic. We will replace the electronic copy, presently on discs, with a CD. One copy has been forwarded to the Department of Fisheries and Oceans, District Habitat Protection Officer, and another to the MELP Water Branch as part of the Water Act Approval Application.

The prescription, for a type 1 project, is for remedial fisheries habitat work to provide fish access through a Beaver-dam complex on tributary 11, located 20 kilometers up the Kitseguecla Lake Road near Moricetown.

We hope to complete the prescribed work in August of 2000. Please forward any comments and requests to myself at the above address. A Site Visit may be arranged, at your convenience.

Sincerely,

Bill Fell,
Watershed Restoration Co-ordinator

cc. ~~Department of fisheries and Oceans~~ District Habitat Protection Officer,
~~MELP Regional Water Branch.~~

Watershed Restoration Program (WRP)

Watershed: Kitseguecla River

1999-2000 Level II Report

Completed: March, 2000

Submitted to Lead Proponent: West Fraser Mills Ltd., Pacific Inland Resources Division.

Contact: Mr. Jay Baker

Co-ordinator: Silvacon Forestry Services

Contact: Mr. Ed Withers

Submitted by: Gitsegukla Band Council

Author: Bill Fell, Cedarvale Resources Ltd.

Report Title: "Survey and Design of Tributary 11,
Kitseguecla River South"

Contract 99-FRBC-27

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**Executive Summary**

The fish presence data was gathered using Gee traps during five (5) field visits to the site. Site survey data was gathered using a digital measuring device, providing a total station survey of the stream wetted width, beaver dams, and channel morphology, delimiting the channel bottom for design.

The aquatic habitat restoration site survey and design technical specifications in this report prescribe works to rehabilitate beaver incursion fish access problems at the impact site.

The options available to provide fish access include:

a) breaching beaver dams during adult migration,

b) building several portable fish access structures to delimit the extent of the problem, and

c) building permanent fish access with beaver fences as per Technical circular #9.

The few juvenile coho found in the mark recapture fish presence study indicate neither enough access by spawning adults nor good dispersal of juveniles. The proposed breaching of beaver dams for adult access will delimit the extent of fish access problems through enumeration at barriers during adult migration.

**The initial breaching of dams number one and four, combined field monitoring of adult access success, is recommended.**

## Introduction

**1.1 Lead Proponent** for this project is West Fraser Mills Ltd.

- Pacific Inland Resources (PIR) Division

**1.2 Implementing partners**

Sub-Contractor: Gitsegukla Band Council

Surveyor/Drafting: Mr. Jon Tunnicliffe, Tunnicliffe Consulting, Master student at UNBC;

Author/Drafting: Bill Fell, Cedarvale Resources Ltd.

Field Work: Earl Williams, Peter Hyzims.

**1.3 Funding source**

Forest Renewal British Columbia (FRBC) funded this project, under WRP Survey and Design Activity # 708824.

The Watershed Restoration Program (WRP) under a multi-year FRBC/MoELP Fisheries agreement with PIR, Multi-year Agreement 0000101, funded field data collection and reporting.

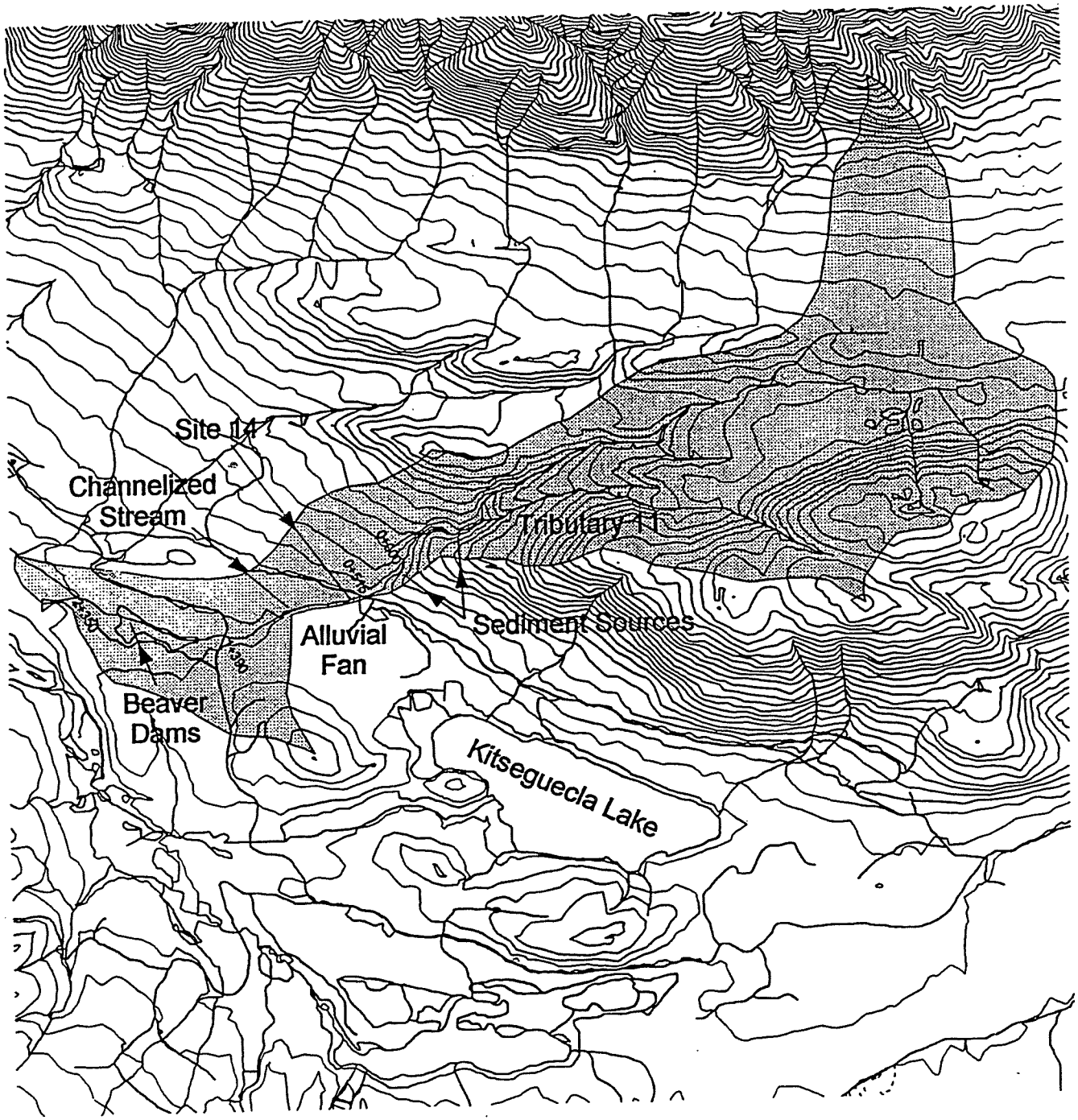
PIR is the Forest License holder in the area.

Silvicon Forestry Services is administering WRP under agreement to PIR.

This Survey and Design contract included determining the location of fish presence, completion of a field survey, development of design, and writing the report.

## 1.4 Watershed Description

An Overview Assessment initiated in 1995 identified the Kitseguecla River South sub-basin as the highest priority area for a Level I detailed Fish Habitat Assessment (FHAP). Impacts identified in the 1995 Overview include collapsed bridges, perched culverts, lost stream complexity, and reduced fish, fish habitat, and LWD cover. A logged riparian area on Tributary 11 is reducing the opportunity for near-future LWD recruitment into the channel. The Kitseguecla River forest resource values are rated very high for both timber and bio-diversity. The watershed also contains some rare ICH ecosystem variants and high fisheries values. Presently depressed stocks of fish are a result of both fishery interception issues and logging related impacts. Approximately 960 meters of Tributary 11 riparian zone was extensively logged, from the lower 200 meters, to the road crossing at 1.15 kilometers, in 1974. Beaver incursion occurred during the silviculture phase of the harvest plan, as the beavers succeeded in taking advantage of the deciduous species ingress on site.
The mid-elevation tributary flows generally North, feeding water into Kitseguecla River South just downstream of the outlet of Kitseguecla Lake.




# Kitseguecla South Watershed - Site 14

HYDROGLYPHIC TERRAIN ANALYSTS

STREAMS
ROADS
TOPOGRAPHIC CONTOURS
Index (100 m)
Index (Depression)
Intermediate (20 m)
Intermediate (Depression)
TRIBUTARY 11 WATERSHED

0.4 0 0.4 0.8 Kilometers

1:35000

N

Map 5

## 3. Methods

**3.1.** An overview assessment of the fish, fish habitat and riparian zone was conducted in 1995, and, based on existing information and photography, the watershed sub-basin priorities were set. A Level 1 detailed field aquatic and riparian habitat assessment was conducted in this high priority sub-basin in 1997. The 1997 Level I assessment identified habitat attributes and developed conceptual rehabilitation options which led to the present Survey and Design contract. Office review for this design project included WRP Overview Watershed Assessment (Wild Stone, 1995) and the Detailed Level I Assessment of Fish and Fish Habitat (BioLith, 1997; 1998).

The aquatic habitat restoration site survey and design technical specifications in this report prescribe works to limit the scope of rehabilitation at the identified fish access barrier site.

**3.1.1.** The methods and procedures for conducting Site Survey and Design were specified in the 99-FRBC-27 Standards Agreement between Pacific Inland Resources (PIR) and the Gitsegukla Band Council (GBC). This survey is for a Type I project, defined as involving less than fifty meters of stream substrate modification, and requiring moderate survey work. Analysis of all pre-existing information included pre- and post-logging 1962 and 1981 air photo coverage, prior reports and maps. This site received intensive study and mapping with a total station survey, using a grid frequency of one point every 10 meters of wetted edge and more intensive sampling points for mapping the thalweg, producing a thalweg map length of approximately six hundred and sixty (660) meters of stream channel. The data map includes the stream and surrounding topography, and occasional valley wall location points for cross-sections. Qualitative accuracy of the survey is to two centimeters. The estimate of streambed stability was incorporated into the design parameters by the design team. Field ribbon was hung at the dam and survey stations, and the survey data was used to produce a schematic of the site surface morphology for fish habitat design. The data was synthesized to develop a workplan in this report.

## 4. Purpose and Scope of Work

The purpose of the project is to improve fish access to fish habitat. Specific prescriptions: 1. Improve fish access to quality fish habitat; and 2. Increase the productivity of the tributary through use of the existing habitat. The purpose is achieved by both determining the limits to fish access through juvenile trapping and fish presence, and prescribing remedial action to allow fish access to existing quality habitat.

## 5. Location

Tributary 11 is identified at UTM 9.589480.6089790-9.591550.6089480, in the 1998 Kitseguecla River South Fish Habitat Assessment Procedure, (BioLith 1998). The site is located approximately nineteen kilometers south of Highway 16 on the Kitseguecla Lake Road. This road is accessed 35 minutes east of Gitsegukla Village on Highway 16, by turning south and staying on that road 20 kilometers. The 1:50,000 scale map number is 93L13 and the Trim and Forest Cover map number is 093L092. The site is located and mapped on page 6 and the folder at the back page of this document.

## 6. Site Description

### 6.1.1. Description of Sub-section 1 of Reach 1

The map of the Tributary watershed boundaries indicates both the extent and the topography of the stream. The lower 200 meters of the tributary riparian zone is lined with mature forest. This sub-section of Reach 1, tributary 11, has a V-shaped channel morphology. There are various pools and woody debris cover locations in this part of the stream.

### 6.1.2. The Survey Sub-section 2 of Reach 1, Prescription Location

The second sub-section of Reach 1 is the nine hundred and sixty meters logged riparian area downstream of the access road culvert. The survey station meter on the Hydroglyphic Map is reversed from standard stream measure, as the meters start at the upstream end of the survey, with the beaver dams commencing at the 1+390 meter mark of that map survey. This prescribed sub-section of Reach 1 of Tributary 1 consists of old logging cuts inundated with beaver dam flooding, between 1+390 and 2+350 marks on the map.

## 6.2. Reach 1 Fish Habitat and Channel Assessment Information

6.2.1. The Tributary 11 geomorphology and hydrology report was completed in 1998-9, and presented in the report titled "Kitwanga River and Kitseguecla River Watershed Restoration Program: Hydrological and Channel Stability Assessments of Specific Impact Sites" by Hydroglyphics (referred to as "CSA"). Stream morphology is primarily riffle type immediately above the beaver dams, with short sections of glide and pool habitat. The beaver dams vary from 0.14 meters to 1.6 meters high, and provide significant rearing habitat when accessible. Fish cover is primarily deciduous growth but is also provided in the pools under beaver dams.

This WRP Design report excerpts passages from the CSA hydrology and channel stability data for a) Reach 1 of Tributary 11 previously known as Site Fourteen, in the Kitseguecla South watershed, and b) for the watershed as a whole. The CSA executive summary notes the assessments provide a physical rationale for stream restoration at Reach 1 of Tributary 11.

Dr. Gilchrist (CSA author) used stream flow and precipitation data (Environment Canada, 1981) to calculate variations in water storage and flow in the Kitseguecla River watershed throughout the year. The channel stability assessments in his report use a modified version of the Channel Assessment Procedure (CAP) from the Forest Practices Code (Hogan and Ward, 1997; Anonymous, 1996a and b) and is based upon the author's experience in Northwestern BC and elsewhere. The CAP procedure is a combination of air photo analysis, including photos taken prior to harvesting activity as well as recent photos, combined with field assessments, to determine changes in channel stability over time.

Local gauged stream information for Station Creek Average Daily Flows (Figure 1), Kitseguecla Watershed Hydrological Balance (Figure 2), Water Storage In Kitseguecla Watershed (Figure 3), and Flood Discharge Data (Table 1) are presented in section 6 of the report.

### 6.3. Reach 1 Attributes and Design Data

**6.3.1** The hydrological assessments, in the "Channel Stability Assessment" report, use regional stream data to determine the amount of stream discharge for floods with a particular return period. Although we found the above report matched very well with the field information, the gauged stream information from Station Creek provides additional data in regard to flood timing. Station Creek is near Kitseguecla River, and of similar watershed size and flow magnitude. Low flows occur between January and March.

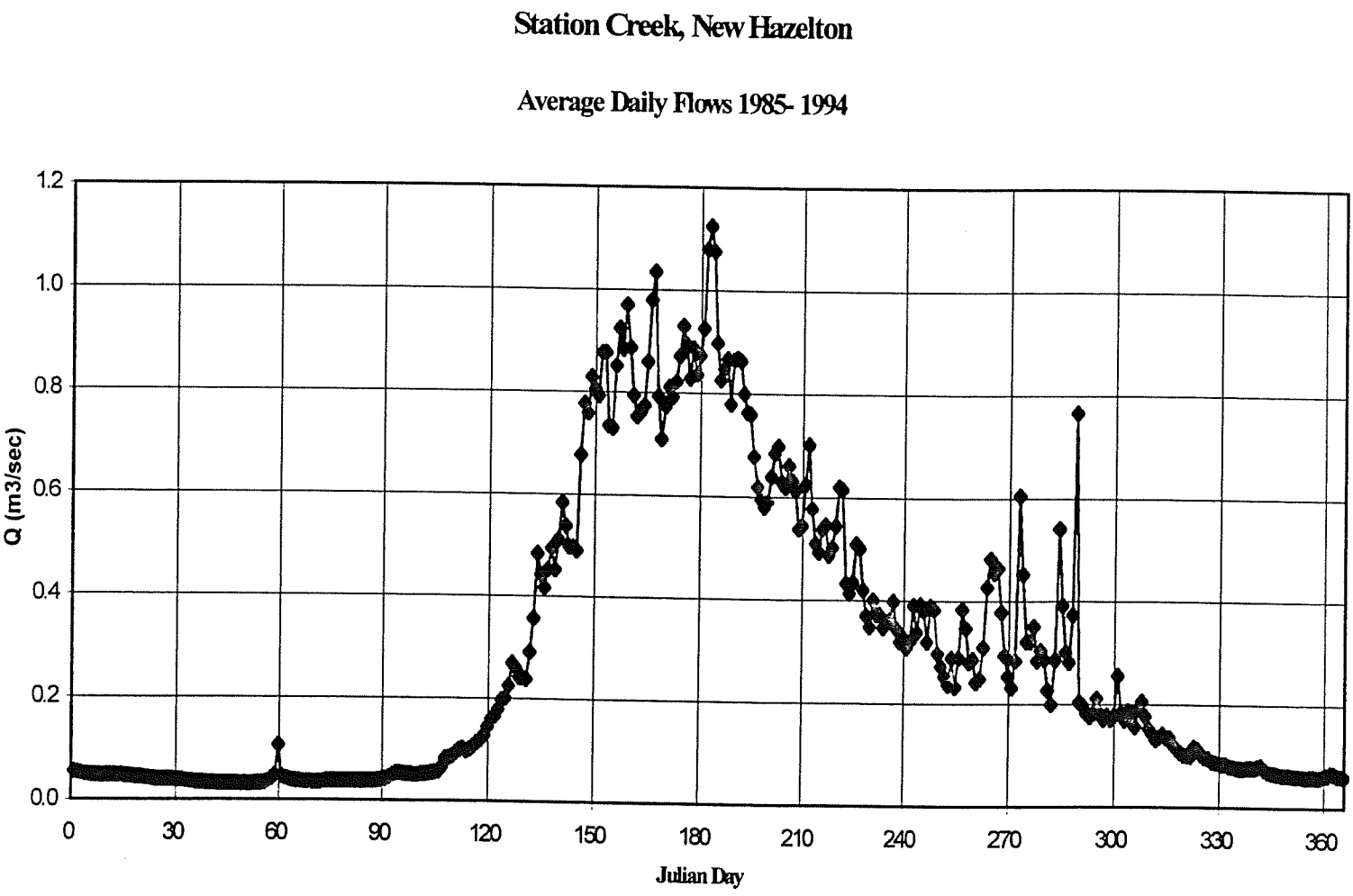



Figure 1. Station Creek Daily Gauged Flow expressed as a ten year average.

### 6.3.2. Water Balance

The water balance data for the Kitseguecla watershed has been calculated from climate data recorded in Kitwanga, the nearest climate station to the watershed, and stream flow data for the Kitseguecla watershed.

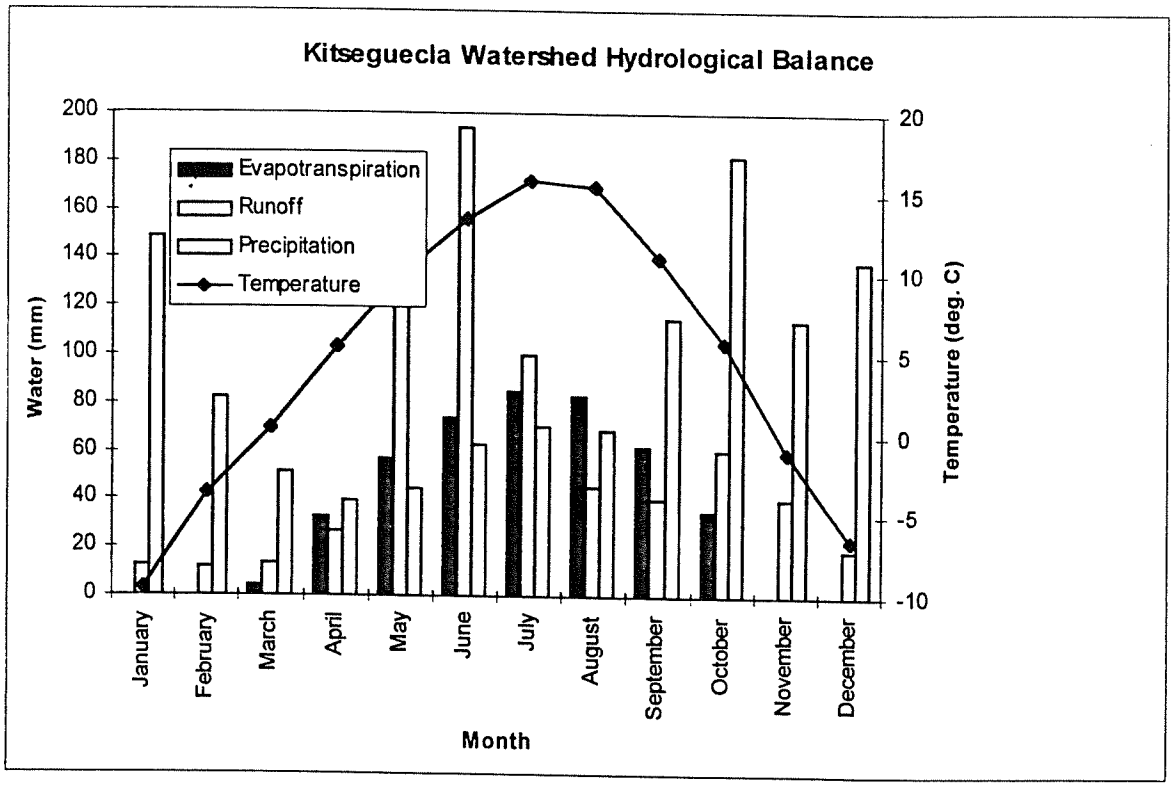



**Figure 2. Water balance for the Kitseguecla watershed.**

This shows monthly variations in precipitation (rain and snow), runoff (calculated as an average depth across the entire watershed) and evapo-transpiration together with mean monthly temperature recorded in Kitwanga at an elevation of 193 meters.

**6.3.2.** A few general statements can be made about the hydrology of the Kitseguecla River based on the regional data presented in Figure 2.

- Flooding occurs due to snowmelt in the spring (May and June). Flooding is of moderate size as melting occurs progressively with altitude as the season changes.
- Flooding occurs due to rainstorms in the fall (October - November). These floods are of short duration due to intense rainfall but are of large magnitude, especially when the weather is relatively warm and rain falls on snow, augmenting flood flows.
- The largest floods are about equally split between spring and fall floods.
  Lowest flows occur during the winter (January - March).

**6.3.3.** Monthly data for precipitation, evapotranspiration and stream discharge varies throughout the year in this watershed (Figure 3).

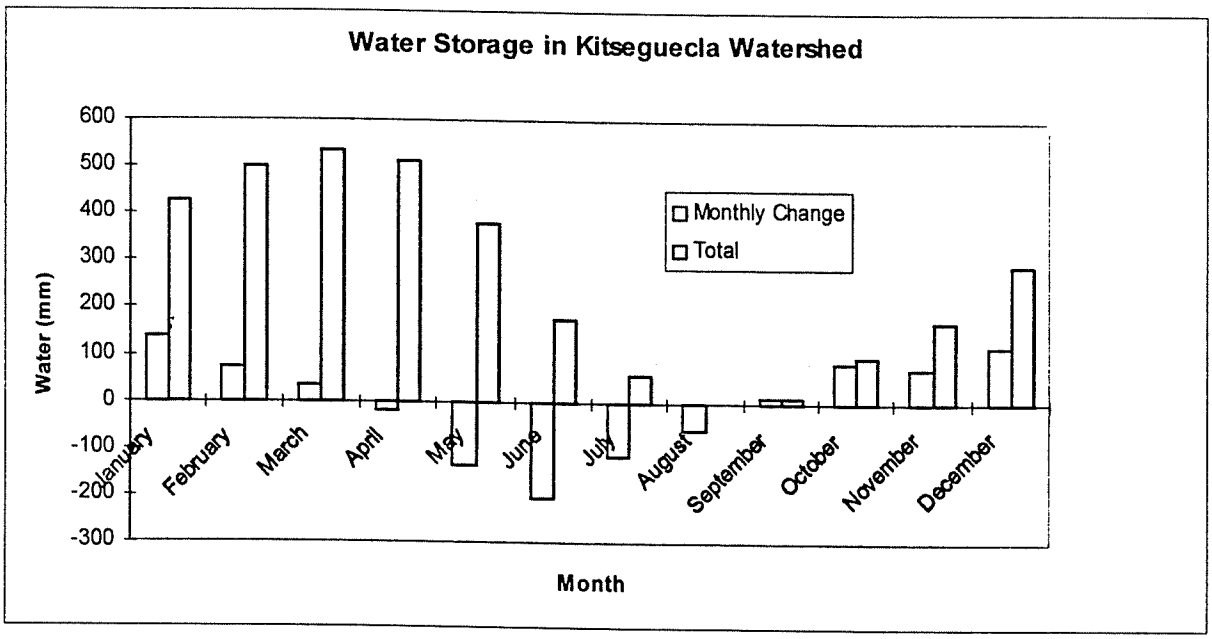



**Figure 3. Water storage in the Kitseguecla watershed.**

The storage of water is primarily explained in terms of snow cover in the watershed and groundwater reservoirs. This shows that the lowest storage levels, and by implication the lowest groundwater levels, occur in August when all snow has melted and rates of evapo-transpiration are high, often in excess of rainfall. During October and November, groundwater levels rise as increasing rainfall replenishes lost reserves. From December to February most precipitation falls as snow, and so storage takes the form of snow-pack on the ground. From March onwards, increasing temperatures cause the snow-pack to melt and storage begins to decrease as rivers swell and discharge increases. By July most snow-pack has melted and storage continue to drop, due to loss of groundwater, through to September when the cycle begins again. This analysis suggests that groundwater levels in the region are lowest in August and September, rise towards December when water begins to be stored as snow, and begin to fall in late spring or early summer after the snow-pack has melted and groundwater discharge helps maintains water levels in streams.

### 6.3.4. Flood Magnitude

The magnitude of floods with different return periods has been estimated from the regional analysis of stream-flow data from the Kitseguecla River, Telkwa River and Zymoetz River. This data analysis is outlined in Appendix 2. The results of this analysis are shown in the table below.

| Return Period (years) | Instantaneous Flow ($m^3/s$) | Daily Peak ($m^3/s$) |
|---|---|---|
| 2 | 2 | 1 |
| 5 | 3 | 2 |
| 10 | 4 | 3 |
| 25 | 5 | 3 |
| 50 | 7 | 4 |
| 100 | 8 | 4 |

Table 1. **Tributary 11 Flood Discharge Data.**

### 6.3.5. Channel Stability (from CSA report)

The estimated flood discharges calculated from broad data compares favourably to field data. The data suggests that flow parameters during major floods (about a 100 year return) are 2.8 meters per second for mean flow velocity and 0.6 meters for the mean flow depth which can transport small cobbles with a b-axis length of 10 centimeters. The few larger sediment particles with a b-axis to 30 centimeters appear to be somewhat aberrant. They may be locally derived from surficial materials in the upper reach. These rocks appear to be very stable and most have a moss or patina covering, suggesting they have been in-situ for a long time. The channel is very stable, which is unusual in this environment. Neither aggradation of degradation is currently happening. The stream is meandering through the beaver dams as beaver activity takes place.

Significant amounts of sedimentary debris can potentially be moved downstream during major flood events. This debris would tend to accumulate in wedges behind constrictions, creating gravel steps in the channel. There is no evidence that LWD is moved during major floods. Flood discharge in this reach would be contained above the culvert upstream of the prescription site, and at beaver dams.

Channel stability is determined by many factors including stream morphology and hydrology, channel bank material, riparian vegetation, and sediment load carried by the river. How these factors influence channel stability is discussed in this section.

Tributary 11 has a riffle/pool morphology with a stream gradient of about 5% in the uppermost quarter of the tributary, beginning upstream at the apex of the debris fan, at 0+000 meters. The gradient at the prescription site is less than 3%.

### 6.3.6 Design Implications for Restoration Activities

The analysis of this site suggests several aspects of fish habitat in this system could be improved. The main evidence of degradation is the lack of vegetative cover and low opportunity for recruitment of LWD conifers in the logged area below the main forestry road. The Beaver Dam fish presence data is presented in the next section, indicating some fish access problems.

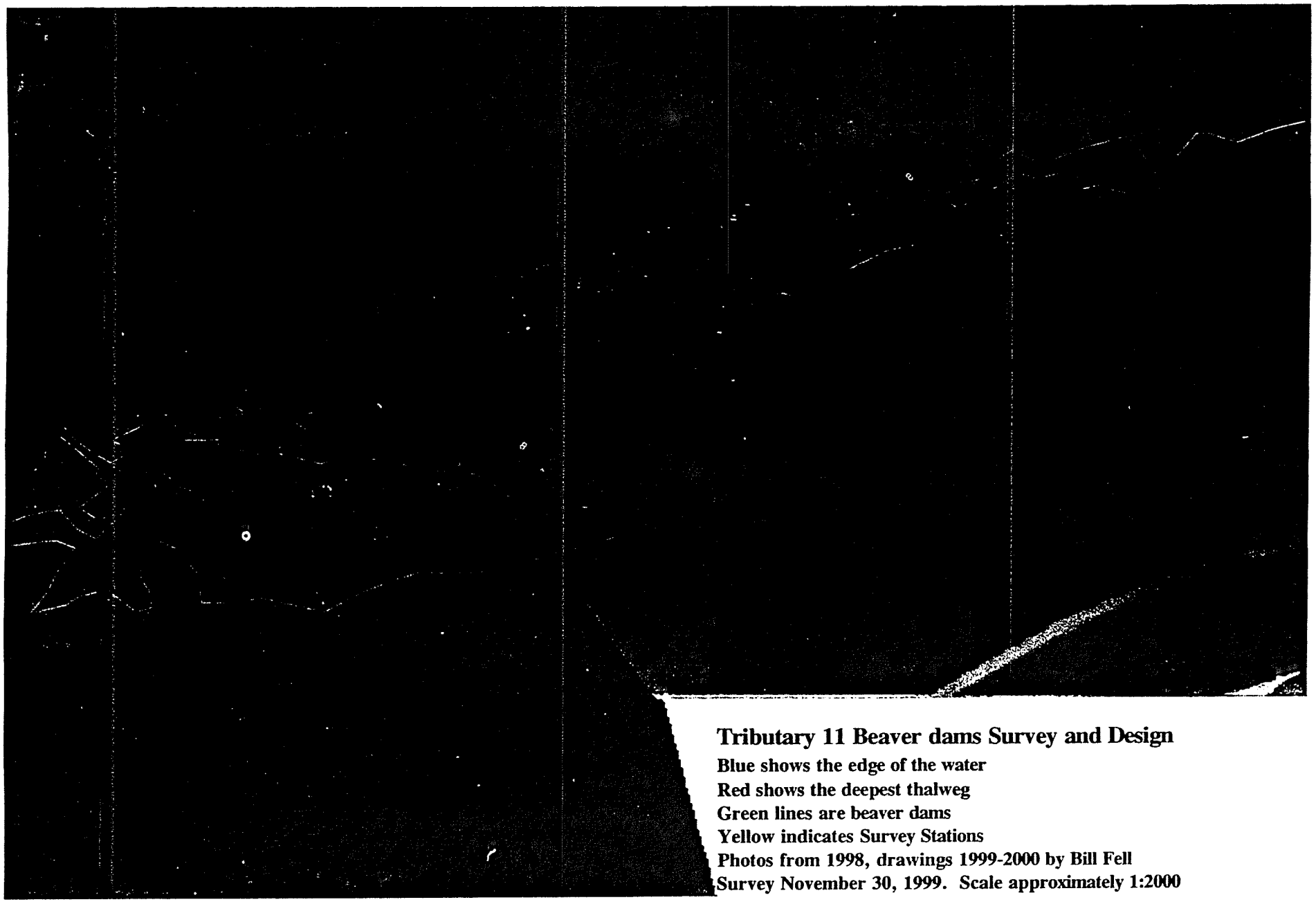
### 6.3.7 Riparian Ecosystem Vegetation

The vegetation assessment indicate the site is vegetated with a variety of deciduous trees, most of which are about 20 years old, and stocking of plantation conifers. The streamside vegetation component adjacent to the Beaver dams is estimated: 50% conifers, 20% cottonwood, 10% alder, and 10% willow and 10% other deciduous and brush.

## 7. Project Objectives

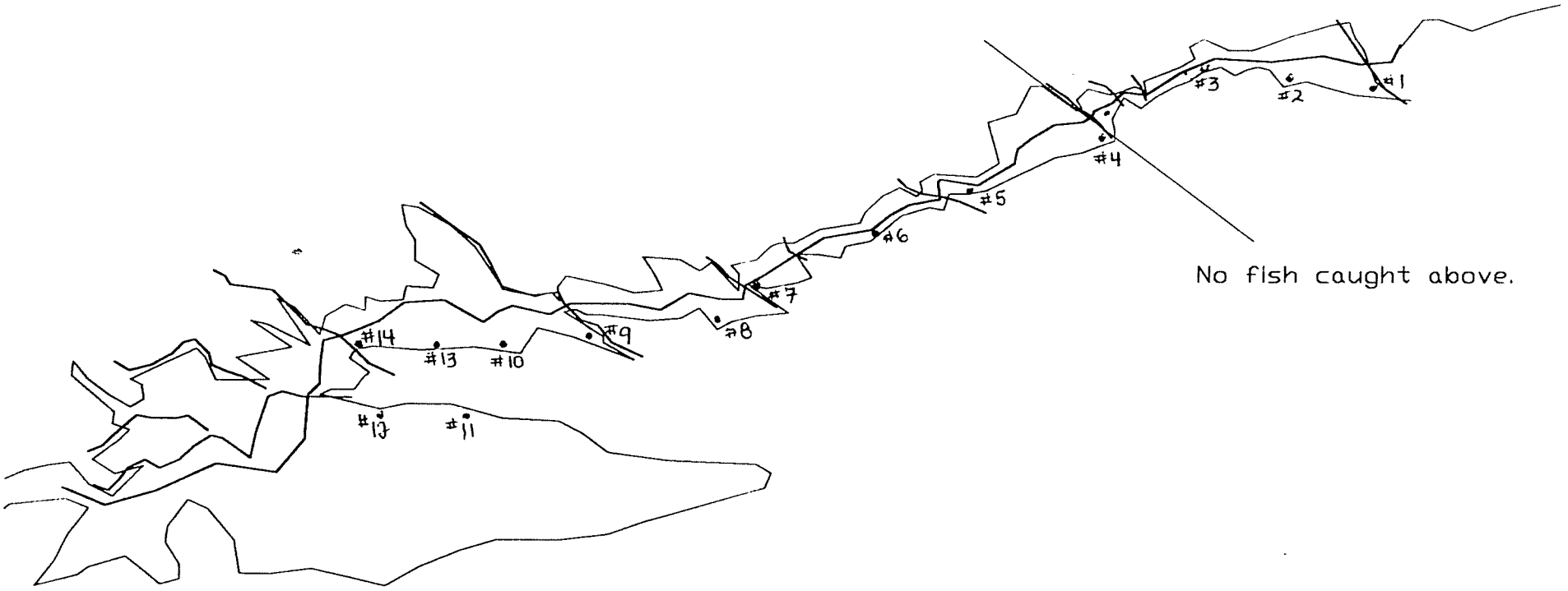
The first objective of this contract is to determine fish presence. The Map of Gee Trap Placement in Figure 4, is shown on the next page, and Fish Presence in Table 2 (fish caught) in Appendix 3, includes 6 pages.

The second objective, the survey and design, will allow fish access of adults upstream and juvenile movement through the beaver impoundment area. The Fish Presence data in table 2 indicates the necessity of fish access improvements.



**Tributary 11 Beaver dams Survey and Design**

**Blue shows the edge of the water**
**Red shows the deepest thalweg**
**Green lines are beaver dams**
**Yellow indicates Survey Stations**
**Photos from 1998, drawings 1999-2000 by Bill Fell**
**Survey November 30, 1999. Scale approximately 1:2000**




**Tributary 11 Beaver dams Survey and Design**

**Blue shows the edge of the water**
**Red shows the deepest thalweg**
**Green lines are beaver dams**
**Yellow indicates Survey Stations**
**Photos from 1998, drawings 1999-2000 by Bill Fell**
**Survey November 30, 1999. Scale approximately 1:2000**

## 8. Discussion

Although coho and cutthroat were captured in the three lower ponds, adult fish access is considered doubtful at dam one, and all dams are considered at least partial barriers at this time.

### 8.1 Prescription Options

The following potential remedial actions are based on information contained in the references in Appendix 1, and conversations with authors of unpublished reports. These options are listed in order of increasing commitment as a function of time and cost expenditure.

a) Cutting notches in dams to allow adult fish passage.

b) Portable fish ladder installations for fish dispersal.

c) Construction of fish passage channels using beaver-proof permanent structures.

The greater the expenditure, in the above options, the greater the level of security that fish passage will occur. The risk of "over-kill" also increases, because we have no clear indication to create fish passage other than to get past the initial beaver dam barrier in Figure 4, page 16.

The schematic of the assessment is in Figure 4, a high oblique photo of the site, with site assessment information placed on the computer-built mosaic. The top of the photo is faces the Southwest, and the stream is flowing west. The red line immediately downstream (towards top right of photo) of the third dam indicates the site upstream of which no anadromous juveniles have been caught during 5 site visits. Eight dams, spanning five hundred meters of stream, may allow adult fish access. Chinook, coho, rainbow, dolly-varden and cut-throat have been captured in Tributary 10, below the barrier site. Large juvenile coho have been caught in the lower pool of the beaver dams, indicating good rearing opportunities likely due to good growth rates. Two kilometers of rearing habitat may be utilized by developing fish access at this site.

### 8.2 Recommendations

**The recommendation for this site proposes to determine the success of fish access by incremental fish presence testing, in combination with breaching of beaver dams for adult access. A second option, to use temporary fish access ladders, to disperse juveniles within the system, may occur in mid-October.**

## 8. Discussion

Although coho and cutthroat were captured in the three lower ponds, adult fish access is considered doubtful at dam one, and all dams are considered at least partial barriers at this time.

### 8.1 Prescription Options

The following potential remedial actions are based on information contained in the references in Appendix 1, and conversations with authors of unpublished reports. These options are listed in order of increasing commitment as a function of time and cost expenditure.

a) Cutting notches in dams to allow adult fish passage.

b) Portable fish ladder installations for fish dispersal.

c) Construction of fish passage channels using beaver-proof permanent structures.

The greater the expenditure, in the above options, the greater the level of security that fish passage will occur. The risk of "over-kill" also increases, because we have no clear indication to create fish passage other than to get past the initial beaver dam barrier in Figure 4, page 16.

The schematic of the assessment is in Figure 4, a high oblique photo of the site, with site assessment information placed on the computer-built mosaic. The top of the photo is faces the Southwest, and the stream is flowing west. The red line immediately downstream (towards top right of photo) of the third dam indicates the site upstream of which no anadromous juveniles have been caught during 5 site visits. Eight dams, spanning five hundred meters of stream, may allow adult fish access. Chinook, coho, rainbow, dolly-varden and cut-throat have been captured in Tributary 10, below the barrier site. Large juvenile coho have been caught in the lower pool of the beaver dams, indicating good rearing opportunities likely due to good growth rates. Two kilometers of rearing habitat may be utilized by developing fish access at this site.

### 8.2 Recommendations

**The recommendation for this site proposes to determine the success of fish access by incremental fish presence testing, in combination with breaching of beaver dams for adult access. A second option, to use temporary fish access ladders, to disperse juveniles within the system, may occur in mid-October.**

## 9. Structure Designs

The design is taken directly from the Portable Fish Ladder Construction report, with the reference material located in Appendix 4, page 34. The following three tables consist of: materials list is provided in Table 2; a construction cost in Table 3; and installation timeline in Table 4.

Overall Construction Materials List

Length 4.5 Meters
Height 68.6 centimeters
Width 91 Centimeters Wide
All plywood is 5/8 inch treated plywood.

| | | | | | | |
|---|---|---|---|---|---|---|
| Side wall X 2 | 4.5 meters x .69 m x 2 sides | | | | 6.21 | |
| Bottom | 4.5 m x .91 m | | | | 4.10 | |
| Adjustment Door | 2.22 m x .76 | | | | 1.69 | |
| Internal Walls for baffle construction | | | | | | |
| 4 Pieces Each | Through | Diagonal | Backstop | Stop Baffle | | |
| | .51x.69 | .27x.69 | .18x.69 | .70x0.69 | total sq m | |
| Subtotal area | 1.40 | 0.74 | 0.49 | 1.92 | 5.47 | |
| Total plywood area | | | | | 22.70 | |
| Area per sheet | | | | per sheet | 2.4384 | |
| Sheets required @76 | | | | sheets req'd | 10.00 | $ 760 |
| Waterproof glue | epoxy mix | | | | | $ 60 |
| Varnish | 4 liter pail | | | | | $ 60 |
| Re-enforcing joints | 6 per baffle | 24 required | | | | $ 48 |
| Sleeve for baffles | 22 channels | $4 per side including screws | | | | $ 176 |
| | | | | | | |
| Materials cost total | | | | | | $ 1,104 |

Materials cost table 2

### 9.1. Construction Materials.

The rationale, design, and photos of prototype selected, in Appendix 4, provide the base information for materials cost estimate. The construction costs are contained in Table 3.

| **Construction costs** | | | |
|---|---|---|---|
| | **Labour** | | |
| | hours | per hour | subtotal |
| Material Source | 1 | $ 50 | $ 50 |
| Transport to shop | 4 | $ 50 | $ 200 |
| Cut Pieces | 4 | $ 50 | $ 200 |
| Assemble parts | 4 | $ 50 | $ 200 |
| Paint | 3 | $ 50 | $ 150 |
| | | | |
| | **Equipment and Shop** | | |
| | days | day rate | extension |
| Circular Saw | 1 | $ 10 | $ 10 |
| Sander | 2 | $ 5 | $ 10 |
| Epoxy gun | 2 | $ 10 | $ 20 |
| Drill | 2 | $ 5 | $ 10 |
| Cut-off saw | 2 | $ 5 | $ 10 |
| Power screwdriver | 2 | $ 5 | $ 10 |
| Brushes | 3 | $ 8 | $ 24 |
| Bits | 2 | $ 4 | $ 8 |
| Shop | 2 | $ 40 | $ 80 |
| | | | |
| **construction costs** | | | **$ 982** |

**Table 3 Construction Costs**

### 9.1.1 Workplan

| Month | September | | October | | November | |
|---|---|---|---|---|---|---|
| Frequency | Items/week | Extension | Items/week | Extension | Items/week | Extension |
| | | | | | | |
| Stream walk | 1 | 4 | 1 | 5 | 1 | 4 |
| Breach dam | 2 | 8 | 2 | 8 | 2 | 8 |
| Pool investigation | 2 | 8 | 2 | 8 | 2 | 8 |
| Ladder construction September, 2001 | | | | | | |
| 1st Ladder Installation, November1, 2001 | | | | | 1 | 1 |
| 2nd Ladder Installation | | | | | ? | ? |
| 3rd Ladder Installation | | | | | ? | ? |

Table 4. Workplan

**11 Site Specific Requirements for Project Types I:**

Type I Requirements for this Project

A detailed drawing of the structures, and their position in the restoration reach, includes chainage. This includes an enlarged aerial photograph overlain with drawings of the works to be implemented.

Methods of design, including design criteria, assumptions and calculations, are included in this report in the methods section. Specifications for development of structures to a 1 in 50 year flood event are incorporated.

Methods and specifications for construction including a detailed description of the methods to be used to construct each structure are in sections 6-12. This information will be provided to all operators and workers involved in the actual restoration work. Estimate of quantities of all materials required for restoration structures, for cost estimate purposes, are included in Table 12. This includes the number and sizes of boulders, trees and other construction materials, as well as the proposed source of these materials.

The principal contract monitor will be:

WRP Fisheries Specialist

BC Environment, Skeena Region

Box 5000

Smithers, BC V0J 2N0

Phone: (250) 847-7337

Fax: (250) 847-7728

## 12. Survey and Design Work and Associated Standards

The Contractor conducted an appropriate site survey and detailed design at the Location. The site survey and design was used to produce all appropriate deliverables outlined in Section 6 of this Schedule "A". The survey and design work standards include:

Final maps at 1:20,000 TRIM and all locations are identified with an accuracy of 50m.

The Contractor proposed date for an office review of the draft designs, presented as per Section 8.1 of this Schedule "A", with the Technical Monitor, is March 27, 2000. The Technical Monitor may require, based on their availability, additional personnel to attend (eg. WRP Fisheries Specialist, DFO, MoF).

Report Specifications

Seven (7) copies of the final report are submitted: six(6) bound and one (1) camera ready (unbound, single-sided). The Contractor will distribute the reports as follows:

One (1) to the Contract Monitor (MELP);
Three (3) bound and one (1) camera-ready copy to WRP Regional Fisheries Specialist (MELP);
One (1) to the Department of Fisheries and Oceans, District Habitat Protection Officer; and
One (1) retained by the Contractor.

A letter of distribution will accompany the report, introducing the report and a distribution list.

**Appendix 1**

Technical References:

The Contractor is familiar with the following technical references:

_____,Draft, March 1998. Riparian Assessment and Prescription Procedures. Watershed Restoration Technical Circular No. 6. MELP, Victoria.

Johnston, N.T. and P.A. Slaney, 1996. Fish Habitat Assessment Procedure. Watershed Restoration Technical Circular No. 8. MELP, Victoria.

Newbury, R.W. and M.N. Gaboury. 1993. Stream analysis and fish habitat design. Manitoba Department of Natural Resources, Winnipeg.

Slaney, P.A. and D. Zaldokas [ed.] 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. MELP, Victoria.

, Draft, April 1998. Habitat Restoration Prescription Guidebook. MELP (Vancouver Island Region 1), Nanaimo.

**Appendix 2**

Stream discharge data for the small tributaries of the Kitwanga South and Kitseguecla South watersheds does not exist. Therefore, records from surrounding gauged watersheds (Kitseguecla River, Telkwa River and Zymoetz River) have been used in a regional analysis to estimate flood discharge in the tributaries studied by this project.

The procedure adopted is modified from Dunne and Leopold (1978) and assumes that each watershed has similar climate and terrain characteristics.

For each gauged watershed the flood return periods were calculated from the Water Survey (Environment Canada, 1991) data and a graph of flood discharge in cubic metres per second (y-axis) against return period in years (x-axis) was plotted using Microsoft EXCEL. A regression equation using a natural log function was fitted to the data for each gauged watershed as shown below for maximum instantaneous and maximum daily discharge.

**Kitseguecla River** (Drainage area - 728 $km^2$)

| | | |
|---|---|---|
| *Maximum Instantaneous Discharge* - | $y = 175.43\text{Ln}(x) + 62.701$ | $R^2 = 0.9119$ |
| *Maximum Daily Discharge* - | $y = 79.764\text{Ln}(x) + 73.673$ | $R^2 = 0.9871$ |

**Telkwa River** (Drainage area - 368 $km^2$)

| | | |
|---|---|---|
| *Maximum Instantaneous Discharge* - | $y = 61.277\text{Ln}(x) + 44.42$ | $R^2 = 0.9324$ |
| *Maximum Daily Discharge* - | $y = 36.716\text{Ln}(x) + 54.285$ | $R^2 = 0.9543$ |

**Zymoetz River** (Drainage area - 2980 $km^2$)

| | | |
|---|---|---|
| *Maximum Instantaneous Discharge* - | $y = 789.16\text{Ln}(x) + 173.81$ | $R^2 = 0.8666$ |
| *Maximum Daily Discharge* - | $y = 420.41\text{Ln}(x) + 281.38$ | $R^2 = 0.9019$ |

For a variety of return periods (2, 5, 10, 25, 50 & 100 years) in turn a graph of discharge (y-axis) against drainage area in square kilometers (x-axis) was plotted and a linear regression equation was fitted to the data with an intercept defined as zero. A variety of other regression functions were tried but the linear model best fitted the data.

**Maximum Instantaneous Discharge**

*2 year return period -* $y = 0.2424x \quad R^2 = 0.9997$

*5 year return period -* $y = 0.4826x \quad R^2 = 0.9987$

*10 year return period -* $y = 0.6643x \quad R^2 = 0.9979$

*25 year return period -* $y = 0.9044x \quad R^2 = 0.9973$

*50 year return period -* $y = 1.0861x \quad R^2 = 0.9969$

*100 year return period -* $y = 1.2678x \quad R^2 = 0.9967$

**Maximum Daily Discharge**

*2 year return period -* $y = 0.1917x \quad R^2 = 0.9987$

*5 year return period -* $y = 0.3189x \quad R^2 = 0.9977$

*10 year return period -* $y = 0.4150x \quad R^2 = 0.9968$

*25 year return period -* $y = 0.5421x \quad R^2 = 0.9959$

*50 year return period -* $y = 0.6383x \quad R^2 = 0.9955$

*100 year return period -* $y = 0.7345x \quad R^2 = 0.9951$

These equations were then used to calculate the flood discharge for different return periods in ungauged watersheds where the watershed area was known. In the case of this study:

Tributary 11 (Kitwanga South) watershed area = 17.48 $km^2$

Tributary 1 (Kitseguecla South) watershed area = 26.73 $km^2$

Tributary 11 (Kitseguecla South) watershed area = 5.99 $km^2$

**The results of the analysis for the site is presented in figures 2 and 3 of this report.**

Population, Mark and Recapture
Site: Tributary #11(beaver dams),Kitsegukla South
Date:03.27.0
0
Obj:ID fish & check possible barrier sites.
Crew:EW / PH

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| #1 | 0+000 | 20-30m | CT | 114mm | |
| **Time in** | **Time out** | **Depth** | | | |
| 11:25am | 9:42a.m | | | | |
| | **Total Fish** | | 1 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 2 | 0+032 | 10m | CT | 107mm | |
| **Time in** | **Time out** | **Depth** | CO | 130mm | |
| 11:47a.m | 9:45a.m | | CT | 106mm | |
| **Temp** | | **GT-Depth** | CT | 100mm | |
| | | | CT | 108mm | |
| | | | CT | 110mm | |
| | | | CT | 85mm | |
| | | **Total Fish** | CT | 75mm | |
| | | | 8 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 3 | 0+058m | | CT | 101mm | |
| **Time in** | **Time out** | **Depth** | CT | 73mm | |
| 11:54a.m | 10:19a.m | | CT | 85mm | |
| **Temp** | | **GT-Depth** | CT | 103mm | |
| | | | CT | 80mm | |
| | | **Total Fish** | CT | 70mm | |
| | | | 6 | 75mm | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 4 | 0+092m | 20-25m | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:04p.m | 10:27a.m | | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 5 | 0+ 137m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:10p.m | 10:36a.m | | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 6 | 0+ 172m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:18p.m | 10:40a.m | | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 7 | 0+ 209m | | NFC | | |

| Time in | Time out | Depth | | | |
|---|---|---|---|---|---|
| 12:25p.m | 10:47a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 8 | 0+ 246m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:30p.m | 10:51a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 9 | 0+ 280m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:38p.m | 10:55a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 10 | 0+ 300m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:45p.m | 10:58a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 11 | 0+332m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:52p.m | 11:00a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 12 | 0+361m | | CT | 115mm | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:00p.m | 11:05a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 13 | 0+ 364m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:13p.m | 11:11a.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 14 | 0+ 373m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:18p.m | 11:13a.m | | | | |

Traps set for overnigth soak on 09.15.99, & checked next day.
Temperature recorded at 9.5
16 Fish were caugth below beaver dams #1,2,3.
1 Fish caugth above BD # 3, in gee trap # 12
IN GEE TRAP # 12

Beaver Dams population
Site : Tributary # 1 - Beaver Dams
Date ; 10.01.99
Obj: Population, mark & recapture
Crew: Earl Williams / Peter Hyzims

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 1 | 0+000m | | CT | 134mm | |
| Time in | Time out | Depth | | | |
| 4:35p.m | 1:44p.m | | | | |
| Temp | | GT-Depth | | | |
| 4 | | | | | |
| | | Total Fish | | | |
| | | 1 | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 2 | 0+032m | | CO | 126mm | |
| Time in | Time out | Depth | CT | 114mm | |
| 4:43p.m | 1:50p.m | | CT | 112mm | |
| Temp | | GT-Depth | CT | 104mm | |
| | | | CT | 103mm | |
| | | | CT | 99mm | |
| | | | CO | 125mm | |
| | | | CT | 97mm | |
| | | | CT | 101mm | |
| | | | CT | 95mm | |
| | | Total Fish | CT | 106mm | |
| | | 11 | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 3 | 0+ 058m | | DV | 122mm | |
| Time in | Time out | Depth | CT | 110mm | |
| 4:47p.m | 2:20p.m | | CT | 105mm | |
| | | Total Fish | | | |
| | | 3 | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 4 | 0+ 092m | | CT | 109mm | |
| Time in | Time out | Depth | CT | 106mm | |
| 4:49p.m | 2:25p.m | | | | |
| | | Total Fish | | | |
| | | 2 | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 5 | 0+ 137m | | NFC | | |
| Time in | Time out | Depth | | | |
| 4:53p.m | 2:;30p.m | | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| # 6 | 0+ 172m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 4:55P.M | 2:30P.M | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 7 | 0+ 209m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 4:59p.m | NFC | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 8 | 0+ 246m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:04Pp.m | 2:38p.m | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 9 | 0+ 280m | | CT | 125mm | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:07p.m | 2:42p.m | | | | |
| | | **Total Fish** | | | |
| | | | 1 | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 10 | 0+ 300m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:11p.m | 2:45p.m | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| #11 | 0+ 332m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:16p.m | 2:48p.m | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 12 | 0 + 361m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:18p.m | 2:51p.m | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 13 | 0+ 393m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 5:20p.m | 2:54p.m | | | | |
| | | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 14 | 0+ 402m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |

2nd set, checked on 02.10.99
gee trap # 4, was set approximatly 15m, from beaver dam barrier.
A total of 17 Fish were caugth below BD barier.
1 Fish caugth in gee trap # 9.

Beaver Dams population
Site : Tributary # 1 - Beaver Dams
Date : 16.10.99
Obj: Population, mark & recapture
Crew: Earl Williams / Peter Hyzims

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 1 | 0+000m | 20-25m | NFC | | |
| Time in | Time out | Depth | | | |
| 12:28p.m | 6:17p.m | 2m+ | | | |
| Temp | | GT-Depth | | | |
| 4 | | 0.3m | | | |
| | | Total Fish | | | |
| | | | 0 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 2 | 0+032m | 11m+ | Co* | 123mm | |
| Time in | Time out | Depth | CT* | 113mm | |
| 12:31p.m | 6:22p.m | 2m+ | CT* | 106mm | |
| Temp | | Gt-Depth | CT | 124mm | |
| | | 0.4m | CT* | 108mm | |
| | | Total Fish | | | |
| | | | 5 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 3 | 0+ 058m | 7m+ | CT | 120mm | |
| Time in | Time out | Depth | CT | 120mm | |
| 12:33p.m | 6:29p.m | 1.25m | CT | 115mm | |
| Temp | | GT-Depth | CO* | 126mm | |
| | | 0.38m | CT | 132mm | |
| | | | CT | 115mm | |
| | | Total Fish | CT* | 105mm | |
| | | | 7 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 4 | 0+ 092m | 7m+ | NFC | | |
| Time in | Time out | Depth | | | |
| 12:35p.m | 6:35p.m | 1.5m+ | | | |
| Temp | | GT-Depth | | | |
| | | 0.48m | | | |
| | | Total Fish | | | |
| | | | 0 | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|
| # 5 | 0+ 137m | | NFC | | |
| Time in | Time out | Depth | | | |
| 12:38p.m | 6:43p.m | | | | |

| Trap | Stn Dist | Wetted W | Species | Length | GPS |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| # 6 | 0+ 1772M | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:44p.m | 6:45p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 7 | 0+209m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:47p.m | 6:50p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 8 | 0+ 246m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:50p.m | 6:54p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 9 | 0+ 280m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 12:55p.m | 6:59p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 10 | 0+ 300m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:00p.m | 7:03p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| #11 | 0+ 332m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:03p.m | 7:07p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 12 | 0+ 361m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:09p.m | 7:11p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 13 | 0+ 393m | | | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:13p.m | 7:15p.m | | | | |
| **Trap** | **Stn Dist** | **Wetted W** | **Species** | **Length** | **GPS** |
| # 14 | 0+ 402m | | NFC | | |
| **Time in** | **Time out** | **Depth** | | | |
| 1:17p.m | 7:20p.m | | | | |

a total of 12 fish caugth below BD barrier.
NFC above BD # 3
Gee traps were checked after 6 hour soak time
Fish roe was used for bait.

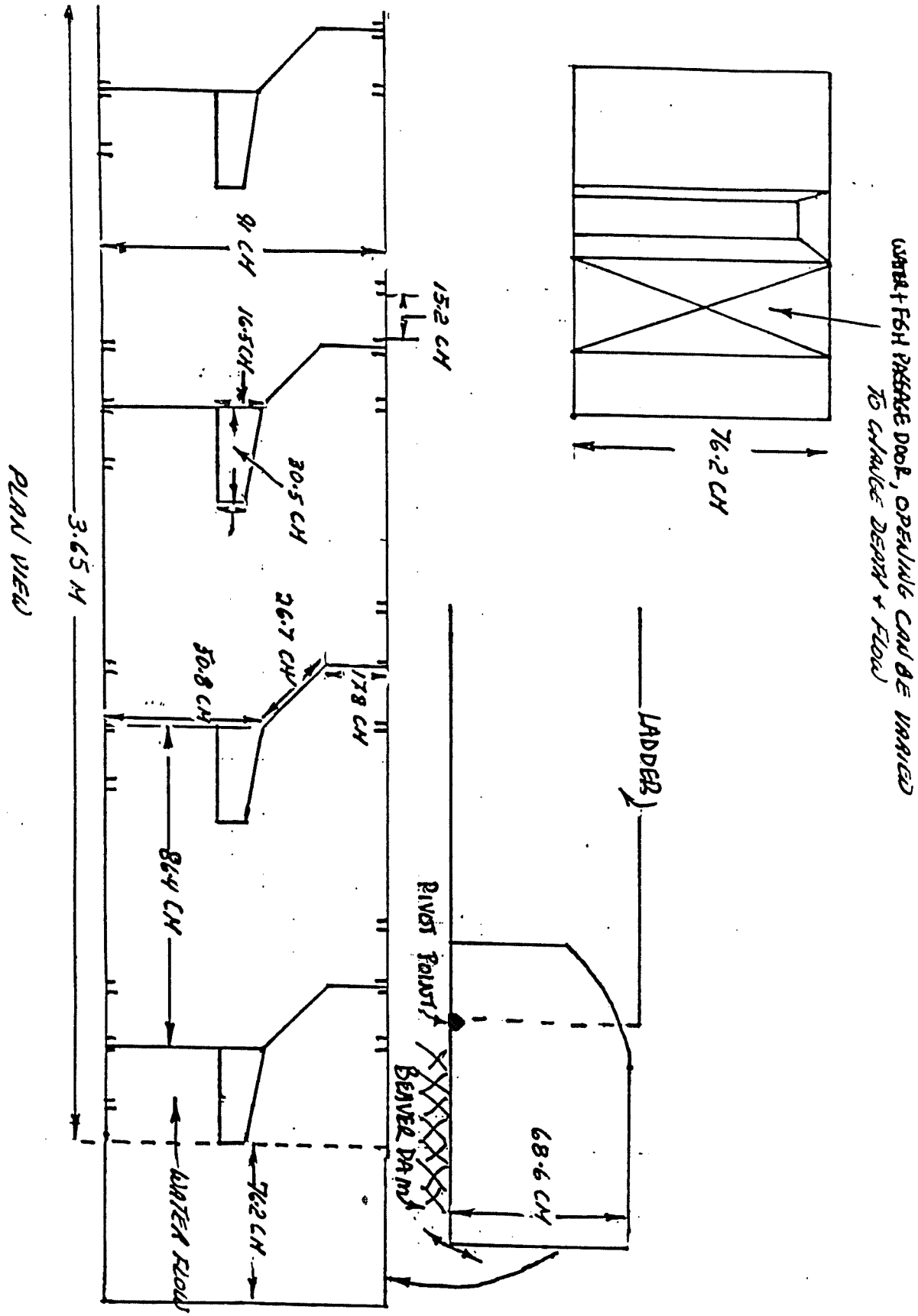



**Figure 5. Modified vertical slot fish ladder (not to scale). Aluminum, single opening.**

## PHASE IV

The final design for the full-size aluminum fish ladder was based on a DFO single opening, vertical slot fish ladder design (DFO, 1993). The DFO design was modified to an all around smaller size with a less elaborate frame construction (Photo 8, 9, and 10, Figure 5). The baffle design and how they fit into the body of the fish ladder remained the same, but the distance between them was reduced from 152 cm to 92 cm, or as wide as a 122 cm. An additional set of two baffle brackets, each 15 cm apart, were welded to the body of the ladder to allow for expansion of each fish holding section to the 122 cm length. The height of the fish ladder was lowered from 127 cm to 76.2 cm with the length of the ladder reduced from 5.49 m to 3.65 m and the frame of the ladder constructed with less box aluminum support members because of the smaller ladder size.

A hinged 76.2 cm long entrance section that will lay on top of the fishway was added to the TSES ladder along with lifting rings, tube brackets for Redi-Rod to hold the ladder in place on a beaver dam and modified cross supports for strength and to hold down the baffles.

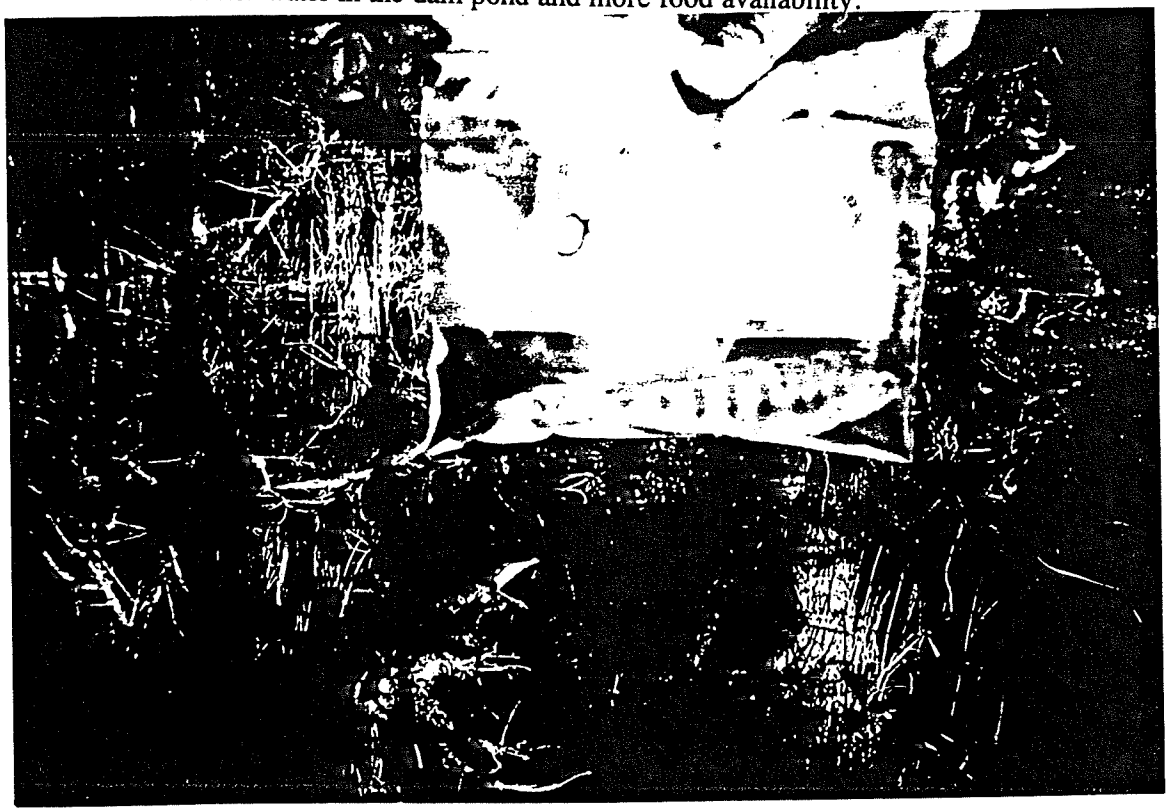
Photo 11 shows prototype #1, #2, #4 and the large-scale aluminum fish ladders.

**Photo 8. Full-size vertical, single slot aluminum fish ladder side view**

Photo 2. Facing northwest, at the location of Gee Trap #14. No fish were caught in this pond which demonstrates the excellent fish habitat to be accessed.
Photo 3. Facing west at the location of Gee Trap #, Just above the lowest dam. This dam is at the edge of timber, with fry present in this pond.

Photo 4. Facing Southeast, Gee Trap 4 location is at Earl's feet. Earl is standing on the dam which is considered a barrier to fish access.

Photo 5. (Below)Photo of 130 mm Coho caught at Gee Trap #2, thirty-two meters upstream of timber line dam. The excellent rearing habitat is indicated by the large size, likely the result of warmer water in the dam pond and more food availability.



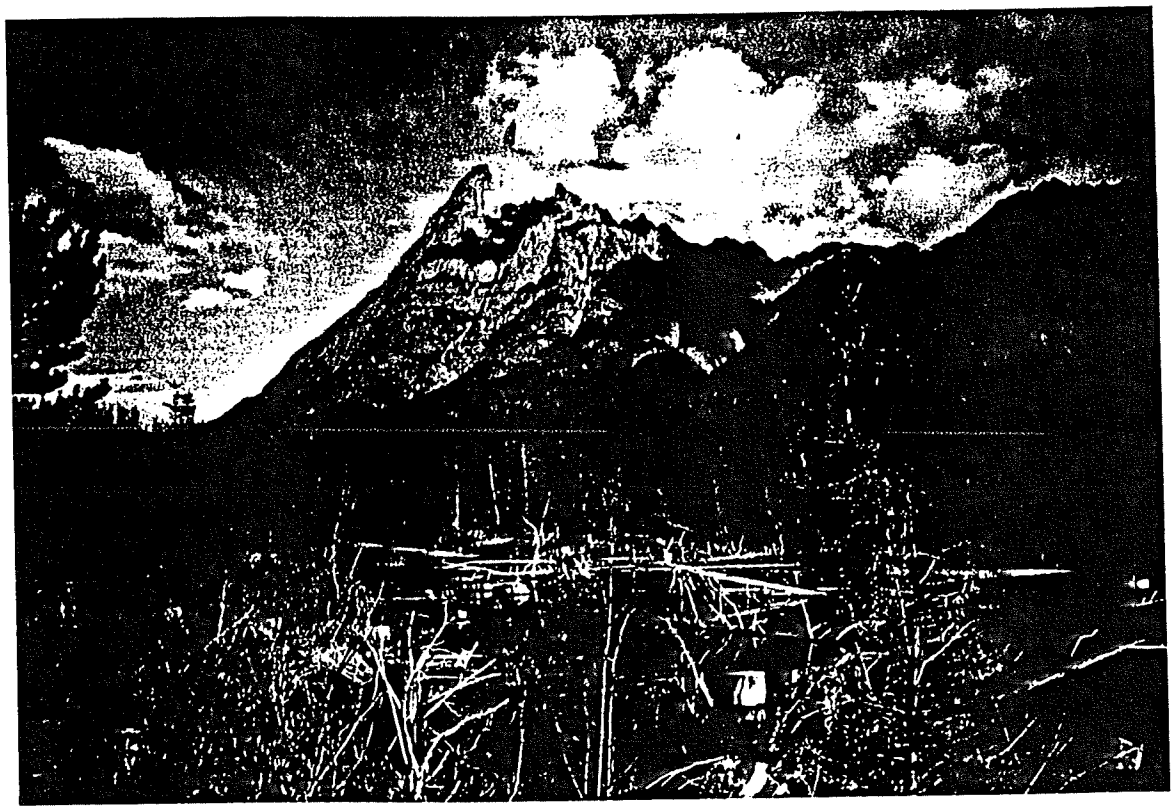
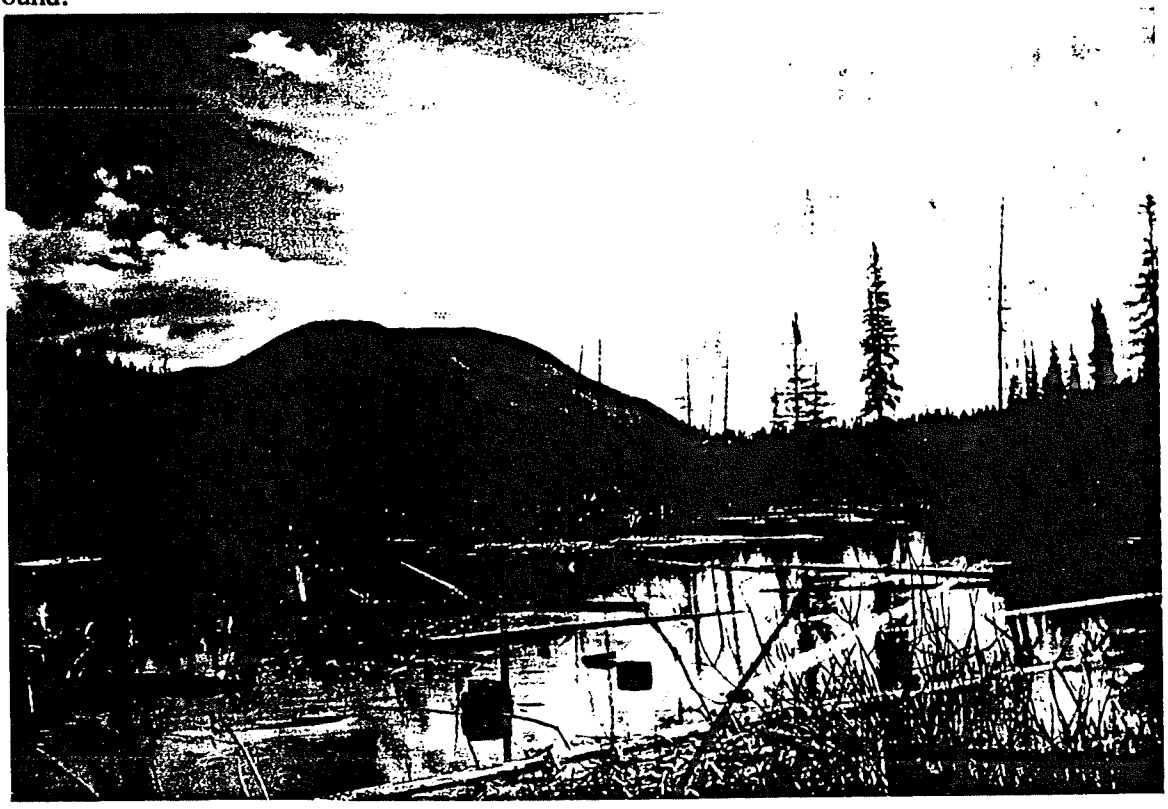
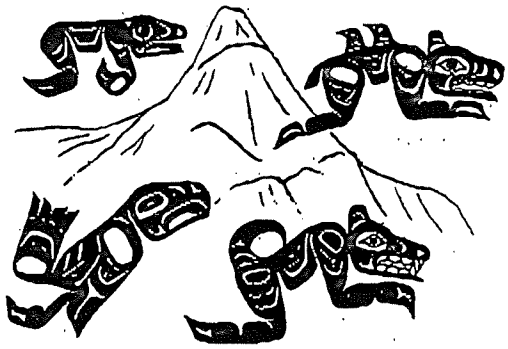


Photo 6. Facing west, at the largest dam pond in the beaver complex, with the "Nipples" in the background.

Photo 7. Facing south, at the Gee Trap #12, with the opening towards Kitseguecla Lake in the background.





WATERGHERMOVE.NET
CAPITAL S


# Gitsegukla Band Council

36 Cascade Avenue, South Hazelton, B.C. V0J 2R0

Ph. (250) 849-5490 Fax (250) 849-5492


**Fax to Jay Baker,**
**847-2530**
Silvicon, Smithers B.C.

October 28, 1999

Dear Jay,

Attached are:
A two page description of the project, in Jeff Lough's format
A budget,
A map of tributary 11, the work-site, 1:20,000
Background rationale for the project from BioLith, and Hydroglyphics, both in 1998.

Should you require further documentation we can fax you more materials and send you copies of photos etc. Thank-you for considering of this project. Preference for payment would be either lump sum in advance or 50% on completion of field work, 35% on draft report, and 15% on final report.

Please call if you have any questions in this regard.

Bill Fell,
For Gitsegukla Band Council

# Skeena Region
# Watershed Restoration Program (WRP)
# Proposed Work Plans

## Project Background

Proponent Name: Pacific Inland Resources

Implementing Partner: Gitsegukla Band Council

Watershed: Kitseguecla River

Project Name: Kitseguecla River South, Tributary 11, Site 14 Survey and Design

Workplan Number,
Activity Code: DAS (Detailed Assessment of Streams)/Survey and Design
Activity Number

## Project Description

**For Stream Survey and Design** – Habitat Restoration, type 2, fish access development assessment and design.

Background: Survey and Design work, in 1998, prescribed Category 1 impacts, the input of logging related sediment sources. The stream is considered stable and suitable for restoration works (Hydroglyphics 1998). Tributary 11 site visits in 1999, conducted under Scientific License, and Fish Collection Permit 34770-20, determined fish access is likely impeded by forest regeneration related beaver dams. Fish Assessment work completed in 1999 determined the presence and extent of fish throughout the beaver complex in the logged area of Site 14, located on Tributary 11 of Kitseguecla river South during 6 one-day visits to the site. It was determined that coho, chinook and cutthroat will benefit from 3 km and 3,000 square meters of rearing habitat (Habitat assessment by BioLith Scientific, 1998). 1998 reports recommend fish passage above the dams be designed to allow fish access to spawning and rearing habitat.

The Survey and Design work for 1999 is for Category 2 impacts, to prescribe and design access past beaver incursion into a clear-cut after logging and silviculture. Site Survey and Design is type 2 works, fish access in reach 1 of Tributary 11, Kitseguecla River South sub-basin, Site 14, from station 0+637 to 1+390 (Point of commencement at the apex of the alluvial fan) as flagged in the field. The fish habitat impacts at site 14 beaver dams are site specific, rather than systemic, for a logging related impact. Hydrological Assessment in 1998 by Dr. Gilchrist (Hydroglyphics) also states the channel averages less than 2%, has a stable stream morphology, and is a good candidate for restoration works.

**Project Specifics**

Bill Fell, Resource Technologist, is project manager.
Brad Pollard of ARC is our R. P. Biologist
Dr. Alan Gilchrist of Hydroglyphics is R. P. Geo-morphologist, Lead.
Dr. Allen Gottesfeld is the planning and strategy Resource Scientist

Proposed schedule for WRP
Dated for reference, field work commencement September 13, 1999.
Field work ending when snow on ground, or December 15 1999.
Report dates are January 25, 2000 for draft submission and March 31 for final report. The deliverables will include Fish presence report, and site design for fish passage above two beaver dams, including: machine access, materials, cost estimates, workplan/ contract ready description of works, and list of permits required. Permit requests will be forwarded to DFO and MoELP at the draft report stage. Works will be signed by an R. P. Geo. or P Eng..

Map of watershed and map of works location attached.

**Regulatory Review and Referral**

Has the project been previously reviewed in detail with MELP WRP staff.
Yes.

Water Act Approval Status. Not applicable.

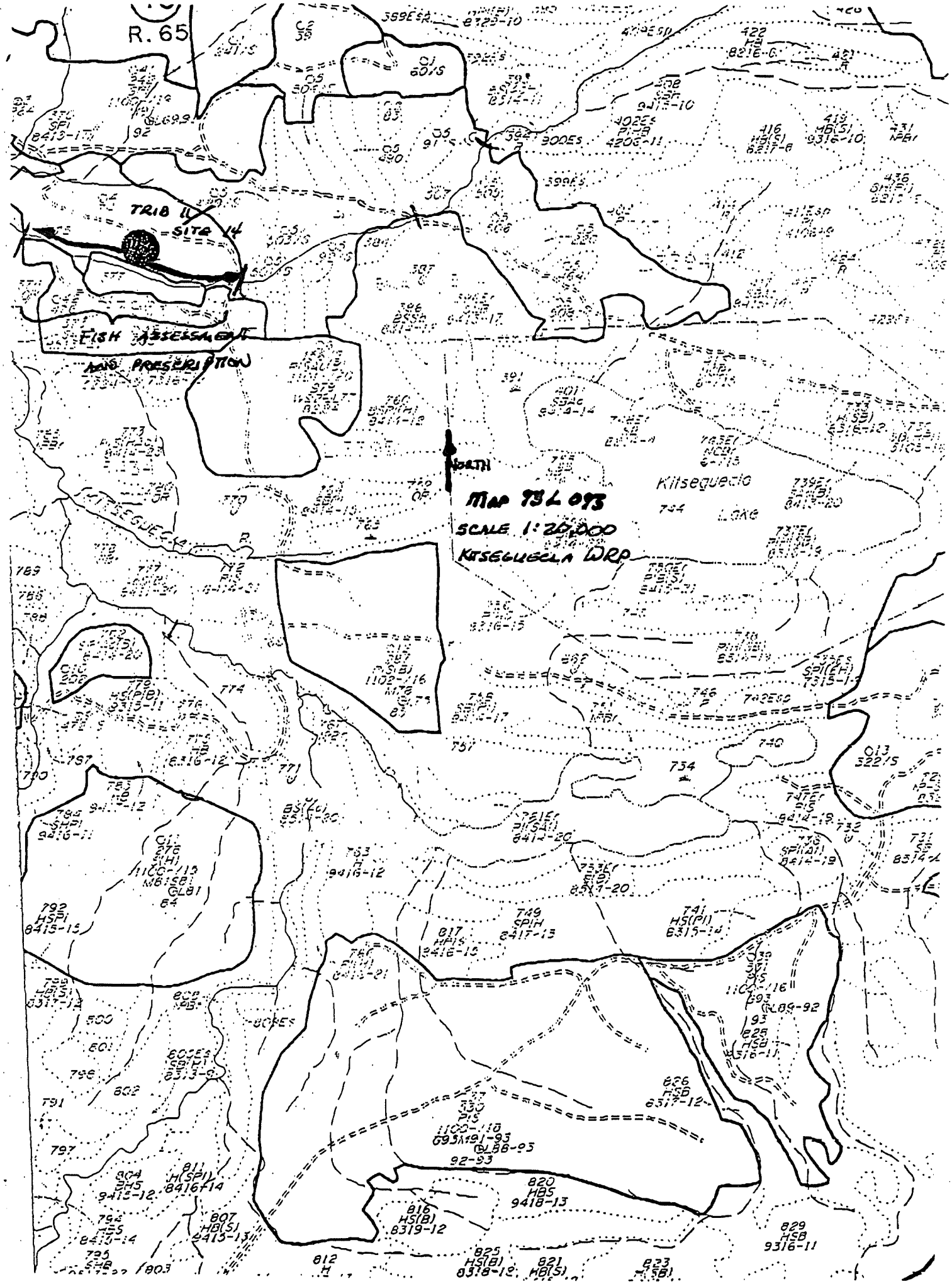
Water Act Notification Status Not applicable.

Ministry of Forests Referral Status Not applicable.

Other Referral Status Not applicable

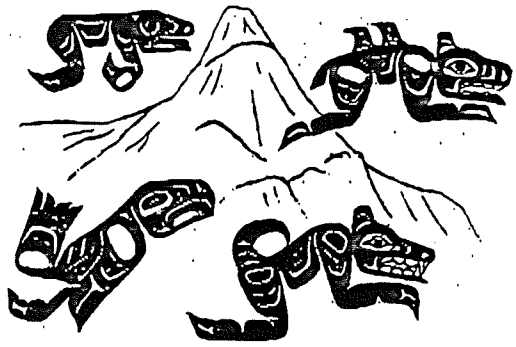
Name _____Bill Fell_____ Submission Date __10/12/99___

Reviewed _____


R. 65
TRIB to SITQ 14
FISH ASSESSMENT
MAP PRESCRIPTION
NORTH
MAP 93L 073
SCALE 1:20,000
KITSEGUECLA WRP
Kitseguecla
LAKE

DAS Site Survey and Design, PIR Contract Particulars

| Category | Unit | Rate ($/unit) | Total Units | Days | Total Costs |
|---|---|---|---|---|---|
| Professional Fees | | | | | |
| Biologist | hr | $ 65 | 56 | 7 | $ 3,640 |
| Env. Monitor | hr | $ 65 | 0 | 0 | $ - |
| Project manager | hr | $ 50 | 16 | 2 | $ 800 |
| Technician | hr | $ 40 | 24 | 3 | $ 960 |
| Labourers | hr | $ 30 | 24 | 3 | $ 720 |
| Subtotal Fees | | | | | $ 6,120 |
| Expenses | | | | | |
| Crew Vehicle Rental | day | $ 51 | 6 | | $ 306 |
| Mileage | km | $ 0.40 | 200 | 8 | $ 640 |
| afety and Fire Insurance | | $ 25 | 4 | | $ 100 |
| Equipment Rental | day | $ 5 | | 6 | $ 30 |
| Film/Processing | roll | $ 35 | 5 | | $ 175 |
| Subtotal Expenses | | | | | $ 1,251 |
| **Sub-totals** | | | | | $ 7,371 |
| Administration @ 3% | | | | | $ 221 |
| **Total** | | | | | $ 7,592 |




# Gitsegukla Band Council

36 Cascade Avenue, South Hazelton, B.C. V0J 2R0

Ph. (250) 849-5490 Fax (250) 849-5492


**Fax to Ed Withers**
**847-2530**
Silvicon, Smithers B.C.

October 12, 1999

Dear Ed,

Attached are:
A two page description of the project,
Two maps of tributary 11, the work-site
Background rationale for the project from BioLith 1998
and six pages of fish data collection for the beaver dams.

Should you require documentation of the fish population work we can fax you more materials and send you copies of photos etc. Thank-you for considering of this project. Preference for payment would be either lump sum in advance or 50% on completion of field work, 35% on draft report, and 15% on final report.

Please call if you have any questions in this regard.

Bill Fell,
For Gitsegukla Band Council

# Skeena Region
# Watershed Restoration Program (WRP)
# Proposed Work Plans

## Project Background

Proponent Name: Pacific Inland Resources

Implementing Partner: Gitsegukla Band Council

Watershed: Kitseguecla River

Project Name: Kitseguecla River South, Tributary 11, Site 14 Assessment and Prescriptions

Workplan Number,
Activity Code: DAS (Detailed Assessment of Streams)/Survey and Design
Activity Number

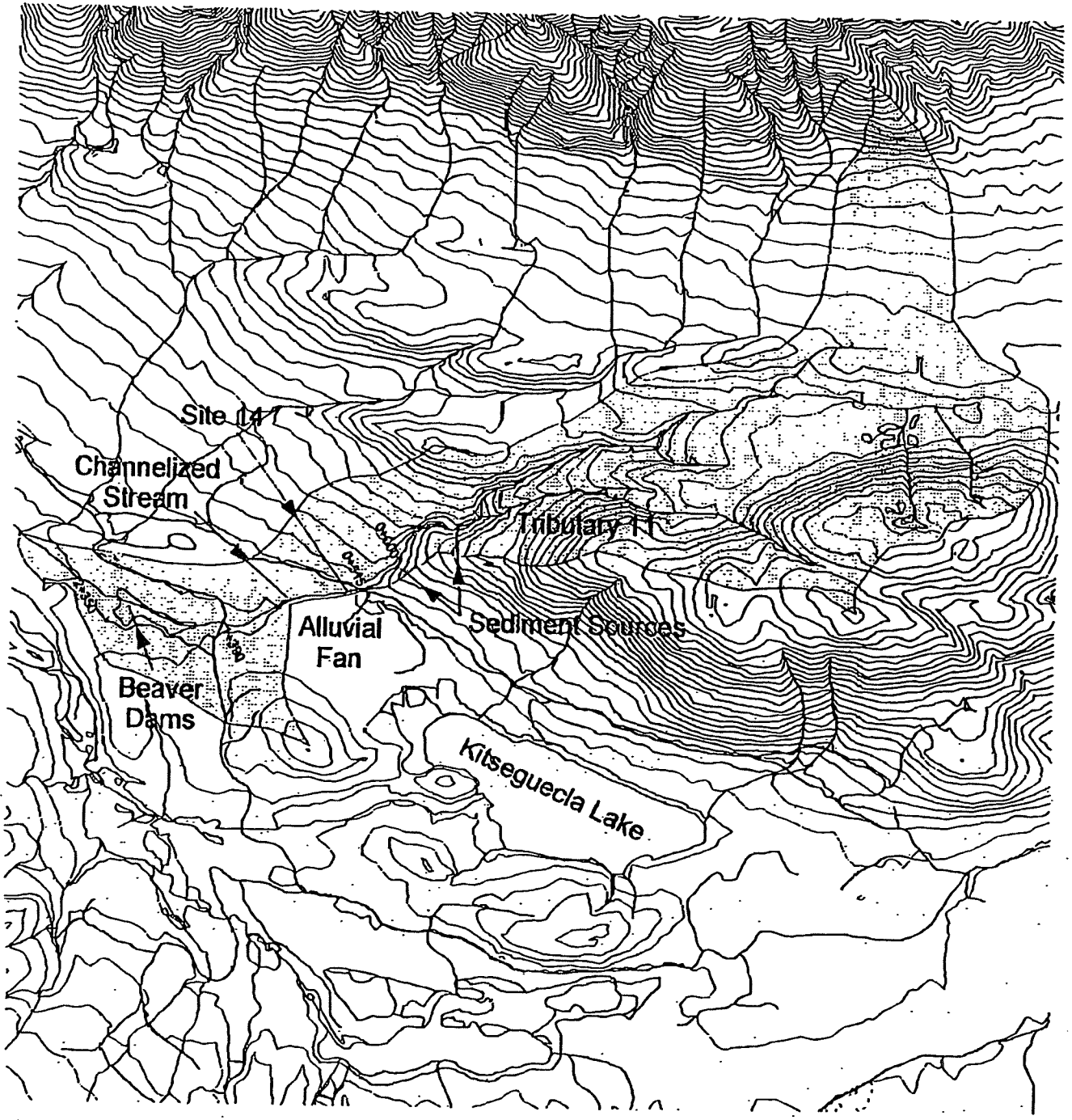
## Project Description

**For Stream Survey and Design** – Habitat Restoration, type 2, fish access development assessment and design.

Background: Survey and Design work, in 1998, prescribed Category 1 impacts, the input of logging related sediment sources. The stream is considered stable and suitable for restoration works (Hydroglyphics 1998). Level 1 assessment fish presence in tributary 11 recommends fish passage above the dams be designed according to fish presence in the reach.

Fish Assessment work for 1999 is to determine the presence and extent of fish throughout the beaver complex in the logged area of Site 14, located on Tributary 11 of Kitseguecla river South. Fish presence and population estimates will also be assessed for Jack Mould Creek through marked recapture of fry. Jack Mould Creek, above and below the main haul road crossing, will be the location of a Population Estimate Survey.

The Survey and Design work for 1999 is to prescribe restoration of Category 2 impacts, beaver incursion into a clear-cut after logging and silviculture, for the area above where the fish passage is blocked by beaver dams. Site Survey and Design is for the restoration type 2 works, fish access in reach 1 of Tributary 11, Kitseguecla River South sub-basin, Site 14 from station 0+637 to 1+390 with the Point of commencement at the apex of the alluvial fan. The fish habitat impacts at site 14 beaver dams are site specific, rather than systemic, for a logging related impact. Hydrological Assessment in 1998 by Dr. Gilchrist (Hydroglyphics) states the channel averages less than 2%, has a stable stream morphology, and is a good candidate for restoration works.




# Kitseguecla South Watershed - Site 14

HYDROGLYPHIC TERRAIN ANALYSTS

STREAMS
ROADS
TOPOGRAPHIC CONTOURS
Index (100 m)
Index (Depression)
Intermediate (20 m)
Intermediate (Depression)
TRIBUTARY 11 WATERSHED

0.4 0 0.4 0.8 Kilometers

1:35000

N

Map 5

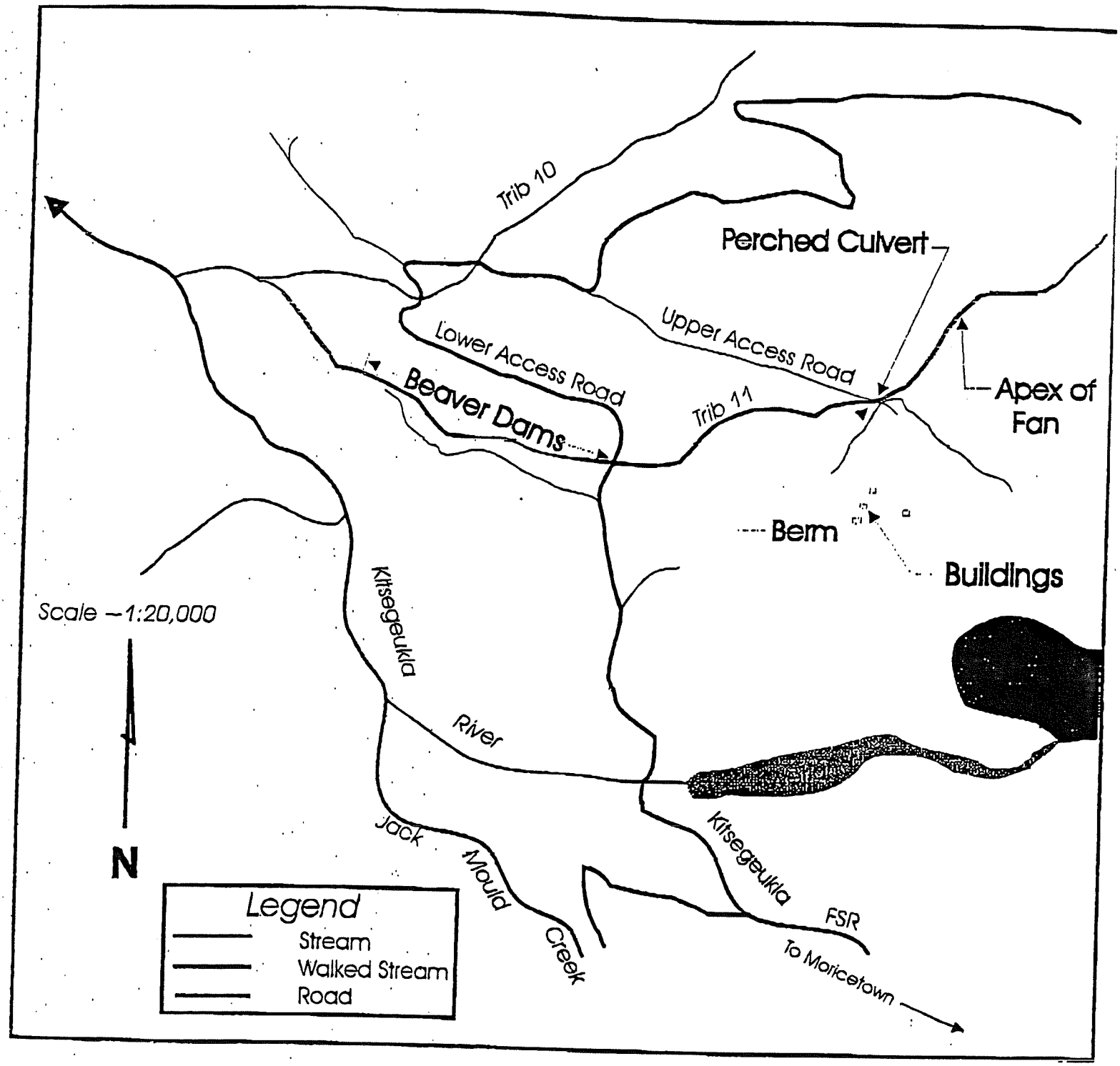



Figure 1. Map showing the location of the study area.

**Photo 6. This is a view looking southeast at the beaver dam furthest downstream. It was considered likely to be a barrier to anadromous salmonids.**

- ***Lowest 500 m of the Stream***

This section of the stream passed through an intact, old growth area that appeared to be in good condition for fish.

- ***Fish Populations***

No information was available on fish in Tributary 11.

## Recommendations in Order of Decreasing Priority

1. The stream should first be fished with roe baited minnow traps or by electroshocking in July or August to determine whether juvenile anadromous salmonids are present above the beaver dams, the species present and their distribution. Fishing effort should concentrate on the area around the Upper Access Road first and then working downstream.

2. If, after a reasonably intense fishing effort, no anadromous salmonids are observed above the beaver dams then access should be provided over the beaver dams with fish ladders, or through the dams by breaching them. A longer term solution for this segment of Tributary 11 would be to remove the beavers, breach the dams, plant deciduous and coniferous trees in mounds and protect these and the existing trees from future beaver harvesting using fencing along the stream. These actions are justified because the parent stream, Tributary 10, is known to support chinook, so that Tributary 11 probably did at

one time too. It was considered to offer at least 3 km and 3,000 $m^2$ of good rearing habitat above the lowest beaver dam. If anadromous salmonids are observed above the dams then no action should be taken at this time.

3. The area above the Upper Access Road and the area just below the road and adjacent to the berm was likely on private property, as it was signed as such along the Upper Access Road. If fish had access to this area they would benefit from stream complexing to increase habitat variety and stabilize banks. The area would also benefit from some fill planting and minor hand brushing around young, regenerating conifers in the riparian area.

The area from below the berm to the Lower Access Road did not require treatment.

## SITE CARD

STREAM NAME (gaz) Unnamed tributary (local) KWRP - Trib #71

WATERSHED CODE

ILP MAP # | ILP # | NID MAP # | NID #

REACH # – | SITE # | FIELD UTM | SITE LG | ACCESS FT

DATE 10/9/1996 | TIME 1121 | AGENCY | CREW EW PH | FISH FORM (Y) N

### CHANNEL

| | mthd | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CHANNEL WIDTH (m) | 17 | | | | | | | | |
| WETTED WIDTH (m) | 1.5 | | | | | | | | |
| RES. POOL DEPTH (m) | 2 | | | | | | | | |
| $W_b$ Dp (m) | | | | | | | | | |

GRADIENT %

STAGE L M H

No Vis. Ch. DW | Dry/Int. Tribs.

### WATER

EMS | REQ. #

TEMP 9.5 °C | COND. µS/cm

pH | TURB. (T) M L (C)

FLD SNS

BED MATERIAL Dominant S Subdom. C

D95 (cm) 15 D (cm) | Morph.

DISTURBANCE INDICATORS: (01) B1 B2 B3 D1 D2 D3 C1 C2 C3 C4 C5 S1 S2 S3 S4 S5

### COVER

| | COVER Total | | | | | | |
|---|---|---|---|---|---|---|---|
| Type | SWD | LWD | B | U | DP | OV | IV |
| AMT | | | | | | | |
| LOC | | | | | | | |

CROWN CLOSURE: 0 | (1) 1-20% | 2 21-40% | 3 41-75% | 4 71-90% | 5 > 90%

LWD FNC N F A DIST C E

LB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

INSTREAM VEG N A M V

RB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

### MORPHOLOGY

PATTERN TM ME IM IR SI ST

ISLANDS N O I F S AN

BARS N SIDE DIAG MID SPAN BR

COUPLING DC PC CO

CONFINEMENT EN CO FC OC UN N/A

### FEATURES

| C | NID MAP # | NID # | TYPE | HT / LG (m) | mthd | PHOTO | COMMENTS | UTM |
|---|---|---|---|---|---|---|---|---|
| | | | | | | R___ F___ | | |
| | | | | | | R___ F___ | | |
| | | | | | | R___ F___ | | |
| | | | | | | R___ F___ | | |

### HABITAT QUALITY

### DOCUMENTATION

FSZ1

| ROLL # | # | FOC LG | DIR | COMMENTS |
|---|---|---|---|---|
| 01 | 1-8 | 35mm | | Pictures u/s d/s Cross section, & Vegetation |
| | | | | |
| | | | | |
| | | | | |

### WILDLIFE

| GROUP | WILDLIFE OBSERVATIONS | GROUP | WILDLIFE OBSERVATIONS |
|---|---|---|---|
| | N/A | | |

### COMMENTS

C

The first 3 traps fish were caught, a possible barrier @ beaver dam photo # 8 EW.

1 # CT Caught in BD on right side @ 0+361

C

# FISH COLLECTION FORM

GAZETTED NAME unnamed trib (local) trib # 11 ☐ LAKE ☑ STREAM ☐ WETLAND

WATERSHED CODE

WATERBODY ID | ILP MAP # | ILP # | SITE/LAKE CARD ATTACHED ☑ Y ☐ N

PROJECT ID | REACH # | FISH PERMIT # 99-076

DATE 09151999 to 09161999 | AGENCY | CREW EW, PH, | ☐ RE-SAMPLE

## SITE / METHOD

| SITE # | NTS MAP # | NID # | SITE UTM | MTD / NO. | STREAM CONDITION TEMP | COB | TURB. | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | | | | 9.5 | | | |

## FISH SUMMARY

| SITE # | MTD / # | H / P | SPECIES | STAGE | AGE | TOTAL # | MIN. LENGTH | MAX LENGTH | FISH ACT. | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | GT, | | CO | | | 1 | 130 | 130 | 4 | |
| | | | CT | | | 16 | 70 | 115 | | |

## GEAR SPECIFICATIONS

NET / TRAP SPECIFICATIONS

| C | SITE # | MTD / # | HAUL | DATE IN | TIME IN | DATE OUT | TIME OUT | NET TYPE | LENGTH | DEPTH | MESH SIZE | SET | HAB. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GT, | | 09115 | 11:25 | 09116 | 11:13am | | | | 1/8 | | OP |

## ELECTROFISHER SPECIFICATIONS

| SITE # | MTD / # | PASS | TIME IN | TIME OUT | EFFEC. | LENGTH | WIDTH | ENCL. | VOLTAGE | FREQ. | PULSE | MAKE | MODEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## COMMENTS

On individual fish data 1-14 all dates, time in, & time out are recorded.

CARD ____ OF ____

915 tributard below culvert site trib #11 0+000 GT# 1 PAGE 16

1

## INDIVIDUAL FISH DATA

FISH COLLECTION FORM #

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | #3 | GT | | CT | 114mm | | | J | | | | | | | | R__ F__ |
| | | | | | | | | | | | | | | | | R__ F__ |
| | | | | | | | | | | | | | | | | R__ F__ |
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| | | | | | | | | | | | | | | | | R__ F__ |

## INDIVIDUAL FISH DATA

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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COMMENT

@ the start of the beaver dams
Wetted Width 20 - 30 m
depth 1 - 1.5 m
photo #1 CT in zip lock 114mm
#2 Cross section veiw PH

Time in 09.15.99
11:25 a.m

Time out 09.16.99
9:42 AM

CARD
OF

## INDIVIDUAL FISH DATA

FISH COLLECTION FORM #

| G | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | CT | 107mm | | | J | | | | | | | | R__ F__ |
| | | 1 | | CO | 130 | | | J | | | | | | | | R__ F__ |
| | | 1 | | CT | 106mm | | | J | | | | | | | Marked #1 | R__ F__ |
| | | 1 | | CT | 100mm | | | J | | | | | | | | R__ F__ |
| | | 1 | | CT | 108mm | | | J | | | | | | | | R__ F__ |
| | | 1 | | CT | 110mm | | | J | | | | | | | | R__ F__ |
| | | 1 | | CT | 85mm | | | J | | | | | | | | R__ F__ |
| | | 1 | | CT | 95mm | | | J | | | | | | | | R__ F__ |
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## INDIVIDUAL FISH DATA

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
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## INDIVIDUAL FISH DATA

FISH COLLECTION FORM #

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
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## INDIVIDUAL FISH DATA

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COMMENT

Gee trap in shallow water
Temperature 9.5°
WW 20 - 25 m
depth 1 - 1.5 m
Photo # 8 BD barrier EW
dominate - Sand & fines
Sub - dom - cobble
Slope 1 percent %

Time in 17:04 p.m.
09.15.99

Time out 10:27 AM
09.16.99

CARD
OF

## INDIVIDUAL FISH DATA

FISH COLLECTION FORM #

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | CT | 101 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 93 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 85 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 105 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 90 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 90 mm | | | | | | | | | | | R__ F__ |
| | | 1 | | CT | 94 mm | | | | | | | | | | | R__ F__ |
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## INDIVIDUAL FISH DATA

| C | SITE # | MTD / # | H / P | SPEC. | LENGTH | WEIGHT | SEX | MATUR. | AGE STRUCTURE | AGE SAMPLE # | AGE | VOUCHER # | GENETIC STRUCTURE | GENETIC SAMPLE # | COMMENTS | PHOTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | | | | | | | | | | | R__ F__ |
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## 2.7 Toboggan/Glacier Gulch Creek Site Survey and Design

This project was originally identified by the Ministry of Environment, Lands and Parks as two stream crossings located on the Silvern Lakes Road that would benefit from stream rehabilitation procedures.

### 2.7.1 Introduction

The Silvern Lakes Road which crosses the two stream rehabilitation sites is located in the southern most portion of the Kitseguecla River Chart area was initially prescribed for deactivation under the Kitseguecla/Blunt Creek Road Deactivation project. During the development of the prescription it was felt that the road should be prescribed in two sections. The prescription for that portion of Silvern Lakes Road above Toboggan Creek was produced by Jack Whittles M.Sc., P.Geo. of Madrone Consultants Ltd. with the assistance of Silvicon Services Inc. and is included as part of this Toboggan/Glacier Gulch Creek Site Survey and Design project. The portion of the Silvern Lakes Road below Toboggan Creek has been included in Part 2 of the Kitseguecla/Blunt road deactivation prescriptions.

The two sites were reviewed by MELP and Silvicon staff prior to the commencement of field work. The site survey and design work for the Toboggan creek crossing has been carried out by Silvicon Services Inc. Silvicon conducted many of the activities associated with the development of the Toboggan Creek Crossing Rehabilitation Project. References utilized in the development of this project are listed near the end of the following Toboggan Creek/Silvern Lakes Road Site Survey and Design Report.

The field work for the Glacier Gulch Creek site is planned to be produced in the spring of 2000. The site survey and design on Glacier Gulch Creek has been postponed until the following season due to some complications. The Glacier Gulch Creek Crossing located on the Silvern Lakes road is also within a section of private land. Although located through private land, the road has been in existence since before 1914 and is considered to be public access. It is the intention, however, of Silvicon to Contact the landowner on behalf of PIR prior to any fieldwork, to review the intended works. The landowner will be given the opportunity to state their opinion for the intended prescription.

The following report was prepared with three preferred options for the crossing and rehabilitation of Toboggan Creek. The intent of this report was to put forward the available and most viable options and prompt discussion from all involved parties. The Ministry of Forests, Ministry of Environment, Lands and Parks, Department of Fisheries and Oceans, PIR and the general public will all have a chance to state their opinions and recommendations. Using the input from all these sources the prescription for the sites of Toboggan Creek and Glacier Gulch Creek will be developed. The prescriptions should be ready for implementation by early summer 2000.

## 2.7.2 Toboggan Creek/Silvern Lakes Road Site Survey and Design Report

**1999/2000 Forest Renewal BC Funded**

# TOBOGGAN CREEK/SILVERN LAKES ROAD SITE SURVEY AND DESIGN PRESCRIPTION REPORT

Prepared for:
**Pacific Inland Resources**
(A Division of West Fraser Mills Ltd)

Prepared by:

**Ed Withers, Watershed Restoration Supervisor**
**Silvicon Services Inc.**
**February 2000**

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## List of Appendices


**Appendix A Site Photos**

**Appendix B Professional Prescription for Silvern Lakes Road**

**Appendix C Site Plan Base Map**

**Appendix D Site Plan Maps (Options 1, 2 and 3)**

**Appendix E Instream Timing Windows**

**Appendix F Original Photos**

## 1.0 Introduction

The Toboggan Creek site and the Silvern Lakes road are part of an ongoing watershed restoration project, funded by FRBC. The proponent of this project is Pacific Inland Resources (PIR), a division of West Fraser Mills Ltd. Toboggan Creek is currently the site of a ford crossing on the Silvern Lakes road. The Silvern Lakes road is an old mining road that originated as a trail in the early 1900's. Evidence of this route in the form of a land survey has been found dating back to 1914. The road is currently used as a four wheel drive/hiking recreational trail. This road accesses mountainous alpine terrain in the vicinity of Silvern Lakes.

A level 1 assessment of the watershed, produced by Sterling Wood Group Inc. has identified the Silvern Lakes road as qualifying for WRP (Watershed Restoration Program) funding and in need of a professional deactivation prescription. Also, PIR was contacted by Ministry of Environment, Lands and Parks (MoELP) about the restoration of Toboggan Creek and Glacier Gulch Creek. Silvicon Services Inc. visited the Sites of Toboggan Creek and Glacier Gulch Creek with MoELP staff to review the necessary treatments. Silvicon Services Inc. conducted the ground work for the Toboggan Creek site plan and assisted with the field portion of the Silvern Lakes road deactivation prescription (Appendix B) developed by Madrone Consultants Ltd.

The site survey and design on Toboggan Creek was conducted mainly due to a washout of the Silvern Lakes road where it crosses Toboggan Creek. An old bridge located at this site has collapsed into the creek and diverted the main stream channel off of its natural course. Due to the new location of the stream channel, the stream washes over its banks and runs down the road surface during high water flows. It is felt that overflowing of the banks at this point could cause excessive siltation and debris accumulations, which may adversely impact important salmon spawning grounds downstream of the crossing.

The Glacier Gulch Creek crossing has not been surveyed yet but will be included in the final prescription. It is felt that the Glacier Gulch Creek crossing will be much simpler in comparison to Toboggan Creek in terms of treatment. The site survey and design on Glacier Gulch Creek has been postponed until the following season due to some complications. The Glacier Gulch Creek Crossing on the Silvern Lakes road is located on private land in the southwest corner of the southwest quadrant of section 21 owned by Peter Lund of Smithers BC. Although located through private land, the road has been in existence since before 1914 and is considered to be public access. It is the intention, however, of Silvicon to Contact the landowner on behalf of PIR prior to any fieldwork, to review the intended works. The landowner will be given the opportunity to state their opinion for the intended prescription.

## 2.0 Method and Objectives

The immediate area around the old bridge site was surveyed and a large site plan was developed from the survey data utilizing digital terrain modeling (DTM). The information collected for this site plan includes the stream profile and cross sections, back channels and overflow channels, road location, general topography of the site, soil types, large standing timber around the site and rough location of LWD and log jams. This report was developed in conjunction with the site plan and refers directly to the site plan drawings. Utilizing the DTMs, three crossing options have been derived from the original site plan with the objective of reestablishing and maintaining the original stream channel, protecting fish habitat, maintaining fish passage and maintaining 4wheel drive recreational access. A number of 35mm photographs were taken of the site, 35 of which were labeled on the base map. Most of the photos have been incorporated in the report as Appendix A. Some of the photos labeled on the map have not been included in the report as it was felt that they were redundant or unnecessary. The photos were shot over a two-day period after a heavy rainstorm and in many cases show the dynamics of Toboggan Creek, depicting the stream before, during and after high water.

This report and Site Pan Options will be used to develop a prescription for the site. It is expected that the works phase of the prescription will take place in the Summer of 2000 within the recommended timing windows for Toboggan Creek.

## 3.0 Instream Project Type:

Of the four project types listed in the Aquatic Habitat Site Survey and Design contract, created by the Ministry of Environment, this project is considered to be **TYPE II.**

**TYPE II** involves work where there would be alteration of the channel bottom, where streambed profiles are modified/impacted for a longitudinal distance of more than 50m, including:

- construction of pool riffle sequences using boulders;
- channel/gravel excavation;
- gravel placement;
- deflector groin installation;
- weir development;
- berm development;
- dyke development.

## 4.0 Options

There are 3 options for the rehabilitation of this site. Each option will be of a **TYPE II** variety as described above. Each option was developed utilizing the original site plan DTM as a base map drawing. For each option a separate drawing has been created. Some of the contours have been altered in these drawings to show the expected results of the stream alterations. The three options developed are as follows:

- Option 1 – Upper ford crossing
- Option 2 – Lower ford crossing
- Option 3 – Bridge crossing

The discussion of these options will refer directly to the site plan drawings.

### 4.1 Option 1 - Upper ford crossing

Option 1 proposed for the rehabilitation of Toboggan Creek at the Silvern Lakes road crossing site consists of the construction of a riprap berm for the protection of the stream banks and the construction of approaches over the berm to maintain four wheel drive access across the stream at the current ford crossing location. Option 1 will require the least amount of work of the three options proposed but is also the most likely to be adversely affected by changes in the stream. The recommended structure and excavation types as labeled on the Option 1 map are:

A – riprap berms
B – riprap approach/west side of berm
C – log stream deflector
D – remove collapsed wooden bridge deck
E – redirect main channel
F – boulder stream breaks
G – approach to berm/east side of berm

A – A riprap berm should be created along the original high water mark to stop the overflow of water during high water. The berm should run along the east side of the stream for roughly 65m starting roughly 8m upstream of cross section D. It is recommended that the minimum size of riprap be class 25 or better. The berm should be slightly embedded below the high water mark and should be 1.0 to 1.5m in height above the high water mark. The estimated volume of rock for this berm is $200m^3$.

B – An approach ramp from the berm down to the stream should be constructed from class 25 riprap as well. This approach ramp should be capped with large gravel to make it possible for 4wheel

drive vehicles to drive on. It is expected that the construction of this approach will require roughly 15 to 20m$^3$ of riprap.

C – The creation of a log stream deflector groin placed directly upstream of the approach ramp (B) should help to keep the stream channel from directing it's full force against approach ramp and the berm or stream banks. A stream deflector groin can be created by imbedding the 50cm butt or better of a 12 to 18m long log into the rock berm and placing the tip of the log pointing upstream into the current. The log should be anchored with a cable fastened to the log, approximately 5m from the center of the berm and tie back through the berm to a log buried on the east side of the berm. The log should be placed at roughly a 30 degree angle to the berm. The V created by placing the log this way should then be filled in with class 25 riprap to the level of the log. It is recommended that a live Cottonwood be used for this purpose and that the root wad be kept intact in hopes that it will sprout new growth to provide shading for the stream.

D – It is felt that the removal of the old bridge deck with this option is unnecessary and allowing the bridge deck to stay in place would be preferred. By removing the bridge, the stream will flow through it's natural course more freely reducing the likelihood of flooding the road but with the addition of the riprap berm, the likelihood of flooding is greatly decreased. The removal of the bridge deck may cause the stream to become more channeled, consequently, the ford crossing at this point would become much more difficult to traverse with a 4wheel drive vehicle. The pooling effect caused by the collapsed bridge may also have created some fish habitat that would not normally exist. The boulders placed in the stream should, at least partly, compensate for the loss, but the removal of the old bridge should be optional as it is not deemed necessary to rehabilitate the site. If upon further examination of the site it is decided to remove the old bridge, the excavation of the side channel, labeled $D_1$ on the map, should take place. The side channel upstream of the collapsed bridge deck at $D_1$ should be redirected into the main stream channel between cross sections D and E by excavating a channel linking the side channel to the main channel. This is not expected to be an effective permanent channel but simply a means of redirecting water away from the old bridge deck prior to it's extraction.

E – The main stream channel currently flows in the general direction of the proposed berm on the east side of Toboggan Creek before curving to the north. By excavating the stream bed towards the west side of the stream, the channel can be straightened to more closely resemble it's course prior to the bridge collapse. This should be done only if the bridge deck is removed. It is expected that the stream velocity will increase somewhat through the center of the stream but that it will slow again upon entering the pool created by the stream breaks below. Roughly 80m$^3$ of material over a 30m stretch will need to be excavated to make this change.

F – Place large boulders within the streambed to create a break in the stream velocity through the long run section between cross section D and F. Boulders should be placed at two locations between cross sections D and A. The locations are marked on the map as $F_1$ and $F_2$.

Location $\mathbf{F_1}$ will consist of large boulders with a minimum mean diameter of 1.5m. These are the largest boulders of the two locations and will be placed the furthest upstream and directly below the ford crossing to reduce the full force of the stream. It is expected that roughly 4 to 5 boulders of this size will be needed as well as 6 to 8 boulders with a mean diameter of roughly 1.0m. Location $\mathbf{F_2}$ will see the placement of 5 to 7 boulders 1.0m in mean diameter and placed approximately 20m downstream of location $F_1$. The result should be a pooling effect above $\mathbf{F_1}$

and between $\mathbf{F_1}$ and $\mathbf{F_2}$ that will reduce the critical velocity of Toboggan Creek as it passes over the crossing. It is expected that boulders will slow the stream and reduce the scouring effect that may occur as the stream curls over the ford. It is anticipated that gravel and cobble will accumulate above the stones placed at $\mathbf{F_1}$ creating an easier ford crossing. The tractive force of the stream at the Q100 flow is estimated to be 51.7 kg, which means that the deepest, fastest part of the stream has the capability to move a stone of roughly 51.7 kg. Smaller boulders can be placed amongst the large boulders at $\mathbf{F_1}$ and $\mathbf{F_2}$, but they must be at least .55m mean diameter to be expected to stay in place. The smaller stones will breakup the current and help provide fish passage.

G – An approach to the east side of the berm should be constructed. This can be done utilizing material excavated from the stream bed or material trucked into the site. This approach should be capped with large gravel to make it possible for 4wheel drive vehicles to drive on. It is expected that the construction of this approach will require roughly 15 to 20$m^3$ of material.

Expected costs* associated with this option are:

- mid sized excavator for roughly 85 hours @ $120/hr $10 200.00
- gravel/rock truck for approximately 25 hours @ $70/hr $1 750.00
- Lowbed for approximately 2 hours @ $90/hr $180.00
- full time supervision for roughly 70 hours @ $45/hr $3 150.00

The estimated total cost of the works is $15 280.00

*costs are based on estimated hourly rates as well as estimated times, the actual costs will likely vary depending on the contractor and equipment hired to construct the site.

**if blasting is required to acquire rock for riprap, costs will be considerably higher

**Problems with option 1**

One problem expected to occur with this option is the ability to maintain a ford crossing of the stream at this point. Toboggan Creek is a strong, fast flowing stream and if the old bridge deck is removed the stream is expected to flow with greater velocity through this section. It is unclear whether the ford crossing currently located at this point will continue to be passable with 4wheel drives. It may be possible for the 4wheeler to navigate different sections of the stream and still utilize this approach but it is also possible that without a permanent structure the crossing will be rendered unusable. Ultimately, this may also cause recreationalists to spend more time with their vehicles in the stream, thereby resulting in increased streambed disturbance over time while attempting to cross the stream. Also, with the creation of the stream breaks and the berm on the east side of Toboggan Creek to prevent flooding the stream may now flood it's bank on the west side. The creation of another berm on the west side may be beneficial.

## 4.2 Option 2 - Lower ford crossing

Option 2 proposed for the rehabilitation of Toboggan Creek at the Silvern Lakes road crossing site consists of the construction of a ford downstream from the original crossing to maintain four wheel drive access across the stream and the development of a riprap berm for the protection of the stream banks from flooding. The recommended structure and excavation types as labeled on the Option 2 map are:

A – boulder stream breaks
B – ford crossing
C – riprap berms
D – log stream deflector
E – 4wheel drive access route
F – redirect side channel
G – remove collapsed wooden bridge deck
H – redirect main channel
I – build gravel/cobble berm

A – Place large boulders within the streambed to create a break in the stream velocity through the long run section between cross section D and F. Boulders should be placed at three locations between cross sections A and F. The locations are marked on the map as $A_1$, $A_2$, and $A_3$.

Location $\mathbf{A_1}$ will consist of large boulders with a minimum mean diameter of 1.5m. These are the largest boulders of the three locations and will be placed the furthest upstream to reduce the full force of the stream. It is expected that roughly 4 to 5 boulders of this size will be needed as well as 6 to 8 boulders with a mean diameter of roughly 1.0m. Location $\mathbf{A_2}$ will see the placement of 5 to 7 boulders 1.0m in mean diameter and placed approximately 12m downstream of location $A_1$ and directly above the proposed ford crossing. The result should be a pooling effect above $A_1$ and between $A_1$ and $A_2$ that will slow the velocity of Toboggan Creek before crossing the ford structure. It is expected that the construction of a ford will cause an increase in stream velocity due to the relatively smooth bed surface that construction of the ford will create. To reduce the critical velocity as the stream passes over the crossing, a third placement of 5 to 7 boulders, 1.0m in mean diameter should be placed against the downstream side of the ford at location $\mathbf{A_3}$. It is expected that boulders with a minimum diameter of 1.0m will slow the stream and reduce the scouring effect that may occur as the stream curls over the ford. The tractive force of the stream at the Q100 flow is estimated to be 51.7 kg, which means that the deepest, fastest part of the stream has the capability to move a stone of roughly 51.7 kg. Smaller boulders can be placed amongst the large boulders at $A_1$, $A_2$ and $A_3$, but they must be at least .55m mean diameter to be expected to stay in place. The smaller stones will breakup the current and help provide fish passage.

B – Create a ford crossing by dumping and tamping in place a layer of rock or large cobble or angular rock. It is expected that the minimum size of rock that will stay in place is roughly .55m in mean diameter, but due to the structures that will be put in place to reduce the stream velocity, a smaller stone size of roughly .2 - .3m should be acceptable. If tamped in place, this size of stone should be small enough to still allow 4wheel drive access. The rock used to bed the ford should extend past the present high water marks for roughly 2m. It is estimated to take roughly 15 to 20 $m^3$ of rock to create this ford. It is also expected that during high water, the stream will deposit gravel and small cobble into the interstitial spaces, creating an easier surface to drive across.

C – It is expected that the stream will be carrying large amounts of gravel and cobble during high water as it enters the zone where the stream channel was altered. The boulders placed in the stream should have the effect of causing the stream to slow and deposit much of the larger material behind the boulders. This would cause the high water marks to spread outward from their original location. A riprap berm should be created along the original high water mark to stop the overflow of water. The berm should run mainly along the east side of the stream for roughly 75m upstream of the crossing. It is recommended that the minimum size of riprap be class 25 or better. The berms should be slightly embedded below the high water mark and should be 1.0 to 1.5m in height, above the high water mark. The estimated volume of rock for this berm is 225 $m^3$. On the west side of the stream it is felt that the berm need only be roughly 20m in length and curve up from the ford crossing to the hillside. Toboggan Creek has the potential to flood it's banks and run down the old road on the west side possibly wiping out the approach to the ford crossing. The west side berm is mainly to protect against this possibility. It is recommended that the minimum size of riprap for the west side berm also be class 25 or better. The volume of rock needed for this berm is roughly 60 $m^3$ for a total of 285$m^3$ of class 25 riprap.

D – The creation of a log stream deflector groin should help to keep the stream channel from directing it's full force against the berm or stream banks. A stream deflector groin can be created by imbedding the 50cm butt or better of a 12 to 18m long log into the rock berm and placing the tip of the log pointing upstream into the current. The log should be anchored with a cable fastened to the log, approximately 5m from the center of the berm and tie back through the berm to a log buried on the east side of the berm. The log should be placed at roughly a 30 degree angle to the berm. The V created by placing the log this way should then be filled in with class 25 riprap to the level of the log. It is recommended that a live Cottonwood be used for this purpose and that the root wad be kept intact in hopes that it will sprout new growth to provide shading for the stream.

E – A new 4wheel drive access route can be built to the ford crossing. It may not be necessary to fall any large timber to build this route, depending on the maneuverability of the machinery used to construct the site and haul the construction materials. Cross ditches should be constructed to ensure adequate drainage past the new access route. On the east side of the stream, the access route needs only to be bladed to clear it of underbrush and small trees. On the west side of Toboggan Creek, the route should be surfaced with coarse non-erodible material due to finer soils.

F – The side channel upstream of the collapsed bridge deck should be redirected into the main stream channel between cross sections D and E by excavating a channel linking the side channel to the main channel. This is not expected to be an effective permanent channel but simply a means of redirecting water away from the old bridge deck prior to it's extraction.

G – Remove the old bridge deck and log stringers from the streambed. By removing the bridge, the stream will flow through it's natural course more freely and with less likelihood of flooding the road. Also, with the addition of the rock berm, the likelihood of flooding is greatly decreased. The removal of the bridge deck may cause the stream to become more channeled, consequently, the old ford crossing at this point would become much more difficult to traverse with a 4wheel drive vehicle. The pooling effect caused by the collapsed bridge may have created some fish habitat that would not normally exist but the boulders placed in the stream should, at least partly, compensate for the loss. The removal of the old bridge should be optional as it is not deemed necessary to rehabilitate the site with this option. If upon further examination of the site it is decided to keep the old bridge in place, the excavation of the side channel, labeled F on the map, should not take place.

H – The main stream channel currently flows in the general direction of the proposed berm on the east side of Toboggan Creek before curving to the north. By excavating the stream bed towards the west side of the stream, the channel can be straightened to more closely resemble it's course prior to the bridge collapse. This should be done whether the bridge deck is removed or not. It is expected that the stream velocity will increase somewhat through the center of the stream but that it will slow again upon entering the pool created by the stream breaks below. Roughly $80m^3$ of material over a 30m stretch will need to be excavated to make this change.

I – Due to the excavation of the stream bed, there may be an excess of material. If large enough, some of the cobble from the excavation can go towards building the berm or placed in the ford crossing. It can also be utilized to armor the west side approach to the ford. Any left over gravel and cobble can be placed as a berm on the west side of Toboggan Creek at cross sections B, C and D, starting on the down stream end and working upstream. This berm is not expected to be a permanent fixture nor is it mandatory, but it may help to deter the stream from changing course towards the west and running down the old road surface by deflecting the flow back into the main channel. It also provides a suitable site to place unwanted material.

Expected costs* associated with this option are:

- mid sized excavator for roughly 110 hours @ $120/hr $13 200.00
- gravel/rock truck for approximately 50 hours @ $70/hr $3500.00
- D4 crawler tractor for approximately 10 hours @ $95/hr $950.00
- Lowbed for approximately 2 hours @ $90/hr $180.00
- full time supervision for roughly 80 hours @ $45/hr $3600.00

The estimated total cost of the works is $21 430.00**

*costs are based on estimated hourly rates as well as estimated times, the actual costs will likely vary depending on the contractor, the type and number of pieces of equipment hired to construct the site and the length of rock haul.

**if blasting is required to acquire rock for riprap, costs will be considerably higher

**Problems with option 2**

One problem expected to occur with this option is the increased probability the stream breaks will capture large floating debris or LWD. There is a chance that during high water, trees and root wads that have fallen into the creek upstream may be caught up in the rocks used for the stream breaks, possibly even blocking the ford after the high-water has subsided. It is expected that any log jams that occur will be similar to the one show in photo #15. This may be quite undesirable to the recreationalist as they would have to clear the ford before passing. It is felt that this problem will not be overly harmful to the situation and is an acceptable risk. The only danger will come from overly large accumulations that could break loose all at once. It is felt that this occurrence would be quite unlikely. Yearly maintenance to clear LWD from the ford is a possibility.

## 4.3 Option 3 – Bridge crossing

Option 3 proposed for the rehabilitation of Toboggan Creek at the Silvern Lakes road crossing site consists of the construction of a bridge to maintain four wheel drive access across the stream and the construction of a riprap berm for the protection of the stream banks and the bridge abutments from high water flooding. The recommended structure and excavation types as labeled on the Option 3 map are:

A – 4wheel drive access route
B – bridge and approaches
C – riprap berms
D – log stream deflector
E – redirect side channel
F – remove collapsed wooden bridge deck
G – redirect main channel
H – build gravel/cobble berm

A – A new 4wheel drive access route can be built to the bridge crossing site. It may not be necessary to cut many of the large trees to build this route, depending on the maneuverability of the machinery used to construct the site and haul the construction materials. Cross ditches should be constructed to ensure adequate drainage past the new access route.

B – A bridge similar to the example on the Option 3 Site Plan Map, can be designed and placed at the site. The bridge drawn on the Option 3 map is only an example of what can be expected for a bridge on this site and is not a professional design. Exact bridge dimensions and construction techniques should come from an engineered bridge design for the site. A rail car bridge would be ideal for this situation as it is relatively inexpensive and exceeds the necessary load capacity for even a large 4wheel drive vehicle. Riprap calculations and dimensions to protect the bridge and approaches will also come from the professional bridge design. It is anticipated that roughly $35m^3$ of fill would be required to fill the west approach and 125 $m^3$ of fill would be required to fill the east approach. Of the $125m^3$ on the east approach, it is expected that roughly $45m^3$ will need to consist of large coarse material to allow for drainage under the approach. Alternatively, a culvert could be placed under the approach for the same purpose.

C – A riprap berm should be constructed along the original high water mark to stop the overflow of water. The berm should run mainly along the east side of the stream for roughly 75m upstream of the crossing. It is recommended that a minimum of 2 sizes of riprap be utilized, class 25 or better and class 50 or better. The area recommended for the class 50 riprap is labeled $C_1$ and is located on the east side of the bridge crossing. The areas recommended for the class 25 riprap are labeled $C_2$ and are located on the west side of the bridge crossing and on the east side upstream of the $C_1$ location. The berms should be slightly embedded below the high water mark and should be 1.0 to 1.5m in height above the high water mark. The estimated volume of rock for this berm is 250 $m^3$. On the west side of the stream it is felt that the berm need only be roughly 20m in length and curve up from the ford crossing to the hillside. Toboggan Creek has the potential to flood it's banks and run down the old road on the west side possibly wiping out the approach to the bridge crossing. The west side berm is mainly to protect against this possibility. The volume of rock needed for the west side berm is roughly 60 $m^3$.

D – The creation of a log stream deflector groin should help to keep the stream channel from directing it's full force against the berm or stream banks. A stream deflector groin can be created by imbedding the 50cm butt or better of a 12 to 18m long log into the rock berm and placing the tip of the log pointing upstream into the current. The log should be anchored with a cable fastened to the log, approximately 5m from the center of the berm and tie back through the berm to a log buried on the east side of the berm. The log should be placed at roughly a 30 degree angle to the berm. The V created by placing the log this way should then be filled in with class 25 riprap to the level of the log. It is recommended that a live Cottonwood be used for this purpose and that the root wad be kept intact in hopes that it will sprout new growth to provide shading for the stream.

E – The side channel upstream of the collapsed bridge deck should be redirected into the main stream channel between cross sections D and E by excavating a channel linking the side channel to the main channel. This is not expected to be an effective permanent channel but simply a means of redirecting water away from the old bridge deck prior to it's extraction.

F – Remove the old bridge deck and log stringers from the streambed. By removing the bridge, the stream will flow through it's natural course more freely and with less likelihood of flooding the road. Also, with the addition of the rock berm, the likelihood of flooding is greatly decreased. The removal of the bridge deck may cause the stream to become more deeply channeled. The removal of the old bridge is recommended with this option as there is a risk that damage could occur to the new bridge if the old bridge gets dislodged during high water and moved downstream. If upon further examination of the site it is decided to keep the old bridge in place, the excavation of the side channel, labeled E on the map, should not take place.

G – The main stream channel currently flows in the general direction of the proposed berm on the east side of Toboggan Creek before curving to the north. By excavating the stream bed towards the west side of the stream, the channel can be straightened to more closely resemble it's course prior to the bridge collapse. This should be done whether the bridge deck is removed or not. It is expected that the stream velocity will increase somewhat through the center of the stream but that it will slow again upon entering the pool created by the stream breaks below. Roughly $80m^3$ of material over a 30m stretch will need to be excavated to make this change.

H – Due to the excavation of the stream bed, there may be an excess of material. If large enough, some of the cobble from the excavation can go towards building the berm or placed in the ford crossing. It can also be utilized to armor the west side approach to the ford. Any left over gravel and cobble can be placed as a berm on the west side of Toboggan Creek at cross sections B, C and D, starting on the down stream end and working upstream. This berm is not expected to be a permanent fixture nor is it mandatory, but it may help to deter the stream from changing course towards the west and running down the old road surface by deflecting the flow back into the main channel. It also provides a suitable site to place unwanted material.

note - if this option is chosen, riprap sizes and placement should be calculated by a Professional Engineer

Expected costs* associated with this option are:

- mid sized excavator for roughly 117 hours @ $120/hr $14 040.00
- gravel/rock truck for approximately 60 hours @ $70/hr $4 200.00
- D4 crawler tractor for approximately 10 hours @ $95/hr $950.00
- Lowbed for approximately 4 hours @ $90/hr $360.00
- 16m span bridge and installation $8 000.00
- full time supervision for roughly 90 hours @ $45/hr $4 050.00

The estimated total cost of the works is $31 600.00

*costs are based on estimated hourly rates as well as estimated times, the actual costs will likely vary depending on the contractor and equipment hired to construct the site.

**if blasting is required to acquire rock for riprap, costs will be considerably higher

**Problems with option 3**

One problem expected to occur with this option is the possible increase in traffic on the trail. It is anticipated that by placing a bridge across Toboggan Creek, firewood cutters, hunters, ATV users, and other users that would not normally have crossed this stream would do so. The area would also be accessible for a longer period of the year because the stream could be crossed at any time instead of only at low flows. The possible increase in traffic could result in increased pressure on wildlife such as mountain goats that may be adversely affected by the increased human presence and motorized traffic into the alpine. At present, the Silvern Lakes Road is considered to be a hazardous road for 4wheel drive vehicles, by placing a bridge across the stream it is anticipated that 4wheel drive enthusiasts will assume the road is now less hazardous and attempt to travel it with unsuitable vehicles. If this option is chosen, a sign should be placed at the bridge clearly explaining the condition of the road and relinquishing liability to the user.

## 5.0 Summary

The three options portrayed in this report are examples of the works anticipated to be the most suitable rehabilitation techniques for the control of the flooding processes of Toboggan Creek while still allowing for the access of 4wheel drive vehicles for recreational purposes. This report is not a final prescription for the site and is open to suggestions and recommendations before the final prescription is written.

The Glacier Gulch Creek crossing which has not yet been surveyed may be a factor in the decision of treatments for Toboggan Creek. Glacier Gulch Creek feeds into Toboggan Creek and is also a fish bearing stream, therefore the same reasoning must be applied to both stream crossings to decide the crossing method. For example, if the decision is made that Toboggan Creek cannot be crossed utilizing a ford crossing for fears of excessive siltation then the same decision must be made for Glacier Gulch Creek for the same reason.

The final prescription for the site will include a detailed work plan summarizing the necessary works and the timing windows in which the works will occur. A copy of the instream works timing windows is included in this report as Appendix E.

Location of riprap and gravel sources will be identified in the final prescription as the current sources cannot be tested for such things as tensile strength and piece size until the sites are snow free.

The Professional Prescription for the Silvern Lakes Road is a prescription for permanent deactivation, therefore, upon receiving a quality certificate for the works of the road deactivation and works of the Toboggan Creek and Glacier Creek crossings, PIR will no longer be responsible for the inspections and maintenance of the sites. It will be the responsibility of the Ministry to inspect and maintain any crossing option chosen for the works of these two sites. The inspection intervals will depend on the chosen option and a recommendation will be given in the final prescription.

## 6.0 References


Madrone Consultants Ltd. Interior Watershed Assessment Procedure Trout/Toboggan/Moricetown Watersheds. 1997

Watershed Restoration Program. BC Ministry of Environment, Lands and Parks and Ministry of Forests. 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9.

Newbury, R.W – Gaboury, MN 1993. Stream Analysis and Fish Habitat Design: A Field Manual.

Sterling Wood Group. 1997. Trout Creek/Moricetown Watershed Assessment Project. Level 1 Assessment.

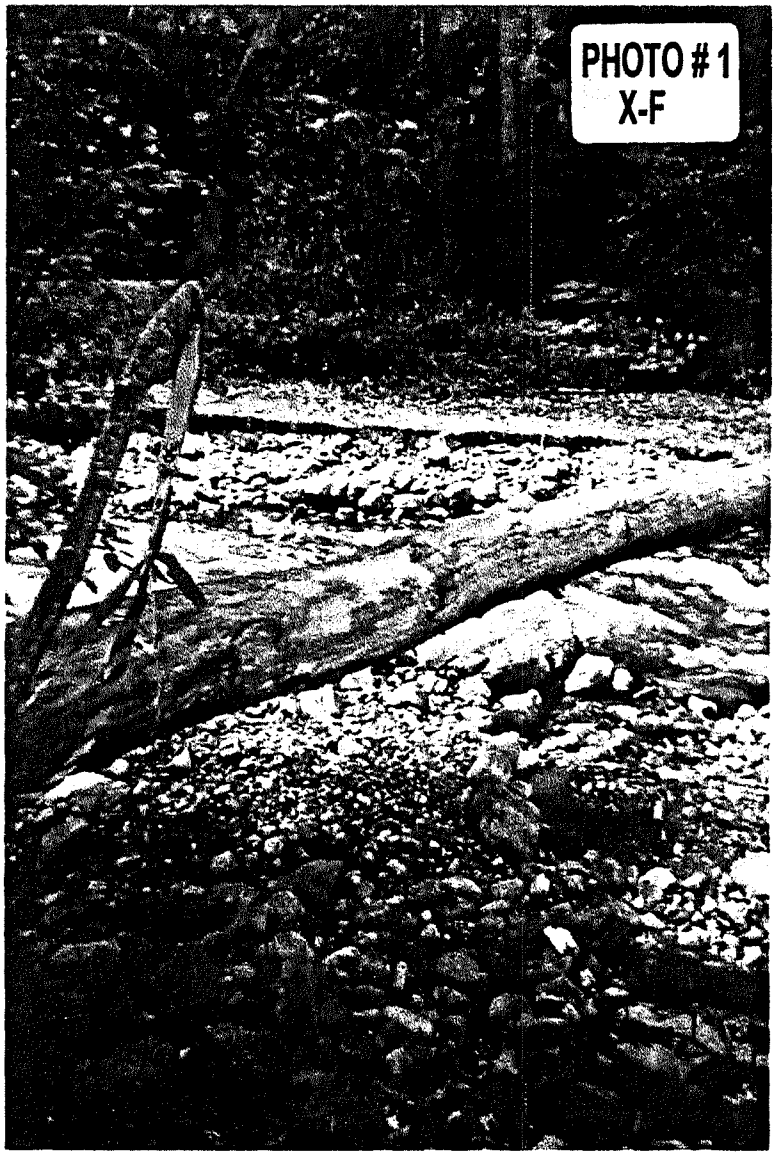
Forest Engineering Research Institute of Canada, Western Division Watershed Restoration Operations and Research Activities. Operations: Roads and Bridges, Article No: 45 Hillslope Stabilization and Fillslope Revetment in the Castle Creek Watershed.

Forest Engineering Research Institute of Canada, Western Division Watershed Restoration Operations and Research Activities. Operations: Roads and Bridges, Article No: 41 Installation of a Used Railcar Frame as a Bridge Along the Small River Mainline Near Tête Jaune Cache, BC.

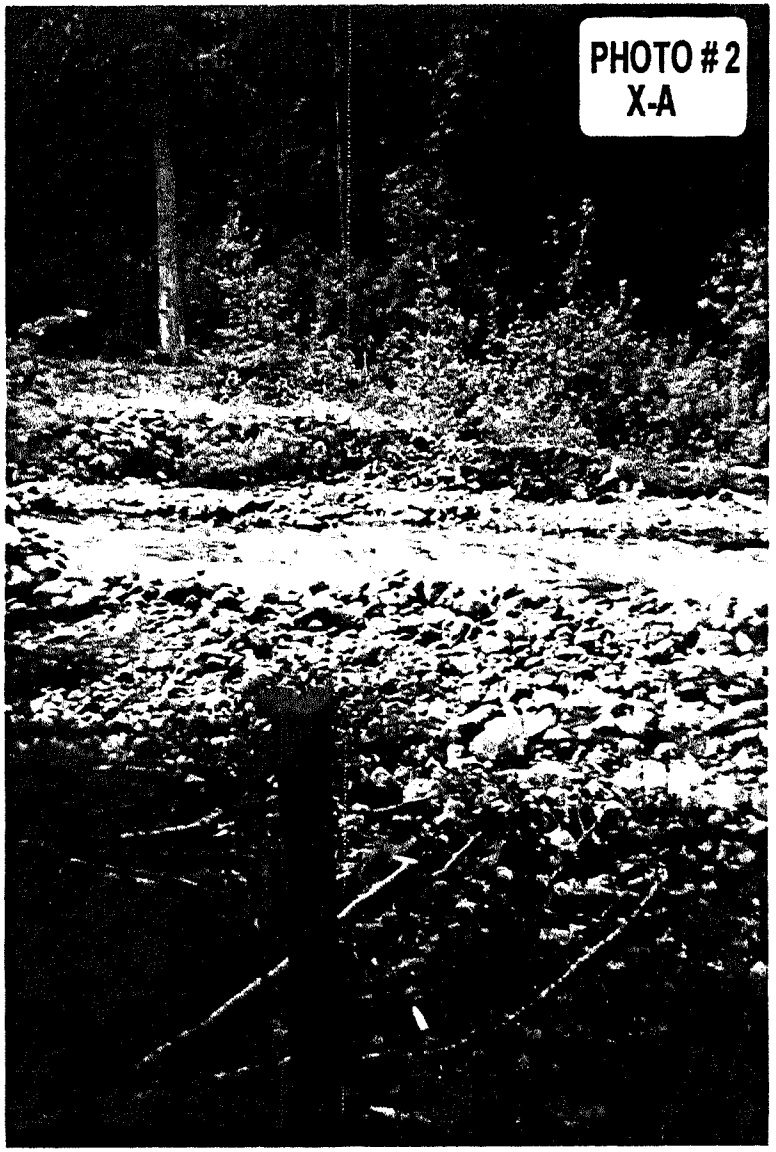
# Appendix A

## Site Photos

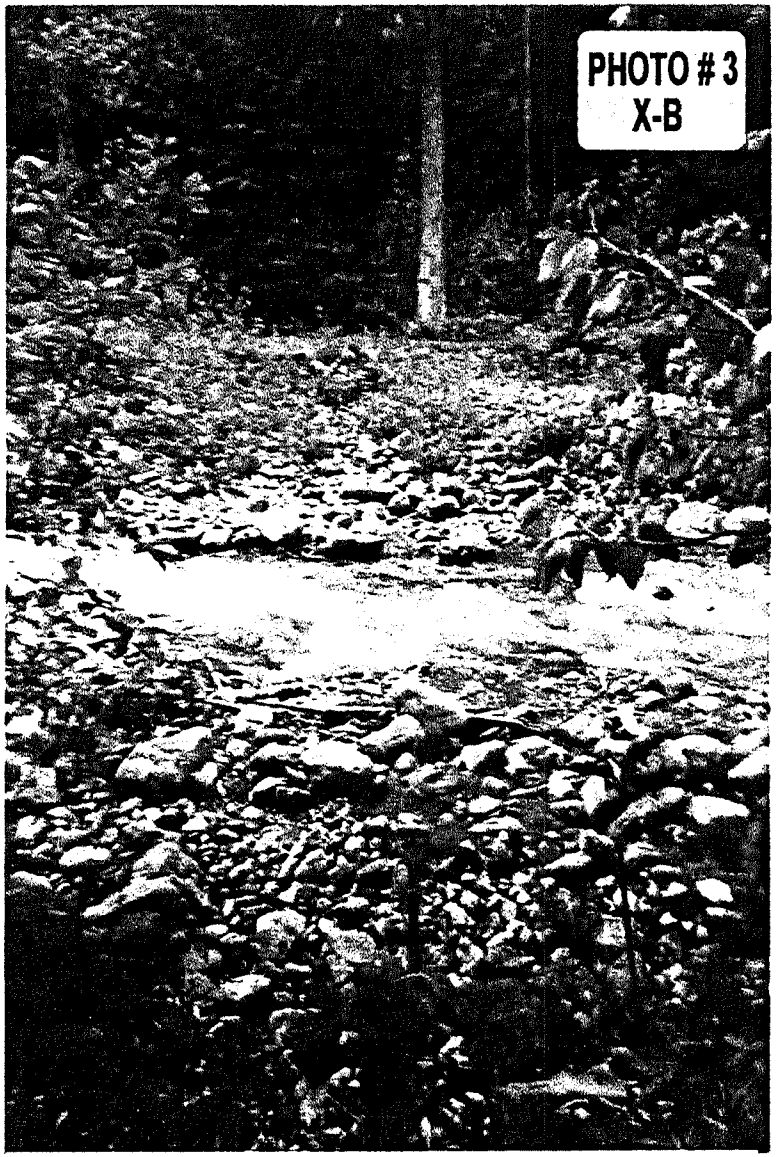
(Photo numbers correspond with numbers on base map)




Cross section F, site of proposed ford crossing (option 2) or proposed bridge crossing (option 3)



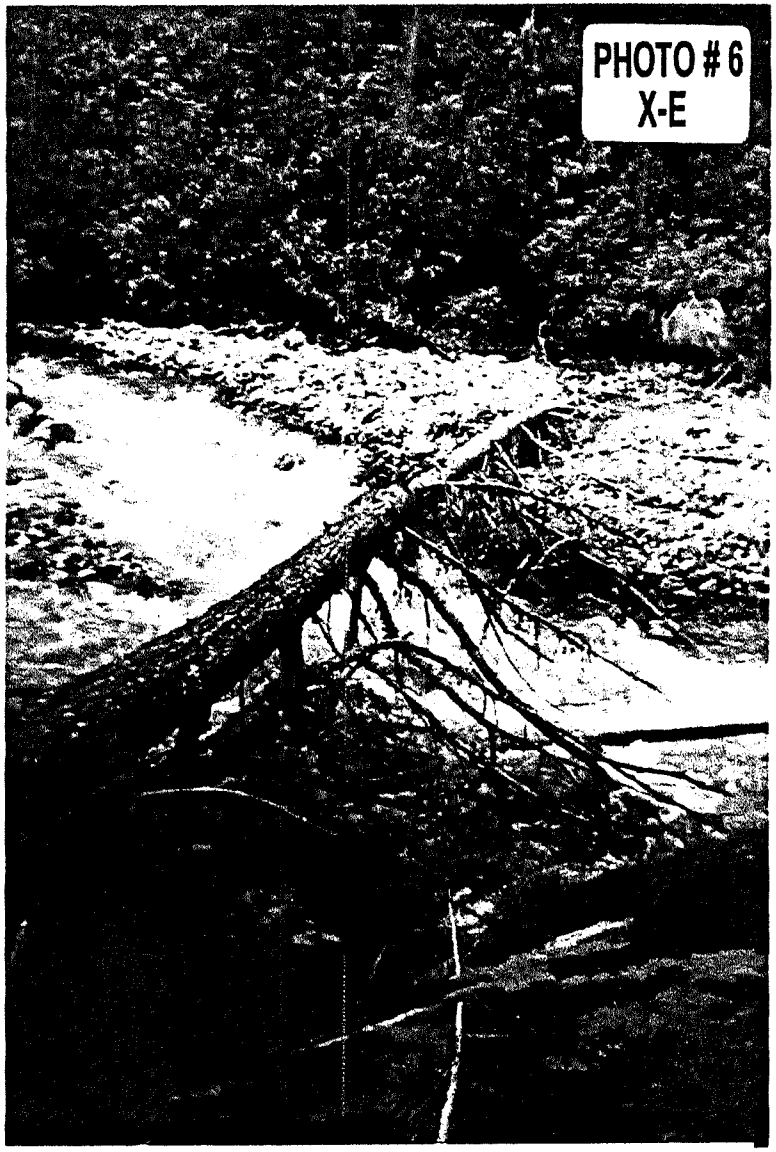

Cross section A, upstream of proposed ford crossing (option 2) or proposed bridge (option 3)




Cross section B, below collapsed bridge deck

Cross section C, collapsed bridge deck

Cross section D, above collapsed bridge deck and site of present ford crossing



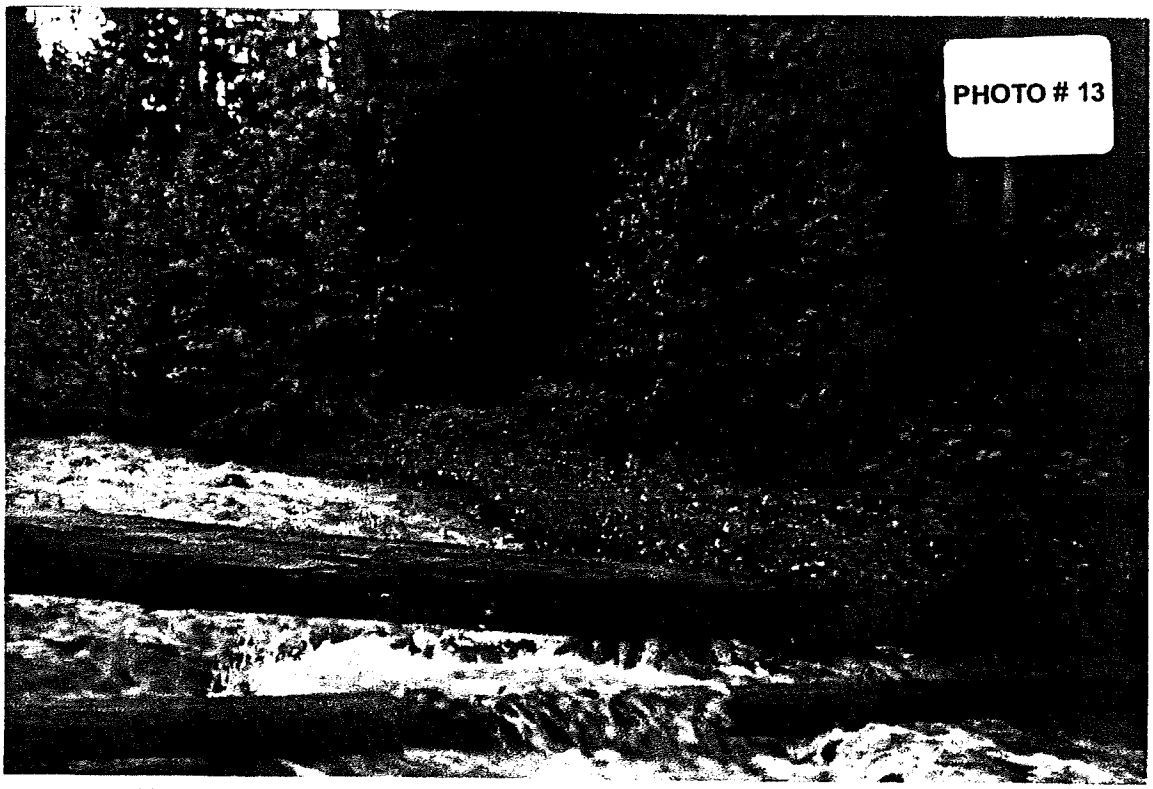

Cross section E above present ford crossing

Loaded approach to present ford crossing

Collapsed bridge deck

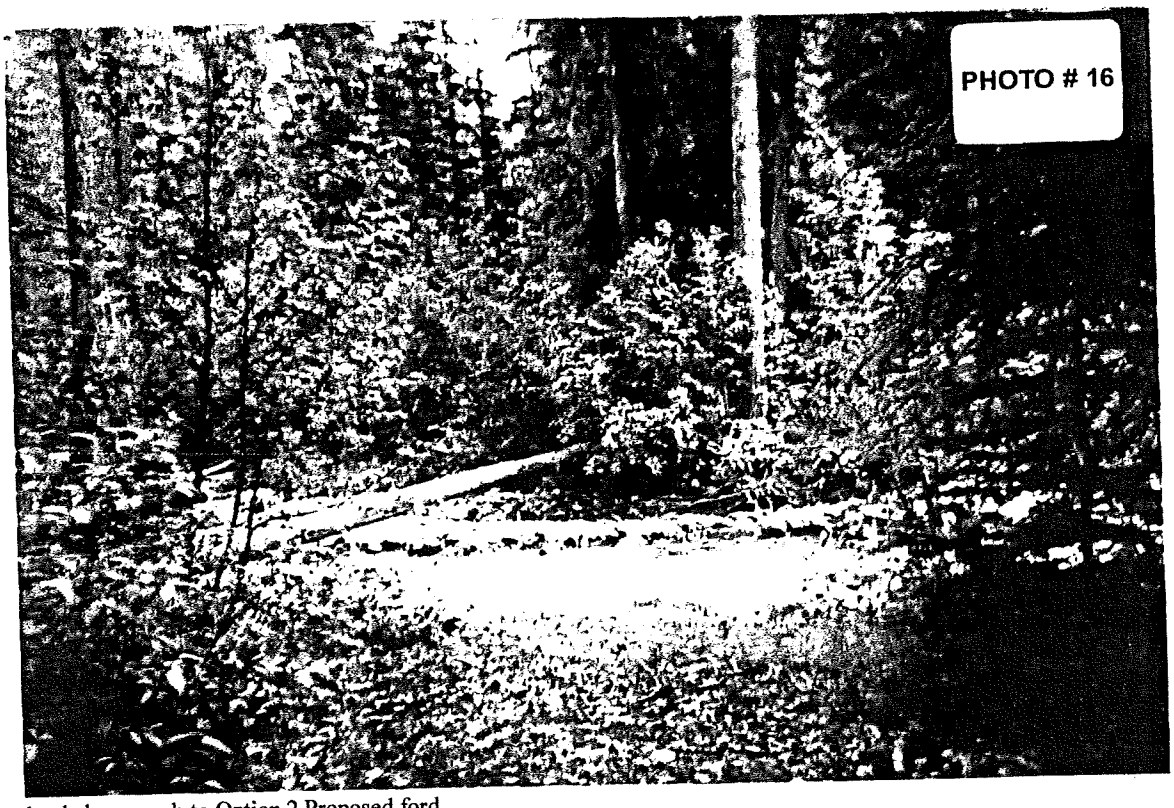
Loaded approach to present ford crossing

Present ford crossing near high water

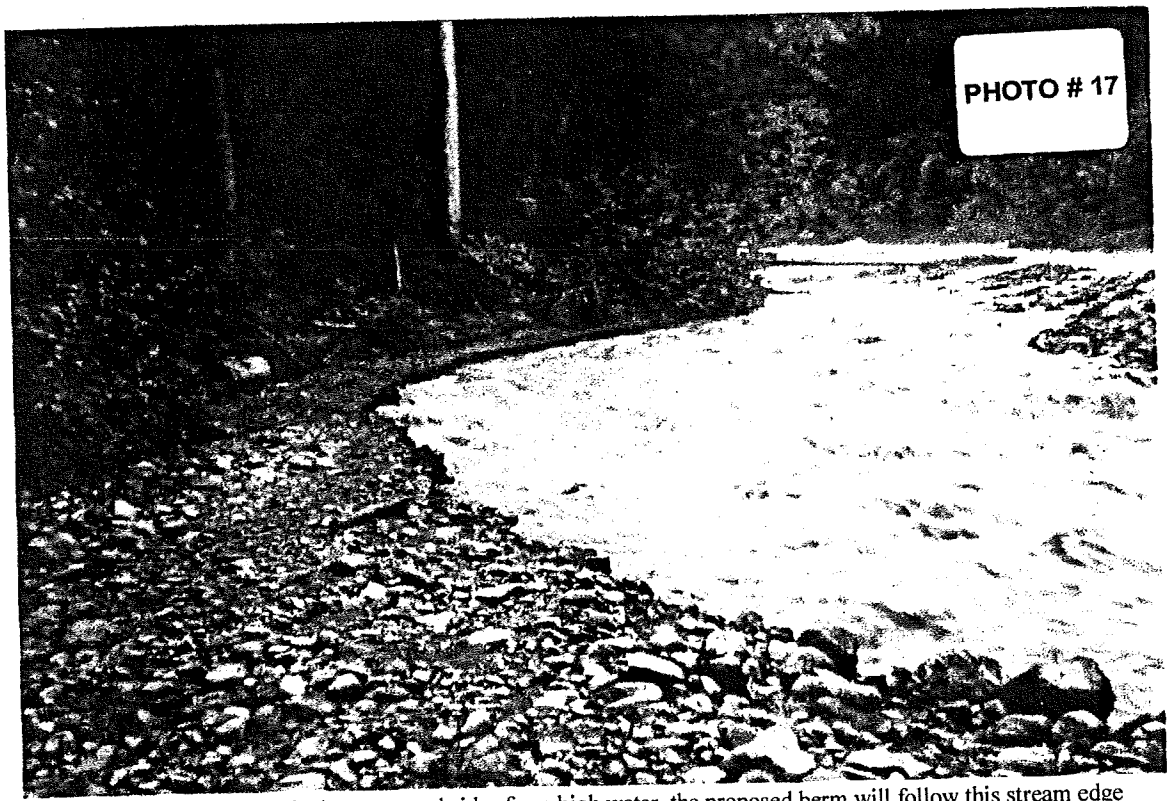



Logs used by hikers to cross. These would be removed for implementation of option 2 and 3

Small island and log jam below proposed ford Option 2

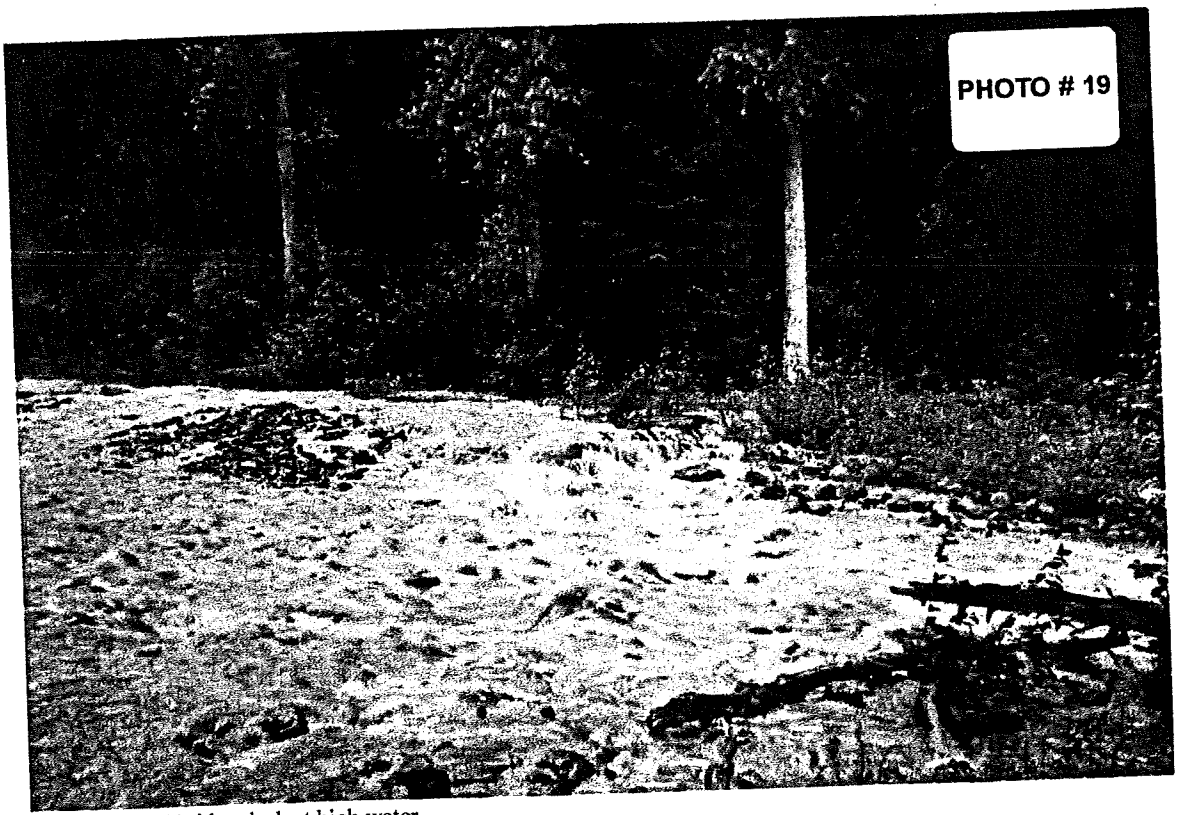



loaded approach to Option 2 Proposed ford

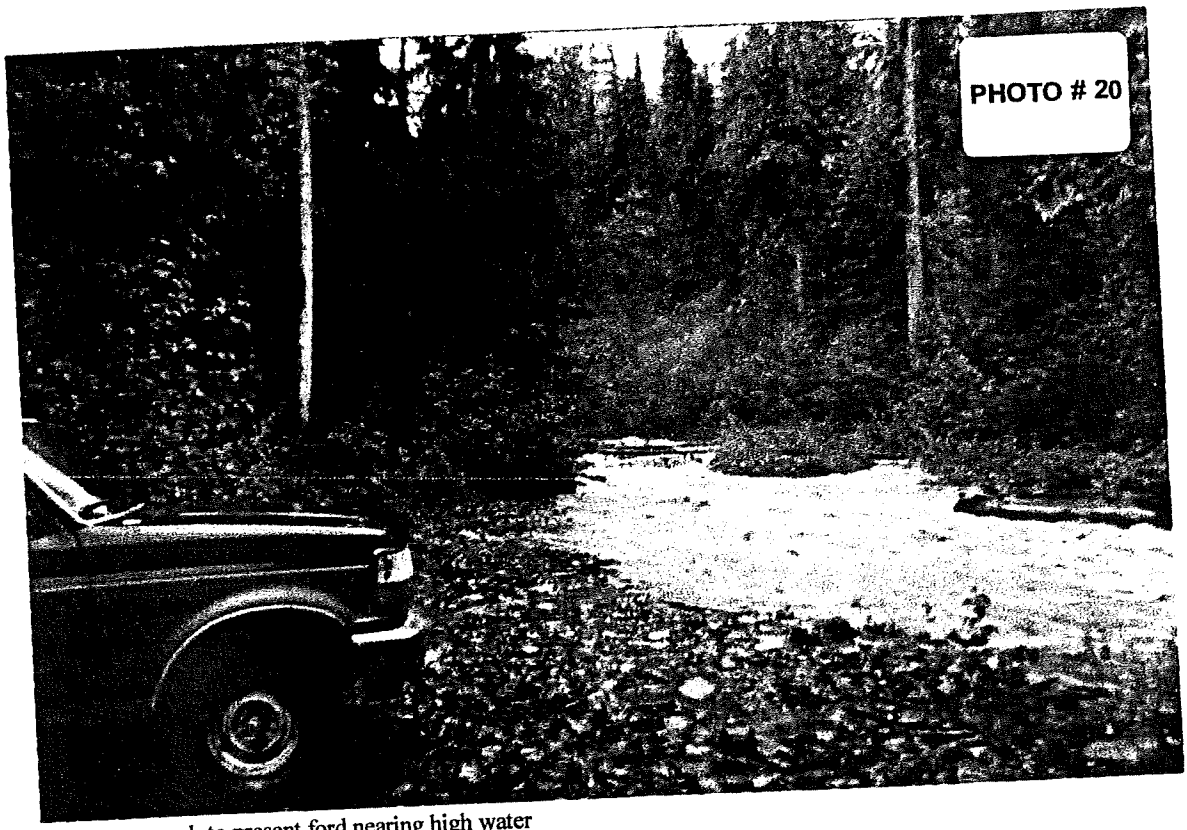



Empty approach to present ford as water subsides from high water, the proposed berm will follow this stream edge

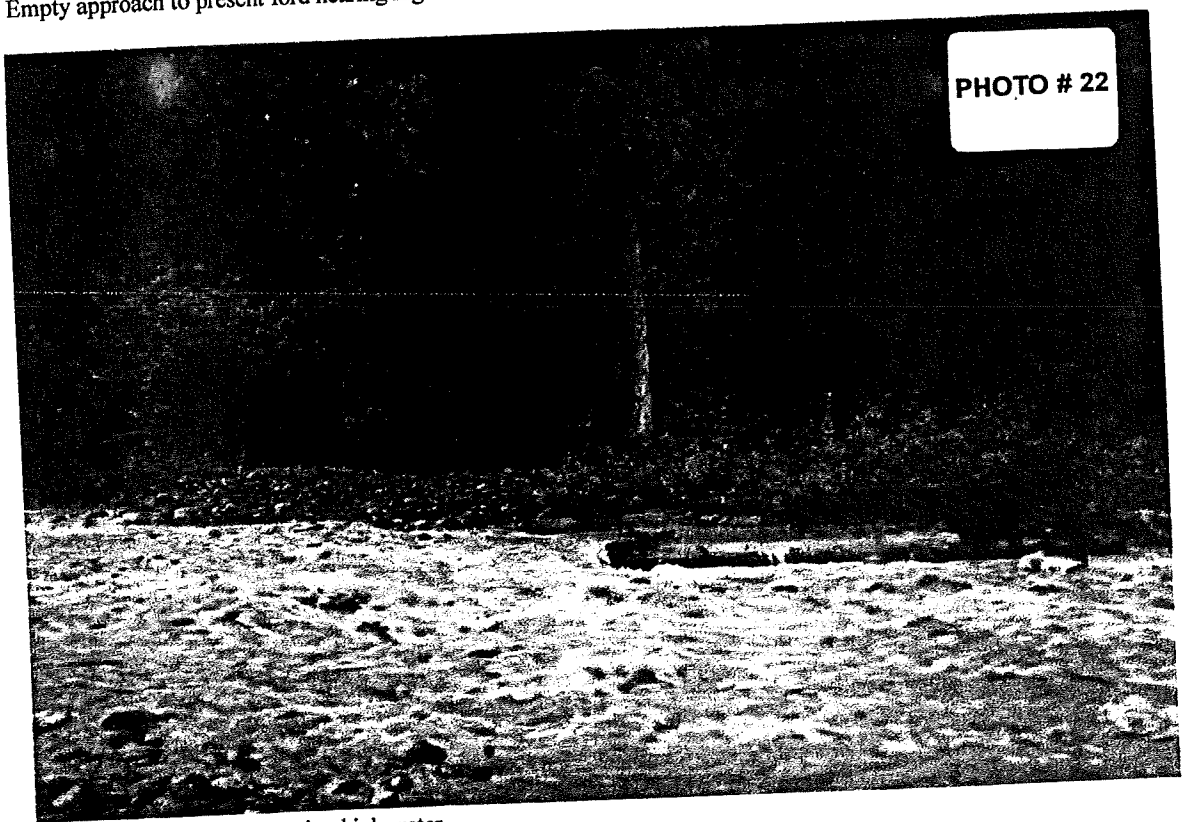
Empty approach to present ford at high water



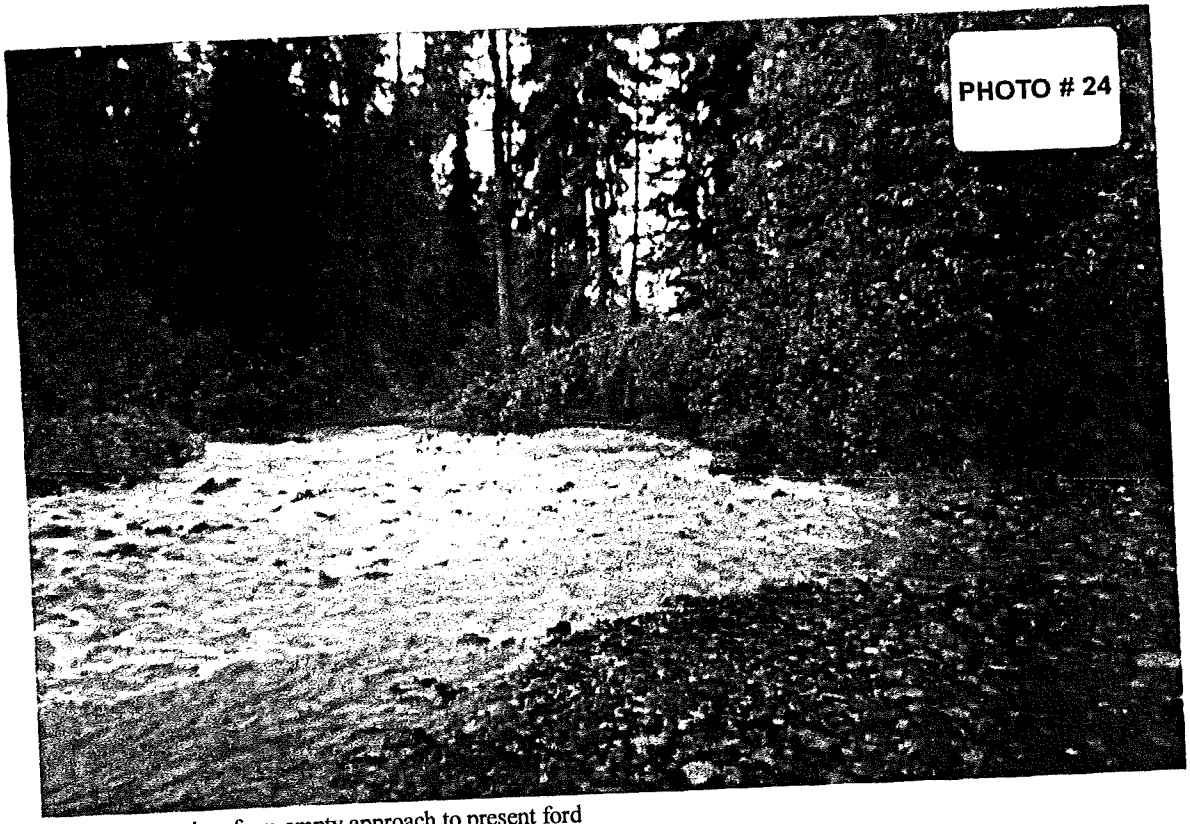

The collapsed bridge deck at high water



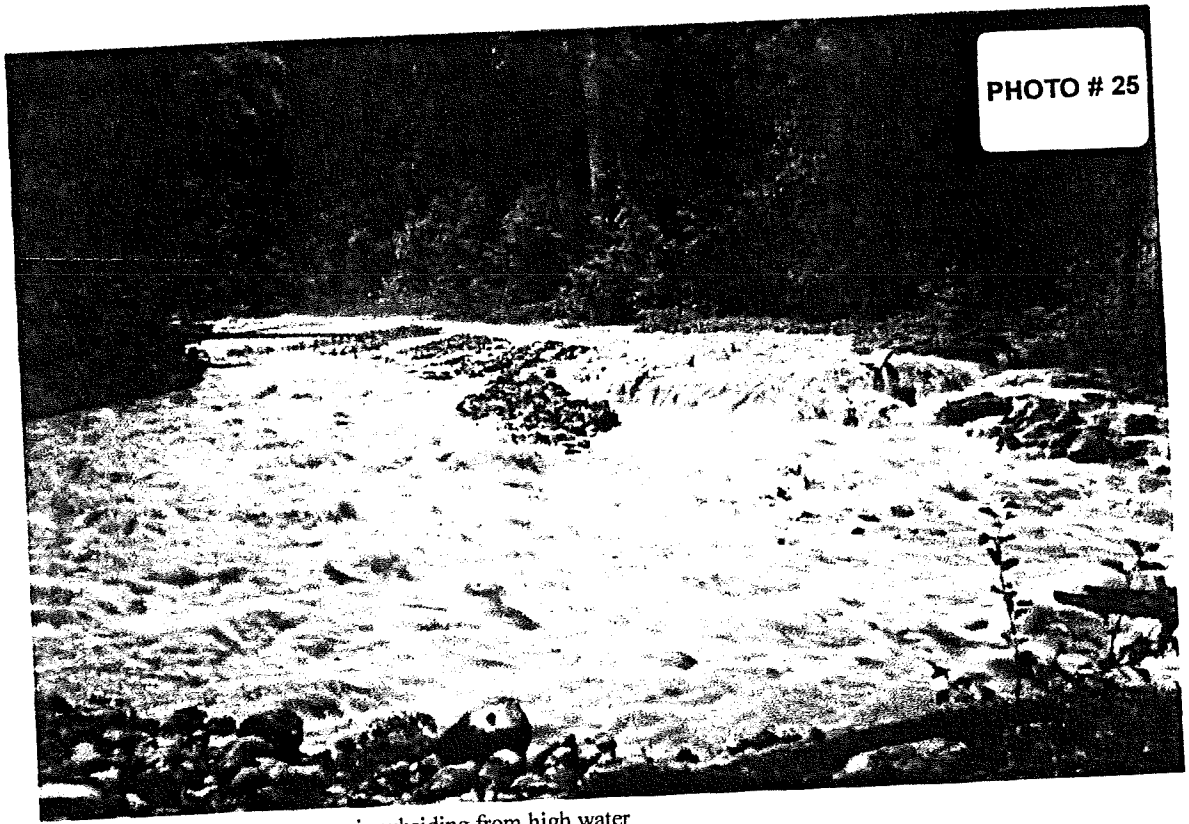

Empty approach to present ford nearing high water




Collapsed bridge deck nearing high water




Down stream view from empty approach to present ford



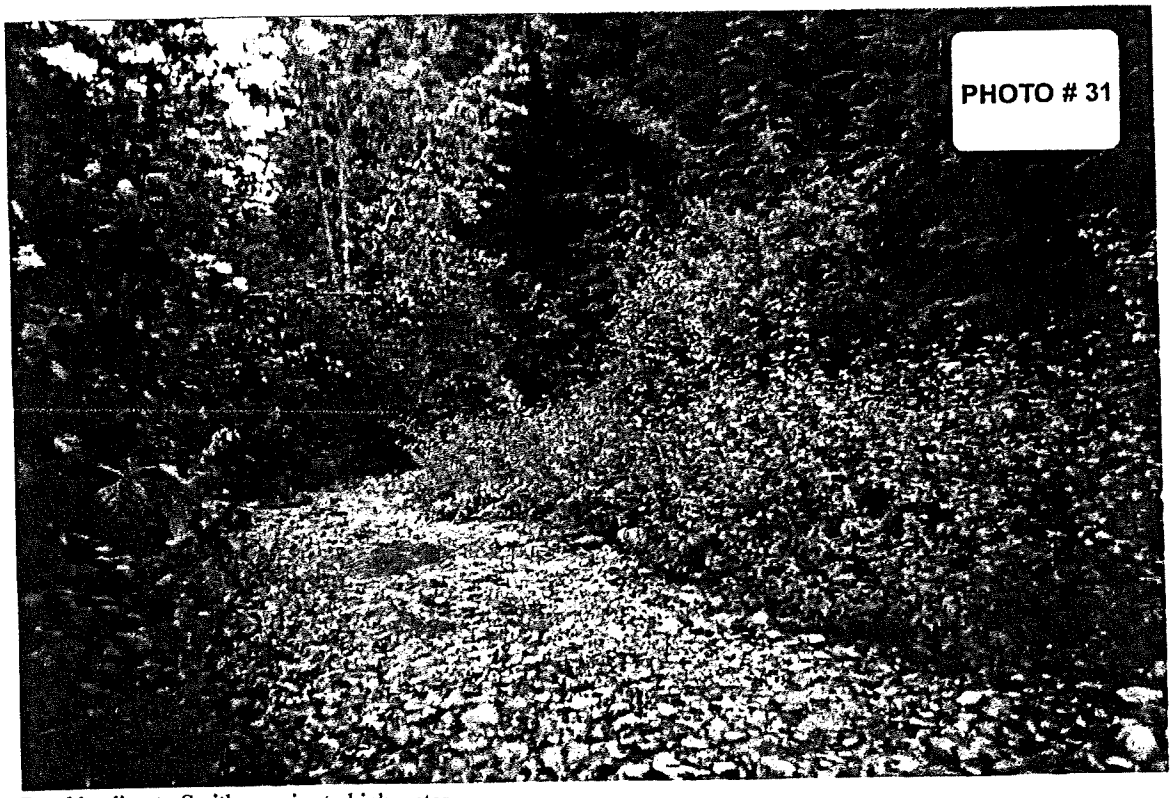

Collapsed bridge deck as stream is subsiding from high water

Road approach to present ford crossing at high water

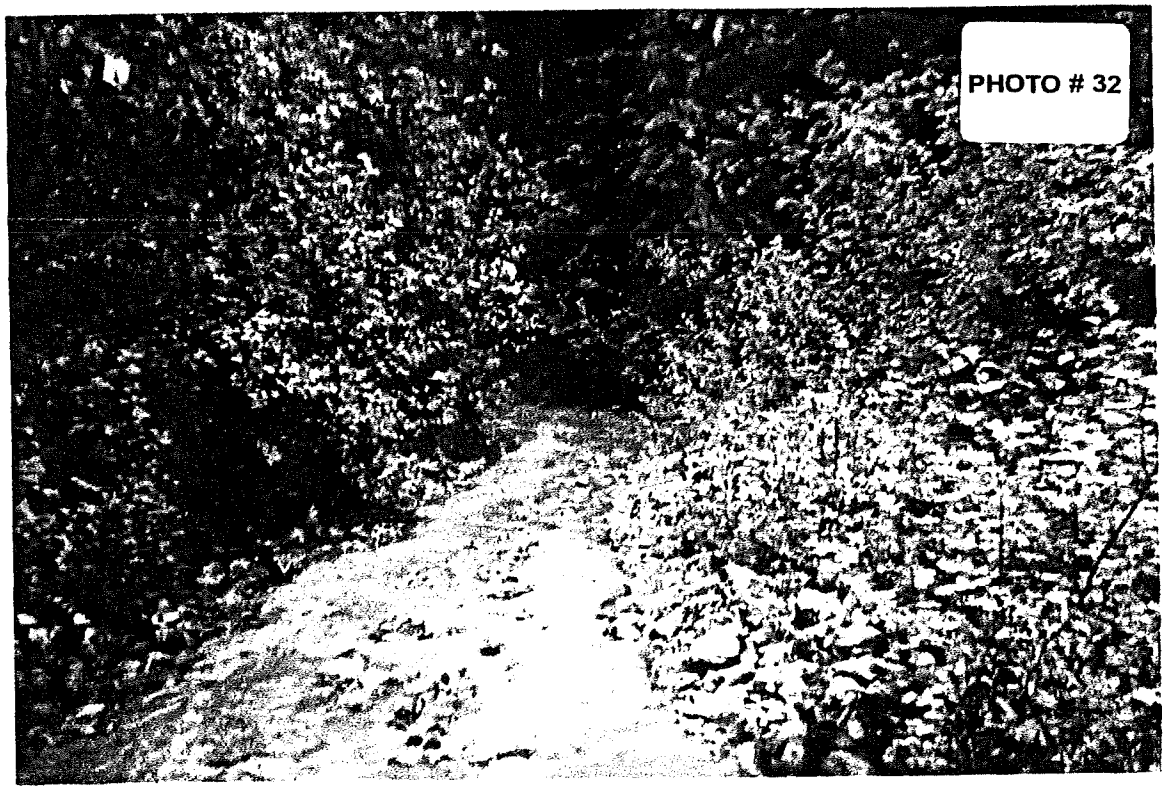
Road approach to present ford crossing at average stream height

Road leading to present ford crossing at high water

Road leading to present ford crossing after high water has subsided

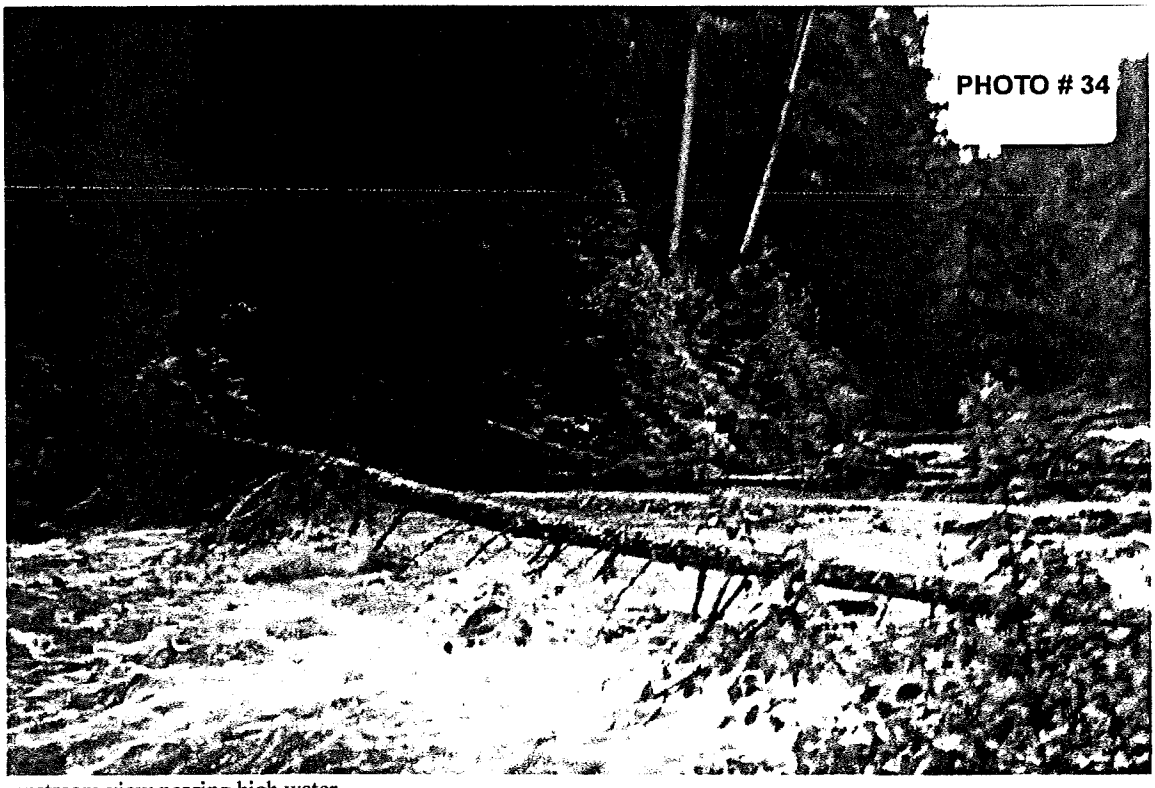



Road leading to Smithers prior to high water




Road leading to Smithers during high water

Loaded approach to present ford crossing nearing high water




upstream view nearing high water

Water flowing through the bush during high water downstream of empty approach to present ford crossing

# Appendix B

# Professional Prescription for Silvern Lakes Road

# ROAD DEACTIVATION OF SILVERN LAKE ROAD
## Toboggan Creek, Smithers

*for:*

Silvicon Services Inc.

*by:*

Jack Whittles, *M.Sc., P.Geo.*
MADRONE CONSULTANTS LTD.
1081 Canada Avenue, Duncan, BC V9L 1V2

February 11, 2000

# ROAD DEACTIVATION OF SILVERN LAKE ROAD
## Toboggan Creek, Smithers

## INTRODUCTION

Madrone Consultants Ltd. (Madrone) was retained by Silvicon Services Inc. (Silvicon) to prepare deactivation plans for Silvern Lake Road in the Toboggan Creek drainage. The road is to be permanently deactivated but will have 4x4 vehicle access as a recreational road. I visited the site on July 22 and 23, 1999, accompanied by Ed Withers of Silvicon. The weather included overcast skies and scattered showers on both days.

The assessed road was constructed ~40 years ago for mining exploration. It is no wider than 3 m to 4 m in many places; therefore, the volume of fillslope material is less than the average logging road. The deactivation of this road is part of the Trout Creek Watershed Restoration Project. The road is to be stabilized so that it can be used for long term recreational access.

Information reviewed prior to my inspection consisted of:

- The report *Trout Creek/Moricetown Watershed Assessment Project – Integrated Watershed Restoration Plan; Roads, Hillslopes & Gullies*, by Sterling Wood Group, February, 1997

- Air photos 30BCB92084 numbers 165-169.

## OBSERVATIONS

### Regional Setting

The headwaters of Toboggan Creek are located approximately 10 km west of Smithers. The next major drainage to the south of Toboggan Creek is Glacier Creek, which flows out of the Hudson's Bay Glacier. The creek cascades off a rock bluff downslope of the glacier in two impressive waterfalls called Twin Falls. The Twin Falls recreation road goes from Smithers to the base of the falls, offering tourists and locals a scenic view of the falls. Silvern Lake Road branches off the Twin Falls recreation road just west of Smithers and heads northwest along the floor of the Bulkley Valley. After crossing Toboggan Creek, the road begins to climb west, upslope along the creek. The road climbs steadily past the cascading Toboggan

Glacier, offering spectacular views of the massive ice and perched lateral moraine. Once the road reaches Schufer Lake, the grade is less steep as it approaches the crest of the pass between Mt. Evelyn and Hudson's Bay Mountain, overlooking a broad, alpine valley and Silvern Lake. The upper reaches of the road include a network of drill and bulk soil sampling trails that wind upslope onto the northern part of Hudson's Bay Mountain. The road was assessed from the crest of the pass between Hudson's Bay Mountain and Mt. Evelyn, downslope to the crossing of Toboggan Creek.

**Downslope Impacts**

The headwaters of Toboggan Creek form a dendritic network of S6 and S5 creeks that feed into the main stem creek (Toboggan Creek) approximately 1 km downstream of Schufer Lake. According to the Watershed Assessment Project report, it is inferred that fish are present for the next 3 km downstream, after which the creek has been sampled, and fish are known to be present.

Much of the road length is located on moderately steep ground with few or no slope breaks between the road and Toboggan Creek. Therefore slides of significant size are likely to reach the creek and give rise to debris flows/torrents. The consequence of a slide entering the fish-bearing creek is high.

There are two concave areas that are of more concern than others. Slumps and slides have occurred in these areas (pre and post road construction), and the creek has been impacted.

**Bedrock Geology**

Bedrock in the area consists of intrusive rocks and altered Jurassic sedimentary rocks, some of which are fossiliferous. Mineralized zones outcrop along the upper portion of the road.

Bedrock controls the topography for the upper 2 km to 3 km of road. Below this bedrock control still exists, but till and, below that, fluvial-glacial material dominate.

**Surficial Geology**

The upper two kilometers of assessed road are dominated by colluvium, weathered bedrock, and bedrock outcrops. There are also pockets of silty, sandy till. There is a mix of deep till pockets and zones of colluvium with bedrock outcrops over the next 3 km of road. In the lower section of road, there is a mix of gravelly fluvial-glacial material and till near and on the valley floor.

**General Road Description**

The distal 3 km of the road is located generally on hummocky, bedrock-controlled terrain with low potential for landslides. The main concern for this portion of the road is restoring natural drainage patterns.

Downslope of Schufer Lake, bedrock and colluvium continue to dominate the terrain. However, the road grade and sideslopes increase, and light pullback is required in several

places. The pullback is designed to remove an oversteepened lip of material that is typically 1 m to 3 m high.

Around the 3 km mark, the road cutbank is sloughing in two places with one section measuring about 40 m long and the other about 30 m. The cutbank material comprises well-drained till. Mature coniferous trees are growing on the slope and might be adding to the slumping potential of this slope. Removing these trees will help to stabilize the slope—evidence of this was found further along the road where it appears that an active slump (from original construction) was halted by removal of the trees. I have also recommended removing loose, slumping material from the cutbank and placing a toe support of coarse rock.

The hillslope is well drained for most of the first 3 km of road; however by Reference Point #1 (TOB RP1), the first of several seepage zones is encountered. In this area it appears that some slumping/sliding may have occurred; however, it does not appear to be related to road construction. Air photo review indicates abundant deciduous plant growth starting from upslope of the road and extending downslope to Toboggan Creek. This, in itself does not mean that slides have occurred; it could just indicate heavy seepage. The road prism is stable in this area; however, light pullback of the fillslope is recommended in order to remove the oversteepened lip of fillslope material.

The road swings to the south and switches back twice through another seepage area before once again heading mainly to the east. It passes through another colluvium and bedrock-dominated area in which light pullback of the fillslope lip is recommended. After this the road swings to the northeast around a rock ridge before entering an area dominated by till.

At Station TOB X73 there is another cutbank slump that does appear to be the result of road construction. There is a headwall scarp extending 30 m upslope of the road by 30 m long. The headwall comprises till, and there is a slide scar extending downslope below the road to Toboggan Creek. It appears that the slump/slide occurred after construction and while the road was still in use because there is a pendant of cutbank material that had slumped downslope and the trees had been cut down there. The trees were removed to lessen the load on the pendant material and stop it from sliding. While it appears that the area is now fairly stable, there still exists a 12 m to 15 m high cutbank of oversteepened till immediately adjacent to the slide headwall. I have recommended that coarse rock be placed at the toe of the cutbank to give it toe support. The road surface should still be sufficiently wide enough to allow passage of recreational vehicles.

Once past the slide the road continues east over a series of well-drained, fluvial-glacial terraces. There are long sections with an open slope gradient of only 5% to 10%. Cross ditches are not recommended on several long stretches because there are no drainage problems. Also, water must not be concentrated and then allowed to flow towards Toboggan Creek. Sidewall failures would result from this activity. At the edge of each terrace, the road cuts across a scarp to the next lower terrace. The scarps are generally only 20 m to 30 m high.

After the fourth broad terrace, the road approaches Toboggan Creek. There are two short sections of road where the fillslope again has a 1 m to 2 m high lip of oversteepened material, and light pullback is recommended.

I understand that other personnel will deal with the crossing at Toboggan Creek (and Glacier Creek), and I was informed not to prescribe any remediation for the crossing. The rest of the road between Toboggan Creek and Glacier Creek is located on Class I and Class II terrain and does not require a professional geoscientist to prescribe deactivation procedures.

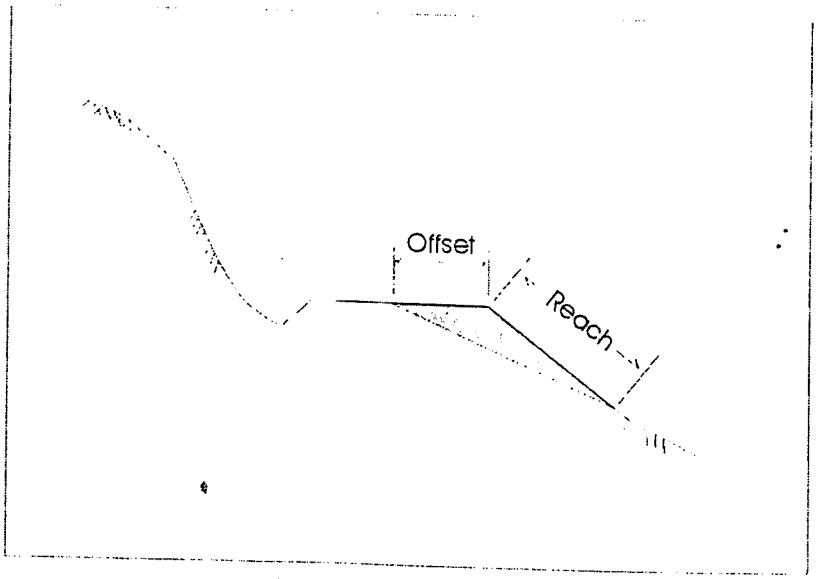
## RECOMMENDED DEACTIVATION WORKS

### Objectives

The deactivation measures recommended below are for permanent deactivation. I understand, however that there will be a requirement for 4x4-vehicle access after deactivation. Therefore, sections of the road not at high risk of instability or water flow problems will be left intact if possible. The objective of the recommended works is to modify the existing road and drainage structures to minimize the hazard of mass wasting and erosion, and restore natural surface and subsurface drainage patterns. The deactivation works are designed to be self-sustaining with no requirement for future maintenance. The works are designed to meet the access requirements without unduly compromising the stability of the remaining road prism.

### Sidecast Pullback

Areas with oversteepened fillslopes will require variable levels of pullback. Sidecast material should be pulled from the fillslope and placed on the inside of the road against the cutslope. The reach and the offset (see illustration below) have been specified for each pullback segment.




*Schematic of pullback showing definition of reach and offset*

Spoil should be placed so that there is no gap between the top of the spoil and the cutslope in which water can collect. Similarly, there should be no lip left at the downslope edge of the sidecast pullback. The configuration of the remaining running surface will be outsloped in many areas. With outsloping, there is the potential hazard of vehicles sliding off the road during slippery conditions.

### Ditches

Road ditches exist only in the upper 1 km of road. Where possible, ditches will be left intact. On all segments in the upper 1 km of road, there is a low potential for cutslope failures to block the ditches. As well, the fillslopes and slopes below are sufficiently stable that they will not be destabilized if ditch water is diverted onto them.

### Cross-Ditches

The purpose of the cross-ditches is to convey areas of surface and subsurface flow across the road prism in their natural drainage pattern. Particular care should be used to ensure that compacted fine material is used to construct ditch blocks in the road ditch on the downslope side of cross ditches (if ditches exist at the crossing). Ditch blocks must completely block the road ditch and should be keyed into the cutslope and armored. In areas where sidecast material will not be pulled-back, a berm of compacted material should be constructed on the downgrade side of the cross ditch.

The base of the cross ditches should be at least 1 m wide. The sidewalls should be sloped so that 4x4 vehicles can cross the ditch. The base, outlet, and lower sidewalls (to approximately 1 m high) should be armored with coarse material. Armoring material on the outlets should be large. In general cross-ditches should be skewed so that the outlet is downgrade of the inlet.

## SITE SPECIFIC RECOMMENDATIONS

The road stations presented in this report and as marked on field ribbons are Global Positioning System (GPS) points and do not represent hip-chained distances. Recommendations were ribboned in the field. Ribbons were labeled with field markings as shown below (Table 1).

**Table 1. Ribbon Labels**

| LABEL | PRESCRIPTIONS |
|---|---|
| TOB | Toboggan Creek |
| RP1 | Reference Point #1 |
| X1 | Construct cross ditch |
| PBH | Heavy pullback of fillslope. Reach and offset are described in an earlier section entitled "Sidecast Pullback" |
| PBM | Moderate pullback of fillslope |
| PBL | Light pullback of fillslope |
| CBS | Cutbank stabilization |
| RMC | Remove metal culvert |
| RWC | Remove wooden culvert |
| RB | Remove berm |
| BB | Breach berm |
| CWB | Construct water bar |

**Table 2. Report Abbreviations (in addition to Table 1)**

| Abbreviations | Meaning |
|---|---|
| FS | Road Fillslope |
| CB | Road Cutbank |
| DS | Downslope (open slope) |
| US | Upslope (open slope) |
| <80>(20) | 80% slope over 20 meters |
| BR | Bedrock |
| M | Till |
| D | Bedrock weathered in place |
| C | Colluvium |

Details of work required are summarized in the following tables.

| Starting Station | Ending Station | Prescription | Comments | Hazard | Consequence |
|---|---|---|---|---|---|
| TOB X1 | | Construct cross ditch | Heavy seepage/BR | Low | Low |
| TOB X2 | | Construct cross ditch | Small S6 | Low | Low |
| TOB RMC 3 | | Remove metal culvert | Cv.Dv/Rh 1-2 m fill | Low | Low |
| TOB X4 | | Construct cross ditch – armor outlet | Light seepage | Low | Low |
| TOB X5 | | Construct cross ditch | | Low | Low |
| TOB RMC 6 | | Remove metal culvert - armor outlet – ensure ditch block thick enough | Small S6 creek. | Low | Low |
| TOB X7 | | Construct cross ditch | | Low | Low |
| TOB X8 | | Construct cross ditch | | Low | Low |
| TOB X9 | | Construct cross ditch | Light seepage | Low | Low |
| TOB X11 | | Construct cross ditch across main road and side spur | Moderate seepage | Low | Low |
| TOB x10 | | Construct cross ditch | Heavy seepage/till | Low | Low |
| TOB X12 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB X13 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB X14 | | Construct cross ditch | | Low | Low |
| TOB X15 | | Construct cross ditch | Heavy seepage/till | Low | Low |
| TOB X16 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB RB17 start | TOB RB17 finish | Remove berm from near last cross ditch | | Low | Low |
| TOB X18 | | Construct cross ditch | Heavy seepage/till | Low | Low |
| TOB X19 | | Construct cross ditch – remove woody debris | Heavy seepage | Low | Low |
| TOB X20 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB RMC 21 | | Remove metal culvert – armor inlet and outlet. Construct channel with 2 m wide base. | S6 creek with 1 to 2 m wide channel. Low to moderate flow potential | Low | Low |
| TOB X22 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB X23 | | Construct cross ditch – armor channel | Small S6 creek | Low | Low |
| TOB RMC24 | | Remove metal culvert | 0.5 m fill | Low | Low |
| TOB X25 | | Construct cross ditch | Small S6 creek | Low | Low |
| TOB RWC26 | | Remove wooden culvert | Small structure still working | Low | Low |

| Starting Station | Ending Station | Prescription | Comments | Hazard | Consequence |
|---|---|---|---|---|---|
| TOB X27 | | Construct cross ditch at 30$^0$ to road | Heavy seepage/till | Low | Low |
| TOB X28 | | Construct cross ditch with 2 m wide base. Armor with >0.3 m coarse rock. Ensure outlet is deep so material will not deposit on road | Fan area – S6 creek with moderate flow and high sediment transport potential. | Low | Low |
| TOB X29 | | Construct cross ditch | Small S6 creek on edge of fan (above) | Low | Low |
| TOB X30 | | | | Low | Low |
| TOB X30 | TOB PBL 38 | Light pullback of fillslope material Reach 2 to 3, Offset 1 Outslope road | FS<80-90>(1-2) <60-75>(5) DS<60> US<60> Need to remove steep lip on fillslope material | Mod | Low |
| TOB X31 | | Construct cross ditch | | Low | Low |
| TOB X32 | | Construct cross ditch | FS<80>(5) DS<60> CB<100> (7) US<60> | Low | Low |
| TOB CBS33 | | Cutbank Stabilization - Remove trees, remove loose, sloughing material, place and key in an apron of coarse rock against cutbank, but still leaving enough room on road for traffic. | The cutbank is sloughing over approximately 40m of road length. CB<90>(10) US<75> FS<80-90>(1-2) DS<65> | High | Mod |
| TOB CWB34 | | Construct water bar | | Low | Low |
| TOB CBS35 | TOB CBS36 | Cutbank Stabilization – Remove trees (3), remove loose material, armor toe of slope with coarse rock but still leaving enough room on road for traffic | The cutbank is sloughing over a 30 m long by 12 m high section of bank. CB<70-90>(12) US<60> FS<60-70> CB comprises well drained till. | High | Mod |
| TOB X37 | | Construct cross ditch | Heavy seepage/till | Low | Low |
| TOD X39 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB PBL41 | TOB PBL43 | Light pullback of fillslope material. Reach 2 to 3, Offset 1 Outslope Road | FS<80-90>(2-3) DS<60-70) CB<100>(5) US<50-55) Road<20> Avalanche area, FS unstable and raveling in a few places. | Mod | Mod |
| TOB X40 | | Construct cross ditch with ~1 m wide base. Armor channel and outlet. | Small S6 creek. | Low | Low |
| TOB X42 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB X44 | | Construct cross ditch | Moderate seepage/till FS<70>(2) DS<50> CB<100>(4) US<50-60> | Low | Low |
| TOB X45 | | Construct cross ditch. Remove old wood box culvert | Small S6 Creek | Low | Low |

| Starting Station | Ending Station | Prescription | Comments | Hazard | Consequence |
|---|---|---|---|---|---|
| TOB PBL46 | TOB X52 | Light pullback of fillslope material. Reach 3 m Offset 1 to 1.5 m | Again removing lip from fillslope material | Mod | Mod |
| TOB X47 | | Construct cross ditch – armor outlet | Small S6 Creek <55, -20> | Low | Low |
| TOB X48 | | Construct cross ditch – armor outlet | Small S6 Creek <55-60> | Low | Low |
| TOB RP1 | TOB RP2 | | The road cuts through what looks like an old slump/ slide area. It does not appear that road construction caused the slide, the headwall is located well upslope. | Low | Mod |
| TOB X49 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB X50 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB X52 | | Construct cross ditch with 2 m wide base. Armor with 0.25 m coarse rock | S6 Creek | Mod | Low |
| TOB X53 | | Construct cross ditch | Moderate seepage/till | Low | Low |
| TOB WB54 | | Construct water bar | FS<70>(8) CB<100>(2) US<10> road<15> | Low | Low |
| TOB WB55 | | Construct water bar | | Low | Low |
| TOB PBL57 | | Light pullback of fillslope material. Reach 3, Offset 1 ~30 m section | FS<80-90>(2-3) DS<60-70> CB<90>(5) US<30> raveling and minor sloughing on FS | Mod | Low |
| TOB X56 | | Construct cross ditch - armor | Small S6 Creek | Low | Low |
| TOB RMC58 | | Remove metal culvert | Small S6 Creek. ~0.5 m fill. | Low | Low |
| TOB PBL59 Start | TOB PBL59 END | Light pullback of fillslope material. Reach 3, Offset 1.5 to 2 m Outslope Road | FS<90>(2) DS<60-70> small sloughs. | Mod | Mod |
| TOB X60 | | Construct cross ditch | Small draw/till | Low | Low |
| TOB X61 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB PBL62 START | TOB PBL62 END | Light pullback of fillslope material. Reach 2 to 3, Offset 1 to 1.5 m. Outslope road, retain all large trees. | FS<80>(2) DS<55-60> CB<80>(3) US<55> Open colluvial slopes. | Mod | Mod |
| TOB CBS63 | | Cutbank stabilization – remove two large conifers that are creeping downslope | | High | Mod |
| TOB X64 | | Construct cross ditch | | Low | Low |
| TOB X65 | | Construct cross ditch | Small draw | Low | Low |
| TOB X66 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB BB67 | | Breach berm (windrow) | bedrock on road surface | Low | Low |

| Starting Station | Ending Station | Prescription | Comments | Hazard | Consequence |
|---|---|---|---|---|---|
| TOB PBL START | TOB PBL END | Light pullback of fillslope material. Reach 2 to 3, Offset 1 to 1.5 m. Outslope road | FS<80-90>(2-3) DS<60-70> CB<100>(2-3) US<55> | Mod | Mod |
| TOB X69 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB X70 | | Construct cross ditch | Light seepage/till | Low | Low |
| TOB X71 | | Construct cross ditch | Light seepage/draw | Low | Low |
| TOB PBL72 START | TOB PBL72 END | Light pullback of fillslope material Reach 3 to 4, Offset 1.5 m Outslope Road | This section contains abundant seepage and several slumps/slides | Mod | Mod |
| TOB X73 | | Construct cross ditch | | Low | Low |
| TOB X73 | TOB CBS74 | Cutbank stabilization ~ 30 m section – place coarse, angular rock (>0.25 m) between 1 and 2 m high against toe of cutbank. Key in rock to stabilize | It appears that this area started to slump shortly after construction. Mature conifers on the slumping material were cut in order to stop the slumping and it looks as though this was successful. However, in the event that the slumping is not terminated, a toe support will ensure stability. | High | High |
| TOB X75 | | Construct cross ditch | Small draw | Low | Low |
| TOB RP3 | | | Reference point for small FS failure – no need for pullback | Mod | Low |
| TOB X76 | | Construct cross ditch | Small draw | Low | Low |
| TOB X77 | | Construct cross ditch | Small S6 creek | Low | Low |
| TOB X78 | | Construct cross ditch | | Low | Low |
| TOB X79 | | Construct cross ditch with water draining to the south side of the road | | Low | Low |
| TOB X80 | | Construct cross ditch | | Low | Low |
| TOB X81 | | Construct cross ditch with water draining to the south side of the road | Small draw | Low | Low |
| TOB X82 | | Construct cross ditch | | Low | Low |
| TOB X83 | | Construct cross ditch | | Low | Low |
| TOB X84 | | Construct cross ditch with water draining to the east | | Low | Low |
| TOB X85 | | Construct cross ditch | Small draw | Low | Low |
| TOB X86 | | Construct cross ditch | | Low | Low |

| Starting Station | Ending Station | Prescription | Comments | Hazard | Consequence |
|---|---|---|---|---|---|
| TOB PBL88 START | TOB PBL88 END | Light pullback of fillslope material Reach 3, Offset 1to 1.5 m. | FS<80-90>(2-3) DS<60-70> CB<100>(4) US<30> | Low | High |
| TOB X87 | | Construct cross ditch | | Low | Low |
| TOB PBL89 START | TOB PBL89 END | Light pullback of fillslope material Reach 3, Offset 1 to 1.5 m. | FS<80>(3) DS<80> CB<70>(3) US<55> | Low | High |

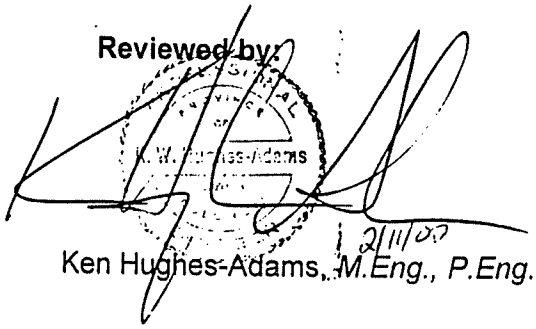
## LIMITATIONS

*This report provides an assessment of the potential for terrain instability for constructed roads if they were left intact and not maintained (no deactivation). Evaluation of these hazards is based on judgment and is inherently imprecise. Deactivation prescriptions presented within this report are designed to reduce the risk of terrain instabilities. The conclusions and recommendations are based on experience in similar roaded terrain. The investigation involved primarily field observation of road cuts, slope failures, gullies, and/or shallow soil pits. No other subsurface investigation was performed, and no laboratory tests were conducted. Geological conditions, other than those indicated above, may exist on the site. If such conditions are observed, Madrone Consultants Ltd. should be contacted so that this report may be reviewed and amended accordingly. Assessment of the potential for bedrock failures is beyond the scope of this report.*

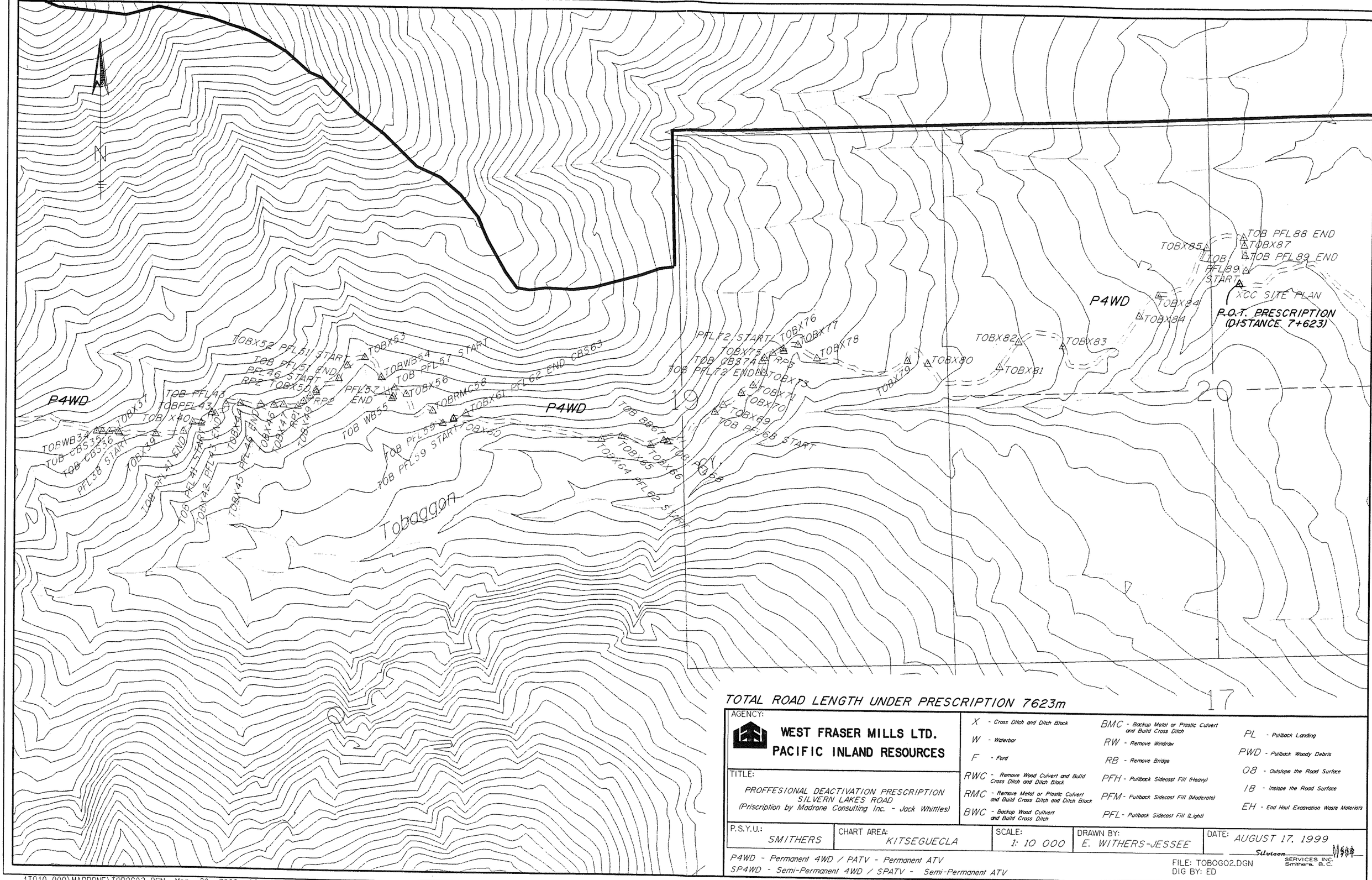
**Prepared by:**

Jack Whittles, *M.Sc., P.Geo.*

**Reviewed by:**



Ken Hughes-Adams, *M.Eng., P.Eng.*




TOTAL ROAD LENGTH UNDER PRESCRIPTION 7623m

AGENCY: WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

TITLE:
PROFFESIONAL DEACTIVATION PRESCRIPTION
SILVERN LAKES ROAD
(Priscription by Madrone Consulting Inc. - Jack Whittles)

| | | | |
|---|---|---|---|
| X - Cross Ditch and Ditch Block | BMC - Backup Metal or Plastic Culvert and Build Cross Ditch | PL - Pullback Landing |
| W - Waterbar | RW - Remove Windraw | PWD - Pullback Woody Debris |
| F - Ford | RB - Remove Bridge | 08 - Outslope the Road Surface |
| RWC - Remove Wood Culvert and Build Cross Ditch and Ditch Block | PFH - Pullback Sidecast Fill (Heavy) | 18 - Inslope the Road Surface |
| RMC - Remove Metal or Plastic Culvert and Build Cross Ditch and Ditch Block | PFM - Pullback Sidecast Fill (Moderate) | EH - End Haul Excavation Waste Materials |
| BWC - Backup Wood Culvert and Build Cross Ditch | PFL - Pullback Sidecast Fill (Light) | |

| P.S.Y.U.: | CHART AREA: | SCALE: | DRAWN BY: | DATE: |
|---|---|---|---|---|
| SMITHERS | KITSEGUECLA | 1: 10 000 | E. WITHERS-JESSEE | AUGUST 17, 1999 |

P4WD - Permanent 4WD / PATV - Permanent ATV
SP4WD - Semi-Permanent 4WD / SPATV - Semi-Permanent ATV

FILE: TOBOG02.DGN
DIG BY: ED

Silvicon SERVICES INC. Smithers, B.C.

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MOUNT EVELYN

N

M.C.

P4WD

TOB RB17 START

TOB RB17 END

TOBRMC3

TOBRMC6

TOBRMC21

TOBRMC24

TOBRWC29

TOB CBS33 START

TOB CBS33 END

TOB CBS36

TOB PFL43

TOB PFL51 START

TOB PFL51 END

PFL46 START

TOB PFL57 START

TOB PFL57 END

TOBWB54

TOBWB55

TOBWB56

TOBWB34

TOB WB55

TOBX1 TOBX2 TOBX3 TOBX4 TOBX5 TOBX6 TOBX7 TOBX8 TOBX9 TOBX10 TOBX11 TOBX12 TOBX13 TOBX14 TOBX15 TOBX16 TOBX17 TOBX18 TOBX19 TOBX20 TOBX22 TOBX25 TOBX27 TOBX28 TOBX29 TOBX30 TOBX31 TOBX32 TOBX37 TOBX38 TOBX39 TOBX40 TOBX41 TOBX42 TOBX43 TOBX44 TOBX45 TOBX46 TOBX47 TOBX48 TOBX49 TOBX50 TOBX52 TOBX53 TOBX54 TOBX55 TOBX56

P.O.C.
0+000 ALPINE

Schufer Lake

Tobaggon

TOTAL ROAD LENGTH UNDER PRESCRIPTION 7623m

AGENCY:
WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

TITLE:
PROFFESIONAL DEACTIVATION PRESCRIPTION
SILVERN LAKES ROAD
(Priscription by Madrone Consulting Inc. - Jack Whittles)

| | | | |
|---|---|---|---|
| X - Cross Ditch and Ditch Block | BMC - Backup Metal or Plastic Culvert and Build Cross Ditch | PL - Pullback Landing |
| W - Waterbar | RW - Remove Windrow | PWD - Pullback Woody Debris |
| F - Ford | RB - Remove Bridge | 08 - Outslope the Road Surface |
| RWC - Remove Wood Culvert and Build Cross Ditch and Ditch Block | PFH - Pullback Sidecast Fill (Heavy) | 18 - Inslope the Road Surface |
| RMC - Remove Metal or Plastic Culvert and Build Cross Ditch and Ditch Block | PFM - Pullback Sidecast Fill (Moderate) | EH - End Haul Excavation Waste Materials |
| BWC - Backup Wood Culvert and Build Cross Ditch | PFL - Pullback Sidecast Fill (Light) | |

| P.S.Y.U.: | CHART AREA: | SCALE: | DRAWN BY: | DATE: |
|---|---|---|---|---|
| SMITHERS | KITSEGUECLA | 1: 10 000 | E. WITHERS-JESSEE | AUGUST 17, 1999 |

P4WD - Permanent 4WD / PATV - Permanent ATV
SP4WD - Semi-Permanent 4WD / SPATV - Semi-Permanent ATV

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Silvicon SERVICES INC. Smithers, B.C.

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# Appendix C

# Site Plan Base Map

WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

BULKLEY

SITE PLAN (BASE MAP: PRESENT SITE CONDITION AS OF PLAN DATE)
PAGE 1 OF 1

DRAWN BY: T. BENNETT
DATE: 30 / 10 / 2009

CONSTRUCTION: SILVICON SERVICES INC.

SCALE: 1:500

N.T.S. | 8x11 | 11x17

AIR PHOTOS: 440

TOBOGGAN CREEK

DEVELOPMENT PLAN NAME: KITSEGUECLA

ENGINEER: PEEL DUNN

APPROVED:

LEGEND

BOUNDARY
- Claim Boundary
- Reappropriation
- Block Tenure
- Site Preservation

Air Photo Centre
Aids to Nav.
Bridges
Brush
Contours
Cutblocks
Cutblock Boundary
Exposure Boundary
Embankment
Ephemeral Stream
Helipad
Landing
Non-Commercial
Non-Productive

CROSS SECTION
PHOTO
BENCHMARK OR REFERENCE POINT
SOIL PIT
ROAD STATION

ROADS
Primary
Main
Insecure Built
Insecure Proposed
Trails

Pipe & Brige
Point of Commencement
Power
Rock
Skid Bridge
Ski Direction
Slide
Snow Fence
Snow Marker
Spring Boggy
Stream
Swamp
Timber Type
Water

HWM HIGH WATER MARK
HWL PRESENT WATER LEVEL
THALWEG STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

CHANNEL DESCRIPTION

| | |
|---|---|
| UPSTREAM | |
| FINES | |
| PEBBLES | 10% |
| COBBLES | 80% |
| BOULDERS | 5% |
| BEDROCK | |
| GRADIENT AVG | 5% |
| VELOCITY AT HIGH WATER MARK APPROX 3.3-3.7 m/s | |

SOIL DESCRIPTION

| SOIL PIT 1 | SOIL PIT 2 |
|---|---|
| DEPTH | DEPTH |
| COARSE FRAGMENTS | COARSE FRAGMENTS |
| BEDROCK | BEDROCK |
| BOULDER | BOULDER 40% |
| GRAVEL 60% | GRAVEL 40% |
| FINE FRAGMENTS | FINE FRAGMENTS |
| FINE 20% | FINE 5% |
| SAND | SAND |
| SILT | SILT |
| CLAY | CLAY |

APPROXIMATE TOTAL WATERSHED AREA ABOVE CROSSING: 1733ha

KEY MAP SCALE: 250,000 MAP SHEETS 93O/15W

WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

BULKLEY

SITE PLAN BASE MAP
PRESENT SITE CONDITION
AS OF PLAN DATE
PAGE 1 OF 2

TIGHTSQUEEZE CREEK

FISHBOTTLE

SKEENA

1200

AUG NOV

SAT

LEGEND

STREAM PROFILE
SCALE 1:200

EXISTING ROAD PROFILE
SCALE 1:200

To Smithers
approx. 10 km

CROSS SECTION
SCALE 1:200
A — A1

CROSS SECTION
SCALE 1:200
B — B1

CROSS SECTION
SCALE 1:200
C — C1

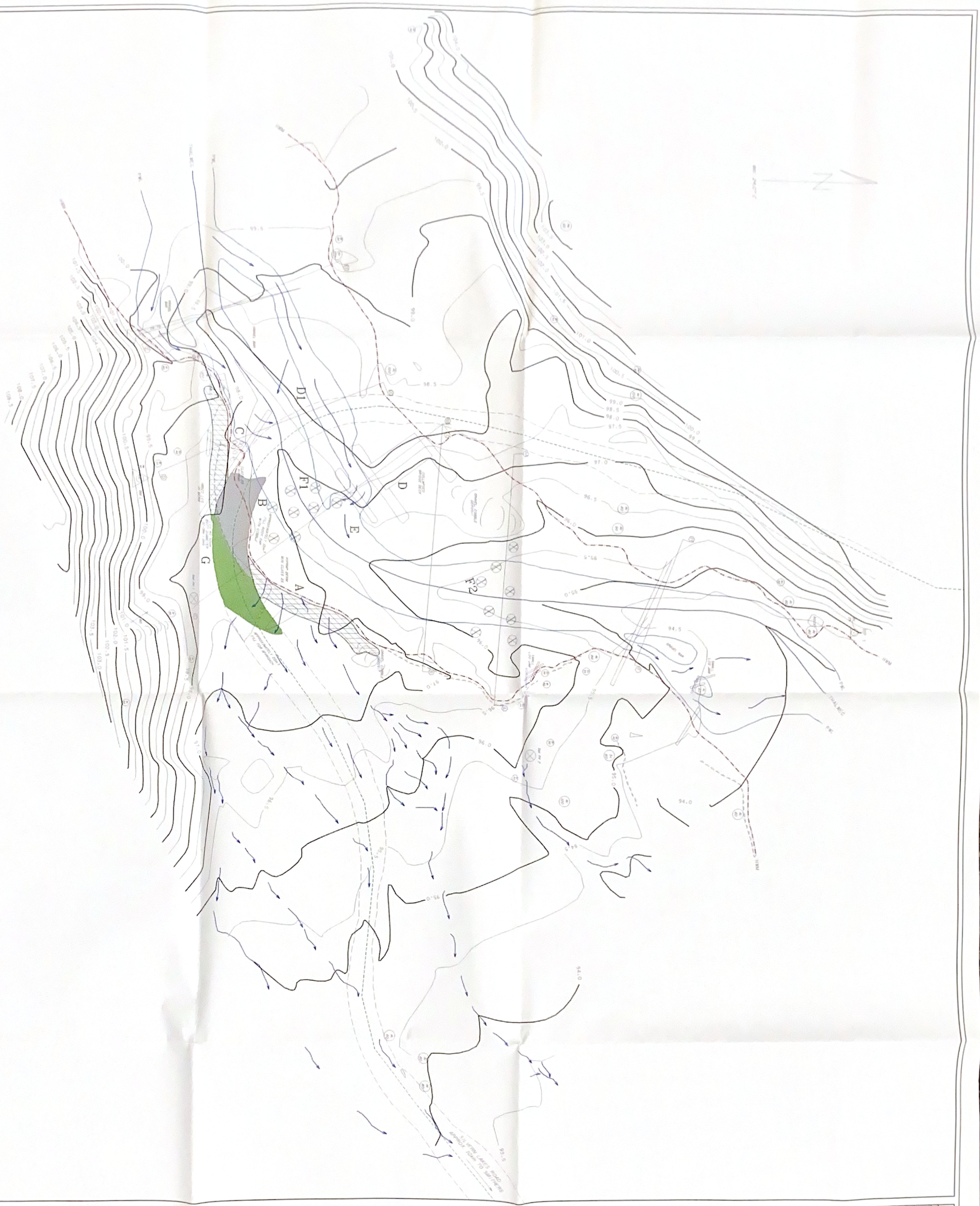
CROSS SECTION
SCALE 1:200
D — D1

CROSS SECTION
SCALE 1:200
E — E1

CROSS SECTION
SCALE 1:200
F — F1

# Appendix D

## Site Plan Maps (Options 1, 2 and 3)




WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

LEGEND

KEY MAP SCALE 1:50 000 NAD83 ZONE 10

STRUCTURES AND EXCAVATION

A - HOSE BIBB

B - HOUSE APPROXIMATE EDGE OF BERM

C - RIP (HOSE) BERM(S)

D - CONTACT ASH WOOD

E - CONTACT (TEMPORARY) WOOD ASH MIX

F - CONTACT ASH CEMENT

G - APPROX. 6 M WIDTH EDGE OF BERM

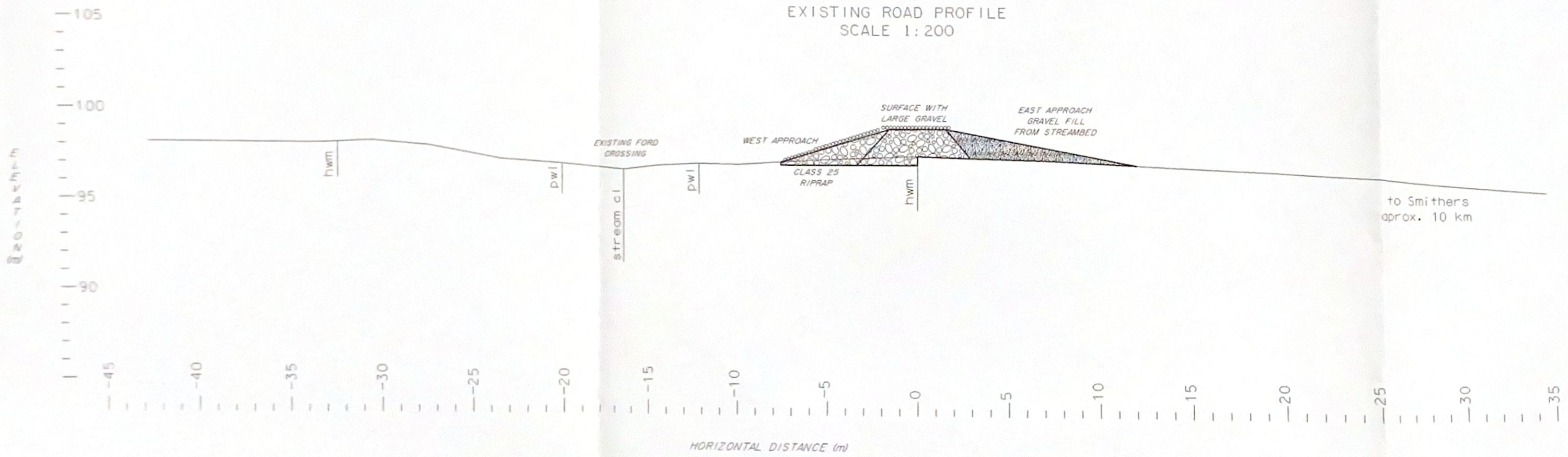
SOIL DESCRIPTION

| SOIL # 1 | SOIL # 2 |
|---|---|
| ROOTS | ROOTS |
| COARSE FRAGMENTS | COARSE FRAGMENTS |
| MOIST | MOIST |
| COLOR | COLOR |
| MOTTLES | MOTTLES |
| GLEY | GLEY |
| FINE FRAGMENTS | FINE FRAGMENTS |
| % | % |

CHANNEL DESCRIPTION

| | |
|---|---|
| ORGANIC | |
| FINES | |
| PEBBLES | (D) |
| COBBLES | (D) |
| BOULDERS | (D) |
| BEDROCK | (D) |
| BOULDERS | (D) |
| VELOCITY | |

# EXISTING ROAD PROFILE
SCALE 1:200




**WEST FRASER MILLS LTD.**
**PACIFIC INLAND RESOURCES**

| | |
|---|---|
| TSA: BULKLEY | LICENCE: |
| PROJECT: SITE PLAN OPTION No. 1 UPSTREAM FORD CROSSING PAGE 2 OF 2 | GEOGRAPHIC LOCATION: TOBOGGAN CREEK |
| DRAWN BY: E. WITHERS | DEVELOPMENT PLAN MAP: KITSEGUECLA |
| DATE: JULY 30, 1999 | MAP SHEET: 093L084 |
| CONTRACTOR: SILVICON SERVICES INC. | APPROVED: |
| SCALE: 1:200 | |
| C.P.: N/A BLK.: N/A | |
| AIR PHOTOS: N/A | |

## LEGEND

HISTORY:
- Disturbance
- Regeneration
- Stand Tending
- Site Preparation

ROADS:
- Highway
- Main
- Traversed Built
- Traversed Proposed
- Trails

- Air Photo Centre
- Alpine
- Bridge
- Brush
- Contours
- Cultivated
- Cutblock Boundary
- Ecosystem Boundary
- Embankment
- Ephemeral Stream
- Helispot
- Landing
- Non-Commercial
- Non-Productive

- Plot & Strip
- Point of Commencement (P.O.C.)
- Ridge
- Rock
- Skid Bridge
- Skid Direction
- Slide
- Slope Percent
- Station Marker
- Stream Boundary
- Stream
- Swamp
- Timber Type
- Windfall

- CROSS SECTION
- PHOTO
- BENCHMARK OR REFERENCE POINT
- SOIL PIT
- ROAD STATION

- HWM - HIGH WATER MARK
- PWL - PRESENT WATER LEVEL
- THALWEG - STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

C:\FABC\9999PLNS\TobogSPT.dgn Mar 29, 2000 14:21:52

WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

BULKLEY

PROJECT: SITE PLAN
OPTION No. 2
DOWNSTREAM FORD CROSSING
PAGE 1 OF 2

DRAWN BY: T. BITNER
DATE: JULY 30, 2008
CONTRACTOR: SILVICON SERVICES INC.
SOURCE: FORD
SCH: SDR BLIC: SHR
SUB PHOTOS: N/A

CHECKED: TORKINGTON
DESIGNATED: TORKINGTON, LINDSAY
DATE: PREVIOUSLY
DEPARTMENT: ENGLISH
APPROVED:

LEGEND

WATERS
Watercourse
Watercourse Ed
Treed Swamp
Bog Meadow

ROADS
Highway
Main
Mainline
Traverse Ed
Traverse Primary
Trails

All Weather Centre
Alpine
Bridge
Bridge
Centreline
Centreline
Controlled Brewers
Equestrian Resident
Embankment
Equipment Slope
Heritage
Landing
Non-Commercial
Non-Primary

Pipe & Wire
Power or Communication
Ridge
Rock
Rock Bridge
Road Primary
Site
Slope Percent
Station Number
Stone Barbell
Stream
Swamp
Timber Type
Viewpoint

GRASS SECTION
PHOTO
BENCHMARK OR REFERENCE POINT
SOIL PIT
ROAD STATION

1000 HIGH WATER MARK
2021 PRESENT WATER LEVEL
THALWEG STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

CHANNEL DESCRIPTION

| | |
|---|---|
| ORGANIC | |
| FINES | |
| PEBBLES | 20% |
| COBBLES | 80% |
| BOULDERS | 0% |
| BEDROCK | |
| GRADIENT AVG. | 6% |
| VELOCITY AT HIGH WATER | |

SOIL DESCRIPTION

| SOIL PIT 1 | SOIL PIT 2 |
|---|---|
| DEPTH 400MM | DEPTH 350MM |
| COARSE FRAGMENTS | COARSE FRAGMENTS |
| BEDROCK | BEDROCK |
| STONES | STONES 50% |
| GRAVEL 50% | GRAVEL 40% |
| FINE FRAGMENTS | FINE FRAGMENTS |
| SAND 20% | SAND 5% |
| SILT | SILT |
| CLAY | CLAY |

STRUCTURES AND EXCAVATION

A [illegible]
B [illegible]
C [illegible]
D [illegible]
E [illegible]
F [illegible]
G [illegible]
H [illegible]
I [illegible]

KEY MAP SCALE 1:50,000 MAPSHEETS 93L/08

WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

| | |
|---|---|
| TSA: BULKLEY | LOCATION: |
| PROJECT: SITE PLAN OPTION No. 2 DOWNSTREAM FORD CROSSING PAGE 2 OF 2 | GEOGRAPHIC LOCATION: TOBOGGAN CREEK |
| DRAWN BY: E. WITHERS | DEVELOPMENT PLAN MAP: |
| DATE: JULY 30, 1999 | KITSEGUECLA |
| CONTRACTOR: SILVICON SERVICES INC. | MAP SHEET: 093L084 |
| SCALE: 1:200 | APPROVED |
| C.P.: N/A BLK.: N/A | |
| AIR PHOTOS: N/A | |

## LEGEND

HISTORY:
- Disturbance
- Regeneration
- Stand Tending
- Site Preparation

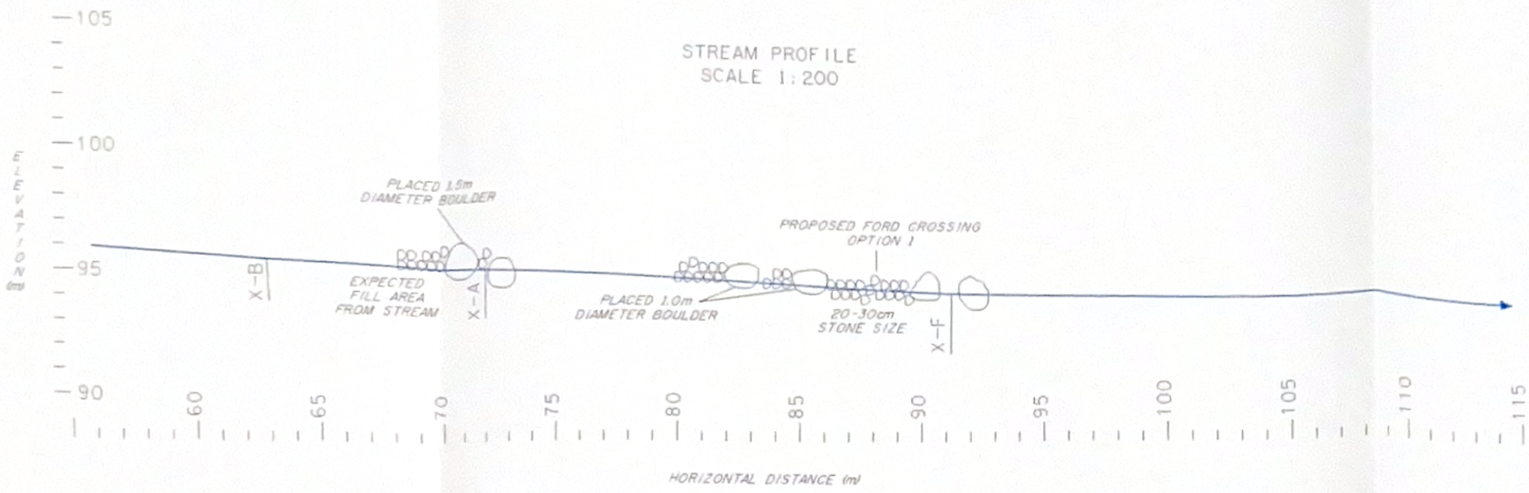
ROADS:
- Highway
- Main
- Traversed Built
- Traversed Proposed
- Trails

- Air Photo Centre
- Alpine
- Bridge
- Brush
- Contours
- Cultivated
- Cutblock Boundary
- Ecosystem Boundary
- Embankment
- Ephemeral Stream
- Helispot
- Landing
- Non-Commercial
- Non-Productive

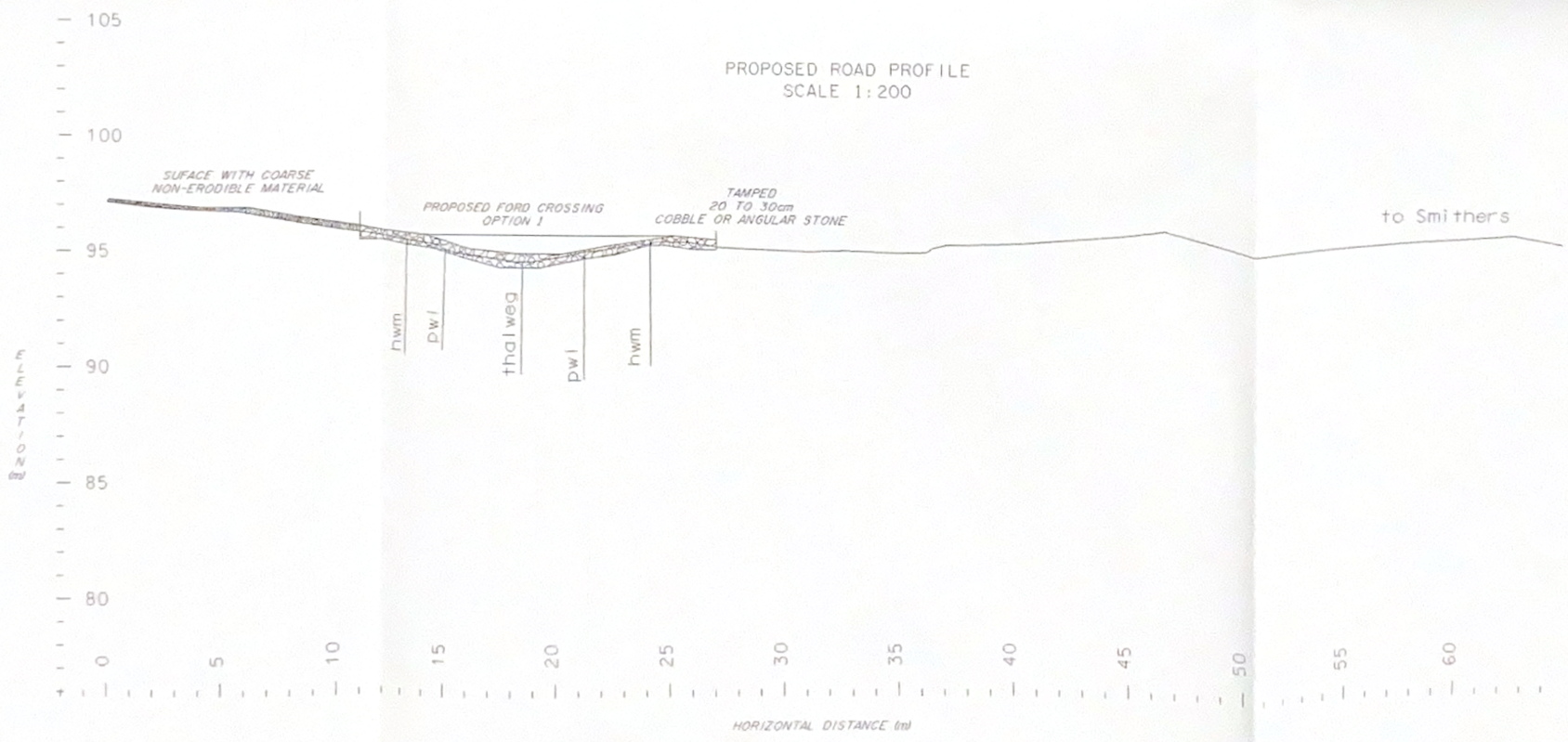
- Plot & Strip
- Point of Commencement (P.O.C)
- Ridge
- Rock
- Skid Bridge
- Skid Direction
- Slide
- Slope Percent
- Station Marker
- Stream Boundary
- Stream
- Swamp
- Timber Type
- Windfall

- CROSS SECTION
- PHOTO
- BENCHMARK OR REFERENCE POINT
- SOIL PIT
- ROAD STATION
- HWM - HIGH WATER MARK
- PWL - PRESENT WATER LEVEL
- THALWEG - STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

STREAM PROFILE
SCALE 1:200




PROPOSED ROAD PROFILE
SCALE 1:200




D:\FRBC\99BXPLNS\TobogDP2.dgn Mar 27, 2000 14:22:26

**WEST FRASER MILLS LTD.**
**PACIFIC INLAND RESOURCES**

| | |
|---|---|
| TSA: BULKLEY | LICENCE: |
| PROJECT: SITE PLAN OPTION No. 3 BRIDGE CROSSING PAGE 1 OF 2 | GEOGRAPHIC LOCATION: TOBOGGAN CREEK |
| DRAWN BY: | DEVELOPMENT PLAN MAP: |
| DATE: JULY 30, 1999 | |
| CONTRACTOR: SILVICON SERVICES INC | MAPSHEET: 093L084 |
| SCALE: 1:200 | APPROVED: |
| C.P.: N/A BLK.: N/A | |
| AIR PHOTOS: N/A | |

## LEGEND

HISTORY: Disturbance, Regeneration, Stand Tending, Site Preparation
ROADS: Highway, Main, Traversed Built, Traversed Proposed, Trails

CROSS SECTION
PHOTO
BENCHMARK OR REFERENCE POINT
SOIL PIT
ROAD STATION
HWM - HIGH WATER MARK
PWL - PRESENT WATER LEVEL
THALWEG - STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

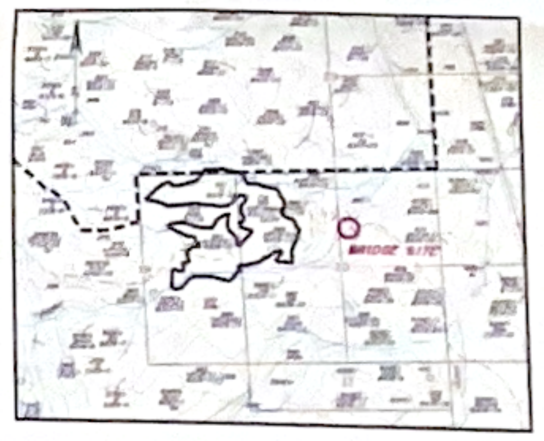
| CHANNEL DESCRIPTION | |
|---|---|
| ORGANIC | |
| FINES | |
| PEBBLES | 15% |
| COBBLES | 80% |
| BOULDERS | 5% |
| BEDROCK | |
| GRADIENT AVG | 5% |
| VELOCITY | |

| SOIL DESCRIPTION | |
|---|---|
| SOIL PIT 1 | SOIL PIT 2 |
| DEPTH - | DEPTH |
| COARSE FRAGMENTS | COARSE FRAGMENTS |
| boulders - | boulders - |
| cobble - | cobble 50% |
| gravel 80% | gravel 45% |
| FINE FRAGMENTS | FINE FRAGMENTS |
| fines 20% | fines 5% |
| sand - | sand - |
| silt | silt |
| clay - | clay - |

STRUCTURES AND EXCAVATION

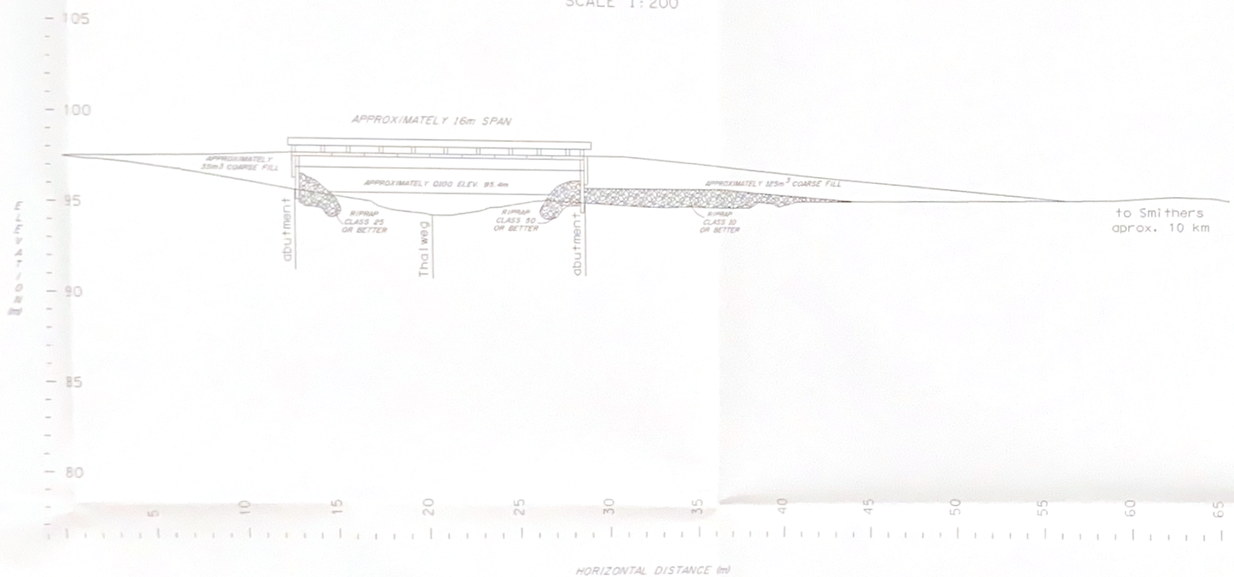
A - proposed 4wheel drive access route
B - bridge and approaches
C - riprap berms
D - log stream deflector
E - redirect side channel
F - remove collapsed wooden bridge deck
G - redirect main channel
H - build gravel/cobble berm
REMOVE TREES

NOTE: THIS IS NOT AN ENGINEERED BRIDGE DESIGN. THIS IS AN EXAMPLE OF A POSSIBLE BRIDGE. IF OPTION No.3 IS CHOSEN AS THE PREFERRED OPTION THEN THE BASE SITE PLAN CAN BE USED TO CREATE AN ENGINEERED BRIDGE DESIGN.



KEY MAP SCALE 1:50 000 MAPSHEETS 93L084

PROPOSED ROAD PROFILE
SCALE 1:200




WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

| | |
|---|---|
| TSR: BULKLEY | LICENCE: |
| PROJECT: SITE PLAN OPTION No. 3 BRIDGE CROSSING PAGE 3 OF 3 | GEOGRAPHIC LOCATION: TOBOGGAN CREEK |
| DRAWN BY: C. RITCEY | DEVELOPMENT PLAN MAP: |
| DATE: JULY 30, 1999 | KITSEGUECLA |
| CONTRACTOR: SILVICON SERVICES INC. | MAP SHEET: 093L.084 |
| SCALE: 1:200 | APPROVED: |
| C.P.: N/A BLK.: N/A | |
| AIR PHOTOS: N/A | |
| FILE: TOBOGBR3.DGN | DATE REVISED: |

## LEGEND

HISTORY:
- Disturbance
- Regeneration
- Stand Tending
- Site Preparation

ROADS:
- Highway
- Main
- Traversed Built
- Traversed Proposed
- Trails

- Air Photo Centre
- Alpine
- Bridge
- Brush
- Contours
- Cutblock
- Cutblock Boundary
- Ecosystem Boundary
- Embankment
- Ephemeral Stream
- Helispot
- Landing
- Non-Commercial
- Non-Productive

- Pier & Strip
- Point of Commencement
- Ridge
- Rock
- Skid Bridge
- Skid Direction
- Slide
- Slope Percent
- Station Number
- Streets Boundary
- Stream
- Swamp
- Timber Type
- Windfall

- CROSS SECTION
- PHOTO
- BENCHMARK OR REFERENCE POINT
- SOIL PIT
- ROAD STATION

HWM - HIGH WATER MARK
PWL - PRESENT WATER LEVEL
THALWEG - STREAM CHANNEL DIRECTION AT DEEPEST PART OF STREAM

NOTE: THIS IS NOT AN ENGINEERED BRIDGE DESIGN. THIS IS AN EXAMPLE OF A POSSIBLE BRIDGE. IF OPTION No.3 IS CHOSEN AS THE PREFFERED OPTION THEN THE BASE SITE PLAN CAN BE USED TO CREATE AN ENGINEERED BRIDGE DESIGN.

C:\FREC\SBSKPLNS\TobogBP3.dgn Mar 27, 2000 14:22:58

# Appendix E

## Instream Timing Windows
## (see Section 4 Completion Report Appendix B)

# Completion Report

## APPENDIX A - Documentation
## - Quality Certificates

**David Bustard and Associates Ltd.**
3745 - 12th Avenue
Box 2792
Smithers, B.C.
V0J 2N0
Telephone: (250) 847-2963
Fax: (250) 847-2375
Email: dbustard@mail.bulkley.net

May 14, 1999

Alan Baxter,
PIR
347-5520

Hi Alan,

Just a quick update on Telkwa Ponds work.
We have been operating Km 1011 since May 1 - Mark-recapture completed and looks like low numbers this year - as expected from poor recruitment last year. No smolts yet.

Km 1010 - We have spent a fair effort installing upstream and downstream traps and developing a system to control debris - fencing for beavers - etc. Approximately 90 hours to get set-up - but system appears to now work. Running a fair bit of the water through culvert at present. Crew had to excavate through berm to install trap. We don't think fry can get up from river at these flows - there are lots of fry coming up at Km 1011 but none in Km 1010 to date.

As I mentioned earlier - operating both traps systems is going to involve extra costs - not just for the set-up- but an extra hour a day for running now that system is set-up. I hope you are able to take this into account in dealing with contract. Actual total cost differences will be easier to calculate once we are through May.

Cheers,
Dave Bustard
Dave

**David Bustard and Associates Ltd.**
3745 - 12th Avenue
Box 2792
Smithers, B.C.
V0J 2N0
Telephone: (250) 847-2963
Fax: (250) 847-2375
Email: dbustard@mail.bulkley.net

June 10, 1999

Alan Baxter,
Pacific Inland Resources Ltd.
Fax - 847-5520

Hello Alan,

Just a quick update on the Telkwa Ponds.

Km 1011 - 1207 fry upstream; 37 yearlings upstream; 253 smolts downstream
Km 1010 - 50 fry upstream; 2 yearlings upstream; 50 smolts downstream

Fry upstream movement in Km 1010 just starting - Telkwa confluence area appears to be a real limitation at lower flows - and area is starting to attract more fry now as flows are somewhat higher.

Overall - everything is late in 1999 as might be expected. If project ends on June 30 - we will have an incomplete picture -

Budget to date indicates that if I reserve $4500 to write report we will be running short around the last week of June. Km 1010 has added a fair chunk of time and effort to the field collection.

Also - if you are going to do modifications to Km 1010 this year - you should ask Jeff Lough if he will have Rheal Finnegan look at site and make suggestions in terms of improvements. He is on contract to Restoration for advice - and is very knowledgeable re pond development.

Cheers,

Dave Bustard

# FAX COVER SHEET

BRITISH COLUMBIA
CONSERVATION FOUNDATION
c\o 1056 Quadling Avenue
Coquitlam, B.C. V3K 2B2

Date: 8/25/99 Time: 10:16:28

To: Al Baxter Fax Number: 1-250-847 5520

From: Rheal Finnigan Phone: (604) 939 - 0854
Fax: (604) 939 - 0882

Number of pages including cover sheet: 2

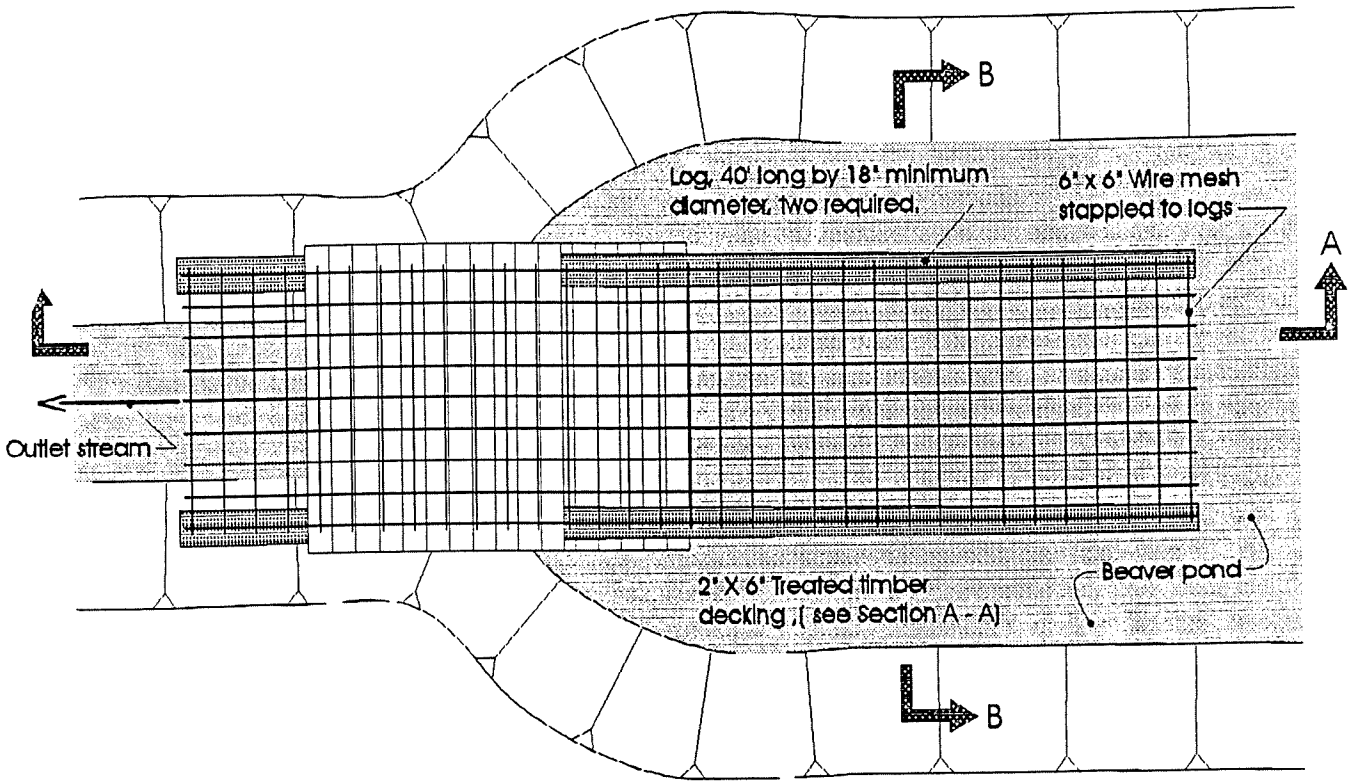
**MESSAGES:**

**Hi Al:**
**Further to our site inspection on August 05. 1999, I've prepared a sketch for a proposed beaver structure to deal with the upper pond at the subject site. I would appreciate your review of the sketch and any comments that you may have on the concept. If you think that it is might work, it should be feasible to install such a structure without silting up the mainstem Telkwa River. The lower pond could be used to settle out most of the sediment. There may be a small release of turbid water but this would have minimal negative impact.**

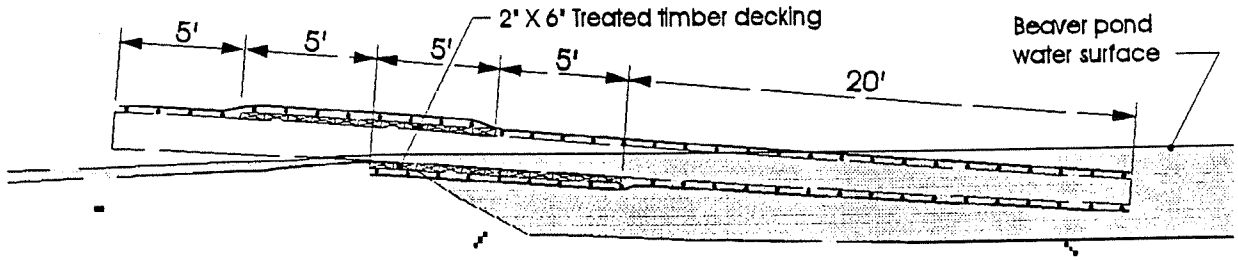
**I'm sending copies of this fax and the attached sketch to Jeff Laugh and Dave Bustard for their review and comments.**

**I look forward to receiving your comments.**

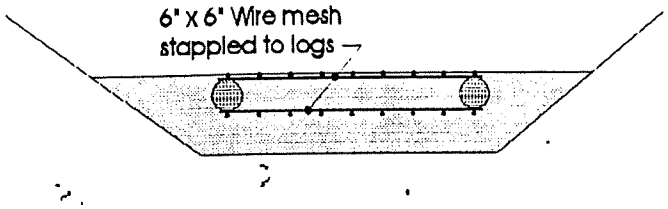
**Rheal Finnigan.**




PLAN VIEW




SECTION A - A




SECTION B - B

Drawn by : R. Finnigan, P. Eng.
Date : August 17, 1999
Revised :

WATERSHED RESTORATION PROGRAM
TELKWA RIVER
BEAVER POND @ KM 1011
PROPOSED STRUCTURE FOR BEAVER CONTROL

McElhanney

27th March 2000

Our File: 2321-00490-0
Your Contract: 99-FRBC-100

Pacific Inland Resources
P.O. Box 3130
Smithers BC V0J 2N0

Attention: Mr. Alan Baxter, RPF

Dear Mr. Baxter:

**Re: Conceptual Design – for fish passage channel and culvert upgrades for Km 1010 pond**

As requested, McElhanney has prepared a conceptual design to provide juvenile fish passage from the Telkwa River to Km 1010 pond. The pond is located across the Telkwa River from Km 1010 Telkwa FSR, near 8km on Telkwa River Road. The existing conditions consist of a perched 500mm diameter culvert that is a partial barrier to juvenile fish migration and acts as the main outlet for the Km 1010 pond. A constructed channel then connects the culvert outlet with the Telkwa River.

McElhanney has prepared a Conceptual Design for review, based on the Site Plan report *'Juvenile Coho Studies at Telkwa River Km 1010 and Km 1011 Ponds', 1999 by David Bustard and Associates Ltd.* This Conceptual Design will be modified once there has been an opportunity to visit and confirm the site features. As David Bustard and Assoc. have previously been involved with this site it would be beneficial if they could visit the site at the same time, as previously discussed.

The proposed works presently include:

- Replacing the existing 500mm diameter culvert with a 1000mm or larger culvert and adjusting the culvert invert elevation and water level at the culvert outlet to create a backwater effect in the culvert to allow juvenile fish passage.
- Creating and complexing a new channel with a gentler gradient and improved juvenile fish access at the confluence with the Telkwa River, total length of 60m @ an average gradient of 2.6%.
- Retaining the old constructed channel to act as an overflow channel during flood events.
- Construction of a rock spillway to pass floodwater to the old channel and provide backwater effects in the culvert.

...2

1 - 5008 Pohle Avenue
Terrace BC
Canada V8G 4S8

Tel 250 635 7163
Fax 250 635 9586

Prior to starting the detailed design the following items will need to be addressed:

1. Perform a site visit under clear ground conditions (probably second half of April).
2. Arrange additional survey pickup to include all of the proposed channel and surrounding area (currently the proposed channel is partially outside the surveyed area so we have assumed and extended the elevation contours).
3. Clarification of the location of PNG's old ROW as mentioned in the David Bustard Ltd. report recommendations and approval from PNG if any works are inside their ROW.
4. Initial review and comments on the proposed works by DFO and MELP.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

McElhanney Consulting Services Ltd.

Alan Hampshire

Alan F. Hampshire, P.Eng.
Project Manager

AFH:ah
Enclosures

Box 787
Smithers BC
Canada V0J 2N0

Tel 250 847 4040
Fax 250 847 4160
email: bwood@mcelhanney.com

**McElhanney**

**Delivery Slip**

Pacific Inland Resources
PO Box 3130
Smithers BC V0J 2N0

NUMBER

DATE 23 Nov. 1999

YOUR ORDER NO.

ATTENTION: Alan Baxter

OUR JOB NO. 2331-00256-0

SHIP VIA Hand Deliver

| QUANTITY | DESCRIPTION |
|---|---|
| 1 | copy of the Telkwa River Side Channel site plan |

Note that an invoice in the amount of approximately $1,570 for the site survey and plan has been issued. Alan Hampshire, hydraulics engineer, of our Terrace office has recently submitted a cost estimate for completion of the design for this site. We look forward to completing the design and will await final approval before commencing this portion of work.

Brian Wood PEng
Branch Manager

1 copy to Recipient 1 copy to Project File 1 copy to Chronological File

1 – 5008 Pohle
Terrace, British Columbia
Canada V8G 4S8

Tel: (250) 635-7163
Fax: (250) 635-9586
e-mail: ahampshire@mcelhanney.com

**McElhanney**

## Fax Transmittal

| DATE | DESTINATION FAX NO. | NO. OF PAGES (INC. THIS PAGE) | FILE NO. |
|---|---|---|---|
| 16th December 1999 | 847-5520 | 2 | 2321-P9900-PIR |

| TO | FROM |
|---|---|
| Alan Baxter | Alan Hampshire |
| COMPANY | ORIGINALS TO BE : |
| Pacific Inland Resources | |
| CITY | COPY TO: |

## MESSAGE

**RE: Proposal for Design of Fish Passage for Telkwa Side Channel near 8km Telkwa River Road – Including Additional Survey**

As requested, we have updated our fee estimate of 19th November 1999 to include the additional survey information that you requested. The total now comes to $9,654.00 as shown in the enclosed breakdown.

As discussed the completion dates for the conceptual design and detailed design are now the 29th February and 29th March 2000 respectively. Some adjustment of the detailed design may be needed during a future pre - construction site visit, as any site visits now performed will be under snow conditions.

I understand you will be sending me a copy of David Bustard's reports, any other information you have on this side channel would also be very welcome.

Should you have any questions or concerns please give me a call.

Sincerely,

McElhanney Consulting Services Ltd.

Alan Hampshire

Alan F. Hampshire
Project Manager

AFH:ah

DEC-20-99 15:33 FROM:MCELHANNEY TERRACE ID:12506359586 PAGE 1/2

Silvicon
SERVICES INC.

P.O. Box 490
3560 Victoria Drive
Smithers, B.C. V0J 2N0
Ph. (250) 847-3680
Fax (250) 847-2530
E-mail: silvicon@mail.bulkley.net

September 13, 1999

Grant Marleau
Ministry of Forests
Bulkley/Cassiar District
Bag 6000
Smithers, B.C.
V0J 2N0

Dear Grant

Please find enclosed PART 1, schedule A, B and C and PART 2, schedule A and B which will form part of the Watershed Restoration Program 'Standard Agreement' between the Ministry of Forests and Pacific Inland Resources.

As discussed in our meeting on August 27, 1999 the prescriptions for the Kitseguecla/Blunt Creek charts have been separated into two parts.

The prescriptions located within the first binder, labeled PART 1 have previously been advertised with PIRs Forest Development Plan and are being scheduled for the works phase in September/October, 1999. There is a total of 29.7 kilometers of road prescribed in PART 1.

Also included with PART 1 is a prescription for the removal of a collapsing culvert that was just located on an old road in the Telkwa chart. This culvert is in an S3 stream and is impeding fish access. The stream is located within the first kilometer on the 119 road and will not be included on the 1:50 000 locator map.

Section 1 of both parts contains an approval form to be signed by MELP and the District Manager approving instream works outside of timing windows. We will begin the works phase of this contract as soon as possible, but we will wait for approval before starting any instream works outside of timing windows. The standards agreement for the works phase has been included as schedule A with the PART 1 prescriptions.

The 68.77 kilometers of prescriptions labeled as PART 2 within the larger binder have not been advertised and are therefore being deferred until the advertising process is complete.

Also, as discussed in our meeting, if there is enough of the budget left over after the works phase of PART 1 is complete some of the less contentious roads from the PART 2 prescriptions will then be sought for the works phase immediately. These roads can be included as part of the standards agreement works found with PART 1.

If you would like a field review of any or all of these prescriptions, please let me know right away and I will be pleased to arrange a field visit before construction begins. We are proposing that construction will start no sooner than September 20, 1999 and run no later than October 30, 1999. We are also proposing that work starts in the Blunt watershed then move to the Kitseguecla watershed, to get the higher elevation areas complete in the event of an early snowfall.

The Prescriptions include:

- table 2 Contract summary sheet
- table 1 Prescription summary
- table 3 Prescription summary
- special construction notes for operator
- 1:10 000 prescription map
- table 4 potential conflict chart
- field notes
- 1:50 000 locator map

Should you have any questions or require any further information, please do not hesitate to contact me at (250) 847-3680.

Yours truly

Ed Withers

Watershed Restoration Supervisor
West Fraser Mills Ltd., Pacific Inland Resources

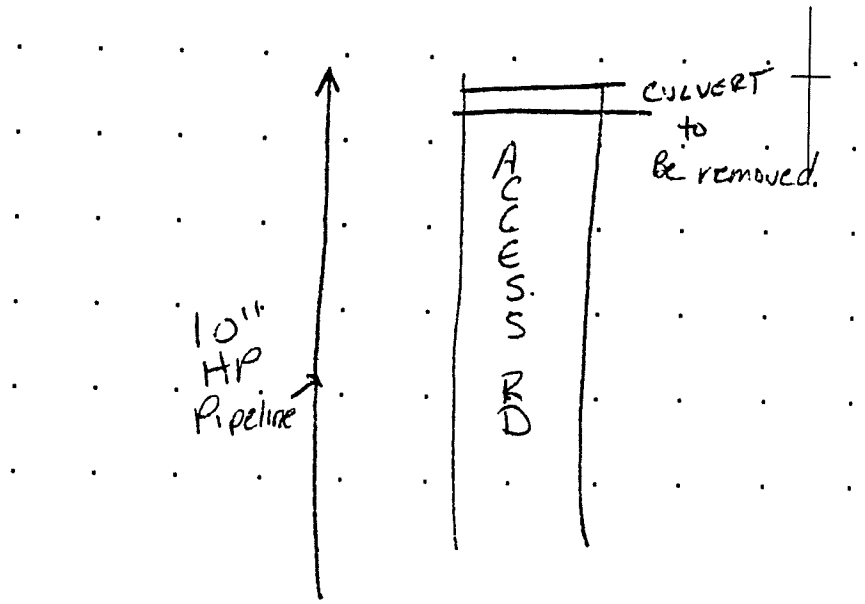
EW:cs
encl

Pacific Northern Gas

# LINE LOCATION REQUEST

| | | | |
|---|---|---|---|
| MAINS ☒ H.P. SERVICES ☐ | | VALVE ☐ | OTHER ☐ |
| LOCATION: TELKWA PASS 119 RD | | | |
| BC I CALL TICKET NUMBER 19993702 21 | | APPOINTMENT KEPT BY PARTY REQUESTING THE LOCATE? | YES ☑ NO ☐ |
| REQUESTED BY: ED WITHERS NAME OF CALLER | | | DATE |
| COMPANY NAME: SILVICON | | | TIME |
| DATE REQUIRED: Sept 9/99 | TIME REQUIRED: 2:00 | ☐ AM ☒ PM | CALL TAKEN BY |
| NAME OF CONTACT ON SITE: ED WITHERS | | | PHONE NUMBER |
| TO BE COMPLETED BY SYSTEM SURVEY | DATE Sept 9/99 | TIME 2 30 | ☐ AM ☒ PM |
| MAINS STAKED | | SERVICES STAKED | |
| | | | |
| | | | |

SKETCH PLAN OF PROPOSED EXCAVATION AND PLANT LOCATION:




**NOTE:** SEE REVERSE SIDE OF THIS SHEET FOR REGULATIONS REGARDING EXCAVATING.

SPECIAL INSTRUCTIONS ☐ EXPOSE PLANT BY HAND DIGGING ☐

| | | |
|---|---|---|
| LOCATOR'S SIGNATURE | | METHOD OF MARKING ☑ FLAGS ☐ PAINT OTHER _____ |
| ACCEPTED & WITNESSED BY | TITLE | COMPANY |

FORM T9124 (REV. 04/99) DISTRIBUTION: WHITE – Office YELLOW – Customer

CONTRACT NO. 99-FRBC-24
DATE: September 20, 1999

# FOREST RENEWAL SERVICES CONTRACT

Pacific Inland Resources, a division of West Fraser Mills Ltd.
of Smithers, B.C. (the "Company") and
Hubert Holdings Ltd.
Smithers, B.C. (the "Contractor") agree as follows:

1. The Company has entered into a Multi-Year Agreement (the "FRBC Agreement") with Forest Renewal British Columbia ("FRBC") and has entered into this Contract for the purpose of engaging the Contractor to perform some of the Company's obligations under the FRBC Agreement.

2. The term of this Contract is approximately 1.5 months beginning on Sept 20, 1999 and ending on October 30, 1999 unless earlier terminated in accordance with this Contract or extended by agreement in writing between the parties.

3. The Contractor will perform Road deactivation as per the attached Schedules 'A', 'B', 'C' and 'D'.

(the "Contract Services") at the Operating Areas (the "Operating Areas") designated by the Company in the Term Sheets agreed to by the Company and the Contractor from time to time, according to the terms of this Contract and the terms agreed to by the Contractor and the Company from time to time as set out in the Term Sheet for each Operating Area. The Term Sheet for each Operating Area will include, but is not limited to, the terms contained in Schedule A.

**[NOTE: This Contract should be used only for Contract Services that DO NOT constitute "a phase of a timber harvesting operation" as defined in the Timber Harvest Contract and Sub-Contract Regulation.]**

4. The Contractor's Federal Goods and Services Tax registration number is: #RT123341430

5. The Contractor's Workers Compensation Board number is: 407880-141

6. The Contractor's insurance agent is: Sovereign General Insurance Co.

7. Other Terms and Conditions: Please see the attached Schedules 'A', 'B', 'C' and 'D'.

8. This Contract, which includes the attached Conditions and the Term Sheet for each Operating Area, constitutes the entire agreement between the Company and the Contractor with respect to the Contract Services.

9. The Contractor hereby confirms receipt of a copy of this Contract.

Pacific Inland Resources
a division of West Fraser Mills Ltd.

Company

By: _____
(Authorized Signatory)

Hubert Holdings Ltd.

Contractor

By: _____
(Authorized Signatory)

Silvicon
SERVICES INC.

P.O. Box 490
3560 Victoria Drive
Smithers, B.C. V0J 2N0
Ph. (250) 847-3680
Fax (250) 847-2530
E-mail: silvicon@mail.bulkley.net

Nov 8, 1999

Butch Morris
Hubert Holding Ltd.

Dear Butch:

This letter is in regards to the work conducted by your operator, Ken MacDonald, up the 608 road in Kitseguecla. I feel that the work produced on this road was more difficult than was originally anticipated and therefor took much longer than expected to finish. Also I feel that the job Ken did on the crossditches and bridge removals was well done, but, armouring of the approaches of some of the crossditches was not completed. This was in the contract and also discussed between Ken and I. As it is now I feel that the crossings are acceptable and will serve their purpose, but it might not be viewed the same way by the forest service. As it is in the contract between PIR and the Forest Service as well, it is our obligation to complete the work as stated in the contract. It is our intention to do further works next year , after the road has setup, to armour the approaches of the crossings. We are hoping that the road will set up well enough to allow access for rock trucks.

The point of this letter is only to notify you of our intentions in this matter and to ask you to, in the future, notify us of any alterations to the contract so we may address them in the most cost effective manner.

Overall we are happy with the work produced by your company and enjoy working with you.

Yours truly,

Ed Withers
Watershed Restoration Supervisor
Pacific Inland Resources

# FAXHEADER

TO: Ed Withers

LOCATION: Salvicor

FAX NUMBER:

DATE: 1999 07 30

FROM: Grant Marlean

PAGES TO FOLLOW: 1

## BULKLEY / CASSIAR FOREST DISTRICT

**SMITHERS OFFICE**
3333 TATLOW ROAD
BAG 6000
SMITHERS, BC V0J 2N0
PHONE: 250-847-6300
FAX: 250-847-6353

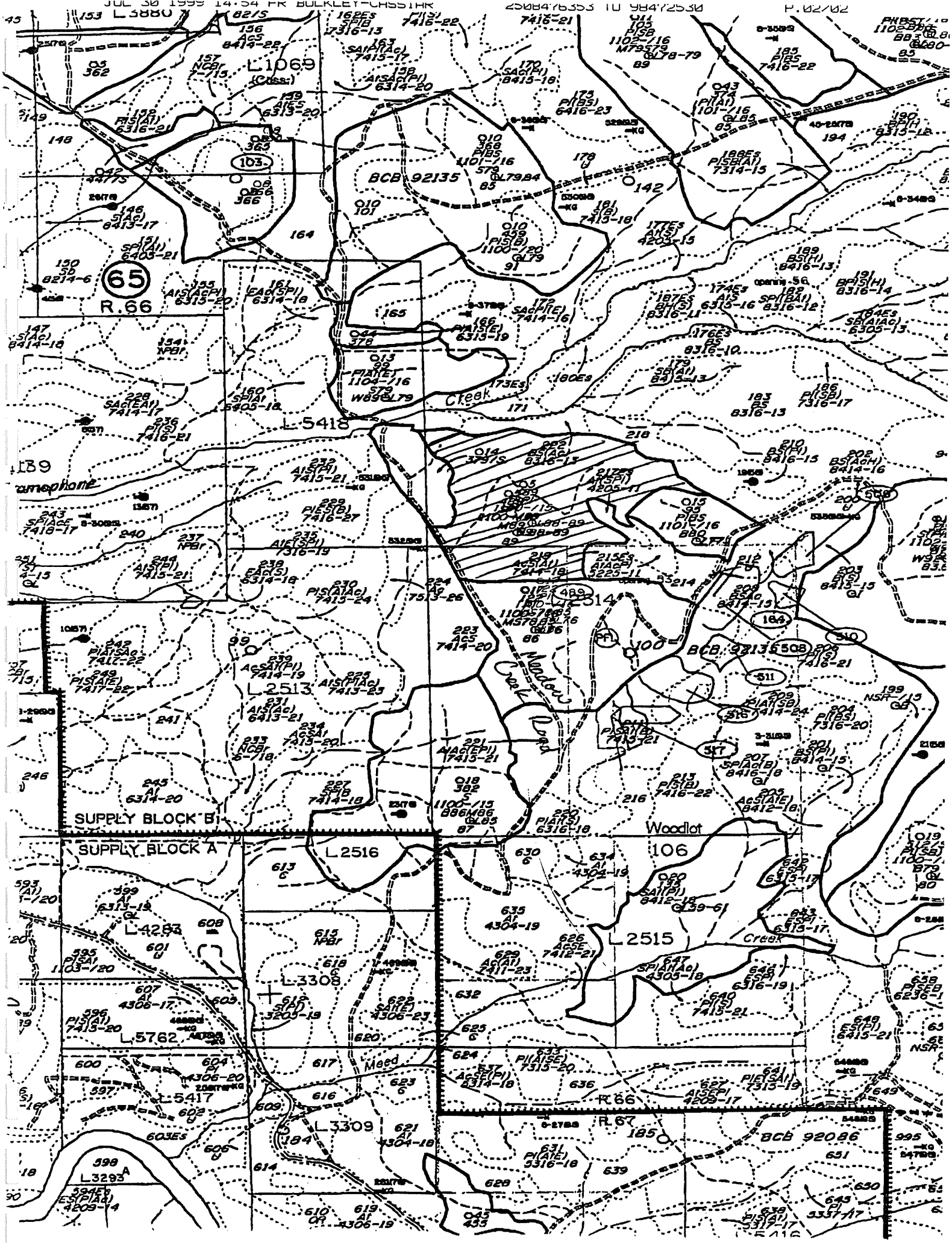
**FIELD OFFICE**
BAG 2000
DEASE LAKE, BC V0C 1L0
PHONE: 250-771-8100
FAX: 250-771-5700

**MESSAGE:**

Ed

This block is on mapsheet 93L094 Opening #5. I believe its the main road.

Grant


L1069
L5418
L2513
L2514
L2516
L2515
L3308
L5762
L5417
L3309
L3293
L4293
65
R.66
R.67
103
Creek
Meadow Creek Road
SUPPLY BLOCK B1
SUPPLY BLOCK A
Woodlot
106
BCB 92135
BCB 92086

Silvicon
SERVICES INC.

P.O. Box 490
3560 Victoria Drive
Smithers, B.C. V0J 2N0
Ph. (250) 847-3680
Fax (250) 847-2530
E-mail: silvicon@mail.bulkley.net

November 17, 1999

Grant Marleau
Ministry of Forests
Bulkley/Cassiar District
Bag 6000
Smithers, B.C.
V0J 2N0

Re: Certification Report, WRP Road Deactivation, Contract 99-FRBC-24 Blunt/Kitseguecla charts

Dear Grant:

In compliance with the Works Schedule 'A' of the WRP Standards Agreement for the above mentioned contract, please accept this letter as certification that the works have been completed in general conformance with the relevant road deactivation prescriptions.

In this package, please find a summary map indicating the roads deactivated under this phase of the contract (Blunt and Kitseguecla areas), and a table indicating the extent of deactivation completed for those roads. Please note that a total of **29.7 kilometers** for the Blunt and Kitseguecla, has been permanently deactivated, **no landslides or gullies have been treated**, and that approximately **0.48 hectares** of treated ground has been revegetated.

No areas under this phase of the contract required deactivation prescriptions prepared by a professional engineer or geoscientist, and as such, no professional certification of works other than this are included herein.

If you require further information, or need clarification on any issue related to this package, please contact me or Steve Webb at (250) 847-3680.

Yours truly,

Ed Withers
Watershed Restoration Supervisor
West Fraser Mills Ltd., Pacific Inland Resources

| | |
|---|---|
| Professional certification that the works have been completed in general conformance with the relevant road deactivation prescription. Contract number 99-FRBC-24 | Signature<br><br>, RPF<br>Registered Professional Forester |

encl.

Attn - Ed Withers

BRITISH COLUMBIA

Ministry of Forests

# Quality Certificate

For inspection of silviculture work delivered under standards agreements

A) IDENTIFICATION

Standards Agreement No. 99-FRBC-24 Activity 11753 WRP (Rd Deactivation)

District DBC (Smithers office) Licencee West Fraser Mills (PIR)

MYA or AA No. SBM 98 112 Date 1999 11 29

B) UNITS INCLUDED IN THIS QUALITY CERTIFICATION: 29.7 Kilometers

(Fill in a separate sheet for each unit where field check indicates significant difference from Licensee report)

C) UNIT INSPECTED: 3 Km

1. Quality reported by Licensee Inspector ± 10 %

2. Ministry calculation of quality (if plots established) % 100 %

Payment percent

4. Number of hectares reported as treated 29.7 ~~ha~~ Km

5. Ministry calculation of area treated (if area traversed) (Believe proponents calculation to be correct) 29.7 ~~ha~~

6. Net value of all assessments recommended to FRBC (write in N/A if 0 or negative)

$

Net assessment = Ministry assessments minus Licensee assessments (Itemize below)

7. Estimated cost of rework required, if any. (write in N/A if none required) $ N/A

(Itemize in the comment section or attach an additional sheet)

8. Comments (include a description of any attachments):

Contract # 22175-80/SBM98112

CERTIFICATE COMPLETED BY: G. Marleau

Ministry Representative (Signature) Ministry Representative (Printed Name)

**Must also be signed by the District Manager if** quality, treated area or assessments are significan different than reported by Licensee. (ie. >10% quality, >5% area, or >$500 assessments)

Distribution: FRBC, Licensee

SAQual.doc HFP 98/06

District Manager signature (If required. See above)

** TOTAL PAGE.01 **

BRITISH COLUMBIA

Ministry of Forests

# Quality Certificate

For inspection of work delivered under standards agreements

A) IDENTIFICATION

| | | | |
|---|---|---|---|
| Standards Agreement No. | 712311 | Activity | Road Rehab Bridge replacement |
| District | Bulkley / Cassiar | Licencee | West Fraser Mills (Ait) |
| MYA or AA No. | SBM-9811Z | Date | 2000 105 101 |

B) UNITS INCLUDED IN QUALITY CERTIFICATION: 1 (Bridge)

C) UNIT INSPECTED: 1

| | | | |
|---|---|---|---|
| 1. | Quality reported by Licensee Inspector | 100 | % |
| 2. | Overall quality of unit | 100 | % |
| 3. | Normal payment percent equivalent if different than #2 above | 100 | % |
| 4. | Number of hectares reported as treated | N/A | ha. |
| 5. | Number of hectares treated | N/A | ha |
| 6. | Assessments recommended to FRBC (write in N/A if none) | $ N/A | |
| 7. | Estimated cost of rework required, if any. (write in N/A if non required) | $ N/A | |

8. Comments:

CERTIFICATE COMPLETED BY: G.M. Marleau — Ministry Representative (Signature)

Grant Marleau — Ministry Representative (Printed Name)

Attachments:

COPY

May 5, 1999

Doug Johnston
Ministry of Environment,
Lands and Parks
Skeena Region
Bag 5000
Smithers, B.C.
V0J 2N0

Dear Doug

Please find enclosed the schedule A and B which will form part of the Forest Renewal B.C. funded Watershed Restoration Program 'Standard Agreement' between the Ministry of Environment, Lands and Parks and Pacific Inland Resources.

A field review with yourself, Jeff Lough and I, as well as any other interested parties, should be arranged as soon as the area is snow free so that prescriptions can commence without delay.

Maps have not been included with this package but will be included for the final package once all the work is reviewed. I am submitting this copy for your approval prior to being signed by Pacific Inland Resources.

Please return this copy along with your comments or concerns to me at Silvicon Services Inc. as soon as possible.

Should you have any questions or require any further information, please do not hesitate to contact me at (250) 847-3680.

Yours truly

Ed Withers

Watershed Restoration Supervisor
West Fraser Mills Ltd., Pacific Inland Resources

EW:cs
encl

# LAND ACT.

Province of
BRITISH COLUMBIA.

No. 6521
350

A. Rivers
Deputy Minister of Lands.

GEORGE THE FIFTH, by the Grace of God, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, KING, Defender of the Faith, Emperor of India.

To all to whom these presents shall come, Greeting:

Know ye that We do by these presents, for Us, Our heirs and successors, in consideration of the sum of One hundred and sixty Dollars to Us paid, give and grant unto Edward Simpson

his heirs and assigns

All that Parcel or Lot of Land situate in Coast District said to contain One hundred and sixty acres, more or less and more particularly described on the map or plan hereunto annexed and coloured red, and numbered South West quarter of Section Twenty-one (21) Township One (1) Range Five (5)

on the Official Plan or Survey of the said Coast District, in the Province of British Columbia, to have and to hold the said Parcel or Lot of Land, and all and singular the premises hereby granted, with their appurtenances, unto the said Edward Simpson

his heirs and assigns, for ever:

PROVIDED NEVERTHELESS that it shall at all times be lawful for Us, Our heirs and successors, or for any person or persons acting in that behalf by Our or their authority, to resume any part of the said lands which it may be deemed necessary to resume, for making roads, canals, bridges, towing-paths, or other works of public utility or convenience; so nevertheless that the lands so to be resumed shall not exceed one-twentieth part of the whole of the lands aforesaid, and that no such resumption shall be made of any lands on which any buildings may have been erected, or which may be in use as gardens or otherwise for the more convenient occupation of any such buildings.

PROVIDED also that it shall at all times be lawful for Us, Our heirs and successors, or for any person or persons acting under Our or their authority, to enter into and upon any part of the said lands, and to raise and get thereout any minerals, precious or base, including coal and petroleum, which may be thereupon or thereunder situate, and to use and enjoy any and every part of the said land, and of the easements and privileges thereto belonging, for the purpose of such raising and getting, and every other purpose connected therewith, paying in respect of such raising, getting and use reasonable compensation.

PROVIDED also that it shall be lawful for any person duly authorized in that behalf by Us, Our heirs and successors, to take and occupy such water privileges, and to have and enjoy such rights of carrying water over, through, or under any parts of the hereditaments hereby granted, as may be reasonably required for mining or agricultural purposes in the vicinity of the said hereditaments, paying therefor a reasonable compensation to the aforesaid Edward Simpson his heirs and assigns.

PROVIDED also that it shall be at all times lawful for any person duly authorized in that behalf by Us, Our heirs and successors, to take from or upon any part of the hereditaments hereby granted, without compensation, any gravel, sand, stone, lime, timber, or other material which may be required in the construction, maintenance or repair of any roads, ferries, bridges, or other public works.

PROVIDED also that in the event of any of the lands hereby granted being divided into lots containing acre or less, one-fourth of all the blocks of lots, or one-fourth of all the lots where the lots are not divided into blocks to be selected as provided in the "Land Act," shall be reconveyed to Us and Our successors.

PROVIDED also that all travelled streets, roads, trails and other highways existing over or through the lands at the date hereof shall be excepted from this grant.

In testimony whereof We have caused these Our Letters to be made Patent and the Great Seal of Our Province of British Columbia to be hereunto affixed. Witness: Thomas Wilson Paterson Lieutenant-Governor of Our Province of British Columbia, at Our Government House, in Our City of Victoria, this Seventh day of April in the year of Our Lord one thousand nine hundred and Fourteen and in the Fourth year of Our Reign.

By Command.

A. Campbell Reddie
Deputy Provincial Secretary

1914

Traced by

Compared by

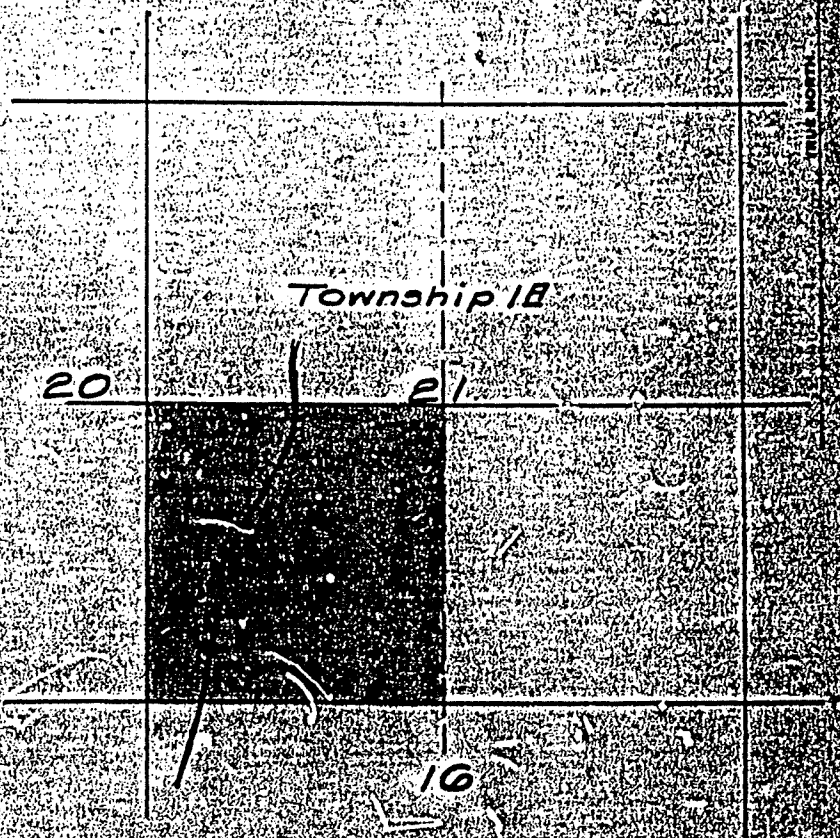
# British Columbia.

Crown Grant No. 6321
355

## COAST DISTRICT. RANGE 5

Edward Simpson

Scale, 20 Chains - One Inch.



INAL (To be retained by Pre-emptor or Purchaser.)

British Columbia 5785

LANDS DEPARTMENT MAR 25 1914 VICTORIA, B.C.

# CERTIFICATE OF PURCHASE

NOT TRANSFERABLE.

STRICT OF Coast Range 5.

Hazelton

DEPARTMENT OF LANDS,

Date March 9th 1914

re-emption Record No. 1273 Date 29th Sept. '11

ificate of Improvement No. 531 Date Feby. 12th '14

S.W. ¼ Sec. 21 Tp. 1S.

d to Edward Simpson at private Sale

reage 160 Price, $ 1.00 per acre = $ 160.00

reage Price, $ per acre = $

reage Price, $ per acre = $

ble as follows:—

March 5th '14 $ 160.00

Interest 1.05

82337 $ 161.05

Certified by

Received this 5th day of March 1914

sum of One hundred & sixty one 05/100 Dollars

being the Payment in full on the above

Crown Timber

* The official number of the parcel of land to be inserted here.

N.B.—Crown Grants are issued in the name of the original purchaser from Government; applicants for which should enclose their Certificates of Pre-emption Record, Certificates of Improvement, and Certificates of Purchase, under covering letter, to the Deputy Commissioner of Lands, Victoria.

P. H. 54 4507 L. I.

Department No. 1912

District COAST RANGE V

**SURVEYED FOR THE GOVERNMENT OF BRITISH COLUMBIA**

| Lot number or Section. | Acreage. | Miles Traversed. | REMARKS. |
|---|---|---|---|
| Tp. 1A. | | | |
| 21 | | whole section | |
| 22 | " | " | |
| 27 | " | 5 1/2 N.W.1/4. | East Renewal Plan 30T804 (NW¼ Sec 27) |
| 28 | " | whole section | |
| 33 | " | S.W.1/4. | |
| Part 34 | " | none (Occupation) | |

Department of Lands
RECEIVED
DEC 9 1912
Surveyor-General's Branch

13 T. 7

Surveyed by H. C. Black, B.C.L.S.

October, 1912

Plotted 26th December, 1912

By whom C.H. Ferris

Survey Gazetted March 20th. 1913

Tp. 1. A.

| Sec Lot No. | PAGES. | REMARKS. |
|---|---|---|
| 21. | 8 | North Boundary |
| | 2 | East " |
| | 6 | South " |
| | 7 | West " |
| | 9 | ℄ |
| 22 | 3 | North " |
| | 4 | East " |
| | 1 | South " |
| | 2 | West " |
| | 5 | ℄ |
| | 26, 27 | G.T.P. Ry. |
| 27 | 11. | North " |
| | 12 | East " |
| | 3 | South " |
| | 10 | West " |
| | 13 | ℄ |
| | 27 | G.T.P.Ry. |
| 28 | 15 | North " |
| | 10 | East " |
| | 8 | South " |
| | 14 | West " |
| | 16 | ℄ |
| | 27, 28, 29 | G.T.P.Ry. |
| 33 | 22 | North " |
| | 20 | East " |
| | 15 | South " |
| | 21 | West " |
| | 23 | ℄ |
| | 24 | Toboggan Lake Traverse |
| | 29, 30 | G.T.P. Ry. |
| 34 | 11 | South Boundary |
| | 20 | West " |
| | 25 | ℄. |

Notes of not more than six lots to be in one book.

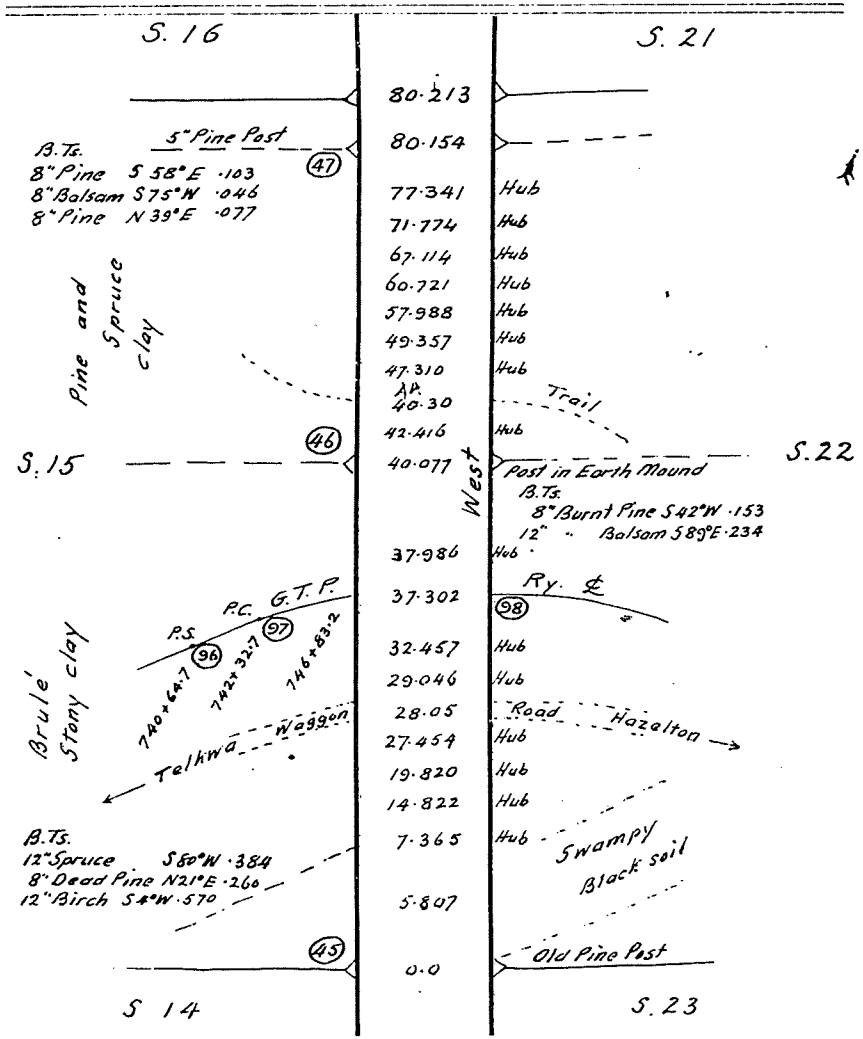
81

1

B. C. Government

Sec Lot No. 22 Tp. 1 A Range V Coast District.

South Boundary. Bearing West




The above line was run the 18th day of September, 1912.

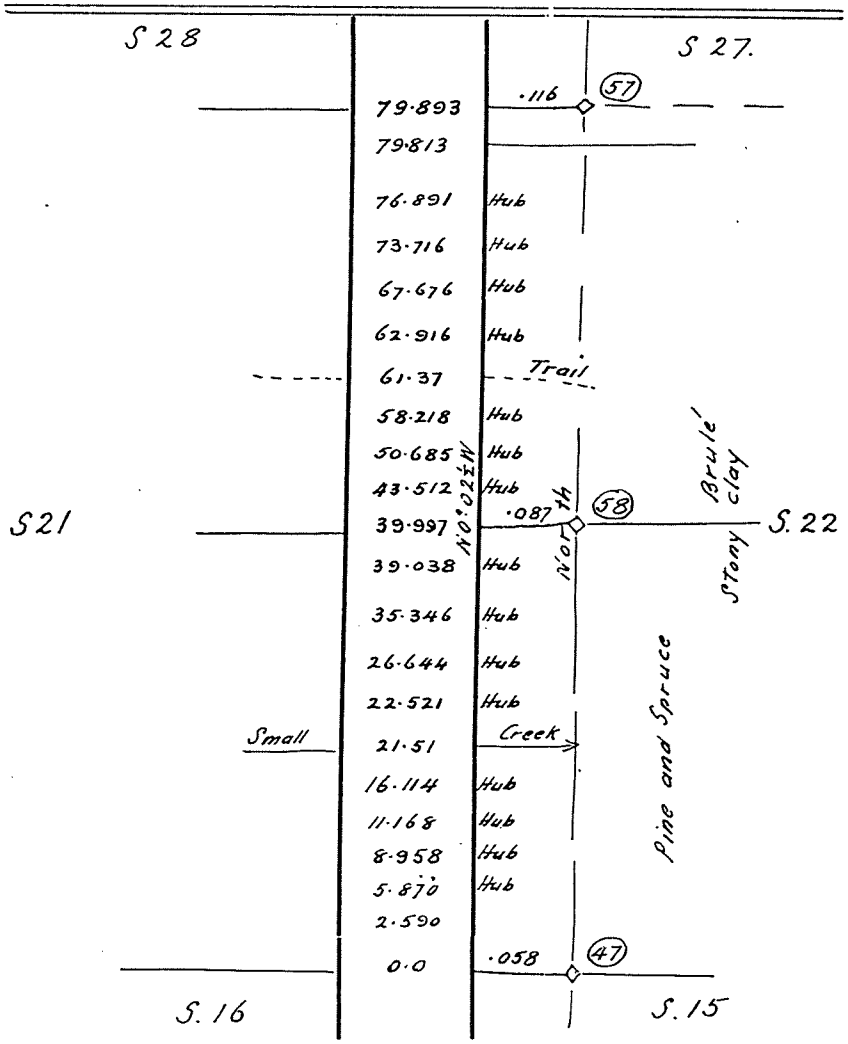
J. C. Black

FORM D. 2.

B.C. Government

Sec
~~Lot~~ No. 22 Tp. 1A Range V Coast District.

West Boundary. Bearing North




The above line was run the 10th & 12th days of September, 1912.

H. C. Black.

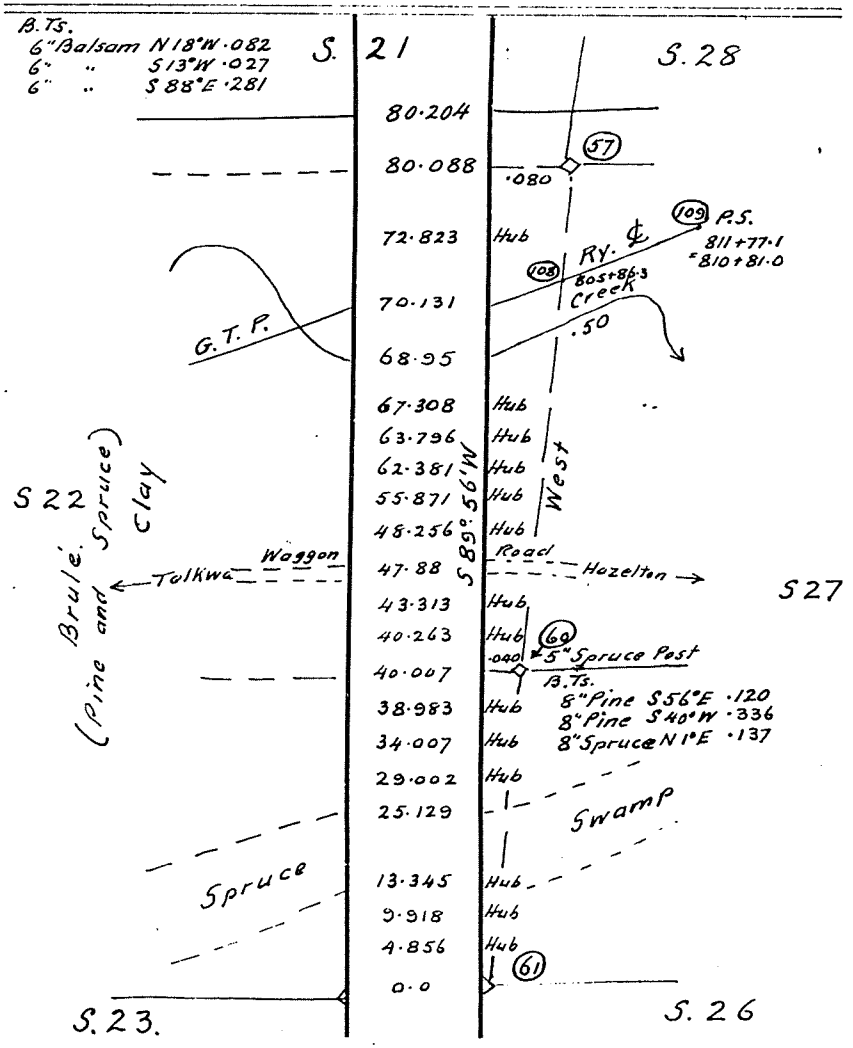
25,000/7/1912

3.

B.C. Government

Sec
~~Lot~~ No. 22 Tp. 1A Range V Coast District.

North Boundary. Bearing West




The above line was run the 1st day of October, 1912.

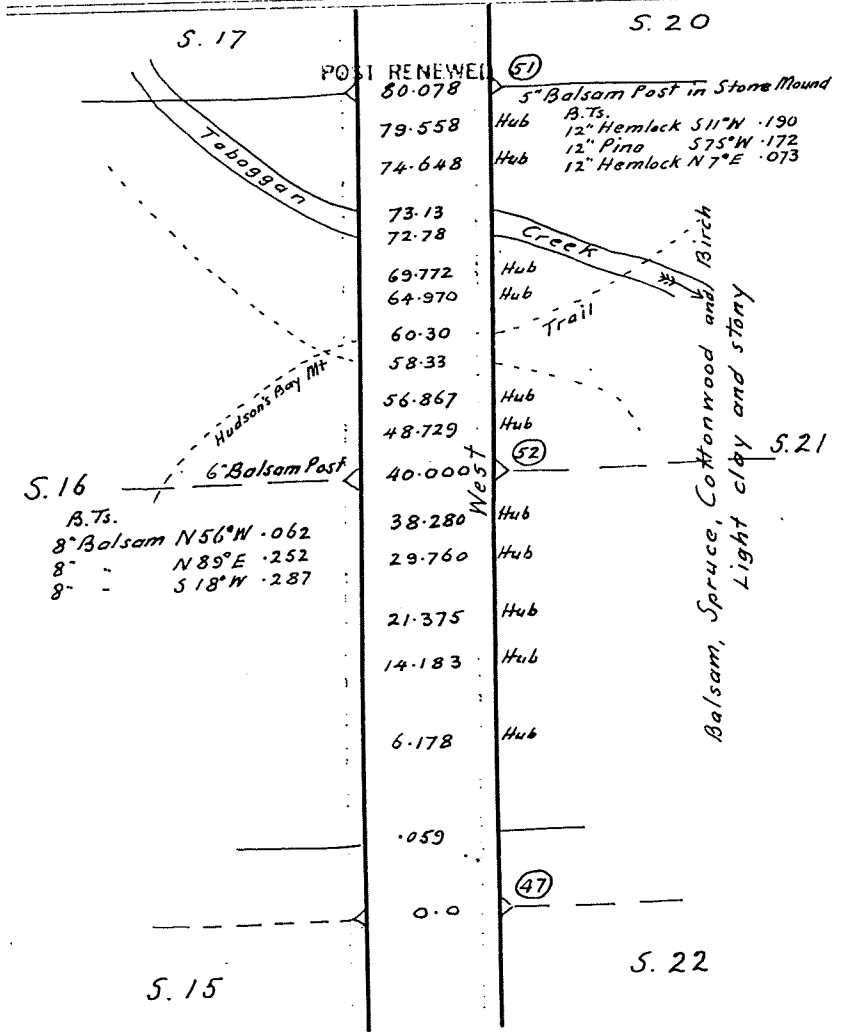
H. C. Black.

6

B.C. Government

Sec. / Lot No. 21 Tp. 1A Range V Coast District.

South Boundary. Bearing West




*The above line was run the* 19th *day of* September, 1912.

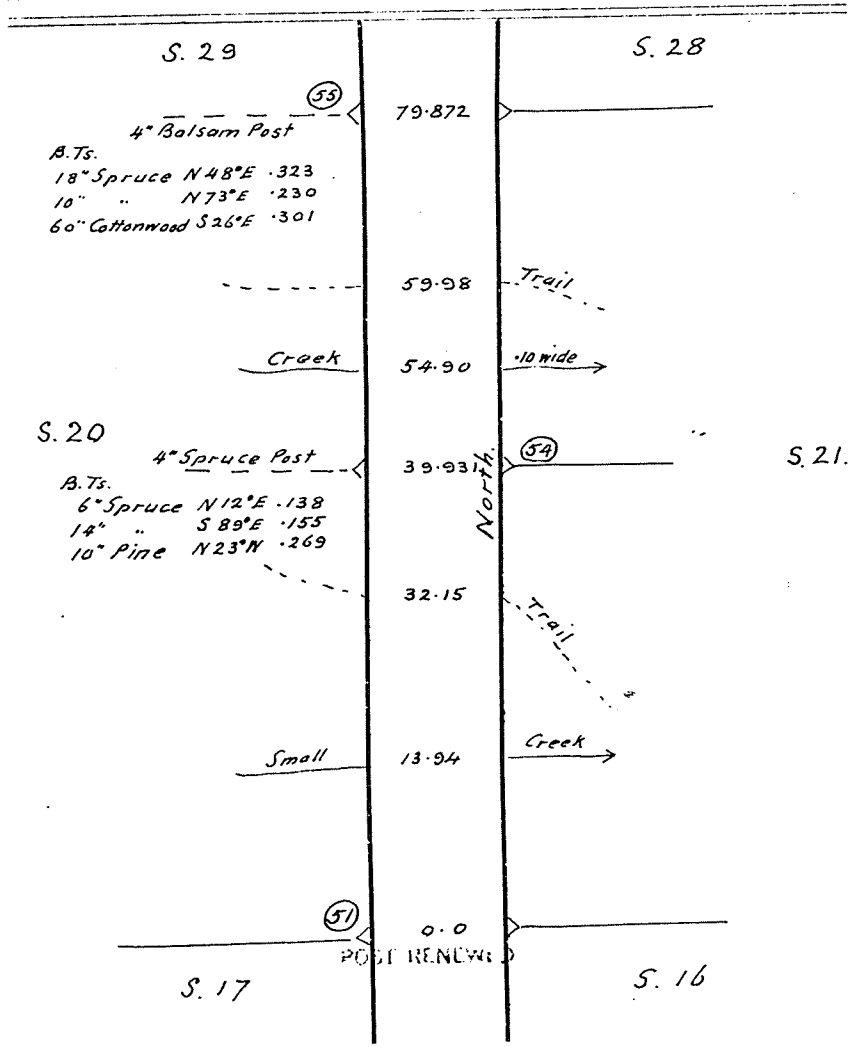
N. C. Black.

7

B.C. Government

Sec. / Lot No. 21 Tp. 1A Range V Coast District.

West Boundary. Bearing North




*The above line was run the* 21st 22nd *day of* September, 1912.

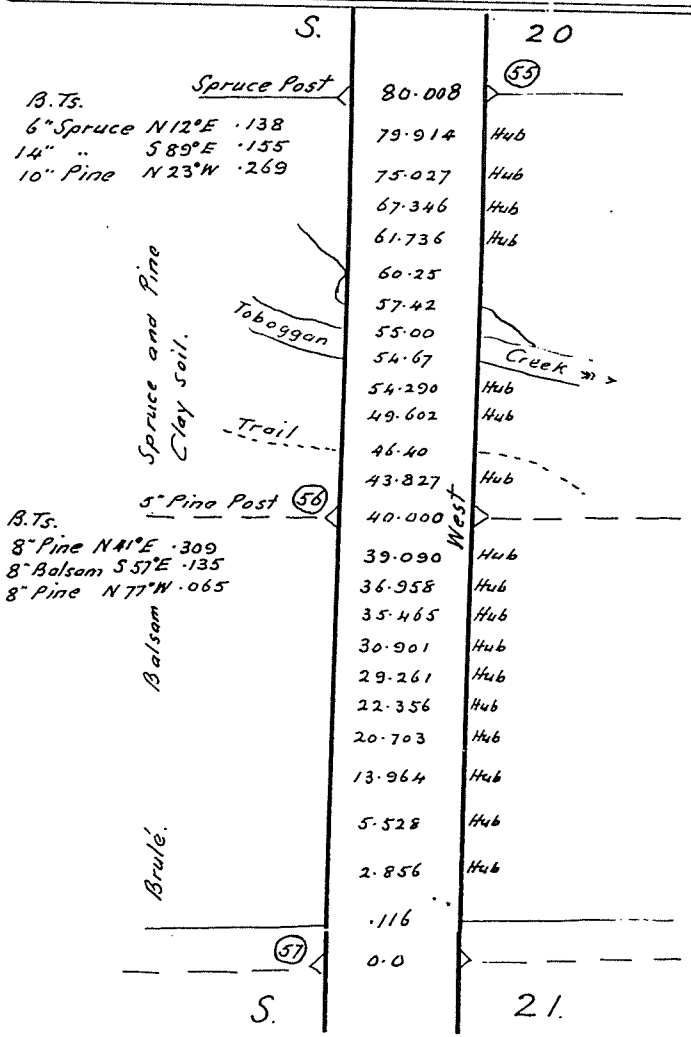
N. C. Black.

FORM D. 8

B. C. Government

Sec. ~~Lot~~ No. 21 Tp. 1A Range V Coast District.

North Boundary. Bearing West




The above line was run the 2nd day of October, 1912.

H. C. Black.

25,000/7/1912

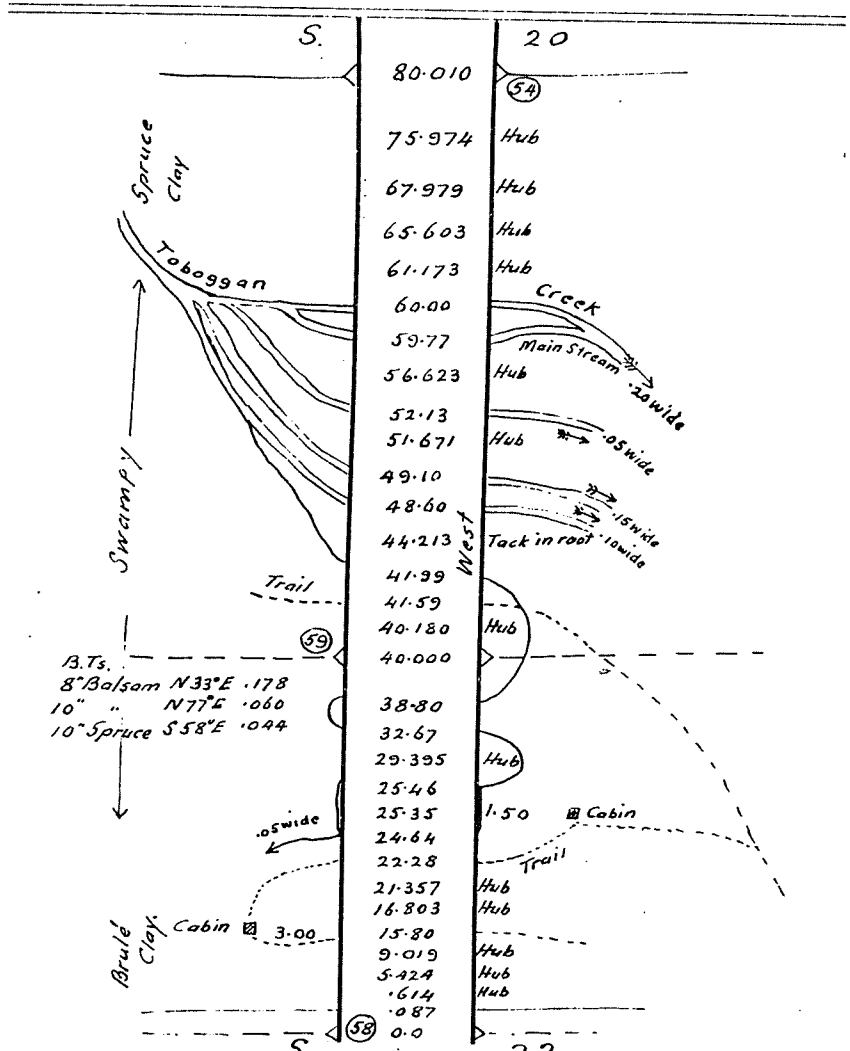


9

B. C. Government

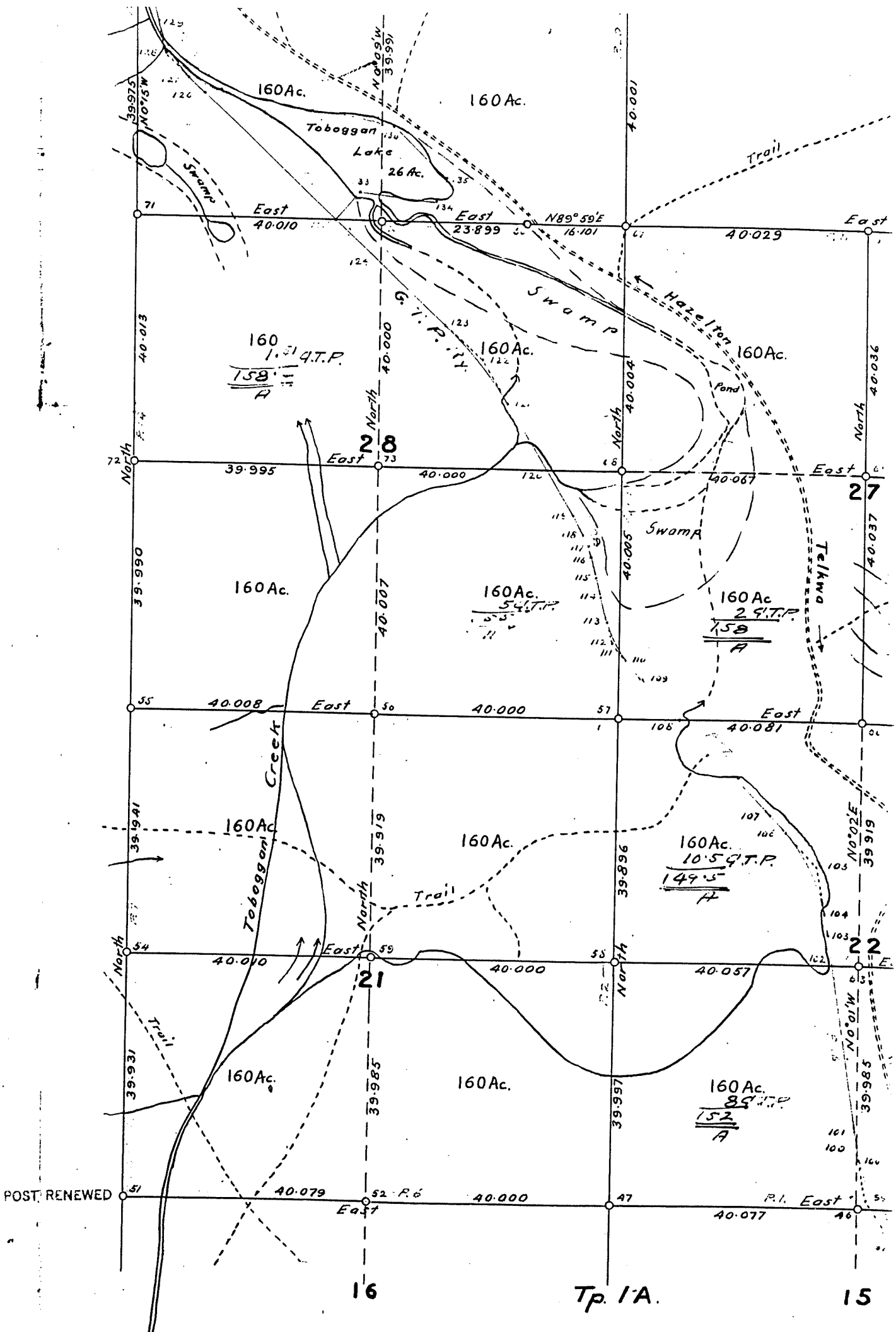
Sec. ~~Lot~~ No. 21 Tp. 1A Range V Coast District.

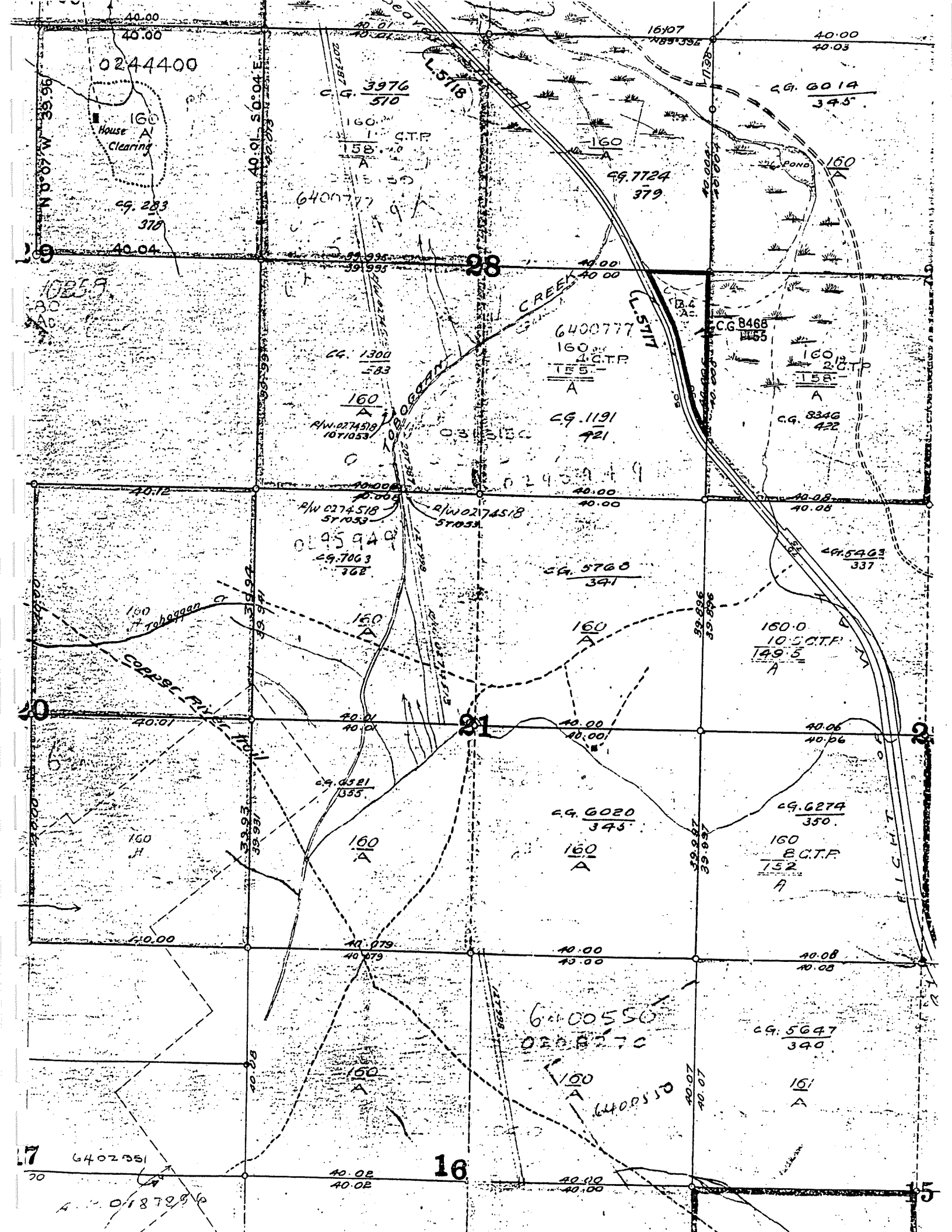
℄ Boundary. Bearing West




The above line was run the 27th day of September, 1912.

H. C. Black.


160Ac.
160Ac.
Toboggan Lake
26 Ac.
Swamp
Trail
East 40.010
East 23.899
N89° 59'E 16.101
East 40.029
Swamp
Hazelton
160Ac.
160 1.31 q.T.P. 158.11 A
G.T.P. 124
Pond
North 40.013
North 40.000
North 40.004
North 40.036
28
27
East 39.995
East 40.000
East 40.067
East
39.990
160Ac.
160Ac. 5.46 T.P.
160Ac. 2 q.T.P. 158 A
Swamp
Telkwa
40.005
40.007
40.037
East 40.008
East 40.000
East 40.081
Creek
160Ac.
160Ac.
160Ac. 10.5 q.T.P. 149.5 A
Toboggan
Trail
39.941
39.919
39.896
39.919
North
North
North
East
East
22
21
40.010
40.000
40.057
Trail
160Ac.
160Ac.
160Ac. 8 q.T.P. 152 A
39.931
39.985
39.997
39.985
POST RENEWED
East 40.079
52 R.6
40.000
47
R.1. East 40.077
16
Tp. 1A.
15


0244400
160 A
House
Clearing
C.G. 3976
510
160
1 C.T.P
158
A
C.G. 283
378
6400777
C.G. 6014
345
160
A
POND
C.G. 7724
379
160
A
C.G. 1300
583
160
A
R/W 0274518
ST 1053
6400777
160
4 C.T.P
155
A
C.G. 8468
455
B.4 Ac.
160
2 C.T.P
158
A
C.G. 1191
421
C.G. 8346
422
R/W 0274518
ST 1053
R/W 0274518
ST 1053
C.G. 7063
362
C.G. 5760
341
C.G. 5463
337
160
A
160
A
160.0
10 C.T.P
149.5
A
C.G. 6321
355
C.G. 6020
345
160
A
160
A
C.G. 6274
350
160
8 C.T.P
152
A
6400550
C.G. 5647
340
160
A
161
A
6402551
6400550
40.00
40.01
40.03
40.04
40.12
40.08
40.01
40.00
40.06
40.08
40.00
40.08
39.996
39.995
39.993
39.931
39.896
39.898
39.938
39.938
39.938

Silvicon
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Fax (250) 847-2530
E-mail: silvicon@mail.bulkley.net

## FAX COVER LETTER

**DATE:** May 26, 1999

**TO:** Gitsegukla Band Council

**ATTENTION:** Bill Fell

**No. of Pages:** 2 (including cover letter)

* Note: Please contact us immediately at (250)847-3680 if you do not receive the complete fax.

**COMMENTS:** WRP partnership coordination

**YOURS TRULY,**

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Fax (250) 847-2530
E-mail: silvicon@mail.bulkley.net

May 26, 1999

Fax to: Bill Fell
WRP Coordinator for Gitsegukla
Band Council
South Hazelton, B.C.

Dear Bill

We are currently at the point where field work could begin anytime, yet before field work can commence we must have our Standards Agreement in place. For us to develope and sign the Standards Agreement, we must have complete knowledge of the proposed work to be done and maps to show the locations. The maps must accompany the Standards Agreement. Also, before work can start, a contract will be drawn up between PIR and the Gitsegukla band. Without all the information it is becoming increasingly difficult to schedule time for this project. Please send me all the relevant information as soon as you can so that I can get started and get this project on the go.

Should you have any questions or require any further information, please do not hesitate to contact me at (250) 847-3680.

Yours truly

Ed Withers

Watershed Restoration Supervisor
West Fraser Mills Ltd., Pacific Inland Resources

EW:cs
encl

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E-mail: silvicon@mail.bulkley.net

April 4, 2000

Peter Lund
C\O Remax
3568 Highway 16
Smithers BC

Dear Peter

As a follow up to our meeting on March 22nd about the proposed works on the Silvern Lakes road within the southwest quarter of section 21, we would like to mention that Silvicon will provide you with a copy of the final prescription for the area and keep you updated on the proposed works. At the moment we are in the development stage of the prescriptions, we expect to conclude the development of the prescriptions and begin construction in late July or early August. We will notify you before any construction starts in this area. We thank you for your cooperation in this matter. Should you have any questions or concerns please feel free to contact me at any time at (250) 847-3680.

Yours truly,

Ed Withers

Watershed Restoration Supervisor
West Fraser Mills Ltd., Pacific Inland Resources

EW:cs
encl

**Completion Report**

**APPENDIX B - Kitseguecla/Blunt Watershed**
**Road Deactivation Map**
**1:50 000**

WEST FRASER MILLS LTD.
PACIFIC INLAND RESOURCES

1998-2003 KITSEGUECLA FOREST DEVELOPMENT PLAN
1998-2003 BLUNT FOREST DEVELOPMENT PLAN

KITSEGUECLA / MORICETOWN WATERSHED
WATERSHED RESTORATION PROGRAM
ROAD DEACTIVATION PRESCRIPTION
OVERVIEW MAP

BLUNT CREEK/KITSEGUECLA CHART AREA

SCALE: 1:50 000
DATE: JANUARY 31, 2000
SOURCE: MOF - FIR Base Maps

LEGEND

Moricetown Watershed Boundaries

GPS Traversed Roads For Deactivation Prescription 1999
-P-ATV-P- -P-4WD-P-
-SR-ATV- -SR-4WD-

GPS Traversed Roads For Deactivation Prescription 2000
-P-ATV-P- -P-4WD-P-
-SR-ATV- -SR-4WD-

GPS Traversed Roads
Trail Head Parking
Slide/Failure
Gullies

LUNO CREEK
SHARPE CREEK
KWUN CREEK
NN-1 CREEK
CAUSQUA CREEK
GRAMOPHONE CREEK
SCHIPPERS CREEK
BEAVERY/COW
MEED CREEK
REISETER CREEK
TWIN CREEK
TROUT CREEK
TOBOGGAN CREEK
BULKLEY

93M.004
93M.005
93L.094
93L.095
93L.083
93L.084
93L.085
93L.082

PROPOSED WOODLOT KITS 1509
PROPOSED WOODLOT GRAMOPHONE 1510
WOODLOT 106
WOODLOT 107

N