Reconnaissance (1:20,000) Fish and Fish Habitat Inventory

of

Bone and Clemina Creek Watersheds

WSC: 129-754600 (Bone) and WSC: 129-838900-39800 (Clemina)

Prepared for:

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Approved by:
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APRIL 2001

PROJECT REFERENCE INFORMATION

FRBC Project Number	TOM-98-106
FRBC Activity Number	10484c
FDIS Project Number	03-UNTH-000000633-1999 (Bone) and 03-UNTH-000000634-1999 (Clemina)
FRBC Region	Thompson Okanagan Region
MELP Region	Southern Interior Region
FW Management Unit	3-43
DFO Sub-District	29J Clearwater
Forest Region	Kamloops Forest Region
Forest District	Clearwater Forest District
Forest Licensee	Slocan Forest Products Ltd.
First Nations Claim Area	North Thompson Indian Band

WATERSHED INFORMATION

Watershed Group UNTH Group

Watershed Name

Phase IV-VI Completed in 1999/2000
Portion of Bone Creek Watershed

Phase IV-VI Completed in 2000/2001
Bone Creek Watershed
Clemina Creek Watershed

Watershed Codes	Bone Creek	129-754600
	Clemina Creek	129-838900-39800
UTM at Mouth	Bone Creek	11.350150.5791150
	Clemina Creek	11.357332.5826005
Watershed Area	Bone Creek	267 km^2
	Clemina Creek	72 km^2
Total of all Stream Lengths	Bone Creek	438.9 km
	Clemina Creek	181.0 km
Stream Order	Bone Creek	5^{th} Order
	Clemina Creek	5^{th} Order

NTS Map	83D/2/3/6/7/10/11
TRIM Map	83D.025, 026, 035, 036, 055 and 056
BEC Zone	AT-Ewcp**,** ESSFwc2, ICHvk1, ICHwk1
Air Photos	30BCC92024: 28-42, 88-133 30BCC91096: 140-144, 159-168 30BCC97117: 186-195 30BCC97118: 5-10 30BCC91077: 195-201 30BCC91078: 65-71 30BCC91078: 94-100

SAMPLING DESIGN SUMMARY

	Phase I to III (Proposed 1998/1999)[3]	Phase IV to VI (Proposed 1999/2000)	Phases IV to VI (Completed 1999/2000)	Phase IV to VI (Proposed 2000/2001)	Phases IV to VI (Completed 2000/2001)
Total No. of Stream Reaches	977	-	658[1]	-	989[2]
Total No. of Lake Reaches	23	-	-	-	23
Random Stream Reach Sampling Sites	26	8	7	19	19
Biased Stream Reach Sample Sites	18	6	10	11	11
Lake Reach Sample Sites	0	0	0	0	0
Total Stream Reach Sample Sites	44	14	17	30	30
Field Sampling Dates	N/A	N/A	Sept. 13 to 15 Oct.13 to 14, 1999	N/A	August 21 to 23, 2000

1. Initially 656 reaches were identified within the Bone Creek Watershed in the Phase I to III pre-field planning report but two more reaches were identified in the field during the Phase IV field sampling component of this project.

2. Due to mapping irregularities between Slocan Forest Products Ltd. Development Plan maps and TRIM maps, 223 reaches were adjusted and 12 reaches were added to the TRIM map base (Map 83D.056). This was done to accommodate TRIM mapping deliverables as Phases I-III were completed on the Development Plan maps.

3. During the completion of this project, the number of random (26) and biased (18) sites proposed were adjusted from the original number of random (48) and biased (25) sites initially identified in the sampling plan. These adjustments were made and agreed upon, following discussions with Slocan Forest Products Ltd., the Ministry of Environment, Lands and Parks, and the Ministry of Forests.

CONTRACTOR INFORMATION

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DISCLAIMER

This product has been accepted as being in accordance with approved standards within the limits of Ministry quality assurance procedures. Users are cautioned that interpreted information on this product developed for the purposes of the Forest Practices Code Act and Regulations, for example stream classifications, is subject to review by a statutory decision-maker for the purposes of determining whether or not to approve an operational plan.

ACKNOWLEDGMENTS

Funding for this inventory was provided by Forest Renewal British Columbia through Slocan Forest Products Ltd. Acknowledgments are extended to Integrated Woods Services Ltd. (IWS) for GIS support.

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1.0 INTRODUCTION

1.1 PROJECT SCOPE/OBJECTIVES

Slocan Forest Products Ltd., in partnership with the North Thompson Indian Band, retained ARC Environmental Ltd. to conduct a Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Program (FFHIP). This was conducted in order to describe watershed-wide fish distribution and habitat characteristics for all basins within the Bone and Clemina Creek Watersheds. Funding was provided by Forest Renewal British Columbia (FRBC). The project also included sampling protocols to satisfy stream classification requirements to describe fish presence in specific stream reaches potentially affected by planned forest harvesting activities for input to Silviculture Prescription, and Road Layout and Design under the Forest Practices Code (BC FPC 1998).

ARC Environmental Ltd. completed Phases I through III of the FFHIP in 1998/1999 on the Bone and Clemina Creek Watersheds. The Phase IV through VI components, completed in 1999/2000, concentrated on the Bone Creek Watershed, where 17 sample sites (7 random and 10 biased) were completed (ARC Environmental Ltd. 2000). The 2000/2001 sampling season included sites in both the Bone (2 random and 4 biased) and Clemina Watersheds (17 random and 7 biased sites) decided upon through discussions with the Ministry of Environment, Lands and Parks (D. Tesch, Contract Monitor), and Slocan Forest Products Ltd. (Rowena Bryan, FRBC Coordinator). A total of 47 sites (26 random and 21 biased) were completed in 1999/2000 and 2000/2001. Generally the objectives of the Reconnaissance Inventory are to:

i) Provide the essential fish and fish habitat information required for resource planning and/or decision making that might affect fisheries resources,

ii) Describe watershed-wide fish distributions and habitat characteristics, and

iii) Provide information to meet British Columbia Forest Practices Code (FPC) stream classification requirements at sites sampled within the Bone Creek Watershed. This involves the establishment of stream classifications recommended by contractors, which are then vetted by appropriate agency staff. The Forest District Manager ultimately approves stream classifications.

1.2 LOCATION

The Bone and Clemina Creek Watersheds encompass an area of approximately 267 km^2 and 72 km^2 , respectively, and are within the Ministry of Environment, Lands, and Parks (MoELP) Southern Interior Region (Region 3), the Clearwater Forest District of the Kamloops Forest Region and the Department of Fisheries and Oceans Clearwater Sub-district (Area 29J). Both Bone (WSC: 129-754600, UTM: 11**.** 350150.5791150) and Clemina Watersheds (WSC: 129-838900-39800, UTM: 11.357332.5826005) are part of the North Thompson River drainage. Bone Creek flows west into the North Thompson River which in turn drains into the South Thompson, Thompson and Fraser Rivers. Clemina Creek flows west into the Albreda River which, in turn, flows into the North Thompson River. Bone Creek is a fifth order stream with a mainstem length of approximately 27.9 km. Clemina Creek is a fifth order stream with a mainstem length of approximately 15.6 km (Figure 1){(National Topographic Series (NTS) Maps: 83D/2, 83D/3, 83D/6, 83D/7, 83D/10, 83D/11) (Terrain Resources Information Management (TRIM) Maps: 83D.025, 83D.026, 83D.035, 83D.036, 83D.055, 83D.056)}.

The British Columbia Ministry of Forests (MOF) Biogeoclimatic Units Maps show that the Bone and Clemina Creek Watershed lie within three biogeoclimatic zones: Alpine Tundra-Englemann Spruce {(stunted trees found midway between Alpine Tundra and Englemann Spruce) (AT-E)}; Englemann Spruce-Subalpine Fir (ESSF); and the Interior Cedar-Hemlock (ICH). The three biogeoclimatic zones are further divided into four subzones: Alpine Tundra-Englemann Spruce, wet, cold, parkland (AT-Ewcp); Englemann Spruce-Subalpine Fir, wet, cold, variant 2 (ESSFwc2); Interior Cedar-

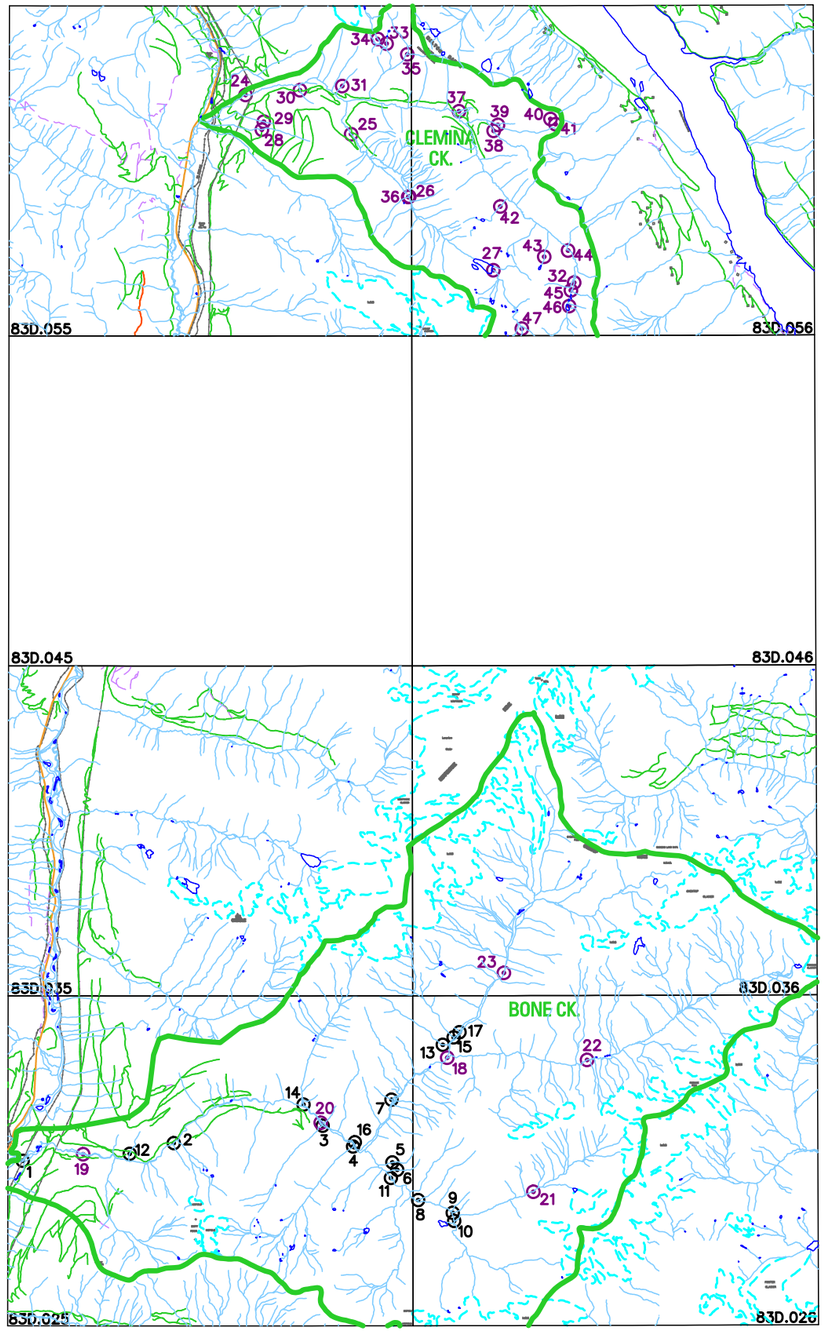

Figure 1:
OVERVIEW MAP
Bone Creek and Clemina Creek Watersheds 1999/2000 & 2000/2001

Project Code: 03-UNTH-000000633-1999
03-UNTH-000000634-1999
Date: April 19, 2001
UTM Zone: Zone 11
Inventory Company: ARC Environmental Ltd.
Printed in Canada by: Integrated Woods Services

Scale 1:200,000

0 1 2 3 4 5 10 kilometres

- Streams
- Lakes
- Watershed Boundary
- Sub-Basin Boundary
- Glacier
- Secondary Road
- Logging Roads
- Trails
- 12 1999 Sample Sites
- 18 2000 Sample Sites

ARC Environmental Ltd

BASE: TR STR SYM: INV
LOC: FDE LK SYM: NA
HAB: INV FISH: INVG
INV MGNT: OTH
DATE INV: Sept. 13, 1999 - Oct. 14, 1999
Aug. 21, 2000 - Aug. 23, 2000

Prepared By:
Integrated Woods Services Ltd.

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Hemlock, very wet, cool, variant 1 (ICHvk1); and the Interior Cedar-Hemlock wet, cool, variant 1 (ICHwk1) (MOF 1989).

The headwater reaches of Bone Creek, (elevation (EL) range 1640-2260 m), flow southwest from the AT-Ewcp into the ESSFwc2 (EL range 1380-1640 m). Then Bone Creek flows west to drain through the ICHvk1 (EL range 800-1380 m) before entering the ICHwk1 (EL range 700-1380 m) as it nears its confluence with the North Thompson River.

Three major tributaries, Oventop Creek, Pancake Creek and one large unnamed tributary (ILP 91, ILP Map 83D.025), drain into Bone Creek. Oventop Creek flows west to its confluence with Bone Creek at Reach 10. Oventop Creek is located within two biogeoclimatic zones. The headwater and mid reaches are located within the AT-Ewcp (EL range 1860-2200 m) and the lower reaches are located within ESSFwc2 (EL range 1350-2200 m). Pancake Creek flows west to its confluence with Bone Creek near the downstream end of Reach 9. Its upper and mid reaches drain from the AT-Ewcp (EL range 1440–2460 m), into the ESSFwc2 (EL 1220-1440 m) and then into ICHvk1 (EL 1150-1220 m) near its confluence with Bone Creek. The headwaters of the unnamed tributary are located within the AT-Ewcp (EL 2200-2400 m) and drain southwest through the ESSFwc2 zone (EL 1400-2200 m). This stream changes direction to the northwest at Reach 3 and flows through the ICHvk1 zone (EL 1000-1400 m) before its confluence with Bone Creek at Reach 7.

The headwater reaches of Clemina Creek (elevation (EL) range 1640-2300 m) flow north from the AT-Ewcp into the ESSFwc2 (EL range 1380-1640 m). Then Clemina Creek flows west to drain through the ICHvk1 (EL range 800-1380 m) before entering the ICHwk1 (EL range 700-1380 m) as it nears its confluence with the Albreda River.

There is one major unnamed tributary (ILP 10, ILP Map 83D.055) that drains west into Reach 3 of Clemina Creek. ILP 10 is located within two biogeoclimatic zones. The

headwater reaches are located within the AT-Ewcp (EL range 1640-2200 m) and the lower reaches are located within the ESSFwc2 (EL range 1380-1640 m) zone.

1.2.1 Access

The Bone and Clemina Creek Watersheds are accessed from Kamloops, B.C., by travelling north on Highway 5, to Blue River. Access into the Bone Watershed is provided by the Bone Creek Forest Service Road (FSR) which is located directly off Highway 5, approximately 18 km north of the town of Blue River. Access into the Clemina Watershed is provided by the Clemina Creek Forest Service Road (FSR) which is also located directly off Highway 5, approximately 55 km north of the town of Blue River

Site access was determined by a review of TRIM Maps (1:20,000) provided by Slocan Forest Products Limited, the British Columbia Recreational Atlas, and the Clearwater Forest District Recreation Map.

The Bone Creek Watershed study area begins at the confluence of Bone Creek with the North Thompson River, located 1.2 km up the Bone Creek Forest Service Road. The Bone Creek road sites were accessed via the Bone Creek FSR. For the 2000/2001 survey, 4 sites within the Bone watershed were accessed via helicopter.

The Clemina Creek Watershed study area begins at the confluence of Clemina Creek with the Albreda River, located approximately 4 km up the Clemina Creek FSR. The Clemina Creek road sites were accessed via the Clemina Creek FSR and various spur roads such as 1903, 1905, 1910, 1931, 1961 and 1960. For the 2000/2001 survey, 12 sites within the Clemina Watershed were accessed via helicopter.

2.0 RESOURCE INFORMATION

The Bone and Clemina Creek Watersheds are subject to a variety of resource uses. The principal resource activity in the watershed is timber harvesting by Slocan Forest Products Ltd.

2.1 FIRST NATIONS ISSUES AND INTERESTS IN THE STUDY AREA

The Bone and Clemina Watersheds are located within the traditional territory of the North Thompson Indian Band (NTIB) (T. Donald, Band Councilor, North Thompson Indian Band 1999, *pers. comm.*).

2.2 DEVELOPMENT AND LAND USE: LOGGING, MINING, RECREATION

Generally, forest harvesting is prevalent in the study area with forest development roads entering both the Bone and Clemina Watersheds.

There are no BC Forest Recreation Sites located within either Bone or Clemina Watersheds. However, a B.C. Forest Recreation Trail, the Bone Creek Ridge Trail, is located on the north side of Bone Creek. The trail head is accessed via the Bone Creek FSR (MOF 1993).

2.3 OTHER DEVELOPMENTS, CONCERNS OR POINTS OF INTEREST

Portions of both Bone and Clemina Watersheds are also designated as a Recreation and Tourism Resource Management Zone under the Remote Management Category, which lists the current watershed uses as heli-skiing, mountaineering and hunting. The Kamloops Land and Resource Management Plan states that significant opportunities exist for a remote wilderness recreation experience although no area-specific management strategies have been specified for the area (Province of BC 1995).

2.4 IMPACTS AND USES BY WILDLIFE

MoELP manages a Habitat Resource Management Zone/Wildlife Management Area (RMZ) within the Bone Creek Watershed (the Bone Caribou RMZ) and the Clemina Watershed (the Clemina Caribou RMZ). The overall objective of the Habitat Resource Management Zone/Wildlife Management Area RMZ/North Thompson Caribou Habitat RMZ is to maintain and enhance select areas throughout the Kamloops Land and Resource Management (KLRM) area.

2.5 WATER USE

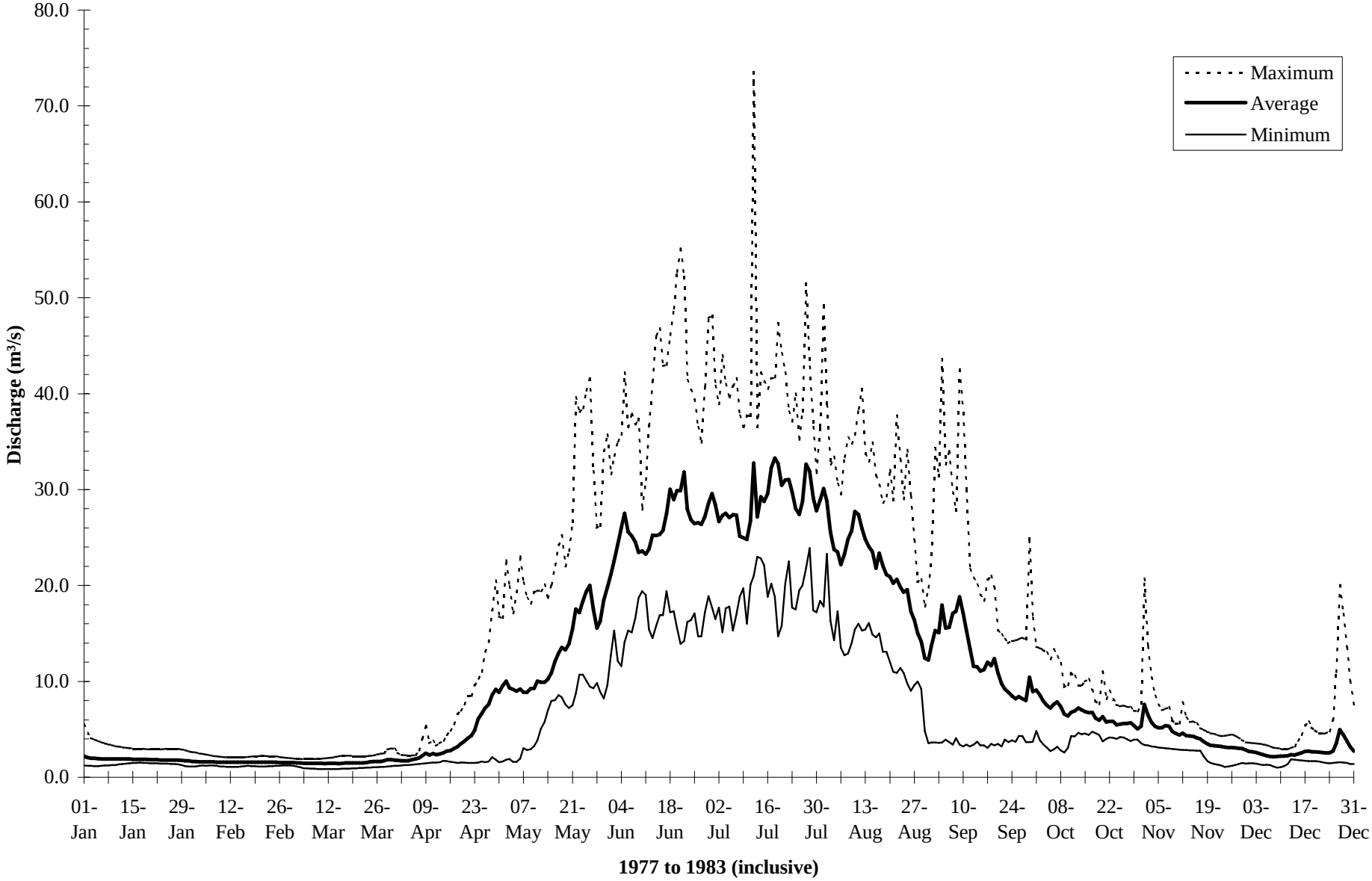
Bone and Clemina Creeks have no registered water license users (MoELP 1999a) nor are they community watersheds (MoELP 1999b).

Hydrographic data on the Bone Creek Watershed is provided by an Environment Canada watershed gauging station (Station Number 08LB077) located on Bone Creek. This station provided hydrographic information for the years 1977 to 1983, inclusive.

The Bone Creek Watershed has a drainage area of 267 km^2. Based on the period of record (1977-1983), low flow occurs in March, with an average minimum discharge of 1.5 m^3/s (range 1.0 to 2.2 m^3/s). The average maximum discharge occurs in July at 28.4 m^3/s (range 20.7-36.5 m^3/s) (Figure 2). The maximum daily discharge ranged between 36.5 m^3/s on June 16, 1980 to 73.5 m^3/s on July 12, 1983 (Environment Canada 1999).

There is no hydrological data available for Clemina Creek. The Clemina Creek Watershed has a drainage area of 72 km^2. Using prorated data from Bone Creek, and based on the period of record (1977-1983), low flow occurs in March, with an average minimum discharge of 0.4 m^3/s (range 0.3 to 0.6 m^3/s). The average maximum discharge occurs in July at 7.4 m^3/s (range 5.4 to 9.5 m^3/s) (Environment Canada 1999).

Figure 2. Bone Creek Watershed: Mean daily discharges recorded at Bone Creek for the period of record from 1977 to 1983 (Station No. WSC08LB077)



2.6 EXISTING INFORMATION ON THE PRESENCE OF FISH

The available information on the aquatic resources of the Bone and Clemina Creek Watersheds is limited. A review of existing information determined that mountain whitefish *(Prosopium williamsoni)* and slimy sculpin *(Cottus cognatus)* are found downstream of a 4 m high waterfall located in Reach 2 of Bone Creek approximately 2 km upstream of the confluence with the North Thompson River (Standen and Wescott 1993).

The 1999/2000 FFHIP conducted by ARC Environmental Ltd. (2000) found chinook salmon *(Oncorhynchus tshawytscha)*, pygmy whitefish (*P. coulteri)* and torrent sculpin *(C. rhotheus)* in Reach 1 of Bone Creek. Bull trout *(Salvelinus confluentus)* and coho salmon *(O. kisutch)* were suspected in Reach 1 of Bone Creek as they are present in the North Thompson River near the mouth of Bone Creek. Information from the 1999/2000 FFHIP supported by the results of the 2000/2001 study found the 4m waterfall in Reach 2 of Bone Creek the upper limit of fish use within the Bone Watershed (ARC Environmental Ltd. 2000).

Coho salmon are known to spawn (ARC Environmental Ltd. 1998) and chinook salmon suspected to spawn in the North Thompson River upstream of the confluence of Bone Creek with the North Thompson River (Harding *et al.* 1994). Bull trout, mountain whitefish, and torrent sculpins *(Cottus rhotheus)* are known to be present in the Upper North Thompson River and its tributaries (ARC 1998).

The available information on the aquatic resources of the Clemina Creek Watershed is limited. The lower end of Clemina Creek, below the waterfall, is known to contain bull trout and mountain whitefish (Standen and Wescott 1993). Bull trout and coho salmon are known to utilize the Albreda River (Harding *et al.* 1994). No other information on the fisheries resources of Bone or Clemina Creeks is available.

3.0 METHODS

The Bone and Clemina Creek Watershed Operational Inventory project involved six phases:

Phase I:	Existing Data Review,
Phase II:	Map and Airphoto Analysis,
Phase III:	Sampling Design and Project Plan,
Phase IV:	Field Data Collection,
Phase V:	Data Compilation and,
Phase VI:	Report and Map Preparation.

Phases I through III were completed in 1998/1999 on both the Bone and Clemina Creek Watersheds. However, only Phases IV through Phase VI were initiated for the Bone Creek Watershed in 1999/2000. In 2000/2001 Phases IV through Phase VI of Bone and Clemina Creek Watersheds were completed.

3.1 PHASE I: EXISTING DATA REVIEW

The objective of the *Existing Data Review* phase was to refine the project objectives through a review of the existing information, both physical and biological. The review of the existing information identified and systematically recorded the physical characteristics of the watershed including, but not limited to; watershed boundaries, reach delineation, and obstructions to fish migration. The existing information on the watershed was sought from various sources. Data was obtained from the MoELP Kamloops Regional Office, Department of Fisheries and Oceans (DFO) in Kamloops, Ministry of Forests (MOF), Clearwater Forest District Office and the MOF Kamloops Forest Region Office.

In addition, the availability of the following information was determined and reviewed:

i) Gazetteer of Canada,

ii) 1:50,000 National Topographic Series (NTS) maps,

iii) 1:20,000 Terrain Resource Information Management (TRIM) Maps,

iv) Aerial photographs,

v) Biogeoclimatic Ecosystem Classification Site Identification and Interpretation Guide and maps,

vi) Water licensee(s),

vii) Recreation maps,

viii) Timber licensee(s),

ix) Forest tenure type, and

x) Forest cover and Development Plan maps, and private lands.

The above information was tabulated and, where appropriate, indicated on 1:20,000 TRIM Maps. Interim Location Points (ILPs) were added to all waterbodies including lakes and streams. In order for lakes and streams to be given ILPs they must be at least 0.5 ha or 100 m in length, respectively. Where possible, existing watershed codes were included in the ILP Table to assist the MoELP Inventory Branch, Victoria in locating reference streams. The ILP Table and corresponding ILP maps were forwarded to MoELP in Victoria via the Contract Monitor to determine watershed coding for uncoded waterbodies. Each 1:20,000 TRIM Map feature was referenced with a Numeric Identifier (NID) unique to the project. The NID number provides a unique identifier to link locational data recorded on the Interim Map to attribute data recorded in the database (Attachment 1).

The focus of the fisheries review was on: the occurrence of rare, threatened, endangered or regional significant fish; historic trends in abundance and distribution of salmon and sport fish; historic trends in water quality and quantity; trends in recreational use, and special public concerns (Resource Inventory Committee (RIC) 1998a). The following

sources, in addition to the above section, were reviewed to identify fish distribution and abundance in the watershed.;

i) Interviews with DFO, MoELP, MoF agency personnel, members of the First Nations, and the public,

ii) Stream Inventory Summary System (SISS),

iii) Fisheries Information Summary System (FISS),

iv) Salmon Escapement Database System (SEDS),

v) DFO and MoELP paper files,

vi) FPC stream classification and,

vii) MoELP, Region 3 Lake Stocking Records.

Once reviews of the available information were complete, the existing fish distribution within the study area was transcribed on the 1:20,000 TRIM maps and the FISS Maps were updated, where appropriate. These maps were sent to the Contract Monitor at MoELP in Kamloops, to be forwarded to MoELP in Victoria along with any reports that were not found in the FISS database. Stream and/or Lake Forms were filled out for any new information added to the FISS map. These forms were also sent to the Contract Monitor at MoELP in Kamloops, to be forwarded to MoELP in Victoria.

3.2 PHASE II: MAP AND AIR PHOTO ANALYSIS

The objective of Phase II was to systematically classify the watershed characteristics and then determine reach-sampling sites.

When the basins in the project area were classified, and their boundaries transcribed onto Interim Maps, the *Basin Classification Table* was completed (RIC 1998a). Numeric Identifier (NID) numbers were assigned to reach breaks and obstructions prior to the entry of the reach and lake properties into the *Reach Table* and *Lake Table*, respectively (RIC 1998c). The 1:20,000 TRIM maps were used to develop reach breaks. Where contour

lines were missing or incomplete, the 1:50,000 NTS Maps were used to determine the reach breaks and any missing contour lines were hand annotated onto the Interim maps (Attachment I). Airphotos, dated 1991-92, were provided by Slocan Forest Products Ltd. and MoELP, Kamloops, provided air photos from 1997. The Airphotos were used for completion of the Phase I-III component, completed in 1998/1999. Reach break delineation was determined by changes in order, pattern, confinement, gradient, and riparian vegetation based on the analysis of Airphotos and TRIM data. Ultimately, reach breaks were confirmed in the field for those sites visited.

After delineating reaches and determining channel pattern, stream gradient, stream order and stream basin type for the Bone and Clemina Creek Watersheds, the reach data was entered into Field Data Information System (FDIS), version 6.5, for a total of 977 reaches.

3.3 PHASE III: SAMPLING DESIGN AND PROJECT PLAN

The objective of Phase III was to finalize the field plan and allow for the collection of field data. A project plan was developed, including; site finalization, the budget, and logistics. The plan was proposed to describe the watershed-wide fish species presence and distribution, and habitat characteristics.

The *Random Sampling* portion of FDIS initially determined that a total of 47 random sites were to be sampled within the Bone and Clemina Creek Watersheds (*ca.* 4.8% of the reaches). The 47 sites were selected by FDIS based on the following criteria: basin type; stream order and magnitude; gradient; and channel pattern. The 47 sites selected were transferred onto inking film over the 1:20,000 scale Interim maps. The Interim maps with inking film were presented to Slocan Forest Products Ltd. (Rowena Bryan, FRBC coordinator) and MoELP (D. Tesch, Contract Monitor) for review. After consultation and further adjustments, a total of 44 sites were proposed (26 random and 18 biased) for sampling within the 1999/2000 and 2000/2001 sampling seasons. Fourteen (14) sites (8

random and 6 biased) were proposed for sampling in 1999/2000 and a total of 17 (7 random and 10 biased) were completed. Thirty (30) sites (19 random and 11 biased) were selected for sampling in Phase IV, 2000/2001.

3.4 PHASE IV: FIELD DATA COLLECTION

The field data collection phase for the selected stream reaches involved fish sampling, habitat description, water quality, wildlife observations, and photographic documentation. In addition to the completion of the sampling of the identified reaches for inventory purposes, sampling included the requirements for fish stream classification.

The field data was collected from August 21 to 23, 2000 (MoELP Sampling Permit No. 00-30-0506; DFO Sampling Permit: License 00.179). In total, 30 sites (19 random and 11 biased) were completed in the Bone and Clemina Creek Watersheds in Phase IV of 2000/2001. All 30 of the proposed sites were completed.

MoELP Site Cards, Fish Collection Forms, and Individual Fish Data forms were completed, where appropriate, at each sample site (Attachment II). Photo Survey Form 1 (Equipment Details) was completed for the project and is included in Attachment II. Methodologies followed those provided in Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures (RIC 1998a), Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Data Forms and User Notes (RIC 1998b), Fish Collection Methods and Standards (RIC 1997), Fish-stream Identification Guidebook (BC FPC 1998), and A Guide to Photodocumentation for Aquatic Inventory (RIC 1996).

In addition to the field equipment required (RIC 1998a) and used, Slocan Forest Products Ltd. requested that each field crew be equipped with a Polaski, shovel, 15 liter backpack fire suppression unit, and a 15 liter oil spill kit (Table 1).

Table 1. Field sampling equipment list.

Habitat Sampling Equipment

Hip Chain and Spare Thread
Measuring Tape (50m)
Clinometer
Compass
Meter Stick
Camera, Film and Water Proof Case
Field notebook with waterproof paper and MoELP Site Cards and Fish Collection Forms
Alcohol Thermometer
pH Meter
Conductivity Meter

Fish Sampling Equipment

Electrofisher
Electrofishing Gloves
Chest Waders
Minnow Traps and Bait
Pole Seine
Fish Collection Permits
Buckets
Fish Anaesthetic
Measuring Board
Weighing Scale
Scale Envelopes and Slides
Scalpel and Scissors
Field Fish Identification Guidebook

Miscellaneous Equipment

First Aid Kit-Workers Compensation Board (WCB) Approved
Tool Kit
Twine and Flagging Tape
Radios
Survival Kit
Location Maps (1:50,000 and 1:20,000 scale)
Spare Batteries (AA)
Global Position System (GPS)
Shovel
Polaski
15 liter Oil Spill Kit – Produced by Can –Ross Environmental Services Ltd.
15 Liter Backpack Fire Suppression Unit

3.4.1 Fish Sampling

Fish sampling focused on defining the overall distribution of all fish species in the Bone and Clemina Study Areas through presence/absence sampling using electrofishing, minnow trapping, pole seining, and visual observation (RIC 1997). When electrofishing, minimum sample lengths were the greater of 100 m or 10 times the bankfull width. The actual site length varied depending upon whether fish were captured, and/or to ensure that all habitat types were sampled in all sections of the primary, secondary, and off-channel stream zones.

To meet stream classification standards (FPC 1998), fish sampling was conducted in all habitats, using two methods (electrofishing and minnow traps, or electrofishing and pole-seining), in 100 linear meters, or 10 times the bankfull width, whichever was greater. If no fish were captured within the original site, a second site, equal in distance to the first was electrofished covering all habitat units. If after 200 m no fish were captured, an additional 500 linear meters of stream were sampled. Sampling beyond the 100 m ended when fish were captured, crews came to the end of the reach, 700 m were sampled or the crew leader confirmed that sampling effort was sufficient to ensure a non fish bearing status.

Fish Collection Forms were completed at each site where fishing was attempted. No fish were captured during the 2000/2001 study, therefore, Individual Fish Data Forms were not completed.

3.4.2 Habitat Description

Specific habitat characteristics were collected during field surveys from at least one site per reach. Site length was the greater of 100 m or 10 times the bankfull width. Site length was increased to adequately capture habitat sequences and to meet the requirements for stream classifications.

The information collected was consistent with the MoELP Site Cards and all fields on the forms were completed with the exception of; 1) Req. No. (dealing with water analysis) and 2) Environmental Monitoring System number (EMS). Gradient was measured using a Suunto clinometer. An average gradient was determined from at least three sightings, where the distance was maximized (60 to 100 m), as much as possible. Channel and wetted widths were measured with a measuring tape, measuring stick, or hip chain. A minimum of six channel and wetted widths were taken from within a reach section 100 m in length or greater, where the distance between measurements was at least one channel width apart within the reach according to the procedures outlined in the Fish-stream Identification Guidebook (BC FPC 1998).

3.4.3 Water Quality

Water quality information was recorded on the MoELP Site Cards and Fish Collection Forms. Water temperature was measured with an alcohol thermometer, pH was measured with an Oakton pHTestr 2, and conductivity was measured with an Oakton TDSTestr 3 recording meter. Turbidity was visually estimated.

3.4.4 Wildlife Observations

Wildlife observations were recorded on the MoELP Site Cards with specific reference to rare, threatened, and endangered species as listed by the British Columbia Conservation Data Center (BC CDC 1997).

3.4.5 Photographic Documentation

Photographs (35 mm) were taken of the stream reach sampling sites, fish species captured, all major features (e.g. fish passage barriers, beaver dams, clay slides, and any other features affecting fish values), and any obvious fish habitat limitations or restoration opportunities. A record of photographs was documented on the MoELP Site Cards and Fish Collection Forms (Attachment II)(RIC 1996).

3.5 PHASE V: DATA COMPILATION

The objective of the data compilation phase was to organize the information collected. Photographs were labeled, referenced and arranged in a binder (Attachment II), and placed in a Kodak Photo CD format with an index along with Photo Survey Form 1 and indexed negatives (Attachment IV). The information from completed Site Cards and Fish Collection Forms was entered into the Field Data Information System (FDIS) database version 7.2 (Attachment V), formerly version 6.5 (previous data entered into version 6.5 was transferred into version 7.2). In addition, Fisheries Information Summary System (FISS) information was updated on NTS 1:50,000 maps and FISS Stream Forms were completed and submitted to Victoria via the Contract Monitor.

3.6 PHASE VI: REPORT PREPARATION AND MAPPING

Three types of 1:20,000 TRIM based maps were prepared for the study area including the 1999/2000 and 2000/2001 projects: the *Overview Map* (Figure 1), the *Project Map*, and the *Interpretive Map* (Appendix II) (RIC 1998c). The *Overview Map* illustrates the project area for presentation in the final report. The information on the *Project Map* and the attached ARC/INFO database includes, but is not limited to, information collected during field sampling, sample sites, reach breaks, Interim Locational Points (ILP's), features and obstructions within the study area. The *Interpretive Map* includes stream classification and fish distribution information. Stream classifications have been completed on those reaches where sampling occurred. Fish distribution on the *Interpretive Map* is based on interpretations and conclusions drawn from the synthesis of data collected during Phase I and Phase IV (review of existing data and field sampling) and includes the entire study area.

4.0 RESULTS AND DISCUSSION

Field investigations involved data collection to describe four items; habitat and fish distribution; fish age, size and life-history; significant features and fisheries observations; and fish bearing status. In 2000/2001 a total of 30 sites (19 random and 11 biased) were sampled within the Bone and Clemina Creek Watersheds from August 21 to 23, 2000.

4.1 LOGISTICS

There were no logistical problems encountered during the field phase. All sites were accessible and completed as planned (Table 2).

In completing Phase V it was discovered that stream networks on Slocan Forest Products Ltd. Development Plan maps differed from those of TRIM maps. Through discussions with the Ministry of Environment and Slocan Forest Products Ltd., it was decided to add Slocan Development Plan stream lines to TRIM maps to create a single map set. A total of 223 reaches were adjusted from their original position and 11 reaches were added. The FDIS database was updated to reflect these changes. As Ministry of Environment GIS programs are based on TRIM mapping it was important to maintain the TRIM mapping base. Kevin Eskelin, GIS Manager for Slocan Forest Products Ltd., confirmed that this is a suitable solution as it will conform to the GIS programs that Slocan uses.

Table 2. Summary of sampling sites completed for the Bone and Clemina Study Areas, August 21 to 23, 2000.

Site No.	Watershed	Survey Date	NID Map No.	NID	ILP Map No.	ILP	Reach No.	Access	Sample Type
18	Bone	2000/08/21	83D.026	5018	83D.026	47	1	FT	R
19	Bone	2000/08/22	83D.025	5019	83D.025	1	3	FT	B
20	Bone	2000/08/21	83D.025	5020	83D.025	1	6	V2	B
21	Bone	2000/08/23	83D.026	5021	83D.025	91	5	H	R
22	Bone	2000/08/23	83D.026	5022	83D.026	47	3	H	B
23	Bone	2000/08/23	83D.036	5023	83D.025	1	10	H	B
24	Clemina	2000/08/22	83D.055	5024	83D.055	1	2	V2	R
25	Clemina	2000/08/21	83D.055	5025	83D.055	1	4	V2	R
26	Clemina	2000/08/22	83D.056	5026	83D.055	1	6	H	B
27	Clemina	2000/08/22	83D.056	5027	83D.055	1	9	H	R
28	Clemina	2000/08/21	83D.055	5028	83D.055	2	3	V2	R
29	Clemina	2000/08/21	83D.055	5029	83D.055	3	3	V2	R
30	Clemina	2000/08/22	83D.055	5030	83D.055	4	1	V2	B
31	Clemina	2000/08/22	83D.055	5031	83D.055	9	2	V2	B
32	Clemina	2000/08/23	83D.056	5032	83D.055	10	3	H	B
33	Clemina	2000/08/22	83D.055	5033	83D.055	15	1	H	R
34	Clemina	2000/08/22	83D.055	5034	83D.055	16	1	H	R
35	Clemina	2000/08/22	83D.056	5035	83D.055	19	1	H	R
36	Clemina	2000/08/22	83D.055	5036	83D.055	43	1	H	R
37	Clemina	2000/08/22	83D.056	5037	83D.056	10	1	H	B
38	Clemina	2000/08/22	83D.056	5038	83D.056	14	1	H	R
39	Clemina	2000/08/22	83D.056	5039	83D.056	15	1	H	R
40	Clemina	2000/08/22	83D.056	5040	83D.056	25	2	H	R
41	Clemina	2000/08/22	83D.056	5041	83D.056	26	2	H	R
42	Clemina	2000/08/22	83D.056	5042	83D.056	45	2	H	B
43	Clemina	2000/08/23	83D.056	5043	83D.056	60	3	H	R
44	Clemina	2000/08/23	83D.056	5044	83D.056	66	1	V2	R
45	Clemina	2000/08/23	83D.056	5045	83D.056	75	1	H	R
46	Clemina	2000/08/23	83D.056	5046	83D.056	78	1	H	B
47	Clemina	2000/08/22	83D.056	5047	83D.056	138	1	H	R

V2 - 2 wheel drive
H - Helicopter
Ft - foot

4.2 HABITAT AND FISH DISTRIBUTION

The upper Bone Creek and Clemina Creek Watersheds are largely pristine. Numerous icefields are located in their headwaters, a source of glacial till which accounts for the turbidity observed mainly within the Bone Creek watershed. Mainstem Bone and Clemina Creeks contain sections that are steep and incised. The majority of the tributaries within these sections are also steep and incised, typically low quality fish habitat.

Of the 30 sites sampled during the 2000/2001 study, 6 were within the Bone Creek Watershed and 24 were within the Clemina Watershed. The 6 sites within the Bone Watershed were primarily follow-up sites to the 1999/2000 sampling work completed. Of the 6 sites conducted, 3 were on the Bone Mainstem (Sites 19, 20 and 23), 2 on Pancake Creek (Sites 18 and 22) and one on an unnamed tributary (ILP 91, Reach 5) to Bone Creek (Site 21). Three (3) of the sampled reaches contained confined channels, 2 were frequently confined and 1 was occasionally confined. The selected sampling parameters, including; channel morphology, available instream cover and substrate composition, are summarized in Table 3. Figure 3 provides a view of Bone Creek, Reach 6.

Of the 30 sites sampled during the 2000/2001 study, 24 sites were located within the Clemina Creek watershed. Of the 24 sites conducted in the Clemina Watershed, 4 were on the Clemina Mainstem (Sites 24, 25, 26 and 27) and the remaining 20 sites were on various tributaries to Clemina Creek. One site had no visible channel (NVC). Of the 23 surveyed reaches 2 contained confined channels, 2 were frequently confined, 12 were occasionally confined and 7 were unconfined. Figure 4 provides a view of Clemina Creek Mainstem, Reach 2.

Table 3. Habitat data summary of sampling sites completed for the Bone and Clemina Study Areas, August 21 to 23, 2000.

Site No.	Watershed	NID Map No.	NID	ILP Map No.	ILP	Reach No.	Channel Condition	Average Channel Width	Average Gradient	Average Pool Depth	Total Cover	SWD Cover	LWD Cover	Boulder Cover	Cutbank Cover	Deep Pool Cover	Overhanging Vegetation Cover	Instream Vegetation Cover	Dominant Bed Material	Subdominant Bed Material	Channel Morpholgy
18	Bone	83D.026	5018	83D.026	47	1		9.6	6	0.5	M	T	S	D	N	S	T	N	B	C	CP
19	Bone	83D.025	5019	83D.025	1	3		21.3	5	1.1	M	N	S	D	N	T	T	N	C	G	RP
20	Bone	83D.025	5020	83D.025	1	6		61.7	5	0.9	M	N	T	D	N	S	T	N	B	C	RP
21	Bone	83D.026	5021	83D.025	91	5		4.8	7	0.4	M	N	T	D	N	T	T	N	B	C	CP
22	Bone	83D.026	5022	83D.026	47	3		10.6	2	0.5	M	N	S	S	T	D	T	N	C	F	RP
23	Bone	83D.036	5023	83D.025	1	10		46.3	5	0.5	T	N	N	D	N	T	T	N	B	C	CP
24	Clemina	83D.055	5024	83D.055	1	2		11.4	5	0.4	A	N	S	D	T	S	T	N	B	C	CPb
25	Clemina	83D.055	5025	83D.055	1	4		6.4	4	0.6	M	N	D	S	T	S	T	N	G	F	RP
26	Clemina	83D.056	5026	83D.055	1	6		11.1	6	0.6	A	T	D	T	S	T	S	N	C	G	RP
27	Clemina	83D.056	5027	83D.055	1	9		4.5	1	0.6	T	N	N	T	D	N	N	T	G	F	RP
28	Clemina	83D.055	5028	83D.055	2	3		0.7	13	0.1	T	S	T	S	T	T	D	T	F	B	RP
29	Clemina	83D.055	5029	83D.055	3	3		1.9	24	0.2	M	T	S	D	T	T	S	N	B	F	CPb
30	Clemina	83D.055	5030	83D.055	4	1	DRY	1.3	26										G	B	
31	Clemina	83D.055	5031	83D.055	9	2	DRY	0.5	33										F	G	
32	Clemina	83D.056	5032	83D.055	10	3		6.7	9	0.2	M	N	T	D	S	N	T	T	B	C	CP
33	Clemina	83D.055	5033	83D.055	15	1		0.4	24	0.1	T	N	N	D	S	T	T	N	B	F	CPb
34	Clemina	83D.055	5034	83D.055	16	1	DRY	0.6	21										B	C	
35	Clemina	83D.056	5035	83D.055	19	1	NVC		40												
36	Clemina	83D.055	5036	83D.055	43	1		2.9	8	0.2	A	T	S	N	T	T	D	S	F	NA	RP
37	Clemina	83D.056	5037	83D.056	10	1		1.2	20	0.1	M	D	S	T	T	T	S	N	F	G	RP
38	Clemina	83D.056	5038	83D.056	14	1		1.5	19	0.2	M	T	T	D	T	S	T	S	B	C	CPb
39	Clemina	83D.056	5039	83D.056	15	1		3.2	19	0.2	A	T	S	D	T	S	T	T	B	C	SP
40	Clemina	83D.056	5040	83D.056	25	2		0.7	3	0.2	T	N	N	D	S	T	T	T	F	B	RP
41	Clemina	83D.056	5041	83D.056	26	2		0.5	3	0.1	T	N	N	S	D	S	T	T	F	B	RP
42	Clemina	83D.056	5042	83D.056	45	2		0.9	7	0.2	T	T	N	S	T	D	T	T	F	B	RP
43	Clemina	83D.056	5043	83D.056	60	3		0.4	7	0.0	N	N	N	N	N	N	N	N	F	NA	RP
44	Clemina	83D.056	5044	83D.056	66	1		0.6	6	0.2	T	N	N	S	D	N	T	T	F	B	RP
45	Clemina	83D.056	5045	83D.056	75	1		1.0	10	0.2	T	N	N	D	S	N	T	T	B	F	CP
46	Clemina	83D.056	5046	83D.056	78	1		0.6	3	0.0	T	N	N	D	N	N	N	S	B	F	RP
47	Clemina	83D.056	5047	83D.056	138	1		6.4	1	0.1	T	N	N	D	S	N	N	N	F	B	RP

N - None
T - Trace
M - Moderate
A - Abundant
D - Dominant
S - Subdominant
DRY - Dry channel
NVC - No Visible Channel

F - Fines
G - Gravels
C - Cobbles
B - Boulder

SP - Step Pool
RP - Riffle Pool
CP - Cascade Pool
CPb - Cascade Pool, boulder

Figure 3. Bone Creek Watershed: Downstream view of typical habitat in the Bone Creek mainstem. Reach 6, ILP 1, Map 83D.025, Site 20, August 21 to 23, 2000.

Figure 4. Clemina Creek Watershed: Downstream view of typical habitat in the Clemina Creek mainstem. Reach 2, ILP 1, Map 83D.055, Site 24, August 21 to 23, 2000.

Within the 2000/2001 study area (including both Bone and Clemina Watersheds), of the 26 sites surveyed that contained water, 16 sites were reported as having clear water, 5 with low turbidity, 4 with moderate turbidity and 1 with turbid water. Clear water or low turbidity suggests low sediment input from erosion at the time of sampling. Five (5) sites contained turbid or moderately turbid water, a result of glacial till from the numerous icefields located in the headwaters of the study area. Four (4) of these sites are located in the Bone Watershed.

Within the 2000/2001 study area (including both Bone and Clemina Watersheds), of the 29 sites surveyed with visible channels, 1 site was described as having high water levels, 20 sites were described as having moderate water levels, and 8 sites described as having low water levels. The pH ranged from 7.4 to 8.9, with a mean pH (± SD) of 7.9 ± 0.3. Water temperatures ranged from 5.0 to 15.0 °C during the period of study, with a mean (± SD) of 8.9 ± 2.5 °C. Water conductivity ranged from 10 to 50 µS at the sites sampled, with a mean (± SD) of 31 ± 11 µS. When a stream with low conductivity (<30 µS) was encountered, salt was added to increase conductivity and improve electrofishing efficiency.

Sites 30, 31 and 34, within the Clemina Watershed, were dry at the time of the survey. Site 35, within the Clemina Watershed, had no visible channel. The remaining 26 sites had sufficient water flows to adequately determine fish presence or absence. No fish were captured during the 2000/2001 survey in either the Bone or Clemina Watersheds.

Bone Watershed

A 4 m waterfall located in Reach 2 of Bone Creek, located approximately 2 km upstream of the North Thompson River, was identified as a barrier to fish upstream migration (Standen and Westcott 1993). A 12 m high waterfall was also located during the 1999/2000 study in Reach 4 of Bone Creek approximately 5 km upstream of the North

Thompson River (ARC Environmental Ltd. 2000). Table 4 lists the historic and new barriers to fish migration found within the Bone and Clemina Watersheds.

Sites 18, 19, 20, 21, 22 and 23, located within the Bone Creek watershed upstream of the 4 m waterfall found in Reach 2 of Bone Creek were non-fish bearing. Sixteen (16) sites conducted during the 1999/2000 study located upstream of the 4 m waterfall in Reach 2 of Bone Creek were non-fish bearing (ARC Environmental Ltd. 2000). Site 19, located 600 m upstream of the 4 m waterfall in Reach 2 and 3.4 km downstream of the 12 m waterfall in Reach 4 of Bone Creek mainstem, was found to contain no fish. The 4 m waterfall located on Reach 2, approximately 1 km upstream of the North Thompson River, is the upper limit of fish use in the Bone Creek watershed.

Clemina Watershed

A 24 m waterfall located at the Reach 1/Reach 2 break of Clemina Creek, 1.9 km upstream of the Albreda River, is a barrier to fish migration (Figure 5). Twenty-two (22) sites surveyed upstream of the 24 m waterfall, including Site 24 immediately upstream, were found to be non-fish bearing. An over-flight of Reach 1 of Clemina Creek revealed no additional waterfalls downstream of the identified 24 m waterfall. Based on this, fish are assumed to be present up to the 24 m waterfall. Upstream of this, no fish are present within the Clemina Creek watershed.

4.3 FISH AGE, SIZE AND LIFE HISTORY

No fish were captured during the 2000/2001 study.

Table 4. Summary of historic and new barriers to fish migration found in the Bone and Clemina Study Areas.

Site No.	Watershed	ILP Map No.	ILP No.	Reach No.	Feature NID No.	NID Map No.	Barrier Type	Height of Barrier (m)	Verified in Field	Description and Comments
N/A	Bone Creek	83D.025	1	2	1002	83D.025	F	4.0	no	Reported by Standen J.and B.Westcott 1993.
24	Clemina Creek	83D.055	1	2	4022	83D.055	F	24.0	yes	Waterfall is a barrier to fish and marks the upper limit of fish presence in the Clemina Watershed.

Codes: F - falls

Figure 5. Clemina Creek Watershed: Aerial view of 24 m waterfall located at the Reach 1/Reach 2 break of Clemina Creek, August 21 to 23, 2000.

4.4 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

4.4.1 Fish and Fish Habitat

Generally, the sampled reaches within the Bone and Clemina Creek watersheds contain poor fish values. The larger streams were typically fast flowing, high energy streams with boulder substrate. Streams such as this usually contain poor spawning values and limited rearing habitat. As the Bone and Clemina valleys are narrow and incised many of the tributary streams are steep, providing limited potential fish habitat.

Bone Creek mainstem is a high energy, turbid or moderately turbid stream with limited spawning and rearing values due mainly to large (boulder) substrate and limited channel complexity. High water marks and channel width indicate that flows vary greatly. High freshet flows typically scour the stream bed and remove and strand available Large Woody Debris (LWD) cover, conditions unfavourable to fish populations. High flows and rapid additions of sediment and LWD to the channel may cause scour of the channel bed and shifting of bedload gravels, which can seriously reduce the availability of food and habitat (Swanston 1991). Chan (1974) described Reach 1 of Bone Creek as having a heavy silt load that blankets the stream bottom and greatly reduces the area available for fish habitat.

Clemina mainstem (Reaches 2, 4 and 6) was described as having moderate fisheries values. Spawning habitat was present in limited quantities, rearing values were typically moderate and overwintering habitat was abundant. However, no fish were present at these sites as they are located upstream of the 24 m waterfall at the Reach 1/Reach 2 break of Clemina Creek.

4.4.2 Habitat Protection Concerns

4.4.2.1 Fisheries Sensitive Zones

No Fisheries Sensitive Zones were identified during the field survey or during the review of the available airphotos and TRIM maps.

4.4.2.2 Fish Above 20% Gradients

No fish were found in reaches with gradients >20%. A total of 7 reaches (Sites 29, 30, 31, 33, 34, 35 and 37), all within the Clemina Watershed, had average gradients >20% (range of 20 to 40%). Sites 30, 34 and 35 were dry or contained no visible channel. Sites 30, 31, 33, 34, 35 and 37 were located upstream of the 24 m waterfall located on Clemina Creek.

4.4.2.3 Restoration and Rehabilitation Opportunities

No restoration or rehabilitation opportunities were noted in the Bone or Clemina Creek Watersheds.

4.5 FISH BEARING STATUS

Within the Bone and Clemina Creek 2000/2001 study areas, no fish were captured or suspected in any of the sampled reaches. This information, combined with measurements of channel width, provided the opportunity to propose stream classifications for each reach surveyed.

Of the 30 reaches sampled in 2000/2001, 29 were designated non-fish bearing (sixteen S6s and thirteen S5s) and 1 site was designated NVC. In contrast to the extensive fish distribution represented on the 1:100,000 scale watershed overview map of the Clemina and Bone Creek Watersheds (Slocan, Vavenby Division, April 4, 2001), the results of the FFHIP indicate that fish presence is limited to the first reach of Clemina Creek below a 24 m waterfall and to the end of the second reach of Bone Creek below a 4 m waterfall.

4.5.1 Fish Bearing Reaches

No fish were captured or suspected in any of the sampled reaches within the Bone or Clemina Creek study areas.

4.5.2 Non Fish Bearing Reaches

Of the 6 reaches sampled within the Bone Creek Watershed, all were classified S5. Of the 24 reaches sampled within the Clemina Watershed, 16 were classified S6, 7 S5 and 1 reach had no visible channel (Table 5). The 4 m waterfall located in Reach 2 of the Bone Creek mainstem appears to be the limiting factor for fish distribution. Similarly, the 24 m waterfall located at the Reach 1/Reach 2 break of Clemina Creek appears to be limiting the distribution of fish within the Clemina Creek watershed. Sampling efforts coupled with channel characteristics were sufficient to designate the reaches upstream of the waterfall as non-fish bearing.

Table 5. Summary of data from surveyed non-fish bearing reaches in the Bone and Clemina Study Areas, August 21 to 23, 2000.

Site No.	Watershed	ILP Map No.	ILP	Reach No.	Channel Condition	Average Channel Width	Average Gradient	Electrofishing Specifications Dist (m)	Time (s)	Cond.	Temp.	Other Methods Type	Effort (hr:min)	Proposed Riparian Class	Follow-up Sampling y/n	
18	Bone	83D.026	47	1		9.6	6	700	420	40	8	SN	0:05	S5	n	Not accessible due to downstream waterfall on Bone Creek. Poor rearing and spawning habitats. Stream has high velocity.
19	Bone	83D.025	1	3		21.3	5	700	1187	40	6	SN	0:08	S5	n	Not accessible due to downstream waterfall on Bone Creek. Limited fish habitat.
20	Bone	83D.025	1	6		61.7	5	700	662	40	7	SN	0:15	S5	n	Not accessible due to downstream waterfall on Bone Creek. Limited fish habitat.
21	Bone	83D.025	91	5		4.8	7	700	512	40	5	SN	0:05	S5	n	Not accessible due to downstream waterfall on Bone Creek. Poor rearing and spawning habitat.
22	Bone	83D.026	47	3		10.6	2	700	710	40	8	SN	0:05	S5	n	Not accessible due to downstream waterfall on Bone Creek.
23	Bone	83D.025	1	10		46.3	5	700	486	20	8	SN	0:08	S5	n	Not accessible due to downstream waterfall on Bone Creek. Poor rearing and spawning habitat.
24	Clemina	83D.055	1	2		11.4	5	440	537	40	7	SN	0:10	S5	n	Not accessible due to downstream waterfall on Clemina Creek.
25	Clemina	83D.055	1	4		6.4	4	700	727	50	7	SN	0:18	S5	n	Not accessible due to downstream waterfall on Clemina Creek.
26	Clemina	83D.055	1	6		11.1	6	700	570	30	8	SN	0:07	S5	n	Not accessible due to downstream waterfall on Clemina Creek. Poor habitat values.
27	Clemina	83D.055	1	9		4.5	1	700	502	30	8	SN	0:05	S5	n	Not accessible due to downstream waterfall on Clemina Creek.
28	Clemina	83D.055	2	3		0.7	13	540	539	40	12	SN	0:03	S6	n	Limited fish habitat. U/s of high gradient section.
29	Clemina	83D.055	3	3		1.9	24	700	645	40	9	SN	0:01	S6	n	Limited fish habitat. U/s of high gradient section.
30	Clemina	83D.055	4	1	DRY	1.3	26							S6	n	Not accessible due to downstream waterfall on Clemina Creek. Dry creek channel with steep gradient.
31	Clemina	83D.055	9	2	DRY	0.5	33							S6	n	Not accessible due to downstream waterfall on Clemina Creek. Dry creek channel.
32	Clemina	83D.055	10	3		6.7	9	700	520	40	6	SN	0:05	S5	n	Not accessible due to downstream waterfall on Clemina Creek. Limited fish habitat.
33	Clemina	83D.055	15	1		0.4	24	210	229	20	8	SN	0:01	S6	n	Not accessible due to downstream waterfall on Clemina Creek.
34	Clemina	83D.055	16	1	DRY	0.6	21							S6	n	Not accessible due to downstream waterfall on Clemina Creek. Dry creek channel.
35	Clemina	83D.055	19	1	NVC		40							NVC	n	No visible channel.
36	Clemina	83D.055	43	1		2.9	8	407	340	30	8	SN	0:05	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Limited fish habitat - limited shockable area.
37	Clemina	83D.056	10	1		1.2	20	200	229	20	13	SN	0:11	S6	n	Not accessible due to downstream waterfall on Clemina Creek.
38	Clemina	83D.056	14	1		1.5	19	700	410	20	11	SN	0:01	S6	n	Not accessible due to downstream waterfall on Clemina Creek.
39	Clemina	83D.056	15	1		3.2	19	700	572	20	11	SN	0:13	S5	n	Not accessible due to downstream waterfall on Clemina Creek.
40	Clemina	83D.056	25	2		0.7	3	80	171	20	12	SN	0:01	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Low fisheries values - reach only 80m in length.
41	Clemina	83D.056	26	2		0.5	3	70	115	20	12	SN	0:01	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Low fisheries values - reach only 70m in length.
42	Clemina	83D.056	45	2		0.9	7	392	316	10	15	SN	0:02	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Limited water - flows through avalanche basin.
43	Clemina	83D.056	60	3		0.4	7	400	335	10	7	SN	0:08	S6	n	Not accessible due to downstream waterfall on Clemina Creek. No fisheries values - reach only 400m in length.
44	Clemina	83D.056	66	1		0.6	6	163	88	40	12	SN	0:07	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Low fisheries values - reach only 163m in length.
45	Clemina	83D.056	75	1		1.0	10	500	462	30	8	SN	0:05	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Limited fish habitat.
46	Clemina	83D.056	78	1		0.6	3	25	15	40	8	SN	0:01	S6	n	Not accessible due to downstream waterfall on Clemina Creek. Upstream rockslide covers stream - only 20m of visible channel
47	Clemina	83D.056	138	1		6.4	1	500	462	40	6	SN	0:05	S5	n	Not accessible due to downstream waterfall on Clemina Creek. Limited fish habitat.

NVC - No Visible Channel
DRY - Dry channel
SN - Pole seine

Stream Class:	Non-Fish Bearing	Channel Width
	S5	>3m
	S6	≤3m

4.5.3 Follow-up Sampling Requirements

Within the Bone and Clemina Creek Watersheds, a total of 47 sites have been completed in the 1999/2000 and the 2000/2001 field seasons. Sampling results and the identification of barriers has resulted in established limits to fish distribution and subsequent stream classifications. No further sampling is recommended.

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