Reconnaissance Inventory of Lapie Lake

Waterbody Identifier: 01070 LIAR

Prepared for:

Muskwa-Kechika Advisory Board
9908 100th Ave.
Fort St. John, BC
V1J 1Y5

Prepared By:

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V2L 3G7

EDI Project No. 704-01

March 2001

PROJECT REFERENCE INFORMATION

FDIS Project Number	3958
MELP Region	Omineca-Peace (7B)
FW Management Units	7-54
DFO Habitat Area	Northern BC Interior
Forest Region	Prince George
Forest District	Fort Nelson
Forest Licensee	N/A
Tenure #	N/A

WATERSHED INFORMATION

Watershed Group	LIAR
Watershed Code	210-547000-06100
Waterbody Identifier	01070LIAR
UTM at Lake Outlet	9.312321.6579250
Order at Lake Outlet	2
Magnitude of Lake	5
Number of Tributaries	3
Drainage Area of Lake	1733 ha
Elevation of Lake	836 m ASL
NTS Map	94M/08
TRIM Map	094M.039
BEC Zone	Spruce-Willow Bridge
Air Photos	BC 5475 #239

LAKE SAMPLING SUMMARY

Lake Survey Type	Primary
Water Surface Area	20.26 ha
Maximum Depth	12.5 m
Mean Depth	7.8 m
Secchi Depth	5.75 m
Volume	1 733 268 m^3
Area above 6m contour	5.7 ha
Shoreline Perimeter	3257 m
Number of Islands	0
Species Present in Lake	BT, CCG, LT
Survey Date	19-21 July 2000

CONTRACTOR INFORMATION

Proponent:	Name:	Muskwa-Kechika Advisory Board
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Field crew:	Names:	J. D. Hamilton, R. M. Van Schubert
Data entry by:	Names:	R. J. Sharples
Report prepared by:	Names:	R. J. Sharples
Report edited by:	Names:	J. D. Hamilton, M.Sc., R.P.Bio.
Maps prepared by:	Names:	P.Walsh
GIS services by:	Company:	Environmental Dynamics Inc.
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Aging sample analysis:	Name:	Birkenhead Scale Analysis Lone Butte, BC
	Phone:	(250) 395-3880
Water chemistry analysis:	Name:	Norwest Labs
	Address:	#104, 19575 – 55A Ave, Surrey, BC, V3S 8P8
	Phone:	(604) 444-4808
Genetic sample analysis:	Name:	N/A
Voucher species ID confirmation:	Name:	N/A

ACKNOWLEDGEMENTS

The Muskwa-Kechika Advisory Board provided funding for the majority of this inventory. Slocan Group, Fort Nelson Woodlands and Forest Renewal BC donated helicopter time necessary to complete this inventory. We would also like to thank Ms. Duda, M.Sc., R.P.Bio. (Slcoan Group – Ft. Nelson) for volunteering her time as a field crew member for a portion of the field work.

Report approved by: ______________________________

J. David Hamilton, M.Sc., R.P.Bio.

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LIST OF ATTACHMENTS AVAILABLE AT MUSKWA-KECHIKA ADVISORY BOARD OFFICE

The following attachments to this report are available at the Muskwa-Kechika Advisory Board office in Fort St. John, BC. The phone number and address are presented below:

Muskwa-Kechika Advisory Board
9908 100th Avenue
Fort St. John, BC
V1J 1Y5
(250) 262-0065

ATTACHMENTS

Attachment I - Photo Documentation

Attachment II - Digital Data

Attachment III – Hard Copy FISS Update Materials

Attachment IV – Original Field Data Forms and Notes

Attachment V - Fish Aging Structures

1.0 INTRODUCTION

An Overview Fish and Fish Inventory of the Vents and upper Toad rivers was conducted in July 2000 (Sharples et al. 2001). This type of fisheries inventory is intended to provide information regarding fish species presence, probable distributions within the watershed and broad habitat classification for interpretation of habitat sensitivity and capability for fish production (BC Ministry of Fisheries 1999a).

As part of the Vents River inventory, a primary lake survey was conducted on Lapie Lake (Watershed Code (WSC) 210-547000-06100), and a secondary lake survey was conducted on Skeezer Lake (WSC 210-547000-22600-82700-1560. The results of the primary lake survey detailed in this report provide baseline information on bathymetry, water quality, fisheries values, and associated lake tributary fish habitat quality.

1.1 Project Scope and Objectives

As several lake surveys had been previously conducted in the Vents River, project staff met with Ministry of Environment, Lands and Parks staff in Ft. St. John to review existing lake survey reports and finalize the selection of the lakes to be surveyed as part of the overview inventory of the Vents River watershed. Skeezer Lake was selected for sampling, as it was the next largest lake in the watershed that had yet to be surveyed.

Following the arrival of the sampling crews at Muncho Lake (the base of operations for the inventory sampling), discussions with one of the local lodge owners revealed that there were no fish in Skeezer Lake (Mr. Urs Schildknecht, Owner/Operator Northern Rockies Lodge, pers. comm. 2000). Therefore, the field crews made the decision to switch the primary lake sampling to Lapie Lake, as this lake was the fourth largest in the Vents River watershed and was known to support fish. As a secondary lake survey could be accomplished within the existing field program, it was also decided that a secondary lake survey be conducted on Skeezer Lake to confirm the absence of fish.

1.2 Location

The study area lies within the Muskwa-Kechika Management Area (M-KMA), 4.4 million hectares situated in BC's Northern Rocky Mountains (Muskwa-Kechika Backgrounder 2000). The Muskwa-Kechika Area is situated in the Fort Nelson, Fort St. John and Mackenzie Forest Districts within the Prince George Forest Region. The Muskwa-Kechika Area lies within the boundaries of BC Environment's sub-region 7B (Peace).

Lapie Lake is located in the western part of the M-KMA, in the Vents River Watershed (Figure 1.1). The lake drains into Lapie Creek (WSC 210-547000-06100), which then flows into the Vents River (WSC 210-547000) approximately 5 km upstream of the Liard River (WSC 210). Table 1.1 presents the survey site location summary for Lapie Lake.

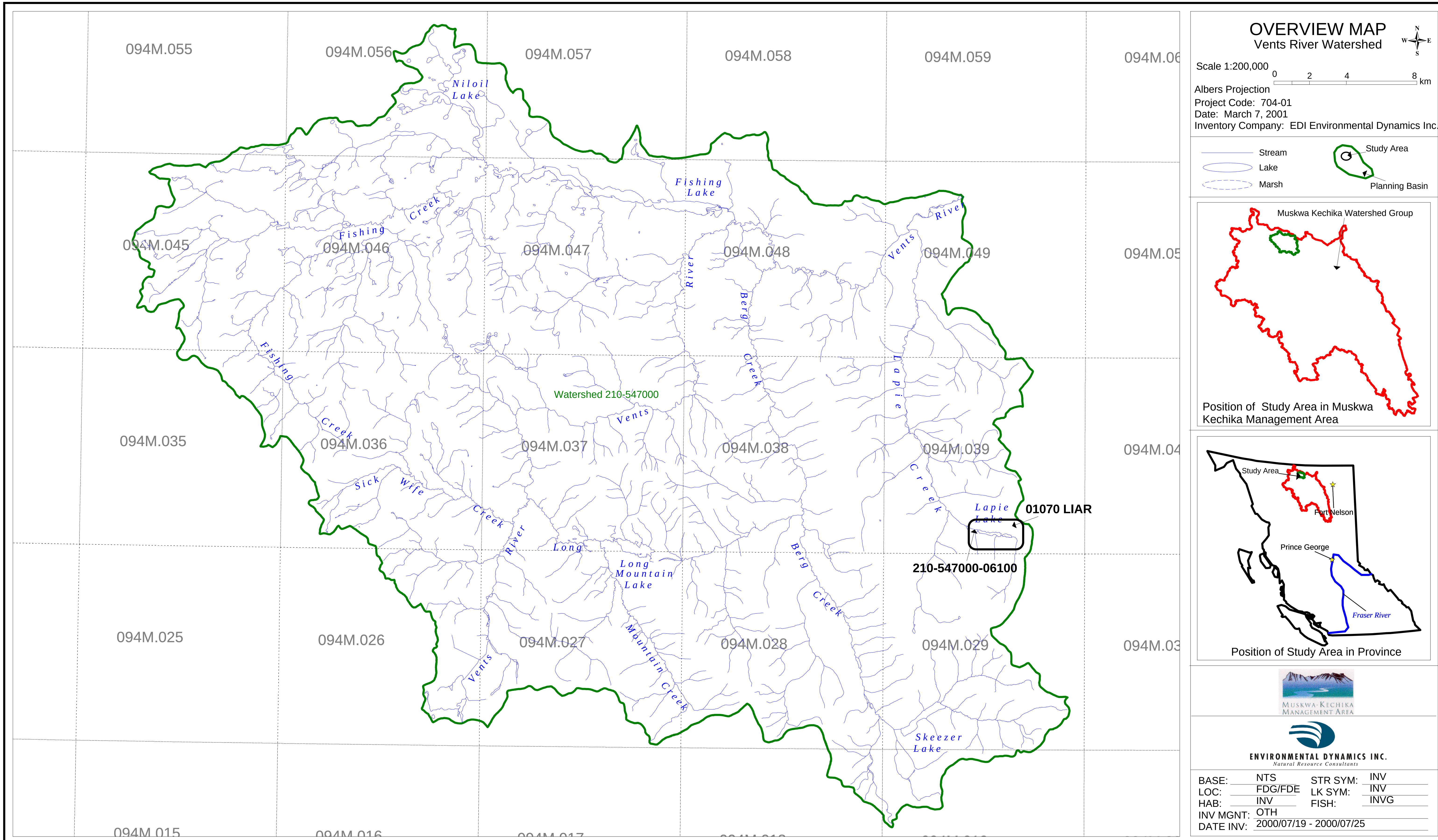


Figure 1.1 Overview Map of Study Area

Table 1.1 Survey site location and description.

WSC	UTM at Lake Outlet	WBID[1]	NTS Maps	TRIM Map	BEC Zone[2]	Lake Area (ha)	Air Photos
210-547000-06100	9.312321 6579250	01070 LIAR	94M/08	094M.039	SWB	20.26	BC 5475 #239

[1]**WBID =**Waterbody Identifier
[2]**BEC Zone** = Biogeoclimatic Zone

Lapie Lake is located in the Spruce-Willow-Birch (SWB) biogeoclimatic zone. The SWB biogeoclimatic zone is a sub-alpine zone occurring at elevations above the boreal forest and below the Alpine Tundra (MacKinnon et al. 1992). At lower elevations, open forests of primarily white spruce (*Picea glauca*) and subalpine fir (*Abies lasiocarpa*) characterize the zone, while upper elevations are dominated by deciduous shrubs including scrub birch (*Betula glandulosa*) and willows (*Salix* spp.) (MacKinnon et al.1992).

1.2.1 Access

There is no road access to the vicinity of Lapie Lake. In order to access Lapie Lake, travel to Muncho Lake or Liard River Hot Springs and take a floatplane or helicopter to Lapie Lake. It may also be possible to access the lake by horseback from the Liard Hot Springs area.

2.0 RESOURCE INFORMATION

An Overview Fish and Fish Habitat Inventory was conducted within the Vents River watershed in July of 2000. This inventory included the sampling of 21 streams as well as Skeezer Lake and Lapie Lake. The stream inventory surveys confirmed the presence of bulltrout (*Salvelinus confluentus*), lake whitefish (*Coregonus clupeaformis*), Arctic grayling (*Thymallus arcticus*), mountain whitefish (*Prosopium williamsoni*) and slimy sculpin (*Cottus cognatus*) within selected reaches within the Vents River watershed (Sharples et al. 2001).

Lake surveys of Fishing and Long Mountain Lakes (Coombes' 1985a; 1985b) revealed northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), burbot (*Lota lota*), lake whitefish, and slimy sculpin in Fishing Lake and Arctic grayling and lake trout in Long Mountain Lake. In addition, BC Environment (2000) documented Arctic grayling, mountain whitefish, slimy sculpins, longnose sucker (*Catostomus catostomus*), burbot and bull trout in the lower portion of Vents River as well as bull trout and slimy sculpins in Lapie Creek. Northern pike were also documented in Fishing Creek, approximately 500 meters upstream from Fishing Lake and lake whitefish were documented in Fishing Creek below Fishing Lake (BC Environment 2000).

Hunting was the only resource activity that was noted in the vicinity of Lapie Lake during this study. Several outfitter cabins were present in the Vents River watershed. Cabins were located on Skeezer, Lapie, Fishing, and Long Mountain Lakes. As there are no roads in the watershed, hunters are flown in to the lakes by floatplane and in some cases access the area by horseback.

There has been no major anthropogenic disturbance in the watershed; however, there was significant evidence of several recent (likely within the last 75 years) fires. The vegetation in the watershed was made up of several pure stands of lodgepole pine (*Pinus contorta*), a pioneer species that establishes after disturbances such as fire. While tree size was uniform within the stands, variation between stands indicated that a number of separate fires had impacted the watershed.

3.0 METHODS

The sampling conducted in July 2000 followed the methodologies outlined in the *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures* (BC Ministry of Fisheries 1998) and *Bathymetric Standards for Lake Inventories* (BC Ministry of Fisheries 1999b), and the *Overview Fish and Fish Habitat Inventory Methodology* (BC Ministry of Fisheries 1999a). Methods used and any deviations from the standard procedures are described below:

3.1 Sampling Equipment and Methodologies

- 4 m Polaris inflatable boat powered by a 15 hp outboard motor
- Meridata Model 100 electronic depth sounder
- Trimble Pro-XL GPS (for georeferencing depth soundings)
- YSI Model 57 oxygen/temperature meter (measured oxygen/temperature profile of water column)
- pH (field) measurement: EM Science colored pH indicator strips
- Conductivity (field) measurement: Hand-held Oakton Model TDS-TESTR 3
- Van Dorn bottle type field water sampler
- Hach H_2S field sample kit for hydrogen sulphide detection
- Six-panel 91 metre sinking monofilament gill net ranging between 25-89 mm (BC Environment standard)
- Six minnow traps
- Camera (Pentax Zoom, 35 mm) (lens focal length 38 - 90 mm)

Data entry and mapping were conducted with
- The Field Data Information System (FDIS) version 7.3 for data entry
- Microsoft Excel was used to produce graphs from the spreadsheet calculations
- Contour interpolation was conducted using Vertical Mapper software in MapInfo
- MapInfo was run on a PC based computer platform
- Air photos were digitized using an HP ScanJet 6100C scanner
- Digitized air photos were annotated using MapInfo® software

3.2 Fish Sampling

Lapie Lake was sampled following the primary lake sampling methodology outlined by the BC Ministry of Fisheries (1998). A short set of the gill net was made to assess the relative abundance of fish in the lake and gauge whether a typical overnight gill net set was required in this lake. Following the short duration set, the decision was made to leave the gill nets and minnow traps in overnight in order to maximize fishing effort and the effectiveness of the gear.

Fish captured during the lake sampling were identified to species, measured for length and weight. The sex, maturity, and stomach contents were also assessed. Otoliths and/or fish fin ray samples or scale samples of the adult lake trout and bull trout were also collected for aging purposes (Attachment 5).

3.3 Bathymetric Mapping

Bathymetric surveys were conducted in accordance with the methodology outlined by RIC (1999b). Depth soundings of the lake were conducted using a Meridata Model 100 electronic depth sounder and a Trimble Pro-XL GPS (Global Positioning System). This system collects simultaneous locational data from the GPS and depths from the sounder and stores the data in the GPS data logger. The locational data was later differentially corrected to increase the precision of the data. The use of this type of system improves the precision of the bathymetric maps and dramatically speeds up production of the bathymetric maps over traditional methods.

The corrected georeferenced information files were imported into Vertical Mapper®, a grid-based contouring and display software system running under the MapInfo® GIS software. The software generates contour maps by triangulating the points provided by the GPS. Lake outlines, tributaries, roads and surrounding wetland locations are obtained from digital Terrain Resource Information Management (TRIM) mapsheets. The bathymetric information was placed over the existing digital TRIM contour grid as a separate layer in the GIS. The mapping software can then used to calculate lake area, volume, and depth statistics. Bathymetric maps were prepared in accordance to the specifications and examples provided by RIC (1999b).

3.4 Annotated Air Photo

The air photo was scanned on an HP ScanJet 6100C scanner and enlarged for presentation. The unregistered raster image was imported into MapInfo® and adjusted so that the orientation of the lake in the photograph matched the orientation of the lake outline on the TRIM map. Symbols and a legend were then added to the photograph. The annotated air photo was printed using a HP DeskJet 1120C colour printer.

3.5 Photodocumentation

Panoramic colour photographs of the surrounding area as well as photographs of shoreline conditions, aquatic plant communities, benchmark, inlet and outlet tributaries and any other significant features are presented within this report as plates in Appendix 4 (tributaries) and Appendix 5 (lakes). The only photos included in Appendix 5 of the report are those that best meet the photodocumentation requirements of the project.

Relevant photographs of the lake presented in Appendix 5 of the report are provided with a caption that includes plate number; description and photo orientation along with the specific roll number and frame number of the photograph. Photographs of Lapie Lake have been scanned and copied to CD and organized according to folders indicating roll numbers conforming to the following file naming convention: Img00025.tif, where:

- Img = Image number
- 00025 = Frame number
- .tif = computer file extension

4.0 RESULTS AND DISCUSSION

4.1 Logistics

Fieldwork for the study on Lapie Lake was conducted between 19-21 July 2000. To access Lapie Lake, take a helicopter or a floatplane from Muncho Lake or Liard River Hot Springs. There were no logistical problems encountered during the survey that impacted the study.

4.2 Immediate Shoreline

Lapie Lake is situated in a narrow east-west oriented valley (Figure 4.1). The majority of the shoreline was rocky (95%). The remainder was wetland, with the majority of the wetland situated along the east end of the lake, near the inlet stream. A mixture of shrubs and spruce grew along most of the shoreline; however, terrestrial vegetation did not provide a significant amount of cover (Figure 4.2). The only visible land use development at the time of survey was a cabin near the outlet stream.

Figure 4.1. Looking west to the outlet of Lapie Lake

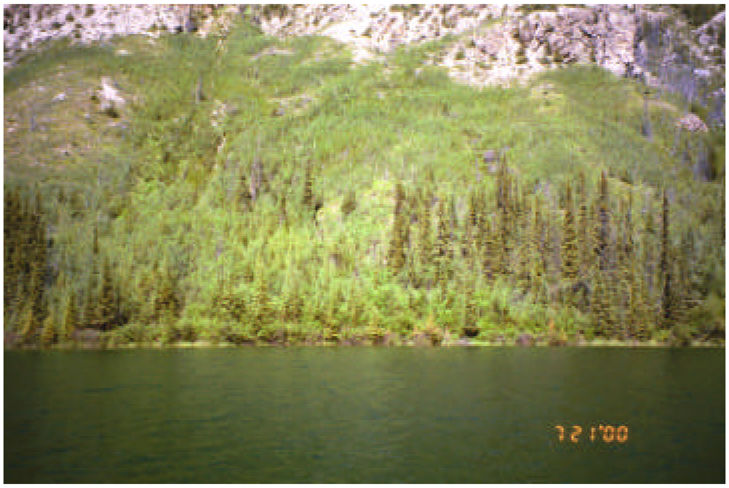


Figure 4.2 Representative shoreline along north shore of Lapie Lake

4.3 Terrain

Lapie Lake is a glacial scour lake in a narrow valley, with a west aspect (i.e., the orientation of the lake is east-west and the lake outlet is at the west end of the lake. Due to the narrow valley, the hillsides along the north and south sides of the lake are coupled (Figure 4.1 and 4.2).

4.4 Aquatic Flora

No aquatic macrophytes were observed in Lapie Lake.

4.5 Site Summary

The annotated air photo (Figure 4.3), and Location of Sampling Sites (Figure 4.4) illustrate the locations of gill net and minnow traps, photograph number and direction, limnological station, benchmark location and stream flow directions.

4.6 Bathymetry

Lapie Lake is relatively small, approximately 22 ha. The mean depth was 7.8 m and the maximum depth was 13 m (Table 4.1).

Table 4.1 Summary of lake morphometric characteristics.

Elevation (m)	Surface Area (ha)	Area Above 6 m contour (m^2)	Volume (m^3)	Mean Depth (m)	Max Depth (m)	Shoreline Perimeter (m)	Island Perimeter (m)	Benchmark Height (m)
836	22.3	56 510	1 733 268	7.8	13	3257	N/A[1]	1.5

[1]where N/A= not applicable

Figure 4.5 presents the bathymetric sounding transect locations for Lapie Lake. Bathymetric maps are provided in Figure 4.6 (11" × 17" format) and Appendix 6.

4.7 Limnological Sampling

A water sampling station was established at the deepest point of the lake (12.5 meters). Two water samples were taken, one at a depth of 0.5 m and the other at a depth of 11.5 m. Three major groups of parameters were measured during the lake inventory, these included physical measurements (e.g., temperature, Secchi depth), general chemical measurements (e.g., alkalinity, pH) and inorganic nutrients (i.e., nitrogen and phosphorus). As metals concentrations are of concern in the region, due to the mineral hotsprings in the region, the MELP requested that a suite of metals analyses also be conducted on water samples collected during the primary lake survey. In addition to the water quality data from the survey of this lake, temperature, conductivity and pH readings for tributaries streams are available (Sharples et al. 2001). The results of the water chemistry sampling are summarized in Table 4.2 and lab results have been included in Appendix II.

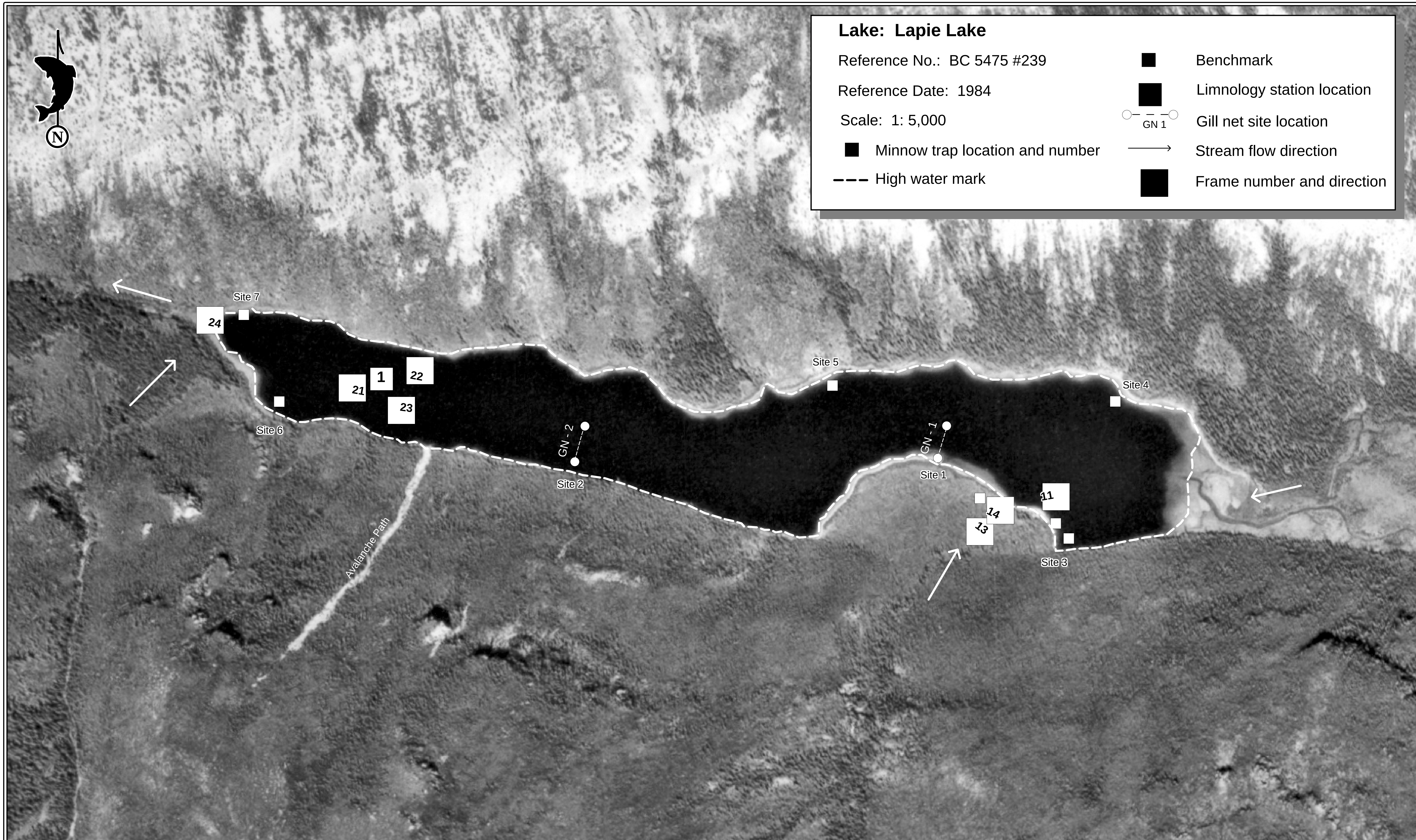
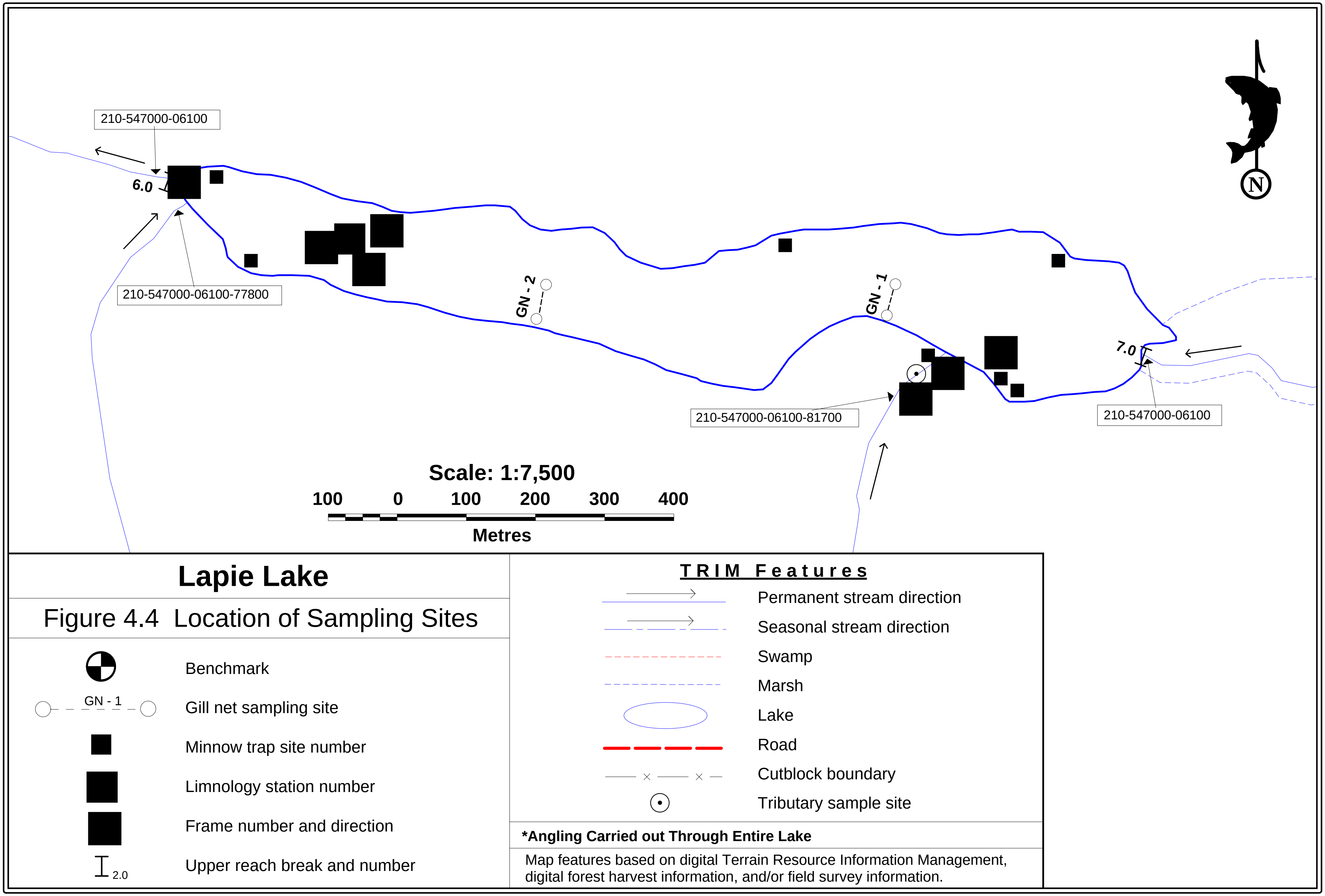
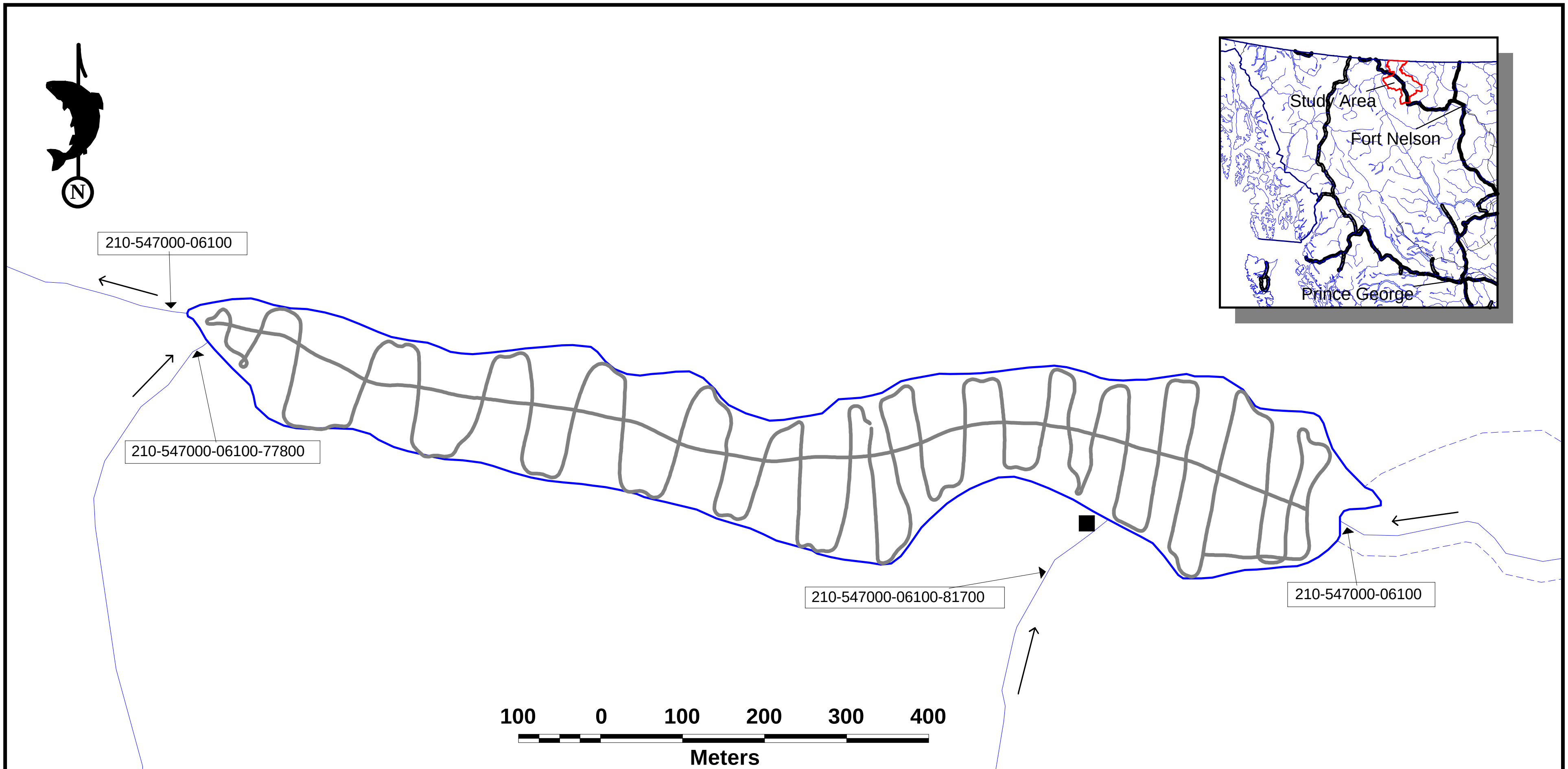


Figure 4.3 Annotated Air Photo



Produced by: Environmental Dynamics Inc., February 2001

2000 Primary Lake Reconnaissance Survey of Lapie Lake (Waterbody ID: 01070 LIAR)



NOTES: 1 - Depths are in metres; 2 - ■ Denotes benchmark; 3 - Not intended for navigational use. Uncharted rocks and shoals may exist.

SURVEYED BY: JDH / RMV
OUTLINE SOURCE: 094M.039 Digital TRIM Mapsheet
DATE: 19 - 21 July, 2000

Lapie Lake

Elevation	**838 m**
Surface Area	**222 600 m²**
Area Above 6 m Contour	**56 510 m²**
Volume	**1 733 268 m³**
Mean Depth	**7.8 m**
Maximum Depth	**13.0 m**
Perimeter, Main Shore	**3 257 m**
Perimeter, Islands	**0 m**
Benchmark	**1.5 m**

Prepared for: MUSKWA - KECHIKA

By: ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

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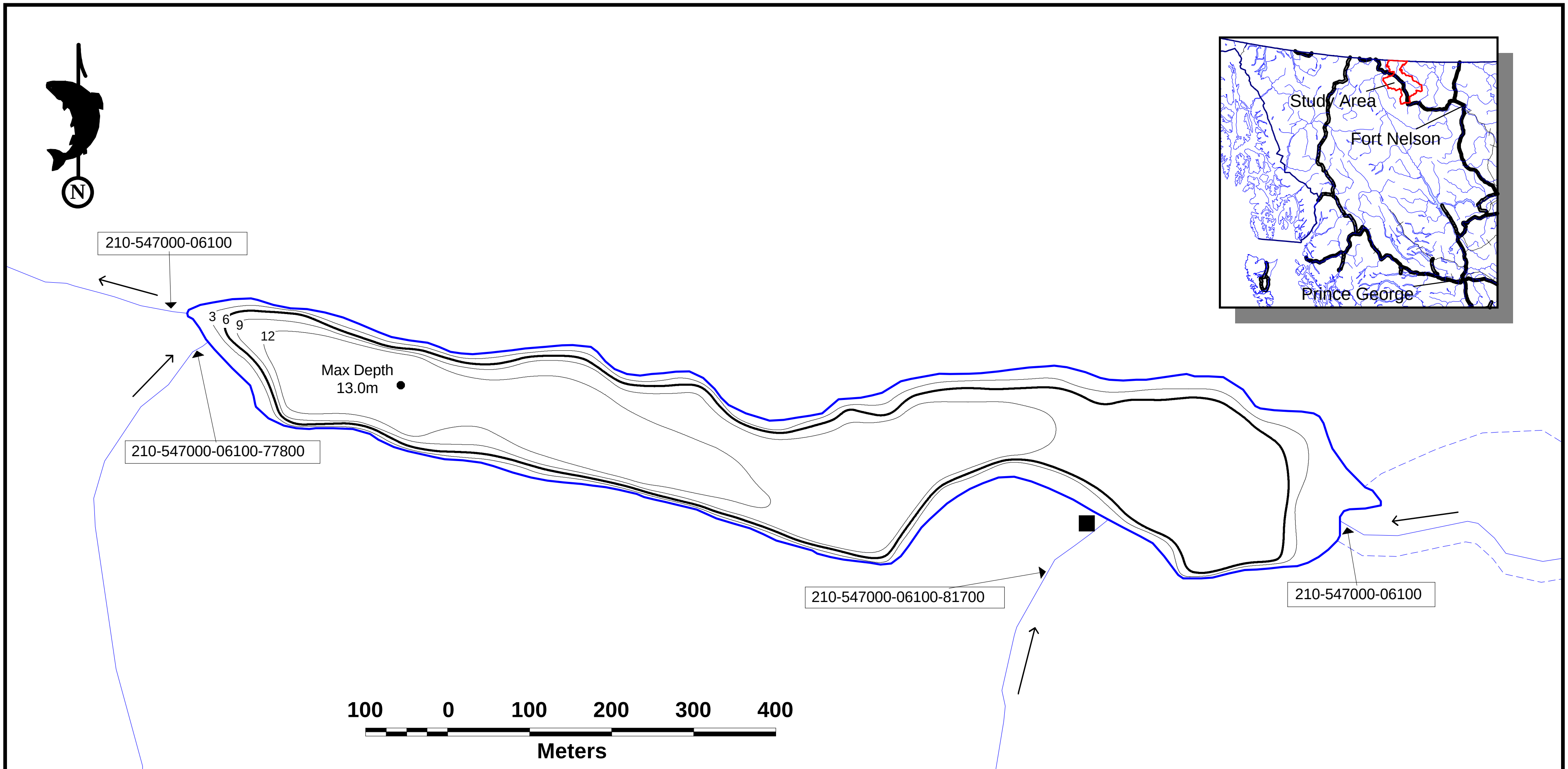
Phone: (250)-562-5412
Fax: (250)-562-5413

WATERSHED CODE: 210-547000-06100		**UTM COORDINATE: 9.654762.6577644**	
WATERBODY ID: 01070 LIAR	**DATE: February, 2001**	**REVISION DATE:**	**SCALE: 1:7,500**
DIGITIZED: MapInfo	**REACH NO: 7.0**	**APPROVED:**	
CONTOURS: Vertical Mapper	**MU: 7-54**		**NTS NO: 94M/8**
TECH. CHECK: PJW	**ESTIMATED ANNUAL FLUCTUATION: 0.0 m**		

Figure 4.5 Location of Sounding Transects

2000 Primary Lake Reconnaissance Survey of Lapie Lake (Waterbody ID: 01070 LIAR)



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CONTOURS: Vertical Mapper	**MU: 7-54**		**NTS NO: 94M/8**
TECH. CHECK: PJW	**ESTIMATED ANNUAL FLUCTUATION: 0.0 m**		

Figure 4.6 Bathymetric Map

Table 4.2 Summary of water chemistry results 21 July 2000.

Group	Parameter Measured	Detection Limits	Surface Ions (0.5 m)	Bottom Ions (11.5 m)
General Chemical	pH (field)	0.1	7.0	7.0
	pH (lab)	0.01	7.81	7.83
	Specific Conductance (µS/cm)	0.01	265	260
	Residue Filterable (TDS)	5	171	157
	Acidity pH 4.5 (mg $CaCO_3$/L)	1	N/A	N/A
	Acidity pH 8.3(mg $CaCO_3$/L)	1	7	7
	Alkalinity Total (mg $CaCO_3$/L)	5	83	104
Nitrogen	Nitrogen: Ammonia (mg/L)	0.005	0.01	0.005
	Nitrogen: Nitrate (mg/L)	0.005	0.088	0.098
	Nitrogen: Nitrite (mg/L)	0.001	<0.001	<0.001
	Total Nitrogen (mg/L)		0.098	0.103
Phosphorus	Ortho-Phosphorus (mg/L)	0.001	<0.001	<0.001
	Phosphorus Total (mg/L)	0.001	0.004	0.005

The lake had a green tinge to the water colour as viewed through the Van Dorn water sampler and a Secchi depth of 5.75 at the time of survey. Typical of northern lakes, the nutrients were very low or not detectable.

The lake was well oxygenated from the surface to a depth of approximately 11.0 m (Figure 4.7). Above this depth the dissolved oxygen levels were well above the recommended standard of 7 mg/L required for salmonids (CCME 1996). The dissolved oxygen levels rapidly decreased to 4 mg/L at depths below 11.0 m. The decline in dissolved oxygen is most likely a result of consumption of oxygen during bacterial decomposition of organic matter in the lake sediments (Wetzel 1983). As the volume of the lake below 11.0 m is only a small portion of the lake (Figure 4.6), the dissolved oxygen profile suggests that fish can utilize the majority of the lake.

The temperature of the lake ranged from 13°C at the surface to 10°C near the lake bottom. It is common for north-temperate lakes to thermally stratify and to develop a thermocline (a transitional area where the water temperature decreases by approximately 1°C per metre change in depth; Wetzel 1983). No evidence of thermal stratification was evident in Lapie Lake (Figure 4.7) during the sampling conducted on 21 July 2000. It is unlikely that Lapie Lake would thermally stratify due to the latitude and elevation at which the lake is located. In addition, the long axis of the lake is parallel to the prevailing winds and not protected by the valley walls, therefore, there would be strong wind driven mixing action that would inhibit the formation of a thermocline.

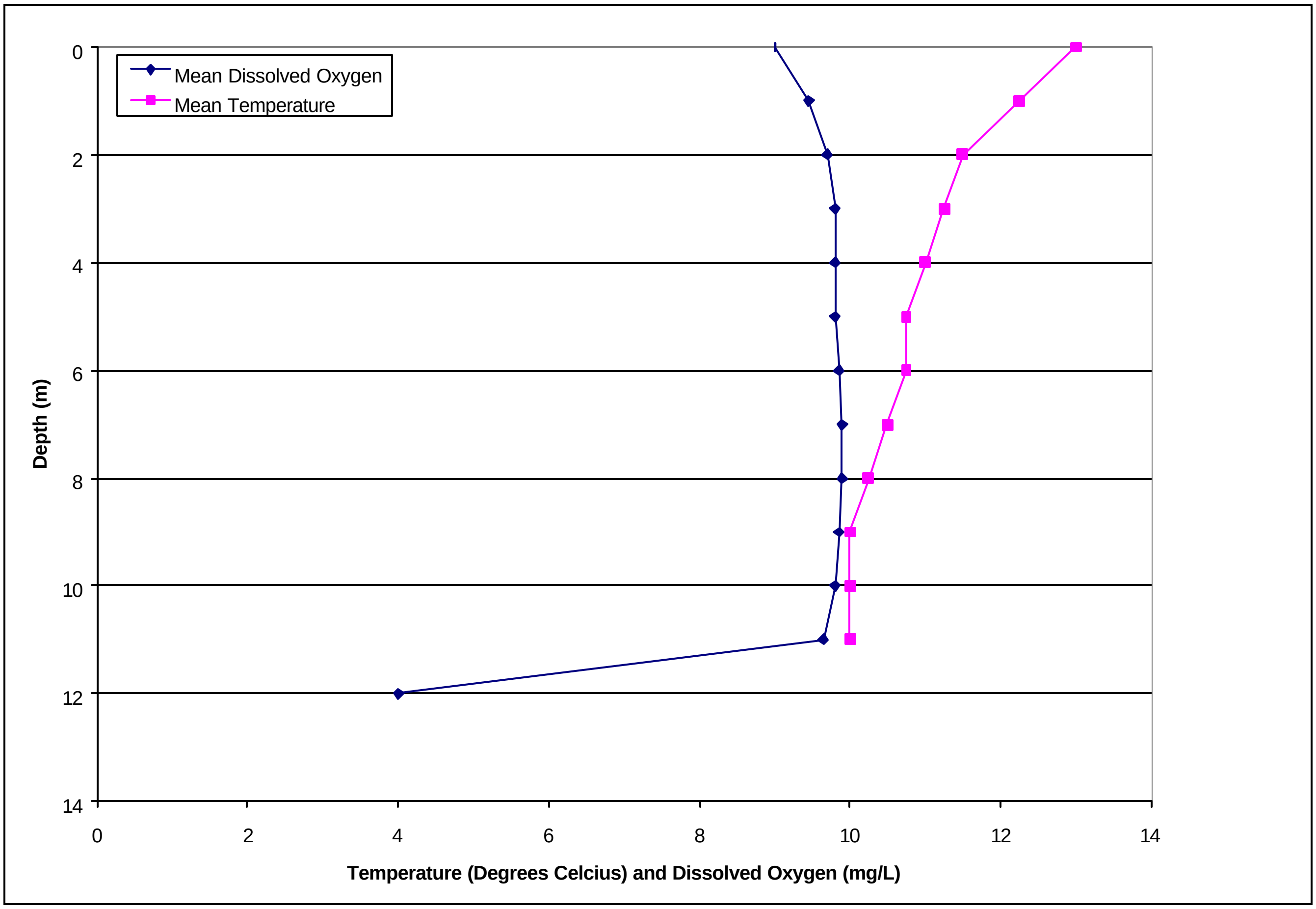

Figure 4.7 Dissolved oxygen and temperature profiles of Lapie Lake taken on 21 July 2000.

There are two fundamental types of lakes to consider when assessing lake productivity, eutrophic (nutrient rich) and oligotrophic (nutrient poor). Features of the study lake, such as low levels of phosphorous and nitrogen (Table 4.2) and the relatively high Secchi reading suggest the study lake is oligotrophic.

An inductively coupled plasma (ICP) analysis of the surface water sample was carried out to assess metals concentrations in the lake (Table 4.3). Of the 35 elements analyzed for in the ICP scan, 25 were at concentrates below detection limits. Of the remaining elements only calcium and copper were above currently listed criteria for the protection of aquatic life. As there are no anthropogenic effluent sources in this watershed, these levels are likely the result of natural sources (i.e., weathering of rock or thermal seeps).

The elevated levels of copper have the potential to be chronically toxic to invertebrates and fish; however, extrapolating the effects of exposure to copper under laboratory conditions to natural system is difficult due to the number of ameliorating effects that can occur in natural systems to reduce copper toxicity. For example, toxicity decreases in the presence of humic acids and suspended solids, while the toxicity increases as water hardness decreases (CCME 1996).

Copper concentrations ranging from 1 to 8000 μg/L are known to inhibit the growth of plankton (CCME 1996). Therefore, the elevated levels of copper detected in Lapie Lake surface water may affect the overall productivity of the lake by reducing the phytoplankton productivity.

Table 4.3 Summary of metals in surface water sample from Lapie Lake 21 July 2000.

Element	Detection Limit (mg/L)	Concentration (mg/L)	Guidelines for Aquatic Life (mg/L)
Aluminum	0.01	<0.01	0.1[a]
Antimony	0.02	<0.02	0.05[b]
Arsenic	0.02	<0.02	0.05[a]
Barium	0.0005	0.0428	1.0[b]
Beryllium	0.0002	<0.0002	0.0053[b]
Bismuth	0.02	<0.02	--
Cadmium	0.0005	<0.0005	0.0008[a]
Calcium	0.01	45.3	<4[b]
Chromium	0.001	<0.001	0.02[a]
Cobalt	0.001	<0.001	0.005[b]
Copper	0.002	0.004	0.002[a]
Iron	0.003	<0.003	0.3[a]
Lead	0.005	<0.005	0.002[a]
Lithium	0.002	0.003	--
Magnesium	0.01	13.7	--
Manganese	0.0005	<0.0005	0.1-1.0[b]
Mercury	0.0001	<0.0001	0.0001[a]
Molybdenum	0.005	<0.005	<1.0[b]
Nickel	0.002	<0.002	0.065[a]
Phosphorus	0.06	<0.06	0.005-0.015[b]
Potassium	0.2	0.5	--
Selenium	0.002	<0.002	0.001[a]
Silicon	0.05	1.35	--
Silver	0.001	<0.001	0.0001[a]
Sodium	0.05	0.6	--
Strontium	0.005	0.118	--
Sulfur	0.1	11.5	--
Thallium	0.003	<0.003	0.03[a]
Thorium	0.005	<0.005	--
Tin	0.005	<0.005	--
Titanium	0.001	<0.001	0.1[b]
Uranium	0.06	<0.06	0.3[b]
Vanadium	0.002	<0.002	10[b]
Zinc	0.001	<0.001	0.03[b]
Zirconium	0.001	<0.001	--

[a]CCME 1996; [b]Nagpal and Pommen 1994

4.8 Inlets and Outlets

Lapie Lake has two inlet streams and a single outlet (Figure 4.3). A third inlet stream (WSC 210-547000-06100-77800) that had been identified on the TRIM map could not be found during the field assessment. A summary of the habitat conditions in each of the tributary streams is provided in Table 4.4. More detailed information about the streams can be found in Appendix 4 and Sharples et al. (2001).

Table 4.4 Lapie Lake inlet and outlet stream summary

Watershed Code	Reach	Channel		Fisheries Habitat		
		Average Width (m)	Gradient (%)	Spawning	Rearing	Overwintering
210-547000-06100	6	n/a	n/a	n/a	n/a	n/a
210-547000-06100	8	5.62	0.5	Good	Good	Good
210-547000-06100-81700	1	1.73	3.5	Poor	Poor	Poor

The immediate outlet stream (i.e., Reach 6 of 210-547000-06100) was not surveyed due to time constraints. In addition, this reach was significantly influenced by a beaver dam, which had backwatered the reach such that the upper portion of the reach had characteristics similar to the lake.

The inlet stream of Lapie Lake (Reach 8 of 210-547000-06100) flows through a low gradient wetland area, approximately 120 m wide. This reach has been significantly influenced by beaver activity; consequently, the average channel width was fairly wide (5.62 m). Although fish were not captured in this reach, the quality and quantity of habitat for fish populations within this reach were considered to be good. There was moderate cover provided mainly by deep pools and spawning habitat for salmonids was good due to the sections of suitable pea-sized gravels within the channel. The quality of overwintering for fish populations in this reach is good due to deep residual pools, as well as overwintering opportunities available immediately downstream in Lapie Lake (Sharples et al. 2001).

Tributary 2 (210-547000-06100-81700) flows in a northerly direction into the east end of Lapie Lake. The stream had a gradient of 3.5% and an average channel width of 1.73 m. No disturbance indicators were observed, although it was noted that fish likely would not be able to access the stream beyond the first 15 m due to a 0.8 m falls created by large woody debris. Slimy sculpins were present in the first 15 m of the stream. In this stream, the overall habitat quality is poor due to low water levels. In addition, spawning habitat is considered poor, as bed materials were too large for fish to spawn in. There were also many small woody debris jumps that restricted access to the stream.

4.9 Fish Age, Size, and Life History

The following sections outline the results of the fish sampling conducted during the period of 19-21 July 2000.

4.9.1 Fish Sampling Summary

A multi-panel sinking gill net with stretched mesh size ranging from 25 to 89 mm and six baited Gee type minnow traps were set in Lapie Lake. The multi-panel sinking gill net was initially set for a 2.2-

hour period in order to assess the abundance of fish in the lake and determine if a standard overnight set would be required. A single multi-panel gill net was set later in the day and left to fish overnight, for a total soak time of 17-hours. Minnow traps were also set overnight and were in the lake for approximately 19 to 22 hours. Refer to the comments section of the FDIS Lake Survey summary and the individual fish collection form summary in Appendix 1 and 3 of this report for detailed information on fish collection methods, sampling times and individual fish data.

Table 4.5 Summary of fish sampling efforts in Lapie Lake

Site No.	Method	Set		Pulled		Species Captured[1]
		Date	Time	Date	Time	
Site 1	Gill Net #1	July 20	12:20	July 20	14:30	BT, LT
Site 2	Gill Net #2	July 20	16:30	July 21	09:30	LT
Site 3	Minnow Trap	July 19	11:50	July 20	13:05	CCG
Site 3	Minnow Trap	July 19	11:50	July 20	13:05	CCG
Site 4	Minnow Trap	July 20	16:30	July 21	13:10	NFC
Site 5	Minnow Trap	July 20	16:40	July 21	13:20	CCG
Site 6	Minnow Trap	July 20	16:45	July 21	13:30	NFC
Site 7	Minnow Trap	July 20	16:45	July 21	13:40	LT, CCG

[1]LT=lake trout; BT= bull trout; CCG= slimy sculpins; NFC = no fish captured

Sampling efforts conducted within Lapie Lake in July 2000 revealed the presence of three fish species in Lapie Lake. Lake trout accounted for approximately 99 % of the total catch in both gill net sets. A total of 143 lake trout, eight slimy sculpin, and a single bull trout were captured (Tables 4.5 and 4.6).

Table 4.6 Summary of fish captured in Lapie Lake, July 2000

Species[1]	# Fish Captured and Capture Method			# of Fish Sampled	# of Fish Preserved	Range of Fork Lengths (mm)
	Gill Net	Minnow Traps	Total			
LT	141	2	143	143	0	89-402
BT	1	0	1	1	0	320
CCG	0	8	8	8	0	48-62
Totals	**142**	**10**	**152**	**152**	**0**	

[1]LT= lake trout; CCG=slimy sculpin; BT= bull trout

The stream survey crews did not capture or observe fish within the inlet stream (i.e., Reach 8 of stream 210-547000-06100). Several slimy sculpin were captured in the first 15 m of Stream 210-547000-06100-87000 (Table 4.7).

Table 4.7 Summary of fish sampling efforts in tributaries of Lapie Lake

WSC	Reach #	Site #	Inlet / Outlet	Length Surveyed (m)	Stream Order	Species Captured[1]
210-547000-06100	8	1	inlet	150	2	NFC
210-547000-06100-81700	1	1	inlet	100	1	CCG

[1]CCG= slimy sculpin; NFC = no fish captured

4.9.2 Individual Fish Data Results

The lake trout captured in Lapie Lake had fork lengths ranging from 89- 402 mm, with an average fork of 311 mm (Figure 4.8). The single bull trout captured was 320 mm in length and the slimy sculpin captured ranged in size from 48-62 mm (total length).

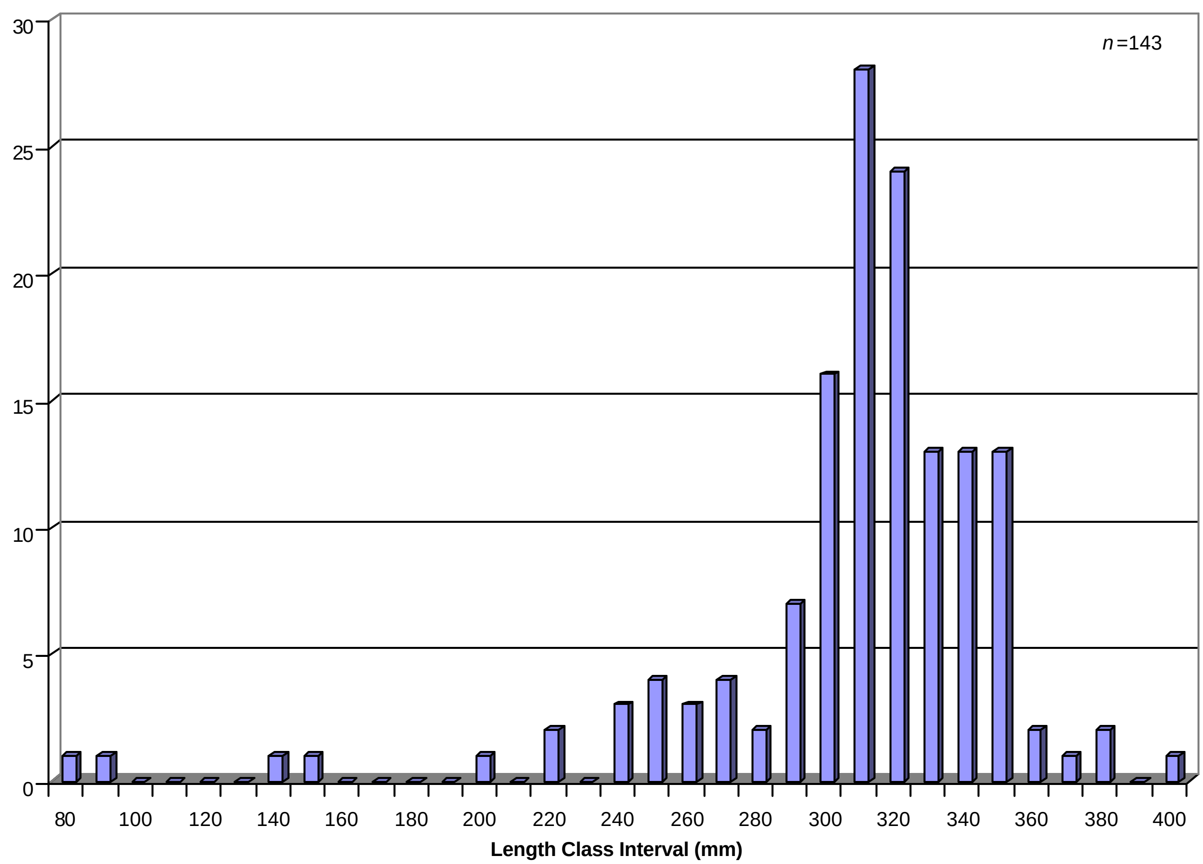

Figure 4.8 Lake trout length frequency histogram for Lapie Lake, July 2000

Weight of the lake trout ranged from 35 to 780 g (average weight was 349 grams). The relationship between fork length and body weight is useful in assessing the well-being of the population. The Fulton-type condition factor index (K) is defined as:

$$K = (Wx10^5 \div L^3)$$

where W = weight in grams and L = fork length in mm and 10^5 is the metric scaling factor used to bring the index closer to 1.0 (Anderson and Gutreuter 1983). A K value of less than 1.0 indicates a "skinnier: fish, whereas a K value greater than 1.0 indicates fish are "plump, "The average Fulton-type condition factor or factor (K) was calculated at 1.09 for lake trout in Lapie Lake, which would suggest that the lake trout population in Lapie Lake were feeding reasonably well.

Overall, the lake trout appeared healthy, and only a few had visible parasites. Examination of stomach contents of the lake trout revealed a mixture of small invertebrates, insect larvae, snails and shrimp. One lake trout had a sculpin among its stomach contents and another had rocks in its stomach.

Ages of the lake trout captured during the sampling of Lapie Lake ranged from Age 1+ to Age 15+ (Table 4.8). As indicated by the size range for each of the age classes shown in Table 4.8, there is considerable overlap in ages and size after fish reach the Age 5+ class. In comparison to length at age data for other lake trout populations, the data from Lapie Lake suggests that the lake trout are growing very slowly. For example, a 10+ lake trout in Great Slave Lake would have a fork length of 582 mm (Scott and Crossman 1973), almost double that of 10+ lake trout from Lapie Lake.

Table 4.8 Summary of fish age and growth data for Lapie Lake and tributary streams.

Waterbody Name	WSC	Species[1] Captured	Age Class	# of Fish Captured	Mean Length (mm)	Range of Lengths (mm)
Lapie Lake	210-547000-06100	CCG		6	53.5	48-62
Lapie Lake	210-547000-06100	BT	5+	1	320	320
Lapie Lake	210-547000-06100	LT	1+	2	89.50	89-90
			2+	--	--	--
			3+	2	152.00	148-156
			4+	1	202.00	202
			5+	9	247.89	223-271
			6+	5	296.20	247-345
			7+	8	314.00	293-339
			8+	9	305.56	295-316
			9+	14	314.93	302-340
			10+	8	317.50	310-330
			11+	13	330.77	310-355
			12+	7	349.57	300-380
			13+	9	345.67	330-355
			14+	2	369.00	354-384
			15+	1	351	351
Unnamed Tributary to Lapie Lake	210-547000-06100-81700	CCG		2	50	48-52

[1]BT = bull trout; LT = lake trout; CCG = slimy sculpin,

Normally a distribution of all age classes and sample sizes would be expected in the catch; however, the older age classes (e.g., greater than Age 9+) dominated the catch in Lapie Lake. The lack of the younger age classes may be an artifact of the sampling techniques employed (i.e., only two gill net sets) and the relatively small size of the lake trout. The two Age 1+ individuals were captured in a minnow trap, placed in the small woody debris adjacent to a beaver lodge. A sampling effort that is more intensive than permitted during a reconnaissance inventory might have captured a greater number of the younger age classes.

4.10 Significant Features and Fisheries Observations

4.10.1 Fish and Fish Habitat

One of the most striking observations during the fish sampling was the small size of the lake trout. As noted above, the fish in Lapie Lake appear to be quite small and slow growing in comparison to other lake trout populations. The slow growth and small body size may be a factor of the diet of these fish. The stomach contents were largely insect, snails, and stones, which suggests that many of the fish were foraging off the bottom. In addition, the field crew noticed a large number of fish "rising," presumably to feed on emerging insects on the lake surface. Carl et al. (1990) noted that lake trout that feed primarily on invertebrates do not reach a large size; as the energy costs of foraging are high relative to the energy intake from this food source. Planktivorous lake trout seldom exceed 1 kg in weight. The data collected from Lapie Lake would support this observation.

Figure 4.9 presents the age and weight data for lake trout from Lapie and Long Mountain Lakes (also located in the Vents River watershed). Small fish also dominated the lake trout catch in Long Mountain Lake; however, lake trout caught in Long Mountain Lake were heavier per age class (Figure 4.7), which suggests that there is a more readily available or higher energy food source in Long Mountain Lake. In addition, at approximately 20 years of age (and 1 kg in weight), a small number of lake trout in Long Mountain Lake attain a size that enables them to switch to a more piscivorous diet. This change in diet would probably account for the increased growth rate in age-classes above 20 years. For example, by Age-26, one individual had increased its mass by seven fold over what it had taken the previous 20 years to reach.

Another explanation for the rapid growth rate for fish older than 20 years is that Long Mountain Lake has two forage species (Arctic grayling and slimy sculpin) for lake trout to utilize, whereas the availability of forage fish in Lapie Lake appears to be limited to slimy sculpin. The larger lake trout in Long Mountain Lake were noted to have consumed Arctic grayling that were 240-250 mm in length (Coombes 1985b).

The apparent lack of large fish may be a result of the relatively limited sampling effort or it may be a result of limited prey availability that would prevent lake trout from switching to a more piscivorous diet. Another consideration may be angling pressure. It was reported that Lapie Lake is subject to some fly-in fishing as there was good opportunity for fly fishing (as evidenced by the large number of fish observed to be rising during field sampling) on this lake (Mr. Urs Schildknecht, pers. comm. 2000). It is possible that fishermen could have taken the few large "lunkers", as recreational anglers will often target the larger individuals.

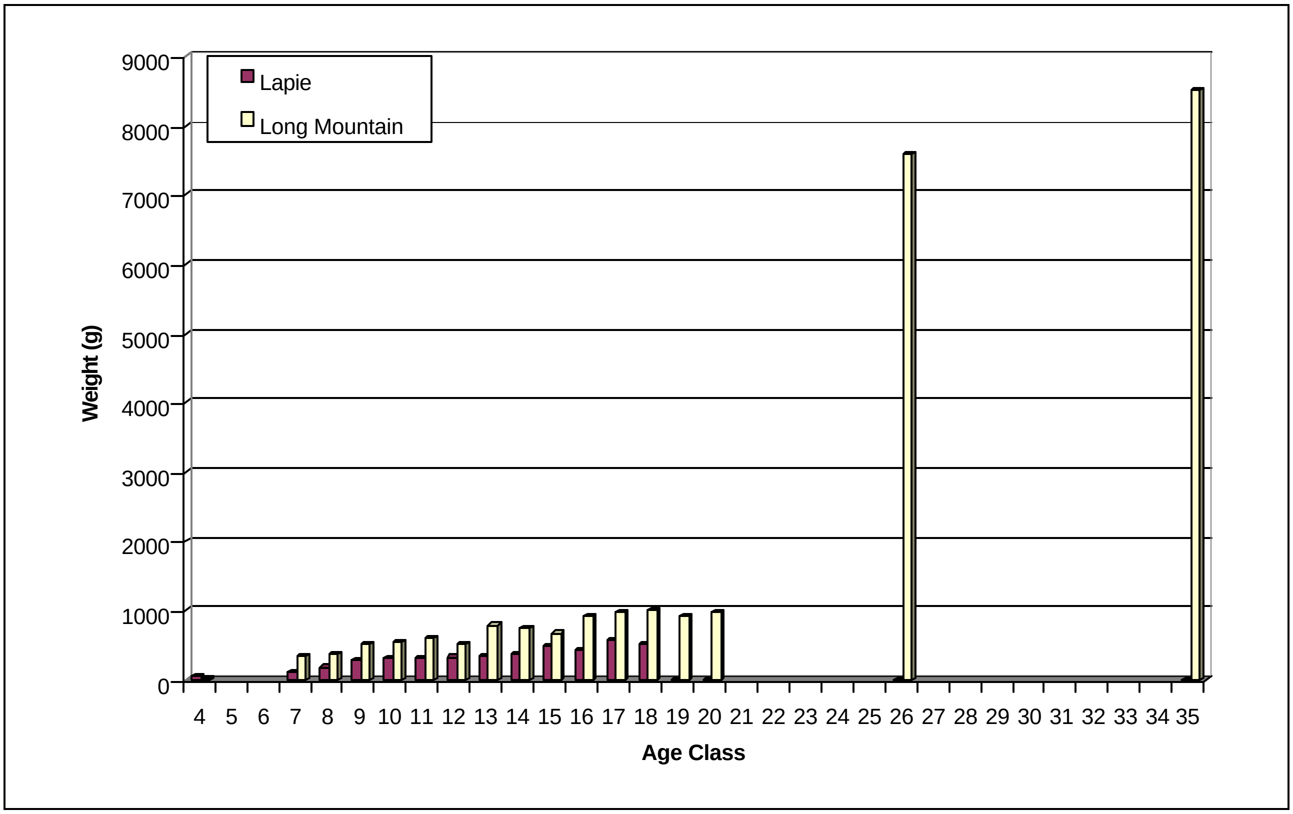

Figure 4.9 Age vs. mean weight for lake trout in Lapie and Long Mountain lakes.

This possibility, combined with the very slow growth rate and the apparent small numbers of large lake trout (as noted by Coombes 1985b) is a concern for the management of these lakes and other lake trout populations in the M-KMA. As noted in Lapie and Long Mountain Lakes (and elsewhere) lake trout are very slow growing and take many years to reach maturity. On average lake trout are not sexually mature until they are approximately 13 years of age (Scott and Crossman 1973). The large fish such as the two exceptionally large individuals noted in Long Mountain Lake would be prime breeding members of the population. If recreational anglers preferentially remove the larger fish, there is the potential to significantly affect the overall health of the population in these lakes.

4.10.2 Habitat Concerns

Evaluation of physical and chemical characteristics of the lake indicated a suitable environment exists for fish populations. For optimal survival, salmonids require DO concentrations greater than or equal to 6.5 mg/L. The dissolved oxygen concentrations were within acceptable ranges to a depth of 12 m at the time of survey; therefore not limiting useable habitat for the salmonids. Proactive measures should be taken to protect the spawning and rearing habitat identified within the inlets and outlet tributaries to insure the present quality and quantity of habitat is maintained for the small isolated lake and bull trout populations of this lake. No other habitat concerns were identified in the study area.

4.10.3 Restoration and Rehabilitation Opportunities

No potential restoration or rehabilitation opportunities were identified for Lapie Lake.

4.11 Wildlife Observations

The habitat at Lapie Lake is ideal for local ungulate populations. A bull moose (*Alces alces)* was observed near the shore of the lake. Ducks, species unknown, were observed on the lake and a bald eagle (*Haliaeetus leucocephalus)* was observed hunting on the lake. No other significant or unusual wildlife observations were noted during the survey.

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APPENDIX I

LAKE SURVEY FORM

APPENDIX II

WATER CHEMISTY RESULTS

APPENDIX III

FISH COLLECTION FORMS

APPENDIX IV

FIELD DATA INFORMATION SYSTEM REPORTS FOR TRIBUTARY STREAMS

APPENDIX V

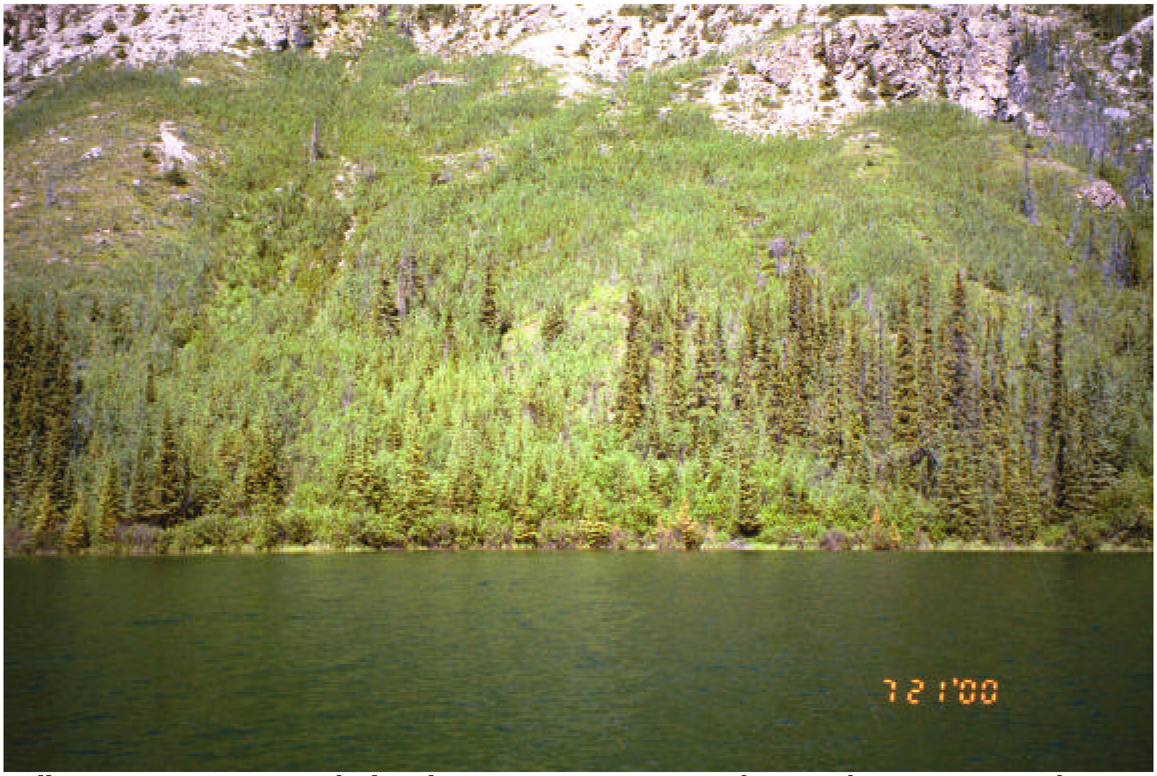
PHOTOGRAPHS

Roll 431, Frame 10. Watershed Code 210-547000-06100, Lapie Lake, Looking east.

Roll 431, Frame 14. Watershed Code 210-547000-06100, Looking north across Lapie Lake from tributary stream 210-547000-06100-81700.

Roll 431, Frame 17. Watershed Code 210-547000-06100, Looking east at inlet to Lapie Lake.

Roll 431, Frame 21. Watershed Code 210-547000-06100, Looking west towards outlet Lapie Lake.



Roll 431, Frame 22. Watershed Code 210-547000-06100, Looking north across Lapie Lake.

Roll 431, Frame 23. Watershed Code 210-547000-06100, Looking at hill side on south side of Lapie Lake.

Roll 431, Frame 24. Watershed Code 210-547000-06100, Looking at outlet of Lapie Lake.

APPENDIX VI

BATHYMETRIC MAP