

**Mackenzie Timber Supply Area
Socio-Economic Analysis**

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**Economics and Trade Branch
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**Prepared by:
Gary Bull and Jeremy Williams**

TABLE OF CONTENTS

Executive Summary.....	i
1.0 Introduction	1
1.1 Background	1
1.2 Approach	1
1.3 Report Structure	2
2.0 Profile of the Mackenzie TSA Area	3
2.1 Introduction	3
2.2 Environmental Setting	6
2.2.1 General Description of Ecoregions in the Mackenzie TSA	7
2.3 Socio-Economic Overview	11
2.3.1 Mackenzie Area	11
2.3.2 First Nations	16
3.0 Mackenzie TSA Forest Sector Overview	23
3.1 Timber Harvesting Land Base	23
3.1.1 Land Base and Timber Supply Issues	23
3.1.2 Current Management Practices	25
3.2 Current Timber Supply Situation	25
3.2.1 Overview of Major Licensees	25
3.2.2 Forest Sector Employment	30
3.3 Employment Coefficients	33
3.4 Timber Harvest Forecasts	35
3.4.1 Scenario 1	35
3.4.2 Alternative Initial Timber Harvest Forecasts	35
3.4.3 Allocation of Harvest Level Changes	36
4.0 Economic Impacts	37
4.1 Scenario 1 - Economic Impacts	37
4.1.1 TSA Employment and Income Impacts	37
4.1.2 Provincial Employment and Income Impacts	38
4.1.3 Government Revenue Impacts	39
4.2 Economic Impacts of Harvest Scenarios 2 and 3	41
4.2.1 Employment and Income Impacts of Scenarios 2 and 3	41
4.2.2 Government Revenue Impacts of Scenarios 2 and 3	44
5.0 Social and Environmental Implications	45
5.1 Implications for Communities	45
5.1.1 Employment Implications	45
5.1.2 Effects of Job Loss on Workers and their Families	45
5.1.3 Employee Transition during Job Loss	46
5.1.4 Effects on Community	47
5.1.5 Opportunities for Mitigation	47
5.2 Implications for the First Nations Communities	48

5.2.1 Timber Supply Reductions	48
5.2.2 Employment Effects	48
5.2.3 Band Interests in Protection of Territory	49
5.3 Environmental Implications	49
6.0 Summary and Conclusions	51
6.1 Summary	51
6.1.1 Harvest Level Forecast	51
6.1.2 Economic Impacts	51
6.1.3 Social and Environmental Implications	52
6.2 Concluding Remarks	53
Bibliography	55
Appendix 1. Mackenzie TSA Red and Blue List Species	57
Appendix 2. Glossary of Terms	59
Appendix 3. List of Contacts	63
Appendix 4. Economic Impact Methodology	65
Appendix 5. Incremental Economic Impacts of the Mackenzie TSA Timber Harvest Forecasts ..	70

List of Tables

Table E1: Mackenzie TSA Current AAC Apportionment	iii
Table E2: Economic and Community Impacts of the Mackenzie TSA Harvest Scenarios	v
Table 2.1: Mackenzie TSA Land Area by Ownership and Type	3
Table 2.2: Overview of First Nation Band Organization Within Mackenzie TSA	5
Table 2.3: Mackenzie Population by Age Group, 1991	11
Table 2.4: Education Levels of Workforce	13
Table 2.5: General Employment Statistics by Gender	13
Table 2.6: Average Income by Gender and Age Class	14
Table 2.7: Mackenzie TSA Basic Sector Dependence	15
Table 2.8: Selected characteristics of the Fort Ware Band	18
Table 2.9: Selected Characteristics of the McLeod Lake Band	20
Table 2.10: Selected Characteristics of the Takla Lake Band	21
Table 3.1: Mackenzie TSA Land Base	24
Table 3.2: Mackenzie TSA AAC Apportionment	26
Table 3.3: Total Volume of Wood Harvested in Mackenzie TSA	26

Table 3.4: AAC Apportionment and Harvest Volume by Type of Licence.....	27
Table 3.5: Total Number of TSA and Provincial Employees Who Work in the Mackenzie TSA, by Employer/Contractor.....	31
Table 3.6: Mackenzie TSA Silvicultural Workforce	33
Table 3.7: Mackenzie TSA Employment Coefficients	34
Table 4.1: TSA Employment and Income Impacts of Scenario 1	38
Table 4.2: Provincial Employment and Income Impacts of Scenario 1	39
Table 4.3: Average Stumpage Fees Paid in Mackenzie TSA (1990-94)	40
Table 4.4: Scenario 1 Annual Provincial Forestry Revenue Impacts (\$ millions)	40
Table 4.5: Estimated Annual Federal Forestry Revenue Impacts under Scenario 1 (\$ millions) ...	41
Table 4.6: TSA Employment and Income Impacts of Scenario 2	42
Table 4.7: Provincial Employment and Income Impacts of Scenario 2	42
Table 4.8: TSA Employment and Income Impacts of Scenario 3	43
Table 4.9: Provincial Employment and Income Impacts of Scenario 3	43
Table 4.10 Scenario 2 Total Provincial and Federal Government Revenues (\$millions)	44
Table 4.11 Scenario 3 Total Provincial and Federal Government Revenues (\$millions)	44
Table A4.1 Mackenzie TSA Direct, Indirect and Induced Employment Coefficients.....	66
Table A4.2 Average After -tax Employment Income Levels by Sector	67
Table A4.3 Government Revenues by Volume of Timber Harvested	69

List of Figures

Figure E1 Mackenzie TSA Harvest Forecasts.....	iv
Figure 2.1 Mackenzie Timber Supply Area	4
Figure 3.1 Mackenzie TSA Harvest Forecasts	36

Executive Summary

The Socio-Economic Analysis of the Mackenzie Timber Supply Area (TSA) is one of four reports prepared as part of the Timber Supply Review process and Allowable Annual Cut (AAC) determination. The purpose of this analysis is to illustrate the social and economic impacts of timber harvest decisions, which might result from the Timber Supply Review, and to generate public comment.

Current Socio-Economic Profile

The Mackenzie TSA is located in the north-eastern interior section of British Columbia (See Figure 2.1). Mackenzie is one of six TSAs within the Prince George Forest Region and is one of the largest TSAs in the province, covering roughly 6 130 604 ha., of which 6 097 386 ha. is Crown land.

In 1991, the population of the Mackenzie Forest District was 6200 with the majority living in the municipality of Mackenzie.

Two First Nations communities are located within the TSA. Fort Ware and Tsay Keh Dene are remote communities located near the north end of Williston Lake. The community of McLeod Lake is located just south of the Mackenzie TSA boundary along Highway 97 between Mackenzie and Prince George. Takla Landing is a remote First Nations community located on the shore of Takla Lake in the adjacent Fort St. James Forest District to the west. All of these First Nations claim traditional territories within the Mackenzie TSA and have strong economic and social interests within the area.

The economy of the Mackenzie TSA is overwhelmingly dominated by forestry. Over 70% of the region's employment is either directly or indirectly dependent on the harvesting and milling of wood products. The second largest economic sector of the area is the Public Sector with 14% of total employment, followed by tourism at about 4%, and agriculture at 2%, mining and mineral processing at 1%, and employment related to transfer payments and pension income at 3%.

The two major forest licensees are Fletcher Challenge Canada Ltd., and Finlay Forest Industries Inc. (recently purchased by Slocan Forest Products Ltd. and Donohue Inc.). Fletcher Challenge operates two sawmills and a pulpmill while Finlay operates two sawmills and a pulp and newsprint mill.

In 1994, direct forestry employment related to harvesting, silviculture and processing in the TSA was over 2650 person years (PYs)¹. This employment can be split into Mackenzie TSA fibre related and non-TSA fibre related. Approximately 95% of the timber harvested in the TSA was processed by local mills. This volume comprised about 88% of the mills' total throughput. Direct employment related to only Mackenzie TSA timber, chips and residents of the TSA accounted for over 1700 of the 2650 PYs. A further 130 PYs are supported by timber shipped from the TSA for processing in Prince George mills.

In 1994, timber harvesting generated approximately \$60.4 million in stumpage revenues. This value is based on a Mackenzie TSA specific stumpage rate of \$20.44 per cubic metre of timber cut. This value reflects the increases in stumpage rates introduced in 1994.

Environmental Setting

The Mackenzie TSA is one of the largest in the province, covering an area of approximately 6.1 million hectares. It is located entirely within the Arctic watershed of the Peace River. Williston Reservoir, covering approximately 1.5 million hectares, is the dominant geographic feature of the area. The Rocky Mountain Trench runs north-south through the centre of the TSA. The rugged Rocky Mountains border the trench along the eastern side. The more rounded Omineca Mountains are found along the western side of the trench.

The climate is continental sub-arctic; cold winter weather is the dominant feature. Daily average temperatures are below freezing for half of the year and three quarters of the annual precipitation falls as snow.

Current TSA Profile

The Mackenzie TSA is some 6 130 604 ha in size, of which approximately 18% is currently considered available for timber harvesting (see Table 3.1).

Spruce, lodgepole pine and balsam (sub-alpine fir) predominate in the TSA. The AAC is constituted solely of coniferous species. Deciduous species such as aspen and birch are present in the TSA, but virtually no volume has been utilised; however, recently there have been expressions of interest.

The current allowable annual cut (AAC) for the TSA is 2 951 121 m³. The AAC has been at this level since 1989. The current apportionment is outlined in Table A1.

¹ A person-year is a measure of employment indicating one full-time job. All part-time and seasonal jobs are translated into PYs; for example, two half-time jobs are considered one PY. Jobs are converted into PYs for proper comparison and use of multipliers.

TABLE E1: MACKENZIE TSA CURRENT AAC APPORTIONMENT

	Apportionment (cubic metres)	Percent of AAC
Forest Licences		
• Fletcher Challenge Canada Ltd.	1 486 863	50.4
• Finlay Forest Industries Inc.	1 174 342	39.8
Total Forest Licences	2 661 205	90.2
Timber Sale Licences >10 000m3	0	0.0
Small Business Forest Enterprise Program		
• Section 16	0	0.0
• Section 16.1 Bid Proposals	183 597	6.2
Total SBFEP	183 597	6.2
Forest Service Reserve	29 511	1.0
Woodlot Licences	20 000	0.7
Forest Licences, non-replaceable	56 808	1.9
Allowable Annual Cut (apportioned)	2 951 121	100.0

Timber Harvest Forecasts

Three harvest forecasts were selected from the Mackenzie TSA Timber Supply Analysis report (TSAR) to provide a basis on which to present potential impacts related to changing harvest levels. Scenario 1 corresponds to the base harvest forecast in the TSAR. Scenarios 2 and 3 have different initial harvest rates, but are modelled under the same current management assumptions as the base harvest forecast. Note that these scenarios are not recommendations, or preferred options, but provide a basis for discussion of potential implications.

Scenario 1

Scenario 1 (the base case harvest forecast in the Mackenzie TSA Timber Supply Analysis report), begins with the continuation of the harvest level at 2 951 121 m3 per year for three decades. In the fourth decade, the harvest level is reduced to 2 796 000 m3 per year and in the fifth to the tenth decade to 2 640 000 m3 per year. The harvest level would then rebound to 2 810 000 m3 per year for the next 200 years. This is in effect the long-term harvest level (LTHL). The LTHL represents a five percent decline over current harvest levels.

Scenario 2

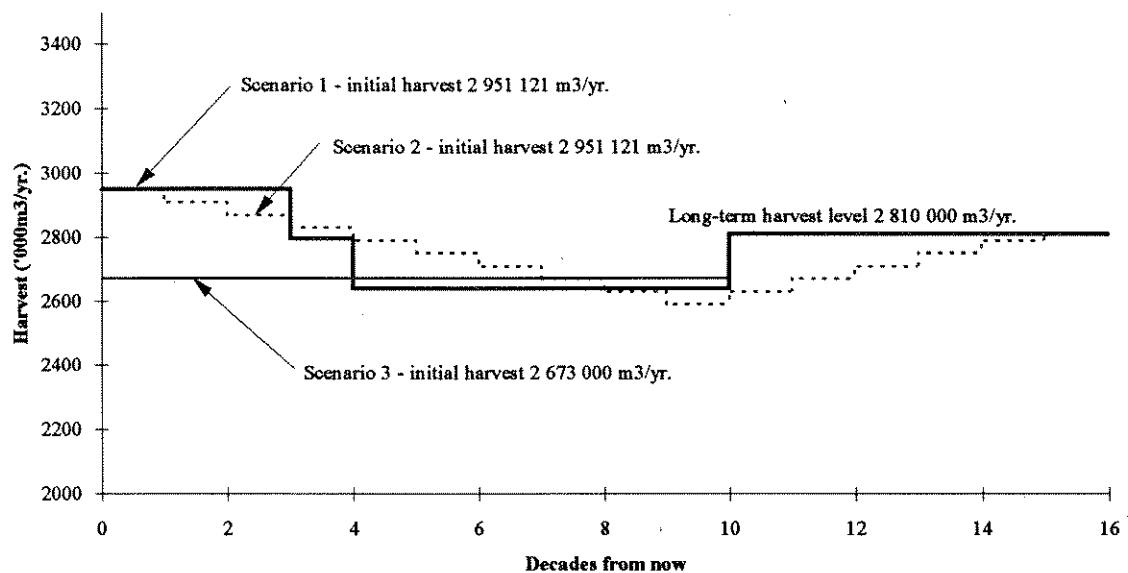
To spread the harvest reduction more evenly, Scenario 2 would reduce the annual harvest by 40 000 m3 in each of the second through tenth decades. Then it would increase at the same rate from the eleventh to sixteenth decades, at which time the LTHL would be reached. The

emphasis is on spreading the change over a long time period, thereby minimizing the socio-economic impacts in any one period.

Scenario 3

This scenario suggests an immediate reduction in the harvest of 278 121 cubic metres, or 9%, to 2 673 000 cubic metres per year. The harvest level would then increase in Decade 11 to the LTHL of 2 810 000 cubic metres per year.

FIGURE E1: MACKENZIE TSA HARVEST FORECASTS



The socio-economic impacts of these scenarios are summarized in the following table.

TABLE E2: ECONOMIC AND COMMUNITY IMPACTS OF THE MACKENZIE TSA HARVEST SCENARIOS.

	Scenario 1			Scenario 2		Scenario 3
	Decades 1-3	Decades 4-5	Decade 11	Decade 1	Decade 2	Decade 1
Change in Harvest (m³)	0	-311 121 (-11%)	+170 000 (+6%)	0	-40 000 (-1%)	-278 121 (-9%)
TSA Level Economic Impacts						
Direct Forestry Employment (PYs)	0	-182	+99	0	-25	-163
Total Forest Employment		-256	+138		-37	-229
Direct Forestry Income (\$millions)		-6.2	+3.4		-0.8	-5.5
Total Forestry Income		-7.7	+4.2		-1.0	-6.8
Provincial Level Economic Impacts						
Direct Forestry Employment (PYs)	0	-277	+150	0	-39	-248
Total Forestry Employment		-692	+374		-98	-619
Direct Forestry Income (\$ millions)		-9.2	+5.2		-1.4	-8.6
Total Forestry Income		-18.3	+9.9		-2.6	-16.3
Government Revenues (\$millions)						
Provincial Revenues	0	-7.61	+4.15	0	-1.03	-6.8
Federal Revenues		-6.16	+3.35		0.84	-5.5
Community Impacts						
Scenario 1	Employment stability for the first three decades, given the continuation of current forestry/employment relationships. Scenario 1 would allow groups ample time to prepare for potential community and individual stresses.					
Scenario 2	Would provide a stable harvest for the first decade prior to reductions beginning in Decade 2. Employment would decline just over 1.3% in Decade 2.					
Scenario 3	Immediate job impacts lowering TSA related PYs by 9%. Would create individual and community stresses. Little time to plan for community impacts. Would provide stability beyond initial declines.					

1.0 Introduction

1.1 Background

The British Columbia Forest Service is presently conducting a provincial timber supply review to assist the Chief Forester in determining the allowable annual cut (AAC) levels. The review examines the amount of timber available for harvesting in Timber Supply Areas (TSAs) if current management practices continue. Four documents are being prepared for each TSA assessment. Two technical documents, a Timber Supply Analysis and a Socio-Economic Analysis, provide information on timber supply, and the social, environmental, and economic implications of changing timber harvest levels. A Discussion Paper summarises the technical information and provides a focus for public discussion of issues surrounding timber harvest levels. A fourth report describes the rationale behind the Chief Forester's AAC decision.

This report, the Mackenzie TSA Socio-Economic Analysis, describes the economy, physical environment, and land use issues within the Mackenzie TSA, and the socio-economic and environmental implications of changing the current Mackenzie TSA timber harvest level.

1.2 Approach

The Socio-Economic Analysis is based on information in the Mackenzie TSA Timber Supply Analysis report (TSAR)². The timber supply analysis focuses on the base timber harvesting forecast³ developed by the Timber Supply Branch of the Ministry of Forests. Two other harvest forecasts are examined, but discussion of their social, economic and environmental implications is limited to the short-term. This report, therefore, demonstrates a range of implications associated with different harvest levels. Note that the timber harvesting forecasts discussed in this study are not meant to suggest a preferred AAC level, nor will they be the only options considered in the final AAC determination.

The report follows a multiple accounts approach, which focuses on a range of values derived from the forest ecosystem, and recognises the need to consider a variety of factors when examining options for forest land management. The objective of multiple accounts analysis is to present the implications of alternatives in terms of these factors.

² Mackenzie TSA Timber Supply Analysis, BC Ministry of Forests, 1995.

³ A timber harvest forecast is a measure of the maximum timber supply that can be realised, over time, from a specified land base under a set of management assumptions. It is produced using forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions. The base timber harvest forecast represents the flow of potential timber harvests that best meets the following criteria: (a) begins as close to the current AAC as possible, and (b) declines/increases to the long-term harvest level (LTHL) at a gradual rate of change.

The report organizes the effects of changing timber harvest levels into five categories, two of which are quantitative in nature (economic), while the other three are discussed in qualitative terms (social, First Nations, and environmental).

Economic Impacts include the following:

1. *Employment* identifies direct and indirect/induced effects on employment and employment income over the short- and long-term, and the direct effect on employment and employment income outside the TSA.
2. *Government revenues* identify impacts on government revenues derived from the timber resource.

Social and Environmental Implications include the following:

3. *Community* discusses possible effects on local residents/families who lose their jobs and pressures they may place on the existing social services infrastructure. Local community adaptive capacity, and opportunities for mitigation are also discussed.
4. *First Nations* identifies and discusses potential areas of conflict with aboriginal cultural values and political aspirations.
5. *Environment* discusses possible implications for the forest ecosystem.

Another objective of the report is to provide an overview of the entire TSA: to describe the environmental and socio-economic setting, and highlight some of the environmental, community and First Nations concerns and issues with respect to current forest management practices. A Land and Resource Management Plan (LRMP) process is likely to begin in the near future. This process will examine land use alternatives and resource management practices for the entire TSA. This socio-economic report can serve as a useful starting point for the LRMP process, including providing a methodological and empirical reference for future socio-economic analysis. Information presented in this report was collected over a four month period and involved discussions with a broad cross-section of individuals and organizations (see Appendix 3).

1.3 Report Structure

The report is organized into six Chapters. Chapter two describes the environment, communities, and economy of the TSA. Chapter three narrows the report's focus to the forestry sector within the Mackenzie TSA. It reviews the timber harvesting land base and initiatives that may affect the land base, identifies the level of employment associated with the current AAC level, and describes the timber harvesting forecasts against which the current situation is compared. Chapters four and five examine economic, social, and environmental implications of the timber harvesting forecasts. Chapter six is a summary and conclusion. Appendices are a table of red and blue list species, glossary, list of contacts, and methodology.

2.0 Profile of the Mackenzie TSA Area

2.1 Introduction

The Mackenzie TSA is located in the north-eastern interior section of British Columbia (see Figure 2.1). Mackenzie is one of six TSAs within the Prince George Forest Region and is one of the largest TSAs in the province, covering roughly 6 130 604 ha., of which 6 097 386 ha. is Crown land (see Table 2.1).

One of the most prominent geographical features in the TSA is Williston Lake, a narrow, 360-km long lake created in the 1960s to serve as the reservoir of the W.A.C. Bennett Dam on the Peace River. The lake serves as a major access route to the interior of the TSA and is used to transport logs to the mills in Mackenzie.

The land in the TSA is hilly to mountainous with the main spine of the Rockies passing through the TSA to the east of Williston Lake. The Omineca Mountains rise to the west, and the town of Mackenzie, and Williston Lake, lie in the Rocky Mountain Trench. The forests are comprised largely of mixed stands, with Englemann spruce, white spruce, sub-alpine fir, and lodgepole pine being the major tree species.

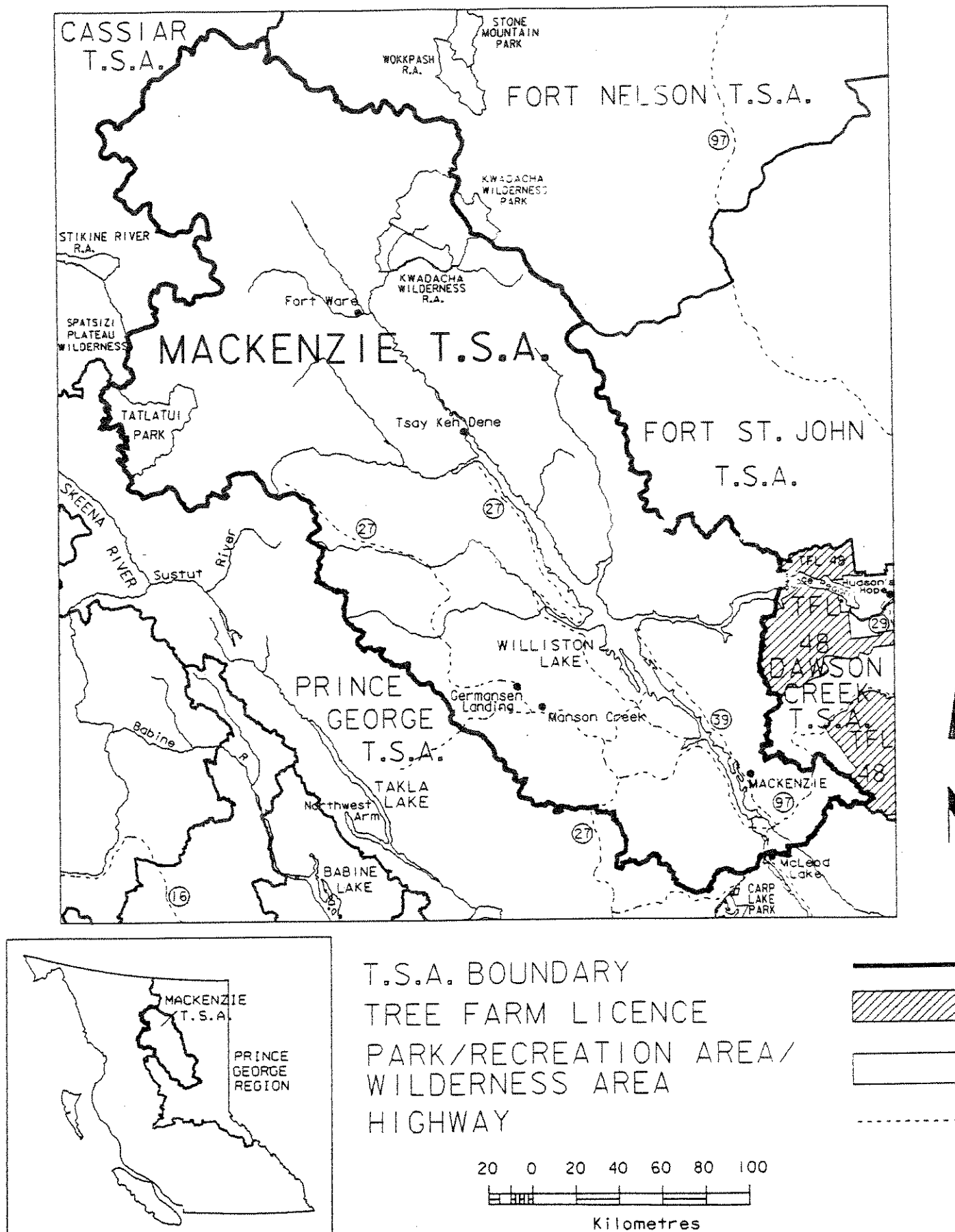
The town of Mackenzie, which also came into being during the 1960s, is the largest population centre in the TSA. It is located some 30 km north of Highway 97 (John Hart Highway), at the south end of the TSA. The other communities within the TSA are very small. Road access extends along both sides of Williston Lake to the vicinity of Fort Ware. The northern third of the TSA is currently without road access.

Table 2.1 shows the land distribution by ownership and type found in the TSA.

TABLE 2.1: MACKENZIE TSA LAND AREA BY OWNERSHIP AND TYPE

Land Use Category	Land Area (ha)	Crown Land by Type (ha)	% of Total
· Crown Land	6 097 386		99.5
Non-Forested Land		3 043 001	49.6
Forest Land		3 054 385	49.8
· Private and Other Allocated Land	33 218		0.5
Total	6 130 604		100.0

FIGURE 2.1 MACKENZIE TIMBER SUPPLY AREA



Two First Nations communities are located within the TSA. Fort Ware and Tsay Keh Dene are remote communities located near the north end of Williston Lake. The community of McLeod Lake is located just south of the Mackenzie TSA boundary along Highway 97 between Mackenzie and Prince George. Takla Landing is a remote First Nations community located on the shores of Takla Lake in the adjacent Fort St. James Forest District to the west. All of these First Nations claim traditional territories within the Mackenzie TSA, where they have both economic and social interests. Table 2.2 shows the bands, their affiliated Tribal Council, and the linguistic group to which each belongs.

The Kaska Dene and Carrier-Sekani Tribal Councils and the Tsay Keh Dene have all filed letters of intent to enter into treaty negotiations under the BC Treaty Commission. The areas involved cover a large portion of the Mackenzie TSA. The McLeod Lake Band is negotiating with the provincial and federal governments to adhere to Treaty 8. The negotiations are identifying specific parcels of land within the Mackenzie and adjoining TSAs based on the provisions of this historic treaty. It is not clear how or when these negotiations will be concluded. In the interim, provincial government policies call for consultation and involvement of First Nations communities in forest management and its economic opportunities.

**TABLE 2.2. OVERVIEW OF FIRST NATION BAND ORGANIZATION
WITHIN MACKENZIE TSA**

Band	Tribal Council	Linguistic Group
Fort Ware	Kaska Dene	Sekani
Tsay Keh Dene	Independent	Sekani
McLeod Lake	Independent	Sekani
Takla Lake	Carrier-Sekani	Carrier

The economy of the Mackenzie area is based almost exclusively on the timber industry. Both Finlay Forest Industries Inc. (recently purchased by Slocan Forest Products Ltd. and Donohue Inc.), and Fletcher Challenge Canada Ltd. have processing complexes with sawmills and each company has a pulpmill. Through Slocan and Donohue, Finlay is now converting the refiner groundwood pulpmill to a thermomechanical pulpmill (TMP). The workforce in these mills is unionised and obtains a high income. There are also several re-manufacturing plants associated with the mills. Ospika Lathe, M&T, and East Fraser have been operating for some time; Analog Wood Products is under construction. Logging and silvicultural work is done by independent contractors and it is here that the First Nations have been most closely associated with the non-native economic sector. It is also noteworthy that no mines are presently in operation in the TSA, although several deposits of lead, zinc, silver, and gold have been discovered surrounding Williston Lake.

Mackenzie is roughly 193 km from Prince George, which is the regional centre. Prince George has been expanding rapidly and has begun to siphon-off an increasing share of business services from Mackenzie. Prince George's principle advantages are lower prices as a result of a larger customer base and reduced transportation costs, and a wider selection and greater availability of goods and services. Thus, local businesses in Mackenzie have a difficult time competing because of the town's remote location and relatively small population.

The following sections of this chapter outline the environmental setting of the TSA and provide a profile of the TSA population, communities, and economy.

2.2 Environmental Setting

The Mackenzie TSA is located entirely within the Arctic watershed of the Peace River. Williston Reservoir, covering approximately 1.5 million hectares, is the dominant geographic feature of the area. The Rocky Mountain Trench runs north-south through the centre of the TSA. The rugged Rocky Mountains border the trench along the eastern side, while the more rounded Omineca Mountains are found along the western side of the trench.

The climate is Continental-Temperate or Sub-Boreal; cold winter weather is the dominant feature. Daily average temperatures are below freezing for half of the year and three quarters of the annual precipitation falls as snow.

The land base in the Mackenzie TSA can be described using two classification systems: the eco-classification system and biogeoclimatic zones. At the TSA level, ecosections best describe land characteristics based on minor physiographic, climatic, and oceanographic differences. At different elevations of these ecosections, biogeoclimatic zones of different climate, vegetation, soils, and wildlife are present. These zones often straddle ecosection boundaries, thus the same biogeoclimatic conditions can appear in more than one ecosection.

Five biogeoclimatic zones are represented in the TSA: Alpine Tundra (33%), Boreal White and Black Spruce (24%), Engelmann Spruce-Subalpine Fir (18%), Sub-Boreal Spruce (12%), and Spruce-Willow-Birch (11%). Large lakes cover the remaining area of the TSA (more than 2%). The total harvesting land base (after netting out 1 893 803 hectares of lands for various reductions - such as inoperability, environmental sensitivity, wildlife habitats, etc. - see table 3.1) is estimated at 1.1 million hectares (representing 17.9% of the total land base or 36% of the productive Crown forest land base 3.1 million hectares).

A list of the red- and blue-list species⁴ of birds, fish, animals and plants is in Appendix 1.

⁴ Red-list species are recognized as threatened or endangered throughout all or a significant portion of their range in B.C., or are considered as potential designates for such status. Blue-list species have been regionally identified as sensitive or vulnerable species, i.e., species that are not threatened but are particularly at risk of such status.

2.2.1. General Description of Ecosections in the Mackenzie TSA⁵

The Mackenzie TSA is comprised of fifteen ecosections according to the Ecoregion Classification of British Columbia. Ecosections which comprise individually more than five percent of the total land base include: (1) Cassiar Ranges, (2) Eastern Muskwa Ranges, (3) Manson Plateau, (4) Missinchinka Ranges, (5) Parsnip Trench, (6) Southern Boreal Plateau, (7) Southern Omineca Mountains, and (8) Western Muskwa Ranges. The remaining ecosections, which are relatively small within the TSA and collectively comprise less than twelve percent of the total land base, include Babine Upland, Eastern Skeena Mountains, Hart Ranges, Kechika Mountains, McGregor Plateau, Nechako Lowland, and Peace Foothills.⁶

Cassiar Ranges (CAR):

This ecosection is the largest within the TSA, occupying over one quarter of the total land base. It is located within the northwest quarter of the TSA and is characterised by rugged, mountainous terrain, extensive U-shaped valleys, fast flowing rivers, large lakes, and extensive alpine areas. The Alpine Tundra and Spruce-Willow-Birch biogeoclimatic zones predominate. The main drainage in the ecosection is the Finlay River which feeds into Williston Lake.

Some access is available via logging roads west of Williston Lake. The First Nations community of Fort Ware is located along the Finlay River in the northern portion of the TSA.

Wildlife is abundant, with large populations of ungulates and carnivores. Carnivore species include grizzly and black bear, wolf, coyote and wolverine. Ungulates found in the area include caribou, moose, Stone sheep, elk and goats. Critical caribou winter habitat occurs in the Chase Ranges of this ecosection. Furbearers include marten, lynx and fisher. Fish species include rainbow and bull trout, lake trout, arctic grayling and kokanee.

Much of the ecosection remains in the primitive recreation class due to limited road access. Extensive wilderness settings offer backcountry recreation opportunities associated with mountain, river and lake settings, including some limited guide-outfitting. No protected areas

⁵ Most of the material for this section comes from Ecosection Summaries for the Prince George Forest Region, Borealis Creative Productions, 1994, written as background material for the Protected Areas Strategy for the Prince George Region.

⁶ The regional ecosystem classification system organizes the province's ecological mosaic into five hierarchical levels: (1) Ecodomain -area of broad climatic uniformity, (2) Ecodivision -area of broad climatic and physiographic uniformity, (3) Ecoprovince -areas with consistent climate or oceanography and physiography, (4) Ecoregion - areas with major physiographic and minor microclimatic or oceanographic differences, (5) Ecosection -areas with minor physiographic and climatic or oceanographic variation. Each ecosection class can be further subdivided by biogeoclimatic criteria. At the biogeoclimatic subzonal level, the climate interacts with land surface materials to create environments suitable for the development of specific plant and animal communities (Campbell et al 1990:57-62).

British Columbia is comprised of 110 ecosections, The Mackenzie TSA falls within the Sub-Boreal Interior and the Northern Boreal Mountains ecoprovinces, and is comprised of five ecoregions: (1) Fraser Basin, (2) Omineca Mountains, (3) Central Canadian Rocky Mountains, (4) Northern Canadian Rocky Mountains, and (5) Northern Mountains and Plateaux.

exist within the Mackenzie TSA portion of this ecosection.

Western Muskwa Ranges (WMR):

This ecosection occupies much of the northeast portion of the TSA and is bounded on the west by the Finlay River and the Rocky Mountain Trench. It is the second largest within the TSA. Characterised by mountainous terrain, the Alpine Tundra and Spruce-Willow-Birch biogeoclimatic zones predominate. Pine, spruce and aspen are the major forest species at lower elevations, with some subalpine fir occurring at higher elevations.

A main road from the west side crosses the Finlay River north of the reservoir and extends down the east side of the reservoir as far as the Ospika River. No communities exist in the ecosection and access is chiefly by aircraft.

Wildlife diversity is extremely high in the Western and Eastern Muskwa Ranges. Wildlife includes grizzly and black bear, wolf, coyote and ungulates, including mountain goat, elk, moose, deer, caribou and sheep. Caribou densities are high and there is a large predator-prey ecosystem. Raptors, owls and passerines are widespread. Fish species include rainbow and bull and lake trout, kokanee, arctic grayling and whitefish.

Due to its remoteness and lack of access, this ecosection is predominantly classed as primitive and offers extensive, remote backcountry recreation opportunities. Kwadacha Wilderness Park and Kwadacha Recreation Area offer backcountry recreation opportunities in a protected areas setting.

Southern Omineca Mountains (SOM):

Lying to the west of the Rocky Mountain Trench approximately 50 kilometres northwest of Mackenzie, the Southern Omineca Mountains ecosection is the third largest within the TSA. The rounded mountains of the Omineca Range dominate the terrain, and the Mesilinka, Osilinka and Omineca rivers drain eastward into Williston Lake. Five biogeoclimatic zones are found in the area: Engelmann Spruce-Subalpine Fir, Alpine Tundra, Boreal White and Black Spruce, Spruce-Willow-Birch, and Sub-Boreal Spruce. Rich wetland areas occur in the valley bottoms. Forests include spruce and subalpine fir in the valleys, with extensive lodgepole pine and aspen stands on the plateau and southern slopes. Spruce and subalpine fir are common on northern exposures.

Secondary logging roads provide extensive access to this ecosection which includes the small communities of Manson Creek and Germansen Landing.

Quality habitat supports significant moose numbers in this ecosection. Critical caribou habitat exists here also. The Wolverine Ranges in this area provide winter and calving habitat for approximately 300 resident caribou. Grizzly and black bears, and wolves are widespread. Marten and wolverine are relatively common, as are lynx, beaver, and otter. Mountain goats can be found in the Osilinka Range. Many species of raptors, owls, cavity nesters and perching birds can also be found throughout the ecosection. Among the fish species, rainbow, lake, and bull trout and arctic grayling are found in moderate numbers.

About 40% of the ecosection is classified as primitive and semi-primitive non-motorised recreation land. Access is mainly from the southwest through the Fort St. James Forest District via public highway and the south from Mackenzie via logging roads. Relatively remote, the ecosection provides recreational opportunities including camping, hunting and fishing, boating, snowmobiling and horseback riding. Chunamon Creek Ecological Reserve is the only protected area within the ecosection.

Missinchinka Ranges (MIR):

The fourth largest ecosection within the Mackenzie TSA, the Missinchinka Ranges lies north of Mackenzie. It is bounded by Williston Lake and the Rocky Mountain Trench to the west and by the Rocky Mountain foothills to the east. The terrain is mountainous, dominated by the Missinchinka Ranges of the Rocky Mountains. The major river within the TSA is the Ospika River draining south to Williston Lake. Biogeoclimatic zones include Alpine Tundra, Engelmann Spruce-Subalpine Fir, and Sub-Boreal Spruce.

This ecosection is home to a variety of wildlife species including grizzly and black bears, wolves, coyotes and large furbearers. Caribou, mountain goat and moose are widespread. Small numbers of thinhorn sheep and elk are also located here, and mule and whitetailed deer are found within the Sub-Boreal Spruce zone. Moderate populations of bull trout, rainbow trout and arctic grayling inhabit the ecosection's waterways.

No major external access exists into this portion of the TSA. Most access is via boat or aircraft and secondary logging roads to log dumps in the reservoir. This area has pristine backcountry recreational opportunities. Current recreational activities are hunting, fishing and wildlife viewing. No protected areas exist within the Mackenzie portion of this ecosection.

Parsnip Trench (PAT):

The Parsnip Trench ecosection occupies the bottom lands of the Rocky Mountain Trench. It is bordered on the west by the Omineca Mountains and on the east by the Hart and Muskwa Ranges. The community of Mackenzie is located in the southeastern corner of the ecosection. The Sub-Boreal Spruce biogeoclimatic zone dominates the area with dense stands of lodgepole pine and white spruce.

Large carnivores and ungulates are widespread. Of note, the area contains low elevation spring range for grizzly bear, highly important winter range for moose, and caribou winter range. Furbearers include lynx, marten, beaver, and otters. Bull and lake trout, rainbow trout and arctic grayling are found in various waterways within the ecosection.

The ecosection has well developed access routes, including highway access to Mackenzie and logging roads on both the eastern and western sides of Williston Lake. Many minor access roads and trails provide further motorised access. Recreational activities include fishing, hunting, camping and boating. Three small ecological reserves are currently the only protected areas within this ecosection.

Southern Boreal Plateau (SBP):

The Southern Boreal Plateau is located within the northwestern quadrant of the TSA. The majority of the ecosection falls within the Prince Rupert Forest Region. The Alpine Tundra and Spruce-Willow-Birch biogeoclimatic zones dominate the ecosection. Extensive willow scrub and wetlands are found within valley bottoms.

Provincially significant wildlife populations occur within this ecosection. Large carnivores are widespread, and very good habitat for moose, caribou and mountain goat exists. Bull and rainbow trout are found in most tributaries.

Most of the ecosection is classified as primitive in terms of the existing recreational opportunities, as a result of its remoteness. Within the Mackenzie TSA, Tatlatui Park is the only protected area, but occupies nearly 30% of the ecosection's area within the TSA.

Manson Plateau (MAP):

The Manson Plateau is located within the southwestern quadrant of the TSA. The major biogeoclimatic zones include Engelmann Spruce - Subalpine Fir, Sub-Boreal Spruce and Alpine Tundra. The terrain varies from rolling upland with low ridges in the south to mountainous in the north. Numerous large lakes are found in the broad forested valleys.

Large carnivores, ungulates and furbearers are widespread. Important winter range for caribou is found in the dry lodgepole pine forests, while some moose are found in the wetter ecosystems. At higher elevations, moderate numbers of mountain goat are found. Fish species include lake, bull and rainbow trout, and arctic grayling.

While portions of this ecosection are heavily roaded, much of it is relatively remote. Recreational opportunities include hunting and fishing, and associated activities. No protected areas exist within the Mackenzie TSA portion of the ecosection.

Eastern Muskwa Ranges (EMR):

The Eastern Muskwa Ranges ecosection is located along the northeastern portion of the TSA, and is largely within the Fort Nelson and Fort St. John TSAs. It is characterised by rugged mountainous terrain. The Alpine Tundra and Spruce-Willow-Birch biogeoclimatic zones predominate.

Carnivore populations include grizzly and black bear, wolf, and coyote. Moose, deer, caribou, elk, Stone sheep and mountain goat are common ungulates.

Much of the ecosection is remote from access and is classified as primitive recreational land. Extensive backcountry recreational opportunities exist. A portion of Kwadacha Wilderness Park is in this ecosection and provides recreational opportunities in a protected area setting.

2.3 Socio-Economic Overview

2.3.1 Mackenzie Area

Alexander Mackenzie is the first European known to have travelled through the area and he camped near the present day site of Mackenzie (named in his honour). In 1871, a gold rush attracted a flood of prospectors, miners, and surveyors to the Omineca area. However, this early population gradually dwindled once the rush subsided. In 1952, the present day Highway 97 was completed, which opened up the southern end of the TSA. However, the area did not begin to develop again until the construction of the Bennett Dam, creation of Williston Lake, and construction of the sawmill and pulp and paper mill complexes in the mid-1960s.

In 1965, the town of Mackenzie was located and built by BC Forest Products (now Fletcher Challenge Canada Ltd.) as a company town to house workers at its mill complex, and also those working for Cattermole Timber Co. (subsequently Finlay Forest Industries Ltd., now Finlay Forest Industries Inc. owned by Slocan Forest Products Ltd. and Donohue Inc.) which operated a second sawmill (Finlay's pulpmill came later). Today, the wood industry remains the dominant economic engine in Mackenzie. Table 2.3 shows the Mackenzie population by age and gender for 1991.

TABLE 2.3: MACKENZIE POPULATION BY AGE GROUP, 1991

Age Class	Males	Females	Total	Percent of Total
Under 4	295	285	580	10.0
5 - 9	325	290	615	10.6
10 - 14	300	270	570	9.8
15 - 19	240	210	450	7.8
20 - 24	200	215	415	7.2
25 - 34	680	605	1285	22.2
35 - 44	580	500	1080	18.6
45 - 54	325	220	545	9.4
55 - 64	135	75	210	3.6
65 - 74	10	20	30	0.5
75+	10	10	20	0.3
Total	3100	2700	5800	100

(Source: Statistics Canada 1991 Census; as reported in Mackenzie Profile 1993.)

The population data provide several insights into the characteristics of the town that are of importance in an assessment of socio-economic impacts. In 1991, the total population of Mackenzie was 5800 while the entire TSA population was approximately 6200.

The population of Mackenzie has fluctuated since 1971. The town's population has remained fairly stable during the 1980s, declining by 6% between 1981 and 1986, as a result of the recession and the replacement of forestry and mill labour by technology. In the late 1980s, the population rebounded by 5% as the employment situation improved and the mills reduced their level of layoffs. The population of Mackenzie is expected to increase at an annual rate of approximately 1.2%.⁷ This may be overly optimistic, however, as the estimated population for 1993 was 5936 when the actual population was 5775.

The population of Mackenzie is extremely young, with only 14% at age 45 or older. By contrast, roughly 20% of B.C.'s population exceeds age 45. Thirty-eight percent of Mackenzie's population is 19 years old or less, while 27% of B.C.'s population falls into this age group. The youthfulness of Mackenzie's population is consistent with the genesis of the town and its history. In the 1960s and 1970s, Mackenzie was viewed as a mill town where people could work hard and earn a high salary for several years before moving on. People are now beginning to put down roots and some second generation Mackenzie citizens are still working there. This description was supported by several interview subjects, who noted that the town is in transition and is quickly becoming a permanent home for older people.

Table 2.3 also shows a dearth of people in the 15-19 and 20-24 year age classes; young people are likely to leave town if they have trouble finding work, or wish to work in professions not well represented in Mackenzie. Interviewees stated that very few young people come back once they have left. This age class imbalance continues to keep the town in a fragile state, as the economy currently relies heavily on the availability of young people for forestry-related jobs.

The Mackenzie workforce (Table 2.4) has an average level of education lower than the province-wide level. This reflects Mackenzie's timber harvesting and primary manufacturing orientation and the lack of other well developed economic sectors. This indicates that the average laid-off worker may be limited in the type of new job that he or she can perform and will have difficulty finding alternate work at a comparably high wage rate.

This was substantiated in interviews which also indicated that training programs for unemployed workers have tended not to be very successful, because many workers have a low level of education.

⁷ Prince George Regional Development Council.

TABLE 2.4: EDUCATION LEVELS OF WORKFORCE

Education Level of Mackenzie Workforce	Number	Percent of total	Cumulative percent
Less than Grade 9	225	6	6
Grade 9 - 13 without secondary certificate	1295	32	38
Grade 9 - 13 with secondary certificate	695	17	55
Trades certificate or diploma	200	5	60
Other non-university without certificate	280	7	67
Other non-university with certificate	725	18	85
University without degree	350	9	94
University with degree	250	6	100
Total	4020	100	--

(Source: Statistics Canada 1991 Census; as reported in Mackenzie Profile 1993).

Table 2.5 shows a male dominated labour force with high participation rates for both genders. The unemployment rate for males (as of 1991) was much lower than the national average, but females had more difficulty locating work. Since 1991 was a recession year in the forest products industry, and since the population of Mackenzie dipped between 1986 and 1991, it is reasonable to conclude that job losses during the recession were higher than the unemployment figures indicate and that many of those laid off left Mackenzie with their families.

TABLE 2.5: GENERAL EMPLOYMENT STATISTICS BY GENDER

Labour Component	Males	Females	Total
Total in Labour Force	1975	1245	3220
Employed	1840	1025	2865
Unemployed	135	220	355
Unemployment Rate	6.8%	17.7%	11.0%
Participation Rate	91.0%	67.3%	

(Source: Statistics Canada 1991 Census; as reported in Mackenzie Profile 1993).

Average incomes in the Mackenzie TSA are significantly higher than provincial and national averages.⁸ The data also show a much greater disparity between income by gender than is found nationally. Fully 44% of working women earn less than \$10 000, while 10% earn in excess of \$40 000 (see Table 2.6). In contrast, 13% of males earn less than \$10 000 and 64% earn more than \$40 000. If a male finds work in Mackenzie it is likely to be very high-paying. In contrast, many women have difficulty finding very rewarding work in Mackenzie, which poses problems for separated couples with children. This is reinforced in the Census figures (Table 2.3), which show a significantly higher number of men than women in the 25-65 year age classes, which is unusual, especially in the older age classes.

Based on the 1991 Census, total after-tax income was \$93.8 million. Of this, 65% originated from employment in the wood products industry. Pension income, unemployment insurance and other transfer payments, and also investment income provides 15% of local income, while the public sector accounted for 12% of the total.

TABLE 2.6: AVERAGE INCOME BY GENDER AND AGE CLASS

Income Range (\$ per year)	Males	Females	Total	Cumulative %
Under 10 000	270	610	880	25.2
10 000 - 15 000	45	155	200	30.9
15 000 - 20 000	40	110	150	35.2
20 000 - 25 000	50	120	170	40.1
25 000 - 30 000	70	95	165	44.8
30 000 - 40 000	280	160	440	57.4
40 000 - 50 000	540	105	645	75.8
Over 50 000	800	45	845	100.0
Average Income	\$42 618	\$17 858		

(Source: Statistics Canada 1991 Census; as reported in Mackenzie Profile 1993).

The average family income is \$60 853, which is roughly \$8000 higher than the provincial average. Over 1/3 of all families had incomes which exceeded \$70 000; in BC, 1/5 of all families are in this income bracket.

⁸ Median income level is generally used a basis of comparison. Mackenzie's median income was \$31 500 in 1991, compared to \$20 000 for B.C. and \$19 300 for Canada (Bridges, 1994).

Table 2.7 categorizes employment by basic sector dependence. Approximately 1491 people are directly employed by the forest industry in the Mackenzie TSA. The 'spin off', or indirect and induced employment supported by each individual sector is also shown. The final column shows the percentage of total employment (direct, indirect and induced) that is dependent on each sector. Note the TSA's overwhelming dependence on the forestry sector.

TABLE 2.7: MACKENZIE TSA BASIC SECTOR DEPENDENCE ⁹

Sector	Direct Employment	Indirect/ Induced Employment	Total Employment	Sector dependence (percent)
Forestry and Forest Products Manufacturing	1491	632	2123	71
Mining and Mineral Processing	20	7	27	1
Petroleum	14	18	32	1
Agriculture	44	7	51	2
Tourism	113	13	126	4
Public Sector	359	74	433	14
Construction	54	21	75	2
Other ¹⁰	40	10	50	2
Non-employment ¹¹	n/a	92	92	3
Total	2134	874	3009	100

(Source: Ministry of Finance and Corporate Relations, 1995)

Males in the Mackenzie TSA tend to dominate the primary, processing, and machining occupations, construction, technological, and transportation jobs - 70% of males are represented in these occupations. Females represent the majority in teaching professions, medicine and health, sales and service occupations - 70% of females in the labour force are employed in these occupations.

In recent years, the community has become more pro-active in attempting to define its future. This involvement accelerated as the town responded to a proposal by BC Hydro to

⁹ Basic sector dependence figures are based on data from the 1991 Census of Canada. Data was tabulated by the Ministry of Finance and Corporate Relations for the Ministry of Forests. The methodology used can be reviewed in G. Horne and C. Penner (February, 1995) *British Columbia Local Area Economic Dependencies and Impact Ratios*. Victoria, Min. of Fin. and Corp. Relations.

¹⁰ Other includes parts of manufacturing, transportation, and construction not allocated elsewhere.

¹¹ Non-employment income is comprised of transfer payments such unemployment insurance, social assistance, pension and investment income. No direct or indirect employment is associated with this income, thus only induced impacts result.

periodically lower the water levels of Williston Lake. Mackenzie residents formed a task force of concerned citizens and became involved in community planning, which included commissioning a consultant to assess potential economic impacts. Mackenzie has hired an economic development officer and the town has recently published a discussion paper on economic development planning (April 1994) and a preliminary development strategy (July 1994). These reports emphasise the need to diversify the local economy.

The most frequently cited possibility is mining, as a number of deposits north of Williston Lake are actively being assessed and appear to have commercial potential. In the Mackenzie TSA, mineral belts with high potential to host mineral deposits are formed by the Takla and Hazelton group rocks, and a large belt of Paleozoic sedimentary rocks. Within these high potential belts however, mineral deposits are rare occurrences and their locations cannot be controlled or predicted. A viable mining industry therefore requires continued access to these belts both for exploration and for mining development. The best local example of the long term nature of mineral exploration and mine development is the Kemess North gold-copper project which is located within the Mackenzie TSA. This proposed project has significant socio-economic implications for First Nations and non-native communities in and near to the Mackenzie TSA. It is evident from this discussion that the future prospects for the mineral sector in the Mackenzie TSA are closely linked to resource planning in general, particularly road access through timber harvesting.

Currently, the tourism industry plays a very modest role in the economy of the Mackenzie TSA. Outdoor pursuits, particularly hunting and fishing are very popular but the potential of these activities to generate employment is quite limited. Guide outfitting provides a livelihood for a few individuals. The hospitality sector in Mackenzie includes three accommodation businesses and several restaurants. These businesses, however, depend very heavily on business travellers related to the forest industry. The community of Mackenzie is handicapped in its efforts to encourage tourism by its location off the main travel route.

2.3.2 First Nations

The four First Nations bands in and adjacent to the Mackenzie TSA have considerable interest in the TSA. The Tsay Keh Dene and Fort Ware bands have reserves within the TSA, the McLeod Lake band has reserves on the TSA boundary, and the Takla Lake band has reserves outside the TSA to the west, but has territorial interests in some of the TSA area. All bands are involved in treaty negotiations, but none have yet been settled. All bands have experienced some social disruption as they struggle to define an appropriate lifestyle and relationship with the non-native world. For many of the bands, there is not yet a consensus on how to approach these issues. The Gitksan and Wet'suwet'en Nations and the Treaty 8 Tribal Council also claim portions of the timber supply area as traditional territory.

Forestry is the main source of employment income for most band members, with some members also earning revenue through trapping, fishing, and guiding. Some members are active as loggers; the Tsay Keh Dene and Fort Ware bands are equal participants (together with Fletcher Challenge and Finlay) in Tsay Tay Forestry Ltd. - a harvesting company which

cuts some 400 000 m³/year. Other band members are employed in forestry work on silviculture and cone collection crews and sometimes on fire suppression. In addition, one or two individuals have worked as foresters for the companies and several members of the bands are currently enrolled in post-secondary forestry/business programs and are expected to return to the reserve once their education is completed.

Both Finlay and Fletcher Challenge have made conscious efforts to employ First Nations people and this has been a learning process for all concerned. One industry person emphasised the importance of being reliable and consistent employers, and the necessity of adapting the work to the lifestyles of many First Nations people. Silvicultural and other short-term contract work appears to best suit the majority of band members. No band members work in the mills.

Unlike many bands in BC, the Mackenzie area bands all depend very heavily on hunting, fishing, and gathering natural foods for sustenance, especially the Fort Ware band. Thus, they are all very sensitive to increased access and potential hunting pressure that may significantly reduce game populations. In fact, there was a general desire exhibited by some bands to lessen the rate of road construction or prevent it altogether.

A strategic direction of the national forest strategy and the provincial government is to increase the participation of First Nations in forest land management to ensure the recognition of Aboriginal and treaty rights and to increase the economic opportunities that Aboriginal people can derive from forest based activities in Canada.

Fort Ware

The community of Fort Ware, located at the north end of Williston Lake, has roughly 50 dwellings, a store, landing field, and a weather station. The Fort Ware band has three reserve areas totalling 391 ha. in the Mackenzie TSA. The band has 310 members registered, and 220 live on reserve, of whom approximately 130 members are over age 15, and 90 are less than 15 years old. As mentioned, the Fort Ware band is part of the Kaska people who speak Kaska, an Athapascan language understood by the neighbouring Tahltan people. Approximately 165 have been taught the language.

The social survey statistics presented in Table 2.8 (Aboriginal Peoples Survey 1991) show a percentage comparison of the Fort Ware band with provincial averages. The numbers indicate several interesting features: 1. The education levels are low compared to provincial averages. 2. The degree of dependence on a subsistence lifestyle is very high as indicated by the statistics on the type of equipment purchased, the participants who spend time on the land, and the participants who spend time in traditional aboriginal activity. 3. The major social challenges faced by the Fort Ware band seem to be less acute in comparison with other bands as indicated by the provincial statistics. This may indicate that the subsistence lifestyle leads to a healthier First Nations community. It may also indicate that the band has yet to be faced with significant pressure to link up with the regional community as a whole.

TABLE 2.8: SELECTED CHARACTERISTICS OF THE FORT WARE BAND

Selected characteristics	British Columbia	Community
Total Reporting Population	101 135	220
Speaks Aboriginal language	12%	30%
Persons participating in traditional activity	34%	57%
Equipment purchased for hunting, fishing or trapping	17%	92%
Living on the land for a portion of the year	15%	97%
Mobility status- never moved	16%	92%
Social indicators		
·Persons feeling safe in community at night	45%	48%
·Suicide	18%	-%
·Unemployment	41%	30%
·Family violence	25%	5%
·Sexual abuse	19%	2%
·Drug abuse	33%	9%
·Alcohol abuse	40%	18%
Education (15-49 age group) who attended a secondary or high school	93%	41%

(Source: Aboriginal Peoples Survey 1991)

Of the 130 members over the age of 15, 25 are employed, 20 are unemployed and 80 are not in the labour force reported. Eighty people reported employment income, but only 25% reported income above \$20,000 and none was above \$40,000. Of the adults 120 - 130 bought equipment for hunting, fishing or trapping. The number of adults who have never moved is reported as 120 - 130.

The band does receive some income from trapping and guiding, but most of its earned income comes from forestry. The Band is part of the Tsay Tay Forestry Ltd. consortium, although it is currently reviewing the suitability of this arrangement. Some band members are employed through Tsay Tay and 33 obtain work in silviculture, cone collection, and fire suppression during the summer. The silviculture work tends to last for three months of the year and cone collection for one month, varying from year to year. In all, there are about ten person years of employment undertaken by the band members. In addition, three to four band members operate forest equipment at various times throughout the year. The Chief indicated that the band would be able to undertake at least twice the amount of this type of work should it become available and very recently they have started a small logging sub-contracting operation where seven band members are now employed.

The band is very isolated and logging roads have only reached the Fort Ware reserve in the last three years. In winter, a temporary river crossing makes it possible to drive to Fort Ware

in about eight hours over logging roads. In summer, freight and fuel are barged to the head of Williston Lake then trucked to Fort Ware. Road access does not extend north from Fort Ware, having important implications for the maintenance of a traditional lifestyle where the economy is based on hunting, trapping and fishing. These are still the major activities, carried out seasonally within traditional family-controlled territories. The Chief feels that a lower level of logging in the area would be desirable, since this would delay road access, which in turn has an enormous impact on their subsistence lifestyle.

Tsay Keh Dene

The Tsay Keh Dene Band, formerly known as the Ingenika Band, has five candidate reserve¹² areas with a total area of 201 hectares on the Finlay and Mesilinka Rivers. The Finlay River site is accessible by air and water only except in winter when a temporary river crossing provides direct road access; the Mesilinka River is accessible by road. The Band used to live on part of the area that was flooded for Williston Lake. The Band numbers 275 people in total, with approximately 187 living in the TSA. Unfortunately, no Census data is available on this band.

The band is part of the Sekani linguistic grouping and is part of the Carrier-Sekani Tribal Council. They have traditionally relied heavily on hunting and fishing as a major part of their activities. The major economic activities include logging, seasonal fire fighting, trapping and big game hunting.

The Tsay Keh Dene are also participants in Tsay Tay Forestry Ltd. and undertake road construction, road maintenance, and silviculture contracts. They also run their own logging and construction camp near Finlay River, and participate in reservoir clean-up with BC Hydro.

McLeod Lake

The McLeod Lake Band has five reserves on 237 ha. situated on Highway 97 south-west of Mackenzie. The main community is roughly 150 km from Prince George and is just on the southern TSA boundary line. Three hundred and thirty-nine people are listed on the Band Register and 137 live on the reserve areas (only 65 of the reserve area population provided information for the 1991 Aboriginal Peoples Survey).

Table 2.9 summarises a profile of selected statistics of the band. Those that speak their Aboriginal language is nearly double the provincial average. The majority of the community participates in traditional activities; living on the land for a portion of the year is still an important part of their culture.

¹² Through a recent agreement, candidate reserve status has been given to the new land occupied by the band after being displaced by the flooding of Williston Reservoir. Formal transfer of the land has not yet occurred.

TABLE 2.9: SELECTED CHARACTERISTICS OF THE MCLEOD LAKE BAND

Selected characteristics	British Columbia	Community
Total Reporting Population	101 135	65
Speaks Aboriginal language	12%	31%
Persons participating in traditional activity	34%	54%
Equipment purchased for hunting, fishing or trapping	17%	unreported%
Living on the land for a portion of the year	15%	30%
Mobility status- never moved	16%	30%
Social Indicators		
Persons feeling safe in community at night	45%	80%
Suicide	18%	30%
Unemployment	41%	60%
Family Violence	25%	40%
Sexual Abuse	19%	20%
Drug Abuse	33%	60%
Alcohol Abuse	40%	70%
Education (15-49 age group) who attended a secondary or high school	93%	90%

(Source: Aboriginal Peoples Survey 1991).

The number of people who live in the community and have never moved is nearly double the provincial average. The community seems to have more serious problems with family violence, and alcohol and drug abuse than other Aboriginal groups in the province. The education level of those between 15 and 49 seems to be roughly equivalent to the provincial averages.

Of the total of 40 adults reporting to the survey, 20 are employed, 10 unemployed and 10 are not in the labour force. Of the adults surveyed, none reported income above \$20 000. Among the Bands living within the Mackenzie TSA area, the McLeod Lake Band has become the most integrated with Mackenzie and Prince George. The Band has its own logging operations and harvests roughly 300 000 m³ of wood annually. Most of this wood is sold to Fletcher Challenge and Finlay although there are no long term contracts to this effect.

Takla Lake

Takla Lake is 150 km west of the Mackenzie town site. Although the band does not have a community within the TSA it does have territorial interest in the Mackenzie TSA and is actively seeking employment through the Takla Development Corporation, and the business activities it pursues. Since most of the local economy is in logging and forestry work, the band is particularly active in these pursuits. The registered population is 479 with 241 reported as

living on reserves.

Like other northern bands in B.C., a significantly higher than average number of Takla Lake band members speak their Aboriginal language, participate in traditional activities, purchase hunting, fishing, and trapping equipment and live off the land for a portion of the year (Table 2.10). The community is also very stable since most adults never move away from the band community. Education levels are lower than the provincial averages. Unfortunately, data is not readily available to compare these findings against the community of Mackenzie.

TABLE 2.10: SELECTED CHARACTERISTICS OF THE TAKLA LAKE BAND

Selected characteristics	British Columbia	Community
Total Reporting Population	101 135	180
Speaks Aboriginal language	12%	36%
Persons participating in traditional activity	34%	56%
Equipment purchased for hunting, fishing or trapping	17%	42%
Living on the land for a portion of the year	15%	44%
Mobility status- never moved	16%	79%
Social Indicators		
Persons feeling safe in community at night	45%	53%
Suicide	18%	53%
Unemployment	41%	56%
Family Violence	25%	31%
Sexual Abuse	19%	28%
Drug Abuse	33%	53%
Alcohol Abuse	40%	56%
Education (15-49 age group) who attended a secondary or high school	93%	67%

(Source: Aboriginal Peoples Survey 1991).

3.0 Mackenzie TSA Forest Sector Overview

The purpose of this chapter is to describe forestry conditions in the Mackenzie Timber Supply Area (TSA), including the land base available for timber harvesting, guidelines that direct forest management and planning which may in the future alter the timber harvesting land base, apportionment of the AAC, and employment associated with timber harvesting. Finally, the chapter outlines the harvest forecasts used in this report to illustrate the economic, social and environmental implications of changes in the harvest level.

3.1 Timber Harvesting Land Base

The Mackenzie TSA comprises some 6 130 604 ha., of which approximately 18% is currently considered available for timber harvesting (see Table 3.1).

Spruce, lodgepole pine and balsam (true fir) predominate in the TSA. The AAC is constituted solely of coniferous species. Deciduous species such as aspen and birch are present in the TSA, but virtually no volume has been utilised; recently there have been expressions of interest.

3.1.1 Land Base and Timber Supply Issues

The use of the forest in the Mackenzie TSA is escalating as a local issue. Three broad areas of concern are 1. land and resource ownership, 2. conflict between economic, environmental and social values, and 3. rapidly changing forest policies.

The conflict over land and resource ownership is centred on First Nations treaty negotiations. It is impossible to forecast what impact these negotiations will have on the TSA timber harvesting land base, since the resolution process is still in the early stages.

The conflict between economic, environmental and social values is another major challenge for decision makers. For example, the goal of economic efficiency in timber production can conflict with social concerns for community sustainability in the town of Mackenzie. New environmental regulations, such as the Forest Practices Code, can make some areas of forest economically inoperable. Finally, the withdrawal of productive forest land to accommodate environmental values often conflicts with the concerns of local residents whose livelihoods could be jeopardised by the accommodation of such values.

The major changes in forest policy now underway are being implemented in Land and Resource Management Plans (LRMPs), Protected Areas Strategy (PAS), and the Forest Practices Code (FPC). The implication of these initiatives are also impossible to forecast, but they may have a significant aggregate impact on the TSA timber harvesting land base.

TABLE 3.1: MACKENZIE TSA LAND BASE

Classification	Area (hectares)	Percent of total area	Percent of productive forest area
Total Mackenzie Forest District Land Base	6 130 604	100.0	
Not managed by Forest Service	33 218	0.5	
Non-forest	3 043 001	49.6	
Total productive forest land base (Crown forest)	3 054 385	49.8	100.0
Deductions from Crown forest			
Non-commercial cover	69 884	1.1	2.3
VQO preservation areas	2 072	0.03	0.06
Environmentally sensitive	244 680	4.0	8.0
Deciduous stands	228 146	3.7	7.5
Non-merchantable	427 552	7.0	14.0
Low timber productivity	31 052	0.5	1.0
Inoperable	855 909	14.0	28.0
Existing roads	6 767	0.1	0.2
Streamside buffers	11 883	0.2	0.4
Settlements	15 197	0.2	0.5
Black Pine Indian Reserve	112	--	--
Pine Pass Ski Area and Azouzetta Recreation Area	549	--	--
Total current deductions	1 893 803	30.9	62.0
Current timber harvesting land base	1 160 581	18.9	38.0
Future reductions			
Future roads	61 620	1.0	2.0
Long-term timber harvesting land base	1 098 961	17.9	36.0

(Source: Mackenzie TSA Timber Supply Analysis, 1995)

The Land and Resource Management Planning (LRMP) Process

An LRMP is a sub-regional, integrated, consensus building process that produces a Land and Resource Management plan. The process considers resource issues such as forestry, wildlife management, ecosystem networks, recreation/tourism potential, protected areas, and it involves a multi-stakeholder team from the local area. A LRMP process is being considered for the Mackenzie area to make the land and resource decision trade-offs. Building consensus could lead to a reduction in the available timber supply.

Protected Areas Strategy (PAS)

In 1992, the government of British Columbia released a Protected Areas Strategy with the intention of protecting representative ecosystems across the province's 119 ecosections, as well as, special natural, cultural and recreational features. The government's goal for the PAS

was to double the amount of protected areas from approximately 6% to 12% of the provincial land base. Government agencies have produced a map and report outlining area of interest for the PAS. Land withdrawals will likely mean a reduction in the available timber supply.

Forest Practices Code (FPC)

The province of British Columbia has developed a new Forest Practices Code which imposes extensive new planning requirements for forestry activities. These requirements are designed to improve integrated resource management and reduce the negative impacts of forestry on biodiversity, fish, wildlife and other environmental values. The Forest Practices Code restricts or prohibits logging in some sensitive areas such as riparian zones. A reduction in the area available for logging may result in a reduction in the annual harvest.

3.1.2 Current Management Practices

The current management assumptions used in the Timber Supply Analysis do not address the issues just mentioned. The analysis incorporated land use decisions, and integrated resource management guidelines and practices that were in place at the time the timber supply analysis data package was developed in September, 1994. Although the current Timber Supply Review did not attempt to model the impacts of these current initiatives, it will provide a useful benchmark against which these initiatives can be measured. For a detailed discussion of the current management practices in the Mackenzie TSA see the Mackenzie TSA Timber Supply Analysis report.

3.2 Current Timber Supply Situation

3.2.1 Overview of Major Licensees

The current allowable annual cut (AAC) for the TSA is 2 951 121 m³. The AAC has been at this level since 1989. The current apportionment is outlined in Table 3.2.

TABLE 3.2: MACKENZIE TSA AAC APPORTIONMENT

	Apportionment (cubic metres)	Percent of AAC
Forest Licences		
• Fletcher Challenge Canada Ltd.	1 486 863	50.4
• Finlay Forest Industries Inc.	1 174 342	39.8
Total Forest Licences	2 661 205	90.2
Timber Sale Licences >10 000m3	0	0.0
Small Business Forest Enterprise Program		
• Section 16	0	0.0
• Section 16.1 Bid Proposals	183 597	6.2
Total SBFEP	183 597	6.2
Forest Service Reserve	29 511	1.0
Woodlot Licences	20 000	0.7
Forest Licences, non-replaceable	56 808	1.9
Allowable Annual Cut (apportioned)	2 951 121	100.0

The total volume harvested on Crown land in the four most recent years for which data are available is shown in Table 3.3.

TABLE 3.3: TOTAL VOLUME OF WOOD HARVESTED IN MACKENZIE TSA

Year	Volume Harvested (m3)
1991	1 880 927
1992	2 987 735
1993	3 533 299
1994	2 952 798
Average 1991-94	2 838 690

The surge in harvest levels is largely a response to improvements in market conditions for wood products. Forest licences make provisions for short-term fluctuations; however, over the longer term, the volume harvested must approximate the AAC.

Table 3.4 compares the AAC allocation and the distribution of the 1994 harvest by licence type. The bulk of the volume is allocated under Forest Licences to the two largest companies, Finlay and Fletcher Challenge. These companies also purchase wood harvested under the Small Business Forest Enterprise Program (SBFEP); in recent years they have purchased

roughly 50% of the SBFEP wood harvested. The high harvests under the SBFEP reflect a temporary increase in wood made available as a result of previous undercutting on the Forest Licences. Woodlot licences yield a mixture of private and Crown wood. The Forest Reserve portion of the AAC is kept for contingencies and to offset timber harvested under licence to cut and other permits which do not have an AAC allocation. Timber removed for right-of-ways, agricultural land clearance and mining exploration is cut under a variety of licences which are broadly classified as Licences to Cut and Other Licences.

TABLE 3.4: AAC APPORTIONMENT AND HARVEST VOLUME BY TYPE OF LICENCE

Type of Licence (1994)	1994 Harvest Volume (m3)	Percent of the 1994 Total Harvest	Current AAC apportionment (m ³)
Forest Licences	2 485 149	84.1	2 723 013
Timber Sales- Small Business	403 459	13.7	183 597
Woodlot Licence	5733	0.1	15 000
Forest Reserve	0	0.0	29 511
Licence to Cut	1377	0.1	0
Other	57 080	2.0	0
Total	2 952 798	100.0	2 951 121

(Source: Ministry of Forests, Revenue Branch, Victoria)

A small percentage (0.55% in 1994) of the harvested wood was not merchantable and therefore not billed.

Fletcher Challenge Canada Ltd.

Fletcher Challenge is a major North American manufacturer of pulp and paper. The Mackenzie operation is one of three major Fletcher Challenge operations located in British Columbia. In Mackenzie, they operate two sawmills and a market pulpmill in an integrated complex.

The two sawmills operate an average of 250 days per year and can produce 370 million foot board measure (fbm) per year. In 1994, they produced 312 million fbm and in 1993, 264 million fbm. The sawmills currently have five lines for log processing. Each line was built at a different time and the older lines tend to be least efficient and face the possibility of being closed as a result of downturns in the business cycle. The oldest line, the A mill large log line, was built in the 1960s. One sawmill was closed in 1992 and the current older sawmill will require upgrades to remain in operation. Fletcher Challenge also sees a future opportunity for a particleboard plant, a veneer plant, and a forest nursery in the TSA.

The Mackenzie pulpmill is a single line mill which started operations in 1972. The fibre for the mill, principally spruce, lodgepole pine and fir, is provided from its mill chips (65%) and from chips obtained under trading arrangements from other sawmills in the region. The northern location means the mill has access to high quality fibre that produces some of the highest strength pulp in the world. The pulpmill operates an average of 344 days per year and has a production capacity of 215 000 metric tonnes per year. Production in 1994 was 182 000 tonnes and in 1993, 180 000 tonnes (approximately 85% of capacity).

The Mackenzie operation currently has an AAC of 1 486 863 m³ under a forest licence. The actual cut in 1994 was 1 396 000 m³ and in 1993 1 248 000 m³. The firm is currently changing its forest practices by moving to a cut-to-length system of forest harvesting, which would increase the proportion of fibre obtained per hectare harvested and reduce wood loss during transportation of logs on Williston Lake. In total, the use of the new harvesting system could increase the amount of delivered wood fibre by 11 to 13%.

Finlay Forest Industries Inc.

Finlay and its predecessor companies have operated in the Mackenzie area since the clearing operations for the Williston Reservoir began in the 1960s. The AAC for Finlay is 1 174 342 m³ under a forest licence. The licence was most recently replaced in 1991 for a term of 15 years. Under the Forest Act the licensee may apply for the replacement of the licence in 1996.

The company operates two sawmills and a pulp and newsprint mill in Mackenzie. At full production these mills consume the allowable annual cut from the forest licence plus additional logs purchased on the open log market.

Harvesting operations take place in a number of areas surrounding the Williston Reservoir. Harvesting is done by local logging contractors.

On May 25th, the Minister of Forests approved a revised apportionment reflecting the approved sale of Finlay Forest Industries Ltd. to Slocan Forest Products Ltd. from Richmond, BC, and Donohue Inc. from Quebec City, Quebec. The sale includes the pulp, paper and sawmilling complexes and the transfer of its forest licence in the Mackenzie TSA. Any future changes in employment that will result from this sale are not reflected in Finlay's employment numbers.

Analog Wood Products Ltd.

Analog Wood Products is a new company founded for the purpose of establishing a secondary wood manufacturing plant in Mackenzie to produce finger-jointed solid wood core door stock, window and door casings as well as window stock. This \$4.7 million plant is currently under construction. The plant is designed to process about 106 000 m³ of wood per year.

In 1994, the Ministry of Forests awarded a timber sale licence to Analog Wood Products Ltd. under the SBFEP. The terms of the licence allow the company to harvest 404 000 m³ of timber in the Mackenzie TSA over the next four years. Under a lumber supply agreement, Analog will obtain 42 000 m³ of trim ends and 64 000 m³ of economy #3 boards from the

Finlay sawmills. In return, Analog has given Finlay the right of first refusal to purchase all timber available to Analog under its timber sale licence.

The company is committed to providing local First Nations groups with opportunities in timber harvesting and log hauling operations.

East Fraser Fibre

This company was started by local logging contractors who would purchase logs from a local mill, chip them and then sell them back to the same firm. Today, the company has expanded to operate a remanufacturing plant which produces finger joint stock. The company has no allocated timber supply, but competes for timber sold under the Small Business Forest Enterprise Program (SBFEP).

Ospika Lathe

This small value added company started by taking low grade lumber from local mills and manufacturing products such as kiln strips and lathe material. Today they have diversified and are also producing pallet material and various joinery material. They have no assured fibre supply for their business operations.

M and T

This company makes various value added wood products including finger joint material, spindles, sashes and door material. They currently have a timber allocation of 250 000 m³ (50 000 m³/yr) under the SBFEP, which is set to expire in 1996. Under the SBFEP, M and T will have to bid for future timber volume.

Small Business Forest Enterprise Program

To further encourage the development of value-added manufacturing, the provincial government started the SBFEP in 1987. The program is provided for in legislation in the Forest Act under sections 16 and 16.1. The overall stated objective of government is to have 25% of the wood supply flowing through this program. Currently, in the Mackenzie TSA about 7% of the wood flow is apportioned through the SBFEP. In 1993-94, about 35% of the wood volume allocated under this program was processed locally and the remaining 65% went to mills outside the TSA. This proportion is likely to shift to a previous level of 70% remaining in the TSA once Analog gets its allocation this year.

The SBFEP has a short-term and long-term component. The short-term competitive sales award timber volumes to the highest bidders. The volume of wood allocated under this sales program is determined by the undercut of the forest licensees in a five year period. Currently, as a result of undercutting in the period 1982-1987, the volume sold has been approximately 165 000 m³ per year. It is anticipated that this volume will not be available in 1997 and the government is under no obligation to continue these types of sales.

The timber supply from the long-term component of the SBFEP is allocated to the bidder who proposes or has an existing manufacturing facility that will add more value than competing bids. The Ministry of Forests assesses these proposals based on certain criteria and then

awards the timber volume, usually for a three to five year period. These sales are not necessarily renewable.

Currently, both Analog and M & T have allocations under this program for a total of 151 000 m³ per year. The total allowable cut under this program is 184 000 m³ per year, leaving 33 000 m³ currently unallocated. Note that major tenure holders can only have minority interest in any company which prepares a proposal for wood supply under this program.

To keep the volume of wood flowing into the SBFEP, in 1987, the provincial government initially took 5% of the wood supply from all major tenure holders and takes another 5% for transfer of ownership. In the case of Mackenzie, the 5% reduction for transfers has already happened twice in recent years: once when British Columbia Forest Products was bought by Fletcher Challenge Canada and then when Finlay Forest Products Ltd. was purchased by Slocan Forest Products Ltd. and Donohue Inc., as reflected in the latest approved revision to the AAC apportionment shown in Table 3.2. The overall objective of government in reducing the volumes allocated to the major tenure holders is to create a log market that would capture more economic rent from the timber resource.

New Non-Replaceable Forest Licences

An opportunity for a new non-replaceable Forest Licence for a volume of 56 800 m³ will be advertised soon. This volume plus 5000 m³ of new volume apportioned to woodlots was recovered as part of 61 800 m³ returned to the Crown through the sale of Finlay to Slocan.

3.2.2 Forest Sector Employment

For analysis purposes, forest sector employment can be divided into harvest dependant and non-harvest dependant categories. Harvest dependant activity includes harvesting, processing and basic silviculture, and is closely correlated with the level of harvest, i.e., if the harvest level changes, harvest dependant activity changes in the same direction. Conversely, non-harvest dependant activity is not so tightly correlated to marginal changes in the harvest level.

For example, the number of government Forest Service employees would not necessarily change as a result of a change in the harvest level. Incremental silviculture is also not as dependant on the level of harvest. This non-dependent assumption would hold in the short term. In the longer term, establishing causal linkages between non-harvest dependant employment and the harvest would still be problematic.

The two major licensees, local contractors, and the Ministry of Forests were surveyed to determine the level of direct employment generated by forestry activities in Mackenzie. These data are shown in Table 3.5. The figures are based on employment data collected during the period of October 1994 to March 1995 and the 1994 harvest volume of 2 952 798 m³ (BC Forest Service, Revenue Branch.).

The total number of both local Mackenzie resident employees and regional harvest dependant employees by category is indicated in Table 3.5. This table includes employment supported by timber harvested in the Mackenzie TSA, other Crown Forest jurisdictions, and private land holdings. The estimates also include people who work in the TSA, but do not reside there.

TABLE 3.5: TOTAL NUMBER OF TSA AND PROVINCIAL EMPLOYEES WHO WORK IN THE MACKENZIE TSA, BY EMPLOYER/CONTRACTOR

Employer	Harvesting	Pulp and paper mills	Sawmills	Smaller Mills	Basic Silviculture	Total
Fletcher	395	265	465	0	77	1202
Finlay*	350	287	483	0	72	1192
Analog	27	0	0	53	0	80
M & T	12	0	0	15	0	27
Ospika	0	0	0	20	0	20
East Fraser	0	0	0	15	0	15
MOF-SBFEP and others	76	0	0	0	47	123
Total	860	552	948	103	196	2659

* The employment figures shown do not reflect any changes that may occur as a result of the sale of Finlay For. Ind. to Slocan. and Donohue.

Fletcher Challenge harvesting operations provide about 395 person years (PYs)¹³ of employment. Silviculture and other forest management activities provide approximately 77 PYs of employment. The total number of people employed in the mills as of December 31, 1994, was 730.

For Finlay, harvesting operations are currently generating about 350 PYs of employment. Silviculture and other forest management activities provide approximately 72 PYs annually of additional contract employment. The mills employ another 770 people.

In 1991, the total number of direct forestry jobs in the Mackenzie Forest District was estimated to be 1491 PYs, the majority of which accrued to residents of Mackenzie. Research for this study found that in 1994 direct employment supported in the TSA had risen to 2659, with approximately 1900 PYs accruing to Mackenzie TSA residents. The difference is largely attributable to the increased harvest levels since 1991, as shown in Table 3.3.

¹³ A person-year is a measure of employment indicating one full-time job. All part-time and seasonal jobs are translated into PYs, for example, two half-time jobs are considered one PY. Jobs are converted into PYs for proper comparison and use of multipliers.

Harvesting

Harvesting and related activities support approximately 860 PYs of direct employment for the local and regional area. Roughly 70% of the timber is harvested by contractors and loggers who live outside the TSA area. Therefore, roughly 887 098 m³ of the total harvested volume is cut by local harvesters. This has a significant impact on local direct employment, as the majority of loggers are estimated to be from outside the Mackenzie district. The loggers who harvest under the SBFEP also predominantly reside outside the TSA and market their harvest to mills located outside the TSA boundary. Harvesting activity provides employment for approximately 260 residents of the TSA and for about 600 PYs for non-residents.

Processing

Approximately 95% of the wood harvested in the Mackenzie TSA is processed in local mills. Thus, reductions in the volume of timber harvested in the TSA will directly impact the employment levels of local wood processing plants, given their heavy dependence on the local wood supply. Approximately 88% of mill throughput (for sawmill and pulpmill operations) came from the Mackenzie TSA harvest. All sawmill and pulp and paper mill workers are local residents, since it is unlikely that workers would commute from outside the TSA. The government's policy to expand the SBFEP has recently added new wood processing facilities and this is expected to increase. Processing activity in the TSA, including solid wood and pulp and paper, supports 1603 PYs within the TSA. The portion of that employment solely related to timber harvested in the Mackenzie TSA is 1416 PYs.

Silviculture

Fletcher Challenge and Finlay are responsible for basic silviculture on their forest licence areas. Basic silviculture on the remaining Crown land under the SBFEP and incremental silviculture on all Crown land remains the responsibility of the Ministry of Forests. Silviculture operations support approximately 196 PYs of employment (Table 3.6). As mentioned, a significant proportion of the work is seasonal in nature and outside workers are heavily used. This does not, however, diminish the importance of this type of work for its contribution to local employment.

Approximately 20%, or 39 PYs, of the silviculture workforce is local. This estimate results from consultation with company foresters and the MOF. Silviculture employment accruing to Mackenzie TSA residents was estimated to be 0.01 PYs per 1000 m³ cut and provincially, 0.07 PYs per 1000 m³ harvested. The actual number of people working in silviculture would be greater than indicated by the 39 PYs. Given the seasonal nature of the work, over 100 local people could be employed in silviculture during the planting season.

TABLE 3.6: MACKENZIE TSA SILVICULTURAL WORKFORCE

Type of Worker	Fletcher (PYs)	Finlay (PYs)	MoF (PYs)	Total
Planters	56.6	59.9	33.7	150.2
Site Preparation	1.5	4.6	4.9	11.0
Silviculture Surveys	5.6	1.2	2.4	9.2
PHSPs/Administration	13.7	6.0	6.6	26.3
Total	77.4	71.7	47.6	196.7

Government employees

The Mackenzie forest district office is located in Mackenzie and is part of the Prince George Forest Region. The current number of employees in the district is 70. The Mackenzie Forest District supports approximately five PYs of employment in the Prince George Forest Region. Forest Service employment levels will likely increase with the implementation of the Forest Practices Code and Forest Renewal Program. Forest Service employment is assumed not to be sensitive to short-term marginal changes in the volume of timber harvested.

3.3 Employment Coefficients

To determine employment levels associated with different harvest levels, employment coefficients are used that reflect the labour intensity of forestry operations and timber processing. Employment coefficients are calculated by dividing employment by the harvest level. Multiplying the coefficients by a forecast harvest level can then provide an estimate of the employment levels that could be supported by the harvest, given current operating conditions. In this case, the harvest levels chosen are those associated with harvest forecasts from the timber supply analysis.

The harvest volume is assumed to be equal to the AAC on average over time. This assumption is reasonable because under the terms of the Forest Licence agreements, the actual harvest must be within 10% of the AAC over a five-year cut control period (the average harvest over the period 1991-1994 was 2 836 440 m³ - see Table 3.3). The full AAC is currently being harvested and none of the interview subjects expected that significant surplus wood volume would develop in the foreseeable future, especially in light of recent industrial expansion, land withdrawals, and timber supply reductions.

Table 3.7 shows employment generated per 1000 m³ cut in Mackenzie TSA. The methodology used to estimate the impacts of the harvest scenarios assumes that these ratios do not change over time. Another assumption made in estimating employment impacts is that employment will react very quickly to changes in harvest levels, which is probably most accurate for employment in the logging sector and least accurate for silvicultural and administrative employment levels.

The provincial estimates include employment associated with the harvesting of Mackenzie TSA timber by non-TSA residents, silviculture operations, and by the processing of Mackenzie TSA timber and wood residue in mills located outside the TSA. About 70% of the harvesting employment accrues to outside residents. Most loggers live in the Prince George area and commute to remote logging camps for shifts of ten days on and four days off. About 600 harvesting employees were assumed to live outside of the TSA. Similarly, we estimated that 80% of the silviculture workers live outside the Mackenzie TSA; of the 196 silviculture jobs located within the TSA, about 157 PYs accrue to non-residents.

Very little of the timber cut leaves the TSA for processing. The Mackenzie mills owned by Fletcher Challenge and Finlay consume all of the timber obtained from their forest licences. The only fibre to leave the TSA is cut under the SBFEP; most of this volume goes to Prince George for processing. The volumes and proportions of SBFEP wood that leave the TSA vary from year to year. For the most recent years, an average of 70% of the SBFEP harvested timber left the TSA for processing, hence this proportion will be used in the analysis.

The volume of SBFEP timber assumed to be processed outside the TSA is 283 300 m³, which was based on the 1994 SBFEP harvest volume. Most of this wood goes to sawmills and the resultant chips go to pulp and paper production. Therefore, this wood creates direct jobs in both the other wood products and pulp and paper sub-sectors. A Price-Waterhouse study (1994) estimated that in Prince George there are 0.31 sawmill jobs per 1000 m³ consumed and 0.14 pulp and paper jobs per 1000 m³ consumed. These ratios were applied to the timber cut from Mackenzie's SBFEP program to estimate the direct jobs created in Prince George. For example, the timber cut in the Mackenzie TSA and processed in Prince George creates 88 (283.3*0.31) direct jobs in sawmills in Prince George. Therefore, 88/2951 or 0.03 direct regional jobs were created per 1000 m³ cut in Mackenzie TSA. In total, the processing of Mackenzie TSA timber outside of the TSA supports a further 128 PYs of direct employment in sawmills and pulp and paper mills.

TABLE 3.7: MACKENZIE TSA EMPLOYMENT COEFFICIENTS

Forest sub-sector	TSA Employment per 1000 m ³ *	TSA Employment (PYs)	Provincial Employment per 1000 m ³ *	Provincial Employment (PYs)**
Harvesting	0.09	258	0.29	860
Pulp and Paper Mills	0.12	365	0.14	405
Sawmills	0.36	1051	0.39	1140
Silviculture	0.01	39	0.07	195
Total Direct	0.58	1713	0.89	2600
Indirect and Induced	0.23	681	1.32	3900
Total Employment	0.81	2394	2.20	6500

* Coefficients derived by dividing employment by 2951.

** Provincial employment includes TSA employment.

The coefficients in Table 3.7 are used to estimate the employment figures presented in Section 4.

3.4 Timber Harvest Forecasts

The purpose of this study is to assess the economic, social and environmental implications associated with variations in the current timber supply level within the Mackenzie TSA. The Mackenzie TSA Timber Supply Analysis report (TSAR) is the technical document that drives this harvest level assessment. It assesses the wood supply available for harvesting over the next 250 years under current forest management practices, and shows potential paths to reach a sustainable long-term harvest level (LTHL). The TSAR also examines the potential changes in timber supply stemming from uncertainties regarding current management assumptions. The forecasts produced in the TSAR are not AAC recommendations, but provide a basis for discussions of the timber supply. The following scenarios from the TSAR are used for this SEA.

3.4.1 Scenario 1

Scenario 1 (the base case harvest forecast in the Mackenzie TSAR), begins with the continuation of the harvest level at 2 951 121 m³ per year for three decades. In the fourth decade the harvest level is reduced to 2 796 000 m³ per year and in the fifth to the tenth decade to 2 640 000 m³ per year. After that the harvest level will rebound to 2 810 000 m³ for the next 200 years. This is the LTHL and represents a five percent decline over current harvest levels.

3.4.2 Alternative Initial Timber Harvest Forecasts

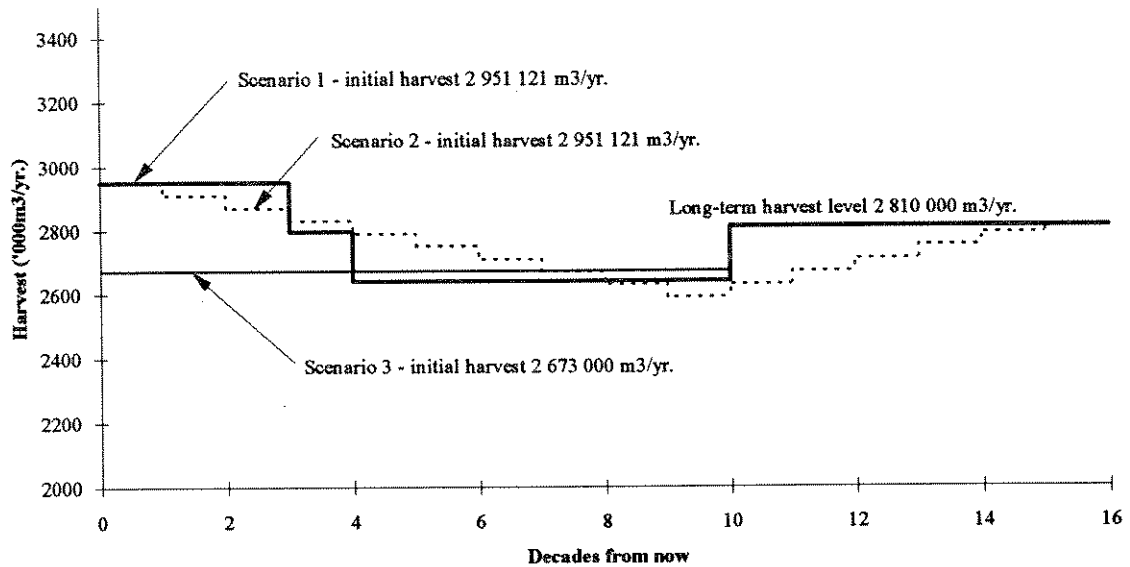
The socio-economic assessment also provides an analysis of the implications of alternative initial harvest rates, prior to a reduction to the LTHL. Discussion of the socio-economic implications of these scenarios will be limited to the short-term, i.e., the first and second decade.

Scenario 2

To spread the harvest reduction more evenly, Scenario 2 would reduce the annual harvest by 40 000 m³ in each of the second through tenth decades. Then it would be increased at the same rate from the eleventh to sixteenth decades, at which time the LTHL would be reached. The emphasis is on spreading the change over a long time period, thereby minimizing the socio-economic impacts in any one period.

Scenario 3

This scenario suggests an immediate reduction in the harvest of 278 121 cubic metres, or 9%, to 2 673 000 cubic metres per year. The harvest level would then increase in Decade 11 to the LTHL of 2 810 000 cubic metres per year.

FIGURE 3.1 MACKENZIE TSA HARVEST FORECASTS

3.4.3 Allocation of Harvest Level Changes

This study assumes that any timber harvest reduction would be proportionally allocated among all tenures according to the current share of the TSA AAC, as shown in Table 3.2.

4.0 Economic Impacts

The purpose of this chapter is to present the results of the economic impact analysis of timber supply forecasts for the Mackenzie TSA. The presentation is organized into two sections: 1. short- and long-term impacts associated with the harvest forecast of Scenario 1, and 2. the impacts associated with Scenarios 2 and 3.

To help understand some of the impacts related to harvest level changes, three types of economic impacts are estimated: direct, indirect, and induced.

Direct Impacts are an estimate of the employment and income generated directly within the forestry sector and attributable to the Mackenzie TSA harvest. At the current AAC of 2 951 121 m³ per year, the Mackenzie TSA supports over 1700 PYs of direct forestry employment within the TSA, and generates approximately \$59 million in employment income. A further 890 PYs of direct employment accrue to non-residents of the TSA.

Indirect impacts consist of the employment and income generated by the spending of forestry companies on goods and services. Induced impacts are generated as a result of forestry workers spending their wages and salaries. These impacts are estimated at the TSA level and for the province. Within the TSA, the current AAC supports approximately 678 PYs of indirect and induced employment.

The weighted average after-tax direct income was found to be \$34 287. The total indirect and induced after-tax income was calculated by multiplying the indirect and induced employment by a weighted average after-tax employment income of approximately \$21 000.

For a more indepth discussion of the assumptions and calculation of these impacts please see Appendix 4.

4.1 Scenario 1 - Economic Impacts

4.1.1 TSA Employment and Income Impacts

Table 4.1 presents the TSA level employment and income impacts associated with Scenario 1. The initial three decades of the forecast would allow harvests to remain at current levels. As a result, no employment and income losses resulting from Scenario 1 would occur during this time.

In the fourth decade, direct employment would decline under Scenario 1 by approximately 91 PYs, accompanied by the loss of a further 38 PYs of indirect and induced employment.

Employment income would follow a similar pattern, remaining stable in the first three decades, followed by a reduction in Decade 4 of \$3.1 million of direct income and \$740 thousand of indirect and induced income.

TABLE 4.1: TSA EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 1

Period	Harvest Level (000m ³ /yr)	TSA Employment Levels			TSA After Tax Income Levels (\$ million)		
		Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	1713	681	2394	58.68	14.05	72.71
1-3	2951	1713	681	2394	58.68	14.05	72.71
4	2796	1622	643	2265	55.60	13.31	68.89
5-10	2640	1531	607	2138	52.50	12.57	65.05
11-40	2810	1630	646	2276	55.88	13.38	69.24

Employment and income supported by the forestry sector in the TSA would reach its lowest point in Decades 5 through 10. In Decade 11, employment and income would increase as the harvest increases to the long-term harvest level.

4.1.2 Provincial Employment and Income Impacts

The timber harvested in the Mackenzie TSA also creates employment outside of the Mackenzie area; much of the direct outside employment goes to residents of the Prince George area. The number of local and provincial jobs created per 1000 m³ is summarized in Table 3.7.

Table 4.2 shows that approximately 2600 PYs of direct employment is supported across the province by the current Mackenzie TSA harvest (this figure includes the TSA portion). A further 3900 PYs of indirect and induced employment is generated by this forestry activity, leading to a total employment impact of 6500 PYs.¹⁴ The employment outside the TSA accrues mainly in the Prince George area; however, impacts will also occur in the Vancouver Lower Mainland where numerous supplies and services originate. Approximately 3221 PYs of total direct, indirect, and induced employment accrues to people living outside the TSA; much of the employment is associated with indirect and induced activity.

¹⁴ Total provincial employment is found by using a provincial multiplier of 2.5, e.g., 2600 * 2.5 = 6500. See Appendix 4 for a discussion of the impact methodology.

TABLE 4.2: PROVINCIAL EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 1

		Provincial Employment Levels			Provincial After Tax Income Levels (\$ million)		
Period	Harvest Level ('000 m3/yr)	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	2600	3900	6500	90.26	81.22	171.48
1-3	2951	2600	3900	6500	90.26	81.22	171.48
4	2796	2460	3691	6151	85.41	76.86	162.28
5-10	2640	2323	3485	5808	80.65	72.57	153.22
11-40	2810	2473	3709	6182	85.84	77.25	163.09

Employment losses under Scenario 1 would not occur until Decade 4 at which time 140 PYs of direct forestry employment would be lost - approximately 90 PYs within the TSA and 50 in other areas. A further 209 PYs of indirect and induced employment would also be lost - approximately 171 of these PYs would be lost outside the TSA.

4.1.3 Government Revenue Impacts

The following revenue estimates are based on historical rates adjusted for inflation. Policy changes announced in April, 1994, as part of the Forest Renewal Plan, have resulted in significantly higher stumpage revenues. The continuation of the present rate would occur if the 1993 increase in lumber prices represents a structural shift in the market. However, stumpage revenues vary with changes in lumber prices and it is not possible to precisely project the impact of these new policy changes at the TSA level until the new policy has been implemented for a period of time.

In 1994, the average level of stumpage paid per cubic metre harvested was \$20.44 on all wood cut in the TSA. Stumpage rates have changed significantly over the past three years, as shown in Table 4.3. The use of this stumpage rate for the estimates of future provincial stumpage revenue assumes that the species mix harvested will not change appreciably, that any changes in product prices will not affect the level of stumpage rates, and that the mix of timber from each licence type will not change. Recent information indicates that lumber prices are falling, thus to account for the potential variation in revenues, the new stumpage rates were averaged based on a wood industry price index for the past five years. The weighted average stumpage rate is estimated at \$14.19 per cubic metre.

TABLE 4.3: AVERAGE STUMPAGE FEES PAID IN MACKENZIE TSA (1990-94)

Year	Average Stumpage Rate (\$/m3)
1990	6.14
1991	7.87
1992	6.53
1993	9.75
1994	20.44

(Source: Ministry of Forests, Revenue Branch)

Stumpage revenue in 1994 was approximately \$60.36 million, using the actual 1994 stumpage rate. Stumpage revenues in Table 4.4 are calculated on the basis of the new stumpage rates adjusted for price changes. For personal income taxes, \$18 979 per 1000 cubic metres harvested came from direct and indirect and induced employment incomes; of this, 1/3 was assumed to be provincial tax revenue and 2/3 federal tax revenue. Appendix 4 shows the provincial and federal tax revenues per 1000 m³ of timber harvested. Other provincial taxes include logging, sales and energy taxes, and other corporate taxes; these revenues were calculated based on a rate of \$7 575 per 1000 cubic metres harvested.¹⁵

TABLE 4.4: SCENARIO 1 ANNUAL PROVINCIAL FORESTRY REVENUE IMPACTS (\$ MILLIONS)

Period	Harvest Level ('000 m3/yr)	Provincial Stumpage	Provincial Income Tax	Other Provincial Tax	Total
Current	2951	41.89	18.6	22.4	82.1
1-3	2951	41.89	18.6	22.4	82.1
4	2796	39.69	17.7	21.2	78.5
5-10	2640	37.47	16.7	20.0	74.2
11-40	2810	39.89	17.8	21.3	78.9

Federal revenues include income tax paid by direct, indirect, and induced employees related to the forest industry - the average federal income tax per 1000 cubic metres harvested is about \$12 659. Other federal taxes is comprised of corporate income tax, sales tax, excise tax, and withholding tax - the average from 1989 - 1993 was \$1 380 per 1000 cubic metres.

¹⁵ Figures for other provincial and federal revenues were obtained from "The Economic Impacts of Timber Harvesting in British Columbia", Economics and Trade Branch, Ministry of Forests, 1995.

TABLE 4.5: ESTIMATED ANNUAL FEDERAL FORESTRY REVENUE IMPACTS UNDER SCENARIO 1 (\$ MILLIONS)

Period	Harvest Level (000 m3/yr)	Federal Income Tax	Other Federal Taxes	Total
Current	2951	37.4	4.1	41.5
1-3	2951	37.4	4.1	41.5
4	2796	35.4	3.9	39.3
5-10	2640	33.4	3.6	37.0
11-40	2810	35.6	3.9	39.5

4.2 Economic Impacts of Harvest Scenarios 2 and 3

The following section outlines the short-term implications of Scenarios 2 and 3. The impacts of Scenarios 2 and 3 were estimated for the Mackenzie TSA using the same methodology and employment data as were used to estimate Scenario 1 impacts.

The current AAC in Mackenzie is 5% higher than the LTHL and this, combined with characteristics of the age class structure, will cause the harvest to fall 6% below the LTHL. The basic choice of future harvest levels concerns the rate of decline in the next 50 to 100 years and the minimum harvest level reached. These two characteristics of the harvest flow are related: one can choose a more gradual reduction in the cut at the cost of a deeper trough in the harvest pattern. See Figure 3.1.

In Scenario 2, a per decade reduction of 40 000 cubic metres in the annual harvest rate is planned for the next 100 years, followed by a 50 year period of regular increases that would bring the harvest level to the LTHL 160 years into the future. As compared to Scenarios 1 and 3, Scenario 2 has the lowest minimum harvest level and requires an additional 60 years to reach the LTHL. Perhaps the chief virtue of this scenario is that the rate of decrease is gradual and regular.

Scenario 3 calls for an immediate reduction in the harvest rate to 2 673 000 m3 per year, which is a drop of 278 121 m3 per year, or 9%. This lower harvest level would be maintained for 100 years, and then would increase to the LTHL of 2 810 000 m3 per year. While the reduction is much more dramatic in this scenario than in Scenario 1, the harvest forecast from Decade 4 - 10 is somewhat higher than it is under Scenario 1.

4.2.1 Employment and Income Impacts of Scenarios 2 and 3

In the first decade of the forecasts, Scenario 3 would result in job losses, while Scenario 2 would maintain current levels. Scenario 3 would reduce TSA direct employment by

approximately 163 PYs in the first decade, then would support 1550 direct PYs for the next 90 years. Scenario 2 would lower direct employment in the second decade by 25 PYs. Tables 4.6 through 4.9 show the employment and income impacts of Scenarios 2 and 3.

Total, direct, indirect and induced, employment associated with Scenario 3 would decline by 229 PYs in the TSA in Decade 1, and by a further 391 PYs outside the TSA. Total employment losses associated with Scenario 2 would be much less severe with 37 total PYs lost in the TSA by the end of Decade 2, and a further 61 total PYs lost outside the TSA.

TABLE 4.6: TSA EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 2

		TSA Employment Levels			TSA After Tax Income Levels (\$ million)		
Period	Harvest Level ('000 m3/yr)	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	1713	681	2394	58.68	14.05	72.71
1	2951	1713	681	2394	58.68	14.05	72.71
2	2910	1688	669	2357	57.87	13.85	71.70
3	2870	1665	660	2325	57.07	13.66	70.72
4	2830	1641	651	2292	56.28	13.47	69.73
5	2790	1618	642	2260	55.48	13.28	68.75
6	2750	1595	633	2228	54.69	13.09	67.76

TABLE 4.7: PROVINCIAL EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 2

		Provincial Employment Levels			Provincial After Tax Income Levels (\$ million)		
Period	Harvest Level ('000 m3/yr)	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	2600	3900	6500	90.26	81.22	171.48
1	2951	2600	3900	6500	90.26	81.22	171.48
2	2910	2561	3841	6402	88.90	80.00	168.89
3	2870	2526	3788	6314	87.67	78.90	166.57
4	2830	2490	3736	6226	86.45	77.80	164.25
5	2790	2455	3683	6138	85.23	76.70	161.93
6+	2750	2420	3630	6050	84.01	75.60	159.61

TABLE 4.8: TSA EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 3

		TSA Employment Levels			TSA After Tax Income Levels (\$ million)		
Period	Harvest Level ('000 m3/yr)	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	1713	681	2394	58.68	14.05	72.71
1-10	2673	1550	615	2165	53.16	12.72	65.86
11-40	2810	1630	646	2276	55.88	13.38	69.24

TABLE 4.9: PROVINCIAL EMPLOYMENT AND INCOME IMPACTS OF SCENARIO 3

		Provincial Employment Levels			Provincial After Tax Income Levels (\$ million)		
Period	Harvest Level ('000 m3/yr)	Direct	Indirect and Induced	Total	Direct	Indirect and Induced	Total
Current	2951	2600	3900	6500	90.26	81.22	171.48
1-10	2673	2352	3528	5880	81.66	73.48	155.14
11-40	2810	2473	3709	6182	85.84	77.25	163.09

4.2.2 Government Revenue Impacts of Scenarios 2 and 3

Tables 4.10 and 4.11 show the total provincial and government revenues for Scenarios 2 and 3. Stumpage revenues account for approximately 58% of total provincial revenue. The majority of federal revenues (95%) comes from income tax.

TABLE 4.10: SCENARIO 2 TOTAL PROVINCIAL AND FEDERAL GOVERNMENT REVENUES (\$MILLIONS)

Period	Harvest Level ('000 m3/year)	Total Provincial	Total Federal
Current	2951	82.9	41.5
1	2951	82.9	41.5
2	2910	81.7	40.8
3	2870	80.6	40.3
4	2830	79.5	39.7
5	2790	78.4	39.2
6+	2750	77.3	38.6

TABLE 4.11: SCENARIO 3 TOTAL PROVINCIAL AND FEDERAL GOVERNMENT REVENUES (\$MILLIONS)

Period	Harvest Level ('000 m3/yr)	Total Provincial	Total Federal
Current	2951	82.9	41.5
1-10	2673	75.1	37.5
11-40	2810	78.9	39.4

5.0 Social and Environmental Implications

This chapter presents the potential effects of changes in the TSA timber harvest level on the communities in the Mackenzie TSA, the First Nations bands and the natural environment.

5.1 Implications for Communities

The social effects of TSA timber supply reductions are organized into two categories: 1. worker and family based effects, and 2. community based effects. The discussion of the potential social effects of harvest reductions is focused on the short term, i.e., the first decade. The PY reductions identified in the economic impact analysis are presented, followed by a short review of how job losses can affect the mental and physical health of individuals and families. Next these job losses are placed into context with respect to the Mackenzie total forest sector employment, and other events currently occurring in the area that will affect local employment. The implication of these changes on the local services infrastructure is then discussed. Finally, opportunities for mitigating the employment and employment income impacts resulting from timber supply reductions are presented.

5.1.1 Employment Implications

Scenario 1

Scenario 1 assumes no reduction in the harvest level for three decades, thus no immediate employment losses would occur, if current production and labour intensity does not change.

Mill closures

Immediate job losses related to mill closures would not occur as a result of Scenario 1. However, local representatives stated that the certainty of a stable supply of timber is essential if the major licensees are to make the reinvestment necessary to upgrade the older sawmills.

Alternative Initial Harvest Forecasts

Scenario 3, with an immediate 9% reduction in the harvest level would cause an employment loss in the TSA of approximately 229 direct, indirect and induced PYs. Scenario 2, with no immediate reduction in the harvest level, would lead to no TSA job losses in the first decade, 37 jobs lost in the second decade, and 32 jobs lost in the third decade.

5.1.2 Effects of Job Loss on Workers and their Families

Unemployment often precipitates physical and/or mental breakdown and has been associated with heart and kidney problems, numerous stress-related diseases, including hypertension,

bone and joint ailments, chronic headaches, as well as diminished self esteem and psychological problems (Lee 1994).

While is impossible to predict how Mackenzie TSA residents will react to job loss, some general impacts are described below:

- increase in measure of behavioural stress,
- negative impact on children as a result of changes in parental roles and the economics of job loss,
- greater suffering by older, longer tenured workers (45 to 55 years old), versus younger workers,
- effects will occur soon after layoffs, then once again after the initial response by community and governments has died down (ARA 1993).

Carlson (1991) reports in a study of forest workers in the U.S. Pacific Northwest, that families as a whole faced strong emotional impacts. While the harvest reductions in the U.S. were far more severe than what would occur in the TSA, individuals could show similar signs of stress. The study found that approximately 7% reported that family relationships became very difficult and unhappy. Children, in particular, are affected by poverty, abuse through distressed parents, and could be psychologically harmed through family and community disintegration. Given the magnitude of impacts estimated under Scenario 1, such severe community impacts are unlikely.

5.1.3 Employee Transition during Job Loss

Evidence suggests that forest workers have strong ties to their communities. Lee (1993) reports that unemployed workers tend to remain in their communities, and will either fall into one of three categories, or will progress through them: 1. Look for another job in the forest industry, using unemployment insurance or social assistance in the interim; 2. Seek retraining and/or other work in another industry; or 3. Adopt a more subsistence lifestyle, relying on community programs such as food banks and short-term jobs. Workers will often move through these options sequentially and the pathway is dynamic not captured by snapshots at one point in time (Lee 1993).

Workers who find themselves in the first category are likely to have limited success, as a result of the decline in traditional forestry related jobs. Workers who fall into the second category have found that, when successful in finding new employment, their incomes are reduced by up to 33% (Lee 1993). Increasing evidence suggests that workers are frequently unsuccessful in finding alternate employment. For example, experience in mining communities in Ontario with retraining programs have clearly indicated that by the time the workers are retrained the potential jobs are already taken, and in any case the workers simply cannot afford to leave their single biggest investment (their homes) in search of greener pastures elsewhere (DeMarco 1994. Personal Communication). This is clearly a dilemma for many resource dependant communities in Canada. The third category then becomes the option by default (or

non-option), particularly where the workers are older with less education (Carlson 1991).

5.1.4. Effects on Community

Stresses placed on workers and their families as a result of job losses, in turn, increase stresses in the local community. In the short term, none of the harvesting Scenarios appear to have the potential to have a large negative effect on the community. However, it is abundantly clear from interviews that Mackenzie is still a very fragile community. While Scenario 1 would not create any impacts for three decades, if reductions were to occur immediately and in the magnitude of Scenario 3, over 6% of the TSA's employment base could be affected.

Local businesses are struggling to survive as many Mackenzie residents shop in regional centres such as Prince George. Currently, there is a cash drainage out of the local economy, meaning that a significant portion of the financial benefits of the large primary industry (wood processing) are being captured outside the local economy.

The fragility of the community is also demonstrated by examining the thresholds at which certain government services are provided. If the town's population is reduced by a significant amount, many 'essential' social and health services could be withdrawn. For example, the presence of a local hospital is largely determined by the level of population in the area. If Mackenzie drops below a certain population level the hospital could be shut down. The same hold true for many other essential social services.

Recent research has also found an unhealthy dependency in single industry towns, and that overdependence on a large manufacturing operation is not healthy for the community and its citizens. Experience has shown that transition in the aftermath of plant closures has been very traumatic (Beckley 1993a; Beckley 1993b).

5.1.5 Opportunities for Mitigation

To mitigate the impacts of changes in harvest levels, communities, government and industry could examine several opportunities. For example, local business people will have to improve local services and the community entrepreneurs will have to continue to explore more opportunities for value added manufacturing. Unions will have to re-examine their position on appropriate wage levels and find other economic incentives such that companies are not pressured to continually substitute capital for labour to save on labour costs. Opportunities now exist to increase local silviculture employment and income through the BC Forest Renewal Plan. All of these initiatives need to be co-ordinated in order to create greater economic diversity and better partnerships among community people in order to build a sustainable future.

There is often the suggestion that tourism or other resource industries may provide alternate employment. However, tourism has never been a large employer in northern Canada and

efforts to increase levels of employment in this sector have not been overly successful to date. Currently, mineral exploration in many jurisdictions, including the Mackenzie TSA, has not been pursued with vigour since mining companies have options in other countries, and because of the increasing uncertainty of being allowed to develop the mineral resource even if found.

5.2 Implications for the First Nations Communities

5.2.1 Timber Supply Reductions

The employment of First Nations members within the TSA is dependant on the timber sector. However, First Nations members also rely heavily on the subsistence use of the resource, which can conflict with timber extraction activities. Bands could have conflicts trying to run logging business and changes in supply could affect the financial viability of their operations. Interview subjects stated that First Nations businesses already face tremendous obstacles in gaining a share of the log contracting market. Forest companies are more comfortable working with established logging contractors of non-Aboriginal descent. Thus, they are frequently not given the opportunity to bid on the rights to cut. Reductions in the timber supply can only make it more difficult for them to gain market share.

5.2.2 Employment Effects

Unemployment levels in First Nations communities within the TSA are extremely high. Nevertheless, some band members do obtain at least short-term employment in forestry activities and there is a great deal of interest in increasing the participation in forestry employment. First Nations face a dilemma in that many of their people still rely heavily on traditional resource use activities, which can conflict with current forest management activities.

First Nations within the TSA have primarily become involved with 'in the bush' activities such as logging, silviculture contracting and fire fighting. There are virtually no First Nations employees in the mills. Some interviews suggested that very few native people are interested in this type of employment. The local Forest Service office and forest companies have expressed interest in recruiting First Nations staff to work in forest management positions. To date there has been a lack of qualified candidates.

Recent provincial government initiatives such as the Forest Worker Development Program and the Forest Renewal Program have a goal of increasing First Nations participation. Local Forest District offices have also been instructed to negotiate interim measures agreements with local bands, which include contracting and other economic opportunities. The Mackenzie Forest District has negotiated interim measures agreements with the McLeod Lake and Tsay Keh Dene bands. Potential agreements are being discussed with the Takla Lake bands.

5.2.3 Band Interests in Protection of Territory

The Fort Ware and Tsay Keh Dene bands have identified positions opposed to logging and other industrial development on large tracts of their traditional territory. The bands have stated that they want to keep these areas in a natural state to continue to pursue their traditional hunting, fishing and cultural activities. If these positions are realized, there will be a significant reduction in the available timber harvesting land base and sustainable harvest levels in the Mackenzie TSA. This in turn would lead to a reduction in economic opportunities for the band members and companies involved in forestry activities.

5.3 Environmental Implications

The creation of Williston Reservoir in the late 1960s caused dramatic impacts on the environment in the Mackenzie TSA. Approximately 1.5 million hectares of mainly forested land was flooded. Although some of the reservoir was cleared, much of the area was flooded with the forest cover remaining in place. Particularly in the first few years, massive volumes of floating woody debris were found in the reservoir. The reservoir flooded vast areas of low elevation, high quality wildlife habitat, and disrupted wildlife migration patterns. The reservoir level commonly fluctuates about 15 metres on an annual cycle, however fluctuations of up to 30 metres are permitted. This water level fluctuation greatly reduces the fish and wildlife habitat potential of the shoreline areas.

In recognition of the impacts of the reservoir on fish and wildlife, BC Hydro and the BC Ministry of the Environment, Lands and Parks jointly manage the Williston Compensation Program. The Williston Compensation Program supports research and inventory projects related to fish and wildlife values and management. It also attempts to maintain and enhance fish and wildlife habitat and populations, and provides opportunities for public involvement and education in fish and wildlife management. It is the responsibility of the BC Ministry of Environment, Lands and Parks to make recommendations on integrating fish and wildlife in resource management.

Forestry activities can have a variety of impacts on environmental values, particularly on fish and wildlife habitats. Road construction provides access to, and increases hunting pressure on, sensitive wildlife populations (e.g. grizzly bears, caribou). Clear-cut harvesting removes thermal and security cover which is important for numerous species of wildlife and results in direct habitat loss for old growth dependant species. Furbearers have been adversely impacted and grizzly bear habitat has also been affected. While the creation of an early seral stage has increased moose populations, this has resulted in increased predation on certain other species by wolves following the increased moose populations. In short, some large predator-prey systems have been influenced.

One species of particular concern is woodland caribou which relies heavily on old growth forests for winter habitat. Forest vegetation management practices also limit browse

production and biodiversity on reforested areas. A further concern is the loss of current and future snags and coarse woody debris through timber harvesting and site preparation practices.

There are two primary impacts on the fisheries resource. Forestry activities, particularly road building, have the potential to cause siltation and damage to fish habitat. The fisheries productivity of the TSA is generally low due mainly to the cold climate, which results in cold water temperatures. Logging road access to previously remote lakes and streams increases the fishing pressures and can lead to the depletion of some fish populations.

Although roads are essential for human commercial and recreational use, they remove land from production and may significantly increase the potential for wildlife disturbance and poaching. Changes in water quality are often a function of altered flow regimes, however they are also caused by forest practices that expose erodible materials. This ranges from the surface erosion of forest roads to mass wasting events caused by logging or road building in unstable terrain. Although there are techniques for minimizing the severity and risk of such incidents, forest practices inevitably elevate the transport of sediment and other materials into water bodies. Closure and rehabilitation of roads as well as proper location and engineering reduces their impact.

There are a number of access options that can be pursued irrespective of the alternative harvest scenarios chosen. For example, the environmental impacts will depend on the mode of log transport, type of harvesting system, road standards, and management actions taken after logging.

Forest practices are being changed to reduce the negative impacts of these activities on environmental values. The new Forest Practices Code contains many requirements to further protect fish and wildlife values. Research has provided innovative methods to maintain environmental values while conducting forestry activities. The application of these practices will likely reduce, but not eliminate the potential for conflict between forestry, fish and wildlife, and other resource use values.

6.0 Summary and Conclusions

6.1 Summary

This report set out to (a) describe the economy, physical environments and land use issues within the Mackenzie TSA, and (b) assess the socio-economic and environmental implications of changing the current TSA timber harvest level.

Chapter two provides a general profile of the Mackenzie TSA. Chapter three focuses on the Mackenzie TSA forest sector. It describes the land base available for timber harvesting, the timber supply issues and current management practices. It also provides an overview of the major licensees and forest sector employment. Finally, it outlines the three harvest forecasts used to illustrate potential implications of changing harvest levels. Chapters four and five examine the potential economic and social and environmental effects of the three harvest forecasts. Economic impacts are estimated at both the TSA and provincial levels.

6.1.1 Harvest Level Forecast

Scenario 1

Scenario 1 begins with the continuation of the harvest level at 2 951 121 m³ per year for three decades. In the fourth decade, the harvest level is reduced to 2 796 000 m³ per year and in the fifth to the tenth decade is reduced to 2 640 000 m³ per year. After that, the harvest level will rebound to 2 810 000 m³ per year. This is in effect the long-term harvest level (LTHL). The LTHL is a 5% decline over current harvest levels.

Scenario 2

To spread the harvest reduction more evenly, Scenario 2 would reduce the harvest by 40 000 m³ in each of the second through tenth decades. Then it would be increased at the same rate for the eleventh to sixteenth decades, at which time the LTHL would be reached. The emphasis is on spreading the change over a longer time period, thereby minimizing the socio-economic impacts in any one period.

Scenario 3

Scenario 3 suggests an immediate harvest reduction of 9% to 2 673 000 m³ per year, where it would remain for the next ten decades. The harvest level would then increase to the LTHL of 2 810 000 m³ per year thereafter.

6.1.2 Economic Impacts

TSA Employment and Employment Income

Forestry plays an overwhelmingly dominant role in the Mackenzie TSA economy. Over 70%

of the TSA's total employment is related either directly or indirectly to the forest industry. The TSA harvest currently supports over 1700 direct forestry person years (PYs) and \$59 million of associated after-tax employment income. This in turn generates a further 681 indirect and induced employment opportunities in the TSA and close to \$14 million in indirect and induced incomes. The BC Forest Service supports a further 70 full time jobs administering the Mackenzie Forest District.

No economic impacts related to Scenario 1 would occur for three decades. However, if the harvest level were to decline by about 9% as in the first decade of Scenario 3, direct forestry employment in the TSA would lower by 163 PYs and direct after tax employment income by about \$5.5 million.

The total TSA direct, indirect and induced employment level supported by the LTHL is estimated to be 2276 PYs: 118 fewer jobs than the current level supports.

Provincial Employment and Employment Income

The current harvest level supports a further 887 direct jobs outside of the TSA and additional direct after-tax employment income of \$31.6 million. In the first decade, a reduction consistent with Scenario 3 would lower total employment by 620 PYs and total employment income by approximately \$16.4 million.

Government Revenues

Forestry operations associated with the current harvest level generates, in total, approximately \$72.08 million in provincial government revenue and \$58.16 million in federal government revenue. A 9% reduction as in Scenario 3 would reduce revenues of the provincial government by \$6.81 million and federal government by \$5.51 million.

6.1.3 Social and Environmental Implications

Implication for Communities

Given the relatively minor degree of change with each of the timber harvest levels, it is difficult to ascertain specific implications. In general, the communities need to be aware that job losses can have a significant effect on the mental and physical health of individuals. Social agencies can help mitigate some of the effects of job loss but reliance on a social agency for income is clearly not a desirable option in the longer term.

Implications for First Nations

There are positive and negative elements of timber harvesting for First Nations bands. Timber harvesting is an important source of employment, and stable employment is seen as essential to the bands in dealing with their social and economic problems. Conversely, harvesting in some areas could have a negative impact on their subsistence lifestyle and could affect other natural resources available to them. For example, road access could reduce large game populations, and disrupt traditional subsistence activities.

Environmental Implications

Given the small amount of change in the harvest forecasts under each Scenario, and the lack of spatial consideration in the harvest forecasts, there are no easily determined differences in the environmental impacts among the scenarios, or between the current harvest level.

Significant environmental impacts are associated with increasing road access. Since the timber supply projections do not provide any information on the spatial location and timing of timber harvesting it is impossible to provide any specific assessment

6.2 Concluding Remarks

This study identifies potential economic, social and environmental implications associated with reductions in the Mackenzie TSA timber harvest level. The analysis assumes that factors such as the timber harvesting land base, forest management practices, harvesting and processing technology, forest regulations and timber prices remain constant. A change in any of these variables would require re-visiting the analysis.

The Mackenzie Timber Supply Analysis indicates that, under existing conditions, the TSA would not experience severe harvest reductions while moving to the long-term harvest level. The purpose of this report is to provide information that can help to indicate how communities may be affected if the level of forestry activity in the Mackenzie TSA changes.

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Appendix 1. Mackenzie TSA Red and Blue List Species

Red-List Species	Blue-List Species
<p>Birds</p> <p>American Peregrine Falcon</p> <p>Mammals</p> <p>Northern Long-Eared Myotis</p> <p>Plants</p> <p>Virginia Polypody</p> <p>Cordate Leaved Saxifrage</p> <p>Mountain Golden Bean</p> <p>Prairie Golden Bean</p> <p>Weak Alkali Grass</p>	<p>Birds</p> <p>Short-Eared Owl</p> <p>American Bittern</p> <p>Trumpeter Swan</p> <p>Yellow-Bellied Flycatcher</p> <p>Bald Eagle</p> <p>Fish</p> <p>Bull Trout</p> <p>Mammals</p> <p>Wolverine</p> <p>Fisher</p> <p>Stone Sheep</p> <p>Woodland Caribou</p> <p>Grizzly Bear</p> <p>Plants</p> <p>Western Dogbane</p> <p>Tundra Milk-Vetch</p> <p>Holm's Rocky Mountain Sedge</p> <p>Slender Paintbrush</p> <p>Grey-Leaved Draba or Willow Grass</p> <p>Small-Flowered Willowherb</p> <p>Northern Daisy</p> <p>Bog Rush</p> <p>Maydell's Locoweed or Oxytropes</p> <p>Coil-Beaked Lousewort</p> <p>Five Leaved Cinquefoil</p> <p>Birdfoot Buttercup</p> <p>Snow Pearlwort</p> <p>Northern Selaginella</p> <p>Umbellate Starwort</p> <p>Smooth Cliff or Woodsia</p> <p>Plant Associations</p> <p>Subalpine fir - alder - horsetail</p> <p>Subalpine fir/black spruce - labrador tea</p>

Source: Mackenzie Forest District.

Red-list species are recognized as threatened or endangered throughout all or a significant portion of their range in B.C., or are considered as potential designates for such status. Blue-list species have been regionally identified as sensitive or vulnerable species, i.e., species that are not threatened but are particularly at risk of such status.

Appendix 2. Glossary of Terms

Allowable Annual Cut (AAC) The volume of timber that may be cut per year from a forest management unit (e.g., a TSA), set by the Chief Forester in accordance with Section 7.0 of the Forest Act.

AAC Apportionment The allocation by the Minister of Forests of the AAC for a TSA among timber tenures in accordance with Section 8.0 of the Forest Act.

Basic silviculture A term used to refer to the silviculture treatments carried out to ensure the establishment of a free growing tree crop. This may include surveying, site preparation, planting, direct seeding or brushing.

Biodiversity The diversity of plants, animals and other living organisms and their habitats measured by factors such as genetic variability, number of species and variation in species composition.

Biogeoclimatic zones Areas which are defined by similar biological, physical and atmospheric characteristics

Cutblock adjacency guidelines Integrated management guidelines that specify the desired spatial relationship among cutblocks. They can be approximated by specifying the maximum allowable proportion of a forested landscape that does not meet green-up requirements.

Direct employment Employment in the forestry sector (harvesting, milling, and silviculture).

Ecosystem Any complex of living organisms together with all the other biotic factors which affect them.

Environmentally Sensitive Area (ESA) An area with significant non-timber values, fragile or unstable soils, problems in establishing a new tree crop, or where timber harvesting may cause avalanches.

Ecoprovince An area of the earth's surface characterized by very broad ecological interactions between the four major environmental components of the ecosystem: air, water, land and biota.

Forest cover requirements These specify desired distributions of areas by age or size class groupings. These requirements can be used to reflect desired conditions for wildlife, watershed visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover requirements.

Forest Licence (FL) This licence is the major forest tenure for timber Supply Areas in BC. It provides a replaceable AAC in a TSA to an operator who has an established or proposed

processing facility.

Green-up period The time needed for a stand of trees to reach a desired condition (e.g. such as a certain minimum height) to ensure maintenance of water quality, wildlife habitat, soil stability, or aesthetics.

Incremental silviculture Refers to stand treatments after basic silviculture has been completed and includes spacing, fertilizing, and pruning).

Indirect employment Employment in sectors which supply materials, equipment, and services to the forest sector.

Induced employment Employment supported by the local respending of the incomes of those employed in the forest sector.

Inoperable areas Areas defined as unavailable for harvest for terrain-related or economic reasons.

Long-term harvest level Refers to timber harvesting levels whereby the volume of timber harvested in any given period can be replaced by a similar volume from regenerated stands within the same period.

Management assumptions Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, minimum cutting ages, utilization levels and standards, integrated resource guidelines, silviculture, and pest management programs.

Non-Crown areas Areas not managed directly by the BC Forest Service (for example, private land, Indian Reserves, and provincial parks).

Non-forest areas Areas not occupied by productive forest cover (such as rock, swamp and alpine areas).

Non-commercial cover areas Areas occupied by non-commercial tree or brush species. Areas occupied by timber stands that are accessible and otherwise available for timber harvesting but are assumed to be non-merchantable due to stand characteristics such as small size, incidence of decay and low stocking.

Person Year (PY) A standard measure of employment that takes into account part-time and seasonal full-time work. For example, an employee working full-time for six months would represent 0.5 PY of employment. Using this measure allows different types of employment to be compared on a similar basis.

Riparian zone The stream bank and flood plain adjacent to streams or water bodies.

Small Business Forest Enterprise Program (SBFEP) A program introduced in 1987 to provide opportunities for small businesses in the forest sector. Timber is sold to loggers, small sawmills, and re-manufacturers.

Timber Sale Licence (TSL) Licences providing established operators with a ten year AAC over undefined areas of Crown land in a TSA. These licences are replaceable in their last year. Shorter term timber sale licences are also issued to small business loggers and to timber processors who qualify for registration under the Small Business Enterprise Program.

Timber Supply Area (TSA) An integrated resource management unit established in accordance with Section 6 of the Forest Act.

Unsalvaged losses The volume of timber killed or damaged annually by natural causes (such as fire, wind, insects and disease) and not harvested.

Visual Quality Objective (VQO) Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes can be defined based on the maximum amount of alteration permitted. VQO restrictions are found in tourist and other visually sensitive areas.

Watershed An area drained by a particular stream or river. A large watershed may contain several smaller watersheds.

Woodlot Licence A licence issued to an individual to manage a specific area of Crown Timber, plus any private woodlands the individual holds. Requires the holder to file a management plan and to harvest at a pre-determined rate.

Appendix 3. List of Contacts

Mackenzie Community

Tammy Rolla	Mackenzie Counselling Services
Ron Terlesky	Economic Development Committee, Mackenzie Chamber of Commerce
Bruce Bennett	Mackenzie 2150 Task Force
Dave Hargreaves	Mackenzie Rotary Club
Brian Ritchie	Administrator, District of Mackenzie
Glen Ball	Pulp and Paper Woodworkers of Canada
Julie Carew	College of New Caledonia

First Nations

Chief Charlie Boya	Fort Ware Band
Gary Jung	Fort Ware Band
Chief Harry Chingee	McLeod Lake Band
Barry Vickers	Takla Development Corp. Takla Lake Band

Industry

Carl Baker	Fletcher Challenge Canada Ltd.
John Dahl	Finlay Forest Industries Inc.
Ron Lind	Analog Forest Products
Lena Brommeland	El Condor Resources

Government

Corrie Ulmer	Ministry of Aboriginal Affairs
Laurie McGregor	Ministry of Aboriginal Affairs
Charlie Hodgson	Ministry of Social Services
Dana Becker	Forest Ecosystem Specialist, Ministry of Environment
Dave Francis	Operations Manager, Mackenzie Forest District
Anne Anderson	Planning Officer, Mackenzie Forest District
Anna Monetta	Resource Planner, Prince George Forest Region
Howard Willis	Planning Officer, Prince George Forest Region
Sinclair Tedder	Economist, Economics and Trade Branch, Ministry of Forests, Victoria
Garett Cousner	Labour Market Analyst, Canada Employment Centre

Appendix 4. Economic Impact Methodology

The impacts presented in this analysis are estimates of the employment and income changes that may occur as timber harvesting moves towards a long-term harvest level. The numbers should not be considered definitive, but illustrative of the trends to expect. Three levels of employment and income impacts occur in response to economic changes: direct, indirect, and induced. Direct activity comprises all forestry related activities involved with harvesting, processing, and silviculture. Indirect impacts result from the purchase of goods and services by direct forestry businesses. Induced impacts arise as a result of employees spending their wages and salaries on consumer goods and services. When direct activity is reduced (increased) the level of spending related to that direct activity also decreases (increases), thus affecting indirect and induced supplier revenues, which in turn leads to staff decreases (increases).

This section first discusses the estimation of labour coefficients, then income levels used to estimate employment income impacts, employment generated outside the TSA, and the multipliers used in the calculation of indirect and induced impacts. Finally, the Appendix lists the provincial and federal revenue rates used to estimate changes in government revenues.

Employment Coefficients

Labour coefficients are used to calculate forestry related employment associated with particular harvest levels. The coefficients reflect the relationship between the number of workers and the quantity of timber harvested, and are presented in the form of labour per 1000 cubic metres of timber cut. Coefficients were derived for harvesting, silviculture, and processing. Multiplying the coefficients by each forecast harvest level provides a projection of the number of workers that would be employed in the forest industry at a selected interval of the forecast period.

Some assumptions are inherent in this type of analysis:

1. The relationship between the number of workers and the quantity of timber harvested is held constant. Thus, the labour coefficients do not change over the forecast period and do not adjust for potential increases or decreases in labour intensity. The method assumes that the current economic relationships will continue into the future. In other words, current socio-economic conditions (productivity, harvest practices, and social objectives of forest use) will continue for the length of the forecast period. These conditions will likely, of course, change in the future.
2. The presentation of impacts suggests that employment and income losses would occur immediately with a change in the quantity of timber harvested. Thus, when the harvest rate declines, employment in harvesting, silviculture, and processing is assumed to immediately decline also. However, the adjustment process would likely occur over a

longer time period. The analysis is not able to predict the exact time at which the losses would occur. While direct harvesting activity would likely decline in concert with harvest levels, processing employment, for example, would adjust over a longer period as timber flows adjust to harvest changes occurring throughout the province, and inventories are lowered. Silviculture employment would not decline immediately either, as a result of a lag-time between harvesting and the completion of basic silviculture.

3. Changes in indirect and induced employment and income would also not occur immediately. While the number of jobs related to the harvest is estimatable, the time at which these 'spin-off' changes will occur is not. Multipliers are static representations of particular economic conditions and do not provide a temporal, or dynamic, insight into the occurrence of impacts.

These qualifications are not the fault of this or any impact analysis, but are the result of theoretical assumptions inherent in static economic impact assessment techniques. As such, the assessment provided here represents the best approximations, given the use of the best available information.

Table A4.1 shows the TSA and provincial employment coefficients for the Mackenzie TSA.

TABLE A4.1: MACKENZIE TSA DIRECT, INDIRECT AND INDUCED EMPLOYMENT COEFFICIENTS.

Forest sub-sector	TSA Direct Employment per 1000 m3 Harvested	TSA Direct Employment (PYs)	Provincial Direct Employment per 1000 m3	Provincial Direct Employment (PYs)
Harvesting	0.09	258	0.29	860
Pulp and Paper Mills	0.12	365	0.14	405
Sawmills	0.36	1051	0.39	1140
Silviculture	0.01	39	0.07	195
Total Direct	0.58	1713	0.89	2600
Indirect and Induced	0.23	681	1.32	3900
Total Employment	0.81	2394	2.20	6500

The figures shown above do not include Ministry of Forests employment levels because it is felt that the MOF employment is more closely tied to government spending and the level of administration activity, and less closely connected with harvest levels. For the sake of completeness, there are 70 PYs of employment generated by the MOF in the Mackenzie District, which is expected to increase as the Forest Practices Code is implemented.

Employment Income

Table A4.2 shows the average after-tax income levels used in the analysis. Information on direct after-tax incomes were obtained through interviews with local forestry operators. Indirect and induced after-tax incomes were obtained from the Ministry of Finance and Corporate Relations.

Provincial average indirect and induced after-tax income estimates were taken from Price Waterhouse (1995) study of the Prince George forest sector.

TABLE A4.2 AVERAGE AFTER -TAX EMPLOYMENT INCOME LEVELS BY SECTOR

Forestry sub sector	TSA After-Tax Income
Harvesting	39 795
Pulp and Paper	37 630
Other Wood Products	32 288
Silviculture	20 433
Weighted Average	34 616
Indirect and Induced	20 826

Provincial level employment

Provincial level impacts include non-TSA residents working in the Mackenzie TSA forestry sector who will not generally spend their incomes in communities within the TSA. Non-TSA employment also results from Mackenzie TSA harvested timber being processed at mills located outside the TSA, and through processing of TSA sourced chips. Provincial employment equals TSA plus non-TSA employment.

The first step in estimating non-TSA employment is to calculate the volume of wood harvested by non-residents. Interviews revealed that a high proportion (roughly 70%) of the logging staff are non-residents of the TSA. Most loggers live in the Prince George area and commute to remote logging camps where they work for ten days and then take four days off. Note that the volumes cut by operators based in McLeod Lake and through the Tsay Tay operation are assumed to have been cut by local contractors. Approximately 600 PYs ($0.7 * 859$) of harvesting employment accrue to non-TSA residents.

Very little of the timber cut within the TSA is processed by non-TSA mills. The Mackenzie mills owned by Fletcher Challenge and Finlay consume all of the timber obtained from their forest licences. The only wood from Mackenzie to leave the TSA is cut under the SBFEP; most of this volume goes to Prince George for processing. In 1994, approximately 283 300

m3 went to Prince George for processing. Based on processing coefficients from Price Waterhouse of 0.31 for solid wood and 0.14 for pulp and paper, approximately 128 PYs are supported in Prince George by Mackenzie TSA harvested timber.

Estimating Indirect and Induced employment

Employment multipliers for the Mackenzie TSA were provided by the Ministry of Finance and Corporate Relations: 1.51, 1.53, and 1.32 for logging, pulp and paper, and other wood manufacturing respectively. The logging multiplier was also used to estimate indirect and induced silviculture employment. Sawmills are part of other wood manufacturing. A weighted average multiplier for the TSA is approximately 1.41.

The multipliers should be interpreted such that for every direct forestry sector person year, the logging sector generates a further 0.51 PYs of indirect and induced employment, the pulp and paper sector generates a further 0.53 PYs, and the sawmill sector generates a further 0.32 PYs. Alternatively, for all sectors of the forest industry in the Mackenzie TSA, an average direct forestry PY supports a further 0.41 PYs of employment in supply and service sectors.

A provincial multiplier of 2.5 was used to estimate the provincial level indirect and induced employment impacts. This higher multiplier is used to capture employment that accrues outside of the TSA. For example, many supply and service jobs are located outside the TSA in the Prince George region. Also, Vancouver is home to the corporate headquarters and headquarter services that support operations in Mackenzie. Induced impacts also spread throughout the province and are captured in the provincial employment multiplier. The multiplier indicates that for each direct forest sector job in Mackenzie, a further 1.5 jobs are created throughout the province (this includes those within the TSA). The total impact related to that job would be 2.5 (direct + indirect + induced).

Provincial and Federal Revenues

Provincial and federal revenues were estimated using information provided by the Ministry of Forests. Stumpage information for five years was gathered to estimate an inflation adjusted stumpage rate, which reflects the increased stumpage rates that went into effect in 1994. The average rate of \$14.19 per cubic metre was estimated by adjusting the 1994 average stumpage rate of \$20.44 per cubic metre by a lumber price index for the years 1990 to 1994. The procedure provides an average rate that reflects price fluctuations.

The income tax portions of government revenues were estimated for direct, indirect and induced incomes using a Revenue Canada tax table that provides income tax rates for various levels of income. The average tax rate for the Mackenzie Forest District was found to be 29%. Table A4.3 shows the revenues by harvest volume.

TABLE A4.3 GOVERNMENT REVENUES BY VOLUME OF TIMBER HARVESTED

	Provincial	Federal
Stumpage rate (\$ per m3)	14.19	n/a
Income tax (\$ per 1000m3)	6 320	12 659
Corporate taxes (\$per 1000 m3)	7 575	1 380

Appendix 5. Incremental Economic Impacts of the Mackenzie TSA Timber Harvest Forecasts

		TSA						Province						Government Revenues	
		Employment (PYs)			Income (\$ millions)			Employment (PYs)			Labour Income (\$ millions)			Provincial	Federal (\$ millions)
		Direct	Indirect/ Induced	Total	Direct	Indirect/ Induced	Total	Direct	Indirect/ Induced	Total	Direct	Indirect/ Induced	Total		
Decade	Harvest '000m ³														
Current Level	2951	1713	681	2394	58.7	14.0	72.7	2600	3900	6500	90.3	81.2	171.5	82.1	41.5
Scenario 1															
1-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	-155	-91	-38	-129	-3.1	-0.7	-3.8	-140	-209	-349	-4.8	-4.4	-9.2	-3.6	-2.2
5	-156	-91	-36	-127	-3.1	-0.7	-3.8	-137	-206	-343	-4.8	-4.3	-9.1	-4.3	-2.3
11	+170	+99	+39	+138	+3.4	+0.8	+4.2	+150	+224	+347	+5.2	+4.7	+9.9	+4.7	+2.5
Total Change	-141	-83	-35	-118	-2.8	-0.7	-3.5	-127	-191	-318	-4.4	-4.0	-8.4	-3.2	-2.0
Scenario 2															
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-41	-25	-12	-37	-0.8	-0.2	-1.0	-39	-59	-98	-1.4	-1.2	-2.6	-1.2	-0.7
3-9	-320	-186	-73	-259	-6.4	-1.5	-7.9	-282	-422	-704	-9.8	-8.8	-18.6	-8.9	-4.5
10-15	+220	+128	+50	+178	+4.4	+1.1	+5.5	+194	+290	+484	+6.7	+6.0	+12.8	+6.2	+3.1
Total Change	-141	-83	-35	-118	-2.8	-0.7	-3.5	-127	-191	-318	-4.4	-4.0	-8.4	-3.2	-2.0
Scenario 3															
1	-278	-163	-66	-229	-5.5	-1.3	-6.8	-248	-372	-619	-8.6	-7.7	-16.3	-7.8	-4.0
11	+137	+80	+31	+111	+2.7	+0.7	+3.4	+121	+181	+301	+4.2	+3.8	+7.9	+3.8	+1.9
Total Change	-141	-83	-35	-118	-2.8	-0.7	-3.5	-127	-191	-318	-4.4	-4.0	-8.4	-3.2	-2.0