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THE UNIVERSITY OF ALBERTA

THE ECONOMIC IMPACT OF THE FOREST INDUSTRY IN NORTH CENTRAL ALBERTA

by

Grant Robert Milne

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

in

FOREST ECONOMICS

DEPARTMENT OF RURAL ECONOMY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "The Economic Impact of the Forest Industry in North Central Alberta" submitted by Grant Robert Milne in partial fulfilment of the requirements for the degree of Master of Science in Forest Economics.

Michael R Carroll
Supervisor

Date . . April 15 1980 . .

DEDICATION

To my parents

ABSTRACT

This study examined the economic impact of forestry industry expansion in north-central Alberta. Under terms of the 1975 Forest Management Agreement between the Simpson Timber Co. (Alta.) Ltd. and the province of Alberta, the company is required to begin construction of a wood fibre processing plant in 1981. This mill must be capable of utilizing deciduous fibre as either a total or partial input.

Three objectives were set in this study;

1) determine feasible mill types which the company could construct, each mill producing a marketable product from a deciduous based furnish.
2) delineate potential mill sites within the Forest Management Agreement area.
3) identify and quantify major economic impacts associated with each potential development scheme.

The study defined three mill types and two sites. Therefore, six potential development alternatives were examined. Using a regional accounting stance, the major economic impacts were evaluated by means of an impact analysis model. Economic impacts for each alternative were quantified for both the construction and operational phases.

The economic impacts were classified as either social benefits or costs. Simpson Timber expenditures within the region were linked to the following social benefits; increases in regional employment, income and value added. The increase in economic activity was also seen to create social costs within the study region. These social costs were quantified as the increased regional infrastructure costs associated with each alternative.

The economic impacts were also evaluated using several criteria which directly compared social benefits and costs as well as company expenditures. In this manner, the impact analysis model utilized in the study may offer an improvement to the method of examining resource development proposals in the Alberta forestry sector.

ACKNOWLEDGMENTS

The completion of this study was made much easier by the assistance of several individuals. My supervisor and friend, Dr. Michael Carroll, went out of his way to provide guidance and encouragement, not only with this study, but during my entire graduate program. His invaluable help will always be remembered and appreciated. The remaining members of my graduate committee, Dr. Bill Phillips and Dr. Mike Micko, both provided a great deal of assistance during this study. I also appreciate the information provided by the Simpson Timber Co. (Alta.) Ltd. . In particular, Murray Summers and Jim Stevens were very cooperative. Finally, I must acknowledge the support of my wife Colleen, whose encouragement made the work much more enjoyable.

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CHAPTER 1

BACKGROUND TO THE STUDY

INTRODUCTION

This study is designed to aid in understanding the economic implications of future development of the forest industry in north-central Alberta. The goal of this study is to evaluate, primarily on a regional basis, the major economic impacts associated with the introduction of a major wood fibre conversion plant within the region. This study describes three potential forest industry development schemes and lays out a framework for quantifying and evaluating the major economic impacts affiliated with each project.

BACKGROUND TO THE PROBLEM

With the majority of Canada's forest resources falling under public ownership, the role of government in allocating these resources is one of great importance. Forest resources are limited. Questions often arise as to how the government may best allocate and distribute these resources through industrial development policies. Obviously, the answers to a large extent, depend on the impact this development will create upon the welfare of the province and the region of concern. Both the scale and location of a large wood fibre conversion plant within a particular forest region

are important factors concerning the accompanying economic impacts.

In the opinion of this author, resource development plans involving forest industry expansion do not adequately outline the scope of socioeconomic impacts associated with the development scheme. Often, the economic impacts are examined following the decision to construct the conversion plant. Socioeconomic studies of the region to be affected should become a major segment of the development plan. In this manner, resources may be allocated more efficiently and the distribution of benefits can be examined more thoroughly.

STATEMENT OF THE PROBLEM

On December 2, 1975, the Simpson Timber Company (Alberta) Limited, signed a Forest Management Agreement (F.M.A.) with the province of Alberta. This Agreement basically guaranteed that Simpson would follow a prescribed plan of development in the Whitecourt-Fox Creek area of Alberta. In 1981, the company is required to initiate the third and final stage in their development, namely the construction of a fibre mill capable of utilizing the large deciduous resource within the F.M.A. lease. The province has designed the Agreement to allow the company flexibility in deciding upon the type of conversion plant, scale of operation, and location within the lease. In terms of this study, the problem becomes:

1) determination of feasible mill types, scale and location under terms within the Agreement.

2) laying out a framework to identify and evaluate the major economic impacts associated with each potential development scheme.

ECONOMIC PERSPECTIVES

Economic analysis is concerned with the allocation of scarce resources among competing users. Efficient allocation of resources implies that society as a whole will receive the maximum present value of net social benefits. Theoretically, a global accounting stance is assumed; that is social costs and benefits are measured regardless of their distribution among different members of society (DePape and Phillips, 1977). However, a national, provincial or even a local accounting stance may be used. For a large development such as the Simpson Timber expansion, social costs and benefits will likely "spill over" from the region itself and affect the nation as a whole. However, the majority of the impacts should be felt within the province of Alberta. With forest resources falling under provincial jurisdiction, policy makers within the Alberta Government will likely direct a large part of their analysis to addressing provincial and regional impacts. Since the Simpson Timber development will occur in one specific region of the province, a local or regional accounting stance is desired, keeping in mind the social benefits and costs which occur on a broader basis.

As stated earlier, the allocation issue in resource development addresses the problem of efficiency. Resources are allocated so as to maximize the present value of net social benefits. With a local accounting stance, the incidence of social benefits and costs becomes difficult to evaluate. When analyzing the allocation question on a regional basis, indirect benefits and costs may take on great importance. However, these same values may simply be transfers from other areas in the province or country. Therefore, on a regional scale, the proposed project may appear highly attractive in terms of high social net benefits, yet when viewed on a broader perspective, the project may be less desirable on efficiency grounds.

Rather than addressing the question of efficient resource allocation, this study is more concerned with considering the redistribution of income from an equity point of view. In this manner, the social costs and benefits, both direct and indirect, can be examined on a regional basis. Therefore a regional study of this nature basically addresses the local economic impacts stemming from the development. The problem of economic efficiency in resource allocation is not of prime importance. Rather than determining whether a given resource development project should or should not occur from an efficiency standpoint, a regional impact study examines the consequences of proceeding with the project. The researcher must be aware that by concentrating on the social benefits and costs, ie) impacts, occuring <u>within</u> the region,

"spill over" effects are not accounted for. Therefore, the researcher must view with care, the regional costs and benefits calculated.

THE IMPACT ANALYSIS MODEL

One tool for measuring the consequences of a project on a regional basis is economic impact analysis. Generally, economic impact analysis attempts to quantify the following:

1) what the impacts are and their magnitude;

2) when the impacts occur;

3) where the impacts occur. (Phillips, McMillan and Gillen, 1979).

For the Simpson Timber expansion, each potential development scheme will incur varying degrees of economic impacts within the region. These impacts may be divided into social and private costs and benefits when viewed strictly on a regional basis although, as stated earlier, the costs and benefits may simply be transfers from outside the region.

Using an impact analysis model, regional costs and benefits can be classified into private and social components. This study will measure the following costs and benefits using impact analysis under a regional accounting stance:

1) Private Costs - company expenditure within the regions during construction and operational phases.

2) Social Costs - increased infrastructure costs within the region due to project induced population increases.

3) Social Benefits - increases in employment, income and value added within the region.

To better understand the measurement of the aforementioned regional impacts, a brief discussion of each component follows.

Private costs are the company expenditures within the region during the construction period and operational phase. Due to Simpson Timber being a subsidiary of an American parent company, the expenditure funds will originate from outside the region. Therefore, these private costs to the firm are transfers into the region.

The social benefits arising from the Simpson Timber expansion are derived from the effects of capital and operational expenditure within the region. Employment and income are closely tied together. Both have direct and indirect elements. Direct employment is the total number of employees hired by Simpson Timber directly. Direct income is the value of wages and salaries paid to these employees which is spent within the study region. Indirect impacts originate from the direct impacts in the following manner. The circulation of direct income via expenditure on local goods and services causes an increase in regional income levels. This indirect impact can be calculated by applying an appropriate multiplier

to the direct income figure. The total increase in regional income is simply the sum of the direct and indirect values.

Indirect employment stems from the increase in regional income levels, induced primarily by company employee expenditures. The increase in demand for goods and services causes local merchants to hire extra staff. This induced employment is the indirect impact and may also be calculated by applying a relevant multiplier to the direct employment figure. The total increase in regional employment is the sum of the direct and indirect values.

Value added is the final regional social benefit considered in this study. Value added is essentially a measure of the value of the inputs which are added to the raw resource (in this case timber), as it passes through the production process. Therefore, value added includes the addition of labour, in the form of wages and salaries, "processed" into the final product. As such, value added is simply another form of expressing the direct income benefits.

Social costs associated with a large development appear primarily as increases in regional infrastructure costs. The Simpson Timber expansion will create sudden increases in population and income levels in the major communities within the region. Therefore, increased demand for infrastructure will incur a higher cost for the required basic services.

This study measures these costs and benefits for both the construction and operational phase. The model is

also set up so as to quantify these costs and benefits over a range of feasible mill types and sites. For example, if five mill types and three potential sites within the region are defined, a total of fifteen possible development schemes are analyzed.

OUTLINE OF CHAPTERS

The following section provides a brief description of each chapter in the study.

Chapter one forms the background to the study. The problem is identified and a brief discussion of economic perspectives follows. The economic model is then outlined and discussed.

Chapter two initially defines and describes the study region. The present level of development of Simpson Timber and the regional economic impacts are discussed. This chapter also outlines the Phase III expansion, based on an evaluation of available fibre and potential markets for Alberta wood products. The Simpson Timber F.M.A. is initially studies to define in broad terms, the requirements for Phase III plant construction and resource use. Following this description, the availability of deciduous fibre both in Alberta and within the study region is analyzed. One requirement of Phase III is the utilization of deciduous fibre. As well, the expected demands and markets for possible wood products produced during Phase III are evaluated.

The third chapter deals with defining feasible mill types which Simpson Timber could construct for Phase III under terms of the F.M.A. While many types of fibre mills are possible, only three are selected as potential options, keeping in mind the following factors: 1) the plant must be classified as a "fibre" mill; 2) the plant must utilize deciduous fibre; 3) the plant must produce a marketable product. Included in this chapter is an estimate for each mill with respect to scale of operation, capital investment, operational costs and labour requirements.

Chapter four lays out a framework for selecting possible mill sites within the study regions based on many factors including: site quality, input cost minimization, environmental and legislative constraints and community factors. Upon evaluation of these constraining factors only two feasible mill sites are defined.

Chapters five and six analyze several economic benefits resulting from mill construction and operation respectively. These benefits, studied on a regional basis, include: company expenditure, employment, income and value added. Both direct and indirect impacts are estimated for the employment and income benefits. All economic benefits are estimated for both sites and each mill type.

One aspect of the economic cost of each alternative is developed in chapter seven by evaluating increased infrastructure costs within the core communities of Whitecourt

and Fox Creek. The present population, infrastructure levels and costs in each community are initially defined. The impact of each mill type in both locations upon these communities is reflected by increases in infrastructure costs.

Chapter nine forms the summary and conclusions of the study. Results are summarized in tabular form and briefly discussed. These results are then evaluated as to their possible application in resource development plans. The chapter concludes with a brief discussion of study limitations.

CHAPTER 2

PAST, PRESENT AND FUTURE FORESTRY ACTIVITY WITHIN THE STUDY REGION

INTRODUCTION

To better understand the potential impacts of expanding the Simpson Timber complex within north-central Alberta, a study region is first defined. This section also considers the constraints of fibre availability and demands for wood products, both important in choosing from several mill options.

THE STUDY REGION

Location

Ideally, one should delineate the boundary of the study region by observing the sphere of economic influence. The area bounded by the Forest Management Agreement zone is not the only area influenced by the operation of Simpson Timber. The development of Phase III within the Forest Management Agreement area will subject communities located near the millsite to some degree of economic impact. Therefore, the area including these major communities must form the study region:

Barrhead
Mayerthorpe
Valleyview
Slave Lake

The region encircles by these communities includes the majority of the F.M.A. area. The towns of Fox Creek and Whitecourt form the core communities of the study region. As well, there are many smaller towns and hamlets within this area. The study region is illustrated on the map shown on the following page.

Physiography and Topography

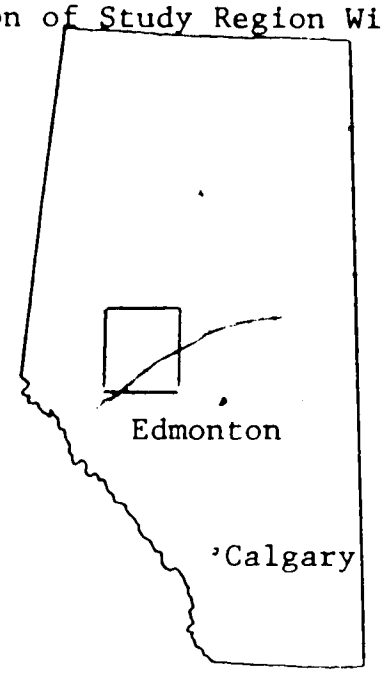
The physiography of the study region can be divided into lowland and highland areas with elevations ranging from 609.6 meters (2,000 feet) to 1,371.6 meters (4,500 feet) above sea level. The highland terrain is found in the Whitecourt, Swan Hills area in the centre of the study region. The lowlands are found in the eastern boundary of the region around the Athabasca river. The western sections of the study region lie at elevations ranging between 762 meters (2,500 feet) and 1,219.2 meters (4,000 feet) above sea level. The topography of the study region is quite varied, ranging from areas of flat bog in the east, to highly undulating terrain in the central and western area. In the latter terrain, slopes exceeding 15% are not uncommon.

Geology and Superficial Deposits

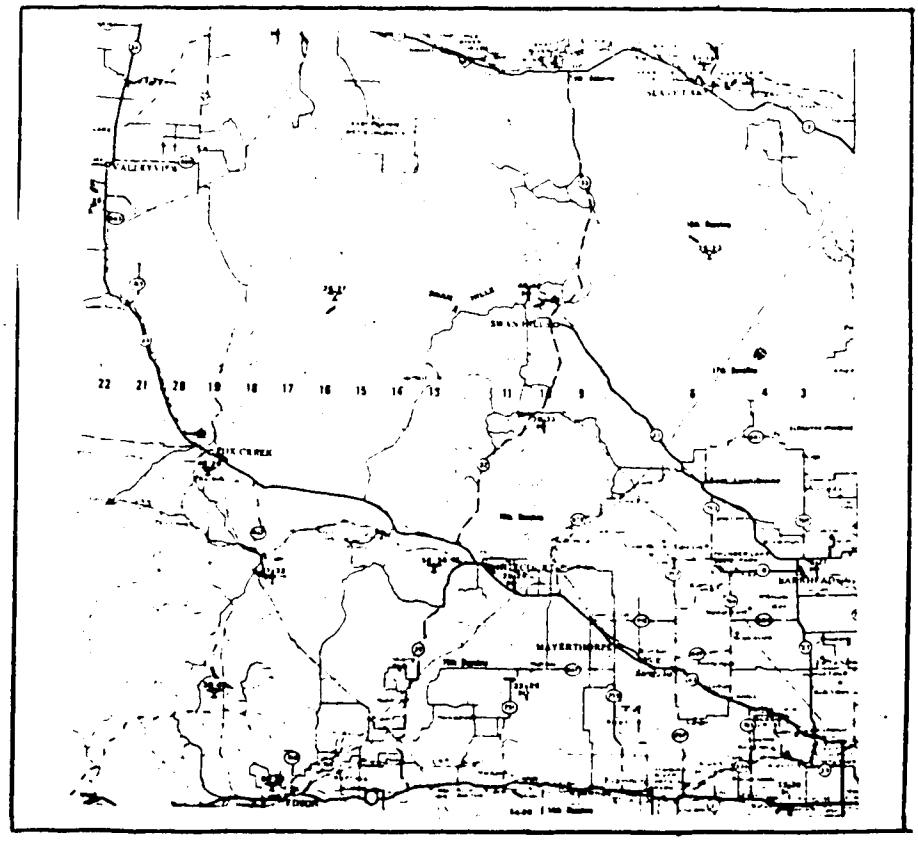
Three geological formations predominate in this area: Paskapoo, Edmonton and Belly River, with the more recent Paskapoo overlaid upon the other two types. The

MAP OF STUDY REGION

Location of Study Region Within Alberta



Expanded View of Study Region



parent materials from which the majority of soils in this area have been formed are deposits from both glacial and post-glacial times. Surface deposits are mainly a result of erosion and deposition of aeolian, alluvial, lacustrine and till materials.

Vegetation

The study region lies within the Boreal Forest region of Canada (Rowe, 1972). A great deal of the native vegetation has been destroyed by land clearing and repeated fires. The central section of the study region has a heavily forested overstory of lodgepole pine, balsam fir, white and black spruce. The eastern and western areas of the study region are composed of parkland vegetation with aspen and balsam poplar the most common species of tree.

Climate

The climate in this region is quite variable, with mild summers and cold winters usually occurring. The mean annual temperature is approximately 1°C., while the mean summer temperature (May to September) is approximately 12°C. Mean annual precipitation increases from east to west from 432 mm. to 533 mm. The number of frost free days averages seventy per year (Alberta Environment, 1978).

Wildlife

The most common species of wildlife in the study

region is moose. Government wildlife officials recognize five important moose population areas within the region, supporting a substantial number of animals. Besides moose, several other large mammals are known to inhabit this region. These include elk, deer, black and grizzly bear. As well, many smaller animals and birds are present.

Local History

In 1825, the first settlement in the study region was established when the North West Co. built a trading post at Fort Assiniboine. By 1905, the community of Whitecourt was established by settlers enroute to the Peace River country. During the next few decades, a logging industry developed alongside agriculture and trapping. With the discovery of oil and gas reserves in 1955 within the study region, rapid expansion in the mineral exploration industry resulted in the town of Fox Creek being built. Major gas and oil discoveries plus the assignment to Simpson Timber in 1975, of a F.M.A. have caused an expansion in the economic base of the study region. At present, the study region has three strong economic bases: oil and gas, forestry and agriculture, all serviced by the major communities of Whitecourt and Fox Creek.

Major Communities

Whitecourt and Fox Creek have evolved into the largest communities within the core of the study region.

Using 1978 figures, the population levels of Whitecourt and Fox Creek are approximately 4,400 and 1,888 respectively (Alberta Dept. of Business Development and Tourism, 1979). As well as containing more than double the population of Fox Creek, the town of Whitecourt possesses a much greater level of infrastructure. Whitecourt enjoys a much more developed business sector with a wider variety of retail and wholesale merchants. By examining the structure of each town's labour force, one can visualize the differences in development.

TABLE 1

LABOUR FORCE STRUCTURES FOR WHITECOURT AND FOX CREEK

Employment Sector	Percentage of Labour Force Involved	
	Whitecourt	Fox Creek
Agriculture	6.8	
Agriculture Services		
Construction	19.1	10.0
Manufacturing	9.0	70.0
Trans/Comm/Utilities	9.6	
Retail Trade	13.7	2.0
Wholesale Trade		
Financial/Real Estate/Ins.	1.6	
Services	10.8	10.0
Government	5.3	
Education	3.8	3.0
Others	20.3	5.0
	100.0%	100.0%

SOURCE: Appendix 1.

From Table 1, one can see that Whitecourt has a significantly more variable economic structure in terms of employment sectors. The size of Whitecourt's labour force is approximately 1,650 persons compared to 550 in Fox Creek. The community survey statistics in Appendix 1 provides additional data.

REGIONAL FORESTRY ACTIVITY

History of Logging Within Study Area

The first commercial logging in the study area took place in 1923 when the Western Lumber and Construction Ltd. commenced operations near Whitecourt. During the next four decades, logging companies concentrated on removing large sawlogs with a minimum stump diameter ranging from 25.4 cm (10 inches) to 35.6 cm (14 inches). By 1955, the Athabasca and McLeod rivers had been bridged at Whitecourt, and coupled with the intensive search for oil and gas, the study region gradually became more accessible to loggers. Numerous sales of sawtimber took place during the next several years.

In 1966, the Province instituted the continuous quota system to ensure sustained yields of forest products and promote permanent settlement within the region. This system is still in effect at present for most of the small and medium sized operations.

Forest Management Agreements Within Study Region

The original Forest Management Agreement (F.M.A.) within the study region was signed in 1958 by Order-in-Council 768/58 between the province of Alberta and the Albertawest Forest Products Corporation Ltd. The F.M.A. entitled the firm to a lease of 673,399 hectares (2,600 square miles) plus a provisional reserve of equal size. In return, the firm was committed to build a pulp mill at the town of Whitecourt.

In 1965, all rights to the F.M.A. were purchased by MacMillan Bloedel and Powell River Ltd. A new Order-in-Council 913/65 enlarged the lease to 1,860,653 hectares (7,184 square miles) in return for the firm constructing a pulp mill and newsprint factory.

In 1971, the F.M.A. was nullified with the default of MacMillan Bloedel. In 1972, the lease was revised and advertised for development by the Province. The lease was divided into two major blocks which five forest products companies bid for. After public hearings and evaluation of each proposal, Simpson Timber was awarded one timber block in 1973. The second block was awarded to the Fox Creek Lumber Co.. However, in 1975, the firm relinquished all rights to that particular block. The Province subsequently awarded all timber rights of the second block to Simpson Timber. This amended F.M.A. still applies.

Present Simpson Timber F.M.A.

The F.M.A. between Simpson Timber and the province of Alberta constitutes a legal contract, with both parties exchanging rights and commitments for a period of 20 years, afterwhich the contract may be renewed.

The F.M.A. allocated the timber rights of 457,652 hectares (1,767 square miles) of forested area in the study region to Simpson Timber. The Province is responsible for maintaining a supervisory staff in the area as well as protecting the forest from fire. In return for these major considerations, the company has various contractual obligations to follow:

1) provisions for payment of timber dues, holding and protection charges and any other development bonds or fees.
2) obligations to manage the forest primarily for timber production on a sustained yield basis with consideration for multiple use.
3) obligations to construct processing facilities as specified in the F.M.A.
4) conduct harvesting and road construction under the terms of the Operating Ground Rules.
5) cooperate with the Province in fire control efforts.

Present Production Capacity of Simpson Timber

The F.M.A. clearly outlines the type of facilities the company has had to construct up to this date. Therefore, the company currently is operating a large sawmill-planer mill complex at its Blue Ridge site. The capacity of this complex is rated over 100 million board feet of lumber annually. At present, this mill utilizes close to 100% softwood furnish from contractor operations in the lease. This development constituted what is known as the Phase I stage of the F.M.A.. In 1979, the Phase II stage of the F.M.A. was implemented, with the construction of a processing plant designed to manufacture laminated wood products. As well, the company is to begin utilization of no less than five million board feet of poplar input annually.

Present Economic Impact of Simpson Timber

During Phase I and more recently, Phase II, a significant impact upon the local economy was felt to occur. A detailed study of this economic impact during Phase I showed that Simpson Timber played an important role in economic growth of major communities within the study region (Carroll, 1977). The company spent approximately $20,000.000. on construction of the Phase I complex. Approximately 20% of this total was spent within the study area, respresenting 6 to 8 percent of the entire region's output from manufacturing.

Capital expenditure for Phase I declined once the complex was built, however, total annual expenditure has increased over time as the mill has expanded to capacity. In 1978, the company spent $12,800,000. on salaries to Simpson personnel and payments to woodlands contractors. From data gathered during Phase I, approximately 33 percent of this expenditure remains within the study region to be circulated. Apart from wages and salaries, operational spending, which includes payments by Simpson to local firms for goods and services essential to mill operation, has also increased. In 1976, operational spending was estimated to be $860,000. Of this total, approximately 21 percent was directed to firms within the study region.

As these figures indicate, the presence of Simpson Timber has resulted in a significant increase in incomes circulated within the study region. While the effects of Phase II have not been evaluated, the increase in employment, incomes and expenditure should enhance the impacts created by the Phase I development.

PHASE III EXPANSION

Introduction

The Phase I and Phase II developments of the Simpson Timber F.M.A. have already been discussed. One important item of the Agreement calls for the implementation of a third development or Phase III. This third and final

expansion, as identified in the F.M.A., is designed to utilize the large amounts of deciduous fibre in the lease areas on a sustained yield management basis.

F.M.A. Description of Phase III

The F.M.A. is very explicit in outlining the requirements for the Phase III development which the following quote should illustrate:

> "Not more than sixty-six calendar months following the commencement date of this Agreement, the Company shall commence construction of a wood fibre processing facility designed to use poplar timber, wood chips manufactured from sawmill waste, and coniferous pulpwood with a minimum investment cost requirement of $15,000,000."
>
> SOURCE: Order-in-Council 1507/75 section 34, subsection 3, Dec. 2, 1975.

Thus, the Agreement sets out a time limit for construction to begin and the minimum required investment. It does not, however, stipulate the exact type of facility which must be built, but rather, provides the company with some flexibility. The company has a financial incentive for following through with the Phase III development. At the time the Agreement was signed, the company was required to deposit $545,000. with the Province as insurance for completion of all three Phases. If Phase III is initiated, Simpson will be refunded $245,000. to help defray costs.

The company will also receive substantial amounts of deciduous timber if construction of Phase III proceeds on schedule. At the time the Agreement was signed, the province

set aside a provisional deciduous reserve to be utilized by the Phase III processing facility. The following quotes illustrate this:

> "As long as the Company is not in default under this Agreement ..., the Minister shall grant a deciduous timber allocation to the Company ... designated as the "Fox Creek Area" ... for the purpose of harvesting from that area the annual cut of deciduous timber as the Minister shall from time to time determine except for 11,000 cords thereof per year."

also:

> "For sixty-six calendar months after the commencement date of this Agreement, the Minister shall set aside and hold for the benefit of the Company the poplar timber ... located on the areas ... on the map ... of this Agreement."

and:

> "Provided that the Company establishes:
> c) that such design facility referred to in the foregoing paragraph is such that the wood requirements of the facility when operating at full design capacity exceeds the poplar timber available from the forest management area and from the "Fox Creek Area" ...,
> then the Minister shall grant deciduous timber allocations to the Company up to the limits imposed by the sustained yield capability of the poplar timber in the areas set aside under papagraph 11(8) for sufficient poplar timber to meet that portion of the Company's requirements for the facility and the said expansion which cannot be met from the timber resources on the Company's forest management area."
>
> SOURCE: Order-in-Council 1507/75 sections 11, subsections 8,9, Dec. 2, 1975.

Essentially, the F.M.A. guarantees that if the Phase III development proceeds, the deciduous cut in the Fox Creek area will be issued to the company. If the wood requirements exceed this supply, additional deciduous fibre

from the provisional deciduous timber allocation areas (D.T.A.'s) will be issued. The D.T.A. areas are shown on the map on the following page.

Deciduous Allowable Cut Available

The annual allowable cut (A.A.C.) for the reserve areas has been calculated on the basis of the following criteria:

a) all volumes for pure and predominantly hardwood stands were calculated using zone 3 volume tables.

b) stand information compiled from interpreted photographs dated 1950-61.

c) a 15% blanket deduction for fire, industry, inoperable areas, and green belt reserves was applied to the gross merchantable volume.

d) rotation age set at 60 years.

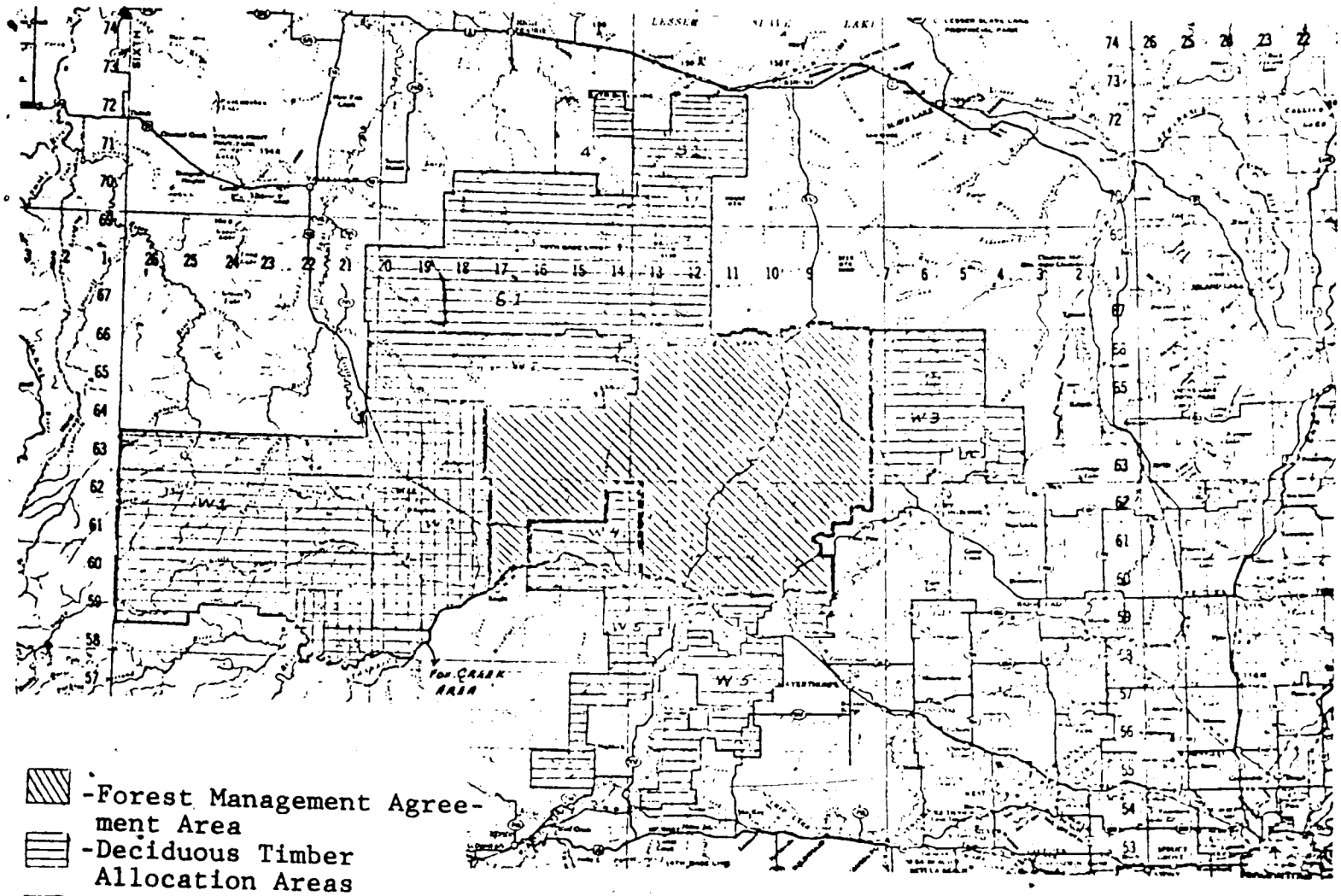
e) use of Von Mantel's equation to calculate A.A.C. where

$$\text{A.A.C.} = \frac{\text{Available Gross Merchantable Volume}}{\text{1/2 Rotation}}$$

The A.A.C. for the reserve areas is as follows:

MAP OF SIMPSON TIMBER F.M.A. AND

DECIDUOUS TIMBER ALLOCATION AREAS



-Forest Management Agreement Area

-Deciduous Timber Allocation Areas

-Fox Creek Area

TABLE 2

DECIDUOUS FIBRE RESOURCES WITHIN

THE SIMPSON TIMBER F.M.A. AREA

Reserve Area	Gross Merch. Vol. (M.C.U.)	Available Gross Merch. Vol. (M.C.U.)	Gross Merch. A.A.C. (M.C.U.)
Fox Creek Reserve	1,866	1,586	43.52
D.T.A. Reserves	10,234	8,700	289.96
Total	12,100	10,286	333.48

SOURCE: (Simpson Timber, 1979)

One must note that these figures are based on Alberta Forest Service photos which are outdated. Recent volume estimates for the coniferous fibre on the F.M.A. area, using up-to-date data indicated that the A.F.S. figures were low. Consequently, the A.A.C. values for the deciduous areas may be somewhat higher.

FIBRE, RESOURCES, MARKETS

Introduction

In recent years the use of hardwood fibres in the manufacturing of lumber, pulp and paper, and panel products has been proposed as one answer in reducing potential softwood fibre shortages in Canada. As trends towards intensive utilization of the forest resource continue, Canada's hardwood species may become valuable sources of fibre input.

Alberta's enormous deciduous timber resource, largely unused, is a highly potential so ce of fibre (Patching, 1977). If world demands for lumber and pulp and paper products continues to increase, the possibility exists for the establishment of a fibre mill in the province capable of utilizing deciduous fibre.

Alberta's Deciduous Resource

The current deciduous timber resources in Alberta have been estimated at 208.31 million cunits (10.16 cm + D.B.H.) with the majority of this fibre being poplar (Populus balsamifera L.) and (Populus tremuloides Michx.). As a comparison, the total softwood timber resources in Alberta have been estimated at 331.75 million cunits (10.16 cm + D.B.H.). In 1976 only 0.3 percent of the deciduous annual allowable cut was realized (Patching, 1977). Therefore, a large volume of untapped deciduous fibre currently exists in the province.

Demands and Markets for Alberta Wood Fibre Products

As the world's population continues to expand an increase in the quantity demanded for wood fibre products can be expected. In Alberta, three major types of wood fibre products are manufactured; lumber, pulp and paper, and panel products. The markets for these products and estimated future are as follows:

a) Lumber

The main market for lumber produced in Alberta has been traditionally the United States mid-western region. High freight rates on shipments across the Rockies successfully prevents Alberta lumber from competing with B.C. markets in the Pacific Rim countries. Eastern Canadian mills have significant advantage in transportation costs for eastern U.S.A. markets. Thus, the mid-west U.S.A. is likely to continue as a main target for Alberta Lumber producers.

The quantity demanded for lumber at real prices constant in the U.S.A. is forecasted to expand at a conservative rate of 3.0% per annum and Alberta's share of the market is expected to keep pace (Jones, 1977).

b) Pulp - Paper

Alberta currently has two major pulp mills, both tied to a United States owned parent company which markets most of their pulp output around the world. Recent estimates (Dept. of Industry, Trade and Commerce, 1978), indicate that world paper consumption should grow by approximately 3.7 percent per year through to 1990. If Canada is to maintain its share of the world market, its pulp and paper industry must grow at a similar rate. Recent studies (Becker and Thomas, 1978) show that Canada's pulp and paper industry could expand by nearly 3.2 percent per year under current economic conditions. Part of this increased growth could

be reflected in the expansion of Alberta's pulp and paper industry.

c) Panel Products

Panel products manufactured in Alberta generally are marketed successfully in the same mid-western states where lumber is exported. However, a high percentage of panel products are consumed in Alberta owing to the boom in all types of construction. The quantity demanded for Alberta panel products at real prices constant, in both domestic and foreign markets is expected to increase 3.0 to 4.0 percent annually through to 1990 (Jones, 1977).

Summary

World demands for Canadian wood based products should increase during the next decade. Therefore a reasonable assumption is that a percentage of this growth in demand could be met by an expansion of the forest products industry in Alberta. A ready source of wood fibre is available in the form of deciduous resources, presently unused.

CHAPTER 3

SELECTING FEASIBLE FIBRE MILLS

INTRODUCTION

As stipulated in the F.M.A., the successful implementation of Phase III requires Simpson Timber to begin construction of a "fibre mill" no later than June 2, 1981. This section will outline several potential mill options which satisfy the "fibre mill" description and produce a marketable product created at least partially with a deciduous furnish.

POTENTIAL MILL OPTIONS

Specifications of a Fibre Mill

While no clear definition of a fibre mill exists, one can classify primary wood-using industries in Alberta according to Statistics Canada categorization. Primary wood-using industries are those which use roundwood or wood chips in their manufacturing processes (Teskey and Smyth, 1972). Plants generally classified as fibre mills are grouped under the heading, Paper and Allied Industries, quite distinct from sawmills and plywood plants. When one considers the type of facilities falling into this category, a common denominator in their manufacturing processes occurs: that is, the wood fibres are ground apart and in some manner rejoined to form a final product.

In general, only two types of processes are available today which follow these guidelines and produce a marketable product. They are: 1) pulp mill, and 2) fibreboard, flakeboard, insulation board etc. mills. Therefore, to adhere to the guidelines of the F.M.A., Simpson Timber must, for Phase III, construct one of the previously mentioned facilities capable of producing a marketable product with deciduous fibre as part of the wood input.

Choosing a Pulping Method

In deciding upon what type of pulp mill to construct, the company must be aware of two major points: 1) the process must utilize poplar/aspen, 2) the final product must be competitive in the world market for pulp.

There are currently several major pulping processes in use today around the world, most utilizing a 100% softwood furnish. They are:

1) sulfate
2) sulfite
3) chemimechanical
4) thermomechanical
5) groundwood

Of these five major processes, only two seem feasible when considering the use of poplar/aspen as a partial input. They are, bleached kraft or sulfate, and chemimechanical with a bleaching line. Both methods result in a high quality product,

capable of competing in world markets with 100% softwood pulps for some end uses.

The sulfite process can be eliminated due to pollution problems and chemical costs. The groundwood method produces a pulp of inferior strength (Hatton, 1974), while the thermomechanical process has high energy costs and produces a pulp only marginally stronger than refined groundwood (Kloetzli, 1978).

1) The Kraft Process

Research indicates that two types of deciduous input can be utilized for sulfate mills (Hatton, 1974). The first is 100% deciduous furnish while the second is a softwood/deciduous mix down to a tolerated limits.

a) 100 Percent Deciduous Pulp

Lower capital investment and uniform pulping are advantages of 100 percent deciduous furnish. Disadvantages include lower strength and possible drying problems. Despite these faults, some experts (Osborne and Harper, 1974), feel that a 100 percent bleached kraft poplar/aspen pulp could be successfully sold to pulp buyers not requiring a particularly strong pulp. The improved brightness of this pulp would offset this one disadvantage.

b) Softwood/Deciduous Mix

If higher strength is desired in your pulp, one can mix poplar/aspen with the longer fibred softwoods. Obviously, strength declines as the percentage of hardwood increases in your input. A 90:10 softwood/deciduous mix will have a pulp strength 97 percent of 100 percent softwood. This is a negligible loss of strength and the pulp could be sold as a high-quality - high-strength product. If a greater percentage of hardwood is used, the strength reduction is noticed. For moderate strength pulps, a 50:50 mix is the minimum ratio acceptable today (Chai, McMullan and Cairns, 1974). The quality and resulting value of your pulp depends on the amount of deciduous fibre used.

2) The Chemimechanical Process

Of all the mechanical processes available today, the chemimechanical method gives the highest strength pulp. Using this process, 70 percent poplar/aspen pulp could be produced, suitable for newsprint and various medium quality papers. A mild bleaching stage would be required (Hatton, 1974). A 100 percent deciduous pulp using this process would lack sufficient strength, making it unmarketable.

Choosing a "Fibre" - board Facility

There are many fibre using plants which can utilize aspen and poplar yet do not fall into the pulp mill category. These include particleboard, flakeboard, chipboard, insulation

board and wet-process hardboard (Neilson, 1974). All of these processes can product finished products from a 100 percent poplar/aspen furnish. However, the marketability of these products, in direct competition with softwood counterparts eliminates many of them from being currently feasible.

Based on the marketability of the finished product, the fibreboard process seems to be the most viable (Vajda, 1974). This product can be used as interior wall panelling, door skins and industrial core board.

Summary

From the foregoing discussion, there are three types of mills which could utilize poplar/aspen as either a partial or total furnish and still produce a marketable end-product. Thus, for the purpose of this study, these three mills; sulfate, chemimechanical and fibreboard, will be used. The next item to determine is the optimum scale of each mill development.

ESTIMATED MILL SCALES

Introduction

If Simpson Timber decided to construct one of the three types of fibre mills previously discussed, a decision would have to be made regarding the exact size of operation. While difficult to predict the exact scale of all three mill types, if built in 1981, an accurate estimate can be produced.

Mill Size, Capital Costs and Operating Costs

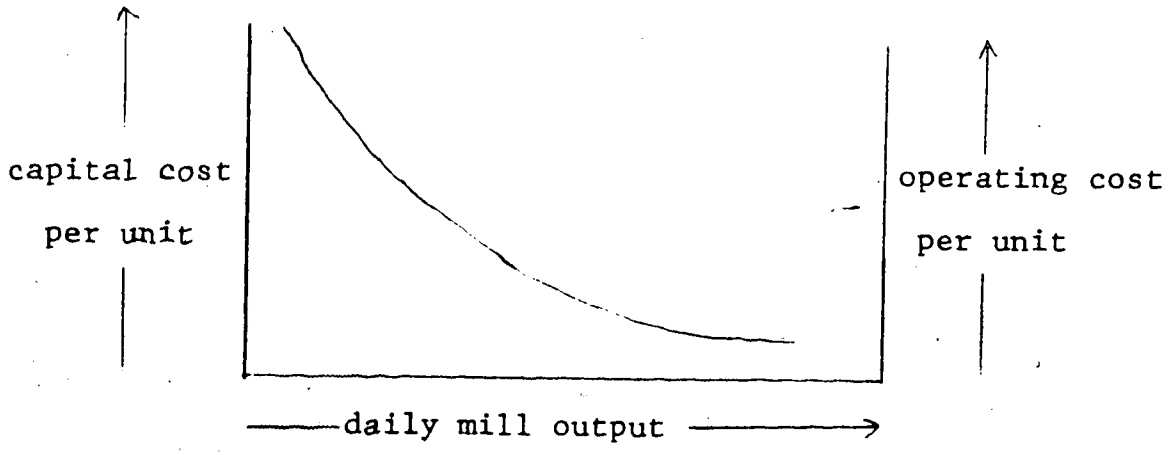
All three mills generally follow the same trend regarding size and costs; that trend is known as economies of scale. The following quote illustrates this fact:

> "Although some types of mills are more costly than others, due to the nature of the equipment and the complexity of the processes involved, it will be noted that all show the same general cost profile in response to changes in size: a fairly rapid decrease in the capital cost per ton of daily capacity as total mill capacity is increased to a certain level on the curve, at which point the economies of scale decreases."
>
> SOURCE: (F.A.O., 1973, p. 129).

The trend of economies of scale can also be shown by a simple graphical illustration:

FIGURE 3

ECONOMIES OF SCALE IN PRODUCTION



As one can see, when the scale of the mill is increased, both capital and operational costs per unit decrease. Thus, an entrepreneur finds construction of the largest mill possible advantageous.

Constraints Against Scale

There are several factors which greatly limit the size of the mill that can be built. These constraints usually mean the entrepreneur can only build a processing plant which will produce an output level at the highest possible capacity (F.A.O., 1973).

The major constraints on mill size are availability of financing, fibre and water plus the ability of markets to absorb large increases in product supply. These constraints are more evident for the much costlier pulp mills than for the fibreboard mills where input requirements and capital are not needed in as large a quantity. However, even the fibreboard mill scale is limited by the assurance of a market capable of absorbing production. As well, all mills have limits to which economies of scale can be generated.

Determining Mill Scale

With the preceding constraints in mind, one must estimate for each of the three mills, the probable scale, if construction began in 1981. In wood processing plants,

particularly in pulp mills, the trend has been to build larger capacity mills over time as inflation continues. This pattern of continually building larger mills, to keep pace with inflation and still capture benefits of scale, will likely continue into the future. Thus, perhaps the simplest means of estimating the scale of the three potential mills is to examine past and present mill construction in Canada. Their size and cost can be evaluated to establish some type of pattern in the trend to build larger mills over time. In this manner, one can forecast a reasonable scale for each mill type Simpson could construct, allowing for the constraints of fibre, water, and financing availability.

From the many references listed and detailed work in appendix 2, the following estimates of forecasted mill size are given:

TABLE 3

PRODUCT OUTPUT BY MILL TYPE

Mill Type	Output Per Year
Bleached Kraft Sulfate	340,000 airdry short tons
Chemimechanical with Bleaching	119,000 airdry short tons
Fibreboard Plant	200 MM. Ft.^{2} 1/8" basis

SOURCE: Appendix 2

ESTIMATED COST DATA FOR SELECTED MILLS

Introduction

For the three potential fibre processing plants which the company could construct in 1981, capital and operational expenses have been estimated. The method chosen to calculate capital costs was to select capital expenditures for similar mills which have recently been constructed and capitalize them forward to 1981. Operational costs were treated similarly except for the fact that they were capitalized forward to the actual time of completion of construction for each facility. As a final comparison, operating costs and product prices were inflation indexed to one common year.

Selecting a Percentage Rate of Cost and Price Increases

a) Capital Costs

Capital costs for pulp mills building in Canada have escalated between 16% and 20% per year over the past several years. A figure of 18% per year increase was chosen for the two pulp mills for inflation purposes. This rate of increase reflects the fact that a great deal of equipment and expertise must be purchased outside the province and even more important, outside the country. One can note that the final capital cost is reduced by 2% to account for the higher yields gained by utilizing deciduous fibre as a pulp furnish.

Cost escalation for a fibreboard mill would be slightly less as a higher proportion of equipment and expertise could be purchased in Canada, some in Alberta. A figure of 15% was selected as the rate of increase in capital costs with the final estimate reduced by 2% to account for deciduous furnish.

b) Operational Costs

Operational costs for all three facilities have shown a fairly constant annual increase over the past several years. Recent estimates forecast a yearly cost increase of 10% over a period of at least five years.

c) Product Prices

The prices of the products each plant could produce are obviously difficult to forecase for the early or mid 1980's. The only feasible method for the purposes of this study is to apply an equal rate of increase to that of the operational cost increases, implying a constant rate of return. This assumption is based on the simplistic view that each plant will produce only one type of product and market prices will rise by 10% per year.

Cost Comparison

TABLE 4

SELECTED MILLS COST ESTIMATES

1) Bleached Kraft Mill

Background

a) Operating Days Per Year	340 days
b) Construction Time	3 years
c) Output per Day	1,000 tpd.
d) Total Investment	$414,000,000.
e) Employment	
1) Construction:	2,000
2) Operation: Mill	450
Woodlands	300

Production Costs/Ton Pulp

Cost Item	$Cost/Ton (1984)
Wood	114.
Chemicals	38.
Operation Materials	47.
Fuel and Power	30.
Labour	47.
Sales, Administration	43.
Depreciation	29.
Shipping	89.
	$437./ton

SOURCE: Appendices 2 and 3

PRODUCT: Bleached Kraft Hardwood Pulp, price in 1984. $531/ton.

Table 4 (cont.)

2) Chemi-Mechanical Pulp Mill (with bleaching line)

Background

a)	Operating Days Per Year	340 days
b)	Construction Time	2 years
c)	Output per Day	350 tpd.
d)	Total Investment	$70,000,000.
e)	Employment	
	1) Construction:	700
	2) Operation: Mill	140
	Woodlands	90

Production Costs/Ton Pulp

Cost Item	$Cost/Ton (1984)
Wood	72.
Chemicals	33.
Operating Materials	26.
Fuel and Power	57.
Labour	42.
Sales, Administration	26.
Depreciation	24.
Shipping	89.
	$437./ton

SOURCE: Appendices 2 and 3

PRODUCT: Bleached Mechanical Hardwood Pulp, price in 1984: $420/ton.

Table 4 (cont'd)

3) Fibreboard Plant

Background

a)	Operating Days Per Year	340 days
b)	Construction Time	2 years
c)	Output per Day	200 MM. ft^2 3/8"
d)	Total Investment	$47,000.000.
e)	Employment	
	1) Construction:	500
	2) Operation: Mill	100
	Woodlands	75

Production Costs/M. ft^2 3/8" Fibreboard

Cost Item	Cost/M. ft^2 3/8" (1984)
Wood	27.
Chemicals	50.
Operating Materials	10.
Fuel and Power	12.
Labour	18.
Sales, Administration	8.
Depreciation	22.
Shipping	37.
	$184./M ft^2 3/8"

SOURCE: Appendices 2 and 3.

PRODUCT: Medium Density Aspen Fibreboard, 3/8" base, price in 1984; $206/M. ft^2 3/8".

CHAPTER 4

LOCATION FACTORS AND OPTIONS

INTRODUCTION

With the feasible mill options defined, the question of location still remains to be answered. There are many factors which must be considered when evaluating potential sites upon which to construct the Phase III development. The purpose of the following sections will be to briefly review industrial location theory, discuss the factors relevant to siting a major conversion plant and delineate feasible locations within the F.M.A. region.

THEORETICAL BACKGROUND

Industrial location theory has evolved over time from simple general methods of analysis to complex mathematical models designed to utilize many parameters. Early theories of location (von Thunen, Weber) mainly considered the evolution of an economic system as people migrate into a previously undeveloped region. Agriculture develops initially as the primary economic base of the region. Eventually, the development of primary and secondary industries within the region occurs. Also, as the population increases, smaller communities grow within the region to service the central

urban centres. Trading of goods and services occurs between communities both within and outside the region. Basically, these theories are very general and do not relate themselves to the problem of location in this study.

Modern theories of location (Karaska, Isard for example) are more concerned with analyzing the problem of plant or industry location. The various theories range in their complexity, depending on the assumptions made and parameters considered. However, a common goal assumed in these theories is the firm will strive to maximize profits, and this goal, to a large extent, determines plant location. In this context, profits are taken as the difference between revenues and costs.

Basic cost parameters generally include transportation, labour, energy, taxes and subsidies, land and scale economies (Karaska and Bramhall, 1969, p. 15). With some modification, these basic cost parameters can be applied to the problem of siting a major forest products conversion plant within the F.M.A. region.

MODIFICATION OF LOCATION THEORY

The reality of siting a large forest products conversion plant in Alberta imposes some modifications to the basic cost parameters previously mentioned. Also, other site factors not related to these basic cost parameters play an important role in determining actual plant location.

If one considers the basic cost parameters initially, (transportation, labour, energy, taxes and subsidies, land, and scale economies), within the F.M.A. region, certain parameters will be constant or have negligible differences over various potential sites. The following basic cost parameters may be considered to be constant throughout the F.M.A. area: labour, energy, taxes, subsidies, land. These will now be examined briefly.

BASIC COST PARAMETERS

1) Labour

On a large construction project such as the mill options already defined, it is likely that a general contractor would be retained to organize various sub-contractors and a general labour pool to construct the plant. General labour rates should be constant throughout the F.M.A. area since most labour is likely to be unionized. The actual labour cost should not vary significantly between potential sites.

2) Energy

The availability of energy at the least possible cost is an important factor in mill location (F.A.O., 1973). The F.M.A. area presently contains a well developed gas industry and electrical power network, both of which could be utilized as energy sources for a fibre mill. While all

three mills will produce a major portion of the required energy by various internal processes, some energy will still need to be purchased from outside sources. Thus, energy produced in the mill by burning hog fuel or waste chemicals will have to be supplemented. Feeder lines to existing natural gas and electrical sources will be needed. However, the actual rate per unit of purchased energy is not expected to vary within the F.M.A. area.

3) Taxes

The F.M.A. area lies entirely within three Improvement Districts: I.D. 15, 16, and 17. As such, any mill development within the lease area will be assessed a similar tax rate by local Governments. On a broader scale, corporate income tax payable to both provincial and federal Governments will not be affected by mill location within the lease.

4) Subsidies

With the capital costs of the three mill types being quite high, there is a strong possibility that some form of Government financial aid would be offered. This financial aid in the form of low interest loans or direct grants will vary in magnitude, in relation to the capital cost of the mill. Thus, while the more expensive mill types will receive a larger amount of financial aid, the actual site of the mill should not be a factor.

5) Land

The company is not required to purchase land for the mill site since the F.M.A. area is crown owned. The following quota illustrated this fact:

> "Land dispositions required within the forest management area for works such as main roads, bridges, camps, sawmill sites and necessary work incidental thereto will be issued to the Company without any dues, fees or rental charges being paid to the Minister."
>
> SOURCE: O.C. 1507/75 section 7, paragraph 3, December 2, 1975

The F.M.A. contract does however state that the company must pay annual holding charges of $3.00 per square mile as of 1975, (C.P.P.A., 1979). This fee, payable to the province, can be considered a constant cost to the company.

6) Transportation and Scale Economies

These two factors are the remaining cost parameters associated with modern industrial location theories. In a previous section (p. 38), the mill options for study were defined and therefore no additional discussion of scale is necessary. Only transportation costs will be expected to differ significantly between feasible sites within the study area and consequently could affect mill location. This cost parameter will be discussed in the following sections.

OTHER FACTORS AFFECTING LOCATION

Aside from transportation costs, there are many other factors which will affect location, generally falling into four major categories: site, input location, environmental and legislative and community factors. These will now be discussed in further detail.

1) Site Factors

To minimize construction costs, the potential mill site must be fairly level and possess suitable foundation conditions. As well, the area, must be large enough to accommodate a sizeable roundwood supply and allow room for expansion of initial facilities if necessary.

2) Input Factors

Input factors and their transportation costs are probably the most serious constraints in choosing a site for the Phase III mill.

The need for an existing source of water is crucial for mill location, especially for the two pulp-mills. Water requirements range from 200,000 M^3/day for the kraft mill to less than 10,000 M^3/day for the fibreboard plant (F.A.O., 1973).

To minimize the cost of obtaining energy, the mill site should also be located as close as possible to existing power, utility and gas lines.

The major input required by the three mill types is obviously wood fibre. The costs associated with the transportation of wood fibre from the lease area to the mill can be a significant component of total harvesting costs and hence resulting net revenue. If possible, the firm should strive to construct the mill in a central location with respect to wood supplies available within the lease. This will minimize hauling costs of roundwood which can be as much as 30% of total wood costs (Dept. of Industry, Trade and Commerce, 1977). As well, a central location will tend to minimize construction and maintenance costs of roadways.

All three mills will utilize varying amounts of wood fibre. The availability of this fibre is as important as the transportation costs. The amounts of fibre required by each mill are as follows:

TABLE 5

FIBRE REQUIREMENTS BY MILL TYPE

1) Kraft:	50/50 Aspen - softwood mix 256,700 cunits aspen 306,000 cunits softwood 562,700 cunits fibre
2) CMP:	70/30 Aspen - softwood mix 87,684 cunits aspen 37,578 cunits softwood 125,262 cunits fibre
3) Fibreboard:	100% Aspen 113,203 cunits fibre

SOURCE: Appendix 4.

When comparing these figures with the A.A.C. figures from Table 2, one can see that timber supply problems may exist with the two pulp-mills. There is enough deciduous fibre available to supply all three mills. However, the coniferous fibre requir[redacted] two pulp-mills is not available to the company under [redacted] of the F.M.A. At the present time, Simpson [redacted] bidding for the right to harvest coniferous timber available from an area west and southwest to the existing F.M.A. The total coniferous A.A.C. available has been calculated to be approximately 427,550 cunits (Alberta Forest Service, 1979). For the purpose of this study, it is assumed that if the company decided to construct either pulp-mill, coniferous fibre would be allocated by the Province in sufficient quantity to satisfy fibre requirements.

Labour, chemicals and other materials must be transported to the mill via rail or road. Thus mill location must take into account the need for existing railways to major industrial centres outside the study area plus a road network from the mill to labour sources within commuting distance. As well, a highway from the general road system around the mill location to the industrial centres outside the study area must be present to enable transportation of inputs normally not carried by rail.

Generally, the company can minimize transportation costs of inputs by locating the mill near water, in a central

proximity to wood sources and near existing rail, roads and energy sources.

3) Environmental and Legislative Factors

The ability to meet provincial criteria regarding effluent levels in water, air and land is an important factor in mill location. Failure to abide by the various environmental regulations could eliminate the entire project or add costly construction delays (Lipke, 1976).

In Alberta, a conversion plant in the forest industry sector would have to be constructed and operated under the following legislations, administered by the Department of the Environment:

a) Department of the Environment Act

b) The Clean Air Act

c) The Clean Water Act

d) The Water Resources Act

e) The Land Surface Conservation and Reclamation Act

f) The Litter Act

SOURCE: (Harrington, 1978).

These various legislative constraints will be briefly examined to assess their application to the problem of mill location.

a) Department of the Environment Act

This Act generally outlines the powers and duties of the Minister of the Department of the Environment with respect to environmental concerns. As well, the Act delineates public hearing responsibilities to the Environmental Council of Alberta. Final acceptance of any resource development project is contingent upon successfully meeting the approval of the Minister.

b) & c) The Clean Air and Clean Water Acts

The Clean Air and Clean Water Acts both require a similar procedure with which the proponent of the project must abide. In each case, a permit is required prior to mill construction, contingent upon the plans meeting the approval of the Department of the Environment. Plans must show plant location and methods of dealing with liquid and gaseous wastes. Following construction, an inspection of effluent treatment equipment is made by Department officials prior to mill operation. If the approval of waste treatment equipment is gained, a licence to operate will be granted to the company. The level of effluent discharges into the water and emissions into the atmosphere must meet stringent criteria, satisfying government standards.

In terms of Phase III, a major conversion plant must be located at lease four miles away from existing oil or gas

plants. This constraint exists because the Department of the Environment wishes to avoid mixing emissions from the Phase III mill with those of another source. Because of the presence of several oil and gas plants within the F.M.A. area, this added restriction becomes an important factor in mill location.

d) Water Resources Act

The Water Resources Act is designed primarily to deal with such things as shoreline erosions, stream diversions and major crossings. This Act also considers the licencing of water supplies stored on site. The three mill possibilities previously outlined all require some degree of water storage on land for effluent treatment purposes, the capacity directly related to mill size.

e) The Land Surface Conservation and Reclamation Act

This particular Act will be a major hurdle for Simpson Timber to overcome when conducting feasibility studies on mill location. The Act allows the Minister to request an Environmental Impact Assessment whereby the proponent of the project must submit a detailed report regarding the following:

a) resource use and management
b) conservation of resources
c) control of air, water, land and noise pollution
d) economic factors affecting firm's prevention of environmental damage

e) consideration of aesthetics

SOURCE: (Harrington, 1977).

In the opinion of this writer, for a project of the magnitude of Phase II, an Environmental Impact Assessment would be requested by the Department of the Environment.

f) The Litter Act

The Litter Act is a relatively minor piece of legislation which deals with the regulation of re-usable containers. This Act should have no real impact upon site location.

If the company can locate a site and construct a plant within the limits of the preceeding legislations, Phase III could proceed as planned. A final factor not yet discussed is also important in determining mill location: community factors.

Community Factors

The distance to a major settlement and the level of infrastructure and ammenities within that settlement are important to mill operation and to a lesser extent, mill construction. While most workers during construction may be housed in temporary quarters on site, all labour will have to commute to the mill during actual operation. For that reason, the mill must be located within a short driving distance to a major settlement.

There must also be a certain level of infrastructure and services within the settlement for both the construction and operational phases. According to the Alberta Dept. of Business Development and Tourism (1979), a settlement must offer the following:

a) local services (ie.) shopping
b) housing and non-housing accommodations
c) medical and dental care
d) schools
e) recreational facilities
f) postal service
g) media availability
h) financial institutions
i) local utilities
j) transportation systems to other communities.

For mill construction, a, c, e, f, g, h and j, are most important where workers may drive to town to spend a short time shopping, banking, etc. During actual mill operation, all the infrastructure requirements are important because workers will either be living directly in town or may reside nearby with a need for basic services. In short, a well developed town within commuting distance to the mill is required when choosing a potential mill site.

FEASIBLE MILL SITES

Introduction

The many factors which have been discussed are all interrelated in the decision to locate a mill over a wide range of sites in one particular region. Some factors, such as water supply, energy sources constraints which may tend to outweigh other less important factors.

Keeping these constraining factors in mind, as well as trying to account for other location factors, only two feasible mill locations appear within the F.M.A. area. Each site will now be discussed briefly.

Site One

1) Location: present Simpson Timber sawmill planer mill location near Blue Ridge, Alberta.

2) Site Characteristics:

a) Water Supply - Athabasca river with flow sufficient for pulp-mill requirements. Average flow - 1,600,679 m^3/hour.

b) Transportation - 1) existing rail service to Edmonton via C.N.R. heavy freight line: distance from mill site to Edmonton via rail is approximately 160 km.

2) close proximity to major highway to Edmonton; highway 43, distance from mill site to Edmonton is approximately 164 km.

c) Stable Site - mill site soil structure suitable for heavy foundations of large scale fibre mill.

d) Major Communities - close proximity to major rural settlements by road:

1) Whitecourt - 40 km.

2) Mayerthorpe - 40 km.

e) Energy Supplies - existing natural gas and electrical power available on site:

1) Electrical - Calgary Power

2) Natural Gas - Northwestern Utilities Ltd.

f) Fibre Availability - existing oil and gas field road system to deciduous fibre from D.T.A. areas. Average haul distance weighted by Gross Merchantable Annual Allowable Cut for each D.T.A. equals 54.6 km. (Source: Appendix 5).

Site Two

1) Location: eighteen miles south east of the town of Fox Creek, Alberta. Site lies on Athabasca river near the hamlet of Knight.

2) Site Characteristics:

a) Water Supply - Athabasca river, with flow sufficient for pulp-mill requirements. Average flow - 1,549,702 m^3/hour.

b) Transportation - 1) existing rail service to Edmonton via same C.N.R. heavy freight line. Distance from mill to Edmonton - 240 km.

2) close proximity to highway 43 to Edmonton distance from mill site to Edmonton - 241 km.

c) Stable Site - mill site soil structure suitable for heavy foundations of large scale fibre mill.

d) Major Communities - close proximity to major rural settlements by road:

1) Fox Creek - 45 km.

2) Whitecourt - 80 km.

e) Energy Supplies - natural gas and electrical energy sources not presently on site. Natural gas source within 3 km. Electrical power source within 15 km.

f) Fibre Availability - existing oil and gas field road system to deciduous fibre from D.T.A. areas. Average haul distance weighted by Gross Merchantable A.A.C. for D.T.A. areas equals 47.6 km. (Source: Appendix 5).

Site Advantages and Disadvantages

Both sites have advantages and disadvantages in their location. Common advantages include a more than adequate water supply from the Athabasca River. The mill which would use the

largest volume of water, the Kraft mill, only utilizes approximately 12% of the average flow. Both sites lie within a close proximity to major rural communities which could provide the necessary infrastructure during mill construction and operation.

A common disadvantage is the fact that both sites are located near small hamlets. The Blue Ridge site lies within 2 km. of the hamlet of Blue Ridge while the second site is located a similarly short distance from Knight.

The Blue Ridge site has some advantages over the Knight site with respect to the basic cost parameters. First, the site is already serviced, with electric and gas lines presently supplying the sawmill complex. Only minimal feeder lines would have to be constructed. The Knight site has a natural gas pipeline within 3 km. Electrical power is available from major transmission lines located 15 km. from the site. These lines presently serve the oil and gas plants in the Windfall oil and gas fields.

The Blue Ridge site also is located closer to Edmonton, 80 km. by rail and 77 km. by major highway. This advantage is not felt to be significant in terms of cost minimization of inputs such as chemicals for example. Many inputs purchased outside the study region will likely be shipped via rail in bulk. In terms of output, pulp is likely to be shipped via rail outside Alberta to the United States markets. An extra 80 km. is insignificant. If fibreboard is produced, tranpsortation by truck to Alberta markets is

expected. The Blue Ridge site has a slight cost advantage for southern markets while the Knight site has the same advantage for northern markets.

The Knight site has one major cost advantage. This advantage is the shorter average hauling distance from D.T.A. areas to the mill site. The distance to the Knight site is approximately 15% less than for the Blue Ridge site. Over the long run, the cost advantage could be significant. The major disadvantage with the Knight site is the fact that it is presently undeveloped. Major clearing and leveling would have to take place before mill construction could proceed.

In summary, both sites have cost advantages and disadvantages with respect to location. Essentially, one could weigh the shorter fibre hauling distance with the Knight site against the fact that the Blue Ridge site is more highly developed.

CHAPTER 5

ECONOMIC ANALYSIS - CONSTRUCTION PHASE

INTRODUCTION

This section deals with the capital expenditure estimates for each sector utilizing data on mill construction costs and previous Simpson capital expanditures during Phase I.

COST CLASSIFICATION

The total mill investment can be classified into the following categories.

TABLE 6

CLASSIFICATION OF MILL INVESTMENT

Cost Item		% of Total Investment
1) Planning, Pre-feasibility		1
2) Engineering		4
3) Construction	a) capital equipment, materials	58
	b) wages	19
4) Start up		4
5) Supervision, overhead		3
6) Debt Capital		5
7) Working Capital		6
		100

SOURCE: (F.A.O., 1973; Jones, 1977).

One must fit these cost items into the eight sector bases shown in the Appendix 7. These are the eight sectors used in the Phase I study. Financing costs, shown above as cost items 6 and 7 and comprising 11% of the total investment are treated as exogenous to the region. For an investment of this scale, one may assume with relative certainty that both working and debt capital will be obtained from outside the regions used in this study. The Simpson Timber Co. will likely obtain the necessary financing through both internal funds and non-Canadian financial institutions.

CAPITAL EXPENDITURE

The following table indicates the amount of capital expenditure which could take place within the study region, flowing into the eight sector bases. Refer to Appendix 6 for details on computation.

TABLE 7

TOTAL CAPITAL EXPENDITURE BY MILL, SECTOR BASE

Sector Base	Expenditure by Mill Type		
	KRAFT	CMP	FIBREBOARD
1	195,283,800.	33,019,000.	22,169,900.
2	1,842,300.	311;500.	209,150.
3	0.	0.	0.
4	95,799,600.	16,198,000.	10,875,800.
5	73,692,000.	12,460,000	8,366,000.
6	663,228.	112,140.	75,294.
7	1,145,910.	193,753.	130,091.
8	33,162.	5,607.	3,765.
TOTAL	368,460,000.	62,300,000.	41,830,000.

The present industrial base within the study region cannot supply a major portion of the complex and sophisticated equipment necessary for a major fibre plant. Previous study of this problem (Carroll, 1977) indicates that a high percentage of equipment and expertise will have to be imported from outside the study region.

Actual Capital Expenditure by Sector

Calculations of the propensity to import, during the construction of the Phase I sawmill were produced in a previous study (Carroll, 1977). This table, with the relevant

sectors and regions, will be used as a base from which to estimate the amounts of capital expenditure being directed into the study region.

TABLE 8

PROPENSITY TO IMPORT: PHASE I

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	.3932	.2424	0	.6746	.6327	0	0	0
2 Study Region	.6344	.4182	0	.9998	.9997	.8076	.2268	.1772
3 Core	.6366	.5316	0	.9998	.9997	.8523	.2268	.1772

SOURCE: (Carroll, 1977).

As expected, the propensity to import increases as the regional boundaries are decreased. However, trends in spending during Phase I will vary considerably for alternate types of mills. One may assume that increases in the complexity and scale of the fibre plant will result in an increase in the propensity to import values. For the mill types selected in this study, the Kraft mill is the largest and most complex, followed next by the CMP mill. The Fibreboard mill is the least complex of the three types, all of which can be considered larger and more sophisticated than the existing sawmill.

Therefore, the following adjustments to the propensity to import figures will be used:

TABLE 9

ESTIMATED INCREASES IN PROPENSITY TO IMPORT

Mill Type	Increase in Propensity to Import
Kraft	20%
CMP	14%
Fibreboard	10%

Those adjustments bringing the propensity to import values greater than one will not be made because those sectors will receive some expenditure. To assume a larger development will cause sectors with an already high propensity to import value to receive absolutely no expenditures is absurd.

The following tables indicate the adjusted propensity to import values for Phase III.

TABLE 10

ESTIMATED PROPENSITIES TO IMPORT: PHASE III - BY MILL TYPE, REGION AND SECTOR BASE

1) Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	.4718	.2909	0	.8095	.7592	0	0	0
2 Study Region	.7613	.5018	0	.9998	.9997	.9691	.2722	.2126
3 Core	.7639	.6379	0	.9998	.9997	.8523	.2722	.2126

2) CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	.4482	.2763	0	.7690	.7213	0	0	0
2 Study Region	.7232	.4767	0	.9998	.9997	.9207	.2585	.2020
3 Core	.7257	.6060	0	.9998	.9997	.9716	.2585	.2020

3) Fibreboard Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	.4325	.2666	0	.7421	.6959	0	0	0
2 Study Region	.6978	.4600	0	.9998	.9997	.8884	.2495	.1949
3 Core	.7003	.5847	0	.9998	.9997	.9375	.2495	.1949

By utilizing these values and the table showing total capital expenditure by mill type, Table 7, one can compute estimated expenditure within each region and for all eight sectors. To arrive at a figure the following formula is used:

$$Eij \times (1 - PTI)$$

where Eij = potential expenditure for each sector and mill type (from Table 7)

PTI = appropriate propensity to import value for each mill type, sector and region (from Table 10).

TABLE 11

ESTIMATED CAPITAL EXPENDITURE BY MILL TYPE, REGION AND SECTOR BASE

1) Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	103,140,000	1,306,374	0	18,249,823	17,745,033	663,228	1,145,910	33,161	142,283,510
2 Study Region	46,614,243	917,833	0	19,159	22,107	20,493	833,993	26,111	48,453,939
3 Core	46,106,505	667,096	0	19,159	22,107	97,958	833,993	26,000	47,772,929

2) CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	18,219,884	225,070	0	3,741,738	3,472,602	112,140	193,753	5,607	25,970,794
2 Study Region	9,139,659	162,746	0	3,239	3,738	8,892	143,667	4,474	9,466,415
3 Core	9,057,111	122,534	0	3,239	3,738	3,184	143,667	4,474	9,337,947

3) Fibreboard Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	12,581,418	[illegible],390	0	2,804,868	2,[illegible]4,100	75,294	130,091	3,764	18,292,925
2 Study Region	6,699,743	112,941	0	2,175	2,[illegible]00	8,402	97,63[illegible]	[illegible],030	6,926,433
3 Core	6,644,319	86,859	0	2,175	2,509	4,705	97,633	3,030	6,841,230

One can note that the percentage of capital expenditure within the study region actually increases as the mill becomes simpler in design and scale. There is very little difference between the CMP and Fibreboard mills in the expenditure within the study region. The impact of either mill upon the study region will be quite similar with respect to capital expenditure.

All three mills will spend a high percentage of available capital within Alberta, indicating that Edmonton will undoubtably receive a large proportion of this money due to its size, economic base and close proximity to the study region.

Within the study regions, sectors 1, 2 and 7: Engineering, Construction, Contracting; Trucking, Transport; Service Companies, receive the major impacts of capital expenditure. Sector 1 actually benefits most of all for every mill type in that it receives 95% or more of the actual expenditure within the region, likely due to the fact that this sector, which also services the oil and gas industry, is already highly developed. The estimated regional expenditure figures (Table 11) also indicate that within the study region, the core communities of Whitecourt and Fox Creek will receive the major impacts of mill construction.

The overall propensity to import out of potential capital expenditure funds ranges from .8345 for the Fibreboard mill to .8685 for the Kraft mill. Thus, an average of roughly

85% of the capital expenditure will occur outside of the study region. This figure is somewhat higher than that obtained for the Phase I sawmill, (80%), and can be attributed to the more advance technology of a fibre mill versus a sawmill.

In summary, between 13.1% and 16.6% of the potential capital expenditure funds will be spent locally depending on the mill type. The Engineering, Construction and Contracting sector will receive the major impact of this expenditure.

EMPLOYMENT IMPACTS.

The direct effect of mill construction upon employment is the short term creation of jobs during the construction phase. The assumption is made that the time necessary for completion of the project and numbers of labourers required will be constant for each site. The following table summarizes construction employment.

TABLE 13

CONSTRUCTION EMPLOYMENT BY MILL TYPE

Mill Type	Labour Requirements	Construction Time
Kraft	2,000	3 years
CMP	700	2 years
Fibreboard	500	2 years

SOURCE: Appendix 2.

From these figures the question of indirect employment arises. How many jobs will be created in the service sector during construction of the mill? Both the CMP and Fibreboard mills should not have any significant effect in creating indirect employment. The larger Kraft mill, built over a duration of three years may only have a very insignificant impact upon indirect employment. Both Whitecourt and Fox Creek could likely absorb the short term influx of labour without the need for expansion in the non-basic sectors of their economies.

INCOME EFFECTS

While the presence of construction employees should not cause significant induced increases in the number of service sector jobs, the wages of these workers will benefit the economy within the study region. From a previous section (p. 62) wages paid to construction and company personnel were shown to equal 19% and 3% respectively of the total mill investment. For each mill these wages are represented by the following table:

Trends in Capital Expenditure

Since no other information was available at the time of writing, the figures compiled will be used as estimates of capital expenditure. One may assume that the total investment required will remain constant for all three mills irrespective of actual location. Thus, costs should not vary significantly between the Blue Ridge and Knight locations.

As might be expected, the actual estimated expenditure within the study region increased as the mill type became more sophisticated. There is a widespread difference between the Kraft mill and both the CMP and Fibreboard mills in terms of actual expenditure. Thus the Kraft mill will have the greatest impact upon the study region and the core communities of Fox Creek and Whitecourt.

The percentage of the potential expenditure in each region is shown as follows:

TABLE 12

PERCENTAGE OF TOTAL POTENTIAL EXPENDITURE BY MILL TYPE AND REGION

Mill Type	% of Total Potential Expenditure by Region		
	Alberta	Study Area	Core
Kraft	38.6	13.1	12.9
CMP	41.6	15.2	14.9
Fibreboard	43.7	16.6	16.3

TABLE 14

ANNUAL WAGES DURING MILL CONSTRUCTION

Mill Type	Construction Labour Gross Incomes per Year	Company Supervisors Gross Incomes per Year	Total Yearly Gross Incomes	Number of Years
Kraft	26,220,000	4,140,000	30,360,000	3
CMP	6,650,000	1,050,000	7,700,000	2
Fibreboard	4,465,000	705,000	5,161,000	2

As one might expect, the annual wage bill increases as the mill type becomes more compex. The figures represent gross incomes only.

To estimate the proportion of this gross wage figure which will be circulated within the study region, one must account for leakages. These leakages of income usually take the form of taxes, savings and imports (Apedaile et al., 1972). All represent a proportion of income not circulated within the study region. From the Phase I Study the overall propensity to withdraw income was 0.67, calculated as follows:

Overall propensity to import	0.21
Average propensity to save out of income	0.16
Average tax rate	0.30
TOTAL	0.67

The larger development of Phase III will likely result in the first two components of the overall propensity to withdraw income to change. Adjustments are made for the following reasons:

1) Transient Labour

   a) The transient workers' motive to save and move on will result in a higher average propensity to save out of income.

b) Because of family ties outside the study region, spending patterns will differ from those found in Phase I. The overall propensity to import will be larger.

2) Proximity of Core Communities to Edmonton

The location of Whitecourt and Fox Creek with respect to Edmonton is an important factor. Edmonton is the closest major urban centre and hence could attract construction workers with its superior shopping and entertainment facilities. As well a large proportion of the labour force will originate from the city and thus would return often to spend income on goods and services. The distance to major urban centres has shown to be a major factor with respect to regional income circulation (Apedaile et al., 1972). The components of the overall propensity to draw out of income will drecrease as the distance to major urban centres increases. Therefore one can expect that Whitecourt and Fox Creek will have different components of the overall propensity to withdraw out of income due to the fact they are different distances from Edmonton. Whitecourt is approximately 177 km. from Edmonton while Fox Creek is located 257 km. from Edmonton. Thus, a smaller overall propensity to draw out of income can be expected for mill construction activity at the Knight-Fox Creek site. The greater distance to Edmonton from this

site over the Blue Ridge-Whitecourt location could dissuade some workers in travelling to Edmonton during construction.

With these points in mind, the overall propensity to draw out of income can be estimated for both mill locations.

1) Fox Creek-Knight

a) Propensity to import	0.27
b) Average propensity to save out of income	0.24
c) Average tax rate (constant)	0.30
Overall propensity to withdraw	0.81

2) Blue Ridge-Whitecourt

a) Propensity to import	0.31
b) Average propensity to save out of income	0.24
c) Average tax rate (constant)	0.30
Overall propensity to withdraw	0.85

By applying these values to Table 14, the amount of income circulated within the study region can be estimated. The following formula is used:

$$I_A = I_G \times (1 - OPW)$$

where I_A = actual income remaining within study region

I_G = gross annual construction wages

OPW = overall propensity to withdraw out of income.

TABLE 15

DIRECT INCOME IMPACT WITHIN THE STUDY REGION

Mill Type	Total Annual Gross Wage Bill	Amount Remaining within Study Region	
		Fox Creek-Knight Site	Blue Ridge-Whitecourt
Kraft	30,360,000	5,768,400	4,554,000
CMP	7,770,000	1,476,300	1,165,500
Fibreboard	5,170,000	982,300	775,500

This table represents the direct income effect of construction; ie., the actual amount of the total annual wage bill that is spent on goods and services within the study region by the workers. As shown in Table 15, the direct income benefit will be greater for a mill built at the Knight-Fox Creek site. The magnitude of this benefit increases as the mill type becomes more complex.

The indirect income effect can be found by use of the income multiplier, calculated from the overall propensity to withdraw out of income. The multiplier represents the pattern of spending of a primary injection. Thus we can study the impacts of the income from construction workers spent within the study region. The multiplier itself is calculated as follows:

$$K = \frac{1}{OPW}$$

where OPW = overall propensity to withdraw out of income

K = income multiplier.

This results in the income multiplier for each site.

TABLE 16

REGIONAL INCOME MULTIPLIERS

Site	Income Multiplier
Knight-Fox Creek	1.23
Blue Ridge-Whitecourt	1.17

The indirect income effect is found by the following formula:

$$I_I = (K \times K_D) - I_D$$

where I_I = indirect income effect

K = income multiplier

I_D = direct income effect.

Therefore, the formula can be applied to produce the resulting values:

TABLE 17

INDIRECT INCOME IMPACT WITHIN THE STUDY REGION

Mill Type	Indirect Income Benefit	
	Fox Creek-Knight Site	Blue Ridge-Whitecourt Site
Kraft	1,326,732	774,180
CMP	339,549	198,135
Fibreboard	225,929	131,835

Again, the trend by which the more complex mills generate a higher degree of income benefits is evident. Also, a mill built at the Knight-Fox Creek site will generate more indirect income within the study region than the same mill at the Blue Ridge-Whitecourt site. By adding the direct and indirect incomes, the resulting figure indicates the total increase in income within the study region as an impact of mill construction in each site.

The following Table illustrates this impact.

TABLE 18

TOTAL REGIONAL INCOME BENEFITS

1) Fox Creek-Knight

Mill Type	Direct Income	Indirect Income	Total Increase In Income
Kraft	5,768,400	1,326,732	7,095,132
CMP	1,476,300	339,549	1,815,849
Fibreboard	982,300	225,929	1,208,229

2) Whitecourt-Blue Ridge

Mill Type	Direct Income	Indirect Income	Total Increase In Income
[illegible]	4,554,000	774,180	5,328,180
[illegible]	1,165,500	198,135	1,363,635
Fibreboard	775,500	131,835	907,335

As expected, the Knight-Fox Creek mills generate a greater total increase in incomes than mills built on the alternate site, with the Kraft mill in both cases producing the largest benefits. While the increased income values seem large, especially for the Kraft mill, induced investment of any significance will likely not result. Business owners in the core communities would recognize the large influx of

TABLE 23

ESTIMATED PROPENSITIES TO IMPORT: PHASE III - BY MILL TYPE,

REGION AND SECTOR BASE: WHITECOURT-BLUE RIDGE SITE

Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1253	0	.3928	0	0	.0293	.0100
2 Study Region	.1772	.3877	.0029	.9464	.7277	.7013	.8369	.7165
3 Core	.4789	.4533	.3308	.9464	.9622	.7049	.8369	.8279

CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1218	0	.3821	0	0	.0285	.0097
2 Study Region	.1724	.3772	.0028	.9464	.7079	.6821	.2142	.6969
3 Core	.4598	.4409	.3217	.9464	.9359	.6857	.8142	.8054

Fibreboard

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1162	0	.3642	0	0	.0271	.0093
2 Study Region	.1643	.3596	.0027	.9653	.6748	.6503	.7761	.6644
3 Core	.4383	.4203	.3067	.9653	.8922	.6537	.7761	.7677

labour as being only a temporary boom and would curtail expansion until the mill began the operation phase. Instead local merchants would use the increased revenue to up-grade their promises to allow better competition with large "chain" stores which could appear during the operation phase (Jones, 1977). Actual induced investment during construction is unlikely.

CHAPTER 6

ECONOMIC ANALYSIS - OPERATION PHASE

INTRODUCTION

As was the case with the construction phase, company expenditure, employment and income will be examined to determine the economic impact upon the study region.

COST CLASSIFICATION

Operational costs refer to those expenditures directly associated with daily plant operation, ie., production costs (F.A.O., 1973). In a previous section (p. 41), production costs were divided into eight categories and a resulting cost per unit of output calculated. These cost figures must now be classified into the eight sector bases utilized in the same manner as were construction costs. The resulting table represents the estimated total annual operating expenditure for each mill. It does not account for the location of such expenditure.

Of the eight unit cost categories listed on p. 41, four are not included in the "transformation" of unit costs into the eight sector bases. Expenditures on chemicals, sales/administration and depreciation are considered exogenous flows out of the study region although 60% of the chemicals will be

purchased in Alberta (Jones, 1977). Also, labour costs (ie., wages paid to company personnel) will be examined in a later section (p. 99). All wood flow from the bush to the mill is assumed to be handled by hired contractors. Thus, their wages are accounted for in the sector bases 1 and ..

Please refer to Appendix 8 for a detailed description of the methodology involved in cost analysis. The following table represents estimated annual operating expenditures.

TABLE 19

TOTAL ANNUAL OPERATIONAL EXPENDITURE BY MILL TYPE AND SECTOR BASE

Sector Base	Expenditure by Mill Type		
	Kraft	CMP	Fibreboard
1	27,132,000	5,914,300	3,780,000
2	13,090,000	2,856,000	3,240,000
3	10,200,000	6,783,000	2,400,000
4	10,608,000	2,046,800	1,320,000
5	442,000	83,300	60,000
6	1,870,000	368,900	240,000
7	1,598,000	309,400	200,000
8	306,000	71,400	40,000
TOTALS	65,246,000	18,433,100	11,280,000

OPERATIONAL EXPENDITURE

During the Phase I study, the propensities to import for operational accounts were calculated for each sector base within the study region. As with the capital expenditure estimates, the original values can be used as a base from which to build on. The original values for Phase I are shown on Table 20.

These values must be adjusted for each mill location due to the difference in the business structure between Fox Creek and Whitecourt. By referring to Appendix 1, one can see that Whitecourt has a larger population base, more diverse manufacturing and non-manufcaturing business sector and developed transportation sector than Fox Creek. Therefore, a mill located in the Whitecourt area would have a tendency to import less operational goods and services than a mill in the Fox Creek location.

A further adjustment must be made to account for the mill type being operated. The Kraft mill will likely require some items not available within the study region in greater amounts than for the Fibreboard mill. The CMP mill would be "in the middle" with exogenous import requirements.

To account for differences in the community's ability to supply operational goods and services, it is assumed that the Knight-Fox Creek site would increase the propensity to import values by 5% above those for Whitecourt.

TABLE 20

PROPENSITY TO IMPORT: PHASE I

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1139	0	.3571	0	0	.0266	.0091
2 Study Region	.1611	.3525	.0027	.9464	.6616	.6375	.7609	.6514
3 Core	.4297	.4125	.3007	.9464	.8747	.6409	.7609	.7527

The adjustments for mill type are as follows: Kraft - 10%; CMP - 7%, Fibreboard - 2%.

Therefore, the estimated increase in the Phase I propensity to import values are as follows:

TABLE 21

ESTIMATED INCREASES IN PROPENSITIES TO IMPORT

Fox Creek Site		Whitecourt Site	
Mill Type	% Increase	Mill Type	% Increase
Kraft	15	Kraft	10
CMP	12	CMP	7
Fibreboard	7	Fibreboard	2

The resulting propensity to import figures for each sector are classed into each mill location separately. Those figures which would increase to greater than one, will not be adjusted. The reasons are the same as for the construction phase. The tables are as follows:

TABLE 22

ESTIMATED PROPENSITIES TO IMPORT: PHASE III - BY MILL TYPE, REGION AND SECTOR BASE: FOX CREEK-KNIGHT SITE

Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1309	0	.4107	0	0	.0306	.0105
2 Study Region	.1853	.4053	.0031	.9464	.7608	.7331	.8750	.7491
3 Core	.4942	.4739	.3458	.9464	.8747	.7370	.8150	.8656

CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1276	0	.3999	0	0	.0298	.0102
2 Study Region	.1804	.3948	.0030	.9464	.7409	.7140	.8522	.7296
3 Core	.4813	.4615	.3368	.9464	.9797	.7178	.8522	.8430

Fibreboard Mill

Region \ Sector	1	2	3	4	5	6	7	8
1 Alberta	0	.1218	0	.3821	0	0	.0285	.0097
2 Study Region	.1724	.3772	.0028	.9464	.7079	.6821	.8142	.6969
3 Core	.4598	.4409	.3217	.9464	.9359	.6857	.8142	.8054

Expenditure Estimates within Study Region

By applying the adjusted propensity to import figures to toal annual operation expenditures for each mill, one can determine the estimated expenditure within the study region. The following is utilized:

$$Eij \times 1 - PTI$$

where Eij = potential expenditure for each mill type and sector (from Table 19)

PTI = propensity to import value for each mill type, sector and region (from Tables 22, 23).

Trends for Operational Expenditure

Several trends with regards to operational spending can be noticed. First, the location factor does not take on the importance originally proposed. For each mill, there is very little difference in operational expenditure totals when comparing sites. Thus, the slightly less developed business sector of Fox Creek does not significantly reduce the economic benefits arising from mill operation within that area.

As with capital expenditure, the Kraft mill contributes the largest injection of expenditure with approximately $42,000,000. per year being spent within the study region.

TABLE 24

ESTIMATED ANNUAL OPERATIONAL EXPENDITURE BY MILL TYPE,

REGION AND SECTOR BASE: FOX CREEK-KNIGHT SITE

Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	11,376,519	0	6,251,294	0	0	1,550,379	302,878	19,481,070
2 Study Region	22,104,440	7,783,314	10,168,380	568,588	105,726	534,820	236,184	82,742	41,584,194
3 Core	13,723,365	6,886,649	6,672,840	568,588	55,382	527,714	236,184	48,042	28,718,764

CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	2,491,574	0	1,228,284	0	0	300,179	70,671	4,090,708
2 Study Region	4,847,360	1,728,451	6,762,651	109,708	21,583	105,505	45,729	19,306	13,640,293
3 Core	3,067,747	1,537,956	4,498,485	109,708	1,690	104,103	45,729	11,209	9,376,627

Fibreboard Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	2,845,368	0	85,628	0	0	194,300	39,612	3,894,908
2 Study Region	3,128,328	2,017,872	2,393,280	70,752	17,526	76,296	37,160	12,124	7,753,338
3 Core	2,041,956	1,811,484	1,627,920	70,752	3,846	75,432	37,160	7,784	5,676,334

TABLE 25

ESTIMATED ANNUAL OPERATIONAL EXPENDITURE BY MILL TYPE,

REGION AND SECTOR BASE: WHITECOURT-BLUE RIDGE SITE

Kraft Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	11,449,823	0	6,441,177	0	0	1,551,178	302,940	19,745,118
2 Study Region	22,324,209	8,015,007	10,170,420	558,588	120,356	558,569	260,633	86,751	42,104,533
3 Core	14,138,485	7,156,303	6,825,840	558,588	16,707	551,837	260,633	52,662	29,571,055

CMP Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	2,508,139	0	1,264,717	0	0	300,582	70,735	4,144,173
2 Study Region	4,894,674	1,778,716	6,764,007	139,708	24,331	117,273	57,486	21,641	13,767,836
3 Core	3,194,904	1,596,789	4,600,908	109,708	5,339	115,945	57,486	13,894	9,694,973

Fibreboard Mill

Region \ Sector	1	2	3	4	5	6	7	8	Total
1 Alberta	0	2,863,512	0	839,256	0	0	194,580	39,628	3,936,976
2 Study Region	3,158,946	2,074,896	2,393,520	45,804	19,512	83,928	44,780	13,424	7,834,810
3 Core	2,123,226	1,878,228	1,663,920	45,804	6,468	83,112	44,780	9,292	5,854,830

The CMP mill injects approximately $13,000,000. and the Fibreboard mill close to $6,000,000. annually.

The sectors receiving the bulk of the expenditure are:

1) Engineering, Construction, Contracting,
2) Trucking and Transport,
3) Oil and Gas Companies.

This is not surprising due to the fact that the entire logging and transport operations of the mill would fall mainly into these three sectors. In fact, these three sectors account for nearly 97% of the entire expenditure within the study region. At present these sectors are highly developed within the study region due to the expansive oil and gas industry. By the time mill operations started, these three sectors could be expected to handle the increase in contracts to Simpson Timber.

When examining the percentage of total expenditure within the Province, study region and core, peculiarities in the data surfaced. Due to the manner in which the Phase I values were calculated, the expenditures by sector, within Alberta, resulted in four sectors having zero expenditure appear. This assumption is obviously wrong because expenditure within the study region certainly could be considered as expenditure within Alberta as well. Therefore, a zero in the preceeding expenditure tables for a sector indicates that all expenditures was within the study region for that sector.

If one considers the study region and core communities only, the following table can be drawn, representing the percent of total expenditure received.

TABLE 26

PERCENTAGE OF TOTAL ANNUAL OPERATIONAL EXPENDITURE RECEIVED BY REGION

Mill Type	% of Total Expenditure Received	
	Study Area	Core
Kraft	64.1	44.6
CMP	74.3	51.7
Fibreboard	69.1	51.1

NOTE: Calculated as follows:

$$\frac{\text{Expenditure received, average between each site}}{\text{Total Expenditure}}$$

The trends indicated differ from these found for the construction phase where the percentage of expenditure received increased directly with a drop in mill scale and complexity. The preceeding table shows that the CMP mill contributes the highest percentage of expenditure into the study region and core, followed by the Fibreboard mill. An explanation can be found by looking at Table 19, showing total expenditure, and Appendix 8. The trucking and transport sector receives more expenditure for the Fibreboard mill than does the CMP mill. This increased expenditure is due to the increased sales of final product within Alberta for the Fibreboard mill, requiring increased local truck transport.

As with capital expenditure, the core communities of Fox Creek and Whitecourt will receive most of the expenditure within the study region.

In summarizing, one can say that the Kraft mill will provide the greatest amount of annual expenditure within the study region, most of which, (44.6%) is directed to the core communities.

EMPLOYMENT IMPACTS

Direct Impact

The direct impact of mill operation upon employment is the actual job positions created and filled within the company. These would be mill positions only. As stated earlier in the chapter dealing with operational expenditure (p. 85), the woodlands employment will be considered to be filled by independent contractors for all three mill types. This will facilitate an easier understanding of the operational impacts of Phase III. Therefore, the following table represents total mill and woodlands employment required during the operational phase.

TABLE 27

OPERATIONAL EMPLOYMENT REQUIREMENTS

BY MILL TYPE

Mill Type	Operational Employment		
	Mill	Woodlands (Contractor)	Total
Kraft	450	300	750
CMP	140	90	230
Fibreboard	100	75	175

SOURCE: Appendix 2.

These figures represent the direct employment effect resulting from mill operation. As shown, the employment total is directly related to mill scale. Thus, the Kraft mill, with its high output of 1000 tpd., requires a large number of mill workers for daily operation and wood contractors to supply the necessary fibre. The Fibreboard mill, on the other hand, has relatively small labour requirements.

Indirect Impact

Unlike mill construction, where the short term influx of labour would not lead to induced employment in non-forestry sectors, the mill operation is likely to cause significant changes in the employment scenario of the study region.

The major reason for this impact upon employment lies in the nature of the Phase III development. Businessmen within the study region are likely to view a large mill development, operating under a sustained yield management policy, as a long term investment by Simpson Timber. As a result, local firms can adjust their scale of operation to meet long term demands created by the mill operation. By judging their expansion needs on the basis of operation rather than construction demand, firms will not have excess capacity during the operational phase.

Therefore, some expansion by firms within the study region is likely to result from the operational phase. To determine the indirect or induced employment, one must use an appropriate employment multiplier. In previous studies regarding this problem (Teskey and Smyth, 1972), employment multipliers were calculated for various types of mill developments. With reference to these studies, the following employment multipliers have been estimated for this study.

TABLE 28

REGIONAL EMPLOYMENT MULTIPLIERS

Mill Type	Employment Multiplier
Kraft	2.01
CMP	1.81
Fibreboard	1.67

If one considers the total operational employment from the mill and woodlands as the direct impact, the indirect or induced impact, using the estimated multipliers, is as follows:

TABLE 29

DIRECT AND INDIRECT EMPLOYMENT IMPACTS

Mill Type	Direct and Indirect Employment		
	Direct	Indirect	Total Increase
Kraft	750	757	1,507
CMP	230	186	416
Fibreboard	175	117	292

As one might expect, the Kraft mill results in the highest level of increased employment within the study region. All eight industry sectors within the study region are expected to benefit from the increased employment, especially those sectors involved with supplying Simpson Timber and local contractors with required goods and services. Thus the following industry sectors supplying operational materials will likely see some expansion.

3) Oil and Gas,

4) Machinery and Tools,

5) Lumber and Wood Products.

As well, the Wholesale and Retail sector, and Service Companies should expand to accommodate the increase in demand of consumer goods and services from Simpson employees, contractors and their families.

The core communities of Whitecourt and Fox Creek will be the focal points of business expansion since these towns are the major centres of business with the study region. The actual effects upon each community will depend on mill location. The community closer to the development will likely experience the greater amount of expansion with the other town receiving more reduced employment increases.

INCOME EFFECTS

The benefits of increased wages and salaries within the study region are expected to incur a significant impact. This income benefit will be examined for each location and mill type. As well, the direct and indirect income benefits will be considered.

Direct Income Benefits

The direct income effect is simply the total of all wages and salaries paid to mill employees and woodlands contractors during the annual operation of the conversion plant. For the mill employees, the effect is calculated by multiplying the number of employees times the average wage rate. To calculate the direct income benefits for the woodlands contractors, an estimated hourly wage, taken out of their total annual payments from Simpson will be used.

1) Mill Workers

Although an estimation of wage rates in the future is difficult, some value must be used as a basis to determine direct income benefits. In 1978, the average annual wage paid to Simpson Timber employees was approximately $20,569. (Simpson Timber, 1979). Since the company is non-unionized, one must simply estimate a "rough" annual percentage increase in wages up to a future year. A conservative estimate of a 10% per year increase in wages will be used. The year 1984 will be the future reference year because one can compare all three mills at once. While the CMP and Fibreboard mills will be completed in 1983, the Kraft mill will not be finished until 1984. Thus, 1984 is a common base year.

2) Contractor (Woodlands) Wages

While not directly being employed by Simpson Timber, the contractors filling the woodlands manpower requirements can be thought of as replacements for company personnel who would otherwise be occupied in those jobs. A study of contractor operations for Phase I revealed an average profit margin of approximately 28% from total payments. Based on 1977 contractor payments, each contractor earned roughly $26,133. The higher income reflects the fact that contractors are risk takers investing large amounts of capital in equipment. Therefore, a logical assumption is that contractors

will likely receive increases in their incomes at a higher rate than that received by mill workers. An annual increase of 12% is not unlikely and this conservative figure will be used to estimate incomes in the base year of 1984. Thus, an average income of $57,766. is estimated.

Calculation of Propensity to Withdraw out of Income

To estimate accurately the direct income benefits, some knowledge of income leakages out of the study region is again necessary. During the construction phase it was estimated that the overall propensity to withdraw was 0.78 for the Fox Creek site and 0.85 for the Whitecourt site. For the operational phase, a tendency for workers to spend locally is likely to occur. All workers will live within the study region and reside mainly in the larger communities (Stevens, 1978). Thus, one may expect a large degree of personal spending to occur within the study region. As well, the location factors mentioned on p. 75 will affect the amounts of income spent locally.

The Phase I study indicated an overall propensity to withdraw of 0.67 for mill workers in the operational phase at the Whitecourt-Blue Ridge site. This trend is likely to continue for Phase III mill workers at that site.

The mill workers at the Fox Creek site would probably be affected by the location factor and thus could be expected to spend a higher percentage of their incomes locally rather than in Edmonton.

Contractor personnel, although residing within the study region, will tend to spend more income outside the area while on trips to Edmonton for parts, service, etc. As well, their higher incomes will place them in an average tax rate somewhat greater than that found in Phase I for mill employees. The location of the mill will have no significant effect on contractor spending as most workers will likely reside outside the core communities.

In light of these points, the following overall propensities to withdraw out of income are estimated:

(1) Fox Creek-Knight Mill

(a) Mill Workers

Overall propensity to import	0.17
Average propensity to save out of income	0.16
Average tax rate	0.30
TOTAL	0.63

(b) Contractors

Overall propensity to import	0.40
Average propensity to save out of income	0.13
Average tax	0.40
TOTAL	0.93

(2) Whitecourt-Blue Ridge Mill

(a) Mill Workers

Overall propensity to import	0.21
Average propensity to save out of income	0.16
Average tax rate	0.30
TOTAL	0.67

(b) Contractors

Constant	TOTAL	0.93

Summary of Direct Income Benefits

The direct income benefits will be calculated for each mill and location. Income remaining within the study region is calculated by:

$$I_A = I_{GX} (1 - OPW)$$

where I_A = actual income remaining within study region

I_G = gross annual wages for mill and woodlands operation

OPW= overall propensity to withdraw out of income.

The annual wages for each mill and location are shown in Table 30.

By applying the overall propensities to withdraw out of income to these annual wages, one can determine the value of the income remaining within the study region.

TABLE 30

TOTAL ANNUAL WAGES AND SALARIES:

OPERATIONAL PHASE

Mill Type	Mill Worker Income			Woodlands Contractor Income		
	Number	X Annual Wage	Total Annual Income	Number	X Annual Wage	Total Annual Income
Kraft	450	35,883	16,147,350	300	57,766	17,329,800
CMP	140	35,883	5,023,620	90	57,766	5,198,940
Fibre-board	100	55,883	3,588,300	75	57,766	4,332,450

TABLE 31

DIRECT INCOME IMPACTS WITHIN STUDY REGION

BY MILL TYPE AND SITE

1) Fox Creek-Knight Site

Mill Type	Income Remaining Within Study Region (Direct Income)		
	Mill Workers	Woodlands Contractors	Total
Kraft	5,974,519	1,213,086	7,187,605
CMP	1,858,739	363,925	2,222,664
Fibreboard	1,327,671	303,271	1,630,942

2) Whitecourt-Blue Ridge Site

Mill Type	Income Remaining Within Study Region (Direct Income)		
	Mill Workers	Woodlands Contractors	Total
Kraft	5,328,625	1,213,086	6,541,711
CMP	1,657,794	363,925	2,021,719
Fibreboard	1,184,139	303,271	1,487,410

Indirect Income Benefits

These figures represent the estimated annual income that will be spent within the study region as direct income. Obviously this direct income will be circulated throughout the study region and result in some level of indirect or

induced income. By using the income multiplier, calculated from the overall propensities to withdraw out of income, this indirect income generation can be estimated.

The following multipliers have been calculated from the previous propensities to withdraw out of incomes.

TABLE 32

REGIONAL INCOME MULTIPLIERS

Mill Site	Income Multiplier	
	Mill Workers	Woodlands Construction
Fox Creek-Knight	1.58	1.07
Whitecourt-Blue Ridge	1.49	1.07

Therefore, the indirect or induced income can be determined by simply taking the multiplier times the direct incomes calculated on Table 31. The results are shown in Table 33.

By summing the value of the direct and indirect income benefits (Tables 31 and 33), the estimated increase in incomes can be calculated for the operational phase. This is shown in Table 34.

TABLE 33

INDIRECT INCOME IMPACTS WITHIN STUDY REGION BY MILL TYPE AND SITE

1) Fox Creek-Knight Site

Mill Type	Indirect Income Benefits		TOTAL
	From Mill Worker Income	From Woodlands Contractor Income	
Kraft	3,465,221	84,916	3,550,137
CMP	1,078,068	25,474	1,103,542
Fibreboard	770,049	21,228	791,277

2) Whitecourt-Blue Ridge Site

Mill Type	Indirect Income Benefits		TOTAL
	From Mill Worker Income	From Woodlands Contractor Income	
Kraft	2,611,026	84,916	2,695,942
CMP	812,319	25,474	837,793
Fibreboard	580,228	21,228	601,456

TABLE 34

TOTAL ANNUAL INCREASE IN REGIONAL INCOMES BY MILL TYPE AND SITE

1) Fox Creek-Knight Site			
Mill Type	Increase in Incomes		
	Direct	Indirect	Total
Kraft	7,187,605	3,550,137	10,737,742
CMP	2,222,664	1,796,586	4,019,250
Fibreboard	1,630,942	791,277	2,422,219
2) Whitecourt-Blue Ridge Site			
Mill Type	Increase in Incomes		
	Direct	Indirect	Total
Kraft	6,541,711	2,695,942	9,237,653
CMP	2,021,719	1,359,998	3,381,717
Fibreboard	1,487,410	601,456	2,088,866

Summary of Income Benefits

While the level of increased incomes is not substantially larger than those estimated for the construction period, it must be remembered that increased incomes in the operational phase are of a long term, if not permanent nature. Therefore, the increase in incomes within the study

region is significant and should have a definite impact upon local firms, especially those in the core communities. As the data shows, the size of this impact varies with the mill type and location. The data shows that mills at the Fox Creek-Knight site will result in a higher level of increased income than mills located at the Whitecourt-Blue Ridge site. A familiar pattern is again developed whereby the Kraft mill produces the greatest impact upon the study region. The Fibreboard mill results is relatively minor impacts.

Due to the recurring nature of this increased income, a significant amount of induced investment by local firms is likely. The towns of Whitecourt and Fox Creek should receive the majority of the investment as new businesses start up and older ones expand to handle the increased income spent on goods and services. This growth pattern will be quite significant for the Kraft mill development and somewhat reduced for the other two mills.

VALUE ADDED AND IMPLICATIONS

The concept of value added in production can be a useful economic measure when comparing the economic importance of industries (Teskey and Smyth, 1972). Value added is essentially a measure of the value which has been added to the product passing through the mill. Thus, it indicates the relative value of inputs used to change raw timber into either kraft pulp, mechanical pulp or fibreboard. To calculate

value added, one simply calculates the net selling value of shipments minus costs for wood inputs, fuel and electicity, materials and supplies. Thus, value added is an estimate of the salaries, wages plus residual which is "processed" into the final product. The value added for each mill will be calculated and compared on an annual base, with 1984 being used as the reference year.

Implications

The actual amount of value added for the Kraft mill is significantly larger than for the other two mills, indicating that a high level of local labour, reflected through wages and salaries is utilized in producing Kraft pulp. There is very little difference in total value added for the CMP and Fibreboard mills.

An interesting trend is shown when considering the percentage that value added comprises of the total selling value of shipment. F.O.B. mill). While the Kraft mill has the highest percentage (48.2), the other two mills are within a close range. A difference of only 6.7% exists between the Kraft and Fibreboard mills. Thus, in terms of actual percentage of value added on product value, there is very little variation between the three mills.

TABLE 35

PRODUCTION COSTS AND NET SALES

(1000's of $)

Mill Type	Wood Inputs 1	Salaries & Wages 2	Fuel & Power 3	Materials & Supplies 4	Misc. Items 5	Residual Left 6	Net Sales 7
Kraft	38,760	16,147	10,200	28,900	14,620	41,653	150,280
CMP	8,568	5,023	6,783	7,022	3,094	9,375	39,865
Fibreboard	5,400	3,588	2,400	12,000	1,600	8,842	33,800

SOURCE: Appendix 9.

TABLE 36

CALCULATION OF VALUE ADDED

Mill Type	Value Added Columns 2+5+6 Table 35	Selling Value of Shipments	% of Value Added of Selling Value.
Kraft	72,420	150,280	48.2
CMP	17,492	39,865	43.8
Fibreboard	14,030	33,800	41.5

CHAPTER 7

INFRASTRUCTURE REQUIREMENTS AND COSTS

INTRODUCTION

Associated with community growth, there will be increases in the demand for basic private and Government services necessary for an urban center to function smoothly. These basic services are known as infrastructure and can be classified into the following categories:

1)	Transportation Services:	Bus, Air and Rail
2)	Power Services:	Gas, Oil and Electricity
3)	Water Supply:	For domestic and industrial consumption
4)	Sewage System:	Storm and Sanitation
5)	Garbage Collection:	Regular Collection
6)	Protection:	Police and Fire
7)	Telephone Service:	Within and outside town
8)	Education:	Schools
9)	Medical Facilities:	Doctor, Dentist and Hospital
10)	Government Facilities:	Post Office, A.L.C.B., Government Representatives

11)	Community Facilities:	Libraries, newspapers, radio, T.V., parks, playgrounds, street construction and maintenance, churches, recreation facilities
12)	Financial:	Insurance, mortgage, trust and finance companies, banks
13)	Housing:	Apartment, mobile homes, residential.

SOURCE: Alberta Dept. of Business Development and Tourism, 1979).

In short, these components of infrastructure are characteristic of most major urban centres. As one might expect, the numbers and availability of these services will vary directly with the population of the community. The larger the population base, the larger the level of infrastructure will be available.

PRESENT INFRASTRUCTURE AND GROWTH PATTERNS OF CORE COMMUNITIES

The actual level of infrastructure for both core communities was discussed in Ch. 2, p. 15. As a further reference, a Community Survey, summarizing the basic level of infrastructure available in both Whitecourt and Fox Creek is located in Appendix 1.

Whitecourt presently has a much larger infrastructure base than does Fox Creek due to the relative population levels of each community. Whitecourt's population as of 1978 was 4,400, while Fox Creek had only 1,888 residents, (Dept. of Business Development and Tourism, 1979). While both communities service similar sectors within the region's economy, Whitecourt has evolved into the larger, more stable urban centre.

The rate of population growth in both communities show interesting trends. Up until 1975, prior to the construction of the Simpson Timber Phase I complex, the rate of increase in Whitecourt's population was slowing down and beginning to level off (Dept. of Business Development and Tourism, 1979). From 1976 until the present, the rate of population growth has been increasing. This trend is expected to continue until 1984 when the Phase III development is complete (Associated Engineering Services Ltd., 1975). The overall rate is estimated at approximately 12% annually, assuming all the benefits of Phase III flow towards Whitecourt. If one only includes Phase I and Phase II of the Simpson project, the population of Whitecourt will likely grow at an annual rate of approximately 4.5%.

Fox Creek has enjoyed steady growth in population since 1973, mainly as a result of the heavy development of the oil and gas sector in the surrounding region. The rate

of population growth has been slowly increasing every year, from 3.4% in 1974 to 8.6% in 1977. For the purpose of this study, a rate of 6% per year will be used.

Thus, while Fox Creek is at present a much smaller community, the town shows a somewhat higher rate of natural increase in population. The location of Phase III will likely alter this pattern significantly.

FUTURE GROWTH AND INFRASTRUCTURE REQUIREMENTS

The location of the Phase III complex along with the inherent impact on employment and income, should greatly affect the community nearest the mill site. It seems quite logical to assume that most of the associated impacts will flow to the community within the shortest commuting distance from the mill.

The large influx of labour during mill construction is unlikely to alter the current demands for infrastructure in either community (Phillips, et al., 1979, p. 178). The main reason for this is that the majority of the transient, temporary workers will be housed at the mill site in modular trailer camps. For example, during the construction of the Procter and Gamble kraft pulp mill in Grande Prairie, construction workers lived on site during the entire construction period. As was the case with the Simpson Timber Phase I construction, these workers tend to be single males, seeking short term employment for the purpose of earning a high income (Stevens, 1978).

One facet of mill operation is the idea of stability of employment where company employees and woodlands contractors wish to settle down within the region. Many will be married with children and will obviously require basic infrastructure in the community they choose to reside in. The sudden increase in local community population will place severe demands upon the community in which the majority of the employees reside. This community will either by Fox Creek or Whitecourt, depending of course, upon mill location.

The estimated increase in population levels is indicated as follows:

TABLE 37

ESTIMATED POPULATION INCREASE BY MILL TYPE

Mill Type	Expected Increase in Population		Total
	Residing in Town	Residing out of Town	
Kraft	1,180	506	1,686
CMP	326	140	466
Fibreboard	229	97	326

SOURCE: Appendix 10.

This table represents the expected increase in population from workers and their families who will originate from outside the study region. While a certain level of employment could be met by local residents, the majority will flow into the communities from areas outside the study region.

One should note that the data presented in Table 37 is not restricted to company related employment only; the figures include the increase in indirect employment that will originate from outside the study region. Thus, the figure represent the total picture of estimated increases in direct and indirect employment from people migrating into the study region.

As one can see from Table 37, a certain percentage of people will likely decide to reside outside of the two core communities on acreages, farms, etc. The Phase I study found that a high proportion of sawmill workers did not choose to reside in Whitecourt, which is the closest major community to the mill site. This trend is expected to continue for the Phase III development.

Depending on the site chosen, either Fox Creek or Whitecourt will experience a dramatic increase in demands for infrastructure as permanent mill and contractor positions become filled during the transition from the construction to the operational phase. These workers and their families will create an increase in infrastructure cost. The expected costs of meeting these new demands upon local infrastructure will be considered as the cost aspect of this study.

ESTIMATED INFRASTRUCTURE COSTS

Data is available which indicates the expenditure by the towns of Whitecourt and Fox Creek on local infrastructure.

This data can be utilized to estimate future expenditures on infrastructure upon completion of the Phase III development.

a) Whitecourt

Municipal expenditure per person can be calculated by dividing total municipal expenditure per operating year by the total population. From data extending from 1974 to 1978, expenditures per person are as follows:

TABLE 38

MUNICIPAL EXPENDITURES, WHITECOURT

Year	$ Expenditure/Person	Percentage Increase
1974	253.9	-
1975	298.8	17.7
1976	315.5	5.6
1977	407.9	29.3
1978	493.9	21.1

SOURCE: Town of Whitecourt Financial Statement for years of 1974 to 1978.

While actual expenditure has increased yearly, the percentage change in this increase has fluctuated every year. The largest percentage increase occurred in 1977 when the Simpson Phase I complex was well into operation. From that point on, the trend seems to be that the rate of expenditure

increase will decline until equilibrium is reached with two major factors, inflation and population increases. A community experiencing only a natural rate of population increase should also have infrastructure costs increasing at a rate equivalent to the annual rate of inflation. As well, as the population base expands, one can expect that higher quality, and hence more expensive infrastructure may be demanded. For example, as a town expands, improvements in roads, street lighting, sewage disposal, refuse collection, etc., may be necessary. Thus, infrastructure costs will increase. The total rate of increase should therefore be somewhat larger than the rate of inflation.

An overall rate of annual increase in expenditure per person is estimated to be approximately 18.0% from the data presented in Table 38. This estimate is based on the assumptions made regarding the effect of inflation and quality upon infrastructure costs.

By compounding the last figure available for municipal expenditure per person in Table 38 by 18.0% per year, an estimate of expenditure per person can be calculated for 1984, when the Phase III mills would all be completed.

b) Fox Creek

The same approach would give an estimate for expenditure per person in 1984. In 1978, municipal expenditure per person for Fox Creek was $353.70 (Financial statement for

New Town of Fox Creek, 1978). At present, Fox Creek is a much less developed town than Whitecourt, with a smaller population and reduced infrastructure reqirements. Thus, the 1978 expenditure per person was approximately 40% less than for Whitecourt. Although the natural rate of population growth for Fox Creek is slightly higher than Whitecourt's. (6% vs. 4.5%), the annual increase in expenditure per person should be less, due to the less costly infrastructure needs of Fox Creek. Keeping these factors in mind, annual increases of 12% in expenditure per person will likely be maintained until 1984. At that time, the Phase III development, if located at Knight, will likely cause large increases in the costs of infrastructure as the town population swells.

The results of the proceeding discussions can be summarized into the following table.

TABLE 39

INFRASTRUCTURE COSTS PER PERSON, 1984;

EXCLUSIVE OF PHASE III IMPACTS

Core Community Near Mill Site	Town Population 1984 (exclusive of Phase III)	Infrastructure Costs Per Person 1984	Total Expenditure
Whitecourt	5,730	1,333.23	7,639,407
Fox Creek	2,678	698.09	1,869,485

As Table 39 shows, the population ratio between the two communities is slightly higher than 2 to 1, as is the case at present. As well, the infrastructure cost per person for Whitecourt is almost twice that for Fox Creek owing to the larger annual increases in expenditure over the time period 1978 to 1984. One should remember that these figures reflect the normal situation excluding the impacts of Phase III. Obviously, during construction some impacts upon infrastructure will be felt, but their effects are likely to be minimal when compared to impacts during mill operation. Therefore for ease of study, the assumption is made that increased demands for infrastructure will occur at the onset of mill operation. 1984 is used as a common year to compare increased infrastructure costs.

IMPACT OF PHASE III ON INFRASTRUCTURE COSTS

The relatively sudden increase in direct and indirect employment resulting from the operational aspect of Phase III is likely to create severe increases in demand for infrastructure. The core community located nearest the mill site will experience most, if not all the impacts from the increase in workers, enterpreneurs and their families. Each mill type brings with it a different level of population increase. As well, both Fox Creek and Whitecourt will vary in their ability to absorb the shock of sudden increases in population. In 1984, Whitecourt's population of approximately

5,730 will be more than twice that of Fox Creek and hence will offer a wider variety of infrastructure items. This trend is evident at present and can be expected to continue. By 1984, the population of Fox Creek, excluding Phase III impacts, will be approximately 2,678. This was the population of Whitecourt in 1968. What this indicates is that by 1984, Fox Creek will still be a relatively undeveloped town with only a moderate level of infrastructure.

The level of town development is critical in determining the extra cost necessary to cope with the sudden increases in infrastructure needs. Obviously, Whitecourt will be better able to absorb an increase in population than Fox Creek and should do so at a lesser cost.

In the absence of published data regarding the effect of a large population influx on local infrastructure costs, some assumptions must be made for this particular study. First, each mill option will affect costs in a direct relationship with respect to mill scale. For example, the kraft mill should cause an increase in population of 1,636, while the fibreboard plant causes an increase of 326 people. Thus, the larger scale mill should create a much higher impact on infrastructure expenditure per person than the smaller developments for Phase III. A second assumption is the mill options will affect infrastructure costs for each town in a different manner. Since the level of infrastructure in each community is a reflection if its population base, it seems logical to

assume that the level of increased infrastructure costs will be related to the ratio of the population increase from Phase III and the original town population.

Using Whitecourt as a starting point and the figures presented in Tables 37 and 39, infrastructure cost expansion factors are developed. These factors serve two purposes. First, they allow comparison between the impacts associated with each mill and its inherent population increase. Second, these factors allow comparison of the increase in infrastructure costs between each community. The cost expansion factors are developed by comparing the population increases associated with each mill (Table 37), with the 1984 population of each community. As well, the 1984 populations of both communities, before the Phase III impacts, are directly compared. Thus, the kraft mill has the largest expansion factor of the three mills while the factors for Fox Creek are double those for Whitecourt.

The cost expansion factors are used to calculate the expected increase in infrastructure cost per person in each community as shown in Table 40.

To summarize, these figures represent <u>estimates</u> of the increase in infrastructure cost per person when the impact of the three Phase III options is felt by either community. These estimates account for the relative impact each mill would have on Whitecourt and Fox Creek. The figures also account for the ability of each town to cope with

TABLE 40

ESTIMATED INCREASE IN INFRASTRUCTURE COSTS/PERSON FROM PHASE III - 1984

Town	Mill Type	Original Infrastructure Cost/Person	Expansion Factor	Increased Infrastructure Cost/Person
Whitecourt (Blue Ridge Site)	Kraft	1,333.23	2.00	3,999.69
	CMP	1,333.23	1.00	2,666.46
	Fibre-board	1,333.23	0.50	1,999.85
Fox Creek (Knight Site)	Kraft	698.09	4.00	3,490.45
	CMP	698.09	2.00	2,094.27
	Fibre-board	698.09	1.00	1,396.18

the sudden increase in population. One must note that these estimates are made in the absence of available supporting data. However, some idea of expected increases in infrastructure demand and hence, costs must be calculated to view the social cost aspect of this study.

The total increase in infrastructure cost can be calculated by the following formula:

$$Aij \times (B + Cij) - D \times B$$

where Aij = increased expenditure/person for each mill type and town, (Table 39)

B = original population base of town, (Table 38)

Cij = increases in population for each mill type and town, (Table 36)

D = expenditure/person previous to Phase III impacts 1984, (Table 39).

These calculations can be carried out for both communities to give the total increase in infrastructure cost necessary as a result of the three possible Phase III developments.

TABLE 41

TOTAL INCREASE IN INFRASTRUCTURE COSTS

Mill Type	Total Increase In Infrastructure Costs	
	Whitecourt	Fox Creek
Kraft	22,022,293	13,362,838
CMP	8,881,978	4,714,899
Fibreboard	4,473,001	2,324,639

SUMMARY

These figures represent the estimated increase in infrastructure costs incurred by the large increases in population for each community assuming the Phase III development was situated nearest to that town.

The kraft mill with its large impact of direct and indirect employment, causes the greatest increase in infrastructure costs for both communities. The fibreboard plant produces the smallest impact. The degree of impact upon each town can be measured in several ways. Obviously, the figures in Table 41 are greater for Whitecourt because with its larger population base, residents would expect a higher quality and hence more costly infrastructure system. Perhaps the best way to compare the impact between the two communities is to consider the 1984 figures for total expenditures on infrastructure, exclusive of Phase III effects. From Table 39, one

can see that the 1984 total expenditure estimate for the town of Whitecourt is $7,639,407.; Fox Creek has a figure of only $1,869,485. By simply calculating the percentage increase in expenditure above the normal 1984 expenditure level (exclusive of Phase III), one can evaluate the impact upon each community.

TABLE 42

PERCENTAGE INCREASE IN TOWN EXPENDITURE

Mill Type	Percentage Increase in Town Expenditure	
	Whitecourt	Fox Creek
Kraft	288.0	714.8
CMP	116.3	252.2
Fibreboard	58.6	124.3

Table 42 indicates that while both communities face tremendous increases in infrastructure costs, the impact upon Fox Creek would be severe. This does seem plausible when one considers that with the kraft mill for example, the population of Fox Creek increase by 67% while for the same mill, Whitecourt's population increases by only 31%.

Increases in expenditure are not an "overnight" situation. In reality, they would likely be spread over several years as development of infrastructure evolves to meet the increase in demand. The impact of this development would be much more severe in Fox Creek and would likely create more social and economic pressures in the community than in Whitecourt.

CHAPTER 8

SUMMARY AND CONCLUSIONS

SUMMARY

In previous chapters, several important economic impacts are quantified for a range of selected forest industry development schemes in the Fox Creek-Whitecourt region of Alberta. An economic impact analysis model is utilized to set up a framework for quantifying several major costs and benefits under a regional accounting stance. Three mill options are defined and two feasible sites within the study region delineated. Therefore, the economic model considers six potential development projects.

Benefit-cost studies, in general, seek to address the question of efficiency in resource allocation. Impact analysis does not attempt to consider the efficiency question. Very simply, impact analysis examines the consequences of resource development rather than evaluating the efficiency of a particular project. The impact analysis model utilized in this study employs a regional accounting stance as opposed to a provincial, national or global viewpoint. Therefore, while the impacts examined can be classified as costs and benefits within the study region, a wider accounting stance would reveal that a large proportion of the regional costs

and benefits may simply be transfers from outside the region. For example, the increased employment within the study region from a given project is certainly a social benefit to the region. However, since the study region is not able to supply sufficient numbers of skilled labourers, prospective employees will migrate into the study region from other areas of Alberta or other provinces. Thus, the increase in regional employment is to a large extent a transfer from one region of Canada to another. A wider accounting stance would reveal this transfer. In a similar manner, Simpson Timber expenditures are transfers of exogenous funds into the study region. The same consideration must be given to increases in regional income and infrastructure costs. When evaluating the results of this study, the reader must be aware of the implications a regional accounting stance may impart on the magnitude of the various costs and benefits.

For the six development schemes considered, the following costs and benefits are quantified and listed in Tables 43 and 44.

a) Social Benefits: 1) direct and indirect regional employment,
2) direct and indirect regional income,
3) value added within the study region.

b) Social Costs: 1) total increased regional infrastructure costs.

c) Private Costs: 1) total capital expenditure by Simpson,

2) capital expenditure within the study region,

3) total annual operating expenditure by Simpson,

4) annual operating expenditure within the study region.

Results are calculated for both the construction and operational phases of each development scheme.

TABLE 43

SUMMARY OF RESULTS - BLUE RIDGE SITE

Economic Parameter	Mill Type		
	Kraft	CMP	Fibreboard
A. Social Benefits			
1.00 Construction Phase: Time Span	3 years	2 years	2 years
1.10 Regional Employment (persons)	2,000	700	500
1.20 Regional Income ($/annum)			
1.21 Direct	4,554,000	1,165,500	775,500
1.22 Indirect	774,180	198,135	131,835
1.23 Total Increase	5,328,180	1,363,635	907,335
2.00 Operational Phase			
2.10 Regional Employment (person)			
2.11 Direct	750	230	175
2.12 Indirect	757	186	117
2.13 Total Increase	1,507	416	292
2.20 Regional Income ($/annum)			
2.21 Direct	6,541,711	2,021,719	1,487,410
2.22 Indirect	2,695,942	1,359,998	601,456
2.23 Total Increase	9,237,653	3,381,717	2,088,866
2.30 Value Added ($/annum)	72,420,000	17,492,000	14,030,000
B. Social Costs			
3.00 Total Infrastructure Costs ($)	22,022,293	8,881,978	4,473,001
C. Private Costs			
4.00 Construction Phase: Time Span	3 years	2 years	2 years
4.10 Total Capital Expenditure ($)	414,000,000	70,000,000	47,000,000
4.20 Total Capital Expenditure within Study Region ($)	48,453,939	9,466,415	6,926,433
5.00 Operational Phase			
5.10 Total Annual Operating Exp. ($)	65,246,000	18,433,100	11,280,000
5.20 Total Annual Operation Exp. within Study Region ($)	42,104,533	13,767,836	7,834,810

TABLE 44

SUMMARY OF RESULTS - KNIGHT SITE

Economic Parameter	Mill Type		
	Kraft	CMP	Fibreboard
A. Social Benefits			
1.00 Construction Phase: Time Span	3 years	2 years	2 years
1.10 Regional Employment (persons)	2,000	700	500
1.20 Regional Income ($/annum)			
1.21 Direct	5,768,400	1,476,300	982,300
1.22 Indirect	1,326,732	339,549	225,929
1.23 Total Increase	7,095,132	1,815,849	1,208,229
2.00 Operational Phase			
2.10 Regional Employment (persons)			
2.11 Direct	750	230	175
2.22 Indirect	727	186	117
2.23 Total Increase	1,507	416	292
2.20 Regional Income ($/annum)			
2.21 Direct	7,187,605	2,222,664	1,630,942
2.22 Indirect	3,550,137	1,796,586	791,277
2.23 Total Increase	10,737,742	4,019,250	2,422,219
2.30 Value Added ($/annum)	72,420,000	17,492,000	14,030,000
B. Social Costs			
3.00 Total Infrastructure Costs ($)	13,363,838	4,714,899	2,324,639
C. Private Costs			
4.00 Construction Phase: Time Span	3 years	2 years	2 years
4.10 Total Capital Expenditure ($)	414,000,000	70,000,000	47,000,000
4.20 Total Capital Expenditure within Study Region ($)	48,453,939	9,466,415	6,926,433
5.00 Operational Phase			
5.10 Total Annual Operating Exp. ($)	65,246,000	18,433,100	11,280,000
5.20 Total Annual Operating Exp. within Study Region ($)	41,584,194	13,630,293	7,753,338

COMMENTS: Total mill invest. includes direct regional income during operation (2.20) both inside and outside region includes direct regional income during construction (1.20). Total annual operation costs inside and outside study region includes direct regional income during operation (2.20).

FOOTNOTES TO TABLE 43 and 44:

Heading Number	Source of Data
1.00, 1.10	
1.20	
2.10	
2.20	
2.30	
3.00	
4.00, 4.10	
4.20	
5.10	
5.20	

DISCUSSION OF RESULTS

The conclusions are based on the relationships between the costs and benefits listed in Tables 43 and 44. These are discussed individually with respect to their derivation and inter-relationships.

A) Social Benefits

1.00 Construction Phase (time period for construction given in Tables 43 and 44).

1.10 Employment

The figures for construction represent the total number of workers required to build the mill structure and install all equipment up to the start-up date.

1.20 Income

Income for the construction phase can be broken down into two parts, direct and indirect. The direct income is the value of the wages and salaries paid to construction labour that is spent within the study region. Some direct income will be spent outside the study region and therefore is not included as a benefit to the region.

The indirect income can be calculated by the use of an income multiplier. The indirect income is the increase in income caused by the circulation of the direct income within the regional economy. Thus, the initial round of spending (direct income) plus the circulation effects of this income (indirect income) can be added to find the total

increase in regional income due to mill construction. Income values are calculated on an annual basis.

2.00 Operational Phase

2.10 Employment

Each particular mill, once in operation, will employ an amount of labour in direct relation to the scale of operation. The operational employment, because of its long term nature, will have both direct and indirect components. Direct employment is the total number of mill employees and woodlands contractors working for the company. The indirect employment stems from jobs being created in the local economy as firms increase output and capacity to meet the demands imposed by Simpson Timber and its employees. Therefore, direct employment by Simpson Timber creates employment in other sectors of the economy. The direct and indirect employment can be summed to produce the total increase in employment within the study region for each mill option.

2.20 Regional Income

The derivation of income benefits for the operational phase is similar to that for the construction phase. The direct income effect is the value of the total wage bill paid by Simpson Timber to mill employees and woodlands contractors which is spent within the study area.

The indirect income benefit stems from the multiplier effect acting upon the direct income. The circulation

of the direct income within the study region causes a further increase in regional income levels. The summation of direct and indirect income produces the total increase in income within the study region. Obviously, regional income and employment are related. The wage bill for direct employment is the origin of direct income. Indirect employment expenditure plus the circulation of direct income produces indirect income benefits. Income values are calculated on an annual basis.

2.30 Value Added

Value added is the increase in value of a product as it passes through the production process. It is derived by deducting input costs (fibre, fuel, electricity, materials and supplies) from the net selling value of the final product. Therefore, value added includes the contribution of labour to the increase in value of the inputs which give the final product. This means that value added includes within it the direct regional income figure for the operational phase. The remaining components of value added are a residual amount (profit and depreciation) plus miscellaneous expenditure, calculated on an annual basis.

B) Social Costs

3.00 Total Infrastructure Costs

Total costs are used as a measure of social costs incident on the province as a whole, and are calculated as the increase in infrastructure expenditure necessary as a

result of increased population levels from each mill option. Thus, it is related to the direct and indirect employment in the operational phase and the employment in the operational phase and the population increases associated with family size.

C) Private Costs

4.00 Construction Phase

Capital expenditure by Simpson Timber for each mill operation can be considered a private cost, exogenous to the study region. Total capital expenditure by the firm does not indicate to which sectors the money flows. Therefore, capital expenditure within the study region is used to determine the economic impacts this expenditure will have upon the study region. One should note that these figures are total values over the construction period, rather than annual capital expenditures.

5.00 Operational Phase

Operational expenditure for each mill option is presented in a similar manner to operational expenditure. Total annual expenditure and annual expenditure within the study region are both shown in the results.

COSTS AND BENEFIT RELATIONSHIPS

In comparing private costs and social benefits one may assume that all funds for Simpson expenditures, (capital

and operational) will originate outside the study region. The total expenditure by the firm (capital and operational) can therefore be considered a social benefit to sectors receiving these expenditures. Expenditures by Simpson within the study region are benefits to the study region. Thus, costs to the firm are benefits to sectors in society including the study region. These exogenous injections take form of expenditure on labour, capital equipment, operational inputs and services, etc. Thus, the labour requirement by the firm can be thought of in terms of social benefits such as employment. This employment, with the wages paid by Simpson Timber contributes to the total income benefits to the study region.

Value added is based on a similar concept to that expressed in the discussion above on the cost-benefit relationship between employment benefits and labour costs. Value added is a more broadly based measure of the labour input of the production process. Therefore, while, the labour component is a cost to the firm, the social benefits stem from the employment and income circulation from these workers within the study region.

Social costs in this study are considered to be the total increase in the regional infrastructure costs for each alternative. The origin of funds necessary to cover these increased infrastructure costs is difficult to determine. A proportion of the necessary funds will certainly come

from the municipality affected, in the form of higher tax revenues and long term debt capital. However, for projects such as these three fibre mills, provincial assistance is likely, keeping in mind the potential social benefits these mills create. The exact magnitude of this provincial funding cannot be determined at this time, although the municipality concerned will likely be required to share a percentage of these costs. Therefore, the infrastructure costs are a combination of social costs to the province and the study region. Funding provided by the province to the study region can be considered a benefit to the study region if the funding is in the form of a grant or subsidy. Thus, infrastructure costs viewed on a provincial scale are social costs. If examined on a smaller scale, a portion of this total expenditure will be an exogenous social benefit to the study region.

EVALUATION OF RESULTS

Using the results listed in Tables 43 and 44, one can compare each alternative development scheme under several criteria. The appropriateness of these criteria depend upon the objectives and policies of the provincial Government. Regional development plans often reflect the objectives and policies of the provincial Government. Objectives may include increasing regional employment or reducing income disparities between regions, etc. The Simpson Timber Phase III expansion is essentially a regional development plan within the forest

industry sector of the Whitecourt-Fox Creek area. Government officials may use criteria such as employment, income or value added when the Phase III expansion proposals are developed by Simpson Timber. The province may simply encourage the project which produces the largest number of jobs or creates the highest level of income within the study region. Other possible criteria include encouraging projects which will have the greatest amount of capital and/or operational expenditure within the study region.

Although criteria such as increased income and high employment may be considered regional benefits, they provide only one half of the development picture. Each project described in this study creates social costs to the province and the study region in particular. Under a regional accounting stance, increased infrastructure costs associated with each project are quantified as the regional social cost in this study. Rather than simply comparing each alternative on the basis of regional benefits, the incorporation of regional social costs into the evaluation should occur. In essence, one can compare each alternative on the basis of the regional impacts, divided into selected costs and benefits. Using the results from Tables 43 and 44, several types of comparisons are possible. Four examples are listed in Tables 45 through 48.

TABLE 45

INFRASTRUCTURE COST/$ CAPITAL EXPENDITURE

WITHIN STUDY REGION

Mill Type	Location	
	Blue Ridge	Knight
Kraft	.454	.276
CMP	.938	.498
Fibreboard	.646	.335

TABLE 46

INFRASTRUCTURE COST/EMPLOYEE - DIRECT + INDIRECT

(OPERATIONAL PHASE)

Mill Type	Location	
	Blue Ridge	Knight
Kraft	14,613	8,867
CMP	21,350	11,333
Fibreboard	15,318	7,961

TABLE 47

INFRASTRUCTURE COST/$ VALUE ADDED

Mill Type	Location	
	Blue Ridge	Knight
Kraft	.304	.185
CMP	.508	.269
Fibreboard	.319	.166

TABLE 48

OPERATIONAL EXPENDITURE WITHIN STUDY REGION/EMPLOYEE

(DIRECT, OPERATIONAL PHASE)

Mill Type	Location	
	Blue Ridge	Knight
Kraft	56,139	55,445
CMP	59,860	59,306
Fibreboard	44,770	44,309

Tables 45 through 48 illustrate using the results under four possible criteria. There are, however, many ways of comparing the results under different criteria. The preceeding four tables indicate trends with respect to selected regional costs and benefits.

Table 45 compares total infrastructure costs with total capital expenditure within the study region. The infrastructure cost per dollar of regional capital expenditure is highest with the Blue Ridge site. As well, the CMP mill results in the largest value for all three mills.

Table 46 represents infrastructure cost per person employed during the operational phase. The employment includes both direct and indirect increases within the region. Of the two locations, the Blue Ridge site has the higher values. The CMP mill results in the largest value among the three alternative mills.

Table 47 again compares a regional cost and benefit. This table represents infrastructure cost per dollar of value added within the study region. The Blue Ridge site results in higher values than the Fox Creek site and among the three mills, the CMP mill results in the largest values.

Table 48 compares two regional benefits, operational expenditure and direct employment during the operational phase. This table shows that there is very little difference between either site while the CMP mill has a slightly larger value over the other two mills.

These four tables offer a means of comparing the six alternatives under several criteria. Rather than simply comparing each alternative on the basis of income or employment generation, the previous four tables are examples of comparisons using both costs and benefits within the study region. The calculated ratios show trends between the three mills and both alternative sites. Based only on the four preceeding tables, one can see that in general, the Blue Ridge site results in higher regional social costs per unit of benefit for all three mill types. If one compares the three mills only, the trends in Tables 44 through 47 show that the CMP mill results in the highest regional social cost per unit of benefit. The Kraft mill has the lowest value. To best compare the six alternatives several additional tables of ratios should be calculated. The trends shown can then be evaluated.

LIMITATIONS AND APPLICATIONS

An impact analysis model as used in this study can only assess the consequences of resource development on a regional scale. In terms of economic efficiency, the model cannot determine which of the six alternatives provides the greatest present value of net social benefits to the region or society as a whole. The impact analysis model simply lays out a framework for comparing each alternative on the basis of several economic impacts. On a strictly regional accounting stance, these economic impacts can be compared as regional

costs and benefits. Policy makers should not use the results alone to select the "best" project. The results found in this study indicate the level of regional impacts associated with each project. One can rank each project on the basis of the results and ratios calculated, under various criteria. However, the scope of this comparison is limited strictly to the study region. To a large extent, several of the regional costs and benefits are simply transfers from one area of the province or country to the study region. Therefore, the policy maker should at least consider the impacts occurring outside the study region. Each project will create impacts outside the study region in the form of costs and benefits. Examples are pollution, labour relocation and increased infrastructure costs in Edmonton. The model also does not evaluate externalities within the study region. Examples are increased housing costs, higher crime rates and traffic congestion.

The use of impact analysis provides a means of quantitatively assessing several economic impacts associated with development of the forest industry in the north central region of Alberta. This study provides a relatively simple framework for evaluation of alternative development schemes. Policy makers should take note of the model's limitations when analyzing potential mill options. However, the use of

impact analysis as such, will increase the amount of information available to policy makers. Therefore, the use of impact analysis will improve the decision making process in regional development plans involving the forest industry.

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APPENDIX 1

COMMUNITY SURVEY

WHITECOURT

ion

Whitecourt is located 176.99 km. northwest of
ton and 468.23 km. northwest of Calgary.

in

ption of Local Terrain - Rolling terrain, located
valley.

Vegetation - Mixed deciduous and evergreen woodland,
and bog.

ce Composition - Alluvial deposits of sand and
Bedrock is of Edmonton Formation.

	Average Temperature
an.	-11.1°C
pr.	3.5°C
uly	15.6°C
ct.	4.0°C
ear	2.0°C

Yearly Precipitation - 51.56 cm.

Hours of sunshine - 1,900 - 2,000 hours

Humidity - 68%

Elevation - 687 - 732 metres

Average windspeed and direction - 10.94 km. - W.N.W./W.

Average number of frost free days per year - 117

5. Population

	1951	1961	1971	1976	1977	1978
Community	397	1,054	3,155	3,878	4,056	4,400
County (M.D. or I.D.)	100	2,351	3,086	2,214	2,214	
Trading Area	500	3,000	10,220	12,000		14,000

Trading area - E - 32.18, W - 96.54, N - 80.45, S - 32.18

Percentage of population of school age - 33%

Percentage of: Males - 52%, Females - 48%

Percentage of work force - 38.7%

Average age in community - 24

Population by Sex and Specified Age Groups

Male Age Groups	Number	Female Age Groups
65+	35 | 30	65+
55-64	70 | 55	55-64
45-54	110 | 95	45-54
35-44	200 | 150	35-44
25-34	300 | 285	25-34
15-24	315 | 305	15-24
5-14	410 | 385	5-14
0-4	245 | 220	0-4

6 Labour

Size of labour force - 1,650 (additional over previous 2/3 in Manufacturing & 1/3 Retail Trade.)

Percentage of the labour force involved in the following:

6.8% Agriculture	% Wholesale Trade
% Agriculture Services	1.6% Finance/Real Estate/ Insur.
19.1% Construction	10.8% Services
9.0% Manufacturing	5.3% Government
9.6% Trans/Comm/Utilities	3.8% Education
13.7% Retail Trade	20.3% Others

Percentage of labour force:

1) Skilled - 25%
2) Semi-skilled - 50%
3) Unskilled - 25%
4) Unionized - 30%

Area from which workers are or could be drawn - Mayerthorpe

Distances - 40.53 km.

Means of transportation - private

Number of workers going out of town to work - 500

Distance and type of job - Oil & Gas Industry - up to 32.18

Main source of labour (urban/Rural) - Urban

7. Non-Manufacturing Employment

Name of Company	No. of Employees	Type of Business
Revelstoke Building Materials Ltd.	10	Retail Lumber
Mobil Oil Ltd.	100	Gas & Propane
Amoco Canada Ltd.	150	Natural Gas
Texas Gulf Sulfur Ltd.	15	Sulfur
Graphics Stationery	4	Printing

Manufacturing Employment

Name of Company	No. of Employees	Type of Business
Merry Dairy	5	Dairy
Whitecourt Bakery	5	Bakery
Simpson Timber Co.	300	Forest Products
Redwood Ready Mix	10	Concrete
HLP Plastics	3	Plastics
Whitecourt Steel Ltd		Steel
McWick Canoes Ltd.		

8. Natural Resources

Commercial deposits for following are available -
Coal, sulfur, sand/gravel, clay, petroleum, natural gas, timber, agriculture

Various products available are - Oil, gas, forest products, fresh water fish, furs, ties and pulp, propane, butane, condensate, beef cattle

9. Transportation

Railway -

Name of Railway - CNR

Frequency of service - once a day, freight only

Spur tracks - yes

Pickup and delivery services - no

Passenger service - no

Truck Transport -

Names of local trucking firms serving the area - Timberline Trucking, Whitecourt Transport Ltd., Poochs Trucking; Art Primeau Truck Services Ltd., Cameron Brothers Oil and Water Transport Ltd.

Terminal Facilities - Whitecourt Transport Ltd.

Overnight delivery to - Edmonton

Passenger Bus Transport -

Is the community served by regular bus service?

Canadian Coachways

What is its frequency and departure times?

3 times daily from Edmonton through to Peace River & return

Air Services -

Nearest commercial airport - Whitecourt Airport

Number and length of runways - 1,740 metres

All weather facilities - yes

Plane servicing - yes

Scheduled passenger services - Oriole Air - Charter

Names of scheduled airlines - none

10. Municipal Government

Number of councillors - 7

Term of office - 3 years

1) Town Manager - yes
2) Planning Commission - no
3) Recreation Board - yes
4) Economic Development Committee - yes
5) Zoning by-laws - yes
6) Building by-laws - yes
7) Other by-laws that may affect industry - none
8) Town Plan - yes

11. Tax Structure

Latest total Assessment - 10,300,000

Year of last general assessment - 1975

Mill Rate -

Residential 69.5

Business/Commercial - 94

Tax Arrears: Total - 30,000

Percentages of taxes - 96 - 97%

Basis of Assessment -

Land at 65% of market value

Industrial Buildings at 22% of present day replacement costs

Equipment at 10-15% of present day replacement costs (15% on new equipment)

Major projects planned and cost (if available) -

Second Access - 1.2 million

Shopping Mall - 4.3 million

Water Treatment Plant - 2.9 million

Whitecourt Hotel-2.1 million

Total debenture debt - 3,431,000

Per capita debenture debt - 884.73

12. Electric Power

Transformer capacity in KW -

Present consumption in KW -

RATES: Farm -

Commercial -

Domestic -

Industrial -

Supplier - For information contact:

Calgary Power

Whitecourt, Alberta

PH. 778-2749

13. Natural Gas

BTU rating - 1,088 BTU per Cubic Foot

Pressure -

RATES: Domestic -

Commercial -

Industrial -

Supplier - For further information contact:

Northwestern Utilities

Whitecourt, Alberta

PH. 778-2929

14. Water Supply

Source of supply - McLeod River

Reservoir capacity (gallons - 1,200,000 gallons

Pumping capacity (gallons/day) - 450,000 gallons/day

Present consumption (gallons/day) - 300,000 gallons/ day

Water Analysis: (parts per million)

Total Solids	340
Hardness	230
Alkalinity	260
SO_4	3
Cl	2

Connection charges - nil

Water rates - $8.60/month minimum for first 3,000 gallons

$1.90/thousand gallons

More detailed information available from -

Town Office

Whitecourt, Alberta

15. Sewer System

Type of system - Treatment Plant

Type of treatment plant : Primary -

Secondary - x

Tertiary -

Capacity of sewers - 8,000 population

Peak flow - 400 gallons/minutes

Sewer service charge - 50% of water rates

Sewer connection charge - nil

Storm sewers and flood control system - 3.218 km. of storm sewers

20.11 km. of sanitary sewers

16. Garbage Collection

Method of collection - truck

Frequency - weekly

Special commercial or industrial collection - daily

17. Fire Protection

Number of personnel - 23

Volunteer - 22

Permanent - 1

Equipment - 3 trucks

Regular inspection programs - yes

Insurance classification of the community -

18. Police Protection

Type of police - R.C.M.P.

No. of personnel - 7

Number of vehicles - 4

Regular industrial protection patrols - yes

Local court facilities - every Wednesday

19. Telephone Service

For rates and types of service available, contact -
Alberta Government Telephones

Flat rate service includes the following communities:

Blue Ridge

20. Governmental Facilities

List of Government of Alberta and Government of Canada offices in the community:

Provincial:

Attorney General	Social Services & Community Health
Treasury Branch	Medical Examiner
Solicitor General	Recreation, Parks & Wildlife
E. & N.R.	Transportation
E.R.C.B.	A.L.C.B.

Federal:

Post Office
R.C.M.P.
Transport - Telecommunications

21. Community Facilities

Note the existence of the following:

Public Libraries - 1

Newspapers - Whitecourt Star)

Radio Stations - Edmonton

T.V. Channels - Direct Edmonton

- Cable

Parks - 10 parks and playgrounds

Playgrounds -

Fraternal organizations - Kinsmen, Lions, Legion, Masons, Eastern Star

Business organizations - Chamber of Commerce

Hotels and Motels - 11

Condition of the streets: 90% paved

10% graded

Street cleaning - yes

Snow removal - yes

Number of churches - 5

Number of shopping centres - none

Recreational facilities:

Recreation center: swimming pool, curling, hockey, auditorium, golf, boating, tennis, hunting, baseball, fishing, bowling, skiing, theatre.

22. Financial

Name of banks - Bank of Commerce, Bank of Montreal, Treasury Branch

Names of insurance, trust and mortgage companies - Gould-Tomlinson Ltd.

Finance companies - none

Credit Unions - Whitecourt Credit Union

Value of building permits: 17,825,000 Year - 1978

Dwellings - 7,709,450

Commercial - 6,509,500

Institutional - 829,700

Industrial - 2,375,000

	1969	1974	Latest Year 1978
Retail Trade Volume	5,238,000	17,573,000	20,500,000 - 1977
Gross Income of Trading Area Population	13,000,000	32,500,000	112,675,000 - 1977
Gross Income of Population	7,107,000	16,267,000	112,675,000 - 1977
Total Construction	1,800,000	3,500,000	7,500,000 - 1977 17,900,000 - 1978
Approx. Retail & Gross Expenditure Available In Trading Area	5,000,000	8,500,000	10,000,000 - 1977

23. Housing

Number of apartments - 350 units

Availability of residential lots - good

Size - approx. 65 feet

Average cost per front foot - $300.

Average residential taxes - $475.

Are they serviced: yes

Percentage of home owners - 98%

Is there a mobile home park? ?

24. Medical facilities

Number of beds - 50

Number of bassinets - 1

Number of doctors - 4

Nursing services - Health Unit

Ambulance Service - yes

Chiropractor - yes

Optometrist once a week

COMMUNITY SURVEY

FOX CREEK

1. Location

Fox Creek is located 250 km. northwest of Edmonton and 495 km. northwest of Calgary.

2. Terrain

Description of Local Terrain - rolling hills

Area Vegetation - Evergreen woodland with peat bogs muskeg

3. Geology

Subsurface Composition - shale and sandstone, upper bedrock is the Paskapoo Formation.

4. Climate

Period	Average Temperature
Jan.	-14°C
Apr.	2.7°C
July	16.0°C
Oct.	3.8°C
Year	2.3°C

Yearly Precipitation - 54 cm.

Hours of sunshine - 2,100 hours

Humidity -

Elevation -

Average windspeed and direction - W.S.W./W.

Average number of frost free days per year - 63

5. Population

	1951	1961	1971	1976	1977	1978
Community		187	1,281	1,625	1,765	1,888
County (M.D. or I.D.)					4,561	
Trading Area						

Trading area - locals

Percentage of population of school age - 30%

Percentage of: Males - 40%, Females - 30%

Percentage of work force - 85%

Average age in community - 35

Population by Sex and Specified Age Groups

Male	Number	Female
Age Groups.		Age Groups
65+	6	10
55-64	25	55-64
45-54	55	45-54
35-44	110	35-44
25-34	225	215
15-24	150	175
5-14	205	225
0-4	140	125

6. Labour

Size of labour force - 550

Percentage of the labour force involved in the following:

% Agriculture	% Wholesale Trade
% Agriculture Services	% Finance/Real Estate/ Insur.
10% Construction	10% Services
70% Manufacturing	% Government
% Trans/Comm/Utilities	3% Education
2% Retail Trade	3% Others

Percentage of labour force:

1) Skilled - 75%
2) Semi-skilled - 25%
3) Unskilled -
4) Unionized -

Area from which workers are or could be drawn - Province

Distances :-

Means of transportation - private

Number of workers going out of town to work - none

Distance and type of job - Oil & Gas Industry

Main source of labour (urban/rural) - Urban

7. Non-Manufacturing Employment

Name of Company	No. of Employees	Type of Business
Kodiak Oilfield Ser.		
Marnevid Const.		
D. Trottier Eng.		
Breland Backhoe		Oilfield Maintenance
Kopiti Oilfield Ser.		
Greig' Crane Ser.		
Kaibob Sand & Gravel		
McClelland Oil Well Serv.		
Pearce Oilfield Serv.		

Manufacturing Employment

Name of Company	No. of Employees	Type of Business
Vi-Ron Const.		
AlStar Welding		
R.G. Electric		
Schafer Welding		
Tattersall Welding		
Vulcan Electric		

8. Natural Resources

Commercial deposits for following are available - sand, gravel, petroleum, natural gas, timber, fish, coal.

Various products available are - mainly gas & oil, forest products, coal

9. Transportation

Railway -

Name of Railway - none

Frequency of service - none

Spur tracks - no

Pickup and delivery services - Bage Cleans - Tuck & [illegible]

[illegible]

Passenger service - no

Truck Transport -

Names of local trucking firms serving the area -

Fox Creek Trucking Service

Terminal facilities - yes

Overnight delivery to - Edmonton

Passenger Bus Transport -

Is the community served by regular bus service? yes

What is its frequency and departure time?

4 times - east and west

Air Services -

Nearest commercial airport - Fox Creek Airport

Number and length of runways - 1 runway

All weather facilities - no

Plane servicing - no

Scheduled passenger services - no

Names of scheduled airlines - none

10. Municipal Government

Number of councillors - 7

Terms of office - 3 years

2)

2)

4) Economic Development Committee - no

5) Zoning by-laws - yes

6) Building by-laws - yes

7) Other by-laws that may affect industry - none

8) Town Plan - yes

11. Tax Structure

Latest total assessment -

Date of last general assessment

Mill Rate -

Residential -

Business/Commercial -

Tax Arrears: Total -

Percentages of taxes -

Basis of Assessment -

Land at 65% of market value

Industrial Buildings at 22% of present day replacement costs

Equipment at 10-15% of present day replacement costs (15% on new equipment)

Major projects planned and cost (if available) -

24 suite apartment

33 room addition to present motel

Industrial development

Family Housing

Multi-housing

Total debenture debt -

Per capita debenture debt -

12. Electric Power

Transformer capacity in KW -

Present consumption in KW -

RATES: Farm -

Commercial -

Domestic -

Industrial -

Supplier - For further information contact:

Alberta Power

Edmonton, Alberta

13. Natural Gas

BTU rating -

Pressure -

RATES: Domestic -

Commercial -

Industrial -

Supplier - For further information contact:

[illegible]

14. Water Supply

Source of supply - 2 wells

Reservoir capacity (gallons) -

Pumping capacity (gallons/day) - 126,000

Present consumption (gallons/day) -

Water Analysis: (parts per million)

Total Solids	640
Ignition loss	138
Hardness	122
Alkalinity	517
SO_4	74
CL	2

Connection charges -

Water rates -

More detailed information available from -

Town Office

Fox Creek, Alberta

15. Sewer System

Type of system - Treatment Lagoon

Type of treatment plant: Primary -

Secondary -

Tertiary -

Capacity of sewers -

Peak flow -

Sewer service charge -

Sewer connection charge -

Storm sewers and flood control system -

16. Garbage Collection

Method of collection - truck

Frequency - weekly

Special commercial or industrial collection -

17. Fire Protection

Number of personnel - 17

Volunteer - 17

Permanent -

Equipment - 1 truck

Regular inspection programs -

Insurance classification of the community -

18. Police Protection

Type of police - R.C.M.P.

No. of personnel - 7.

Number of vehicles - 2

Regular industrial protection patrols - yes

Local court facilities -

19. Telephone Service

For rates and types of service available, contact -

Alberta Government Telephones

Flat rate service includes the following communities:

Town of Fox Creek

20. Governmental Facilities

List of Government of Alberta and Governments of Canada offices in the community:

Provincial -

Court House presently under construction

To be completed by June/79

Federal -

21. Community Facilities

Note the existence of the following:

Public Libraries -

Newspapers - Fox Creek Booster

Radio Stations - none

T.V. Channels - Direct - CBC CFRN Edmonton

- Cable -

Parks -

Playgounds - 2

Fraternal organization - Kinsmen, Legion, Lions

Business Organizations -

Hotels and Motels - 5

Condition of the streets: 95% paved
5% graded

Street cleaning - yes

Snow removal - yes

Number of churches - 2

Number of shopping centres - none

Recreational facilities:

curling, hockey, golf, fishing, hunting, skiing, craft training, theatre.

22. Financial

Name of banks - Bank of Commerce

Names of insurance, trust and mortgage companies -

Zadderey Agencies

Finance companies - none

Credit Unions - none

Value of building permits: 2,031,840 Year - 1978

Dwellings - $797,500

Commercial - $641,000

Institutional - $464,340

Industrial - $129,000

	1969	1974	Latest Year 19__
Retail Trade Volume			
Gross Income of Trading Area Population			
Gross Income of Population			
Total Construction			
Approx. Retail & Gross Expenditure Available In Trading Area			

23. Housing

Number of apartments - 6 apartments

Availability of residential lots - new subdivision proposed by A.H.C.

Size - 70 x 120 average lot size

Average cost per front foot - contact Alberta Housing Corporation

Average residential taxes - $500

Are they services? yes

Percentage of home owners - 10%

Is there a mobile home park? yes - one

APPENDIX 2

CAPITAL COST DATA

1) Capital Cost Escalation (Pulp Mills)

Rate of Increase	Source
17% per year	(Styan, 1978)
20% per year	(Becker and Thomas, 1978)
18% per year	(Cauvin, 1972)

Average rate of annual increase estimate: 18%.

2) Effect of Hardwood Furnish on Total Capital Costs (Pulp Mills)

Higher yields will result in a 2%-3% reduction in total capital costs (Hatton, 1974).

3) Calculation of Capital Costs, Scale, Employment

a) Kraft Mill

$ Capital Cost	Source and Date	Scale (tpd)	$ Cost in 1981
95,000,000	Cauvin, 1972	750	421,000,000
80,000,000	F.A.O., 1973	760	300,000,000
248,000,000	Jones, 1977	800	480,000,000
300,000,000	P & P, 1978	760	492,000,000

Averaged cost = $423,000,000.

For mill built in 1981: Capital Cost: $423,000,000 less 2%
= $414,000,000

Scale: Estimated at 1000 tpd

24. Medical Facilities

Number of beds - 4
Number of doctors - 1
Number of surgeons - none
Nursing services - no
Dental services - no
Ambulance Service - yes
Medical Clinic - yes
Chiropractor - no
Other medical facilities -

25. Education

Number of schools:

Total enrollment and types:

Elementary -

High School -

Number of high school graduates per year:

Male -

Female -

Future school construction plans - none

* Employment: construction - 2,000

operation:

mill [illegible]

woodlands - [illegible]

SOURCES: (Jones, 1977; F.A.O., 1973).

b) Chemi-Mechanical Mill (with bleaching line)

$ Capital Cost	Source and Date	Scale (tpd)	$ Cost in 1981
34,000,000	(Jones, 1977)	300	66,000,000

Estimated 1981 cost: $66,000,000 + $6,000,000 for bleaching equipment, less 2% = $70,000,000.

Scale: Estimated at 350 tpd.

* Employment: construction - 700

operation:

mill - 140

woodlands - 90

SOURCES: (Jones, 1977; F.A.O., 1973).

) Fibreboard Mill

Average rate of annual cost escalation estimate: 15% (Vajda, 1974).

$ Capital Cost	Source and Date	Scale (MM ft^2 3/8")
13,338,200	Symposium, 1973	170 per annum

$ Cost/MM ft^2 3/8" (1973)	$ Cost/MM ft^2 3/8" (1981)
78,460	240,000

Estimated Scale, 1981: 200 MM ft^2 3/8"/year

Estimated Capital Cost, 1981:

200 MM ft^2 3/8" x 240,000 MM ft^2 3/8" = $48,000,000.

less 2% = $47,000,000.

* Employment: construction - 500

operation:

mill - 100

woodlands - 75

SOURCE: (Jones, 1977).

APPENDIX 3

CALCULATION OF OPERATION COSTS

1) Kraft Mill

Cost Item	$ Cost/ton, 1976	$ Cost/ton, 1984
Wood	53	114
Chemicals	18	38
Operating Materials	22	47
Fuel and Power	14	30
Labour	22	47
Sales and Administration	20	43
Depreciation	13	29
Shipping	42	89
	$204/ton	$437/ton

SOURCE: (Dept. of Industry Trade and Commerce, 1977).

NOTE: - estimated annual cost increases of 10%.

- wood and chemical costs reduced by 5% due to increased yields from hardwood pulp.

PRODUCT: - Bleached Kraft Hardwood Pulp.

PRODUCT PRICE: 1978 = $300/ton (Becker and Thomas, 1978).

PRICE IN 1984 @ 10%/YEAR = $531/ton.

2) CMP Mill

Cost Item	$ Cost/ton, 1976	$ Cost/ton, 1984
Wood	33	72
Chemicals	15	33
Operating Materials	12	26
Fuel and Power	27	57
Labour	20	42
Sales and Administration	12	26
Depreciation	11	24
Shipping	42	89
	$172/ton	$369/ton

SOURCE: (Jones, 1977)

NOTE: - estimated annual cost increases of 10%.
- wood and chemical costs reduced by 5% due to increased yields from hardwood pulp.

PRODUCT: - Bleached Mechnical Hardwood Pulp.

PRODUCT PRICE: 1978 = $240/ton (Becker and Thomas, 1978).

PRICE IN 1984 @ 10%/YEAR = $420/ton.

3) Fibreboard Mill

Cost Item	$ Cost/M. ft^2 3/8", 1973	$ Cost/M. ft^2 3/8" 1984
Wood	10	27
Chemicals	19	50
Operating Materials	4	10
Fuel and Power	5	12
Labour	7	18
Sales and Administration	3	8
Depreciation	9	22
Shipping	14	37
	$ 71/ton	$184/ton

SOURCE: (Vajda, 1974).

NOTE: - estimated annual cost increases of 8% from 1973 to 1977 and 10% from 1978 to 1984.

PRODUCT: Medium Density Hardwood Fibreboard.

PRODUCT PRICE: 1973 = $71/M. ft^2 3/8" (Vajda, 1974).

PRICE IN 1984 @ 10%/YEAR = $206/M. ft^2 3/8".

APPENDIX 4

FIBRE REQUIREMENTS FOR EACH MILL

1) Bleached Kraft Mill*

- assume species mix of: 50% hardwood (aspen, poplar)
  50% softwood (spruce, pine)
- mill output = 340,000 tons/year air dry bleached kraft pulp
- greenwood requirements per ton of pulp:
  a) hardwood: 1.51 cunits/ton pulp
  x 170,000 tons output (½ yield)
  256,700 cunits hardwood
  b) softwood: 1.80 cunits/ton pulp
  x 170,000 tons output (½ yield)
  306,000 cunits softwood

Total fibre requirements: 256,700 + 306,000 = 562,700 cunits.

2) CMP Mill

- assume species mix of: 70% hardwood (aspen, poplar)
  30% softwood (spruce, pine)
- assume 95% yield (pulp from fibre)
- mill output = 119,000 tons/year air dry bleached CMP
- greenwood requirements = $\frac{1}{\%\ \text{yield}}$ x mill output

  $= \frac{1}{.95} \times 119{,}000 = 125{,}263$ cunits

  a) hardwood: 125,263 x .70 = 87,684 cunits.
  b) softwood: 125,263 x .30 = 37,579 cunits.

3) Fibreboard Mill*

mill output = 200 MM ft^2 3/8" fibreboard from 100% hardwood.

greenwood required/1000 ft^2 of product calculated by:

$$I = \left(\frac{1000t}{12w} \cdot \frac{d(1-mc-a)}{(1-s-k)}\right) \cdot \frac{1}{(1-v)} \cdot \frac{1}{(1-f)} .$$

where I = wood input in ft^3 (solid wood)

t = board thickness

w = species density in o.d. lbs./ft^3

d = board density in lbs./ft^3

mc= moisture content in % of original weight

a = additives as a proportion of product weight

s = sander waste as a proportion of input weight

k = trim waste as a proportion of input weight

v = volumetric shrinkage as a proportion of input volume

f = fines less as a proportion of input volume.

Mill values: t = 3/8"

w = 23.09

d = 35

mc= .08

a = .05

s = .10

k = .10

v = .08

f = .02

$$\therefore I = \left(\frac{1000 \times .375}{12 \times 23.09} \times \frac{35(1 - .08 - .05)}{(1 - .10 - .10)} \right.$$

$$\left. \times \frac{1}{1 - .08} \times \frac{1}{1 - .02} \right.$$

$$= 56.6 \text{ ft}^3 \text{ wood/1000 ft}^2 \text{ product}$$

$$56.6 \times \frac{200,000,000}{1,000} = 11,320,000 \text{ ft}^3 \text{ fibre}$$

1 cunit = 100 ft^3 solid wood

$$\therefore \text{ fibre required} = \frac{11,320,000}{100}$$

$$= 113,200 \text{ cunits}$$

* Source of data and calculation procedurers:

(Dobie, J. and Wright, D.M., 1975).

APPENDIX 5

CALCULATION OF AVERAGE HAUL DISTANCE

1) Blue Ridge Site

D.T.A. Area	Gross Merchantable A.A.C. (MCU)	Distance From Mill Site to Centroid of D.T.A. (km)	Volume x Distance (weighted value)
W1	17.57	64	1,124.5
W2	12.52	57	713.6
W3	37.29	128	4,773.1
W4	12.89	37	476.9
W5	73.55	60	4,413.0
S1	136.14	94	12,797.2
Fox Creek	43.52	25	1,088.0
		465	25,386.3

Average haul distance, weighted by volume = $\frac{25,386.3}{465}$

= 54.6 km.

2) Knight Site

D.T.A. Area	Gross Merchantable A.A.C. (MCU)	Distance From Mill Site to Centroid of D.T.A. (km)	Volume x Distance (weighted value)
W1	17.57	140	2,459.8
W2	12.52	100	1,252.0
W3	37.29	64	2,386.6
W4	12.89	50	644.5
W5	73.55	29	2,132.9
S1	136.14	110	14,975.4
Fox Creek	43.52	97	4,221.4
		590	28,072.6

Average haul distance, weighted by volume = $\frac{28,072.6}{590}$

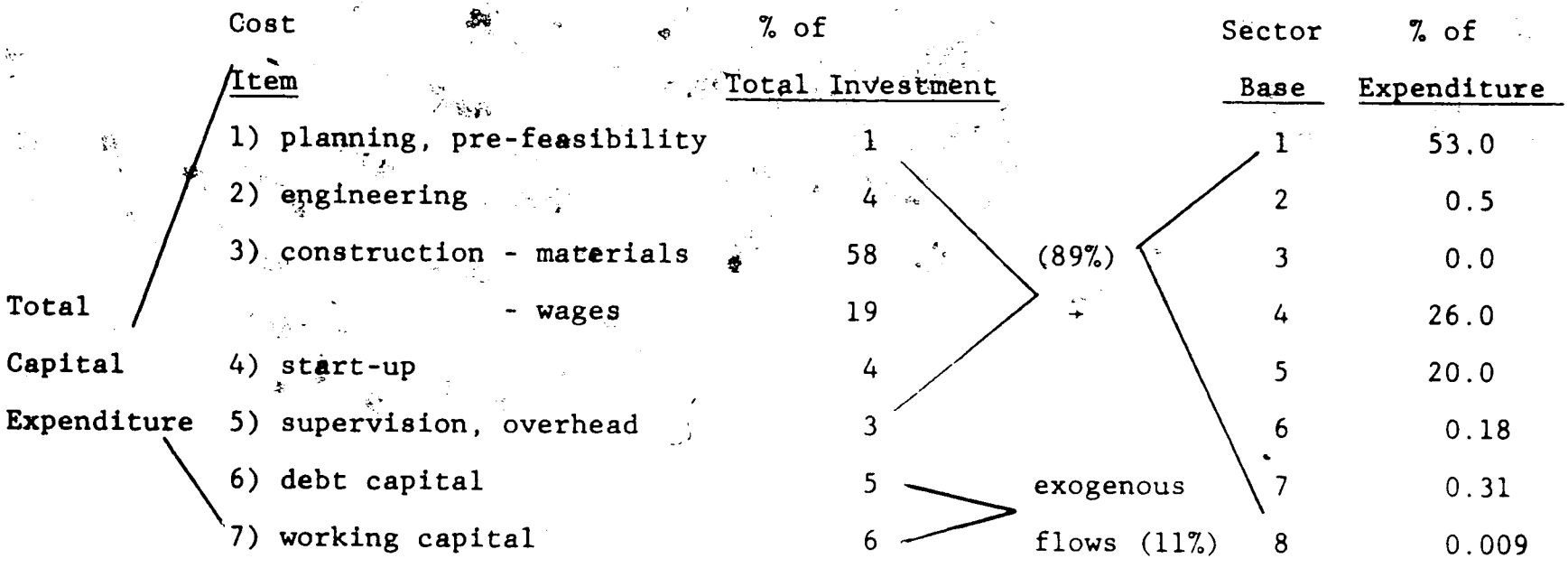
= 47.6 km.

APPENDIX 6

CAPITAL EXPENDITURES TO SECTORS WITHIN STUDY REGION

Total capital expenditure is shown in Chapter 5. This total figure can be divided into seven cost items as listed in Table 6, p. 62. Of the seven cost items shown, only the initial five can be considered when calculating expenditures within the study region. Debt capital and working capital will not flow into the study region. Thus, one is able to calculate the amount of total capital expenditure which could be spent within the study region. This amount can then be allocated into the eight economic sector bases, following expenditure patterns found in the Phase I study.

The following illustrates the procedure used to allocate total capital expenditure inot the eight sector bases within the study region.


Cost Item
% of Total Investment
Sector Base
% of Expenditure
Total Capital Expenditure
1) planning, pre-feasibility 1
2) engineering 4
3) construction - materials 58
- wages 19
4) start-up 4
5) supervision, overhead 3
6) debt capital 5
7) working capital 6
(89%)
exogenous flows (11%)
1 53.0
2 0.5
3 0.0
4 26.0
5 20.0
6 0.18
7 0.31
8 0.009

The end result is indicated in Table 7 which shows the amount of the total investment available for each sector base.

1) Kraft Mill

Total Capital Investment - $414,000,000.

Amount available in study region -

414,000,000 x 89% = 368,460,000.

Allocation into sector bases:

Sector Base	Potential Expenditure
1	195,283,800
2	1,842,300
3	0
4	95,799,600
5	73,692,000
6	663,228
7	1,145,910
8	33,162
	368,460,000

2) CMP Mill

Total Capital Investment - $70,000,000.

Amount available in study region -

70,000,000 x 89% = 62,300,000.

Allocation into sector bases:

Sector Base	Potential Expenditure
1	33,019,000
2	311,500
3	0
4	16,198,000
5	12,460,000
6	112,140
7	193,753
8	5,607
	62,300,000

3) Fibreboard Mill

Total Capital Investmet - $47,000,000.

Amount available in study region -

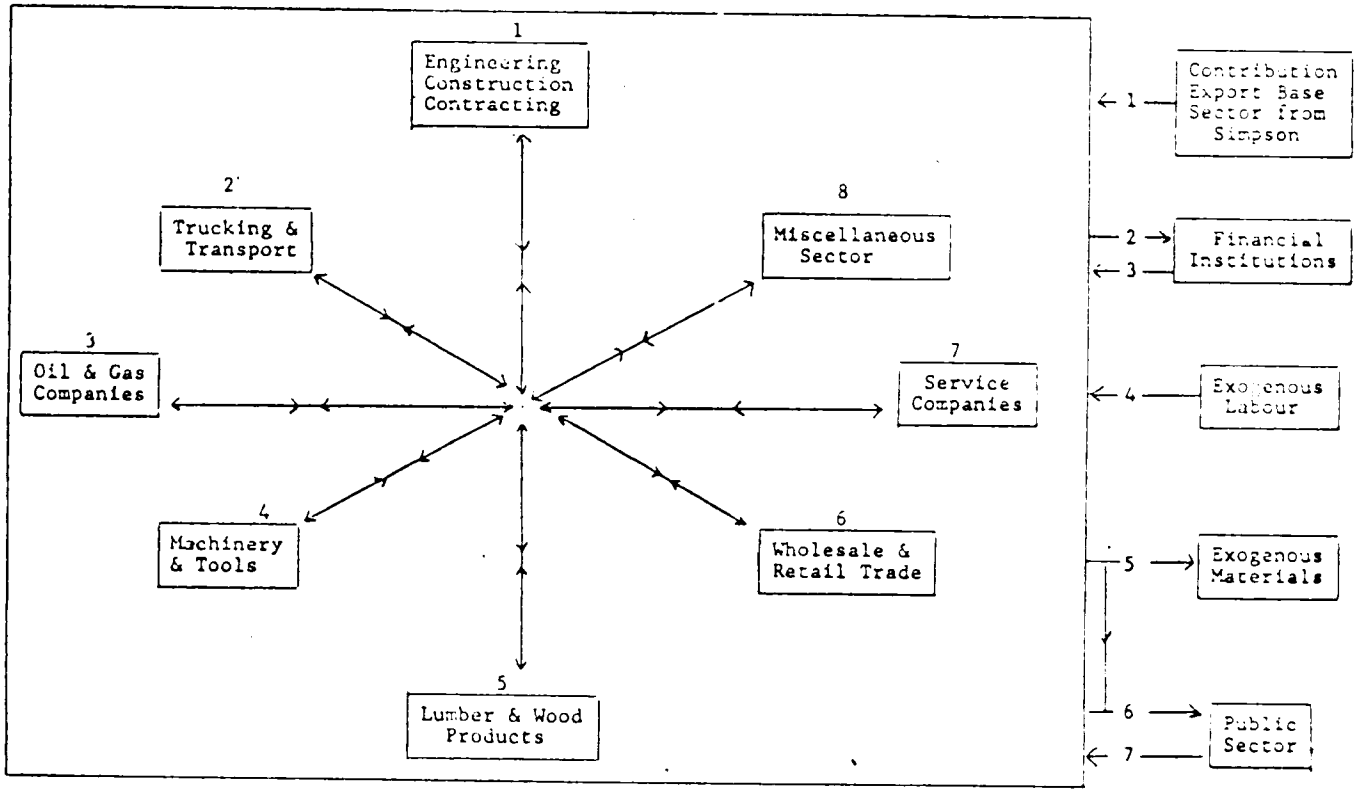
47,000,000 x 89% = 41,830,000.

Allocation into sector bases:

Sector Base	Potential Expenditure
1	22,169,900
2	209,150
3	0
4	10,875,800
5	8,366,000
6	75,294
7	130,091
8	3,765
	41,830,000

APPENDIX 7

SIMPSON TIMBER IMPACT FLOW TO EIGHT SECTOR BASES



1. Payments to endogeneous labour and material sectors. (eg., Engineering and construction hire transport companies to haul goods that buy gas from the gas companies, etc. - include 2-way flows).
2. Flow of money endogeneous materials and labour to financial institutions.
3. Flow of money from financial institutions to endogeneous material and labour.
4. Immigration of workers into area, i.e., brings in money.
5. Payments for imported materials purchased by endogeneous material or labour sector.
6. Taxes to local, provincial and federal governments from endogeneous materials and labour sectors.
7. Transfer payments from public sector to endogeneous material and labour sectors as well as purchases of materials and labour for public works projects.

APPENDIX 8

OPERATIONAL EXPENDITURES TO SECTORS WITHIN STUDY REGION

The operational costs shown in Chapter 6 are listed under eight cost items. These are as follows:

1) Wood
2) Chemicals
3) Operating Materials
4) Fuel and Power
5) Labour
6) Sales, Administration
7) Depeciation
8) Shipping

These costs must be transformed into the eight economic sector bases used in Phase I, (see Appendix 7). It is noted that cost item 5; labour, will be evaluated under income effects and is not included in the transformation. As well, cost items 2, 6 and 7 are considered exogenous flows out of the study region and are not included. By calculating the amount of expenditure for each cost item into each sector base, the value of operational expenditures within the study region can be found. The calculations of expenditure in each sector base are carried out under assumptions based on trends found in Phase I and other references.

When the expenditure/unit of output in each sector base is multiplied by total output, total expenditure for the operational phase within the study region results.

1) Kraft Mill

Cost Item	Cost/Unit	Sector Base
Wood	114	30% hauling (sector 2), 70% (sector 1)
Chemicals	38	exogenous to study region
Operating Materials	47	7.2% (2), 66.4% (4), 2.7% (5), 11.7% (6), 10% (7), 1.9% (8)
Fuel and Power	30	100% (3)
Labour	47	considered under income effects
Sales and Administration	43	exogenous to study region
Depreciation	29	exogenous to study region
Shipping	89	1% by truck (2), rail transport has no impact.

Sector Base	Σ expenditure/unit	Total Expenditure
1	79.8	27,132,000
2	38.5	13,090,000
3	30.0	10,200,000
4	31.2	10,608,000
5	1.3	442,000
6	5.5	1,870,000
7	4.7	1,598,000
8	0.9	306,000
		65,280,000

2) CMP Mill

Cost Item	Cost/Unit	Sector Base
Wood	72	30% hauling (2), 70% (1)
Chemicals	33	exogenous to study region
Operating Materials	26	7.2% (2), 66.4% (4), 2.7% (6), 11.7% (6), 19% (7), 1.9% (8)
Fuel and Power	57	100% (3)
Labour	42	considered under income effects
Sales and Administration	26	exogenous to study region
Depreciation	24	exogenous to study region
Shipping	89	1% by truck (2), rail transport has no impact.

Sector Base	Σ expenditure/unit	Total Expenditure
1	49.7	5,914,300
2	24.0	2,856,000
3	57.0	6,783,000
4	17.2	2,046,800
5	0.7	83,300
6		368,900
7		309.400
8		71,400
		18,433,100

3) Fibreboard Mill

Cost Item	Cost/Unit	Sector Base
Wood	27	30% hauling (2), 70% (1)
Chemicals	50	exogenous to study region
Operating Materials	10	7.2% (2), 66.4% (4), 2.7% (5), 11.7% (6), 10% (7), 1.9% (8)
Fuel and yower	12	100% (3)
Labour	18	considered under income effects
Sales and Administration	8	exogenous to study region
Depreciation	22	exogenous to study region
Shipping	37	20% by truck (2), rail transport has no impact.

Sector Base	Σ expenditure/unit	Total Expenditure
1	18.9	3,780,000
2	16.2	3,240,000
3	12.0	2,400,000
4	6.6	1,320,000
5	0.3	60,000
6	1.2	240,000
7	1.0	200,000
8	0.2	40,000
		11,280,000

APPENDIX 9

CALCULATION OF VALUE ADDED

The approach used to calculate value added is taken from procedures used by other studies in Alberta such as Teskey and Smyth (1972).

Table 35 indicates the figures necessary to calculate value added. The following is a summary of their source.

1) Wood Imputs: cost/ton of wood fibre (Appendix 3) times annual output.
2) Salaries & Wages: from Table 30, p. 104. For mill workers only. Salaries to woodlands operators included in wood costs.
3) Fuel and Power: cost/ton (Appendix 3) times annual output.
4) Materials & Supplies: cost/ton of chemicals and operating materials (Appendix 3).
5) Miscellaneous: cost/ton of sales and administration (Appendix 3).
6) Residual: profit/ton depreciation/ton times annual output where: profit/ton = selling price - total operating costs (Appendix 3).
7) Net Sales: selling price - shipping costs (Appendix 3).

NOTE: figures in Table 35 rounded off for ease of comparison. Slight errors may be a result.

APPENDIX 10

PATTERNS OF SETTLEMENT IN PHASE III - OPERATIONAL PHASE

1) Percent of work force available from region:

1978 - 69% (Stevens, 1978), 1984 - 40% (estimated)

2) Housing preference: (for Phase I)

1978: in towns - 72.4% (Stevens, 1978)

on farms - 27.6% (Stevens, 1978)

1984: (estimated)

in towns - 70%

on farms - 30%

3) Marital Status:

1978: Married - 69% (Stevens, 1978)

Single - 31% (Stevens, 1978)

1984: (estimated)

Married - 60%

Single - 40%

4) Family size: 3.44 people/dwelling

∴ 1.4 children/dwelling (Sword, 1975)

A) <u>Kraft Mill</u>

Direct + Indirect Employment = 1507 (from Table 29)

a) 1507 x .60 = 904 (work force from outside region)

b) 904 x .70 = 633 (residing in town)

633 x .40 = 253 (single)

633 x .60 = 380 (married)

380 x 2.44 = 927 (wives + children for married workers)

927 x 253 = 1,180 (total residing in town)

c) 904 x .30 = 271 (residing out of town)

271 x .40 = 108 (single)

271 x .60 = 163 (married)

163 x 2.44 = 398 (wives + children)

398 + 108 = 506 (total residing out of town)

B) CMP Mill

Direct + Indirect Employment = 416 (from Table 29)

a) 416 x .60 = 250 (work force from outside region)

b) 250 x .70 = 175 (residing in town)

175 x .40 = 70 (single)

175 x .60 = 105 (married)

105 x 2.44 = 256 (wives + children)

256 + 70 = 326 (total residing in town)

c) 250 x .30 = 75 (residing out of town)

75 x .40 = 30 (single)

75 x .60 = 45 (married)

45 x 2.44 = 110 (wives + children)

110 + 30 = 140 (total residing out of town)

C) Fibreboard Mill

Direct + Indirect Employment = 292 (from Table 29)

a) 292 x .60 = 175 (work force from outside region)

b) 175 x .70 = 123 (residing in town)

123 x .40 = 49 (single)

123 x .60 = 74 (married)

74 x 2.44 = 180 (wives + children)

180 + 49 = 229 (total residing in town)

c) 175 x .30 = 52 (residing out of town)

52 x .40 = 21 (single)

52 x .60 = 31 (married)

31 x 2.44 = 76 (wives + children)

76 + 21 = 97 (total residing out of town)