

A COMMUNITY IMPACT STUDY OF
COAL DEVELOPMENT IN NORTHEAST
BRITISH COLUMBIA

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Ross Eric Taylor
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Department of Community and Regional Planning

The University of British Columbia
2075 Wesbrook Place
Vancouver, Canada
V6T 1W5

Date October 5, 1978

ABSTRACT

The northeast coal sector of the British Columbia economy may be the first comprehensively planned resource development in this province. If development proceeds, it will mark the first time government has taken the lead in planning townsites and community development, transportation, manpower and other key elements. The implications of coal development for existing communities within the region could be immense. The purpose of this thesis is to determine the likely effects of coal development and to anticipate the level of change that can be expected to take place in the communities of the region.

Because there is a wide range of development possibilities, the method chosen to estimate the effects utilizes scenarios ranging from minimal development to full development. For each scenario projections of selected variables are compared to the baseline situation - a projection of the same variables in the absence of coal development. Each scenario is described in terms of the geographic distribution of impacts and corresponding demand for services to be provided in each community. The capacity of the communities to accommodate the predicted magnitude of change is evaluated and the impact on the region as a whole is examined.

Coal development has the potential to benefit the impacted communities, the region, and the provincial and federal governments as well as private sector interests. However, this is contingent upon a competent planning process that can balance economic, social, environmental and political concerns.

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1.0 INTRODUCTION

The general subject area of this thesis is resource planning in British Columbia. As a specific example of resource planning, the exploitation of coal deposits in the northeastern part of the province is the object of attention. Being something of a unique case, the northeast coal sector is of particular interest for a number of reasons. It has been the object of an intensive federal-provincial planning effort. The prime focus of this effort has been on the potential benefits to the provincial and federal economies of developing a major coal exporting industry in the Northeast Region. No other sector of the provincial economy has received such intensive feasibility evaluation as has northeast coal. In addition to the broader economic benefits of balance of payment improvements and tax revenues, coal development is also seen as a lever for economic development of the Northeast Region. This region presently lags behind the province as a whole in many key aspects like average income, economic diversification and other socio-economic indicators.

1.1 Importance of Northeast Coal to British Columbia

The economy of British Columbia has traditionally been dependent on primary resources. Pulp and lumber account for 22.5% and 20.1% of the Province's exports respectively.¹ Of the ten leading export commodities only three, newsprint, cedar shingles and shakes, and plywood, are not primary goods.² Even these commodities are only minimally pro-

cessed. However, the primary sectors are not as dynamic in terms of growth potential as in the past. In the forestry sector value added and employment have been declining for a decade and the industry is undergoing a rationalization process to maintain profitability. To some extent the declining value of the Canadian dollar should lead to an increase in exports however, as the cost of Canadian forest products drops on the world market. Herring appears to be the only fishery that has not declined in terms of tonnage caught. Although the value of mineral production has increased in recent years on a dollar basis, there have been no new major mines developed or opened during this time.

Coal has tremendous growth potential. The reserves in the Northeast are sufficient to sustain optimistic export levels for many years. Coal has the potential of becoming the dynamic growth sector in the B.C. economy, and as such, is of interest from the point of view of an economic development strategy for the province as a whole.

The Northeast Coal exercise may be the first comprehensively planned resource development in B.C. Government is taking the lead in planning this sector. Government involvement is seen as necessary to ensure that development is consistent with overall provincial goals. Individual coal developers will not have this overall perspective in mind. The overall goal is to promote economic growth so long as environmental and social costs do not exceed the economic benefits to the province.

Regional disparities, per se, are of secondary importance in the planning of this project.

Given these objectives, the planning process for the Northeast Coal Sector would seem to be effective. Certainly no other sector has been as thoroughly evaluated. Traditionally, government's role has been one of responding to the initiatives of the private sector on an incremental or project by project basis. For the first time there is an overall strategy that includes other economic sectors such as forestry and tourism. Government is planning the key infrastructure components - transportation and settlement. The feasibility of all concerned sectors depends on road and rail infrastructure being in place.

In many respects Northeast Coal represents a unique opportunity. It has forced an evaluation of resource development policy in British Columbia. The stimulus was provided by the mining companies. They wanted commitments from the Provincial Government so that, when negotiating with the Japanese, they could make certain guarantees such as delivery price and schedules. To make any such guarantees the mining companies require policy commitments - particularly with respect to transportation and settlement infrastructure, royalties and, to a degree, manpower policies.

1.2 Objectives of the Thesis

Given the uncertainties of the market and the high costs of bringing the coal onto the market, it is impossible to accurately predict the

level and timing of coal development. Yet the implications of coal development for the Peace River - Liard Region could be immense. The current regional trends of economic stagnation and population decline may be reversed if development proceeds. The social and economic impact on individual communities, especially Chetwynd could be even more dramatic. Faced with these possibilities, it is clear that there is a recognized need for planning at both the local and regional level.

Systematic planning cannot be undertaken without realistic knowledge as to possible future events. Only with advance knowledge of the order of magnitude of population growth and subsequent infrastructure requirements can the communities adequately plan for the future. Furthermore, a certain amount of lead time is necessary - planning for essential services must be well in advance of major developments to avoid crises in such areas as the housing sector and to avoid undue strain on delivery of social services.

This paper will attempt to anticipate the likely effects of potential coal developments in the northeast of British Columbia. Specifically, the objectives are as follows:

- (a) To determine the level of change that can be realistically expected to take place, in terms of developments proposed for particular communities, coal developments adjacent to these communities and the development of a new community at Tumbler Ridge;

- (b) To determine the capacities of the various communities in the northeast region to accommodate a range of expected changes;
- (c) To determine the range of actions that will have to be taken by the Province and the various communities to accommodate this change.

1.3 Organization of the Thesis

The general approach adopted for this paper is the generation of scenarios which encompass the range of relevant development possibilities. It is felt that this approach is the simplest method available that deals with the uncertainties surrounding the probability of individual projects being developed.

The first step is to describe the individual projects. They are summarized in terms of location; magnitude of reserves; production schedules; development or construction schedules; employment scheduling; infrastructure requirements; location of the deposits; community to be impacted and so on.

In the second step the communities identified as potentially being affected are described with respect to population trends, employment structure, commercial structure and housing. A full community description is necessary as a base against which the predicted impacts of development can be compared.

A third section considers the methodology of economic impact assessment. Three methods of estimating or predicting economic impact are discussed and evaluated as to their usefulness for this study. Given the nature of the problem and the objectives of the thesis, the income/expenditure approach was chosen as the method of analysis.

Also examined is the population impact. A population model serves as the link between the economic analysis and the community impacts. Direct, indirect and induced employment are translated into a detailed population breakdown.

Another section is devoted to a summary of the impact of the coal developments on community services. In particular housing, physical services and social services are examined. Lastly, a summary and conclusions are presented including the impacts of development on the existing communities and steps that must be taken to accommodate change.

Before getting into the main body of the thesis, it is useful to review some of the background material to northeast coal. A knowledge of certain events is essential to an understanding of the implications of development. Hopefully this will give the reader a feel for the Northeast Coal sector and the process as it has unfolded so far. To this we turn our attention in the next section.

1.4 Notes to Section 1.0

1. Ministry of Economic Development, The Manual of Resources,
 p. 50.
2. Ibid.

2.0 BACKGROUND TO NORTHEAST COAL

Coal has been known to exist in the Peace River region since exploration by Alexander MacKenzie and others in the late eighteenth and early nineteenth centuries. Over the years a number of mines have operated off and on, mostly in the Chetwynd area. The last of these closed in 1964.

Interest in northeast coal was once again stimulated by the export of Crowsnest coal to the large Japanese market for coking (metallurgic) coal. The steel industry, most notably the Japanese steel industry, is expected to be the main source of export demand for British Columbian coal. Compared to the Crowsnest coal field, the Peace River seams are more complex for mining and are located in a more severe geographic environment. However, tests indicate that the measured reserves are of a higher quality for coking as compared to Crowsnest coal and compare very favourably with other sources of supply in United States and Australia, the main competitors for the Japanese market.¹ On this premise, several mining companies engaged in extensive exploration activity from 1969 until the present time.

A number of mining companies resumed major initiatives in exploration and marketing in the mid-1970's. Several took out options to develop properties including Quintette Coal Limited - a joint venture of Denison Mines, two Japanese steel companies and Imperial Oil Limited - and British Petroleum Canada Limited. These two development proposals would see 5 million and 3 million tonnes per year respectively extracted at full development.

Other key events in the mid-1970's included the commissioning of a report by the Ministry of Economic Development under the terms of a Subsidiary Agreement on Planning with the federal Department of Regional Economic Expansion. This report, entitled "The Northeast Report '75", studied the economic development potential of the Northeast Region. Among the findings was that there is a major opportunity for regional economic development and diversification of the economy through development of the coal fields. The report cautioned that detailed and careful planning would be required to maximize economic benefits while minimizing adverse social and environmental impacts.

At this time, there were no explicit regional resource development policies within which to respond to the initiatives of private mining companies concerning coal development. The mining companies would have preferred to have policy commitments from the government as a means of improving their negotiating position with the Japanese steel interests. They were primarily interested in the government's position with respect to townsite and transportation infrastructure, coal royalties and other taxes, and environmental policies such as reclamation, pollution control and other requirements. For their own part, the government position was not clear on the question of assuming direct equity in coal development or to continue on as in the past assuming a supportive role in marketing efforts, provision of infrastructure and so on.

Against this background, in January 1976, the Ministry of Economic Development submitted to Cabinet a policy paper proposing a detailed

evaluation of the potential viability of northeast coal developments. Following up on the submission, Cabinet established the Cabinet Committee on Coal Development to investigate coal policy and development issues. Five ministries are represented on the Cabinet Coal Committee: Economic Development; Mines and Petroleum Resources; Energy; Transport and Communications; Environment; and Forests. The respective ministers and deputy ministers sit on the committee with the exception of Forestry which is represented by the minister only. A technical committee comprised of the respective deputy ministers was set up to oversee a feasibility study, the Northeast Coal Study. Economic Development was assigned the responsibility of coordination of the study.

2.1 The Northeast Coal Study

The scope of the Northeast Coal Study was to "investigate the economic, social and environmental consequences of proceeding with various possible coal mining developments, and of providing the transportation links, town facilities and other supporting infrastructural services which these mines would require."² Five subcommittees were established to report to the Cabinet Coal Committee on various aspects of the proposed developments:

- (1) the Environment and Land Use Sub-Committee (ELUSC), which is responsible for the overall evaluation of environmental aspects of proposed developments;

- (2) the Transportation Sub-Committee (TptSC), which is responsible for the overview planning of transportation, communications and utilities networks;
- (3) the Townsite and Community Development Sub-Committee (TCDSC), which is responsible for assessing the need for new communities, and for prioritizing alternative locations for town development;
- (4) the Manpower Sub-Committee (MSC), which is responsible for developing labour supply policy recommendations; and
- (5) the Coal Resources Sub-Committee (CRSC), which is responsible for evaluating the coal resource.

Seven reports have been released by the Cabinet Committee. Some of the findings of these reports are summarized below. The reserves of the Peace River coal field are very extensive. The inferred inplace resources have been estimated at 7.7 billion tonnes. Of this approximately 300 million tonnes have been classified as inplace mineable reserves.³ The difference in classification between inferred resources and mineable reserves is a variable of degree of confidence of existence (geological knowledge), and degree of feasibility of production (economic knowledge). "Reserves" are those resources that have been accurately measured and determined to be mineable given current technology and economic conditions. The inplace reserves can sustain production for at least 25 years at rates of extraction currently being proposed. In many cases the mine-head costs of Northeast coal will be high due to higher northern develop-

ment costs, difficult mining resulting from highly fractured geological structures, and costs due to anticipated high labour force turnover rates.

From an economic and technical point of view the most efficient rail route and port combination for shipping coal for export is the CNR railine from Prince George to Prince Rupert with a coal terminal at Ridley Island.⁴ Construction of the rail routes could not be completed before 1980 without substantially increasing construction costs.

The development of a single new community would be required to serve the two major proposed operations, Sukunka/Bullmoose, and Babcock/Murray.⁵ The resulting population would be in the order of 10,500. Two townsite alternatives were given detailed consideration. Tumbler Ridge was chosen largely due to more favourable physical features and central location relative to the commuting distances to the various mine-sites.

Direct employment could peak as high as 3,500 in 1987. Labour shortages will not be likely for the open pit operation in terms of availability of people but labour supply and demand may be mismatched qualitatively, especially for skilled jobs and underground workers. Appropriate manpower training and development programs are essential to meet this problem.

The environmental impacts of coal development need not be excessive provided minesites and related infrastructure are designed to avoid or reduce the identified impacts.⁶

The medium to long term export potential for coking coal is not as optimistic as it seemed in the early 1970's. Japanese import requirements are not as great as once thought. Steel production is down worldwide with a subsequent reduction in coking coal requirements.

The above work programme indicated that the viability of the Northeast Coal developments was dependent on: favourable market conditions for coking coal (volume and price), a sufficient supply of underground miners, and the successful application of certain specialized mining techniques. Uncertainties in future market conditions and the costly infrastructure requirements seem to be the major barriers to development. Long term export contracts appear to be a prerequisite to full scale development in the Northeast. However, development at some of the properties on a smaller scale may be feasible.

An additional \$12.6 million was allocated for the period 1977 - 1978 to further the work of the Northeast Coal Study. A work program was developed to accomplish two objectives:⁷

- (1) To obtain a better comprehension and assessment of the critical factors of market conditions, underground labour supply and underground mining technology, identified as con-

straints to be overcome in developing the Northeast Coalfield;

- (2) To take the project to a stage of readiness in terms of final engineering and design studies for roads, rail, community development, and environmental management such that a major decision could be taken in the fall of 1978 as to whether a 1980 start-up could be met.

These studies were completed in March 1978. As of this time no decision to proceed has been made.

2.2 The Coal Guidelines Process

The Environment and Land Use Committee (ELUC) is a cabinet committee composed of nine ministries responsible for resource use and conservation and major public facilities such as highways. ELUC has adopted a document prepared by its secretariat entitled "Guidelines for Coal Development".⁸ This document describes a four stage impact assessment procedure required by the Provincial Government for the review of license and permit applications before coal mines can be developed. The process is coordinated by a Coal Guidelines Steering Committee, comprised of representatives of the Ministry of Mines and Petroleum Resources, Ministry of Economic Development and the ELUC Secretariat. The Coal Guidelines Steering Committee is a separate entity from the steering committee associated with the subcommittee structure of the Northeast Coal Study. The review process is one that goes from a general overview of the project

to specific impact assessments and management proposals with review at each stage by the Coal Guidelines Steering Committee and the appropriate line departments including the relevant subcommittees of the Northeast Coal Study.

The process begins with the submission of a Prospectus by the developer to the Ministry of Mines and Petroleum Resources. The Prospectus, which is reviewed by the Coal Steering Committee, is a general outline of the proposed exploration, minesite and offsite development programs. The Prospectus is circulated to line departments and their comments are returned to the Coal Guidelines Steering Committee.

The next step is the submission of a Stage I Report. This is a preliminary identification and assessment of the major economic, social and environmental impacts of the proposed development on the region and specific communities which will be affected. The Stage I Report will include an outline of the development's impacts related to exploration, mine development, reclamation, coal processing, power development, transportation, community development, and the regional economy. An assessment is made of existing data for the region in order that information gaps may be identified. After consultation with relevant Government agencies, study and/or monitoring programs are initiated to fill the identified information gaps. A systematic documentation of the major interactions between the proposed development and the environment - biophysical and socio-community - is included at this stage as is a prelim-

inary estimate of gross economic benefits. Lastly, alternatives for mitigating or avoiding adverse environmental and social impacts must be included.

The Stage I Report is submitted to the Coal Guidelines Steering Committee and circulated to various line departments for review. If the draft report conforms to the guidelines a formal commentary is submitted to the developer indicating the degree to which the identified alternatives are likely to meet required standards. At this point the developer is ready to move on to the Stage II studies.

The objective of the Stage II report is to develop a proposal that assesses and plans for economic, social and environmental concerns in such a way so as to maximize net social well being in the region and province. Generally, the Stage II Report parallels the Stage I Report except that more in-depth analysis is called for. The same review process as for the Stage I Report is applied to the Stage II Report. Acceptance of the Stage II Report represents approval in principle for the development.

Stage III is the process of application and granting of the various permits and licences as required by various statutes. Altogether, seventeen statutes are applicable including: Coal Act, Coal Mines Regulation Act, Controlled Access Highways Act, Corporation Capital Tax Act, Environment and Land Use Act, Forest Act, Income Tax Act, Land Act, Land Registry Act, Mineral Land Act, Mining Tax Act, Municipal Act, Parks Act, Pollution Control Act, Taxation Act, Water Act and Regulations, and the Wildlife Act.⁹

Generally submission of detailed plans and analyses are required for statutory approvals. Also during this stage monitoring programs for the construction and operation phases are to be designed. Successful projects are granted the necessary permit approvals and a production lease is granted by the Lieutenant-Governor in Council upon the recommendation of the Minister of Mines and Petroleum Resources.

The last stage of the process is the implementation of continuing monitoring programs. Key areas include air and water quality and surface reclamation. The most intensive monitoring is done in the development phase. In the operations phase the normal regulatory functions such as safety standards are implemented.

2.3 The Nature of Resource Planning

The decision to exploit natural resources is most often made by the private sector. The private sector is assumed to be motivated by profit concerns. Limitations on development of resource based industries in the northeast as opposed to alternative regions of the province are the result of estimations of profitability as perceived by private investors. This, in turn, is affected by the market for the resource or product and the costs associated with producing them.

The rationale for public sector involvement in resource sectors of the economy is both direct, in that resources are owned by the Crown,

and indirect, in the sense that the public sector has a broader mandate than the narrow, primarily economic one of individual developers. The structure of the B.C. economy is such that primary resources support all other sectors. Although the same could be said of most every economy, this relationship is particularly strong in B.C. because other sectors are, relatively speaking, underdeveloped. This is particularly true, by definition, of hinterland areas such as the northeast.

To the extent that the economy is resource based, it could be described as a negotiated economy.¹⁰ Prior to development of a resource, negotiations take place between private sector developers and the appropriate government agencies. Through this process government attempts to realize public goals and objectives. In exchange is offered development rights (leases, permits, etc.) and, where appropriate, concessions such as infrastructure investments or tax breaks.

Planning is undertaken by both public and private sectors. Private sector planning is characterized by decentralization and economic motivation. Although decentralized, decisions are not necessarily made locally. Multi-national firms most often reserve policy and other fundamental decisions for the head office, delegating only the routine decision-making to the location of the operation. Public sector planning is broader in scope and may include non-economic issues and objectives. Like private sector decisions, public policy decisions are often made in a different location from where they may be actually implemented (i.e. Victoria or Ottawa).

There is another dimension of planning that deserves mention. Planning may be sectoral and/or spatial in its scope. Sectoral planning usually refers to primary resource sectors such as fishing, forestry, coal and so on, but can include other economic sectors such as transportation, communications, power or recreation and tourism. In fact, sectoral planning may also encompass non-economic concerns such as manpower planning, education, parks and social services of all types. The spatial dimension of planning is concerned with distribution of people and services throughout the province. This may imply a development strategy favouring certain location or regions in the province or it may be concerned with allocation within a specific region or among certain social groups.

Resource planning tends to be sectoral although it may be integrated with spatial or regional concerns into an overall, comprehensive planning process. This is usually the case with development planning for an underdeveloped or declining region. Comprehensive approaches are less often exercised in developed or growth regions, the implicit reasoning being that growth in itself is an indicator of health hence structural intervention is unnecessary.

2.3.1 Planning in the Northeast

When the mining companies began approaching the government with proposals for large scale development of northeast coal and requests for

provision of townsite and transportation infrastructure there was uncertainty as to how to respond. The traditional role of the Provincial Government in B.C. with regard to resource development has been a supportive one. The government would provide or assist in the provision of infrastructure and would actively promote B.C. resources in foreign markets. It has not been the practice to assume an equity position in resource development. However, northeast coal represents a different situation in some key respects. This was not just another incremental decision. The entire region would be radically altered socially, economically, and environmentally. Therefore, a decision was made to carefully evaluate the implications of coal development before making any commitments. Would the benefits - balance of payments, tax revenue and employment - outweigh the costs - social and environmental disruption; and infrastructure investments?

Out of this process has evolved a coal policy for the northeast. Basically the position adopted is that coal development is approved in principle but with a wait and see attitude with respect to the market. The government does not wish to commit itself to full scale infrastructure development on the basis of future expectations of market conditions that may or may not materialize. In the meantime small scale developments will be encouraged and marketing efforts will be continued. Design and policy analysis for transportation and townsite infrastructure is being carried out under the terms of the second phase of the Subsidiary Agreement to Evaluate Northeast Coal Development and world markets will be

continually monitored so that decisions can be made quickly should circumstances warrant this in the future.

For the first time government is taking the lead in planning resource development in B.C. Instead of providing assistance in the development of offsite infrastructure, government is directly involved in designing and analysing townsite and transportation infrastructure. Manpower training and development programs will be organized. A policy of fixed royalties for thermal and metallurgic coal has been adopted. A planning process for large scale coal developments has been implemented to ensure that assessment of land use, environmental and socio-economic impacts is undertaken prior to the approval process.

While it is unquestionably an improvement from resource planning in the past, the northeast coal experience still has some major shortcomings. For example, it is questionable that local interests are effectively represented. The decisions are being made in Victoria and in the head offices of the mining companies. Typically, administrators and professionals in the region are the last to be informed of important decisions or findings since lines of communication are weak. Representation of all affected bodies should be sought to the maximum extent feasible. This is already the case with conventional resource management in the province. Here a committee structure is employed to resolve conflicts and coordinate all concerned interests. The Environment and Land Use Committee coordinates at the provincial level and the Regional Resource

Management Committees and Regional Districts at the regional level. However, the planning links between provincial planners and local interests are not well defined.

The northeast coal planning exercise is something of an experiment. It is the first resource sector and region that has been comprehensively researched and planned. However, the remainder of resource sectors are planned in an essentially ad hoc fashion and no agency has a clear mandate to formulate complete provincial and regional development strategies. Resource planning is isolated from industrial development planning. In the northeast coal exercise, these concerns were integrated into one overall frame of reference. This procedure should be extended so that a set of provincial and regional land use, resource and industrial goals and objectives is formulated. The institutional framework is already in place, although the mandates of the committees may have to be expanded to include these broader concerns.

2.4 Notes to Section 2.0

1. Resource Sub-Committee on Northeast Coal Development, Coal Resource Evaluation.
2. Environment and Land Use Sub-Committee, Preliminary Environmental Report on Proposed Transportation Links and Townsite, p. 1.
3. Resource Sub-Committee on Northeast Coal Development, op. cit., p. 2.

4. Transportation Sub-Committee on Northeast Coal Development, Northeast Coal Study: Preliminary Report on Transportation Developments.
5. Townsite and Community Development Sub-Committee, Preliminary Feasibility Report on Townsite/Community Development, Victoria: Ministry of Municipal Affairs and Housing.
6. Environment and Land Use Sub-Committee, op. cit.
7. Ministry of Economic Development, Northeast Coal Development Information Summary, p. 16.
8. Environment and Land Use Committee Secretariat, Guidelines for Coal Development.
9. Ibid.
10. H.V. Nelles, The Politics of Development.

3.0 PROPOSED COAL MINING PROJECTS

This section outlines proposed coal mining projects in the Northeast. Location, level of reserves, production and development schedules are considered. Employment and income effects are described and impacted communities are identified:

3.1 Sukunka/Bullmoose (B.P. Canada)

British Petroleum Canada, through B.P. Canada Holdings, has acquired 100% control of the Bullmoose property. This property was formerly held by Brameda Resources. Additionally, they hold 87.5% of the adjoining Sukunka Property with Brascan Resources holding the remaining 12.5%. Foreign Investment Review Act (F.I.R.A.) approval of these transactions was granted in June 1977. Sukunka is located about 60 kilometers south of Chetwynd and Bullmoose about 100 kilometers south. Access to the two properties is via two different roads as there is no direct road connection between the two properties.

Although there are several coal seams on these properties, only two, the Skeeter and Chamberlain seams, are considered to be economically viable at the present time.¹ Recoverable reserves are conservatively estimated at 88 million tonnes of high quality coking coal, enough to support an annual rate of production of 3 million tonnes of saleable coal for at least 20 years.²

B.P. is planning to phase development of the properties in two stages. Feasibility of the second stage is contingent upon the completion of a certain infrastructure component which could include a new townsite closer to the property, a new rail line, a new port at Prince Rupert and a Provincial Highway. Stage 2, which involves an increase in yearly production from 0.8 million tonnes (the maximum production of stage I) to a maximum of 3 million tonnes, will only be undertaken if the required infrastructure is in place.

It should not be inferred from the above that there are no infrastructure costs involved in stage I. Infrastructure related to the needs of mine employees such as housing, water and sewer and roads etc. as well as upgrading of the road up the Sukunka Valley are necessary during this stage. The critical constraining factors are the rail and port facilities which have tonnage limits and yet are essential if there is to be access to export markets.

It is proposed that in the initial phase coal will be produced from both the Sukunka and Bullmoose properties. Two mines will be developed in the Saddle Creek area (Bullmoose). The workings of the Window Mine (Sukunka) will be extended towards the Saddle Creek mines so that a connection between these mines will eventually be made in 1981 or soon after.³ The coal that is produced prior to completion of the connection will be trucked to Chetwynd for washing via roads up the Sukunka and Bullmoose Valleys. After the connection is made between the Window mine and a Saddle Creek mine then the entire production (.5 million tonnes)

will be trucked via the Window mine up the Sukunka Valley as the distance to Chetwynd is shorter and transportation cost may be minimized. Production in the first stage will increase from an initial 40,000 tonnes in 1978 to 500,000 tonnes in 1980. Production will remain at 500,000 tonnes until Stage 2 begins.

Coal produced in Stage I is to be processed at a temporary wash plant in Chetwynd. The capacity of this facility will be approximately 150 tonnes per hour.⁴ The washery is to be modular and can be transported by truck and assembled on site. The washery is expected to be in use for about five years after which it could be dismantled and moved elsewhere. Through use of the temporary washery it will be possible to gather test data on the washing characteristics of the coal as well as to train mine workers. This information is necessary in order to design a more efficient permanent plant and to develop customer confidence, helpful in securing an early market.

Stage 2 involves an increase in production over four years from .8 million tonnes to 2 million tonnes and possibly 3 million tonnes. By the time full production is reached all production will be brought out of the Saddle Creek mines. By this time a permanent washing facility will be operational. The washery likely will be located at the confluence of Bullmoose and Saddle Creeks, the Bullmoose townsite.

TABLE 3.1

B.P. DEVELOPMENT SCHEDULE

YEAR	OUTPUT (TONNES)	OPERATING WORKFORCE	CONSTRUCTION WORKFORCE
1977			
1978	40,000	50	100
1979	350,000	160	250
1980	500,000	240	230
1981	500,000	240	230
1982	800,000	400	300
1983	1,100,000	500	300
1984	2,000,000	740	200
1985	3,000,000	920	100
1986	3,000,000	1,100	
1987	3,000,000	1,100	

Source B.P. Exploration Ltd., 1977 and Ministry of Economic Development, memo dated November 1, 1977

3.2 Babcock/Murray (Quintette Coal)

The Quintette coal licenses were acquired by Denison Mines Limited in 1969 and 1970. Exploration began shortly after. A feasibility study completed in 1976 examined the possibility of producing 5 million tonnes of coking coal annually.⁵ Based on the favourable results of the study, the Japanese steel industry expressed interest in negotiating a long term purchase agreement with Quintette Coal provided the coal could be exported at competitive prices. A proposed sales agreement called for the delivery of 92,500,000 metric tonnes of metallurgical bituminous coking coal produced by Quintette, delivered over a period of 20 years, commencing April 1, 1980.⁶ Denison Mines is the major shareholder in Quintette Coal Limited with 38.25% of the total equity. The remainder of equity is distributed among Mitsui Mining, 22.5%, Tokyo Boeki, 22.5% and Imperiod Oil, 6.75%.⁷

The coal properties are located about 95 kilometers south of Chetwynd and 105 kilometers south west of Dawson Creek. Indicated in-place reserves are estimated to be 1 billion tonnes and potential in-place reserves are estimated to be greater than 2.8 billion tonnes.⁸ Development will be at two separate sites, Babcock and Murray (also referred to as Wolverine). The Murray is proposed to be developed first. There are to be two open pits on the Murray site, the Sheriff pit, originally scheduled for a 1978 start-up, and the Frame pit, scheduled for 1984. At the Babcock area there are to be two open pits as well, the

Windy pit, scheduled for 1980, and the Roman pit scheduled for 1984, in addition to one underground mine. Quintette plans to operate a coal preparation plant (washery) at each of the sites. The first treatment facility will be adjacent to the Sheriff and Frame pits. Construction is scheduled to begin in 1977 and by 1980 it is expected to be operating at full capacity of 2 million tonnes per year. The second wash plant, on the Babcock site, is expected to reach its full capacity of 3 million tonnes per year in 1983. Coal will be transported from the preparation plants to Prince Rupert in unit trains with a capacity of 10,000 tons. It is anticipated that six unit train sets will be required.⁹

There are considerable infrastructure requirements that must be met if the Quintette project is to go ahead. These requirements include a townsite, access roads to the townsite and minesites, railway trackage and upgrading of existing track, and power lines to the mines and the townsite.

Pre-production development was expected to begin in 1977 to meet a start-up date of 1978. However, these dates must be revised in light of more up-to-date information. The following development schedule is currently the best available estimate.

TABLE 3.2

QUINTETTE DEVELOPMENT SCHEDULE

YEAR	PRODUCTION PER YEAR (MILLIONS OF TONNES)	CONSTRUCTION WORKFORCE	OPERATING WORKFORCE
1979		475	
1980	0.25	750	83
1981	3.0	600	990
1982	3.65	495	1534
1983	5.0	495	1650
1984	5.0	130	1650
1985	5.0	130	1650
1986	5.0		1650
1987	5.0		1750

Source Ministry of Economic Development, Interdepartmental memo, dated November 1, 1977.

Note: Construction figures include a townsite labour force.

3.3 Carbon Creek (Utah Mines)

Development rights to Carbon Creek are owned by Utah Mines Limited. Carbon Creek is located 30 kilometers west of W.A.C. Bennett Dam or 50 kilometers west of Hudson's Hope. Chetwynd is about 75 kilometers southeast. Hudson's Hope would be the preferred location for company employees. Recoverable reserves are fairly extensive at 75 million

tonnes of which 39 million are recoverable by surface techniques and 35 million by underground methods.¹⁰

In the Utah Stage 1 Report it is indicated that construction is planned for the period 1977 - 1980, pre-production from 1978 to 1981, and production from 1980 - 2004 with full production of 2.3 metric tonnes of clean coal per year being reached in 1982. In the table below the schedule has been moved ahead one year. There will be two open pits, one underground mine and one contour mine. Infrastructure requirements include: a construction camp in the vicinity of the mine industrial complex, a mine access route from the Bennett Dam, a wash plant, mine shops, warehousing, offices and housing for workers. The coal would be transported to rapid loading facilities at Windy Station where it would be shipped via unit trains to Prince Rupert.

TABLE 3.3

<u>UTAH DEVELOPMENT SCHEDULE</u>			
<u>YEAR</u>	<u>PRODUCTION PER YEAR (MILLIONS OF TONNES)</u>	<u>CONSTRUCTION WORKFORCE</u>	<u>OPERATING WORKFORCE</u>
1978		108	
1979		588	
1980	0.35	636	200
1981	0.80	350	385
1982	1.90	194	729
1983	2.30		862

Source Urat Stage 1 Report

3.4 Cinnabar (Cinnabar Peaks)

This property is located around 25 kilometers south of Hudson's Hope and approximately 40 kilometers northwest of Chetwynd. The mining rights are owned by a small firm from Fort St. John called Cinnabar Peak Mines Limited. The low magnitude of reserves weakens economic justification of development. However, there are advantages to the Cinnabar holdings - the proximity of Hudson's Hope and Chetwynd; the infrastructure already in place and the readily available access routes.

If development occurs, start-up could be as early as 1984 with full production of 0.5 million tonnes per year by 1985 (see development schedule below). This would involve an operating work force of approximately 180 at full production. The construction labour estimated below are based on comparable projects and not from direct communication with Cinnabar Peak Mines. The workforce would likely be drawn equally from Chetwynd and Hudson's Hope.

TABLE 3.4

<u>CINNABAR DEVELOPMENT SCHEDULE</u>			
YEAR	PRODUCTION PER YEAR (MILLIONS OF TONNES)	CONSTRUCTION WORKFORCE	OPERATING WORKFORCE
1983		150	
1984	0.35	100	120
1985	0.5		180
1986	0.5		180
1987	0.5		180

Source Ministry of Economic Development, Interdepartmental memo dated November 1, 1977.

3.5 Teck (Brameda)

The last potential development to be considered is the Gates Seam on the Sukunka property. The mining rights to this seam have been retained by Teck Corporation Limited. The mine would be a small scale endeavor involving the extraction of 1 to 1.5 million tonnes per year for perhaps 10 years. However, it is a surface operation and could therefore go ahead at relatively short notice. The timing of the development schedule below was chosen arbitrarily because of this uncertainty. Construction and operating manpower build-up was estimated on the basis of company data from similar projects in the northeast rather than on direct communication with Teck.

TABLE 3.5

<u>TECK DEVELOPMENT SCHEDULE</u>			
<u>YEAR</u>	<u>PRODUCTION PER YEAR (MILLIONS OF TONS)</u>	<u>CONSTRUCTION WORKFORCE</u>	<u>OPERATING WORKFORCE</u>
1982		150	
1983	0.35	100	120
1984	0.50		180
1985	0.50		180

3.6 Other Developments

In addition to coal development two other projects may have an impact on the study area in the future. It is felt that these potential

developments should be included in the analysis because they will add to regional and community impact. To a certain extent, they will compete with the coal projects for available labour and will add to the increased demand for services. These projects are briefly outlined below.

3.6.1 Westcoast Transmission Gas Scrubbing Plant

Westcoast Transmission is building a pipeline and will be building a gas scrubbing plant near Chetwynd. To construct the plant and a pipeline an average workforce of around 500 will be employed over a period the two years 1978 and 1979. The operating work force would be approximately 50. The community to be impacted is Chetwynd. In fact W.C.T. has already purchased a number of lots in Chetwynd for their employees.

3.6.2 Forest Products

There are a number of development possibilities in the forestry sector of the Northeast. Options include expansion of existing saw mills and the construction and operation of a new mill. Two sawmills in Chetwynd, Canfor and Chetwynd Forest Industries, were identified as having potential for expansion in the N.E. Report.¹¹ This would result in the addition of up to 85 direct jobs. In the same report the possibility of a new mill producing 90 MM fbm at Tumbler Ridge is brought out. Direct employment was estimated at 240.¹²

3.7 Summary of Development Possibilities

The following table summarizes the developments discussed above. In a later section the projects are combined into five development profiles for the region. As can be seen from the table the total potential for the region is very significant, over 4,400 direct jobs could be created by 1992. Timing of the projects could prove to be a problem especially with regard to labour force attraction.

TABLE 3.6

<u>SUMMARY OF PROJECTS</u>				
COMPANY	PRODUCTION	OPERATING EMPLOYMENT	AFFECTED COMMUNITY	START-UP DATE
A COAL				
B.P.	3.0 M tonnes/yr	1,100	Chetwynd/ Tumbler Ridge	1978
Quintette	5.0 M tonnes/yr	1,750	Tumbler Ridge	1979 or 1984
Utah	2.3 M tonnes/yr	862	Hudson's Hope	1978 or 1983
Cinnabar	0.5 M tonnes/yr	180	Hudson's Hope/ Chetwynd	1983
Teck	0.4 M tonnes/yr	80	Chetwynd	1982
B OTHER DEVELOPMENTS				
Sawmill	90 mm fbm	240	Tumbler Ridge	1982
W.C.T.	--	50	Chetwynd	1979
Sawmill Expansion		130	Chetwynd	1978-79

3.8 Notes to Section 3.0

1. B.P. Exploration Canada Ltd., Prospectus for Sukunka/Bullmoose Property, p. 1.
2. Ibid.
3. Ibid., p. 23.
4. Ibid., p. 28.
5. Quintette Coal Ltd., A Study of the Socio-Economic Impact of the Proposed Mine Development.
6. Quintette Coal Ltd., Quintette Project Information Survey, p. I.
7. Ibid., p. ii-2.
8. Ibid., p. i-1.
9. Ibid., p. ii-7.
10. Utah Mines Ltd., Carbon Creek Coal Development, Stage I Preliminary Impact Assessment, Volume I.
11. Ministry of Economic Development, A Summary Report on Development Possibilities in the Northeastern Region of British Columbia, p. 30.
12. Ibid.

4.0 DESCRIPTION OF THE REGION

In order to determine the impact of a project or number of projects on communities there must be a base for comparison. In the absence of knowledge as to what circumstances would be without development of the project(s) in question it is not possible to estimate the impact due to the project(s). This section outlines some of the major features and trends of the Northeast region and the three existing communities most likely to be affected by coal development: Chetwynd, Hudson's Hope and Dawson Creek.

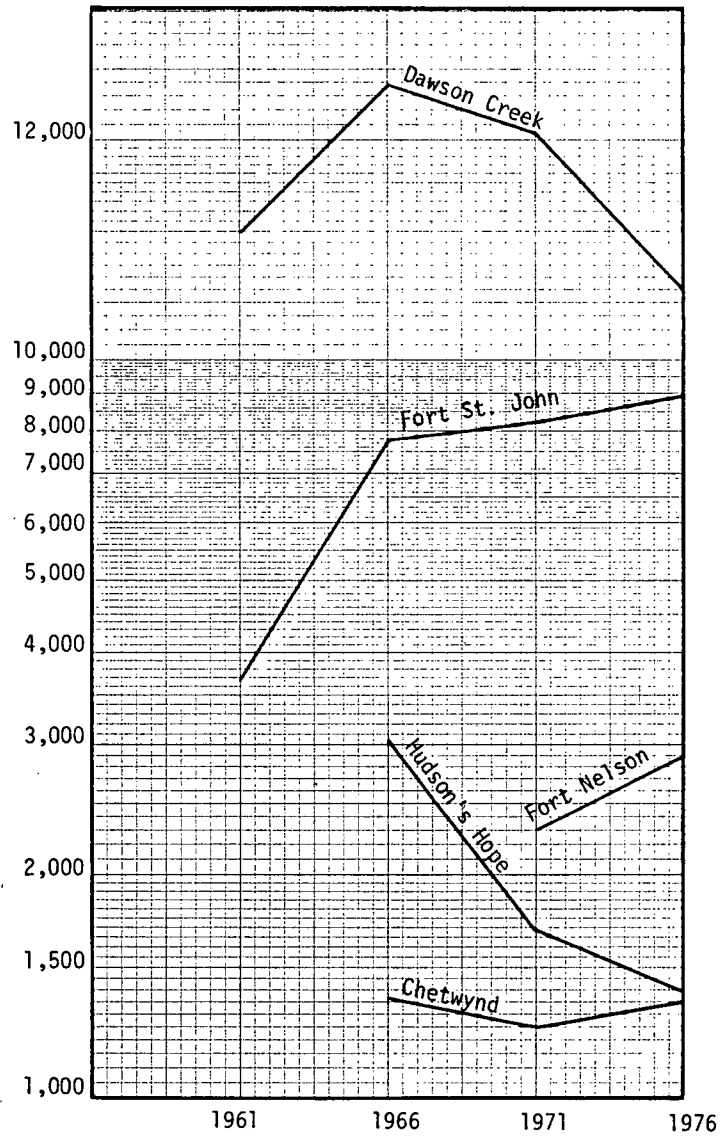
4.1 The Northeast Region

Although the Northeast Region comprises nearly 25% of the province's land area, only 2% of the total B.C. population lives there. In 1971 this amounted to 43,996.¹ Population growth has been irregular in the past as is typical of resource based economies. Between 1966 and 1971 population increased by 6.2% compared to a 16.6% growth rate for the province during the same period.² During the previous five year period, 1961 to 1966, the rate of increase was 32%.³

There are three main sub-regions in the Northeast. These are centred on Dawson Creek, Fort St. John and Fort Nelson. These three communities comprise about 50% of the region's population. Of the remaining population about 80% is rural and the rest is distributed among a number of secondary settlements including Chetwynd, Hudson's Hope, Pouce Coupe and Taylor.

FIGURE 4.0

POPULATION TRENDS MAJOR COMMUNITIES
PEACE RIVER - LIARD REGIONAL DISTRICT, 1961 - 1976



The economy of the Northeast region is principally based on forestry, agriculture and to some extent petroleum products. Forestry and coal have the greatest potential for development. Other sectors such as agriculture and tourism do not have much potential for expansion, especially in terms of employment creation.

The population of the Northeast region is relatively young and is male biased, particularly in the age 35 - 64 cohort. This reflects the male orientation of the employment structure and the selective migration that tends to occur because of this.

4.2 Chetwynd

The population of Chetwynd was estimated at 1,462 in 1976.⁴ The growth rate has averaged 4.3% per year since 1961 although there is considerable fluctuation from year to year reflecting economic developments in surrounding areas. Population is divided very evenly among male and female with 50% of the population and 69% of the labour force being male. The population of Chetwynd is fairly young with 40% being under the age of 15 and only 2% being 65 or older.⁵

The economic base of Chetwynd and the surrounding area is primarily based on the forest industry and to a lesser extent on coal mining and agriculture. These two sectors also have the most potential for economic development. Potential employment from a new sawmill or expansion

TABLE 4.0
EXPERIENCED LABOUR FORCE BY INDUSTRY
PEACE RIVER LIARD REGIONAL DISTRICT

Town	Agric.		Forestry		Fishing & Trapping		Mines		Manuf.		Construction		Transp'n.		Trade		Finance & Ins. & Real Est.		Community and Business Services		Public Admin. & Defense		Unspec'd	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Peace River Area:																								
Dawson Creek	105	5	75	5	10	-	45	5	265	55	445	15	520	200	680	270	85	90	430	820	150	55	225	175
Peace Coupe	15	-	5	-	-	-	5	-	10	-	5	-	40	10	20	-	-	10	30	40	5	-	15	10
Rural Area	390	5	85	-	-	-	80	-	210	5	175	10	175	65	-	65	80	-	40	160	240	5	195	105
Ft. St. John	60	5	35	5	5	-	275	20	170	20	365	25	410	65	415	200	80	55	310	540	100	35	160	125
Rural Area	105	35	20	-	-	-	115	-	80	5	120	10	220	30	145	55	15	20	90	185	55	-	65	45
Taylor	-	-	5	-	-	-	30	5	10	5	20	-	20	5	10	10	-	5	20	45	-	-	10	-
Rural Area	165	70	5	-	-	-	55	5	25	-	30	-	50	5	20	25	-	-	25	35	5	-	70	10
Chetwynd	-	-	20	5	-	-	5	-	90	-	30	-	55	15	20	20	5	5	35	70	5	5	15	5
Rural Area	15	10	65	-	-	-	-	-	95	-	55	-	50	-	25	15	-	20	50	40	-	-	45	10
Norberley IR	-	-	10	-	-	-	-	-	5	-	-	-	5	-	-	-	-	-	5	-	-	-	5	-
Hudson Hope	-	-	10	-	-	-	-	-	5	-	125	-	70	15	15	15	-	5	50	65	5	5	15	10
Rural Area	60	15	15	-	-	-	10	-	20	-	95	-	60	5	15	10	5	-	15	25	-	-	15	5
Sub-Total	915	145	350	15	15	-	620	35	905	90	1465	60	1675	415	1365	605	270	220	1100	2025	565	110	835	500

Source: Statistics Canada 1971 Census Tapes.

TABLE 4.1

CHETWYND DEMOGRAPHICS

DEMOGRAPHICS								
	1966	%	1971	%	1976	%	Estimated 1981	%
Population:								
Regional District	41,441	6	43,996	-	43,841			
Municipality	1,368		1,260		1,462			
Households:								
Regional District			11,050					
Municipality			291					
Household size:								
Regional District			3.8					
Municipality	4.2		4.1					

source: Ministry of Municipal Affairs and Housing Community Profile.

of an existing one could amount to 285 new jobs during the period 1978-82.⁶ Coal mining could create even more employment. The proposed gas scrubbing plant would provide an additional 50 jobs.

TABLE 4.2

EXISTING HOUSING STOCK CHETWYND, 1977 ¹

	Units	%
1. Single detached	261	61
2. Apartments	52	11
3. Mobile homes	64	12
4. Medium density residential	<u>54</u>	<u>15</u>
5. Total	431	100%

Source 1. Village of Chetwynd Survey and Analysis
 2. The Sukunka/Bullmoose Stage 1 Environmental Study Volume 1
 Text B.P. Exploration Canada Ltd. Nov. 1977 indicates further that 100 units were underway or in final planning stages (35 apartments, 15 houses and 50 trailer pads).

The existing housing stock consists of 431 units with an average household size of 4.1.⁷ The stock can be broken down as follows: 261 single detached, 54 medium density units, 52 multiple units and 64 mobile units (Ministry of Municipal Affairs and Housing, Community Profiles). Land availability for housing is adequate. There are 80 serviced lots and 350 potential lots available for development.⁸

The commercial sector of Chetwynd is not very well developed. Chetwynd does not have a significant retail trade area as it cannot compete with Dawson Creek in this respect. Dawson Creek has long been the regional service centre in this area.

TABLE 4.3

CHETWYND COMMERCIAL STRUCTURE

COMMERCIAL TYPE	GROSS TOTAL FLOORSPACE		SQ. METRES/CAPITA (SQ. FT/CAPITA)		
	Sq. Meters	(Sq. Ft.)	Chetwynd (1500)	Trading Area* (3300 or 5050)	
Hotels/Motels	2,650	(29,400)	1.8 (19.6)	0.5	(5.8)
Retail/Storage	7,350	(81,700)	4.9 (54.5)	2.2	(24,8)
Office	2,640	(29,300)	1.8 (19.5)	0.5	(5.8)
Misc	970	(10,800)	0.6 (7.2)	0.2	(2.1)
TOTAL	13,610	(151,200)	9.1 (100.8)	3.4	(38.5)

*Primary trading area for retail/storage - 3,300 people
 Secondary trading area for all other commercial - 5,050 people

Source Village of Chetwynd (Survey and Analyses)

Stanley Associates Engineering Ltd.

4.3 Hudson's Hope

Hudson's Hope's 1976 population was 1,319.⁹ This is a substantial decline from the 1966 level of 3,068. This decline was caused by the fall-off in employment following completion of the W.A.C. Bennett Dam. Despite the heavy out-migration following completion of the dam, the age structure of the community has remained young, 38% of the population is in the 0 - 15 age cohort and 33% is in the 15-34 cohort.¹⁰ This is about average for the Northeast region. Approximately 53% of the population and 76% of the labour force is male.¹¹

The economic basis of Hudson's Hope is operation of the power generation facilities at the Bennett Dam. Hudson's Hope is also a service centre for the construction crew at the Site One Dam. Potential for future development comes mainly from possible coal developments. The operating phase of the Site One Dam is expected to generate 15 to 20 permanent jobs.

The housing stock in 1971 consisted of 210 single, 10 double, 30 multiple and 185 mobile units for a total of 435.¹² Average household size is 3.7,¹³ slightly below the regional average. Although there is no municipally-owned land available for housing, B.C. Hydro owns many vacant lots.

Like Chetwynd, Hudson's Hope does not service a large contiguous area. Therefore, the commercial sector of the local economy is not well

TABLE 4.4
HUDSON'S HOPE DEMOGRAPHICS

	1966	%	1971	%	1976	%	Estimated 1981	%
Population:								
Regional District	41,441	6	43,996	-	43,841			
Municipality	3,068		1,741		1,319			
Households:								
Regional District			11,050					
Municipality			435					
Household size:								
Regional District			3.8					
Municipality								

Comments - Employment associated with the operation of the Site One Reservoir is expected to bring approximately 20 families into Hudson's Hope. An additional 50 people may settle in the general area.

Source Municipal Affairs and Housing 1977, Community Profiles

4.4 Dawson Creek

Dawson Creek has been experiencing a population decline during the last two census periods. The population is down from a high of 12,392 in 1966 to 11,885 in 1971 and 10,406 in 1976.¹⁴ Despite this Dawson Creek is still the largest settlement in the Northeast region and comprises 24% of the region's total population. The male:female ratio is 51/49 and the age structure is fairly young, although not as young as some of the other communities such as Hudson's Hope. Approximately 35% of the population is in the 0-14 age group, 33% is in the 15-34 cohort, 28% is in the 35-64 age group and the remaining 4% are over 65.¹⁵

The economic basis of Dawson Creek is its role as a regional supply and service centre for the Peace River area, particularly for the agricultural sector. The main economic development potential is related to this role as a regional supply and service centre. The expanded regional population and the servicing requirements of coal mines would create employment in those sectors of the Dawson Creek economy.

There were a total of 3,090 housing units in 1971 including 2,480 single, 185 double, 430 multiple and 70 mobile.¹⁶ There is a shortage of rental accommodation despite the decline in population however. Land availability for housing is not a problem as the City owns considerable land.

Because of its role as a service centre Dawson Creek has a relatively well developed commercial/retail sector. The retail structure of Dawson Creek is summarized in the following table.

TABLE 4.5

<u>DAWSON CREEK DEMOGRAPHICS</u>							
	1966	%	1971	%	1976	%	Estimated 1981
Population							
Regional District	41,441	6	43,996	-	43,841		
Municipality	12,474		11,885		10,406		*
Households:							
Regional District			11,050				
Municipality			3,162				
Household size:							
Regional District			3.8				
Municipality	3.9		3.6				

Comments - *Dawson Creek: Continuing decline in population anticipated unless Northeast Coal developments are implemented. Impact of coal developments on population at Dawson Creek cannot be estimated until details on their scale and timing are clarified.

Source Municipal Affairs and Housing 1977, Community Profiles

TABLE 4.6

DAWSON CREEK COMMERCIAL STRUCTURE

<u>RETAIL STORE TYPE</u>	<u>NO. OF STORES</u>	<u>SQUARE FEET</u>
Food and Beverage	15	68,439
General Merchandise	9	114,684
Automotive	38	107,775
Apparel and Accessories	9	20,441
Hardware & Home Furnishings	14	38,854
Other Retail	25	48,263
Total	110	398,456

Source Dawson Creek Economic Study
Johnston Associates 1975

4.5 Notes to Section 4.0

1. Statistics Canada, 1971 Census.
2. Ibid.
3. Ibid.
4. Ministry of Municipal Affairs and Housing, Community Profiles.
5. Environment and Land Use Committee Secretariat, B.C. Towns Study.
6. Ministry of Economic Development, A Summary Report on Development Possibilities in the Northeastern Region of British Columbia, p. 30.

7. Environment and Land Use Committee Secretariat, op. cit.
8. Ministry of Municipal Affairs and Housing, op. cit.
9. Ibid.
10. Statistics Canada, op. cit.
11. Environment and Land Use Committee Secretariat, op. cit.
12. Statistics Canada, op. cit.
13. Environment and Land Use Committee Secretariat, op. cit.
14. Ministry of Municipal Affairs and Housing, op. cit.
15. Statistics Canada, op. cit.
16. Ministry of Municipal Affairs and Housing, op. cit.

5.0 METHODOLOGY

5.1 Economic Impact Methodology

Early in the process of developing a conceptual framework for the analysis of the economic impact of large projects such as the North-east coal development, it becomes apparent there is no single established method to undertake such an analysis. It is felt that no study has been undertaken which systematically and thoroughly categorizes and compares methods of economic impact analysis. However, there have been articles written critiquing various individual approaches.¹

The state of development is not surprising when you consider it has only been recently that impact studies have become an implicit or explicit requirement for project approval. Statutory requirements to study economic, (or other) impacts before approval is granted by the appropriate government agency are not always in place. However, it has become a requirement in fact, if not legally, as most departments make an impact study a necessary prerequisite for project approval or include some sort of impact requirements in the terms of reference of contracts let out to private consultants. For example, the Province's "Guidelines for Coal Development" establishes a procedure for assessment of the biophysical and social-economic impacts of coal developments. Coal companies must follow this procedure, among other requirements, before approval is granted by the Ministry of Mines and Petroleum Resources for development. Unfortunately, no specific methodology is mentioned in the Guidelines although they do identify components of an impact study.

The main body of the economic impact literature has been developed by private consultants under contract to government agencies or the private sector. In some cases they may be under contract to a private company which is required to submit an impact statement. Most of these studies are designed for a specific project. Through examination of a number of privately done studies, certain conclusions can be drawn. Virtually all economic impact studies are based, at least loosely, on the economic base theory. The single most important reason for this is its simplicity, both conceptually and in terms of data demands. Conceptually, models can be classified into three categories: descriptive, predictive and normative. Descriptive models simply represent an existing situation. Often they are used to gain an understanding of a complex system through analysis of the component parts. Descriptive models may also be employed for the purpose of developing predictive models. Predictive models, also called causal or forecasting models, simulate future rather than current situations. Cause and effect relationships are demonstrated and projected over time. Impact analysis is an example of conditional prediction, the consequences of a specified external impact are predicted given an otherwise undisturbed environment. Lastly, normative, or planning, models are extensions of predictive models. They are designed to predict what range of performance is acceptable in relation to defined goals and objectives. While most analysts would probably agree a predictive model would be preferable to a simple descriptive model, such as the economic base model, in practice most impact analyses are based on this descriptive model. This fact is due to its simplicity, its low cost and the quality

of data generally available. It is futile to design a model beyond the capacity of available data. Although the economic base model may be conceptually weak compared to other methods of impact analysis, it is relatively cost effective.

There are at least three accepted techniques or tools for undertaking economic impact analysis. These are: export base, input-output, and income-expenditure analysis. The following sections will discuss each of these theories as they may be applied to impact analysis. Following this will be an outline of the method of analysis proposed for the study.

5.1.1 Economic Base Theory

Economic base theory is a demand model. That is, it assumes that supply of inputs is unlimited and that the key to a region's growth is change in the level of final demand. The central idea is that certain activities in a region lead and determine overall economic development. These are called basic activities. Other nonbasic activities are consequences of the region's overall economic development. Basic activities are those that produce goods or services for export outside the region. Basic activities bring income from the outside world. The reasoning is, in a sense, that a region earns its wealth from the sale of basic or export commodities to the outside world. All other econo-

mic activities exist as a result of the level of income and demand achieved within the region and therefore depend on basic activities. More correctly they depend upon the demand generated by consumers earning their income through employment in basic industries.

An economic impact study based on the above model generally proceeds in three steps: (1) identification of export or basic activities, (2) empirical determination of the relationship between basic and non-basic activities in the region (usually expressed in terms of an employment multiplier), (3) prediction of level of change in the basic sector (often this is known), and subsequent calculation of impact on the non-basic sector, assuming the relationships identified in (2) remain constant.

Operationally, the initial problem with the above method of analysis is distinguishing between basic and non-basic employment. There are at least four ways of drawing this distinction. The first, and crudest, is to simply assign industries or sectors as a block to either the basic or non-basic sector. For example, manufacturing, mining and forestry etc. would be assigned to the basic sector while commercial, local government, personal services and other similar activities would be assigned to the non-basic category. The obvious flaw in the above procedure is that almost all firms or establishments in a region will produce partly for export and partly for local consumption.

A second, and more sophisticated, approach in sorting out what is basic and non-basic is through location quotients. A location quotient compares regional employment in a specific activity or category with the national average. The implication being that surplus employment produces for export outside the region. A location quotient may also be constructed by comparing percentage of national output (of an activity) to personal income as a percent of the national total. Use of location quotients tends to underestimate a region's exports however, since it is a measure of net exports, not gross exports.

A third method of categorizing economic activity is actually measuring shipments of goods and services out of the region. Detailed information may be next to impossible to obtain however. In this event a sample of firms in each category is often surveyed to keep the project manageable.

Lastly a fourth approach to operationally defining basic and non-basic economic activity is known as the minimum requirements method. This approach involves selecting a large number of regions similar to the one under study and computing the distribution of total employment or income among the various industries.² The lowest ranked value of each industry is selected and together these comprise a minimum requirements profile. The underlying assumption of this approach is that the region with the smallest proportion of employment or income engaged in that industry represents the minimum requirements necessary to service local needs. Basic employment is therefore the sum of employment or income in excess of the minimum requirements level in each industry.³

Once employment in the region is designated as basic and non-basic an employment multiplier may be derived by calculating the ratio of total employment to the basic employment. For example, if it is observed through one of the above methods that 25% of total employment in a region is basic the employment multiplier is 4.0 ($100/25$). This means that every basic job in the economy generates an additional three in the non-basic sector, for total employment of four.

There are a number of conceptual shortcomings in the economic base approach. For one, exports are considered to be the sole stimulus to growth. The role of consumption in increased spending and the concept of leakages in the economy are not explicitly considered. Exports are considered to be homogeneous in terms of their effects on the rest of the economy. No treatment is given the nature of the backward and forward linkages and the subsequent employment in support or indirect industries. The constant ratio of base to service activity that follows from the above simplification is unrealistic. Not only is this ratio likely to be different for various industries, it also may change over time and vary with other factors such as community size and maturity.

The categorization of all employment as either basic, or non-basic is a gross simplification. Although the impact of a job in the coal industry with an income of \$18,000 would clearly be different than that of a manufacturing job paying \$12,000 they are treated as equal, i.e. one job in the basic sector.

5.1.2 Input-Output Analysis

Input-output is an economic technique which explicitly focuses on interdependencies among sectors of the economy.⁴ It can be thought of as a type of social accounting. Much the same kind of approach is used as in systems of national income accounting in that double entry accounting is the technique by which transactions between the region and external regions and among activities within the region are recorded. All transactions are recorded as both outputs (sales) and inputs (purchases). Unlike other forms of social accounting however, input-output records inter-industry transactions generated by demand for final product. These would be considered double counting in other social accounting procedures. Transactions are recorded in dollars in order to document relationships in a common unit.

Activities are categorized among the following major economic sectors:

"Intermediate" - private business activities within the region.

The sector is broken down into individual industries such as mining, food processing, construction, or chemical products. It is sometimes referred to as the interindustry sector because much of the detail of the input-output statements refers to transactions among the separate industries within the sector.

Households - individuals or families residing or employed in the region, considered both as buyers of consumer goods and services and sellers (primarily of their own labour).

Government - state, local and national public authorities, both within and outside the region.

Government - state, local and national public authorities, both within and outside the region.

Outside world - activities (other than government) and individuals located outside the region.

Capital - the stock of private capital, including both fixed capital and inventories."⁵

All inter-industry relationships (sales and purchases) are displayed in tables or matrices. The standard input-output model consists of three tables. A transaction table records basic data concerning total flows of goods and services through all the sectors of the economy including intermediate and final demand. Transactions are recorded in money terms. It may be helpful to clarify the above with a simple example. Suppose we have a four sector economy composed of agriculture, manufacturing, services and households (final demand). Agriculture may have sold the following: \$20 to other firms in the agriculture sector, \$30 to manufacturing, \$50 to firms in their service sector and \$25 to the household sector for a total output of \$125. Manufacturing may have purchased inputs of \$30 from agriculture, \$50 from elsewhere within manufacturing, \$20 from the service sector and \$50 from the household sector (in the form of wages) for a total outlay of \$150. The transactions table is really a descriptive account of the regional economy at a particular point in time.

TABLE 5.1

HYPOTHETICAL TRANSACTIONS TABLE

Purchasers Sellers	<u>Intermediate Sales</u>			<u>Final Sales</u>	Total Outlay
	Agriculture	Manufacutring	Services	House- holds	
Agriculture	20	30	50	25	125
Manufacturing	30	50	20	50	150
Services	45	10	30	40	125
Households	30	60	25		
Total Outlay	125	150	125		

A second table, the direct requirements table, shows the relative input purchases required by each processing sector per unit of output it produces. This table, also known as a technical coefficients table, is derived from the transactions table. Each individual entry is arrived at by dividing that particular input by the total outlay of the sector concerned. Using the same example to illustrate, the direct requirements column for the manufacturing sector would read agriculture: 0.20; manufacturing: 0.33; service: 0.06. For every dollar of output in the manufacturing sector inputs worth 20¢ from agriculture, 33¢ from elsewhere in the manufacturing sector, and 13¢ from the service sector.

TABLE 5.2

HYPOTHETICAL DIRECT REQUIREMENTS TABLE

	Agriculture	Manufacturing	Services
Agriculture	.16	.20	.40
Manufacturing	.24	.33	.16
Services	.36	.06	.24

The third and last table of the input-output table is known as a table of direct plus indirect requirements. This table is derived from the coefficients table by matrix inversions. The direct plus indirect requirements table discloses the total economic impact, sector by sector, of an increase in any one of the individual sectors on the regional economy.

TABLE 5.3

HYPOTHETICAL DIRECT PLUS INDIRECT
REQUIREMENTS TABLE

	Agriculture	Manufacturing	Services
Agriculture	1.20	.30	.53
Manufacturing	.29	1.49	.21
Services	.45	.09	1.31

Input-output tables can be constructed at various levels of disaggregation according to the needs of the study. Time, manpower, data

and other resource constraints play a major role in determining the appropriate trade off between detail of analysis and costs to be incurred. In particular, input-output studies are very data demanding. Hence, data availability is most often the bottleneck in the study. To compensate for the heavy data requirements a number of restrictive assumptions are necessary thus limiting the validity of this approach. The standard assumptions include: no multiproduct industries, linear input functions, no external economies, neglect of capital formation and capacity variations.⁶

5.1.3 Income-Expenditure Analysis

The income-expenditure model can be represented mathematically by some variation of the standard $Y = C+I+G+E$ equation. One modified form of Keynesian analysis, the income/expenditure approach, has been tailored to economic impact studies. The model specifically measures the impact of a new or expanded activity on a regional economy. It was designed as an alternative to the economic base model discussed above. In contrast to the economic base model which uses an employment multiplier, the income/expenditure approach uses an income multiplier.

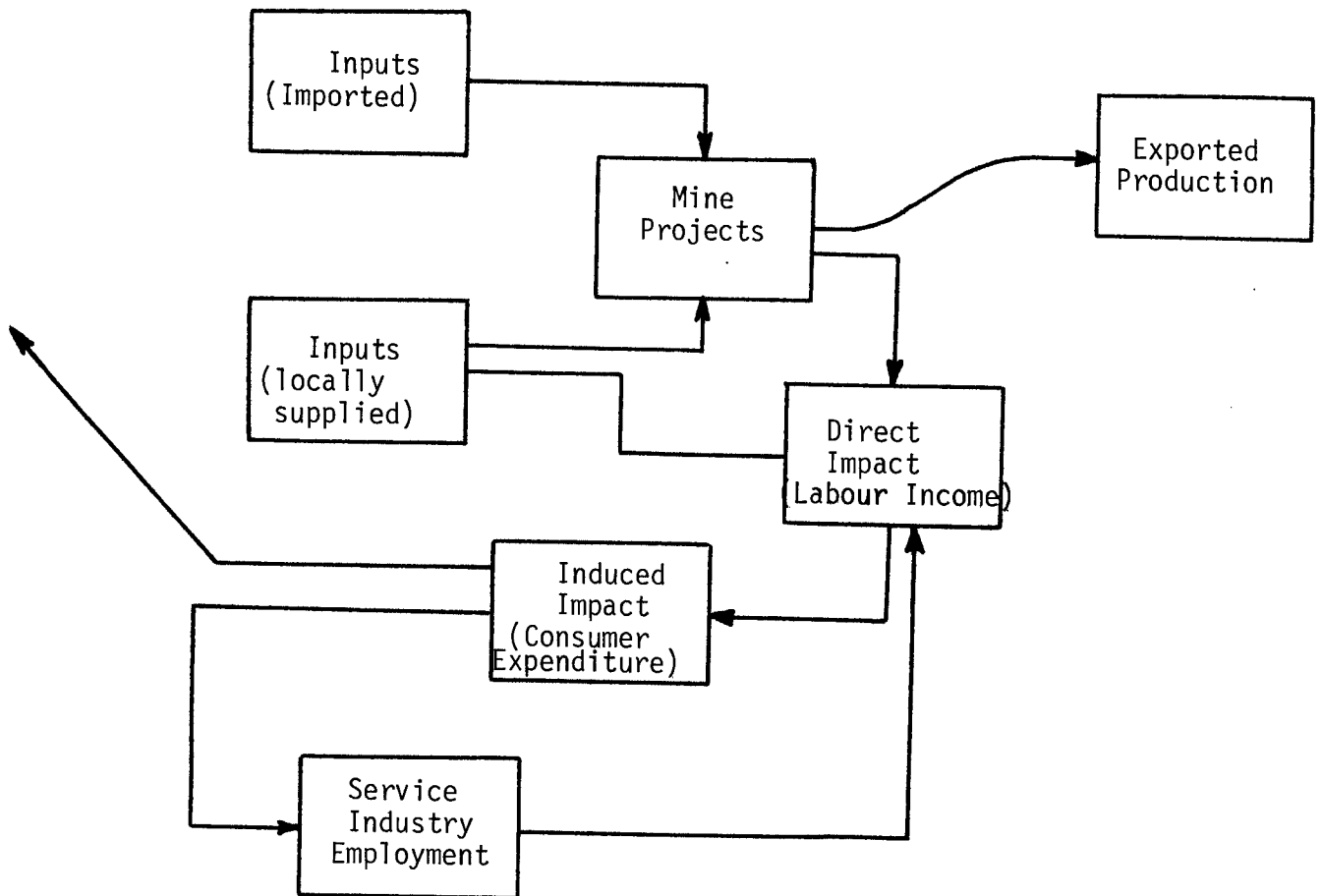
In one version of this model economic activity is conceptually divided into direct, indirect and induced categories.⁷ Direct activity is taken to be that of the new enterprise or project. Indirect is that activity attributed to firms in the region that sell inputs to, or pur-

chase outputs from, the new enterprise. Induced activity is that which is attributed to consumption spending generated by wages and salaries of direct and indirect employees. The income multiplier estimates induced income given direct and indirect income generated to arrive at total regional income. The relationship of direct, indirect and induced activities is diagrammatically represented in Figure 5.1.

Regional income is increased by an amount greater than direct and indirect income because a portion of this income is spent locally and retained in the economy in the form of wages, salaries and profit. Likewise, a certain proportion of these wages, salaries and profits will be spent locally further increasing the regional income. The magnitude of this multiplier effect depends upon leakages in the economy which in turn depends upon the characteristics of the population as well as the structure of the economy.

Leakage is the process by which income is lost from local economy. This can occur through savings, non-local expenditures or non-local taxation all of which take money out of local circulation. Income not lost from the economy through leakages is divided between local taxation and local consumption expenditures. Revenue of local government is partially retained as local income (wages and salaries and local expenditures on goods and services) and the remainder is lost from the economy through leakages i.e. local governments purchase supplies or services from outside the area. Local consumption expenditures are disposed of

FIGURE 5.1

THE IMPACT PROCESS

in a way peculiar to the individual tastes and preferences of the population.

A certain proportion of income is spent on food, clothing, transportation and so on. This is known as the expenditure pattern. In each of the expenditures categories part of the income is lost through leakages, part is taxed by the local government and the remainder stays in the local area in the form of wages and salaries.

Successive rounds of expenditures are generated by the proportion of local consumption expenditures and local government expenditures that is captured locally. A relationship of this type is mathematically represented by the series $k = 1 + r + r^2 + r^3 + \dots + r^n$ or $k = 1 / (1 - r)$, where k is the regional multiplier and r is the proportion of expenditures captured locally. Therefore, total income generated in a regional economy, Y_t , equals k times the income generated by the new direct activity, Y_c .

To derive the value of k a number of assumptions must be made. A brief summary of these assumptions and the mathematical derivation of the multiplier follows.⁸

First, it is assumed that consumption, C , of local goods and services varies linearly with disposable income:

$$C = c_0 + c_1 Y (1 - t_n - t_l) \text{ where:}$$

c_0 = constant

c_1 = marginal propensity to consume locally-supplied commodities

Y = income

t_n = non-local taxes

t_l = local taxes

Secondly, it is assumed that imports (M) by the local consumer goods industry and by local government is a function of the levels of local consumption, C , and local government spending, G .

$M = m_c C + m_g G$ where:

m_c = marginal propensity to import of the local consumer goods sector.

m_g = marginal propensity to import of local government

Thirdly, it is assumed that local government spending is functionally related to revenues raised:

$G = t_l Y + t_b C + R$ where:

t_b = business tax revenue as a proportion of total sales

R = senior government transfers

Fourthly, since R is politically determined in B.C. to be approximately \$35 per person then:

$R = rP$ where:

r = provincial grant per person

Lastly, population increase is assumed to be functionally related to income:

$$P = P_0 + p_1 Y \text{ where}$$

P_0 is a constant,

p_1 = marginal propensity for population to increase with local income

Combining assumptions one through five, the local income multiplier can be stated as:

$$k = 1 / 1 - c_1 1 + t_b(1 - m_g) - m_c(1 - t_n - t_1) - (t_1 + rp_1)(1 - m_g)$$

5.1.4 Evaluation of the Models

Each of the three models discussed above has its limitations, both conceptually and practically. The economic base model, due to the degree of aggregation, provides a fairly crude measure of impact on the non-basic sector. However, it is attractive because the necessary data is readily available. Input-output would perhaps provide the most detailed analysis of the economy but the data requirements are costly and time consuming. The income-expenditure model is more detailed than export-base but less so than input-output. Likewise, data requirements fall between the simple requirements of the export base model and the demanding input-output model.

Time constraints and the expense of data collection effectively rule out input-output analysis for the purposes of this exercise. This effectively leaves a choice of economic base or income/expenditure as

the model upon which the economic impact analysis is to be based. The income/expenditure approach was favoured for three main reasons. Firstly, income is a more sensitive unit of measure than is employment. An implicit assumption in the economic base approach is that all jobs are equivalent in their effects. This is clearly not the case - the average direct job may pay \$18,000 while the average indirect only \$12,000. Secondly, the degree of disaggregation permitted is much greater in the income/expenditure method. This allows greater detail in assigning induced impact to sectors of the local economy. Thirdly, the income/expenditure explicitly recognizes leakages. This is particularly relevant in a region such as the Northeast where leakage is extremely high due to the small market size and poorly developed backward and forward linkages in the regional economy. We can now apply the income expenditure approach to the community of Chetwynd.

5.1.5 Parameters of the Income/Expenditure Approach

Stated simply, the income/expenditure model can be represented by $Y_T = k Y_C$ where Y_T is the total income generated in a regional economy, Y_C is the income generated by the new direct activity and K is the multiplier. The multiplier can be derived as follows:

$$K = \frac{1}{1 - c(1 + t_b)(1 - m_g) - m_c(1 - t_n - t_1) - (1 - m_g)(rpl + t_l)}$$

The following discusses the parameters of the multiplier. If possible, the parameters are estimated for Chetwynd but if data is un-

available estimates are made on the basis of regional data or income group data.

C_l - The marginal propensity to consume locally supplied commodities, is considered to be a residual component of the total consumption after personal savings, non-local expenditures and local and non-local taxation. Expressed as a proportion of local disposable income, $C_l = 0.657$. What this means is that for every additional dollar of income 66¢ will be spent locally. The value of s , t_l and t_n were obtained from Family Expenditure Pattern data of Statistics Canada. Non-local consumption was derived by estimating local and non-local proportions of current consumption patterns as given in the Family Expenditure Patterns.

Business tax revenue as a proportion of total local sales, t_b , is not applicable in this exercise as Chetwynd does not have a business tax at the present time.

M_g , the marginal propensity to import of local government, - basically a measure of the level of village income exported outside the local area. It is estimated by examining the expenditure pattern of the Village of Chetwynd. The assumption is made that the magnitude of M_g is approximated by the ratio of debt charges to total municipal expenditures, in this case equal to $\$48,706/\$268,060$ or 0.182. (Debt charges are approximately 18% of the budget).

M_c , the marginal propensity to import of the local consumer goods sector, must, in the absence of specific data, be estimated on the basis of the economic structure of the community. Davis estimated the value of the M_c to be 0.671 in Prince George, a city of 60,000.⁹ That is, 67% of the goods consumed are imported by the service sector. Obviously the value in Chetwynd would be higher than this due to a lower level of integration of the economy. The value of M_c was therefore estimated to be 0.70.

Personal taxes comprise 0.136 of average family expenditure in B.C. urban areas of from 1,000 - 29,999 population.¹⁰ Local taxes are a small proportion of this since Chetwynd has a low mill rate. Of the total 0.136 an estimated 0.03 would be local taxes (t_l) and the remaining 0.106 would be non local taxation (t_n).

Based on a provincial per capita grant of \$35,000 and a marginal population/employment ratio of 2.7, rpl was estimated to equal 0.01.

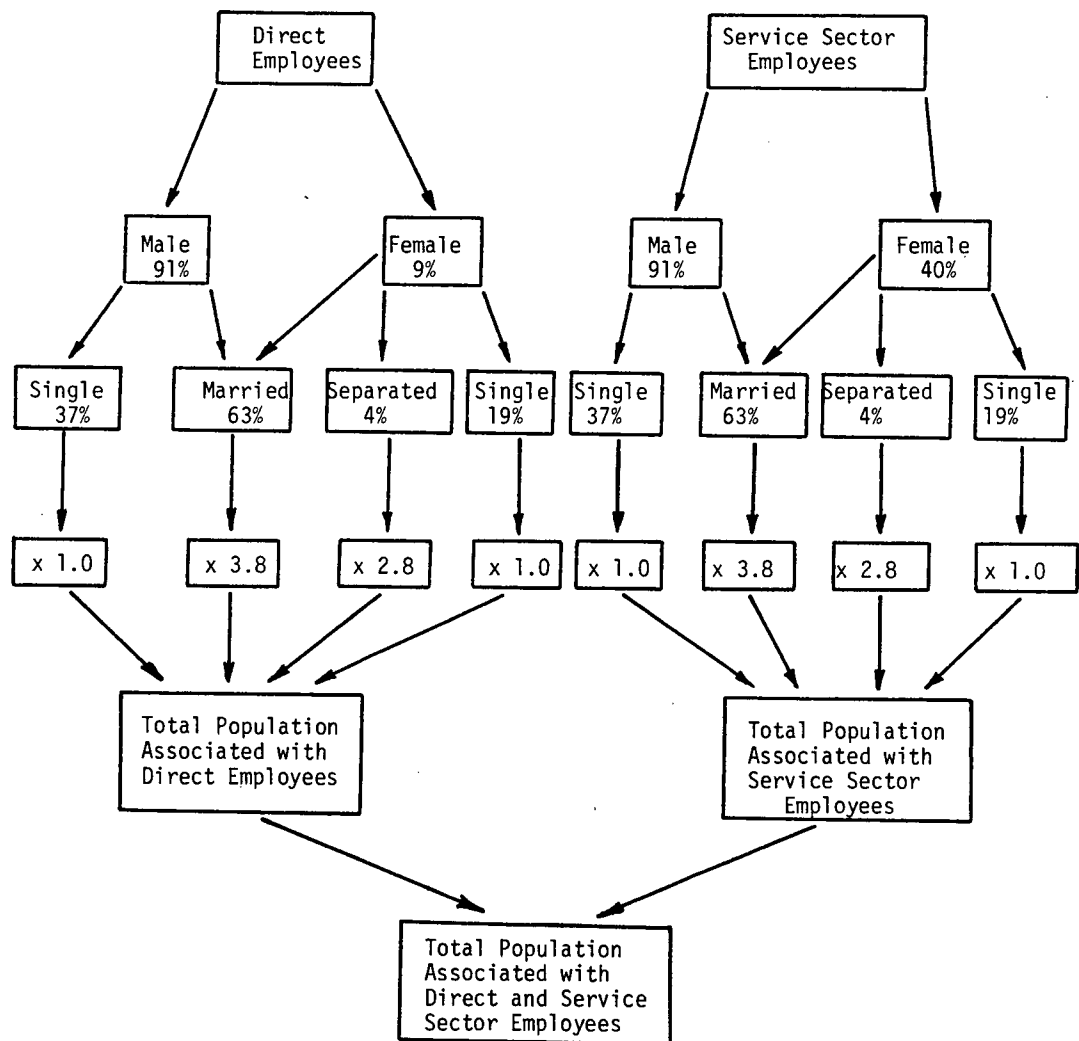
5.2 Population Multiplier Methodology

Converting employment to population estimates involves two critical assumptions, one involving female participation rate in the labour force and the other concerning average household size. At the present time in Chetwynd 31% of the employed labour force and 49.6% of the total population is female and the average household size is 4.1.¹¹

It may not be valid to assume that these ratios will remain constant if major development takes place but newcomers to the community would exhibit characteristics similar to resource or primary towns in B.C., at least in the short run. For example, the direct employment has been traditionally male orientated. Unless specific policies effectively promote the hiring of females, that sector of the labour force will remain male dominated. Typically immigrants are younger and have a higher proportion of singles than the existing population. Therefore, it is probably a closer approximation of reality to assume that the characteristics of the in-migrant population will be the same as those observed in B.C. resource communities. As a result the experience in other B.C. towns will be relied on.

A model has been developed by Cornerstone Planning Group Limited to generate population estimates for the proposed new town at Tumbler Ridge. (see Figure 5.2). In a model such as this certain assumptions must be made and in this case assumptions are based on results from studies of similar B.C. resource towns. Sex distribution of direct employees is assumed to be 91% male and 9% female based on current employment practises in similar projects in the Kootenays rather than desired or optimum hiring policies. Marital characteristics of direct employees are assumed to be the following: male: 37% single, 63% married; female: 4% separated, 19% single, 77% married and assumed to be married to direct or service sector employees. Family size characteristics are assumed to be as follows: single male, 1.0, married (male

FIGURE 5.2

POPULATION MODEL

Source: Cornerstone Planning Group Limited, 1977

or female), 3.8, separated female, 2.8 and single female 1.0. Females married to male employees are accounted for in the 3.8 persons per family assigned to married male employees.

The sex distribution of service sector employees is assumed to be 60% male and 40% female. Marital characteristics and family size characteristics of service sector employees is assumed to be the same as those for direct employees.

Population is expected to increase at a rate of 2% per year due to natural increase. This high rate of annual increase is justified by virtue of a younger than average population - hence the birth rate can be expected to be higher than average.

5.3 Community Impact Methodology

Community impact assessment can be thought of as a subset of the broader field of social impact assessment. Social impact assessment (S.I.A.) is a procedure for anticipating the unintentional consequences of purposive social action.¹² It is a means of reducing uncertainty in the planning process. Implicitly the intention is to forestall or mitigate adverse effects that may arise due to the project in question. Ideally, an applied technique such as social impact assessment should be firmly grounded in theoretical constructs. Unfortunately this is not the case. The field of S.I.A. is best characterized by its

practioners and what they study than by any distinct theoretical perspectives.¹³ In this respect S.I.A. methodology is at a comparable stage of development with economic impact assessment. The similarity ends here however. Whereas there appears to be research efforts in progress to develop methods firmly grounded in economic theory for identifying and evaluating economic impacts this does not appear to be the case in the development of S.I.A. methodology. "In spite of the large and growing body of empirical research on social impacts, little attention has yet been given to its systematic theoretical development."¹⁴

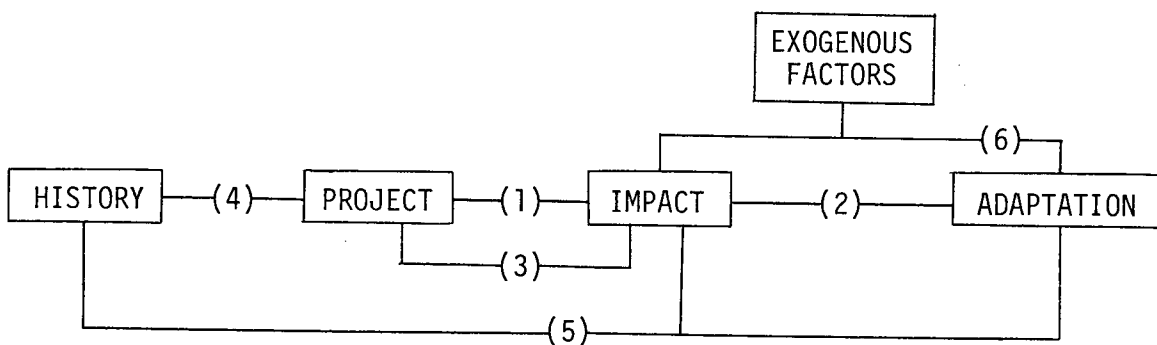
Although there is a lack of established methodology and expertise with respect to S.I.A., this does not mean that conventional social research methodologies are not applicable. All of the following social science methodologies may appropriately enter S.I.A. at one or another stage: demographic analysis, community studies, causal models, social indicators, ethnomethodology, archival research, survey research, evaluative research, institutional analysis, value analysis, multivariate analysis, social network analysis, social forecasting, and matrix methodologies.¹⁵ The art of designing a social impact study lies in coordinating these diverse methodologies in a manner that yields the desired result for a particular study. A review of the literature reveals that many research efforts are directed towards a specific situation or case study,¹⁶ while others study S.I.A. methodology in the most general of terms.¹⁷ The state of the art is that social impact assessment methodology has developed only to the point of determining

what questions to ask and which variables are significant. When the relevant variables have been determined techniques such as those listed above are applied to measure their magnitude if appropriate. More often than not choice of variables and techniques of analysis are influenced by data availability or other resource constraints.

Identification of the consequences of a social action is complicated by the complex nature of social interactions between the agents of change and those members of the society that are affected. The process is depicted in Figure 5.3 below. In this interactive model of social impact social factors are as much a cause of the impact as they are the effects. "Instead of assuming that the social effect is the result of a specific cause or chain of causes. . . we think of an effect

FIGURE 5.3

INTERACTIVE MODEL OF SOCIAL IMPACT



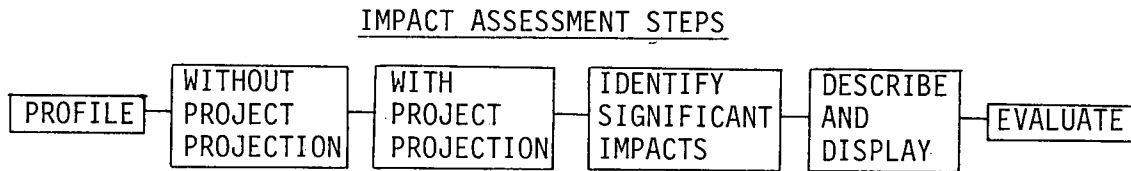
Source Wolf 1974 p. 11

as the outcome in the form of altered human conduct of the interaction between the agents of change and the people who have an interest in the proposed public works project."¹⁸ In figure 5.4 the direct impact (1) is the initial change in the identified variables. Step (2) is the initial response by the impacted units. Francis¹⁹ (1975), Olsen²⁰, and others have noted that this response is differential, that is, referent groups must be identified because what is beneficial to one group of people may be detrimental to another. This initial reaction may even feedback to the project in the form of plan modification in response to public opposition. This possibility is represented by step (3). Furthermore, the "history" of the project as a prospective solution to pre-existing issues may influence both the project itself (4) and the initial impact and adaptation (5). Lastly, the random or systematic actions of exogenous variables (6) complicate the process further in terms of estimating the impact of the project.

A typical impact study proceeds in steps as outlined below. A profile of the referent region or community is prepared. This baseline for later comparison includes a description of all the salient variables. The level of detail of the profile will vary according to the specific needs of the study but the variables may be grouped into six general categories of impact: displacement and relocation, demographic, institutional, economic, community cohesion, and lifestyles.²¹ The identification of differential groups and the spatial dimensions of the profile are critical because what is beneficial to one group of

people may be detrimental to another group and often those who receive the benefits of an action may not be those who pay the costs.²²

FIGURE 5.4



Source Wolf 1974, p. 21.

The next step is to project the variable performance into the future. The time frame will depend upon the specific requirements of the study but it must be long enough to cover the time lag between the imposition of costs and the realization of the benefits.²³ This projected end state of the system is compared to a second projection of the variables with the project included to yield an objective estimate of magnitude of impact. These results are interpreted for second-order consequences and may be evaluated in terms of policy goals and objectives.

The art of projecting or forecasting is still in the early stages of its development.²⁴ The limitations of this technique must be recognized. Futures forecasting is based explicitly or implicitly on models which are subsets of reality. Certain factors or variables are assumed to represent the total system and all variation in the system is assumed to be explained by the interrelationships of these

variables. As a result, predictions are essentially estimations of future parameter performance based on past parameter development and the present state-of-the-art of prediction.²⁵ In reality at least a portion of the total change in the system will be due to variables excluded from the analysis for the sake of simplicity and manageability.

Profiles or predictions of the future are actually statements of probability. The degree of uncertainty increases with the distance into the future of the time period under consideration as well as with the number of variables the model is concerned with. Thus, a so called "surprise free" future scenario such as Herman Kahn's "The Year 2000",²⁶ has less than a 2% chance of being correct by the author's own admission. To illustrate this, suppose a system is represented by 20 key variables and each of these variables could be projected 10 years into the future with a probability of 0.8. The probability of the predicted end state actually being correct would be 0.8^{20} or approximately 0.012.

As a concluding thought it is useful to remember what the purpose of a forecast is in a planning context. Forecasting techniques are really only decision making aids. Of primary importance is the ability to differentiate between alternative courses of action. Planners design alternative futures which are feasible and then identify policy instruments which increase the probability of realization of desirable alternative futures in terms of values, and decrease the probability of undesirable futures.²⁷ The extent to which an individual technique or combination of techniques satisfies this criterion is the extent to which it is useful to planners.

5.4 Notes to Section 5.0

1. See for example: C. Davis, Assessing the Impact of a New Firm on a Small Scale Regional Economy; D.D. Detomasi, The Decentralization of a Population and/or Economic Activity; C. Garrison, The Impact of New Industry: An Application of the Economic Base Multiplier to Small Rural Areas; W.G. Waters, Impact Studies and the Evaluation of Public Projects.
2. Aurom Bendavid, Regional Economic Analysis, p. 110.
3. Ibid.
4. C. David, An Interindustry Study of the Metropolitan Vancouver Economy, p. 1.
5. E.M. Hoover, An Introduction to Regional Economics, p. 223.
6. H.W. Richardson, Elements of Regional Economics, p. 142.
7. C. Davis, Assessing the Impact of a New Firm on a Small Scale Regional Economy.
8. For the original discussion see Davis, op. cit.
9. Davis, Ibid.
10. Statistics Canada, Family Expenditure Patterns.
11. Environment and Land Use Committee Secretariat, B.C. Towns Study.
12. C.P. Wolf, Social Impact Assessment: The State of the Art, p. 3.
13. Mark Shields, Grounded Theory Construction in Social Impact Assessment, p. 64.
14. Ibid.

15. C.P. Wolf, op. cit., p. 21.
16. For example: J. Palmer and M. St. Pierre, Monitoring Socio-Economic Change; and, Mark Francis, Urban Impact Assessment and Community Involvement.
17. Mark Francis, op. cit.; Marvin Olsen and Donna Merwin, Toward a Methodology for Conducting Social Impact Assessment, Using Quality of Life Social Indicators; Mark Shields, Social Impact Studies, An Expository Analysis; C.P. Wolf, op. cit.
18. E.J. Baur, Assessing the Social Effects of Public Works Projects, p. 3.
19. Mark Francis, op. cit.
20. Marvin Olsen, op. cit.
21. Mark Shields, Social Impact Studies, An Expository Analysis, p. 266.
22. Marvin Olsen, op. cit., p. 44.
23. Ibid.
24. Joseph Martino, Technological Forecasting for Decision-Making, p. 125.
25. H.A. Langford, Technological Forecasting Methodology, p. 208.
26. Herman Kahn, The Year 2000.
27. Yehzekel Dror, A Third Look at Future Studies, p. 111.

6.0 ECONOMIC IMPACT

The major economic implications of coal development on the communities of the Northeast of the province is outlined in this section. The economic indicators to be considered are employment, income, and by extension population. Employment and income are first discussed in general terms according to a conceptual breakdown or categorization into direct, indirect and induced activity. (See Table 6.0). A further distinction is made between the temporary construction phase and the operations phase. Following this five profiles covering the entire range of development possibilities are presented. Within each profile is included a discussion of the economic implications implied by that level of development. Lastly, the impact of each profile is summarized including a geographical distribution of the employment, income and population.

6.1 Employment and Income

6.1.1 Direct Impact

The direct impact refers to the economic effects (i.e. employment and income) on the local economy associated with or due to, the coal developments in question. In other words it is simply the number of new jobs created in the development and the resulting wage bill.

The projected manpower build-ups for each development have been presented above. This section looks at the direct effects of these developments.

TABLE 6.0

DEFINITIONS, DIRECT, INDIRECT AND INDUCED IMPACT

$$M_E = E_D + E_L + E_F$$

M_E = Total induced employment of new plants

E_D = Direct induced employment of new plants

E_L = Indirect induced employment due to interindustry flows

E_F = Indirect induced employment generated by the new plants through the final demand impact

Definitions

- A. DIRECT ECONOMIC IMPACT: wage, salary and other income payments made by the firms to their employees.
- B. INDIRECT ECONOMIC IMPACT: income payments made to local suppliers and industries who provide goods and services to the three firms or utilize goods and services from the three firms in their operations.
- C. INDUCED ECONOMIC IMPACT: increase in wages, salaries and other income payments of local business and commercial outlets as a result of spending of incomes by the three study firms and the business indirectly tied to those three firms.

Source M.H. Yeates and P.E. Lloyd, Impact of Industrial Incentives: Southern Georgian Bay Region Ontario Geographical Paper No. 44 Energy and Mines, (Ottawa, 1970).

The first step in determining the total direct income associated with the various projects is to obtain a breakdown by category of workers and to assign average wage rates to these categories. Since the projects are proposals only, at the present, it is necessary to examine existing coal operations in B.C. (i.e. Fording & Kaiser) and combine this with communications with company officials to obtain averages for the coal industry. Wage rates are estimated from union agreements and escalated according to Anti-Inflation Board Guidelines. To keep the analysis manageable, occupational categories will be limited to: supervisory and clerical (administrative), open-pit mining, underground mining, preparation plant and maintenance trades. To arrive at an occupational breakdown, various company estimates are summarized and on this basis a composite is derived which will be used in the study.

Qunitette has projected the following breakdown at full employment:¹ supervisory and clerical, 19.5%; mining, 47.9%, (open-pit, 24.9% and underground, 23%); preparation plant, 7.9%; and maintenance, 24.8%. Kaiser Resources had the following breakdown in 1975:² administration (supervisory and clerical), 11%; mining (maintenance included), 70%; (mining employment included open-pit, 51% and underground 19%); preparation, 19%. Employment by occupation at Fording Coal (1975) was as follows:³ administration, 18%; mining, 68%; preparation, 14%. The Manpower Subcommittee gives the following breakdown based on various collective agreements in the industry:⁴ administration, 20%; mining, 65%; preparation, 15%.

In summary, administrative or supervisory and clerical varied between 11 and 20%, mining personnel (including maintenance) from 65 to 72.7% and preparation from 14 to 19%. Averaging of the above classifications yields figures of 17% administrative, 69% mining (including maintenance) and 14% preparation. If we assume 35% of mining manpower could be classified as maintenance personnel (based on data from Denison Mines) our final breakdown is as follows:

Administrative	17%
Mining	45%
Maintenance	24%
Preparation	14%

Union wage rates for hourly workers ranged between \$6.00 and \$8.00/hour or between \$12,500 and \$16,500 annually in 1976. The overall average for the industry was \$15,500 in 1975,⁵ From various union agreements it can be seen that open-pit workers receive a higher rate than underground workers mainly due to the operation of heavy equipment. Maintenance workers fall between open-pit and underground rates as do rates for workers in the preparation plants.

It is more difficult to arrive at an estimate for administrative staff as only a portion of these employees are unionized, and there is considerable variation within this category. All estimates of yearly earnings are in 1977 dollars.

CATEGORY OF WORKERS	AVERAGE ANNUAL GROSS EARNINGS
Administrative	\$19,000
Open-pit	18,800
Underground	15,500
Mining (average)	17,800
Preparation	18,000
Maintenance	18,500
Weighted average	18,200

Until other information is available the assumption will be made that W.C.T. employees will be paid at a rate comparable to underground coal miners. Earnings of construction workers were not derived from union rates because overtime and seasonal shutdowns can have an effect in such situations. An arbitrary assumption has been made that construction workers will average \$18,000 per annum.

A number of assumptions must be made in order to determine the direct impact of the construction phase. Most of the workers will be housed in construction camps. From a regional perspective the direct impact could be the same as the impact of an operational workforce except for the fact that the impact would be short term rather than long term in duration. The difficulty arises in assessing the impact on the various communities. For example, even though it is to be expected

that most employees will be housed in the camps, a certain number will probably choose to live in one of the existing communities. Any estimation of the proportion of workers residing in communities will, to a certain extent, have to be arbitrary. Communication with officials from Westcoast Transmission revealed that it is their intention that all construction workers be housed in camps to minimize disruptive impacts on communities in the region. However, experience with other major developments in B.C. suggests that approximately 15% of married workers would choose to live in town.⁶ Based on this experience the assumption is made that 10% of the construction work force will locate in existing communities.

6.1.2 Indirect Impact

The indirect impact of a project is the impact due to the increased activity of firms in the region which sell inputs (goods or services required in the company's productive processes) or purchase outputs or products from the coal companies. In estimating the magnitude of the indirect impact it is important to distinguish between open pit and underground mines during both the construction and operation phases. Of course, in both open pit and underground developments the actual costs and input requirements will depend on site specific conditions. However, it is still possible to discuss in general terms the type of equipment and supplies etc. that are required. Assumptions

can be made concerning the geographical distribution of the indirect impact by examining the capabilities of the various communities in the Region to supply the equipment and/or materials needed.

There are five categories of potential indirect impact. These are: mine preparation, mine equipment, preparation facilities, mine-site infrastructure and offsite infrastructure. The first four categories can be attributed to the construction phase while the categories of offsite infrastructure and (to a lesser extent) mine equipment are applicable to the operations phase.

The cost of pre-production or preparation activity varies mainly with mine size and stripping ratio in the case of open pit mines while most of the development work of an underground mine involves the driving of tunnels and therefore varies with the angle of the coal seams and other geological and structural conditions. These site specific conditions dictate the mining method (room and pillar, hydraulic, longwall, shortwall or short/long wall). Cost of development varies significantly among these mining methods.

Equipment needs during the construction phase include both developmental needs and start-up needs. Start-up equipment is included in the construction phase rather than the operations phase because it is a "one-shot" effort that precedes production. Equipment replacement however, is included in the operations phase.

Approximately 80% of the investment in mining equipment for an open pit operation is for shovels, loaders and trucks.⁷ This involves waste trucks and shovels in the preproduction stage and coal trucks and shovels for the operation phase.

Equipment requirements for underground mines are more varied. They range from specialized drilling equipment necessary in the pre-production phase to conveyors, loaders, feeders, coal cars and so on in the operations phase. Cost of specific requirements vary with seam thickness and other site conditions as well as level of production.

Preparation facilities basically include the wash plant, a coal dryer, storage facilities and loading facilities. Investment varies not only with the level of output but also depends on the specific qualities of the coal (i.e. the washability).

Preparation facilities would essentially be the same for open pit and underground operations.

Minesite infrastructure includes the offices, warehouses, repairshops, power lines, etc. The type of input required here is the various construction materials such as metals, concrete, lumber, etc. Offsite infrastructure includes access road, spur lines and other communication links.

Taking the local economy into account it is likely that only a small amount of the capital expenditures of the mines would be captured locally. This is particularly true of heavy equipment which comprises

such a large proportion of a coal mines capital expenditures. It is doubtful that the N.E. region could capture much of this expenditure. Likewise for underground mines the drilling equipment is too highly specialized to be supplied locally. Even replacement parts or drilling bits, etc. would more likely be supplied from Edmonton or Vancouver than from Chetwynd or Dawson Creek.

Indirect impact during the operations phase is derived mainly from equipment replacement and repair services, supplies and so on. B.C. Research, in a study done for Crowsnest Industries, listed the following commodities and services as those likely to be purchased locally by the mine in the Kootenay region,⁸ small vehicle and equipment purchases, (fuel, oil, grease, tires, etc.), steel fabrication, vehicle maintenance, vehicle and equipment rentals, office supplies and equipment rentals, and general trades and services (i.e. carpenters, painters, electricians, sand, gravel, topsoil, lumber, etc.). Given the circumstances of the Northeast it is assumed the same types of commodities and services as above will potentially be supplied locally. To this list must be added the impact due to residential construction, government spending on land servicing institutional buildings and services, and commercial expansion.

The key question is what proportion of total mine expenditures fall into the above categories. This information is difficult to obtain even for existing operations such as those in the Southeast of the

province. An accurate picture of the Northeast is more difficult because we are dealing with a future situation and the mines generally have little definite knowledge on their purchasing requirements or purchasing patterns. B.C. Research estimated indirect employment to amount to 5% of the direct workforce.⁹ However, this is an arbitrary assumption and is not based on an analysis of the existing employment structure of the Southeast region. For our purposes we would prefer to estimate indirect employment on the basis of the expenditure patterns of the mining companies. Total sales would be converted to employment on the basis of observed ratio of sales volume to employment. However lack of information rules this approach out. The degree of uncertainty surrounding expenditure patterns is too great for the analysis to be carried out acceptably in this fashion. Instead, the approach will be to estimate an indirect employment multiplier on the basis of the capacity of the region to supply commodities and services required in the operation and construction phases. These have been estimated at 0.05 and 0.10 respectively. Although subject to the limitations discussed above these estimates are the best available to the author. The corresponding income impact is estimated to average \$16,000 per job based on average weekly wage data from Statistics Canada for various industry groups in B.C.

6.1.3 Induced Impact

The induced impact may be defined as that impact due to economic activity generated by the consumption spending from the income of

those directly and indirectly employed.¹⁰ The induced impact will be measured using the income expenditure approach.

Inserting these values into the multiplier equation a value of 1.255 is reached for k . Conversion of the income multiplier to an employment multiplier is accomplished by multiplying the direct and indirect wage bill by k , adjusting this to reflect profits, and dividing this figure by the average service sector wage. In this study the conversion yields an employment multiplier of 1.43. This compares with the observed economic base multiplier of 1.77 in Chetwynd.¹¹

6.1.4 Geographic Distribution of Impacts

The distribution of benefits is a major concern. The question of how and where the benefits of coal development are to be distributed is difficult to answer precisely and requires a number of assumptions.

For the most part Tumbler Ridge, Chetwynd and Hudson's Hope will be receiving the great majority of the benefits of direct impact as they would be the principal communities in terms of meeting housing requirements.

Distribution of indirect benefits is primarily determined by purchasing patterns of the mines. This of course will be influenced by the existing economic structure of the region. Many of the inputs to the mines will not be available in the region. This is especially true of inputs during the operating phase which are largely comprised of specialized machinery. There is greater potential during the construction

phase although this phase is of limited duration. Heavy machinery will probably be mostly purchased through Vancouver or Edmonton. Smaller equipment and machinery may be supplied from regional distributors. Dawson Creek, of all Northeastern communities would be best able to capture some of these benefits. Only a limited portion of the indirect benefits will accrue to the lower order centres, Chetwynd and Hudson's Hope. These centres will be capable of supplying some inputs such as fuel, tires, repair service but these will not be of a great magnitude.

Indirect benefits to the region appear to be limited because of the nature of the coal industry and its required inputs. Potential does exist however for the region to supply goods and service. If a greater proportion of the inputs to the mines could be handled regionally there would be substantial employment gains and possible diversification of the regional economy. To capture this potential requires explicit consideration by the Government and the coal companies. A policy of buying regional goods and services wherever possible would produce considerable regional benefit.

The remaining category of impact, induced, will be distributed according to the geographical consumption patterns of the direct and indirect labour forces. Of all the categories of impact this perhaps is the one most difficult to deliberately influence. Small centres such as Chetwynd and Hudson's Hope do not provide the full range and variety of selection of goods and services that workers desire. As a

result income will leak from the local area to the extent that people shop in other communities. A good portion of this consumption will accrue to Dawson Creek because of its well developed commercial service cell. A further portion will be captured outside the region in centres such as Grande Prairie, Prince George, Edmonton and Vancouver.

6.2 Development Profiles

In order to effectively cover the entire range of development possibilities a scenarios approach is utilized. Five development profiles are presented ranging from minimal development scenario to a maximum development scenario. The choice of profiles was made to complement development scenarios generated in the N.E. Coal Study. The profiles are arranged roughly in order of their probability of occurrence. It should be noted that this ranking is based on the considered judgment of the author as to the timing of the various developments.

6.2.1 Profile I - B.P., Sukunka, Bullmoose and Quintette, Babcock, Murray

Profile I represents the scenario currently the focus of government policy. Profile I involves a high level of total output as both Sukunka and Quintette properties are assumed to reach full production. With output at Sukunka reaching 3.0 million tonnes in 1985 and Quintette reaching 5.0 million tonnes in 1986, this profile assumes considerably

brighter market conditions than either profiles 2 or 3. Coal from Babcock/Murray is to be shipped by rail directly from the minesite to Anzac via the B.C.R. Coal from the Sukunka property is, until 1982, to be shipped through the Sukunka Valley by truck to a temporary wash plant at Chetwynd. The operation shifts to a plant site in the Bullmoose Valley in 1983. Beginning in 1983 port facilities at Ridley Island near Prince Rupert are to be used. The W.C.T. gas plant and pipeline are included in this profile as outlined in Section 3.6.1.

The development of Quintette Coal properties necessitates a new townsite, presumably at Tumbler Ridge. Workers on the Babcock and Murray sites will be temporarily housed in camps until the townsite is ready for occupancy, around 1982. The existence of Tumbler Ridge will affect the housing plans of B.P. Tumbler Ridge is closer to the operations than is Chetwynd. B.P. will have an economic incentive in the form of reduced cost of commuting to promote the location of their employees in Tumbler Ridge. It is assumed that once the temporary wash plant is removed and a permanent facility operational, the focus of their operations will shift from Chetwynd to Tumbler Ridge. In this analysis it will be assumed that all employees hired up to 1982 will locate in Chetwynd and those hired from 1983 on will locate in Tumbler Ridge as from this time forward Sukunka coal is to be shipped via rail in conjunction with Quintette coal. This mine alignment is known as the "east side" option.

Employment build-up proceeds rapidly in this profile. Non-construction employment rises from 183 in 1978 to 3,118 in 1982 and reaches a maximum of 4,347 in 1987. This results in a regional income increment of \$69 million (1977 dollars) annually in wages and salaries.

Population of the new town increases rapidly from an initial 300 housed in a temporary camp in 1979 to over 6,000 in 1982 and about 8,000 in 1985. A maximum of approximately 16,500 is reached from 1987 and onward.

Up until 1982 the impact on the Village of Chetwynd is the same as in other profiles in which a new town is not assumed. A permanent workforce of approximately 350 (including induced) is expected to locate there for a population increment in the order of 1,700. After this date population could fall off however, as some workers would undoubtedly choose Tumbler Ridge because of the shorter commuting distance. Since Chetwynd will fulfill a role as a sub-regional service centre the assumption is made that losses due to coal employees relocating in Tumbler Ridge will be approximately cancelled by service sector gains due to increased activity in the region. This should hold at least in the early stages of the new town's history.

Construction impact is considerable in this profile. Some 5,510 man years throughout 1978 to 1985 injecting close to \$100 million into the regional economy in direct wages. The peak year is 1980 when a workforce of 980 is required at the Sukunka and Quintette sites.

Table 6.1

IMPACT SUMMARY, PROFILE 1:
B.P. SUKUNKA/BULLMOOSE QUINTETTE BABCOCK/MURRAY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
OUTPUT (Tonnes):															
B.P.	0.004	0.35	0.5	0.8	1.1	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Quintette			0.25	3.0	3.65	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
EMPLOYMENT:															
Construction	600	950	980	830	795	795	330	230							
Direct	50	210	373	1280	1984	2200	2440	2620	2800	2900	2900	2900	2900	2900	2900
Indirect ¹	63	106	117	147	179	190	155	154	140	145	145	145	145	145	145
Induced ²	70	171	246	642	955	1052	1122	1195	1257	1302	1302	1302	1302	1302	1302
Total	783	1437	1716	2899	3913	3517	4047	4199	4197	4347	4347	4347	4347	4347	4347
INCOME: (000's)															
Construction	10800	17100	17640	14940	14310	14310	5940	4140							
Direct	910	3822	6789	23296	36109	40040	44408	47684	50960	52780	52780	52780	52780	52780	52780
Indirect ³	1008	1696	1872	2352	2864	3040	2480	2464	2240	2320	2320	2320	2320	2320	2320
Induced ⁴	779	1879	2711	7057	10505	11573	12345	13146	13832	14326	14326	14326	14326	14326	14326
Total	13497	24497	29012	47645	63788	68963	65173	67434	67032	69426	69426	69426	69426	69426	69426
POPULATION:⁵															
Total Increment	535	1339	1918	4950	7355	8101	8625	9182	9653	9998	9998	9998	9998	9998	9998
Chetwynd	2022	2516	2637	2637	3233	2888	2888	2888	2888	2888	2888	2888	2888	2888	2888
Tumbler Ridge				2313	4122	5213	5737	6294	6765	7110	7110	7110	7110	7110	7110

1. the indirect employment multiplier is 0.05 as developed in section 6.1.2.
2. the induced employment multiplier is derived by multiplying induced multiplier (1.23) x the direct jobs and dividing by the average wage of that sector (\$11,000).
3. the indirect multiplier of 0.05 is developed in section 6.1.3.
4. the induced income multiplier is 1.23 as developed in section 6.1.3 x total wages / average wage of that sector, approximately \$16,000/year.

5. 1) construction workers in camps are excluded: these are 80% of all workers.
2) demographic assumptions:
 . sex: direct workforce: 91% male 9% female-service sector 60% male 40% female.
 . marital status: direct workforce: male 37% single 63% married - service sector 37% single 63% married
 . family size: single male (1.0), married male or female (3.8), separated female (2.8), single female (1.0).

6.2.2 Profile 2 - B.P. Sukunka, "West Side" Option

In this profile partial development of Sukunka/Bullmoose is the only coal development that takes place. Production is limited to a maximum of 2.0 million tonnes per year reached in 1984 and remains constant at this level until the year 2004. All coal is transported through the Sukunka Valley, originally by truck to temporary washing facilities in Chetwynd and after 1983 to the permanent wash plant. Manpower build-up would remain the same as outlined in Section 3.1 above except that production remains at 2.0 million tonnes per year from 1984 onwards and direct employment reaches 920 in 1985 and remains at this level until the year 2004. In addition to B.P.'s coal development the W.C.T. gas plant is included in this profile. Operating employment is as described in Section 3.6.1.

Profile 2 maintains maximum flexibility. Compared to other options the infrastructure requirements are slight, mainly rail and highway improvements. Coal would be shipped by rail to existing facilities in North Vancouver (Neptune Terminals) and workers located in Chetwynd. This compares to the costly alternatives of building major new port facilities at Ridley Island near Prince Rupert and a new townsite at Tumbler Ridge. However, if, at a later date, the situation warrants it, output can be increased to 3.0 million tonnes per year and the facilities at Ridley Island and Tumbler Ridge used. This would likely be contingent

on at least one other major development such as Quintette taking place in order to justify the expense of the additional infrastructure.

Chetwynd is the only community that is directly impacted in this profile. The assumption has been made that a new town will not be built unless Quintette's Babcock and Murray properties are exploited. Direct employment in this profile reaches a maximum of 970 in 1985 which includes 50 jobs at the gas scrubbing plant.

Employment build-up begins in 1978 and peaks in 1985. Significant increases occur in 1978 (783 new jobs), 1982 (322 new jobs), and 1984 (242 new jobs). At the peak the distribution of jobs is as follows: direct sector, 970; support industries, 49; and the induced sector, 436. The resulting income increment to the regional economy reaches a maximum of around \$27 million (1977 dollars) once peak employment is reached.

Population generated by development totals 3,347 in this profile, all of which is expected to impact Chetwynd. This amounts to a population increase of over 230% during an eight year period. This is a growth rate of nearly 29% per year.

Construction activity is a major impact component in the early years of profile I. The peak construction workforce is 600 in 1978 and this declines to 200 in 1984 and 0 in 1985. Altogether some 2,335 man years of employment are created in the region with an associated

TABLE 6.2

IMPACT SUMMARY, PROFILE 2

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
EMPLOYMENT:															
Construction	600	475	230	230	300	300	200								
Direct	50	210	290	290	450	550	790	970	970	970	970	970	970	980	970
Indirect (1)	63	58	38	38	53	58	60	49	49	49	49	49	49	49	49
Induced (2)	70	132	149	149	226	271	371	436	436	436	436	436	436	436	436
Total	783	875	707	707	1029	1179	1421	1455	1455	1455	1455	1455	1455	1455	1455
INCOME: (ooo's)															
Construction	10800	8550	4140	4140	5400	5400	3600								
Direct	910	3822	5278	5278	8190	10010	14378	17654	17654	17654	17654	17654	17654	17654	17654
Indirect (3)	1008	928	608	608	848	928	960	784	784	784	784	784	784	784	784
Induced (4)	779	1457	1638	1638	2490	2984	4181	8635	8635	8635	8635	8635	8635	8635	8635
Total	13497	14757	11664	11664	16928	19322	23119	27073	27073	27073	27073	27073	27073	27073	27073
POPULATION: Impact Chetwynd (5)															
Increment	535	1029	1150	1150	1746	2091	2854	3347	3347	3347	3347	3347	3347	3347	3347
Total	2022	2516	2637	2637	3233	3578	4341	4834	4834	4834	4834	4834	4834	4834	4834

- the indirect employment multiplier is 0.05 as developed in section 6.1.2.
- the induced employment multiplier is derived by multiplying induced multiplier (1.23) x the direct jobs and dividing by the average wage of that sector (\$11,000).
- the indirect multiplier of 0.05 is developed in section 6.1.3.
- the induced income multiplier is 1.23 as developed in section 6.1.3 x total wages / average wage of that sector, approximately \$16,000/year.

- 1) construction workers in camps are excluded: these are 80% of all workers.
- 2) demographic assumptions:
 - sex: direct workforce: 91% male 9% female-service sector 60% male 40% female.
 - marital status: direct workforce: male 37% single 63% married - service sector 37% single 63% married
 - family size: single male (1.0), married male or female (3.8), separated female (2.8), single female (1.0).

wage bill of about \$42 million (1977) in total. Most of the workers will be housed in camps located outside existing communities reducing disruptive influences on Chetwynd and other communities.

6.2.3 Profile 3 - B.P. Sukunka 2

This profile differs from Profile 2 only in that output increases to 3.0 million tonnes per year in 1985 and remains at this level until 2004, and port facilities at Ridley Island are used beginning in 1984 after production reaches a level of 2.0 million tonnes per year. Originally, coal is trucked to Chetwynd but beginning in 1984 it will be shipped via rail spur directly from the minesite.

There is some uncertainty surrounding townsite location. The alternatives are major expansion of Chetwynd or a new town in the Sukunka Valley. On the one hand the commuting distance from Chetwynd approaches the maximum feasible limit but on the other hand it is questionable if a direct workforce of 1,100 justifies the expense of a new town.

Profile 3 represents the maximum possible impact on the Village of Chetwynd assuming a new town is not built. Chetwynd could reach a total population of around 5400 by the year 1986. This population increment of over 280% would be fairly evenly distributed throughout the period of 1978 to 1986 resulting in an annual growth rate close to 359.

TABLE 6.3

IMPACT SUMMARY, PROFILE 3

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
EMPLOYMENT:															
Construction	600	475	230	230	300	300	200	100							
Direct	50	210	290	290	450	550	790	970	1150	1150	1150	1150	1150	1150	1150
Indirect ⁽¹⁾	63	58	38	38	53	58	60	59	58	58	58	58	58	58	58
Induced ⁽²⁾	70	132	149	149	226	271	371	444	517	517	517	517	517	517	517
Total	783	875	707	707	1029	1179	1421	1493	1725	1725	1725	1725	1725	1725	1725
INCOME: (ooo's)															
Construction	10800	8550	4140	4140	5400	5400	3600	1800							
Direct	910	3822	5278	5278	8190	10010	14378	17654	20930	20930	20930	20930	20930	20930	20930
Indirect ⁽³⁾	1008	928	608	608	848	928	960	944	928	928	928	928	928	928	928
Induced ⁽⁴⁾	779	1457	1638	1938	2490	2984	4081	4882	5683	5683	5683	5683	5683	5683	5683
Total	13497	14757	11664	11664	16928	19322	23119	25280	27541	27541	27541	27541	27541	27541	27541
POPULATION: ⁽⁵⁾															
Increment	535	1029	1150	1150	1746	2091	2854	3411	3968	3968	3968	3968	3968	3968	3968
Chetwynd	2022	2516	2637	2637	3233	3578	4341	4834	5455	5455	5455	5455	5455	5455	5455

- the indirect employment multiplier is 0.05 as developed in section 6.1.2.
- the induced employment multiplier is derived by multiplying induced multiplier (1.23) x the direct jobs and dividing by the average wage of that sector (\$11,000).
- the indirect multiplier of 0.05 is developed in section 6.1.3.
- the induced income multiplier is 1.23 as developed in section 6.1.3 x total wages / average wage of that sector, approximately \$16,000/year.

- 1) construction workers in camps are excluded: these are 80% of all workers.
- 2) demographic assumptions:
 - sex: direct workforce: 91% male 9% female-service sector 60% male 40% female.
 - marital status: direct workforce: male 37% single 63% married - service sector 37% single 63% married
 - family size: single male (1.0), married male or female (3.8), separated female (2.8), single female (1.0).

At the peak operating level, reached in 1986, there will be some 1,150 jobs created in the direct sector, 58 in support industries and 517 in the service sector. Total income generated could reach over \$27 million annually (1977 dollars).

Construction activity is also significant in profile 2 with a peak force of 600 in 1978 dropping to 100 in 1985 and 0 thereafter. Total man years of employment are estimated to be 2435 over this time period with an associated total average bill of \$43.8 million in 1977 dollars. The assumption is made that only 10% of the workforce will choose to live outside construction camps thus minimizing this potential impact on Chetwynd.

6.2.4 Profile 4 - Quintette, Sukunka and Cinnabar

Profile 4 differs from earlier profiles not only in the inclusion of Cinnabar but also in the timing of Quintette. Production from the Babcock/Murray property is delayed until 1985. The Production schedule for Sukunka is basically the same as in Profile 1 and 3 and the shipping pattern is the same as in Profile 1. The townsite needs will be met in Chetwynd, however, as the delay of the Quintette project will hold up construction on the townsite five years.

Cinnabar comes on stream in 1984, in this profile, reaching full production of 0.5 million tonnes in 1985. The feasibility of this

development is at least partly contingent on the establishment of an agreement with B.P. for use of the Chetwynd wash plant in 1983, after B.P. establishes a permanent facility. Since Cinnabar is located between the established centres of Hudson's Hope and Chetwynd, it is assumed that 50% of the housing requirements will be met in each community.

Employment buildup is fairly regular throughout except for the period between 1983 to 1987. Buildup during this period is very rapid because both Cinnabar and Quintette start up during this time. Employment peaks in 1988 at a level of 5,052 but levels off to 4,603 in 1992 and onwards. This carries an annual regional income increment of \$73 million, almost half of which will accrue to Tumbler Ridge.

As can be expected, the population generated by the developments in this profile is significant. Regional growth is about 10,600 over the 15 year period under consideration. Chetwynd reaches a maximum population of 5,700 in 1986 and remains at this level thereafter (not including natural growth). Hudson's Hope reaches a population of 2,000 in 1985 and Tumbler Ridge eventually attains a level of 6,000 in 1992.

The construction activity involved in Profile 4 provides a fairly steady short run boost to the area economy. A total of 5,860 man years of employment are created during the 13 year period from

TABLE 6.4

IMPACT SUMMARY, PROFILE 4

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
EMPLOYMENT:															
Construction	600	475	230	230	300	450	775	950	600	495	495	130	130		
Direct	50	210	290	290	450	550	910	1233	2320	2864	2980	2980	2980	2980	3080
Indirect ⁽¹⁾	63	58	38	38	53	73	124	157	176	193	199	162	162	149	154
Induced ⁽²⁾	70	132	149	149	226	283	471	630	1090	1326	1378	1349	1349	1338	1369
Total	783	875	707	707	1029	1356	2280	2970	4186	4878	5052	4621	4621	4467	4603
INCOME: (ooo's)															
Construction	10800	8550	4140	4140	5400	8100	13950	17100	10800	8910	8910	2340	2340		
Direct	910	3822	5278	5278	8190	10010	16562	22441	42224	52125	54236	54236	54236	54236	55440
Indirect ⁽³⁾	1008	928	608	608	848	1168	1984	2512	2816	3088	3184	2592	2592	2384	2464
Induced ⁽⁴⁾	779	1457	1638	1638	2490	3117	5185	6932	11991	14587	15161	14836	14836	14721	15055
Total	13497	14757	11664	11664	16928	22395	37681	48985	67831	78806	81491	74004	74004	71341	72959
POPULATION: ⁽⁵⁾															
Chetwynd	2022	2516	2637	2637	3233	3640	4581	5144	5765	5765	5765	5765	5765	5765	5765
Tumbler Ridge									3798	5608	6008	5771	5771	5686	5999
Hudson's Hope						1381	1559	1629	1629	1629	1629	1629	1629	1629	1629

1. the indirect employment multiplier is 0.05 as developed in section 6.1.2.
2. the induced employment multiplier is derived by multiplying induced multiplier (1.23) x the direct jobs and dividing by the average wage of that sector (\$11,000).
3. the indirect multiplier of 0.05 is developed in section 6.1.3.
4. the induced income multiplier is 1.23 as developed in section 6.1.3 x total wages / average wage of that sector, approximately \$16,000/year.

5. 1) construction workers in camps are excluded: these are 80% of all workers.
- 2) demographic assumptions:
 - sex: direct workforce: 91% male 9% female-service sector 60% male 40% female.
 - marital status: direct workforce: male 37% single 63% married - service sector 37% single 63% married
 - family size: single male (1.0), married male or female (3.8), separated female (2.8), single female (1.0).

1978 to 1990. A peak of 950 is reached in 1985 but the average is 450 per year. The income gain to the Northeast economy is slightly over \$105 million in constant 1977 dollars.

6.2.5 Profile 5 - Full Development

Profile 5 represents the maximum possible development scenario. It has been included to enable the determination of the greatest possible economic impact on the Northeast region. Every development listed in Section 3 is included in the analysis. Most are assumed to proceed according to schedules described in Section 3 with the following exceptions. Quintette is delayed 5 years (as in Profile 4) and Utah is delayed 5 years as well.

Profile 5 differs from Profile 4 in the addition of Teck, Utah and the sawmill. These three developments would impact Chetwynd, Hudson's Hope and Tumbler Ridge respectively with regard to housing requirements. Profile 5 is the only profile that has a significant impact on Hudson's Hope. The impact of Utah's Carbon Creek project will be felt there as will a portion of the Cinnabar impact.

Total employment is considerably greater in this profile compared to the others. A level of 6,509 permanent jobs is reached in 1992 when Quintette reaches full employment. Employment buildup is most rapid between the years 1982 and 1987 when it increases from 1,536 to 6,800 an average of 1,053 new positions a year. Annual income from

TABLE 6.5

IMPACT SUMMARY, PROFILE 5

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
EMPLOYMENT:															
Construction	600	475	230	230	450	658	1363	1586	2030	689	495	130	130		
Direct	50	210	290	290	450	670	1090	1613	2885	3993	4242	4242	4242	4242	4342
Indirect ⁽¹⁾	65	58	38	38	68	101	191	240	257	269	262	225	225	212	217
Induced ⁽²⁾	70	132	149	149	238	351	599	852	1372	1849	1945	1915	1915	1905	1950
Total	783	875	707	707	1206	1788	3243	4291	6544	6800	6944	6512	6512	6359	6509
INCOME: (ooo's)															
Construction	10800	8550	4140	4140	8100	11844	24534	28548	17100	12402	8910	2340	2340		
Direct	910	3822	5278	5278	8190	12060	19838	29357	52507	72672	77204	77204	77204	77204	79024
Indirect ⁽³⁾	1008	928	608	608	1088	1616	3056	3840	3824	4304	4192	3600	3600	3392	3472
Induced ⁽⁴⁾	779	1457	1638	1638	2623	3864	6590	9374	15091	20336	21395	21070	21070	20955	21449
Total	13497	14757	11664	11664	20001	29384	54018	71119	88522	109714	111701	104214	104214	101551	103945
POPULATION:⁽⁵⁾															
Increment	535	1029	1150	1150	1854	2751	4637	6587	10364	14214	14948	14709	14709	14626	14971
Chetwynd	2022	2516	2637	2637	3271	4079	5169	5764	5764	5764	5764	5764	5764	5764	5764
Tumbler Ridge									4304	7031	7388	7149	7149	7066	7611
Hudson's Hope						1424	1803	2580	3102	4225	4602	4602	4602	4602	4602

- the indirect employment multiplier is 0.05 as developed in section 6.1.2.
- the induced employment multiplier is derived by multiplying induced multiplier (1.23) x the direct jobs and dividing by the average wage of that sector (\$11,000).
- the indirect multiplier of 0.05 is developed in section 6.1.3.
- the induced income multiplier is 1.23 as developed in section 6.1.3 x total wages / average wage of that sector, approximately \$16,000/year.

- 1) construction workers in camps are excluded: these are 80% of all workers.

2) demographic assumptions:

- sex: direct workforce: 91% male 9% female-service sector 60% male 40% female.
- marital status: direct workforce: male 37% single 63% married - service sector 37% single 63% married
- family size: single male (1.0), married male or female (3.8), separated female (2.8), single female (1.0).

these projects peaks at \$112 million (1977 dollars) in 1988 and remains constant at \$104 million annually from 1992 onward.

Population increases dramatically throughout this scenario. This profile represents the maximum possible impact on all the communities under consideration. Chetwynd, which is impacted by Sukunka, W.C.T., Teck and Cinnabar, reaches a population of 6,200 by the year 1987 and remains at this level thereafter (excluding natural growth). Hudson's Hope is impacted by Cinnabar and Carbon Creek, reaching a population of 4,900 by 1983. The remaining developments, Quintette and the sawmill, impact Tumbler Ridge. The new town will reach a population of about 6,500 in 1992.

Construction is once again a fairly steady impetus to the area economy. A workforce is maintained over a 13 year period with peak requirements being 1,586 in 1985. All told, some 8,166 man years are involved injecting a total of \$150 million into the economy in the form of wages.

6.3 Summary of Development Profiles

The impact of the coal developments on the Northeast region would be of a scale to affect the structure of the regional economy. Coal would be the new dynamic sector of the economy replacing forestry and gas and oil. Other sectors, agriculture and tourism, simply do not have much potential in terms of providing employment or drawing investment capital.

Coal development could see considerable immigration to the region, up to 15,000 people in the case of full development. This could alter the social characteristics of the Northeast region - migration tends to be selective. As well the coal industry demands a specialized, highly trained labour force. For example, there may be considerable in-migration from the Maritimes and Alberta in Canada and perhaps overseas.

The role and relationship of the communities in the region will undergo changes. Large scale development would see a relative decline in the importance of such centres as Dawson Creek and Fort St. John. These centres will not receive a direct impact from coal development. In the case of Fort St. John other resource developments will likely provide a continued impetus to growth. The economic base of Dawson Creek is primarily related to its role as a service centre for agriculture. Coal development will have an indirect impact on the City but in terms of magnitude it is not likely to reverse the relative decline in importance of that community.

Some of the major features of each of the five development profiles are summarized in Table 6.6.

TABLE 6.6

SUMMARY OF PROFILES

Profile	Developments	Production	Peak Jobs	Community Implications
1. Sukunka & Quintette	1. Sukunka/Bullmoose 2. Babcock/Murray 3. W.C.T.	3.0 million tonnes 5.0 million tonnes	1100 1750 50	Moderate impact on Chetwynd, new town of Tumbler Ridge created.
2. B.P. Sukunka One	1. Sukunka/Bullmoose 2. W.C.T.	2.0 million tonnes	920 50	Heavy impact on Chetwynd (pop. of 4,750 in 1985)
3. B.P. Sukunka Two	1. Sukunka/Bullmoose 2. W.C.T.	3.0 million tonnes	1100 50	Heavy impact on Chetwynd (pop. of 5,400 in 1986)
4. Quintette/Sukunka/Cinnabar	1. Sukunka/Bullmoose 2. Babcock/Murray 3. Cinnabar 4. W.C.T.	3.0 million tonnes 5.0 million tonnes 0.5 million tonnes	1100 1750 180 50	Heavy impact on Chetwynd (pop. of 5,700 in 1986), small impact on Hudson's Hope, new town development delayed five years
5. Full Development	1. Sukunka/Bullmoose 2. Babcock/Murray 3. Cinnabar 4. Carbon Creek 5. Teck 6. W.C.T. 7. Sawmill	3.0 million tonnes 5.0 million tonnes 0.5 million tonnes 2.3 million tonnes 0.5 million tonnes	1100 1750 180 862 180 50 220	Maximum impact on Chetwynd (pop. 6,000 in 1987), Maximum impact on Hudson's Hope (pop. of 4,900 in 1983) Tumbler Ridge reaches 6,500 in 1992.

6.4 Notes to Section 6.0

1. Quintette Coal Ltd., A Study of the Socio-Economic Impact of the Proposed Mine Development, p. 20.
2. Resource Sub-Committee on Northeast Coal Development, Coal Resource Evaluation, p. 86.
3. Ibid, p. 87.
4. Manpower Sub-Committee on Northeast Coal Development, Report of the B.C. Manpower Sub-Committee on N.E. Coal Development, p. 50.
5. Quintette Coal Ltd., op. cit. p. 49.
6. Cornerstone Planning Group Ltd., Population Projections and Social/Cultural/Income Characteristics for the Proposed New Town at Tumbler Ridge, B.C.
7. Resource Sub-Committee on Northeast Coal Development, op. cit., p. 60.
8. B.C. Research, Stage 2 Environmental Study of the Line Creek Project, Vol. I., pp. 0-12.
9. Ibid., pp. 9-12.
10. C. Davis, Assessing the Impact of a New Firm on a Small Scale Regional Economy, p. 171.
11. Environment and Land Use Committee Secretariat, B.C. Towns Study.

7.0 COMMUNITY IMPACT

The impact of the proposed developments on the communities of Chetwynd and Hudson's Hope, the only two existing communities that will be directly impacted by coal development in the Northeast, will be examined. Other communities, especially Dawson Creek, may be indirectly affected by large scale development. However measured in terms of population increases and subsequent demands on community services the impact will be minimal. The fact that Dawson Creek has had no growth over the last 10 years means that there is excess capacity in most community services.

The types of community impact we will be concerned with are effects on employment, population, housing, physical and social services, and commercial/retail floorspace requirements.

7.1 Chetwynd

Chetwynd of all communities in the Northeast faces the greatest degree of uncertainty with respect to coal development. No matter which development profile takes place the impact upon Chetwynd is great. It appears from our analysis that the impact on Chetwynd is of a magnitude at least as great as the existing population. The predicted population in 1982 is expected to be about 3,000 in all profiles. The population in 1986 ranges from less than 3,000 represented by profile 1

to approximately 6,200 in profile 5. Therefore Chetwynd is relative to the other communities emphasized in this section.

7.1.1 Demographic Impact

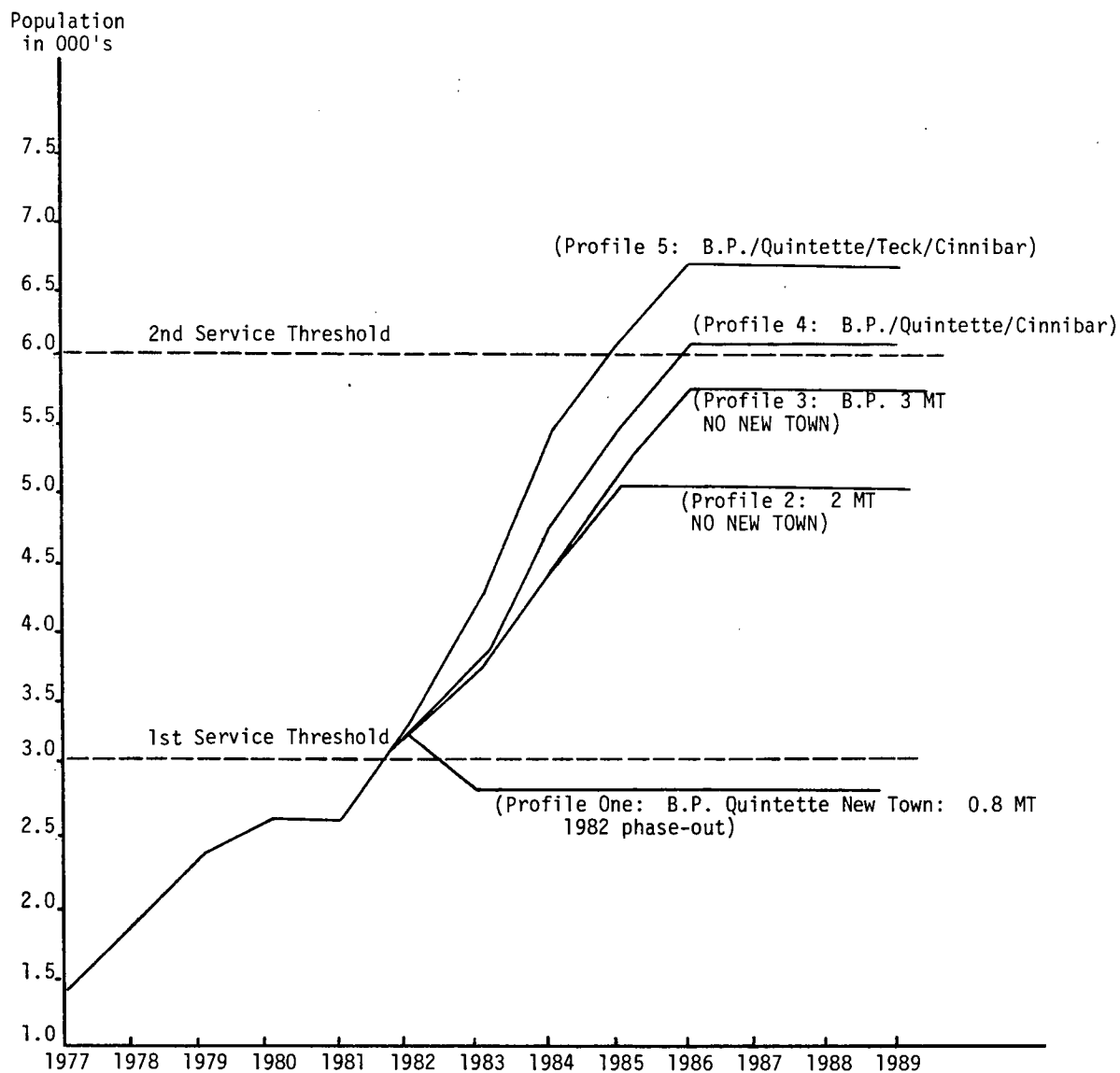
It is essential to start an analysis of community impact with an outline of the likely effects of development on the population of Chetwynd and its demographic characteristics because the other relevant impact areas are all estimated on the basis of population thresholds, basis of per capita standards or, in the case of commercial floor space requirements, some measure of income increment.

The population increment resulting from each of the development profiles is summarized in Figure 7.1. These estimates were derived following the methodology described in Section 5.2 above. For comparison purposes physical service thresholds are included in the graph. These services thresholds basically are the levels or limits beyond which major investments in services are necessary. The notion of thresholds is dealt with more completely below.

As can be seen from the graph there is at least until 1982 an expectation of approximately 3,000 people. This appears to be a realistic 5 year horizon for current planning efforts. Beyond that date things get pretty uncertain. For that reason the discussions of impacts in this paper focus on demands in the year 1982.

FIGURE 7.1

POPULATION IMPLICATIONS OF DEVELOPMENT
SCENARIOS (1977 - 1982) FOR THE
VILLAGE OF CHETWYND



The population impact on the Village of Chetwynd beyond 1982 is significantly affected by the timing of the Quintette project. This development will not have a direct population impact on Chetwynd because of the physical distance separating the village and the coal properties. However, there is an indirect effect because the proposed new town is located between the B.P. properties and the Quintette properties. Tumbler Ridge is an attractive locational alternative to Chetwynd in terms of reduced commuting time and expense by virtue of being approximately 25 kilometers closer to the Sukunka/Bullmoose properties. The long term would likely see B.P. join Quintette in operating out of the new community at Tumbler Ridge.

B.P. has expressed its intended settlement policy.¹ Direct employees would be located in Chetwynd from 1978 - 1981 inclusive. After 1981 all employees would be located in Tumbler Ridge presumably including those previously located in Chetwynd. The resulting population impact on Chetwynd of the strategy could be very substantial. Figure 7.2 compares the short term population impact with the impact assuming Chetwynd to be the permanent location for the workforce. It is obvious from a superficial examination, that the choice of alternatives by B.P., as well as the timing of their operations are crucial to the future of Chetwynd. The difference amounts to a 250% differential in the relatively short time period between 1978 and 1985. Furthermore, if the short term option involving a gradual phasing out of Chetwynd is chosen there will be an absolute decline in population of approximately 500 involving

some 205 housing units in 1982. This would be disruptive from a community point of view. Community services in particular schools and commercial facilities would be built in expectation of a higher population. Both public and private costs could therefore be incurred.

The question of the potential magnitude of the population loss for Chetwynd is a crucial one. Various points of view can be expressed:

- . The company will by virtue of its operating procedures and housing policies encourage the 240 workers who will be operating out of Chetwynd to move to Tumbler Ridge. The implications for Chetwynd would be catastrophic.
- . The company may remain relatively neutral leaving the choice of residence location up to the worker. Housing subsidies would be provided regardless of location. Profile 1 of this paper is based on such an assumption - it assumes that workers hired up to 1982 will remain in Chetwynd but after that will locate at Tumbler Ridge, this results in a slight population loss for Chetwynd. The Cornerstone projection makes a similar assumption although the retention rate is much lower - perhaps 18% of the total workforce would commute.

Two other points that should be kept in mind in considering options are the following:

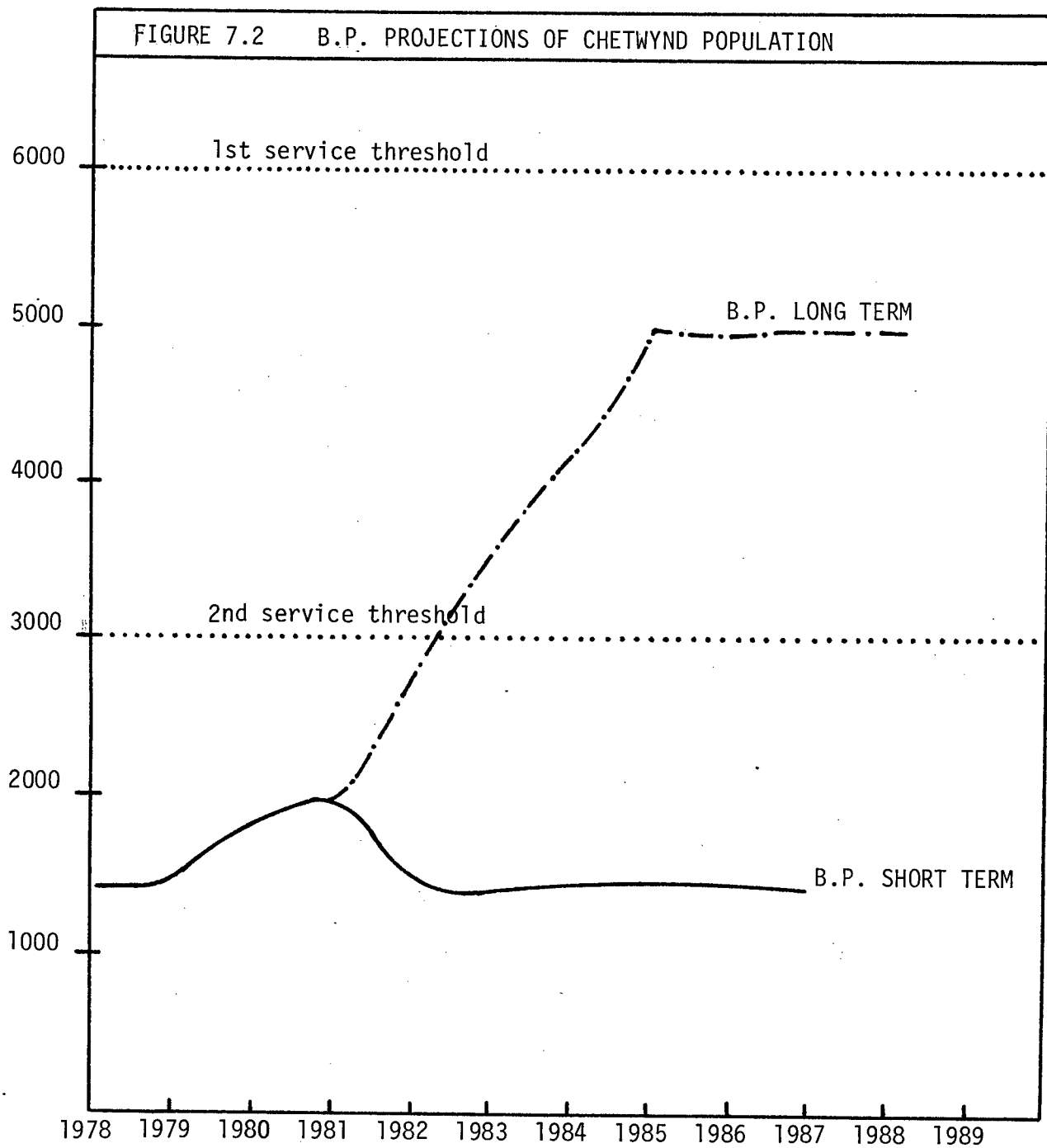


FIGURE 7.3 POPULATION GROWTH AND DECLINE: CHETWYND
 ASSUMING 1981 PHASE-OUT OF CHETWYND
 AND PHASE-IN OF THE NEW TOWN

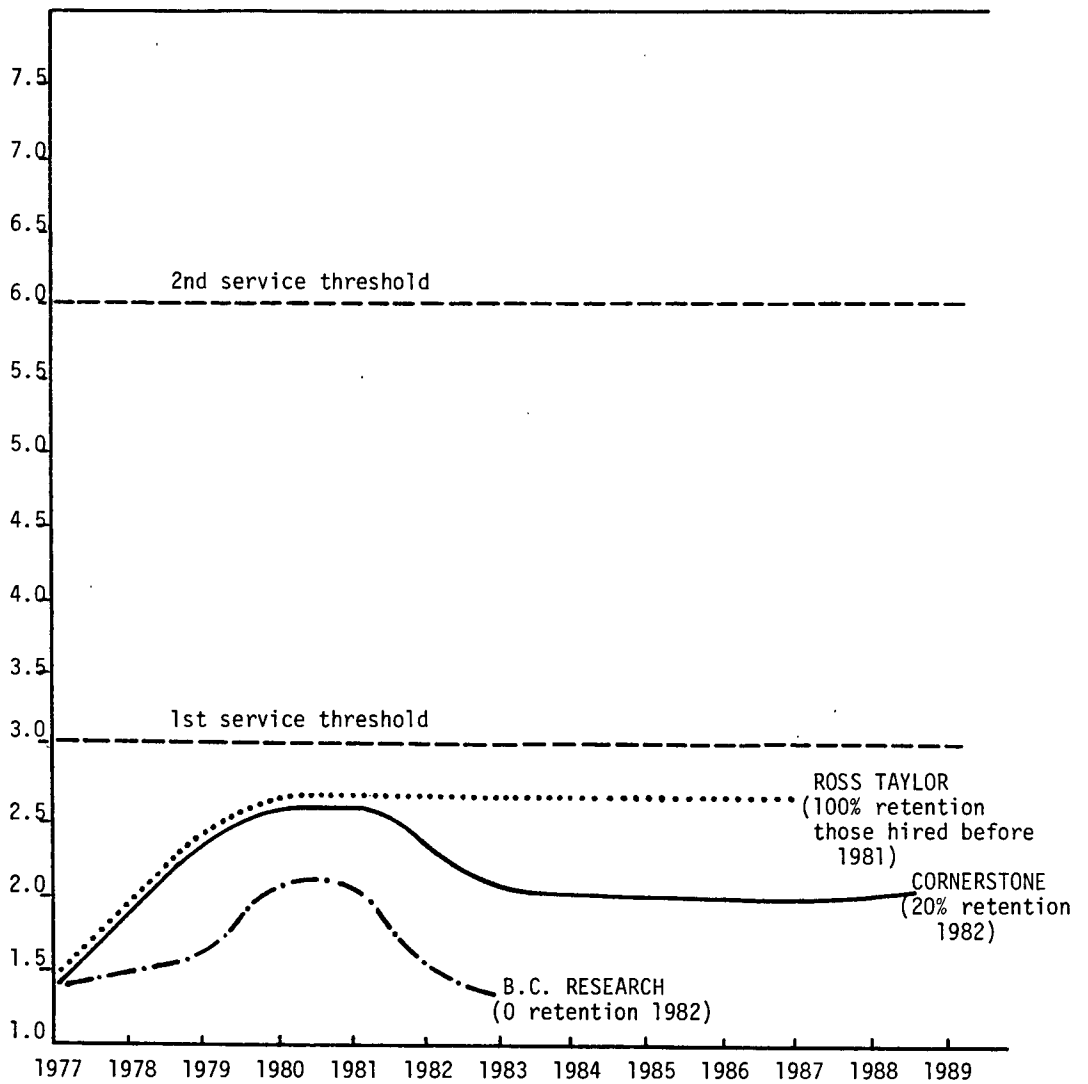
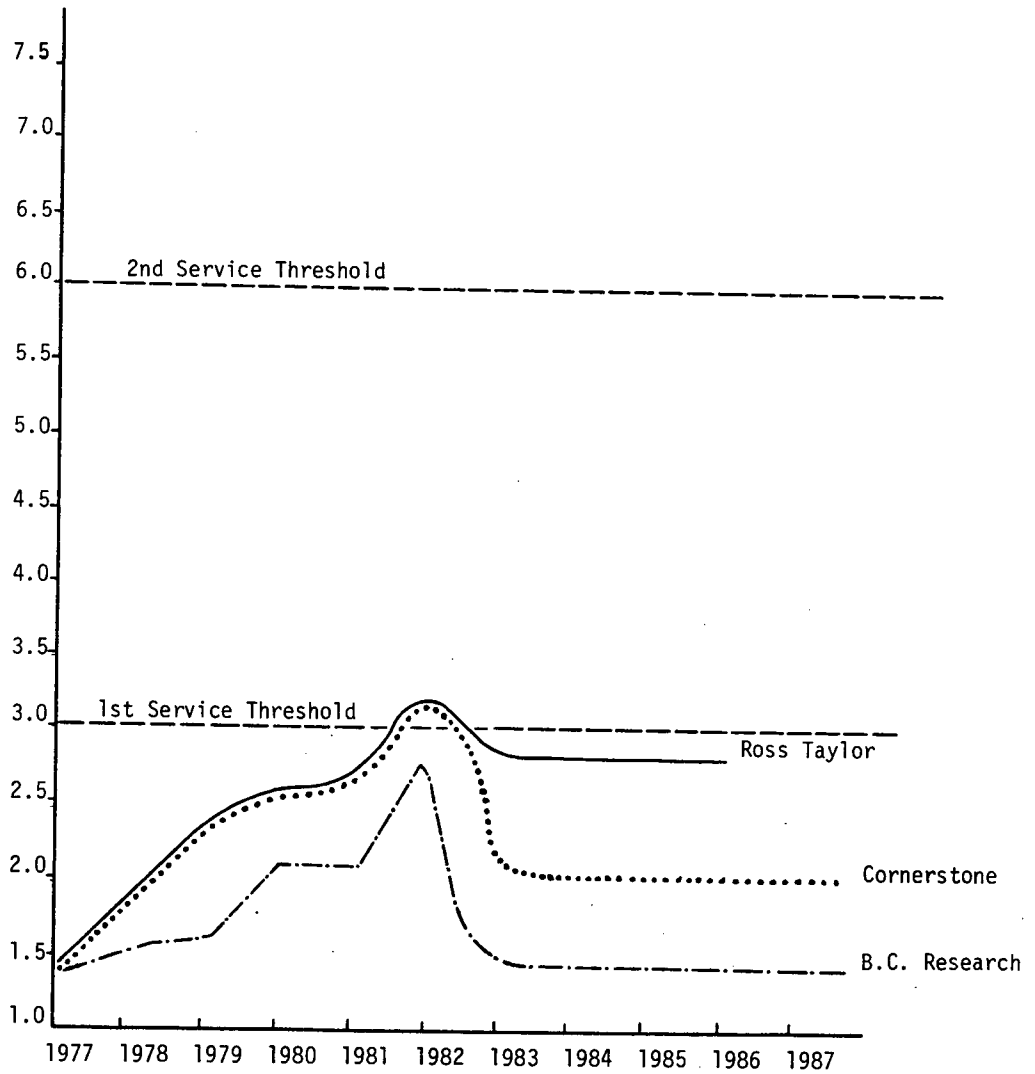


FIGURE 7.4

POPULATION GROWTH: CHETWYND
ASSUMING 1982 PHASE-OUT OF CHETWYND
AND PHASE-IN OF THE NEW TOWN



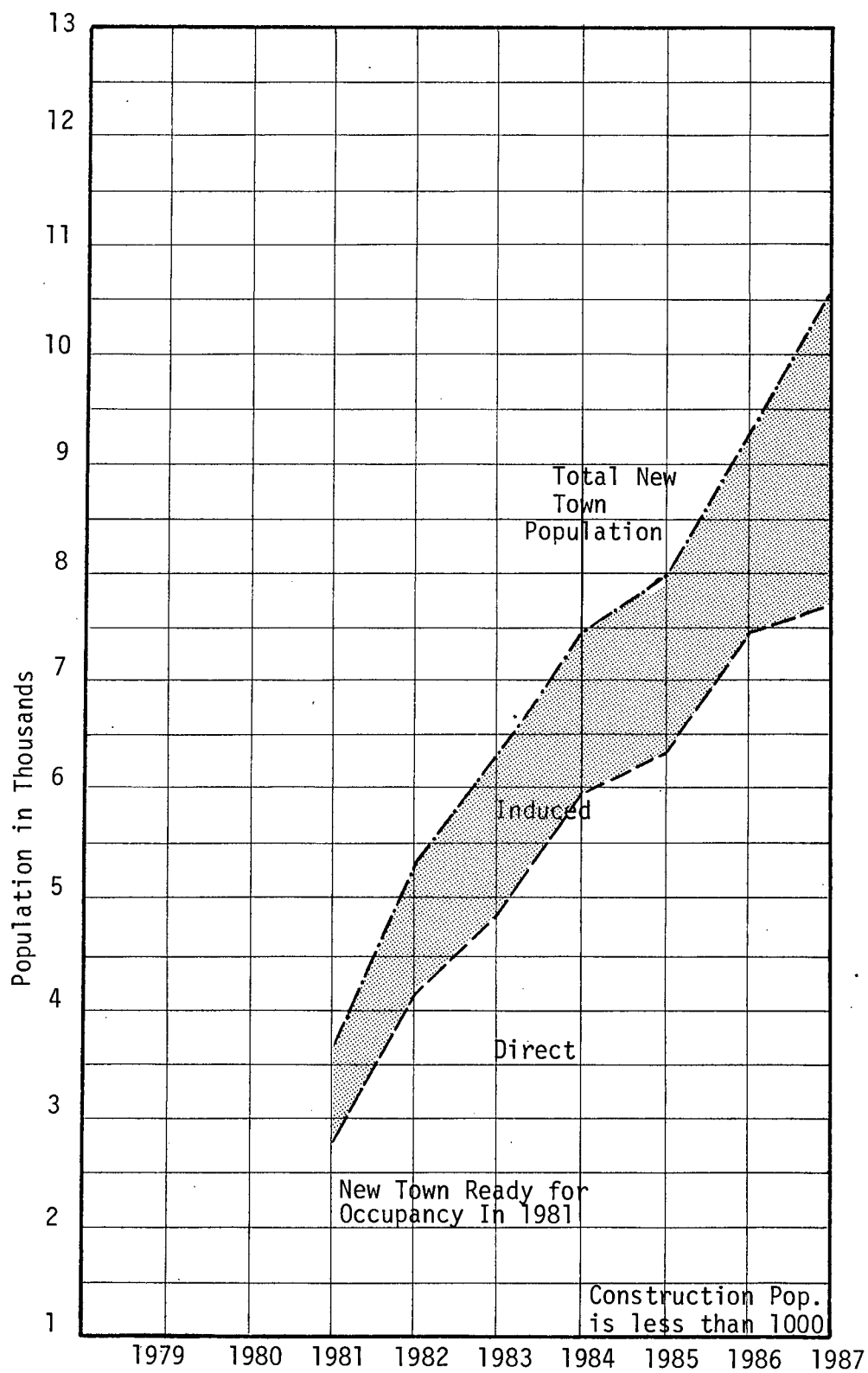
- . the prevailing pattern in the region of remote commuting in both the forest products and the oil and gas industry
- . the expressed willingness according to the Northeast coal employment survey of Northeast residents to move to the townsite.

One other consideration deserves mention here. According to the projections of the Tumbler Ridge townsite planners the combination of a rapid build-up of production by both B.P. and Quintette will result in a phenomenal growth rate for Tumbler Ridge. It would grow from approximately 1,200 in 1980 to 4,000 in 1981 to approximately 6,000 in 1982. This has a number of likely consequences for the development of the community:

- . logistically, the provision of the necessary housing units will push the construction industry to its technical limits
- . the high rate of growth will increase costs because of competition for labour
- . the community will likely run large fiscal deficits
- . social consequences could be severe due to the large number of unacquainted people on the site and the problems of delivering services when needed

FIGURE 7.5

TUMBLER RIDGE TOWNSITE POPULATION
PROJECTIONS 1979 - 1987



There would appear as a result advantages to the Province, the two companies and the Village in adopting a planning approach which attempts to moderate the potential decline of Chetwynd by maintaining a slower population build-up at Tumbler Ridge. This could be done through a development agreement which provides for the retention of a contingent of B.P. workers in Chetwynd who would commute to the minesites either on a daily basis using bus and/or helicopter or on a rotation basis - seven days on seven days off. These workers could be gradually phased out of Chetwynd in line with a desirable growth rate at Tumbler Ridge. Company housing policy would appear to be the crucial element in whether such an approach would be feasible.

7.1.2 Housing Requirements

A number of assumptions must be made regarding housing characteristics and demand. Many families have more than one income earner. Some single workers will double up in accommodation. Therefore, there is not a one to one relationship between employment and housing demand. For the purpose of this exercise the ratio has been estimated at 1.4. This figure does not reflect the existing situation but is felt to be representative of additional demand generated by coal development.

There are presently 35 hectares of land within the Village of Chetwynd designated as residential. During preparation of a community plan for Chetwynd, Stanley Associates surveyed the current housing mix.² This survey is summarized in the following table.

TABLE 7.1

CURRENT HOUSING MIX, CHETWYND

<u>Housing Density and Type</u>	<u>Percentage of Total Housing Units</u>	
1 Low Density Residential Single Family and Duplex	261	61
2 Medium Density Residential Four-plex and Townhouses	54	11
3 Apartment	52	12
4 Mobile Home Park	64	15
5 TOTAL	431	100

Source Chetwynd Survey and Analyses, Stanley & Associates Engineering

In projecting housing requirements, however, it is more appropriate to base the estimate on the housing mix of a typical British Columbia mining community as this should more accurately reflect the characteristics of additional demand for housing. The current housing mix in the municipality of Sparwood, a coal mining town in Southern British Columbia, is summarized below:

TABLE 7.2

CURRENT HOUSING MIX, SPARWOOD

Single Detached	49.4%
Single Attached (Duplexes)	17.6%
Apartments	14.8%
Mobile Homes	16.5%
Others	1.7%

Source Environment and Land Use Secretariat, 1976: b

Applying these standards to expected demand in 1982, (Profile 1) and 1986 (Profile 4), a range of housing and land requirements can be derived as follows:

TABLE 7.3

<u>HOUSING REQUIREMENTS, CHETWYND</u>			
<u>1982 and 1986</u>			
Housing Form	Existing Stock ¹ p = 1487	Additional Units Minimum Impact 1982 p = 3233	Additional Units Maximum Impact 1986 p = 5764
1. Single Detached	244	189 ²	660 ³
2. Single Attached	17	67	233
3. Apartments	52	57	194
4. Mobile Homes	64	63	207
5. Other	54	7	--
6. Total Units	431	383	1294

Source ¹Village of Chetwynd Survey and Analysis 1977, Stanley and Associates Engineering

²Assumes 51% single family

³Assumes 51% single family

TABLE 7.4

RESIDENTIAL LAND REQUIREMENTS
IN ACRES, CHETWYND

Housing Type and Density	1982 (Minimum Impact)	1986 (Maximum Impact)
1. Single detached @ 5 units/acre	102	170
2. Single attached @ 6 units/acre	30	51
3. Apartments @ 15 units/acre	10	17
4. Mobile units @ 8 units/acre	21	36
5. Other @ 5 units/acre	3	6
6. Total acres	166	280

7.1.3 Physical Services

Provision of the physical services, water, sewer, and roads, etc., represent the greatest expense to a municipality experiencing rapid growth. Although assistance is available from senior levels of government the share of capital outlay borne by the municipality can place a burden on that community's taxpayers. This is especially the case when servicing must take place well in advance of the materialization of the expected population increase. In this situation the borrowing capacity of the community may be insufficient to raise the required funds. The following sections look at the capacity of community services to accommodate growth.

The Water Supply

The water system is described in the Chetwynd Community Plan as follows:

"The original water system was installed in 1958 and consisted of a dam on Windrem Creek with gravity flow to the Fort St. John Lumber Co. (now Canfor), Pacific Great Eastern Railway (now B.C.R.), and the Chetwynd Hotel. Inadequate supply and low operating pressures prompted the waterworks district to consider an alternate source of water. Economic considerations and limited water supplies ruled out groundwater sources."³

In 1968 the Pine River was chosen as the alternate raw water source, and new feeder mains were constructed and incorporated into the old distribution system. A booster station was constructed shortly after to supply potable water and fire protection to the Hospital, R.C.M.P., and the B.C. Forest Service.

The Village of Chetwynd is presently upgrading their water system under the contract title of "Chetwynd Water Improvements 1976" (initial design population 3,000, final 6,000). Under this contract the Pine River Pumping Station will be upgraded by replacing the two existing Johnston pumps with two 10 H.P. Floway vertical turbines. These Floway, low head, pumps will have an individual capacity of 360 U.S.G.P.M. Also the 1976 Water Improvements will negate the use of the Windrem Creek Pumping Station."⁴

Water demands for future population levels can be predicted assuming average daily demand remains constant on a per capita basis. This was estimated to be approximately 100 Imperial gallons per day. The two raw water sources, the Pine River and Windrem Creek, are currently licensed to supply 600,000 and 70,000 Imperial gallons per day respectively. This would be adequate for conditions under all of the development profiles although dangerously close to capacity in profiles 3, 4 and 5 by the year 1992.

Water Treatment

The Chetwynd Community Plan comments as follows: "The existing water treatment facilities consist of gas chlorination and hypochlorination in the Pine River and Windrem Creek pumping stations respectively. The new water program still provides for chlorination of water before pumping into the distribution system. From water analyses taken on the Pine River it is evident that the phenol concentration from both supply systems is above that of acceptable limits established by the Canadian Water Standards. High phenol concentrations could adversely effect the quality of the potable water. The new upgrading program will eliminate Windrem Creek as a source and therefore any further discussions on water treatment in this section will be directed at the Pine River."⁵

Turbidity is the major problem during Spring run-off, creating undesirable conditions in the water supply system. Under the new upgrading program large open reservoirs are being utilized to store water

pumped from the Pine River during low turbidity periods. The stored water can then be utilized during times of high turbidity.

The treatment system has a design population of 3,000 and with modification could serve 6,000 people. The system should easily handle growth until 1982 and could manage the maximum growth scenario with modification to the system.

Sewage Treatment

The sewage treatment system consists of an aerated lagoon facility with a polishing pond. The system consists of a three cell aerated lagoon system, a blower house and a chlorination chamber. The capacity and retention periods comply with British Columbia pollution control standards. The outfall was designed for a population of 3,000 at peak flows.

The recently renovated system can easily accommodate the expected growth until 1981. Changes would be required if the Village grew beyond 3,000 people as anticipated in profiles 2 to 5.

Roads and Drainage

Both the road and the storm drainage systems are currently in need of upgrading. Only 30% of the roads in Chetwynd are paved. The storm drainage system consists of ditches and culverts only.

7.1.4 Human Services

The principal categories of social services we are concerned with are: Education, Health, Human Resources and Protective Services. In some cases the delivery agencies employ per capita standards or minimum acceptable levels of service but some of the agencies do not have any established standards due to the nature of the service they provide.

Education

Basic elementary and secondary school services as well as certain specialized school services are delivered by the Peace River South School District, an elected body which secures its funding partly through Provincial operating and capital grants and partly through property taxes levied by District municipalities and the Regional District.

Approximately 90% of approved capital costs are picked up by the Province and 10% is carried by local taxpayers. Approximately 60% of operating costs are picked up by the Province and 40% by local taxpayers.

The two elementary schools in Chetwynd are currently over-crowded. The lower birth rates have kept school population in check. The Chetwynd area has according to the School Board had a history of lower educational expectations for its children which has kept crowding at the higher levels of the system down.

It appears that Chetwynd will need an additional elementary school of five classrooms in a K-6 format even if the B.P. developments don't proceed as planned.

TABLE 7.5

CHETWYND VICINITY
EDUCATIONAL FACILITIES INVENTORY - 1976

<u>School</u>	<u>School Type</u>	<u>No. of Classrooms</u>	<u>Capacity</u>	<u>Enrollment</u>	<u>Spare Capacity</u>
Windrem	K-5	8	195	233	--
Don Titus	K-5	8	225	218	7
Moberly Lake	K-3	2	60	30	30
Chetwynd					
Elementary	6-7	7	210	184	26
Secondary	8-12	<u>15</u>	<u>315</u>	<u>320</u>	<u>--</u>
TOTAL		40	1,005	985	20

Source Chetwynd Survey and Analysis, Stanley and Associates Engineering

Standards for educational services are based on a student population rather than total population. The province-wide pupil:teacher ratio is approximately 20:1 at the present time.⁶ This figure includes all teaching staff but not non-teaching staff such as clerical or maintenance. Average class size for elementary and secondary schools is 30 pupils, and an average of 50 is the norm for kindergarten. Average enrollment for schools is as follows: elementary, 330; junior, 750; junior-secondary, 1,000.

Facilities are already at capacity in Chetwynd but not critically overcrowded. Development will mean the need for additional elementary and secondary schools. If minimal development takes place one new elementary school of approximately 300 students and 12 classrooms would be needed. Full development could mean an additional 1,000 elementary and 500 secondary pupils. In this case two elementary and one secondary school would be necessary as around 50 classrooms would be needed. A full time staff of 75 would be required.

Secondary Health Services

Health service needs for both Chetwynd and Hudson's Hope are currently met in Chetwynd. Presently the 30 bed hospital is being utilized at 43% capacity. Based on the 43% occupancy rate and a service standard of 4.25 beds per 1,000 population a doubling of the service population would not affect hospital capacity. Only if the higher growth scenarios were evident would there be a need for expansion.

Other Health Services

Other components of the health system tend to be affected in terms of additional professional and other staff requirements. For instance the average ratio of general practitioners per population is 1:2,200 throughout British Columbia. Therefore two or three additional G.P.'s must be attracted to Chetwynd or Hudson's Hope. Likewise two or three dentists would be needed if development proceeds. One additional public health nurse would be required to maintain the current stand-

ard of 1 per 4,000 population. All of the above positions have space requirements but if some or most of them can be consolidated in one building, costs can be minimized.

Human Resources

Human Resources maintains an office in Chetwynd but not in Hudson's Hope. The Chetwynd office has one human resources officer. One more officer may be required to handle the increased caseload that would be associated with coal development.

Protection

In communities under 5,000 population one police officer is required for every 750 people. All the requirements of the police force are looked after by the R.C.M.P. including salaries, building costs and vehicles. For this the province is billed a flat \$35,000 per year per man.

The Chetwynd Community Plan described the existing situation as follows:

"Public protection and provincial and federal law enforcement is the responsibility of the Chetwynd Detachment of the RCMP. The present detachment consists of a staff sergeant and five constables who are responsible for policing an area containing between 5,500 and 6,500 persons. The

power formulas and financial arrangements are set out in the standard Provincial-Federal Agreement. At present, the manpower standard followed is one constable per 750 population. Out of the total manpower allotment over the detachment area, the Village is responsible for generating 90 percent of police work. Out of this 90 percent, the greatest time is spent dealing with juvenile crimes such as break-ins, auto theft, and liquor offences. Reasons given by the police for the problems with juveniles range from lack of parental supervision to the school dropout problem. The dropout problem has been recognized in the community and an alternate school program is being operated out of the Chetwynd Secondary School. Future plans of the police include the establishment of a 2-man highway detachment."⁷

Provided that the existing situation remains relatively constant, i.e. the current problems above are not exacerbated then a manpower increase of 2 should be capable of handling growth up until 1982. Should the maximum profile occur a manpower increase of approximately 6 would not be out of line. The costs to the Province would be \$70,000 and \$210,000 respectively.

Other Human Services

In addition to the above categories of social services increased demand will be placed on the recreation, the judicial and library systems.

It is difficult to set standards for these services however, as the difference between the minimum acceptable level and the desirable standard is so great.

Summary

The attached Table 7.6 summarizes the physical and social service thresholds for the key services. It can be seen that growth beyond the 3,000 population level will involve considerable capital expense. Key physical service components are designed for that level. With regard to the education system, any growth will require expansion.

7.1.5 Commercial Impact

Commercial/Retail Floorspace Requirements

Estimating demand for retail floorspace is done by a three step process. First, average proportion of personal income spent on retail trade items is estimated. Secondly, the proportion of this income spent locally in each retail sector is estimated. Lastly, this is translated into floorspace requirements by the appropriate figure for sales per gross area.

From Statistics Canada family expenditure data the proportion of income spent on each of the relevant categories can be obtained. In 1969, the latest year for which these figures are available, the

TABLE 7.6

CHETWYND VILLAGE
THRESHOLDS FOR SERVICES

Component	Threshold Populations	
	Without Modification	With Modification
1. Water Supply	3,000	6,000
2. Water Distribution and Transmission	6,000	
3. Water	3,000	6,000
Treatment	3,000	6,000
4. Pumping and Storage	6,000	
5. Sanitary Sewage Treatment	3,000	6,000
6. Sanitary Sewage Collection	3,000	6,000
7. Hospital	3,000	--
8. Elementary School	at capacity	--
9. Secondary School	at capacity	--

Source Stanley and Associates, 1977

breakdown is as follows: food, 0.18, general merchandise, 0.04, apparel, 0.07, hardware/furnishings, 0.05, automotive, 0.12, others, 0.03.

The assignment of weights to each trade sector indicating what proportion of total sales are captured locally is done judgementally according to the nature of the goods involved and the structure of the local economy. Obviously, perishables and other lower order goods will be purchased locally more often than consumer durables and speciality items. The weights assigned for the categories of retail trade in Chetwynd are: food, 0.70; general merchandise, 0.65; apparel, 0.35; hardware/furnishings, 0.50; automotive, 0.25; other, 0.50.

The remaining step is to calculate floorspace requirements by multiplying income spent locally by a figure for annual sales per square meter of gross leasable area. The following sales per floor area figure are used: food group, \$2,400 per sq. meter; general merchandise, \$1,700 per sq. meter; apparel, \$1,300 per sq. meter; hardware and home furnishings, \$1,000 per sq. meter; automotive, \$2,000 per sq. meter; and other establishments, \$1,400 per sq. meter.

When the above co-efficients are multiplied by income generated by development an estimate of additional floorspace requirements is generated. For example, if \$10 million is injected into the local economy the floorspace requirements for the food group would be \$10

million x 0.18 (% of gross income spent on feed) x 0.70 (proportion captured locally) / 2,400 (sales per sq. meter) = 525 sq. meter.

Using this model the additional floorspace requirements in Chetwynd are calculated for profiles 3 and 1, the situations of maximum and minimum requirements respectively. The results are summarized in Table 7.7.

TABLE 7.7

CHETWYND: COMMERCIAL
FLOORSPLACE REQUIREMENTS

Category	Gross Total Floorspace	
	Maximum (sq.m)	Minimum (sq.m)
	<u>1981</u>	<u>1986</u>
Food	1,446	889
General Merchandise	421	259
Apparel	519	320
Hardware/Home Furnishings	689	425
Automotive	413	255
Other	<u>295</u>	<u>181</u>
Total Floorspace Requirements	3,783	2,329

Source Environment and Land Use Committee Secretariat, 1976

7.1.6 Summary

It is possible that Chetwynd will experience rapid growth in the next 8 to 10 years. The settlement policies of the coal companies

will determine the extent to which Chetwynd is directly affected. A development agreement negotiated between B.P. Coal and the Province would clarify the situation and facilitate planning for future growth.

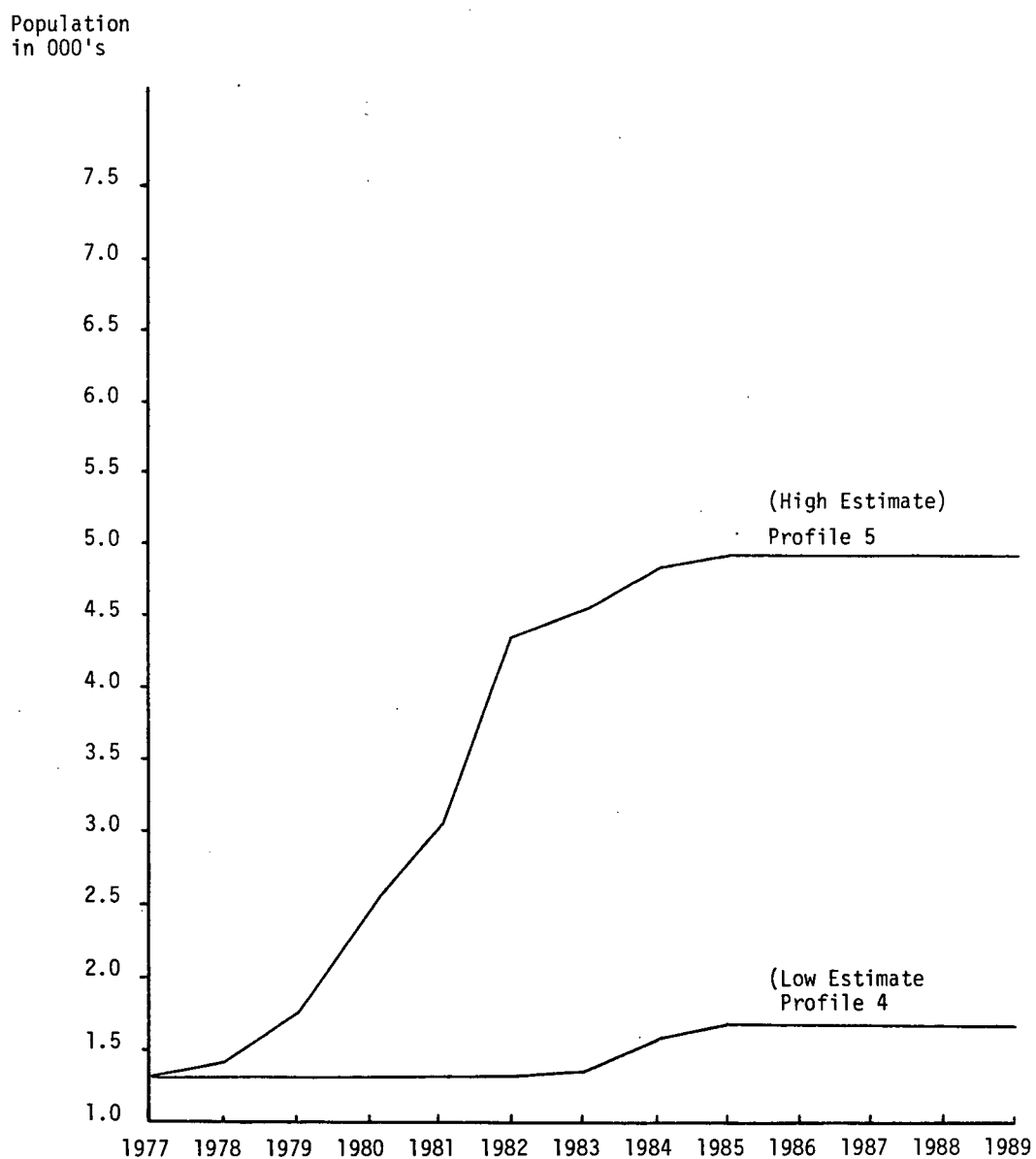
Growth thresholds of 3,000 and 6,000 beyond which infrastructure investment is required particularly in the water and sewer systems are evident for Chetwynd. Growth up to, but not beyond, 6,000 will be beneficial to Chetwynd. The commercial sector will be expanded and the range of services offered improved. Growth beyond 6,000 may or may not have net benefits depending on further costs of growth and who pays them.

7.2 Hudson's Hope

Hudson's Hope is less likely than Chetwynd to be significantly impacted by N.E. coal developments. It is only when the marginal developments of Cinnabar and Carbon Creek are brought into the analysis that an impact is felt in Hudson's Hope. These possibilities are represented in Profile 4 (Cinnabar only) and Profile 5 (Cinnabar and Carbon Creek). Of these two possibilities only the latter has a large scale population implication, however, as total population reaches 4,900 in 1985 (see Table 7.4).

The present housing mix in Hudson's Hope is 48% single detached, 2% single attached, 7% apartments and 43% mobile units. Applying the

FIGURE 7.6

POPULATION IMPACT, HUDSON'S HOPE

same assumptions and standards as used for Chetwynd above, the projected housing requirements for Hudson's Hope are as follows:

TABLE 7.8

<u>HOUSING REQUIREMENTS, HUDSON'S HOPE</u>		
Housing Type	Number of Units	Land Requirements (acres)
Single detached	517	103
Single attached (duplexes)	184	31
Apartments	155	10
Mobile Homes	173	22
Other	<u>18</u>	<u>4</u>
Total	1,047	170

Hudson's Hope is in good shape to handle moderate expansion in terms of land availability but significant improvements to the physical infrastructure are required if a population increase on the scale implied by development at Carbon Creek is to take place. There is some slack in the system at present, mainly because the population of Hudson's Hope was formerly over 3,000 whereas today it is approximately 1,300. This drop in population happened after construction of the W.A.C. Bennett Dam was completed. A construction workforce numbering well over 1,000 at peak times is followed by a permanent or operating workforce of 150 - 200 based in Hudson's Hope.

Capacity of the water system is adequate for present purposes with a storage capacity of 100,000 gallons. This will not accommodate considerable population growth of the scale implied by the Carbon Creek development. For growth of this magnitude upgrading of the water system is necessary. Increased storage capacity to approximately 500,000 gallons would be required and an increase in the diameter of the lines would probably be necessary.

In terms of social services, impact is significant but less than at Chetwynd. If only Cinnabar is developed (Profile 4) the impact on the educational system would be slight enough to be absorbed by the existing facilities. However, if Carbon Creek comes on stream nearly 1,000 additional pupils can be expected. This would require the addition of one elementary and one secondary school. Health services needs will be primarily met in Chetwynd, as has been discussed above.

If Carbon Creek is developed, there will be a substantial impact on the service sector. The same type of analysis as was done for Chetwynd is applied to Hudson's Hope. The proportion of total sales captured locally was estimated as: food, 0.60; general merchandise, 0.55; apparel, 0.25; hardware/furnishings, 0.40; automotive, 0.25; and other 0.40. The other values of family expenditures and sales per floor area are assumed to be the same as those estimated for Chetwynd.

TABLE 7.9

HUDSON'S HOPE: COMMERCIAL
FLOORSPLACE REQUIREMENTS

<u>Category</u>	<u>Gross Total Floorspace (sq. m.)</u>
Food	1,069
General Merchandise	306
Apparel	320
Hardware/Home Furnishings	474
Automotive	356
Other	<u>204</u>
Total Floorspace Requirements	2,729

7.3 Dawson Creek

As stated earlier, Dawson Creek is not expected to be directly impacted by coal development. However, there may be some impact on the service sector, particularly in the government, medical and hotel/motel sectors. The retail sector may also be impacted to a certain extent. A new major shopping centre has recently opened so it is not likely that further expansion in terms of floorspace will occur unless major development takes place in the coal sector.

It does not appear that forestry and coal developments will directly affect Dawson Creek. The principal prospect for economic development on Dawson Creek remains to be its role as a regional service and supply centre. Most of the key government offices in the North-

east region are located in Dawson Creek as well as the widest selection of commercial outlets. The alternatives to shopping in Dawson Creek for many types of goods are rather long trips to either Prince George or Grande Prairie. Dawson Creek should therefore benefit indirectly from coal development.

7.4 The Region

Coal and forestry developments could have large scale impacts on the entire Northeast region, particularly in the area near Chetwynd. Major development would see the roles and relationships of communities within the region shift as Dawson Creek continues to decline relatively within the region and Tumbler Ridge emerges as a major new centre of development. Chetwynd seems likely to continue growing at least until 1982. Hudson's Hope will probably stabilize in the short run but may grow from 1981 onward. Other dynamic centres in the region such as Fort Nelson and Fort St. John will continue to grow being stimulated by the oil and gas and forestry sectors.

Based on this analysis of potential coal developments and the Northeast Report 75, the following regional population projections have been made.

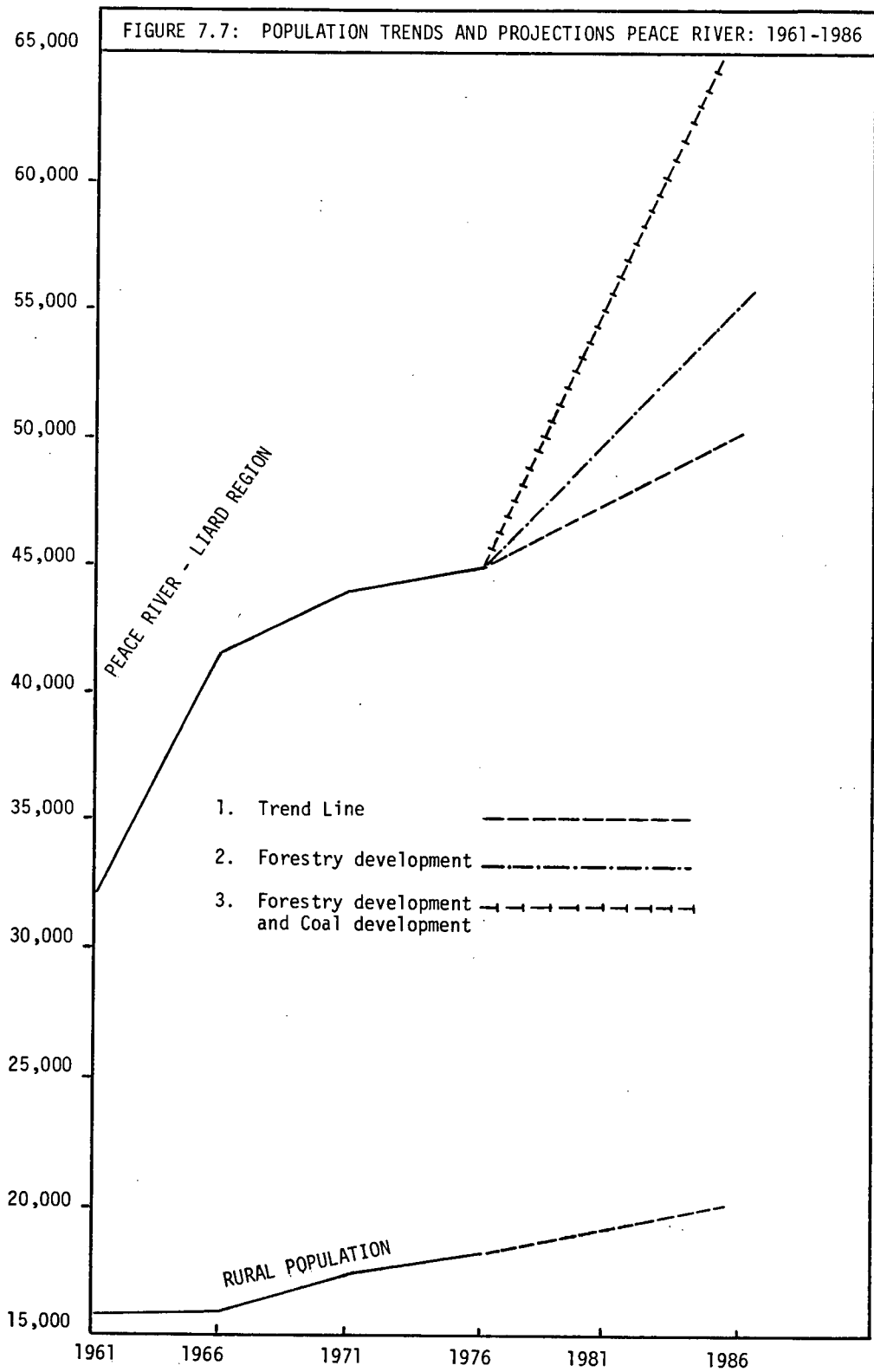
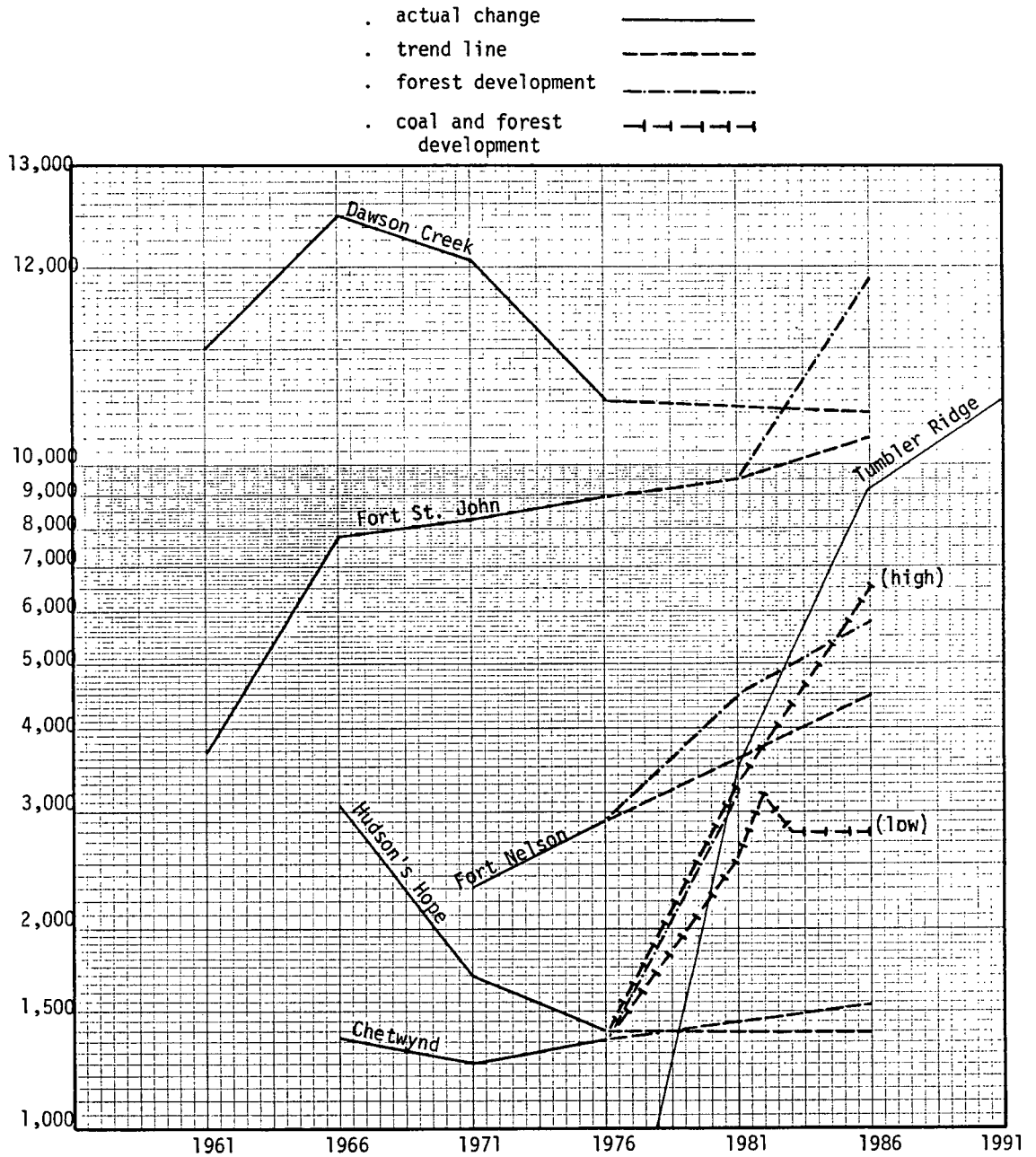


FIGURE 7.8

POPULATION CHANGE AND PROJECTIONS
PEACE RIVER COMMUNITIES



7.5 Notes to Section 7.0

1. B.P. Exploration Canada Ltd., Stage I Preliminary Impact Assessment.
2. Stanley Associates, Village of Chetwynd Survey and Analysis.
3. Ibid.
4. Ibid, p. 28.
5. Ibid. p. 30.
6. Environment and Land Use Committee Secretariat, B.C. Town's Study.
7. Stanley Associates, Chetwynd Community Plan.

8.0 SUMMARY AND CONCLUSIONS

Coal reserves in Northeastern British Columbia are very extensive and generally of a higher quality than reserves elsewhere in the province and other, competitive sources of coal including the United States and Australia. However, northeast coal is not readily accessible to markets and production costs are high due to complex geological formations and geographic isolation.

Costly infrastructure investments are necessary to move large volumes of coal to export markets. Total investment in road, rail, townsite and port facilities may be as high as \$2.0 billion to meet the requirements of full development. However, selective development of some properties on a smaller scale is feasible without major infrastructure investments.

The combined annual production of all of the proposed projects totals 11.3 million tonnes per year at full production. Of this total the largest single project is Quintette Coal with a proposed annual production of 5.0 million tonnes. Other large scale proposals include British Petroleum Limited, 3.0 million tonnes per year; and Utah Mines, 2.3 million tonnes per year. Even at the maximum proposed level of production reserves in the Peace River Coalfield are sufficient to sustain operations for at least 25 years.

8.1 Regional Impacts

The potential impact of coal development is of a great magnitude and would profoundly affect the economic, demographic and social structure of the region as well as impacting the physical environment. If all the potential developments were to take place, the full development scenario, total direct employment would exceed 4,300 jobs. Indirect and induced employment given this level of direct employment is estimated to be over 2,100 jobs resulting in total employment, directly and indirectly attributable to coal development, or approximately 6,500 positions. This figure does not include the temporary impacts of the construction workforce in the pre-production phase of the operation. The population increase associated with this level of development is nearly 15,000 and the annual wage bill is upwards of \$0.1 billion.

Other development profiles involve a smaller scale of development and hence total employment would not be as great. For example, the minimum development profile - development of Sukunka to 2.0 million tonnes per year - has a total employment impact estimated at 1,455. Although this does not really constitute a major impact when considered from a regional perspective, there will be significant local impacts, most notably in Chetwynd.

The roles of the various communities in the regional settlement system will undergo change as a result of even minimum development. Particularly affected will be Chetwynd, Hudson's Hope and Dawson Creek. Dawson Creek may decline somewhat in its capacity as regional service centre. Chetwynd may gain somewhat in this capacity although it

likely would be overshadowed by the new town of Tumbler Ridge, if it is built.

8.2 Community Impacts

Coal development will have a large impact upon Chetwynd even if it is assumed that only a minimal level of output will be produced. An increase in the level of overall production does not proportionately increase the impact on the village. In fact, in certain circumstances an increase in coal exploitation may result in a reduced impact at Chetwynd. This apparent contradiction is explained by the effects of the proposed new town on employee distribution. Tumbler Ridge is closer to the Sukunka property than is Chetwynd. The attractiveness of a shorter daily commute is sure to improve the drawing power of Tumbler Ridge relative to Chetwynd, negating the positive attractions of an established community with available housing and a wider range of services, at least in the initial stages of the new town's development. Based on a recent Coal Guidelines submission, it appears that Sukunka will be developed first.¹ As a result Chetwynd will initially absorb most of the impact but by 1982 will have become the secondary centre with respect to coal development.

The option of developing Sukunka to an output level of 2.0 million tonnes per year using Chetwynd as a base has significant growth implications for Chetwynd. Population will increase from 2,000 in 1978

to 3,100 in 1982, 4,200 in 1984 and level at about 4,700 in 1985. Full development at Sukunka could result in an additional 180 direct jobs over and above that of the first option resulting in a stable population close to 5,400. Other development profiles could have an even greater impact populationwise with the exception of Profile 1. Due to the timing of Tumbler Ridge, the population of Chetwynd will decline slightly between 1982 and 1983 stabilizing at about 2,700. Stable population under the conditions projected in Profile 4 and 5 would be 5,700 and 6,200 respectively.

The final stable population turns out to be of critical importance to the Village of Chetwynd. In assessing the capacity to accommodate growth it becomes clear there are distinct thresholds at 3,000 and 6,000 people beyond which considerable infrastructure investment is required, particularly in the water and sewer systems. Most development possibilities would necessitate heavy investment and place a significant financial burden on Chetwynd. The threshold for schools is even lower as the system is presently at capacity.

Other than the above infrastructure problems, Chetwynd is in a good position to accommodate growth up to 5,000 to 6,000. Most of the increase in demand for social services can be handled by staff additions only. That is, the increase in demand is not on a scale that involves the passing of thresholds so that for example, new buildings or other facilities are required, with the exception of education

where two or three new schools would be required. Land availability for housing should not be a great problem with many infill areas and large blocks adjacent to present development.

Aside from the physical impacts of growth there could be a host of other less tangible impacts as a result of major coal development. The economic structure of Chetwynd will be radically altered. Presently the economic structure is reasonably diversified with the economic base being mainly the forest industry with other major employers being the coal mine, B.C. Rail and the school district. Development of coal will change Chetwynd into a "single industry" town. Heavy population growth will change the character of the community. This could be resented by the established residents.

Hudson's Hope is much less likely to be directly impacted by Northeast coal developments than is Chetwynd. Only under full development conditions when the relatively marginal project of Carbon Creek comes into play is there a significant impact on Hudson's Hope. In these circumstances the population could reach upwards of 4,900 by 1986 from its present 1,300.

8.3 Factors Influencing Development

The decision to develop the coal resources of the northeast is based on expectation of profit. This in turn is related to perception of the future market for coking coal, capital costs, and production and

marketing costs. Some of these factors cannot be influenced one way or the other but policy decisions will have a good deal of impact on some of the above factors in terms of profitability of exploiting coal.

The market for coal is almost totally beyond the control or influence of the Province. Price is related to world steel output and is therefore dependent on world economic cycles because steel production tends to be indicative of general economic performance. This limits the scope and effectiveness of potential intervention measures. The Province can actively promote B.C. coal through trade missions, a process that is ongoing with regard to many of B.C.'s natural resources. The market can be monitored for signs of improvement so that a quick response is possible. Directly affecting the price or quantity demanded of coal is, however, quite beyond the capabilities of the Province of British Columbia.

There are other factors over which little, if any, influence can be exerted directly. Many of the production and capital costs are higher in northeast British Columbia because of the relative remoteness of the area and the complex geological formations in which the coal is found. The problems encountered mining coal out of the split seams found in the Peace River Coalfield are of a technical nature and hence there can be no planning solutions. Factors related to remoteness can be compensated for to a certain degree through government action however.

There are at least three facets of remoteness that have a bearing on the final cost of delivered coal. First, remoteness increases the cost of transporting the product to market. Second, remoteness will increase the operating costs of the project. Third, the capital costs likewise are increased by remoteness. All of the above factors detract from the competitive position of northeast coal on world markets by increasing its cost and reducing the profit margin.

There being no local market for northeast coal, the relative remoteness of the areas adds considerably to the costs of delivering the product to market. Spatial remoteness can be offset to a certain degree by investment in transportation facilities but this entails huge capital requirements. Required transportation facilities include road access to the mines, branchline rail access routes into the coalfields, and port facilities at Ridley Island. In addition, some improvement on the existing CNR line from Prince George to Prince Rupert are necessary. These investments would require a substantial portion of total capital invested within British Columbia during this period.

Operating costs tend to be higher for resource developments in the hinterland mainly due to higher labour costs. Although wage rates tend to be the same as in southern B.C. indirect costs are higher. Compensation may be necessary in the forms of transportation allowances, housing subsidies, recreation facilities, and others. In such situations labour turnover is invariably high because of remoteness and the higher

cost of living. The cost of labour turnover can become a substantial proportion of total operating cost because of the considerable expense of training employees.

Capital costs of northeast coal development may tend to be higher because of three related factors. The first factor, development, or pre-production, costs, will probably be higher owing to greater expense of transporting men and equipment to the minesite. Road and rail connections must be built for access to the minesite.

A larger inventory of working capital may be required as compared with operations closer to major supply centres such as Vancouver or Edmonton. Larger stocks of process supplies, replacement parts, fuel and so on must be held at the minesite because the local economy simply will not be able to supply these needs. As a result, total investment per unit of productive capacity is higher than in comparable operations with better access to such needs.

Finally, investment may be necessary in certain facilities that, in other locations, would possibly have been provided by other agencies. It is difficult to attract entrepreneurs in the commercial sectors of food, shelter, clothing, recreation and others. As a result, there is a tendency for social overhead capital investment to lag behind investment in directly productive activity. The company often finds it necessary to undertake most or all of this investment itself.

8.4 Options for the Region

This section proposes to consider which groups or institutions will benefit from coal development and also to outline some of the options for the region if maximum community benefits are to be realized. Five main "actors" have been identified as being central to the impacts of coal development. These are: the Federal Government; the Provincial Government; the respective mining companies; the people of the affected communities of the northeast; and the people of the northeast region as a whole.

The implications for these actors will be considered for each of four types of development options. These are: to postpone development temporarily or indefinitely; development on a small scale; development on a large scale but with no government investment; and, development on a large scale with government investment. The four options will be examined in turn below.

8.4.1 Delayed Development

In the absence of coal development it can be expected that trends in the region will remain pretty much as they are at the present time. Projecting these trends into the future, one can expect regional population to increase slightly although individual communities such as

Fort St. John will likely experience more rapid growth and others such as Dawson Creek may decline slightly or remain stable. Major sectors of the economy besides coal such as agriculture and tourism do not have a great deal of potential for employment creation. Likewise, forestry does not hold much potential for expansion without the infrastructure that would accompany coal development. Once in place this infrastructure would have a beneficial side effect of improving the accessibility of forestry products in the region. This raises the possibility that selective outmigration could occur as young adults entering the labour force find it difficult to secure employment in the region. Females may be particularly affected because the employment structure is male oriented, there being an emphasis on the primary sectors and a poorly developed service sector.

Certain communities would be drastically affected by coal development while others would receive only indirect impacts or spinoffs. Chetwynd will likely experience moderate growth in the absence of coal development. Independent projects such as the gas scrubbing plant and the possibility of a new sawmill or expansion of an existing one should assure this. Similarly, Fort St. John will in all probability experience considerable growth regardless of whether or not coal development proceeds because of gas projects that are not affected by coal decisions.

Hudson's Hope and Dawson Creek have both been declining in population in recent years. There are signs that population may have sta-

bilized finally however, Neither of these communities have much case to expect significant population increase unless coal development proceeds. The economic base of Hudson's Hope is tied to the operation of power facilities at the W.A.C. Bennett Dam. The operating phase of the Site One Dam will only generate an additional 15 to 20 jobs. Employment expansion in Dawson Creek is related to its role as regional supply and service centre in the absence of any significant economic development potential in the city itself.

With no development occurring the other central actors - the federal and provincial governments and the mining companies - are not really affected except to the extent of their investments in exploration, feasibility studies and so on. None of the above actors are really impacted by this possibility of delayed development, at least at the present time. Hence no one really benefits. On the other hand, no party is adversely affected either. Perhaps most regrettable is that the unemployed of the region will not gain the opportunity to enter the mining workforce. Even this is not a clearly demonstratable since the unemployed do not necessarily have the skills required in mining operations. It remains to be seen what proportion of workers would originate from outside the region or province.

8.4.2 Small Scale Development

By small scale development is meant one or two million tonnes a year in total. This would correspond to Scenario 2, development of

Sukunka to an output of two million tonnes per year. The Sukunka field is the only one that could be economically feasible at such a low rate of extraction. Other fields require larger infrastructure investments and hence are only feasible given higher levels of output.

The regional implications of small scale development are not that great but there are significant implications for the Village of Chetwynd. The employment and population related impacts have been outlined above. The significance is that Chetwynd would undergo fairly rapid growth and this carries both positive and negative implications. Positive impacts would include threshold related aspects such as better recreational facilities, increased selection of commercial goods, a diversified economic base and so on. Negative implications might include such phenomena as inflated housing and other costs, social disruption due to heavy immigration, a "boom and bust" situation associated with the construction phase of the operation and displacement of local business ventures by larger, potentially more efficient, operators from outside the region.

The economic implications of small scale coal development are not particularly significant from the point of view of the Federal Government. This is not to say that there will be no impact, but that in comparison with total federal expenditures these impacts are relatively insignificant. There are a number of ramifications for the Province of B.C., however. Although direct investment in transportation

and townsite infrastructure is not required, the Province is directly or indirectly responsible for a number of social services that will have heavy demands placed upon them. Additionally, the Province is committed through various cost sharing schemes to pick up a proportion of costs associated with expansion and improvements to physical services such as roads, water, sewer and others. This will be more or less offset by income from royalties and other taxes paid by the mining companies and its employees. All royalties accrue to Victoria while tax revenue goes to both Victoria and Ottawa.

Given the assumption that a profit seeking mining company would not choose to develop even at a modest scale unless a reasonable profit could be anticipated, it would appear that the mining company and Ottawa would be clear cut benefactors under conditions of small scale development. The mining company because they expect to show a profit, and Ottawa because they will receive some revenue yet will not be responsible for any of the expenses.

Evaluating the position of Chetwynd and the Province is more complicated because there are both positive and negative factors. Some of these factors are not readily quantifiable and others are value judgments. For example, some residents consider population growth per se as a good thing and others consider it bad. Certain of the expenses of population growth can be quantified - social and physical servicing for

example - but it is impossible to determine or evaluate the effects of a change in character of a community on its residents. To keep this question in its proper perspective it must be remembered that we are talking of an order of magnitude of change that is not overwhelming in this instance. Therefore, social disruption will not be as pronounced as under conditions of full development. Hence, in the writer's opinion, there are marginal benefits to both the Province and the Village of Chetwynd.

8.4.3 Large Scale Development with No Government Investment

Large scale development will have massive impacts on all five actors, even if governments do not take an equity position or provide some or all of the necessary infrastructure. Even at the regional level the economic structure will be altered and the impact for individual communities can be enormous. A new town would be created that would be the second largest community in the northeast. This could result in a redefinition of community roles within the region. Communities such as Chetwynd and Hudson's Hope could more than double in size in a very short time period. A situation could be created whereby established residents become alienated from the new local leadership thus losing control over the public decision-making process.

Even though the assumption is made that there is no direct government involvement, both governments will be affected by coal development of this scale. The federal government will be affected

in terms of a favourable impact on the international balance of payments and the receipt of substantial tax revenues. The provincial government will also be in receipt of revenues from royalties and other taxes but the effects on the province go much deeper than that.

Assuming there is no government intervention in other aspects of development such as hiring policies there will undoubtedly be heavy migration into the region. Even though the pool of unemployed labour presently in B.C. is greater than the numerical requirements of even full development there is a structural mismatch in terms of labour force skills and the requirements of open pit and underground mining. Despite the fact that costs associated with labour force turnover are a major component of operating costs, it is unlikely that a private firm would operate a manpower training program. Even if they would, there would not be the same emphasis on training B.C. residents that a provincially run training program would have. Furthermore, an employment survey of the northeast indicated that of the unemployed about half were willing to work in open pit operations but less than 2% were willing to work underground.² Unfortunately a large proportion of workforce requirements are underground, and this proportion increases over time. Therefore, it is almost certain there will be an inflow of labour from areas where a skilled labour pool exists. Also, with such a large project as northeast coal, there will be an influx of unskilled transients attracted by the myth of high wages in the north. However, there are no high paying jobs for unskilled workers in this region. In fact, wages are lower in the northeast than the provincial average.

Once again the assumption is made that there are net positive benefits for the private mining companies; otherwise they would choose not to go ahead with development until conditions were perceived as favourable. Given the great cost of the infrastructure requirements to move the coal to export markets this is a distinct possibility at current market prices for coking coal. In the future, if prices rise, conditions may seem more favourable.

8.4.4 Large Scale Development with Government Investment

Even though tonnage of coal extracted, total revenue, employment, income, and population impact could be the same as is the case with no government intervention, the effects on the actors can be quite different. The most fundamental difference is related to the profitability of the various projects. With total investment into the billions of dollars for full development, private companies may be unable or unwilling to raise the investment capital. Therefore, it is possible that the final decision whether or not to develop is contingent upon working out an investment sharing formula between the two governments, the mining companies and other entities such as the railroad. At least this would tend to be the case under marginal conditions of profitability.

With government involvement in the entire process beginning with the planning stages control can be exercised over coal development for the benefit of the public in general and the communities of the northeast in particular. For example, by retaining a measure of con-

trol over transportation infrastructure a multi-resource development plan can be implemented. Expansion of the forestry industry is more or less depending on the transportation infrastructure of the coal operations because forestry alone would not justify the expense. Similarly, a single multi-purpose townsite can be planned. Such a new town would be more diversified economically and generally more viable socially than would be a number of smaller new towns, one for each project.

Another significant benefit of government intervention involves manpower policies. A coordinated manpower training program could reduce the need for importing labour from outside B.C. and Canada. If northeast coal development does not result in employment for people of the region and the province, the desirability of government investment of many millions of dollars comes into question. Employment opportunity is the single most important benefit for many of the residents of the northeast. There is also increased social disruption the greater is immigration to the area, especially if the migrants are from a different culture which might be the only alternative as the number of skilled miners in Canada is far below the labour force requirements of northeast coal development.

In sum, the question of government involvement in coal development boils down to a tradeoff between the expense of investment and the degree of control that may be gained through involvement. Whether this additional control over timing, hiring policy, townsite development, transportation decisions, and other aspects justifies the expense is a political consideration.

8.5 Concluding Comments

A summary of some of the implications of the four types of development possibilities is presented in Table 8.1 below. It should be emphasized that these four development possibilities do not replace the five development scenarios generated in Section 6.2. Instead, they represent a more general classification based on public involvement in the process.

One conclusion to be drawn from Table 8.1 is that the alternative that is most capable of accommodating change and otherwise planning for coal development is large scale development with government intervention. This is particularly true if a local or regional perspective is adopted. If maximum benefits from development are to be captured in the northeast region then coordinated resource planning is essential. The Province is best equipped to undertake such a task. Policies and programs from many diverse sectors such as manpower, transportation, townsite development, human resources, education, environment and many others must be coordinated. Clearly, the private sector does not have the necessary broad perspective to accomplish such an undertaking.

Northeast coal potentially may benefit the affected communities, the Peace River - Liard Region and the Province of British Columbia as well as Ottawa and the private sector. However, this is contingent upon a competent planning process that can balance social, economic and poli-

TABLE 8.1

<u>SUMMARY OF DEVELOPMENT IMPLICATIONS</u>				
ACTOR	DELAY DEVELOPMENT	SMALL SCALE DEVELOPMENT	LARGE SCALE, NO GOVERNMENT INVESTMENT	LARGE SCALE, WITH GOVERNMENT INVESTMENT
FEDERAL GOVERNMENT	No impact	Marginal impact	Impact On balance of payments	Investment in port facilities
PROVINCIAL	No impact	Marginal impact	Revenue inflow	Transportation and community infrastruc- ture investments, planning initiative
COMMUNITIES	Existing trends	Direct im- pact on Chetwynd	Uncertain, de- pends on set- tlement policy of private sector	Planning may reduce uncertainty and social disruption
REGION	Existing trends	Marginal impact	Heavy immigra- tion of workers	More benefits to remain in region
PRIVATE SECTOR	No impact	Profit for B.P. Sukunka	Assumes plann- ing function	Not responsible for planning

tical concerns. Certainly the background studies have documented most questions relating to environmental sensitivities, efficiency criteria and many social concerns. Out of this has evolved policy related to coal development in the Northeast. Therefore, if and when conditions appear favourable for development everything will be in place and development may proceed without lengthy delays.

One possible shortcoming in this process may be the institutional framework for planning. There is no one agency that is responsible for the planning function. Instead what could be called a referral approach is utilized whereby line agencies, each responsible for delivery of a particular service or function, are kept in touch with each other. Perhaps it would be well advised to develop an institutional arrangement specifically with this end in mind. This end however, could well stand on its own as the focus of a separate study. Given the possibility that coal development may not take place for a number of years, it could prove to be a worthwhile effort. An efficient planning agency could reduce many of the unnecessary delays that are so costly to the developer yet do not necessarily benefit any other entity.

8.6 Notes to Section 8.0

1. B.P. Exploration Canada Ltd., Stage I Preliminary Impact Assessment.
2. Cornerstone Planning Group, Northeast Coal Employment Survey, p. 42.

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