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THE IMPACT OF DIVISION ON DISTRIBUTION OF NWR NON-RENEWABLE RESOURCE WEALTH

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THE IMPACT OF DIVISION ON DISTRIBUTION

OF NWT NON-RENEWABLE RESOURCE WEALTH

By: Marvin Shaffer and Associates

ERRATA SHEET

1. **Page 87**, Table **4.9** -- Total resources for the East should read 889 $10^6 m^3$ for oil and 2488 $10^9 m^3$ for gas.

2. Page 90, Table 4.11 -- Total resources for the East should read 2160 $10^6 m^3$ for oil and 4209 $10^9 m^3$ for gas.

3. Page 92, Table 4.12 -- The % of total NWT Gas Reserves accruing to the East under Boundary Proposal 5 should read 74.

4. Page 93, Table 4.13 -- The % of total NWT Oil Resources at 50% level accruing to the East under Boundary Proposals 4, 1a, 2a, and 3a should read 36.

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IMPACT OF DIVISION ON DISTRIBUTION OF NWT NON-RENEWABLE RESOURCE WEALTH

Prepared for

The Western Constitutional Forum

by

MARVIN SHAFFER & ASSOCIATES. LTD.

August 1984

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Impact of Division on Distribution of Northwest Territories Non-Renewable Resource Wealth

1.0 INTRODUCTION

1.1 Background and Purpose

As a result of a 1982 plebiscite in which a majority of Northwest Territory residents voted in favour of dividing the Territories into two political jurisdictions, an Alliance of Western and Nunavut Constitutional Forums was established to develop specific boundary proposals which can be submitted to the public for consideration and approval.

The Alliance has agreed that a major objective for division and boundary selection is that the two resulting jurisdictions should have the political and economic potential to evolve toward provincial status. ' One of the principles that has been agreed upon in this regard is that the new territories should have reasonable prospects for eventual economic viability over the short and long term, taking into consideration land mass and renewable and non-renewable resource potential.

A complete assessment of the economic viability of the two emerging jurisdictions would require an examination of the full economic consequences of division, including consideration of the following questions:

- how will division distribute and affect overall economic activity and potential in the NWT;
- how will division distribute and affect government revenues;
- how will division distribute and affect government service delivery, infrastructure requirements and costs?

This study does not attempt to answer these questions. Rather, the purpose of this study is to provide background information on non-renewable resource wealth in the Northwest Territories, and the related revenues and employment they may generate, in order to assist the Alliance in assessing how these resources and potential revenues will be distributed by division. The implications of a base case and alternative set of boundaries are specifically addressed.

Non-renewable resources (oil, gas, minerals) are not the only resources of economic significance in the Territories, nor in terms of on-going, stable employment are they necessarily the most important. They are, however, potentially very important sources of government revenues and of short to medium term high-income employment opportunities. How they will be distributed by division will have an important bearing on how economic activity and government revenues will be shared.

1.2 Organization of Report

This study is divided into two main parts. The first part, encompassing sections 2, 3 and 4, contains a review of the inventory of mineral and oil and gas resources in the Northwest Territories and an assessment of how these resources would be distributed by alternative boundary proposals. The principal sources for the inventory estimates are data compiled by the Department of Indian and Northern Affairs for minerals and by the Canada Oil and Gas Lands Administration for oil and gas. Maps showing minersl and oil and gas inventories, exploration activity and the implications of alternative boundary proposals are located at the back of the report.

The second part of the report contains an assessment of the revenue and employment potential associated with non-renewable resources in the Northwest Territories. Principal sources for this assessment include Price Waterhouse reports for minerals, and various industry and government reports for selected oil and gas developments. Specific examples are used to illustrate the potential amount of revenues that different types of resource developments might generate for the Government of the Northwest Territories or successor governments under various taxation and resource ownership regimes. Employment impacts are also addressed. No attempt is made to forecast revenues and employment in non-renewable resource industries in the Territories. Rather the objective in this section is to use selected examples in order to illustrate their potential importance as sources of revenues and employment in the region.

1.3 Report Summary

1.3.1 Mineral Inventory

Mineral reserves and resource potential in the Northwest Territories are summarized in Table 2.3 in the report. Reserves are defined to reflect ore bodies associated with existing mines, and currently include deposits of gold, silver, zinc-lead, and tungsten. Resource potential includes in-place ore that has been identified and which while not necessarily economic under current conditions, may become recoverable as economic and other conditions permit. Resource potential is much greater than reserves and includes minerals not currently being produced in the Northwest Territories, such as various base metals, copper, copper-nickel, coal, iron, uranium, lithium and others. With the major exception of uranium, estimated mineral resources are for the most part concentrated in the western region of the Territories.

Estimates of reserves and resource potential in the Northwest Territories will change over time as. new exploration identifies and, defines new deposits. Currently exploration is in decline because of poor world markets. The exploration which is taking place is largely concentrated around existing known deposits.

Over the next ten to twenty years, it is not very likely that major changes in the pattern of mineral reserves and mining activity will take place. Because of the concentration of exploration around existing deposits, discoveries which are made are most likely to reinforce existing patterns. Even if a major discovery is made in a new area, because of the long lead time between discovery and production, major shifts in mining activity could take more than twenty years to materialize.

Over the longer term, it is possible and indeed likely that significant changes in our knowledge of the resource potential of the Territories will occur. As to type and location of minerals it is impossible to predict. One could argue that new finds are more likely in the Eastern regions, because it has been subject to less exploration effort in the past. On the other hand, the greater accessibility and exploration effort in the Western regions could maintain, for many years, a disproportionate share of mineral discoveries and potential.

1.3.2 Oil and Gas Inventory

Oil and gas reserves and resource potential in the Northwest Territories are summarized in Table 3.2 and 3.3 of the report. It should be noted that the reserve and resource definitions are not exactly the same as for minerals. Reserves are defined as rigorously quantified amounts of oil and gas that are currently economical to produce. Resources are based on probability of discovery and recovery, estimated at different probability levels. Oil and gas resource estimates, particularly at the lower probability levels, are more speculative than mineral resource estimates.

As shown in Table 3.2 and 3.3, there are large oil and gas reserves and resource potential in the Northwest Territories. Onshore oil and gas reserves are concentrated in the Mainland and Mackenzie/-Beaufort areas. Offshore reserves are concentrated in the Beaufort and Arctic Islands area. With respect to resource estimates, the largest potential, for both oil and gas, are shown for the Beaufort and Arctic Islands areas. The potential in these areas is very large, almost ten times as great as estimated reserves (at the 50% probability level).

The future development of the oil and gas resources is highly uncertain, depending on the results of continuing exploration, the development of transportation systems and prices in potential markets. In the near term, more intensive activity along the Mackenzie Valley may occur as a result of the completion of the Norman Wells line. Extension of the line to Tuktoyaktuk may occur, providing some stimulus to continued efforts in the Mackenzie-Beaufort area. Large scale efforts in the Beaufort, however, may not continue unless exploration results are more promising. Arctic Islands is a very important source of oil and gas, though because of its high cost, major development will probably be deferred for some time into the future.

1.3.3 Implications of Boundary Alternatives

Five main alternative boundary divisions and four sub-alternatives have been hypothesized for purposes of this study (see Figure 5). The Base Case is essentially an extension of the Saskatchewan/Manitoba border to the North Pole and divides the Territories roughly in two. The other four main alternatives move the middle portion of the boundary successively to the West. The three sub-alternatives la, 2a, 3a shift the northern portion of boundary proposals 1, 2, and 3 from a line running north from Melville Sound to the Pole to an east-west line running to the Yukon/NWT border. The sub-alternative 5a extends boundary 5 westward to the NWT/Yukon border, resulting in most of the Mackenzie Delta and all of the Beaufort north of the NWT being included in the East.

The implications of these boundaries on the distribution of mineral and oil and gas potential is shown in Figure 6 and 7 and in Tables 4.1 through 4.12 in the report.

With respect to minerals, most of the existing mines (7 out of 10), the overall majority of deposits and by far the greatest share of reserves and resource potential for precious metals, lead-zinc, polymetallic deposits, copper, tungsten and rare earths would be located in the West, regardless of the boundary chosen. The East would contain the largest share of uranium, iron and copper-nickel resources, although the regional disparity for the latter two types of deposits would not be as great as for the other minerals listed above. Coal resources are distributed relatively equally under all boundary proposals. One mineral for which the distribution is sensitive to the boundary is copper-nickel in the Coppermine area. The share of this resource shifts dramatically to the East in the case of alternatives 3, 4, and 5. The distribution of mineral resources in sub-alternatives la, 2a, 3a, and 5a is the same as for the proposals 1, 2, 3, and 5, respectively.

It is expected that the distribution of mineral resources and benefits generated by them would not be altered greatly in the fore-seeable future (eg. 10-20 years) because of the current concentration of exploration around existing mines and known deposits; the long lead time between exploration and actual production; and the more highly developed transportation and infrastructure in the West. Projections over the very long term are much more uncertain because of the possibility of unexpected discoveries (particularly in the East where exploration has generally been less intensive) or of significant changes in the economics of particular minerals related to world supply/demand, transportation access or mining technology.

With respect to the distribution of oil and gas reserves (see Figure 7) there are basically four distinct groups of boundary pro-posals - (i) Base Case and Alternatives 2 and 3; (ii) Alternative 4, la, 2a and 3a; (iii) Alternative 5; and (iv) Alternative 5a. For the first group, most of the hydrocarbon reserves (i.e. 81% of oil and 82% of gas reserves) and resources (i.e. 84% of oil and 79% of gas resources)(1) would be located in the West. However, unlike for minerals, moving the boundary further to the west would result in a significant shift in the East's share, particularly with respect to gas reserves and potential. This is because of the importance of the off-shore and Arctic Islands natural gas potential. In alternative 4 and sub-alternatives 1a, 2a and 3a the majority of oil reserves and resources would still be in the West but gas reserves and resources would be distributed about 50/50. Under Alternative 5, the West's share of oil and gas reserves would decline to 62% and 26%, respectively. Its share of oil and gas resources (at the 50% probability level) would decline to 61% and 45%, respectively. Under Alternative 5a, the shift to the east would be very dramatic. The west would contain only 22% of the oil and 5% of the gas reserves, and 4% of the oil and 7% of the gas resources (at the 50% probability level).

1.3.4 Revenue and Employment Implications

Mining is currently an important generator of economic activity, accounting in 1980, for 2076 direct jobs plus related indirect and spinoff employment. Direct government revenues for mining totalled $38.7 million of which some $8.7 million accrued to the GNWT.(2)

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(1) At the 50% probability level. At the higher (95%) level the West would contain 50% of the oil and 45% of the gas resources.

(2) This is a measure of the gross return to government. The net return, after deducting infrastructure and other costs directly attributable to mining, would, of course, be less.

To illustrate the potential revenues from new mining projects, a hypothetical uranium mine and a gold project are analyzed. The results show that substantial rents (i.e. net revenues over and above all costs, including return on capital) can be generated by such projects. Under current taxation arrangements, however, a relatively low proportion of these rents are appropriated by governments. The magnitude of Federal mineral royalties is such that simply transferring these revenues to the GNWT through resource ownership would not provide GNWT with large revenues.

If the NWT were to obtain provincial status and were to institute one of the more aggressive royalty schemes, the revenue potential would be significantly increased. The hypothetical uranium mine, for example, would generate $190 million in tax revenue to the GNWT (in present value terms over the life of the mine); the hypothetical gold project would generate $7 million over its life.[1] (By comparison, under the current taxation regime, the GNWT would receive $40 million and $2 million for these two projects respectively.)

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(1) The marked difference in the potential returns from the uranium and gold mine analyzed in this study may overstate the actual difference in revenues realizable from these two minerals. The gold mine hypothesized for analysis was of average size and grade, whereas the uranium mine was very large. Also the price assumption for gold could be considered conservative, whereas for uranium it could be considered optimistic. Nevertheless the point still remains that uranium will generate significantly more revenues on a per unit of output basis, illustrating why a simple comparison of physical inventories will not, by itself, indicate which region will derive more economic benefits from mineral resources.

If resource ownership is transferred to the GNWT, a policy choice will have to be made as to the aggressiveness with which to pursue resource rents. Against the value of increasing direct revenues from resources must be balanced the desire to provide an incentive for firms to explore for and develop mines in the north. This would provide employment, directly and through spinoff effects, and would increase GNWT revenues through income and other taxes.(1) It is estimated that the uranium mine considered would result in 538 direct jobs during operation, and that the gold mine would provide 155 jobs during operation. Tax revenue and employment potential for other lower-valued minerals was not analyzed in detail but could be significant because of large tonnage throughputs involved.

Employment and tax revenue benefits from existing and potential mineral developments would accrue more to the West regardless of the boundary chosen. This disparity, particularly in terms of tax revenues, could be offset to a large degree if uranium deposits in the East were developed, because of the substantial rents generated by this mineral.

With respect to oil and gas, current activity is limited to relatively small scale production at Norman Wells and at Pointed Mountain: The most employment intensive activity is currently exploration, providing approximately 2400 jobs in 1982.

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(1) The magnitude of impacts on territorial employment and revenues would depend on the proportion of the direct and indirect income which is earned by NWT residents (as defined by the income tax regulations) and on the extent to which the mine purchases goods and services in the north. Those mines which operate on a fly-in-fly-out basis would have little impact on territorial employment and income.

Oil and gas offer significant revenue potential, much greater than minerals. Analysis of proposed Beaufort Mackenzie oil production shows that large revenues will be available, particularly under the high production scenario. Under the current taxation regime, little of these revenues will accrue to the GNWT but they are still relatively large in absolute terms (a total present value of $.9 billion for the high production scenario; $.09 billion for the low production scenario). Under provincial status, however, GNWT revenues would be greatly increased ($11.3 billion for the high production scenario; $1.2 billion for the low production scenario).

Under boundary alternatives 1, 2, and 3 the West would receive most of the tax and employment benefits from oil and gas resources. Under boundary alternatives la, 2a, 3a, 4, and 5, the West would receive most of the tax and employment benefits from oil resources (defined at the 50% probability level) (1), and the East would receive most of the tax and employment benefits from gas resources. Under boundary alternative 5a, the East would receive by far most of the tax and employment benefits from both oil and gas resources. The timing of the benefits would be very different. The West's share in the Mackenzie Valley and Delta areas will accrue more in the near and intermediate term. Its share in the Beaufort will accrue in the intermediate to long term. The East, dependent on the development of Arctic resources, would realize its benefits in the more distant future.

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(1) Of the resources defined at the 95% probability level (that is, expected with a much greater degree of certainty), the estimated oil resources are divided more evenly between East and West in these boundary alternatives.

2.0 MINERALS

2.1 Introduction

2.1.1 Overview of the Geology and Mineral Potential of the NWT

The mineral potential of the Northwest Territories is reflected in the structural "provinces" which are large areas containing rocks that are of similar age and have undergone similar geological events. There are 7 major geological areas in the NWT. The Slave/Bear areas in the central NWT contain most of the gold and silver mines and deposits in the NWT and also have significant base metal (especially copper) and other minerals such as beryllium and tantalum. The Interior Platforms lying to the west of the Slave/Bear areas and among the Arctic Islands contain all of the existing lead-zinc mines in the NWT, extensive lead-zinc and coal deposits and an important rare earth deposit. The mountainous Cordilleran area on the NWT-Yukon border contains the existing tungsten mine and the huge Mactung deposit as well as large lead-zinc, copper and coal deposits. The Churchill area lies east of the Slave/Bear areas and encompasses all of the Keewatin District and a large part of Baffin Island. Much of the mainland portion of the eastern boundary area alternatives are dominated by the Churchill geological Province. There is one gold mine at Cullaton Lake in this area and it also contains important uranium and iron deposits.

Mineral potential in the Innuitian and Coastal Plain areas in the Arctic is not well known.(1) They are, however, known to be important for their oil and gas potential. A map of these geological areas is shown as Figure 1.

2.1.2 Overview of World Supply/Demand and Outlook for Selected NWT Minerals

To give an indication of the significance of the various minerals found in the NWT a brief outline of world supply and demand, the importance of Canada and NWT as suppliers, trends in end uses and long term outlook for each of these minerals is presented below. World mineral markets and prices are just now recovering from recessionary conditions experienced in 1981-82. The short term outlook for most minerals is for an upswing in prices and demand as the world economy recovers. For most minerals, except precious metals such as gold and silver, new developments in other parts of Canada and elsewhere in the world have a clear advantage over deposits in the NWT because of easier access, greater proximity to markets and infrastructure already in place. In order to overcome these disadvantages, deposits in the NWT have to be of exceptional size and quality.

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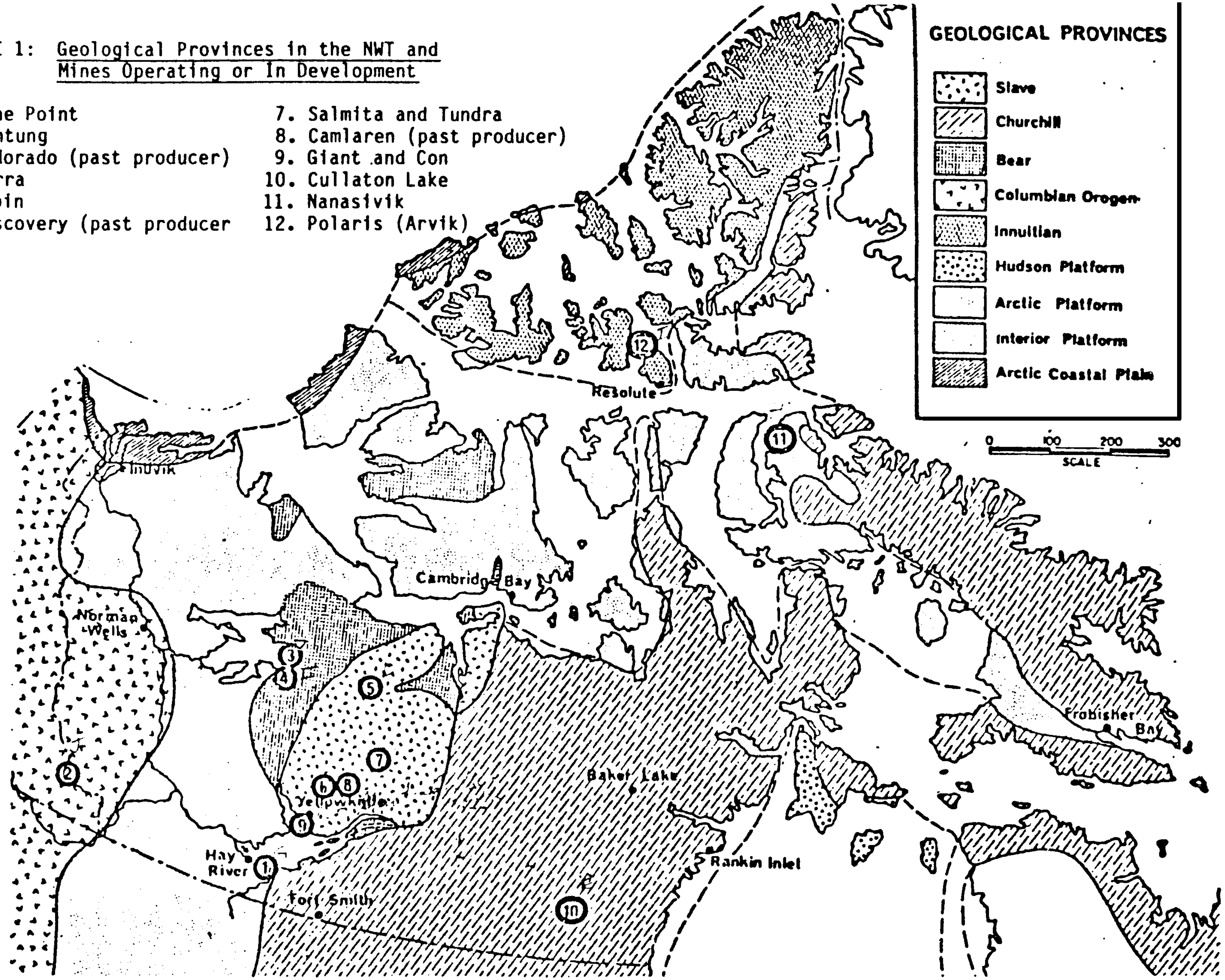
(1) With respect to the Coastal Plain, the geology is such that significant deposits are not expected to be found. With respect to the Innuition, there has been little exploration and very little is known about the underlying geology and long term potential.

FIGURE 1: Geological Provinces in the NWT and Mines Operating or In Development

1. Pine Point	7. Salmita and Tundra
2. Cantung	8. Camlaren (past producer)
3* Eldorado (past producer)	9. Giant and Con
4. Terra	10. Cullaton Lake
5* Lupin	11. Nanasivik
6. Discovery (past producer	12. Polaris (Arvik)



(a) Gold

South Africa accounts for most of the world production of gold, about 68% in 1981. The NWT accounted for only about 0.5% of world production in that year. Over 1,000 tonnes of gold were purchased for jewellry, coin and industrial (e.g. electronics, dentistry, chemicals) purposes in 1981. Traditionally, gold has also served as a hedge against inflation and as a store of value.

Since the formal monetary link to gold was abolished by the U.S. in 1971, free market gold prices have been cyclical and subject to speculative activity but the period and the economic and political causes of price cycles have not been clearly established. There does appear to be an inverse relationship with interest rates and the international exchange value of the U.S. dollar. Current prices of about $14/gram (U.S.) are high enough to sustain existing NWT gold operators. In fact, several new mines have come on-stream in the NWT in recent years. A major advantage of gold is that unit prices are high enough to warrant air transpiration, thus mitigating the major constraint on most other potential mineral deposits in the NWT - accessibility. Gold exploration activity in the NWT is down from peak levels in 1980-81 but continues fairly strongly in anticipation of an expected upswing in prices and in reaction to the recent Hemlo discovery in Ontario.

(b) Silver

The U.S.S.R., Mexico, Peru, Canada and the U.S., in that order, accounted for about 61% of world silver production in 1981. The NWT accounted for about 0.3% of total world production in that year. Silver is used in a wide range of applications in the photographic and electronic industries, for electroplate ware and for brazing alloys and solders. Research is ongoing continuously for the development of new applications and future demand for silver is expected to be strong because of its superior characteristics. However, electronic technology currently being developed in the photographic industry may have a negative impact on silver demand in the future. Speculation will continue to play a major role in determining silver prices.

(c) Lead

The U.S. is the single largest producer of lead in the non-communist world, accounting for about 26% of refined output in 1981. Canada ranked sixth in lead production, accounting for about 6% of output in 1981. The NWT accounted for about 24% of total Canadian lead mine production in 1981.

The major uses of lead are for lead-acid batteries and gasoline additives. Further technological improvements in battery life, decreasing engine sizes, impact of environmental legislation on additive usage and increased competition from scrap recycling and among producers is expected to continue patterns of oversupply, price instability and increasing market competition.

(d) Zinc

Canada is the single largest producer of zinc in the western world, accounting for about 25% of total mined output in 1981. The NWT accounted for almost 20% of total Canadian mining output in that year. The major uses for zinc are in galvanized metal and automobile manufacturing. In recent years there has been a downward trend of zinc consumption in these markets due to the trend toward smaller vehicles and substitution of other materials and techniques. The use of galvanized steel and zinc-rich paints in automobiles to improve corrosion resistance is expected to increase. However, the use of "galvalume" an aluminium-zinc alloy coated sheet product could significantly reduce the zinc usage in galvanizing, the largest market for zinc.

(e) Tungsten

Canada is among the top producers of tungsten in the non-communist world, accounting for about 11% of total ore and concentrate output in 1982. However, the People's Republic of China and the U.S.S.R. are the largest producers of tungsten in the world.

Ore production from these countries was over 8 times that of Canada’s output in 1982. Nearly all of Canadian production comes from Canada Tungsten Mining Corporation Limited at Tungsten, NWT.

The main uses for tungsten include tungsten carbide, tungsten bearing steels, super-alloys, mill products and chemicals. End use applications for tungsten do not appear to be threatened by substitutes nor technological change. In fact, development of new “super-alloys” containing large amounts of tungsten could significantly expand the demand for this metal. The outlook for tungsten will depend very heavily on the current efforts of the many producing/exporting countries to co-ordinate production and stabilize prices.

(f) Copper

Canada accounted for about 9% of total world output of mined copper in 1981 with the U.S., U.S.S.R. and Chile all ranking higher as producers. Most uses of copper are dependent on the metal’s high electrical conductivity and ability to withstand high temperatures. About half the copper consumed is for electrical uses such as wire and cable. Other major uses include industrial machinery, heat exchangers, turbines, locomotives and the manufacture of brass. There is some concern about the longer term implications of fiberoptic development for copper demand in communications uses. In the past, copper markets have been characterized by periods of oversupply and price instability.

(g) Iron Ore

The USSR is the world's single largest producer of iron ore accounting for an estimated 28% of world output in 1981. Canada ranks as the sixth largest producer with less than 6% of total world output in 1981. All iron ore goes into the production of iron and steel and associated end products. In recent years there has been a reduction in "steel intensity" due to the decreasing size and weight of automobiles and other technological changes such as the development of alloys.

(h) Nickel

Canada is the single largest producer of nickel in the world, accounting for about 12% of world output in 1981. Nickel is used in a wide range of applications including stainless steel (which accounts for about 50% of consumption), nickel base alloys, electroplating, alloy steels, foundary and copper base alloys. The proportion of nickel used in stainless steel has been growing steadily in recent years. Relatively new end uses which may contribute to increased nickel consumption in the future include pollution abatement equipment, copper-nickel alloy hull-plating for boats, electric car batteries and solar applications.

(i) Coal

Canada is one of the largest coal producers in the world. About 60% of output is consumed within the country, primarily in coal-fired thermal power plants in Alberta, Saskatchewan, Ontario and the Maritimes; the remainder of Canadian coal output is exported, primarily to Japan, Korea and Brazil for coking purposes. Even pessimistic forecasts of demand indicate relatively strong, long term growth prospects, particularly for thermal and metallurgical coal exports to Pacific Rim countries. However, over the next ten years, and possibly longer, new development potential will be limited because of the large coal and related transportation developments or expansions which are underway or planned in Western Canada and in other parts of the world to serve domestic thermal electric plants and export markets.

(j) Uranium

Canada is the second largest uranium producer in the western world, accounting for about 18% of world supply in 1981. Virtually all of uranium production goes to the nuclear power industry. Current surpluses in uranium supply are expected to continue for most of the 1980's and the longer term outlook depends very critically on the cost competitiveness of nuclear power versus other sources of electricity supply and on the ability of the industry to deal with public concerns about environmental and health hazards.

2.2 Summary of Existing Mines in the NWT

Table 2.1 summarizes the type of mineral, owner, location reserves/grades, average 1982/83 production, milled throughput and employment for each of the operating mines in the NWT in 1982/83.

Eight mining companies treated ores from 12 mines at 10 milling plants in the NWT during 1983. The continuing recession and low prices for most metals resulted in the temporary closures of the Pine Point (lead, zinc) and Cantung mines during this year. Operations at the two lead-zinc mines in the High Arctic, Polaris (sustained production began in 1982) and Nanisivik, continued during 1983 although profits of both companies were adversely affected by low base metal prices. Giant Yellowknife cut back gold production 25% to extend the mine life and the Eldorado mine was closed in March, 1982 due to lack of reserves. The impact of world-wide recession on precious metal demand and prices has not been as severe as for base metals, and in fact, production of precious metals has increased in the NWT over the past several years.

TABLE 2.1

Summary of NWT Operating Mines: 1982/83[a]

Mine	Owner	Minerals	Location	Milled (1982/83) (tonnes)	Production (1982/83)[b] (tonnes)	Reserves & Grades[c] Minehead (1983)	Average # Employees (1982)
A. Con	Cominco Ltd.	Gold, silver, arsenic trioxide	1.4 km S of Yellowknife	1982 - 212,600 1983 - 188,000	1982 - 2.471 Au; .494 Ag 1983 - 2.300 Au; .462 Ag	1,700,000 t; 16.1 g/t Au	309
B. Giant	Giant Yellowknife Goldmines Ltd.	Gold, silver, arsenic trioxide	2.4 km N of Yellowknife	1982 - 366,123 1983 - 300,000	1982 - 2.250 Au; .459 Ag 1983 - 1.940 Au; .450 Ag	590,000 t; 8.22 g/t Au	343
C. Salmita	Giant Yellowknife Goldmines Ltd.	Gold	250 km N of Yellowknife	1982 - -- 1983 - 29,200	1982 - -- 1983 - .740 Au	111,000 t; 26.7 g/t Au	
D. Lupin	Echo Bay Mines Ltd.	Gold, silver	400 km NE of Yellowknife	1982 - 199,300 1983 - 325,000	1982 - 1.626 Au 1983 - 3.300 Au; 130 Ag	2,800,000 t; 13.6 g/t Au	227
E. Cullaton Lake	Cullaton L. Gold Mines Ltd.	Gold, silver	Cullaton Lake area, Keewatin	1982 - 65,911 1983 - 92,000	1982 - .695 Au; .032 Ag 1983 - 1.350 Au	110,000 t; 17.14 g/t Au	138
F. Terra (Silver Bear, Norex, Smallwood)	Terra Mines Ltd.	Silver, copper, lead, zinc	15 km S of Great Bear on Camsell R.	1982 - 36,100 1983 - 49,500	1982 - 28.4 Ag 1983 - 32.9 Ag	63,000 t (estimate)[d]	78
G. Pine Point	Cominco Ltd.	Lead, zinc	Pine Point	1982 - 2,200,000 1983 - 900,000	1982 - 64,322 Pb; 152,791 Zn 1983 - 26,000 Pb; 62,000 Zn	31,000,000 t; 2.4% Pb 6.1% Zn	622
H. Nanisivik	Nanisivik Mines Ltd.	Lead, zinc, silver, cadmium	29 km NE of Arctic Bay, Baffin Island	1982 - 634,000 1983 - 622,000	1982 - 9,379 Pb; 74,791 Zn; 21 Cd; 30.160 Ag 1983 - 6,175 Pb; 53,900 Zn; 23.8 Ag	3,760,000 t; 10.5% Zn; 0.8% Pb.	208
I. Polaris	Cominco Ltd.	Lead, zinc	100 Km NW of Resolute	1982 - 469,700 1983 - 760,000	1982 - 35,649 Pb; 93,331 Zn 1983 - 31,800 Pb; 116,500 Zn	11,240,000 t; 3.6% Pb; 11.9% Zn	222
J. Cantung	Canada Tungsten Mining Corp. Ltd.	Tungsten	Tungsten	1982 - 333,100 1983 - 16,290	1982 - 3,600 WO_3 1983 - 279 WO_3	2,742,000 t; 1.32% WO_3	246

Source: ________________ Geology

(a) The Eldorado mine at Port Radium produced 3,971 tonnes of silver in 1982 but ceased production in 1983.
(b) Production figures from Mines Inspection Services, GNWT. 1983 figures are extrapolated from September.
(c) Reserve/grade figures based on company annual reports for 1982 minus 1983 production. Does not include new reserves found in 1983.
(d) W.A. Gibbons, Mining Developments, Mineral Inventory and Metallogenic Models: Arctic Regions, NWT, Canada, December, 1982.

Gold production commenced at the Salmita mine in August, 1983 (incorporating the inactive Tundra mill and mining property) and mill capacity at the Lupin gold mine (opened in 1982) was increased by 70% due to successful operations. Cullaton Lake (gold) was also brought to full production in January, 1983. After a successful two year exploration program Terra Mines announced plans to double the milling capacity of its silver operation. The locations of operating existing mines in the NWT are shown in Figure 1. All except the Polaris and Nanasivik lead-zinc mines in the Arctic and the Cullaton Lake gold mine in the Keewatin, would fall in the western area of the NWT regardless of which boundary alternative was chosen.

2.3 Mineral Reserves and Resource Potential in the NWT

2.3.1 Inventory of Mineral Deposits

An inventory of individual mineral deposits in Yukon and NWT has recently been compiled by DIAND.(1) This inventory, including data compiled from other sources and contacts, is listed in Table 2.2 below and shown in Figure 2 at the back of the report. Based on this mineral inventory documentation and discussions with DIAND officials in Yellowknife and Ottawa, a number of points emerge with respect to the economic viability of these deposits.

A number of gold and silver mines in the NWT are likely to come onstream in the 1980's (eg. possibly Ptarmigan (24), Shear Lake (29), Bullmoose (31), Thompson-Lundmark (33)).(2) As the mineral inventory shows, however, many gold and silver mines have been relatively short-lived or intermittent producers. production is planned at Mactung (the largest known tungsten deposit in the world) in the late 1980's. A recent beryllium discovery at the Thor rare earth deposit (138) in the Pine Point area may also be developed within the near future. Most base metals such as lead, zinc, copper, iron and moly-

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(1) Mines and Important Mineral Desposits in the Yukon and Northwest Territories: 1982, D.D. Brown, T.W. Caine, DIAND, November 1983. Draft. Contents subject to revision. We have excluded some of the less important deposits for which reserve tonnage estimates are unknown.

(2) Numbers in brackets refer to the deposit numbers shown in Table 2.2 and Figure 2.

bdenum and nickel are generally too low valued to warrant the access, infrastructure and mine development and transportation costs associated with them unless metal prices are substantially higher in real terms than current levels. Also, long term trends such as the development of substitutes and environmental regulations may negatively affect traditional end uses for copper, lead, zinc and iron. Metals such as nickel and molybdenum probably have better long term market prospects, but again access, transportation costs and the existence of lower cost deposits elsewhere in the world are constraints. The most promising base metal deposits in the NWT are Prairie Creek (66), Eclipse (49), Slave Reef (50-52) (lead-zinc); Borealis (103,104), Mary River (110) (iron); Coates Lake (70), Ferguson Lake (78) (copper, copper-nickel).

There are very large deposits of coal in the NWT, but as indicated above, there are already a number of developments planned or underway in southern Canada and throughout the world which can produce and deliver coal at much lower cost. The largest and most promising coal deposits in the NWT are the Brackett Basin (87) and Slidre Fiord (96) deposits. There may be the possibility of uranium development in the NWT, particularly the Lone Gull deposit .(119) near Baker Lake. Uranium is a very high-value metal but the existence of a number of other rich deposits elsewhere in Saskatchewan, Australia and South Africa and the long term political and economic uncertainty associated with nuclear power constrain uranium development potential in the NWT.

TABLE 2.2

Inventory of Northwest Territories Mineral Deposits[a]

1. Precious Metals

Gold

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
ARCADIA (1)	Canuc Resources Limited Arcadia Exploration Limited	NTS 76M-11 LAT 67°41′44″ LONG 111 °2?′28″	Gold 9.6 g/t	0.806 million	Average width of 4.4 m. Northern Miner, Dec. 2, 1982.
ARSENO (2)	Nationwide Minerals Limited	NTS 86B-6 LAT 64°16′30″ LONG 115″12′ 30″	Gold 15.8 y/t	0.11 million	National Mineral inventory
BUGOW (3)	n.a.	NTS 850-4 LAT 63″14′ LONG 115″40′	Gold 5.14 y/t	0.050 million	National Mineral Inventory
CAMLAREN (4)	Discovery Mines Limited Camlaren Mines Limited	NTS 85I-14 LAT 62°59′05″ LONG 113 °12′05″	Gold 19.9 g/t Silver n.a.	unknown	Past producer, 1962-63, 1979-81. Produced 1 ,017.7 kg gold and 311.9 kg silver from 58,111 + of ore. Mineralization open at depth below 305 m depth. National Mineral Inventory and INA files
COLOMAC/ HYORA (5)	Johnsby Mines Limited	NTS 86B-6 LAT 64°23′55″ LONG 115 °05′08″	Gold 1.82 g/t or 2.94 g/t	18.1 million 11.8 million	Reserves by Cominco Limited in 1974 for larger figure and 1946 for smaller tonnage but higher grade. National Mineral Inventory.
CRESTAURUM (6)	Northbelt Yellowknife Mines Ltd. (Giant Yellowknife Mines Ltd.)	NTS 85I-9 LAT 62°35′ LONG 114″21′ 10″	Gold 18.86 y/t	0.091 million	Reserves to 122m depth. National Mineral Inventory.
DAF (7)	n.a.	NTS 85J-14 LAT 62 °54′21″ LONG 113 °13′58″	Gold n.a. Silver n.a.	Unknown	Past producer, 1947-48. Produced 8.43 kg gold and 0.89 kg silver from 278.5 t. National Mineral Inventory.
DELORO (8)	Angelo United Development Corp.	NTS 85 N-8 LAT 63″21′05″ LONG 116″18′ 15″	Gold 13.7 g/t	0.046 million	Tonnage to 152 m and excludes 20,975 t grading 12.5 g/t Au in crown pillar (1981 annual report). Semi-portable milling plant under consideration in 1979.
DISCOVERY (9)	Discovery Mines Limited	NTS 85 P-4 LAT 63 °11′12′4 LONG 113 °53′30″	Gold 20 g/t (1946) 28.1 g/t (1966)	Unknown	Past producer, 1949-68. Tonnage in 1966 was 0.173 million t. Produced 32,004 kg gold from 937,138 t of ore. National Mineral Inventory
GAB (10)	n.a.	NTS 85 P-4 LAT 63°06′10″ LONG 113 °32′30″	Gold 15.1 9/t (diluted)	Unknown	Vein 90m long, 1m wide and to a depth of 26m. National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
GOLDCREST (11)	Johnsby Mines Limited	NTS 86 B-6 LAT 64°22'42" LONG 115 °06'30"	Gold 4.94 g/t	1.16 million	Tonnage in 1945. National Mineral Inventory.
JES (12)	Ashnola Mining Company Limited	NTS 850-1 LAT 63°01'40" LONG 114 °10'10"	Gold 16.46 g/t	0.009 million	Tonnage reported George Cross News Letter, March 13, 1981.
JINGO (13)	Barons Oil Ltd.	NTS 86B-12 LAT 64"35'20" LONG 115"32' 35"	Gold 10.9 g/t	0.037 million	Tonnage calculated from 4 veins to depth of 30 m. National Mineral Inventory.
JOON (June) (14)	O. Nickerson	NTS 85I-7 LAT 62"25'07" LONG 112 °51'06"	Gold 68.6 g/t	0.002 million	Past producer, 1977-78. Tonnage from 1976. Produced 9.33 kg gold with some silver from several hundred t of ore. Gold Deposits of the NWT, by W.A. Padgham; in Proceedings of the Gold Workshop, Yellowknife, NWT, Dec. 1979.
LETA (15)	Lexindin Gold Mines Ltd.	NTS 86B-6 LAT 64 °17'12" LONG 115 °12'36"	Gold 10.6 g/t	0.068 million	Tonnage from 1947 drilling on No. 1 zone. There are 9 other zones in the area. National Mineral Inventory
MOS (16)	n.a.	NTS 850-4 LAT 63°02' LONG 115°30' 30"	Gold 4.46 g/t	0.26 million	National Mineral Inventory.
NORMA (17)	Consolidated Beaulieu Mines Limited	NTS 851-7 LAT 62"24'26" LONG 112 °54'22"	Gold 34.3 g/t	0.011 million	Past producer, 1947-48. Tonnage from 1946. Produced 1.49 kg gold from 419 t of material . National Mineral Inventory
NORRIS LAKE (18)	Granex Mines Ltd.	NTS 86 B-5 LAT 64°26'30" LONG 115 °45' 30"	Gold 7.8 g/t	0.073 million	Tonnage in 1947. National Mineral Inventory.
NORTH INCA (19)	n.a.	NTS 866-6 LAT 64°15'48" LONG 115"13' 18"	Gold 18.5 g/t	0.021 million	Tonnage in 1949. National Mineral Inventory.
NOSE (20)	Shield Resources Limited	NTS 85J-16 LAT 62"54'50" LONG 114°14'	Gold 14.5 g/t Silver n.a.	unknown	Past producer, 1967. Produced 15.1 kg of gold and 3.5 kg of silver from 1,035.1 t of ore. Mines and Mineral Activities, 1972 and G. S.C. Paper 70-70
OLO PARR (21)	n.a.	NTS 851-12 LAT 62"44' LONG 113°31'	Gold n.a. Silver n.a.	unknown	Past producer, 1963-65. Produced 7.25 k gold and 0.37 kg silver (1964 only) fro an unknown quantity of material . National Mineral Inventory.
OUTPOST ISLAND (22)	Tungsten Corp. of Canada Ltd.	NTS 85tl-11 LAT 61"44' LONG 113"28'	Gold 16.7 g/t Silver 0.13 g/t Copper 0.28% W03 0.07%	unknown	Past Producer, 1941-42. Grade based on metal recovered during life of the mine Milled 18,438 t to produce 308.1 kg of gold. Gold deposits of the NUT, by W.A. Padgham; in Proceedings of the Gold Workshop, Yellowknife, NWT, Dec. 1979.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
PENSIVE (23)	n.a.	NTS 85I-11 LAT 64 °44' 10" LONG 113°20'	Gold n.a.	Unknown	Past producer, 1939. Produced 10.9 kg gold from several thousand t of material . National Mineral Inventory.
PTARMIGAN (24)	Cominco Limited	NTS 85 J-9 LAT 62°31' 10" LONG 114 °11'50"	Gold 14.7 g/t	0.10 million	Past producer, 1941-42. Produced 370.8 kg gold from 31,234 t of ore. National Mineral Inventory. Product Ion decision postponed in 1983 because owner's existing mill at full capacity.
RICH (25)	n.a.	NTS 85 J-8 LAT 62 °27' 50" LONG 114 °18' 50"	Gold 428.6 g/t	unknown	Past producer 1935. Grade based on average assay of ore shipped in 1935. Produced 6 kg gold from 14.1 t of ore. National Mineral Inventory.
ROO (26 I	O. Nickerson	NTS 85 J-8 LAT 62°29'50" LONG 114"26'	Gold 39.4 g/t	0.002 million	Past producer, 1978-79. Reported production of 0.47 to 0.62 kg gold from 10.9 t of material. Gold Deposits of NWT by W.A. Padgham; in Proceedings of the Gold Workship, Yellowknife, NuT, lee. 1979. National Mineral Inventory.
RUTH (27)	Comi nco Limited Hidden Lake Gold Mines Ltd.	NTS 85I-7 LAT 62 °27'45" LUNG 112"34' 15"	Gold 67.2 g/t	0.002 million	Past producer, 1942, 1959. Tonnage and grade from 1973. Produced 16.8 kg gold and 2.8 kg silver from 704.7 t of ore. Hidden Lake Gold Mines statement of material facts (VSE) , Feb. 24, 1983.
SALMITA (28)	Giant Yell owknife Mines Limited	NTS 76D-3 LAT 64°04' LONG 111°14'	Gold 28 g/t	0.140 million	Tonnage from Northern Miner, Ott. 21, 1982.
SHEAR LAKE (29)	Cull aton Lake Gold Mines Ltd.	NTS 65 G-7,8 LAT 61°18'N LONG 98°30 ' W	n.a.	n.a.	Deposit near existing Cullaton L. mine and mill . Production planned for 1984. Northern Miner, Oec. 15, 1983
SP1OER (30)	Treasure Island Resources Corp.	NTS 86B-6 LAT 64°29'35" LONG 115"07'45"	Gold 15.5 y/t	0.072 million	Tonnage in 1980. Company prospectus, April 1, 982.
TA (Bul lmoose Lake) (31)	Terra Mines Ltd.	NTS 85I-7 LAT 62 °20'40" LONG 112°44'50"	Gold 13.7 g/t	0.002 million	Past producer, 1940-41. Produced 6.53 kg gold from 10.9 t of material grading 600 g/t told. National Mineral Inventory and statement of materi al facts (VSE), Feb. 10, 1983.
TERM POINT (32)	n.a.	NTS 55 K-1 LAT 62"08' LONG 92°28'	Gold n.a.	unknown	Past producer, 1928. Nipissing Mining Co. mined 2.7 kg gold. Mine Finders by B.C. Towns ley, 1935.
THOMPSON-LUNDMARK (33)	Thompson-Lundmark Gold Mines Limited	NTS 85I-11 LAT 62 °36'45" LONG 113 °28'15"	Gold 6.86 g/t Silver n.a.	0.053 million	Past producer,1941-43, 1947-49. Produced 2,187.8 kg gold and 428.7 kg silver from 121,537 t of ore. Reserves are in the Kim Vein. Addition reserves of 12,428 t of 5.49 g/t gold. National Mineral Inventory and Northern Miner, Jan. 27, 1983.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
TIN (34)	Consolidated Five Star Resources Limited	NTS 85 J-9 LAT 62°32'35" LONG 114 °10'55"	Gold 13.1 g/t (diluted)	0.002 million	Past producer, 1950. Produced 0.72 kg gold from 27.2 t of material. Reserves from 1981 company annual report.
TUNDRA (35) (Taurcanis, Bulldog)	Giant Yellowknife Mines Limited	NTS 76D-3 LAT 64"U2' 12" LONG 111"11'36"	Gold 7.X2 y/t Silver n.a.	0.073 million	Past producer, 1964-68. Produced 3,251.5 kg gold and 644.5 kg silver from 170 28 t of ore. National Mineral Inventory.
VIKING (36)	n.a.	NTS 85O-1 LAT 63°06 ' 18" LONG 114°03'18"	Gold 20.6 y/t	unknown	Grade of 1968. Reserves reported at 2000t per vertical metre. National Mineral Inventory.
WINTER LAKE (Bruce-Avis)(37)	Discovery Mines Limited	NTS 85 P-4 LAT 63°1 0'1 0" LONG 113"55' 20"	Gold 9.9 y/t	0.21 million	National Mineral Inventory.
WT (38)	Precambrian Shield Resources Ltd. Numac Oil & Gas Limited	NTS 85I-14 LAT 62°47'15" LONG 113"14' 10"	Gold 5.38 g/t	0.058 million	National Mineral Inventory.
Yellowknife Area					
NEGUS (39)	Cominco Limited	NTS 85 J-8 LAT 62°26' 10" LONG 114"21'	Gold n.a. Silver n.a.	Unknown	Past producer, 1939-1952. Produced 7,956.4 kg gold and 1 ,324.9 kg silver from 445,352 t. Silver production only to 1948 from 218,506 t of ore. Location close to Con Mine. National Mineral Inventory.
VOL (40)	Cominco Limited	NTS 85J-8 LAT 62°27' LONG 114"21' 30"	Gold n.a.	Unknown	Past producer, 1964-67. Produced 314.7 kg gold from 19,923 t of ore. Location close to Con Mine. National Mineral Inventory.
Silver					
Camsell River Area					
SILVER BAY (41)	Northrim Mines Limited	NTS 86F-12 LAT 65 °35'45" LONG 117"58'35"	Silver 109 g/t	Unknown	Past producer, 1971-72, 1976-79. Company in receivership in 1979. Milled 3,629 t in 1971-72 but not record of silver production. Produced 3,310.6 kg silver from 7,159 t in 1976-79. National Mineral Inventory and INA files.
HOPE BAY (42)	Hope Bay Mines Limited	NTS 77 A-3 LAT 68 °11'00" LONG 106 °32'45"	Silver n.a.	Unknown	Past producer, 1973-75. Produced 2 507. kg silver from 1,417 t milled and 9 t of hand-sorted ore. National Mineral Inventory.
Port Radium Area					
ECHO BAY (43)	Echo Bay Mines Limited	NTS 86L-1, K-4 LAT 66°06' LONG 118°00'	Silver 1,618 y/t (1976) Copper 1.1% (1976)	Unknown	Past producer, 1964-76. Produced 811.6 silver and 4,791.4 t copper from 390,21 t of ore. National Mineral Inventory, Canadian Mines Handbook and INA files.

Deposit	Owner	Location	Mineralization tirade	Tonnage (tonnes)	Comments
EL-BONANZA (44)	El-Bonanza Mining Corp.	NTS 86 L-1 LAT 66''00' 10" LONG 118°00"	Silver 318 kg/t (1935 highgrade) Copper n.a. Uranium n.a.	Unknown	Past producer, 1934-36 and 1965. Produced 938.5 kg silver from 3 t of high grade ore in 1935. Produced 272 t of stockpile material in 1965. No grade reported. National Mineral Inventory.
2. Base Metals					
Zinc-Lead (Silver)					
BEAR-TWIT (45)	Bethlehem Copper Corporation	NTS 106 A-3 LAT 64"02' LONG 129°22'	Zinc 5.4% Lead 2.6%	9.07 million	National Mineral Inventory and Mississippi Valley Type Lead-Zinc Districts of Northern Canada, by W.A. Gibbins, INA, 1982.
GAYNA RIVER (46)	Rio Tinto Canadian Exploration Limited	NTS 106B-15 LAT 64°56' LONG 130°41 '	Zinc 6%	Unknown	Body "A" deposit is estimated to be 3011 wide, 244m long and 6 to 14 m thick. 18 showings are known. National Mineral Inventory.
			Zinc 4.7% Lead 0.3%	50 million	Resource estimate from Mississippi Valley Type Lead-Zinc Districts of Northern Canada, by W.A. Gibbins.
Howards Pass Area					
HOWARDS PASS (XY) (47)	Placer Development Limited Cygnus Mines Ltd.	NTS 1051-6 LAT 62"28' LONG 129°10'	Lead 2.1% Zinc 5.4% including Lead 5.5% Zinc 10.6%	59 million 8.2 million	These are drill indicated tonnages. Additional inferred tonnage in excess o 360 million t of 7% combined lead-zinc Howards Pass property (see ANNIV i n Yukon deposits). Personal Communication 1982.
JUDGE DALY (48)	n.a.	NTS 120 C-7 LAT 81°22' LONG 66"30'	Combined lead and zinc equivalent to 3-9% zinc	Unknown	Mineralization traced for 396 m with a gravity anomaly. National Mineral Inventory.
Little Cornwallis Island					
ECLIPSE (49)	Cominco Limited	NTS 68 H-9 LAT 75°32' LONG 96°10'	Lead 12.4% Zinc 2.18%	1.4 million	National Mineral Inventory.
Pine Point Area					
SLAVE REEF X-25 (50)	Westmin Resources Limited	NTS 85B-11 LAT 60"44'15" LONG 115"03' 15"	Lead 3.3% Zinc 9.1X	3.45 million	Total tonnage for Slave Reef Project are 7.25 million t of 10.3% combined lead-zinc (Western Miner, June 1981). Test production has been undertaken to determine feasibility.
SLAVE REEF R-190 (51)	Westmin Resources Limited	NTS 85B-11 LAT 60"44' 15" LONG 115"08'	Lead 6.42% Zinc 11.59%	1.12 million	National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
SLAVE REEF V-46 (52)	Westmin Resources Limited	NTS 85B-11 LAT 60°44'30" LONG 115°03'45"	Lead/zinc - 8% combined	0.54 million	Deposit is 700 m NW of the 25. National Mineral Inventory.
RAM-ROD (53)	Ramrod Mining Corporation	NTS 95E-12 LAT 61°32'20" LONG 127"33'45"	Zinc 5.42% Lead 5.12% Silver 24.3 g/t	1.48 million	National Mineral Inventory
WRIGLEY (54)	Cominco Limited	NTS 950-4 LAT 63°14' LONG 123"35'	Lead/zinc - 15% combined Silver n.a.	0.9-1.8 million	Tonnage estimated by R.W. Hornal, INA, 1972.

3. Polymetallic Base Metals

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
GONDOR (55)	Kidd Creek Mines Ltd. Noranda Mines Ltd.	NTS 76E-12 LAT 65 °33'50" LONG 111 °47' 30"	Zinc 16.4% Lead 0.4% Copper 0.1% Silver 0.7 g/t	Unknown	Assays from drill hole G-13 over length of 46.5 m. Yellowknife Geoscience Forum, December, 1982.
Hackett River Area					
A ZONE (56)	Bathurst Norsemines Limited Cominco Limited (44%)	NTS 76F-16 LAT 65"55'00" LONG 108 °22'00"	Zinc 8.5% Lead 1.4% Copper 0.25% Silver 240 g/t Gold 1.7 g/t	3.63 to 4.5 million	Total Hackett River resources are listed as 19.5 million t of 4.98% zinc, 0.75% lead, 0.41% copper, 150 g/t silver and 0.45 g/t gold (1975). Includes the A, Cleaver, Boot Lake and other zones of, mineralization of Hackett River National Mineral Inventory.
BOOT LAKE (57)	Bathurst Norsemines Limited Cominco Limited	NTS 76F-16 LAT 65°54'55" LONG 108"25'50"	Zinc 4.97% Lead 0.99% Copper 0.29% Silver 201 g/t Gold 0.5 g/t	4.5 million	Another 1.8 million t of lower grade mineralization also occurs in the Boot Lake zone. National Mineral Inventory.
CLEAVER ZONE (58)	Bathurst Norsemines Limited Cominco Limited	NTS 76F-16 LAT 65 °55'55" LONG 108 °27'30"	Zinc 7.07% Lead 1.04% Copper 0.46% and Zinc 1.08% Lead 0.84% Copper 0.48% Silver 33.3 g/t	3.63 million 3.63 million	National Mineral Inventory. National Mineral Inventory.
HENINGA LAKE (59)	Sulpetro Mineral Limited	NTS 65H-16 LAT 61"46'25" LONG 96"12' 10"	Zinc 9.0% Copper 1.3% Silver 68.6 g/t Gold 1 g/t	5.44 million	National Mineral Inventory.
HIGH LAKE (60)	Kennco Explorations (Canada)	NTS 76 M-8 LAT 67°22'50" LONG 110 °51'10"	O Zone Zinc 3.6% Lead 0.2% Copper 2.0% Silver 37.7 g/t and AB Zone Copper 5.4% Zinc 1.1%	2.54 million 2.18 million	Total 4.72 million t grading 3.53% copper, 2.45% zinc, 0.79 g/t gold and minor silver and lead. Gold Deposits of NUT by W.A. Padgham.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
HOOD RIVER #lo (61)	idd Creek Mines imited	NTS 861-2 LAT 66″04′40″ LONG 112 °45′00″	Zinc 3.5% Copper 5.0% Silver 34.3 g/t	0.45 million	National Mineral Inventory.
HOOD RIVER #41 (62)	:idd Creek Mi nes .imited	NTS 861-2 LAT 66°03′30″ LONG 112°42'00"	Zinc 4.2% Copper 1 .5% Silver 17.1 Y/t	0.29 million	Combined tonnage potential at #41 and #41A (an extension of #41 to the south-east) may be 2 million t, Yel lowknife Geoscience Forum, Oec. , 1981.
INDIAN MOUNTAIN LAKE (63) - BB Zone	nitiative xplorations Ltd.	NTS 75 M-2 LAT 63 °01′57″ LONG 110 °56′57″	Zinc 10.3% Lead 0.85% Silver 118.3 g/t Cadmium 0.1%	1.88 nil lion	Total of all Indian Mountain Lake (BB, (ennedy Lake and Susu Lake zones is 1.61 million t. National Mineral Inventory.
- Kennedy Lake	nitiative xploration Ltd.	NTS 75 M-2 LAT 63°02′ LONG 110°57′	West Zone Copper 1.12% Main Zone Zinc 7.3% Lead 1.1% Silver 137 g/t	0.56 million 0.04 million	National Mineral Inventory.
- Susu Lak	Initiative exploration Ltd.	NTS 75 M-2 LAT 63°00'40" LONG 11 0″47′3U″	Copper 0.95%	0.13 million	National Mi neral Inventory.
IZOK LAKE (64)	(idd Creek Mines .imited	NTS 86H-10 LAT 65°38'00" LONG 112 °47′45″	Zinc 13.77% Lead 1.42% Copper 2.82% Silver 70.3 9/t	11 million	National Mineral Inventory.
MUSK (65)	Noranda Mines Limited	NTS 76 G-5 LAT 65″19′ 30″ LONG 107°32′	Zinc 10.0% Lead 1.4% Copper 1.2% Silver 342.88 g/t	0.34 million	Noranda personnel feel there is excel 1-ent potential for much larger tonnage, Yel lowknife Geoscience Forum, Oec. 1981
PRAIRIE CREEK (66)	Cadillac Explor-ations Limited	NTS 95F-7, 10 LAT 61°33′ LONG 124″47′	Zinc 13.5% Lead 10.9% Silver 191 g/t Copper 0.52% Cadmium 0.087%	1.94 million	Tonnage is from six zones of mineraliz-ation. Thirteen zones are known. Mine construction 97% complete but placed on hold due to financial difficulties of owner. National Mineral Inventory and Northern Miner, July 22, 1982.
YAVA (67)	Conwest Explor-ation Ltd. Westmin Resources Limited	NTS 76G-12 LAT 65°36' LONG 107°55'	Zinc 5% Lead 1.5% Copper 0.6-1.5% Silver 103-137 g/t Gold trace to 0.34 g/t	1.13 million	National Mineral Inventory.
Copper					
BURNT CREEK (68)	Pickle Crow Exploration Ltd.	NTS 860-5 LAT 67°17'55" LONG 115°48'55"	Copper 9.1%	0.018 million	National Mineral Inventory.
CARL (69)	n.a.	NTS 86N-12 LAT 67°44' LONG 117°35'35"	Copper 2%	0.113 million	National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Cements
COATES LAKE (70)	Redstone Resources Ltd.	NTS 95L-10 LAT 62°41′30″ LONG 126°37′30″	Copper 3.9% Silver 11.3 g/t	37 million	One mineralized bed lm thick. Tonnage drill indicated. Possible resources is 27 million t. Redstone Resources press release, Feb. 16, 1983.
COPPER LAMB (71)	n.a.	NTS 86N-10 LAT 67″37′ 55″ LONG 116 °51′45″	Copper 44.44-49.94$	Unknown	Series of generally narrow (0.91m) copper bearing veins. National Mineral Inventory.
CORONATION (72)	Range Industries Limited	NTS 86 N-8 LAT 67°27′ LONG 116″27′	Copper 2.89%	0.119 million	National Mineral Inventory.
DICK (73)	Pickle Crow Exploration Ltd.	NTS 86 N-8 LAT 67°20′08″ LONG 116°01′33″	Copper 8.78%	0.056 million	National Mineral Inventory.
GW (74)	Westfield Minerals Ltd.	NTS 86 K-5 LAT 66 °26′43″ LONG 117 °31′25″	Copper 8.4%	0.091 million	National Mineral Inventory.
JAY (75)	Shel 1 Canada Resources Ltd.	NTS 95M-13 LAT 63″49′ LONG 127°46′	Copper 2.2%	1.09 million	National Mineral Inventory.
JUNE (76)	8ernack Copper-mine Exploration Limited	NTS 86O-11 LAT 67 °34′25″ LONG 115″03′30″	Copper 2.5%	0.91 million	National Mineral Inventory.
WRECK LAKE (Dot 47) (77)	Coppermine River Mines Limited	NTS 86 N-8 LAT 67″24′ LONG 116″23′	Copper 3.07% Silver 8.59 g/t	3.72 million	National Mineral inventory.
Copper-Nickel					
FERGUSON LAKE (78)	Into Limited Esso Minerals Limited	NTS 651-15 LAT 62 °52′00″ LONG 96°50′30″	Copper 0.9% Nickel 0.8%	7.3 million	Personal communication, P.J. Laporte, INA, Yellowknife.
MAR (79)	Perry River Nickel Mines Ltd.	NTS 55 K-7 LAT 62″29′3u″ LONG 92 °46′54′4	Copper 0.81% Nickel 0.08%	0.064 million	National Mineral Inventory.
PERRY RIVER (80)	Perry River Nickel Mines Ltd.	NTS 66 M-8 LAT 67°28′30″ LONG 102 °11′30″	Copper 0.5% Nickel 1.25%	Unknown	Boulder train occurrence, some copper-nickel mineralization in situ but of lower grade. Location is ‘Showing L’ . National Mineral Inventory.
RANKIN NICKEL (81)	n.a.	NTS 55K-16 LAT 62″49′12″ LONG 92″04′48″	Copper 0.93% Nickel 3.20% Platinum 3.77 g/t plus Copper 0.93% Nickel 1.25%	405 972 58 514 (indicated	Past producer, 1957-62. Grade of platinum given from 1929. No figure for platinum is available from 1957 reserv estimates stated at left, prior to the commencement of mining. Produced 2 631 copper and 9,662 t nickel from 368,099 of ore. National Mineral lnventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
MUSKOX (82)	n.a.	NTS 860-3 LAT 67 °03′18″ LONG 115 °12′ 12″	Chromium 15.3% Copper 0.25% Nickel 0.15% Platinum/ palladium - minor	4.54 million	INA assessment files.
Tungsten					
LENED (83)	Union Carbide Canada Ltd.	NTS 105I-7 LAT 62°22' 30″ LONG 128″37′	W03 1 .0%	1 million	National Mineral Inventory.
MACTUNG (84)	Amax Incorporated	NTS 1050-8 LAT 63 °17′ 15″ LONG 130″09′	WO_3 0.95% Including 1.02%	57.15 million 12.34 million	Largest known tungsten deposit in Western world. Production planned for for late 1980's. Deposit straddles Yukon-NWT border. Northern Miner, Dec. 10, 1981 and Mining Magazine, Nov. 198
Coal					
8ARTLETT 8AY (85)		NTS 39 H-3 LAT 79″10′ LONG 74°55′	Sub-bituminous	Unknown	One 4.6 m seam with several other 0.9 - 1.5 m located in the area. National Mineral Inventory.
BAY FIORD (86)	Petro-Canada Lt	NTS 49 H-2 LAT 79°04′ LONG 82°00′	Lignite	Unknown	One seam 1.8 or 2.1 m thick of Tertiar age. Coal in the Arctic Archipelago, by T.W. Caine, INA, 1973.
8RACKET 8ASIN (87)	Manalta Coal Lt Luscar Limited	NTS 96C-14 LAT 64 °46′06″ LONG 125 °23′ 30″	Lignite A to Sub-Bituminous C including	2 billion 128 million 24 million 82 million 13 million	Large Tertiary coal basin. Fort Norman Upper seam Fort Norman Lower seam Seagull Island upper seam Seagull Island lower seam. INA assessment files.
BUCHANAN LAKE (88)	n.a.	NTS 49 G-4 LAT 79″12′ LONG 87″40′	Unknown rank	Unknown	One 1.8 m in Isachsen Fm. (Lower Cretaceus). National Mineral Inventory.
CAPE CROZIER (89)	n.a.	NTS 98 E-8 LAT 74″25′ LONG 121°30′	Bituminous	Unknown	One seam varying in thickness from 3-4.6 m. Coal in the Arctic Archipela by T.W. Caine.
COAL MINE (Aklavik) (90)	n.a.	NTS 107 B-4 LAT 68°12′ LONG 135″25′	Sub-bituminous A (12,240 BTU)	Unknown	Past producer prior to 1939. Three or seams 0.3-1.5 m thick. National Mineral Inventory.
COAL MINE (Paulatuk) (91)		NTS 970-5 LAT 69 °22′03″ LONG 123 °33′41″	Lignite	Unknown	One of the 2 past producers near Paulatuk, 1936-41 and 1941-55. 9 t of coal mined per year. National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
COAL MINE LAKE (92)	Petro-Canada Ltd.	NTS 117 A-9 LAT 68°41′ LONG 136°19′	Sub-Bituminous C	Unknown	Past producer, 1930's to later 40's from 2.4 m seam. Approximately 635 t of coal mined over the live of the mine. Other occurrences in area grade at anthracite. National Mineral Inventory.
MEADOW RIVER (93)	Petro-Canada Ltd	NTS 490-15 LAT 77°58' LONG 81°41′	Lignite	Unknown	Five seams varying from 0.3-2.1 m in thickness. Coal in the Arctic Archipelago, by T-u. Caine.
MIDDLE KANGUK (94)	Gul f Resources Limited	NTS 59 H-5 LAT 79°16′ LONG 91°10′	High volatile bituminous C to sub-bituminous A	Unknown	Sixteen coal seams including two 1.8 m, one 2.4 m, one 4.6 m and one 9.1 m seam in Eureka Sound Fm. Coal in the Arctic Archipelago, by T.W. Caine.
SALMON RIVER (95)	n.a.	NTS 38B-11 LAT 72°38′ LONG 78°05'	Sub-Bituminous	Unknown	Two locations in the same area were worked from 1925-63 with production averaging 113 t per year from 1954-63. Mineral Industry Report, 1976, Northwet Territories and INA files.
SLIDRE FIORD (96)	Gulf Resources Limited	NTS 49G-15 LAT 79°57' LONG 85″10′	Sub-bituminous	2 billion	6.2 m seam in Eureka Sound Fm. (Tertiary Age). A.E. Schiller in Mining Magazine, July, 1982 estimated 2 billio t of coal amenable to surface mining in Fosheim Peninsula. R.M. Bustin in Arcti Vol. 33, 19B0 estimated 21 billion t of coal in same area.
STOR ISLAN (97)	n.a.	NTS 49 G-2 LAT 79°03′ LONG 85″50′	Lignite to sub-bituminous	Unknown	One seam 2.1 m thick. Coal in Arctic Archipelago, by T.W. Caine.
VENDOM FIORD (98)	Petro-Canada Ltd	NTS 49 E-3 LAT 78°07′ LONG 82°27′	Lignite		Five seams including one 2.4 m seam in Eureka Sound Fm. National Mineral Inventory.
WATERCOURS VALLEY (99)	n.a.	NTS 120 C-9 LAT 81″44′18″ LONG 64°24 ′	High volatile bituminous A	Unknown	Past producer, 1875-76. 6.1 m seam. National Mineral Inventory.
WESTERN KANGUK (loo)	n.a.	NTS 59 G-8 LAT 79″17′ LONG 92°45′	Unknown rank	Unknown	20 seams including four 1.8 m and two 2.4 m seam in Eureka Sound Fm. Coal in the Arctic Archipelago by T.W. Caine.

Iron

Belcher Islands Area

HAIG INLET (101)	n.a.	NTS 340-6 LAT 56″20′ LONG 79°05′	Iron 27%	907 million	Mineral ization is magnetite and hematite. INA files and National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
INNETALLING ISLAND (102)	ı.a.	‹TS 33M-14 .AT 55″53′ .ONG 79°02′	[ron 32%	816 million	liberalization is magnetite and was frilled in 1955 and 1956. National ‹ineral Inventory and INA files.
BOREALIS EAST (103)	3orealis Explor- ation Limited	‹TS 47 A-6 .AT 68 °28′05″ .ONG 82 °43′00′	[ron 23-34%	1100 million	‹eserves from Exploration and Mining Journal , April , 1982.
BOREALIS WEST (,104)	3orealis Explor- ation Limited	‹TS 47 B-2 .AT 68 °17′00″ .ONG 85″29′54″	Iron 32-38%	3200 million	ſonnage from Exploration and Mining Journal , April , 1982.
CHORKBAK INLET (105)	n.a.	‹TS 368-7 .AT 64°28′ .ONG 74″42′	Iron 20%	350 million	‘our deposits contained 350 mi 11 ion t of 1-20% Iron as reported by company in 1957. INA assessment files.
EAST KOROK (106)	n.a.	NTS 36 A-6 LAT 64″20′ LONG 73″25′	Iron 30-70%	10 million	Potential indicated in 1958. INA assessment fi les.
EQE 8AY (107)	n.a.	NTS 37 C-9 LAT 69 °40′24″ LONG 76″48′20″	Iron 32-45%	360 million	National Mineral Inventory.
ICE (108)	n.a.	NTS 55 E-4 LAT 61°05′ LONG 95″45′	Iron 29-40%	400 million	Tonnage from Geological Survey of Canada Open File 716 (p. 29), 1981.
MALTBY LAKE (109)	n.a.	NTS 36C-13 LAT 64″55′ LONG 77″56′	Iron 34%	200 million	National Mineral Inventory. INA Assessment files.
MARY RIVER (110)	Baffinland Iron Limited	NTS 37 G-5 LAT 71″19′ LONG 79°21 ′	Iron 68% plus Iron 30%	260 million 500 million	Canadian Mines Handbook reported 112 million t of 68.13% iron based on 1963-64 drilling. Reserves from Geological Survey of Canada Open File 716 (p. 29), 1981. Over 100 million t ready to be shi Pped without milling.
NASTAPOKA ISLANDS Jill)	n.a.	NTS 34 C-2 LAT 56°15′ LONG 76°40′	Iron 30%	400 million	National Mineral Inventory.

Uranium

Baker Lake Area

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
AMER LAKE (112)	Aquitaine Company of Canada Ltd.	NTS 66H-10 LAT 65 °32′54″ LONG 96″45′ 12″	Uranium n.a. Molybdenum n.a.	Unknown	National Mineral Inventory.
BAKER LAKE NORTH SHORE (68-2) (113)	Aberford Resources Ltd.	NTS 560-2 LAT 64 °10′11″ LONG 94″33′25″	Uranium 0.13-0.81% Molybdenum n.a.	Unknown	Up to 1,360 t of U308 and 910 t of ?40s2. National Mineral Inventory. Mining exploration restricted by weathe and environmental concerns of residents

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
(114) BISSETT CREEK (75-3)	Aberford Resources Ltd.	NTS 55M-14 LAT 63°47'51" LONG 95°07'44"	Uranium n.a.	Unknown	National Mineral Inventory.
(115) CHRISTOPHER ISLAND (68-1)	Aberford Resources Ltd.	NTS 56D-2 LAT 64°04'35" LONG 94°32'53"	Uranium 0.04% Molybdenum n.a.		Greater than 72 t of U_3O_8 and 68 t of MoS_2. National Mineral Inventory.
KAZAN FALLS (68-4) (116)	Aberford Resources Ltd.	NTS 55M-12 LAT 63 °41'25" LONG 95 °46'41"	Uranium 0.46%	Unknown	455 t of U308 in fracture system 1.8m wide and 90m deep (Northern Miner August, 1974). National Mineral Inventory.
KAZAN RIVER (74-1E) (117)	Aberford Resources Ltd.	NTS 55M-12 LAT 63"48'22" LONG 95 °33'18"	Uranium n.a.	Unknown	National Mineral Inventory.
KAZAN RIVER (74-1W) (118)	Aberford Resources Ltd.	NTS 54M-13 LAT 63 °48'59" LONG 95°35'09"	Uranium n.a.	Unknown	National Mineral Inventory.
LONE GULL (119)	Urangesellschaft Canada Limited	NTS 66 A-5 LAT 64°27' LONG 97°36'	Uranium 1.0% Lead trace 50%	Unknown	16,783 t of U_3O_8. CIM Convention, Quebec City, 1982.
HOTTAH LAKE (Cormac) (120)	n.a.	NTS 860-9 LAT 64 °44'05" LONG 118 °11'10"	Uranium 40.5%	Unknown	Past producer, 1934. 1.35 t of hand-cobbed ore from trenches produced 463 kg U_3O_8.
LAC CINQUANTE (121)	Aberford Resources Ltd.	NTS 65J-10 LAT 62"32' LONG 98°38'	Uranium n.a.	Unknown	Estimated resource of 5.26 t U_3O_8. Northern Miner, Oct. 14, 1982.
Mountain Lake Area					
PEC (122)	Aquitaine Company of Canada Ltd. Cominco Limited	NTS 86 N-7 LAT 67"16' 18" LONG 116"56'	Uranium n.a.	Unknown	Continuation of YUK mineralization.
YUK (123)	Esso Minerals Limited	NTS 86 N-7 LAT 67°18' LONG 116°51'	Uranium 0.26-1. U% Copper up to 5%	Unknown	Mineralization in sandstones 20-100m thick over area 1000m x 400m. Yellowknife Geoscience Forum, 1981 and National Mineral Inventory.
Port Radium Area					
CONTACT LAKE (124)	Echo Bay Mines Limited Ulster Petroleum Limited	NTS 86F-13 LAT 65"49'40" LONG 117°48'00"	Uranium n.a. Silver 1474 g/t	7,303	Past producer, 1934, 1936-39, 1947, 197 1979. Tonnage, March, 1981. Produced 3.15 t U308 in 1939. Silver production for 1934 to 1947 was 14.5 t fro approximately 11,000 t of ore. Production in 1977 and 1979 included in silve production of Eldorado Mine. National Mineral Inventory and INA files. Produc tion based on tailings being considered

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
ELDORADO (125)	:cho Bay Mines .imited	NTS 86 L-1 LAT 66°05'05" LONG 118"U2'10"	Uranium n.a. Copper n.a. Silver n.a.	Unknown	Producer 1931-40, 1942-60, 19/7-82. To 1960 produced 6,808.5 t U_3O_8, 46.655 t silver, 226.8 t cobalt, 127 t nickel, 99.8 t lead, 450 g radium and1000 microcuries polonium from 1.04 mil non t of ore. During 1977 to 1982 produced 275.5 t silver and 1 ,293.3 t copper from 178,622 t of ore. Mine closed in Oec. 1981 and mill closed in March, 1982 after ore reserves depleted. National Mineral Inventory and INA files.
RAYROCK (126)	ìayrock Mines .imited	NTS 85 N-7 LAT 63 °27'10" LONG 116"33'	Uranium 0.33%	Unknown	Past producer, 1957-59. Produced 207.8 t U308 from 71,470 t of ore. National Mineral Inventory.
Other Minerals					
BIG (127)	Canadian Superior Exploration Ltd.	NTS 851-5,12 LAT 62°30' LONG 114"00'	L102 1.5%	1.36 million	National Mineral Inventory.
BLAISDELL LAKE (128)	Beauport Invest-ors Limited	NTS 851-13 LAT 52"48'37" LONG 113"34'54"	8e0 0. 3%	0.1 81 million	Two dike deposits explored in 1961. National Mineral Inventory.
CAB (129)	New Athena Mines Limited	NTS 85N-10 LAT 63 °33'00" LONG 116 °44'45"	Bismuth 0.162% Copper n.a. Cobalt n.a. Gold n.a.	0.20 million	Tonnage reported in 1969 from No. 1 zone. National Mineral Inventory.
ECHO (Thor) (130)	Canadian Superior Exploration Ltd.	NTS 851-8 LAT 62"25' 50" LONG 112 °10' 50"	LI02 1.5%	1.63 million	National Mineral Inventory.
ELK (131)	Hemi sphere Deve-lopment Corp.	NTS 851-1 LAT 62"12' LONG 112°15'	L102 7.44% Ta_2O_5 0.2-0.75%	0.70 million	Northern Miner, June 5, 1980.
FI (132)	Canadian Superior Exploration Ltd.	NTS 851-11 LAT 62"34' 57" LONG 113 °29'30"	LI02 1.37% plus LIO_2 1.1%	4.81 million 6.99	National Mineral Inventory.
JAKE (133)	Amhawk Resources Corporation	NTS 851-6 LAT 62"25'24" LONG 113"28'00"	LIO_2 1.2%	1.81 million	Northern Miner, Oec. 24, 1981.
KI (134)	Canadian Superior Exploration Ltd.	NTS 851-11 LAT 62"35' 30" LONG 113"28'00"	L102 1.4%	1.81" million	National Mineral Inventory.
LENS (135)	Canadian Superior Exploration Ltd.	NTS 851-2 LAT 62°12' LONG 112°41'	L102 1.97%	0.09 million	National Mineral Inventory.

Deposit	Owner	Location	Mineralization Grade	Tonnage (tonnes)	Comments
NAI NTE HARBOUR (136)	n.a.	NTS 26B-16 LAT 64°53' LONG 66°18'	Mi ca	Unknown	Past producer, 1876. W.A. Mentzer mine 14.5 t of mica worth $120,000 as well graphite and other industrial minerals Mineral Developments, Mineral Inventor and Metal logenic Models: Arcti c Region NUT, Canada by W.A. Gibbins in Arctic Geology and Geophysics, 1982.
PEG (Toke) (137)	International Bibis Tin Mines Limited	NTS 851-11 LAT 62 °43'40" LONG 113 °06'50"	Ta_2O_5/Cb_2O_5 - 0.4% Combined	Unknown	Past producer, 1946-47. Produced 1.715 t of concentrate from 989 of pegmatite material. National Miners Inventory.
THOR (138)	Hi ghwood Resources Ltd.	NTS 851-2 LAT 62 °06'52" LONG 112"35' 35"	Cb_2O_5 0.4% Ta_2O_5 0.03%	63 million	Northern Miner, July 23, 1981. Other rare earths present, as well as beryllium.
VO (139)	Canadian Superic Exploration Ltd.	NTS 851-13 LAT 62°50' LONG 113°34'	L102 1.5%	3.0 million	National Mineral Inventory.

(a) Sources: Mines and Important Mineral Deposits of the Yukon and Northwest Territories, [illegible], DIAND, Northern Mineral Policy Series, NM, 1. Exploration Overview, " DIAND, 1983, op. cit. W.A. Gibbons, op. cit.

(b) National Topographic System designation.

2.3.2 Overall Estimate of Mineral Reserves and Potential

Estimates of reserves and overall mineral resource potential in the NWT have been developed based on the preceding information on existing mines and the inventory of mineral deposits. It must be understood that they represent order-of-magnitude estimates. The mineral inventory at even the most thoroughly explored deposits is not known with certainty until it has been actually mined out. Many deposits have been incompletely outlined and estimates for these represent minimum values. Only the inventory at producing and developing mines can be considered to be currently economically viable and for our purposes deposits associated with these deposits are designated as "reserves". Resource potential is defined here as reserves plus estimated tonnages for identified ore bodies which are currently not producing. Mines for which development is planned and stockpiled tailings are included in this category.

Mineral inventory estimates for the NWT are presented in Table 2.3. This inventory indicates ore tonnages and grades for various minerals or mineral groups and includes existing and developing mines and currently unexploited but potentially important mineral occurrences. It should also be noted that total reserve tonnage estimates are based to a large degree on figures reported by owners of various mineral properties and these figures, although they have been summed up, may not be totally comparable. Production and new discoveries will also cause inventory estimates to change over time.

TABLE 2.3

Mineral Inventory Estimates: NWT

	Reserves[a]		Resource Potential[b]	
Minerals	10^6 Tonnes	Grade	10^6 Tonnes	Grade
Gold	5.311	Au 8.29 g/t - 26.7 g/t	26.869	Au 1.8 g/t-428.6 g/t
Silver	.063	Ag 686 g/t- 1,028 g/t	,108	Ag 109 g/t-3,758 g/t
Zinc-Lead (Silver)	46.000	Pb 0.8%-3.6% Zn 6.1%-11.9%	181.000	Pb 2.5%-12.4% Zn 2.18%-11.6%
Polymetallic Base Metals[c]			42.745	Pb 0.2%-10.9% Zn 1.08%-16.4% Cn .25%-5.4%
Copper (silver)			43.117	Cu 2.0%-49.9%
Copper-Nickel[d]			12.368	Cu 0.25%-0.93% Ni 0.08%-3.20%
Tungsten	2.742	WO_3 1.32%	73.232	WO_3 0.95%-1.02%
Coal			4,247.000	Lignite-Bituminous
Iron			8,503.000	Fe 20%-68%
Uranium[e]			2.46	U_3O_8 0.04%-1.0%
Lithium			22.200	LiO_2 1.1%-7.4%
Other Minerals[f]			63.381	Cb_2O_5 0.4% Ta_2O_5 0.03%-0.75%

Sources: Exploration Overview, DIAND, 1983, op. cit. Mines and Important Mineral Deposits of the Yukon and Northwest Territories: 1982, op. cit. Also, W.A. Gibbons, op. cit.

(a) Ore reserves for all operating mines.
(b) Includes reserves plus identified in-place ore that is currently non-economic but which may contain recoverable reserves as economic and other conditions permit. Includes stockpiled tailings from past producers.
(c) These deposits contain lead, zinc, copper, gold, silver, cadmium.
(d) These deposits also contain chromium, platinum, palladium.
(e) These deposits also contain molybdenum, lead, copper silver.
(f) Primarily tantalum and columbium.

2.4 Trends in Exploration and Mineral Discoveries

As shown in Table 2.4 exploration activity in the NWT has fallen off sharply from peak levels in 1981 reflecting the decline in world markets and metal prices. Generally speaking, exploration has been most active over the 1975-1983 period in the Churchill, Slave, Bear and Cordilleran geological areas, in roughly that order of importance. Exploration activity usually centres around existing mines and results from this activity reflect mineralization around these mines. Thus, exploration in the Slave/Bear/Pine Point areas, where most of the existing mines are located, accounted for over 40% of exploration activity in the NWT over the 1975-83 period. As shown in Table 2.5 exploration activities in these areas also tends to be more advanced in nature (eg. drillings and mine development).

Exploration in the Slave/Bear areas is primarily for precious metals and base metals (gold, silver, lead, zinc, copper) again reflecting the type of mining activity there. Exploration in the Churchill geological area is also very active and centres around gold, silver and uranium. The Cordilleran region is the next most active area for exploration which is for base metals, precious metals and tungsten. Exploration activity in the Arctic Islands is much less significant and centres around base metals, coal and iron. Recent patterns of exploration activity in the NWT are shown in Figure 3. These patterns are reflective of the geographic distribution of exploration activity over the past several years.

TABLE 2.4

Exploration Activity by Geographic Region in NWT: 1975-1983

Gee-Region	Number of Properties Explored								
	1975	1976	1977	1978	1979	1980	1981	1982	1983
Cordillera	25	28	13	14	21	29	24	12	11
Arctic Island Baffin and Melville	8	9	6	8	4	7	24	11	11
Keewatin (Churchill Province)	31	37	38	36	48	53	59	34	24
SE Mackenzie (Churchill Province Nonacho & Thelon Areas)	3	7	11	7	13	14	25	10	10
East Arm	10	7	2	7	6	4	1	4 3	1
Pine Point	3	4	3	7	5	6	6	3	2
Bear Prov.	18	27	35	32	32	22	24	10	11
Slave Prov.	44	44	28	29	33	29	42	23	44
Totals (NWT)	142	163	136	140	162	164	218	106	113

Source: DIAND, Geology Division, Exploration Overview NWT, 1983.

TABLE 2.5

Exploration by Type of Activity and Region in NWT: 1983

District	Total Projects	Prospa Recon	Gen[b] Expl.	Drilling[c]	Mine[d] Develop	DIAND[e] Projects
Arctic Island	10	4	4	2	1	2
SE Mackenzie	13	3	4	6		3
Keewatin	24	3	11	9	1	3
Cordillera	11	6	-	4	1	1
Bear	11	2	1	8		5
S1 ave	44	3	10	26	5	16
Totals	113	21	30	55	8	30

(a) Low cost prospecting and reconnaissance.

(b) Intermediate cost geophysics, geology, geochemistry

(c) Most drilling projects included a and b

(d) Most mine development included some a, b, and c

(e) Projects by Geology Division Staff or supported by Geology Division, NAP.

Source: 'Exploration Overview NWT 1983, op. cit.

With respect to future exploration activity and the implications for the geographic distribution of mineral potential in the NWT, barring unforeseen discoveries, it is likely that the distribution of mining activity and known mineral deposits will not be dramatically different in the foreseeable future (eg. 10-20 years) than today. Most of the recent exploration activity has occurred in the western boundary areas except for uranium and iron ore. This is because most of the mines and known deposits are located in these areas and transportation access and servicing is more highly developed. Because of long lead times between discovery and operation, even if new deposits are discovered which significantly alter the distribution of mineral potential in the NWT, there will not be an immediate shift in the distribution of mining activity. Such shifts could take well over 20 years to materialize.[1]

Projections regarding the distribution of mineral potential over the longer term are much more difficult to make with any degree of confidence. Over the very long term changes are greater in that a new discovery or series of discoveries could substantially alter existing knowledge about mineral potential in the NWT. One could argue that the chances for such discoveries are more likely in the East because it has

(1) There is generally a long lead time in the NWT between discovery and mining of a deposit. For example, the Lupin (gold, silver), Cullaton Lake (gold, silver) and Polaris (lead, zinc) mines which came onstream only very recently were all first discovered 20 or more years ago.

been less intensively explored. On the other hand the greater accessibility and more intensive exploration effort in the West may for some time maintain and even reinforce its disproportionate share of mineral potential.

Changes in world supply and demand, mining technology or transportation access could also significantly affect the distribution of economic benefits actually realized from mineral potential in the NWT even if the physical distribution of resources was unaltered. Our brief analysis of world supply and demand for various minerals suggests that precious metals and those which have applications in new alloys such as tungsten and nickel have the strongest economic outlook. Except for nickel, the West currently has a much greater share of these minerals under all boundary alternatives.

3.0 OIL AND GAS

3.1 Introduction

3.1.1 Overview of the Geology and Oil and Gas Potential of the NWT

The Northwest Territories contain significant reserves and potential resources of hydrocarbons, which include crude oil, liquefied petroleum gases,(1) and natural gas.

Estimates of occurrences of hydrocarbons in the NWT are largely speculative, and are based on limited exploration activity over extremely large areas. For this reason, proven reserve estimates are quite low relative to the rest of Canada, but potential resources are believed to be vast. The NWT accounts for an estimated 10 to 13% of total crude oil and liquefied petroleum gas reserves of Canada (including Eastcoast offshore) and about 23% of natural gas reserves.(z) The major portion of NWT crude oil and pentanes plus reserves are located in the Mackenzie Delta-Beaufort Sea and Mackenzie Plain. The major portion of NWT natural gas reserves occur in the Arctic Islands and to a lesser extent the Mackenzie Delta-Beaufort Sea.

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(1) Propane, butanes and pentanes plus are higher order hydrocarbons.

(2) Sources: Canadian Petroleum Association, News Release, June 1983 and COGLA, Annual Report, 1982.

It is generally agreed that the NWT contains significant proven hydrocarbon resources and also that the potential resource base is vastly greater. Whether the reserves and potential are ever fully or partially realized depends critically on transportation access, markets and resource and revenue-sharing regimes.

There are 10 sedimentary basins located in the Northwest Territories; Arctic Stable Platform, Franklinian Geosyncline, Sverdrup Basin, Arctic Coastal Plain, Baffin Bay-Davis Strait Basin, Banks Basin, Mackenzie-Beaufort Basin, Interior Plains (1), Liard Plateau and Peel Plateau. The first eight are wholly located in the NWT and the latter two straddle the Yukon-NWT boundary. The locations of these basins and oil and gas fields are shown in Figure 4. Table 3.1 lists the names of the oil and gas fields.

In general, the major portion of hydrocarbon occurrences have been found in the Mackenzie Delta-Beaufort Sea, the Arctic Islands and offshore, and in the mainland basins of Liard and Mackenzie. There has been some exploration effort in other areas and basins, but few commercially promising discoveries have been found. The formations and their potential are described in more detail below.(2) Formations and drilling activity are shown in Figure 4 at the back of the report.

(a) Mackenzie-Beaufort Basin

The Mackenzie Delta-Beaufort Sea basin has geological characteristics that make it an area of great promise for hydrocarbons.

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(1) The Interior Plains are comprised of five relatively separate plains; Great Bear, Mackenzie, Peel, Great Slave and Anderson.

(2) In some cases, the descriptions of the basins have been combined because of common geology and locational proximity.

TABLE 3.1

Yukon and Northwest Territories
Oil and Gas Field Discoveries

Yukon Territory

1. Kotaneelee Gas Field
2. Chance Gas Field
3. Socony Mobil et al Blakie No. 1
4. Socony Mobil et al Birch Y.T. B-34

Northwest Territories

5. Pointed Mountain Gas Field
6. Rabbit Lake Gas Field
7. C.P. O.G. et al LaBiche F-08
8. H.8. Cameron Hill A-05
9. S. Island River Gas Field
10. Home Signal Celibeta H-78
11. Shell H.8. Grumbler G-63
12. Sun Netla C-07
13. Texaco Bovie Lake J-72
14. Union Pan Am. Trainer Lake C-39
15. Pacific Amoco Tathlina N-18
16. Normal Hells Oil Field
17. Taglu Gas Field
18. Parsons Gas Field
19. Gulf Imperial Shell Titalik K-26
20. Gulf Imperial Shell Reindeer F-36
21. GuI f Mobi 1 Ya Ya P-53 and A-28 Gas Pools
22. Shell Niglintgak H-30 and M-19
23. Imperial I.O. E. Mallik L-38
24. Imperial Ivik J-26
25. I.O.E. Mayogiak J-17
26. I.O. E. Atkinson H-25
27. Shell Kugpik 0-13
28. Imp. Adgo F-28
29. Ashland Tedji Lake F-24
30. Kumak Oil and Gas Field
31. Garry Oil and Gas Field
32. Imp. Netserk F-40
33. Gulf Mobil Kamik O-48
34. Dome Hunt Nektoral ik K-59
35. Oome ulf et al Ukalerk C-50
36. Hunt Oome Kopanoar M-13
37. Imp. Isserk E-27
38. Paramount et al Cameron J-62
39. Paramount et al Liard 0-29
40. Esso et al Issungnak 0-61
41. Dome Koakoak O-22
42. Dome at al Tarsiut A-25

Arctic Islands

51. Orak Point Gas Field
52. Hecla Gas Field
53. King Christian Gas Field
54. Panarctic Tenneco et al Kri stoffer Bay B-06
55. Oome Arctic Ventures Wal l is K-62
56. Thor Gas Field
57. Panarctic Whitefish
58. Oome Sutherland O-23
59. Panarctic 8ent Horn N-72, A-02
60. Panarctic Jackson Bay G-16A
61. Panarctic Roche Point
62. Aquitaine Hekja 0-71
63. Panarctic et al Balaena O-58
64. Panarctic et al Char G-07
65. Panarctic et al Maclean 1-72
66. Panarctic et al Cisco 8-66
6?. Panarctic et al Skate G-80

SOURCE: DIAND, Oil and Gas Activities, 1981.

NOTE : In order to maintain consistency among information sources the numbering system for fields used by DIAND has been repeated here. It should be noted that the reserve estimates quoted in Table 3.2 and in section 4.3 do not include Yukon fields, however, the resource estimates do.

Exploration activity has been quite intense in this area for the past decade, and up to 1982 some 52 wells had been drilled.

The basin has been divided by geologists into three 'zones or structural provinces. Zone I is the southernmost, at the southern and southeastern margins of the basin, and is characterized by both major and minor growth faults. This structure is similar to that found in the U.S. Gulf Coast and Niger Delta basins, both of which are producing areas.

Zone II is made up of major growth faults, and contains the Taglu gas field and the Ukalerk oil field. Zone II is located just north of Zone 1.

Zone III is the farthest offshore of the three zones, and is primarily made up of shale formations of various types. Zone III contains the offshore Niktoralik gas and liquefied petroleum gas (condensate) field which was the first offshore discovery from a drillship. Exploration to date suggests that some of the offshore discoveries in Zone 111 may prove to be giant oil and natural gas fields.

(b). Banks and Arctic Coastal Plain Basins

Banks basin and Arctic Coastal Plain basin lie to the east and immediate north of the Mackenzie-Beaufort Basin, and extend as far as the North Greenland Shelf. These two basins(l) comprise most of the continental slope and cover about 140,000 square kilometres, of which about 20,000 is along the western side of Banks Island, 90,000 is along the margin of the Arctic Archipelago, and 30,000 bounds the North Greenland Shelf.

The hydrocarbon resource potential of the basin is considered good, although none of the wells drilled have discovered significant volumes. Indeed, some geologists have hypothesized that the Banks Island coastal plain may have a stratigraphy similar to Alaska's Prudhoe Bay, which would suggest a large potential. However, a major problem to realizing this potential, if it indeed does exist, is the inaccessibility of much of the area because of ice conditions.

(c) Franklinian Geosyncline - Sverdrup Basin

The Franklinian Geosyncl ine-Sverdrup basin comprises the major part (about 70%) of the Canadian Arctic Archipelago, which has a total area of some 1,722,000 sq. km.

The Sverdrup basin is where most exploration effort has been concentrated to date. The first expiatory well was drilled in 1961 at Winter Harbour on Melville Island, and the first discovery was made in

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(1) Most of Banks Island is shown as two basins on many geological maps, but recent research suggests that the two basins are structurally very similar.

1969 at Drake Point. Up to 1982, 10 gas fields had been discovered in the basin, on Melville Island, Thor Island, Ellis Rignes Island, King Christian Island and offshore.[1] As well, crude oil discoveries have been recorded from Ellesmere Island, Thor Island and offshore from seven wells.

The potential for further discovery of major hydrocarbon reserves is considered high, because of the existence of traps, seals, source rocks and potential reservoirs. The principle problems that pose constraints to development are logistics (i.e. access), great expense, and the extremely short drilling season, particularly for offshore activity. However, the whole area, particularly the Sverdrup Basin, holds promise if these problems can be worked out.

There are several other small basins and platforms within the Franklinian Geosyncline, notably the Wandel Sea basin, the Fox basin, the Jones basin, the Lancaster basin, and several others. These basins are quite small and lie to the east and south of the Sverdrup basin. Exploration effort has been limited in these areas, consequently little is known about their hydrocarbon potential.

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(1) The offshore fields are the gas sources for the proposed Arctic Pilot Project. However, the National Energy Board has halted further consideration of this project.

(d) Hudson Bay and Strait

This area comprises two main geological formations, the Hudson Platform and the Hudson Strait-Ungava Bay basin. Exploration began in 1923 with the first onshore well drilled, and offshore activity commenced in 1973. The underlying strata is considered to have limited potential for hydrocarbon accumulations, as seals and traps have several unconformities. It is considered unlikely that there are commercially significant resources in this area.

(e) Baffin Shelf - Davis Strait

This area comprises the continental shelf off the south and east coasts of Baffin Island, extending south to Hudson Strait and east to Greenland. It covers about 320,000 sq. km.

The stratigraphy and structure of the Baffin Island Shelf are extremely complex, and not enough is known about the area to draw firm conclusions about the hydrocarbon potential. A few wells have been drilled; one discovered gas while the rest were unsuccessful. For this reason, it is unlikely that much more exploration activity will take place in this area, given that other basins hold more promise.

(f) Interior Plains Basins

The Interior Plains lie to the east of the Yukon-NWT border and comprise most of the mainland territorial area. The five basins which make-up this area all have been explored in varying degrees. The Mackenzie Plain contains the Norman Wells oil field which is currently producing commercial volumes of oil. The Great Slave Plain has had 13 wells drilled and most have shown gas potential. The other three plains, Great Bear, Peel and Anderson, have had limited drilling activity, and all have recorded hydrocarbon shows.

The hydrocarbon potential of the Mackenzie Plain Basin area has already been demonstrated, and the "deep-pool" potential of the area is considered good. Most of the future exploration effort will likely take place in the Norman Wells vicinity.

The Great Bear Basin has a complex stratigraphy, consisting of shale, limestone of marine origin, carbonate rocks, and other potential hydrocarbon bearing formations. Oil seeps have been observed for many years along the shores of Great Bear and Pond Lakes, and oil-saturated limestones are known from Lac de Bois to Belot Ridge. The general opinion is that the Basin has a very large resource potential, and that development will depend primarily on favorable government policies towards exploration and exploitation.

(g) Peel and Liard Plateau Basins

The other two major geological formations within the mainland territory are the Peel Plateau Basin and the Liard Plateau Basin, both of which extend into Yukon.

The Liard Plateau has a stratigraphy that has good potential for significant volumes of hydrocarbons, particularly natural gas. The Pointed Mountain gas field is located in the NWT part of the Liard Plateau near the B.C. border, and is current"ly producing commercial quantities from five wells.

The Peel Plateau basin also has a stratigraphy that is conducive to hydrocarbon accumulation, and fairly vigorous drilling activity occurred in the 1950s and 1960s. Some of these wells showed hydrocarbons, but no commercial oil or gas discoveries were made. Despite this relative lack of success, the Basin is considered to have good promise.

(h) Summary of Potential

To summarize, the Mackenzie Delta-Beaufort sea, the Mackenzie Plain Basin and the Great Bear Basin hold the most promise for significant commercial volumes of crude oil and condensates. The Sverdrup basin, the Mackenzie-Beaufort, the Arctic Coastal Plain and the Liard Plateau have the greatest potential for large quantities of natural gas. The other areas have lower potential, and will probably not be explored heavily in the foreseeable future.

3.2 Summary of Producing Oil and Gas Fields in the NWT

There are two producing petroleum areas in the NWT: the Norman Wells oil field located in the Mackenzie Plain Basin and the Pointed Mountain gas field located in the NWT portion of the Liard Plateau near the B.C. Border. These producing fields are shown in Figure 4 at the back of the report.

(a) Norman Wells

The Norman Wells oil field had 59 wells producing 176,000 m^3 of oil and 46.6 $10^6 m^3$ of gas in 1982. This represents an increase of about 2% in output over 1981. There is a refinery associated with the field, operated by Esso Resources Canada Ltd., which has a capacity of 508 m^3 per calendar day. In 1982 the refinery averaged 485 m^3 per day, about 95% of rated capacity. Total employment in the field and refinery totalled about 500.

In 1981 Interprovincial Pipeline received permission from the National Energy Board to construct a 300 mm pipeline from Norman Wells to Zama in Northern Alberta, in order to tie-in with the provincial pipeline network. Development work on field expansion began in July 1982 with 7 new oil wells and 20 water injection wells completed during the year. The pipeline is now about one-half built and is scheduled to come on-stream by July 1985. Upon pipeline completion, production from the field will be increased by a factor of eight, with a corresponding increase in refinery output to 3975 m^3 (about 25,000 bbl.) per day. An estimated 500 construction workers are employed in the project expansion.

(b) Pointed Mountain

Pointed Mountain is the only producing gas field in the NWT. In 1982 production totalled 218 million m^3 of gas from 4 wells, down from 351 million m^3 from 6 wells in 1981. A new development well was drilled in 1982 in an attempt to reverse declining production from the field. The well was a dry hole, and it is expected that production will continue to fall in the future.

3.3 Hydrocarbon Reserves and Potential Resources

There are numerous definitions of reserves and potential reserves commonly in use by geologists and government and industry analysts. These definitions are based on different underlying assumptions of field dimension, scale and hydrocarbon recoverability, among others, and consequently estimates for the same area can vary from one source to another.

Estimating hydrocarbon resources can be viewed as a dynamic process whereby potential resources move to proven reserves and production by way of discovery and development of new pools and fields. Further exploration and development in turn result in revisions to estimates of reserves and resources. This is particularly applicable to frontier basins, where geological and geophysical information is often extremely limited and broad interpretations are therefore necessary.

With respect to definitions, established or proven reserves are generally viewed as rigorously quantified amounts of oil and gas that can be produced with known economics and high certainty. Potential resources, on the other hand, are estimated on the basis of probability of discovery and recovery rather than on confirmed shows through exploration activity.

(a) Reserves

Table 3.2 shows the range of hydrocarbon reserve estimates based on COGLA annual reports and unpublished data. Several other sources were also reviewed including Canadian Petroleum Association news releases, Geological Survey of Canada publications,[1] and an article in the Canadian Society of Petroleum Geologists.[2] Data from these supplemental sources was generally consistent with COGLA estimates, although the latter estimates were somewhat higher for oil and somewhat lower for gas.

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(1) The GSC combines stati sties on establ i shed reserves and discovered resources. Discovered resources are based on 'single well drillings plus available geological and engineering judgments, and are subject to major revisions.

(z) Embry, A.F. and H.R. BalkWill, Editors, Arctic Geology and Geophysics in Canadian Society of Petroleum Geologists, Memoir 8, December 1982.

TABLE 3.2

Hydrocarbon Reserves in the NWT, by Onshore and Offshore, 1984

	Oil ($10^6 m^3$)			Gas ($10^9 m^3$)		
	Onshore	Offshore	TOTAL	Onshore	Offshore	TOTAL
Mackenzie Delta	11.1 - 40.5	--	11.1 - 40.5	141.0 - 170.0	--	141.0 - 170.0
Beaufort Sea[a]	14.9 - 41.0	57.5 - 96.0	72.4 - 137.0	8.3 - 26.5	94.6 - 137.5	102.9 - 164.0
Mainland Territories	50.0 - 60.0	--	50.0 - 60.0	23.0 - 35.5	--	23.0 - 35.5
Arctic Islands	3.0 - 5.0	57.0 - 78.0	60.0 - 83.0	39.0 - 45.0	238.0 - 315.0	277.0 - 360.0
TOTAL	79.0 - 146.5	114.5 - 174.0	193.5 - 320.5	211.3 - 277.0	332.6 - 452.5	543.9 - 729.5

Source: COGLA, unpublished data on field reserves, 1984.

(a) Includes Richards Island.

The table shows that the oil and condensate reserves in the NWT range from 194 x $10^6 m^3$ to 321 x $10^6 m^3$, and gas, from 544 x $10^9 m^3$ to 730 x $10^9 m^3$. According to these sources the Mackenzie Delta-Beaufort Sea and Arctic Islands areas are the most important hydrocarbon regions, and the Mainland Territories are somewhat less important. (1)

Table 3.2 also shows that the majority (56%) of the oil reserves are located onshore whereas the majority (62%) of the gas reserves are offshore. It should be noted that individual fields within these basins contain quantities of hydrocarbons that are so small that they could not be produced economically, therefore, these reserve estimates should be considered optimistic.

(b) Potential Resources

Estimating the potential scale and location of hydrocarbon resources in the NWT is more difficult than establishing reserves and therefore available estimates are much more uncertain. Indeed, the published data is couched in terms of probability of discovery and recovery rather than being based on confirmed shows through exploration activity.

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(1) Other data sources showed even greater disparity between mainland and non-mainland areas as hydrocarbon resources.

Data on hydrocarbon resources have been compiled from three sources, GSC, DIAND, and Embry and are shown in Table 3.3. It is clear from the wide variation that there is significant uncertainty in the estimates.

The table shows that the potential petroleum resources in the NWT are several orders of magnitude higher than the proven reserves. As reported by GSC and DIAND, at the 50% probability level potential oil resources are about 9 times higher than discovered reserves. For gas the factor is about 7 times higher. At lower (5%) confidence levels and as reported by Embry, the factors are even greater, clearly indicating the enormous undiscovered potential in the Territories.

TABLE 3.3

Potential Oil and Gas Resources in the NWT, 1982

	GSC AND DIAND ESTIMATES						EMBRY ESTIMATES	
	High Probability (95%)		Average Probability (50%)		Low Probability (5%)			
	Oil (10^6m^3)	Gas (10^9m^3)	Oil (10^6m^3)	Gas (10^9m^3)	Oil (10^6m^3)	Gas (10^9m^3)	Oil (10^6m^3)	Gas (10^9m^3)
Mackenzie Delta	8	93	76	144	171	402		
Beaufort Sea[a]	287	747	1271	1721	3060	4070	4767	1980
Mainland Terri- tories	16	56	95	310	715	1972	588	1080
Arctic Islands[c]	316	1100	686	2257	1305	3662	5144	5100
Hudson Bay[d]	--	--	127	87	1556	394	.4	70
TOTAL	627	1996	2255	4519	6807	10500	10599.4	8230

Sources: DIAND, Oil and Gas Activities, 1981, GSC, Oil and Natural Gas Resources of Canada. 1983 and Embry. 1981.

(a) Includes Richards Island. There are no fields in the Yukon portion of the Beaufort.
(b) Includes Yukon Territory basins. The portion located in Yukon is not known.
(c) Includes Baffin Bay.
(d) Includes Eastern portion of Keewatin District
(e) It should be noted that in some cases (eg. Mackenzie Delta oil potential) the estimates of potential at the high probability level are less than the reserve estimates. This is because the potential resource estimates do not include estimated reserves.

It must be emphasized that these figures are order-of-magnitude estimates and subject to major revisions, probably downwards according to COGLA analysts, as more information comes available. In reporting this data, there is no consideration of economic constraints nor whether or when the resources may be discovered.

3.4 Current Exploration Activity and Future Prospects

This section summarizes current hydrocarbon exploration activity in various regions of the Territories, and discusses the prospects for exploration and development in the foreseeable future.(1) It should be noted that the prospects for hydrocarbon exploration activity in the NWT in the longer term (eg. over 20 years) are difficult to project, depending critically on the success of current efforts in the NWT and in other frontier areas (eg. east coast, British Columbia) and on government policies with respect to frontier exploration.

(a) Mackenzie Delta-Beaufort Sea

This region has been subject to significant exploration effort since 1976. At present 13 wells are active and some 10 others have been terminated. In 1982 there were four drillships, three artificial island drilling rigs and one land based rig actively operating. Most of the work is done by Dome Petroleum, Gulf Canada Resources and Esso Resources Canada.

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(1) Sources: DIAND and COGLA Annual Reports, op. cit.

This region will likely remain one of the most important in the NWT in terms of exploration effort in the near future. The federal government and the companies have already incurred substantial costs in development and given that the results of crucial drilling programs are due within the next 2-3 years, these parties will continue their commitment to exploration activity in the short term.

Activity in the longer term is less certain. Exploration efforts in the Mackenzie-Beaufort have to date not been as successful as initially envisaged, leading some government analysts to suggest that activity should be redirected toward other frontier areas (eg. the East Coast) holding more promise. This could be reinforced because of PetroCanada's recent find in the Hibernia field. However, Shell has recently reported a large find in the Alaskan section of the Beaufort which some believe will be commercially viable. As well, Esso Canada in a recent newspaper article[(1)] has reaffirmed its commitment to the Canadian Beaufort, and suggests that the discovery of an additional 100 million barrels of proven reserves in the area, when combined with the previous discoveries totalling some 200 million barrels, would be sufficient to support commercial development. The company further suggests that the oil would likely be marketed by extending the pipeline from Norman Wells to Tuktoyaktuk, at an estimated cost of some $500 million. Both these recent events point to continued activity in the area in the long term.

(1) The Globe and Mail, Toronto, May 7, 1984.

(b) Mainland Territories

There was only one new well drilled in this region in 1982, a wildcat well northeast of the Pointed Mountain gas field. The well was terminated in December after making little progress since April of that year.

As mentioned above, the Norman Wells oil project is being expanded, and should be fully operational by mid-1985. It is anticipated that exploration in the near and long term will take place in this vicinity and further northwest along the Mackenzie Valley in keeping with known occurrence of hydrocarbons. Future exploration and production will be facilitated by the completion of the pipeline into northern Alberta.

(c) Arctic Islands

Exploration effort in the Arctic Islands and Eastern Arctic Offshore area is currently next in importance to activity to the Mackenzie Delta-Beaufort Sea.

'Exploration for natural gas in the Arctic Island area is problematic. There is little doubt that there exist large quantities of natural gas in the area, however, the major constraint will be the commercial viability of development which, in turn, will depend on market access. Arctic gas, if it were to be developed, would have to compete with conventional reserves and with east coast supplies in, primarily, the U.S. east coast market. Given that these two alternative sources are closer in proximity to potential markets, it is unlikely that Arctic gas would be competitive. Thus, the prospects for commercial development of Arctic Island reserves is considered to be limited in the foreseeable future. This will undoubtedly constrain gas exploration in the area.

Prospects for oil exploration and development are more promising. Panarctic has recently announced plans to move ahead with its Bent Horn oil play. Again, access will be a major consideration in future development.

(d) Hudson Bay

There was very little exploration activity in the Hudson Bay area in 1982 and given the lack of significant hydrocarbon discoveries in the region and greater promise in other areas, it is not considered likely that exploration activity will increase significantly in this area in the foreseeable future.

4.0 IMPLICATIONS OF PROPOSED ALTERNATIVE BOUNDARY DIVISIONS FOR THE DISTRIBUTION OF NON-RENEWABLE RESOURCE WEALTH IN THE NWT

4.1 Introduction

There are five basic alternative boundary divisions which have been hypothesized by the Western Constitutional Forum for purposes of this study. Variations of boundary proposals 1, 2, 3, and 5 are also assessed. They are shown in Figure 5 and are described briefly below.

(a) Boundary Proposal 1

The Base Case division alternative divides the NWT roughly in two and is an extension of the Saskatchewan Manitoba border north to intersect with the dotted line,(1) north along the dotted line to Parry Channel, then north via the Byam and Byam Martin Channels to the North Pole. The area of the Western and Eastern areas are approximately 1.58 million square km and 1.67 million square km, respectively.(2)

(b) Boundary Proposal 2

Federal riding to its northeast corner, diagonal to the southeast corner of WAR area, north along WAR boundary to Parry Channel, then north via the Byam and Byam Martin Channel to the North Pole. The area of the Western and Eastern areas are approximately 1.52 million square km and 1.73 million square km, respectively.

(c) Boundary Proposal 3

Federal riding to Great Bear Lake, north to connect with eastern boundary of the WAR area, north along WAR boundary to 'Parry Channel, then north via the Byam and Byam Martin Channels to the North Pole. The area of the Western and Eastern areas are approximately 1.42 million square km and 1.83 million square km, respectively.

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(1) The 1963 proposed boundary for the division of the NWT.

(2) All area estimates are comprised of mainland, Arctic Islands plus inland freshwater.

(d) Boundary Proposal 4

Federal riding to Great Bear Lake, north to the 70° latitude, northeast to 71° latitude 124° longitude, northwest to 71°45′ latitude 126°45′ longitude, then north to the North Pole. The area of the Western and Eastern areas are approximately 1.17 million square km and 2.08 million square km, respectively.

(e) Boundary Proposal 5

The federal riding. The area of the Western and Eastern areas are approximately 1.05 million square km and 2.20 million square km, respectively.

(f) Boundary Proposals la, 2a, and 3a

These boundary proposals are identical to alternatives 1, 2, and 3, respectively except that when they intersect the 1963 proposed boundary line in Melville Sound, they run west along this line through MacLure Strait to the Yukon-Alaska border. The area of the Western and Eastern areas for each of these boundary alternatives is as follows:

	West	East
la	1.51 km^2	1.74 km^2
2a	1.45 km^2	1.80 km2
3a	1.35 km^2	1.90 km^2

(g) Boundary Proposal 5a

The federal riding to its most westerly point and from there an extension of the riding's northern boundary to the Yukon-Alaska border. The area of the Western and Eastern areas are approximately 1.04 million square km and 2.21 million square km, respectively.

4.2 Implications of Proposed Boundary Divisions on Mineral Distribution

The five alternative boundary divisions are super-imposed on the mineral and oil and gas inventory maps (Figures 6 and 7), respectively. A summary of the results of this exercise is outlined below.[1]

4.2.1 Boundary Proposal 1: Base Case

Table 4.1 summarizes the reserve and resource potential by mineral and boundary area for the Base Case boundary proposal. Under this proposal the large majority of existing mines (8 out of 11) and known deposits (102 out of 139) lie in the western side. The west would have by far the greatest share of proven reserves and resource potential and near term prospects for all minerals except for iron, copper-nickel, coal and uranium. Note that the Perry River copper-nickel deposit (80) lies almost on the boundary line.

(1) The number *in* brackets following a particular deposit name refers to its map number as shown in Table 2.2 and Figure 2.

TABLE 4.1

Mineral Inventory Estimate for Alternative Boundary

Divisions of the NWT Alternatives 1, 2, la, 2a

(10^6 Tonnes)

	WEST		EAST	
Mineral	Reserves	Resource Potential	Reserves	Resource Potential
Gold	5.2	26.9	0.1	n.a.
Silver	0.06	0.11	--	--
Zinc-Lead	31.0	164.6	15.0	16.4
Polymetallic	--	37.3	--	5.4
Copper	--	43.1	--	--
Copper-Nickel	--	4.6	--	7.8
Tungsten	2.74	73.2	--	--
Coal	--	2,247	--	2,000
1 ron	--	2,123	--	6,380
Uranium	--	--	--	2.46
Lithium	--	22.2	--	--
Other Minerals	--	63.4	--	n.a.

NOTE : Minerals for which there are known deposits but unknown resource potential' are denoted by "n.a." Minerals for which there are no known major deposits are denoted by "--".

4.2.2 Boundary Proposal 2

Relative to the Base Case, two known deposits would be shifted from the Western area to the Eastern area -- the Hope Bay, silver deposit (42) and the Perry River copper-nickel showing (80). Resource tonnages for these deposits were not readily available. In any case, this alternative would not differ significantly from the Base Case in terms of mineral resource distribution.

4.2.3 Boundary Proposal 3

Relative to the Base Case, a number of known deposits, particularly in the Coppermine district would be shifted from the Western to Eastern area. These are listed below.

Deposit		Mineralization	
Arcadia	(1)	Gold	n.a.
Hope Bay	(42)	Silver	.806
High Lake	(60)	Polymetallic	4.72
Burnt Creek	(68)	Copper	.018
Carl	(69)	Copper	.113
Copper Lamb	(71)	Copper(Silver)	n.a.
Coronation	(72)	Copper	n.a.
Dick	(73)	Copper	.056
June	(76)	Copper	0.91
Coates Lake	(77)	Copper	3.72
Perry River	(80)	Copper-Nickel	n.a.
Muskon	(82)	Copper-Nickel	4.54
PEC	(122)	Uranium	n.a.
YUK	(123)	Uranium(Copper)	n.a.

Relative to the Base Case, Boundary Proposal 3 would shift a number of deposits, primarily copper and copper- nickel, as well as two uranium, one polymetallic and one silver deposit from the Western to Eastern areas. The shifting of resource potential shares to the East would be most significant with respect to copper-nickel type deposits. The overall impact on the resource inventory distribution is summarized in Table 4.2.

Note that there are several deposits, including the Hacket River polymetallic deposits (56, 57, 58) in the West and the Muskox polymetallic (82) and YUK/PEC uranium deposits (122, 123) in the East, which are very close to the proposed boundary.

4.2.4 Boundary Proposal 4

This boundary would result in a very similar distribution of mineral deposits as in Boundary Proposal 3 with the addition of a relatively minor bituminous coal deposit on Banks Island (89), with unknown resource potential, to the Eastern area.

TABLE 4.2

Mineral Inventory Estimate for Alternative Boundary

Divisions of the NWT

Alternatives 3, 3a, 4, 5 and 5a

(10^6 Tonnes)

	WEST		EAST	
Mineral	Reserves	Resource Potential	Reserves	Resource Potential
Gold	5.2	26.9	0.1	n.a.
Silver	0.06	0.11	--	--
Zinc-Lead	31.0	164.6	15.0	16.4
Polymetallic	--	32.6	--	10.1
Copper	--	38.3	--	4.8
Copper-Nickel	--	0.1	--	12.3
Tungsten	2.74	73.2	--	--
Coal	--	2,247	--	2,000
Iron	--	2,123	--	6,380
Uranium	--	--	--	2.46
Lithium	--	22.2	--	--
Other Minerals	--	63.4	--	n.a.

NOTE : Minerals for which there are known deposits but unknown resource potential are denoted by "n.a." Minerals for which there are no known major deposits are denoted by "--".

4.2.5 Boundary Proposal 5

The distribution of mineral deposits between East and West would be the same as Boundary Proposal 4 with the addition of the Coal Mine lignite coal deposit (92), formerly under very small scale production and with unknown resource potential.

4.2.6 Boundary Proposals la, 2a, and 3a

The distribution of known mineral deposits between East and West under these alternatives is the same as for proposals 1, 2, and 3, respectively.

4.2.7 Boundary Proposal 5a

The distribution of known mineral desposits would be the same as Boundary Proposal 5.

4.2.8 Summary

With respect to distribution of known mineral deposits, the alternative boundary divisions can be lumped into 2 main groups. The first group would be comprised of the Base Case and Boundary Proposal 2 and sub-alternatives la and 2a. The second group would be comprised of Boundary Proposals 3, 4 and 5 and sub-alternatives 3a and 5a. Differences within these boundary proposal groups were minor and even differences between them were not great.

Most of the existing mines would be located in the west regardless of the boundary chosen. Also, for all boundary alternatives the west would contain the overall majority of deposits and by far the greatest share of reserves and known resource potential for gold, silver, lead-zinc, polymetallic deposits, copper, tungsten and rare earths and other minerals. The east would contain the largest share of uranium, iron and copper-nickel resources. Coal resources are distributed relatively equally under all boundary proposals. The distribution of near term prospects in the various mineral categories would basically mirror the above distribution of resource potential. The effect of Boundary Proposals 3, 3a, 4, 5, and 5a is to increase moderately the East's share of polymetallic and copper resources and to sharply increase its share of copper-nickel resources.

The distribution of the largest and more promising mineral deposits identified in section 2.3.1 basically reflects the distribution of mineral resource potential regardless of the boundary chosen. The disparity in favour of the West, however, is not as great in terms of the number of these prospects. Eight out of the 19 more promising deposits indicated above would fall in the Eastern side. However, as section 2.1.2 showed, market prospects for these mineral desposits which are in the East (iron and uranium) are more uncertain than for such minerals as gold, silver, tungsten and rare earths. Nevertheless, in the event the large Lone Gull deposit near Baker Lake was developed it could significantly offset, from a tax revenue perspective at least, disparities in mineral resource distribution in favour of the West.

TABLE 4.3

Distribution of Mineral Resources for Alternative Boundary Divisions of the NWT

(%

	Alternatives [illegible] 2, [illegible]a, 2a				Alternatives 3, 4, 5, 3a, 5a			
	[illegible]		[illegible]		WEST		EAST	
Mineral	Reserves	Resource Potential	Reserves	Resource Potential	Reserves	Resource Potential	Reserves	Resource Potential
Gold	98	100	2	--	98	100	2	--
Silver	100	100		--	100	100	--	
Lead-Zinc	67	91	33	9	67	91	33	9
Polymetallic	--	87	--	13	--	76	--	24
Copper	--	100	--	--	--	89	--	11
Copper-Nickel	--	37	--	63	--	1	--	99
Tungsten	100	100	--	--	100	100	--	--
Coal	--	53	--	47	--	53	--	47
Iron	--	25	--	75	--	25	--	75
Uranium	--	--	--	100	--	--	--	100
Lithium	--	100	--		--	100	--	--
Other Minerals	--	100	--	--	--	100	--	--

This also points out the problems of making simplistic statements about overall distribution of a number of minerals which' differ markedly in terms of unit volume values, extraction costs and timing of development. The implications for the distribution of mineral potential of future exploration activity and changes in world supply and demand, mining technology or transportation access as noted in Section 2.4 should also be re-emphasized here.

Table 4.3 summarizes the percentage distribution of known reserve and resource potential tonnages by mineral and area for the 5 proposed boundary alternatives and the three sub-alternatives. It should be noted that the distribution of resource potential for gold and "other minerals" overstates the Western share somewhat since resource estimates for deposits in the East were not available. On the other hand the Eastern share of uranium resources is overstated for the same reason. However, this does not significantly bias the results.

4.3 Implications of Proposed Boundary Division on Hydrocarbon Distribution

This section discusses the implications that alternative boundary divisions would have on the distribution of oil and gas in the NWT . The boundaries are superimposed on the hydrocarbon basins and are shown in Figure 7.

4.3.1 Boundary Proposal 1: Base Case

The Base Case Boundary Proposal would run through and divide the Arctic Islands hydrocarbon fields located in the Sverdrup Basin. The other three areas having proven hydrocarbon reserves, the Mackenzie Delta, Beaufort Sea and Mainland Territories, would all be located in the western portion. Table 4.4 shows how the reserves would be divided.

The table shows that the western portion would contain about 81% of established oil reserves and 82% of gas reserves of the NWT. In the western portion, 53% of the oil reserves and 47% of the gas reserves would be onshore; the balance offshore. In the east 8% of the oil reserves and none of the gas reserves would be onshore.

Table 4.5 shows the distribution of hydrocarbon resources under the Base Case boundary proposal. It shows that 84% of the estimated oil and 79% of the estimated gas resources (at the 50% probability level) would be located in the Western area. At the high (95%) probability level, the West would contain 78% of the estimated oil and 89% of the estimated gas resources. It is not possible to calculate the onshore/offshore split due to lack of data, however, it can be inferred that the distribution would be similar to that for proven reserves.

TABLE 4.4

Base Case Boundary Proposal: Distribution of NWT Oil and Gas Reserves

		WEST			EAST		
		Onshore	Offshore	TOTAL	Onshore	Offshore	TOTAL
MacKenzie-Delta	Oil $10^6 m^3$	25.8	--	25.8	--	--	--
	Gas $10^9 m^3$	155.5	--	155.5	--	--	--
Beaufort Sea[a]	Oil	30.0	76.8	106.8	--	--	--
	Gas	17.4	116.1	133.5	--	--	--
Mainland Territories	Oil	55.0	--	55.0	--	--	--
	Gas	29.3	--	29.3	--	--	
Arctic Islands	Oil	--	22.5	22.5	4.o	45.0	49.5
	Gas	42.0	160.5	202.5	--	115.8	115.8
TOTAL	Oil	110.8	99.3	210.1	4.o	45.0	49.5
	Gas	244.2	276.6	520.8	--	115.8	115.8

NOTE: These figures are based on the midpoint of the range of estimates as reported in Table 3.2.

(a) Includes Richards Island.

TABLE 4.5

Base Case Boundary Proposal: Distribution of NWT Oil and Gas Resources

	WEST		EAST	
	OIL $10^6 m^3$	GAS $10^9 m^3$	OIL $10^6 m^3$	GAS $10^9 m^3$
Mackenzie-Delta	76	144	--	--
Beaufort Sea	1271	1721	--	--
Mainland Territories	95	310	--	--
Arctic Islands	460	1406	353	938
TOTAL :	1902	3581	353	938

NOTE : Based on average (50%) probability of discovery.

4.3.2 Boundary Proposals 2 and 3

These boundary proposals would have the same effect on hydrocarbon distribution as the Base Case.

4.3.3 Boundary Proposal 4

This proposal would result in the eastern portion being considerably larger than the western portion. The Mackenzie Delta, Beaufort Sea and Mainland Territories hydrocarbon basins would be located in the West, and the Arctic Islands in the East. Table 4.6 shows how the hydrocarbon reserves would be divided.

TABLE 4.6

Boundary Proposa Number 4: Distr but on of NWT o and Gas Reserves

		WEST			EAST		
		Onshore	Offshore	TOTAL	Onshore	Offshore	TOTAL
MacKenzie-Delta	Oil $10^6 m^3$	25.8	--	25.8	--	--	--
	Gas $10^9 m^3$	155 .5	--	155.5	--	--	--
Beaufort Sea[a]	Oil	30 .0	76.8	106.8	--	--	--
	Gas	17 .4	116.1	133.5	--	--	--
Mainland Territor es	Oil	55.0	--	55.0	--	--	--
	Gas	29.3	--	29.3	--	--	--
Arctic Islands	Oil	--	--	--	4.0	67.5	71.5
	Gas	--	--	--	42.0	276.3	318.3
TOTAL	Oil	110.8	76.8	187.6	4.0	67.5	71.5
	Gas	202.2	116.1	318.3	42.0	276.3	318.3

(a) Includes Richards Island

Under this proposal the West would contain about 72% of oil reserves and 50% of gas reserves. In the West some 59% of the oil and 64% of the gas would be contained in onshore fields. In the East 6% of the oil and 13% of the gas would be located onshore. Thus, this boundary proposal would result in the East receiving more of proven reserves of both oil and gas than the base case division.

Table 4.7 shows the distribution of resources. Under this boundary proposal 64% of the oil and 48% of the gas resources (at the 50% probability level) would be located in the West. Of the resources defined at the 95% probability level, 50% of the oil and 45% of the gas would be situated in the West.

TABLE 4.7

Boundary Proposal Number 4: Distribution of NWT Oil and Gas Resources

	WEST		EAST	
	OIL 10^6m^3	GAS 10^9m^3	OIL 10^6m^3	GAS 10^9m^3
Mackenzie-Delta	76	144	--	--
Beaufort Sea	1271	1721	--	--
Mainland Territories	95	310	--	--
Arctic Islands	--	--	813	2344
TOTAL :	1442	2175	813	2344

NOTE : Based on 50% probability level.

4.3.4 Boundary Proposal Number 5

This alternative would result in the NWT being divided into two areas of very different sizes. The West would be much smaller than the East, however, it would still contain the hydrocarbon reserves located in the Beaufort Sea Basin (including Richards Island) and the Mainland Territories. Mackenzie Delta and Arctic Island reserves would be located in the eastern portion. Table 4.8 shows the distribution of reserves.

This proposal would result in the West containing 62% of the oil and 26% of the established NWT gas reserves. About 53% of the western portion's oil and 29% of the gas reserves would be onshore. In the East, 31% of the oil and 42% of the gas reserves would be onshore.

TABLE 4.8

Boundary Proposal Number 5: Distribution of NWT Oil and Gas Reserves

		WEST			EAST		
		Onshore	Offshore	TOTAL	Onshore	Offshore	TOTAL
MacKenzie-Delta	Oil $10^6 m^3$ Gas $10^9 m^3$	-- --	-- --	-- --	25.8 155.5	-- --	25.8 155.5
Beaufort Sea[a]	Oil Gas	30.0 17.4	76.8 116.1	106.8 133.5	-- --	-- --	-- --
Mainland Territories	Oil Gas	55.0 29.3	-- --	55.0 29.3	-- --	-- --	-- --
Arctic Islands	Oil Gas	--	-- --	-- --	4.0 42.0	67.5 276.3	71.5 318.3
TOTAL	Oil [illegible]	85.[illegible] [illegible]	76.8 [illegible]	161.8 162.8	29.8 197.5	67.5 276.3	97.3 473.8

(a) Includes Richards Island

Table 4.9 shows the distribution of resources. Under this boundary proposal the West would contain 61% of the oil resources and 45% of the gas resources (at the 50% probability level). The West would contain 48% of the oil and 40% of the gas resources (at the 95% probability level).

TABLE 4.9

Boundary Proposal Number 5: Distribution of NWT Oil and Gas Resources

	WEST		EAST	
	OIL $10^6 m^3$	GAS $10^9 m^3$	OIL $10^6 m^3$	GAS $10^9 m^3$
Mackenzie-Delta	--	--	76	144
Beaufort Sea	1271	1721	--	--
Mainland Territories	95	310	--	--
Arctic Islands	--	--	813	2344
TOTAL :	1366	2031	813	2344

NOTE : Based on average (50%) probability of discovery.

4.3.5 Boundary Sub-Alternatives la, 2a, 3a

' These boundary proposals would have the same effect on hydrocarbon distribution as boundary proposal 4.

4.3.6 Boundary Proposal 5a

This proposal is similar to proposal 5 except that the dividing line extends westward to the NWT-Yukon border, then north to the pole. This would result in most of the Mackenzie Delta and all of the Beaufort Sea and Arctic Island hydrocarbon fields being situated in the East. Table 4.10 shows the distribution of reserves under this alternative.

Table 4.10 indicates that the West would contain 22% of the oil and 5% of the gas reserves. All of the reserves situated in the West would be onshore. In the East 28% of the oil and 35% of the gas would be onshore; the balance offshore.

Table 4.11 shows the distribution of resources. As indicated, the West would account for 4% of the estimated oil and 7% of the estimated gas resources, at the 50% probability level. At the higher confidence level, the West would contain only 3% of the oil and 3% of the gas resources.

TABLE 4.10

oundary Sub-A ternative 5a: D stribution of NWT il and Gas eserves

		WEST			EAST		
		Onshore	Offshore	TOTAL	Onshore	Offshore	TOTAL
MacKenzie-Delta	Oil $10^6 m^3$	[illegible]	--	3 [illegible]	22.8	--	22.8
	Gas $10^9 m^3$		--	--	155.5	--	155.5
Beaufort Sea[a]	Oil	--	--	--	30	76.8	106.8
	Gas	--	--	--	17.4	116.1	133.5
Mainland Territories	Oil	55.0	--	55.0	--	--	--
	Gas	29.3	--	29.3		--	--
Arctic Islands	Oil	--	--	--	4 [illegible]	67.5	71.5
	Gas	--	--	--	42 [illegible]	276.3	318.3
[illegible]	Oil	58.0	--	58.0	56.8	144.3	2[illegible]1.1
	Gas	29.3	--	29.3	214.9	392.4	6[illegible]7.3

(a) Includes Richards Island

TABLE 4.11

Boundary Sub-Alternative 5a: Distribution of NWT Oil and Gas Resources

	WEST		EAST	
	OIL $10^6 m^3$	GAS $10^9 m^3$	OIL $10^6 m^3$	GAS $10^9 m^3$
Mackenzie-Delta	--	--	76	144
Beaufort Sea	--	--	1271	1721
Mainland Territories	95	310	--	--
Arctic Islands	--	--	813	2344
TOTAL :	95	310	2084	4065

NOTE : Based on average (50%) probability of discovery.

4.3.7 Summary of Hydrocarbon Distribution

Tables 4.12 and 4.13 summarize the distributional implications of proposed boundary division on hydrocarbon reserves and estimated resources respectively.

It is clear from the table that the eastern portion would contain progressively more hydrocarbon reserves and estimated resources the further west the boundary were to be located. Under the Base Case boundary proposal, the East would contain 19% of the total NWT oil reserves and 18% of the gas reserves. Under proposal number 5, the East's share of oil reserves would increase to 38% and gas reserves to 72%.

Under sub-alternative 5a the East's share would increase even further to 78% of the oil and 95% of the gas reserves. With respect to resources, under the Base Case boundary proposal at the 50% probability level, 16% of the oil and 21% of the gas resources would be located in the East. Under Boundary Proposal number 5a the East would contain 96% of the oil and 93% of the gas resources at the 50% probability level.

TABLE 4.12

of Proposed Boundaries on Hydrocarbon Reserves

	EAST											
	Boundary 1, 2, 3			Boundary 4,1a,2a,3a			Boundary 5			Boundary 5a		
TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT
58.0	4.0	45.0	49.5	4.0	67.5	71.5	29.8	67.5	97.3	56.8	144.3	201.1
22	3	31	61	3	47	82	26	47	38	49	100	78
29.3		511.8	511.8	42.0	276.3	318.3	197.5	276.3	473.8	214.9	392.4	607.3
s	0	30	18	17	70	50	81	[illegible]	72	88	100	95

4.3.7 Summary of Hydrocarbon Distribution

Tables 4.12 and 4.13 summarize the distributional implications of proposed boundary division on hydrocarbon reserves and estimated resources respectively.

It is clear from the table that the eastern portion would contain progressively more hydrocarbon reserves and estimated resources the further west the boundary were to be located. Under the Base Case boundary proposal, the East would contain 19% of the total NWT oil reserves and 18% of the gas reserves. Under proposal number 5, the East's share of oil reserves would increase to 38% and gas reserves to 72%.

Under sub-alternative 5a the East's share would increase even further to 78% of the oil and 95% of the gas reserves. With respect to resources, under the Base Case boundary proposal at the 50% probability level, 16% of the oil and 21% of the gas resources would be located in the East. Under Boundary Proposal number 5a the East would contain 96% of the oil arid 93% of the gas resources at the 50% probability level.

TABLE 4.12

Summary of Distributional Effects of Proposed Boundaries on Hydrocarbon Reserves

	WEST												EAST											
	Boundary 1, 2, 3			Boundary 4,1a,2a,3a			Boundary 5			Boundary 5a			Boundary 1, 2, 3			Boundary 4,1a,2a,3a			Boundary 5			Boundary 5a		
	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT	ON SHORE	OFF SHORE	TOT
OIL																								
(Quantity) 10^6m^3	110.8	99.3	210.1	110.8	76.8	187.6	85.0	76.8	.61.3	58.0	-	58.0	4.0	45.0	49.5	4.0	67.5	71.5	29.8	67.5	97.3	56.8	144.3	201.1
% of total NW Oil Reserves	97	69	81	97	53	72	74	53	62	51	0	22	3	31	19	3	47	28	26	47	38	49	100	78
GAS																								
(Quantity) 10^9m^3	244.2	276.6	520.8	202.2	116.1	318.3	46.7	116.1	162.8	29.3	-	29.3	--	115.8	115.8	42.0	276.3	318.3	197.5	276.3	473.8	214.9	392.4	607.3
% of Total NWT Gas Reserves	100	70	82	83	30	50	19	30	26	12	0	5	0	30	18	17	70	50	81	70	72	88	100	95

TABLE 4.13

Summary of Distributional Effects of Proposed Boundaries on Hydrocarbon Resources

	WEST				EAST			
	Boundary 1, 2, 3	Boundary 4, 1a, 2a, 3a	Boundary 5	Boundary 5a	Boundary 1, 2, 3	Boundary 4, 1a, 2a, 3	Boundary 5	
OIL								
% of Total NWT Oil Resources at 95% level	78	50	48	3	22	50	52	
% of Total NWT Oil Resources at 50% level	84	64	61	4	16	26	39	
GAS								
% of Total NWT Resources at 95% leve	89	45	40	3	11	55	60	
% of Total NWT Gas Resources at 50% leve	79	48	45	7	21	52	55	

5.0 REVENUE AND EMPLOYMENT CONSIDERATIONS

5.1 Introduction

Revenues from non-renewable resource extraction will be important contributors to the ability of northern governments to provide public services. Direct government resource revenues take two principal forms: a sharing of the return on the investment of private capital (through the corporate income tax) and a capturing of rents as the owner of natural resources, collected through royalties. Government also obtains revenues indirectly, from personal income, sales and other taxes.

Resource rents occur because the revenues generated by selling a resource stock may exceed the full costs of extracting it including a "normal" return on capital. Thus, a firm wishing to extract the stock would be willing to bid an amount equal to the rent for the right to do so.

In practice, uncertainty about the size, quality and costs of extraction of a stock leads governments (as resource owners) to collect rents by means of a tax on profits as extraction proceeds. Problems of using accounting data to define the rent (eg. profits from processing operations should conceptually not be included although they are in practice often difficult to separate) and problems of defining a taxation schedule that treats firms of different sizes and deposits of different qualities appropriately, lead to imperfect appropriation of rents.

This section of the study considers the revenue and employment potential from non-renewable resources for governments within the current boundaries of the NWT. It summarizes current revenues from mining (Section 5.2) and from oil and gas (Section 5.3). With respect to future revenues, it analyzes sample projects rather than attempting to forecast the total of all such revenues. It considers revenues that may be realized under current rates and tax sharing arrangements and those which may become available under other possible regimes. In this context, existing arrangements elsewhere in Canada are taken as demonstrating the range of possibilities. The issues involved are the total size of tax collections by all levels of government, and, more importantly, the assignment of resource ownership which determines which level of government may collect resource royalties. The discussion in this report focusses particularly on royalties and their potential for revenue generation for the GNWT and successor governments.

It must be noted, however, that northern governments may not wish to impose royalty schemes which collect as much revenue as the more aggressive among the current provincial systems. Lower rates may be desirable to compensate cost differentials, or to give incentives for activity in the north which will result in development and growth in employment. Current employment levels and employment potentials are discussed and revenue and employment implications of the split into East and West are discussed.

5.2 Mineral Sector in the NWT

5.2.1 Taxation Regimes

The present sharing of mining revenue in the Northwest Territories between industry, the GNWT, and the Federal governments is determined primarily by the Federal tax system applicable to the resource sector on Canada Lands. The taxes currently accruing to the GNWT are limited to 10% of corporate taxable income (rebated by the Federal Government), plus local taxes, the most important of which is the property tax. Resource royalties are levied in the form of a Federal mining tax. Table 5.1 illustrates the calculation of the major taxes with the exception of the property tax.

The immediate effect of a change to provincial status would be to transfer the proceeds of the mining tax to the GNWT. A choice would then have to be made as to the aggressiveness with which to pursue resource rents. The range of possibilities is illustrated by current royalty arrangements in the ten provinces. All the schemes are broadly similar in that they are levied on mining profits, they allow depreciation deductions for capital and exploration costs, and most

TABLE 5.1
Taxes Applicable to the Mining Industry: Current System

Income Tax:
Mining Revenues
Less: Operating Costs ( )
CCA
Equals Income Subject to Resource Allowance
Less: Resource Allowance (25%) ( )
CEE and CDE ( )
Interest Expense ( )
Equals Income subject to Depletion Allowance
Less: Earned Depletion (max. 25%) ( )
Equals Taxable Income
Federal Tax (36%)
GNWT Income Tax (10%)

Federal Mining Tax:
Gross Revenues
Less: Operating Costs ( )
Transportation charge to Treatment or Smelter ( )
Exploration or Dev. Costs at mine ( )
Depreciation of mine or mill assets (maximum 15%/year) ( )
Production Expenses (max. 15%/yr.)
Processing Allowance ( )
Equals Revenue Subject to Mining Tax

Mining Tax Rates:

Annual Values ($000)	Rate on Increment
10 - 1,000	3%
1,000 - 5,000	5%
5,000 - 10,000	6%
10,000 - 15,000	7%
15,000 - 20,000	8%
20,000 - 25,000	9%
25,000 - 30,000	1 0%
30,000 - 35,000	11%
above 35,000	12%

NOTES:

CCA: Capital Cost Allowance. Assets are grouped into classes and written off at different rates.
CDE : Canadian Development Expense. 30% of unclaimed balance.
CEE: Canadian Exploration Expense. 100% deductible in year incurred.
Earned Depletion: $1 for each $3 of eligible expenditures with a maximum of 25% of income subject to depletion allowance.
Processing Allowance: Only applies if ore is treated within the NWT. Equals the lesser of 8% of the original cost of processing assets and 65% of the value of the output of the mine prior to this allowance.
An investment tax credit of 7% of the cost of eligible assets is generally available to offset Federal income tax payable.

allow a processing allowance so royalty is not levied on profits due to processing.[1] The calculation of the deductions and allowances varies between provinces as do the rates of tax. In some cases profits are taxed at a flat rate (eg. B.C., Manitoba) and in other the schedule is strongly progressive. Price Waterhouse has developed models which calculate effective rates of tax (based on accounting income) for a "typical" mining operation which extracts copper, gold, and silver from an orebody which lasts for ten years after the commencement of production.[2] Models are developed for six provinces and the two territories. Effective rates of royalty taxation are shown in Table 5.2. These rates would vary depending on the actual characteristics of particular mines but they do give an indication of the large range of rates between jurisdictions. The table indicates that there is large scope for increasing collections of the NWT mining tax if it is desired to do so.

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(1) For a complete summary of mining tax provisions by province, see price Waterhouse, Canadian Mining Taxation, 1983, Appendix J.

(2) Price Waterhouse, Canadian Mining Taxation. A complete description of the example is given on Page 19.

TABLE 5.2

Effective Rates of Royalty Based on Accounting Profit

New Brunswick	19.89
Ontario	17.32
Ouebec	15.86
Manitoba	15.71
Newfoundland	15.66
British Columbia	13.56
Yukon	8.24
Northwest Territories	4.03

Source: Price Waterhouse, Canadian Mining Taxation, 1983.

5.2.2 Current Revenues

A summary of minehead revenues and tax revenues generated directly by the mining industry in the NWT over the 1978-1982 period is given in Table 5.3. Zinc, gold and tungsten are the most important minerals currently produced in the NWT, accounting for 41%, 32%, and 16%, respectively, of total NWT minehead revenues in 1982. As can be seen in Table 5.3, there is substantial variability over time in the income based taxes (income tax and royalties). The share of total tax revenues received by the GNWT is relatively small except in years of extremely low industry income when the income based taxes become negligible in amount. Royalty collections are not large at current rates. The GNWT share of the income tax, on average, yields more revenue than does the mining tax. Thus, without a large increase in royalty rates, tranfer of resource ownership to the NWT will not result in large increases in fiscal capacity at least as far as mining is concerned.

TABLE 5.3

Summary of Revenue Directly Generated by
Mining Operations in the NWT:
1978-82a

	1978	1979	1980	1981	1982
Gross Minehead Revenues[b] ($ x 10^6)	207.0	311.0	293.0	256.0	255.0
Tax Revenues ($ x 10^6)					
Federal					
Corporate Income Tax	12.8	32.3	23.3	8.2	1.0
DINA Royalties	2.6	2.7	6.7	0.9	0.7
Total	15.4	35.0	30.0	9.1	1.7
NWT					
Share of Fed. Income Tax	3.5	9.0	6.0	2.0	0.3
Gasoline and Fuel Oil Taxes	0.5	0.5	0.7	0.9	1.8
Other (Municipal Taxes)	0.2	0.3	2.0	0.3	0.5
Total	4.2	9.8	8.7	3.2	2.6

Source: Price Waterhouse Associates, The Northwest Territories Mining Industry: 1981-1982, December, 1983. Draft report, figures subject to revision.

(a) Excludes Salmita and Cullaton L. mines. Includes Eldorado.

(b) Excludes treatment and refining charges, marketing expenses and transportation charges to f.o.b. point of delivery.

5.2.3 Hypothetical Uranium Project Revenues

Future mineral development will provide a continuing source of revenues for the GNWT and successor governments. The total magnitudes of such revenues are highly uncertain since it is difficult to predict which minerals and which deposits will be rendered economic and which not by the typically fluctuating prices of the metals concerned. Given high incremental transportation costs for mineral products in the north, particularly for deposits not near transportation corridors, the brightest prospects for significant resource rents are for those minerals with very high values per kg, i.e. precious metals and uranium. To illustrate the general magnitude of the revenue potential from such minerals, two hypothetical single projects, a uranium mine, and a gold mine are analyzed.

Potential rents and revenue sharing for a uranium project are analyzed based on cost and reserves estimates for the Lone *Gull* deposit near Baker Lake. The calculations presented should be viewed as illustrative only, since they are rough in nature. Government revenues under the current taxation regime and revenues under the Saskatchewan uranium royalty system are estimated. The latter is chosen since it is the most aggressive in Canada in terms of rent appropriation.

Cost estimates for Lone Gull were obtained from an analysis performed in 1979 by Wright Engineers Ltd. in Vancouver. Accuracy of the estimates was considered to be in the range of plus or minus 30%

when compiled. The reserves estimate is taken from Table 2.2 of this study.

Capital cost estimates[1] are broken down into 13 categories of cost. They total $242.50 million (1983$) excluding interest charges which are part of the return on capital and, as such, are accounted for by the use of a 10% discount rate. Capital costs are assumed to be incurred over a three year period, 25% in the first and third years and 50% in the second year. As shown in Table 5.4, the year 0 present value of capital costs total $200.88 million (1983$ at a 10% discount rate). Production is assumed to begin in the fourth year with operating costs of $117 per ton of mill throughput. The mill is assumed to process 750 tons of ore per day and operate 350 days each year. Given an ore body containing 16,783 tons of U308 occurring at. a concentration of 1%, mill output will be 2.39 million kg per year of yellowcake (U_3O_8) and will continue for 6.4 years. Operating costs are thus $30.79 million (1983$) per full operating year and, as shown in Table 5.4, they total $196.45 million over the project life or $105.27 million in present value.

The price of yellowcake was $98 per kg in 1983. This price is assumed to remain constant in real terms through the project life. This results in revenues of $234.22 million per full operating year, a total of $1,494.50 million over the project life, or $800.79 million in present value.

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(1) Wright Engineers Ltd., Output from Quick Capital Cost Estimate Program, results contained in a letter to Mr. R.S.R. Weldwood, Senior Assessor of Uranium Reserves, November 29, 1979. Values were escalated to 1983 dollars by use of the non residential construction price index, Statistics Canada Statistical Review, publication 11-003E.

TABLE 5.4

Rents from the Lone Gull Uranium Deposit

(millions $1983)

Year	Capital Costs	Operating Costs	Gross Revenue	Net Revenue
0	0	0	0	0
1	60.62	0	0	-60.63
2	121.25	0	0	-121.25
3	60.63	0	0	-60.63
4	0	30.79	234.22	203.43
5	0	30.79	234.22	203.43
6	0	30.79	234.22	203.43
7	0	30.79	234.22	203.43
8	0	30.79	234.22	203.43
9	0	30.79	234.22	203.43
10	0	11.70	89.18	77.48
TOTAL	242.50	196.45	1,494.50	1,055.54
Year O NPV @ 10%	200.88	105.27	800.79	494.65

Net revenues are shown in the last column of Table 5.4. Costs do not include interest charges, taxes, or depreciation charges since these are not measures of true economic costs. Net revenues total $1,055.54 million or $494.65 million in present value. This latter figure is a measure of the economic rents from the project, since the use of 10% discount rate in calculating the present value accounts for the "normal" return on capital. Governments could theoretically take the entire $495 million in taxes and a private firm would still be willing to undertake the project. The only condition which must be noted is that exploration costs have not been included in the calculation. This is a correct procedure in calculating the returns from proceeding with this project since exploration costs have already been incurred and are thus sunk. However, in the long run, firms would be unwilling to undertake exploration for new deposits if governments were to not allow them to recoup exploration costs. Thus the practical limit in appropriation of these rents is less than $495 million.

Taxes due under the current regime were calculated. Income taxes payable to the Federal government and to the GNWT are estimated as in Table 5.1. The Investment Tax Credit is taken as 7% of eligible assets, and reduces Federal taxes payable to zero in year four and reduces them by about $3 million in year five. As shown in Table 5.5, Federal income taxes total some $273 million, or $136.70 million in present value. The income taxes due the GNWT total some $79 million, or $39.78 million in present value.

The current Federal mining tax is subject to a 36 month royalty holiday after commencement of production so payments begin in year seven. As shown in Table 5.5, they total $63.4 million, or $29.03 million in present value.

TABLE 5.5

Uranium Revenue Sharing: Current System

(millions, $1983)

Year	Federal Income Tax	GNWT Income Tax	Federal Mining Tax	Revenues After Taxes
0	0	0	0	0
1	0	0	0	-60.63
2	0	0	0	-121.25
3	0	0	0	-60.63
4	0	1.83	0	201.60
5	38.43	11.57	0	153.43
6	49.02	13.62	0	140.79
7	54.93	15.26	16.86	116.39
8	54.93	15.26	20.26	112.99
9	54.93	15.26	20.57	112.68
10	20.92	5.81	5.72	45.03
Total	273.15	78.60	63.41	640.39
NPV @ 10%	136.70	39.78	29.03	289.14

Net revenues (rents) accruing to the firm are given in the final column of Table 5.5. They total $640.4 million or $289.14 million in present value. The GNWT would obtain some small portion of these through property and other local taxes, which were not estimated for this analysis.

Under these taxation arrangements, approximately 42% of the rents are captured by governments. The GNWT obtains only 8% of the rents through the income tax and another small proportion through local taxes. The royalty payments are small in total, partly because of the relatively low rates of royalty and partly because of the three year royalty free period which covers almost half of the planned production period for this mine. Transfer of this royalty to the GNWT through provincial status would only contribute two-thirds again as much revenue (in present value) as is already obtained through the corporate income tax.

Royalties payable under the Saskatchewan uranium royalty were estimated as an example of aggressive rent collection. If the GNWT were to obtain provincial status, this is one regime which could be implemented. The Saskatchewan system consists of a 3% basic royalty on gross revenue plus a graduated royalty on profits. Profits are defined as gross revenue less production costs, allowances for administrative, marketing, and working capital costs, and the basic royalty. No graduated royalties are payable until all initial capital investment has been recouped in operating profits.(1) Operating profits are computed as a percentage of capital invested and royalty is charged at the following rates:

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(1) Price Waterhouse, Canadian Mining Taxation, op. cit.

Operating Profit as a % of Capital Investment	% Tax in Range
o - 15	o
15 - 25	15
25 - 45	30
over 45	50

Table 5.6 shows the tax streams due under this regime. The income tax streams are reproduced from Table 5.5 for purposes of comparison. The royalty payments total $299.08 million or $151.24 million in present value. Collections of this royalty are over five times as great in present value as are those of the current royalty applicable in the NWT. Firm rents are reduced from some $289 million in the previous case, to approximately $167 million.

TABLE 5.6

Uranium Revenue Sharing: Saskatchewan Royalty

(millions, $1983)

Year	Federal Income Tax	GNWT Income Tax	Royalty	Net Revenues After Taxes
0	0	0	0	0
1	0	0	0	-60.63
2	0	0	0	-121.25
3	0	0	0	-60.63
4	0	1.83	7.03	194.57
5	38.43	11.57	28.55	124.89
6	49.02	13.62	63.66	77.13
7	54.93	15.26	63.66	69.59
8	54.93	15.26	63.66	69.59
9	54.93	15.26	63.66	69.59
10	20.92	5.81	8.88	41.87
Total	273.15	78.60	299.08	404.72
NPV @ 10%	136.70	39.78	151.24	166.93

In sum, a uranium development such as Lone Gull, could generate significant economic rents, but the return to the GNWT or successor governments would be relatively small under present taxation arrangements. Even if it received the current federal royalty, the revenue potential would not be greatly increased. More aggressive royalty schemes which could be implemented as a result of resource ownership would, however, hold promise for significantly increasing GNWT revenues.

5.2.4 Hypothetical Gold Project Revenues

Potential rents and revenue sharing for a "typical" gold project are considered under two taxation regimes. Payments due under the current regime and those which would be realized by implementing the New Brunswick mining tax are calculated. The New Brunswick system, as shown in Table 5.2, is among the most aggressive in Canada with regard to rent collection.

Wright Engineers Ltd.[1] provided a summary of the characteristics of a gold deposit judged to be "typical" in the context of the Northwest Territories. It was cautioned, however, that conditions vary widely between deposits so the estimates may not apply to any actual deposit. A set of conditions with regard to location and size of the deposit and type of processing required were postulated. A concentration of .6 ounces of gold per ton of ore was assumed.

Costs and revenues are shown in Table 5.7. Capital costs total $34.22 million (1983$) excluding interest charges. As before, capital costs are assumed to be incurred in years one through three. Production occurs in years four through thirteen, assuming a deposit of sufficient size to support ten years of production.

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(1) Wright Engineers Ltd., "Output from Quick Capital Cost Estimate program", May 2, 1984, deflated to 1983 dollars by Statistics Canada non-residential construction price index.

TABLE 5.7

Rents From A Typical Gold Deposit

(millions $1983)

Year	Capital Costs	Operating Costs	Gross Revenue	Net Revenue
0	0	0	0	0
1	8.56	0	0	-8.56
2	17.10	0	0	-17.10
3	8.56	0	0	-8.56
4	0	8.05	19.69	11.64
5	0	8.05	19.69	11.64
6	0	8.05	19.69	11.64
7	0	8.05	19.69	11.64
8	0	8.05	19.69	11.64
9	0	8.05	19.69	11.64
10	0	8.05	19.69	11.64
11	0	8.05	19.69	11.64
12	0	8.05	19.69	11.64
13	0	8.05	19.69	11.64
TOTAL	34.22	80.52	196.88	82.15
Year 0 NPV @ 10%	28.34	37.17	90.89	25.38

operating costs are estimated to be $115.02 per ton throughput for a mill processing 200 tons of ore per day. It is assumed to operate 350 days per year. operating costs are $8.05 million per year, and total $80.52 million over the project life.

Mill output is 42,000 ounces of gold per year. A gold price of $375 Us. per ounce,[1] constant in real terms through the project life is assumed. It must be noted that the price of gold

(1) A constant exchange rate of $1.25 Cdn. to the American dollar is assumed, giving a Canadian dollar price of $469 per ounce.

is highly volatile and that a firm may be unwilling to undertake a large capital commitment without some expectation of earning above normal profits at this price. This would guarantee the viability of the project if prices were to fall somewhat. Gross revenues of $19.69 million per year or $196.88 million in total are projected.

Net revenues are estimated at $82.15 million in total or $25.38 million in net present value over the project life. Thus the economic rent available to governments is approximately $25 million, bearing in mind the problems of firms recovering exploration costs and of price risk. The rent from this project is much smaller than that estimated for the uranium project, but the scale of the project, as measured by total capital costs, is also significantly lower. Even on a normalized basis, however, the rents are significantly lower for the gold project. The ratio of rent to present value of capital costs is 2.46 for the uranium project and only .90 for the gold project.

Taxes payable under the current regime are shown in Table 5.8. The tax treatment of a gold project for this regime is identical to that accorded a uranium project. Federal income taxes are not payable in the early years of the project due to various cost write-offs. They are payable starting in the seventh year and total $19.03 million or $7.11 million in present value. GNWT income taxes total $5.63 million or $2.15 million in present value. Payments under the current Federal mining tax are relatively low, as in the uranium example, comprising only $.90 million in present value.

TABLE 5.8

Gold Revenue Sharing: Current System

(roil lions $1983)

Year	Federal Income Tax	GNWT Income Tax	Federal Mining Tax	Net Revenue After Taxes
0	0	0	0	0
1	0	0	0	-8.56
2	0	0	0	-17.10
3	0	0	0	-8.56
4	0	0	0	11.64
5	0	0	0	11.64
6	0	0	0	11.64
7	.18	.39	0	11.06
8	3.14	.87	.21	7.41
9	3.14	.87	.41	7.21
10	3.14	.87	.44	7.18
11	3.14	.87	.46	7.16
12	3.14	.87	.48	7.14
13	3.14	.87	.50	7.13
TOTAL	19.03	5.63	2.49	55.00
Year O NPV @ 10%	7.11	2.S5	.90	15.22

Firm revenues after taxes total $55.00 million for the project. Firm rents after a normal return on capital are $15.22 million.

Under the current regime, approximately 38% of the rents are captured by governments of which 8.5% of the rents accrue to the GNWT. These percentages are similar to the corresponding values for the uranium project, since the proceeds of the mining tax are proportionally quite small and since the income taxes are both calculated at a flat rate on profits. As before, in the event of provincial status for the NWT, the acquisition of the revenues of the mining tax in its current form would not add significantly to GNWT revenues. In that case some 12% of project rents would be appropriated by the GNWT.

Royalties payable under the New Brunswick mining tax are shown in Table 5.9. These are calculated to show how a more aggressive royalty combined with resource ownership could enhance revenues for the GNWT and successor governments. The New Brunswick royalty consists of two parts, a 2% royalty and a 16% tax. The 2% royalty is charged on a net revenue base which is gross revenues less transportation costs, costs of refining, smelting and milling, and a processing allowance.(1) A two year royalty holiday is in effect. The 16% tax is charged on net profit over $100,000 per year. Net profit is defined as for the 2% tax, but with additional deductions for mining costs, the 2% royalty paid, and specified allowances for depreciation, financing charges, processing (this allowance is defined differently for the two royalties) and exploration expenditures.

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(1) For greater detail, see price Waterhouse, Canadian Mining Taxation, op. cit., p. 16.

TABLE 5.9

Gold Revenue Sharing: New Brunswick Royalty

(mi 11 ions $1983)

Year	Federal Income Tax	GNWT Income Tax	Royalty	Net Revenue After Taxes
0	0	0	0	0
1	0	0	0	-8.56
2	0	0	0	-17.10
3	0	0	0	-8.56
4	0	0	0	11.64
5	0	0	0	11.64
6	0	0	.41	11.23
7	.18	.39	1.14	9.92
8	3.14	.87	1.80	5.82
9	3.14	.87	1.80	5.82
10	3.14	.87	1.80	5.82
11	3.14	.87	1.80	5.82
12	3.14	.87	1.80	5.82
13	3.14	.87	1.80	5.82
TOTAL	19.03	5.63	12.34	45.15
Year O NPV @ 10%	7.11	2.15	4.84	11.27

The income tax streams shown in Table 5.9 are identical to those in Table 5.8. The royalty payments total $12.3 million or $4.84 million in present value. Collections of this royalty, as in the case of uranium, are significantly larger than those of the GNWT income tax. Under this regime, approximately 56% of rents are captured by governments. Of this, 28% of the rents would accrue to the GNWT.

‘It is interesting to note that for this project, the New Brunswick royalty (a flat rate royalty) has similar consequences to those obtained if one applies the Saskatchewan uranium royalty system (a fairly strongly progressive royalty). The Saskatchewan regime would yield $4.54 million in royalties in present value, resulting in approximately 54% of the rents being appropriated by governments.

As in the uranium example, it is clear that the potential for large new direct revenues from mining lies not so much in obtaining current royalty revenues through provincial status as it does in raising royalty rates.

5.2.5 Employment

Assuming that the GNWT or successor governments obtain resource ownership, the choice must be made as to what royalty scheme to adopt. Against considerations of increasing revenues *must* be balanced the level of incentive (in the form of firm rents) which is desired to give firms, so that they will proceed with projects in the north which would lead to employment and to development through spinoff income and employment. This section discusses current employment (both in total and for northerners) and wages in the industry and the potential employment impacts of the two hypothetical projects discussed earlier.

Employment and direct wages in the entire mining sector are shown in Table 5.10. Employment has been steadily rising over the five years shown. In 1982, approximately 2400 jobs were accounted for by mining, not including contractor and exploration company employees. It should be noted, however, that over 40% of employment and gross wages accrue to non-permanent residents of the NWT.[1] In spite of this fact, mining clearly provides significant employment in the NWT in relation to the size of the labour force.

(1) Price Waterhouse Associates, The Northwest Territories Mining Industry 1981-1982, December 1983.

TABLE 5.10

Employment and Direct Wages from Mining

	1978	1979	1980	1981	1982
Direct Employees	1968	2054	2076	2256	2425
Gross Direct Wages ($ millions)	50.4	58.6	65.0	90.2	116.4

Source: Price Waterhouse Associates, The Northwest Territories Mining Industry, 1981-1982, December, 1983.

Future projects will provide further employment and impetus for development. It is estimated that development of the Lone Gull Uranium project could result in approximately 1400 man years of employment during the construction phase and in 538 jobs during operation.(1) Assuming average wages of $37,000 per year,(2) this would result in $51.8 million in direct wages during the construction phase and $19.9 million per operating year, plus spinoff employment and income depending on the magnitude of the multiplier effects.

The hypothetical gold project analyzed previously would result in much less employment than the uranium mine due to its smaller scale. It is estimated that 75 man years of employment would be created during construction of which only 25% would accrue to local inhabitants,(3) and that 155 employees would be required during operation.(4)

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(1) Marvin Shaffer & Associates Ltd., Impacts of Canada's Uranium Mining Industry, May 1982.

(2) Price Waterhouse Associates, The Northwest Territories Mining Industry 1981-1982, Table 16. Average wages and salaries are estimated in Table 16 at $37,000 per year in 1982, so this is probably an underestimate for 1984."

(3) Personal communication, Wright Engineering.

(4) Based on average number of operating employees per kg output for a number of gold and silver mines in the NWT. See Table 2.1.

5.2.6 Implications of Division

(a) Current Activity

The majority of existing mines (i. e 7 out of 10) and therefore tax revenue and employment generated by these operations would accrue to the West regardless of the boundary chosen.

(b) Potential Revenues

(i) Uranium:- The East contains most of the known uranium resource and therefore uranium tax revenue and employment potential in the NWT, regardless of the boundary alternative chosen. The example chosen for analysis, the Lone Gull deposit, is also the most likely uranium deposit to be developed in the NWT in the short term. The tax revenue potential from this deposit and for uranium in general is very high, in fact, comparable with hydrocarbons on a per dollar output basis. However, operating employment per dollar output for open pit uranium mining is lower than for other minerals and known resources are relatively small. The economic outlook for uranium, tied to the outlook for nuclear power, is also very uncertain at this time.

(ii) Gold:- Most of the known gold reserves and resource and therefore tax revenue and employment potential is located in the West regardless of the boundary chosen. Gold is also a very high valued mineral with a high per dollar output tax revenue potential, although not generally as high as for hydrocarbons or uranium.[1]

Currently known gold resources are substantially larger than for uranium and mining (underground) is much more labour intensive. Therefore gold's overall tax revenue and employment potential is very substantial. The longer term outlook for gold is also probably stronger and more stable than for most other minerals.

(iii) Other Minerals:- Analysis of tax revenue potential for other minerals were not undertaken for this study. A study by Smith, Weisbeck & Associates of the rent potential associated with several existing mines in the NWT[2] indicates that although zinc/lead and tungsten deposits, for example, do not have nearly the same tax revenue potential on a per dollar output basis as gold or uranium, they nevertheless can generate substantial rents and employment on an overall basis because of the large tonnages of resources involved. The same is true for minerals such as copper, nickel and iron although these are likely to be much more long term development prospects. As indicated above, except for nickel, the West would have by far the largest share of tax revenues and employment benefits from these minerals regardless of the boundary chosen.

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(1) It should be noted that while uranium can generate more government revenues than gold, the disparity is not as great as the previous examples suggest. Firstly the hypothetical gold mine is average for the NWT in terms of size and grade, whereas the Lone Gull example is very large - the largest known deposit in the NWT. Secondly, the price assumed for gold is relatively low, at least by recent historical standards, and could be conservative. The price assumed for uranium, on the other hand, may be optimistic in light of the uncertainties surrounding uranium demand.

(2) Economic Rents Associated with Major Mining and Hydrocarbon Activities, Smith, Weisbeck & Associates, March, 1978.

5.3 Oil and Gas Sector

5.3.1 Taxation Regimes

For purposes of representing the range of taxation systems which could be applied to revenue from the production of oil and gas in the NWT, three regimes are discussed. The first is the current system. Next is the sharing of petroleum revenues according to the Federal-Alberta taxation agreement. Finally, petroleum revenue sharing according to the recent Canada-Nova Scotia Offshore Oil and Gas Agreement is described. Any new agreement signed between the GNWT and the Federal Government would likely fall in the range of these three systems.

The current revenue sharing system for petroleum is similar in broad outline to that in effect for mining. Royalties are levied by the Federal government, and the GNWT tax base is limited to a 10% share of taxable income plus local taxes. Table 5.11 illustrates the calculation of taxes and royalties applicable to the petroleum industry operating in the Northwest Territories.[1]

(1) Table 5.11 presents a general outline of the taxation structure. For additional detail, the reader should refer to the relevant tax regulations.

TABLE 5.11

Taxes and Royalties Applicable to the Petroleum Industry in the NWT: Current System

I. Petroleum and Gas Revenue Tax (PGRT)

Gross Revenue
    Less: Operating Costs
Equals Net Production Revenue
    Less: Resource Allowance
Equals Revenue Subject to PGRT
PGRT (16%)

II. Income Tax Calculation:

Gross Revenue
    Less: Operating Costs
        CCA
        Resource Allowance
        CDE
        CEE
        Interest Expense
Equals Taxable Income

Federal Tax (36%)

Income Tax Rebated to GNWT (10%)

III. Basic Royalty:

Gross Revenue
Basic Royalty (10%)

IV. Progressive Incremental Royalty (PIR):

Gross Revenue
    Less: Operating Costs
        PGRT
        Income Tax Abatement
        Basic Royalty
Equals Profit
    Less: Allowed Return
        Capital Allowance
Equals Net Profit
PIR (40%)

NOTES:

Gross Revenue: Valuation at the wellhead. For natural gas an allowance is deducted for the cost of processing.
Operating costs: Field operating costs
Resource Allowance: For PGRT: 25% of gross revenue less operating costs. For calculation of taxable income: 25% of gross revenue less operating costs and CCA.
Capital Cost Allowance (CCA): A 30% CCA (declining balance basis) is permitted on most equipment necessary to petroleum development.
CDE: Canadian Development Expense; can be written off at 30% on a declining balance basis.
CEE: Canadian Exploration Expense; can be written off at 100% in the year incurred.
Income Tax Abatement: Deduction of income tax payable
Allowed Return: 25% rate of return on invested capital. Includes exploration and development expenditures net of PIP grants and class 10 investments net of Investment Tax Credit (ITC)
Capital Allowance: 17% of same capital bdse as used in calculating Allowed Return.

The Petroleum and Gas Revenue Tax (PGRT) is 16% of gross revenue less field operating costs and a resource allowance. The resource allowance equals 25% of gross revenue less operating costs. Net of the resource allowance, the PGRT is effectively 12% of gross revenue less operating costs.

The Corporate Income Tax equals 46% of taxable income of which 10% of taxable income is rebated to the GNWT. Taxable income equals gross revenue less operating costs, a capital cost allowance (CCA), a resource allowance, and write offs relating to development and exploration expenses.[1]

The Federal government applies two royalties to petroleum revenue generated on Canada lands. The Basic Royalty equals 10% of gross revenue. The Progressive Incremental Royalty (PIR) is applied at a rate of 40% on a net income base. The deductions allowed in calculating this net income are shown in the table and explained in the accompanying notes.

In addition to the taxation revenue received by the Federal Government, it has the option of acquiring a 25% share of all petroleum production on Canada Lands. In return the Federal Government contributes 25% of post 1980 exploration expenses. The Federal Government is thus in a position to earn significant revenue through this direct participation.

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(1) Calculations of the various deductions are described in greater detail in the notes to Table 5.11.

The Federal Government also bears a portion of development expenditures through Petroleum Incentives Program (PIP) grants. up to 80% of exploration costs and up to 20% of other development expenditure for a project on Canada Lands may be covered depending on the degree of Canadian ownership of the firms involved.

If the NWT were to obtain resource ownership and to adopt a taxation regime for oil and gas like the one currently in effect in Alberta, resource revenue sharing would be considerably different from the current system.

The most important change would be the transfer of royalties to the GNWT. The structure of royalties would also change. In Alberta royalties equal to approximately 35% of wellhead revenue for new oil and 33% of field revenue for gas (after a processing allowance) are charged. A PGRT is levied, but remains with the Federal government.

With respect to the income tax, the Federal share would remain the same. The GNWT share, however, would change from the current system. The income tax base in Alberta is lower (by allowing a deduction for royalties which are not offset by the resource allowance), and a higher rate (11%) is charged.

Following the Alberta regime there would also be incentive programs for exploration drilling and geophysical activity. These incentives can take the form of a royalty exemption for a maximum of 5 years for oil and 1 year for natural gas. PIP grants are administered by the Alberta government but paid by the Federal government. The payment limits are 20% of development expenditures and 35% of exploration expenditures.

A third prototype for revenue sharing is provided by the Canada-Nova Scotia Offshore Oil and Gas Agreement. It permits Nova Scotia to receive all provincial type petroleum revenues plus up to 100% of the PGRT provided Nova Scotia's fiscal capacity remains low relative to other provinces. The provincial type revenues are the Basic Royalty, the Progressive Incremental Royality (PIR), bonus payments, and rentals and license fees in excess of administration costs. Only when Nova Soctia's fiscal capacity exceeds

> "... 110% of the national average per capita fiscal capacity plus 2 percentage points for every percentage point by which Nova Scotia average annual unemployment rate exceeds the national average annual unemployment rate,"(1)

will Nova Scotia need to share these revenues with the Federal Government. Complex formulae based on fiscal capacity and the unemployment rate determine the shares when Nova Scotia fiscal capacity (including these hydrocarbon revenues) exceeds 110% of the national average, with an increasing share accruing to the Federal Government as fiscal capacity increases and as Nova Scotia unemployment decreases. If and when Nova Scotia's fiscal capacity reaches 140% of the national average, all additional revenues from the above mentioned taxes will accrue to the Federal Government.

Thus, the Canada Nova Scotia model, if applied to the Northwest Territories would result in some features of each of the current and Alberta systems. The corporate income taxes would be as in the previous cases. The GNWT could set its income tax rate as desired. The

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(1) Canada-Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing, March 2, 1982, p. 12. Fiscal capacity is determined in accordance with the Fiscal Equalization Program of the Government of Canada, April 1, 1982.

structure and collections of royalties would be as in the first (Canada Lands) case (PIR, Basic Royalty, PGRT) but the assignment of the revenues generated would vary from 100% to the GNWT(1) to a significant sharing, depending on the fiscal capacity of the GNWT.

5.3.2 Current Activity and Revenues

Current production of oil and gas is limited to Norman Wells (oil and gas) and Pointed Mountain (gas). Federal tax payments for 1980 and 1981 excluding income tax are given in Table 5.12.

TABLE 5.12

Federal Government Gross Revenues from Oil and Gas in the NWT

(current $,000)

	1980	1981
Rentals	5,788.9	7,469.8
Royalties	4,886.6	4,470.3
Transfer Fees, Lease Fees, Permit and License Fees	47.1	21.5
Miscellaneous Taxes	73.0	229.0
TOTAL	10,795.7	12,190.6

Source: DIAND, Oil and Gas Activities, 1981.
Note: Does not include income taxes.

Detailed data on income tax payments to Federal or NWT governments or on property taxes paid to local governments are not available. Rentals, which are payments by firms for rights to continue exploratory drilling were, for the years shown, a larger income generator than royalties from production. Rentals are currently in the process of being phased out.

(1) With all royalty revenues assigned to the GNWT, the "provincial" share would be greater than that resulting from the Alberta regime, since the PGRT is assigned to the Federal Government in the latter regime.

Current production of oil and gas is extremely small compared to that which may occur if producing areas in the Beaufort and the Arctic Islands are brought on stream. However, expansion of production at Norman Wells will lead to increased tax revenues even in the absence of other major projects. There is also much potential for increasing GNWT revenues from current producers through transfer of royalty powers to the GNWT.

Estimates of past rents from Norman Wells for the period 1950-1976[1] indicate that the amount collected by Governments was small relative to total rents. Government rents totalled $39.3 million (1977$) including the share accruing to the Federal government as one-third operator of Norman Wells. Total rents, were estimated at $170.2 million.(2) The share that accrued to the GNWT was very small, and was not specifically estimated in the Weisbeck study.

Projections of future rents indicate that they will be much greater than those generated in the past due to increased product values and increased production. Rents for the period 1981-2010 have been estimated at $8.53 billion (1981$).[3] GNWT revenues would be quite small under the current tax regime, $2 million in present value compared to Federal revenues of $6.42 billion. They would be

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(1) Smith, Weisbeck & Associates, Economic Rents Associated with Major Mining and Hydrocarbon Activities, March 1978, pp. 43-66.

(2) These values would be equivalent to approximately $65 million (government rents) and $282 million (total rents) in 1983 dollars.

(3) Marvin Shaffer & Associates Ltd., Non-Renewable Resource Development in the Northwest Territories, January 1982, pp. 19-22. Total rents are approximately $9.9 billion in 1983 dollars.

large, estimated at some $3.01 billion in present value under an Alberta fiscal regime, compared to a Federal share of $5.18 billion.

5.3.3 Revenues from Beaufort-Mackenzie Oil Development

There are two regions showing great promise for future production of oil and gas, the Beaufort Sea-Mackenzie Delta area and the Arctic Islands. Data for tax revenues projected under the current regime for the Beaufort Sea development were obtained from the cash flow simulation model developed by the Government of the Northwest Territories.(1) Model results are available for three scales of the project and two transport modes (tanker and pipeline). This analysis focusses on three scenarios, the medium production marine transportation mode, the high production pipeline mode, and the low production pipeline scenario. Detailed data were not obtained on the structure of costs so a total rent estimate is not developed. Estimates of tax payments under alternative regimes are developed by direct calculation from payment values for the current regime.

Tax revenues under the current regime for the medium production (200,000 bbl/day) scenario with transport by tanker are shown in Table 5.13(2) Revenues are projected for a planned 28 year production program. Taxes are shown for the production operation and for transportation separately. GNWT property taxes are not payable for the marine transportation system. Income taxes total $85.4 million

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(1) Beaufort Sea-Mackenzie Delta Hydrocarbon Development Cash Flow Simulation Model, Mark Haney, Economic Planning Secretariat, Department of Economic Development & Tourism, June 1983.

(2) For a description of production profiles, cost breakdowns, and financial assumptions (particularly concerning tariff levelization for transportation) see Mark Haney, op. cit.

TABLE 5.13
BEAUFORT TAX REVENUES: MEDIUM SCENARIO , CURRENT TAX REGIME
(millions $1983)

YEAR	MARINE TRANSPORT: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PRODUCTION: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PGRT	BASIC ROYALTY	PIR	PIP	TOTAL GNWT REVENUE	NET FEDERAL REVENUE
1982	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983	.00	.00	.00	3.80	.00	.00	.00	.00	.00	-247.38	3.80	-247.38
1984	.00	.00	.00	11.97	.00	.00	.00	.00	.00	-378.82	11.97	-378.82
1985	.00	.00	.00	16.45	.00	.00	.00	.00	.00	-692.02	16.45	-692.02
1986	.00	2.45	17.68	16.16	.00	.00	55.03	23.94	.00	-399.55	18.61	-327.38
1987	.00	.00	.00	15.58	.00	.00	92.59	60.60	.00	-856.34	15.58	-703.15
1988	.00	.00	.00	16.23	.00	.00	113.00	96.28	.00	-221.62	16.23	-26.16
1989	.00	.00	.00	16.11	.00	.00	130.75	181.82	.00	-134.49	16.11	128.05
1990	.00	.00	.00	14.83	.00	.00	124.42	179.91	.00	-65.94	14.83	238.39
1991	.00	.00	.00	13.43	.00	.00	126.24	184.43	.00	-44.93	13.43	265.74
1992	.00	2.42	17.47	12.16	.00	.00	122.23	181.52	.00	-44.94	14.58	276.28
1993	.00	5.07	36.52	11.01	.00	.00	123.72	183.16	20.73	-44.93	16.08	319.20
1994	.00	5.57	40.15	10.01	.00	.00	115.45	176.76	.00	-668.75	15.58	-336.39
1995	.00	5.82	41.94	9.03	.00	.00	112.09	190.36	.00	-44.94	14.85	299.45
1996	.00	5.92	42.66	8.18	.00	.00	137.85	161.90	.00	-44.94	14.10	326.63
1997	.00	5.90	42.49	7.41	.00	.00	147.76	198.72	15.62	-44.95	13.31	359.64
1998	.00	5.78	41.65	6.71	.00	.00	149.16	201.39	17.16	-44.94	12.49	388.97
1999	.00	5.60	40.32	6.08	.00	.00	158.23	206.15	36.34	-140.37	11.68	300.67
2000	.00	5.36	38.65	5.50	.00	.00	164.12	208.87	44.68	-140.34	10.86	315.98
2001	.00	5.10	36.75	5.93	.00	.00	160.98	206.31	66.34	-84.82	11.03	385.56
2002	.00	4.81	34.69	7.49	.00	.00	161.97	214.26	76.78	-95.39	12.30	392.31
2003	.00	4.52	32.57	8.19	.00	.00	150.75	213.69	83.73	-47.70	12.71	433.04
2004	.00	4.22	30.43	7.66	20.39	73.43	146.63	197.71	89.43	-5.30	32.27	532.33
2005	.00	3.93	28.29	6.93	26.61	95.79	126.36	183.38	15.65	.00	37.47	493.33
2006	.00	3.64	26.21	6.28	29.73	107.03	108.80	168.67	36.77	.00	39.65	447.48
2007	.00	3.35	24.18	5.69	24.89	89.60	83.79	147.79	10.5	.00	33.93	350.37
2008	.00	3.08	22.23	5.15	19.09	68.72	61.01	109.33	.00	.00	27.32	261.29
2009	.00	2.83	20.38	4.66	18.91	68.09	49.92	100.05	.00	.00	26.40	238.44
2010	.00	.00	.00	4.22	8.03	28.92	91.44	92.95	.00	.00	12.25	163.31
TOTAL	.00	85.37	615.26	262.85	147.65	531.58	2939.81	4085.29	576.65	-4543.40	495.87	4205.19
N W	.00	20.26	146.00	116.09	15.83	57.00	856 089	1116.41	99.78	-2762.98	152.18	-486.90

to the GNWT and $615.3 million to the Federal Government or $20.3 million and $146 million, respectively in present value at a 10% discount rate. GNWT property taxes on the production system totalling $262.8 million or $116.1 million in present value constitute the largest single revenue generator for NWT governments under the current regime. Income taxes on the production system become payable only late in the production plan for a period of seven years. They total $147.6 million and $531.6 million for NWT and Federal governments respectively. Because these income taxes are late in occurring and fairly small in magnitude, they are smaller in present value for both governments than the income taxes from the transportation system.

Royalty revenues of the Federal government are large compared to those of the taxes already discussed. They are partially offset, however, by Petroleum Incentive Program (PIP) grants to producers. Revenues of the PGRT, Basic Royalty and PIR taken together total some $7.60 billion over the life of the project, or $2.07 billion in present value. PIP payments amount to $4.54 billion in total and $2.76 billion in present value.

NWT total revenues and Federal government revenues net of PIP grants are shown in the last two columns of Table 5.13. In total, NWT revenues comprise only 10.5% of total net government revenues from this project. In Federal net revenues become

Tax streams under an Alberta taxation regime are considered next. PIP grants cover the same proportion of development costs as before (assuming a sufficient level of Canadian ownership) but they cover only 35% (instead of 80%) of exploration costs. Exploration cost data from the cash flow model documentation were used to adjust the PIP payment streams. Income tax streams were adjusted for the fact that PIP grants affect capital cost deductions with regard to income taxes. Royalty payments to the GNWT of 35% of gross revenues replace the Basic Royalty and PIR streams.

Tax payments for the same production and transport scenario under an Alberta type regime are presented in Table 5.14. Property tax streams and PGRT revenues are unchanged in amount and in terms of which level of government receives them. GNWT income taxes on the transportation system are slightly larger than under the current system since these taxes are charged at 11% of taxable income instead of at lo%. The corresponding Federal income tax stream is unchanged. GNWT income taxes on the production operation are 11% of a taxable income base which is reduced from Federal taxable income by the difference between royalty paid and the resource allowance. For this scenario, royalty payments are sufficiently large that GNWT income taxes are zero throughout the production period. Federal income tax payments for the production operation differ slightly from those shown in Table 5.13 due to the income tax impacts of the revised PIP stream.

TABLE 5.14
BEAUFORT TAX REVENUES: MEDIUM SCENARIO , ALBERTA TAX REGIME
(millions $1983)

YEAR	MARINE TRANSPORT: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PRODUCTION: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PGRT	ROYALTY	PIP	TOTAL GNWT REVENUE	NET FEDERAL REVENUE
1982	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06
1983	.00	.00	.00	3.80	.00	.00	.00	.00	-247.38	3.80	-247.38
1984	.00	.00	.00	11.97	.00	.00	.00	.00	-378.82	11.97	-378.82
1985	.00	.00	.00	16.45	.00	.00	.00	.00	-692.02	16.45	-692.02
1986	.00	2.70	17.68	16.16	.00	.00	30.55	83.79	-359.55	102.65	-311.32
1987	.00	.00	.00	15.58	.00	.00	65.26	212.01	-816.34	227.68	-723.75
1988	.00	.00	.00	16.23	.00	.00	113.00	288.61	-221.62	304.84	-108.62
1989	.00	.00	.00	11.91	.00	.00	130.75	636.37	-184.49	652.48	-53.74
1990	.00	.00	.00	14.83	.00	.00	124.42	629.69	-65.94	644.52	58.48
1991	.00	.00	.00	13.43	.00	.00	126.24	645.51	-44.93	658.94	81.31
1992	.00	2.66	17.47	12.16	.00	.00	122.23	635.32	-44.94	650.14	94.76
1993	.00	5.58	36.52	11.01	.00	.00	123.72	641.06	-44.93	657.65	115.31
1994	.00	6.13	40.15	10.01	.00	.00	115.45	618.66	-548.75	634.80	-393.15
1995	.00	6.40	41.94	9.03	.00	.00	112.09	666.26	-44.94	681.69	109.09
1996	.00	6.15	42.66	8.18	.00	.00	137.85	668.71	-44.94	683.40	135.57
1997	.00	6.49	42.49	7.41	.00	.00	147.76	695.52	-44.95	709.42	145.30
1998	.00	6.35	41.65	6.71	.00	.00	149.16	704.87	-44.94	717.93	145.87
1999	.00	6.16	40.32	6.08	.00	.00	158.23	721.53	-140.37	733.77	58.18
2000	.00	5.90	38.65	5.50	.00	.00	164.12	731.05	-100.34	742.44	102.43
2001	.00	5.19	36.75	5.93	.00	.00	160.98	722.09	-44.82	733.63	152.91
2002	.00	5.29	34.69	7.49	.00	.00	161.97	749.91	-95.39	762.69	101.27
2003	.00	4.97	32.57	8.19	.00	.00	150.75	747.92	-47.70	761.08	135.62
2004	.00	4.64	30.43	7.66	.00	.00	146.63	691.99	-5.30	704.29	171.76
2005	.00	4.32	28.29	6.93	.00	68.40	126.36	641.83	.00	653.08	223.05
2006	.00	4.00	26.21	6.28	.00	107.03	108.80	590.35	.00	600.63	242.04
2007	.00	3.69	24.18	5.69	.00	89.60	83.79	517.27	.00	526.64	197.57
2008	.00	3.39	22.23	5.15	.00	68.72	61.01	382.66	.00	391.19	151.96
2009	.00	3.11	20.38	4.66	.00	68.08	49.92	350.18	.00	357.95	138.38
2010	.00	.00	.00	4.22	.00	16.82	41.44	325.33	.00	329.55	70.35
TOTAL	.00	93.91	615.26	262.85	.00	430.74	2939.81	14298.52	4263.40	14655.27	-277.59
NPV	.00	22.28	146.00	116.09	.00	43.71	856.89	3907.45	2648.44	4045.82	-1601.87

Royalty payments to the GNWT under the Alberta regime are quite large, totalling $14.30 billion and comprising $3.91 billion in present value. These payments result in total GNWT revenues of $14.66 billion (almost 30 times as great as under the current regime) or present value revenues of $4.05 billion. Federal government revenues net of PIP payments, however, are large and negative due to the loss of royalty revenues compared to the situation under the current regime. Net Federal revenues total -$278 million and are -$1.6 billion in present value.

The NWT revenue consequences of a Canada-Nova Scotia agreement regime fall between the two cases whose results appear in Tables 5.13 and 5.14. The total tax streams would be identical to those shown in Table 5.13 but some revenues would be shifted to the GNWT from the Federal government. Assuming that the GNWT would have low per capita fiscal capacity compared to other provinces, the Basic Royalty, the PIR, and the PGRT would all accrue to the GNWT. As in the "Alberta" case, net Federal revenues are strongly 'egative 'ince incentive payments are still made by the Federal government. As shown in Table 5.15, GNWT revenues would be $8.10 billion in total, or over 16 times as great as they are under the current distribution of revenues.'

TABLE 5.15

Medium Scenario - Canada-Nova Scotia Regime,
Low Fiscal Capacity

(million $1983)

	GNWT Revenues	Net Federal Revenue
Total	8,097.62	-3,396.56
NPV	2,?25.26	-2,559.98

If the GNWT royalty revenues resulted in raising its per capita fiscal capacity above 110% of the national average, some revenues would be shifted back towards the Federal government. The actual outcome in this case would be difficult to project since future revenues from all other sources would have to be forecasted. Given that NWT population is quite small, it seems likely that oil revenues would quickly raise GNWT fiscal capacity to 140% of the national average, after which all additional royalty revenues would flow to the Federal government. No data were obtained on current revenue levels or fiscal capacities.

The second scenario to be analyzed is the high production (750,000 bbl/day) one with transportation by pipeline. Revenues under the current regime are shown in Table 5.16.[1] GNWT property taxes are payable on the pipeline system, in contrast with the treatment accorded tanker transportation. They are projected to total $218.6 million over the project life. GNWT property taxes on the production system are only a fraction greater than they are under the medium production scenario, totalling $350.2 million.

GNWT income taxes from the transport and production operations total $4.08 billion but are only $694.3 million in present value since payments, particularly for production, occur late in the project life. Federal income taxes from both operations total $15.90 billion or $2.83 billion in net present value.

Total royalties to the Federal government (PGRT, Basic Royalty, PIR) are $37.58 billion and comprise some $8.54 billion in present value. These are offset by PIP payments totalling $6.65 billion and $3.59 billion in present value.

The total government shares are shown in the last columns of Table 5.16. Net revenues to both levels of government under the current tax regime are more than proportionately greater for the increase in project size (see Table 5.13). GNWT revenues total some

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(1) Cash Flow Simulation Model, op. cit.

5.16
SCENARIO, CURRENT TAX REGIME
($1983)

ERAL COME TAX	PGRT	BASIC ROYALTY	PIR	PIP	TOTAL GNWT REVENUE	NET FEDERAL REVENUE
.00	.00	.00	.00	-73.92	1.17	-73.92
.00	.00	.00	.00	-279.91	7.82	-279.91
.00	.00	.00	.00	-144.46	20.15	-144.46
.00	.00	.00	.00	-695.87	28.26	-695.87
.00	27.11	21.42	.00	-365.21	30.52	-316.68
.00	76.77	47.96	.00	-356.52	27.74	-231.79
.00	102.53	61.14	.00	-945.89	25.14	-782.22
.00	185.28	214.30	.00	-330.81	25.08	73.29
.00	274.75	295.04	109.77	-201.85	48.80	633.86
.00	316.49	331.86	.00	-871.47	53.25	-47.08
.00	422.64	443.80	197.76	-379.51	55.84	869.01
.00	576.63	582.08	602.69	-190.34	57.24	1954.20
0.12	615.42	620.48	653.33	-166.33	119.08	2124.89
6.01	606.67	617.53	576.00	-377.81	94.02	1732.90
7.29	673.28	667.76	702.79	-53.42	201.77	2693.73
5.91	719.94	712.83	630.67	-189.06	114.06	1774.99
3.43	775.29	775.40	837.95	-89.88	222.09	3084.18
1.65	797.28	794.33	797.56	-356.96	216.63	2803.09
9.04	859.04	852.62	906.35	-89.67	312.52	3674.99
7.49	888.99	877.49	990.08	.00	395.08	4172.40
0.44	831.01	829.01	908.93	.00	404.11	4018.81
3.21	744.62	756.93	796.24	.00	382.71	3671.94
0 06	655.90	682.92	684.58	.00	351.29	3285.36
2.71	575.96	614.49	587.75	.00	319.44	2926.26
7.05	503.28	553.84	500.22	.00	287.96	2592.63
3.62	438.82	500.06	423.16	.00	258.65	2292.24
7.30	381.21	451.96	354.24	.00	231.49	2020.05
6.01	326.41	406.23	287.43	.00	204.45	1755.60
5.80	280.85	368.26	265.21	.00	155.96	1450.12
6.11	12656.17	13079.74	11842.69	-6648.89	4652.32	46834.61
7.00	3004.51	3039.35	2499.77	-3594.07	929.94	7784.18

$4.65 billion (9.0% of total net government revenues) and comprise $.93 billion in present value. Net Federal revenues are very large under this scenario, since PIP payments only grow by some 46% as the project grows from 200,000 bbl/day to 750,000 bbl/day. Federal revenues total over $46.8 billion, or some $7.8 billion in present value.

Tax streams under an Alberta taxation regime are shown in Table 5.17. These were adjusted from current payment streams in the same ways as for the medium production scenario. Property tax and PGRT streams are unchanged from the current regime to the Alberta regime, as are the Federal income taxes on the transportation operation. GNWT income taxes for transportation rise slightly as the income tax rate rises by one percentage point. GNWT income taxes on the production operation would fall significantly in an Alberta regime since the deduction from taxable income amounting to the difference between the royalty paid and the resource allowance more than offsets the one percentage point increase in tax rate. Federal income taxes fall slightly due to the reduction in PIP payments and the corresponding increase in CEE deductions.

The 35% royalty which would accrue to the GNWT and which replaces the current PIR and Basic Royalty would be the largest single revenue source from the project. These revenues total $45.8 billion over the project life or $10.6 billion in Present value.

TABLE 5.17
TAX.REVENUES : HIGH SCENARIO, ALBERTA TAX REGIME
(millions $1983)

YEAR	PIPELINE TRANSPORT: PROPERTY TAX	PIPELINE TRANSPORT: GNWT INCOME TAX	PIPELINE TRANSPORT: FEDERAL INCOME TAX	PRODUCTION: PROPERTY TAX	PRODUCTION: GNWT INCOME TAX	PRODUCTION: FEDERAL INCOME TAX	PGRT	ROYALTY	PIP	TOTAL GNWT REVENUE	NET FEDERAL REVENUE
1982	1.17	.00	.00	.00	.00	.00	.00	.00	-73.92	1.17	-73.92
1983	4.97	.00	.00	2.85	.00	.00	.00	.00	-279.91	7.82	-279.91
1984	11.17	.00	.00	8.98	.00	.00	.00	.00	-144.46	20.15	-144.46
1985	15.92	.00	.00	12.34	.00	.00	.00	.00	-695.87	28.26	-695.87
1986	18.40	.00	.00	12.12	.00	.00	27.11	74.97	-365.21	105.49	-338.10
1987	16.76	.00	.00	10.98	.00	.00	76.77	167.86	-261.52	195.60	-184.75
1988	15.20	.00	.00	9.94	.00	.00	102.53	213.99	-850.89	239.13	-748.36
1989	13.85	.74	4.52	10.56	.00	.00	185.28	750.05	-330.81	775.20	-141.01
1990	12.62	25.44	156.15	13.05	.00	.00	274.75	1032.64	-144.85	1083.75	286.05
1991	11.44	28.69	176.04	15.73	.00	.00	316.49	1161.51	-814.47	1217.37	-321.94
1992	10.43	30.03	184.32	18.11	.00	.00	422.64	1553.30	-379.51	1611.87	227.45
1993	9.51	30.16	185.14	20.31	.00	.00	576.63	2037.28	-190.34	2097.26	571.43
1994	8.66	29.63	181.87	22.34	.00	56.66	615.42	2171.68	-147.33	2232.31	706.62
1995	7.87	28.44	174.50	22.52	.00	136.01	606.67	2161.36	-358.81	2220.18	558.37
1996	7.17	27.05	166.03	20.77	61.37	537.26	673.28	2337.16	-.01	2453.52	1376.56
1997	6.51	25.53	156.70	18.81	.00	235.91	719.94	2494.91	-622.46	2545.76	490.09
1998	5.94	23.95	146.99	17.04	74.22	638.42	775.29	2713.90	-89.88	2835.04	1470.82
1999	5.42	22.36	137.23	15.43	69.89	631.62	797.28	2780.16	-354.96	2893.26	1211.17
2000	4.92	20.79	127.63	13.97	170.81	989.03	859.04	2984.17	-89.67	3194.66	1886.03
2001	4.49	19.28	118.35	12.65	262.34	1297.48	888.99	3071.22	.00	3369.98	2304.82
2002	4.10	17.83	109.42	11.46	280.84	1340.42	831.01	2901.54	.00	3215.77	2280.85
2003	3.72	16.45	100.94	10.38	268.25	1273.18	744.62	2649.26	.00	2948.05	2118.74
2004	3.40	15.14	92.93	9.40	244.59	1169.03	655.90	2390.22	.00	2662.75	1917.86
2005	3.10	13.90	85.35	8.51	220.12	1062.68	575.96	2150.72	.00	2396.35	1723.99
2006	2.82	12.75	78.24	7.71	194.53	957.02	503.28	1938.44	.00	2156.25	1538.54
2007	2.57	11.66	71.58	6.98	170.39	858.60	438.82	1750.21	.00	1941.81	1369.00
2008	2.35	10.65	65.34	6.32	147.81	767.30	381.21	1581.86	.00	1748.99	1213.85
2009	2.14	9.69	59.52	5.72	124.96	676.01	326.41	1421.81	.00	1564.32	1061.94
2010	1.95	.00	.00	5.18	86.29	535.79	280.85	1288.91	.00	1382.33	[illegible]
TOTAL	210.57	420.16	2578.79	350.16	2376.42	13162.43	12656.17	45779.09	6194.88	49144.39	22202.51
NPV	108.90	116.92	717.61	126.71	347.35	2059.67	3004.51	10637.73	-3370.74	11337.61	2411.06

The total taxation streams by level of government show that transfer of the royalty to the GNWT dramatically redistributes revenues from the current regime. GNWT revenues total $49.14 billion (68.8% of total government net revenue from the project) and Federal net revenues total $22.20 billion or $11.34 billion and $2.41 billion, respectively, in net present value. As before, the transfer of the royalty to the GNWT with the responsibility for PIP grants remaining with the Federal government severely reduces net Federal revenues from the project.

The institution of a Canada-Nova Scotia type of agreement would result in total revenues to all levels of government as in Table 5.16. The distribution of these revenues would depend on the fiscal capacity of NWT governments. The probable effect, given the magnitude of revenues from the project, is that the GNWT would be guaranteed 140% of the average per capita fiscal capacity of other provinces in Canada. Remaining royalty revenues would accrue to the Federal government.

Finally, the low production (75,000 bbl/day) scenario with pipeline transport is analyzed. Production and tax streams under this scenario were projected over 20 years (rather than the 28 years used for the other scenarios) for the territorial cash flow simulation model. The required pipeline would be 16 inches in diameter, as compared to the 24 inch and 36 inch lines required for the medium and high scenarios. Revenues under the current regime are shown in Table

5.18[1] All revenues are significantly lower than in other scenarios. GNWT property taxes are projected to total $6 million and $173 million on the pipeline and production facilities respectively.

GNWT income taxes from both activities total $58.4 million or some $21.7 million in present value. Federal income taxes total $355.2 miillion or $133.4 million in present value.

Royalties to the Federal Government total $1,447 million or $583 million in present value, which are offset by PIP payments totalling $854 million, or $587 million in present value.

Total revenues to the GNWT comprise $93.9 million in present value, or some 62% of those projected for the medium scenario and only 10% of those projected for the high scenario. Net Federal revenues are positive, but small , comprising some $129 million in present value.

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(1) Cash Flow Simulation Model, op. cit.

TABLE S.T8

BEAUFORT TAX.REVENUES : LOW SCENARIO, CURRENT TAX REGIME

(millions $1983)

YEAR	PIPELINE TRANSPORT: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PRODUCTION: PROPERTY TAX	GNWT INCOME TAX	FEDERAL INCOME TAX	PGRT	BASIC ROYALTY	PIR	PIP	TOTAL GNWT REVENUE	NET FEDERAL REVENUE
1982	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.ob
1983	.00	.00	.00	.95	.00	.00	.00	.00	.00	-117.70	.9S	-117.70
1984	.00	.00	.00	2.99	.00	.00	.00	.00	.00	-144.46	Z.99	-144.46
1985	.00	.00	.00	q-!!	.00	.00	.00	.00	.00	-96.Z9	4.11	-96.29
1986	.61	.00	.00	5.02	.00	.00	ZO.90	13.96	.00	-77.05	S.63	-42.19
1987	.57	.ZZ	1.41	6.66	.00	.00	44.41	29.49	.00	-63.58	7.45	11.73
1988	.52	Z.99	18.67	7.45	.00	.00	46.75	30.88	.00	-ƎI.8T	T0.96	64.49
1989	.49	q.ZZ	26.29	7.92	.00	.00	46.60	64.33	.00	-Z6.SO	12.63	110.72
1990	.47	4.85	30.25	9.30	.00	.00	43.02	64.13	29.58	-47.70	14.62	119.28
1991	.43	5.11	31.86	10.77	.00	.00	39.18	6T.06	9.00	-SZ.98	16.31	88.12
1992	.qO	5.13	31.98	12.11	.00	.00	39.95	64.50	Z.T6	-53.00	17.64	8S.S9
1993	.38	S.00	31.17	13.33	.00	.00	36.32	64.24	.00	-SZ.99	18.71	˥8.˥*
1994	.ƎS	4.79	29.90	14.48	.00	.00	36.99	67.69	.00	-ƎƎ.1˥	19.62	81.41
1995	.33	4.51	28.12	14.48	.00	.00	39.48	67.00	4.45	-31.80	19.32	107.25
1996	.31	4.21	26.28	13.35	.00	.00	37.19	67.63	7.39	-5.Z9	17.87	133.20
1997	.28	3.91	24.39	12.09	.54	T.9S	36.91	69.92	17.40	.00	16.82	150.57
1998	.Z6	3.61	22.51	10.95	1.19	4.30	27.15	6T.66	.49	.00	T6.0T	TT6.TT
1999	.25	3.32	ZO.68	9.9Z	1.81	6.51	20.15	50.44	.00	.00	15.30	97.78
2000	.ZƎ	3.03	18.93	8.98	.00	.00	8.SS	40.67	.00	.00	12.24	68.15
2001	.21	.00	.00	8.13	.00	.00	1.45	34.68	.00	.00	8.34	36.13
TOTAL	6.09	54.90	342.44	172.99	3.54	12.76	525.00	852.28	70.47	-854.32	237.52	948.63
NPV	2.80	20.9Z	130.47	69.31	.8Z	Z.96	231.54	322.˥Ǝ	Z8.SS	-587.03	93.85	129.22

Tax streams under an Alberta regime are shown in Table 5.19. These streams were adjusted as in the two previous cases. As before, property taxes, Federal income taxes on transportation, and PGRT streams are unaffected by the change in regime. GNWT income taxes on production are completely eliminated due to the Alberta deduction from taxable income amounting to the difference between the royalty paid and the resource allowance. Federal income taxes on production are eliminated in all but one year due to increased exploration expense deductions which arise from decreased PIP payments in the Alberta scheme. As before, the 35% royalty is the largest revenue source from the project, contributing $2,983 million in tots"l and $1,130 million in present value.

The total revenues by level of government show greatly increased GNWT revenues over the current regime ($1,225 million in present value compared to $94 million). Federal net revenues fall from those projected for the current regime, becoming only $39 million in total, and negative ($-206 million) in present value. This regime clearly appropriates more revenues from the project in total, since the increase in GNWT revenues is significantly greater than the decrease in Federal revenues.

a Canada-Nova Scotia type of revenue sharing

TABLE 5.19
TAX REVENUES LOW SCENARIO, ALBERTA TAX REGIME
(millions $1983)

YEAR	PIPELINE TRANSPORT PROPERTY TAX	PIPELINE TRANSPORT GNWT INCOME	PIPELINE TRANSPORT FEDERAL INCOME	PRODUCTION: PROPERTY TAX	PRODUCTION: GNWT INCOME	PRODUCTION: FEDERAL INCOME	PGRT	ROYALTY	P w	TOTAL GNWT	NET FEDERAL
1983	.00	.00	.00	.95	.00	.00	.00	.00	-117.70	.95	-117.70
1984	.00	.00	.00	2.99	.00	.00	.00	.00	-134.46	2.99	-134.46
1985	.00	.00	.00	4.11	.00	.00	.00	.00	-86.29	4.11	-86.29
1986	.61	.00	.00	5.02	.00	.00	20.90	48.86	-77.05	54.49	-56.15
1987	.57	.24	.41	6.66	.00	.00	44.41	103.22	-63.58	110.69	-17.76
1988	.52	3.29	.67	7.45	.00	.00	46.75	108.08	-31.81	119.34	33.61
1989	.49	4.64	20.29	7.92	.00	.00	46.60	225.16	-26.50	238.21	46.39
1990	.47	5.34	30.25	9.30	.00	.00	43.02	224.46	-47.70	239.56	25.57
1991	.43	5.62	31.86	10.77	.00	.00	39.18	213.71	-52.98	230.53	18.06
1992	.40	5.64	31.98	12.11	.00	.00	39.95	225.75	-53.00	243.90	18.93
1993	.38	5.50	31.17	13.33	.00	.00	36.32	224.84	-52.99	244.05	14.50
1994	.35	5.27	29.90	14.48	.00	.00	36.99	236.92	-53.17	257.01	13.72
1995	.33	4.96	28.12	14.48	.00	.00	39.48	234.50	-31.80	254.27	35.80
1996	.31	4.63	26.28	13.35	.00	.00	37.19	236.71	-5.29	255.00	58.18
1997	.28	4.30	24.39	12.09	.00	.00	36.91	244.72	.00	261.39	61.30
1998	.26	3.97	22.51	10.95	.00	.00	27.15	215.81	.00	230.99	49.66
1999	.25	3.65	20.68	9.92	.00	5.54	20.15	176.54	.00	190.36	46.37
2000	.23	3.33	18.93	8.98	.00	.00	8.55	142.35	.00	154.89	27.48
2001	.21	.00	.00	8.13	.00	.00	1.45	121.38	.00	129.72	1.45
TOTAL	6.09	60.39	342.44	172.99	.00	5.54	525.00	2982.98	-834.32	3222.45	38.66
NPV	2.80	23.01	130.47	69.31	.00	1.21	231.54	1129.55	-569.68	1224.67	-206.46

between the Federal Government and the GNWT would depend on the magnitude of the revenues, the pre-existing fiscal capacity of the GNWT, and territorial unemployment rates.

5.3.4 Employment

Oil and gas exploration activity accounts for a much higher proportion of current petroleum industry expenditures and employment than production related activity and is thus more important in terms of economic impact to the NWT.

Exploration activity *in* the Mackenzie Delta-Beaufort Sea areas is the most important generator of employment and income. For example, the industry expended $1260 million on capital investments (movable caisson units and supply/support vessels), and on drilling and drilling related operations in 1982.[1] It is estimated that over 1400 jobs (1000 person years) were created by exploration activity in the region. Approximately 95% of these jobs were filled by Canadians of which some 300 positions were filled by northerners. Some 80% of northern positions were filled by native people. There were also special northern training programs initiated to increase employment opportunities.

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(1) Source: DIAND and COGLA Annual Reports, op. cit.

Exploration activity in the Arctic Islands and Eastern Arctic offshore area is second in importance to the Beaufort. In 1982, an estimated $175 million was spend on capital equipment and operations. The eight wells which were active generated over 550 jobs at peak periods or about 125 person years of employment. Some 460 of these jobs were filled by Canadians, and about 60 by native people. There are special apprenticeship training programs in place for Canadians, and particularly natives, with a view to replacing all foreign workers in the near future.

In the mainland territories, there was only one new well drilled in 1982, a wildcat well northeast of the Pointed Mountain gas field. Some $105.6 million was spent. An estimated 400 jobs (117 person years) were created by exploration in the Pointed Mountain and Norman Wells areas. Almost all these jobs were filled by Canadians, and about 20% by native northerners.

There was a small amount of exploration activity in the Hudson Bay area in 1982. $6.5 million was expended on geophysical (seismic) surveys by Canadian Occidental. Thirty-four positions were created by this exploration. Of these, 10 went to Canadians and 2 were filled by native people.

Employment potential of possible development and production in the Beaufort and the Arctic Island is very great. Esso has estimated that under a major development scenario (400,000 bbl/day by 2000) there would be a peak of 13,000 employees during the construction phase which would cover 5-6 years.(1) Many of these workers would be non-northerners, however. During the operating phase, direct and induced jobs in the north were estimated at 2000 by 1990 and 3400 by the year 2000. Dome Petroleum has estimated that a tanker transportation alternative with a "technically achievable rate of production" would employ 7000 persons by 1990.

With respect to the Arctic Islands, employment, for the Arctic Pilot Project (APP) will be relatively low. It is estimated that the construction phase will result in 752 person years of employment.(2) Average annual direct and induced employment during the operating phase (1986-2005) is estimated at only 25.

Thus, future exploration, development, and production activities in oil and gas will result in significant employment opportunities in the NWT. The spinoff employment and income will be a further spur to economic activity in the NWT.

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(1) Proceedings of the Special Committee of the Senate on the Northern Pipeline, Tuesday, February 16, 1982, Issue #17.

(2) APP application to the National Energy Board, Vol. 6 (Canadian Economic Benefits).

5.3.5 Implications of Division

(a) Current Activity

Tax revenues and employment generated by existing oil and gas producers (i.e., Norman Wells, Pointed Mountain) in the NWT would accrue to the West regardless of the boundary chosen.

(b) Potential Revenues

The West contains most of the measured oil reserves and potential, under a'll boundary alternatives except for 5a. Under alternative 5a the East has the vast majority of oil reserves and resources. The West also has more gas resources than the East in the Base Case, although this distribution is reversed in alternatives 4, 5, la, 2a, 3a and 5a. Tax revenue potential from both oil and gas in total and on a per dollar output basis is very high and of the same order of magnitude.

There are two important qualifications with respect to gas revenue and employment potential in the East, much of which is located in the Arctic and, under boundary 5a, in the Beaufort Sea. First, in view of the current surplus of gas in world markets, higher costs and uncertainties associated with production and transportation, Arctic gas is likely to be brought into production more slowly than Mackenzie Delta and corridor gas. Secondly, much of the oil and gas potential in the East is offshore (except for the Bent Horn oil field located on Melville Island) and it is more likely that the NWT's share of tax revenues from these resources (eg. as determined by a Nova Scotia revenue sharing model) would be less than if they had been onshore and therefore taxed as provincial resources.

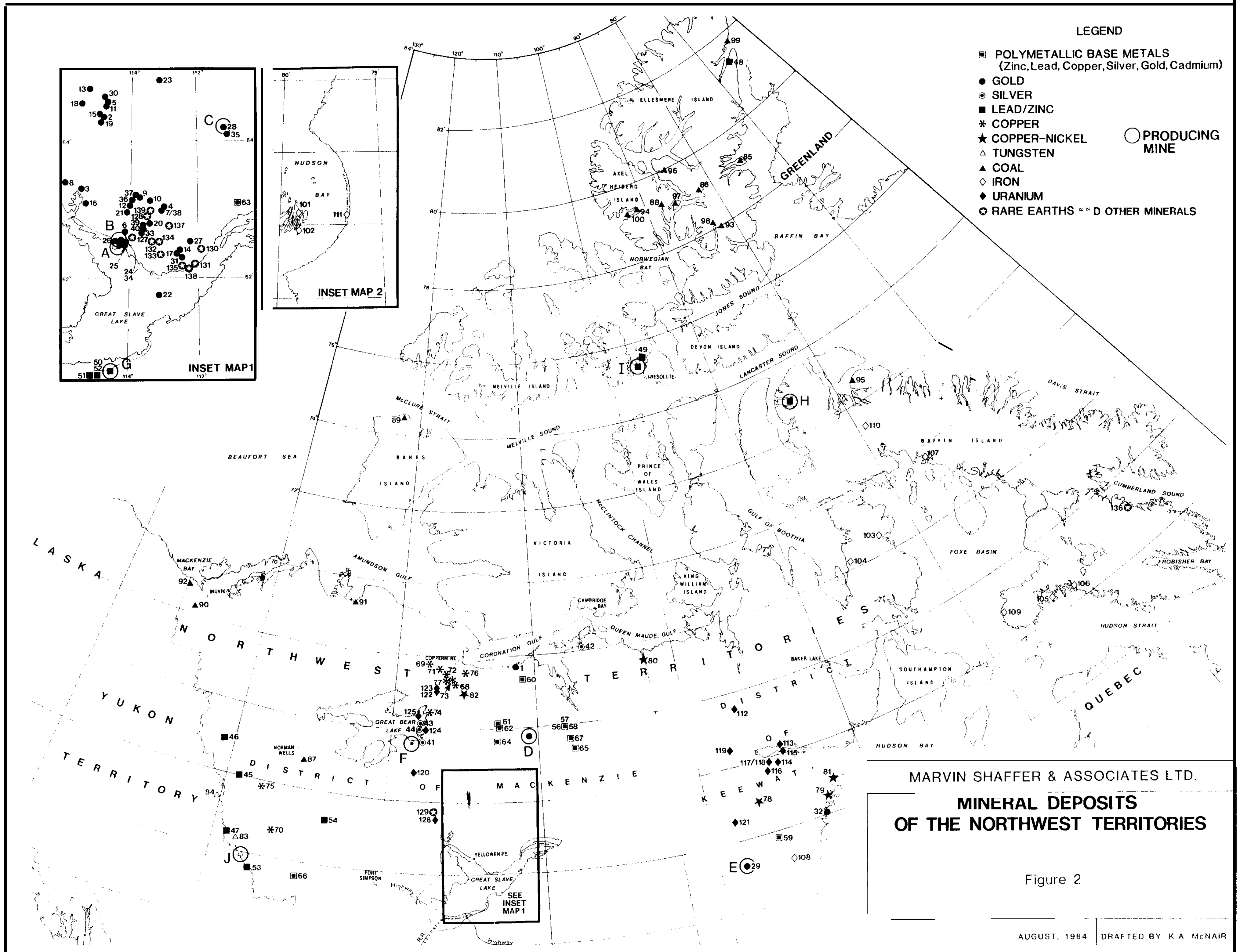
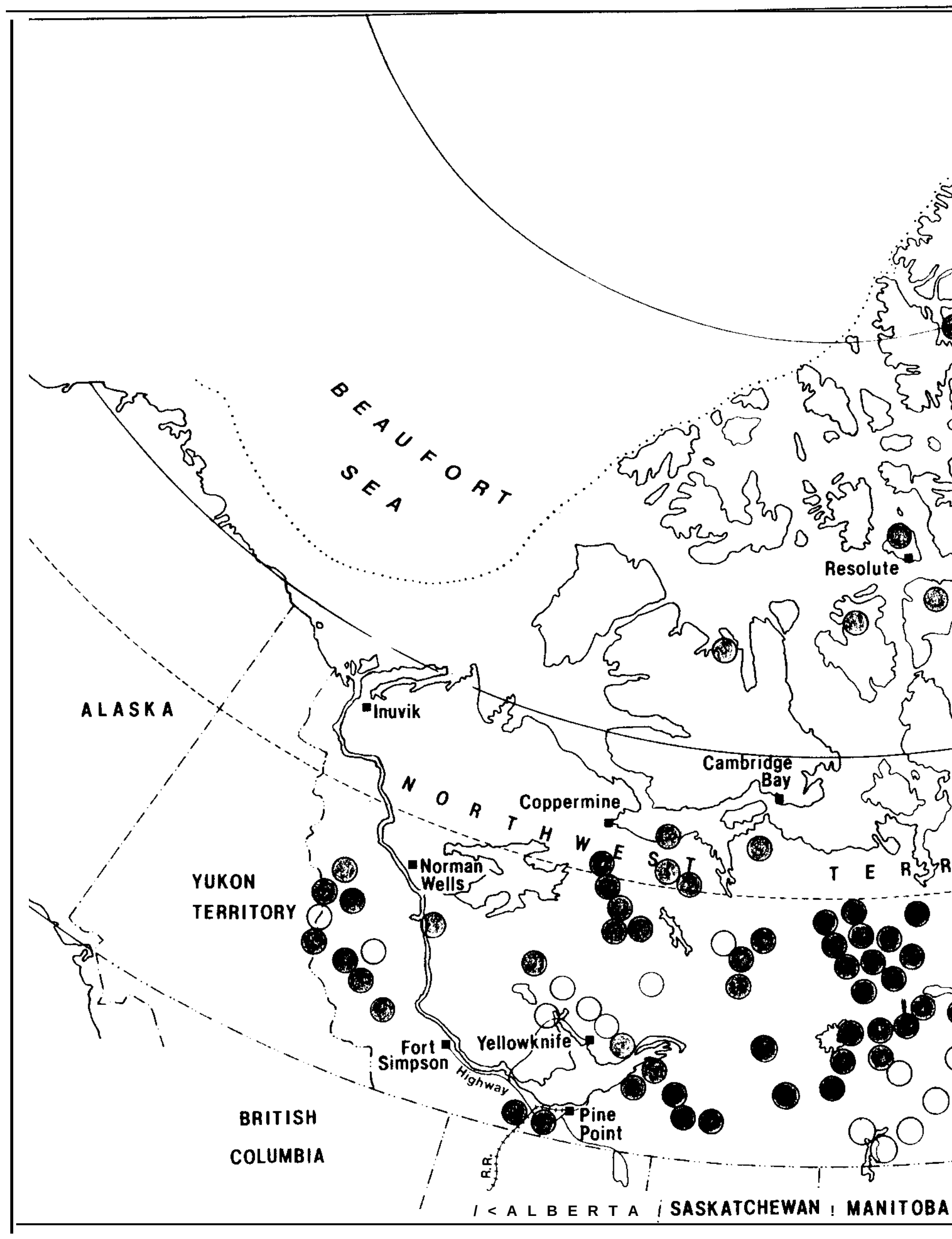
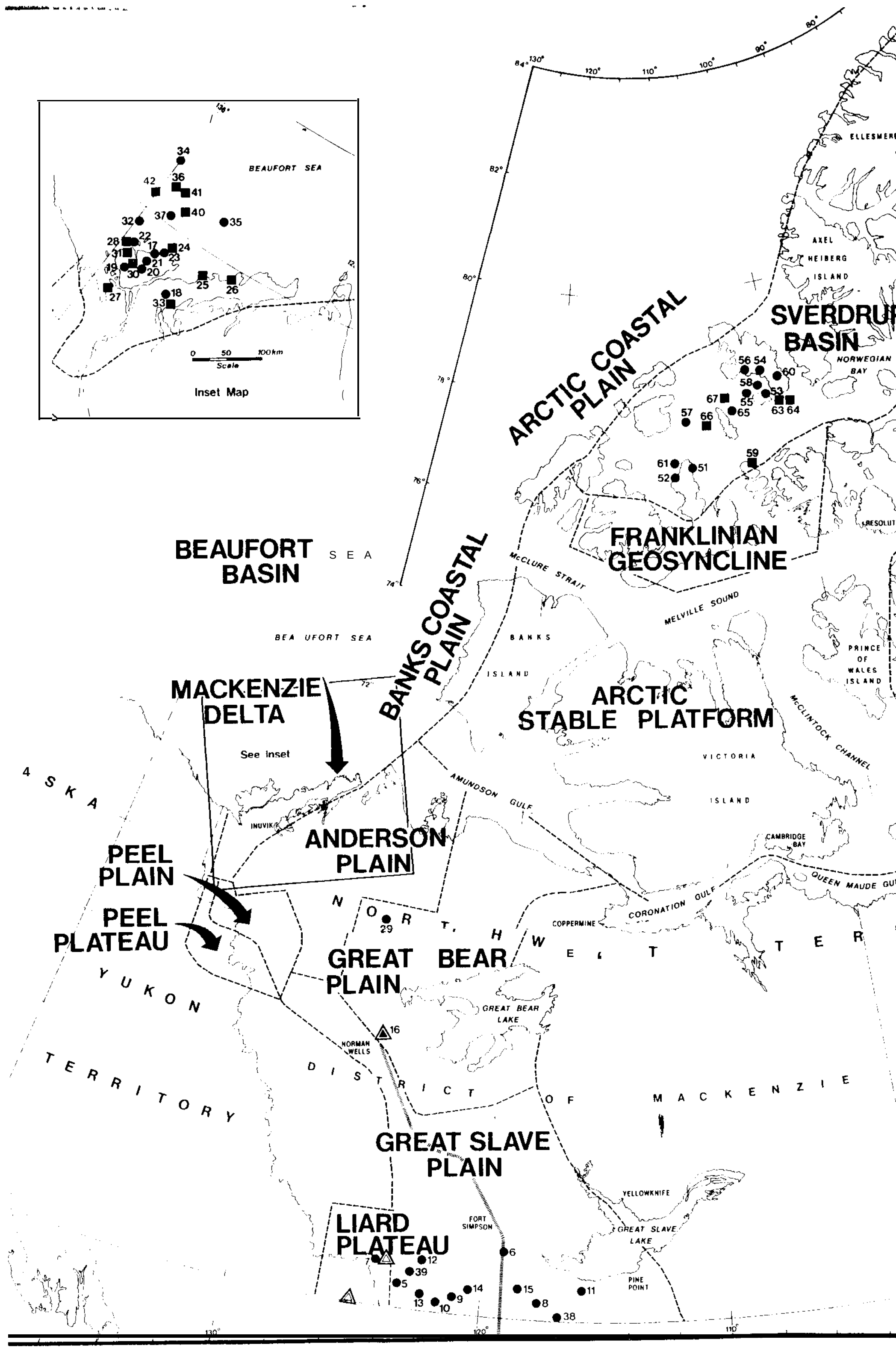

LEGEND
POLYMETALLIC BASE METALS (Zinc, Lead, Copper, Silver, Gold, Cadmium)
GOLD
SILVER
LEAD/ZINC
COPPER
COPPER-NICKEL
TUNGSTEN
COAL
IRON
URANIUM
RARE EARTHS AND OTHER MINERALS
PRODUCING MINE
INSET MAP 1
INSET MAP 2
GREAT SLAVE LAKE
HUDSON BAY
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
GREENLAND
BAFFIN BAY
NORWEGIAN BAY
JONES SOUND
DEVON ISLAND
LANCASTER SOUND
RESOLUTE
DAVIS STRAIT
BAFFIN ISLAND
MELVILLE ISLAND
McCLURE STRAIT
MELVILLE SOUND
BEAUFORT SEA
BANKS ISLAND
PRINCE OF WALES ISLAND
McCLINTOCK CHANNEL
GULF OF BOOTHIA
CUMBERLAND SOUND
FOXE BASIN
FROBISHER BAY
HUDSON STRAIT
VICTORIA ISLAND
KING WILLIAM ISLAND
CAMBRIDGE BAY
AMUNDSON GULF
MACKENZIE BAY
INUVIK
ALASKA
QUEEN MAUDE GULF
CORONATION GULF
COPPERMINE
BAKER LAKE
SOUTHAMPTON ISLAND
QUEBEC
NORTHWEST TERRITORIES
DISTRICT OF KEEWATIN
DISTRICT OF MACKENZIE
YUKON TERRITORY
GREAT BEAR LAKE
NORMAN WELLS
FORT SIMPSON
YELLOWKNIFE
SEE INSET MAP 1
Highway
MARVIN SHAFFER & ASSOCIATES LTD.
MINERAL DEPOSITS OF THE NORTHWEST TERRITORIES
AUGUST, 1984
DRAFTED BY K A McNAIR

Figure 2

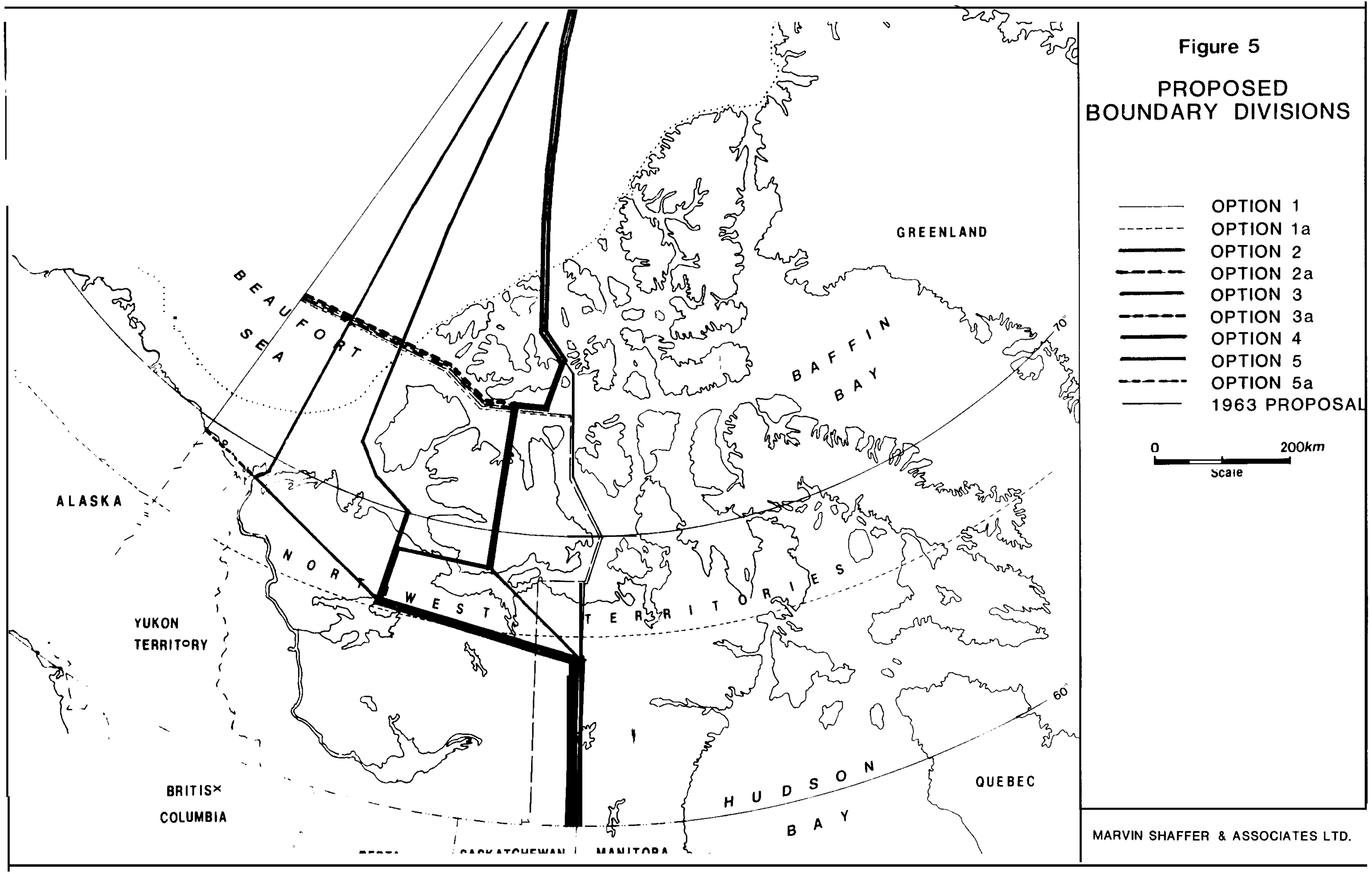

BEAUFORT SEA
ALASKA
Inuvik
Resolute
Cambridge Bay
Coppermine
NORTHWEST
YUKON TERRITORY
Norman Wells
Fort Simpson
Yellowknife
Highway
Pine Point
R.R.
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA



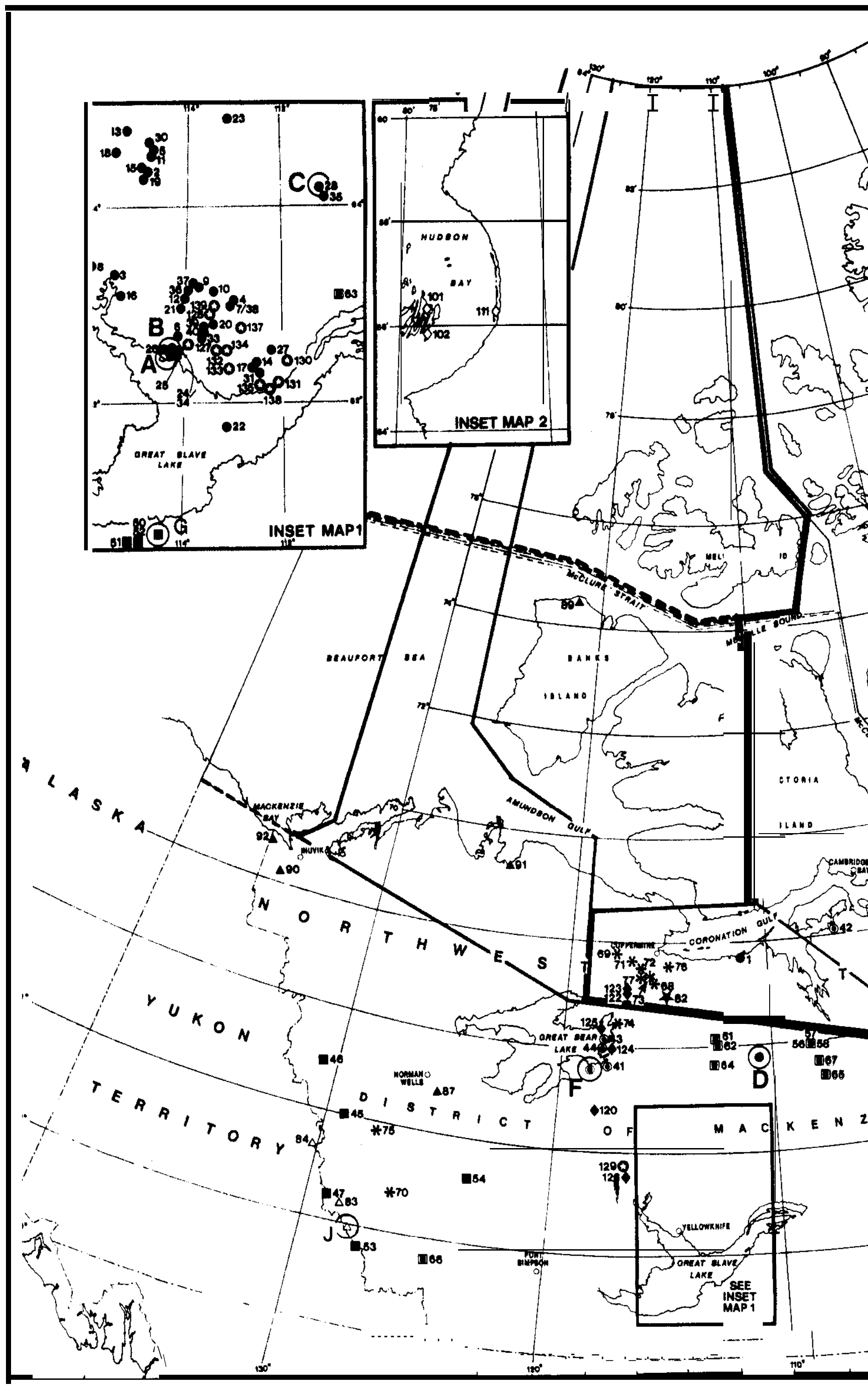
BEAUFORT SEA
Inset Map
BEAUFORT BASIN
ARCTIC COASTAL PLAIN
SVERDRUP BASIN
FRANKLINIAN GEOSYNCLINE
BANKS COASTAL PLAIN
MACKENZIE DELTA
See Inset
ARCTIC STABLE PLATFORM
ANDERSON PLAIN
PEEL PLAIN
PEEL PLATEAU
GREAT BEAR PLAIN
GREAT SLAVE PLAIN
LIARD PLATEAU
YUKON TERRITORY
DISTRICT OF MACKENZIE
NORTHWEST TER
AXEL HEIBERG ISLAND
NORWEGIAN BAY
MELVILLE SOUND
BANKS ISLAND
VICTORIA ISLAND
PRINCE OF WALES ISLAND
AMUNDSON GULF
CORONATION GULF
QUEEN MAUDE GU
GREAT BEAR LAKE
GREAT SLAVE LAKE
INUVIK
NORMAN WELLS
FORT SIMPSON
YELLOWKNIFE
PINE POINT
COPPERMINE
CAMBRIDGE BAY

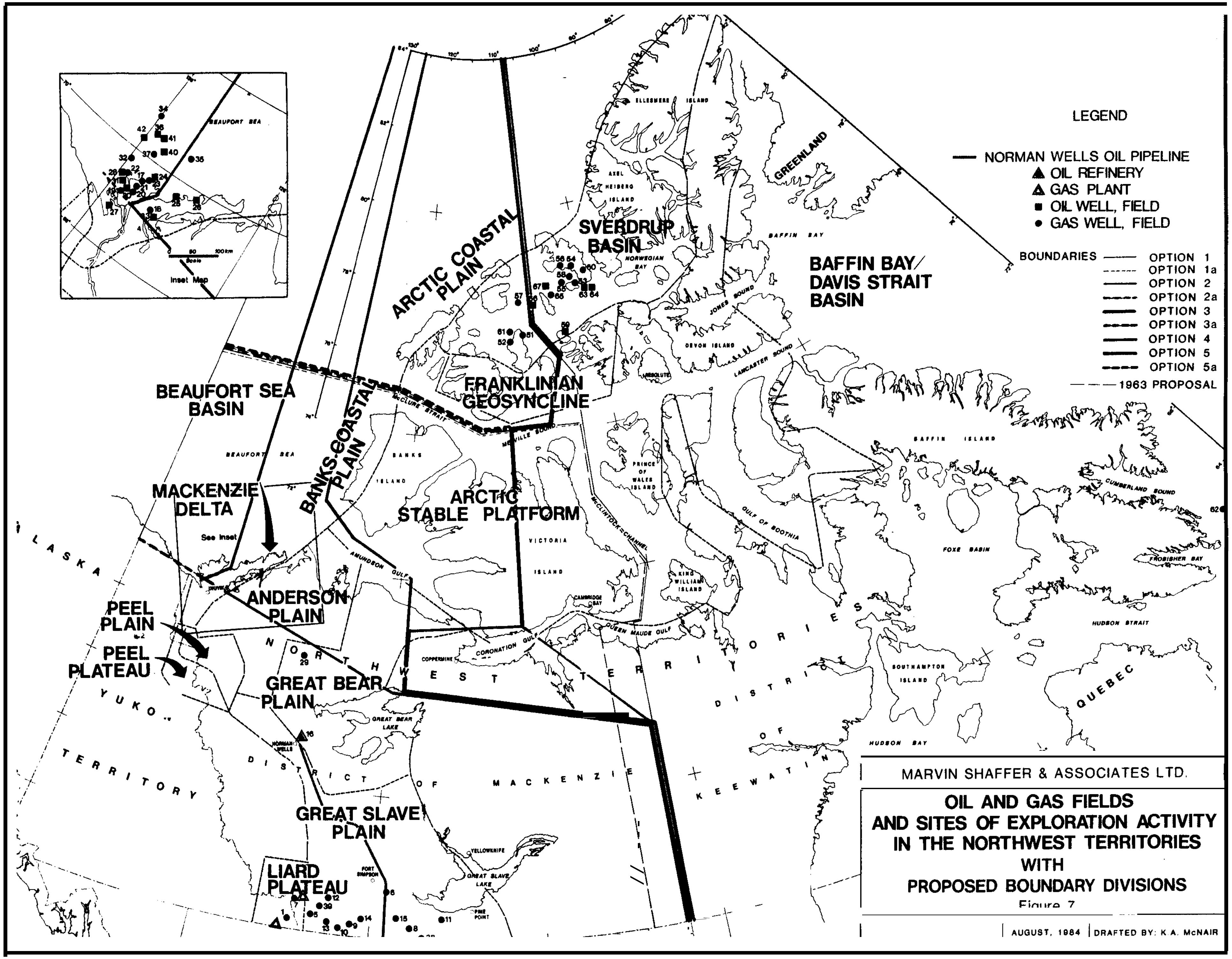
Figure 5

PROPOSED BOUNDARY DIVISIONS



MARVIN SHAFFER & ASSOCIATES LTD.


INSET MAP1
GREAT SLAVE LAKE
INSET MAP 2
HUDSON BAY
BEAUFORT SEA
M'CLURE STRAIT
BANKS ISLAND
AMUNDSON GULF
MACKENZIE BAY
INUVIK
CORONATION GULF
COPPERMINE
GREAT BEAR LAKE
NORMAN WELLS
ALASKA
YUKON TERRITORY
NORTHWEST
DISTRICT OF MACKENZ
YELLOWKNIFE
FORT SIMPSON
SEE INSET MAP 1



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OIL AND GAS FIELDS AND SITES OF EXPLORATION ACTIVITY IN THE NORTHWEST TERRITORIES WITH PROPOSED BOUNDARY DIVISIONS

Figure 7

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