NATIONAL HARBOURS BOARD

PORT DEVELOPMENT

PRINCE RUPERT B.C.

Project 694 Aug. 1972

WRIGHT ENGINEERS LIMITED
Vancouver Canada

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1. INTRODUCTION

There have been numerous studies and evaluations with respect to the development of Northern British Columbia and, in particular, of ports located north of the 52nd parallel.

The Port of Prince Rupert was recently designated a National Harbour and, subsequently, Wright Engineers Limited were commissioned by the National Harbours Board to review and update the appropriate earlier studies (listed in this introduction) for the purpose of establishing relevant-to-the need recommendations for development of port facilities at Prince Rupert, their optimum timing and capacity.

The Terms of Reference were essentially as stated above and did not, originally, include engineering investigations of alternative sites. During the course of the review of the various reports it was ascertained that sufficient engineering data existed for evaluation of the various sites and, consequently, the Terms of Reference were expanded to include this evaluation and to enable recommendations to be made. However, alternative schemes and cost estimates to determine the optimum development of the recommended sites have not been carried out.

Wright Engineers Limited gratefully acknowledge the co-operation received from the representatives of the Federal and Provincial Governments, industry, and the Railway Companies who were contacted during the preparation of this report.

Previous Reports by Others

1. Canadian National Railways, Mountain Region,
"Report on a Harbour Development Survey for
Prince Rupert, B.C."
by: CBA Engineering Ltd. and Nedeco - October, 1965.

2. Soils Investigation, Drydock Site - Harbour Development,
Prince Rupert, B. C.
by: Paul M. Cook, March 11, 1966.

3. Western Wharves Limited, Deepsea Shipping Terminal
Development Plans for the Port of Prince Rupert, B.C.
by: Stothert Engineering Ltd., Vancouver, B. C.
February, 1967.

4. City of Prince Rupert - Port Development Commission,
"Ridley Island Bulk Terminal",
by: CBA Engineering Ltd. - September, 1969.

5. Norport, Prince Rupert,
Federal Grain Limited, Project 2285,
by: Swan Wooster Engineering Co. Ltd., and
Dames and Moore - approx. January, 1970.

6. The Canadian Northwest Transportation Study,
by: Hedlin Menzies and Associates Ltd. - November, 1970.

7. Economic Development of the Regional District of
Kitimat - Stikine, B.C. - January, 1971.
by: AVG Management Science Ltd., Vancouver, B.C.

8. "Westport" - an evaluation of potential traffic for a
proposed bulk port facility in northern British Columbia.
by: The M.W. Menzies Group Ltd. - March 1971.
for: Ministry of Transport, Government of Canada.

9. Soils Investigation, Fairview Deepsea Terminal,
Prince Rupert, B. C.
by: Cook, Pickering and Doyle Ltd. Vancouver, B.C. -
March, 1971.

10. Northern British Columbia Development Forecast 1971-81",
by: Regional District of Fraser Fort George) March , 1971,
and the City of Prince George)

11. Kitson Harbour Development,
by: Maui Enterprises Ltd. - May 20, 1971.

12. "The Importance of the Commercial Fishing Industry to Selected Remote Coastal Communities of B.C.",
by: W.F. Sinclair, Department of the Environment, Fisheries Service, Pacific Region - August, 1971.

13. "Sulphur Disposals Through the Port of Vancouver",
by: Concept Distribution and Marketing Services Ltd., March, 1972.

14. "A Cursory Investigation of the Productivity of the Skeena River Estuary",
by: Fisheries Service, Department of Environment, April, 1972.

2. SUMMARY AND CONCLUSIONS

SUMMARY

2.1 The objective of this report is to review the previous studies carried out on Prince Rupert port development, update the relevant data, assess the current and probable future needs for new port facilities and analyze the sites available for port development.

2.2 Investigations were undertaken in three main areas:

a) Economic development and resulting cargo movement

b) Port requirements

c) Port development sites

2.3 The economic and traffic study team reviewed the contents of the studies listed in the introduction and carried out extensive field investigations in many areas. In summary, the findings are as follows:

2.3.1 The new politico-economic realignment in the Pacific Rim area has changed the pattern of Western Canadian export trade. Such changes have been taken into consideration whilst carrying out the Traffic Survey for various commodities.

2.3.2 A review of the Regional Economy shows that its major potential lies in mineral and forest resource development. For such development an expansion of the transportation infrastructure is essential.

2.3.3 The future and growth of the Port of Prince Rupert hinges on co-operation between the Canadian National and British Columbia Railways. Without such co-operation the growth pattern of the port is bound to be stinted.

2.3.4 The March 1971 "Westport" report by the M.W. Menzies Group Ltd. has been accepted as the "base" report. Cargo volume projections have been related to this report and the differences are shown for each commodity.

2.3.5 The Traffic Review shows the potential movement of the following commodities (in long tons per year):

		1975	1985
Bulk cargoes:	Grain	744,000	1,060,000
	Concentrates	120,000	* 400,000
	Coal	-	5,000,000
	Potash	750,000	1,200,000
Forest products		* 600,000	* 600,000
General cargoes (miscellaneous)		73,000	320,000
Total (exports/imports)		2,287,000	8,580,000

* Average of forecast range.

2.3.6 There is a possibility of the Port of Prince Rupert participating in the surge movement of northern pipeline construction cargoes. The tonnage projected is of the order of 440,000 tons over two years.

2.3.7 The port and other associated industrial development in the Prince Rupert area would generate an additional direct personal income in excess of $7 m. per annum.

2.4 Detailed benefit-cost and sensitivity analyses for the proposed port development have not been undertaken in this phase of the study.

2.5 The terminal facilities necessary to accommodate the predicted cargo flows are identified in the section on Port Requirements. It is recognized that the ultimate need will be for two deep-sea terminal installations in the Prince Rupert area.

2.6 The first requirement is a general-purpose terminal, consisting of a 40-acre marginal wharf with a marshalling yard incorporated. The wharf should provide 1,400 feet of berthing space with a water depth of 45 feet. The indicated future cargo volume will require an increase in wharf area to 68 acres and the berth length extended to 2,000 feet.

2.7 In addition to the general-purpose terminal, the predicted shipments of bulk cargoes (potash and coal) through Prince Rupert will ultimately require the special facilities of a deep-sea bulk loading terminal.

2.8 Four sites have been considered as having potential for port development and are indicated on Plate 8. The Drydock and Fairview sites have been reviewed for handling general cargoes, bulk metal concentrates and potash. The Ridley and Kitson Island sites have been reviewed as sites for bulk terminals.

2.9 There are a number of disadvantages to the development of the Drydock site for a general-purpose terminal, namely: (1) the total land area available does not meet the predicted future requirements; (2) numerous existing facilities will require relocation; (3) the cost of reclaiming additional land is very high; and (4) the configuration of the site does not lend itself to satisfactory layout for a modern port. For these reasons the Drydock site is not recommended for port development, but should be retained for presently planned and future light industrial plants.

2.10 The Fairview site, despite high land development costs, has two distinct advantages: (1) land area can be created in excess of the predicted requirements; and (2) there are no restrictions on the orderly development of the site as a modern port. For these reasons the Fairview site, with the dock face located at the harbour headline, is recommended for development as the "City Port" of Prince Rupert. A proposed layout for initial development is shown on Plate 10.

2.11 Order-of-magnitude cost estimates for development of the Drydock and Fairview sites with 1,400 feet of berth are as follows:

	Site Development, Dock Apron, Access and General Services	Cargo Handling Facilities and Port Services
Drydock (Refer Tables 7, 8)	$ 6,130,000	$ 5,150,000
Fairview - Scheme 1 (Tables 7, 9)	$ 7,050,000	$ 5,150,000
Fairview - Scheme 2 (Tables 7,10)	$ 9,040,000	$ 5,150,000

(In Fairview Scheme 1 the dock face is at the depth required for berthing; in Scheme 2 the dock face is at the harbour headline).

2.12 There are no apparent physical limitations to the development of the Ridley Island site as a bulk terminal. Sufficient site space can be created to meet the predicted requirements. Consideration was given to the possibility of the Ridley site for a general-purpose terminal, but this was discounted because the exposed site makes it unsuitable for the smaller vessels which would use such a terminal.

2.13 A limiting factor to the development of the Kitson Island site for a bulk terminal is the detrimental effect it could have on the fish feeding grounds of Flora Bank. Further investigations are currently being carried out by the Fisheries Service of the Department of the Environment and a report is pending.

CONCLUSIONS

A. The predicted cargo flows indicate a need for initial port development in Prince Rupert of a general-purpose terminal with 1,400 feet of wharf length and 40 acres of back-up land; and provision for future expansion to 2,000 feet of wharf length and 68 acres of land. The Fairview site is considered suitable to meet these requirements.

B. In the absence of agreement on priorities concerning the location of new bulk terminals (coal) on the West Coast, there appears to be no justification for such a facility in the Prince Rupert area until about 1980. Based on information available to date, Ridley Island is considered the most suitable location for a bulk terminal.

3

Economic & Traffic Studies

BY

CAPTAIN G. A. VERES , MARINE ECONOMIST

J. M. LIVINGSTONE , C.I.T.T.

3. ECONOMIC AND TRAFFIC STUDIES

3.1 GENERAL

The objective of the economic and traffic studies is not to add yet another volume to the many that already testify to the effort expended on investigating the feasibility of new port facilities at Prince Rupert, from 1965 onwards. Its aim has been to review, analyze and update the previous reports and - so far as this proved possible - to bring them to a common denominator, related to current and probable future need. It draws upon the studies and projections of the recent past to a substantial degree, and endeavours to apply a careful analysis to the opportunities and economics of the present and immediate future.

For the purposes of the economic and traffic study, the following reports have been considered in detail:

The Canadian Northwest Transportation Study,
by: Hedlin Menzies and Associates Ltd.
November, 1970.

Economic Development of the Regional District of Kitimat - Stikine, B.C. - January, 1971.
by: AVG Management Science Ltd. Vancouver, B.C.

"Westport" - An evaluation of potential traffic for a proposed bulk port facility in northern British Columbia.
by: The M.W. Menzies Group Ltd. - March, 1971.
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and the City of Prince George)

Kitson Harbour Development,
by: Maui Enterprises Ltd. - May 20, 1971.

"Sulphur Disposals Through the Port of Vancouver",
by: Concept Distribution and Marketing Services Ltd.
March, 1972.

Of the above, the Menzies Group "Westport" Report has been selected as the "base" report. Some commencts on this report are given in Section 3.7.

3.2 INVESTIGATIONS AND SOURCES OF INFORMATION

Field trips and investigations have been carried out and meetings held by the economic-traffic study team as follows:

In Prince Rupert -
- Prince Rupert Port Development Commission
- Prince Rupert Industrial Development Committee
- Columbia Cellulose Co. Ltd.
- Government Grain Elevator
- G. W. Nickerson Co. Ltd. - Shipping Agents
- Prince Rupert Forest Products Ltd.
- Harbour Master, Prince Rupert
- Fisheries Officer, Prince Rupert
- Canadian National Railways, Prince Rupert
- Prince Rupert Cement Products (1965) Ltd.
- Prince Rupert Fishermen's Co-op.

In Prince George -
- Canadian National Railways
- Regional District, Fraser-Fort George
- Northwood-Mead Group (Northwood Pulp Ltd.)
- Intercontinental Pulp and Paper
- Prince George Pulp and Paper Ltd.

In Victoria -
- Department of Mines and Petroleum Resources, Government of B.C.
- Department of Lands and Forests, Government of B.C.

Department of Tourist Industry,
Government of B.C.

Bureau of Economics and Statistics,
Government of B.C.

Speaker of the Legislative Assembly and
M.L.A. for Prince Rupert

and others

In Edmonton - Canadian National Railways

Williams Brothers Canada Ltd.
Pipeline Contractors

Canadian Phoenix Steel and Pipe Ltd.

Alberta Wheat Pool

Department of Industry and Commerce,
Government of the Province of Alberta

In Calgary - Trimac Limited

Alberta and Saskatchewan Wheat Pools

Imperial Oil Ltd.

Shell Canada Ltd.

Greentre, Cooke Offshore Ltd.

In Vancouver - Department of Fisheries,
Government of Canada

Canadian National Railways - Mountain Region

British Columbia Railway

B.C. and Yukon Chamber of Mines

In Vancouver Cont'd.	-	B.C. Packers Ltd.
		Canadian Fishing Co.
		McCallum Sales Ltd.
		Coalition Mining Ltd. (Brascan)
		Bralorne Mining
		Vancouver Wharves Ltd.
		Overseas Marine Services Ltd.
		Ancore International Ltd.

3.3 BACKGROUND TO ECONOMIC STUDY AND TRAFFIC SURVEY

Apart from considerations of Government policy under which Prince Rupert has become in 1972, a National Harbours Board port, designated as the second major port on the West Coast, a review of previous studies and projections of probable cargo movements has become necessary due to a new factor emerging in the latter half of 1971: the accelerating change in the politico-economic environment. Such change has strong influence on international trade. To understand the premises forming the economic base of this report, the following background information is considered essential.

Pacific Basin trade, to which exports through Western Canadian ports are closely tied, faces emphatic economic re-alignments. The growth pattern of Japan, our largest Pacific-Rim customer, is undergoing significant change, as a result of the new U.S. economic policies. Understandably, this is bound to lead to basic changes in the commercial relationships of Japan not only with Canada, but also with other countries.

Japan's soaring demand for a wide range of minerals (the expansion of her non-ferrous metal imports shows an annual increase, during the 1960's, of over 15%) has been the primary incentive for most of the recent mining expansion in Western Canada (and also in South America and Australia). Similarly, an increasing share of Japan's coking coal requirements came from Western Canada.

Some economists claim that Japan has been "blessed" with lack of basic raw materials, prompting her to seek high quality resources elsewhere in the world. Based on long-term, low-cost contracts, combined with the employment of large carriers (in the development and construction of which Japan has led and is still leading the world), Japan achieved optimized quality-cost ratios and perhaps the lowest industrial raw material costs of any industrialized nation.

The effects on international trade of a grossly undervalued yen is beyond the scope of this report. It should be mentioned, however, that it contributed to the emergence of what has been called "volumism" - an economic cult typical of postwar Japanese industrial endeavour, where success was measured by gross volume whilst the profit motivation was relegated to secondary importance.

The reduction of domestic demand in Japan, from the end of 1970 onwards, evoked pressures to maintain production volume by price-reduction and aggressive selling, especially in the export market, whilst the Western Countries, aiming at price stability, tried to adjust to reduced demand by curtailing production. It was this difference in basic philosopy, aggravated by a persistent Japanese effort to "export" her recession, that has led to a wave of protectionist reaction.

Obviously, basic changes of pattern in the spiralling Japanese industrial growth-rate are inevitable for the rest of the 1970's. The digestible limit of raw materials import - increase has been clearly exceeded in 1971. It seems logical to expect the following economic developments for the rest of the current decade:

a) A slowing down of the industrial expansion rate in Japan.

b) Price increases for resource material exports to Japan (resulting from revaluation of the yen).

c) A more elastic pattern of demand schedule for resource material imports.

d) A determined Japanese move to increase her overseas investments.

Whilst the outlook, therefore, is "cooler and somewhat cloudy", the last item (d) could be particularly important for the Canadian West. Japan will be manifestly anxious to slow down and reverse her growing balance of payments surplus and thus stem the pressure of further yen revaluation. Some of this money will no doubt help finance Canadian resource development. Japan's new interest in capital intensive industries abroad is also highly significant and goes hand-in-hand with her anxiety to see some of her resource material requirements processed outside Japan.

Summing up - the economic dynamics of Japan, more than any other factor in the Pacific basin, will influence resource and industrial development, and hence the pattern of export trade, of Western Canada. Such pattern, however, will be different and certainly more volatile, than what we have seen in the 1960's.

It is also desirable to place into proper perspective the newly emerging Chinese market. This vast market looms promising, but experts recommend following a cautious vein.

Having recently emerged from a long period of political and economic isolation, China has little difficulty in finding suppliers. Canada's chances on this market require evaluation on an economic basis that cannot be divorced from political considerations.

Foreign policy objectives have a significant influence on China's trade patterns which reveal complex and sophisticated thrusts aimed at dual objectives - economic and political - in trade with those countries which have extended her diplomatic recognition.

In general, economic conditions are well reflected by the world trade figures for 1971, as compared with 1970. Excluding the communist bloc nations, world trade in 1971 increased by 5.6 percent, as against 8.9 percent in 1970. At the same time world trade prices rose 3.6 percent in 1971, compared with a 5.6 percent gain in 1970. (Constant dollars)

3.4 COMMENTS ON TRANSPORTATION ECONOMICS

In competitive terms, Western Canadian export trade is essentially "transportation business". It is paramount, therefore, to remain sensitive to current trends in transportation.

Whilst inland transportation costs during the past two decades have increased at an average annual rate of 4 to 5 percent, the revolution in ocean transportation generated a dramatic saving in ton per mile costs. As a result, in terms of bulk transport costs, Tokyo is closer to Vancouver than is Calgary. Such a profound change in economic geography is bound to promote economic interdependence between Pacific Rim regional areas.

New developments in materials handling techniques at the ports also have a significant impact on the total transportation costs and thus on international trade. At the same time, rapidly rising port development costs and the capital intensive nature of modern port facilities and equipment represent a growing economic barrier. Trade-offs will assist in arriving at optimized solutions, with the best incremental benefit-cost ratios.

3.5 REVIEW OF REGIONAL ECONOMY

Regional economies, as a rule, are always vulnerable to forces originating outside the borders of the region. Consequently, an economic investigation always rests on certain assumptions which can be numerous and are always fundamental. Failure to satisfy one or more of these assumptions to a material extent invalidates the conclusions of the investigation.

In Section 3.3 - Background to Economic Study and Traffic Survey - the general international economic and market conditions have been briefly discussed. Regional economy, whilst still subject to world market trends, is not immune to national and provincial economic forces and policies.

In the terms of this review, the "region" consists of the economic impact area of a developed deepsea port at Prince Rupert. It embraces not only Northern British Columbia (defined approximately as north of parallel 52°) but the whole of the Yukon Territory and the Northern parts of Alberta and Saskatchewan.

The "region" therefore is larger than the area considered by previous reports. The definition of the geographical area is based on the following evaluation:

a) A modern port facility is a vital instrument of regional development. A port at Prince Rupert has a significant potential for generating economic growth within the area indicated.

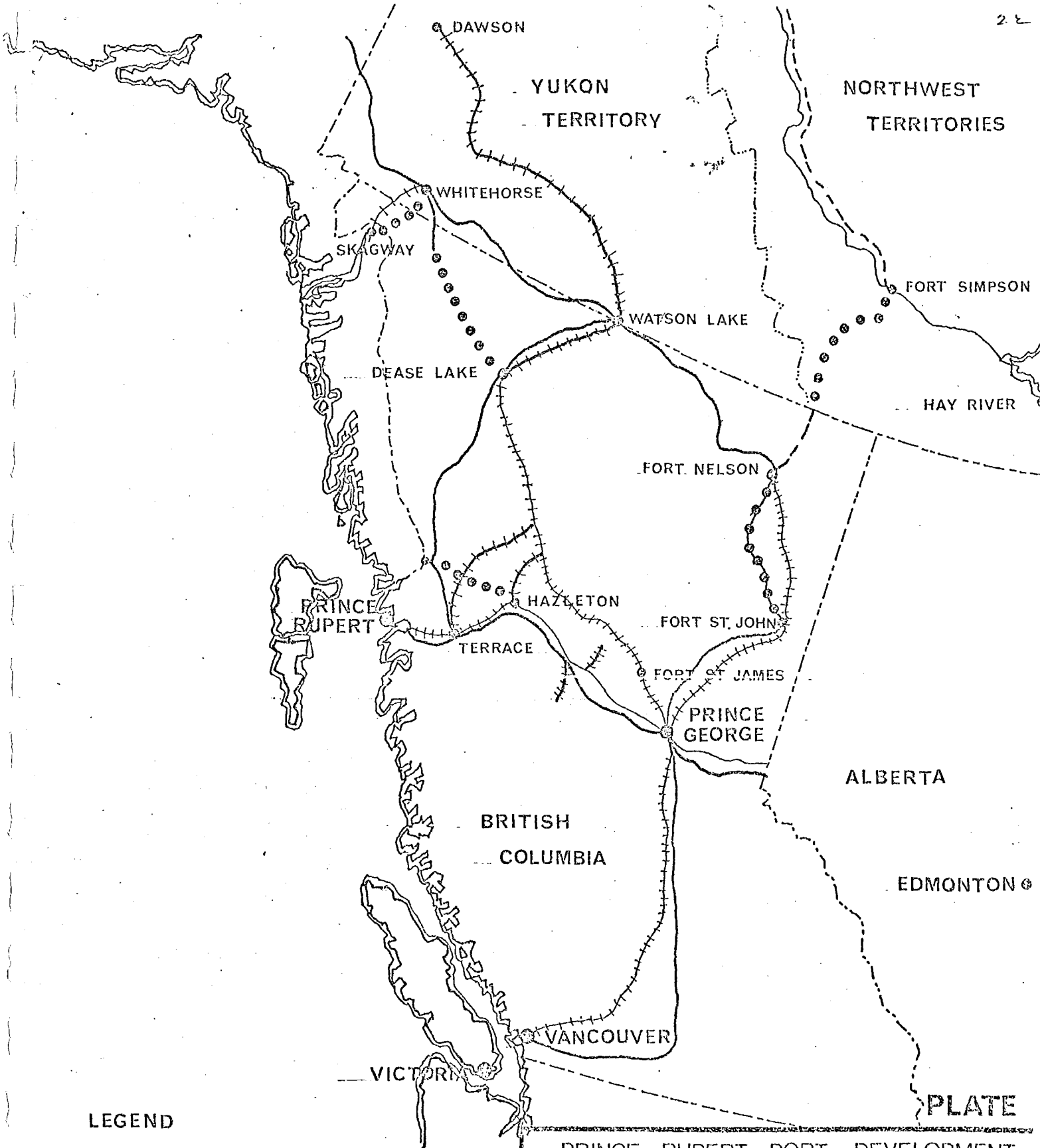
b) Resource and industrial development is dependent not only upon market availability, but also on the economics of scale in the production and transportation processes. Fluctuating economic conditions and even recessions of comparatively long duration should not affect long term resource development.

c) It follows from b) that a transportation network through the economic hinterland of a port (together with a system of direct and indirect services that facilitate through movements with speed-efficiency-economy) is mandatory for regional development (see also Section 3.6 - The Railways and the Port of Prince Rupert).

d) The provision of the capital required, by various levels of governments, for developing an adequate inland transportation system through the impact area and a proper port facility at Prince Rupert will materially benefit economic growth of the region.

e) The factors outlined under a) to d), above, received recognition from the Ministry of Transport in the newly proposed development of the Northwest Transportation System, announced on July 4, 1972 (Plate 1).

A fairly obvious pattern of regional economic growth follows from the above; resource development hand-in-hand with a continuation of infrastructure expansion. Mineral and forest resources are the key and transportation is the catalyst.



LEGEND

EXISTING HIGHWAYS ——————

HIGHWAYS UNDER CONSTRUCTION – – – –

HIGHWAY PROPOSALS • • • •

EXISTING RAILWAYS ++++++

RAILWAY PROPOSALS ++++++

JUNE 1972

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

PROPOSED DEVELOPMENT OF
NORTHWEST TRANSPORTATION SYSTEM

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

The following outline of current regional industrial activities is "slanted" from the point of view of their relative importance to and potential to be generated through a port development programme at Prince Rupert. In the case of major commodities, these are discussed in some detail in Section 3.8 - Traffic Reviews.

Agriculture - The only significant agricultural product emanating from the economic hinterland of the port is represented by the grain shipments via the Prince Rupert Grain Elevator. This Government owned facility is grossly under-utilized at present. Potential throughput, if the new hopper-style rail cars are used, is approximately 50 million bushels per annum (equal 1.3 million long tons). Note: 1971 shipments: 389,197 long tons.

Forestry - The major industry of the port's hinterland. Forest resources are also under-utilized, present cut being barely over 50 percent of the allowable cut at close utilization. Further development in this industry is largely linked to railway-road network development. A forest products terminal at Prince Rupert will stimulate sawmill construction in the area, with beneficial results for existing pulp mills.

Mining - Whilst substantial orebodies and coal deposits in the economic hinterland are unquestioned, large-scale exploitation is contingent upon a number of factors. Road-rail access is paramount; reluctance of developers to rely explicity on Japanese contracts (in the light of recent experience) represents a barrier which will take time to overcome; agreement by national and provincial railway systems on perpetual "running rights" over certain tracks of each other seems highly desirable; present long-term contracts of existing mines with Vancouver area terminals and lack of equalized rail freight rates between Prince George-Vancouver and Prince George-Prince Rupert militate against the prospects of near-term large-scale ore/coal exports via Prince Rupert.

Keen competition between the railways tends to make an attempt to accurately forecast the location of a large new bulk terminal of questionable value, especially in the light of increasing production costs, coupled with reduced Japanese demand. It would seem however, that there may be little or no economic justification for a large coal handling bulk facility in the Prince Rupert area until about 1980-85. (See Section 3.8.4 - Coal)

Fishing - The major industry and employer of labour in the City of Prince Rupert at present. The revival of the herring fishery, after being dormant for the past five years, will enhance the chances of direct export shipments via refrigerated ships (or containers) from Prince Rupert. Exports of halibut and tuna might also follow suit, although salmon is likely to continue to be exported via Vancouver where the required "product mix" is processed. In the meantime Canadian Fishing Company's plan to build a new large and consolidated fish processing and cold storage plant at Prince Rupert should create a substantial number of new jobs in the area.

Tourism - The recreation and tourist potential of Prince Rupert's economic-impact area is substantial. The number of cruise ships calling at the port, the hotel, catering and service industries at Prince Rupert itself (in relation to her resident population) and other factors, bear witness to this fact. Northern road network development as recently announced by the Minister of Transport will undoubtedly enhance the rate of growth of this industry. Direct measurement of such annual growth is difficult, but it has been projected at about 15 percent. There is a potential for larger increase with the new road development programme.

Service Industries - Apart from industrial development, the population growth (forecast for Northern B.C. at 2.5 percent for the period 1971-76 and 4.5 percent during the five years 1976-1981), will ensure significant growth rates in the service trades.

Construction Industry - Whilst the fortunes of the construction industry are largely tied to industrial development (construction of new sawmills, pulp mills, mines and mineral beneficiation plants, and the associated town sites, etc.) the projected population growth will also generate steady growth of this industry. Larger resident population will help to overcome what is, at present, a definite economic barrier, i.e. substantially higher construction costs compared with the Lower Mainland (approximately 30 percent) which is partly due to the need to import skilled labour for construction jobs.

Transportation - All the economic reports that have been reviewed, as outlined in Section 3.1, stress the importance of the transportation infrastructure. The "Northern British Columbia Development Forecast 1971-1981" states: "Transportation facilities are the prime requisite", whilst the AVG Management Science Report comments: "The economic validity of these industries depends on transportation costs".

These statements place correct emphasis on the cardinal condition upon which depends the industrial development of the economic hinterland of Prince Rupert.

Whilst a modern port development at Prince Rupert will generate economic growth, without adequate transportation infrastructure throughout the hinterland such growth is bound to be stinted.

3.6 THE RAILWAYS AND THE PORT OF PRINCE RUPERT

Railroads, like other enterprises, are in competition for business (traffic). They are capital-intensive undertakings and thus extremely sensitive to unit cost reductions, through increased traffice volumes.

Utilization - Most railways are either under-utilized or can substantially increase their carrying capacity through comparatively small capital expenditures. Canadian National Railway to Prince Rupert and B.C. Railway to Squamish/Vancouver are excellent examples of carriers with considerable unused capacity. The result is a competitive drive for new traffic volumes at rates which provide a contribution to overheads and profit.

Reliability - The Canadian National Railway route to Prince Rupert and the B.C. Railway route to Squamish are both subject to some delays during the winter and spring run-off months. During the last severe and unusual winter, the performance of the B.C. Railway was materially better than that of Canadian National Railway. The opposite has been true for three of the four winters previous to the last. There is in fact, little to choose between the two routes and, in any case, the reliability factor is not, on average experience, of major economic significance.

Sharing of coal traffic - An analysis of the variable costs of operating trains over the somewhat severe B.C. Railway grades (up to 2.2 percent) to Squamish, as compared to the optimum Canadian National grades (.5 percent) to Prince Rupert, appears to indicate that the potential savings over the latter route are of a magnitude that could afford an opportunity for the sharing of Sukunka area coal traffic, to the ultimate advantage of both carriers. Naturally such an arrangement would have to assure the B.C. Railway the same absolute contribution to overhead and profit as would be realized if this railroad were to maintain control over this traffic all the way to Squamish. These, of course, are matters for negotiation between the carriers concerned.

Congestion vs. extra rail mileage - While there is no agreement on the ultimate capacity of a single track railroad, it should be noted that the Canadian National volume to Vancouver is as yet only one-half that of the Canadian Pacific Railway and, therefore, is not a major factor to the Canadian National Railway with respect to the alternative route to Prince Rupert.

However, there is yard, bridge and bunching congestion evident all about the Lower B.C. Mainland and it is this factor that is causing considerable concern to the rail carriers serving Vancouver. It should be noted that the

present practice in Vancouver to concentrate activities during the five principal working days of the week compounds this problem and requires the provision of additional yard space with an approximate capacity equal to two full days deliveries by all carriers concerned.

Prince Rupert is about 190 rail miles further from points east of the Alberta/British Columbia border than is Vancouver. However the small increase in variable unit costs occasioned by these extra miles is easily offset by avoiding the congestion evident in the Lower Mainland area and there should be no reason for any premium on rates to Prince Rupert. In fact, until Prince Rupert is developed to the point where vessels are readily available there without any premium on ocean freight rates compared to Vancouver, a case could be made for some modest Canadian National pricing incentives. It should be noted, nevertheless, that the last Canadian National quotation to McIntyre Porcupine Mines Ltd. apparently required a freight premium on coal, if destined to Prince Rupert. This may represent an attempt by the Canadian National Railway to realize a portion of the anticipated savings in ocean freight rates on the proposed movement to Japan, assuming that terminal costs at Prince Rupert would be equal to those prevailing in the Lower Mainland area.

The future and growth of the new port of Prince Rupert will unquestionably hinge on co-operation and mutual running rights by the two railways over each other's tracks (to the north and west of Prince George), as well as on further rail development in northern British Columbia and the Yukon. These facts are further supported by the Transport Minister's announcement of July 4, 1972, which is attached in full.

ANNOUNCEMENT BY THE MINISTER OF TRANSPORT

July 4, 1972.

"BRITISH COLUMBIA - YUKON RAILWAY EXTENSION

OTTAWA - Transport Minister Don Jamieson announced today that extensive Federal studies of the development needs and potential of the northern British Columbia - Yukon region have identified a key need for new railway transportation links from the Yukon to the Prince Rupert area. This is of particular importance to the British Columbia and Yukon resource-based forestry products and mineral industries.

The decision announced earlier this year, which declared Prince Rupert a National Port, was made in recognition of the foreseen growth of this region's economy as well as the need to provide additional western port outlets for all the western Provinces.

While expansion of the port facilities of Prince Rupert are seen as vital to the needs of the export market, it was also anticipated at that time that provision of an adequate rail network in the hinterland area would both trigger and provide the means for a major part of the overall development of the region.

The construction of two principal rail lines has been identified as essential to fostering the future growth of the area and to providing economic access to both continental and offshore markets. The first of these is a

generally north-south line running from the Prince George region through Dease Lake and with eventual access to the Yukon. The second is a connecting link between that line and the Canadian National's existing east-west route into Prince Rupert.

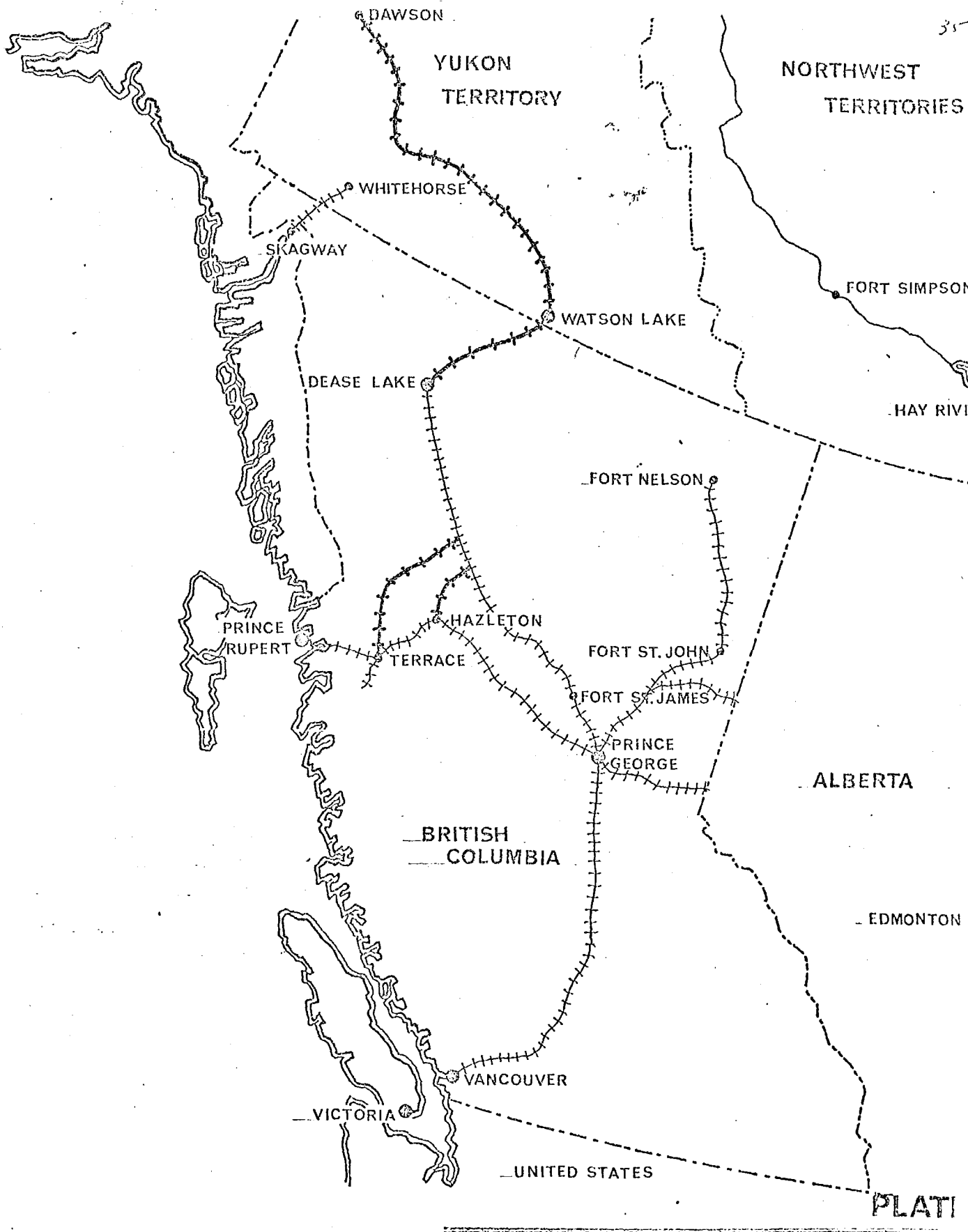
The Federal Government and the British Columbia government have been carrying out extensive consultations to rationalize railway development in the Province and are exploring co-operatively the optimum use of present rail facilities and the building of new lines over the routes of greatest advantage to the region's development. In addition, the Federal Government would pursue collaterally a rail access programme for the Yukon itself.

Implementation of such a programme will require:

1. Co-operative development of the Dease Lake line now under construction by the British Columbia Railway, with the intention that this will eventually form the major continental access route into the Yukon. This would involve Federal contributions towards that part of the line already completed or now being built north of Fort St. James, as well as joint financing of the portion now scheduled for completion into Dease Lake by 1974. A later phase, which would provide for extension northward from that point into the Yukon, would also receive Federal-Provincial funding. It is anticipated that the Canadian National Railways would operate the Yukon portion of this system and would also have appropriate access over the British Columbia portion of it.

2. Joint Federal-Provincial construction of the major connecting line would link the new north-south route with the Canadian National's Prince Rupert line. While designation of exact location pends further exploration by the railway companies involved, it would run in a geneally north-easterly direction from the Hazelton-Terrace area to a junction point south of Dease Lake. It is expected that this line would be a joint undertaking of the Canadian National Railway and the British Columbia Railway.

Detailed operating and traffic agreements for this northwestern railway network are now to be worked out between the Canadian National Railway and the B.C. Railway as necessary. Final route selection and timing of construction also remain to be agreed upon, although it is expected that these could be announced in a relatively short period of time. Concurrently, the Federal Government and the Canadian National Railway anticipate pursuing plans for the "next phase" extension which would carry into the Yukon, with an eventual terminus possibly as far north as Dawson City."



PRINCE RUPERT PORT DEVELOPMEN
ECONOMIC AND TRAFFIC STUDIES

PROPOSED B.C.-YUKON
RAIL EXTENSIONS

WRIGHT ENGINEERS LIMITE
VANCOUVER CANAL

3.7 COMMENTS ON THE "WESTPORT" REPORT (BY THE M. W. MENZIES GROUP LTD. MARCH, 1971.)

Basic Premise - Traffic allocations and "particularly their allocation between port areas have been made assuming that there would be no cost difference or physical capacity restraints on the movement of commodities through any port area. It was also assumed that, in the longer run, products would tend to be shipped via the lowest combination rail and ocean route from origination at the inland point of production to final export designation."

It is considered that such basic premise, aiming as it does at a perfect balance between various vested interests, is unlikely to be ever achieved in its entirety.

Rail Network - "The differentiated ownership of the system between operating railway companies was not considered. Distortions in rail distances which may result from rail line ownership, running rights, interlining and captive traffic have been excluded. The network therefore reflects the shortest rail distance assuming the entire rail network to be a homogeneous operating entity."

This assumption does not consider the competitive realities of the existing rail networks in British Columbia.

Rail/Ocean Mile Relationships - "It was found that for the major export commodities included in this study, one rail mile was equivalent to between 6.5 and 10.0 statute ocean miles."

This is considered correct, but the statement avoids the issue of backhauls.

"Westport" Projections -

	1975	1985
Total export cargo	6,517,000	10,817,000
of which		
Coal	4,480,000	5,600,000
Forest products	1,523,000	4,452,000

In other words, coal and forest products are forecast to constitute approximately 92 percent of both the 1975 and 1985 export cargo totals.

As shown in the comparative cargo projections in this Report, the "Westport" forecast is questionable, especially as far as coal is concerned.

Import Cargoes - "It is improbable that imports through the West Coast, no matter what port expansion takes place, will be significant by either 1975 or 1985."

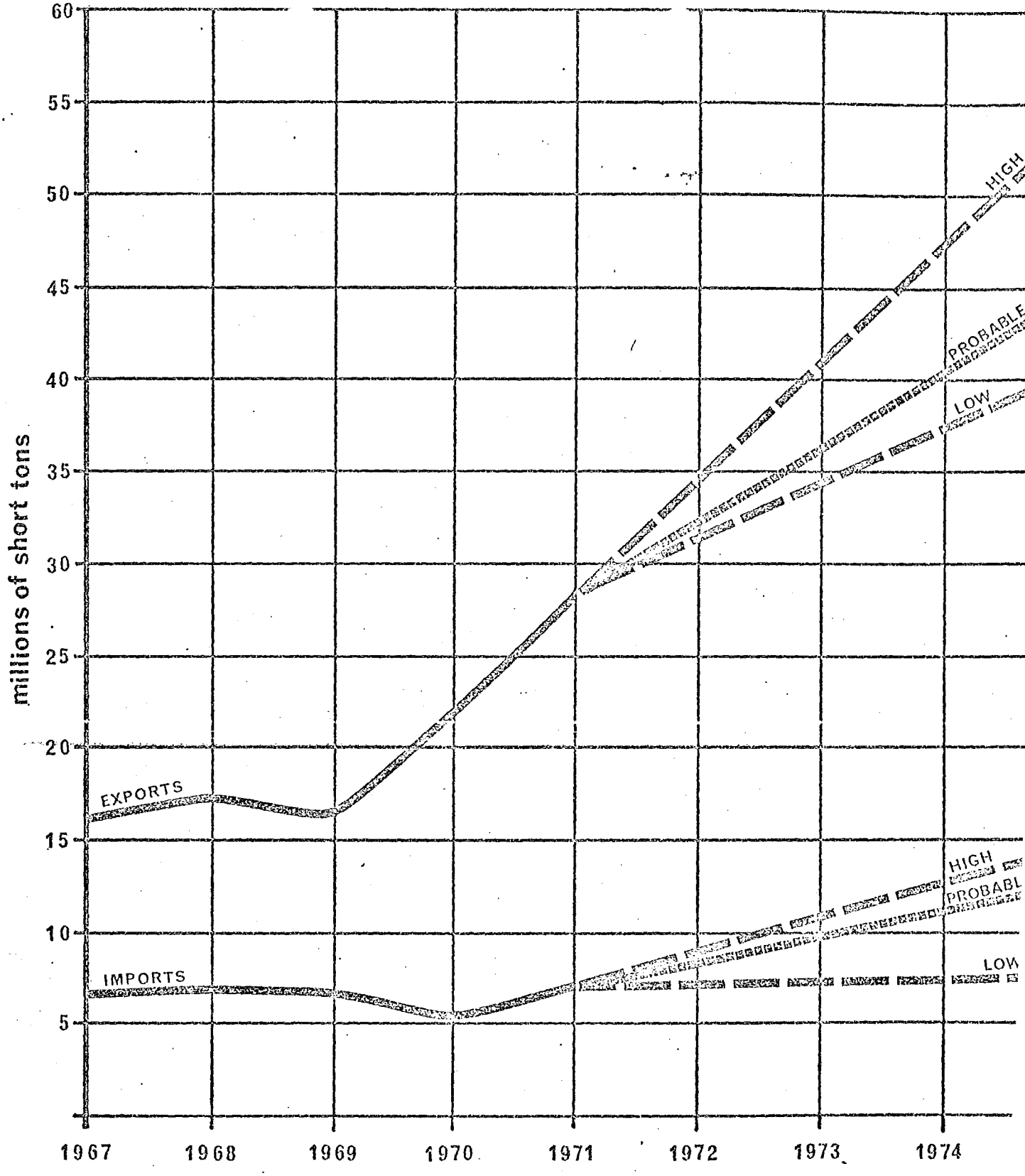
Whilst this is agreed, specific cargo movements connected with Northern Development are totally disregarded.

Alternative Transportation Modes - "For all practical purposes, railways are and will remain the main land mode of transport for all bulk export traffic."

This is agreed, although piplines for bulk commodities could radically alter the picture, at some future date.

The "Westport" Report's projections, within the assumptions outlined, and with certain notable exceptions (e.g. coal, grain), are considered acceptable as a broad overview of ultimate potential. Attention will be directed to its particular projections and the assumptions on which these are based in Section 3.8 - Traffic Reviews.

3.8 TRAFFIC REVIEWS



PLAT

SOURCE – NATIONAL HARBOURS BOARD STATISTICS

PRINCE RUPERT PORT DEVELOPMEN
ECONOMIC AND TRAFFIC STUDIES

EXPORT–IMPORT CARGO MOVEMENTS THROUGH THE PORT OF VANCOUVER (SHOWING RELEVANT TRENDS)

WRIGHT ENGINEERS LIMIT
VANCOUVER CANA

TABLE 1

TRAFFIC REVIEW - EXPORT PROJECTIONS

(in 000's of Long Tons)

TABLE OF COMPARISON WITH "WESTPORT"

	1975		1985	
Commodities	Westport	This Report	Westport	This Report
GRAINS				
Wheat	140	700	140	1,000
Other	-	44	-	60
Total (1)	140	744	140	1,060
MINERALS *				
Potash	-	750	-	1,200
Sulphur	-	-	-	-
Coal	4,480	-	5,600	5,000
Concentrates	40	120	60	400
Total (2)	4,520	870	5,660	6,600
FOREST PRODUCTS *				
Roundwood	483	100	504	-
Lumber	514	500**	2,154	600**
Pulp	526	-	1,796	-
Paper	-	-	-	-
Total (3)	1,523	600	4,454	600
OTHER EXPORTS *				
Total (4)	334	43	559	90
Total All Exports * (1) (2) (3) (4)	6,517	2,257	10,813	8,350

* Westport forecasts include all northern ports, (Prince Rupert, Kitimat, Port Edwards and Stewart).

** Average of Forecast Range.

3.8.1 GRAIN

It is well known that the Government owned grain facilities at Prince Rupert are under-utilized. The reasons for this are generally accepted as being a combination of private as well as co-operative ownership of competing facilities and the extra 191.7 route miles of the Canadian National Northern main line, over the main line distance to Vancouver. Any prediction then must be based upon either direct government interference in the current patterns, surge movements during peak years or a change in the underlying basic economics to all parties concerned. It is proposed to examine some of the possible changes.

"Seasonality" and Idle Equipment - Under present conditions, seasonal grain movement fluctuations are occasioned by sales activities and ship arrivals. The problem and the cost of such fluctuations in rail carrier power and equipment utilization is that of the rail carriers, particularly as the carriers are prevented by legislation from applying car demurrage to export grain movements. An idle standard box car has a cost to the carrier of about $7.00 per day at replacement value. An idle grain hopper car, with a larger capacity, has a cost to the carrier in the order of $9.00 per day. For purposes of describing the environment, 10 cents per ton per day has been chosen as representing unavoidable carrier cost in this respect.

Route Differences - Rail cost formulas are very complex and, in the case of the "national carriers", they are a series of average costs arrived at through regression analysis within which there is considerable latitude for the introduction of assumptions and the application or non-application of particular overheads (i.e., sales and marketing activities). However, it is generally accepted that a factor of between 1/8 and 1/4 of a cent per ton mile will fairly represent the incremental costs of the last additional "line haul" miles of a "long haul" movement. Thus, it is suggested that the Canadian National Railway could assess the extra 191.7 miles to Prince Rupert over Vancouver at between 25 and 50 cents per ton.

Trade-offs - In fact, the Canadian National applies the "Crows Nest Rates" to both ports and is obligated to haul products as directed. The recent acquisition by the Government of Canada of a number of new large hopper cars can and should create an environment whereby hopper cars are directed to Prince Rupert simply to ensure a quicker turn around as compared with yard and terminal delays in the Lower Mainland. While compensation arrangements between the Government and the railways for the use of the new equipment is not known and believed to be not yet finalized, the additional rail miles to Prince Rupert should not require

Canadian National to recompense the Government for use of the hopper cars over the extra rail mileage any more than the additional maintenance charges Canadian National would charge the Government for the additional miles. (Perhaps $1.00 per round trip equivalent). In any case, Canadian National should encourage Prince Rupert movements whenever average car delays in Vancouver and vicinity exceed 4 to 6 days, as the savings in car costs would then exceed the losses in extra miles.

The Wheat Pools and Prince Rupert - The two major Wheat Pools have an excess (cleaning) capacity at this time. They realize most of their earnings through the operation of their inland and coastal terminals. When grain is diverted for whatever reason from one coastal terminal to another, a diversion premium of 1.5 cents per bushel is paid by the receiving terminal to the terminal from where the grain is diverted. This applies to Prince Rupert as well. It is not accepted by the "pools" that this is fair compensation for the loss of revenue from elevation, cleaning, drying, etc. They consider that the 2-3/4 cents premium paid by interior mills for diverted grain is fair compensation. It is necessary, of course, to recognize that the natural objective of the co-operative terminals is to utilize their own

facilities in Vancouver and Victoria to the maximum and an increase in the diversion premium to Prince Rupert would appear one way of increasing the utilization rate at Prince Rupert. Another way would be to accord some consideration towards leasing or selling the terminal to the co-operatives or private interests.

The cleaning capacity of the Prince Rupert terminal is in the area of 240 tons per hour, the belts are adequate to maintain box cars unloading at a rate of fifty per 8 hour shift, or hoppers at eighty per 8 hour shift, and the terminal has an absolute storage capacity of 2,500,000 bushels, or 75,000 long tons, more or less. The present rate of utilization is less than half that of other (private) terminals.

It follows from the foregoing that serious consideration is warranted to increasing the diversion premium and encouraging Government-owned hopper car movements to the port, through inter-departmental negotiations.

Should, however, the situation remain unchanged, movements through Prince Rupert will be as directed by the Grain Board with little growth except in peak years or because of surge movements imposed by outside factors (such as experienced in the first few months of 1972).

Provided the National Harbours Board wishes to see the terminal better utilized and is instrumental in introducing an economic incentive, there seems to be no physical constraints in handling an average of 100,000 long tons per month, or 1,000,000 long tons per year through this terminal.

Projection

		Wheat	Other Grains and Pellets
(Actual)	1971	390,000 LT	22,000 LT
	1975	700,000 LT	44,000 LT
	1985	1,000,000 LT	60,000 LT
Relationship to "Westport"	1975	140,000 LT	Nil
	1985	140,000 LT	Nil

These projections represent an average monthly rail car movement into Prince Rupert of 650-90 long ton capacity hopper cars in 1975 and 1,000-90 long ton capacity hopper cars by 1985.

It should be placed on record that the above projections do not take into consideration the uncertain future prospects of Canadian grain exports to China, which country has annoi nced in 1971 that it was becoming self-sufficient in grain production. The reason for continued grain imports may li

in China's desire to increase her grain varieites and her rice exports to South-East Asian countries. The rice thus exported is replaced by grain, which is a nutritional equivalent.

It is interesting to observe that Professors P.S.Ho and Ralph Huenemann of the U.B.C. Faculty of Economics, have been quoted to have stated recently: "China's wheat imports are unlikely to rise and may well decline".

Sources - Alberta Wheat Pool
Grains Study Group
Government Grain Elevator - Prince Rupert
Canadian National Railways
Canadian Pacific Railways

3.8.2 CONCENTRATES

The loss of the Prince Rupert "Ocean Dock" has precipiated the need for new facilities for concentrate handling that will be adequate to meet future requirements.

The probable construction of a new copper smelter north-east of Clinton and the possibility of another near Kimberley make export forecasts somewhat difficult, as the Mineral Processing Act of British Columbia provides that 12.5 percent of the production of any copper mine may be directed to a new smelter once it commenced operations.

The proposed smelter(s) should be adequately serviced by the large new ore reserves in the Highland Valley. However, pressure can be expected on the new smelters to use concentrates from other mines as well, especially if copper concentrates become increasingly difficult to sell, whilst the price of metallic copper strengthens, as it is forecast to do in the near and middle term future.

Further, the concentrate terminal facilities at Vancouver will continue to attract export volumes, due to their ability to pool cargoes in larger vessels, offering the economies of transportation scale. Hand-in-hand goes their relatively rapid loading capability and thus rapid turn around of ships.

B.C. Railway - The B. C. Railway is likely to continue to maintain control over product movement originating close to their right of way, at least as far north as Dease Lake. Beyond Dease Lake, some concentrate may be attracted to Prince Rupert in the event the B. C. Railway secures running rights over the proposed Hazelton cut-off.

Major Concentrate Producers (not on B.C. Railway Line) - The Sherritt Gordon copper concentrate production of about 100,000 tons per year from Fox Lake is believed committed for export via Vancouver Wharves and the present nickel output from Lynn Lake is committed to the refinery at Fort Saskatchewan, Alberta. A part of the zinc concentrates production (about 200,000 tons per year) could be directed via Prince Rupert for export.

Ruttan Lake copper is reported destined to Flin Flon, with the zinc probably destined for export via Vancouver Wharves.

Assured Prince Rupert Tonnage - The immediate "assured" production that could be consigned to Prince Rupert is the 60,000 long tons per year of copper concentrates originating at Topley on the C.N. Railway (Granisle) and the 30,000 long tons per year zinc originating at Hazelton on the C.N. Railway (Nadina).

Due to the loss of the dock at Prince Rupert through fire, both mines have diverted the concentrates to Vancouver Wharves, at an additional rail cost of about $3.00 per ton, but an apparent overall saving, due to reduced ocean rates for larger and more regular vessels and substantial savings in ships demurrage, due to vastly improved loading rates.

Any new facility at Prince Rupert would have to overcome an apparent $2.00 per ton overall cost differential in the initial years, due to the low volumes. It is considered this would disappear as annual throughputs approached 300,000 tons per year.

Future Traffic - Economic conditions dictate the start and success or failure of most mines. North of Dease Lake and the C.N. Railway line, as far east as Endako, are considered the most probable areas of Prince Rupert influence over the forecast period. Beyond Endako, Canadian National will likely equalize rates with Vancouver, but vessel frequency and the established volumes will probably continue to attract tonnage to the latter port. Beyond Dease Lake, the B.C. Railway, with running rights to Prince Rupert, may be willing to participate in movements to the northern port. Concentrate movements originating below Dease Lake will be controlled by the B.C. Railway or committed to the smelter north of Clinton.

Substantial increase in concentrate tonnage movements through Prince Rupert is likely to follow only after the completion of the new C.N. Railway line from Lower Post to Carmacks, Yukon Territory. This new railway line should greatly encourage the construction of mines and mineral beneficiation plants in the Yukon Territory.

Growth of concentrate shipments via Prince Rupert seems assured over the long term, provided adequate facilities are available. It is pertinent to mention in this connection that Canadian National - when negotiating the transport of the new Sherritt Gordon mine's production destined to West Coast tidewater - appear not to have taken Prince Rupert into consideration at all, due to lack of suitable storage and port facilities.

Prospects for pre-1985 increase of concentrate throughput at Prince Rupert include development of the large Shaft Creek copper deposit (Hecla Mining) and Kenneco's copper-moly deposit south of Smithers (Berg mine).

Traffic Projections -

	1975	1985
This report	120,000	350 - 450,000
"Westport"	40,000	60,000

The projections represent an average monthly movement into Prince Rupert of 125-80 long ton capacity rail cars in 1975 and 365 to 470-80 long ton capacity rail cars in 1985.

Sources - Department of Mines and Resources,
Government of B.C.
B. C. and Yukon Chamber of Mines.
Canadian National Railways
B. C. Railway.
Wright Engineers Limited.
Vancouver Wharves Limited.

3.8.3 FOREST PRODUCTS

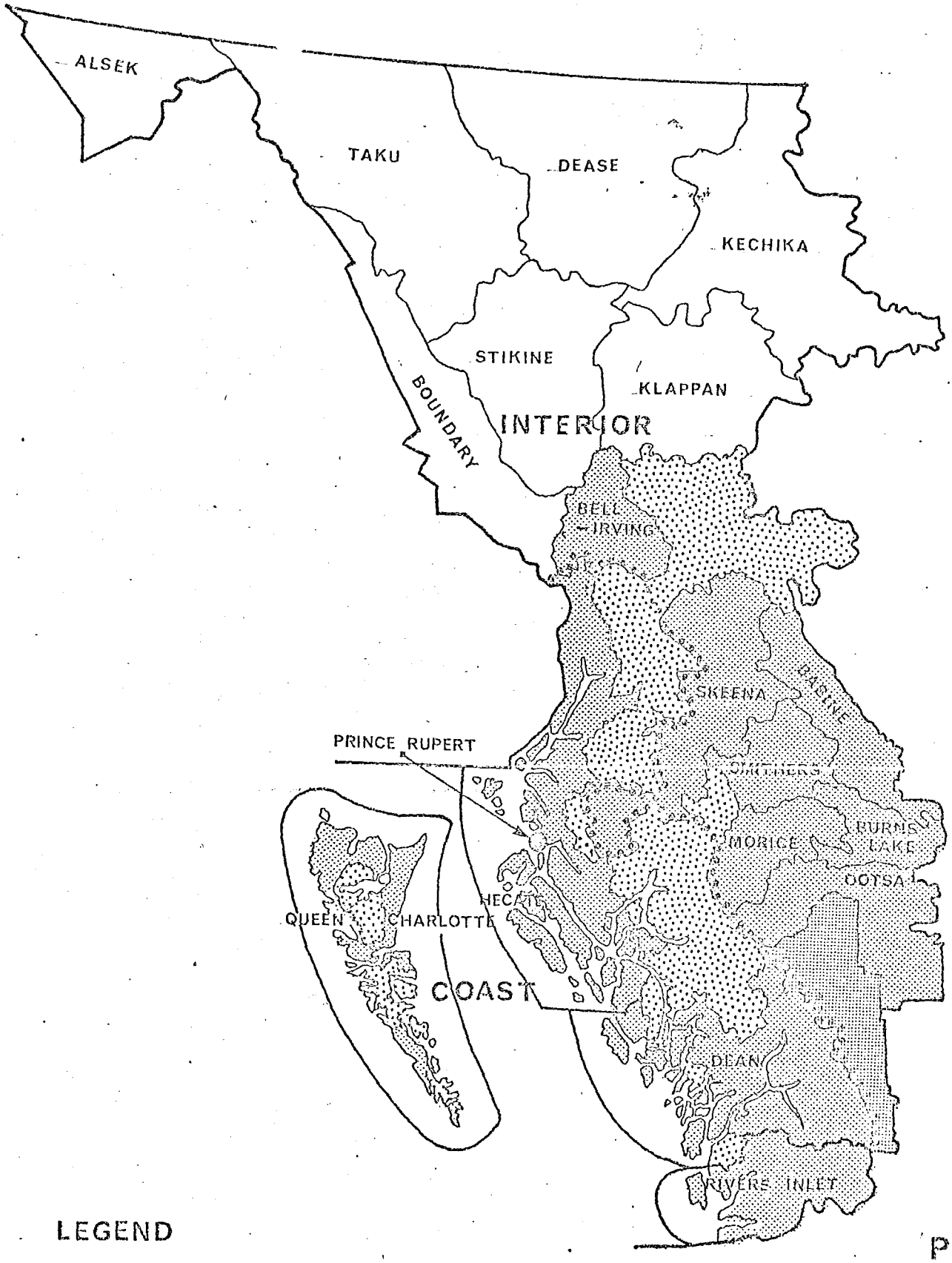
Apart from logs, there is at present no export movement of forest products directly through the port of Prince Rupert, possibly due to the absence of suitable port facilities. Previous predictions are an assessment of the forest potential of the total area that might be served by the port and tend to produce unrealistically high projections.

However, since it is intended to develop new port facilities at Prince Rupert, it seems reasonable to consider the obvious industrial and economic needs that can be identified in this area and particularly the related expansion of one aspect of the forest industry. If such identification is successful and the objective is determined, the availability of the resource must be ensured.

When discussing the "availability of the resource", it is pertinent to observe that in 1971 the total provincial timber scale was 1.9 billion cubic feet. The British Columbia Forest Service has estimated the annual allowable cut for the entire province at 3.4 billion cubic feet at close utilization (to a 6 inch top diameter). Therefore an additional 1.5 billion cubic feet is theoretically available for expansion of the forest industry, although a portion of this resource is economically inaccessible at present.

As far as the Prince Rupert Forest District is concerned (Plate 4), out of a total allowable cut for 1971 of 420.5 million cubic feet only 224 million cubic feet were used, leaving an unused surplus of 196.5 million cubic feet. (Table 2)

A further fact should be noted, as a corollary of what has been stated above. Some of our timber stands - and this holds true of the Prince Rupert Forest Distrct - are over-mature. This results in lower quality pulp and increased bleaching costs. (The quality of the lumber produced remains, however, of a high standard).



LEGEND

Approved Unit — SKEENA P.S.Y.U.

Proposed Unit — DEASE P.S.Y.U.

Tree Farm Licence — T.F.L.

Major Provincial Parks

Inferior--Coast Boundary

PLATE

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

PRINCE RUPERT FOREST DISTRICT

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

TABLE 2

PRACTICAL WOOD ALLOWABLES AND ACTUAL "CUTS" IN THE PRINCE RUPERT FOREST DISTRICT IN AREAS TRIBUTARY TO WATSON ISLAND - 1971

				MCFM
Total "allowables" in approved yield units				481,000
Tree Farm Licence #1 - Columbia Cellulose				72,000
Sub-Total				553,000
Less Eurocan share of Ootsa and Burns Lake		P.S.Y.U.'s	38,000	
Rivers Inlet	(Ocean Falls)	P.S.Y.U.'s	33,854	
Dean	(Ocean Falls)	P.S.Y.U.'s	48,100	
Bell	(Remote Area)	P.S.Y.U.'s	12,500	132,454
Sub-Total				420,546
Total Cut Prince Rupert District 1971			279,000	
Less total cut from in the four P.S.Y.U.'s described above			55,000	224,000
Not Utilized				196,546
Plus 1971 Watson Island Consumption				75,000
Available for Lumber				271,546
Additional in event railroad connection is provided between the C.N. Railway at Hazelton and B.C. Railway Dease Lake extension.				
Stikine		P.S.Y.U.'s	28,000	
Bell Irving		P.S.Y.U.'s	12,500	
Klappan		P.S.Y.U.'s	13,000	53,500
Total Available for Lumber				325,046

Source: B. C. Forest Service

Basic Facts - The wood pulp and lumber industry in British Columbia is based upon a fragile combination of circumstances and geography. These are:

1. The Transcontinental Railway Structure - that encourages large geographic areas to originate forest products for movement to distant and equally large markets, at freight rates not directly related to distance.

(Example: Wood pulp to Hartford City, Indiana - not corrected for latest increases:-

	Rate Miles	Freight Rate
from Watson Island, B. C.	2,704.6	$26.80 per ST
from Prince George, B. C.	2,245.6	$26.40 per ST
from Hinton, Alberta	1,941.1	$26.00 per ST)

2. Labour Rates - that, while higher in British Columbia than in the adjacent provinces, are not themselves, like the outbound rail rates, a significant portion of production cost.

3. Chemical Costs - that tend to be equalized on a delivered basis, slightly below the cost of on-site production.

It will be seen, therefore, that the combination of higher rail charges to market, higher labour costs and the equal or slightly lower chemical costs borne by the B. C. wood pulp industry can only be compensated by competitive or lower wood costs. This is, in fact, the case, primarily through the generally higher utilization of wood residuals in British Columbia by wood pulp mills and, of course, the quality of our trees for the manufacture of lumber.

Prime Markets - The largest consumer market for wood pulp and lumber in the world is that area of the United States east and south-east of Minneapolis. Production is directed away from that market only as a second choice and primarily by producers located at or near tidewater or, in the case of Prince George, by captive mills of European producers. Offshore exports are also assisted by favourable charges over the B. C. Railway.

Japan, whilst being an important customer for Canadian forest products, has not, to date, approached the importance of the U.S. markets. The recently announced programme of the Government of Japan to provide two million housing units a year for the next 10 years will offer new opportunities for West Coast lumber producers in general, and

Prince Rupert area sawmills in particular, especially if a combination of modern sawmills and efficient port facilities exist in the area.

The Problem - Two British Columbia wood pulp mills are located at the extreme western portion of the Canadian producing area, at a maximum distance from the major population centres and from the prime markets in the midwestern and eastern United States. These mills are located at Kitimat and Prince Rupert (Watson Island) respectively. They have extremely high wood costs due to their dependence on round wood, to the point of jeopardizing their continued economic viability.

Background to Wood Costs - The basic unit of wood to a wood pulp mill is the Bone Dry Unit (BDU) of chips. One BDU will weigh approximately 5,000 pounds wet (with wide variance) and will contain about 2,400 pounds of dry wood. In British Columbia, it is the Provincial policy to ensure that this residue of the sawmilling industry is available as the prime wood source to the pulp mills. Where it is in good or surplus supply, and this is certainly not the case at present in the Prince Rupert area, it has a value, loaded on a rail car, of the order of $9.00 per BDU. In the Prince George

area, the final cost of this unit delivered to the "digesters", screened and cleaned, is in the order of $15.00 to $17.00. Virtually all of the "furnish" of the Prince George pulp mills is provided by "residual" wood.

Comparison with Watson Island - Watson Island regularly purchases wood "chips" from Upper Fraser, B.C., located east of Prince George, as an alternative to their own "round wood" supply, at competitive wood chip prices (i.e. $9.00 per BDU). Thus, one BDU at $9.00 plus $2.00 handling, plus freight, at approximately $20.00 per BDU, totals $31.00 per BDU, as compared to Prince George maximum costs of $17.00 per BDU. Approximately two units of BD chips are needed for the manufacture of one ton of wood pulp. The cost disadvantage to Watson Island is about $28.00 per ton of pulp produced.

Significance to the Port of Prince Rupert - It is deemed desirable therefore to provide a lumber terminal at Prince Rupert to encourage and enhance the manufacture and export of lumber to a degree adequate to support the pulp mill at Watson Island on wood chips, at a delivered cost not exceeding $21.00 per BDU. It is known that the Provincial Goverment are aware of the problem and would encourage such production by facilitating new forest leases as required in the immediate area.

It is possible to identify the potential forest products movements resulting from the eventual attainment of this objective.

Basis:

Watson Island capacity	- Kraft pulp	270,000 tons per year
	- Sulphide pulp	170,000 tons per year
	Total	440,000 tons per year

Two BDU chips per ton, or	880,000 BDU's per year
Present chip supply, about	280,000 BDU's per year
Additional required	600,000 BDU's per year
One half BDU per 1,000 FBM sawn	1,200,000 MFBM per year

The average production of a "chip-intensive" mill is 6 FBM sawn for 1 CF of lumber, therefore an additional allowable of 200,000 MCF would be required to sustain this production (less Watson Island's present round wood consumption of 72,000 MCF per annum). As shown in Table 2, the above additional round wood requirement is but a small part of the available and unused surplus.

Rail Cost Constraints - Residual wood and lumber should be within a rail freight rate of $10.00 to Watson Island or within a maximum distance of about 220 rail miles. This criterion should

produce a competitive "digester" delivered cost to Prince Rupert of $21.00 per BDU, based on an average selling price on rail car of $9.00 per BDU.

Objective and Export Forecast - Provided substantial sawmill development is actively encourage by the Provincial Government, so as to coincide or immediately follow the construction of a forest product shipping terminal, waterborne shipments of lumber and lumber related products (but excluding logs and chips for export) from Prince Rupert should approach the following projections:

1975 - 50% of 600,000 MFBM or about 400,000 to 600,000 long tons per year (two major sawmills).

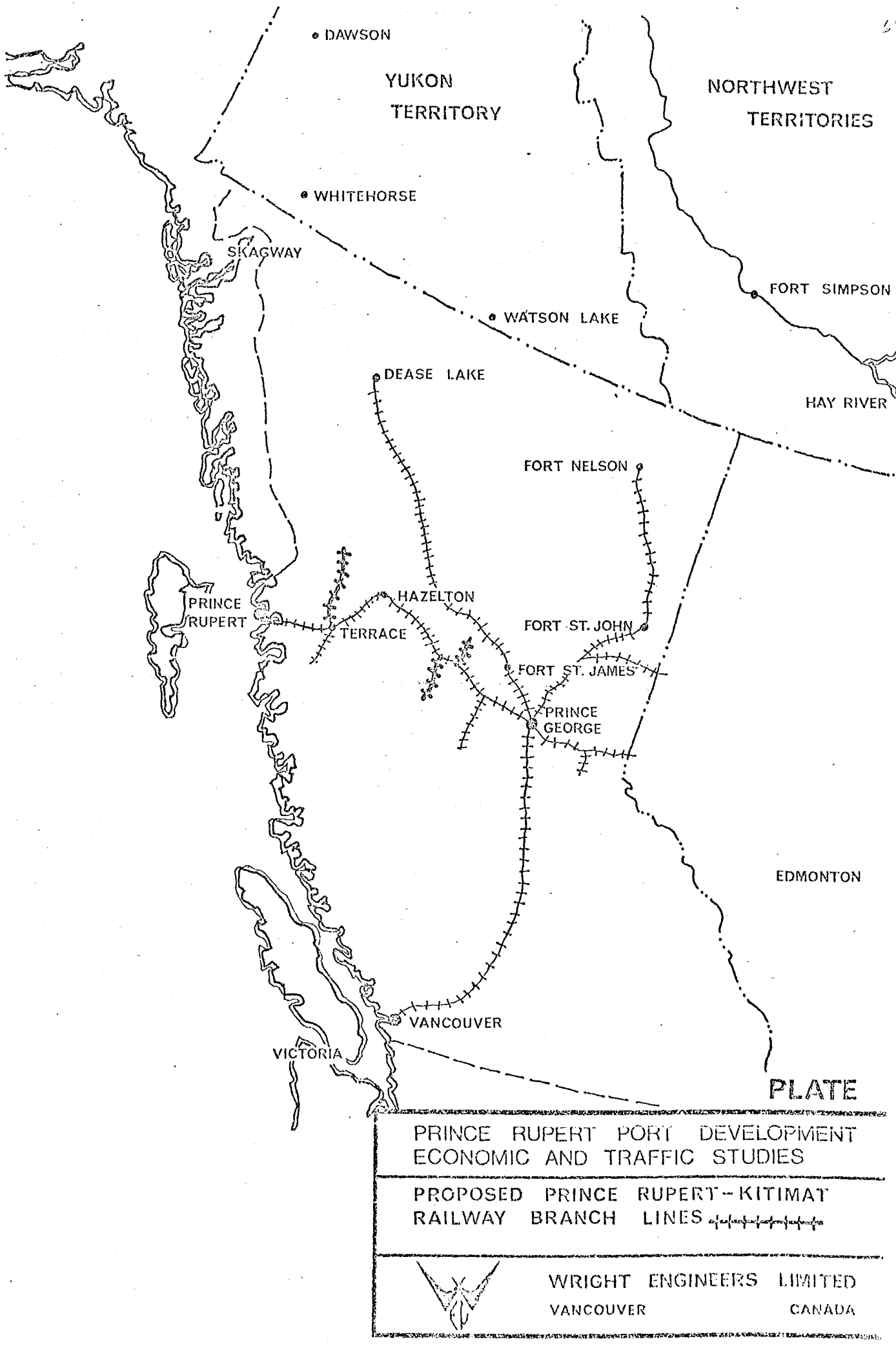
1985 - 30% of 1,200,000 MFBM or about 500,000 to 700,000 long tons per year (four major sawmills).

The range in tonnage forecasts is due to the uncertainty of the quality of the end product which would be shipped by the sawmills, especially in the earlier years of production. Initial movement through Prince Rupert is likely to be rough green lumber for the Japanese markets - (1,000 FBM green rough lumber = 3,900 - 4,200 pounds), whilst later production would tend to be kiln-dried, dimension grade (packaged) lumber - (1,000 FBM dry dimension lumber = 2,900 - 3,200 pounds).

Other Pulp Mills - It is deemed most unlikely that any other pulp mill development will take place in the area under review until after the requirements of Watson Island for residual wood are met. Nor is it anticipated that there would be any significant diversion of B.C. Railway captive wood pulp tonnage from Vancouver to Prince Rupert, or significant diversion of lumber shipments to Prince Rupert from points more than 200 miles distant. The round wood now exported should commence to be consumed in the local area for lumber within the forecast period.

The announcement of the Federal Minister of Transport, made on July 4, 1972, identifying the need for assistance to the B.C. Forest Industry in the form of rationalized transportation, fully confirms the analysis of the situation described in the preceding pages. The Minister's announcement stated, inter alia:

"The key to this undertaking would be the construction of up to three new railway branch lines to serve the forest areas at Ootsa Lake, Babine Lake and the Nass River. New sawmills constructed at these locations would, in addition to increasing the region's supply of cut and dressed lumber, be capable of producing sufficient wood chips at low cost to serve the pulp mill of Kitimat and Prince Rupert. These chips would be moved by rail to the pulp mills in high capacity rail cars, similar to those employed elsewhere in the Province." (Plate 5).



PLATE

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

PROPOSED PRINCE RUPERT - KITIMAT
RAILWAY BRANCH LINES

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

Projection		1975	1985
Round Wood	"Westport"	483,000 LT	504,000 LT
	This Report	100,000 LT	Nil
Lumber	"Westport"	514,000 LT	2,154,000 LT
	This Report	400,000 - 600,000 LT	500,000 - 700,000 LT
Pulp	"Westport"	526,000 LT	1,796,000 LT
	This Report	Nil	Nil
Paper	Both Reports	Nil	Nil

Note:

The "Westport" projections included both Kitimat and Prince Rupert and were based upon the announced, but since cancelled Bulkley Valley production. This report does not include Watson Island pulp export projections, as they are unlikely to affect the tonnage throughput of Prince Rupert port proper.

Assuming that 50% of the projected tonnages would arrive by truck, the other 50% represents an average monthly movement into Prince Rupert of 350 to 485 - 60 long ton capacity rail cars both in 1975 and 1985.

Finally, it is felt that the statement made by Empire Traffic Services Ltd., concerning a forest product terminal at Prince Rupert ("Kitson Harbour Development", by Maui Enterprises, May, 1971) should not go unrecorded in this report.

> "...we cannot be too strenuous in specifying that one of the greater requirements for obtaining overall cost and operational control in the total transportation and distribution of forest products is the centralizing, in one or perhaps two areas for the on-forwarding cargoes. Therefore we feel ... there is no immediate requirement for the establishment of any facilities for the handling of forest products in the Prince Rupert area at this time."

For the reasons outlined in the preceding pages, this report cannot agree with the views and recommendations of Empire Traffic Services Ltd.

Sources - B. C. Forest Service.
Department of Industrial Development, Trade and Commerce, Victoria, B. C.
Canadian National Railway.
Northwood Limited, Prince Rupert, B. C.
Northwestern Pulp and Paper Ltd., Hinton, Alberta.

3.8.4 COAL

The information in this analysis is based upon the best available information at this time and does not necessarily rely upon demand-supply projections around the world. It is suggested that such projections are valid tools to describe ultimate potential but can be hazardous if not tempered by commercial intelligence during periods of capital allocation.

Background - Western Canada's coal resources are recognized to be very large and certainly adequate for any foreseeable demand, providing the economics of the production will support Canadians wages and, generally, the costs of production and distribution.

There are at present, four major and two minor producers for the Japanese market. Two of the major producers appear to be in financial difficulties and one new major producer has already expressed some concern over prices and escalations, and also over quality and standards that were agreed upon, but which are either not being met, or are under dispute. In this situation a consolidation and retrenchment can be expected until a new basis for pricing and escalation has been arrived at and some of the underground problems are solved. The Japanese can be expected to avoid, as long as possible, renegotiation of outstanding contract terms and escalations. The major rail carriers are also determined to improve their return on coal movements.

Railway Competition - The B.C. Railway has a stated objective of a major bulk terminal at Squamish and the Canadian National fears this will "set back" any coal movement to Prince Rupert by about ten years.

The B.C. Railway holds that the lesser mileage to Squamish and their proven ability to operate an efficient railway will be the deciding factor. The Canadian National holds that their easy gradients and curvatures provide an inherently superior route to tidewater.

As far as a new bulk coal terminal development is concerned on the West Coast, the diverging policies to develop Prince Rupert and/or Squamish do not appear capable of reconciliation in the short term. However, these factors and how they may be resolved are outside the Terms of Reference of this Report. The following analysis is confined therefore to a description of some of the cost trade-outs, as they are seen at present.

Order of Development - (Plate 6)

Sukunka - The property at Sukunka is now effectively proved to a degree necessary to sustain an average production of 2,000,000 long tons per year. The group supporting

the property includes Brascan, Coalition Coal of the United Kingdom and a competent group of Australian mining engineers. The group appears adequately financed and has a stated objective to commit only part of the production to Japan, on a medium term contract, the balance being assigned to the open market in Europe.

The coal itself has a very low ash content and will be an ideal "sweetener" for the higher ash content coals, such as produced by Kaiser Resources Ltd.

In fact, the very problems associated with the higher ash content of the Kaiser coal may be the factor assuring early Sukunka production. The B. C. Railway plans to build a forty-mile spur to the site and planning is well advanced to have the Squamish coal terminal ready to meet the production schedule (access immediately to the surplus capacity of Neptune Terminals in Vancouver is also available.) Rail rates are essentially established and all that seems to be required is for a major purchaser such as the Japanese to agree to a price, on a five or ten year basis, with provision for proper escalation.

There is no alternative to B. C. Railway access at this time. The Sukunka mine should commence production at 1,000,000 long tons per year in 1974, and move up to an

annual rate of 2,000,000 long tons per year in 1975 or 1976. The initial production will be mainly consigned to Japan and subsequent production to Europe.

Teck - Another of the principals in the Sukunka area deposit is Teck Mining Company of Toronto. They have a proven deposit within twenty miles of the Sukunka deposit of comparable quality and capable of supporting an annual production of 500,000 tons per year. Teck is considering trucking the raw coal to the Sukunka washing and cleaning plant, and thence forwarding by B.C. Railway. This mine should be in production slightly ahead of Phase II of the Sukunka operation in 1975. The Teck mine's production is also intended primarily for the "open" markets in Europe and Japan.

Denison - Denison Mines' "Quintette" property is located some 60 miles south of the Sukunka deposit, but beyond the other side of a local divide. Canadian National is prepared to build (under assurance of volume) a 104 mile branch line from Hansard north through the Monkman Pass to give access to this and other promising properties in the same area. The proposed line, while expensive at about half a million dollars per mile, would appear to be potentially very efficient and would likely

have controlling grades of less than .75 percent to Hansard and .5 percent the remaining route to Prince Rupert. Total route mileage would be only 615 miles, compared to about 670 miles Sukunka to Squamish, or 713 miles Sukunka to Prince Rupert. It is considered that about 5 million tons of potential coal movement would be required to justify the Canadian National's investment in the branch line. (Based on the experience of existing terminals, as well as the capital cost estimates of some of the previous reports, the 5 million tons volume is also the order-of-magnitude economic threshold of a major bulk terminal at Prince Rupert).

Luscar (1974-75) and Minalta (1975-76) - Cardinal River Coal at Luscar, Alberta, is negotiating for an increase from the present 1,000,000 long tons per year rate to a 1,500,000 long tons per year rate. Minalta (Alberta Coal) is also negotiating for a 2,000,000 long ton year contract. The success of Luscar in meeting commitments has enhanced Japanese interest.

Utah Mining (1978) - This deposit is north and west of the B.C. Railway line to Fort St. John and will require another spur line. It is considered likely that the B. C. Railway will provide this spur if and as additional tonnage is required to support a new coal facility at Squamish.

McIntyre Porcupine (1977-78) - The continued underground problems at McIntyre may be resolved within a year and at that time McIntyre appear to need an additional 2,000,000 long tons a year contract, in order to open the new mine that appears necessary in any case, to support the current 15 year, two million long-ton-a-year commitment. The Japanese are expected to take a firm attitude and McIntyre are likely to be cautious. Additional McIntyre production is not expected before 1977-78.

Neptune Terminals - Neptune Terminals could handle the additional 2,000,000 long-tons-per-year from Sukunka, the 500,000 long-tons-per-year from Teck and the 500,000 long-tons-per-year from Luscar without expansion. Beyond this (1976-77) a new facility either at Squamish or Prince Rupert must be built.

Probable Movement - In the absence of an agreement on priorities (re new bulk terminal locations in B.C.), it is considered that there will not be sufficient coal available to support a facility at Prince Rupert before 1980-1985. This coal should originate from the Denison Quintette, Belcourt and Saxons mines over a new Canadian National

spur line in the amount of at least five million tons per year, as a start. Before this time, it appears the Squamish terminal will be operating and approaching designed capacity in the order of six-seven million long tons per year.

Economic Outlook Conference - It is pertinent to quote the following extract from the Report on this Conference (Page 5) held at Terrace, B.C. in December, 1969:

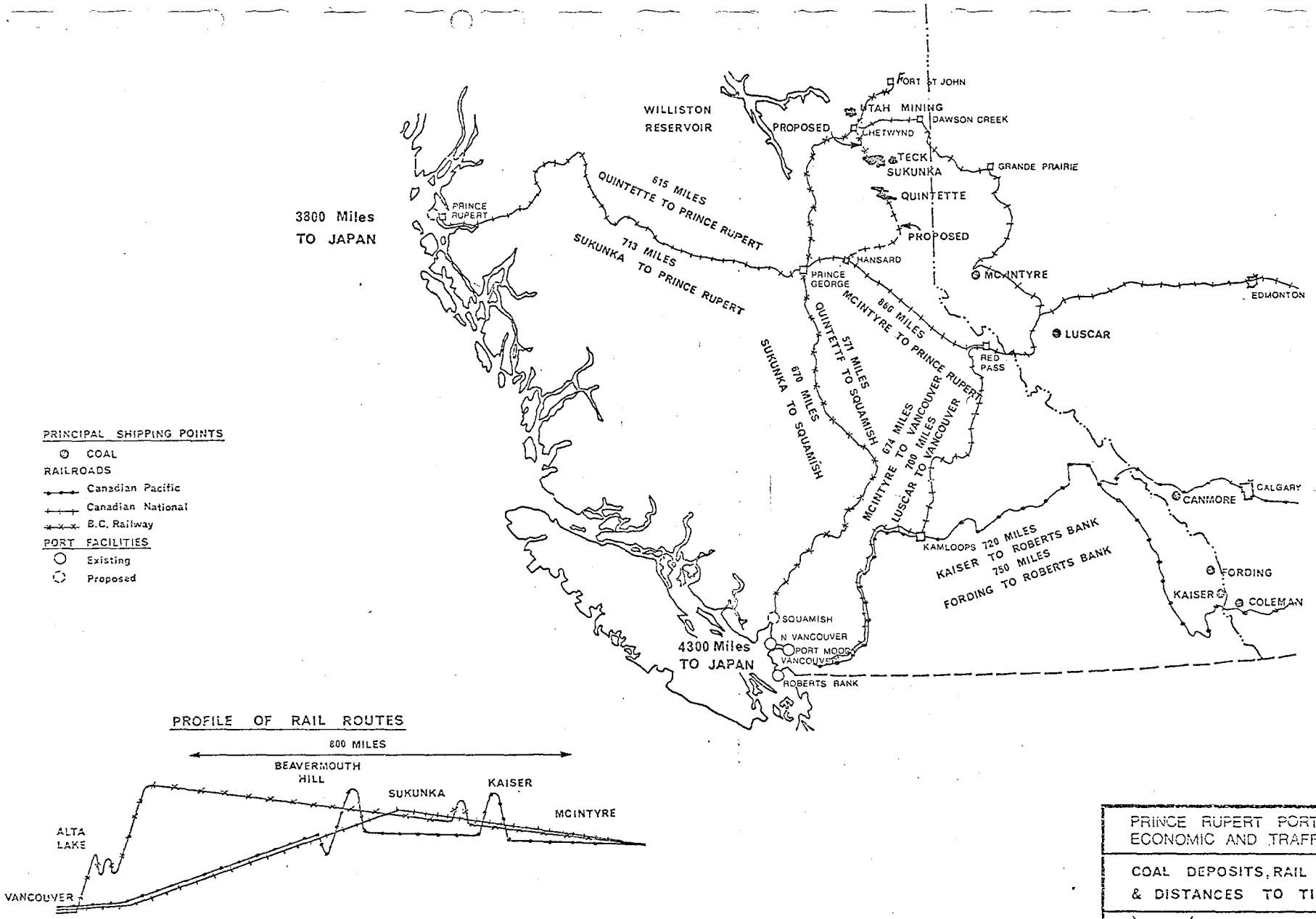
"...Development of bulk loading facilities in the area will be necessary to assure this prospective growth. The resources from fully one-half of the land area of the province as well as from the Yukon and North West Territories, and the northern part of the Prairie provinces, could be funnelled through the ports of Kitimat, Prince Rupert and Stewart..."

Projection -

	1975	1985
"Westport"	4,480,000 LT	5,600,000 LT
This Report	Nil	5,000,000 LT

The above projections represent an average monthly movement into Prince Rupert of 4,166 - 100 long ton capacity unit train cars by 1985 (three unit trains every two days.)

Sources - B. C. Department of Mines and Petroleum Resources.
Alberta Department of Mines.
Canadian National Railways.
B. C. Railway.
Brascan Ltd.
Vancouver Wharves Ltd. Vancouver, B. C.



PROFILE OF RAIL ROUTES

PLATE 6

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

COAL DEPOSITS, RAIL ROUTES,
& DISTANCES TO TIDEWATER

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

3.8.5 POTASH

World demand for potash has been increasing at a rate of about 5 percent per annum over the past decade. No major change is expected in this pattern over the forecast period, with the possible exception of the opening up of a substantial market in China.

Potential Chinese Market - According to the United Nations "World Economic Survey", the Chinese industrial and agricultural production increase in 1971 (10 percent) far surpassed the increase in production in the rest of the world (4 percent). Agriculture now constitutes approximately 33 percent of China's GNP, provides work for 75 percent of the 100 million families in China and was described by Chairman Mao as "the foundation of the economy."

At the same time agriculture presents the country's most disturbing problem. Poor soil composition, inadequate fertilizers, natural disasters and political whims periodically beset this sector of the economy. The Food and Agricultural Organization of the United Nations has estimated that 80 percent of Chinese soil lacks in nitrogen, 20 percent need phosphorous and 10 percent is wanting in potassium. Most of the chemical fertilizers produced in China are nitrogenous; potassium appears to be scarcely

Japanese Market - Japan has been one of Canada's large Pacific Rim customers for potash but the current Japanese affluence has had the effect of a "red meat" diet replacing what until recently had essentially been a rice based diet; the result might well be a decline in Japanese potash requirements in the future.

Saskatchewan Potash Production - Experience has shown that development of the Saskatchewan potash reserves was somewhat premature. Such development was the result of calculations based on world crop potash withdrawals. These calculations proved to be correct measurement of potential absolute demand only, without reflecting actual market conditions. This resulted in some difficulties in the Canadian potash industry, and to overcome them, the Saskatchewan Department of Mineral Resources and the Canadian Potash Producers Association, have set up a marketing organization (CANPOTEX Ltd.) which will handle all offshore sales of Saskatchewan potash. Obviously it will be the policy of this organization to actively promote Chinese awareness of their need for potash.

Market Projections Through West Coast Ports - The industry projects export tonnages through West Coast ports of 4.2 million tons in 1975 and 5.5 million tons in 1985.

It is the considered view that Prince Rupert could participate in this cargo movement to a substantial extent, provided facilities are available for at least two different grades of potash for each of at least three major producers. It must be borne in mind, however, that potash, being a low density commodity, would require stockpiling and handling acreage which might be difficult to find within the "city port". It is envisaged that this commodity, if proper facilities are to be made available for it, would be handled at a bulk terminal site, such as Ridley Island.

Projections for Prince Rupert - Recognizing the fact that the tendency to date has been to consolidate cargoes in Vancouver for large shipments (average parcel size 30,000 long tons and some as big as 60,000 long tons) it is obvious that the Prince Rupert facility would have to be competitive. For a properly designed and operated facility, the following cargo movement should be attainable:

1975	1985
750,000 LT	1,200,000 LT

Relationship to "Westport" - "Westport" did not consider that potash would move through the northern port area within the forecast period.

The projections represent an average monthly movement into Prince Rupert of 695-90 long ton capacity rail cars in 1975 and 1,110-90 long ton capacity rail cars in 1985.

Sources - D. J. Stark and Associates.
Canadian National Railways
Overseas Marine Services Ltd.
Vancouver Wharves Ltd.

3.8.6 COMMERCIAL FISHING

Whilst commercial fishing is unquestionably the industry providing at present the largest number of jobs in the Prince Rupert area, in terms of potential export tonnage through the port it does not represent a major item. Nevertheless, the tonnage of fish export that may be handled in the future assumes importance partly because of it being a high value commodity, when compared with lumber, concentrates or coal, and also because it represents one of the few items of "general cargo" available for export.

Salmon - It is the dominant sector of the commercial fishery, based in Prince Rupert. Most of the catch is canned locally and is disposed of in the following way:

a) Two of the major companies operating at Prince Rupert (B. C. Packers and Canadian Fishing Co.) ship their canned salmon production to eastern Canadian and U.S. destinations by rail, whilst offshore exports of canned salmon are handled in Vancouver where the required "product mix" (by species and sizes) is processed.

b) The largest local fishing operation, however, is the Prince Rupert Fisherman's Cooperative which exports to offshore markets anything up to 1,500 tons of canned salmon. Investigation has revealed that this shipment either goes by rail to Halifax and thence to Europe or via Panama from Vancouver.

Representatives of the Fisherman's Co-operative were most emphatic in stating that proper port facilities, and the ensuing availability of ships, would enable them to ship their production directly from Prince Rupert and effect very substantial savings in overall transportation costs.

Statistical information obtained from the Federal Department of Environment (Fisheries) shows that the five-year average (1966-70) of salmon catch landed and processed at Prince Rupert was 1,822 long tons per year.

Other Species - The two-year (1969-70) averages of landings at Prince Rupert are as follows:

Halibut	7,536 long tons per year
Cod and other bottom fish	4,643 long tons per year

No offshore exports are shipped direct from Prince Rupert. The canned production is partly rail-despatched to eastern Canada and U.S. markets, in part is sent to the Vancouver area for consolidation.

Herring - The B. C. herring fishery has shown a steady decline from a 1963 peak of 265,647 tons to 133,823 tons by 1967, whilst in 1968 the production was only 18,815 tons. These tonnages represent the following end-use production:

	1963	1967	1968
Fishmeal (tons)	48,035	23,356	3,077
Oil (Imp. gallons)	4,771,087	2,776,610	427,768

Herring fishing was suspended after 1968 and is only being resumed now, on a limited scale. The preliminary figures for 1972 indicate a total coastal catch of about 50,000 tons and it is not thought that the industry will ever be in a position to allow catches of the 1963-64 magnitude.

An increasing percentage of what herring is now available is channelled towards actual food use. The offshore market is directed mainly to Europe and Japan and the industry anticipates shipping in the next few years approximately 10,000 long tons per annum, direct from Prince Rupert.

Herring Roe and Salmon Roe - The combined export tonnage shipped to offshore markets is not expected to exceed 3 to 5,000 tons.

In the longer term, a new development would influence and possibly increase the total projected offshore export tonnage from Prince Rupert. It would appear that the Canadian Fishing Company intend to replace their recently burnt down plant with a new and much larger cannery and cold storage

which would consolidate several other processing/storage plants this firm owns around the coast. If such plans come to fruition, obviously the catch handled and processed at Prince Rupert would be much larger and chances of shipment of offshore export, direct from Prince Rupert, much better.

		1975	1985
Projection	-	15,000 LT	20,000 LT

Relationship to "Westport" - The "Westport" report did not deal with commercial fishing.

Sources - Department of Environment (Fisheries).
Department of Industrial Development, Trade and Commerce (B.C.)
Prince Rupert Fisherman's Cooperative.
Canadian Fishing Company Ltd.
B. C. Packers Ltd.
McCallum Sales Ltd.

3.8.7 TRAFFIC REVIEW - OIL

In the absence of a major oil discovery in Northern British Columbia's offshore waters, or export of tar sands oil to Japan, substantial movements of crude oil and/or refined products cannot be expected to take place via Prince Rupert.

Offshore Prospects - Shell Canada Limited have carried out a two-year offshore exploratory drilling programme off the West Coast (1967-68) without apparent success. The exploration leases have not, however, been terminated and it is known that the Standard Oil Company is planning to undertake a 6 to 24 months drilling programme in the Hecate Straits, on "farm-out" acreage from Shell Canada Limited.

A major oil strike in this area would require the oil to be taken to a mainland point, for onward transmission by pipeline to a refinery of suitable capacity. Depending on the location of an oil deposit, such mainland point could well be Prince Rupert.

Whilst such oil movement is somewhat hypothetic at present, it should be mentioned that the acreage requirements of a major tank-farm are such that would rule out its eventual location in the Prince Rupert "city port" area, but provision for such facilities could be made on, say, Ridley Island.

Tar Sands Development - Japan Petroleum Exploration (JAPEX) and Japanese capital in general, have shown considerable interest in the Canadian tar sands developments. It would be a matter for government policy-decision, of course, whether this oil production should serve Canadian petroleum requirements, be exported to the United States, or to Japan.

The Japanese would favour Prince Rupert as the Canadian export point and it is interesting to observe that the Athabasca area is approximately equidistant from the U.S. border and Prince Rupert (although pipeline construction and pumping would be more costly across the Rocky Mountains). The Peace River area tar sands (scheduled for development around 1984) are some 200 miles closer to the West Coast.

Crude oil production from the tar sands is scheduled to come "on stream" in 1978-79, one plant per annum and a total of some 10 plants, each plant with a capacity of 100,000 barrels per day. The cost of each of these plants is of an order-of-magnitude of 450-500 million dollars. It is quite possible, therefore, that the help of foreign capital will be required to establish them, and thus Prince Rupert may well have a future role to play in Pacific Rim

exports of Canadian synthetic crude oil, although not within the forecast period of this report.

Refined Products - At present the only refinery in Northern British Columbia is located at Prince George with a 7,500 barrel per day capacity. This refinery supplies the requirements of the Prince George area, including the pulp and paper mills, sawmills, etc., located there.

Although the Northern British Columbia Development Forecast 1971-81 clearly shows a "planned" refinery near Prince Rupert, investigation and discussions with the oil industry failed to reveal any actual plans for such a new refinery. In fact, the industry no longer considers a small "grass root" type of refinery (6,000 - 8,000 barrels per day capacity) an economically viable proposition, because of the expensive environmental control requirements. The construction of a refinery at Prince Rupert, to cater for the local needs, would be contingent upon the two following important conditions:

a) The availability of ample supply of crude oil (a major tank farm supplied by offshore or synthetic crude).

b) Largely increased local consumption of petroleum products (major resource-industrial development with associated population increase, etc.)

Current Movement of Refined Products - Prince Rupert is currently supplied from the Vancouver area refineries via coastal tankers and/or tug tank-barge systems. Until and unless the two conditions mentioned earlier are satisfied and, as a result, a local refinery is built (which is unlikely to take place within the forecast period), the existing supply pattern is expected to continue and grow, in keeping with the growth and development of Northern British Columbia.

Since petroleum products are handled by the oil companies at their own docks-tank farms, this commodity is excluded from the traffic volume projections.

Relationship to "Westport" - The "Westport" Report did not deal with oil.

Sources - Imperial Oil Limited
Shell Canada Limited
Greentre, Cooke Offshore Limited

3.8.8 LIQUEFIED NATURAL GAS

The principal natural gas reserves for which Prince Rupert could be considered a suitable offshore loading point are located in the Fort Nelson area and are held by Westcoast Transmission. These reserves are believed to be earmarked for supply to the U. S. market, via pipeline.

Potential Markets - Potential offshore markets for Canadian LNG would be Hawaii and Japan. The interest shown in 1968 by Honolulu Gas in Canadian LNG (as opposed to LNG from Alaska) stemmed from the provisions of the Jones Act, restricting trade between U.S. ports to American flag vessels - this means higher operating costs and thus higher freight rates. Some negotiations for Canadian gas supplies were conducted at that time, but they were inconclusive.

As far as Japan is concerned, interest in West Coast Canadian supplies is difficult to visualize at present, as long as the U.S. is willing to supply Alaskan LNG to them (obviously a political consideration when the U.S. herself is a major importer of natural gas); and in view of new sources of supply (e.g. Brunei) which are substantially nearer.

Topographical Constraints - Another factor militating against Prince Rupert being an LNG export point is the dearth of suitable water front land. A reasonably square, flat land area of some 40 acres is required for a base plant and storage tanks with a capacity of 80 million standard cubic feet per day. The required acreage could, no doubt, be made available on Ridley Island, although the possible presence of a major oil tank farm in the vicinity could render such location subject to special scrutiny by the Fire Prevention Authorities.

Whilst locating the liquefaction plant and storage tanks away from the waterfront is feasible, initial capital costs incurred would be substantially higher due to the expensive piping installation required for LNG, which is of the order of 130-150 dollars per foot of piping.

In view of the factors briefly outlined above, it is not considered likely that Prince Rupert will become an offshore export point during the period under review for liquefied natural gas. This forecast could materially change if the Standard Oil offshore drilling programme would result in a large gas deposit being found in the Hecate Straits area.

Relationship to "Westport" - The "Westport" Report did not deal with LNG.

Sources - West Coast Transmission
Wright Engineers Limited, Cryogenic Division
Shell Canada Limited
Greentre, Cooke Offshore Limited

3.8.9 OTHER COMMODITIES

Sulphur - Sulphur exports are expected to "peak" and possibly decline in the near future due to the rising world environmental concern and consequent production of sulphur as a by-product of mining, petroleum and manufacturing processes. It is significant to observe that some countries, hitherto importers of sulphur, have now a surplus available. The present very depressed sulphur market cannot be therefore expected to improve, until and unless new uses are found for this commodity.

In any case, the economics of scale of one terminal, (Vancouver Wharves), over two or more, preclude a sulphur facility at Prince Rupert, all the more so because over half of the elemental sulphur capacity is in southern Alberta, on the Canadian Pacific Railway line.

The "Westport" Report concurs with this view.

Asbestos - Asbestos moves to markets in bales or containers with a wide distribution to many countries. The yearly Canadian export of approximately 130,000 long tons per year is expected to be captured by the B. C. Railway, once the new extension reaches Dease Lake. Diversion of a part of this traffic to Prince Rupert would be contingent on a number of

factors, amongst which the completion of the Hazelton connecting railway loop and suitable general cargo facilities should be mentioned. Paramount, of course, will be an agreement between the B.C. Railway and the Canadian National Railway on "divisions" (shares). Little prospect for such divisions is seen at present.

Non-Board Grains - It is considered most unlikely that the commercial elevators will, in the forecast period, willingly forego their relative high elevation and cleaning profits at Vancouver on non-board grains, in favour of a Government-owned facility at Prince Rupert.

Tall Oil - Tall oil is a by-product of a Kraft pulp mill. It is a low-cost, but essential raw material for "binders", inks, fixing agents, paper sizing and many other uses. The mill on the Canadian National line at Hinton, Alberta, currently part-refines its own production and also that of two mills at Prince George and the mill at Prince Albert. This part-refined product, currently in the amount of 14,000 long tons per year, is exported to Japan in ships' deep tanks. There is an acute shortage of a suitable tank farm in Vancouver. Additionally, the economic production of the oil is directly related to the percentage of "pine" species trees in the

mill wood-furnish, and production is therefore most economic in the northern areas of the Prairie Provinces. At some time in the future, it may be possible to fully refine the product within Canada.

Providing the Japanese buyers (Mitsui) make ships with deep tanks available at Prince Rupert, there seems to be no reason why this traffic could not be diverted from Vancouver, provided suitable facilities are installed (insulated and/or heated tank, pumps, steam for unloading tank cars, etc.)

Automobiles - Prince Rupert is being considered to become the main distribution centre for Northern B. C. and Alaska. Cars would be rail shipped from Eastern Canadian and United States plants.

Canadian National Railways projects an initial movement of 4,000 cars per annum (standard size North American automobiles - approximately 2 DWT each) rising to 20,000 cars per annum. Shipment to Alaska would be made by a 250 foot coastal vessel of 1,000 DWT capacity fitted with bow loading Ro-Ro ramp and carrying between 200 and 250 automobiles per trip.

Projections -

	1975	1985
Tall oil	20,000 LT	30,000 LT
Automobiles	8,000 LT	40,000 LT

Relationship to "Westport" - "Westport" did not consider these commodities.

Sources - Department of Mines and Petroleum Resources, Government of the Province of B.C.
Department of Industry and Commerce, Government of the Province of Alberta.
Alberta and Saskatchewan Wheat Pools.
Canadian National Railways.
Ancore International Limited.

3.8.10 PIPELINES

The recent announcement by the Federal Government of an all-weather highway to the Arctic and the merger of the two major competing pipeline groups, "Gas Arctic" and "Northwest", seem to assure a start on the McKenzie Valley pipeline by the winter of 1974. The projected route is from Prudhoe Bay to Emerson, Manitoba, with a branch to Hay River, North West Territories.

Statistical Data -	Miles of route:	2,400
	Tons of pipe:	2,000,000 LT
	Construction sections:	8 in total, known as "spreads" of approximately 300 miles each.
	Men per "spread":	1,000
	Major pieces of equipment per spread:	550
	Period of construction:	Two winters and one summer.
	Fuel requirements:	24,000,000 gallons in year one, and 48,000,000 gallons in year two.
	Food requirements:	100,000 pounds per day.
	Methonal:	500,000 tons (for flushing pipes).
	Swamp weights:	400,000 tons (cement).

Probable Supply Routes -

Spread #1 - Northern Alaska via Valdez and Prudhoe Bay

Spread #2 - Lower McKenzie via Fort Simpson and Hay River. (Some "backhaul" by barge from Tuktoyaktuk).

Spread #3 - Northern Yukon via Skagway, Fort Simpson and Hay River.

Spread #4 - Central McKenzie Valley via Fort Simpson and Hay River.

Spread #5 - Fort Simpson vicinity via Fort Simpson and Hay River.

Spread #6 through to Spread #8 - To Emerson by truck and rail through Edmonton and Saskatoon.

Anticipated Supply Sources -

Note: Pipe specifications, especially for Arctic spreads, are stated to be very exacting.

Pipe:	Alberta	100,000 LT
	Ontario	400,000 LT
	Saskatchewan	100,000 LT
	Japan	1,400,000 LT

Methonal:	Alberta	300,000 LT
	United States or Japan	200,000 LT
Food:	Total 12,500 LT of which, 70 percent from Canada, 30 percent from the United States, (including 10 percent by air).	

Compressors and similar large equipment - estimated total deadweight 80,000 long tons of which 65 percent from Canada, about 35 percent from Japan and/or the United States.

Other - sheet metal for storage tanks, buildings, etc., approximately 10,000 long tons, likely to be of Canadian origin.

Prince Rupert Potential - The Port's potential primarily depends on railway equipment supply and on the provision of at least 20 acres of suitable back-up land adjacent to a berth capable of handling pipe of 48 to 56 inch diameter, in lengths to 80 feet; also heavy compressors and other associated equipment. The imported pipe will be used almost exclusively on the Northern portions of the line.

The spreads described as the Lower McKenzie, Northern Yukon, Central McKenzie Valley and Fort Simpson vicinity, or 50 percent of the total construction could be supplied via Prince Rupert.

The strain on the port and other transportation facilities, will, in the final analysis, govern the routes. The principal routes for import traffic are likely to be:

Vancouver - Fort Nelson:	B. C. Railway, thence truck and barge, say 30 percent.
Vancouver - Hay River	Via Canadian National or Canadian Pacific and Northern Alberta Railways, thence truck and barge, say 40 percent.
Prince Rupert - Prince George to Hay River:	Canadian National - Alberta Resources Railway or Northern Alberta Railway, thence truck or barge, say 30 percent.

Potential Movement through Prince Rupert -

Imported Pipe:	420,000 LT over 2 years
Compressors and Equipment	10,000 LT over 2 years
Miscellaneous:	10,000 LT over 2 years

Oil Pipeline - Should Canada decide to proceed with an oil line after completion of the gas line, then the estimates herein can be doubled, but the construction period of the oil pipeline would be spread out over 5 to 6 winters.

Movement Logistics - The dimensions of the task of moving the quantity of very bulky materials, from their point of origin to destination, combining various transportation modes and often under extremely inclement weather conditions will be readily appreciated. The multiple origins of various materials, their multiple destination and the seasonal availability and capacity fluctuations of certain vital links in the transportation chain render compatibility and coordination of the various transportation modes a mandatory concomitant.

It should be also mentioned that, to date, Prince Rupert has not been considered in the movement logistics of a pipeline construction programme. This fact, however, would not exclude the port's participation in handling the cargoes outlined above, provided the required facilities are constructed and available in time.

Relationship to "Westport" - "Westport" did not comment on the effect of a northern pipeline.

Sources - Canadian National Railways, Pipeline Logistics Planning.
Williams Brothers of Canada Ltd.
Canadian Phoenix Steel.
Trimac Limited.

3.8.11 IMPORTS AND COASTAL SHIPPING

For purposes of a Prince Rupert port projection, it is considered that import, import redistribution and coastal distribution opportunities and characteristics are similar.

Due partly to the absence of proper port facilities, Prince Rupert has lacked to date the infrastructure necessary to thriving importing and redistribution activities. Another factor contributing to this situation is the low population density in the port's hinterland.

The development of communities and industries in the north as a result of rail route expansions should, for the first time, provide the base for a substantial service and wholesale industry in Prince Rupert. The immediate need, sometimes at any cost, for parts and equipment, as the proposed Arctic gas line is progressed, should provide a basis for capital accumulation by local enterpreneurs.

A good example of lost opportunities is found in the two cargoes of Japanese oranges frozen on the dock at Prince Rupert in recent years, while en route to the "time-critical" markets of Saskatchewan and Manitoba, due to lack of heated shed space.

Pool Cars and Containers - Much of Canada's merchandise moves to market in "pool" cars. The large companies purchase rail cars on a wholesale basis and consolidate shipment for major

wholesale and retail houses. The Canadian Pacific Railway dominates this traffic, but both national carriers generate as much as 90-100 cars a day in Vancouver.

This traffic is so attractive and competitive, that shed and assembly facilities are often supplied by the carriers on a very favourable basis. Obviously, there is an opportunity to develop such traffic at Prince Rupert with the co-operation of Canadian National Railways. However, the "through" movement of containers now considered beneficial by the major railroads, poses a threat to pool car operators. These containers may ultimately displace a portion of the pool car shipments, through all ports.

The intercoastal carriers, particularly Northland Navigation, dominate the intercoastal trade. Their facilities in terms of dock and/or transit-shed areas are not adequate for a substantial increase in containerization and may require relocation before 1985.

Effects of Increased Shipping Activities - In addition, experience shows that more frequent vessel arrivals resulting from increased export tonnages do, in turn, generate an increase in total import traffic, at

least in direct proportion to the increase in vessel arrivals over the forecast period.

Projections - Assuming that any new development at Prince Rupert will include a large general commodities shed, the following projections are realizable objectives:

	1975	1985
Seasonal movements of oranges/perishables, etc.	30,000 LT/Yr.	70,000 LT/Yr.
General merchandise for assembly-direct import	Nil	60,000 LT/Yr.
Containerized traffic direct import	NIL	50,000 LT/Yr.
Containerized traffic intercoastal	Nil	50,000 LT/Yr.

Relationship to "Westport" - The "Westport" statistics are in this order-of-magnitude.

Sources - Canadian Pacific Limited
Canadian National Railways
Western Assembly Ltd.

TABLE 3

TOTAL PROJECTED CARGO FLOWS

(Long Tons)

	1975	1985
Wheat	700,000	1,000,000
Other Grains	44,000	60,000
Concentrates	120,000	400,000*
Round wood	100,000	-
Lumber/Plywood	500,000*	600,000*
Coal	-	5,000,000
Potash	750,000	1,200,000
Fish	15,000	20,000
Tall Oil	20,000	30,000
Automobiles	8,000	40,000
Imports and Coastal	30,000	230,000
	2,287,000	8,580,000

* Average of Forecast Range.

Note: Surge movements (pipeline, etc.) omitted.

WHEAT, OTHER GRAINS	744,000 1,060,000
ROUNDWOOD, LUMBER & PRODUCTS	600,000 600,000
CONCENTRATES	120,000 400,000
MISCELL., & COASTAL	73,000 320,000
POTASH	750,000 1,200,000
COAL	*NIL* 5,000,000

LEGEND

1975

1985

CARGO PROJECTIONS

PLATE

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

CARGO PROJECTIONS

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA

TABLE 4

SUMMARY OF PROJECTED MONTHLY AVERAGE
RAIL CAR MOVEMENTS INTO PRINCE RUPERT

(Major Commodities only)

	1975	1985
Wheat	650	1,000
Concentrates	125	365
Forest Products	417*	417*
Coal	-	4,166
Potash	695	1,110
	1,887	7,058

* Average of Forecast Range.

3.9 SOCIO-ECONOMIC EFFECTS OF PROPOSED PORT DEVELOPMENT

Whilst the Terms of Reference do not specifically call for an evaluation of the socio-economic aspects of the proposed port development, it is considered that a brief review of the spin-off effects of the projected programme should be included in this report.

Most of the reports that have been perused omit consideration of this item, whilst one, "Kitson Harbour Development" (Page 24), projects additional employment, population increase, etc., on a scale which is considered excessive, especially in view of the number of variables that can affect this type of forecast.

Social benefits flow outward from an investment, like ripples in a pool, and obviously different results will be obtained by following the ripples to difference distances. In the following evaluation only the City of Prince Rupert and its immediate vicinity are considered, based on the following assumptions:

a) A forest product and general cargo terminal will be built within the limits of the "city port".

b) Concentrate cargoes will also be handled within the "city port".

c) Anglo-Canadian Fishing Company's new enlarged plant will be located at Prince Rupert.

d) Two new sawmills will be located in the area under consideration.

e) The additional employment created will largely require a human infrastructure of trained/skilled labour which cannot be drawn from the errant work force.

f) To satisfy the requirements of d) and e) above, a casual system of employment would be an uneconomic practice.

g) Since the timing of a bulk terminal (coal) is somewhat doubtful, the effects of this development are considered separately.

Therefore, employment:

Forest industry, general cargo and concentrate terminal	62	men
Fishing employment (incremental - Canadian Fishing Co.) - (Note a)	170	men
Two sawmills - (Note b)	600	men
Total (1)	832	men
Bulk terminal (coal-potash)	25	men
Total (2)	857	men

Taking the average gross income at $8,500 per annum, the new source of employment generated by the port development represents a total additional personal income for the area under review of $7.07 million (1), or $7.29 million (2) respectively. Taking into account the

marginal propensity to consume locally, by the class of workers mentioned above, the additional employment/income should generate:

(1)		(2)
555	New Households (Note c)	571
$9.5 m	Additional retail sales	$9.8 m
$1.2 m	Additional bank deposits	$1.25 m

assuming the local multiplier as being 2.

Note a) - The incremental employment by Canadian Fishing Company resulting from the new consolidated plant which is planned to be built has been arrived at after averaging female and male employee wage rates and allowing for the seasonality of the canning operations. (It is appreciated that Canfisco's new plant is not strictly "Port Development." However, since its construction could coincide with the construction of new port facilities, it has been included in this overall review of Socio-Economic spin-off effects on the area.)

Note b) - A total of 4-6 sawmills, each with an annual capacity of approximately 200,000 MBFM will be required to sustain the production forecast in the "Traffic Review". However, only two of these new mills are projected to be located in Prince Rupert itself and/or in the immediate vicinity.

Note c) - Estimates of new households adjusted to reflect female employment.

4. PORT REQUIREMENTS

4.1 GENERAL

The traffic study has identified and summarized both the initial (1975) and the future (1985) volumes of different commodities, expected to create a flow of cargo through the harbour of Prince Rupert, should suitable port facilities become available.

In order to determine the specific types of port development and installations necessary for the efficient transfer of these cargoes between the various modes of land and sea transportation, the commodities are arranged into two basic groups:

Group 1: - General cargoes, i.e. cargoes suitable for handling through a general purpose type deep sea terminal.

Group 2: - Bulk cargoes, i.e. products which due to their characteristics and volume, rely on special, high speed bulk handling facilities for the economic transfer from rail cars to ships.

The physical requirements in terms of land area, rail yard configuration, road access, dock structure, water depth and cargo handling facilities, for a general purpose terminal, are completely different from those needed for a specialized bulk handling terminal, and the two types of terminals also differ

fundamentally in their operational aspects. In order to minimize the effect of any potential cargo contamination problems and to ensure that either type of terminal has adequate space available for possible future expansion, the two different terminal types should not be sited in too close proximity.

Table 5 lists the yearly tonnages (both initial and future) of the different commodities in Group 1 and shows their individual land and berth requirements within a general-purpose terminal. Table 6 shows the same relationship for a bulk terminal, (Group 2).

TABLE 5

GENERAL-PURPOSE TERMINAL REQUIREMENTS

	Initial (1975)			Future (1985)		
Commodity	Yearly Tonnages	Land Require-ments Acres	Berth Require-ments	Yearly Tonnages	Land Require-ments Acres	Berth Require-ments
Concentrates	120,000	2.0	0.10	400,000	5.0	0.30
Forest Products	600,000	15.0	1.20	600,000	15.0	1.20
Fish	15,000	1.0	0.05	20,000	1.0	0.05
Tall Oil	20,000	1.0	0.05	30,000	1.0	0.05
Automobiles	8,000	(5.0)*	0.10	40,000	(15.0)*	0.40
General Cargo	30,000	4.0	0.30	230,000	20.0	1.50
Cruise Ships, etc.	-	-	0.20	-	-	0.40
Sub-total (Cargo)	793,000	23.0	2.00	1,320,000	42.0	3.90
Road Access	-	1.0	-	-	1.0	-
Rail Access & Yard	-	10.0	-	-	15.0	-
Port Services	-	6.0	-	-	10.0	-
Total for General Purpose Terminal	793,000	40.0	2.00	1,320,000	68.0	3.90

* Not located in Port Area

TABLE 6

BULK TERMINAL REQUIREMENTS

	Initial (1975)			Future (1985)		
Commodity	Yearly Tonnage	Land Requirements Acres	Berth Requirements	Yearly Tonnages	Land Requirements Acres	Berth Requirements
Potash	750,000	10.0	0.20	1,200,000	15.0	0.30
Coal	Nil	-	-	5,000,000	40.0	0.70
Sub-total (Cargo)	750,000	10.0	0.20	6,200,000	55.0	1.00
Road Access	-	5.0	-	-	5.0	-
Rail Access & Yard	-	10.0	-	-	15.0	-
Port Services	-	5.0	-	-	10.0	-
Total for Bulk Terminal	750,000	30.0	0.20	6,200,000	85.0	1.00*

* Based on average ship size of 100,000 DWT.

The magnitude of the initial and the future cargo flows in the general cargo category (793,000 growing to 1,320,000 long tons per year by 1985) is deemed sufficient to proceed with plans for the design and construction of a general-purpose, deep sea terminal in Prince Rupert.

The magnitude of the predicted initial potash cargo volume (Group 2) of 750,000 (growing to 1,200,000 long tons per year by 1985) would appear to be inadequate to support the cost of a separate bulk terminal. A detailed economic analysis of the transportation cost for potash may indicate otherwise, but it seems more likely that a viable operation for bulk shipments through Prince Rupert could be attained by having potash and coal sharing the same basic bulk handling facilities. This prospect may help precipitate an early decision on coal shipments through Prince Rupert.

4.2 GENERAL-PURPOSE TERMINAL CARGO HANDLING FACILITIES

As pointed out in the traffic study, the economic feasibility of most of the products making up the predicted cargo flows is highly dependent on low transportation and handling costs. Consequently, new port facilities in Prince Rupert must be carefully designed and constructed to provide efficient and economic handling of the predicted commodities; only this way can the new port hope to compete with existing, well-established marine terminals in the lower mainland area.

By handling a broad range of commodities, a well-planned, general-purpose terminal should also be able to achieve the high degree of operational flexibility, necessary to cope with changes in production, transport and market patterns; an important feature in any new port development.

Although the actual physical arrangement of the various components of port operation will depend on the geography of the site chosen, the specific facilities recommended for the proposed general-purpose terminal in Prince Rupert have been established from an examination of the means and methods used for the transportation, storing and general handling of the different commodities.

Concentrates - Mineral concentrates are usually considered as bulk products and are often handled through special terminals. The relatively low yearly volume, however, predicted to go through Prince Rupert initially, can conveniently be handled across a general cargo type dock.

Over the past six years mineral concentrates have been handled through Prince Rupert at the old Canadian National Railway, Ocean Dock. The handling method was adapted to the existing rail and wharf facilities and the yearly volume was in the order of 35,000 long tons.

Improved road-rail systems in northern British Columbia, combined with new, efficient unloading, storing and ship-loading facilities in Prince Rupert, are expected to generate a yearly volume of various metal concentrates in the order of 120,000 long tons. Initially, covered storage capacity is required for 12,000 long tons of Granisle Copper concentrate and 7,000 long tons of Nadina lead-zinc concentrate.

Allowing room for operation of stockpiling, reclaiming and conveying equipment, a total covered area of 30,000 square feet should be provided.

The concentrates will arrive at the port in 80 - 100 ton covered, gondola-type rail cars. Unloading of the cars will be accomplished by a GRADALL machine, mounted on a travelling bridge structure, which straddles the rail cars. Inside the storage building, rubber-tired, front-end loaders, fitted with 2-1/2 yard buckets, will stockpile the concentrate. When a ship is ready to load, the front-end loaders will be used for reclaiming the concentrate, and a mobile,

sectionalized conveyor system will transfer the product to the ship's hold. This type of shiploading arrangement is quite flexible and eliminates the need for moving the ship during the loading operation, thus saving valuable berthing space. The reclaim and shiploading rate should not be less than 500 long tons per hour (average).

Depending on the type of concentrate, the size of a shipload will vary over a range from 3,000 long tons to about 30,000 long tons. The average load is expected to be about 10,000 long tons.

The proposed arrangement of concentrate unloading, storing and shiploading can be expanded to handle a yearly throughput of up to 400,000 long tons.

The capital cost of the proposed initial concentrate handling facility, including storage building and equipment for unloading, stockpiling, reclaiming and shiploading, (but exclusive of land, dock and rail work) is estimated to be about $650,000.

Forest Products - The forest products cargoes consist mainly of packaged lumber and logs, and will provide the larger volume of cargo for a new port installation. Depending to some extent where new

sawmills are located, it is nevertheless expected that at least 50 percent of all lumber for overseas export will arrive in Prince Rupert by rail.

The rail cars likely to be used are the type known as "bulkhead flats", each car carrying about 50 tons of packaged lumber. To handle the predicted tonnage, about 6,000 rail cars will arrive at the port each year. Extensive support trackage, near the port's lumber storage yard, will be required to accommodate these cars.

The lumber storage yard should be paved and should have sufficient area to store and to sort a volume equal to about 10 percent of the yearly throughput, i.e.50,000 long tons. This tonnage is also roughly equal to two average-sized shiploads. To handle this tonnage quickly and efficiently, a minimum area of 15 acres is required. This includes the necessary acreage for rail tracks, roads and aisles within the storage yard.

The lumber will be off-loaded from the rail cars by means of 15 ton capacity fork lift trucks. The same type of machines will be used for sorting and for moving lumber from the yard to the ship's side during a shiploading operation. Two fork lift trucks are normally required for unloading from rail cars; six to seven machines are needed for shiploading. Each

fork lift truck costs about $50,000 and is usually the property of the stevedoring company operating the terminal.

The size of the shiploads of lumber may vary from 10,000 to 30,000 long tons, but typical loads are expected to be in the range of 20,000 to 25,000 long tons.

Experience of existing operations in Vancouver (Vancouver Wharves and Seaboard Terminal) indicates that the maximum yearly throughput of lumber over a single berth is in the order of 400,000 to 500,000 long tons, so the predicted volume will require the full time use of one berth.

For lumber coming in, or going out of the terminal by barge, a barge ramp should be provided.

Opinions within the industry are divided on the subject of the most practical and economical method for storing and loading of logs for export. The accepted practice in the past has been to unload the logs from trucks or rail cars and store them in the water. When a ship is ready to load, the logs are towed to the ship's side, sorted and loaded by the ship's gear. Recent studies, however, have found this method too slow and suggest storing logs on land and loading them over a dock, using special handling equipment.

Since the traffic forecast predicts that the export of logs will decrease, and is likely to cease altogether in the not too distant a future, no provision for log storage and handling is provided in this report.

Fish - Fishing and fish packing is presently the main industry of Prince Rupert, and a new port installation can be expected to handle increasing volumes of fish products for overseas markets.

The fish products will be handled through the general cargo section of the proposed terminal and it may be convenient to have a cold storage, fish warehouse within the dock area. Aside from this, no special facilities are required for fish cargoes.

Tall Oil - Twenty thousand long tons per year of tall oil does not constitute a large amount of cargo, but as it is likely to be shipped out at infrequent intervals, a generous storage tank capacity of about 7,000 - 10,000 tons is indicated. The tanks should be insulated and provided with heating coils. They can be located well back from the dock face near a railway siding. Shiploading is achieved through a buried pipeline to a suitable outlet on the dock. The cost of this installation is estimated to be in the order

of $300,000 and the required area of land for tall oil storage tanks, heating, pumping equipment and rail siding is about 1.0 acre.

Automobiles - The predicted initial flow of some 4,000 domestic automobiles through Prince Rupert will require a storage area of about 5 acres.

The economics of automobile shipping and storing cannot justify the use of high-priced land at the dock site. Consequently it is suggested that new storage be provided on inexpensive land, near the new deep sea terminal installation. It should be possible to increase the storage area in the future to about 15 acres. Suitable areas exist adjacent to the acces road in the vicinity of the site.

It is understood that a small vessel of about 1,000 DWT capacity will carry about 200 to 250 cars per trip to Alaska. Loading will be accomplished by Ro-Ro facilities through the bow of the vessel.

General Cargo - The term general cargo covers the wide range of unspecified incoming and outgoing commodities which are required to support the industry and population of Prince Rupert and the hinterland. Part of this cargo volume is being handled by barges and small coastal vessels operating on the West Coast

of British Columbia. New improved cargo handling facilities in the form of an efficient transit warehouse and good road and rail access are now needed and will help to establish Prince Rupert as a major distribution centre on the West Coast.

A transit shed covering about 64,000 square feet should be provided for short term storage of general cargo. The shed will be fitted with docks for both rail cars and trucks for easy transfer of cargo. Containers are already in use by Northland Navigation Company and will probably increase in number in the future. For this reason it is suggested that provision be made in the structure of the dock apron to support a future container crane. The initial area required for general cargo is estimated to be about 4 acres, growing to about 20 acres by 1985.

The large growth predicted for the general cargo flow (from 30,000 to 230,000 long tons per year over a 10 year period) is not fully reflected in the increase in berth requirements (from 0.3 to 1.5 berths) as shown in Table 5. The reason is, that while the berth requirements for break-bulk type cargo are calculated on the basis of 150,000 long tons per year being equal to 100 percent occupancy of one berth, by

the time this cargo volume is reached (about 1980), containers are expected to carry a substantial portion of the total annual general cargo flow. The presently accepted figure for a modern container terminal is in the order of 600,000 to 800,000 long tons per year, per berth. Therefore, with increased use of containers, the need for additional berth capacity decreases. Land requirements, on the other hand, necessary for storing and handling containers, are likely to increase, and have been taken into account in the acreage requirements in Table 5.

Short Term Peak Loads - The traffic study indicates the possibility that the port of Prince Rupert may be required to unload and store about 420,000 long tons of pipeline steel for the McKenzie Valley Pipeline Project. The pipes, plus a smaller volume of supplies for construction would arrive over a two year period and it is expected that the need for storage area, at or near the dock, will be in the order of 20 acres. It is probable that this space requirement can be met at the dock-site before full utilization of the initial space provision for forest products is attained.

Cruise Ships - Over the past years there has been a steady growth in the number of cruise ships calling at Prince Rupert harbour, and it is expected this growth will continue. The majority of the ships arrive during the five summer months (May to September) and stay, as a rule, only a few hours. During the 1971 season, about 120 cruise ships called at the port, and although the actual economic value to the city is difficult to establish, it is recognized that many tourists "discover" cities and places this way, and often come back via different routes at a later time.

No special facilities are required for cruise ships or their passengers, but it is estimated that they (the ships) will require the equivalent of 20% of occupancy of a single berth, increasing to about 40 percent over the next 10 years.

Road and Rail Access - Efficient operation of the terminal facilities is largely dependent on the performance of the land-based transport system and the scheduled arrival of ships. Trucks and trains must be able to enter the port and load and discharge their cargoes directly from or to the designated areas, with a minimum of handling effort. Consequently, the physical arrangement of the different cargo handling facilities must provide for good road and rail access to all areas where cargo is in transit storage.

Ideally, the access road to the port area should provide a direct route to the City of Prince Rupert, as well as connect directly to the inland highway system. The arrangements for access road right-of-way for the proposed terminal, has been discussed with the City of Prince Rupert and is not expected to present any problem.

The arrangement of the marshalling yard and the support trackage for the proposed initial terminal layout was reviewed by the engineering office of the Canadian National Railway.

Port Services - Port services relating to ships usually consist of the following items:

a) Electric power.

b) Telephone.

c) Fresh water.

d) Disposal of sewage and solids from ships.

e) Bunkering facility.

For the proposed, general-purpose terminal in Prince Rupert, two service points, containing items a), b) and c) should be provided for each berth. Services d) and e) will be handled by barges

In addition to the services required for ships, the terminal should provide the necessary facilities for port maintenance and for storage and repairs of cargo handling equipment.

Ancillary buildings for port administration, customs stevedoring offices, lunchrooms and washrooms must also be included.

Berth Length - Until quite recently, the accepted practice for the design of general-purpose docks was to provide a single berth with a length of 700 feet and to plan for two or more lengths in multiples of 600 feet. However, a review of the dimensions of the latest cargo liners and product carriers clearly reflects the trend set by the new, fast, container ships for higher speeds and greater overall length. This trend was also confirmed during discussion with terminal operators and stevedoring firms.

Since container ships are expected to call at the new facilities in Prince Rupert within a few years after the completion of the terminal, it is recommended that a total dock length of 1,400 feet for two berths, in the initial dock installation, be provided.

Water Depth - To accommodate for ships up to 60,000 DWT, the water depth at low tide along the new dock should not be less than 45 feet.

Cost Estimate of Cargo Handling Facilities and Services - Table 7 shows in summary, the estimated order-of-magnitude costs of cargo handling facilities and of port services required for the proposed, initial phase of the general-purpose terminal.

These costs do not include site development, access and general services, which are given in Tables 8, 9, 10 and 11.

TABLE 7

GENERAL-PURPOSE TERMINAL

COST ESTIMATE OF CARGO HANDLING FACILITIES AND PORT SERVICES

(EXCLUDING SITE DEVELOPMENT, ACCESS AND GENERAL SERVICES)

Commodity	Facility	Costs $
Concentrate	Unloading, storing, reclaiming and shiploading	650,000
Forest products	10 Fork-lift trucks @ $50,000	500,000
Fish	Cold storage building	150,000
Tall oil	Storage tanks, heating, pumping	400,000
Automobiles	-	-
General cargo)	Transit shed,	1,000,000
)	6 Fork-lift trucks	200,000
Cruise ships		-
Sub-Total	(Cargo Handling)	2,900,000
Rail services	Track work in yard and port area	650,000
Port services	Fencing, paving, lights, buildings	1,600,000
Total	(Cargo Handling and Services)	$ 5,150,000

Note: The cost figures shown above include cost of equipment and facilities normally provided by shippers or stevedoring firms.

4.3 BULK TERMINAL CARGO HANDLING FACILITIES

As mentioned in the beginning of this section, the initial potash volume may not be sufficient to justify, by itself, a new deep sea bulk loading terminal in Prince Rupert. Assuming that a more detailed investigation does prove such an operation to be feasible, the following is a brief description of the required cargo handling facilities.

The physical arrangement of a bulk loading terminal is entirely dependent on the features of the site chosen. However, the main bulk handling components tend to vary little and consist of:

a) Railway access and terminal trackage.

b) Car unloading (bottom dump).

c) Reclaim and conveying system to stockpiles.

d) Reclaim, conveying and shiploading systems.

e) Fender and mooring dolphins for ships berthing.

f) Basic terminal services including road access.

Terminal trackage beyond the car unloading station may be a straight-line arrangement with a bypass for locomotives and return of cars, or it can be the loop type configuration where the entire trains remain coupled. Both systems provide for rapid unloading and fast turn-around time for the rail haul.

Potash is a corrosive product particularly when damp, and special materials and coatings are required for the structures and equipment exposed to it. Potash must be stored in fully covered buildings.

The capital cost for a potash terminal is estimated to be in the order of $12,000,000.

Assuming that the shiploading equipment and the berthing installations for the potash terminal are adequate to handle large volumes of coal at a suitable rate, the future expansion of the potash terminal facilities, to provide for coal shipments will require the following additional installations:

a) Additional track work.

b) Rotary type car dumper.

c) Land for coal stockpiles.

d) Conveying, stockpiling-reclaiming equipment.

e) Automatic sampling plant.

The capital cost for these additional installations is in the order of $10,000,000.

5. SITES FOR PORT DEVELOPMENT

5.1 GENERAL

The waterfront from the north end of Prince Rupert to the estuary of the Skeena River has been reviewed for potential dock sites.

The physical characteristics of the coastline in the Prince Rupert area limit the number of sites with suitable berthing and foreshore land to meet the requirements outlined in Section 4 of this report. Four sites are considered as having potential and have been designated as the Drydock, Fairview, Ridley Island and Kitson Island sites. Plate 8 shows the location of the sites. The Drydock and Fairview sites are located within the boundaries of the City of Prince Rupert and all four sites are located within the area under the jurisdiction of the National Harbours Board.

The Drydock and Fairview sites have been reviewed for handling general cargoes and some bulk commodities. The Ridley and Kitson Island sites have been reviewed essentially as sites for bulk terminals.

The site of the old Canadian National Railway Ocean Terminal was also considered. However, the only land available for port development is presently occupied by the Canadian National Railway marshalling yards and covers an area of approximately 22 acres which is less than the initial or future requirements indicated by the traffic studies. No further evaluation of this site was therefore undertaken.

Order-of-magnitude cost estimates for staged development of the Drydock and Fairview sites for a general purpose terminal are given in Tables 8, 9 and 10. A cost comparison for development of 1,400 feet of berth at the two sites is shown in Table 11. The estimates do not include contingencies or engineering services.

Cost estimates for a bulk terminal at the Ridley Island site, which have been extracted from the C.B.A. Engineering report of September 1969, and increased by 20 percent to allow for inflation, are given in Table 12.

5.2 DRYDOCK SITE

Location - Named because of the former existence of a drydock (now removed), this site is located at the mouth of Hays Creek and is shown on Plate 8. Its location in the inner harbour of Prince Rupert presents no problem for the docking of large ocean-going vessels.

Site Development - At the present time about 45 acres of development land exists at the site of which approximately 25 acres are occupied by various industries, including the Prince Rupert Forest Products' sawmill which has been shut down for some time. An additional 10 to 15 acres can be created by filling the balance of the Hays Creek estuary and by extending fill out to water depth suitable for ocean vessels. A total of 55 to 60 acres of land could therefore be made available at this site.

An old B.C. Hydro plant occupies 3.5 acres of the site and is currently used for standby power production. However, it is understood that this plant will be phased out of operation in about one year.

Access - Road and rail access exist to the site, although both services will require modification and improvement to serve a modern port development. Water and electric power are also available.

Development Costs - Cost estimates for providing 700 feet and 1,400 feet berths and for reclaiming land between the berths and the existing filled area are given in Table 8.

Disadvantages - There are however, several drawbacks to the development of the Drydock site for a general cargo and bulk metal concentrate terminal, namely:

1. The total land area of 55 to 60 acres, which could ultimately be available, does not meet the projected future area requirements of 68 acres.

2. It will be necessary to relocate numerous existing facilities at considerable expense, particularly the various oil terminals located at the south end of the site.

3. The cost of reclaiming land in excess of the existing 45 acres is very high, about $200,000 an acre. This is caused by the depth to sea bed immediately offshore from the existing fill and by the need to import fill material.

4. The configuration of the site does not lend itself to satisfactory layout for a modern port.

5. Soil reports indicate that a fairly large part of the present fill at the site consists of old coal and sawmill waste which will result in increased costs for development of facilities.

Recommendation - In view of the foregoing disadvantages, it is not recommended that the Drydock site be developed as a general cargo and bulk metal concentrate dock, but that it be retained for presently planned and future light industrial plants.

5.3 FAIRVIEW SITE

Location - The Fairview site is located in the approach channel to the harbour of Prince Rupert and extends south from the breakwater at Fairview Point to Casey Point, a distance of about 5,000 feet. (See Plate 8).

The site is not presently developed except for the Canadian National Railway lines.

Site Development - The site has a shallow foreshore shelf of approximately 56 acres, part of which is dry at low tide. Beyond this shelf there is a sharp drop to deep water. Immediately west of the Canadian National main line, which passes through the site, the ground rises steeply to an elevation of about 1,800 feet. Examination of aerial photographs of the slope, and physical inspection on the ground, indicate no evidence of recent slide action at the site. However, Canadian Hydrographic Service Map No. 3701 and a soils investigation carried out for the Canadian National Railway indicate recent slides south of Casey Point, which is beyond the area designated as the Fairview site but which could militate against any development south of Casey Point.

To develop the site it will be necessary to fill the area on the seaward side of the Canadian National Railway to the elevation required for dock facilities. A soils report, dated March 31, 1971, prepared by Cook, Pickering and Doyle, for the Department of Public Works, indicates that suitable fill material can be obtained from the hillside east of the railway. By excavating fill material from this area, additional land for port development will be created. The borrow pit overburden material, consisting of peat, silt and gravel will be disposed of in areas designated as yard space. The talus and shot rock will be used for dyke construction and general fill. A number of small streams and water courses in the borrow area will need to be diverted.

The depth of overburden over the rock on the foreshore shelf is insufficient to permit the use of conventional driven piles at the dock face. The method of wharf construction considered for preparation of the cost estimates consists of a dyke constructed of imported gravel fill through which concrete piles with rock points are driven to the rock below. The piles at the dock face, at the toe of the gravel dyke, are socketed into the rock. The seaward face of the gravel dyke is protected with rip-rap. The area between the dyke

and railway embankment is then filled with material excavated from the borrow pit.

If the dock face is located at the harbour headline, the amount of usable land which can be reasonably created between Fairview Point and Casey Point, is approximately 85 acres. If the dock face is located at the line where sufficient depth for berthing exists, then the port area created is approximately 70 acres. These acreages do not include the dock apron.

Access - At the present time there is no satisfactory road access to the site. However, two possible alternative routes, both originating from Provincial Highway No. 16, and of relatively short length, are shown on Plate 9. The status of ownership or leases for the land for these routes has not been investigated. It is proposed that the access road overpasses the Canadian National Railway for access to the dock area. General road access to the port would be further improved by extension of Highway No. 16 to bypass Prince Rupert, as indicated on Plate 9.

The Canadian National Railway main line passes through the site and a suitable spur track layout for the port facilities can be accommodated.

Services - Electric power (12 kv) is available at the north end of the site.

Extension of water service to the site will be required.

Construction of the dock and yard area immediately north of the Fairview Breakwater will necessitate relocation of the existing submarine power and telephone cables crossing to Digby Island. The estimated cost of this work is $250,000.

Docking - According to the B. C. Pilotage Authority, the Fairview site is more exposed than other sites in the inner harbour, but no serious docking problems exist for locations north of Casey Point. The tidal current in the dock area runs at 2 to 3 knots which will require additional docking precautions. The site is well sheltered from high wave action.

Layout of Facilities - A layout of facilities for the Fairview site, based on the port requirements for a general purpose terminal (as given in Section 4) are shown on Plate 10. The dock face in this layout is located at the harbour headline.

Environment - In general, provided attention is paid to aesthetics, the impact on the environment of the development of the Fairview site will be minimal.

During operation of the facility, measures will be necessary to prevent sea water pollution from metal concentrate stored at the site.

Development Costs - Order-of-magnitude cost estimates for staged development of the site are given in Tables 8 and 9. These costs include land development, dock apron, access road and other essential services, but do not include rail trackage, storage buildings, equipment or other surface facilities.

Costs in Table 8 are based on the dock face located at the depth required for berthing. Costs in Table 9 are for the dock face located at the harbour headline, the location for obtaining the maximum land acreage. Plate 11 compares the cost per acre (excluding apron costs) for various lengths of berth with the dock face at both the harbour headline and at the depth required for berthing. It will be noted that, because of the increased depth of fill required at the harbour headline, the costs per acre are greater for the dock face in this location. In both schemes the costs per acre are a minimum for development of the land behind a 1,400 foot berth.

5.4 RIDLEY ISLAND SITE

Location - Located at the north end of Ridley Island, the site includes the tidal flats between Ridley and Kaien Island. (See Plate 8)

Site Conditions - The northern part of the island is relatively low lying with varying depths of water-logged peat and granular soils overlying bedrock.

Pockets of gravel, sand and fine silt exist in the tidal flats. Some areas of fine silt could be sufficiently sensitive to warrant removal before fill is placed.

The site is generally protected from extreme wave action by the islands and rocky banks to the west. The CBA Engineering report, of September 1969, notes that waves of 9 to 15 feet, for short periods, were logged during the Second World War. However, a later study indicates that wave action will not prevent the use of the site for a bulk terminal.

Previous reports provide additional details on site conditions, none of which indicate that the site is unsuitable as a bulk terminal.

Site Development - Sufficient land can be reasonably developed in a number of ways to meet the foreseeable requirements for a bulk terminal outlined in Section 4 of this report. Initial development can be achieved by levelling areas at the north end of the island; subsequent development by expanding into the tidal flats.

Road Access - Can be obtained by a branch road from the existing road to Watson Island.

Although relatively short, the access road will be expensive to construct. Previous reports show a suitable route across the northern end of Watson Island over Zanardi rapids, then alongside the Canadian National Railway track and finally across the tidal flats to the site.

Rail Access - Provided by a branch from the Canadian National Railway line which passes the northern end of the site.

Sufficient space exists for a loop track suitable for continuous unit train operation.

Services - Electric power is available from the existing B. C. Hydro facilities in the Port Edwards area.

The CBA Engineering Report of September, 1969, indicates a source of water supply at the south end of Kaien Island.

It is recommended that more detailed studies for water supply be undertaken when the needs of proposed facilities are established.

Existing Pipeline - An existing effluent pipeline from the Columbia Cellulose pulp mill crosses the site and discharges into Chatham Sound on the west side of Ridley Island. Allowance is made in the cost estimate for relocating this pipeline.

Environment - Previous reports do not consider the environmental impact of a bulk terminal at the site.

It is recommended that a study be undertaken to determine the biota of the tidal flats and a survey of vegetation and wildlife be carried out to provide baseline data for evaluation of the effects on the environment of a bulk terminal development. However, at the present time, there is no indication that the type of development envisaged at Ridley Island will seriously affect the environment of the area.

Development Costs - The cost estimates contained in the CBA report of September 1969 are considered to be of the correct order-of-magnitude for staged development of the site. These costs, increased by 20% to allow for inflation, are reproduced in Table 12.

5.5 KITSON ISLAND

Location - On the north-west side of the mouth of Inverness Passage at the estuary of the Skeena River.

Site Conditions - The site embraces Flora Bank, a fluvial deposit between Kitson and Lelu Islands.

The western side of the site, adjacent to Kitson Island, is relatively exposed to wave action from Chatham Sound. Waves up to 16 feet have been previously reported. The south-east side of the site, in Inverness Channel, is more protected.

Site Development - The space available (up to 1,000 acres) is well in excess of the requirements for a bulk terminal outlined in Section 4.

Proposals for site development envisage pumping or dredging the fluvial material adjacent to the site and depositing it in the required locations on Flora Bank. Previous reports do not cover the soils aspects of placing fill on Flora Bank or of the suitability of the local dredged material for fill.

In order to provide the most sheltered dock arrangement at the south-east side of the site, it will be necessary to dredge Hornsey Bank and part of Inverness Channel.

Access and Services - Road and rail access, and provision of essential services, can be obtained by extending existing facilities, similar to the outline for the Ridley site.

Environment - In a report entitled "A Cursory Investigation of the Skeena River Estuary" the Fisheries Service of the Department of the Environment concluded as follows:

"The present data indicate that Flora Bank is the most important shallow water area of the Skeena River estuary in terms of rearing juvenile fish. The proposed port development would completely destroy the complex Flora Bank ecosystem and damage to the fisheries resource of the Skeena River and its estuary would be immense. Since the fishing industry contributes 30-40 percent of the base income in Prince Rupert, it is probable that the construction of port facilities in this important tidal flat area would be economically unsound, and it is suggested that water areas away from estuaries should be investigated as alternate port development sites."

Further studies are currently being undertaken by the Fisheries Service of the Department of the Environment and a report should be available by the end of 1972.

Development Costs - It is considered that site development costs for equivalent acreage, access and services will be of the same order-of-magnitude as at the Ridley Island site, provided soils investigations indicate that locally dredged material is suitable for fill.

TABLE 8

GENERAL-PURPOSE TERMINAL

DRYDOCK SITE

COST ESTIMATE OF SITE DEVELOPMENT,
DOCK APRON AND GENERAL SERVICES

Length of Dock	700 ft.	1,400 ft.
Remove Existing Piles	$ 40,000	$ 50,000
Dredging	120,000	140,000
Site Preparation	90,000	330,000
General Fill	570,000	1,065,000
Rip-Rap	290,000	455,000
Piles	1,130,000	2,220,000
Apron	790,000	1,770,000
Drains, Sewers, Water, and Power Supply	100,000	100,000
Total	$ 3,130,000	$ 6,130,000

Note: Costs of buildings and other facilities are covered in Table 7.

TABLE 9

GENERAL-PURPOSE TERMINAL

FAIRVIEW SITE (SCHEME 1)

DOCK FACE AT DEPTH REQUIRED FOR BERTHING

COST ESTIMATE OF SITE DEVELOPMENT,
DOCK APRON, ACCESS AND GENERAL SERVICES

Length of Dock	700 ft.	1,400 ft.	2,000 ft.
Acreage Developed	15.1 Acres	25.6 Acres	35.0 Acres
Clearing and Grubbing	$ 30,000	$ 45,000	$ 65,000
Waste Disposal	95,000	155,000	215,000
Gravel Dyke	340,000	710,000	1,055,000
General Fill	840,000	1,440,000	2,000,000
Rip-Rap	360,000	655,000	920,000
Piles	960,000	1,660,000	2,380,000
Apron	790,000	1,520,000	2,290,000
Drains, Sewers, Water Power	100,000	100,000	100,000
Re-locate Submarine Cables	250,000	250,000	250,000
Raise CNR and Telephone Lines	15,000	15,000	15,000
Access Road	500,000	500,000	500,000
Total	$ 4,280,000	$ 7,050,000	$ 9,790,000

Notes: 1. Acreages do not include dock apron.

2. Costs of buildings and other facilities are covered in Table 7.

TABLE 10

GENERAL-PURPOSE TERMINAL

FAIRVIEW SITE (SCHEME 2)

DOCK FACE AT HARBOUR HEADLINE

COST ESTIMATE OF SITE DEVELOPMENT,
DOCK APRON, ACCESS AND GENERAL SERVICES

Length of Dock	700 ft.	1,400 ft.	2,000 ft.
Acreage Developed	26.5 Acres	40.0 Acres	47.7 Acres
Clearing and Grubbing	$ 45,000	$ 75,000	$ 75,000
Waste Disposal	150,000	250,000	260,000
Gravel Dyke	340,000	950,000	1,400,000
General Fill	2,280,000	2,800,000	3,400,000
Rip-Rap	620,000	920,000	1,100,000
Piles	960,000	1,660,000	2,380,000
Apron	790,000	1,520,000	2,290,000
Drains, Sewers, Water Power	100,000	100,000	100,000
Re-locate Submarine Cables	250,000	250,000	250,000
Raise CNR and Telephone Lines	15,000	15,000	15,000
Access Road	500,000	500,000	500,000
Total	$ 6,050,000	$ 9,040,000	$ 11,770,000

Notes: 1. Acreages do not include dock apron.

2. Costs of buildings and other facilities are covered in Table 7.

TABLE 11

GENERAL-PURPOSE TERMINAL

1,400 FT. DOCK

COST COMPARISON OF DRYDOCK AND FAIRVIEW SITES

Item	Drydock	Fairview *
Remove Existing Piles	$ 50,000	$ -
Dredging	140,000	-
Site Preparation	330,000	-
Clearing and Grubbing	-	75,000
Waste Disposal	-	250,000
Gravel Dyke	-	950,000
General Fill	1,065,000	2,800,000
Rip-Rap	455,000	920,000
Piles	2,220,000	1,660,000
Apron	1,770,000	1,520,000
Access Road	-	500,000
Drains, Sewers, Water Power	100,000	100,000
Re-locate Submarine Cables	-	250,000
Raise CNR and Telephone Lines	-	15,000
Total	$ 6,130,000	$ 9,040,000

* Dock face at harbour headline

TABLE 12

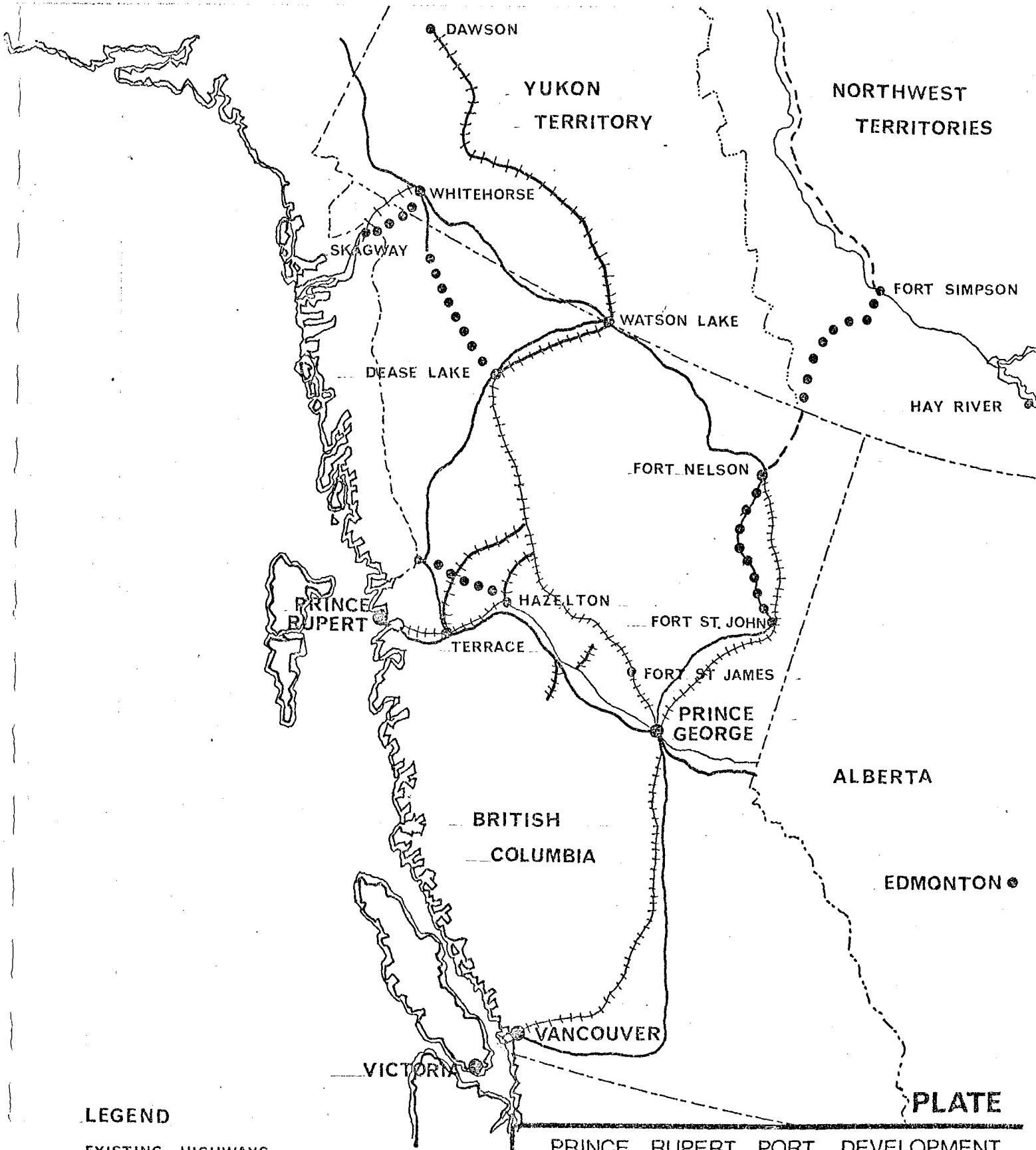
BULK TERMINAL

RIDLEY ISLAND

COST ESTIMATE

PHASE 1	(28 Acres)	
	Site Development	$ 2,050,000
	Dock, Car-dumper, Stacker-reclaimer, etc.	12,000,000
	Paved two-lane Highway	4,000,000
	Water Supply	500,000
	Electrical Effluent Line	360,000
		$ 19,110,000
PHASE 2	(28 Acres)	
	Site Development	$ 4,000,000
	Additional Equipment	4,800,000
		$ 8,800,000
PHASE 3	(50 Acres)	
	Site Development	$ 5,900,000
	Additional Dock and Equipment	10,800,000
		$ 16,700,000
Total Cost of Development (106 Acres)		$ 44,610,000

Note: 1. Above figures are from CBA Engineering Report dated September, 1969, increased 20% to allow for inflation.



LEGEND

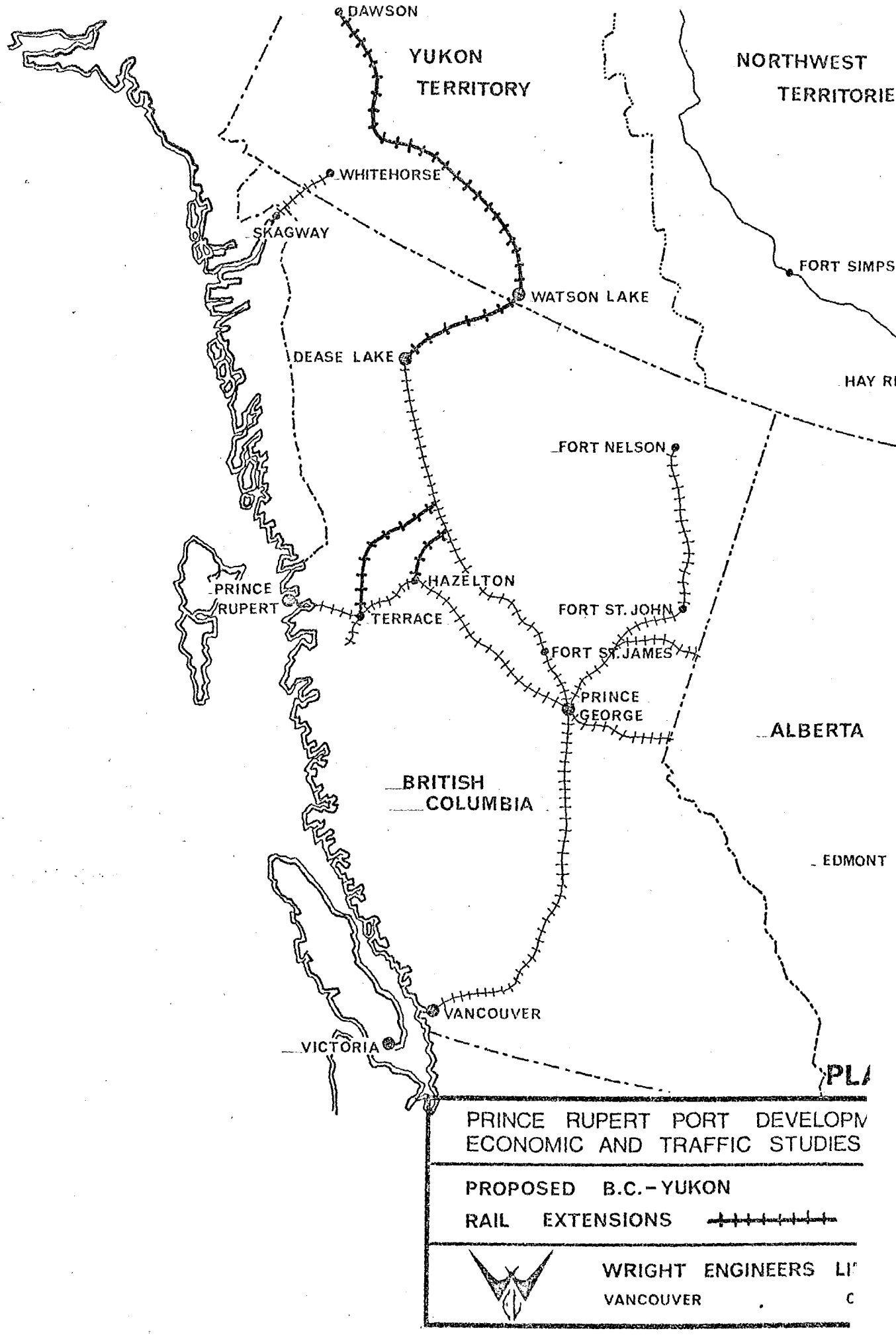
- EXISTING HIGHWAYS
- HIGHWAYS UNDER CONSTRUCTION
- HIGHWAY PROPOSALS
- EXISTING RAILWAYS
- RAILWAY PROPOSALS

PLATE

PRINCE RUPERT PORT DEVELOPMENT ECONOMIC AND TRAFFIC STUDIES

PROPOSED DEVELOPMENT OF NORTHWEST TRANSPORTATION SYSTEM

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA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FORT SIMPS
WATSON LAKE
DEASE LAKE
HAY RI
FORT NELSON
PRINCE
RUPERT
HAZELTON
TERRACE
FORT ST. JOHN
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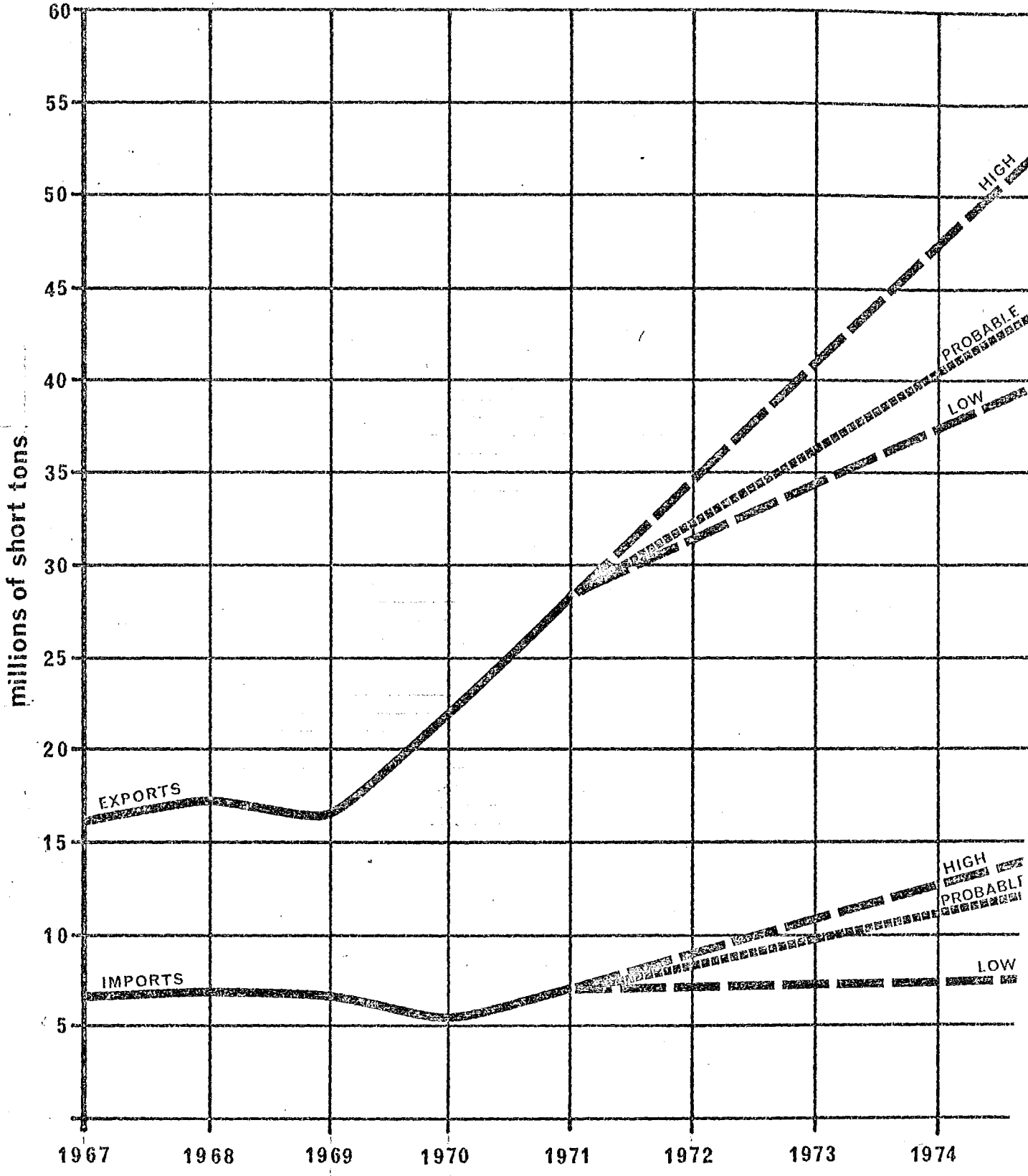


PLATE

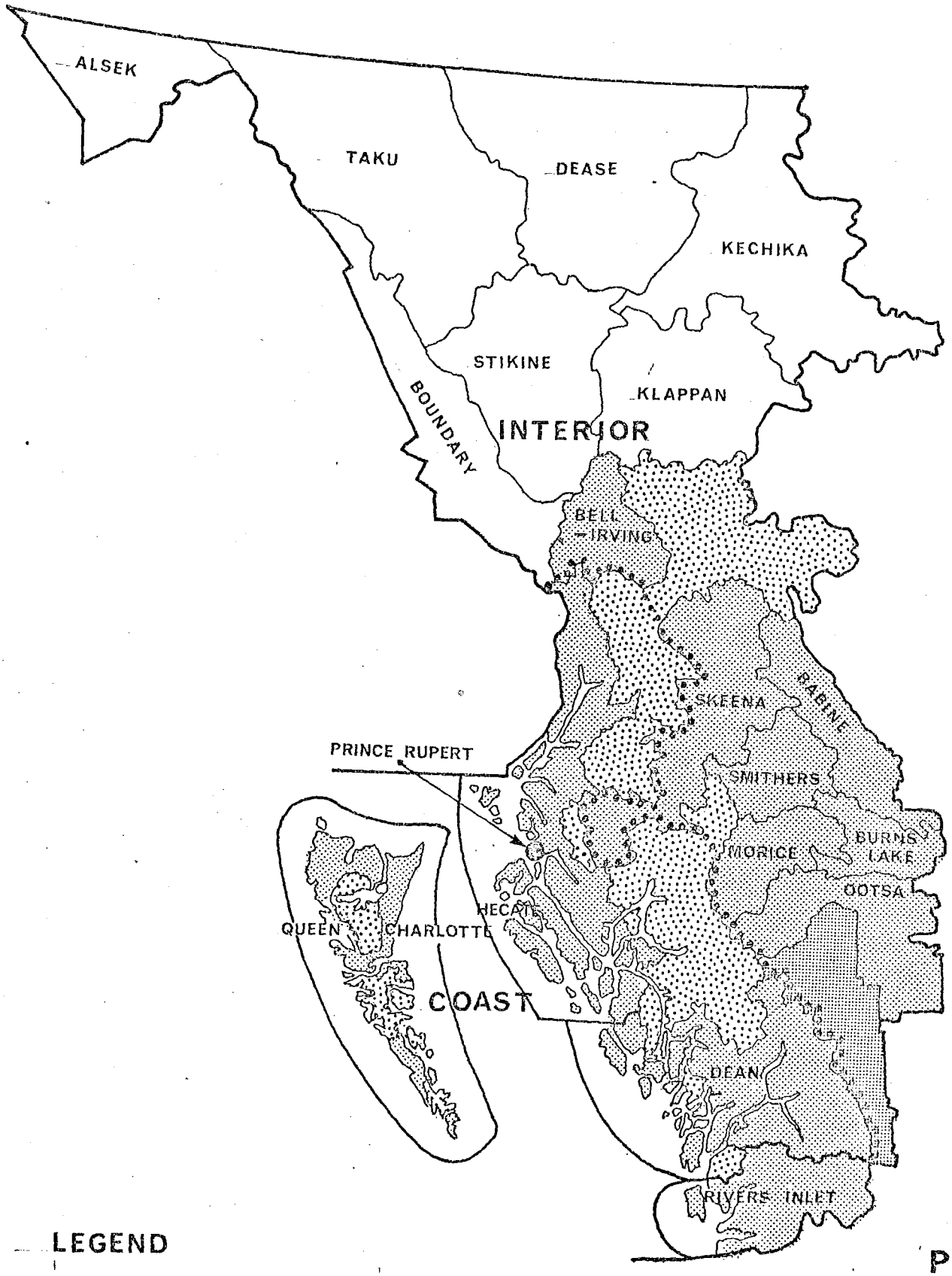
PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

EXPORT-IMPORT CARGO MOVEMENTS THROUGH THE PORT OF VANCOUVER (SHOWING RELEVANT TRENDS)

SOURCE- NATIONAL HARBOURS BOARD STATISTICS

WRIGHT ENGINEERS LIMIT

VANCOUVER CANA



LEGEND

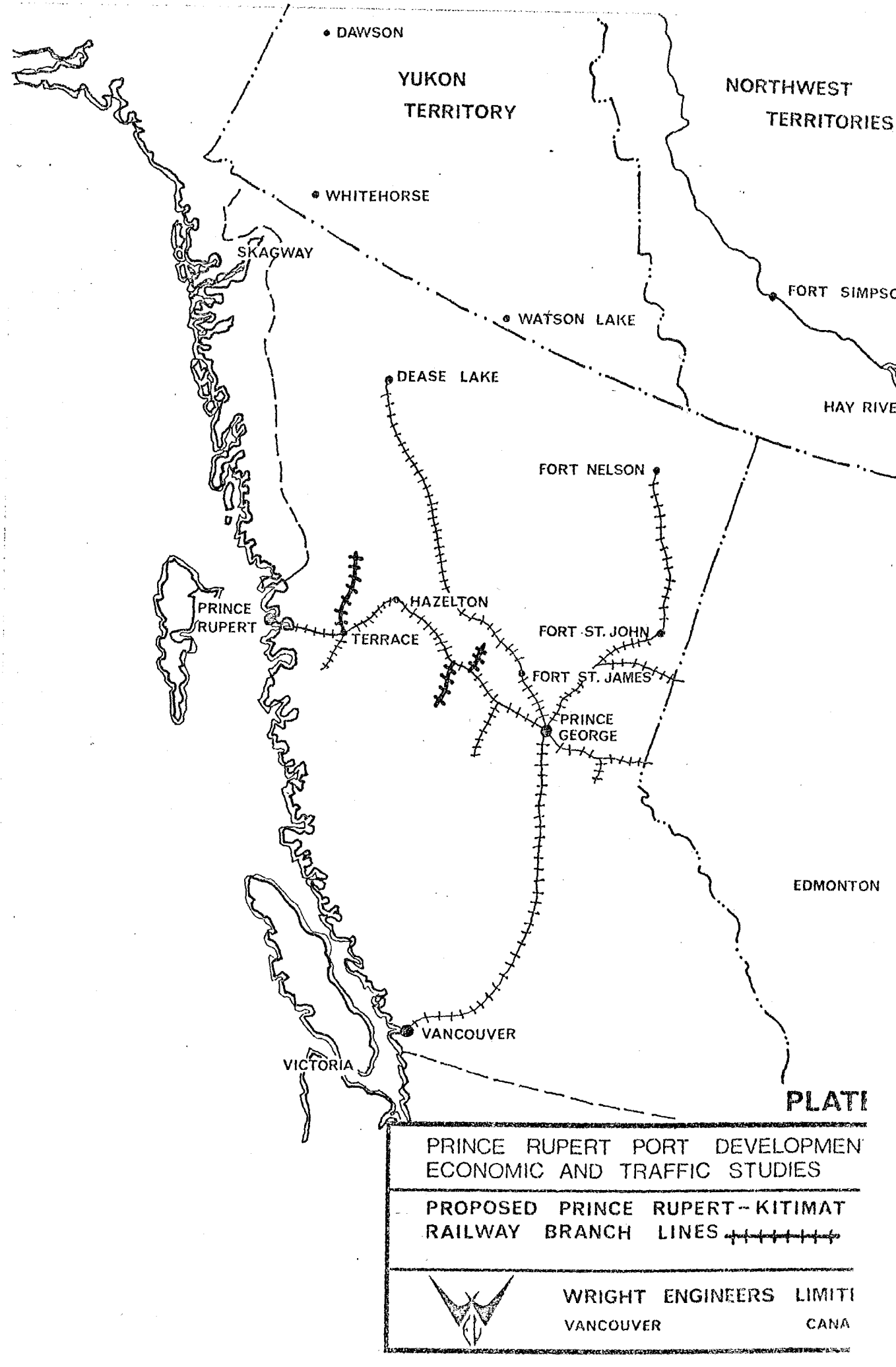
Approved Unit	SKEENA P.S.Y.U.
Proposed Unit	DEASE P.S.Y.U.
Tree Farm Licence	T.F.L.
Major Provincial Parks	
Inferior–Coast Boundary	

PLATE

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

PRINCE RUPERT FOREST DISTRICT

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA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SKAGWAY
FORT SIMPSO
WATSON LAKE
DEASE LAKE
HAY RIVE
FORT NELSON
PRINCE RUPERT
HAZELTON
TERRACE
FORT ST. JOHN
FORT ST. JAMES
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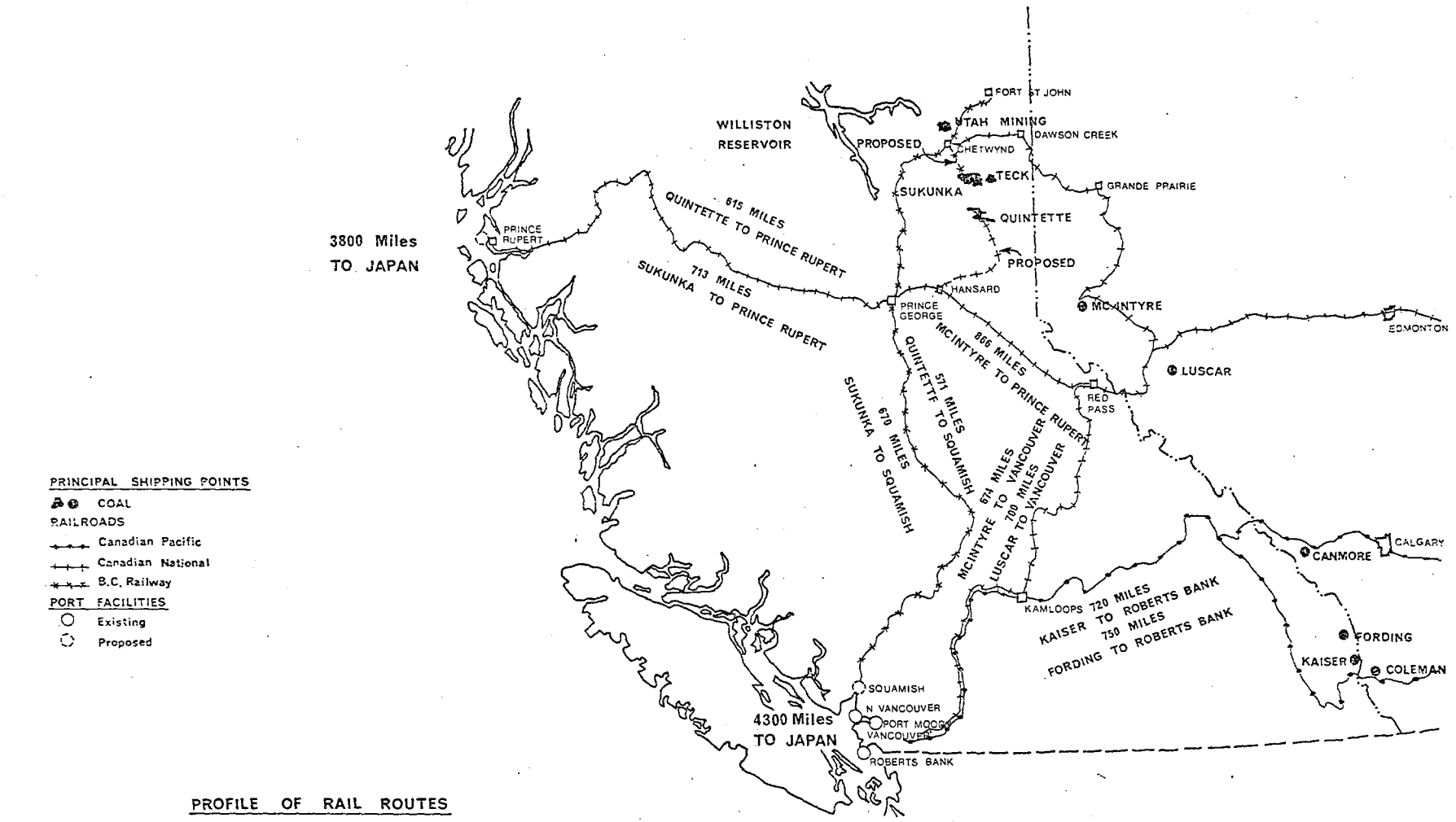


PROFILE OF RAIL ROUTES

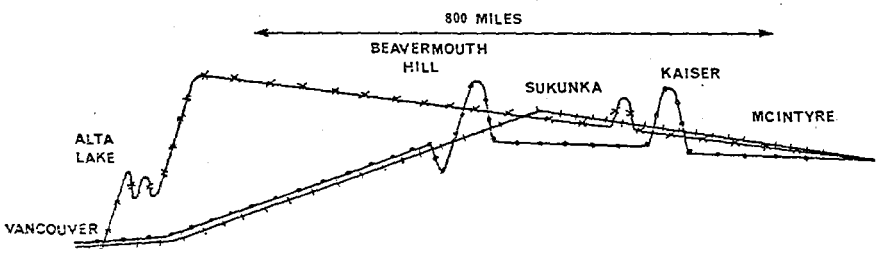


PLATE 6

PRINCE RUPERT PORT DEVELOPMENT
ECONOMIC AND TRAFFIC STUDIES

COAL DEPOSITS, RAIL ROUTES,
& DISTANCES TO TIDEWATER

WRIGHT ENGINEERS, LIMITED

WHEAT, OTHER GRAINS	744,000 1,060,000
ROUNDWOOD, LUMBER & PRODUCTS	600,000 600,000
CONCENTRATES	120,000 400,000
MISCELL., & COASTAL	73,000 320,000
POTASH	750,000 1,200,000
COAL	*NIL*

LEGEND

1975

1985

CARGO PROJECTIONS

PRINCE RUPERT PORT DE
ECONOMIC AND TRAFFIC S

CARGO PROJECTIONS

WRIGHT ENGINEE
VANCOUVER

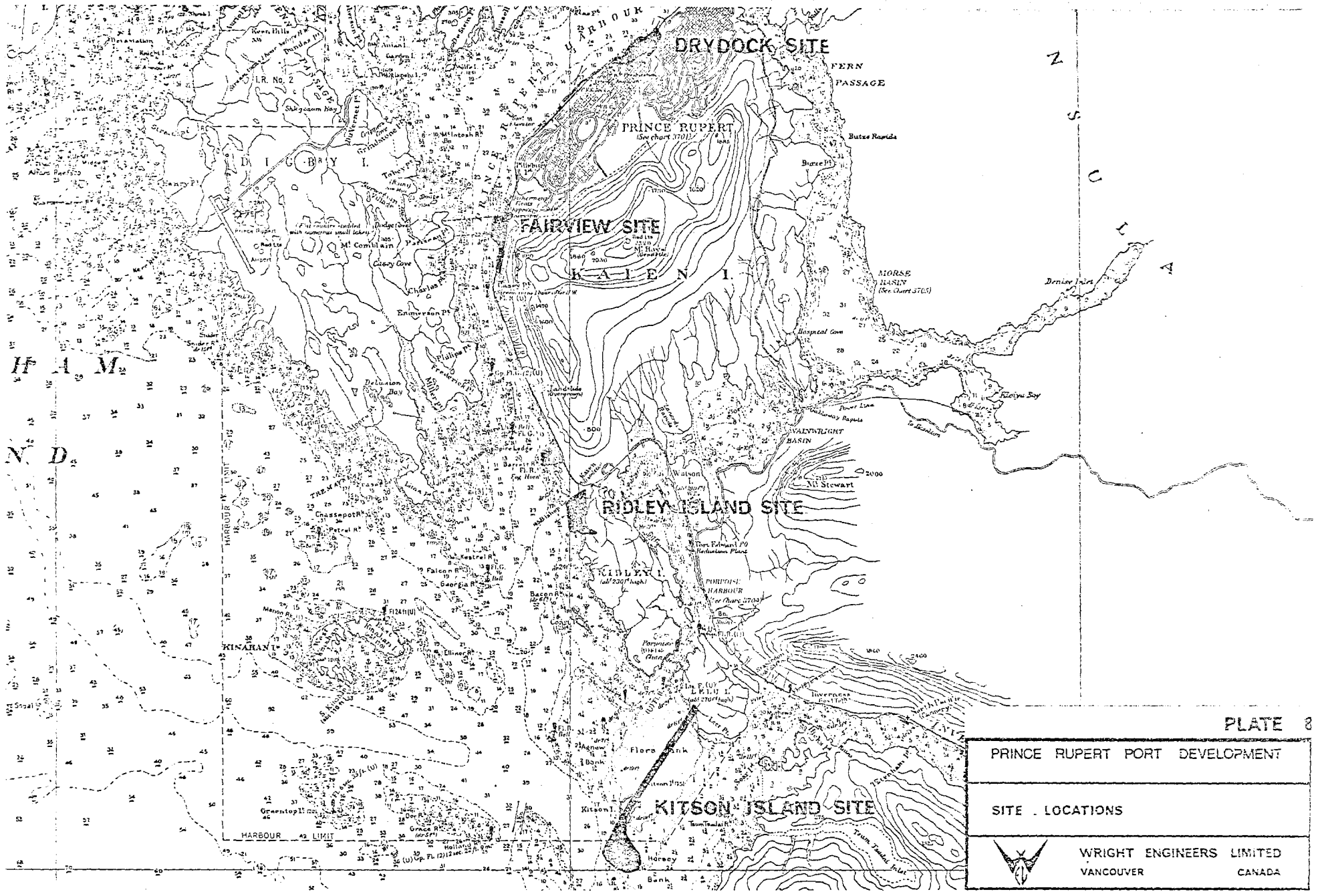
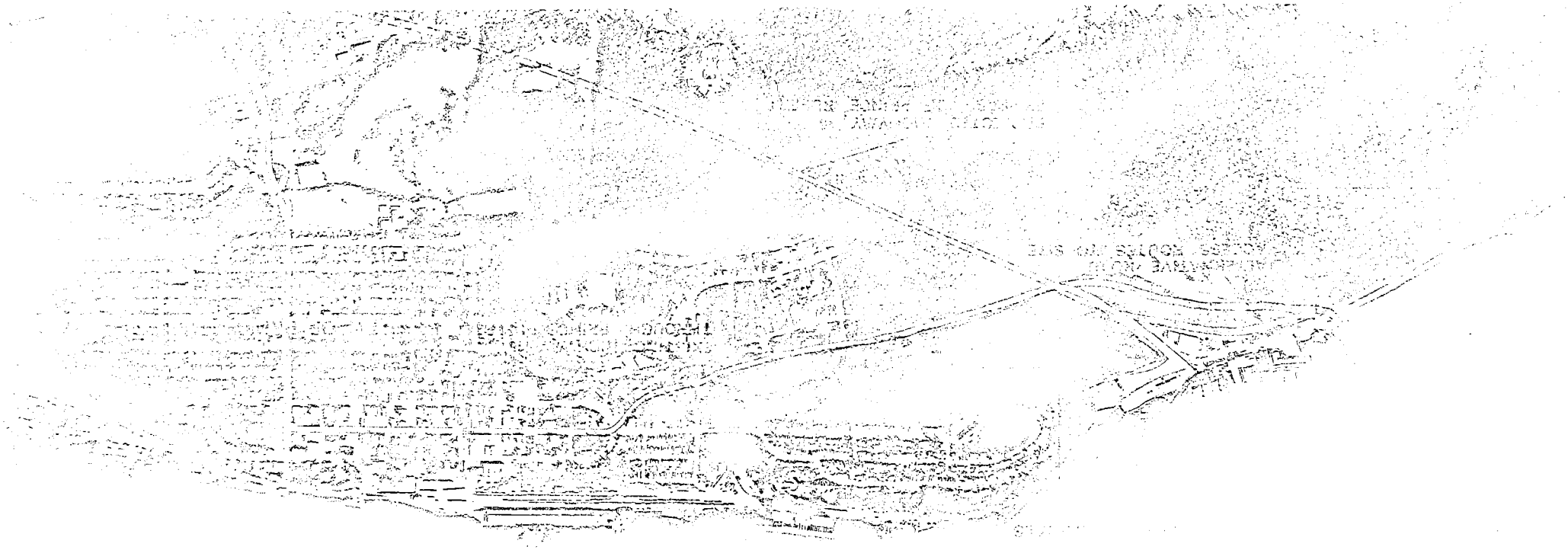


PLATE 8

PRINCE RUPERT PORT DEVELOPMENT

SITE . LOCATIONS

WRIGHT ENGINEERS LIMITED
VANCOUVER CANADA



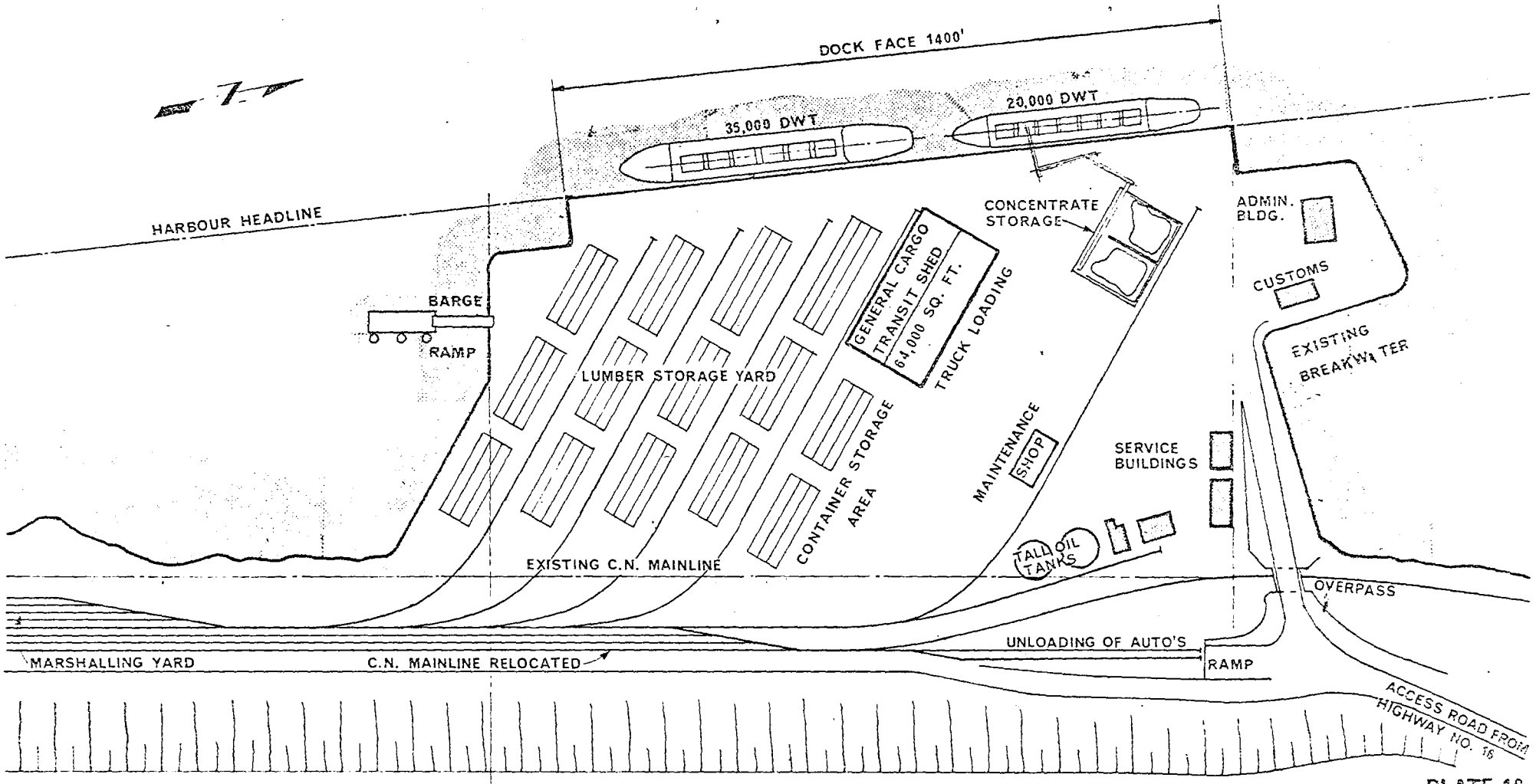


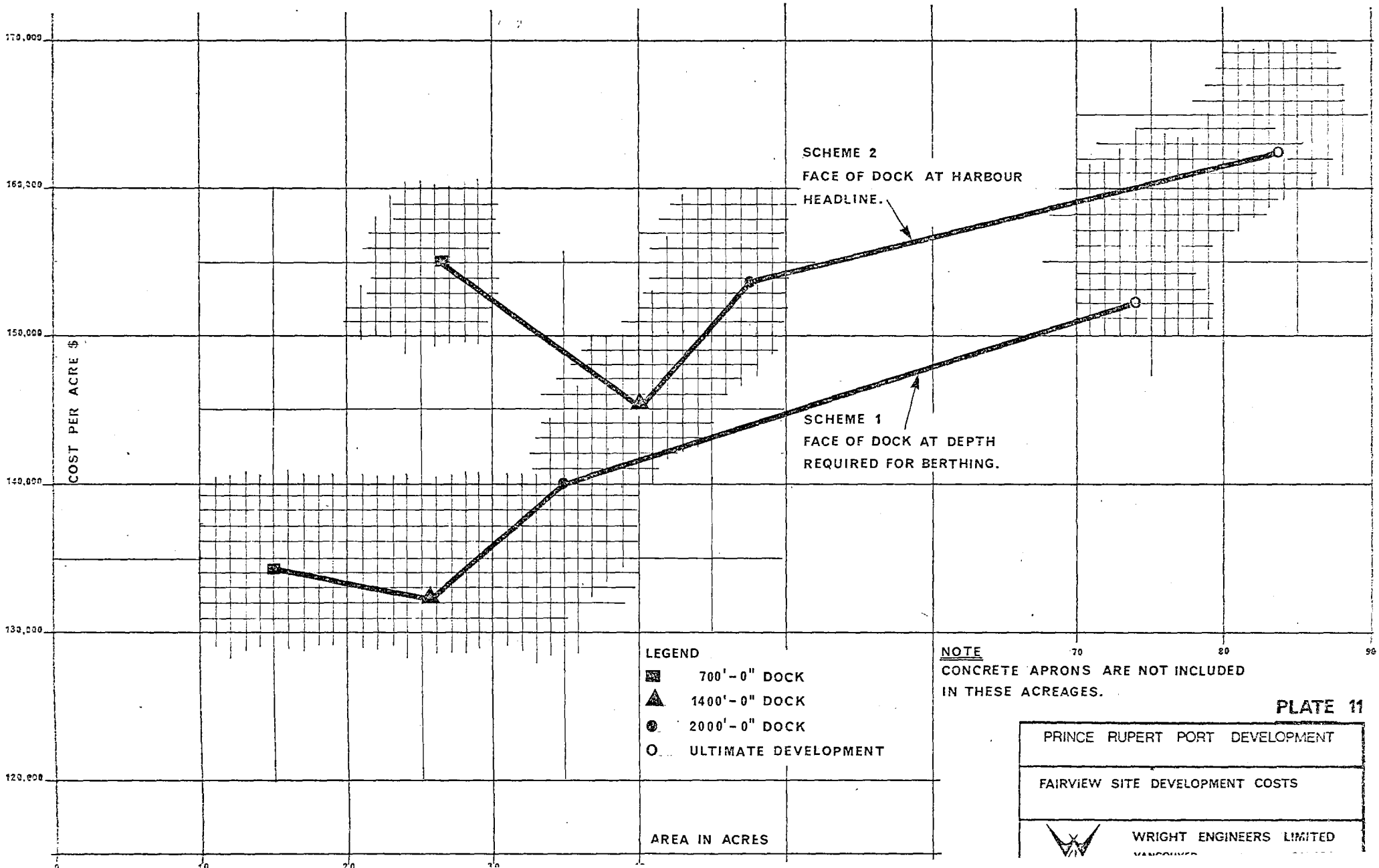
PLATE 10

PRINCE RUPERT PORT DEVELOPMENT

PROPOSED TERMINAL LAYOUT AT FAIRVIEW SITE

SCALE - 1" = 200'

WRIGHT ENGINEERS LIMITED



NOTE
CONCRETE APRONS ARE NOT INCLUDED IN THESE ACREAGES.

PLATE 11

PRINCE RUPERT PORT DEVELOPMENT

FAIRVIEW SITE DEVELOPMENT COSTS

WRIGHT ENGINEERS LIMITED
VANCOUVER

SUBMITTED BY:

WRIGHT ENGINEERS LIMITED

J. C. BOWLING, P.ENG

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
J. C. BOWLING

K.I.H. NIELSEN, NAVAL ARCHITECT

CONSULTANTS :

G.A. VERES, MARINE ECONOMIST

J. M. LIVINGSTONE, C.I.T.T.

VANCOUVER, CANADA,
AUGUST, 1972.