

**PRELIMINARY GRANULAR RESOURCES DEMAND
MACKENZIE DELTA REGION**

Prepared for:



Hardy BBT Limited

CONSULTING ENGINEERING & PROFESSIONAL SERVICES



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**PRELIMINARY GRANULAR RESOURCES DEMAND
MACKENZIE DELTA REGION**

Prepared for:

**Indian and Northern Affairs Canada
Hull, Quebec**

Prepared by:

**Hardy BBT Limited
Calgary, Alberta**

Revised, January, 1991

CG14143





TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 RECENT GRANULAR RESOURCE DEMAND STUDIES	3
3.0 METHODOLOGY	6
4.0 UPDATED DEMAND INFORMATION	8
5.0 DEMAND-SUPPLY MODEL	10
6.0 SUMMARY AND CONCLUSIONS	12
7.0 REFERENCES	14
APPENDIX A: Letter Requesting Updated Demand Information	
APPENDIX B: Updated Granular Resources Demand	





LIST OF TABLES

3.1	Potential Granular Resource Users in the Mackenzie Delta Region Contacted Regarding Updating of Granular Resources Demand Tables	7
3.2	Respondents to the Granular Demand Survey	9
5.1	Overall Demand - Supply Comparison	11





LIST OF FIGURES

	<u>Page</u>
1. Borrow Mapping Areas and Physiographic Regions	5





LIST OF PLATES

	<u>Page</u>
1. Granular Resources Potential Mackenzie Delta Region Demand-Supply Model	(in map pocket)





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

1.0 INTRODUCTION

The granular resources in the Mackenzie Delta region are relatively scarce and in many cases quite remote from the communities in the region. The demand for granular resources comes from both community and resource development activities. The establishment of granular resource reserves for use by the Inuvialuit Committee was one of the conditions of the Inuvialuit Final Agreement, signed in 1984. An additional major demand for granular resources will stem from the anticipated development of the hydrocarbon reserves in the region. The Department of Indian Affairs and Northern Development (DIAND) recognized these further demands on the limited granular resources and planned a workshop on the Inventory and Management of Granular Resources in the Mackenzie Delta Region. Hardy BBT Limited was contracted to prepare and facilitate the workshop. This project was undertaken as part of the Inuvialuit Final Agreement Implementation Program (IFAIP); Task 7 - Sand and Gravel Inventories. Mr. R.J. Gowan, P.Geol. of DIAND was the Scientific Authority during this study, which was carried out under Department of Supply and Services Contract No. A7134-9-0053/01-ST.

The Inuvialuit Final Agreement (IFA) granted the Inuvialuit ownership of granular resources within a major portion (35,000 square miles) of the Western Arctic Region. The Inuvialuit Land Administration (ILA) is responsible for management of the granular resources on Inuvialuit lands, while the Department of Indian Affairs and Northern Development (DIAND) manages those on the surrounding (Crown) lands. Because of the importance of sand and gravel in the north, special provisions circumscribing Inuvialuit ownership of these resources





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

were included in the IFA to ensure the reservation of adequate supplies of suitable materials for public community needs. This reservation was to be based on co-operative demand forecasting. As part of the implementation of the IFA, a sand and gravel inventory program was initiated by DIAND to assist the ILA with the identification of suitable reserves. Studies conducted by EBA Engineering Consultants Ltd. (1987) and Hardy BBT Limited (1989 and 1990) have proposed the reservation of certain granular deposits that could provide for the requirements of each of the six Inuvialuit communities. Despite this work, there remains concern regarding the impact of major industrial developments on granular resources in the region.

This potentially massive industrial demand for a resource that is already scarce will place added pressure on the supplies that will be required for community use and for other major public projects such as the possible extension of the Mackenzie Highway. The potential effects of large scale granular resource extraction have been identified as one of the main issues to be addressed in regional land use planning.

Recent planning meetings have raised a number of concerns relating to granular resources, including the adequacy of existing inventories of supply and forecasts of demand for both communities and major developments; and the need for conservation of existing materials, reservation of community supplies, identification of critical areas, protection of the environment and rehabilitation of depleted sources. The need was recognized for a further exchange of information and discussion among government, communities, industry, contractors, planners and others interested in granular resources.





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

From this background, DIAND proposed a workshop as an effective way of addressing these concerns. Although the workshop was cancelled, DIAND requested that two studies forming part of the preparation for the workshop be completed, namely:

- (1) An updated inventory of the granular resource potential of the Mackenzie Delta region
- (2) An updated granular resource demand for the Mackenzie Delta region

It had been intended that the results of these studies would be presented at the workshop and subsequently be published. This report comprises the preliminary study on the granular resources demand.

This report is divided into five sections. Following the introduction, previous granular resource demand studies for the Mackenzie Delta Region are introduced (Section 2.0). This is followed by a description of the methodology used in the present study (Section 3.0) and the updated demand information (Section 4.0). Section 5.0 presents a correlation of granular resource demand with granular resource sources in the region. Section 6.0 presents summary and conclusions of the study and offers some suggestions on how to improve the demand forecasting process.

2.0 RECENT GRANULAR RESOURCE DEMAND STUDIES

Figure 1 shows the borrow mapping areas and physiographic regions of the Lower Mackenzie Valley. Hardy Associates (1978) Ltd. (1986) presented information





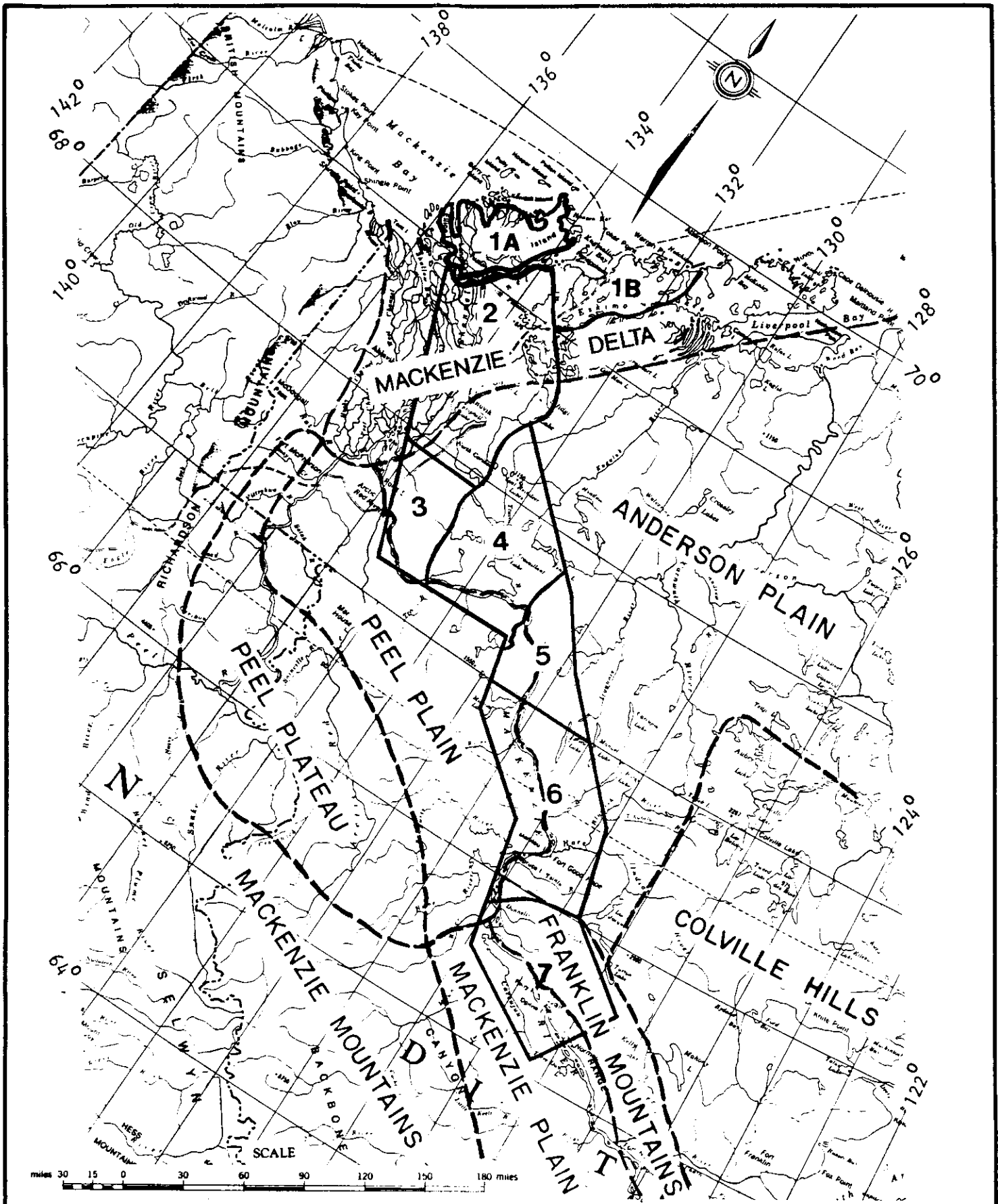
PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

on projected demands for granular materials in the Lower Mackenzie Valley for the period 1986 to 1990. This data provided a first approximation of typical pipeline and community demands. A more formal assessment of the potential demands in the Inuvik, Tuktoyaktuk, and Aklavik Inuvialuit Lands was undertaken as part of a comprehensive review of existing granular resource information by EBA Engineering Consultants Ltd. (EBA) in 1987 (EBA 1987a, 1987b, 1987c). EBA conducted a granular resource demand survey using a questionnaire and follow-up interviews with potential granular resource users in the area.

In the EBA studies, projects identified as requiring granular materials were divided into three categories: planned capital projects, speculative projects, and maintenance. Planned capital projects are, typically, those contained in relatively short-term (5 year) capital expenditure plans of communities or more senior governments. Even these projects are subject to revision or cancellation due to economic or political reasons.

Speculative projects generally refer to large-scale projects that may or may not occur within the next 20 years. These projects usually require a political decision and a substantial commitment of both funding and granular materials. Speculative projects typically include new airstrips, lengthy highways, and construction of infrastructure for the production of oil and gas.





HARDY ASSOCIATES (1978) LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

**BORROW MAPPING AREAS
AND PHYSIOGRAPHIC REGIONS
OF LOWER MACKENZIE VALLEY**

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FIGURE 1



PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

Maintenance demands refer to the ongoing requirements for routine roadway or airstrip repairs and minor upgrading and other continuing small-scale development. These demands are generally the best known ones since they tend to be based on historical requirements.

Demand was presented in five-year blocks for the periods 1987 to 1991, 1992 to 1996, 1997 to 2001, and 2002 to 2006. The results of the demand survey were included as tables in the EBA reports.

The demand tables of the EBA study were discussed at workshops in the three communities by Hardy BBT Limited and Avati Associates (1988a, 1988b, 1988c). These workshops, commissioned by DIAND, were not specifically intended to revise the forecast demands, but any community concerns with the demand figures were noted.

3.0 METHODOLOGY

The 1988 workshops concluded that the tabulated demand figures (EBA 1987a, 1987b, 1987c) were generally adequate for initial resource management planning. The approach taken in this study, therefore, was to simply update the 1987 figures to reflect changed or new projects. To this end, on March 1, 1990, a letter requesting updating of the information was mailed or faxed together with the relevant tables from EBA reports to potential users, as listed in Table 3.1. A copy of this letter appears as Appendix A. Due to the poor initial response to the survey, finalization of the report was delayed, and subsequent attempts were made until early July, 1990, through telephone calls and follow-up letters from





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

TABLE 3.1

POTENTIAL GRANULAR RESOURCE USERS
IN THE MACKENZIE DELTA REGION
CONTACTED REGARDING UPDATING OF
GRANULAR RESOURCE DEMAND TABLES

NAME	AFFILIATION
John Banksland	Aklavik Community Corporation
Doug Bruchet	Canadian Petroleum Association
Brian Crist	NWT Municipal and Community Affairs
William Day	Inuvik Community Corporation
Tom Detlor	Town of Inuvik
John Ellwood	Foothills Pipe Lines (Yukon) Ltd.
Kevin Hewitt	Canadian Marine Drilling Limited
Rick Hoos	Polar Gas Project
James McDougall	Esso Resources Canada Ltd.
Bob Nasmith	Inuvialuit Development Corporation
Jim Nicholson	NWT Department of Public Works
Eugene Pascal	Aklavik Dene Band
Brian Peterson	NWT Department of Transportation
Elmer Schultz	Air Transportation Sector, Public Works Canada
Vince Teddy	Tuktoyaktuk Community Corporation
David Townsend	Gulf Canada Corporation
Peter Tremblay	NWT Department of Public Works
Pim van de Pypekamp	Shell Canada Limited
Peter Vician	NWT Department of Public Works
Carl Yurchak	Public Works Canada
Marvin Zaozirny	NWT Department of Transportation





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

both Hardy BBT and DIAND personnel, to contact those who had not yet responded. Despite this, only 8 of the 21 potential users responded. These are identified in Table 3.2.

The information received was incorporated into the EBA tables for Inuvik, Tuktoyaktuk, and Aklavik.

4.0 UPDATED DEMAND INFORMATION

The updated demand information for Inuvik, Tuktoyaktuk, and Alkavik is presented in Appendix B.

Because only 38 percent of the potential users responded, updated information is noted by an asterisk on the tables. This denotation was deemed necessary because the detailed raw survey data upon which the EBA figures were based was not available to the study team and the grouping of some of the private sector demands (i.e., oil and gas industry) in the EBA report did not allow for distinguishing the requirements of individual companies.





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

TABLE 3.2
RESPONDENTS TO THE GRANULAR DEMAND SURVEY

NAME	AFFILIATION
Tom Detlor	Town of Inuvik
Ollie Kaustinen	Polar Gas Project
James McDougall	Esso Resources Canada Ltd.
Elmer Schultz	Air Transportation Sector, Public Works Canada
Al Simm	Canadian Marine Drilling Limited
David Townsend	Gulf Canada Corporation
Pim van de Pypekamp	Shell Canada Limited
Carl Yurchak	Public Works Canada

Number of requests for information:	21
Responses:	8
Percent of Responses:	38





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

A review of the tables identifies the following points:

1. Most of the updated information applies to Inuvik. Only one updated demand figure was received for Tuktoyaktuk and none were received for Aklavik.
2. Granular requirements for onshore oil and gas production were almost exclusively assigned to Tuktoyaktuk's demand table in the EBA study. In the present study, these demands are assigned to Inuvik, closer to where proposed gas development would occur and to where the proposed gas pipeline to southern Canada would be located. This gas pipeline was not being considered at the time of the EBA study.
3. The year groups in the present study do not always coincide with those of the EBA study. Demand information from the Town of Inuvik was presented for the ten-year periods 1990-1999 and 2000-2009. These periods were incorporated into Table 4.1 without any attempt to reassign the demands to the EBA five-year groups.

5.0 DEMAND-SUPPLY MODEL

The intent of the demand study was to provide input, on a geographical grid basis, to a demand-supply model so that demand could be matched more specifically with supply. Plate 1 (in map pocket) represents a granular resource demand-supply model for the Mackenzie Delta. Because of the lack of response to the demand survey and the potential for overestimating quantities needed





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

(specifically for the oil and gas industry requirements), it was considered inappropriate to assign the available demand data to a grid cell. Therefore, only the supply information is included in the model at this stage. A more comprehensive survey of granular resource demand in the region, as was envisioned with the proposed workshop, is required before the model can be completed.

A very tentative comparison between the demand, as summarized in Tables 4.1, 4.2 and 4.3, and the supply summarized in Table 1 of the companion report (Hardy BBT 1990) is presented in Table 5.1. Based on proven volumes of good prospects there is more than adequate granular supply for Inuvik and Aklavik, but a shortage of $9.0 \times 10^6 \text{ m}^3$ for Tuktoyaktuk. However, if probable volumes of good prospects in Borrow Mapping Area 1B are considered, there exists $35.3 \times 10^6 \text{ m}^3$ of Class 1, 2 and 3 material. This is more than adequate to meet Tuktoyaktuk's projected needs.

Demand (20 year demand volumes for Class 1, 2 and 3)		Supply (proven volumes of Good Prospects Class 1, 2 and 3)	
Community	Volume (10^6 m^3)	Borrow Mapping Area	Proven Volume (10^6 m^3)
Inuvik	9.2	1A	13.2
Tuktoyaktuk	10.4	1B	1.4
Aklavik	0.2	2	23.5





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

While the tabulated data imply that there is a more than adequate granular supply in the region, much of the supply may be quite remote from the demand sites. The objective behind the Demand-Supply model based on the UTM grid was to determine if there are local shortages. Once the model can be completed with specific demand data, the priorities for proving sources closer to the demands will be evident.

6.0 SUMMARY AND CONCLUSIONS

Granular resource demand information was collected for the Mackenzie Delta Region as part of preparatory work for a proposed granular resources workshop. Unfortunately, response to a request for updated demand information was minimal and the granular resource demand-supply model could not be completed. A more complete granular material demand survey is required for the region. A suggested approach to obtain more complete demand data is through using a combination workshop/interview/questionnaire approach.

A workshop of the type intended to be held as part of this contract would allow the presentation, discussion, and refinement of granular resource demand figures for the area. The workshop setting would offer the opportunity to identify duplication of demand estimates among communities, ILA, and contractors and to identify potential users who may not be present. These persons could be later contacted for their input. The results of the workshop, incorporating any additional demand estimates from the potential users not present, would be distributed among potential users. The repetition of the workshop, at some regular interval, perhaps bi-annually, would allow for updating the demand





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

information based on the revision of development plans. These workshops would also allow the presentation of new granular supply data. After holding two or three workshops to familiarize granular resource users with the updating program, the frequency of workshops may decrease to one every six years, with bi-annual updates being accomplished through interviews and questionnaires during the intervening years.





PRELIMINARY GRANULAR RESOURCES DEMAND MACKENZIE DELTA REGION

7.0 REFERENCES

EBA Engineering Consultants Ltd., 1987a. Inuvialuit settlement sand and gravel inventory and recommendations for development Inuvik, N.W.T. Report prepared for Indian and Northern Affairs Canada.

EBA Engineering Consultants Ltd., 1987b. Inuvialuit settlement sand and gravel inventory and recommendations for development Tuktoyaktuk, N.W.T. Report prepared for Indian and Northern Affairs Canada.

EBA Engineering Consultants Ltd., 1987b. Inuvialuit settlement sand and gravel inventory and recommendations for development Aklavik, N.W.T. Report prepared for Indian and Northern Affairs Canada.

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Hardy BBT Limited, 1990. Evaluation of granular resource potential Mackenzie Delta Region. Prepared for Indian and Northern Affairs Canada.

Hardy BBT Limited and Avati Associates, 1988a. Plan for the reservation and development of granular materials in the vicinity of Inuvik, N.W.T. Prepared for Indian and Northern Affairs Canada.

Hardy BBT Limited and Avati Associates, 1988b. Plan for the reservation and development of granular materials in the vicinity of Tuktoyaktuk, N.W.T. Prepared for Indian and Northern Affairs Canada.

Hardy BBT Limited and Avati Associates, 1988c. Plan for the reservation and development of granular materials in the vicinity of Aklavik, N.W.T. Prepared for Indian and Northern Affairs Canada.





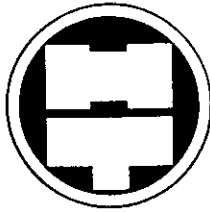
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APPENDIX A

Letter Requesting Updated Demand Information





Hardy BBT Limited

CONSULTING ENGINEERING & ENVIRONMENTAL SERVICES

CG14143

Our Project No.

Your Reference No.

1 March 1990

Dear Sir :

Re: Supply - Demand Analysis for Mackenzie Delta
Granular Resource Workshop

By now you should have received general details on the planned Workshop on the Inventory and Management of Granular Resources in the Mackenzie Delta Area. The purpose of this letter is to request of your company/department any updated data you may have on your projected demand for granular materials in the Mackenzie Delta Area.

One of the prime emphases of the workshop is to present an analysis of granular material supply and demand on a geographical basis so that local/regional shortages and conflicts between community and industry demands can be identified and discussed. In order to adequately carry-out the supply-demand analysis, Hardy BBT Limited, as organizers of the Workshop on behalf of DIAND, require your present projections on granular demand for community, government and industry requirements. Your response to this request is crucial to the success of this aspect of the workshop. It is hoped you would still consider addressing your demands during the relevant session of the workshop.

Your company/department is requested to provide updated granular demand data in the format of the attached forms prepared for DIAND in 1988. In order for this data to be compiled and analyzed for presentation at the workshop, your response is requested by March 12, 1990. It is requested that your submission be sent by courier to the address below or by fax transmission:

Courier: Hardy BBT Limited
219 - 18th Street S.E.
Calgary, Alberta T2E 6J5

Fax no: (403) 248-2188

Attention: Alan J. Hanna

Attention: Alan J. Hanna, P.Eng.

We thank you for your consideration on this matter. Should you have any queries please contact the writer or Jim Howell at (403) 248-4331.

Yours truly,
Hardy BBT Limited

Alan J. Hanna, P.Eng.
Manager Northern Operations

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Hardy BBT Limited

CONSULTING ENGINEERING & ENVIRONMENTAL SERVICES

APPENDIX B

Updated Granular Resources Demand



TABLE B.1

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1987-1991	FOL (Forward Operating Location) (replaces Airport Overlays)	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	300 000*
			TOTAL	300 000*
1987-1991	Hangar	PUBLIC	Class 1:	100
			Class 2:	600
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	700
1987-1991	Highway: Inuvik to Airport	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	100 000*
			TOTAL	100 000*
1987-1991	Yard Development	OTHER	Class 1:	
			Class 2:	
			Class 3:	1 530
			Class 4:	
			Class 5:	153
			TOTAL	1 683
1987-1991	Yard Maintenance	OTHER	Class 1:	
			Class 2:	
			Class 3:	750
			Class 4:	
			Class 5:	
			TOTAL	750

* 1990 update figure

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1987-1991	Winter Drilling (Shell) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	500*
			Class 4:	
			Class 5:	
			TOTAL	500*
1990-1999	Recreation Centre	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	5 000*
			Class 4:	
			Class 5:	
			TOTAL	5 000*
1990-1999	Visitor's Centre	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	13 900*
			Class 4:	
			Class 5:	
			TOTAL	13 900*
1990-1999	Department Store	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	2 350*
			Class 4:	
			Class 5:	
			TOTAL	2 350*
1990-1999	Microwave Tower and Access Road	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	56 000
			Class 4:	
			Class 5:	
			TOTAL	56 000

* 1990 update figure

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1990-1999	Subdivision Lot Fill and Park	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	45 000*
			Class 4:	
			Class 5:	
			TOTAL	45 000*
1990-1999	Navy Road Expansion	PUBLIC	Class 1:	
			Class 2:	5 250*
			Class 3:	6 000*
			Class 4:	
			Class 5:	
			TOTAL	11 250*
1990-1999	Road Paving	PUBLIC	Class 1:	29 000*
			Class 2:	15 400*
			Class 3:	40 000*
			Class 4:	
			Class 5:	
			TOTAL	84 400*
1990-1999	Road/General Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	218 000*
			Class 4:	
			Class 5:	
			TOTAL	218 000*
1990-1999	Sidewalks	PUBLIC	Class 1:	9 400*
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	9 400*

* 1990 update figure

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1990-1999	Lot Development	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	18 100*
			Class 4:	
			Class 5:	
			TOTAL	18 100*
1990-1999	Private Business/Homeowners	OTHER	Class 1:	
			Class 2:	105 000*
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	105 000*
1992-1996	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	10 000*
			TOTAL	10 000*
1992-1996	Base Camp and Yard Development (Shell) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	3 000*
			Class 4:	
			Class 5:	
			TOTAL	3 000*
1992-1996	Yard Maintenance	OTHER	Class 1:	
			Class 2:	
			Class 3:	750*
			Class 4:	
			Class 5:	
			TOTAL	750*

* 1990 update figure

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1992-1996	Onshore Oil & Gas Exploration (Shell) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	5 000*
			Class 4:	
			Class 5:	
			TOTAL	5 000*
1992-1996	Onshore Oil & Gas Production (Esso) (speculative)	OTHER	Class 1:	
			Class 2:	1 192 706*
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	1 192 706*
1992-1996	Offshore Oil & Gas Production (Gulf) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	80 000*
			TOTAL	80 000*
1995-1998*	Polar Gas Pipeline (speculative)	OTHER	Class 1:	948*
			Class 2:	
			Class 3:	793 287*
			Class 4:	
			Class 5:	
			TOTAL	794 235*
1995-1998*	Mackenzie Valley Pipeline (Gulf) (speculative)	OTHER	Class 1:	15 000*
			Class 2:	53 000*
			Class 3:	867 000*
			Class 4:	
			Class 5:	
			TOTAL	935 000*

* 1990 update figure

° Only one of the Polar Gas or Mackenzie Valley pipeline will be constructed.

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1997-2001	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	12 000*
			TOTAL	12 000*
1997-2001	Onshore Oil & Gas Production (Shell) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	25 000*
			Class 4:	
			Class 5:	
			TOTAL	25 000*
1997-2001	Yard Maintenance	OTHER	Class 1:	
			Class 2:	
			Class 3:	750
			Class 4:	
			Class 5:	
			TOTAL	750
1999-2001+	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1:	5 000*
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	2 800 000
			TOTAL	2 805 000*
1997-2001	Offshore Oil: Erosion Protection (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	900 000
			TOTAL	900 000

* 1990 update figure

+ New hypothetical date for project - no program has been established (C. Yurchak, PWC, pers. comm.).

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
1997-2001	Parsons Lake Gas Plant* (speculative)	OTHER	Class 1:	
			Class 2:	532 500*
			Class 3:	1 242 500*
			Class 4:	
			Class 5:	
			TOTAL	1 775 000*
1997-2001	Niglintak Field Development (Shell) (speculative)	OTHER	Class 1:	
			Class 2:	20 000*
			Class 3:	230 000*
			Class 4:	
			Class 5:	
			TOTAL	250 000*
2000-2009	Public Projects	PUBLIC	Class 1:	96 000*
			Class 2:	51 600*
			Class 3:	1 273 000*
			Class 4:	
			Class 5:	
			TOTAL	1 420 600*
2002-2006 +	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1:	
			Class 2:	1 700 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	1 700 000
2002-2006	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	12 000*
			TOTAL	12 000*

* 1990 update figure

+ This assumes a single processing plant. If a joint industry plant is constructed, 394 500 m³ of Class 2 and 920 500 m³ of Class 3 for a total of 1 315 000 m³ of material will be required (D. Townsend, Gulf, pers. comm.).

° New hypothetical date for project - no program has been established (C. Yurchak, PWC, pers. comm.)

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK			
Year	Project	Category	Volume (m ³)
2002-2006	Road/General Maintenance	PUBLIC	Class 1: Class 2: Class 3: 20 000 Class 4: Class 5: TOTAL 20 000
2002-2006	Yard Maintenance	OTHER	Class 1: Class 2: Class 3: 750 Class 4: Class 5: TOTAL 750
2002-2006	Onshore Gas Production (Esso) (speculative)	OTHER	Class 1: Class 2: 238 541* Class 3: Class 4: Class 5: 298 177* TOTAL 536 718*
2002-2006	Onshore Oil & Gas Production (Shell) (speculative)	OTHER	Class 1: Class 2: Class 3: 25 000* Class 4: Class 5: TOTAL 25 000*
2007-2011+	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1: Class 2: 100 000 Class 3: Class 4: Class 5: TOTAL 100 000

* 1990 update figure

+ New hypothetical date for project - no program has been established (C. Yurchak, PWC, pers. comm.).

TABLE B.1 (Cont'd)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY INUVIK				
Year	Project	Category	Volume (m ³)	
2007-2011	Onshore Oil & Gas Production (Esso) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	1 467 946*
			TOTAL	1 467 946*
2012-2016+	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1:	
			Class 2:	100 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	100 000
2012-2017	Onshore Oil Production (Esso) (speculative)	OTHER	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	376 161*
			TOTAL	376 161*

* 1990 update figure

+ New hypothetical date for project - no program has been established (C. Yurchak, PWC, pers. comm.).

TABLE B-2

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)	
1987-1991	Curling Rink	PUBLIC	Class 1:	100
			Class 2:	100
			Class 3:	1 000
			Class 4:	
			Class 5:	
			TOTAL	1 200
			1987-1991	Garage
			Class 2:	250
			Class 3:	600
			Class 4:	
			Class 5:	
			TOTAL	900
1987-1991	Garage Workshop	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	40
			Class 4:	
			Class 5:	
			TOTAL	40
			1987-1991	General Maintenance
Class 2:				
Class 3:	20 000			
Class 4:				
Class 5:				
TOTAL	20 000			
1987-1991	Lot Development	PUBLIC		
			Class 2:	
			Class 3:	500
			Class 4:	
			Class 5:	
			TOTAL	500

TABLE B-2(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)	
1987-1991	Nursing Station	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	300
			Class 4:	
			Class 5:	
			TOTAL	300
1987-1991	Primary School	PUBLIC	Class 1:	200
			Class 2:	100
			Class 3:	400
			Class 4:	
			Class 5:	
			TOTAL	700
1987-1991	Road Maintenance	PUBLIC	Class 1:	5 000
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	5 000
1987-1991	Shore Protection	PUBLIC	Class 1:	
			Class 2:	60 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	60 000

TABLE B-2 Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)
1987-1991	Staff Housing	PUBLIC	Class 1: 50
			Class 2: 1 350
			Class 3: 2 800
			Class 4:
			Class 5:
			TOTAL 4 200
1987-1991	Yard Development	OTHER	Class 1:
			Class 2: 500
			Class 3: 1 000
			Class 4:
			Class 5:
			TOTAL 1 500
1987-1991	Gas Well/Pipeline and Site Develop. (speculative)	INUVIALUIT	Class 1:
			Class 2:
			Class 3: 14 100
			Class 4:
			Class 5:
			TOTAL 14 100
1990-1991	Yard Maintenance	OTHER	Class 1:
			Class 2:
			Class 3: 4 739*
			Class 4:
			Class 5:
			TOTAL 4 739*

* 1990 update figure

TABLE B-2(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)	
1992-1996	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	5 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>5 000</u>
1992-1996	Erosion Control	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	20 000
			TOTAL	<u>20 000</u>
1992-1996	General Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
1992-1996	Land Development	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	20 000
			Class 5:	
			TOTAL	<u>20 000</u>

TABLE B-2(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category		Volume (m ³)
1992-1996	Land Development	PUBLIC	Class 1:	5 000
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>5 000</u>
1992-1996	Road Construction	PUBLIC	Class 1:	5 000
			Class 2:	60 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>65 000</u>
1992-1996	Road Maintenance	PUBLIC	Class 1:	5 000
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>5 000</u>
1992-1996	Solid Waste Site	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	20 000
			Class 5:	
			TOTAL	<u>20 000</u>

TABLE B-2 (Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY TUKTOYAKTUK			
Year	Project	Category	Volume (m ³)
1992-1996	Yard Maintenance	OTHER	Class 1: Class 2: Class 3: 400 Class 4: Class 5: TOTAL <u>400</u>
1992-1996	Airport Expansion (speculative)	PUBLIC	Class 1: Class 2: 58 100 Class 3: 1 491 000 Class 4: Class 5: TOTAL <u>1 549 100</u>
1992-1996	Onshore Gas Production (speculative)	OTHER	Class 1: Class 2: 680 000 Class 3: Class 4: Class 5: TOTAL <u>680 000</u>
1992-1996	Pads and Roads (speculative)	OTHER	Class 1: Class 2: 1 176 000 Class 3: Class 4: Class 5: TOTAL <u>1 176 000</u>

TABLE B-2 (Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)	
1997-2001+	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	1 700 000
			Class 4:	
			Class 5:	
			TOTAL	<u>1 700 000</u>
1997-2001	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	5 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>5 000</u>
1997-2001	General Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
1997-2001	Road Maintenance	PUBLIC	Class 1:	5 000
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>5 000</u>

+ New hypothetical date for project - no program has been established (C. Yurchak, pers. comm.).

TABLE B-2(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category		Volume (m ³)
1997-2001	Yard Maintenance	OTHER	Class 1:	
			Class 2:	
			Class 3:	400
			Class 4:	
			Class 5:	
			TOTAL	<u>400</u>
1997-2001	Onshore Gas Production (speculative)	OTHER	Class 1:	
			Class 2:	700 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>700 000</u>
1997-2001	Onshore Oil Production (speculative)	OTHER	Class 1:	
			Class 2:	1 200 000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	<u>1 200 000</u>
1997-2001	Onshore Oil and Gas Production (Esso) (speculative)	OTHER	Class 1:	
			Class 2:	802 783*
			Class 3:	
			Class 4:	
			Class 5:	<u> </u>
			TOTAL	802 783*

* 1990 update figure

TABLE B-2 (Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
TUKTOYAKTUK

Year	Project	Category	Volume (m ³)
2002-2006+	Inuvik-Tuktoyaktuk Highway (speculative)	PUBLIC	Class 1:
			Class 2:
			Class 3: 1 400 000
			Class 4:
			Class 5:
			TOTAL 1 400 000
2002-2006	Airfield Maintenance	PUBLIC	Class 1:
			Class 2: 5 000
			Class 3:
			Class 4:
			Class 5:
			TOTAL 5 000
2002-2006	General Maintenance	PUBLIC	Class 1:
			Class 2:
			Class 3: 20 000
			Class 4:
			Class 5:
			TOTAL 20 000
2002-2006	Road Maintenance	PUBLIC	Class 1: 5 000
			Class 2:
			Class 3:
			Class 4:
			Class 5:
			TOTAL 5 000

+ New hypothetical date for project - no program has been established (C. Yurchak, pers. comm.).

TABLE B-2(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY TUKTOYAKTUK			
Year	Project	Category	Volume (m ³)
2002-2006	Yard Maintenance	OTHER	Class 1: Class 2: Class 3: 400 Class 4: Class 5: TOTAL 400
2002-2006	Onshore Oil Production (Esso) (speculative)	OTHER	Class 1: Class 2: 688 100* Class 3: Class 4: Class 5: TOTAL 688 100*
2007-2011+	Inuvik-Tuktoyaktuk Highway	PUBLIC	Class 1: Class 2: Class 3: 100 000 Class 4: Class 5: TOTAL 100 000
2012-2016+	Inuvik-Tuktoyaktuk Highway	PUBLIC	Class 1: Class 2: Class 3: 100 000 Class 4: Class 5: TOTAL 100 000

* 1990 update figure

+ New hypothetical date for project - no program has been established (C. Yurchak, pers. comm.).

TABLE B-3

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

Year	Project	Category		Volume (m ³)
1987-1991	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	3 000
			TOTAL	<u>3 000</u>
1987-1991	Airfield Rehabilitation	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	15 000
			TOTAL	<u>15 000</u>
1987-1991	Arena/Community Hall	PUBLIC	Class 1:	
			Class 2:	325
			Class 3:	1 350
			Class 4:	
			Class 5:	
			TOTAL	<u>1 675</u>
1987-1991	Detachment Building	PUBLIC	Class 1:	10
			Class 2:	
			Class 3:	200
			Class 4:	
			Class 5:	
			TOTAL	<u>210</u>
1987-1991	Garage	PUBLIC	Class 1:	
			Class 2:	100
			Class 3:	100
			Class 4:	
			Class 5:	
			TOTAL	<u>200</u>

TABLE B-3(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

Year	Project	Category	Volume (m ³)
1987-1991	Misc. Public Projects	PUBLIC	Class 1: Class 2: Class 3: 20 000 Class 4: Class 5: TOTAL <u>20 000</u>
1987-1991	Road/General Maintenance	PUBLIC	Class 1: Class 2: Class 3: 20 000 Class 4: Class 5: TOTAL <u>20 000</u>
1987-1991	R/S/L Land Development	PUBLIC	Class 1: Class 2: 3 800 Class 3: Class 4: 9 500 Class 5: 100 TOTAL <u>13 400</u>
1987-1991	R/S/L Shoreline Protection	PUBLIC	Class 1: Class 2: Class 3: Class 4: Class 5: 8 300 TOTAL <u>8 300</u>
1987-1991	School Addition	PUBLIC	Class 1: 200 Class 2: 100 Class 3: Class 4: Class 5: TOTAL <u>300</u>

TABLE B-3(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

Year	Project	Category	Volume (m ³)
1987-1991	Sewage and Solid Waste Improvements	PUBLIC	Class 1: Class 2: Class 3: Class 4: 1 000 Class 5: TOTAL <u>1 000</u>
1987-1991	Shoreline Protection	PUBLIC	Class 1: Class 2: Class 3: Class 4: Class 5: 8 000 TOTAL <u>8 000</u>
1987-1991	Staff Housing	PUBLIC	Class 1: 50 Class 2: 100 Class 3: 300 Class 4: Class 5: TOTAL <u>450</u>
1987-1991	Tradeshop	PUBLIC	Class 1: Class 2: 400 Class 3: 500 Class 4: Class 5: TOTAL <u>900</u>

TABLE B-3(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

Year	Project	Category	Volume (m ³)	
1992-1996	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	3 000
			TOTAL	<u>3 000</u>
1992-1996	Misc. Public Projects	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
1992-1996	Road/General Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
1997-2001	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	3 000
			TOTAL	<u>3 000</u>

TABLE B-3 (Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

Year	Project	Category	Volume (m ³)	
1997-2001	Misc. Public Projects	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
1997-2001	Road/General Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>
2002-2006	Airfield Maintenance	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	3 000
			TOTAL	<u>3 000</u>
2002-2006	Misc. Public Projects	PUBLIC	Class 1:	
			Class 2:	
			Class 3:	20 000
			Class 4:	
			Class 5:	
			TOTAL	<u>20 000</u>

TABLE B-3(Cont'd.)

UPDATED GRANULAR RESOURCES DEMAND SUMMARY
AKLAVIK

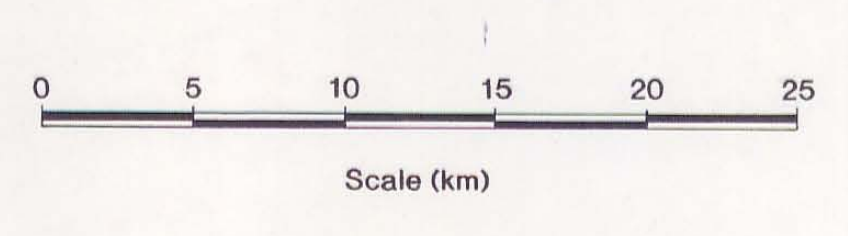
Year	Project	Category	Volume (m ³)
2002-2006	Road/General Maintenance	PUBLIC	
		Class 1:	
		Class 2:	
		Class 3:	20 000
		Class 4:	
		Class 5:	
		TOTAL	<u>20 000</u>



LEGEND

— Borrow Mapping Area Boundary
 - - - Inuvialuit Land Section Boundary

SUPPLY	A) 3,000,000 (2) B) 10,000,000 (2) C) 10,000,000 (2)
DEMAND	



Indian and Northern Affairs Canada

Hardy BBT Limited
 CONSULTING ENGINEERING & PROFESSIONAL SERVICES

**GRANULAR RESOURCES POTENTIAL
 MACKENZIE DELTA REGION
 DEMAND - SUPPLY MODEL**

SCALE As shown DATE July, 1990 MADE GDE CHRD AH APPD AH
 JOB No. CG14143 PLATE 1 REV