REPORT ON
EVALUATION OF GRANULAR RESOURCE POTENTIAL
MACKENZIE DELTA REGION

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

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EVALUATION OF GRANULAR RESOURCE POTENTIAL
MACKENZIE DELTA REGION

Prepared for:

Indian and Northern Affairs Canada
Hull, Quebec

Prepared by:

Hardy BBT Limited
Calgary, Alberta

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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 communities 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.

1.1 BACKGROUND

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 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 the 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.

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 study on the granular resources inventory.

In 1986, Hardy Associates (1978) Ltd. was retained by Department of Indian Affairs and Northern Development (DIAND) to undertake a review of borrow material studies completed in the vicinity of the proposed Lower Mackenzie Valley pipeline corridor, and to assess the granular resource potential of the area. A Report on "Evaluation of Granular Resource Potential, Lower Mackenzie Valley, was presented to DIAND in March 1986. The Richards Island area of that study region was specifically excluded from the 1986 study since additional field investigations were in progress at that time. In order to complete the inventory of granular resources in the Mackenzie Delta Region, for presentation at the proposed workshop, DIAND authorized Hardy BBT Limited to carry out this present study. In addition, the results from 1989 granular investigations carried out by Hardy

BBT for DIAND, have been incorporated into an update of relevant portions from the original 1986 report.

1.2 TERMS OF REFERENCE

The overall objective of the study is to provide an updated inventory of the granular resource potential of the Mackenzie Delta Region. Much of this inventory of granular deposits has been compiled and maintained in a computer data file in order to facilitate development planning for these resources.

To this end, the detailed terms of reference for the study were established as follows:

- identify and delineate, on the basis of a literature review and from granular resource database files provided by DIAND, all potential granular resource deposits in the Mackenzie Delta Region.
- subdivide the study area into proposed borrow mapping areas based on physiographic regions, the regional supply/demand situation, and/or likely pipeline construction corridor;
- prepare preliminary estimates of proven, probable, and prospective quantities of various granular material types in each of the proposed borrow mapping areas;
- identify any known physical/environmental constraints that are encountered in delineating the source;
- assess the overall suitability of each granular resource prospect with respect to the quality, overburden and drainage;
- provide guidelines for estimating the amount of additional field testing that should be considered for the more promising borrow sources;

- summarize the results of the study by preparing a table, or series of tables, for each proposed borrow mapping area indicating all sources identified, location, access, landform and generic origin of deposit, environmental concern, quantity and quality of materials, and an overall assessment of the prospect; and

- prepare a final report, including maps and tables, describing the results of the study. The report was to include descriptions of:

  physiographic regions;
  surficial geology and geomorphology;
  granular material types;
  proposed borrow mapping areas;
  granular resource potential; and
  recommendations for future granular resource studies.

1.3 METHODOLOGY

The previous (1986) study involved an extensive review of existing published and unpublished information. Most of the data included in the inventory of resources was obtained by detailed review of the original reports on the various sources. In the case of this present study, now incorporating Richards Island and a portion of Tuktoyaktuk Peninsula, most of the granular resource data has been obtained from database files provided by DIAND. The scope of work for this study did not include verification of information in the database nor any attempt to re-assess the Richards Island or Tuktoyaktuk Peninsula data to be consistent with the assessment process of the previous report.

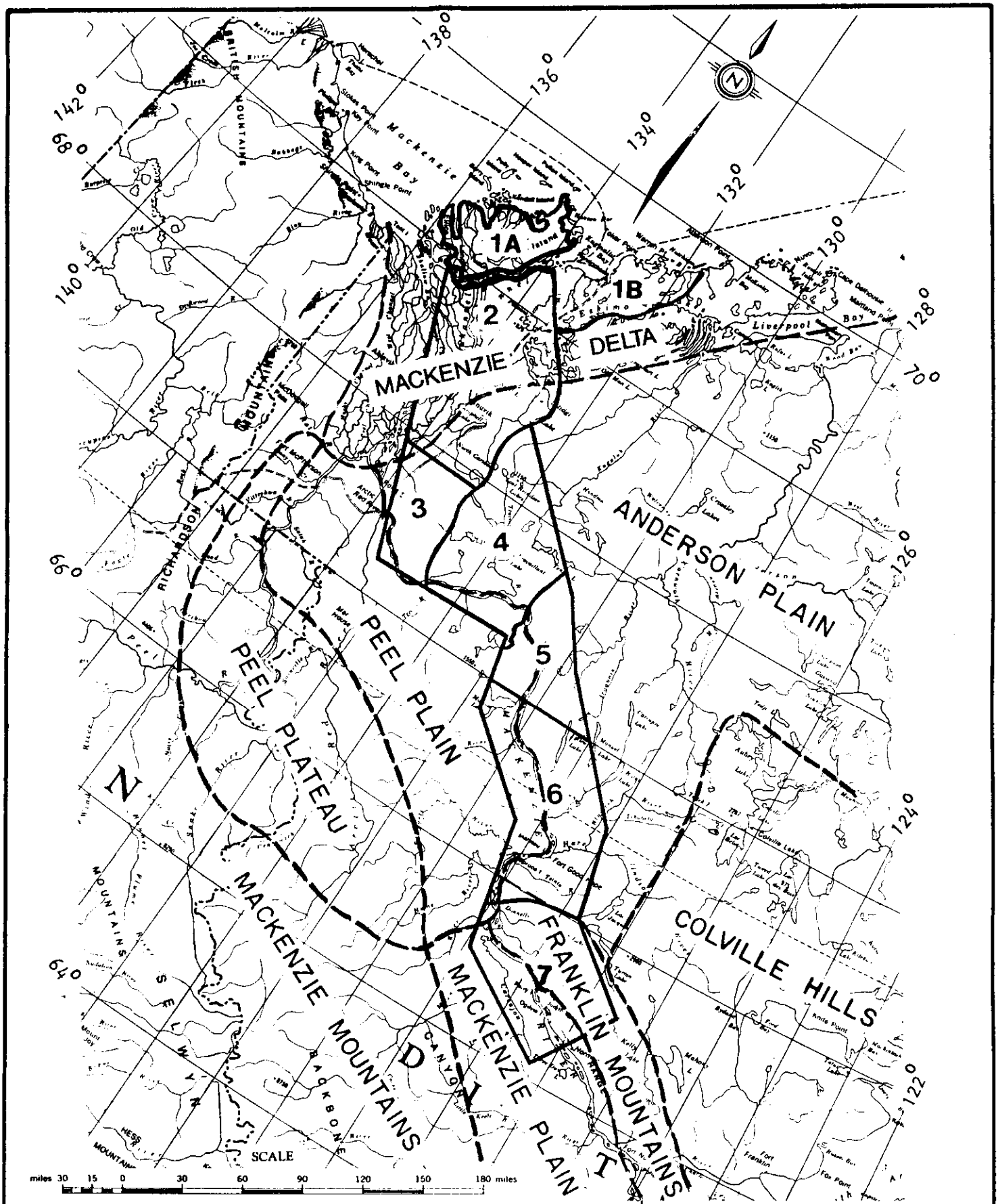
The locations of all potential granular deposits were plotted on 1:250,000 scale map sheets which cover the whole study area. At the same time, all relevant geotechnical information on each deposit was compiled in tabular

form. Individual deposits have been identified, investigated and described (in varying degrees of detail) by at least one and up to four or five previous studies.

Seven proposed "borrow management areas" were previously defined within the Lower Mackenzie Valley corridor, Figure 1. The areas were defined on the basis of physiography, location of existing communities and existing administrative boundaries. Natural physical boundaries were utilized where appropriate (e.g. rivers, uplands and lowlands), however in some cases NTS grid lines form the boundaries. This present study is concerned with only the most northerly portion, namely Areas No. 1 and 2, of the previous study.

Utilizing the tabulated information on each granular deposit, an overall assessment (in terms of material quality and quantity) was determined. The more favourable deposits, i.e. those with fair to good quality material, were then further evaluated with respect to proven, probable and prospective quantities of reserves.

Finally this report, which presents the results of the study together with all contingent maps and tables, was prepared. All aspects of the study are described in more detail in the following sections.



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BORROW MAPPING AREAS AND PHYSIOGRAPHIC REGIONS OF LOWER MACKENZIE VALLEY

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FIGURE 1

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2.0 STUDY AREA

The study area is based upon the two northernmost areas delineated in the Hardy (1986) report, but expanded to the east to include the Tuktoyaktuk Peninsula to McKinley Bay. The area is subdivided into three portions: 1A - Richards Island; 1B - Tuktoyaktuk Peninsula and 2 - Caribou Hills. The sources in Borrow Management Area No. 1 were not reviewed or assessed in the 1986 study, primarily due to ongoing field investigations at that time.

The impetus behind the previous study was the possible development of the hydro-carbon resources in the region. The focal locations of these energy resources are situated at Parsons Lake, on Richards Island (Taglu and Niglintgak) and offshore, north of Richards Island. The previous study therefore concentrated on a wide corridor from Richards Island south to Norman Wells.

It is the intention of this report to address more specifically the Mackenzie Delta region and not just a prime corridor. It therefore, incorporates not only Richards Island, as Area 1A, but also a portion of Tuktoyaktuk Peninsula, as Area 1B. The boundaries of Borrow Mapping Areas No.1A, 1B and 2 are illustrated on Figure 1. The east boundary of Area 2 has been altered from the 1986 alignment to ensure that the sources most likely to be used by the community of Tuktoyaktuk would be in Area 1B.

The majority of the area covered by the previous study was south of Inuvik. As such the majority of the land was Crown Land, administered by DIAND. It was the express objective of that study to provide DIAND with a basis for better administration and the development of the granular resources. Hence

the establishment of distinct management areas. The vast majority of the land being considered in this report is Inuvialuit Land and the objective of this report is not to propose a basis for management of these Inuvialuit resources. Rather, the objective is to provide a complete inventory of the regions resources and to make suggestions as to which sources are potentially worth further exploration and assessment. Therefore, in this report, the previously established management areas are referred to as Borrow Mapping Areas.

2.1 REGIONAL GEOLOGIC SETTING

The regional geologic setting of the study area is described below with respect to the physiographic regions intersected. Within each physiographic region the geomorphology and geologic conditions are considered to be relatively uniform; this influences the type and occurrence of surficial granular deposits. The physiographic regions intersected by the study area are shown on Figure 1. Reference to the 1:250,000 scale map sheets in Appendix C will aid in identifying specific geographic features which are discussed in the following sections.

2.1.1 Mackenzie Delta

The Mackenzie Delta is a division of the Arctic Coastal Plain physiographic region (Bostock 1970). The Mackenzie Delta Division has been divided into two areas (Rampton 1988): the Mackenzie Delta and the Tuktoyaktuk Coastlands. The former refers to the modern or Holcene Mackenzie Delta while the latter refers to that older portion of the coast, composed of Pleistocene sediments, which probably owes its existence to former rivers

having courses located east of the present-day Mackenzie River. Rampton also redrew the boundary between the Tuktoyaktuk Coastlands and the Anderson Plain to include the Caribou Hills with the latter. This places the hills which are bedrock controlled, with the plain where the Quaternary sediments are thinner and pre-Quaternary bedrock controls the topography. For this study, however, Bostock's (1970) physiographic divisions have been maintained because all of the previous work has been based on this mapping.

The Mackenzie Delta is a flat to hummocky deltaic plain comprising a large number of lakes and channels. It is composed of a mixture of unconsolidated Pleistocene and Recent deposits; the Recent deposits forming the present-day delta and the Pleistocene deposits occurring on Richards Island and east of East Channel. The Pleistocene deposits include morainal (till-like) materials, glaciofluvial sand and gravel (outwash and kames) and glaciolacustrine sediments, which overlie pre-glacial deltaic sands. Thermokarst activity is common in the Pleistocene deposits. Pingos, massive ice, and retrogressive-thaw flow slides are common. The Recent deposits include fine-grained alluvial, organic, marine beach, and lacustrine sediments, however, some tributary channels contain coarse alluvial material (sand and gravel).

Bedrock is generally deeply buried beneath about 30 m to 150 m of pre-glacial, glacial and post-glacial deposits. However in the Caribou Hills area, bedrock rises to near surface elevations. Bedrock exposures in the northern Caribou Hills are Cretaceous shales, however, in the Campbell Lake Hills, south of Inuvik, erosion resistant Precambrian quartzites and argillites and Palaeozoic carbonates are outcropping.

Surface drainage in the Mackenzie Delta area is often poorly developed, particularly on the areas with subdued topography. The Mackenzie River is the main drainage which comprises a maze of distributary channels in the Mackenzie Delta. Flat topography is characterized by small beaded creeks which flow between the lakes; seepage often occurs along ice-wedge trenches which are characteristic of polygonal ground. On gentle slopes drainage tends to occur as seepage along fen-filled valleys with no definite channel. Where definite channels exist the adjacent alluvial terraces often have standing water at the surface.

2.1.2 Anderson Plain

The Anderson Plain is a physiographic subdivision of the Interior Plains region. The Anderson Plain occupies the area on the east side of the Mackenzie River from the Mackenzie Delta to as far south as the Franklin Mountains.

This physiographic unit defines the very southeast portion of the Borrow Mapping Area No.2. In this zone of the Anderson Plain, adjacent to the Mackenzie River, is the Sitidgi Lake/Campbell Lake lowland. This lowland area reflects the presence of a broad pre-glacial valley feature which is incised into bedrock. Surficial deposits in this area consist of glaciolacustrine clays capped with organic deposits (peat). Along the southeast flank of the lowland (adjacent to the Anderson Plain upland) are drumlinized till deposits, fluted bedrock outcrops and some esker features which tend to parallel the drumlin/fluting lineation.

2.2 PERMAFROST CONDITIONS

The Mackenzie Delta lies within the continuous permafrost zone. Frozen ground is ubiquitous, from near surface to several hundred meters depth. Taliks or unfrozen zones exist beneath most water bodies, and the active layer (seasonally thawed) varies in thickness from 0.3-3.0 m depending upon material type, drainage conditions, insulating cover, and solar aspect.

Excess ground ice occurs commonly and varies from ice crystals to reticulate ice veins to ice wedges, pingos and massive tabular ice bodies. Pingos, formed by the aggradation of permafrost in shallow lake beds (MacKay, 1962), are very common on Richards Island and along the Tuktoyaktuk Peninsula. Ice wedges occur in all types of material and ice lenses may be common in till and other finely textured deposits. Hummocky and rolling terrain is often due to the presence of massive ice in the cores of the hummocks. Massive ice bodies often occur at the contact between coarse granular material and finely textured deposits. The majority of this type of massive ice is probably segregational ice (MacKay, 1971), however, remnant glacial ice has been identified beneath the Ya Ya Lake deposits (Dallimore and Wolfe, 1988). Gowan and Dallimore (1990) have shown that bodies of ice are also common within layers of granular material in this area. The presence of massive ice is an important factor in planning the development and restoration of granular resource deposits.

Permafrost related processes impact significantly on the geomorphology via the dynamic processes of frost heaving, ice-wedge formation, pingo formation, thermokarst, solifluction and soil creep. Additional dynamic processes such

as slumping and other modes of slope failure also serve to modify the landscape.

2.3 PROPOSED BORROW MAPPING AREAS

The mapping areas relevant to the Mackenzie Delta region are defined as follows:

MAPPING AREA	DESCRIPTION
1A	Richards Island is within the Mackenzie Delta physiographic subdivision. The boundary with Area 2 follows the Mackenzie River's East Channel and Reindeer Channel.
1B	The southwest portion of Tuktoyaktuk Peninsula, centred on the community of Tuktoyaktuk. This area is within the Mackenzie Delta Physiographic subdivision. It is separated from Area 2 by a line which cuts across the southern end of Eskimo Lakes in a northwest direction, extending to the mouth of East Channel.
2	Centred upon Noel Lake, with Inuvik as the main community, this area includes parts of the Mackenzie Delta and Anderson Plain physiographic subdivisions. The boundary with Area 3 is approximately Latitude 67° 55' North, (just south of Caribou Lake). The boundary with Area 4 is a line from the southeast shores of Sitidgi Lake to the west shores of North Caribou Lake then around the east side of Caribou Lake; this line essentially separates the Travailant Lake uplands from the Sitidgi/Campbell Lake lowlands to the west.

3.0 DATA EVALUATION AND PRESENTATION

3.1 SOURCE INFORMATION

Geological and geotechnical data was compiled from previous granular borrow studies in the Lower Mackenzie Valley. The sources of information included: Granular Material Inventories for DIAND, pipeline route investigations for industry, geotechnical investigations for the proposed Mackenzie Highway (Department of Public Works), and Geological Survey of Canada reports and maps. A complete list of reference material utilized in this study is presented in Appendix A.

The deposit outline and location of each potential borrow source is plotted on a composite 1:250,000 scale map, Sheets C1 and C2, in Appendix C. Where more than one study has been conducted on a particular deposit, the largest or most recent interpreted outline is plotted. Proposed borrow mapping area boundaries are also shown, plus the established Inuvialuit Land Selections.

Each potential borrow source is identified with a number which defines the following:

i) the borrow mapping area in which the source occurs
ii) the source number (unique)
iii) the class of material which occurs in the source (in parentheses).

This identification scheme is illustrated in the legend to the map sheets.

The source numbers generally increase from north to south or west to east across the respective borrow mapping areas. Sources incorporated into the study following the initial numbering are numbered consecutively regardless of location. The material classification scheme used for this study is discussed in the next section.

3.2 SUMMARY TABLES

Three tables (B-1A, B-1B and B-2) summarize, for each respective Mapping Area, the pertinent geological and geotechnical data for each potential borrow source and are presented in Appendix B. The summary typically represents an integration of data from several information sources for most deposits, however some deposits only have one information source. In the case of the tables for Areas 1A and 1B, the information is based directly upon the database files created by IDC (1988). There has been no reference, as part of this study, to the original source documents or assessment of the information.

The following data and source parameters are presented on the tables.

3.2.1 Borrow Identification

i) Borrow Source Number: - a unique identification number as discussed above which defines the borrow mapping area, and the source/deposit number; but omits the material classification.

ii) Cross Reference: - the borrow source or deposit number(s) previously defined for a particular deposit during other studies. The super-script number refers to the previous study report as listed in Appendix A.

iii) Location: - the geographic location of each deposit is defined with respect to Universal Transverse Mercator (UTM) zone and coordinates. For irregularly shaped deposits and groups of two or more deposits, the coordinates represent an estimated "centre-of-gravity" point.

3.2.2 Deposit Description

i) Material Type: - a description of the physical nature of the material available in the deposit, in accordance with the Unified Soil Classification system, and including the USC Group symbol where established. An explanation of this system is included in Appendix A.

ii) Material Class: - an assessment of the material quality with respect to its suitability for use in construction. The classification used in this report is one which was developed by DIAND. A condensed version of the classification is included in the legend to the four 1:250,000 scale map sheets. The full classification is as follows:

Granular Material

Class 1 - Excellent quality material consisting of well graded, sands and gravels suitable for concrete aggregate, with a minimum of processing.

Class 2 - Good quality material generally consisting of well graded sands and gravels with varying quantities of silt. The occurrence of deleterious materials may negate its use as concrete aggregate. This material will provide good quality embankment fill; base and surface course aggregates; or possible production of concrete aggregates with extensive processing.

Class 3 - Fair quality material consisting generally of poorly graded, sands and gravels with or without substantial silt content. This material will provide fair quality general fill.

Class 4 - Poor quality material consisting generally of fine-grained, poorly graded silty sand with minor gravel. These deposits usually contain minimal quantities of sand and gravel, weak particles and deleterious materials. These materials are considered unsuitable for construction except as marginal general fill.

Class NG - Non-granular material, including both:

a) Silt and clay material, which is generally unsuitable for construction purposes, and

b) Bedrock of fair to good quality; only available if blasted, quarried and processed. Potentially excellent sources of construction material.

iii) Landform: - a comment on the origin of the geomorphic feature/terrain unit which constitutes the deposit, and within which geologic conditions are interpreted to be relatively uniform. This

allows inferences to be made with respect to the disposition and quality of material in a deposit.

iv) Ice Content: - an estimate of the likely ice content within the material based upon inference, and where available results of test pitting and drillholes. Data is presented in a semi-quantitative form indicating of visible excess ground ice by volume, as follows:

None	=	0% visible excess ice or unfrozen
Low	=	less than 10% visible excess ice
Medium	=	10-30% visible excess ice
High	=	greater than 30% visible excess ice

Terms describing ice features rather than ice content are used in Tables B-1A and B-1B.

v) Surface Drainage: - a comment on the surface drainage characteristics of the deposit (landform) which is semi-quantitative as follows:

Good	=	Surface water drains quite rapidly by runoff and infiltration, soil generally unsaturated, water table relatively depressed.
Fair	=	Surface water drains slowly, no standing water, soil partially saturated, watertable shallow.
Poor	=	Surface water collects (standing water), soil saturated, perched watertable at surface, often associated with thick organic deposits.

Other, self explanatory terms are used in Tables B-1A and B-1B.

3.2.3 Borrow Pit Development Information

i) Estimated Volume: - estimates of the useable granular material volumes available from the deposit, which are assessed and quantified on the basis of the following criteria.

a) Proven Resources: - granular material whose occurrence, distribution, thickness, and quality is supported by ground truth information such as geotechnical drilling, test pitting, and/or exposed stratigraphic sections. The volume is calculated assuming an average actual thickness of granular material sampled, extrapolated over an area of approximately 50 m radius around a drillhole/test pit. Adjustments are applied by assessing deposit homogeneity, ice content, drainage conditions and topography.

b) Probable Resources: - granular material whose existence and extent has been inferred on the basis of several different types of direct or indirect evidence including topography, landform characteristics, airphoto interpretation, extrapolation of stratigraphy, geophysical data and/or limited sampling. Additional investigation is required to determine a reliable estimate. The volume is estimated by projecting the known parameters (used to estimate proven resources) over the entire deposit, while adjustments are applied for drainage conditions and the erratic nature of some deposits.

c) Prospective Resources: - granular material whose existence is merely speculated on the basis of limited indirect evidence such as airphoto interpretation, and/or general geological considerations. The volume is estimated for the maximum areal extent of the deposit, which is assessed from the physical features of the deposit and surrounding areas.

The volumes for some poor quality and non-granular sources have not been evaluated because they are unlikely to be considered for borrow. In addition

volumes for most bedrock sources cannot be defined with any accuracy, as the potential volume is usually very large; hence bedrock volumes are usually assessed as "unlimited".

The database used for Borrow Mapping Areas No 1A and 1B contained limited "Proven" and "Probable" volumes. Hence this information is missing in Tables B-1A and B-1B.

ii) Estimated Recovery Depth: - represents the likely maximum recoverable thickness of useable granular material, which is based upon test-pit and drillhole information (where available), or is otherwise inferred from an assessment of the deposit's physical features.

iii) Overburden Thickness and Type: - a comment on the proven and/or likely type and thickness of non-useable material overlying the granular deposit.

iv) Access: - a comment on the state of development of the deposit, together with information on modes of winter and summer access (where applicable) and the nature of surrounding terrain.

v) Environmental Considerations: - factual comments on particular aspects of environmental sensitivity which would have to be addressed if it was planned to develop the deposit.

vi) Data Quality/Reliability: - a qualitative assessment of the amount of investigative effort which has been put into evaluating the deposit.

This does not include a detailed evaluation of drilling/sampling methods or depth of ground truthing. It is a measure of the level of confidence which can be placed in the summary data. The scheme is as follows:

None	=	no groundtruth test-pitting or drilling information. The data is based solely on airphoto interpretation/terrain analysis.
Poor	=	very few test pits and drillholes, and none to minimal laboratory testing (grain sizes)
Fair	=	several to numerous test pits, drill holes, and numerous laboratory tests (grain sizes, moisture contents, petrographic)
Good	=	numerous to many (tens) of test pits and drill holes, with a comprehensive laboratory testing program including moisture content, grain size, petrographic, organic content, abrasion and soundness tests etc.

The database for Areas 1A and 1B did not included a data quality evaluation.

vii) Overall Assessment: - this is a summary comment which is based on the quality of available granular material with adjustments for ice content, surface drainage conditions and overburden. Little account is taken of accessibility or environmental sensitivity as these are issues which will have to be addressed when development is planned, and once the locations of particular construction projects are known.

The rating applied to each deposit is a qualitative assessment of its suitability for development; the scheme used is as follows: unsuitable, favourable, good, excellent. Other similar terms were available in the database for Areas 1A and 1B.

It is recognized that this scheme reflects (to some extent) the data quality/reliability and so is slightly biased towards those deposits which have been investigated in most detail.

3.3 GUIDELINES FOR ADDITIONAL WORK

This section provides guidelines which could assist in estimating the scope of work for groundtruth drilling and sampling plus comprehensive laboratory testing, which would be required to fully evaluate a particular deposit. It should be noted that some specific recommendations have been made for certain potential sources in recent reports prepared for DIAND by Hardy BBT (1990 a and b).

The basis for estimating the extent of additional work, outlined in the following paragraphs, is considered to be sufficient to allow borrow pit development and restoration plans to be produced.

i) Number of Boreholes:

This would be estimated from a knowledge of the area of a deposit and the likely uniformity of the stratigraphy. Generally, a borehole grid spacing of 50-150 m would be applied. For particularly large deposits i.e., large areal extent, this could result in very large numbers of boreholes (thousands) to fully investigate and prove the whole deposit. It is recognized that in reality

investigations would zero in on small areas of the whole deposit and hence would require proportionately less exploration work.

In any investigation of granular deposits a certain number of test pits are desirable in conjunction with drilling. Test pits provide an opportunity to log exposed stratigraphic sections and obtain representative bulk samples for testing. Thus, a number of test pits should be substituted for drillholes wherever possible. In addition, detailed topographic surveying should be undertaken as part of the field program to obtain data necessary for volume calculations, and also to locate drillholes/test pits and aid in the preparation of stratigraphic sections.

ii) Depth of Boreholes:

This would be estimated from the likely maximum recoverable thickness of useable granular material, which could be either based on drillhole/test pit data, or inferred from geomorphic features.

iii) Laboratory Testing:

The scheme of laboratory tests suggested to classify and evaluate the material properties include the following: Moisture Content, Grain Size, Petrographic Analysis, Los Angeles Abrasion, Sulphate Soundness and Organic Impurities. This testing scheme is focused mainly on determining suitability for use as concrete aggregate. Should grain size and petrographic analyses indicate the material to be unsuitable as concrete aggregate then the latter tests are unnecessary.

Determination of the moisture content is a relatively inexpensive standard test which is most useful in granular materials which contain significant

proportions of sand and fines. It is appropriate in determining suitability for use as general fill, and also suitability for winter development of the source.

The grain size analysis provides the grading characteristics of the material (i.e. percentage of gravel, sand, silt and clay) which aids in classification for various uses, eg. concrete aggregate, base coarse, general fill etc.

The petrographic analysis is a method for appraising the quality of granular material for use as concrete aggregate, and particularly to identify any components which may be deleterious to the concrete. It provides a method for comparing the mineralogical/petrological quality of samples from the same or different sources.

The sulphate soundness and Los Angeles abrasion tests would be applied only to those samples which are considered, on the basis of routine classification testing (gradation/petrographics) to be suitable for use in concrete aggregate. These two tests appraise the durability of coarse aggregate components to both physical abrasion and chemical attack; which simulate conditions which the aggregate is subject to in the manufacture of concrete.

Similarly, the organic impurity determination assesses the proportion of organic compounds in fine aggregates, as these compounds are deleterious to cement mortar and concrete.

The amount of testing suggested is calculated on the following basis:

2 Moisture Contents per 5 m of drilling/test pitting

3 Grain Sizes per 10 m of drilling/test pitting

1 Petrographic Analysis per 5 drillholes/test pits

1 L.A. Abrasion/Sulphate Soundness and Organic Impurity per 10 drillholes/test pits (or a minimum of one per site)

It is recognized that programs for site specific investigations may vary considerably from those indicated, depending on the stratigraphic conditions encountered and the nature of the demand (i.e. general fill or aggregate).

iv) A priority rating is assigned to each deposit. The rating reflects a qualitative assessment of the value of further exploration considering mainly the quality and quantity of available granular material, but also such factors as the local availability of good quality granular material, and proximity to community sites which may consider developing the deposits.

4.0 GRANULAR RESOURCE POTENTIAL

The detailed summary tables of significant granular deposit parameters are presented in Appendix B. The tables are organized by Borrow Mapping Area and the following discussion summarizes the granular resource potential of each mapping area.

4.1 BORROW MAPPING AREA NO. 1A

On Richards Island, 30 potential granular borrow sources have been identified. Based on the evaluation criteria discussed in Section 3.2, the

majority of these sites (18) are considered Unsuitable or Poor prospects. Only 3 deposits are considered Good prospects, 7 are considered Fair, Poor to Good or Suitable. Two of the deposits are recorded as Unknown in the databank. These deposits may be Fair deposits except massive ice is noted.

The Inuvialuit Land Selections occupy the southern part of this mapping area. Preliminary estimates of the total available quantities of Class 1, 2 and 3 granular material in the mapping area, are presented in Table 1. Calculated volumes are presented for those sources within the Inuvialuit Land Selections, the sources on Crown land and combined total volumes within the Mapping Area for each class of material. As discussed in Section 3.2, the Area 1A deposits have been assessed by various investigators. There has been no attempt, as part of this present study, to re-assess or standardize the data as contained in the database (IDC, 1988).

The three Good deposits (1A.08, 09 and 11; Ya-Ya Lake) are within the Inuvialuit Lands. These Ya Ya Lake reserves constitute 90% of the entire potential sources in Area 1A and 99% of the Good sources. A much smaller Suitable deposit (1A.13; Source 220) is on the boundary of the Inuvialuit Lands with the larger geologic feature situated outside the boundary. All of the Fair, Poor and Unsuitable sources are located on Crown land.

The majority of the granular material at Ya-Ya Lake is Class 2. Some Class 3 material is available at Source 1A.13.

TABLE 1

SUMMARY OF GRANULAR RESOURCE VOLUMES, MACKENZIE DELTA REGION

Borrow Mapping Area	Material Class	ALL BORROW SOURCES Estimated Total Volume (10^6 m^3)			GOOD PROSPECTS Estimated Total Volume (10^6 m^3)		
		Proven	Probable	Prospective	Proven	Probable	Prospective
1A ILA	1	-	-	-	-	-	-
	2	23.8	23.8	23.8	13.2	13.2	13.2
	3	0.2	0.2	0.2	-	-	-
1A CROWN	1	-	-	-	-	-	-
	2	0.2	0.2	0.2	-	-	-
	3	0.1	1.4	1.4	-	-	-
1A TOTAL	1	-	-	-	-	-	-
	2	24.0	24.0	24.0	13.2	13.2	13.2
	3	0.3	1.6	1.6	-	-	-
1B ILA	1	0.6	1.3	150.7	0.6	0.6	150.0
	2	-	31.3	34.1	-	29.8	31.9
	3	0.8	162.6	162.6	0.8	4.6	4.7
1B CROWN	1	-	-	-	-	-	-
	2	-	3.8	3.8	-	-	-
	3	-	5.2	5.2	-	-	-
1B TOTAL	1	0.6	1.3	150.7	0.6	0.6	150.0
	2	-	35.1	37.9	-	30.1	32.1
	3	0.8	167.8	167.8	0.8	4.6	4.7

Table 1 (continued)

Borrow Mapping Area	Material Class	ALL BORROW SOURCES Estimated Total Volume (10^6 m^3) Proven	Probable	Prospective	GOOD PROSPECTS Estimated Total Volume (10^6 m^3) Proven	Probable	Prospective
2 ILA	1	0.4	1.0	1.0	0.4	1.0	1.0
	2	9.3	35.3	124.0	1.4	9.5	64.0
	3	23.3	190.0	717.0	15.2	59.0	172.0
2 CROWN	1	-	-	-	-	-	-
	2	6.5	26.0	54.0	6.5	26.0	54.0
	3	10.2	105.0	531.0	-	-	-
2 TOTAL	1	0.4	1.0	1.0	0.4	1.0	1.0
	2	15.8	61.3	178.0	7.9	35.5	118.0
	3	33.5	295.0	1,248.0	15.2	59.0	172.0
STUDY AREA ILA	1	1.0	2.3	151.7	1.0	1.6	151.0
	2	33.1	90.4	181.9	14.6	52.6	109.6
	3	24.3	352.8	879.8	16.0	63.6	176.7
STUDY AREA CROWN	1	-	-	-	-	-	-
	2	6.7	30.0	58.0	6.5	26.0	54.0
	3	10.3	111.6	537.6	-	-	-
STUDY AREA TOTAL	1	1.0	2.3	151.7	1.0	1.6	151.0
	2	39.8	120.4	239.9	21.1	78.6	163.3
	3	34.6	464.4	1,417.4	16.0	63.6	176.7

4.2 BORROW MAPPING AREA No. 1B

The southwest portion of the Tuktoyaktuk Peninsula contains 41 potential granular resources. Of these, 12 are considered Good (Class 1, 2 & 3), 24 are Fair, Poor to Good, Good (Class 4) or Suitable and 5 are considered Unsuitable or Poor.

All of the sources are on Inuvialuit Land with the exception of some underwater deposits (i.e. 1B.21 and 1B.22). Preliminary estimates of the total available quantities of Class 1, 2 and 3 granular material in the mapping area, are presented in Table 1. Calculated volumes are presented for the sources on ILA and Crown land separately as well as totals for the Area.

As in the case of Area 1A, the data has not been re-assessed. It is suspected, however, that the Class 2 reserves may be over-estimated in Area 1B.

4.3 BORROW MAPPING AREA NO.2

A total of 64 potential granular borrow sources have been identified in this area. The overall assessment of this area indicates that 2 deposits are Excellent prospects, 9 are Good prospects, 28 are Favourable prospects, and 25 are Unsuitable prospects.

The Inuvialuit Land Selections occupy much of northern part of this mapping area. Preliminary estimates of the total available quantities of Class 1, 2 and 3 granular material in the management area are presented in Table 1. Calculated volumes are presented for ILA, CROWN sources and totals for the Area. It should be noted that four deposits included in the original Area

2, have been transferred to the new Area 1B as a result of the re-alignment of Area 2, discussed in Section 2.0.

The eleven excellent and good prospects are distributed such that six of them are on ILA land, and five occur on Crown land. The Inuvialuit deposits contain the majority of the Area volume and the only potential Class 1 material. Most of the remaining Inuvialuit granular sources are Class 3. The Crown land contains only potential Class 2 material.

5.0 FUTURE INVESTIGATIONS

The criteria for selecting particular granular resource prospects for future investigation will to a large extent be driven by local or resource development demand. Since the majority of the Good prospects and volume of granular materials are on Inuvialuit land, it is expected most of the future investigations will occur on Inuvialuit land. In 1989, Hardy BBT, on behalf of DIAND (IFA Implementation), investigated two Inuvialuit deposits in more detail, namely, 1B. 1B.01 (155) and 2.13 (I407). The respective tables in Appendix B include the latest data from this investigation.

In conjunction with that 1989 study, Hardy BBT (1990a and b) have made recommendations for further investigations. This present report will provide a starting point for the assessment of supply and demand and for the development of priorities for future granular resource investigations, whether initiated by DIAND, ILA or industry.

In a companion report, also intended for presentation at the March 1990, Inuvik Workshop, Hardy BBT has prepared an update on government,

community and industry granular demands. This study presents a preliminary supply-demand model, depicting supply and demand volumes on a UTM grid basis. This first attempt to bring together known demands along with the complete regional summary of all supply provides a potentially useful tool for the development of regional and local borrow source management plans. However, the response to a demand survey of all potential users was poor and therefore the supply-demand model is of limited value at this stage.

As soon as particular granular deposits are identified for future investigation, the guidelines provided in Section 3.3 can be used to determined the approximate scope of work that should be considered.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This study has tabulated 135 potential granular sources in the Mackenzie Delta region and has provided a summary of all pertinent geological and geotechnical parameters for each source. The summary of these sources has identified 28 deposits which are excellent or good prospects by virtue of the quality of granular material which they contain. The majority (23) of these deposits are within the Inuvialuit Land Selections and the remainder (5) are on Crown land. Most of these 28 deposits should probably be considered for additional exploration work and testing to fully evaluate their potential as sources of excellent to fair quality (Class 1, 2 and 3) granular material.

The study has focused only on natural granular materials; bedrock sources have been classified as non-granular (NG)b. However, as some bedrock sources have the potential to provide granular material of excellent quality,

more detailed evaluation of bedrock in the study area is warranted. This is particularly true in areas where surficial granular materials are scarce.

It is quite likely that "pods" of Class 1 material may occur within deposits which are classified as Class 2 or 3. Also, some processing of Class 2 material may provide Class 1 aggregate which is suitable for use in concrete.

The occurrence of massive ice bodies within granular deposits is of particular concern during borrow pit development. The massive ice represents waste material which must often be removed to access valuable granular material. Melt water from stockpiled ice must be controlled to prevent siltation of streams; and if left in situ care must be taken to prevent or control melting and degradation of pit slopes/faces. A more accurate delineation of massive ice is therefore desirable in the investigation stage, so that better planning can be undertaken. The use of geophysical techniques, such as resistivity surveying and ground radar, have been employed successfully in permafrost terrain for various purposes. It is suggested that geophysics could form a useful component to any subsequent field programs designed to evaluate granular deposits in the Mackenzie Delta Region.

Comprehensive guidelines for the development of borrow sources exist in the publication "Environmental Guidelines Pits and Quarries" which is published by INAC (1982). This booklet covers all aspects of planning, designing, operating and restoring borrow pits. Additional sections deal with the special problems of permafrost, and particular aspects of planning, designing and operating quarries.

The environmental impact of borrow source development has been addressed in a general way only in the tables which are included in Appendix B. The comments included on the tables are taken from studies conducted up to 15 years ago. In the light of more recent data, increased environmental knowledge and modern philosophies concerning environmental protection, a comprehensive environmental study would now be appropriate to fully update and highlight those environmental parameters which will constrain borrow source development in the Mackenzie Delta Region.

A relatively small proportion of the borrow sources have been developed, and are either abandoned or still being exploited. In order to maintain a relatively accurate inventory of remaining volumes, the amounts of granular materials extracted needs to be determined.

Reference should be made to the companion report "Preliminary Granular Resources Demand, Mackenzie Delta Region", by Hardy BBT (1990).

Respectfully submitted,

Hardy BBT Limited

A.J. Hanna, M.A.Sc., P.Eng.
Manager, Northern Operations

AH/gw
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- Community Study Area, Norman Wells, NWT
- Community Study Area, Fort Good Hope, NWT
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APPENDIX A

LIST OF CROSS REFERENCED REPORTS, AND EXPLANATION SHEETS

LIST OF CROSS REFERENCED REPORTS

Super-Script Number

1. Pemcan Services "72". Stage I, Granular Materials Inventory.
- Intercommunity Study Area, Norman Wells to Fort Good Hope, NWT
- Community Study Area, Norman Wells, NWT
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APPENDIX B

TABLES B-1A, B-1B AND B-2
SUMMARY OF POTENTIAL BORROW SOURCE DATA

TABLE 8-1A BORROW MAPPING AREA 1A - SUMMARY OF POTENTIAL BORROW MAPPING AREA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
1A.01	202A	ZONE 8 492,000E 7,691,000N	SAND-TRACE SILT	3	GLACIOFLUVIAL DELTA		MODERATE		3.7	0.9 SILT	UNDEVELOPED OVER LAKES AND CHANNELS OF DELTA WINTER ICE ROAD	KENDALL BIRD SANCTUARY CRITICAL WILDLIFE; MASSIVE ICE; MACKENZIE REINDEER		UNSUITABLE
1A.02	203A	ZONE 8 496,000E 7,686,000N	SAND-TRACE SILT	3	GLACIOFLUVIAL DELTA AND BEACH		MODERATE		2.4	0.6 ORGANIC SILT	UNDEVELOPED OVER LAKES AND CHANNELS OF DELTA WINTER ICE ROAD	KENDALL BIRD SANCTUARY CRITICAL WILDLIFE; MASSIVE ICE; NEGLIGIBLE VOLUME		UNSUITABLE
1A.03	200A	ZONE 8 495,000E 7,684,500N	SAND-TRACE GRAVEL	3	GLACIOFLUVIAL BEACH & DELTA DEPOSIT	MASSIVE ICE	MODERATE	B) 11,400 C) 11,400	0.7 - 9.1	0.6 MOSS & SILT	UNDEVELOPED OVERCHANNEL & RIVERS WINTER ICE ROAD	KENDALL BIRD SANCTUARY CRITICAL WILDLIFE; EROSION; MASSIVE ICE		UNSUITABLE
1A.04	201A	ZONE 8 496,000E 7,683,000E	SAND-TRACE GRAVEL TRACE SILT	3	GLACIOFLUVIAL DELTA PLAIN		MODERATE TO POOR	B) 38,000 C) 38,000	0.3 - 4.6	0.9 SILT	UNDEVELOPED OVER LAKES AND CHANNELS WINTER ICE ROAD	KENDALL BIRD SANCTUARY CRITICAL WILDLIFE; MASSIVE ICE; BEACH EROSION		UNSUITABLE
1A.05	205A	ZONE 8 515,000E 7,695,500N	SILT-SAND TRACE GRAVEL	4	GLACIOFLUVIAL KAME REMNANT		MODERATE		0.4	0.3 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD	CRITICAL WATERFOWL & REINDEER; MASSIVE ICE; POOR QUALITY;		UNSUITABLE
1A.06	227	ZONE 8 510,000E 7,670,000N	SAND-SOME GRAVEL, TRACE SILT	3	GLACIOFLUVIAL KAME	MASSIVE ICE	MODERATE	B) 304,000 C) 304,000	1.2 - 9.1	0.3 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	IMPORTANT WATERFOWL & REINDEER, SILTATION; MASSIVE ICE		POOR
1A.07	YAYA-D 226	ZONE 8 514,000E 7,665,900N	SAND-GRAVEL	2	GLACIOFLUVIAL LACUSTRINE ESKER-KAME COMPLEX	MASSIVE ICE, ICE WEDGE POLYGONS; ICE LENSES	WELL		0 - 6.1	0 - 3.1 SILT & ORGANICS	PARTIALLY DEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	MASSIVE ICE REQUIRIES PIT MANAGEMENT; HIGH COST EXCAVATION; RESTORATION		UNSUITABLE
1A.08	YAYA-A 225	ZONE 8 509,500E 7,665,200N	SAND-GRAVEL	2	GLACIOFLUVIAL-LACUSTRINE ESKER-KAME COMPLEX	MASSIVE ICE, ICE WEDGE POLYGONS; ICE LENSES	WELL	TOTAL: 6,004,000	0.0 - 29.0	0 - 11.3 SILT,ORGANICS & ICE	PARTIALLY DEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	MASSIVE ICE REQUIRIES PIT MANAGEMENT; HIGH COST EXCAVATION; RESTORATION		GOOD
1A.09	YAYA-B 224	ZONE 8 512,500E 7,665,000N	SAND-GRAVEL	2	GLACIOFLUVIAL LACUSTRINE ESKER-KAME COMPLEX	MASSIVE ICE, ICE WEDGE POLYGONS; ICE LENSES	WELL	TOTAL: 4,180,000	1.2 - 22.6	0.3 - 7.6 SILT & ORGANICS	PARTIALLY DEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	MASSIVE ICE REQUIRIES PIT MANAGEMENT; HIGH COST EXCAVATION; RESTORATION		GOOD
1A.10	204	ZONE 8 518,000E 7,656,000N	SAND-GRAVEL	3	GLACIOFLUVIAL TERRACE	MASSIVE ICE	MODERATE	A) 152,000 B) 152,000	2.5	0.6 ORGANIC	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	SILTATION; FISH SPAWNING; ARCHAEOLOGICAL SITE; MASSIVE ICE; MACKENZIE REINDEER		POOR
1A.11	YAYA-C 223	ZONE 8 515,000E 7,664,900N	SAND-GRAVEL	2	GLACIOFLUVIAL LACUSTRINE ESKER-KAME COMPLEX	MASSIVE ICE, ICE WEDGE POLYGONS; ICE LENSES	WELL	TOTAL: 3,040,000	0 - 14.9	0 - 8.2 SILT,ORGANICS CLAY TILL, ICE	PARTIALLY DEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	MASSIVE ICE REQUIRIES PIT MANAGEMENT; HIGH COST EXCAVATION; RESTORATION		GOOD
1A.12	221A	ZONE 8 515,000E 7,669,000N	SAND-SILT	4	GLACIOFLUVIAL KAME	MASSIVE ICE	MODERATE		4.3	0.3 -0.9 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	IMPORTANT WATERFOWL & REINDEER; RECREATIONAL AREA; LOW QUALITY; MASSIVE ICE		UNSUITABLE
1A.13	220	ZONE 8 516,000E 7,676,000N	SAND-SOME GRAVEL	3	GLACIOFLUVIAL ESKER		MODERATE	B) 76,000 C) 76,000	5.4	0.3 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	IMPORTANT WATERFOWL & REINDEER; SILTATION; RECREATION; MASSIVE ICE		SUITABLE
1A.14	219	ZONE 8 517,000E 6,677,000N	SAND-SOME GRAVEL	2	GLACIOFLUVIAL FLAT - TOPPED RIDGE			A) 230,000		3.0 PEAT TRACE SILT	PARTIALLY DEVELOPED WINTER ICE ROAD BARGE IN SUMMER	WATERFOWL & REINDEER LAKE SILTATION; RECREATION		FAIR
1A.15	218	ZONE 8 521,500E 7,683,500N	SAND-SILT	3	GLACIOFLUVIAL HILLOCKS	MASSIVE ICE			1.5	0.3 ORGANIC SILT, ROOTS	PARTIALLY DEVELOPED WINTER ICE ROAD	WATERFOWL & REINDEER		POOR TO GOOD
1A.16	218W	ZONE 8 523,500E 7,688,000N	SAND-SILT AND ICE	3	GLACIAL OUTWASH	MASSIVE ICE			0.0 - 6.5	1.5 - 2.0 PEAT ROOTLETS, ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD	WATERFOWL & REINDEER		POOR TO GOOD

TABLE B-1A BORROW MAPPING AREA 1A - SUMMARY OF POTENTIAL BORROW MAPPING AREA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M^3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
1A.17	207	ZONE 8 518,500E 7,695,000N	SAND-TRACE GRAVEL	3	GLACIOFLUVIAL KAME-ESKER COMPLEX	POLYGON ICE WEDGES	MODERATE	B) 152,000 C) 152,000	1.2	0.5 ORGANIC TOPSOIL	UNDEVELOPED ACROSS DELTA WINTER ICE ROAD; BARGE IN SUMMER	IMPORTANT WATERFOWL & REINDEER; MASSIVE ICE; VARIABLE DEPOSIT; THERMOKARSTIC		POOR
1A.18	206	ZONE 8 521,000E 7,696,000N	SAND-SOME SILT, TRACE GRAVEL	3	GLACIOFLUVIAL ESKER REMNANT	MASSIVE ICE; ICE WEDGE POLYGONS; ICE LENSES	MODERATE	B) 152,000 C) 152,000	1.2 - 6.1	0.5 ORGANIC TOPSOIL	UNDEVELOPED ACROSS LAKES AND CHANNELS OF DELTA WINTER ICE ROAD	IMPORTANT WATERFOWL & REINDEER; MASSIVE ICE; INCONSISTANT MATERIAL		POOR
1A.19	210A	ZONE 8 525,000E 7,707,000N	SAND-SILT	4	GLACIOFLUVIAL TERRACE		MODERATE		4.6	0.9 SILT	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WATERFOWL & REINDEER; HIGH SILT & ICE CONTENT; THERMOKARSTIC		UNSUITABLE
1A.20	209	ZONE 8 526,000E 7,727,500N	SAND-TRACE SILT	4	GLACIOFLUVIAL KAME		MODERATE	B) 91,200 C) 91,200	1.8	ORGANIC GROUND COVER	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WATERFOWL & REINDEER; MASSIVE ICE; HIGH % FINE SAND		POOR
1A.21	208	ZONE 8 527,000E 7,704,500N	SAND-SOME SILT	3	GLACIOFLUVIAL TERRACE REMNANT	MASSIVE ICE	MODERATE			0.3 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WATERFOWL & REINDEER; MASSIVE ICE; POOR MATERIAL; HIGH ICE & SILT		POOR
1A.22	211	ZONE 8 528,000E 7,690,000N	SAND-SOME GRAVEL,	2/4	GLACIOFLUVIAL ESKER	MASSIVE ICE	POOR	A) 136,000 B) 494,000	4.0	0.3 - 0.9 PEAT SILT, ROOTLETS	PARTIALLY DEVELOPED WINTER ICE ROAD	DRAINAGE; HUNTING AND TRAPPING AREA; WATERFOWL & REINDEER		FAIR
1A.23	212	ZONE 8 527,000E 7,684,000N	SAND-LITTLE GRAVEL	3	GLACIOFLUVIAL OUTWASH REMNANT	POLYGONAL ICE WEDGES	MODERATE	B) 190,000 C) 190,000	1.4	PEAT	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WATERFOWL & REINDEER; MASSIVE ICE; FURTHER DELINEATION		FAIR
1A.24	217	ZONE 8 522,500E 7,675,000N	SAND-SILT BEDS	4	GLACIOFLUVIAL RIDGE	MASSIVE ICE		A) 7,500	5.0	0.2 ROOT MATERIAL ORGANICS	PARTIALLY DEVELOPED WINTER ICE ROAD	WATERFOWL & REINDEER		POOR
1A.25	217E	ZONE 8 524,000E 7,676,000N	SILT-SAND	4	GLACIOFLUVIAL KAMES;TERRACES				2.5	0.2 ROOT MATERIAL & ORGANICS	UNDEVELOPED WINTER ICE ROAD	SILT PREDOMINATES; NO ENGINEERING VALUE		UNSUITABLE
1A.26	222	ZONE 8 522,500E 7,667,500N	SAND & GRAVEL LITTLE SILT	2	GLACIOFLUVIAL TERRACE REMNANTS	MASSIVE ICE; ICE WEDGE POLYGONS	MODERATE WELL	A) 10,640,000 B) 10,640,000		0 - 3.4 PEAT SAND, SILT CLAY	UNDEVELOPED STEEP APPROACHES WINTER ICE ROAD; BARGE IN SUMMER	SUMMER USE ENVIRONMENTAL PROBLEMS & ACCESS COSTS; SILTATION OF WATERWAYS; REINDEER GRAZING		FAIR
1A.27	216S	ZONE 8 526,400E 7,675,000N	SAND-SOME SILT	3	GLACIOFLUVIAL OUTWASH PLAIN	MASSIVE ICE			4.0		UNDEVELOPED WINTER ICE ROAD	WATERFOWL & REINDEER		UNKNOWN
1A.28	216	ZONE 8 527,000E 7,677,000W	SAND-VARIABLE SILT, TRACE GRAVEL	4	GLACIOFLUVIAL RIDGE	MASSIVE ICE			4.5	0.3 - 0.5 PEAT ORGANIC SILT	PARTIALLY DEVELOPED WINTER ICE ROAD	WATERFOWL & REINDEER		UNKNOWN
1A.29	213	ZONE 8 534,000E 7,692,000N	SAND-TRACE SILT	4	GLACIOFLUVIAL TERRACE REMNANTS		MODERATE	B) 304,000 C) 304,000	1.5	0.6 ORGANIC SILT	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	IMPORTANT WATERFOWL & REINDEER; FISH SPAWNING; MASSIVE ICE; LOW QUALITY		POOR
1A.30	211E	ZONE 8 534,000E 7,690,000N	SAND	4	GLACIOFLUVIAL RIDGE; TERRACE	MASSIVE ICE		A) 15,000	2.0	0 - 0.5 ORGANIC SILT ROOTLETS	W RIDGE PARTIAL DEV WINTER ICE ROAD	WATERFOWL & REINDEER		UNSUITABLE

TABLE B-1B BORROW MAPPING AREA 1B - SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
1B.01	155N 155S	ZONE 8 555,000E 7,681,000N	SAND-SOME GRAVEL, LITTLE SILT (SM-SP)	3 2/3	ALLUVIAL BENCHES	MEDIUM TO HIGH	FAIR	A) 368,000 A) 423,000 B) 1,235,000 C) 1,375,000	0.9 - 1.5	0.3 - 0.6 PEAT/SILT	UNDEVELOPED REMOTE THERMOKARST TERRAIN	SILTATION OF ADJACENT STREAM		GOOD GOOD
1B.02	174 30b	ZONE 8 566,000E 7,663,000N	SAND-GRAVEL SOME SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE PROBABLY	EXCELLENT TO MODERATE	B) 3,268,000	0.9 - 4.9	VARIABLE SILT	UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		GOOD
1B.03	30S	ZONE 8 570,000E 7,662,500	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE	B) 225,000 C) 229,000	0.6 - 4.6	0.2 - 0.5 SILT ORGANICS PEAT, ROOTS	UNDEVELOPED WINTER ICE ROAD	CRITICAL CARIBOU CALVING AREA - CWS APPROVAL		SUITABLE
1B.04	173 23C, 23D, 23B	ZONE 8 569,000E 7,664,000N	SAND-GRAVEL SOME SILT	1	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE PROBABLY	EXCELLENT	B) 684,000	4.6	0 - 2.7 PEAT SILT, ROOTLETS	UNDEVELOPED WINTER ICE ROAD	DISTANCE SMALL VOLUME		FAIR
1B.05	23A	ZONE 8 570,000E 7,662,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD				UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR TO GOOD
1B.06	23	ZONE 8 573,000E 7,661,500N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD			4.6 - 6.1 SILTY CLAY, ICE	UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		POOR TO FAIR
1B.07	24B	ZONE 8 573,000E 7,663,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD				UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR TO GOOD
1B.08	30d	ZONE 8 574,000 7,671,500	GRAVEL AND SAND	3	GLACIOFLUVIAL ESKER REMNANT	THERMO-KARSTIC	MODERATE	B) 45,600 C) 45,600	3.0	0.3 SILT, PEAT	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WILDLIFE AREA		POOR
1B.09	179	ZONE 8 578,000E 7,674,000N	SAND-THIN GRAVEL, LITTLE SILT	3	GLACIOFLUVIAL OUTWASH PLAIN		EXCELLENT	B) 4,560,000	9.1	0 - 1.5 SILT-PEAT WITH ROOTLETS	UNDEVELOPED OVERLAND WINTER ICE ROAD	DISTANCE; DETAILED EXPLORATION		FAIR
1B.10	24A	ZONE 8 578,000E 7,667,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL KAME FIELD	POLYGONAL ICE WEDGES, MASSIVE ICE	GOOD	B) 134,000			UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR
1B.11	172 24	ZONE 8 579,000E 7,669,000N	SAND-MINOR GRAVEL	4	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE POSSIBLY	GOOD	B) 912,000	4.6	0.9 - 3.1 PEAT-ROOTLETS	UNDEVELOPED WINTER ICE ROAD	DISTANCE; LOW VOLUME		FAIR
1B.12	171 25	ZONE 8 584,000E 7,672,000N	SAND-GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE POSSIBLY	GOOD	B) 1,520,000	6.1	2.1 SILT	UNDEVELOPED ALONG PROPOSED TUK-INUVIK HIGHWAY ROUTE WINTER ICE ROAD	EASIER ACCESS IF HIGHWAY CONSTRUCTED; NEEDS DETAILED EXPLORATION		GOOD
1B.13	26,26A,26B	ZONE 8 584,000E 7,677,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD				UNDEVELOPED WINTER ICE ROAD	LOW VOLUME		POOR
1B.14	27B	ZONE 8 583,500E 7,680,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 38,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.15	27A	ZONE 8 585,000E 7,681,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 191,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.16	27	ZONE 8 584,000E 7,682,500N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 34,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.17	28	ZONE 8 583,500E 7,683,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD				UNDEVELOPED WINTER ICE ROAD	LOW VOLUME		POOR

TABLE B-1B BORROW MAPPING AREA 1B - SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
1B.18	177	ZONE 8 581,000E 7,665,000N	SAND-GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN	MASSIVE ICE POSSIBLY	EXCELLENT	B) 19,000,000	4.6	0 - 1.5 PEAT-SOME SILT	UNDEVELOPED WINTER ICE ROAD	LIMITED EXPLORATION; DISTANCE		GOOD
1B.19	182	ZONE 8 580,000E 7,694,000N	SAND-TRACE GRAVEL	3	GLACIOFLUVIAL OUTWASH PLAIN AEOLIAN DUNES	POLYGONAL ICE WEDGES	MODERATE TO WELL				UNDEVELOPED OVER TUNDRA WINTER ICE ROAD	LAKE SILTATION NOT COST EFFECTIVE		POOR
1B.20	156	ZONE 8 575,000E 7,703,000N	SAND-SOME GRAVEL	3	GLACIOFLUVIAL OUTWASH PLAIN;			B) 288,800	0.3 - 0.8		UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	COASTAL EROSION; ENVIRONMENTAL CONCERNS		GOOD
1B.21	162	ZONE 8 579,000E 7,707,000N	SAND-GRAVEL	3	GLACIOFLUVIAL HARBOUR SEDIMENTS	NONE-EXCEPT NEAR SHORELINE		B) 5,244,000	0.3		UNDEVELOPED ACROSS TUK HARBOUR WINTER ICE ROAD; BARGE IN SUMMER	LIMITED TESTING		FAIR
1B.22	158	ZONE 8 578,000E 7,702,000N	SAND-SOME GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN;	ABSENT	FLOODED	B) 3,100,000	0.3		UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	COASTAL EROSION NEEDS FURTHER INVESTIGATION; FLOODED		FAIR
1B.23	157	ZONE 8 577,000E 7,720,000N	SAND-SOME GRAVEL	4	GLACIOFLUVIAL OUTWASH PLAIN;			B) 1,092,000	1.8	NONE	UNDEVELOPED WINTER ICE ROAD; BARGE IN SUMMER	COASTAL EROSION		GOOD
1B.24	159	ZONE 8 580,000E 7,708,000N	SAND-DISCONTINOUS GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN;		GOOD	B) 3,500,000	0.1 - 2.1	0.3 - 1.8 PEAT-ROOTS SILT	UNDEVELOPED ACROSS TUK HARBOUR WINTER ICE ROAD; BARGE IN SUMMER	PRESERVATION OF PERMAFROST; PIT RESTORATION		GOOD
1B.25	160A	ZONE 8 582,000E 7,704,000N	SAND-LITTLE SILT AND GRAVEL	2-3	GLACIOFLUVIAL OUTWASH PLAIN; TERRACE	MASSIVE, DENSE, VEIN ICE WEDGES	MODERATELY WELL	A) 300,000 B) 300,000	2.3 -5.6	0.0 - 1.0 PEAT-ORGANIC SILT	UNKNOWN DOWN TUK HARBOUR WINTER ICE ROAD; BARGE IN SUMMER WEATHER	THAW PONDS; DOCKING FACILITIES & ACCESS IN SUMMER; DRAINAGE		FAIR
1B.26	160B	ZONE 8 582,000E 7,704,000N	SAND-GRAVEL, SOME SILT	2-3	GLACIOFLUVIAL TERRACE	MASSIVE DENSE, VEIN & ICE WEDGES	WELL	A) 148,000 B) 148,000	2.7 - 6.0	0.2 - 2.5 PEAT-ORGANIC SILT	UNKNOWN ACROSS TUK HARBOUR & MAYOGIAK INLET WINTER ICE ROAD; BARGE IN SUMMER	SMALL VOLUME; GREAT DISTANCE; THAW PONDS; DOCKING FACILITIES & SUMMER ACCESS		FAIR TO GOOD
1B.27	161C	ZONE 8 582,000E 7,702,000N	SAND-SOME GRAVEL AND SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; TERRACE	MASSIVE DENSE, VEIN & ICE WEDGES	MODERATE TO WELL	A) 13,500 B) 13,500	2.0 - 3.7	0.0 - 1.6 PEAT - ORGANICS, SILT	ACROSS TUK HARBOUR & MAYOGIAK INLET; WINTER ICE ROAD; BARGE	SMALL VOLUME, GREAT DISTANCE, DOCKING FACILITIES SUMMER		GOOD TO FAIR
1B.28	160D	ZONE 8 582,000E 7,704,000N	SAND-GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN; TERRACE	MASSIVE DENSE, VEIN & ICE WEDGES	MODERATE TO WELL	A) 92,000 B) 92,000	2.0 - 4.5	PEAT-ORGANICS, SILT	ACROSS TUK HARBOUR & MAYOGIAK INLET; WINTER ICE ROAD; BARGE	SMALL VOLUME, GREAT DISTANCE, DOCKING FACILITIES SUMMER		FAIR TO GOOD
1B.29	161E	ZONE 8 582,000E 7,702,000N	SAND-SOME GRAVEL,TRACE SILT	2-3	GLACIOFLUVIAL OUTWASH PLAIN; TERRACE	MASSIVE, DENSE, VEIN & ICE WEDGES	MODERATE TO WELL	A) 65,000 B) 65,000	3.4 - 6.2	0.0 - 0.2 PEAT-ORGANIC SILT	UNKNOWN ACROSS TUK HARBOUR & MAYOGIAK INLET WINTER ICE ROAD; BARGE IN SUMMER	WEATHER; SMALL VOLUME GREAT DISTANCE; DOCKING FACILITIES & SUMMER ACCESS		GOOD TO FAIR
1B.30	161F	ZONE 8 582,000N 7,702,000N	SAND-GRAVEL	2-3	GLACIOFLUVIAL OUTWASH PLAIN; TERRACE	MASSIVE DENSE, VEIN & ICE WEDGES	MODERATE TO WELL	A) 50,000 B) 50,000	3.3	0.0 - 0.2 PEAT-ORGANIC SILT	UNKNOWN ACROSS TUK HARBOUR & MAYOGIAK INLET WINTER ICE ROAD; BARGE IN SUMMER	WEATHER; SMALL VOLUME GREAT DISTANCE; DOCKING FACILITIES & SUMMER ACCESS		GOOD TO FAIR
1B.31	181	ZONE 8 583,000E 7,695,000N	SAND-SOME GRAVEL	3	GLACIOFLUVIAL OUTWASH PLAIN; KAME TERRACE	POLYGON ICE WEDGES	MODERATE TO WELL	B) 260,000 C) 260,000	0.4 - 1.3	0.1 - 0.3 PEAT-SAND SOME SILT	UNDEVELOPED OVER TUNDRA WINTER ICE ROAD	LAKE SILTATION LOW VOLUME, NOT COST EFFECTIVE		FAIR
1B.32	183	ZONE 8 580,000E 7,692,000N	SAND-SOME GRAVEL	3	GLACIOFLUVIAL OUTWASH PLAIN; KAME TERRACE	POLYGON ICE WEDGES	MODERATE TO WELL	B) 118,500 C) 118,500	0.6 - 1.7	0.1 - 0.3 PEAT-SAND SOME SILT	UNDEVELOPED OVER TUNDRA WINTER ICE ROAD	LAKE SILTATION; LOW VOLUME, NOT COST EFFECTIVE		FAIR

TABLE B-1B BORROW MAPPING AREA 1B - SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
1B.01	155N 155S	ZONE 8 535,000E 7,681,000N	SAND-SOME GRAVEL, LITTLE SILT (SM-SP)	3 2/3	ALLUVIAL BENCHES	MEDIUM TO HIGH	FAIR	A) 388,000 A) 427,000 B) 1,235,000 C) 1,325,000	0.9 - 1.5	0.3 - 0.6 PEAT/SILT	UNDEVELOPED REMOTE THERMOKARST TERRAIN	SILTATION OF ADJACENT STREAM		GOOD GOOD
1B.02	174 306	ZONE 8 566,000E 7,663,000N	SAND-GRAVEL SOME SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE PROBABLY	EXCELLENT TO MODERATE	B) 3,268,000	0.9 - 4.9	VARIABLE SILT	UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		GOOD
1B.03	305	ZONE 8 570,000E 7,662,500	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE	B) 228,000 C) 228,000	0.6 - 4.6	0.2 - 0.5 SILT ORGANICS PEAT, ROOTS	UNDEVELOPED WINTER ICE ROAD	CRITICAL CARIBOU CALVING AREA - CWS APPROVAL		SUITABLE
1B.04	173 23C, 23D, 23B	ZONE 8 569,000E 7,664,000N	SAND-GRAVEL SOME SILT	1	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE PROBABLY	EXCELLENT	B) 684,000	4.6	0 - 2.7 PEAT SILT, ROOTLETS	UNDEVELOPED WINTER ICE ROAD	DISTANCE SMALL VOLUME		FAIR
1B.05	23A	ZONE 8 570,000E 7,662,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD				UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR TO GOOD
1B.06	23	ZONE 8 573,000E 7,661,500N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD			4.6 - 6.1 SILTY CLAY, ICE	UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		POOR TO FAIR
1B.07	24B	ZONE 8 573,000E 7,663,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	POLYGONAL ICE WEDGES, MASSIVE ICE	MODERATE TO GOOD				UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR TO GOOD
1B.08	304	ZONE 8 574,000 7,671,500	GRAVEL AND SAND	3	GLACIOFLUVIAL ESKER REMNANT	THERMO-KARSTIC	MODERATE	B) 45,600 C) 45,600	3.0	0.3 SILT, PEAT	UNDEVELOPED WINTER ICE ROAD	IMPORTANT WILDLIFE AREA		POOR
1B.09	170	ZONE 8 578,000E 7,674,000N	SAND-THIN GRAVEL, LITTLE SILT	3	GLACIOFLUVIAL OUTWASH PLAIN		EXCELLENT	B) 4,560,000	9.1	0 - 1.5 SILT-PEAT WITH ROOTLETS	UNDEVELOPED OVERLAND WINTER ICE ROAD	DISTANCE; DETAILED EXPLORATION		FAIR
1B.10	24A	ZONE 8 578,000E 7,667,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL KAME FIELD	POLYGONAL ICE WEDGES, MASSIVE ICE	GOOD	B) 134,000			UNDEVELOPED WINTER ICE ROAD	DISTANCE, DIFFICULT TERRAIN		FAIR
1B.11	172 24	ZONE 8 579,000E 7,669,000N	SAND-MINOR GRAVEL	4	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE POSSIBLY	GOOD	B) 912,000	4.6	0.9 - 3.1 PEAT-ROOTLETS	UNDEVELOPED WINTER ICE ROAD	DISTANCE; LOW VOLUME		FAIR
1B.12	171 25	ZONE 8 584,000E 7,672,000N	SAND-GRAVEL	2	GLACIOFLUVIAL OUTWASH PLAIN; KAME COMPLEX	MASSIVE ICE POSSIBLY	GOOD	B) 1,520,000	6.1	2.1 SILT	UNDEVELOPED ALONG PROPOSED TUK-INUVIK HIGHWAY ROUTE WINTER ICE ROAD	EASIER ACCESS IF HIGHWAY CONSTRUCTED; NEEDS DETAILED EXPLORATION		GOOD
1B.13	26.26A,26B	ZONE 8 584,000E 7,677,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD				UNDEVELOPED WINTER ICE ROAD	LOW VOLUME		POOR
1B.14	27B	ZONE 8 583,500E 7,680,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 38,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.15	27A	ZONE 8 585,000E 7,681,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 191,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.16	27	ZONE 8 584,000E 7,682,500N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD	B) 34,000			UNDEVELOPED WINTER ICE ROAD			GOOD
1B.17	28	ZONE 8 583,500E 7,683,000N	SAND AND GRAVEL-TRACE SILT	2	GLACIOFLUVIAL OUTWASH PLAIN		GOOD				UNDEVELOPED WINTER ICE ROAD	LOW VOLUME		POOR

TABLE B-2 BORROW MAPPING AREA 2 – SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
2.01	151[2]	ZONE 8 515,000E 7,641,000N	DEPOSIT TRANSFERRED TO BORROW MAPPING AREA No. 1B - SEE TABLE B - 1B											
2.02	214[2] BO2-16[9]	ZONE 8 542,100E 7,644,100N	SAND-FINE TRACE SILT (SP)	4	ALLUVIAL TERRACE	MEDIUM	GOOD	A) 50,000 B) 500,000 C) 6 X 10^6	9	0-0.6 TOPSOIL/ SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	MAJOR WATERFOWL STAGING AREA SILTATION INTO RIVER	POOR	UNSUITABLE
2.03	213[2]	ZONE 8 532,500E 7,641,500N	SAND & GRAVEL TRACE SILT (SW)	3	DELTA REMNANT	LOW TO MEDIUM	GOOD	A) 5,000 B) 25,000 C) 35,000	1.5	0.3-1.8 TOPSOIL & SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	MAJOR WATERFOWL STAGING AREA, SILTATION OF RIVER	POOR	UNSUITABLE
2.04	304[2]	ZONE 8 573,000E 7,671,500N	DEPOSIT TRANSFERRED TO BORROW MAPPING AREA No. 1B - SEE TABLE B - 1B											
2.05	305[2]	ZONE 8 549,000E 7,642,000N	DEPOSIT TRANSFERRED TO BORROW MAPPING AREA No. 1B - SEE TABLE B - 1B											
2.06	306[2] BO3-1[9]	ZONE 8 542,700E 7,661,500N	DEPOSIT TRANSFERRED TO BORROW MAPPING AREA No. 1B - SEE TABLE B - 1B											
2.07	BO2-37[9]	ZONE 8 525,000E 7,664,000N	SAND	4	GLACIOFLUVIAL OUTWASH PLAIN		FAIR TO GOOD	C) 25 X 10^6	30	0.6-3.3 TOPSOIL & SILT	UNDEVELOPED WINTER ROAD, FLAT THERMOKARST TERRAIN SUMMER-BARGE	NO MAJOR CONCERNS	NONE	UNSUITABLE
2.08	303[2] LUCAS POINT[5] BO2-32[9]	ZONE 8 518,200 E 7,622,000N	SAND AND GRAVEL, TRACE OF SILT (SW-GP)	3	GLACIOFLUVIAL TERRACES	LOW TO MEDIUM	GOOD	A) 4.5 X 10^6 B) 7 X 10^6 C) 10 X 10^6	6	0.9-1.5 PEAT/ORG. SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	MAJOR WATERFOWL STAGING AND BREEDING AREA SILTATION INTO RIVER	GOOD	GOOD
2.09	302[2] BO2-23[9]	ZONE 8 516,600E 7,657,700N	GRAVEL AND SAND SOME SILT (GW-GM)	1	GLACIOFLUVIAL TERRACE	LOW TO HIGH	GOOD	A) 400,000 B) 1 X 10^6 C) 1 X 10^6	3	0-0.15 PEAT AND SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	IMPORTANT WATERFOWL STAGING AND BREEDING AREA	POOR	GOOD
2.10	301[2] BO2-3[9]	ZONE 8 519,800 E 7,652,200N	SAND AND GRAVEL, LITTLE SILT (GW-GM)	3	GLACIOFLUVIAL TERRACE	LOW TO HIGH	GOOD	A) 500,000 B) 2.5 X 10^6 C) 4 X 10^6	3	0.3 - 1.2 PEAT/SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	WITHIN THE MACKENZIE CRITICAL WILDLIFE REGION	POOR	FAVOURABLE
2.11	308A[2] BO2-36[9]	ZONE 8 536,800E 7,641,400N	SILT SOME GRAVEL TRACE SAND (ML)	NG	GLACIOFLUVIAL TERRACE	MEDIUM TO HIGH	GOOD			0.3 - 1.2 PEAT/SILT	UNDEVELOPED	MACKENZIE DELTA CRITICAL WILDLIFE REGION	POOR	UNSUITABLE
2.12	324[2] DEVILS LAKE[6] BO3-15[9]	ZONE 8 521,600E 7,632,000N	SAND AND GRAVEL TRACE SILT	2	FLUVIAL TERRACE/DELTA	LOW TO MEDIUM	FAIR	A) 6.5 X 10^6 B) 17 X 10^6 C) 30 X 10^6	12	0.15-1.5 PEAT AND SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	MACKENZIE DELTA CRITICAL WILDLIFE REGION	GOOD	EXCELLENT
2.13	340[2] BO3-16[9]	ZONE 8 522,900E 7,637,700N	GRAVEL AND SAND (GW-GM)	1	GLACIOFLUVIAL TERRACE/DELTA	LOW	GOOD	A) 1 X 10^6 B) 5 X 10^6 C) 11 X 10^6	12	0.3-1.5 TOPSOIL/ SILT	PARTIALLY DEVELOPED (INUVIK) BARGE-SUMMER TRUCK-WINTER RD.	MACKENZIE DELTA CRITICAL WILDLIFE AREA SILTATION OF RIVER	POOR	GOOD
2.14	324A[2] BO3-21[9]	ZONE 8 525,600E 7,634,200N	GRAVEL AND SAND TRACE SILT (GW-GM)	2	FLUVIAL DELTA (TERTIARY)	LOW	GOOD	A) 180,000 B) 12 X 10^6 C) 35 X 10^6	15	0-1.5 PEAT/SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	WITHIN CARIBOU HILLS RESERVE-INTERNATIONAL BIOLOGICAL PROGRAM CANNOT BE DEVELOPED	NONE	GOOD (SEE BW.)
2.15	323A[2] BO3-23[9]	ZONE 8 526,000E 7,631,200N	GRAVEL AND SAND TRACE SILT (GW-GM)	2	FLUVIAL DELTA (TERTIARY)	LOW	GOOD	A) 30,000 B) 1 X 10^6 C) 85 X 10^6	15	0-1.5 PEAT/SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER ROAD	WITHIN CARIBOU HILLS RESERVE-INTERNATIONAL BIOLOGICAL PROGRAM CANNOT BE DEVELOPED	POOR	GOOD (SEE BW.)
2.16	322[2] BO3-22[9]	ZONE 8 529,500E 7,633,200N	SAND SOME GRAVEL SOME SILT (SW)	4	GLACIOFLUVIAL TERRACES	LOW TO HIGH	GOOD	A) 350,000 B) 2 X 10^6 C) 7.5 X 10^6	6	0-0.6 PEAT/SILT	UNDEVELOPED BARGE-SUMMER TRUCK-WINTER SNOW ROAD	NO MAJOR CONCERNS, SILTATION OF STREAMS AND LAKES	POOR	UNSUITABLE

TABLE B–2 BORROW MAPPING AREA 2 – SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION							
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (yd3)	ESTIMATED RECOVERY DEPTH (ft)	OVERBURDEN THICKNESS (ft)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
2.17	3173 BCS-149	ZONE 8 535,400E 7,651,100N	SAND AND GRAVEL TRACE SILT (SP)	3	ESKER WITH SECONDARY OUTWASH AREA	NONE TO LOW	GOOD	A) 450,000 B) 1.5 X 10^6 C) 3 X 10^6	3	0-1.65 PEAT/SILT	UNDEVELOPED WINTER SNOW ROAD, LEVEL THERMOKARST TERRAIN	NO MAJOR CONCERNS SILTATION OF STREAMS AND LAKES	POOR TO FAIR	FAVOURABLE
2.18	3167 BCS-259	ZONE 8 535,600E 7,650,600N	SAND & GRAVEL TRACE SILT (SW-SM)	3	GLACIOFLUVIAL OUTWASH	NONE TO LOW	GOOD	A) 650,000 B) 3 X 10^6 C) 10 X 10^6	9	0-0.3 PEAT/SILT	PART DEVELOPED WINTER SNOW ROADS ONLY, FLAT THERMOKARST TERRAIN	NO MAJOR CONCERNS SILTATION INTO PETER LAKE	POOR TO FAIR	FAVOURABLE
2.19	3182 BCS-149	ZONE 8 536,500 E 7,647,400N	SAND & GRAVEL TRACE SILT (SP-SM) GRAVEL & SAND (GP-GW)	3	GLACIOFLUVIAL OUTWASH AND REWORKED ALLUVIAL FAN	LOW TO HIGH	GOOD	A) 250,000 B) 2.5 X 10^6 C) 5.5 X 10^6	3	0-0.3 PEAT/SILT	UNDEVELOPED WINTER SNOW ROAD LEVEL THERMOKARST TERRAIN	NO MAJOR CONCERNS	POOR	FAVOURABLE
2.20	3192 1078-327 BCS-99	ZONE 8 535,500E 7,646,700N	SAND & GRAVEL TRACE SILT (SP) GRAVEL & SAND (GW)	2	LAKE FIELD	LOW	GOOD	A) 350,000 B) 4.5 X 10^6 C) 10 X 10^6	6	0-0.6 PEAT/SILT	UNDEVELOPED, REMOTE, WINTER SNOW ROAD	NO MAJOR CONCERNS SILTATION TO WOLVERINE LAKES	POOR TO FAIR	GOOD
2.21	3202 1078-317 BCS-99	ZONE 8 533,800E 7,691,500N	SAND, SOME GRAVEL & SILT (SM-SP)	3	LAKE FIELD	LOW TO HIGH	GOOD	A) 30,000 B) 400,000 C) 1.2 X 10^6	3	0-1.5 PEAT/SILT	UNDEVELOPED WINTER SNOW ROAD	NO MAJOR CONCERNS SILTATION OF HOUKES CREEK	POOR TO FAIR	FAVOURABLE
2.22	3212 BCS-79	ZONE 8 542,300E 7,651,000N	SAND, SOME GRAVEL TRACE SILT (SP)	3	GLACIOFLUVIAL OUTWASH	LOW	GOOD	A) 200,000 B) 2 X 10^6 C) 5.7 X 10^6	6	0-0.6 PEAT/SILT	UNDEVELOPED BARGES-SUMMER TRUCK-WINTER ROAD	NO MAJOR CONCERNS SILTATION OF STREAMS AND LAKES	POOR	FAVOURABLE
2.23	3163 BCS-19	ZONE 8 547,000E 7,656,500N	SAND AND SILT TRACE GRAVEL (SP)	4	ESKERS AND ESKER COMPLEX	HIGH	GOOD	A) 55,000 B) 150,000 C) 5.5 X 10^6	7.5	0.3-0.9 PEAT/SILT	UNDEVELOPED WINTER SNOW ROAD	NO MAJOR CONCERNS	POOR	UNSUITABLE
2.24	BCS-69	ZONE 8 549,000E 7,652,500N	SAND & GRAVEL	3	GLACIOFLUVIAL DEPOSITS			A) 400,000 B) 4 X 10^6 C 12 X 10^6			UNDEVELOPED WINTER ROAD FLAT THERMOKARST TERRAIN	SILTATION OF PARSONS LAKE	NONE	FAVOURABLE
2.25	3062 BCS-98	ZONE 8 560,000E 7,657,500N	SAND AND GRAVEL TRACE SILT (GW-GP) (SW-SP)	3	GLACIOFLUVIAL TERRACES AND LAKES	LOW TO MEDIUM	GOOD	A) 5,000 B) 300,000 C) 1.5 X 10^6	7	0-0.6 PEAT/SILT	UNDEVELOPED, WINTER SNOW ROAD, FLAT THERMOKARST TERRAIN	REINDEER FAWNING GROUND MARGINAL TO CRITICAL WILDLIFE HABITAT	POOR	FAVOURABLE
2.26	3072 BCS-79	ZONE 8 560,000E 7,656,500N	GRAVEL & SAND TRACE SILT (GP-GW)	3	ESKERS ON GLACIOFLUVIAL OUTWASH PLAIN	LOW TO HIGH	GOOD	A) 30,000 B) 300,000 C) 650,000	4	0-1.2 PEAT/SILT	UNDEVELOPED WINTER SNOW ROAD, FLAT THERMOKARST TERRAIN	REINDEER FAWNING GROUNDS	POOR	GOOD
2.27	BCS-109	ZONE 8 562,500E 7,647,200N	GRAVEL & SAND	3	GLACIOFLUVIAL OUTWASH			A) 7.5 X 10^6 B) 75 X 10^6 C) 350 X 10^6	15		UNDEVELOPED, TWO EXISTING WINTER ROADS	REINDEER FAWNING GROUNDS SILTATION OF STREAMS AND LAKES	NONE	FAVOURABLE
2.28	3092 1078-337 PARSONS LK[1] BCS-59	ZONE 8 559,900E 7,653,000N	GRAVEL AND SAND TRACE SILT (GW,SW-SM)	2	LAKE FIELD & GLACIOFLUVIAL OUTWASH PLAIN	LOW	GOOD	A) 350,000 B) 1 X 10^6 C) 4 X 10^6	20	0-0.6 PEAT/SILT	PART DEVELOPED ADJACENT WINTER ROAD EXISTS	REINDEER FAWNING GROUNDS, SILTATION OF PARSONS LAKE	GOOD	GOOD
2.29	3152 1078-347 BCS-139	ZONE 8 544,600E 7,642,200N	SAND & GRAVEL TRACE SILT (SW-GW)	2	GLACIOFLUVIAL OUTWASH (DISSECTED)	LOW	GOOD	A) 3 X 10^6 B) 18 X 10^6 C) 30 X 10^6	9	0-0.45 PEAT/SILT	UNDEVELOPED, WINTER ROAD	NO MAJOR CONCERNS SILTATION OF STREAMS	POOR TO FAIR	GOOD
2.30	3132 PARSONS LAKE-1 BCS-119	ZONE 8 560,000E 7,693,000N	GRAVEL AND SAND TRACE SILT (GW,SP-SM)	2	FLUVIAL/ GLACIOFLUVIAL TERRACES	LOW	GOOD	A) $4X10^6$ B) $4.5X10^6$ C) $30X10^6$	6	0-1.2 PEAT/SILT	UNDEVELOPED SUMMER-BARGE WINTER ROAD, FLAT THERMOKARST TERRAIN	REINDEER FAWNING GROUNDS, SILTATION OF STREAMS AND LAKES	GOOD	EXCELLENT
2.31	3112 BCS-129	ZONE 8 549,200E 7,642,600N	SAND, TRACE SILT AND GRAVEL (SP)	4	SAND BAR/ BEACH RIDGE	NONE TO LOW	GOOD	A) 250,000 B) 400,000 C) 9 X 10^6	11	NONE	UNDEVELOPED WINTER SNOW/ICE ROAD SUMMER BARGES	REINDEER FAWNING GROUNDS SILTATION OF ESKIMO LAKE	POOR	UNSUITABLE
2.32	3132 BCS-139	ZONE 8 542,700E 7,638,000N	SAND TRACE SILT (SP-SM)	4	GLACIOFLUVIAL OUTWASH ON COASTAL PLAIN	NONE TO LOW	GOOD	A) 7,500 B) 45,000 C) 5.5 X 10^6	4.5	0.9 TOPSOIL SILT/CLAY	UNDEVELOPED SUMMER-BARGE WINTER ROAD, FLAT THERMOKARST TERRAIN	REINDEER FAWNING GROUND, SILTATION OF STREAMS INTO LAKE	POOR	UNSUITABLE

TABLE B-2 BORROW MAPPING AREA 2 – SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION							
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (m^3)	ESTIMATED RECOVERY DEPTH (m)	OVERBURDEN THICKNESS (m)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
2.33	3273 BCS-198	ZONE 8 560,000E 7,635,000N	GRAVEL, SOME SAND TRACE SILT (GP-GM)	3	GLACIOFLUVIAL COMPLEX	LOW TO HIGH	GOOD	A) 350,000 B) 7.5×10^6 C) 15×10^6	4.5	0.3-1.5 PEAT/SILT	UNDEVELOPED SUMMER-BARGE WINTER ROAD, FLAT THERMOKARST TERRAIN	REINDEER FAWNING GROUND SILTATION INTO LAKE	POOR	FAVOURABLE
2.34	BCS-208	ZONE 8 563,300E 7,634,400N	SAND & GRAVEL	3	GLACIOFLUVIAL DEPOSIT			A) 1.5×10^6 B) 15×10^6 C) 35×10^6	9		UNDEVELOPED DIFFICULT ACCESS WINTER SNOW ROAD SUMMER-BARGE	ENVIRONMENTALLY SENSITIVE REINDEER FAWNING GROUNDS SILTATION OF ESKIMO LAKES	NONE	FAVOURABLE
2.35	BCS-179	ZONE 8 563,000E 7,633,700N	SAND & GRAVEL	3	GLACIOFLUVIAL DEPOSIT			A) 2.5×10^6 B) 25×10^6 C) 100×10^6	9		UNDEVELOPED WINTER SNOW ROAD SUMMER-BARGE	REINDEER FAWNING GROUNDS, SILTATION OF ESKIMO LAKES	NONE	FAVOURABLE
2.36	BCS-179	ZONE 8 536,000E 7,631,000N	SAND & GRAVEL	3	GLACIOFLUVIAL PLAIN			A) 7.5×10^6 B) 75×10^6 C) 300×10^6	9		UNDEVELOPED WINTER-SNOW/ ICE ROADS, SUMMER BARGE	ENVIRONMENTALLY SENSITIVE REINDEER FAWNING GROUNDS	NONE	FAVOURABLE
2.37	BCS-268	ZONE 8 577,000E 7,631,000N	GRAVEL	3	GLACIOFLUVIAL DEPOSIT			A) 1×10^6 B) 12.5×10^6 C) 50×10^6	9		UNDEVELOPED WINTER ROAD, FLAT, THERMOKARST TERRAIN	REINDEER FAWNING GROUNDS	NONE	FAVOURABLE
2.38	BCS-269	ZONE 8 576,000E 7,625,000N	SAND & GRAVEL	3	GLACIOFLUVIAL DEPOSIT			A) 2.5×10^6 B) 25×10^6 C) 100×10^6	9		UNDEVELOPED WINTER SNOW/ ICE ROADS, SUMMER-BARGE	REINDEER FAWNING GROUNDS SILTATION OF ESKIMO LAKES	NONE	GOOD
2.39	3244 BCS-319	ZONE 8 571,700E 7,621,500N	SILT TRACE SAND & CLAY (ML)	NG	GLACIOFLUVIAL DEPOSIT	HIGH	FAIR			MOSS/SILT	UNDEVELOPED WINTER ROAD SUMMER-BARGE	REINDEER FAWNING GROUNDS	POOR	UNSUITABLE
2.40	BCS-269	ZONE 8 570,000E 7,630,000N	SAND & GRAVEL	3	GLACIOFLUVIAL PLAIN			A) 1×10^6 B) 10×10^6 C) 40×10^6	9		UNDEVELOPED WINTER ROAD - FLAT THERMOKARST TERRAIN SUMMER-BARGE	REINDEER FAWNING GROUNDS, CRITICAL AREA.	NONE	FAVOURABLE
2.41	3252 BCS-298	ZONE 8 563,000E 7,628,600N	GRAVEL & SAND TRACE SILT (GP)	3	GLACIOFLUVIAL TERRACE	LOW TO HIGH	GOOD TO FAIR	A) 600,000 B) 6×10^6 C) 15×10^6	6	0.3-1.35 PEAT/SILT	UNDEVELOPED WINTER RD, FLAT THERMOKARST TERRAIN SUMMER-BARGE	REINDEER FAWNING GROUNDS, CRITICAL WILDLIFE AREA. SILTATION OF STREAMS & LAKE	POOR	FAVOURABLE
2.42	3242 BCS-329	ZONE 8 561,600E 7,642,200N	SAND & GRAVEL (SW)	3	FLUVIAL TERRACES	LOW	GOOD	A) 30,000 B) 3×10^6 C) 30×10^6	9	0-0.45 PEAT/SILT	UNDEVELOPED TRUCK-WINTER RD. THERMOKARST TERR. SUMMER-BARGE	REINDEER FAWNING GROUNDS SILTATION OF ADJACENT STREAM	POOR	FAVOURABLE
2.43	3278-367 3278-367 BCS-335	ZONE 8 562,000E 7,610,500N	SAND & GRAVEL SOME SILT (GP-SW)	3 - 4	LACUSTRINE VENEERED OUTWASH PLAIN	HIGH	FAIR TO GOOD	A) 1.8×10^6 B) 18×10^6 C) 180×10^6	15	1.5-6.0 ICY CLAYS	UNDEVELOPED WINTER RD, FLAT THERMOKARST TERRAIN	NO MAJOR CONCERNS	POOR	UNSUITABLE
2.44	3278-327 BCS-339	ZONE 8 559,000E 7,608,500N	SAND-SILTY (SW)	3	GLACIOFLUVIAL OUTWASH	HIGH	FAIR	A) 25,000 B) 250,000 C) 1×10^6	6	0.3-2.1 ICY PEAT SILT	UNDEVELOPED WINTER ROAD THERMOKARST TERRAIN	NO MAJOR CONCERNS	POOR	FAVOURABLE
2.45	BCS-349	ZONE 8 557,000E 7,607,500N	SAND & GRAVEL	2	GLACIOFLUVIAL OUTWASH			A) 800,000 B) 8×10^6 C) 25×10^6	15		UNDEVELOPED WINTER ROAD FLAT THERMOKARST TERRAIN	SILTATION OF NOEL LAKE	NONE	GOOD
2.46	10 & 11[18]	ZONE 8 554,500E 7,603,500N	SAND & GRAVEL SOME SILT/CLAY (GP, SW-SM)	3 - 4	SMALL KAMES OR ESKERS FILLINGS	MEDIUM	GOOD	A) 10,000 B) 20,000 C) 25,000	1.0-3.5	0-1.1 PEAT/SILT CLAY	UNDEVELOPED ADJACENT TO EXISTING WINTER ROADS	NO MAJOR CONCERNS	POOR	UNSUITABLE
2.47	3403A3 BCS-398	ZONE 8 552,500E 7,592,000N	SAND, SOME GRAVEL AND SILT (SM)	4	SMALL LAKES	HIGH	GOOD	A) 20,000 B) 250,000 C) 750,000	3.5	0.3-1.8 PEAT/SILT	UNDEVELOPED WINTER ROAD SUMMER BARGE	NO MAJOR CONCERNS	POOR TO FAIR	UNSUITABLE
2.48	3400 BCS-449	ZONE 8 554,000E 7,582,700N	SAND SOME GRAVEL & SILT (SM)	3	GLACIOFLUVIAL OUTWASH	LOW TO HIGH	GOOD TO FAIR	A) 20,000 B) 250,000 C) 950,000	3.5	0.3-0.9 PEAT/SILT	PARTIALLY DEVELOPED (1MI/KM) ALL WEATHER ROAD	NO MAJOR CONCERNS	FAIR	FAVOURABLE

TABLE B-2 BORROW MAPPING AREA 2 – SUMMARY OF POTENTIAL BORROW SOURCE DATA

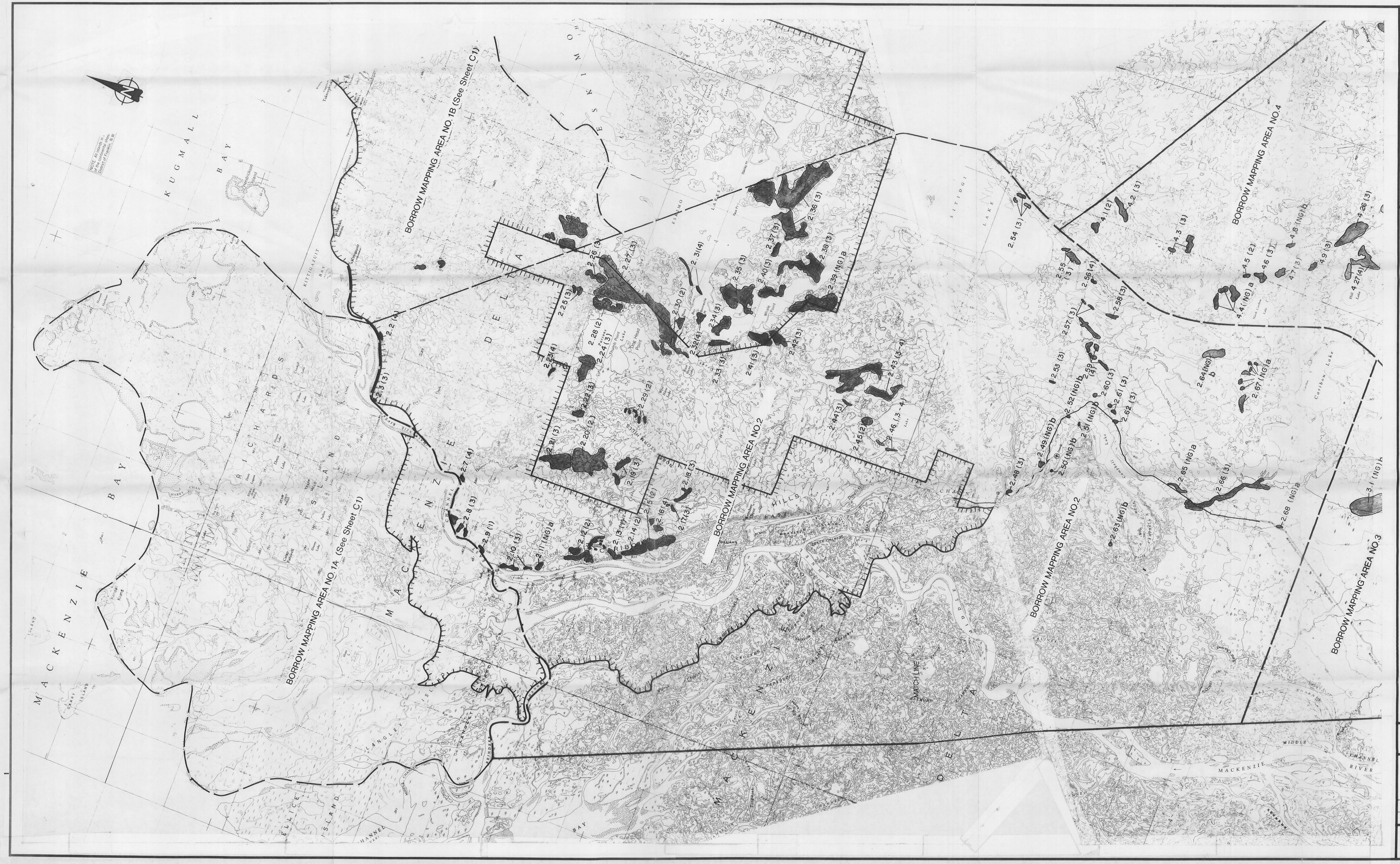
SITE IDENTIFICATION			DEPOSIT DESCRIPTION					BORROW PIT DEVELOPMENT INFORMATION						
BORROW SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (M3)	ESTIMATED RECOVERY DEPTH (M)	OVERBURDEN THICKNESS (M)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
2.49	BD3-45[9]	ZONE 8 560,500E 7,579,500N	SHALE	NG	BEDROCK OUTCROP					3.5	DEVELOPED FOR MACKENZIE HIGHWAY GOOD ACCESS-FLAT THERMOKARST TERRAIN	NO MAJOR CONCERNS	NONE	UNSUITABLE
2.50	1402[3] BD3-49[8]	ZONE 8 560,400E 7,577,300N	SHALE	NG	BEDROCK OUTCROP	NONE	GOOD	C) 4.5 X 10^6 TO UNLOGGED	9 APPROX.	0-0.6 TOPSOIL SILT	DEVELOPED AND IN USE.	NO MAJOR CONCERNS	POOR TO FAIR	FAVOURABLE
2.51	1404[3] BD3-48[9]	ZONE 8 568,500E 7,576,200N	SANDSTONE	NG	BEDROCK OUTCROP	NONE	GOOD	C) 75,000 TO UNLOGGED	7.5 APPROX.	0-0.9 TOPSOIL SILT	DEVELOPED FOR DEMPSTER HIGHWAY	NO MAJOR CONCERNS	POOR	FAVOURABLE
2.52	1403[3] BD3-46[9]	ZONE 8 569,000E 7,578,100N	LIMESTONE	NG	BEDROCK OUTCROP	NONE	GOOD	C) 2 X 10^6 TO UNLOGGED	13 APPROX.	0-0.9 TOPSOIL SILT	DEVELOPED FOR DEMPSTER HIGHWAY	NO MAJOR CONCERNS	POOR	FAVOURABLE
2.53	1406[3] BD3-45[9]	ZONE 8 573,000E 7,582,300N	GRAVEL & SAND TRACE SILT (GW-SW) (GW-SM)	3	ESKER RIDGE	LOW TO MEDIUM	GOOD	A) 4,500 B) 45,000 C) 250,000	4.5	0.3-0.6 TOPSOIL SILT	UNDEVELOPED WINTER ROAD FROM DEMPSTER HIGHWAY	NO MAJOR CONCERNS SILTATION OF STREAM	POOR	UNSUITABLE
2.54	BD3-36[9]	ZONE 8 590,000E 7,597,000N	SAND & GRAVEL	3	ESKER RIDGES			A) 10,000 B) 100,000 C) 750,000			UNDEVELOPED WINTER ROAD-FLAT THERMOKARST TERRAIN	ENVIRONMENTALLY SENSITIVE - REINDEER WINTER RANGE	NONE	FAVOURABLE
2.55	453[2] 1073-B[7] BD3-40[8]	ZONE 8 583,400E 7,586,500N	SAND & GRAVEL (SW-SM, GM)	3	ESKER/KAME COMPLEX	LOW	GOOD	A) 200,000 B) 350,000 C) 4.5 X 10^6	7.5	0.3-0.9 PEAT & SILT	UNDEVELOPED WINTER SNOW ROAD, FLAT THERMOKARST TERRAIN	REINDEER HERD WINTER RANGE	POOR	FAVOURABLE
2.56	451[2] BD3-41[9]	ZONE 8 589,600E 7,852,500N	SAND LITTLE SILT (SW)	4	ESKERS	LOW TO MEDIUM	GOOD	A) 15,000 B) 50,000 C) 250,000	4.5	0.3-0.9 PEAT & SILT	UNDEVELOPED, WINTER ROAD FLAT THERMOKARST TERRAIN	REINDEER HERD WINTER RANGE	POOR	UNSUITABLE
2.57	450[2] 1073-B[7] BD3-42[8]	ZONE 8 586,500E 7,581,600N	SAND LITTLE GRAVEL & SILT (SW-SM)	3	ESKER RIDGES	MEDIUM	GOOD	A) 15,000 B) 150,000 C) 3.5X10^6	9	0.3-0.9 PEAT AND SILT	UNDEVELOPED WINTER ROAD FLAT THERMOKARST TERRAIN	REINDEER HERD WINTER RANGE, CRITICAL WILDLIFE AREA.	POOR	UNSUITABLE
2.58	BD4-3[9]	ZONE 8 586,200E 7,577,000N	SAND & GRAVEL	3	ESKER RIDGES			A) 1,000 B) 5,000 C) 5,000	6		UNDEVELOPED, WINTER ROAD FLAT-GENTLY SLOPING THERMOKARST TERRAIN	NO MAJOR CONCERNS	NONE	UNSUITABLE
2.59	1405A3 1073-B[7] BD3-47[8]	ZONE 8 579,300E 7,578,200N	SAND & SILT (SM)	4	KAME TERRACES AND ESKERS	MEDIUM	GOOD	A) 2 X 10^6 B) 7.5 X 10^6 C) 15 X 10^6	9	0.3-1.2 TOPSOIL, PEAT&SILT	UNDEVELOPED, WINTER ROAD FROM DEMPSTER HIGHWAY, OVER WET TERRAIN	NO MAJOR CONCERNS, SILTATION OF STREAMS	POOR TO FAIR	UNSUITABLE
2.60	BD3-54[9]	ZONE 8 573,500E 7,575,000N	SAND & GRAVEL	3	KAME TERRACE		GOOD	A) 5,000 B) 50,000 C) 250,000	6	0-0.3 TOPSOIL & SILT	UNDEVELOPED ADJACENT TO DEMPSTER HIGHWAY WINTER ROAD	NO MAJOR CONCERNS	NONE	FAVOURABLE
2.61	BD3-50[9]	ZONE 8 572,500E 7,572,000N	SAND & GRAVEL SOME SILT	3	GLACIOFLUVIAL TERRACE			A) 250,000 B) 2.5 X 10^6 C) 10 X 10^6	9		UNDEVELOPED, CLOSE TO DEMPSTER HIGHWAY WINTER ROAD	NO MAJOR CONCERNS	NONE	FAVOURABLE
2.62	452[2] BD3-51[9]	ZONE 8 570,600E 7,570,200N	SAND SOME GRAVEL (SW-SP)	3	SMALL KAMES	LOW	GOOD	A) 1,500 B) 15,000 C) 75,000	6	0.3-0.6 TOPSOIL SILT	FULLY DEVELOPED FOR DEMPSTER HIGHWAY SMALL QUANTITY REMAINING	MACKENZIE REINDEER GRAZING RESERVE, INTERNATIONAL BIOLOGICAL PROGRAM RESERVE	POOR	UNSUITABLE
2.63	454[2]	ZONE 8 552,000E 7,564,500N	SANDSTONE	NG	BEDROCK OUTCROP	NONE	GOOD	C) UNLOGGED	30 +	0-0.9 TOPSOIL	UNDEVELOPED WINTER SNOW ROAD SUMMER-BARGE	MACKENZIE REINDEER GRAZING RESERVE, PEREGRINE FALCON HABITAT	FAIR	FAVOURABLE
2.64	L115[4] BD4-6[9]	ZONE 8 564,900E 7,560,000N	SHALE & SILTSTONE	NG	BEDROCK OUTCROP	MEDIUM TO HIGH	FAIR			2.5 SILT, ICE RICH	UNDEVELOPED WINTER ROAD THERMOKARST TERRAIN	MODERATELY SENSITIVE, CARIBOU WINTER RANGE.	POOR	UNSUITABLE

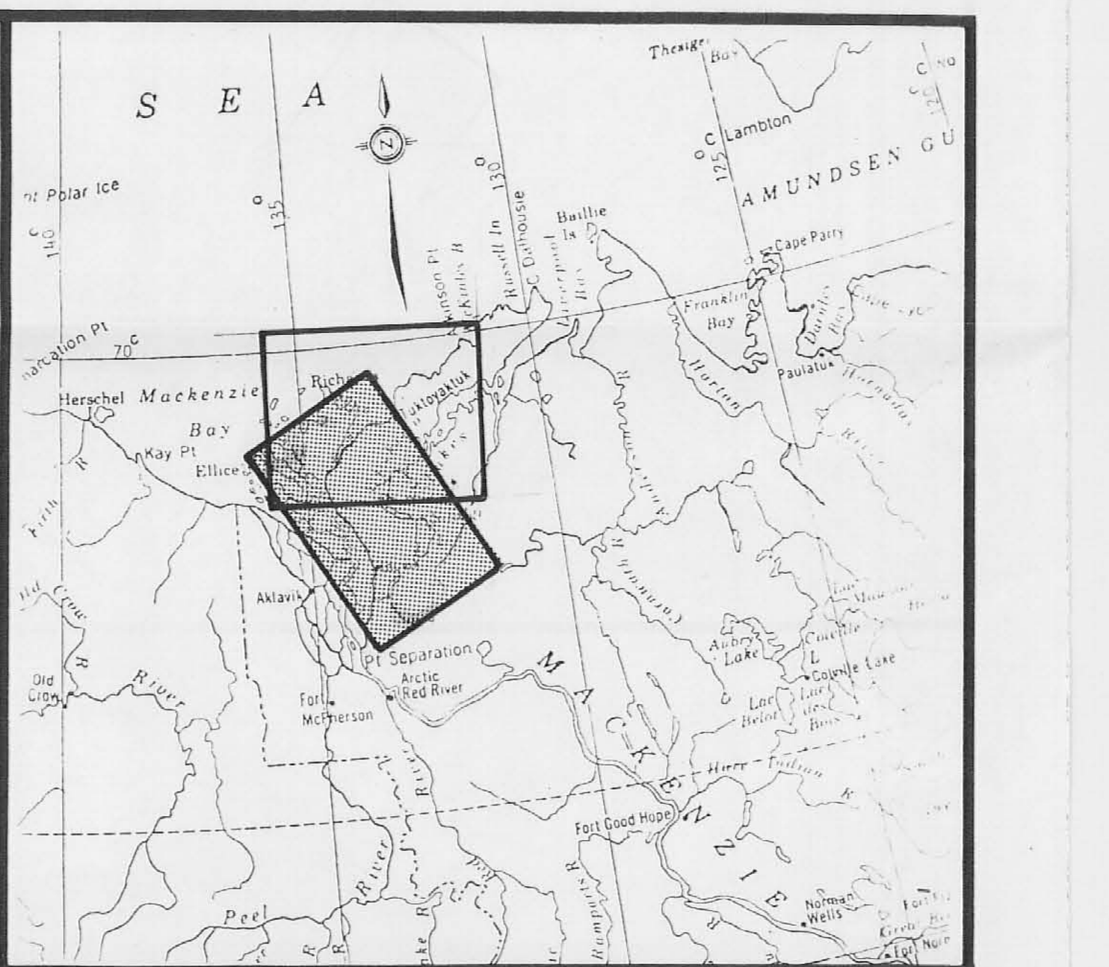
TABLE B-2 BORROW MAPPING AREA 2 – SUMMARY OF POTENTIAL BORROW SOURCE DATA

SITE IDENTIFICATION			DEPOSIT DESCRIPTION					EDISON PIT DEVELOPMENT INFORMATION						
EDISON SOURCE NUMBER	CROSS REFERENCE	LOCATION (UTM)	MATERIAL TYPE	MATERIAL CLASS	LANDFORM	ICE CONTENT	SURFACE DRAINAGE	ESTIMATED VOLUME (m3)	ESTIMATED RECOVERY DEPTH (m)	OVERBURDEN THICKNESS (m)	ACCESS	ENVIRONMENTAL CONSIDERATIONS	DATA QUALITY RELIABILITY	OVERALL ASSESSMENT
2.65	458A[2] BO4-8[9]	ZONE 8 584,500E 7,558,000N	SILT & SAND (ML)	NG	ESKER	MEDIUM	GOOD	C) 450,000	1.5	0.3-0.9 TOPSOIL & SILT	UNDEVELOPED ADJACENT TO DEMPSTER HIGHWAY	NO MAJOR CONCERNS	POOR	UNSUITABLE
2.66	BO4-10[9]	ZONE 8 566,000E 7,550,000N	GRAVEL & SILT	3	ALLUVIAL FLOOD PLAIN			A) 500,000 B) 5 X 10^6 C) 20 X 10^6	3		UNDEVELOPED WINTER ROAD-FLAT THERMOKARST TERRAIN	SILTATION OF ADJACENT RIVER	NONE	FAVOURABLE
2.67	1156A[4] BO4-11[9]	ZONE 8 545,000E 7,554,000N	SILT & SAND LITTLE GRAVEL	NG	ESKER RIDGES	MEDIUM TO HIGH	GOOD				UNDEVELOPED, THERMOKARST TERRAIN	MODERATELY SENSITIVE WILDLIFE WINTER RANGES, SILTATION OF LAKES & STREAMS	POOR	UNSUITABLE
2.68	655A[2]	ZONE 8 564,500E 7,540,000N	SILT SOME SAND LITTLE GRAVEL (ML)	NG	ESKER, RIDGE OR LAKE TERRACE	MEDIUM TO HIGH	GOOD			0.3-0.9 PEAT & SILT	UNDEVELOPED ADJACENT TO DEMPSTER HIGHWAY	NO MAJOR CONCERNS	POOR	UNSUITABLE

APPENDIX C

MAP SHEETS C1 AND C2
1:250,000 SCALE





SCALE

0 100 200 300km

LEGEND

BORROW SOURCE DESIGNATION

2.5 (3)

- Deposit Outline
- Material Classification
- Deposit Number
- Borrow Mapping Area

EXPLANATION OF MATERIAL CLASSIFICATION

(1) CLASS 1 – Excellent granular material, well graded, requiring a minimum of processing, suitable for concrete.

(2) CLASS 2 – Good quality, well graded, granular material, with some fines, suitable for good quality fill and construction material. Requires processing for concrete.

(3) CLASS 3 – Fair quality granular material, poorly graded with a variable portion of fines. Suitable only for general fill.

(4) CLASS 4 – Poor quality material, predominantly fine grained with little granular material. Unsuitable for construction purposes.

(NG) NON-GRANULAR – a) Silt and clay material, unsuitable for construction purposes.
b) Bedrock, ranging from fair to good quality. Only available if blasted and quarried.

Borrow Mapping Area Boundary

Inuvialluit Land Selection Boundary

Indian and Northern Affairs Canada

GRANULAR RESOURCE POTENTIAL

MACKENZIE DELTA REGION

Drawn YK	Check AH	Date Mar/90	Proj. CG14143
Scale 1:250 000		Appr.	Sheet C2

Hardy BBT Limited

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