A

PLAN FOR THE RESERVATION AND DEVELOPMENT OF GRANULAR MATERIALS IN THE VICINITY OF AKLAVIK, N.W.T.

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Prepared For:

INDIAN AND NORTHERN AFFAIRS CANADA, OTTAWA

Prepared By:

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This project was a joint venture of Hardy BBT Limited,
Calgary, Alberta and Avati Associates,
Yellowknife, N.W.T.

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John Banksland	Aklavik Community Corporation (CC)
Flora Elanik	Aklavik CC
Charlie Furlong	President, Metis Local
Danny C. Gordon	Hamlet Foreman
Eugene Pascal	Chief, Dene Band
Dean Smith	Manger, Dene Band
Buck Storr	Akalvik Hunters and Trappers Committee/ Storr and Sons Contracting Ltd.
Ronald Storr	
Margie Storr	

The following individuals/organizations were also consulted:

Leslie Huget	Senior Land Officer, Lands Division, Municipal and Community Affairs, GNWT, Yellowknife
Kevin McCormick	Habitat Biologist, Canadian Wildlife Service, Yellowknife
Evan Birchard	Esso Resources Canada Limited
James McDougall	Esso Resources Canada Limited
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Brian Rogers	Gulf Canada Resources Limited
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Ted McRae	Canadian Marine Drilling Limited

SUMMARY OF RECOMMENDATIONS

This plan was produced as part of the implementation of the Inuvialuit Final Agreement. It recommends a strategy to reserve and develop supplies of sand and gravel on Inuvialuit lands in the vicinity of Aklavik, N.W.T. Its goals are the reservation of adequate supplies of sand and gravel for the community's future needs, and the siting and management of these reserves so as to minimize the environmental and social impacts of their development. The plan was developed with members of the entire community, including representatives of Inuvialuit and the Dene-Metis. It is based on existing scientific and community information, and will be revised at least every 5 years. The plan assesses four potential sources of granular materials in the Aklavik area: Sources 455 (Willow Creek), 467 (immediately uphill of Willow Creek), 468 (Mt Gifford), and 464 (Ulagvialuk).

The recommendations of the plan are:

- Sources 455 (Willow Creek), 467, and 468 (Mt Gifford) should be reserved for public community use in Aklavik. The Willow Creek area is currently the least expensive alternative for delivering granular materials to the community. At the scale required to serve public community needs in Aklavik, the development of these sources should cause no significant environmental or social impacts.

- The quality and quantity of materials in Source 467 should be more accurately determined through field studies.

- Source 467 is not expected to contain better than Class 3 materials. If, however, the source is proven to contain Class 1 or 2 materials, then these materials should be actively managed to minimize high grading (the use of better-quality materials than are necessary for a job).

. Other (non-public) users should be assured access to the reserved sources, provided that the estimated total (public and other) 20-year demand is within the estimated total volume of the reserves.

. Aklavik does not currently have an affordable source of Class 1 or 2 materials. This is a significant problem in the community. The location and development of an affordable source should be actively investigated. Alternatively, consideration should be given to the use of a crusher in the Aklavik area.

. There is some community interest in developing a large scale source in the Aklavik area, using a crusher, to supply the range of needs of the community and the oil and gas industry in the Beaufort Sea. Sources 464 (Ulagvialuk) and 468 could be reserved with this in mind. Similarly Source R 28/29 in the Inuvik area is being considered as a large-scale source of supply for armour stone and rip rap for artificial island construction (Nesbitt and Howell 1988). This study could not, however, fully assess the impacts of large-scale development of the above sources; the impacts of transporting substantial quantities of material to the Beaufort Sea; or the comparative impacts or the foregoing. The potential environmental, social and economic impacts of developing any larger-scale, regional source of supply should be more fully assessed by the responsible authorities prior to the development of any such source. Excavations of these sources should not, as a general principle, be permitted until the quantity and quality of materials available are confirmed by field investigation.

. A granular development and environmental protection plan should be produced for the Source 455/467/468 area as a whole (including access). In the event that Source 464 is developed, then a similar plan should be produced for that area. The plans should lay out a 5-to-10 year strategy for the orderly development of each area, so as to ensure the integration of granular planning and other land use planning initiatives. They should also ensure that each area is developed so as to minimize environmental and visual effects, and maximize the amount of materials recovered from the area. They should also lay out procedures for the proper development and restoration of pits.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In March 1988, as part of the implementation of the Inuvialuit Final Agreement, Indian and Northern Affairs Canada (INAC) contracted Hardy BBT Limited of Calgary, Alberta and Thomas Nesbitt and Associates (now Avati Associates) of Yellowknife, N.W.T. to carry out the present study. The INAC departmental representative for the project was R.J. Gowan, Geotechnical Advisor, Land Management Division.

The terms of reference of the study were:

(1) To determine the potential environmental, cultural, and economic implications of the possible future exploitation of selected granular borrow deposits within and adjacent to Inuvialuit lands

(2) To identify and evaluate other community concerns

(3) To prepare recommendations on the establishment of reserves of granular borrow for public community needs

These objectives were met through the preparation of a plan outlining a strategy for the reservation and development of granular materials around each of the six Inuvialuit communities (Aklavik, Holman, Inuvik, Paulatuk, Sachs Harbour, and Tuktoyaktuk). The Aklavik plan is divided into four parts:

Part 1 sets out the scope of the study: why it was undertaken, its objectives, how it was carried out, and how it is intended to be used. It also defines the technical terms used in the plan and outlines the potential impacts of granular development.

Part 2 describes the goals of the plan.

Part 3 presents the factual information upon which the plan is based and assesses different plan options.

Part 4 presents the plan recommendations.

PART 1: SCOPE OF THE STUDY

1.1 REASONS FOR UNDERTAKING THE STUDY

1.1.1 Requirements of the Inuvialuit Final Agreement

With the signing of the Inuvialuit Final Agreement (IFA) and the enactment and proclamation of the Western Arctic (Inuvialuit) Claims Settlement Act in 1984, the Government of Canada granted Inuvialuit title to substantial tracts of land in the vicinity of each of the six Inuvialuit communities. These lands, shown in Figure 1, are commonly known as Inuvialuit 7(1)(a) and 7(1)(b) lands, in reference to the sections of the Final Agreement where their interests are described. They are administered by the Inuvialuit Land Administration (ILA) and the Inuvialuit Land Administration Commission (ILAC).

In the Aklavik area, Inuvialuit lands are situated approximately 15 km northwest of the community. On 7(1)(a) lands, which cover approximately 1665 square kilometres (643 square miles), the Inuvialuit own both surface and subsurface rights. On 7(1)(b) lands, which cover approximately 100 square kilometres (38 square miles) the Inuvialuit own surface rights only. Granular materials (sand and gravel) are surface resources. The Inuvialuit Final Agreement thus transferred ownership of some of the more accessible sources of sand and gravel in the Aklavik area, and indeed throughout the Western Arctic region, to the Inuvialuit. Because of this, and because of the general scarcity of suitable sand and gravel throughout the region, the Final Agreement also attached several

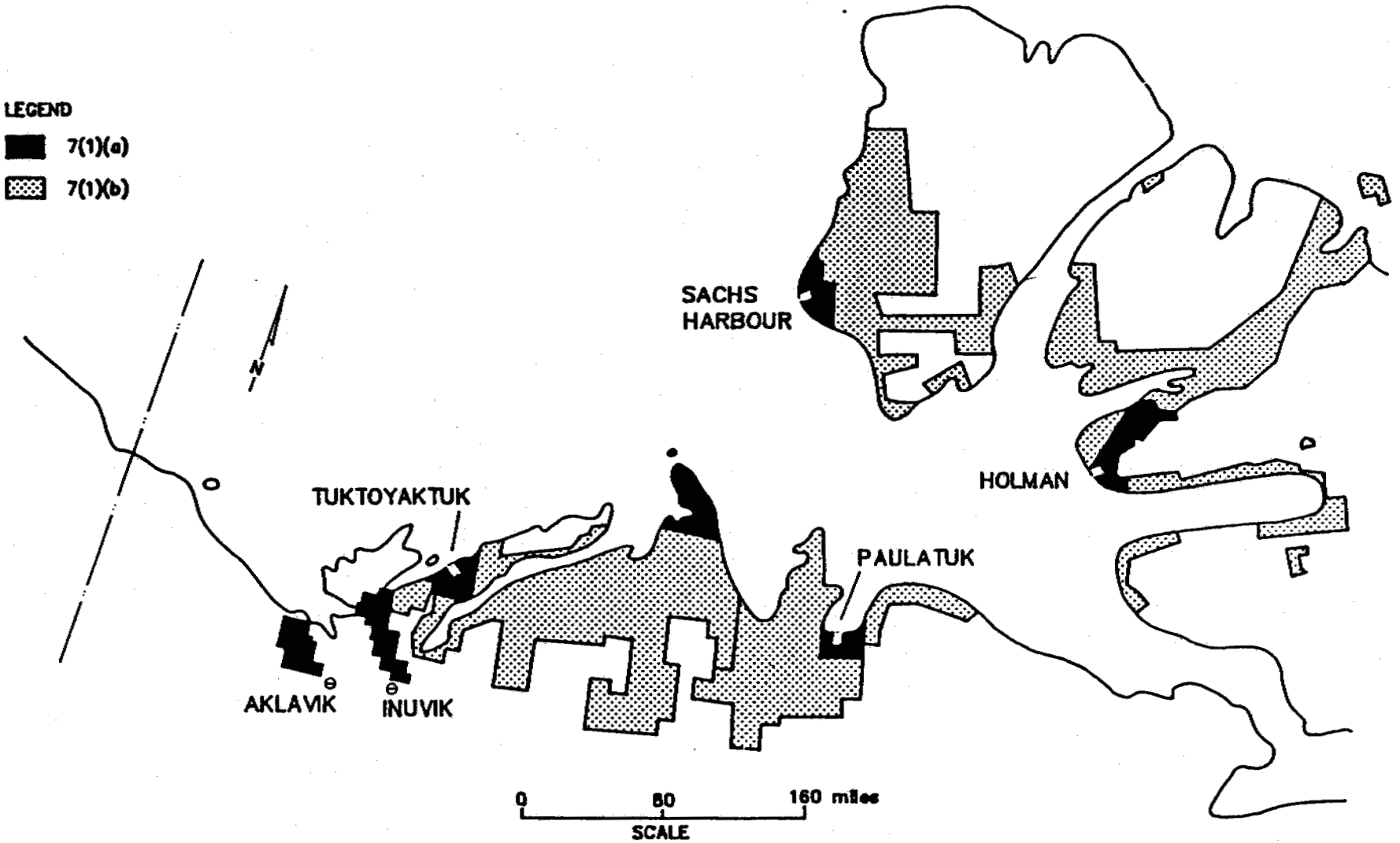

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FIGURE 1. INUVIALUIT LANDS LOCATION PLAN

conditions to Inuvialuit ownership and management of these resources.

The Agreement regulates the price which can be charged for sand and gravel. It also requires that the Inuvialuit establish and maintain reserves of sand and gravel on Inuvialuit lands. In the establishment of these reserves, the first priority is that adequate supplies of suitable materials be set aside to meet public community needs (IFA, Section 7(27)). These needs include granular requirements for the community's roads and airfields, community arenas, firehalls, and sewage lagoons. Reserves are also to be established, as a second priority, for the private and corporate needs of the Inuvialuit (Section 7(28)). Such needs include projects advocated and owned by the Inuvialuit, for example the proposed Tuktoyaktuk gas gathering system. As a third priority, sand and gravel are to be made available for any project approved by the appropriate government agencies (Section 7(29)). Examples of this sort of granular requirement include pads for oil rigs and rip rap for erosion protection on artificial islands.

This study focuses primarily on the establishment of granular reserves to meet Aklavik's public community needs (the first priority above). The Final Agreement requires that the reserves be based upon reasonable 20-year forecasts of the volumes required from Inuvialuit lands. Reserves are to be of an appropriate quantity and quality to meet these forecasts, and are to be within reasonable transport distances of the communities. The demand forecasts upon which the reserves are based are to be

prepared jointly by the Inuvialuit and government. They are to be revised at least every 5 years.

1.1.2 Implementation

In order to implement the above-mentioned requirements of the Final Agreement, the Federal Government established a specific granular materials project as part of the IFA Implementation Program. This project, designated Task 7- Sand and Gravel Inventories, involves a four-phase process developed in consultation with the Territorial Government and the ILA.

(1) An analysis of the projected 20-year demand for sand and gravel and an inventory of potential sources to supply this demand was carried out by EBA Engineering Consultants Ltd. This study, completed in April, 1987, made recommendations on the development of specific sources of supply.

(2) The present study is designed to supplement the EBA information with environmental and socio-economic information, particularly from the community level. It is also designed to develop a plan, with community representatives and other affected parties, for the reservation and future development of granular materials for public community needs in each of the six Inuvialuit communities.

(3) The quality and/or quantity of materials at some of the recommended sources of supply will have to be confirmed by more-detailed site investigations. These investigations will be based on the recommendations of the communities.

(4) In order to assist the Inuvialuit with the preparation and implementation of granular resource development plans which can be managed at the local level, additional studies will be undertaken each year to 1994.

1.2 INVOLVEMENT OF THE DENE-METIS

The Aklavik area has traditionally been used by the Dene-Metis as well as by the Inuvialuit. Although the present study was carried out as part of the implementation of the Inuvialuit Final Agreement, the Dene-Metis were invited to participate in it for several reasons:

(1) The Inuvialuit and the Dene-Metis have traditionally lived side by side in Aklavik. Although the two peoples have negotiated separately with the Federal Government for land claims purposes, many local people would prefer that, wherever possible, community issues should be addressed by the community as a whole.

(2) A land claims agreement-in-principle between the Dene-Metis and the Government of Canada was signed in September 1988. While a Final Agreement and the selection of specific parcels of land have not yet been negotiated, substantial tracts of land will be affected by the future settlement of the Dene-Metis claim. It is also likely that the Dene-Metis claim settlement will include provisions dealing with sand and gravel that are fairly similar to the provisions of the Inuvialuit Final Agreement.

(3) In its search for sources of sand and gravel to serve public community needs, the initial inventory (EBA 1987) considered sources throughout the Aklavik area, irrespective of their ownership. Some of the sources recommended by EBA for reservation and future development lie outside Inuvialuit lands, and may well, in future, fall under the ownership and/or administration of the Dene-Metis. In any case, the Dene-Metis should be involved in any granular decisions which are the ultimate prerogative of the community as a whole.

In order to ensure their input to decisions affecting the reservation of granular sources in the Aklavik area, representatives of the Dene-Metis were approached by the authors. They were offered two options:

(1) To take part in the community workshop held in Aklavik in April 1988, together with the Inuvialuit representatives.

(2) To take part at some later stage in the process, possibly in conjunction with or following the settlement of their land claim. In the event that this latter option were chosen, the authors promised to note in their report that the Dene-Metis should be consulted before any final decisions were made on the reservation of granular sources in the Aklavik area.

Representatives of the Dene-Metis chose to take part in the Aklavik workshop. The results of the workshop thus represent a consensus of the community as a whole.

1.3 OBJECTIVES AND METHODS OF THE PRESENT STUDY

The ultimate objectives of the present study were:

(1) The identification of environmental, cultural, and economic concerns, particularly at the community level, associated with local granular resource development

(2) The development of a fair and reasonable plan which could be understood and managed at the local level

(3) The achievement of a consensus among the affected parties

In order to accomplish these ends, workshops of a full day's duration were carried out in each of the six Inuvialuit communities. The workshops were carried out primarily with members of the existing land use planning working group in each community. Other affected interests were also invited to participate.

The land use planning working groups were established in 1987 to provide each community with an ongoing land use

planning capability, and a means of making recommendations on the use of lands surrounding the communities to the Beaufort/Delta Regional Planning Commission and the decision-making bodies at the community level. The Aklavik working group includes nominees from the Aklavik Community Corporation, the Dene Band, the Hunters and Trappers Association Committee, the Metis Local, and the Hamlet.

The workshops supplemented the supply/demand information and recommendations produced in Phase 1 of the study (EBA 1987a). They also identified potential environmental, cultural, and economic impacts of developing the sites identified in Phase I. The workshops were designed to solicit community concerns and to allow the working groups to use the information in a planning context. They were facilitated by Tom Nesbitt, an environmental planning consultant who has worked extensively with the working groups in the past. Technical advice for the workshops was provided by Jim Howell, an environmental consultant and professional geologist.

Unless noted otherwise, the plan detailed in this report represents the consensus of the Aklavik Workshop.

1.4 STATUS AND INTENDED USES OF THE PLAN

The conclusions of this report have the status of recommendations only. They are recommendations to INAC and the ILA/ILAC, the parties implementing the Inuvialuit Final Agreement and administering Crown and Inuvialuit lands respectively, and to the Hamlet and the GNWT as the administrators of Hamlet and Commissioner's Lands. The

results will also be of interest to the various government departments and other granular resource users. Finally, the study can be considered a sectoral plan recommended to the Regional Land Use Planning Commission in the Beaufort/Delta region. As such, the conclusions of the study are subject to changes within the context of the larger planning exercise. Given the community basis of the plan, however, the authors do not expect fundamental changes to it.

1.5 TERMINOLOGY

Several terms describing the kinds of granular materials required by the communities and the confidence of volume estimates are used extensively throughout the plan. These terms are explained in this section.

1.5.1 Classification of Granular Resources

Granular resource supply and demand is discussed in terms of five classes of material:

Class 1 Excellent quality material
Class 2 Good quality material
Class 3 Fair quality material
Class 4 Poor quality material
Class 5 Bedrock, felsenmeer, and talus

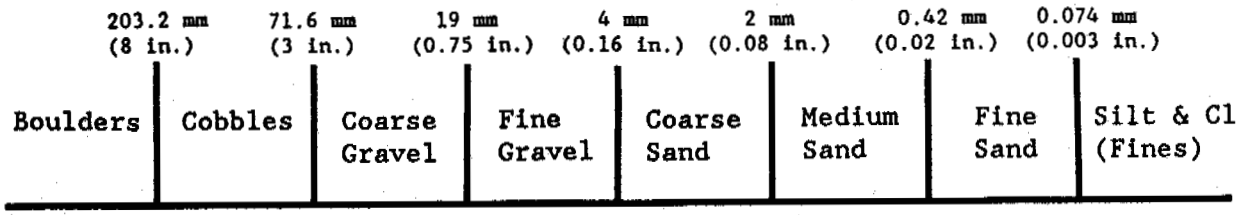
The first four classes are defined in terms of the gradation of the deposit. A brief discussion on gradation is necessary prior to describing these classes in more detail.

1.5.1.1 Gradation

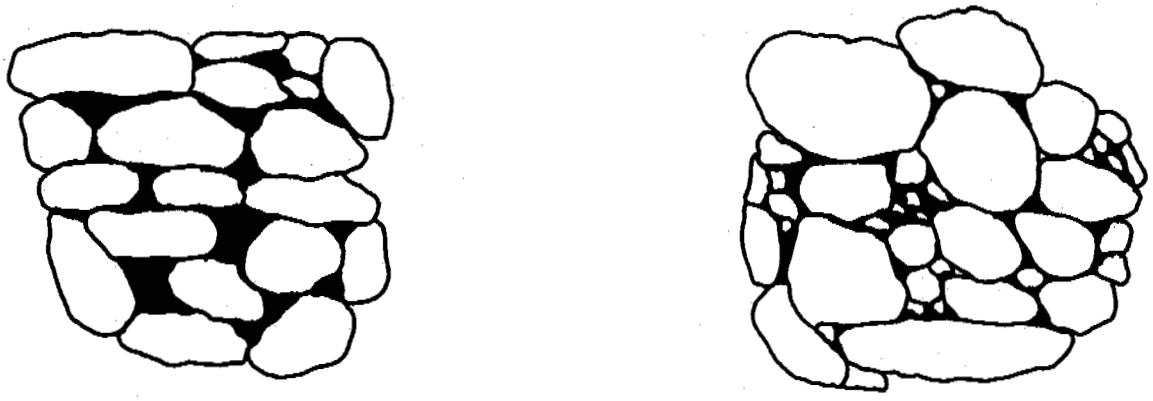
The term gradation refers to the relative size of particles in a deposit. Granular resources can contain particles ranging in size from boulders through clay, as shown in Figure 2. Boulders and cobbles are usually undesirable in a granular deposit. They may be crushed to smaller sizes or discarded as waste. The gravel- and sand-sized particles are the more desirable components of a granular deposit. Silt- and clay-sized particles, also called fines, cannot be seen by the naked eye. These particles are undesirable in high proportions because they hold more water which, in the North, results in higher ice contents and a greater likelihood of frost heaving or thaw slumping.

A well-graded granular deposit has an equal amount of each gravel and sand size and little or no fines. Deposits such as this are called "clean". A poorly-graded granular deposit has an excess of some particle sizes and a shortage or lack of others, or has nearly all particles the same size. Poorly-graded deposits can be processed to improve and upgrade their quality. Screening and washing can be used to remove undesirable particle sizes. Boulders and cobbles can be crushed to produce gravel and sand.

The importance of using well-graded materials for pads on which structures will be built is shown in Figure 2. With well-graded materials, the finer particles tend to fit between the coarse ones, reducing the amount of voids or empty spaces to a minimum and forming a strong pad. Pads formed of poorly-graded materials where many voids are



2a. Particle size limits for gravel, sand, and fines. A well-graded granular deposit contains an equal amount of each gravel and sand size.



2b. Poorly-graded materials with all particles the same size or with a lack of certain particle sizes (left drawing) have more voids and are less stable than well-graded materials where the voids are filled by the smaller particle (right drawing).

present are more likely to shift when the weight of a structure is added.

1.5.1.2 Description of Granular Resource Classes

The five granular resource classes are defined below in terms of their gradation and recommended uses. Figures 3 and 4 show photographs of each class and examples of their use.

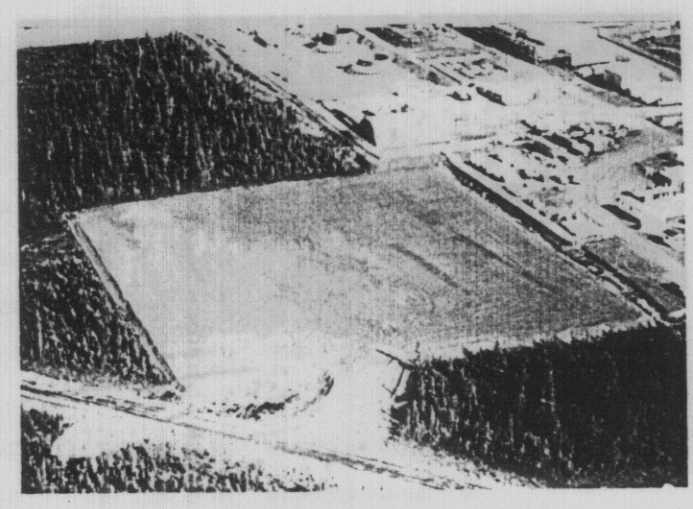
Class 1. Excellent quality material consisting of clean, well-graded, structurally-sound sands and gravels suitable for use as high-quality surfacing materials, or as asphalt or concrete aggregate, with a minimum of processing.

Class 2. Good quality material generally consisting of well-graded sands and gravels with limited quantities of silt. This material will provide good-quality base and surface-course aggregates or structure-supporting fill. Production of concrete aggregate may be possible with extensive processing, except where weak materials such as shale are present.

Class 3. Fair quality material consisting of poorly-graded sands and gravels with or without substantial silt content. This material will provide fair-quality general fill for roads, foundation pads, or lay-down yards.

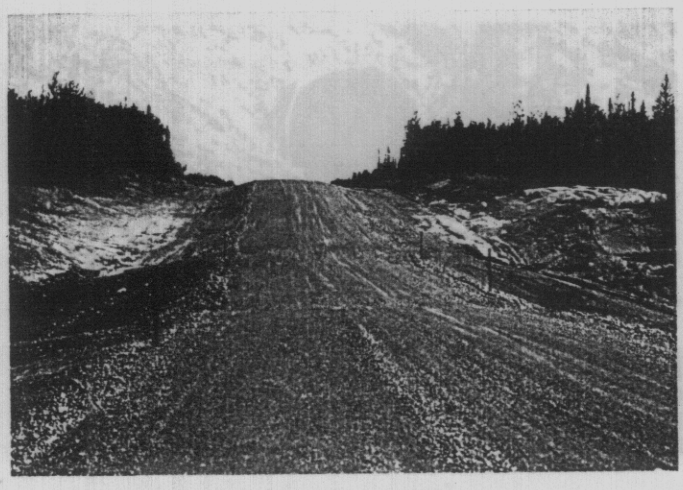
Class 4. Poor quality material generally consisting of silty, poorly-graded, fine-grained sand with minor gravel. These deposits may also contain weak particles. These

Class 1 - Excellent quality materials; well-graded, no fines.

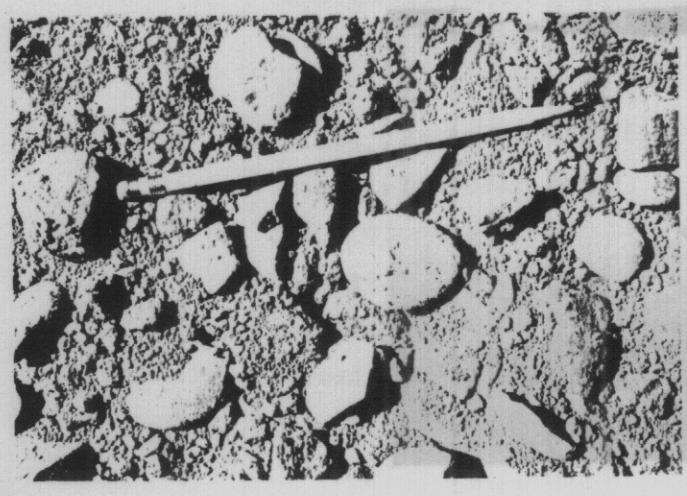


Class 1 material used for a pipeline pumping station pad at Norman Wells

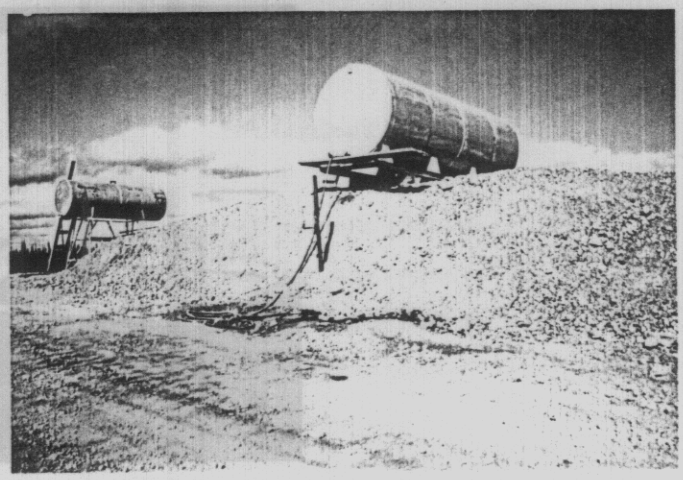
Class 2 - Good quality materials; generally well-graded, some fines



Class 2 material used for surfacing the Mackenzie Highway near Fort Simpson



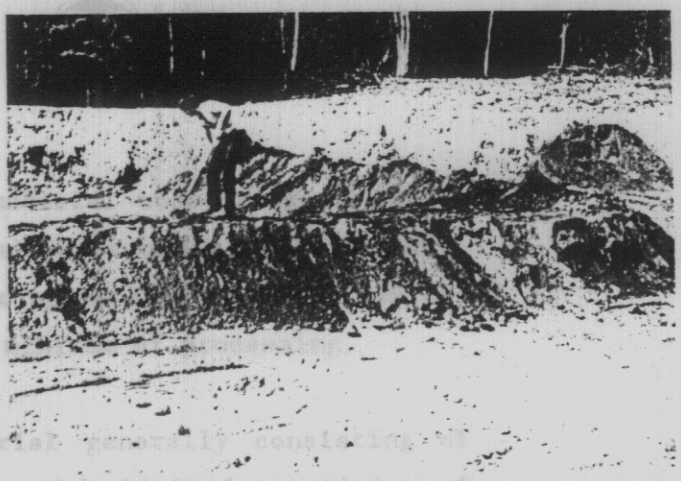
Class 3 - Fair quality materials; poorly-graded with substantial fines



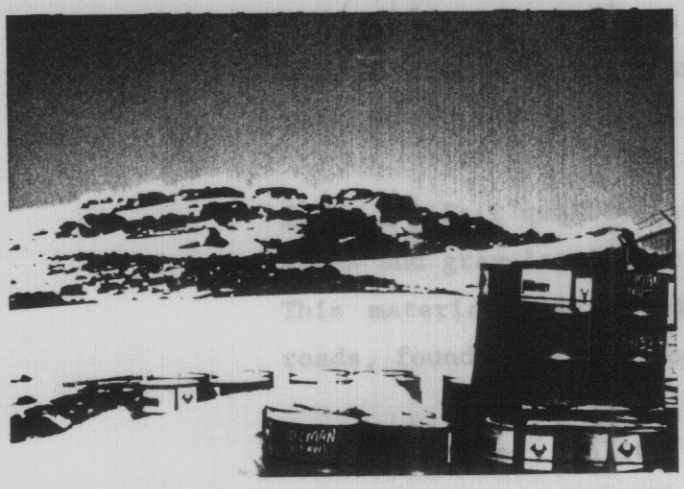
Class 3 material used as a pad for fuel storage tanks

FIGURE 3. CLASS 1,2, AND 3 GRANULAR MATERIALS

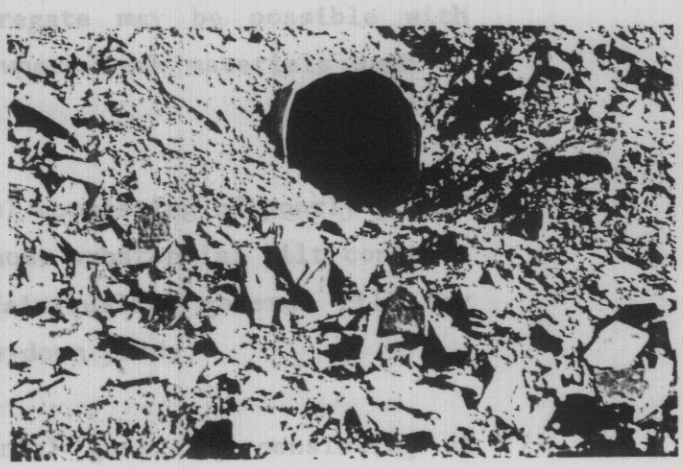
Class 4 - Poor quality materials; poorly-graded with minor gravel and a large proportion of fines



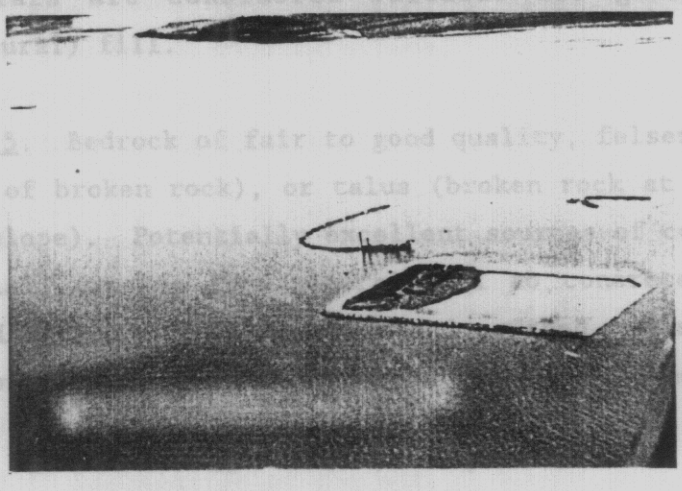
Class 4 material used as a berm around a fuel storage site



Class 5 - Outcropping of bedrock at Holman, N.W.T.



Class 5 material used as rip rap to protect a culvert outlet



Class 5 material used as armour stone around an artificial island in the Mackenzie River at Norman Wells

FIGURE 4. CLASS 4 AND 5 GRANULAR MATERIALS

materials are considered suitable for general (non-structural) fill.

Class 5. Bedrock of fair to good quality, felsenmeer (open areas of broken rock), or talus (broken rock at the bottom of a slope). Potentially excellent sources of construction material, ranging from general fill to concrete aggregate or building stone if quarried and crushed. Also includes erosion control materials such as rip-rap or armour stone.

1.5.2 Confidence of Volume Estimates

The volume estimates for the granular material sources identified in the EBA (1987a) report are classified as being proven, probable, or prospective.

A proven volume is one whose existence, extent, thickness, and quality is supported by ground truth information such as geotechnical drilling, test-pitting, and/or exposed stratigraphic sections. Usually the thickness of material encountered in a borehole is extrapolated to a radius not exceeding 50 metres around the hole.

A probable volume is one whose existence, extent, thickness, and quality is inferred on the basis of direct and indirect evidence, including topography, landform characteristics, airphoto interpretation, extrapolation of stratigraphy, geophysical data, and limited sampling.

A prospective volume is one whose existence, extent, thickness, and quality is suspected on the basis of limited

direct evidence, such as airphoto interpretation and/or general geological considerations.

1.6 IMPLICATIONS OF GRANULAR MATERIAL EXTRACTION

The development of granular resource deposits normally involves three major tasks:

(1) Obtaining access to the deposit.
(2) Development of the deposit.
(3) Reclamation of the pit.

Each of these tasks can have economic, cultural, and environmental implications associated with it.

1.6.1 Obtaining Access to the Deposit

The development of access to a source can involve significant economic costs. These costs will have a strong bearing on the cost of materials delivered to the community and on the ultimate feasibility of developing the source. There are also several potential social and cultural impacts associated with the development of access to a granular source. The development of access, particularly year-round access, can lead to unforseen development activities in an area, and to long-term changes to an area or region which could not be anticipated at the time of the original development. Hunting, fishing, and trapping pressure on an area may increase, visitors to the region may gain access to an area that was previously accessible only to the limited population of the community, and there may be some interference with community activities in the

area of the source. On the other hand, road construction may open an area to year-round recreational use by the community, or to possible tourism development benefits on the part of the community.

Environmentally, access road construction can create drainage and erosion problems and habitat destruction if proper construction techniques are not followed. Disturbance to the active layer in permafrost terrain can result in thawing erosion. If eroded sediments enter watercourses, fish habitat can be damaged or destroyed. Furthermore, the development of larger access roads could conceivably affect wildlife movements and result in habitat abandonment.

Access road impacts can be minimized by following guidelines presented in the INAC (1984) publication "Land Use Guidelines Access Roads and Trails".

1.6.2 Development of the Deposit

The development of a deposit involves the stripping of vegetation, the removal of overburden, and the extraction of granular materials. The amount of vegetative stripping and overburden removal required to develop a source will play an important role in the costs of development. A thick covering of silts or clays may make the development of the source unfeasible. Similarly, ease of extraction will affect costs. A dry deposit is much cheaper to develop than one with substantial volumes of ice, which may require blasting.

The opening of a pit may destroy important wildlife and fisheries habitat or may interfere with hunting, trapping, or fishing activities. The pit may be located in an area used for recreation by the community or be near enough to such an area that the presence of the pit will impair the aesthetics of the recreational site. As with the opening of an access road, pit development may lead to the discovery of heritage resource sites, but it also offers the opportunity to destroy such sites if their presence is not noted prior to extraction.

Environmentally, pit development offers the potential for drainage and erosion problems, habitat destruction, and wildlife disturbance. Vegetative stripping and overburden removal expose materials to wind and water erosion. The deposition of eroded materials in streams can result in damage to fish habitat. A high ice content in the deposit can result in further erosion and siltation when thawing occurs during extraction. Noise from equipment used during development can disturb wildlife during critical periods such as calving or nesting.

Guidelines to minimize the impacts of development of the deposits are available in the INAC (1982) publication "Environmental Guidelines Pits and Quarries".

1.6.3 Reclaiming the Pit

The costs of pit abandonment and reclamation should be factored into the costs of developing a source. Pits which have not been properly restored can be subject to unnecessary longer-term erosion and drainage problems. Pit

reclamation can enhance the recreational and habitat capabilities of a site.

Reclamation guidelines for pits and quarries are included in the INAC (1982, 1987) publications "Environmental Guidelines Pits and Quarries" and "Reclamation Guidelines for Northern Canada".

PART 2: PLAN GOALS

The definitions, principles, and goals of the Inuvialuit Final Agreement form the basis of this plan. The plan should also be interpreted so as to be consistent with any future land claims agreement between the Dene-Metis and the Government of Canada.

Specifically, the goals of this plan are:

(1) To reserve adequate supplies of appropriate quality granular materials for the community's future needs.

(2) To site and manage these reserves within reasonable distance of the community, and so as to ensure that granular development does not interfere with wildlife, wildlife habitat, archaeological resources, or with people out camping, hunting, fishing, or trapping.

(3) To find the best sources for the long term, integrating the granular requirements of all users (the Hamlet, the Federal and Territorial Governments, the Inuvialuit, the Dene-Metis, and the oil and gas industry etc.).

(4) To minimize the negative environmental and visual effects of granular development (pits and access roads). To prevent drainage problems. To ensure that pits are fully restored when depleted.

(5) To ensure that the development of granular materials is well planned and managed, so as to ensure that the materials in existing and planned pits are fully used. To ensure the integration of granular planning with other planning initiatives.

(6) To produce a plan that is written in clear and concise terms, so that it can be understood, implemented, and revised at the local level.

PART 3: PRESENTATION AND ASSESSMENT OF RESOURCE INFORMATION

3.1 PHYSICAL SETTING

Aklavik is located on the west channel of the Mackenzie River Delta. The distribution of granular deposits, as discussed in this plan and mapped by EBA (1987a), is shown in Figure 5. Most of the deposits occur on non-Inuvialuit lands.

Terrain in the Aklavik area ranges from the low-lying, relatively flat Mackenzie Delta to the 600 m-high Richardson Mountains west of the community. The sediments of the Mackenzie Delta are unsuitable for use as granular materials because of their high fines content. The closest suitable granular materials to Aklavik are present in alluvial deposits along the flank of the Richardson Mountains and in colluvial deposits and bedrock within the mountains (Rampton 1988).

Alluvial deposits are present as both terraces and fans. Alluvial terraces consist of sand, gravel, silt, and organic matter deposited by streams in bedrock channels in the Richardson Mountains. Alluvial fans are formed where streams exit the Richardson Mountains. These fans consist of clayey silt and silty sand and are poor quality sources of granular material. Source 455 occurs on an alluvial terrace. Source 467 occurs on an alluvial fan.

Colluvial deposits occur on moderate-to-steep slopes in the Richardson Mountains. The deposits are composed of shale

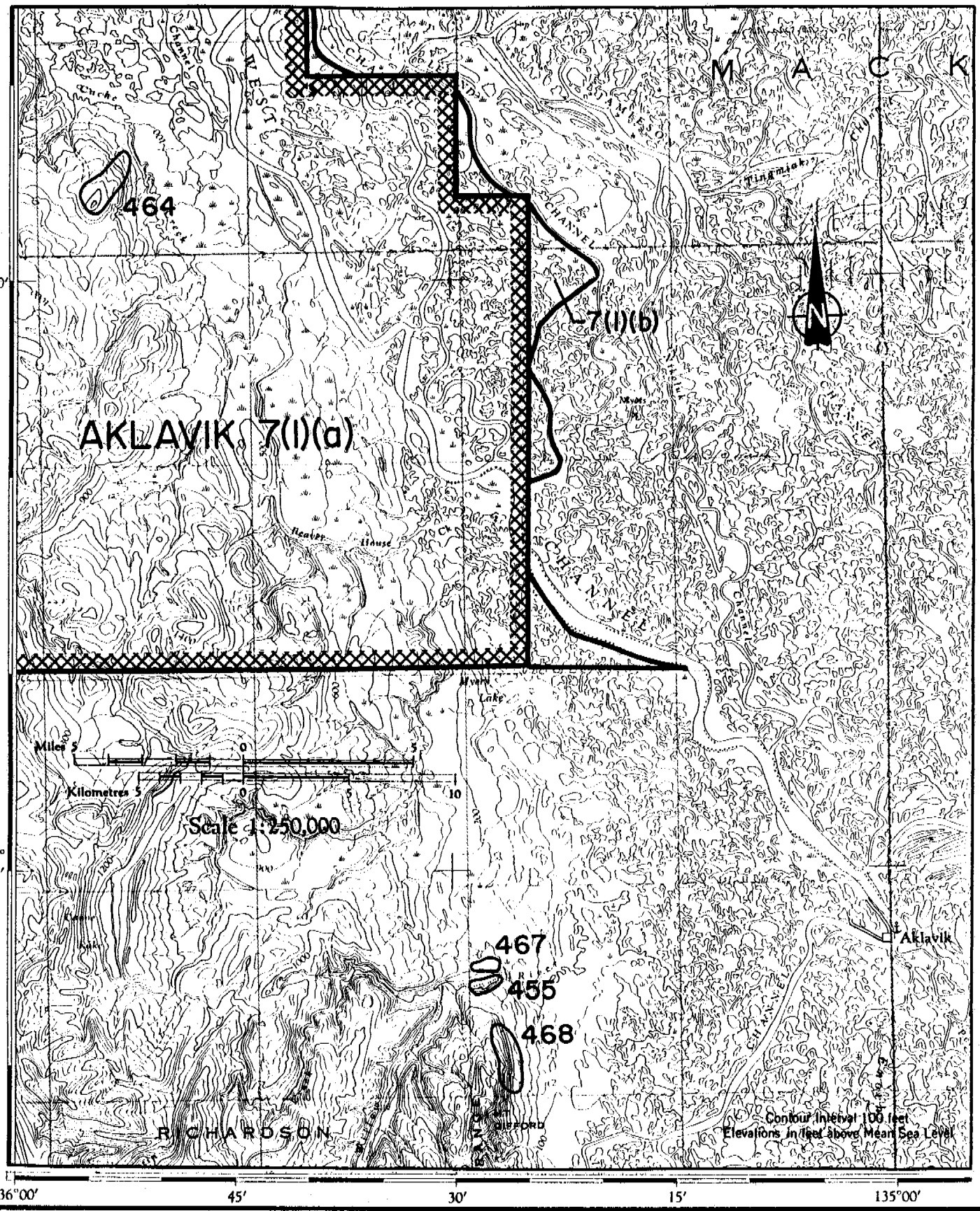


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Figure 5

Location of granular deposits, Aklavik, N.W.T.

and sandstone, reflecting the composition of the underlying bedrock. Source 464 occurs in colluvium.

Bedrock exposures within the Richardson Mountains consist of sandstones and shales of Jurassic and Cretaceous age. Source 468 is a bedrock outcrop which is suitable as a source of Class 5 materials.

3.2 COMMUNITY SETTING

Aklavik is a moderately-sized, predominantly aboriginal community that is situated in the western part of the Mackenzie Delta. It is below the tree line and is approximately 110 km from the Arctic Ocean. Historically, it owes its location primarily to the trapping, whaling, and caribou hunting potential of the region. According to Usher (1976), trapping was introduced into the regional economy in the early part of the century, and in 1912 the Hudson Bay Company established a post just across the channel from the site of the present settlement. By the mid-1920's, with the establishment of Anglican and Roman Catholic missions in Aklavik and the movement of the RCMP post from Herschel Island to the community, Aklavik had become the administrative and trading centre of the region. Significant population changes were also occurring at this time, primarily with the immigration of many Inuit of Alaskan origin to the Delta, and the community included a hospital and residential school that were built by the Churches.

Between 1930 and 1950, muskrat and fox prices were generally high, and the Delta was intensively trapped. By 1952, the population of Aklavik was 1556. In 1954, however, because of flooding and erosion problems and limitations in the land available for town expansion, the Federal Government began moving its school, hospital, airport, and administrative services to the newly-established Inuvik, and the regional focus of the Delta shifted to the newer community. But while its population decreased with the administrative shift, Aklavik continues to flourish. In 1974, the community was incorporated as a Hamlet. In 1986, the population of Aklavik was 763 (Statistics Canada 1986).

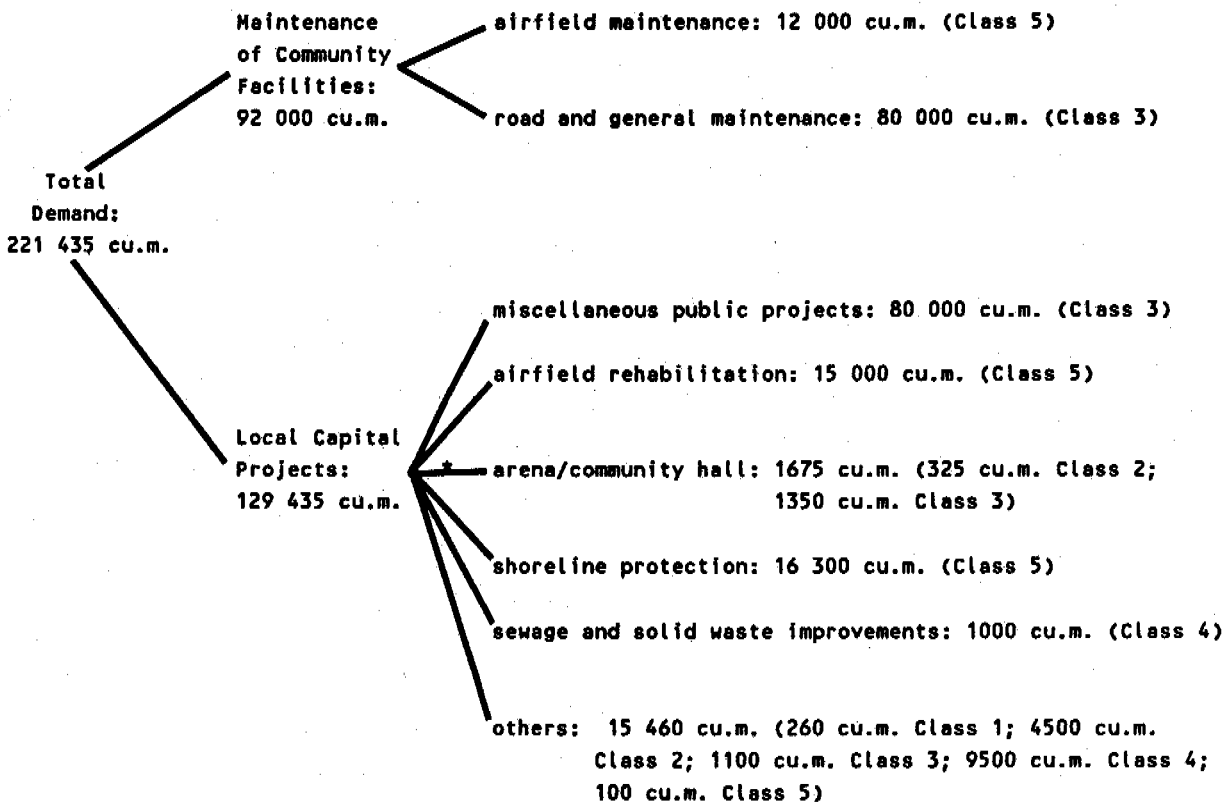
As in many Arctic communities, the economy of Aklavik is a blend of the cash economy and the hunting, fishing, and trapping economy and way of life. Accurate and up-to-date figures on the relative contribution of different sectors to the overall cash economy are not, however, available. In non-quantitative terms, the community derives its income from local private construction, service, transportation, and tourism businesses; from employment with the Hamlet, the Government of the Northwest Territories, the School, the RCMP, and the Nursing Station; from Federal and Territorial transfer payments; and from trapping and the imputed value of the country food harvest (Lutra and Ruitenbeek 1985). Generally speaking, the economic orientation of the community is two-fold. On the one hand, it relies on a diversity of private businesses and wage employment for the income necessary in a modern community. On the other, Akalvik continues to look to the hunting, fishing, and trapping economy and way of life for a

significant proportion of its food, and for many of its cultural and economic values. While the people of Aklavik want to diversify and enhance their local economy, they are also concerned that environmental quality and wildlife habitat and populations be preserved.

3.3 NEED FOR GRANULAR MATERIALS (DEMAND)

Figure 6 presents an overall picture of the projected 20-year demand for granular materials in Aklavik, based on the EBA (1987a) figures. Of a forecast demand of approximately 222 000 cubic metres over 20 years, EBA estimates that approximately 92 000 cubic metres will be required for the maintenance of community facilities, and 129 400 cubic metres will be required for local capital projects. Community maintenance projects include airfield maintenance (12 000 cubic metres, Class 5) and road and general maintenance (80 000 cubic metres, Class 3). The main local capital users, as listed in the figure, include miscellaneous public projects (80 000 cubic metres, Class 3), airfield rehabilitation (15 000 cubic metres, Class 5), an arena/community hall (1675 cubic metres, Classes 2 and 3), shore line protection (16 300 cubic metres, Class 5) and sewage and solid waste improvements (1000 cubic metres, Class 4). Since the completion of the EBA report, the arena/community hall has been constructed.

Table 1 presents a 20-year summary of the volumes of different classes of material that will likely be required in the community. Note that in this table and in Figure 6, EBA has used the term "Class 5" to refer both to rip rap, used for erosion protection in Aklavik, and to granular



* arena/community hall constructed in 1988.

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FIGURE 6.

REQUIRED VOLUMES OF GRANULAR MATERIALS (DEMAND) BY MAIN USERS, AKLAVIK 1987-2006 (EBA 1987a)

TABLE 1

REQUIRED VOLUMES OF GRANULAR MATERIALS (DEMAND), IN CUBIC METRES, AND RECOMMENDED SOURCES OF SUPPLY, AKLAVIK, 1987 - 2006 (FROM EBA 1987a)

Class	1987-91	1992-96	1997-2001	2002-06	Totals	Recommended Sources
Class 1	300	0	0	0	300	# YaYa or I 403
Class 2	4 900	0	0	0	4 900	# YaYa, I 407 or I 403
Class 3	42 500	40 000	40 000	40 000	162 500	# 467
Class 4	10 500	0	0	0	10 500	# 467
Class 5	34 400	3 000	3 000	3 000	43 400	# I 402 &/or 468
				TOTAL	221 600	

Note: EBA figures used in this table have been rounded to the nearest 100 cu.m.

materials that are produced by crushing rock. Approximately 27 000 cubic metres of the projected Class 5 requirement is for airstrip rehabilitation and maintenance. Crushing and screening to produce Class 1 materials is recommended by EBA (1987a). If they were locally available, however, a combination of Class 2 and Class 3 materials could be used, consistent with airstrip rehabilitation and maintenance projections in the other Inuvialuit communities. The projected requirement for rip rap for erosion protection is approximately 16 400 cubic metres.

The present study was not mandated to revise the forecast demand figures. Any community concerns with the figures were, however, noted in the workshop. Community representatives suggest that Class 1 and 2 requirements, and particularly the latter, are somewhat under-estimated. While the 20-year requirement for Class 1 material in Aklavik should remain relatively modest, the Hamlet Foreman and local contractors suggest that Aklavik could conservatively use approximately 2000 cubic metres of Class 2 material per year if such materials were available. The community's 20-year requirement for Class 2 materials might thus be in order of approximately 45 000 cubic metres. With these minor exceptions, however, EBA's figures should be sufficiently accurate for the purpose of establishing reserves, particularly given that the demand forecasts are to be reviewed at least every 5 years.

3.4 GRANULAR MATERIALS SUPPLY

Granular materials sources in the Aklavik area are shown in Figure 5 and described in Table 2.

3.4.1 Class 1 Materials

To supply the community's Class 1 requirements, EBA (1987a) has recommended the use of better-quality materials in the Ya-Ya Lakes pit, or crushed materials from the Campbell Lake quarry (I 403). The Ya-Ya Lakes pit is situated approximately 90 km northwest of Inuvik, primarily on Inuvialuit 7(1)(b) lands. Its access to Inuvik is by a winter ice road along the East Channel of the Mackenzie River. The Campbell Lake quarry is situated on Crown Lands, and is approximately 18 km southeast of Inuvik. Its access to Inuvik is by an all-weather road. To deliver materials from either of these sources to Aklavik would require transporting the materials via Inuvik. The distance across the Delta from Inuvik to Aklavik (by barge or winter ice road) is approximately 125 km.

Community representatives consider the costs of transporting granular materials across the Delta to be prohibitively high for most users. Bids to deliver materials to Aklavik from the Campbell Lake quarry have run in the order of $45 to $50 per cubic yard in the past. The Ya-Ya Lakes and Campbell Lake sources are thus unrealistic as options for the long term supply of Class 1 materials to many users in Aklavik.

TABLE 2

GRANULAR MATERIAL SOURCES - AKLAVIK
(FROM EBA 1987a)

Source No.	Location	Estimated Volume	Access	Comments
455	24 km west of Aklavik	500 000 m^3 Class 3 (probable)	Tundra/ice road in winter	
464	51 km northwest of Aklavik	20 million m^3 Class 5 (probable)	Tundra/ice road in winter	
467	24 km west of Aklavik	3 million m^3 Class 3 (probable)	Tundra/ice road in winter	
468	17 km west-southwest of Aklavik	10 million m^3 Class 5 (probable)	Tundra/ice road in winter	

3.4.2 Class 2 Materials

EBA (1987a) has recommended that Aklavik's class 2 requirements be supplied from the Ya-Ya Lakes pit, Source I 407 or the Campbell Lake quarry (I 402). The Ya-Ya Lakes pit and the Campbell Lake quarry are described above. Source I 407 lies 61 km north-west of Inuvik on Inuvialuit 7(1)(a) lands. Like the Ya-Ya Lakes pit, it is accessible to Inuvik via the East Channel of the Mackenzie River.

Once again, for most users in Aklavik, the costs of delivering Class 2 materials from the recommended sources are prohibitively high. There are, however, no other known sources of higher quality materials in the Aklavik area. The practical implication of this dilemma is that many of Aklavik's users are having to substitute lower-quality Class 3 materials for Class 2 requirements. The use of these lower-quality materials with a relatively high percentage of fines, and the generally low-lying location of Aklavik on the Mackenzie Delta lead to problems with drainage and with foundation settling throughout much of the community.

Community representatives stress the need to secure a source of reasonably-priced, higher-quality materials in the Aklavik area. The acquisition of a crusher has been recommended if naturally-occurring materials cannot be discovered within reasonable transportation distances of the community. Community representatives suggest that a crusher might be stationed either at Source 464, known locally as Ulagvialuk, or in the vicinity of Source 468 (Mt Gifford).

Source 464 (Ulagvialuk) is located approximately 51 km northwest of Aklavik on Inuvialuit 7(1)(a) lands. It is accessible to the community via the West Channel of the Mackenzie River, and is approximately five kilometres inland of the Channel. The source contains a probable volume of approximately 20 million cubic metres of Class 5 materials. Preliminary investigations of the site have been carried out by Esso Resources Canada Ltd. and Storr and Sons of Aklavik. The site was investigated as a possible source of a range of materials for the oil and gas industry and the community, from higher-quality granular materials to rip rap for artificial island protection. Results of the investigation are not available. No actions have yet been taken to develop the source.

Source 468 (Mt Gifford) lies in the foothills of the Richardson Mountains, 17 km west of Aklavik. While the source currently sits on Crown lands, its ownership could be affected by the settlement of the Dene-Metis land claim. The source is accessible by winter ice road from Aklavik.

Source 468 has a probable volume of approximately 10 million cubic metres of Class 5 material. Like Source 464, its development would require the crushing of stone.

While a crusher was used in the past in the construction of Aklavik's airport, it is no longer available. Aklavik's Hamlet Council has approached authorities in the Federal and Territorial Governments in an effort to acquire a crusher for the community, but it has not as yet been successful. The general consensus of the workshop was that

the acquisition and use of a crusher would probably require the cooperation of several users (Federal, Territorial, and Municipal Governments and the oil and gas industry). Cooperation with the oil and gas industry, and the establishment of a regional source of a range of granular materials, was seen as the most promising alternative to the community's current lack of Class 1 and 2 materials in the Aklavik area.

3.4.3 Class 3 and 4 Materials

Aklavik is currently using Source 455 to supply most of its granular requirements. This source is located approximately 24 km west of Akalvik near Willow Creek. EBA (1987a) recommends the use of Source 467 to supply the community's Class 3 and 4 requirements. This source is an alluvial fan located just uphill of Source 455. Both sources are accessible to Aklavik via a winter ice road. In the past, the community has recommended that consideration be given to the construction of an all-weather road to the foothills and the Willow Creek area, but no actions have been taken on this issue. Both sources are located on Crown Lands. Like Mt Gifford, the ownership of these sources could, however, change with the settlement of the Dene-Metis land claim.

While Source 455 has a probable volume of 500 000 cubic metres of Class 3 material, materials taken from this source have generally been found to contain a relatively high proportion of fines. The materials in Source 467 are expected to be superior in quality to those at Source 455. The use of Source 467 for Akalvik's Class 4 needs might

result in some high grading (the use of higher-quality materials than are necessary for a job). Source 467 would appear, however, to have ample materials to serve the community's future needs: Aklavik's combined Class 3 and 4 needs are in the order of 200 000 cubic metres of granular materials over 20 years, and the probable volume of Source 467 is 3 million cubic metres of Class 3 materials.

3.4.4 Class 5 Materials

As noted above, EBA's (1987a) projected Class 5 requirements for Aklavik are actually comprised of approximately 27 000 cubic metres of high-quality aggregate for runway rehabilitation and maintenance, and approximately 16 400 cubic metres of rip rap for erosion protection in the community.

EBA recommends that the runway aggregate requirement be supplied by the Transport Canada quarry (Source I 402) near Inuvik. This quarry is located 10 km south of Inuvik, and is accessible by an all-weather road from Inuvik. It has a proven volume of 4.6 million cubic metres of Class 5 material. Transport Canada could presumably afford to transport materials from the quarry to Aklavik if no other less-expensive local source was available. It could also presumably benefit from the development of a less-expensive local source, if one could be located.

EBA recommends the use of Source 468 (Mt Gifford) to supply Aklavik's requirement for rip rap for erosion protection. Should the demand for well-graded granular materials increase to the point that a crusher is justified, EBA

recommends the use of this source for all Aklavik's Class 5 requirements. Because of the different interests and factors involved, community representatives are uncertain whether a crusher would be best situated at Mt Gifford or Ulagvialuk (Source 464), described earlier.

3.5 ASSESSMENT OF POTENTIAL SOURCES

3.5.1 Sources 455 (Willow Creek), 467, and 468 (Mt Gifford)

As noted above, Source 455 is currently the Hamlet's primary source of supply for gravel. Materials taken from the source frequently have a high content of fines. Source 467, immediately uphill of Source 455, has been recommended as a potential source of better-quality Class 3 materials. Source 468 is a potential source of Class 5 material.

Community representatives do not foresee significant environmental or wildlife problems with the development of the 455/467/468 area to serve Aklavik's future needs. While the area is used in some years by part of the Porcupine Caribou Herd (during spring and fall migrations, and, less frequently, during winter), significant effects on the herd are considered very unlikely. Nor is the scale of development required to serve the community's needs expected to have a significant impact on the hunting, fishing, and trapping economy. While some hunting takes place in the area, it has not been significantly affected by the development of Willow Creek in the past. The area is not used for fishing. Nor are there locally-known archaeological resources in the area. The foothills area is considered promising from the perspective of potential

tourism development in Aklavik, but, once again, community representatives do not foresee conflicts between granular and tourism development that could not be managed at the local level. Community representatives hope, in fact, that the combined granular and tourism potential of the area might support the construction of an all-weather road to the foothills, so as to increase access to the area as a whole. The only limitations of Sources 455, 467, and 468 are the apparent lack of naturally-occurring, high-quality materials in the sources, and access. In 1987/88, the ice road to Source 455 lasted less than a month. The contract with DPW and the Hamlet was not completed and the community is currently approximately 7000 cubic metres short of granular materials.

The consensus of the workshop was that Sources 455/467/468 could be reserved and developed for the community's future needs without significant environmental and social impacts.

3.5.2 Source 464 (Ulagvialuk)

The consensus of the workshop was that the Ulagvialuk area is only likely to be developed as a cooperative venture to supply the combined needs of the community and the oil and gas industry. With a crusher stationed at the source, Ulagvialuk might become a regional source of the range of materials required by the community and the industry, including rip rap for artificial island protection.

The impacts of developing Ulagvialuk as a regional source could not be fully assessed in this study. The nature and scale of the eventual development is unclear. It would

very likely, however, be much larger than what would be required simply to supply the community's needs. The community's total projected granular requirement, for example, is only approximately 225 000 cubic metres over 20 years. On the other hand, EBA (1987b) has projected a requirement for armour stone and rip rap for artificial island protection of approximately 2.7 million cubic metres.

Like the Willow Creek area, Ulagvialuk is used by portions of the Porcupine Caribou Herd during its spring and fall migrations, and, less frequently, during some winters. Some hunting takes place in the area. Development of the area would require transportation of materials for community use approximately 5 km overland, and approximately 50 km south along the West Channel of the Mackenzie River. Transportation of rip rap for artificial island construction would likely be north via the West and Tiktalik channels into Shallow Bay and hence to the required areas of the Beaufort Sea. If it is proposed that transportation take place during the open-water season, several potential impacts should be more accurately assessed. These include the effect of transportation on the use of the affected area by caribou, on local fishing in the West Channel south of Ulagvialuk (June to October), on beluga calving in the Shallow Bay/Mackenzie Bay areas (July), and on whaling in the same areas (early July to early August).

Until such time as the plans of the oil and gas industry and the potential impacts of developing Source 464 as a regional supply are better known, community representatives

see no difficulty in reserving Source 464 for possible future use.

3.6 COMPARATIVE ASSESSMENT OF SOURCES

A comparative assessment of the granular resource sites near Aklavik is summarized in Table 3 and discussed below.

The consensus of the workshop was that Sources 455, 467, and 468 could all be reserved and developed for the community's future use without significant environmental and social impacts. This area would also be the least expensive alternative in terms of the strict costs of delivering Class 3 and 4 materials to Aklavik: while the costs of materials from Willow Creek in 1987 and 1988 have been $17 to $22 per cubic metre, transportation costs from Source 464 (exclusive of the costs of crushing) have been estimated at $25 per cubic metre (Buck Storr, pers. comm.). The 455/467/468 area has not yet proven, however, to contain the Class 1 and 2 materials necessary for Aklavik.

The acquisition of a crusher may be an option for the region. However, this option may require a larger scale of development, with potentially more significant impacts, than would be required simply to serve the community's needs. If the option appears viable, and if consideration is being given to the development of a regional source of supply, then community representatives would prefer that more detailed environmental, social, and economic assessments be carried out, comparing the development of Sources 455, 467, and 468 on the one hand, and Source 464 on the other. Potential sources of armour stone and rip

TABLE 3

COMPARISON OF GRANULAR RESOURCE SOURCES
AKLAVIK

Source	Use	Environmental and Aesthetic Considerations	Wildlife and Social-Cultural Considerations	Economic Considerations	Comments	Ranking	
						Significance of Impacts	Acceptability of Development
455	Class 3 & 4 needs	Area used by Porcupine Caribou Herd during spring and fall migrations.	Area used for hunting. Potential area for tourism development.	24-km winter ice road required.	Community would like to see all-weather road constructed to the foothills.	Insignificant	Acceptable
464	Class 5 needs	Area used by Porcupine Caribou Herd during spring and fall migrations. If transportation by barge to Beaufort Sea, potential impacts on beluga calving in Shallow Bay and Mackenzie Bay.	Area used for hunting. If transportation by barge to Beaufort Sea, potential impacts on local fishing in the West Channel and on whaling in Shallow Bay and Mackenzie Bay.	51-km winter ice road required. If developed in conjunction with the oil industry, a crusher would likely be located at the source, supporting the use of the site as a regional source for all classes of materials.	Further assessment required once the scale of development is known.	Potentially significant	Requires further assessment.
467	Class 3 needs	Area used by Porcupine Caribou Herd during spring and fall migration.	Area used for hunting. Potential area for tourism development.	24-km winter ice road required.	Community would like to see all-weather road constructed to the foothills.	Insignificant	Acceptable
468	Class 5 needs	Area used by Porcupine Caribou Herd during spring and fall migrations.	Area used for hunting. Potential area for tourism development.	17-km winter ice road required. Site too steep for on-site crushing.	Community would like to see all-weather road constructed to the foothills. Site preparation is required if a crusher were to be located here. Further assessment required.	Insignficant at the scale required by the community; potentially significant if developed as a larger-scale, regional source of supply.	Acceptable at the community scale; regional scale requires further assessment.

rap in the vicinity of Inuvik should also be considered in such a study (EBA 1987b). Community experience suggests that while Source 464 is farther from the Aklavik than Sources 455/467/468 (51 km vs 17 to 24 km), its development may be more attractive to the oil and gas industry. Local contractors in Aklavik also consider Mt Gifford too steep for on-site crushing. This site would thus likely require extensive site preparation work. A detailed comparison of the impacts and costs of developing the two sources (and sources near Inuvik) could not, however, be carried out as part of the present study.

PART 4: RECOMMENDATIONS

(1) Sources 455 (Willow Creek), 467, and 468 (Mt Gifford) should be reserved for public community use in Aklavik. The Willow Creek area is currently the least expensive alternative for delivering granular materials to the community. At the scale required to serve public community needs in Aklavik, the development of these sources should cause no significant environmental or social impacts.

(2) The quality and quantity of materials in Source 467 should be more accurately determined through field studies.

(3) Source 467 is not expected to contain better than Class 3 materials. If, however, the source is proven to contain Class 1 or 2 materials, then these materials should be actively managed to minimize high grading (the use of better-quality materials than are necessary for a job).

(4) Other (non-public) users should be assured access to the reserved sources, provided that the estimated total (public and other) 20-year demand is within the estimated total volume of the reserves.

(5) Aklavik does not currently have an affordable source of Class 1 or 2 materials. This is a significant problem in the community. The location and development of an affordable source should be actively investigated. Alternatively, consideration should be given to the use of a crusher in the Aklavik area.

(6) There is some community interest in developing a large scale source in the Aklavik area, using a crusher, to supply the range of needs of the community and the oil and gas industry in the Beaufort Sea. Sources 464 (Ulagvialuk) and 468 could be reserved with this in mind. Similarly Source R 28/29 in the Inuvik area is being considered as a large-scale source of supply for armour stone and rip rap for artificial island construction (Nesbitt and Howell 1988). This study could not, however, fully assess the impacts of large-scale development of the above sources; the impacts of transporting substantial quantities of material to the Beaufort Sea; or the comparative impacts of the

foregoing. The potential environmental, social, and economic impacts of developing any larger-scale, regional source of supply should be more fully assessed by the responsible authorities prior to the development of any such source. Excavations of any of these sources should not, as a general principle, be permitted until the quantity and quality of materials available are confirmed by field investigation.

(7) A granular development and environmental protection plan should be produced for the Source 455/467/468 area as a whole (including access). In the event that Source 464 is developed, then a similar plan should be produced for that area. The plans should lay out a 5-to-10 year strategy for the orderly development of each area, so as to ensure the integration of granular planning and other land use planning initiatives. They should also ensure that each area is developed so as to minimize environmental and visual effects, and maximize the amount of materials recovered from the area. They should also lay out procedures for the proper development and restoration of the pits.

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APPENDIX A

LETTER FROM NANCY WITHERSPOON, HABITAT MANAGEMENT BIOLOGIST, WESTERN ARCTIC AREA, FISHERIES AND OCEANS CANADA

Government of Canada / Gouvernement du Canada
Fisheries and Oceans / Pêches et Océans

May 29, 1988

Your file / Votre référence

Our file / Notre référence

Fisheries & Oceans
Western Arctic Area
Box 1871
Inuvik, NWT
X0E 0T0

Mr. Tom Nesbitt
Thomas Nesbitt and Associates
5210 Lundquist Road
Yellowknife, NWT
X1A 3G2

GRAVEL EXTRACTION IN THE WESTERN ARCTIC AREA

Dear Tom:

We have looked at existing and potential sites for gravel extraction in our area and provide the following comments related to the fisheries resources:

1. Gravel extraction near creeks or lakes should be conducted so that;
   a) silt is not released into the water body
   b) bank disturbances are minimized as are changes to the shape and direction of the watercourse
   c) that watercourses are not dammed as a result of the activity
   d) pounding along side watercourses does not take place
   e) spawning gravels are not removed on creek or river bottoms
   f) refuse does not enter water bodies
   g) winter and summer road construction to the sites are constructed to minimize disruptions to water bodies as outlined above
   h) any summer operations near water bodies should be conducted outside fish migratory or spawning periods if they are conflicting

2. Underwater gravel extractions should be conducted giving consideration to;
   a) type of equipment used for extraction
   b) timing of migration and spawning of species in the area
   c) utilizing of the areas by fish for feeding or rearing

Specific sites identified that have fisheries concerns include:

1. Aklavik area sites 455 and 467

....2

2. Tuk area sites 155, 160, 162 and 158

3. Inuvik area sites 2.45, 2.44, 2.43,314, R28 and R29

4. Sachs Harbour sites 9, 10 and 11

5. Paulatuk sites 14 to 19

All sites could be reviewed in detail as they come up for development.

I hope this will assist you in producing your report and if you have any questions don't hesitate to contact me or Richard Barnes at (403)979-3314.

Yours truly,

Nancy Witherspoon
Habitat Management
Biologist
Western Arctic Area

cc: D.V. Gillman
B. Wong
J. Stein
R. Barnes