

#554
550

BEAUFORT SEA



GRANULAR MATERIALS INVENTORY

ZONE IV

ZONE V

ZONE VI

RICHARDS ISLAND

CARIBOU HILLS

INUVIK

AKLAVIK

DEPARTMENT OF INDIAN AFFAIRS
AND
NORTHERN DEVELOPMENT

FORT McPHERSON

ARCTIC RED RIVER

MACKENZIE RIVER

RIPLEY, KLOHN & LEONOFF INTERNATIONAL LTD.

Consulting Geotechnical Engineers

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1. INTRODUCTION

1.1 Assignment

The Department of Indian Affairs and Northern Development commissioned Ripley, Klohn & Leonoff International Ltd. to undertake Stage #2 of a granular material inventory which includes all unconsolidated material and bedrock suitable for engineering construction. The search area included the Tuktoyaktuk Peninsula, Richards Island, and the Mackenzie River Delta, south to Fort McPherson and Arctic Red River.

This report presents the results of the investigation and testing of granular materials in Zones IV, V, and VI, as shown on the Zone Location Plan. In general, the report discusses sources that lie outside the 10-mile radius of the Communities; Inuvik, Fort McPherson and Arctic Red River. The work was conducted in accordance with the requirements of the Stage #2 Terms of Reference provided by the Department which requested recommendations for usage, development and restoration of all sources that could be identified.

Authorization to proceed with the work was received September 5, 1972 under Contract No. OTT-72-141 and Authority Reference T.B. No. 714562.

1.2 Procedure

The investigation procedure entailed a study and compilation of existing geological data from the work of the Geological Survey of Canada, pipeline route studies, and other previous work conducted within the designated area by Ripley, Klohn & Leonoff International Ltd. Airphoto interpretation was carried out prior to the field reconnaissance and drilling program. This work was done in co-operation with J.D. Mollard and Associates of Regina. The field reconnaissance to ground-check potential sources was done by means of surface sampling and hand-dug test pits. At the same time the field staff observed access roads, drainage

conditions, biotic environmental concerns and source development considerations. The reconnaissance program identified 9 sources in Zone IV, 6 sources in Zone V, and 6 sources in Zone VI, in addition to those identified within 10 miles of the Communities of Inuvik, Fort McPherson, and Arctic Red River.

1.3 Data Presented

Information for the granular material sources is presented in three sections, one covering each zone.

The first division in each section entitled "Zone ____" is the text of the report which provides a general appreciation of the surficial geology and environment in the Zone and recommendations with respect to use of materials, management, development and restoration of the source areas.

The second division is entitled "Maps and Tables" - provides topographic maps showing the Zone and the location of the sources within it. A summary table giving the pertinent information relative to each source is provided in this section. An explanation of the symbols and terms used in this report is provided in the first section, Zone IV.

The third division entitled "Source No ____" - provides all details for each source including test pit and test hole logs, results of laboratory analyses and details of the development and restoration of each source.

2. ZONE IV2.1 Surficial Geology

This area consists of four physiographic units, the Mackenzie Delta lying in the central position, the Anderson Plain in the southeast corner, the Caribou Hills lying on the eastern boundary of the Delta north of Inuvik, and the Richardson Mountains west of the Delta.

Bedrock is exposed along the west flank of the Caribou Hills and south of Inuvik, between Campbell Lake and the Delta. The age is Precambrian to Tertiary, and the Rocky Hills area is mainly Devonian to Ordovician, with Devonian sandstone dominating, resistant to weathering but weakly cemented.

The Anderson Plain is generally covered by a silty ground moraine of variable thickness over the bedrock, in turn covered locally by more recent glacial features (eskers, kames, etc.) left by the last glacial retreat.

The Delta is predominantly recent silt deposits. Some rivers entering from the east have deposited sand and gravel in their streambeds.

The upper levels of the Richardson Mountains are a competent sandstone of Jurassic and Cretaceous age, but are too remote to warrant consideration. The bedrock exposed near the Delta is a thin-bedded shale alternating with sandstone. The products of erosion of this material are a poor quality granular material, but the major streams contain sounder material in their beds, derived from the high mountains in the upper reaches of their drainage basins.

2.2 Environment

The Anderson Plain is almost altogether covered by forests of a variety of trees, mostly coniferous. Generally the poorly-drained areas support a heavy ground cover of moss.

The eastern flank of the Richardson Mountains is covered by scattered stands of spruce and similar trees, many of them dwarfed, and by shrubs. Here again, the ground is generally covered by a heavy growth of moss.

Zone IV contains a portion of the Winter Range of the Mackenzie Reindeer Herd, a critical wildlife area. This area lies within the Anderson Plain, and several esker deposits studied in this report (Sources 450, 451 and 452) are located in this critical area.

Another critical wildlife zone lies along the northwest side of Campbell Lake, containing an important habitat of the Peregrine Falcon. The same general area is proposed as a reserve for horticultural value under the International Biological Programme. Two sources recommended for consideration or development (453, 454) are in or adjacent to these critical areas.

With the exception of the three critical areas described above, the eastern part of Zone IV is the habitat of the Mackenzie Reindeer Herd and of some barren-land caribou, with calving and breeding taking place in some areas. The area supports some trapping, and moose are hunted during the winter.

The western part of Zone IV is the habitat of caribou and sheep, and the Richardson Mountains are an important big-game hunting area. Along the lower reaches of the Mountains, adjacent to the Delta, is a band recognized as prime lynx habitat, but this area is not trapped to any great extent. The area supports a normal population of small fur-bearing animals.

The channels of the Delta and tributary streams support a fishery that is important to the native population. Some of the larger lakes are fished during the winters.

2.3 Sources and Materials

Nine sources were investigated in Zone IV, and six of them are recommended for further consideration. Sources 456A and 457A are discarded because of poor quality and the serious environmental problems connected with their development. Source 458A contains silt mixed with fine sand, a material considered to be unsuitable for construction.

Source 454 is bedrock, and can be developed to provide granular material. The material exposed at the surface is sandstone, and the suitability of this rock for manufacturing aggregate must await further examination. The source will provide a good quality general fill and road construction material.

The other sources at the eastern end of Zone IV can be developed for general fill.

Only one source in the western section of Zone IV is recommended for further consideration, and this is source 455 in the stream bed of the Willow River. Although deficient in sand, this source contains a deposit of sound rock.

The petrographic analysis of a sample taken at source 455 indicates that 96% of the material is sandstone, quartzite, and limestone, with quartz, chert, and granite making up the remaining 4%. Only some iron staining in the limestone identifies a potentially deleterious constituent, and this is not serious.

2.4 Management

The development of sources in Zone IV will depend on new projects, particularly with respect to their nature and size.

Source 455, in the west, will undoubtedly be developed to serve any work projected in this area, as well as the continued requirements of Aklavik. Fortunately the source is large and is within 4 miles of the Delta.

In the eastern part of Zone IV the choice for development is among sources 450, 452 and 454, with little assistance from sources 451 (inferior quality) and 453 (almost depleted). The sources can all provide general fill and road construction material. The potential for aggregate production is limited.

The indiscriminate development of sources for small volumes must be discouraged, in order to avoid environmental problems, and in all cases restoration must follow close behind development.

2.5 Development

2.5.1. General

Of the six sources under consideration, one (453) is almost depleted, but the others are untouched. The choice of which source to develop will be determined by the nature and size of new projects.

2.5.2. Access

All sources are accessible by truck during the winter, and in fact sources 450, 451, 452 and 455 are accessible only during winter. All are too remote from current activity to warrant consideration of all-weather access.

Source 454 is located near the eastern channel of the Mackenzie River, and may be served by barge during the summer.

Source 453 is beside the Dempster Highway, and the small volume remaining here can be hauled by truck throughout the year.

2.5.3. Material Uses and Handling

Source 454 may produce rock from which aggregates can be manufactured. Source 455 can provide a good grade of coarse aggregate, but is deficient in sand.

All sources can provide a good to satisfactory grade of general fill, although the coarser gravel may require a surface treatment of fine material to provide a suitable surface for traffic or construction.

With the exception of source 454, all sources are fluvial or glacial deposits that can be developed by an assembly of dozers, front-end loaders, and trucks. Those deposits that contain frost at shallow depths would require the attachment of rippers to the dozers.

Source 454 is bedrock, and development of this source would be a quarrying operation calling for drilling and blasting equipment, shovels or loaders, and trucks, probably with a fairly complex crushing and screening plant.

2.5.4. Stripping and Restoration

With the exception of source 453, which has been stripped during the highway construction program, all sites must be cleared of trees and stripped. Trees and roots must be burned, and all organic cover and topsoil must be stripped before the removal of granular material can begin. At source 455, the burning of trees and the disposal of organic cover must be above the flood-plain of the river, to prevent future contamination of the water. Elsewhere the organic material must be stockpiled for the restoration that will follow removal of the granular material.

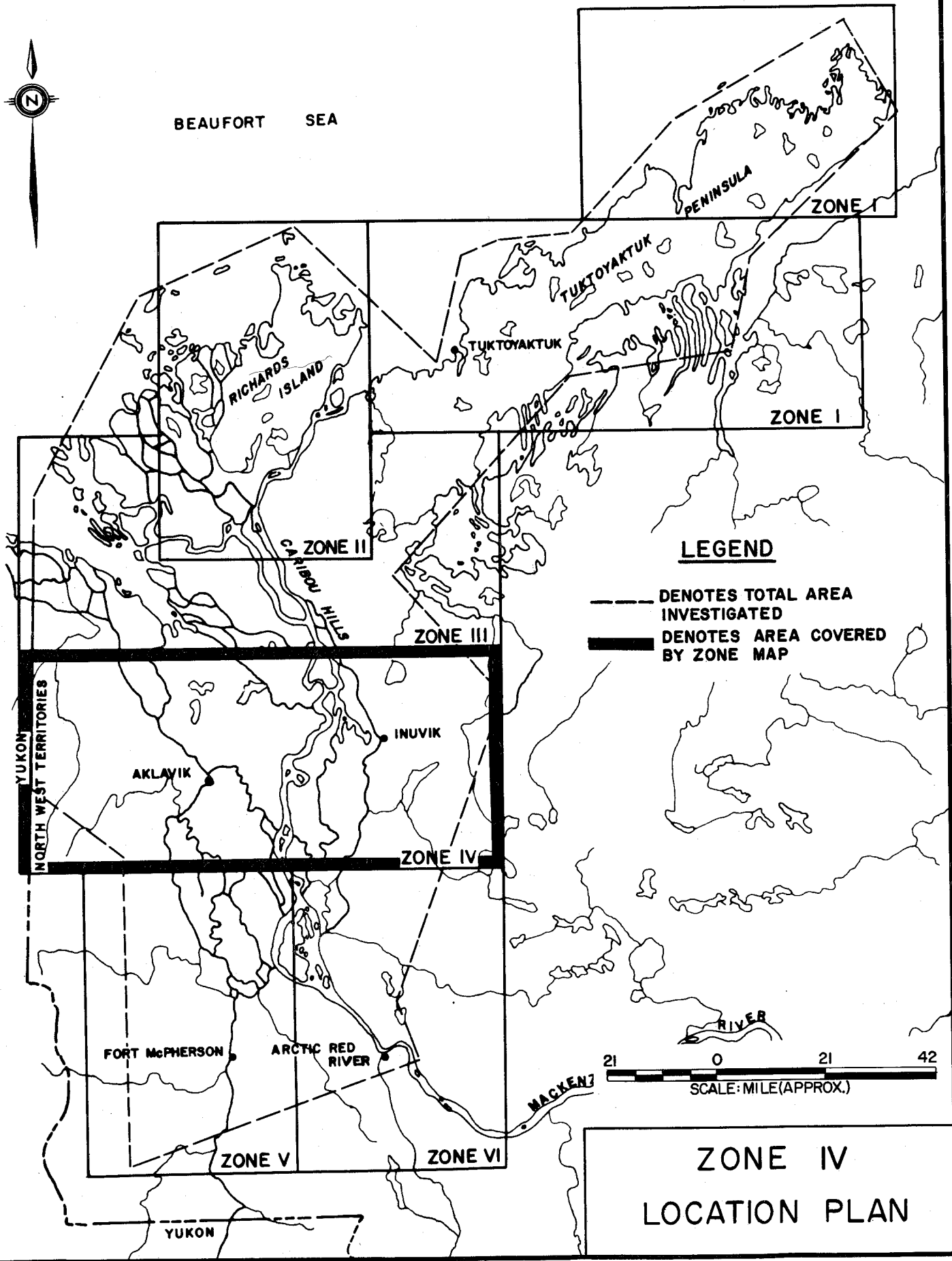
Sources 453 and 454 are near the proposed reserve of the International Biological Programme, and the reclamation of these sources should be planned in consultation with the staff of this Programme, especially with respect to the choice of plants for revegetation.

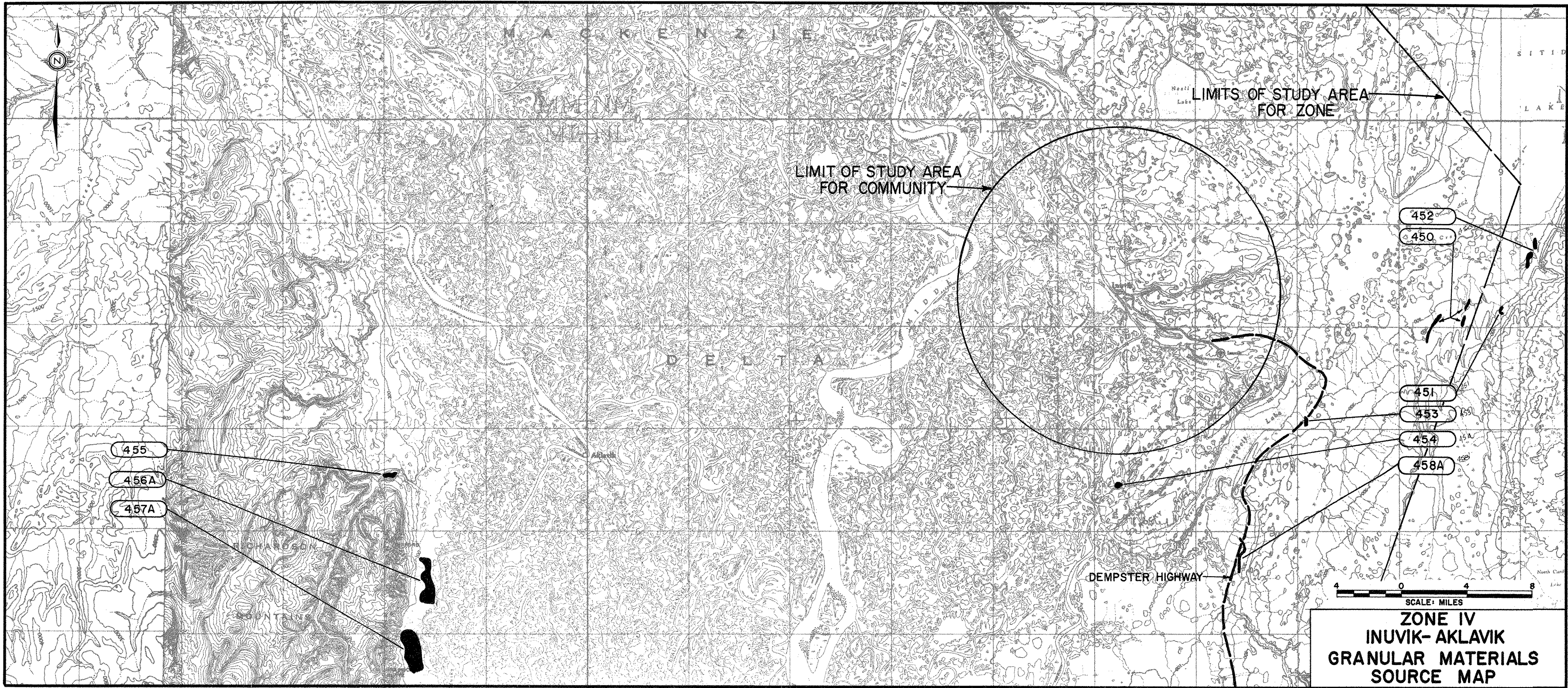
In general, the description of vegetative cover to be employed in restoring disturbed areas is beyond the scope of this report, but can be provided by a botanist familiar with the Arctic region.

More detailed comments concerning the stripping and restoration of the six sources investigated in Zone IV are provided in the discussion of each source.



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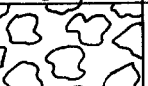
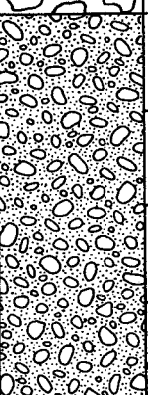
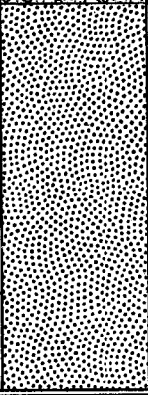
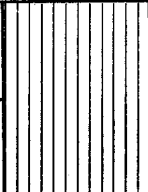
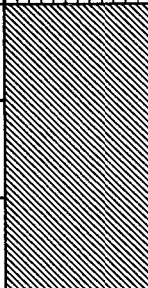
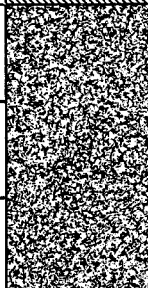


SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
450	11 east of Dempster Highway, 20 by air east of Inuvik	SAND - little gravel little silt (SW-SM)	400,000 approximately	Source is located in winter range of Mackenzie Reindeer Herd	Low priority for development due to marginal quality	Good	Peat and silt	1 to 3	Stockpile adjacent to pit for immediate regrading in depleted area	Low to Med	10	Rip, doze into piles, thaw and drain, load in trucks	General fill	Dozer-Ripper, Loader, Trucks	Undeveloped
SEE SECTION 450 FOR SOURCE DETAILS															
451	13 east of Dempster Highway, 24 by air east of Inuvik	SAND - little silt (SM)	50,000	Source located in winter range of Mackenzie Reindeer Herd	Low priority for development due to marginal quality	Good	Peat and silt	1 to 3	Stockpile adjacent to pit for immediate regrading in depleted area	Low to Med	10	Rip, doze in- to piles, thaw and drain, load in trucks	General fill	Dozer-Ripper, Loader, Trucks	Undeveloped
SEE SECTION 451 FOR SOURCE DETAILS															
452	17 east of Dempster Highway, 26 by air east of Inuvik	SAND - and gravel (SW-SM) GRAVEL - some sand (GM)	1,500,000	Source located in winter range of Mackenzie Reindeer Herd	Suitable for development once limits of pit are outlined	Good	Topsoil and silt	1 to 2	Stockpile adjacent to pit for re-grading in depleted area	Low	10	Rip, doze in- to piles, thaw and drain, load in trucks	General fill	Dozer-Ripper, Loader, Trucks	Undeveloped
SEE SECTION 452 FOR SOURCE DETAILS															
453	Adjacent to Dempster Highway 14 by air south east of Inuvik	SAND - some gravel (SW) SAND - trace gravel (SP)	10,000	Source located in Mackenzie Reindeer Grazing Reserve and a reserve of the International Biological Programme	Suitable to remove remainder of material in source area	Good	Topsoil and silt	1 to 2	Stockpile adjacent to pit for later re-grading in depleted area	Low	5	Doze into piles, load in trucks	General fill	Dozer, Loader, Trucks	Fully developed by Department of Public Works for Dempster Highway
SEE SECTION 453 FOR SOURCE DETAILS															

SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
454	12 by air south of Inuvik	SANDSTONE - coarse	10,000,000	Source lies with-in Mackenzie Reindeer Grazing Reserve and adjacent to Peregrine falcon habitat	Suitable for development	Good	Topsoil	0 to 3	Stockpile adjacent to quarry for regrading	Nil	100 plus	Drill, blast, load into trucks Maybe crush and screen	General fill, coarse aggregate	Drills, Loaders-Shovel Trucks, Crusher, Screens	Undeveloped
SEE SECTION 454 FOR SOURCE DETAILS															
455	13 by air west of Aklavik	GRAVEL - some sand (GP-GM)	500,000	No major environmental concern	Suitable for development	Good	Peat, Topsoil and silt	0 to 3	Stockpile away from River	Nil	3	Doze into piles, load into trucks	General fill, coarse aggregate	Dozer, Loader, Trucks	Undeveloped
SEE SECTION 455 FOR SOURCE DETAILS															
456A	13 by air south west of Aklavik	SILT - some sand, trace gravel (ML)		No major environmental concern except to physical if source is developed	Not suitable for development due to poor quality and problems in restoration	Good	Peat and silt	1 to 6		Med to High			Poor quality general fill		Undeveloped
SEE SECTION 456A FOR SOURCE DETAILS															
457A	15 by air south west of Aklavik	SILT - trace sand, trace gravel (ML)		No major environmental concern except to physical if source is developed	Not suitable for development due to poor quality and problems in restoration	Good	Peat and silt	1 to 6		Med to High			Poor quality general fill		Undeveloped
SEE SECTION 457A FOR SOURCE DETAILS															

[illegible]

EXPLANATION OF SYMBOLS AND TERMS USED IN THIS REPORT

GENERAL CLASSIFICATION SYSTEM FOR SOILS					
MAJOR DIVISION		Group SYMBOL	Graph SYMBOL	TYPICAL DESCRIPTION	
COARSE-GRAINED SOILS (more than half by weight larger than 200 sieve)	BOULDERS		N/A		LARGER THAN 8 INCHES DIAMETER
	COBBLES		N/A		3 TO 8 INCHES DIAMETER
	GRAVELS more than half coarse grains larger than No. 4 sieve & 100% smaller than 3 inches diameter	CLEAN GRAVELS (little or no fines)	G W		WELL GRADED GRAVELS, LITTLE OR NO FINES
			G P		POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		DIRTY GRAVELS (with some fines)	G M		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			G C		CLAYEY GRAVELS, GRAVEL-SAND CLAY MIXTURES
	SANDS more than half fine grains smaller than No. 4 sieve.	CLEAN SANDS (little or no fines)	S W		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			S P		POORLY GRADED SANDS, LITTLE OR NO FINES
		DIRTY SANDS (with some fines)	S M		SILTY SANDS, SAND-SILT MIXTURES
			S C		CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS (more than half by weight passes 200 sieve)	SILTS below "A" line negligible organic content	W_L 50%	M L		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY
		W_L 50%	M H		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS
	CLAYS above "A" line on plasticity chart negligible organic content	W_L 30%	C L		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS
		30% W_L 50%	C I		INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS
		W_L 50%	C H		INORGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS
	ORGANIC SILTS & CLAYS below "A" line on chart	W_L 50%	O L		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		W_L 50%	O H		ORGANIC CLAYS OF HIGH PLASTICITY
	HIGHLY ORGANIC SOILS		P t		PEAT AND OTHER HIGHLY ORGANIC SOILS

SUPPLEMENTARY TERMS IDENTIFYING THE COMPOSITION OF GRANULAR SOILS

Component	Identification	Terms Identifying Proportions	Defining Range Percentage by Weight
Principal Component.....{	GRAVEL SAND SILT	50 or more
Minor Component.....{	Gravel Sand Silt	and some little trace	35 to 50 20 to 35 10 to 20 1 to 10

CLASSIFICATION SYSTEM FOR ICE

Non Visible Ice	Nf Nbn Nbe	Poorly bonded Well bonded Excess Ice
Visible Ice Less than 1 inch thick	Vx Vc Vr Vs	Individual ice crystals or inclusions Ice coatings or particles Random or irregularly oriented ice formation Stratified or distinctly oriented ice formations
Visible Ice Greater Than 1 inch thick	ICE+ ICE	Ice with soil inclusions Ice without soil inclusions

GROUND ICE CONTENT - % BY VOLUME

Low - <10% Med - 10% to 20% High - >20%

DESCRIPTIVE SOIL TERMS

Well graded having wide range of grain sizes and substantial amounts of all intermediate sizes.

Poorly graded .. predominantly of one grain size.

Coarse Aggregate .. Gravel retained on $\frac{1}{4}$ inch screen.

Fine Aggregate . Sand passing $\frac{1}{4}$ inch screen.

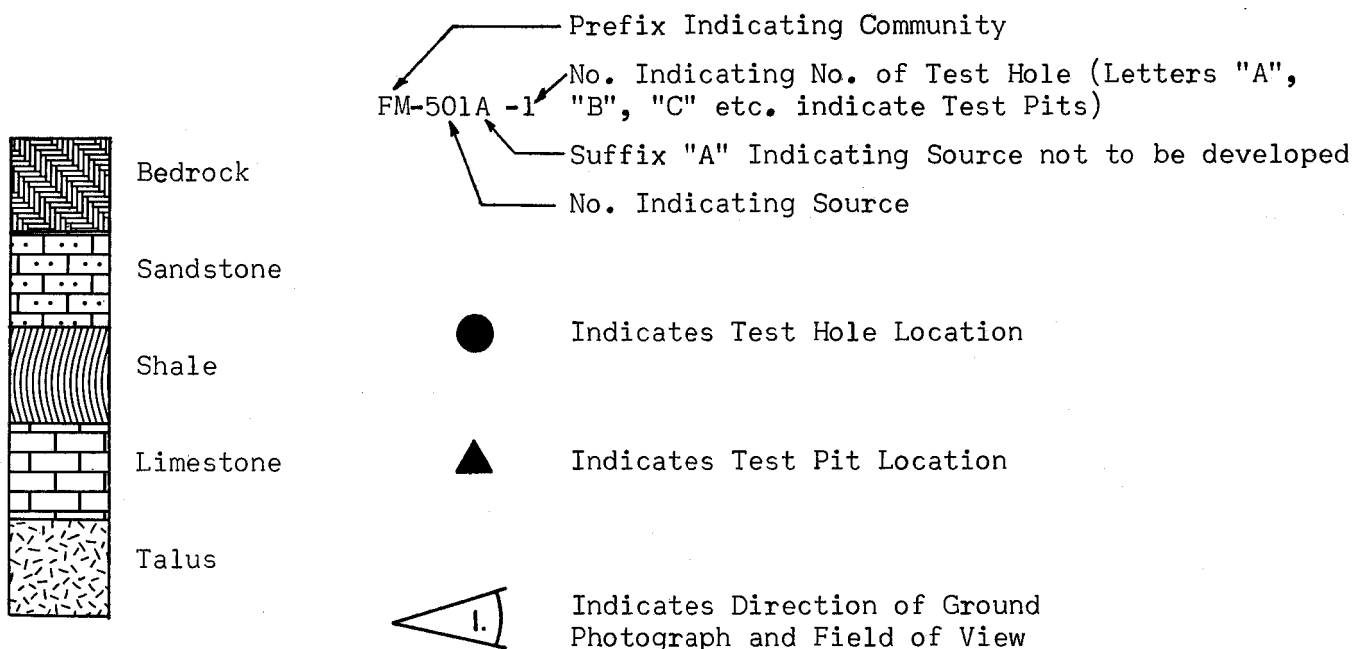
Interbedded composed of alternate layers of different soil or rock types.

Calcareous containing appreciable quantities of calcium carbonate.

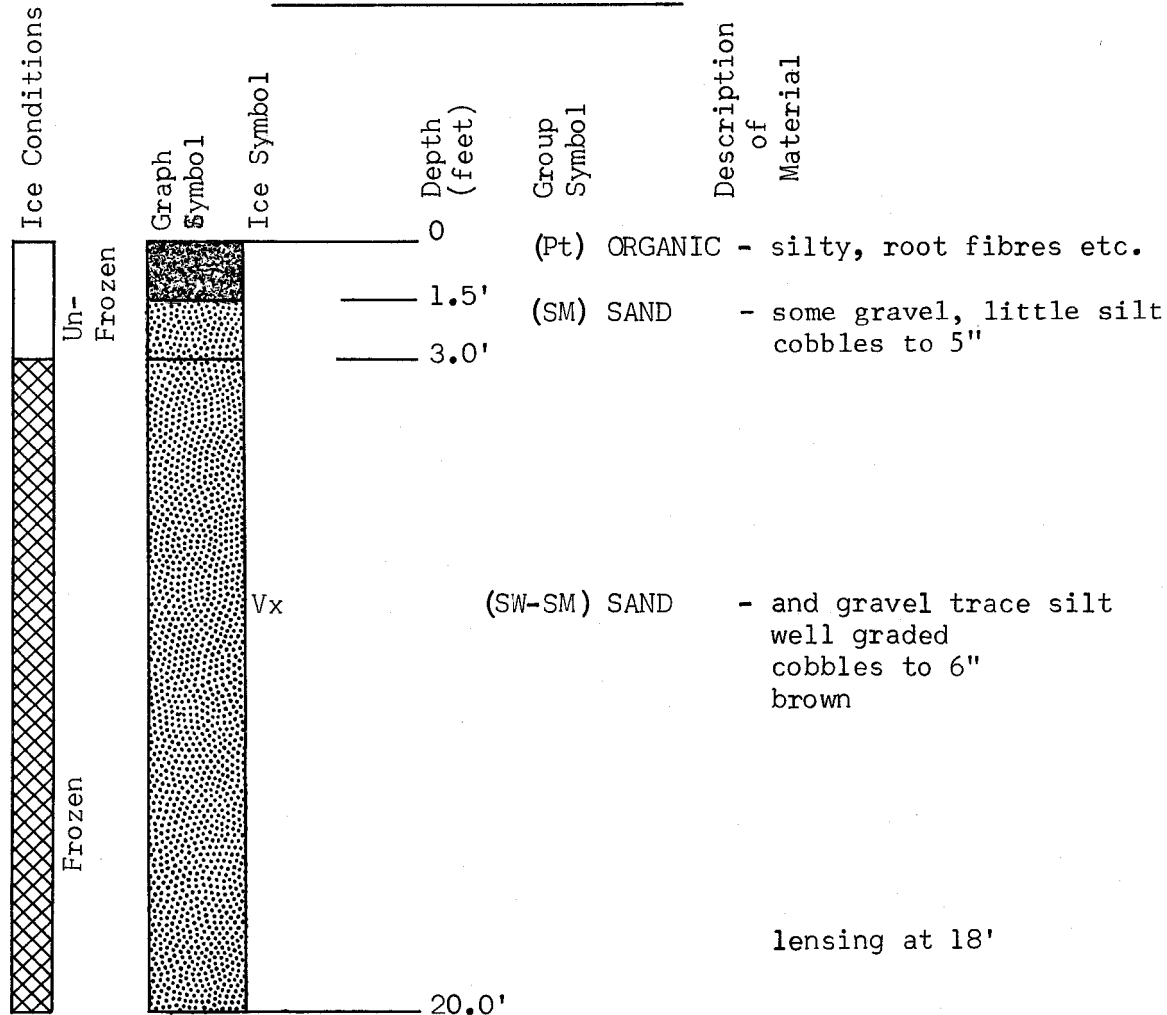
Organic containing organic matter; may be decomposed or fibrous.

Peat a fibrous mass of organic matter in various stages of decomposition. Generally dark brown to black in colour and of spongy consistency.

SUPPLEMENTARY SYMBOLS AND NOTATIONS



EXAMPLE OF SOIL LOG



ZONE IV

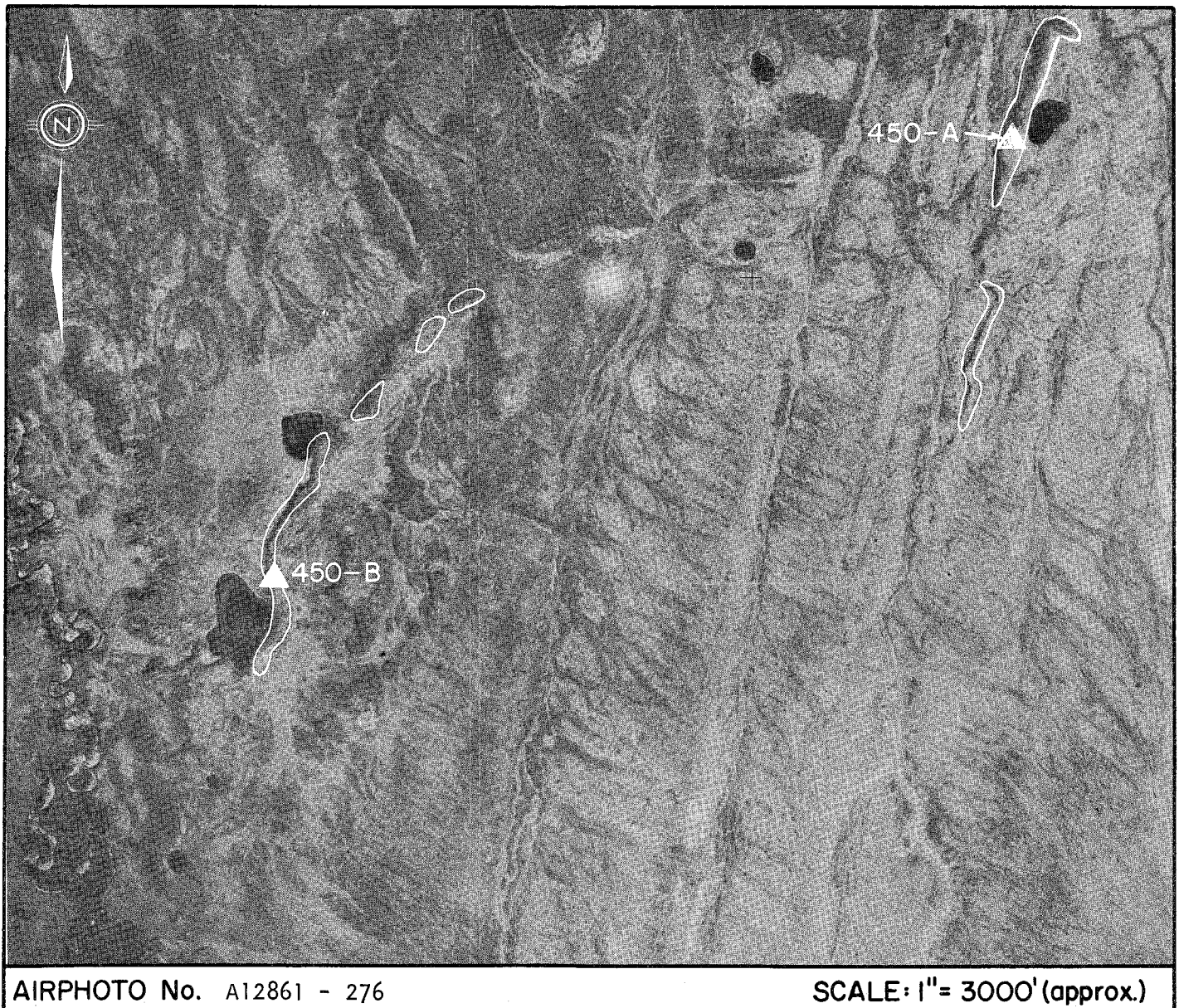
SOURCE No. 450

LANDFORM AND LOCATION: Two discontinuous esker ridges located about 11 miles east of the Dempster Highway and 20 miles by air east of Inuvik

MATERIAL: SAND - little gravel, little silt

VOLUME: 400,000 cu. yds. approximately

CONCLUSION: Source is low priority for development due to marginal quality. Source is also in winter range of Mackenzie Reindeer Herd and development may require an impact study.



AIRPHOTO No. A12861 - 276

SCALE: 1" = 3000' (approx.)

450 ENVIRONMENT

Physical

The source is two discontinuous esker ridges located on the Anderson Plain, 20 miles by air east of Inuvik. The individual ridge segments are from 500 to 5,000 feet long and 20 to 40 feet high.

The area around the eskers is relatively flat, but sloping to the northwest. Drainage is good. The source has not been developed.

Biotic

On the esker ridges the forest cover consists of white spruce and feather moss, the trees being about 25 feet high. On the surrounding flat areas the forest cover is transitional to black spruce about 20 feet high in sphagnum bogs.

The source lies within a critical wildlife area, the winter range of the Mackenzie Reindeer Herd, also of some barren-land caribou. The area is occasionally trapped for marten, lynx, and fox. Moose are hunted here through the winter.

A concentration of burrowing animals can be expected in the vicinity of this esker, because of the favourable conditions for building dens.

450 MATERIALS AND QUANTITIES

The material is primarily sand (70%), little gravel (18%), and some silt (12%). The material was free of ground ice to a depth of 2½ to 3 feet in September, but below that depth ice lensing was observed.

The volume of suitable material in this source is estimated to be 400,000 cubic yards.

450 DEVELOPMENT

General

This source should be considered low priority. Before development proceeds, drilling should be carried out to delineate the suitable fill material and also an impact study will probably be necessary to determine the effect of the development on the Mackenzie Reindeer Herd.

When development proceeds, the full depth of usable material should be removed in one operation, rather than removing only the unfrozen veneer. Only in this way can the environmental disturbance be minimized by concentrating the operation in a small area.

Access

Access is considered to be feasible only during winter, when a road could be developed from the Dempster Highway at the north end of Campbell Lake, northeast along a chain of lakes, then across land to the source. The distance from the source to the Highway is about 11 miles, and to Inuvik is about 24 miles.

Material Use and Handling

The material from this source can be used as general fill. Most of the deposit will require ripping, stockpiling, thawing, and draining before it can be used.

The equipment required for development is the usual assembly of dozers with ripper attachments, front-end loaders, and trucks.

Stripping and Restoration

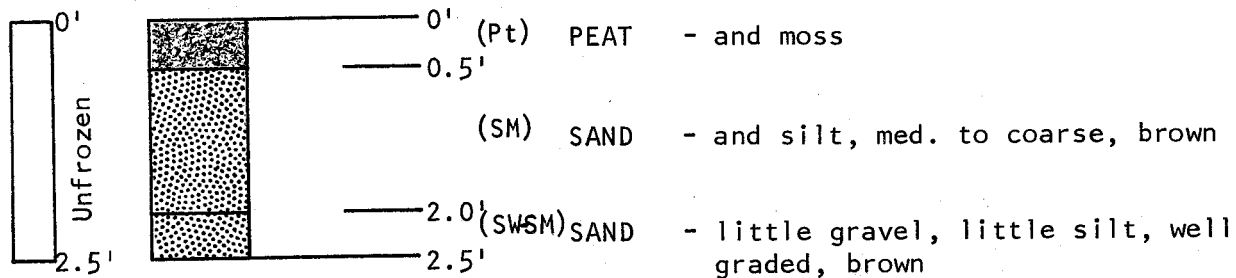
The trees in the area to be developed would have to be cleared, and the trees and roots burned. The organic cover and topsoil would then be stripped and stockpiled for replacement after the granular material had been removed.

Restoration should follow close behind the depletion of an area. Steep banks must be graded to a stable slope before the topsoil is replaced, and then the area should be seeded for speedy re-vegetation, using a selection of plants and methods of preparation recommended by a scientist experienced in Arctic horticulture.

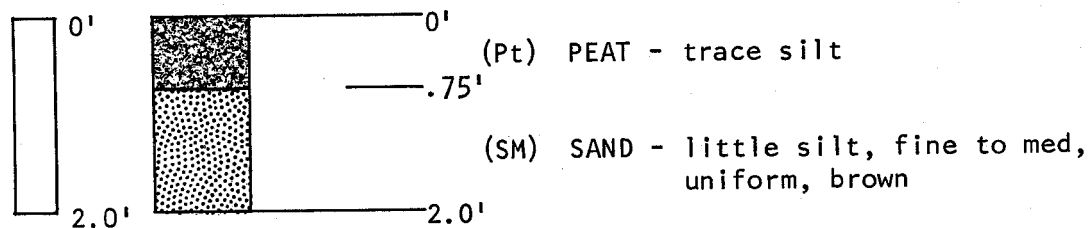
TEST PIT LOGS

SOURCE No. 450

450-A



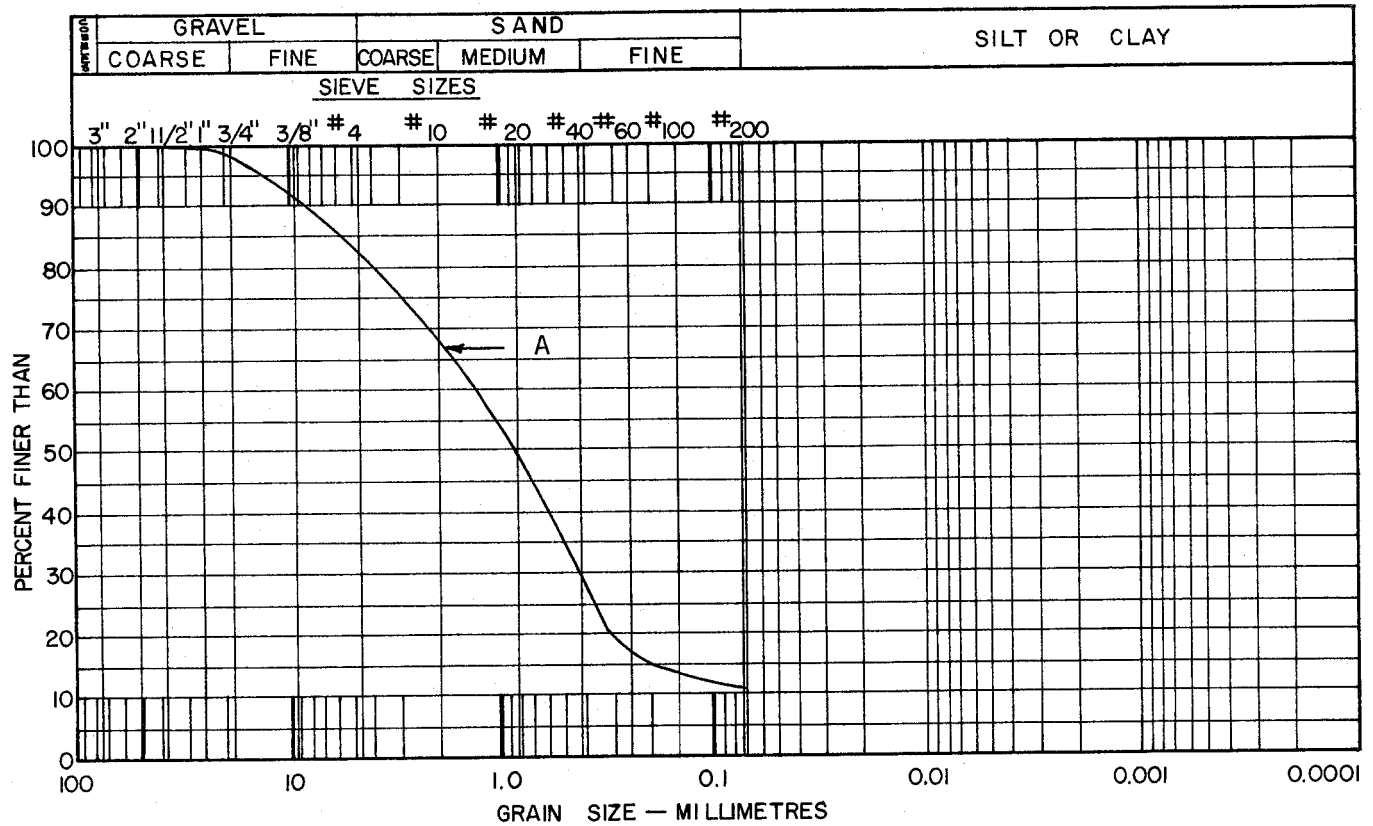
450-B



LABORATORY TEST DATA

TEST PIT-SOURCE No.450

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample A depth (2'-2.5') - 8.7%

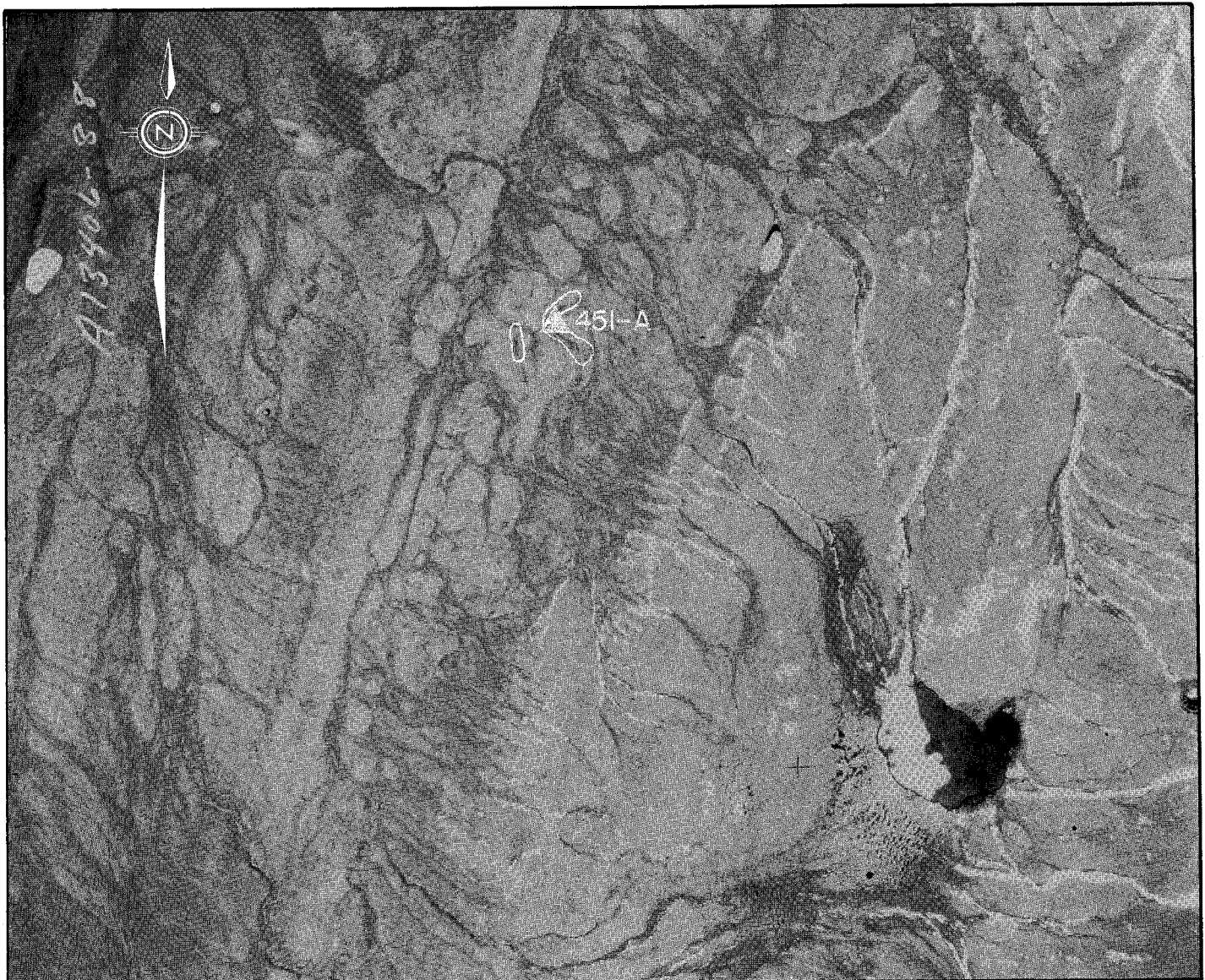
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

ZONE IV
SOURCE No. 451

LANDFORM AND LOCATION: Two small eskers located approximately 24 miles
by air east of Inuvik
MATERIAL: SAND - little silt
VOLUME: 50,000 cu. yds., approximately
CONCLUSION: Source is considered low priority for development
due to marginal quality of material. Environmental
study may be required due to presence of Mackenzie
Reindeer Herd



AIRPHOTO No. A13406 - 88

SCALE: 1" = 3000' (approx.)

451 ENVIRONMENT

Physical

This source consists of 2 small eskers, 300 and 1,000 feet in length and 20 feet high, located on the Anderson Plain, 24 miles east of Inuvik.

Drainage is good. The source has not been developed.

Biotic

Forest cover on the eskers is white spruce with feather moss, the trees standing about 30 feet high. On the surrounding lowland area the cover is black spruce transitional to sphagnum bogs, the spruce running 10 to 15 feet high.

The source lies within a critical wildlife area, the winter range of the Mackenzie Reindeer Herd, also of some barren land caribou. The area is occasionally trapped for marten, lynx and fox. Moose are hunted here through the winter.

A concentration of burrowing animals can be expected in the vicinity of this esker, because of the favourable conditions for building dens.

451 MATERIAL AND QUANTITIES

The material in this source is primarily sand (75%) with little silt (18%) and a trace of gravel (7%). The surface of the deposit was free of ground ice to a depth of 3 feet in September, but below that depth was some ice lensing and ice coating on the particles.

The source is estimated to contain 50,000 cubic yards.

451 DEVELOPMENT

General

Because of the small size of this source it is not recommended for development unless for a project nearby. The source is, therefore, considered to be of low priority.

Drilling should be carried out on the area to delineate the proposed pit limits. It is possible an impact study would be required before development because the source lies within the winter range of the Mackenzie Reindeer Herd.

Access

Access is considered to be feasible only during winter, when a road could be developed from the Dempster Highway at the north end of Campbell Lake, northeast along a chain of lakes, then across land past source 450 to source 451. The distance from the source to the Highway is about 13 miles, and to Inuvik is about 26 miles.

Material Use and Handling

The material from this source can be used as general fill. Most of the deposit will require ripping, stockpiling, thawing, and draining before it can be used.

The equipment required for development is the usual assembly of dozers with ripper attachments, front-end loaders, and trucks.

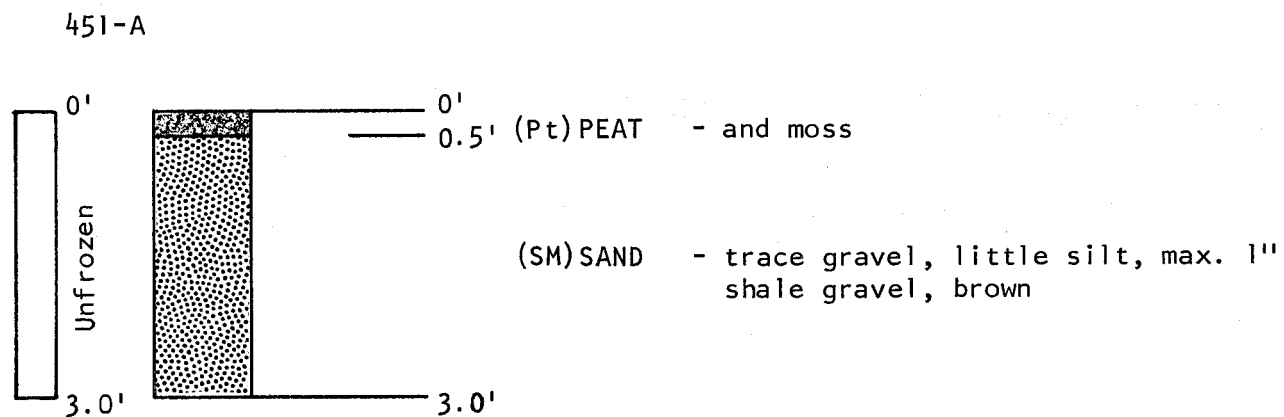
Stripping and Restoration

The trees in the area to be developed would have to be cleared, and the trees and roots burned. The organic cover and topsoil would then be stripped and stockpiled for replacement after the granular material had been removed.

Restoration should follow close behind the depletion of an area. Steep banks must be graded to a stable slope before the topsoil is replaced, and then the area should be seeded for speedy re-vegetation, using a selection of plants and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS

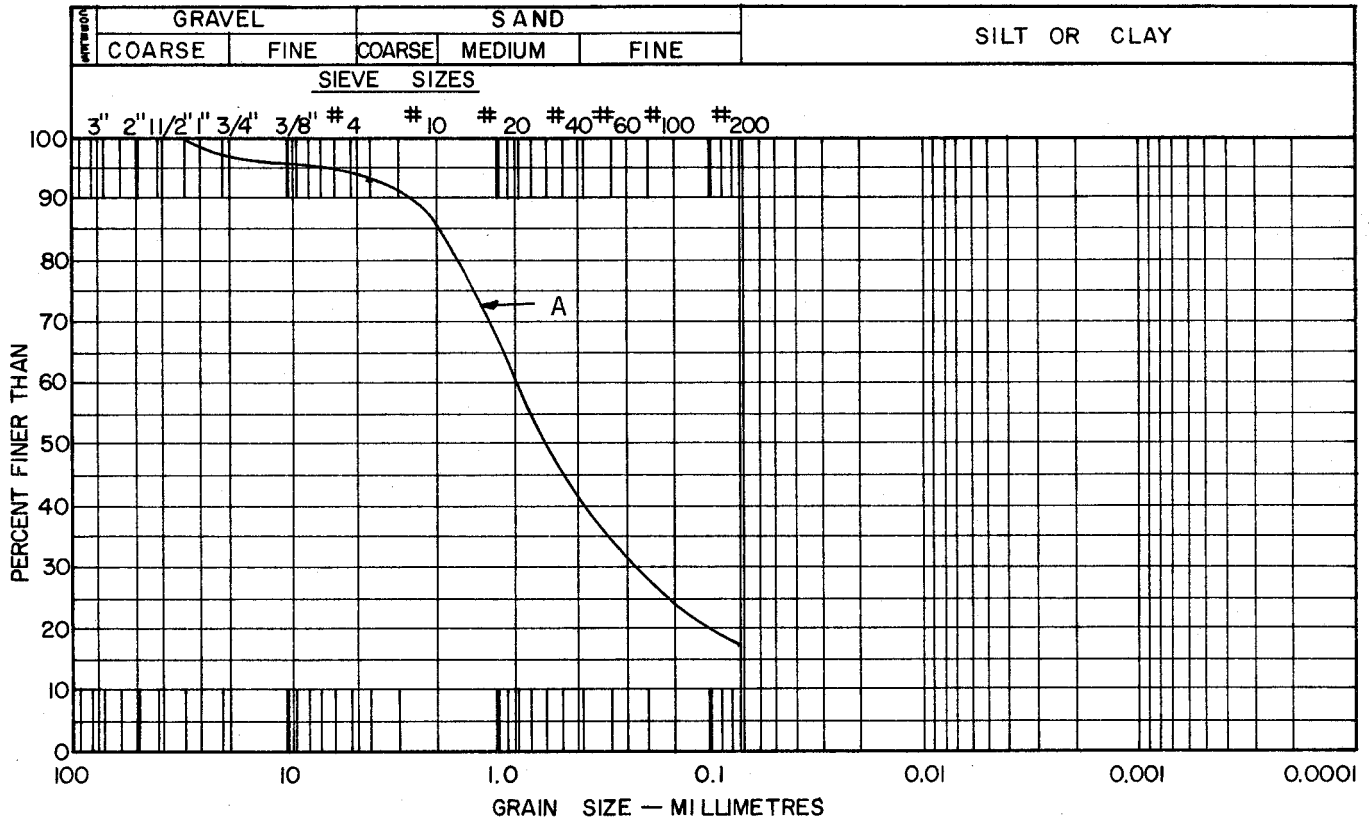
SOURCE No. 451



LABORATORY TEST DATA

TEST PIT - SOURCE No. 451

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample A (2'-2.5') - 9.9%

ORGANIC CONTENT

HARDNESS TEST

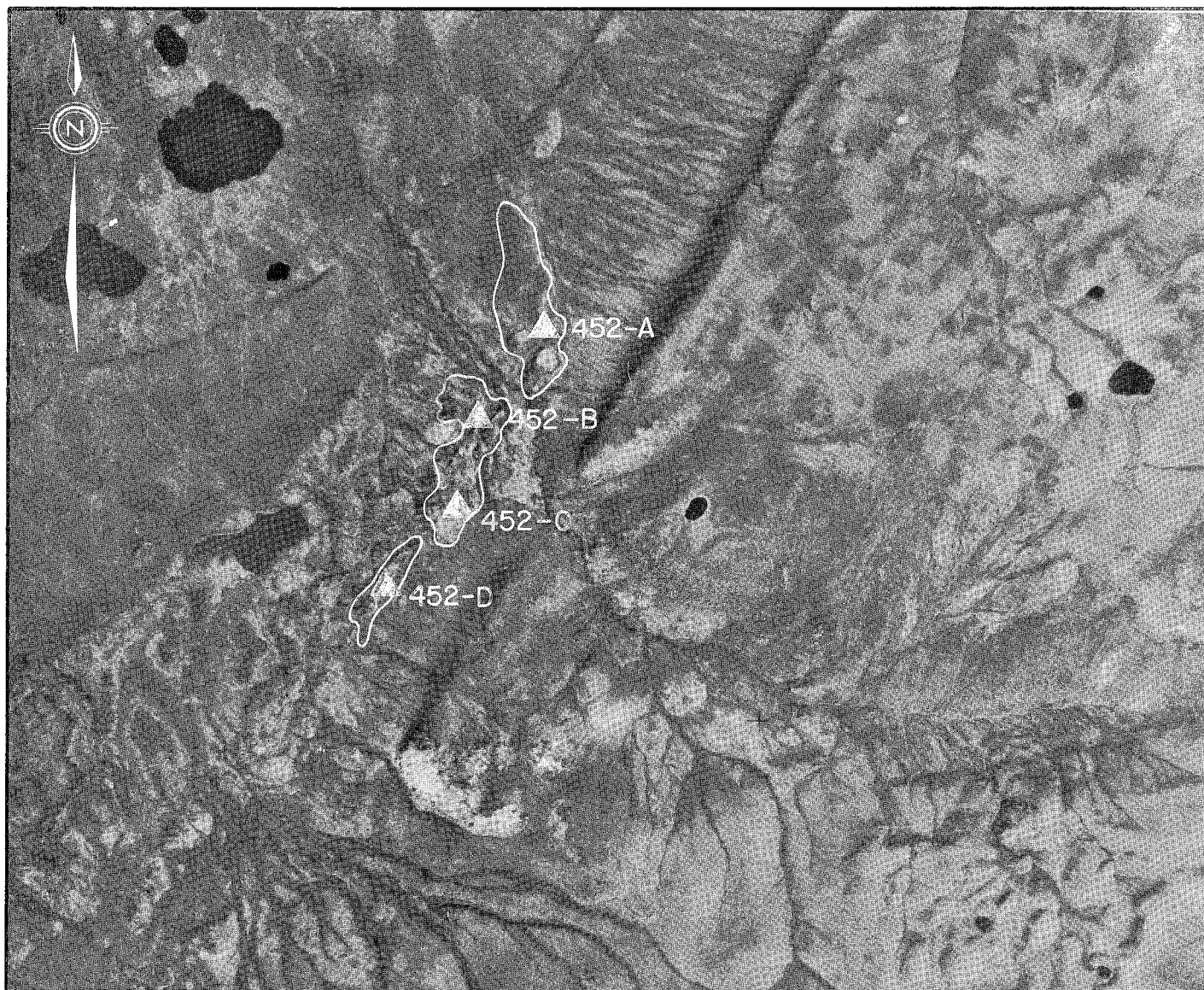
PETROGRAPHIC ANALYSIS

ZONE IV
SOURCE No. 452

LANDFORM AND LOCATION: Several disconnected esker remnants located 26 miles by air east of Inuvik

MATERIAL: Variable SAND and gravel
GRAVEL, some sand

VOLUME: Source is suitable for development after limits of proposed pit have been delineated by further drilling. Source may require environmental impact study as it lies within winter range of the Mackenzie Reindeer Herd



AIRPHOTO No. A12918 - 30

SCALE: 1" = 3000' (approx.)

452 ENVIRONMENT

Physical

This source is a series of disconnected eskers, 100 to 1,000 feet long and 30 feet high, located on the Anderson Plain, 26 miles east of Inuvik. Sitidgi Lake is about 1 mile to the north.

Drainage is good, and the source has not been developed.

Biotic

Vegetation cover is mainly upland dwarf shrubs, with some white spruce and aspens. The trees are 20 to 30 feet high.

The source lies within a critical wildlife area, the winter range of the Mackenzie Reindeer Herd, also of some barren-land caribou. The area is occasionally trapped for marten, lynx, and fox. Moose are hunted here through the winter.

A concentration of burrowing animals can be expected in the vicinity of this esker, because of the favourable conditions for building dens.

452 MATERIALS AND QUANTITIES

The test pits show that the material in this source is variable, including sand and silt, sand and gravel, organic silt, and gravel with some sand. The deposit was free of ground ice to a depth of about 4 feet in September. The organic cover and peat over the granular material is about 1 foot thick.

No petrographic analysis was conducted on these samples, but a visual assessment indicates that the rock particles are angular to sub-rounded, soft, and not suitable for concrete or asphalt aggregate. The material is a satisfactory general fill.

The estimated volume within the source area is 1,500,000 cubic yards.

452 DEVELOPMENT

General

This source is located outside the study area, but was covered in the reconnaissance. In the winter drilling program that followed the source

was not investigated further, but the source should be drilled before any development proceeds because the test pits indicate a highly variable material.

Access

Access is considered to be feasible only during winter, when a road could be developed from the Dempster Highway at the north end of Campbell Lake, northeast along a chain of lakes for about 14 miles, then east to the source. The distance from the source to the Highway is about 17 miles, and to Inuvik about 30 miles. For development to the north it will be practical to haul across Sitidgi Lake and Eskimo Lakes during the winter.

Material Use and Handling

The material is suitable for road construction or for general fill, although further investigation may disclose better materials within this large source area.

The development of the source will require the usual assembly of dozers with ripper attachments, front-end loaders, and trucks.

Stripping and Restoration

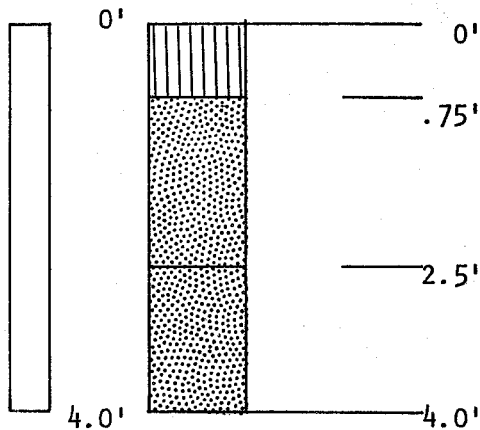
All trees and dwarf shrubs must be removed and burned. The topsoil and organic cover must then be stripped and stockpiled for replacement after the granular material has been removed.

Restoration should follow close behind the depletion of an area. Steep banks must be graded to a stable slope before the topsoil is replaced, and then the area should be seeded for speedy re-vegetation, using a selection of plants and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS

SOURCE No. 452

452 - A



(OL)

SILT - organic, trace sand, roots etc.

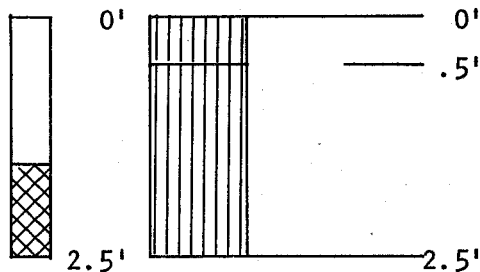
(SM)

SAND - and silt, uniform gradation, brown

(SW-SM)

SAND - and gravel trace silt, max 3/4", well graded, cohesionless brown

452 - B



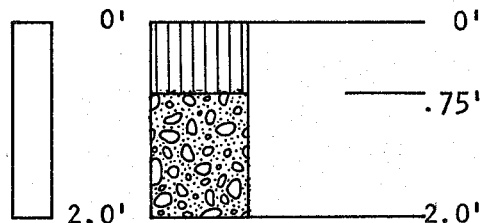
(OL)

SILT - organic moss, roots etc.

(SM)

SILT - some sand, very fine uniform gradation, nonplastic, dark brown

452 - C



(OL)

SILT - organic moss, roots etc.

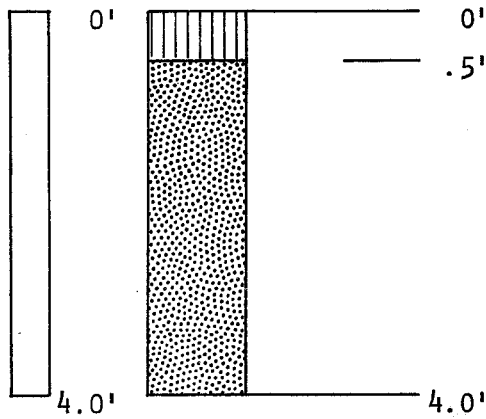
(GM)

GRAVEL - some sand, little silt well graded flat shale

TEST PIT LOGS

SOURCE No. 452

452 - D



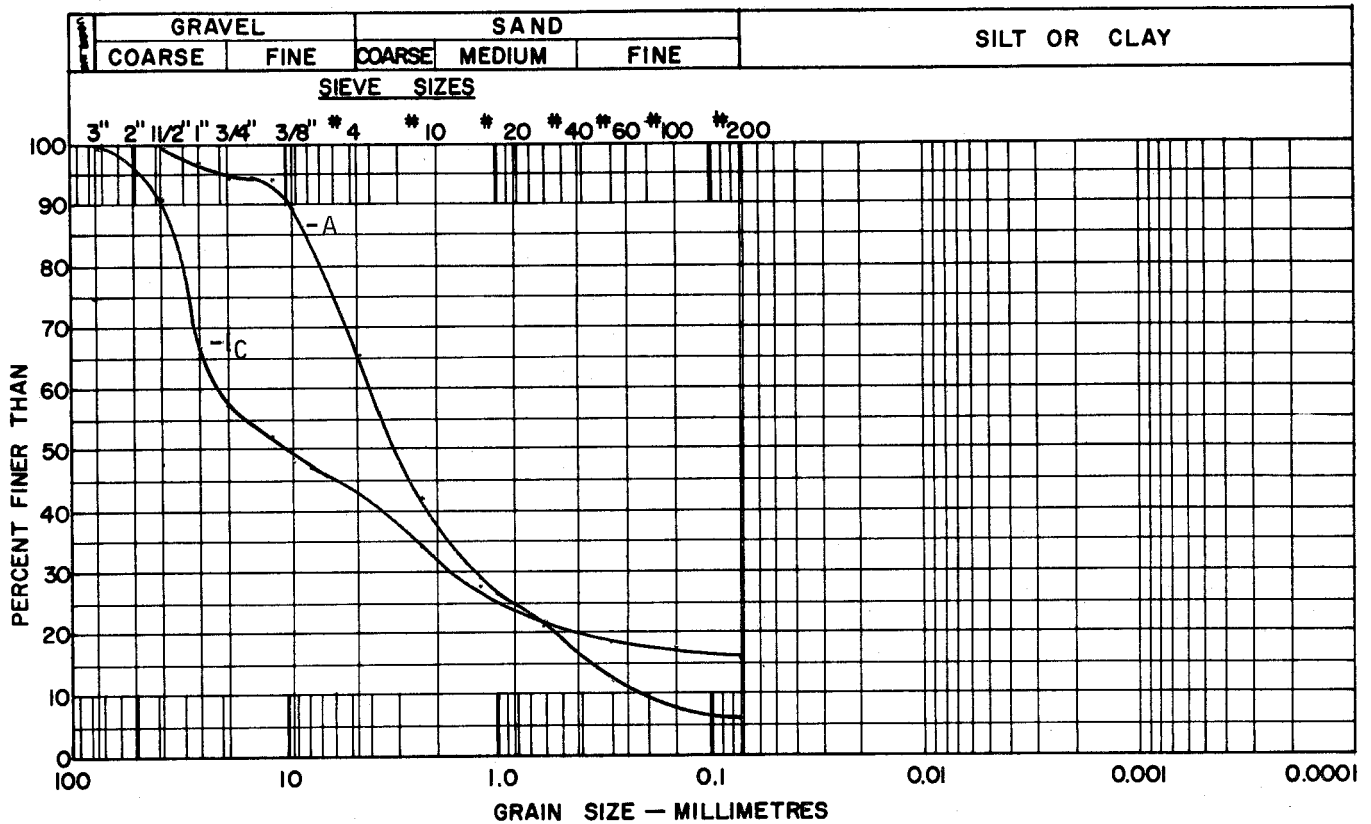
SILT - organic roots, moss etc.

(SM)

SAND - little silt, trace gravel.
Flat sandstone, fine uniform
gradation, brown

LABORATORY TEST DATA SOURCE No. 452

GRAIN SIZE DISTRIBUTION



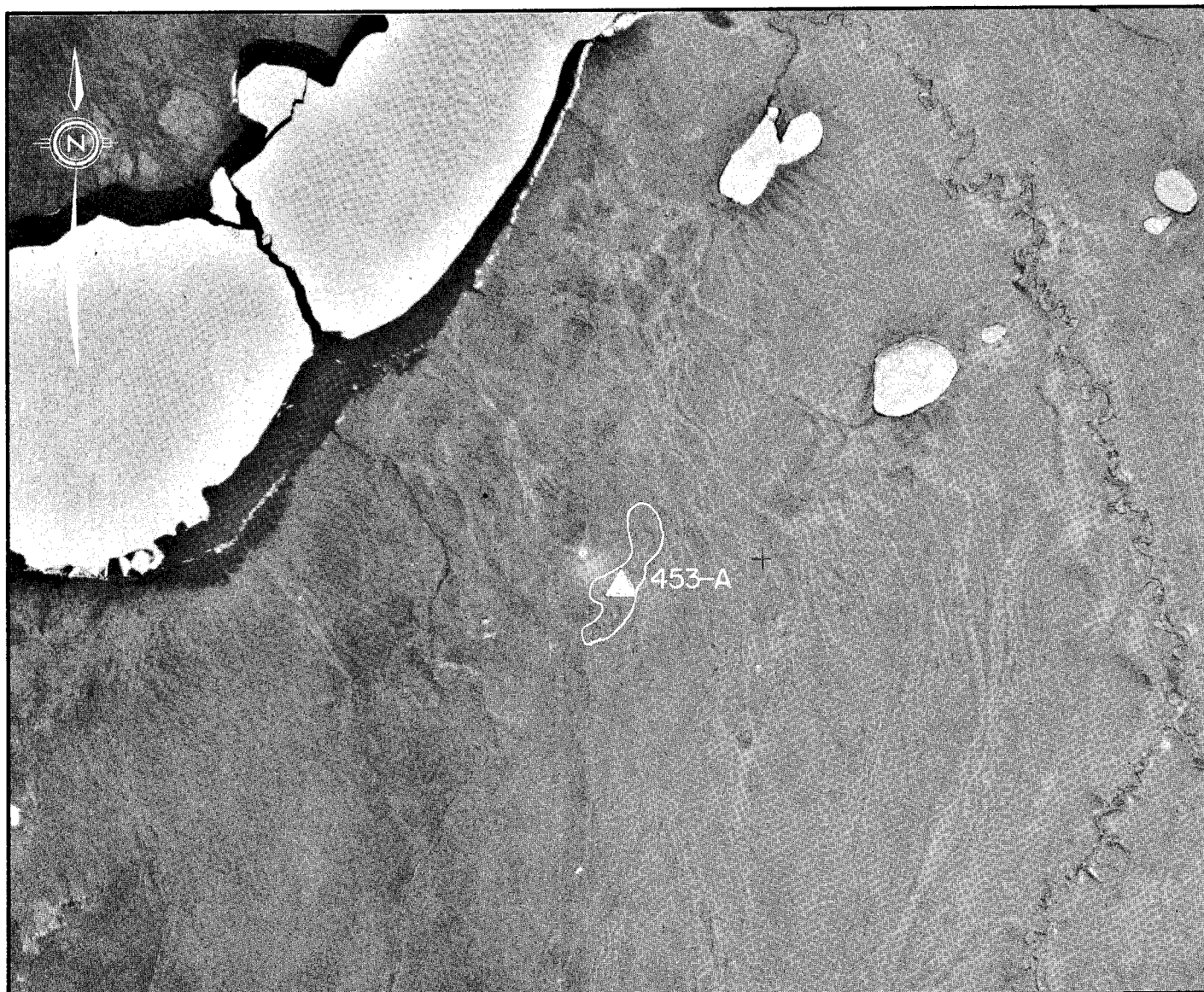
ZONE IV
SOURCE No. 453

LANDFORM AND LOCATION: Small kames located adjacent to Dempster Highway, approximately 14 miles by air southeast of Inuvik

MATERIAL: Stratified - SAND - some gravel
SAND - trace gravel

VOLUME: 10,000 cu. yds., approximately

CONCLUSION: Source has been developed and very little material remains. Remainder may be used as general fill



AIRPHOTO No. A13406 - 126

SCALE: 1" = 3000' (approx.)

Physical

The source is a field of small kame knolls or esker remnants located 14 miles by air southeast of Inuvik. The features are scattered over an irregular area about 7,000 feet long and up to 700 feet wide, rising to a height of 25 to 30 feet above the surrounding plain. The source is 1 mile southeast of Campbell Lake.

The area is well drained. The source has been developed extensively for the construction of the Dempster Highway.

Biotic

Vegetative cover in the area is largely transitional between black spruce and sphagnum bogs.

The area is important from an ecological point of view. Firstly, it lies within the Mackenzie Reindeer Grazing Reserve, and both calving and breeding occur at different seasons.

Secondly, the source lies within a proposed reserve of the International Biological Programme, selected because it contains a very rare diversity of plant species.

Finally, the area is trapped occasionally for marten, lynx, and fox, and is hunted for moose in winter.

453 MATERIALS AND QUANTITIES

A test pit dug into the undisturbed portion of the source produced a fine sand at a depth of 1½ feet, and a well graded sand and gravel at a depth of 4 feet. Both samples contain less than 5% fines passing the 200 mesh. The finer material contained 94% sand and 3% each of gravel and silt. The coarser material contained gravel (27%), sand (70%), and less than 3% silt.

The source is estimated to contain less than 10,000 cubic yards at this time.

General

Although the quality of this material is very good, the small volume remaining does not warrant a reservation for specified uses. Probably the source will continue to be used as a convenient supply of common fill, and occasionally will be used for small volumes of concrete aggregate.

The areas that have been exhausted should be covered with the topsoil that has been stockpiled nearby.

Access

The source is adjacent to the Dempster Highway about 18 miles by road from Inuvik. All-weather access is assured.

Material Use and Handling

The material is a high-quality aggregate, but the small remaining volume is scattered over a large area and would not warrant an aggregate operation. It is recommended, therefore, that the source be used for producing general fill.

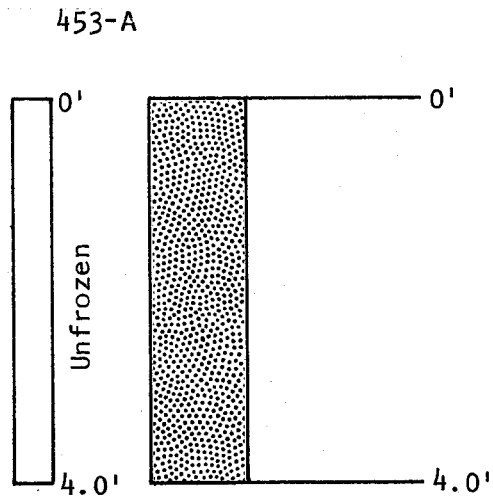
The continued operation of this source will require dozers, front-end loaders, and trucks.

Stripping and Restoration

At present the source is stripped, and the organic cover and topsoil are stockpiled beside the clearing. As an area is exhausted it should be graded, and the topsoil replaced. If the stockpiles contain trees and roots, these should be raked out and burned. Finally, the area should be reseeded for speedy re-vegetation, but particular care is necessary in choosing the plant cover. The International Biological Program Staff should be consulted on this point.

TEST PIT LOGS

SOURCE No. 453



(SW)

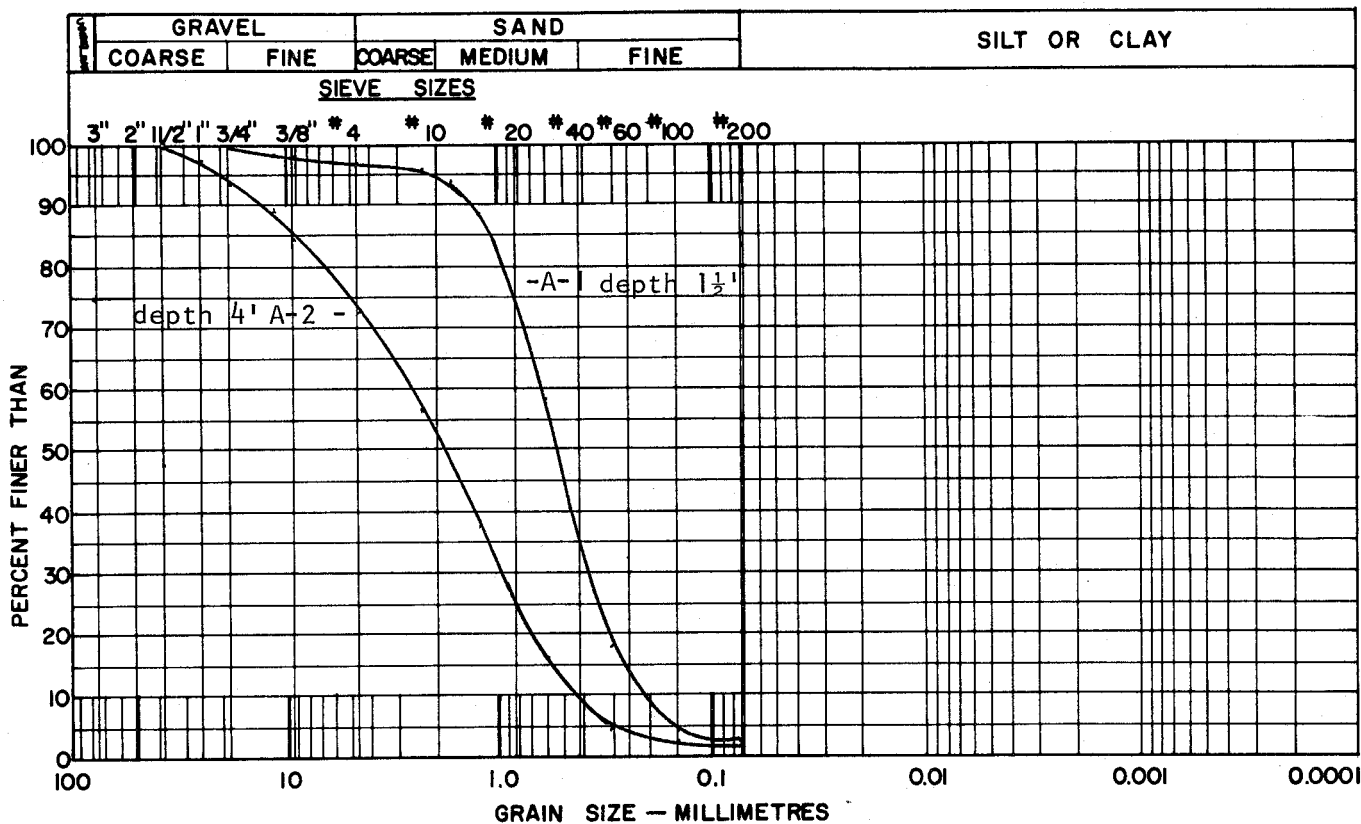
STRATIFIED

SAND - some gravel, clean
SAND - trace gravel, uniform
trace silt

Soil profile from pit exposure

LABORATORY TEST DATA SOURCE No. 453

GRAIN SIZE DISTRIBUTION



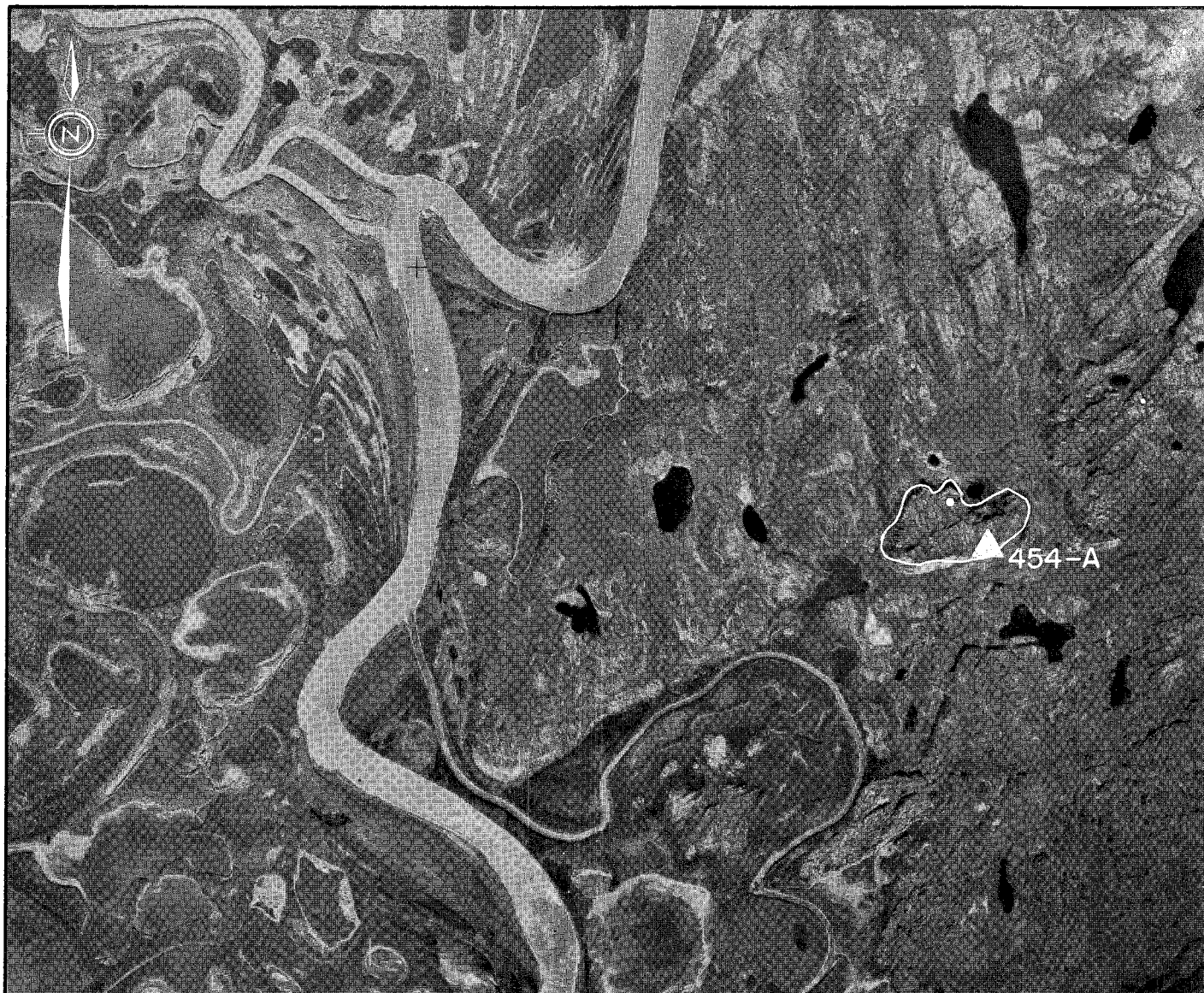
ZONE IV
SOURCE No. 454

LANDFORM AND LOCATION: Bedrock outcrop located 12 miles by air south of Inuvik

MATERIAL: SANDSTONE - coarse

VOLUME: 10,000,000 cu. yds. at least

CONCLUSION: Source is suitable for a large development but will require attention be given to the impact of the quarry operation on the environment



AIRPHOTO No. A12857 - 272

SCALE: 1" = 3000' (approx.)

454 ENVIRONMENT

Physical

The source is a prominent bedrock knoll which stands about 300 feet above the Mackenzie Delta, 12 miles south of Inuvik and 2 miles east of the east channel of the Mackenzie River. The knoll lies in a very rough area of bedrock exposure known as Rocky Hill.

The area is very well drained, and no development has been attempted.

Biotic

Vegetative cover in this area is very sparse, consisting of scattered spruce or poplar trees and some dwarf shrubs. The area may however, contain a valuable assortment of plants, because the proposed reserve of the International Biological Programme is only 4 miles to the east.

The Rocky Hill area lies within the Mackenzie Reindeer Grazing Reserve, and calving and breeding take place in spring and fall.

The area is trapped occasionally for marten, lynx, and fox, and is hunted for moose in winter.

The critical peregrine falcon habitat is located nearby, and the effect of quarrying on this rare bird would have to be evaluated.

454 MATERIALS AND QUANTITIES

The source is a bedrock outcrop of coarse sandstone, containing some sulphide, possibly pyrite, and traces of copper. The rock is strongly fractured and jointed, and has been severely folded.

The source contains over 10,000,000 cubic yards of rocks.

454 DEVELOPMENT

General

By setting up a large quarrying operation at this source, the needs of the area could be satisfied in terms of general fill and manufactured aggregates. Probably the operation could succeed only on a substantial scale, and the demand for granular material would need to be greater than it is now.

Access

The direct route to Inuvik is very rough, and a road built on this route would be expensive. Alternatively, material could be hauled the short distance to the east channel of the River and there loaded to barges which would deliver at the waterfront in Inuvik.

The easiest and most flexible transport is in winter, when trucks could haul directly to Inuvik on the east channel, or could travel over Campbell Lake to the Dempster Highway. In either case the haul to Inuvik would be 25 miles.

Material Use and Handling

The sandstone from this source can be used as general fill with little or no processing. With a process of crushing and screening it could be used for aggregates.

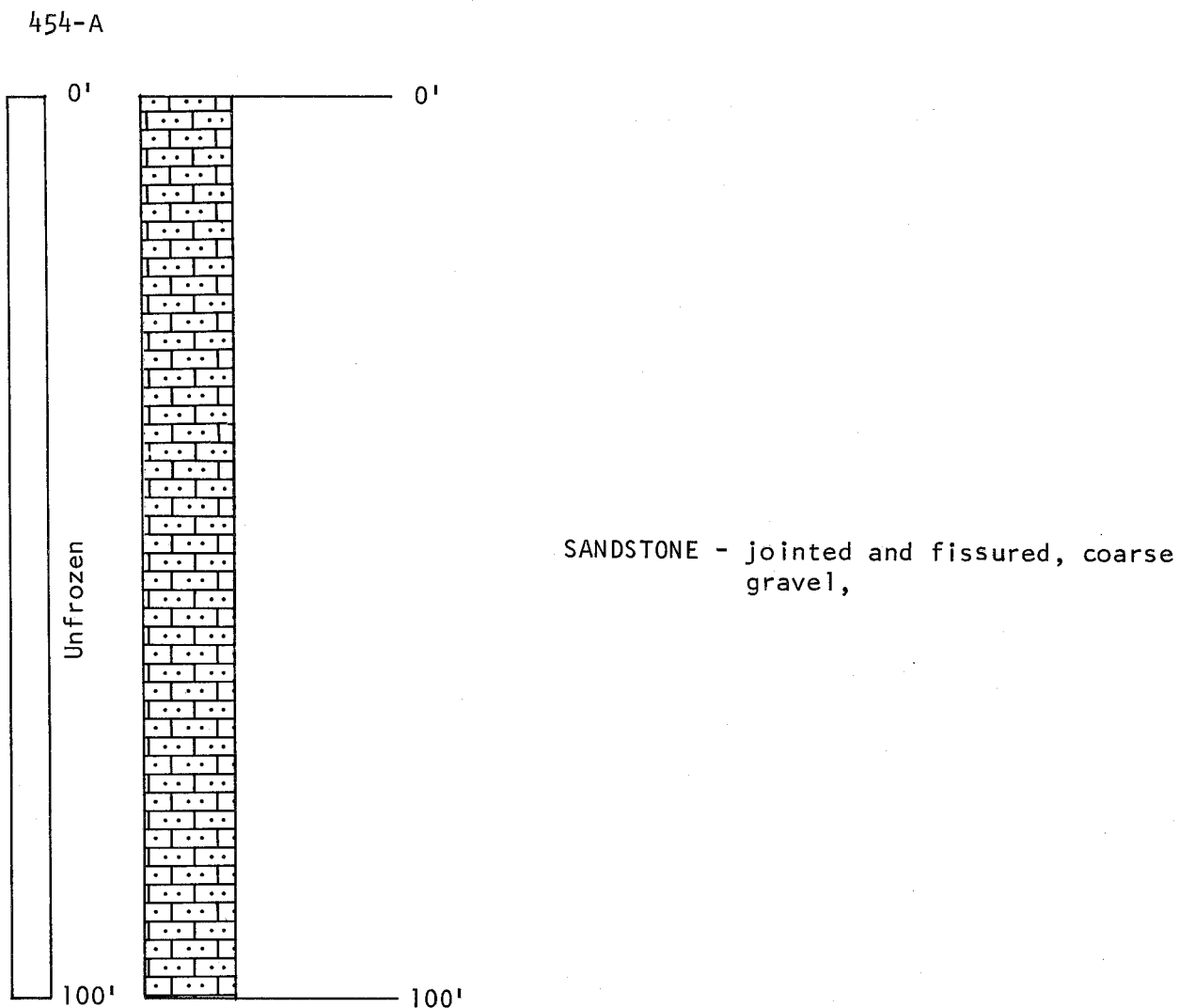
The equipment required for the development of this source is fairly complex. The quarrying operation would require drilling equipment, shovels or loaders, trucks, crushers and a screening plant. Transporting the materials to the consumer would require trucks and possible scows and river rafts.

Stripping and Restoration

Careful selection of the quarry site would be necessary to minimize the environmental dislocation brought about by a development of this type. The operation would have to be planned from beginning to some time in the future, with provision for reclamation close behind the quarrying. Probably the staff of the International Biological Programme could advise on the reclamation program required for this source.

TEST PIT LOGS

SOURCE No. 454



Rock profile from exposure

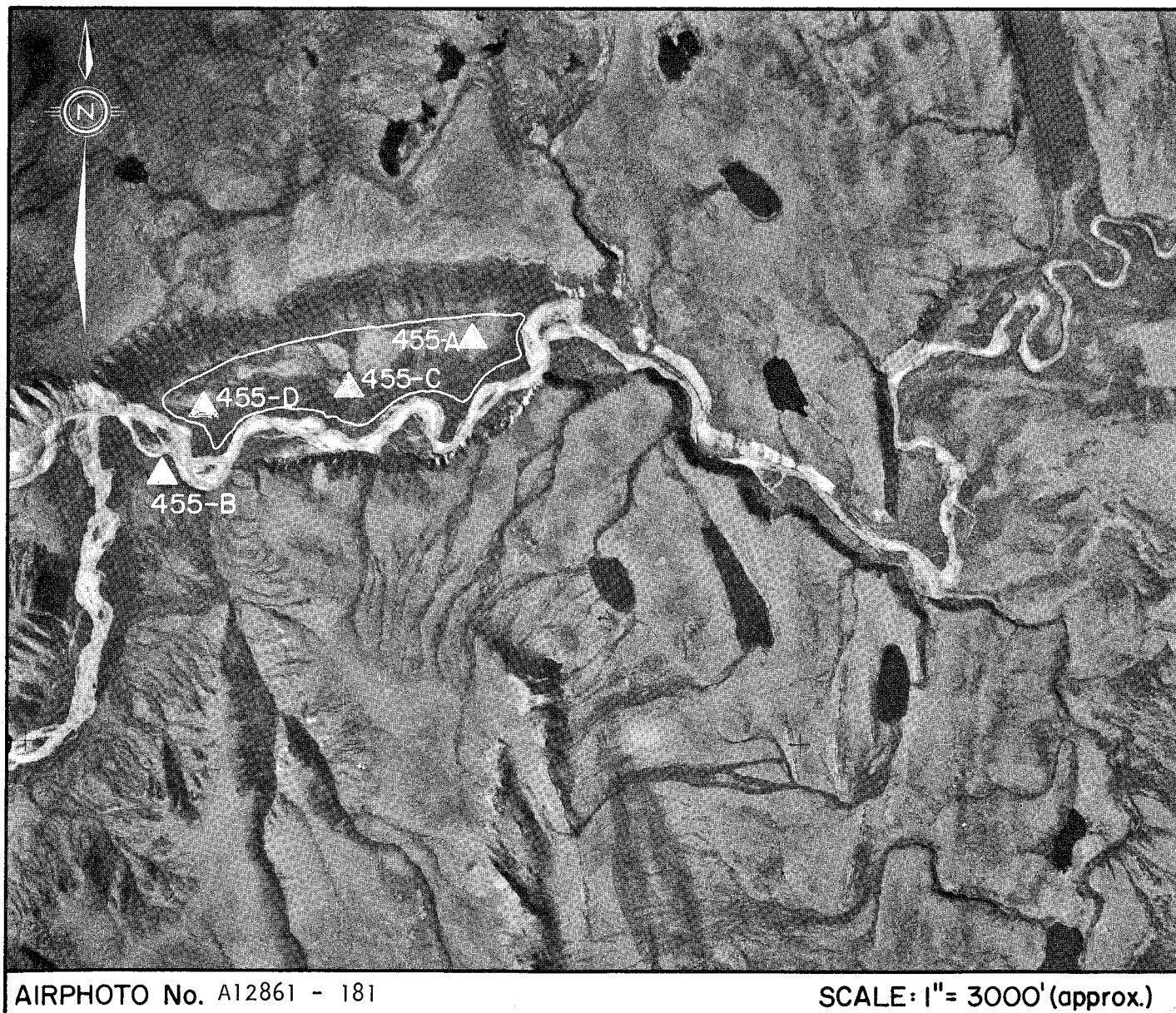
ZONE IV
SOURCE No. 455

LANDFORM AND LOCATION: Inactive flood-plain of the Willow River about 4 miles from the Mackenzie Delta and 13 miles by air west of Aklavik.

MATERIAL: GRAVEL and some sand, trace silt

VOLUME: 500,000 cu. yds.

CONCLUSION: Source is suitable for development as general fill and coarse aggregate



AIRPHOTO No. A12861 - 181

SCALE: 1" = 3000' (approx.)

455 ENVIRONMENT

Physical

The source lies in the inactive flood-plain of the Willow River about 4 miles upstream from its mouth at the Mackenzie Delta. The source is about 6000 feet long and as much as 1000 feet wide and is located 13 miles by air west of Aklavik. At this point the valley bottom is about $\frac{1}{2}$ mile wide, and the steep valley walls are cut in thin bedded shales and sandstone.

The drainage of the source is good. Although some material has been taken to Aklavik from the flood-plain at the mouth of the river, none has been taken from this source.

Biotic

Forest cover in the inactive flood-plain is largely white spruce, with some aspens. Some areas are transitional black spruce to sphagnum bog. In places the organic cover and peat are as much as 2 feet thick.

The source lies at the eastern limit of the Richardson Mountains, an important big-game area containing caribou and some sheep. It is also a potentially important lynx habitat, although not heavily trapped at this time. Otherwise the source is not located within an important wildlife area.

455 MATERIALS AND QUANTITIES

The material is gravel with some sand and a little silt. The gravel, about 30% of the total, is poorly graded to a maximum size of 12 inches. Sand constitutes about 15% of the material, and silt about 5%.

The gravel is primarily sandstone (59%), quartzite (25%), and limestone (12%), with quartz, chert, and granite making up the remaining 4%. The gravel is sound, and with the exception of some iron stains in the limestone, contains no potentially deleterious material.

The source is estimated to contain about 500,000 cubic yards, based on a recoverable depth of 3 feet.

General

This source can be developed for general fill and road-building material. If necessary, it can be further developed for manufacturing aggregates by installing a crushing and screening plant.

Access

Winter access to Aklavik is not difficult, following the Willow River downstream to the Mackenzie Delta, then along the channels of the Delta to the Community. The distance is about 15 miles.

Summer access is not practical.

Material Use and Handling

The material from this source is suitable for general fill, and can be processed for aggregate. If used as aggregate, sand would have to be imported to make up the deficiency in this material.

The equipment required for the development of this source is dozers, front-end loaders, and trucks.

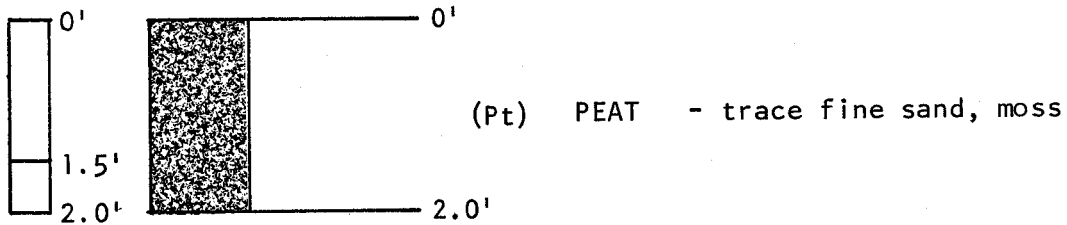
Stripping and Restoration

Before development of an area, all trees and shrubs should be cleared and burned above flood-plain elevation. The organic cover and topsoil should then be stripped and distributed over a suitable area above the flood-plain. A substantial berm or dyke must be left between the river and the operation, and particular care taken to avoid the spillage of oil or grease within the stream-bed. After depletion the area must be left clean and free of debris.

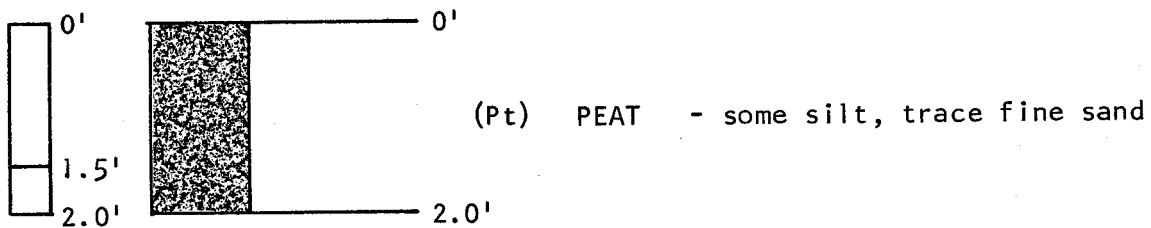
TEST PIT LOGS

SOURCE No. 455

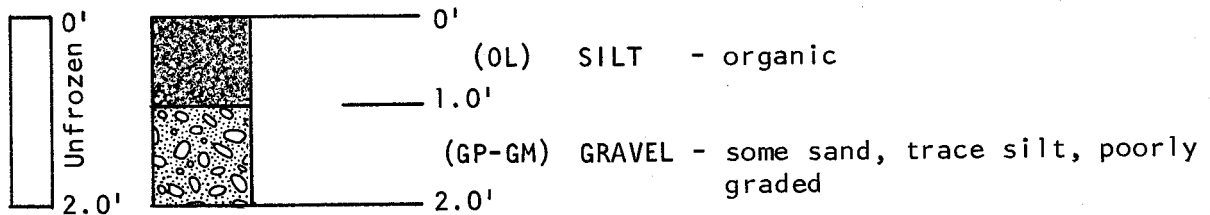
455-A



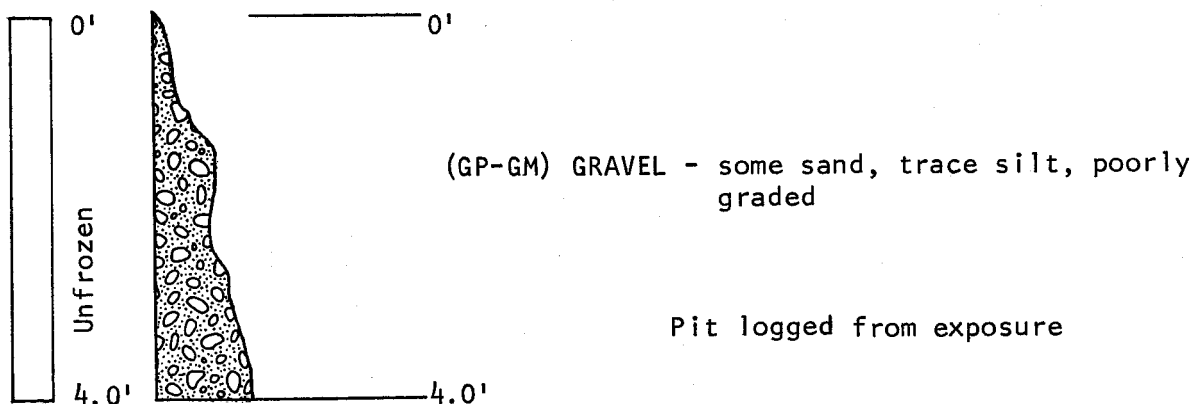
455-B



455-C

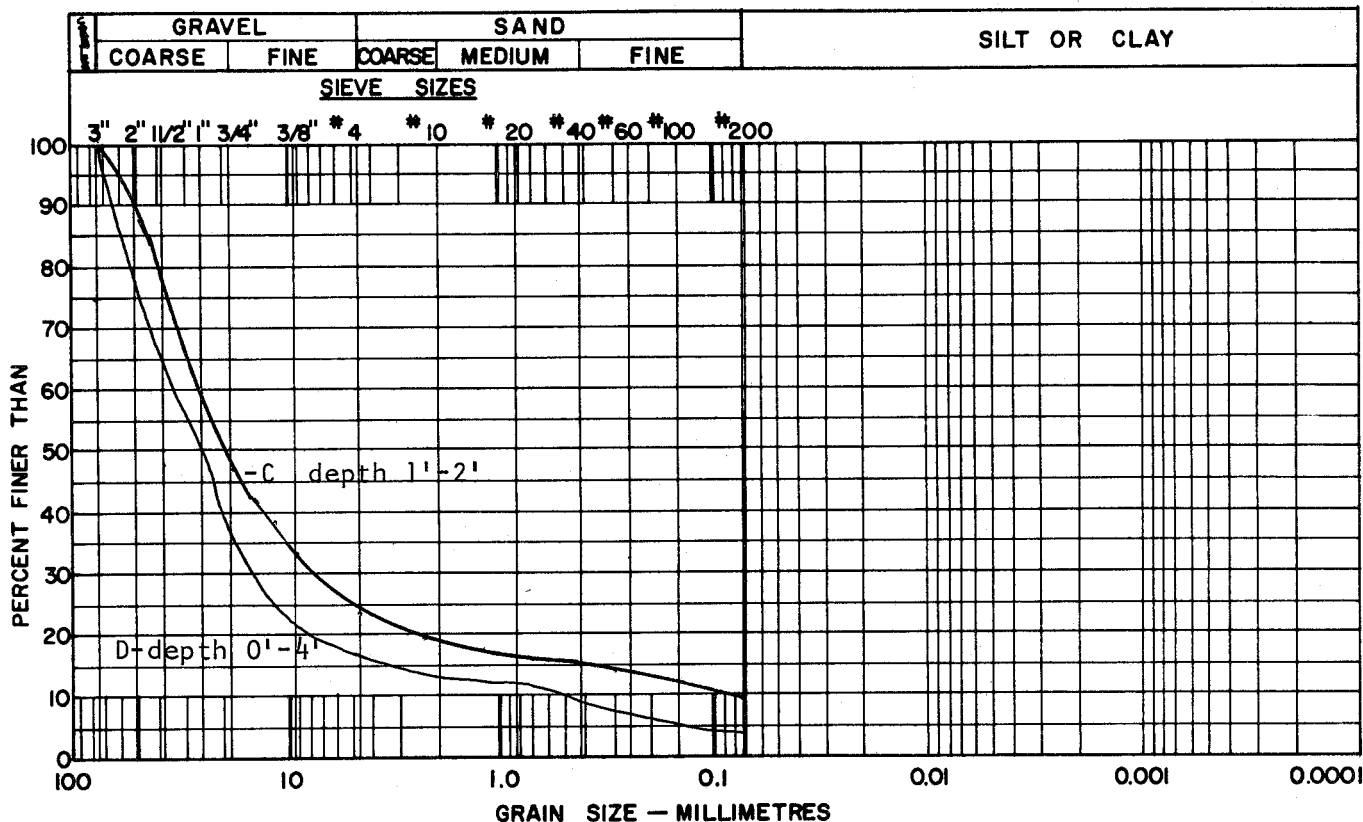


455-D



LABORATORY TEST DATA SOURCE No. 455

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample C depth 1'-2' 4.4%

Sample D depth 0'-4' 2.8%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

Sandstone -59%

Quartzite -25%

Limestone -12%

Chert - 2%

Quartz - 2%

Granite neg

Total 100%

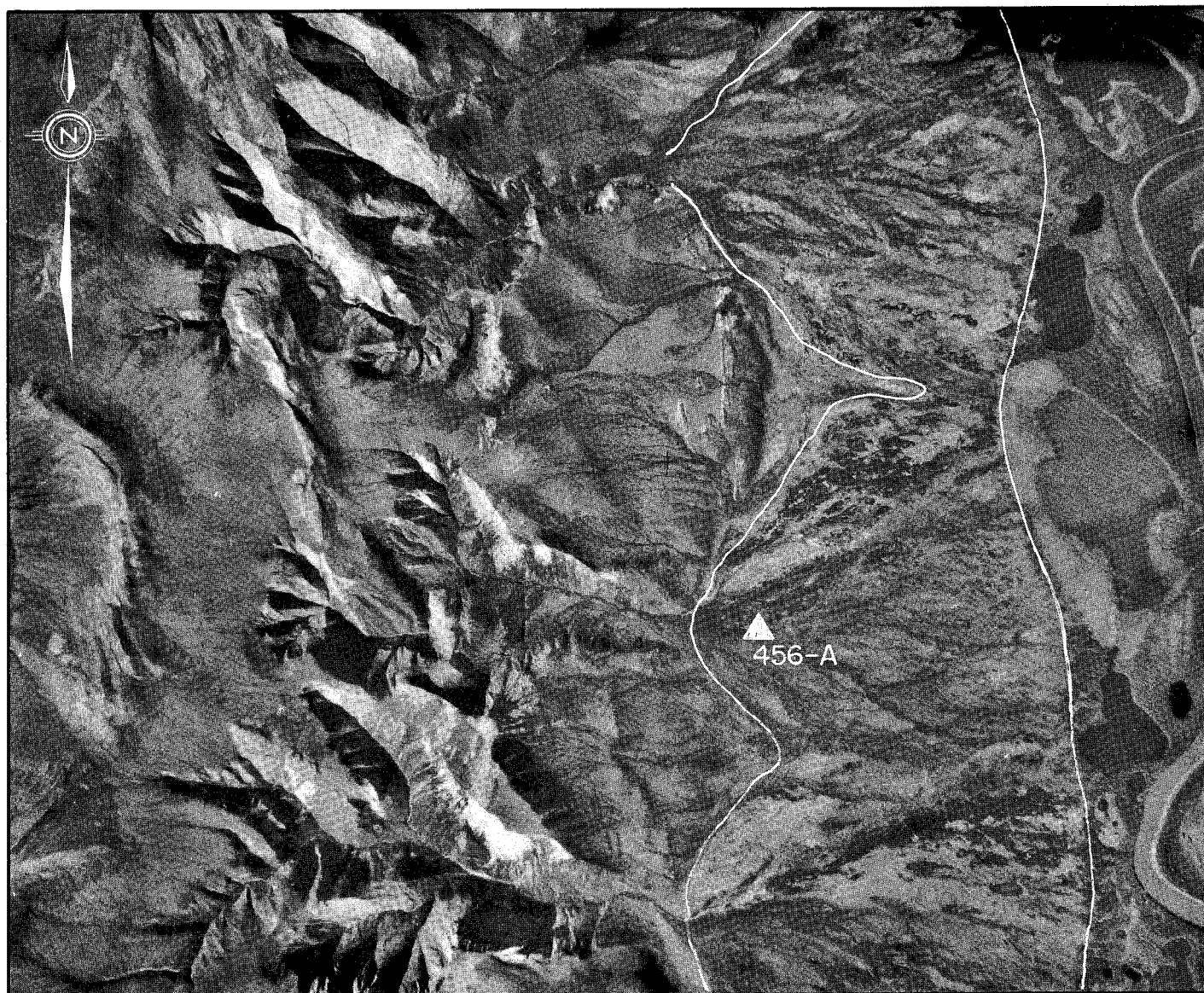
ZONE IV
SOURCE No. 456A

LANDFORM AND LOCATION: Alluvial fan located about 13 miles by air southwest of Aklavik

MATERIAL: SILT - some sand, trace gravel

VOLUME: ---

CONCLUSION: Source is not recommended for development due to poor quality and problems of restoration of area



AIRPHOTO No. A12861 - 183

SCALE: 1" = 3000' (approx.)

456A ENVIRONMENT

Physical

This source is a series of alluvial fans located between the Richardson Mountains and the Mackenzie Delta. The fans are continuous for about 4 miles, and are from 1000 to 6000 feet in width. The slope is about 15% near the upper edge and about 10% at the Delta. The source is 13 miles southwest of Aklavik.

Drainage is good because of the topography. No development of this source can be seen.

Biotic

The vegetative cover is scattered dwarf spruce, some shrubs, and a dense ground cover of moss.

The Richardson Mountains are an important big-game area, with caribou and some sheep being hunted regularly. The source also lies within a potentially important lynx habitat, although very little trapping is done at present. Otherwise the area contains no noteworthy wildlife.

The west channel of the Mackenzie River, close off-shore, is an important fishing area, and any development would have to avoid the disruption of this activity.

456A MATERIALS AND QUANTITIES

The material in this source is highly variable. All of it is derived from the native bedrock, a soft thin bedded shale alternating with sandstone. The upper levels of the fans contain coarse deposits of this rock, whereas the lower levels are largely organic silt with traces of sand and gravel.

In all cases the ice content is high, and ice is found directly beneath the organic ground cover in September.

456A DEVELOPMENT

General

This source is not recommended for development. The material is poor in

quality, and the development would expose a large area of permafrost on a steep slope, leading to problems of restoration.

Access

Winter access to Aklavik is not difficult, travelling on the west channel on which the Community is built.

Summer access is feasible only by scow.

The distance from the source to Aklavik is about 15 miles, following the channel.

Material Use and Handling

The material from this source is suitable for only a poor quality of general fill. However, there would be difficulty in ripping, thawing and draining the material before it could be used.

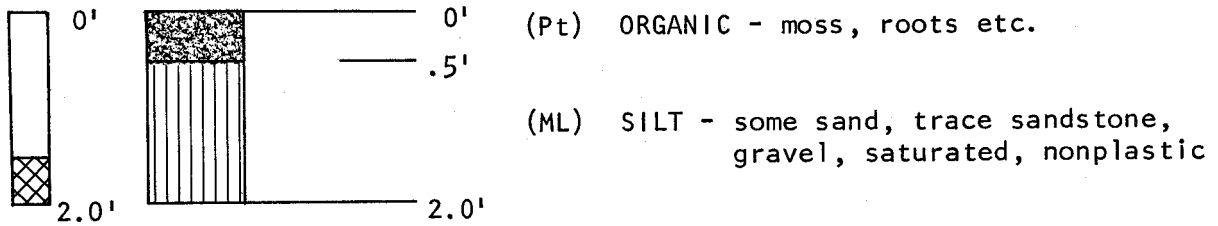
Stripping and Restoration

If this source were disturbed, restoration would be very difficult. The slope of the source, the high ice and silt content would all provide problems in restoring a covering on the area. For this reason development is not recommended.

TEST PIT LOGS

SOURCE No. 456A

456A-A



ZONE IV
SOURCE No. 457A

LANDFORM AND LOCATION: Alluvial fan located 15 miles by air southwest of Aklavik
MATERIAL: SILT - trace sand, trace gravel
VOLUME: ---
CONCLUSION: Source not recommended for development due to poor quality
and problem of restoration of the area.



AIRPHOTO No. A12861 - 185

SCALE: 1" = 3000' (approx.)

457A ENVIRONMENT

Physical

This source is a series of alluvial fans located between the Richardson Mountains and the Mackenzie Delta. The fans are continuous for about 4 miles, and are from 1000 to 6000 feet in width. The slope is about 15% near the upper edge and about 10% at the Delta. The source is 15 miles by air southwest of Aklavik.

Drainage is good because of the topography. No development of this source can be seen.

Biotic

The vegetative cover is scattered dwarf spruce, some shrubs, and a dense ground cover of moss.

The Richardson Mountains are an important big-game area, with caribou and some sheep being hunted regularly. The source also lies within a potentially important lynx habitat, although very little trapping is done at present. Otherwise the area contains no noteworthy wildlife.

The west channel of the Mackenzie River, close off shore, is an important fishing area, and any development would have to avoid the disruption of this activity.

457A MATERIALS AND QUANTITIES

The material in this source is highly variable. All of it is derived from the native bedrock, a soft thin bedded shale alternating with sandstone. The upper levels of the fans contain coarse deposits of this rock, whereas the lower levels are largely organic silt with traces of sand and gravel.

In all cases the ice content is high, and ice is found directly beneath the organic ground cover in September.

457A DEVELOPMENT

General

This source is not recommended for development. The material is poor

in quality, and development would expose a large area of permafrost on a steep slope, leading to problems of restoration.

Access

Winter access to Aklavik is not difficult, travelling on the west channel on which the Community is built.

Summer access is feasible only by scow.

The distance from the source to Aklavik is about 21 miles, following the channel.

Material Use and Handling

The material from this source is suitable for only a poor quality of general fill. However, there would be difficulty in ripping, thawing and draining the material before it could be used.

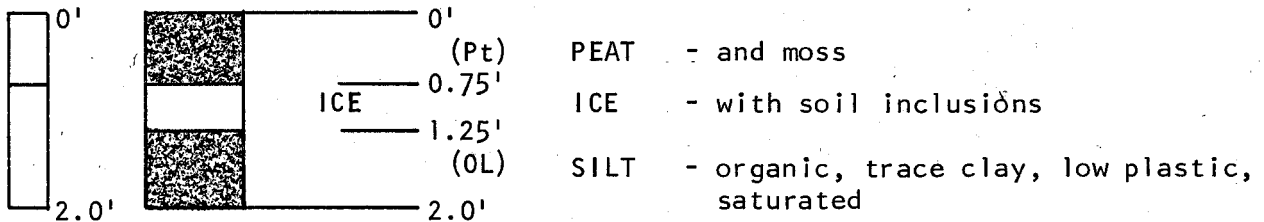
Stripping and Restoration

If this source were disturbed, restoration would be very difficult. The slope of the source, the high ice and silt content would all provide problems in restoring a covering on the area. For this reason development is not recommended.

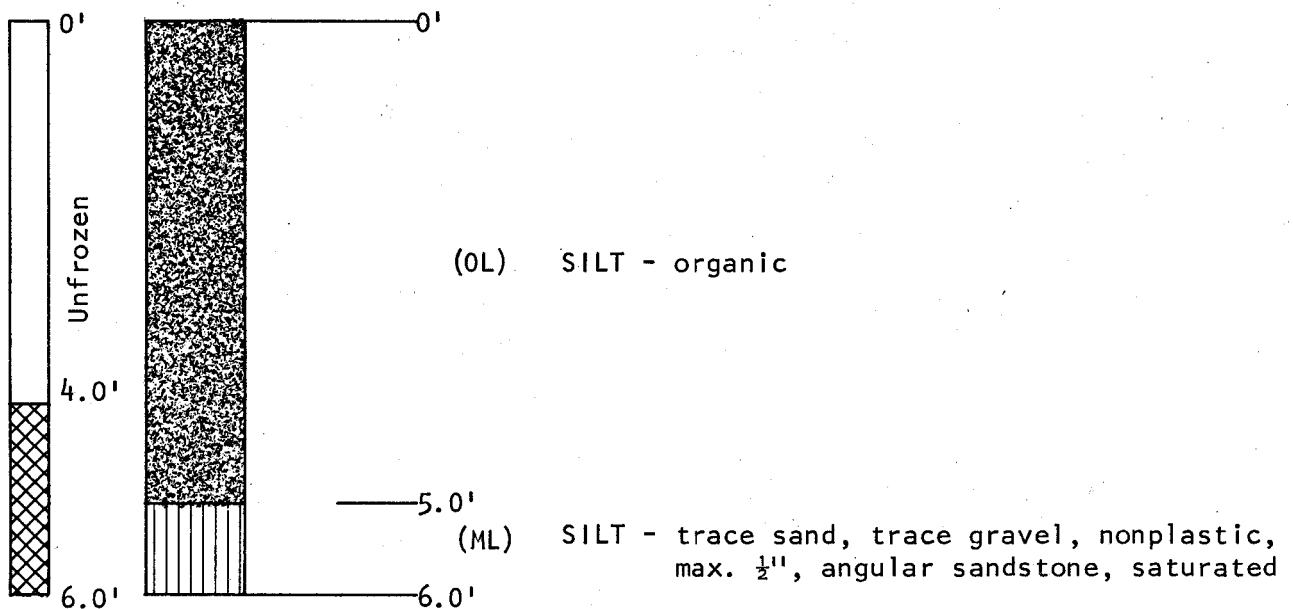
TEST PIT LOGS

SOURCE No. 457A

457A-A



457A-B



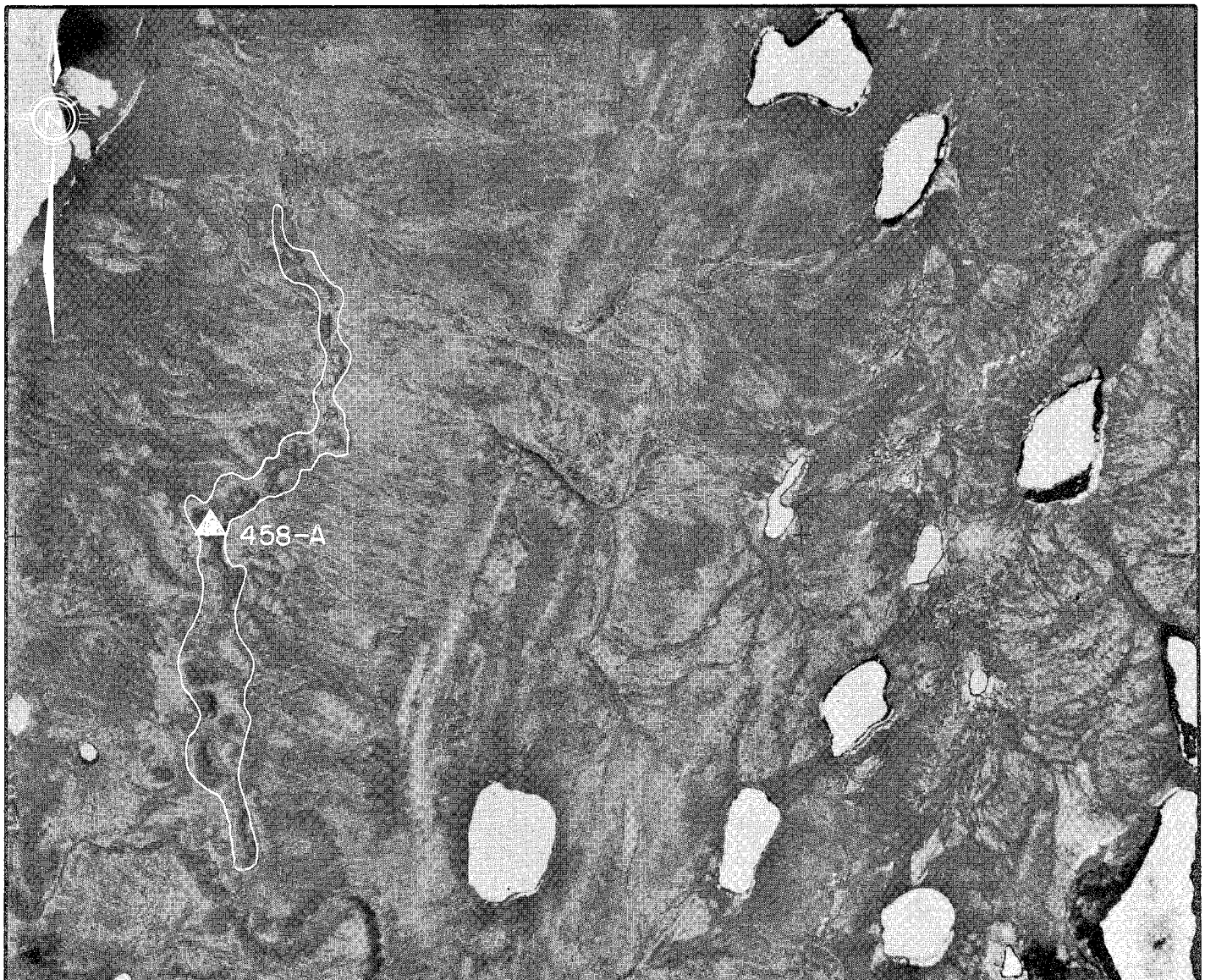
ZONE IV
SOURCE No. 458A

LANDFORM AND LOCATION: Esker about $2\frac{1}{2}$ miles long located 18 miles by air south of Inuvik and adjacent to Dempster Highway

MATERIAL: SILT and sand

VOLUME: 600,000 cu. yds.

CONCLUSION: Source not recommended for development due to poor quality



AIRPHOTO No. A13406 - 181

SCALE: 1" = 3000' (approx.)

458A ENVIRONMENT

Physical

This source is an esker about $2\frac{1}{2}$ miles long, 200 feet wide, and 20 to 40 feet high, located 18 miles by air south of Inuvik. The source lies on a well drained plain, and is adjacent to the Dempster Highway, about $1\frac{1}{2}$ miles from the south end of Campbell Lake.

This source has not been developed, although it appears to have been drilled for evaluation.

Biotic

Forest cover in the area is primarily white spruce, with some aspen. The trees are about 20 feet high.

The source lies within the Mackenzie Reindeer Grazing Reserve, and both calving and breeding occur in the area at different seasons. Otherwise, the source is not in an important wildlife area.

458A MATERIALS AND QUANTITIES

The material in this source is primarily silt and fine sand. When examined in September the esker was free of ground ice to a depth of $3\frac{1}{2}$ feet, but below that depth the deposit contained ice crystals and ice coating on particles.

The estimated volume contained in the esker to a recoverable depth of 5 feet is 600,000 cubic yards.

458A DEVELOPMENT

General

The material in this source would be only suitable as a very poor quality general fill, and thus it is not recommended for development.

Access

The Dempster Highway passes along the esker and provides all-weather access. The distance to Inuvik is about 28 miles by road.

Material Use and Handling

The material is silt with fine sand, which is considered too fine for

use as general fill. The material would be highly frost susceptible. If exposed to water it would frost heave in the winter and lose strength in the spring.

Stripping and Restoration

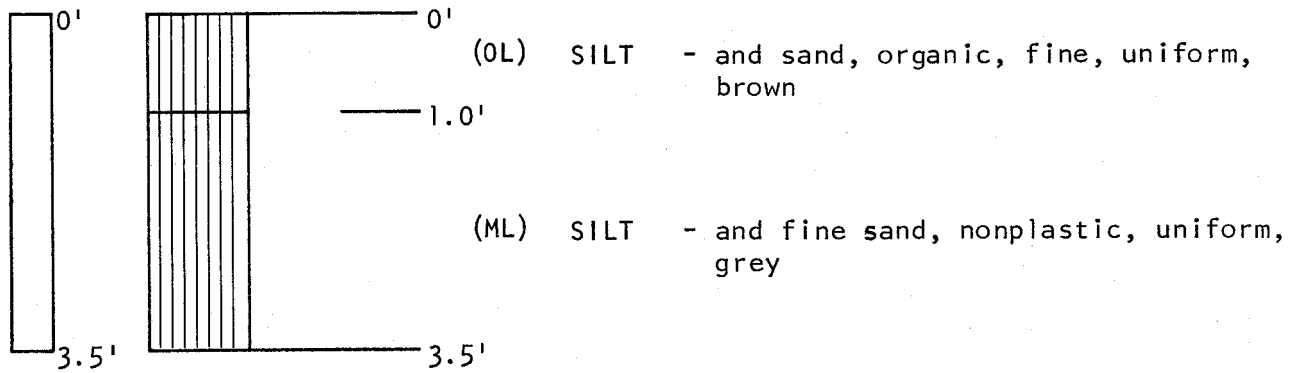
The development of this source would require the clearing of all trees, and the burning of trees and roots. The organic cover and topsoil would then be stripped and stockpiled for replacement after the granular material had been removed. It is recommended that if development is carried out, it should be started in relatively level areas, in order to simplify the problem of restoration.

The choice of plants for re-vegetating the area could be of interest to the staff of the proposed reserve of the International Biological Programme, and they should be consulted.

TEST PIT LOGS

SOURCE No. 458A

458A-A



Moisture Content

Sample A depth 0'-3.5' 19.3%

3. Zone V

3.1 Surficial Geology

The Zone V study area covers three physiographic regions; the Peel Plain in the centre and east, the Peel Plateau to the west, and the Mackenzie Delta to the north.

A silty ground moraine covers most of the area except for the Mackenzie Delta, which consists of recent alluvial silts and clays. The surficial deposit is reportedly up to 50 feet thick overlying shale and sandstone bedrock, and is associated with sparsely scattered glaciofluvial sand and gravel deposits in ridges, terraces and eskers, laid down during the last glacial retreat.

In geologically recent time, rivers and streams flowing east from the Richardson Mountains over the Peel Plateau have deposited granular materials in their channels.

3.2 Environment

Zone V is bisected by the Peel River which discharges into the Mackenzie Delta in the north.

The Mackenzie Delta region is part of a critical wildlife zone supporting muskrat, mink, beaver and water fowl as well as being the habitat of large numbers of fish. West of the Peel River at the base of the Peel Plateau escarpment is a lynx trapping area. The Peel River Valley itself is a noted moose hunting area during the fall, and the river is fished during periods of open water. Most of the area west of the Peel River is used for spring beaver hunting, and winter trapping of mink, beaver, lynx and marten. Muskrat are also found in significant numbers in the southern part of the area. By corresponding with the Division of Lands, Forests and Wildlife, of Environment Canada, it has been ascertained that development of these sources is not likely to conflict with critical wildlife uses, although latter information indicates possible conflict with Fisheries and the International Biological Programme regarding the two sources at Rat River.

Some of the lakes in the eastern half of the area support fishing, principally in the winter months.

Development of gravel sources must be compatible with other uses of streams and lakes, especially for fishing and for beaver habitat. A survey of granular material sources must take into account the necessity of avoiding siltation and other disruption of natural drainage systems.

3.3 Sources and Materials

A total of 6 sources of granular material were investigated, in addition to those reported under the Fort McPherson Community Report. One source (552A) is considered unworthy of further study because of poor quality. Of the remainder, three sources (550, 551, and 554) are glacial features such as kames, eskers, or glaciofluvial terraces, and two sources (553 and 555) are inactive flood-plains within river valleys.

Two sources (553 and 554) contain material that could be used as aggregate, but Source 553 is deficient in sand. Source 554 is very complex, and can probably be developed to meet any specification in reasonable quantities. The other sources contain general fill.

The petrographic analyses of Sources 553 and 554 indicate an assembly of hard, durable rock with a small amount of deleterious material (4% in 553, 0.5% in 554).

It should be pointed out that Source 650 will be readily available to all current developments in the southern part of Zone V, and that this source is large and contains high-quality aggregate. Source 650 is discussed fully under Zone VI of this report.

3.4 Management

Development of the two sources in and adjacent to Rat River is not considered probable because of the proposed reserve classification of this area under the International Biological Programme.

Source 555 must be developed with care to avoid siltation of the Vittrekwa and Peel Rivers. It is located 16 miles from the Dempster Highway.

Sources 550 and 551 are located within areas of relatively low environmental concern, but are remote from Fort McPherson (about 20 miles by winter road). Both sources will receive consideration if any development northwest from Fort McPherson is planned.

For current development, largely concentrated in the southern part of Zone V, Source 650 is considered the best source of specification material, as well as for general fill within an economic hauling distance.

The indiscriminate development of sources for small volumes must be discouraged, in order to avoid environmental problems, and in all cases restoration must follow close behind development.

3.5 Development

3.5.1. General

Although 5 sources of the 6 investigated are suitable for development, all are remote from current projects.

3.5.2. Access

All 5 sources reported in Zone V are accessible by winter road, and only Source 555 can be operated during the summer as well as in winter. Sources 550, 551, 553, and 554 can be reached from the winter road running northwest from Fort McPherson.

3.5.3. Material Uses and Handling

Two of the Sources (553 and 554) in Zone V can be developed to supply aggregates, and all 5 sources can provide general fill.

Sources 553 and 554 contain primarily coarse material which would require crushing and screening facilities to produce specification aggregates. In addition the use of this coarse material for general fill would necessitate a levelling layer of fine aggregate to obtain a smooth surface for roads or building pads.

In all cases the equipment required for development is an assembly of dozers (with or without a ripper attachment), front-end loaders, and trucks. For summer operation of Source 555 a fleet of barges will be required to haul on the Peel River.

3.5.4. Stripping and Restoration

Two sources (553 and 555) are located on inactive flood-plains within river valleys, and their development will require special consideration to avoid siltation and other disruption of the streams. It is recommended that all trees be burned above flood level, and that all organic cover and topsoil be distributed on a suitable area above the flood-plain. Care must be exercised to avoid spilling oil and grease in the stream-bed. In both cases the alluvial deposits contain little silt, and the precautions outlined above should preserve the quality of water.

The other three sources (550, 551, and 554) are glacial deposits containing gravel, sand, and silt in varying combinations. All contain ice, and all are covered by trees and a surface cover of organic material. Because of the problems associated with restoring slopes on which permafrost affected silts have been exposed, it is recommended that sidehill pits be excavated as narrow cuts following the contour. It should then be possible to restore the surface cover with minimum sloughing.

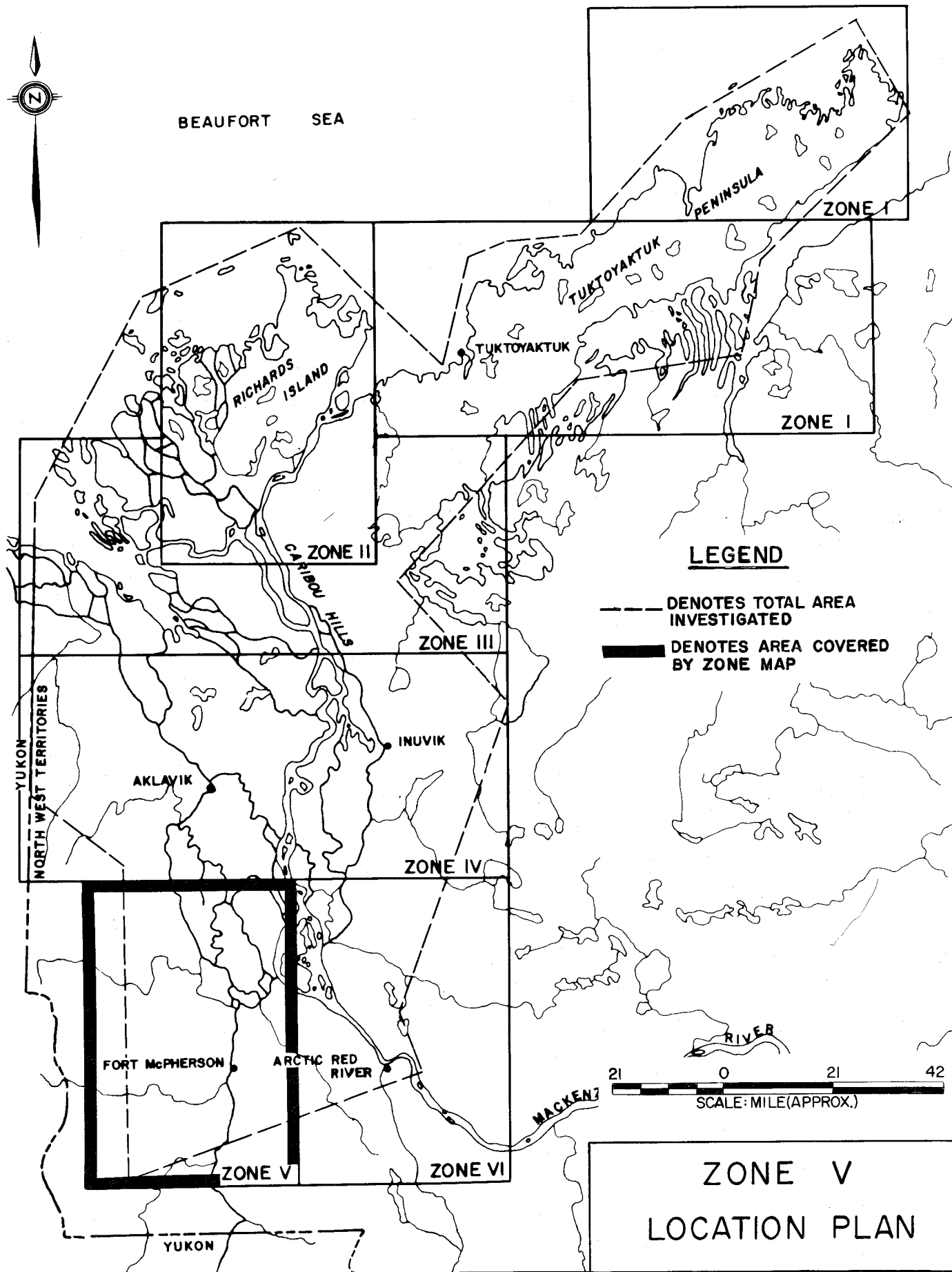
In general, the full depth of usable material should be removed in one operation, in order to minimize the area that is exposed at any one time.

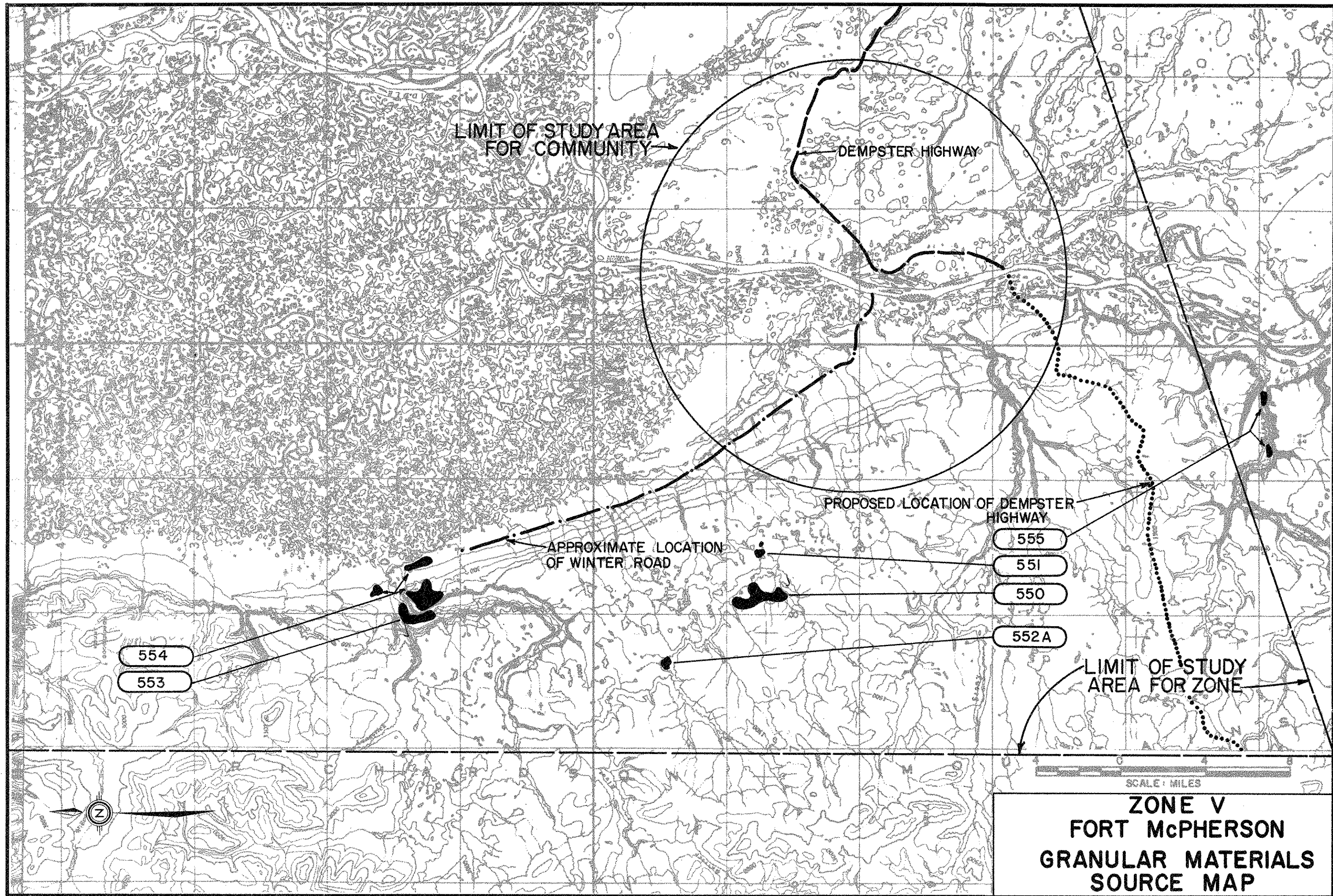
In all cases, the replacement of surface cover must follow close behind the depletion of an area and, where necessary, seeding must be done under expert guidance.

More detailed comments on restoration of the different sources are included in the individual source reports.



BEAUFORT SEA





SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
550	20 from Ft McPh 8 from exist winter road	GRAVEL - and sand (GW)	5,000,000	No major environmental concerns	Suitable for development	Good	Peat and topsoil	1/2 to 3	Stockpile adjacent to pit for later re-grading	Low	10	Doze into piles, drain and load into trucks	General fill	Dozer, Loader, Trucks	Undeveloped
SEE SECTION 550 FOR SOURCE DETAILS															
551	18 from Ft McPh 6 from exist winter road	SAND - some gravel (SW) GRAVEL - and sand (GW)	200,000	No major environmental concerns	Low priority for development	Good	Peat and topsoil	1 to 3	Stockpile adjacent to pit for later re-grading	Low to Med	3 at least	Doze into piles, drain and load into trucks	General fill	Dozer, Loader, Trucks	Minor development comprised of clearing and stripping a small area
SEE SECTION 551 FOR SOURCE DETAILS															
552A	22 from Ft McPh	SILT - little sand	200,000	If development was attempted there could be damage to the physical environment	Not suitable for development due to poor quality	Good	Peat and organic silt	1 to 3		High			Not suitable for fill or aggregate		Undeveloped
SEE SECTION 552A FOR SOURCE DETAILS															
553	25 from Ft McPh 2 from winter road	GRAVEL - some sand (GW)	2,500,000	Source is the center of a reserve under the International Biological Programme. Rat River has a major run of Arctic Char	Satisfying environmental concern will be major factor in development of the source	Good	Peat and topsoil	1 to 3	Distribute away from River	Nil	6 to 10	Doze into piles, load into trucks	General fill, coarse aggregate	Dozer, Loader, Trucks, maybe crusher and screens	Undeveloped
SEE SECTION 553 FOR SOURCE DETAILS															

[illegible]

ZONE V
SOURCE No. 550

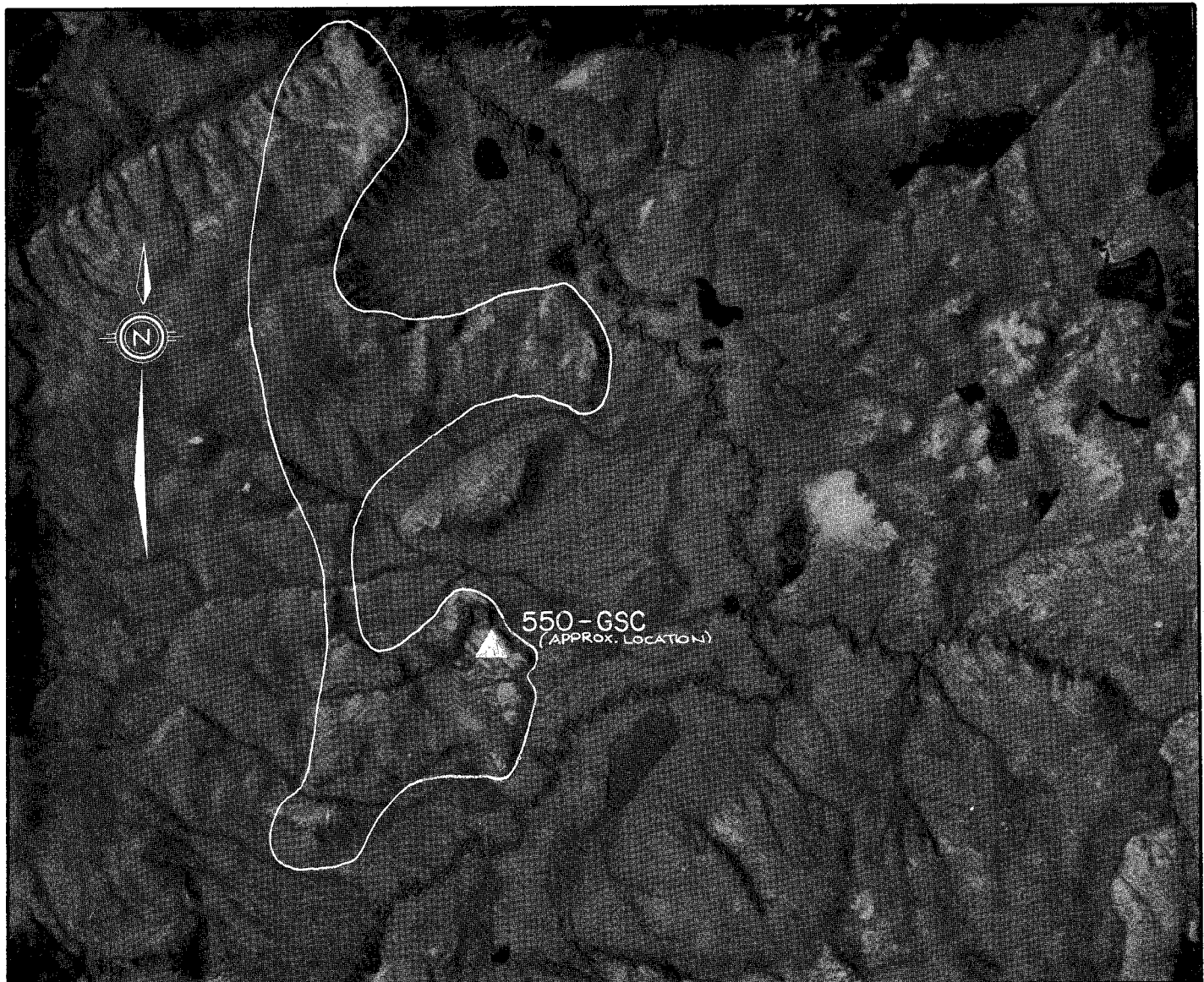
HT.

LANDFORM AND LOCATION: Glaciofluvial terrace located approximately 14 miles by air northwest of Fort McPherson and about 8 miles west of the winter road.

MATERIAL: GRAVEL and sand, little silt.

VOLUME: 5,000,000 cu. yds. at least.

CONCLUSION: Source is suitable for development as general fill and possibly for fine and coarse aggregate should further testing indicate the material is sound.



AIRPHOTO No. A13754 - 185

SCALE: 1" = 3000' (approx.)

550 ENVIRONMENT

Physical

The source is a glaciofluvial terrace located 14 miles northwest of Fort McPherson. The terrace is irregular in shape, about 3 miles long and 500 to 5,000 feet in width. It lies 50 to 100 feet above a small stream which flows north to the Barrier River, which in turn flows into the Rat River. Drainage of the source is good.

The source has not been developed, although a number of test pits have been excavated at some time in the past.

Biotic

The source lies at an elevation of about 1,000 feet in a relatively barren area, covered primarily by tufted grass and the occasional stunted black spruce grading to upland dwarf shrubs. The canopy density is less than 20% over the area. The valley bottom contains some larch, but here as well the height of trees is less than 20 feet, and canopy density less than 20%.

The Porcupine caribou herd passes close to this source in its annual migration. Otherwise the area contains little wildlife of note, and is not considered important to wildlife.

550 MATERIAL TYPES AND QUANTITIES

An on-site evaluation of this source by the G.S.C. indicates that the material is gravel and sand with a trace of silt. A petrographic analysis of the material is unavailable and hence the amount of unsound material is not known.

The ice content is expected to be low to medium. The volume of material available in this source is estimated to be at least 5,000,000 cubic yards.

550 DEVELOPMENT

General

This source may be developed to serve construction projects in the vicinity, but it is too remote for use near the Communities or along the Dempster Highway.

If development is anticipated in the vicinity of this large source, it is recommended that the developer drill a number of holes to find the best area to commence development. Otherwise the large area may be scarred by a number of small excavations.

Access

At present the only access to this source is by the winter road running northwest from Fort McPherson, which passes about 8 miles east of the source. A new access road from the winter road would climb 300 to 400 feet to the higher level on which the source is located. The total distance by road to Fort McPherson would be over 20 miles.

Material Use and Handling

The material in this source can be used as general fill, but without further qualitative data it cannot be assumed to be suitable for concrete or asphalt aggregate.

Equipment required for development would be the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

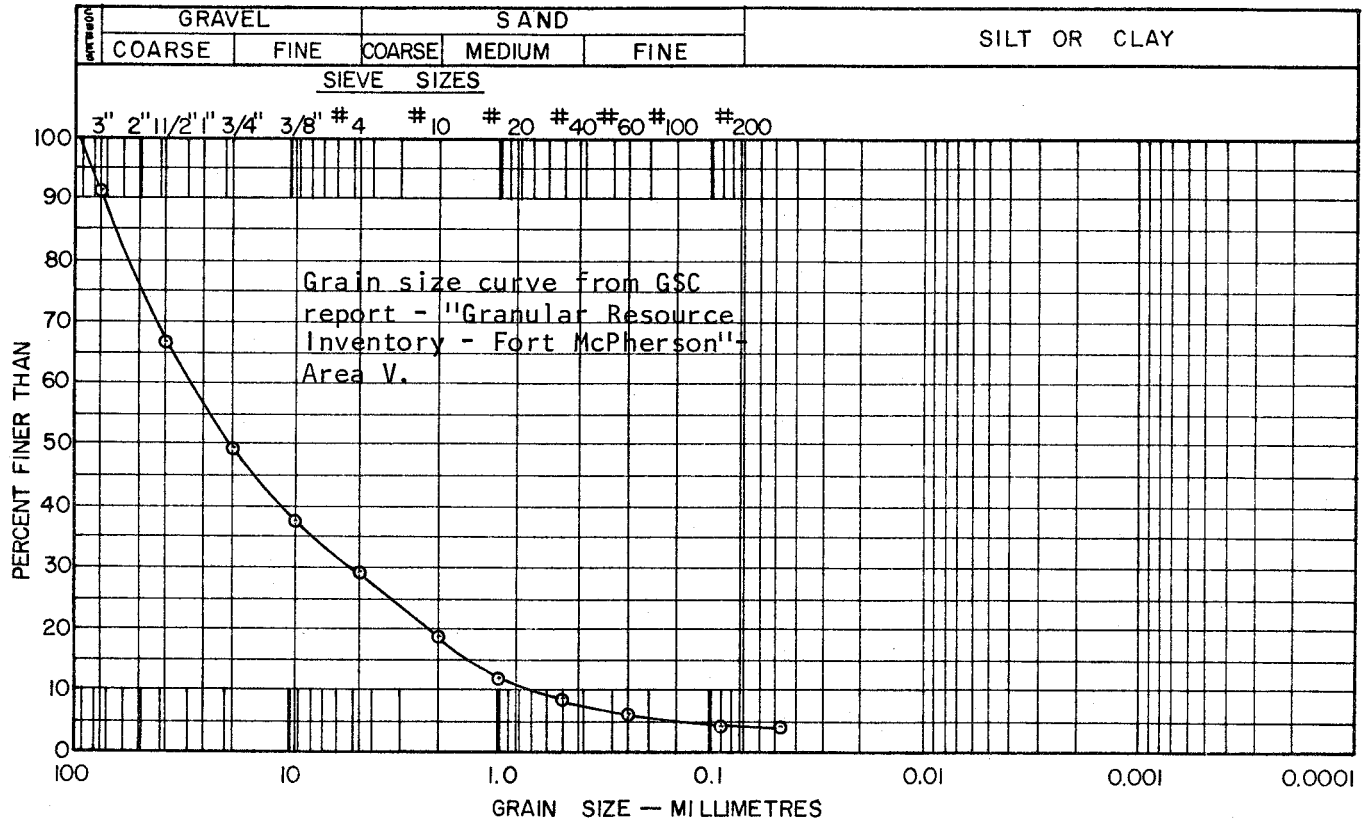
Stripping and Restoration

The depth of stripped material may be as much as 3 feet, most of it peat. This material would have to be stockpiled for replacement after the granular material had been removed. Stockpiles of all kinds should be kept away from the drainage system, to avoid siltation of the small rivers.

LABORATORY TEST DATA

TEST PIT-SOURCE No.550-GSC

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

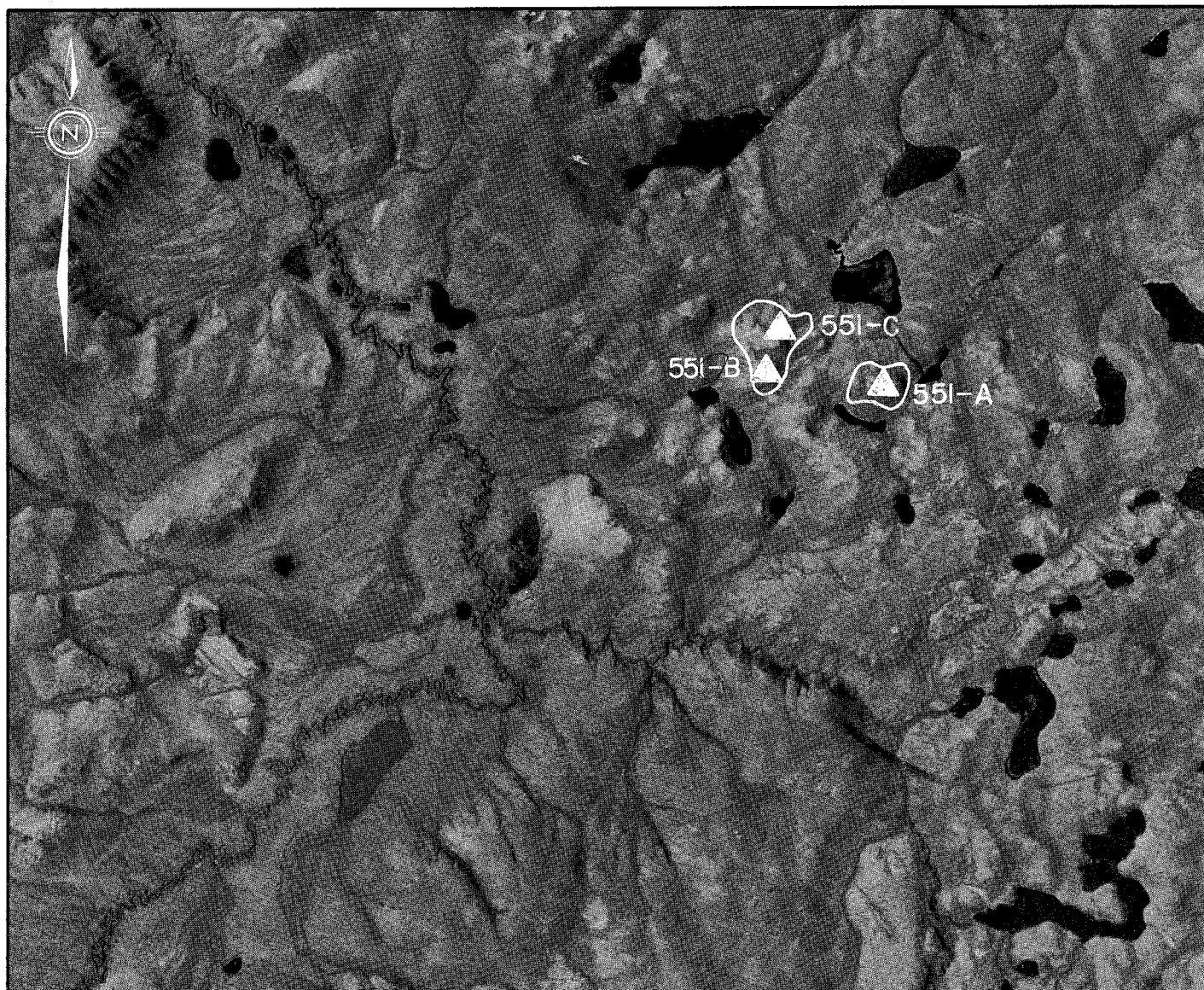
ZONE V
SOURCE No. 551

LANDFORM AND LOCATION: Two kames about 1000 feet in diameter, located about 14 miles by air northwest of Fort McPherson and about 6 miles west of the winter road.

MATERIAL: GRAVEL-and sand ; SAND - some gravel

VOLUME: 200,000 cu. yds. from active permafrost layer.

CONCLUSION: Low priority for development due to variability of material, and high percentage of unsound rock.



AIRPHOTO No. A13754 - 185

SCALE: 1" = 3000' (approx.)

551 ENVIRONMENT

Physical

The source consists of a field of two kame knolls about 1,000 feet in diameter within a group of small thermal ponds. The area is hummocky terrain typical of this part of the Peel Plateau. The source is 14 miles west, northwest of Fort McPherson.

Drainage of the kames is good, although drainage of the surrounding area is very poor. The surface of the source was free of ground ice to a depth of at least 3 feet when examined in September.

A small area of the source has been cleared and stripped, indicating the removal of some material, but when and for what purpose is not known. Removal must have been during the winter, because no road can be seen at this time.

Biotic

The source lies above the 1,000 foot elevation, in a relatively barren area covered by tufted grass and the occasional black spruce less than 20 feet high. The area is transitional to sphagnum bogs. Canopy density of the trees is less than 20%.

The Porcupine caribou herd passes close to this source in its annual migration. Otherwise, the area contains little wildlife of note, and is not considered important to wildlife.

551 MATERIALS AND QUANTITIES

The material in the source is gravel and sand, with some silt pockets. Two test pits exposed gravel and sand, and one cut into silt.

The gravel and sand contain about 10% fines, passing the #200 mesh. The rock is primarily quartzite, granite, and some hard sandstone, but also contains 35% to 40% soft porous limestone and sandstone.

The estimated volume of material available to a depth of 3 feet is 200,000 cubic yards.

551 DEVELOPMENT

General

This source could serve construction projects in the vicinity, but it is too remote for use near the Communities or along the Dempster Highway. However, this source should be considered low priority for development due to the variability and poor quality of the material.

Access

The only access to this source is by the winter road running northwest from Fort McPherson, which passes about 6 miles east of the source. A new access road would follow a seismic line from the existing winter road and would climb 300 to 400 feet to the higher level on which the source is located. The total distance to Fort McPherson would be about 18 miles by road.

Material Use and Handling

The material in this source could be used as general fill. The large content of unsound rock makes it unsuitable for concrete or asphalt aggregate.

Equipment required for development would be the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

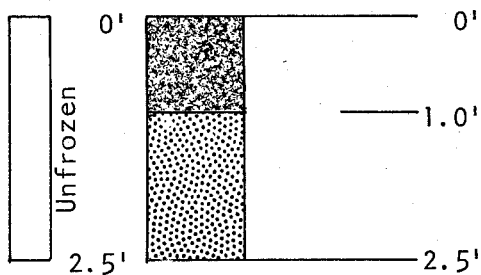
Stripping and Restoration

All vegetation would have to be stripped from the area and stockpiled for replacement after the granular material was removed.

TEST PIT LOGS

SOURCE No. 551

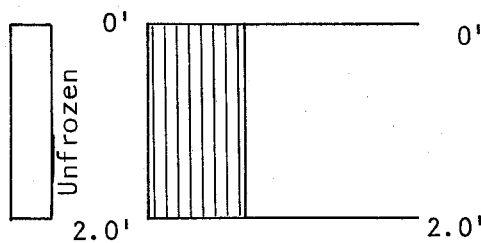
551 - A



(Pt) PEAT - trace silt

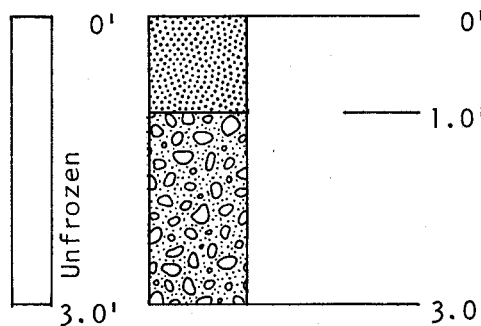
(SW) SAND - some gravel, trace silt,
max. 3" well graded

551 - B



(ML) SILT - trace sand, trace fine
gravel low to med. plastic

551 - C

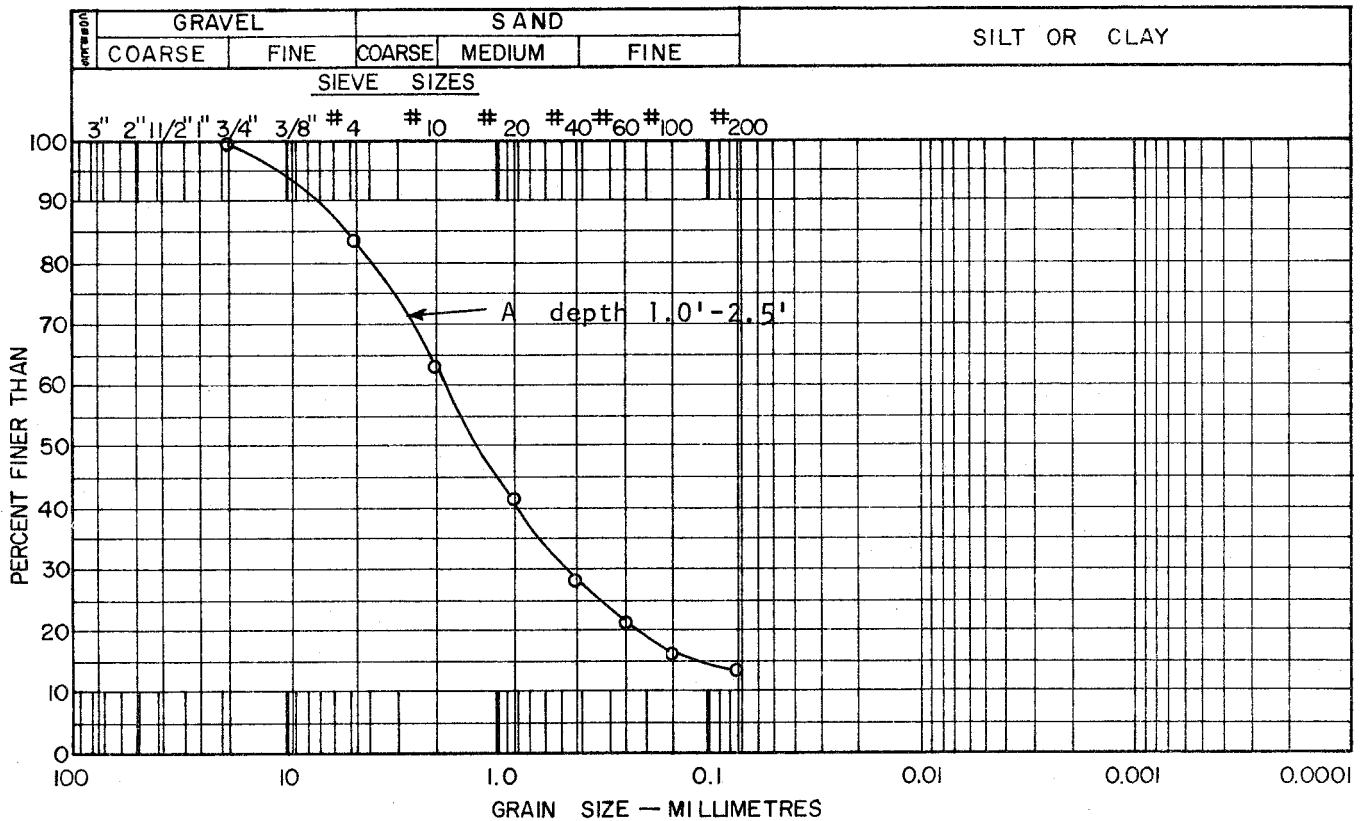


(SM) SAND - and silt, organic

(GW) GRAVEL - and sand, trace silt, max.
2" rounded to subrounded

LABORATORY TEST DATA TEST PIT-SOURCE No. 551

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample A depth 1.0'-2.5' 4.7%

ORGANIC CONTENT

HARDNESS TEST

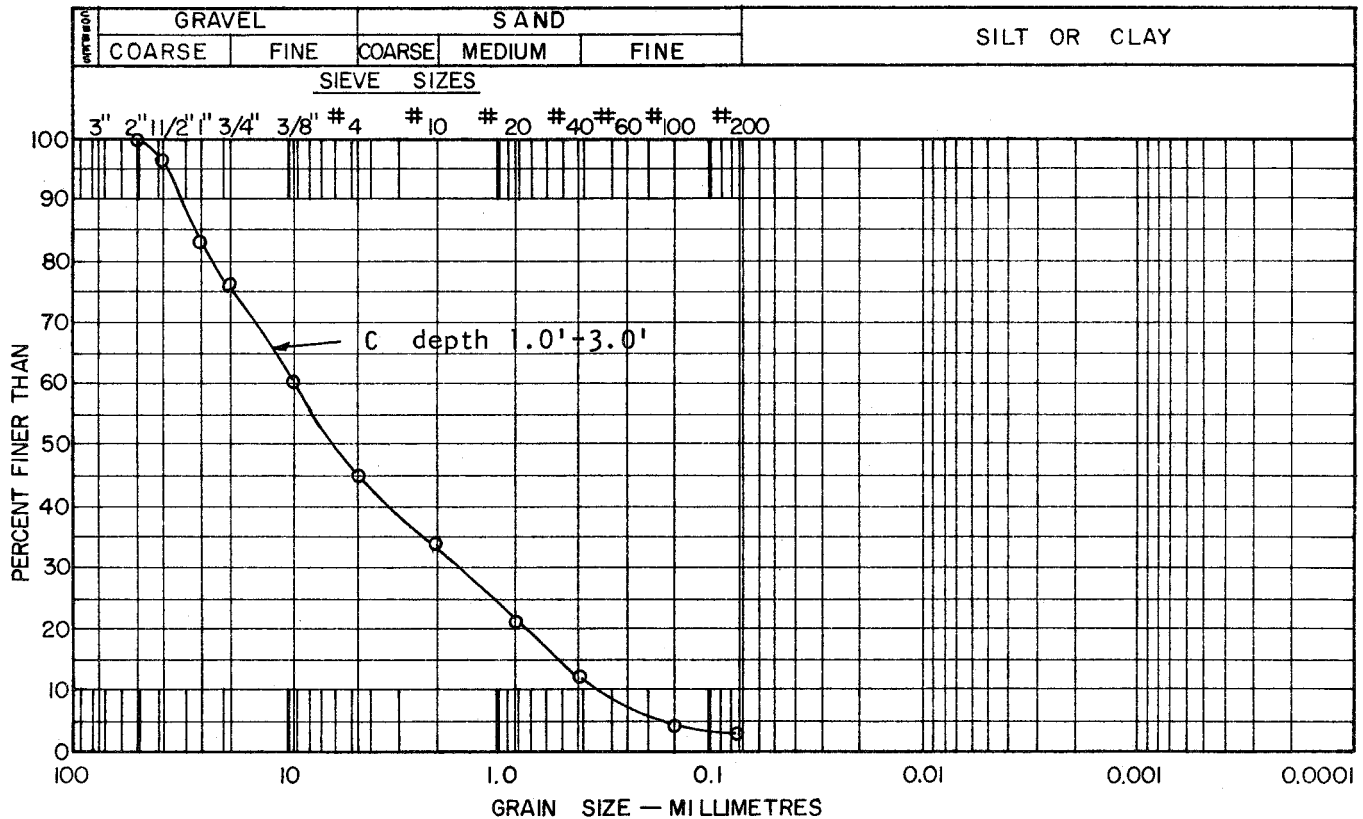
PETROGRAPHIC ANALYSIS

Quartzite	-45%
Sandstone, soft	-17%
Sandstone, hard	-15%
Limestone, soft	-11%
Chert	- 9%
Ironstone	- 1%

Quartz	- 1%
Granite	- 1%
Total	100%

LABORATORY TEST DATA TEST PIT-SOURCE No. 551

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample C depth 1.0'-3.0' 3.4%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

Quartzite	-32%	Shale	- 4%
Sandstone, soft	-26%	Concretion	- 1%
Limestone, soft	-15%	Sandstone, hard	- 1%
Granite	-10%		
Chert	-11%		
		Total	100%

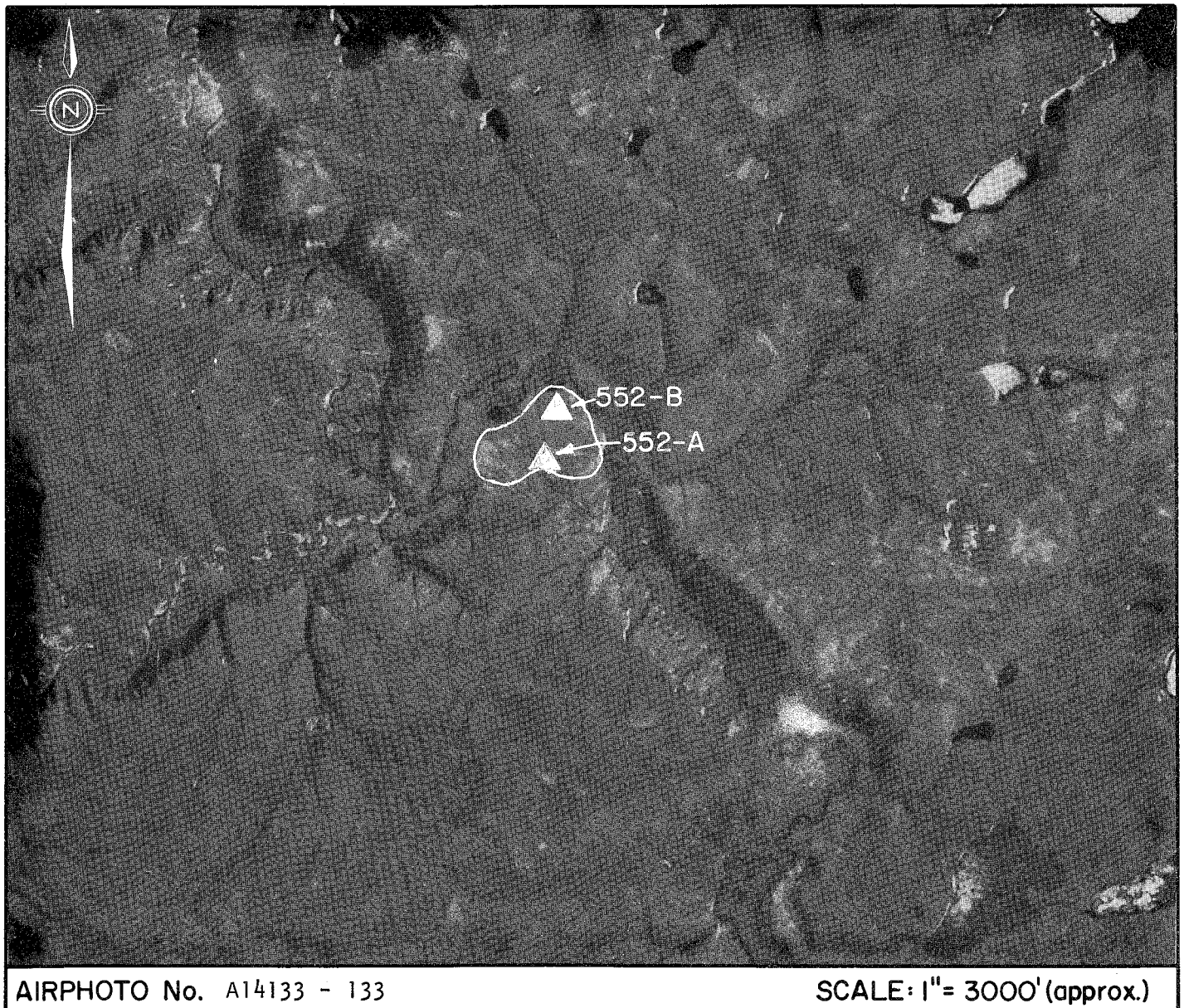
ZONE V
SOURCE No. 552A

LANDFORM AND LOCATION: Alluvial deposit, located 22 miles by air northwest of Fort McPherson

MATERIAL: SILT - little sand

VOLUME: 200,000 cu. yds.

CONCLUSION: Source not suitable for development due to quality and possible damage to physical environment.



AIRPHOTO No. A14133 - 133

SCALE: 1" = 3000' (approx.)

552A ENVIRONMENT

Physical

This source is an alluvial deposit located beside a small unnamed river draining north to the Rat River system. The source is 22 miles by air northwest of Fort McPherson. Drainage of the source is good.

Biotic

The surface of the area is covered by low shrubs and sparse black spruce up to 20 feet high. The canopy density is less than 20%.

The Porcupine caribou herd passes close to this source in its annual migration. Otherwise the area contains little wildlife of note, and is not considered important to wildlife.

552A MATERIALS AND QUANTITIES

The material is primarily silt, with little sand and a trace of gravel. Ice content is high.

The estimated volume of material to a depth of 5 feet is 200,000 cubic yards.

552A DEVELOPMENT

General

The material from this source would be difficult to excavate and would require thawing and draining before it could be used as a very poor quality general fill. In addition, it is remote from present development and within 5 miles of a source containing much better material.

The source is not recommended for development.

Access

The only access is by the winter road running northwest from Fort McPherson, which passes about 8 miles east of the source. A new access road from the existing winter road could follow a seismic line, but would have to negotiate a 20% grade as it leaves the winter road. For this reason, access could be accomplished only by tracked vehicles.

Material Use and Handling

The material is primarily silt with a high ice content. Before removal it would have to be ripped, then stockpiled for thawing and draining. After this procedure the material could be used as a poor quality general fill, but would be difficult to place in inclement weather.

Handling would require the usual assembly of equipment, except that tracked vehicles would be required for haulage because of the difficult access.

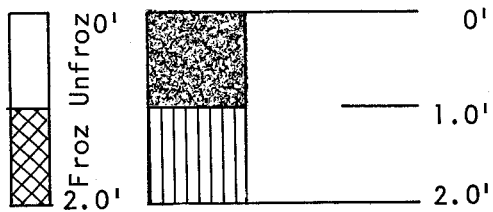
Stripping and Restoration

Exposing a large area of this silty material would lead to environmental problems, such as bank instability, thermal erosion, and siltation of the nearby stream. Therefore development is not recommended for environmental reasons as well as for the poor quality of the source.

TEST PIT LOGS

SOURCE No. 552A

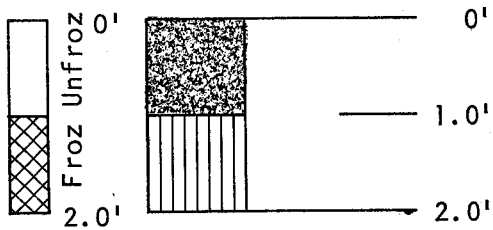
552A-A



(Pt) PEAT - some silt

(OL) SILT - little sand, organic

552A-B



(Pt) PEAT - some silt

(OL) SILT - little sand, organic

ZONE V
SOURCE No. 553

LANDFORM AND LOCATION: Inactive flood plain in Rat River Valley about 25 miles by road northwest of Fort McPherson

MATERIAL: GRAVEL - some sand

VOLUME: 2,500,000 cu. yds. at least

CONCLUSION: Due to the environmental concerns discussed in the source details permission may be difficult to obtain to develop this source



Physical

The source is an area of inactive flood plain within the valley of the Rat River about 3 miles west of the Mackenzie Delta. The largest area of the potential source is about 2 miles long and from 600 to 700 feet wide.



Photo 1 Source 553 - looking north
along river valley.

Biotic

The valley bottom is partly covered by a heavy stand of aspen and spruce, generally 40 to 60 feet high and with a canopy density of 40% to 60%. Some areas of the source are covered by a very light cover of black spruce with sphagnum moss.

Wildlife within the area is limited to small fur-bearing animals and rodents, in addition to the lynx.

This general area is important to environmentalists for a number of reasons. To begin with the Rat River is on the historic canoe route leading from the Mackenzie River to the Klondike, and is still a challenge for experienced canoeists.

The Rat River supports a significant run of Arctic Char, and the area adjacent to the source is an important domestic fishing area.

The source lies within a recognized lynx habitat, not heavily trapped but potentially important.

The area around the Rat River Valley has been proposed as a reserve under the International Biological Programme. The proposed reserve contains a complete range of vegetation types, from river lowland to alpine tundra.

553 MATERIALS AND QUANTITIES

The material is primarily gravel (75%), with some sand (22%) and a trace of silt (3%).

The petrographic analysis shows that the main constituent is quartzite (82%). The other rocks identified are sandstone (9%), chert (5%), and granite (4%), with traces of quartz and siltstone. The only unsound constituent is the soft porous fraction of the sandstone, about 4% of the total.

The source is estimated to contain more than 2,500,000 cubic yards of usable material.

553 DEVELOPMENT

General

Because of its central position in an important environmental picture, it is considered improbable that permission will be granted to develop this source. In addition, it is probable that any development would require a major impact study to determine its effects on the biotic environment.

If, however, development were permitted, this source could supply a large volume of general fill and coarse aggregate to nearby projects. It is too far from Fort McPherson and the Dempster Highway to assist in the development of that area.

Access

The winter road running northwest from Fort McPherson crosses the Rat

River just downstream from this source. A short winter access road could be built to the source in the valley bottom, placing the source about 25 miles from Fort McPherson by road.

Material Use and Handling

The material from this source is suitable for general fill and, with some crushing and screening, for coarse aggregate.

The equipment required for development of this source is the usual assembly of dozer, front-end loader, and trucks. Development of the source for coarse aggregate would require the installation of a crushing and screening plant.

Stripping and Restoration

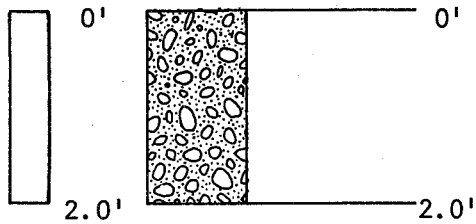
An important consideration here is the necessity of avoiding siltation or other damage to the river. Fortunately the gravel contains very little silt, but all stockpiles of topsoil and gravel would have to be placed so that surface drainage would not carry silt or waste into the river.

Before development of an area, all trees and shrubs should be cleared and burned above flood-plain elevation. The organic cover and topsoil should then be stripped and distributed over a suitable area above the flood-plain. A substantial berm or dyke must be left between the river and the operation, and particular care taken to avoid the spillage of oil or grease within the stream-bed. After depletion the area must be left clean and free of debris.

TEST PIT LOGS

SOURCE No. 553

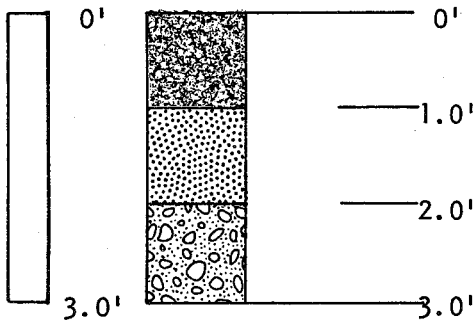
553 - A



(GW)

GRAVEL - some sand, trace silt, max 3" rounded to subrounded, well graded

553 - B



(Pt)

PEAT

(SM)

SAND - and silt, organic

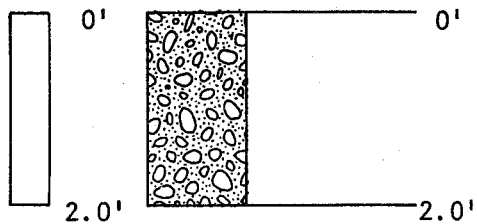
(GW)

GRAVEL - some sand, trace silt, max. 3"

TEST PIT LOGS

SOURCE No. 553

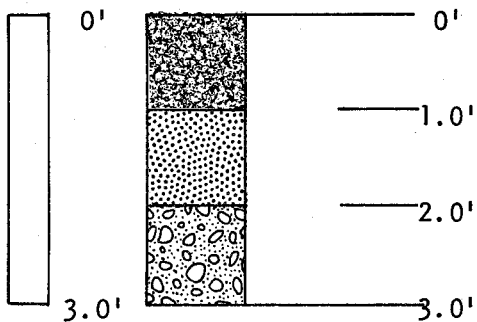
553 - A



(GW)

GRAVEL - some sand, trace silt, max 3" rounded to subrounded, well graded

553 - B



(Pt)

PEAT

(SM)

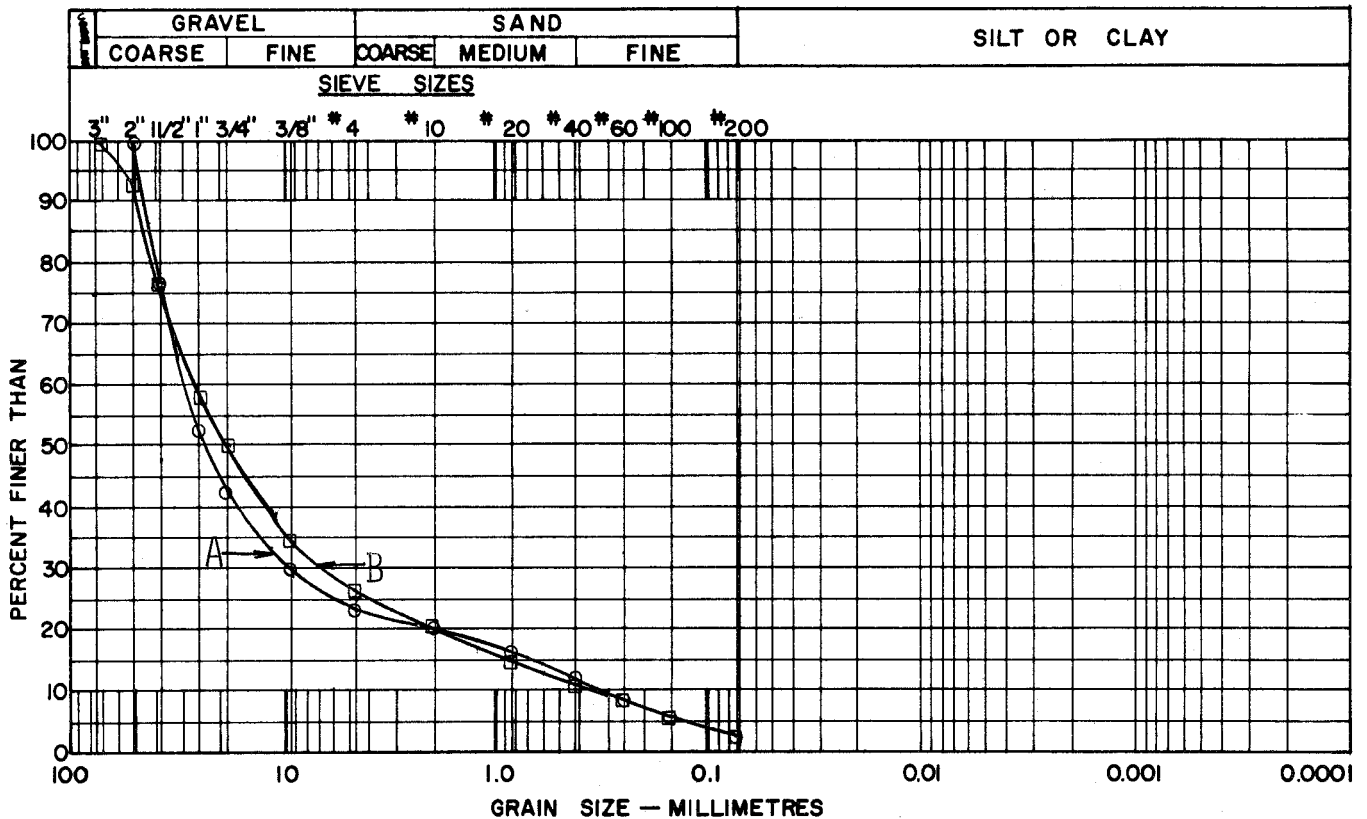
SAND - and silt, organic

(GW)

GRAVEL - some sand, trace silt, max. 3"

LABORATORY TEST DATA SOURCE No. 553

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0.0' - 2.0') M/C = 1.4%

B-(2.0' - 3.0') M/C = 1.8%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

Quartzite	-83%
Chert	- 5%
Granite	- 4%
Sandstone, hard	- 4%
Sandstone, soft	- 4%
Siltstone	nil

Total 100%

ZONE V
SOURCE No. 554

411

LANDFORM AND LOCATION: Two eskers, two terraces and a morainal plain located about 25 miles from Fort McPherson and adjacent to an existing winter road.

MATERIAL: GRAVEL and sand

VOLUME: 2,500,000 cu. yds. at least

CONCLUSION: Due to the environmental concerns discussed in the source details, permission may be difficult to obtain to develop this source area.



AIRPHOTO No. A12861 - 10

SCALE: 1" = 3000' (approx.)

Physical

This source is an extensive area of glacial landforms on either side of the Rat River Valley, about 3 miles west of the Mackenzie Delta. On the north side are two glaciofluvial terraces. The largest is 5,000 feet by 1,000 feet. There are also two small eskers about 1,000 feet in length and 25 feet in height. On the south side of the valley is a large morainal plain about 2 miles by 1½ miles, apparently channeled and modified by glaciofluvial action. The maximum observed difference in elevation across the moraine plain is 100 feet.

The source area is located 25 miles northwest of Fort McPherson, and has not been developed to date.

Biotic

The vegetative cover over the morainal plain is upland dwarf shrubs. The elevated area north of the Rat River is covered with isolated black spruce, aspen, and larch from 20 to 40 feet high and with a canopy density of 20% to 40%.

The most important wildlife in the area is lynx, although they are not trapped heavily. In addition, the area supports the usual population of small fur-bearing animals and rodents, but not in large numbers.

The source lies within an area that has been proposed as a reserve under the International Biological Programme. The proposed reserve encompasses the Rat River Valley, and contains a complete range of vegetation types, from river lowland to alpine tundra.

554 MATERIALS AND QUANTITIES

The materials taken from test pits in the two eskers are primarily gravel (65%) and sand (27%) with a trace of silt (8%). The petrographic analysis shows the main constituents to be hard sandstone (69%), quartzite (22%), and chert (4%), with granite, quartz, limestone, and shale making up the remaining 5%. Only 0.5% is considered unsound or deleterious.

Test holes no. 554-3 to 554-6 inclusive from a previous investigation in the morainal area, south of Rat River, indicated primarily sand and silt, but these holes were between areas investigated by G.S.C. A sample taken by the G.S.C. from the morainal plain indicated gravel (77%), little sand (17%) and a trace of silt (6%), however the depth of this sample is unknown and the source may be a very shallow surface deposit. The maximum size of cobbles found in the source area is 8 inches diameter.

The total estimated volume of material in the area is more than 2,500,000 cubic yards.

554 DEVELOPMENT

General

The development of this source is improbable because of the proposed reserve classification. If permission were granted, it is probable that a major environmental impact study would be required. Any development of the source in the future would require additional drilling to delineate the most desirable material. Indiscriminate excavation of pits should not be allowed.

Aside from the important environmental considerations, the source contains a large volume of granular material suitable for use as general fill or as concrete and asphalt aggregate.

The source is remote from the Communities and from the current development along the Dempster Highway, and would be developed only for major developments within the vicinity.

Access

The only present access to this source is by the winter road that runs northwest from Fort McPherson and passes by the morainal plain. The distance to Fort McPherson by road is approximately 25 miles.

Material Use and Handling

The material from this source can be used as general fill or concrete and asphalt aggregate.

The development of this source will require the usual assembly of dozer with ripper attachment, front-end loader, and trucks. A crusher and screening plant would be required for production of high quality concrete and asphalt products.

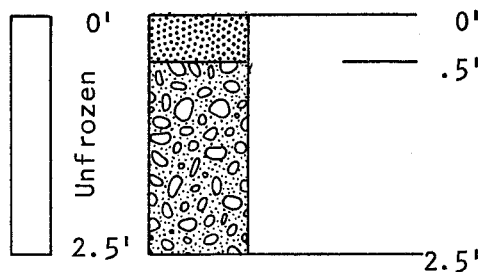
Stripping and Restoration

All trees and shrubs must be removed and burned before the source is stripped. The topsoil and organic material would then be stockpiled for replacement after the granular material had been removed. All banks and steep slopes must be graded to a stable slope before being covered with topsoil. Finally the area should be re-seeded for speedy revegetation, using a selection of plants and a method of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS

SOURCE No. 554

554 - A



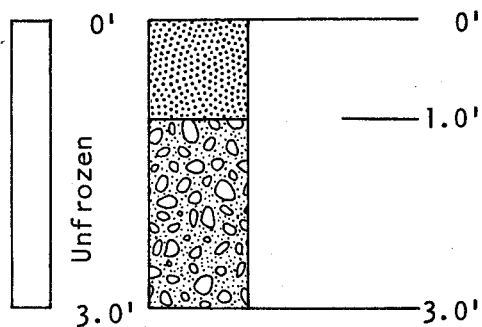
(SM)

SAND - and silt, organic

(GW-GM)

GRAVEL - and sand, trace silt,
max $2\frac{1}{2}$ " rounded to sub-
angular, well graded

554 - B



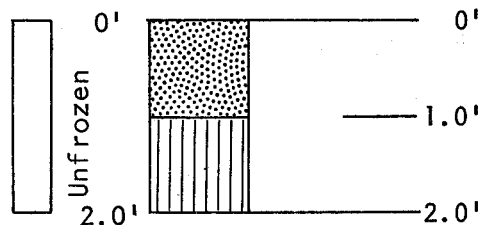
(SM)

SAND - and silt, organic roots etc.

(GW-GM)

GRAVEL - and sand, trace silt,
max $2\frac{1}{2}$ " rounded to sub-
angular, well graded

554 - C



(SM)

SAND - and silt, organic

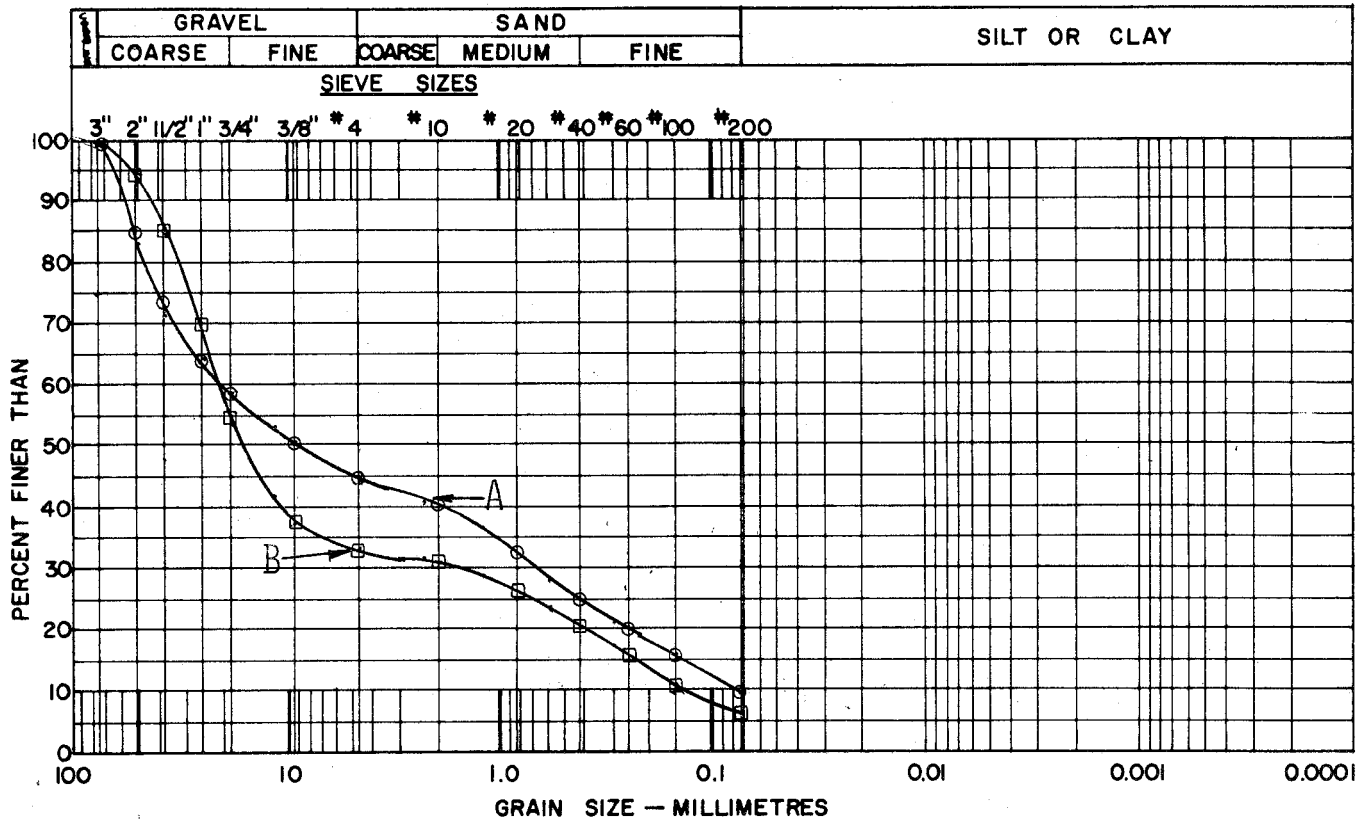
(ML)

SILT - trace clay, low plastic

LABORATORY TEST DATA

SOURCE No. 554

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0.0' - 2.5') M/C = 4.4%

B-(0.0' - 2.5') M/C = 2.3%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

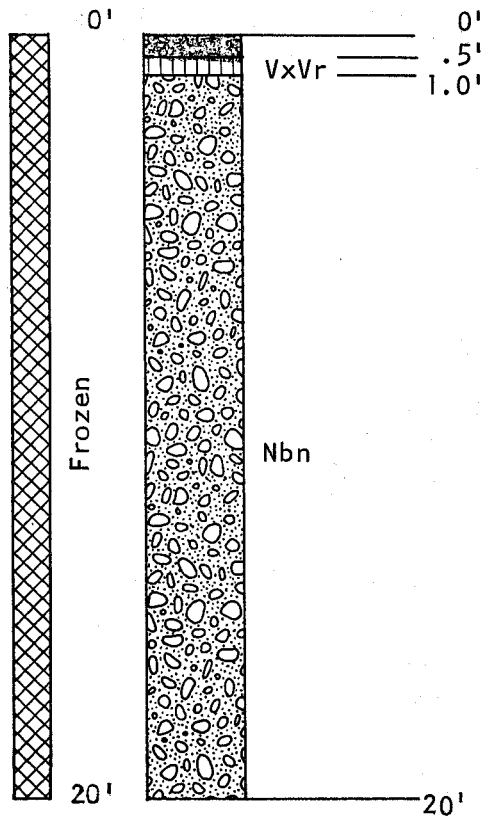
Sandstone - 69%
Quartzite - 22%
Chert - 4%
Limestone, hard - 4%
Quartz - 1%

Granite - neg
Siltstone - neg
Total 100%

TEST HOLE LOGS

SOURCE No. 554

554 - 1



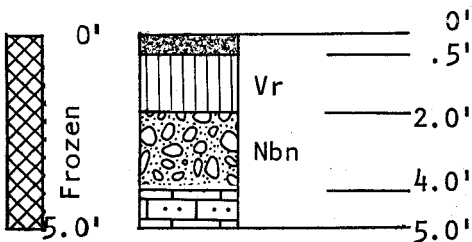
(Pt)
(ML)

PEAT

SILT - med to high ice content

GRAVEL - sands, clean and brown,
well graded gravel, very
dense from 5'

554 - 2



(Pt)
(ML)
(GP)

PEAT

SILT - high ice content

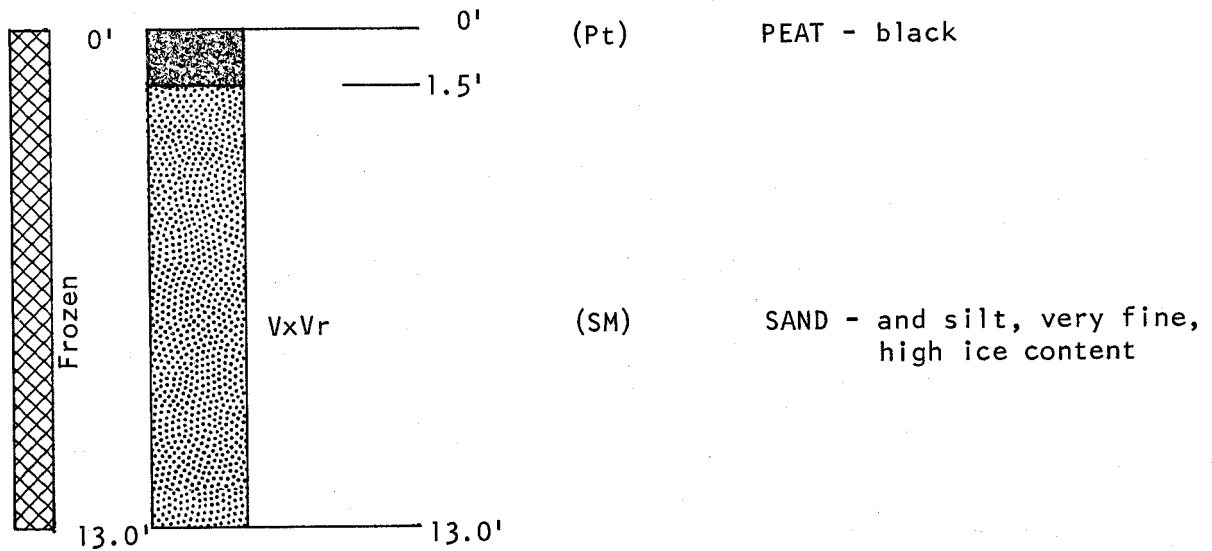
GRAVEL - and sand, some silt

SANDSTONE - very hard

TEST HOLE LOGS

SOURCE No. 554

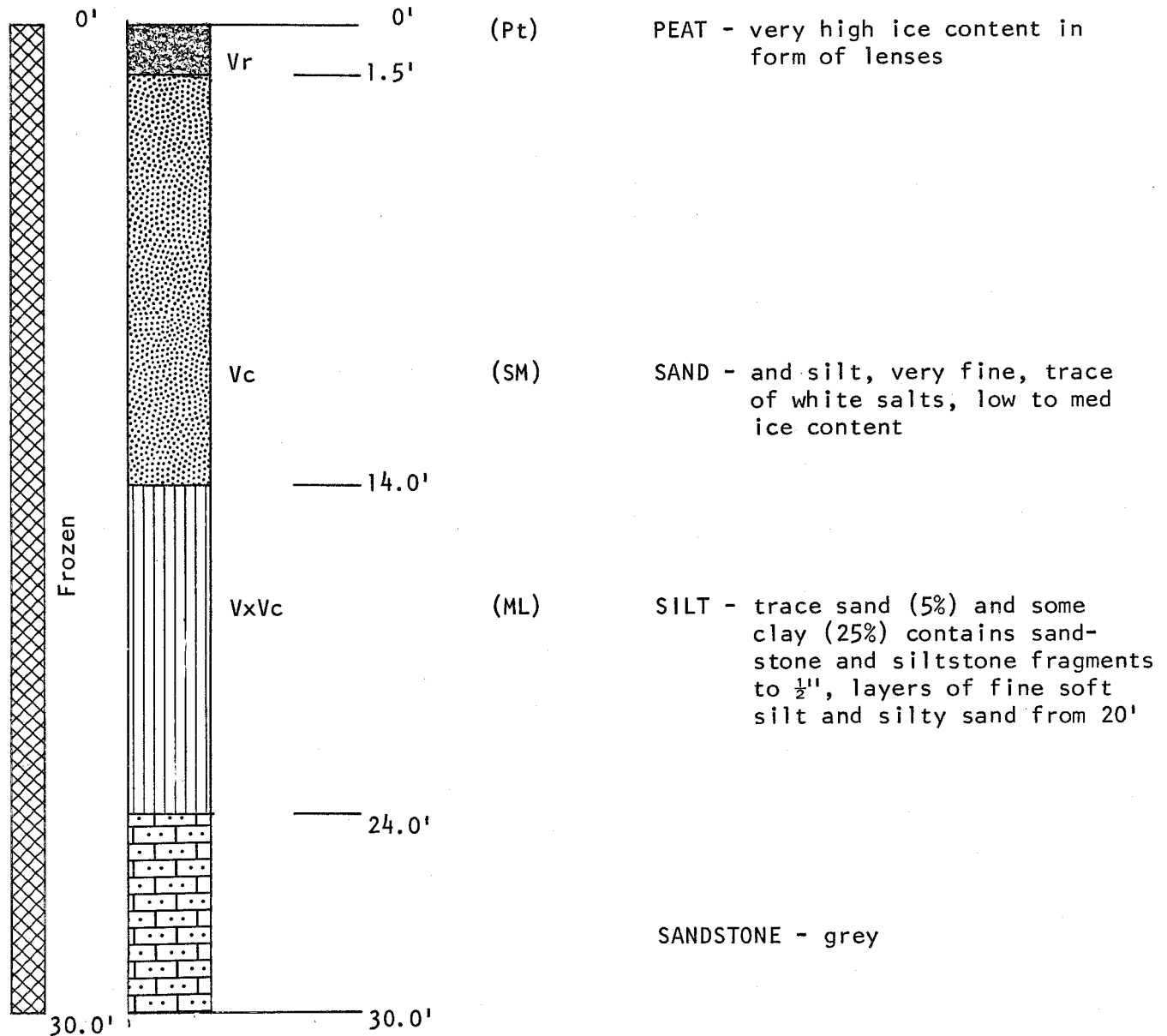
554 - 3



TEST HOLE LOGS

SOURCE No. 554

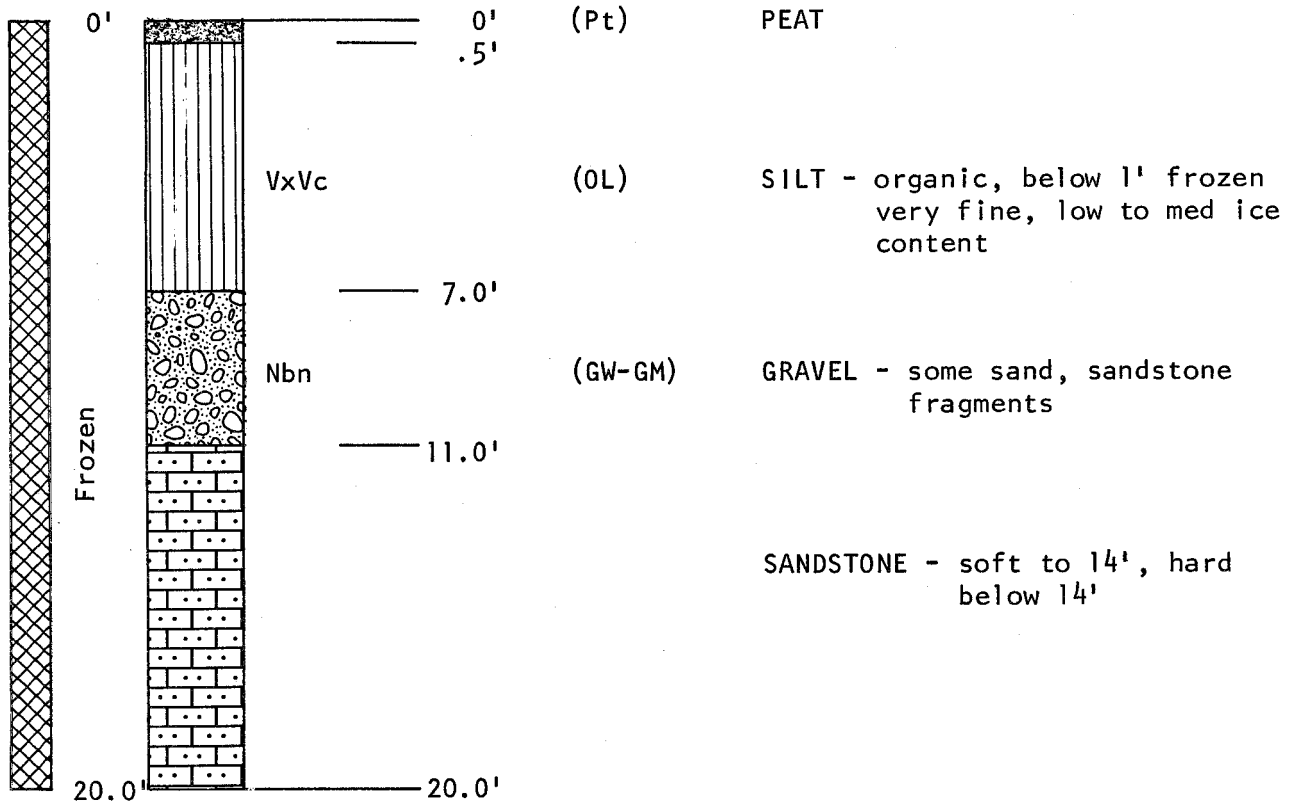
554 - 4



TEST HOLE LOGS

SOURCE No. 554

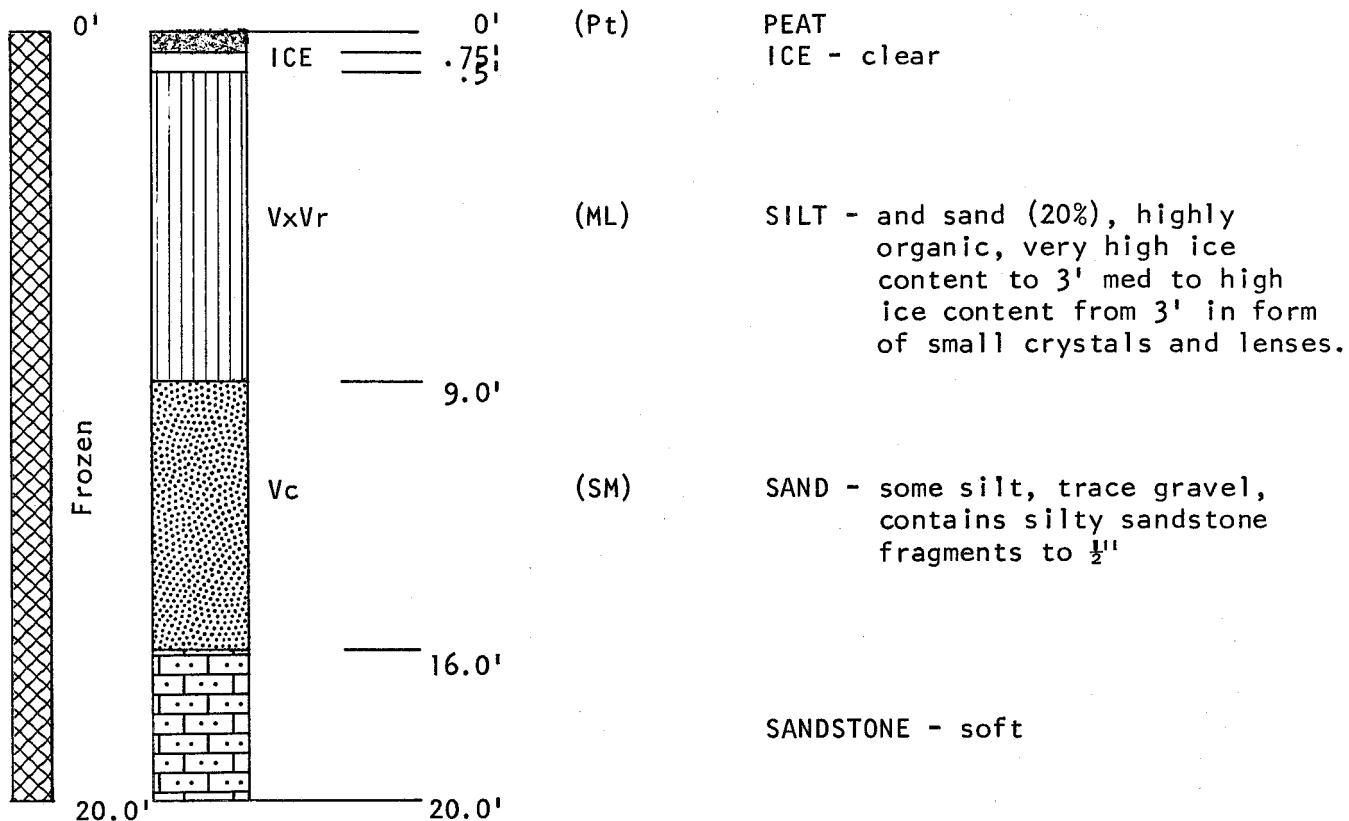
554 - 5



TEST HOLE LOGS

SOURCE No. 554

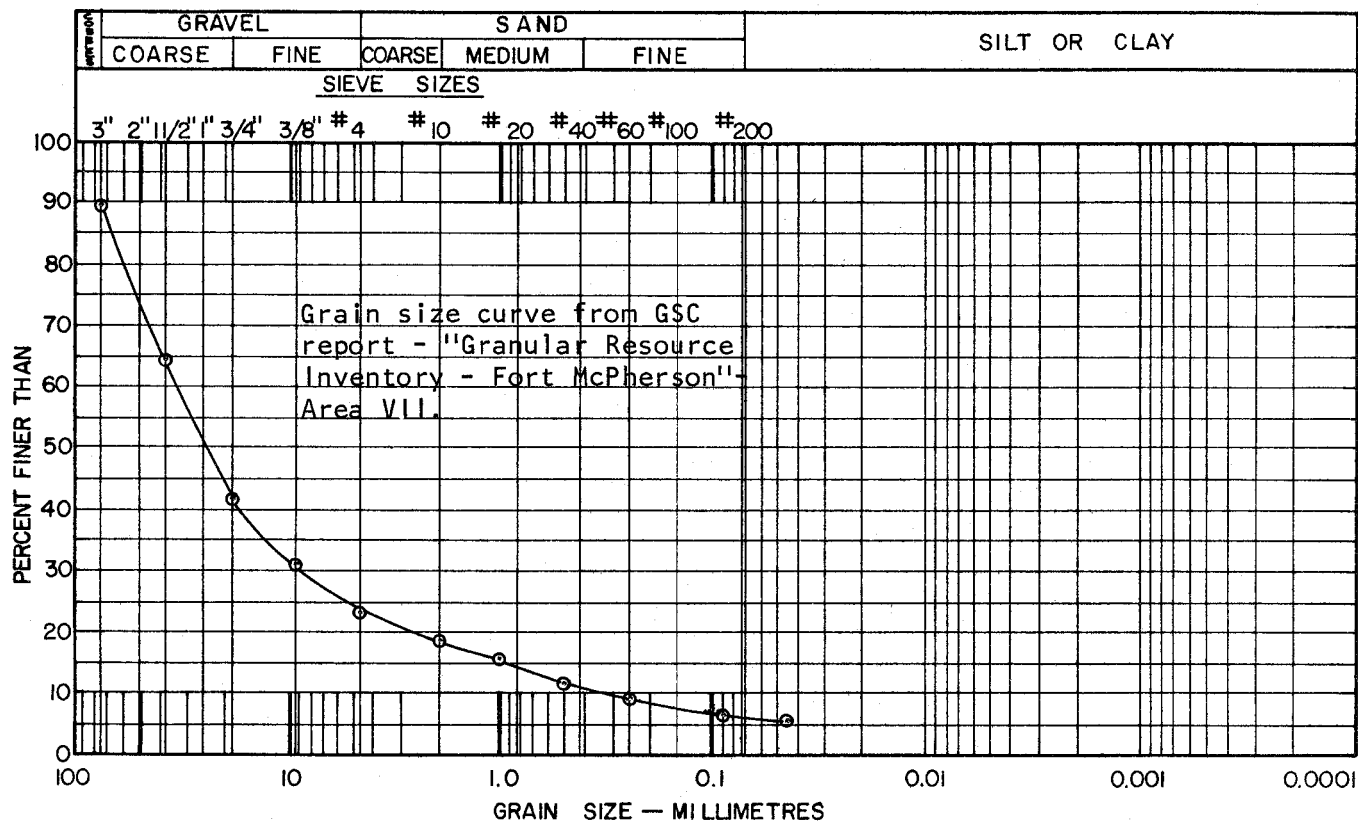
554 - 6



LABORATORY TEST DATA

TEST PIT-SOURCE No. 554-GSC

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

ZONE V
SOURCE No. 555

LANDFORM AND LOCATION: Inactive flood plains located on the Vittrekwa River between 1 and 3 miles upstream of the confluence with the Peel River.

MATERIAL: GRAVEL - and sand, some boulders to 12 inches

VOLUME: 500,000 cu. yds.

CONCLUSION: Suitable for development for base course aggregates and general fill



AIRPHOTO No. A12847 - 260

SCALE: 1" = 3000' (approx.)

Physical

The source is two sections of inactive flood plain within the stream-bed of the Vittrekwa River, located 1 mile and 3 miles from the confluence with the Peel River. Each section is 2,000 to 3,000 feet long and 200 to 500 feet wide, and can be developed to a depth of about 4 feet.



Photo No. 1 Source 555 Looking west along river valley at inactive flood plain.

Drainage of the source is good to the watertable at the 4 foot depth, with no ground ice reported in September. The source has not been developed.

The source lies 22 miles southwest of Fort McPherson.

Biotic

The vegetation on the source is predominantly poplar and some white

spruce with unforested areas having a cover of small bushes and tufted grass.

The valley is not a critical or important wildlife area, partly because of its remoteness.

555 MATERIALS AND QUANTITIES

The material is gravel and sand, some boulders to 12 inches diameter.

The gravel is rounded to sub-angular. The material contains a large percentage of sandstone, eroded from the valley in which the river flows.

A petrographic analysis of this material shows that the major constituents are fine grained sandstone (65%) and soft porous sandstone (15%) with quartzite, chert and granite making up most of the remainder. The unsound materials are the soft sandstone and a small amount (less than 1%) of shale.

The estimated volume of material is 500,000 cubic yards.

555 DEVELOPMENT

General

This source can be developed for general fill and for coarse aggregate.

Access

The source is close to the Peel River, on which the material can be transported by scow in summer or by truck in winter. By either means of haulage the source is 16 miles from the Dempster Highway crossing of the Peel and 24 miles from Fort McPherson.

Material Use and Handling

The material from this source will be suitable for general fill. It may also find use as base course for road construction, in which case crushing and screening will be necessary.

The development of this source will require a dozer for clearing and stripping, a front-end loader, and trucks.

Stripping and Restoration

The main concern in developing this source is that the river should not

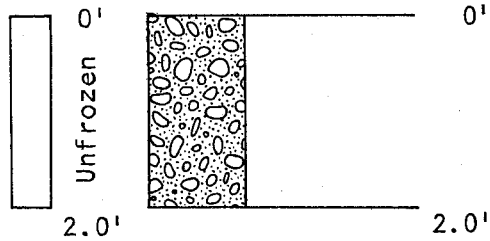
be silted or otherwise affected. Fortunately, the samples tested contain almost no silt, so the danger of siltation is reduced considerably. In addition, the river is apparently not an important fishing stream.

Before development of an area, all trees and shrubs should be cleared and burned above flood-plain elevation. The organic cover and topsoil should then be stripped and distributed over a suitable area above the flood-plain. A substantial berm or dyke must be left between the river and the operation, and particular care taken to avoid the spillage of oil or grease within the stream-bed. After depletion the area must be left clean and free of debris.

TEST PIT LOGS

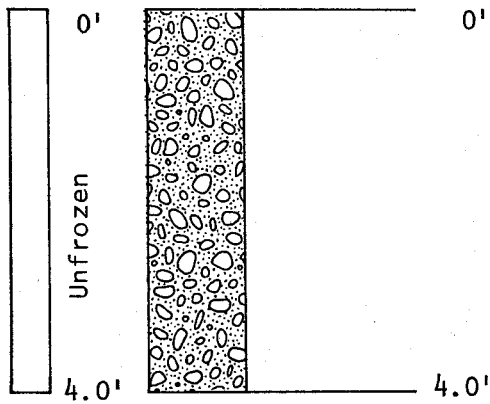
SOURCE No. 555

555 - A



GRAVEL - and sand, rounded to subangular
well graded

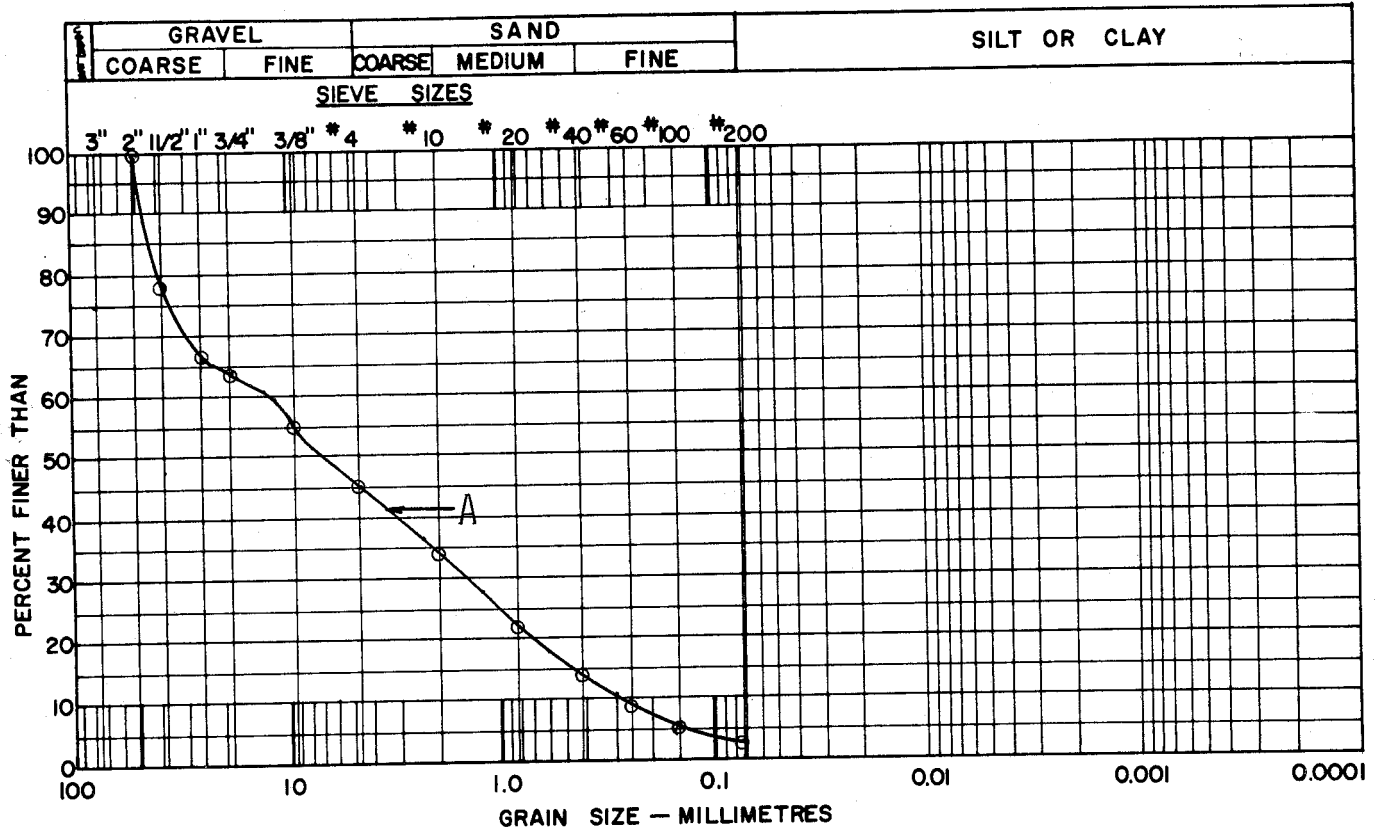
555 - B



GRAVEL - and sand rounded to subangular
well graded

**LABORATORY
TEST DATA
SOURCE No. 555**

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A (0.0' - 2.0') M/C = 2.0%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

Sandstone, hard	-66%
Sandstone, soft	-15%
Quartzite	-10%
Chert	- 5%
Granite	- 2%
Shale	- 1%

Concretion	- 1%
Limestone, soft	neg.
Total	100%

4. ZONE VI

4.1 Surficial Geology

The Zone VI Study area consists of two main physiographic regions, the Peel Plain south of the Mackenzie River, and the Anderson Plain to the north. Over the area shale and sandstone bedrock is exposed primarily beside stream channels, and elsewhere is covered by surficial material of glacial origin. A widespread ground morainal till is overlain by a variety of glacial landforms, laid down during the last glacial retreat. Much of the area is covered by either glaciofluvial or glaciolacustrine plains.

In geologically recent times the rivers flowing east and north to the Mackenzie River have cut through the morainal till, building up deposits of silt and clay in the streambeds.

4.2 Environment

Arctic Red River lies at the confluence of the Arctic Red and Mackenzie Rivers, near the eastern limit of the Peel River Game Preserve. The surrounding area supports a population of small fur-bearing animals, such as beaver, mink, lynx, and marten, which are trapped by the men from the Community. Certain areas in this zone are regarded as important wildlife areas, but none of the sources of granular material investigated for this report infringe on these areas. The point has been confirmed in correspondence with the Division of Lands, Forests, and Wildlife, of Environment Canada.

The Arctic Red and Mackenzie Rivers are important fisheries. Fortunately, none of the sources of granular material investigated in this report lie within the valley bottoms.

4.3 Sources and Materials

A total of 6 sources of granular material were investigated in Zone VI, in addition to those reported under the Arctic Red River Community Report. Two sources are considered unworthy of further consideration. Source 651A is silt, frozen to the surface, and

source 655A is primarily silt with high ice content. Of the remaining 4 sources, one (650) is a glaciofluvial outwash plain and the rest are glacial features such as eskers and kames.

Source 650 contains materials suitable for any use, including concrete aggregate. Source 652 contains good gravel and sand, but as a thin veneer over a frozen silt. Source 653 contains sand, suitable for general fill or as fine aggregate for concrete. Source 654 contains gravel and sand suitable for general fill and road construction.

The petrographic analysis of source 650 shows that the material contains primarily quartzite (62%) and chert (20%), with granite, limestone, ironstone, quartz, shalestone, and sandstone making up the remaining 18%. The potentially deleterious rocks are chert (18%), ironstone (2%), siliceous limestone (3%), and shalestone (2%). The chert and limestone are not considered to be reactive, however, pending further qualitative studies, it is recommended that concrete made with this aggregate should use cement that contains less than 0.6% alkali.

4.4 Management

The development of Zone VI will follow the Dempster Highway in a fairly narrow band around the Mackenzie Delta. Except for the northern end of this band, the area is quite well supplied with granular material.

Source 653 can provide a satisfactory quality general fill. Source 650 can be developed to serve any requirement. Further north, source 654 can be developed for winter haulage, however no source in the Zone VI map area has been discovered north of the Rengleng River.

The sources mentioned above will probably be developed in connection with the construction of the Dempster Highway. Other work that follows may draw on them as well, depending on the location of work and economic hauling distance.

Source 650 is recommended for the continuing supply of granular material in the southern part of Zone VI, and will probably contain an aggregate plant as soon as the market warrants. This source will probably supply the Communities of Fort McPherson and Arctic Red River with specification aggregates and therefore co-operation is essential among all parties wishing to use the source. Scalping of material from the source must not be allowed and any operator using the pit should leave it in a clean and tidy condition.

The indiscriminate development of sources for small volumes must be discouraged, in order to avoid environmental problems, and in all cases restoration must follow close behind development.

4.5 Development

4.5.1. General

At the time of investigation, only one of the sources reported in Zone VI was developed, and that is 652, the kame deposit beside the highway. Further development of this source is not considered desirable because of the environmental problems of restoring a large sloping area underlaid by permafrost affected silt.

Probably sources 653 and 650 are under development now in connection with road construction. Source 654 has not been developed.

4.5.2. Access

Access to sources 650 and 653 will be good, when the Highway is constructed. Source 650 lies about $1\frac{1}{2}$ miles from the highway, and for all-weather use this length of road must be built.

Source 654 lies about 14 miles from the Highway, along a route that follows two seismic lines. Probably this source will be operated only during the winter, because of the length and expense of road construction necessary for summer use. The large-scale development of this source may depend on the location of another route for hauling to the north, perhaps over Cardinal and Tundra Lakes.

4.5.3. Material Use and Handling

Source 650 can be developed for any use, from concrete aggregate to

general fill. Source 653 will supply a good grade of sand that can be used in concrete, after washing. The other sources in Zone VI are useful for general fill.

All sources will require the same assembly of equipment, dozers with ripper attachments, front-end loaders, and trucks. Preparation of aggregate for concrete will also require a screening plant, and perhaps a crusher.

4.5.4. Stripping and Restoration

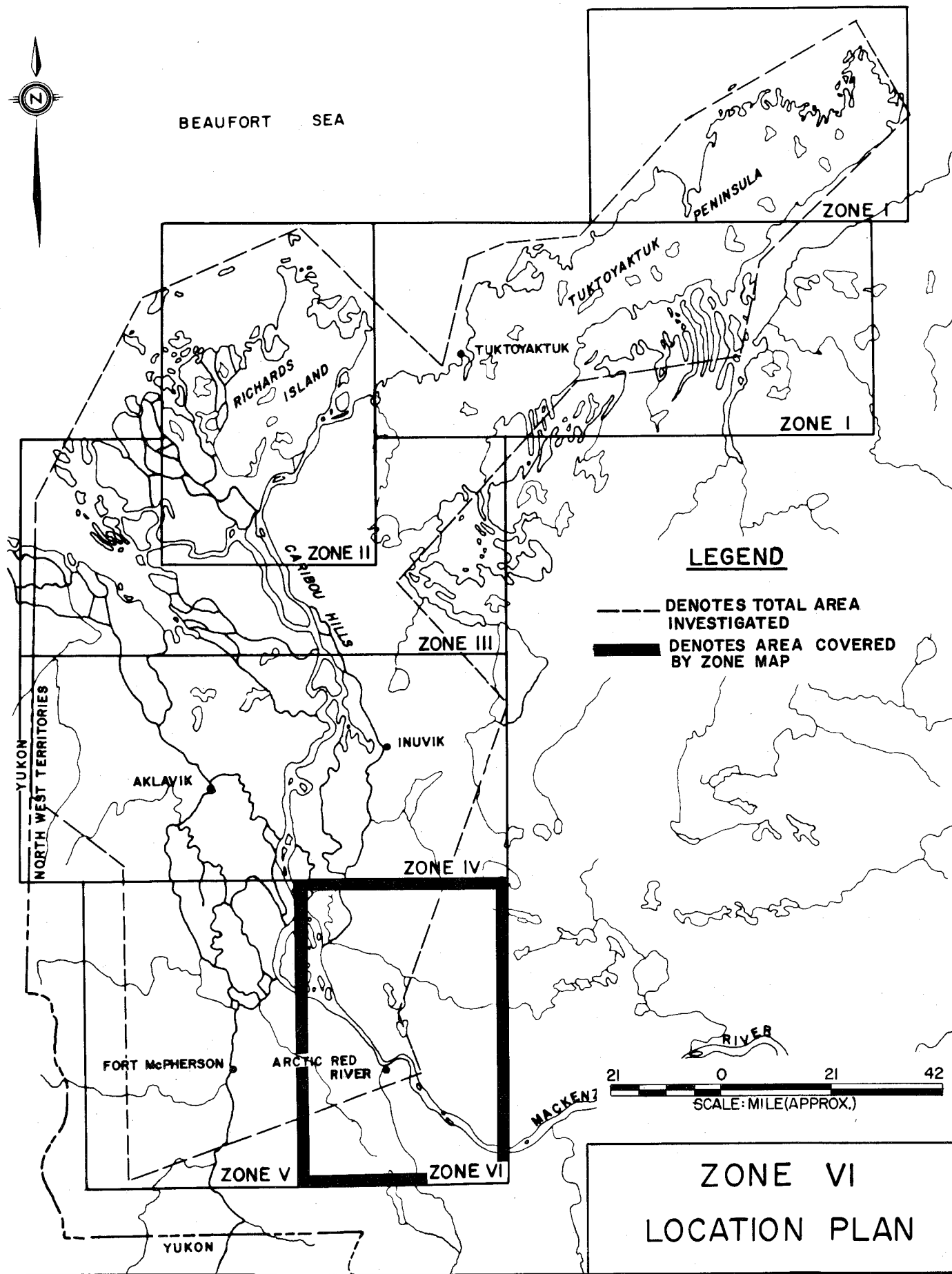
All sources of granular material in Zone VI will require the removal of trees and the stripping of organic cover. In all cases it is recommended that trees and heavy roots be burned, and that organic cover and surficial soils be stockpiled for later restoration of the source. Banks of pits or other excavations must be graded to a stable slope before restoration. More specific recommendations are provided in the discussion of each source, in this report.

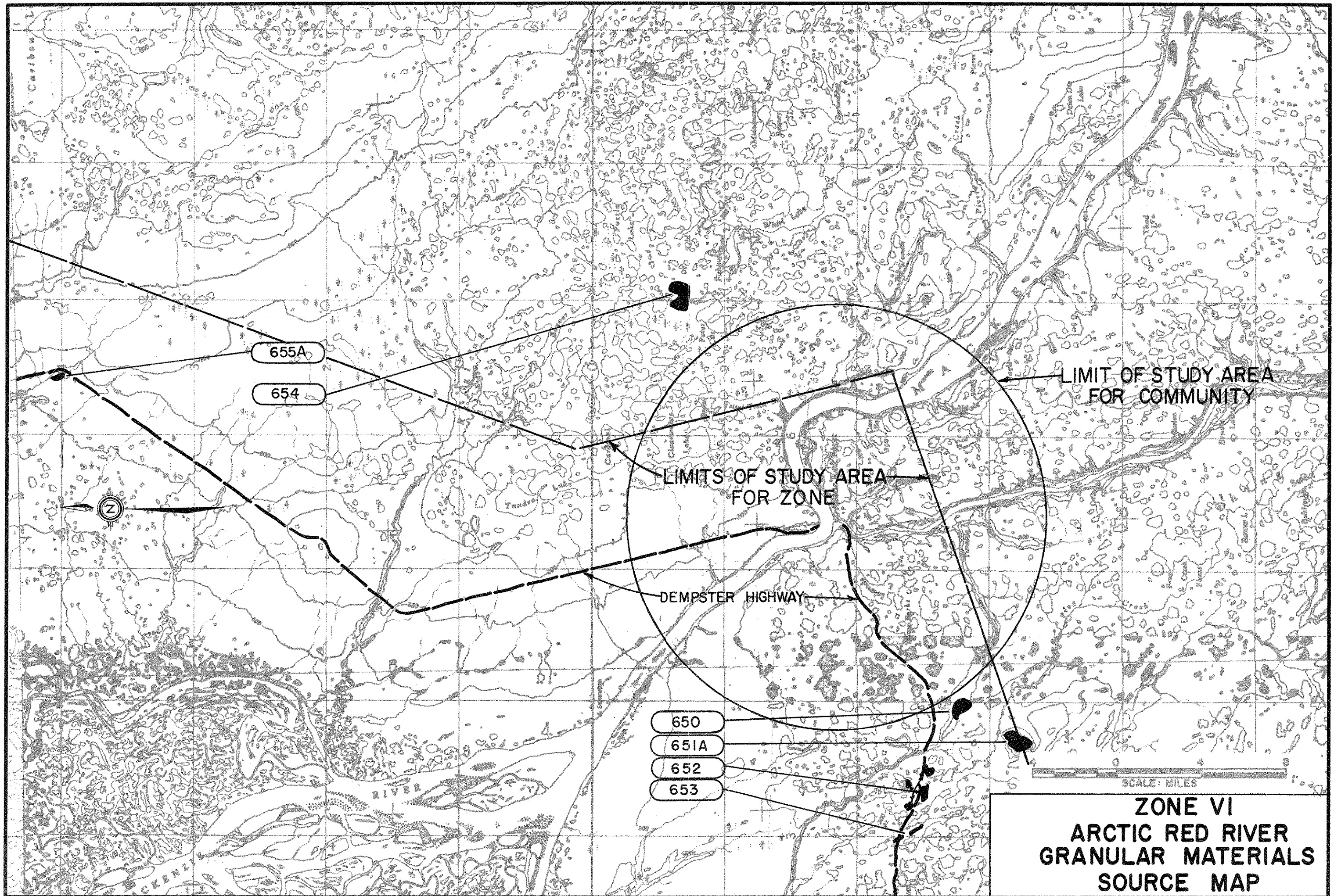
Source 650 is drained by a small river flowing north to Frog Creek, and drainage from the area may require clarification in a series of ponds before it is returned to the natural drainage system.

Detailed descriptions of vegetative cover to be employed in restoring disturbed areas are beyond the scope of this report, but can be provided by a botanist familiar with the Arctic region.



BEAUFORT SEA





SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
650	1½ south of Dempster Highway 13 from Arctic Red River	GRAVEL - and sand (GW) SAND - and gravel (SW)	2,500,000 at least	No major environmental concern	Suitable for development	Poor	Moss and Silt	0 to 3	Stockpile adjacent to pit for later re-grading into depleted area	Low	25	Rip, Stockpile, Thaw, Load into trucks Screen perhaps crush	General fill, fine and coarse aggregate	Dozer, Loader, Trucks, Screen and Crusher plant	Undeveloped
SEE SECTION 650 FOR SOURCE DETAILS															
651A	13 S.W. of Arctic Red River	SILT - and clay (ML)		No major environmental concern	Not suitable for development due to poor quality and high ice content	Good	Peat and Silt	1 to 3		High	Nil		None		Undeveloped
SEE SECTION 651A FOR SOURCE DETAILS															
652	Adjacent to Dempster Highway 16 miles west Arctic Red River	GRAVEL - and sand (GW)	200,000	No major environmental concern	Low priority for further development due to problem of restoration	Good	Topsoil and Silt	0 to 2	Stockpile adjacent to pit for immediate regrading into depleted area	Low	4	Rip, Stockpile, Thaw, Load into trucks	General fill, Fine and coarse aggregate	Dozer, Loader, Trucks, Screen and Crusher	Partially developed by Department of Public Works for Dempster Highway
SEE SECTION 652 FOR SOURCE DETAILS															
653	Adjacent to Dempster Highway 19 miles east Fort McPherson	SAND - some gravel (SW)	200,000	No major environmental concern	Suitable for continued development	Good	Topsoil and Silt	1 to 3	Stockpile adjacent to pit for later re-grading in depleted area	Low to Med.	20	Rip, Stockpile, Thaw, Load into trucks	General fill, Fine aggregate for concrete or asphalt	Dozer, Loader, perhaps wash plant	Partially developed by Department of Public Works for Dempster Highway
SEE SECTION 653 FOR SOURCE DETAILS															

[illegible]

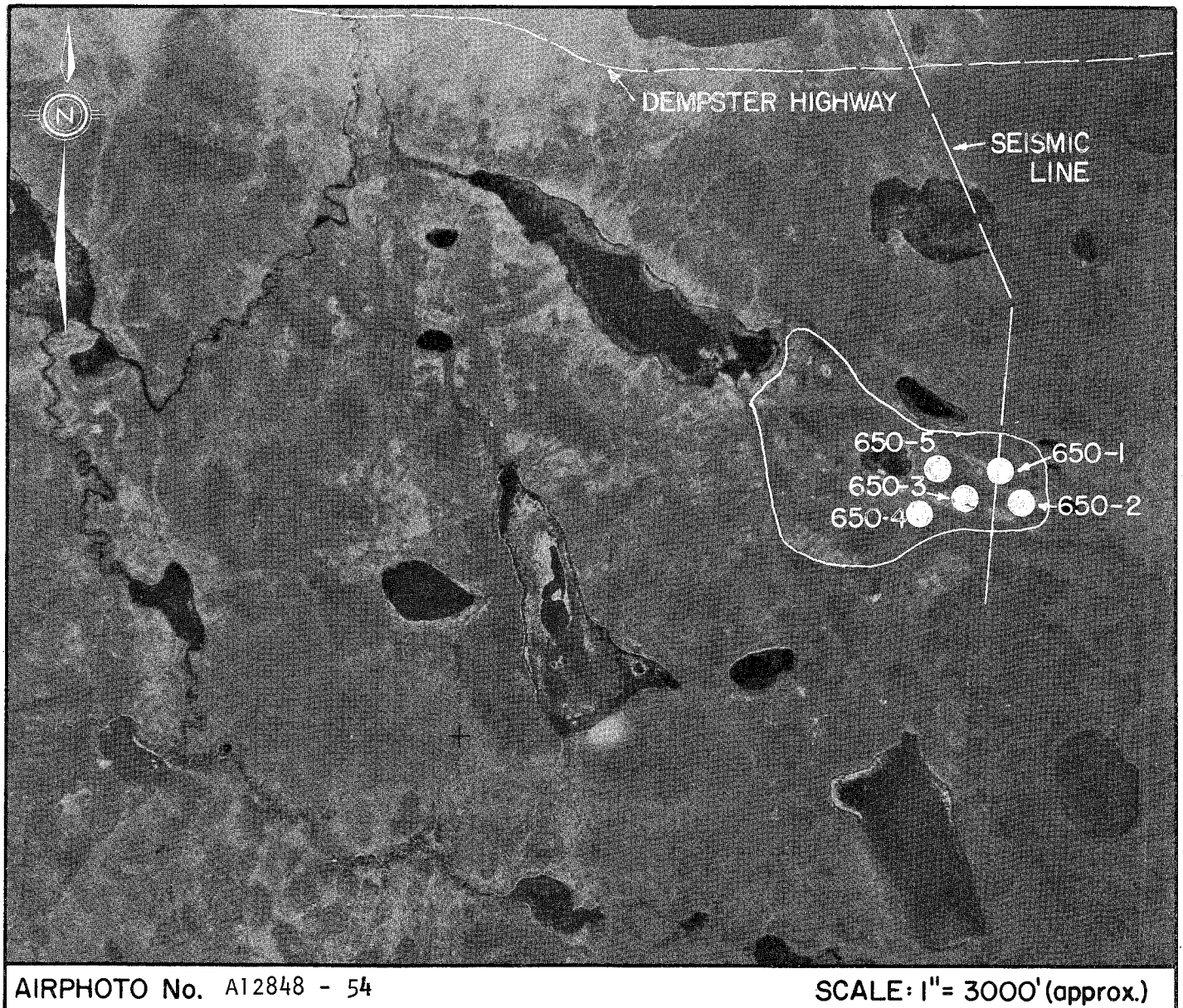
ZONE VI SOURCE No. 650

LANDFORM AND LOCATION: A glaciofluvial outwash plain located 27½ miles east of Fort McPherson along the Dempster Highway, and 13 miles from Arctic Red River.

MATERIAL: GRAVEL and sand

VOLUME: 2,500,000 cu. yds., at least

CONCLUSION: Because this source contains the best granular material that has been located in the area it is recommended that the source be reserved for controlled development. The first investigation indicates that this source is large enough to supply all the granular materials required in the nearby Communities and in the general area.



650 ENVIRONMENT

Physical

This source is located in a glaciofluvial outwash plain south of the Dempster Highway between the Communities of Fort McPherson and Arctic Red River. It is 4 miles north of Nevejo Lake.

The outwash plain covers a wide valley bottom and is approximately 5000 feet long and between 1000 and 2000 feet in width. It is adjacent to a small stream which flows in a northwesterly direction into a small lake which drains into Frog Creek. Several small lakes are present in the source area.

The topography of the source varies as much as 20 feet, and surface drainage into the small lakes and streams is good.

Biotic

Tree cover in the source consists of black spruce and upland spruce varying between 20 and 40 feet in height. Some low alder are also present in the area. An old burn covers about 10% of the source area. The canopy density is approximately 20%.

The source lies within the Peel River Game Reserve, and is in a large area known to be an important habitat of beaver. Productivity is low and the populations are easily disturbed by man. Harvesting in the past has resulted in decreased population, but the present population densities are probably between 0.5 and 1.0 beaver colonies per square mile.

Mink, lynx and marten are trapped in the surrounding areas during the winter months.

650 MATERIALS AND QUANTITIES

The source contains clean, well graded gravel and sand with a trace of silt. The maximum size of cobbles encountered in the deposit is 8 inches diameter.

The volume of material in this source is estimated to be more than 2,500,000 cubic yards, based on the test-hole information obtained during the winter drilling program. The approximate quantities of

coarse and fine aggregates in the area investigated are estimated at 1,000,000 and 1,500,000 cubic yards respectively. Additional drilling is required to obtain more qualitative information about the material in different parts of this large source, and to establish limits for development.

Petrographic analysis of two typical samples indicates that the material is primarily quartzite (62%) and chert (20%), with granite, limestone, ironstone, quartz, shalestone, and sandstone making up the remaining 18%.

Organic tests on selected samples indicate an average color code between 3 and 4. Loss on ignition tests on two typical samples gave an average value of 3.25%.

The potentially deleterious rocks are chert (18%), ironstone (2%), siliceous limestone (3%), and shalestone (2%). The conventional test for refractive index, however, indicates that the chert and limestone are not likely to be reactive. Pending further qualitative investigation, however, it is recommended that concrete produced with this aggregate should be made with cement containing less than 0.6% alkali.

650 DEVELOPMENT

General

This source has not been developed up to the present time. It is the only major source of granular materials between Fort McPherson and Arctic Red River. Sufficient granular materials are available for the needs of the Communities and for surfacing of the Dempster Highway. The source covers a large area and development must be strictly controlled to prevent wasteful use of the material.

Access

The source is located approximately $1\frac{1}{2}$ miles south of the Dempster Highway along a seismic line which passes through the source, and intersecting the Dempster Highway about 26 miles by road from the Community of Fort McPherson. The total distance by road from Fort McPherson to the source will be $27\frac{1}{2}$ miles, and the distance from

Arctic Red River will be 13 miles.

Year-round access to the intersection with the seismic line will be available along the Dempster Highway. For winter operation a winter road can be used along the seismic line. For summer operation, a road will have to be constructed along the seismic line, if in fact one has not already been built by the Department of Public Works.

Material Use and Handling

The materials in this source would be suitable for concrete, asphalt, and for base course aggregates as well as for general fill.

The materials can be processed into coarse and fine aggregate by screening, perhaps by crushing as well. Screening of the materials to produce coarse and fine aggregates is feasible for small quantities, however, an estimated 15 to 20 per cent of the material will be wasted. For large quantities, crushing will be more economical and substantially all of the gravel and sand can be used to produce coarse and fine aggregates.

The materials are frozen and the ice content is generally low. For processing, the materials will have to be ripped, bulldozed into piles and allowed to thaw and drain before screening or crushing begins. In addition to the screening and crushing plant, other equipment that will be required for the complete operation is conventional - bulldozers, loaders, and trucks.

Stripping and Restoration

All trees will have to be cut and disposed of by burning. The depth of stripping in the area investigated varies between 0 and 6 feet, and this surface material can be stored adjacent to that area of the source being developed. After depletion of the gravels, the stripped materials can be used to cover slopes and the bottom of the pit area.

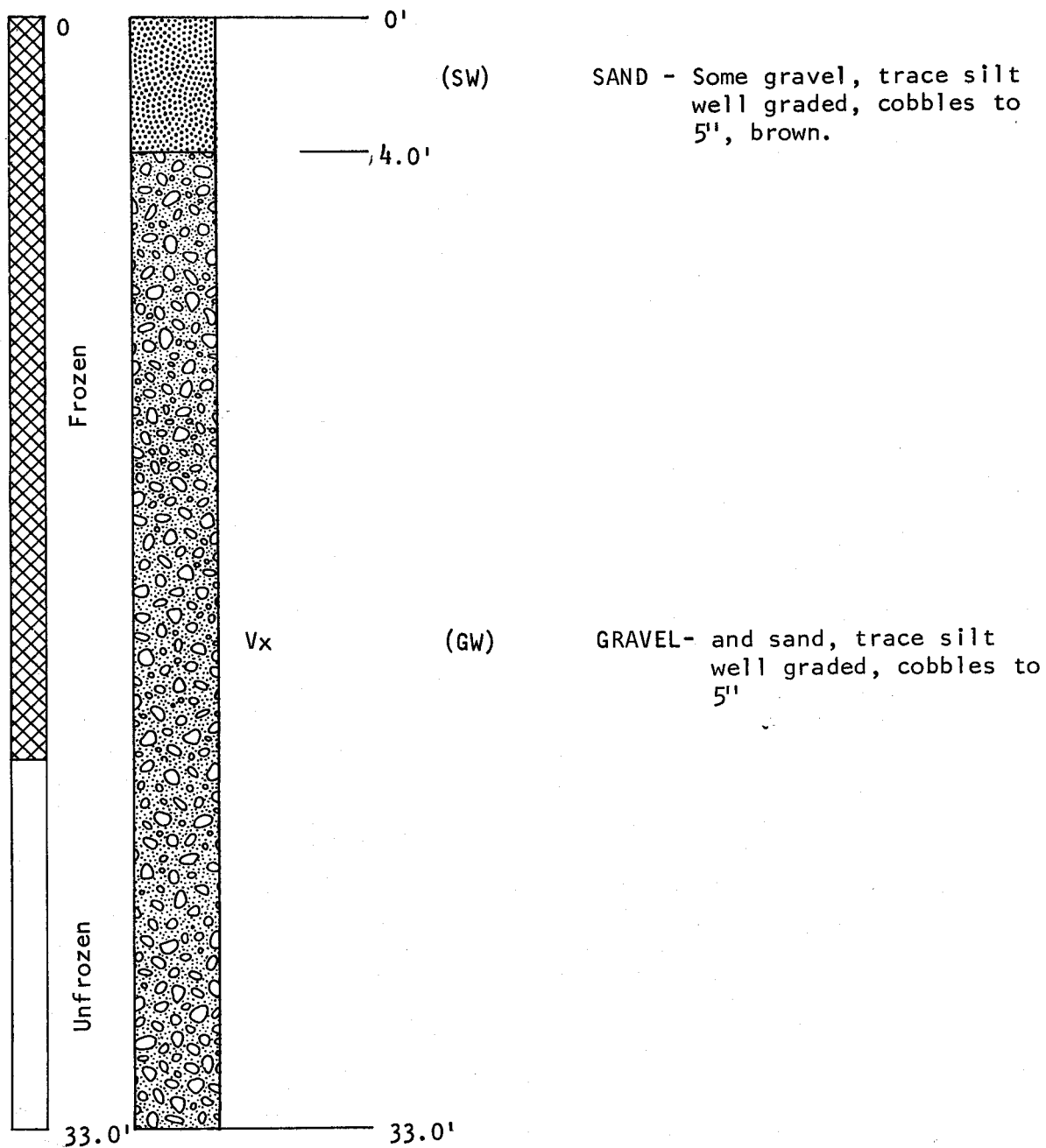
In early stages of development, water which accumulates in the pit can be drained by ditches to the natural drainage system passing through the source. When the pit becomes too low to permit natural drainage, the water will have to be pumped periodically from the pit area. In all cases the water may need to be clarified in ponds before it is introduced into the natural stream.

TEST HOLE LOGS

SOURCE No. 650

1
5

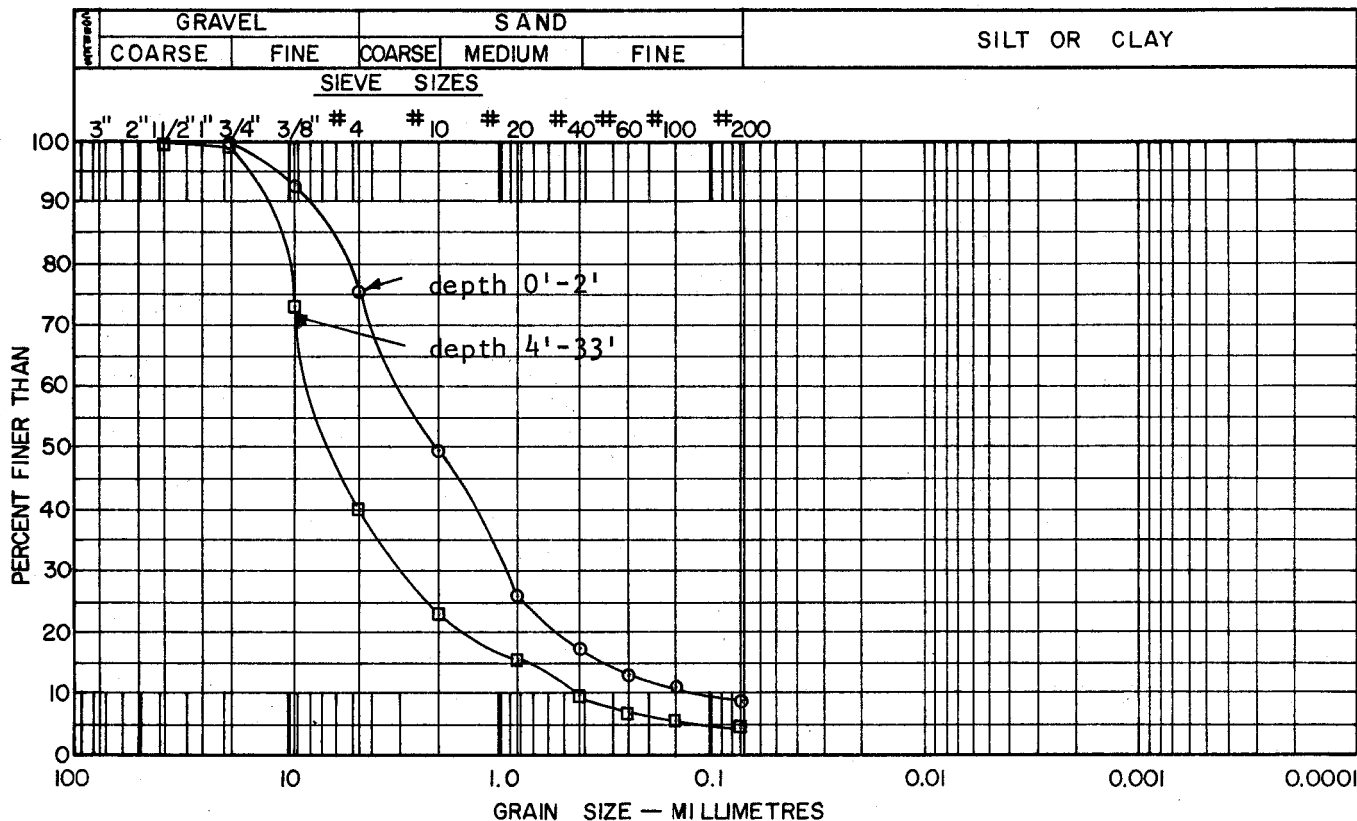
650-1



LABORATORY TEST DATA

TEST HOLE-SOURCE No. 650-1

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample 1	depth 0'-2'	7.7%	Sample 5	depth 12'-14'	10.9%
Sample 2	depth 4'-6'	4.8%	Sample 6	depth 18'	6.1%
Sample 3	depth 6'-7'	4.0%	Sample 7	depth 25'	8.6%
Sample 4	depth 8'-10'	4.8%	Sample 8	depth 32'-33'	3.1%

ORGANIC CONTENT

Loss of ignition test

Sample 2 to 8 depth 4'-33' - 3.67%

Color test - sample 2 to 8 depth 4'-33' - Rdg 3

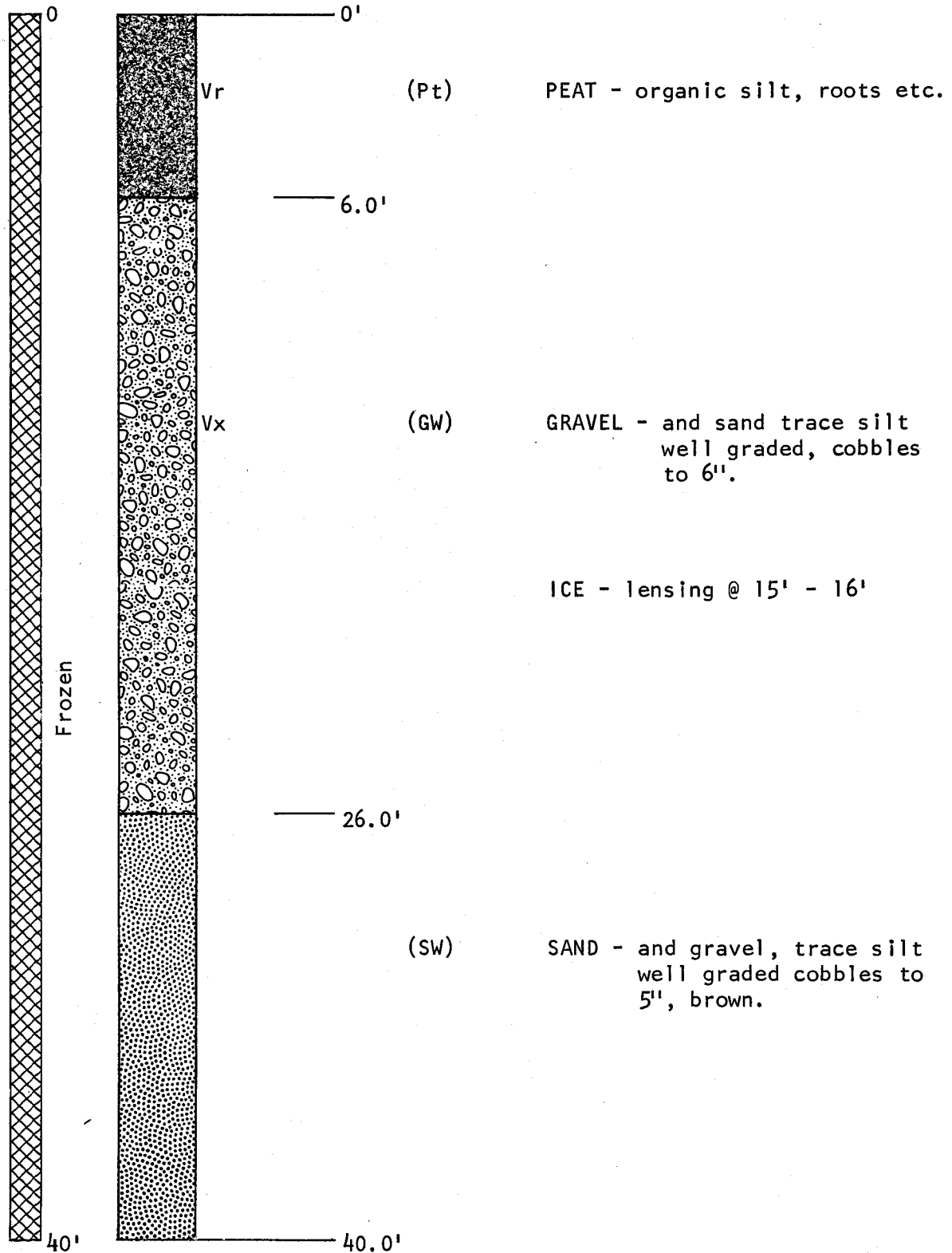
PETROGRAPHIC ANALYSIS

Quartzite	- 59%
Granitic	- 7%
Limestone	- 3%
Cherts	- 18%
Quartz	- 5%
Ironstone	- 2%
Porous Sandstone	- 4%
Shalestone	- 2%
Total	100%

TEST HOLE LOGS

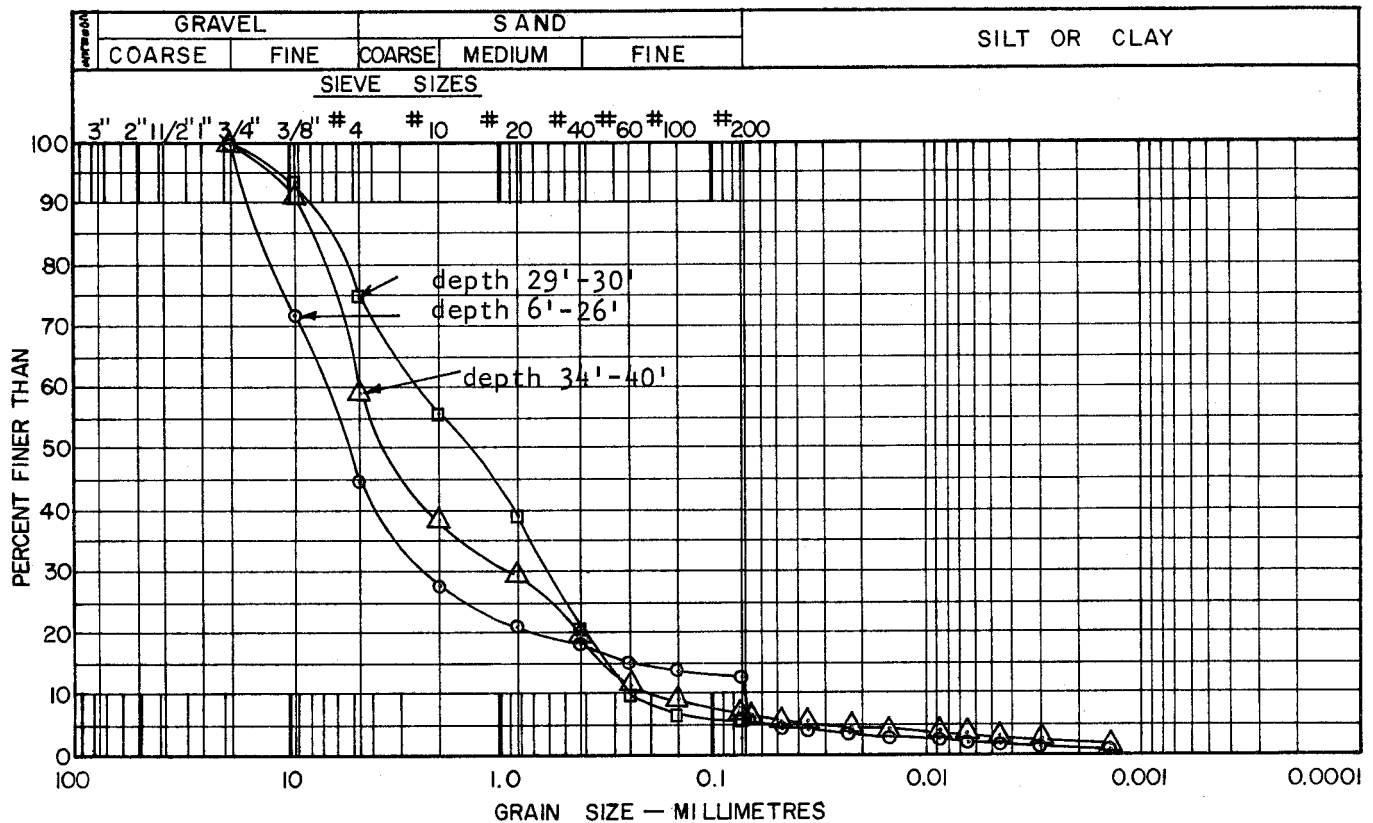
SOURCE No. 650

650-2



LABORATORY TEST DATA TEST HOLE-SOURCE No. 650-2

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample 1	depth 3'-4'	*130.8%
Sample 2	depth 6'-8'	9.0%
Sample 3	depth 8'-10'	11.9%
Sample 4	depth 10'-12'	8.9%
Sample 5	depth 12'-14'	9.2%

Sample 6	depth 19'-20'	6.4%
Sample 7	depth 24'-26'	5.5%
Sample 8	depth 29'-30'	12.3%
Sample 9	depth 34'-35'	10.1%
Sample 10	depth 39'-40'	9.6%

*Bag leaked

ORGANIC CONTENT

Color Test

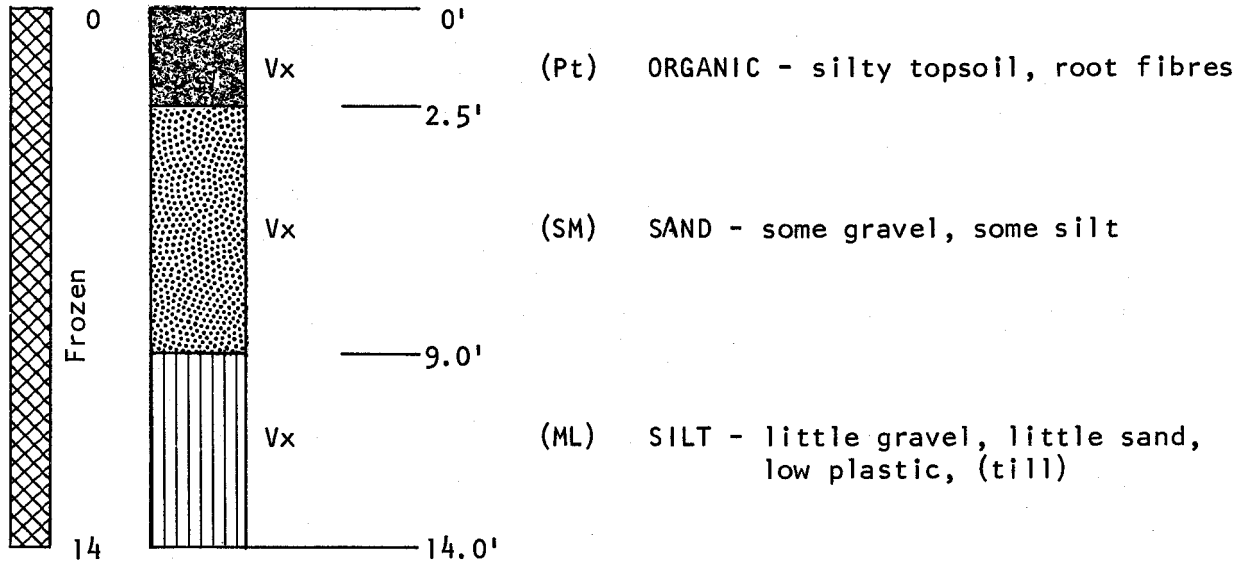
Sample 2 to 7 Depth 6'-26' - Rdg. 4 & 5

PETROGRAPHIC ANALYSIS

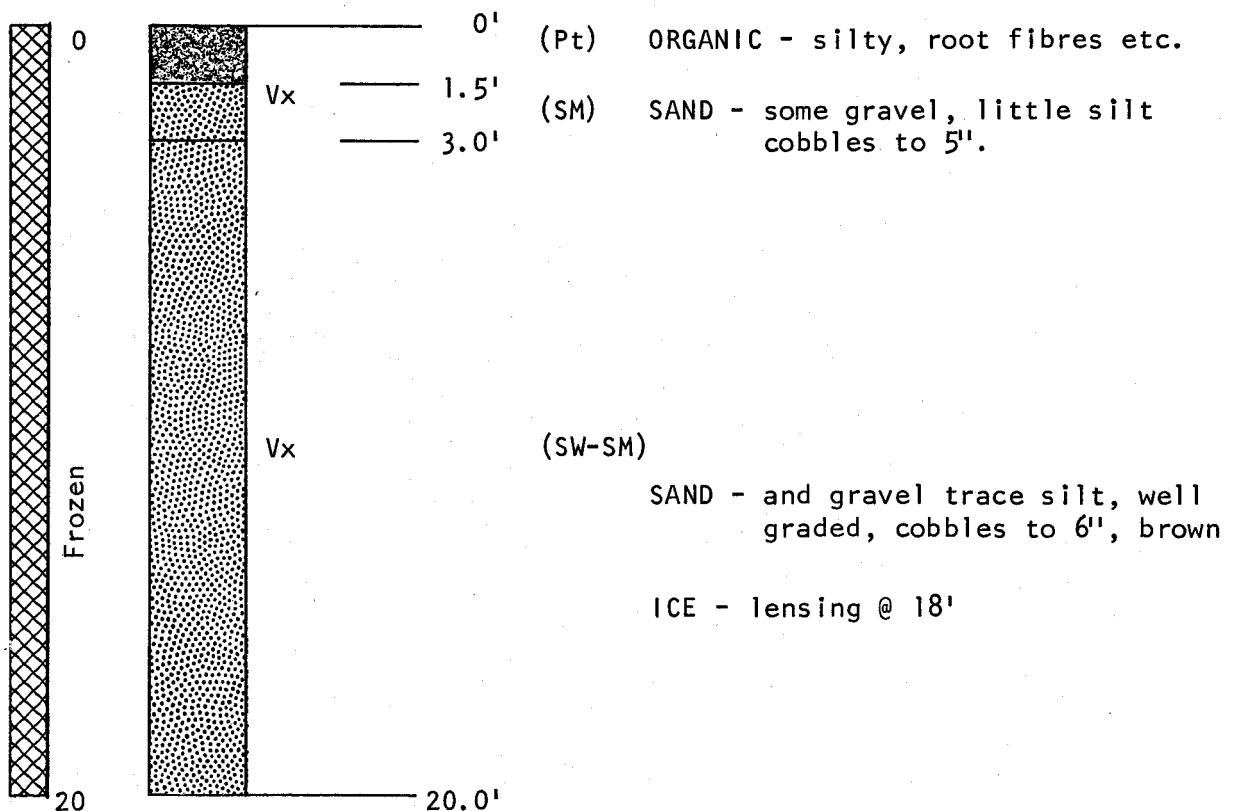
TEST HOLE LOGS

SOURCE No. 650

650-3



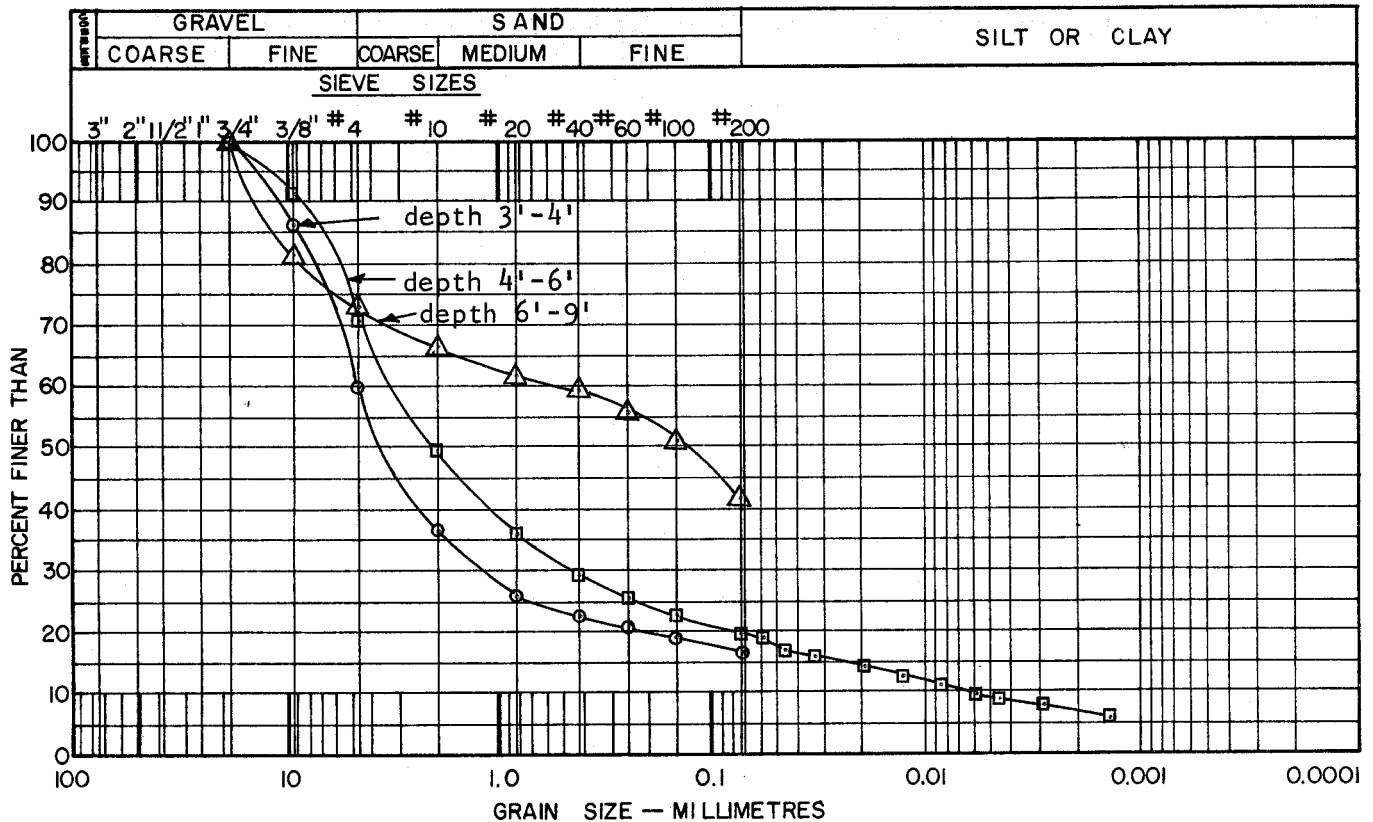
650-4



LABORATORY TEST DATA

TEST HOLE-SOURCE No. 650-3

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample 1	depth 3'-4'	21.2%
Sample 2	depth 4'-6'	25.1%
Sample 3	depth 6'-8'	17.0%
Sample 4	depth 8'-9'	16.4%

Sample 5	depth 9'-10'	18.4%
Sample 6	depth 10'-12'	14.0%
Sample 7	depth 12'-14'	15.1%

ORGANIC CONTENT

Color Test

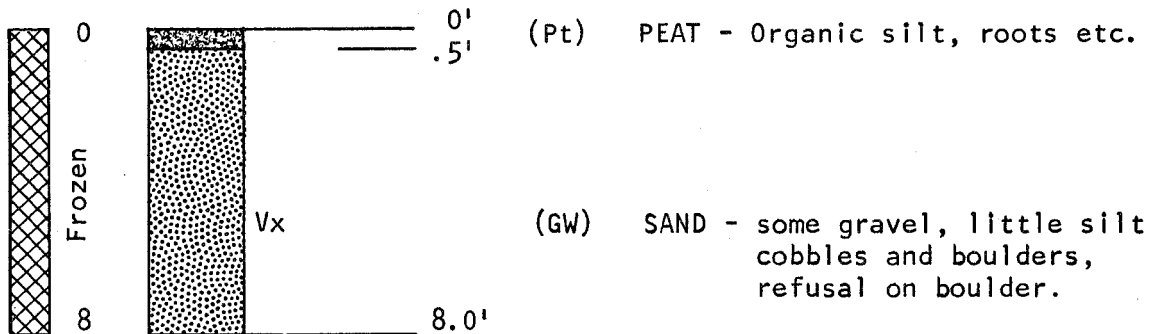
Sample 3 depth 4'-6' - Rdg 3 to 4

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. 650

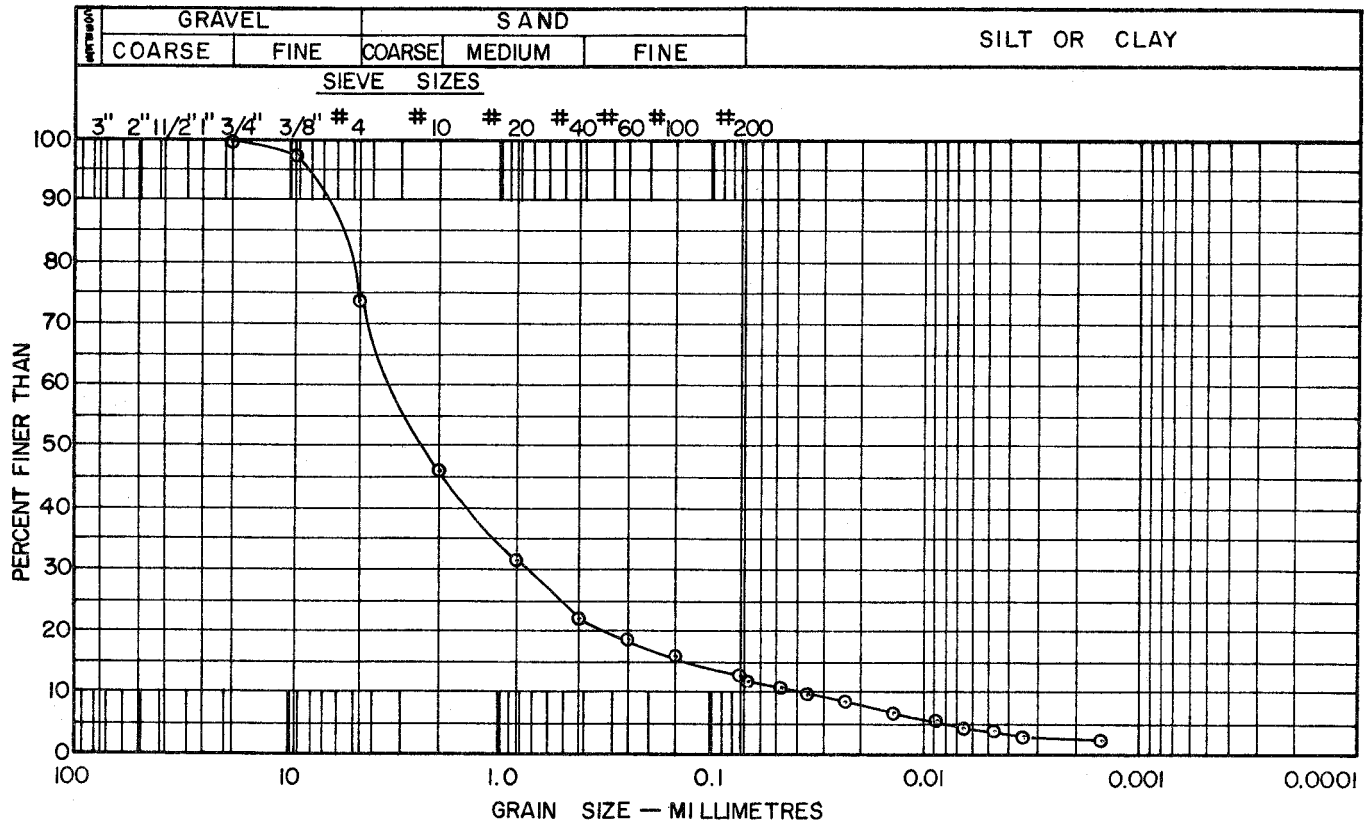
650-5



LABORATORY TEST DATA

TEST HOLE-SOURCE No.650-5

GRAIN SIZE DISTRIBUTION



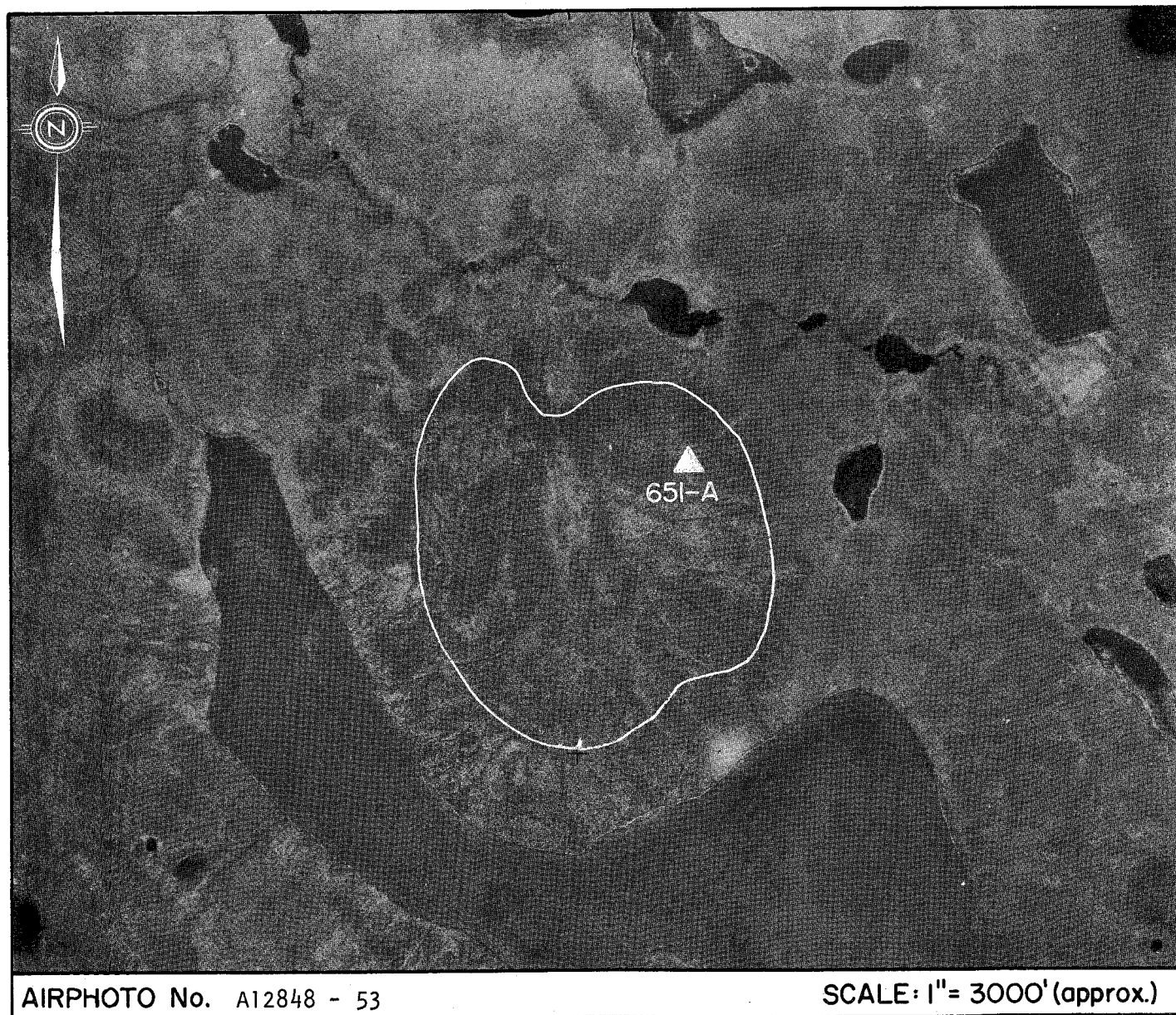
ZONE VI
SOURCE No. 651A

LANDFORM AND LOCATION: Conical hill 200 feet above adjacent topography
located about 13 miles southwest of Arctic Red
River.

MATERIAL: SILT - and clay

VOLUME: ---

CONCLUSION: Source is unsuitable for development due to high
silt-clay and ice content



AIRPHOTO No. A12848 - 53

SCALE: 1" = 3000' (approx.)

651A ENVIRONMENT

Physical

This source is a large conical hill rising more than 200 feet above the rolling terrain of the Peel Plain. It lies adjacent to the north end of Navejo Lake, 13 miles southwest of the Community of Arctic Red River. Surface drainage is good because of the topography but ground ice was found only 1 to 2 feet deep in September.

Biotic

The area is heavily treed. The lower slopes are covered by a stand of white spruce, pine and white birch 20 to 40 feet high with a canopy density of about 50%. The upper slopes are less densely covered by black spruce up to 40 feet high with a canopy density of less than 20% grading into a transition zone of sphagnum bogs.

The source is located in the Peel River Game Reserve, in an area containing a considerable number of beaver, now estimated at 0.5 to 1 colony per square mile. The area also supports marten, lynx, and mink.

Navejo Lake is a domestic fishery, used mostly in the winter as a source of fish for dog-food, as well as for human consumption.

651A MATERIALS AND QUANTITIES

The material in this source is primarily silt and clay, with very little sand and gravel. Ice content is high, right to the under side of the insulating ground cover.

651A DEVELOPMENT

General

None of the material in this source is suitable for construction. Even after thawing and draining, if in fact draining is possible, the material would not form a suitable fill.

The source is not recommended for development.

Access

At this time the only feasible access is by winter road from source 650, following an existing seismic line for a distance of 3 miles. Source

650, in turn, is 1½ miles from the Dempster Highway and 13 miles from Arctic Red River.

Materials and Handling

This material is not suitable as a construction material.

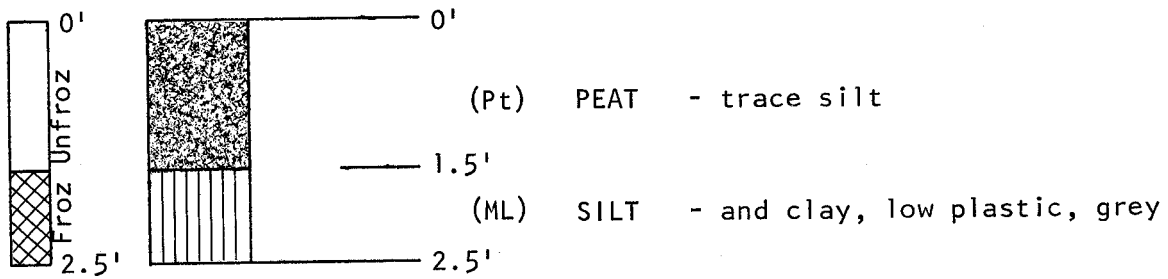
Stripping and Restoration

If the source were developed, it would present a severe environmental problem in terms of sloughing and surface instability. It is recommended that the existing effective insulating cover be left undisturbed.

TEST PIT LOGS

SOURCE No. 651A

651A-A



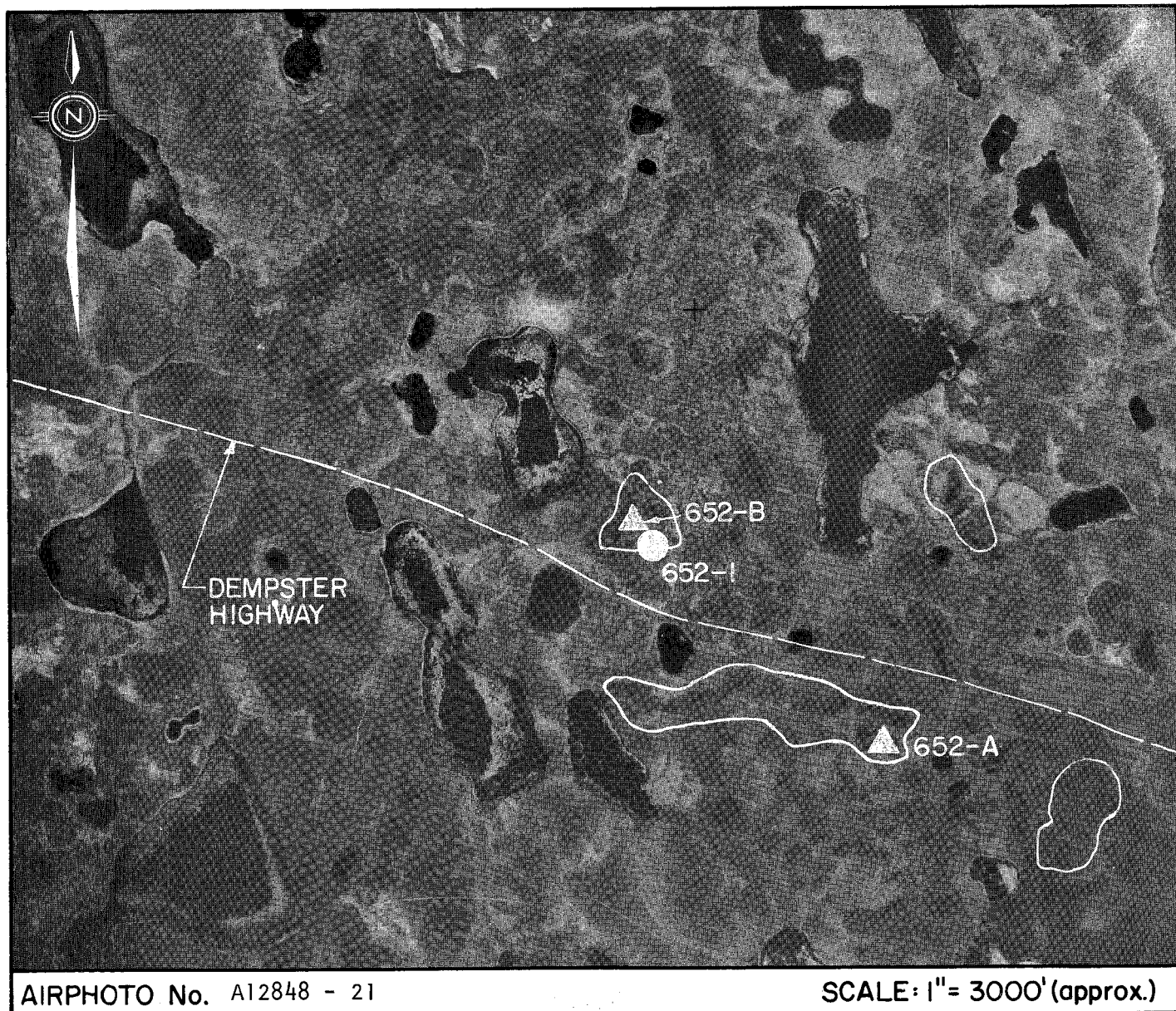
ZONE VI
SOURCE No. 652

LANDFORM AND LOCATION: Four large kames adjacent to the Dempster Highway approximately 16 miles west of Arctic Red River

MATERIAL: SAND - and gravel

VOLUME: 200,000 cu. yds.

CONCLUSION: Source should be low priority for further development due to shallow depth of material available and the problems of restoration.



652 ENVIRONMENT

Physical

This source is a field of four large kame knolls located in the rolling terrain of the Peel Plain, 13 miles by air west of Arctic Red River. The kames are 100 to 150 feet high. The Dempster Highway passes through the field, and in fact a considerable volume of granular material has been borrowed from pits on the sides of two kames. The pits are shallow, and the exposed high ice content silt deposit beneath is sloughing badly.

Drainage of the kames is good, although the drainage of the surrounding area is very poor. A number of thermokarst lakes are located in and around the source area.

Biotic

The forest cover on the kames consists of black spruce about 30 feet high and with a canopy density of about 30%, transitional to black spruce and sphagnum bogs in the surrounding area.

The source is located within the Peel River Game Reserve, and supports a substantial population of beaver, about 0.5 to 1 colony per square mile, as well as some lynx, marten, and mink. The immediate area is not an important wildlife habitat.

Some of the larger lakes in the vicinity are used for fishing during the winter.

652 MATERIALS AND QUANTITIES

The material near the surface of these kames is well-graded gravel and sand, containing about 55% gravel, 35% sand, and 10% fines passing 200 mesh. The deposit is shallow, generally less than 4 feet in depth, and overlies a deposit of silt and some sand. The moisture content of the surface material is low (about 5%), whereas the moisture content of the silt beneath runs up to 25%.

Petrographic analyses of the gravel from the two test pits show the main constituents to be quartzite (21 to 45%), hard limestone (17 to 42%), and granite 6 to 21%). Chert is variable ranging from 1 to 18%.

The remainder is made up of quartz, ironstone, soft limestone, soft sandstone and siltstone. The deleterious materials are ironstone (2 to 5%), soft limestone (2 to 7%), soft sandstone (2 to 3%) and soft siltstone (1%) for an average of 11%.

The chert contained in this material is not likely to be reactive, but pending further qualitative analysis it is recommended that concrete made with this aggregate should contain cement with less than 0.6% alkali.

The estimated volume of the remaining sand and gravel deposit is 200,000 cubic yards.

652 DEVELOPMENT

General

The development of this source by the Department of Public Works demonstrates the problems associated with a shallow gravel deposit overlying frozen silt, especially on a slope. The area disturbed is large for a given volume removed, and restoration is difficult.

Therefore further development of this source area should be very low priority.

Access

The Dempster Highway provides excellent all weather access to this source area. At most, an access road $\frac{1}{2}$ mile long would be required to reach all the kames in the area. The source is 16 miles from Arctic Red River, and 20 miles from Fort McPherson.

Materials and Handling

The material near the surface of this source is suitable for concrete aggregate, asphalt aggregate, or general fill. The maximum size of gravel is 6 inches, so the most efficient development of the source for aggregate would require the installation of a crushing and screening plant. For small scale development a simpler process of screening and washing would be adequate.

The underlying silt is not considered suitable for construction fill.

The equipment required for the development of this source is the usual assembly of dozer, front-end loader, and trucks. Production of aggregates would require a screening plant, possibly with a crusher.

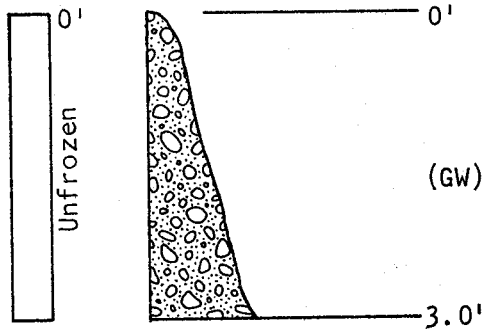
Stripping and Restoration

The further development of this source will call for the removal and burning of all trees and roots. The surface organic layer would then be stripped and stockpiled for replacement. Restoration by grading with stripped material should follow close behind depletion of a pit area, to minimize thawing of the silt beneath. The area should then be revegetated, using a selection of ground cover and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS

SOURCE No. 652

652-A

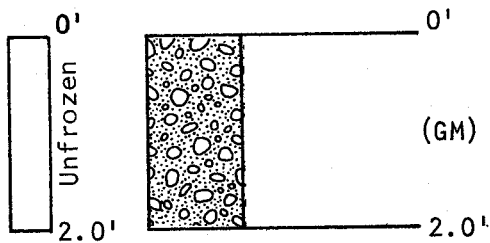


(GW)

GRAVEL - and sand, trace silt, well graded rounded to subrounded, max. 3"

Soil profile as logged from pit wall

652-B



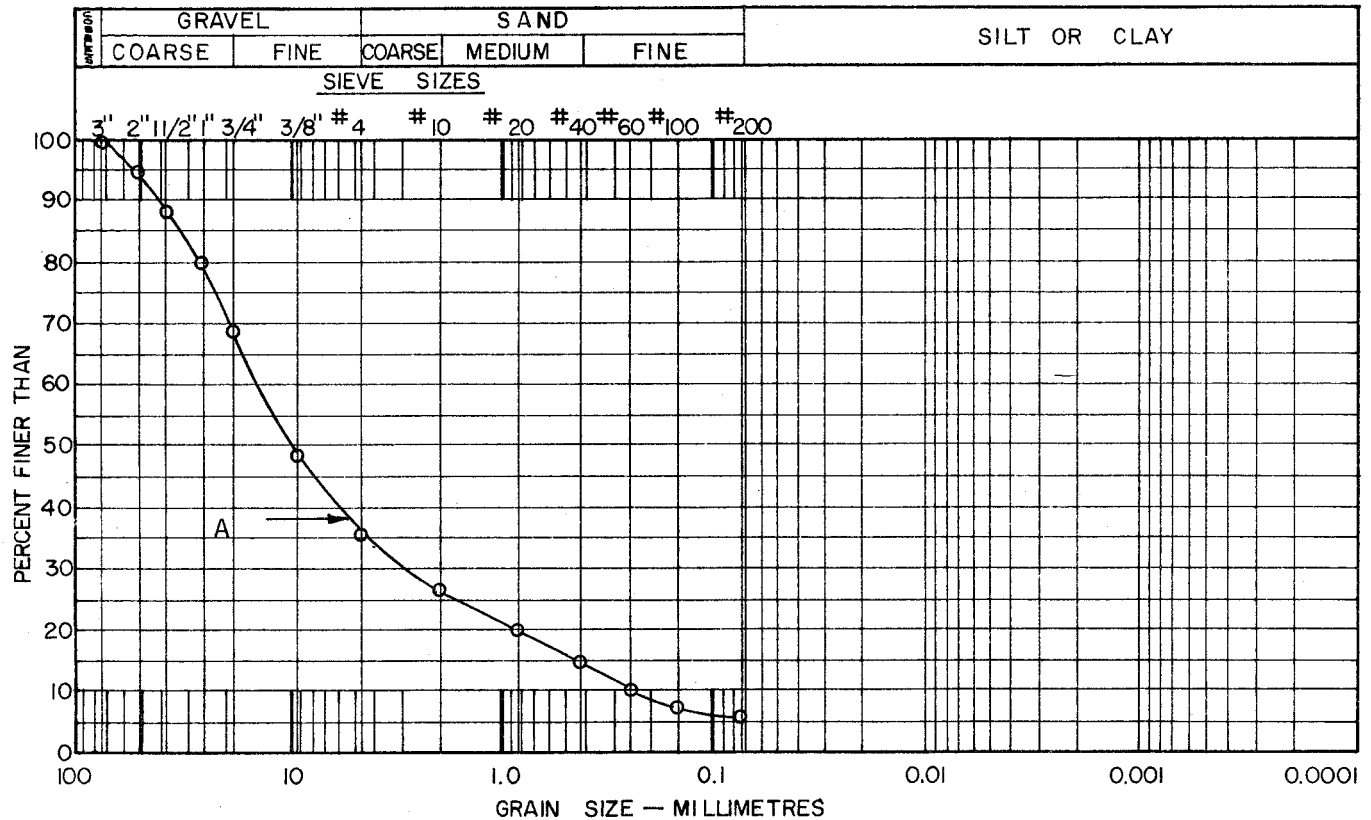
(GM)

GRAVEL - and sand, little silt, well graded rounded to subrounded, max. 3"

LABORATORY TEST DATA

TEST PIT-SOURCE No. 652

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A (Pit Face) M/C = 2.2%

ORGANIC CONTENT

HARDNESS TEST

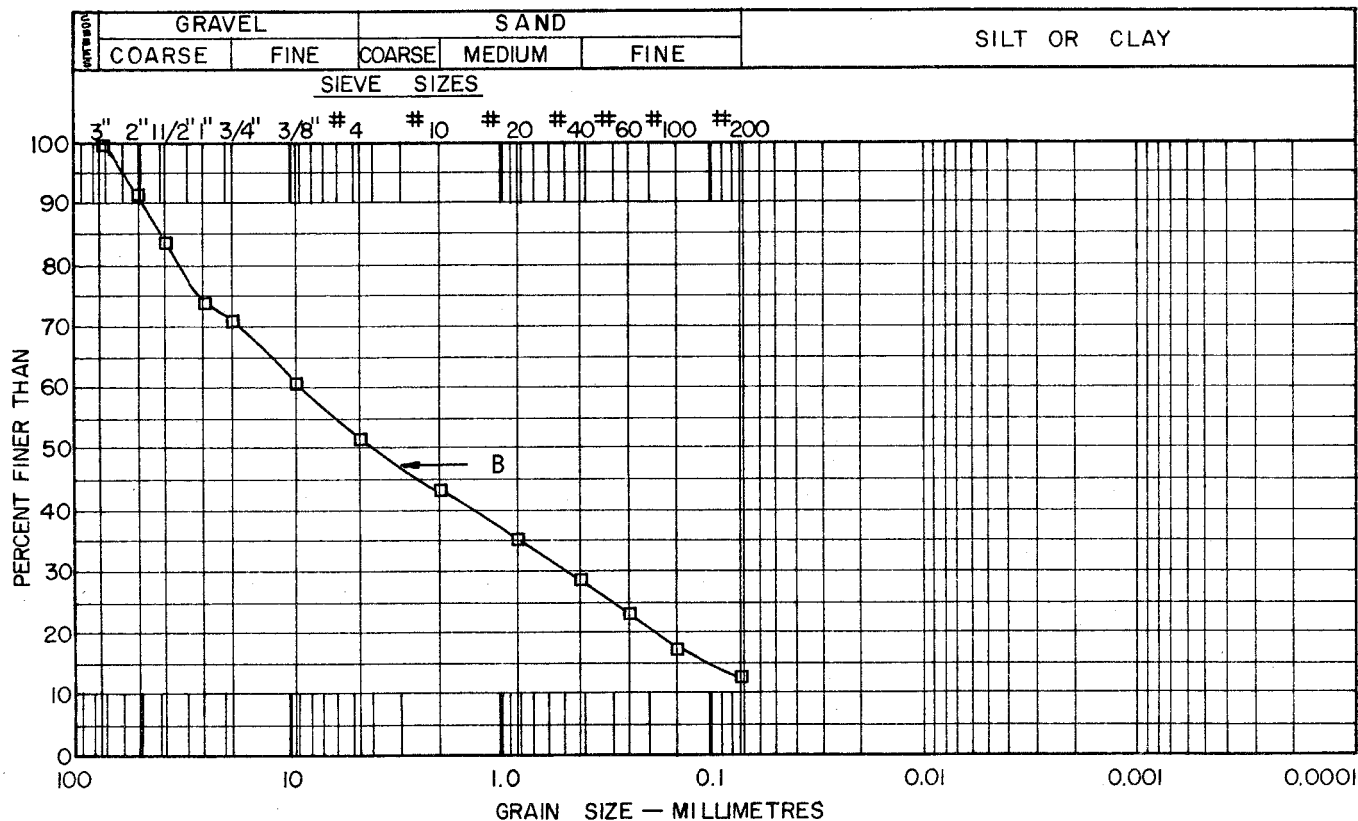
PETROGRAPHIC ANALYSIS

Quartzite	-45%	Quartz	- 2%
Chert	-18%	Limestone, soft	- 2%
Limestone, hard	-17%	Sandstone, soft	- 3%
Granite	- 6%	Siltstone, hard	- 1%
Ironstone	- 5%	Siltstone, soft	- 1%
		Total	100%

LABORATORY TEST DATA

TEST PIT-SOURCE No. 652

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

B (0.0' - 2.0') M/C = 4.8%

ORGANIC CONTENT

HARDNESS TEST

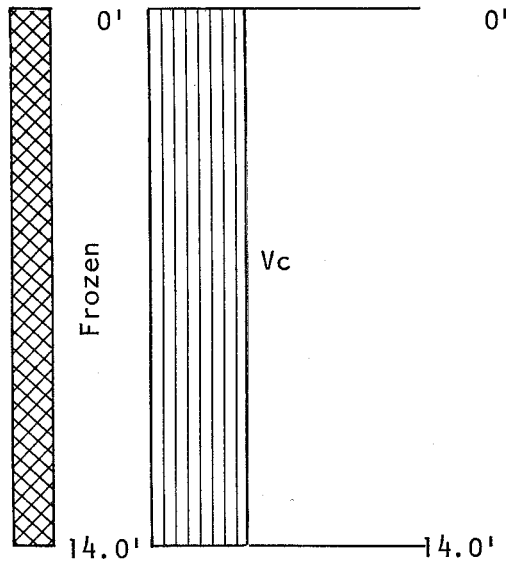
PETROGRAPHIC ANALYSIS

Quartzite	-21%	Sandstone, soft	- 2%
Limestone, hard	-42%	Ironstone	- 2%
Granite	-21%	Siltstone & Shale	- 1%
Limestone, soft	- 7%	Chert	- 1%
Quartz	- 3%		
		Total	100%

TEST HOLE LOGS

SOURCE No. 652

652 - 1



(ML)

SILT - trace fine sand. Low plastic, brownish grey, ice crystals and coatings

Moisture Content

Sample 1 depth 2' 25.7%

Sample 2 depth 12' 21.7%

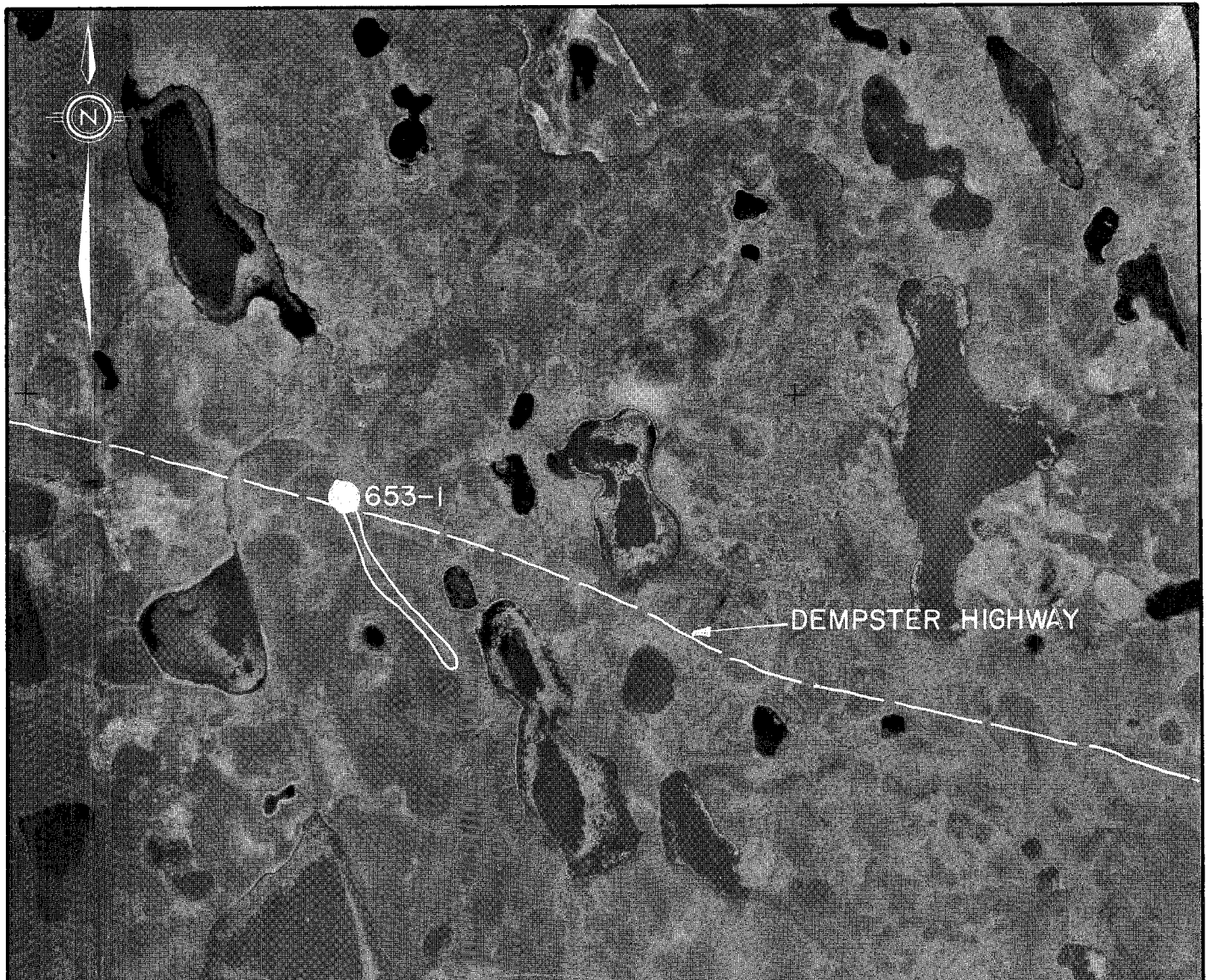
ZONE VI
SOURCE No. 653

LANDFORM AND LOCATION: Small discontinuous esker ridge about 7,000 feet long, located adjacent to Dempster Highway approximately 19 miles from Fort McPherson

MATERIAL: SAND - some gravel, trace silt

VOLUME: 200,000 cu. yds.

CONCLUSION: Source is suitable for continued use as general fill and may be used for fine aggregate for concrete and asphalt



AIRPHOTO No. A12848 - 21

SCALE: 1" = 3000' (approx.)

653 ENVIRONMENT

Physical

The source is a small discontinuous esker ridge lying across the Dempster Highway about 17 miles by road (15 to 16 miles by air) west of Arctic Red River. The esker is about 7,000 feet long and rises to a height of 20 to 40 feet above the rolling plain. Drainage is good. The Dempster Highway, in passing through this esker, will undoubtedly lead to some development during the current year.

Biotic

Forest cover along the esker is primarily black spruce, in transition to sphagnum bogs. The trees are about 30 feet high, with a canopy density less than 20%.

The source is located in the Peel River Game Reserve, in an area containing a considerable number of beaver, now estimated at 0.5 to 1 colony per square mile. The area also supports marten, lynx and mink. In general, an esker of this type offers good burrowing for wildlife that build their dens beneath the surface of the ground, so a concentration of this class of wildlife can be expected.

653 MATERIALS AND QUANTITIES

The material is largely sand (75%), with some gravel (17%) and a trace of silt (8%). The surface cover is an organic soil about 1½ feet thick. The sand contains isolated ice lenses, and generally a coating on the particles. The moisture content of the top 6 to 8 feet of sand, as measured in winter, indicated that this zone is likely to thaw during the summer, whereas the deeper sand is in permafrost.

The estimated volume of material is about 200,000 cubic yards, assuming that the esker is removed completely.

653 DEVELOPMENT

General

This source will undoubtedly be developed for general fill during construction of the Highway. Later on, it will probably be valuable to

the nearby Communities as a source of relatively clean sand.

Access

All-weather access to this source is excellent, located as it is across the Highway. The distance to Arctic Red River is 17 miles, and to Fort McPherson is 19 miles.

Material Use and Handling

This material is relatively clean sand, suitable for general fill as it is, or for concrete, with a simple washing process.

The development of this source will require clearing and stripping of the trees and topsoil, then probably 8 feet of sand could be removed by dozer blade. Below that depth the sand will require ripping, stockpiling, thawing, and draining. It is recommended that the full depth be removed in an operation, in order to concentrate the work and minimize the area disturbed.

The equipment required to develop this source is a dozer with ripper attachment, a front-end loader, and trucks. Later, if necessary, a washing plant can be installed, drawing on a nearby lake for water to re-circulate through a series of clarification ponds.

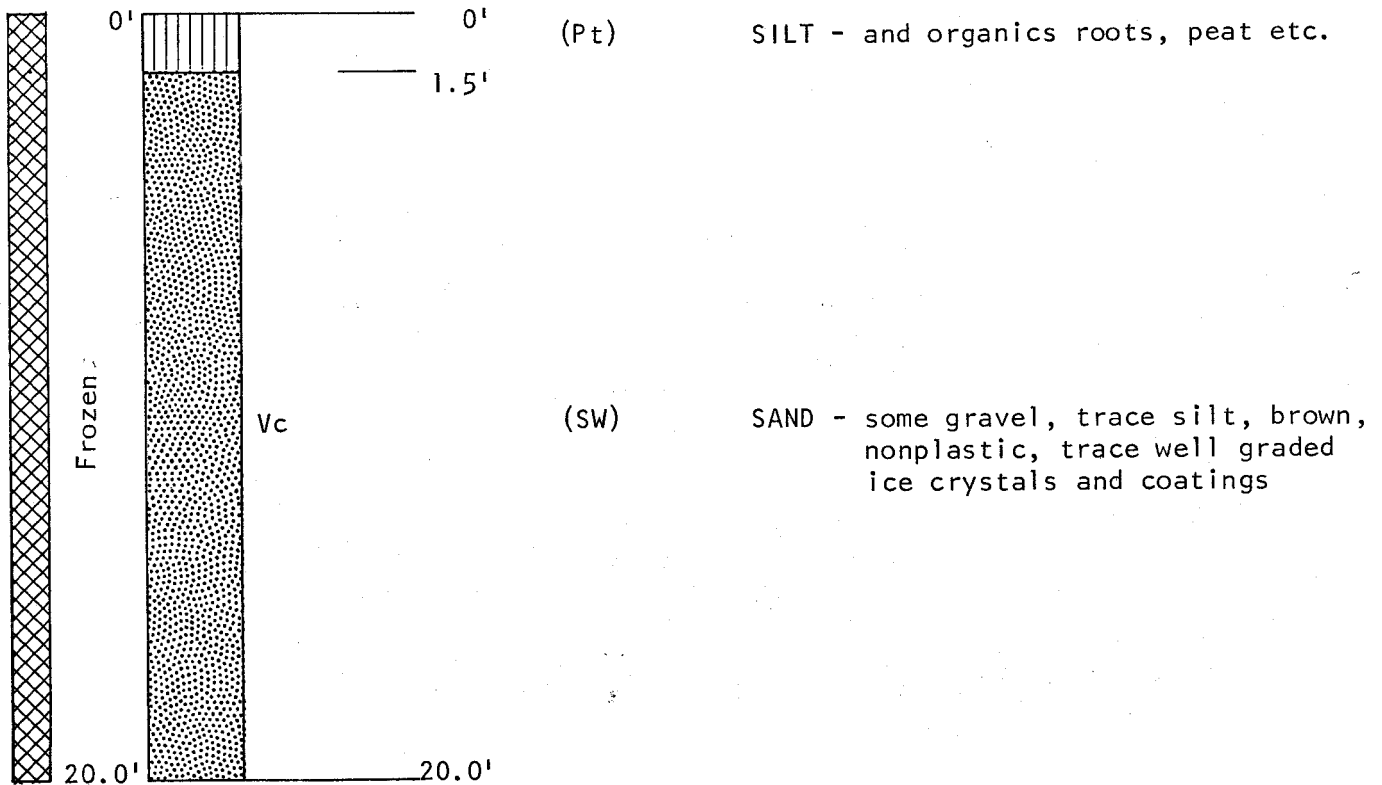
Stripping and Restoration

All trees and roots will have to be removed and burned. The topsoil must then be stripped and stockpiled for replacement after the sand has been removed. Some kind of vegetative cover should be re-established as soon as possible, in order to minimize the disturbance to the underlying permafrost zone.

TEST HOLE LOGS

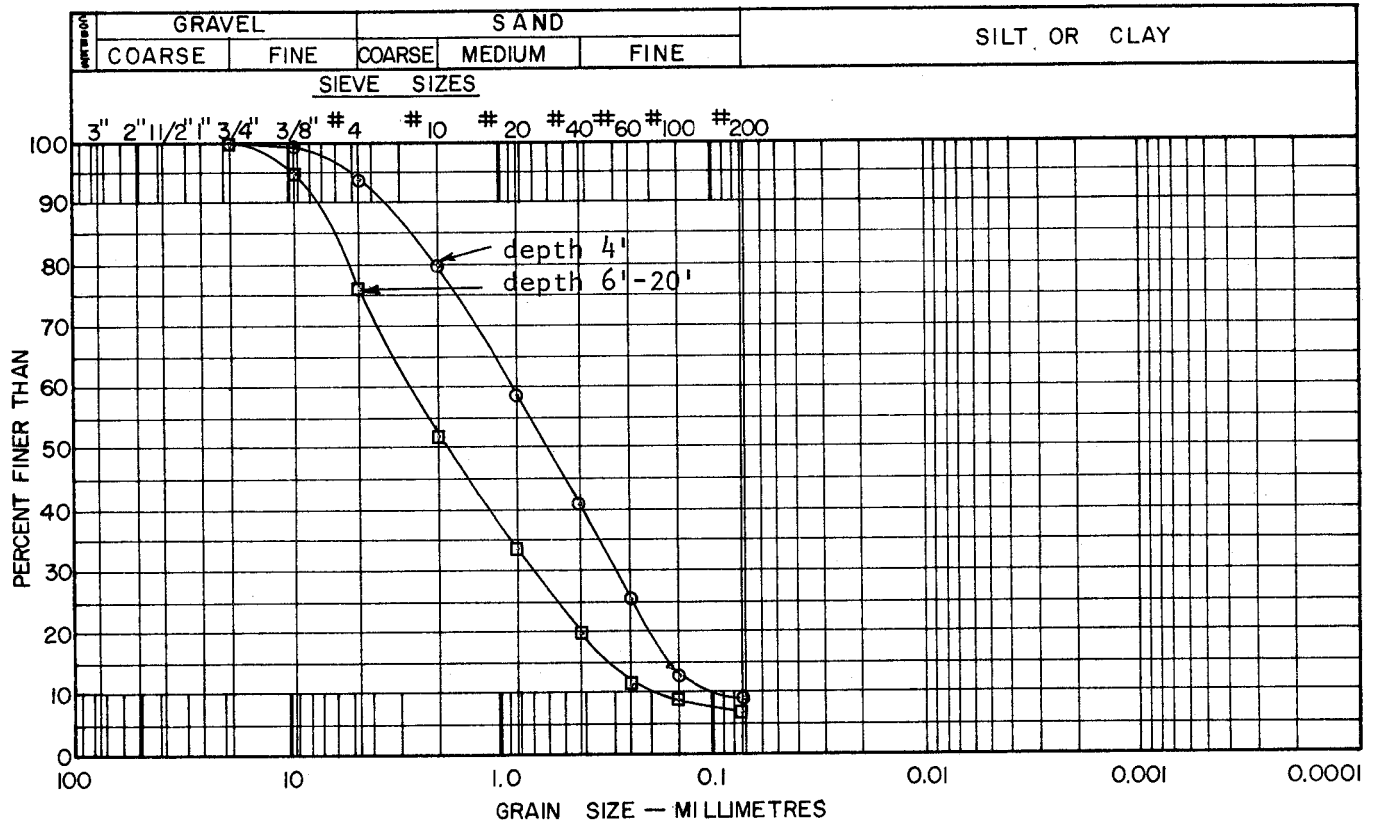
SOURCE No. 653

653 - 1



LABORATORY TEST DATA TEST HOLE-SOURCE No.653-1

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample 1 depth 2'-4' 5.8%
 Sample 2 depth 6'-8' 7.0%
 Sample 3 depth 8'-10' 10.2%
 Sample 4 depth 10'-12' 11.7%
 Sample 5 depth 14' 10.8%

Sample 6 depth 20' 8.1%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

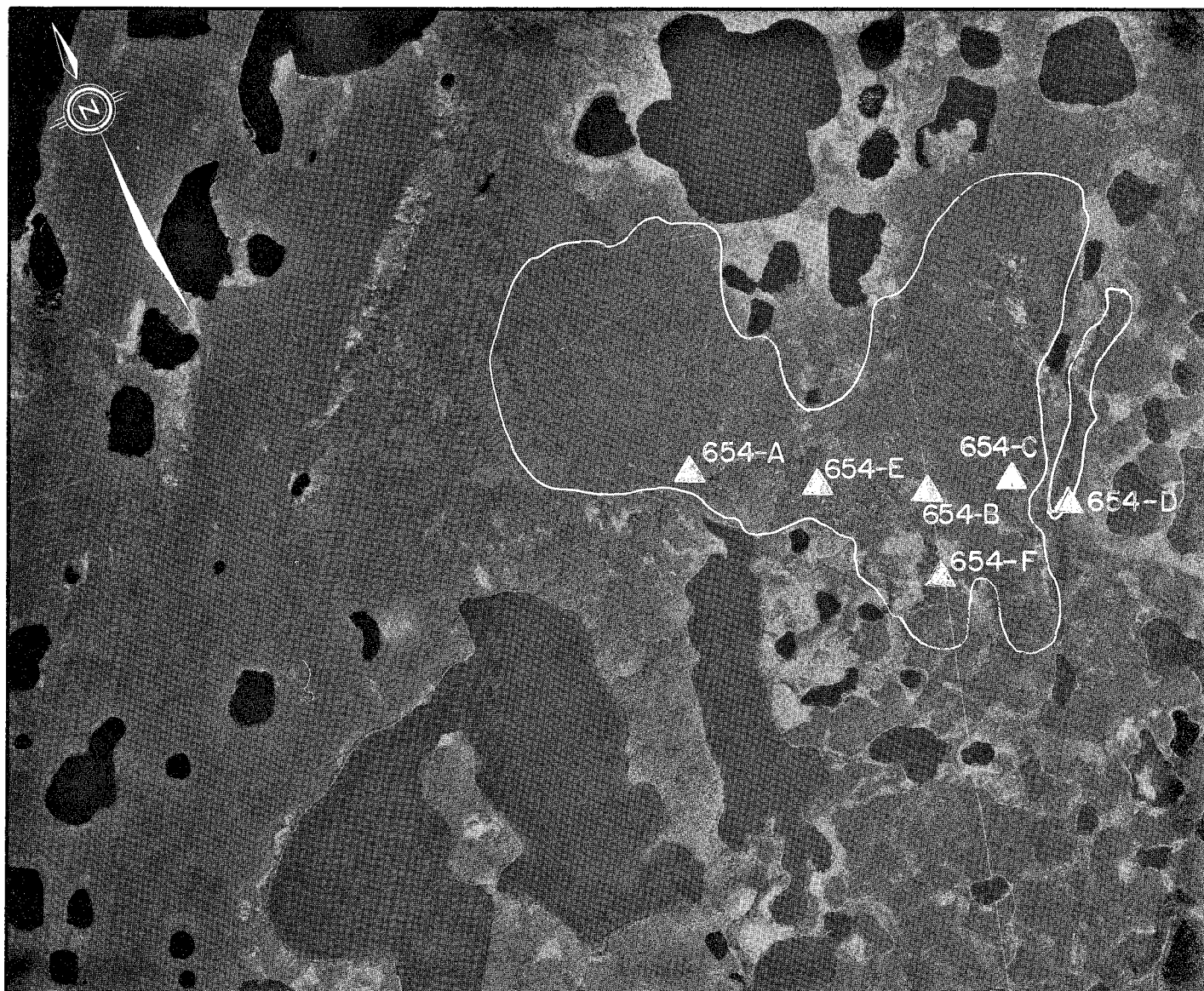
ZONE VI
SOURCE No. 654

LANDFORM AND LOCATION: Glaciofluvial outwash plain, eskers and some small kames in an area about 13 miles by air northeast of Arctic Red River.

MATERIAL: GRAVEL - and sand, some silt

VOLUME: 2,000,000 cu. yds. at least

CONCLUSION: Source is suitable for development after drilling program delineates exact boundaries of gravel and sand areas.



AIRPHOTO No. A22890 - 161

SCALE: 1" = 3000' (approx.)

Physical

This source is a field of glacial features on the Anderson Plain, 13 miles northeast of Arctic Red River Community. The area is about 2 miles long by $\frac{1}{2}$ to 2 miles wide, and contains a large glaciofluvial outwash plain, eskers, and small kame knolls.

Drainage of the source area is good, and the source has not been developed.

This source lies outside the study area, but was covered in the fall reconnaissance program.

Biotic

Forest cover over the area consists of black spruce ranging to 40 feet in height with a canopy density of 40%, transitional to black spruce in sphagnum bogs.

The source lies on the boundary of an area identified as a grizzly bear denning area and year-round habitat. In addition, the area is trapped for beaver, mink, lynx, fox, muskrat, and some marten, although not as intensively as in past years. The area is not part of a critical wildlife zone.

Some lakes are fished during the winter, but this activity has decreased in recent years.

654 MATERIALS AND QUANTITIES

The materials in this source vary from a well graded sand and gravel to silts and clays containing a large amount of ice. All these materials lie beneath a surface cover of peat varying in depth to 3 feet. The sands and gravels were generally unfrozen to a depth of $2\frac{1}{2}$ to 3 feet in September, whereas the silts and clays were generally frozen to the surface cover.

The volume of suitable material is estimated to exceed 2,000,000 cubic yards.

General

The winter drilling program did not provide enough time to complete the investigation of this source which is outside the limits of this study area, so further work, and especially drilling, must be done before the source can be fully evaluated.

Access

A winter road can be used to provide access to the source, following the Dempster Highway north from Arctic Red River for 3 miles, then on a seismic line leading east for 10 miles, thence on another seismic line north for 4 miles to the source. The total distance by road from Arctic Red River is about 17 miles.

An all-weather road is considered too expensive for consideration at this time.

Material Use and Handling

Apparently this source contains a wide range of materials.

No petrographic analysis has been performed, but a visual assessment of the samples indicates that the gravel could not be used for concrete or asphalt aggregate because of unsound material and calcareous deposits on some particles. At this time the material is considered only suitable for road construction or for general fill.

The development of this source will require the usual assembly of equipment, dozer with ripper attachment, front-end loader, and trucks.

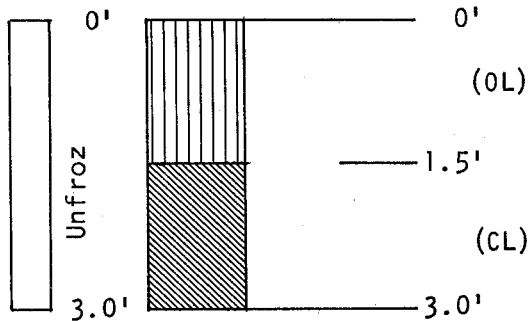
Stripping and Restoration

All trees and roots must be removed from the area to be developed, and burned. The peat and topsoil would then have to be stripped and stockpiled for replacement after the granular material has been removed. Pit slopes and banks must be graded to a stable slope before replacing the topsoil. The area should then be seeded to speed revegetation, using a choice of plants and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS

SOURCE No. 654

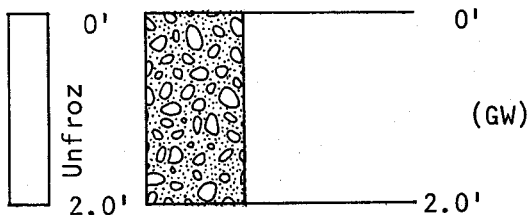
654 - A



SILT - organic, trace sand, some cobbles

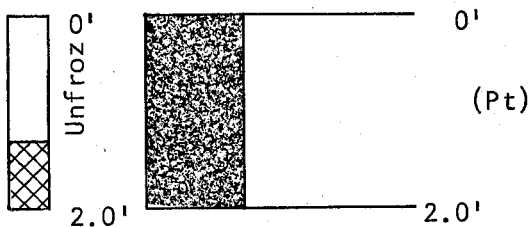
CLAY - some silt, trace sand and gravel, gray

654 - B



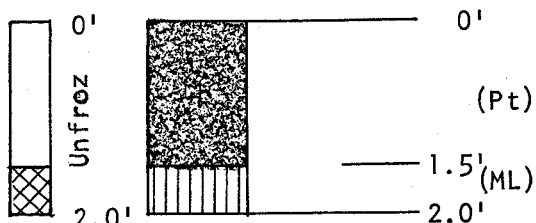
GRAVEL - some sand, trace silt, angular to subrounded, max 2½", well graded

654 - C



PEAT - black

654 - D



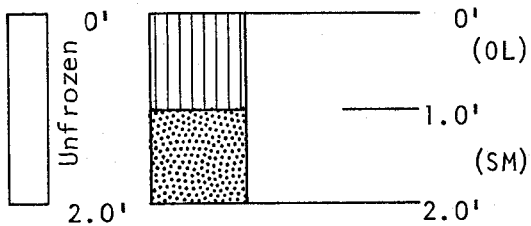
PEAT - trace silt with depth

SILT - trace clay, trace gravel

TEST PIT LOGS

SOURCE No. 654

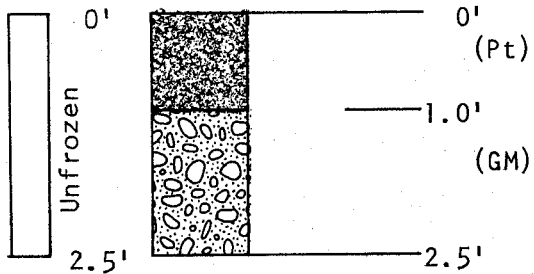
654 - E



SILT - organic and sand

SAND - and gravel, some silt, rounded to subangular

654 - F



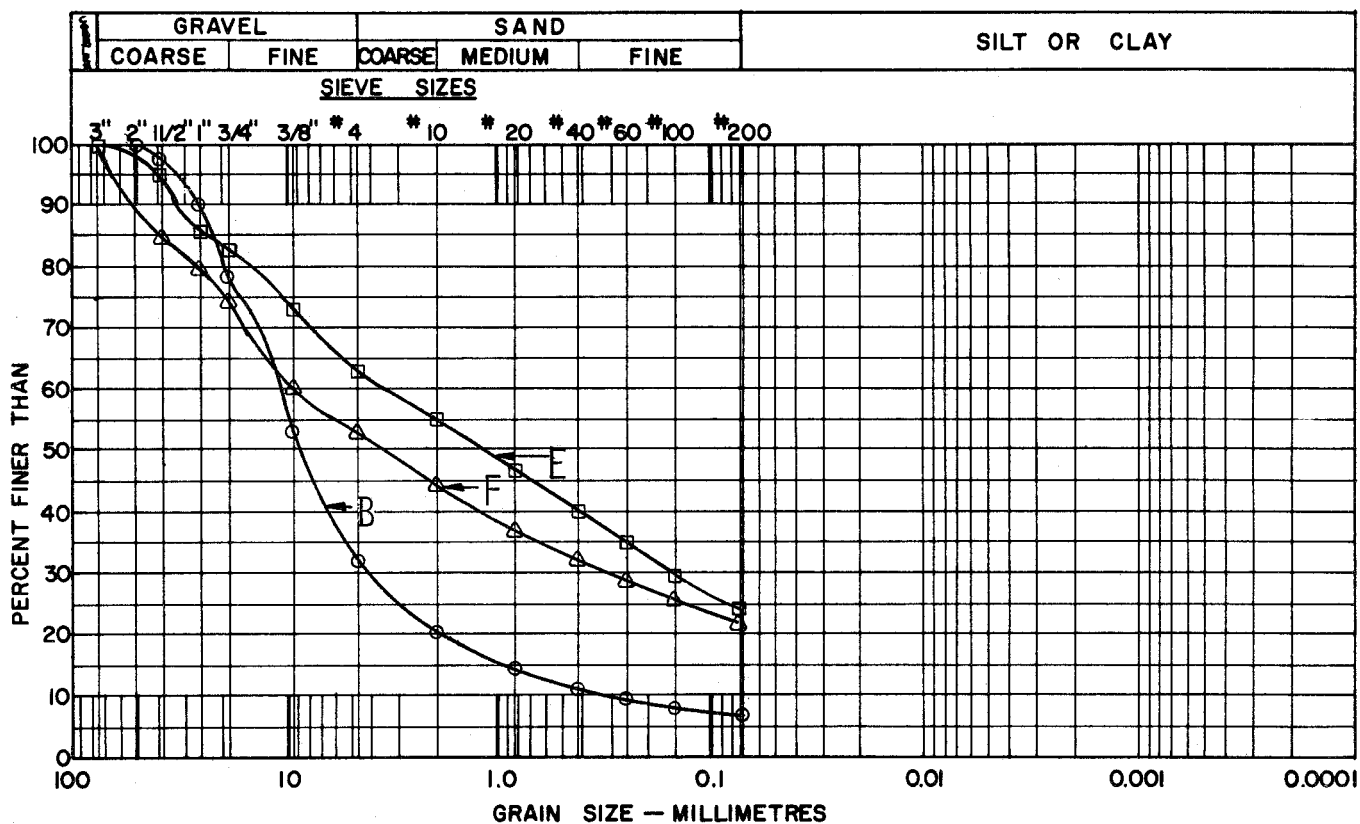
PEAT - and silt

GRAVEL - and sand, some silt, max 2 1/2", rounded to subangular

LABORATORY TEST DATA

SOURCE No 654

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

B (0.0' - 2.0') M/C = 3.6%

E (1.0' - 2.0') M/C = 7.1%

F (1.0' - 2.0') M/C = 12.6%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

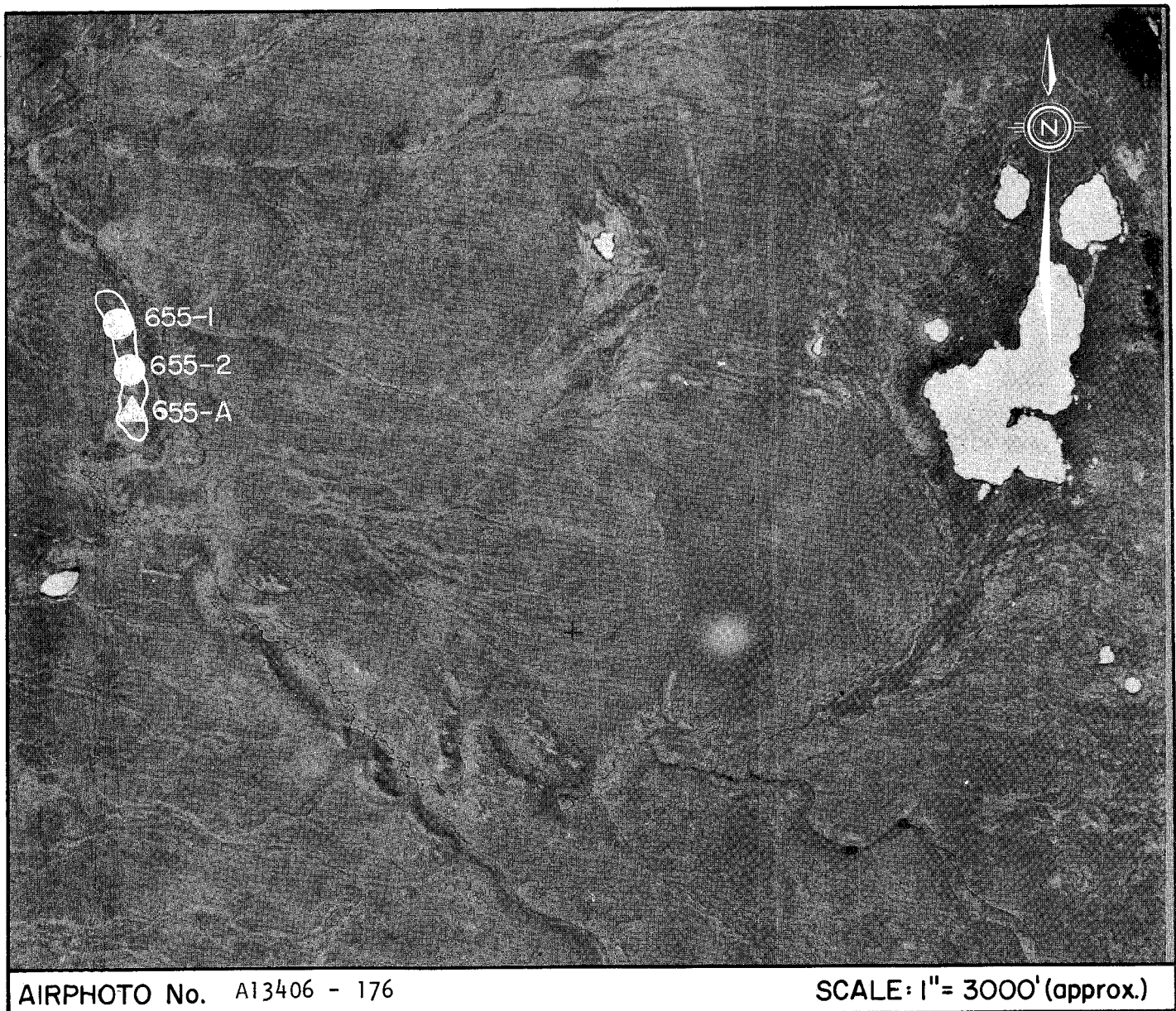
ZONE VI
SOURCE No. 655A

LANDFORM AND LOCATION: Esker ridge or kame terrace about 3,000 feet long
located 1 mile west of Dempster Highway and 37 miles
north of Arctic Red River

MATERIAL: SILT - some sand

VOLUME: ---

CONCLUSION: Source not suitable for development due to silt
content and medium to high ice content



AIRPHOTO No. A13406 - 176

SCALE: 1" = 3000' (approx.)

655A ENVIRONMENT

Physical

The source is an esker ridge or kame terrace about 3,000 feet long and 50 feet high, running parallel to a small un-named stream. The proposed Dempster Highway location passes within 1 mile of the source, which is 37 miles by air north of Arctic Red River.

Drainage of the ridge is good, and no development has taken place. Other small glacial features are located southeast of this esker ridge, but were not investigated.

Biotic

Forest cover in the area is mostly poplar and white spruce up to 40 feet high and with a canopy density of about 40%. The lower areas nearby are covered by sparse stands of white spruce with some feather moss, the spruce running to 20 feet in height with a canopy density below 20%.

The source lies within the southern boundary of the Mackenzie Reindeer Grazing Reserve. Otherwise the source is not contained within any important wildlife area.

655A MATERIALS AND QUANTITIES

The material sampled in the test pit is a well graded fine sand with some gravel and a trace of silt. However, materials encountered in the two drill holes are silt, with some fine sand, containing a medium to high ice content.

The gravel from the test pit contains a large proportion of shale fragments.

Since it is believed that the majority of the material in this source is unsuitable no volume has been estimated.

655A DEVELOPMENT

General

Since the test holes indicated mainly silt in the ridge, development of this source is not recommended.

Access

The Dempster Highway will pass within 1 mile of this source, so access would have been very good if suitable material had been uncovered.

Materials and Handling

The silt material with a medium to high ice content would prove very difficult to excavate, thaw and drain. Even if its moisture content were reduced it would be a very poor fill material.

The gravel from the test pit would only be suitable as general fill or base course material because of the high shale content.

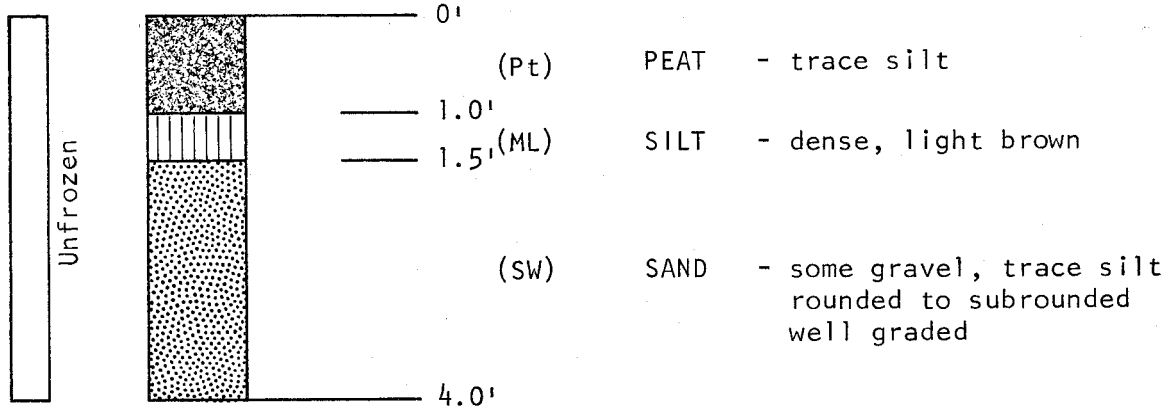
Stripping and Restoration

Excavation in a deposit of silt with high ice content could cause slope instability and thermal erosion, thus making restoration difficult. Therefore stripping or excavation of pits in this feature should not be permitted.

TEST PIT LOGS

SOURCE No. 655A

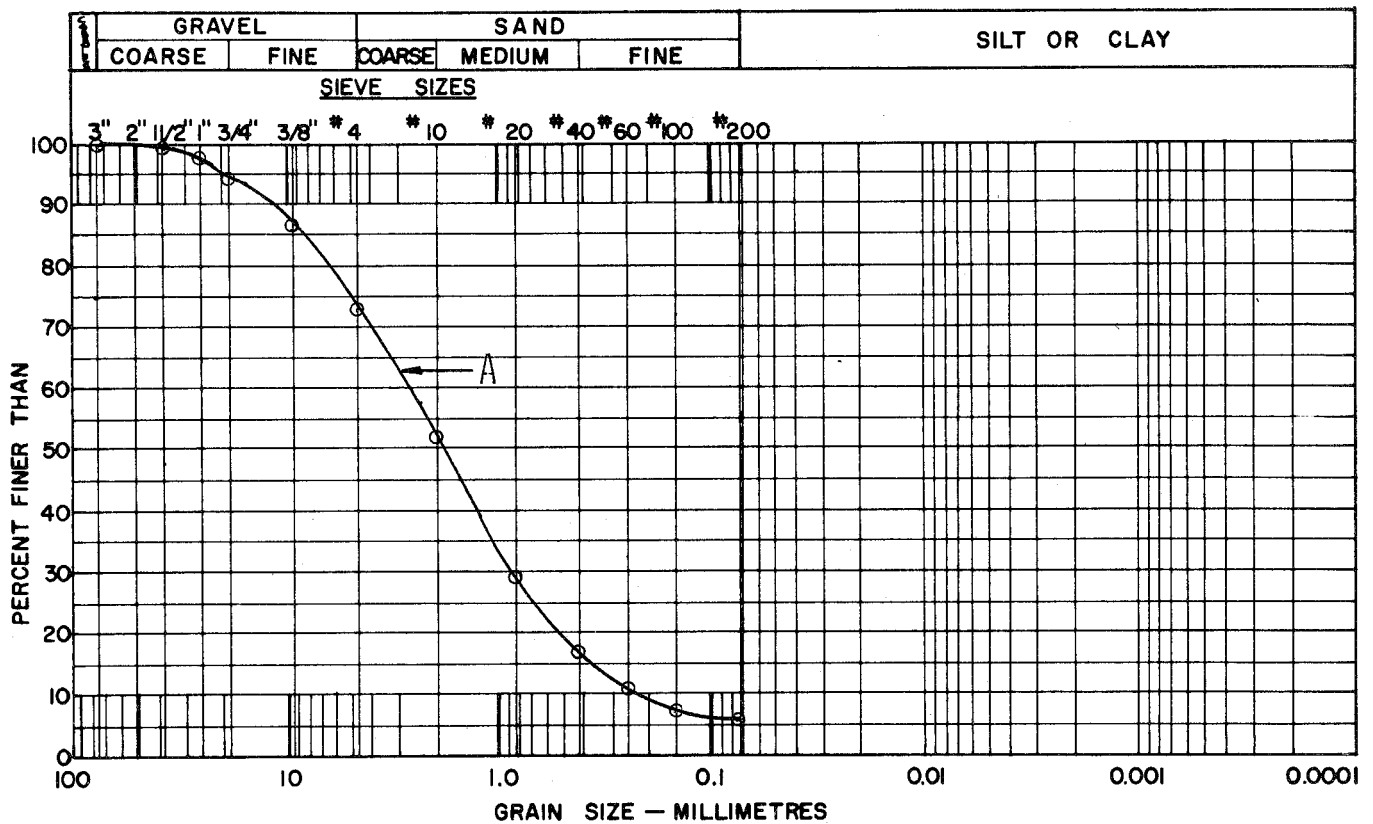
655A-A



LABORATORY TEST DATA

SOURCE No 655A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A (0.0' - 4.0') M/C = 4.6%

ORGANIC CONTENT

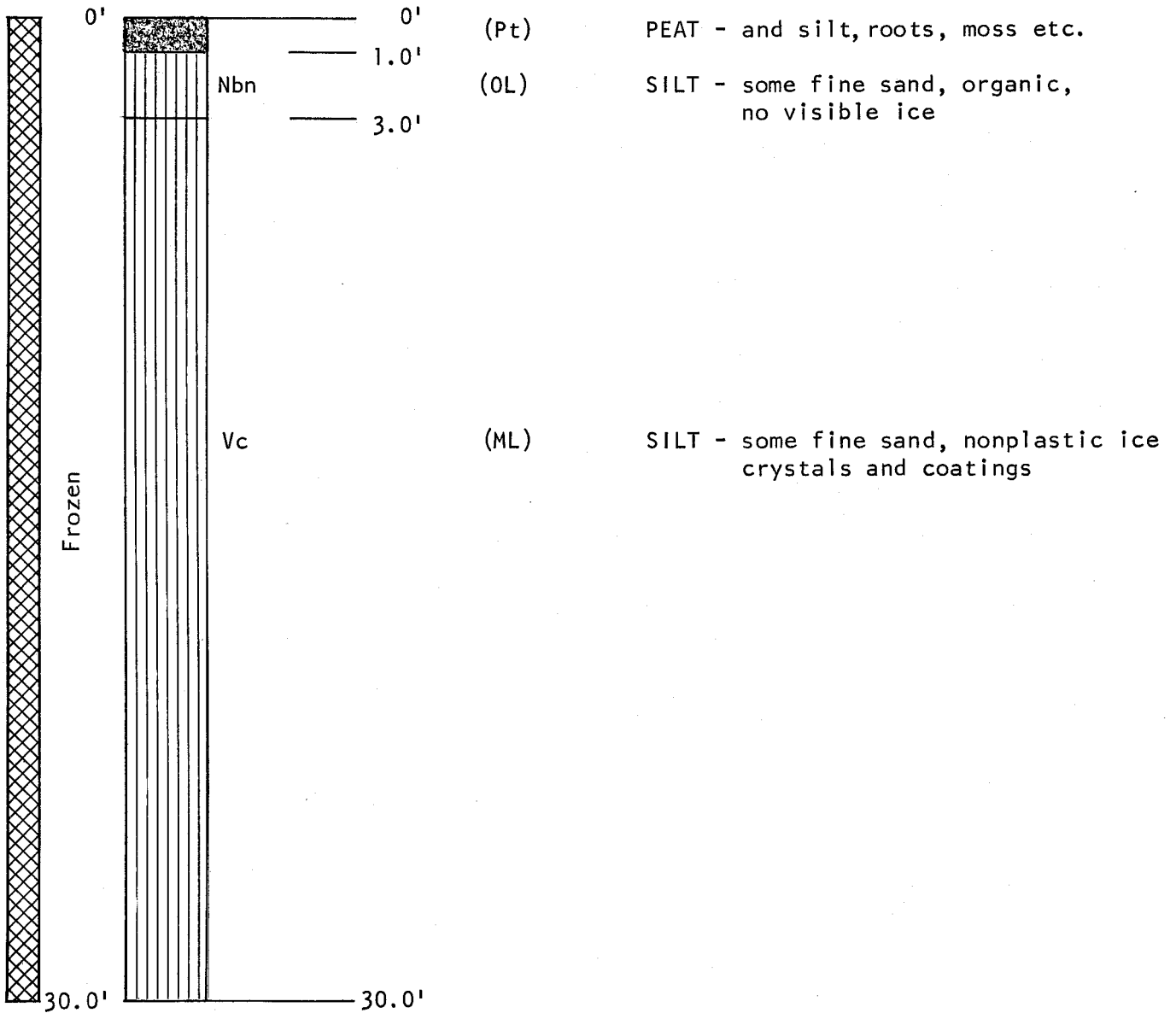
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. 655A

655A-1



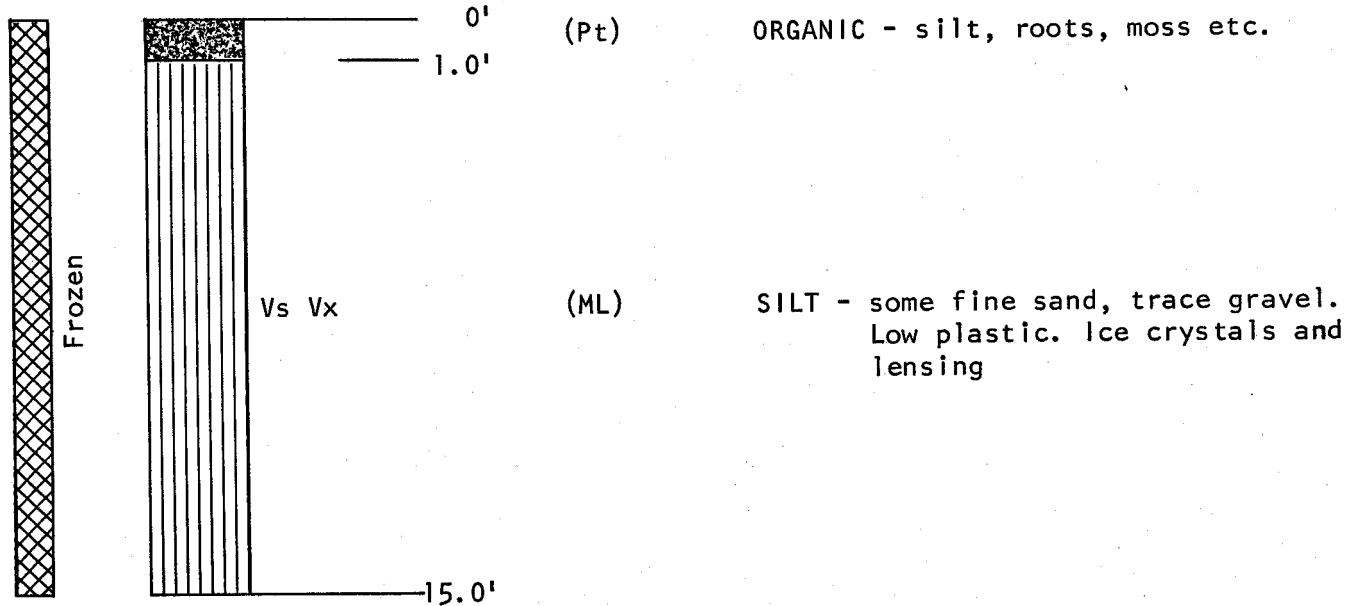
Moisture Content

Sample 1	depth	2'	13.1%
Sample 2	depth	4'	24.9%
Sample 3	depth	15'	21.1%
Sample 4	depth	30'	21.1%

TEST HOLE LOGS

SOURCE No. 655A

655 A-2



Moisture Content

Sample 1	depth	2'	22.3%
Sample 2	depth	4'	28.5%
Sample 3	depth	15'	26.2%