Granular Resources Inventory
- Southern Mackenzie Valley -
Fort Simpson - 95 H

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

GRANULAR RESOURCE INVENTORY - SOUTHERN MACKENZIE VALLEY FORT SIMPSON (95H) (1:125,000)

Gretchen V. Minning
J. A. Rennie
J. L. Domansky
A. N. Sartorelli
Terrain Sciences Division
Geological Survey of Canada
November, 1972
(First Revision)

106

Table of Contents

SUMMARY

Natural granular material is abundant in the Fort Simpson map-area. Medium to fine sand mixed with silt is readily available in the northern two-thirds of the map-sheet. Unconsolidated deposits with coarse sand and gravel are widely scattered, but are most common along the escarpment which trends northwest. Competent, crushable bedrock is also at the surface along this escarpment and in banks of the Liard River, Jean Marie Creek, and Trout River.

Coarse natural granular material comes primarily from glaciofluvial outwash plain, ridge, and esker deposits which are well-drained and have little organic cover. Alluvial, glaciolacustrine, eolian, and morainal deposits sometimes consist of sand and gravel or contain gravel along with finer material. They generally have poorer drainage and more organic cover than the glaciofluvial deposits.

Competent bedrock at or near the surface is limited. Three limestone formations do outcrop in the southern half of the map-sheet along the northwest trending escarpment and in river banks.

Although natural granular material is abundant in the Fort Simpson map-area, it is not readily available north and east of the Mackenzie River which may lead to problems if construction projects are undertaken in this area.

INTRODUCTION

Granular material for construction purposes can be obtained from unconsolidated deposits or competent bedrock. This report will discuss the distribution and physical characteristics of these sources of granular material and will also present an estimate of the quantity of material available in unconsolidated deposits.

Unconsolidated deposits resulting from various geologic processes, i.e. glacier activity, river deposition, wind action, and mass wasting, are a source of natural granular material of gravel (> 2 mm), sand (1/16-2 mm), silt (1/16-1/256 mm), and clay (< 1/256 mm) sizes.

Good natural granular material for construction uses is generally larger than silt size (1/16 mm)[1]. In the southern Mackenzie Valley good granular material comes primarily from deposits of glaciofluvial and glaciolacustrine origin, and secondarily from morainal, eolian, alluvial, and colluvial deposits.

Bedrock that can be crushed by mechanical means can also supply granular material. Competent bedrock suitable for crushing includes limestone, dolomite, sandstone, and certain igneous and metamorphic rock types. Other less resistant rock types, i.e. shale, can be used for fill material but will not be included here as a bedrock source of granular material. In the southern Mackenzie

[1] Silt and clay size material < 1/16 mm can be used for fill. This material is unlimited in the unconsolidated deposits of this map-sheet and will not be included in the numerical estimate of the quantity of granular material available.

Valley limestone and dolomite are the best sources of rippable bedrock.

Published and unpublished Geological Survey of Canada maps and reports, personal communication with officers of the Geological Survey, and field investigation have provided the basic data for this report. Supplementary information on distribution, thicknesses, and textures of unconsolidated deposits was obtained from unpublished oil and pipeline company shot hole and drilling records (see sources of information, Appendix A).

A Geological Survey surficial geology map at a scale of 1:125,000 (Rutter, N.W., Minning G.V., and Netterville, J.A., 1972) provided data on location and areal extent of unconsolidated deposits containing good granular material. This map is indexed as GSC Open File 93 and may be viewed at the Geological Survey of Canada offices in Ottawa, Calgary and Vancouver. Copies may be obtained at a nominal cost from Riley's DataShare International, 631 - 8 Avenue South West, Calgary, Alberta.

Quantities of natural granular material in unconsolidated deposits have been computed using data on areal extent and thicknesses obtained from the surficial geology map, drilling results, and field observations. Variables such as ground ice and height of water table were considered when deriving final volumes of material available in each deposit[2]. The tabular summary at the end of this report contains detailed volumetric data.

Information on bedrock that can supply granular material comes mainly

---

[2]The area of each deposit was measured on the surficial geology map with a planimeter. The average thickness of the deposit was multiplied by the area to get the total volume of the deposit. Variables, i.e. water table, type of deposit, were assessed to obtain the final percentage of the total volume that is listed in the table as material available for exploitation.

from Geological Survey of Canada Paper 58-11. Map 28-1958, which accompanies this paper, has been used as a base for indicating competent bedrock that is available at or near the surface.

GENERAL GEOLOGY AND PHYSIOGRAPHY

The Fort Simpson map-area lies within the Great Slave physiographic region (see location map, Figure 1).

Bedrock geology was mapped by the Geological Survey on Operation Mackenzie in 1957 (Douglas, R.J.W., 1959). A reconnaissance surficial geology investigation was undertaken by B. G. Craig as part of this operation (Douglas, 1959; Craig, 1965). A detailed surficial geology map based on airphoto interpretation and field investigations was compiled by the Geological Survey in 1971 (Rutter, N.W., Minning, G.V., and Netterville, J.A., 1972).

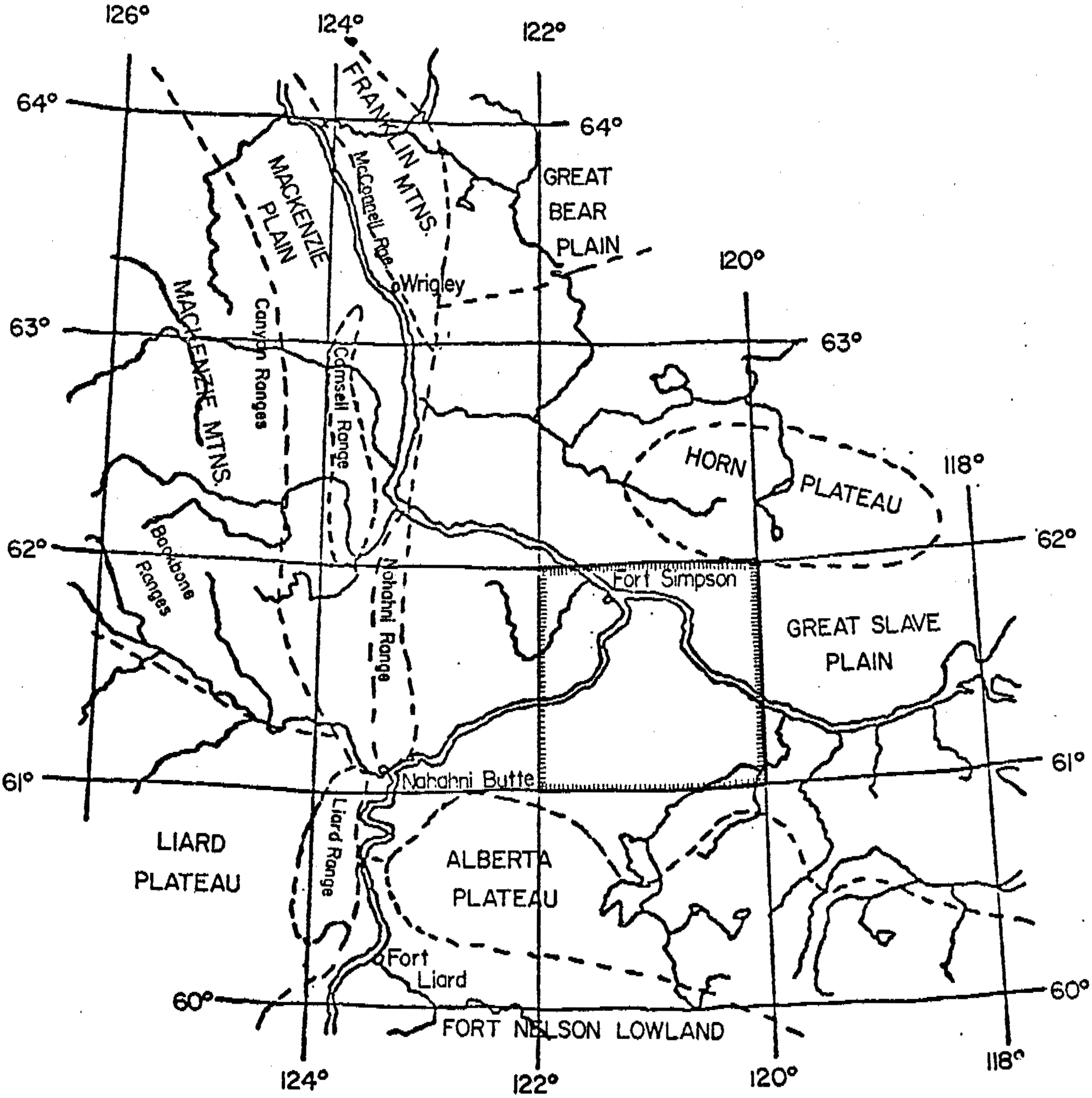
Bedrock formations[3] are mostly Upper Devonian shales and limestones with minor sandstones and siltstones. Cretaceous shale is also present in the Horn Plateau.

The Upper Devonian shales and siltstones which occur in the lowland in the northern half of the map-sheet and the Cretaceous shale of the Horn Plateau are poor sources of granular material.

Competent Upper Devonian limestone formations, good for construction materials, are found at or near the surface in the southern half of the map-sheet.

---

[3] A formation is a bed (of rocks) or assemblage of beds with well-marked upper and lower boundaries that can be traced and mapped over a considerable tract of country.



PHYSIOGRAPHIC REGIONS – FORT SIMPSON, 95H

miles 50 Scale

Figure I

after Bostock 1969

Morainal deposits (at least 20 feet thick in most places) mantle the bedrock. In addition to the ground moraine cover, glacier activity has produced glaciofluvial channel and esker deposits, and glaciolacustrine plain and beach ridge deposits. Rivers have reworked unconsolidated material into alluvial plain and terrace deposits. Wind activity has caused glaciolacustrine sands to be redeposited into dunes. All of these unconsolidated deposits contain natural granular material.

GEOLOGIC DESCRIPTION OF EXPLOITABLE MAP UNITS

Unconsolidated deposits and bedrock that can supply granular material appear on Figures 2 and 3.

Figure 2 is adapted from a Geological Survey of Canada surficial geology map. Unconsolidated deposits with good natural granular material are labelled with the appropriate map-unit name and assigned a pattern designation (see Figure 2, 2b). Pattern designations are based on geologic origin and texture of material in the deposit. Where map-unit names are used without pattern designations, the deposit either consists almost entirely of material $< 1/16$ mm, or has organic material and high water table present throughout 50% of its surface area.

Figure 3 is a Geological Survey of Canada bedrock geology map. Bedrock at or near the surface is indicated by solid lines or an x. Bedrock formations preceded by an asterisk (*) could be crushed to obtain granular material (see legend, Figure 3).

Unconsolidated Deposits

Glacial Deposits

Glaciofluvial outwash deposits contain high quality coarse granular material. Glaciolacustrine beach ridge and plain deposits also have coarse sand and some buried gravel in addition to fine sand and silt. Eolian deposits are made of well-sorted fine sand. Till of morainal deposits is primarily fine material but contains gravel and sand at several localities.

Glaciofluvial Deposits
(Gp, Gpc, Gr, Grp, Gpct, $\frac{\text{Gpv}}{\text{tm}}$, $\frac{\text{Gvc}}{\text{R}}$, esker)

Good quality granular material is present in glaciofluvial deposits along the northwest trending escarpment where the Mackenzie Highway is located. Other gravelly glaciofluvial deposits are found along Jean Marie Creek and near the Birch River. These deposits have been indicated by a dot and circle pattern on the natural granular materials map (see Figure 2).

The capital G in the unit mapped indicates the glaciofluvial origin of the deposits and the lower case prefix denotes the principal type(s) of material, e.g. silt (si), sand (s), and gravel or gravel and sand (g). It should be noted that when two prefixes are used, the first refers to the most abundant constituent (see legend for surficial geology maps, Figure 2b).

Topographic expression of the unit is indicated by the suffix attached, e.g. ridge (r), plain (p), hummocky (h), veneer (pv). Glaciofluvial units vary from flat and gently sloping (Gp, Gpc, Gpr, $\frac{\text{Gpv}}{\text{tm}}$, Gpct, $\frac{\text{Gvc}}{\text{R}}$) to ridged (Gr, esker). Thicknesses of deposits vary but most are estimated to be 50 feet thick.

Esker ridges () are sinuous, ridged deposits formed by rivers beneath glacial ice. Eskers are rare in the Fort Simpson map-area.

Glaciofluvial deposits are generally well drained and have little ground ice or organic cover.

Glaciolacustrine Deposits
(Lp, )

Glaciolacustrine plain deposits consist mainly of sand and silt but may contain buried gravels. On the natural granular materials map these deposits have been assigned one of several striped patterns (see Figure 2).

The capital L in each map-unit indicates its glaciolacustrine origin and the lower case prefixes and suffixes give textural and morphologic information respectively.

Glaciolacustrine plain deposits are generally flat (Lp) and in some areas eolian dune ridges may also be associated (sLp/sEr). An average thickness of 23 feet was used for volume calculations., Ground ice, organic cover, and high water table may make exploitation of these fined grained glaciolacustrine deposits difficult.

Glaciolacustrine beach ridges have been built by glacial Lake McConnell along the northwest trending escarpment. These ridges contain coarse sand and some gravel and are from 5 to 20 feet high and approximately 20 feet wide.

Morainal Deposits
(tMp)

Morainal deposits generally do not contain sufficient amounts of sand and gravel to be classified as a potential source for granular material.

River exposures and shallow drilling have shown gravel layers in till of morainal deposits, especially directly above bedrock. In most cases these gravels are too deep to be utilized.

Two morainal deposits (H-8 and H-47) contain enough coarse surface material to be considered a source of granular material. They have been assigned a broken line pattern on the granular materials map.

In the southern half of the map-area till has been used for fill during construction of the Mackenzie Highway.

Alluvial Deposits
(Ap, At, Atc)

Alluvial deposits consist of silt, sand, and gravel left by rivers and streams. Only those deposits with significant coarse material have been assigned a pattern designation on the accompanying natural granular materials map (see Figure 2). All alluvial deposits are mapped as A with textural and morphologic prefixes and suffixes.

Alluvial deposits form plains with little relief along present river and stream channels and terraces (flat surfaces) above present channels. Alluvial plain deposits vary in thickness from 8 to 20 feet. Alluvial terrace deposits are thicker and an average of 40 feet was used in most volume computations. Alluvial terrace deposits sometimes contain gravel at depth, i.e., H-65 and H-69 which are alluvial terraces along the Liard River[4].

---

[4] A gravel pit was operated in H-65, about 6 miles SE of Fort Simpson during 1971.

Alluvium with economic deposits of gravel and sand are found along the Liard and Martin Rivers and at a few localities on Jean Marie Creek and Rabbitskin River.

Alluvial deposits along the Mackenzie River are primarily silt as seen in excavations at the townsite of Fort Simpson.

Eolian Deposits
(Er, Erh)

Eolian deposits are widespread. Sandy glaciolacustrine material has been blown by wind into hummocks and dune ridges. These deposits are mapped as E with appropriate textural and morphologic prefixes and suffixes and are indicated by a dotted pattern on the natural granular materials map.

Sand in eolian deposits is usually well-sorted and medium to fine grained. Dune ridges range from 15 to 60 feet in height and contain dry sand. Between dune ridges organic material, ground ice, and high water table are common. Eolian areas with 50% or more organic cover were not included on the map or in volume calculations.

Bedrock

Devonian limestone of three geologic formations can be used to supply granular material. Outcrop areas of these formations are indicated on Figure 3 with heavy dashed lines or an x symbol.

The northern half of the map-sheet is underlain by soft Devonian and Cretaceous shales and siltstones which are not good construction materials.

Competent limestones occur in an east-west trending band in the southern half of the map-sheet. In most places they are covered by thick surficial deposits with outcrops usually located along river banks.

High Quality Bedrock
for Construction Materials

Bedrock formations are described in order of their suitability for construction materials.

Unit 21 is an Upper Devonian sandy, silty limestone. It is a tough well-jointed formation and is a good source of crushable rock. Exposures occur along the northwest trending escarpment near the eastern edge of the map-sheet, in the shoreline of Deep Lake, and in the banks of the Poplar River.

Unit 20 appears in the banks of Jean Marie Creek and the Liard River. Where this formation is sandstone or sandy limestone, as along the Liard River where sections show 110 feet of sandy limestone, it is a good source of construction material. Siltstone and mudstone members present at some localities are not suitable for construction purposes.

Unit 22, a sandy limestone, is a good source of construction material. Throughout most of the Fort Simpson area it is covered by thick till and organic deposits, but it does outcrop along Trout River and at Deep Lake.

GEOGRAPHIC DISTRIBUTION OF EXPLOITABLE MATERIALS

All natural granular deposits have been assigned an identification number, i.e., H-1 for use in assembling data. Roman numerals I to VI and geographic names designate groups of natural granular deposits discussed in this report. The lowest Roman numeral applies to the best area of natural granular deposits (see Figure 2). The same system of Roman numerals and geographic names has been used to assemble bedrock information for different localities on the map-sheet (see Figure 3).

Further details on volumetric estimates of natural granular material and types of bedrock available in each Roman numeral area are found in the tabular summary of this report.

I. Turkey Lake - Deep Lake Complex

This area contains considerable sand and gravel resources. Glaciofluvial outwash deposits (20 to 50 feet thick and 40 - 70% available material) near the junction of the Mackenzie and Fort Liard Highways and along the northwest trending escarpment have already supplied gravel for highway construction. Glaciolacustrine beach ridges concentrated along the bedrock escarpment and alluvial deposits along Jean Marie Creek also contain considerable coarse granular material. Minor amounts of gravel are available at depth in glaciolacustrine plain deposits and in one morainal-glaciofluvial unit. Glaciolacustrine deposits and eolian dune ridges contain ample amounts of sand.

Limestone of units 20, 21, and 22 could be crushed to obtain granular material.

II. Mackenzie-Liard Lowland Complex

This group of deposits occurs in the lowland area between the Liard and Mackenzie Rivers. Glaciolacustrine sand is the primary constituent of the deposits, but some gravel may be found in beach ridges, buried under glaciolacustrine plain deposits, and in alluvial terraces along the Liard River. Eolian deposits provide significant quantities of sand.

The entire area has high water table and heavy organic cover and probably a fair amount of ground ice making exploitation of the natural granular materials difficult.

No competent bedrock is exposed.

III. Fort Simpson Complex

This area is similar to area II because there is little coarse granular material, high water table, heavy organic cover, and ground ice conditions.

Gravel has been found at depth in glaciolacustrine and alluvial deposits adjacent to the Liard River and in alluvial material along the Martin River. Sand of glaciolacustrine and eolian origin in ridges and higher areas is the principal natural granular material.

No competent bedrock is exposed in area III.

IV. Upper Liard River Complex

This area, like areas II and III, has mostly sandy material of glacio-lacustrine and eolian origin. High water table, organic cover, and ground ice may make use of materials difficult.

Sandy limestone of unit 20 is exposed along the Liard River and where accessible it can be crushed to obtain granualr material.

V. Birch River Glaciofluvial

Minor deposits of glaciofluvial sands and gravels form plains, ridges, and small eskers in this area. The deposits are well drained and have little organic cover.

VI. Harris River Area

Glaciofluvial gravel is available here beneath glaciolacustrine sands and as a veneer over till.

No competent bedrock is present.

Miscellaneous Deposits

These glaciolacustrine, glaciofluvial, and alluvial deposits north and east of the Mackenzie River contain sand and minor gravel.

No bedrock material is available.

TABULAR SUMMARY

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	I. Turkey Lake - Deep Lake Complex				
H- 33	sandy, glaciolacustrine plain	23	4.31	93.66	37.46
H- 34	deposits, some gravel at depth	23	7.39	160.37	64.14
H- 35	(beneath approx. 20 feet sand)	23	3.18	77.23	30.89
H- 90	sand dunes, medium to fine	33	0.42	14.63	3.65
H- 91	sand	33	0.11	3.96	0.99
H- 43	glaciofluvial plain deposits,	50	18.43	971.38	388.55
H- 44	mostly gravel and sand, fairly	50	4.94	260.27	104.10
H- 45	thick; gravel pits already	50	7.62	401.71	160.68
H- 46	present	50	15.31	1086.30	760.41
H- 47		10	7.66	71.25	24.93
H-137		50	1.08	57.46	22.98
H-162	glaciofluvial plain deposits,	23	4.0	86.73	34.69
H-163	sand and gravel	23	7.2	156.11	62.44
H-157	veneer of glaciofluvial sands and gravels over bedrock	5	17.27	107.06	42.82

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
H-124	glaciolacustrine beach deposits of			1.13	0.67
H-125	sand and gravel approx. 10 feet			0.14	0.08
H-126	high, 20 feet wide concentrated			0.22	0.13
H-127	along bedrock escarpment			0.22	0.13
H-128				0.04	0.02
H-129				0.20	0.12
	Bedrock - limestone 21 (good)				
	limestone 20 (good)				
	limestone 22 (good)				
				I. TOTAL	1739.88
	II. Mackenzie - Liard Lowland Complex				
H-138	glaciolacustrine beach deposit, sand and gravel	10	1.32	12.30	8.61
H- 26	sandy, glaciolacustrine plain deposits,	23	0.54	11.83	4.14
H- 27	some ground ice and organic cover,	23	2.87	62.44	21.85
H- 28	medium to fine sand	23	0.62	13.51	5.40
H- 29		23	0.54	11.83	4.73
H- 30		23	1.12	24.50	9.80
H- 36		23	18.24	395.78	158.31
H- 37		23	1.82	39.69	15.87
H- 38		23	9.49	205.94	72.07
H- 39		23	3.11	67.48	26.99
H-102		23	10.26	221.81	77.98
H-107		23	4.47	97.02	33.95
H-109		23	2.06	44.73	15.65

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
H- 11	sandy glaciolacustrine plain deposits,	23	10.61	230.37	92.14
H- 12	mainly sand; some gravel at depth,	30	2.80	86.80	30.38
H- 16	some ground ice and only minor	23	6.30	136.71	54.68
H- 18	organic cover	23	34.68	777.39	310.94
H- 19		23	1.28	27.86	11.14
H- 20		23	6.96	151.06	60.42
H- 23		23	0.77	16.87	6.74
H- 24		23	2.37	51.45	20.58
H- 84	sand dunes and intervening flat areas,	33	30.53	1041.04	260.26
H- 85	medium to fine sand, dunes up to 60	33	0.73	25.19	6.80
H- 86	feet high (i.e. H-88); organic deposits,	33	0.97	33.11	6.62
H- 87	ground ice and high water table in flat	33	4.47	152.46	38.11
H- 88	inter-dune areas	60	0.62	21.23	5.30
H- 89		33	6.88	234.74	58.68
H-149		33	0.42	14.63	3.65
H- 66	alluvial terrace deposits along Liard	40	3.15	127.01	25.40
H- 70	River; silt, very fine sand, some gravel at depth	40	1.16	47.06	9.41
H-134	sandy, silty alluvial plain deposits	8	2.91	27.12	2.71
H-135	along Jean Marie Creek	8	1.67	15.54	1.55

Bedrock – none

II. TOTAL 1460.86

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
H- 11	sandy glaciolacustrine plain deposits,	23	10.61	230.37	92.14
H- 12	mainly sand; some gravel at depth,	30	2.80	86.80	30.38
H- 16	some ground ice and only minor	23	6.30	136.71	54.68
H- 18	organic cover	23	34.68	777.39	310.94
H- 19		23	1.28	27.86	11.14
H- 20		23	6.96	151.06	60.42
H- 23		23	0.77	16.87	6.74
H- 24		23	2.37	51.45	20.58
H- 84	sand dunes and intervening flat areas,	33	30.53	1041.04	260.26
H- 85	medium to fine sand, dunes up to 60	33	0.73	25.19	6.80
H- 86	feet high (i.e. H-88); organic deposits,	33	0.97	33.11	6.62
H- 87	ground ice and high water table in flat	33	4.47	152.46	38.11
H- 88	inter-dune areas	60	0.62	21.23	5.30
H- 89		33	6.88	234.74	58.68
H-149		33	0.42	14.63	3.65
H- 66	alluvial terrace deposits along Liard	40	3.15	127.01	25.40
H- 70	River; silt, very fine sand, some	40	1.16	47.06	9.41
	gravel at depth				
H-134	sandy, silty alluvial plain deposits	8	2.91	27.12	2.71
H-135	along Jean Marie Creek	8	1.67	15.54	1.55

Bedrock - none

II. TOTAL 1460.86

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	III. Fort Simpson Complex				
H- 2	sandy glaciolacustrine deposits; medium	23	1.86	40.53	16.21
H- 3	to fine sand, some silt, ground ice and	23	26.16	648.26	259.30
H- 4	organic material (gravel at depth in H-3)	23	1.94	42.21	16.88
H- 13		23	13.65	338.26	135.30
H- 14		23	5.48	119.00	41.65
H- 15		23	2.37	51.45	18.00
H-132		23	27.34	593.25	237.30
H-140		23	6.37	138.39	37.36
H-150		33	1.55	53.02	18.35
H-140A		23	4.10	88.90	31.12
H- 62	alluvial plain and terrace deposits along	20	9.06	196.70	19.67
H- 63	Martin River; silt and gravel	20	0.89	19.39	1.93
H- 64		20	1.59	34.58	3.46
H- 65	alluvial terrace deposits along the	50	4.20	221.34	44.26
H- 67	Liard River; gravel at depth, mostly	40	1.90	76.83	15.34
H- 68	fine to medium sand at surface	8	0.31	2.88	0.28
H- 69		40	1.16	47.06	9.41
H- 72	sand dunes, medium to fine sand, some	33	2.48	84.92	22.92
H- 73	intervening flat areas of sand with minor	33	2.33	79.53	19.88
H- 74	gravel; organic cover, ice content, and	33	1.55	53.02	14.31
H- 75	high ground water table in flat areas	33	14.19	484.00	96.80
H- 76		33	3.11	106.04	26.51
H- 92		33	0.73	25.19	6.29

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
H- 93		33	0.70	23.98	5.99
H- 94		33	0.58	16.61	4.15
H- 95		33	0.50	17.27	4.31
H- 96		33	0.15	5.28	1.32
H-131		33	1.12	38.50	9.62
H-148		33	4.12	140.58	28.11
	Bedrock - none				
				III. TOTAL	1146.03
	IV. Upper Liard River Complex				
H- 6	sandy glaciolacustrine plain deposits,	23	28.35	615.23	246.09
H- 7	minor organic cover	23	9.06	196.63	78.65
H-145		23	3.18	69.23	27.69
H- 77	sand dunes and intervening sandy areas,	33	3.89	132.66	38.47
H- 78	medium to fine sand, some organic and	33	6.37	217.47	63.06
H- 79	ground ice in interdune areas	33	4.12	140.58	37.95
H- 80		33	0.73	25.19	6.29
H- 81		33	0.54	18.59	4.64
H- 82		33	0.46	15.95	3.98
H- 83		33	0.70	23.87	5.96
H- 61A	glaciofluvial gravel in a ridge	50	0.35	18.53	7.41
	Bedrock - limestone of Unit 20 (good)				
				IV. TOTAL	520.19

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	Miscellaneous Deposits				
H- 32	glaciolacustrine silt, sand, gravel	23	4.74	102.97	41.18
H-123	beach ridges of sand and gravel			0.20	0.12
H-159	alluvial terrace of sands and silts	40	0.93	37.45	7.49
H- 40	esker - sand and gravel ridge, low			0.08	0.06
H- 41				0.04	0.03
H- 42				0.08	0.06
				MISC. TOTAL	48.94

Total sand and gravel resources for Fort Simpson map-sheet - 5233.98 million yds.^{3}

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million $yds.^3$) Available
	V. Birch River Glaciofluvial				
H- 50	glaciofluvial plains and ridges; limited in area, composed of sand and gravel, associated with old meltwater channels, well drained, little to no ice or organic cover	50	0.54	28.73	11.49
H- 51		50	0.11	6.12	4.28
H- 52		20	1.28	27.79	11.11
H- 53		50	0.50	26.69	10.67
H- 56		50	0.23	12.24	4.89
H- 57		50	0.19	10.20	4.08
H- 58		50	0.27	14.28	5.71
H- 59		50	0.15	8.16	3.26
H- 60		50	0.70	36.89	14.75
H- 61		50	2.13	112.71	45.08
H- 54	esker ridges of sand and gravel			.018	0.01
H- 55				.025	0.02
	Bedrock - none				
				V. TOTAL	115.35
	VI. Harris River Area				
H- 8	glaciolacustrine plain sand deposits, glaciofluvial gravel at depth, some organic cover	23	10.69	232.05	81.21
H-139	till with veneer of glaciofluvial gravel	60	5.60	347.20	121.52
	Bedrock - none				
				VI. TOTAL	202.73

Appendix A

Sources of Information

American Geological Institute
1960: Glossary of geology and related sciences; Am. Geol. Institute.

Bostock, H.S.
1948: Physiography of the Canadian Cordillera, with special reference to the area north of the fifty-fifth parallel; Geol. Surv. Can., Mem. 247.

1969: Physiographic regions of Canada; Geol. Surv. Can., Map 1254A.

Chevron Standard Ltd.
1969: Seismic Shot Hole Data (unpublished).

Craig, B.G.
1965: Glacial Lake McConnell, and surficial geology of parts of Slave River and Redstone River map-areas, District of Mackenzie, Geol. Surv. Can., Bulletin 122.

Douglas, R.J.W.
1959: Great Slave and Trout River map-areas, Northwest Territories; Geol. Surv. Can., Paper 58-11.

Holmes, A.H.
1965: Principles of physical geology, Thomas Nelson and Sons Ltd., London.

Pemcan Services
1971: Transportation corridor study, volumes I, II, and III; Gas Arctic Systems Study Group Report.

Prest, V.K., Grant, D.R., and Rampton, V.N.
1967: Glacial Map of Canada; Geol. Surv. Can., Map 1253A.

Ripley, Klohn, and Leonoff Alberta Ltd.
1969: Mackenzie Valley pipline report, volumes I and II.

1970: Presentation of test hole log data.

Rutter, N.W., Minning, G.V., and Netterville, J.A.
1972: Surficial geology and geomorphology of Fort Simpson, 95H; Geol. Surv. Can., Open File Series 93.