GRANULAR RESOURCES AND BEDROCK

CONSTRUCTION MATERIALS -

FORT SIMPSON (95H)

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July 7, 1972

## Table of contents

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## INTRODUCTION

The Fort Simpson map-sheet is bounded by latitudes 61° and 62°N, and longitudes 120° and 122°W. Information on natural granular material and bedrock resources was obtained mainly from published Geological Survey of Canada surficial and bedrock geology maps and reports. Unpublished results of Geological Survey geophysical and shallow drilling programs, pipeline company drilling records, and oil company shot hole records provided additional subsurface information.

Unconsolidated material is abundant, but deposits with significant coarse material are not numerous. Fine-grained deposits may be difficult to exploit because of ground ice, high water table, and organic cover.

High quality granular material suitable for coarse and fine aggregate, granular base, sub-base, and free draining fill are found primarily in glaciofluvial and glaciolacustrine deposits, and secondarily in eolian, morainal, and alluvial deposits[1]. Bedrock which is broken down by weathering or mechanical crushing can also be used.

## GEOLOGIC DESCRIPTION OF AVAILABLE RESOURCES

### Glacial Deposits

Glaciofluvial outwash supplies good quality granular material, both coarse and fine. Glaciolacustrine deposits are mostly fine material

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[1] Definitions

a. Glaciofluvial deposits are composed of sediments left by streams flowing from glaciers.
b. Glaciolacustrine deposits consist of sediment left in lakes fed by meltwater from glaciers.
c. Morainal deposits are sediments deposited directly from glacier ice.
d. Eolian deposits are sediments transported and deposited by the wind.
e. Alluvial (fluvial) deposits are sediments deposited by post-glacial rivers and streams.

but occasionally contain buried glaciofluvial gravels. Glacial till of morainal deposits is usually composed of fine material, but in the southern half of the map-area it includes considerable gravel lenses (t, g, siMp units, Fig. 1).

Glaciofluvial Deposits

(Gp, Gt, Gpc, Gpct, $\underset{tm}{Gpv}$, $\underset{R}{Gvc}$, Gr, Grp, ⌇ )

Glaciofluvial sand and gravel deposits are concentrated in the central, southeastern, and south-central sections. Minor deposits occur in the east-central and southwestern portions. Glaciolacustrine sand and silt deposits, which may include glaciofluvial gravel at depth, are found throughout the northern two-thirds of the map-area (see Fig. 1a).

On the surficial geology photomosaic map 95H, these deposits are shown in solid red or in a red striped pattern (see Figs. 1 and 1b).

The capital G in the unit indicates the glaciofluvial origin of the deposit and the small letter prefix indicates the principal type(s) of material it contains, e.g. silt (si), sand (s), gravel-and/or sand (g), till (t). It should be noted that when two letters are used, the first refers to the most abundant constituent (see Fig. 1b).

The topographic expression of a unit is indicated by the suffix, e.g. plain (p), terrace (t), ridge (r), veneer (pv). Symbols, such as ⌇ (eskers), also show the surface expression of the deposits.

Glaciofluvial units vary from flat and gently sloping (Gp, Gt, $\underset{tm}{Gpv}$, $\underset{R}{Gvc}$) to ridged (Gr, Grp, ⌇ (eskers)). Thickness varies but has been estimated at 50 feet for most deposits in the Fort Simpson area.

Esker ridges ( ⌇ ) are sinuous ridges of gravel and sand formed by rivers beneath glacial ice. The gravel and sand are clean,

well washed, and well sorted. Eskers vary in height and width and, where exact dimensions were unknown, volume calculations were based on a 10 foot width and 10 foot thickness. Eskers are rare in this area.

Organic deposits (pO,fO) make exploitation of several glaciofluvial deposits difficult. Deposits affected are described in the section on the geographic distribution of exploitable materials and in the Granular Resources estimate sheets.

More than 2070 million cubic yards of granular material are available from the glaciofluvial units.

Glaciolacustrine Deposits
(Lp, Lpv, Lpbx)

Glaciolacustrine deposits consist mainly of sand, silt, and clay but may contain buried glaciofluvial gravels. Glaciolacustrine beach deposits ( , Lpbx) may also have considerable gravel. The surficial geology map shows glaciolacustrine plain deposits in solid light blue, light blue with red dots, or a light blue striped pattern, the latter being used where organic material and high water table are present in 50% of the surface area. Beach deposits are dark blue and borehole stations where buried glaciofluvial deposits have been located are underlined in red.

The L in each unit indicates its glaciolacustrine origin and the small letter prefixes and suffixes give textural and morphologic information respectively.

Glaciolacustrine plain deposits are generally flat or gently sloping (Lp, Lpv) but some areas have eolian dune ridges (sLp/sEr).

Thicknesses of glaciolacustrine deposits vary, but an average of 23 feet was used in volume computations. Ground ice, organic cover, and high water table may make their use difficult and so no volume computations are included for them.

Glaciolacustrine beach deposits were formed by wave action along the shorelines of glacial Lake McConnell[2]. They commonly occur as a series of ridges ( ) surrounding bedrock highs. These ridges contain variable amounts of gravel and sand, and average widths and heights of 10 to 7 feet were used in calculating their volumes.

The total volume of glaciolacustrine deposits is about 4500 million cubic yards.

Morainal Deposits

(Mr, M, tMp $+ \frac{gGpv}{tm}$, t, g, siMp or Md)

Morainal deposits have been labelled M with the appropriate textural and morphologic modifiers. Morainal deposits containing coarse material are present in southeastern and northwestern sections. Those deposits believed to contain significant gravel at the surface have been colored yellow or yellow with red dots. Other morainal units not represented by a colour on the map, especially in the southern third of the map-sheet, may also be sources of coarse material. Till has already been used in the construction of the Mackenzie and Fort Nelson highways, even though it contains relatively little coarse granular material.

Ground moraine of three deposits (tMr, tMm, tMp, $+ \frac{SGpv}{tm}$) is most likely to contain coarse granular material. Till of the ground moraine throughout the southern third of the map-area (t, g, si Mp or Md) contains some shallow gravel lenses, although it has been left uncoloured on the surficial geology map. Both the shallow drill holes of the Geological Survey and river

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[2] Glacial Lake McConnell occupied this part of the Mackenzie Valley as the last glacier retreated to the northeast (Craig, 1965).

exposures have shown that the ground moraine units may contain thick gravel layers, especially directly above the bedrock. In most cases these gravels are too deep to be utilized.

In general, the amount of valuable material in the moraine is low due to its high content of silt and clay. The amount of ice content and organic cover in morainal areas is controlled largely by topography. Ridges are the best drained areas and hence have less organic cover and ground ice.

Granular material recoverable from the morainal areas coloured on the map is approximately 70,000 cubic yards.

## Alluvial Deposits

(Ap, At, Atc)

Alluvial (fluvial) deposits consist of silt, sand, and gravel left by rivers and streams. They are designated A with textural and morphologic prefixes and suffixes and have been coloured in light green in Figures 1 and 1b. They form plains with little relief along present river and stream channels and terraces (flat surfaces) above the channels.

Alluvium with economic deposits of gravel and sand is found along the Liard and Martin Rivers in the north-central and northwestern parts of the map-area. Mackenzie River alluvial deposits are not widespread and, where present, consist of silt and clay[3].

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[3]Silt and clay are < 1/16 mm. Good granular material is generally > 1/16 mm.

Alluvial plain deposits are approximately 8 feet thick. Alluvial terrace deposits are thicker and an average figure of 40 feet was used for most calculations. Alluvial terrace deposits sometimes contain gravel at depth[4].

Mackenzie River alluvium is scarce in the Fort Simpson map-area. Where present, it appears as low islands or on terraces as a veneer over till. These deposits consist of silt and clay and are not considered as a source of granular material. Alluvial deposits account for 160 million cubic yards.

## Eolian Deposits

(Er, Erh)

Eolian deposits are widespread in central, north-central, west-central and northwestern areas. They consist of medium to fine sand. In a few localities they cover glaciolacustrine and glaciofluvial deposits that contain some gravel.

Eolian deposits are widespread in the Fort Simpson area. They have been mapped as E with appropriate prefixes and suffixes and have been coloured in pink or pink striped pattern on the surficial geology map (see Fig. 1 and 1b). They consist of medium to fine sand and occur as dune ridges with intervening flat areas. Most of the dunes are between 15 to 60 feet high. The inter-dune areas often contain organic material, ground ice, or surface water, but the sand in the ridges is dry and accessible.

The eolian deposits were formed when wind redeposited glaciolacustrine deposits.

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[4] A gravel pit was operated as late as the summer of 1971 in H-65, about 6 miles SE of Fort Simpson and recently gravel was reported in or near H-69. Both terraces are along the Liard River.

Areas with 50% or more organic cover and surface water (pink striped pattern) were not included in volume computations of granular material. Their volume is estimated at 800 million cubic yards.

## Bedrock

Regions underlain by the various bedrock formations are shown in colour on the bedrock map (Fig. 2).

The northern two-thirds of the map-area is underlain by soft Devonian and Cretaceous shales, siltstones, and mudstones which do not form good construction materials. On the other hand, competent limestones occur in the southern third of the map-area and three of these formations of Devonian age can be used as a source of construction material. However, in most places they are covered by thick surficial deposits. These three formations of suitable quality will be described in detail, the best being listed first[6].

### Good Quality Bedrock for Construction Materials

Unit 21 is a sandy, silty limestone of Devonian age. It is tough, well-jointed formation and is a good source of crushable rock where exposed.

Unit 20 outcrops along the same northwest-trending escarpment and in banks cut by Jean Marie Creek and 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. The siltstones and mudstones present at some localities are not suitable for construction purposes.

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[5] A formation is a bed (of rock) or assemblage of beds with well-marked upper and lower boundaries that can be traced and mapped over a considerable tract of country (Holmes, 1965).

[6] Bedrock information comes from Geological Survey of Canada Paper 58-11 and from discussion with D.K. Norris, Geological Survey of Canada.

Unit 22 is a sandy limestone and 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 the Trout River and at Deep Lake.

## GEOGRAPHIC DISTRIBUTION OF AVAILABLE MATERIALS

All natural granular deposits have been assigned an identification number, e.g., H-1, (see Fig. 1). Roman numberals I to VIII and geographic names designate groups of natural granular deposits discussed in this report (see Fig. 1a). On the bedrock map (Fig. 2) geographic names and capital letters A to D indicate areas where bedrock construction materials might be obtained. Further details, e.g. volume estimates of both groupings and their individual components, can be found in the Resources Estimate section of this report.

### Natural Granular Materials

#### I. Turkey Lake - Deep Lake Complex

This area of the central, south-central, and southeastern parts of the map-area is a good location for granular material. Most of the deposits are glaciofluvial outwash gravels and sands, which cover 83 sq. mi. The Mackenzie highway crosses several of these deposits.

Glaciolacustrine beach deposits also provide sand and gravel, and glaciolacustrine plain deposits, which cover 15 sq. mi. are a source of sand.

Minor morainal and eolian deposits account for 1.14 and 0.53 sq. mi. of material respectively.

II. Mackenzie - Liard Lowland Complex

This group of deposits covers the lowland between the Liard and Mackenzie Rivers. It does not contain much coarse granular material, and ground ice, high water table, and organic deposits may interfere with the exploitation of the sand.

Gravel is probably present at depth in alluvial terrace and glaciolacustrine plain deposits along the Liard River (H-10, H-66, H-70 and H-133).

The glaciolacustrine plain deposits cover 232.39 sq. mi., but there is too much surface water and organic cover for them to be exploitable.

Eolian deposits are a source of sand. They cover 45 sq. mi. Alluvial deposits, mostly sand and silt, cover 12 sq. mi.

III. Fort Simpson Complex

This area is very similar to area II. It has little good, coarse granular material and has a high water table, extensive ground ice and heavy organic cover.

Gravel has been found at depth in the glaciolacustrine plain and alluvial terrace deposits, e.g. H-65, H-69.

Glaciolacustrine sand plain deposits cover 174 sq. mi., eolian sand 32 sq. mi., and alluvial plain and terrace deposits 12.5 and 7.6 sq. mi. respectively.

IV. Upper Liard Complex

This area, like areas II and III, contains mostly sand but has considerable ground ice and organic cover in poorly drained areas. Glaciolacustrine plain deposits cover 68 sq. mi., and eolian deposits 17 sq. mi. In one area (H-146) a glaciofluvial veneer about 5 feet

thick over the bedrock may provide gravel.

V. Birch River Glaciofluvial

This group includes small deposits of glaciofluvial sands and gravels which form plains, ridges, and eskers in the southwestern and south-central parts of the map-area. These glaciofluvial deposits cover 6.25 sq. mi.

VI. North Shore Mackenzie River Glaciolacustrine

Minor gravel can be found at depth in the glaciolacustrine sand plain deposits and as a veneer over till in an adjacent deposit. These materials cover 16 sq. mi.

VII. Spence River Complex

This group includes minor glaciofluvial and glaciolacustrine deposits along the Spence River, covering 13 sq. mi.

VIII. Rabbitskin River Glaciolacustrine

This is a small glaciolacustrine deposit along the Rabbitskin River in the northeastern part of the map-area. The deposits cover 35 sq. mi. and, in places, are merely a veneer of 5 feet over till.

IX. Total Natural Granular Resources

The total estimated volume of sand and gravel resources in the Fort Simpson map-area is 7500 million cubic yds.

## Bedrock Construction Materials

A. Northwest Trending Escarpment

Unit 21 is exposed intermittently along a low northwest-trending escarpment in the southeastern corner of the map-area. Unit 20

is also found, but it is not well exposed. Both formations could be crushed to provide construction materials.

B. Trout River

Unit 22 is exposed along the Trout River and is suitable for construction purposes.

C. Deep Lake - Jean Marie Creek

Units 20, 21 and 22 can be seen along the shores of Deep Lake and unit 20 on the banks of Jean Marie Creek. All three formations are good sources of construction material.

D. Liard River - Poplar River

Unit 21 is exposed in sections along the Poplar River and is a good source of construction material.

Unit 20 is exposed in numerous sections on both banks of the Liard River but it is generally overlain by glaciolacustrine and till deposits.

## Granular Resources Estimate

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume ( yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| I. | Turkey Lake - Deep Lake Complex | | | | |
| H-33 | sandy, glaciolacustrine plain deposits; | 23 | 4.31 | 93.66 | 37.46 |
| H-34 | some buried gravel (beneath approx. | 23 | 7.39 | 160.37 | 64.14 |
| H-35 | 20 feet sand). | 23 | 3.18 | 77.23 | 30.89 |
| H-90 | sand dune, medium to fine sand. | 33 | 0.42 | 14.63 | 3.65 |
| H-91 | | 33 | 0.11 | 3.96 | 0.99 |
| H-43 | | 50 | 18.43 | 971.38 | 388.55 |
| H-44 | | 50 | 4.94 | 260.27 | 104.10 |
| H-45 | glaciofluvial plain deposits, mostly | 50 | 7.62 | 401.71 | 160.68 |
| H-46 | gravel and sand, fairly thick; gravel | 50 | 15.31 | 1086.30 | 760.41 |
| H-47 | pits present. | 10 | 7.66 | 71.25 | 24.93 |
| H-48 | | 50 | 0.73 | 38.93 | 2.44 |
| H-137 | | 50 | 1.08 | 57.46 | 22.98 |
| H-97 | glaciofluvial gravels, channelled, high percentage of organic material. | 50 | 9.45 | 498.10 | 174.33 |
| H-157 | veneer of glaciofluvial sands and gravels over bedrock | 5 | 17.27 | 107.06 | 42.82 |
| H-124 | | | | 1.13 | 0.67 |
| H-125 | glaciolacustrine beach deposits of sand | | | 0.14 | 0.08 |
| H-126 | and gravel approx. 7 feet thick, 10 feet | | | 0.22 | 0.13 |
| H-127 | wide; concentrated along bedrock | | | 0.22 | 0.13 |
| H-128 | escarpment | | | 0.04 | 0.02 |
| H-129 | | | | 0.20 | 0.12 |
| H-162 | Morainal ridged areas, possible | 60 | 0.18 | 0.70 | 0.01 |
| H-163 | gravelly material | 60 | 0.96 | 3.73 | 0.04 |
| | | | | I. TOTAL | 1819.64 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume (yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| II. | Mackenzie - Liard Lowland Complex | | | | |
| H-130 | glaciolacustrine beach deposits, sand | | | 0.07 | 0.04 |
| H-138 | and gravel | 10 | 1.32 | 12.30 | 8.61 |
| H- 26 | | 23 | 0.54 | 11.83 | 4.14 |
| H- 27 | | 23 | 2.87 | 62.44 | 21.85 |
| H- 28 | | 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- 31 | | 23 | 72.97 | 1583.19 | 633.27 |
| H- 36 | sandy, glaciolacustrine plain deposits, | 23 | 18.24 | 395.78 | 158.31 |
| H- 37 | some ground ice and organic cover, | 23 | 1.82 | 39.69 | 15.87 |
| H- 38 | medium to fine sand | 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 |
| H-133 | | 23 | 8.01 | 593.25 | 237.30 |
| H-152 | | 23 | 5.60 | 190.96 | 66.83 |
| H-156 | | 23 | 5.79 | 35.92 | 14.36 |
| H- 10 | | 43 | 6.53 | 283.50 | 113.40 |
| H- 11 | | 23 | 10.61 | 230.37 | 92.14 |
| H- 12 | | 30 | 2.80 | 86.80 | 30.38 |
| H- 16 | | 23 | 6.30 | 136.71 | 54.68 |
| H- 17 | sandy glaciolacustrine plain deposits, | 23 | 10.61 | 230.37 | 92.14 |
| H- 18 | mainly sand but containing some buried | 23 | 16.06 | 348.53 | 139.41 |
| H- 19 | gravel, some ground ice, | 23 | 1.28 | 27.86 | 11.14 |
| H- 20 | only minor organic cover | 23 | 6.96 | 151.06 | 60.42 |
| H- 21 | | 23 | 0.23 | 5.04 | 2.01 |
| H- 22 | | 23 | 0.42 | 9.31 | 3.72 |
| H- 23 | | 23 | 0.77 | 16.87 | 6.74 |
| H- 24 | | 23 | 2.37 | 51.45 | 20.58 |
| H- 25 | | 23 | 0.23 | 5.04 | 2.01 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume ($yds^3 \times 10^6$) Total | Available |
|---|---|---|---|---|---|
| H- 84 | | 33 | 30.53 | 1041.04 | 260.26 |
| H- 85 | | 33 | 0.73 | 25.19 | 6.80 |
| H- 86 | sand dunes and intervening flat | 33 | 0.97 | 33.11 | 6.62 |
| H- 87 | areas. Medium to fine sand | 33 | 4.47 | 152.46 | 38.11 |
| H- 88 | dunes up to 60 feet high (i. e. H-88). | 60 | 0.62 | 21.23 | 5.30 |
| H- 89 | organic material, ground ice and high water | 33 | 6.88 | 234.74 | 58.68 |
| H-149 | table in flat inter-dune areas | 33 | 0.42 | 14.63 | 3.65 |
| H- 66 | along Liard River alluvial terrace deposits, silt, very fine sand, some limited gravel | 40 | 3.15 | 127.01 | 25.40 |
| 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 |
| H-136 | | 8 | 3.89 | 36.18 | 3.62 |
| | | | | II. TOTAL | 2448.62 |

III. Fort Simpson Complex

| | | | | | |
|---|---|---|---|---|---|
| H- 1 | | 23 | 86.94 | 1885.45 | 754.18 |
| H- 2 | | 23 | 1.86 | 40.53 | 16.21 |
| H- 3 | | 23 | 16.76 | 363.72 | 145.48 |
| H- 4 | | 23 | 1.94 | 42.21 | 16.88 |
| H- 5 | sandy glaciolacustrine deposits, medium | 23 | 7.85 | 170.45 | 68.18 |
| H- 13 | to fine sand, some silt, ground ice and | 23 | 11.24 | 243.88 | 97.55 |
| H- 14 | organic material present, in places | 23 | 5.48 | 119.00 | 41.65 |
| H- 15 | (gravel at depth in H-3) | 23 | 2.37 | 51.45 | 18.00 |
| H-117 | | 23 | 2.99 | 64.96 | 22.73 |
| H-132 | | 23 | 27.34 | 593.25 | 237.30 |
| H-140 | | 23 | 6.37 | 138.39 | 37.36 |
| H-141 | | 23 | 0.93 | 20.23 | 7.08 |
| H-150 | | 33 | 1.55 | 53.02 | 18.35 |
| H- 62 | | 20 | 9.06 | 196.70 | 19.67 |
| H- 63 | alluvial plain and terrace deposits along | 20 | 0.89 | 19.39 | 1.93 |
| H- 63A | Martin River; silt and gravel, 20 feet | 20 | 0.93 | 20.23 | 2.03 |
| H- 64 | thick in places | 20 | 1.59 | 34.58 | 3.46 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume (yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| H-65 | alluvial terrace deposits along the | 50 | 4.20 | 221.34 | 44.26 |
| H-67 | Liard River. Buried gravel 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 | | 33 | 2.48 | 84.92 | 22.92 |
| H-73 | | 33 | 2.33 | 79.53 | 19.88 |
| H-74 | | 33 | 1.55 | 53.02 | 14.31 |
| H-75 | sand dunes, medium to fine sand, | 33 | 14.19 | 484.00 | 96.80 |
| H-76 | some intervening flat areas of sand | 33 | 3.11 | 106.04 | 26.51 |
| H-92 | with minor gravel. Organic cover, | 33 | 0.73 | 25.19 | 6.29 |
| H-93 | ice content, and higher ground water | 33 | 0.70 | 23.98 | 5.99 |
| H-94 | table in interdune areas | 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 | 102.48 | 40.99 |
| | | | III. TOTAL | | 1830.42 |



IV. Upper Liard Complex

| | | | | | |
|---|---|---|---|---|---|
| H- 6 | | 23 | 28.35 | 615.23 | 246.09 |
| H- 7 | sandy glaciolacustrine plain deposits, | 23 | 9.06 | 196.63 | 78.65 |
| H-113A | minor organic material | 23 | 7.85 | 170.45 | 59.65 |
| H-145 | | 23 | 3.18 | 69.23 | 27.69 |
| H-143 | veneer (5 feet thick) of sandy glacio- | 5 | 2.72 | 16.88 | 6.75 |
| H-147 | lacustrine material over till | 5 | 16.53 | 102.48 | 40.99 |
| H-146 | veneer of glaciofluvial gravel and glacio-lacustrine sand over bedrock | 5 | 8.94 | 55.46 | 22.18 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume (yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| H-77 | | 33 | 3.89 | 132.66 | 38.47 |
| H-78 | | 33 | 6.37 | 217.47 | 63.06 |
| H-79 | sand dunes and intervening sandy areas, | 33 | 4.12 | 140.58 | 37.95 |
| H-80 | medium to fine sand, some organic cover | 33 | 0.73 | 25.19 | 6.29 |
| H-81 | and ground ice in interdune areas | 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 |
| | | | IV. | TOTAL | 649.76 |
| | V. Birch River Glaciofluvial | | | | |
| H-49 | | 50 | 0.15 | 8.16 | 3.26 |
| H-50 | | 50 | 0.54 | 28.73 | 11.49 |
| H-51 | glaciofluvial plains and ridges, limited | 50 | 0.11 | 6.12 | 4.28 |
| H-52 | extent; sand and gravel, associated with | 20 | 1.28 | 27.79 | 11.11 |
| H-53 | old meltwater channels, well drained, | 50 | 0.50 | 26.69 | 10.67 |
| H-56 | little to no ice or organic cover. | 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 composed of sand and | | | .018 | 0.01 |
| H-55 | gravel | | | .025 | 0.02 |
| | | | V. | TOTAL | 118.61 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume (yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| | **VI. North Shore Mackenzie River Glaciolacustrine** | | | | |
| H- 8 | glaciolacustrine sand with buried glaciofluvial gravel, some organic cover and ground ice | 23 | 10.69 | 32.05 | 81.21 |
| H-139 | till with veneer of glaciofluvial gravels | 60 | 5.60 | 347.20 | 121.52 |
| | | | | VI. TOTAL | 108.20 |
| | **VII. Spence River Complex** | | | | |
| H- 32 | glaciolacustrine silt, sand, and some gravel. | 23 | 4.74 | 102.97 | 41.18 |
| H-123 | glaciolacustrine beach ridges of sand and gravel | | | 0.20 | 0.12 |
| H-160 | glaciofluvial gravel along Spence River | 50 | 8.24 | 434.52 | 152.08 |
| | | | | VII. TOTAL | 193.38 |
| | **VIII. Rabbitskin River Glaciolacustrine** | | | | |
| H-158 | glaciolacustrine plain of sand and silt, | 23 | 33.84 | 734.23 | 293.69 |
| H-161 | in places only a veneer over till | 23 | 1.78 | 38.85 | 13.59 |
| H-159 | alluvial terrace of sand, and silt | 40 | 0.93 | 156.78 | 31.35 |
| | | | | VIII. TOTAL | 338.63 |

| | Description & Material | Thickness (ft.) | Area (sq. mi.) | Volume (yds.$^3$ x $10^6$) Total | Available |
|---|---|---|---|---|---|
| | **Miscellaneous Deposits** | | | | |
| H-40 | eskers - ridges of sand and gravel | | | 0.08 | 0.06 |
| H-41 | | | | 0.40 | 0.03 |
| | | | | TOTAL | 338.72 |

Total sand and gravel resources for Fort Simpson map-sheet = 7507.35 million cubic yards
= 7500 million cubic yards

## Bedrock Resources

| Formation | Rock Type | As a Source for Construction Materials | Availability* |
|---|---|---|---|
| A. Northwest Trending Escarpment | | | |
| Unit 21 | limestone | good | 1 |
| Unit 20 | limestone | good | 2 |
| B. Trout River | | | |
| Unit 22 | limestone | good | 1 |
| C. Deep Lake - Jean Marie Creek | | | |
| Unit 21 | limestone | good | 1 |
| Unit 22 | limestone | good | 2 |
| Unit 20 | limestone | good | 3 |
| D. Liard River - Poplar River | | | |
| Unit 20 | limestone | good | 1 |
| Unit 21 | limestone | good | 2 |

* The most available unit in each area has been designated by the lowest number.

# APPENDIX A

## Sources of Information

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# Legend (Figure 1c) - Fort Simpson (95H)

| Color | Pencil No. | Major General Symbol | Description |
|---|---|---|---|
| | 744 | G | glaciofluvial sand and gravel some silt |
| | 743 | E | eolian sands |
| | 740 ½ | L | lacustrine sand and silt, some gravel |
| | 740 | Lb | beach sand + gravel |
| | Any Striped Colour | | at least 50% of the area enclo: is peat (p0) or fen (f0) |
| | 751 | A | alluvial sand + gravel |
| | 735 | Mh<br>Mr | hummocky and ridged moraine composed of glacial till |
| | 737 | M | marine deposits of sand, silt and clay |
| | Red 744<br>Blue Stabilo<br>8741 | G + L | glaciofluvial, with an unknown percentage of lacustrine deposits |
| | Blue 740 ½<br>Red Stabilo<br>8040 | L + G | lacustrine, with an unknown percentage of glaciofluvial deposits |
| | Green 751<br>Red Stabilo<br>8040 | A + G | alluvial, with an unknown percentage of glaciofluvial deposits |
| | Red 744<br>Green Stabilo<br>8043 | G + A | glaciofluvial, with an unknown percentage of alluvial deposits |
| | Yellow 735<br>Red Stabilo<br>8040 | Mh + G | morainal, with an unknown percentage of glaciofluvial deposits |
| | | | eskers, (sand, gravel) |
| | | | beach ridges (sand, gravel) |
| N-157* | | (example) | indicates river sections observed during field work |

| Pencil No. | Major General Symbol | Description |
|---|---|---|
| 325* | (example) | indicates helicopter stations |
| H-65 | (example) | indicates a relevant area where volumetric calculations are made, first letter refers to map-sheet |
| R-1<br>M-1 | (example) | indicates stations where sections appear in borrow pits along the Mackenzie Highway |
| N-8 | (example) | stations underlined in red contain sections of unconsolidated material with gravel buried |