SAND AND GRAVEL RESOURCES OF THE PEERLESS LAKE (SOUTH HALF OF 84B)

AND

LESSER SLAVE LAKE (NORTH HALF OF 83O) MAP AREAS, ALBERTA

Open File Report 86-5

D.W. SCAFE
P.C. SHAM
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ILLUSTRATIONS

ABSTRACT

The aggregate materials present in the south half of Peerless Lake (NTS 84B) and in the north half of Lesser Slave Lake (NTS 83O) map areas were studied in 1985 to provide information on the distribution and characteristics of the resource. The study area is 1,300 km^2 in size and was investigated at a reconnaissance level. The program consisted of: compiling existing information, air photo interpretation plus some site and laboratory analyses. Sand and gravel materials are distributed unevenly and are of variable quality. High quality, quartzite-rich preglacial sand and gravel commonly is present at elevations greater than 1,000 m in the area. Overburden is thin, volume probably is large and the material currently is unexploited. Further investigation is recommended. Major glaciofluvial kame and esker features located southwest of Whitefish Tower and south of Utikuma Lake are primary sources of aggregate material. Meltwater channels and outwash deposits in the west and northeast portions of the study area also are potential sources of aggregate. Glaciolacustrine coarse beach sand is located north of McMullen Lake. Recent sediments have little promise for aggregate exploitation.

INTRODUCTION

This study is part of a program initiated in 1976 by the Alberta Research Council and Alberta Energy and Natural Resources to provide information on the aggregate resources of the Province of Alberta. The area of study (Figure 1), level of detail and materials to be investigated were determined by the Resources Evaluation and Planning Division (REAP) of Alberta Energy and Natural Resources. The actual investigations were conducted by the Geological Survey Department of the Alberta Research Council.

The study was completed at the enhanced reconnaissance level (category 4 in Table 1). This type of mapping is designed to provide a minimum data level for the management and planning of aggregate resources in the province and to form a base from which further exploration can proceed.

The Lesser Slave Lake-Peerless Lake study area is bounded by longitudes 114° and 116° west and latitudes 55°30' and 56°30' north. Total area is approximately 1,300 km^2. The population centre is Slave Lake with population approximately 4,500.

ACKNOWLEDGMENTS

Thanks are due to Julian Fox and Dixon Edwards of Alberta Research Council for suggestions. Capable field assistance was provided by H. Berhane and W. Buchan. H. Berhane also performed the laboratory analyses and assisted with the office preparations.

Funds for the project were provided by Resource Evaluation and Planning Division of Alberta Energy and Natural Resources and the Alberta Research Council.

Helicopter time was provided by Alberta Forest Service, Alberta Energy and Natural Resources. Special acknowledgment also is given to the Alberta Forest Service employees in Slave Lake for their assistance.

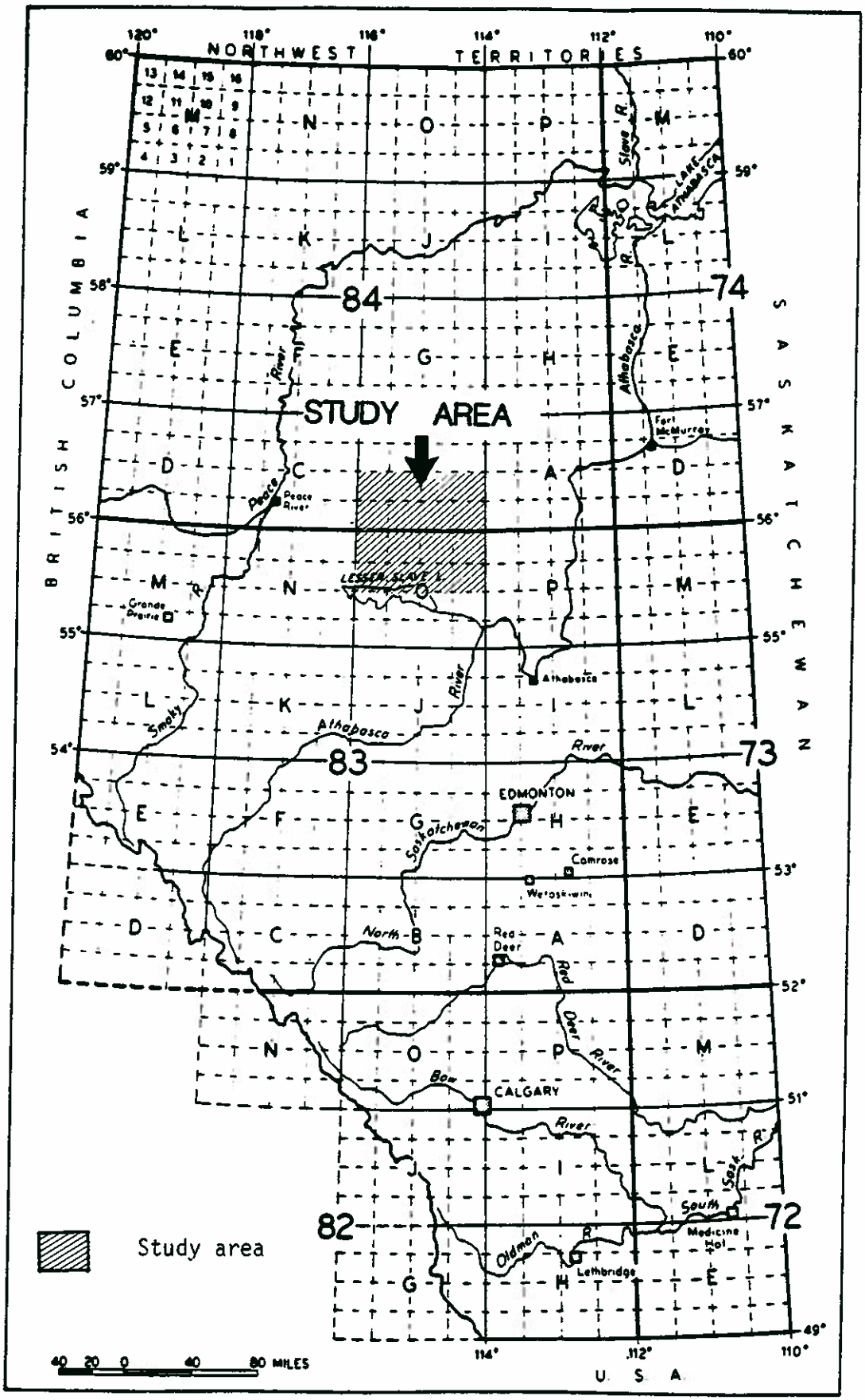

Figure 1 Location Map

Table 1. AGGREGATE INVENTORY MAPPING LEVELS

Format	Reconnaissance Study 5	Enhanced Reconnaissance Study 4	Regional Mapping 3	Detailed Mapping 2	Deposit Evaluation 1
Scale (Common)	1:250,000 (approx. 11x14 townships)	1:250,000 (approx. 11x14 townships)	1:50,000 (approx. 3x3 townships)	1:10,000	1:10,000 or larger
Mapping Methodology	Derived from existing surficial geology information. Aerial photograph interpretation.	Derived from existing surficial geology information. Aerial photograph interpretation. Some field traverses and site examination.	Aerial photograph interpreation. Field traverses. Site examinations. Selected deposit testing. Laboratory testing.	Sedimentological studies. Site examination. Deposit testing. Laboratory testing.	Test pitting on an established grid. Hole logging. Materials analysis.
Uses	Broad scale planning. Preliminary aggregate exploration.	Broad scale planning. Preliminary aggregate exploration. Preliminary resource assessment.	Land use planning. Resource management. Resource estimates.	Land management. Reserve estimates. Deposit management.	Deposit evaluation. Development plan preparation.
Comments	Only potential areas suitable for finding deposits shown.	Potential areas suitable for finding deposits are shown. Some deposits are examined.	Estimates deposit boundaries and gives quality and quantity estimations.	Establishes deposit boundaries. Refines quantity/ quality information.	Precise quality and quantity estimates. Deposit variations identified.
	Fairly quick and inexpensive to produce.	A map will take 6 months to a year to produce.	A map may take 8 months to a year to produce.	Fairly expensive survey.	Very expensive survey.
Output	2 map sheets per prof-year	1 map sheet per prof-year	2 to 3 map sheets prof-year	Special projects only.	Special projects only.

METHODS

The study was initiated with the review and compilation of existing information such as water well logs from Alberta Environment Department and data provided by the Alberta Transportation Department. A preliminary surficial geology map was produced by L.D. Andriashek of the Terrain Science Department of the Alberta Research Council prior to field investigation. Additional air photo interpretation of the area was performed by the principal investigators. A number of sites were identified within the map areas as possible locations for sampling or for site descriptions during the field component of the study.

Field work was conducted between the months of June and September, 1985 by truck, three-wheeled motorcycles and helicopter. Access to normal vehicle traffic is very limited. All the most important geological features were located and sampled. Limited geophysical surveying (EM31) was conducted. Whenever possible, samples were taken for later laboratory analysis. Bulk samples were taken from major deposits. These samples were brought back for grain size, petrographic and physical analysis. A limited number of geophysical traverses using a Geonics EM31 were made to detect buried granular material.

This report is based mainly on surface geological observation, limited field checking and limited laboratory data.

GEOLOGY

Physiography and Bedrock

Major physiographic features (Pettipiece, 1984) within the study area are the Loon Lake Plain and Peerless Lake upland in the north, the Wabasca Plain in the east, the Heart River upland in the west, the Utikuma Plain located centrally and the High Prairie Plain and Pelican Mountains in the south.

The study area ranges in elevation from 1,000 m above sea level on

Marten Mountain to 550 m in the Loon Lake Plain and Wabasca Plain areas. Most of the area is heavily forested and swampy.

Bedrock is of Cretaceous age (Green, 1972). The southern part of the study area is underlain by the Wapiti Formation that consists mainly of gray, feldspathic, clayey sandstones. The major bedrock unit in the central and northern portion of the study area is the Smoky Group, which consists of marine shale. The northwest corner of the area is underlain by shale of the Shaftesbury Formation.

Surficial Geology

No detailed studies are available on the surficial geology of the study area. The description of surficial material is based on a preliminary surficial geology map, some detailed air photo interpretation and field ground checks, combined with water well and Alberta Transportation data.

Glaciation, the latest major geological event throughout this area, was followed by a period of erosion and deposition which determined the general contour of much of the present surface. During glacial events in Pleistocene time, abundant unconsolidated material was deposited. The predominant surficial material is till in the form of ground and hummocky disintegration moraine. Ground moraine is present primarily on topographic highs. Hummocky disintegration moraine, characterized by knob and kettle topography, is present in the northwest corner of the map area. The till, a mixture of clay, silt, sand and gravel, is composed mainly of material derived from the local bedrock but other material from as far away as the Precambrian Shield also is present. Glacial flutings in till in the northeast portion of the map area suggest dominant ice movement during glaciation was from northeast to southwest.

An extensive thin sheet of glaciolacustrine clays covers the lowlands, such as the Wabasca Lowland near the northeast corner of the map area. Glaciolacustrine deposits are composed mainly of silt and clayey silt. Very fine sand also is present locally. In most of the area,

glaciolacustrine sediments overlie till.

Ice contact features such as kames and eskers are located approximately 15 km northwest of Utikuma Lake.

Eolian sands, probably derived from local surficial material, cover extensive areas east of Muskwa Lake.

Glaciofluvial deposits generally are widespread. Sand and gravel materials are associated with meltwater channels and outwash.

Raised beaches are common along Lesser Slave Lake and Ulikuma Lake. No recent alluvium deposits of aggregate quality are associated with the present river system in the area.

SAND AND GRAVEL RESOURCES

Gravel and sand deposits in the area are variable. Their composition and origin vary widely and they are distributed unevenly: some deposits are very extensive, others are only scattered, small bodies of gravel, and some are just a thin sheet of sand.

Locations of sand and gravel deposits are shown in figure 2 (in pocket). All pit locations and sample sites are plotted in figure 2. Deposit descriptions are in Appendix 1 and EM31 stations and helicopter ground check sites are on file at the Alberta Research Council. Deposits with potential require further investigation and this is noted in the descriptions in Appendix 1.

The gravel and sand bearing deposits are classified on the basis of origin into the four major types listed below:

1. Preglacial alluvial deposits;
2. Glaciofluvial deposits;
3. Glaciolacustrine deposits;
4. Recent deposits.

1. Preglacial Alluvial Deposits

Most of the preglacial gravel is situated at elevations above 1,000 m (3,000 ft) above sea level. At present, this material is not being exploited but could become a major potential gravel source in the future. Overburden varies from place to place. Near Marten Mountain Tower, overburden thickness is less than 0.5 m. Near Pelican Tower (just outside the eastern boundary of the study area) more than 1.0 m of overburden is present. This gravel is high quality, fractured, quartite-rich and locally may exceed 25 m in thickness. It was deposited during preglacial time, most likely during the middle to late Tertiary period. The total amount of sand and gravel in these deposits may be extremely large (Figure 2). Further investigation is highly recommended.

2. Glaciofluvial Deposits

The glaciofluvial deposits are the most widespread within the study area (Figure 2) and are the major source of sand and gravel. Glaciofluvial deposits are by nature highly variable in composition and extent. The major rock components are igneous and metamorphic rocks from the Precambrian Shield, quartzite and local bedrock. Scattered lenses of oil sand transported from the Ft. McMurray area are a deleterious component. Major deposits along Highway 754 are largely depleted. Other major sand and gravel deposits are kame and esker features located southwest of Whitefish Tower and south of Utikuma Lake. Meltwater channels and outwash deposits are in the west and northeast portions of the study area (Figure 2).

3. Glaciolacustrine Deposits

A sandy beach deposit composed of clean, coarse sand, excellent for winter road purposes, is located along Highway 754 north of McMullen Lake.

4. Recent Deposits

There is no major drainage system within the study area. Most of the

present streams have deposits of only silty or sandy material with minor amounts of dirty gravel derived from local till.

Large areas of fine-grained sand dunes northeast of Muskwa Lake, were derived from wind-reworked glaciofluvial material as the glaciers melted and the glacial lake drained.

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APPENDIX 1
DEPOSIT DESCRIPTIONS

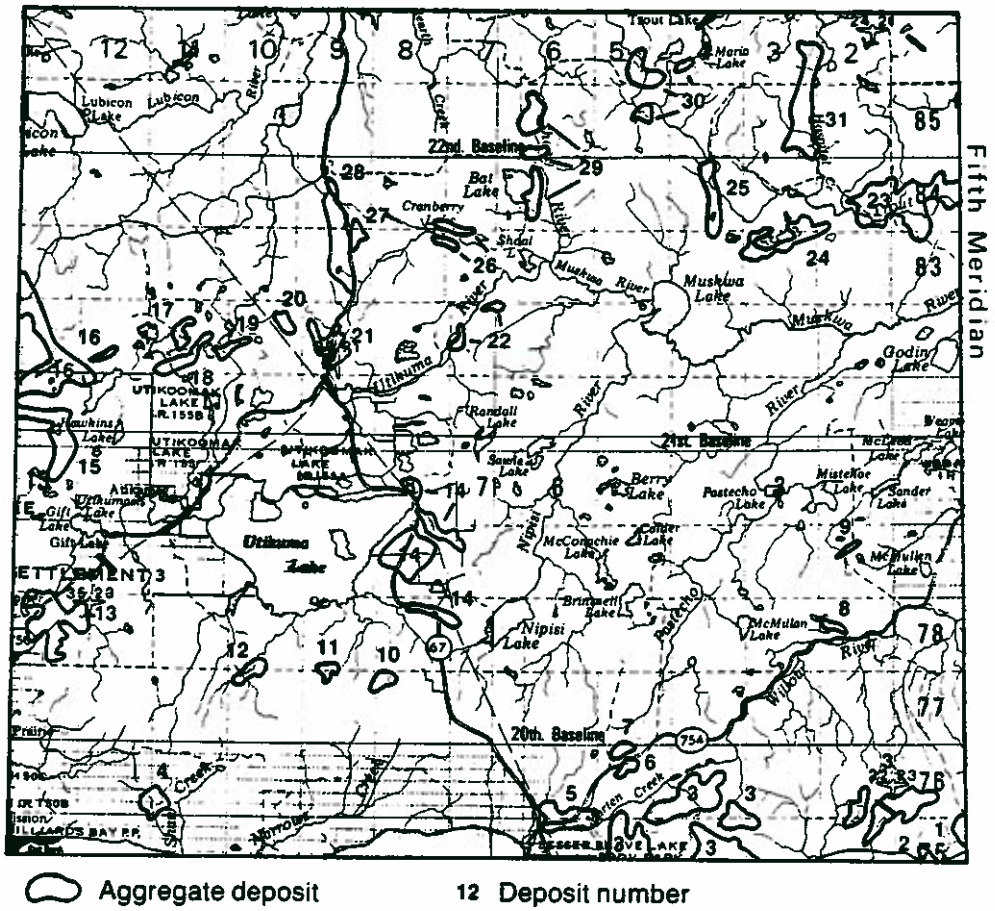


Figure 3. Deposit Location Map

LESSER SLAVE LAKE (NORTH HALF 830)

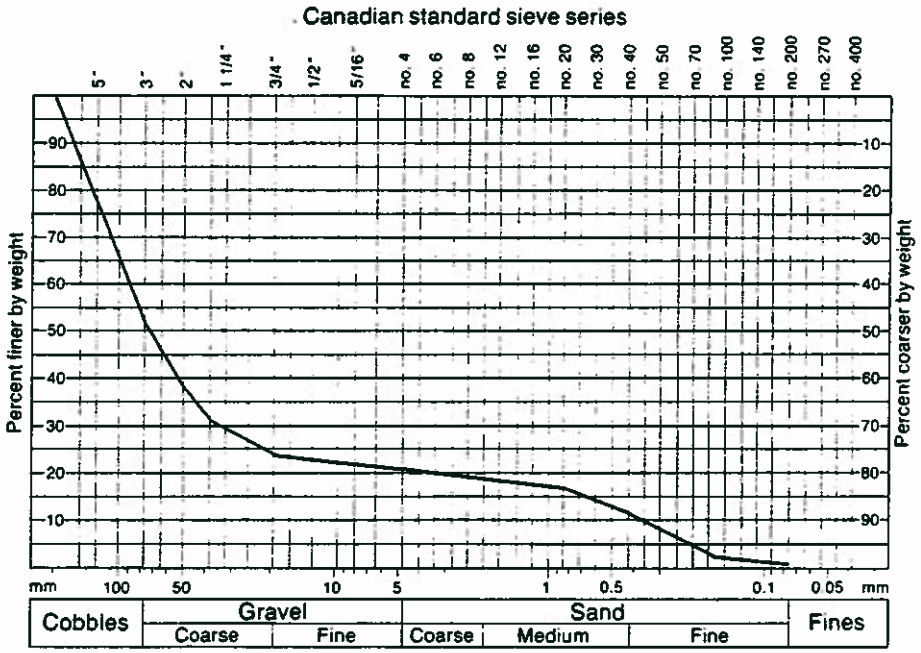
Deposit No. 1

Location: Sec. 25 & 36, Tp. 75, R 1, W5th Mer

Description: Field checked. Preglacial gravel, east of Pelican Mt. (east of eastern boundary of map area), fractured quartzite. Maximum clast to 20 cm, till overburden 1.0 - 2.0 m. Clean sand below gravel, very good access, potential gravel area, crushing required.

Gradation: 49% cobbles 30% gravel
20% sand 1% fines

Gradation curve



Remarks: Sample was taken outside study boundary, extension of Deposit No. 1.

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Deposit No. 2

Location: Sec 16 & 21, Tp 75, R 1, W5th Mer

Description: Field checked. Glaciofluvial ice contact, kame deposit, material very dirty, poorly sorted, boulders (to 20 cm) common, poor quality, good access.

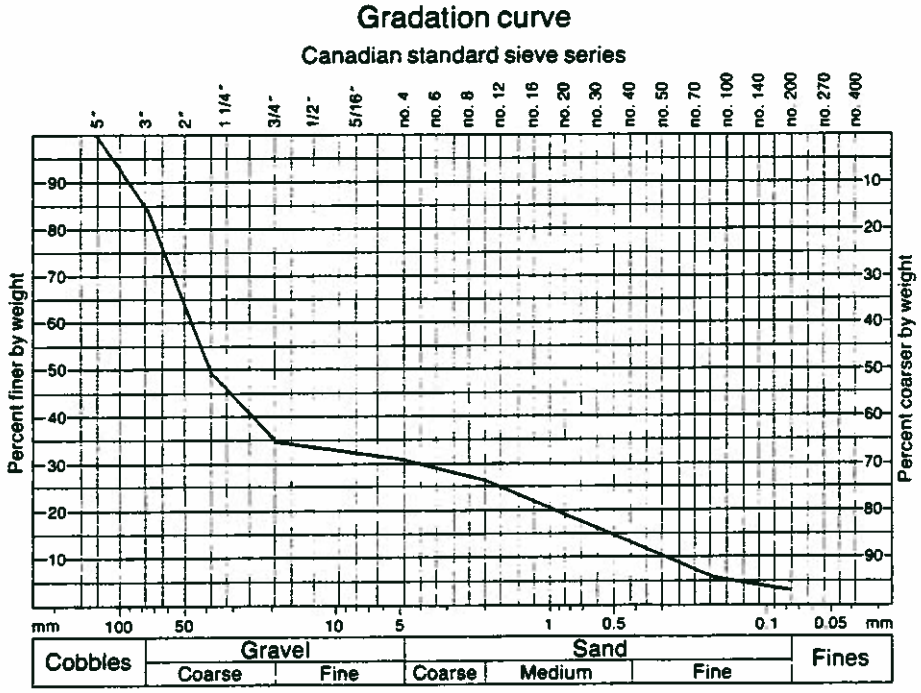
****

Deposit No. 3

Location: Tp 75 & 76, R 1 to 5, W5th Mer.

Description: Field checked (two locations). Marten Mt., preglacial gravel, potential gravel area, gravel located on higher elevation (>1,000 m), good access. Near Meridian Tower. Recommend further investigation.

Gradation: 15% cobbles 55% gravel
28% sand 2% fines



Remarks: Sample was taken outside of study boundary, extension of Deposit No. 3

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Deposit No. 4

Location: Sec 5 & 6, Tp 76, R 11, W5th Mer.

Description: Helicopter flyover. Glaciofluvial sand, limited data available, no access.

****

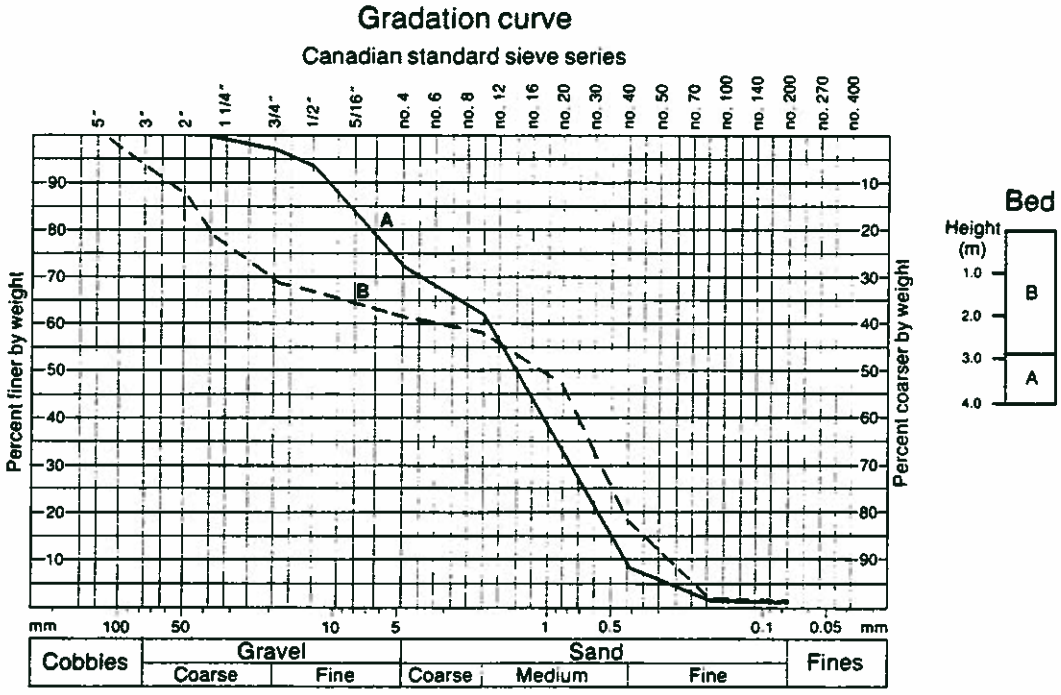
Deposit No. 5

Location: Tp 75 & 76, R 6, W5th Mer.

Description: Field checked. Glaciofluvial highly extracted area. Very good access.

Gradation:

(A)	-% cobbles	28% gravel
	71% sand	1% fines
(B)	7% cobbles	32% gravel
	60% sand	1% fines



Remarks: Samples were taken from NW corner of Deposit No. 5.

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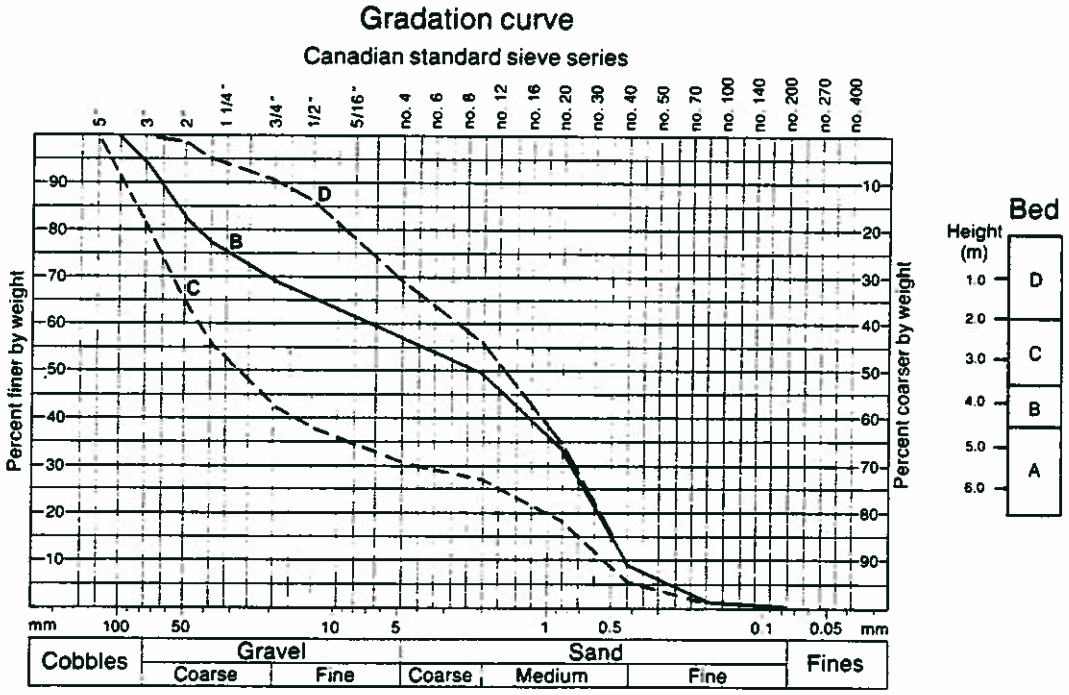
Deposit No. 5

Location: Tp 75 & 76, R 6, W5th Mer.

Description: Field checked. Glaciofluvial, highly extracted area but still a good gravel source. Layers and pockets of oil sand may lower the value of the material, very good access.

Gradation:

(B)	5% cobbles	38% gravel
	56% sand	1% fines
(C)	18% cobbles	51% gravel
	30% sand	<1% fines
(D)	-% cobbles	31% gravel
	68% sand	1% fines



Remarks: Different gradation in layers B,C and D within the same section. Samples were taken from south side of Deposit No. 5.

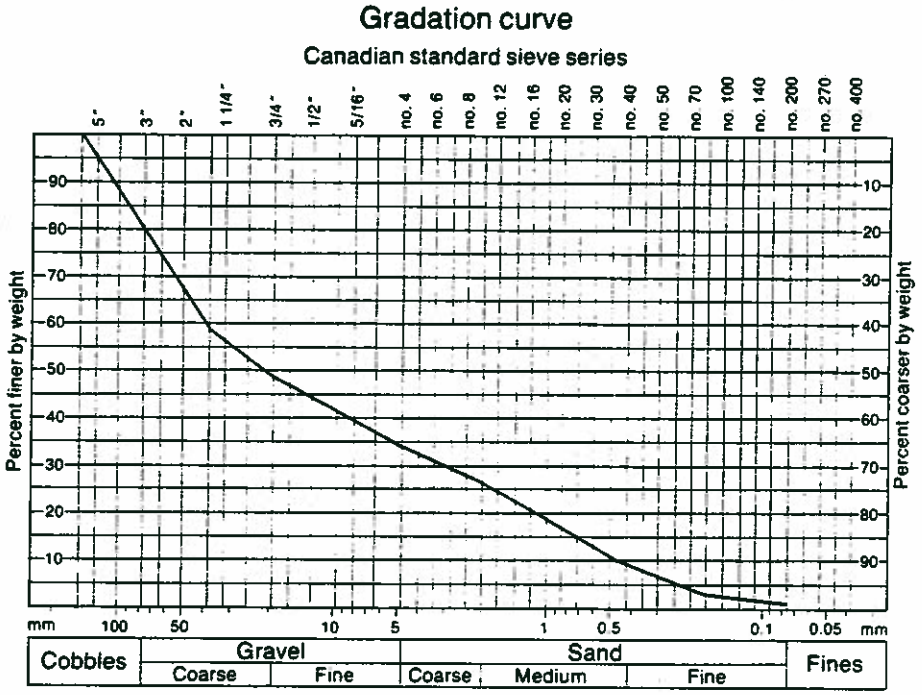
****

Deposit No. 6

Location: Sec 21,27 & 28, Tp 76, R 5, W5th Mer.

Description: Field checked. Glaciofluvial. Thin deposit (<2.5 m), high cobble content will require crushing, overburden <0.5 m, water table 2.0 m below surface. Potential gravel area, very good access.

Gradation: 20% cobbles 46% gravel
33% sand 1% fines



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Deposit No. 7

Location: Sec 34 & 35, Tp 76, R 5, W 5th Mer.

Description: Field checked. Similar to Deposit No. 6

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Deposit No. 8

Location: Sec 19,20,21,19 & 30, Tp 78, R 2, W5th Mer.

Description: Field checked. Glaciofluvial, ice contact, kame deposit. Hummocky area, reclaimed recently, may still contain gravel, good access.

****

Deposit No. 9

Location: Sec 16,17,21 & 22, Tp 79, R 2, W5th Mer.

Description: Field checked. Glaciolacustrine beach. Coarse clean sand, 0.5 - 1.0 m overburden, thickness 2.0 - 5.0 m, very good winter road sand, very good access.

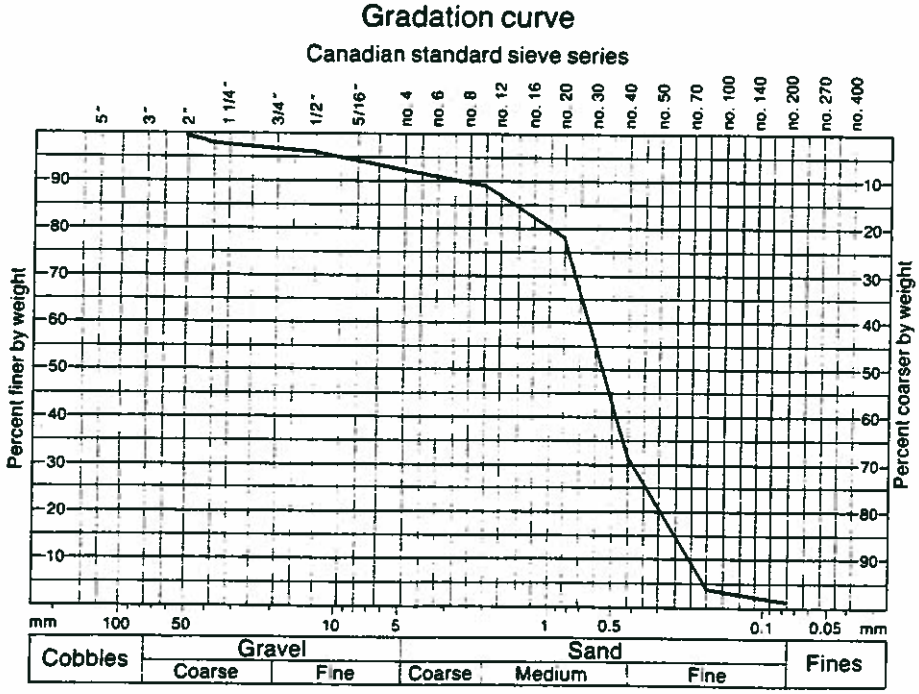
****

Deposit No. 10

Location: Sec 30 to 33, Tp 77, R 8, W5th Mer.

Description: Field checked. Glaciofluvial, ice contact, esker. Over 90% sand, deposit does not appear to be extensive, less than 2.0 m thick, poor access.

Gradation: -% cobbles 7% gravel
92% sand 1% fines



Deposit No. 11

Location: Sec 33, Tp 77, R 9, W5th Mer.
Sec 4 & 5, Tp 78, R 9, W5th Mer.

Description: Field checked. Glaciofluvial, sand with less than 5% gravel, poor access.

****

Deposit No. 12

Location: Sec 32 & 33, Tp 77, R 10, W5th Mer.
Sec 4, Tp 78, R 10, W5th Mer.

Description: Field checked. Glaciofluvial, clean fine sand with less than 5% gravel, 4.0- 5.0 m thick, poor access.

****

Deposit No. 13

Location: Tp 78, R 12 & 13, W5th Mer.

Description: Field checked. Glaciofluvial, clean sand to dirty sand, less than 5.0 m thick.

****

Deposit No. 14

Location: Tp 79 & 80, R 7 & 8, W5th Mer.

Description: Field checked (four locations). Glaciofluvial, thin, extensive deposit, over 95% dirty sand, generally high water table, low value.

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Deposit No. 15

Location: Tp 80 & 81, R 13, W5th Mer.

Description: Field checked. Glaciofluvial, clean sand. Helicopter access at present.

****

PEERLESS LAKE (SOUTH HALF 84B)

Deposit No. 16

Location: Tp 81 to 83, R 12 & 13, W5th Mer.

Description: Field checked (helicopter). Glaciofluvial, clean sand to dirty sand, poor access.

****

Deposit No. 17

Location: Sec 15,16,21 & 22, Tp 82, R 11, W5th Mer.

Description: Field checked. Glaciofluvial, sand, partially reworked by wind, less than 3% fine gravel, good access.

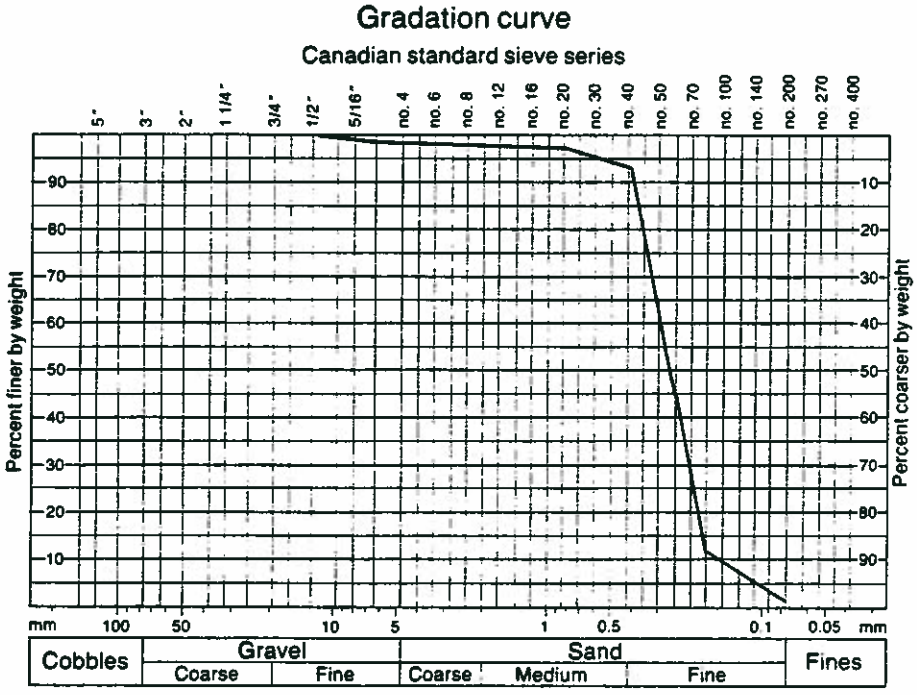
****

Deposit No. 18

Location: Sec 3,4,5,10,13,14 & 15, Tp 82, R 11, W5th Mer.

Description: Field checked. Glaciofluvial, ice contact, esker. Over 97% medium-fine sand, with less than 2% small clasts, fairly good access, potential sand area.

Gradation: -% cobbles 2% gravel
97% sand 1% fines

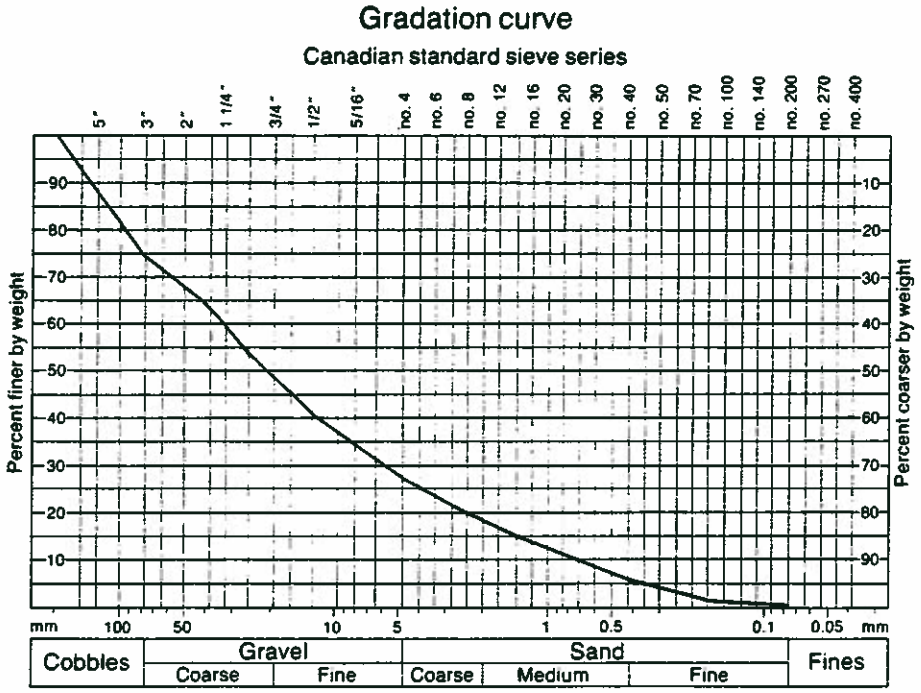


Deposit No. 19

Location: Sec 17,18,20,21 & 22, Tp 82, R 10, W5th Mer.
Sec 2,11 & 12, Tp 82, R 11, W5th Mer.

Description: Field checked. Glaciofluvial, ice contact, kame. Variable material (mostly sandy gravel), crushing may be necessary, good potential sand and gravel area, good access.

Gradation: 26% cobbles 48% gravel
25% sand 1% fines



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Deposit No. 20

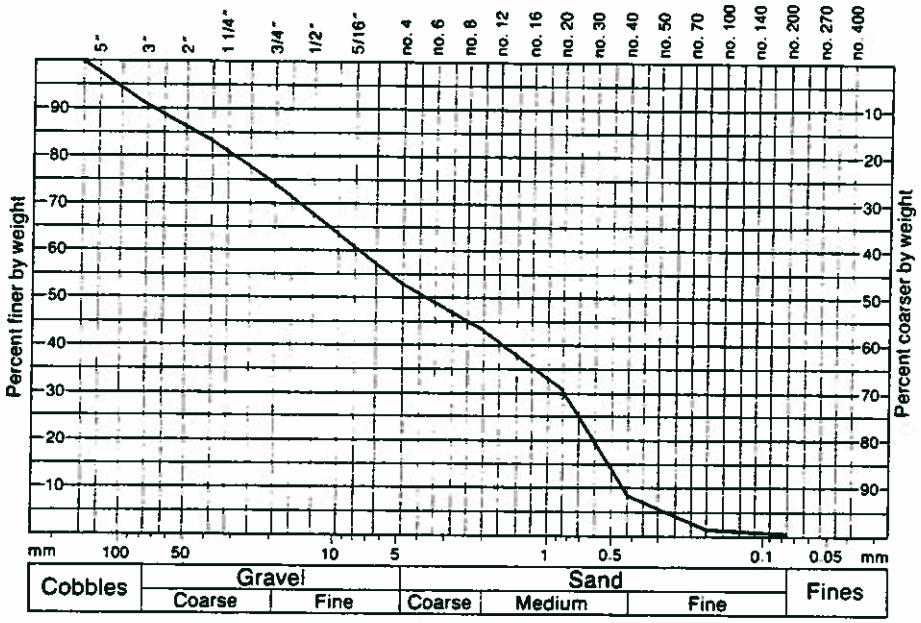
Location: Sec 26 & 35, TP 82, R 10, W5th Mer.

Description: Field checked. Glaciofluvial, ice contact, probably kame delta deposit. Material varies, interbedded sand and pea gravel with till lenses as contaminants, up to 10 m thick, thin overburden, good potential sand and gravel area, fairly good access.

Gradation: 9% cobbles 38% gravel
52% sand 1% fines

Gradation curve

Canadian standard sieve series



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Deposit No. 21
Location: Sec 4,9,10,15,16,20,21 & 23, Tp 82, R 9, W5th Mer.

Description: Field checked. Glaciofluvial, gravelly sand to sand. Generally less than 2.5 m thick, potential sand area, good access.

****

Deposit No. 22

Location: Sec 17,18,20,23,34 & 35, Tp 82, R 7, W5th Mer.

Description: Field checked. Glaciofluvial, terraces. Gravelly sand to sand, mostly sand, few clasts to 15 cm. Poor access, poor potential.

****

Deposit No. 23

Location: Tp 84, R 1 & 2, W5th Mer.

Description: Field checked (helicopter). Glaciofluvial, fine sand. No access.

****

Deposit No. 24

Location: Tp 83 & 84, R 2 & 3, W5th Mer.

Description: Helicopter flyover. Eolian, very open area. Potential sand, no access.

****

Deposit No. 25

Location: Tp 84, R 4, W5th Mer.

Description: Helicopter flyover. Probably thin sand, no access.

****

Deposit No. 26

Location: Sec 29 & 33, Tp 83, R 7, W5th Mer.

Description: Field checked (helicopter). Glaciofluvial, fine clean sand with a few angular pebbles. Potential for sand, no access.

****

Deposit No. 27

Location: Sec 36, Tp 83, R 9, W5th Mer.
Sec 2, Tp 84, R 9, W5th Mer.

Description: Helicopter flyover. Glaciofluvial, probably sand, poor access.

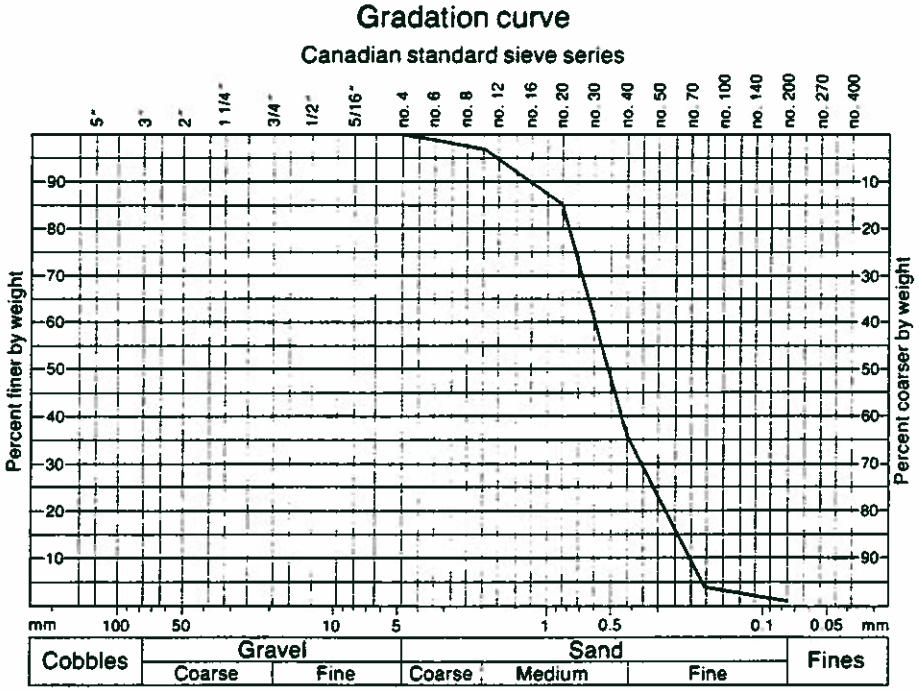
****

Deposit No. 28

Location: Sec 21 & 28, Tp 84, R 9, W5th Mer.

Description: Field checked. Glaciofluvial. Highly extracted area, reclaimed, medium to fine sand, very good access.

Gradation: -% cobbles -% gravel
99% sand 1% fines



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Deposit No. 29

Location: Tp 84 & 85, R 6, W5th Mer.

Description: Helicopter flyover. Glaciofluvial, probably sand. No access.

****

Deposit No. 30

Location: Tp 85 & 86, R 4 & 5, W5th Mer.

Description: Field checked. Glaciofluvial, terraces. Potential for sand and gravel. No access.

****

Deposit No. 31

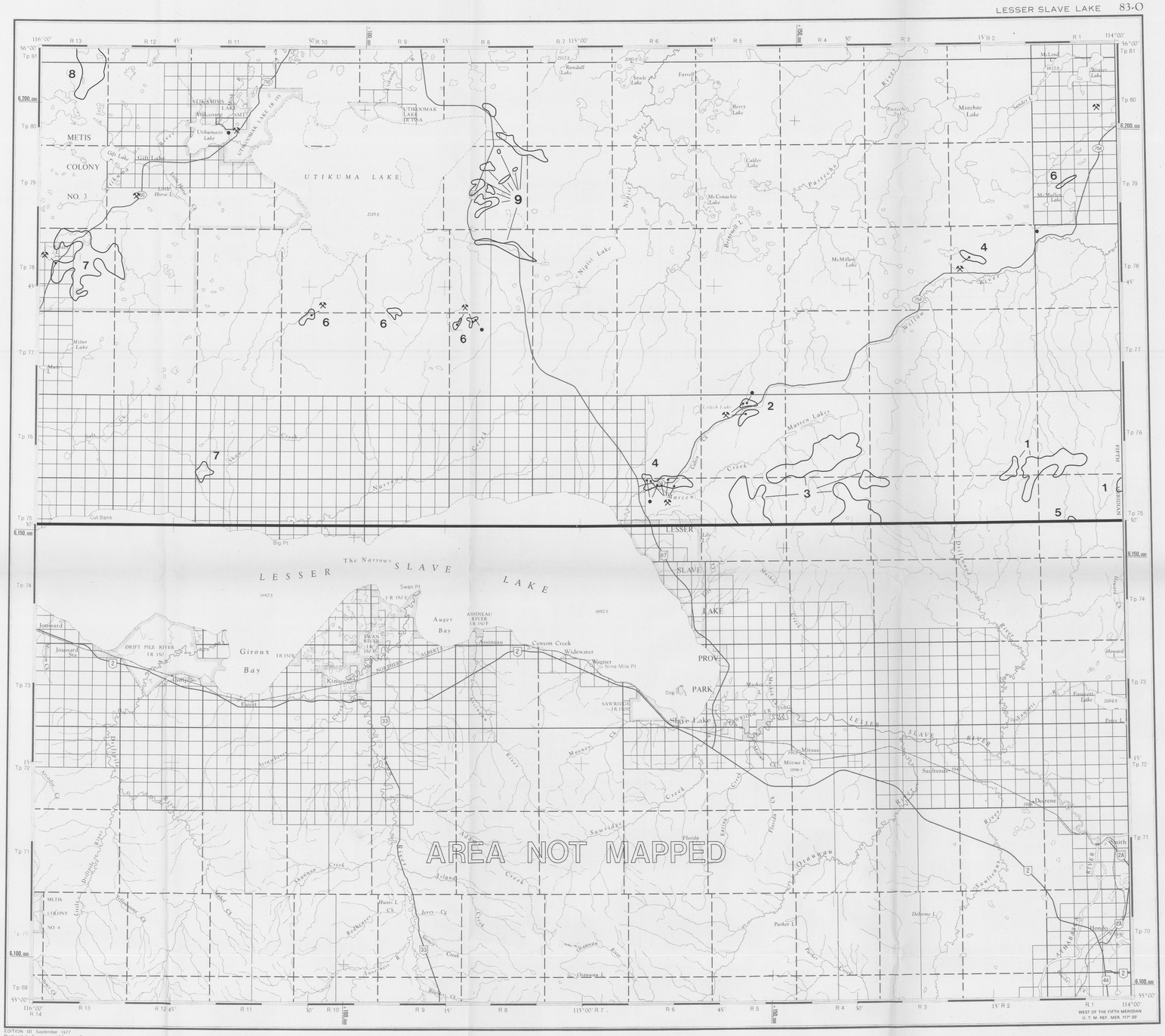
Location: Tp 85 & 86, R 2 & 3, W5th Mer.

Description: Helicopter flyover. Sand indicated at edges of swamp, no access.

****

83-O - Lesser Slave Lake

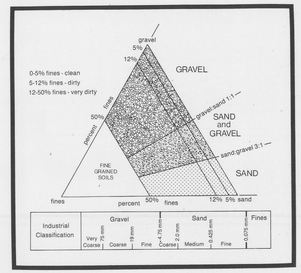
LESSER SLAVE LAKE 83-O



EDITION III September 1977
Produced by Surveys and Mapping Branch
Alberta Transportation Edmonton
Base maps in part by Surveys and Mapping Branch
Department of Energy Mines and Resources Ottawa

This reconnaissance-level, aggregate potential map is derived from published information, aerial photograph interpretation and limited field checking. As such, deposit outlines are assumed and material descriptions are either assumed or approximate. The sources of information used to produce this map are listed below and terms used in the legend are defined in the ternary diagram.

- 1 Gravel, coarse, clean
- 2 Gravel, coarse, dirty
- 3 Sand and gravel, clean
- 4 Sand and gravel, clean to dirty
- 5 Sand and gravel, dirty to very dirty
- 6 Sand, very coarse to medium grained, clean
- 7 Sand, very coarse to medium grained, dirty
- 8 Sand, fine grained, clean
- 9 Sand and gravel: thin, discontinuous, or inadequately known
- ▲ Pocket of sand and/or gravel
- ⚒ Pit, active or inactive
- ● Sample site
- //// Sand and gravel, buried
- **a** Thick (>1.5 m) and/or continuous
- **b** Thin (<1.5 m) and/or discontinuous



Published sources of information

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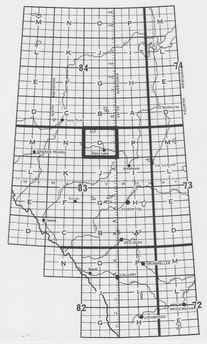
Other sources of information

1. Aerial photographs, 1983-84, AS2770, AS2790-2791, and AS3056-3058, Alberta Energy and Natural Resources.



Aggregate Resources

83O Lesser Slave Lake 1:250,000

D.W. Scafe, P.C. Sham
Field assistants: W. Buchan, H. Berhane

Published 1986
Geology and compilation 1985-86
Open file report 1986-5

This sand and gravel resource map was prepared by the Alberta Geological Survey as part of an ongoing aggregate inventory of Alberta. This information shown on this map is intended for general land-use planning, land management and aggregate exploration until such time as more detailed maps or reports are available for the area.

Cartography by Alberta Research Council

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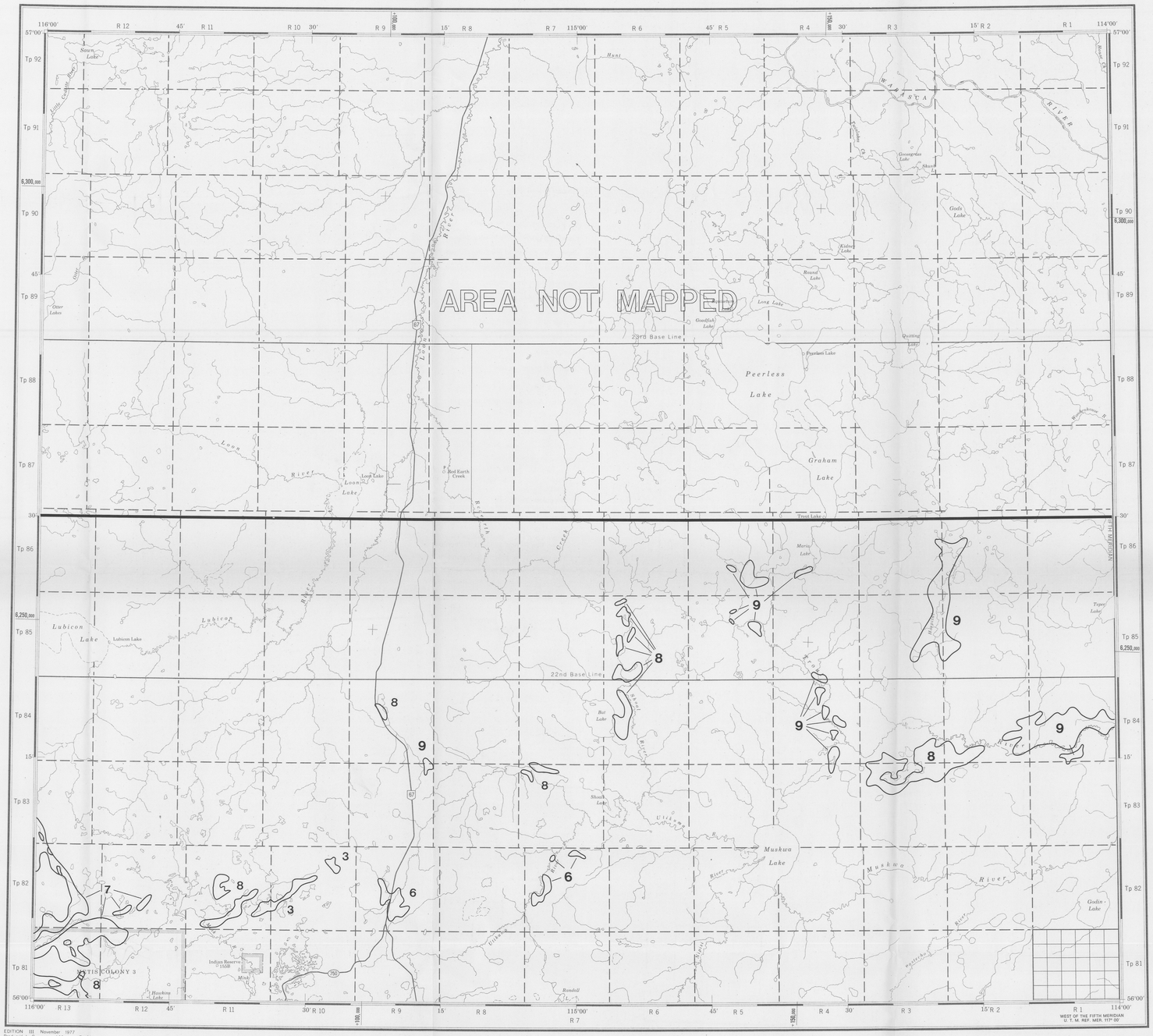
Natural Resources Division
Alberta Geological Survey

84B- Peerless Lake

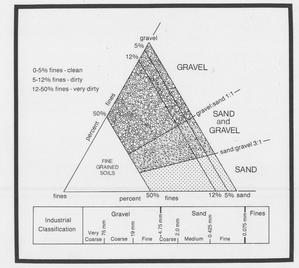
PEERLESS LAKE 84 B



EDITION III November 1977
Produced by Surveys and Mapping Branch, Alberta Transportation, Edmonton
Base maps, in part, by Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa

This reconnaissance-level, aggregate potential map is derived from published information, aerial photograph interpretation and limited field checking. As such, deposit outlines are assumed and material descriptions are either assumed or approximate. The sources of information used to produce this map are listed below and terms used in the legend are defined in the ternary diagram.

- 1 Gravel, coarse, clean
- 2 Gravel, coarse, dirty
- 3 Sand and gravel, clean
- 4 Sand and gravel, clean to dirty
- 5 Sand and gravel, dirty to very dirty
- 6 Sand, very coarse to medium grained, clean
- 7 Sand, very coarse to medium grained, dirty
- 8 Sand, fine grained, clean
- 9 Sand and gravel: thin, discontinuous, or inadequately known
- ▲ Pocket of sand and/or gravel
- ⚒ Pit, active or inactive
- ● Sample site
- //// Sand and gravel, buried
- **a** Thick (>1.5 m) and/or continuous
- **b** Thin (<1.5 m) and/or discontinuous



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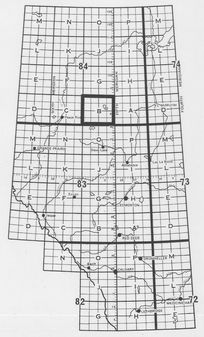

Aggregate Resources

84B Peerless Lake 1:250,000

D.W. Scafe, P.C. Sham
Field assistants: W. Buchan, H. Berhane

Published 1986
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