Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 62

KABINAKAGAMI LAKE AREA

(NTS 42C/NE)

District of Algoma

by

John F. Gartner and D.F. McQuay

1980

Ontario

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John F. Gartner[1] and D.F. McQuay[2]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the Kabinakagami Lake area, District of Algoma. The area, which covers NTS block 42C/NE, lies between Latitudes 48°30'N and 49°00'N and Longitudes 84°00'W and 85°00'W. This report forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5095, accompanying this report).

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[1]Consulting Engineering Geologist, Gartner Lee Associates Limited, Markham, Ontario.

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Manuscript approved for publication by the Chief, Engineering and Terrain Geology Section, October 19, 1979. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

Interpretation of existing black and white aerial photographs, at scales of approximately 1:54 000, was the primary method of obtaining this terrain information. The interpretation was checked with published and unpublished literature which documented previous field visits and observations. During the summer of 1978, roads in the area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common format for the entire map series. This legend is shown on the accompanying Data Base Map. Further information of the mapping techniques, legend format, and possible uses of the terrain data is available in the "Ontario Engineering Geology Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

Much of the terrain in the Kabinakagami Lake area is bedrock-controlled. This rock terrain is moderately to severely rugged and is composed of Early Precambrian felsic igneous and metamorphic rocks (e.g. granite and gneiss) and metavolcanics (e.g. mafic lavas). Overburden generally forms only a thin, discontinuous mantle over the bedrock, except in the northeastern and northwestern parts of the map-area, where Quaternary sediments cover much of the land surface.

A band of mafic metavolcanics crosses the area diagonally, from Doucett Township in the southwest through Kabinakagami Lake to Hawkins Township in the northeast. The remainder of the area is underlain by undifferentiated felsic igneous and metamorphic rocks. A number of northwest- and northeast-trending Middle to Late Precambrian diabase dikes cut al! other rock types in the area. A major northeast-trending fault extends from Esnagi Lake in the south-central part of the area to the northeast corner (Ayres *et al.* 1971; Milne *et al.* 1972).

The part of the metavolcanic belt extending from Nameigos Lake northeast to Cameron Lake has medium mineral potential, particularly for base metals, gold, and silver, while the remainder of the belt has medium to "least" potential. The mineral potential of the felsic intrusive and metamorphic rocks is "least" to "unknown" (Springer 1977).

2.2 QUATERNARY:

The Laurentide ice sheet advanced from the north-northeast, depositing a generally thin mantle of stony, sandy till over the bedrock. This till is seldom more than 1 m thick on the crests of the hills, but can thicken to 5 m or more on the flanks and in the valleys between the bedrock hills.

Once deglaciation began, the ice front retreated rapidly to the north-northeast. At present, there is no evidence of the ice front having halted in this area during its recession. Glaciofluvial processes, active during the deglaciation, left a number of Quaternary deposits. These deposits mark the locations of ancient spillways and esker trains, and are shown in yellow on the Data Base Map (OGS Map 5095, accompanying this report).

During the final stage of deglaciation, the northern part of the map-area was inundated by the waters of Glacial Lake Barlow-Ojibway. Glaciolacustrine sediments, consisting of clay, silt, and sand, are most common in the northeastern part of the area.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK:

3.1.1 Description:

Bedrock knob (RN) terrain is the dominant unit in the southern and north-central portions of the Kabinakagami Lake area. A typical map symbol is

$$\frac{\text{RN(tMG/R,pOT)}}{\text{Hnj-D}}$$

This indicates that rock knobs are the dominant landform. Relief is high (often greater than 60 m) and the terrain is knobby, rugged, and dry. The flanks of these bedrock hills and the valleys between them are often occupied by deposits of ground moraine of varying thicknesses forming a mantle over the bedrock, and by organic terrain. Siragusa (1977a) observed a 2.4 to 3.6 m thick deposit of till on the southeast shore of Kabinakagami Lake. This probably represents a local thickening of the subordinate till unit.

Rock knobs also occur as subordinate landforms in many of the other terrain units. Thus, bedrock controls much of the terrain throughout the map-area, a situation which is significant from an engineering viewpoint.

3.1.2 Significance:

RESOURCES: Portions of the rock can be used for crushed stone purposes, but detailed evaluations of suitability for aggregate use would be required. Ground water resources within the rock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has only poor to fair potential for ground water supplies.

GENERAL CONSTRUCTION: The major constraint in terms of construction is the presence of massive, irregular and complexly sloping bedrock outcrops and large boulders on the ground surface. This means that, in most instances, below-ground excavations will require blasting. Site-grading will be expensive and rock fills will be necessary in grading works. Footing conditions for supporting foundations should be excellent on the bedrock, but route alignments will require rock cut-and-fill operations.

Because of the shallow drift cover and complex bedrock slopes, development activities are more difficult, and hence more expensive, than in areas of thicker overburden. Construction will be extremely difficult in those areas of high, sheer rock cliffs and steep bedrock hills. Also, land management for any development would be complex. The variable and steep rock slopes, combined with the shallow overburden, will make the terrain sensitive to surface erosion, especially when cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is not amenable, in its natural state, to the disposal of waste, whether it be garbage, septic tank effluent or industrial liquid waste. Development of lagoons or tile fields would require extensive grading of rock materials and importation of suitable soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and the impact on surface drainage courses could be significant.

3.2 MORAINAL LANDFORMS:

3.2.1 Description:

Ground moraine (MG) occurs mainly as a subordinate landform in conjunction with the bedrock knob terrain, as previously discussed. There are only two small areas where the airphoto interpretation indicates that the glacial till reaches a sufficient thickness to warrant classification as a dominant unit.

Ground moraine is the dominant landform in two small patches, both less than 3 km^2 in area, located in central Bayfield Township in the northwest corner of the area and in southeastern Martin Township near the area's eastern boundary. Both of these small deposits are represented by the symbol:

$$\frac{\text{tMG/R(RN,pOT)}}{\text{Lpu-M}}$$

This indicates a stony, silty sand till, possibly reaching thicknesses of a few metres over the bedrock, associated with subordinate amounts of bedrock knobs and organic terrain.

A sample of till, taken in Beaton Township, consisted of 76% sand, 22% silt, and 2% clay. The exposure was stony and bouldery, but only the matrix of the till was tested in the laboratory.

Thus, ground moraine by itself is clearly not a significant deposit within this map-area. It attains importance only locally, where it forms a thicker mantle over the bedrock, such as on the flanks of hills and in the valleys between them.

3.2.2 Significance:

The engineering and resource significance of the ground moraine deposits is not particularly great in this area, since they are generally thin and not extensive.

From a resource viewpoint, there is a lack of mineral aggregate materials in this unit, and ground water supplies could be difficult to locate.

Bearing capacities are probably adequate, but excavations may have to contend with bouldery materials, and even bedrock where the drift is thin.

Ground moraine often provides good sites for septic systems, landfills, and lagoons. However, detailed studies on depth of till, slope, and drainage are required prior to development of such facilities.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Glaciofluvial outwash (GO) deposits cover about 10 percent of the Kabinakagami Lake area. These deposits usually occur as the dominant landform within complex terrain units. The outwash is predominantly sandy and occurs in association with eskers, ground moraine, and as a veneer over bedrock. Rock knobs and organic terrain are often found as subordinate landforms within the units.

There are two small outwash deposits, located in Mosambik Township and Carney Township in the central part of the area, that consist of gravelly sand. They appear to be deeper and less complex in stratigraphy than the other glaciofluvial deposits in the map-area and are represented by the symbol:

$$\frac{\text{sgGO}}{\text{Lpk-D}}$$

This indicates a sand and gravel outwash plain of low relief that is kettled and dry on surface.

Typical symbols depicting the more complex terrain units are:

$$\frac{\text{sGO,sgGE(RN,pOT)}}{\text{Lupk-D(M)}} \qquad \frac{\text{sGO/R(pOT,RN)}}{\text{Lpu-Mh}}$$

In both of these examples, the outwash is sandy in texture, although it may contain some gravel components. In the first case, eskers share the position of dominant landform, and rock knobs and isolated organic deposits can be expected as subordinate landforms. In the second case, the outwash forms a thin mantle over the bedrock and again there are subordinate amounts of small organic deposits and isolated bedrock knobs. In both examples, the relief is low and the topography is planar to undulating. Drainage is either mixed or dry, and there may be a high water table.

With this complexity of landforms and stratigraphy, the potential of these glaciolacustrine units as sources of aggregate is rated as only fair.

In some areas, sand dunes (ED) are mapped as a subordinate landform. For example, a terrain unit in Nameigos Township, in the western part of the area, has been mapped as:

$$\frac{\text{sgGO/R(RN,pOT,ED)}}{\text{Lupd-M}}$$

Eskers (GE, >>>>>>>>>>>) generally trend in a south-southwesterly direction. The largest of these extends from Derry Township, near the northern margin of the area, southward for a distance of nearly 23 km into Ermine Township. The esker ridge in this unit is generally less than 15 m in height and the topography is knobby and kettled. Bedrock is close to the surface and rock knobs are a common subordinate landform. The unit is generally represented by the symbol:

$$\frac{\text{sgGE/R(RN,pOT)}}{\text{Lnk-D(M)}}$$

Most of the eskers mapped consist of sand and gravel. Although sand is the dominant material, the eskers generally contain sufficient gravel to have potential as sources of aggregate.

3.3.2 Significance:

RESOURCES: The glaciofluvial landforms have potential as sources of sand and gravel. However, this potential has only local significance, since the material is often too sandy in texture and many of the deposits form only a thin mantle over the bedrock.

The best potential occurs in 1) the esker ridges that are represented by the chevron symbol (>>>>) on the Data Base Map (OGS Map 5095, accompanying this report), 2) an outwash-esker complex in Bayfield Township in the northwest corner of the map-area, and 3) in two flat, sand to gravel outwash deposits in Carnie Township and adjacent Mosambik Township, in the central part of the area. Ministry of Transportation and Communications records indicate the existence of eight pits along Highway 631 that provide both Granular C and crushable materials. These pits probably supplied material for the construction and maintenance of this highway, but none of them are large. Access to any of the other deposits within the map-area is poor.

The potential for ground water supplies within these glaciofluvial landforms is rated as only fair, since most of the deposits are thin and small in surface area.

GENERAL CONSTRUCTION: Most of the glaciofluvial landforms are part of complex terrain units and have subordinate amounts of ground moraine, bedrock knobs, and organic terrain associated with them. Because of this variability, construction conditions will also be variable. However, where deep deposits of sand and gravel occur, construction conditions should be good. The material will have acceptable handling qualities for general grading operations. Construction of foundations should present few problems. Excavations in these deposits may encounter variable conditions in some areas, but where the deposit is deep, they should be relatively free from serious difficulties. Problems can be expected where bedrock is close to surface, where ground water levels are high, and where organic landforms are present. Site-specific investigations are necessary prior to the start of all engineering activity.

WASTE DISPOSAL: Because of the permeable nature of these soils and the possibility of bedrock being close to surface, the disposal of liquid and solid wastes must be approached with considerable caution. There is the potential for contaminant flow within the ground water system. On the other hand, septic systems, if properly designed, should function satisfactorily. However, raised tile fields may be necessary in areas of high water table. Detailed hydrogeological investigations are recommended prior to design and construction of any waste disposal facility.

3.4 GLACIOLACUSTRINE LANDFORMS:

3.4.1 Description:

Glaciolacustrine plains (LP) occur in scattered pockets throughout the northern half of the Kabinakagami Lake area. These are remnants of the sediments that were deposited in Glacial Lake Barlow-Ojibway between 8 000 and 9 000 years ago.

These deposits are typically variable and complex. A stratigraphic section might comprise, from bottom to top: bedrock, a variable stratum of till, glaciolacustrine silt and clay, and occasionally stratified fine sand and silt. The full sequence occurs in some areas, while only portions of it are present in others. This results in a very complicated map-unit which reflects a complex geologic origin. A sample of surficial silt, taken along Highway 631 in the northwestern part of the map-area, contained 6% sand, 90 % silt, and 4% clay. Typical map symbols depicting this terrain unit are:

$$\frac{\text{msLP,tMG/R(pOT,RN)}}{\text{Lpu-Mh}} \qquad \frac{\text{sLP,pOT/R(RN)}}{\text{Lpu-Mh}} \qquad \frac{\text{smLP/R(tMG,RN)}}{\text{Lp-D}}$$

In all of these examples, the glaciolacustrine plain is composed of silt and sand (smLP) and shares the position of dominant landform with either organic terrain or ground moraine. In all cases, the Quaternary deposits occur as a thin mantle over the bedrock. Relief is low, topography is level to undulating, and surface drainage is generally mixed, with some areas of high water table.

From the above description, it is evident that the unit is complex and will have a variable significance from an engineering viewpoint.

3.4.2 Significance:

RESOURCES: These glaciolacustrine sediments have little resource potential with respect to sand and gravel. Ground water resources are generally scarce because of the impermeable nature of the soils and the fact that the deposits are generally too thin.

GENERAL CONSTRUCTION: Because the glaciolacustrine soils are basically fine grained, with high percentages of both silt and clay, construction conditions within the unit are far from ideal. The variability and complexity of the stratigraphy also introduces a number of construction problems. The following conditions might occur, under certain circumstances:

1) Slope instability where deep deposits of silt and clay are encountered along river banks or on man-made cuts;

2) Erosion and gullying on exposed slopes, with resulting siltation of drainage courses;

3) Difficulties in earth movement operations and subsequent compaction of fills where silt and clay are the dominant materials and where surface drainage conditions are poor, especially during wet weather;

4) Low bearing strength for footings and foundations where fine-grained soils are deep;

5) Frost susceptible soils which could affect pavement design and backfill operations;

6) Where the sediments form only a thin veneer over bedrock, excavation will be difficult and blasting may be required in deep cuts.

WASTE DISPOSAL: Septic tile field designs must contend with impermeable soils and poor drainage conditions. These problems will be less severe in areas where adequate thicknesses of sand overlie the silt and clay. Solid waste disposal facilities may lack suitable fill materials and care must be taken to protect surface waters from contamination. It would be necessary to investigate, in detail, the stratigraphic sequences and ground water regimes at depth. The disposal of liquid waste in lagoons is possible, but construction could be complicated by the existence of surface sand and poorly drained silty soil.

3.5 ORGANIC TERRAIN:

3.5.1 Description:

Organic terrain (OT) occurs either as a simple terrain unit, as shown by the symbol:

$$\frac{\text{pOT}}{\text{Lp-W}}$$

or in conjunction with lacustrine deposits, as denoted by:

$$\frac{\text{pOT,smLP(AP,RN)}}{\text{Lp-W}}$$

In both cases, the organic terrain is the landform of significance from an engineering viewpoint. The unit has poor drainage, high water tables, and compressible materials with very poor engineering characteristics.

3.5.2 Significance:

From an engineering viewpoint, organic terrain is generally not suitable for most types of development. Compressible soils, high ground water tables, and poor surface drainage place severe constraints on any type of activity. If possible, these landforms should be avoided as development sites.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceding section described the characteristics of the major landform types and the engineering and resource significance of these units. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions. Also, it must be realized that there are a number of conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

TABLE 1 SUMMARY OF ENGINEERING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL		GLACIOLACUSTRINE	ORGANIC
		RN(tMG,pOT)	tMG/R(RN,pOT)	sGO/R(pOT,RN)	sgGE/R	smLP/R(tMG,RN)	pOT
RESOURCE POTENTIAL	Sand & Gravel	Poor	Poor	Fair	Good	Poor	N/A
	Ground Water	Fair to Poor	Poor	Fair	Fair	Poor	Very Poor
	Excavation	Blasting	Fair to Poor	Fair	Fair	Fair	Poor
CONSTRUCTION CONDITIONS	Foundation	Excellent	Good	Good	Good	Fair to Poor	Very Poor
	Grading	Difficult	Fair to Poor	Fair	Good	Poor	Very Poor
	Material Re-Use	Rock Fill	Fair to Good	Good	Good	Poor	Very Poor
WASTE DISPOSAL SUITABILITY	Septic Systems	Very Poor	Fair to Good	Fair to Good	Fair	Fair to Poor	Very Poor
	Landfill	Poor	Fair	Fair	Fair	Fair	Very Poor
	Lagoons	Very Poor	Fair	Fair	Fair	Fair	Very Poor

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Strip Map Index, Materials and Testing Division, Contract No.

70-208	Highway 631
70-215	Highway 631
70-317	Highway 631
70-303	Highway 631

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3.1.2 Significance:

RESOURCES: Portions of the rock can be used for crushed stone purposes, but detailed evaluations of suitability for aggregate use would be required. Ground water resources within the rock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has only poor to fair potential for ground water supplies.

GENERAL CONSTRUCTION: The major constraint in terms of construction is the presence of massive, irregular and complexly sloping bedrock outcrops and large boulders on the ground surface. This means that, in most instances, below-ground excavations will require blasting. Site-grading will be expensive and rock fills will be necessary in grading works. Footing conditions for supporting foundations should be excellent on the bedrock, but route alignments will require rock cut-and-fill operations.

Because of the shallow drift cover and complex bedrock slopes, development activities are more difficult, and hence more expensive, than in areas of thicker overburden. Construction will be extremely difficult in those areas of high, sheer rock cliffs and steep bedrock hills. Also, land management for any development would be complex. The variable and steep rock slopes, combined with the shallow overburden, will make the terrain sensitive to surface erosion, especially when cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is not amenable, in its natural state, to the disposal of waste, whether it be garbage, septic tank effluent or industrial liquid waste. Development of lagoons or tile fields would require extensive grading of rock materials and importation of suitable soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and the impact on surface drainage courses could be significant.

3.2 MORAINAL LANDFORMS:

3.2.1 Description:

Ground moraine (MG) occurs mainly as a subordinate landform in conjunction with the bedrock knob terrain, as previously discussed. There are only two small areas where the airphoto interpretation indicates that the glacial till reaches a sufficient thickness to warrant classification as a dominant unit.

Ground moraine is the dominant landform in two small patches, both less than 3 km^2 in area, located in central Bayfield Township in the northwest corner of the area and in southeastern Martin Township near the area's eastern boundary. Both of these small deposits are represented by the symbol:

$$\frac{\text{tMG/R(RN,pOT)}}{\text{Lpu-M}}$$

This indicates a stony, silty sand till, possibly reaching thicknesses of a few metres over the bedrock, associated with subordinate amounts of bedrock knobs and organic terrain.

A sample of till, taken in Beaton Township, consisted of 76% sand, 22% silt, and 2% clay. The exposure was stony and bouldery, but only the matrix of the till was tested in the laboratory.

Thus, ground moraine by itself is clearly not a significant deposit within this map-area. It attains importance only locally, where it forms a thicker mantle over the bedrock, such as on the flanks of hills and in the valleys between them.

3.2.2 Significance:

The engineering and resource significance of the ground moraine deposits is not particularly great in this area, since they are generally thin and not extensive.

From a resource viewpoint, there is a lack of mineral aggregate materials in this unit, and ground water supplies could be difficult to locate.

Bearing capacities are probably adequate, but excavations may have to contend with bouldery materials, and even bedrock where the drift is thin.

Ground moraine often provides good sites for septic systems, landfills, and lagoons. However, detailed studies on depth of till, slope, and drainage are required prior to development of such facilities.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Glaciofluvial outwash (GO) deposits cover about 10 percent of the Kabinakagami Lake area. These deposits usually occur as the dominant landform within complex terrain units. The outwash is predominantly sandy and occurs in association with eskers, ground moraine, and as a veneer over bedrock. Rock knobs and organic terrain are often found as subordinate landforms within the units.

There are two small outwash deposits, located in Mosambik Township and Carney Township in the central part of the area, that consist of gravelly sand. They appear to be deeper and less complex in stratigraphy than the other glaciofluvial deposits in the map-area and are represented by the symbol:

$$\frac{\text{sgGO}}{\text{Lpk-D}}$$

This indicates a sand and gravel outwash plain of low relief that is kettled and dry on surface.

Typical symbols depicting the more complex terrain units are:

$$\frac{\text{sGO,sgGE(RN,pOT)}}{\text{Lupk-D(M)}} \qquad \frac{\text{sGO/R(pOT,RN)}}{\text{Lpu-Mh}}$$

In both of these examples, the outwash is sandy in texture, although it may contain some gravel components. In the first case, eskers share the position of dominant landform, and rock knobs and isolated organic deposits can be expected as subordinate landforms. In the second case, the outwash forms a thin mantle over the bedrock and again there are subordinate amounts of small organic deposits and isolated bedrock knobs. In both examples, the relief is low and the topography is planar to undulating. Drainage is either mixed or dry, and there may be a high water table.

With this complexity of landforms and stratigraphy, the potential of these glaciolacustrine units as sources of aggregate is rated as only fair.

In some areas, sand dunes (ED) are mapped as a subordinate landform. For example, a terrain unit in Nameigos Township, in the western part of the area, has been mapped as:

$$\frac{\text{sgGO/R(RN,pOT,ED)}}{\text{Lupd-M}}$$

Eskers (GE, >>>>>>>>>>>) generally trend in a south-southwesterly direction. The largest of these extends from Derry Township, near the northern margin of the area, southward for a distance of nearly 23 km into Ermine Township. The esker ridge in this unit is generally less than 15 m in height and the topography is knobby and kettled. Bedrock is close to the surface and rock knobs are a common subordinate landform. The unit is generally represented by the symbol:

$$\frac{\text{sgGE/R(RN,pOT)}}{\text{Lnk-D(M)}}$$

Most of the eskers mapped consist of sand and gravel. Although sand is the dominant material, the eskers generally contain sufficient gravel to have potential as sources of aggregate.

3.3.2 Significance:

RESOURCES: The glaciofluvial landforms have potential as sources of sand and gravel. However, this potential has only local significance, since the material is often too sandy in texture and many of the deposits form only a thin mantle over the bedrock.

The best potential occurs in 1) the esker ridges that are represented by the chevron symbol (>>>>) on the Data Base Map (OGS Map 5095, accompanying this report), 2) an outwash-esker complex in Bayfield Township in the northwest corner of the map-area, and 3) in two flat, sand to gravel outwash deposits in Carnie Township and adjacent Mosambik Township, in the central part of the area. Ministry of Transportation and Communications records indicate the existence of eight pits along Highway 631 that provide both Granular C and crushable materials. These pits probably supplied material for the construction and maintenance of this highway, but none of them are large. Access to any of the other deposits within the map-area is poor.

The potential for ground water supplies within these glaciofluvial landforms is rated as only fair, since most of the deposits are thin and small in surface area.

GENERAL CONSTRUCTION: Most of the glaciofluvial landforms are part of complex terrain units and have subordinate amounts of ground moraine, bedrock knobs, and organic terrain associated with them. Because of this variability, construction conditions will also be variable. However, where deep deposits of sand and gravel occur, construction conditions should be good. The material will have acceptable handling qualities for general grading operations. Construction of foundations should present few problems. Excavations in these deposits may encounter variable conditions in some areas, but where the deposit is deep, they should be relatively free from serious difficulties. Problems can be expected where bedrock is close to surface, where ground water levels are high, and where organic landforms are present. Site-specific investigations are necessary prior to the start of all engineering activity.

WASTE DISPOSAL: Because of the permeable nature of these soils and the possibility of bedrock being close to surface, the disposal of liquid and solid wastes must be approached with considerable caution. There is the potential for contaminant flow within the ground water system. On the other hand, septic systems, if properly designed, should function satisfactorily. However, raised tile fields may be necessary in areas of high water table. Detailed hydrogeological investigations are recommended prior to design and construction of any waste disposal facility.

3.4 GLACIOLACUSTRINE LANDFORMS:

3.4.1 Description:

Glaciolacustrine plains (LP) occur in scattered pockets throughout the northern half of the Kabinakagami Lake area. These are remnants of the sediments that were deposited in Glacial Lake Barlow-Ojibway between 8 000 and 9 000 years ago.

These deposits are typically variable and complex. A stratigraphic section might comprise, from bottom to top: bedrock, a variable stratum of till, glaciolacustrine silt and clay, and occasionally stratified fine sand and silt. The full sequence occurs in some areas, while only portions of it are present in others. This results in a very complicated map-unit which reflects a complex geologic origin. A sample of surficial silt, taken along Highway 631 in the northwestern part of the map-area, contained 6% sand, 90 % silt, and 4% clay. Typical map symbols depicting this terrain unit are:

$$\frac{\text{msLP,tMG/R(pOT,RN)}}{\text{Lpu-Mh}} \qquad \frac{\text{sLP,pOT/R(RN)}}{\text{Lpu-Mh}} \qquad \frac{\text{smLP/R(tMG,RN)}}{\text{Lp-D}}$$

In all of these examples, the glaciolacustrine plain is composed of silt and sand (smLP) and shares the position of dominant landform with either organic terrain or ground moraine. In all cases, the Quaternary deposits occur as a thin mantle over the bedrock. Relief is low, topography is level to undulating, and surface drainage is generally mixed, with some areas of high water table.

From the above description, it is evident that the unit is complex and will have a variable significance from an engineering viewpoint.

3.4.2 Significance:

RESOURCES: These glaciolacustrine sediments have little resource potential with respect to sand and gravel. Ground water resources are generally scarce because of the impermeable nature of the soils and the fact that the deposits are generally too thin.

GENERAL CONSTRUCTION: Because the glaciolacustrine soils are basically fine grained, with high percentages of both silt and clay, construction conditions within the unit are far from ideal. The variability and complexity of the stratigraphy also introduces a number of construction problems. The following conditions might occur, under certain circumstances:

1) Slope instability where deep deposits of silt and clay are encountered along river banks or on man-made cuts;

2) Erosion and gullying on exposed slopes, with resulting siltation of drainage courses;

3) Difficulties in earth movement operations and subsequent compaction of fills where silt and clay are the dominant materials and where surface drainage conditions are poor, especially during wet weather;

4) Low bearing strength for footings and foundations where fine-grained soils are deep;

5) Frost susceptible soils which could affect pavement design and backfill operations;

6) Where the sediments form only a thin veneer over bedrock, excavation will be difficult and blasting may be required in deep cuts.

WASTE DISPOSAL: Septic tile field designs must contend with impermeable soils and poor drainage conditions. These problems will be less severe in areas where adequate thicknesses of sand overlie the silt and clay. Solid waste disposal facilities may lack suitable fill materials and care must be taken to protect surface waters from contamination. It would be necessary to investigate, in detail, the stratigraphic sequences and ground water regimes at depth. The disposal of liquid waste in lagoons is possible, but construction could be complicated by the existence of surface sand and poorly drained silty soil.

3.5 ORGANIC TERRAIN:

3.5.1 Description:

Organic terrain (OT) occurs either as a simple terrain unit, as shown by the symbol:

$$\frac{\text{pOT}}{\text{Lp-W}}$$

or in conjunction with lacustrine deposits, as denoted by:

$$\frac{\text{pOT,smLP(AP,RN)}}{\text{Lp-W}}$$

In both cases, the organic terrain is the landform of significance from an engineering viewpoint. The unit has poor drainage, high water tables, and compressible materials with very poor engineering characteristics.

3.5.2 Significance:

From an engineering viewpoint, organic terrain is generally not suitable for most types of development. Compressible soils, high ground water tables, and poor surface drainage place severe constraints on any type of activity. If possible, these landforms should be avoided as development sites.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceding section described the characteristics of the major landform types and the engineering and resource significance of these units. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions. Also, it must be realized that there are a number of conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

TABLE 1 SUMMARY OF ENGINEERING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL		GLACIOLACUSTRINE	ORGANIC
		RN(tMG,pOT)	tMG/R(RN,pOT)	sGO/R(pOT,RN)	sgGE/R	smLP/R(tMG,RN)	pOT
RESOURCE POTENTIAL	Sand & Gravel	Poor	Poor	Fair	Good	Poor	N/A
	Ground Water	Fair to Poor	Poor	Fair	Fair	Poor	Very Poor
	Excavation	Blasting	Fair to Poor	Fair	Fair	Fair	Poor
CONSTRUCTION CONDITIONS	Foundation	Excellent	Good	Good	Good	Fair to Poor	Very Poor
	Grading	Difficult	Fair to Poor	Fair	Good	Poor	Very Poor
	Material Re-Use	Rock Fill	Fair to Good	Good	Good	Poor	Very Poor
WASTE DISPOSAL SUITABILITY	Septic Systems	Very Poor	Fair to Good	Fair to Good	Fair	Fair to Poor	Very Poor
	Landfill	Poor	Fair	Fair	Fair	Fair	Very Poor
	Lagoons	Very Poor	Fair	Fair	Fair	Fair	Very Poor

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70-215	Highway 631
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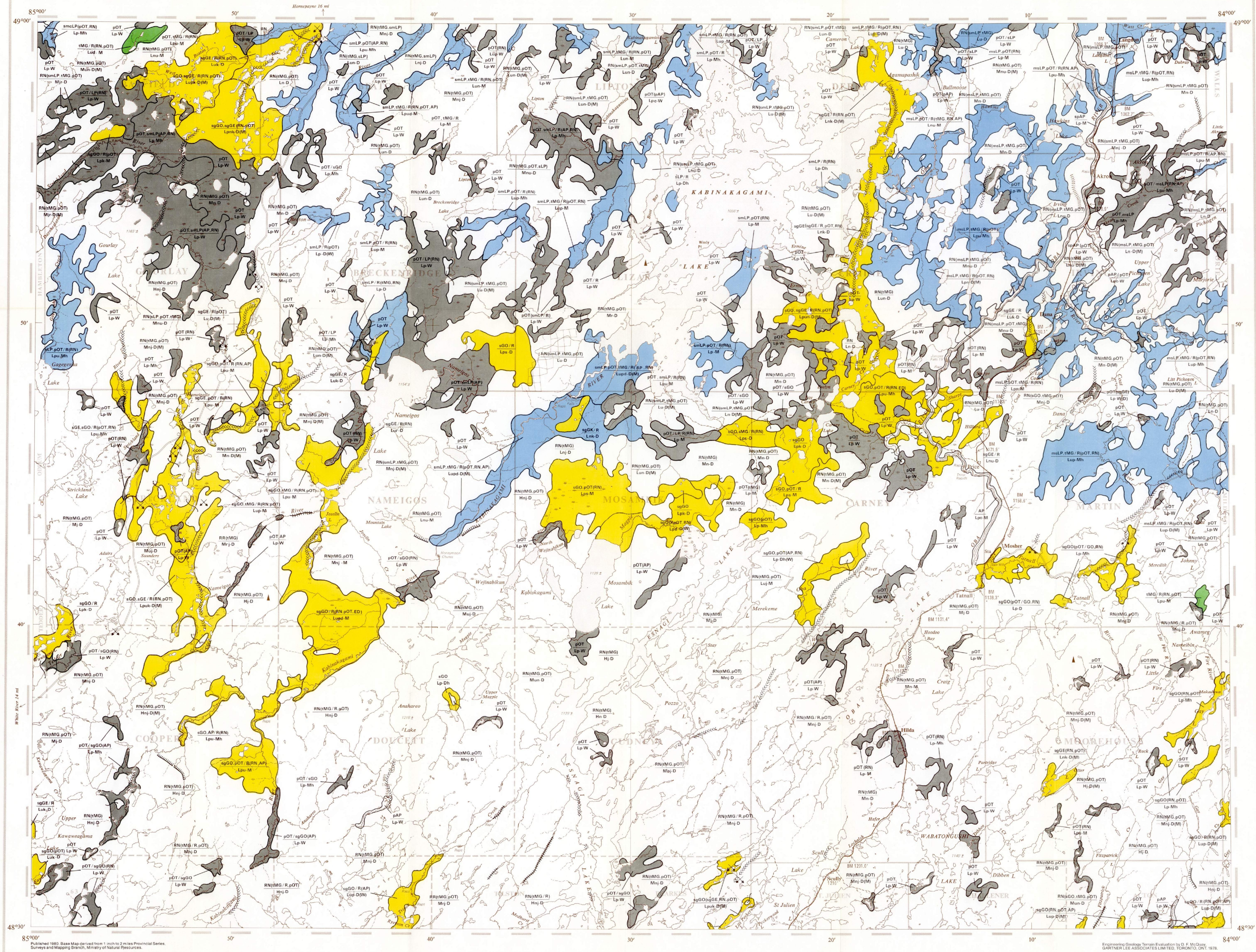

Published 1980. Base Map derived from 1 inch to 2 miles Provincial Series, Surveys and Mapping Branch, Ministry of Natural Resources.

Engineering Geology Terrain Evaluation by D. F. McQuay, GARTNER LEE ASSOCIATES LIMITED, TORONTO, ONT. 1978.

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Hon. James A. C. Auld
Minister
Dr. J. K. Reynolds
Deputy Minister

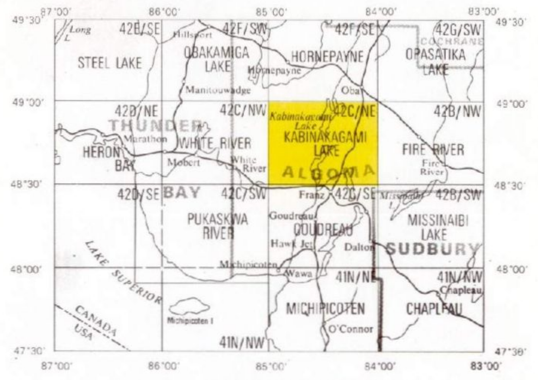
Ontario Geological Survey

Map 5095
KABINAKAGAMI LAKE

NTS 42 C/NE

Data Base Map

Northern Ontario Engineering Geology Terrain Study



INDEX TO ADJOINING SHEETS

1:100 000

2 1 0 2 4 6

One centimetre represents one kilometre

LEGEND

LANDFORM

MORAINAL

- **ME** *End moraine*
- **MG** *Ground moraine*
- **MH** *Hummocky moraine*

GLACIOFLUVIAL

- **GD** *Ice contact delta, esker delta, kame delta, delta moraine*
- **GE** *Esker, esker complex, crevasse filling*
- **GK** *Kame, kame field, kame terrace, kame moraine*
- **GO** *Outwash plain, valley train*

GLACIOLACUSTRINE

- **LB** *Raised (abandoned) beach form*
- **LD** *Glaciolacustrine delta*
- **LP** *Glaciolacustrine plain*

ALLUVIAL

- **AP** *Alluvial plain*

COLLUVIAL

- **CS** *Slope failure*
- **CT** *Talus pile*
- **CW** *Slopewash and debris creep sheet; minor talus*

EOLIAN

- **ED** *Sand dunes*

ORGANIC

- **OT** *Organic terrain*

BEDROCK

- **RL** *Bedrock plateau*
- **RN** *Bedrock knob*
- **RP** *Bedrock plain*
- **RR** *Bedrock ridge*
- **/R** *Bedrock below a drift veneer*

MATERIAL

- **b** *boulders, bouldery*
- **c** *clay, clayey*
- **g** *gravel, gravelly*
- **p** *peat, muck*
- **r** *rubble*
- **s** *sand, sandy*
- **m** *silt, silty*
- **t** *till*

TOPOGRAPHY

LOCAL RELIEF

- **H** *Mainly high local relief*
- **M** *Mainly moderate local relief*
- **L** *Mainly low local relief*

VARIETY

- **c** *channelled*
- **d** *dissected, gullied*
- **j** *jagged, rugged, cliffed*
- **j*** *cliffed volcanic rock signature*
- **k** *kettled, pitted*
- **n** *knobby, hummocky*
- **p** *plain*
- **r** *ridged*
- **s** *sloping*
- **t** *terraced*
- **u** *undulating to rolling*
- **w** *washed, reworked*

DRAINAGE

SURFACE CONDITION

- **W** *Wet*
- **D** *Dry*
- **M** *Mixed wet and dry*
- **h** *Suspected high water table*

The letter codes describing the terrain units are made up of four components arranged as follows:–

MATERIAL	LANDFORM
TOPOGRAPHY	DRAINAGE

Examples:

1.

dominant landform
material
subordinate landform
tMG(RN)
Mu(Hj)-D
drainage
relief of subordinate landform
local relief
topographic variety of dominant landform

2.

pOT/sGO
Lp-W
slash indicates a veneer of one landform overlying a second landform

SYMBOLS

- *Significant end moraine or linear moraine-like feature*
- *Well expressed drumlins and drumlinoid ridges*
- *All other linear ice-flow features*
- *Esker ridge (continuous, discontinuous; the symbol does not indicate direction of flow)*
- *Abandoned shoreline (continuous, discontinuous)*
- *Local dune area (type and location of individual dunes not indicated)*
- *Abandoned river channel, spillway, or ice marginal channels*
- *Escarpment*
- ●10 *Sample location*
- *Small landslide scar*
- *Sand or gravel pit*
- *Quarry or mine workings evident from airphotos or field observation (crossed picks are shown in the area of open excavation)*
- *Other man-made features (rock dumps, tailings, lagoons, landfills, etc.: type of feature mentioned where identifiable)*
- *Steep-walled valleys, often bedrock-controlled features*
- *Talus (defined, inferred; base of talus triangle indicates downslope side of escarpment)*
- *Line joining the same terrain units*

NOTE 1:

This map is intended to be an inventory of regional engineering terrain conditions, as determined largely by airphoto interpretation. Its purpose is to provide a guide for engineering and resource planning functions. The boundaries of the terrain units shown on the map are approximate only, consistent with a 1:100 000 scale. Site specific investigations are required in order to obtain detailed information for a particular area. The map user should refer to the accompanying report for a fuller description of terrain in the study area.

NOTE 2:

Colour is used to enhance what is considered to be the dominant engineering condition in simple, complex or layered terrain units.

NOTE 3:

Not all letter and graphic symbols shown in the legend necessarily appear on this map sheet.

Information from this publication may be quoted if appropriate credit is given.
Reference to this map is recommended as follows:

McQuay D. F.
1980: Northern Ontario Engineering Geology Terrain Study, Data Base Map, Kabinakagami Lake
Ontario Geological Survey, Map 5095, Scale 1:100 000