

AGGREGATE ENDOWMENT OF NORTHWEST ITASCA COUNTY

By
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INTRODUCTION

For the purpose of this study, aggregate endowment refers to geologic map units within which there is a reasonable probability of discovering and developing economically viable aggregate deposits. The endowment of sand and gravel in northwest Itasca County is subdivided into three categories of relative deposit potential on the basis of geologic attributes and physical properties of the mapped materials. Bedrock formations that may be suitable for crushing for aggregate are not close enough to the surface to be economically viable at this time.

The judgement of potential deposit quality is based predominantly on reconnaissance-level geologic information and interpretation. This study does not identify specific aggregate resources, which are defined in part on economic and societal criteria and concerns. Furthermore, this assessment does not mean that economic aggregate deposits exist everywhere within a given map unit; rather, the materials represented by each map unit were created by geologic processes that could have produced aggregate deposits at specific sites. Geologic endowment, although imprecisely measured, is fixed; whereas, economic criteria and environmental regulations vary across time and place. Important site-specific factors such as land ownership, zoning, protected waters and wetland designations, environmental impact, required permits, distance to markets, royalties, and site access, all contribute to the final "potential" of a specific parcel. These factors are outside the scope of this study.

DESCRIPTION OF MAP UNITS

POTENTIAL SAND AND GRAVEL SOURCES—These units exhibit geologic characteristics that typically produce sand and gravel deposits. Existing gravel pits and aggregate sources used by the Minnesota Department of Transportation within these units are "identified" or "known" resources. Geologic units that have the best potential for sand and gravel include delta and ice-contact sediments (eskers, kames, and fans); they typically contain sorted sand and gravel with little silt and clay. The map units are classified by the thickness of sand and gravel, thickness of overlying deposits, percentage of material retained on the number 4 sieve (4.76-millimeter pore space), and percentage of spall materials¹ (Table 1). Very good to good quality deposits generally contain less than 1.5 percent total spall materials. Good to moderate quality deposits generally contain less than 5 percent total spall materials. Gravel in moderate to poor quality deposits generally contains more than 5 percent total spall materials.

Highly desirable sand and gravel deposits—Highly desirable deposits are defined as having a sand and gravel thickness of 20 to more than 50 feet (6 to 15 meters); generally less than 5 feet (1.5 meters) of overburden; on average more than 20 percent of material retained on the number 4 sieve; and are of very good to moderate quality. The probability that a sand and gravel deposit exists within this unit is very high to moderately high.

Moderately desirable sand and gravel deposits—Moderately desirable deposits have a sand and gravel thickness ranging from near zero to more than 40 feet (12 meters); less than 10 feet (3 meters) of overburden; generally more than 15 percent material retained on the number 4 sieve; and are of very good to poor quality. The probability that a sand and gravel deposit exists within this unit is high to moderate.

Less desirable sand and gravel deposits—Less desirable deposits consist primarily of sand and gravelly sand (less than 15 percent retained on the number 4 sieve) ranging from near zero to greater than 20 feet (6 meters) thick, with overburden no more than 20 feet (6 meters) thick, and are of very good to poor quality. The probability that a sand and gravel deposit exists within this unit is high to moderately low.

LIMITED POTENTIAL FOR AGGREGATE SOURCES—The map shows that the remainder of northwest Itasca County is underlain by geologic units that have little or no potential for significant aggregate resources. This area may include aggregate deposits that are too small to map.

IDENTIFIED AGGREGATE RESOURCES—Areas where aggregate resources have been mined or are currently being mined. Pit locations have been gathered from aerial photographs, topographic maps, the county soil survey (Nyberg, 1987), files from the Minnesota Department of Natural Resources, Division of Minerals, and fieldwork for this study. No distinction is made on the map between active, inactive, depleted, and reclaimed pits.

Large gravel pit, or an area of more than one gravel pit or gravel-pit operation—The areas of larger pits shown on the map were primarily determined using aerial photographs from 1997 and orthophoto quadrangles dating from the late 1970s and earlier; some pit areas are probably more extensive than portrayed. Aggregate resources may remain within some pits. Smaller pits are indicated only by the pit symbol.

Gravel pit listed in the Aggregate Source Information System data base of the Minnesota Department of Transportation—May include test-hole logs, sieve data, test data on aggregate quality and information drawn from U.S. Geological Survey 7.5-minute topographic quadrangles.

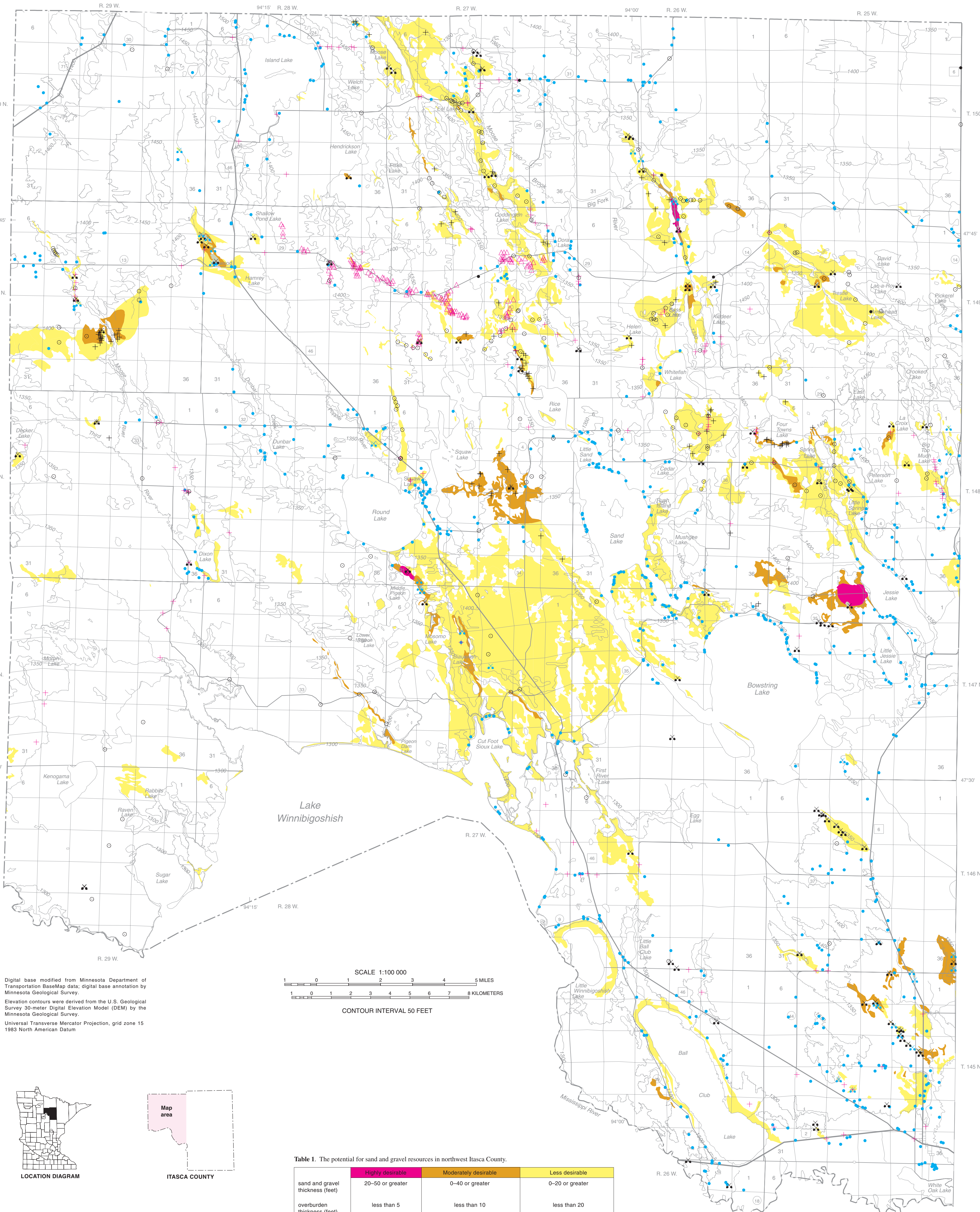
MAP SYMBOLS

- +** Field observation—Location for which data are available; includes outcrops, roadcuts, and construction sites.
- o** Soil boring—Includes Itasca County Highway Department borings and Minnesota Geological Survey auger holes drilled for this study.
- Record of water-well construction from the County Well Index (CWI) data base.
- Rotary-sonic drill hole location—Drill core from a deep test hole (Martin and others, 1989); housed in the Minnesota Department of Natural Resources core library in Hibbing, Minnesota.
- +** Project 333 observation site—From the Minnesota Department of Natural Resources, Division of Minerals Open-File Project 333 (Oberhelman, 1999).
- △** Backhoe-pit record—Record of a test pit dug by the Itasca County Highway Department.

SELECTED BIBLIOGRAPHY

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- Resources and Reserves Committee, 1999, A guide for reporting exploration information, mineral resources, and mineral reserves; Littleton Colo., unpublished report submitted to the Board of Directors, Society for Mining, Metallurgy and Exploration, 17 p.

Every reasonable effort has been made to ensure the accuracy of the factual data on which this map interpretation is based; however, the Minnesota Geological Survey does not warrant or guarantee that there are no errors. Users may wish to verify critical information; sources include both the references listed here and information on file at the offices of the Minnesota Geological Survey in St. Paul. In addition, effort has been made to ensure that the interpretation conforms to sound geologic and cartographic principles. No claim is made that the interpretation shown is rigorously correct, however, and it should not be used to guide engineering-scale decisions without site-specific verification.



Digital base modified from Minnesota Department of Transportation BaseMap data; digital base annotation by Minnesota Geological Survey.
Elevation contours were derived from the U.S. Geological Survey 30-meter Digital Elevation Model (DEM) by the Minnesota Geological Survey.
Universal Transverse Mercator Projection, grid zone 15 1983 North American Datum

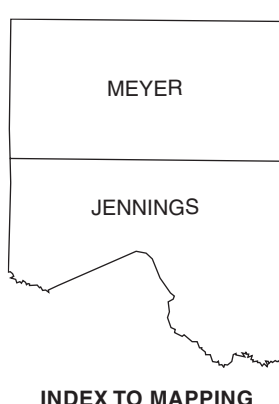
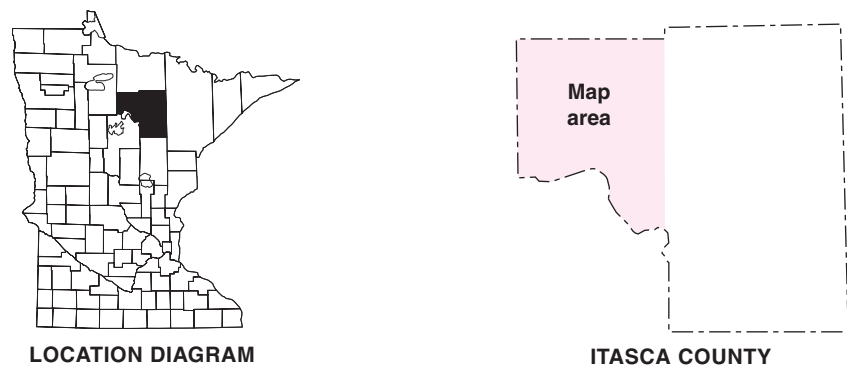
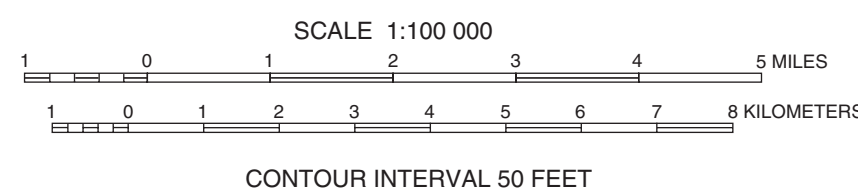


Table 1. The potential for sand and gravel resources in northwest Itasca County.

	Highly desirable		Moderately desirable		Less desirable	
sand and gravel thickness (feet)	20–50 or greater		0–40 or greater		0–20 or greater	
overburden thickness (feet)	less than 5		less than 10		less than 20	
retained on # 4 sieve	greater than 20%		greater than 15%		less than 15%	
probability	very high to moderately high		high to moderate		high to moderately low	
total spall ¹	<1.5%	<5%	<1.5%	<5%	>5%	<1.5%
quality	very good to good	good to moderate	very good to good	good to moderate	moderate to poor	very good to good
						good to moderate
						Moderate to poor

¹Spall materials are rock particles that will cause a pop-out in hardened concrete or bituminous pavement. Maximum permissible spall materials allowed by the MNDOT in coarse aggregate for concrete used in highway construction, by weight percent of total sample, are: shale, 0.7 percent; soft iron oxide particles, 0.3 percent; total spall materials (shale and iron oxide, plus unsound chert, coal, and clayey limestone), no more than 1.5 percent. Maximum permissible total spall materials in bituminous pavement is 5.0 percent.

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