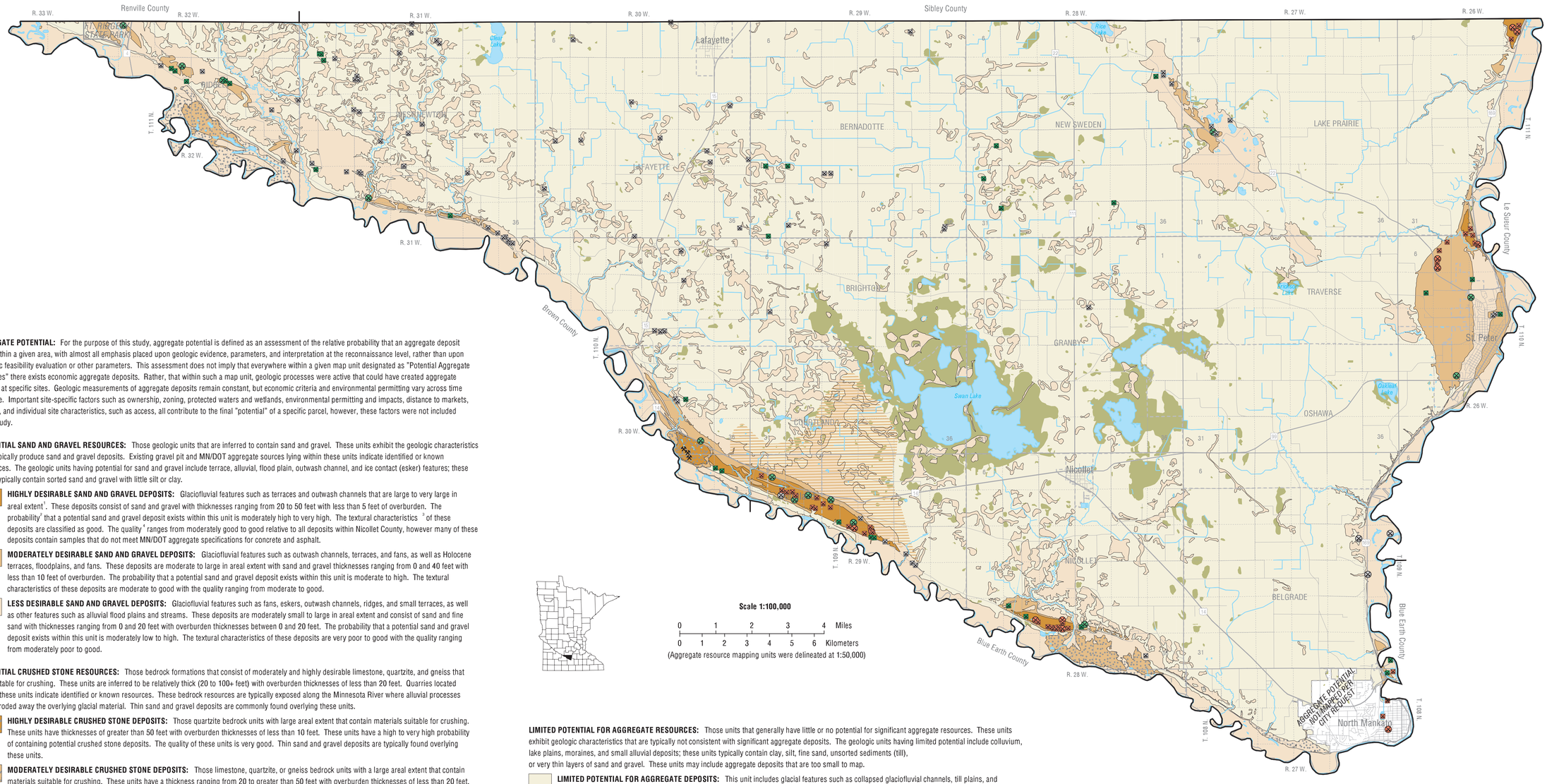
Minnesota Department of Natural Resources
Division of Lands and Minerals
William C. Brice, Director

AGGREGATE RESOURCES
NICOLLET COUNTY, MINNESOTA

JONATHAN B. ELLINGSON

2000



AGGREGATE POTENTIAL: For the purpose of this study, aggregate potential is defined as an assessment of the relative probability that an aggregate deposit exists within a given area, with almost all emphasis placed upon geologic evidence, parameters, and interpretation at the reconnaissance level, rather than upon economic feasibility evaluation or other parameters. This assessment does not imply that everywhere within a given map unit designated as "Potential Aggregate Resources" there exists economic aggregate deposits. Rather, that within such a map unit, geologic processes were active that could have created aggregate deposits at specific sites. Geologic measurements of aggregate deposits remain constant, but economic criteria and environmental permitting vary across time and place. Important site-specific factors such as ownership, zoning, protected waters and wetlands, environmental permitting and impacts, distance to markets, royalties, and individual site characteristics, such as access, all contribute to the final "potential" of a specific parcel, however, these factors were not included in this study.

POTENTIAL SAND AND GRAVEL RESOURCES: Those geologic units that are inferred to contain sand and gravel. These units exhibit the geologic characteristics that typically produce sand and gravel deposits. Existing gravel pit and MN/DOT aggregate sources lying within these units indicate identified or known resources. The geologic units having potential for sand and gravel include terrace, alluvial, flood plain, outwash channel, and ice contact (esker) features; these units typically contain sorted sand and gravel with little silt or clay.

HIGHLY DESIRABLE SAND AND GRAVEL DEPOSITS: Glaciofluvial features such as terraces and outwash channels that are large to very large in areal extent[1]. These deposits consist of sand and gravel with thicknesses ranging from 20 to 50 feet with less than 5 feet of overburden. The probability[2] that a potential sand and gravel deposit exists within this unit is moderately high to very high. The textural characteristics [3] of these deposits are classified as good. The quality[4] ranges from moderately good to good relative to all deposits within Nicollet County, however many of these deposits contain samples that do not meet MN/DOT aggregate specifications for concrete and asphalt.

MODERATELY DESIRABLE SAND AND GRAVEL DEPOSITS: Glaciofluvial features such as outwash channels, terraces, and fans, as well as Holocene terraces, floodplains, and fans. These deposits are moderate to large in areal extent with sand and gravel thicknesses ranging from 0 and 40 feet with less than 10 feet of overburden. The probability that a potential sand and gravel deposit exists within this unit is moderate to high. The textural characteristics of these deposits are moderate to good with the quality ranging from moderate to good.

LESS DESIRABLE SAND AND GRAVEL DEPOSITS: Glaciofluvial features such as fans, eskers, outwash channels, ridges, and small terraces, as well as other features such as alluvial flood plains and streams. These deposits are moderately small to large in areal extent and consist of sand and fine sand with thicknesses ranging from 0 and 20 feet with overburden thicknesses between 0 and 20 feet. The probability that a potential sand and gravel deposit exists within this unit is moderately low to high. The textural characteristics of these deposits are very poor to good with the quality ranging from moderately poor to good.

POTENTIAL CRUSHED STONE RESOURCES: Those bedrock formations that consist of moderately and highly desirable limestone, quartzite, and gneiss that are suitable for crushing. These units are inferred to be relatively thick (20 to 100+ feet) with overburden thicknesses of less than 20 feet. Quarries located within these units indicate identified or known resources. These bedrock resources are typically exposed along the Minnesota River where alluvial processes have eroded away the overlying glacial material. Thin sand and gravel deposits are commonly found overlying these units.

HIGHLY DESIRABLE CRUSHED STONE DEPOSITS: Those quartzite bedrock units with large areal extent that contain materials suitable for crushing. These units have thicknesses of greater than 50 feet with overburden thicknesses of less than 10 feet. These units have a high to very high probability of containing potential crushed stone deposits. The quality of these units is very good. Thin sand and gravel deposits are typically found overlying these units.

MODERATELY DESIRABLE CRUSHED STONE DEPOSITS: Those limestone, quartzite, or gneiss bedrock units with a large areal extent that contain materials suitable for crushing. These units have a thickness ranging from 20 to greater than 50 feet with overburden thicknesses of less than 20 feet. These units have a moderately high to very high probability of containing potential crushed stone deposits. The quality of these units is moderately good to very good. Thin sand and gravel deposits are typically found overlying these units.

LESS DESIRABLE CRUSHED STONE DEPOSITS: Those limestone, sandstone (quartzose sandstone), and gneiss bedrock units that are large in areal extent that contain materials suitable for crushing. These units have thicknesses ranging from 20 to greater than 50 feet with overburden thicknesses ranging from 0 to 20 feet. These units have a moderately high to very high probability of containing potential crushed stone deposits. The quality of the limestone and gneiss units are moderately good, however, the sandstone units are moderately poor. Thin sand and gravel deposits are commonly found overlying these units.

[1] Areal Extent - the size, horizontal extent, or distribution of a unit (e.g., area in acres).
[2] Probability - the degree of certainty that aggregate exists within a mapping unit.
[3] Textural Characteristics - particle size distribution - the percent of gravel or sand vs. silt or clay (e.g., sieve analysis).
[4] Quality - the characteristics of the material - soundness (e.g., magnesium sulfate test), durability (Los Angeles rattler test), and mineral makeup (percent deleterious material such as shale, iron oxide, and unsound chert).

LIMITED POTENTIAL FOR AGGREGATE RESOURCES: Those units that generally have little or no potential for significant aggregate resources. These units exhibit geologic characteristics that are typically not consistent with significant aggregate deposits. The geologic units having limited potential include colluvium, lake plains, moraines, and small alluvial deposits; these units typically contain clay, silt, fine sand, unsorted sediments (till), or very thin layers of sand and gravel. These units may include aggregate deposits that are too small to map.

LIMITED POTENTIAL FOR AGGREGATE DEPOSITS: This unit includes glacial features such as collapsed glaciofluvial channels, till plains, and moraines; small alluvial features such as flood plains and streams; and colluvium deposits. The probability that a potential aggregate deposit exists within this unit is very low to moderate. The aggregate deposits occurring in this unit are moderate to very small in areal extent with sand (some gravel) thicknesses of less than 20 feet with up to 100 feet of overburden. The textural characteristics are very poor to moderate with the quality ranging from very poor to moderate. This unit also contains bedrock units with an overburden thickness of greater than 20 feet.

BURIED SAND AND GRAVEL DEPOSITS: Glaciofluvial outwash fan deposit that is buried under glacial till, as indicated by an examination of the geological logs for 30 wells in the County Well Index data (see Plate IV for the locations of these wells). The deposit is very large in areal extent and consists of gravel, coarse sand, and fine sand. The thickness of the deposit ranges from 35 to 120 feet (average = 78 feet) with 20 to 75 feet of overburden (average = 38 feet). The probability that a potential sand and gravel deposit exists is moderately poor to moderate. The textural characteristics of this deposit are moderately poor to good with the quality being uncertain (not sampled).

OTHER FEATURES:

WETLANDS: Wetland area.

WATER: Lakes or rivers.

IDENTIFIED AGGREGATE RESOURCES: Those areas where aggregate resources (sand, gravel, and/or crushed stone) have been or are currently being mined. Pit and quarry locations have been gathered from several different sources, including topographic maps, aerial photographs, county records, county highway department maps, soil surveys, MN/DOT files, fieldwork, gravel operators, and other miscellaneous sources. The pits and quarries range in size from less than 1 acre to greater than 50 acres and may be active, inactive, depleted, or reclaimed. The aggregate quality of the pits varies.

Gravel Pits: Locations were gathered from several different sources. Any given pit may be active, inactive, depleted, or reclaimed. The color indicates the relative size of the pit.

- Large - larger than 10 acres in size.
- Medium - larger than a few acres.
- Small - less than a few acres in size.

Gravel Pits - MN/DOT files: Minnesota Department of Transportation's Aggregate Source Information System listing of aggregate sources. Test hole logs, sieve, and quality test data are available. The color indicates the relative size of the pit.

- Large - larger than 10 acres in size.
- Medium - larger than a few acres.
- Small - less than a few acres in size.

Quarries: Quartzite quarries (Sioux Quartzite) from several sources. Any given unit may be active, inactive, depleted, or reclaimed.

Aggregate Resources:
Aerial photograph interpretation, field work, and delineation of mapping units by Jonathan B. Ellingson, 1999-2000, County Aggregate Mapping Program, Division of Lands and Minerals, Minnesota Department of Natural Resources. Source information included aerial photographs from NAPP (National Aerial Photography Program), 1991-1992, 9"x 9" color infrared photos at 1:40,000; DOQs (Digital Orthophoto Quadrangles) at 1:12,000 from USGS (United States Geological Survey); DRGs (Digital Raster Graphics) at 1:24,000 from USGS; 7.5-minute USGS topographic quadrangles at 1:24,000 (dating from 1964-1993); and Soil Survey Geographic (SSURGO) data base files from USDA-NRCS (United States Department of Agriculture - Natural Resources Conservation Service), 1998.

Base map data sources:
Lakes, wetlands, and rivers from National Wetland Inventory, U.S. Fish and Wildlife Service, compiled at 1:24,000 from aerial photography (1979-1988) and spot field checked.
Public Land Survey - PLS Project, 1999, Minnesota Department of Natural Resources, Division of Lands and Minerals.
Roads from State of Minnesota Basemap, 1998, Department of Transportation Surveying and Mapping BaseMap Development Group.
Minor Civil Divisions - township boundaries from the 1990 TIGER line files, city boundaries from Nicollet County, December 2000.

GIS database design and cartography by Renee Johnson. Digitizing assistance by Lori Riggs.
Field and drilling assistance by Ricco Riihiluoma.

Prepared with support from the Mineral Diversification Program of the Minnesota State Legislature.
Projects are determined by a committee composed of Governor-appointed members from the public and private sectors.

This project includes a CD/ROM of maps, data, and metadata in a digital format and the following plates:
Plate I, Report 343, Significant Aggregate Resource Deposits.
Plate II, Report 343, Aggregate Resources.
Plate III, Report 343, Surficial Geology.
Plate IV, Report 343, Data Sources and Mapping Methodology.