

MAP OF PRIMARY AGGREGATE SOURCES

**SAND AND GRAVEL SOURCES**  
Sand and gravel deposits were mapped and named as simple land forms (Table 1) and divided into deposit classifications (Table 2) using various criteria. Several operators and consultants in the aggregate industry, staff of the Minnesota Division of the Minnesota Department of Transportation and the Division of Minerals of the Minnesota Department of Natural Resources helped to establish the criteria. Deposits are classified by thickness of material retained on the number 4 sieve (4.75-millimeter pore space), sand and gravel thickness, thickness of overlying deposits, location of the sand table, and relative amounts of subsurface information available (Table 2).

**Source Evaluation**  
Primary Sources—For classification as a primary source, the following criteria must be met: (1) more than 20 percent of the material is retained on a number 4 sieve (4.75 millimeter pore space) and (2) overlying sediments are no thicker than 10 feet.  
Quality of sources where the water table is more than 20 feet below land surface (classifications 1, 2, 3, and 6):

- Excellent to good (less than 5 percent total spill materials)
- Good to moderate (less than 5 percent total spill materials)
- Moderate to poor (generally more than 5 percent total spill materials)

Quality of sources where the water table is less than 20 feet below land surface (classifications 7 and 8):

- Excellent to good (less than 5 percent total spill materials)
- Good to moderate (less than 5 percent total spill materials)
- Moderate to poor (generally more than 5 percent total spill materials)

**Secondary Sources**—A secondary source must meet one or more of the following conditions: (1) less than 20 percent of the material is retained on a number 4 sieve, and/or (2) the deposit is less than 20 feet thick, and/or overlying sediments is more than 10 feet.

**Potential secondary source**—Classifications 4 and 5

**Gravel pit**—Active or inactive pit

**Large gravel pit, or an area of more than one gravel pit or gravel-pit operation**

**Four-character code indicating deposit name, deposit type, and aggregate quality classification**—In the circled numbers, the circle number is the deposit name, the circle number is the deposit type, and the circle number is the aggregate quality classification. For example, 1001 indicates a sand and gravel deposit, sand and gravel, excellent to good quality, and is located in Township 112 N. and Range 20 W. for further information.

**Table 1. Three-letter codes for Informally Named Sand and Gravel Deposits**

AW... Alluvial valley fill	CM... Clay River network	LD... Longhorn Lake (St. Cloud River)	PL... Prior Lake to contact
AO... Arroyo valley network	CO... Clay River contact	LE... Lake Elzev network	RF... Richfield to contact
AS... Arroyo valley network	CS... Clay River contact	LI... Lake Itasca network	RI... Richfield to contact
AW... Arroyo valley network	CS... Clay River contact	LI... Lake Itasca network	RI... Richfield to contact
AW... Arroyo valley network	CS... Clay River contact	LI... Lake Itasca network	RI... Richfield to contact

**Table 2. Numerical Classification of Sand and Gravel Deposits**

CLASSIFICATION	PROPORTION OF MATERIAL RETAINED ON NO. 4 SIEVE*	THICKNESS OF SAND & GRAVEL DEPOSIT	POSITION OF OVERLYING SEDIMENTS	POSITION OF WATER TABLE	QUALITY OF SUBSURFACE DATA
1	More than 20% and More than 40"	and 10' to less than 20'	More than 20' below land surface	More than 20' below land surface	Good subsurface data
2	More than 20% and More than 20"	and 10' to less than 20'	More than 20' below land surface	More than 20' below land surface	Limited subsurface data. Presence of carbonate bedrock beneath. Soil maps and geologic maps suggest presence of gravel deposits. Some good deposits probably available, but uncertain locations.
3	Less than 20% and/or Less than 20"	and/or More than 10'	May be less than 20' below land surface	May be less than 20' below land surface	Limited subsurface data. Free or no sand lying on water table nearby, or sand deposits are unconsolidated. Soil maps and geologic maps suggest presence of gravel deposits. Good deposits may be present in areas, but in good cases the classification requires gravel-pit waste deposits or thick sand overlying gravel.
4	Less than 20% and/or Less than 10"	and/or More than 10'	May be less than 20' below land surface	May be less than 20' below land surface	Good subsurface data
5	More than 20% and 10-40" thick over deposition	and 10' to less than 20'	More than 20' below land surface	More than 20' below land surface	Good to fair subsurface data. Presence of carbonate bedrock beneath. Soil maps and geologic maps suggest presence of gravel deposits, but statements may vary especially in the larger areas mapped.
6	More than 20% and More than 20"	and 10' to less than 20'	Less than 20' below land surface	Less than 20' below land surface	Good subsurface data
7	More than 20% and More than 20"	and 10' to less than 20'	Less than 20' below land surface	Less than 20' below land surface	Limited subsurface data. Free or no sand lying on water table nearby, or sand deposits are unconsolidated. Soil maps and geologic maps suggest presence of gravel deposits. Good deposits may be present in areas, but in good cases the classification requires gravel-pit waste deposits or thick sand overlying gravel.

\*The width of the pore space on a number 4 sieve is 4.75 millimeters.

**BEDROCK AGGREGATE SOURCES**  
**Source Evaluation and Reliability of Data**  
The only available bedrock aggregate source in the Seven-County Metropolitan Area is Prairie du Chien dolomite whose outcrops are thinner than 10 feet. Both quality and quantity of data determine how reliable the various units of Prairie du Chien are delineated on the map. Information that was used to map bedrock source units includes bedrock outcrop, water-well and well-logging records, soil maps, and topographic maps.

**Excellent Reliability**—Areas shown as having excellent reliability are characterized by:

- outcrops of Prairie du Chien dolomite;
- extensive, evenly distributed water-well and well-logging records that indicate carbonate bedrock at less than 10 feet below the land surface;
- bedrock outcrops by present material or sediment of carbonate bedrock; and
- the presence of thick, flat, planar, ridges, or flat outcrops—features that typically form in areas underlain by carbonate bedrock.

**Good Reliability**—Areas shown as having good reliability are delineated using criteria 1 and 4 above and criterion 1 or 2. Characteristically, areas mapped as having good reliability have fewer outcrops and water-well and well-logging records. Where rock data are available, they are not as evenly distributed as those in areas mapped as having excellent reliability.

**Fair Reliability**—Areas shown as having fair reliability are delineated mainly by criteria 1 and 4. The mapping is primarily based on soil maps and topographic expressions. There are no outcrops and only a few water-well and well-logging records to support the distribution of bedrock.

When Prairie du Chien dolomite is thicker than 10 feet:

- Excellent reliability
- Good reliability
- Fair reliability

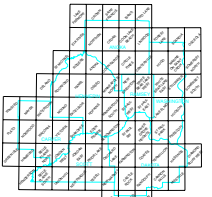
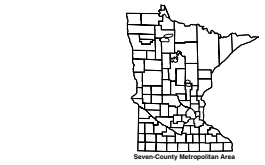
When Prairie du Chien dolomite is 10-20 feet thick:

- Excellent reliability
- Good reliability
- Fair reliability

When Prairie du Chien dolomite is less than 10 feet thick:

- Excellent reliability
- Good reliability
- Fair reliability

Large quarry, or area of more than one quarry or quarry operation



Note: This map depicts deposits of sand, gravel, and dolomite within the Seven-County Metropolitan Area that occur geologically and are potentially available as sources of construction aggregate. It is not a depiction of aggregate resources, in that large portions of the mapped deposits do not have "reasonable prospects for eventual economic extraction" because of competing land uses and zoning restrictions, and thus are excluded from the operational definition of a mineral resource.

\*Resources and Reserves Committee, 1999. A guide for reporting exploration information, mineral resources, and mineral reserves. Linton, Cok, unpublished report submitted to the Board of Directors, Society for Mining, Metallurgy and Exploration, 17 p.

PRIMARY SOURCES OF CONSTRUCTION AGGREGATE IN THE SEVEN-COUNTY METROPOLITAN AREA, MINNESOTA

Compiled by  
Gary N. Meyer and John H. Mosler

Every reasonable effort has been made to ensure the accuracy of the data shown on which this map is based. However, the user of this map should be aware that the data shown on this map are not a guarantee that these are the correct data. Users may wish to verify critical information with the Minnesota Geological Survey and the Minnesota Department of Natural Resources. The Minnesota Geological Survey is 300 Park Avenue, St. Paul, Minnesota 55105. For more information, contact the Minnesota Geological Survey at 651-224-2600. This map is intended for general informational purposes only and should not be used for engineering, construction, or other specific applications. The user should consult with a professional engineer or other qualified person for such purposes.