UNIVERSITY OF MINNESOTA
MINNESOTA GEOLOGICAL SURVEY
D.L. Southwick, Director

SUPPORTED IN PART BY THE MINNESOTA MINERALS DIVERSIFICATION PROGRAM AS ADMINISTERED BY THE MINERALS COORDINATING COMMITTEE FOR THE MINNESOTA LEGISLATURE

MISCELLANEOUS MAP SERIES
MAP M-102, PLATE 1
Primary Aggregate Sources, South Sheet

AREA OF OVERLAP WITH NORTH SHEET

AREA OF OVERLAP WITH NORTH SHEET

Base modified from 1990 Census TIGER/Line Files of U.S. Bureau of the Census; county border files modified from Minnesota Department of Transportation files; digital base annotation by Minnesota Geological Survey

Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

SCALE 1:100 000

1 0 1 2 3 4 5 MILES
1 0 1 2 3 4 5 6 7 8 KILOMETERS

GIS compilation by T.E. Wahl, G.N. Meyer, and J.H. Mossler
Cartography and graphic design by T.E. Wahl

SAND AND GRAVEL SOURCES

Sand and gravel deposits were mapped and named as simple land forms (Table 1) and divided into different classifications (Table 2) using various criteria. Several operators and consultants in the aggregate industry, staff of the Materials 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 percentage of material retained on the number 4 sieve (4.76-millimeter pore space), sand and gravel thickness, thickness of overlying deposits, location of the water 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; (2) the deposit is thicker than 10 feet; and (3) overlying sediment is no thicker than 10 feet.

Quality of source where the water table is more than 20 feet below land surface (classifications 1, 2, 3, and 6):

- Excellent to good (less than 1.5 percent total spall materials)
- Good to moderate (less than 5 percent total spall materials)
- Moderate to poor (generally more than 5 percent total spall 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 1.5 percent total spall materials)
- Good to moderate (less than 5 percent total spall materials)
- Moderate to poor (generally more than 5 percent total spall 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 sediment 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**

The third letter represents the type of deposit
MPO4
The first two letters represent the deposit name / *The number represents the class of the deposit*

Four-character code indicating deposit name, deposit type, and aggregate-quality classification—In the example shown, the code indicates a deposit named Minneapolis outwash that has a classification of 4. Refer to Tables 1 and 2 for further information.

Table 1. Three-Letter Codes for Informally Named Sand and Gravel Deposits

AFV ..... Afton valley fill
ARK ..... Arsenal kame
AVO ..... Apple valley outwash
BFG ..... Bluff gravel (Dakota & Ramsey Cos.)
BLG ..... Bluff gravel (Carver Co.)
BLO ..... Bloomington outwash
BMO ..... Big Marine outwash
BRN ..... Burns ice contact
BVK ..... Burnsville kame
BVO ..... Burnsville outwash
CGO ..... Cottage Grove outwash
CLS ..... Crystal Lake sand
COO ..... Crow River outwash (Hennepin Co.)
CRI ..... Credit River ice contact
CRO ..... Cannon River outwash
CSV ..... Castle Rock valley fill
CWO ..... Crow River outwash (Carver Co.)
DEI ..... Des Moines ice contact (Scott Co.)
DM ..... Des Moines ice contact (Dakota & Scott Cos.)
DMU ..... Denmark upland gravel
EAK ..... Eagan kame
EPO ..... Eden Prairie outwash
ERO ..... Elk River outwash
FLE ..... Fish Lake esker
GB ..... Gransburg ice contact
GCT ..... Grey Cloud terrace
GRT ..... Grey Cloud terrace (Carver & Scott Cos.)
GVO ..... Golden Valley outwash
HAM ..... Hampton moraine
HLG ..... Hillside gravel
LDT ..... Langdon terrace (St. Croix River)
LEO ..... Lake Elmo outwash
LGT ..... Langdon terrace (Mississippi River)
LVO ..... Lakeville outwash
MHO ..... Mendota Heights outwash
MPF ..... Mississippi floodplain (Anoka & Hennepin Cos.)
MPO ..... Minneapolis outwash
MSF ..... Mississippi floodplain
MTK ..... Minnetonka kame
MYO ..... May outwash
NOI ..... North Oaks ice contact
OSK ..... Osseo kame
OSO ..... Osseo outwash
PLI ..... Piersons Lake ice contact
PRI ..... Prior Lake ice contact
RFT ..... Richfield terrace
RHT ..... Richfield terrace (Washington Co.)
RIV ..... Rich valley train
RSO ..... Rosemount outwash
SCI ..... Sand Creek ice contact
SCO ..... St. Croix outwash
SCV ..... Sand Creek valley fill
SFI ..... San Francisco ice contact
SMT ..... St. Mary's terrace
SPO ..... St. Paul outwash
SUI ..... Superior ice contact
TOK ..... Tower kame
VDG ..... Valley delta gravel
VPO ..... Vermilion River outwash
WFO ..... Waterford outwash

Table 2. Numerical Classification of Sand and Gravel Deposits

CLASSIFICATION NO.	PROPORTION OF MATERIAL RETAINED ON NO. 4 SIEVE[1]		THICKNESS OF SAND & GRAVEL DEPOSIT		THICKNESS OF OVERLYING SEDIMENTS	POSITION OF WATER TABLE	QUALITY OF SUBSURFACE DATA
1	More than 20%	***and***	More than 40 ft	***and***	10 ft or less	More than 20 ft below land surface	Good subsurface data: Deep Minn. Dept. of Transportation test borings or many detailed water-well records from several drillers
2	More than 20%	***and***	10–40 ft	***and***	10 ft or less	More than 20 ft below land surface	Good subsurface data
3	More than 20%	***and***	More than 20 ft	***and***	10 ft or less	More than 20 ft below land surface	Limited subsurface data: Few borings or water-well records. Soil maps and surficial geology suggest the presence of gravel deposits. Some good deposits probably available, but boundaries uncertain.
4	Less than 20%	***and/or***	Less than 20 ft	***and/or***	More than 10 ft	May be less than 20 feet below land surface	Limited subsurface data. Few or no soil-boring or water-well records, or well records are too generalized. Soil maps and surficial geology indicate possible sand and gravel deposits. Good deposits may be present in places, but in most cases this classification represents gravel-poor sand deposits or thick sand overlying gravel.
5	Less than 20%	***and/or***	Less than 10 ft	***and/or***	More than 10 ft	May be less than 20 feet below land surface	Good subsurface data
6	More than 20%	***and***	10–40 ft thick over dolostone	***and***	10 ft or less	More than 20 ft below land surface	Good to fair subsurface data. Presence of carbonate bedrock generally well established, but percentage of gravel in overlying sediments may vary, especially in the larger areas mapped.
7	More than 20%	***and***	More than 20 ft	***and***	10 ft or less	Less than 20 ft below land surface	Good subsurface data
8	More than 20%	***and***	More than 20 ft	***and***	10 ft or less	Less than 20 ft below land surface	Limited subsurface data. Few soil-boring or water-well records. Soil maps and surficial geology suggest gravel deposits. Good deposits probably available, but boundaries uncertain.

[1]The width of the pore space on a number 4 sieve is 4.76 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 dolostone where overburden is thinner than ten feet. Both quality and quantity of data determine how reliably the various units of Prairie du Chien are delineated on the map. Information that was used to map bedrock source units includes bedrock outcrops, water-well and soil-boring records, soil maps, and topographic maps.

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

1. outcrops of Prairie du Chien dolostone;
2. numerous, evenly distributed water-well and soil-boring records that indicate carbonate bedrock at less than ten feet below the land surface;
3. soils characterized by parent material or substratum of carbonate bedrock; and
4. the presence of bluffs, flat plateaus, ridges, or rock terraces—landforms that typically form in areas underlain by carbonate bedrock.

Good reliability—Areas shown as having good reliability are delineated using criteria 3 and 4 above and criterion 1 or 2. Characteristically, areas mapped as having good reliability have fewer outcrops and water-well and soil-boring records. Where such 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 3 and 4. The mapping is primarily based on soil maps and topographic expression. There are no outcrops and only a few water-well and soil-boring records to support the distribution of bedrock shown.

Where Prairie du Chien dolostone is thicker than 30 feet.

- Excellent reliability
- Good reliability
- Fair reliability

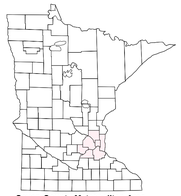
Where Prairie du Chien dolostone is 10–30 feet thick.

- Excellent reliability
- Good reliability
- Fair reliability

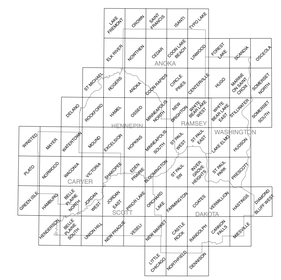
Where Prairie du Chien dolostone is less than 10 feet thick.

- Excellent reliability
- Good reliability
- Fair reliability
- Quarry
- Large quarry, or area of more than one quarry or quarry operation

MAP OF PRIMARY AGGREGATE SOURCES



Seven-County Metropolitan Area



Index to 7.5-Minute Quadrangles
(Boundaries of individual quadrangles shown on 1:100,000-scale map)

Note: This map depicts deposits of sand, gravel, and dolostone 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"[1] because of competing land uses and zoning restrictions, and thus are excluded from the operational definition of a mineral resource.

[1]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.

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

Compiled by
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