

**Kanabec County, Minnesota - Aggregate Resources**  
**Sand and Gravel Potential**  
**kana\_sgp**

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**Metadata Summary**

<b><i>Originator</i></b>	Minnesota Department of Natural Resources, Division of Lands and Minerals, Mineral Potential Evaluation Section
<b><i>Abstract</i></b>	This dataset consists of information about the geology, geological characteristics, and sand and gravel potential of 177 map units. Five fields relate to the surficial geology of the map unit, including a unique map unit id, sediment, landform, surficial geology description, and dominant lithology. Six fields relate to sand and gravel characteristics, including probability, quality, texture, overburden thickness, deposit size, and sand and gravel thickness. These characteristics were used to calculate the aggregate potential of the map unit for sand and gravel.
<b><i>Browse Graphic</i></b>	none available
<b><i>Time Period of Content Date</i></b>	2011
<b><i>Currentness Reference</i></b>	Data were gathered in the fall of 2010 and the spring of 2011. Data were compiled and interpreted in the spring and summer of 2011.
<b><i>Access Constraints</i></b>	
<b><i>Use Constraints</i></b>	Acknowledgement of the Minnesota Department of Natural Resources is appreciated for products derived from these data.
<b><i>Distributor Organization</i></b>	Minnesota Department of Natural Resources, Division of Lands and Minerals
<b><i>Ordering Instructions</i></b>	Kanabec County's aggregate resource spatial datasets (shapefiles & file geodatabase) are included in the file kanabecdata.zip, accessible from the MN DNR Aggregate Mapping web page: <a href="http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/completed/index.html">http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/completed/index.html</a> The spatial datasets include: sand and gravel resource potential, test-holes drilled, geologic field observations, aggregate pits, Minnesota Geological Survey (MGS) County Well Index (CWI) data points, Mn/DOT Aggregate Source Information System (ASIS) points, and Mn/DOT ASIS pit quality table.
<b><i>Online Linkage</i></b>	<a href="#">Click here</a> to download data. (See Ordering Instructions above for details.) By clicking here, you agree to the notice in "Distribution Liability" in Section 6 of this metadata.

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## Full Metadata

### Kanabec County, Minnesota - Aggregate Resources: Sand and Gravel Potential kana\_sgp

Section 1	Identification Information		
<b>Originator</b>	Minnesota Department of Natural Resources, Division of Lands and Minerals, Mineral Potential Evaluation Section		
<b>Title</b>	Kanabec County Aggregate Resources: kana_sgp (sand and gravel potential)		
<b>Abstract</b>	This dataset consists of information about the geology, geological characteristics, and sand and gravel potential of 177 map units. Five fields relate to the surficial geology of the map unit, including a unique map unit id, sediment, landform, surficial geology description, and dominant lithology. Six fields relate to sand and gravel characteristics, including probability, quality, texture, overburden thickness, deposit size, and sand and gravel thickness. These characteristics were used to calculate the aggregate potential of the map unit for sand and gravel.		
<b>Purpose</b>	To summarize the geological characteristics, surficial geology, and aggregate potential (sand, gravel) of the different units. To help categorize the geological characteristics and incorporate them into a model to help determine the aggregate potential of the deposit.		
<b>Time Period of Content Date</b>	2011		
<b>Currentness Reference</b>	Data were gathered in the fall of 2010 and the spring of 2011. Data were compiled and interpreted in the spring and summer of 2011.		
<b>Progress</b>	Complete		
<b>Maintenance and Update Frequency</b>	None planned		
<b>Spatial Extent of Data</b>	Kanabec County, Minnesota		
<b>Bounding Coordinates</b>	-93.52 -93.05 46.16 45.72		
<b>Place Keywords</b>	Kanabec County, Minnesota		
<b>Theme Keywords</b>	aggregate potential, sand and gravel, surficial geology, geological characteristics, probability, quality		
<b>Theme Keyword Thesaurus</b>			
<b>Access Constraints</b>			
<b>Use Constraints</b>	Acknowledgement of the Minnesota Department of Natural Resources is appreciated for products derived from these data.		
<b>Contact Person Information</b>	Aggregate Resource Mapping Program, Industrial Minerals Geologist or GIS Specialist Minnesota Department of Natural Resources, Division of Lands and Minerals 500 Lafayette Road St. Paul, MN 55155-4045 Phone: 651-259-5959 FAX: 651-296-5939 E-mail: <a href="mailto:aggregatemap@state.mn.us">aggregatemap@state.mn.us</a>		

**Browse Graphic**

none available

**Browse Graphic  
File Description****Associated Data  
Sets**

Kanabec County's aggregate resource spatial datasets (shapefiles & file geodatabase) are included in the file kanabecdata.zip, accessible from the MN DNR Aggregate Mapping web page: [http://www.dnr.state.mn.us/lands\\_minerals/aggregate\\_maps/completed/index.html](http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/completed/index.html)

The spatial datasets include: sand and gravel resource potential, test-holes drilled, geologic field observations, aggregate pits, Minnesota Geological Survey (MGS) County Well Index (CWI) data points, Mn/DOT Aggregate Source Information System (ASIS) points, and Mn/DOT ASIS pit quality table.

**Section 2****Data Quality Information****Attribute Accuracy****Logical Consistency****Completeness**

The sand and gravel potential map units were delineated by the interpretation of aerial photographs at a 1:40000 scale. These interpretations were plotted on 1:24000 USGS topographic maps. These delineations and unit descriptions were field checked and revised. The final coverage was digitized onscreen using ArcGIS 9.3.1 with USGS DOQs (at a scale of 1:12000) and USGS DRGs (at a scale of 1:24000) as the spatially registered backdrops. This was a reconnaissance-scale survey and was mapped at 1:50000

**Horizontal  
Positional Accuracy**

1:50,000

**Vertical Positional  
Accuracy**

Not applicable.

**Lineage**

Color, color-infrared (CIR), and black-and-white aerial photographs were used to delineate geological landforms and aggregate resources. Sources include; Stereoscopic pairs of color infrared aerial photographs (NAPP, 9in x 9in at 1:40000 scale, April 1991 and April 1992); On-screen landform analysis was used with FSA (Farm Services Administration) Color Aerial Photography collected from the following years, with their associated pixel resolution in parenthesis; 2003-04 (1 meter), 2005 (10 meter), 2006 (10 meter), 2008 (1 meter), 2009 (1 meter); and FSA CIR (Color Infrared) Imagery collected in 2008 (1 meter). Aerial photographic interpretation was completed with a glacial mapping technique known as the landsystems approach. This technique relies on the principle that depositional glacial landforms are composed of a predictable range of sediments, some consisting of sorted sand and gravel and others consisting of silts, clays, or unsorted materials. In addition to the landsystems approach, several other general characteristics helped determine the nature of the material, such as tonal contrasts, texture, context, shape, size, trend, association, and patterns. These characteristics can help determine the properties of the surface material (e.g., certain vegetation grows on well drained soils such as sand and gravel, which on an aerial photograph has a distinctive texture, tone, pattern, etc.).

The landform recognition approach (part of the landsystems approach) was also used when interpreting the topography within the MPES Report 384 project boundary. Glacial landforms have distinct and unique shapes and patterns that can be observed in their topographic expression. Topographic maps (USGS 1:24000), digital elevation models, and shaded relief maps were all used to help delineate these sand and gravel bearing features. The topographic expression of a feature can also be observed by looking at the distribution of lakes and wetlands. For example, a string of lakes and/or wetlands may be the signature of a glacial outwash channel or collapsed channel, which may host sand or gravel deposits. Several aggregate bearing features were located using this technique (outwash channels, collapsed channels, glaciofluvial fans, eskers, and terraces).

Other mapping sources include the Soil Survey Geographic Database for Kanabec County, Minnesota, published December 14th, 2009, from the USDA-NRCS (United States Department of Agriculture - Natural Resource Conservation Service); 10-meter DEMs (Digital Elevation Models) from the USGS National Elevation Dataset; and CWI (County Well Index) database of located and unlocated wells from the Minnesota Department of Health and MGS (Minnesota Geological Survey), downloaded in June 2010.

Related geological maps were referenced including: MN DNR Report 365 Plate A, Sand and Gravel Potential of Mille Lacs County, MN, by H. Arends, 2008; MGS Miscellaneous Map M-180, Surficial Geology of the Mora 30' x60' Quadrangle, Central Minnesota, by G. Meyer, 2008; MGS County Atlas C13, Surficial Geology of Pine County, by C. Patterson and A. Knaeble, 2001 and MGS State Map Series S21: Preliminary Bedrock Outcrop

Map, 2010. Gravel pits and quarries were extracted from several sources (refer to kana\_pits) and reviewed in the field or on air photos.

**Source Scale  
Denominator**

24000

### Section 3

#### Spatial Data Organization Information

**Native Data Set  
Environment**

ArcGIS 9.3

**Geographic  
Reference for  
Tabular Data**

**Spatial Object Type**

Vector

**Vendor Specific  
Object Types**

Polygon

**Tiling Scheme**

None

### Section 4

#### Spatial Reference Information

**Horizontal  
Coordinate Scheme**

UTM

**Ellipsoid**

GRS80

**Horizontal Datum**

NAD83

**Horizontal Units**

Meters

**Distance Resolution**

**Altitude Datum**

Not applicable

**Depth Datum**

Not applicable

**UTM Zone Number**

15E

### Section 5

#### Entity and Attribute Information

**Entity and Attribute  
Overview**

The polygons were delineated to represent geological features, geological characteristics, and aggregate potential for sand and gravel.

**Entity and Attribute  
Detailed Citation**

See beyond Section 7 for detailed field and attribute information

### Section 6

#### Distribution Information

<b><i>Publisher</i></b>	Minnesota Department of Natural Resources, Division of Lands and Minerals, Mineral Potential Evaluation Section
<b><i>Publication Date</i></b>	2012
<b><i>Contact Person Information</i></b>	Aggregate Resource Mapping Program Industrial Minerals Geologist or GIS Specialist Minnesota Department of Natural Resources, Division of Lands and Minerals 500 Lafayette Road St. Paul, MN 55155-4045 Phone: 651-259-5959 FAX: 651-296-5939 E-mail: <a href="mailto:aggregatemap@state.mn.us">aggregatemap@state.mn.us</a>
<b><i>Distributor's Data Set Identifier</i></b>	Kanabec County Aggregate Resources, Sand and Gravel Potential
<b><i>Distribution Liability</i></b>	The State of Minnesota makes no representations or warranties express or implied, with respect to the use of the information contained herein regardless of its format or the means of its transmission. There is no guarantee or representation to the user as to the accuracy, currency, suitability, completeness, usefulness, or reliability of this information for any purpose. The user accepts the information "as is." The State of Minnesota assumes no responsibility for loss or damage incurred as a result of any user's reliance on this information. All maps, reports, data, and other information contained herein are protected by copyright. Permission is granted to copy and use the materials herein for any lawful noncommercial purpose. Any user of this information agrees not to transmit or provide access to all or any part of this information to another party unless the user shall include with the information a copy of this disclaimer.
<b><i>Transfer Format Name</i></b>	
<b><i>Transfer Format Version Number</i></b>	
<b><i>Transfer Size</i></b>	mb for data, mb for associated maps
<b><i>Ordering Instructions</i></b>	Kanabec County's aggregate resource spatial datasets (shapefiles & file geodatabase) are included in the file kanabecdata.zip, accessible from the MN DNR Aggregate Mapping web page: <a href="http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/completed/index.html">http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/completed/index.html</a> The spatial datasets include: sand and gravel resource potential, test-holes drilled, geologic field observations, aggregate pits, Minnesota Geological Survey (MGS) County Well Index (CWI) data points, Mn/DOT Aggregate Source Information System (ASIS) points, and Mn/DOT ASIS pit quality table.
<b><i>Online Linkage</i></b>	<a href="#">Click here</a> to download data. (See Ordering Instructions above for details.) By clicking here, you agree to the notice in "Distribution Liability" above.

<b>Section 7</b>	<b>Metadata Reference Information</b>		
<b><i>Metadata Date</i></b>	2012		
<b><i>Contact Person Information</i></b>	Aggregate Resource Mapping Program, Industrial Minerals Geologist or GIS Specialist Minnesota Department of Natural Resources, Division of Lands and Minerals 500 Lafayette Road St. Paul, MN 55155-4045 Phone: 651-259-5959 FAX: 651-296-5939 E-mail: <a href="mailto:aggregatemap@state.mn.us">aggregatemap@state.mn.us</a>		
<b><i>Metadata Standard Name</i></b>	Minnesota Geographic Metadata Guidelines		
<b><i>Metadata Standard</i></b>	2.1		

***Version***

***Metadata Standard*** <http://www.lmic.state.mn.us/gc/stds/metadata.htm>  
***Online Linkage***

Table Name	Field Name	Definition	Valid Values	Descriptions
kana_sgp.dbf	SGPOT_ID	Number, 4	e.g., 100-999	Unique identifier for the field-mapping units.
	SEDIMENT	Text, 50	e.g., Bedrock Outcrop; Silt, and Sand over Till; Organics over Sand and Gravel; Sand and Gravel over Bedrock; see below text values and their descriptions for subsequent information. Multiple values may be used in descriptions.	General description of the dominant sediment material for each mapping unit.
			Bedrock	Presence of bedrock in the form of an outcrop, boulder or below sediment.
			Clay	Clay is very fine-grained sediment that is less than 0.004 mm in size.
			Gravel	Rock fragments of specific particle size that is larger than 2 mm and less than 63 mm.
			Organics	Soil that contains decaying organic matter.
			Sand	Rock fragments that range in diameter from 0.0625 to 2 mm.
			Sand with Gravel	Sediment that contains a mixture of rocks in varying sizes ranging from 0.0625 to 64 mm. This description is given to sediment that contains less than 15% by volume gravel.
			Sand and Gravel	Sediment that contains a mixture of rocks in varying sizes ranging from 0.0625 to 64 mm. This description is given to sediment that contains greater than 15% by volume gravel.
			Silt	Rock fragments that have a diameter between 0.004 to 0.0625 mm.
			Till	A term used to describe the unsorted sediment deposited by glaciers- contains a mixture of clay, silt, sand, gravel, cobbles and boulders.
	SGPOT_DESC	Text, 125	e.g., Mostly till with isolated pockets of sand and gravel.	A summarized description of each mapping unit.
	LANDFORM	Text, 50	See Below	The geological landform associated with each mapping unit.
			Alluvial Valley	Valley carved by flowing water like a river, stream or creek valley.
			Ground Moraine	Till covered areas with irregular topography forming gently rolling

				hills or plains. It is accumulated under glacial ice as transports and deposits sediment.
			Ice Contact Feature	A landform consisting of sediments that was initially contained or bound by glacial ice. Steep slopes characterize these landforms where ice once existed. Common ice contact features in mpes380 include eskers, kames, and ice-walled lakes.
			Lake Plain	Characterized by a flat topography consisting of sands, silts, and clays formed by the impoundment of glacial meltwater forming a glacial lake.
			Outwash Channel	Stratified sediments, chiefly silt, sand, and gravel, transported from a glacier by meltwater streams and deposited in a channel or valley.
			Outwash Feature	A landform consisting of stratified sediments, chiefly sand and gravel, removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier.
			Outwash Terrace	Terrace deposited by meltwater flowing through a glacial outwash channel. Generally sediments deposited in terraces are sorted sand and gravel, silt is possible and local till can be incorporated by erosional activity.
			Recessional Moraine	Consisting of mostly till as well as stratified sediments. A recessional moraine forms during standstills in a glaciers retreat. The resulting landform is an arcuate ridge-like accumulation of till that can range from a distinct ridge to a large-scaled hummocky landform. Besides till, they also bear sorted outwash deposits.
			Tunnel Valley	Consisting of sand, gravel, silt, and till. Organic material accumulates in low areas. A tunnel valley serves as a subglacial drainage pathway that transports large amounts of meltwater and has the capacity to sort sediments. Ice contact features commonly form within tunnel valleys.
	Potential	Text, 75	See Below	
			Significant Potential for Sand and Gravel Resources	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 are considered identified or known resources. These resources include the classes High and Moderate potential for sand and gravel deposits.
			Nonsignificant Potential for Sand and Gravel Resources	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. These units typically contain clay, silt, fine sand, unsorted sediments (till), or very thin layers of sand and gravel. Nonsignificant potential regions also coincide where bedrock is at or near the surface. Or these units may include aggregate deposits that are too small to map.
	CLASS	Text, 75	See Below	
			High Potential for Sand and Gravel Resources	Outwash terrace, outwash feature, ice contact feature, and sorted areas of recessional moraines. Deposits consist typically of sand and gravel. The probability <sup>2</sup> that a potential sand and gravel deposit exists within any mapping unit is moderately high to very high. Thickness of the deposits ranges from 10 to 50+ feet with less than 10 feet of overburden. These deposits are moderately large to very large in areal extent <sup>3</sup> and the textural characteristics <sup>4</sup> are good to very good. The quality <sup>5</sup> is typically high to very high relative to other deposits within kana384.
			Moderate Potential for Sand and Gravel Resources	Outwash channel, terrace and feature; ice contact feature; tunnel valley and sorted areas of recessional moraines. Deposits typically consist of sand and gravel to sand with gravel. The probability that a potential sand and gravel deposit exists within this unit is moderate to high. Deposit thickness ranges from 5 to 30+ feet with less than 15 feet of overburden. These deposits are moderate to moderately large in areal extent and the textural characteristics are moderate to good. The quality is typically moderate to high.
			Low Potential for Sand and Gravel Resources	Alluvial valley, tunnel valley, ice contact features, outwash features, lake plains, ground and recessional moraines. Deposits consist of till, sand, and sand with gravel. The probability that a potential deposit exists within this unit is low to moderately. Thickness of the deposits ranges from 0 to 20+ feet

				with overburden thickness ranging from 0 to 50 feet. These deposits are small to moderately small in areal extent and the textural characteristics are poor to moderate. The quality ranges from low to moderate.
			Limited Potential for Sand and Gravel Resources	Ground and recessional moraines, lake plain, tunnel valley, outwash channel and feature, and alluvial valley. The deposits of this unit contain all or one of the following: till, clay, silt, sand and/or organics. The probability that a significant sand and gravel deposit exists within this unit is low to very low. The thickness of these deposits is typically less than 20 feet with overburden thickness ranging from 0 to 100 feet. The sand and gravel deposits occurring in this unit are very small to small in areal extent. The textural characteristics are very poor to poor with the quality ranging from very low to low.
	PROBABLTY	Text, 20	Very High, High, Moderately High, Moderate, Moderately Low, Low, Very Low	The relative degree of certainty that sand and gravel exists within a unit. Based on air photo interpretations, field observations, CWI, drilling, presence of gravel pits, etc. Each unit is relative to the other units and range from very high to very low.
	SIZE	Text, 20	Very large, Large, Moderately Large, Moderate, Moderately Small, Small, Very Small	The relative size of the sand and gravel deposit.
	ACREAGE	Text, 8	See Below	The size of the deposit in acres.
			30+	Very Large
			20-30	Large
			15-20	Moderately Large
			10-15	Moderate
			5-10	Moderately Small
			3-5	Small
			< 3	Very Small
	TEXTURE	Text, 20	Very Good, Good, Moderately Good, Moderate, Moderately Poor, Poor, Very Poor.	A relative scale of the textural quality of the sand and gravel resource (sieve analysis). The coarser the material the higher the rating. Fine sand material would have a poorer rating. See MN/DOT Pit sheets for more detail.
	QUALITY	Text, 20	Very High, High, Moderately High,	A relative scale of the quality of the sand and gravel (soundness,

			Moderate, Moderately Low, Low, Very Low	durability, and mineral makeup). Determined from MN/DOT pit sheets.
	DOM_LITHO	Text, 30	See Below	Glacial Lobe Source
			Superior/Des Moines Lobe Sediments	<p>An area that was influenced by both the Superior and Des Moines lobes. See Superior lobe description below, Des Moines follows.</p> <p>A glacial lobe that flowed from the northwest, down the Minnesota River valley to a glacial maximum in Des Moines, Iowa. A sublobe flowed north from Mankato into the Twin Cities basin. It is this sublobe that deposited sediment in the extreme southeastern portion of Kanabec County. The Des Moines lobe blocked meltwater drainage creating a lake plain in southern Kanabec County. In this region there is slight influence by the Des Moines lobe. A tan, silty loam with the indicator lithologies of shale and limestones characterizes the till. Sediment from this lobe tends to produce aggregate with lower quality due to the water absorption of the shale and higher percentages of soft limestones and iron oxides.</p>
			Superior Lobe Sediments	<p>Superior lobe is a northeastern sourced glacier flowing from the Lake Superior basin to the southwest. Superior lobe sediments tend to contain rhyolites, basalts, and other Duluth Complex rock types. Aggregate with Superior lobe rock lithologies generally are of high quality and durability. Within kana384 project boundaries, Superior Lobe outwash draining from the northeast to the southwest has been identified. Presence of Superior Lobe till is found throughout the county.</p>
	THICKNESS	Text, 15	5-15, 10-30, 20-100+	Gives range of minimum and maximum thickness for sand and gravel deposit.
	THICK_MOD	Text, 1	+	The thickness modifier indicates that the thickness of the unit exceeds the value listed in the Thick_max field.
	THICK_MIN	Number , 19, 5	0, 5, 10, 15, 20, 25, 30	Describes the minimum thickness of the sand and gravel unit.
	THICK_MAX	Number , 19, 5	5, 10, 15, 20, 25, 30, 40, 50, 75	Describes the maximum thickness of the sand and gravel unit.
	OVERBURDEN	Text, 15	0-100+, 0-5, 10-50	Gives range of minimum and maximum thickness for overburden.

	OB_MOD	Text, 1	+	The overburden modifier indicates that the thickness of the overburden exceeds the values listed in the Ob_max field.
	OB_MIN	Number , 19, 5	0, 3, 10, 20	Describes the minimum thickness of the overburden covering the sand and gravel.
	OB_MAX	Number , 19, 5	1, 3, 5, 10, 15, 20, 30, 40, 50	Describes the maximum thickness of the overburden covering the sand and gravel.
	BURIED_DEP	Text, 3	Yes or No	‘Yes’ indicates that the deposit/mapping unit is buried by significant overburden (15-45 ft).
	MNDOT_DATA	Text, 3	Yes or No	‘Yes’ indicates that the deposit/mapping unit has a MN DOT ASIS data sourced point or a sampled test hole.
	MAP_LABEL	Text, 2	See Below	A cartographic map label for the sand and gravel potential classifications.
			Hp	High Potential for Sand and Gravel Resources
			Mp	Moderate Potential for Sand and Gravel Resources
			Lp	Low Potential for Sand and Gravel Resources
			Ltd	Limited Potential for Sand and Gravel Resources