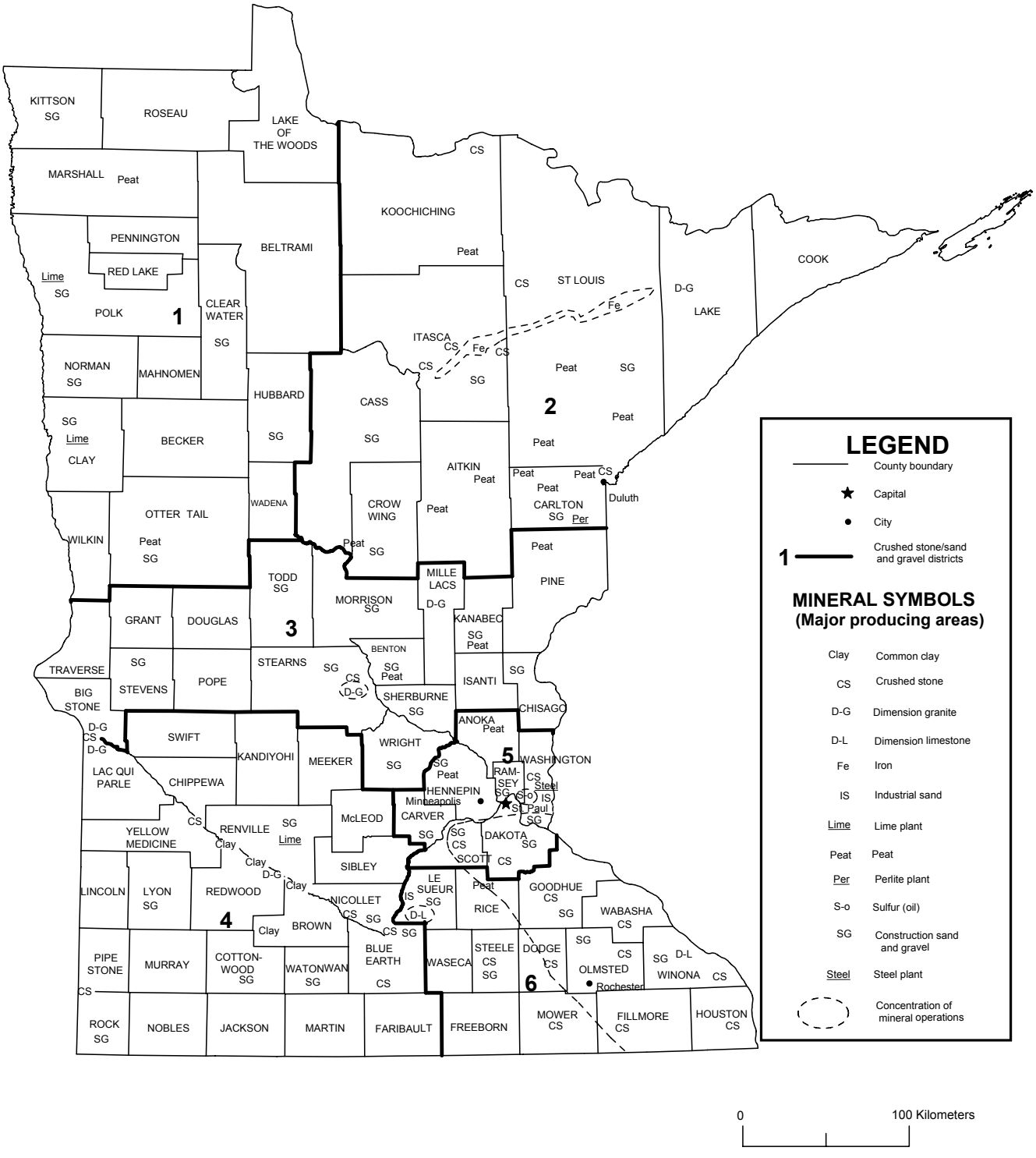
MINNESOTA



Source: Minnesota Department of Natural Resources, Division of Lands and Minerals/U.S. Geological Survey (2002)

The Mineral Industry of Minnesota

In 2002, the estimated value[1] of nonfuel mineral production for Minnesota was $1.09 billion, based on preliminary U.S. Geological Survey (USGS) data. This was about a 1% increase from that of 2001[2] and followed a 26% decrease from 2000 to 2001. The State continued as 11th in rank among the 50 States in total nonfuel mineral production value, of which Minnesota accounted for nearly 3% of the U.S. total.

In 2002, iron ore, by value, remained Minnesota's leading nonfuel raw mineral, followed by construction sand and gravel, crushed stone, industrial sand and gravel, dimension stone, and lime (descending order of value). The increase in construction sand and gravel production led the State's increase in nonfuel mineral production value, supported by smaller increases in crushed stone, peat, dimension stone, and industrial sand and gravel (table 1). Iron ore production stabilized after declining in 2001.

In 2001, Minnesota's decrease in value largely resulted from the significant drop in the production and value of iron ore, down $324 million. Iron ore production and consumption declined in the United States in 2001 because of the economic slowdown. Production in the United States, more than 70% of which was mined and produced in Minnesota, fell by about 27%—the steepest drop since the decline of 1982. The LTV Steel Mining Co. closed permanently in 2001; LTV Steel had operated in the State for 43 years and had produced more than 328 million metric tons (Mt) of iron ore. Other Minnesota iron ore operations reduced crude ore production, temporarily idled mines, or reduced (sometimes temporarily shutting down) pellet production at their furnaces. Domestic stocks fell overall by 10 Mt as iron ore producers idled facilities in response to declining demand. Internationally, consolidation within the iron ore industry, in progress during the past several years, continued in 2001, after accelerating in 2000 (Kirk, 2003, p. 41.1).

Also down in 2001 were the values of crushed stone, dimension stone, construction sand and gravel, and peat (descending order of change). Industrial sand and gravel and lime production and values were up, $2 million and slightly less than $1 million, respectively (table 1).

Compared with USGS estimates of the quantities produced in the other 49 States in 2002, Minnesota remained first in the Nation in iron ore, third in peat, and rose to sixth from eighth in construction sand and gravel. Additionally, the State produced significant quantities of industrial sand and gravel and dimension stone.

The following narrative information was provided by the Minnesota Department of Natural Resources' Division of Lands and Minerals (DLM).[3] Production data in the following text are those reported by the DLM, based upon its own surveys and estimates. The data may differ from some production figures reported by the USGS.

Exploration and Nonferrous Metallic Leasing

Thirteen private exploration companies continued to work on exploration and development projects in Minnesota primarily for copper, nickel and platinum-group metals. There has been activity on at least two development projects—the Birch Lake Deposit and the Mesaba Project.

Lehmann Exploration Management Inc.'s Birch Lake platinum-group metals (PGM) project is at the eastern end of the Mesabi Iron Range at a point where the Biwabik Iron Formation disappears into the basal contact of the Duluth Complex. The Birch Lake deposit contains an estimated 29 Mt grading 3.94 grams platinum per metric ton. It has an average thickness of 24 meters (m) and occurs at a depth of 490 m to 850 m beneath the surface. Additional information is available on the Internet at URL http://www.franconiaminerals.com/pges.htm and www.pge-birchlake.com/.

There is an estimated 4 billion metric tons of identified resource averaging 0.66% copper and 0.2% nickel in nine known subeconomic deposits within the mafic Duluth Complex in the vicinity of Babbitt about 110 kilometers (km) due north of Duluth. The Duluth Complex is the focus of several other exploration projects. PGM are important potential byproducts in several of the deposits. At a location about 80 km west of Duluth, another buried intrusive body was evaluated by geophysical methods and by drilling 14 core holes in the area during 2001.

Franconia Minerals Corp. drilled core holes on two PGM properties, Cloquet Valley and Lillian, in the Duluth Complex (2002§[4]). Franconia controlled 14 properties covering 11,000 hectares (ha) and operated an exploration program funded by Impala Platinum Holdings Ltd. (Republic of South Africa). Under the agreement, Franconia already has received $600,000 in funding for exploration and was to receive an additional $200,000 in May 2003. Also, Franconia has obtained supplementary financing from the State of Minnesota for initial drilling at four targets on the Duluth Complex and has requested

[1]The terms "nofuel mineral production" and related "values" encompass variations in meaning, depending upon the minerals or mineral products. Produciton may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2002 USGS mineral production data published in this chapter are preliminary estimates as of July 2003 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Specialist contact information may be retrieved over the Internet at URL http://minerals.usgs.gov/ minerals/contacts/comdir.html; alternatively, specialists' names and telephone numbers may be obtained by calling USGS information at (703) 648-4000 or by calling the USGS Earth Science Information Center at 1-888-ASK-USGS (275-8747). All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at URL http://minerals.usgs.gov/minerals.

[2]Values, percentage calculations, and rankings for 2001 may differ from the Minerals Yearbook, Area Reports: Domestic 2001, Volume II, owing to the revision of preliminary 2001 to final 2001 data. Data for 2002 are preliminary and are expected to change; related rankings may also change.

[3]Maryanna Harstad, Senior Planner, authored the text of the State mineral industry information provided by the Minnesota Department of Natural Resources' Division of Lands and Minerals.

[4]A reference that includes a section mark (§) is found in the Internet Reference Cited section.

financing for two additional targets. In November 2002, Franconia signed an earn-in agreement with the Beaver Bay Joint Venture, owners of the Birch Lake property.

Minnesota also has potential for gold and base metals in Archean greenstone environments. There are several known prospects for copper, gold, and zinc available for exploration through State mineral leases in the Lake Vermillion and Ely areas. Most of the northern portion of the State is underlain by Archean greenstone terranes, portions of which have been explored in the past for metallic minerals.

The State Department of Natural Resources, Division of Lands and Minerals, maintains an archive of drill core and related exploration data at its Hibbing office. Scanned copies of these archives may be accessed through the DNR's Web site at URL http://minarchive.dnr.state.mn.us.

On July 16, 2002, Minnesota held its 26th sale of metallic mineral leases in St. Paul. A total of 1,360 mining units, covering 171,000 ha within Cook, Lake, and St. Louis Counties, were offered in the lease sale, with more than half of these (91,000 ha) in St. Louis County. About 15, 200 ha had never been offered at a lease sale previously, including about 9,430 ha in Cook County, 1,340 ha in Lake County, and 4,440 ha in St. Louis County.

Prior to the lease sale, a total of six bids were submitted on six mining units, all by Ernest K. Lehmann & Associates, Inc. Four of these bids were for Cook County (230 ha), one was for Lake County (180 ha), and one was for St. Louis County (65 ha). The lease sale resulted in Ernest K. Lehmann & Associates, Inc. being issued leases for all six of its bids.

In addition, eleven negotiated leases were issued in 2002. In St. Louis County, five negotiated leases (covering 848 ha) were issued to Falconbridge U.S., Inc., and three (covering 677 ha) were issued to Ernest K. Lehmann & Associates, Inc. In Lake County, two (covering 243 ha) were issued to Ernest K. Lehmann & Associates, Inc., and one (covering 97 ha) was issued to Lehmann Exploration Management, Inc.

A total of 18 leases were terminated in 2002, including 3 leases held in Carlton County by Minerals Processing Corp., 13 in Lake County held by Ernest K. Lehmann & Associates, Inc., and 2 in St. Louis County held by American Shield Co.

The interest in metallic mineral leases for 2002 brought the total active State-issued leases of this type to 265, covering 31,777 ha, as of January 1, 2003. Metallic mineral leases brought in a total of $191,985 for calendar year 2002, of which $55,592 went to the State's School Trust Fund.

Teck Cominco Ltd. leased the Babbitt Deposit and was actively developing a new hydrometallurgical flowsheet for this copper and nickel ore by applying its patented CESL process. Teck Cominco has applied for a permit to take a 45,000-metric-ton bulk sample in order to evaluate the metal extraction process. This process also neutralizes the sulfide minerals in the tailings. More information can be found at URL http://www.teckcominco.com/research/index.htm.

Commodity Review

Industrial Minerals

Aggregate.—Minnesota's aggregate industry produces three types of materials—sand and gravel mined from glacial or alluvial deposits; crushed carbonate from quarries in southeastern Minnesota where natural gravel is scarce; and high-quality crushed rock from quarries in granite, quartzite, or traprock elsewhere in the State.

Aggregate has been or is currently being mined in all of the State's 87 counties. The Minnesota Department of Natural Resources program to identify the location of construction aggregate resources will have completed 18 counties by the end of summer 2003, as shown on the Internet at URL http://www.dnr.state.mn.us/lands_minerals/aggregatemaps.html. In addition to the production reported by the USGS, some of the same quarries that produce crushed carbonate rock also produce granular carbonate (limestone or dolomite) rock, which is used for soil amendment or for cement. The Minnesota Department of Agriculture (MDA) analyzes the granular carbonate soil amendment commonly called ag-lime to determine the neutralization potential. The MDA compilation lists total sales of ag-lime for crop year 2001-2002 as 757,000 metric tons (t) and is available on the Internet at URL www.mda.state.mn.us/lime/tonnagestats.pdf. Of that amount, 431,000 t (57%) was primary production from Minnesota quarries.

Minnesota's dimension stone industry has quarry production from granite, dolostone, quartzite, and anorthosite. Cold Spring Granite Co.'s greenstone (Lake Superior Green) was used in the National D-Day Memorial in Bedford, VA, and its black stone (Mesabi Black) has significantly increased in popularity.

Metals

Iron Ore.—Iron ore production in Minnesota increased from 34.2 Mt in 2001 to 39.3 Mt in 2002, an increase of 15%. Minnesota continued to rank first in the Nation in iron ore production, accounting for approximately 70% of 2002 domestic iron ore shipments to the U.S. steel industry. Although the uncertain market and financial situation of the Nation's integrated steel mills had a significant effect on Minnesota's iron ore production, iron mining continued to rank among the State's largest industries, contributing more than $1 billion to Minnesota's economy each year.

The State responded with some initiatives to help offset economic losses of Minnesota's taconite companies and competition from imported subsidized steel. Royalty rates were reduced for those companies mining Minnesota owned ore, and the State awarded a grant to USX (Minntac) to encourage capital investment and improvement in Minnesota's taconite operations.

Minnesota's long-term effort to promote value added iron production resulted in the construction of a pilot plant in

Silver Bay, MN. The pilot plant is a joint venture between Cleveland Cliffs Inc., Kobe Steel of Japan, Steel Dynamics Inc., and Ferrometrics Inc. The pilot plant will begin operating in June 2003 and will produce pig iron nuggets. This project has the potential to bring commercial pig iron production to northeastern Minnesota.

Environmental Issues

The Environmental Cooperative Research Program addresses environmental and land use impacts associated with mining. Typical research projects are cosponsored by industry, Federal Agencies, or other units of government on a cost-share or in-kind service basis. Projects undertaken in 2002 were continuations of studies initiated in 2001 and included characterization and modeling of acid rock drainage, dissolution of greenstones, mercury volatization in taconite tailings, mercury removal from induration off gas by wet scrubbers, dissolution of individual silicate minerals of the Duluth Complex, and use of biosolids to reclaim coarse taconite tailings. Biennial appropriation (July 2001 to June 2003) for minerals cooperative environmental research was $100,000 in the first fiscal year and is $101,000 in the second. Only a portion ($50,000 and $50,500) is available if matching non-State funds are not provided.

The Iron Ore Cooperative Research Program funds research supporting rapid improvements in iron ore/taconite processing. The selection process for funding new research projects for the next 2 years (July 2003 to June 2005) was in progress. Research projects that will be completed by June 30, 2003, include borehole geophysical investigations supporting improved ore blending; magnetic studies that may lead to reduced need for flotation chemicals in final stage processing; and online chemical analysis that may lead to increased taconite pellet quality and processing efficiency through better information on calcium, iron, magnesium, and silica in taconite ore.

The Minerals Diversification Program funds research supporting the long-term health of the State's mining economy. This is achieved through improvements to existing industry and by encouraging environmentally sound exploration and development of new mineral resources. Research projects undertaken in 2002 were continuations of studies initiated in 2001 and include delineation of potential PGM mineral resources, mapping of county aggregate resources, mercury investigations, and evaluation of known but undeveloped resources, such as copper and nickel. Biennial appropriation (July 2001 to June 2003) for Minerals Diversification was $370,000 in the first fiscal year and is $342,000 in the second (a reduction of $30,000). The selection process for funding new research projects for the next biennium (July 2003 to June 2005) will soon be completed.

Legislation and Government Programs

In the 2002 session, the Minnesota Legislature amended the statute relating to the aggregate material tax by making a technical change to the sales tax on delivery charges of aggregate materials by a contractor to an end user. In 2002, four more counties—Benton, Dodge, Goodhue, and Meeker and imposed the aggregate materials tax. A total of 27 counties and 4 townships in St. Louis County imposed the tax in 2002.

In addition to the "Public Access to Minerals Information," as shown on the Internet at URL http://minarchive.dnr.state.mn.us, the following information is available on the DNR Web site at URL http://www.dnr.state.mn.us: monthly data releases, information on mineral lease availability, aggregate resource maps, seven-county Minneapolis-St. Paul metropolitan area aggregate resource map and report on projected availability of aggregate resources, and many online documents pertaining to mineral and mining research and exploration.

Reference Cited

Kirk, W.S., 2003, Iron ore, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2001, v. I, p. 41.1-41.22.

Internet Reference Cited

Franconia Minerals Corp., 2002, (April 2), Winter drilling program successfully completed on Franconia Minerals-Impala Platinum exploration program properties in the Duluth Complex, Minnesota, USA, News Release, accessed August 21, 2003, at URL http://www.franconiaminerals.com/nr0203.htm.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MINNESOTA[1, 2]

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		2000		2001		2002[p]	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays, common		14	15	14	15	14 [e]	14 [e]
Gemstones		NA	6	NA	6	NA	6
Iron ore, usable		46,700	1,180,000	37,300	856,000	36,800	844,000
Peat		75	5,100	83	4,430	51	5,130
Sand and gravel, construction		39,500	158,000	39,800	155,000	42,400	168,000
Stone:							
Crushed		12,400	68,100	9,730	57,000	9,700	57,900
Dimension	metric tons	W	W	15,700	11,800	22,900	12,300
Combined values of lime, sand and gravel (industrial), stone [dimension granite and limestone (2000)], and values indicated by symbol W		XX	44,100	XX	(3)	XX	(3)
Total		XX	1,460,000	XX	1,080,000	XX	1,090,000

[e]Estimated. [p]Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Value excluded to avoid disclosing company proprietary data.

TABLE 2
MINNESOTA: CRUSHED STONE SOLD OR USED, BY KIND[1]

Kind	2000				2001			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	49	6,400	$30,300	$4.73	36	3,980	$19,100	$4.79
Granite	4	W	W	6.43	4	W	W	6.66
Dolomite	8	3,370	20,400	6.06	7	3,320	21,000	6.34
Quartzite	1	W	W	9.60	1	W	W	9.70
Total or average	XX	12,400	68,100	5.50	XX	9,730	57,000	5.85

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

TABLE 3

MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2001, BY USE[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	$3.31
Riprap and jetty stone	48	$660	13.75
Filter stone	19	118	6.21
Other coarse aggregates	38	675	17.76
Coarse aggregate, graded:			
Concrete aggregate, coarse	52	277	5.33
Bituminous aggregate, coarse	W	W	8.17
Bituminous surface-treatment aggregate	22	201	9.14
Railroad ballast	W	W	8.54
Other graded coarse aggregates	1,020	8,180	8.06
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	W	W	7.72
Screening, undesignated	W	W	3.58
Other fine aggregates	182	1,120	6.16
Coarse and fine aggregates:			
Graded road base or subbase	894	4,740	5.30
Unpaved road surfacing	314	1,130	3.60
Terrazzo and exposed exposed aggregate	W	W	13.23
Crusher run or fill or waste	86	424	4.93
Roofing granules	W	W	9.92
Other coarse and fine aggregates	1,100	5,470	4.97
Agricultural:			
Limestone	198	902	4.56
Poultry grit and mineral food	W	W	30.64
Special, asphalt fillers or extenders	W	W	5.73
Unspecified:[2]			
Reported	3,880	23,000	5.92
Estimated	1,700	8,500	5.03
Total or average	9,730	57,000	5.85

W Withheld to avoid disclosing company proprietary data; included in "Total."

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Reported and estimated production without a breakdown by end use.

TABLE 4

MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2001, BY USE AND DISTRICT[1, 2]

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:	--	--	--	--	W	W
Coarse aggregate (+1 1/2 inch)[3]	--	--	--	--	W	W
Coarse aggregate, graded[4]	--	--	--	--	W	W
Fine aggregate (-3/8 inch)[5]	--	--	--	--	W	W
Coarse and fine aggregates[6]	--	--	--	--	W	W
Agricultural[7]	--	--	--	--	W	W
Special[8]	--	--	--	--	--	--
Unspecified:[9]						
Reported	--	--	1,390	9780	907	5340
Estimated	7	36	260	1,300	640	3,230
Total	7	36	1,650	11,100	1,540	8,570

	District 5		District 6	
	Quantity	Value	Quantity	Value
Construction:				
Coarse aggregate (+1 1/2 inch)[3]	78	1260	W	W
Coarse aggregate, graded[4]	1,020	8,200	W	W
Fine aggregate (-3/8 inch)[5]	182	1,120	W	W
Coarse and fine aggregates[6]	1,800	9,490	W	W
Agricultural[7]	W	W	W	W
Special[8]	W	W	--	--
Unspecified:[9]				
Reported	1,590	7,890	--	--
Estimated	40	220	750	3700
Total	4,720	28,200	750	3,700

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]No production reported in District 1.

[3]Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregates.

[4]Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregates.

[5]Includes screening (undesignated), stone sand bituminous mix or seal, and other fine aggregates.

[6]Includes crusher run (select material or fill), graded road base or subbase, roofing granules, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

[7]Includes agricultural limestone and poultry grit and mineral food.

[8]Includes asphalt fillers or extenders.

[9]Reported and estimated production without a breakdown by end use.

TABLE 5

MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2001, BY MAJOR USE CATEGORY[1]

Use	Quantity (thosuand metric tons)	Value (thousands)	Unit value
Concrete aggregates (including concrete sand)	11,300	$59,700	$5.28
Plaster and gunite sands	228	1,190	5.24
Concrete products (blocks, bricks, pipe, decorative, etc.)	185	2,140	11.56
Asphaltic concrete aggregates and other bituminous mixtures	4,450	17,100	3.84
Road base and coverings[2]	8,560	24,900	2.91
Fill	2,620	6,000	2.29
Snow and ice control	314	1,370	4.36
Other miscellaneous uses[3]	857	3,070	3.58
Unspecified:[4]			
Reported	2,980	8,560	2.87
Estimated	8,300	31,000	3.68
Total or average	39,800	155,000	3.88

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Includes road and other stabilization (cement and lime).

[3]Includes filtration, railroad ballast, and roofing granules.

[4]Reported and estimated production without a breakdown by end use.

TABLE 6

MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2001, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products[2]	1,010	5210	571	3280	3,690	15500
Asphaltic concrete aggregates and other bituminous mixtures	253	574	W	W	2,030	7,580
Road base and coverings[3]	973	2,490	1,510	4,890	3,370	8,930
Fill	318	613	205	535	384	833
Snow and ice control	W	W	38	95	79	261
Other miscellaneous uses[4]	8	52	18	103	233	1,520
Unspecified:[5]						
Reported	222	488	1,640	3,700	216	488
Estimated	1,400	4,300	2,000	6,500	820	3,000
Total	4,140	13,700	6,040	19,300	10,800	38,000

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products[2]	356	1420	W	W	W	W
Asphaltic concrete aggregates and other bituminous mixtures	W	W	340	1880	W	W
Road base and coverings[3]	588	1,650	W	W	W	W
Fill	138	390	1,440	3,040	126	570
Snow and ice control	27	91	W	W	42	127
Other miscellaneous uses[4]	337	3,630	5,050	34,300	1,160	7,030
Unspecified:[5]						
Reported	257	1,430	559	2,240	1	8
Estimated	1,600	7,200	750	2,700	1,700	6,900
Total	3,290	15,800	8,130	44,100	3,080	14,700

	Unspecified districts	
	Quantity	Value
Concrete aggregates and concrete products[2]	1,510	3370
Asphaltic concrete aggregates and other bituminous mixtures	1,320	2,920
Road base and coverings[3]	1,380	2,450
Fill	8	17
Snow and ice control	--	--
Other miscellaneous uses[4]	--	--
Unspecified:[5]		
Reported	89	211
Estimated	--	--
Total	4,310	8,970

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes plaster and gunite sands.

[3]Includes road and other stabilization (cement and lime).

[4]Includes filtration, railroad ballast, and roofing granules.

[5]Reported and estimated production without a breakdown by end use.