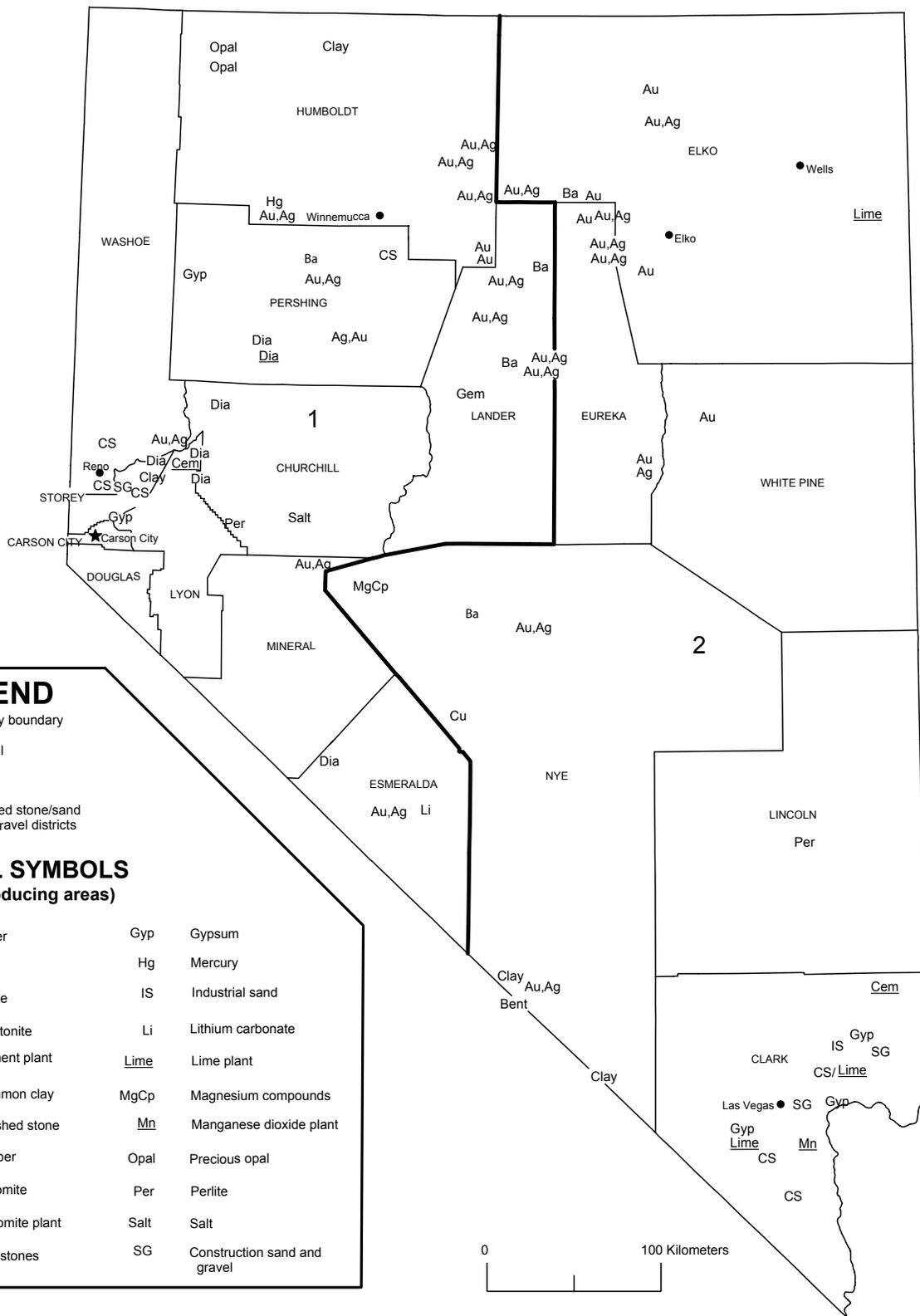


NEVADA



LEGEND

- County boundary
- ★ Capital
- City
- 1** — Crushed stone/sand and gravel districts

MINERAL SYMBOLS (Major producing areas)

Ag	Silver	Gyp	Gypsum
Au	Gold	Hg	Mercury
Ba	Barite	IS	Industrial sand
Bent	Bentonite	Li	Lithium carbonate
<u>Cem</u>	Cement plant	<u>Lime</u>	Lime plant
Clay	Common clay	MgCp	Magnesium compounds
CS	Crushed stone	<u>Mn</u>	Manganese dioxide plant
Cu	Copper	Opal	Precious opal
Dia	Diatomite	Per	Perlite
<u>Dia</u>	Diatomite plant	Salt	Salt
Gem	Gemstones	SG	Construction sand and gravel

0 100 Kilometers

THE MINERAL INDUSTRY OF NEVADA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Nevada Bureau of Mines and Geology for collecting information on all nonfuel minerals.

In 2003, the estimated value¹ of nonfuel raw mineral production for Nevada was more than \$2.9 billion, based upon preliminary U.S. Geological Survey (USGS) data. This was about a 1% increase compared with that of 2002² and followed a 5.4% increase in 2002 from 2001. The State continued to rank second in the Nation in nonfuel mineral production and accounted for more than 7.5% of the U.S. total.

Nevada, which has led the Nation in gold production since 1981, provided 81% of the Nation's gold in 2003. The "Silver State" ranked first in silver production from 1987-2001 and second in 2002 and 2003, and accounted for nearly 30% and 24% of the silver produced from U.S. mines in 2002 and 2003, respectively. In 2003, gold accounted for 83% of Nevada's total nonfuel raw mineral production value, followed by construction sand and gravel with about 6% and crushed stone and silver with about 1.5% each. Increases in the values of gold (which were accompanied by somewhat lower production), construction sand and gravel, lime, crushed stone, and gypsum (in descending order of change) accounted for most of the State's increase in value in 2003. These increases were offset somewhat by decreases in the values of silver, portland cement, lithium carbonate, and magnesite (in descending order of change) (table 1).

In 2002, increases in the values of gold, which rose by \$190 million, and crushed stone, which rose by about \$4 million, and magnesite accounted for most of the State's increase in nonfuel mineral value. These increases were offset somewhat by decreases in the values of construction sand and gravel and silver, which fell by about \$14 million each; copper; diatomite; and lead (in descending order of change). The change in the combined values of Nevada's other nonfuel minerals between 2001 and 2002 was negligible (table 1).

Based upon USGS estimates of the quantities produced in the 50 States during 2003, Nevada continued to be the only State to

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production 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 2003 USGS mineral production data published in this chapter are preliminary estimates as of July 2004 and are expected to change. For some mineral commodities, such as construction sand and gravel, crushed stone, and portland cement, 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 USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

²Values, percentage calculations, and rankings for 2002 may differ from the Minerals Yearbook, Area Reports: Domestic 2002, Volume II, owing to the revision of preliminary 2002 to final 2002 data. Data for 2003 are preliminary and are expected to change; related rankings also may change.

produce magnesite and lithium carbonate minerals. It remained the leader in gold production among the States that produce gold. Nevada ranked first in barite production of the two States that produce barite; first in the production of brucite of the two brucite-producing States, and first in the production of diatomite of the four diatomite-producing States. Nationwide, it ranked second in the production of silver, third in gypsum, fifth in perlite, and seventh in lime. It rose in rank to 6th from 11th in gemstone production, was one of the top 10 construction-sand-and-gravel-producing States, and was a significant producer of industrial sand and gravel.

The following narrative information was provided by the Nevada Bureau of Mines and Geology (NBMG).³ Production data in the following text are those reported by the NBMG, based upon its own surveys, estimates, and information gathered from company annual reports. The NBMG data are reported by that agency to be nonproprietary and may differ from some USGS preliminary estimates and production figures as reported to and estimated by the USGS.

Exploration and Development Activities

For the second consecutive year, exploration activity in Nevada showed a significant increase. The concept of "high-grade feeder veins" beneath previously exploited low-grade surface ores continued to gain followers and was expressed as claim staking and drilling in numerous old districts scattered across the State. Interest spread from Newmont Mining Corp.'s Midway property in Nye County and generated activity in the nearby Belle Helen, Clifford, Ellendale, Golden Arrow, and Hannapah districts. To the north, in the Cortez and Simpson Park Mountains of Eureka County, continued discoveries by Placer Dome Inc. stimulated increased claim staking and drilling in that area. Several companies were active in the Battle Mountain and adjacent districts of Humboldt and Lander Counties, sparked by announcements of pending development and production at Newmont's Phoenix project.

In recent years, aggregate producers have staked mining claims on carbonate rock resources in the Las Vegas area; however, some of the material may be slated as feed for lime or cement operations. This process was initiated in 2001 when Rinker Materials Inc. acquired claims on carbonate rock in the Sloan area south of Las Vegas. In 2003, U.S. Bureau of Land Management (BLM) personnel began preparation of a Mining Claim Validity Report on these claims, which included comparative testing of materials from the claims with similar material from four producers of crushed carbonate rock in the Las Vegas area. A decision on whether or not to challenge the

³Jonathan G. Price, the State Geologist, and Stephen B. Castor and Joseph V. Tingley, Research Geologists, coauthored the text of the State mineral industry information provided by the Nevada Bureau of Mines and Geology.

claims will be made by the BLM Nevada State Director in 2004. If a challenge is issued by the BLM, a hearing may take place in 2004, but a final judgment and appeal may take as long as 10 years.

Companies that staked claims on carbonate rock or other aggregate material in 2003 included Frehner Construction Co., which is in the Sloan area; Sierra Ready Mix, which is in the Ivanpah area about 32 kilometers (km) south of Las Vegas near the proposed site of a new international airport; and Las Vegas Paving, which is in the Dry Lake area northeast of Las Vegas. Diamond Generating Corp. (a subsidiary of Mitsubishi Electric), a company that was building a powerplant in the Ivanpah area, also staked claims in that area that possibly covered a construction aggregate resource. Other companies may have staked aggregate resource claims in the Las Vegas area by proxy.

Milestone Minerals Inc. staked the Champagne Marble claims in the vicinity of an inactive marble quarry that is about 8 km northeast of Luning in Mineral County. Other potential dimension stone operations were evaluated for variously colored marble deposits at the old Carrara marble quarries near Beatty in Nye County and for mottled pink to purple or blue dumortierite-andalusite-quartz rock at Lincoln Hill in Pershing County.

Gold and silver remained the principal metals sought by Nevada exploration companies, although two copper properties received mention in 2003. Most noteworthy was the announcement that the porphyry copper deposit at the Robinson Mine near Ely in White Pine County might be brought into production again.

More than 17,700 new mining claims were recorded in Nevada in 2003, which exceeded the 2002 total of 13,500. As was true in 2002, the 2003 claims were spread across the State. Major staking was recorded in the Battle Mountain district (940 claims), the Northern Simpson Park area (745 claims), and the Ivanhoe district (730 claims).

Exploration in 2003 expanded beyond high-grade (mostly vein) targets, which tend to be popular during times of depressed prices for gold, to once again include low-grade, large-tonnage deposits, which generally become more profitable when gold prices are higher. The average price in 2003 was \$365 per ounce, which was substantially greater than the \$311 per ounce average price in 2002 (Amey, 2005). New discoveries were reported along the Carlin trend, in the Jerritt Canyon district, and in several other districts.

Most exploration efforts focused on gold and silver. As measured by the numbers of active claims on public lands, grass-roots exploration activity was slightly more than the previous year, but other reports indicated increased activity. According to a survey of exploration activities by the Nevada Division of Minerals, exploration activity in Nevada had been steadily declining since 1997, but 2002 saw an increase of 26% more than that of 2001, and exploration expenditures in 2003 rose another 7% more than those of 2002 (Driesner and Coyner, 2004a⁴). The 30 companies that responded to the survey reported that they spent \$69.2 million on exploration in Nevada in 2003, which was more than the \$64.6 million

spent in 2002 but much less than the \$138.8 million spent in 1995. They projected that they would spend \$89.1 million in Nevada in 2004. Another measure of exploration activity was the number of exploration geologists employed by these companies—126 in 2003 compared with 129 in 2002 and 309 in 1997. These companies projected that they would employ 158 exploration geologists in 2004. The decline in exploration was largely the result of low metal prices, and the increases in 2002 and 2003 were probably the result of relatively higher prices. Because of its favorable geology and regulatory climate, Nevada continued to attract a large portion of the worldwide exploration expenditures of the companies that actively explore in Nevada. Significant exploration (which included drilling, geochemical sampling, and geologic mapping) was reported in 13 of Nevada's 17 counties, and new claims were staked in 16 counties (only the County of Carson City did not show activity).

Commodity Review

The productivity of Nevada mining operations was exceptionally high. Measured simply by the value of the mineral commodities produced divided by the number of employees, productivity of Nevada miners in the nonfuel minerals industry was approximately \$357,000 per employee in 2003, which was an alltime high.

Industrial Minerals

The total value of industrial minerals produced in Nevada in 2003, which was estimated to be \$425 million, was slightly higher than that of 2002. In order of estimated value, the most important Nevada industrial minerals in 2003 were construction aggregate, lime, diatomite, cement, gypsum, magnesia, barite, silica, and clay, each valued at more than \$10 million. Commodities with values of less than \$10 million were lithium, dolomite, perlite, dimension stone, salt, zeolite, potassium alum, and gemstones. Borate and some zeolite were processed in Nevada but mined in California and were not included in the estimate of total industrial mineral value. Data used for these estimates and data reported for the individual commodities described below were obtained from the Nevada Division of Minerals, the BLM, or directly from companies that produced the commodities.

In May 2003, the 39th annual Forum on the Geology of Industrial Minerals was held in Sparks, NV. This meeting, which was attended by about 250 participants from industry, government, and academia offered 3 days of technical sessions and eight field trips. The published proceedings of the meeting, which included several papers on Nevada industrial mineral deposits as well as papers on other domestic and international industrial mineral topics, were available from the NBMG (Castor, Papke, and Meeuwig, 2004).

Aggregate (crushed stone and sand and gravel) production reached an alltime high in 2003 as a result of Nevada's expanding population and need for construction materials used to build homes, schools, streets, highways, airports, resort hotels, and other businesses. Demand for construction

⁴References that include a section mark (§) are found in the Internet References Cited section.

raw materials was likely to remain strong owing to Nevada's booming population.

Crushed Stone and Sand and Gravel.—Some of the crushed stone reported by the USGS was used in the manufacture of commodities such as cement and lime; such material was not included in Nevada's aggregate figures because the processed commodities were listed separately. Nevada's statewide construction aggregate production in 2003 was estimated to be 34 million metric tons (Mt), which was 2 Mt more than was produced in 2002. This production had an approximate value of \$166 million, which was much less than that of gold but much more than that of any of the State's other mined commodities. Aggregate production from sand and gravel deposits accounted for about 75% of aggregate production statewide; crushed stone and lightweight aggregate made up the balance.

Construction aggregate produced in the Las Vegas area in 2003 was estimated to be 24 Mt, which was slightly more than that produced in 2002. Continued growth in the Las Vegas area will likely maintain these levels of demand and production, and the planned new Ivanpah Valley Airport and attendant urbanization south of Las Vegas were expected to constitute major future markets.

Sand and gravel operations accounted for about 80% of the aggregate used in the Las Vegas metropolitan area in 2003; crushed stone and lightweight aggregate made up the balance. The most important source of sand and gravel for Las Vegas was the Lone Mountain area northwest of Las Vegas, which accounted for about 6 Mt in 2003. Significant production also came from sand and gravel pits in the southwest part of Las Vegas. Since the mid-1990s, portable crushers that produce aggregate from sand and gravel at construction sites had become important producers of base aggregate in Las Vegas. Crushed stone—mostly crushed carbonate rock mined from outlying areas—has gained importance in the Las Vegas construction aggregate market in recent years, particularly for concrete aggregate.

Companies in the Las Vegas area that produced more than 900,000 metric tons (t) of aggregate in 2003 were Nevada Ready Mix Corp., Las Vegas Paving Corp., Rinker Materials Corp. (a subsidiary of the Australian-based CSR Group), Frehner Construction Co., Inc., and Diamond Construction Co. Other important producers were Granite Construction Inc., Wells Cargo Inc., Impact Sand and Gravel, Infiniton Llc, and Southern Nevada Liteweight.

Nevada Ready Mix mined all of its aggregate from a complex of pits in alluvium in the Lone Mountain area; minor production also came from adjacent bedrock. Las Vegas Paving Corp. produced sand and gravel from its Blue Diamond and Lone Mountain pits and portable crushing operations. The company also produced crushed stone from the Apex landfill, which is about 16 km northeast of the metropolitan area. Rinker Materials produced sand and gravel from its Buffalo Road pit and crushed granite from the El Dorado pit near Railroad Pass. Frehner Construction mined and crushed limestone from its Sloan property, which is a few kilometers south of Las Vegas. Community pits and other aggregate mining facilities administered by the BLM and operated by several companies contributed more than 4 Mt to the Las Vegas area total in 2003.

The Southern Nevada Liteweight operation near Jean mainly produced aggregate for lightweight concrete block and sand for use in stucco. Lightweight aggregate was also shipped into the Las Vegas market from a cinder operation near Amargosa Valley in Nye County by Cind-R-Lite Block Co.

In 2003, about 5 Mt of construction aggregate was produced in the Reno-Sparks-Carson City area, which was about the same as was produced in the area in 2002. Three companies in the area produced more than 900,000 t of aggregate—Granite Construction Co., RMC Nevada, Inc., and Martin Marietta Materials Inc. Granite Construction produced aggregate from five pits in the area. RMC Nevada (part of a U.S. holding company for a United Kingdom group) owned All-Lite Aggregate and Paiute Pit Aggregates. Most of Martin Marietta's production came from the Rocky Ridge Quarry, which is north of Sparks. Rilite Aggregate Co., Frehner Construction, and A&K Earthmovers, Inc. were also important producers. Crushed rock, which accounted for more than 60% of the aggregate used in 2002 in the Reno-Sparks-Carson City area, included material from Martin Marietta Materials, Granite Construction, and Frehner operations and lightweight rhyolite aggregate from All-Lite, Rilite, and Naturalite Aggregate Corp.

The amount of aggregate that was produced outside of the major metropolitan areas in 2003 was estimated to be about 3 Mt. Operators in Nye County together produced more than 450,000 t of aggregate in 2003 mostly in the Pahrump area. Churchill County and Lyon County each produced more than 270,000 t of aggregate; much of the Lyon County material was sold into the Reno-Carson City metropolitan area. Elko, Humboldt, Lincoln, and Storey County each produced more than 90,000 t of aggregate; other rural Nevada counties were estimated to have produced less than 90,000 t of aggregate each in 2003.

Barite.—Nevada produced most of the barite mined in the United States. About 422,000 t of barite was produced in the State in 2003, which was a significant increase from the 342,000 t produced in 2002. In 2003, 4 companies mined barite in Nevada; by contrast, in the early 1980s when as much as 2.3 Mt was produced annually, there were more than 25 Nevada producers. Foreign competition and relatively little domestic oil drilling were the main factors that have limited Nevada barite mining in recent years. About 95% of the barite sold in the United States was used as a weighting agent in oil- and gas-well-drilling fluids. In 2002, about 700 domestic onshore rigs operated; by contrast, nearly 1,000 operated in the third quarter of 2003. U.S. net imports were 1.6 Mt of barite in 2003, down from 2.5 Mt in 2001. Most of the imported barite was from China.

M.I. Drilling Fluids (jointly owned by Smith International Inc. and Schlumberger Ltd.) was again the leading Nevada barite producer in 2003 and had a combined production of about 236,000 t of screened and crushed high-grade ore from the Greystone Mine and ground and bagged barite from its Battle Mountain plant, both of which are in Lander County. The company reportedly evaluated barite deposits elsewhere in Nevada in 2003 and staked seven claims in the Lone Mountain area in Elko County presumably on barite deposits.

Baroid Drilling Fluids, Inc. (a subsidiary of Halliburton Co.) was the second leading producer in Nevada in 2003. The company mined barite from the Rossi Mine in Elko County and processed it at the Dunphy Mill in Eureka County. Baker Hughes INTEQ also produced a significant amount of barite from its Argenta property near Battle Mountain. Standard Industrial Minerals Inc. shipped a small amount of barite from a deposit of white, paint-grade barite at the P and S Mine in Nye County to a processing plant in Bishop, CA.

Boron.—In 2003, American Borate Co. mined borate minerals at the Billie Mine in Death Valley, CA. The ore was processed in Nye County at the Lathrop Wells mill, which had a 20,000-metric-ton annual capacity (B_2O_3 basis), but because the ore was from out of State, this production was excluded from the total value of Nevada minerals.

Cement.—Based on USGS data, in 2003, about 91 Mt of cement was produced in the United States at an average mill price of about \$76 per metric ton. The only major Nevada producer, the Nevada Cement Co., which is in Fernley, Lyon County, had annual production in excess of 450,000 t of cement. The cement was manufactured from limestone mined from a deposit a few kilometers south of Fernley, and other ingredients came from northern Nevada. The limestone deposit formed in a Tertiary lake and showed many features that were similar to modern tufa deposits in northern Nevada. Because the Fernley deposit had limited reserves, Nevada Cement Co. planned a drilling project in limestone of the Natchez Pass Formation in the Humboldt Range in Pershing County on claims staked in 1991. The limestone was to be evaluated as raw material for portland cement production possibly in a new plant to be constructed near the Rye Patch exit on Interstate 80.

Limestone suitable for cement production was widespread near Las Vegas, and several attempts were made to initiate cement production in the area, without long-term success. In 1999, Royal Cement Co. restarted an idle cement plant near Logandale in Clark County. Limestone was mined at a site near the plant, and other raw materials were purchased from regional suppliers. According to the Directory of Nevada Mine Operations, American Cement & Aggregate Co. of Lake Forrest, CA, was the operator in 2001. The Logandale plant was shut down in mid-2003. In 2002, Minerals Mining staked limestone for cement in the Apex district northeast of Las Vegas. Claims were staked over carbonate rock in the same area by Republic Dumpco, but this activity may have been defensive staking of rock that was being mined as construction aggregate.

Clays.—Nevada clay production in 2003 was estimated to be 33,000 t, which was an increase of about 10% from that of 2002. This figure excluded halloysite clay mined in Washoe County for Nevada Cement Co., which was included in the cement figure.

IMV Nevada (owned by Mud Camp Mining Co., LLC) produced more than 30,000 t of bentonite, saponite, and sepiolite from deposits in lacustrine sediments in the Ash Meadows area of Nye County. The company had a processing plant in Amargosa Valley and exported a variety of clay products worldwide. Most of the value from the operation came from the sepiolite, which has specific uses in asbestos replacement

and saltwater drilling. IMV Nevada had the only commercial sepiolite deposit in North America.

Two companies campaign mined and shipped relatively minor amounts of Nevada clay from several sites for use in high-cost specialty products. At its White Caps Mill near Beatty in Nye County, Vanderbilt Minerals Co. processed small amounts of clay stockpiled from several Arizona, California, and Nevada deposits. In 2003, the company mined no clay in Nevada, but shipped stockpiled clay from the New Discovery Mine near Beatty, the Blanco Mine in Esmeralda County, and the Buff and Satin Mines in Pershing County. The American Colloid Co. mined white bentonite from Coal Canyon in Pershing County and hectorite from the Disaster Peak Mine in Humboldt County. The clays were shipped to a plant in South Dakota, where they were blended into specialty clay products.

The Moltan Co. used clay from a deposit near Empire in northern Washoe County to mix with diatomite in clumping cat litter produced at its plant near Fernley. In addition, Art Wilson Co. mined clay that was mostly used as pond liner sporadically from the Jupiter Mine near Wabuska in Lyon County. Specialty Clays Corp. had been evaluating a deposit of bentonite about 16 km southeast of Fallon in Churchill County. This bentonite was reported to have expansive qualities similar to that of Wyoming bentonite.

In 1999, Oil-Dri Corp., which was the world's largest manufacturer of cat litter, announced discovery of a montmorillonite deposit with 270 Mt of proven reserves in Hungry Valley north of Reno. In 2000, the BLM ruled that the clay was a locatable mineral and issued the final environmental impact statement (EIS) in 2001. The clay, considered to be excellent for making clumping cat litter, was mainly calcium montmorillonite. According to the EIS, the deposit consisted of clay-rich lacustrine strata as much as 30 m thick, was aerially extensive, and was near the surface. The company planned to employ about 100 people at a Hungry Valley Mine and plant to mine about 245,000 t of clay annually and to process it into more than 180,000 t of products for absorbent and agricultural markets. In 2002, Washoe County denied operating permits on the basis of local opposition to the plan, and the company litigated this decision. In order to proceed with its plans to become a major west coast supplier of cat litter, the company purchased a mine and plant in Taft, CA, from the Clorox Co. Oil-Dri also held the Capricorn clay deposit in northern Washoe County, but this deposit was considered to be too remote to be competitive at present.

Diatomite.—Diatomite production in Nevada, which accounted for more than 30% of domestic production, was virtually unchanged from 2002 to 2003. About two-thirds of the diatomite produced was used in filtration, and the remainder was used largely in absorbents, cement, and fillers. Emerging small-scale uses included pharmaceutical processing and nontoxic insecticides.

Eagle-Picher Minerals, Inc. (a division of Eagle-Picher Industries, Inc., which was in turn a wholly owned subsidiary of Granaria Holdings Ltd. of the Netherlands) produced most of Nevada's diatomite at three different locations. The most productive was the Colado operation in Pershing County, which consisted of a plant at Lovelock that made diatomaceous

earth filtration products from diatomite mined from pits that were about 24 km northwest of Lovelock. The company also produced diatomite used in fillers and absorbents at its Clark plant and mine, which were about 32 km east of Reno in Storey County, and diatomite used in insulation from a pit near Hazen in Lyon County.

Moltan Co. of Tennessee was the second leading diatomite producer in Nevada; it produced absorbent products, cat litter, and soil conditioner at a mine and plant complex, which was about 32 km northeast of Fernley in Churchill County. The diatomite resource was reported to contain 100 years of reserves. Moltan shipped diatomaceous earth absorbents under several labels. The company produced two cat litter types in Nevada: a nonclumping diatomite product and a clumping product composed of diatomite and clay.

Other companies that mined diatomite in Nevada in 2002 were the Celite Corp. at Hazen in Lyon County and Grefco Inc. at Basalt near the Esmeralda/Mineral County line. Celite (a subsidiary of World Minerals Inc., which was, in turn, part of the Alleghany Group) had a large diatomite facility in California and recently acquired the CR Minerals' mine at Hazen and plant in Fernley, which produced functional filler. The Grefco operation, which was small relative to other Nevada diatomite producers, was being expanded and could become a second producer of filter-grade diatomaceous earth in Nevada. American Diatomite Inc. staked four claims in the Monte Cristo Range about 16 km north of Coaldale in Esmeralda County. The claims were in the vicinity of the Shu Fly diatomite deposit.

Dimension Stone.—Nevada was not well known as a producer of dimension stone, and high-quality cut and polished products were not produced from stone mined in the State. However, split dimension stone products were produced at two localities in Nevada, new dimension stone operations were evaluated, and oversize stone blocks were used in wall construction.

Las Vegas Rock Inc. produced flagstone, ashlar, boulders, and crushed landscape rock from its Rainbow Quarries near Goodsprings, which is about 32 km southwest of Las Vegas. The stone was quartz-cemented sandstone that was part of the Jurassic Aztec Sandstone, which crops out extensively in Clark County, but is too friable at most localities for building stone. The company also marketed some cut stone and planned to produce polished slabs and custom stone shapes.

Mt. Moriah Stone quarried flaggy, light-gray quartzite from the Cambrian Prospect Mountain Quartzite at a quarry that is about 24 km north of Baker in White Pine County. This material, which naturally splits into slabs up to 1.5 meters (m) by 2.4 m by 10 centimeters thick, was used for flagstone and other types of uncut building stone. The company typically operated from April to December each year.

In recent years, large amounts of stone boulders have been used to construct retaining walls in major metropolitan areas in Nevada. Most of this stone was produced as an oversized byproduct of quarried construction aggregate, and, in terms of volume, it constituted a much larger market than traditional dimension stone mined in the State.

Gemstones.—During 2003, precious opal was produced from the Royal Peacock, Rainbow Ridge, Bonanza, and Hidden

Valley Mines in Virgin Valley, Humboldt County. Virgin Valley is a well-known source of gemstones in North America; much of the opal comes from pay-to-dig operations and is unreported. In 2003, gem chalcedony was produced from the Sage Mine in Humboldt County, and faustite and turquoise were recovered from the Blue Ridge (Wintle) Mine in Lander County.

Gypsum.—In 2003, gypsum production in Nevada was estimated to be 1.68 Mt, which was about the same as in 2002. This estimate was less than the 1.91 Mt reported in NBMG Special Publication SP-15 because the gypsum production reported in that publication included the impurities in the gypsum ore mined by PABCO Gypsum (Tingley, Horton, and Lincoln, 1993). Nevada accounted for more than 10% of domestic gypsum production, ranking only behind Oklahoma and Iowa. The three largest Nevada producers, PABCO Gypsum, BPB PLC, and USG Corp., used most of this gypsum in local wallboard plants.

PABCO Gypsum, which is northeast of Las Vegas in Clark County, mined and processed more than 900,000 t of gypsum ore in 2003. Although processing yielded only about 70% by weight gypsum from the ore, the company still ranked as the leading producer in Nevada. The gypsum was in a nearly flat-lying gypsite blanket, which was more than 37 m thick in places, atop a 1,300-hectare (ha) mesa. The ore was crushed in the pit and conveyed to a washing plant where impurities, mainly clay and silt, were removed.

The Blue Diamond operation of BPB PLC, which had been recently owned by James Hardie Gypsum Inc. and was southwest of Las Vegas in Clark County, produced 513,000 t of gypsum and was the second leading producer in the State. The gypsum deposit was the largest of several Permian deposits in the Las Vegas area. It consisted of more or less flat-lying beds of pure gypsum as much as 9 m thick on a table mountain that overlooked the city. The Blue Diamond area had been the site of gypsum mining since 1925, but was in the path of metropolitan growth, and gypsum mining there could give way to upscale housing development.

USG, which was the Nation's leading wallboard producer, was the third leading Nevada producer in 2003, produced about 254,000 t of gypsum. The company mined gypsum in western Pershing County and processed it into wallboard and plaster at a plant at Empire in Washoe County. The gypsum was of Triassic or Jurassic age and formed several masses in a 500-ha area. The largest mass, the Selenite ore body, contained 85% to 95% gypsum and was generally well bedded with variable dips.

The Art Wilson Co. of Carson City shipped gypsum and anhydrite from the Adams Mine in Lyon County, and the D.L. Denman Construction Co. mined gypsum at the Pioneer Mine, which was about 16 km east of Las Vegas. Material from these relatively small operations was used in cement and agricultural applications. The Adams deposit was a folded, diapiric mass associated with limestone in Triassic metavolcanic rocks. The Pioneer Mine was in the same gypsite deposit as the nearby PABCO operation.

Lime, Limestone, and Dolomite.—In 1997, lime supplanted diatomite as Nevada's second most valuable industrial mineral. Limestone was mined for lime production at two sites in Nevada that were nearly at opposite ends of the State. The high-

calcium limestone that was used at both sites was from the same Devonian limestone unit, although it was assigned to different stratigraphic formations. In addition to lime, relatively minor amounts of crushed limestone were also shipped from both sites, and dolomite was mined at one of the sites.

The Pilot Peak high-calcium lime operation of Graymont Western U.S. Inc. (formerly Continental Lime, Inc.), which was 16 km northwest of Wendover in Elko County, was Nevada's leading producer, and marketed lime to gold-mining operations for use in cyanide-solution pH control. The Pilot Peak plant had three kilns with a combined capacity of more than 635,000 t of quicklime per year and a hydrated lime plant capable of producing 318 metric tons per day. In 2000, the Pilot Peak plant was rated the ninth leading producer in the country.

Chemical Lime Co. produced lime at Apex, which was 32 km northeast of Las Vegas. The operation made high-calcium quicklime used in environmental markets, metallurgical processing, and paper manufacturing. The company also produced dolomitic lime and hydrated high-calcium lime at Apex mainly for construction uses. The Chemical Lime dolomite quarry at Sloan ceased operation in 1997, but in 2003, their Henderson plant continued to process Type S lime for building and home construction.

In addition to lime, both Graymont Western U.S. Inc. and Chemical Lime Co. shipped crushed limestone. Other carbonate rock producers in Nevada were Min-Ad, Inc. and Nutritional Additives Corp., which produced agricultural and nutritional dolomite products near Winnemucca. Columbus SM LLC, which was a small California-based company, evaluated the production of calcium carbonate and magnesium hydroxide from the Columbus Salt Marsh in Esmeralda County. The company planned to leach the commodities from material mined from the playa and to market the calcium carbonate as a food additive.

Lithium.—Chemetall Foote Co. (a subsidiary of Chemetall GmbH) produced lithium carbonate, lithium hydroxide monohydrate, and lithium hydroxide anhydrite at Silver Peak in Esmeralda County. This operation, which was the only primary lithium producer in the United States, produced these chemicals from brine that was pumped from beneath Clayton Valley playa. Fifty production wells tapped six aquifer systems beneath the playa. Lithium preconcentration was carried out in 20 active evaporation ponds that covered more than 1,600 ha. Production figures were confidential; the most recent public information from 1998 Securities and Exchange Commission data showed production of about 5,400 t of lithium carbonate and 2,300 t of lithium hydroxide. Lithium carbonate was the main feedstock for major uses of the element in aluminum production, batteries, ceramics, glass, and lubricants. U.S. prices have remained steady at about \$2.00 per pound for lithium carbonate and \$2.60 per pound for lithium hydroxide monohydrate since 1997, but since 1998, large shipments of lithium carbonate have sold at about one-half of list price owing to low pricing by South American brine operations. Accordingly, U.S. lithium imports have increased more than 200% and exports have fallen by more than 20% since 1997.

Magnesium.—Premier Chemicals LLC of Cleveland, OH, owned the Gabbs magnesia operation in Nye County.

Magnesium minerals have been mined at Gabbs since 1935 and, in the 1940s, were processed in Henderson, NV, to make magnesium metal. From the 1950s to the 1980s, mining and processing was by Basic Industries, which was a major producer of refractory magnesia. In 1991, Combustion Engineering Inc. sold Basic Industries to Premier Refractories Inc., which subsequently sold its U.S. magnesia chemicals business to Premier Chemicals LLC in 1999. During the 1990s, the ready availability of low-cost foreign refractory magnesia caused production at Gabbs to be switched to light-burned (caustic) magnesia that was marketed mainly for waste water treatment and agricultural uses. Although production of magnesia at Gabbs in 2003 was still substantially below its peak in 1981, magnesia shipments from the Gabbs operation have increased steadily since 1996.

Brucite, which was shipped in relatively small amounts from the Gabbs operation, was mined mainly from pods adjacent to igneous rocks in magnesite pits. Magnesite and brucite at Gabbs occur over an area of about 500 ha in complex replacement bodies in Triassic dolomite. The magnesite was thought to have formed by hydrothermal activity related to emplacement of granite, and the brucite, by alteration of the magnesite during later granodiorite intrusion.

Perlite.—Nevada has large perlite resources and several deposits of perlite that have been mined extensively. The largest historical producer was the Hollinger Mine near Pioche in Lincoln County. Current perlite production in Nevada was restricted to relatively small-scale mining of two deposits for niche markets, and the State produced less than 1% of the domestic total.

Wilkin Mining and Trucking Inc. mined perlite from the Tenacity Perlite Mine, which was about 40 km west of Caliente in Lincoln County. The company has been mining perlite in the area for more than 25 years. In the past, most of the perlite was shipped as crude; however, the company had a small “popping plant,” the Tenacity Perlite Mill in Caliente, and present sales were almost exclusively of expanded perlite that was mainly used for horticultural purposes. In 2003, the company filed a plan to mine perlite from a deposit near the Hollinger Mine in the Wilson Creek Range northeast of Pioche.

Eagle-Picher Minerals Inc. produced expanded perlite at its Colado diatomite plant in Pershing County from perlite mined at the Popcorn Mine, which was about 24 km south of Fallon in Churchill County. The perlite was marketed as a filter aid, and plant capacity was reportedly about 7,300 metric tons per year (t/yr). In 2001, Noble International S.A. mined perlite from a deposit in Nevada for use in the production of “Noblite” microspheres at a plant in Fallon. In 2002, the company ceased mining Nevada perlite and switched to raw material from the Tucker Hill perlite mine in Oregon. Although the United States is the world's leading producer of perlite, domestic perlite suffered transportation cost disadvantages in some areas of the eastern United States compared to Greek perlite, and domestic production has slipped for 4 years in a row while imports have increased.

Potash.—A small amount of potassium alum (kalinite) was mined by Rulco from a deposit in Esmeralda County that is about 16 km north of Silver Peak. The kalinite, which occurred

with sulfur as veins and stringers in rhyolitic rock, was being marketed for horticultural use.

Salt.—The Huck Salt Co. produced about 8,200 t of salt in 2003, which was a decrease of 35% compared with that of 2002. The salt was used mainly for deicing roads, and production levels were dependent on weather. The salt was mined from a playa in Fourmile Flat about 40 km southeast of Fallon in Churchill County; it had been harvested there almost continuously since the 1860s when it was hauled to the mills that processed Comstock silver and gold ore.

Silica.—Simplot Silica Products at Overton in Clark County shipped about 612,000 t of silica sand in 2003, which was about the same amount as in 2002. The sand was mined from an open pit 2.4 km long and 91 m feet deep in the relatively friable Cretaceous Baseline Sandstone, washed in the pit, and transported by way of 8-km slurry pipeline to a plant where it was screened and bagged. Silica sand has been produced from the deposit since the 1930s; Simplot acquired the operation in 1955. The company plans to upgrade its processing facilities in the near future, with a view toward increasing production from current levels to as much as 770,000 t/yr.

In 2002, Silica LLC began mining quartzite from the Sugar mining claims, which are about 5 km southeast of Mercury in Nye County. A Plan of Operations submitted to the BLM in 2001 called for annual production of as much as 73,000 t. The material, in the Ordovician Eureka Quartzite, was described as strongly brecciated and fractured and amenable to mining without blasting.

Zeolites.—Nevada contains several large zeolite deposits that were discovered and evaluated during a flurry of zeolite exploration activity in the 1950s and 1960s; however, natural zeolite production never evolved into a major industry in the State. Ash Meadows Zeolite LLC (a subsidiary of Badger Mining Corp.) shipped 900 to 4,500 t/yr of clinoptilolite used in water filtration, odor control, and nuclear cleanup from a plant in Amargosa Valley in Nye County. The clinoptilolite was mined from a large deposit in California that extends into Nevada.

Moltan Co. mined mordenite from a deposit that is in the Trinity Range about 64 km northeast of Fernley in Churchill County. The company used the zeolite mineral to make absorbents at its Fernley plant.

Metals

Gold and Silver.—As has been the case in recent years, gold was the leading commodity produced in Nevada. Production of gold in 2003 came from 23 major mining operations. The Carlin trend in northeastern Nevada accounted for 44% of the total production. Eight additional mining operations that were not on the Carlin trend each produced more than 3,100 kilograms (kg) of gold.

Nevada produced 228,000 kg of gold and 319,000 kg of silver in 2003, compared with 240,000 kg and 422,000 kg, respectively, in 2002. Gold production was down by almost 12,900 kg, and silver production, by about 103,000 kg. The substantial decline in silver production was mainly because of the absence of production from the

McCoy/Cove Mine in Lander County, which closed in 2002. Twenty-three mines in Nevada reported gold production in 2003, and 20 reported silver production.

Barrick Gold Corp., with production from its Betze-Post, Meikle, and Ruby Hill Mines (plus its 50% share of Round Mountain's production and one-third share of Marigold's production), had a total production of 79,901 kg of gold, which made it the leading gold producer in the State in 2003. Newmont Mining Corp., which reported production from its Carlin trend mines (Twin Creeks, Lone Tree, Mule Canyon, Phoenix, McCoy/Cove, and the Midas Mine) had a total Nevada production of 77,500 kg of gold.

For a fourth consecutive year, Barrick Gold's Betze-Post Mine was Nevada's largest gold-producing mine with an output of 48,503 kg. Newmont's Carlin trend mines produced 34,905 kg of gold, and Placer Dome's Cortez operation produced 33,138 kg of gold. Barrick's Meikle Mine, which was the largest underground mine in Nevada, produced 17,159 kg of gold in 2003, which was about 2,800 kg less than in 2002.

Coeur D'Alene Mines Corp.'s Rochester Mine was the largest silver mine in Nevada in 2003 and produced 173,725 kg of silver. Newmont's Midas Mine was the second leading producer in Nevada with 82,342 kg produced, and the Round Mountain Mine ranked third with 23,680 kg produced.

Much of Nevada's silver production in 2003, which totaled 319,000 kg, was a coproduct or byproduct of gold mining. With a ratio of value (average price of gold to average price of silver) of 75:1 in 2003, only those deposits with more than 75 times as much silver as gold could be considered primary silver deposits. Only one such deposit operated in Nevada in 2003—the Coeur Rochester Mine in Pershing County (with a silver-to-gold production ratio of 107:1 and total silver production of nearly 174,000 kg). This one mine produced 55% of Nevada's silver in 2003. Nevada's production in 2003 accounted for 26% of the U.S. total and 1.7% of the world total.

Government Programs

Through a survey conducted early in 2004, the Nevada Division of Minerals collected data for Nevada Bureau of Mines and Geology Special Publication P-15, Major Mines of Nevada 2003 (Driesner and Coyner, 2004b§). This publication included, in handbook form, location maps, names and telephone numbers of operators, numbers of employees, and preliminary, nonproprietary production figures for most mines in Nevada. It also contained a section on economic impacts of the industry. The full contents of this 28-page publication are available free of charge on the Internet at URL <http://www.nbmng.unr.edu>.

Additional information about the Nevada mineral industry and the U.S. gold industry, including the contents of selected publications, may be found on the Internet via the NBMG Web site at URL <http://www.nbmng.unr.edu/> and the Nevada Division of Minerals Web site at URL <http://minerals.state.nv.us/>.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEVADA^{1,2}

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2001		2002		2003 ^P		
	Quantity	Value	Quantity	Value	Quantity	Value	
Clays:							
Bentonite	5	758	6	W	6	W	
Fuller's earth	28	3,870	28	3,870	28	3,870	
Gold ³	kilograms	253,000	2,220,000	240,000	2,410,000	216,000	2,440,000
Sand and gravel:							
Construction	34,000	173,000	35,400	159,000	38,000	173,000	
Industrial	609	W	615	11,000	603	11,100	
Silver ³	kilograms	544,000	76,800	424,000	63,000	292,000	43,700
Stone, crushed	7,720 ^r	37,600 ^r	8,010	41,900	8,700	46,100	
Zeolites	metric tons	(4)	NA	(4)	NA	(4)	NA
Combined values of barite, brucite, cement (portland), clays (kaolin), copper (2001), diatomite, gemstones, gypsum (crude), lead (2001-02), lime, lithium carbonate, magnesite, perlite (crude), salt, and values indicated by symbol W							
	XX	248,000	XX	228,000	XX	224,000	
Total	XX	2,760,000	XX	2,910,000	XX	2,940,000	

^PPreliminary. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Combined values" data. XX Not applicable.

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

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

³Recoverable content of ores, etc.

⁴Withheld to avoid disclosing company proprietary data.

TABLE 2
NEVADA: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2001				2002			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	4 ^r	4,730 ^r	\$19,100 ^r	\$4.03 ^r	4	3,760	\$16,600	\$4.41
Dolomite	4	W	W	17.09 ^r	4	W	W	4.72
Granite	1	W	W	3.86	4	W	W	4.78
Traprock	14	93	430	4.63 ^r	3	84	388	4.63
Volcanic cinder and scoria	2	W	W	6.22 ^r	2	W	W	7.68
Miscellaneous stone	4	1,250	10,200	8.19 ^r	4	1,350	10,700	7.94
Total or average	XX	7,720 ^r	37,600 ^r	4.87 ^r	XX	8,010	41,900	5.23

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

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

TABLE 3
NEVADA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	W	W	\$5.84
Coarse aggregate, graded:			
Concrete aggregate (coarse)	(2)	(2)	4.74
Bituminous surface treatment aggregate	(2)	(2)	4.63
Other coarse graded aggregates	(2)	(2)	8.17
Total or average	442	\$2,380	5.38
Fine aggregate (-3/8 inch):			
Stone sand concrete	(2)	(2)	4.74
Sreening undesignated	(2)	(2)	4.74
Total or average	136	645	4.75
Coarse and fine aggregates:			
Unpaved road surfacing	(2)	(2)	6.81
Crusher run, select material or fill	(2)	(2)	7.45
Other coarse or fine aggregate	(2)	(2)	6.18
Total or average	617	4,217	6.84
Agricultural, other agricultural uses	W	W	4.72
Chemical and metallurgical:			
Cement manufacture	(2)	(2)	4.57
Lime manufacture	(2)	(2)	4.28
Total or average	1,750	7,660	4.39
Special, mine dusting or acid water treatment	W	W	5.05
Other miscellaneous uses and specified not listed	61	337	5.52
Unspecified³			
Reported	3,370	15,300	4.55
Estimated	1,560	10,900	7.00
Total or average	4,930	26,300	5.33
Grand total or average	8,010	41,900	5.23

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

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

²Withheld to avoid disclosing company proprietary data; included in "Total."

³Reported and estimated production without a breakdown by end use.

TABLE 4
NEVADA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE AND BY DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Construction:				
Coarse aggregate (+1 1/2 inch) ²	W	W	--	--
Coarse aggregate graded ³	W	W	W	W
Fine aggregate (-3/8 inches) ⁴	W	W	--	--
Coarse and fine aggregate ⁵	W	W	W	W
Agricultural ⁶	W	W	--	--
Chemical and metallurgical ⁷	W	W	W	W
Special ⁸	--	--	W	W
Other miscellaneous uses	--	--	61	337
Unspecified: ⁹				
Reported	1,900	9,140	1,470	6,200
Estimated	--	--	1,560	10,900
Total	3,710	18,900	4,300	23,000

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

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

²Includes riprap and jetty stone.

³Includes concrete aggregate (coarse), bituminous surface treatment aggregate, and other coarse graded aggregates.

⁴Includes stone sand (concrete) and screening (undesigned).

⁵Includes crusher and (select material or fill), unpaved road surfacing, and other coarse and fine aggregates.

⁶Includes other agricultural uses.

⁷Includes cement and lime manufacture.

⁸Includes mine dusting or acid water treatment.

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

TABLE 5
NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
BY MAJOR USE CATEGORY¹

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregate (including concrete sand)	2,430	\$14,200	\$5.85
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	437	4,350	9.95
Asphaltic concrete aggregates and other bituminous mixtures	531	7,750	14.59
Road base and coverings ³	4,550	18,100	3.97
Fill	1,510	5,410	3.57
Snow and ice control	44	234	5.32
Other miscellaneous uses	675	3,520	5.22
Unspecified: ⁴			
Reported	12,800	40,600	3.18
Estimated	12,000	65,000	5.24
Total or average	35,400	159,000	4.50

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

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement).

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

TABLE 6
 NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products ²	1,370	8,820	1,500	9,770	--	--
Asphaltic concrete aggregates and road base materials ³	1,870	10,300	3,220	15,500	--	--
Other miscellaneous uses ⁴	1,210	4,750	1,110	4,410	--	--
Unspecified: ⁵						
Reported	53	104	5,990	29,400	6,750	11,200
Estimated	780	4,700	11,000	57,000	470	3,100
Total	5,280	28,700	22,900	116,000	7,220	14,300

-- Zero.

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

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement).

⁴Includes fill and snow and ice control.

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