New Mexico
Ground-Water Quality

New Mexico, a State with an arid to semiarid climate, relies on fresh ground-water supplies for almost one-half of its water needs. About 1.9 million acre-feet of fresh ground water was withdrawn during 1980, of which 86 percent of this supply was used for the irrigation of 861,000 (U.S. Geological Survey, 1985, p. 317) acres of farmland and 12 percent was used in urban and rural areas for public or domestic supplies to serve about 1.2 million people (or 89 percent of the State's population). The remaining 2 percent was used for industries, electric powerplants, or livestock watering (Solley and others, 1983). The State's major population centers and population distribution are shown in figure 1.

The total volume of water in aquifers in New Mexico is estimated to be 20 billion acre-feet. Although ground water is abundant, the total volume cannot be extracted. It is not available everywhere in the State, and 75 percent of it is too saline for most uses. The remaining 25 percent contains dissolved-solids concentrations of smaller than 2,000 mg/L (milligrams per liter), and is suitable for most uses; however, these more suitable supplies commonly are found in unconfined shallow aquifers where water quality is easily affected by human activities and by the water quality of nearby rivers (Hale and others, 1965). This situation exists along the principal rivers in the State, especially in the Rio Grande basin where most of the State's commercial, industrial, and agricultural enterprises are located (Sorenson, 1982).

New Mexico's 1980 population of about 1.3 million was about 28 percent greater than the 1970 population (U.S. Bureau of the Census, 1982), and the State's population is projected to reach 2.0 million by the year 2000. Most of this growth has been and is anticipated to continue in the State's few large urban centers. Metropolitan Albuquerque, located on the Rio Grande near the center of the State, is New Mexico's largest city. During 1980, metropolitan Albuquerque's population was 454,000, or 34 percent of the State's total. The State's next two largest urban centers, Santa Fe to the north and Las Cruces to the south of Albuquerque, are both located in the Rio Grande basin. Each had a population of about 45,000 in 1980. Albuquerque and Las Cruces rely totally on ground water for their public supply. Santa Fe, which relies mostly on surface water for its public supply, is becoming more dependent on ground-water supplies as its population grows.

New Mexico's aquifers generally have not been affected by the many water-quality problems associated with the more densely populated regions of the Nation. Still, significant ground-water-quality problems have been identified and reported in New Mexico's biannual water-quality report to Congress (New Mexico Water Quality Control Commission, 1984). The ground-water-quality problems occur along the major river valleys and in other areas with shallow aquifers where numerous sewage-disposal systems and leaking underground storage tanks are located; in oil-and-gas producing and refining areas in the southeastern and northwestern parts of the State; at uranium mining and milling sites in McKinley and Cibola Counties; at copper mines and mills in Grant County; at coal mines and coal-fired electric power-generation plants in San Juan County; at molybdenum mining and milling sites in Taos County; at potash mining and processing sites in Eddy and Lea Counties; within industrialized areas of Bernalillo County; near dairy farms in Dona Ana and Sierra Counties; and at a few Federal civilian and military installations throughout the State (New Mexico Water Quality Control Commission, 1984). In most places, the severity and extent of the ground-water-quality problem are only partially known.

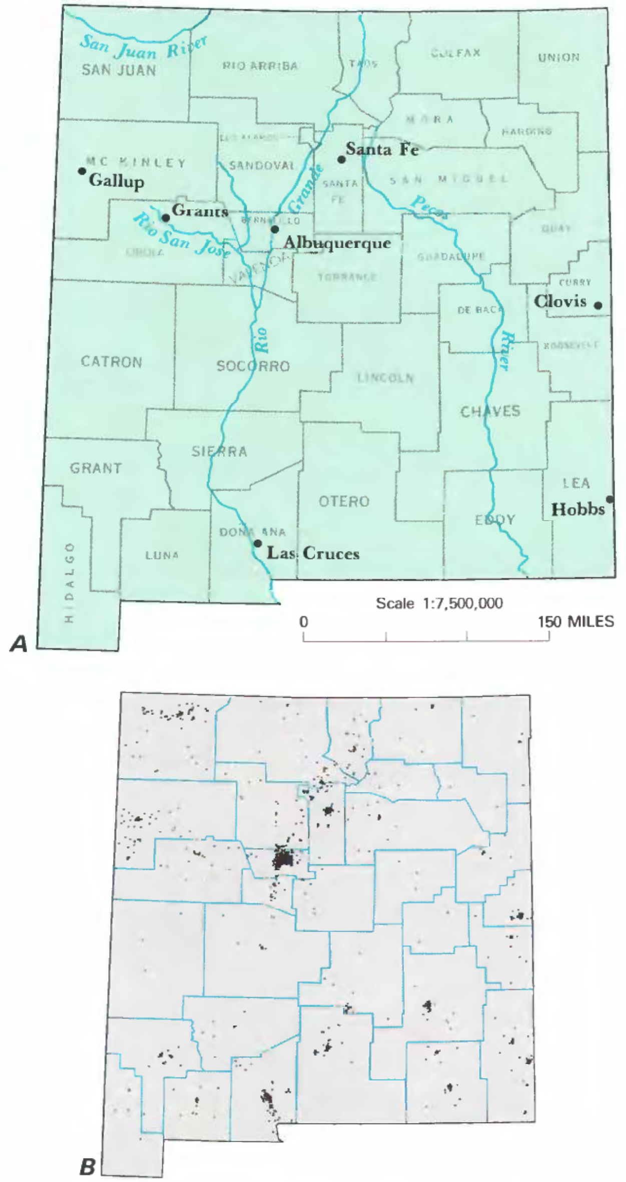

Figure 1. Selected geographic features and 1985 population distribution in New Mexico. *A*, Counties, selected cities, and major drainages. *B*, Population distribution, 1985; each dot on the map represents 1,000 people. (Source: *B*, Data from U.S. Bureau of the Census 1980 decennial census files, adjusted to the 1985 U.S. Bureau of the Census data for county populations.)

WATER QUALITY IN PRINCIPAL AQUIFERS

New Mexico's fresh ground water is withdrawn from parts of the principal aquifers described in the 1984 edition of the National Water Summary (U.S. Geological Survey, 1985, p. 317–322). Those aquifers which are outlined in figures 2*A* and 2*B* are grouped into four types: (1) Valley-fill aquifers along New Mexico's major rivers; (2) basin-fill aquifers in eastern, central, southern and southwestern New Mexico; (3) sandstone aquifers in the San Juan River basin in northwestern New Mexico; and (4) limestone artesian aquifers in the Pecos River basin and in the Rio San Jose basin.

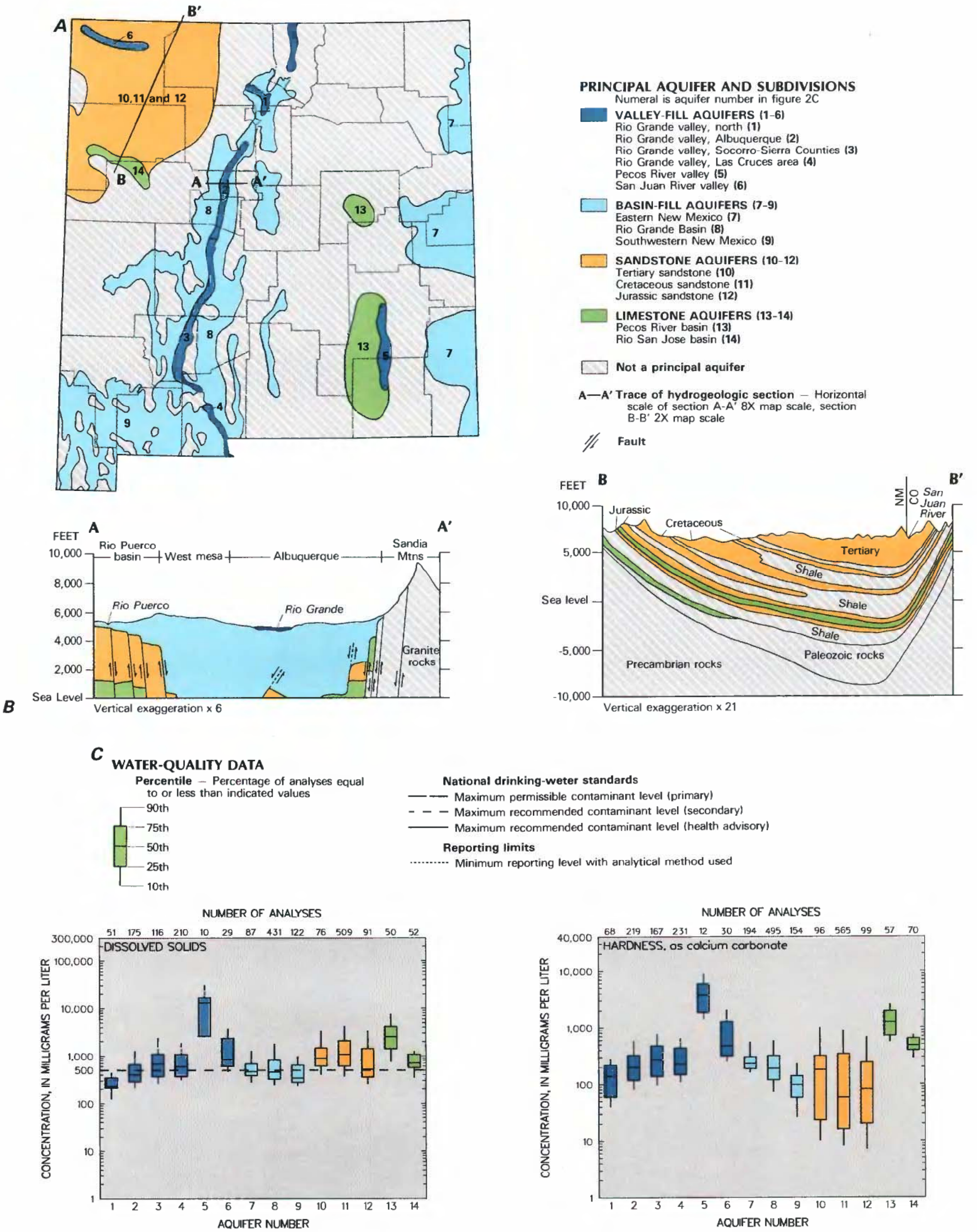

Figure 2. Principal aquifers and related water-quality data in New Mexico. *A*, Principal aquifers. *B*, Generalized hydrogeologic sections. *C*, Selected water-quality constituents and properties, as of 1986. (Sources: *A*, Modified from Hale and others, 1965. *B*1, Modified from Bjorklund and Maxwell, 1961. *B*2, Modified from Lyford, 1979. *C*, Analyses compiled from U.S. Geological Survey files; national drinking-water standards from U.S. Environmental Protection Agency, 1986a,b.)

Concentrations of chemical constituents differ in these principal aquifers, mostly because of natural causes. However, human activities may be responsible for some of the larger extremes.

Background Water Quality

Background water-quality conditions are described in the following paragraphs for each of the four types of aquifers. A graphic statistical summary of selected water-quality variables compiled from the U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) (U.S. Geological Survey, 1975) through 1986 is presented in figure 2*C*. The summary is based on dissolved-solids, hardness, nitrate (as nitrogen), sodium, and sulfate analyses of water samples collected from about 2,000 wells. Percentiles of these variables are compared to national standards that specify the maximum concentration or level of a contaminant in drinking-water supply as established by the U.S. Environmental Protection Agency (EPA) (1986a,b). The primary maximum contaminant level standards are health related and are legally enforceable. The secondary maximum contaminant level standards apply to esthetic qualities and are recommended guidelines. The primary drinking-water standards include a maximum concentration of 10 mg/L nitrate (as nitrogen), and the secondary drinking-water standards include maximum concentrations of 500 mg/L dissolved solids and 250 mg/L sulfate. The health advisory level of 20 mg/L for sodium is not a primary standard, but it is recommended by EPA for individuals with very restricted sodium-intake diets as prescribed by their physicians.

Valley-Fill Aquifers

Principal valley-fill aquifers (fig. 2*A*, aquifers 1–6) are located along the Rio Grande, Pecos River, and San Juan River. Principal valley-fill aquifers 1 through 4 are along the Rio Grande. Wells located upstream along the Rio Grande produce water with smaller dissolved-solids concentrations than wells downstream. The median dissolved-solids concentration was 230 mg/L for aquifer 1 and 406 mg/L for aquifer 2, whereas the median was 681 mg/L for aquifer 3 and 598 mg/L for aquifer 4. Increased salinity in these aquifers usually is caused by infiltration of more mineralized water from low river flows, tributary inflows, or irrigated fields. Seventy-five percent or more of the wells completed in the Rio Grande's valley-fill aquifers produce water that was classified as hard (120 to 180 mg/L as calcium carbonate) to very hard (more than 180 mg/L). Wells producing soft water (less than 60 mg/L) generally were located in the northern valley-fill aquifers. Wells that produce moderately hard water (60 to 120 mg/L) were located near recharge areas that are underlain by carbonate rocks, such as the mountainous area east of Albuquerque (Bjorklund and Maxwell, 1961). Nitrate concentrations were smaller than 4.0 mg/L for more than 90 percent of the wells sampled (fig. 2*C*). Water in these aquifers is suitable for public supplies and irrigation. The usually small salinity and small sodium concentrations are tolerated by most crops (U.S. Department of Agriculture, 1954).

The Pecos River valley-fill aquifer (aquifer 5) contains water that is much more saline than the water in the valley-fill aquifers

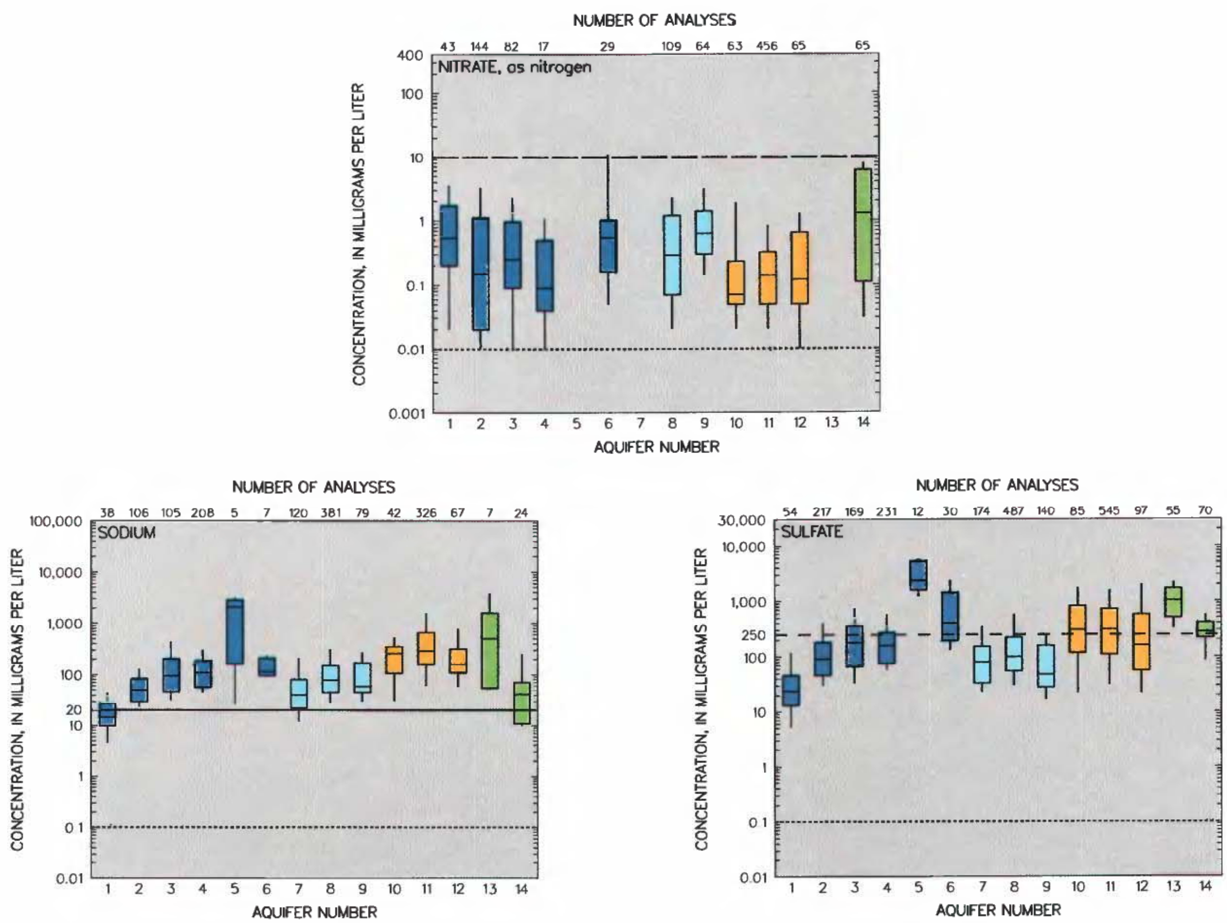

Figure 2. Principal aquifers and related water-quality data in New Mexico—Continued.

along the Rio Grande. The small number of wells in the statistical summary for aquifer 5 may not be representative of the entire aquifer. However, the large salinity values that are characteristic of the water withdrawn from these few wells make the water unsuitable for most uses, which probably explains the small number of wells completed in this aquifer. The increased salinity is caused by contact of the water with soluble evaporite deposits, such as gypsum. Saline water also seeps upward from the underlying limestone aquifer (Welder, 1983), and brine moves into the southern part of the aquifer from deeper and older deposits that contain halite (Hale and others, 1965).

The San Juan River valley-fill aquifer (aquifer 6) is less extensive than the valley-fill aquifers along the Rio Grande and Pecos Rivers. The moderately saline water near the edge of the aquifer is caused by ground water infiltrating from the adjacent or underlying sedimentary formations of the San Juan basin (Lyford, 1979). Water-quality characteristics are similar to those characteristics found in the San Juan River itself, except that the valley-fill aquifer contains water with larger salinity values. Calcium and bicarbonate ions are predominant in the less saline river water, whereas sodium and sulfate ions are predominant in the more saline aquifer water. The source of the aquifer solutes is the shale or clay deposits of the underlying formations (Roybal and others, 1983). Wells completed in the aquifer produce water for rural domestic supplies, livestock watering, and limited irrigation. The San Juan River with its tributaries has the largest streamflow volume in New Mexico and is used for the major public, industrial, and irrigation-water supplies along the valley. The more saline and much smaller water supply available from the valley-fill aquifer is used mostly in isolated rural areas.

Basin-Fill Aquifers

Principal basin-fill aquifers (aquifers 7, 8, and 9) consist of extensive deposits of coarse sediments with differing amounts of clay. Water in these aquifers is suitable for most uses; consequently, these aquifers have been extensively developed. About 70 percent of the ground-water withdrawn in New Mexico during 1980 (Sorenson, 1982) was taken from the basin-fill aquifers.

The Eastern New Mexico basin-fill aquifer (aquifer 7) is part of the High Plains aquifer, mainly the Tertiary Ogallala Formation. The High Plains aquifer is an extensive sandstone aquifer, but it is included in the basin-fill category because many of its lithologic and water-quality characteristics are similar to the basin-fill aquifers in other parts of the State. The water in the aquifer generally contains small concentrations of dissolved solids, hardness, and sodium which make the aquifer suitable for agricultural irrigation. The fluoride concentrations in water from about 5 percent of the wells sampled in this aquifer (U.S. Geological Survey files) were larger than 4.0 mg/L (not shown in fig. 2*C*). The Federal primary drinking-water standard for fluoride is 4.0 mg/L (U.S. Environmental Protection Agency, 1986a).

The Rio Grande basin-fill aquifer (aquifer 8) is composed of Quaternary and Tertiary sediments of the Santa Fe Group. The aquifer flanks the Rio Grande in a very irregular pattern and may be more than 6,000 feet deep (fig. 2*B*, section A-A′). Freshwater is found at depths ranging from 10 to 3,500 feet. Large volumes of saline water usually occur near the edges or in deeper parts of the aquifer (Kelly, 1974). Large sodium concentrations in this aquifer are found in association with the large salinity values. Some very saline water may be moving upward into different parts of the basin-fill aquifer through faults (Anderholm, 1983). Water quality in the shallow part of the aquifer commonly is indistinguishable from that in the overlying valley-fill aquifer because the two are hydraulically connected (fig. 2*B*, section A-A′). Although irrigation is the principal use of the water withdrawn from aquifer 8, about 40 percent of the withdrawals during 1980 based on county data were for nonagricultural use, mostly near Albuquerque (Sorenson, 1982). About 75 percent of the wells completed in aquifer 8 produce freshwater, which usually is hard.

The southwestern New Mexico basin-fill aquifer (aquifer 9) consists of coarse-grained sediments deposited in closed basins. Irrigation accounted for about 85 percent of the 1980 withdrawals from this aquifer based on county data. Copper mining and milling accounted for 9 percent, and the remaining 6 percent was mostly for domestic or public-supply uses (Sorenson, 1982). The water was fresh in 90 percent of the wells sampled and soft to moderately hard in nearly 75 percent of the wells sampled (fig. 2*C*). Nitrate concentrations were smaller than 3.2 mg/L in 90 percent of the wells. Fluoride data from aquifer 9 were not included in figure 2*C*, but concentrations exceeded 4.0 mg/L in 10 percent of the analyses on file with the U.S. Geological Survey.

Two other locally important, but smaller, basin-fill aquifers, the Estancia basin-fill aquifer in Santa Fe and Torrance Counties and the Tularosa basin-fill aquifer in Lincoln and Otero Counties, accounted for about 5 to 6 percent of the State's total ground-water withdrawal during 1980 (Sorenson, 1982). Both of these aquifers contain saline water that is the result of the concentration of salts by evaporation in the topographically lower parts of these closed-basin aquifers (Smith, 1957; McLean, 1970). The Tularosa aquifer contains some relatively soluble calcium-sulfate minerals, which also contribute to the large salinity values.

Sandstone Aquifers

The principal sandstone aquifers in New Mexico are part of the geologic structure called the San Juan basin in the northwestern part of the State. The principal aquifers, differentiated by geologic ages, are composed of Tertiary sandstone (aquifer 10), Cretaceous sandstone (aquifer 11), and Jurassic sandstone (aquifer 12). These aquifers are separated by semipermeable and confining shale layers (fig. 2*B*, section B-B′).

Water withdrawn from the sandstone aquifers is used primarily for rural domestic supplies or livestock watering. These aquifers also supply Gallup and other communities away from the San Juan River with freshwater that contains large concentrations of sulfate and iron (Dinwiddie and others, 1966). Until recently, large quantities of water were pumped from the sandstone aquifers to dewater uranium mines near Gallup and Grants. Nearly all the mines are currently inactive because of depressed uranium markets.

Water in about 50 percent of the wells sampled in these aquifers was fresh. Freshwater generally occurred in outcrop areas where recharge takes place, mostly around the perimeter of the San Juan basin.

Salinity of water in the sandstone aquifers is increased mostly by solution of sodium, carbonate, chloride, and sulfate ions present in the interbedded shale, sandstone cement, or small localized deposits of readily soluble minerals, such as gypsum or halite (Roybal and others, 1983). Water with larger salinity values occurred in the Cretaceous sandstone (aquifer 11). Hardness of the water in all three sandstone aquifers varied considerably, with the greatest range of hardness occuring in the Cretaceous aquifer. Nitrate concentrations for more than 90 percent of the wells in the sandstone aquifers were smaller than 1.0 mg/L, with the larger concentrations occurring in the Jurassic sandstone. Water from about 5 percent of the wells in the principal sandstone aquifers contained more than 4.0 mg/L fluoride, with most of those wells located in the Cretaceous sandstone.

Limestone Aquifers

The two principal limestone aquifers in New Mexico (aquifers 13 and 14) are in the Pecos River basin and the Rio San Jose basin.

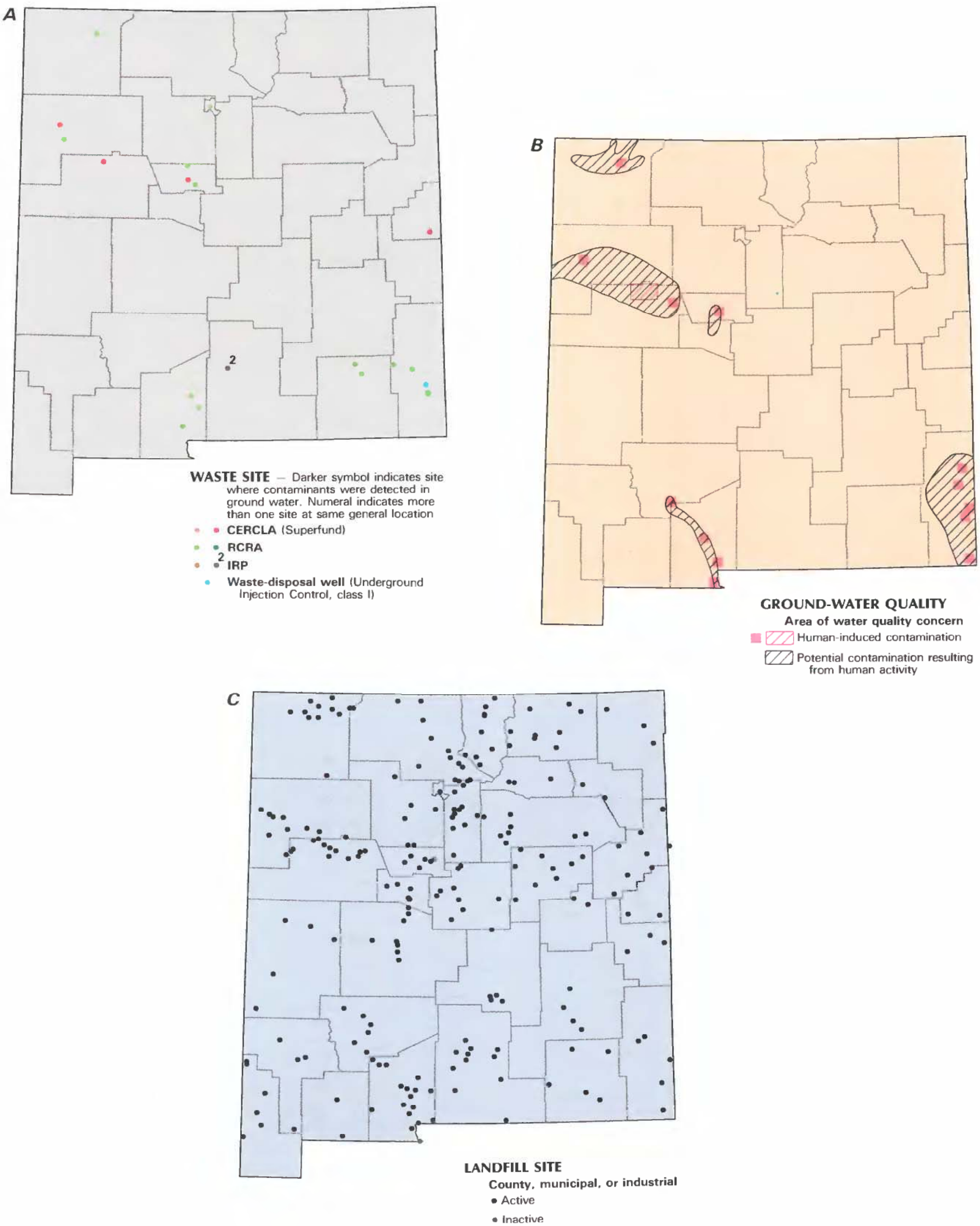

Figure 3. **Selected waste sites and ground-water-quality information in New Mexico.** *A*, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, as of 1986; Resource Conservation and Recovery Act (RCRA) sites, as of 1986; Department of Defense Installation Restoration Program (IRP) sites, as of 1985; and other selected waste sites, as of 1986. ***B***, Areas of human-induced and potential contamination, as of 1986. ***C***, County, municipal, and industrial landfills, as of 1986. (Sources: *A*, U.S. Environmental Protection Agency, 1984, 1986c; U.S. Department of Defense, 1986; and New Mexico Environmental Improvement Division files. *B*, New Mexico Water Quality Control Commission, 1986. *C*, New Mexico Environmental Improvement Division files.)

These aquifers are segments of the areally extensive, but discontinuous, San Andres Formation of Permian age.

Water in the Pecos River basin limestone aquifer (aquifer 13) flows eastward from its recharge area toward the Pecos River where the water discharges either to the river, to the valley-fill aquifer, or to wells. Increased salinity in aquifer 13 occurs as the water moves toward the Pecos River and dissolves gypsum within the aquifer. The relatively large sulfate concentrations of water from most wells may indicate this process. The water was fresh in less than 25 percent of the wells sampled, most of which were located near the recharge areas. In many wells in the eastern part of the aquifer, salinity has increased because saltier water in adjacent aquifers has been drawn into this aquifer by large irrigation withdrawals (Welder, 1983).

The Rio San Jose basin limestone aquifer (aquifer 14) produced freshwater from about 75 percent of the wells sampled and very hard water from 100 percent of the wells (fig. 2*C*). The sodium concentrations usually were small, whereas the sulfate concentrations usually were large. Water with smaller dissolved-solids concentrations occurred in recharge areas of the San Andres Formation in the Zuni Mountains between Gallup and Grants. Large differences in salinity values between nearby wells indicate complex flow patterns (Gordon, 1961) that are caused by the irregular topography, geologic faults, and complex solution channels in the limestone.

The Rio San Jose basin limestone aquifer (aquifer 14) produces water for domestic, community, livestock-watering, irrigation, and industrial supplies. Large ground-water withdrawals have modified local ground-water flow patterns, including seepage to or from the Rio San Jose (Risser, 1982). Aquifer 14 is located within the Grants Mineral Belt, an area rich in uranium that extends from 20 miles west of Albuquerque to Gallup (Gordon, 1961). The effects on water quality of waste-water from uranium-milling operations are a major concern. Contamination of ground-water by radioactive elements, such as radium and uranium, and by nonradioactive elements, such selenium, sulfate, and molybdenum, have been reported by the U.S. Environmental Protection Agency (Kaufman and others, 1975) and the New Mexico Environmental Improvement Division (New Mexico Water-Quality Control Commission, 1986).

EFFECTS OF LAND USE ON WATER QUALITY

Sewage disposal, leaking underground storage tanks, urbanization, mining, mineral milling, petroleum production and refining, and concentrated dairy-farm activities have caused water-quality changes in the principal aquifers. A summary of known water-quality contamination is presented in the table below, which was modified from information in New Mexico's biannual water-quality report to Congress (New Mexico Water Quality Control Commission, 1984).

Known Water-Quality Contamination in Principal Aquifers

Water-quality contaminant	Number of occurrences	Principal aquifer number (fig. 2*A*)	Primary sources of contamination
Nitrate and ammonia	27	1,2,3,4,5,7, 8, and 9	Sewage-treatment plants, individual septic systems, fertilizer use, dairy waste-disposal systems.
Bacteria	6	1,2, and 7	Septic tanks.
Salinity	50	2,5,6,7, and 8	Oil, gas, and mineral production.
Trace inorganic compounds	7	1,9,10,11, 12, and 14	Mining and mineral milling
Natural and synthetic organic compounds	25	2,3,4,5,6,7, 8, and 13	Commercial and industrial sites.
Petroleum products (oils, gases, fuels)	53	1,2,3,5,6,7, 8, 9, 10, and 13	Service stations, petroleum refineries, leaky underground storage tanks, and highway spills.

The table includes the four sites in New Mexico that were placed on the Environmental Protection Agency's (EPA) National Priorities List (NPL) of hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (U.S. Environmental Protection Agency, 1986c). The four CERCLA (Superfund) sites are shown in figure 3*A* and the ground-water quality problems associated with these sites follow:

(1) San Jose industrial area in Albuquerque's south valley (Bernalillo County)—Numerous organic compounds including benzene and chlorinated solvents have been found in the valley-fill and basin-fill aquifers.

(2) Uranium-mill-tailings disposal area near Grants (Cibola County)—Radioactive isotopes and trace elements in leachates from tailings ponds are infiltrating the local valley-fill or limestone aquifers.

(3) Uranium-mill-tailings disposal area near Gallup (McKinley County)— Radioactive isotopes, trace elements, nitrate, and ammonia are infiltrating the sandstone aquifers from tailings ponds.

(4) Railway company (Curry County) refueling facility in Clovis—Diesel fuel and organic solvents in waste impoundments are infiltrating the local ground-water supply in the basin-fill aquifer.

Also shown in figure 3*A* are 15 sites that the State is monitoring closely under the Federal Resources Conservation and Recovery Act (RCRA) for hazardous waste (U.S. Environmental Protection Agency, 1985). These sites are the locations of electronic-fabrication companies, petroleum refineries, petrochemical companies, natural-gas plants, governmental research facilities, and military installations. Most of these RCRA sites overlie the principal aquifers, and wastes that are stored or processed at these sites may consist of a mixture of inorganic chemicals, such as acids, bases and trace metals; organic compounds, such as halogenated solvents, polychlorinated biphenyls (PCB's), and spent petroleum products; and explosive materials, both inorganic and organic.

In addition, one New Mexico well is registered by the EPA as a Class-I injection well under the Federal Underground Injection Control Act (UIC) (U.S. Environmental Protection Agency, 1984). The well is used for disposal of industrial effluent and its location in Lea County is shown in figure 3*A*.

As of September 1985, 48 hazardous-waste sites at 5 facilities in New Mexico have been identified by the U.S. Department of Defense (DOD) as part of their Installation Restoration Program (IRP) as having potential for contamination. The IRP, established during 1976, parallels the EPA Superfund program under CERCLA. The EPA presently ranks these sites under a hazard ranking system and may include them in the NPL. The DOD evaluated the 48 sites in New Mexico and determined that 12 sites contained contaminants but did not present a hazard to the environment. Additionally, two sites at one facility in Dona Ana County (fig. 3*A*) were considered to present a hazard significant enough to warrant response action in accordance with CERCLA (U.S. Department of Defense, 1986). The remaining sites were scheduled for confirmation studies to determine if remedial action is required.

The New Mexico Environmental Improvement Division has designated five areas of potential contamination that have special ground-water concerns (New Mexico Water Quality Control Commission, 1986). These areas (fig. 3*B*) all overlie principal aquifers and are:

(1) Albuquerque's south valley industrial and commercial area.

(2) Lea County's oil-production and sewage-disposal area.

(3) Grants Mineral Belt's uranium-mining and milling area, west of Albuquerque.

(4) San Juan River valley's oil and gas refinery and liquid-landfill area, mostly near Farmington (San Juan County).

(5) Lower Rio Grande's dairy farms and agricultural disposal area.

Within these areas, zones of known or suspected human-induced ground-water contamination are delineated in figure 3*B*.

POTENTIAL FOR WATER-QUALITY CHANGES

New Mexico has experienced a rapid population growth during the past two decades, and that growth is anticipated to continue, mostly in Albuquerque and other established urban centers along the Rio Grande valley (U.S. Bureau of Census, 1982). The use of water by cities, commerce, light industries, and government will increase, but agricultural irrigation will continue to be the State's major water use. Limited freshwater supplies will continue to restrict the development of heavy industries. The depletion of ground-water resources by irrigation in the eastern and southern parts of the State and increases in pumping costs may cause a decrease in agricultural activities in these areas. Unless 1986 marketing conditions improve for New Mexico's petroleum and mineral resources, these industries probably will continue to decrease their production levels or will cease operations completely. However, the large quantities of mining and petroleum wastes that presently exist in tailings piles or holding ponds are sources of contamination for the principal aquifers. The human-induced water-quality contamination that has occurred already in the principal aquifers probably will persist unless cleanup techniques can be implemented. As more inventories are conducted by the New Mexico Environmental Improvement Division and by other agencies, more contaminated sites probably will be discovered.

The potential for water-quality changes will be greater in the valley-fill and basin-fill aquifers along the Rio Grande because of intensive land use and greater susceptibility of the aquifers. These changes probably would be related to urban, commercial, industrial, and governmental activities. The potential exists for large quantities of nitrate, trace elements, synthetic organic compounds, and petroleum products to infiltrate these aquifers. Sources for these compounds are the large number of landfills overlying these aquifers (fig. 3*C*).

Many different types of pesticides have been applied to irrigated fields overlying the Rio Grande valley's principal aquifers and the eastern New Mexico High Plains aquifer during the past several decades, and pesticide usage will continue in these and other irrigated areas. These pesticides have the potential to percolate into the underlying aquifers. When fully implemented the Navajo Indian Irrigation Project in northwestern New Mexico will irrigate 110,000 acres of arid mesas south of the San Juan River. Fertilizers and pesticides may infiltrate the Tertiary sandstone aquifers underlying the project area.

Radioactive wastes, generated by military and national defense projects, are planned for underground storage in salt deposits in Eddy County, southeastern New Mexico. The geohydrology of the waste site has been studied to aid in assessing the potential for radioactive waste to move into adjacent aquifers (Mercer, 1983).

New Mexico's abundant saline ground water has been considered as a potential supply for municipal use. Research on various methods of desalinization was initiated in 1963 at a U.S. Department of the Interior-sponsored test facility near Roswell in Chaves County (U.S. Department of the Interior, 1963). Saline ground water also is being evaluated for use in large-scale, shallow, solar ponds for the commercial cultivation of algae for energy fuels, food, and chemicals (Lansford and others, 1986). Application of successful research findings in either of these activities potentially could affect ground-water quality.

GROUND-WATER-QUALITY MANAGEMENT

New Mexico has taken the primary legal role in the protection of ground-water quality through the New Mexico Water Quality Control Commission (NMWQCC), which was established by the New Mexico Water Quality Act adopted in 1967. The Commission consists of the head (or designee) of each of eight State agencies plus a representative of the public appointed by the Governor (Goad, 1982). The eight agencies are the New Mexico Environmental Improvement Division (NMEID), the State Engineer and the Interstate Streams Commission, the State Department of Game and Fish, the State Oil Conservation Division, the State Park and Recreation Division, the State Department of Agriculture, the State Soil and Water Conservation Division and the State Bureau of Mines and Mineral Resources. This commission has the authority and responsibility for pollution control in both surface and ground water.

During 1977, regulations were adopted to protect all ground water with a dissolved-solids concentration of 10,000 mg/L or less for present and potential future use as domestic and agricultural water supplies, and to protect those segments of surface waters that are gaining because of ground-water inflow for use designated in the New Mexico (surface) Water-Quality Standards (Goad, 1982). For ground water containing 10,000 mg/L dissolved solids or less, water-quality standards have been set for 24 inorganic constituents, 2 radiochemicals, and 21 natural or synthetic organic compounds in order to protect the ground-water supply for human health, domestic-water supply, and irrigation use. These standards do not apply to effluent discharged at the land surface, but rather, to the ground water itself. If the concentration of any contaminant in ground water already exceeds the standard, the existing concentration becomes the standard.

The primary administrative and enforcement authority and responsibility for these regulations are delegated to the NMEID, with other NMWQCC agencies having coordinating roles for activities related to their respective agency mission. For example, the State's Oil and Conservation Division administers and enforces the regulations as they apply to the production and refinement of oil and gas; the State Engineer may, under other laws, regulate the withdrawal of ground water to prevent the impairment of water rights caused by the movement of saline water into pumped zones.

The NMWQCC's regulations apply to underground injection, seepage from surface impoundments or leach fields, land application of wastes, and any other discharges of effluent or leachate that may affect ground water. Discharges from certain oil, natural gas, carbon-dioxide or geothermal facilities, from coal mines, or from small home septic systems are covered by other statutes and regulations that were enacted before the NMWQCC's regulations (Goad, 1982).

Effluent dischargers are required to submit discharge plans that must be approved by NMEID. The plan must demonstrate that the water-quality standards will not be violated in ground water at any place of present or foreseeable future use. The plan must provide for adequate monitoring and reporting of water-quality conditions. The public has opportunities to hear and to review those plans for conformance with the regulations. Approved discharge plans essentially become discharge permits (New Mexico Water Quality Control Commission, 1984).

The EPA is the lead agency for the CERCLA programs, but the NMEID has an active role in coordinating these projects among the various industrial, commercial, and governmental entities (New Mexico Water Quality Control Commission, 1986). The EPA has delegated to the NMEID the primary enforcement authority for the hazardous-waste program under RCRA, for underground waste injection under UIC, and for the drinking-water-supply programs under the Federal Safe Drinking Water Act (New Mexico Water Quality Control Commission, 1986). The State recently returned authority to the U.S. Nuclear Regulatory Commission for issuing and regulating uranium milling and in-situ leaching licenses. This authority includes assessing and monitoring the effects of uranium milling and leaching on ground-water supplies.

The agencies that manage ground-water quality in New Mexico may require additional hydrologic information to help remedy existing contamination or to help prevent potential contamination in the principal aquifers. Ground-water studies that include completely the areas of human-induced and potential contamination (fig. 3*B*) may help document the extent and severity of known contamination. The establishment of a network of monitoring wells and periodic sampling in these areas would help detect any water-quality changes in the principal aquifers.

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FOR ADDITIONAL INFORMATION: District Chief, U.S. Geological Survey, 4501 Indian School Rd. NE, Suite 200, Albuquerque, NM 87110–3929