

GROUND WATER QUALITY  
IN THE SOUTH VALLEY OF ALBUQUERQUE

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The Albuquerque South Valley is underlain by a fresh water aquifer with a saturated thickness of approximately 3,000 feet (1). Water-bearing valley fill materials include permeable units of the Santa Fe group and of the Rio Grande alluvium (2).

Ground water quality problems in the Albuquerque valley date back to at least 1927. Water from shallow (less than 100 feet deep) wells in the valley was so hard that the city, in response to agitation by water consumers, constructed an iron removal and lime softening plant. The plant was operated only until 1933 because water of better quality was discovered deeper within the aquifer (3). In 1932-33, four "soft water deep wells" were drilled to depths of approximately 425 to 715 feet. Waters from the shallow and deep wells were mixed for the city supply (4).

Since 1927, further documentation of the relatively poor quality of shallow (less than 100 feet) alluvial ground water was provided by Bjorklund and Maxwell (2), Clayton (5), Wilson et al. (6), Heggen et al. (7) and by studies of the New Mexico Environmental Improvement Division (EID). The EID, however, found an exception to this phenomenon (table 1). Possible causes of this regional ground water quality problem include evapotranspiration, contaminant discharges and naturally occurring, water-soluble materials.

TABLE 1  
 "Pristine" Water Quality  
 (milligrams/liter)

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	<u>Rio Grande</u>	<u>21 Foot Well East of River</u>
Calcium	53.	55.3
Sulfate	100.	70.8
Total Dissolved Solids	306.	280.

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The Rio Grande station is at the downstream side of Old Town Bridge on old U.S. Highway 66. The 21 foot deep well is approximately 2.5 miles downstream of the Rio Grande station.

The river water data in this table were generated by the United States Geological Survey (USGS) and published in the USGS's annual Water Resources Data for New Mexico for 1981.

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### Evapotranspiration

Irrigation canals have diverted water from the Rio Grande for hundreds of years. Percolating irrigation water caused ground water levels in many valley areas to rise and be more vulnerable to evapotranspiration. The degree to which riverbed aggradation may have worsened this condition is not quantified.

The high water table killed orchards, ruined adobe houses and laid once productive alfalfa land idle. In 1919, about 28 percent of the valley floor area was covered by salt grass and alkali or was swampland (8). Such features are located on topographic maps of the U.S. Reclamation Service dated June 1922.

The Middle Rio Grande Conservancy District designed and constructed drains in the early 1930s to control the waterlogging of irrigated lands.

The drains lowered the water table and, as croplands were reclaimed, much of the alkali was leached from the soil surface.

### Contaminant Discharges

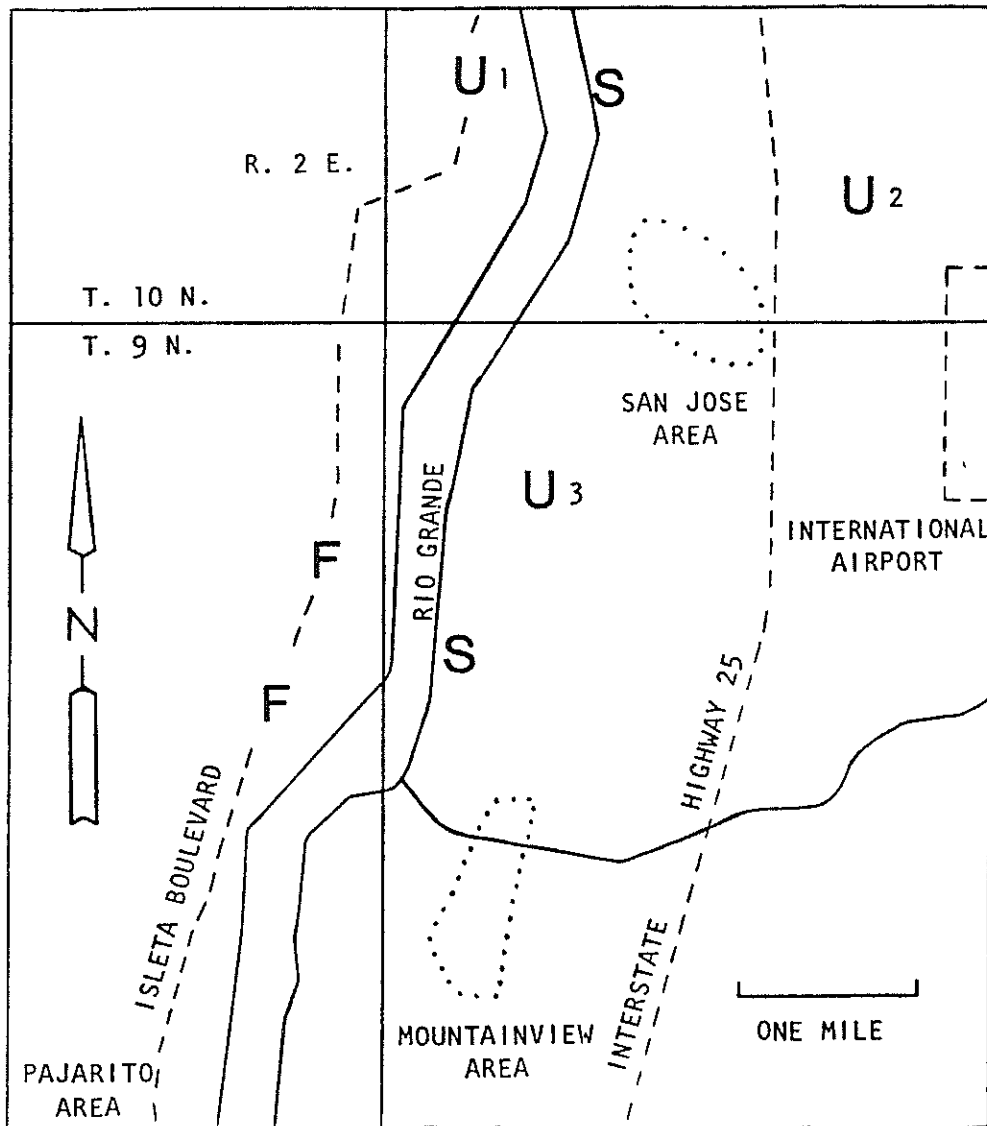
As the population grew from 2,315 in 1880 when the railroad reached Albuquerque, so did the quantity of waste generated by human activity. In 1919, a sewage treatment plant consisting of large Imhoff tanks was built on south Second Street (9). In the late 1930s, with a 10-year-old ground water quality problem at its northern boundary, the South Valley acquired a "new" sewage treatment plant and a petroleum refinery.

Since the 1930s, and especially after World War II, Albuquerque grew at an unprecedented rate. Several residential or industrial areas in the South Valley, originally developed with on site waste disposal, were later connected to the municipal sewage system which received numerous federally assisted improvements, including the construction of a second plant.

Today, potential sources of water contaminants in the South Valley include private and municipal wastewater systems, dumps, animal confinement facilities and packing plants. Other potential sources include agricultural chemicals, petroleum product handling facilities (pipelines, bulk terminals, tank truck firms, retail outlets and domestic sources) and numerous other industrial facilities, many of which have had some degree of on site waste disposal. Industrial wastes also have been discharged to several landfills and to the municipal sewage system.

### Specific Instances of Ground Water Pollution or Anomalous Water Quality

There are several specific instances of ground water pollution or anomalous water quality (figure 1) in addition to the regional problem



Explanation

- F** Hydrocarbon fuel contamination of ground water
- S** Municipal sewage treatment plant
- U** Anomalous water quality occurrence, cause unknown
- Roadway or airport boundary
- Watercourse or boundary of township or range
- ..... Area of ground water quality concern

Fig. 1. The Albuquerque South Valley. All cases on this map are discussed in the text except for U3, where unusually mineralized ground water was recently found. The Five Points Area discussed in the Isleta Blvd. section is U1. The city well, Miles #1, discussed in the San Jose section is U2. The Pajarito area extends off the map to the south and west.

discussed above. Water chemistry data for several of these cases are listed in tables 2, 3 and 4.

San Jose Area. Inorganic water quality data, from most San Jose area wells located on the floodplain (table 2), reflect the regional problem of poor quality, shallow, alluvial ground water discussed above. However, ground water produced from a 21-foot-deep well located less than 1,000 feet east of the Riverside Drain in the South Valley is of very good quality. With regard to inorganic solutes, water from this well closely resembles river water (table 1).

Organic contaminants were detected in water from a supply well at a chemical handling facility in 1978. Reports of tastes and odors in well water elsewhere in the San Jose area date back to at least the mid 1960s.

Several organics, including halogenated two and three carbon compounds, were detected in water samples in 1979 from municipal supply wells San Jose 3 and 6. These two wells and Miles 1, another city well, were shut down in late 1980 when "priority pollutant" compounds were detected in their waters. (These compounds are on the list of 114 organic chemicals designated as "priority pollutants" by the U.S. Environmental Protection Agency [EPA].) Subsequent analyses did not detect volatile organics in Miles 1 which was put back to use in 1981.

With financial support from the EPA, the New Mexico Environmental Improvement Division (EID) conducted an investigation of the source(s) and extent of organic contamination. The EID study found at least three sources of organic ground water contaminants: at least two sources of chlorinated two carbon compounds and at least one source of refined petroleum oil (e.g., diesel). Potential sources of the organic compounds in-

TABLE 2  
San Jose Area  
(milligrams/liter)

	Well Depth		
	19 Feet	66 Feet	912 Feet
Calcium	165.	93.	34.
Sulfate	307.9	194.1	65.
Total Dissolved Solids	874.	576.	329.
Volatiles	0.059	0.085	0.064

These three wells, located on the floodplain, reflect the regional problem of poor quality, shallow alluvial ground water discussed in the text. Ground waters with total dissolved solids levels higher than 874 mg/l exist in the shallowest (approximately 20 feet deep) zone. These three wells were selected because they were each contaminated with low part per billion levels of volatile organics, as shown.

The term "volatiles" in this table refers to volatile organic contaminants, including the benzenes and halogens mentioned in table 3. The term "benzenes" includes the sum of the concentrations of benzene, toluene, ethylbenzene and isomers of xylene.

All data were generated by the EID except for the inorganic data for the 912 foot deep well which was generated by the U.S. Geological Survey (USGS) and published in 1980 in the USGS's annual Water Resources Data for New Mexico.

clude chemical and petroleum product handling facilities, manufacturing or processing establishments, sewer lines, dumps and domestic products such as septic tank and cesspool cleaning solvents.

The San Jose well in table 3 is heavily contaminated with industrial chemicals such as calcium chloride and halogenated organic solvents. Table 4 compares the highest levels of organic halogens detected in San Jose area ground water with New Mexico Water Quality Control Commission

TABLE 3  
South Valley Worst Case Examples  
(milligrams/liter)

	<u>Mountainview</u>	<u>San Jose</u>	<u>Isleta Blvd.</u>
Calcium	765.	1,023.	120.
Nitrate-Nitrogen	501.	7.9	0.23
Total Dissolved Solids	4,776.	7,066.	1,383.
Benzenes	Not Detected	1.6	43.
Halogens	Not Detected	80.	Not Detected

Volatile organics, including the benzenes and halogens, were not detected in the excessively mineralized Mountainview ground water. This particular Mountainview well at one time was a private source of drinking water.

The San Jose case is a monitor well heavily contaminated with industrial chemicals. In addition to the benzenes and halogens, other classes of volatile organics (e.g., ketones) were detected in water from the well at levels up to 100 mg/l).

The Isleta Blvd. case is a monitor well heavily contaminated with unleaded gasoline. The levels of calcium and total dissolved solids probably reflect the regional mineralization problem; the well is only 25 feet deep.

The halogens mentioned in this table should not be confused with inorganic halogens such as chloride.

health standards. No such standards exist for other contaminants such as 1,1-dichloroethane.

No organic contaminants, other than low part per billion levels of trihalomethanes (only in chlorinated samples), have been confirmed in the product waters from other city wells or reservoirs that were sampled; in the South Valley, this includes reservoirs of the San Jose and Atrisco

TABLE 4  
Organic Halogens  
(milligrams/liter)

<u>Contaminant</u>	<u>New Mexico Water Quality Control Commission Ground Water Standard</u>	<u>South Valley Ground Water</u>
Carbon Tetrachloride	0.01	0.001
1,2-Dichloroethane	0.02	0.36
1,1-Dichloroethene	0.005	9.
Trichloroethene	0.1	6.
Tetrachloroethene	0.02	20.

All of the New Mexico Water Quality Control Commission ground water standards listed are based upon human health considerations rather than aesthetics. The ground water concentrations are worst case examples.

The halogens mentioned in this table should not be confused with inorganic halogens such as chloride.

well fields. San Jose wells 3 and 6 remain shut down. However, organic contaminants have been detected in several private water supply wells in the San Jose area.

The San Jose area has been designated as the state's top priority "superfund" site pursuant to the federal Comprehensive Environmental Response Compensation and Liability Act. Application for funding has been made for additional investigation and a feasibility study to determine what remedial action, if any, should be taken.

## Mountainview

Excessively mineralized ground water has caused water supply problems in the Mountainview area at least since 1961. The worst cases historically show several hundred mg/l of nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) and calcium, with most other major ions also at high concentrations, such that there are several thousand mg/l total dissolved solids (TDS [table 3]). Bicarbonate levels, however, are relatively low (e.g., 151 mg/l). Recently sampled well waters also contained anomalously high levels of selenium (e.g., 10.024 mg/l), strontium (e.g., 2.6 mg/l), uranium (e.g., 10.018 mg/l), vanadium (e.g., 0.084 mg/l) and chemical oxygen demand (e.g., 113 mg/l).

Interestingly, water collected in 1936 from test wells located immediately northwest of what is now the Mountainview community was found to be excessively mineralized with TDS concentrations on the order of 9,000 mg/l (10). These were the highest TDS levels found anywhere in the Albuquerque area during the 1936 study. In fact, the next highest level was an order of magnitude less.

In 1980, a six-month-old infant residing in Mountainview developed methemoglobinemia after ingesting food prepared with well water containing more than 200 mg/l  $\text{NO}_3\text{-N}$  (the health standard is 10 mg/l). The child recovered after being treated at a local hospital.

After 22 years of monitoring and investigation involving federal, state, county, city and private parties, numerous hypotheses have been produced, but the cause(s) of the Mountainview problem remain a mystery. In 1982, the state and city governments appropriated funds to help provide

Mountainview residents with drinking water from the Albuquerque municipal system.

### Isleta Boulevard

Isleta Boulevard (U.S. Highway 85) was a major north-south highway before the construction of Interstate Highway 25. According to Bjorklund and Maxwell (2, Plate 2a) the depth to ground water along Isleta Boulevard in the South Valley area is very shallow (approximately 10 feet or less).

Many old, and sometimes abandoned, petroleum product retail outlets (i.e., filling stations) with underground steel storage tanks are located along Isleta Boulevard. Gasoline has been found floating on ground water at two locations near Isleta Boulevard (figure 1). The northern case is described as the "first example" by Jercinovic (1983, this publication). The Isleta Boulevard well in table 3 is heavily contaminated with unleaded gasoline. In the southern case, gasoline floating on the water table was encountered in a construction related excavation in 1980.

Additionally, hydrocarbon of unknown origin(s) was detected in two different well waters in the Five Points area (figure 1) in the early 1970s. Just recently (early 1982), a family in the Los Padillas area (located south of the Pajarito area shown in figure 1) has complained of a fuel like odor in water from their 50-foot-deep domestic well. This case is now under investigation by the EID.

### Pajarito Area

Elevated nitrate levels (greater than 1 mg/l, but usually less than 10 mg/l  $\text{NO}_3\text{-N}$ ) also have been reported in the Pajarito area (11). Wilson et al. (6, p. D-74) believed that septic tanks and cesspools to

the north of Pajarito may be at least partly responsible for the problem, but that other possibilities could not be ruled out.

#### Municipal Sewage Treatment Plants

The city's monitoring program indicates localized nitrate contamination at both plants (figure 1). Concentrations of  $\text{NO}_3\text{-N}$  were on the order of several hundreds of mg/l and several tens of mg/l at plants 1 and 2, respectively.

Sludge drying beds appear to be the source of contamination at plant 2 (the newer and southernmost facility). Sources at the site of the older plant, where sewage treatment activity dates back to at least 1919, are not defined.

#### Discussion and Conclusions

A long history of human activity in a zone of shallow ground water has created a regional ground water quality problem in the Albuquerque South Valley. The problem appears to be limited to ground waters less than 100 feet deep, but its areal extent and chemical nature(s) is poorly defined.

Additionally, there are numerous cases of ground water pollution that are less extensive in geographic area. Most of these cases undoubtedly are the result of contaminant discharges.

Contaminants of health concern include nitrate, aromatic hydrocarbons and chlorinated one or two carbon organics. Other parameters reduce the amenities of water supplies derived from shallow valley ground water.

## REFERENCES

1. Kelly, T. E., 1974, Reconnaissance Investigation of Ground Water in the Rio Grande Drainage Basin: United States Geological Survey Hydrologic Investigations Atlas HA-510, Sheet 1.
2. Bjorklund, L. J. and Maxwell, B. W., 1961, Availability of Ground Water in the Albuquerque Area, Bernalillo and Sandoval Counties, New Mexico: New Mexico State Engineer Technical Report 21, 117 p.
3. Southwest Engineers and Burns & McDonnell Engineering Company, 1952, Albuquerque, New Mexico, Report on Municipal Water System: p. 19.
4. Black and Veatch, Consulting Engineers, 1935, Albuquerque, New Mexico, Report on Jemez River Water Project and Soft Water Well Supply: p. 5.
5. Clayton, C. L., 1966, Summary of Chemical Analysis of Water from Private Wells in Bernalillo County: Albuquerque Department of Environmental Health file report, 9 p.
6. Wilson, L.; Jenkins, D.; Anderson, S.; Classen, A.; Hanna, D. and Diebold, C., 1977, Technical Reference Document for Albuquerque Wastewater Treatment Facilities, Project No. C-35-1020-01, Albuquerque, New Mexico, Part D: 155 p.7.
7. Heggen, R. J.; Thomson, B. M.; Matthews, J. R. and Tefera, A., 1979, Ground Water Quality Study, City of Albuquerque North Valley: University of New Mexico Bureau of Engineering Research Report CE-49-812-1, 34 p.
8. Bloodgood, D. W., 1930, The Ground Water of the Middle Rio Grande Valley and its Relation to Drainage: New Mexico State College, Agricultural Experiment Station.
9. Turney, W. F., and Associates, 1963, Long Range Master Plan for Sanitary Sewers and Sewage Treatment Works for City of Albuquerque, New Mexico, Volume 1 - Text: p. 45-56
10. Scofield, C. S., 1938, Quality of Water of the Rio Grande Basin Above Fort Quitman, Texas: U.S. Geological Survey Water-Supply Paper 839, 294 p.
11. Anderson, D. W., 1972, Technology, Public Administration and Quality of Ground Water: Master's Thesis, University of New Mexico, p. 37-38.