GEOHYDROLOGY OF THE MESILLA GROUND-WATER BASIN, DOÑA ANA COUNTY, NEW MEXICO, AND EL PASO COUNTY, TEXAS

By Edward L. Nickerson and Robert G. Myers

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FIGURES--Continued

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
acre	4,047	square meter
foot per mile	0.1894	meter per kilometer
foot per day	0.3048	meter per day
foot per day	0.000353	centimeter per second
foot squared per day	0.0929	meter squared per day
acre-foot	1,233	cubic meter
gallon	3.785	liter
gallon	0.003785	cubic meter
gallon per minute	0.06309	liter per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by the equation:

$$°F = 9/5\ (°C) + 32$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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ABSTRACT

In 1983 the U.S. Geological Survey began a multiphase study of the geohydrologic system of the Mesilla ground-water basin in Doña Ana County, New Mexico, and El Paso County, Texas, to provide information for orderly development of ground-water supplies within the basin. Information is needed about the recharge and discharge mechanisms; aquifer characteristics; ground-water movement; river/aquifer relations; horizontal and vertical water-quality variability within the aquifer; and effects of structural geology on the lithology, water quality, and characteristics of the aquifer in the West Mesa. Methods of investigation include data collection from the (1) Mesilla ground-water basin observation-well network; (2) Mesilla Valley hydrologic sections; and (3) West Mesa geohydrologic test holes.

The aquifer system of the Mesilla ground-water basin is in the Quaternary flood-plain alluvium and the Quaternary and Tertiary Santa Fe Group. The ground-water basin was divided into two areas of study: (1) the Mesilla Valley along the Rio Grande in the east, and (2) the West Mesa in the west. The direction of ground-water flow in the study area is south to southeast, toward the lower end of the basin. The hydraulic gradient in the shallow flood-plain alluvium within the Mesilla Valley is generally between 4 and 6 feet per mile. The hydraulic gradient in the Santa Fe Group ranges from about 100 feet per mile in the northwestern part of the study area to less than 2 feet per mile in the southwestern part of the study area.

Recorded hydraulic gradients from the river to the aquifer identify the Rio Grande as a losing river at the Las Cruces, Mesquite, and Cañutillo well-field hydrologic sections. The length and seepage rate of losing reaches of the Rio Grande may fluctuate with annual and seasonal variations in streamflow. Ground-water levels in nearby observation wells correspond to increases in river stage and indicate significant recharge to the aquifer at the river. Seasonal trends in the shallow water table generally correspond to recharge during the irrigation season.

Water in storage within the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system occurs under unconfined (water-table) and semiconfined (leaky-confined) conditions. Water in storage within the shallow flood-plain alluvium generally is unconfined. Water generally occurs within the Santa Fe Group under semiconfined conditions.

Water moves from the shallow flood-plain alluvium to the upper Santa Fe Group through a series of interbedded gravel, sand, and clay lenses. Horizontal permeability usually exceeds vertical permeability by several orders of magnitude because of the heterogeneity and layering of the aquifer. The thickness and extent of finer grained, less permeable material increase vertically with depth and horizontally toward the southern end of the basin.

Freshwater zones are overlain by zones of slightly saline to saline water in the Mesilla Valley. The shallow, slightly saline (1,000 to 3,000 milligrams per liter dissolved solids) to saline (greater than 3,000 milligrams per liter dissolved solids) water is flushed from the aquifer by surface-water recharge near the Rio Grande and irrigation canals. The zone of slightly saline water overlying the freshwater zone is absent or thin near the Rio Grande and increases in thickness away from the river.

Water levels, drill cuttings, borehole-geophysical logs, and water-quality data were collected from four geohydrologic test holes drilled on the West Mesa. Geohydrologic data indicate that the thickness of the freshwater zone is significantly less than previously estimated in the vicinity of the proposed West Mesa well field. The thickness of the Santa Fe Group at the Lanark test hole on the horst between the Fitzgerald fault zone and the Mid-Basin fault zone is almost 500 to 900 feet less than previous estimates. Lithologic data, borehole-geophysical logs, water-quality data, and potentiometric contours of ground water in the upper Santa Fe Group indicate a hydraulic connection between the Mesilla Valley and the West Mesa.

INTRODUCTION

The significant increase in population within the Mesilla ground-water basin and adjacent areas has resulted in competition for existing ground-water resources. The City of El Paso, Texas, applied for water rights in New Mexico at the proposed West Mesa well field. Well applications (266) were filed with the New Mexico State Engineer Office on September 6-7, 1980. The well applications were withdrawn subsequent to a settlement agreement on March 6, 1991. In 1983, the U.S. Geological Survey began a multiphase study to better define the hydrologic system of the Mesilla ground-water basin in Doña Ana County, New Mexico, and El Paso County, Texas (fig. 1). To provide for orderly development of ground-water supplies within the basin, information is needed about recharge and discharge; aquifer characteristics; ground-water movement; river/aquifer relations; and water quality within the aquifer. The study was conducted in cooperation with the New Mexico State Engineer Office; City of El Paso, Texas; U.S. Section--International Boundary and Water Commission; U.S. Bureau of Reclamation; and City of Las Cruces, New Mexico.

Purpose and Scope

The purpose of this study was to better define the geohydrologic system of the Mesilla ground-water basin in Doña Ana County, New Mexico, and El Paso County, Texas. Specific objectives of the report were to evaluate recharge/discharge mechanisms and aquifer characteristics, document ground-water levels, determine direction of ground-water flow, identify ground-water movement and river/aquifer relations, and determine water-quality zones at selected sites in the Mesilla ground-water basin. The scope of the report is to present geohydrologic information determined as part of this study from January 1983 through March 1987, and to briefly summarize previously published information when necessary for discussion.

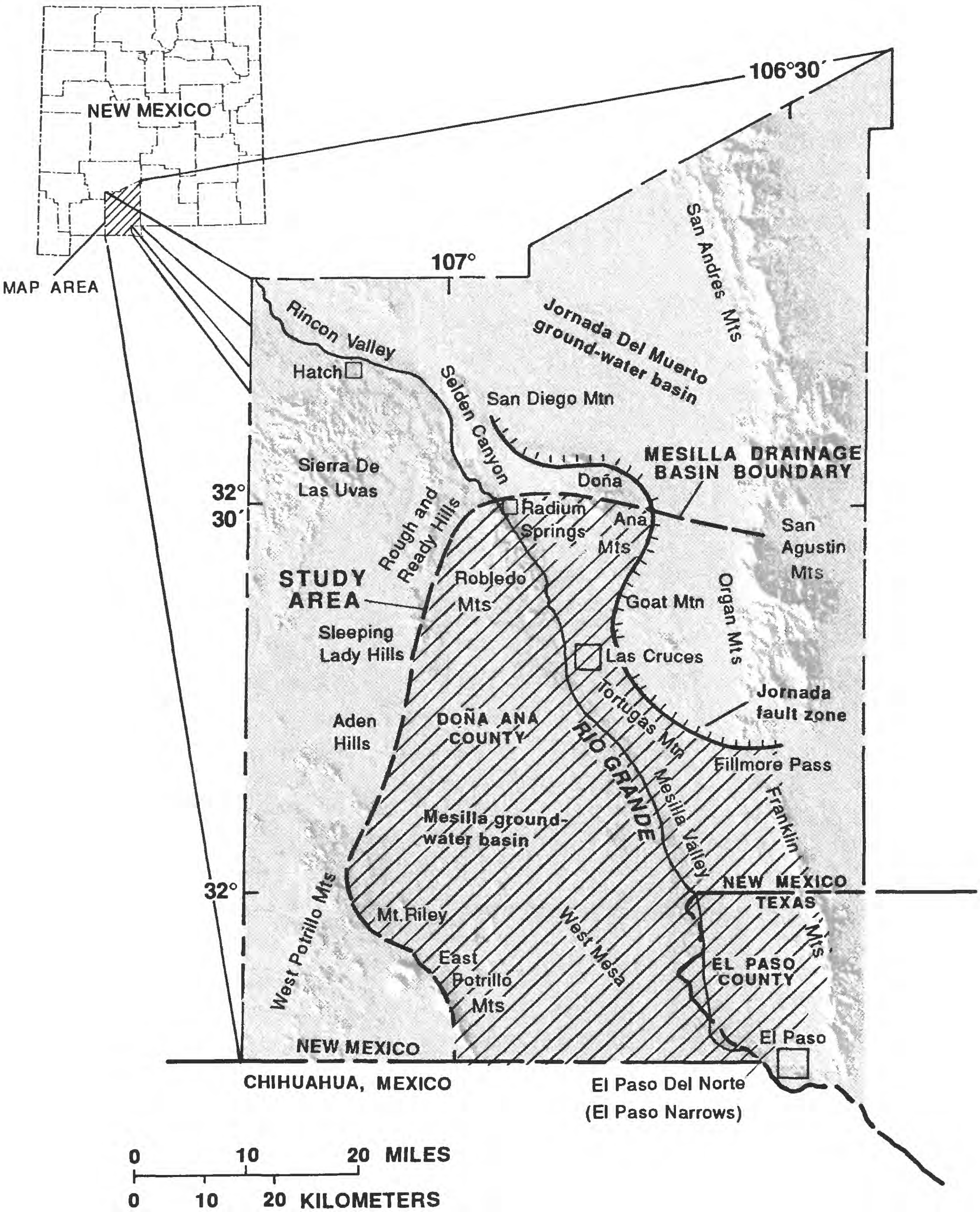


Figure 1.--Location of the study area.

Description of the Study Area

The Mesilla drainage basin is located in Doña Ana County in south-central New Mexico; El Paso County, Texas; and northwestern Chihuahua, Mexico (fig. 1). The Mesilla drainage basin includes the Mesilla ground-water basin and the southern part of the Jornada del Muerto ground-water basin. The study area encompasses most of the Mesilla ground-water basin (fig. 1)--the portion that is within the United States. The study area is bounded on the north by the Robledo and Doña Ana Mountains, on the east by the Jornada fault zone and Franklin Mountains, on the south by the United States-Mexico boundary, and on the west by the East Potrillo and West Potrillo Mountains, Aden Hills, Sleeping Lady Hills, and Rough and Ready Hills. The Mesilla ground-water basin in this report refers only to the United States section. The study area is geographically divided into the Mesilla Valley along the Rio Grande in the east, and the West Mesa in the west (fig. 1). The surface of the West Mesa ranges from 300 to 350 feet above the Rio Grande. Most of the population of and water use within the basin are in the Mesilla Valley. The four major physiographic units in the Mesilla ground-water basin (Hawley, 1965, p. 189) are: (1) mountains along the basin boundary; (2) valley-border and flood-plain surfaces along the Rio Grande on the eastern side of the study area; (3) basin and basin remnants in the West Mesa between the mountains and valley border; and (4) volcanic cones and lava flows on the West Mesa.

Methods of Investigation

Methods of investigation for the Mesilla ground-water basin study included collection and analysis of data from three sources. These are the (1) Mesilla ground-water basin observation-well network; (2) Mesilla Valley hydrologic sections; and (3) West Mesa geohydrologic test holes.

Mesilla Ground-Water Basin Observation-Well Network

The Mesilla ground-water basin observation-well network was established in 1983 to monitor ground-water levels. The network currently consists of 147 water wells that were selected on the basis of geologic unit and location. Well records, including annual water-level measurements, were collected from network wells. Water samples for chemical analysis were collected from 65 wells.

Mesilla Valley Hydrologic Sections

Three hydrologic sections were constructed in the Mesilla Valley near Las Cruces, Mesquite, and Cañutillo (Nickerson, 1986). Each hydrologic section consists of a river-stage station and several observation-well groups aligned perpendicular to the Rio Grande. Each well group consists of several observation wells completed at depths ranging from 35 to 801 feet. Water-level, borehole-geophysical, and water-quality data were collected at all well groups. Observation wells and river-stage stations are equipped with water-level recorders to collect continuous water-level data. Borehole-geophysical logs were obtained from the deepest test well at each well group (Nickerson, 1986).

The hydrologic sections were established to monitor ground-water conditions in the flood-plain alluvium/Santa Fe Group aquifer system. Data collected at the hydrologic sections were used to evaluate aquifer characteristics, document river stage and ground-water levels, determine ground-water movement, identify river/aquifer relations, and determine water-quality zones.

West Mesa Geohydrologic Test Holes

Four geohydrologic test holes ranging in depth from 1,295 to 2,463 feet below land surface were drilled by the City of El Paso to identify aquifer characteristics on the West Mesa. The test holes were located to determine the lithology and water quality of the aquifer in the Santa Fe Group in the vicinity of the proposed West Mesa well field and their relation to the structural geology of the Mesilla ground-water basin. Water levels, drill cuttings, borehole-geophysical data, and water-quality data were collected from all test holes. Three of the test holes were completed as observation wells. Drill cuttings from the geohydrologic test holes are described and interpreted in Hawley and Lozinsky (in press).

Water samples were collected for chemical analysis from selected 20-foot intervals in the test holes by the air-jet method. A 20-foot section of well screen was attached to the end of the drill stem and placed at the selected sample depth in the test hole. Gravel was placed in the test hole up to a level above the screen, and air was forced down an air line in the drill stem. The well was pumped at a rate of about 20 gallons per minute using compressed air until the water became clear. Specific conductance of the production water was monitored during the jetting process until the conductance stabilized. A water sample was then collected for chemical analysis. The bentonite drilling mud and wall cake above and below the pumped interval restrict vertical flow in the test hole. Water samples collected by this method are believed to be representative of the screened interval. Air jetting may affect some chemical characteristics of the sample, such as alkalinity, pH, and concentration of some trace elements.

Acknowledgments

Special cooperation and assistance by many individuals and their agencies are gratefully acknowledged. These include John Nixon, New Mexico State Engineer Office; Thomas Cliett, El Paso Water Utilities Department; David Overvold, U.S. Bureau of Reclamation; and William Saad, Elephant Butte Irrigation District. Water-level measurements in observation wells were made by the U.S. Geological Survey with assistance from the U.S. Bureau of Reclamation and New Mexico State Engineer Office.

Well-Numbering Systems

Two different systems of numbering wells are used because the study area is located in New Mexico and Texas. The system used by most Federal, State, and municipal agencies in their respective States was used in that part of the study area to ensure consistency.

New Mexico System

The system of numbering wells and springs in New Mexico (fig. 2) is based on the common subdivision of public lands into sections. The well number, in addition to designating the well, locates its position to the nearest 10-acre tract in the land network. The number is divided by periods into four segments. The first segment denotes the township north or south of the New Mexico base line; the second denotes the range east or west of the New Mexico principal meridian; and the third denotes the section. The fourth segment of the number, which consists of three digits, denotes the 160-, 40-, and 10-acre tracts, respectively, in which the well is situated. For this purpose, the section is divided into four quarters, numbered 1, 2, 3, and 4 in the normal reading order, for the northwest, northeast, southwest, and southeast quarters, respectively. The first digit of the fourth segment gives the quarter section, which is a tract of 160 acres. Similarly, the 160-acre tract is divided into four 40-acre tracts numbered in the same manner, and the second digit denotes the 40-acre tract. Finally, the 40-acre tract is divided into four 10-acre tracts, and the third digit denotes the 10-acre tract. Thus, well 24S.02E.23.342 is in the NE 1/4 of the SE 1/4 of the SW 1/4, section 23, Township 24 South, Range 02 East. The letters a, b, c, etc. are added to the last segment to designate succeeding wells in the same 10-acre tract.

Where sections are irregularly shaped, the well is located on the basis of a regular square-section grid that is superimposed on the irregular section with the southeast corner and eastern section lines matching. The well is then numbered by its location in the superimposed square grid. In valley areas where land grants existed when the public lands were subdivided into sections, the section lines have been extended and the artificial sections numbered.

Texas System

In Texas, the well-numbering system used in this report is the same as that used by the Texas Department of Water Resources (fig. 3). Under this system, which is based on latitude and longitude, each 1-degree quadrangle in the State is given a two-digit number from 01 through 89. These are the first two digits of the well number. El Paso County is in parts of quadrangles 48 and 49. Each 1-degree quadrangle is subdivided into 7 1/2-minute quadrangles that are given a two-digit number from 01 to 64. These are the third and fourth digits of the well number. Each 7 1/2-minute quadrangle is further subdivided into 2 1/2-minute quadrangles that are each given a single-digit number ranging from 1 through 9. This is the fifth digit of the well number. Finally, each well within a 2 1/2-minute quadrangle is given a two-digit number in the order in which the well was inventoried, starting with 01. These are the last two digits of the well number. In addition to the seven-digit well number, a two-letter prefix is used to identify the county; the prefix for El Paso County is JL. Thus, well JL-49-12-501 is well number 1 located in the 5th 2 1/2-minute quadrangle of the 12th 7 1/2-minute quadrangle in the 49th 1-degree quadrangle, which is in El Paso County (JL).

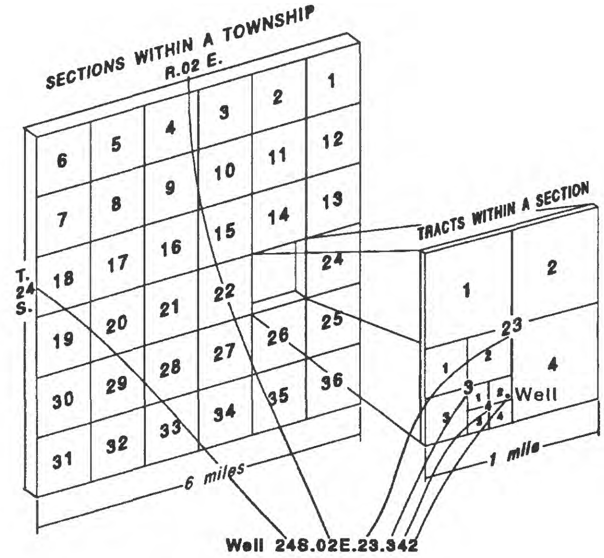


Figure 2.--System of numbering wells in New Mexico.

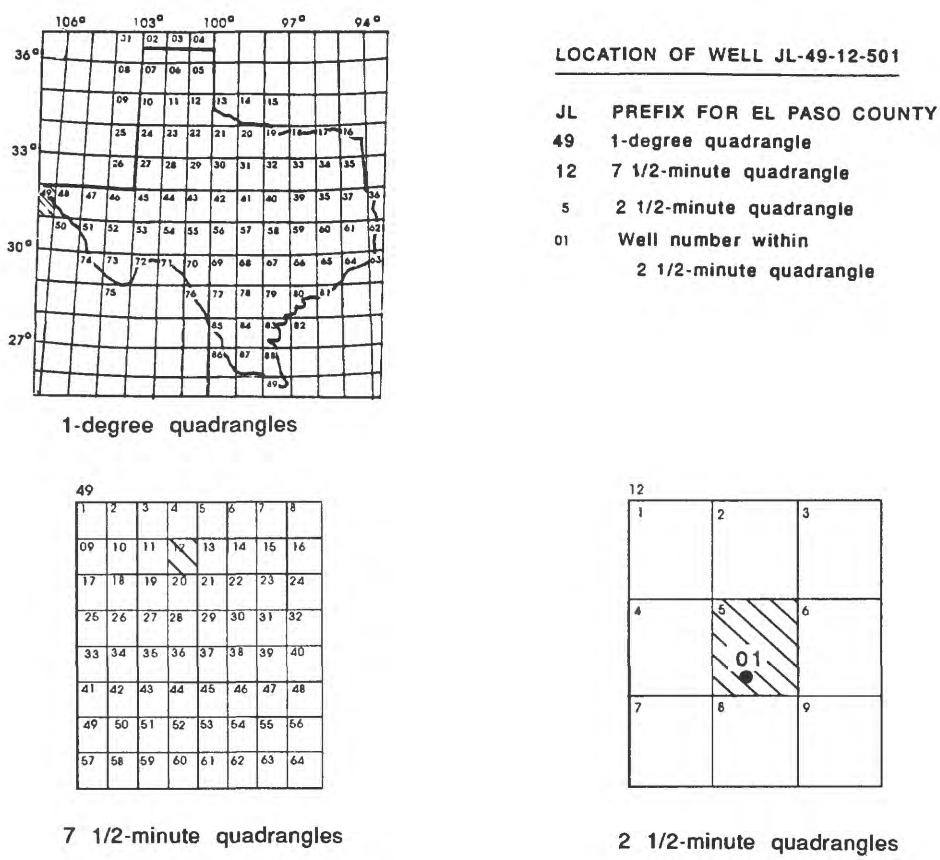


Figure 3.--System of numbering wells in Texas.

GEOHYDROLOGY

The Mesilla drainage basin includes the southern part of the Jornada del Muerto ground-water basin and the Mesilla ground-water basin (fig. 1). The Mesilla ground-water basin is separated from the Jornada del Muerto ground-water basin by the Jornada fault zone (Seager and others, 1987). The ground-water connection across the fault zone is considered slight, and flow between the basins is restricted by a buried volcanic ridge (horst) between Goat Mountain and Tortugas Mountain (fig. 4) (Wilson and others, 1981, p. 39). The horst is delineated by the Jornada fault zone on the eastern side and the Mesilla Valley fault zone (fig. 4) on the western side. Several test holes drilled in the center of the horst between 1979 and 1986 penetrate few or no thin, water-saturated sediments. However, there may be buried arroyo channels incised into the ridge that allow some water to pass from the Jornada del Muerto ground-water basin into the Mesilla ground-water basin.

Several fault zones and major faults in the Mesilla ground-water basin form a series of horsts and grabens (fig. 4) that affect the thickness of basin-fill sediments and the occurrence of ground water. These include the East Potrillo fault zone, West Robledo fault zone, East Robledo fault zone, Fitzgerald fault zone, Mid-Basin fault zone, Mesilla Valley fault zone, and Jornada fault zone.

The Rio Grande enters the Mesilla ground-water basin in the north from Rincon Valley through Selden Canyon and exits to the south at El Paso Narrows (fig. 1). Some ground water enters the Mesilla ground-water basin from Selden Canyon through thin alluvial sediments overlying the bedrock in the river channel of the Rio Grande. Some ground water leaves the Mesilla ground-water basin through thin alluvial sediments overlying the bedrock in the river channel of the Rio Grande at El Paso Narrows.

The aquifer system in the Mesilla ground-water basin is composed of two stratigraphic units: (1) the Quaternary alluvium of the Rio Grande flood plain, and (2) the Quaternary and Tertiary Santa Fe Group basin fill, which is of Pleistocene to Miocene age (King and others, 1971). The Rio Grande flood-plain alluvium occurs beneath the Mesilla Valley in the eastern part of the basin. The flood-plain alluvium generally ranges in thickness from 50 to 125 feet (Wilson and others, 1981, p. 27) and consists of sand and gravel with lenses of silt and clay (Hawley, 1984). The Santa Fe Group, which extends throughout the basin, consists of clay, silt, sand, gravel, and caliche, and some occasional igneous rocks composed of volcanic ash and basalt. The thickness of the Santa Fe Group ranges from zero to greater than 5,000 feet (Hawley, 1984) within the study area. In the west-to-east hydrogeologic sections of Hawley (1984), the thickest part of the aquifer generally is west of the Mesilla Valley fault zone, beneath the Mesilla Valley.

The Santa Fe Group is composed of at least four formations: (1) Camp Rice Formation; (2) Fort Hancock Formation; (3) Hayner Ranch Formation; and (4) Rincon Valley Formation. An unnamed upper part of the Santa Fe Group composed of an eolian facies possibly of Pliocene to Miocene age occurs in the central-southern part of the basin (Hawley, 1984).

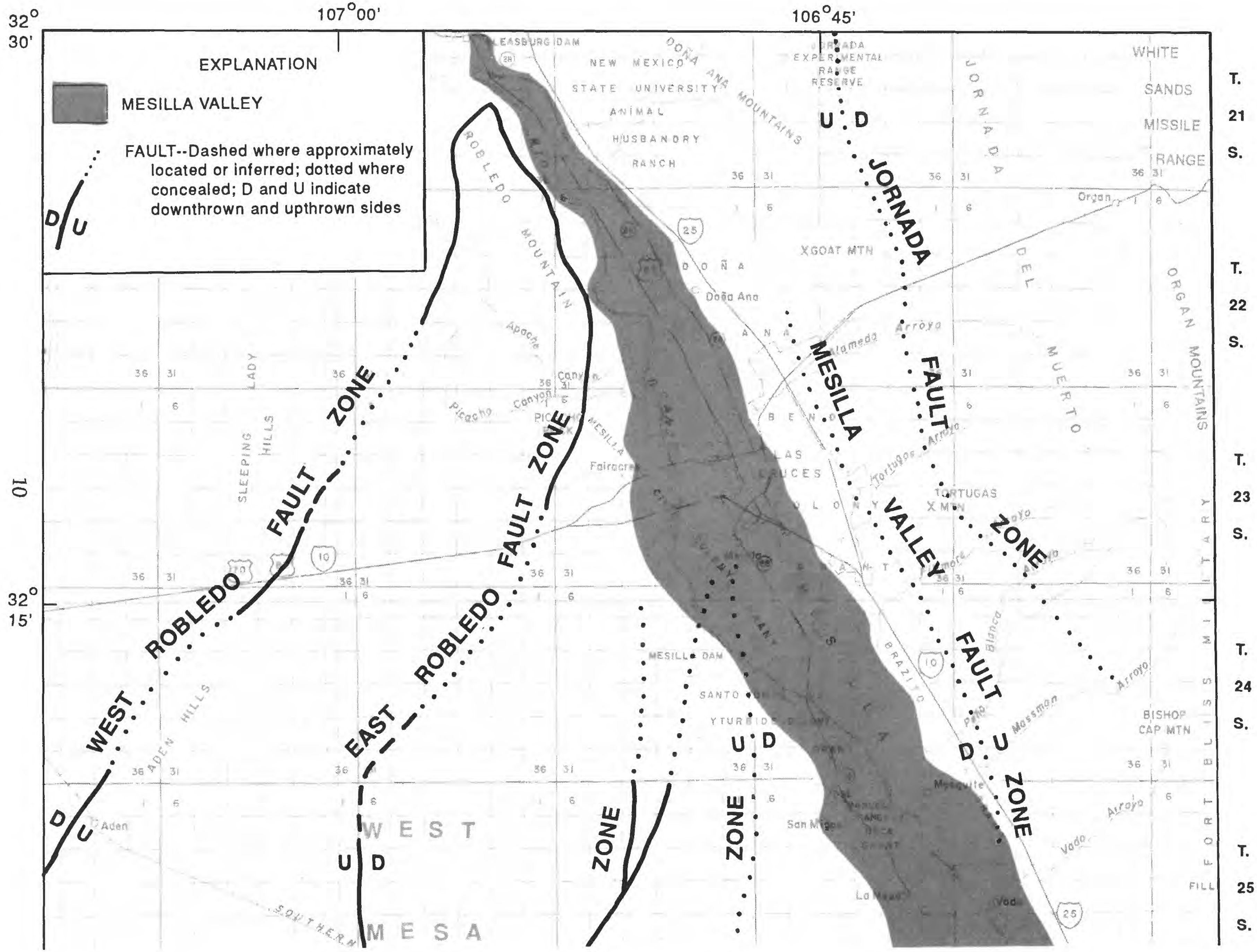
Hawley (1984) divided the aquifer system into four major types of depositional environments. These are (1) valley-fill deposits, which correlate with the Rio Grande flood-plain alluvium; (2) younger basin-fill deposits characterized by basin-floor fluvial to deltaic facies, which correlate with the Camp Rice and Fort Hancock Formations; (3) younger basin-fill deposits characterized by piedmont-slope and basin-floor facies, which correlate with the Camp Rice and Fort Hancock Formations and the unnamed eolian facies; and (4) older basin-fill deposits characterized by piedmont-slope and basin-floor facies, which correlate with the basal Camp Rice Formation and the Rincon Valley and Hayner Ranch Formations of the lower Santa Fe Group.

The Santa Fe Group can be divided into the lower Santa Fe Group, composed of one lithologic unit or lithofacies, and the upper Santa Fe Group, composed of two lithologic units or lithofacies (Mack, 1985). The lower Santa Fe Group is predominantly composed of clay, silt, sandstone, mudstone, and conglomerate, and shale with some lenses of sand. The lower unit of the upper Santa Fe Group is predominantly a mixture of clay, sand, and gravel with discontinuous zones of calcite. Grain size decreases in the northern part of the basin from east to west (Mack, 1985). The lower lithologic unit of the upper Santa Fe Group sometimes intertongues with the upper unit and also with the underlying lower Santa Fe Group. The upper unit of the upper Santa Fe Group correlates with the Camp Rice Formation; formation names or boundaries for the lower unit of the upper Santa Fe Group and the lower Santa Fe Group cannot be applied with any degree of certainty (Mack, 1985). The upper unit of the upper Santa Fe Group is predominantly composed of sand with lenses and discontinuous layers of clay, silt, and gravel. The clay lenses thicken southward (Peterson and others, 1984). In the northern part of the basin, the gravel content decreases with depth (Mack, 1985).

The Mesilla ground-water basin observation-well network was established in 1983 (Nickerson, 1986) to monitor water levels in the flood-plain alluvium/Santa Fe Group aquifer system. The locations of observation wells in the Mesilla ground-water basin are shown in figure 5. Records of selected wells, including annual water-level measurements, are listed in table 1 (tables are in the back of the report). Chemical analyses of water samples from selected wells are listed in table 2. Hydrographs showing monthly water levels in selected observation wells are shown in figure 6.

The U.S. Bureau of Reclamation has maintained a series of observation wells in the Mesilla Valley since 1946. These wells are completed in the flood-plain alluvium at depths ranging from 15 to 40 feet below land surface. Hydrographs showing annual February water levels since 1946 in selected Bureau of Reclamation observation wells are shown in figure 7.

The general direction of ground-water flow in the aquifer system is south-southeast, toward the lower end of the basin. The water-table contour map of the aquifer in the flood-plain alluvium is shown in figure 8. The contours were constructed from water-level measurements collected in February 1985. The hydraulic gradient in the flood-plain alluvium generally ranges from 4 to 6 feet per mile. The potentiometric-surface map of the aquifer in the Santa Fe Group is shown in figure 9. The potentiometric contours were constructed from water-level measurements collected from January to March 1985. The hydraulic gradient in the Santa Fe Group ranges from about 100 feet per mile in the northwestern part of the study area to less than 2 feet per mile in the southwestern part of the study area.


EXPLANATION
MESILLA VALLEY
FAULT--Dashed where approximately located or inferred; dotted where concealed; D and U indicate downthrown and upthrown sides
D U
32° 30'
107°00'
106°45'
32° 15'
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
JORNADA FAULT ZONE
MESILLA VALLEY FAULT ZONE
EAST ROBLEDO FAULT ZONE
WEST ROBLEDO FAULT ZONE
ZONE
WEST MESA
ROBLEDO MOUNTAIN
DOÑA ANA MOUNTAINS
ORGAN MOUNTAINS
JORNADA DEL MUERTO
WHITE SANDS MISSILE RANGE
FORT BLISS MILITARY
NEW MEXICO STATE UNIVERSITY ANIMAL HUSBANDRY RANCH
JORNADA EXPERIMENTAL RANGE RESERVE
SLEEPING LADY HILLS
ADEN HILLS
LEASBURG DAM
MESILLA DAM
XGOAT MTN
TORTUGAS X MTN
BISHOP CAP MTN
Doña Ana
Organ
Fairacres
Aden
San Miguel
La Mesa
Vado
Mesquite
LAS CRUCES
SANTO TOMAS
YTURBIDE GRANT
BRAZITO
SOUTHERN

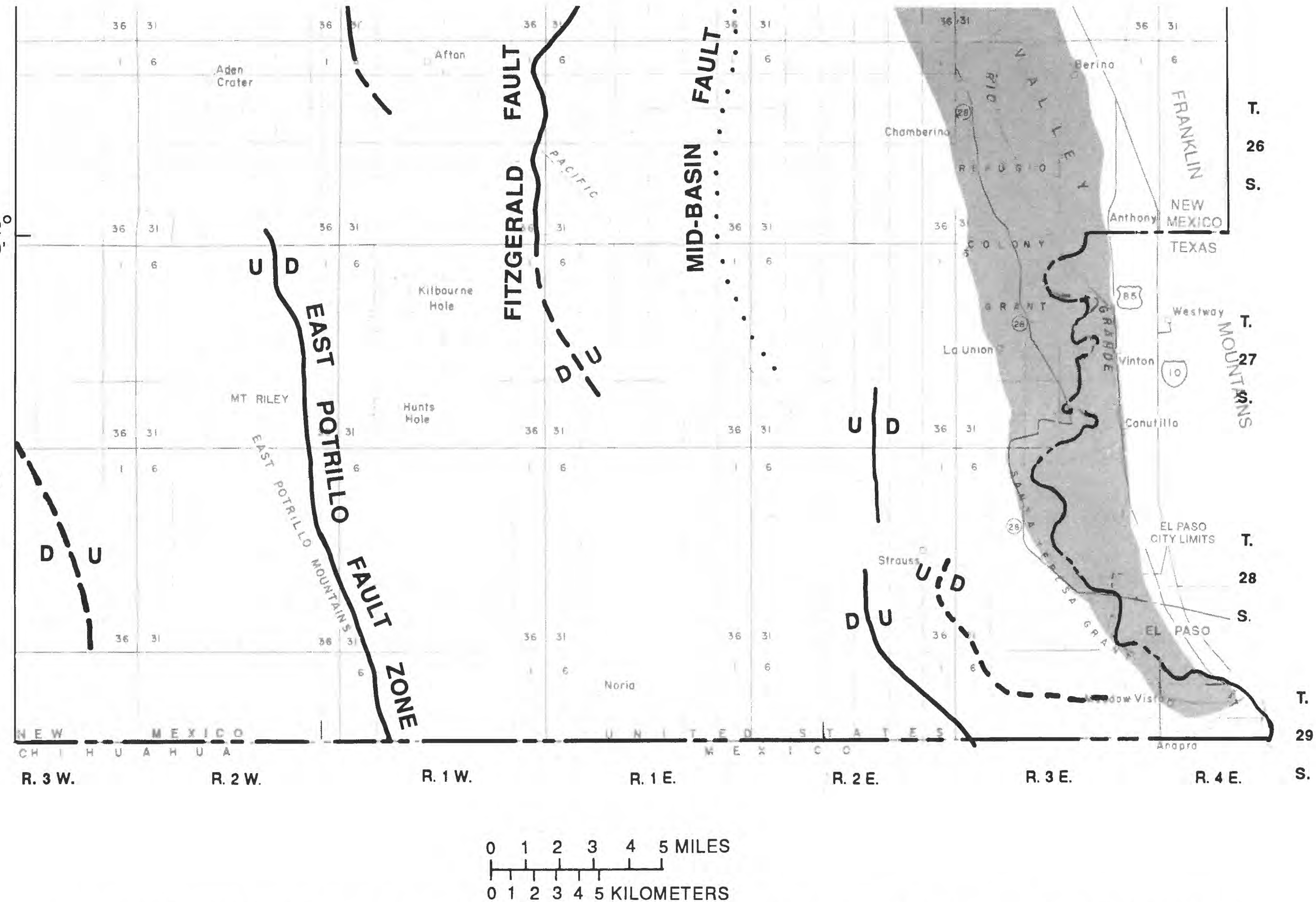
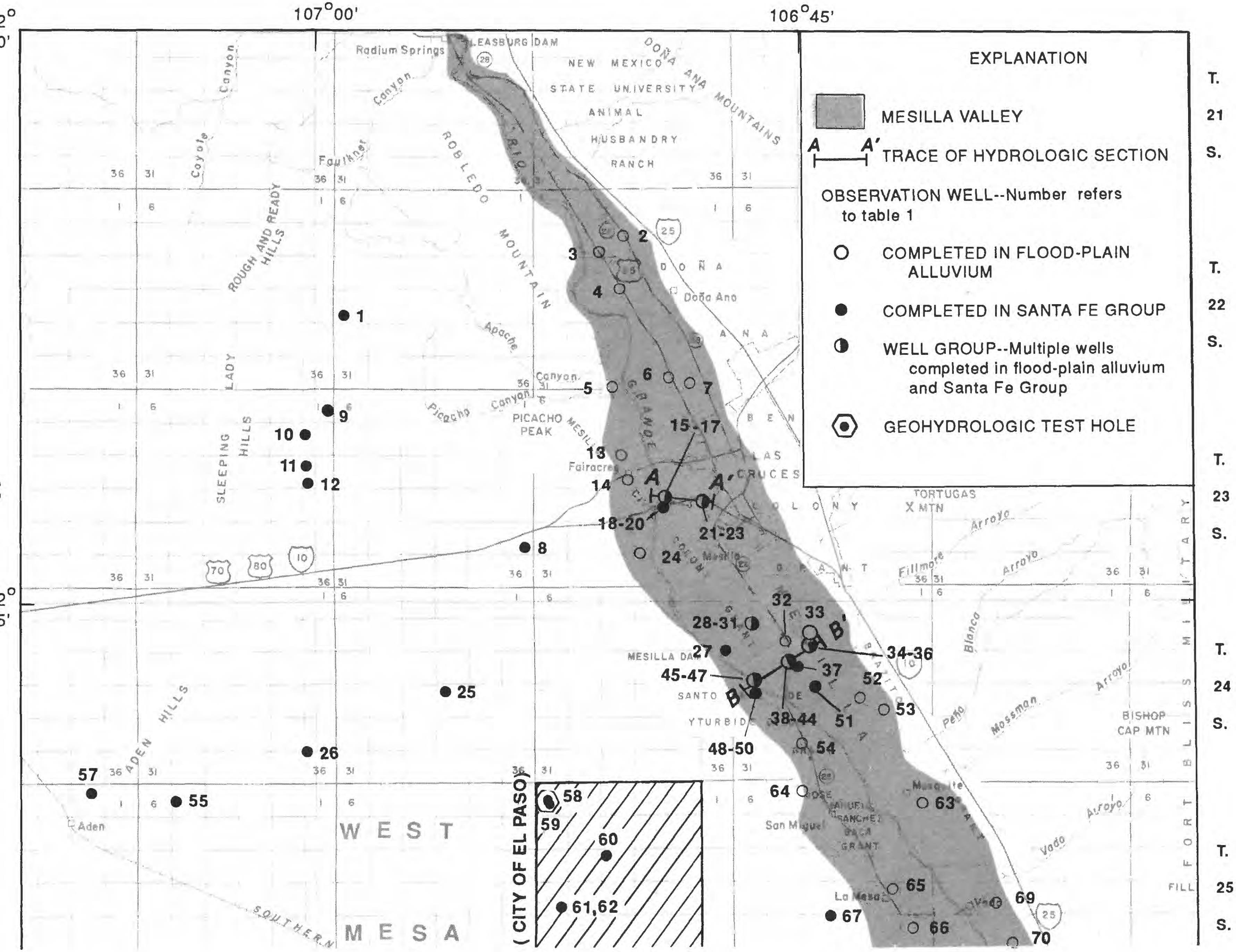


Figure 4.--Selected major faults of the Mesilla ground-water basin, New Mexico and Texas (modified from Hawley, 1984; and Seager and others, 1987).


EXPLANATION
MESILLA VALLEY
A A′ TRACE OF HYDROLOGIC SECTION
OBSERVATION WELL--Number refers to table 1
COMPLETED IN FLOOD-PLAIN ALLUVIUM
COMPLETED IN SANTA FE GROUP
WELL GROUP--Multiple wells completed in flood-plain alluvium and Santa Fe Group
GEOHYDROLOGIC TEST HOLE
32° 30′
107°00′
106°45′
32° 15′
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
Radium Springs
LEASBURG DAM
NEW MEXICO STATE UNIVERSITY ANIMAL HUSBANDRY RANCH
DOÑA ANA MOUNTAINS
ROBLEDO MOUNTAIN
RIO GRANDE
ROUGH AND READY HILLS
SLEEPING LADY HILLS
PICACHO PEAK
Fairacres
LAS CRUCES
Mesilla
MESILLA DAM
TORTUGAS X MTN
BISHOP CAP MTN
FORT BLISS MILITARY
WEST MESA
ADEN HILLS
Aden
SOUTHERN
(CITY OF EL PASO)
San Miguel
La Mesa
Doña Ana
Mosquite
Vado
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15-17
18-20
21-23
24
25
26
27
28-31
32
33
34-36
37
38-44
45-47
48-50
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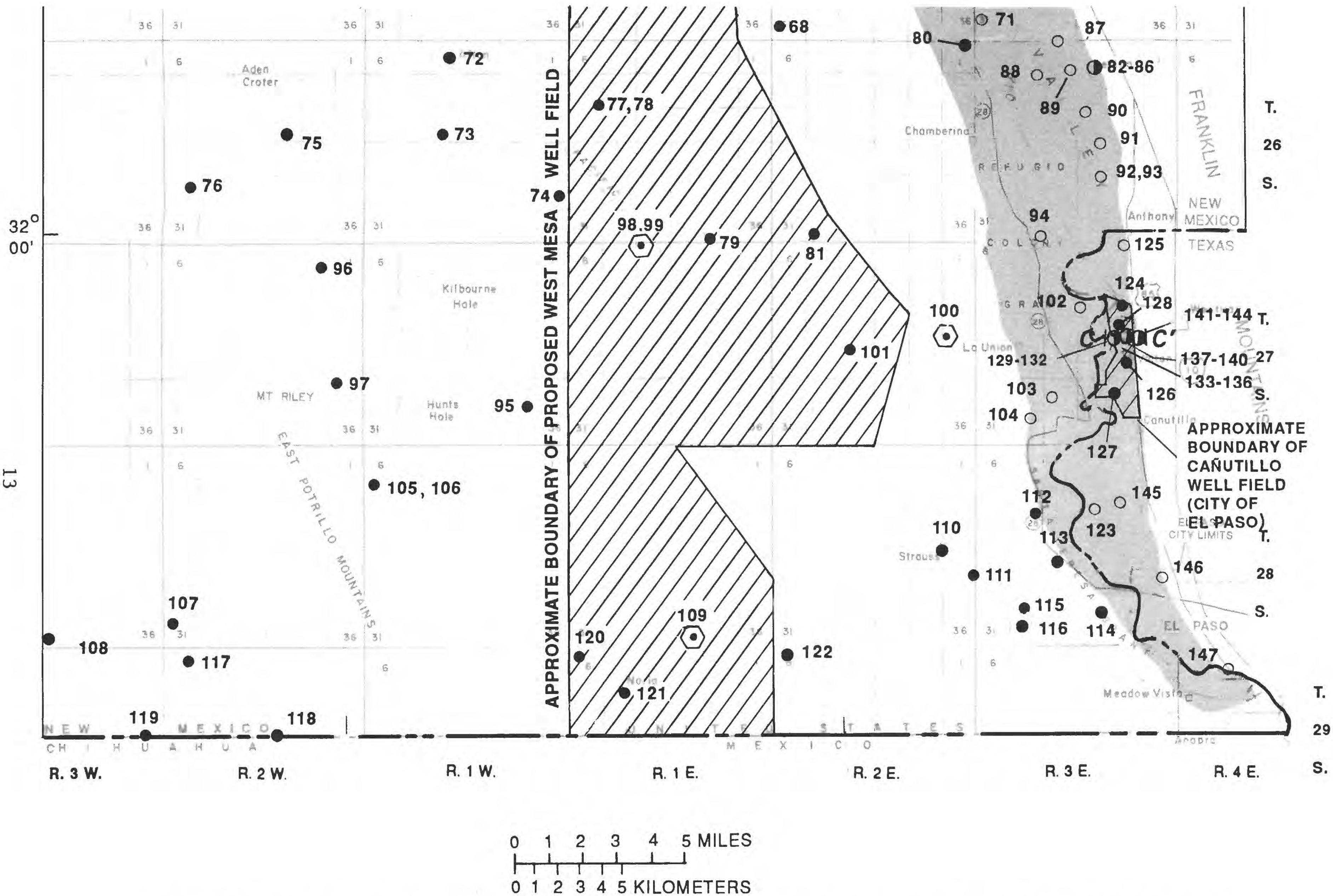


Figure 5.--Location of observation wells, hydrologic sections, and geohydrologic test holes in the Mesilla ground-water basin, New Mexico and Texas (modified from Nickerson, 1986, fig. 4).

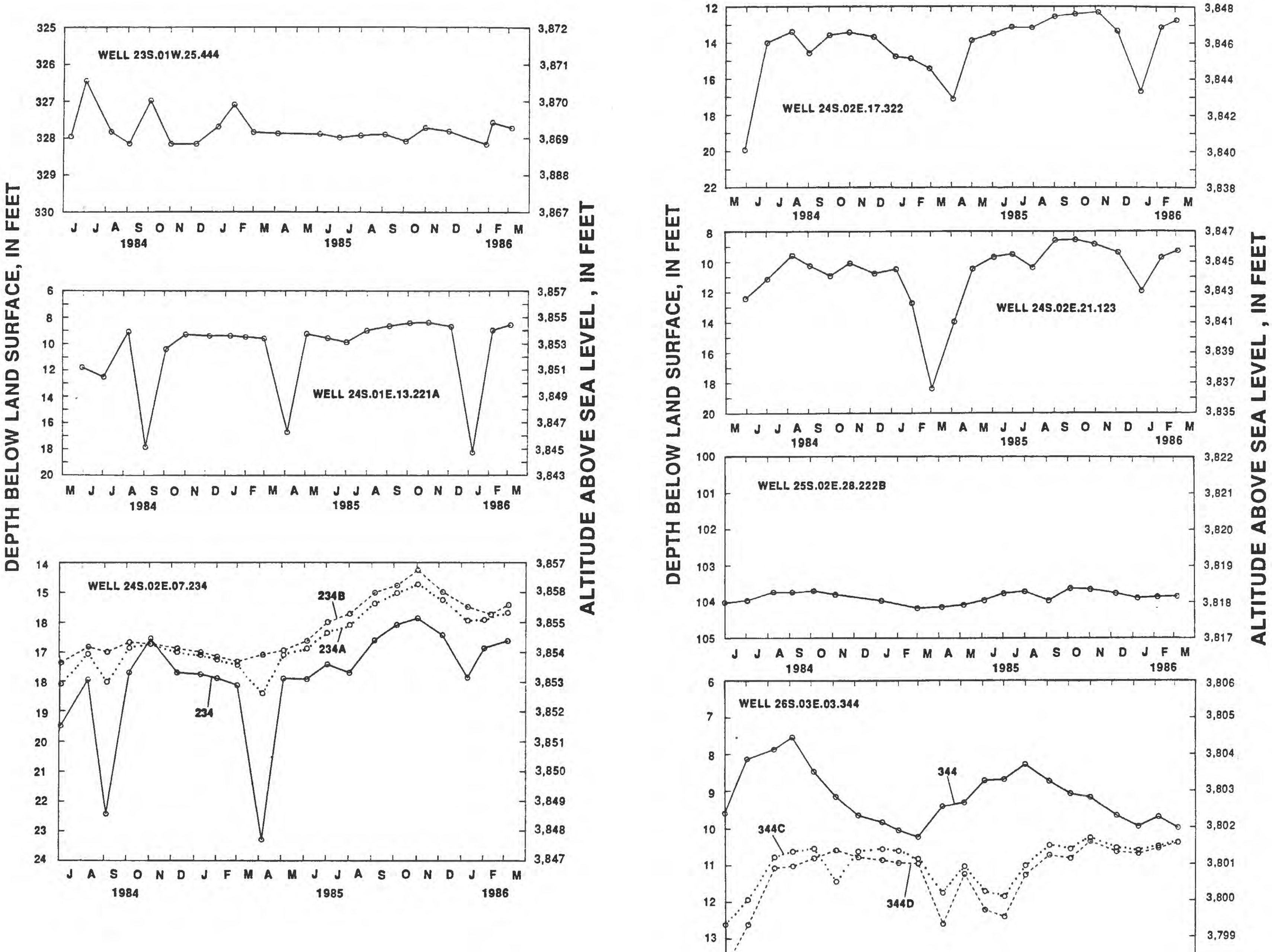


Figure 6.--Monthly water levels in selected observation wells in the Mesilla Basin, 1984-86.

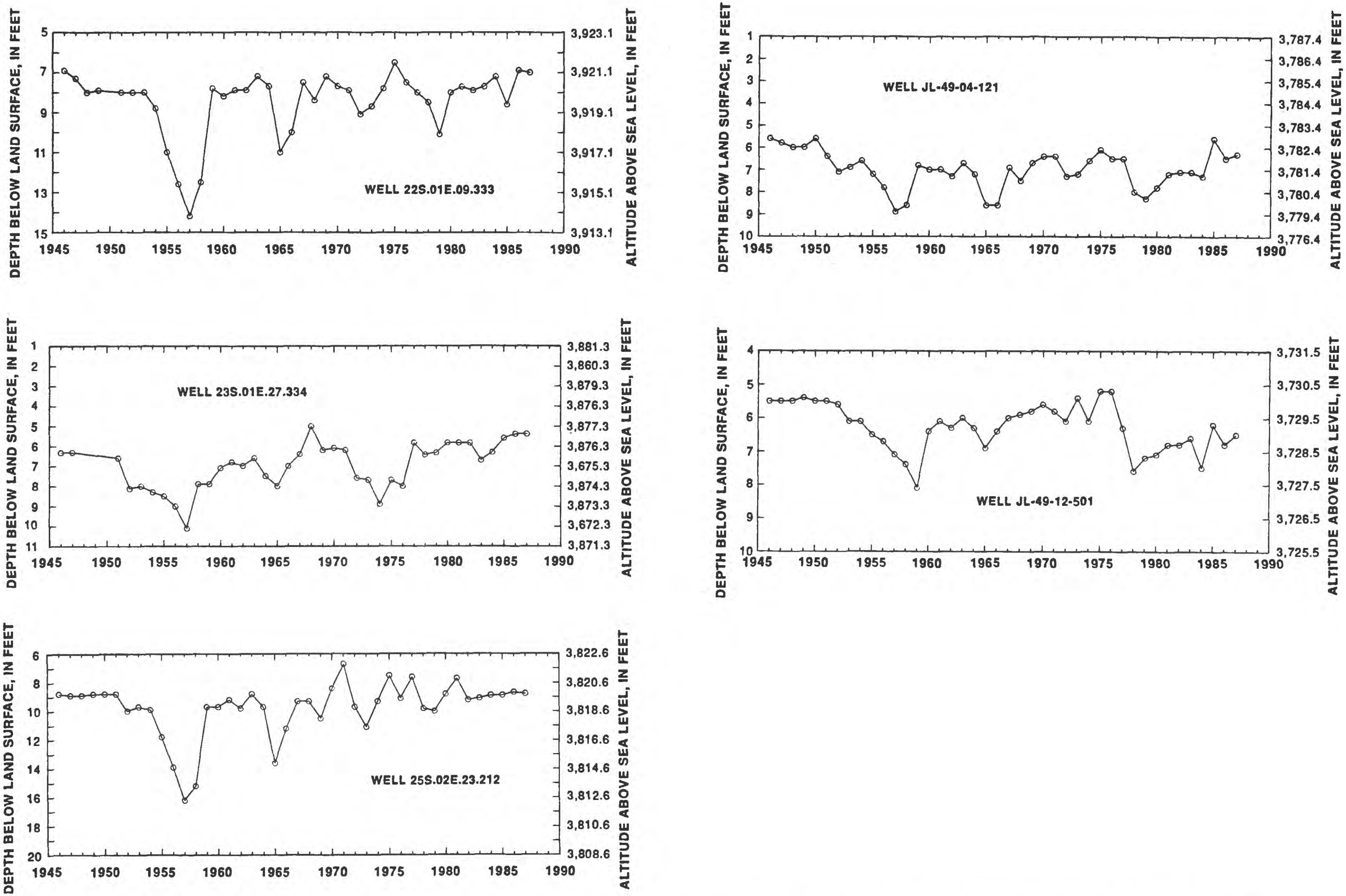
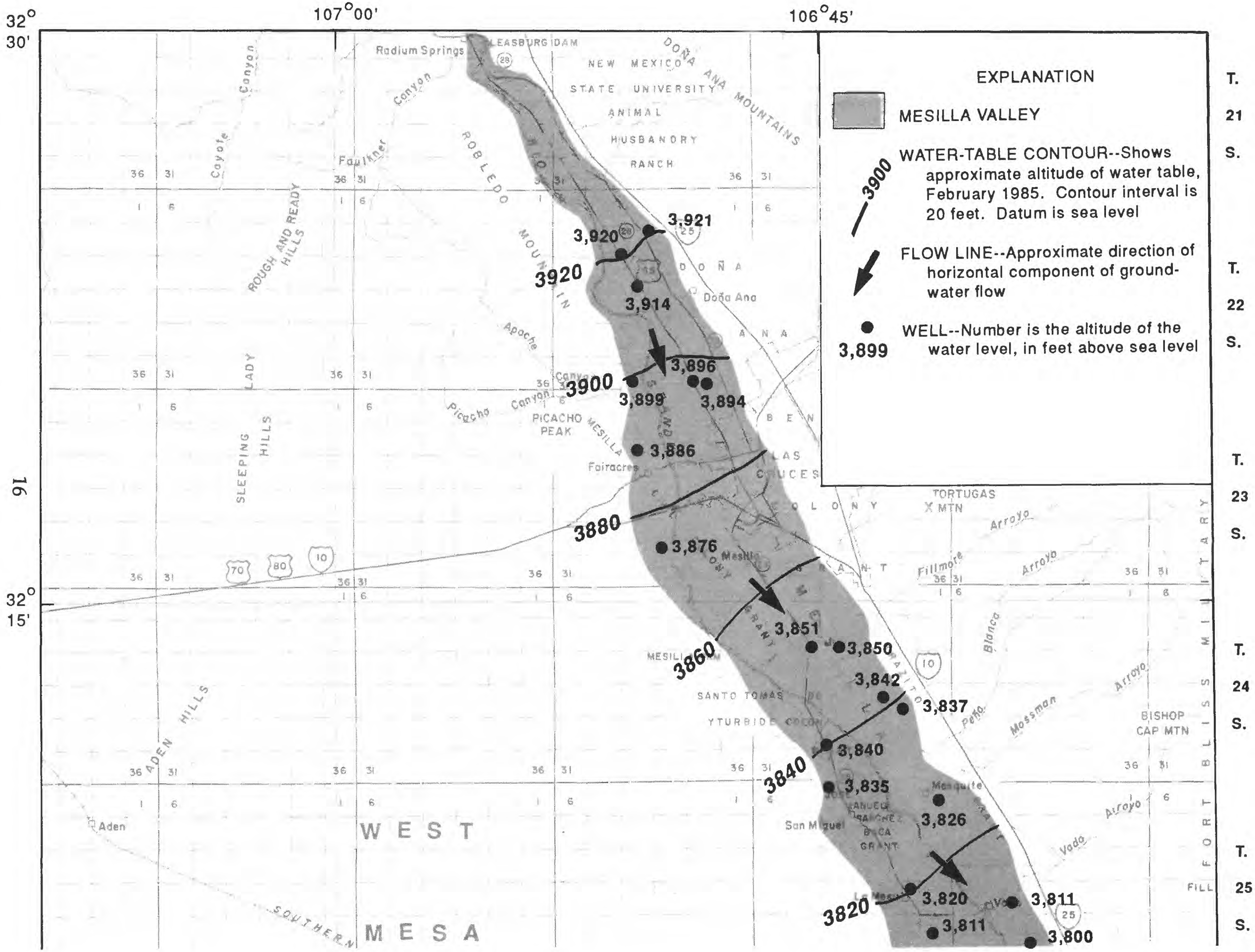


Figure 7.--Annual February water levels in selected observation wells in the Quaternary flood-plain alluvium, 1946-87.


EXPLANATION
MESILLA VALLEY
WATER-TABLE CONTOUR--Shows approximate altitude of water table, February 1985. Contour interval is 20 feet. Datum is sea level
FLOW LINE--Approximate direction of horizontal component of ground-water flow
WELL--Number is the altitude of the water level, in feet above sea level
3900
3,899
32°30'
107°00'
106°45'
32°15'
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
Radium Springs
LEASBURG DAM
NEW MEXICO STATE UNIVERSITY ANIMAL HUSBANDRY RANCH
DOÑA ANA MOUNTAINS
ROBLEDO MOUNTAIN
ROUGH AND READY HILLS
SLEEPING LADY HILLS
PICACHO PEAK
Doña Ana
LAS CRUCES
Fairacres
TORTUGAS MTN
Mesilla
SANTO TOMAS
YTURBIDE
BISHOP CAP MTN
FORT BLISS MILITARY
San Miguel
Mesquite
Aden
ADEN HILLS
WEST MESA
SOUTHERN
3920
3880
3860
3840
3820
3,921
3,920
3,914
3,896
3,894
3,886
3,876
3,851
3,850
3,842
3,837
3,840
3,835
3,826
3,820
3,811
3,811
3,800

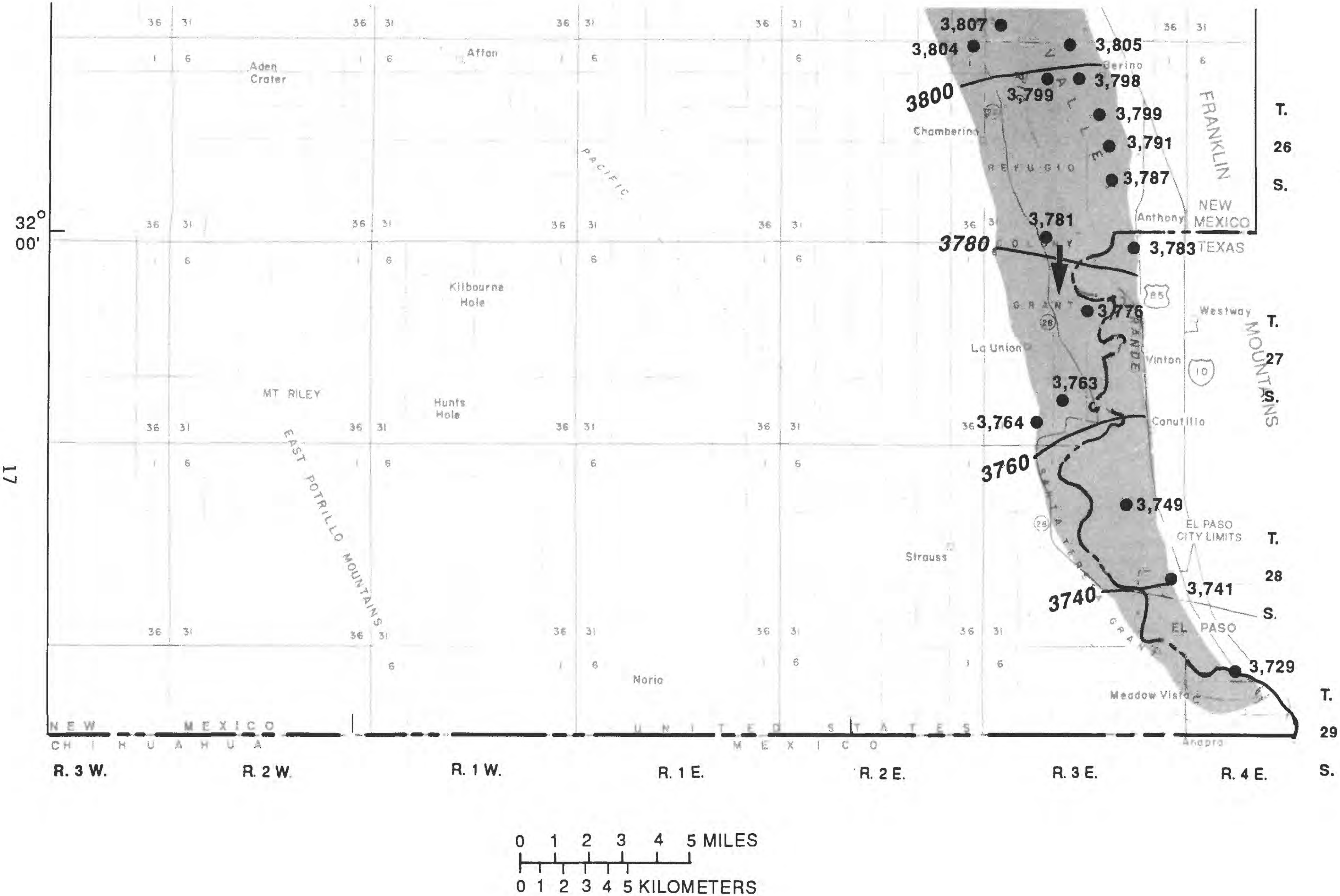
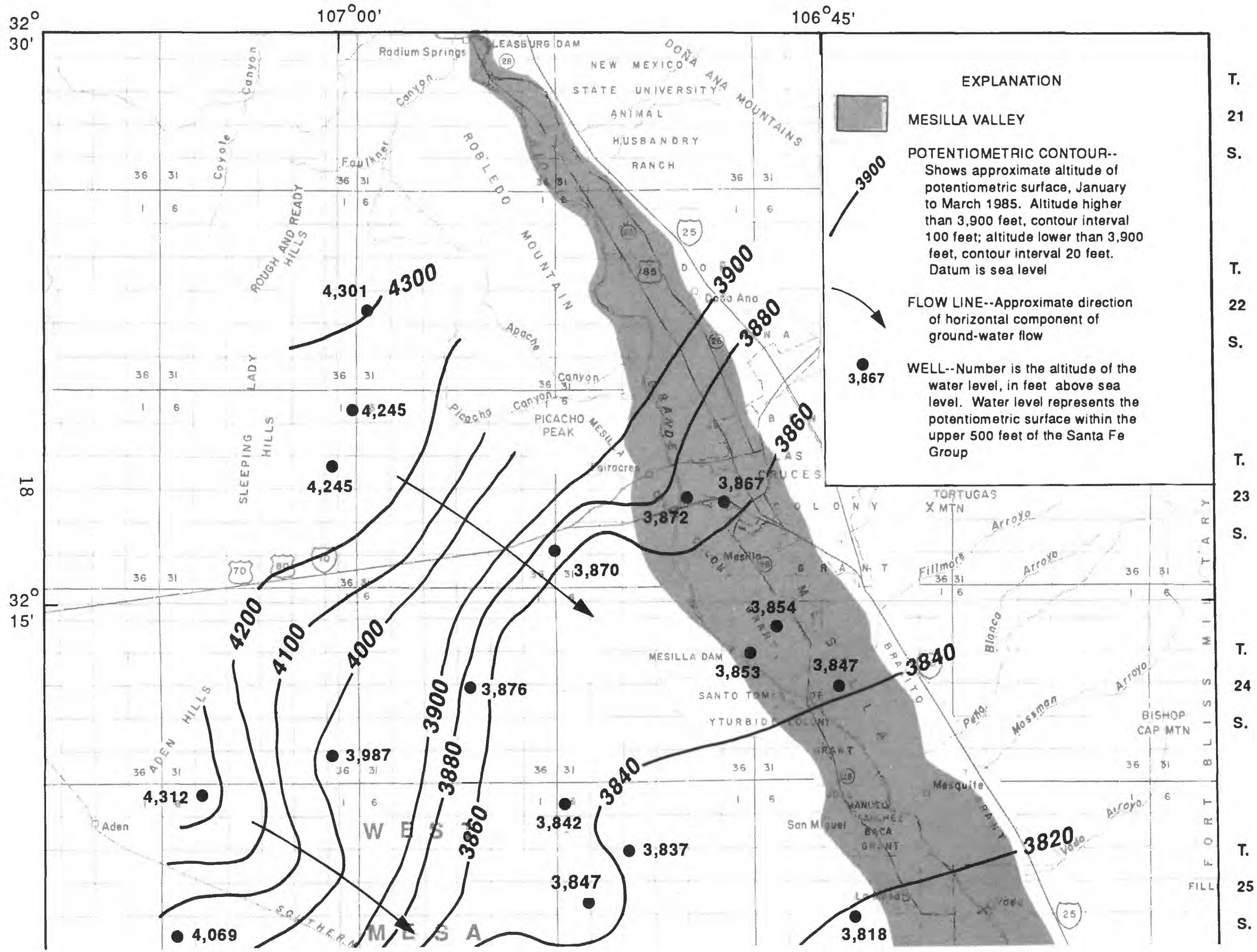


Figure 8.--Altitude of the water table of the aquifer in the Quaternary flood-plain alluvium, February 1985.



32° 30'
107°00'
106°45'
18
32° 15'
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
EXPLANATION
MESILLA VALLEY
POTENTIOMETRIC CONTOUR--Shows approximate altitude of potentiometric surface, January to March 1985. Altitude higher than 3,900 feet, contour interval 100 feet; altitude lower than 3,900 feet, contour interval 20 feet. Datum is sea level
FLOW LINE--Approximate direction of horizontal component of ground-water flow
WELL--Number is the altitude of the water level, in feet above sea level. Water level represents the potentiometric surface within the upper 500 feet of the Santa Fe Group
3900
3,867
4300
4200
4100
4000
3900
3880
3860
3840
3820
4,301
4,245
4,245
4,312
4,069
3,987
3,876
3,870
3,872
3,867
3,854
3,853
3,847
3,842
3,837
3,847
3,818
Radium Springs
LEASBURG DAM
NEW MEXICO STATE UNIVERSITY ANIMAL HUSBANDRY RANCH
DOÑA ANA MOUNTAINS
ROBLEDO MOUNTAIN
ROUGH AND READY HILLS
SLEEPING LADY HILLS
PICACHO PEAK
TORTUGAS MTN
BISHOP CAP MTN
ADEN HILLS
Aden
WEST MESA
MESILLA DAM
SANTO TOMAS
YTURBIDE COLONY
Mesquite
San Miguel
Mesilla
Fairacres
Doña Ana
LAS CRUCES
FORT BLISS MILITARY

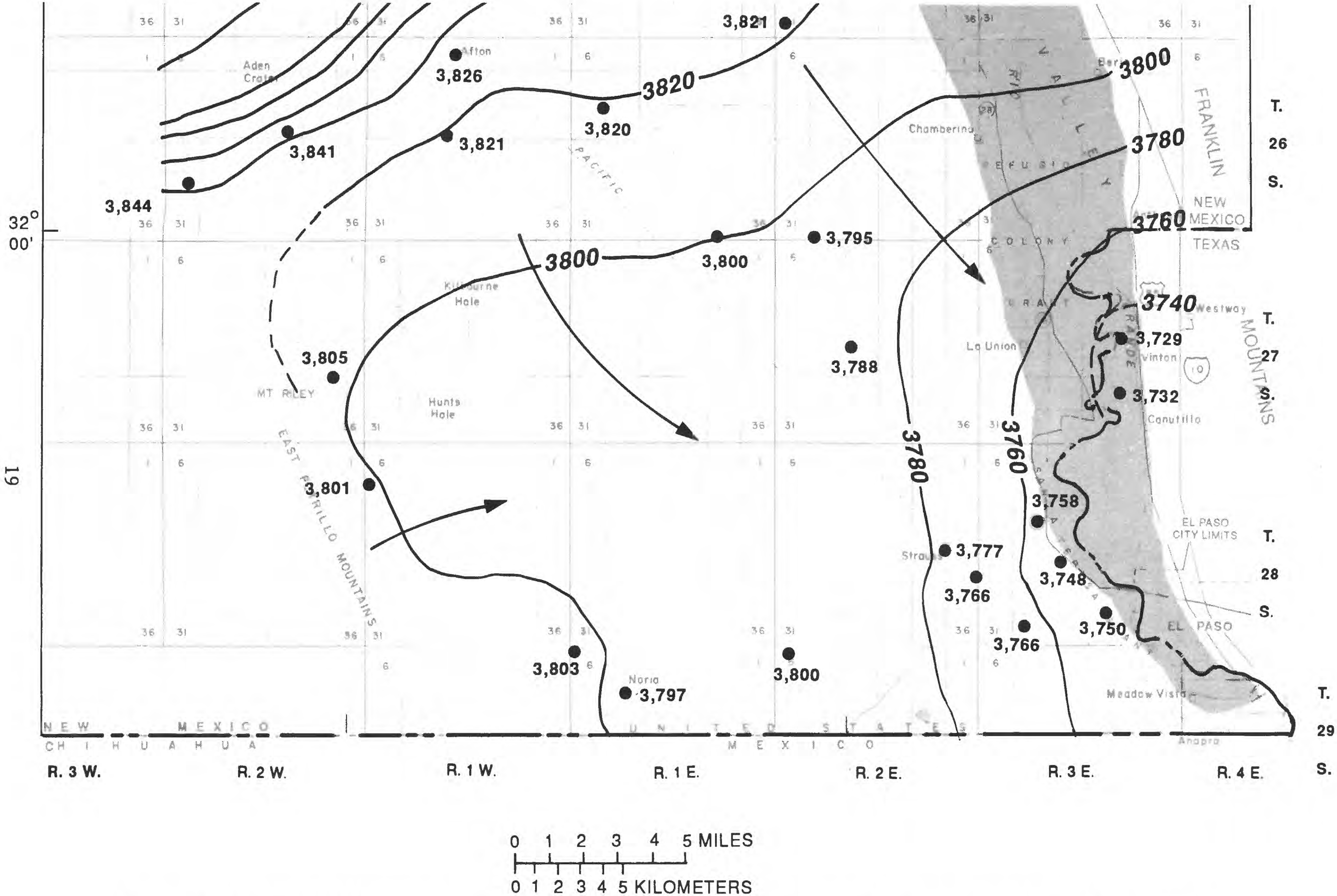


Figure 9.--Altitude of the potentiometric surface of the aquifer in the Santa Fe Group, January to March 1985.

Aquifer System in the Mesilla Valley

Water in storage within the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system occurs under unconfined and semiconfined (leaky-confined) conditions. Water in storage within the shallow flood-plain alluvium generally is unconfined. Thin, interbedded clay lenses in the lower part of the flood-plain alluvium and upper part of the Santa Fe Group restrict vertical flow and result in semiconfined conditions at depth. Water in storage within the upper Santa Fe Group is semiconfined. The thickness and extent of finer grained, less permeable material increase with depth and laterally toward the southern end of the basin.

Recharge and Discharge Mechanisms

Rio Grande streamflow is the primary source of recharge to the aquifer system in the Mesilla Valley. Most recharge to the aquifer system is from Rio Grande seepage in losing reaches of the stream, seepage from irrigation canals, and infiltration of applied irrigation water. Recharge from precipitation and interbasin ground-water inflow is considered minor. The net transfer of water to or from the aquifer system by recharge and discharge mechanisms is related directly to Rio Grande streamflow and the volume of river water used for irrigation. A diagram of the circulation of water in the Mesilla Valley is shown in figure 10.

Previous seepage investigations conducted during steady low-flow conditions indicate that the Rio Grande is usually a losing stream along most of the 62-mile reach in the Mesilla Valley. Slight river gains have been reported in the short upstream reach from Leasburg Dam to about 6 miles north of Las Cruces (Wilson and others, 1981, p. 66) and immediately upstream from the El Paso Narrows (fig. 1) in the extreme southern end of the Mesilla Valley (Peterson and others, 1984, p. 29). A gain-loss study of the Rio Grande from the Mesilla Dam to El Paso was initiated by the International Boundary and Water Commission and the U.S. Bureau of Reclamation in 1985. Preliminary data, based on continuous streamflow records, indicate the Rio Grande to be a losing stream in that reach. Occasional gains, however, have been recorded (G.R. Baumli, U.S. Section--International Boundary and Water Commission, written commun., 1989).

Rio Grande streamflow within the study area is regulated on the basis of discharge at upstream index stations and storage in upstream reservoirs. Streamflow in the Rio Grande and the amount of river water used for irrigation may vary considerably from year to year. The length and seepage rate of losing reaches of the Rio Grande may fluctuate with annual and seasonal variations in streamflow. During wet years with relatively high streamflow, the ground-water table may rise above the riverbed. Under these conditions, the Rio Grande is considered hydraulically connected to the aquifer; seepage rates are proportional to the hydraulic conductivity of the aquifer and the hydraulic gradient between the river (surface-water altitude) and the ground-water table. During dry years with relatively low streamflow and increased ground-water withdrawals, ground-water levels may drop as much as 10 feet below the riverbed (Peterson and others, 1984, p. 32). Under these conditions, the seepage rate is assumed to be equal to the infiltration rate of the riverbed.

River water is diverted to irrigated areas through a conveyance-channel network of irrigation canals, laterals, and ditches. Conveyance losses from irrigation canals in the Mesilla Valley normally range from 35 to 50 percent of the total diversion of irrigation water from the Rio Grande (Peterson and others, 1984, p. 28). Conveyance losses include seepage from unlined channels, evaporation from water surfaces, and transpiration by vegetation along channel banks. The amount of surface water that reaches the ground-water table from canal seepage is probably 40 to 60 percent of total conveyance losses (Richardson and others, 1972, p. 61).

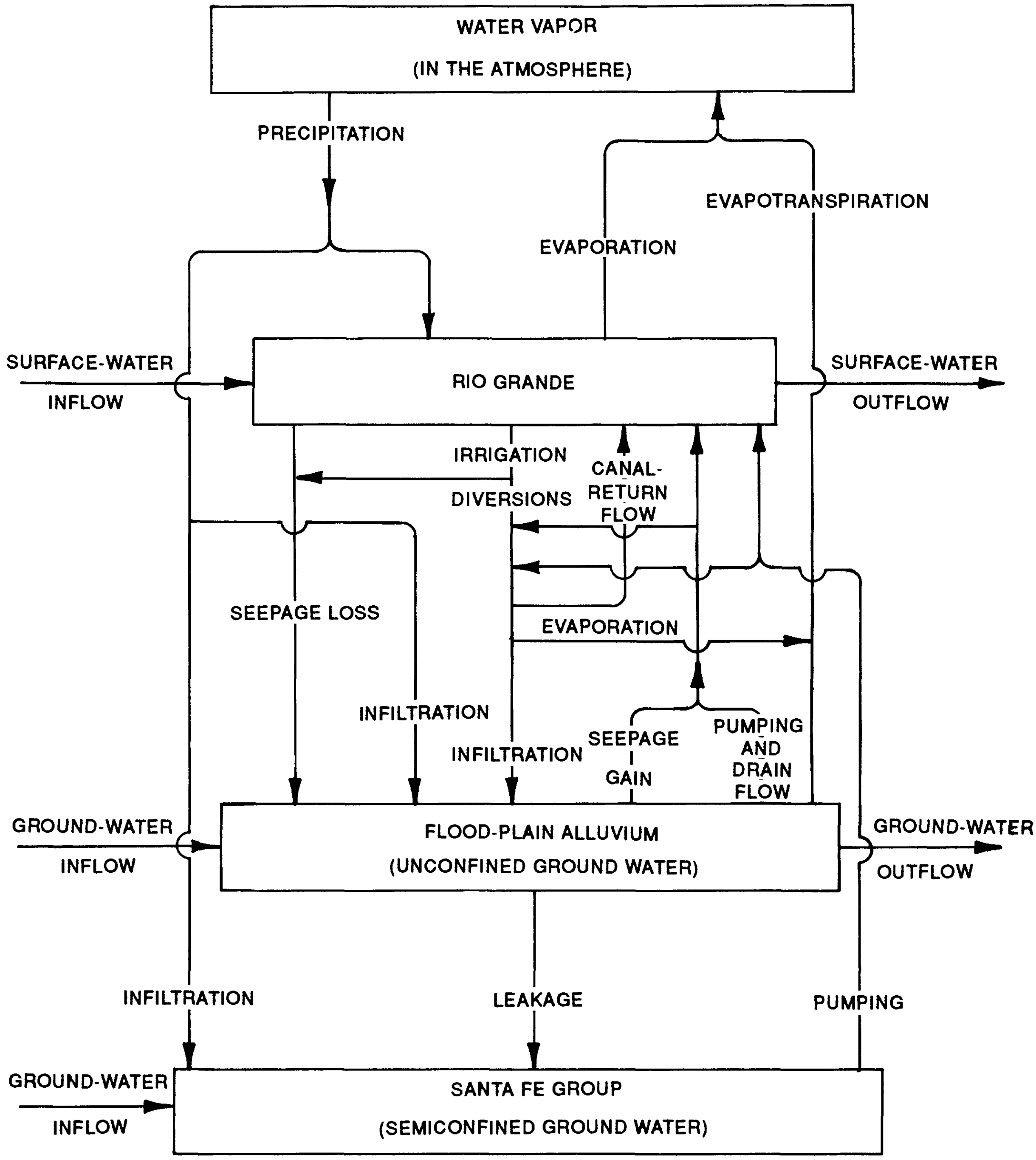


Figure 10.--Generalized circulation of water in the Mesilla Valley.

Recharge from applied irrigation water occurs during the growing season. Much of the water applied to irrigated fields is lost to transpiration by crops and evaporation from freestanding water surfaces. Applied irrigation water that is not intercepted by evapotranspiration infiltrates to the ground-water table and is considered an important component of recharge to the aquifer (Peterson and others, 1984, p. 27).

Recharge from precipitation on the valley floor is considered negligible. The average annual precipitation for the Las Cruces area is about 8.4 inches. Most of the rainfall that percolates into the soil returns to the atmosphere by evapotranspiration before it reaches the water table (Wilson and others, 1981, p. 7). Storm runoff in arroyo channels is brought to the Mesilla Valley from upland areas. Some recharge may occur from infiltration along arroyo channels during brief periods of flow after intense rainfall.

Most recharge from interbasin subsurface inflow comes from the north through Selden Canyon (fig. 1) from the Rincon Valley in the shallow alluvium beneath the Rio Grande. Some recharge from the Jornada ground-water basin to the east may occur through alluvium-filled arroyo channels in the buried volcanic (horst) ridge between Goat Mountain and Tortugas Mountain and locally over the ridge.

Most ground-water discharge in the basin is in the vicinity of the valley-margin and flood-plain surfaces of the Mesilla Valley. Discharge occurs as (1) flow to agricultural drains; (2) seepage to the Rio Grande in the gaining reaches of the stream; (3) well discharge; and (4) evapotranspiration (fig. 10). Discharge from interbasin ground-water outflow is considered minor (Wilson and others, 1981, p. 39).

Ground water discharges to the agricultural drains when the water table of the aquifer intersects the drain channel. Some drains flow all year, whereas others flow only part of the year. Drain discharge fluctuates with water levels in the shallow water table. Much of the applied irrigation water that infiltrates to the water table is intercepted by local irrigation drains and returned to the river.

Discharge from seepage to the Rio Grande in the gaining reaches of the stream occurs when the water table of the aquifer rises above the river stage (surface-water altitude). The length of the gaining reaches of the Rio Grande may fluctuate with seasonal variations in river flow. Some discharge of ground water to the Rio Grande in the extreme southern end of the Mesilla Valley also may contribute to interbasin water transfer between the Mesilla ground-water basin and the Hueco Basin (east of the study area) through the El Paso Narrows.

Discharge from wells currently (1987) is concentrated in the valley where most irrigation, municipal, industrial, and domestic wells are located. Ground-water pumpage for irrigation of crops accounts for much of the annual ground-water withdrawal in the Mesilla Valley. Withdrawals from large-capacity irrigation wells supplement the surface-water supply available for local irrigation demand. Annual ground-water withdrawals may vary considerably, depending on the amount of surface water available from the Rio Grande (Wilson and others, 1981, p. 79).

Evapotranspiration is a major source of discharge from the Mesilla Valley (Peterson and others, 1984, p. 39). Much of the applied irrigation water is intercepted by evapotranspiration before it reaches the water table. Discharge from evaporation occurs from freestanding water surfaces in irrigated fields and conveyance channels.

Discharge from interbasin subsurface outflow is considered small. Slichter (1905, p. 13) measured ground-water flow to be about 50 gallons per minute or about 81 acre-feet per year in the alluvium underneath the Rio Grande in the El Paso Narrows between the Mesilla ground-water basin and the Hueco Basin.

Aquifer Characteristics

Water in storage within the flood-plain alluvium generally is unconfined and usually occurs under water-table conditions in which the storage coefficient is virtually equal to the specific yield of the aquifer. Estimated values for specific yield from previous studies range from 0.10 (Leggat and others, 1962, p. 34) to 0.25 (Conover, 1954, p. 103). Water within the Santa Fe Group generally is semiconfined. Estimated storage coefficients from aquifer tests conducted in wells completed within the Santa Fe Group range from 0.002 to 0.00003 (Wilson and others, 1981, table 3). Water moves from the flood-plain alluvium to the upper Santa Fe Group through a series of interbedded gravel, sand, and clay lenses. The sand-clay sequence restricts vertical flow and serves as a confining unit relative to the aquifer below. Horizontal permeability within the aquifer system usually exceeds vertical permeability by several orders of magnitude. Permeability of the aquifer system generally decreases with depth. Gravel and coarse-grained sand generally within the upper 150 feet of the aquifer have a much greater permeability than deeper sediments of predominantly finer grain size.

The Las Cruces hydrologic section (A-A') is at the western edge of the city of Las Cruces (fig. 5). This section consists of a river-stage station on the Rio Grande and three observation-well groups aligned perpendicular to the Rio Grande (fig. 11). Observation-well groups at the Las Cruces hydrologic section are completed in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system at depths ranging from 30 to 327 feet below land surface. Estimated aquifer thickness at the Las Cruces hydrologic section is about 3,800 feet (Hawley, 1984, pl. 6). Analyses of borehole-geophysical logs (Nickerson, 1986), selected drill-cutting samples, and driller's logs indicate that the Rio Grande flood-plain alluvium probably extends less than 100 feet below land surface and primarily consists of poorly sorted gravel and coarse- to medium-grained sand with thin interbedded clay lenses. From 100 to 327 feet below land surface the Santa Fe Group primarily consists of alternating layers of coarse- to fine-grained sand and silty clay with numerous gravel lenses.

The Mesquite hydrologic section (B-B') is approximately 5 miles northwest of Mesquite (fig. 5). This section consists of a river-stage station on the Rio Grande and four observation-well groups aligned perpendicular to the Rio Grande (fig. 12). Observation-well groups at the Mesquite hydrologic section are completed in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system at depths ranging from 30 to 596 feet below land surface. Thickness of the aquifer at the Mesquite hydrologic section is estimated to exceed 3,800 feet (Hawley, 1984, pl. 9). Analyses of borehole-geophysical logs, selected drill-cutting samples, and driller's logs indicate that the Rio Grande flood-plain alluvium probably extends less than 80 feet below land surface. The flood-plain alluvium primarily consists of poorly sorted gravel and coarse- to fine-grained sand with thin, discontinuous clay lenses. From about 80 to 596 feet below land surface the Santa Fe Group primarily consists of alternating layers of coarse- to fine-grained sand and silty clay with some gravel.

In February 1977, an aquifer test was conducted at well group M-3 (Mesquite hydrologic section) as part of a previous study. Analysis of the multiple-well aquifer test is presented in Wilson and White (1984). Estimated aquifer properties of the upper Santa Fe Group from 310 to 680 feet below land surface are:

(1) Transmissivity = 16,700 feet squared per day;

(2) Storage coefficient = 1×10^{-3};

(3) Hydraulic conductivity of sand layers (thickness 250 feet) = 67 feet per day; and

(4) Vertical hydraulic conductivity of the upper confining unit from 118 to 310 feet below land surface = 0.30 foot per day.

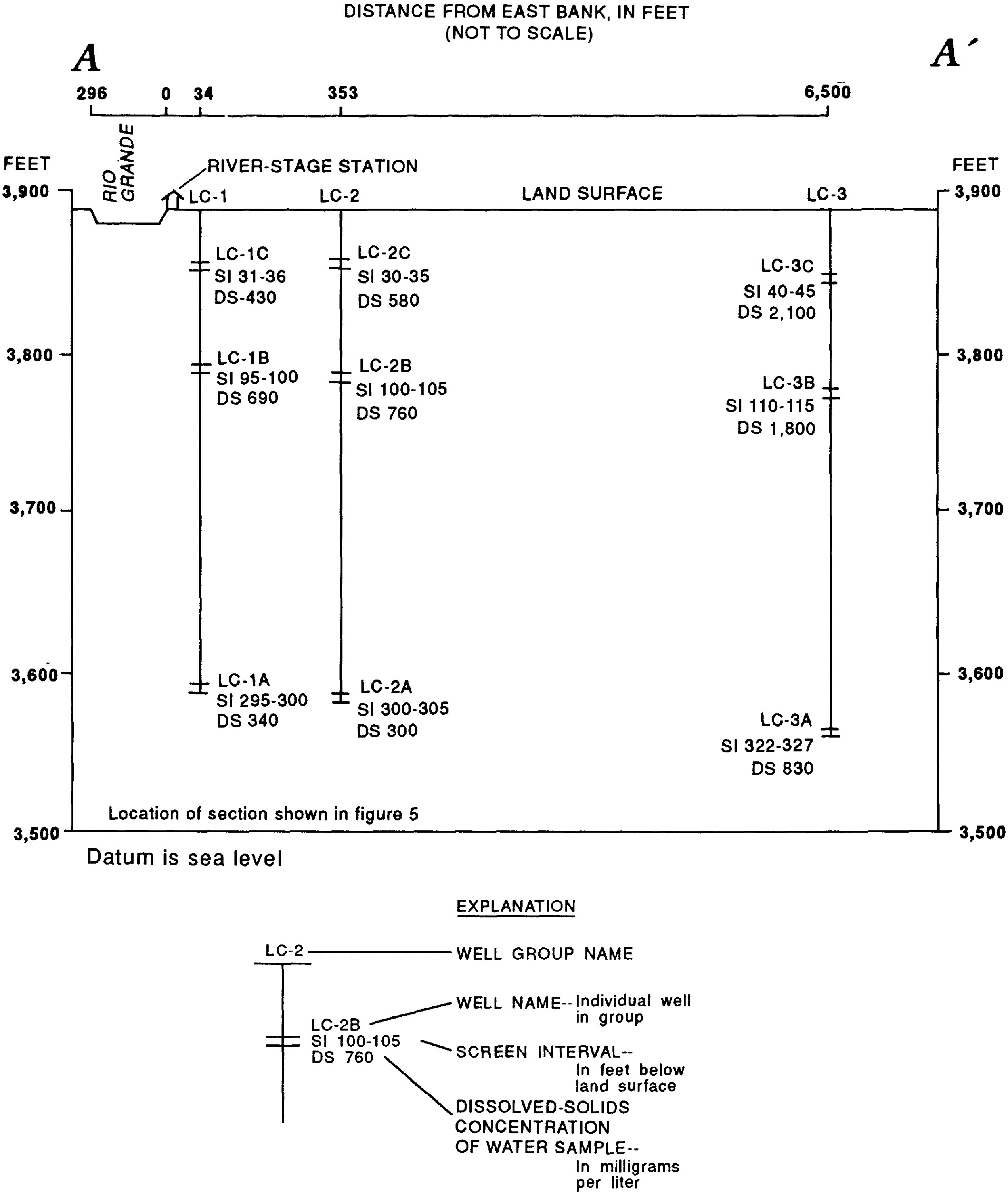


Figure 11.--Las Cruces hydrologic section (modified from Nickerson, 1986, fig. 8).

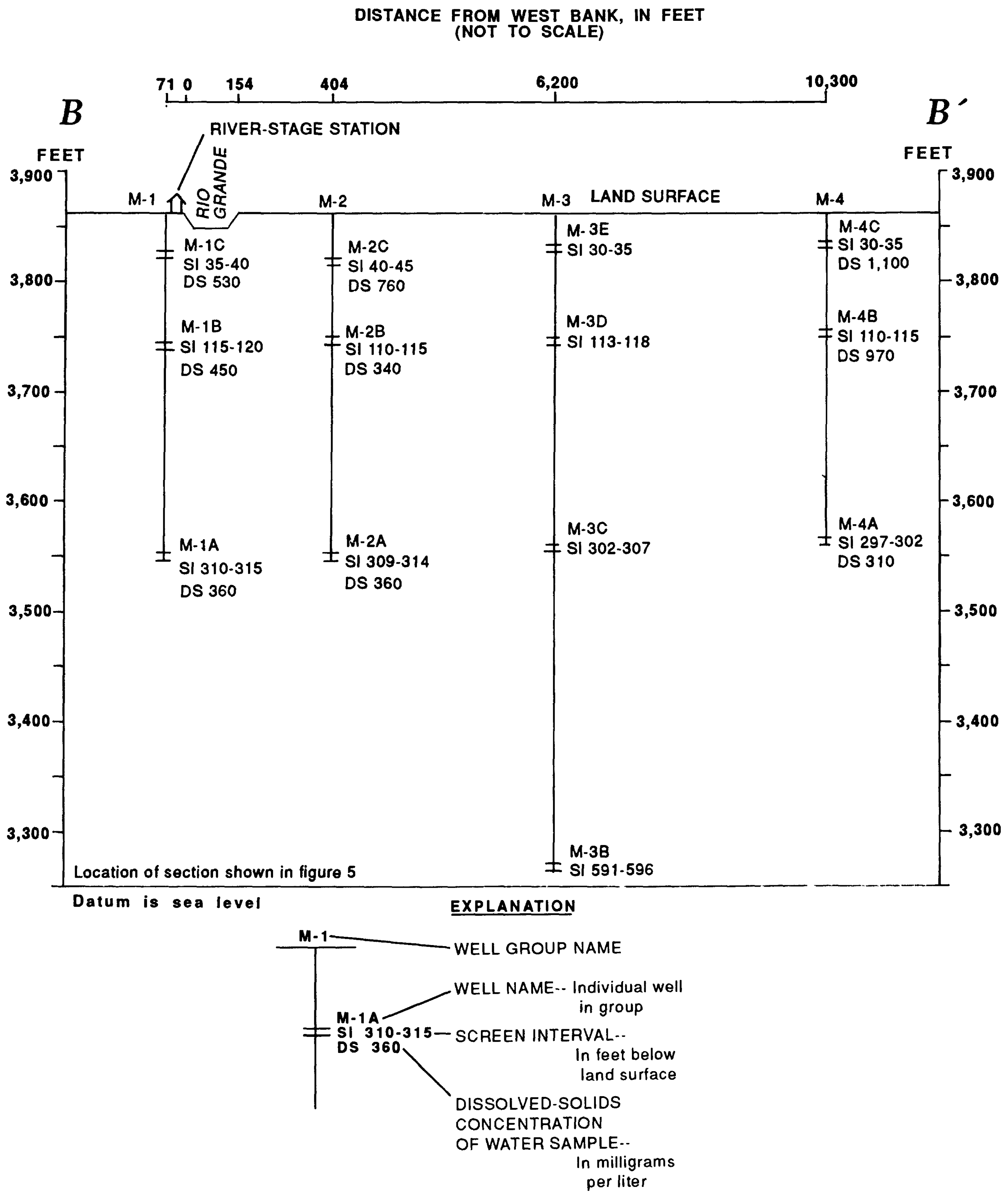


Figure 12.--Mesquite hydrologic section (modified from Nickerson, 1986, fig. 16).

The Cañutillo well-field hydrologic section (C-C') is within the city of El Paso's Cañutillo well field, approximately 3 miles north of Cañutillo, Texas (fig. 5). This section consists of a river-stage station on the Rio Grande and four observation-well groups aligned perpendicular to the Rio Grande (fig. 13). Observation-well groups at the Cañutillo well-field hydrologic section are completed in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system at depths ranging from 40 to 801 feet below land surface. The aquifer system at the hydrologic section is divided into shallow, upper intermediate, lower intermediate, and deep zones on the basis of borehole-geophysical logs and lithologic samples (Nickerson, 1986). Aquifer zones at the Cañutillo well-field hydrologic section are shown in figure 14. Division of the aquifer is similar to that of previous investigations (Leggat and others, 1962; Alvarez and Buckner, 1980; and Gates and others, 1984) in the lower Mesilla Valley. However, the shallow zone is relatively thinner, and the intermediate zone is subdivided into a clayey upper intermediate zone and a sandy lower intermediate zone. The following discussion of specific depth intervals and lithologic descriptions of aquifer zones applies only to the Cañutillo well-field hydrologic section.

The shallow zone is approximately 80 feet thick and primarily consists of poorly sorted gravel and coarse- to medium-grained sand with thin, interbedded, discontinuous clay lenses. The Rio Grande flood-plain alluvium penetrates the shallow zone, to which it is hydraulically connected (Alvarez and Buckner, 1980, p. 5).

The top of the upper intermediate zone is about 80 feet below land surface; the thickness ranges from approximately 130 feet at well group CWF-1 to 160 feet at well group CWF-4. The upper intermediate zone consists of alternating layers of fine- to coarse-grained sand, silty clay, and some gravel. Sand beds in the upper intermediate zone are predominantly medium to fine grained and have numerous silty clay lenses. Borehole-geophysical logs indicate that individual clay lenses are not continuous at the test site.

The top of the lower intermediate zone is about 210 to 240 feet below land surface; the thickness ranges from approximately 190 feet at well group CWF-1 to 270 feet at well group CWF-4. Sand beds in the lower intermediate zone are predominantly medium to fine grained with few silty clay lenses. Locally, the lower intermediate zone is separated from the deep zone by a thick clay layer. This clay layer is as much as 60 feet thick at well group CWF-3 and thins to about 20 feet to the west at well group CWF-4.

The top of the deep zone is about 500 feet below land surface; the thickness ranges from approximately 430 feet at well group CWF-1 to 520 feet at well group CWF-4. The deep zone consists of a relatively uniform fine-grained sand and some silt and clay. The limestone conglomerate (Leggat and others, 1962) underlying the deep zone is considered to be the base of the aquifer system, which is assumed to be relatively impermeable. The top of the limestone conglomerate in borehole CWF-1D is at a depth of about 890 feet. The top of the conglomerate in previous test holes located west of CWF-1D indicates a dip to the west of about 4 degrees or about 370 feet per mile.

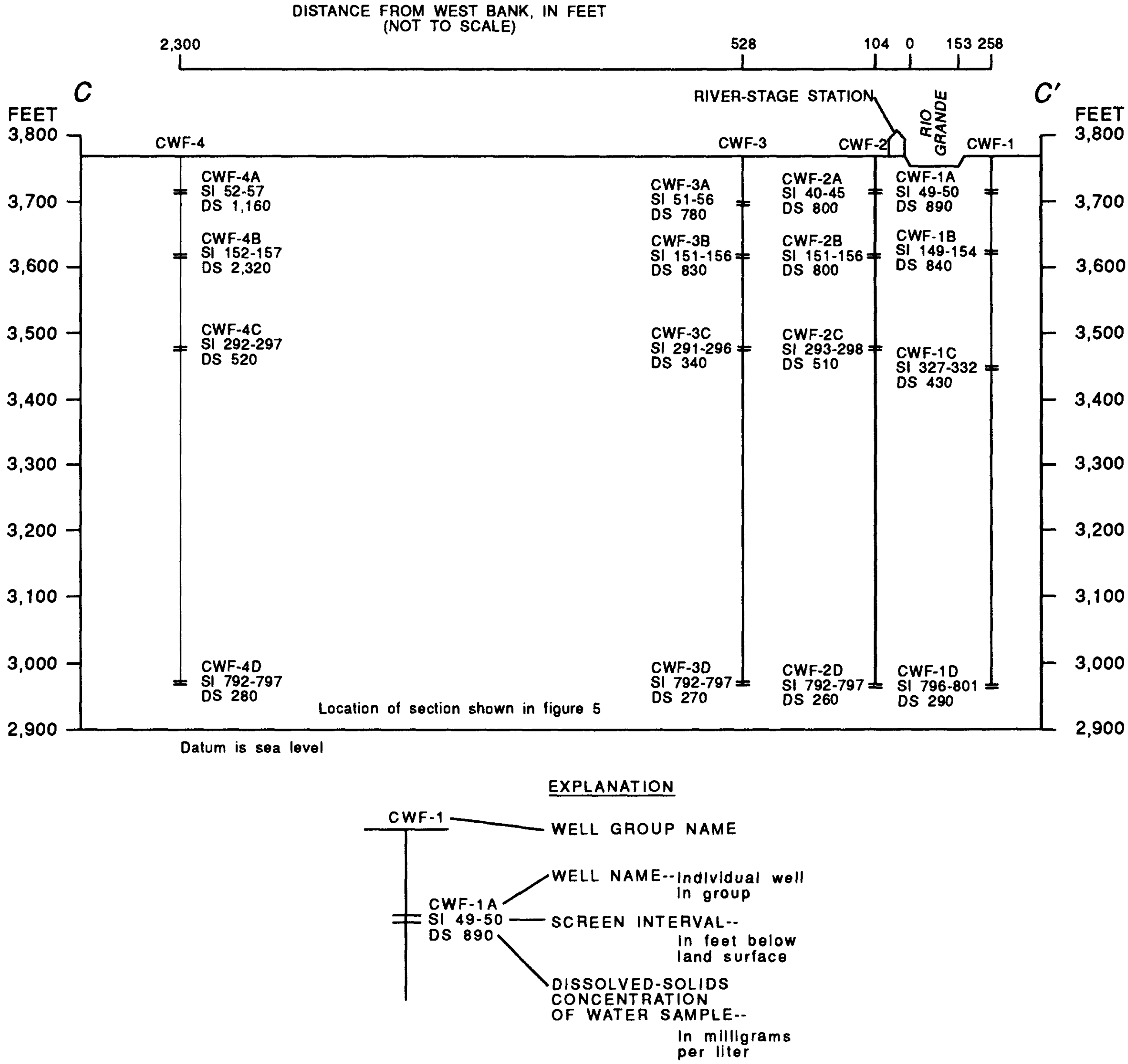


Figure 13.--Cañutillo well-field hydrologic section (modified from Nickerson, 1986, fig. 27).

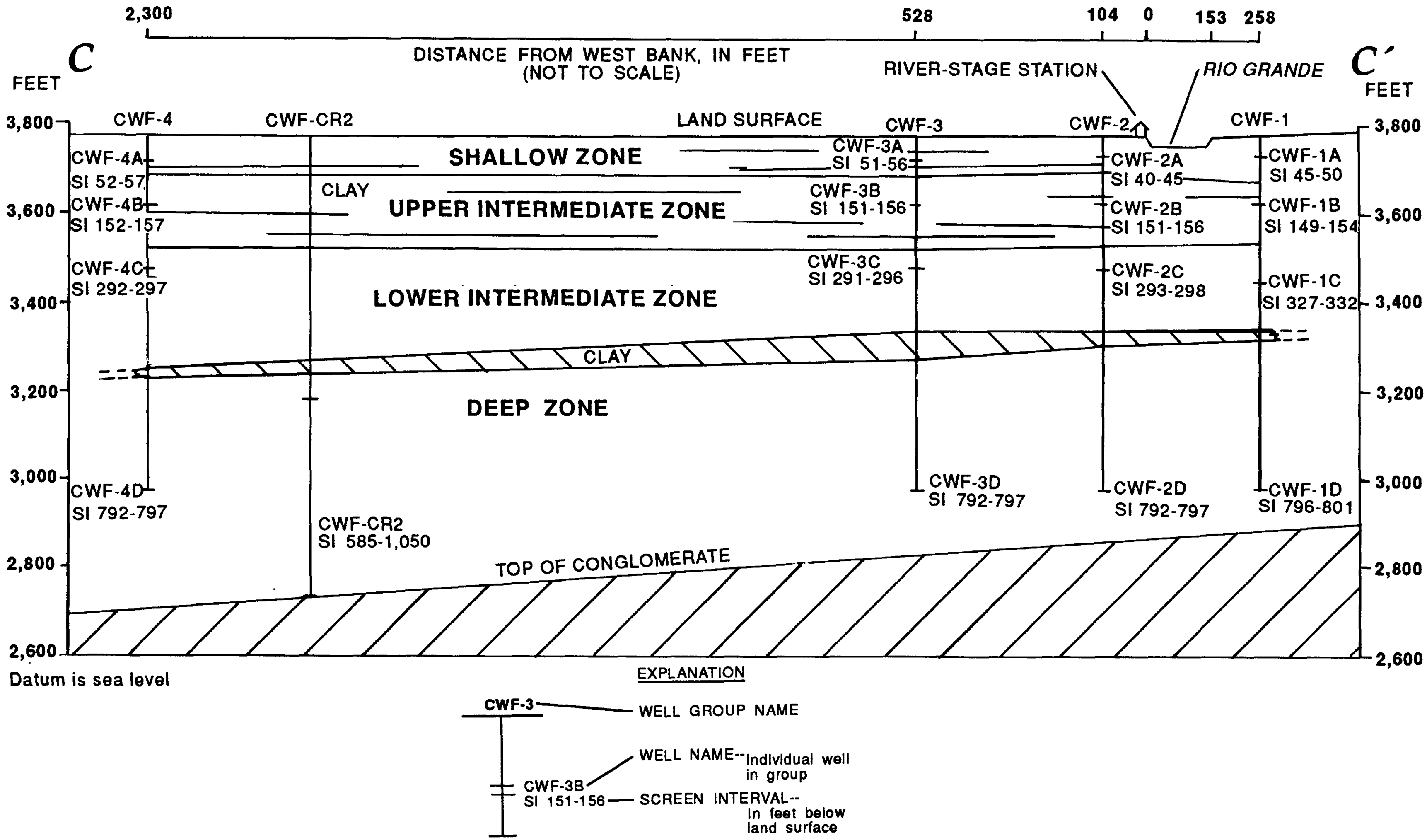


Figure 14.--Aquifer zones at the Cañutillo well-field hydrologic section (modified from Nickerson, 1986, fig. 5).

In December 1985 and January 1986, a series of aquifer tests were conducted at the Cañutillo well-field hydrologic section to determine aquifer properties in the shallow, upper intermediate, and deep zones. Analyses of the multiple-well aquifer tests are presented in Nickerson (1989). The estimated hydraulic diffusivity of the shallow zone is 175,000 feet squared per day. Estimated aquifer properties of the upper intermediate zone from 97 to 200 feet below land surface (Nickerson, 1989, p. 19) are:

(1) Transmissivity = 2,600 feet squared per day;

(2) Storage coefficient = 4.3×10^{-4};

(3) Hydraulic conductivity of sand layers = 26 feet per day; and

(4) Vertical hydraulic conductivity of the upper confining unit = 0.16 foot per day.

Estimated aquifer properties of the deep zone (Nickerson, 1989, p. 24) are:

(1) Transmissivity = less than or equal to 4,700 feet squared per day;

(2) Storage coefficient = less than or equal to 4.3×10^{-4};

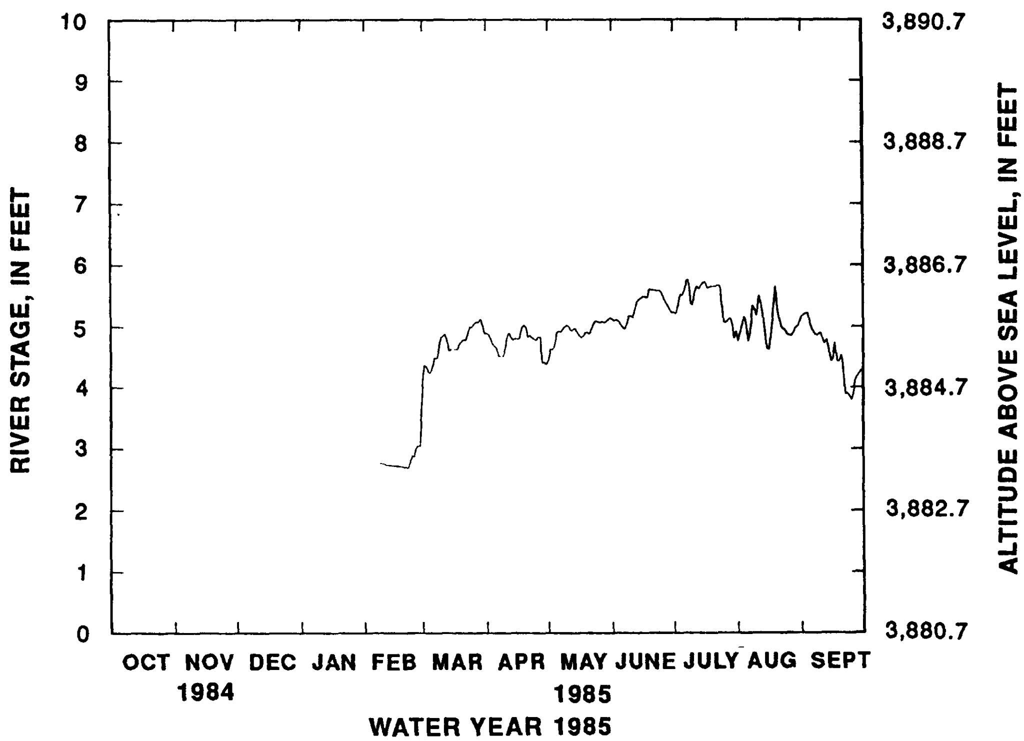
(3) Hydraulic conductivity = less than or equal to 11 feet per day; and

(4) Vertical hydraulic conductivity of the upper confining layer = less than 0.01 foot per day.

River Stage and Ground-Water Levels

The river-stage station at the Rio Grande below Picacho Bridge, located at the Las Cruces hydrologic section (fig. 5), is operated by the U.S. Geological Survey to record river stage (water-surface altitude). The mean daily stage of the Rio Grande from February 1985 through September 1986 is shown in figure 15. Mean annual river stage for water year 1986 was 3,885.6 feet above sea level. The minimum mean daily river stage was 3,883.8 feet on January 8, 1986; the maximum mean daily river stage was 3,887.6 feet on July 18, 1986.

Continuous water-level records were collected at the Las Cruces hydrologic section (fig. 11) in well groups LC-1, LC-2, and LC-3. Well records are listed by well number in table 1. Mean daily water levels in well groups LC-1 through LC-3 are shown in figures 16 through 18, respectively. Water-level records for water years 1985 and 1986 represent potentiometric heads in the aquifer during wet years, with full surface-water allocation from the Rio Grande and minimal withdrawal from local irrigation wells. Mean daily water levels during water year 1986 ranged from a minimum of 3,868.8 feet above sea level in LC-3A on May 24, 1986, to a maximum of 3,887.0 feet above sea level in LC-1C on July 18, 1986. Minimum mean daily, maximum mean daily, and mean annual water levels in observation wells at the Las Cruces hydrologic section during water year 1986 are listed in table 3.



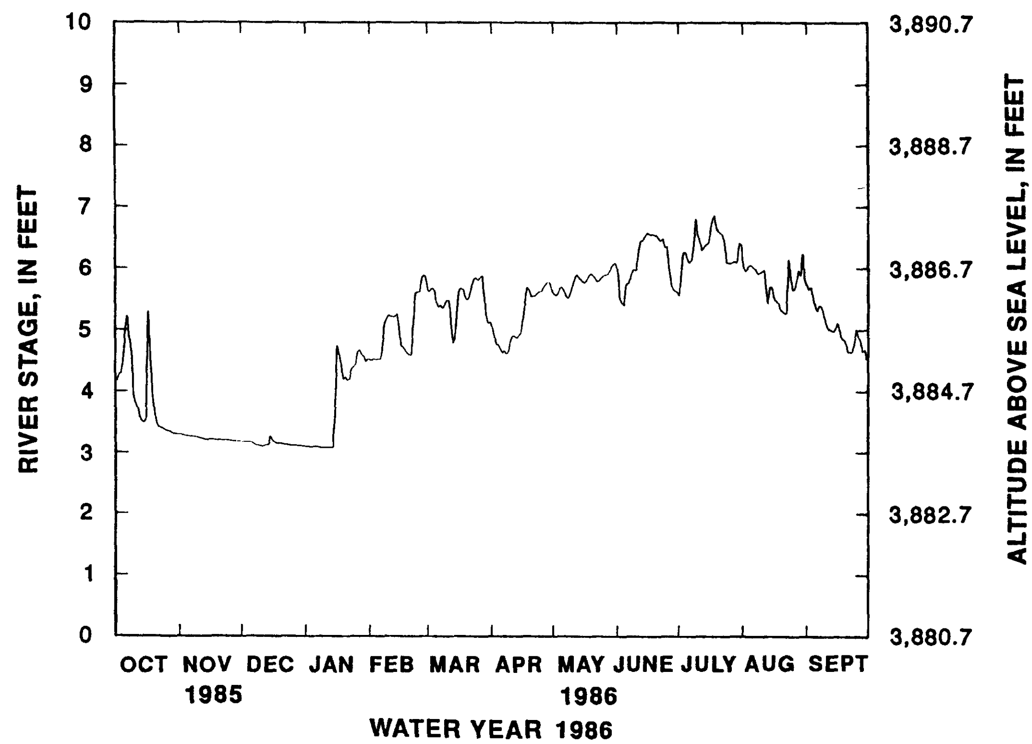


Figure 15.--Mean daily river stage of the Rio Grande below Picacho Bridge, February 1985 through September 1986.

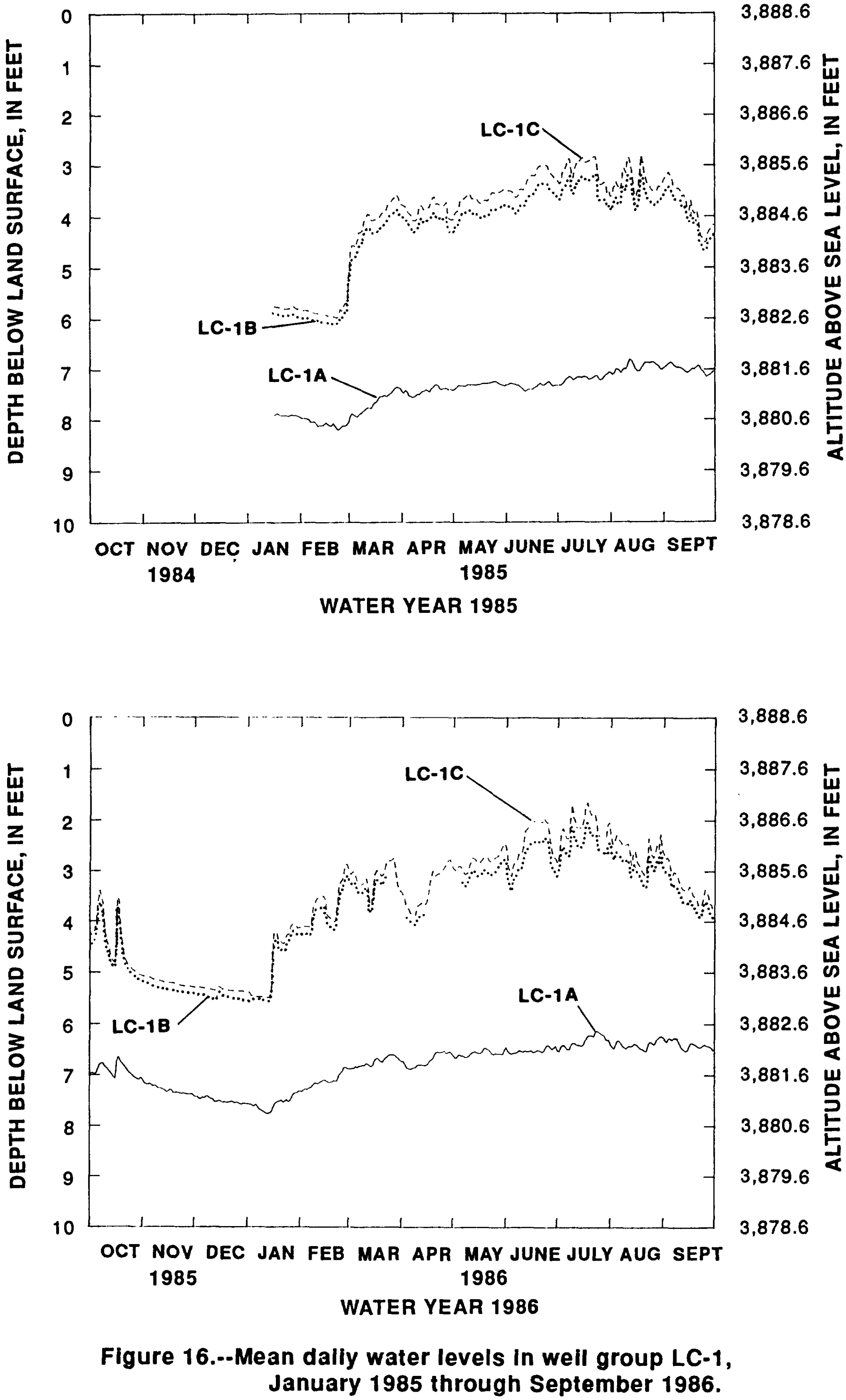


Figure 16.--Mean daily water levels in well group LC-1, January 1985 through September 1986.

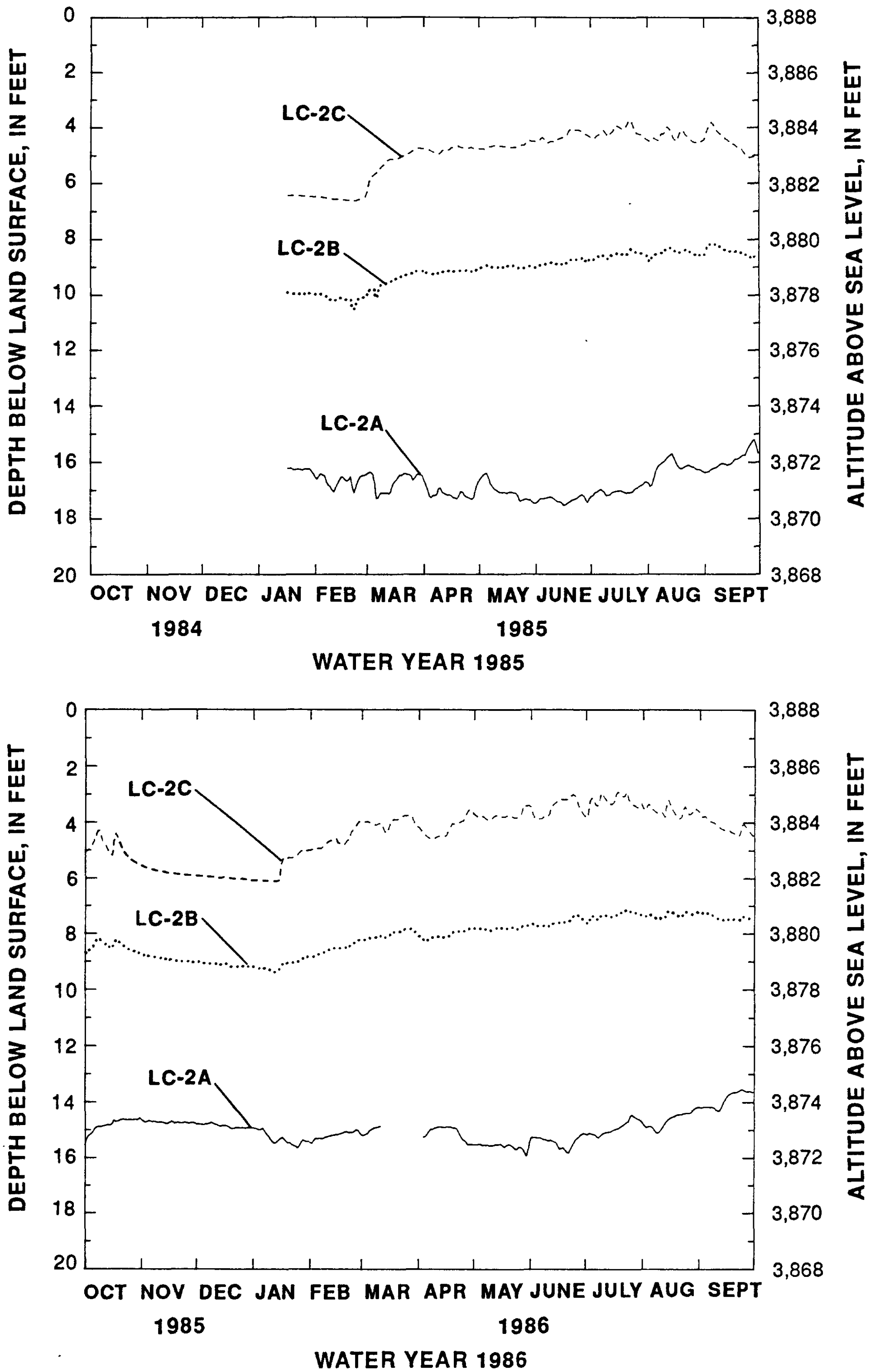


Figure 17.--Mean daily water levels in well group LC-2, January 1985 through September 1986.

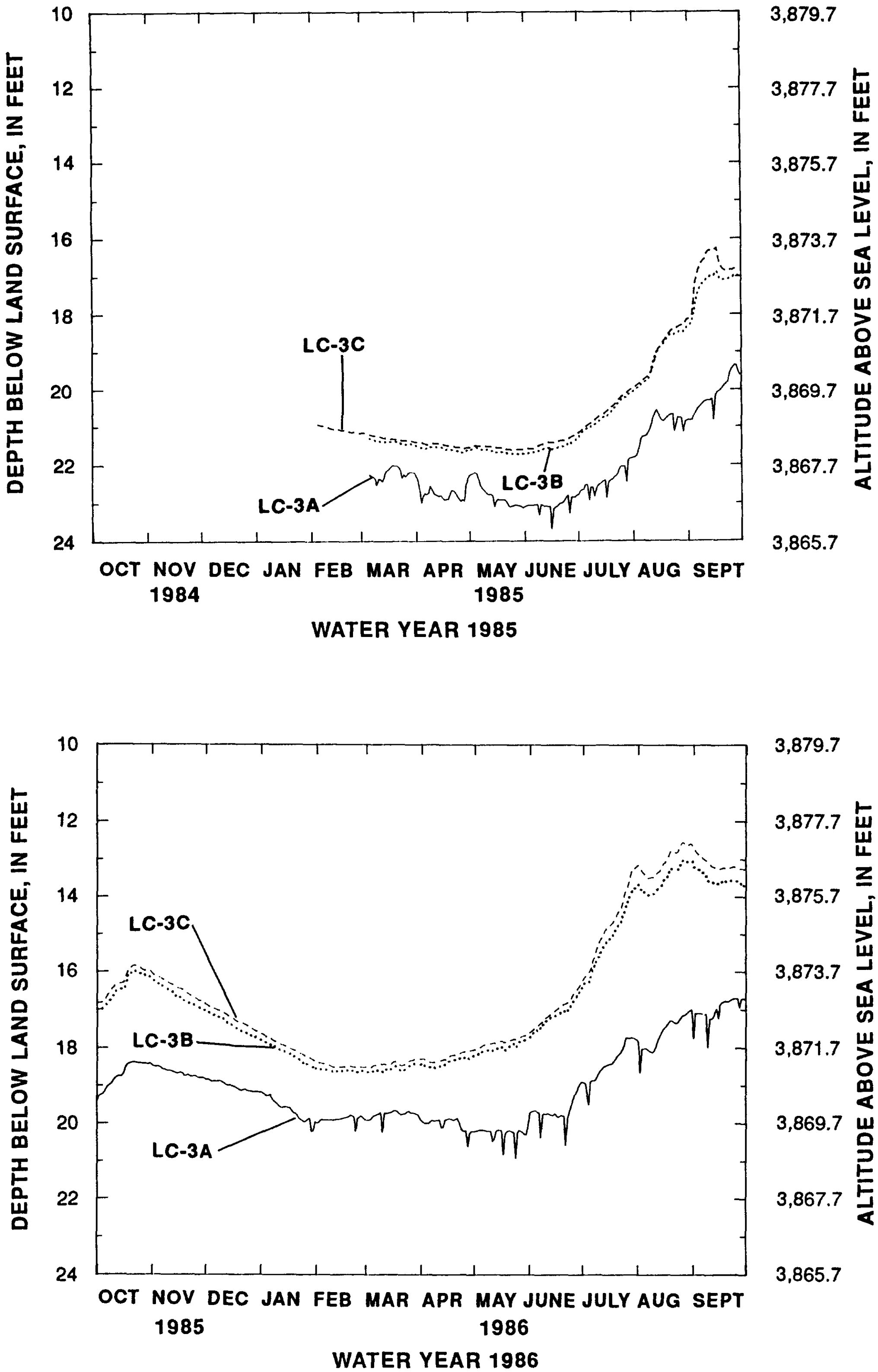


Figure 18.--Mean daily water levels in well group LC-3, February 1985 through September 1986.

The river-stage station at the Rio Grande below Mesilla Dam is located at the Mesquite hydrologic section (fig. 5). Mean daily stage of the Rio Grande from October 1984 through September 1986 is shown in figure 19. Mean annual river stage for water year 1986 was 3,854.0 feet above sea level. The minimum mean daily river stage was 3,852.4 feet on September 23, 1986; the maximum mean daily river stage was 3,855.7 feet on June 18, 1986.

Continuous water-level records were collected at the Mesquite hydrologic section (fig. 12) in well groups M-1, M-2, and M-4; monthly water-level measurements were collected in well group M-3. Well records are listed by well number in table 1. Mean daily water levels in well groups M-1, M-2, and M-4 are shown in figures 20 through 22, respectively. Monthly water levels in well group M-3 are shown in figure 23. Water-level records for water years 1985 and 1986 represent potentiometric heads in the aquifer during wet years, with full surface-water allocation from the Rio Grande and intermittent withdrawal from nearby irrigation wells. Mean daily water levels during water year 1986 ranged from a minimum of 3,839.2 feet in M-1A on January 17, 1986, to a maximum of 3,855.5 feet in M-2C on June 14, 1986. Minimum mean daily, maximum mean daily, and mean annual water levels in observation wells at the Mesquite hydrologic section during water year 1986 are listed in table 3.

The river-stage station at the Rio Grande below Vinton Bridge is located at the Cañutillo well-field hydrologic section (fig. 5). Mean daily stage of the Rio Grande from April 1985 through September 1986 is shown in figure 24. Mean annual river stage for water year 1986 was 3,768.2 feet above sea level. The minimum mean daily river stage was 3,766.5 feet on January 12, 1986; the maximum mean daily river stage was 3,770.0 feet on July 9, 1986.

Continuous water-level records were collected at the Cañutillo well-field hydrologic section (fig. 13) in well groups CWF-1, CWF-2, CWF-3, and CWF-4. Well records are listed by well number in table 1. Mean daily water levels in well groups CWF-1 through CWF-4 are shown in figures 25 through 28, respectively. Mean daily water levels during water year 1986 ranged from a minimum of 3,688.6 feet in CWF-3D on April 24, 1986, to a maximum of 3,768.2 feet in CWF-1A on August 15, 1986. Minimum mean daily, maximum mean daily, and mean annual water levels in observation wells at the Cañutillo well-field hydrologic section during water year 1986 are listed in table 3.

Recorded water levels for water years 1985 and 1986 represent potentiometric head in the aquifer during wet years, with full surface-water allocation from the Rio Grande and substantial ground-water withdrawals from municipal wells in the Cañutillo well field. Pumpage rates vary considerably during the year depending on municipal water demand. Minimum water levels in the intermediate and deep zones generally represent drawdown within the well field. Mean daily water levels during water year 1986 dropped to as low as 85 feet below land surface in the deep zone at well group CWF-3 (fig. 27). During brief, nonpumping periods, static water levels in the deep zone recovered to within 25 feet below land surface.

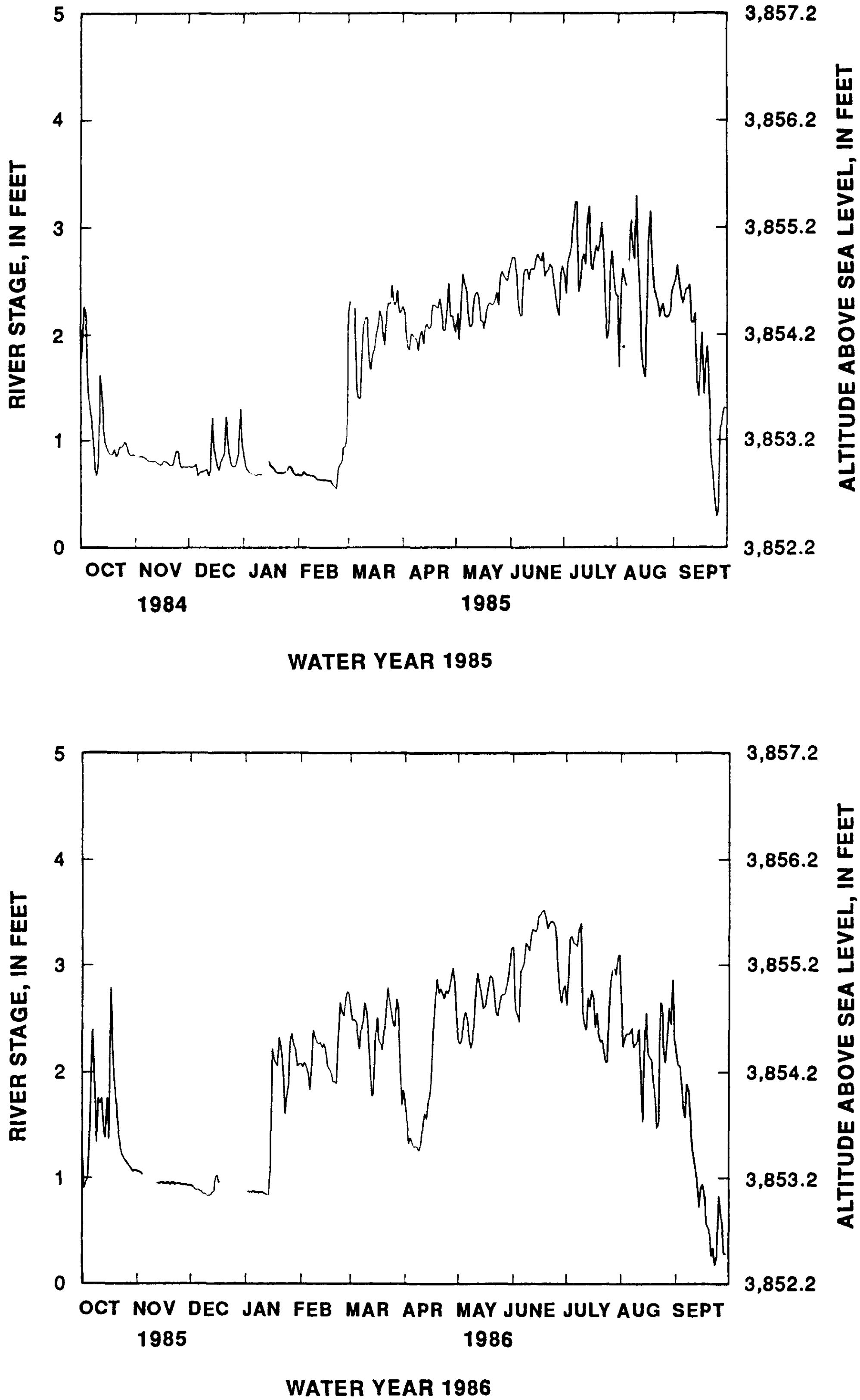
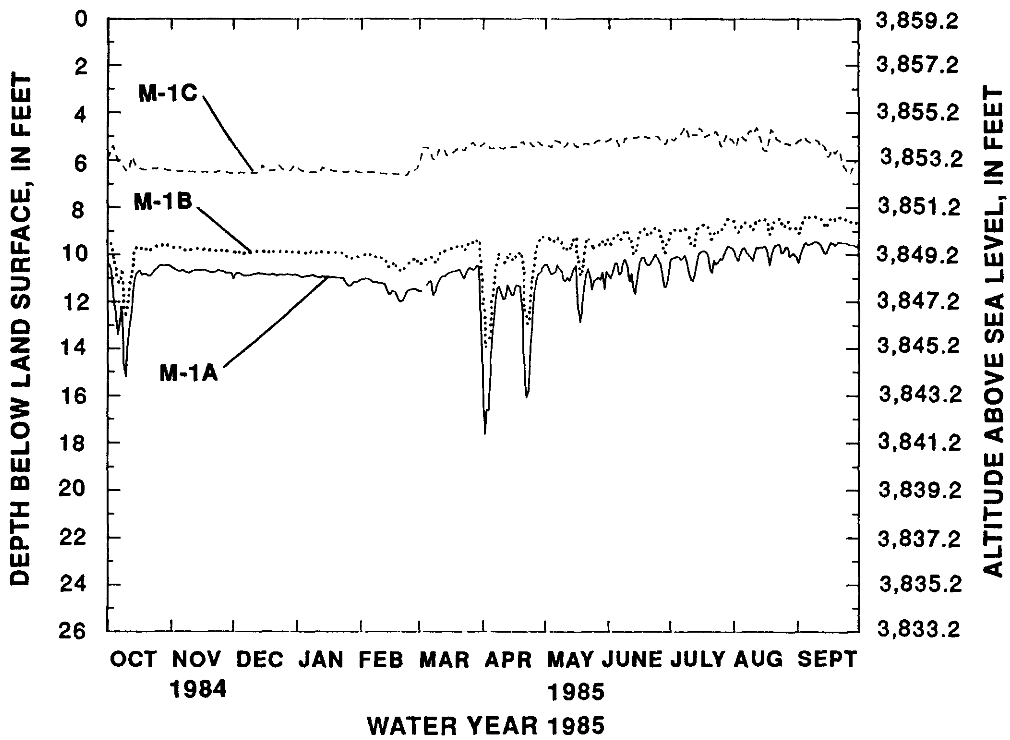


Figure 19.--Mean daily river stage of the Rio Grande below Mesilla Dam, October 1984 through September 1986.



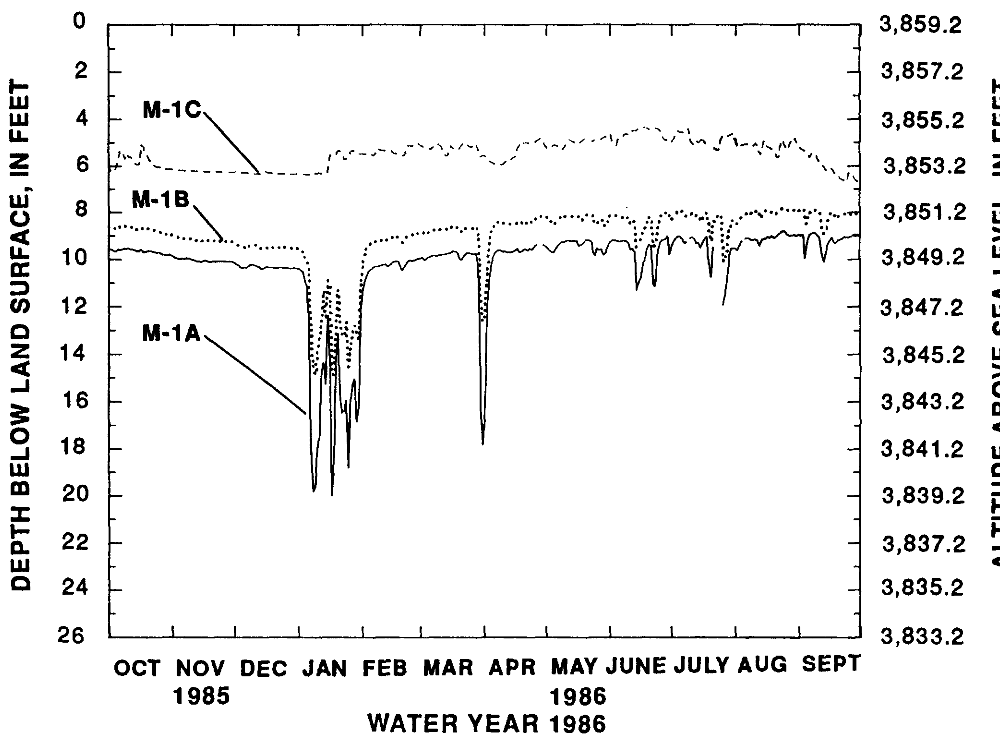


Figure 20.--Mean daily water levels in well group M-1, October 1984 through September 1986.

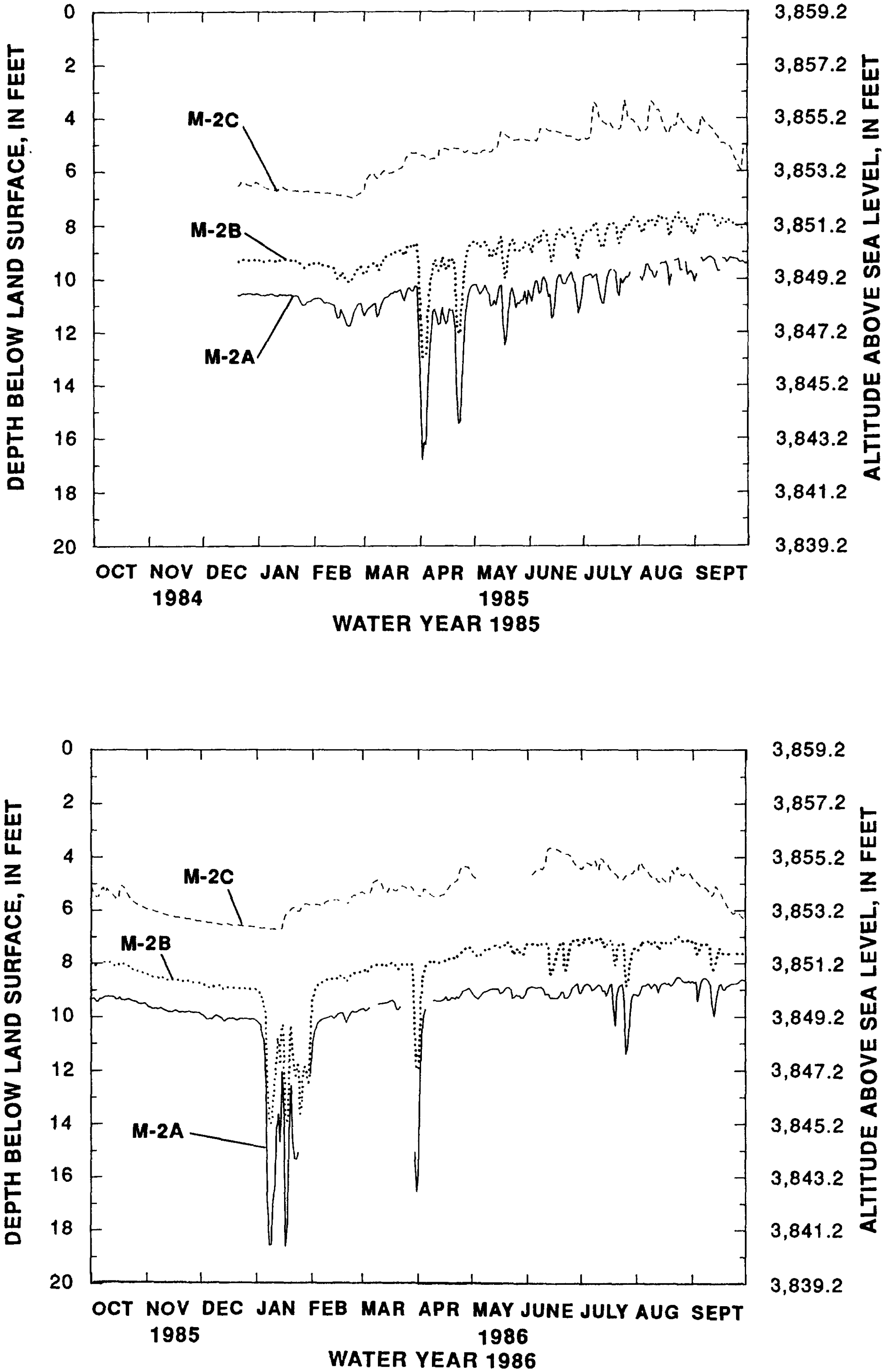
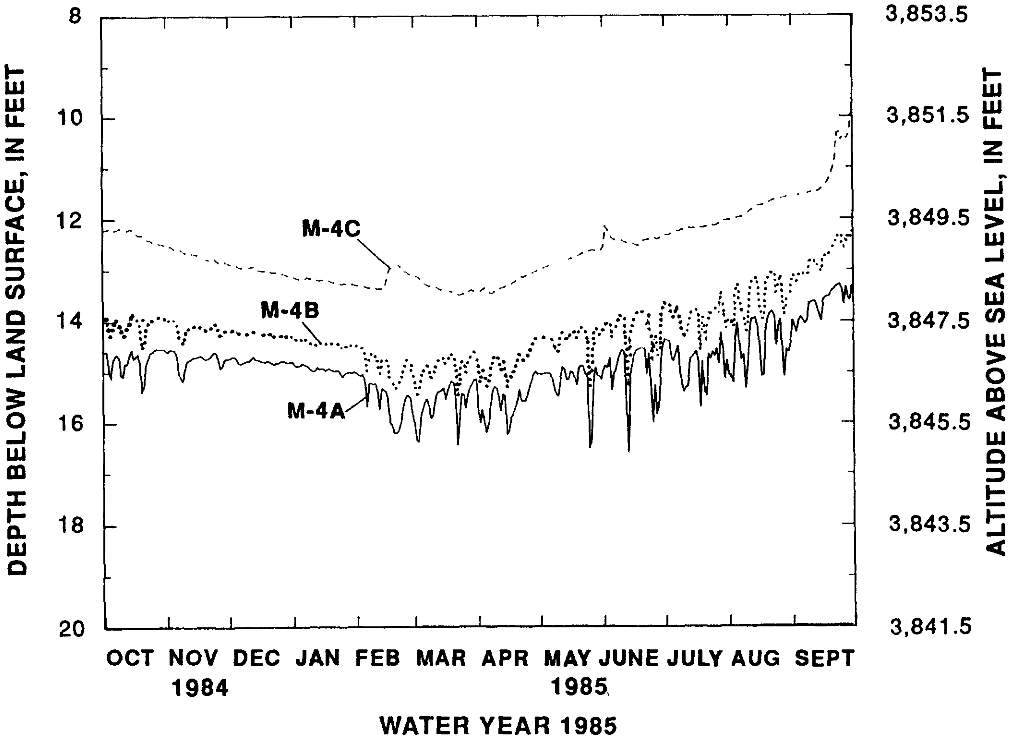


Figure 21.--Mean daily water levels in well group M-2, December 1984 through September 1986.



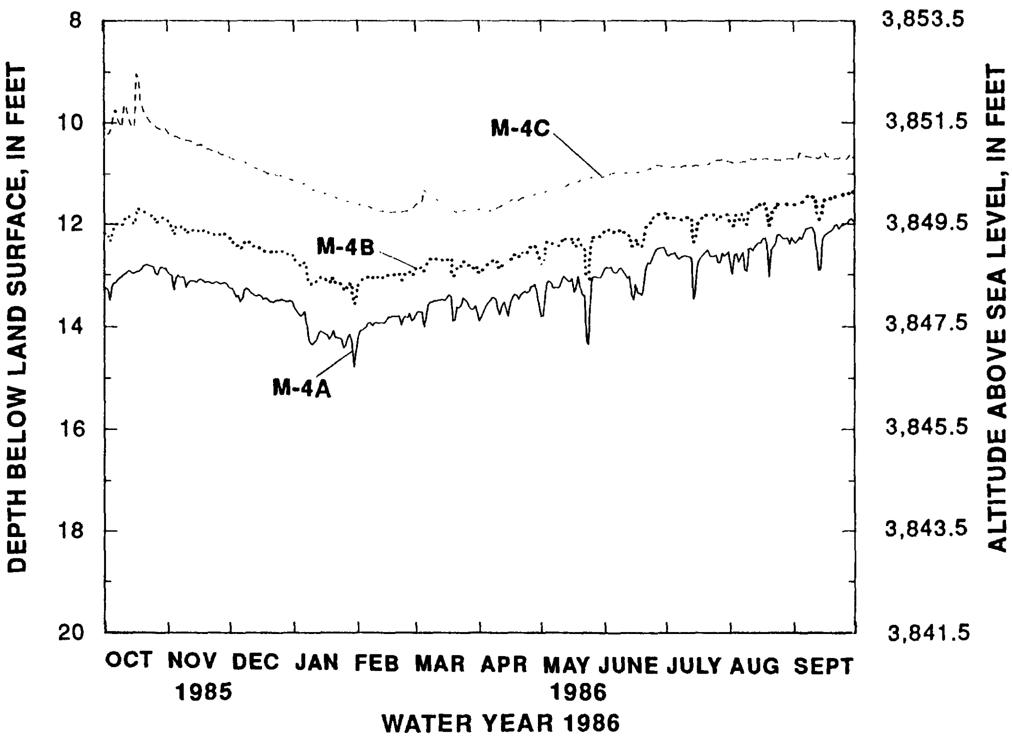
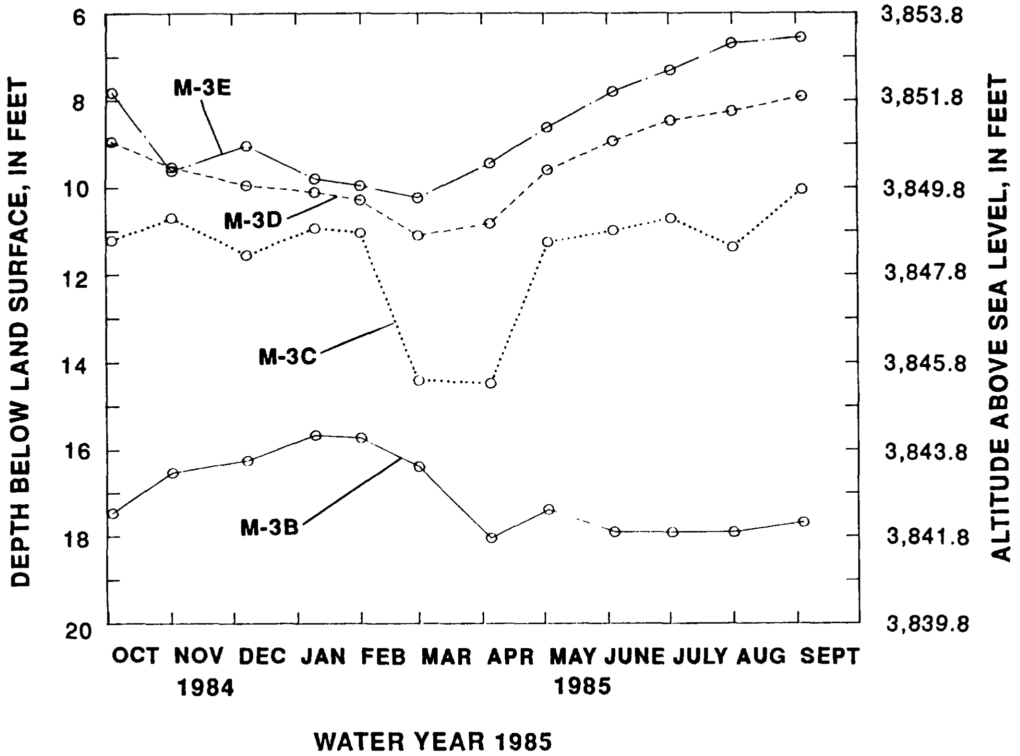


Figure 22.--Mean daily water levels in well group M-4, October 1984 through September 1986.



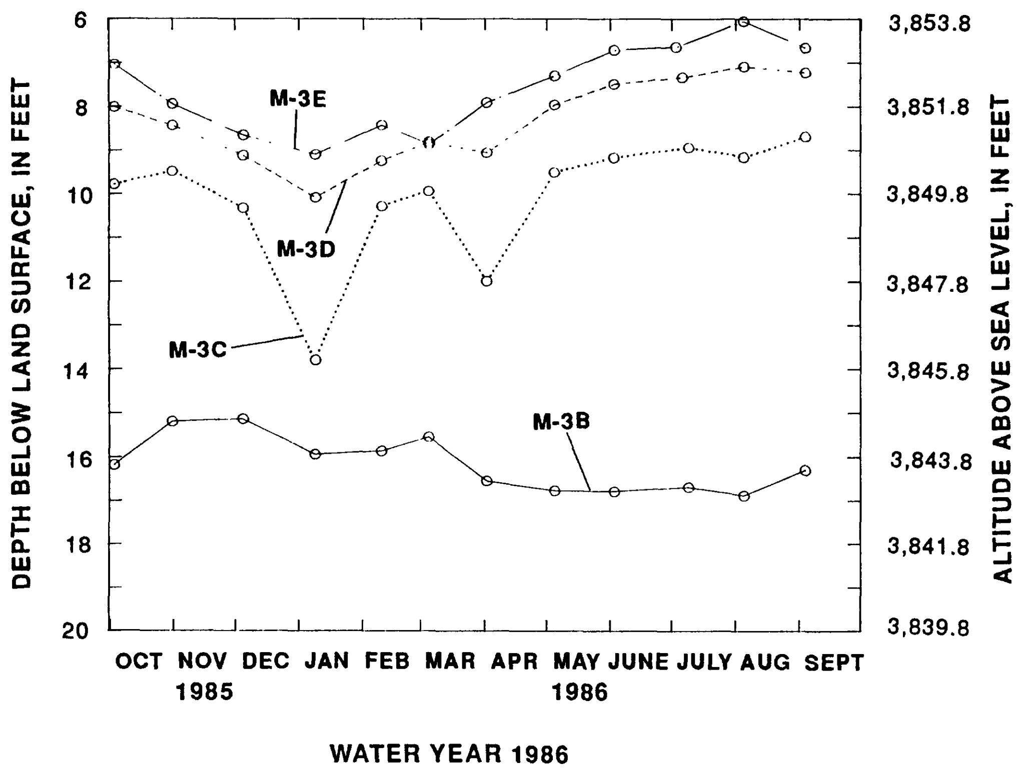


Figure 23.--Monthly water levels in well group M-3, October 1984 through September 1986.

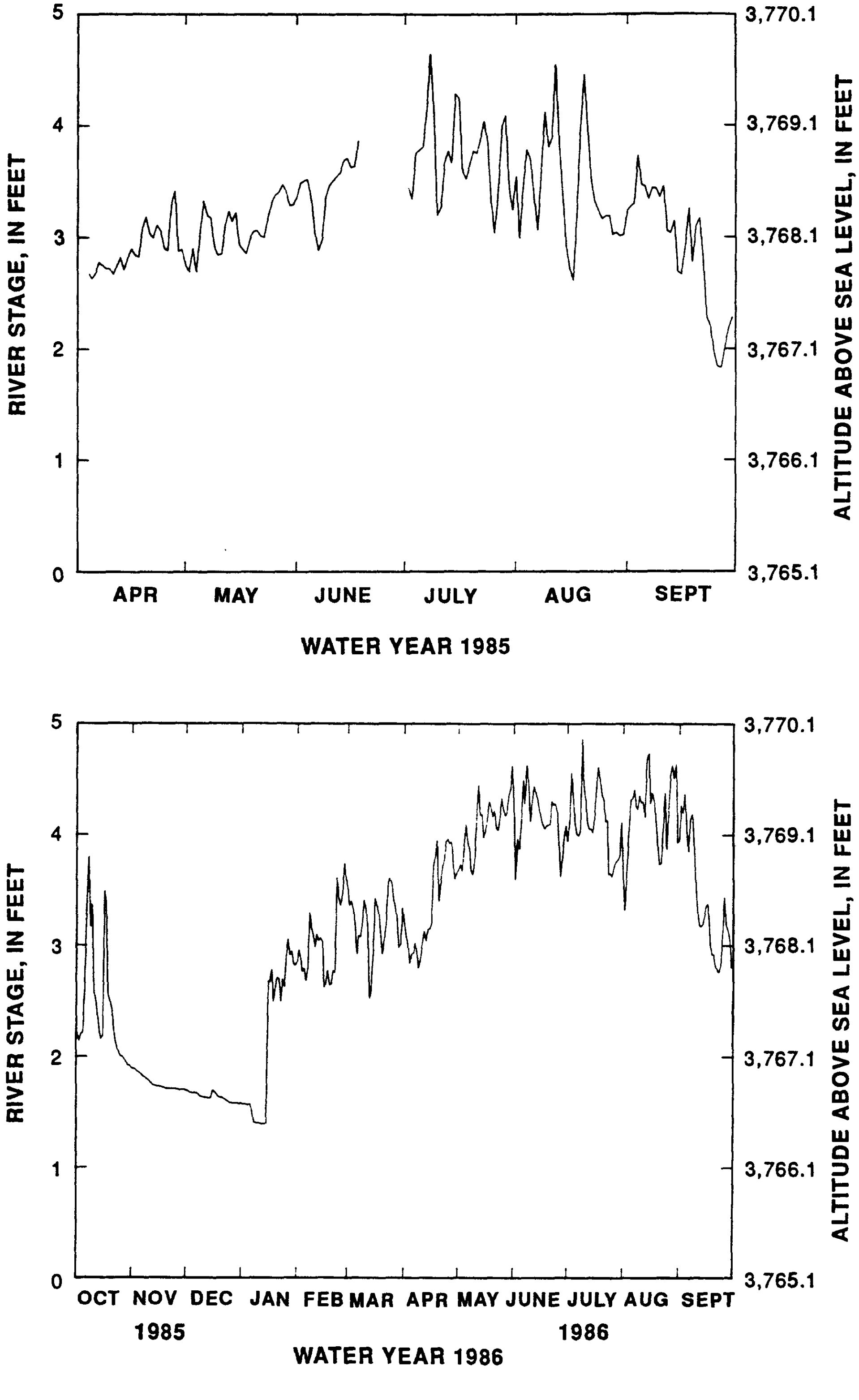


Figure 24.--Mean daily river stage of the Rio Grande below Vinton Bridge, April 1985 through September 1986.

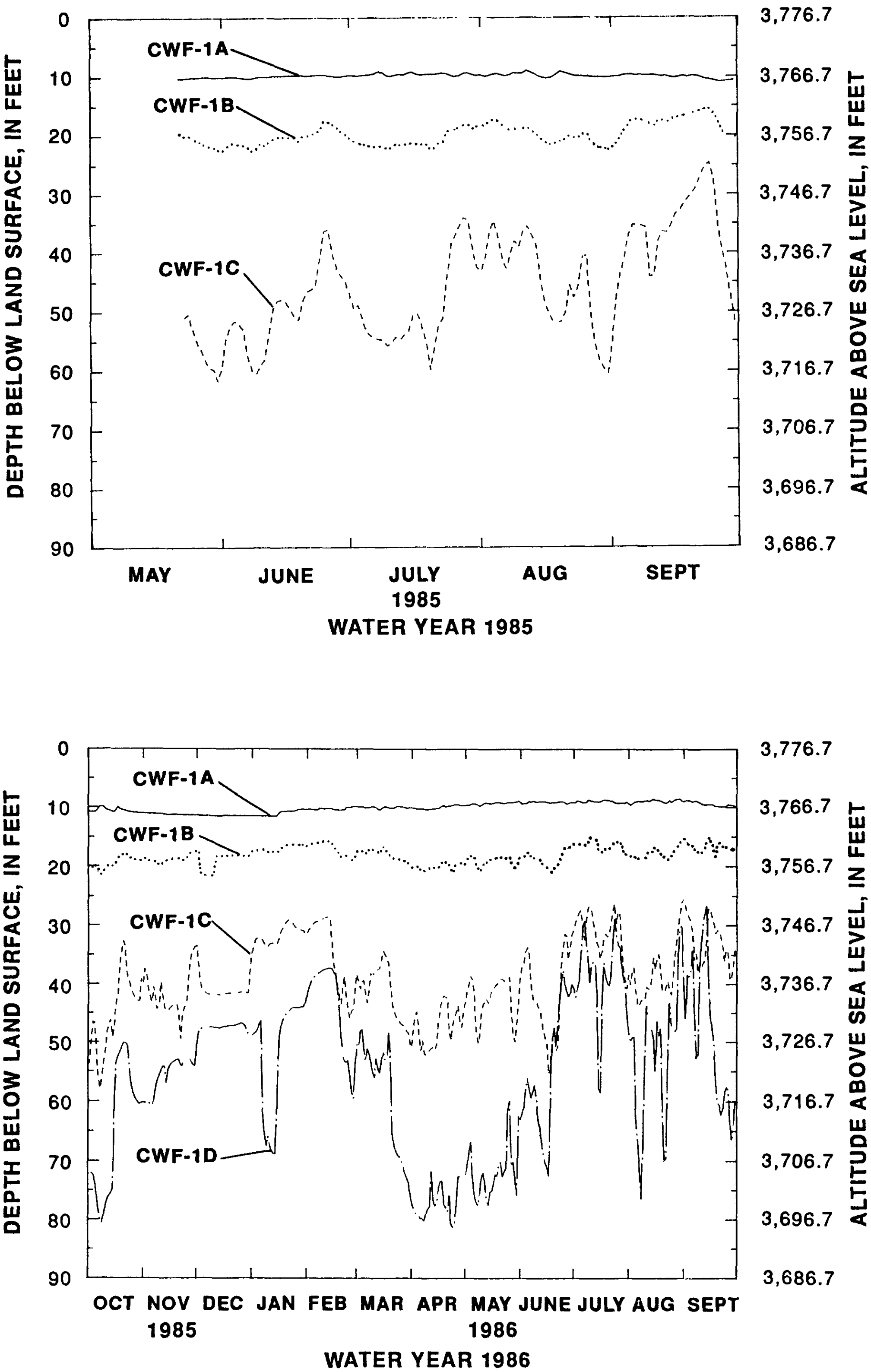
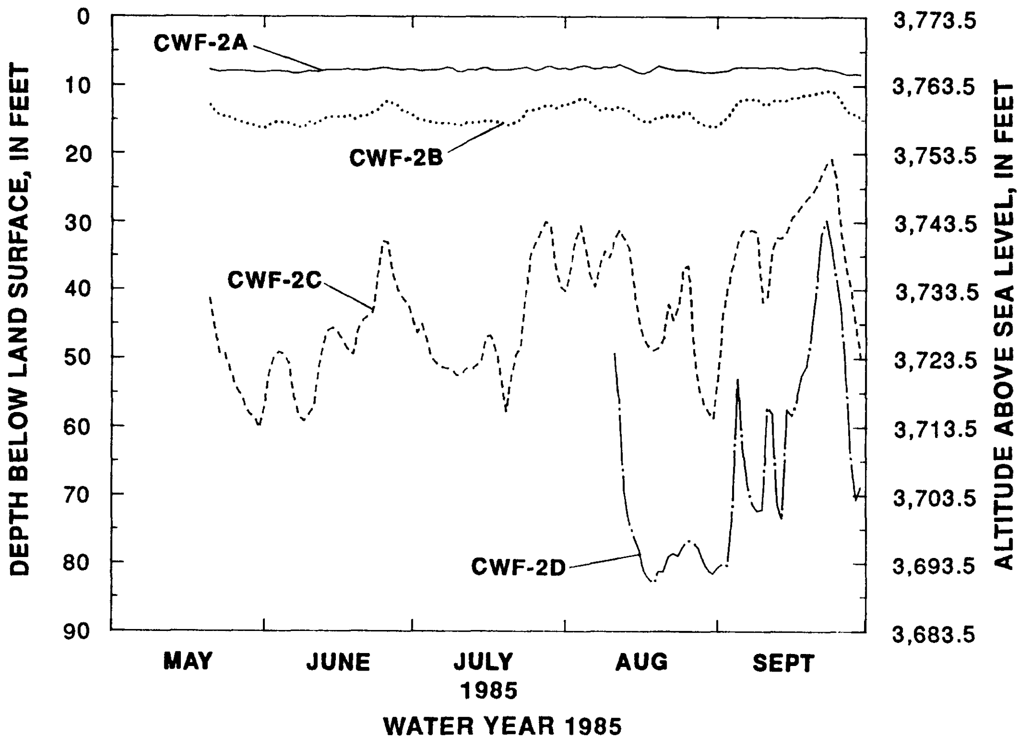


Figure 25.--Mean daily water levels in well group CWF-1, May 1985 through September 1986.



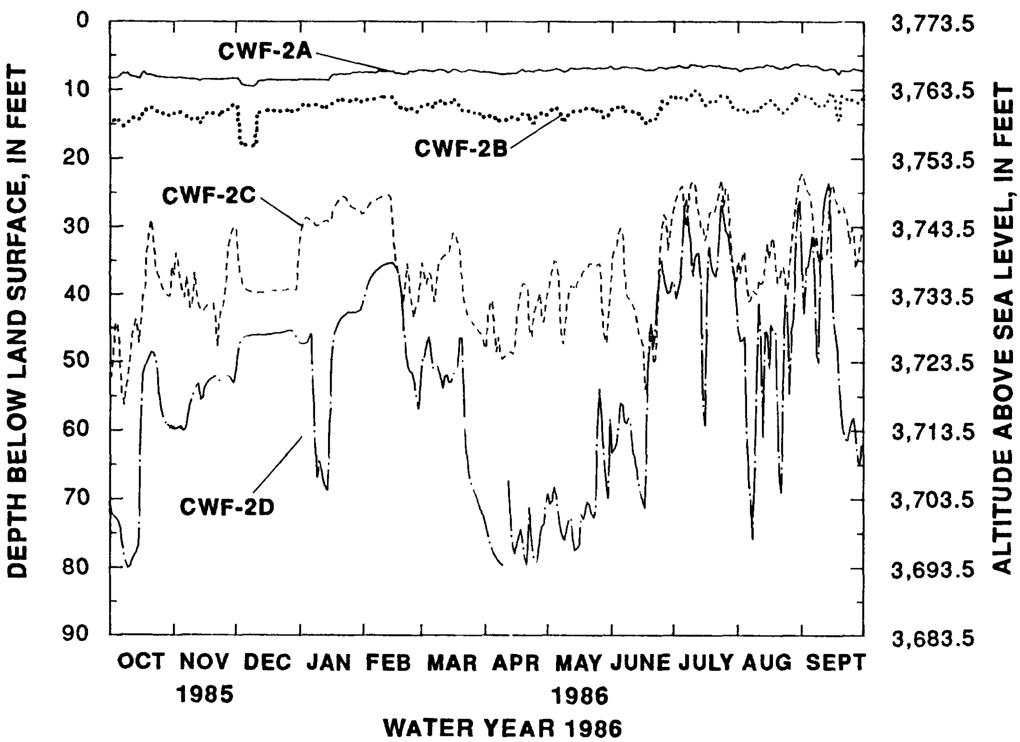
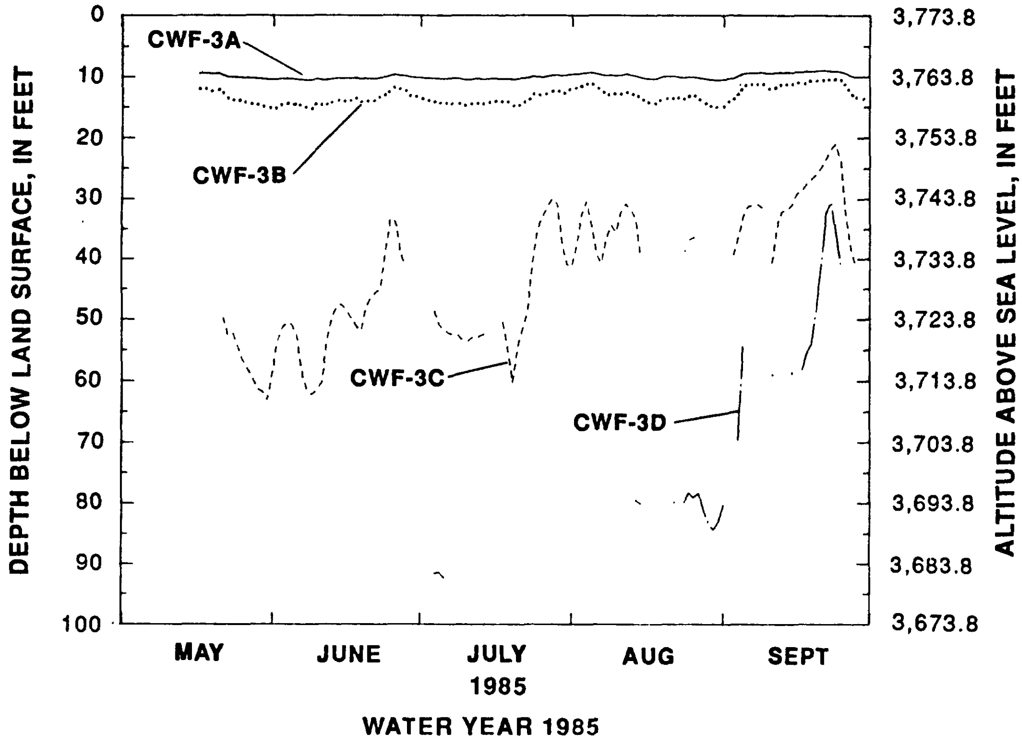


Figure 26.--Mean daily water levels in well group CWF-2, May 1985 through September 1986.



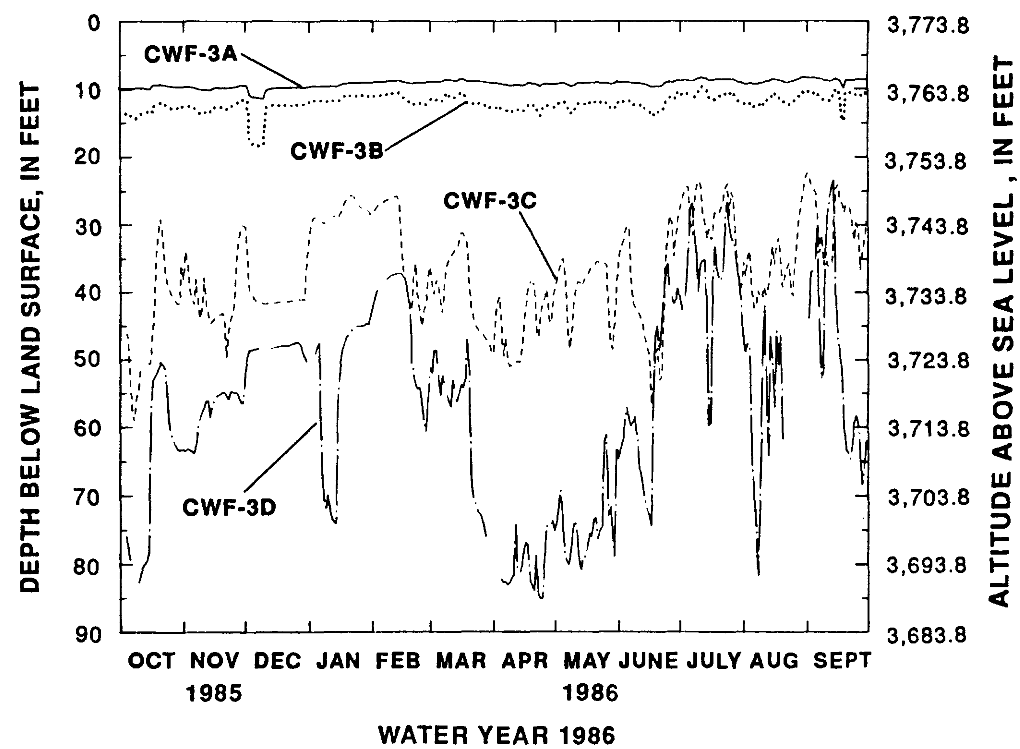


Figure 27.--Mean daily water levels in well group CWF-3, May 1985 through September 1986.

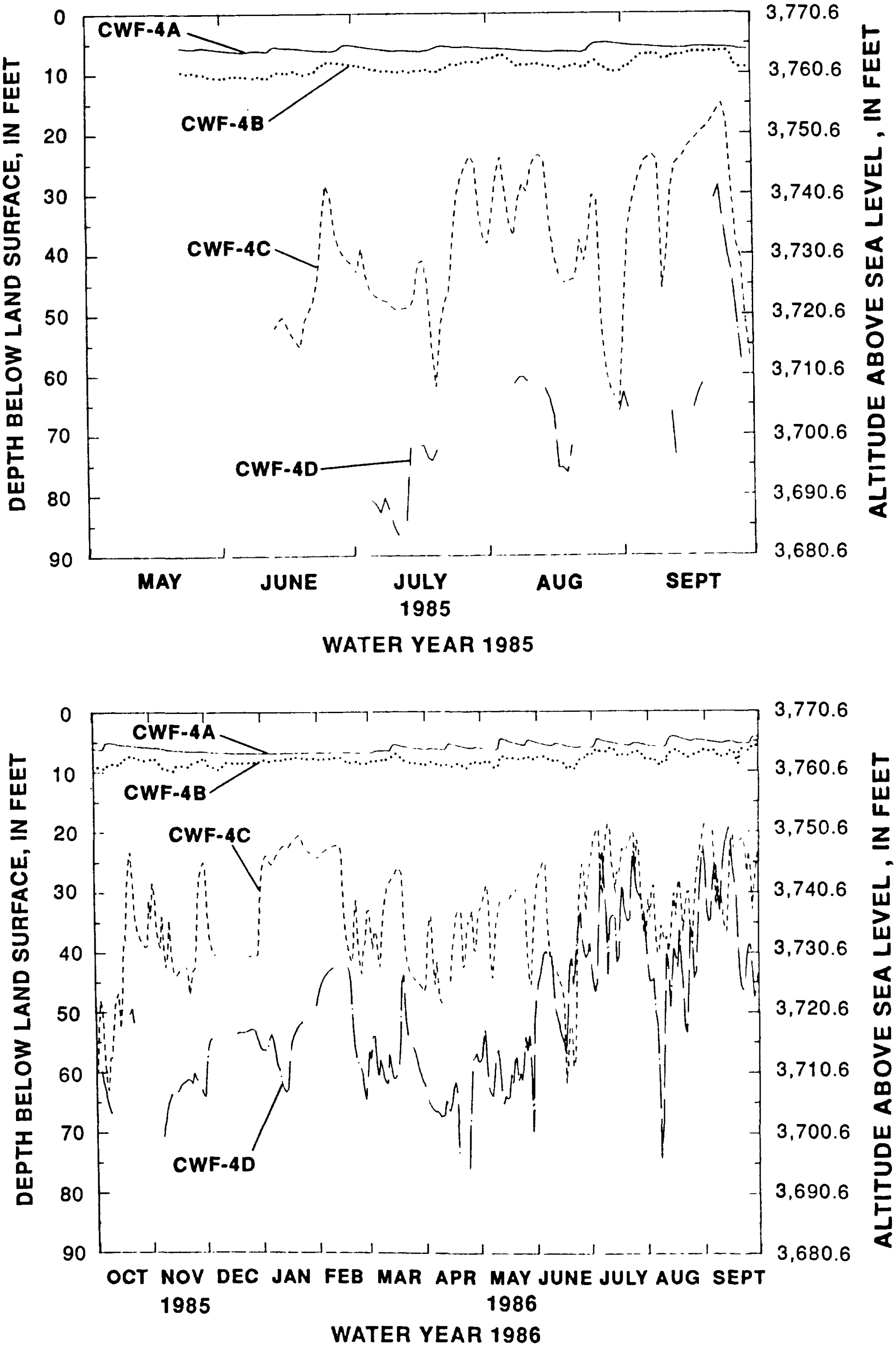


Figure 28.--Mean daily water levels in well group CWF-4, May 1985 through September 1986.

Ground-Water Movement

Ground water moves horizontally and vertically within the aquifer system in the direction of decreasing hydraulic head. The water table in the aquifer system decreases with distance from the river at the hydrologic sections, which indicates horizontal ground-water flow away from the Rio Grande. The potentiometric head also decreases with depth below land surface, which indicates a downward, vertical direction of ground-water flow within the aquifer system. Downward vertical hydraulic gradients were recorded in all well groups at the Mesilla Valley hydrologic sections.

Distribution of potentiometric head in the flood-plain alluvium/Santa Fe Group aquifer at the Las Cruces hydrologic section on January 1, 1986, is shown in figure 29. Ground-water levels in figure 29 represent the potentiometric head during the nonirrigation season at a period of low river stage. The LC-C wells, which include LC-1C, LC-2C, and LC-3C, are completed in the shallow flood-plain alluvium at depths ranging from 30 to 45 feet below land surface. Water levels in the LC-C wells represent the shallow water table. The LC-B wells, which include LC-1B, LC-2B, and LC-3B, are completed in the Santa Fe Group at depths ranging from 95 to 115 feet below land surface. The LC-A wells, which include LC-1A, LC-2A, and LC-3A, are also completed in the Santa Fe Group at depths ranging from 295 to 327 feet below land surface (fig. 11). Water levels in the LC-B and LC-A wells represent the potentiometric head at depth within the upper Santa Fe Group.

Distribution of potentiometric head in the flood-plain alluvium/Santa Fe Group aquifer at the Mesquite hydrologic section on December 5, 1985, is shown in figure 30. Ground-water levels in figure 30 represent the potentiometric head during the nonirrigation season at a period of low river stage and minimal ground-water withdrawals. Observation wells M-1C, M-2C, M-3E, and M-4C are completed in the shallow flood-plain alluvium at depths ranging from 30 to 45 feet below land surface. Water levels in these wells represent the shallow water table. The other Mesquite observation wells are completed in the Santa Fe Group. Observation wells M-1B, M-2B, M-3D, and M-4B are completed at depths ranging from 110 to 120 feet below land surface; observation wells M-1A, M-2A, M-3C, and M-4A are completed at depths ranging from 297 to 315 feet below land surface; and observation well M-3B is completed at a depth of 591 to 596 feet below land surface (fig. 12). Water levels in these wells represent the potentiometric head at depth within the upper Santa Fe Group.

Distribution of potentiometric head in the flood-plain alluvium/Santa Fe Group aquifer at the Cañutillo well-field hydrologic section on January 1, 1986, is shown in figure 31. Ground-water levels in figure 31 represent the potentiometric head during a period of low river stage and normal withdrawal from nearby municipal wells in the Cañutillo well field. The CWF-A wells, which include CWF-1A, CWF-2A, CWF-3A, and CWF-4A, are completed in the shallow zone at depths ranging from 40 to 57 feet below land surface. Water levels in the CWF-A wells represent the shallow water table. The CWF-B wells, which include CWF-1B, CWF-2B, CWF-3B, and CWF-4B, are completed in the upper intermediate zone at depths ranging from 149 to 157 feet below land surface. The CWF-C wells, which include CWF-1C, CWF-2C, CWF-3C, and CWF-4C, are completed in the lower intermediate zone at depths ranging from 291 to 332 feet below land surface. Water levels in the CWF-B wells and the CWF-C wells represent the potentiometric head within the upper and lower intermediate zones. The CWF-D wells, which include CWF-1D, CWF-2D, CWF-3D, and CWF-4D, are completed in the deep zone at depths ranging from 792 to 801 feet below land surface (fig. 14). Water levels in the CWF-D wells represent the potentiometric head in the deep zone.

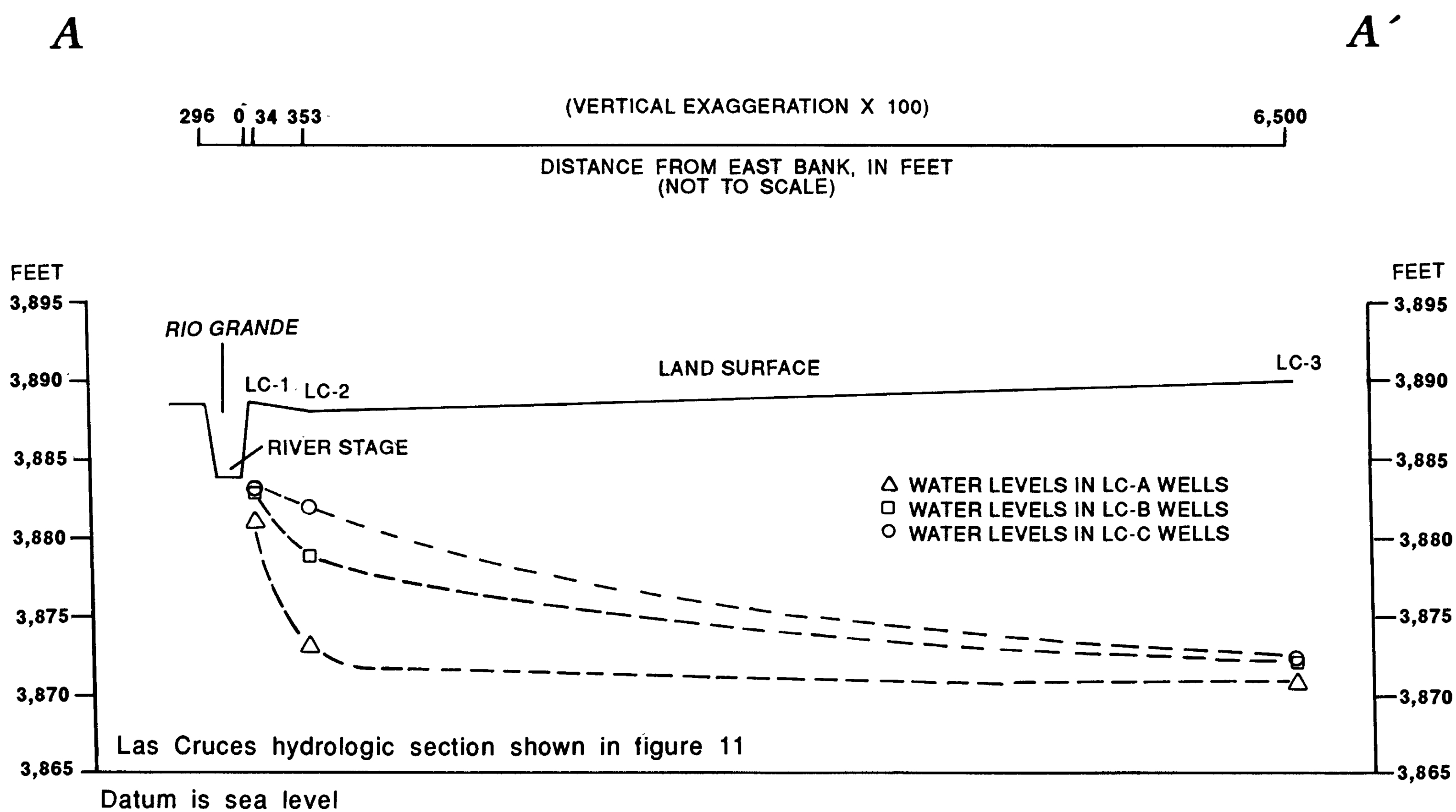


Figure 29.--Distribution of potentiometric head in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer at the Las Cruces hydrologic section, January 1, 1986.

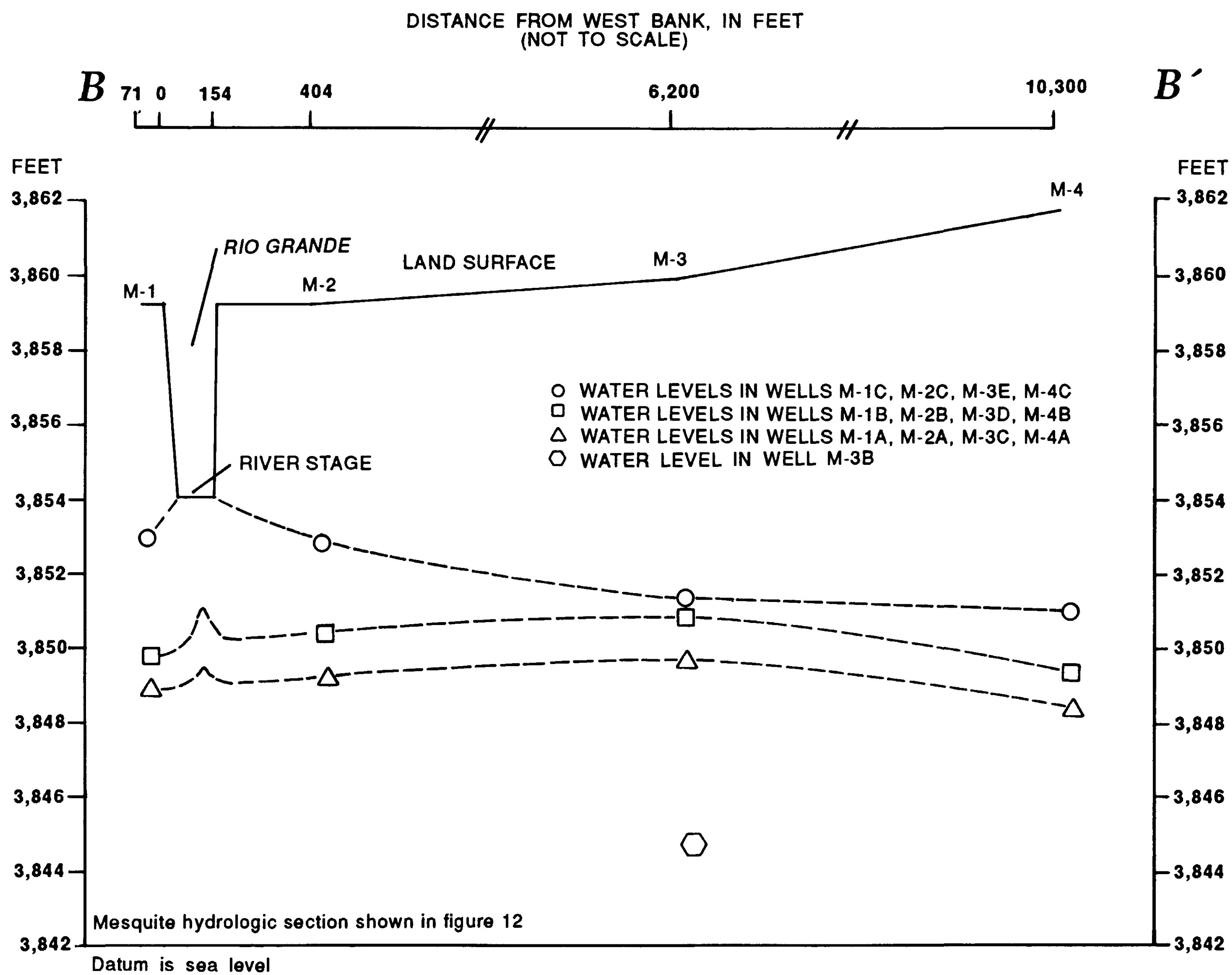


Figure 30.--Distribution of potentiometric head in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer at the Mesquite hydrologic section, December 5, 1985.

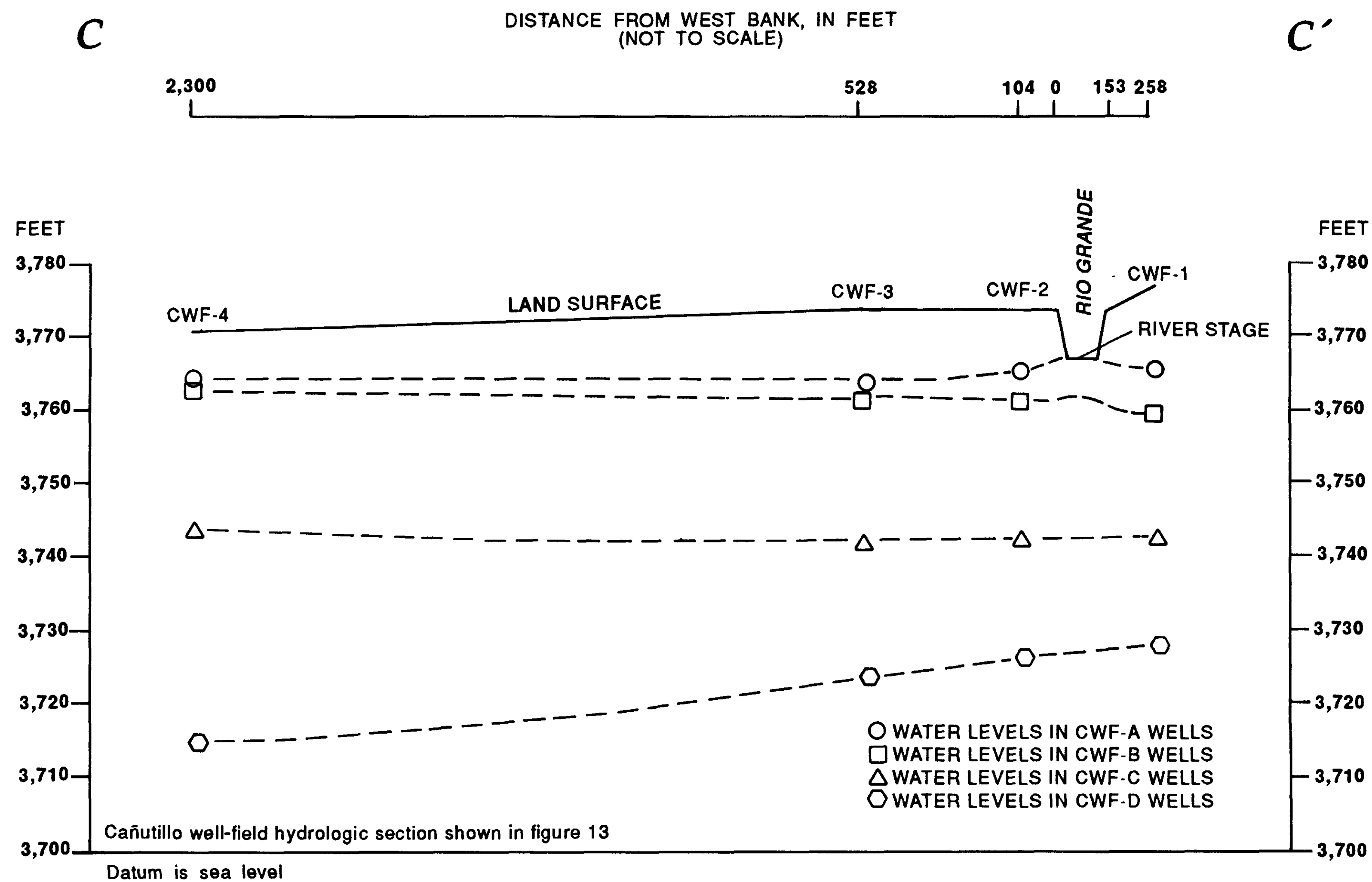


Figure 31.--Distribution of potentiometric head in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer at the Cañutillo well-field hydrologic section, January 1, 1986.

Seasonal trends in the shallow water table correspond to recharge during the irrigation season, which generally occurs from March through September. Water levels in shallow observation wells located near the Rio Grande fluctuate with changes in river stage. Maximum water levels in observation wells LC-1C, M-1C, and CWF-1A occur at high river stage during the irrigation season (figs. 16, 20, and 25). Water levels in LC-3C and M-4C, located at considerable distance from the Rio Grande, increase in response to infiltration of applied irrigation water and begin to decline after the irrigation season. Seasonal water-level trends in observation wells LC-3C and M-4C are shown in figures 18 and 22.

Under static (nonpumping) conditions, potentiometric head in observation wells completed within the upper 350 feet of the aquifer system generally corresponds to seasonal trends in the shallow water table. The relation between mean daily water levels in observation well M-4C screened at 30 to 35 feet below land surface, M-4B screened at 110 to 115 feet below land surface, and M-4A screened at 297 to 302 feet below land surface is shown in figure 22. The distinct correlation between mean daily water levels in well group M-4 indicates a vertical hydraulic connection with movement of water from the shallow flood-plain alluvium to the upper Santa Fe Group. Similar relations were observed in other well groups. Water levels in the shallow zone also respond to drawdown in the intermediate zone during peak periods of pumpage at the Cañutillo well field (figs. 26 and 27). Sharp water-level drawdown and recovery (figs. 18 and 20) in observation wells at the Las Cruces and Mesquite hydrologic sections are caused by intermittent pumpage of nearby large-capacity irrigation wells.

River/Aquifer Relations

Rio Grande streamflow is a major source of recharge to the aquifer system. Ground-water levels in nearby observation wells correspond to changes in elevated river stage (river stage remains elevated above ground-water levels) and indicate significant recharge to the aquifer at the river.

An abrupt rise in Rio Grande stage due to a scheduled upstream release was recorded at the Las Cruces hydrologic section January 15, 1986. Rio Grande stage and water levels in observation wells LC-1C and LC-2C, completed within the shallow flood-plain alluvium at distances 34 feet and 353 feet from the river, are shown in figure 32. The rapid response of ground-water levels to the abrupt rise in river stage indicates a significant hydraulic connection between the river and the shallow flood-plain alluvium. The increase in potentiometric head within the aquifer in response to elevated river stage attenuates with depth and distance from the river (fig. 32).

A similar ground-water response to the January 1986 rise in river stage was observed at the Mesquite hydrologic section and the Cañutillo well-field hydrologic section. Rio Grande stage at the Mesquite hydrologic section and water levels in observation wells M-1C and M-2C, completed within the shallow flood-plain alluvium at distances 71 feet from the west bank and 250 feet from the east bank, are shown in figure 33. Rio Grande stage at the Cañutillo well-field hydrologic section and water levels in observation wells CWF-1A, CWF-2A, and CWF-3A, completed within the shallow flood-plain alluvium at distances 105 feet from the east bank, 104 feet from the west bank, and 528 feet from the west bank, respectively, are shown in figure 34.

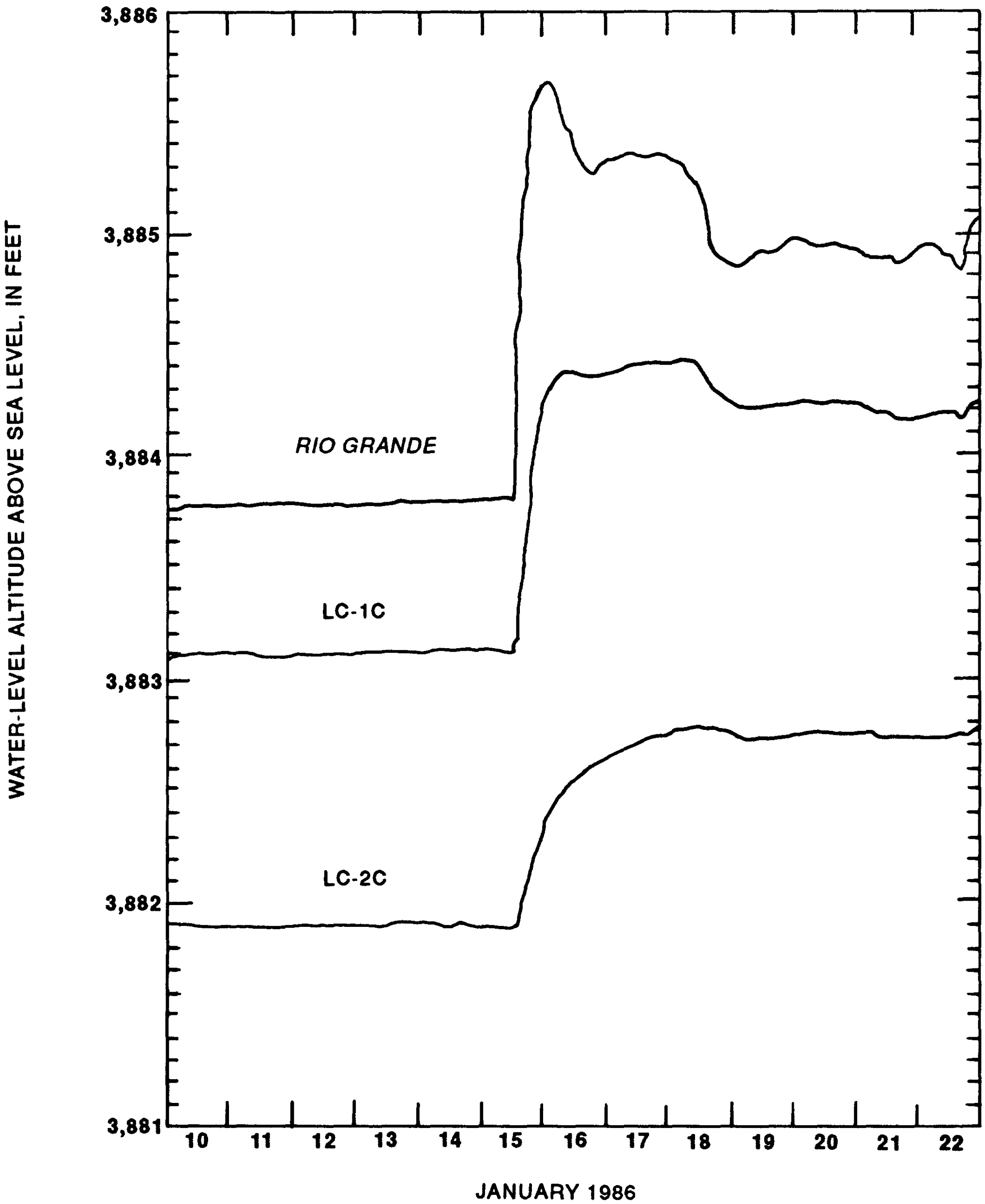


Figure 32.--Rio Grande stage at the Las Cruces hydrologic section and water levels in observation wells LC-1C and LC-2C, January 10-22, 1986.

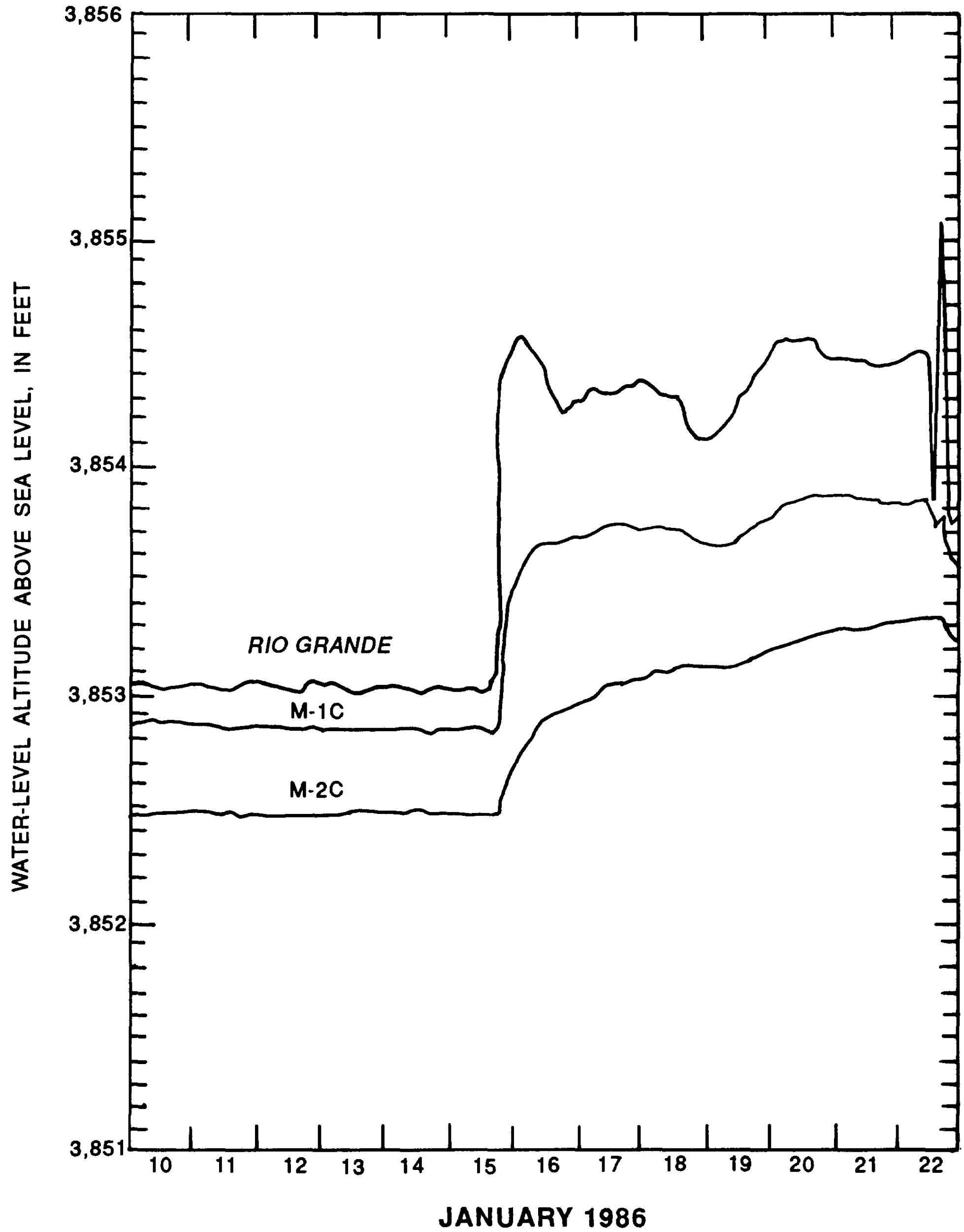


Figure 33.--Rio Grande stage at the Mesquite hydrologic section and water levels in observation wells M-1C and M-2C, January 10-22, 1986.

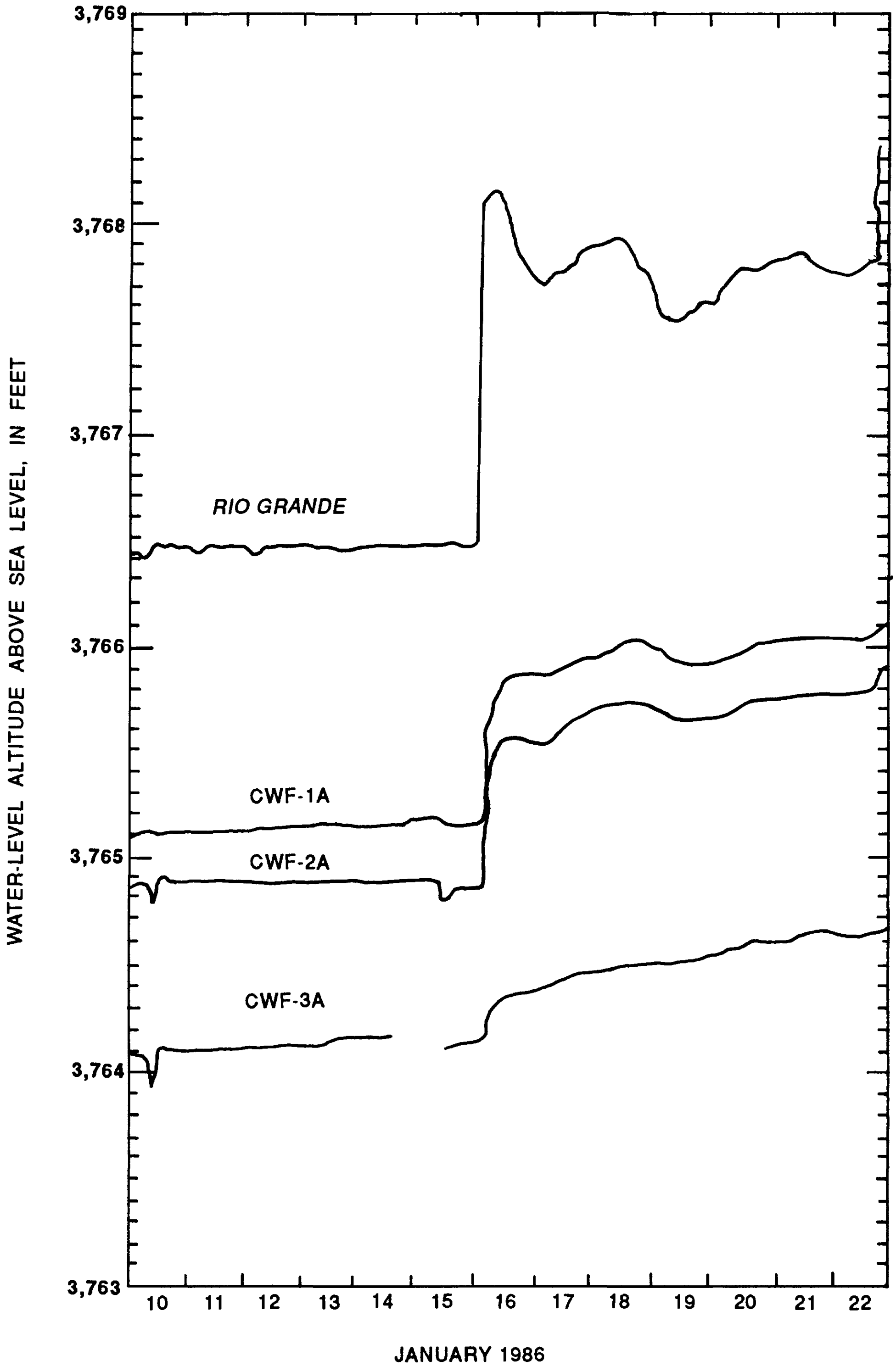


Figure 34.--Rio Grande stage at the Cañutillo well-field hydrologic section and water levels in observation wells CWF-1A, CWF-2A, and CWF-3A, January 10-22, 1986 (from Nickerson, 1989, fig. 6).

During this study, the Rio Grande was in hydraulic connection with the aquifer system and lost or gained water by seepage through the riverbed in the direction of decreasing hydraulic head. Recorded hydraulic gradients from the river to the aquifer identify the Rio Grande as a losing river at the Las Cruces hydrologic section, Mesquite hydrologic section, and Cañutillo well-field hydrologic section.

River stage (fig. 15) at the Las Cruces hydrologic section remained above the potentiometric head in the aquifer throughout the period of continuous water-level record from February 1985 through September 1986 (figs. 16-18). Water levels during water year 1986 indicate a decrease in hydraulic head, from a mean annual river stage of 3,885.6 feet to a mean annual water level of 3,885.0 feet in observation well LC-1C at a distance 34 feet from the east bank.

River stage (fig. 19) at the Mesquite hydrologic section remained above the potentiometric head (figs. 20-23) in the aquifer throughout most of the period of continuous water-level record from October 1984 through September 1986. Hydraulic gradients from the river to the aquifer indicate river losses from November through June. Water levels during water year 1986 indicate a decrease in hydraulic head, from a mean annual river stage of 3,854.0 feet to a mean annual water level of 3,853.7 feet in observation well M-1C, at 71 feet from the west bank, and 3,853.8 feet in observation well M-2C, at 250 feet from the east bank. Gradients from the aquifer to the river occurred along the east bank at observation well M-2C (fig. 21) during intermittent periods from July through October. River gains during these periods probably are from subsurface irrigation-return flow and bank storage.

River stage (fig. 24) at the Cañutillo well-field hydrologic section remained above the potentiometric head (figs. 25-28) in the aquifer throughout the period of continuous water-level record from May 1985 through September 1986. Water levels during water year 1986 indicate a decrease in hydraulic head, from a mean annual river stage of 3,768.2 feet to a mean annual water level of 3,766.7 feet in observation well CWF-1A (fig. 25), at 105 feet from the east bank, and 3,766.0 feet in observation well CWF-2A (fig. 26), at 104 feet from the west bank.

Water Quality

The water quality of the aquifer in the valley area in the Mesilla ground-water basin is described in Conover (1954, p. 79-90), Basler and Alary (1968), and Wilson and others (1981, p. 45-53, 55-59). Wilson and others (1981, p. 55) divided the aquifer into four zones: (1) freshwater zone I with dissolved-solids concentration less than 500 milligrams per liter; (2) freshwater zone II with dissolved-solids concentration between 500 and 1,000 milligrams per liter; (3) slightly saline water zone with dissolved-solids concentration between 1,000 and 3,000 milligrams per liter; and (4) saline-water zone with dissolved-solids concentration greater than 3,000 milligrams per liter.

The freshwater zones generally are overlain by zones of slightly saline to saline water (Basler and Alary, 1968; Wilson and others, 1981) in the flood plain of the Rio Grande. Evapotranspiration from applied irrigation water and the shallow ground-water table concentrates the dissolved solids and causes increased salinity in the upper part of the aquifer. Downward migration of slightly saline to saline water is primarily a function of the vertical hydraulic conductivity and vertical hydraulic gradient within the aquifer system. The thickness of the upper zones of slightly saline to saline water normally ranges from 100 to 250 feet (Wilson and others, 1981, p. 59); the dissolved-solids concentration increases from north to south to as much as 24,800 milligrams per liter (Gates and others, 1980, p. 98). Thick freshwater zones occur below the shallow saline water throughout most of the Mesilla Valley. The estimated thickness of the freshwater zone at the Las Cruces and Mesquite hydrologic sections is greater than 2,000 feet (Wilson and others, 1981, pl. 15). Zones of slightly saline to saline water probably underlie the freshwater zones (Wilson and others, 1981, p. 59). At the Cañutillo well-field hydrologic section, the freshwater zone extends to the base of the aquifer, about 890 feet below land surface at well group CWF-1.

The shallow zones of slightly saline to saline water are flushed from the aquifer by surface-water recharge near the Rio Grande and irrigation canals (Wilson and others, 1981). The dissolved-solids concentrations of water samples collected from observation wells at the Las Cruces, Mesquite, and Cañutillo well-field hydrologic sections are shown in figures 11, 12, and 13, respectively. The zones of slightly saline to saline water generally overlying the freshwater zone are absent or thin near the Rio Grande and increase in thickness away from the river. Salinity may also increase near agricultural drains (Basler and Alary, 1968). Chemical analyses of water samples and analyses of borehole-geophysical logs indicate that the zone of slightly saline to saline water overlying the freshwater zone may extend to as much as 280 feet below land surface at well group LC-3, located next to the Mesilla Drain (fig. 5). In contrast, the zone of slightly saline water at well group M-4, located next to the Park Drain (fig. 5), probably extends to about 80 feet below land surface. Salinity in the upper part of the aquifer near the Rio Grande, irrigation canals, and agricultural drains may vary locally and seasonally depending on the quality and quantity of streamflow.

Aquifer in the West Mesa

The potentiometric surface of ground water in the West Mesa is shown in figure 9. The direction of ground-water flow in the West Mesa is toward the southeast corner of the study area. The hydraulic gradient in the northwestern West Mesa ranges from more than 100 feet per mile to 5 feet per mile, decreasing toward the southeast. In the south-central part of the West Mesa, the hydraulic gradient is about 1.3 feet per mile.

There is little recharge of ground water to the Mesilla ground-water basin in the West Mesa. Most storm runoff ponds and evaporates in small playas. Near-surface layers of caliche retard percolation of infiltration water. Some recharge occurs along mountain fronts on the north and west boundaries of the West Mesa.

Little ground water is withdrawn from the Mesilla ground-water basin in the West Mesa. Current ground-water withdrawals are mostly from stock and domestic wells, several irrigation wells, and two municipal wells in the northeast corner of the West Mesa.

The horst in the northern part of the West Mesa between the East and West Robledo fault zones (fig. 4) is characterized by fine-grained sediments (King and others, 1971, p. 41-42) below the water table. The thickness of the Santa Fe Group overlying the horst is less than 1,000 feet in most areas (Hawley, 1984). The closely spaced water-table contours, lithologic data, and water-yield data in this area are indicative of small transmissivity values (Myers and Orr, 1985, p. 20-21).

In a small, shallow graben west of the West Robledo fault zone near Sleeping Lady Hills the Santa Fe Group consists of coarser grained sediments than on the horst. Several irrigation wells in the graben produce 300 to 400 gallons of water per minute.

The sediments on the large horst between the Fitzgerald fault zone and the Mid-Basin fault zone are much thinner than the grabens on either side (Hawley, 1984). Information from a recent test hole (1985) indicates that the Santa Fe Group may be less than 1,500 feet thick in the vicinity of Lanark. Hawley's (1984) hydrogeologic sections indicate little or no displacement along the faults in the upper Santa Fe Group. This indicates that the sediments in the upper part of the Santa Fe Group on the horst probably are continuous toward the east into the Mesilla Valley. The effects of the horst at depth on the regional flow system of the West Mesa are unknown.

Hawley (1984) and Seager and others (1987) estimated more than 4,000 feet of Santa Fe Group deposits in the graben between the Fitzgerald fault zone and the East Robledo and East Potrillo fault zones. Wells in the northern part of this graben produce more than 1,000 gallons of freshwater per minute (Halpenny and others, 1972; Spiegel, 1972a,b; Myers and Orr, 1985). Little is known about water-quality and aquifer characteristics of the southern part of the graben, although a few wells have produced about 300 gallons per minute of fresh to slightly saline water.

The freshwater zones in the West Mesa are underlain by zones of slightly saline to saline water. Wilson and others (1981, p. 55-59) used borehole-geophysical logs, vertical electrical-resistivity soundings, and chemical analyses of water samples from selected wells to estimate the saturated thickness (Wilson and others, 1981, pl. 15) of sediments containing freshwater in the Mesilla Valley and adjacent areas, including the West Mesa.

Four geohydrologic test holes were drilled on the West Mesa by the City of El Paso to depths ranging from 1,295 to 2,463 feet below land surface. The locations of the test holes were chosen to assist in determining the effects of the structural geology on the thickness, lithology, and water quality of the aquifer in the Santa Fe Group in the vicinity of the proposed West Mesa well field (fig. 5). The Afton test hole (25S.01E.06.333) was drilled to a depth of 2,463 feet below land surface in the graben between the East Robledo fault zone and Fitzgerald fault zone. The Afton test hole was completed as an observation well to a depth of 680 feet below land surface (table 1). The Lanark test hole (27S.01E.04.121a) was drilled to a depth of 1,560 feet below land surface on the horst between the Fitzgerald fault zone and Mid-Basin fault zone. Tertiary volcanics marking the base of the Santa Fe Group aquifer were penetrated in the test hole at approximately 1,490 feet below land surface. An existing observation well (27S.01E.04.121) completed to a depth of 560 feet below land surface was used to measure water levels at the test-hole site (table 1). La Union test hole (27S.02E.13.331) was drilled to a depth of 2,245 feet below land surface at the edge of the West Mesa in the graben east of the Mid-Basin fault zone. La Union test hole was completed as an observation well to a depth of 722 feet below land surface (table 1). The Noria test hole (28S.01E.34.414) was drilled to a depth of 1,295 feet below land surface in the southern part of the West Mesa, where little or no data were available. The Noria test hole was completed as an observation well to a depth of 533 feet below land surface (table 1).

Water levels (table 1), drill cuttings, borehole-geophysical logs, and water-quality data (table 2) were collected from the four West Mesa test holes. Long-normal and short-normal resistivity logs for the four test holes are shown in figures 35 through 38. The dissolved-solids concentration of water samples jetted from selected intervals (table 2) and borehole-geophysical logs indicate that the approximate thickness of freshwater differs by several hundred feet or more from the freshwater estimates of Wilson and others (1981, pl. 15). The approximate thickness of freshwater in the four test holes and the thickness of freshwater previously estimated by Wilson and others (1981, pl. 15) are listed below:

Test hole and location	Estimated base of of freshwater, in feet below land surface	Approximate thickness of freshwater zone, in feet	Previous estimate of freshwater thickness, in feet (Wilson and others, 1981, pl. 15)
Afton 25S.01E.06.333	920	550	1,100
Lanark 27S.01E.04.121a	930	550	1,100
La Union 27S.02E.13.331	1,740	1,420	700
Noria 28S.01E.34.414	540	210	1,200

Information from the Afton, Lanark, and Noria test holes indicates that the thickness of the freshwater zone is significantly less than previously estimated in the vicinity of the proposed West Mesa well field. The freshwater zone is thicker than previously estimated at La Union test hole east of the proposed West Mesa well field. The thickness of the Santa Fe Group at the Lanark test hole on the horst between the Fitzgerald fault zone and the Mid-Basin fault zone is almost 500 to 900 feet less than previous estimates (King and others, 1971, p. 22; Wilson and others, 1981, pl. 8). The dominant cation in all samples from the four test holes is sodium; the dominant anion varies (figs. 39 through 42). The effects of the structural geology and lithology upon water quality and the regional flow system are still unknown in many places at this time (1987).

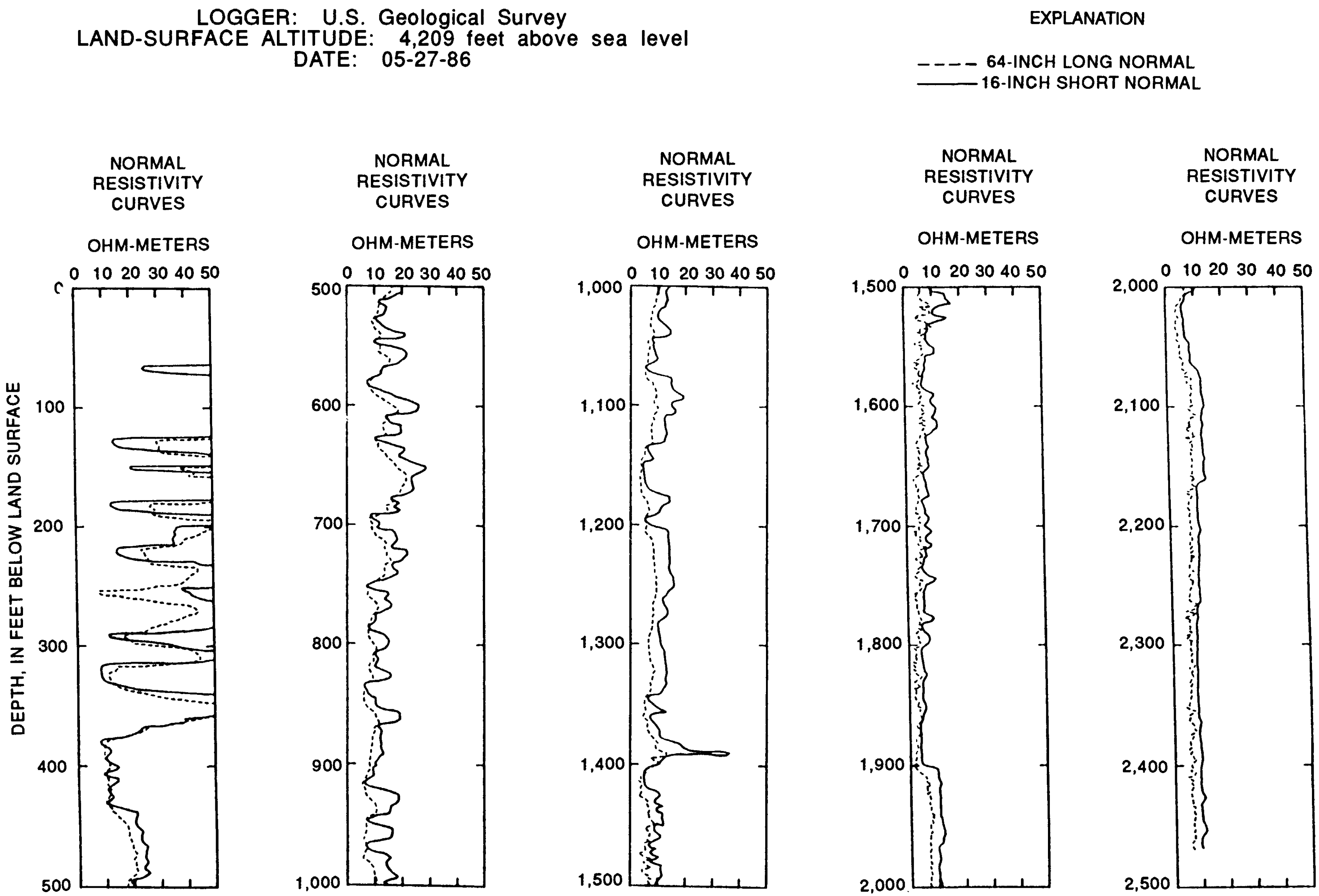


Figure 35.--Long-normal and short-normal resistivity logs from the Afton test hole (25S.01E.06.333).

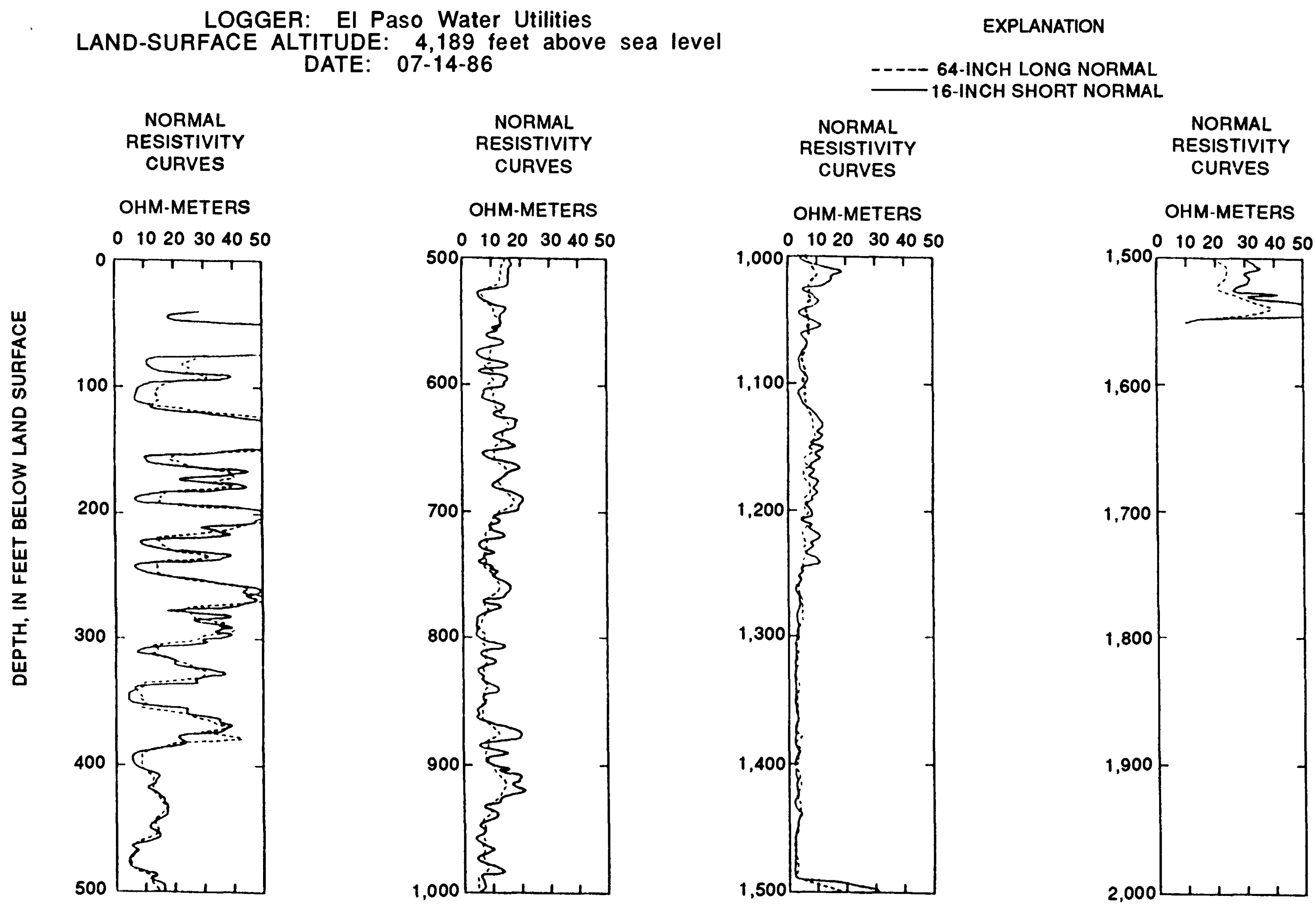


Figure 36.--Long-normal and short-normal resistivity logs from the Lanark test hole (27S.01E.04.121a).

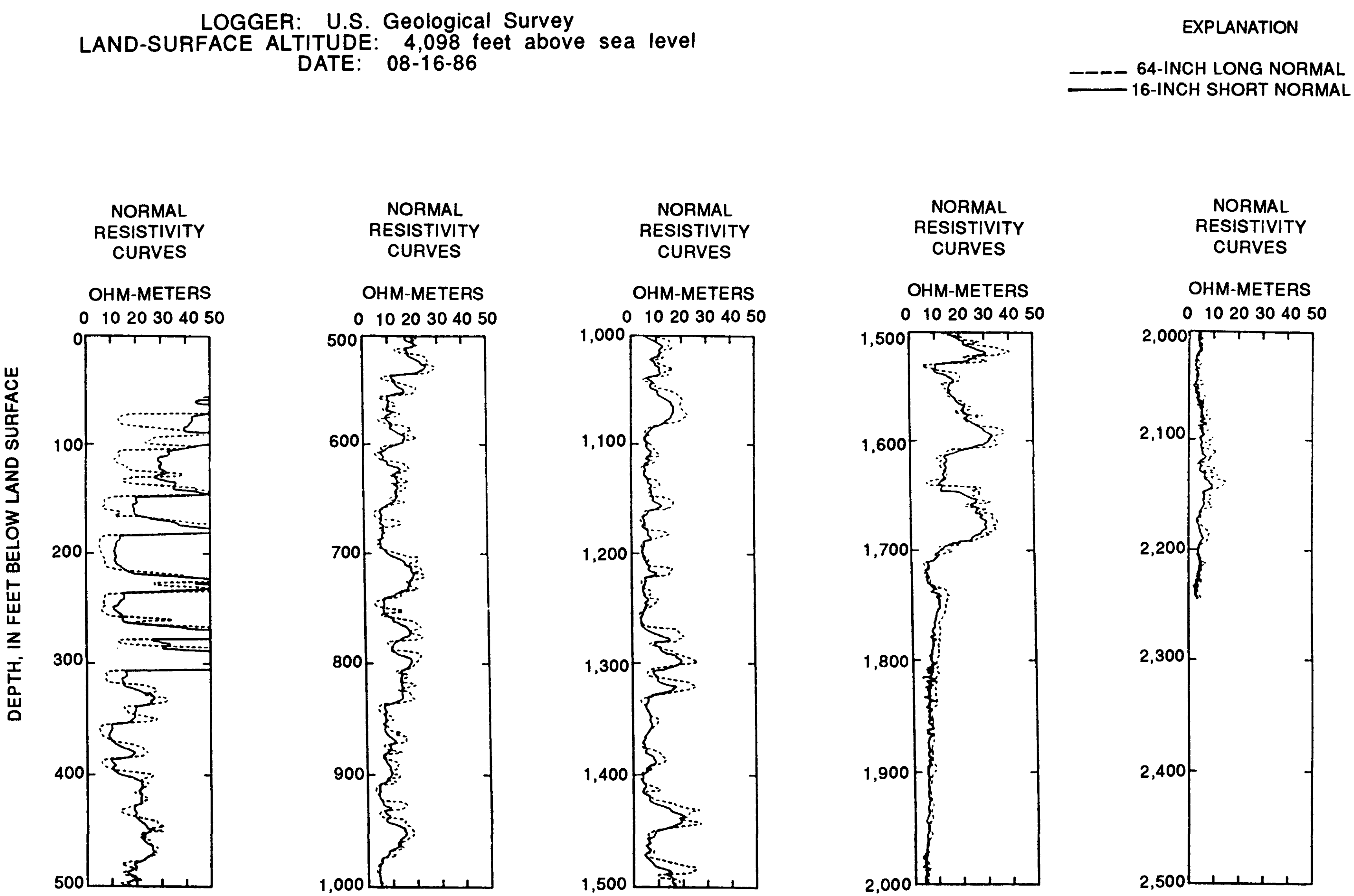


Figure 37.--Long-normal and short-normal resistivity logs from La Union test hole (27S.02E.13.331).

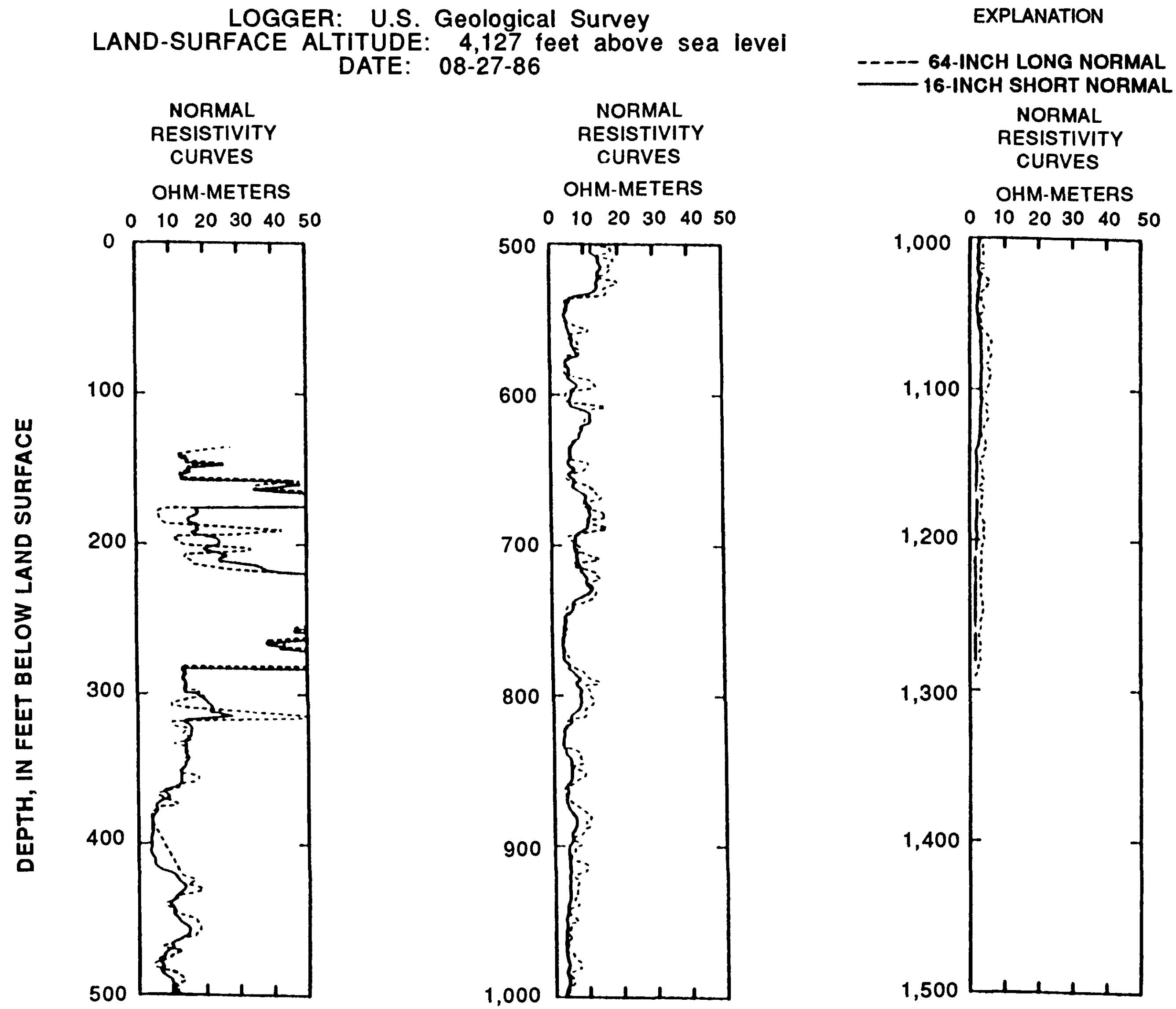
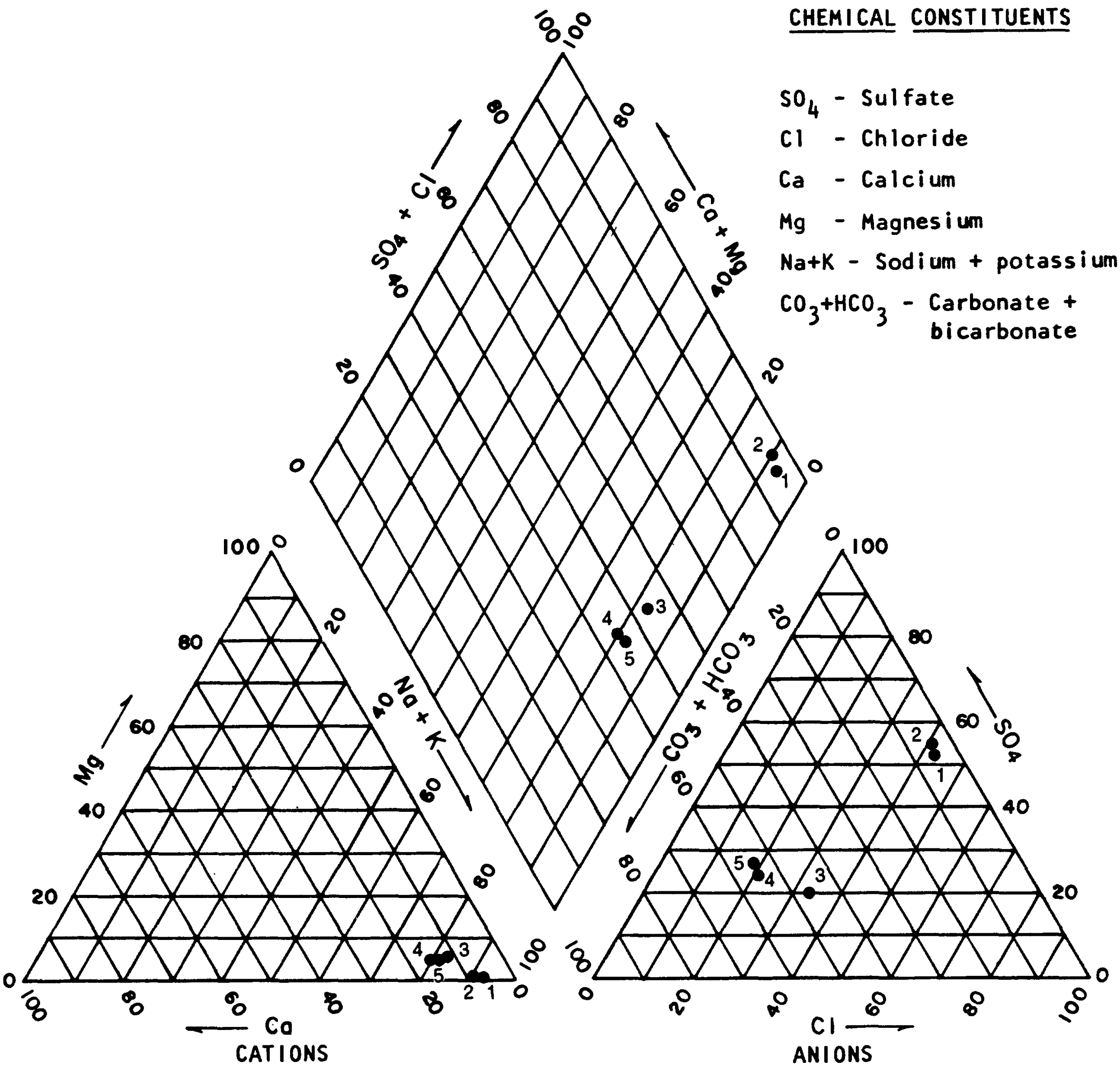


Figure 38.--Long-normal and short-normal resistivity logs from the Norla test hole (28S.01E.34.414).

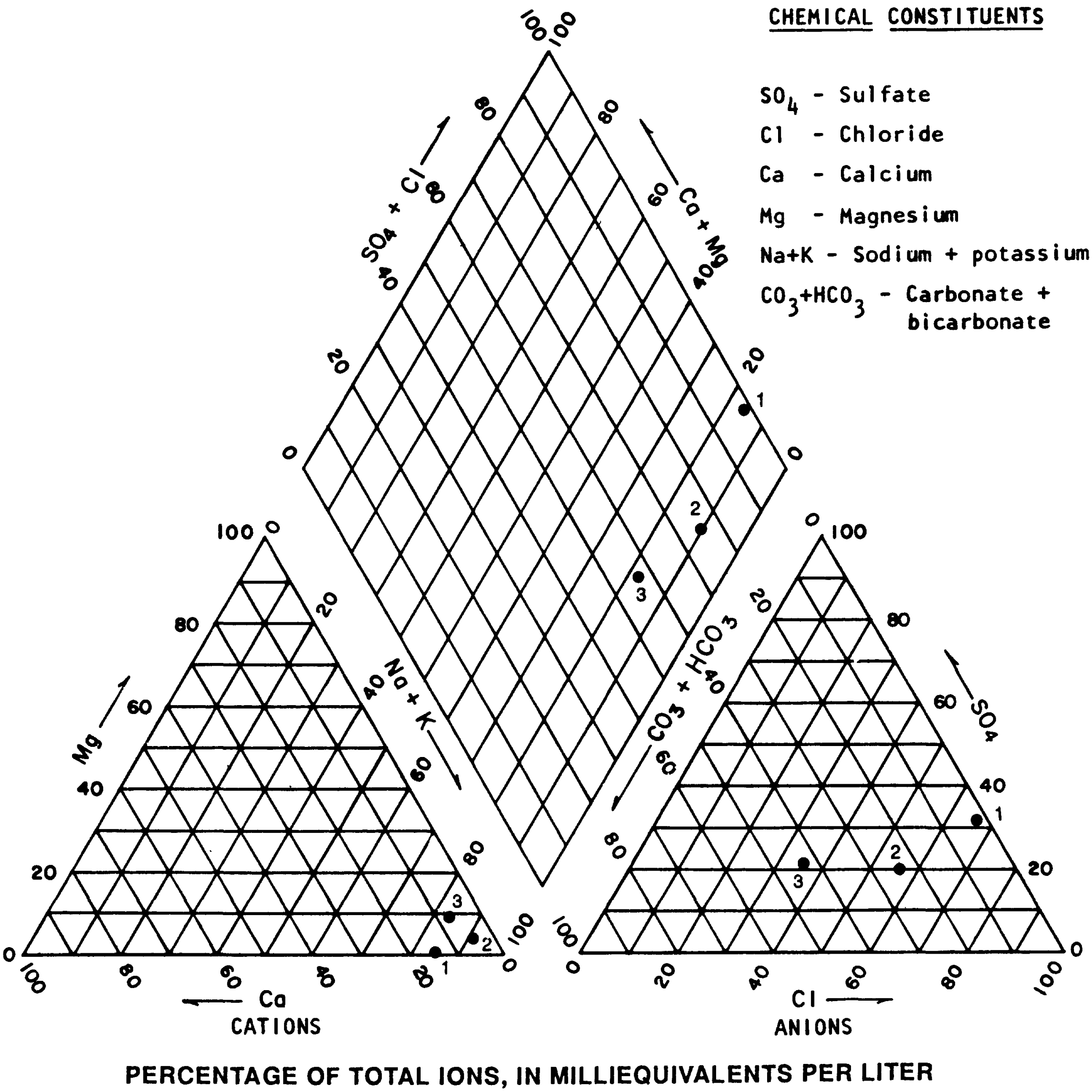


PERCENTAGE OF TOTAL IONS, IN MILLIEQUIVALENTS PER LITER

EXPLANATION

Plot number	Sample interval (feet below land surface)	Dissolved-solids concentration (milligrams per liter)
1	2,200 - 2,220	3,300
2	1,900 - 1,920	3,150
3	1,170 - 1,190	2,070
4	665 - 675	820
5	635 - 655	755

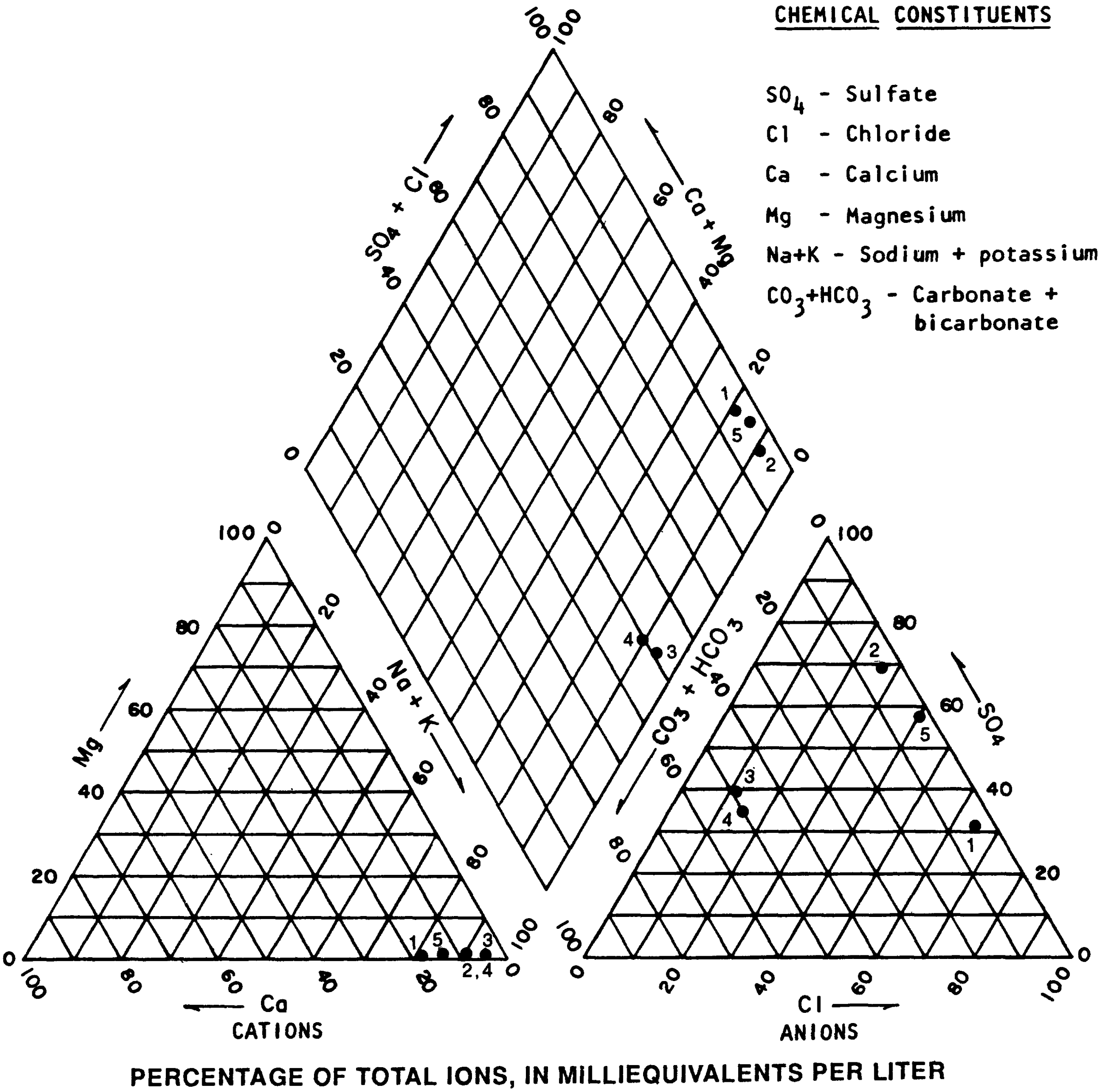
Figure 39.--Chemical analyses of water from selected depth intervals in the Afton test hole (25S.01E.06.333).



EXPLANATION

Plot number	Sample interval (feet below land surface)	Dissolved-solids concentration (milligrams per liter)
1	1,530 - 1,550	6,990
2	1,130 - 1,150	1,350
3	897 - 917	955

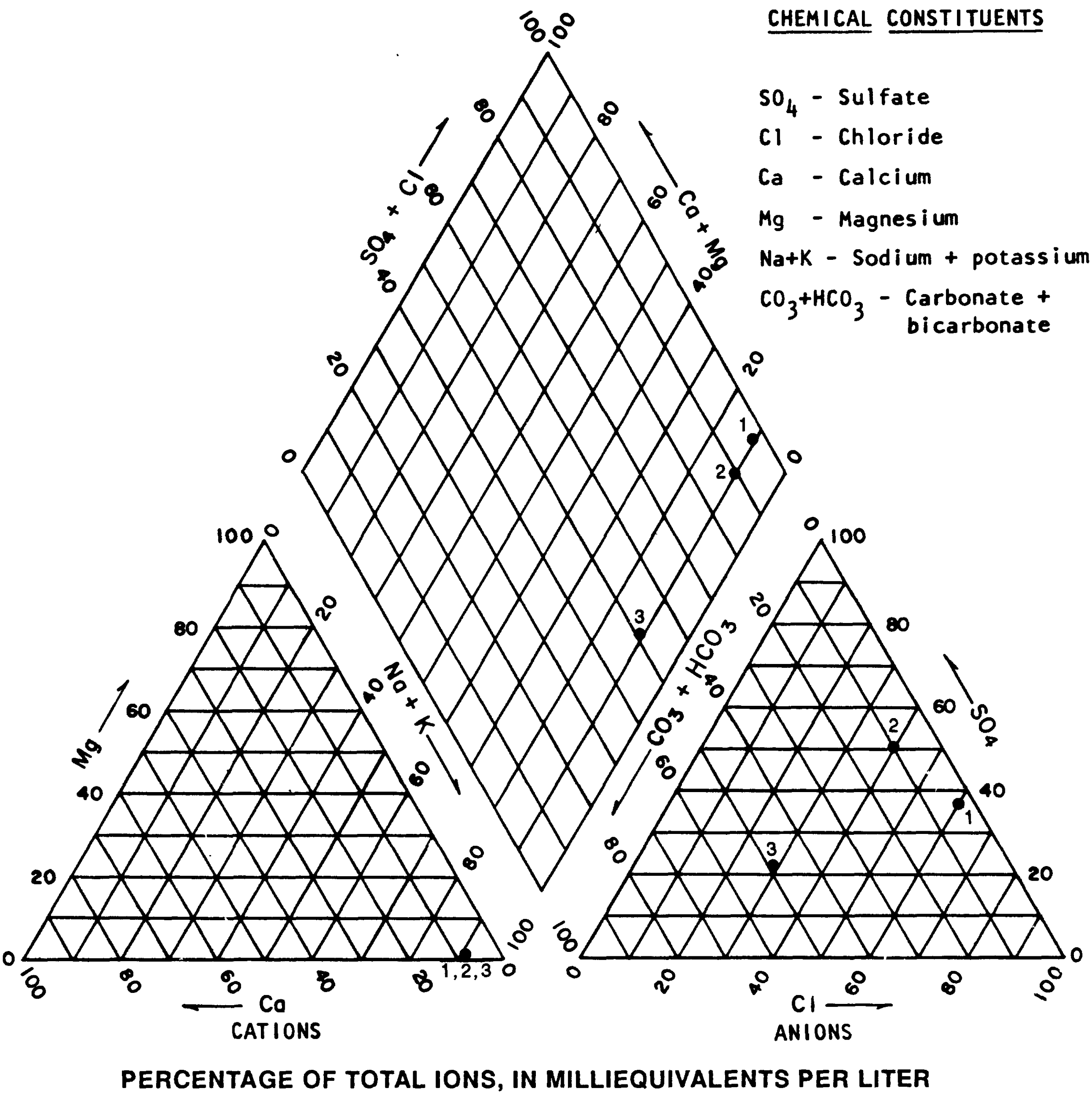
Figure 40.--Chemical analyses of water from selected depth intervals in the Lanark test hole (27S.01E.04.121a).



EXPLANATION

Plot number	Sample interval (feet below land surface)	Dissolved-solids concentration (milligrams per liter)
1	1,780 - 1,800	1,300
2	1,570 - 1,590	475
3	796 - 816	656
4	707 - 717	535
5	458 - 478	524

Figure 41.--Chemical analyses of water from selected depth intervals in La Union test hole (27S.02E.13.331).



EXPLANATION

Plot number	Sample interval (feet below land surface)	Dissolved-solids concentration (milligrams per liter)
1	979 - 999	3,780
2	794 - 814	1,500
3	518 - 528	713

Figure 42.--Chemical analyses of water from selected depth intervals in the Noria test hole (28S.01E.34.414).

SUMMARY AND CONCLUSIONS

The Mesilla ground-water basin is located in the central, southern, and western part of the Mesilla drainage basin in Doña Ana County in south-central New Mexico, El Paso County in Texas, and the State of Chihuahua in Mexico. The major aquifer of the basin is in the Quaternary flood-plain alluvium and Quaternary and Tertiary Santa Fe Group. The ground-water basin was divided into two areas of study: (1) the Mesilla Valley along the Rio Grande in the east, and (2) the West Mesa in the west.

The direction of ground-water flow in the Mesilla Valley study area is south to southeast toward the lower end of the basin. The hydraulic gradient in the shallow flood-plain alluvium within the Mesilla Valley generally is between 4 and 6 feet per mile. The hydraulic gradient in the Santa Fe Group ranges from about 100 feet per mile in the northwestern part of the study area to less than 2 feet per mile in the southwestern part of the study area.

Rio Grande streamflow is the primary source of recharge to the aquifer in the Mesilla Valley. The net transfer of water to or from the aquifer by recharge and discharge mechanisms is directly related to Rio Grande streamflow and the volume of river water available for irrigation.

Most recharge to the aquifer in the Mesilla Valley is from Rio Grande seepage in losing reaches of the stream, seepage from irrigation canals, and infiltration of applied irrigation water. The Rio Grande predominantly is a losing stream along most of the 62-mile reach in the Mesilla Valley. The length and seepage rate of losing reaches of the Rio Grande may fluctuate with annual and seasonal variations in streamflow.

Most discharge from the aquifer occurs as flow to agricultural drains, seepage to the Rio Grande in gaining reaches of the stream, well discharge, and evapotranspiration. Slight river gains have been reported in short upstream reaches and in the extreme lower reach of the river. Annual ground-water withdrawal may vary considerably depending on the volume of surface water available from the Rio Grande.

Water in the Rio Grande flood-plain alluvium/Santa Fe Group aquifer system is present under unconfined (water-table) and semiconfined (leaky-confined) conditions. Water in the shallow flood-plain alluvium generally is unconfined. Water generally occurs within the Santa Fe Group under semiconfined conditions.

Water moves from the shallow flood-plain alluvium to the upper Santa Fe Group through a series of interbedded gravel, sand, and clay lenses. Thin, interbedded clay lenses in the lower part of the flood-plain alluvium and upper part of the Santa Fe Group restrict vertical flow and result in semiconfined conditions at depth. Horizontal permeability usually exceeds vertical permeability by several orders of magnitude. The thickness and extent of finer grained, less permeable material increase vertically with depth and horizontally toward the southern end of the basin.

River stage and ground-water levels were recorded at the Las Cruces, Mesquite, and Cañutillo well-field hydrologic sections. Water-level records for water years 1985 and 1986 represent Rio Grande stage and potentiometric heads in the aquifer system during wet years, with full surface-water allocation from the Rio Grande. Downward vertical hydraulic gradients were recorded in all well groups at the Mesilla Valley hydrologic sections. Seasonal trends in the shallow water table generally correspond to recharge during the irrigation season. Under static conditions, potentiometric head in observation wells completed within the upper 350 feet of the aquifer system generally corresponds to seasonal trends in the shallow water table.

The Rio Grande is in hydraulic connection with the aquifer system. Water levels in nearby observation wells correspond to changes in river stage and indicate significant recharge to the aquifer at the river. Recorded hydraulic gradients from the river to the aquifer identify the Rio Grande as a losing river at the Las Cruces, Mesquite, and Cañutillo well-field hydrologic sections.

Freshwater zones are overlain by zones of slightly saline to saline water in the Mesilla Valley. Evapotranspiration concentrates the dissolved solids at the shallow water table and causes increased salinity in the upper part of the aquifer. The shallow, slightly saline to saline water is flushed from the aquifer by surface-water recharge near the Rio Grande and irrigation canals. The zone of slightly saline water overlying the freshwater zone is absent or thin near the Rio Grande and increases in thickness away from the river.

The direction of ground-water flow in the West Mesa is toward the southeast corner of the study area. The hydraulic gradient in the northwestern West Mesa ranges from more than 100 feet per mile to 5 feet per mile, decreasing toward the southeast. In the south-central part of the West Mesa, the hydraulic gradient is about 1.3 feet per mile. In the West Mesa, there is little recharge or discharge of ground water from the Mesilla ground-water basin.

Geohydrologic data collected from four test holes on the West Mesa indicate that the thickness of the freshwater zone is less than previously estimated in the vicinity of the proposed West Mesa well field, and thicker than previously estimated east of the proposed well field. The thickness of the Santa Fe Group on the horst between the Fitzgerald fault zone and the Mid-Basin fault zone is almost 500 to 900 feet less than previous estimates at the Lanark test hole. The dominant cation in all samples from the four test holes is sodium; the dominant anion varies.

Lithologic data, borehole-geophysical logs, water-quality data, and potentiometric contours of ground water in the upper Santa Fe Group indicate a hydraulic connection between the Mesilla Valley and West Mesa. The effects of structural controls on the thickness, aquifer characteristics, and water quality of the aquifer and on the regional flow system(s) are not well understood for many parts of the study area.

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Table 1.--Records of selected wells in the Mesilla ground-water basin

[Main geologic unit: SNTF, Santa Fe Group; AVMB, flood-plain alluvium. Depth of well: R, reported. Altitude: datum is sea level. Water level: P, pumping; RP, recently pumped. Use of water: H, domestic; I, irrigation; S, stock; U, unused. Remarks: OWN, other well numbers or names; USBR, U.S. Bureau of Reclamation; EBID, Elephant Butte Irrigation District; SI, screened interval, in feet below land surface; QW, chemical analysis available; WL, additional water-level measurements available. -- indicates no data]

					Water level			
Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Depth below land surface (feet)	Date measured	Use of water	Remarks
1	22S.01W.19.333	SNTF	250	4,460	156.08	01-23-84	U	--
					158.62	02-26-85		
					160.50	03-20-86		
					161.82	02-09-87		
2	22S.01E.09.241a	AVMB	--	3,930.1	7.7	02-01-84	U	OWN: USBR-26; QW; WL
					9.3	02-01-85		
					8.6	02-01-86		
					7.2	02-01-87		
3	22S.01E.09.333	AVMB	--	3,928.1	6.9	02-01-84	U	OWN: USBR-20; QW; WL
					7.7	02-01-85		
					6.9	02-01-86		
					7.0	02-01-87		
4	22S.01E.16.433	AVMB	--	3,923.4	9.4	02-01-84	U	OWN: USBR-19; QW; WL
					9.2	02-01-85		
					8.5	02-01-86		
					8.2	02-01-87		
5	22S.01E.33.341	AVMB	--	3,906.6	7.9	02-01-84	U	OWN: USBR-15; QW; WL
					8.0	02-01-85		
					6.7	02-01-86		
					6.5	02-01-87		
6	22S.01E.35.334	AVMB	--	3,909.9	13.9	02-01-84	U	OWN: USBR-18; QW; WL
					14.0	02-01-85		
					13.3	02-01-86		
					12.9	02-01-87		
7	22S.01E.35.434b	AVMB	--	3,909.6	15.0	02-01-84	U	OWN: USBR-17; QW; WL
					15.9	02-01-85		
					15.4	02-01-86		
					13.9	02-01-87		
8	23S.01W.25.444	SNTF	380	4,197	329.70	02-22-84	U	SI: 330-380; WL
					327.11	02-01-85		
					327.62	02-10-87		

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
9	23S.02W.01.422	SNTF	--	4,460	200.58	02-23-83	U	--
					212.38	01-23-84		
					215.37	02-27-85		
10	23S.02W.12.122	SNTF	--	4,463	175.1	01-23-84	U	--
					217.34	02-27-85		
					219.83	03-20-86		
					215.50	02-09-87		
11	23S.02W.13.134	SNTF	--	4,431	182.85	01-23-84	--	--
					185.62	02-27-85		
					188.04	03-20-86		
					183.43	02-09-87		
12	23S.02W.13.341	SNTF	--	4,429	213.10	01-23-84	I	OWN: 23S.02W.13.311; QW; WL
					199.5	02-27-85		
					202.08	03-20-86		
					201.35	02-09-87		
13	23S.01E.09.433	AVMB	--	3,894.7	8.3	02-01-84	U	OWN: USBR-16; QW; WL
					9.2	02-01-85		
14	23S.01E.16.424	AVMB	--	3,865.7	13.4	02-01-84	U	OWN: USBR-12; QW; WL
					14.4	02-01-85		
					13.4	02-01-86		
					13.6	02-01-87		
15	23S.01E.22.232a	SNTF	322	3,888.6	7.91	01-16-85	U	OWN: LC-1A; SI: 295-300; QW; WL
16	23S.01E.22.232b	SNTF	117	3,888.6	5.88	01-16-85	U	OWN: LC-1B; SI: 95-100; QW; WL
17	23S.01E.22.232c	AVMB	42	3,888.6	5.75	01-17-85	U	OWN: LC-1C; SI: 31-36; QW; WL
18	23S.01E.22.241a	SNTF	314	3,888.0	16.23	01-17-85	U	OWN: LC-2A; SI: 300-305; QW; WL
19	23S.01E.22.241b	SNTF	119	3,888.0	9.92	01-17-85	U	OWN: LC-2B; SI: 100-105; QW; WL
20	23S.01E.22.241c	AVMB	40	3,888.0	6.44	01-17-85	U	OWN: LC-2C; SI: 30-35; QW; WL
21	23S.01E.23.244a	SNTF	332	3,889.7	22.26	03-06-85	U	OWN: LC-3A; SI: 322-327; QW; WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
22	23S.01E.23.244b	SNTF	120	3,889.7	21.32	03-06-85	U	OWN: LC-3B; SI: 110-115; QW; WL
23	23S.01E.23.244c	AVMB	50	3,889.7	21.20	03-06-85	U	OWN: LC-3C; SI: 40-45; QW; WL
24	23S.01E.27.334	AVMB	--	3,882.3	6.3	02-01-84	U	OWN: USBR-11; QW; WL
					6.2	02-01-85		
					5.4	02-01-86		
					5.4	02-01-87		
25	24S.01W.22.121	SNTF	--	4,230	353.25	01-24-83	S	OWN: 24S.01W.22.123; QW; WL
					353.85	02-28-85		
					353.33	03-20-86		
26	24S.02W.36.111	SNTF	--	4,319	332.12	03-06-85	S	--
					437.4P	03-20-86		
27	24S.01E.13.221a	SNTF	370	3,863	9.52	02-01-85	U	OWN: EBID 5; SI: 145-370; QW; WL
					8.94	02-06-86		
					8.44	02-09.87		
28	24S.02E.07.231	SNTF	460	3,870	15.55	02-01-85	U	OWN: EBID 2; SI: 180-460; WL
					14.51	02-10-86		
					13.52	02-09-87		
29	24S.02E.07.234	SNTF	310	3,871	17.88	02-01-85	U	SI: 305-310; QW; WL
					16.83	02-10-86		
					15.86	02-09-87		
30	24S.02E.07.234a	SNTF	125	3,871	17.26	02-01-85	U	SI: 120-125; QW; WL
					15.88	02-10-86		
					14.78	02-09-87		
31	24S.02E.07.234b	AVMB	80	3,871	17.16	02-01-85	U	SI: 75-80; QW; WL
					15.70	02-10-86		
					14.49	02-09.87		
32	24S.02E.08.434a	AVMB	--	3,862.9	12.4	02-01-84	U	OWN: USBR-13; WL
					11.5	02-01-85		
					9.7	02-01-86		
33	24S.02E.09.433	AVMB	--	3,861.9	13.0	02-01-84	U	OWN: USBR-14; QW; WL
					12.3	02-01-85		
					10.8	02-01-86		
					10.5	02-01-87		

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
34	24S.02E.16.124a	SNTF	307	3,861.5	16.68 14.93	01-26-84 01-15-85	U	OWN: M-4A; SI: 297-302; QW; WL
35	24S.02E.16.124b	SNTF	125	3,861.5	16.09 14.40	01-26-84 01-15-85	U	OWN: M-4B; SI: 110-115; QW; WL
36	24S.02E.16.124c	AVMB	45	3,861.5	13.85 13.17	01-30-84 01-15-85	U	OWN: M-4C; SI: 30-35; QW; WL
37	24S.02E.17.322	SNTF	464	3,860	14.97 13.23 13.68	02-01-85 02-10-86 02-09-87	U	OWN: EBID 3; SI: 180-464; QW; WL
38	24S.02E.17.414a	SNTF	312	3,858	11.14 10.34 11.19	02-01-85 02-10-86 02-09-87	U	SI: 292-297; QW; WL
39	24S.02E.17.414b	SNTF	618	3,858	16.28 16.50 15.85	02-01-85 02-10-86 02-09-87	U	SI: 612-617; QW; WL
40	24S.02E.17.423a	SNTF	686	3,858	12.26 10.96 10.31 11.09	02-01-84 02-01-85 02-10-86 02-09-87	U	OWN: EBID 1; SI: 310-680; QW; WL
41	24S.02E.17.423b	SNTF	610	3,859.8	15.72 15.87 15.30	02-01-85 02-10-86 02-09-87	U	OWN: M-3B; SI: 591-596; QW; WL
42	24S.02E.17.423c	SNTF	310	3,859.8	11.04 10.27 11.10	02-01-85 02-10-86 02-09-87	U	OWN: M-3C; SI: 302-307; QW; WL
43	24S.02E.17.423d	SNTF	121	3,859.8	10.28 9.24 9.42	02-01-85 02-10-86 02-09-87	U	OWN: M-3D; SI: 113-118; QW; WL
44	24S.02E.17.423e	AVMB	35	3,859.8	9.95 8.42 8.66	02-01-85 02-10-86 02-09-87	U	OWN: M-3E; SI: 30-35; QW; WL
45	24S.02E.19.214a	SNTF	335	3,859.2	10.45 10.96	12-01-83 01-15-85	U	OWN: M-1A; SI: 310-315; QW; WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
46	24S.02E.19.214b	SNTF	130	3,859.2	9.95 9.91	12-01-83 01-15-85	U	OWN: M-1B; SI: 115-120; QW; WL
47	24S.02E.19.214c	AVMB	50	3,859.2	6.17 6.42	12-01-83 01-15-85	U	OWN: M-1C; SI: 35-40; QW; WL
48	24S.02E.19.223a	SNTF	321	3,859.2	10.59	01-15-85	U	OWN: M-2A; SI: 309-314; QW; WL
49	24S.02E.19.223b	SNTF	122	3,859.2	9.28	01-15-85	U	OWN: M-2B; SI: 110-115; QW; WL
50	24S.02E.19.223c	AVMB	52	3,859.2	6.61	01-15-85	U	OWN: M-2C; SI: 40-45; QW; WL
51	24S.02E.21.123	SNTF	480	3,855	12.73 9.82	02-01-85 02-08-86	U	OWN: EBID 4; SI: 170-480; QW; WL
52	24S.02E.22.242	AVMB	--	3,851.4	10.1 9.8 9.0 8.3	02-01-84 02-01-85 02-01-86 02-01-87	U	OWN: USBR-10; WL
53	24S.02E.23.342	AVMB	--	3,848.6	10.9 11.3 9.0	02-01-84 02-01-85 02-01-86	U	OWN: USBR-9; QW; WL
54	24S.02E.28.334	AVMB	--	3,850.5	11.8 10.7 10.4 9.9	02-01-84 02-01-85 02-01-86 02-01-87	U	OWN: USBR-8; WL
55	25S.02W.05.133	SNTF	--	4,432	120.11 119.52 117.65	03-06-85 03-20-86 02-10-87	S	OWN: 25S.02W.05.134; WL
56	25S.02W.30.324	SNTF	--	4,288	219.98 218.85 216.15 215.74	02-16-84 02-27-85 03-21-86 02-11-87	H	--
57	25S.03W.02.214	SNTF	527R	4,499	404.18 392.62 387.75	01-24-84 02-27-85 03-02-87	S	WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
58	25S.01E.06.331	SNTF	400R	4,210	368.30	09-22-83	U	--
					368.24	02-20-85		
					367.60	03-21-86		
					368.43	02-10-87		
59	25S.01E.06.333	SNTF	680	4,209	366.52	06-20-86	U	OWN: Afton test hole; SI: 665-675; QW
					366.08	02-10-87		
60	25S.01E.16.111	SNTF	1,650	4,190	352.82	01-24-84	U	OWN: 25S.01E.16.114; WL
					352.85	02-27-85		
					352.48	02-04-87		
61	25S.01E.19.424a	SNTF	--	4,154	323.93	01-24-84	S	--
62	25S.01E.19.424b	SNTF	--	4,154	307.01	02-28-85	S	--
					309.78	03-21-86		
63	25S.02E.01.411	AVMB	12.27	3,835.3	8.3	02-01-84	U	OWN: USBR-25; QW; WL
					9.3	02-01-85		
					7.5	02-01-86		
					7.5	02-01-87		
64	25S.02E.04.114	AVMB	--	3,847	12.7	02-01-84	U	OWN: USBR-7; QW; WL
					11.5	02-01-85		
					12.1	02-01-86		
					12.4	02-01-87		
65	25S.02E.23.212	AVMB	--	3,828.6	9.1	02-01-84	U	OWN: USBR-6; WL
					8.9	02-01-85		
					8.7	02-01-86		
					8.8	02-01-87		
66	25S.02E.25.322	AVMB	--	3,821.3	9.3	02-01-84	U	OWN: USBR-5; QW; WL
					10.4	02-01-85		
					9.2	02-01-86		
					9.7	02-01-87		
67	25S.02E.28.222b	SNTF	120	3,922	104.60	02-16-84	S	WL
					103.97	01-09-85		
					103.85	02-13-87		
68	25S.02E.31.312b	SNTF	1,000R	4,171	349.77	02-19-85	S	--

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
69	25S.03E.20.421	AVMB	--	3,818.9	7.6	02-01-84	U	OWN: USBR-24; QW; WL
					7.9	02-01-85		
					6.6	02-01-86		
					6.8	02-01-87		
70	25S.03E.28.343a	AVMB	--	3,810.5	9.9	02-01-84	U	OWN: USBR-21; QW; WL
					10.1	02-01-85		
					9.3	02-01-86		
					9.6	02-01-87		
71	25S.03E.31.143	AVMB	--	3,814.3	7.6	02-01-84	U	OWN: USBR-4; WL
					7.4	02-01-85		
					7.3	02-01-86		
					7.6	02-01-87		
72	26S.01W.04.412	SNTF	445	4,211	414.19P	01-24-84	S	OWN: 26S.01W.04.322
					384.85	02-27-85		
73	26S.01W.16.334	SNTF	1,000R	4,210	388.75	02-27-85	S	--
74	26S.01W.25.412b	SNTF	--	4,194	375.42	03-26-86	U	--
					375.32	02-12-87		
75	26S.02W.15.434	SNTF	437R	4,250	409.17	02-27-85	S	QW
					409.90	03-24-86		
					408.41	02-11-87		
76	26S.02W.30.233	SNTF	800	4,333	489.58	03-07-85	S	
					488.00	03-21-86		
77	26S.01E.18.222a	SNTF	430	4,213	394.4	02-16-84	S	QW; WL
78	26S.01E.18.222b	SNTF	600R	4,213	393.1	02-28-85	H,S	
					393.5	03-21-86		
					393.16	02-10-87		
79	26S.01E.35.332	SNTF	500R	4,158	358.39	03-05-85	U	OWN: 26S.01E.35.333; WL
					358.40	03-26-86		
					363.99	02-12-87		
80	26S.02E.01.211	AVMB	--	3,812.6	8.5	02-01-84	U	OWN: USBR-3; WL
					8.5	02-01-85		
					8.1	02-01-86		
					6.4	02-01-87		
81	26S.02E.32.333	SNTF	--	4,128	332.38	02-20-84	U	--
					333.18	02-15-85		

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
82	26S.03E.03.344	AVMB	26	3,812	10.06	02-01-85	U	SI: 16-26; QW; WL
					9.71	02-06-86		
					9.47	02-09-87		
83	26S.03E.03.344a	AVMB	36	3,812	10.11	02-01-85	U	SI: 26-36; QW; WL
					9.75	02-06-86		
					9.53	02-09-87		
84	26S.03E.03.344b	AVMB	48	3,812	10.07	02-01-85	U	SI: 45-48; QW; WL
					9.73	02-06-86		
					9.48	02-09-87		
85	26S.03E.03.344c	AVMB	75	3,812	10.62	02-01-85	U	SI: 72-75; QW; WL
					10.51	02-06-86		
					9.98	02-09-87		
86	26S.03E.03.344d	SNTF	150	3,812	10.95	02-01-85	U	SI: 147-150; QW; WL
					10.57	02-06-86		
					10.07	02-09-87		
87	26S.03E.04.122	AVMB	--	3,814.6	8.4	02-01-84	U	OWN: USBR-27; WL
					9.2	02-01-85		
					7.8	02-01-86		
					8.3	02-01-87		
88	26S.03E.08.221	AVMB	--	3,809.0	9.3	02-01-84	U	OWN: USBR-23; WL
					10.0	02-01-85		
					9.9	02-01-86		
					9.3	02-01-87		
89	26S.03E.09.221a	AVMB	--	3,804.7	6.8	02-01-84	U	OWN: USBR-22; WL
					7.2	02-01-85		
					6.9	02-01-86		
					6.7	02-01-87		
90	26S.03E.15.112	AVMB	--	3,806.5	6.9	02-01-84	U	OWN: USBR-28; WL
					7.8	02-01-85		
					7.2	02-01-86		
					7.8	02-01-87		
91	26S.03E.22.211	AVMB	--	3,794.5	4.6	02-01-84	U	OWN: USBR 30; QW; WL
					4.0	02-01-85		
					4.4	02-01-86		
					4.6	02-01-87		

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
92	26S.03E.27.211	AVMB	--	3,793.6	6.8	02-01-84	U	OWN: USBR-32; QW; WL
					6.5	02-01-85		
					6.3	02-01-86		
					6.6	02-01-87		
93	26S.03E.27.212	AVMB	--	3,792.9	5.5	02-01-84	U	0WN: USBR-31; WL
					5.8	02-01-85		
					5.3	02-01-86		
					5.4	02-01-87		
94	26S.03E.32.441	AVMB	--	3,790.0	9.0	02-01-84	U	OWN: USBR-39; QW; WL
					8.6	02-01-85		
					8.9	02-01-86		
					9.3	02-01-87		
95	27S.01W.26.433	SNTF	314R	4,095	284.48	02-26-85	S	--
96	27S.02W.02.413	SNTF	406	4,203	P	02-16-85	S	--
97	27S.02W.25.111	SNTF	600	4,167	361.44	02-21-84	I	QW; WL
					361.68	02-13-85		
					374.45	03-24-86		
					374.86	02-11-87		
98	27S.01E.04.121	SNTF	560	4,189	382.89	06-13-86	U	OWN: Phillips 66; SI: 440-560
					382.81	02-12-87		
99	27S.01E.04.121a	SNTF	--	4,189	--	--	--	OWN: Lanark test hole; QW
100	27S.02E.13.331	SNTF	722	4,098	316.59	08-23-86	U	OWN: La Union test hole;
					316.69	02-13-87		SI: 707-717; QW
101	27S.02E.21.111	SNTF	--	4,092	304.20	02-15-85	U	OWN: 27S.02E.21.113
					303.72	03-26-86		
					303.91	02-12-87		
102	27S.03E.09.444	AVMB	--	3,779.1	6.9	02-01-84	U	OWN: USBR-38; QW; WL
					3.5	02-01-85		
					5.8	02-01-86		
					5.9	02-01-87		
103	27S.03E.28.314	AVMB	--	3,771.2	8.6	02-01-84	U	OWN: USBR-1; QW; WL
					8.7	02-01-85		
					7.9	02-01-86		
					8.3	02-01-87		

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
104	27S.03E.32.124a	AVMB	--	3,773.2	9.7	02-01-84	U	OWN: USBR-2; WL
					9.2	02-01-85		
					8.6	02-01-86		
					8.5	02-01-87		
105	28S.01W.07.113a	SNTF	--	4,111	308.86	02-22-84	U	WL
					310.49	03-25-86		
106	28S.01W.07.113b	SNTF	600	4,111	309.34	02-22-84	U	--
					309.74	02-12-85		
					310.95	03-25-86		
					309.57	02-12-87		
107	28S.02W.31.111	SNTF	--	4,153	315.89	03-02-84	S	--
					316.84	02-13-85		
108	28S.03W.33.443	SNTF	--	4,142	226.10	03-02-84	S	--
					280.76RP	02-13-85		
					289.08	03-25-86		
109	28S.01E.34.414	SNTF	533	4,127	327.35	09-04-86	U	OWN: Noria test hole; SI: 518-528; QW
					327.53	02-12-87		
110	28S.02E.23.222	SNTF	--	4,111	333.78	03-06-84	--	--
					334.08	02-14-85		
					333.98	03-26-86		
					335.18	02-12-87		
111	28S.02E.24.444	SNTF	--	4,079	313.50	01-22-85	U	WL
					314.46	12-02-86		
112	28S.03E.17.214	SNTF	330	3,828	70.30	01-23-85	U	WL
					70.22	12-02-86		
113	28S.03E.21.144	SNTF	300	3,803	54.64	01-23-85	U	WL
					54.48	12-02-86		
114	28S.03E.27.434	SNTF	300	3,822	72.07	01-23-85	U	WL
					71.43	12-02-86		
115	28S.03E.29.344	SNTF	550	4,065	325.56	01-22-85	U	WL
					326.58	12-02-86		
116	28S.03E.32.143	SNTF	605	4,095	328.86	01-22-85	U	WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
117	29S.02W.06.231	SNTF	715R	4,109	263.73	02-26-85	U	WL
					263.79	03-25-86		
					263.95	02-12-87		
118	29S.02W.15.234	SNTF	--	4,037	196.37	02-22-84	S	WL
119	29S.03W.13.134	SNTF	--	4,050	202.04	02-22-84	S	--
					191.92	02-20-85		
					192.08	03-25-86		
120	29S.01E.06.111	SNTF	--	4,130	326.63	03-01-84	S	--
					326.77	02-15-85		
					326.96	02-12-87		
121	29S.01E.08.124	SNTF	565	4,121	324.52	02-29-84	S	WL
					323.96	02-15-85		
					333.72	03-25-86		
122	29S.02E.06.122b	SNTF	600	4,108	307.54	02-21-85	H,S	--
					309.10	03-25-86		
					307.01	02-12-87		
123	JL-49-03-916	AVMB	--	3,754.7	7.9	02-01-84	U	OWN: USBR-36; QW
					7.1	02-01-86		
					7.4	02-01-87		
124	JL-49-04-111	SNTF	1,060	3,775.8	25.45	02-26-85	U	OWN: CR-6; SI: 740-860, 980-1,060; WL
					61.04	12-04-86		
125	JL-49-04-121	AVMB	--	3,788.4	7.0	02-01-84	U	OWN: USBR-29; QW; WL
					5.5	02-01-85		
					6.5	02-01-86		
					6.3	02-01-87		
126	JL-49-04-416	SNTF	1,013	3,768.5	21.42	02-26-85	U	OWN: CR-3; SI: 528-1,013; WL
					27.71	12-04-86		
127	JL-49-04-418	SNTF	545	3,769.8	37.78	02-26-85	U	OWN: CR-5; SI: 445-545; WL
					18.52	12-04-86		
128	JL-49-04-419	SNTF	1,050	3,772.5	33.62	02-26-85	U	OWN: CR-2; SI: 585-1,050; WL
					67.95	12-04-86		
129	JL-49-04-466	AVMB	59	3,770.6	7.86	12-05-84	U	OWN: CWF-4A; SI: 52-57; QW; WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Continued

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
130	JL-49-04-467	SNTF	159	3,770.6	10.20	12-05-84	U	OWN: CWF-4B; SI: 152-157; QW; WL
131	JL-49-04-468	SNTF	299	3,770.6	53.40	12-05-84	U	OWN: CWF-4C; SI: 292-297; QW; WL
132	JL-49-04-469	SNTF	800	3,770.6	41.11	12-05-84	U	OWN: CWF-4D; SI: 792.5-797.5; QW; WL
133	JL-49-04-470	AVMB	58	3,773.8	9.48	01-16-85	U	OWN: CWF-3A; SI: 51-56; QW; WL
134	JL-49-04-471	SNTF	158	3,773.8	12.48	01-16-85	U	OWN: CWF-3B; SI: 151-156; QW; WL
135	JL-49-04-472	SNTF	298	3,773.8	48.60	01-16-85	U	OWN: CWF-3C; SI: 291-296; QW; WL
136	JL-49-04-473	SNTF	799	3,773.8	37.05	01-16-85	U	OWN: CWF-3D; SI: 792-797; QW; WL
137	JL-49-04-474	AVMB	47	3,773.5	8.74	02-04-85	U	OWN: CWF-2A; SI: 40-45; QW; WL
138	JL-49-04-475	SNTF	158	3,773.5	13.48	02-04-85	U	OWN: CWF-2B; SI: 151-156; QW; WL
139	JL-49-04-476	SNTF	300	3,773.5	44.44	02-04-85	U	OWN: CWF-2C; SI: 293-298; QW; WL
140	JL-49-04-477	SNTF	799	3,773.5	51.31	02-04-85	U	OWN: CWF-2D; SI: 792-797; QW; WL
141	JL-49-04-478	AVMB	52	3,776.7	12.05	02-15-85	U	OWN: CWF-1A; SI: 45-50; QW; WL
142	JL-49-04-479	SNTF	156	3,776.7	19.42	02-15-85	U	OWN: CWF-1B; SI: 149-154; QW; WL
143	JL-49-04-480	SNTF	334	3,776.7	48.73	02-15-85	U	OWN: CWF-1C; SI: 327-332; QW; WL
144	JL-49-04-481	SNTF	803	3,776.7	53.19	02-15-85	U	OWN: CWF-1D; SI: 796-801; QW; WL

Table 1.--Records of selected wells in the Mesilla ground-water basin--Concluded

Well number	Location[1]	Main geologic unit	Depth of well (feet)	Altitude of land surface (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Use of water	Remarks
145	JL-49-04-701	AVMB	--	3,755.5	6.8	02-01-84	U	OWN: USBR-37; QW; WL
					6.9	02-01-85		
					6.6	02-01-86		
					6.5	02-01-87		
146	JL-49-12-117	AVMB	--	3,747.3	6.3	02-01-84	U	OWN: USBR-33; QW; WL
					6.5	02-01-85		
					6.0	02-01-86		
					5.7	02-01-87		
147	JL-49-12-501	AVMB	--	3,735.5	6.6	02-01-84	U	OWN: USBR-34; WL
					6.7	02-01-85		
					6.8	02-01-86		
					6.5	02-01-87		

[1]Well locations are shown in fig. 5.

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin

[deg C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; 110AVMB, Quaternary flood-plain alluvium; 112SNTF, Quaternary and Tertiary Santa Fe Group; --, no data; <, less than]

Well location and name	Date	Geo-logic unit	Altitude of land-surface datum (feet above sea level)	Depth to top of sample inter-val (feet)	Depth to bot-tom of sample inter-val (feet)	Temper-ature (deg C)	pH (stand-ard units)	pH, lab (stand-ard units)	Spe-cific con-duct-ance, lab (µS/cm)	Solids, residue at 180 deg C, dis-solved (mg/L)	Solids, sum of constit-uents, dis-solved (mg/L)	Alka-linity, lab (mg/L as $CaCO_3$)	Alka-linity, field (mg/L as $CaCO_3$)	Chlo-ride, dis-solved (mg/L as Cl)	Sulfate, dis-solved (mg/L as SO_4)	Fluo-ride, dis-solved (mg/L as F)	Nitro-gen NO_2+NO_3, dis-solved (mg/L as N)
22S.01E.09.241 USBR-26A	04-29-86	110AVMB	3,930	--	--	21.0	--	7.40	2,260	--	1,400	271	--	180	540	0.8	<0.10
22S.01E.09.333 USBR-20	04-29-86	110AVMB	3,928	--	--	19.0	--	7.90	2,410	--	1,500	319	--	220	540	0.3	11.0
22S.01E.16.433 USBR-19	04-29-86	110AVMB	3,923	--	--	18.0	--	8.20	1,030	--	620	66	--	140	230	1.0	<0.10
22S.01E.33.341 USBR-15	04-29-86	110AVMB	3,907	--	--	20.0	--	7.70	804	--	500	234	--	49	120	1.2	0.30
22S.01E.35.334 USBR-18	04-28-86	110AVMB	3,910	--	--	19.0	--	7.50	1,060	--	610	185	--	83	180	0.5	0.20
22S.01E.35.434 USBR-17B	04-28-86	110AVMB	3,909	--	--	18.0	--	7.60	703	--	430	176	--	48	120	0.8	0.14
23S.01E.23.244A LC-3A	11-17-84	112SNTF	3,890	322	327	19.0	8.10	8.20	1,280	866	830	200	--	150	270	0.2	<0.10
23S.01E.23.244B LC-3B	11-20-84	112SNTF	3,890	110	115	19.0	7.90	8.10	2,630	1,960	1,800	359	--	120	880	0.2	<0.10
23S.01E.23.244C LC-3C	11-27-84	110AVMB	3,890	40	45	21.0	7.90	8.00	2,970	2,170	2,100	374	--	290	880	0.3	<0.10
23S.01E.09.433 USBR-16	04-29-86	110AVMB	3,895	--	--	19.5	--	7.70	2,510	--	1,700	345	--	240	640	0.6	<0.10
23S.01E.16.424 USBR-12	04-29-86	110AVMB	3,866	--	--	20.5	--	7.50	942	--	600	307	--	50	140	0.6	0.27
23S.01E.22.232A LC-1A	11-06-84	112SNTF	3,889	295	300	20.0	8.80	8.30	560	330	340	118	--	51	81	0.4	<0.10
23S.01E.22.232B LC-1B	10-10-84	112SNTF	3,889	95	100	20.0	8.20	8.20	1,090	702	690	172	--	110	220	0.4	<0.10
23S.01E.22.232C LC-1C	10-12-84	110AVMB	3,889	31	36	27.0	7.00	8.30	700	437	430	139	--	50	140	0.6	<0.10
23S.01E.22.241A LC-2A	11-09-84	112SNTF	3,888	300	305	17.0	8.20	8.40	517	302	300	132	--	41	62	0.3	<0.10
23S.01E.22.241B LC-2B	10-20-84	112SNTF	3,888	100	105	18.0	--	8.20	1,190	783	760	179	--	130	250	0.3	<0.10
23S.01E.22.241C LC-2C	10-22-84	110AVMB	3,888	30	35	20.0	--	8.30	914	573	580	168	--	73	190	0.6	<0.10
23S.01E.27.334 USBR-11	04-29-86	110AVMB	3,882	--	--	17.5	--	8.00	714	--	410	157	--	48	99	0.8	<0.10
24S.02E.09.433 USBR-14	04-24-86	110AVMB	3,862	--	--	19.5	--	7.80	2,140	--	1,300	236	--	130	540	0.4	9.10
24S.02E.16.124A M-4A	11-21-83	112SNTF	3,861	297	302	18.0	8.40	8.20	493	306	310	148	--	45	44	0.4	<0.10
24S.02E.16.124B M-4B	12-06-83	112SNTF	3,861	110	115	18.0	--	7.90	1,390	949	970	162	--	140	380	0.3	0.13
24S.02E.16.124C M-4C	12-08-83	110AVMB	3,861	30	35	17.5	--	7.90	1,580	1,140	1,100	164	--	150	460	0.4	0.29
24S.02E.19.214A M-1A	11-08-83	112SNTF	3,859	310	315	18.0	8.20	8.20	562	372	360	146	--	51	75	0.2	<0.10
24S.02E.19.214B M-1B	11-11-83	112SNTF	3,859	115	120	16.5	9.70	8.30	700	460	450	51	--	130	130	0.3	<0.10
24S.02E.19.214C M-1C	11-16-83	110AVMB	3,859	35	40	17.5	9.80	9.30	705	519	530	174	--	59	170	0.7	<0.10

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin--Continued

Well location and name	Date	Geologic unit	Altitude of land-surface datum (feet above sea level)	Depth to top of sample interval (feet)	Depth to bottom of sample interval (feet)	Temperature (deg C)	pH (standard units)	pH, lab (standard units)	Specific conductance, lab (µS/cm)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Alkalinity, lab (mg/L as $CaCO_3$)	Alkalinity, field (mg/L as $CaCO_3$)	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Nitrogen NO_2+NO_3, dissolved (mg/L as N)
24S.02E.19.223A M-2A	12-01-84	112SNTF	3,859	309	314	18.0	8.30	8.10	598	360	360	152	--	52	77	0.2	<0.10
24S.02E.19.223B M-2B	12-05-84	112SNTF	3,859	110	115	18.0	8.20	8.20	572	339	340	139	--	53	69	0.3	<0.10
24S.02E.19.223C M-2C	12-06-84	110AVMB	3,859	40	45	19.0	8.10	8.20	1,160	758	760	185	--	130	250	0.5	<0.10
24S.02E.23.342 USBR-9	04-24-86	110AVMB	3,848	--	--	18.5	--	7.40	1,810	--	1,200	449	--	130	340	1.1	1.00
25S.01E.06.333 Afton	05-28-86	112SNTF	4,209	2,200	2,220	29.5	8.50	7.70	3,330	--	2,100	77	--	460	760	4.0	<0.10
25S.01E.06.333 Afton	05-30-86	112SNTF	4,209	1,900	1,920	28.0	8.00	7.80	3,150	--	1,900	49	--	430	750	4.4	<0.10
25S.01E.06.333 Afton	05-31-86	112SNTF	4,209	1,170	1,190	28.5	8.60	8.10	2,070	--	1,200	484	--	240	180	0.8	<0.10
25S.01E.06.333 Afton	06-01-86	112SNTF	4,209	635	655	27.5	8.70	8.50	828	--	490	215	--	52	96	4.5	<0.10
25S.01E.06.333 Afton	06-06-86	112SNTF	4,209	665	675	--	8.00	8.50	755	--	460	205	195	53	82	4.4	<0.10
25S.02E.01.411 USBR-25	04-23-86	110AVMB	3,835	--	--	17.5	--	7.80	940	--	590	242	--	60	170	0.8	0.70
25S.02E.04.114 USBR-7	04-24-86	110AVMB	3,847	--	--	20.0	--	7.50	2,450	--	1,600	315	--	220	600	0.4	<0.10
25S.02E.25.322 USBR-5	04-24-86	110AVMB	3,821	--	--	--	--	7.80	4,020	--	3,000	202	--	440	1,400	2.5	<0.10
25S.03E.20.421 USBR-24	04-23-86	110AVMB	3,819	--	--	19.5	--	7.90	1,380	--	840	236	--	110	270	1.4	<0.10
25S.03E.28.343A USBR-21	04-23-86	110AVMB	3,810	--	--	20.0	--	7.50	2,600	--	1,700	314	--	300	540	1.7	<0.10
26S.03E.22.211 USBR-30	04-24-86	110AVMB	3,794	--	--	19.0	--	7.90	5,640	--	3,800	501	--	850	1,300	1.8	<0.10
26S.03E.27.211 USBR-32	05-01-86	110AVMB	3,794	--	--	--	--	8.10	789	--	480	200	--	55	130	0.7	0.75
26S.03E.32.441 USBR-39	04-23-86	110AVMB	3,790	--	--	21.0	--	7.50	1,620	--	990	370	--	110	290	1.0	<0.10
27S.01E.04.121a Lanark	07-16-86	--	4,189	1,530	1,550	42.5	8.60	7.90	10,100	6,990	6,900	66	--	2,700	1,700	2.6	<0.10
27S.01E.04.121a Lanark	07-16-86	112SNTF	4,189	1,130	1,150	35.0	8.70	8.80	2,010	1,350	1,200	240	--	400	180	0.9	<0.10
27S.01E.04.121a Lanark	07-17-86	112SNTF	4,189	897	917	31.5	8.60	8.70	1,510	955	950	329	--	200	160	0.9	<0.10
27S.02E.13.331 La Union	08-17-86	112SNTF	4,098	1,780	1,800	30.5	8.00	7.40	2,180	1,300	1,300	43	--	460	300	0.8	<0.10
27S.02E.13.331 La Union	08-19-86	112SNTF	4,098	1,570	1,590	32.0	8.60	8.20	584	475	320	90	--	40	130	1.7	<0.10
27S.02E.13.331 La Union	08-19-86	112SNTF	4,098	796	816	30.5	8.90	8.60	993	656	650	244	--	44	190	2.2	<0.10
27S.02E.13.331 La Union	08-19-86	112SNTF	4,098	458	478	28.5	8.50	8.50	829	524	460	121	--	80	150	1.6	<0.10
27S.02E.13.331 La Union	08-20-86	112SNTF	4,098	707	717	29.0	8.60	8.40	846	535	560	220	--	48	140	2.2	<0.10
27S.03E.09.444 USBR-38	04-22-86	110AVMB	3,779	--	--	21.0	--	4.80	759	--	--	<3.0	--	180	59	0.5	<0.10
27S.03E.28.314 USBR-1	04-22-86	110AVMB	3,771	--	--	23.5	--	9.10	3,650	--	1,600	450	--	510	220	0.4	<0.10
28S.01E.34.414 Noria	08-29-86	112SNTF	4,127	979	999	31.0	7.80	7.80	5,510	3,780	3,600	81	--	1,200	1,000	1.0	<0.10
28S.01E.34.414 Noria	08-29-86	112SNTF	4,127	794	814	28.0	7.80	8.20	2,330	1,500	1,500	118	--	330	560	1.3	<0.10
28S.01E.34.414 Noria	08-29-86	112SNTF	4,127	518	528	--	7.90	8.50	1,210	713	790	317	--	140	130	1.3	<0.10

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin--Continued

Well location and name	Date	Geo-logic unit	Altitude of land-surface datum (feet above sea level)	Depth to top of sample inter-val (feet)	Depth to bot-tom of sample inter-val (feet)	Temper-ature (deg C)	pH (stand-ard units)	pH, lab (stand-ard units)	Spe-cific con-duct-ance, lab (µS/cm)	Solids, residue at 180 deg C, dis-solved (mg/L)	Solids, sum of constit-uents, dis-solved (mg/L)	Alka-linity, lab (mg/L as $CaCO_3$)	Alka-linity, field (mg/L as $CaCO_3$)	Chlo-ride, dis-solved (mg/L as Cl)	Sulfate, dis-solved (mg/L as SO_4)	Fluo-ride, dis-solved (mg/L as F)	Nitro-gen NO_2+NO_3, dis-solved (mg/L as N)
JL-49-03-916 USBR-36	05-01-86	110AVMB	3,755	--	--	21.0	--	7.50	936	--	550	265	--	56	120	0.5	<0.10
JL-49-04-121 USBR-29	04-23-86	110AVMB	3,788	--	--	20.5	--	8.10	1,990	--	1,200	138	--	250	430	1.2	<0.10
JL-49-04-466 CWF-4A	12-04-84	110AVMB	3,771	52	57	--	--	8.30	1,400	--	1,164	386	--	75	285	0.34	--
JL-49-04-467 CWF-4B	12-04-84	112SNTF	3,771	152	157	--	--	8.20	3,150	--	2,320	378	--	369	750	0.12	--
JL-49-04-468 CWF-4C	11-30-84	112SNTF	3,771	292	297	--	--	8.60	800	--	519	94	--	88	155	0.50	--
JL-49-04-469 CWF-4D	11-20-84	112SNTF	3,771	792	5797.5	--	--	8.90	480	--	276	68	--	30	77	1.1	--
JL-49-04-470 CWF-3A	01-10-85	110AVMB	3,774	51	56	--	8.00	8.20	1,200	779	780	185	182	120	260	0.6	<0.10
JL-49-04-471 CWF-3B	01-09-85	112SNTF	3,774	151	156	--	8.00	8.20	1,280	825	830	140	139	160	270	0.2	<0.10
JL-49-04-472 CWF-3C	01-07-85	112SNTF	3,774	291	296	--	7.80	8.40	551	340	340	75	74	50	100	0.8	<0.10
JL-49-04-473 CWF-3D	12-31-84	112SNTF	3,774	792	797	30.5	8.10	8.70	423	268	270	63	61	32	81	0.9	<0.10
JL-49-04-474 CWF-2A	01-30-85	110AVMB	3,774	40	45	170.0	8.10	8.20	1,240	--	800	--	198	120	270	0.6	<0.10
JL-49-04-475 CWF-2B	01-29-85	112SNTF	3,774	151	156	18.0	8.00	8.30	1,230	--	800	--	175	130	260	0.4	0.13
JL-49-04-476 CWF-2C	01-29-85	112SNTF	3,774	293	298	24.0	7.70	7.90	806	--	510	--	57	110	160	0.6	0.25
JL-49-04-477 CWF-2D	01-25-85	112SNTF	3,774	792	797	29.5	8.10	8.00	417	--	260	--	67	30	69	0.8	0.20
JL-49-04-478 CWF-1A	02-13-85	110AVMB	3,777	45	50	19.0	8.00	8.10	1,430	--	890	--	185	150	300	0.7	0.81
JL-49-04-479 CWF-1B	02-12-85	112SNTF	3,777	149	154	--	7.90	8.10	1,270	--	840	--	143	140	270	0.2	0.41
JL-49-04-480 CWF-1C	02-12-85	112SNTF	3,777	327	332	24.0	7.70	7.30	708	--	430	--	64	90	120	0.5	0.24
JL-49-04-481 CWF-1D	02-15-85	112SNTF	3,777	796	801	29.0	8.60	8.70	479	--	290	--	75	39	79	0.8	<0.10
JL-49-04-701 USBR-37	04-22-86	110AVMB	3,756	--	--	22.0	--	9.80	3,720	--	2,000	585	--	710	140	1.3	0.10
JL-49-12-117 USBR-33	04-22-86	110AVMB	3,747	--	--	21.5	--	8.20	4,000	--	2,500	354	--	660	620	0.2	0.19
JL-49-12-501 USBR-34	04-21-86	110AVMB	3,735	--	--	25.0	--	7.50	15,200	--	11,000	119	--	4,000	3,200	0.4	<0.10

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin--Continued

Well location and name	Date	Phosphorus, dissolved (mg/L as P)	Calcium, dissolved (mg/L as Ca)	Magnesium, dis solved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Manganese, dissolved (µg/L as Mn)	Silver, dissolved (µg/L as Ag)	Zinc, dissolved (µg/L as Zn)	Selenium, dissolved (µg/L as Se)
22S.01E.09.241 USBR-26A	04-29-86	0.02	180	45	240	30	22	--	--	360	--	--	--	--	1	--	--	--	--
22S.01E.09.333 USBR-20	04-29-86	<0.01	220	52	250	23	16	--	--	400	--	--	--	--	37	--	--	--	--
22S.01E.16.433 USBR-19	04-29-86	<0.01	29	1.5	170	7.1	21	--	--	60	--	--	--	--	2	--	--	--	--
22S.01E.33.341 USBR-15	04-29-86	0.02	71	18	68	4.6	23	--	--	110	--	--	--	--	<1	--	--	--	--
22S.01E.35.334 USBR-18	04-28-86	<0.01	65	21	120	14	18	--	--	190	--	--	--	--	1	--	--	--	--
22S.01E.35.434 USBR-17B	04-28-86	<0.01	58	11	60	11	16	--	--	100	--	--	--	--	<1	--	--	--	--
23S.01E.23.244A LC-3A	11-17-84	0.01	170	26	68	5.6	23	--	--	80	--	--	--	6	2	460	--	--	--
23S.01E.23.244B LC-3B	11-20-84	0.02	240	56	220	8.6	31	--	--	230	--	--	--	60	2	2,900	--	--	--
23S.01E.23.244C LC-3C	11-27-84	<0.01	330	50	310	15	37	--	--	430	--	--	--	40	1	3,300	--	--	--
23S.01E.09.433 USBR-16	04-29-86	0.02	170	37	330	10	28	--	--	410	--	--	--	--	1	--	--	--	--
23S.01E.16.424 USBR-12	04-29-86	0.01	110	16	70	7.1	24	--	--	150	--	--	--	--	<1	--	--	--	--
23S.01E.22.232A LC-1A	11-06-84	0.01	62	9.3	41	3.2	22	--	--	60	--	--	--	13	<1	67	--	--	--
23S.01E.22.232B LC-1B	10-10-84	0.02	84	14	130	4.3	24	--	--	180	--	--	--	230	3	320	--	--	--
23S.01E.22.232C LC-1C	10-12-84	0.03	52	11	73	6.6	17	--	--	140	--	--	--	130	3	53	--	--	--
23S.01E.22.241A LC-2A	11-09-84	0.01	50	8.0	38	3.2	23	--	--	60	--	--	--	7	<1	78	--	--	--
23S.01E.22.241B LC-2B	10-20-84	0.03	110	17	120	4.9	23	--	--	150	--	--	--	150	3	660	--	--	--
23S.01E.22.241C LC-2C	10-22-84	0.02	67	13	110	6.1	19	--	--	160	--	--	--	150	3	320	--	--	--
23S.01E.27.334 USBR-11	04-29-86	<0.01	66	9.4	70	5.0	18	--	--	140	--	--	--	--	1	--	--	--	--
24S.02E.09.433 USBR-14	04-24-86	<0.01	170	35	260	14	20	--	--	470	--	--	--	--	2	--	--	--	--
24S.02E.16.124A M-4A	11-21-83	0.02	45	9.0	46	3.1	24	--	--	70	--	--	--	8	3	110	--	--	--
24S.02E.16.124B M-4B	12-06-83	0.01	160	28	120	10	29	--	--	120	--	--	--	12	<1	520	--	--	--
24S.02E.16.124C M-4C	12-08-83	0.01	150	25	170	9.3	32	--	--	200	--	--	--	8	<1	320	--	--	--
24S.02E.19.214A M-1A	11-08-83	0.01	54	8.6	55	3.7	25	--	--	60	--	--	--	690	4	34	--	--	--
24S.02E.19.214B M-1B	11-11-83	<0.01	56	11	67	5.7	21	--	--	50	--	--	--	9	2	6	--	--	--
24S.02E.19.214C M-1C	11-16-83	0.28	53	5.8	110	7.7	20	--	--	190	--	--	--	6	2	34	--	--	--

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin--Continued

Well location and name	Date	Phosphorus, dissolved (mg/L as P)	Calcium, dissolved (mg/L as Ca)	Magnesium, dis solved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Manganese, dissolved (µg/L as Mn)	Silver, dissolved (µg/L as Ag)	Zinc, dissolved (µg/L as Zn)	Selenium, dissolved (µg/L as Se)
24S.02E.19.223A M-2A	12-01-84	0.02	54	9.2	52	3.3	23	–	–	70	–	–	–	10	5	30	–	–	–
24S.02E.19.223B M-2B	12-05-84	0.01	53	8.7	46	3.3	22	–	–	60	–	–	–	3	6	120	–	–	–
24S.02E.19.223C M-2C	12-06-84	0.02	100	17	120	5.5	22	–	–	160	–	–	–	8	5	610	–	–	–
24S.02E.23.342 USBR-9	04-24-86	<0.01	140	29	210	16	38	–	–	330	–	–	–	–	<1	–	–	–	–
25S.01E.06.333 Afton	05-28-86	–	37	2.5	690	11	63	<1	100	–	<1	<10	1	30	<1	110	<1	1,400	<1
25S.01E.06.333 Afton	05-30-86	–	47	2.5	590	9.0	57	7	100	–	<1	<10	1	30	<1	80	<1	1,600	<1
25S.01E.06.333 Afton	05-31-86	–	51	13	390	28	34	8	100	–	<1	<10	2	40	1	100	<1	190	<1
25S.01E.06.333 Afton	06-01-86	–	22	3.4	140	16	29	3	49	–	<1	<10	2	1,100	23	68	<1	500	<1
25S.01E.06.333 Afton	06-06-86	–	25	3.4	130	17	32	3	45	–	<1	<10	1	27	<1	26	<1	82	<1
25S.02E.01.411 USBR-25	04-23-86	<0.01	86	19	78	10	23	–	–	130	–	–	–	–	2	–	–	–	–
25S.02E.04.114 USBR-7	04-24-86	0.04	250	40	280	11	33	–	–	380	–	–	–	–	<1	–	–	–	–
25S.02E.25.322 USBR-5	04-24-86	<0.01	250	70	650	7.8	15	–	–	770	–	–	–	–	28	–	–	–	–
25S.03E.20.421 USBR-24	04-23-86	<0.01	44	10	200	38	29	–	–	350	–	–	–	–	2	–	–	–	–
25S.03E.28.343A USBR-21	04-23-86	<0.01	32	15	520	20	33	–	–	470	–	–	–	–	4	–	–	–	–
26S.03E.22.211 USBR-30	04-24-86	0.03	30	30	1,200	34	33	–	–	1,700	–	–	–	–	2	–	–	–	–
26S.03E.27.211 USBR-32	05-01-86	<0.01	50	19	78	8.7	18	–	–	140	–	–	–	–	<1	–	–	–	–
26S.03E.32.441 USBR-39	04-23-86	<0.01	74	19	240	10	25	–	–	370	–	–	–	–	<1	–	–	–	–
27S.01E.04.121a Lanark	07-16-86	–	290	10	2,100	19	63	6	200	–	<1	<10	6	<10	<5	<10	<1	120	1
27S.01E.04.121a Lanark	07-16-86	–	20	12	370	13	52	2	100	–	2	<10	4	290	5	<10	<1	70	2
27S.01E.04.121a Lanark	07-17-86	–	25	16	280	6.6	67	20	60	–	<1	<10	4	17	<5	3	<1	33	1
27S.02E.13.331 La Union	08-17-86	–	76	0.6	390	3.4	45	9	200	–	<1	<10	2	30	<5	50	<1	340	<1
27S.02E.13.331 La Union	08-19-86	–	9.5	0.1	110	1.5	22	17	25	–	<1	<10	2	24	<5	3	<1	40	<1
27S.02E.13.331 La Union	08-19-86	–	9.7	1.1	210	2.8	42	32	32	–	<1	<10	3	21	<5	1	<1	20	<1
27S.02E.13.331 La Union	08-19-86	–	22	1.2	160	3.5	37	12	140	–	<1	<10	2	110	5	3	<1	20	2
27S.02E.13.331 La Union	08-20-86	–	14	2.3	180	2.4	43	26	52	–	<1	<10	4	87	15	28	<1	180	<1
27S.03E.09.444 USBR-38	04-22-86	<0.01	72	3.2	20	1.4	1.5	–	–	50	–	–	–	–	<1	–	–	–	–
27S.03E.28.314 USBR-1	04-22-86	<0.01	0.5	<0.1	560	9.8	0.8	–	–	220	–	–	–	–	2	–	–	–	–
28S.01E.34.414 Noria	08-29-86	–	84	24	1,200	9.1	34	8	<100	–	<1	<10	1	30	<5	40	<1	290	<1
28S.01E.34.414 Noria	08-29-86	–	30	4.0	460	5.3	37	36	<100	–	<1	<10	1	30	<5	10	<1	50	<1
28S.01E.34.414 Noria	08-29-86	–	15	6.1	240	11	59	27	39	–	<1	<10	4	73	<5	5	<1	46	<1

Table 2.--Chemical analyses of water samples from selected wells in the Mesilla ground-water basin--Concluded

Well location and name	Date	Phosphorus, dissolved (mg/L as P)	Calcium, dissolved (mg/L as Ca)	Magnesium, dis solved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Manganese, dissolved (µg/L as Mn)	Silver, dissolved (µg/L as Ag)	Zinc, dissolved (µg/L as Zn)	Selenium, dissolved (µg/L as Se)
JL-49-03-916 USBR-36	05-01-86	0.02	68	23	81	15	29	--	--	180	--	--	--	--	3	--	--	--	--
JL-49-04-121 USBR-29	04-23-86	0.02	70	20	260	48	23	--	--	220	--	--	--	--	1	--	--	--	--
JL-49-04-466 CWF-4A	12-04-84	--	83	16	226	8.0	25	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-467 CWF-4B	12-04-84	--	162	19	540	19	32	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-468 CWF-4C	11-30-84	--	27	3.4	135	3.0	34	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-469 CWF-4D	11-20-84	--	4.0	0.5	80	8.0	30	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-470 CWF-3A	01-10-85	0.01	55	18	180	6.7	33	--	--	220	--	--	--	28	<1	73	--	--	--
JL-49-04-471 CWF-3B	01-09-85	<0.01	55	4.4	210	5.2	37	--	--	210	--	--	--	5	5	8	--	--	--
JL-49-04-472 CWF-3C	01-07-85	0.01	13	1.6	99	3.0	32	--	--	110	--	--	--	7	4	1	--	--	--
JL-49-04-473 CWF-3D	12-31-84	0.01	4.2	0.1	83	1.2	28	--	--	100	--	--	--	33	<1	1	--	--	--
JL-49-04-474 CWF-2A	01-30-85	--	68	26	160	11	23	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-475 CWF-2B	01-29-85	--	77	7.7	180	5.8	35	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-476 CWF-2C	01-29-85	--	25	2.7	140	4.0	35	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-477 CWF-2D	01-25-85	--	3.3	0.1	85	0.9	27	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-478 CWF-1A	02-13-85	--	72	31	190	10	28	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-479 CWF-1B	02-12-85	--	54	4.3	230	4.8	46	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-480 CWF-1C	02-12-85	--	21	1.5	120	3.5	32	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-481 CWF-ID	02-15-85	--	7.5	0.03	93	1.4	23	--	--	--	--	--	--	--	--	--	--	--	--
JL-49-04-701 USBR-37	04-22-86	0.05	1.6	0.3	820	14	3.0	--	--	1,100	--	--	--	--	4	--	--	--	--
JL-49-12-117 USBR-33	04-22-86	<0.01	30	14	900	13	6.3	--	--	760	--	--	--	--	1	--	--	--	--
JL-49-12-501 USBR-34	04-21-86	<0.01	310	120	3,400	33	6.5	--	--	1,400	--	--	--	--	<1	--	--	--	--

Table 3.--Minimum mean daily, maximum mean daily, and mean annual water levels at the Mesilla Valley hydrologic sections during water year 1986

	Water level, in feet above sea level				
Site name	Minimum mean daily	Date	Maximum mean daily	Date	Mean annual
		Las Cruces hydrologic section			
Rio Grande below Picacho Bridge	3,883.8	01-08-86	3,887.6	07-18-86	3,885.6
LC-1A	3,880.8	01-13-86	3,882.5	07-24-86	3,881.7
LC-1B	3,883.0	01-13-86	3,886.6	07-18-86	3,884.7
LC-1C	3,883.1	01-11-86	3,887.0	07-18-86	3,885.0
LC-2A	3,872.1	05-30-86	3,874.5	09-24-86	3,873.1
LC-2B	3,878.6	01-12-86	3,880.9	07-23-86	3,879.9
LC-2C	3,881.9	01-11-86	3,885.1	07-18-86	3,883.6
LC-3A	3,868.8	05-24-86	3,873.0	09-24-86	3,870.6
LC-3B	3,871.0	02-23-86	3,876.7	08-26-86	3,872.9
LC-3C	3,871.2	02-24-86	3,877.2	08-26-86	3,873.2
		Mesquite hydrologic section			
Rio Grande below Mesilla Dam	3,852.4	09-23-86	3,855.7	06-18-86	3,854.0
M-1A	3,839.2	01-17-86	3,850.4	08-24-86	3,849.0
M-1B	3,844.2	01-18-86	3,851.4	08-24-86	3,850.2
M-1C	3,852.5	09-30-86	3,854.8	06-18-86	3,853.7
M-2A	3,848.6	01-17-86	3,850.7	08-24-86	3,849.4
M-2B	3,845.1	01-09-86	3,852.2	08-24-86	3,850.9
M-2C	3,852.5	01-12-86	3,855.5	06-14-86	3,853.8
M-4A	3,846.7	01-30-86	3,849.6	09-29-86	3,848.3
M-4B	3,847.9	01-30-86	3,850.2	09-29-86	3,849.2
M-4C	3,849.7	02-17-86	3,852.5	10-17-85	3,850.5

Table 3.--Minimum mean daily, maximum mean daily, and mean annual water levels at the Mesilla Valley hydrologic sections during water year 1986--Concluded

Site name	Water level, in feet above sea level				
	Minimum mean daily	Date	Maximum mean daily	Date	Mean annual
	Cañutillo well-field hydrologic section				
Rio Grande below Vinton Bridge	3,766.5	01-12-86	3,770.0	07-09-86	3,768.2
CWF-1A	3,765.2	01-08-86	3,768.2	08-15-86	3,766.7
CWF-1B	3,755.1	12-10-85	3,761.7	09-15-86	3,758.6
CWF-1C	3,718.8	10-08-85	3,751.2	09-01-86	3,737.5
CWF-1D	3,695.5	04-24-86	3,750.0	09-14-86	3,721.2
CWF-2A	3,764.0	12-10-85	3,767.3	08-30-86	3,766.0
CWF-2B	3,755.4	12-10-85	3,763.4	07-11-86	3,760.7
CWF-2C	3,717.2	10-08-85	3,751.4	09-11-86	3,737.2
CWF-2D	3,693.4	10-10-85	3,750.0	09-14-86	3,719.7
CWF-3A	3,762.3	12-10-85	3,765.5	08-31-86	3,764.5
CWF-3B	3,755.5	12-10-85	3,763.9	07-12-86	3,761.6
CWF-3C	3,714.7	10-08-85	3,751.5	09-01-86	3,736.8
CWF-3D	3,688.6	04-24-86	3,750.4	09-14-86	3,717.6
CWF-4A	3,763.7	01-07-86	3,766.5	08-15-86	3,764.7
CWF-4B	3,761.0	06-18-86	3,764.8	09-30-86	3,762.6
CWF-4C	3,707.6	10-08-85	3,752.4	09-01-86	3,736.8
CWF-4D	3,694.8	04-25-86	3,751.2	09-14-86	3,720.2

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