COMPREHENSIVE REVIEW AND MODEL OF THE HYDROGEOLOGY OF THE ROSWELL BASIN

Volume II: Appendices A Through P

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APPENDIX A

DOCUMENT REVIEW

SEO: ROSWELL BASIN

Project 2200

Bibliography

KEYWORDS	REFERENCE	NOTES
Aquifer Parameters	Akin, P.D. 1961. Data from aquifer tests on saline water wells near Roswell (New Mexico). New Mexico State Engineer Office Open-File Report, 53 p.	Aquifer test results and data from three saline test wells, drilled by PVACD, are provided.
	Akin, P.D. 1963. Application of Town of Hagerman to move shallow water rights into artesian well. New Mexico State Engineer Office memorandum dated November 18, 1963.	*Available at SEO library.*
Previous Model	Akin, P.D., and B.K. Rao. 1991. An analytical model for determining effects of pumping a well in the Roswell Basin. State Engineer Office Technical Division Hydrology Report 91-1.	Rao has documented the analytical model developed by Akin in the 1960s which has been used for administration of water rights in the Roswell Basin by the SEO.
Water Quality	Anonymous. 1954. Salt water east of Roswell, New Mexico. U.S. Geological Survey Open-File Report.	Report includes map showing location and elevation of test holes.
Stream Flow	Anonymous. 1956. Results of spot discharge measurements and chemical analysis of water along the Pecos River, tributaries, and diversions between Acme and Artesia, N.M., January and February 1956. U.S. Geological Survey Open-File Report.	
Surface Water Supply, Return Flow	Anonymous. 1960. Water supply of Hagerman Irrigation Company. New Mexico State Engineer Office Technical Division Memorandum Report.	

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Database	Babcock, C., R.R. Luckey, C.C. Morgan, and D.M. Stephens. 1989. Ground-water sites-inventory coding instructions. U.S. Geological Survey Vol. 2, Chapter 4.	Instructions provide documentation for data retrieved from the USGS.
	Barnes, C.E. 1969. Irrigation water requirements for crop production, Roswell Artesian Basin, an agronomic analysis and basic data. WRRI Report 4, Part I.	
	Barroll, Peggy. 1993. Groundwater leakage through the Roswell Basin aquitard, Results of a subsurface temperature study in southeastern New Mexico. New Mexico State Engineer Office Technical Division Hydrology Report-93-3.	
Recharge, Geology	Bean, R.T. 1949. Geology of the Roswell Artesian Basin, New Mexico, and its relation to the Hondo Reservoir. New Mexico State Engineer Office Technical Report 9, p. 1-31.	Process that formed Bottomless Lakes and other sinkholes which tap the Artesian aquifer are described. Structural features are described with a discussion of probable offset. Areas showing the greatest recharge capacity are identified and discussed. Channel loss from the Rios Hondo and Peñasco is estimated.
	Benard, Merrill. 1942. Climatic characteristics and data — Report of the U.S. Weather Bureau. The Pecos River Joint Investigation — Reports of the participating agencies: National Resources Planning Board, Part I, p. 1-26.	
Recharge	Besbes, M., J.P. Delhomme, and G. De Marsily. 1978. Estimating recharge from ephemeral streams in arid regions: A case study at Kairouan, Tunisia. Water Resources Research, Vol. 14, No 2.	

KEYWORDS	REFERENCE	NOTES
Return Flow	Blaney, H.F., and W.D. Criddle. 1962. Determining consumptive use and irrigation water requirements. Technical Bulletin No. 1275, U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C.	
Return Flow	Blaney, H.F., and E.G. Hanson. 1965. Consumptive use and water requirements in New Mexico. New Mexico State Engineer Technical Report 32.	Estimates of consumptive use and irrigation efficiencies are provided for various regions throughout the State of New Mexico.
	Borton, R.L. 1961. Geohydrology of the San Andres Limestone, Roswell Basin (abs). New Mexico Geological Society Guidebook, 12th Field Conf., Albuquerque Country 1961.	
	Borton, R.L. 1965. Temperature, chloride content, and specific conductance of ground water from the Roswell Artesian Basin, Chaves and Eddy Counties, New Mexico (August 1965). New Mexico State Engineer Office Open-File Tabulation.	
	Borton, R.L. 1972. Structure of Glorieta Sandstone in northwest Chaves County, New Mexico. New Mexico State Bureau of Mines and Mineral Resources Circular 122, 25 p.	
Well Construction	Borton, R.L. 1984. Records of wells, lakes and springs, Northwestern Chaves County Area, New Mexico. New Mexico State Engineer Office Open-File Tabulation.	

KEYWORDS	REFERENCE	NOTES
Return Flow	Bouwer, H. 1980. Deep percolation and groundwater management. Proceedings of the deep percolation symposium. Arizona Department of Water Resources Report No. 1.	Deep percolation from irrigation is discussed. Average irrigation efficiencies are about 50% nationwide, but in Arizona they are higher, around 70%. Maximum permissible range for irrigation efficiencies is 80-90% without danger of salinity build-up. Deep percolation water contains a few mg/L of NO_3-N below grassland to more than 100 mg/L below heavily fertilized crops, but are usually 15 to 20 mg/L. Drainage water can also contain phosphate. Deep percolation from conventional irrigation systems is about 1 foot/year (Darcy velocity).
	Boyd, D.W. 1958. Permian sedimentary facies, central Guadalupe Mountains, New Mexico. New Mexico State Bureau of Mines and Mineral Resources Bulletin 49, 100 p.	*Available at SEO Library.*
Stratigraphy	Bunte, A.S. 1960. The northwest recharge area of the Roswell Artesian Basin, with emphasis on the Glorieta Sandstone as a recharging aquifer. Pecos Valley Artesian Conservancy District Bulletin 1, 22 p.	Well logs and water levels north of Roswell are examined. Cross sections and contour maps showing structure and stratigraphy are included.
Geology, Recharge	Bunte, A.S. 1962. The southern portion of the recharge area of the Roswell Artesian Basin. Pecos Valley Artesian Conservancy District Bulletin 1 (Supplement).	The stratigraphy of the southern portion of the recharge area of the Roswell Basin was examined along with potentiometric data. "In summary, it appears that water whether it originates in the Yeso, Glorieta, or San Andres Formations, eventually is accumulated in the main San Andres reservoir of the Roswell Artesian Basin."
	Bureau of Reclamation. Undated. Brantley Dam, Brantley project, New Mexico. Solicitation/Specifications 4-SI-57-00690/DC-7612.	Geologic cross sections, well logs with permeability data.

KEYWORDS	REFERENCE	NOTES
Return Flow	Carmen, P.C. 1956. Flow of gases through porous media. Academic Press, N.Y.	
Geology, Recharge	Childers, Amy, and G.W. Gross. 1985. The Yeso aquifer of the middle Pecos Basin, analysis and interpretation--Hydrogeological analysis of geophysical well logs from the Pecos slope. New Mexico Institute of Mining and Technology Report H-16, final report submitted to the New Mexico Interstate Stream Commission, 162 p.	Fifteen geophysical well logs were examined in an attempt to gain an understanding of the hydrology of the Yeso Formation. Most of the logs started in the upper Yeso, and therefore no detailed information on the San Andres could be gleaned from this report. Water quality estimates from permeable zones in the Yeso indicate that the salinity is generally high, but varies from 1000 to over 500,000 mg/L (as NaCl). Porosity in the Yeso appears to decrease from west to east, with a marked change around range 20E, where the San Andres becomes confined.
	Cox, E.R. 1957. Preliminary results of test drilling between Lake McMillan and Major Johnson Springs, Eddy County, New Mexico. U.S. Geological Survey Open-File Report, 28 p.	
	Cox, E.R. 1967. Geology and hydrology between Lake McMillan and Carlsbad Springs, Eddy County, New Mexico. U.S. Geological Survey Water-Supply Paper 1828, 48 p., 6 plates.	The hydrogeology influencing leakage from Lake McMillan and the presence of Major Johnson Springs reservoir is explored. A geologic map, water-level contour map, chloride and specific conductance map, and several cross sections are provided.
	Cox, E.R., and J.S. Havens. 1974. An appraisal of potential water salvage in the Lake McMillan Delta area, Eddy County, New Mexico. U.S. Geological Survey Water-Supply 2029-E. 26 p., 2 plates.	
Surface Water	Cranston, C., G.E. Kues, G.E. Welder. 1981. Miscellaneous surface water data, Pecos River basin. U.S. Geological Survey Open-File Report 81-218.	Surface water data available for the Pecos River is summarized. DBS&A has a computer print-out of the actual data. Data are sorted by location of gage, not individual studies.

KEYWORDS	REFERENCE	NOTES
	Crawford, R.E., and R.L. Borton. 1961. Logs of, and water levels in, observation wells in recharge area of Roswell Artesian Basin. *In* H.O. Reeder et al., Ground-water levels in New Mexico, 1957: New Mexico State Engineer Office Technical Report 22, p. 256-306.	
	Crouch, T.M., and G.E. Welder. 1988. Potential hydrologic effects of a drainage system in McMillan Delta and water impoundment in Brantley Reservoir, Eddy County, New Mexico. USGS Water-Resources Investigations Report 88-4054, 44p.	
Aquifer Parameters	Cushman, R.L. 1965. Evaluation of the hydraulic characteristics of the Major Johnson Springs aquifer, Eddy County, New Mexico. USGS Open-File Report, 38p.	Water-level fluctuations, reservoir stage, and stream discharge measurements were analyzed to determine aquifer parameters in the Major Johnson Springs aquifer.
Geology	Dane, C.H., and G.O. Bachman. 1958. Preliminary geologic map of the southeastern part of New Mexico. U.S. Geological Survey Misc. Geologic Investigations Map I-256, 1 sheet, scale 1:380,160.	
Return Flow	d'Arge, R.C. 1970. Quantitative water resource basin planning: An analysis of the Pecos Basin, New Mexico.	Water withdrawals in 1960 for various uses and estimates of return flow for these uses are summarized.
Geostatistics	Davis, John C. 1986. Statistics and data analysis in geology. John Wiley & Sons, Inc., New York.	

KEYWORDS	REFERENCE	NOTES
Chemistry, Recharge, Isotopes	Davis, P., R. Wilcox, and G.W. Gross. 1979. Spring characteristics of the western Roswell Artesian Basin. New Mexico Water Resources Research Institute Report 116, 93p.	Twenty-one major springs in the western Roswell Basin were sampled for tritium and general chemistry to gain an understanding of the recharge mechanisms from the western portion of the basin. Geologic investigation of the springs "led to the conclusion that impermeable beds within the Yeso Formation are primarily responsible for the location of springs." Recharge to the main carbonate aquifer in the east portion of the basin (San Andres) from springs is postulated to occur by two mechanisms: (1) by percolation down to the water table in the Yeso, then flow eastward across the Yeso-San Andres contact into the San Andres, or (2) by discharge to streams which eventually lose their flow directly to the San Andres Formation in the principal intake area.
	de Marsily, G. 1986. Quantitative hydrogeology. Academic Press, 440p.	
	DeWilde, E.G. 1961. Reconnaissance report on geology and ground-water conditions in the vicinity of the Flying H Ranch, Roswell Artesian Basin. New Mexico State Engineer Office Open-File Report, 18 p.	
	Dinwiddie, G.A., and A. Clebsch, Jr. 1973. Water resources of Guadalupe County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 3, 43 p.	*Available at SEO library.*

KEYWORDS	REFERENCE	NOTES
Recharge	Duffy, C.J., L.W. Gelhar, and G.W. Gross. 1978. Recharge and groundwater conditions in the western region of the Roswell Basin. New Mexico Water Resources Research Institute Report 100, 111p.	Hydrographs of PVACD observation wells in the recharge area of the Yeso/Glorieta aquifers are examined. Wells located near major drainages showed no long-term trend, but water levels fluctuated widely, indicating that recharge is occurring along drainages. Channel loss on the Hondo between Picacho gage (3901) and the Diamond 'A' Ranch gage (3905) was estimated at 220 ft^3/mo per foot of channel. Using the stochastic analysis of well response to streamflow for three wells, the approximate value for recharge was found to be about 600 ft^3/month per foot of channel, assuming $S = 0.1$ and $T = 2.28 \times 10^3$ ft^2/day. The recharge from the Hondo for a 20-mile stretch (Tinnie to Diamond 'A' Ranch) was found to be 17,425 afy, which is comparable to the 19,400 afy that Bean estimated with 1944 streamflow data. Discharge from the "western aquifers" to the basin was estimated at 133,000 afy using Darcy's Law.
Cross Sections	Elliott, L.A. and J.K. Warren. 1989. Stratigraphy and depositional environment of lower San Andres Formation in subsurface and equivalent outcrops, Chaves, Lincoln, and Roosevelt Counties, New Mexico. American Assoc. of Petroleum Geologists Bulletin 73(11):1307-1325.	Authors describe lithofacies changes of the San Andres Formation in the Roswell Basin. Aquifer porosity variation is discussed.
	Emerick, W.L. 1950. Geology and groundwater resources of the northern extension of the Roswell Artesian Basin, New Mexico. U.S. Geological Survey unpublished draft.	
	Fiedler, A.G. 1926. Report on investigations of the Roswell Artesian Basin, Chaves and Eddy Counties, New Mexico. New Mexico State Engineer Office Seventh Biennial Report.	

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	Fiedler, A.G. 1928. The Au deep-well current meter and its use in the Roswell Artesian Basin, New Mexico. U.S. Geological Survey Water-Supply Paper 596-A.	*Not obtained.*
	Fiedler, A.G., and S.S. Nye. 1928. Ground water investigation of the Roswell Artesian Basin, New Mexico. Eighth Biennial Report of the State Engineer of New Mexico, p. 81-107.	
Geology, Recharge	Fiedler, A.G., and S.S. Nye. 1933. Geology and ground-water resources of the Roswell Artesian Basin, New Mexico. U.S. Geological Survey Water-Supply Paper 639, 372p.	Comprehensive study of the hydrogeology of the Roswell Basin is presented. *Available at UNM library.*
Geology, History, Water Quality	Fisher, C.A. 1906. Preliminary report on the geology and underground waters of the Roswell artesian area, New Mexico. U.S. Geological Survey Water-Supply Paper 158, 29 p.	Author documented over 200 wells in the basin and provides drillers logs, water quality analysis and partial list of artesian and shallow wells. First artesian well was drilled in 1896. He warned against the waste of water by allowing the wells to flow continuously. Most of the wasted water flowed to pools or directly to the river.
Recharge, Aquifer Boundaries	Flook, L.R., Jr. 1958. Memorandum on Pecos River base flows and their relation to precipitation: consulting report. Tipton and Kalmbach, Inc., Denver, CO, 18p.	Precipitation and baseflow are correlated. The best correlation (0.88) was obtained by averaging concurrent and previous year precipitation from Artesian, Roswell and White Tail stations. Correlation with mountain stations only (White Tail and Mayhill) was poor.
Recharge, Stream Flow, Water Balance	Flook, L.R., Jr. 1959a. Pecos River baseflow hydrology. Tipton and Kalmbach, Inc., Review of Basic Data.	Precipitation and baseflow are correlated with artesian pressures (winter months) in three wells. Correlation varied from 0.53 to 0.79 for pressure vs. precipitation and from 0.79 to 0.81 for pressure vs. baseflow.
Stream Flow	Flook, L.R. 1959b. Supplement to report on Pecos River base flow hydrology: Consulting report. Tipton and Kalmbach, Inc., 3p.	

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Geology	Foster, R.W., R.M. Frentress, and W.C. Riese. 1972. Subsurface geology of east-central New Mexico. New Mexico Geological Society Special Publ. No. 4, 22 p.	
Recharge	Fox, I.A., and K.R. Rushton. 1976. Rapid recharge in a limestone aquifer. Ground Water 14(1):21-26.	Authors introduced an infiltration mechanism called "rapid recharge" in the mathematical modeling of a limestone aquifer in Lincolnshire, England. The simulation of the "rapid recharge" as an alternative and supplementary flow mechanism to that generally used in the estimation of seasonal infiltration helped explain the large seasonal variations of piezometric head in the confined portion of a aquifer.
	Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604p.	
	Galloway, S.E. 1975. Investigation of recent changes in physical environment within and immediately south of southern part of Bottomless Lakes State Park, Chaves County, New Mexico. New Mexico State Engineer Office internal memorandum to F.R. Allen, dated December 5, 1975.	
Non-Beneficial Use	Garn, H.S. 1988. Hydrologic effects of phreatophyte control Acme-Artesia reach of the Pecos River, New Mexico, 1967-1982. U.S. Geological Survey Water Resources Investigations Report 87-4148.	
Recharge	Gee, G.W., and D. Hillel. 1988. Ground water recharge in arid regions: review and critique of estimation methods. Hydrological Processes Journal 2:255-266.	
	Gelhar, L.W., and J.L. Wilson. 1974. Ground-Water Quality Modeling. Ground Water 12(6):399-408.	

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Eastern Boundary	Geohydrology Associates, Inc. 1978. Ground Water. *In* collection of hydrologic data, eastside Roswell range EIS area, New Mexico. Consultant report to the U.S. Bureau of Land Management. New Mexico Bureau of Mines and Mineral Resources Open-File Report OF-95.	Report contains a collection of available information from water wells on the east side of the Pecos River, which was prepared for the USBLM for use in preparing Environmental Impact Statements. The few water wells in existence on the east side of the Pecos near Roswell were shallow and used primarily for stock. Surface drainage characteristics were also evaluated.
Eastern Boundary	Gratton, P.J. and W.J. Lemay. 1969. San Andres oil east of the Pecos. F.E. Kottlowski and W.K. Summers, eds. The San Andres Limestone, a reservoir for oil and water in New Mexico: New Mexico Geological Society Special Report 3, p. 37-43.	The stratigraphy, structure and hydrodynamics of the oil fields in the San Andres Formation east of the Roswell Basin are described.
	Griswold, G.B. 1959. Mineral deposits of Lincoln County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 67, 117 p.	*Available at SEO library.*
Recharge, Isotopes	Gross, G.W. 1982. Recharge in semiarid mountain environments. New Mexico Water Resources Research Institute Report 153, 36p.	Recharge estimates are reviewed and discussed for the Roswell Basin. Based on results of tritium samples of ground water, Gross concludes that several mechanisms for recharge exist, a fast and a slow component. He suggests that the slow component must contribute greater than 50% of the recharge in the basin, from underlying Yeso and Glorieta aquifers. This value is based on the precipitation available for a fast component and total recharge needed to reproduce heads in the aquifer. He assumes that no more than 10% of precipitation is available for recharge.
Recharge, Isotopes	Gross, G.W. 1985. Hydrology of the Rio Felix drainage, the Yeso aquifer of the Middle Pecos Basin. Final report submitted to the New Mexico Interstate Stream Commission.	Information pertaining to the hydrogeology of the Rio Felix drainage basin is compiled. Gross concluded that the regional fault systems and solution features affect flow patterns and water quality. Results of "tritium activity determinations indicate that direct recharge over the basin's area is minor."

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Isotopes, Recharge	Gross, G.W. and R.N. Hoy. 1980. A geochemical and hydrological investigation of groundwater recharge in the Roswell Basin of New Mexico — Summary of results and updated listing of tritium determinations. New Mexico Water Resources Research Institute Report 122, 141p.	
Isotopes	Gross, G.W., R.N. Hoy, and C.J. Duffy. 1976. Application of environmental tritium in the measurement of recharge and aquifer parameters in a semi-arid limestone terrain. New Mexico Water Resources Research Institute Report 80, 212p.	
Recharge, Isotopes	Gross, G.W., P. Davis, and K.R. Rehfeldt. 1979. Paul Spring — An investigation of recharge in the Roswell (NM) Artesian Basin. New Mexico Water Resources Research Institute Report 113, 135p.	Authors review previous recharge estimates. Study evaluates the flow of Paul Spring, located near the Rio Peñasco, which due to the local geology has a relatively isolated drainage basin. The study was aimed at gaining an understanding of recharge mechanisms and percentage of precipitation which contributes to the perched aquifer which discharges at Paul Spring. Tritium concentrations of significant precipitation events were analyzed from 1974 to 1977 and compared to samples collected from the spring. Results indicate that a significant amount of "older" water from the Yeso is mixing with younger water, and that precipitation in the local drainage can only account for 18% of the flow at Paul Spring. This results in an estimate of 3% of precipitation becoming recharge. Discharge of Paul Spring and precipitation were correlated with varying lags and assumptions regarding a "deep flow" component. Results show that if no deep flow component is considered, then 28.7 to 18% of precipitation becomes recharge, whereas only 3.3 to 7.8 % becomes recharge if a deep component is included.

KEYWORDS	REFERENCE	NOTES
Isotopes, Recharge	Gross, G.W., R.N. Hoy, C.J. Duffy, and K.R. Rehfeldt. 1982. Isotope studies of recharge in the Roswell Basin. Isotope studies of hydrologic processes, Northern Illinois University Press.	
Return Flow	Halderman, A.D. 1980. Irrigation efficiencies. *In* Proceedings of the deep percolation symposium, Arizona Department of Water Resources Report No. 1.	Terms used in describing irrigation efficiencies and conveyance losses are discussed.
Pecos River, Recharge	Hale, D.P., J.J. Vandertulip, C.L. Slingerland, C.J. Anderson, and J.R. Erickson. 1960. Report on review of basic data. Submitted to the Engineering Advisory Committee, Pecos River Commission.	Report reviews data utilized in the Pecos River Compact, Senate Document 109, and the PRJI that relates to Pecos River flows. Seepage losses and gains in various reaches of the Pecos River, evaporation and seepage losses from reservoirs, and effect of precipitation on baseflow are discussed with respect to the 1947 condition of flow in the Pecos River.
Return Flow	Hanson, E.G. 1966. The seepage problem defined. ASAE Paper No. 66-728.	Paper discusses general findings of seepage rates from lined and unlined canals.
Geology, Recharge, Water Balance	Hantush, M.S. 1957. Preliminary quantitative study of the Roswell groundwater reservoir, New Mexico. New Mexico Institute of Mining and Technology, Research and Development Division, 118p.	Comprehensive study of the hydrogeology of the basin. Recharge and the water budget of the basin are estimated.
Non-Beneficial Consumptive Use	Hantush, M.S. 1959. Potential evapotranspiration in areas along the rivers of New Mexico. New Mexico Institute of Mining and Technology Professional Paper 101.	The Thornthwaite method was used to obtain estimates of potential evapotranspiration along rivers in New Mexico.
Aquifer Parameters	Hantush, M.S. 1961a. Aquifer tests on saline water wells near Roswell. New Mexico Institute of Mining and Technology Open-File Report, 21p.	

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	Hantush, M.S. 1961b. Aquifer tests on partially penetrating wells. J. Hydraulic Div., Proceedings American Society of Civil Engrs. 87(MY5):171-195.	
Reservoirs, Southern Boundary	Haskett, G.I. 1984. Groundwater study, Brantley dam and reservoir site, New Mexico. U.S. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho.	
Geology	Harbour, R.L. 1970. The Hondo Sandstone member of the San Andres Limestone of south-central New Mexico. U.S. Geological Survey Professional Paper 700C, p. 175-182.	*Available at UNM library.*
Return Flow	Harper, W.G. 1936. Soil survey of the Roswell Area, New Mexico. U.S. Department of Agriculture, Bureau of Chemistry and Soils, Series 1933, NO 2.	
Previous Model, Aquifer Properties	Hathaway, D.L. 1986. Three-dimensional simulation of ground-water flow in the southern Roswell Basin. New Mexico State Engineer Office, Technical Division Hydrology Report 86-1.	
Geology, Aquifer Boundaries	Havenor, K.C. 1968. Structure, stratigraphy, and hydrogeology of the northern Roswell Artesian Basin, Chaves County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Circular 93, 30p.	Hydrology of Glorieta Sandstone is described. Details of water-producing zones observed in drilling City of Roswell test holes in the San Andres are described.
	Hayes, P.T. 1959. San Andres Limestone and related Permian rocks in Last Chance Canyon and vicinity, southwestern New Mexico. Bulletin of the American Association of Petroleum Geologists 43(9):2197-2213.	*Not obtained.*

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	Hayes, P.T. 1964. Geology of the Guadalupe Mountains New Mexico. U.S. Geological Survey Professional Paper 446, 69 p.	*Available at SEO library.*
	Hayes, P.T., and R.L. Koogle. 1958. Geology of the Carlsbad Caverns west quadrangle, New Mexico-Texas. U.S. Geological Survey Geologic Quadrangle Map GQ-112, scale 1:62,500.	*Available at SEO library.*
Return Flow	Hazen, A. 1911. Discussion: Dams on sand foundations. Transactions, American Society of Civil Engineers 73:199.	
Southern Boundary, Reservoir	Hendrickson, G.E and R.S. Jones. 1952. Geology and ground-water resources of Eddy County, New Mexico. New Mexico Bureau of Mines and Mineral Resources ground-water report 3.	The hydrogeology of Eddy County, from T16S to the state line and from R21E to 31E is investigated with a focus on the Carlsbad area. Plates show geology, general ground-water flow direction, location of springs and wells, with depth to water and depth of well.
	Henninghausen, F.H. 1969. Meters and their effects in the Roswell Artesian Basin in Chaves and Eddy Counties, New Mexico. 14th Annual New Mexico Water Conference Proceedings, New Mexico State University. Also, Irrigation Age, Sept. 1969; Water Journal Mar-Apr 1979.	The author, District Supervisor, SEO Roswell, provides an overview of the effort to meter wells in the basin. Prior to metering in December 1966, the majority of water users pumped large volumes of water to build up the soil moisture content of the fields. In 1967, the average diversion was 2.9 af/acre, and 30% of users exceeded 3 af/acre. By 1968 only 22.6% exceeded the 3 af/acre allotment. 95% of water was used for irrigation, 3.8% for municipal purposes and 0.4% for commercial and industrial purposes. *Available at SEO library.*
	Henninghausen, F.H. 1970. Change in chloride content of water in response to pumping in the artesian aquifer in the Roswell-East Grand Plains area, Chaves County, New Mexico. *In* R.B. Maddox, eds., Saline Water, AAAS Committee on Desert and Arid Zones Research, Contribution No. 13, p. 71-86.	

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	Hill, M.C. 1990. Preconditioned Conjugate-Gradient 2 (PCG2), A computer program for solving ground-water flow equations. Water-Resources Investigations Report 90-4048. U.S. Geological Survey, Denver, Colorado.	
	Hill, M. 1992. A computer program (MODFLOWP) for estimating parameters of a transient, three-dimensional, ground-water flow model using nonlinear regression. U.S. Geological Survey Open-File Report 91-484, 358p.	
Return Flow	Hodson, M.V., T.E. Calhoun, C.L. Chastain, L.W. Hacker, W.G. Henderson, and C.R. Seagraves. 1980. Soil survey of Chaves County, New Mexico, southern part. U.S. Department of Agriculture Soil Conservation Service and U.S. Department of Interior Bureau of Land Management.	The soil types are mapped for the southern portion of Chaves County with a listing of soil permeabilities and depths of soil horizons.
Water Quality	Hood, J.W. 1960. Summary of saline ground-water conditions in the Roswell Basin, Chaves and Eddy Counties, New Mexico, 1958-59. U.S. Geological Survey Open-File Report.	
Water Quality	Hood, J.W. 1963. Saline ground water in the Roswell Basin, Chaves and Eddy Counties, New Mexico, 1958-59. U.S. Geological Survey Water-Supply Paper 1539-M, 46p.	
Water Quality	Hood, J.W., R.W. Mower, and M.J. Grogin. 1960. The occurrence of saline ground water near Roswell, Chaves County, New Mexico. New Mexico State Engineer Office Technical Report 17, 93 p., 12 plates.	

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Water Quality, Surface Water	Howard, C.S. 1937. Analyses of water from the Pecos River made before 1937. U.S. Geological Survey Open-File Report.	
Water Quality	Howard, C.S., and W.F. White. 1938. Chemical character of Pecos River water in New Mexico, 1937-1938. U.S. Geological Survey Preliminary Statement.	General chemistry of water was evaluated at various gaging stations, seeps, and wells from Fort Sumner to Orla, Texas, 15 miles south of the Texas-New Mexico state line.
Water Quality	Howard, C.S., W.F. White, and W.W. Hastings. 1942. Quality of water. *In* The Pecos River Joint Investigation — Reports of the participating agencies, National Resources Planning Board, Part II, Sec. 3, p. 102-132.	
Recharge	Hoy, R.N., and G.W. Gross. 1982. A baseline study of Oxygen 18 and Deuterium in the Roswell, New Mexico, groundwater basin. New Mexico Water Resources Research Institute Report 144. 144 p.	Stable isotopes were analyzed in an attempt to distinguish recharge sources in ground water. The results were inconclusive, ground-water samples were remarkably homogeneous and narrowly clustered even though the deuterium and oxygen-18 values of precipitation were diverse.
	Huntoon, P.W. 1995. Is it Appropriate to Apply Porous Media Groundwater Circulation Models to Karstic Aquifers?. *In* A. El-Kadi (ed.), Groundwater Models for Resources Analysis and Management.	
Non-Beneficial Consumptive Use	Jackson, R.D. 1985. Evaluating evapotranspiration at local and regional scales. Proceedings of the IEEE, Vol. 73, No. 6.	
Aquifer Parameters	Jacob, C.E. 1947. Drawdown test to determine effective radius of artesian wells. Trans. American Geophysical Union, 112:1040-1070.	
	James, L.B. 1979. Ground-water investigation, Brantley Dam and Reservoir site. Unpublished report.	

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Geostatistics	Journel, A.G. and Ch.J. Huijbregts. 1978. Mining Geostatistics. Academic Press, London.	
Geology	Kelley, V.C. 1971. Geology of the Pecos country, southeastern New Mexico. New Mexico Bureau of Mines and Mineral Resources Memoir 24, 75p., 7 plates.	Discussion of the stratigraphy and structure of the Pecos River basin is presented. No emphasis on ground-water hydrology.
Geology	Kelley, V.C. 1972. Geology of the Fort Sumner sheet, New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 98, 55 p., 2 plates.	*Available at SEO library.*
Overview, Geology	Kinney, E.E. 1969. The San Andres Formation in New Mexico. New Mexico Geological Society Special Report 3, p. 3-4, 2 plates.	Report provides a regional overview of the San Andres Formation from central New Mexico to West Texas. Plates show east-west and north-south cross-sections of the San Andres Formation.
Geology, Basin Boundaries, Leakance	Kinney, E.E., J.D. Nations, B.J. Oliver, P.G. Wagner, T.A. Siwula, R.E. Renner. 1968. The Roswell Artesian Basin. The Roswell Geological Society, 31p.	Overview of hydrogeology of the Roswell Basin is presented. The impact of structural features on ground-water flow is explored and basin boundaries are discussed. Vertical leakance through the aquitard is considered insignificant by the authors. They believed that vertical flow occurs through fractures.
Geology	Kottlowski, F.E. and W.K. Summers (eds.). 1969. The San Andres Limestone, a reservoir for oil and water in New Mexico. New Mexico Geological Society Special Report 3, 51p.	
	Kruseman, G.P., and N.A. de Ridder. 1991. Analysis and evaluation of pumping test data, second edition (completely revised). Publication 47, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.	

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Return Flow	Landsford, R.R., C.E. Barnes, B.J. Creel, E.G. Hanson, H.E. Dregne, Evan Carroon, and H.R. Stucky. 1969. Irrigation water requirements for crop production — Roswell Artesian Basin: Project analysis and summary. New Mexico Water Resources Research Institute Report 4, Part IV, 116p.	Study was designed to obtain information on crops grown, yields, soil quality, water quality, types of irrigation systems, methods of irrigation, and amounts of water consumed in order to analyze these factors as they relate to water requirements for crop production. Farm irrigation efficiency calculated from data developed by Barnes (1969) averaged 61.21% for the 12 case-study farms and ranged from 42.7 to 84.4%.
Return Flow	Landsford, R.R., E.T. Garnett, and B.J. Creel. 1970. An economic land classification of the irrigated cropland in the Pecos River Basin, New Mexico. New Mexico Water Resource Research Institute Report 7.	The primary objective of this study was to delineate those areas in the basin having similar combinations of soil and water quantity and/or quality. Describes soil and slope types and groups irrigated acres by soil productivity. Summarizes sources of water diversions.
Geology	Lang, W.B. 1937. The Permian Formation of the Pecos Valley of New Mexico and Texas. Bulletin of the American Association of Petroleum Geologists, 21(7) 833-898.	Overview of regional geology of the Pecos Basin is provided. Shows schematic cross sections of formations throughout the Pecos Basin.
Recharge, Water Quality, Leakance	Le Febre, Vernon. 1975. Aquifer parameters by a chemical tracer technique — non-linear mixing in the Roswell confined aquifer. New Mexico Water Resources Research Institute Report 56, 33 p.	Soil column tests were performed on soil samples from six locations to determine the projected change in chemical quality of water as it recharges to the aquifer. Twenty-five ground water samples were collected and analyzed for major cations and anions. Areas of greater mixing between the confined and unconfined aquifers were identified based on sulfate concentrations.
Water Quality	Le Febre, Vernon. 1977. Chemical dynamics of a confined limestone aquifer. New Mexico Water Resources Research Institute Report 84, 253p.	Chemical and temperature analyses of water samples in the area of salt water encroachment indicate that the source of the solute in the artesian aquifer is from the shallow aquifer above.
Return Flow	Lenfesty, C.D. 1983. Soil survey of Chaves County, New Mexico, northern part. U.S. Department of Agriculture, Soil Conservation Service.	Soil types are mapped for the northern portion of Chaves County with a listing of soil permeabilities and depths of soil horizons.

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Geology	Lloyd, E.R. 1949. Pre-San Andres stratigraphy and oil-producing zones in southeastern New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 29, 87 p., 10 plates.	Regional pre-San Andres Stratigraphy is described with cross sections throughout southeastern New Mexico. No detail shown in the Roswell Basin. *Available at SEO library*.
Well Completion	Lobley, H.E., J.S. McGee, and G.E. Welder. 1968. Records of metered wells in the Roswell Basin. U.S. Geological Society Open-File Report.	
Geology	Lyford, F.P. 1973. Valley fill in the Roswell-Artesia area, New Mexico. U.S. Geological Survey Open-File Report 73-163, 26p.	Welder (1983) utilized this study for his interpretation of the shallow aquifer.
General Hydrology	Maddox, G.E. 1965. Availability and quality of ground water in the Pecos River Basin. 10th Annual New Mexico Water Conference Proceedings, New Mexico State University.	Summary of major aquifers and general quality of water throughout the Pecos River Basin is discussed.
Previous Models	Maddox, G.E. 1966. Electrical analog model of the Roswell Basin — Its use in hydrologic analysis. 11th Annual New Mexico Water Conference Proceedings, New Mexico State University.	Describes how the electric analog model of the Roswell Basin worked, but does not give details of parameters used, or the outcome of the verification.
	Maddox, G.E. 1968. Geology and hydrology of the Roswell Artesian Basin, New Mexico. University of Arizona Ph.D. dissertation.	
Geologic Cross Sections, Aquifer Boundaries	Maddox, G.E. 1969. Relation of the San Andres Limestone to the "carbonate aquifer" in the Roswell Basin, New Mexico. p. 32-36 *in* F.E. Kottlowski and W.K. Summers (eds.), The San Andres Limestone, a reservoir for oil and water in New Mexico: New Mexico Geological Society Special Report 3.	The author examined hundreds of drillers' logs of water wells in the Roswell Basin to identify the top and bottom and extent of the carbonate aquifer and San Andres Formation.

KEYWORDS	REFERENCE	NOTES
Reservoirs	Mantei, E.L. 1984. Estimated reservoir losses for Brantley Reservoir. U.S. Bureau of Reclamation Technical Memorandum BR-230-40.	
Data Source, Aquifer Properties, Streamflow, Climate	McAda, D. 1992. Source of information related to geohydrology in the vicinity of the Roswell Basin in parts of Chaves, Eddy, DeBaca, Guadalupe, Lincoln and Otero Counties. U.S. Geological Survey Open-File Report 92-xxxx.	Report compiles and lists sources of data pertaining to the Roswell Basin.
Well Construction	McCombs, J., and A.G. Fiedler, with a preface by O.E. Meinzer. 1927. Methods of exploring and repairing leaky artesian wells. *In* Contributions to the hydrology of the United States, 1927. U.S. Geological Survey Water Supply Paper 596.	
	McDonald, M.G., and A.W. Harbaugh. 1988. A modular three-dimensional finite-difference ground-water flow model. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Modeling Techniques, Chapter A1, U.S. Government Printing Office, Washington, D.C.	
	McDonald, M.G., A.W. Harbaugh, B.R. Orr, and D.J. Ackerman. 1991. A method of converting no-flow cells to variable-head cells for the U.S. Geological Survey modular finite-difference ground-water flow model. Open-File Report 91-536. U.S. Geological Survey.	

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	Meinzer, O.E., B.C. Renick, B.C. and Kirk Bryan. 1927. Geology of No. 3 reservoir site of the Carlsbad Irrigation Project, New Mexico, with respect to water-tightness. Contributions to the hydrology of the United States, 1926/U.S. Geological Survey Water-Supply Paper 580, p. 1-39.	
General	Melhase, J. 1931. Report on the Roswell Artesian Basin. SEO Open-File Report (Chaves County File), 27 p.	Precipitation, climate, stream system, geology, and structure are reviewed. It is unclear whom Melhase works for and purpose of report. *Available at SEO library.*
Southern Boundary	Miller, F. 1969. The San Andres reef zone. *In* F.E. Kottlowski, and W.K. Summers, eds., The San Andres Limestone, a reservoir for oil and water in New Mexico, New Mexico Geological Society Special Report 3, p. 27-31, 3 plates.	Lithology and porosity changes in the transition zone of the reef environment is described. The hydrologic communication between the shelf facies of the San Andres and Capitan Reef is described as non-existent due to a zone of porcelaneous dolomite that acts as an effective barrier to fluid migration.
Well Completion	Minton, E.G., Jr. 1940. Theory and practice of well plugging, Roswell Artesian Basin, New Mexico. New Mexico State Engineer Open-File Report.	
Recharge	Minton, E.G., Jr. 1941. Analysis of the relationship between artesian pressure head and precipitation and consumptive use, Roswell Artesian Basin, New Mexico. New Mexico State Engineer 14th and 15th Biennial Reports, 1938-42.	
	Minton, E.G., Jr. 1942. Report of Artesian Well Supervisor, Roswell Artesian Basin, New Mexico. New Mexico State Engineer 14th and 15th Biennial Reports, 1938-42.	

KEYWORDS	REFERENCE	NOTES
Recharge, General Hydrogeology	Morgan, A.M. 1938. Geology and shallow-water resources of the Roswell Artesian Basin, New Mexico. New Mexico State Engineer Bulletin 5. Also in New Mexico State Engineer 12th and 13th Biennial Reports, 1938, p. 155-249.	Maps of water-level contours and thickness of the shallow aquifer are presented. Lyford (1973) updated this investigation.
	Morgan, A.M. 1941. Depth of active solution by ground-waters in the Pecos Valley, New Mexico. American Geophysical Union Transactions of 1941, p. 779-783.	
	Morgan, A.M. 1942. Solution-phenomena in the Pecos Basin in New Mexico. American Geophysical Union Transactions of 1942, p. 27-35.	
Geology	Morgan, A.M., and A.N. Sayre. 1942. Geology. *In* The Pecos River Joint Investigation — Reports of the participating agencies, National Resources Planning Board, p. 28-38.	
Recharge	Motts, W.S., and R.L. Cushman. 1964. An appraisal of the possibilities of artificial recharge to ground-water supplies in part of the Roswell Basin, New Mexico. USGS Water-Supply Paper 1785, 85p.	Physical and geologic features of the Roswell Basin were studied to delineate areas where artificial recharge would be possible. The source of water that could be made available for artificial recharge was from evaporation savings of floodwaters in tributaries of the Pecos that spread out on flood plains, from sinkholes, and evapotranspiration from phreatophytes. Permeability of soils in sinkholes was tested using variable head permeameters.

KEYWORDS	REFERENCE	NOTES
Geology, Hydrology, Chemistry	Mourant, W.A. 1963. Water resources and geology of the Rio Hondo drainage basin, Chaves, Lincoln, and Otero Counties, New Mexico. New Mexico State Engineer Office Technical Report 28, 85p.	The hydrogeology of the Rio Hondo drainage basin is described. Provides water-level contour map, water quality ($CaCO_3$, Cl, SO_4) electrical conductivity maps for selected wells springs and streams and a geologic map for the basin are included. Information on wells is summarized in a table. About 3,650 acres are irrigated with surface water from the Rio Hondo, Rio Ruidoso, and Rio Bonito. Ground water supplemented 2,650 acres of these lands. Mourant estimated that about 7,000 af is used annually in the Hondo Basin, by assuming 50% supplemental use of ground water.
	Mourant, W.A., and J.W. Shomaker. 1970. Reconnaissance of water resources of De Baca County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Ground-Water Report 10, 87 p.	*Available at UNM library.*

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Return Flow, Water Budget, Leakance	Mower, R.W. 1960. Pumpage in the Roswell Basin, Chaves and Eddy Counties, New Mexico. U.S. Geological Survey Open-File Report, 88p.	The history of pumping in the Roswell Basin, which began in 1903 for irrigation, is reviewed. The gross duty of water (precipitation and diversion of ground or surface water) between 1952 and 1957 averaged 3.85 af/acre as determined from power consumption. A correlation between precipitation and pumping for the period for 1952 to 1957 was used to extrapolate the pumping for 1925, 1938 and 1951, based on precipitation records for those years. Mower estimated that 20% of water diverted for irrigation in the Roswell Basin eventually reaches the alluvium. In 1955, about 90,000 af recharged the alluvium from irrigation return flow. In 1931 the PVACD began plugging leaky artesian wells and by 1958, 1129 wells were plugged. "Essentially all the known leaky wells in the basin have been plugged; therefore, at present time (1958) the alluvium is being recharged by only small quantities of water from this source." Mower also states that about 55% of water discharged from the shallow aquifer is pumped from wells, 5% from drains, and 40% by natural means. Mower determined that since 1952 about 2,200 af of reclaimed sewage water has been used for irrigation. Maps are included which show the location of wells and irrigated land in 1959 with the source of water. Water-level maps for 1956, 1957, and 1938 are also included in the report.
Recharge, Non-Beneficial Use, Aquifer Parameters	Mower, R.W., J.W. Hood, R.L. Cushman, R.L. Borton, and S.E. Galloway. 1964. An appraisal of potential ground-water salvage along the Pecos River between Acme and Artesia New Mexico. U.S. Geological Survey Water-Supply Paper 1659, 98p., 10 plates.	Report includes results of aquifer tests from 12 wells completed in the shallow aquifer.
	National Resources Planning Board. 1942. The Pecos River joint investigation: Reports of the participating agencies. U.S. Government Printing Office, Washington, D.C.	

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Well Construction	Neel, G.M. 1932. Well plugging, Pecos Valley Artesian Basin. New Mexico State Engineer 10th Biennial Report, 1930-32.	
	Neuman, S.P. and P.A. Witherspoon. 1969. Theory of flow in a confined two aquifer system. Water Resources Research 5(4):803-816.	
	New Mexico's Response to Texas' Comments on the River Master's Draft Computation of Major Johnson Springs. 1992. State of Texas v. State of New Mexico. In the Supreme Court of the United States, October Term, 1991.	
	New Mexico State Engineer. 1959a. Hydrologic summary, New Mexico — Streamflow and reservoir content 1888-1954. New Mexico State Engineer Office Technical Report 7, 326 p.	
Precipitation	New Mexico State Engineer. 1959b. Climatological summary, New Mexico — Temperature 1850-1954. New Mexico State Engineer Office Technical Report 6, 407 p.	
Water Quality	Nunez, M.F., and A.B. Mason. 1988. Chloride content of water form selected wells finished in the San Andres Formation. PVACD map QW-128-D.	Nunez and Mason prepared an isochlor map with intervals of 500 ppm, showing location of control points without values. Chloride concentrations were determined from samples collected and analyzed by PVACD.
	Nye, S.S. 1927. Geology of the Cactus Flat reservoir site for the Hope Community, New Mexico. New Mexico State Engineer 8th Biennial Report, p. 179-188.	

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History, Stream Flow	Pease, C.T. 1923. Memorandum on the Pecos River drainage basin in New Mexico and Texas. State Engineer Open-File Report, 71 p.	Report compiles data from published and unpublished reports for the Pecos River Commission. Historical overview of development of water supplies along the Pecos River is provided. Table of mean precipitation and temperature for six stations (none in Roswell Basin) along the Pecos for up to 37 years of record and summary of reservoir operation from 1912 to 1922 is included. Hydrographic survey map showing development of irrigation is presented.
Outside of Basin	Pitt, W.D., and G.L. Scott. 1981. Porosity zones of lower part of San Andres Formation, east-central New Mexico. New Mexico Bureau of Mines and Mineral Resources Circular 179, 19 p.	Report investigates the lower portion of the San Andres, using geophysical well logs to determine lithology and porosity in an area north of the Roswell Basin. Three cyclical zones were identified and used to determine the depositional environment.
	Plato, P.R. 1993. SHYDG.FOR—Hydrograph package for MODFLOW. Ground Water 31(6):1025-1028.	
Isotopes	Rabinowitz, D.D., and G.W. Gross. 1972. Environmental tritium as a hydrometeorologic tool in the Roswell Basin, New Mexico. New Mexico Water Resources Research Institute Report No. 16, 268p.	
Isotopes, Recharge	Rabinowitz, D.D., G.W. Gross, and C.R. Holmes. 1977a. Environmental tritium as a hydrometeorologic tool in the Roswell Basin, New Mexico. Journal of Hydrology 32(1/2):2-17.	Tritium peaks in ground water were correlated with atmospheric water to estimate the residence time of recharge in the aquifer. A residence time of 4 years for ground water in the northern part of the Roswell Basin was estimated, resulting in a particle flow velocity of about 70 feet/day. Residence time in the southern portion of the basin was estimated at 7 years or more.
Isotopes	Rabinowitz, D.D., G.W. Gross, and C.R. Holmes. 1977b. Environmental tritium as a hydrometeorologic tool in the Roswell Basin, New Mexico, II. Tritium patterns in groundwater. Journal of Hydrology, Vol. 32.	

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Isotopes	Rabinowitz, D.D., G.W. Gross, and C.R. Holmes. 1977c. Environmental tritium as a hydrometeorologic tool in the Roswell Basin, New Mexico, III. Hydrologic Parameters. Journal of Hydrology, Vol. 32.	
Previous Model, Aquifer Properties	Rao, B.K. 1991. Roswell Basin analytical groundwater flow model users manual. State Engineer Office Technical Division Hydrology Report 91-2.	The manual describes the various input parameters required for various regions of the basin. The regional transmissivity distribution for the shallow and artesian aquifers is estimated by averaging the log of values obtained from numerous aquifer tests
Isotopes	Reeder, H.O. 1964. Tritium content as a indicator of age and movement of ground water in the Roswell Basin, New Mexico. U.S. Geological Survey Professional Paper 501-C.	
	Reeder, H.O., R.W. Mower, and L.J. Bjorklund. 1959. Annual water-level measurements in observation wells, 1951-1955, and atlas of maps showing changes in water levels for various periods from beginning of record through 1954, New Mexico Part B-Pecos River Valley.	

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Previous Model Study, Recharge, Aquifer Parameters	Rehfeldt, K.R., and G.W. Gross. 1982. The carbonate aquifer of the central Roswell Basin — recharge estimation by numerical modeling. New Mexico Water Resources Research Institute Report 142, 136p.	A two-dimensional ground-water flow model of the central Roswell Basin was developed. The authors believed that the use of a porous media flow model for the fractured carbonate aquifer is valid because (1) fractures are, for the most part, closely spaced based on the fact that few wells if any fail to encounter water in the San Andres, and (2) potentiometric surface indicates hydrologic continuity. The unconfined portion of the carbonate aquifer was modeled as confined due to a lack of data for the thickness of the aquifer in that area. Assumption considered valid since water-level fluctuations were small compared to aquifer thickness for the period modeled. The western and eastern boundaries were treated as constant head. The western boundary is the unconfined portion of the Yeso which has maintained approximately the same head for many years and is largely unaffected by pumping near Roswell. The northern and southern boundaries are treated as no flux, justified by the direction of ground-water flow, which is generally parallel to those boundaries. The shallow aquifer was treated as constant head. Aquifer parameters were based on existing data and literature. Model calibrated for one year, 1967 to 1968. Pumping was divided into three periods, where all the pumping occurred in the second period (March 1 to September 30). Recharge was initially estimated as 5% of precipitation (increased to 7% after calibration) that falls on the "area of unconfined flow" or 18,711 afy and distributed over three periods throughout the year, weighted by the percentage of precipitation falling in each period. In addition, recharge from the Rio Hondo to the principal intake area was set equal to the flow at Diamond 'A' Ranch, since flow in the Rio Hondo rarely flows to Roswell. Recharge above the Diamond 'A' gage was set equal to the loss from the Picacho gage and distributed evenly throughout the reach. However, after calibration, recharge was redistributed.

KEYWORDS	REFERENCE	NOTES
		Using mixing equations for tritium concentrations observed in ground water, it was determined that about 16-20% of recharge comes from precipitation, the remainder from a deep flow source (Yeso/Glorieta). The authors note that water-level response in a suspected "high recharge area" after heavy rainfall was minimal in October when pumping was at a minimum suggesting that water level rises in summer after heavy rainfalls are actually due to reduced pumping. "The water quality of the carbonate aquifer decreases from west to east with a marked change near the Six Mile Hill structural zone and the postulated 'High Recharge Area'." The sensitivity of the model to various aquifer parameters, recharge and leakance varied over the modeled domain.
	Reiter, M. and D.L. Jordan. In press. Hydrogeothermal studies across the Pecos River valley, southeastern New Mexico.	Preprint, submitted to GSA bulletin
	Renick, B.C. 1926. Geology and ground water resources on the drainage basin of the Rio Peñasco above Hope, New Mexico, with an introduction by O.E. Meinzer. New Mexico State Engineer 7th Biennial Report, 1925-1926, p. 103-138.	
	Rovey, C.W. II, and D.S. Cherkauer. 1995. Scale dependency of hydraulic conductivity measurements. Ground Water 33(5):769-780.	

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Aquifer Parameters, Recharge, Non-beneficial Use, Water Balance, Well Construction	Saleem, Z.A., and C.E. Jacob. 1971. Dynamic programming analysis, Roswell Basin, New Mexico. New Mexico Bureau of Mines and Mineral Resources Institute Report No 10., 180p.	More than 340 step-drawdown tests in the Roswell Basin were analyzed. Assumptions and potential errors in evaluating aquifer tests due to partial penetration, leaky aquifers, and short- duration aquifer tests are discussed. Consumptive use by salt cedars for 1937-1968 is estimated. Use of water in 1967 and 1968 was examined, and it was found that 95% of ground water was used for farming. A list of wells with the aquifers of completion is provided. In more than one aquifer 174 wells are completed. Water budgets for different periods are estimated.
Bibliography	Senkpiel, W.C. 1942. Summary of certain investigations in Pecos River Basin, New Mexico and Texas. U.S. Geological Survey Open-File Report, 26 p.	This is a bibliography of references for the Pecos River, sorted by topic.
Isotopes, Recharge, Geology	Simcox, A.C., and G.W. Gross. 1985. Hydrology and evolution of the upper Rio Peñasco drainage basin, New Mexico. Final report submitted to the Interstate Stream Commission, Part I.	The hydrogeology of the Upper Rio Peñasco drainage basin is studied. A geologic map of the study area was produced (from Cloudcroft to Mayhill). Using a two-dimensional finite-difference ground water flow model, the underflow to the Roswell Basin was estimated to be at least 3,778 afy.
Return Flow	Slingerland, C. 1967. Depletion rates in Roswell Basin for use in computations involving change in place and purpose of use. New Mexico State Engineer Office internal memorandum to Steve Reynolds, State Engineer, dated March 17, 1967. 10p.	Memorandum provides recommendation for return flow rate to be utilized in administration of water rights in the Roswell Basin.
	Sloan, C.E., and M.S. Garber. 1971. Ground-water hydrology of the Mescalero Apache Indian Reservation, south-central New Mexico. U.S. Geological Survey Hydrologic Investigations Atlas HA-349, Scale 1:125,000.	*Available at SEO library.*

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	Smith, R.E. 1957. Geology and ground-water resources of Torrance County, New Mexico. New Mexico Bureau of Mines and Mineral Resources Ground Water Report 5, 186 p.	*Available at SEO library.*
Recharge	Soil Conservation District. 1957. Watershed work plan for watershed protection and flood prevention, Zuber Draw Watershed. Hagerman-Dexter SCD, Roswell SCD, Upper Hondo SCD and USDA SCD.	Report describes flooding problems associated with Zuber Draw. Floods do not flow directly to Pecos River channel, but spread out around the town of Dexter, scouring irrigated lands. Hydrologic calculations utilized infiltration data from the "Hydrology Guide". Rain gage data was taken from a tributary 15 miles north of Zuber Draw. No stream gages were available. *Available at SEO library.*
Return Flow	Sorenson, E. 1981. Comparative analysis of Blaney-Criddle crop irrigation requirements and actual application of water to beneficial use in the Roswell Basin, 1967-1980. Internal State Engineer Office memorandum to Fred Allen, dated April, 1981.	Memorandum provides consumptive irrigation requirements for 1967 to 1980.
Return Flow	Spiegel, Z. 1955. Probable effect of the Hagerman Canal and ground water development on the flow of the Rio Felix. New Mexico State Engineer Office memorandum to file dated July 28, 1955.	Discussion of history of the Hagerman Canal and estimates for seepage rates are provided.
	Spiegel, Z. 1967. Fundamental concepts of geohydrology applied to the Pecos Valley and related aquifer systems. New Mexico State Engineer Office, prepared for New Mexico Water Resources Research Institute Project No. B-006-NMEX-3109-102.	

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Recharge	Summers, W.K. 1972. Geology and regional hydrology of the Pecos River Basin, New Mexico. New Mexico Bureau of Mines and Mineral Resources Open-File Report 37, 208p., 27 plates.	The regional hydrogeology of the Pecos River Basin is presented. Using stream gages and a water budget, Summers estimated that the natural recharge rate for the recharge area of the lower Pecos River Basin (of which the Roswell Basin is in the central part) to be 0.6 inches per year. He estimated that 19.6 cfs of natural recharge to the shallow aquifer and 320.3 cfs to the Artesian aquifer occurs in the Roswell Basin, over a total area of 7310 square miles.
Aquifer Parameters	Summers, W.K., and Z.A. Saleem. 1966. Nelson pump test, Roswell New Mexico. New Mexico Institute of Mining and Technology Open-File Report.	
	Tait, D.B., J.L. Ahlen, A. Gordon, G.L. Scott, W.S. Motts, and M.E. Spitler. 1962. Artesia Group of New Mexico and West Texas. Bulletin of the American Association of Petroleum Geologists, 46(4):504-517.	
Stream Flow, Recharge	Theis, C.V. 1938. Relationship of increase in flow of Pecos River and recharge of shallow water in Roswell Basin. U.S. Geological Survey Open-File Report.	
	Theis, C.V. 1938. Origin of water in Major Johnson Springs near Carlsbad, New Mexico. New Mexico State Engineer 12th and 13th Biennial Reports.	
	Theis, C.V. 1942. Groundwater conditions north of Roswell. U.S. Geological Survey Open-File report.	
Recharge, Aquifer Parameters	Theis, C.V. 1951. Effect on artesian aquifer of storage of flood water in Hondo Reservoir. New Mexico State Engineer Office Technical Report 9, p. 33-36.	Theis calculated the expected increase in head in the artesian aquifer caused by leakage of water from the Hondo Reservoir due to projected flood events

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	Theis, C.V., A.N. Sayre, A.M. Morgan, W.E. Hale, and O.J. Loeltz. 1942. Geology and ground water. The Pecos River Joint Investigation, Part II, Section 2. National Resources Planning Board.	Comprehensive investigation of the Pecos River Valley for use in defining compact obligations between Texas and New Mexico.
General	Tipton, R.J. 1953. One or the other: A resume of Pecos River problems. From a talk given at a luncheon in Santa Fe, New Mexico, for the Governor and members of the legislature of the State of New Mexico.	A broad overview of the political and physical problems surrounding the administration of the Pecos River is given.
	Tipton, R.J. 1958. Letter from R.J. Tipton, Tipton and Kalmbach, Inc., Denver, Colorado, to Engineering Advisory Committee to Pecos River Commission, September 22, 1958.	
	U.S. Environmental Protection Agency. 1991. GEO-EAS 1.2.1. EPA 600/8-91/008. Environmental Systems Laboratory, Las Vegas, Nevada.	
	U.S. Geological Survey, Ground-Water Division. 1941. Water resources of the Pecos River Basin, Report B: Geology and ground water. Part III of the Pecos River Joint Investigation reports.	
Water Quality	U.S. Geological Survey. 1954. Salt water east of Roswell, New Mexico. U.S. Geological Survey unapproved, not for public release (draft), 4 p.	Report describes results from tests wells drilled by the USGS that indicate greater salt content with increase in depth.
	U.S. Geological Survey. 1970. City of Roswell pump test data. Unpublished.	

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	U.S. Senate. 1949. Pecos River Compact. Senate Document No. 109, 81st Congress, 1st Session. U.S. Government Printing Office, Washington, D.C. August 19, 1949.	
	Wasiolek, M. 1991a. The hydrogeology of the Permian Yeso Formation within the upper Rio Hondo Basin and the eastern Mescalero Apache Indian Reservation, Lincoln and Otero Counties, New Mexico. pp. 343-351. *In* New Mexico Geological Society Guidebook, 42nd Field Conference, Sierra Blanca, Sacramento, Capitan Ranges.	
	Wasiolek, M. 1991b. Hydrology of the Fish and Wildlife Service water rights appurtenant to the Bitter Lakes National Wildlife Refuge.	Consultant report
	Wasiolek, M. 1992. An investigation of the hydrogeologic conditions existing within the drainage basins of Arroyo del Macho and Salt Creek.	Consultant report
	Wasiolek, M. 1992. An investigation of the hydrogeologic conditions existing within the lower drainage basin of the Rio Hondo.	Consultant report
Recharge, Geology	Wasiolek, M., and G.W. Gross. 1983. The hydrogeology of the upper Rio Peñasco area between James and Cox Canyons in the Sacramento Mountains of southeastern New Mexico. New Mexico Institute of Mining and Technology, Geophysical Research Center Report H-13.	The hydrogeology of the upper Rio Peñasco is studied. The water budget for the study area is estimated.

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Non-Beneficial Use	Weeks, E.P., H.L. Weaver, G. Campbell, and B. Tanner. 1987. Water use by salt cedar and by replacement vegetation in the Pecos River floodplain between Acme and Artesia, N.M. U.S. Geological Survey Professional Paper 491-G.	
	Welder, G.E. 1973. Base flow in the Acme-Artesia reach of the Pecos River, New Mexico 1957-71. U.S. Geological Survey Open-File Report 73-359, 50p.	
Hydrology, Geology	Welder, G.E. 1983. Geohydrologic framework of the Roswell ground-water basin, Chaves and Eddy Counties, New Mexico. New Mexico State Engineer Technical Report 42, 28p., 28 plates.	
	Welder, G.E. 1988. Hydrologic effects of phreatophyte control, Acme-Artesia reach of the Pecos River, New Mexico, 1967-1982. USGS Water resources Investigations Report 87-4148, 46p.	
	Whipple, J. 1992. New Mexico Interstate Stream Commission letter to Nancy Lynch, Assistant Attorney General, Chief, Environmental Protection Division, State of Texas, January 17, 1992.	
Return Flow	Wilson, B.C. 1991. Quantification of irrigation water requirements for 1940 and 1985 cropping pattern, Roswell artesian groundwater basin in Chaves and Eddy Counties, New Mexico. New Mexico State Engineer Office Open-File Report.	Consumptive irrigation requirements for 1940 and 1985 are estimated using the original Blaney-Criddle method. Cropping patterns in the basin have shifted to an increase in crops with higher water demand, thus causing an increase in the CIR for the basin.

KEYWORDS	REFERENCE	NOTES
Return Flow	Wilson, B.C. 1992. Water use by categories in New Mexico counties and river basins, and irrigated acreage in 1990. New Mexico State Engineer Office Technical Report 47.	Summaries of water diversions and consumptive use are provided for various uses in counties throughout the state of New Mexico.
Return Flow, Recharge	Wilson, L.G., K.J. DeCook, and S.P. Neuman. 1980. Final report, regional recharge research for southwest alluvial basins. Water Resources Research Center, University of Arizona.	Recharge from mountain fronts, stream channels, irrigation return flow, canal seepage, sewage effluent and surface impoundments are discussed. Approaches to quantifying recharge are discussed along with values obtained for basins in Arizona.
Stream Flow	Yates, J.R. 1925. Water supply studies of Pecos River. Compiled for the Pecos River Commission and Vernon Sullivan (consulting engineer). Bureau of Reclamation Report.	Report reviews the water supply of the Pecos River from 1906 to 1923 with a focus on flood control and storage capacity and requirements. Reservoir operations are discussed and shown graphically. *Available at SEO library.*
Return Flow	Yates, J.C., and A.T. Watson. 1970. Ditch losses from earthen ditches on lands irrigated with ground water in the Roswell Basin, Chaves and Eddy Counties, New Mexico. New Mexico State Engineer Office Open-File Report.	Seepage loss curves for various flow were calculated using measured and estimated seepage rates for the Roswell Basin.

APPENDIX B

DOCUMENTATION OF DATABASE

APPENDIX B
DOCUMENTATION OF DATABASE

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DOCUMENTATION OF WELLINFO.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
C802	A9	**Stat-type** (Station-type codes) - designates the type of site. A 'Y' for yes is positioned in the column corresponding to the type of site as follows: 1 - Stream 2 - Lake or reservoir 3 - Estuary 4 - Unassigned 5 - Spring 6 - Ground water other than spring 7 - Meteorological 8 - Unassigned 9 - Unassigned In this file all stat-type should have a 'Y' in column 6 of this field.
C003	A3	**Recd** (Record classification) - indicates the reliability of the data available for the site as follows: C - Data have been field checked by the reporting agency L - Location not accurate M - Minimal data U - Data have not been field checked by the reporting agency, but the reporting agency considers the data reliable

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

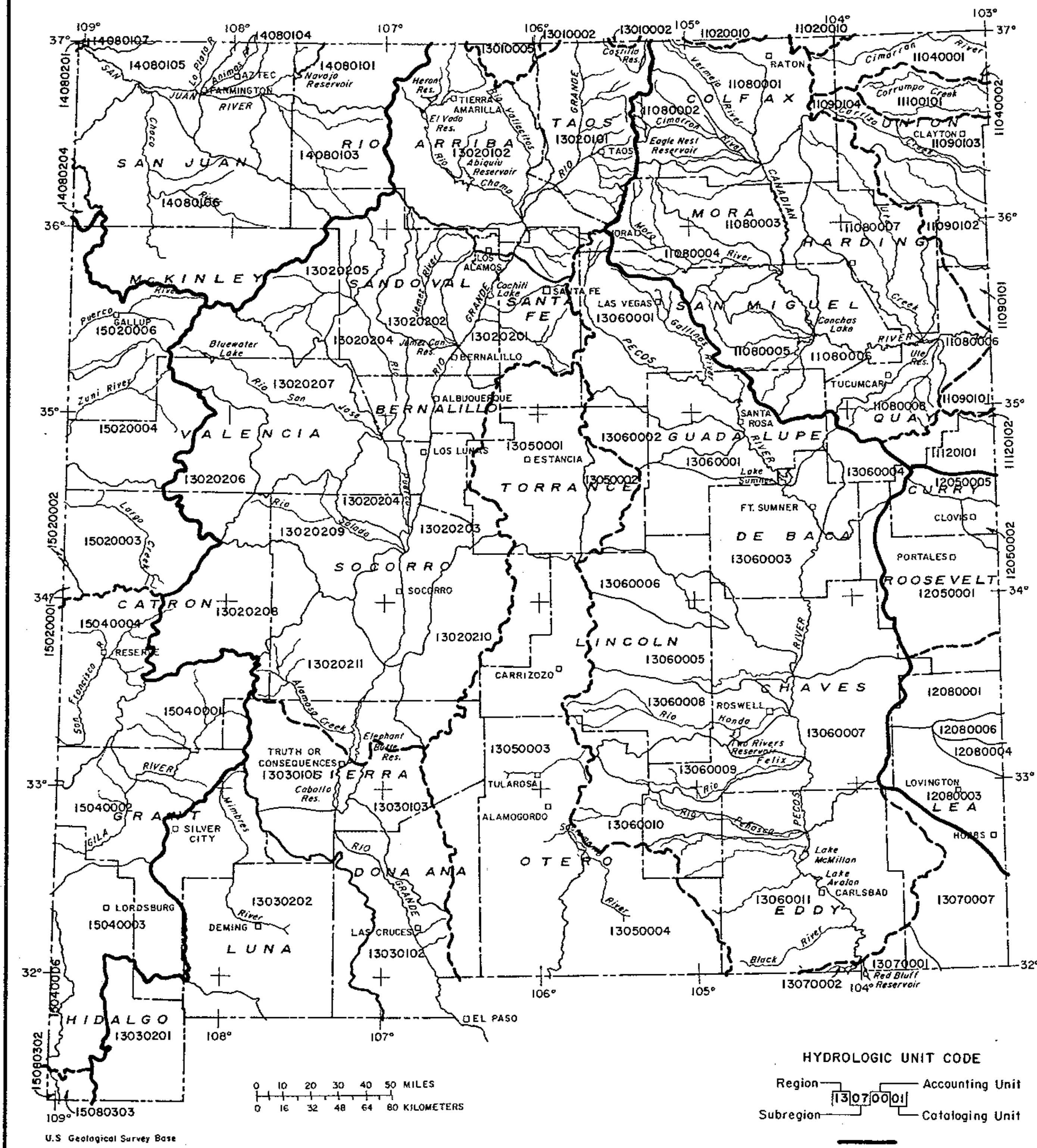
C004	A6	**Source** (Source agency code) - denotes the agency providing the data. The USGS is the only source listed in this field.
C005	A10	**ProjNo** (Project number) - number utilized by the USGS for retrieval of all data for a particular project.
C006	N3	**Dcode** (District code) - denotes the USGS Water Resource Division District that reported the data. '35' is the code for the Albuquerque District Office.
C007	N2	**Scode** (State code) - denotes the state in which the site is located. All sites are located in New Mexico (state code 35).
C008	N3	**Ccode** (County code) - denotes the county in which the site is located as follows: 05 - Chaves 11 - DeBaca 15 - Eddy 27 - Lincoln 35 - Otero 57 - Torrance
C009	N7	**Latitude** (Latitude) - latitude for the site in degrees, minutes, and seconds.
C010	N8	**Longitude** (Longitude) - longitude for the site in degrees, minutes, and seconds.
C011	A3	**LLac** (Lat-Long accuracy code) - indicates the accuracy of the latitude and longitude values as follows: S - Accurate to ± 1 second F - Accurate to ± 5 seconds T - Accurate to ± 10 seconds M - Accurate to ± 1 minute Blank - Accuracy unknown
C012	A26	**Local Well Number** (Local well number) - identifies the location of the well by the township, range and section. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

C013	A22	**Land-net location** (Land-net location) - provides the legal description of the 10-acre tract in which the site is located. The smallest subdivision of the quarter section in listed first.
C014	A12	**Name of location map** (Location map) - name of the USGS topographic map on which the site can be located.
C015	N7	**Map scale** (Map scale) - identifies the scale of the map named in the previous field.
C016	N8	**LSD_feet** (Altitude) - altitude of the land surface in feet above mean sea level.
C017	A3	**LSDmeth** (Method altitude determined) - describes the method used to determine the altitude of land surface as follows: A - Altimeter L - Level or other surveying method M - Interpolated from topographic map
C018	N3	**Altacc** (Altitude accuracy) - denotes the accuracy of the altitude of land surface in feet.
C019	A3	**Toposet** (Topographic setting code) - describes the topographic setting in which the site is located. The following USGS codes are permitted: A - Alluvial fan B - Playa C - Stream channel D - Local depression E - Dunes F - Flat surface G - Flood plain H - Hilltop K - Sinkhole L - Lake, swamp, or marsh M - Mangrove O - Offshore P - Pediment S - Hillside (slope) T - Alluvial or marine terrace U - Undulating V - Valley flat (valleys of all sizes) W - Upland draw

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

C020	N8	**Hydrounit** (Hydrologic unit code) - designates the hydrologic unit code for the Office of Water Data Coordination cataloging unit in which the site is located. Figure B-1 shows the currently designated hydrologic unit codes for the State of New Mexico.
C021	N8	**Drildate** (Date of first construction) - the earliest date for which data are available for the site or the date when construction began, whichever is earlier.
C023	A3	**SUse1** (Primary use of site) - code describing the principal or first use for the site. The USGS codes are as follows: A - Anode C - Standby emergency supply D - Drain E - Geothermal G - Seismic H - Heat reservoir M - Mine O - Observation P - Oil or gas well R - Recharge S - Repressurize T - Test U - Unused W - Withdrawal of water X - Waste disposal Z - Destroyed
C024	A3	**WUse1** (Primary use of water) - code describing the principal use of water from the site. The USGS codes are as follows: A - Air conditioning B - Bottling C - Commercial D - Dewater E - Power F - Fire H - Domestic I - Irrigation J - Industrial (cooling) K - Mining M - Medicinal N - Industrial P - Public supply Q - Aquaculture



Map of New Mexico Showing Location of Hydrologic Units

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

R - Recreation
S - Stock
T - Institutional
U - Unused
Y - Desalination
Z - Other (explained in remarks)

C025	A3	**WUse2** (Secondary use of water) - if the water from the site is used for more than one purpose, a code may have been entered.
C026	A3	**WUse3** (Tertiary use of water) - if a third use of the water from the site exists, a code may have been entered.
C027	N8	**Drildepth** (Hole depth) - total depth in feet the well was drilled below land-surface datum, even though it may have been plugged back in completing the well.
C028	N8	**Welldepth** (Well depth) - depth of the finished well in feet below land-surface datum.
C029	A3	**Depthsrc** (Source of depth data) - code indicating the source of the depth of the well. The USGS codes are as follows: A - Reported by another government agency D - From driller log or report G - Private geologist-consultant or university associate L - Depth interpreted from geophysical logs by personnel of source agency M - Memory (owner, operator, driller) O - Owner of well R - Other individual S - Measured by personnel of reporting agency Z - Other source, explained in remarks
C030	N7	**DTW** (Inventory water level) - depth to water in feet below land surface. A negative sign precedes the measurement if head is above land surface.
C031	N8	**DTWdate** (Date measured) - year, month and date of water-level measurement. If month or day is not known, 00 is used.
C033	A3	**DTWsrce** (Source of water-level data) - code that describes the source of the water-level measurement. The codes are the same as those used for Depthsrc (C029).

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

C034	A3	**DTWmeth** (Method of water-level measurement) - code that indicates how the water level was measured. The USGS codes are as follows: A - Airline measurement B - Analog or graphic recorder C - Calibrated airline measurement E - Estimated G - Pressure-gage measurement H - Calibrated pressure-gage measurement L - Interpreted from geophysical logs M - Manometer measurement N - Non-recording gage R - Reported, method not known S - Steel-tape measurement T - Electric-tape measurement V - Calibrated electric-tape measurement Z - Other
C037	A10	**WLstat** (Site status for water level) - code indicating the status of the site at the time the water level was measured. The field is blank if the inventoried water-level measurement represents a static level. The USGS Codes are as follows: D - Dry E - Flowing recently F - Flowing, but head could not be measured G - A nearby site that taps the same aquifer was flowing H - A nearby site that taps the same aquifer had been flowing recently I - Injector site J - Injector site monitor N - Measurements were discontinued O - Obstruction encountered in the well P - Pumping R - Pumped recently S - A nearby site that taps the same aquifer was being pumped T - A nearby site that taps the same aquifer had been pumped recently V - Foreign substance was present on the surface of the water W - Destroyed X - Water level was affected by stage in nearby surface water site

DOCUMENTATION OF WELLINFO.DB (CONTINUED)

		Z - Other conditions affecting water-level measurement are explained in remarks
C714	A10	**AQUIFCODE** (Primary aquifer) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
---	N10	**X** (A DBS&A generated field) - X coordinate in meters using a UTM projection for zone 13.
---	N10	**Y** (A DBS&A generated field) - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.

DOCUMENTATION OF WELLPUMP.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
C077	N5	**DcasTop** (Depth to top of this casing string) - depth in feet below land surface to the top of the casing interval reported for this record. If the casing extends above ground surface, then a negative sign will precede the height.
C078	N7	**DcasBot** (Depth to bottom of this casing string) - depth in feet below land surface to the bottom of the casing interval reported for this record.
C079	N6	**Casdiam** (Diameter of this casing string) - diameter in inches of the casing interval reported for this record.
C083	N7	**DscrnTop** (Depth to top of this open interval) - depth to the top of the open section in feet below land surface.
C084	N7	**DscrnBot** (Depth to bottom of this open interval) - depth to the bottom of the open section in feet below land surface.
C087	N7	**Scrndiam** (Diameter of this open interval) - the inside diameter, in inches, of the perforated or slotted pipe, diameter of a screen, or the diameter of the hole, if the well is finished open-hole.

DOCUMENTATION OF WELLPUMP.DB (CONTINUED)

C093	A8	**AQUIFCODE** (Unit identifier) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
C096	A4	**LITHCODE** (Lithology) - code identifying the principal lithology of the unit at the screen interval. Codes used in this file are: ALVM - Alluvium CLAY - Clay GRDS - Gravel, sand, and silt GRNT - Granite GRVL - Gravel LMSN - Limestone OTHR - Other SAND - Sand SDGL - Sand and gravel SHLE - Shale SNDS - Sandstone SOIL - Soil
48	A8	**Dischdate** (Date discharge measured) - date on which the discharge data were determined. If the day and/or month were not known, 00 was entered.
C150	N12	**Discharge** (Discharge) - discharge from the site in gallons per minute.
C151	A1	**DischSource** (Source of data) - code indicating who furnished the data. The following USGS codes were utilized in this field: A - Reported by another government agency D - From driller log or report G - Private geologist-consultant or university associate

DOCUMENTATION OF WELLPUMP.DB (CONTINUED)

		L - Depth interpreted from geophysical logs by personnel of source agency M - Memory (owner, operator, driller) O - Owner of well R - Other individual S - Measured by personnel of reporting agency Z - Other source, explained in remarks
C152	A1	**DischMeth** (Method of discharge measurement) - code indicating the method used to measure the discharge. The USGS codes are: A - Acoustic meter (transient-time meter) B - Bailer C - Current meter D - Doppler meter E - Estimated F - Flume M - Totaling meter O - Orifice P - Pitot-tube meter R - Reported, method not known T - Trajectory method U - Venturi meter V - Volumetric measurement W - Weir Z - Other
C153	N12	**Prodlevel** (Production level) - water level, in feet below land surface, while the well was discharging. The Prodlevel minus the Statwl is equivalent to the drawdown. A negative sign will precede the Prodlevel if the well is naturally flowing.
C154	N12	**Statwl** (Static level) - the static water level, in feet below land surface.
C155	A1	**WlSource** (Source of data) - code indicating who provided the data. The USGS codes are: A - Reported by another government agency D - From driller log or report G - Private geologist-consultant or university associate L - Depth interpreted from geophysical logs by personnel of source agency M - Memory (owner, operator, driller) O - Owner of well R - Other individual

DOCUMENTATION OF WELLPUMP.DB (CONTINUED)

S - Measured by personnel of reporting agency
Z - Other source, explained in remarks

C156	A1	**WlMet** (Method of water-level measurement) - code that indicates how the water level was measured. The USGS codes are as follows: A - Airline measurement B - Analog or graphic recorder C - Calibrated airline measurement E - Estimated G - Pressure-gage measurement H - Calibrated pressure-gage measurement L - Interpreted from geophysical logs M - Manometer measurement N - Non-recording gage R - Reported, method not known S - Steel-tape measurement T - Electric-tape measurement V - Calibrated electric-tape measurement Z - Other
C157	A7	**Pumptime** (Pumping period) - length of time, in hours, that the well was pumped prior to the measurement of production levels.
C159	A8	**Dateowned** (Date of ownership) - the date that the owner acquired ownership of the well, spring, etc., or the earliest date on which this owner was known to own the source.
C161	A42	**Owner** (Owner's name) - name of the owner.

DOCUMENTATION OF WELINFO2.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
C199	A1	**Logtype** (Type of log) - code describing the type of log for the log interval described in this record. The USGS codes are:

A - Drilling time
B - Casing collar
C - Caliper
D - Drillers
E - Electric
F - Fluid conductivity
G - Geologist or sample
H - Magnetic
I - Induction
J - Gamma ray
K - Dipmeter
L - Lateral log
M - Microlog
N - Neutron
O - Microlateral log
P - Photographic
Q - Radioactive-tracer
S - Sonic
T - Temperature
U - Gamma-gamma
V - Fluid velocity
X - Core
Z - Other (explained in remarks)

DOCUMENTATION OF WELINFO2.DB (CONTINUED)

C201	N12	**LogBot** (Ending depth) - depth to the bottom of the logged interval, in feet below land surface.
C202	A1	**LogSource** (Source of data) - code indicating who provided the information. The USGS Codes are: A - Reported by another government agency D - From driller log or report G - Private geologist-consultant or university associate L - Depth interpreted from geophysical logs by personnel of source agency M - Memory (owner, operator, driller) O - Owner of well R - Other individual S - Measured by personnel of reporting agency Z - Other source, explained in remarks
C272	N12	**Specific Capacity** (Specific capacity) - specific capacity in (gallons/minute)/feet of drawdown.
C304	A1	**Aquif** (Contributing unit) - code indicating if unit is considered the principal aquifer. The USGS codes are: P - Principal contributing aquifer S - Secondary contributing aquifer N - Contributes no water U - Unknown contribution
C714	A8	**AQUIFCODE** (Primary aquifer) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone

DOCUMENTATION OF WLE.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
C235	A8	**DTWDATE** (Date) - year, month and date of water-level measurement. If month or day is not known, 00 is used.
C236	A1	**Dacc** (Date accuracy) - code for accuracy of date as follows: M - to nearest month Y - to nearest year
C237	N7	**DTW** (Water level) - depth to water in feet below land surface. A negative sign precedes the measurement if head is above land surface.
C238	A1	**WLstat** (Status) - code indicating the status of the site at the time the water level was measured. The field is blank if the water-level measurement represents a static level. The USGS Codes are as follows: D - Dry E - Flowing recently F - Flowing, but head could not be measured G - A nearby site that taps the same aquifer was flowing H - A nearby site that taps the same aquifer had been flowing recently I - Injector site J - Injector site monitor N - Measurements were discontinued O - Obstruction encountered in the well P - Pumping

DOCUMENTATION OF WLE.DB (CONTINUED)

- R - Pumped recently
- S - A nearby site that taps the same aquifer was being pumped
- T - A nearby site that taps the same aquifer had been pumped recently
- V - Foreign substance was present on the surface of the water
- W - Destroyed
- X - Water level was affected by stage in nearby surface water site
- Z - Other conditions affecting water level measurement are explained in remarks

C239 A1 **DTWmeth** (Method of measurement) - code that indicates how the water level was measured. The USGS codes are as follows:

- A - Airline measurement
- B - Analog or graphic recorder
- C - Calibrated airline measurement
- E - Estimated
- G - Pressure-gage measurement
- H - Calibrated pressure-gage measurement
- L - Interpreted from geophysical logs
- M - Manometer measurement
- N - Non-recording gage
- R - Reported, method not known
- S - Steel-tape measurement
- T - Electric-tape measurement
- V - Calibrated electric-tape measurement
- Z - Other

C240 A1 **DTWref** (Statistics code) - if measurement was made by a continuous recorder, the code describes how the measurement was selected from the readings available for that day. The USGS codes are as follows:

- M - Water level shown is a daily maximum (deepest water level for the day)
- N - Water level shown is a daily minimum (shallowest water level for the day)
- A - Water level is 12:00 noon reading
- P - Water level is 12:00 midnight reading

C016 N8 **LSD_feet** (Altitude) - altitude of the land surface in feet above mean sea level. (Obtained from Wellinfo.db.)

DOCUMENTATION OF WLE.DB (CONTINUED)

C020	N8	**Hydrounit** (Hydrologic unit code) - designates the hydrologic unit code for the Office of Water Data Coordination cataloging unit in which the site is located. Figure B-1 shows the currently designated hydrologic unit codes for the State of New Mexico. (Obtained from Wellinfo.db.)
C714	A10	**AQUIFCODE** (Primary aquifer) - identifies the primary aquifer unit from which the water is obtained. (Obtained from Wellinfo.db.) The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
---	N10	**X** (A DBS&A generated field) - X coordinate in meters using a UTM projection for zone 13. (Obtained from Wellinfo.db.)
---	N10	**Y** (A DBS&A generated field) - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters. (Obtained from Wellinfo.db.)
---	N8	**WLE** (A DBS&A generated field) - water-level elevation in feet above mean sea-level, obtained by subtracting the depth to water measurement (DTW) from the elevation of the land surface (LSD_feet).

DOCUMENTATION OF REMARKS.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
C184	A8	**RmksDate** (Remark date) - date pertaining to origin of remark.
C185	A44	**Remarks** (Remarks) - miscellaneous information pertaining to the site. Often contains SEO permit number or construction details.

DOCUMENTATION OF GWSAMP.DB

Source: USGS National Well Inventory System (NWIS)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of some of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989). An explanation for water-quality fields was not available from the USGS, and thus the description provided below is based on the interpretation by DBS&A of the field name provided by the USGS. A -999999 recorded in a field indicates that no data were collected for that sampling event.

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
---	A21	**Local** (Local) - identifies the location of the well by the township, range and section. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**Cntyc** (Cntyc) - denotes the state and county in which the site is located. The first two digits refer to the state code and the last two to the county code. The code for New Mexico is 35, and the codes for counties included in this file are as follows: 05 - Chaves 11 - DeBaca 15 - Eddy 27 - Lincoln 35 - Torrance
---	A4	**Sitec** (Sitec) - code describing the type of site. All are GW for ground-water site in this file.
---	N10	**SAMPDATE** (Dates) - year, month, and day ground-water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.

DOCUMENTATION OF GWSAMP.DB (CONTINUED)

C714	A10	**AQUIFCODE** (Gunit) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
72000	N10	**LSD** (Elevation of land surface datum, ft) - elevation of the ground surface in feet above mean sea level.
72001	N10	**Drildepth** (Depth of hole, drilled total, ft) - total depth well was drilled.
72002	N10	**DTWBZ** (Depth to top of water bearing zone, ft) - depth to the top of the water bearing zone.
72008	N10	**Casingdepth** (Depth of well, total, ft) - total depth of well (to bottom of casing or open interval).
72015	N10	**Dtop sampunit** (Depth to top of sample interval, ft) - top of screen interval in well.
72016	N10	**Dbot sampunit** (Depth to bottom of sample interval, ft) - bottom of screen interval in well.
72019	N10	**Dsamp** (Water level depth, ft) - depth to water in well at time of sample collection.
00010	N10	**Temp** (Water temperature) - temperature of water in degrees Celsius from well at time of sample collection.
00027	N10	**Collect agency** (Collecting agency) - code describing the agency collecting sample. USGS codes included in this field are as follows: 01028 - Geological Survey 80020 - Denver Central Laboratory

DOCUMENTATION OF GWSAMP.DB (CONTINUED)

00028	N10	**Lab** (Analyzing agency) - code describing the agency performing the water-chemistry analyses. USGS codes included in this field are as follows: 01028 - Geological Survey 80020 - Denver Central Laboratory
00059	N10	**Flow rate** (Flow rate instantaneous, gallons/minute) -discharge rate measured from well in gallons per minute at time of sample collection.
00095	N10	**Cond_25C** (Specific conduct us/cm @ 25C) - electrical conductivity, in micromhos per centimeter, of ground water at time of sample collection, corrected to 25^{o}C.
00400	N10	**pH (field)** (pH, wh, field) - pH of ground-water sample measured in the field at time of sample collection.
00403	N10	**pH (lab)** (pH, wh, laboratory) - pH of ground-water sample measured in the laboratory.

DOCUMENTATION OF GWCARB.DB, GWMAJ.DB, AND GWMETL.DB

Source: USGS National Well Inventory System (NWIS)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of some of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989). An explanation for water-quality fields was not available from the USGS, and thus the description provided below is based on the interpretation by DBS&A of the field name provided by the USGS. A -999999 recorded in a field indicates that no data were collected for that sampling event.

GWCARB.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day ground-water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
00405	N10	**CO2** (Carbon dioxide d (mg/L as CO_2)) - carbon dioxide concentration in milligrams per liter.
00410	N10	**Alk_CaCO3** (Alkalinity, wh, fe (mg/L as $CaCO_3$)) - alkalinity expressed as milligrams per liter of $CaCO_3$.
00440	N10	**HCO3** (Bicarbonate, wh, f (mg/L as HCO_3)) - bicarbonate concentration in milligrams per liter.
00445	N10	**CO3** (Carbonate, wh, fet (mg/L as CO_3)) - carbonate concentration in milligrams per liter.
00618	N10	**NO3_N** (Nitrogen nitrate (mg/L as N)) - nitrate concentration expressed as milligrams per liter of nitrogen.

DOCUMENTATION OF GWCARB.DB, GWMAJ.DB, AND GWMETL.DB (CONTINUED)

00630	N10	**NO2+NO3_N** (NO_2 + NO_3 total (mg/L as N)) - nitrite and nitrate concentration expressed as milligrams per liter of nitrogen.
00660	N10	**PO4** (Phosphate ortho. (mg/L as PO_4)) - phosphate concentration in milligrams per liter.
00671	N10	**P** (Phosphorus ortho. (mg/L as P)) - phosphorus concentration in milligrams per liter.
00900	N10	**Hardness_CaO3** (Hardness total (mg/L as CaO_3)) - total hardness expressed as calcium oxide in milligrams per liter.
00902	N10	**Noncarb Hard_CaCO3** (noncarbonate har (mg/L as $CaCO_3$)) - hardness of water attributed to non-carbonated elements (Mg) expressed as milligrams per liter of calcium carbonate.

DOCUMENTATION OF GWCARB.DB, GWMAJ.DB, AND GWMETL.DB (CONTINUED)

GWMAJ.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day ground-water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
00915	N10	**Ca** (Calcium dissolved (mg/L as Ca)) - calcium concentration from a filtered water sample in milligrams per liter.
00925	N10	**Mg** (magnesium dissolved (mg/L as Mg) - magnesium concentration from a filtered water sample in milligrams per liter.
00930	N10	**Na** (Sodium dissolved (mg/L as Na) - sodium concentration from a filtered water sample in milligrams per liter.
00931	N10	**SAR** (Sodium adsorption (ratio)) - sodium adsorption ratio.
00932	N10	**Na%** (Sodium percent) - milliequivalent of sodium divided by the total milliequivalent.
00933	N10	**Na+K** (Sodium + potassium (mg/L as Na)) - sodium and potassium concentration expressed as sodium in milligrams per liter.
00935	N10	**K** (Potassium dissolved (mg/L as K)) - potassium concentration from a filtered water sample in milligrams per liter.
00940	N10	**Cl** (Chloride dissolved (mg/L as Cl)) - chloride concentration from a filtered water sample in milligrams per liter.
00945	N10	**SO4** (Sulfate dissolved (mg/L as SO_4)) - sulfate concentration from a filtered water sample in milligrams per liter.
00950	N10	**F** (Fluoride dissolved (mg/L as F)) - fluoride concentration from a filtered water sample in milligrams per liter.

DOCUMENTATION OF GWCARB.DB, GWMAJ.DB, AND GWMETL.DB (CONTINUED)

00955	N10	**SiO2** (Silica dissolved (mg/L as SiO_2)) - silica concentration from a filtered water sample in milligrams per liter.

DOCUMENTATION OF GWCARB.DB, GWMAJ.DB, AND GWMETL.DB (CONTINUED)

GWMETL.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the well location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day ground-water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
01005	N10	**Ba_dis** (Barium dissolved (µg/L as Ba)) - barium concentration from a filtered water sample in micrograms per liter.
01020	N10	**B_dis** (Boron dissolved (µg/L as B)) - boron concentration from a filtered water sample in micrograms per liter.
01046	N10	**Fe_dis** (Iron dissolved (µg/L as Fe)) - iron concentration from a filtered water sample in micrograms per liter.
01056	N10	**Mn_dis** (Manganese dissolved (µg/L as Mn)) - manganese concentration from a filtered water sample in micrograms per liter.
01090	N10	**Zn_dis** (Zinc dissolved (µg/L as Zn)) - zinc concentration from a filtered water sample in micrograms per liter.
70300	N10	**TDS** (Residue dis 180C mg/L) - total dissolved solids concentration in milligrams per liter determined by evaporating a water sample at 180°C and weighing the remaining residue.
70301	N10	**TDS_sum** (Dissolved solids mg/L) - total dissolved solids concentration in milligrams per liter determined by adding the concentrations of measured constituents.

DOCUMENTATION OF SPRGINFO.DB

Source: USGS Ground-Water Sites Inventory (GWSI)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989).

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the spring location. The last two digits are a sequence number used to distinguish between sites of the same location.
C802	A9	**Stat-type** (Station-type codes) - designates the type of site. A 'Y' for yes is positioned in the column corresponding to the type of site as follows: 1 - Stream 2 - Lake or reservoir 3 - Estuary 4 - Unassigned 5 - Spring 6 - Ground water other than spring 7 - Meteorological 8 - Unassigned 9 - Unassigned In this file all stat-type should have a 'Y' in column 5 of this field.
C003	A3	**Recd** (Record classification) - indicates the reliability of the data available for the site as follows: C - Data have been field checked by the reporting agency L - Location not accurate M - Minimal data U - Data have not been field checked by the reporting agency, but the reporting agency considers the data reliable

DOCUMENTATION OF SPRGINFO.DB (CONTINUED)

C004	A6	**Source** (Source agency code) - denotes the agency providing the data. The USGS is the only source listed in this field.
C006	N3	**Dcode** (District code) - denotes the USGS Water Resource Division District that reported the data. '35' is the code for the Albuquerque District Office.
C007	N2	**Scode** (State code) - denotes the state in which the site is located. All sites are located in New Mexico (state code 35).
C008	N3	**Ccode** (County code) - denotes the county in which the site is located as follows: 05 - Chaves 11 - DeBaca 15 - Eddy 27 - Lincoln 35 - Otero 57 - Torrance
C009	N7	**Latitude** (Latitude) - latitude for the site in degrees, minutes, and seconds.
C010	N8	**Longitude** (Longitude) - longitude for the site in degrees, minutes, and seconds.
C011	A3	**LLac** (Lat-Long accuracy code) - indicates the accuracy of the latitude and longitude values as follows: S - Accurate to ± 1 second F - Accurate to ± 5 seconds T - Accurate to ± 10 seconds M - Accurate to ± 1 minute Blank - Accuracy unknown
C012	A26	**Local Well Number** (Local well number) - identifies the location of the spring by the township, range and section. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
C013	A22	**Land-net location** (Land-net location) - provides the legal description of the 10-acre tract in which the site is located. The smallest subdivision of the quarter section in listed first.

DOCUMENTATION OF SPRGINFO.DB (CONTINUED)

C014	A12	**Name of location map** (Location map) - name of the USGS topographic map on which the site can be located.
C015	N7	**Map scale** (Map scale) - identifies the scale of the map named in the previous field.
C016	N8	**LSD_feet** (Altitude) - altitude of the land surface in feet above mean sea level.
C017	A3	**LSDmeth** (Method altitude determined) - describes the method used to determine the altitude of land surface as follows: A - Altimeter L - Level or other surveying method M - Interpolated from topographic map
C018	N3	**Altacc** (Altitude accuracy) - denotes the accuracy of the altitude of land surface in feet.
C019	A3	**Toposet** (Topographic setting code) - describes the topographic setting in which the site is located. The following USGS codes are permitted: A - Alluvial fan B - Playa C - Stream channel D - Local depression E - Dunes F - Flat surface G - Flood plain H - Hilltop K - Sinkhole L - Lake, swamp, or marsh M - Mangrove O - Offshore P - Pediment S - Hillside (slope) T - Alluvial or marine terrace U - Undulating V - Valley flat (valleys of all sizes) W - Upland draw
C020	N8	**Hydrounit** (Hydrologic unit code) - designates the hydrologic unit code for the Office of Water Data Coordination cataloging unit in which the site is located. Figure B-1 shows the currently designated hydrologic unit codes for the State of New Mexico.

DOCUMENTATION OF SPRGINFO.DB (CONTINUED)

C023	A3	**SUse1** (Primary use of site) - code describing the principal or first use for the site. The USGS codes are as follows: A - Anode C - Standby emergency supply D - Drain E - Geothermal G - Seismic H - Heat reservoir M - Mine O - Observation P - Oil or gas well R - Recharge S - Repressurize T - Test U - Unused W - Withdrawal of water X - Waste disposal Z - Destroyed
C024	A3	**WUse1** (Primary use of water) - code describing the principal use of water from the site. The USGS codes are as follows: A - Air conditioning B - Bottling C - Commercial D - Dewater E - Power F - Fire H - Domestic I - Irrigation J - Industrial (cooling) K - Mining M - Medicinal N - Industrial P - Public supply Q - Aquaculture R - Recreation S - Stock T - Institutional U - Unused Y - Desalination Z - Other (explained in remarks)
C025	A3	**WUse2** (Secondary use of water) - if the water from the site is used for more than one purpose, a code may have been entered.

DOCUMENTATION OF SPRGINFO.DB (CONTINUED)

C026	A3	**WUse3** (Tertiary use of water) - if a third use of the water from the site exists, a code may have been entered.
C714	A10	**AQUIFCODE** (Primary aquifer) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
---	N10	**X** (A DBS&A generated field) - X coordinate in meters using a UTM projection for zone 13.
---	N10	**Y** (A DBS&A generated field) - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.

DOCUMENTATION OF SPSAMP.DB

Source: USGS National Well Inventory System (NWIS)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of some of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989). An explanation for water-quality fields was not available from the USGS, and thus the description provided below is based on the interpretation by DBS&A of the field name provided by the USGS. A -999999 recorded in a field indicates that no data were collected for that sampling event.

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the spring location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	A21	**Local** (Local) - identifies the location of the spring by the township, range and section. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
---	N10	**Cntyc** (Cntyc) - denotes the state and county in which the site is located. The first two digits refer to the state code and the last two to the county code. The code for New Mexico is 35, and the codes for counties included in this file are as follows: 05 - Chaves 11 - DeBaca 15 - Eddy 27 - Lincoln 35 - Torrance
---	A4	**Sitec** (Sitec) - code describing the type of site. For this file the following codes are used: SP - Spring SPSW - Spring/Stream
---	N10	**SAMPDATE** (Dates) - year, month and day spring water sample was collected.

DOCUMENTATION OF SPSAMP.DB (CONTINUED)

---	N10	**SAMPTIME** (Times) - time sample was collected.
C714	A10	**AQUIFCODE** (Gunit) - identifies the primary aquifer unit from which the water is obtained. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 313CPTN - Capitan Formation 313GRBG - Greyburg Formation 318BSPG - Blue Springs Formation 210MNCS - Mancos Formation 310GLRT - Glorieta Sandstone
00010	N10	**Temp** (Water temperature) - temperature of water in degrees Celsius from spring at time of sample collection.
00027	N10	**Collect agency** (Collecting agency) - code describing the agency collecting sample. USGS codes included in this field are as follows: 01028 - Geological Survey 80020 - Denver Central Laboratory
00028	N10	**Lab** (Analyzing agency) - code describing the agency performing the water-chemistry analyses. USGS codes included in this field are as follows: 01028 - Geological Survey 80020 - Denver Central Laboratory
00059	N10	**Flow rate** (Flow rate instantaneous, gallons/minute) -discharge rate measured from spring in gallons per minute at time of sample collection.
00095	N10	**Cond_25C** (Specific conduct µs/cm @ 25C) - electrical conductivity, in micromhos per centimeter, of water at time of sample collection, corrected to 25^{o}C.
00400	N10	**pH (field)** (pH, wh, field) - pH of water sample measured in the field at time of sample collection.
00403	N10	**pH (lab)** (pH, wh, laboratory) - pH of water sample measured in the laboratory.

DOCUMENTATION OF SPCARB.DB, SPMAJ.DB, AND SPMETL.DB

Source: USGS National Well Inventory System (NWIS)
Retrieved: June 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. A more detailed explanation of some of these codes is presented in the USGS GWSI coding manual (Babcock et al., 1989). An explanation for water-quality fields was not available from the USGS, and thus the description provided below is based on the interpretation by DBS&A of the field name provided by the USGS.

SPCARB.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the spring location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
00405	N10	**CO2** (Carbon dioxide d (mg/L as CO_2)) - carbon dioxide concentration in milligrams per liter.
00410	N10	**Alk_CaCO3** (Alkalinity, wh, fe (mg/L as $CaCO_3$)) - alkalinity expressed as milligrams per liter of $CaCO_3$.
00440	N10	**HCO3** (Bicarbonate, wh, f (mg/L as HCO_3)) - bicarbonate concentration in milligrams per liter.
00445	N10	**CO3** (Carbonate, wh, fet (mg/L as CO_3)) - carbonate concentration in milligrams per liter.
00618	N10	**NO3_N** (Nitrogen nitrate (mg/L as N)) - nitrate concentration expressed as milligrams per liter of nitrogen.
00630	N10	**NO2+NO3_N** (NO_2 + NO_3 total (mg/L as N)) - nitrite and nitrate concentration expressed as milligrams per liter of nitrogen.

DOCUMENTATION OF SPCARB.DB, SPMAJ.DB, AND SPMETL.DB (CONTINUED)

00660	N10	**PO4** (Phosphate ortho. (mg/L as PO_4)) - phosphate concentration in milligrams per liter.
00671	N10	**P** (Phosphorus ortho. (mg/L as P)) - phosphorus concentration in milligrams per liter.
00900	N10	**Hardness_CaO3** (Hardness total (mg/L as CaO_3)) - total hardness expressed as calcium oxide in milligrams per liter.
00902	N10	**Noncarb Hard_CaCO3** (Noncarbonate har (mg/L as $CaCO_3$)) - hardness of water attributed to non-carbonated elements (Mg) expressed as milligrams per liter of calcium carbonate.

DOCUMENTATION OF SPCARB.DB, SPMAJ.DB, AND SPMETL.DB (CONTINUED)

SPMAJ.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the spring location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day spring water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
00915	N10	**Ca** (Calcium dissolved (mg/L as Ca)) - calcium concentration from a filtered water sample in milligrams per liter.
00925	N10	**Mg** (Magnesium dissolved (mg/L as Mg) - magnesium concentration from a filtered water sample in milligrams per liter.
00930	N10	**Na** (Sodium dissolved (mg/L as Na) - sodium concentration from a filtered water sample in milligrams per liter.
00931	N10	**SAR** (Sodium adsorption (ratio)) - sodium adsorption ratio.
00932	N10	**Na%** (Sodium percent) - milliequivalent of sodium divided by the total milliequivalent.
00933	N10	**Na+K** (Sodium + potassium (mg/L as Na)) - sodium and potassium concentration expressed as sodium in milligrams per liter.
00935	N10	**K** (Potassium dissolved (mg/L as K)) - potassium concentration from a filtered water sample in milligrams per liter.
00940	N10	**Cl** (Chloride dissolved (mg/L as Cl)) - chloride concentration from a filtered water sample in milligrams per liter.
00945	N10	**SO4** (Sulfate dissolved (mg/L as SO_4)) - sulfate concentration from a filtered water sample in milligrams per liter.
00950	N10	**F** (Fluoride dissolved (mg/L as F)) - fluoride concentration from a filtered water sample in milligrams per liter.

DOCUMENTATION OF SPCARB.DB, SPMAJ.DB, AND SPMETL.DB (CONTINUED)

00955	N10	**SiO2** (Silica dissolved (mg/L as SiO_2)) - silica concentration from a filtered water sample in milligrams per liter.

DOCUMENTATION OF SPCARB.DB, SPMAJ.DB, AND SPMETL.DB (CONTINUED)

SPMETL.DB

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
C001	A15	**Siteid** (Siteid) - a unique number provided by the USGS which is initially formed from the latitude and longitude of the spring location. The last two digits are a sequence number used to distinguish between sites of the same location.
---	N10	**SAMPDATE** (Dates) - year, month and day spring water sample was collected.
---	N10	**SAMPTIME** (Times) - time sample was collected.
01005	N10	**Ba_dis** (Barium dissolved (μg/L as Ba)) - barium concentration from a filtered water sample in micrograms per liter.
01020	N10	**B_dis** (Boron dissolved (μg/L as B)) - boron concentration from a filtered water sample in micrograms per liter.
01046	N10	**Fe_dis** (Iron dissolved (μg/L as Fe)) - iron concentration from a filtered water sample in micrograms per liter.
01056	N10	**Mn_dis** (Manganese dissolved (μg/L as Mn)) - manganese concentration from a filtered water sample in micrograms per liter.
01090	N10	**Zn_dis** (Zinc dissolved (μg/L as Zn)) - zinc concentration from a filtered water sample in micrograms per liter.
70300	N10	**TDS** (Residue dis 180C mg/L) - total dissolved solids concentration in milligrams per liter determined by evaporating a water sample at 180°C and weighing the remaining residue.
70301	N10	**TDS_sum** (Dissolved solids mg/L) - total dissolved solids concentration in milligrams per liter determined by adding the concentrations of measured constituents.

DOCUMENTATION OF ISOTOPE.DB

Source: Compiled by DBS&A from reports and files of G.W. Gross
Created: August 1992

The following fields included in this database are described below.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A9	**Town** - township in which the site is located.
A8	**Range** - range in which the site is located.
A10	**Section** - section in which the site is located. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
A33	**Well name** - name used to described the well or spring. Well or spring name is often that of the owner.
A15	**Welldepth** - depth of the well in feet below land surface.
A24	**Screen Interval** - screen interval of well, in feet below land surface.
N	**Sampdate** - date sample was collected.
N	**TU** - tritium concentration expressed as tritium units.
A8	**TUacc** - accuracy of the tritium analyses.
N	**O18** - oxygen 18 concentration expressed as o/oo.
N	**Deuterium** - deuterium concentration expressed as o/oo.
A26	**Compzone** - lithologic units contributing water to the well or spring. USGS aquifer codes were utilized for this field. The following codes were identified: 110AVMB - Alluvium 110GTUN - Gatuna Formation 313ARTS - Artesia Group 313SADR - San Andres Formation 310GLRT - Glorieta Sandstone 310YESO - Yeso Formation
A45	**Remarks** - comments regarding the sample location or event.

DOCUMENTATION OF TRITIUM.DB

Source: Compiled by DBS&A from reports and files of G.W. Gross
Created: August 1992

This database was created as a summary of ISOTOPE.DB and was utilized in creating a plot of the tritium data. The following fields included in this database are described below.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A13	**Siteid** - a unique number for the site which was created by determining the latitude and longitude of the site from the township, range and section using the USGS program called LAND.EXE. The Siteid in this file may not correspond precisely to the Siteid in WELLINFO.DB or SPRGINFO.DB due to variations in the numbers of divisions used to describe the quarter section location.
N10	**Xlocation** - X coordinate in meters using a UTM projection for zone 13.
N10	**Ylocation** - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.
A9	**Twnshp** - township in which the site is located.
A8	**Range** - range in which the site is located.
A10	**Section** - section in which the site is located. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
A33	**Wellname** - name used to described the well or spring. Well or spring name is often that of the owner.
A15	**Welldepth** - depth of the well in feet below land surface.
A24	**Screen Interval** - screen interval of well, in feet below land surface.
A13	**Per.record** - period of record for tritium sample analyses for the site.
N	**#samp** - number of samples collected for site for the period of record.
N	**TU avg** - average tritium concentration determined from the samples collected.
A12	**TU range** - range of tritium concentrations detected for the period of record for the site.

DOCUMENTATION OF TRITIUM.DB (CONTINUED)

A26 **Compzone** - lithologic units contributing water to the well or spring.

A60 **Remarks** - comments regarding the sample location or event.

DOCUMENTATION OF AQPARA.DB

Source: Compiled by DBS&A using summary tables of McAda (1991), Rao (1991), files of G.W. Gross, and other references.
Created: September 1992

This database was created as a summary of aquifer parameters and will be used for preparing maps of transmissivity, specific storage, and leakance for major hydrogeologic units. The following fields included in this database are described below.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A15	**Siteid** - a unique number for the site which was created by determining the latitude and longitude of the site from the township, range and section using the USGS program called LAND.EXE. The Siteid in this file may not correspond precisely to the Siteid in WELLINFO.DB or SPRGINFO.DB due to variations in the numbers of divisions used to describe the quarter section location.
N10	**Xlocation** - X coordinate in meters using a UTM projection for zone 13.
N10	**Ylocation** - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.
A5	**Townshp** - township in which the well is located.
A5	**Range** - range in which the well is located.
A10	**Section** - section in which the well is located. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
A42	**Scint** - screen interval of well, in feet below land surface. Intervals separated by a semi-colon indicate that more than one well was identified for the location from the data sources listed in the field **comp.data**. The screen intervals are listed in order corresponding to the order listed in **Seo#**. Intervals separated by a comma indicate that the well was screened in more than one section.
N	**Sclen_calc** - the estimated screen length used to calculate K for pump tests that were too short to ignore the effects of partial penetration.
A19	**Sclen** - screen length of well in feet. Screen lengths separated by a comma correspond to the screen intervals listed in **Scint**.
N	**Aq.thick** - The thickness of the aquifer at the location of the well as depicted by Welder (1983).

DOCUMENTATION OF AQPARA.DB (CONTINUED)

A16 **Elev_LSD** - elevation of the ground surface in feet above mean sea-level datum. If more than one well was identified for the location, the elevations are listed in corresponding order. In some cases, more than one elevation is recorded for a particular well by different sources.

A39 **Seo#** - well number as designated by the State of New Mexico Engineer Office. Well numbers separated by a comma indicate that more than one well was identified at the designated location. The '?' alerts database user that well has not been identified.

A5 **Comp.data** - denotes the source of the well completion data. Well completion data sources separated by a comma indicate that the data was acquired from more than one data source. The data source numbers correspond to the following sources:

1 - Summers, W.K. 1968. Records of wells in the Roswell Basin. Data from Dr. W. Gross, New Mexico Institute of Mining and Technology.

2 - Hantush, M.S. 1957. Preliminary quantitative study of the Roswell ground-water reservoir, New Mexico. New Mexico Institute of Mining and Technology, Research and Development Division, Socorro, New Mexico, 118p.

3 - Saleem Books I & II. Data from Dr. W. Gross, New Mexico Institute of Mining and Technology.

4 - Mower, R.W., Hood, J.W., Cushman, R.L., Borton, R.L., and Galloway, S.E. 1964. An appraisal of potential ground-water salvage along the Pecos River between Acme and Artesia New Mexico. U.S. Geological Survey Water-Supply Paper 1659, 98p., 10 plates.

5 - Hantush, M.S. 1961. Aquifer tests on saline water wells near Roswell: New Mexico Institute of Mining and Technology Open-File Report, 21p.

6 - USGS. City of Roswell pump test data, 1970.

A3 **Conf.** - confidence in well completion data. An "X" denotes those wells which DBS&A are confident in the well completion data. All other wells have uncertain completion data.

A11 **Latitude** - latitude for the site in degrees, minutes, and seconds.

A12 **Longitude** - longitude for the site in degrees, minutes, and seconds.

N **T_ft^2/day** - transmissivity in square feet/day as listed in McAda, 1991 data summary tables.

DOCUMENTATION OF AQPARA.DB (CONTINUED)

A10	**Storage** - storage as listed in McAda, 1991 data summary tables.
N	**Scalc** - the storage coefficient used to estimate quality of pump tests.
N	**R_calc** - radius of well used in calculation to estimate the quality of the pump tests. All were assumed to be 0.5 feet.
N	**U_test** - test to determine if aquifer test was sufficiently long for Jacob straight-line method. If $U < 0.1$, then straight-line method okay. $U = r^2S/4Tt$.
N	**Jactest_hrs** - test to determine if aquifer test was long enough to ignore the effects of partial penetration. If $t > D^2S/2KD$, then partial penetration can be ignored.
A10	**L_gpd/ft^3** - leakance in gallons per day/cubic foot (gpd/ft^3) as listed in McAda, 1991 data summary tables.
N	**Ttime_hrs** - length of pumping test (t) in hours.
A3	**Tl** - test length evaluation. If t is greater than **Jactest_hrs**, then **Tl** = L; if t is less than **Jactest_hrs**, then **Tl** = S.
N	**K_ft/d** - hydraulic conductivity of the aquifer obtained by dividing T by the aquifer thickness where **Tl** = L, or by **Sclen_calc** where **Tl** = S.
N	**Quality** - DBS&A evaluation of the overall reliability of the aquifer test. 1 - Excellent (where observation wells were utilized) 2 - Fair (where **Ttime** was greater than **Jactest_hrs**) 3 - Uncertain (where **Ttime** was less than **Jactest_hrs**)
A15	**Aquifer** - identifies the primary aquifer unit from which the water is obtained (screened interval) as described by the original source.
A25	**AQUIFCODE** - identifies the primary aquifer unit from which the water is obtained based on construction details identified for each well and comparing to figures presented by Welder (1983). Only those wells with construction details could be verified. The primary aquifers identified in the vicinity of the Roswell Basin are as follows: 110AVMB - Alluvial fill 310YESO - Yeso Formation 312RSLR - Rustler Formation 313ARTS - Artesia Group 313SADR - San Andres Formation

DOCUMENTATION OF AQPARA.DB (CONTINUED)

313GRBG - Grayburg Formation
310GLRT - Glorieta Sandstone

A9 **Aqplot** - the aquifer designation used in preparing plots. Based on **AQUIFCODE** or **Aquifer**.

A23 **Aqdatsour** - denotes the original source of the aquifer parameters.

A34 **Testtype** - denotes the method used to estimate aquifer parameters. For pump tests, the duration of the test is given.

A15 **Wellname** - denotes the well name, or well owner as listed in well completion data source.

A50 **Comments** - additional comments on well completion data, and number of observation wells used for pump tests.

DOCUMENTATION OF SURWQ.DB

Source: USGS National Well Inventory System (NWIS)
Retrieved: July 1992

The following fields are included in this database. The field name utilized by the USGS is included in parentheses and the USGS Code is listed in the left column. An explanation for water-quality fields was not available from the USGS, and thus the description provided below is based on the interpretation by DBS&A of the field name provided by the USGS.

USGS CODE	FIELD LENGTH	FIELD NAME AND DESCRIPTION
---	A10	**StatID** (Station number) - a unique number provided by the USGS. The location and name for each station is listed in Table 16 of McAda, 1992.
---	N10	**DATES** (Dates) - year, month and day water sample was collected.
---	N10	**TIMES** (Times) - time sample was collected.
00060	N8	**Disch** (Discharge) - discharge in cubic feet per second.
00061	N8	**DischInst** (Discharge, inst.) - instantaneous discharge in cubic feet per second.
00095	N8	**Cond_25C** (Specific conduct μs/cm @ 25C) - electrical conductivity, in micromhos per centimeter, of water at time of sample collection, corrected to 25^{o}C.
00400	N8	**pH (field)** (pH, wh, field) - pH of water sample measured in the field at time of sample collection.
00020	N8	**AirTemp** (Air temperature) - temperature of air in degrees Celsius.
00010	N8	**WaterTemp** (Water temperature) - temperature of water sample in degrees Celsius.
00080	N8	**Color** (Color platinum-cobalt) - color of water sample.
00070	N8	**TurbJCU** (Turbidity JCU) - turbidity of water sample expressed as Jackson Candle Units.
00076	N8	**TurbNTU** (TURBIDITY NTU) - turbidity of water sample expressed in naphelonepahleometric turbidity units.

DOCUMENTATION OF SURWQ.DB (CONTINUED)

71820	N8	**Density** (Density at 20 C gm/ml) - density of water sample at 20°C, expressed as grams per milliliter.
00300	N8	**Oxygen** (Oxygen dissolved) - milligrams per liter of dissolved oxygen.
00335	N8	**CODLow** (COD low level) - chemical oxygen demand in milligrams per liter.
00340	N8	**CODhigh** (COD high level) - chemical oxygen demand in milligrams per liter.
00310	N8	**BOD** (BOD 5-day at 20) - biological oxygen demand in milligrams per liter.
00900	N8	**CaO3** (Hardness total (mg/L as CaO_3)) - total hardness expressed as calcium oxide in milligrams per liter.
00904	N8	**CaCO3** (Hardness nc.Dis) - milligrams per liter dissolved hardness as $CaCO_3$.
00915	N8	**Ca** (Calcium dissolved (mg/L as Ca)) - calcium concentration from a filtered water sample in milligrams per liter.
00925	N8	**Mg** (Magnesium dissolved (mg/L as Mg) - magnesium concentration from a filtered water sample in milligrams per liter.
00930	N8	**Na** (Sodium dissolved (mg/L as Na) - sodium concentration from a filtered water sample in milligrams per liter.
00931	N8	**SAR** (Sodium adsorption (ratio)) - sodium adsorption ratio.
00933	N8	**Na+K** (Sodium + potassium (mg/L as Na)) - sodium and potassium concentration expressed as sodium in milligrams per liter.
00935	N8	**K** (Potassium dissolved (mg/L as K)) - potassium concentration from a filtered water sample in milligrams per liter.
99440	N8	**HCO3** (Bicarbonate (mg/L HCO_3)) - bicarbonate concentration in milligrams per liter.
00450	N8	**HCO3_tot(450)** (Bicarbonate, wh,i (mg/L as HCO_3)) - bicarbonate concentration from an unfiltered sample in milligrams per liter.

DOCUMENTATION OF SURWQ.DB (CONTINUED)

00453	N8	**HCO3dis_F** - (Bicarbonate, dis (mg/L as HCO_3)) bicarbonate concentration from a filtered water sample.
99445	N8	**CO3** (Carbonate (mg/L as CO_3)) - carbonate concentration in milligrams per liter.
00447	N8	**CO3tot(447)** (Carbonate, wh, it (mg/L as CO_3)) - carbonate concentration from an unfiltered water sample in milligrams per liter.
00452	N8	**CO3dis_F** (Carbonate, dis, it (mg/L as CO_3)) - carbonate concentration from a filtered water sample in milligrams per liter.
99430	N8	**CO3_Alk** (Carbonate alkali mg/L) - carbonate alkalinity determined from incremental titration.
00419	N8	**Alktot_F** (Alkalinity, wh, it (mg/L as $CaCO_3$) - field determination of $CaCO_3$ alkalinity concentration from an unfiltered sample.
39086	N8	**Alkdis_F** (Alkalinity, dis, it (mg/L as $CaCO_3$) - field determination of $CaCO_3$ alkalinity concentration from a filtered sample.
00410	N8	**Alk_CaCO3_F** (Alkalinity, wh, fe (mg/L as $CaCO_3$)) - field determination of alkalinity expressed as milligrams per liter of $CaCO_3$ from an unfiltered sample.
90410	N8	**Alk_L** (Alkalinity (mg/L as $CaCO_3$)) - laboratory determination of alkalinity expressed as milligrams per liter of $CaCO_3$, titration to pH 4.5.
00440	N8	**HCO3tot(440)** (Bicarbonate, wh, f (mg/L as HCO_3)) - bicarbonate concentration in milligrams per liter.
00445	N8	**CO3tot(445)** (Carbonate, wh, fet (mg/L as CO_3)) - carbonate concentration in milligrams per liter.
00945	N8	**SO4** (Sulfate dissolved (mg/L as SO_4)) - sulfate concentration from a filtered water sample in milligrams per liter.
00940	N8	**Cl** (Chloride dissolved (mg/L as Cl)) - chloride concentration from a filtered water sample in milligrams per liter.
00950	N8	**F** (Fluoride dissolved (mg/L as F)) - fluoride concentration from a filtered water sample in milligrams per liter.
71870	N8	**Br** (Bromide dissolved (mg/L as Br)) - bromide concentration from a filtered water sample in milligrams per liter.

DOCUMENTATION OF SURWQ.DB (CONTINUED)

00955	N8	**SiO2** (Silica dissolved (mg/L as SiO_2)) - silica concentration from a filtered water sample in milligrams per liter.
70300	N8	**TDS** (Residue dis 180C mg/L) - total dissolved solids concentration in milligrams per liter determined by evaporating a water sample at 180°C and weighing the remaining residue.
70301	N8	**TDS_sum** (Dissolved solids mg/L) - total dissolved solids concentration in milligrams per liter determined by adding the concentrations of measured constituents.
00530	N8	**TDS_nonfilt** (Residual dis 180C mg/L) - total suspended and dissolved solids in a water sample.
00620	N8	**NO3-N_tot** (Nitrogen nitrate (mg/L as N)) - nitrate concentration from an unfiltered water sample expressed as milligrams per liter nitrogen.
00618	N8	**NO3-N_dis** (Nitrogen nitrate (mg/L as N)) - nitrate concentration expressed as milligrams per liter of nitrogen from a filtered water sample.
00615	N8	**NO2-N_tot** (Nitrogen nitrite (mg/L as N)) - nitrite concentration from an unfiltered water sample expressed as milligrams per liter nitrogen.
00613	N8	**NO2-N_dis** (Nitrogen nitrite (mg/L as N)) - nitrite concentration expressed as milligrams per liter of nitrogen from a filtered water sample.
00630	N8	**NO2+NO3-N_tot** (NO_2 + NO_3 total (mg/L as N)) - nitrite and nitrate concentration expressed as milligrams per liter of nitrogen from an unfiltered water sample.
00631	N8	**NO2+NO3-N_dis** (NO_2 + NO_3 dissol (mg/L as N)) - nitrite and nitrate concentration expressed as milligrams per liter of nitrogen from a filtered water sample.
00610	N8	**NH3-N_tot** (Nitrogen ammonia (mg/L as N) - ammonia concentration from an unfiltered water sample expressed as milligrams per liter nitrogen.
00608	N8	**NH3-N_dis** (Nitrogen ammonia (mg/L as N) - ammonia concentration from a filtered water sample expressed as milligrams per liter nitrogen.

DOCUMENTATION OF SURWQ.DB (CONTINUED)

00605	N8	**OrgN_tot** (Nitrogen organic (mg/L as N) - organic nitrogen species concentration from an unfiltered water sample expressed as milligrams per liter nitrogen.
00607	N8	**OrgN_dis** (Nitrogen organic (mg/L as N) - organic nitrogen species concentration from a filtered water sample expressed as milligrams per liter nitrogen.
00600	N8	**N** (Nitrogen total (mg/L as N) - nitrogen concentration in an unfiltered water sample in milligrams per liter.
00665	N8	**P-Tot** (Phosphorus total (mg/L as P)) - phosphorus concentration in milligrams per liter from an unfiltered water sample.
00671	N8	**P** (Phosphorus ortho. (mg/L as P)) - phosphorus concentration in milligrams per liter.
01045	N8	**Fe_Tot** (Iron total (µg/L as Fe)) - iron concentration from an unfiltered water sample in micrograms per liter.
01046	N8	**Fe_dis** (Iron dissolved (µg/L as Fe)) - iron concentration from a filtered water sample in micrograms per liter.

DOCUMENTATION OF ANNPUMP.DB

Source: State Engineer Office (SEO) Meter Reading Records
Created: October 1992

This database was created by the SEO from meter reading records and modified by DBS&A to include aquifer code. The following fields included in this database are described below.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A13	**Siteid** - a unique number for the site which was created by determining the latitude and longitude of the site from the township, range and section using the USGS program called LAND.EXE. The Siteid in this file may not correspond precisely to the Siteid in WELLINFO.DB or SPRGINFO.DB due to variations in the numbers of divisions used to describe the quarter section location.
N	**Latitude** - latitude for the site in degrees, minutes, and seconds converted from the township, range, and section using the USGS program called LAND.EXE.
N	**Longitude** - longitude for the site in degrees, minutes, and seconds converted from the township, range, and section using the USGS program called LAND.EXE.
N10	**Xlocation** - X coordinate in meters using a UTM projection for zone 13.
N10	**Ylocation** - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.
A4	**Townshp** - township in which the well is located.
A3	**Range** - range in which the well is located.
A2	**Section** - section in which the well is located. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
A6	**Quarter** - quarter section(s) in which the well is located. The largest subdivision of the quarter section is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, SE as 4.
D	**Date** - the year for which the **use_afy** field is totalled.
N	**use_afy** - the total pumping in acre-feet per year for the year listed in the **Date** field.

DOCUMENTATION OF ANNPUMP.DB (CONTINUED)

A10 **Aquifcode** - identifies the primary aquifer unit from which the water is obtained. Designation identified from SEO records, USGS GWSI, and DBS&A review of well logs. The aquifer designations are:

CARB - Carbonate aquifer
SHAL - Shallow aquifer
UNK - Unknown aquifer

A10 **Keyaqcode** - the aquifer designation determined by DBS&A from investigations of well records.

A35 **Remarks** - information keyed by SEO when database was generated. Includes well use and **aquifcode** for some wells.

DOCUMENTATION OF MONPUMP.DB

Source: State Engineer Office (SEO) Meter Reading Records
Created: October 1992

This database was created by the SEO from meter reading records and modified by DBS&A to include aquifer code and use. The following fields included in this database are described below.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A28	**File#** - well number as designated by the SEO.
A10	**Aquifcode** - identifies the primary aquifer unit from which the water is obtained. Designation identified from SEO records, USGS GWSI, and DBS&A review of well logs. The aquifer designations are: CARB - Carbonate aquifer SHAL - Shallow aquifer UNK - Unknown aquifer
A17	**Location** - location of well by township, range, and section. The largest subdivision of the quarter is listed first. The NW quarter is identified with the number 1, NE as 2, SW as 3, and SE as 4.
A13	**Siteid** - a unique number for the site which was created by determining the latitude and longitude of the site from the township, range and section using the USGS program called LAND.EXE. The Siteid in this file may not correspond precisely to the Siteid in WELLINFO.DB or SPRGINFO.DB due to variations in the numbers of divisions used to describe the quarter section location.
N	**Latitude** - latitude for the site in degrees, minutes, and seconds converted from the township, range, and section using the USGS program called LAND.EXE.
N	**Longitude** - longitude for the site in degrees, minutes, and seconds converted from the township, range, and section using the USGS program called LAND.EXE.
N	**Xlocation** - X coordinate in meters using a UTM projection for zone 13.
N	**Ylocation** - Y coordinate in meters using a UTM projection for zone 13 and a Y shift of -4,000,000 meters.
A24	**Meter#** - the meter number as recorded by the SEO.
A5	**Use** - the use of the water derived from the well.

DOCUMENTATION OF MONPUMP.DB (CONTINUED)

MUN - City supply well
IND - Industrial well

N **Jan 82-86 - Dec 82-86** - monthly usage for well.

Total 82-86 - summary of monthly usage for each year.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1

STREAMF2.WQ1

Source: McAda (1992)

The following fields are included in this database. Monthly and annual total stream discharge data are included for 26 gaging stations along the Pecos River (for periods ranging from 1906 to 1992). For each gaging station, the first row contains the station name, its ID number, and a brief location description. Field 1 (Col. A) contains the water year, Fields 2-13 (Cols. B-M) contain the monthly discharge, Field 14 (Col. N) contains the annual total discharge, and Field 15 (Col. O) is the annual discharge divided by 1000 (for plotting purposes).

FIELD LENGTH	FIELD NAME AND DESCRIPTION
N10	**ID** - the gaging station identification number.
A60	**STATION NAME** - a brief location description.
N10	**LAT** - latitude of the gaging station.
N10	**LONG** - longitude of the gaging station.
N10	**DRAINAGE AREA** - drainage area of the gaging station location in acres.
N10	**WATER YEAR** - year of record for stream discharge measurement.
N10	**OCT** - monthly measurement of stream discharge for October in acre-feet.
N10	**NOV** - monthly measurement of stream discharge for November in acre-feet.
N10	**DEC** - monthly measurement of stream discharge for December in acre-feet.
N10	**JAN** - monthly measurement of stream discharge for January in acre-feet.
N10	**FEB** - monthly measurement of stream discharge for February in acre-feet.
N10	**MAR** - monthly measurement of stream discharge for March in acre-feet.
N10	**APR** - monthly measurement of stream discharge for April in acre-feet.
N10	**MAY** - monthly measurement of stream discharge for May in acre-feet.
N10	**JUN** - monthly measurement of stream discharge for June in acre-feet.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

N10 **JUL** - monthly measurement of stream discharge for July in acre-feet.

N10 **AUG** - monthly measurement of stream discharge for August in acre-feet.

N10 **SEP** - monthly measurement of stream discharge for September in acre-feet.

N10 **ANNUAL TOTAL (AC-FT)** - annual total stream discharge for the corresponding gar in acre-feet.

N10 **TOTAL/1000** - annual total stream discharge divided by 1000 (for plotting purposes).

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

PRSEEP.WQ1

Source: Compilation of USGS Water Resources Data Reports

The following fields are included in this database, which is a compilation of all known seepage study results for the Pecos River, Acme-Artesia reach (for 1955 to present). River reach is in Field 1 (Col. A), river mile is in Field 2 (Col. B), and computed gains/losses for various seepage studies are in Fields 3-32 (Cols. C-AE).

FIELD LENGTH	FIELD NAME AND DESCRIPTION
A36	**Brief Descrp**. - name and/or brief description of the river reach.
N10	**Pecos River Mile** - location of the river reach in miles, according to a mile marker along the Pecos River.
N10	**1955 JANa** - seepage measurement for January 1955 in cubic feet per second; a designates measurement number 1.
N10	**1955 JANb** - seepage measurement for January 1955 in cubic feet per second; a designates measurement number 2.
N10	**1956 JANa** - seepage measurement for January 1956 in cubic feet per second; a designates measurement number 1.
N10	**1956 JANb** - seepage measurement for January 1956 in cubic feet per second; b designates measurement number 2.
N10	**1956 FEBa** - seepage measurement for February 1956 in cubic feet per second; a designates measurement number 1.
N10	**1956 FEBb** - seepage measurement for February 1956 in cubic feet per second; b designates measurement number 2.
N10	**1956 JUNE** - seepage measurement for June 1956 in cubic feet per second.
N10	**1956 OCT** - seepage measurement for October 1956 in cubic feet per second.
N10	**1957 JAN** - seepage measurement for January 1957 in cubic feet per second.
N10	**1957 MARCH** - seepage measurement for March 1957 in cubic feet per second.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

N10 **1957 JUNE** - seepage measurement for June 1957 in cubic feet per second.

N10 **1958 JANa** - seepage measurement for January 1958 in cubic feet per second; a designates measurement number 1.

N10 **1958 JANb** - seepage measurement for January 1958 in cubic feet per second; b designates measurement number 2.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

BASF1.WQ1

Source: McAda (1992, Table 17)

The following fields are included in this database, which is a compilation of monthly and annual total baseflow data for Acme to Artesia (for 1905 to 1989). Field 1 (Col. A) contains the year; Fields 2-13 (Cols. B-M) contain the monthly baseflow estimates for a given year; Field 14 (Col. N) contains the annual total baseflow; Field 15 (Col. O) contains the annual total baseflow divided by 1000 (for plotting purposes); and Field 16 (Col. P) is the original source of the baseflow estimate.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
N10	**Year** - year of record for baseflow measurement.
N10	**JAN** - monthly measurement of baseflow for January in acre-feet.
N10	**FEB** - monthly measurement of baseflow for February in acre-feet.
N10	**MARCH** - monthly measurement of baseflow for March in acre-feet.
N10	**APRIL** - monthly measurement of baseflow for April in acre-feet.
N10	**MAY** - monthly measurement of baseflow for May in acre-feet.
N10	**JUNE** - monthly measurement of baseflow for June in acre-feet.
N10	**JULY** - monthly measurement of baseflow for July in acre-feet.
N10	**AUG** - monthly measurement of baseflow for August in acre-feet.
N10	**SEPT** - monthly measurement of baseflow for September in acre-feet.
N10	**OCT** - monthly measurement of baseflow for October in acre-feet.
N10	**NOV** - monthly measurement of baseflow for November in acre-feet.
N10	**DEC** - monthly measurement of baseflow for December in acre-feet.
N10	**Annual Total** - annual total baseflow for the corresponding year in acre-feet.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

N10 **Annual Total/1000** - annual total baseflow for the corresponding year in acre-feet divided by 1000 (for plotting purposes).

A10 **Source** - original source of the baseflow estimate.

DOCUMENTATION OF STREAMF2.WQ1, PRSEEP.WQ1, BASF1.WQ1, AND PRECIP.WQ1 (CONTINUED)

PRECIP.WQ1

Source: McAda (1992, Table 17)

The following fields are included in this database. Monthly and annual total precipitation data are included for 12 stations (for 1930 to 1990). For each station, the first row contains the station name, its ID number, and the county in which it is located. Field 1 (Col. A) contains the year, Fields 2-13 (Cols. B-M) contain the monthly values, and Field 14 (Col. N) contains the annual total precipitation. Discontinuous periods of record are marked by a blank line.

FIELD LENGTH	FIELD NAME AND DESCRIPTION
N10	**Year** - year of record for precipitation measurement.
N10	**JAN** - monthly measurement of precipitation for January in inches.
N10	**FEB** - monthly measurement of precipitation for February in inches.
N10	**MAR** - monthly measurement of precipitation for March in inches.
N10	**APRIL** - monthly measurement of precipitation for April in inches.
N10	**MAY** - monthly measurement of precipitation for May in inches.
N10	**JUNE** - monthly measurement of precipitation for June in inches.
N10	**JULY** - monthly measurement of precipitation for July in inches.
N10	**AUG** - monthly measurement of precipitation for August in inches.
N10	**SEPT** - monthly measurement of precipitation for September in inches.
N10	**OCT** - monthly measurement of precipitation for October in inches.
N10	**NOV** - monthly measurement of precipitation for November in inches.
N10	**DEC** - monthly measurement of precipitation for December in inches.
N10	**TOTAL** - annual total precipitation for the corresponding year in inches.

APPENDIX C

EVALUATION OF THE TOPS OF AQUIFERS AND AQUITARDS

APPENDIX C
EVALUATION OF THE TOPS OF AQUIFERS AND AQUITARDS

The basis of the hydrogeologic framework used to develop the numerical model is based almost entirely on the work presented by Welder (1983). In order to verify Welder's aquifer boundaries, we have compared his estimates with other literature and with our own independent well log analysis. This appendix describes the methodology and results used to evaluate Welder's studies.

C.1 Shallow Aquifer

Literature sources describing the thickness and extent of the shallow aquifer were researched for comparison with data and concepts presented by Welder (1983). Twenty well record documents obtained from the New Mexico State Engineer Office (SEO) were analyzed and then compared to Welder's maps for the valley fill, and 11 well logs were reviewed to check the thickness of the Major Johnson Springs (MJS) aquifer.

C.1.1 Comparative Literature Analysis

Valley Fill. As discussed in Section 3.4.1, Welder based his shallow aquifer map entirely on work by Lyford (1973) who in turn had built on the work of Morgan (1938). Therefore, comparison with the various references shows 100% agreement with Welder.

Major Johnson Springs Aquifer. The thickness of the MJS aquifer is not explicitly defined in any references reviewed. Cox (1967) estimated that the average thickness of the aquifer is about 150 feet. Haskett (1984) mentions that the deepest part of the MJS aquifer is about 500 feet in the area below Lake McMillan. Crouch and Welder (1988) reviewed Bureau of Reclamation data and found that the aquifer ranges from 35 to 470 feet thick and averages 250 feet thick. The information presented by Welder (1983) on cross sections E-E' indicates that the MJS aquifer ranges from 0 to 450 feet thick, which does not conflict with the more recent studies.

C.1.2 Well Record Analysis

Valley Fill. Twenty well record documents were researched for wells which penetrated the valley-fill alluvium (Qal) and, in many cases, encountered underlying Permian sedimentary rocks. Table C-1 presents data obtained from this analysis and lists water-bearing intervals, rock descriptions, and apparent depths to the base of the alluvium at each well location. Welder's reported depths to the base of the Qal at each well site are also presented in Table C-1 for comparison.

Conclusions drawn from this comparative analysis are favorable in terms of Welder's presentation of the Lyford's data on the alluvial fill. Fifteen of the well records reviewed confirm the reported depth to the base of the alluvium to within 25 feet. Four of the well records agree to within 80 feet of Welder's and Lyford's depths. Some of the well logs are imprecise and/or ambiguous with regard to lithologic descriptions. Well No. RA-3103 indicates two possible formation contacts at 110 and 408 feet. Lyford (1973) appears to have taken an average of the two depths in reporting a figure of 260 feet. In summary, the review of well records generally supports the base of the alluvium as presented by Welder.

Major Johnson Springs Aquifer. Well logs were examined to check the thickness of the MJS aquifer as designated by Welder (1983, fig. 4) and to obtain more information about the extent and thickness of the aquifer. Well logs from the Bureau of Reclamation and SEO were examined as well as permeability data from the Bureau of Reclamation in order to assess the thickness of the MJS aquifer.

Welder (1983, fig. 4) shows the thickness of the MJS aquifer on cross sections E-E' and F-F' and does not provide a contour map of the base of the MJS aquifer (only the base of the valley fill). Therefore, it is difficult to precisely compare Welder's thickness to that determined from a particular well since most of the wells examined are not located exactly on a cross section. A range for the thickness of the MJS aquifer as inferred from Welder is used for comparison to data from well logs and permeability tests.

Examination of lithology or formation tops is not sufficient to define the thickness of the MJS aquifer due to the erratic development of permeable zones in the aquifer. For example, the MJS aquifer is comprised of permeable zones within the Seven Rivers Formation, but the percentage of the formation that is permeable may change from one locale to another.

DBS&A reviewed well logs from Bureau of Reclamation drill holes but could only obtain formation thicknesses from these logs. Table C-2 lists the thickness of the Seven Rivers Formation as determined from three of these logs. The thickness of the Seven Rivers Formation in these three wells ranged from 440 to 531 feet, which is about 100 feet greater than the thickness of the MJS aquifer shown by Welder. As stated above, this difference may be due to the fact that the aquifer thickness is not equal to the formation thickness.

Three SEO well logs close to Welder's cross sections were examined. Formation tops could not be determined from the driller's descriptions of cuttings, and the only indication of possible aquifer thickness were descriptions such as "principle water-bearing strata." The total thickness of the water-bearing strata ranged from 15 to 129 feet. This is considerably less than the 350-foot thickness presented by Welder; however, these logs are not a reliable indicator of the aquifer thickness.

Permeability data provided on cross sections produced by the Bureau of Reclamation (Undated) provided the best information on the thickness of the MJS aquifer. As shown in Table C-2, the thickness of the permeable zones in the Seven Rivers Formation varied form 275 to 425 feet. This information does not conflict with the data presented by Welder except for the southernmost well (DH-164), which indicates a thickness about 125 feet more than Welder's.

In summary, it appears that Welder's estimates of the thickness of the MJS aquifer may be about 100 feet less in some areas than the thicknesses obtained from well logs.

C.2 Carbonate Aquifer

Vertical hydrogeologic sections and related data from various literature sources were compared with those presented by Welder (1983). Additionally, well record information obtained from the SEO was used to verify Welder's interpretation regarding the carbonate aquifer.

C.2.1 Comparative Literature Analysis

The hydrogeologic study of the Roswell ground-water basin by Welder (1983) was compared to published data on the same subject by Havenor (1968), Maddox (1969), Kinney et al. (1968), and Lyford (1973). Our study focused in particular on Welder's cross sections and maps, which show the top of the San Andres Formation, the base of valley-fill sediments, the top of the artesian (carbonate) aquifer, and the thickness of the confining bed. Comparisons were then made to establish areas where the authors substantially agree and where there are strong conflicts in interpretation (noted in the "Remarks" column in Tables C-3 through C-8). A criterion of 40 feet was used to gauge the agreement between the author's interpretations. This criterion was chosen as 20% of the average carbonate aquifer thickness. The carbonate aquifer thickness was taken as the average of the difference between the top of the San Andres Formation and the base of the carbonate aquifer (from Tables C-6 through C-8).

In this phase of the analysis, elevations to specific horizons were taken from 29 wells that are located on the maps of Havenor (1968), Maddox (1969), and Kinney et al. (1968). These elevations were compared to the respective altitudes on Welder's (1983) cross sections and maps. Choosing the respective altitudes on Welder's cross sections and maps is subject to an error of ± 10 feet. Tables C-3 through C-8 list the locations and elevation data for the wells used in this study. From Maddox's report (1969), sufficient data were available to generate cross sections showing his interpretation of the top and base of the carbonate aquifer. These cross sections were then used as overlays for direct comparison with the cross sections of Welder (1983). Elevation data from Havenor (1968) were obtained from cross sections which are also subject to an error of ± 10 feet.

Comparison of Maddox (1969) and Welder (1983). Using data from maps by Maddox (1969), four cross sections were constructed along east-west lines identical to Welder's cross sections. Maddox defines the boundaries for the carbonate aquifer as follows:

- *Base of aquifer:* The sharp decrease in porosity, as shown in neutron logs (refer to plate 6 of Maddox [1969])

- *Top of aquifer:* Near the top of carbonate rocks of Permian age (refer to plate 1 of Maddox [1969])

- *Lateral aquifer boundary:* The line of intersection between two surfaces marking (1) the change in the porosity horizon and (2) the top of the carbonate rocks

Maddox bases the top of the carbonate aquifer on lithologic changes as defined by drillers' logs and bases the bottom of the carbonate aquifer on a decrease in porosity as indicated on neutron logs. Maddox maintains that the carbonate aquifer is confined to that part of the Permian section which primarily is comprised of carbonate rocks (i.e., limestone and dolomite). Complex facies changes are known to occur in the San Andres, Grayburg, and Queen Formations. These changes occur from north to south in the direction of the El Capitan reef. As inferred by Maddox, the carbonate section makes up the middle and upper parts of the San Andres Formation in the north and central regions of the ground-water basin, respectively. Hence, the carbonate aquifer locally occupies the mid- to upper stratigraphic zones within the San Andres. Approximately south of T. 17 S., the carbonate section occurs at stratigraphically higher positions in the Grayburg Formation and, progressively southward, in the Queen Formation. The carbonate aquifer here exists within the lower Artesia Group. Evaporite rocks (gypsum, anhydrite, and halite) make up the Artesia Group above the carbonate aquifer.

DBS&A compared the extent, thickness, and position of the carbonate aquifer by overlaying the cross sections generated from Maddox's maps (1969) on those of Welder (1983). The main conclusion of this comparison is that the two authors generally agree on the horizontal and vertical boundaries of the aquifer in the north and central parts of the ground-water basin. South of T. 18 S., however, interpretations begin to diverge. Maddox shows the carbonate aquifer pinching out southward of T. 18 S. and does not recognize its existence in the southernmost part of the basin. Welder's cross section F-F′ shows that he interprets the aquifer to continue considerably farther to the south than does Maddox. A comparison of the cross sections is summarized in Table C-3. Welder's estimates for the elevation of the aquifer top tend to be greater than those of Maddox, because of his attempt to generalize the aquifer system. This could lead to the disagreement between Welder and Maddox regarding the extension of the carbonate aquifer in the southernmost part of the basin.

Comparison of Kinney et al. (1968) Versus Welder (1983). Two cross sections presented by Kinney et al. (1968) display neutron and gamma-ray logs, with interpretive elevation picks from the top of the carbonate aquifer and the top of the San Andres Formation for 13 oil test wells. These elevation data were compared to respective elevations calculated from Welder's maps for each of the wells. Tables C-4 and C-5 summarize the comparisons.

Kinney et al. (1968) used neutron log interpretations to define the top of a "shallow porosity" zone. This shallow porosity zone, not to be confused with the "shallow aquifer" of Welder, represents the carbonate aquifer according to Kinney et al. (1968). The top of the San Andres Formation was defined by Kinney et al. (1968) using gamma-ray log interpretation. Although the top of the San Andres unit is not critical to this modeling study of the Roswell ground-water basin, comparison of these data gives an added indication of the overall reliability of Welder's investigation. Conclusions reached by comparing data of the two authors are summarized below.

North-south cross section (Kinney et al., 1968, fig. 4):

1. In general, the north-south cross section of Kinney et al. (1968) shows a gradual southward stratigraphic rise in the top of the "shallow porosity" zone. The zone rises from the mid- to upper part of the San Andres Formation in the north, but transects its upper contact at the south end of the Roswell ground-water basin. This is in agreement with Welder's interpretation (1983).

2. Data shown in Table C-4 indicate that the two authors substantially agree to within 40 feet regarding the elevation of the top of the San Andres Formation in 8 of the 10 wells analyzed.

3. Kinney et al. (1968) and Welder (1983) have different interpretations regarding elevations to the top of the carbonate aquifer. Welder's aquifer top is higher than Kinney's by 90 to 290 feet in 8 of 13 analyzed wells. This fact may not be surprising, since Welder's generalized upper aquifer surface indicates a maximum upper limit. At many well locations, the actual depth to a water-producing zone might be significantly below Welder's generalized upper limit. In comparison to Kinney et al., Welder's elevation of the aquifer top is higher.

East-west cross section (Kinney et al., 1968, fig. 4):

1. Table C-5 summarizes comparative data for this cross section. The authors substantially agree in picking the stratigraphic top of the San Andres Formation for all three wells analyzed.

2. Both investigators agree that the carbonate aquifer shifts stratigraphically upward in the southern part of the Roswell ground-water basin, crossing the top of the San Andres Formation into the overlying Grayburg Formation, from west to east.

3. Welder (1983) picks the top of the carbonate aquifer at 120 to 179 feet higher than Kinney et al. (1968).

Comparison of Havenor (1968) and Welder (1983). Havenor (1968) presents stratigraphic and structural interpretations for 17 oil test wells, based on electric log analysis. These wells are shown in three cross sections across the north part of the Roswell ground-water basin. Tables C-6, C-7, and C-8 list the comparative elevations for the top of the San Andres Formation and the base of the carbonate aquifer as shown by Havenor (1968), together with those estimated from maps in Welder (1983).

There is substantial agreement between the authors as to the elevation of the top of the San Andres Formation. Likewise, Havenor and Welder agree on the estimated base of the aquifer and its eastern boundary. The following are comparative observations for each cross section analyzed.

Southwest-northwest cross section (Havenor, 1968, plate 3):

1. As shown in Table C-6, good agreement exists for elevations at the top of the San Andres Formation for four of the five wells.

2. The base of Havenor's aquifer (1968) is generally located near the estimated bottom of Welder's zone; the elevation differences vary approximately 10 feet (except for one well location, where the elevation difference is 68 feet).

3. The authors agree on the position of the eastern boundary of the carbonate aquifer.

East-west cross section (Havenor, 1968, plate 4):

1. As indicated in Table C-7, there is very good agreement regarding elevations to the top of the San Andres Formation in three of the four wells analyzed.

2. Welder and Havenor disagree as to elevations at the base of the carbonate aquifer (e.g., elevation differences equal 60 and 62 feet).

3. There is good agreement regarding the position of the east limit of the aquifer.

Southwest-northeast cross section (Havenor, 1968, plate 5):

1. There is good agreement on elevations at the top of the San Andres Formation in six of eight wells listed in Table C-8.

2. The authors agree on the elevations at the base of the aquifer (within 24 feet) in five of six wells.

3. Both authors interpret the eastern limit of the aquifer consistently.

Conclusions. The comparison of published data described above lends confidence to Welder's study describing the carbonate aquifer in the northern and central Roswell ground-water basin. Havenor's estimates to the base of the aquifer in the northern third of the ground-water basin closely approximate those of Welder. Welder's upper aquifer boundary is highly generalized, smoothing over a complex and irregular zone of high porosity and permeability. With respect to Kinney et al., Welder's estimate of the elevations to the top of the aquifer is higher at some locations by as much as 100 to 300 feet. At other locations Kinney et al. agree with Welder's top of the carbonate aquifer within 50 feet. Because Welder's aquifer thickness is highly generalized, it seems to represent a maximum estimate.

There is substantial agreement between Maddox and Welder on the aquifer position and geometry in the northern and central ground-water basin areas. However, important differences exist between the authors' interpretations for the southern ground-water basin (south of T. 18 S.). Maddox reports the absence of the aquifer, whereas Welder describes its continuing presence as far south as T. 20 S. Two wells in T. 18 S. and T. 19 S. reported by Kinney et al. support Welder's interpretation. However, an analysis of additional well records may be helpful in verifying the southern extent of the aquifer.

As an additional check on Welder's work, elevations to the top of the San Andres Formation were analyzed at 30 well locations given by Kinney et al. and Havenor. There was very good agreement (within 40 feet of elevation) in 26 of the 30 wells, suggesting that Welder's overall approach was reasonable and further indicating the reliability of his results.

C.2.2 Well Record Analysis

Well record documents on file with the SEO were examined for data pertaining to ground water in the carbonate aquifer. Of the 20 well logs examined, 9 apparently were incorporated in maps by Welder (1983). Well completion data such as total depth, collar elevation, screened intervals, water-bearing intervals, and drillers' lithologic descriptions were used to define the depth to the top of the aquifer. An estimate of apparent aquifer thickness was also made. These spatial parameters were then compared to aquifer tops and thicknesses, calculated or measured from Welder's maps and cross sections, at each well location. Table C-9 summarizes well locations, water-bearing zones, depth to aquifer top, and apparent aquifer thickness as recorded on well records and compares these data to measured values from Welder (1983).

In general, the two data sets compare favorably; however, in some areas Welder has plotted the position of the carbonate aquifer considerably higher in elevation than what the well record data show. In the north and central parts of the ground-water basin, Welder has plotted the position of the carbonate aquifer with best accuracy. For 12 of 16 wells, the top of the aquifer is shown by Welder to be within ± 100 feet of the zone recorded on the well logs. Well records for two wells located at or outside the east boundary of Welder's carbonate aquifer have no recorded water-producing intervals, except as deep (+1,600 feet) oil shows. Welder's eastern aquifer boundary appears reasonably accurate in the region of T. 18 S. R. 26 E. and T. 19 S. R. 27 E. Two additional wells near the southern ground-water basin margin, where Welder lacks data, suggest that significant water-producing zones may be present as far south as T. 22 S.

Welder's (1983) estimates of aquifer thickness invariably exceed those indicated from an individual well record. His upper and lower aquifer boundaries are generalized, reflecting what he interprets to be the maximum thickness for a zone of high porosity/permeability made up of numerous interconnected solution voids. The comparative data in Table C-9 show that the water-producing intervals from well records fall within the vertical limits shown by Welder in 14 of 16 wells. Based on well record data, Welder's aquifer thickness is, on average, 181 feet greater than the thickness identified in a particular well. However, the water-producing zones indicated in most of the well records researched lie within or partially overlap the vertical aquifer boundaries shown in his cross sections.

Table C-1. Comparison of Welder's (1983) Reported Depth to Base of Valley Fill to Well Record Data

Seo Well Permit Number	Well Location	Well Record Data			Welder (1983)
		Water Bearing Intervals (ft)	Lithologic Description	Apparent Depth to Base of Qal (ft)	Reported Depth to Base of Qal (ft)
RA-53, RA-189-A	9.24.33.214	55-57 (2)	Sand, Gravel	62	60
RA-5213	10.24.17.230	None	Clay and Cemented Gravel	78	80
RA-5115	10.24.33.113	None	Clay, Sand and Gravel	190	150
RA-3103	11.25.8.422	None	Clay, Sand and Gravel	110 or 408	260
RA-1519	11.25.31.233	23-43 (20) 120-160 (40)	Gypsum Rock Clay and Gravel	219	240
RA-1539	12.25.34.311	100-124 (24) 129-135 (6) 171-181 (10)	Sand and Gravel Sand and Gravel Clay and Sand	181	150
RA-5361	12.25.25.333	73-77 (4) 135-147 (12)	Sand and Gravel Sand and Gravel	≥ 157	> 157
RA-379	13.26.31.411	None	Sand and Gravel	280 (?)	280
RA-4192	13.24.27.210	None	Clay, Sand and Gravel	160	160
RA-5518	14.26.30.444	None	Clay, Sand and Gravel	115	90
RA-1851	15.26.13.222	None	Sand and Clay	122	110
O-2-E-359	17.25.20.232	200-215 (15)	Shale (Clay), Sand and Clay	215	240
RA-1903	17.26.5.112	160-212 (52)	Gravel and Sand	≥ 216	210
RA-5416	17.26.5.111	95-175 (80)	Sand and Gravel	220	210
RA-305	17.26.24.311	None	Clay, Sand and Gravel	280	240
RA-1895	18.26.8.233	190-210 (20)	Sand and Gravel	295 (?)	270
RA-813-S	19.26.14.233	None	Sand and Gypsum	200	120
RA-1333-E	14.26.9.313	None	Clay, Sand and Gravel	> 250	> 222
RA-7296*	14.26.26.221	156-167 (11)	Sand and Gravel	> 167	> 150
RA-7766*	10.25.34.122	31-33 (2) 107-109 (2) 112-114 (2)	Sand Sand and Gravel Sand and Gravel	> 111	80

* Well drilled after September 1973. Not part of Lyford's (1973) database.

Qal = Valley fill

Table C-2. Comparison of the Thickness of the Seven Rivers Formation and Permeable Zones to the Thickness of the Major Johnson Springs Aquifer

Well Name	Thickness of Seven Rivers Fm.[1] (ft)	Thickness of Permeable Zones[1] (ft)	Thickness of MJS aquifer[2] (ft)
Bureau of Reclamation Wells			
DH-360	531.1	NA	300-450
DH-109	440.9	NA	300
DH-136	505.8	NA	300
DH-210	NA	275	300-450
DH-229	NA	325	300-450
DH-399	NA	325	300-450
DH-171	NA	350	300-450
DH-164	NA	425	300
SEO Wells			
RA-1732	NA	15	350
RA-3422	NA	97	300-450
RA-434	NA	129	350

[1] Determined from Bureau of Reclamation well logs
[2] As presented by Welder (1983)

NA = Not available

Table C-3. Conclusions Drawn in Comparing Data for the Carbonate Aquifer from Maddox (1969) and Welder (1983)

Cross Section[1]	Township	Remarks
A - A′	T7S, T8S	No comparison possible; Maddox lacks data.
B - B′	T10S, T11S	Very good agreement on aquifer thickness, elevation in R23E, R24E, and R25E, and location of east aquifer boundary. Welder shows greater aquifer thickness in the vicinity of Six-Mile Buckle, R23E, than does Maddox. No data by Maddox west of R23E. No comparison possible.
C - C′	T14S, T15S	Good agreement in R23E, R24E, and R25E. Welder shows aquifer present throughout R26E; Maddox shows the aquifer to pinch out near the K-M fault in R26E.
D - D′	T17S, T18S	Reasonable comparison of data in R23E, R24E. In R25E, R26E, Maddox shows extreme thinning and pinching out of the aquifer. Welder shows continuity of the aquifer, 300-500 ft thick, as far east as R27E. This is an area of conflicting interpretation.
E - E′	T19S, T20S	Maddox shows no carbonate aquifer present in R23E, R24E, R25E, and R26E. Welder indicates that the aquifer is continuous. This is a conflict area.

[1] Welder, 1983

Table C-4. Comparison of Welder's (1983) Top of Carbonate Aquifer to the Kinney et al. (1968) North-South Section

	Kinney et al. (1968)		Welder (1983)		
Well Location	Top of San Andres (ft)	Top of Shallow Porosity (ft)	Top of San Andres (ft)	Top of Carbonate Aquifer (ft)	Remarks
D.L. Ward No. 1 Blain-Fed T7S.R25E.4	3,278	3,217	3,290	Outside east limit of basin	Agree at top of San Andres (Δe = 12 ft). Conflict area regarding carbonate aquifer.
Steinberger No. 1 Santa Fe T9S.R25E.8	3,341	3,328	3,310	3,100	31-ft Δe at top of San Andres. 228-ft Δe at top of carbonate zone.
Turner, No. 2 Childress T10S.R25E.18	3,039	2,879	3,040	3,125	Agree at top of San Andres (Δe = 1 ft). 246-ft Δe at top of carbonate aquifer.
Cities Service No. 1, Nelson T11S.R25E.20	3,052	2,778	3,060	3,050	Agree at top of San Andres (Δe = 8 ft). 272-ft Δe at top of carbonate aquifer.
U.S.G.S. Irrigation Well T13S.R25E.28	2,778	2,880	2,890	2,970	112-ft Δe at top of San Andres. 90-ft Δe at top of carbonate aquifer.
Holmes/Ford No. 1 Moats T15S.R25E.4	2,915	2,640	2,770	2,930	145-ft Δe at top of San Andres. 290-ft Δe at top of carbonate aquifer.
Martin Yates III No. 2 LDY, T17S.R25E.34	2,730	2,736	2,770	2,970	40-ft Δe at top of San Andres. 234-ft Δe at top of carbonate aquifer.
Western Ventures, No. 1 Johnson, T18S.R25E.2	2,695	2,832	2,700	2,940	Agree at top of San Andres (Δe = 5 ft). 108-ft Δe at top of carbonate aquifer.
Yates Bros. No. 1 Sheirch-Fed, T19S.R25E.3	2,888	2,984	2,870	3,270	Agree at top of San Andres (Δe = 18 ft). 286-ft Δe at top of carbonate zone.
U.S.G.S. Irrigation T16S.R25E.11	2,827	2,937	2,811	2,890	Agree at top of San Andres (Δe = 16 ft). 47-ft Δe at top of carbonate zone.

Δe = elevation difference

Table C-5. Comparison of Welder's (1983) Top of Carbonate Aquifer to the Kinney et al. (1968) East-West Section

Well Location	Kinney et al. (1968)		Welder (1983)		Remarks
	Top of San Andres (ft)	Top of Shallow Porosity (ft)	Top of San Andres (ft)	Top of Carbonate Aquifer (ft)	
Yates & Martin No. 1 Estelle T17S.R23E.14	3,859	3,543	3,860	3,545	Good agreement on all elevations.
Miller Bros. No. 1 Jackson T17S.R25E.14	2,760	2,760	2,760	2,880	Agree at top of San Andres (Δe = 0 ft). 120-ft Δe at top of carbonate aquifer.
Western Ventures, No. 1 Pound, T17S.R26E.27	2,361	2,441	2,340	2,620	Agree at top of San Andres (Δe = 21 ft). 179-ft Δe at top of carbonate aquifer.

Δe = elevation difference

Table C-6. Comparison of Welder's (1983) Top of Carbonate Aquifer to Havenor's (1968) Southwest-Northeast Section

Well Location	Havenor (1968)		Welder (1983)		Remarks
	Top of San Andres (ft)	Base of Aquifer (ft)	Top of San Andres (ft)	Base of Carbonate Aquifer (ft)	
Franklin, Aston, Fair, Orchard Park 1, T12S.R25E.22	2,928	2,800	2,924	2,740	Agree at top of San Andres (Δe = 4 ft). 60-ft Δe at base of carbonate aquifer.
Westland Wagner I, T11S.R25E.18	3,120	2,860	3,134	2,870	Agree at top of San Andres (Δe = 14 ft). Agree at base of carbonate aquifer (Δe = 10 ft).
Valtz, Barbe No. 1, T11S.R25E.9	2,980	2,752	2,967	2,820	Agree at top of San Andres (Δe = 13 ft). 68-ft Δe at base of carbonate aquifer.
Spears, Leonard No. 1, T11S.R25E.2	3,012	3,032	3,020	At east boundary of carbonate aquifer.	Agree at top of San Andres (Δe = 8 ft). Agree on east limit of carbonate aquifer.
DeKalb, Lewis I T10S.R25E.13	2,968	Aquifer not present.	3,051	Outside east boundary of aquifer.	83-ft Δe at top of San Andres. Agree aquifer is not present.

Δe = elevation difference

Table C-7. Comparison of Welder's (1983) Top of Carbonate Aquifer to Havenor's (1968) East-West Section

Well Location	Havenor (1968)		Welder (1983)		Remarks
	Top San Andres (ft)	Base of Aquifer (ft)	Top San Andres (ft)	Base Carbonate Aquifer (ft)	
Kerr, No. 1 T12S.R24E.22	3,056	No data	3,150	No data	94-ft Δe at top of San Andres. Havenor infers the base of carbonate aquifer contact only.
Franklin, Aston, Fair, Orchard Park No. 1, T12S.R25E.22	2,932	2,800	2,924	2,740	Agree at top of San Andres (Δe = 8 ft). 60-ft Δe at base of carbonate aquifer.
Shell Bogie 1 T11S.R25E.34	2,872	2,628	2,875	2,690	Agree at top of San Andres (Δe = 3 ft). 62-ft Δe at base of carbonate aquifer.
Buffalo Comanche 1 T11S.R26E.26	2,796	Aquifer not present; east of boundary.	2,795	At east boundary of carbonate aquifer.	Agree at top of San Andres (Δe = 1 ft). Agree on east limit of carbonate aquifer.

Δe = elevation difference

Table C-8. Comparison of Welder's (1983) Top of Carbonate Aquifer to Havenor's (1968) Southwest-Northeast Section

Well Location	Havenor (1968) Top San Andres (ft)	Havenor (1968) Base of Aquifer (ft)	Welder (1983) Top San Andres (ft)	Welder (1983) Base Carbonate Aquifer (ft)	Remarks
Roswell, Well 16 T11S.R24E.18	3,508	3,212	3,500	3,230	Agree at top of San Andres (Δe = 8 ft). 28-ft Δe at base of carbonate aquifer.
Roswell, Test 1 T10S.R24E.33	3,468	3,056	3,405	3,080	63-ft Δe at top of San Andres. 24-ft Δe at base of carbonate aquifer.
PVACD, Test 1 T10S.R24E.34	3,352	3,056	3,320	3,060	32-ft Δe at top of San Andres. Agree at base of carbonate aquifer (Δe = 4 ft).
Hagerman Irrigation, Test 1 T10S.R24E.35	3,252	3,000	3,249	3,050	Agree at top of San Andres (Δe = 3 ft). 50-ft Δe at base of carbonate aquifer.
Turner, Childress No. 1 T10S.R25E.18	3,040	2,888	3,032	2,910	Agree at top of San Andres (Δe = 8 ft). 22-ft Δe at base of carbonate aquifer.
Kirk, Hightower I T10S.R25E.16	2,860	2,860	2,932	2,850	72-ft Δe at top of San Andres. Agree at base of carbonate aquifer (Δe = 10 ft).
INTEX, Bright I T10S.R25E.23	2,988	2,988	2,990	Near, but outside limit of carbonate aquifer of Welder.	Agree at top of San Andres (Δe = 2 ft). Boundary conflict regarding carbonate aquifer.
McAdams, Lewis I T10S.R25E.13	3,048	Aquifer not present.	3,051	Aquifer not present.	Agree at top of San Andres (Δe = 3 ft). Agree at east limit of aquifer.

Δe = elevation difference

Table C-9. Comparison of Welder's (1983) Thickness and Top of Carbonate Aquifer to Well Record Data
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SEO Well Permit Number	Well Location	Well Record Data: Water Bearing Intervals (ft)	Well Record Data: Depth to Top of Aquifer (ft)	Well Record Data: Apparent Aquifer Thickness (ft)	Welder (1983): Depth to Top of Aquifer (ft)	Welder (1983): Reported Aquifer Thickness (ft)
RA-2454	8.24.4.333	280-315 (35) 378-408 (30)	280	128	100	400 (WBZ @ 230-350, Sec. A-A′)
RA-5540*	9.24.28.111	92-240 (148) 249-352 (103)	92	260	65	380 (Avg.)
RA-4304*	10.25.33.442	554-574 (20) 580-589 (9) 590-595 (5)	554	41	500	70
RA-4672*	11.24.6.311	93-110 (17) 154-158 (4) 167-173 (6)	93	80	80	270
RA-3476	12.23.33.440	440-450 (10)	440	10	280 (Est.)	---
RA-1539*	12.25.34.311	814-850 (36) 870-896 (26) 905-915 (10)	650	265	542	460 (Avg.)
RA-3021-S	14.23.24.433	210-217 (7) 270-275 (5) 351-376 (25) 387-392 (5)	210	122	320	330
RA-5399*	14.26.9.313	945-1060 (115)	945	115	950	320 (Avg.)
V-5*	15.26.6.111	842-992 (150)	842	150	800	400
RA-5584	16.26.20.433	760-785 (25) 960-970 (10) 1010-1025 (15)	760	265	720	350
RA-3081	17.23.30.120	555-600 (45)	555	45	500	150
O-2-E-252*	18.26.1.420	None	---	---	E. Boundary of Aquifer	
O-2-E-420*	19.27.9.310	None	---	---	Outside E. Boundary of Aquifer	
RA-3085	20.24.3.140	278-285 (7) 285-292 (7)	278	14	350	200

*Well location shown on Welder's (1983) map as actual data point.

Table C-9. Comparison of Welder's (1983) Thickness and Top of Carbonate Aquifer to Well Record Data
Page 2 of 2

SEO Well Permit Number	Well Location	Well Record Data			Welder (1983)	
		Water Bearing Intervals (ft)	Depth to Top of Aquifer (ft)	Apparent Aquifer Thickness (ft)	Depth to Top of Aquifer (ft)	Reported Aquifer Thickness (ft)
RA-3422*	20.26.10.120	745-750 (5) 787-794 (7) 822-843 (21) 915-943 (28) 957-969 (12)	745	287	470	530 (WBZ @ 700-900, Sec. E-E′)
RA-5792	20.22.29.122	850-920 (70)	850	70	---	
RA-5778	20.22.4.213	680-725 (45)	680	45	---	
RA-5518	14.26.30.444	975-1015 (40) 1043-1089 (46) 1099-1106 (7)	975	131	912	340 (WBZ @ 900-1200, Sec. C-C′)
O-2-E-359	17.25.20.232	678-710 (32) 935-950 (15)	678	272	602	230
RA-305	17.26.24.311	900-965 (65)	900	65	750	300

*Well location shown on Welder's (1983) map as actual data point.

APPENDIX D

HYDROGRAPHS OF KEY WELLS AND LIST OF WELLS USED FOR WATER LEVEL CONTOUR MAPS

Appendix D, Part 1

List of Shallow Aquifer Wells Used for Water Level Contour Maps

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332626104294101	10S.24E.15.34220	3553		110AVMB	3541	19430104
332651104310601	10S.24E.16.13142	3587	150	110AVMB	3564	19430104
332707104314601	10S.24E.17.122223	3601	102	110AVMB	3576	19430104
332632104321601	10S.24E.18.42424	3611		110AVMB	3576	19430104
332523104314501	10S.24E.20.34440 CROCKET	3614	65	110AVMB	3577	19430104
332546104293801	10S.24E.22.411144	3570	24	110AVMB	3558	19430104
332522104301101	10S.24E.27.11111	3579		110AVMB	3563	19430104
332436104321201	10S.24E.29.33312	3603	72	110AVMB	3570	19430104
332337104322901	10S.24E.31.333	3600		110AVMB	3571	19430104
332350104321701	10S.24E.31.424434	3585		110AVMB	3568	19430104
332337104321801	10S.24E.31.44443	3589	29	110AVMB	3570	19430104
332241104334201	11S.23E.12.221141	3630	85	110AVMB	3578	19430104
332310104283901	11S.24E.02.32221	3549		110AVMB	3538	19430105
332244104300701	11S.24E.03.33333	3586	120	110AVMB	3566	19430104
332310104331001	11S.24E.06.311121	3615		110AVMB	3575	19430104
332244104324101	11S.24E.06.433	3611	52	110AVMB	3580	19430104
332247104322101	11S.24E.06.443412	3607		110AVMB	3576	19430104
332243104314101	11S.24E.08.122	3602		110AVMB	3579	19430104
332243104303901	11S.24E.09.122	3598		110AVMB	3569	19430104
332227104295301	11S.24E.10.13242	3587	214	110AVMB	3569	19430105
332231104290701	11S.24E.10.22434	3567	129	110AVMB	3554	19430105
332214104295201	11S.24E.10.32131	3589		110AVMB	3567	19430105
332131104274201	11S.24E.13.144444	3552	164	110AVMB	3536	19430106
332112104285901	11S.24E.14.31344	3593	85	110AVMB	3565	19430106
332124104292101	11S.24E.15.42131	3597	125	110AVMB	3567	19430106
332111104293301	11S.24E.15.43121	3601	199	110AVMB	3570	19430106
332145104314601	11S.24E.17.122334	3624	145	110AVMB	3575	19430105
332059104331101	11S.24E.18.333334	3655	148	110AVMB	3576	19430105
332006104330001	11S.24E.19.33443	3666	105	110AVMB	3581	19430105
332012104300501	11S.24E.22.333121	3609		110AVMB	3568	19430106

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332026104282801	11S.24E.23.41144	3571	131	110AVMB	3559	19430106
332008104281901	11S.24E.23.44331	3576	50	110AVMB	3562	19430106
331940104310901	11S.24E.28.13333	3633	143	110AVMB	3576	19430105
331940104314101	11S.24E.29.14444	3643	90	110AVMB	3569	19430105
331913104321001	11S.24E.29.3333	3657		110AVMB	3575	19430105
331846104293601	11S.24E.34.41111	3609		110AVMB	3569	19430106
331910104273501	11S.24E.36.12220	3572	220	110AVMB	3554	19430106
331847104280401	11S.24E.36.133333	3586	192	110AVMB	3561	19430106
332327104263801	11S.25E.06.123314	3526		110AVMB	3513	19430105
332309104260801	11S.25E.06.421131	3510	85	110AVMB	3505	19430105
332007104235001	11S.25E.22.33333	3493		110AVMB	3486	19430106
331942104241301	11S.25E.28.234311	3503	186	110AVMB	3496	19430106
332003104255001	11S.25E.29.11114	3530	120	110AVMB	3521	19430106
331914104253701	11S.25E.29.34333	3535	160	110AVMB	3528	19430106
331914104245501	11S.25E.29.44443	3521	30	110AVMB	3515	19430106
331923104264701	11S.25E.30.33231	3557	146	110AVMB	3546	19430106
331901104260801	11S.25E.31.223331	3548	98	110AVMB	3538	19430106
331827104262401	11S.25E.31.43133	3561		110AVMB	3537	19430106
331821104262401	11S.25E.31.433331	3563	232	110AVMB	3540	19430106
331824104255301	11S.25E.32.33313	3554	106	110AVMB	3533	19430106
331648104302901	12S.24E.12.333144	3632	125	110AVMB	3570	19430107
331518104301801	12S.24E.23.442311	3648		110AVMB	3572	19430107
331821104251001	12S.25E.02.112322	3530	50	110AVMB	3519	19430107
331819104250201	12S.25E.02.12130	3530	109	110AVMB	3518	19430107
331733104262001	12S.25E.03.33334	3557	92	110AVMB	3534	19430107
331711104290001	12S.25E.07.32222	3601	65	110AVMB	3564	19430107
331705104262801	12S.25E.09.42230	3564	90	110AVMB	3523	19430107
331648104241601	12S.25E.13.111141	3524	73	110AVMB	3513	19430107
331646104261301	12S.25E.15.11232	3558		110AVMB	3516	19430107
331558104262301	12S.25E.15.333333	3556	120	110AVMB	3499	19430107
331649104262701	12S.25E.16.222213	3562		110AVMB	3516	19430107

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331546104255101	12S.25E.22.231134	3552	185	110AVMB	3491	19430107
331435104234701	12S.25E.25.431111	3508		110AVMB	3487	19430108
331447104251801	12S.25E.26.311142	3540	230	110AVMB	3491	19430108
331514104255201	12S.25E.27.21111	3550	198	110AVMB	3492	19430107
331509104283201	12S.25E.30.222431	3600		110AVMB	3522	19430107
331422104271001	12S.25E.33.121331	3568	197	110AVMB	3493	19430108
331427104255201	12S.25E.34.21111	3541	187	110AVMB	3493	19430108
331348104255201	12S.25E.34.43111	3540	198	110AVMB	3494	19430108
331427104252101	12S.25E.35.11111	3531	224	110AVMB	3492	19430108
331401104252001	12S.25E.35.311112	3535	125	110AVMB	3489	19430108
331401104251701	12S.25E.35.31121	3534	190	110AVMB	3493	19430108
331401104245001	12S.25E.35.41111	3528		110AVMB	3497	19430108
331402104241801	12S.25E.36.133333	3515	170	110AVMB	3488	19430108
331408104234801	12S.25E.36.1420	3500	173	110AVMB	3482	19430108
331351104241801	12S.25E.36.313311	3512	200	110AVMB	3489	19430108
331728104222901	12S.26E.07.42113	3470	160	110AVMB	3468	19430107
331703104223001	12S.26E.18.212224	3485	65	110AVMB	3471	19430107
331429104221301	12S.26E.29.33333	3472	110	110AVMB	3455	19430108
331329104241402	13S.25E.01.11130 A	3504		110AVMB	3488	19430108
331256104241701	13S.25E.01.31333	3504	166	110AVMB	3491	19430108
331329104261501	13S.25E.03.11100	3544		110AVMB	3490	19430112
331328104281801	13S.25E.05.11411	3589	150	110AVMB	3524	19430112
331243104292001	13S.25E.06.33433	3616	142	110AVMB	3536	19430112
331219104282601	13S.25E.08.13331	3595		110AVMB	3533	19430112
331151104255901	13S.25E.10.34344	3541	73	110AVMB	3478	19430112
331240104251701	13S.25E.11.111143	3526	180	110AVMB	3487	19430112
331151104250201	13S.25E.11.343343	3522	165	110AVMB	3475	19430112
331151104244501	13S.25E.11.43330	3516	73	110AVMB	3478	19430112
331127104241701	13S.25E.13.13331	3509	54	110AVMB	3476	19430112
331124104241402	13S.25E.13.13334 A	3508	175	110AVMB	3471	19430112
331127104234602	13S.25E.13.23331 A	3495	78	110AVMB	3469	19430112

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331124104234601	13S.25E.13.23333	3495	225	110AVMB	3468	19430112
331122104241701	13S.25E.13.311131	3509	167	110AVMB	3472	19430112
331058104234601	13S.25E.13.43333	3494	146	110AVMB	3464	19430112
331134104251602	13S.25E.14.13114 A	3528	164	110AVMB	3474	19430112
331137104244501	13S.25E.14.21334	3520	152	110AVMB	3475	19430112
331122104252101	13S.25E.15.422241	3526		110AVMB	3472	19430112
331124104275501	13S.25E.17.23333	3586	191	110AVMB	3526	19430112
331057104251501	13S.25E.23.11121	3521	204	110AVMB	3465	19430112
331008104241701	13S.25E.24.333311	3504	202	110AVMB	3458	19430112
331002104244801	13S.25E.26.21113	3509	190	110AVMB	3457	19430112
331002104241801	13S.25E.26.22220	3504	150	110AVMB	3458	19430112
331004104261901	13S.25E.27.11112	3534	187	110AVMB	3459	19430112
331004104254601	13S.25E.27.21121	3524	166	110AVMB	3459	19430112
330846104275501	13S.25E.32.41111	3566		110AVMB	3487	19430113
330823104253501	13S.25E.34.443311	3522		110AVMB	3456	19430113
330844104251301	13S.25E.35.311241	3508	177	110AVMB	3445	19430113
330846104244901	13S.25E.35.32222	3501		110AVMB	3442	19430113
330856104233201	13S.25E.36.23224	3491	120	110AVMB	3446	19430113
330851104233301	13S.25E.36.234241	3492	120	110AVMB	3448	19430113
330852104232401	13S.25E.36.24322	3491	98	110AVMB	3448	19430113
331332104221301	13S.26E.05.11131	3467	94	110AVMB	3455	19430108
331320104214101	13S.26E.05.23113	3452	102	110AVMB	3441	19430108
331320104213401	13S.26E.05.23213	3448	25	110AVMB	3433	19430108
331254104221301	13S.26E.05.33113	3464	110	110AVMB	3449	19430108
331152104231501	13S.26E.07.33333	3478	131	110AVMB	3468	19430121
331154104224801	13S.26E.07.34441	3470		110AVMB	3459	19430108
331202104220501	13S.26E.08.33213	3453	98	110AVMB	3447	19430108
331214104211501	13S.26E.08.42232	3435	78	110AVMB	3420	19430114
331108104190301	13S.26E.14.331323	3402		110AVMB	3401	19430113
331139104205701	13S.26E.16.114432	3428	200	110AVMB	3423	19430113
331138104210701	13S.26E.16.13112	3428	61	110AVMB	3423	19430113

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331138104210001	13S.26E.16.132121	3425	152	110AVMB	3417	19430113
331125104215701	13S.26E.17.32111	3452	122	110AVMB	3443	19430113
331103104212601	13S.26E.17.443131	3440	130	110AVMB	3428	19430113
331059104211101	13S.26E.17.44444	3434	51	110AVMB	3420	19430113
331150104223101	13S.26E.18.212214	3465		110AVMB	3455	19430108
331122104231501	13S.26E.18.31113	3482		110AVMB	3469	19430112
331058104221501	13S.26E.19.222221	3470	265	110AVMB	3450	19430113
331007104231502	13S.26E.19.333333	3483	200	110AVMB	3459	19430113
331007104225901	13S.26E.19.34333	3476		110AVMB	3456	19430113
331020104223601	13S.26E.19.414333	3466	265	110AVMB	3457	19430113
331046104220601	13S.26E.20.11344	3472	100	110AVMB	3453	19430113
331007104221301	13S.26E.20.333333	3458	157	110AVMB	3445	19430113
331005104210901	13S.26E.28.111114	3441	105	110AVMB	3419	19430114
331005104205401	13S.26E.28.121113	3434	122	110AVMB	3418	19430114
330943104203901	13S.26E.28.233311	3426		110AVMB	3415	19430114
330940104211001	13S.26E.28.31111	3439	198	110AVMB	3424	19430114
331004104221001	13S.26E.29.111144	3458	53	110AVMB	3447	19430113
330956104221301	13S.26E.29.11331	3461	196	110AVMB	3445	19430113
331004104213101	13S.26E.29.21210	3446	100	110AVMB	3431	19430114
330923104221301	13S.26E.29.33131	3457	171	110AVMB	3443	19430113
330931104211101	13S.26E.29.42424	3438	110	110AVMB	3430	19430114
330900104222901	13S.26E.31.23222	3464		110AVMB	3455	19430113
330847104231501	13S.26E.31.311111	3487	165	110AVMB	3447	19430113
330847104202301	13S.26E.33.421113	3429	70	110AVMB	3412	19430114
330836104200701	13S.26E.34.313332	3419	39	110AVMB	3409	19430114
330834104191401	13S.26E.34.441222	3402		110AVMB	3377	19430114
330817104240001	14S.25E.01.11224	3481		110AVMB	3447	19430119
330728104235701	14S.25E.01.343343	3490	130	110AVMB	3437	19430119
330730104235101	14S.25E.01.34431	3488	109	110AVMB	3441	19430119
330805104243901	14S.25E.02.231242	3500	200	110AVMB	3444	19430119
330738104244601	14S.25E.02.43113	3503	260	110AVMB	3435	19430119

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330728104241701	14S.25E.02.444443	3495		110AVMB	3440	19430119
330703104241401	14S.25E.12.133332	3501	145	110AVMB	3437	19430119
330702104241201	14S.25E.12.13334	3501	226	110AVMB	3437	19430119
330655104241501	14S.25E.12.31311	3504	226	110AVMB	3436	19430119
330628104234301	14S.25E.13.213112	3492	159	110AVMB	3430	19430119
330608104241201	14S.25E.13.311124	3507	148	110AVMB	3437	19430119
330622104251701	14S.25E.14.13111	3524	202	110AVMB	3436	19430119
330452104273901	14S.25E.20.43440	3584	87	110AVMB	3511	19430119
330528104272301	14S.25E.21.13113	3575	91	110AVMB	3487	19430119
330518104241401	14S.25E.24.133334	3501	150	110AVMB	3438	19430120
330451104241501	14S.25E.25.11111	3501	151	110AVMB	3438	19430119
330449104241201	14S.25E.25.111142	3501	170	110AVMB	3441	19430119
330451104232101	14S.25E.25.22122	3481		110AVMB	3435	19430121
330359104241501	14S.25E.36.11111	3494	121	110AVMB	3438	19430120
330818104200701	14S.26E.03.11131	3421		110AVMB	3407	19430114
330812104193001	14S.26E.03.21324	3409		110AVMB	3401	19430118
330747104193301	14S.26E.03.41310	3418		110AVMB	3407	19430118
330742104190701	14S.26E.03.44222	3412		110AVMB	3393	19430118
330808104205301	14S.26E.04.14111	3434	202	110AVMB	3413	19430114
330808104203801	14S.26E.04.23111	3427	150	110AVMB	3409	19430114
330755104210901	14S.26E.04.31111	3439		110AVMB	3419	19430114
330755104210801	14S.26E.04.311114	3438		110AVMB	3418	19430114
330808104221001	14S.26E.05.131111	3458	200	110AVMB	3433	19430114
330820104213501	14S.26E.05.211214	3449		110AVMB	3425	19430114
330756104212401	14S.26E.05.24333	3442	164	110AVMB	3421	19430114
330730104214001	14S.26E.05.43333	3453		110AVMB	3425	19430114
330821104230901	14S.26E.06.11112	3469	157	110AVMB	3448	19430114
330808104224201	14S.26E.06.142222	3464	150	110AVMB	3441	19430114
330821104224001	14S.26E.06.211112	3465	95	110AVMB	3443	19430114
330806104223401	14S.26E.06.23213	3462	110	110AVMB	3432	19430114
330806104221901	14S.26E.06.24124	3461	100	110AVMB	3433	19430114

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330639104230801	14S.26E.07.33343	3485		110AVMB	3436	19430115
330641104222601	14S.26E.07.44331	3475	120	110AVMB	3435	19430115
330729104215901	14S.26E.08.11221	3458	150	110AVMB	3433	19430114
330705104212901	14S.26E.08.23434	3456		110AVMB	3433	19430115
330703104220501	14S.26E.08.311223	3481	157	110AVMB	3436	19430114
330639104213701	14S.26E.08.43334	3472	132	110AVMB	3427	19430115
330710104205301	14S.26E.09.14311	3452		110AVMB	3422	19430115
330707104203101	14S.26E.09.23342	3429		110AVMB	3417	19430115
330645104200801	14S.26E.09.44244	3429	45	110AVMB	3414	19430115
330729104195201	14S.26E.10.121	3419		110AVMB	3404	19430118
330723104191401	14S.26E.10.223222	3415	210	110AVMB	3403	19430118
330711104190701	14S.26E.10.24240	3414	48	110AVMB	3400	19430118
330726104190501	14S.26E.11.11131	3414	35	110AVMB	3397	19430118
330729104184801	14S.26E.11.121121	3411		110AVMB	3392	19430118
330703104184201	14S.26E.11.322113	3406		110AVMB	3393	19430118
330639104182101	14S.26E.11.434441	3399	18	110AVMB	3389	19430118
330714104180401	14S.26E.12.13113	3394	60	110AVMB	3372	19430118
330646104173301	14S.26E.12.431331	3396	40	110AVMB	3383	19430118
330638104174301	14S.26E.13.121221	3393	132	110AVMB	3377	19430118
330635104182101	14S.26E.14.212243	3395		110AVMB	3382	19430118
330602104181901	14S.26E.14.42331	3390	125	110AVMB	3380	19430118
330557104181501	14S.26E.14.44123	3392	162	110AVMB	3379	19430118
330626104200601	14S.26E.15.113334	3431		110AVMB	3414	19430115
330608104193701	14S.26E.15.322424	3419	34	110AVMB	3411	19430118
330547104200701	14S.26E.15.333333	3443	178	110AVMB	3422	19430115
330637104213601	14S.26E.17.211213	3471	140	110AVMB	3425	19430115
330547104211401	14S.26E.17.44430	3472		110AVMB	3429	19430115
330628104231201	14S.26E.18.11331	3488		110AVMB	3434	19430115
330621104231201	14S.26E.18.13131	3487	280	110AVMB	3433	19430115
330546104223501	14S.26E.19.21122	3473	150	110AVMB	3427	19430115
330531104221201	14S.26E.19.24224	3481	155	110AVMB	3427	19430115

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330518104230901	14S.26E.19.31110	3477		110AVMB	3434	19430115
330455104221201	14S.26E.19.44444	3485	153	110AVMB	3430	19430115
330521104215501	14S.26E.20.14333	3485	170	110AVMB	3431	19430115
330458104215801	14S.26E.20.334234	3493	83	110AVMB	3426	19430115
330455104215201	14S.26E.20.343344	3492	168	110AVMB	3430	19430115
330457104210901	14S.26E.21.333313	3465	243	110AVMB	3428	19430115
330520104200801	14S.26E.21.4222	3443		110AVMB	3425	19430115
330533104195201	14S.26E.22.14111	3439		110AVMB	3414	19430118
330528104190501	14S.26E.23.13133	3406	175	110AVMB	3397	19430118
330531104182301	14S.26E.23.232231	3390	236	110AVMB	3378	19430118
330452104200701	14S.26E.27.11113	3431	31	110AVMB	3419	19430115
330448104210701	14S.26E.28.113121	3465	130	110AVMB	3429	19430118
330442104210201	14S.26E.28.113444	3462	65	110AVMB	3428	19430118
330449104203801	14S.26E.28.211333	3451	179	110AVMB	3423	19430118
330420104202301	14S.26E.28.423133	3437		110AVMB	3413	19430115
330454104215901	14S.26E.29.11221	3493	157	110AVMB	3428	19430115
330415104212401	14S.26E.29.44111	3466	170	110AVMB	3429	19430118
330413104212401	14S.26E.29.44113	3466		110AVMB	3430	19430118
330415104222801	14S.26E.30.432221	3484		110AVMB	3428	19430115
330324104221001	14S.26E.32.33111	3471	104	110AVMB	3436	19430115
330315104184601	14S.26E.35.343233	3442	150	110AVMB	3376	19430122
325932104305501	15S.24E.23.43333	3584		110AVMB	3518	19430120
325841104320301	15S.24E.27.344314	3585		110AVMB	3525	19430120
325909104322901	15S.24E.28.244243	3608		110AVMB	3512	19430120
325838104335901	15S.24E.32.211114	3628	200	110AVMB	3590	19430120
325812104310301	15S.24E.35.32122	3543		110AVMB	3510	19430120
325806104293401	15S.24E.36.42321	3515		110AVMB	3476	19430120
330213104240502	15S.25E.12.11211 A	3463	125	110AVMB	3425	19430120
330027104241301	15S.25E.24.111113	3418	56	110AVMB	3405	19430120
330027104234301	15S.25E.24.122224	3409		110AVMB	3400	19430120
325840104270301	15S.25E.33.121131	3467	78	110AVMB	3451	19430120

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325841104251501	15S.25E.35.111113	3415	101	110AVMB	3392	19430120
325815104250801	15S.25E.35.311222	3412	142	110AVMB	3377	19430122
325750104241303	15S.25E.36.333333A	3382		110AVMB	3356	19430122
330216104201201	15S.26E.04.444113	3423	106	110AVMB	3388	19430122
330301104215901	15S.26E.05.112141	3466	113	110AVMB	3428	19430122
330247104214301	15S.26E.05.142144	3460	220	110AVMB	3434	19430122
330236104231101	15S.26E.06.31111	3462	155	110AVMB	3428	19430120
330149104210601	15S.26E.09.133133	3415	125	110AVMB	3396	19430120
330026104224101	15S.26E.19.12222	3411	83	110AVMB	3384	19430120
325947104221301	15S.26E.19.44221	3381		110AVMB	3374	19430122
330003104215201	15S.26E.20.143312	3392	63	110AVMB	3370	19430122
325947104213701	15S.26E.20.431112	3373		110AVMB	3360	19430122
325933104220601	15S.26E.29.111124	3369	120	110AVMB	3364	19430122
325934104211801	15S.26E.29.22121	3359		110AVMB	3345	19430122
325919104231101	15S.26E.30.131131	3372	256	110AVMB	3364	19430120
325921104221401	15S.26E.30.24212	3365	31	110AVMB	3357	19430122
325750104231001	15S.26E.31.333330	3356	168	110AVMB	3339	19430122
325825104213501	15S.26E.32.231324	3334		110AVMB	3325	19430122
325657104262601	16S.25E.01.12110	3426		110AVMB	3410	19430123
325659104264401	16S.25E.01.311334	3431	156	110AVMB	3412	19430123
325645104262501	16S.25E.01.34321	3415	120	110AVMB	3404	19430123
325700104271501	16S.25E.02.411331	3442	177	110AVMB	3423	19430123
325704104264701	16S.25E.02.422214	3434		110AVMB	3415	19430123
325711104295001	16S.25E.04.13311	3491		110AVMB	3479	19430122
325657104304601	16S.25E.05.111222	3518		110AVMB	3506	19430122
325716104305201	16S.25E.05.13113	3522	70	110AVMB	3509	19430122
325708104305201	16S.25E.05.13331	3520		110AVMB	3515	19430122
325642104300201	16S.25E.05.44341	3508	40	110AVMB	3492	19430122
325730104314801	16S.25E.06.111224	3548	100	110AVMB	3535	19430122
325656104315401	16S.25E.06.31313	3558	39	110AVMB	3531	19430121
325634104304801	16S.25E.08.111432	3515		110AVMB	3488	19430122

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325550104283301	16S.25E.10.34331	3471	204	110AVMB	3422	19430123
325614104271601	16S.25E.11.233331	3441	133	110AVMB	3411	19430123
325630104261901	16S.25E.12.124143	3420	127	110AVMB	3404	19430123
325613104260401	16S.25E.12.412121	3416	177	110AVMB	3404	19430123
325543104260801	16S.25E.13.211423	3422	300	110AVMB	3401	19430123
325535104271301	16S.25E.14.213343	3444	135	110AVMB	3412	19430123
325522104281701	16S.25E.15.233331	3470	250	110AVMB	3402	19430123
325451104260301	16S.25E.24.21232	3432	148	110AVMB	3400	19430125
325727104244001	16S.26E.05.111132	3392		110AVMB	3360	19430123
325727104241801	16S.26E.05.121244	3385	300	110AVMB	3358	19430123
325650104244101	16S.26E.05.33111	3383	111	110AVMB	3366	19430123
325644104254001	16S.26E.06.33134	3396	142	110AVMB	3384	19430123
325635104252701	16S.26E.07.121131	3405	136	110AVMB	3397	19430123
325611104252701	16S.26E.07.321111	3403	180	110AVMB	3399	19430125
325637104244001	16S.26E.08.111112	3385	175	110AVMB	3371	19430123
325457104223401	16S.26E.15.333142	3351		110AVMB	3340	19430125
325513104233701	16S.26E.16.311344	3361	160	110AVMB	3356	19430125
325516104243801	16S.26E.17.31114	3394	124	110AVMB	3376	19430125
325501104244101	16S.26E.17.331313	3385	180	110AVMB	3379	19430125
325518104251301	16S.26E.18.32222	3402		110AVMB	3387	19430125
325505104254205	16S.26E.18.33111 D	3412	160	110AVMB	3396	19430125
325446104254201	16S.26E.19.11311	3411	178	110AVMB	3393	19430125
325432104254201	16S.26E.19.133113	3408	168	110AVMB	3390	19430125
325454104251401	16S.26E.19.21111	3398	108	110AVMB	3387	19430125
325426104250901	16S.26E.19.411124	3412		110AVMB	3382	19430125
325401104233801	16S.26E.21.333334	3366	131	110AVMB	3360	19430125
325309104233601	16S.26E.28.33330	3373	87	110AVMB	3363	19430125
325314104230801	16S.26E.28.433113	3360	165	110AVMB	3350	19430125
325233104250901	16S.26E.31.41310	3420	168	110AVMB	3378	19430125
325255104241001	16S.26E.32.231111	3393	170	110AVMB	3373	19430125
325242104241001	16S.26E.32.41111	3390	203	110AVMB	3373	19430125

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325242104235601	16S.26E.32.412221	3383	114	110AVMB	3368	19430125
325300104213301	16S.26E.35.113141	3335		110AVMB	3327	19430125
325022104264801	17S.25E.13.113313	3483	280	110AVMB	3396	19430127
324925104275501	17S.25E.22.24214	3530		110AVMB	3389	19430127
324852104261701	17S.25E.24.43313	3469	122	110AVMB	3385	19430128
324848104264901	17S.25E.26.2222	3472		110AVMB	3379	19430128
324728104271901	17S.25E.35.411113	3489	142	110AVMB	3381	19430128
325200104213401	17S.26E.02.13123	3324	83	110AVMB	3317	19430126
325202104220701	17S.26E.03.231123	3331	104	110AVMB	3324	19430126
325126104224001	17S.26E.03.333313	3339	155	110AVMB	3329	19430126
325214104232501	17S.26E.04.121132	3358	23	110AVMB	3347	19430126
325131104234201	17S.26E.04.33133	3365	250	110AVMB	3361	19430126
325132104234201	17S.26E.04.331331	3365	250	110AVMB	3361	19430126
325138104231101	17S.26E.04.413331	3353	225	110AVMB	3340	19430126
325141104234301	17S.26E.05.42424	3367	45	110AVMB	3354	19430120
325137104251501	17S.26E.06.413333	3426	190	110AVMB	3390	19430125
325110104254605	17S.26E.07.13111	3427	150	110AVMB	3382	19430125
325032104252001	17S.26E.07.34430	3416	140	110AVMB	3382	19430125
325057104245901	17S.26E.07.421111	3403	150	110AVMB	3381	19430125
325051104245901	17S.26E.07.423111	3401	150	110AVMB	3381	19430125
325032104251301	17S.26E.07.433343	3412	148	110AVMB	3383	19430125
325034104245201	17S.26E.07.44431	3400	143	110AVMB	3375	19430125
325032104234201	17S.26E.09.3333	3368		110AVMB	3359	19430126
325032104224005	17S.26E.10.33333	3348	278	110AVMB	3342	19430126
325033104220201	17S.26E.10.433442	3340	210	110AVMB	3323	19430126
325029104222301	17S.26E.15.121134	3341		110AVMB	3334	19430126
325029104220201	17S.26E.15.21124	3341	225	110AVMB	3327	19430126
324958104220801	17S.26E.15.413111	3342	192	110AVMB	3328	19430126
324943104233801	17S.26E.16.33323	3377	81	110AVMB	3369	19430126
325004104230301	17S.26E.16.412113	3361		110AVMB	3348	19430126
324946104235401	17S.26E.17.441433	3383	217	110AVMB	3365	19430126

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
324940104251401	17S.26E.18.43333A	3423	170	110AVMB	3382	19430126
324950104244901	17S.26E.18.44214	3405		110AVMB	3376	19430126
324935104232901	17S.26E.21.112412	3372	232	110AVMB	3361	19430126
324857104232601	17S.26E.21.34113	3370	186	110AVMB	3369	19430128
324916104220201	17S.26E.22.233422	3345	75	110AVMB	3325	19430126
324808104220901	17S.26E.27.41333	3331	128	110AVMB	3318	19430126
324614104230901	18S.26E.04.433311	3369	139	110AVMB	3352	19430128
324553104250201	18S.26E.07.234122	3412	159	110AVMB	3368	19430128
324551104245801	18S.26E.07.23420	3412	84	110AVMB	3358	19430128
324554104234001	18S.26E.09.13133	3385	165	110AVMB	3359	19430128
324546104234001	18S.26E.09.31111	3385	163	110AVMB	3358	19430128
324542104220601	18S.26E.10.411314	3335		110AVMB	3324	19430128
324500104223701	18S.26E.15.13313	3351	133	110AVMB	3332	19430128
324452104223701	18S.26E.15.31131	3351	175	110AVMB	3334	19430128
324516104242601	18S.26E.17.12133	3400	165	110AVMB	3364	19430128
324509104245701	18S.26E.18.24111	3411	230	110AVMB	3374	19430128
324449104252801	18S.26E.18.32311	3425	235	110AVMB	3387	19430128
324353104222901	18S.26E.22.314334	3334		110AVMB	3326	19430128
324421104210201	18S.26E.23.21332	3314	40	110AVMB	3293	19430128
324418104203301	18S.26E.24.13111	3305	80	110AVMB	3291	19430128
324415104194701	18S.26E.24.24131	3288		110AVMB	3285	19430118
324329104233101	18S.26E.28.114332	3421	86	110AVMB	3371	19430128
324340104231701	18S.26E.28.121222	3403		110AVMB	3370	19430121
324247104233701	18S.26E.33.11114	3395	300	110AVMB	3330	19430129
324026104202201	19S.26E.12.31444	3290	35	110AVMB	3273	19430129
324026104202202	19S.26E.12.31444 A	3290		110AVMB	3273	19430129
324013104203601	19S.26E.12.333	3294		110AVMB	3272	19430129
324014104200601	19S.26E.12.433331	3281	75	110AVMB	3271	19430129
323810104221601	19S.26E.27.141422	3296	127	110AVMB	3255	19430129
323737104232501	19S.26E.28.33442	3304		110AVMB	3255	19430129
323747104225701	19S.26E.28.43221	3303	220	110AVMB	3247	19430129

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334401104182501	07S.26E.04.332133	3597	60	110AVMB	3583	19560110
334423104192901	07S.26E.05.13312	3603	60	110AVMB	3583	19560109
334424104193602	07S.26E.06.242343A	3605	62	110AVMB	3586	19560109
334141104183601	07S.26E.20.244321	3590	72	110AVMB	3564	19560110
334129104192201	07S.26E.20.31410	3576	112	110AVMB	3563	19560109
333432104282301	08S.24E.35.411442	3616	74	110AVMB	3554	19560109
333255104285401	09S.24E.11.13324	3597	155	110AVMB	3553	19560109
333145104283001	09S.24E.14.34222 B PETTY	3581	192	110AVMB	3548	19560109
332947104281901	09S.24E.26.43434	3566	20	110AVMB	3552	19560109
332801104283901	10S.24E.02.43333	3552	100	110AVMB	3537	19560109
332815104301201	10S.24E.04.424134 LEWIS	3595	180	110AVMB	3553	19560110
332800104270801	10S.24E.12.22243 HARGROV	3546	97	110AVMB	3521	19560109
332643104273701	10S.24E.13.233331	3542	50	110AVMB	3519	19560110
332646104282501	10S.24E.14.23424	3541	48	110AVMB	3513	19560110
332655104294101	10S.24E.15.124444	3564		110AVMB	3549	19560110
332626104294101	10S.24E.15.34220	3553		110AVMB	3538	19560110
332653104311301	10S.24E.16.131131	3589	150	110AVMB	3554	19560111
332633104321601	10S.24E.18.424242	3611	110	110AVMB	3555	19560111
332546104293801	10S.24E.22.411144	3570	24	110AVMB	3553	19560110
332338104285401	10S.24E.35.343331	3550	126	110AVMB	3529	19560113
332617104252401	10S.25E.17.344441	3505	10	110AVMB	3496	19560110
332535104260503	10S.25E.19.331113	3550	58	110AVMB	3512	19560110
332526104262301	10S.25E.19.433311	3524	52	110AVMB	3498	19560110
332350104252201	10S.25E.32.431113	3475	103	110AVMB	3470	19560113
332241104334201	11S.23E.12.221141	3630	85	110AVMB	3556	19560111
332247104322101	11S.24E.06.443412	3607		110AVMB	3553	19560111
332224104295201	11S.24E.10.14311	3587		110AVMB	3556	19560112
332231104290701	11S.24E.10.22434	3567	129	110AVMB	3542	19560130
332131104274201	11S.24E.13.144444	3552	164	110AVMB	3536	19560112
332105104285401	11S.24E.14.33243	3589	107	110AVMB	3544	19560119

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332124104292101	11S.24E.15.42131	3597	125	110AVMB	3546	19560112
332111104293301	11S.24E.15.43121	3601	199	110AVMB	3547	19560112
332059104331101	11S.24E.18.333334	3655	148	110AVMB	3552	19560112
332006104321001	11S.24E.20.33333	3647	175	110AVMB	3550	19560112
332012104300501	11S.24E.22.333121	3609		110AVMB	3547	19560130
332026104282801	11S.24E.23.41144	3571	131	110AVMB	3549	19560112
331940104310901	11S.24E.28.13333	3633	143	110AVMB	3555	19560112
331842104280401	11S.24E.36.31131	3586	240	110AVMB	3545	19560112
331820104280401	11S.24E.36.33333	3586	225	110AVMB	3540	19560117
332327104263801	11S.25E.06.123314	3526		110AVMB	3501	19560112
332307104260801	11S.25E.06.42131	3512	100	110AVMB	3503	19560112
332123104242601	11S.25E.16.32214	3495	117	110AVMB	3478	19560112
332007104235001	11S.25E.22.33333	3493		110AVMB	3485	19560112
331942104241301	11S.25E.28.234311	3503	186	110AVMB	3492	19560112
331940104240201	11S.25E.28.24334	3502	119	110AVMB	3493	19560112
331916104245101	11S.25E.28.33331	3519	150	110AVMB	3507	19560112
331914104253701	11S.25E.29.34333	3535	160	110AVMB	3525	19560112
331914104245501	11S.25E.29.44443	3521	30	110AVMB	3510	19560113
331923104264701	11S.25E.30.33231	3557	146	110AVMB	3535	19560113
331901104260801	11S.25E.31.223331	3548	98	110AVMB	3530	19560113
331822104262301	11S.25E.31.433314	3563	75	110AVMB	3529	19560113
331648104302901	12S.24E.12.333144	3632	125	110AVMB	3551	19560130
331518104301801	12S.24E.23.442311	3648		110AVMB	3545	19560117
331821104251001	12S.25E.02.112322	3530	50	110AVMB	3511	19560113
331819104250201	12S.25E.02.12130	3530	109	110AVMB	3508	19560113
331733104262001	12S.25E.03.33334	3557	92	110AVMB	3515	19560113
331711104290001	12S.25E.07.32222	3601	65	110AVMB	3544	19560130
331705104262801	12S.25E.09.42230	3564	90	110AVMB	3501	19560118
331702104251901	12S.25E.11.313143	3546		110AVMB	3497	19560113
331716104234501	12S.25E.12.233141	3511	45	110AVMB	3493	19560113
331647104241601	12S.25E.13.111143	3524	80	110AVMB	3492	19560113

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331600104262301	12S.25E.15.33331	3555	126	110AVMB	3456	19560117
331649104272601	12S.25E.16.11111	3576	120	110AVMB	3529	19560117
331649104265401	12S.25E.16.211114	3566	200	110AVMB	3491	19560117
331649104262701	12S.25E.16.222213	3562		110AVMB	3490	19560117
331636104290101	12S.25E.18.142221	3612	91	110AVMB	3541	19560117
331540104272301	12S.25E.21.13314	3579		110AVMB	3502	19560117
331546104255101	12S.25E.22.231134	3552	185	110AVMB	3443	19560117
331532104255202	12S.25E.22.41131 A	3554	147	110AVMB	3444	19560117
331512104244801	12S.25E.23.433323	3538	153	110AVMB	3465	19560113
331527104231701	12S.25E.24.42424	3501	99	110AVMB	3460	19560113
331447104251801	12S.25E.26.311142	3540	230	110AVMB	3441	19560117
331514104255201	12S.25E.27.21111	3550	198	110AVMB	3444	19560117
331510104283101	12S.25E.30.222414	3600	130	110AVMB	3520	19560117
331427104255201	12S.25E.34.21111	3541	187	110AVMB	3447	19560130
331348104255201	12S.25E.34.43111	3540	198	110AVMB	3445	19560118
331427104252102	12S.25E.35.11111 A	3531	120	110AVMB	3450	19560117
331409104251801	12S.25E.35.131342	3532	281	110AVMB	3442	19560117
331358104252101	12S.25E.35.311133	3534	200	110AVMB	3446	19560117
331357104245001	12S.25E.35.41131	3528	203	110AVMB	3450	19560118
331423104241001	12S.25E.36.112312	3510	134	110AVMB	3462	19560119
331415104240301	12S.25E.36.123333	3505	129	110AVMB	3459	19560119
331402104241601	12S.25E.36.133343	3514	190	110AVMB	3461	19560130
331427104234701	12S.25E.36.21111	3501	237	110AVMB	3455	19560119
331351104241801	12S.25E.36.313311	3512	200	110AVMB	3461	19560130
331728104222901	12S.26E.07.42113	3470	160	110AVMB	3464	19560113
331642104215001	12S.26E.17.144133	3450	41	110AVMB	3437	19560113
331703104223001	12S.26E.18.212224	3485	65	110AVMB	3468	19560113
331703104222901	12S.26E.18.221113	3483	68	110AVMB	3465	19560130
331553104221701	12S.26E.19.242434	3472		110AVMB	3450	19560113
331547104214701	12S.26E.20.144344	3448	70	110AVMB	3427	19560113
331429104221301	12S.26E.29.33333	3472	110	110AVMB	3456	19560119

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331514104224601	12S.26E.30.12240	3492	142	110AVMB	3466	19560119
331055104302101	13S.24E.24.112132	3635		110AVMB	3516	19560118
331335104241701	13S.25E.01.11111	3507	210	110AVMB	3467	19560118
331256104241701	13S.25E.01.31333	3504	166	110AVMB	3467	19560118
331328104281801	13S.25E.05.11411	3589	150	110AVMB	3516	19560118
331243104292001	13S.25E.06.33433	3616	142	110AVMB	3533	19560118
331233104262101	13S.25E.10.11313	3546	123	110AVMB	3448	19560118
331240104251701	13S.25E.11.111143	3526	180	110AVMB	3447	19560130
331151104250201	13S.25E.11.343343	3522	165	110AVMB	3436	19560130
331223104241702	13S.25E.12.13133 A	3509	225	110AVMB	3453	19560130
331213104241601	13S.25E.12.311134	3506	190	110AVMB	3452	19560118
331137104241701	13S.25E.13.11333	3508	182	110AVMB	3442	19560124
331124104241402	13S.25E.13.13334 A	3508	175	110AVMB	3438	19560124
331127104234602	13S.25E.13.23331 A	3495	78	110AVMB	3444	19560119
331124104234601	13S.25E.13.23333	3495	225	110AVMB	3443	19560119
331122104241701	13S.25E.13.311131	3509	167	110AVMB	3438	19560124
331058104234601	13S.25E.13.43333	3494	146	110AVMB	3434	19560118
331145104251901	13S.25E.14.111331	3529	274	110AVMB	3437	19560118
331134104251602	13S.25E.14.13114 A	3528	164	110AVMB	3436	19560118
331135104244601	13S.25E.14.231141	3521	262	110AVMB	3439	19560118
331123104255001	13S.25E.15.411113	3535	665	110AVMB	3442	19560118
331124104275501	13S.25E.17.23333	3586	191	110AVMB	3507	19560118
331143104290101	13S.25E.18.12421	3605	156	110AVMB	3520	19560118
331057104251501	13S.25E.23.11121	3521	204	110AVMB	3457	19560118
331002104244801	13S.25E.26.21113	3509	190	110AVMB	3424	19560124
331004104254601	13S.25E.27.21121	3524	166	110AVMB	3427	19560118
330952104273601	13S.25E.29.22334	3559	126	110AVMB	3463	19560118
330838104260701	13S.25E.34.314224	3526	136	110AVMB	3424	19560124
330843104251101	13S.25E.35.31213	3507	210	110AVMB	3398	19560124
330846104244901	13S.25E.35.32222	3501		110AVMB	3391	19560124
330851104233302	13S.25E.36.234241A	3492	200	110AVMB	3411	19560124

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330852104232401	13S.25E.36.24322	3491	98	110AVMB	3424	19560124
331320104214101	13S.26E.05.23113	3452	102	110AVMB	3445	19560119
331320104213402	13S.26E.05.23213 A	3448		110AVMB	3431	19560119
331254104221301	13S.26E.05.33113	3464	110	110AVMB	3448	19560119
331152104231501	13S.26E.07.33333	3478	131	110AVMB	3455	19560117
331108104190301	13S.26E.14.331323	3402		110AVMB	3395	19560124
331138104210701	13S.26E.16.13112	3428	61	110AVMB	3421	19560124
331125104215701	13S.26E.17.32111	3452	122	110AVMB	3431	19560124
331103104212601	13S.26E.17.443131	3440	130	110AVMB	3424	19560124
331058104221501	13S.26E.19.222221	3470	265	110AVMB	3444	19560124
331007104231502	13S.26E.19.333333	3483	200	110AVMB	3434	19560124
331022104200701	13S.26E.22.313312	3412	230	110AVMB	3408	19560124
331006104211001	13S.26E.28.111111	3441		110AVMB	3421	19560124
331005104205401	13S.26E.28.121113	3434	122	110AVMB	3413	19560124
331000104202301	13S.26E.28.22133	3420	190	110AVMB	3408	19560124
330940104211001	13S.26E.28.31111	3439	198	110AVMB	3420	19560124
330956104221302	13S.26E.29.11331 A	3461	213	110AVMB	3437	19560124
330953104221001	13S.26E.29.13112	3461	140	110AVMB	3434	19560124
331004104213102	13S.26E.29.21210 A	3446	120	110AVMB	3425	19560124
330923104221301	13S.26E.29.33131	3457	171	110AVMB	3432	19560124
330847104231501	13S.26E.31.311111	3487	165	110AVMB	3413	19560124
330847104202301	13S.26E.33.421113	3429	70	110AVMB	3407	19560124
330836104200701	13S.26E.34.313332	3419	39	110AVMB	3406	19560124
330819104241501	14S.25E.01.11111	3488	255	110AVMB	3387	19560125
330728104235701	14S.25E.01.343343	3490	130	110AVMB	3384	19560125
330728104235101	14S.25E.01.34433	3488	135	110AVMB	3386	19560125
330738104244601	14S.25E.02.43113	3503	260	110AVMB	3379	19560126
330701104274701	14S.25E.08.41122	3587		110AVMB	3489	19560126
330636104251101	14S.25E.11.333443	3522	200	110AVMB	3389	19560126
330636104244601	14S.25E.11.43333	3513		110AVMB	3380	19560126
330702104241301	14S.25E.12.133343	3501	315	110AVMB	3377	19560125

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330649104240401	14S.25E.12.31434	3501		110AVMB	3379	19560125
330608104241202	14S.25E.13.311124A	3507		110AVMB	3384	19560126
330622104251701	14S.25E.14.13111	3524	202	110AVMB	3390	19560126
330559104254901	14S.25E.15.413313	3545	177	110AVMB	3410	19560126
330452104273901	14S.25E.20.43440	3584	87	110AVMB	3507	19560126
330518104241401	14S.25E.24.133334	3501	150	110AVMB	3393	19560126
330515104232701	14S.25E.24.421132	3483	165	110AVMB	3385	19560126
330451104241401	14S.25E.25.111112	3501	296	110AVMB	3397	19560127
330449104241201	14S.25E.25.111142	3501	170	110AVMB	3400	19560127
330451104232101	14S.25E.25.22122	3481		110AVMB	3391	19560126
330415104241401	14S.25E.25.313312	3495	149	110AVMB	3400	19560127
330359104241201	14S.25E.36.11112	3494		110AVMB	3407	19560127
330338104241501	14S.25E.36.133113	3492		110AVMB	3410	19560127
330359104234301	14S.25E.36.21111	3494	124	110AVMB	3400	19560127
330759104192101	14S.26E.03.24313	3411		110AVMB	3397	19560131
330747104193301	14S.26E.03.41310	3418		110AVMB	3406	19560131
330730104193201	14S.26E.03.433433	3419	95	110AVMB	3403	19560131
330808104203801	14S.26E.04.23111	3427	150	110AVMB	3404	19560125
330755104210901	14S.26E.04.31111	3439		110AVMB	3413	19560125
330808104221001	14S.26E.05.131111	3458	200	110AVMB	3416	19560125
330756104212401	14S.26E.05.24333	3442	164	110AVMB	3414	19560125
330734104214001	14S.26E.05.43313	3452	185	110AVMB	3413	19560125
330821104230901	14S.26E.06.11112	3469	157	110AVMB	3413	19560125
330821104224001	14S.26E.06.211112	3465	95	110AVMB	3412	19560125
330806104223401	14S.26E.06.23213	3462	110	110AVMB	3403	19560126
330639104224201	14S.26E.07.344442	3479	126	110AVMB	3370	19560125
330729104215901	14S.26E.08.11221	3458	150	110AVMB	3394	19560125
330703104220501	14S.26E.08.311223	3481	157	110AVMB	3384	19560125
330701104220501	14S.26E.08.311243	3482	190	110AVMB	3385	19560125
330639104213702	14S.26E.08.433344	3472		110AVMB	3366	19560125
330712104205302	14S.26E.09.141331A	3455	153	110AVMB	3408	19560125

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330639104203001	14S.26E.09.434333	3435	107	110AVMB	3394	19560125
330645104200801	14S.26E.09.44244	3429	45	110AVMB	3400	19560125
330723104191401	14S.26E.10.223222	3415	210	110AVMB	3401	19560131
330711104190701	14S.26E.10.24240	3414	48	110AVMB	3400	19560131
330726104190501	14S.26E.11.11131	3414	35	110AVMB	3397	19560131
330711104183501	14S.26E.11.23133	3405	67	110AVMB	3392	19560131
330646104173301	14S.26E.12.431331	3396	40	110AVMB	3380	19560131
330636104174901	14S.26E.13.112242	3393	250	110AVMB	3376	19560131
330635104182101	14S.26E.14.212243	3395		110AVMB	3381	19560131
330602104181901	14S.26E.14.42331	3390	125	110AVMB	3373	19560131
330557104181501	14S.26E.14.44123	3392	162	110AVMB	3374	19560131
330547104181901	14S.26E.14.443333	3393	133	110AVMB	3374	19560131
330547104200701	14S.26E.15.333333	3443	178	110AVMB	3391	19560131
330635104213601	14S.26E.17.211233	3471	185	110AVMB	3361	19560126
330610104220801	14S.26E.17.31114	3476		110AVMB	3384	19560126
330547104211401	14S.26E.17.44430	3472		110AVMB	3375	19560126
330628104231201	14S.26E.18.11331	3488		110AVMB	3376	19560126
330518104230901	14S.26E.19.31110	3477		110AVMB	3384	19560126
330508104221201	14S.26E.19.42440	3485		110AVMB	3376	19560126
330455104215201	14S.26E.20.343344	3492	168	110AVMB	3374	19560126
330515104210801	14S.26E.21.311334	3465	185	110AVMB	3381	19560126
330533104195201	14S.26E.22.14111	3439		110AVMB	3384	19560131
330544104190501	14S.26E.23.11113	3406	200	110AVMB	3388	19560131
330531104182302	14S.26E.23.232231A	3390	135	110AVMB	3369	19560131
330420104190702	14S.26E.27.42424 A	3406		110AVMB	3365	19560131
330449104210902	14S.26E.28.11133 A	3466		110AVMB	3385	19560104
330448104210701	14S.26E.28.113121	3465	130	110AVMB	3383	19560126
330413104212401	14S.26E.29.44113	3466		110AVMB	3394	19560127
330454104231201	14S.26E.30.111111	3477	210	110AVMB	3388	19560126
330353104220801	14S.26E.32.11332	3482	171	110AVMB	3391	19560127
330318104210701	14S.26E.33.331343	3448	100	110AVMB	3428	19560131

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330315104184701	14S.26E.35.34314	3444	150	110AVMB	3366	19560131
330328104180301	14S.26E.36.313132	3395	48	110AVMB	3360	19560131
325841104315501	15S.24E.27.433312	3593		110AVMB	3469	19560130
325909104322901	15S.24E.28.244243	3608		110AVMB	3517	19560130
325838104335901	15S.24E.32.211114	3628	200	110AVMB	3563	19560130
325812104310301	15S.24E.35.32122	3543		110AVMB	3520	19560130
330148104282401	15S.25E.07.24443	3578	158	110AVMB	3483	19560130
330213104240501	15S.25E.12.11211	3462		110AVMB	3409	19560127
330213104233001	15S.25E.12.21221	3461	108	110AVMB	3404	19560127
330046104265701	15S.25E.16.323241	3486		110AVMB	3440	19560130
330027104234302	15S.25E.24.122224A	3409		110AVMB	3383	19560127
325911104251501	15S.25E.26.133313	3412	150	110AVMB	3396	19560127
325932104280001	15S.25E.29.121234	3485	120	110AVMB	3423	19560130
325840104270301	15S.25E.33.121131	3467	78	110AVMB	3451	19560130
325841104251501	15S.25E.35.111113	3415	101	110AVMB	3389	19560130
325750104241302	15S.25E.36.333333	3382		110AVMB	3350	19560130
330301104193001	15S.26E.03.211142	3436		110AVMB	3401	19560131
330216104201201	15S.26E.04.444113	3423	106	110AVMB	3370	19560131
330247104214301	15S.26E.05.142144	3460	220	110AVMB	3411	19560127
330236104231101	15S.26E.06.31111	3462	155	110AVMB	3393	19560127
330136104213201	15S.26E.08.413241	3418	72	110AVMB	3378	19560130
330132104213101	15S.26E.08.41340	3416	97	110AVMB	3376	19560130
330149104210601	15S.26E.09.133133	3415	125	110AVMB	3373	19560131
330210104190201	15S.26E.11.111113	3400	53	110AVMB	3363	19560131
330032104182701	15S.26E.14.43321	3359	75	110AVMB	3346	19560131
330118104224002	15S.26E.18.211111	3438	116	110AVMB	3381	19560127
330042104221701	15S.26E.18.42431	3414	75	110AVMB	3383	19560130
330026104222201	15S.26E.19.221121	3408	104	110AVMB	3361	19560127
330003104215201	15S.26E.20.143312	3392	63	110AVMB	3354	19560131
330024104191701	15S.26E.22.22113	3349	99	110AVMB	3336	19560131
325933104220601	15S.26E.29.111124	3369	120	110AVMB	3351	19560130

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325922104225201	15S.26E.30.12343	3371	195	110AVMB	3351	19560104
325919104231101	15S.26E.30.131131	3372	256	110AVMB	3357	19560130
325836104221201	15S.26E.31.222434	3346		110AVMB	3335	19560130
325750104231001	15S.26E.31.333330	3356	168	110AVMB	3336	19560130
325657104264501	16S.25E.01.111111	3436	262	110AVMB	3422	19560124
325657104262601	16S.25E.01.12110	3426		110AVMB	3407	19560124
325659104264401	16S.25E.01.311334	3431	156	110AVMB	3412	19560124
325645104262501	16S.25E.01.34321	3415	120	110AVMB	3383	19560124
325716104274401	16S.25E.02.131142	3453		110AVMB	3436	19560124
325704104264701	16S.25E.02.422214	3434		110AVMB	3413	19560130
325711104295001	16S.25E.04.13311	3491		110AVMB	3468	19560130
325657104304601	16S.25E.05.111222	3518		110AVMB	3510	19560124
325708104305201	16S.25E.05.13331	3520		110AVMB	3498	19560124
325730104314801	16S.25E.06.111224	3548	100	110AVMB	3535	19560124
325656104315401	16S.25E.06.31313	3558	39	110AVMB	3530	19560124
325634104304801	16S.25E.08.111432	3515		110AVMB	3479	19560124
325550104284001	16S.25E.10.334312	3475	250	110AVMB	3405	19560123
325613104281701	16S.25E.10.41111	3464	275	110AVMB	3410	19560130
325616104274401	16S.25E.11.133321	3452	235	110AVMB	3402	19560130
325614104271601	16S.25E.11.233331	3441	133	110AVMB	3394	19560123
325540104260701	16S.25E.13.21322	3423	415	110AVMB	3362	19560123
325535104271301	16S.25E.14.213343	3444	135	110AVMB	3384	19560123
325458104284601	16S.25E.15.333321	3495		110AVMB	3405	19560123
325451104260301	16S.25E.24.21232	3432	148	110AVMB	3360	19560130
325402104261301	16S.25E.25.211111	3448	225	110AVMB	3352	19560123
325701104215701	16S.26E.03.412134	3338		110AVMB	3330	19560124
325722104244101	16S.26E.05.11311	3391	300	110AVMB	3358	19560124
325727104241801	16S.26E.05.121244	3385	300	110AVMB	3355	19560124
325650104244101	16S.26E.05.33111	3383	111	110AVMB	3359	19560124
325727104253101	16S.26E.06.112233	3411		110AVMB	3383	19560124
325726104252701	16S.26E.06.121311	3406		110AVMB	3373	19560130

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325657104251101	16S.26E.06.21111	3402	170	110AVMB	3371	19560130
325635104252701	16S.26E.07.121131	3405	136	110AVMB	3372	19560124
325611104252701	16S.26E.07.321111	3403	180	110AVMB	3363	19560130
325637104244001	16S.26E.08.111112	3385	175	110AVMB	3360	19560130
325612104225601	16S.26E.09.23443	3345	68	110AVMB	3332	19560124
325521104215601	16S.26E.15.234323	3327	55	110AVMB	3319	19560124
325457104223401	16S.26E.15.333142	3351		110AVMB	3335	19560124
325516104243801	16S.26E.17.31114	3394	124	110AVMB	3354	19560123
325501104244101	16S.26E.17.331313	3385	180	110AVMB	3359	19560123
325541104245701	16S.26E.18.212424	3401		110AVMB	3345	19560123
325446104254201	16S.26E.19.11311	3411	178	110AVMB	3352	19560123
325454104251401	16S.26E.19.21111	3398	108	110AVMB	3348	19560130
325426104254001	16S.26E.19.311123	3412	71	110AVMB	3365	19560123
325404104253601	16S.26E.19.33324	3431	212	110AVMB	3351	19560123
325426104250902	16S.26E.19.411124A	3412		110AVMB	3349	19560123
325401104233801	16S.26E.21.333334	3366	131	110AVMB	3342	19560123
325233104250901	16S.26E.31.41310	3420	168	110AVMB	3332	19560123
325229104251105	16S.26E.31.431112D	3420	235	110AVMB	3332	19560123
325255104241001	16S.26E.32.231111	3393	170	110AVMB	3319	19560130
325242104235301	16S.26E.32.421112	3382	148	110AVMB	3317	19560130
325300104213301	16S.26E.35.113141	3335		110AVMB	3317	19560125
325158104262801	17S.25E.01.143214	3481	245	110AVMB	3337	19560125
325022104264801	17S.25E.13.113313	3483	280	110AVMB	3346	19560120
325032104271901	17S.25E.14.211113	3496	215	110AVMB	3337	19560120
324925104275501	17S.25E.22.24214	3530		110AVMB	3347	19560120
324854104261401	17S.25E.24.433122	3465	225	110AVMB	3330	19560120
324757104301801	17S.25E.29.433442	3593	195	110AVMB	3438	19560120
325200104213401	17S.26E.02.13123	3324	83	110AVMB	3309	19560125
325212104232601	17S.26E.04.12131	3358		110AVMB	3340	19560125
325132104234201	17S.26E.04.331331	3365	250	110AVMB	3331	19560125
325032104224005	17S.26E.10.33333	3348	278	110AVMB	3323	19560131

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325033104220201	17S.26E.10.433442	3340	210	110AVMB	3309	19560125
325051104213801	17S.26E.11.313111	3322	140	110AVMB	3313	19560125
324952104203601	17S.26E.13.33111	3303	90	110AVMB	3301	19560131
325024104224001	17S.26E.15.113111	3349	240	110AVMB	3313	19560125
325029104222301	17S.26E.15.121134	3341		110AVMB	3319	19560125
325029104220201	17S.26E.15.21124	3341	225	110AVMB	3314	19560125
324958104220801	17S.26E.15.413111	3342	192	110AVMB	3316	19560125
324943104233801	17S.26E.16.33323	3377	81	110AVMB	3323	19560125
325004104230301	17S.26E.16.412113	3361		110AVMB	3323	19560131
324940104251401	17S.26E.18.43333A	3423	170	110AVMB	3329	19560120
324912104254601	17S.26E.19.31111	3438	180	110AVMB	3326	19560120
324910104244401	17S.26E.20.31113	3405	190	110AVMB	3328	19560120
324935104232901	17S.26E.21.112412	3372	232	110AVMB	3323	19560131
324857104232601	17S.26E.21.34113	3370	186	110AVMB	3336	19560131
324916104220201	17S.26E.22.233422	3345	75	110AVMB	3318	19560131
324939104213801	17S.26E.23.11111	3322	15	110AVMB	3314	19560125
324847104203602	17S.26E.24.333333A	3299	7	110AVMB	3296	19560125
324808104220901	17S.26E.27.41333	3331	128	110AVMB	3313	19560131
324810104215301	17S.26E.27.423313	3326	190	110AVMB	3309	19560131
324614104230901	18S.26E.04.433311	3369	139	110AVMB	3313	19560131
324612104254401	18S.26E.06.33333	3434		110AVMB	3330	19560120
324553104250201	18S.26E.07.234122	3412	159	110AVMB	3334	19560120
324551104245801	18S.26E.07.23420	3412	84	110AVMB	3336	19560120
324554104234001	18S.26E.09.13133	3385	165	110AVMB	3317	19560119
324546104234001	18S.26E.09.31111	3385	163	110AVMB	3330	19560131
324542104220602	18S.26E.10.411314A	3335	147	110AVMB	3302	19560131
324444104204901	18S.26E.14.42333	3309	200	110AVMB	3287	19560119
324501104223701	18S.26E.15.133113	3352	235	110AVMB	3317	19560119
324433104244001	18S.26E.17.333321	3416	212	110AVMB	3329	19560131
324509104245701	18S.26E.18.24111	3411	230	110AVMB	3323	19560119
324449104252801	18S.26E.18.32311	3425	235	110AVMB	3321	19560119

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
324438104253001	18S.26E.18.3324413	3429	230	110AVMB	3339	19560119
324353104222901	18S.26E.22.314334	3334		110AVMB	3299	19560119
324422104210201	18S.26E.23.213321	3314	162	110AVMB	3265	19560131
324403104213501	18S.26E.23.311131	3317	154	110AVMB	3276	19560131
324418104203301	18S.26E.24.13111	3305	80	110AVMB	3263	19560131
324418104194701	18S.26E.24.24111	3288	63	110AVMB	3280	19560119
324249104213301	18S.26E.26.33334	3331		110AVMB	3287	19560108
324325104233001	18S.26E.28.122111 DAYTON	3403	250	110AVMB	3322	19560100
324314104232501	18S.26E.28.13440	3406	94	110AVMB	3323	19560131
324250104224101	18S.26E.28.444432	3378	160	110AVMB	3301	19560118
324339104251301	18S.26E.30.211131	3448	150	110AVMB	3325	19560119
324250104233701	18S.26E.33.11112	3395	200	110AVMB	3300	19560118
324041104294801	19S.25E.08.42222	3537	142	110AVMB	3442	19560118
323934104274501	19S.25E.15.442224	3446	100	110AVMB	3381	19560118
323948104302801	19S.25E.17.321212	3534		110AVMB	3452	19560118
324154104210701	19S.26E.02.21131	3303	87	110AVMB	3269	19560118
324144104210701	19S.26E.02.23111	3302	120	110AVMB	3247	19560118
324129104233701	19S.26E.04.311142	3364	150	110AVMB	3306	19560118
324035104201801	19S.26E.12.321322	3288	77	110AVMB	3255	19560118
324013104200301	19S.26E.12.43334	3281		110AVMB	3252	19560131
323920104203601	19S.26E.13.33333	3271		110AVMB	3259	19560118
323929104210702	19S.26E.14.431311A	3285	100	110AVMB	3254	19560118
323929104210703	19S.26E.14.431311B	3284	132	110AVMB	3254	19560118
323917104235201	19S.26E.20.22110	3354	110	110AVMB	3292	19560118
323847104232001	19S.26E.21.32143	3332		110AVMB	3278	19560131
323810104221601	19S.26E.27.141422	3296	127	110AVMB	3233	19560131
323737104232501	19S.26E.28.33442	3304		110AVMB	3232	19560117
323738104253801	19S.26E.30.33323	3389		110AVMB	3329	19560117

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334453104182601	06S.26E.33.33213	3596	76	110AVMB	3589	19670118
334401104182501	07S.26E.04.332133	3597	60	110AVMB	3582	19670118
334422104192901	07S.26E.05.133124	3603	250	110AVMB	3578	19670118
334423104192801	07S.26E.05.133212	3603		110AVMB	3579	19670118
334424104193602	07S.26E.06.242343A	3605	62	110AVMB	3579	19670108
334346104182201	07S.26E.09.11232	3597	87	110AVMB	3579	19670118
334311104174701	07S.26E.09.41444	3655	39	110AVMB	3621	19670118
334218104193101	07S.26E.18.42444	3583	200	110AVMB	3560	19670118
334151104191801	07S.26E.20.132222	3577	98	110AVMB	3562	19670118
334141104191801	07S.26E.20.13442	3576	118	110AVMB	3560	19670118
334141104183601	07S.26E.20.244321	3590	72	110AVMB	3565	19670118
334132104191801	07S.26E.20.31240	3576	73	110AVMB	3556	19670118
333818104313201	08S.24E.08.23141	3635		110AVMB	3527	19670126
333605104294701	08S.24E.22.341313	3590	160	110AVMB	3532	19670126
333606104292501	08S.24E.22.43142	3586		110AVMB	3531	19670126
333610104283101	08S.24E.23.32434 B CORN	3581	180	110AVMB	3534	19670126
333504104274401	08S.24E.25.343113 US F&W	3609	223	110AVMB	3529	19670125
333549104285801	08S.24E.26.11312	3587	101	110AVMB	3535	19670126
333553104293701	08S.24E.27.12232	3595	122	110AVMB	3535	19670126
333504104321801	08S.24E.30.44343	3631	150	110AVMB	3557	19670125
333438104283901	08S.24E.35.143442	3615	120	110AVMB	3527	19670126
333415104283901	08S.24E.35.343244	3614	115	110AVMB	3524	19670119
333920104200501	08S.26E.06.124222	3560	139	110AVMB	3544	19670118
333322104282302	09S.24E.02.43324 A	3596	157	110AVMB	3526	19670119
333255104285401	09S.24E.11.13324	3597	155	110AVMB	3526	19670119
333219104283601	09S.24E.14.122334	3580	133	110AVMB	3527	19670119
333145104283001	09S.24E.14.34222 B PETTY	3581	192	110AVMB	3528	19670119
333133104281501	09S.24E.14.43444	3576		110AVMB	3546	19670119
333126104272101	09S.24E.24.21144	3556		110AVMB	3529	19670119
333310104244501	09S.25E.08.22422	3654	137	110AVMB	3544	19670119

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
333045104241701	09S.25E.21.34421	3540	85	110AVMB	3511	19670125
332653104311301	10S.24E.16.131131	3589	150	110AVMB	3539	19670126
332629104232701	10S.25E.15.32344	3476	13	110AVMB	3471	19670126
332704104252301	10S.25E.17.12242	3522	68	110AVMB	3497	19670126
332105104285401	11S.24E.14.33243	3589	107	110AVMB	3523	19670127
332006104321001	11S.24E.20.33333	3647	175	110AVMB	3524	19670127
332307104260801	11S.25E.06.42131	3512	100	110AVMB	3495	19670127
331716104234501	12S.25E.12.233141	3511	45	110AVMB	3489	19670127
331524104245101	12S.25E.23.344234A ORCHA	3540	231	110AVMB	3433	19670100
331642104215001	12S.26E.17.144133	3450	41	110AVMB	3433	19670127
331213104241601	13S.25E.12.311134	3506	190	110AVMB	3435	19670127
331248104194801	13S.26E.03.343231	3414	28	110AVMB	3401	19670127
331138104210001	13S.26E.16.132121	3425	152	110AVMB	3405	19670127
330847104202301	13S.26E.33.421113	3429	70	110AVMB	3398	19670126
330309104343401	14S.24E.32.333341	3715	235	110AVMB	3526	19670127
330730104193201	14S.26E.03.433433	3419	95	110AVMB	3394	19670126
330756104212401	14S.26E.05.24333	3442	164	110AVMB	3401	19670126
330547104211401	14S.26E.17.44430	3472		110AVMB	3341	19670126
330531104182302	14S.26E.23.232231A	3390	135	110AVMB	3355	19670126
330423104203801	14S.26E.28.41133	3446	135	110AVMB	3373	19670126
330213104233001	15S.25E.12.21221	3461	108	110AVMB	3401	19670126
330236104231101	15S.26E.06.31111	3462	155	110AVMB	3363	19670126
330024104191701	15S.26E.22.22113	3349	99	110AVMB	3335	19670126
325932104193001	15S.26E.27.211142	3349	32	110AVMB	3335	19670126
325638104274801	16S.25E.11.111131A COTTO	3450	171	110AVMB	3405	19670100
325612104225601	16S.26E.09.23443	3345	68	110AVMB	3331	19670128
325501104244101	16S.26E.17.331313	3385	180	110AVMB	3347	19670128
325120104261201	17S.25E.12.211432	3452	225	110AVMB	3304	19670128
325216104202401	17S.26E.01.11221	3311	151	110AVMB	3301	19670131
324935104232901	17S.26E.21.112412	3372	232	110AVMB	3288	19670128
324916104220101	17S.26E.22.234311	3347	200	110AVMB	3311	19670131

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
324939104213801	17S.26E.23.11111	3322	15	110AVMB	3314	19670128
324620104255101	18S.26E.06.442212B LANNI	3402	246	110AVMB	3283	19670100
324522104195901	18S.26E.12.433342	3290	25	110AVMB	3278	19670129
324453104204901	18S.26E.14.421133	3309		110AVMB	3273	19670129
324340104202301	18S.26E.25.112122	3294	100	110AVMB	3259	19670129
324325104233001	18S.26E.28.122111 DAYTON	3403	250	110AVMB	3292	19670100

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332801104283901	10S.24E.02.43333	3552	100	110AVMB	3523	19750118
332751104291801	10S.24E.10.22342	3576	150	110AVMB	3521	19750118
332532104280801	10S.24E.24.33131	3532	180	110AVMB	3512	19750118
332337104281501	10S.24E.35.444334	3540	200	110AVMB	3515	19750118
332711104254201	10S.25E.08.33432	3521	43	110AVMB	3492	19750117
332743104225301	10S.25E.10.242324	3486	22	110AVMB	3480	19750118
332738104230101	10S.25E.10.243143	3487	19	110AVMB	3480	19750118
332731104231601	10S.25E.10.411144	3487	19	110AVMB	3481	19750118
332629104232701	10S.25E.15.32344	3476	13	110AVMB	3471	19750118
332704104252301	10S.25E.17.12242	3522	68	110AVMB	3497	19750118
332350104240602	10S.25E.33.432422A #5A	3463	45	110AVMB	3461	19750118
332347104235301	10S.25E.33.442411	3465	19	110AVMB	3453	19750118
332231104290701	11S.24E.10.22434	3567	129	110AVMB	3519	19750114
332105104285401	11S.24E.14.33243	3589	107	110AVMB	3521	19750113
332006104321001	11S.24E.20.33333	3647	175	110AVMB	3522	19750119
332044104273201	11S.24E.24.231114	3553	205	110AVMB	3522	19750113
331821104280001	11S.24E.36.333431	3585	295	110AVMB	3523	19750120
332307104260801	11S.25E.06.42131	3512	100	110AVMB	3497	19750120
332136104232301	11S.25E.15.14223	3450	74	110AVMB	3448	19750120
332126104263601	11S.25E.18.14334	3540	160	110AVMB	3516	19750128
331956104213501	11S.25E.25.11441	3444	47	110AVMB	3438	19750120
331940104235001	11S.25E.27.13333	3499	65	110AVMB	3487	19750113
331914104253701	11S.25E.29.34333	3535	160	110AVMB	3519	19750113
331923104264701	11S.25E.30.33231	3557	146	110AVMB	3522	19750113
331853104213301	11S.25E.36.134221	3435	42	110AVMB	3425	19750127
331854104212101	11S.25E.36.142344	3431	16	110AVMB	3426	19750127
331901104211501	11S.25E.36.213332	3433	17	110AVMB	3427	19750127
331903104211102	11S.25E.36.213412A	3438	29	110AVMB	3428	19750127
331855104205101	11S.25E.36.242323	3439	70	110AVMB	3436	19750127
331840104212301	11S.25E.36.324112	3432	15	110AVMB	3424	19750127

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331846104211001	11S.25E.36.411221	3434	14	110AVMB	3427	19750127
331818104250501	12S.25E.02.123111	3531	103	110AVMB	3496	19750128
331705104262801	12S.25E.09.42230	3564	90	110AVMB	3487	19750113
331532104255201	12S.25E.22.41131	3553	187	110AVMB	3423	19750114
331524104245101	12S.25E.23.344234A ORCHA	3540	231	110AVMB	3432	19750114
331435104234701	12S.25E.25.431111	3508		110AVMB	3434	19750114
331427104255201	12S.25E.34.21111	3541	187	110AVMB	3451	19750114
331812104211801	12S.26E.05.424312	3429	24	110AVMB	3422	19750127
331642104215001	12S.26E.17.144133	3450	41	110AVMB	3435	19750114
331416104221301	12S.26E.32.11333	3471	123	110AVMB	3441	19750115
331335104241701	13S.25E.01.11111	3507	210	110AVMB	3448	19750114
331213104241601	13S.25E.12.311134	3506	190	110AVMB	3427	19750114
331122104241701	13S.25E.13.311131	3509	167	110AVMB	3412	19750114
331002104244801	13S.25E.26.21113	3509	190	110AVMB	3397	19750114
330952104273601	13S.25E.29.22334	3559	126	110AVMB	3451	19750114
330838104260701	13S.25E.34.314224	3526	136	110AVMB	3401	19750116
331254104221301	13S.26E.05.33113	3464	110	110AVMB	3441	19750115
331241104195501	13S.26E.10.112230	3411	18	110AVMB	3400	19750127
331138104210001	13S.26E.16.132121	3425	152	110AVMB	3399	19750115
331103104212601	13S.26E.17.443131	3440	130	110AVMB	3402	19750115
331058104221401	13S.26E.19.22222	3472	197	110AVMB	3416	19750115
331022104200701	13S.26E.22.313312	3412	230	110AVMB	3392	19750115
330940104211002	13S.26E.28.31111 A	3439	216	110AVMB	3399	19750116
330956104221302	13S.26E.29.11331 A	3461	213	110AVMB	3405	19750115
330921104220601	13S.26E.29.33100	3457	200	110AVMB	3406	19750124
330847104202301	13S.26E.33.421113	3429	70	110AVMB	3397	19750116
330309104343401	14S.24E.32.333341	3715	235	110AVMB	3524	19750115
330819104241501	14S.25E.01.11111	3488	255	110AVMB	3365	19750124
330728104241601	14S.25E.02.44444	3494	263	110AVMB	3323	19750116
330609104240901	14S.25E.13.311221	3507	250	110AVMB	3320	19750116
330559104254901	14S.25E.15.413313	3545	177	110AVMB	3389	19750116

Wells Used To Produce Water Level Map
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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330449104241201	14S.25E.25.111142	3501	170	110AVMB	3378	19750121
330730104193201	14S.26E.03.433433	3419	95	110AVMB	3393	19750115
330808104203801	14S.26E.04.23111	3427	150	110AVMB	3392	19750116
330756104212401	14S.26E.05.24333	3442	164	110AVMB	3402	19750116
330734104214001	14S.26E.05.43313	3452	185	110AVMB	3389	19750116
330806104223401	14S.26E.06.23213	3462	110	110AVMB	3405	19750116
330642104173301	14S.26E.12.433131	3396	125	110AVMB	3378	19750116
330547104211401	14S.26E.17.44430	3472		110AVMB	3318	19750120
330557104223501	14S.26E.18.43124	3474	184	110AVMB	3316	19750120
330531104182302	14S.26E.23.232231A	3390	135	110AVMB	3355	19750116
330420104190901	14S.26E.27.42423	3405	153	110AVMB	3354	19750124
330423104203801	14S.26E.28.41133	3446	135	110AVMB	3368	19750120
330413104212402	14S.26E.29.44113 A	3465	170	110AVMB	3374	19750120
330318104210701	14S.26E.33.331343	3448	100	110AVMB	3413	19750120
330303104262501	15S.25E.04.22142	3516	164	110AVMB	3423	19750120
330213104233001	15S.25E.12.21221	3461	108	110AVMB	3400	19750119
330236104231101	15S.26E.06.31111	3462	155	110AVMB	3350	19750120
330118104230101	15S.26E.18.112121	3442	132	110AVMB	3387	19750120
330024104191701	15S.26E.22.22113	3349	99	110AVMB	3337	19750120
325932104193001	15S.26E.27.211142	3349	32	110AVMB	3337	19750120
325919104231101	15S.26E.30.131131	3372	256	110AVMB	3349	19750120
330309104163401	15S.27E.06.122113	3360	14	110AVMB	3354	19750127
330253104163701	15S.27E.06.141414	3363	15	110AVMB	3354	19750127
330257104162701	15S.27E.06.142	3363	18	110AVMB	3356	19750127
325721104305601	16S.25E.06.224413	3521	80	110AVMB	3502	19750120
325656104315401	16S.25E.06.31313	3558	39	110AVMB	3528	19750120
325638104274801	16S.25E.11.111131A COTTO	3450	171	110AVMB	3393	19750117
325614104271601	16S.25E.11.233331	3441	133	110AVMB	3360	19750120
325451104260301	16S.25E.24.21232	3432	148	110AVMB	3315	19750120
325245104281705	16S.25E.34.23333 D	3516	185	110AVMB	3350	19750120
325637104244001	16S.26E.08.111112	3385	175	110AVMB	3345	19750120

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325612104225601	16S.26E.09.23443	3345	68	110AVMB	3329	19750120
325521104215601	16S.26E.15.234323	3327	55	110AVMB	3319	19750120
325501104244101	16S.26E.17.331313	3385	180	110AVMB	3329	19750120
325450104251101	16S.26E.19.21113	3399	160	110AVMB	3302	19750120
325401104233801	16S.26E.21.333334	3366	131	110AVMB	3314	19750120
325242104254201	16S.26E.31.31111	3447	200	110AVMB	3298	19750120
325246104203401	16S.26E.35.244244	3316	19	110AVMB	3306	19750127
325225104210501	16S.26E.35.342424	3311	19	110AVMB	3308	19750127
325228104203901	16S.26E.35.442123	3313	17	110AVMB	3305	19750127
325120104261201	17S.25E.12.211432	3452	225	110AVMB	3296	19750114
325217104205501	17S.26E.02.21243	3304	25	110AVMB	3299	19750127
325202104220401	17S.26E.03.231214	3331	177	110AVMB	3304	19750114
325124104223701	17S.26E.03.33334	3338	283	110AVMB	3305	19750114
325053104203401	17S.26E.12.311323	3304	40	110AVMB	3301	19750114
324935104232901	17S.26E.21.112412	3372	232	110AVMB	3285	19750114
324859104232501	17S.26E.21.341114	3370	250	110AVMB	3296	19750123
324916104220101	17S.26E.22.234311	3347	200	110AVMB	3312	19750114
324614104230901	18S.26E.04.433311	3369	139	110AVMB	3295	19750123
324620104255101	18S.26E.06.442212B LANNI	3402	246	110AVMB	3285	19750113
324554104234001	18S.26E.09.13133	3385	165	110AVMB	3318	19750128
324522104195901	18S.26E.12.433342	3290	25	110AVMB	3279	19750114
324453104204901	18S.26E.14.421133	3309		110AVMB	3274	19750113
324440104223701	18S.26E.15.33113	3352	175	110AVMB	3301	19750128
324413104213501	18S.26E.23.131331	3322	180	110AVMB	3258	19750128
324340104202301	18S.26E.25.112122	3294	100	110AVMB	3257	19750113
324325104233001	18S.26E.28.122111 DAYTON	3403	250	110AVMB	3286	19750113
324244104243501	18S.26E.32.11100	3421	152	110AVMB	3334	19750113
324144104210701	19S.26E.02.23111	3302	120	110AVMB	3239	19750113
324034104201801	19S.26E.12.321324	3288		110AVMB	3249	19750113
323929104210703	19S.26E.14.431311B	3284	132	110AVMB	3243	19750113
323917104235201	19S.26E.20.22110	3354	110	110AVMB	3280	19750113

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1975

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
323810104221601	19S.26E.27.141422	3296	127	110AVMB	3224	19750114

Wells Used To Produce Water Level Map
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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334424104193601	07S.26E.06.242343	3606	210	110AVMB	3581	19840131
334218104193101	07S.26E.18.42444	3583	200	110AVMB	3559	19840131
334141104191801	07S.26E.20.13442	3576	118	110AVMB	3563	19840131
333818104313201	08S.24E.08.23141	3635		110AVMB	3529	19840130
333606104292501	08S.24E.22.43142	3586		110AVMB	3527	19840130
333610104283101	08S.24E.23.32434 B CORN	3581	180	110AVMB	3530	19840130
333504104274401	08S.24E.25.343113 US F&W	3609	223	110AVMB	3523	19840127
333504104321801	08S.24E.30.44343	3631	150	110AVMB	3555	19840126
333414104283901	08S.24E.35.343422	3614	160	110AVMB	3523	19840127
333849104165501	08S.26E.03.414313	3771	22	110AVMB	3754	19840124
333841104202602	08S.26E.06.33233 A	3555	105	110AVMB	3545	19840124
333642104173001	08S.26E.22.11130	3830	160	110AVMB	3743	19840124
333554104173201	08S.26E.27.111111	3773	149	110AVMB	3731	19840124
333322104282302	09S.24E.02.43324 A	3596	157	110AVMB	3524	19840127
333244104302901	09S.24E.09.41321	3622	100	110AVMB	3526	19840117
333145104283001	09S.24E.14.34222 B PETTY	3581	192	110AVMB	3524	19840127
332828104270801	10S.24E.01.24444	3548	68	110AVMB	3518	19840124
332801104283901	10S.24E.02.43333	3552	100	110AVMB	3521	19840125
332751104291801	10S.24E.10.22342	3576	150	110AVMB	3522	19840125
332800104270801	10S.24E.12.22243 HARGROV	3546	97	110AVMB	3510	19840124
332643104273701	10S.24E.13.233331	3542	50	110AVMB	3505	19840124
332653104311301	10S.24E.16.131131	3589	150	110AVMB	3539	19840125
332532104280801	10S.24E.24.33131	3532	180	110AVMB	3512	19840124
332447104271401	10S.24E.25.42413	3501	140	110AVMB	3493	19840124
332455104291301	10S.24E.27.422212	3562	60	110AVMB	3545	19840126
332510104305801	10S.24E.28.11440	3595	150	110AVMB	3552	19840126
332343104301301	10S.24E.33.444221	3554	20	110AVMB	3538	19840125
332338104285401	10S.24E.35.343331	3550	126	110AVMB	3519	19840126
332337104281501	10S.24E.35.444334	3540	200	110AVMB	3514	19840126
332711104254201	10S.25E.08.33432	3521	43	110AVMB	3492	19840124

Wells Used To Produce Water Level Map
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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332743104225301	10S.25E.10.242324	3486	22	110AVMB	3481	19840106
332738104230101	10S.25E.10.243143	3487	19	110AVMB	3480	19840106
332731104231601	10S.25E.10.411144	3487	19	110AVMB	3481	19840106
332629104232701	10S.25E.15.32344	3476	13	110AVMB	3471	19840125
332704104252301	10S.25E.17.12242	3522	68	110AVMB	3494	19840124
332540104262301	10S.25E.19.41313	3530	100	110AVMB	3494	19840125
332350104260501	10S.25E.31.33111	3519	230	110AVMB	3499	19840124
332350104252201	10S.25E.32.431113	3475	103	110AVMB	3469	19840124
332350104243601	10S.25E.33.342311 JP WHI	3468	47	110AVMB	3462	19840124
332350104242001	10S.25E.33.431422 JP WHI	3466	47	110AVMB	3460	19840124
332350104240602	10S.25E.33.432422A #5A	3463	45	110AVMB	3458	19840124
332347104235301	10S.25E.33.442411	3465	19	110AVMB	3454	19840124
332214104282101	11S.24E.11.412422	3561	180	110AVMB	3523	19840130
332237104275601	11S.24E.12.114111	3548	150	110AVMB	3516	19840130
332218104273305	11S.24E.12.233333	3548	123	110AVMB	3516	19840130
332147104273501	11S.24E.13.12242	3538	34	110AVMB	3517	19840130
332109104273501	11S.24E.13.34224	3553	180	110AVMB	3516	19840130
332105104285401	11S.24E.14.33243	3589	107	110AVMB	3521	19840130
332102104281901	11S.24E.14.443133	3562	193	110AVMB	3519	19840130
332006104321001	11S.24E.20.33333	3647	175	110AVMB	3524	19840131
332026104282801	11S.24E.23.41144	3571	131	110AVMB	3525	19840130
332245104255302	11S.25E.05.33333 A	3521	103	110AVMB	3495	19840126
332258104264001	11S.25E.06.33222	3532	180	110AVMB	3503	19840126
332307104260801	11S.25E.06.42131	3512	100	110AVMB	3494	19840126
332205104255001	11S.25E.08.33112	3512		110AVMB	3490	19840126
332153104251401	11S.25E.08.434331	3484	8	110AVMB	3482	19840126
332227104232001	11S.25E.10.142424	3458		110AVMB	3460	19840126
332146104215101	11S.25E.14.222431	3455	13	110AVMB	3454	19840126
332136104232301	11S.25E.15.14223	3450	74	110AVMB	3448	19840126
332147104225001	11S.25E.15.222423	3451	82	110AVMB	3450	19840126
332126104263601	11S.25E.18.14334	3540	160	110AVMB	3512	19840127

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332016104262901	11S.25E.19.34210	3541	190	110AVMB	3521	19840127
332056104221801	11S.25E.23.21113	3467	168	110AVMB	3456	19840127
331940104235001	11S.25E.27.13333	3499	65	110AVMB	3483	19840125
331939104232001	11S.25E.27.32222	3488	105	110AVMB	3470	19840125
331916104245101	11S.25E.28.33331	3519	150	110AVMB	3502	19840125
331919104241401	11S.25E.28.43322	3509	53	110AVMB	3492	19840125
331914104253701	11S.25E.29.34333	3535	160	110AVMB	3517	19840125
331923104264701	11S.25E.30.33231	3557	146	110AVMB	3517	19840127
331901104260802	11S.25E.31.223331A	3548	180	110AVMB	3520	19840125
331822104262301	11S.25E.31.433314	3563	75	110AVMB	3518	19840125
331840104242101	11S.25E.33.413111	3517	134	110AVMB	3490	19840125
331854104235001	11S.25E.34.131333	3508	113	110AVMB	3485	19840125
331853104213301	11S.25E.36.134221	3435	42	110AVMB	3426	19840106
331854104212101	11S.25E.36.142344	3431	16	110AVMB	3427	19840106
331901104211501	11S.25E.36.213332	3433	17	110AVMB	3428	19840106
331903104211102	11S.25E.36.213412A	3438	29	110AVMB	3428	19840106
331855104205101	11S.25E.36.242323	3439	70	110AVMB	3435	19840106
331846104211001	11S.25E.36.411221	3434	14	110AVMB	3428	19840106
331720104294201	12S.24E.12.241411	3612	170	110AVMB	3519	19840130
331518104301801	12S.24E.23.442311	3648		110AVMB	3519	19840130
331511104293301	12S.24E.25.222243	3622	127	110AVMB	3515	19840130
331524104245101	12S.25E.23.344234A ORCHA	3540	231	110AVMB	3431	19840101
331524104245101	12S.25E.23.344234A ORCHA	3540	231	110AVMB	3430	19840120
331812104211801	12S.26E.05.424312	3429	24	110AVMB	3422	19840106
331648104210401	12S.26E.16.13142	3424	6	110AVMB	3420	19840131
331626104222901	12S.26E.18.42333	3475	111	110AVMB	3442	19840131
331524104214201	12S.26E.20.43313	3441		110AVMB	3418	19840131
331540104202801	12S.26E.21.41243	3449	66	110AVMB	3430	19840131
331441104173701	12S.26E.25.34221 A	3511	52	110AVMB	3462	19840131
331337104221701	12S.26E.31.444434	3470	50	110AVMB	3443	19840131
331335104241701	13S.25E.01.11111	3507	210	110AVMB	3439	19840131

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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331253104241701	13S.25E.01.331131	3503	220	110AVMB	3425	19840131
331303104231901	13S.25E.01.42243	3486	47	110AVMB	3450	19840131
331213104241601	13S.25E.12.311134	3506	190	110AVMB	3421	19840131
331122104241701	13S.25E.13.311131	3509	167	110AVMB	3405	19840130
331058104234601	13S.25E.13.43333	3494	146	110AVMB	3407	19840130
331145104251901	13S.25E.14.111331	3529	274	110AVMB	3403	19840131
331028104244401	13S.25E.23.41123	3511	200	110AVMB	3395	19840130
330851104233302	13S.25E.36.234241A	3492	200	110AVMB	3384	19840127
331314104194801	13S.26E.03.143233	3422	56	110AVMB	3406	19840131
331333104221302	13S.26E.05.11113 A	3468	109	110AVMB	3441	19840131
331254104221301	13S.26E.05.33113	3464	110	110AVMB	3440	19840131
331214104211501	13S.26E.08.42232	3435	78	110AVMB	3414	19840131
331241104195501	13S.26E.10.112230	3411	18	110AVMB	3400	19840131
331237104200101	13S.26E.10.113222	3412	47	110AVMB	3399	19840131
331127104210601	13S.26E.16.133413	3428	150	110AVMB	3401	19840131
331103104212601	13S.26E.17.443131	3440	130	110AVMB	3404	19840131
331046104220601	13S.26E.20.11344	3472	100	110AVMB	3415	19840130
331022104200701	13S.26E.22.313312	3412	230	110AVMB	3394	19840131
331026104180401	13S.26E.23.424222	3399	19	110AVMB	3387	19840131
331006104211001	13S.26E.28.111111	3441		110AVMB	3400	19840130
330959104202301	13S.26E.28.223111	3422	200	110AVMB	3397	19840131
330940104211002	13S.26E.28.31111 A	3439	216	110AVMB	3402	19840130
330956104221302	13S.26E.29.11331 A	3461	213	110AVMB	3408	19840130
330847104202301	13S.26E.33.421113	3429	70	110AVMB	3399	19840127
330728104241601	14S.25E.02.44444	3494	263	110AVMB	3315	19840126
330701104274702	14S.25E.08.41122 A	3587		110AVMB	3471	19840126
330643104241501	14S.25E.12.33133	3502		110AVMB	3283	19840126
330609104240901	14S.25E.13.311221	3507	250	110AVMB	3318	19840126
330559104254901	14S.25E.15.413313	3545	177	110AVMB	3382	19840127
330544104285601	14S.25E.18.43333	3596		110AVMB	3488	19840127
330452104273901	14S.25E.20.43440	3584	87	110AVMB	3499	19840127

Wells Used To Produce Water Level Map
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Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330451104241401	14S.25E.25.111112	3501	296	110AVMB	3362	19840126
330730104193201	14S.26E.03.433433	3419	95	110AVMB	3395	19840125
330808104205301	14S.26E.04.14111	3434	202	110AVMB	3397	19840125
330821104221002	14S.26E.05.111112	3457	228	110AVMB	3378	19840125
330734104214001	14S.26E.05.43313	3452	185	110AVMB	3396	19840125
330808104224201	14S.26E.06.142222	3464	150	110AVMB	3371	19840125
330750104221201	14S.26E.06.42240	3451	117	110AVMB	3369	19840125
330729104220001	14S.26E.08.11212	3459	235	110AVMB	3357	19840125
330701104220501	14S.26E.08.311243	3482	190	110AVMB	3344	19840125
330729104202301	14S.26E.09.22111	3426	210	110AVMB	3398	19840125
330639104203001	14S.26E.09.434333	3435	107	110AVMB	3363	19840130
330705104200101	14S.26E.10.133443	3424	190	110AVMB	3390	19840125
330642104173301	14S.26E.12.433131	3396	125	110AVMB	3376	19840126
330636104174901	14S.26E.13.112242	3393	250	110AVMB	3376	19840125
330616104190501	14S.26E.14.13313	3409	171	110AVMB	3377	19840125
330635104182101	14S.26E.14.212243	3395		110AVMB	3378	19840125
330553104181301	14S.26E.14.44140	3392		110AVMB	3369	19840130
330612104193601	14S.26E.15.411111	3419	199	110AVMB	3376	19840125
330638104210901	14S.26E.16.11111	3454	180	110AVMB	3347	19840125
330635104214401	14S.26E.17.12223	3472	192	110AVMB	3331	19840125
330547104211401	14S.26E.17.44430	3472		110AVMB	3345	19840125
330628104231202	14S.26E.18.11331 A	3488		110AVMB	3309	19840125
330557104223501	14S.26E.18.43124	3474	184	110AVMB	3317	19840125
330531104221201	14S.26E.19.24224	3481	155	110AVMB	3342	19840126
330518104230901	14S.26E.19.31110	3477		110AVMB	3336	19840125
330455104215201	14S.26E.20.343344	3492	168	110AVMB	3367	19840124
330457104210901	14S.26E.21.333313	3465	243	110AVMB	3361	19840125
330533104195201	14S.26E.22.14111	3439		110AVMB	3355	19840125
330544104190501	14S.26E.23.11113	3406	200	110AVMB	3370	19840125
330531104182302	14S.26E.23.232231A	3390	135	110AVMB	3361	19840125
330419104200701	14S.26E.27.31331	3425	100	110AVMB	3362	19840125

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330420104190901	14S.26E.27.42423	3405	153	110AVMB	3355	19840125
330449104203802	14S.26E.28.211333A	3451	186	110AVMB	3347	19840125
330423104203801	14S.26E.28.41133	3446	135	110AVMB	3364	19840125
330444104214001	14S.26E.29.213313	3483		110AVMB	3364	19840130
330359104181901	14S.26E.35.22131	3395	150	110AVMB	3351	19840125
330138104302401	15S.24E.12.311311	3618	132	110AVMB	3500	19840126
325932104305502	15S.24E.23.43333 A	3584	119	110AVMB	3500	19840130
325841104315501	15S.24E.27.433312	3593		110AVMB	3450	19840126
325813104302201	15S.24E.36.133343	3522		110AVMB	3489	19840126
330303104262501	15S.25E.04.22142	3516	164	110AVMB	3415	19840126
330213104235901	15S.25E.12.112221	3464		110AVMB	3404	19840125
325954104285601	15S.25E.19.324124	3519	102	110AVMB	3455	19840126
330025104244301	15S.25E.23.211134	3425	61	110AVMB	3405	19840125
325911104251501	15S.25E.26.133313	3412	150	110AVMB	3377	19840125
325932104280001	15S.25E.29.121234	3485	120	110AVMB	3398	19840126
325840104270301	15S.25E.33.121131	3467	78	110AVMB	3433	19840125
325830104241301	15S.25E.36.11333	3386	148	110AVMB	3364	19840126
330235104175801	15S.26E.01.311141	3386	62	110AVMB	3353	19840124
330301104193001	15S.26E.03.211142	3436		110AVMB	3354	19840124
330247104214301	15S.26E.05.142144	3460	220	110AVMB	3351	19840124
330236104231101	15S.26E.06.31111	3462	155	110AVMB	3359	19840124
330136104213201	15S.26E.08.413241	3418	72	110AVMB	3358	19840124
330132104213101	15S.26E.08.41340	3416	97	110AVMB	3360	19840124
330119104203601	15S.26E.09.34400	3400		110AVMB	3361	19840124
330210104190201	15S.26E.11.111113	3400	53	110AVMB	3350	19840124
330032104182701	15S.26E.14.43321	3359	75	110AVMB	3344	19840124
330118104230101	15S.26E.18.112121	3442	132	110AVMB	3389	19840124
330026104224101	15S.26E.19.12222	3411	83	110AVMB	3356	19840124
330013104214901	15S.26E.20.14121	3400	121	110AVMB	3337	19840124
325932104193001	15S.26E.27.211142	3349	32	110AVMB	3336	19840124
325750104231001	15S.26E.31.333330	3356	168	110AVMB	3321	19840125

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330253104163701	15S.27E.06.141414	3363	15	110AVMB	3353	19840106
330248104161902	15S.27E.06.233244A	3356	6	110AVMB	3352	19840106
325657104262601	16S.25E.01.12110	3426		110AVMB	3380	19840126
325645104262502	16S.25E.01.34321 A	3415	148	110AVMB	3344	19840126
325721104305601	16S.25E.06.224413	3521	80	110AVMB	3502	19840127
325656104315401	16S.25E.06.31313	3558	39	110AVMB	3529	19840126
325634104304801	16S.25E.08.111432	3515		110AVMB	3469	19840126
325550104284001	16S.25E.10.334312	3475	250	110AVMB	3403	19840126
325638104274801	16S.25E.11.111131A COTTO	3450	171	110AVMB	3392	19840120
325535104271301	16S.25E.14.213343	3444	135	110AVMB	3346	19840126
325522104281702	16S.25E.15.233331A	3471	270	110AVMB	3391	19840126
325531104290801	16S.25E.16.23223	3498		110AVMB	3426	19840126
325406104271301	16S.25E.23.43332	3461		110AVMB	3377	19840130
325451104260301	16S.25E.24.21232	3432	148	110AVMB	3309	19840125
325402104261301	16S.25E.25.211111	3448	225	110AVMB	3338	19840130
325313104311901	16S.25E.30.43341	3604		110AVMB	3428	19840127
325245104281705	16S.25E.34.23333 D	3516	185	110AVMB	3344	19840130
325722104244101	16S.26E.05.11311	3391	300	110AVMB	3339	19840126
325727104253101	16S.26E.06.112233	3411		110AVMB	3368	19840126
325611104252701	16S.26E.07.321111	3403	180	110AVMB	3320	19840126
325552104252401	16S.26E.07.34130	3405		110AVMB	3315	19840126
325612104225601	16S.26E.09.23443	3345	68	110AVMB	3324	19840125
325521104215601	16S.26E.15.234323	3327	55	110AVMB	3315	19840125
325458104223501	16S.26E.15.333123	3351	260	110AVMB	3320	19840125
325544104231301	16S.26E.16.12212	3346	171	110AVMB	3328	19840125
325513104233601	16S.26E.16.31134	3361	230	110AVMB	3322	19840125
325516104243801	16S.26E.17.31114	3394	124	110AVMB	3312	19840125
325503104244101	16S.26E.17.33113	3385	200	110AVMB	3311	19840125
325401104233801	16S.26E.21.333334	3366	131	110AVMB	3305	19840125
325335104223401	16S.26E.27.13330	3356	83	110AVMB	3322	19840124
325310104215501	16S.26E.27.434342	3341	90	110AVMB	3305	19840124

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325245104254201	16S.26E.31.13331	3445	228	110AVMB	3282	19840124
325255104241001	16S.26E.32.231111	3393	170	110AVMB	3283	19840124
325301104213401	16S.26E.35.113114	3335		110AVMB	3304	19840124
325246104203401	16S.26E.35.244244	3316	19	110AVMB	3306	19840121
325225104210501	16S.26E.35.342424	3311	19	110AVMB	3302	19840124
325120104261201	17S.25E.12.211432	3452	225	110AVMB	3285	19840125
325216104202401	17S.26E.01.11221	3311	151	110AVMB	3300	19840124
325202104220401	17S.26E.03.231214	3331	177	110AVMB	3297	19840124
325124104223701	17S.26E.03.33334	3338	283	110AVMB	3297	19840124
325137104251201	17S.26E.06.413344	3425	220	110AVMB	3291	19840125
325051104213801	17S.26E.11.313111	3322	140	110AVMB	3302	19840131
325053104203401	17S.26E.12.311323	3304	40	110AVMB	3299	19840125
324953104223701	17S.26E.15.31334	3352	220	110AVMB	3287	19840131
324935104232901	17S.26E.21.112412	3372	232	110AVMB	3275	19840125
324859104232501	17S.26E.21.341114	3370	250	110AVMB	3281	19840125
324916104220101	17S.26E.22.234311	3347	200	110AVMB	3301	19840125
324614104230901	18S.26E.04.433311	3369	139	110AVMB	3281	19840125
324620104255101	18S.26E.06.442212B LANNI	3402	246	110AVMB	3277	19840125
324542104220602	18S.26E.10.411314A	3335	147	110AVMB	3281	19840131
324453104204901	18S.26E.14.421133	3309		110AVMB	3266	19840126
324519104250201	18S.26E.18.21214	3417	276	110AVMB	3277	19840131
324413104213501	18S.26E.23.131331	3322	180	110AVMB	3254	19840126
324340104202301	18S.26E.25.112122	3294	100	110AVMB	3252	19840126
324325104233001	18S.26E.28.122111 DAYTON	3403	250	110AVMB	3282	19840126
324259104232501	18S.26E.28.332242	3394	170	110AVMB	3281	19840131
324327104245501	18S.26E.30.241123	3441	205	110AVMB	3307	19840131
324244104243501	18S.26E.32.11100	3421	152	110AVMB	3324	19840131
324042104265801	19S.25E.11.24333	3417	211	110AVMB	3349	19840131
324004104285801	19S.25E.16.22332	3462		110AVMB	3362	19840131
324144104210701	19S.26E.02.23111	3302	120	110AVMB	3233	19840126
324034104201801	19S.26E.12.321324	3288		110AVMB	3231	19840126

Wells Used To Produce Water Level Map
In Shallow Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
323929104210703	19S.26E.14.431311B	3284	132	110AVMB	3234	19840126
323917104235201	19S.26E.20.22110	3354	110	110AVMB	3272	19840127
323810104221601	19S.26E.27.141422	3296	127	110AVMB	3216	19840127

Appendix D, Part 2

List of Carbonate Aquifer Wells Used for Water Level Contour Maps

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332519104390701	10S.23E.30.21122	3819		313SADR	3581	19430111
332800104321401	10S.24E.08.11111 STOCKTO	3623	368	313SADR	3579	19430104
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3574	19430100
332529104292101	10S.24E.22.44321	3562	343	313SADR	3571	19430113
332307104295701	11S.24E.03.31214	3579	368	313SADR	3574	19430104
331952104311001	11S.24E.29.242222	3627	553	313SADR	3574	19430113
332221104260801	11S.25E.07.24331	3526	430	313SADR	3567	19430113
332105104233001	11S.25E.15.343212	3476	843	313SADR	3561	19430113
332007104260901	11S.25E.19.43444	3536	820	313SADR	3566	19430113
331756104383701	12S.23E.05.31112	3816	647	313SADR	3591	19430111
331751104383201	12S.23E.05.31233	3811	250	313SADR	3582	19430111
331553104252101	12S.25E.23.11313	3546	810	313SADR	3541	19430100
331136104262001	13S.25E.15.131114	3548	820	313SADR	3530	19430113
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3531	19430100
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3530	19430113
331056104224401	13S.26E.19.21113	3472	990	313SADR	3522	19430113
330951104230601	13S.26E.30.132132	3473	998	313SADR	3520	19430113
330905104231501	13S.26E.31.113133	3487	955	313SADR	3519	19430112
330702104402401	14S.23E.08.144344	3844	460	313SADR	3586	19430111
330449104210901	14S.26E.28.11133	3466	1100	313SADR	3456	19430113
330028104235701	15S.25E.24.12111	3414	990	313SADR	3419	19430112
325654104324101	16S.24E.01.121111	3571	771	313SADR	3587	19430112
325640104322601	16S.24E.12.122224	3551	798	313SADR	3582	19430112
325621104324301	16S.24E.12.134212	3558	801	313SADR	3585	19430112
325729104295001	16S.25E.04.11113	3501	893	313SADR	3535	19430112
325640104301901	16S.25E.05.43334	3511	1156	313SADR	3537	19430112
325400104244701	16S.26E.30.222112	3397	1000	313SADR	3421	19430112
325034104231501	17S.26E.09.344411	3364	1157	313SADR	3406	19430111
324810104234101	17S.26E.28.313312	3383	148	313SADR	3373	19430126
324831104244401	17S.26E.29.13113	3407	201	313SADR	3379	19430126

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1943

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
324729104254701	17S.26E.31.133333	3438	219	313SADR	3381	19430128
324739104244401	17S.26E.32.13113	3405	861	313SADR	3407	19430111
324745104224701	17S.26E.33.224134	3346	957	313SADR	3405	19430111
324643104400501	18S.23E.03.240000	3937	1079	313SADR	3599	19430111
324431104274601	18S.25E.23.111134	3502	300	313SADR	3411	19430128
324612104213301	18S.26E.02.33333	3321	202	313SADR	3309	19430128
324654104233701	18S.26E.04.11110	3374	148	313SADR	3356	19430128
324614104244101	18S.26E.05.333312	3402	1056	313SADR	3402	19430111
323818104405701	19S.23E.27.111144	3951	430	313SADR	3580	19430111

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1956

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334138104343801	07S.23E.23.24431	3811	436	313SADR	3561	19560110
334144104193901	07S.26E.19.243222	3576	565	313SADR	3564	19560109
333918104303501	08S.24E.04.12424	3642	441	313SADR	3560	19560109
333837104310401	08S.24E.04.333313	3627	416	313SADR	3561	19560109
333908104314401	08S.24E.05.14144	3640	402	313SADR	3563	19560109
333912104314301	08S.24E.05.14213	3640		313SADR	3575	19560109
333842104314001	08S.24E.05.342344	3642		313SADR	3562	19560109
333836104314801	08S.24E.05.343341	3647	415	313SADR	3567	19560109
333716104323401	08S.24E.18.23330	3694	444	313SADR	3558	19560109
333636104294701	08S.24E.22.142113 J CORN	3599	275	313SADR	3559	19560109
333636104291801	08S.24E.22.232423 J CORN	3590	315	313SADR	3561	19560109
332903104343501	09S.23E.35.42422 E SONS	3695	826	313SADR	3560	19560111
333344104315901	09S.24E.05.31122	3661	364	313SADR	3558	19560110
332651104363501	10S.23E.15.13112	3726	700	313SADR	3558	19560111
332613104355501	10S.23E.15.434431	3697	250	313SADR	3559	19560111
332459104355301	10S.23E.27.234223	3723	425	313SADR	3560	19560111
332443104364801	10S.23E.28.423423	3756	212	313SADR	3565	19560111
332413104371101	10S.23E.33.142223	3765	528	313SADR	3584	19560111
332800104321401	10S.24E.08.11111 STOCKTO	3623	368	313SADR	3577	19560111
332702104301101	10S.24E.15.111333	3571	322	313SADR	3549	19560103
332525104325401	10S.24E.19.343424	3624	170	313SADR	3555	19560110
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3554	19560100
332448104291701	10S.24E.27.424113	3562	375	313SADR	3563	19560103
332357104300101	10S.24E.34.312344	3550	325	313SADR	3570	19560103
332343104280801	10S.24E.36.33311	3537	373	313SADR	3550	19560103
332306104403901	11S.22E.01.312323	3836	345	313SADR	3561	19560111
332244104335501	11S.23E.01.433433	3631	169	313SADR	3556	19560111
332249104362101	11S.23E.03.334211	3745	622	313SADR	3562	19560111
332255104360401	11S.23E.03.342223	3725	478	313SADR	3559	19560111
332150104353201	11S.23E.15.22223	3675	649	313SADR	3559	19560111

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1956

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332007104361801	11S.23E.22.33444	3725	346	313SADR	3555	19560111
332007104353201	11S.23E.22.44444	3703	233	313SADR	3556	19560111
331941104363201	11S.23E.27.133333	3733	255	313SADR	3556	19560111
331941104360301	11S.23E.27.144444	3722	250	313SADR	3556	19560111
331836104373201	11S.23E.33.313343	3775	425	313SADR	3556	19560111
331853104361301	11S.23E.34.14323	3750	500	313SADR	3556	19560111
332257104292101	11S.24E.03.441111	3571	350	313SADR	3550	19560105
332331104323801	11S.24E.06.21134	3597		313SADR	3553	19560103
332220104273301	11S.24E.12.233311	3548	498	313SADR	3545	19560100
332220104273301	11S.24E.12.233311	3548	498	313SADR	3544	19560111
332125104285001	11S.24E.14.143334 FRST N	3582	406	313SADR	3547	19560103
332109104313701	11S.24E.17.43114	3628	355	313SADR	3553	19560103
332059104313701	11S.24E.17.43334	3629	245	313SADR	3550	19560130
332006104330701	11S.24E.19.333434	3669	263	313SADR	3555	19560112
332029104285001	11S.24E.23.32113	3580	392	313SADR	3545	19560112
332006104281501	11S.24E.23.443434	3575	535	313SADR	3545	19560103
331952104311001	11S.24E.29.242222	3627	553	313SADR	3551	19560103
332219104260801	11S.25E.07.243333	3524	500	313SADR	3542	19560103
332218104245302	11S.25E.08.42222 A	3483	796	313SADR	3543	19560103
332218104245303	11S.25E.08.42222 B	3483	796	313SADR	3542	19560103
332105104233001	11S.25E.15.343212	3476	843	313SADR	3535	19560103
332125104265301	11S.25E.18.311112	3544	437	313SADR	3545	19560103
332007104260901	11S.25E.19.43444	3536	820	313SADR	3545	19560103
332040104225101	11S.25E.22.242432	3478	782	313SADR	3533	19560103
332005104245101	11S.25E.28.11111	3513	757	313SADR	3516	19560103
331756104383701	12S.23E.05.31112	3816	647	313SADR	3556	19560111
331743104382501	12S.23E.05.33222	3807	458	313SADR	3557	19560111
331811104390001	12S.23E.06.214342	3831	655	313SADR	3559	19560111
331645104305201	12S.24E.10.44444	3653	360	313SADR	3556	19560117
331553104252101	12S.25E.23.11313	3546	810	313SADR	3524	19560103
331357104244701	12S.25E.35.41132	3528	937	313SADR	3524	19560103

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1956

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331243104244401	13S.25E.02.433433	3521	1155	313SADR	3524	19560103
331123104262102	13S.25E.15.31111 A	3546	839	313SADR	3515	19560103
330936104241401	13S.25E.25.311142	3499	990	313SADR	3512	19560103
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3513	19560103
331332104195401	13S.26E.03.112423	3422	1150	313SADR	3478	19560105
331320104230701	13S.26E.06.132133	3486	1345	313SADR	3510	19560103
331135104211001	13S.26E.16.13113	3428	1066	313SADR	3492	19560103
331057104231501	13S.26E.19.111131	3483	1004	313SADR	3506	19560103
331056104224401	13S.26E.19.21113	3472	990	313SADR	3503	19560103
330951104230601	13S.26E.30.132132	3473	998	313SADR	3500	19560103
330905104231501	13S.26E.31.113133	3487	955	313SADR	3501	19560103
330702104402401	14S.23E.08.144344	3844	460	313SADR	3561	19560127
330538104360601	14S.23E.24.211342	3737	365	313SADR	3564	19560127
330455104354201	14S.23E.24.444411	3724	287	313SADR	3560	19560127
325810104364401	15S.23E.35.421234	3658		313SADR	3567	19560130
325817104322701	15S.24E.34.133131	3564	740	313SADR	3532	19560104
325813104312301	15S.24E.35.133343	3554	900	313SADR	3530	19560104
325806104302101	15S.24E.36.31312	3514	925	313SADR	3516	19560104
330028104235501	15S.25E.24.121122	3413	926	313SADR	3414	19560104
330116104174101	15S.26E.13.121142	3361	1381	313SADR	3367	19560104
330118104224701	15S.26E.18.122112	3439	1157	313SADR	3433	19560104
325732104324001	16S.24E.01.121114	3570	796	313SADR	3552	19560104
325621104324301	16S.24E.12.134212	3558	801	313SADR	3553	19560104
325657104274401	16S.25E.02.111121	3464	860	313SADR	3482	19560104
325729104295001	16S.25E.04.11113	3501	893	313SADR	3509	19560104
325640104301901	16S.25E.05.43334	3511	1156	313SADR	3511	19560104
325638104315401	16S.25E.07.111113	3540	870	313SADR	3545	19560104
325633104274601	16S.25E.11.11133	3454	800	313SADR	3400	19560100
325633104274601	16S.25E.11.11133	3454	800	313SADR	3399	19560104
325638104244601	16S.26E.06.444344	3387	979	313SADR	3360	19560104
325410104203401	16S.26E.23.442422	3320	1205	313SADR	3341	19560105

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1956

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325400104244701	16S.26E.30.222112	3397	1000	313SADR	3357	19560104
325239104213501	16S.26E.35.31131	3332	1238	313SADR	3340	19560105
325034104231501	17S.26E.09.344411	3364	1157	313SADR	3343	19560104
324831104244401	17S.26E.29.13113	3407	201	313SADR	3331	19560131
324729104254701	17S.26E.31.133333	3438	219	313SADR	3331	19560120
324739104244401	17S.26E.32.13113	3405	861	313SADR	3336	19560104
324744104225501	17S.26E.33.223311	3348	1100	313SADR	3341	19560104
324622104430401	18S.23E.05.33321	4008	575	313SADR	3579	19560121
324543104272401	18S.25E.11.32233	3480		313SADR	3347	19560119
324509104264501	18S.25E.13.13113	3466		313SADR	3344	19560119
324431104274601	18S.25E.23.111134	3502	300	313SADR	3352	19560119
324325104271201	18S.25E.26.231434	3479	200	313SADR	3327	19560131
324658104213501	18S.26E.02.11133	3315	1108	313SADR	3331	19560104
324612104213301	18S.26E.02.33333	3321	202	313SADR	3297	19560131
324654104233701	18S.26E.04.11110	3374	148	313SADR	3321	19560125
324614104244101	18S.26E.05.333312	3402	1056	313SADR	3344	19560104
324421104225301	18S.26E.21.2233113	3358	1099	313SADR	3341	19560104
324108104222401	19S.26E.03.33442	3348	1192	313SADR	3328	19560118

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1975

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334846104411901	06S.22E.02.342214	4093	500	313SADR	3621	19750107
334852104325001	06S.24E.06.32313	3994	500	313SADR	3525	19750107
334341104340301	07S.23E.12.12223	3947	459	313SADR	3526	19750107
334138104343801	07S.23E.23.24431	3811	436	313SADR	3527	19750107
334141104323601	07S.24E.19.14424	3765	408	313SADR	3526	19750117
333954104322601	07S.24E.31.13333 E CORN	3743	275	313SADR	3528	19750117
333755104334401	08S.23E.12.42323	3743	582	313SADR	3529	19750117
333735104373201	08S.23E.16.11100	4049	585	313SADR	3528	19750107
333918104303501	08S.24E.04.12424	3642	441	313SADR	3526	19750117
333650104310401	08S.24E.16.33333 PVACD	3630	440	313SADR	3526	19750117
333504104293201	08S.24E.27.433431 C PATT	3637	490	313SADR	3528	19750117
333449104255601	08S.25E.31.13142 D HATCH	3611	480	313SADR	3524	19750117
333131104362601	09S.23E.15.33441	3810	386	313SADR	3525	19750108
333344104315901	09S.24E.05.31122	3661	364	313SADR	3526	19750117
333208104291201	09S.24E.15.24141	3590	365	313SADR	3522	19750122
333059104313501	09S.24E.20.32422	3633	370	313SADR	3524	19750117
332947104290101	09S.24E.27.44443 McLEAN	3566	480	313SADR	3522	19750117
332934104302101	09S.24E.33.21443	3584	510	313SADR	3525	19750117
332519104472401	10S.21E.25.11233	4092	703	313SADR	3531	19750108
332808104334801	10S.23E.01.432242	3677	175	313SADR	3526	19750116
332729104370701	10S.23E.09.411123	3787	550	313SADR	3526	19750116
332527104385101	10S.23E.19.44144	3831	943	313SADR	3526	19750106
332459104355301	10S.23E.27.234223	3723	425	313SADR	3528	19750116
332413104371101	10S.23E.33.142223	3765	528	313SADR	3527	19750108
332820104305301	10S.24E.04.323212	3611	320	313SADR	3526	19750116
332542104324201	10S.24E.19.413122	3624	275	313SADR	3525	19750116
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3524	19750116
332448104291701	10S.24E.27.424113	3562	375	313SADR	3518	19750118
332542104232301	10S.25E.22.32412	3477	650	313SADR	3520	19750118
332306104403901	11S.22E.01.312323	3836	345	313SADR	3529	19750106

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1967

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334435104384101	06S.23E.32.33333	3945	413	313SADR	3536	19670120
334439104320401	06S.24E.31.43343 EL PASO	4042	640	313SADR	3532	19670120
334138104343801	07S.23E.23.24431	3811	436	313SADR	3534	19670127
333954104322601	07S.24E.31.13333 E CORN	3743	275	313SADR	3530	19670127
334144104193901	07S.26E.19.243222	3576	565	313SADR	3552	19670118
333900104340501	08S.23E.01.322121	3701	604	313SADR	3526	19670127
333925104315601	08S.24E.05.112144	3644	494	313SADR	3532	19670127
333908104314401	08S.24E.05.14144	3640	402	313SADR	3530	19670127
333842104314001	08S.24E.05.342344	3642		313SADR	3533	19670127
333650104310401	08S.24E.16.33333 PVACD	3630	440	313SADR	3530	19670126
333726104323701	08S.24E.18.23113	3691	461	313SADR	3526	19670126
333716104323401	08S.24E.18.23330	3694	444	313SADR	3532	19670126
333611104320201	08S.24E.20.313431	3662	220	313SADR	3531	19670126
333609104310601	08S.24E.20.44223 C CORN	3648	478	313SADR	3530	19670126
333636104294701	08S.24E.22.142113 J CORN	3599	275	313SADR	3546	19670126
333504104293201	08S.24E.27.433431 C PATT	3637	490	313SADR	3532	19670126
333544104304901	08S.24E.28.123331	3609	455	313SADR	3532	19670126
333556104300801	08S.24E.28.22212	3603	461	313SADR	3533	19670126
333517104303401	08S.24E.28.413321 D PATT	3651	416	313SADR	3535	19670126
333424104303401	08S.24E.33.431121 SPURRI	3645		313SADR	3529	19670125
333427104285401	08S.24E.35.31342	3617	501	313SADR	3527	19670119
333449104255601	08S.25E.31.13142 D HATCH	3611	480	313SADR	3529	19670125
332958104340701	09S.23E.25.32441	3679	725	313SADR	3530	19670125
332903104343501	09S.23E.35.42422 E SONS	3695	826	313SADR	3532	19670125
333405104314601	09S.24E.05.12143	3665	340	313SADR	3533	19670125
333344104315901	09S.24E.05.31122	3661	364	313SADR	3531	19670126
333322104312201	09S.24E.05.434232	3623	500	313SADR	3526	19670125
333226104315601	09S.24E.08.334341	3692	200	313SADR	3528	19670125
333149104290001	09S.24E.14.313133	3586	415	313SADR	3525	19670119
333208104291201	09S.24E.15.24141	3590	365	313SADR	3525	19670119

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1967

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
333059104313501	09S.24E.20.32422	3633	370	313SADR	3528	19670120
332947104290101	09S.24E.27.44443 McLEAN	3566	480	313SADR	3525	19670119
333028104311901	09S.24E.29.223313	3617		313SADR	3537	19670126
332934104302101	09S.24E.33.21443	3584	510	313SADR	3530	19670119
333227104254701	09S.25E.07.44442	3680	556	313SADR	3523	19670119
332808104334801	10S.23E.01.432242	3677	175	313SADR	3526	19670126
332729104370701	10S.23E.09.411123	3787	550	313SADR	3524	19670126
332613104355501	10S.23E.15.434431	3697	250	313SADR	3526	19670126
332413104371101	10S.23E.33.142223	3765	528	313SADR	3519	19670126
332820104305301	10S.24E.04.323212	3611	320	313SADR	3530	19670126
332542104324201	10S.24E.19.413122	3624	275	313SADR	3528	19670112
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3527	19670100
332446104313401	10S.24E.29.423333	3605	340	313SADR	3527	19670127
332255104434701	11S.22E.04.33124	3944	483	313SADR	3532	19670115
331853104361301	11S.23E.34.14323	3750	500	313SADR	3517	19670127
332220104273301	11S.24E.12.233311	3548	498	313SADR	3525	19670125
332013104294901	11S.24E.22.34444	3600	413	313SADR	3527	19670127
331915104283301	11S.24E.26.433323	3591	650	313SADR	3522	19670127
331952104321401	11S.24E.30.242211	3650	400	313SADR	3521	19670113
332218104245302	11S.25E.08.42222 A	3483	796	313SADR	3515	19670127
332106104265201	11S.25E.18.331344	3545	520	313SADR	3523	19670113
331826104255001	11S.25E.32.33312	3553	817	313SADR	3520	19670127
331907104233601	11S.25E.34.11200	3505	998	313SADR	3519	19670127
331702104402401	12S.22E.12.14444	3874	415	313SADR	3518	19670131
331515104405601	12S.22E.23.422243	3890	406	313SADR	3526	19670131
331811104390001	12S.23E.06.214342	3831	655	313SADR	3530	19670127
331756104282801	12S.25E.05.11111	3591	500	313SADR	3522	19670115
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3505	19670100
331400104262001	12S.25E.34.311124	3547	920	313SADR	3508	19670126
331406104220701	12S.26E.32.13324	3471	1001	313SADR	3495	19670127
331425104205301	12S.26E.33.121322	3417	1145	313SADR	3471	19670127

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1967

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331243104244401	13S.25E.02.433433	3521	1155	313SADR	3506	19670127
331123104262102	13S.25E.15.31111 A	3546	839	313SADR	3513	19670127
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3494	19670100
330936104263401	13S.25E.28.42114	3533	853	313SADR	3502	19670127
331151104182701	13S.26E.14.21122	3402	1290	313SADR	3468	19670127
331053104224301	13S.26E.19.211332	3471	1028	313SADR	3478	19670127
330951104230601	13S.26E.30.132132	3473	998	313SADR	3481	19670127
330702104402401	14S.23E.08.144344	3844	460	313SADR	3531	19670127
330455104354201	14S.23E.24.444411	3724	287	313SADR	3549	19670127
330624104251101	14S.25E.14.113442	3521	951	313SADR	3465	19670126
330518104213901	14S.26E.20.411132	3481	1020	313SADR	3408	19670130
325957104375501	15S.23E.22.23430	3766	440	313SADR	3536	19670126
325817104322701	15S.24E.34.133131	3564	740	313SADR	3511	19670130
330256104204501	15S.26E.04.123221	3443	1220	313SADR	3392	19670127
325344104393602	16S.23E.26.233111A	3776	284	313SADR	3536	19670127
325732104324001	16S.24E.01.121114	3570	796	313SADR	3532	19670130
325552104332801	16S.24E.11.34442	3575	850	313SADR	3532	19670128
325621104324301	16S.24E.12.134212	3558	801	313SADR	3531	19670130
325729104295001	16S.25E.04.11113	3501	893	313SADR	3504	19670128
325638104315401	16S.25E.07.111113	3540	870	313SADR	3528	19670128
325529104233901	16S.26E.16.13113	3360	1094	313SADR	3314	19670128
325410104203401	16S.26E.23.442422	3320	1205	313SADR	3293	19670131
325239104213501	16S.26E.35.31131	3332	1238	313SADR	3298	19670131
324939104554901	17S.20E.18.434441	4512	801	313SADR	4051	19670100
324831104244401	17S.26E.29.13113	3407	201	313SADR	3290	19670129
324729104254701	17S.26E.31.133333	3438	219	313SADR	3286	19670129
324744104225501	17S.26E.33.223311	3348	1100	313SADR	3277	19670129
324622104430401	18S.23E.05.33321	4008	575	313SADR	3541	19670127
324327104425201	18S.23E.29.14311	4012	580	313SADR	3534	19670127
324612104213301	18S.26E.02.33333	3321	202	313SADR	3284	19670129
324620104255001	18S.26E.06.442221A ARTES	3402	1008	313SADR	3293	19670100

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1967

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
323818104405701	19S.23E.27.111144	3951	430	313SADR	3559	19670127

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1975

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332255104434701	11S.22E.04.33124	3944	483	313SADR	3527	19750108
332151104452201	11S.22E.18.21123	4066	560	313SADR	3531	19750109
332057104424501	11S.22E.22.111424	3943	416	313SADR	3528	19750109
332255104360401	11S.23E.03.342223	3725	478	313SADR	3527	19750106
332135104334501	11S.23E.13.23224	3646	355	313SADR	3522	19750117
332150104353201	11S.23E.15.22223	3675	649	313SADR	3528	19750109
332007104361801	11S.23E.22.33444	3725	346	313SADR	3524	19750109
332311104300701	11S.24E.03.13333	3581	380	313SADR	3523	19750113
332257104322701	11S.24E.06.33111	3617	173	313SADR	3523	19750109
332220104273301	11S.24E.12.233311	3548	498	313SADR	3522	19750106
332013104294901	11S.24E.22.34444	3600	413	313SADR	3523	19750113
331952104321401	11S.24E.30.242211	3650	400	313SADR	3519	19750119
332106104265201	11S.25E.18.331344	3545	520	313SADR	3522	19750113
332007104260901	11S.25E.19.43444	3536	820	313SADR	3523	19750113
331907104233601	11S.25E.34.11200	3505	998	313SADR	3516	19750113
331746104340601	12S.23E.01.324414	3708	334	313SADR	3519	19750109
331743104385101	12S.23E.06.44121	3820	640	313SADR	3531	19750109
331531104380601	12S.23E.20.23114	3825	471	313SADR	3526	19750109
331527104340001	12S.23E.24.23130	3715	515	313SADR	3522	19750110
331324104352901	12S.23E.35.31344	3760	305	313SADR	3527	19750109
331520104305201	12S.24E.22.44220	3668	585	313SADR	3522	19750110
331756104255101	12S.25E.03.211112	3552	845	313SADR	3520	19750114
331756104282801	12S.25E.05.11111	3591	500	313SADR	3521	19750114
331729104271101	12S.25E.09.321143	3575	900	313SADR	3521	19750113
331650104234201	12S.25E.12.433232	3512	895	313SADR	3518	19750114
331649104262301	12S.25E.15.111113	3563	866	313SADR	3522	19750113
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3513	19750114
331400104262001	12S.25E.34.311124	3547	920	313SADR	3518	19750114
331237104380901	13S.23E.03.41342	3843	350	313SADR	3526	19750109
331038104360201	13S.23E.24.21431	3765	330	313SADR	3528	19750109
330821104405501	13S.23E.31.444414	3917	440	313SADR	3532	19750110

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1975

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330912104351201	13S.24E.31.12221	3766	250	313SADR	3529	19750110
331243104244401	13S.25E.02.433433	3521	1155	313SADR	3512	19750114
331123104262102	13S.25E.15.31111 A	3546	839	313SADR	3506	19750114
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3503	19750114
330936104263401	13S.25E.28.42114	3533	853	313SADR	3506	19750124
331309104193901	13S.26E.03.322212	3431	1176	313SADR	3485	19750115
331135104211001	13S.26E.16.13113	3428	1066	313SADR	3486	19750115
330951104230601	13S.26E.30.132132	3473	998	313SADR	3496	19750116
330847104214901	13S.26E.32.32211	3453	1075	313SADR	3484	19750116
330702104402401	14S.23E.08.144344	3844	460	313SADR	3527	19750110
330509104360901	14S.23E.24.413133	3737	397	313SADR	3530	19750110
330624104251101	14S.25E.14.113442	3521	951	313SADR	3475	19750116
330518104213901	14S.26E.20.411132	3481	1020	313SADR	3413	19750121
330404104221201	14S.26E.30.44444	3484	1150	313SADR	3406	19750117
330213104452801	15S.22E.04.344443	4020	520	313SADR	3534	19750110
330300104405101	15S.23E.06.22222	3955	450	313SADR	3531	19750113
325959104411001	15S.23E.19.144424	3861	370	313SADR	3534	19750115
325957104375501	15S.23E.22.23430	3766	440	313SADR	3533	19750121
325815104375701	15S.23E.34.234311	3696	425	313SADR	3536	19750115
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3522	19750117
330031104235701	15S.25E.13.34331	3418	1040	313SADR	3407	19750116
325834104244101	15S.25E.35.213142	3406	924	313SADR	3335	19750117
330256104204501	15S.26E.04.123221	3443	1220	313SADR	3398	19750117
330100104200001	15S.26E.15.13143	3381	1290	313SADR	3393	19750117
325431104423901	16S.23E.20.23334	3952	442	313SADR	3540	19750115
325344104393602	16S.23E.26.233111A	3776	284	313SADR	3531	19750115
325702104352801	16S.24E.04.411341	3624	610	313SADR	3531	19750115
325552104332801	16S.24E.11.34442	3575	850	313SADR	3530	19750120
325621104324301	16S.24E.12.134212	3558	801	313SADR	3528	19750120
325638104315401	16S.25E.07.111113	3540	870	313SADR	3520	19750120
325638104244601	16S.26E.06.444344	3387	979	313SADR	3325	19750121

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1975

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
325549104213001	16S.26E.11.333232	3331	1194	313SADR	3319	19750117
325529104233901	16S.26E.16.13113	3360	1094	313SADR	3327	19750117
325410104203401	16S.26E.23.442422	3320	1205	313SADR	3311	19750117
325248104254201	16S.26E.31.133113	3441	950	313SADR	3318	19750115
325248104254201	16S.26E.31.133113	3441	950	313SADR	3316	19750117
325239104213501	16S.26E.35.31131	3332	1238	313SADR	3311	19750117
324838104435301	17S.23E.30.12344	4085	600	313SADR	3536	19750113
325214104244201	17S.26E.05.111141	3398	1261	313SADR	3314	19750115
324814104234201	17S.26E.28.31311	3383	300	313SADR	3297	19750113
324831104244401	17S.26E.29.13113	3407	201	313SADR	3289	19750113
324729104254701	17S.26E.31.133333	3438	219	313SADR	3284	19750113
324744104225501	17S.26E.33.223311	3348	1100	313SADR	3292	19750123
324732104213101	17S.26E.35.13324	3310	167	313SADR	3297	19750114
324622104430401	18S.23E.05.33321	4008	575	313SADR	3536	19750113
324327104425201	18S.23E.29.14311	4012	580	313SADR	3532	19750128
324612104213301	18S.26E.02.33333	3321	202	313SADR	3287	19750114
324620104255001	18S.26E.06.442221A ARTES	3402	1008	313SADR	3308	19750113

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
334341104340302	07S.23E.12.12223 A	3948	460	313SADR	3503	19840117
334138104343801	07S.23E.23.24431	3811	436	313SADR	3528	19840117
334141104323601	07S.24E.19.14424	3765	408	313SADR	3527	19840117
333755104334401	08S.23E.12.42323	3743	582	313SADR	3530	19840125
333918104303501	08S.24E.04.12424	3642	441	313SADR	3528	19840126
333908104314401	08S.24E.05.14144	3640	402	313SADR	3530	19840126
333650104310401	08S.24E.16.33333 PVACD	3630	440	313SADR	3527	19840105
333650104310401	08S.24E.16.33333 PVACD	3630	440	313SADR	3527	19840116
333650104310401	08S.24E.16.33333 PVACD	3630	440	313SADR	3527	19840125
333716104323401	08S.24E.18.23330	3694	444	313SADR	3526	19840125
333611104320201	08S.24E.20.313431	3662	220	313SADR	3526	19840125
333636104293301	08S.24E.22.14222	3594	286	313SADR	3524	19840130
333636104291801	08S.24E.22.232423 J CORN	3590	315	313SADR	3529	19840130
333504104293201	08S.24E.27.433431 C PATT	3637	490	313SADR	3529	19840127
333544104304901	08S.24E.28.123331	3609	455	313SADR	3529	19840125
333458104321001	08S.24E.31.22243	3631	308	313SADR	3528	19840126
333417104310401	08S.24E.33.333112	3645	340	313SADR	3540	19840125
333449104255601	08S.25E.31.13142 D HATCH	3611	480	313SADR	3526	19840127
333344104315901	09S.24E.05.31122	3661	364	313SADR	3528	19840126
333149104293101	09S.24E.15.41313	3589	425	313SADR	3523	19840127
333059104313501	09S.24E.20.32422	3633	370	313SADR	3526	19840117
333059104313501	09S.24E.20.32422	3633	370	313SADR	3527	19840126
333031104310301	09S.24E.28.113132	3612	352	313SADR	3525	19840105
333031104310301	09S.24E.28.113132	3612	352	313SADR	3526	19840116
333031104310301	09S.24E.28.113132	3612	352	313SADR	3526	19840125
332729104370701	10S.23E.09.411123	3787	550	313SADR	3528	19840119
332651104363501	10S.23E.15.13112	3726	700	313SADR	3527	19840119
332613104355501	10S.23E.15.434431	3697	250	313SADR	3525	19840119
332413104371101	10S.23E.33.142223	3765	528	313SADR	3529	19840119
332800104321401	10S.24E.08.11111 STOCKTO	3623	368	313SADR	3527	19840127

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
332651104305701	10S.24E.16.141311	3586	200	313SADR	3527	19840125
332542104324201	10S.24E.19.413122	3624	275	313SADR	3527	19840126
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3525	19840100
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3525	19840105
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3525	19840116
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3525	19840120
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3525	19840125
332615104303601	10S.24E.21.212222 BERREN	3581	329	313SADR	3526	19840126
332546104285501	10S.24E.23.31224	3541	350	313SADR	3519	19840127
332522104292602	10S.24E.27.21212A ISLERA	3568	345	313SADR	3521	19840125
332510104302701	10S.24E.28.223313 L H BA	3584	312	313SADR	3528	19840126
332542104232301	10S.25E.22.32412	3477	650	313SADR	3519	19840130
332306104403901	11S.22E.01.312323	3836	345	313SADR	3531	19840119
332255104434701	11S.22E.04.33124	3944	483	313SADR	3529	19840110
331919104404901	11S.22E.25.331142	3895	410	313SADR	3529	19840119
332244104335501	11S.23E.01.433433	3631	169	313SADR	3527	19840119
332150104353201	11S.23E.15.22223	3675	649	313SADR	3531	19840131
332007104361801	11S.23E.22.33444	3725	346	313SADR	3525	19840131
332007104353201	11S.23E.22.44444	3703	233	313SADR	3527	19840131
332257104322701	11S.24E.06.33111	3617	173	313SADR	3525	19840131
332220104273301	11S.24E.12.233311	3548	498	313SADR	3523	19840105
332220104273301	11S.24E.12.233311	3548	498	313SADR	3523	19840116
332220104273301	11S.24E.12.233311	3548	498	313SADR	3524	19840125
332006104330701	11S.24E.19.333434	3669	263	313SADR	3527	19840131
332029104285001	11S.24E.23.32113	3580	392	313SADR	3522	19840130
332006104281501	11S.24E.23.443434	3575	535	313SADR	3523	19840130
332106104265201	11S.25E.18.331344	3545	520	313SADR	3522	19840127
331826104255001	11S.25E.32.33312	3553	817	313SADR	3519	19840125
331746104340601	12S.23E.01.324414	3708	334	313SADR	3521	19840130
331527104340001	12S.23E.24.23130	3715	515	313SADR	3525	19840130
331645104305201	12S.24E.10.44444	3653	360	313SADR	3529	19840130

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3510	19840100
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3511	19840105
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3512	19840116
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3512	19840120
331525104245201	12S.25E.23.344412 ORCHAR	3540	930	313SADR	3512	19840125
331425104205601	12S.26E.33.121311	3416	1057	313SADR	3415	19840131
331243104244401	13S.25E.02.433433	3521	1155	313SADR	3507	19840131
331223104241701	13S.25E.12.13133	3509	916	313SADR	3508	19840131
331121104255001	13S.25E.15.411133	3535	870	313SADR	3500	19840131
331011104241301	13S.25E.24.33321	3503	966	313SADR	3500	19840130
330936104241401	13S.25E.25.311142	3499	990	313SADR	3501	19840130
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3502	19840105
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3503	19840116
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3502	19840120
331002104254701	13S.25E.27.211144 GREENF	3524	923	313SADR	3503	19840125
331135104211001	13S.26E.16.13113	3428	1066	313SADR	3482	19840131
330954104224401	13S.26E.30.21333	3467	1005	313SADR	3493	19840127
330854104231201	13S.26E.31.13312	3487	979	313SADR	3486	19840127
330702104402401	14S.23E.08.144344	3844	460	313SADR	3530	19840120
330624104251101	14S.25E.14.113442	3521	951	313SADR	3469	19840127
330404104221201	14S.26E.30.44444	3484	1150	313SADR	3398	19840126
330213104452801	15S.22E.04.344443	4020	520	313SADR	3541	19840130
330300104405101	15S.23E.06.22222	3955	450	313SADR	3535	19840130
330017104384801	15S.23E.21.22134	3777		313SADR	3542	19840127
325815104375701	15S.23E.34.234311	3696	425	313SADR	3544	19840130
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3528	19840100
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3529	19840105
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3528	19840116
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3528	19840120
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3528	19840125
325845104295501	15S.24E.25.433331 JACKSO	3529	910	313SADR	3528	19840130

Wells Used To Produce Water Level Map
In Carbonate Aquifer for Jan, 1984

Siteid	Local well number	LSD_feet	Welldepth	AQUIFCODE	WLE	DTWDATE
330031104235701	15S.25E.13.34331	3418	1040	313SADR	3402	19840125
325834104244101	15S.25E.35.213142	3406	924	313SADR	3334	19840125
330256104204501	15S.26E.04.123221	3443	1220	313SADR	3391	19840124
325702104352801	16S.24E.04.411341	3624	610	313SADR	3540	19840127
325552104332801	16S.24E.11.34442	3575	850	313SADR	3538	19840126
325638104315401	16S.25E.07.111113	3540	870	313SADR	3521	19840126
325549104213001	16S.26E.11.333232	3331	1194	313SADR	3318	19840125
325529104233901	16S.26E.16.13113	3360	1094	313SADR	3327	19840125
325248104254201	16S.26E.31.133113	3441	950	313SADR	3319	19840125
324838104435301	17S.23E.30.12344	4085	600	313SADR	3546	19840123
325117104230901	17S.26E.09.213121	3352	1205	313SADR	3310	19840125
325034104231501	17S.26E.09.344411	3364	1157	313SADR	3306	19840131
324814104234201	17S.26E.28.31311	3383	300	313SADR	3284	19840125
324831104244401	17S.26E.29.13113	3407	201	313SADR	3277	19840125
324729104254501	17S.26E.31.133334	3437	230	313SADR	3274	19840125
324732104213101	17S.26E.35.13324	3310	167	313SADR	3289	19840126
325102104151401	17S.27E.11.134232	3401		313SADR	3367	19840131
324943104171201	17S.27E.16.34314	3428	1042	313SADR	3249	19840131
324718104181201	17S.27E.32.323234	3430	198	313SADR	3344	19840131
324327104425201	18S.23E.29.14311	4012	580	313SADR	3537	19840123
324612104213301	18S.26E.02.33333	3321	202	313SADR	3277	19840126
324620104255001	18S.26E.06.442221A ARTES	3402	1008	313SADR	3310	19840125
323755104352701	19S.24E.28.322412	3713	600	313SADR	3374	19840124

Appendix D, Part 3

Hydrographs of Key Wells

List of Wells Selected for Hydrographs
Page 1 of 3

Local Well Number	LSD (ft)	Date Drilled	Well Depth (ft)	Screen Interval (ft)	Aquifcode[a]	Period of Record	Owner	Well Name
20S.26E.07.12210	3315	---	120	---	313ARTS	1937-84	J.B. Moutray	RA-3790, USGS #124
19S.26E.33.41224	3282.0		225		313ARTS	1938-92	V.L. Clark	USGS #129, RA-1664
19S.26E.27.141422	3296	---	127	---	110AVMB	1937-89	Lakewood School	USGS# 130.
19S.23E.27.111144	3951	---	430	---	313SADR	1940-71	C.R. Coffin	---
19S.20E.16.11111	4650	---	1120	---	310GLRT	1957-70	---	EL. RA-3458.
18S.26E.28.122111	3403	---	250	---	110AVMB	1951-90	Dayton Recorder	RA-2786. USGS# 476A.
18S.26E.06.442221A	3402	1/13/60	1008	726-1008	313SADR	1961-92	NMSEO	RA-4250, Artesia Recorder
18S.26E.06.442212B	3402	---	246	192-242	110AVMB	1963-92	Artesia A Recorder	RA-4793, Lanning shallow recd
18S.26E.05.333312	3402	---	1056	---	313SADR	1908-61	W.T. Armstrong	LOG# A-11. NYE# 1263
18S.23E.05.33321	4008	---	575	---	313SADR	1945-79	Ray Loya	RA-5870
17S.20E.18.434441	4512	---	801	---	313SADR	1957-83	PVACD Well No. 7	PVACD #7
16S.26E.35.342424	3311	---	19	---	110AVMB	1967-89	USBR	USBR #1
16S.26E.35.244244	3316	---	19	---	110AVMB	1967-89	USBR	USBR #4
16S.26E.31.133113	3441	12/16/69	950	---	313SADR	1970-89	PVACD ZUMWALT	RA-5547
16S.26E.28.433113A	3359.9		390		313ARTS	1950-89	Robert Horner	USGS #49, RA-1363
16S.25E.11.111131A	3450	---	171	---	110AVMB	1964-92	USGS	RA-4989
16S.25E.06.31313	3558	---	39	---	110AVMB	1935-91	Frank Childress	USGS #12
16S.23E.15.322333	3807	---	1550	---	310YESO	1940-92	D.W. Runyan	---
15S.27E.06.141414	3363	---	15	---	110AVMB	1958-89	---	---

[a] See Appendix A for explanation of aquifer codes
LSD = Land surface datum
--- = Information not available.

List of Wells Selected for Hydrographs

Local Well Number	LSD (ft)	Date Drilled	Well Depth (ft)	Screen Interval (ft)	Aquifcode[a]	Period of Record	Owner	Well Name
15S.27E.06.133332	3368	---	150	---	313ARTS	1967-89	Vern Jenkins	RA-4891
15S.26E.27.211142	3349	---	32	---	110AVMB	1957-84	---	---
15S.25E.35.111113	3415	---	101	---	110AVMB	1938-79	---	USGS #135
15S.24E.25.433331	3529	2/17/67	910	546-910	313SADR	1967-92	Jackson Recorder	RA-5304
14S.26E.12.431331	3396	---	40	---	110AVMB	1940-92	---	RA-1374, USGS #18
14S.25E.20.43440	3584	---	87	---	110AVMB	1940-84	---	---
14S.23E.08.144344	3844	---	460	---	313SADR	1940-92	Jim Grassie	NYE #1728
13S.26E.14.33433	3403.0		327		313ARTS	1938-89		USGS #354, RA-1219
13S.25E.34.314224	3526	---	136	---	110AVMB	1948-89	Kerr	USGS #267A
13S.25E.27.211144	3524	1/13/40	923	655-880	313SADR	1940-89	PVACD	RA-1744, Greenfield Recorder
13S.20E.13.222	4524	---	386	---	310GLRT	1956-80	---	RA-3502
12S.26E.18.221113	3483	---	68	---	110AVMB	1944-89	---	USGS #642
12S.26E.05.424312	3429	---	24	---	110AVMB	1973-89	---	RA-5816 & USBR-2-73
12S.25E.23.344234A	3540	---	231	105-231	110AVMB	1966-89	Orchard Park Recorder Well?	RA-4944, Orchard Park Shallow Rcd
12S.25E.23.344412	3540	5/27/64	930	304-714	313SADR	1964-89	NMSEO & USGS	RA-4945, Orchard Park Recorder
12S.25E.09.42230	3564	---	90	---	110AVMB	1937-92	Cumberland Townsite	USGS #366, RA-366
12S.23E.05.31112	3816	---	647	---	313SADR	1940-70	A.S. Patterson	RA-2887
11S.25E.36.142344	3431	---	16	---	110AVMB	1958-89	NMSEO & USGS	USGS-TR-1
11S.25E.36.242323	3439	---	70	---	110AVMB	1956-89	NMSEO & USGS	SEO-4

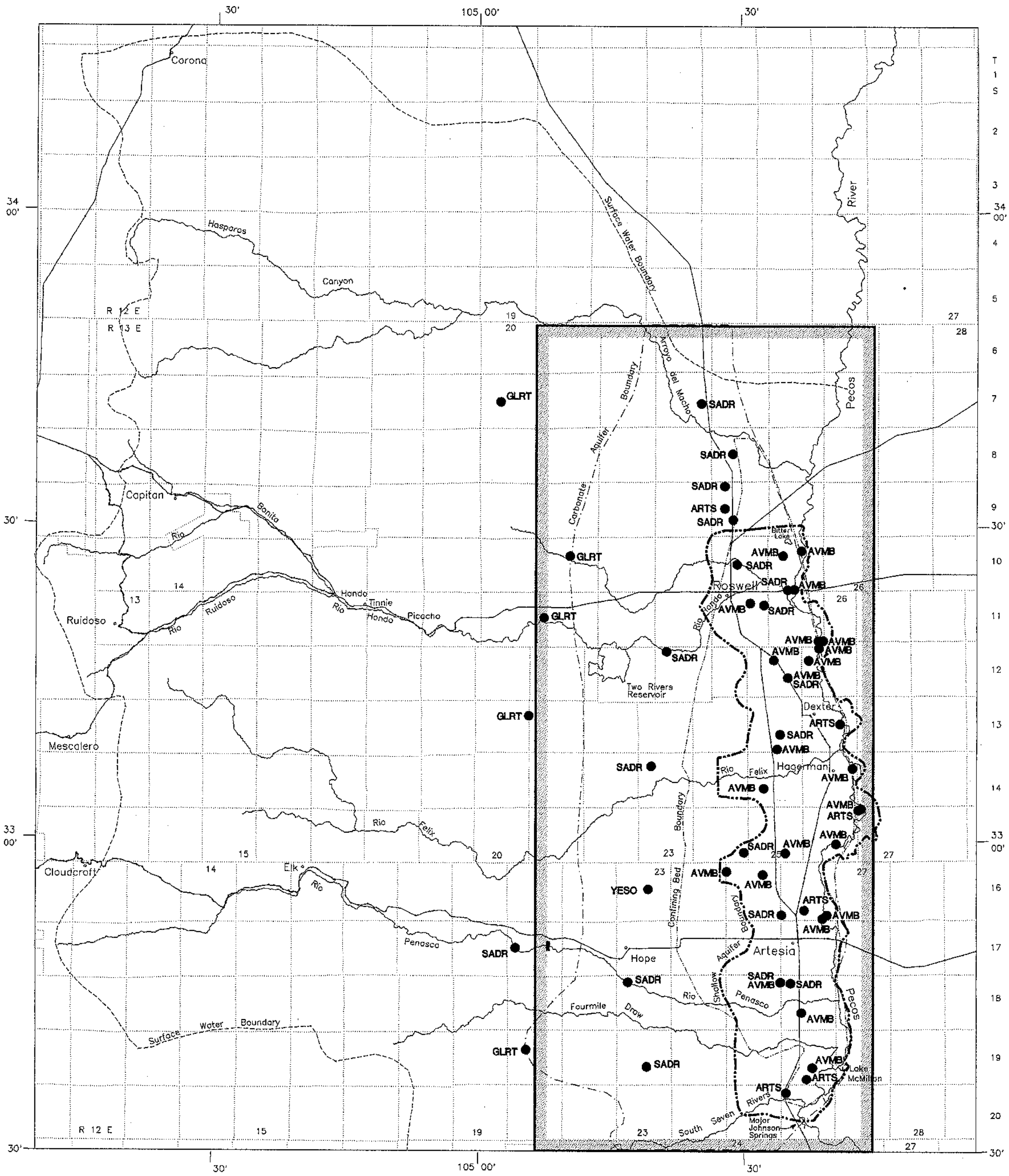
[a] See Appendix A for explanation of aquifer codes
LSD = Land surface datum
--- = Information not available.

List of Wells Selected for Hydrographs

Local Well Number	LSD (ft)	Date Drilled	Well Depth (ft)	Screen Interval (ft)	Aquifcode[a]	Period of Record	Owner	Well Name
11S.21E.18.33312	4273	---	524	---	310GLRT	1957-85	PVACD No 8	RA-3697, PVACD #8
11S.24E.12.233311	3548	---	498	---	313SADR	1955-84	A.S. Patterson	RA-2236, LFD Recorder
11S.24E.10.22434	3567	---	129	---	110AVMB	1937-89	C.E. Smith	USGS #428
10S.25E.33.33113 A	3469	---	30	---	110AVMB	1957-89	PVACD	PVACD #2
10S.25E.33.432422A	3463	---	45	---	110AVMB	1957-89	---	---
10S.25E.17.12242	---	---	68	---	110AVMB	1957-84	NMSEO & USGS	PVACD #3
10S.25E.10.411144	3487	---	19	---	110AVMB	1967-89	USBR	USBR #12
10S.24E.21.212222	3581	5/31/40	329	40-166	313SADR	1940-89	PVACD	RA-1844, Berendo-Smith Recorder
10S.21E.16.22244	4175	---	672	---	310GLRT	1956-83	PVACD No 3	RA-3457, PVACD #3
09S.24E.28.113132	3612	---	352	---	313SADR	1969-85	PVACD	Transwestern Recorder, RA-5540
09S.24E.17.331222	---	---	208	---	313ARTS	1948-67	Oscar White	Toltec #1
09S.24E.05.31122	---	---	364	---	313SADR	1948-89	Jack Doyal	RA-2376
08S.24E.16.33333	3630	---	440	---	313SADR	1957-84	PVACD No 10	RA-3745
07S.23E.23.24431	---	---	436	426-436	313SADR	1951-92	Jess Corn	RA-2460
07S.20E.16.333	4694	---	750	---	310GLRT	1955-80	---	RA-3455

[a] See Appendix A for explanation of aquifer codes
LSD = Land surface datum
--- = Information not available.

Z\2200\220095C.DWG



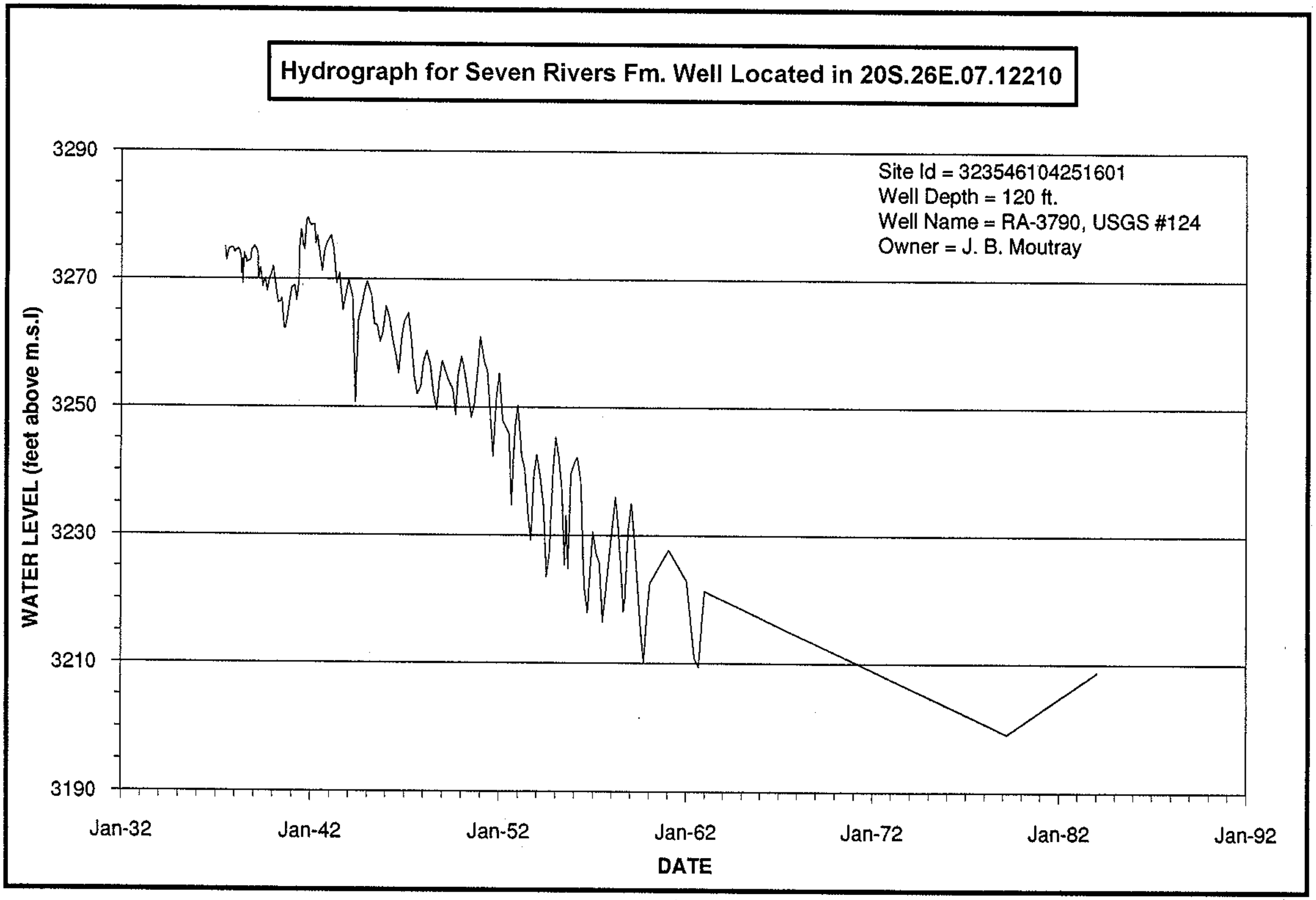
Explanation

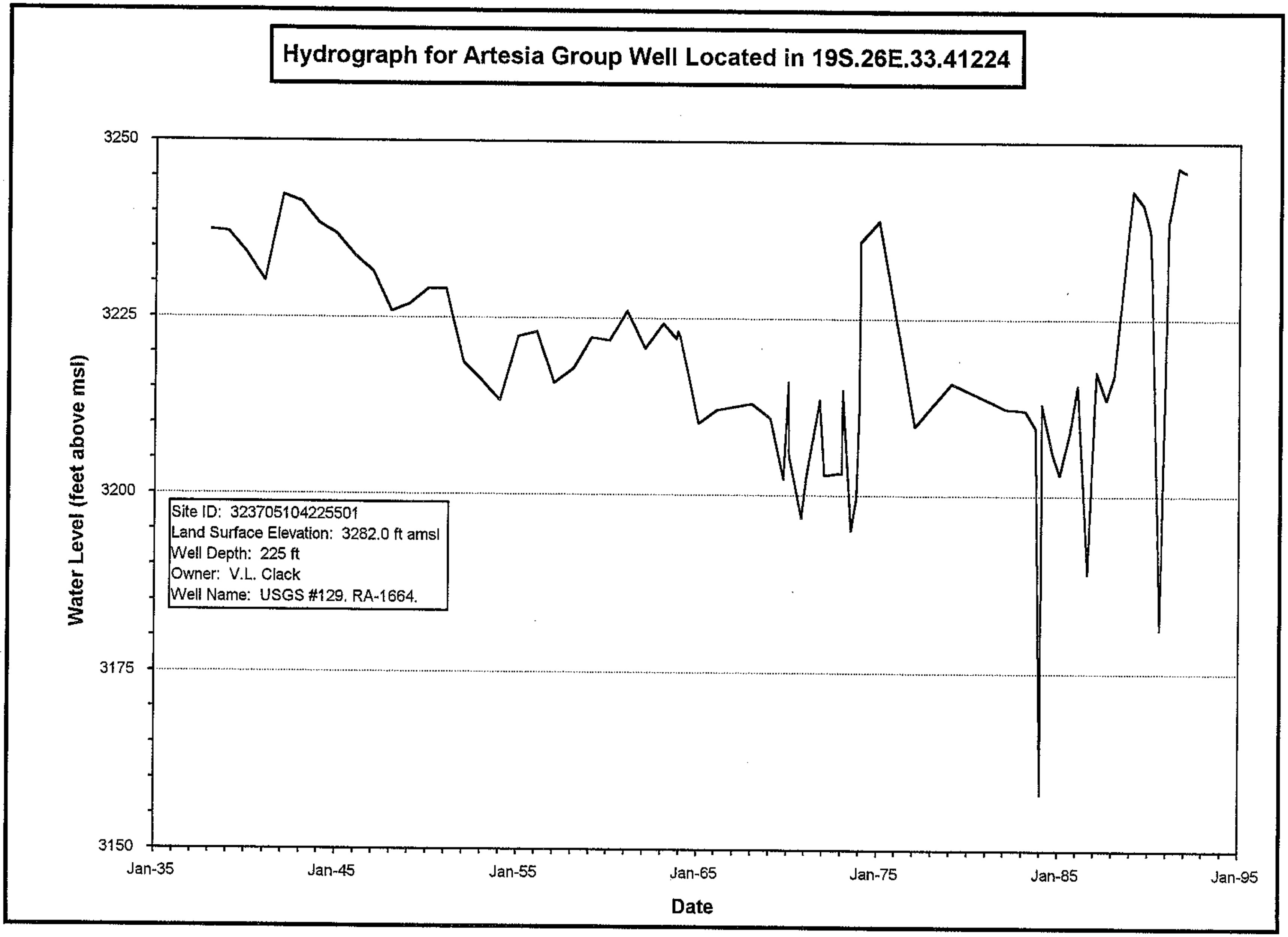
- Well
- Model Area
- Confining Bed Boundary (Welder, 1983)
- Shallow Aquifer Boundary (Welder, 1983)
- Carbonate Aquifer Boundary (Welder, 1983)
- Surface Water Boundary (Kinney, 1968)

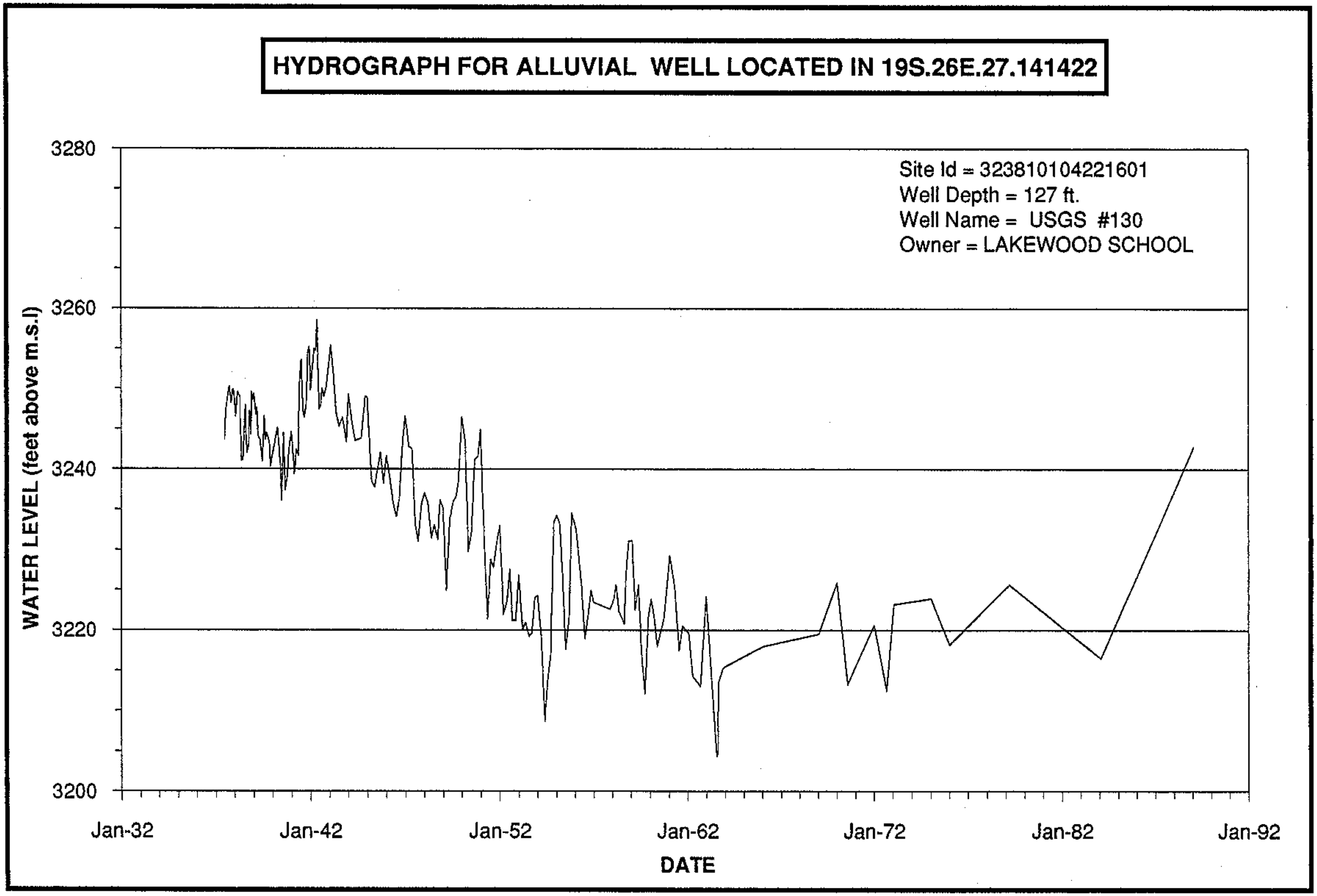
AVMB = Alluvium
ARTS = Artesia Group
SADR = San Andres Formation
GLRT = Glorieta Sandstone
YESO = Yeso Formation

ROSWELL BASIN
Location of Wells with Hydrographs

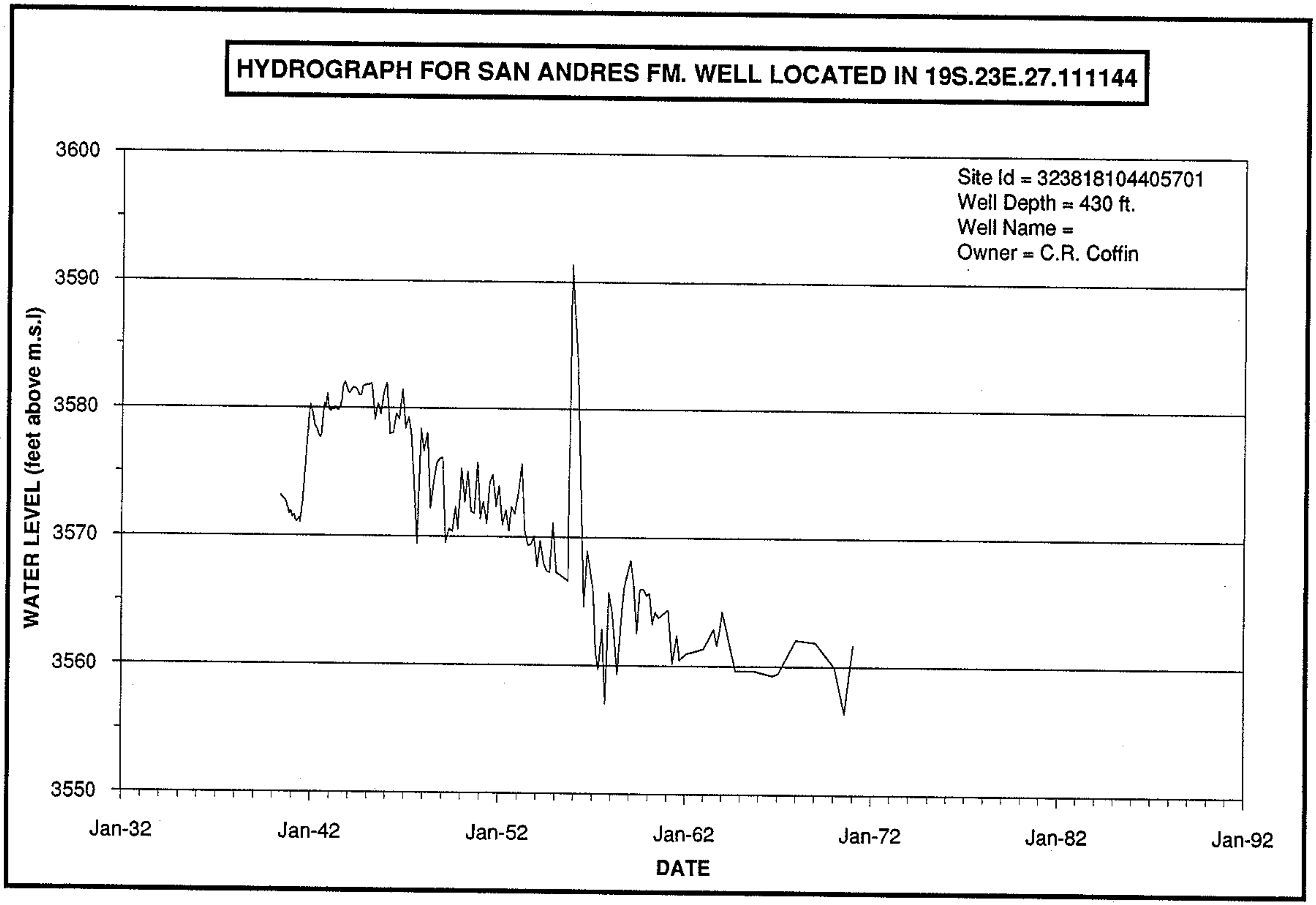
DANIEL B. STEPHENS & ASSOCIATES, INC.
11-9-95
JN 2200


Hydrograph for Seven Rivers Fm. Well Located in 20S.26E.07.12210
Site Id = 323546104251601
Well Depth = 120 ft.
Well Name = RA-3790, USGS #124
Owner = J. B. Moutray
WATER LEVEL (feet above m.s.l)
3290
3270
3250
3230
3210
3190
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

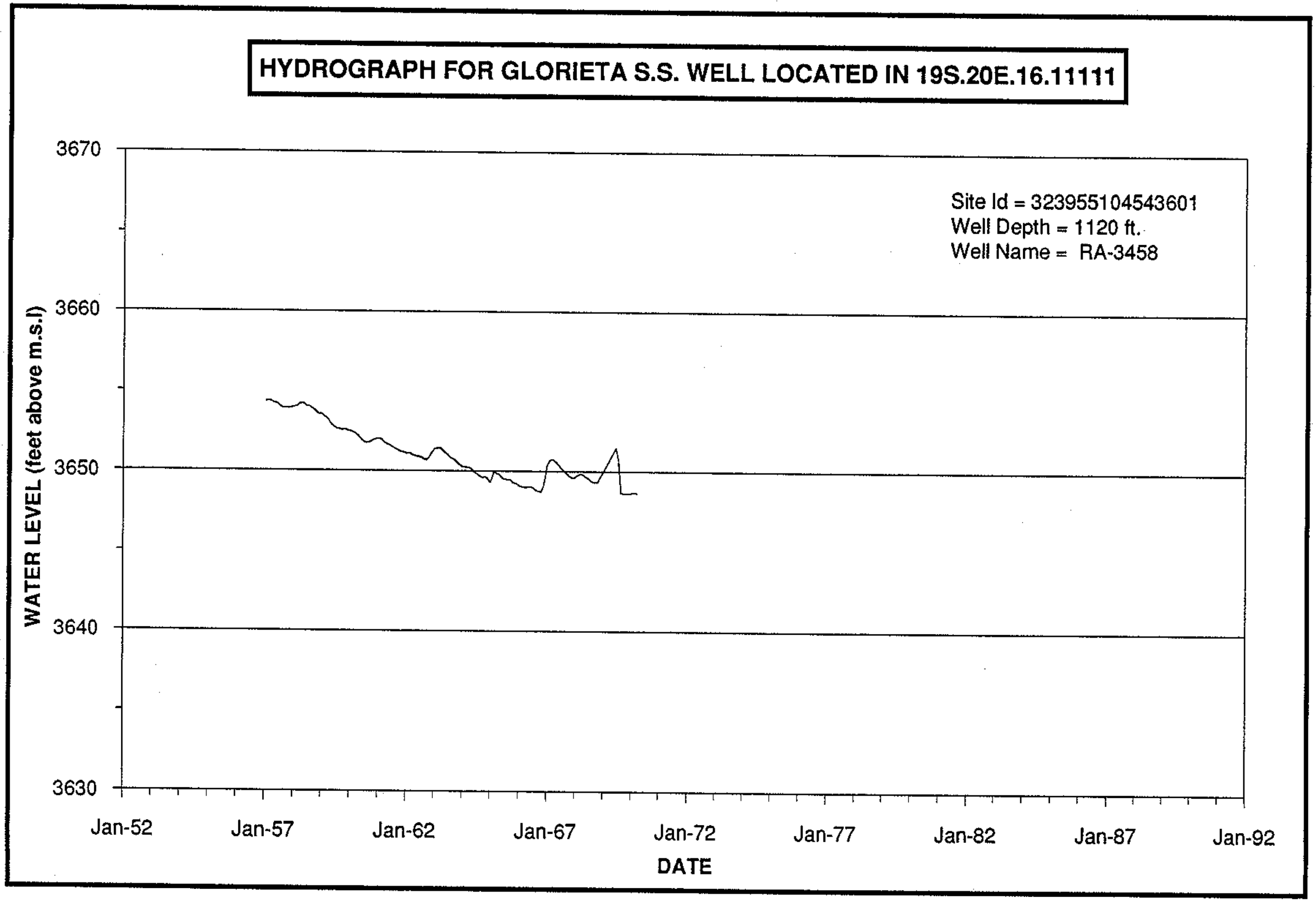

Hydrograph for Artesia Group Well Located in 19S.26E.33.41224
Water Level (feet above msl)
3250
3225
3200
3175
3150
Jan-35
Jan-45
Jan-55
Jan-65
Jan-75
Jan-85
Jan-95
Date
Site ID: 323705104225501
Land Surface Elevation: 3282.0 ft amsl
Well Depth: 225 ft
Owner: V.L. Clack
Well Name: USGS #129, RA-1664.

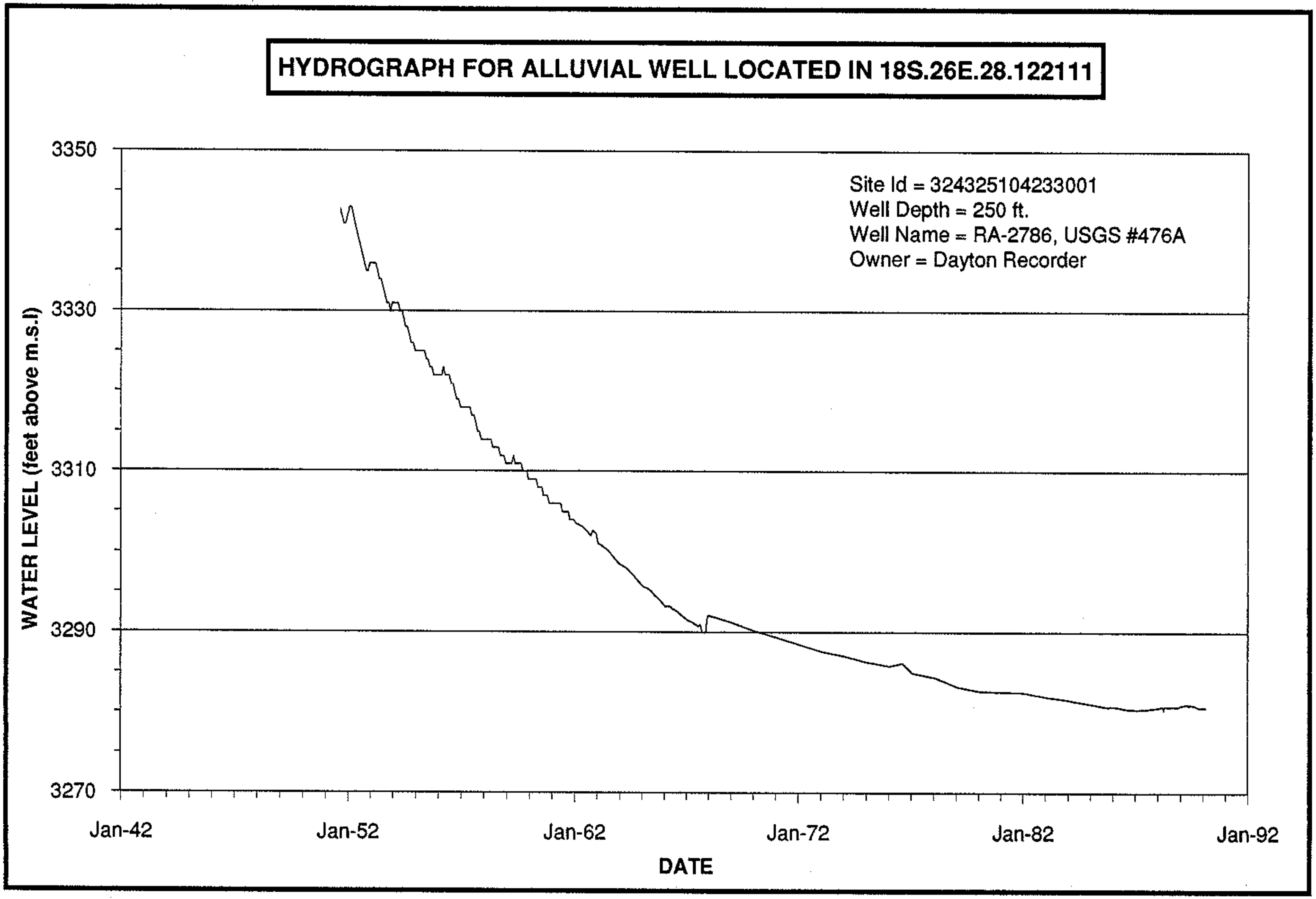


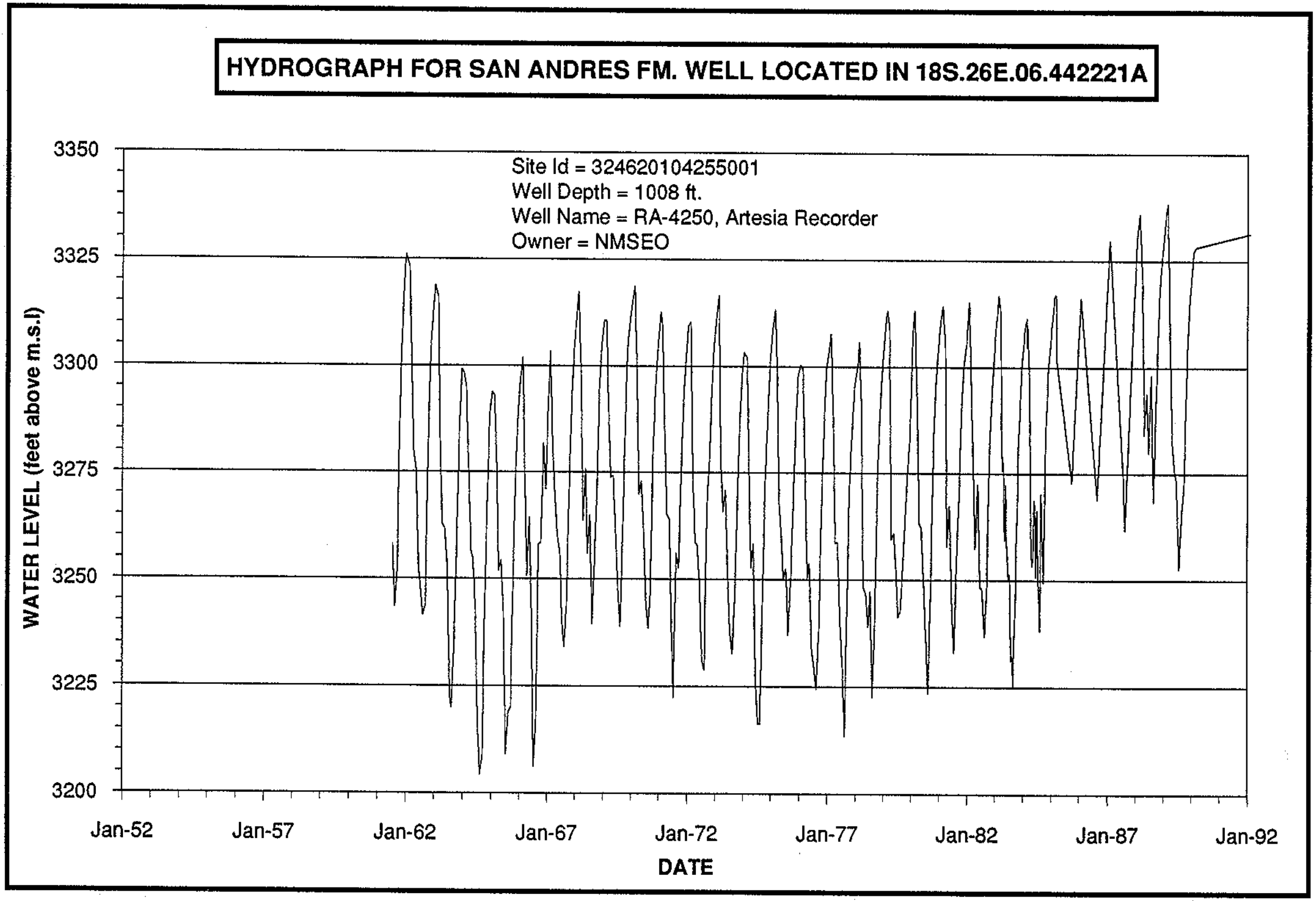
HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 19S.26E.27.141422
Site Id = 323810104221601
Well Depth = 127 ft.
Well Name = USGS #130
Owner = LAKEWOOD SCHOOL
WATER LEVEL (feet above m.s.l)
3280
3260
3240
3220
3200
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE



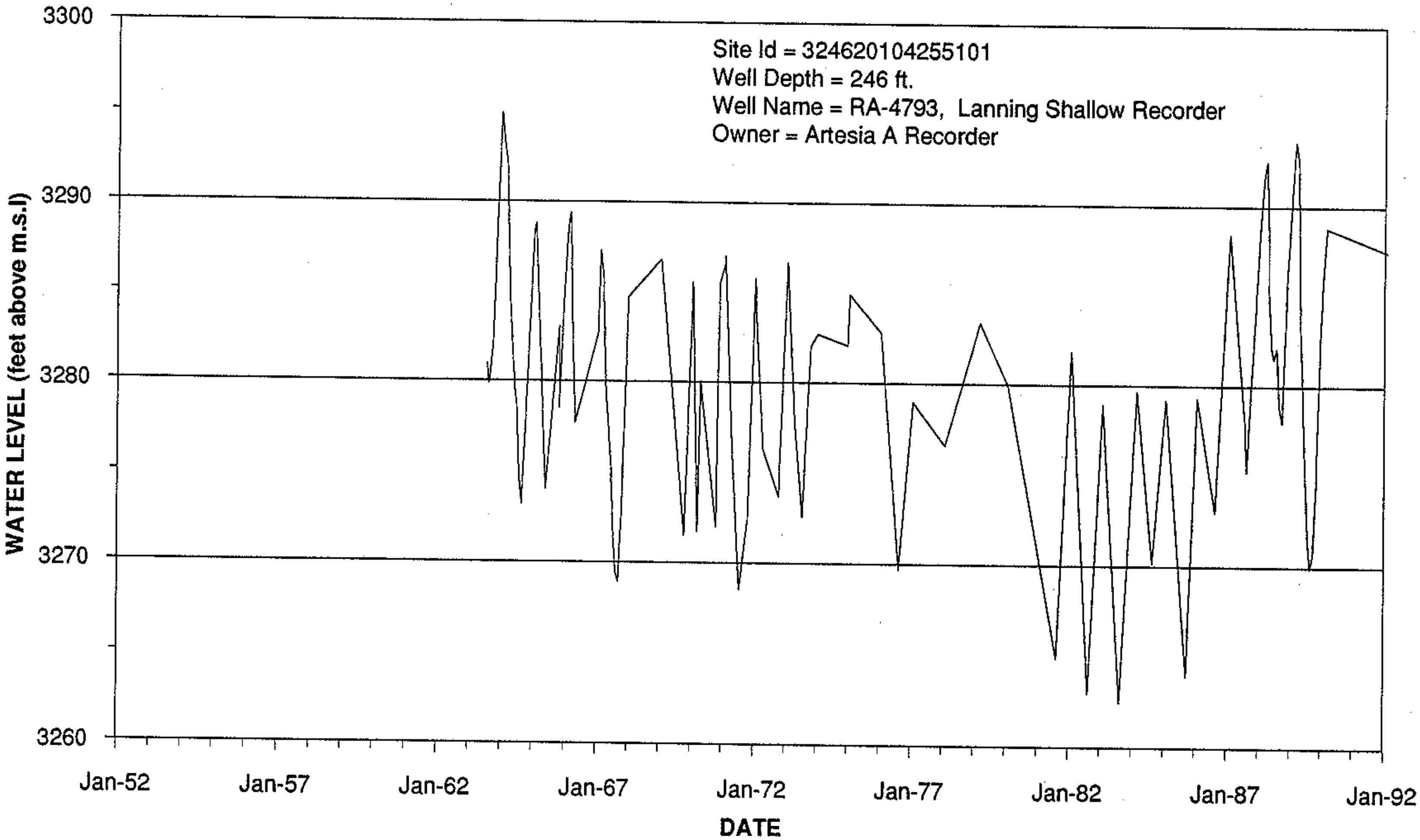
HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 19S.23E.27.111144
Site Id = 323818104405701
Well Depth = 430 ft.
Well Name =
Owner = C.R. Coffin
WATER LEVEL (feet above m.s.l)
3600
3590
3580
3570
3560
3550
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

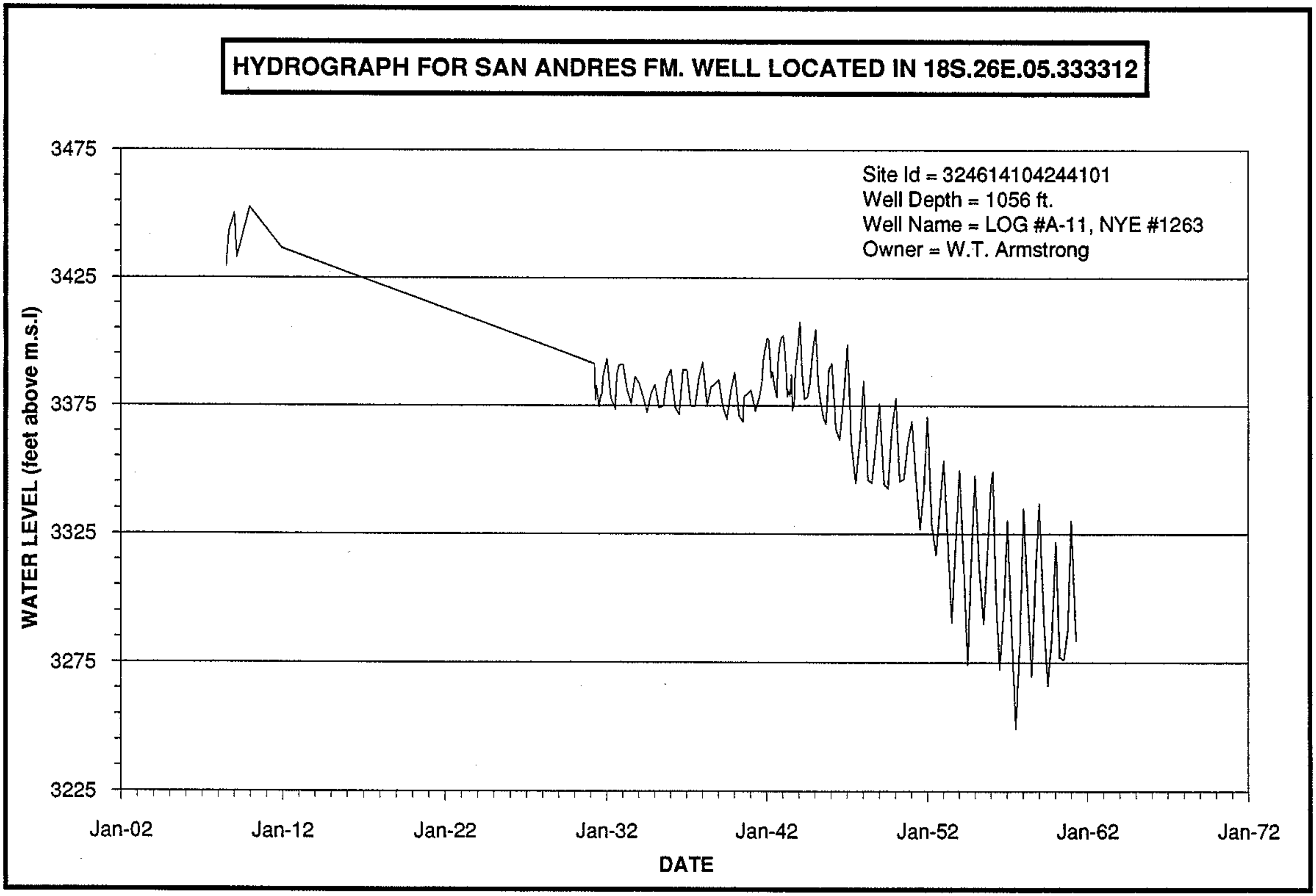

HYDROGRAPH FOR GLORIETA S.S. WELL LOCATED IN 19S.20E.16.11111
Site Id = 323955104543601
Well Depth = 1120 ft.
Well Name = RA-3458
WATER LEVEL (feet above m.s.l)
3670
3660
3650
3640
3630
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE


HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 18S.26E.28.122111
Site Id = 324325104233001
Well Depth = 250 ft.
Well Name = RA-2786, USGS #476A
Owner = Dayton Recorder
WATER LEVEL (feet above m.s.l)
3350
3330
3310
3290
3270
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

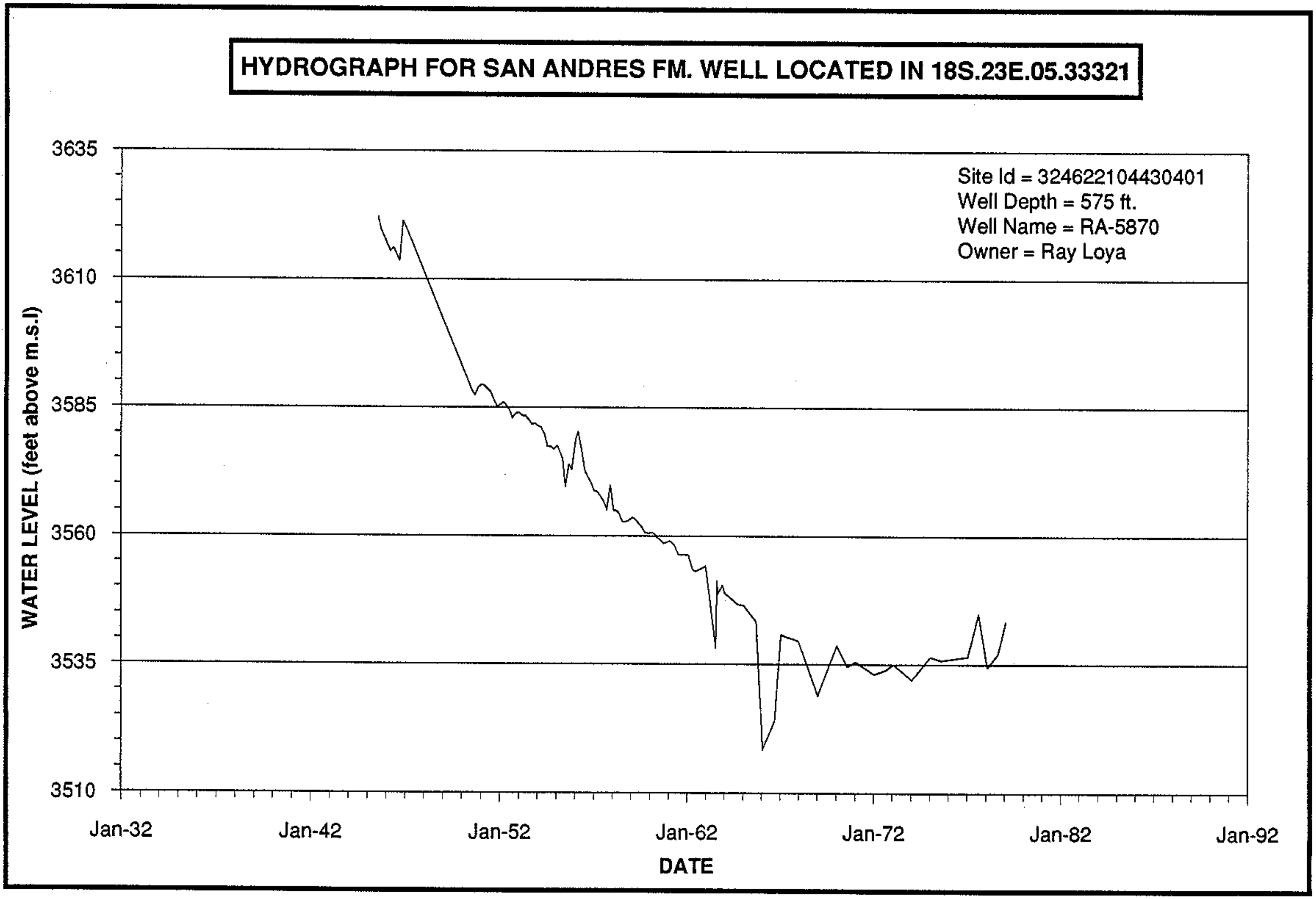

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 18S.26E.06.442221A
Site Id = 324620104255001
Well Depth = 1008 ft.
Well Name = RA-4250, Artesia Recorder
Owner = NMSEO
WATER LEVEL (feet above m.s.l)
3350
3325
3300
3275
3250
3225
3200
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

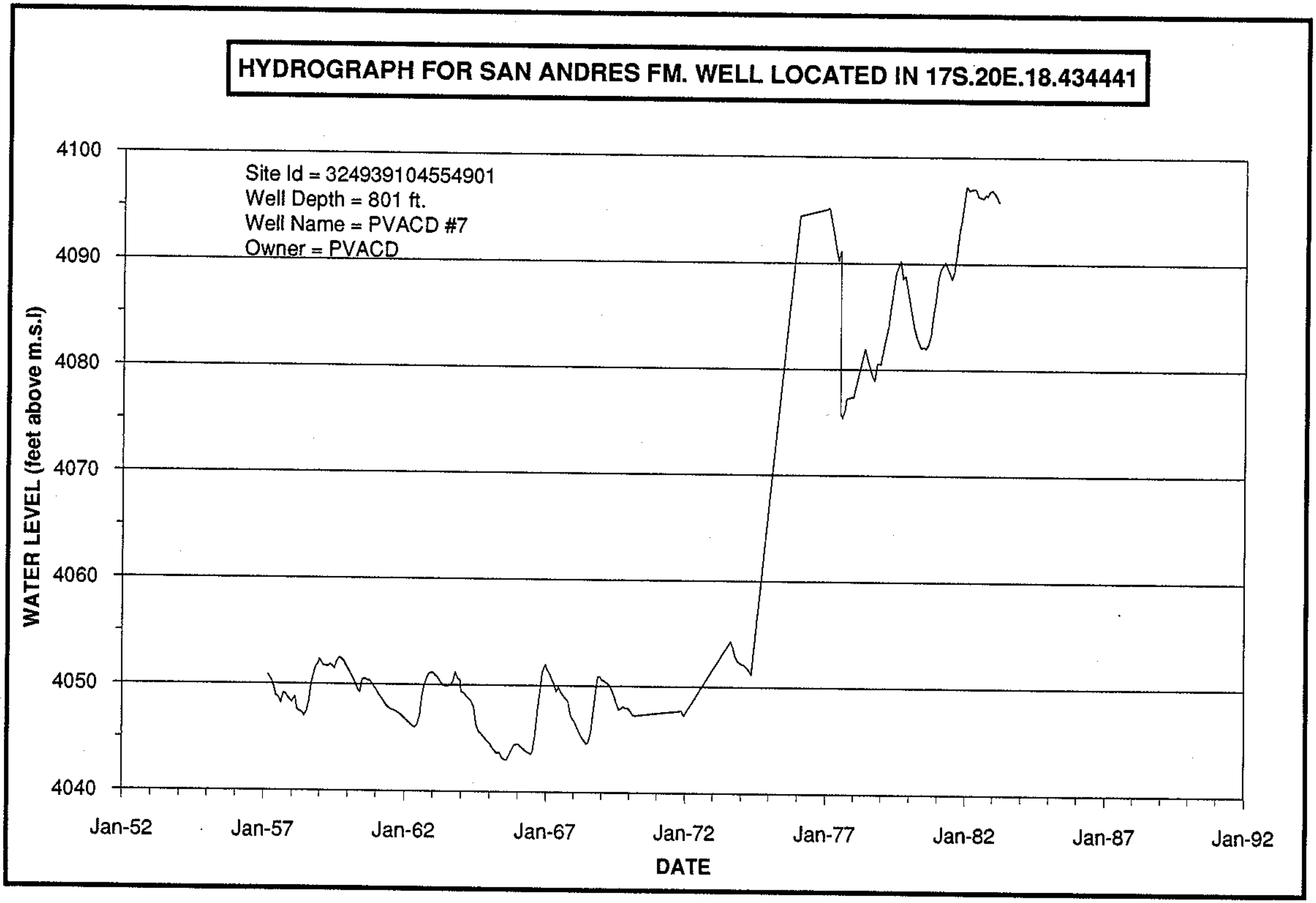
HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 18S.26E.06.442212B

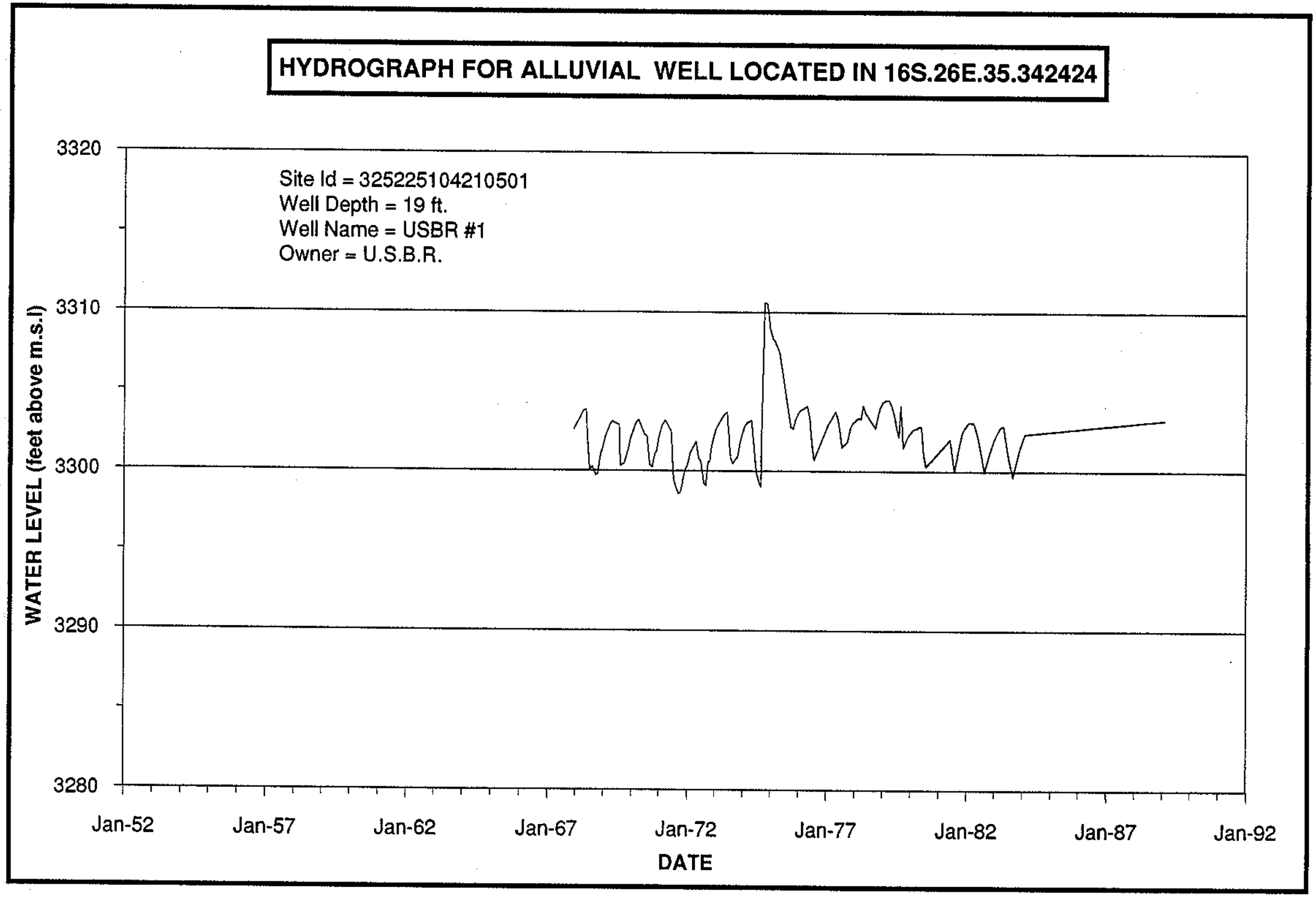


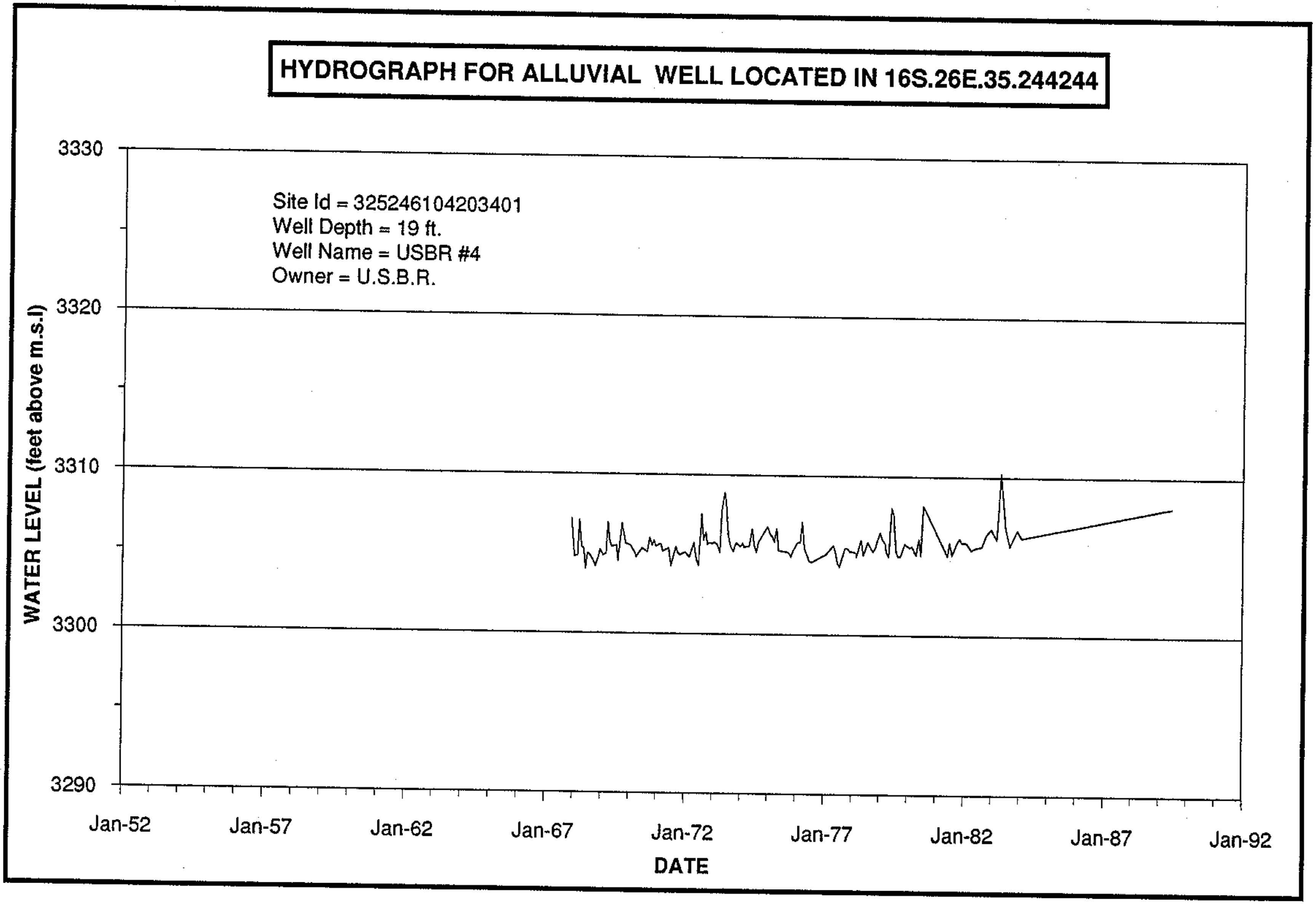


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 18S.26E.05.333312
Site Id = 324614104244101
Well Depth = 1056 ft.
Well Name = LOG #A-11, NYE #1263
Owner = W.T. Armstrong
WATER LEVEL (feet above m.s.l)
3475
3425
3375
3325
3275
3225
Jan-02
Jan-12
Jan-22
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
DATE

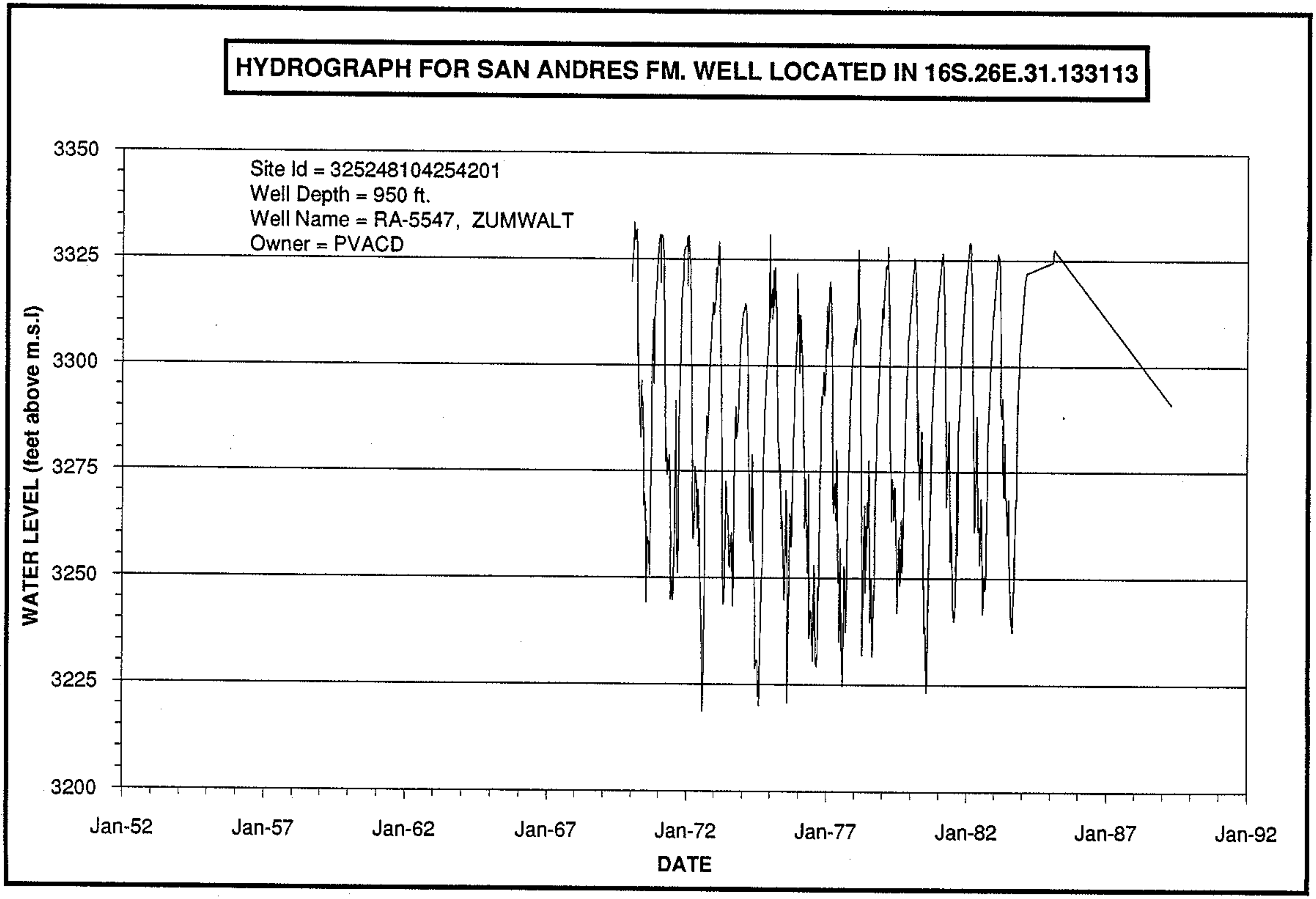

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 18S.23E.05.33321
Site Id = 324622104430401
Well Depth = 575 ft.
Well Name = RA-5870
Owner = Ray Loya
WATER LEVEL (feet above m.s.l)
3635
3610
3585
3560
3535
3510
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

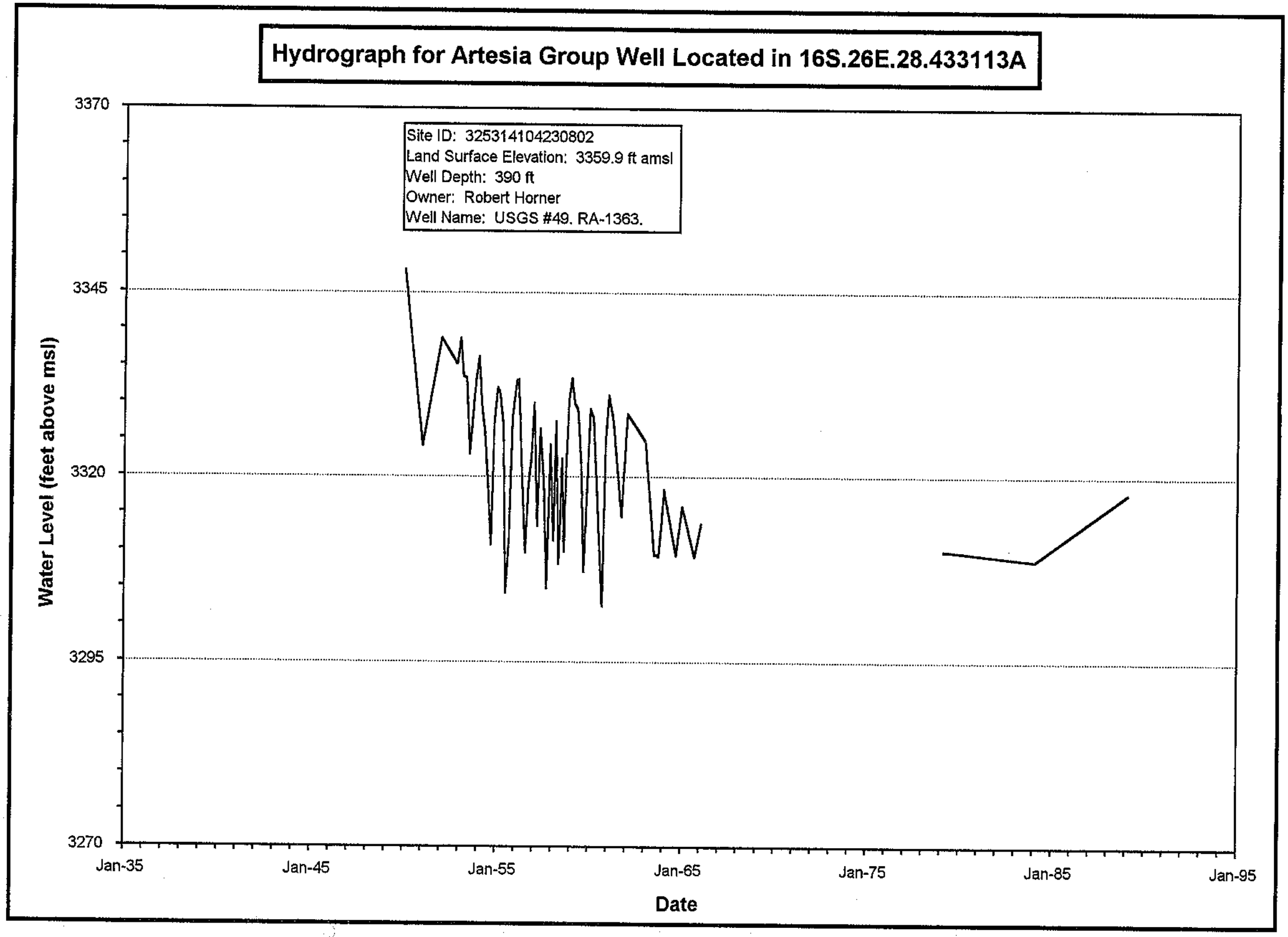

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 17S.20E.18.434441
Site Id = 324939104554901
Well Depth = 801 ft.
Well Name = PVACD #7
Owner = PVACD
WATER LEVEL (feet above m.s.l)
4100
4090
4080
4070
4060
4050
4040
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE


HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 16S.26E.35.342424
Site Id = 325225104210501
Well Depth = 19 ft.
Well Name = USBR #1
Owner = U.S.B.R.
WATER LEVEL (feet above m.s.l)
3320
3310
3300
3290
3280
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

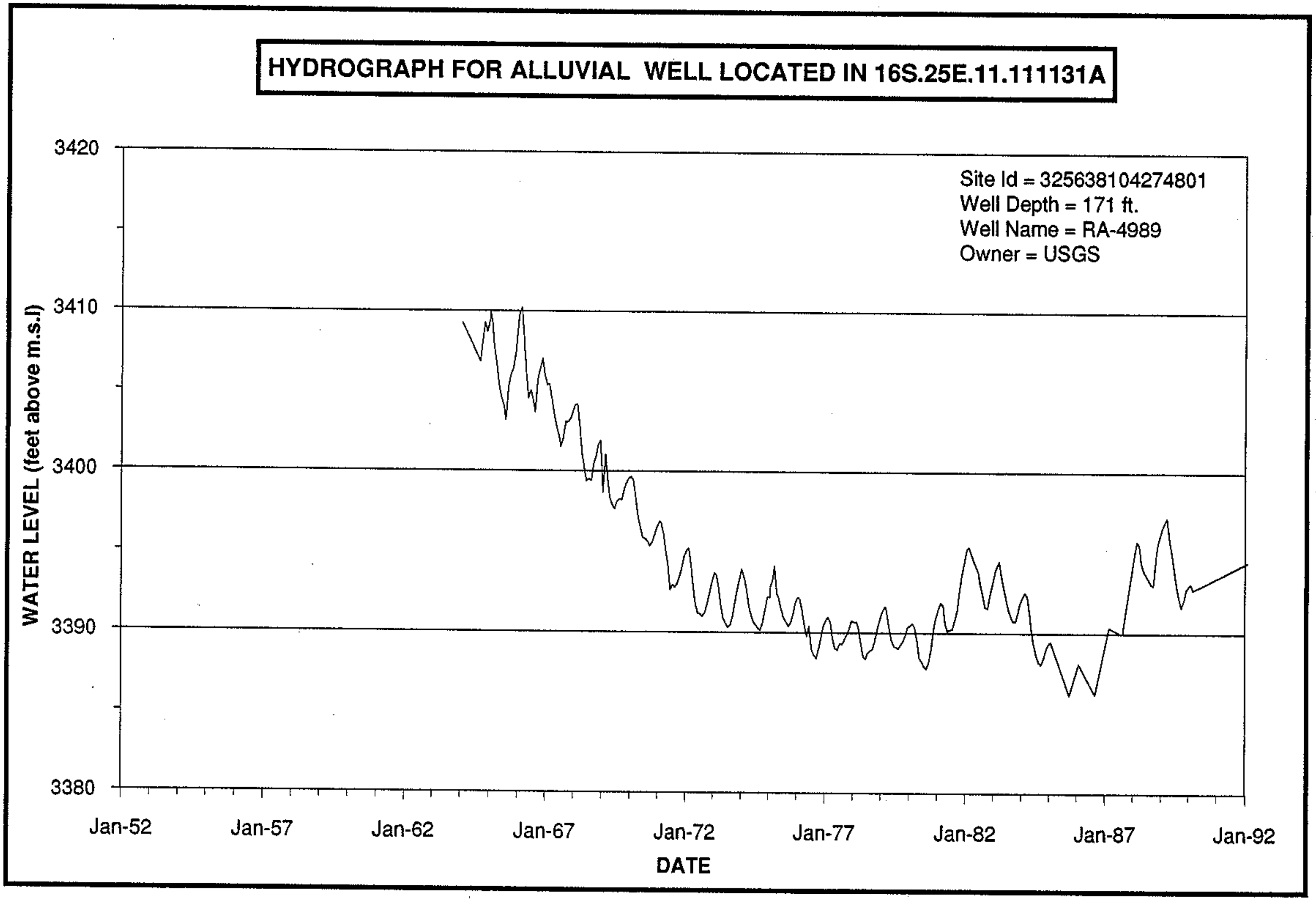


HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 16S.26E.35.244244
Site Id = 325246104203401
Well Depth = 19 ft.
Well Name = USBR #4
Owner = U.S.B.R.
WATER LEVEL (feet above m.s.l)
3330
3320
3310
3300
3290
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

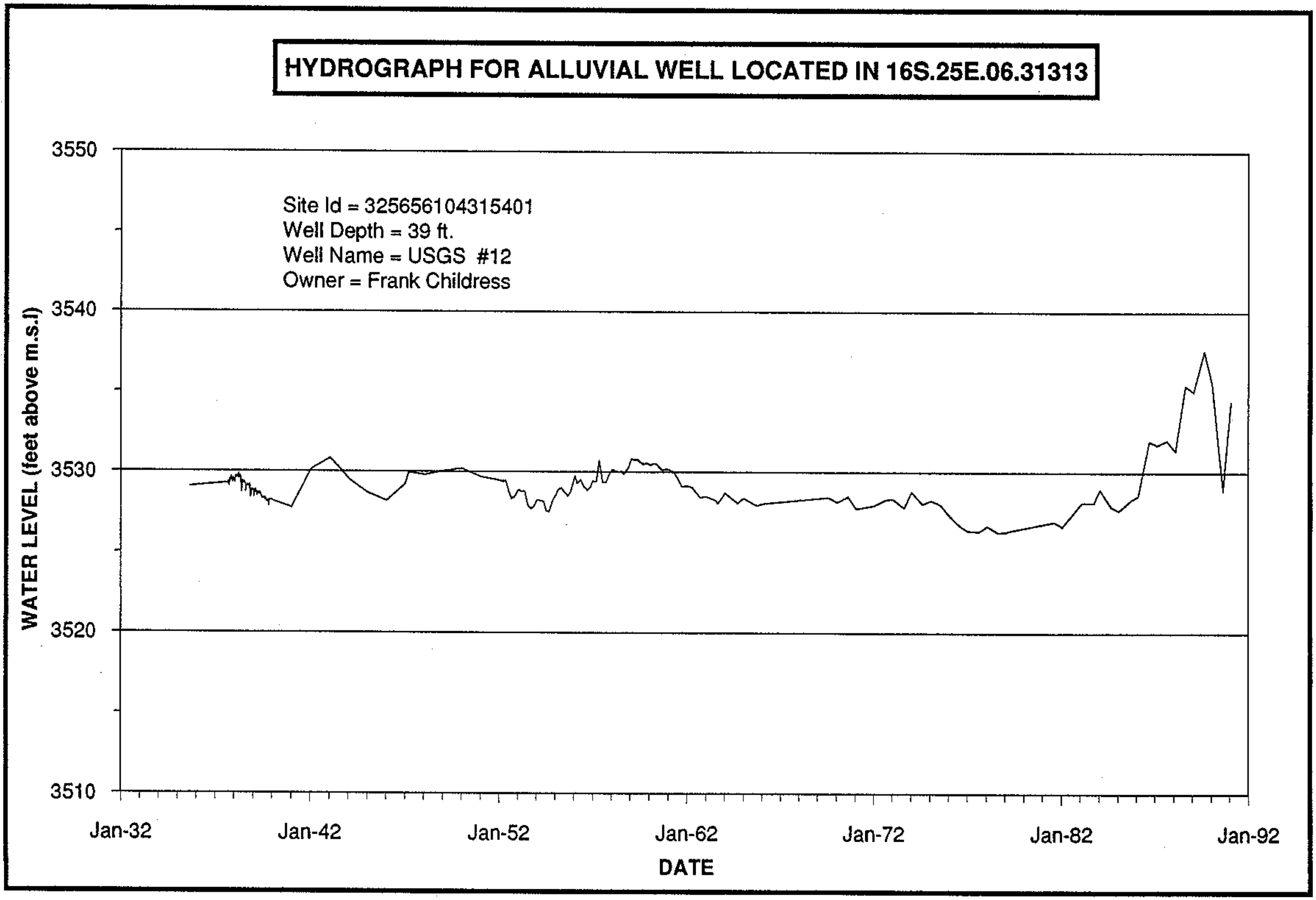

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 16S.26E.31.133113
Site Id = 325248104254201
Well Depth = 950 ft.
Well Name = RA-5547, ZUMWALT
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3350
3325
3300
3275
3250
3225
3200
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

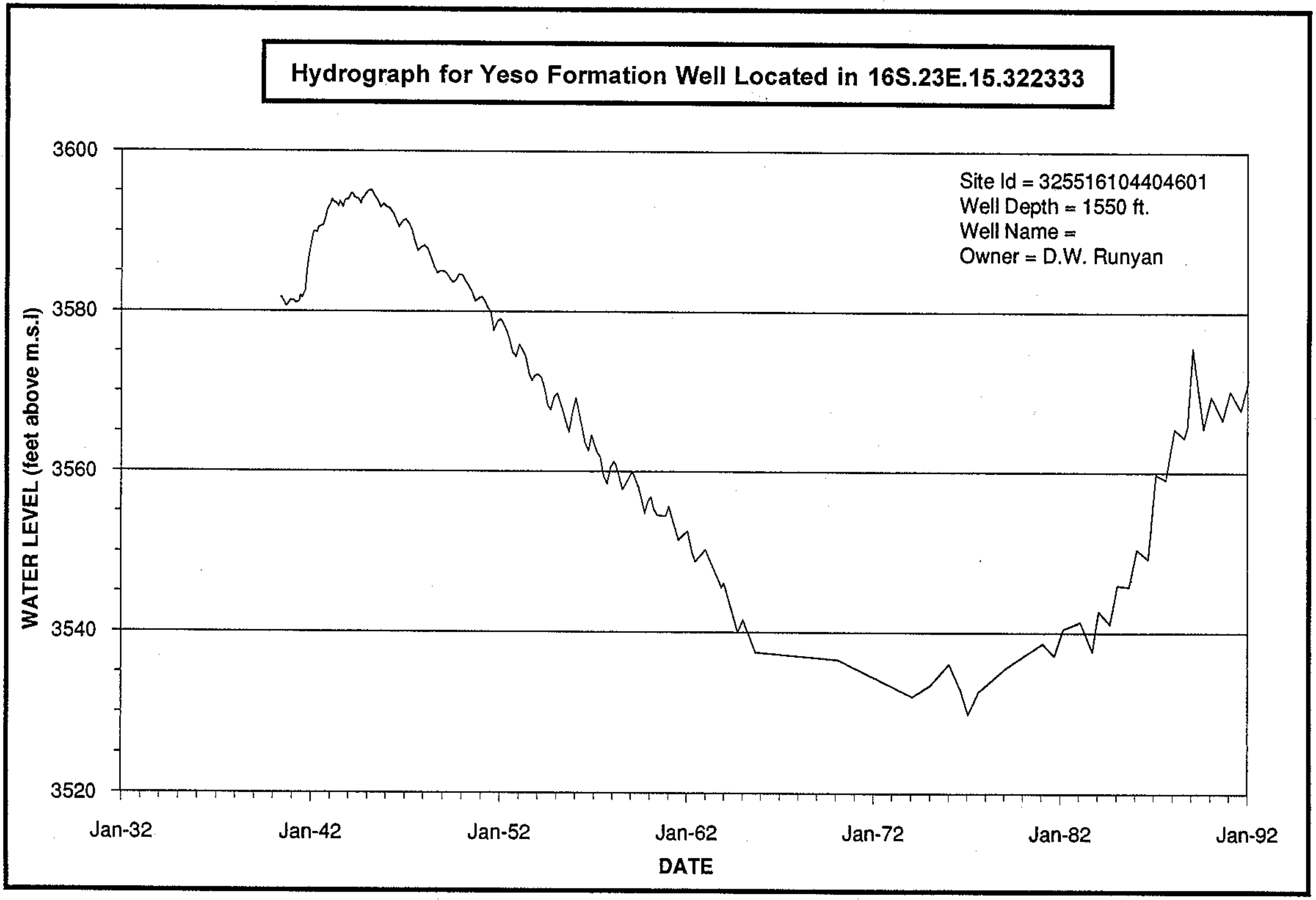


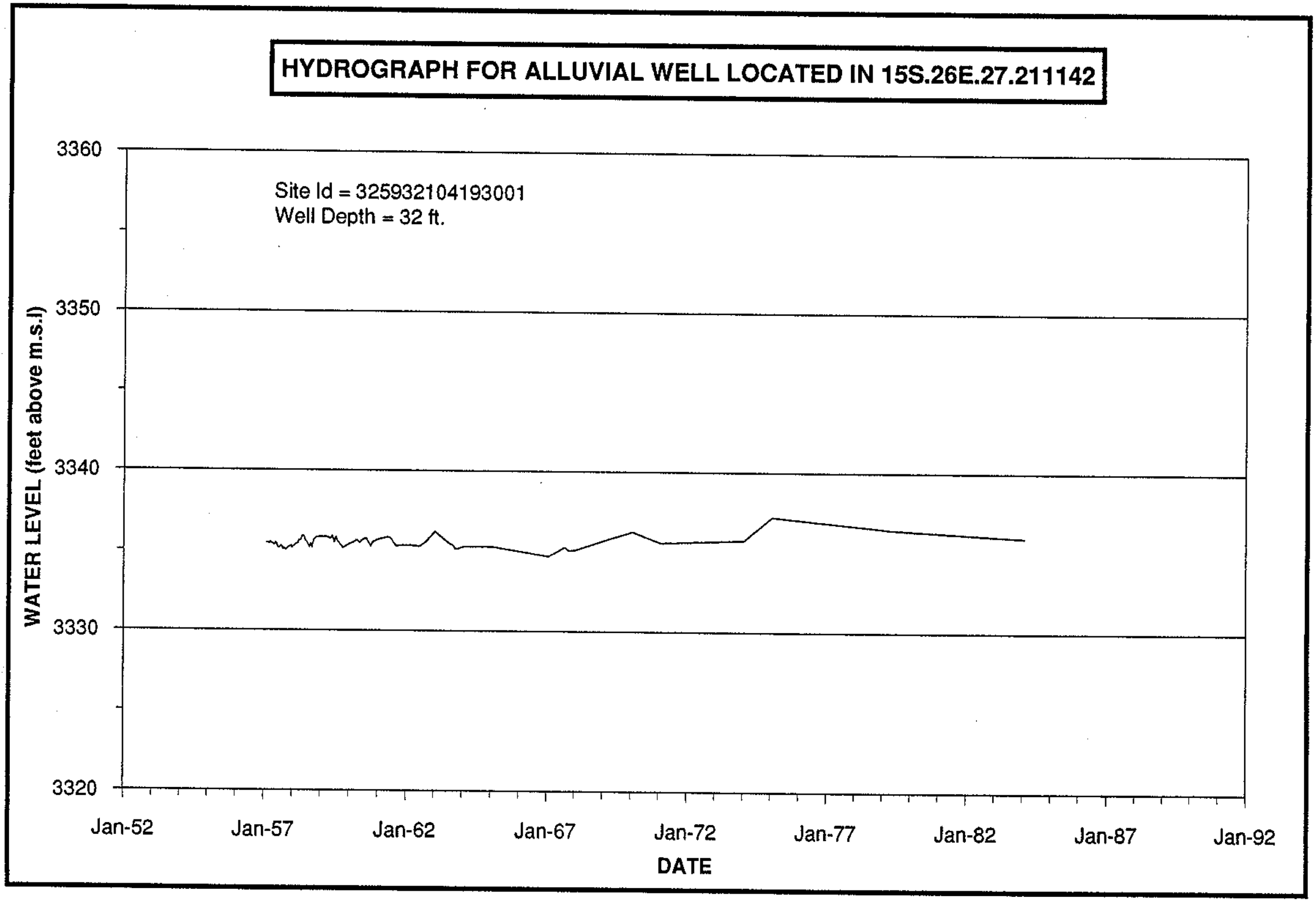
Hydrograph for Artesia Group Well Located in 16S.26E.28.433113A
Site ID: 325314104230802
Land Surface Elevation: 3359.9 ft amsl
Well Depth: 390 ft
Owner: Robert Horner
Well Name: USGS #49. RA-1363.
Water Level (feet above msl)
3370
3345
3320
3295
3270
Jan-35
Jan-45
Jan-55
Jan-65
Jan-75
Jan-85
Jan-95
Date

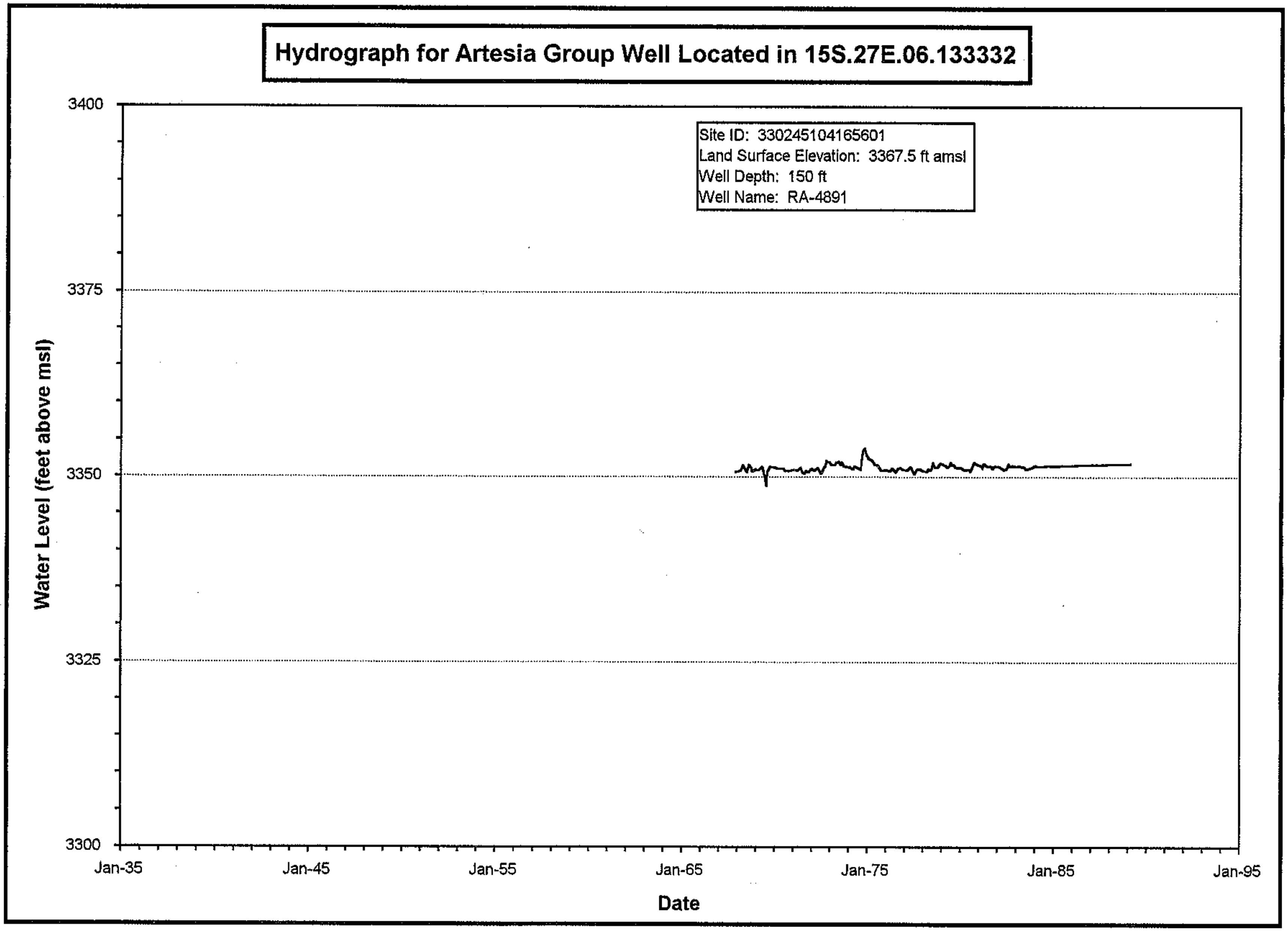


HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 16S.25E.11.111131A
Site Id = 325638104274801
Well Depth = 171 ft.
Well Name = RA-4989
Owner = USGS
WATER LEVEL (feet above m.s.l)
3420
3410
3400
3390
3380
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

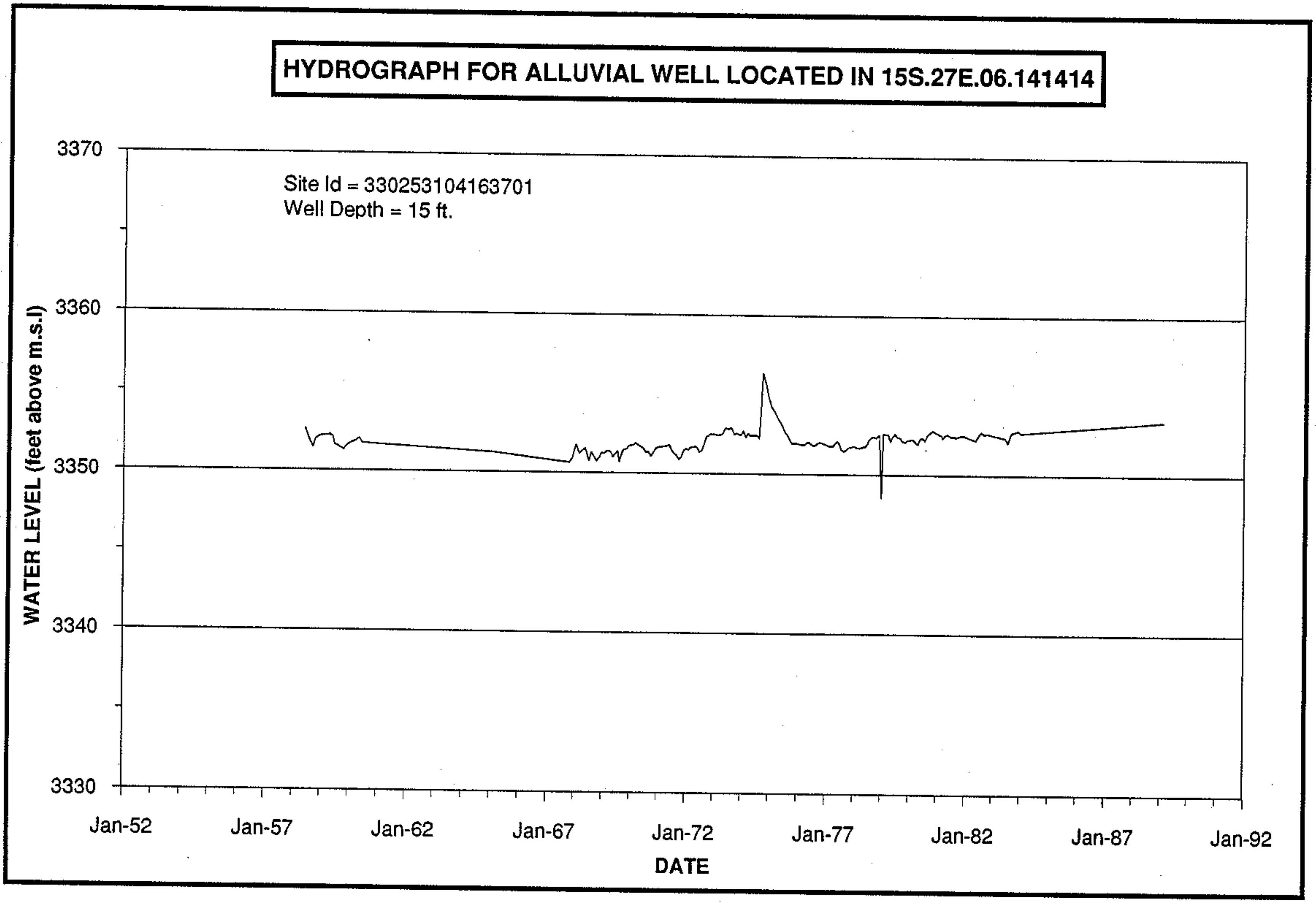

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 16S.25E.06.31313
Site Id = 325656104315401
Well Depth = 39 ft.
Well Name = USGS #12
Owner = Frank Childress
WATER LEVEL (feet above m.s.l)
3550
3540
3530
3520
3510
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

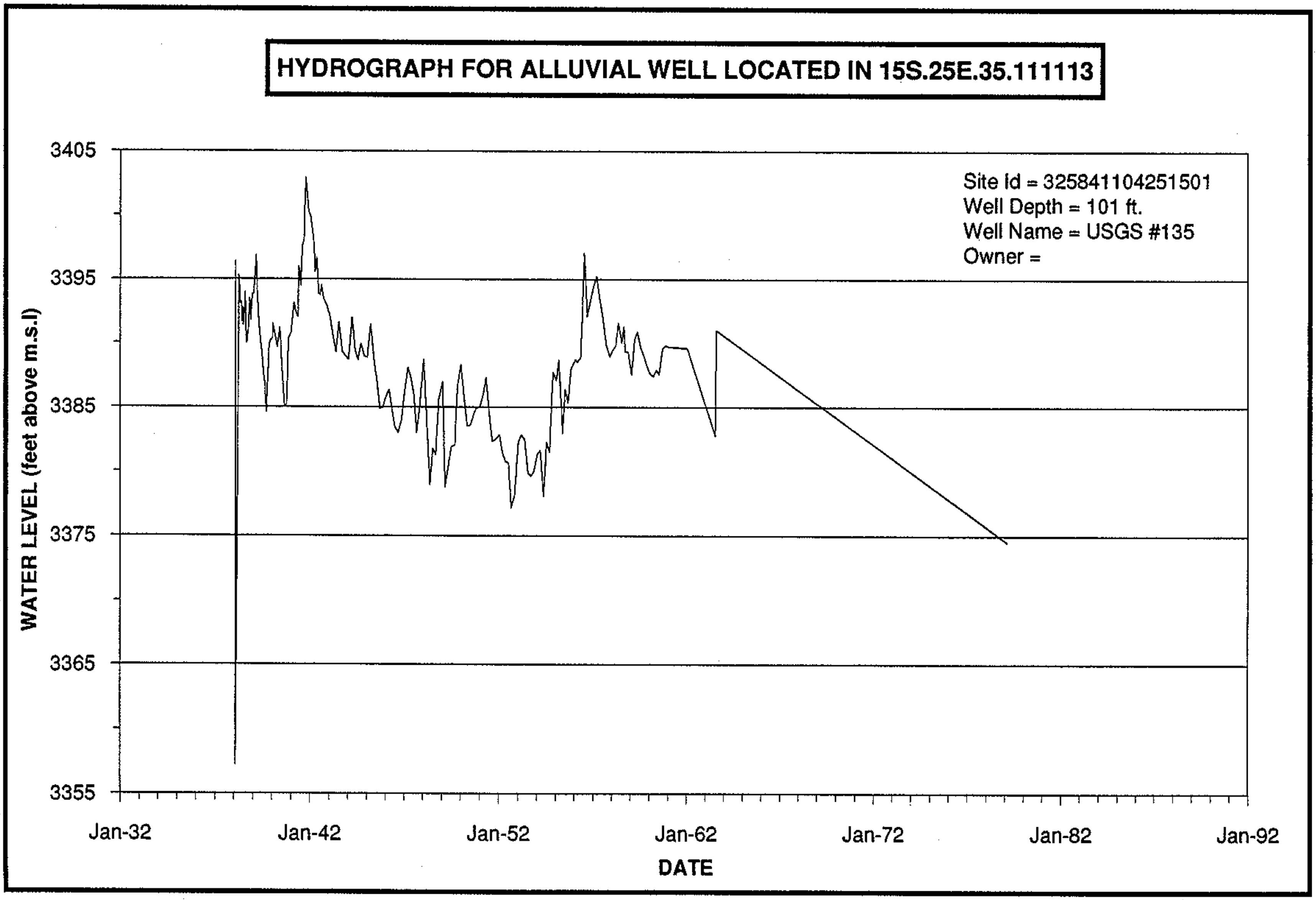

Hydrograph for Yeso Formation Well Located in 16S.23E.15.322333
Site Id = 325516104404601
Well Depth = 1550 ft.
Well Name =
Owner = D.W. Runyan
WATER LEVEL (feet above m.s.l)
3600
3580
3560
3540
3520
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE


HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 15S.26E.27.211142
Site Id = 325932104193001
Well Depth = 32 ft.
WATER LEVEL (feet above m.s.l)
3360
3350
3340
3330
3320
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

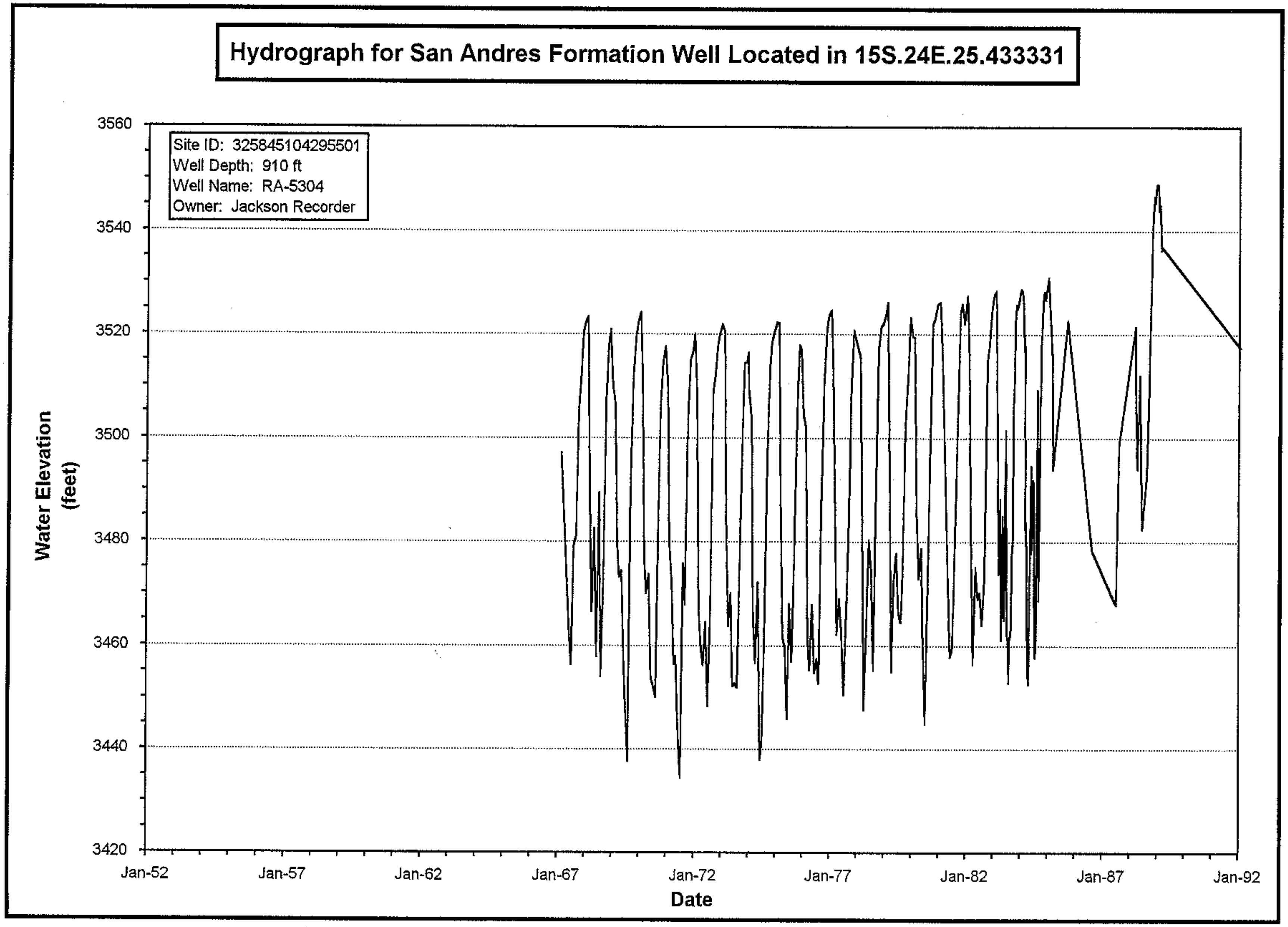


Hydrograph for Artesia Group Well Located in 15S.27E.06.133332
Site ID: 330245104165601
Land Surface Elevation: 3367.5 ft amsl
Well Depth: 150 ft
Well Name: RA-4891
Water Level (feet above msl)
3400
3375
3350
3325
3300
Jan-35
Jan-45
Jan-55
Jan-65
Jan-75
Jan-85
Jan-95
Date

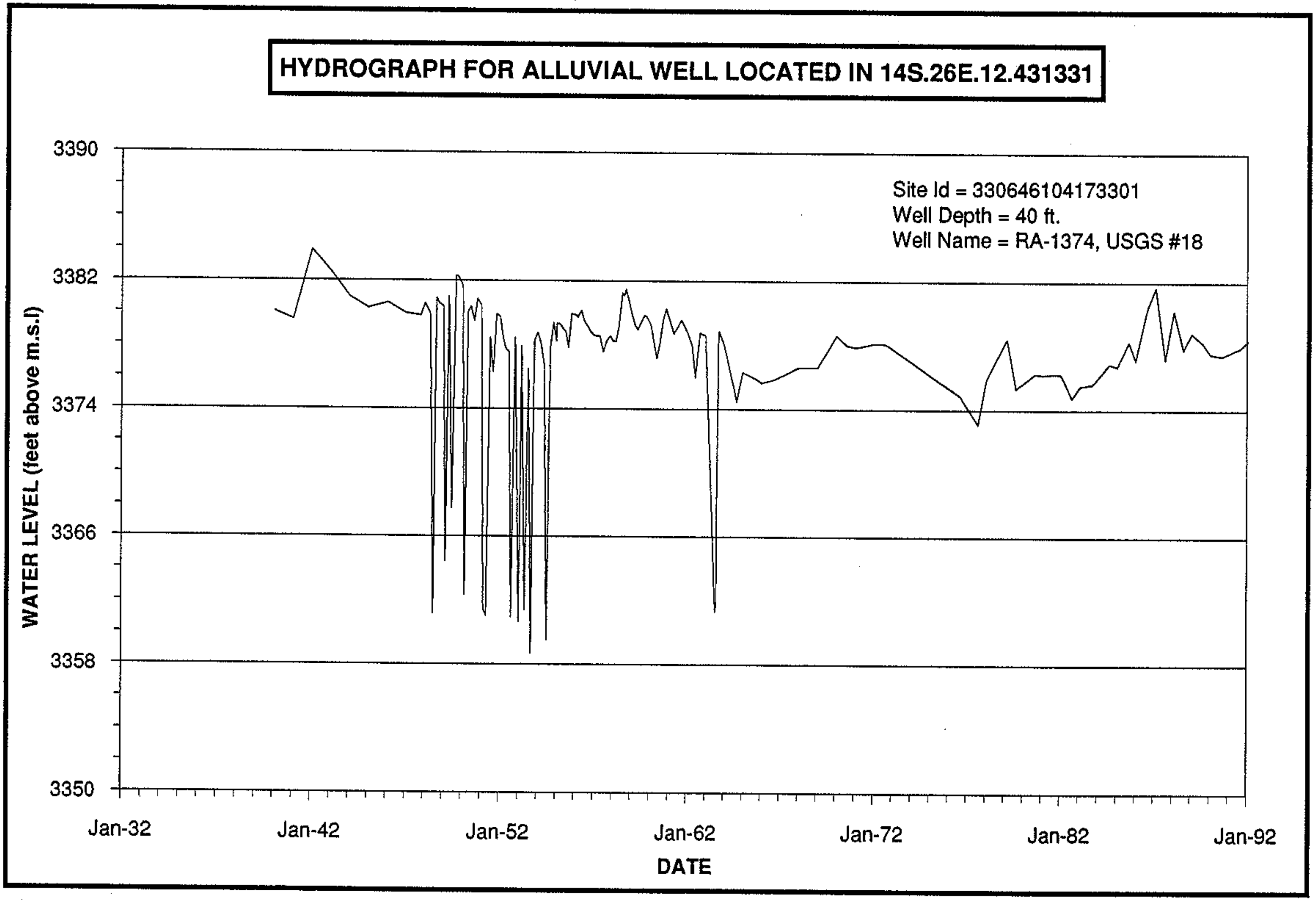

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 15S.27E.06.141414
Site Id = 330253104163701
Well Depth = 15 ft.
WATER LEVEL (feet above m.s.l)
3370
3360
3350
3340
3330
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

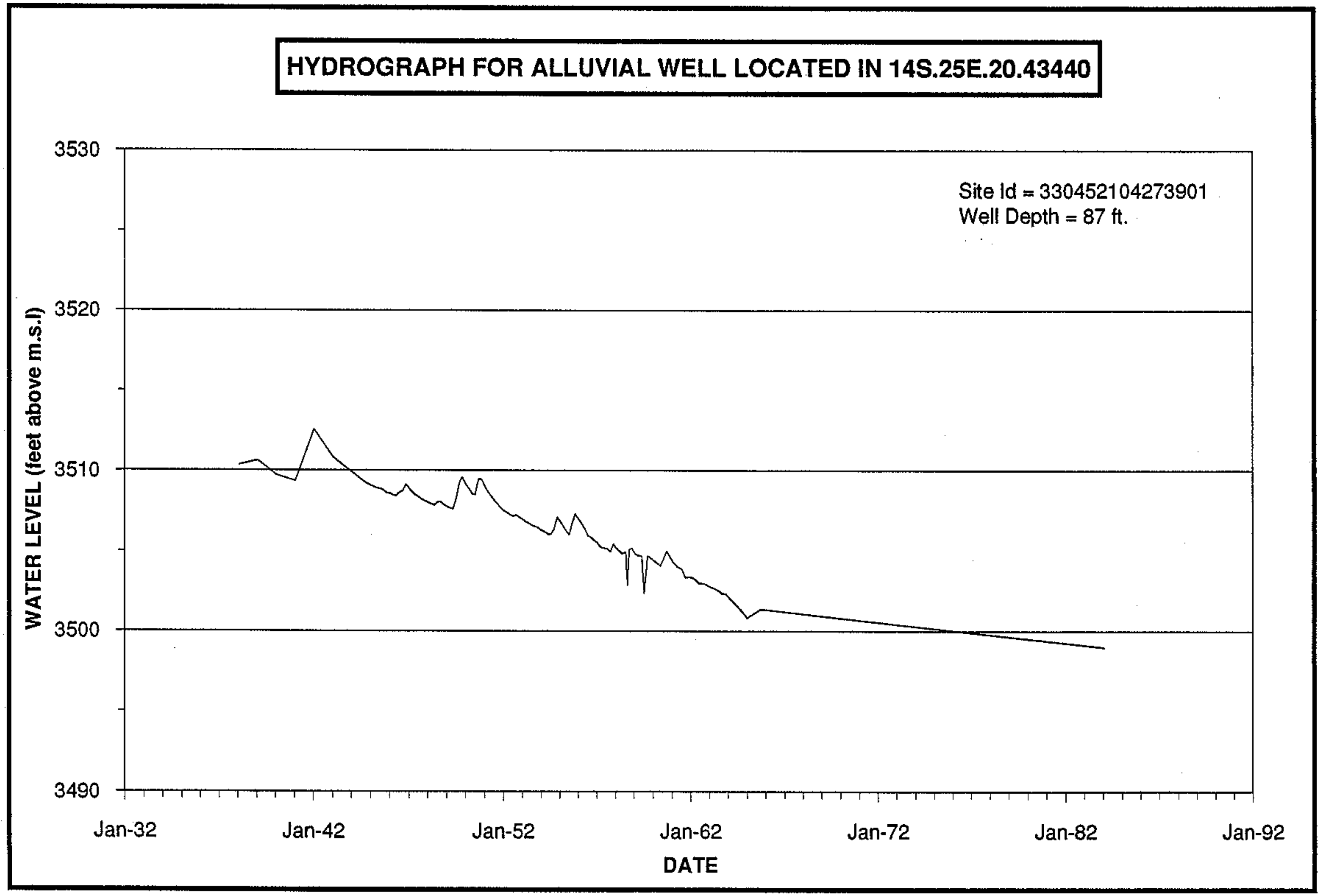


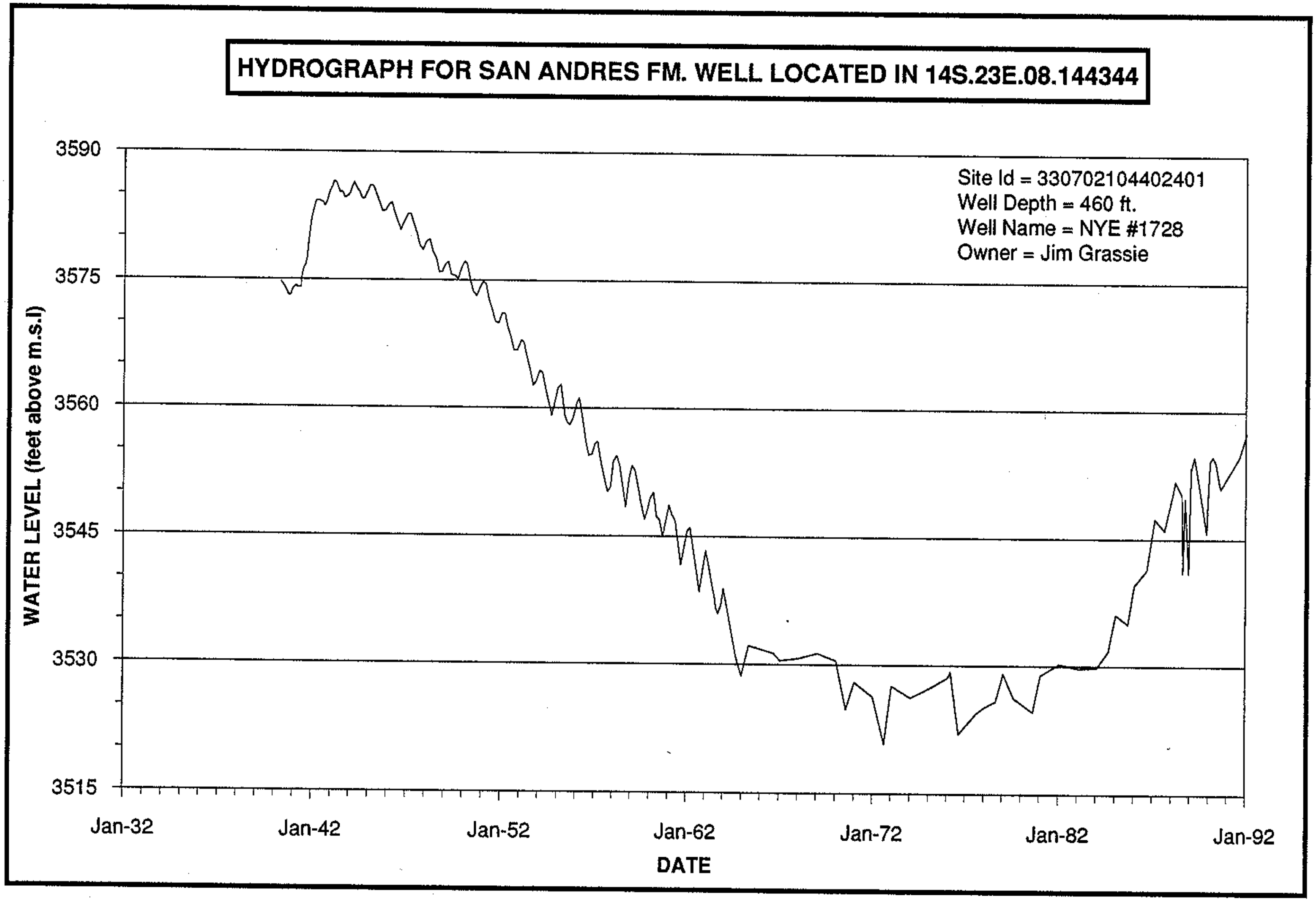
HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 15S.25E.35.111113
Site Id = 325841104251501
Well Depth = 101 ft.
Well Name = USGS #135
Owner =
WATER LEVEL (feet above m.s.l)
3405
3395
3385
3375
3365
3355
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

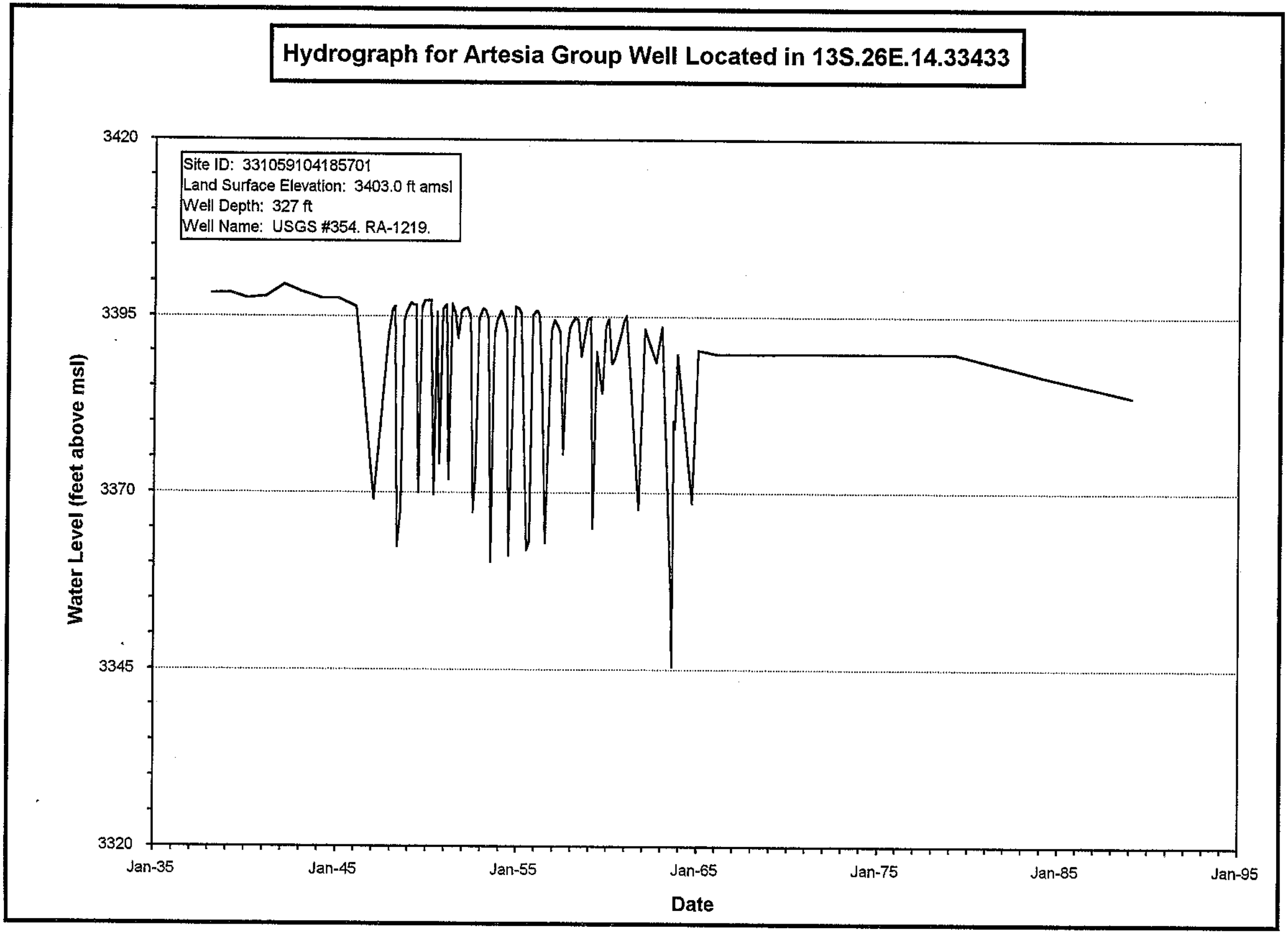


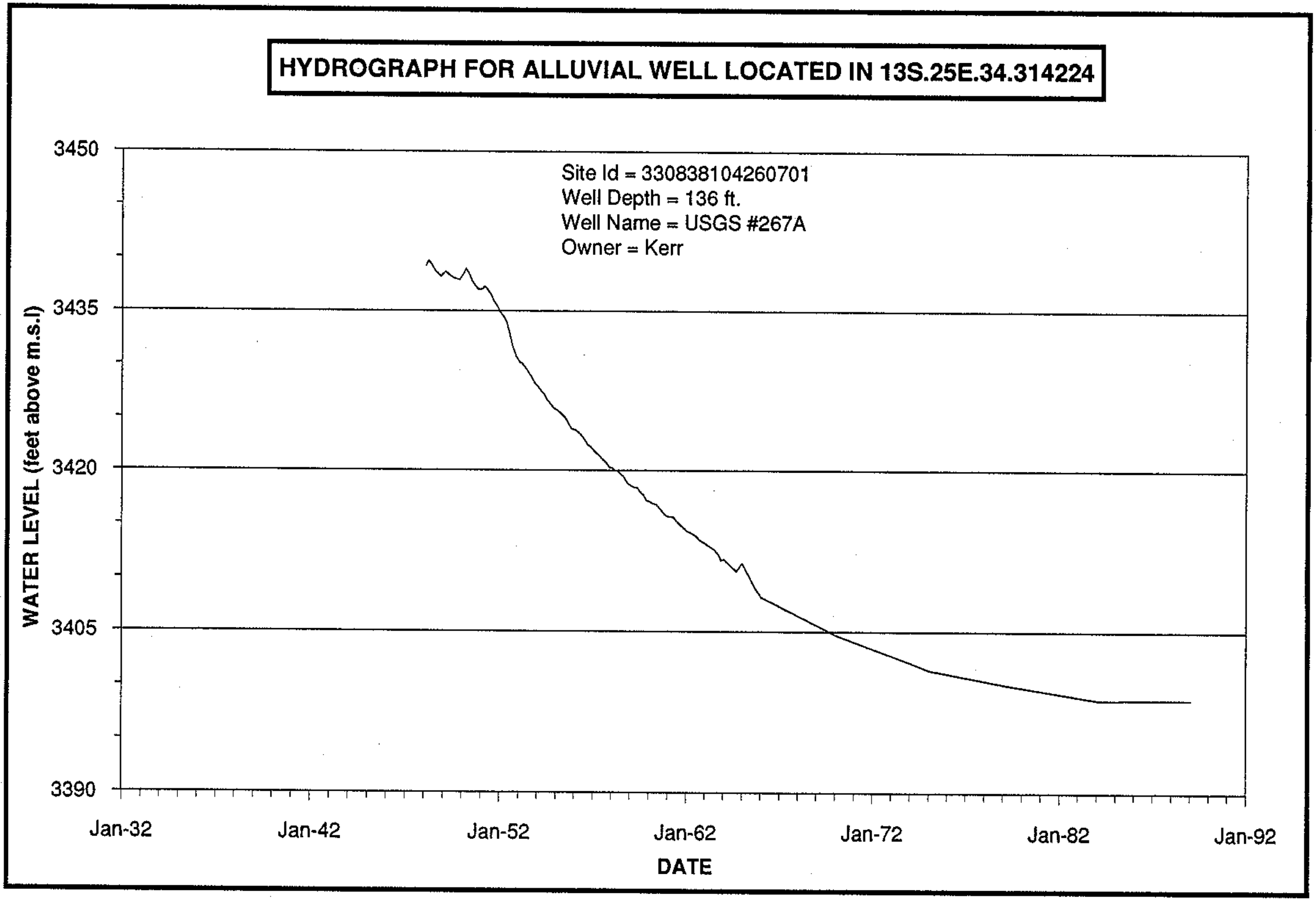
Hydrograph for San Andres Formation Well Located in 15S.24E.25.433331
Site ID: 325845104295501
Well Depth: 910 ft
Well Name: RA-5304
Owner: Jackson Recorder
Water Elevation (feet)
3560
3540
3520
3500
3480
3460
3440
3420
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
Date

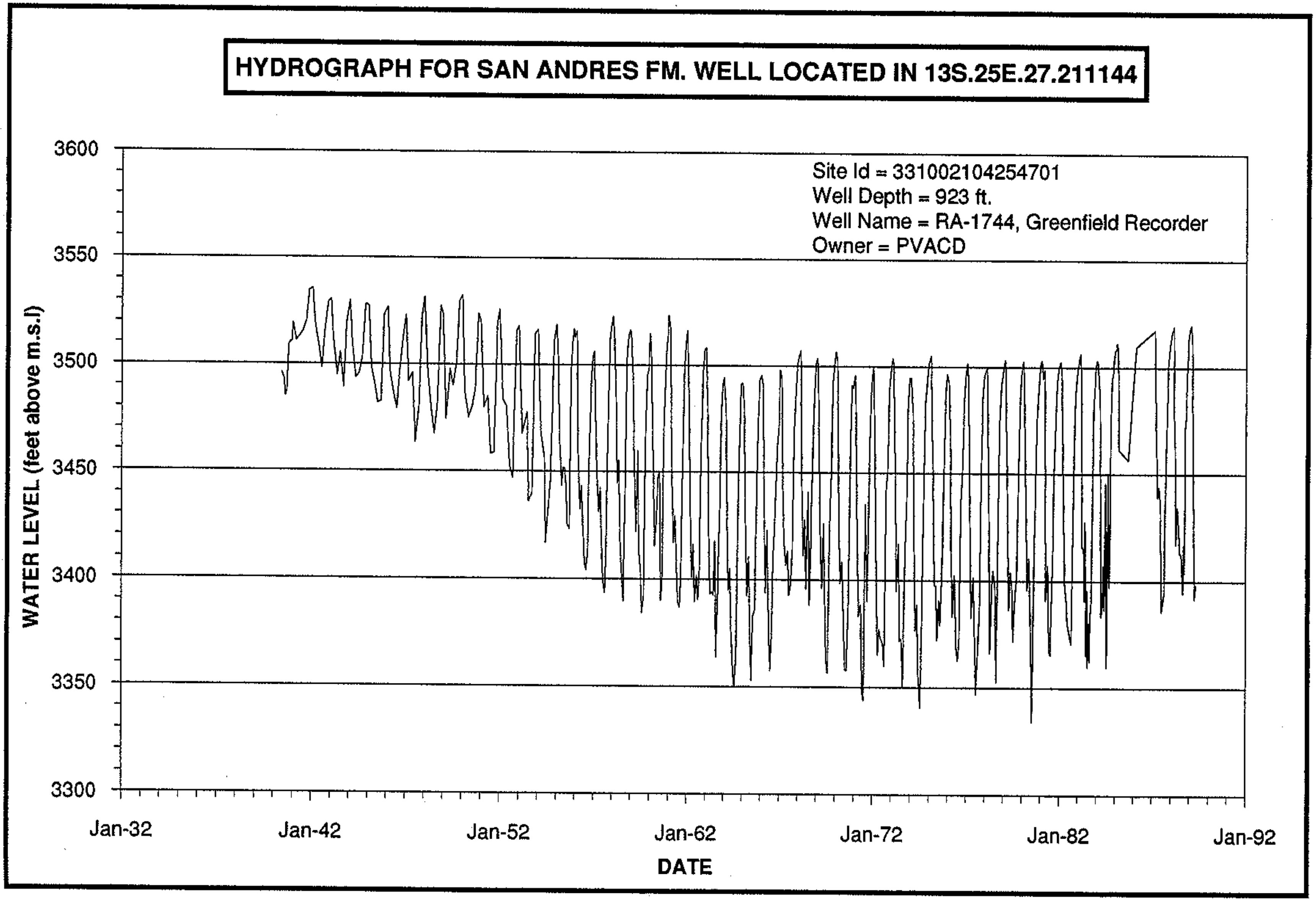

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 14S.26E.12.431331
Site Id = 330646104173301
Well Depth = 40 ft.
Well Name = RA-1374, USGS #18
WATER LEVEL (feet above m.s.l)
3390
3382
3374
3366
3358
3350
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

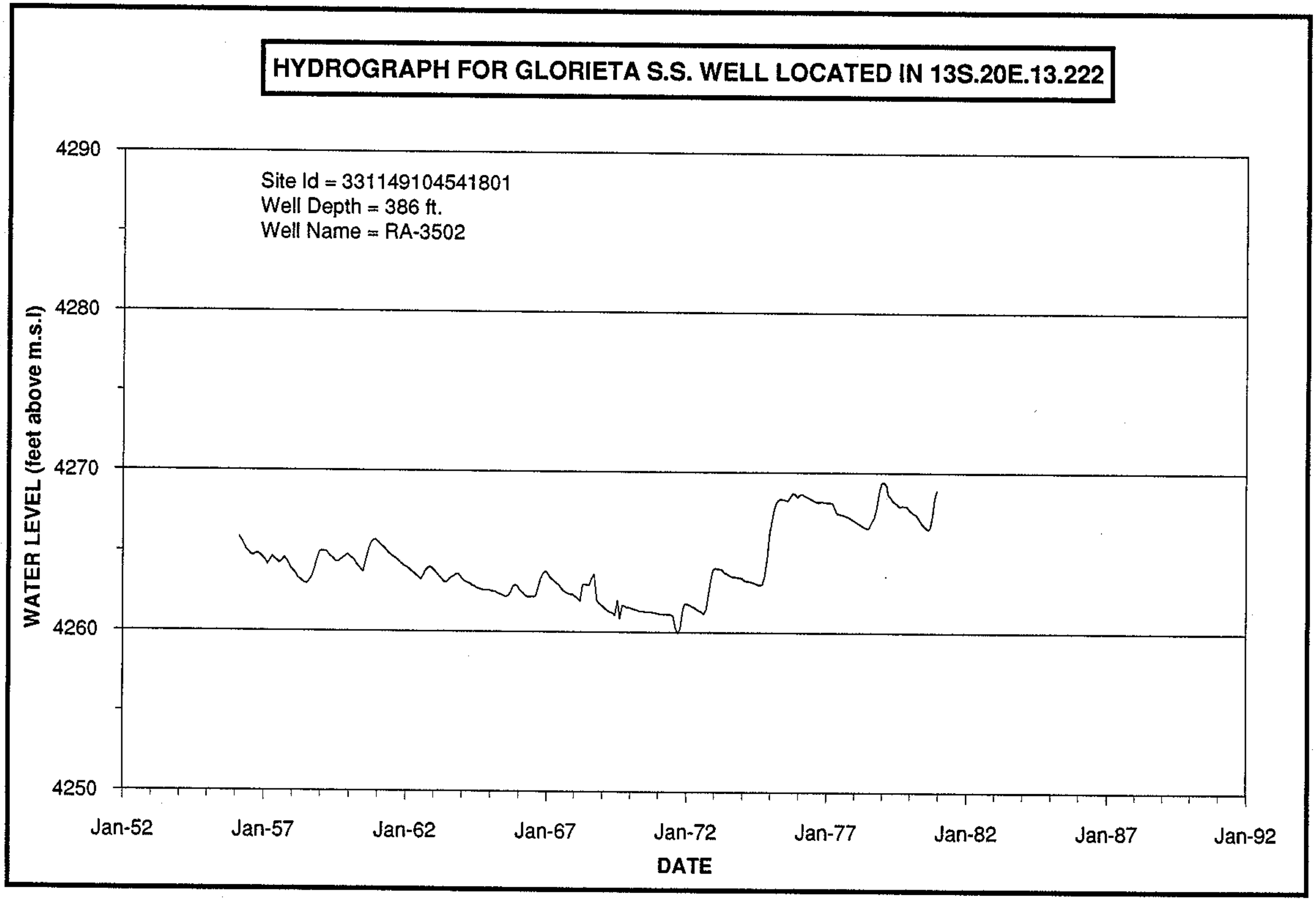

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 14S.25E.20.43440
Site Id = 330452104273901
Well Depth = 87 ft.
WATER LEVEL (feet above m.s.l)
3530
3520
3510
3500
3490
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

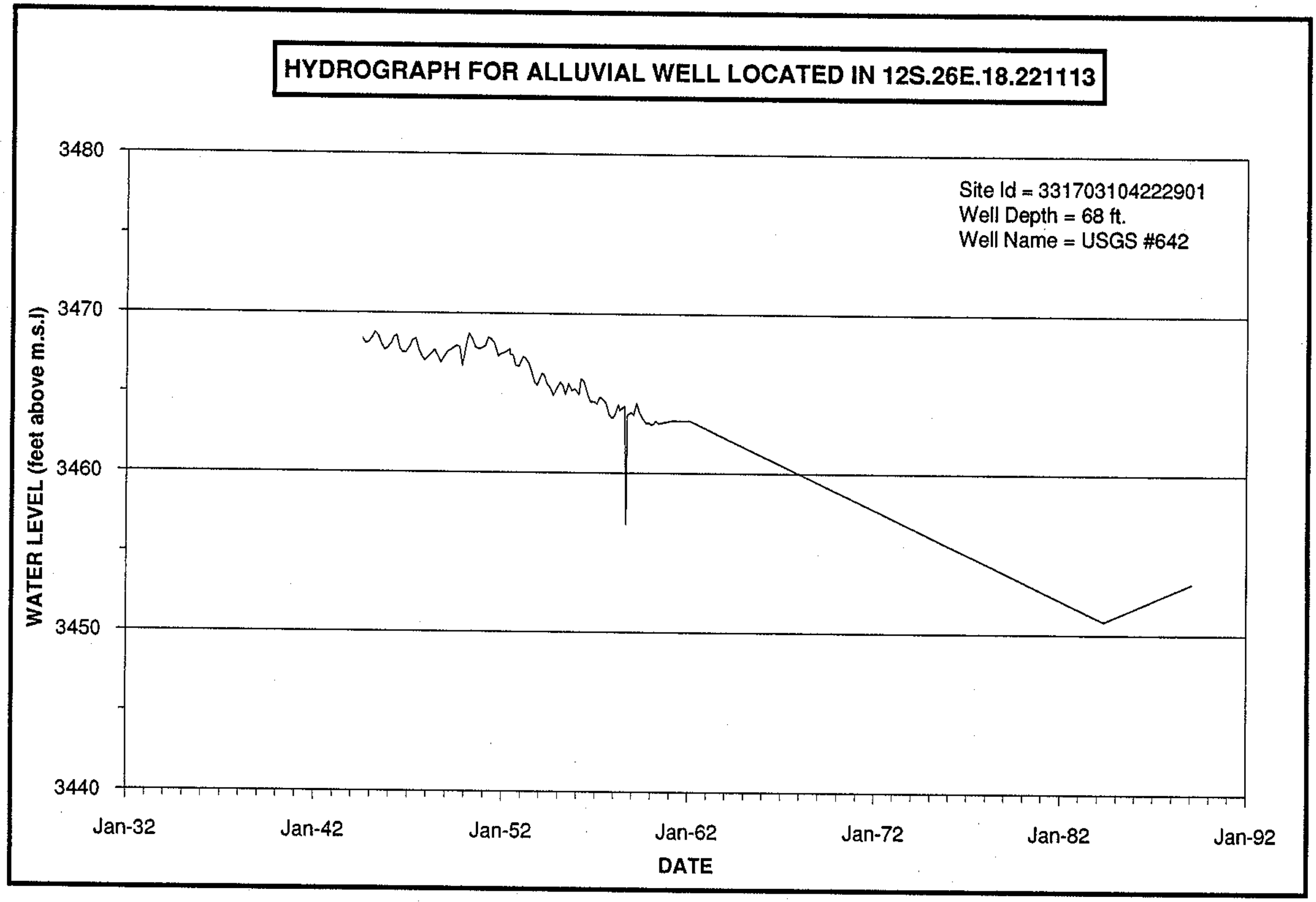

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 14S.23E.08.144344
Site Id = 330702104402401
Well Depth = 460 ft.
Well Name = NYE #1728
Owner = Jim Grassie
WATER LEVEL (feet above m.s.l)
3590
3575
3560
3545
3530
3515
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

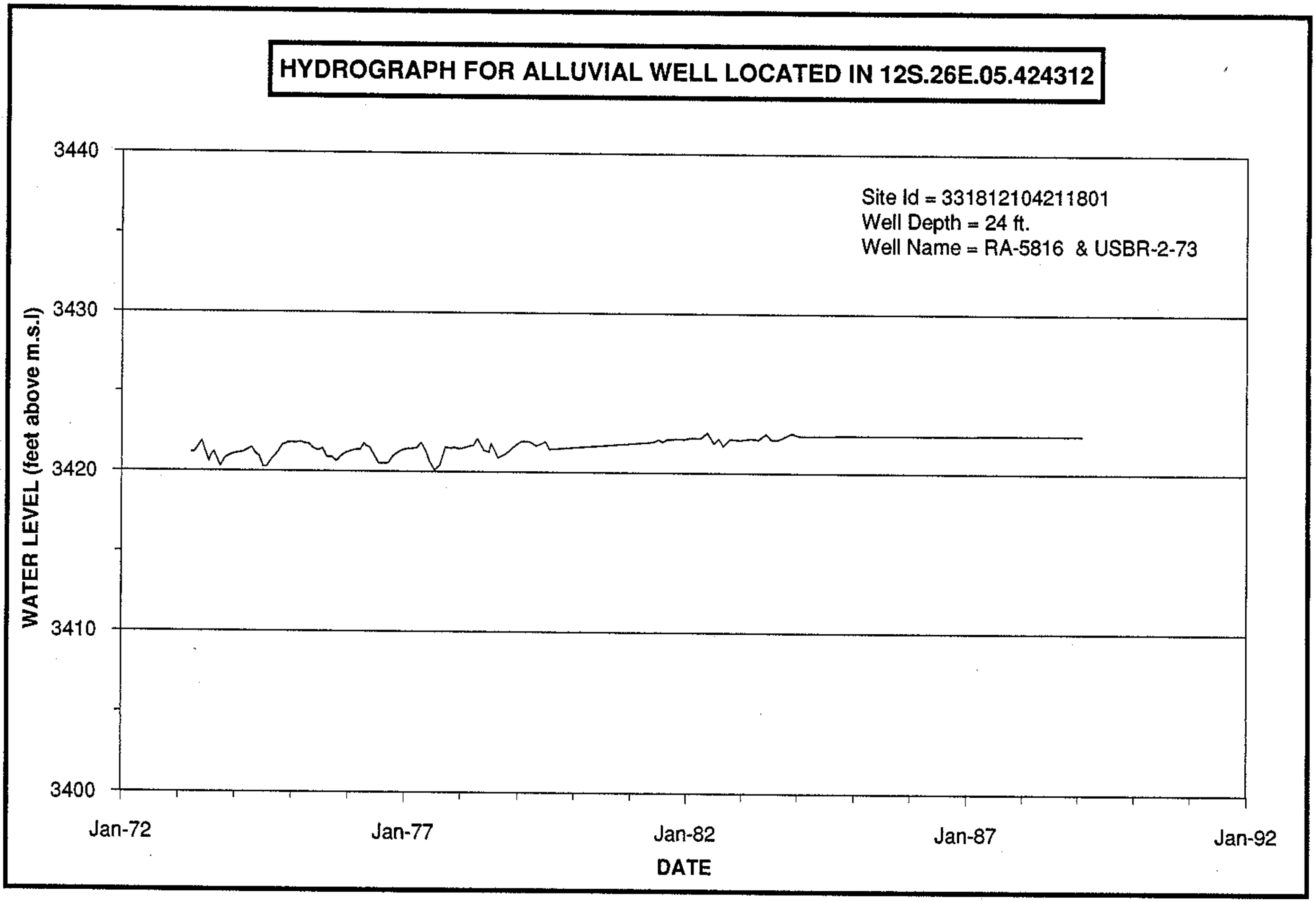

Hydrograph for Artesia Group Well Located in 13S.26E.14.33433
Site ID: 331059104185701
Land Surface Elevation: 3403.0 ft amsl
Well Depth: 327 ft
Well Name: USGS #354. RA-1219.
Water Level (feet above msl)
3420
3395
3370
3345
3320
Jan-35
Jan-45
Jan-55
Jan-65
Jan-75
Jan-85
Jan-95
Date

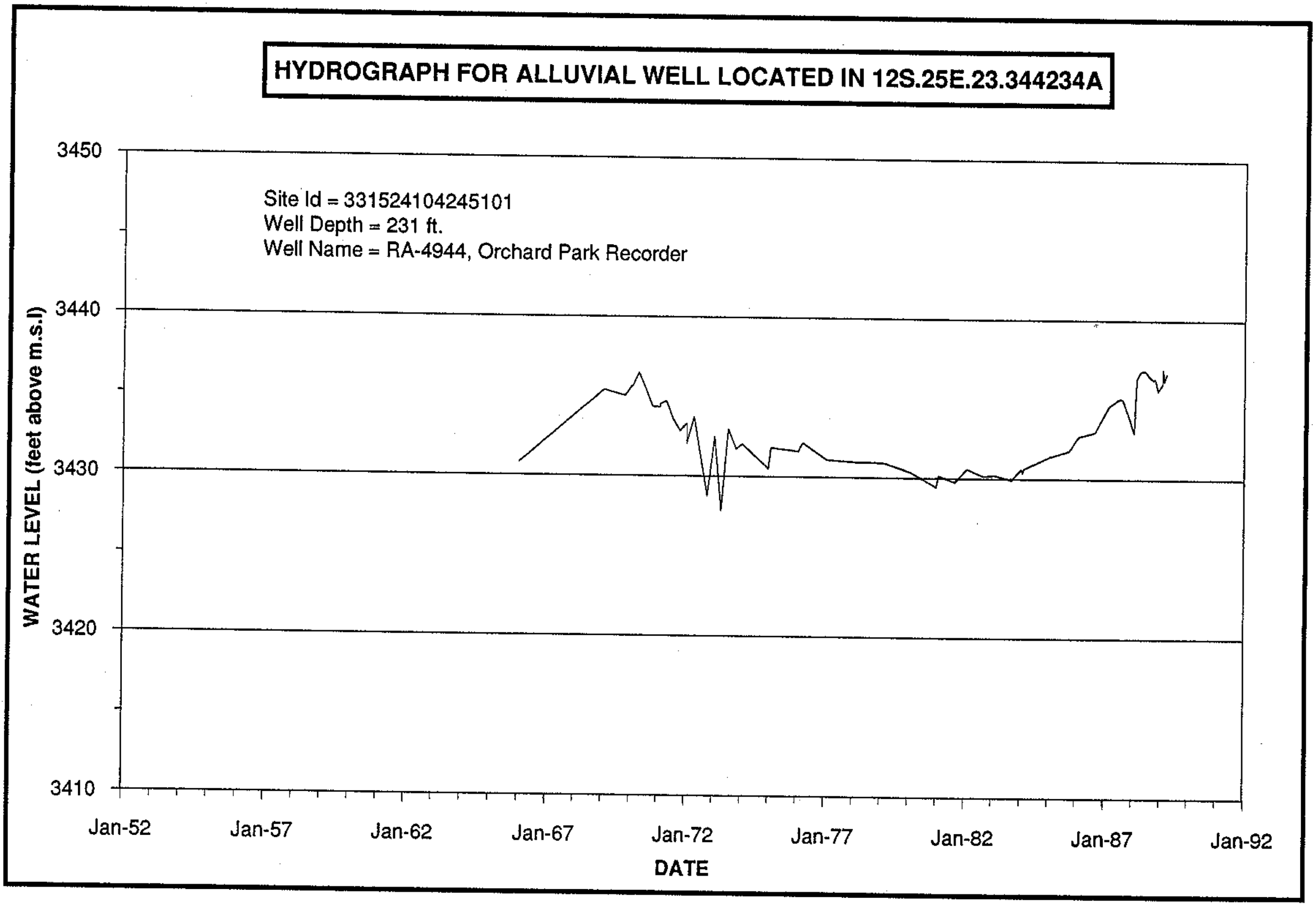

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 13S.25E.34.314224
Site Id = 330838104260701
Well Depth = 136 ft.
Well Name = USGS #267A
Owner = Kerr
WATER LEVEL (feet above m.s.l)
3450
3435
3420
3405
3390
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 13S.25E.27.211144
Site Id = 331002104254701
Well Depth = 923 ft.
Well Name = RA-1744, Greenfield Recorder
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3600
3550
3500
3450
3400
3350
3300
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

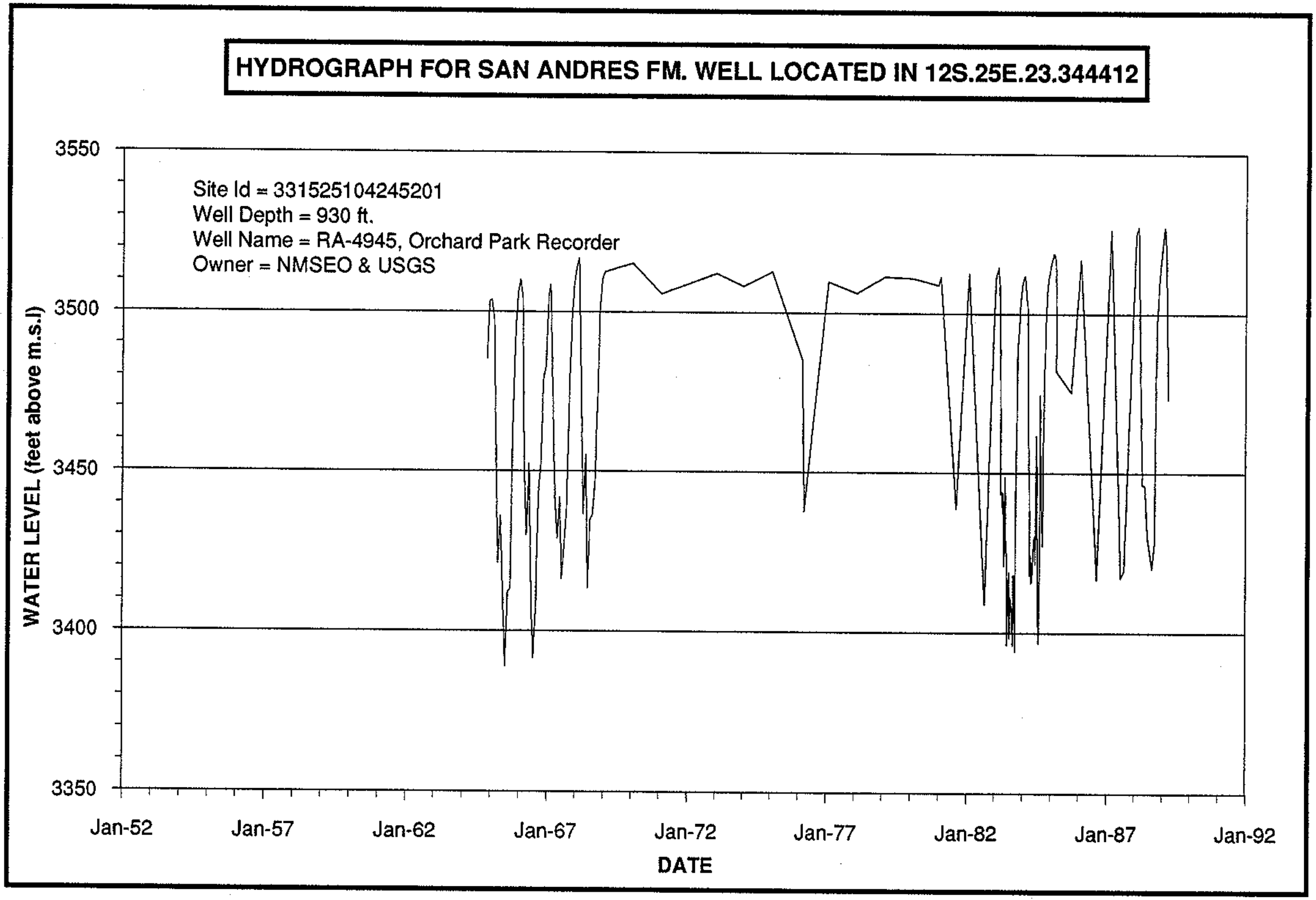

HYDROGRAPH FOR GLORIETA S.S. WELL LOCATED IN 13S.20E.13.222
Site Id = 331149104541801
Well Depth = 386 ft.
Well Name = RA-3502
WATER LEVEL (feet above m.s.l)
4290
4280
4270
4260
4250
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

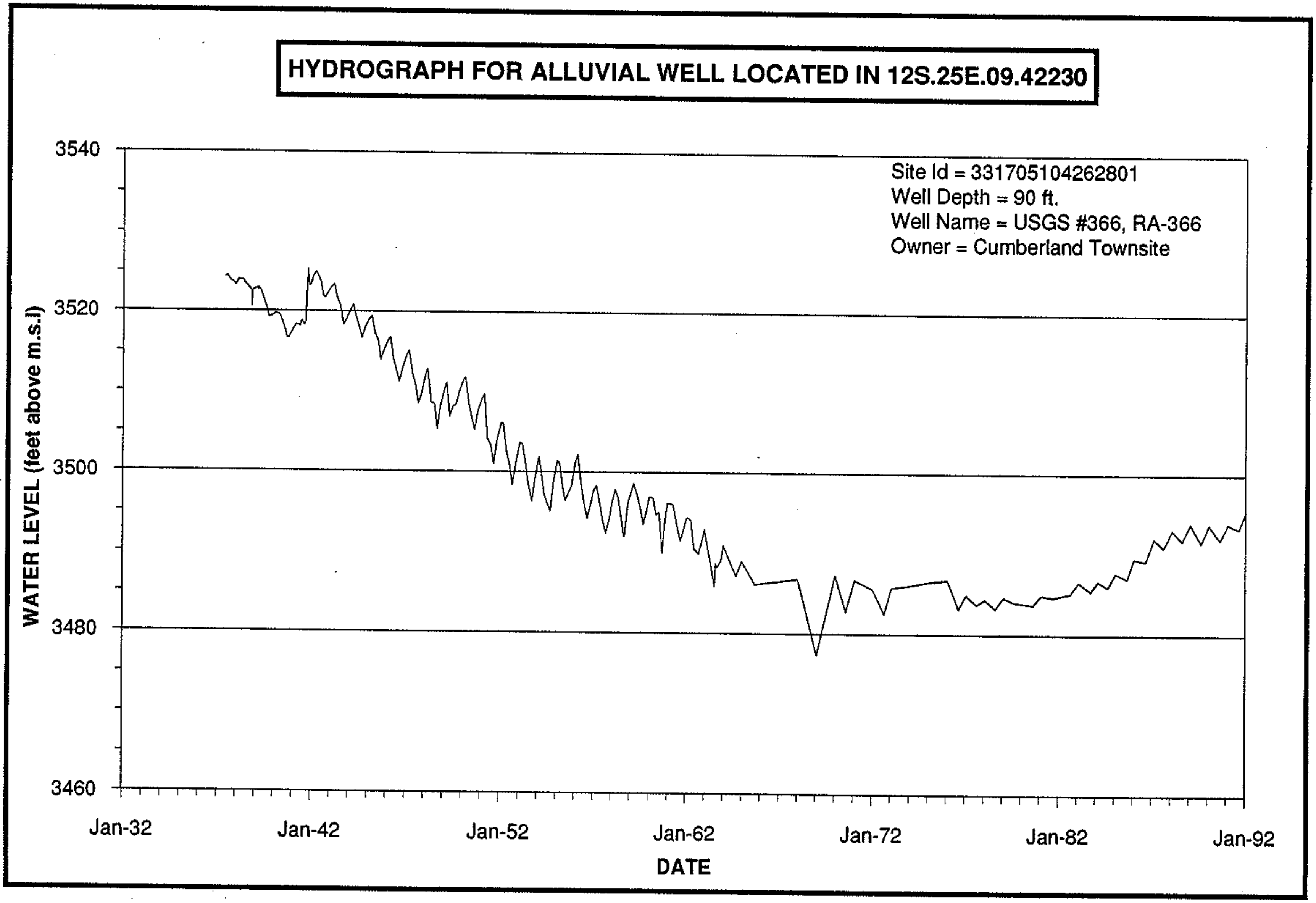

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 12S.26E.18.221113
Site Id = 331703104222901
Well Depth = 68 ft.
Well Name = USGS #642
WATER LEVEL (feet above m.s.l)
3480
3470
3460
3450
3440
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

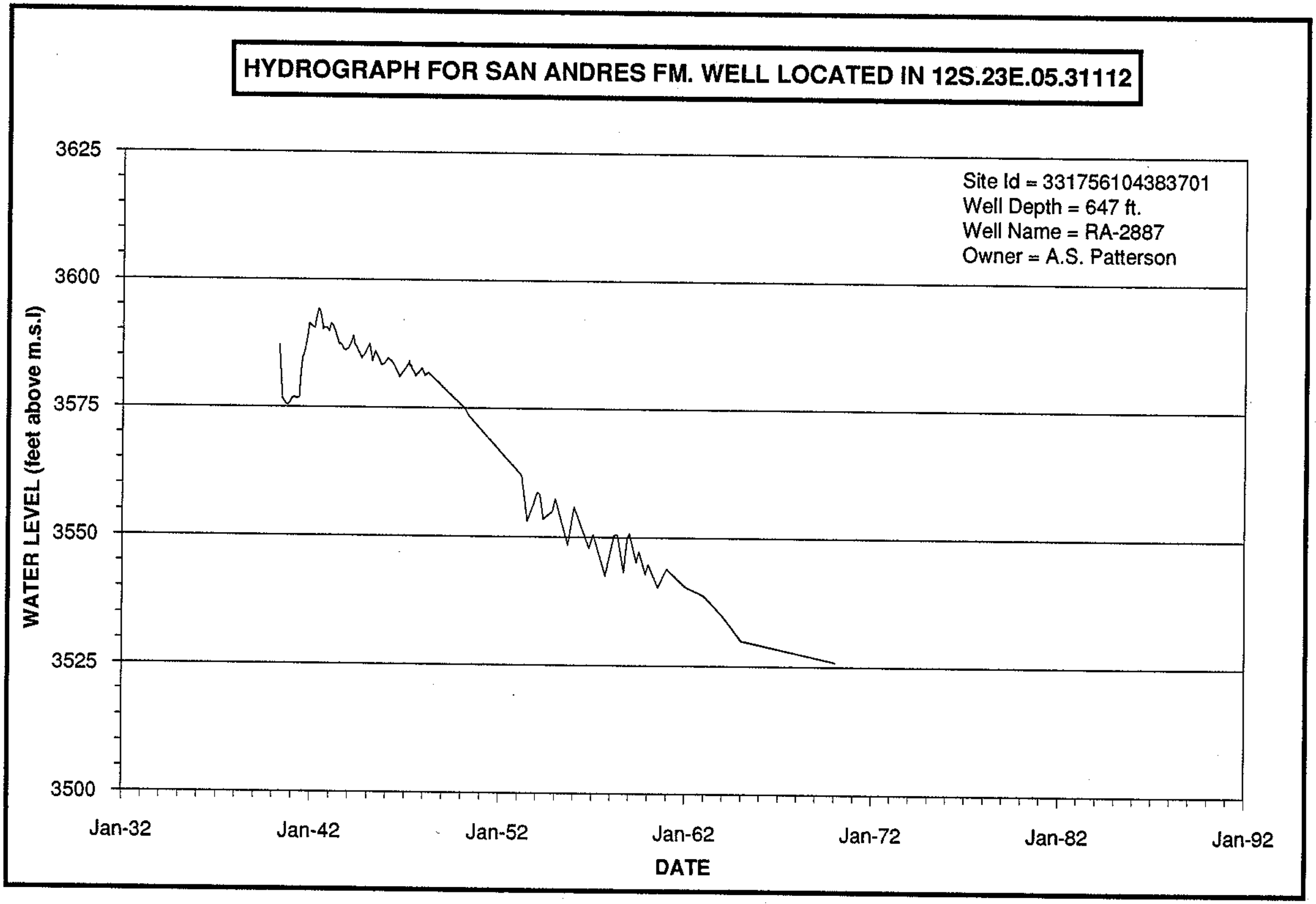

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 12S.26E.05.424312
Site Id = 331812104211801
Well Depth = 24 ft.
Well Name = RA-5816 & USBR-2-73
WATER LEVEL (feet above m.s.l)
3440
3430
3420
3410
3400
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

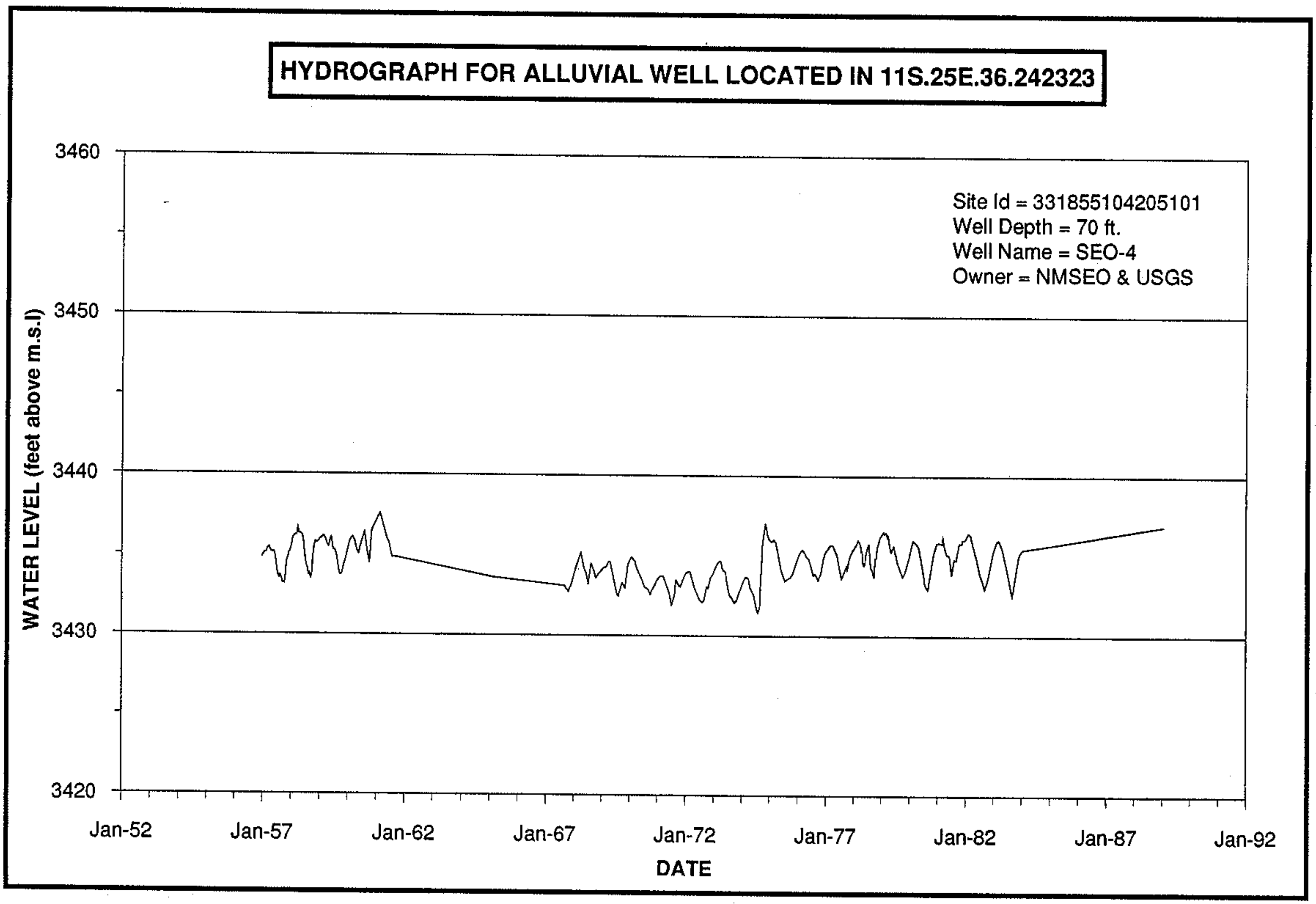


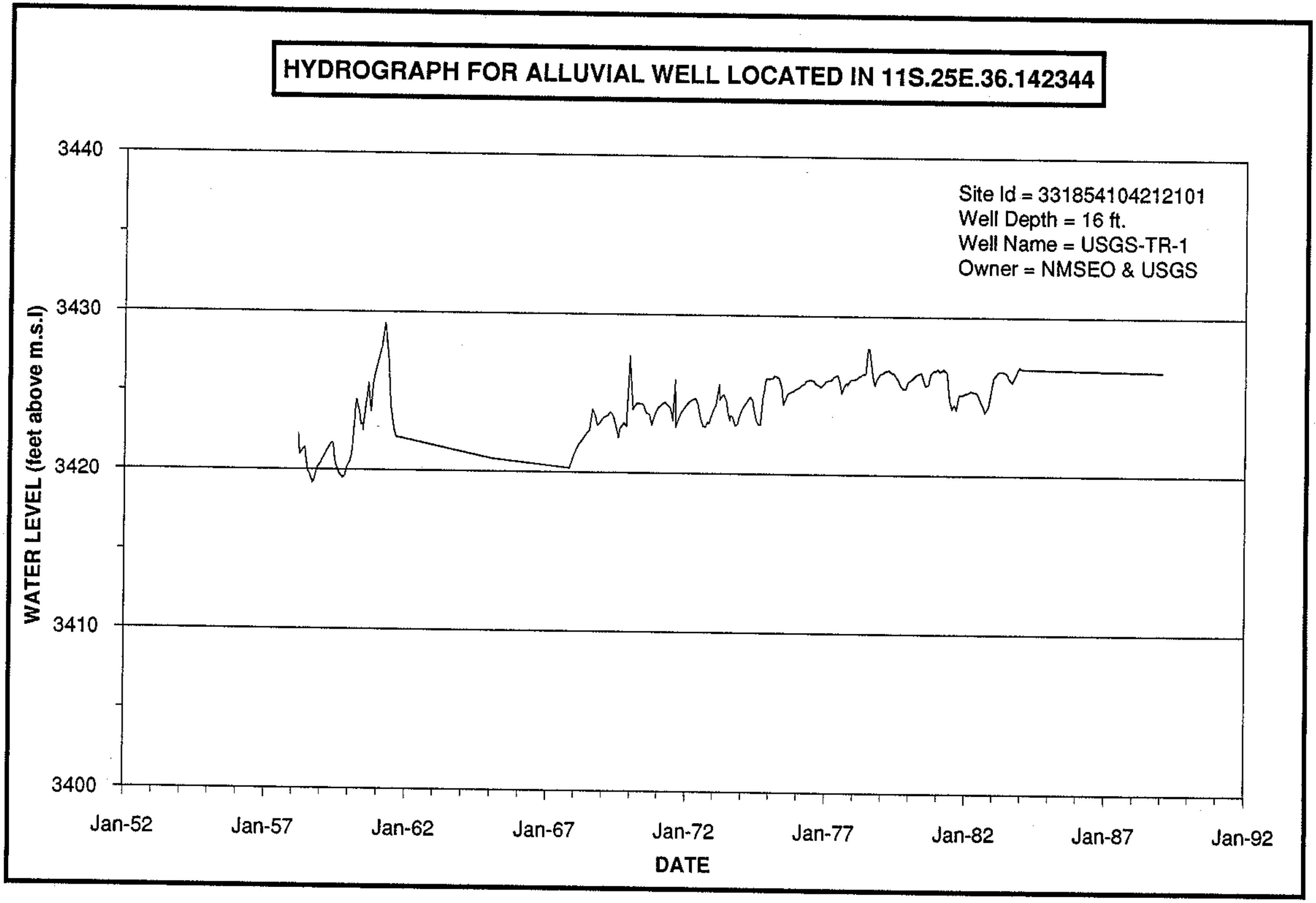
HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 12S.25E.23.344234A
Site Id = 331524104245101
Well Depth = 231 ft.
Well Name = RA-4944, Orchard Park Recorder
WATER LEVEL (feet above m.s.l)
3450
3440
3430
3420
3410
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 12S.25E.23.344412
Site Id = 331525104245201
Well Depth = 930 ft.
Well Name = RA-4945, Orchard Park Recorder
Owner = NMSEO & USGS
WATER LEVEL (feet above m.s.l)
3550
3500
3450
3400
3350
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

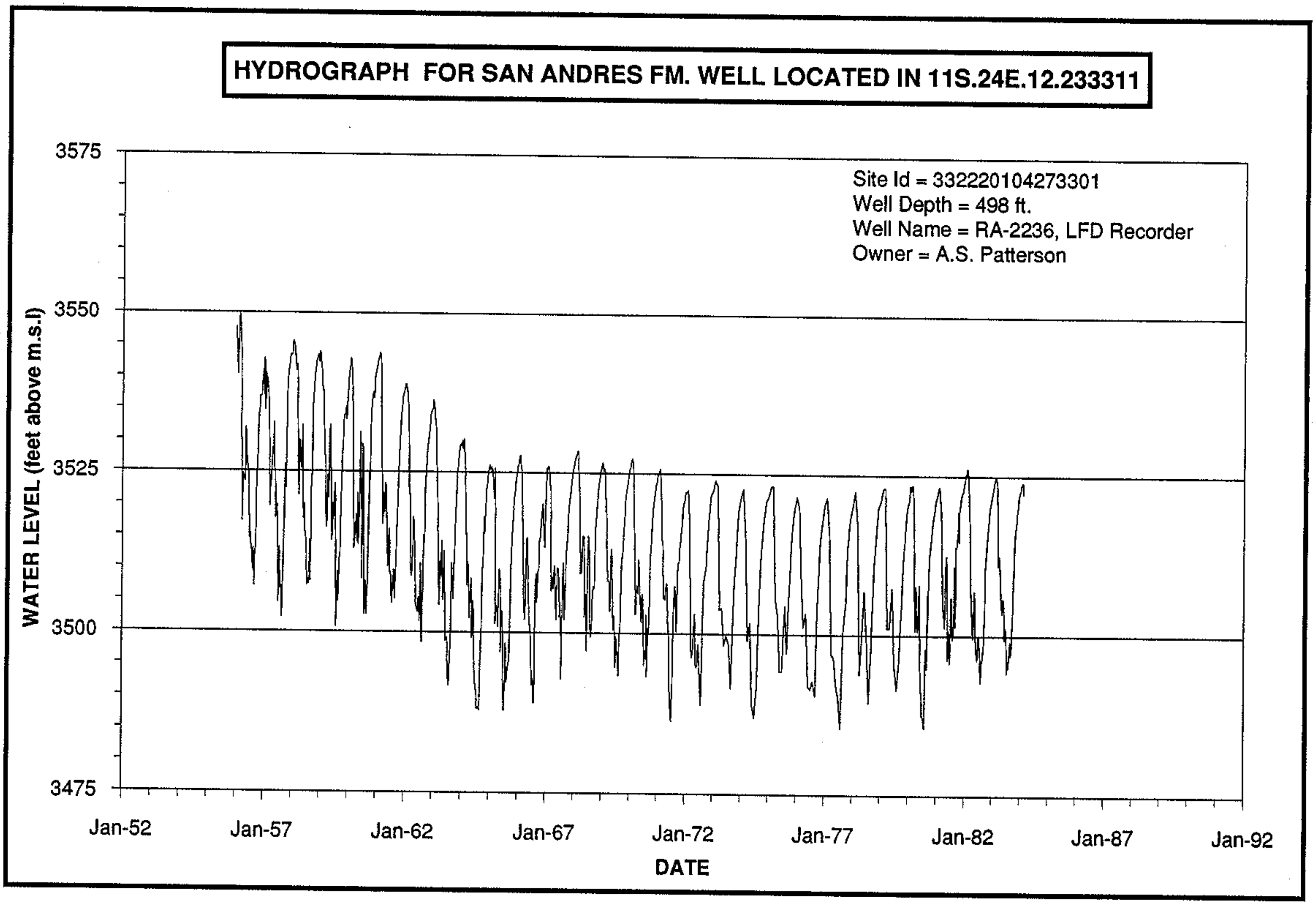

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 12S.25E.09.42230
Site Id = 331705104262801
Well Depth = 90 ft.
Well Name = USGS #366, RA-366
Owner = Cumberland Townsite
WATER LEVEL (feet above m.s.l)
3540
3520
3500
3480
3460
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

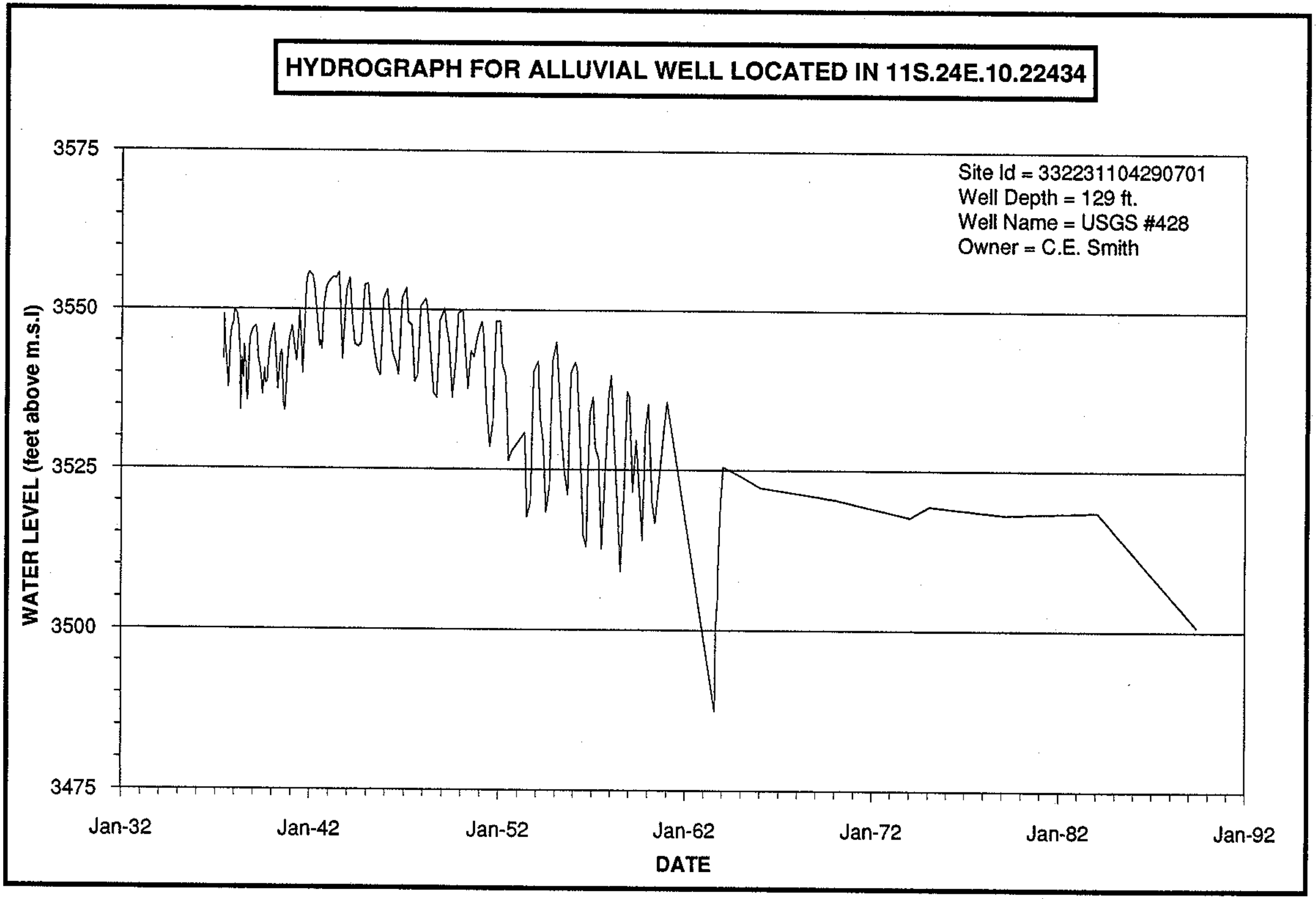

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 12S.23E.05.31112
Site Id = 331756104383701
Well Depth = 647 ft.
Well Name = RA-2887
Owner = A.S. Patterson
WATER LEVEL (feet above m.s.l)
3625
3600
3575
3550
3525
3500
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

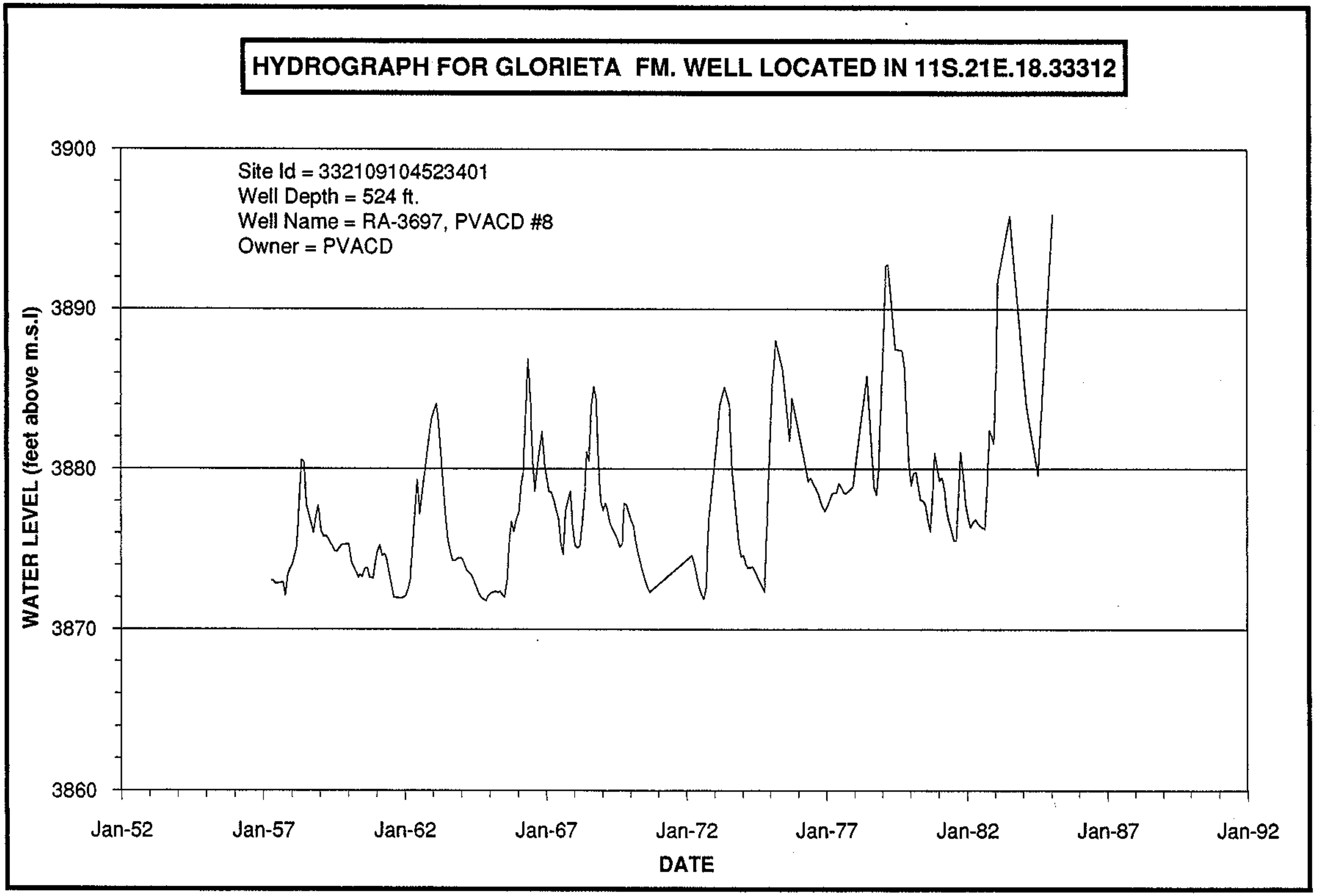

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 11S.25E.36.242323
Site Id = 331855104205101
Well Depth = 70 ft.
Well Name = SEO-4
Owner = NMSEO & USGS
WATER LEVEL (feet above m.s.l)
3460
3450
3440
3430
3420
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

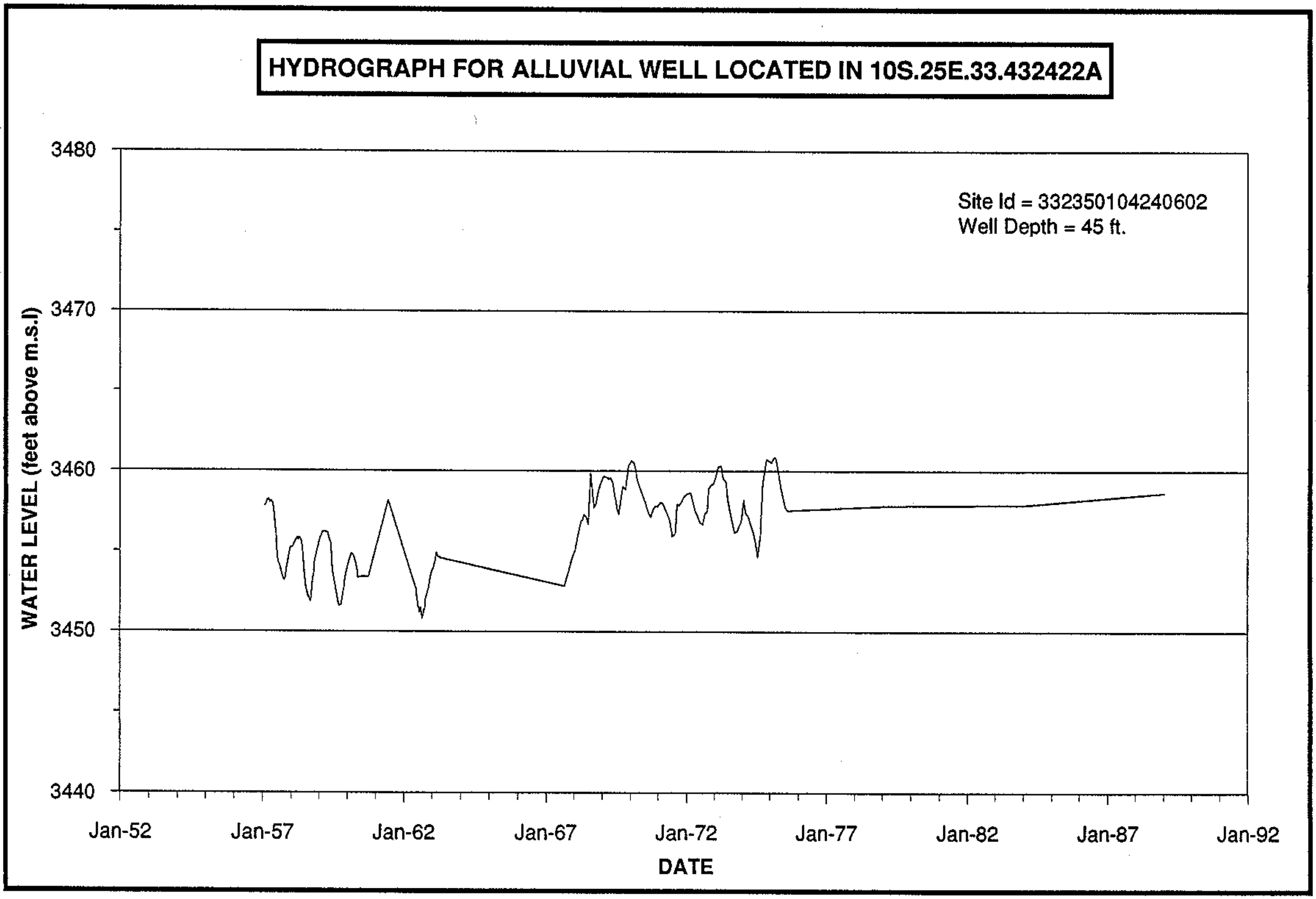


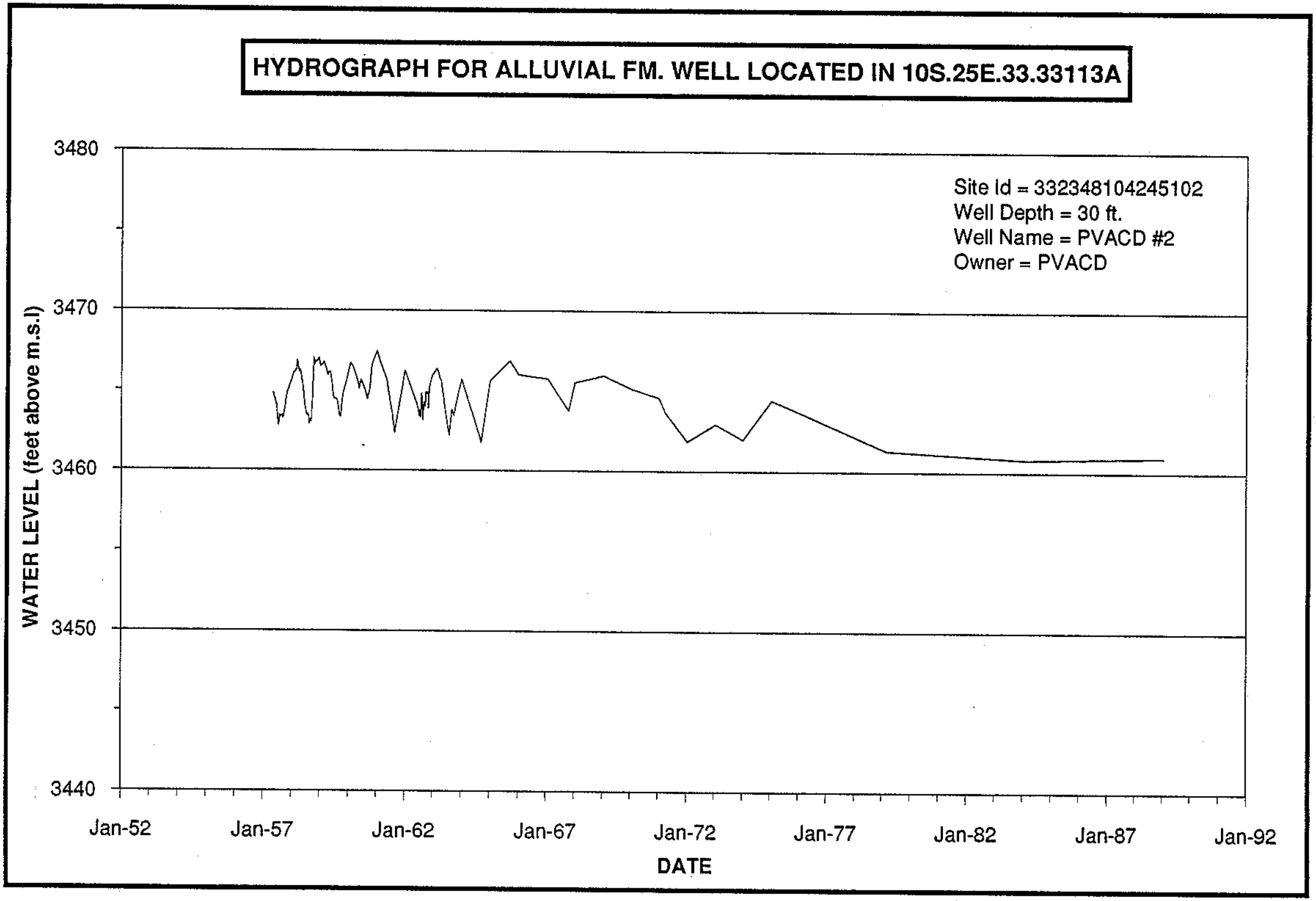
HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 11S.25E.36.142344
Site Id = 331854104212101
Well Depth = 16 ft.
Well Name = USGS-TR-1
Owner = NMSEO & USGS
WATER LEVEL (feet above m.s.l)
3440
3430
3420
3410
3400
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

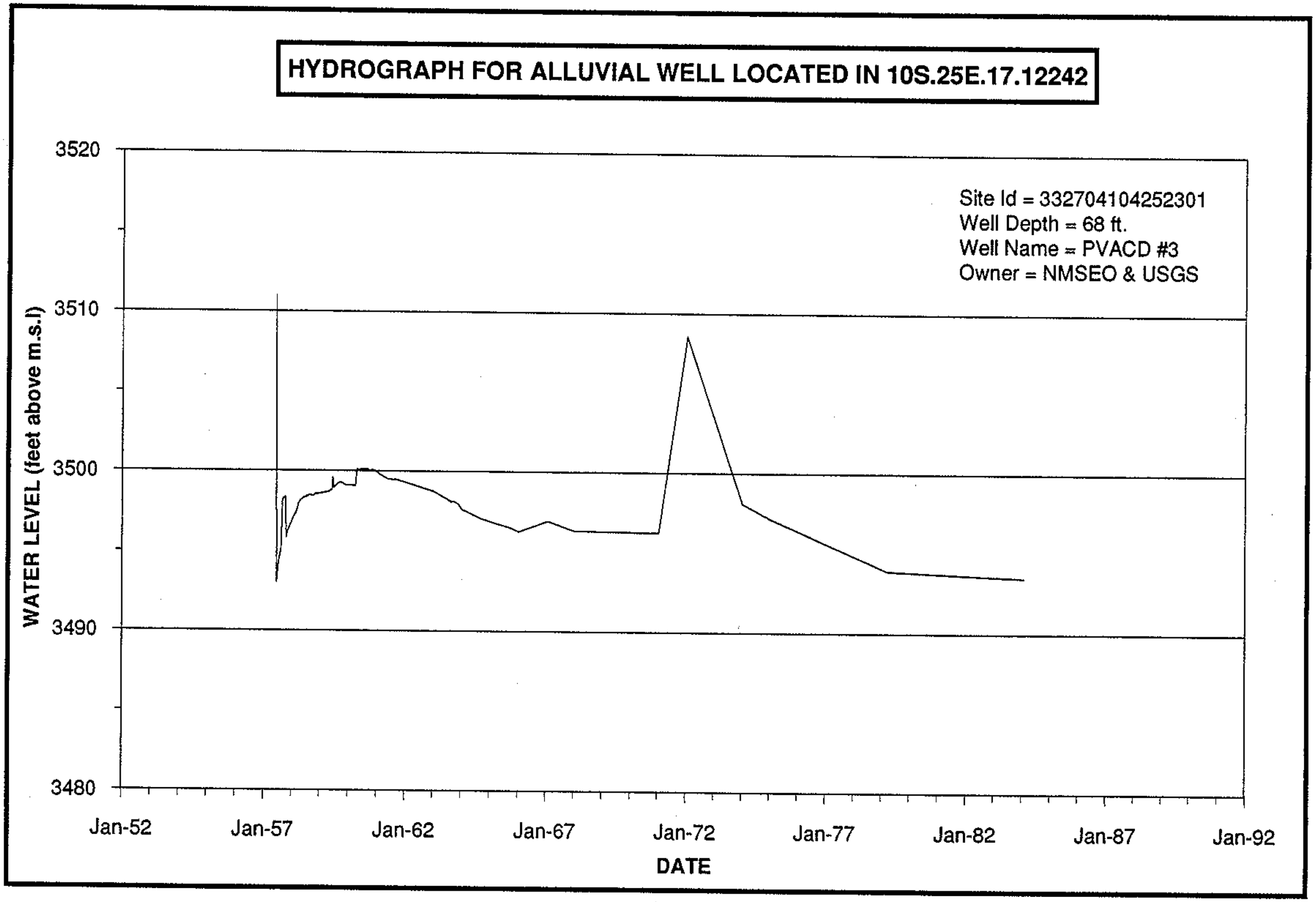

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 11S.24E.12.233311
Site Id = 332220104273301
Well Depth = 498 ft.
Well Name = RA-2236, LFD Recorder
Owner = A.S. Patterson
WATER LEVEL (feet above m.s.l)
3575
3550
3525
3500
3475
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

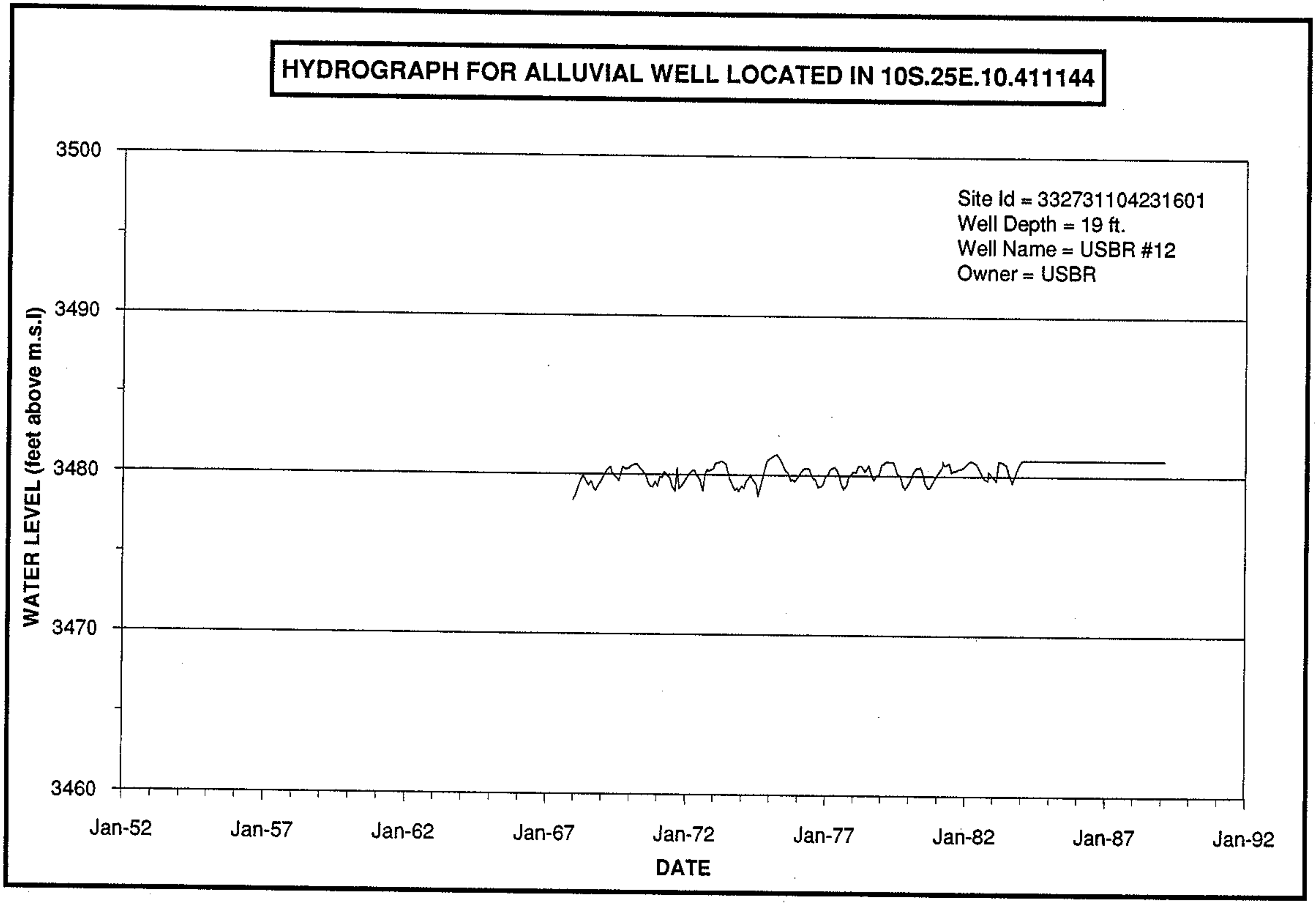

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 11S.24E.10.22434
Site Id = 332231104290701
Well Depth = 129 ft.
Well Name = USGS #428
Owner = C.E. Smith
WATER LEVEL (feet above m.s.l)
3575
3550
3525
3500
3475
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

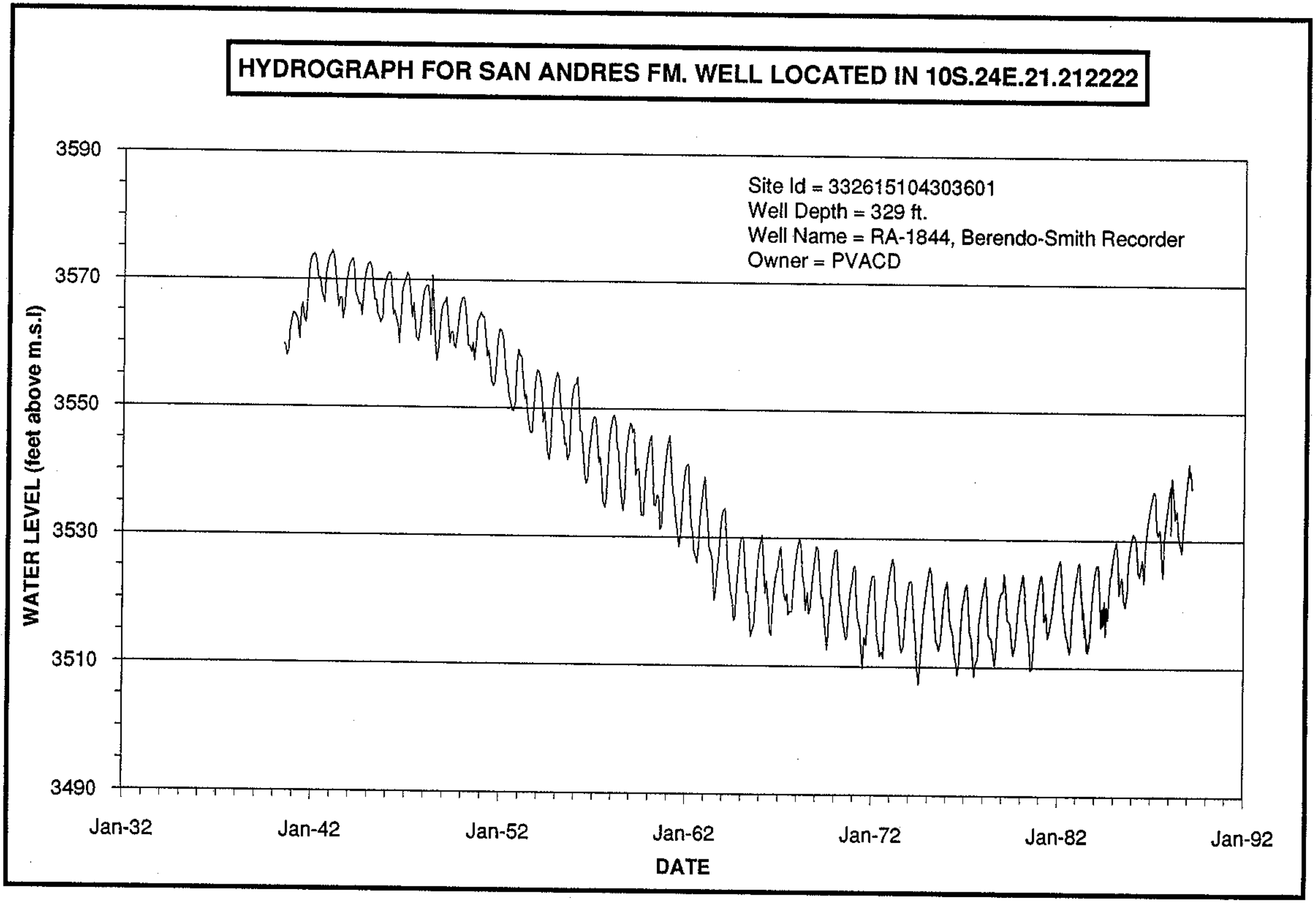

HYDROGRAPH FOR GLORIETA FM. WELL LOCATED IN 11S.21E.18.33312
Site Id = 332109104523401
Well Depth = 524 ft.
Well Name = RA-3697, PVACD #8
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3900
3890
3880
3870
3860
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

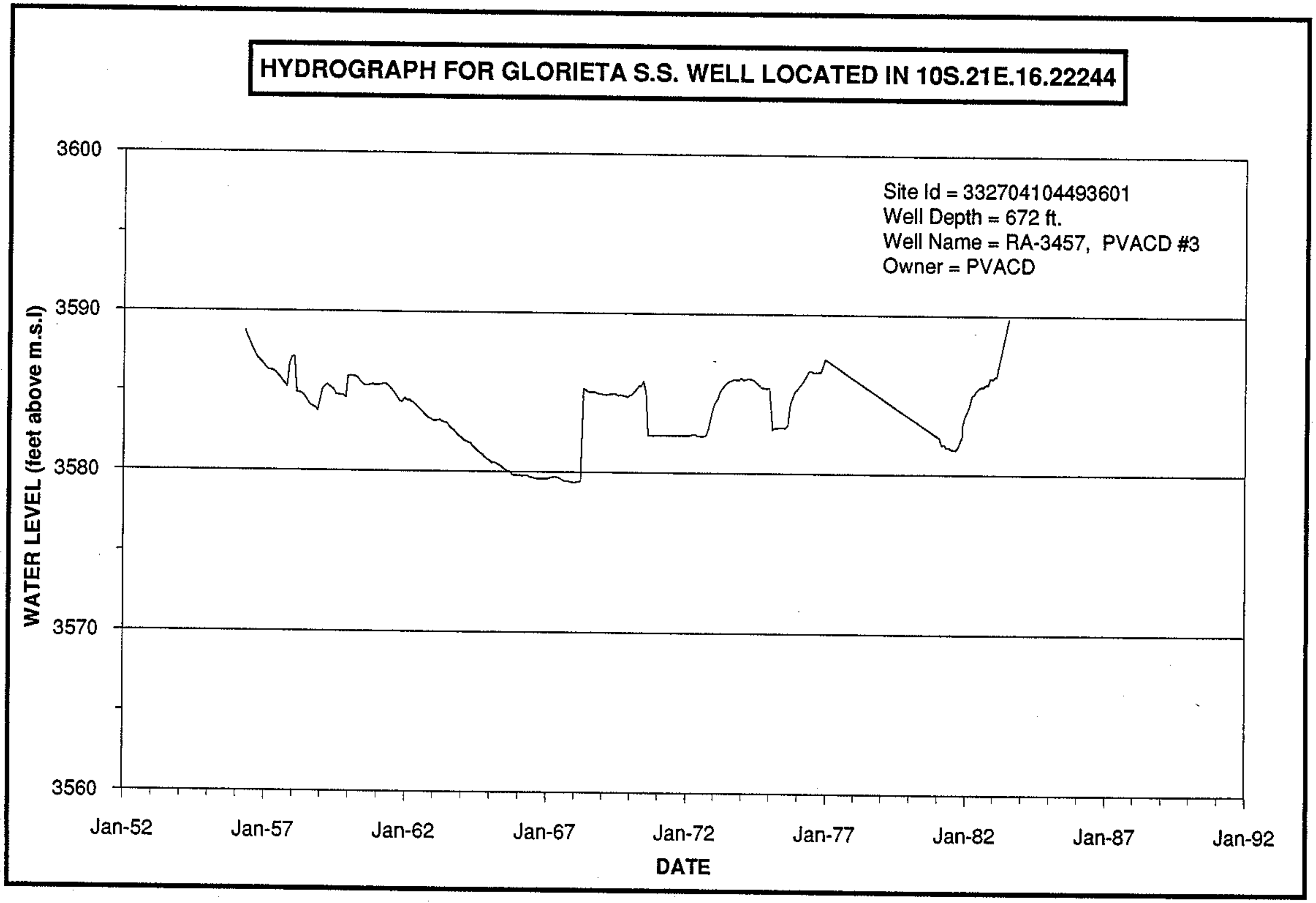

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 10S.25E.33.432422A
Site Id = 332350104240602
Well Depth = 45 ft.
WATER LEVEL (feet above m.s.l)
3480
3470
3460
3450
3440
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

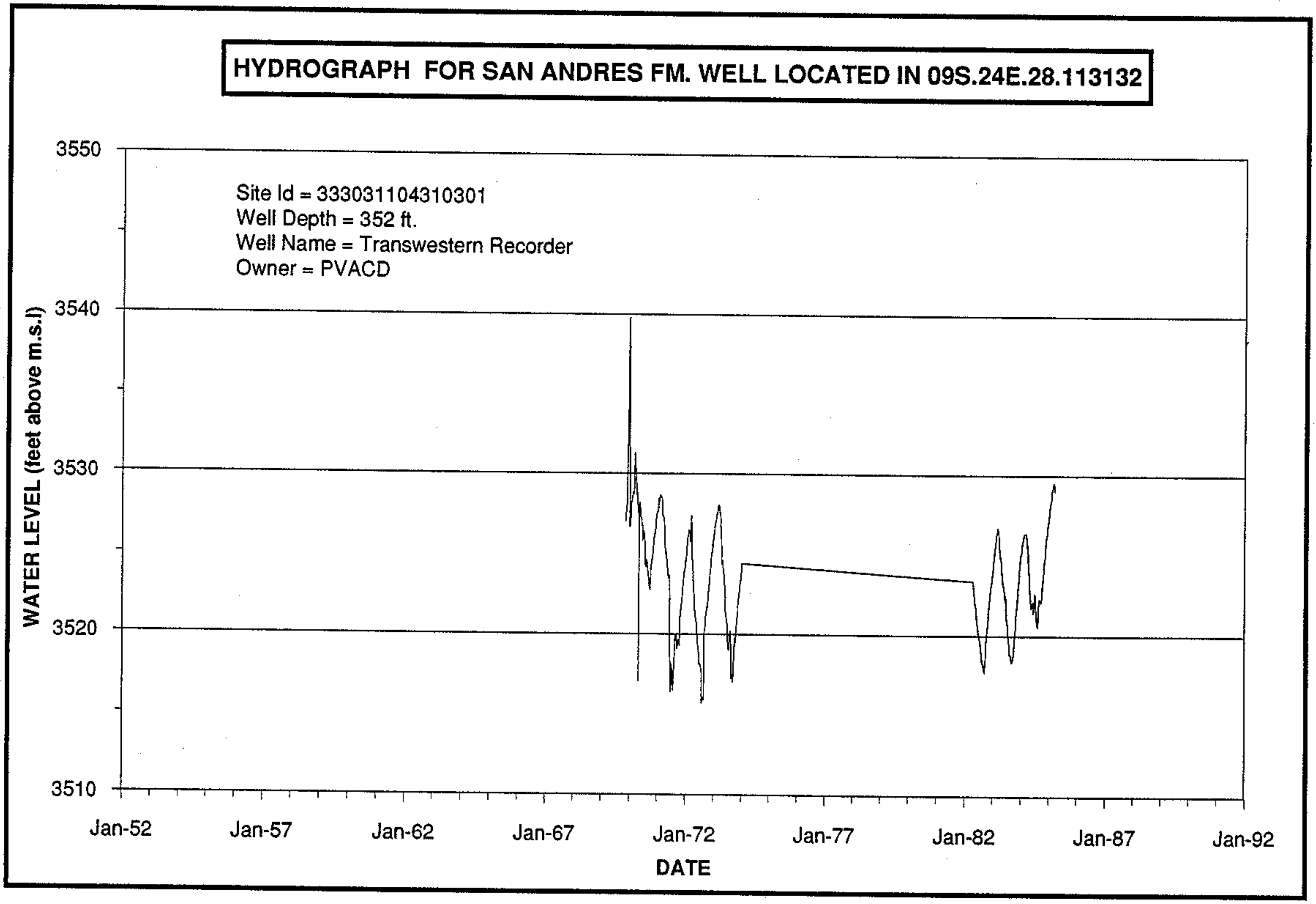

HYDROGRAPH FOR ALLUVIAL FM. WELL LOCATED IN 10S.25E.33.33113A
Site Id = 332348104245102
Well Depth = 30 ft.
Well Name = PVACD #2
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3480
3470
3460
3450
3440
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

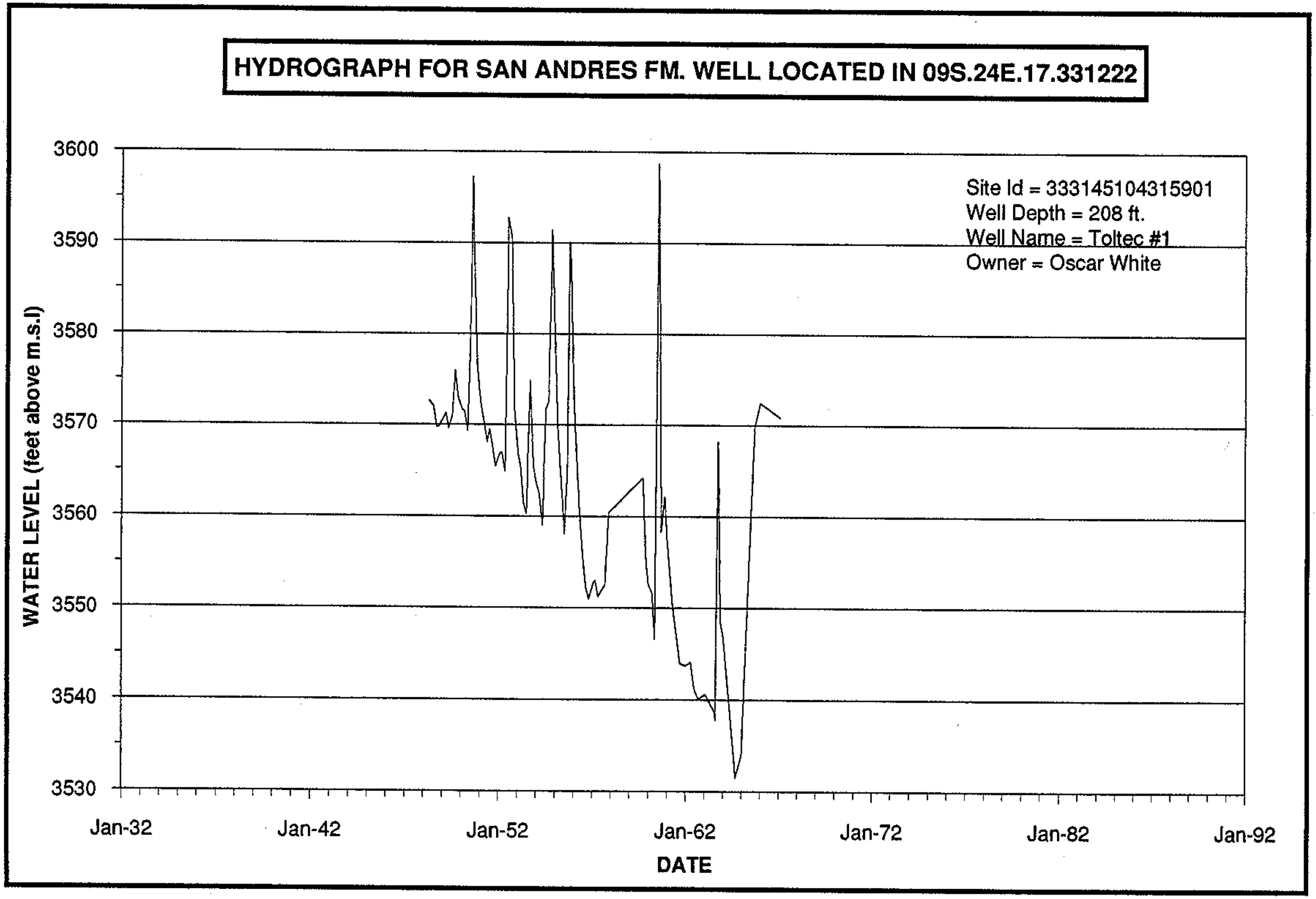

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 10S.25E.17.12242
Site Id = 332704104252301
Well Depth = 68 ft.
Well Name = PVACD #3
Owner = NMSEO & USGS
WATER LEVEL (feet above m.s.l)
3520
3510
3500
3490
3480
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

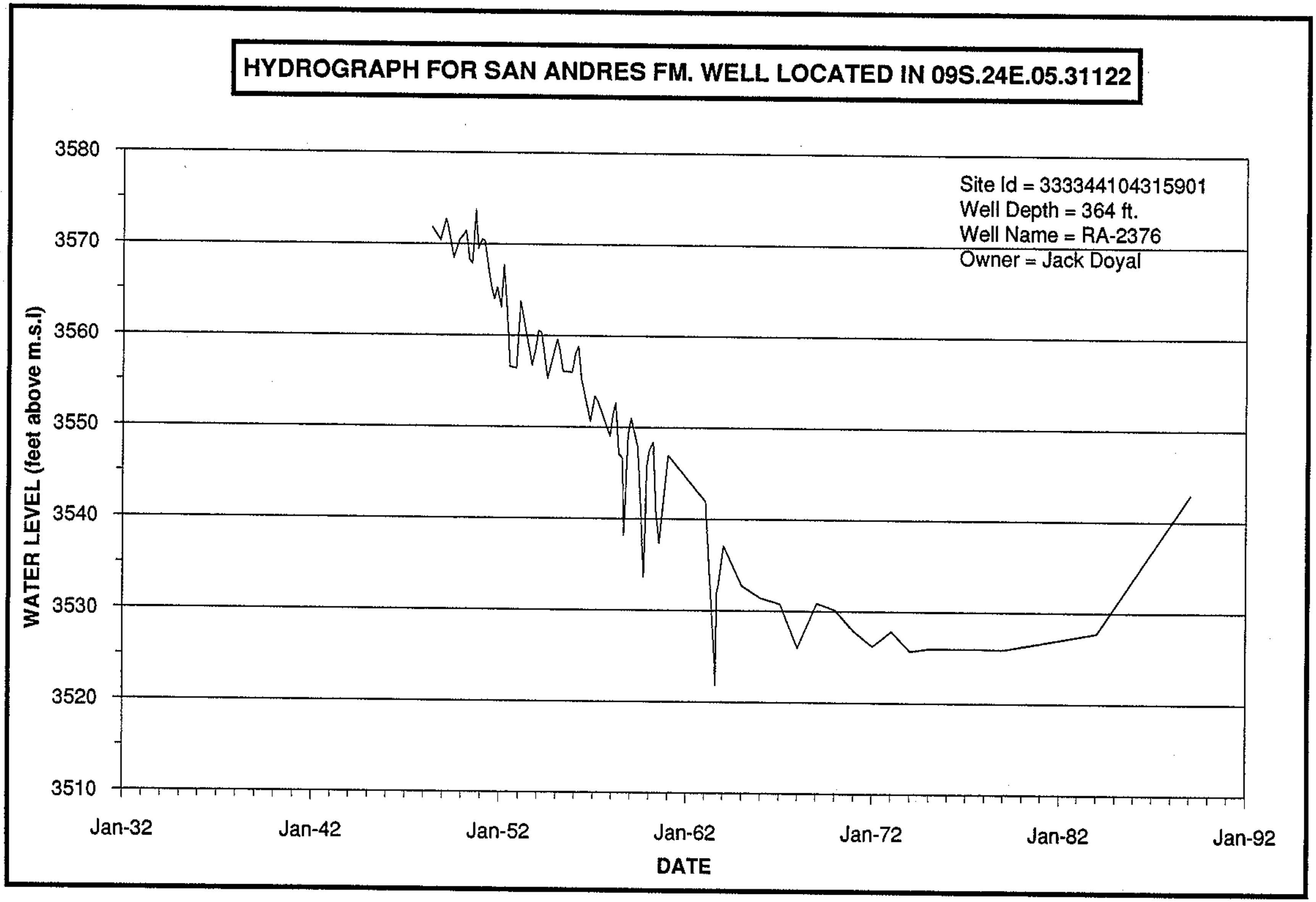

HYDROGRAPH FOR ALLUVIAL WELL LOCATED IN 10S.25E.10.411144
Site Id = 332731104231601
Well Depth = 19 ft.
Well Name = USBR #12
Owner = USBR
WATER LEVEL (feet above m.s.l)
3500
3490
3480
3470
3460
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

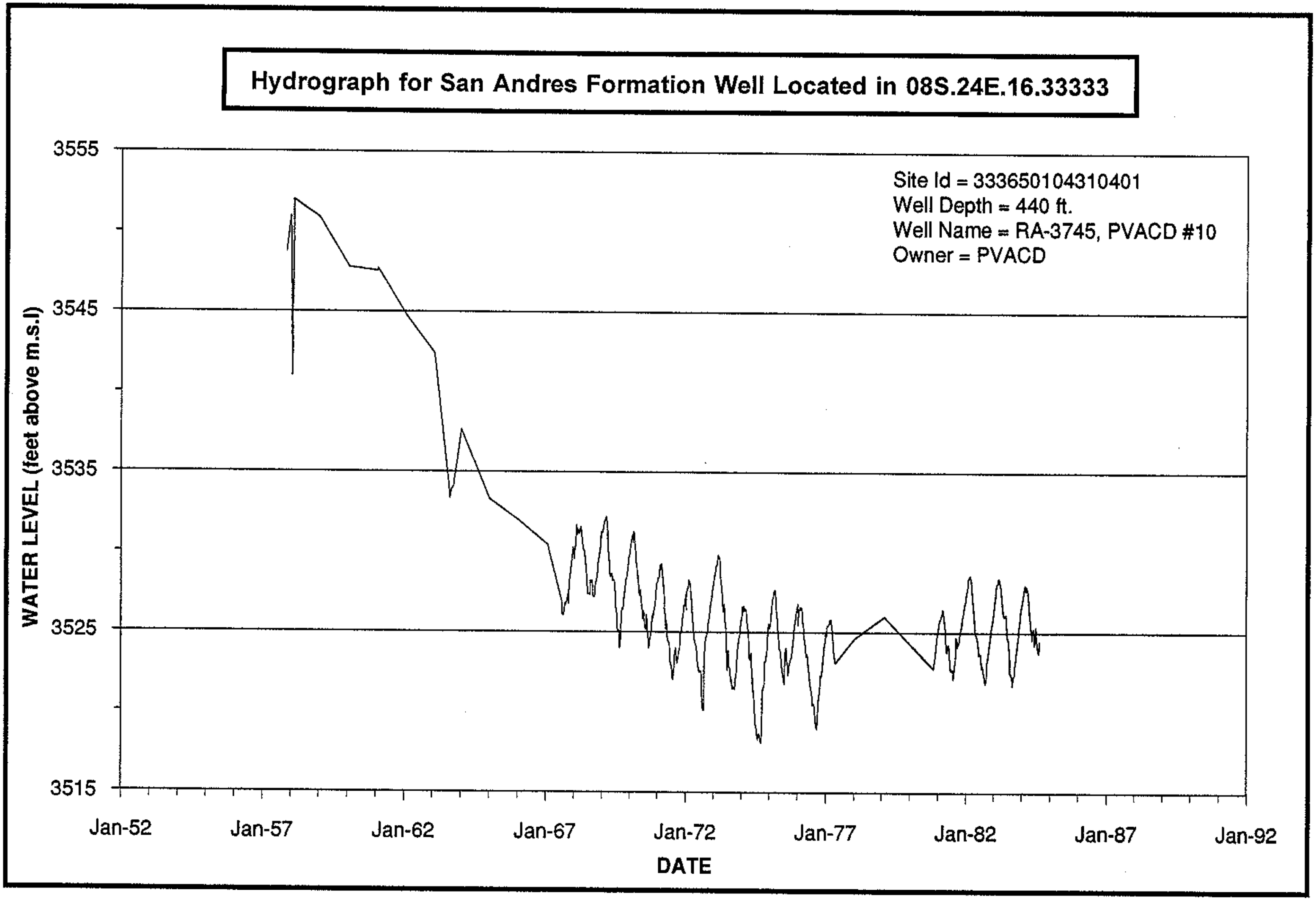

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 10S.24E.21.212222
Site Id = 332615104303601
Well Depth = 329 ft.
Well Name = RA-1844, Berendo-Smith Recorder
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3590
3570
3550
3530
3510
3490
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

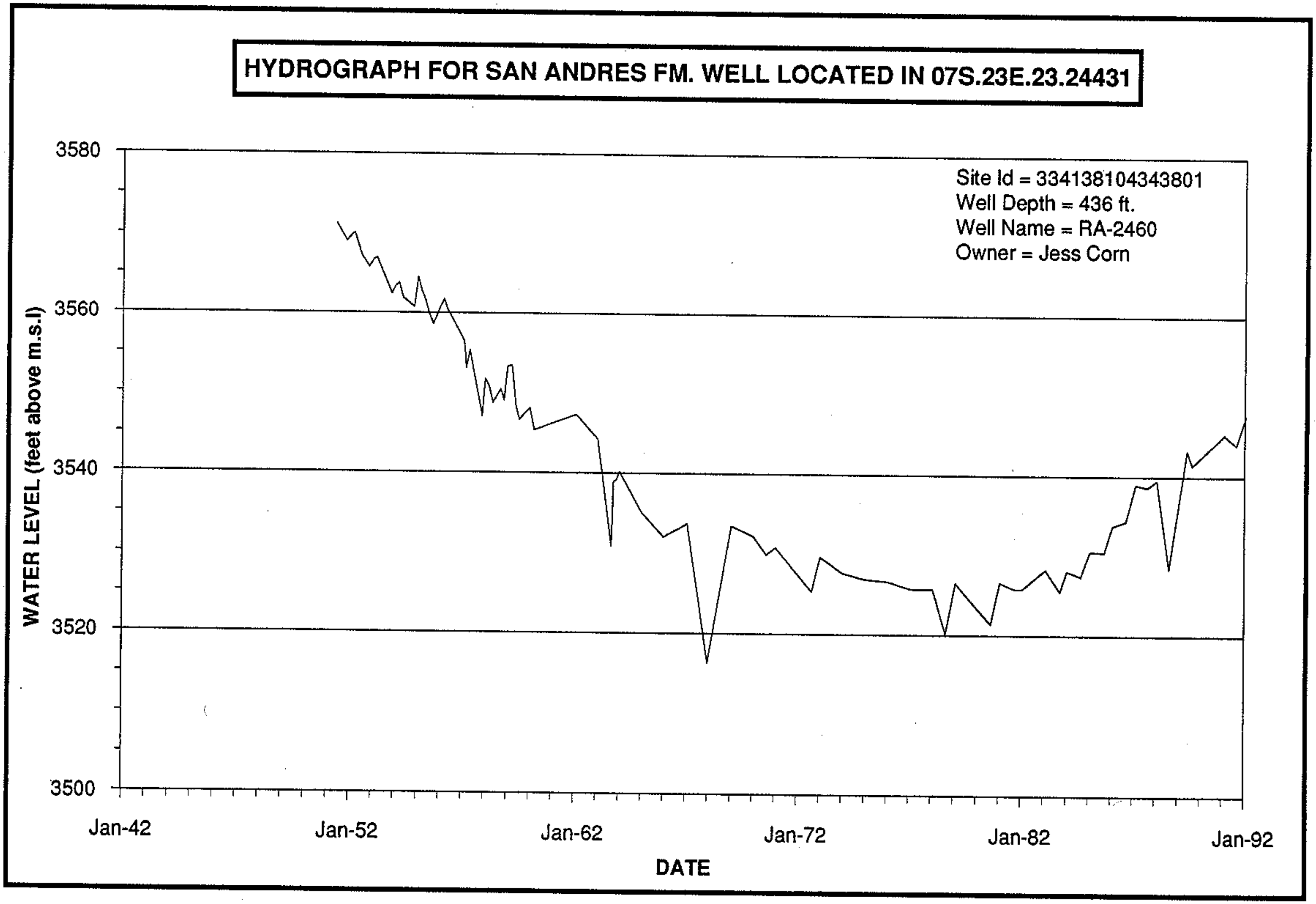

HYDROGRAPH FOR GLORIETA S.S. WELL LOCATED IN 10S.21E.16.22244
Site Id = 332704104493601
Well Depth = 672 ft.
Well Name = RA-3457, PVACD #3
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3600
3590
3580
3570
3560
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

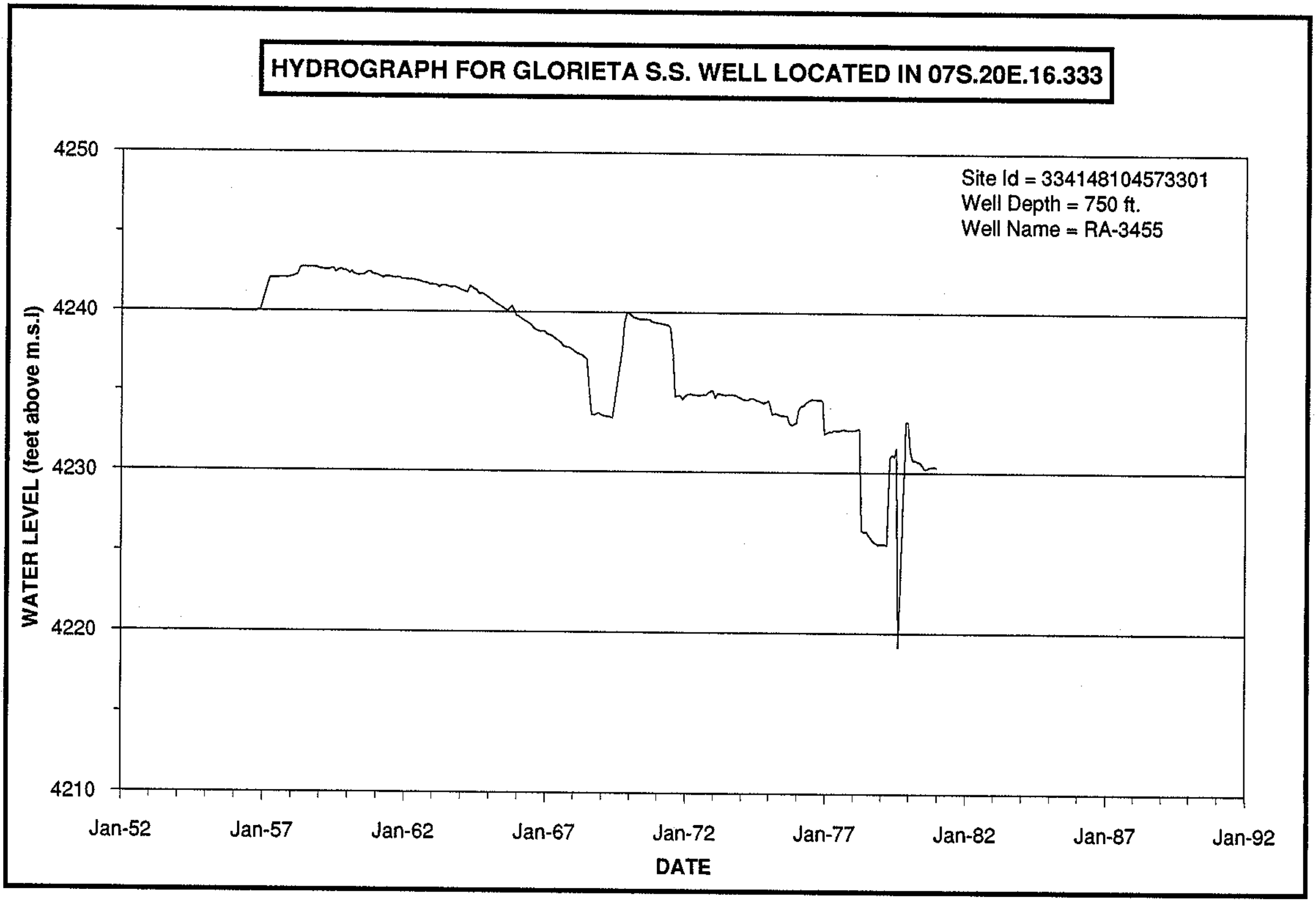

HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 09S.24E.28.113132
Site Id = 333031104310301
Well Depth = 352 ft.
Well Name = Transwestern Recorder
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3550
3540
3530
3520
3510
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 09S.24E.17.331222
Site Id = 333145104315901
Well Depth = 208 ft.
Well Name = Toltec #1
Owner = Oscar White
WATER LEVEL (feet above m.s.l)
3600
3590
3580
3570
3560
3550
3540
3530
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 09S.24E.05.31122
Site Id = 333344104315901
Well Depth = 364 ft.
Well Name = RA-2376
Owner = Jack Doyal
WATER LEVEL (feet above m.s.l)
3580
3570
3560
3550
3540
3530
3520
3510
Jan-32
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE


Hydrograph for San Andres Formation Well Located in 08S.24E.16.33333
Site Id = 333650104310401
Well Depth = 440 ft.
Well Name = RA-3745, PVACD #10
Owner = PVACD
WATER LEVEL (feet above m.s.l)
3555
3545
3535
3525
3515
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE


HYDROGRAPH FOR SAN ANDRES FM. WELL LOCATED IN 07S.23E.23.24431
Site Id = 334138104343801
Well Depth = 436 ft.
Well Name = RA-2460
Owner = Jess Corn
WATER LEVEL (feet above m.s.l)
3580
3560
3540
3520
3500
Jan-42
Jan-52
Jan-62
Jan-72
Jan-82
Jan-92
DATE

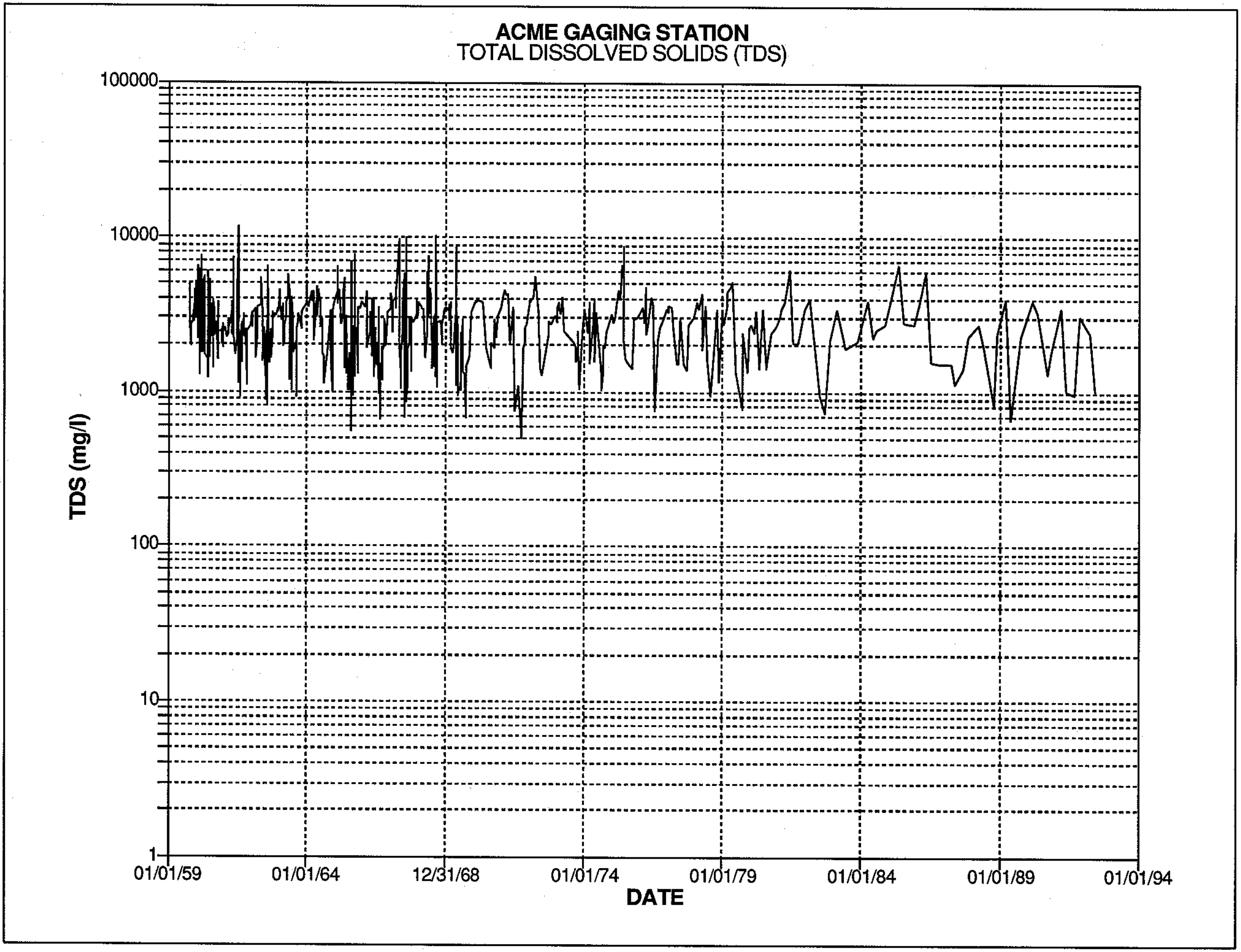

HYDROGRAPH FOR GLORIETA S.S. WELL LOCATED IN 07S.20E.16.333
Site Id = 334148104573301
Well Depth = 750 ft.
Well Name = RA-3455
WATER LEVEL (feet above m.s.l.)
4250
4240
4230
4220
4210
Jan-52
Jan-57
Jan-62
Jan-67
Jan-72
Jan-77
Jan-82
Jan-87
Jan-92
DATE

APPENDIX E

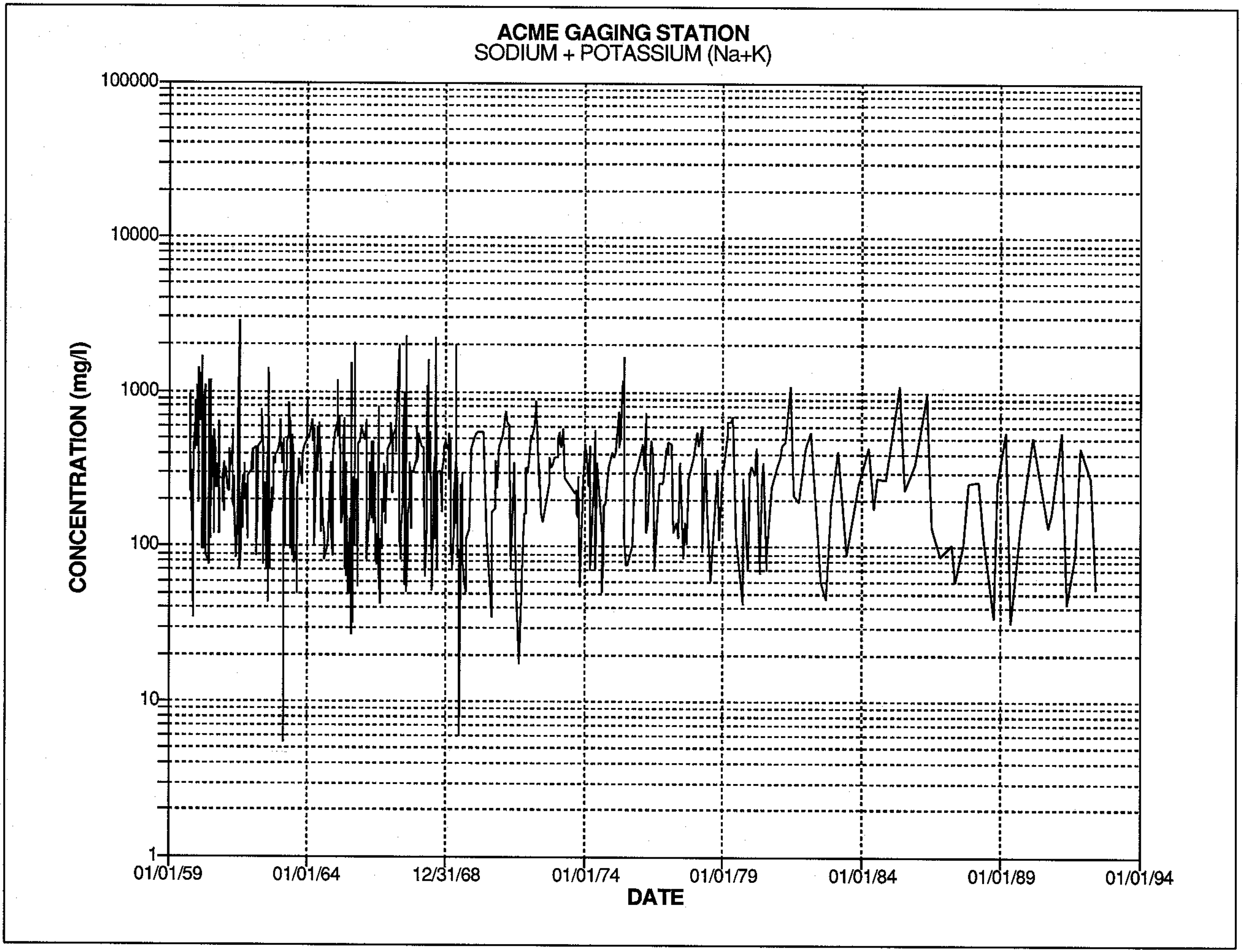
WATER CHEMISTRY DATA

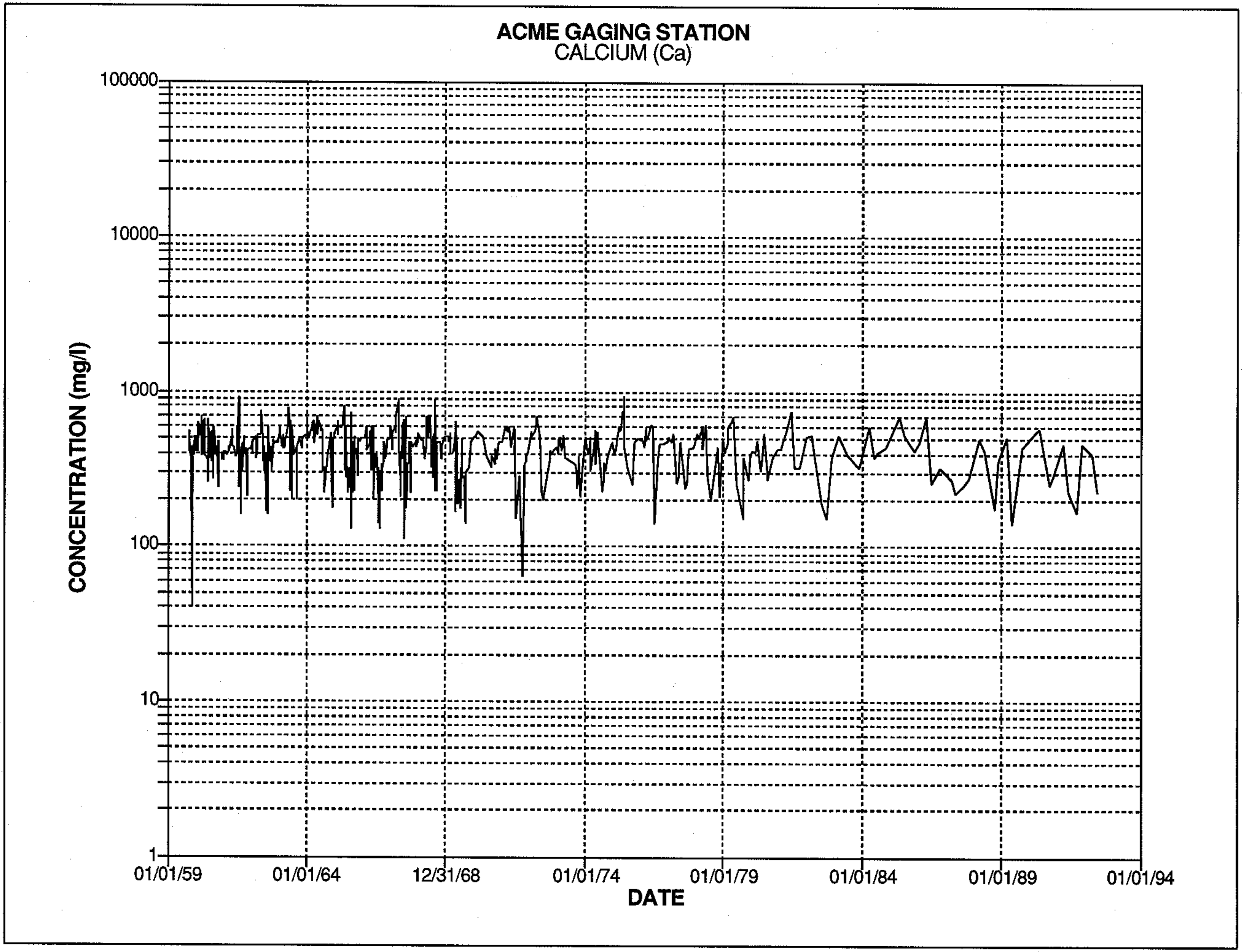
Appendix E, Part 1

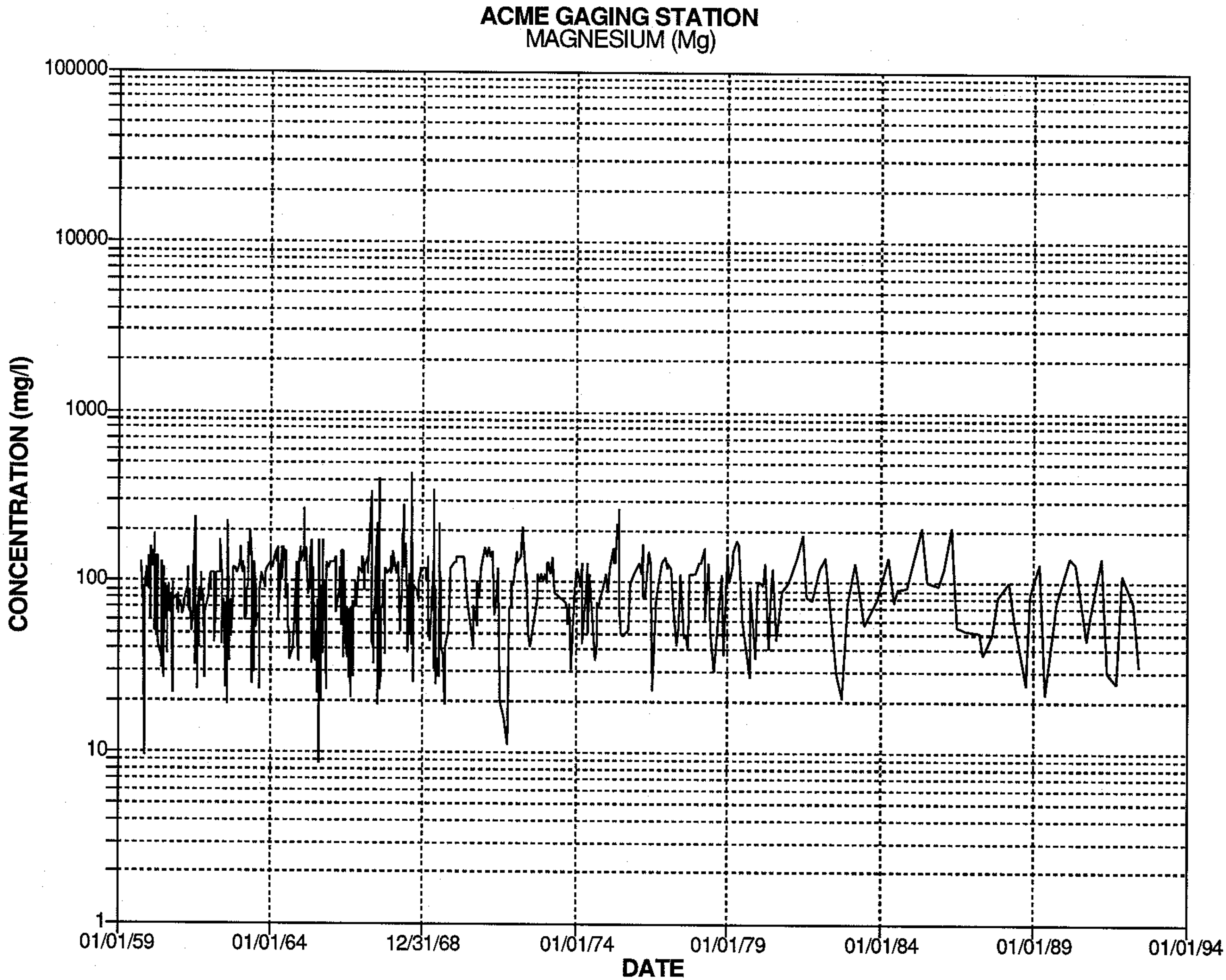
Time Series Plots of Surface-Water Quality for Selected Stations in the Roswell Basin

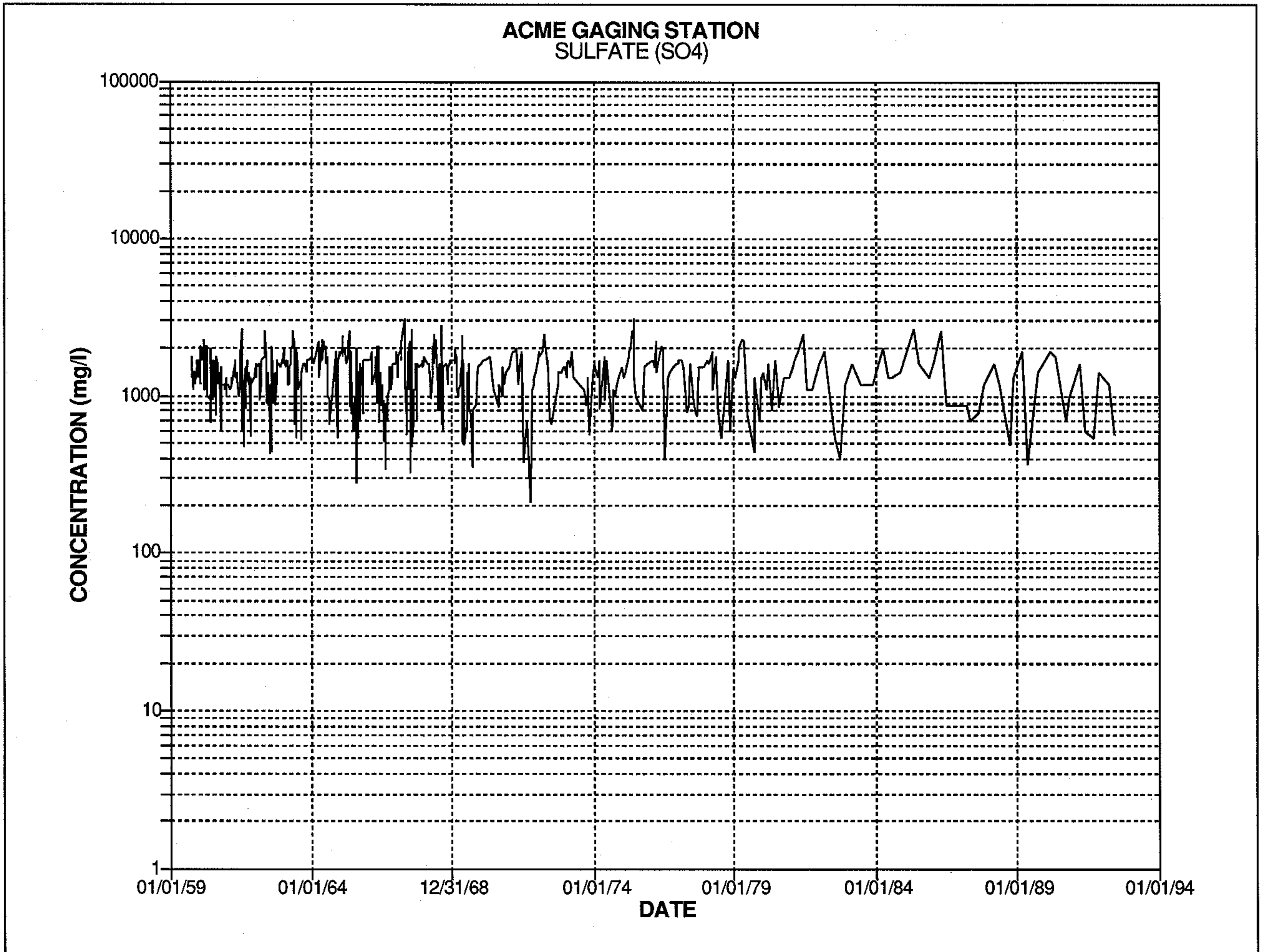


ACME GAGING STATION
TOTAL DISSOLVED SOLIDS (TDS)
TDS (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

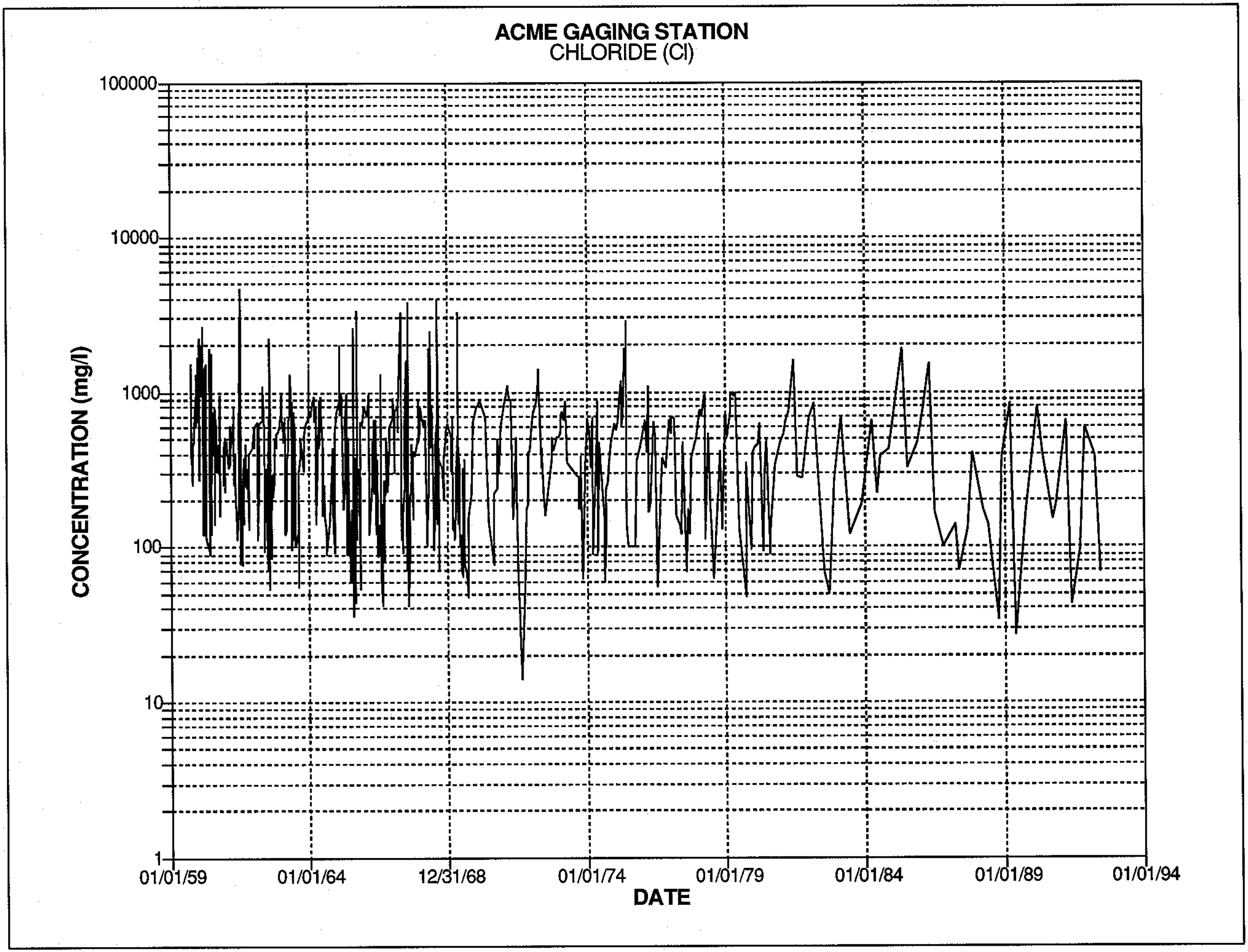

ACME GAGING STATION
SODIUM + POTASSIUM (Na+K)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

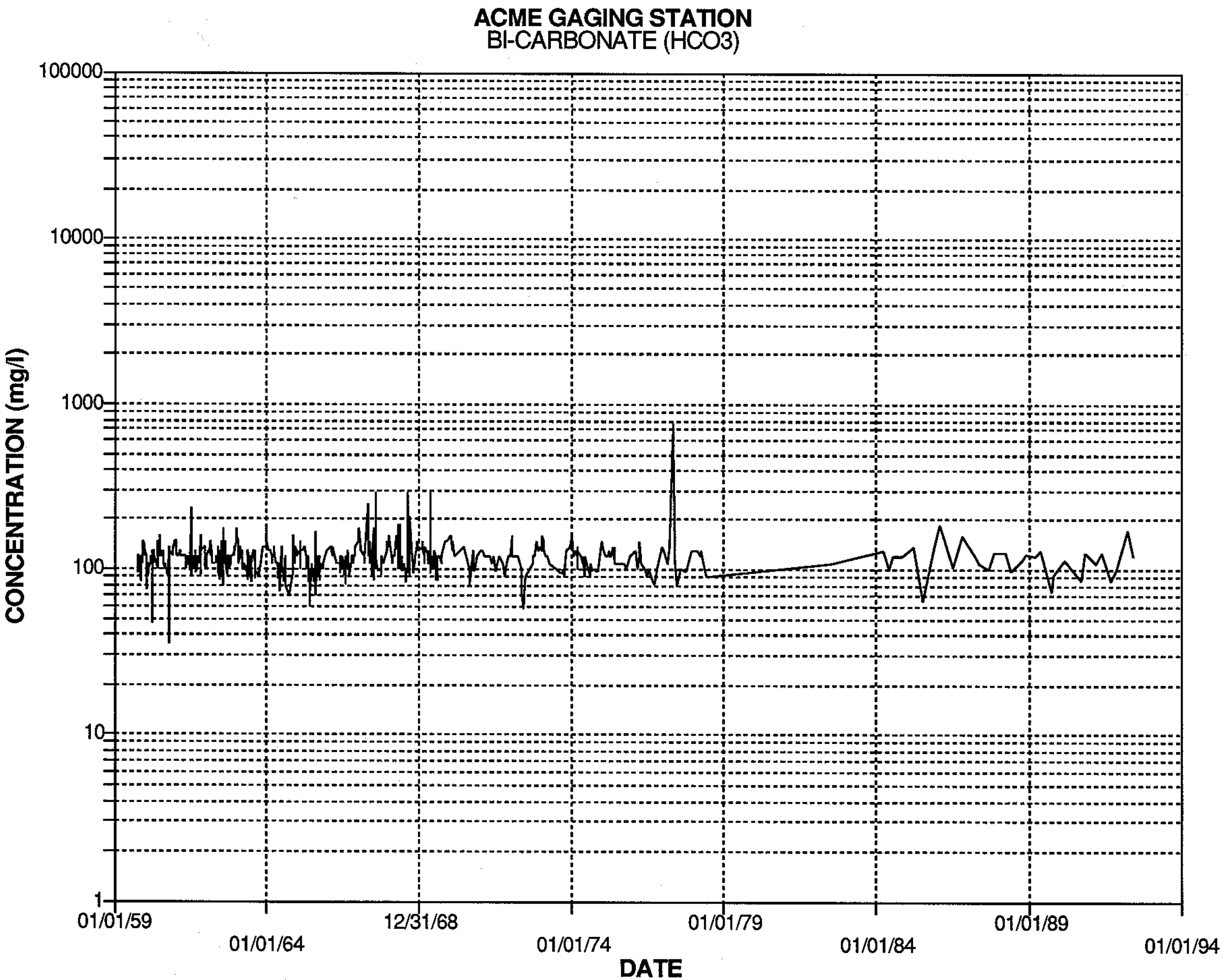

ACME GAGING STATION
CALCIUM (Ca)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

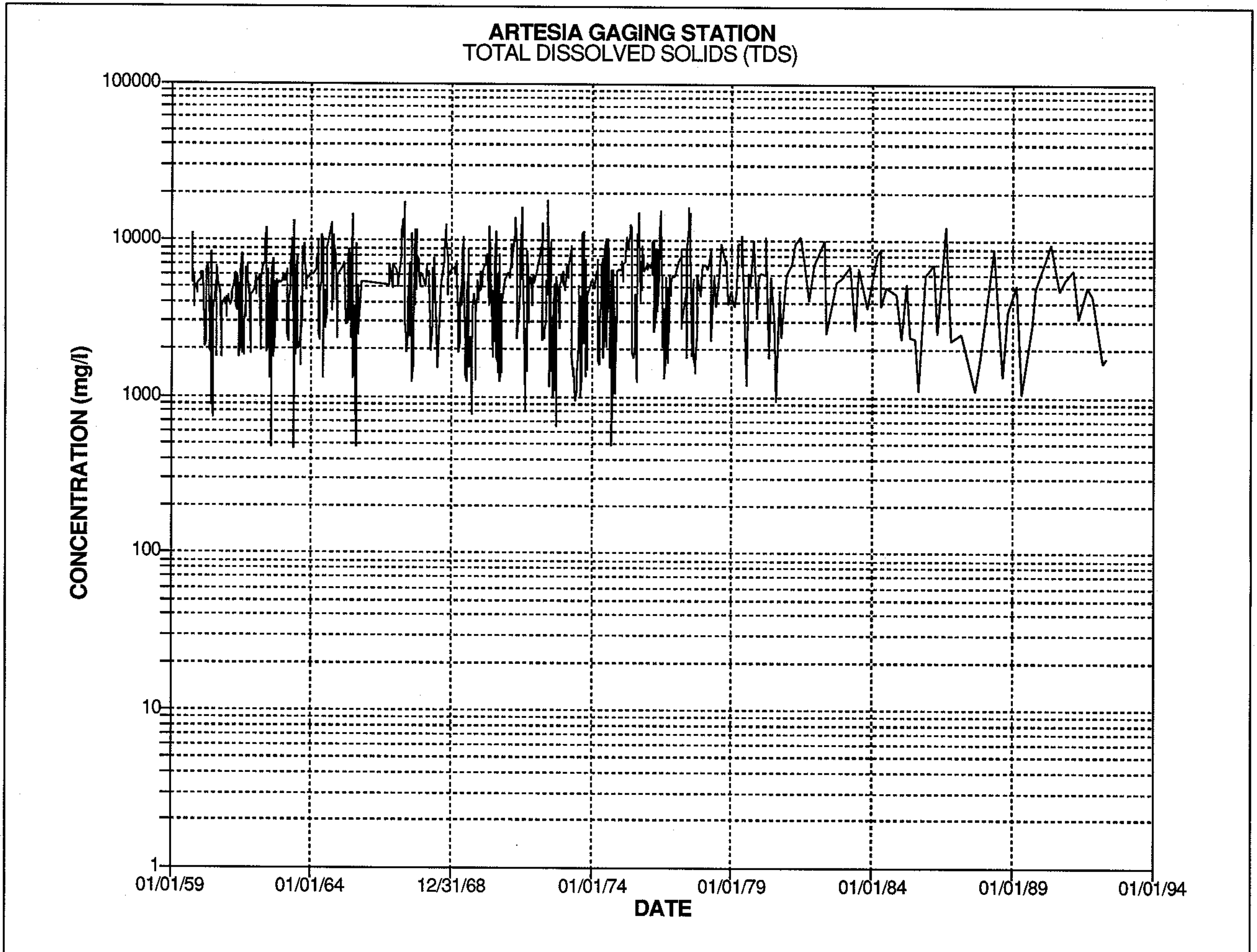

ACME GAGING STATION
MAGNESIUM (Mg)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE



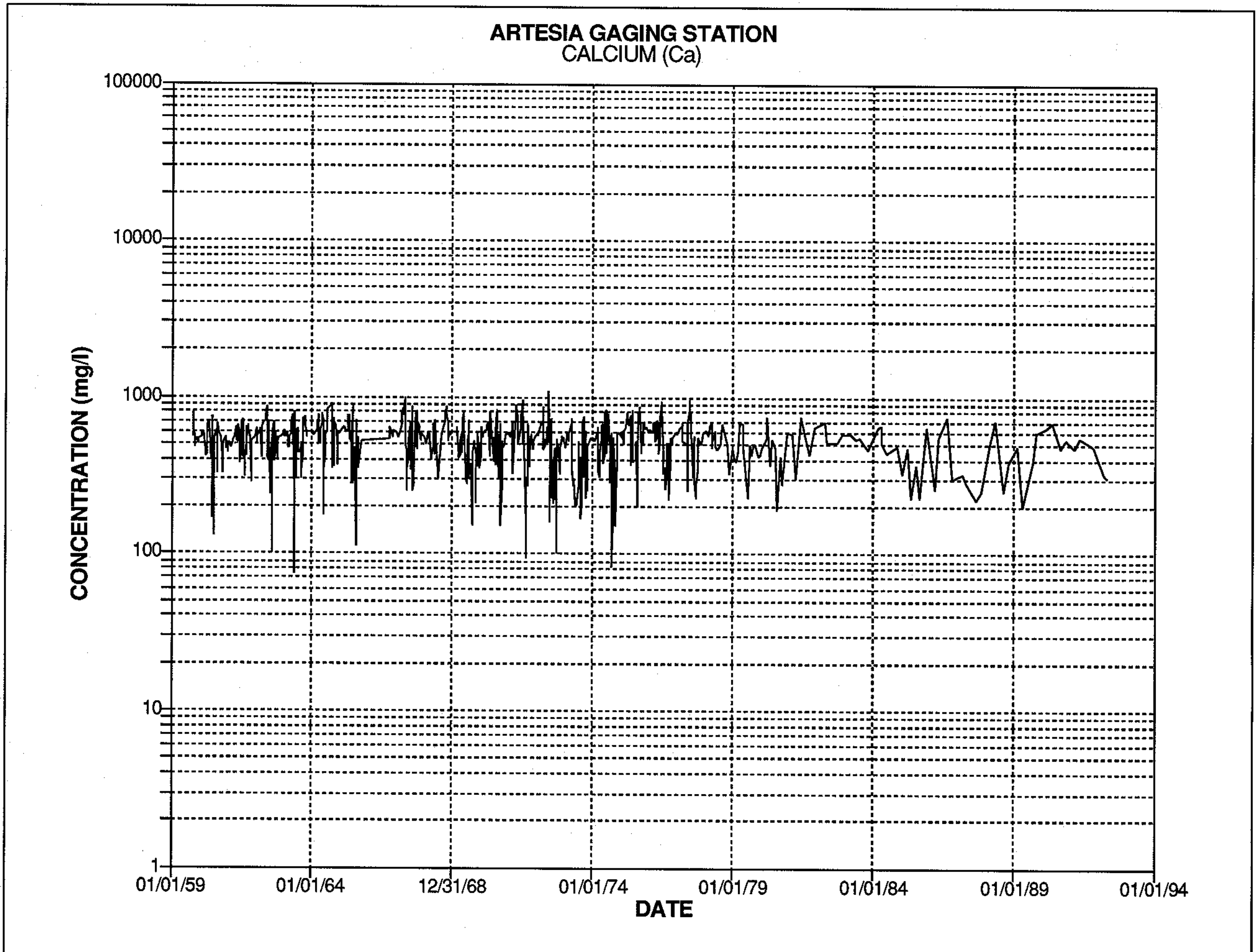
ACME GAGING STATION
SULFATE (SO4)
100000
10000
1000
100
10
1
CONCENTRATION (mg/l)
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE


ACME GAGING STATION
CHLORIDE (Cl)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

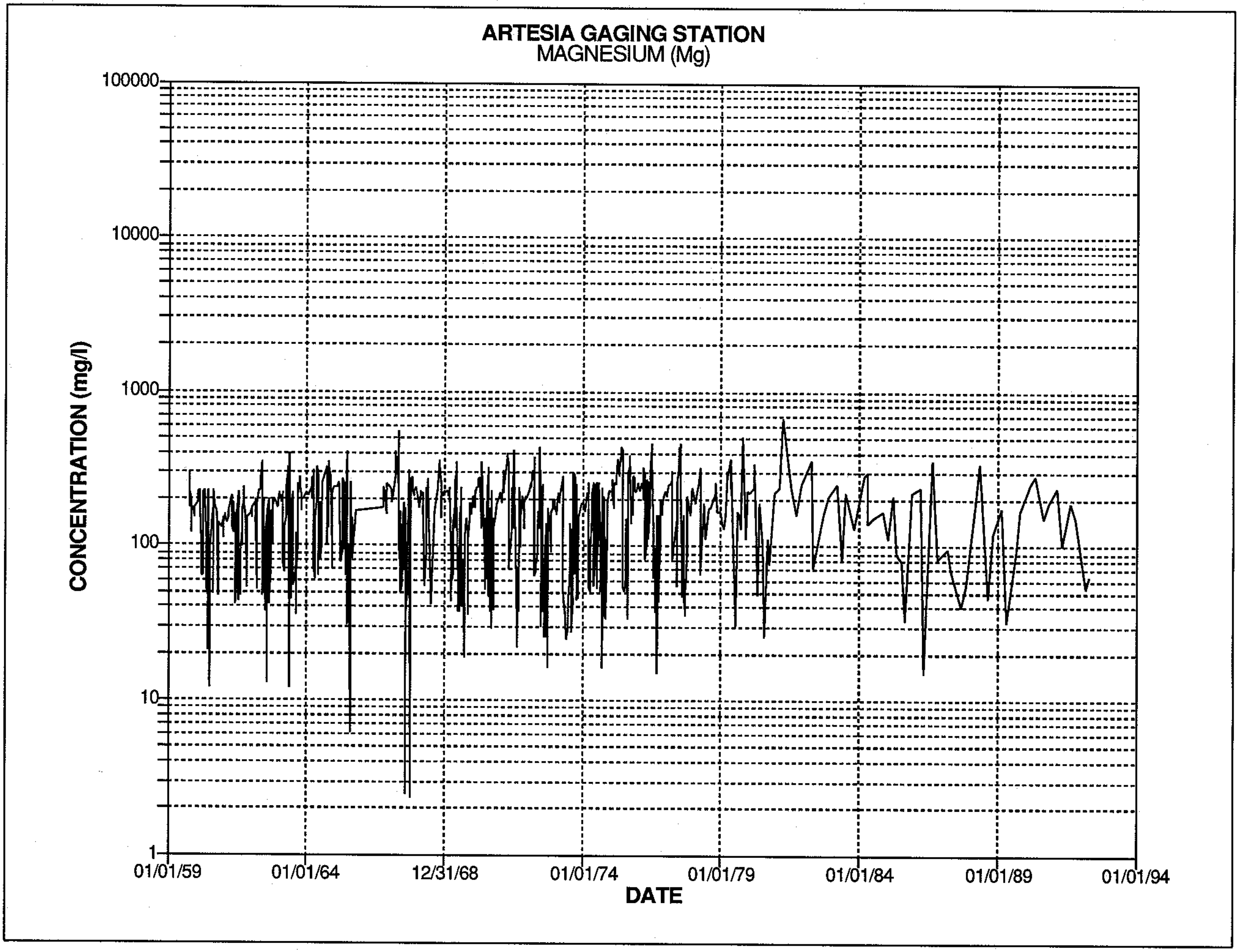

ACME GAGING STATION
BI-CARBONATE (HCO3)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

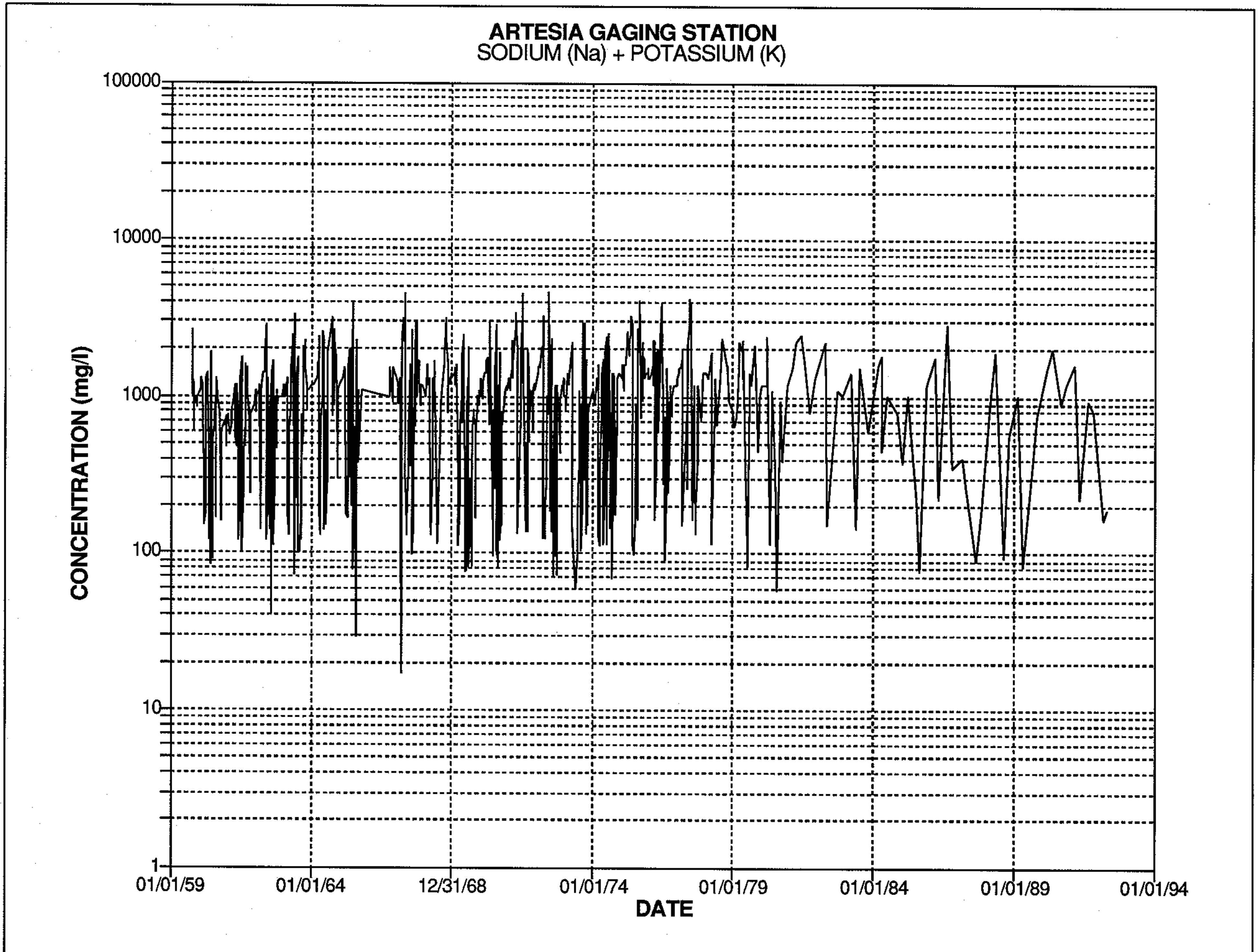


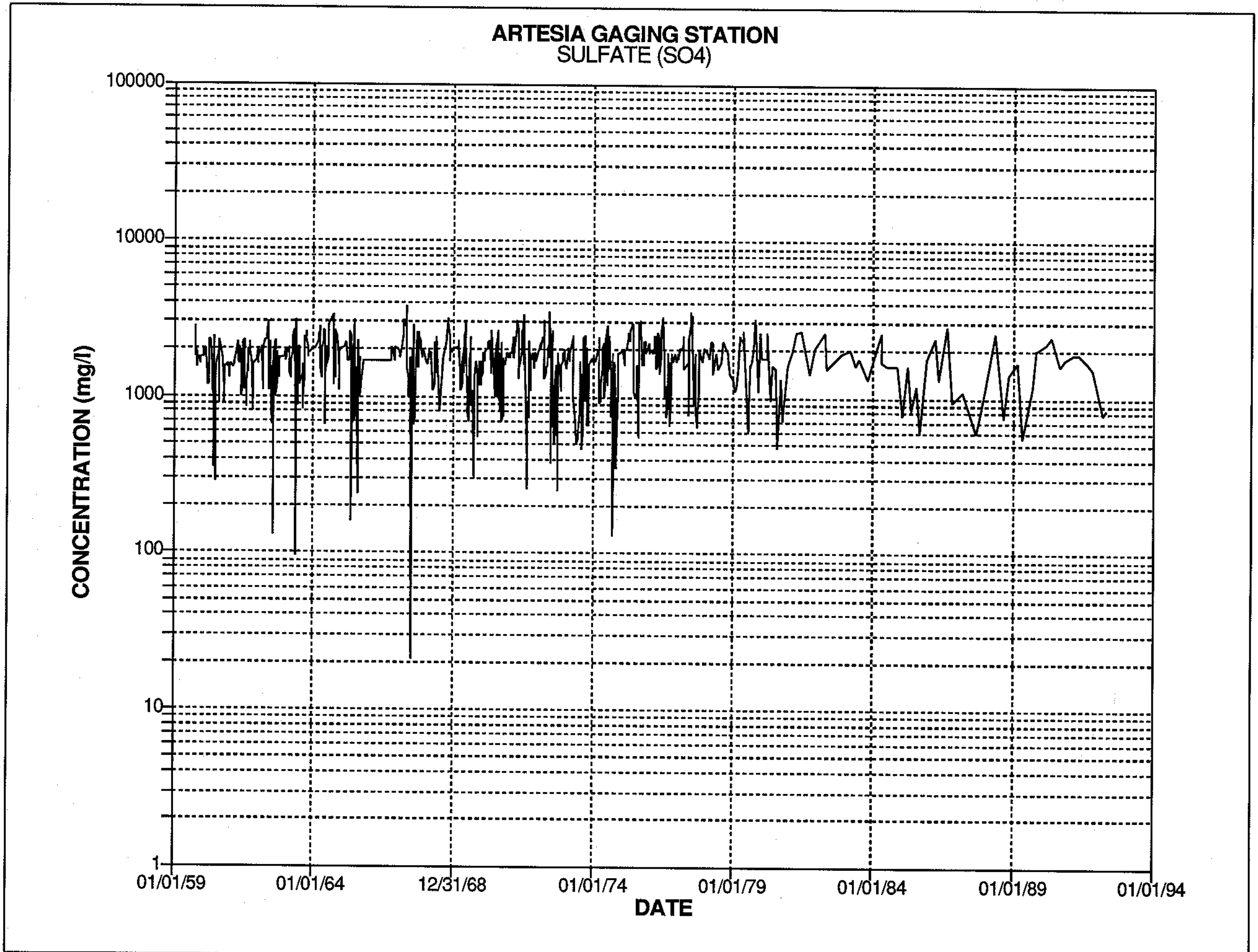
ARTESIA GAGING STATION
TOTAL DISSOLVED SOLIDS (TDS)
100000
10000
1000
100
10
1
CONCENTRATION (mg/l)
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

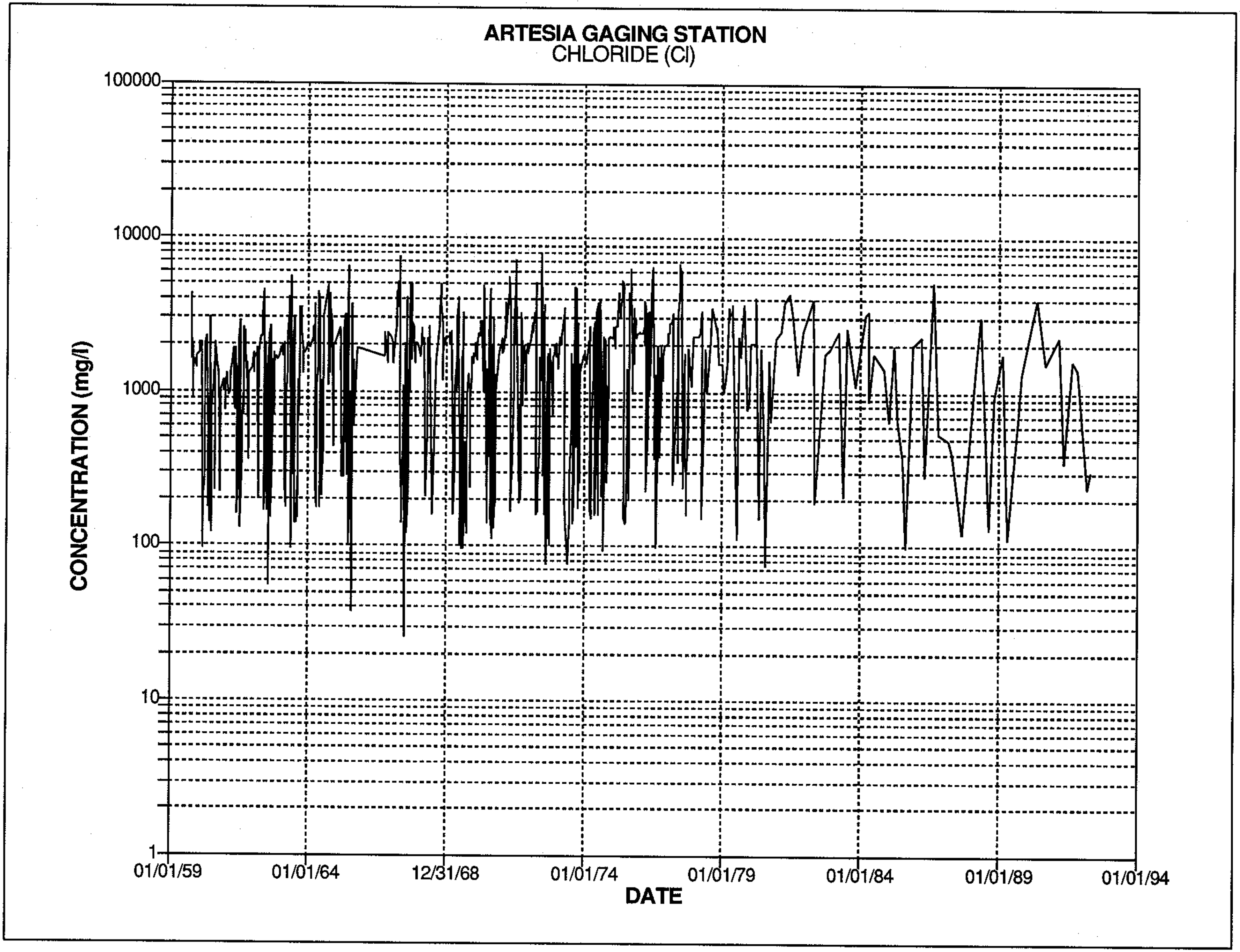


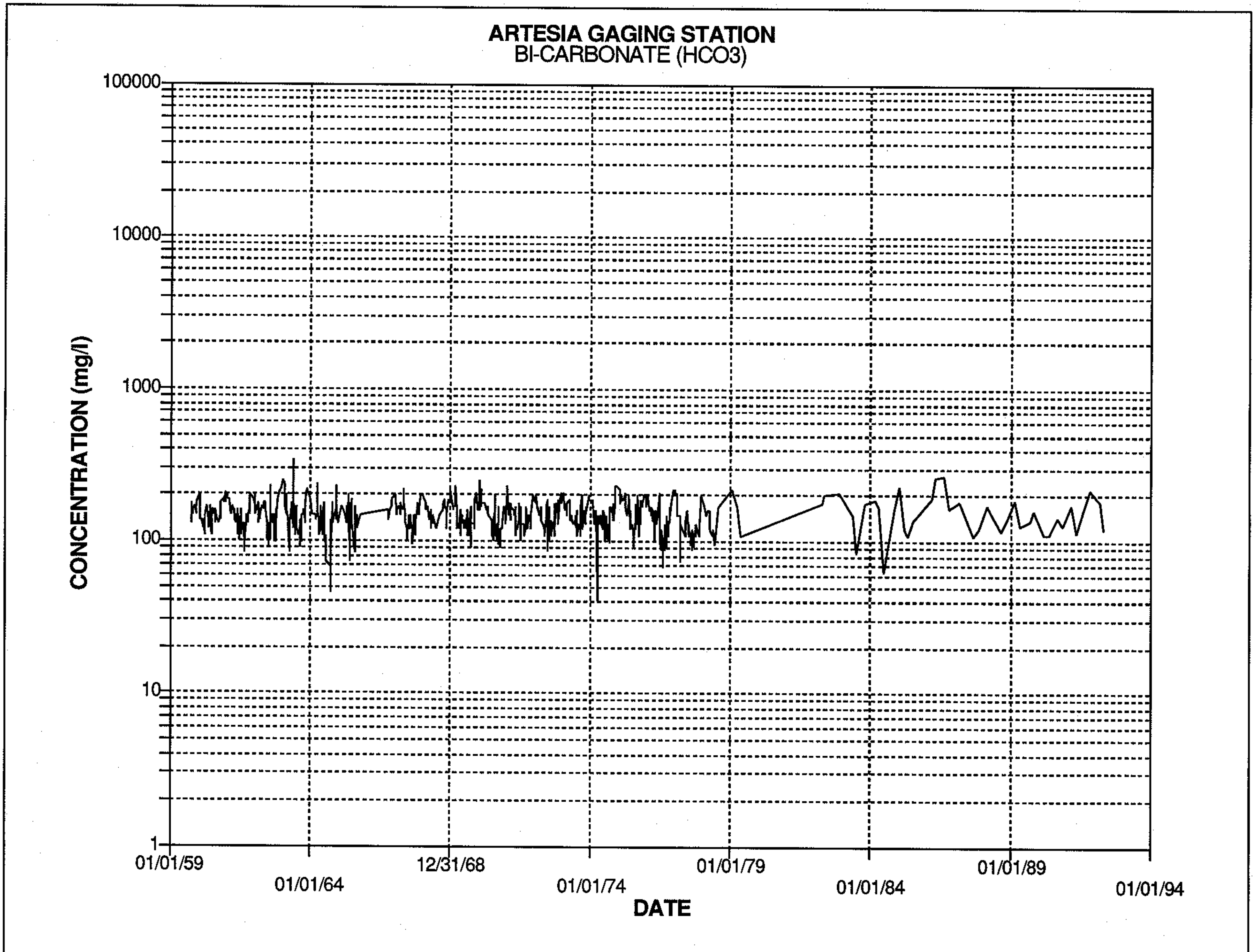
ARTESIA GAGING STATION
CALCIUM (Ca)
100000
10000
1000
100
10
1
CONCENTRATION (mg/l)
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

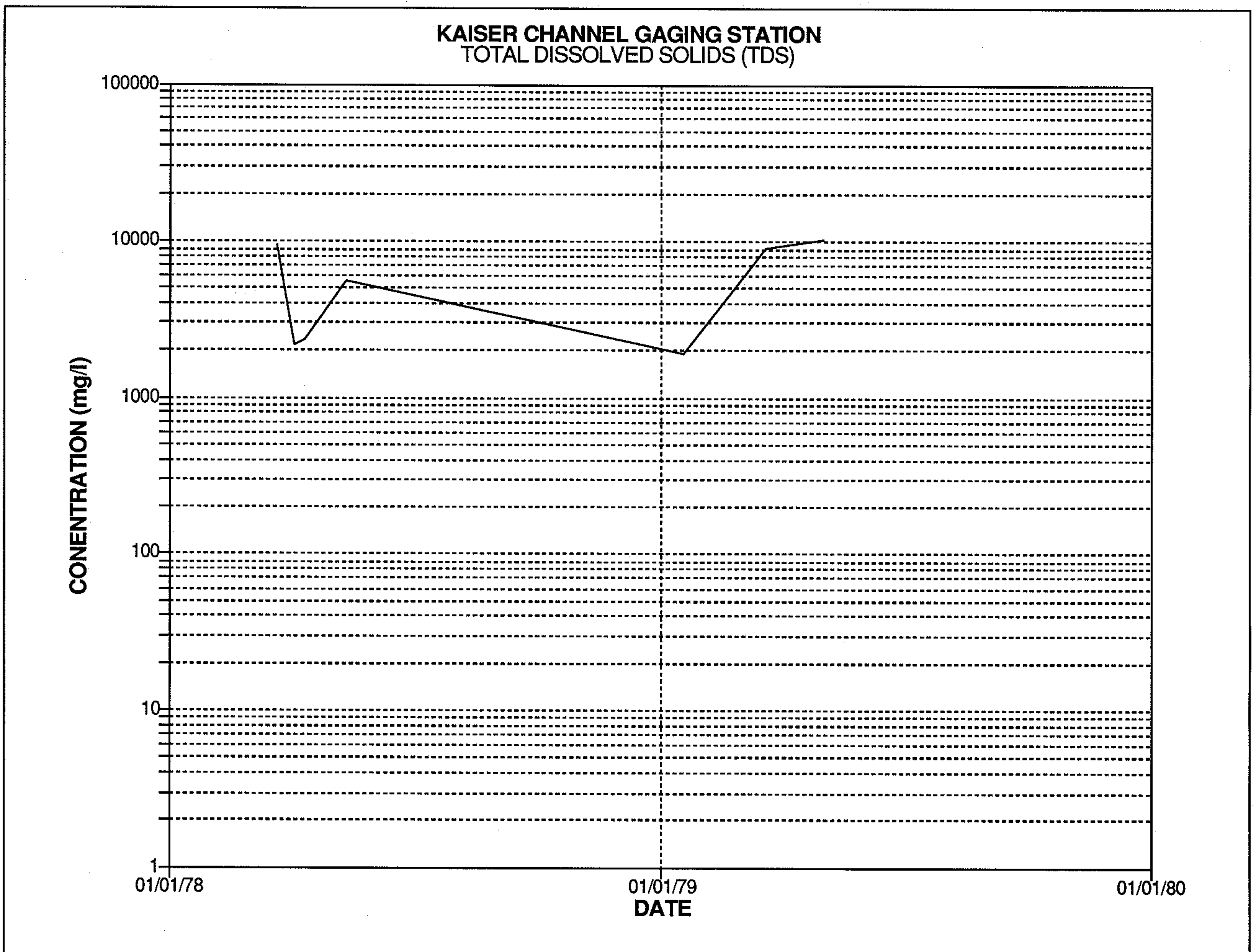

ARTESIA GAGING STATION
MAGNESIUM (Mg)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

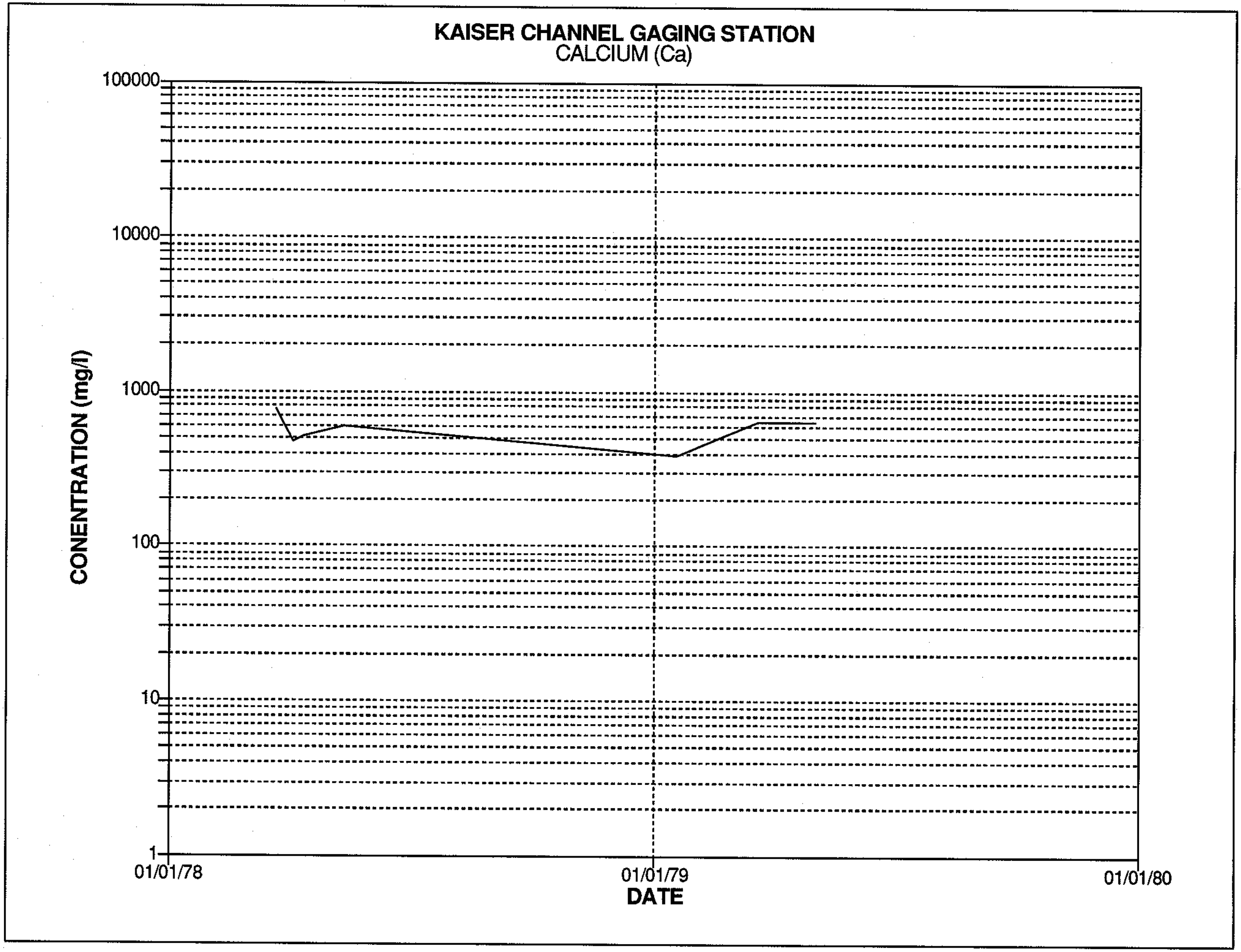

ARTESIA GAGING STATION
SODIUM (Na) + POTASSIUM (K)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

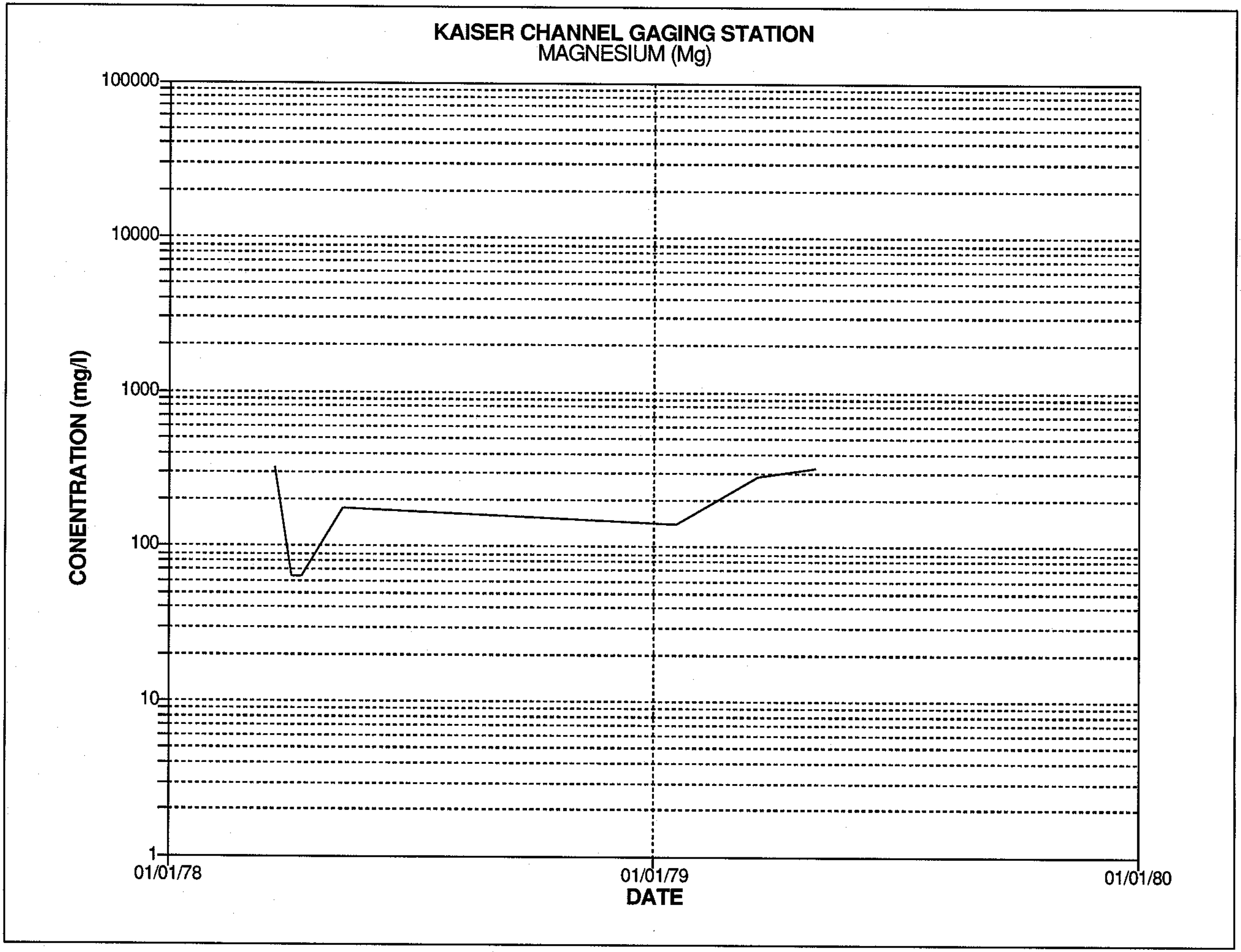

ARTESIA GAGING STATION
SULFATE (SO4)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE


ARTESIA GAGING STATION
CHLORIDE (Cl)
100000
10000
1000
100
10
1
CONCENTRATION (mg/l)
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

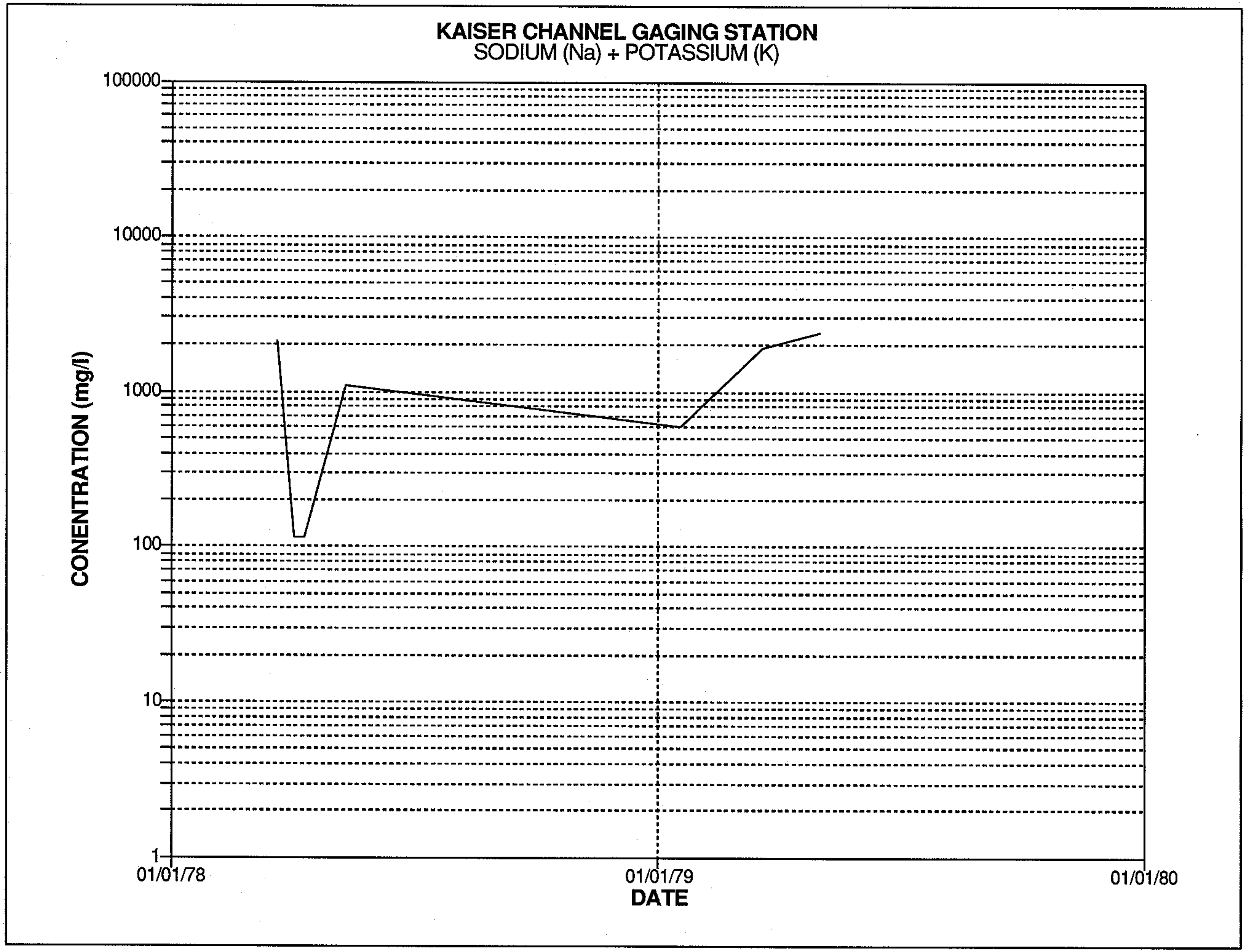

ARTESIA GAGING STATION
BI-CARBONATE (HCO3)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/59
01/01/64
12/31/68
01/01/74
01/01/79
01/01/84
01/01/89
01/01/94
DATE

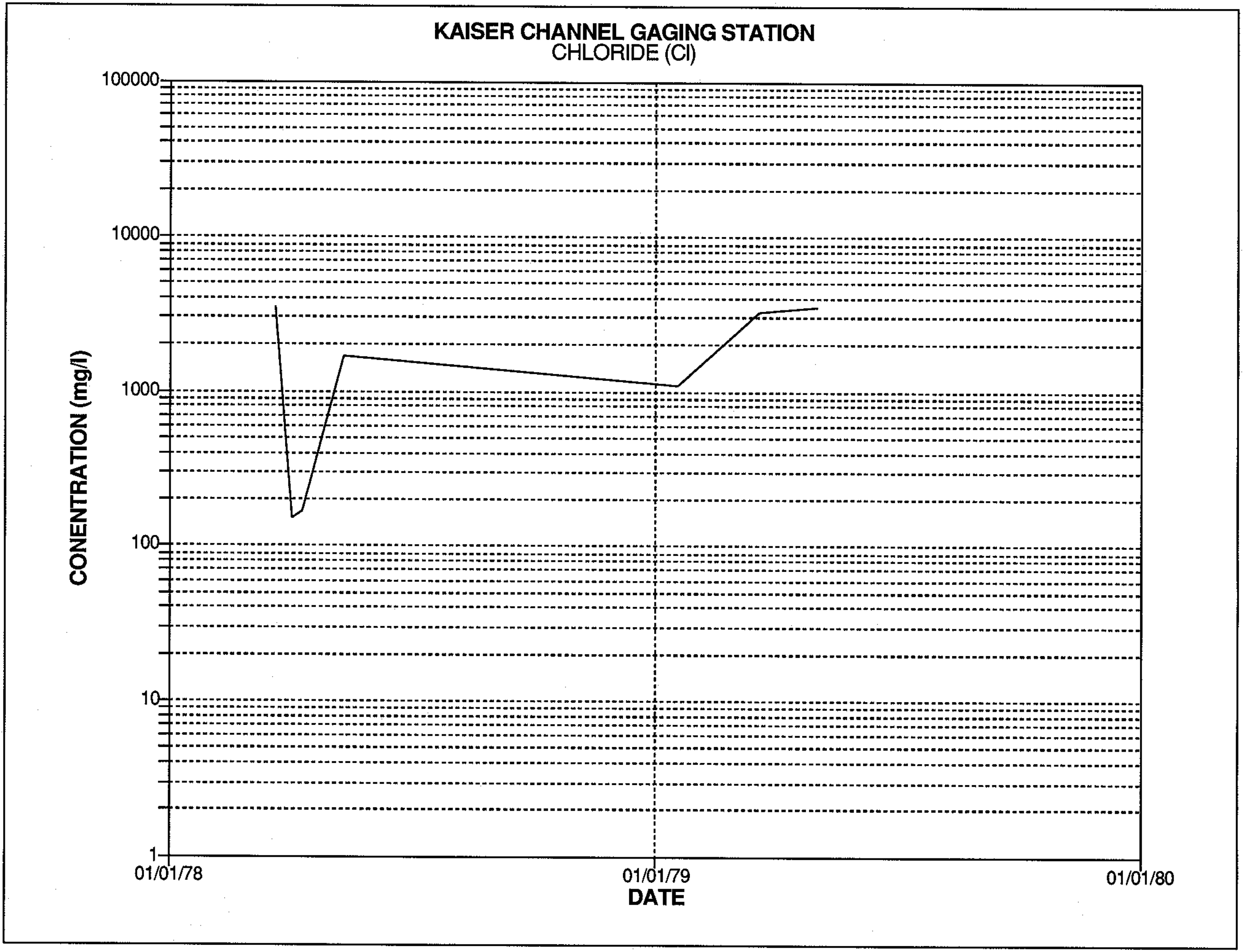

KAISER CHANNEL GAGING STATION
TOTAL DISSOLVED SOLIDS (TDS)
100000
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/79
01/01/80
DATE

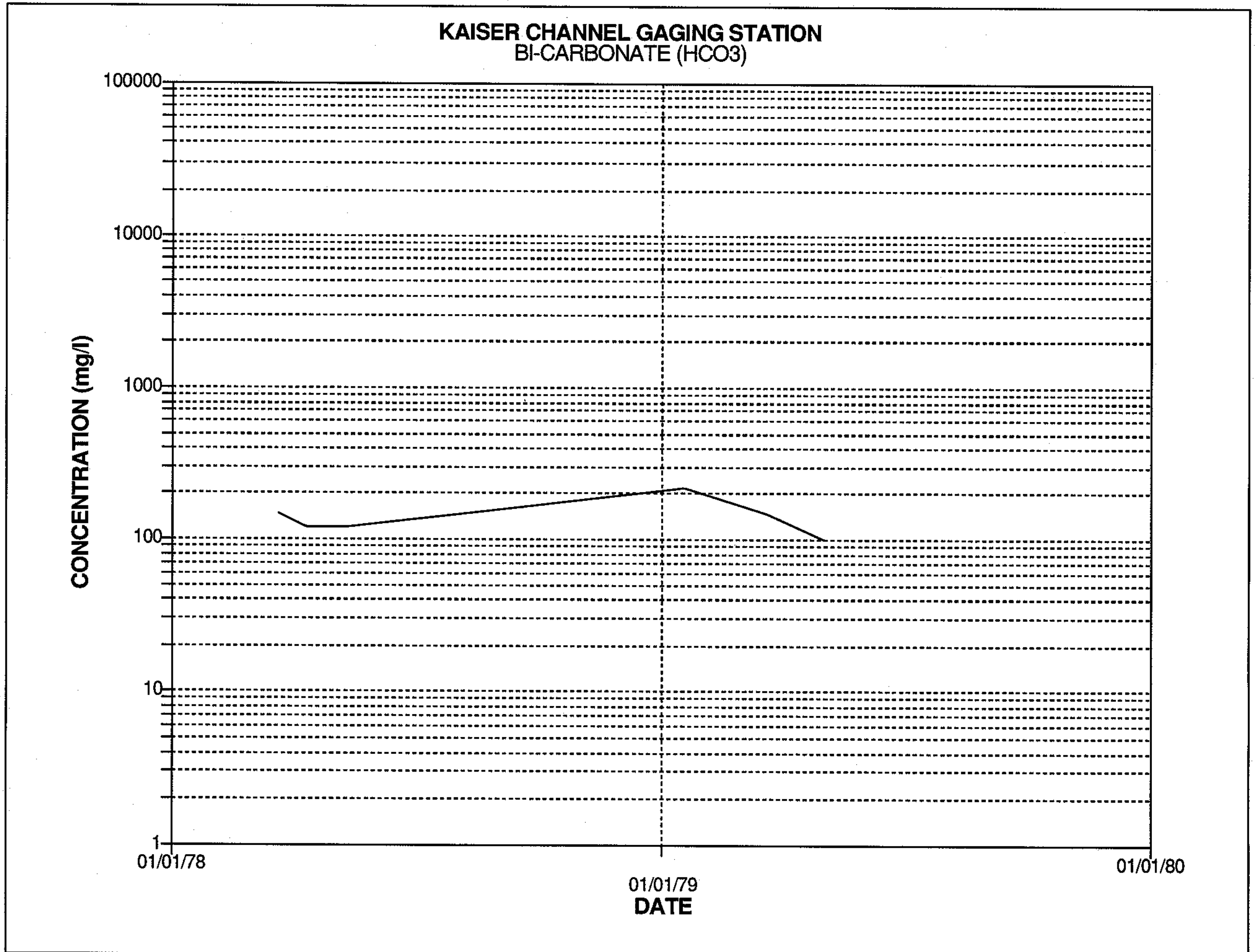

KAISER CHANNEL GAGING STATION
CALCIUM (Ca)
100000
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/79
01/01/80
DATE



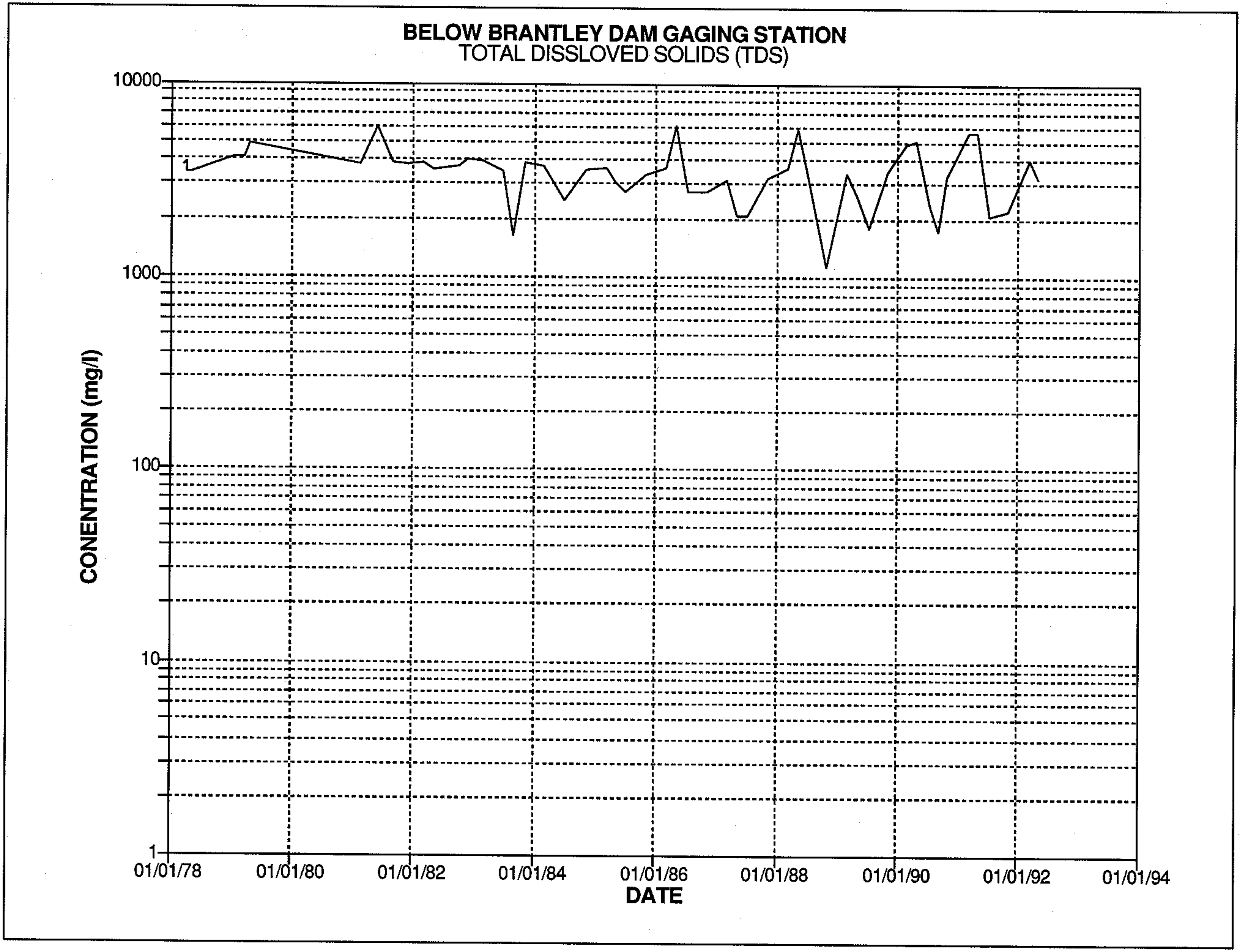
KAISER CHANNEL GAGING STATION
MAGNESIUM (Mg)
CONENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/78
01/01/79
01/01/80
DATE


KAISER CHANNEL GAGING STATION
SODIUM (Na) + POTASSIUM (K)
CONENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/78
01/01/79
01/01/80
DATE

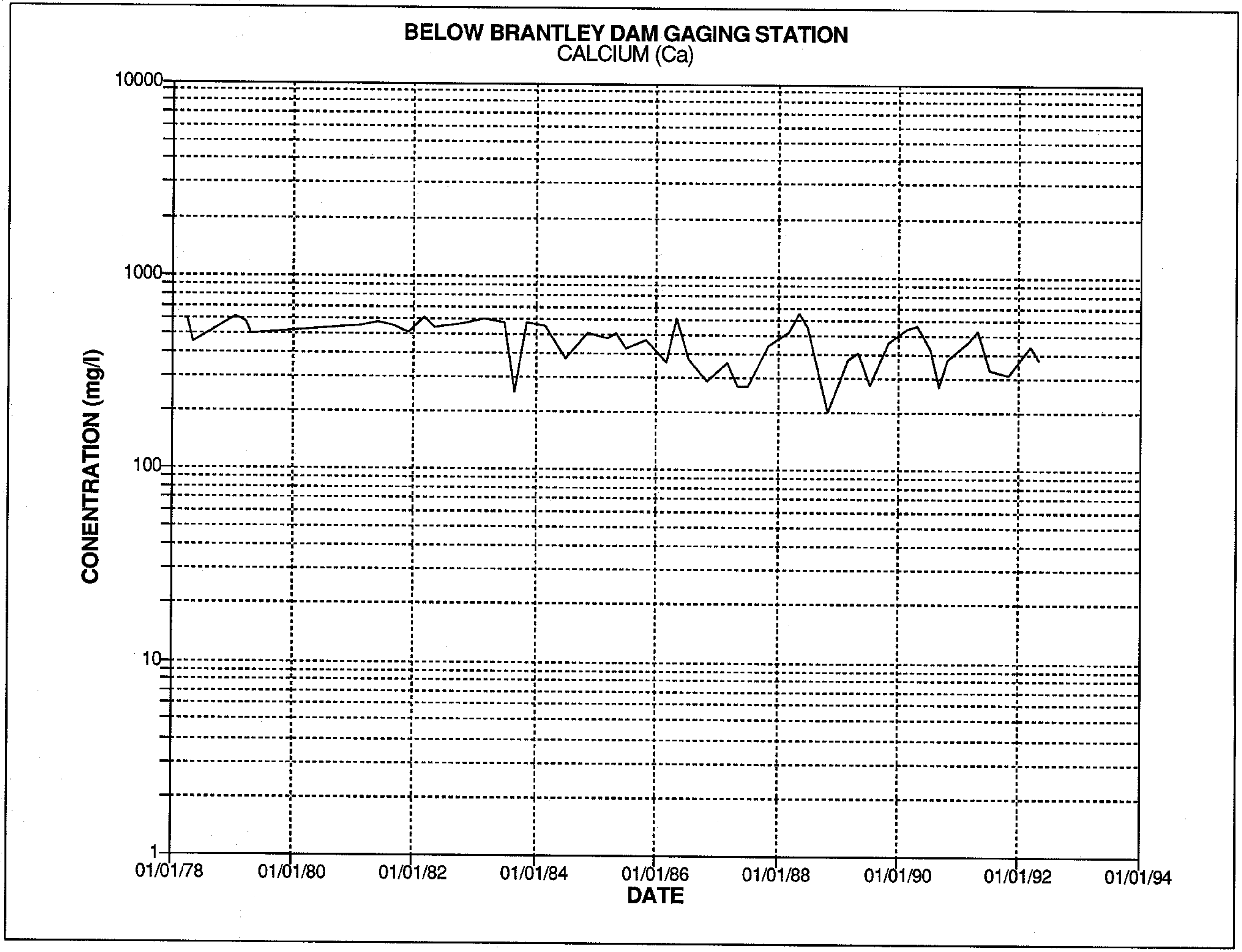

KAISER CHANNEL GAGING STATION
CHLORIDE (Cl)
100000
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/79
01/01/80
DATE



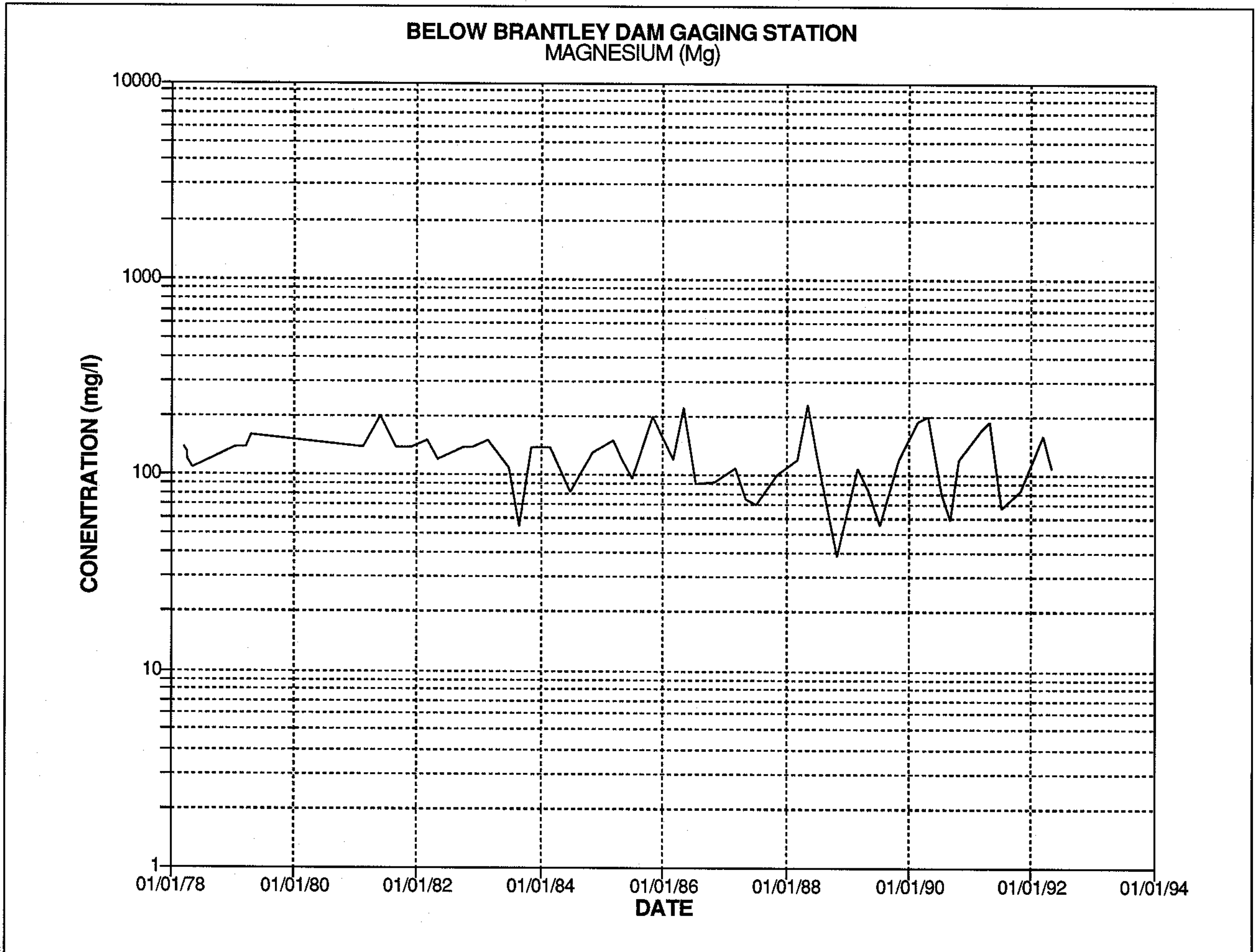
KAISER CHANNEL GAGING STATION
BI-CARBONATE (HCO3)
100000
10000
1000
100
10
1
CONCENTRATION (mg/l)
01/01/78
01/01/79
01/01/80
DATE



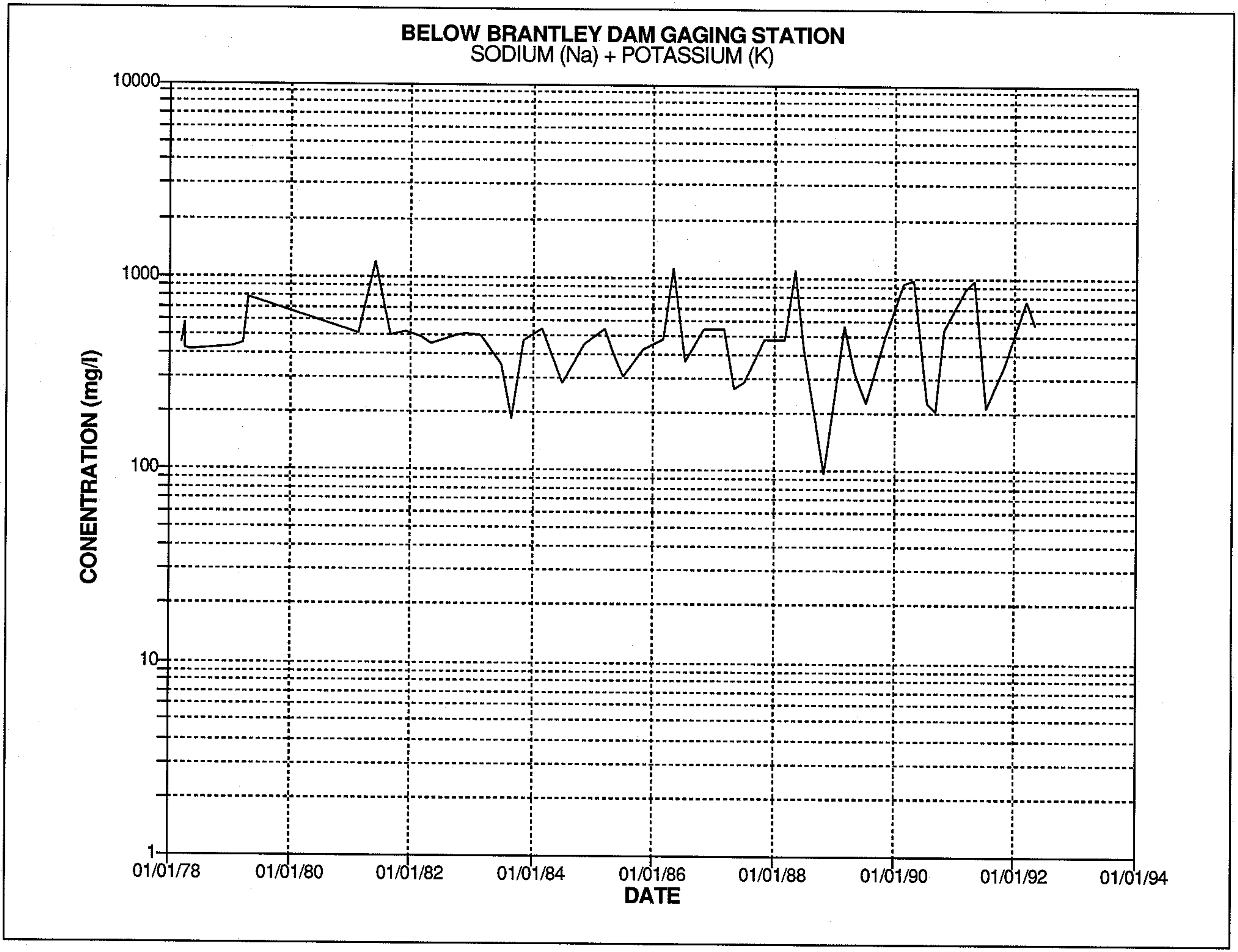
BELOW BRANTLEY DAM GAGING STATION
TOTAL DISSLOVED SOLIDS (TDS)
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE

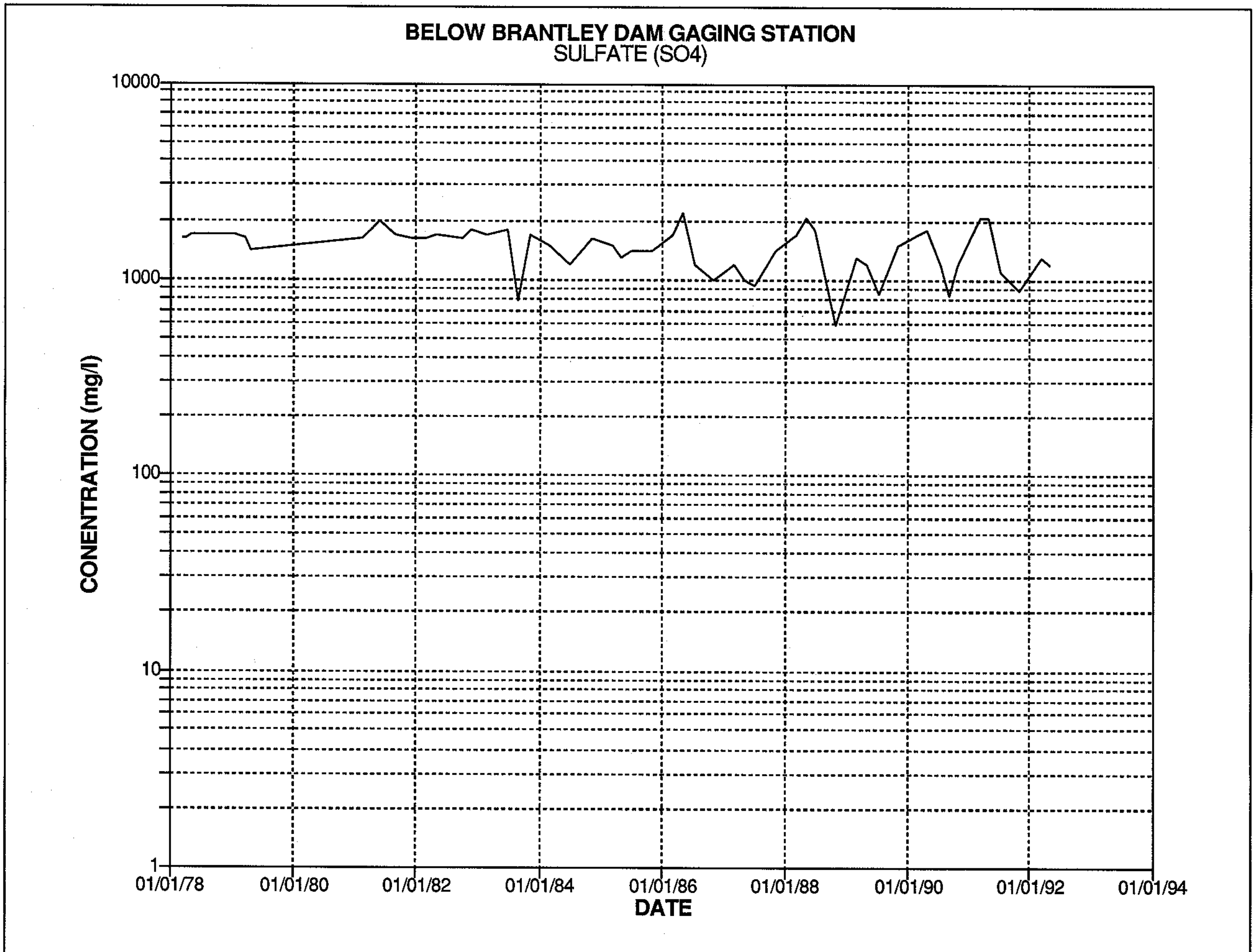


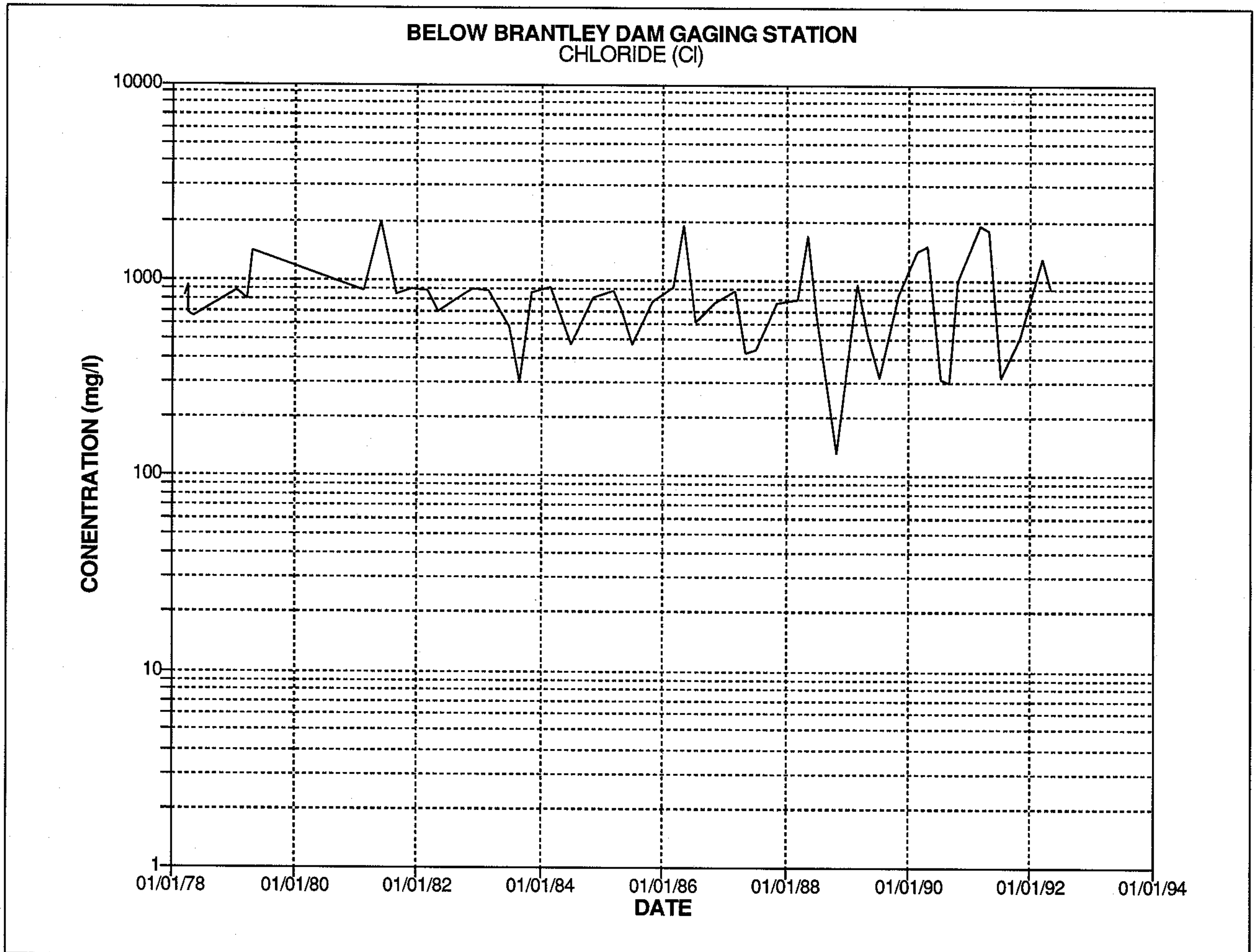
BELOW BRANTLEY DAM GAGING STATION
CALCIUM (Ca)
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE

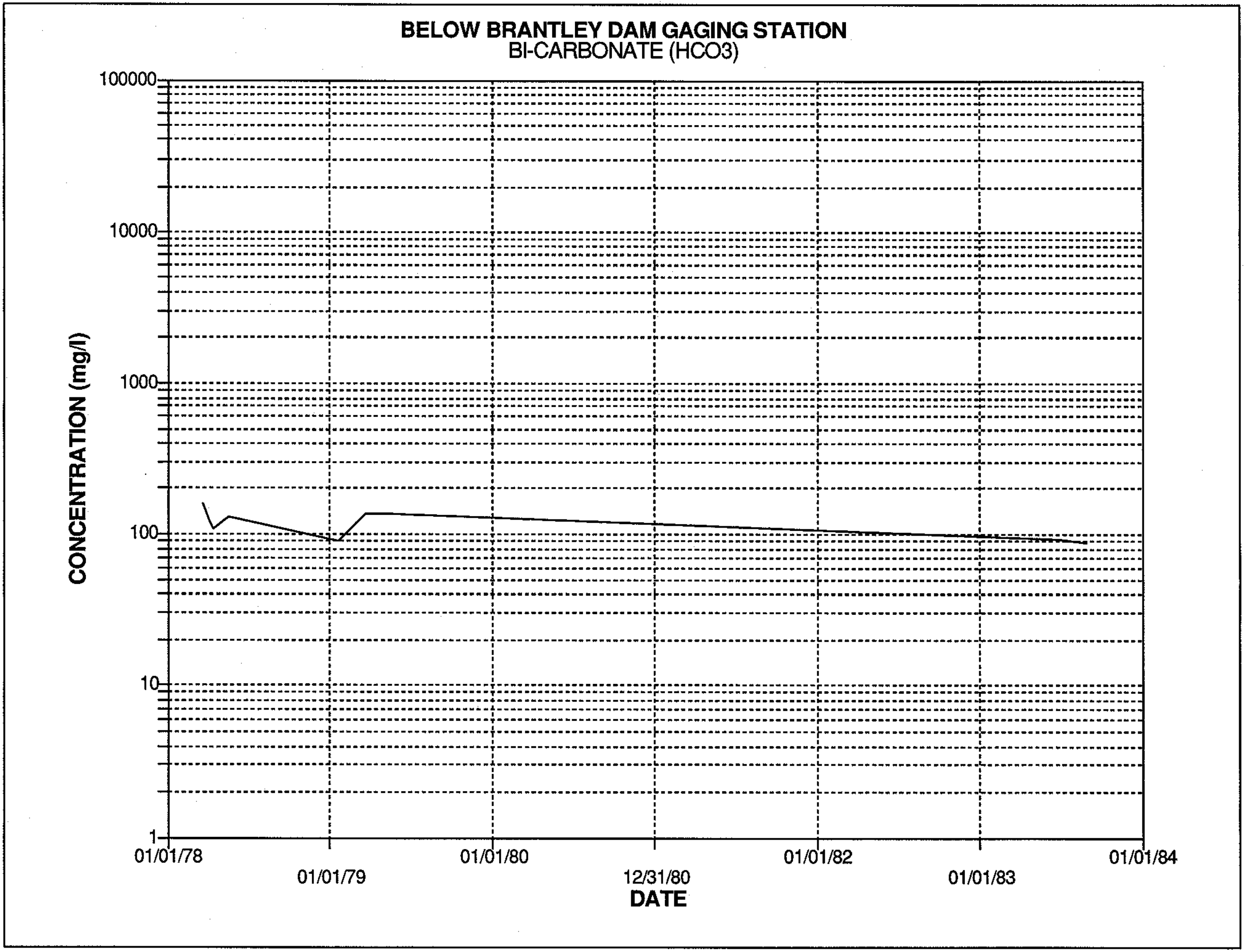


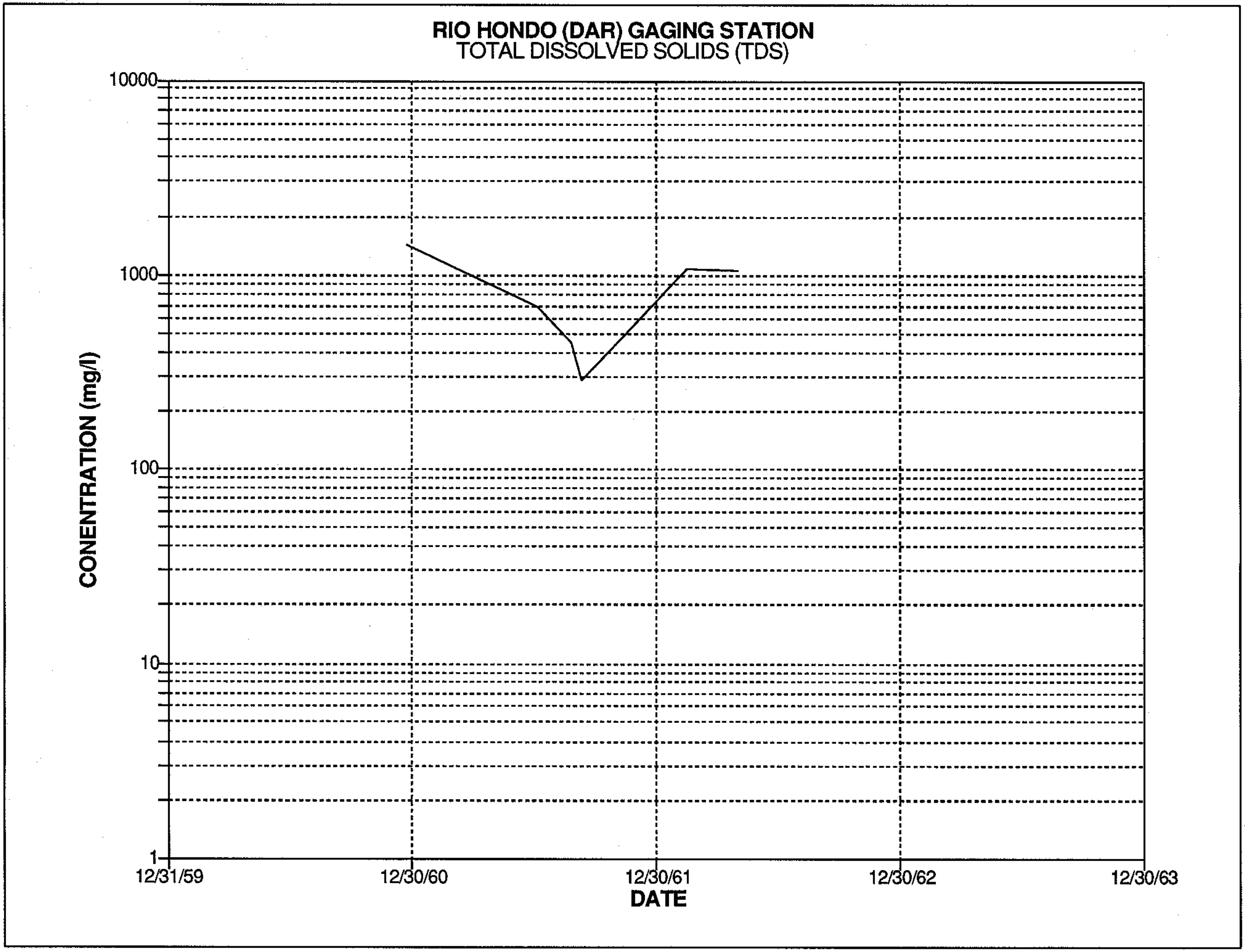
BELOW BRANTLEY DAM GAGING STATION
MAGNESIUM (Mg)
CONENTRATION (mg/l)
10000
1000
100
10
1
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE

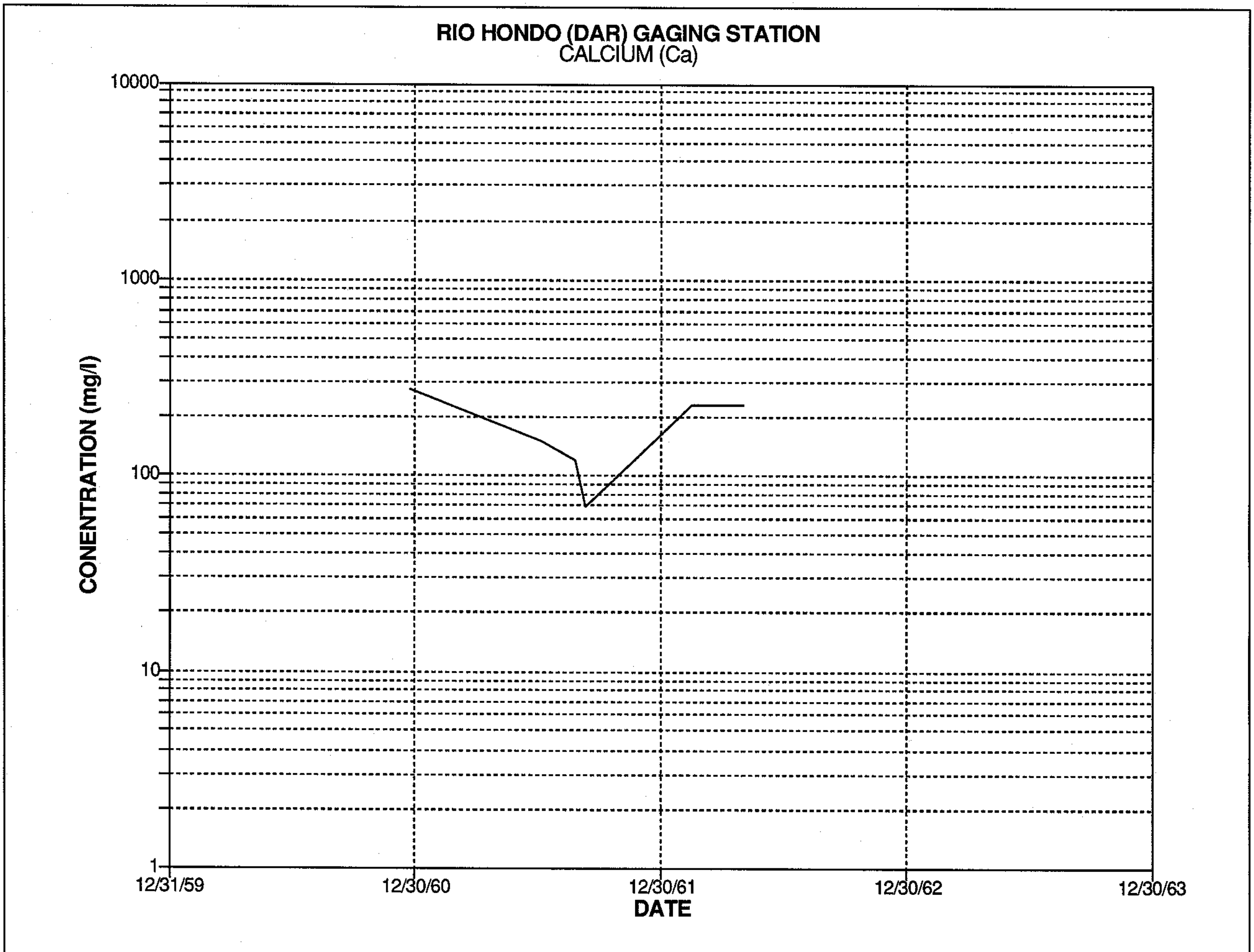

BELOW BRANTLEY DAM GAGING STATION
SODIUM (Na) + POTASSIUM (K)
CONENTRATION (mg/l)
10000
1000
100
10
1
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE

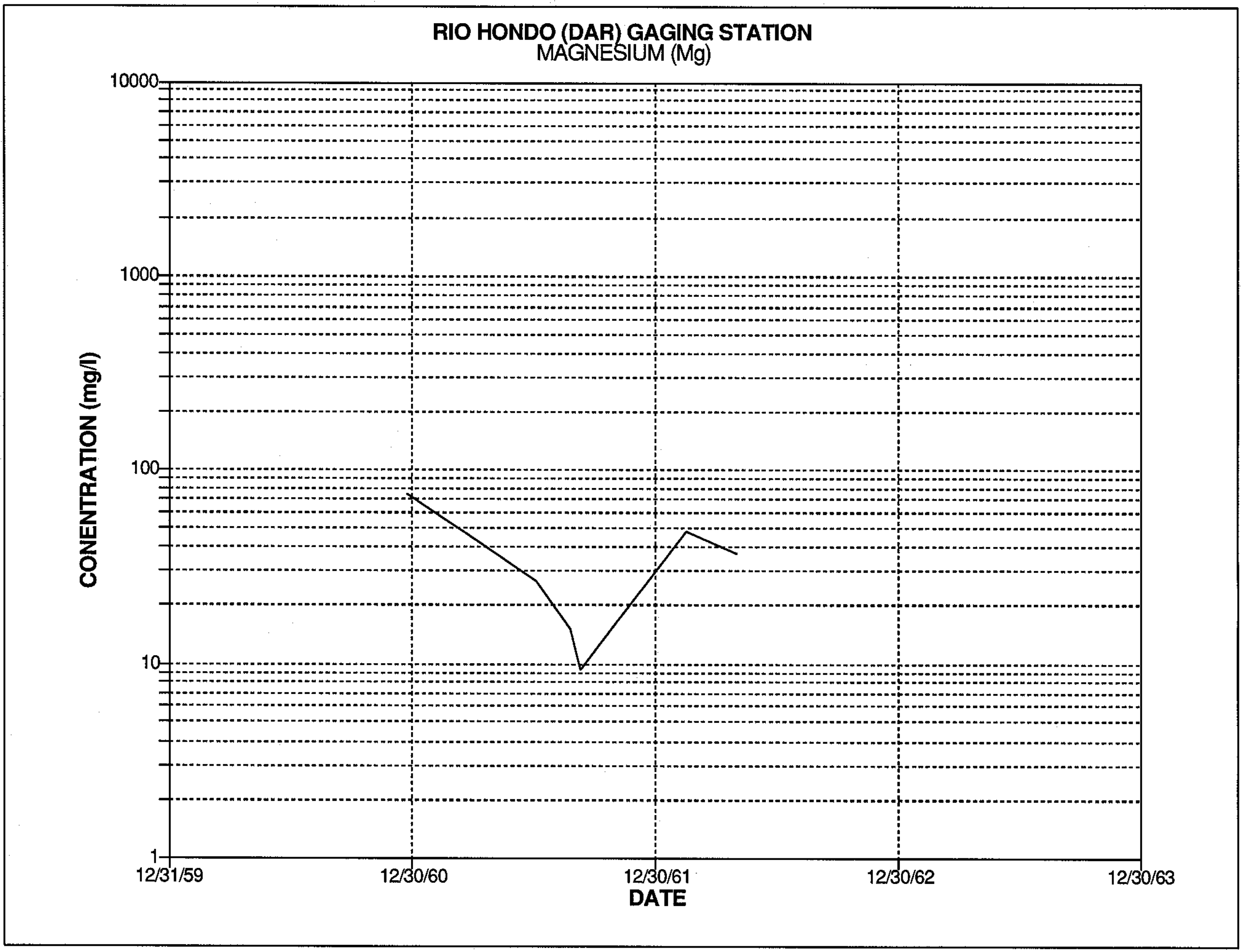

BELOW BRANTLEY DAM GAGING STATION
SULFATE (SO4)
CONENTRATION (mg/l)
10000
1000
100
10
1
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE

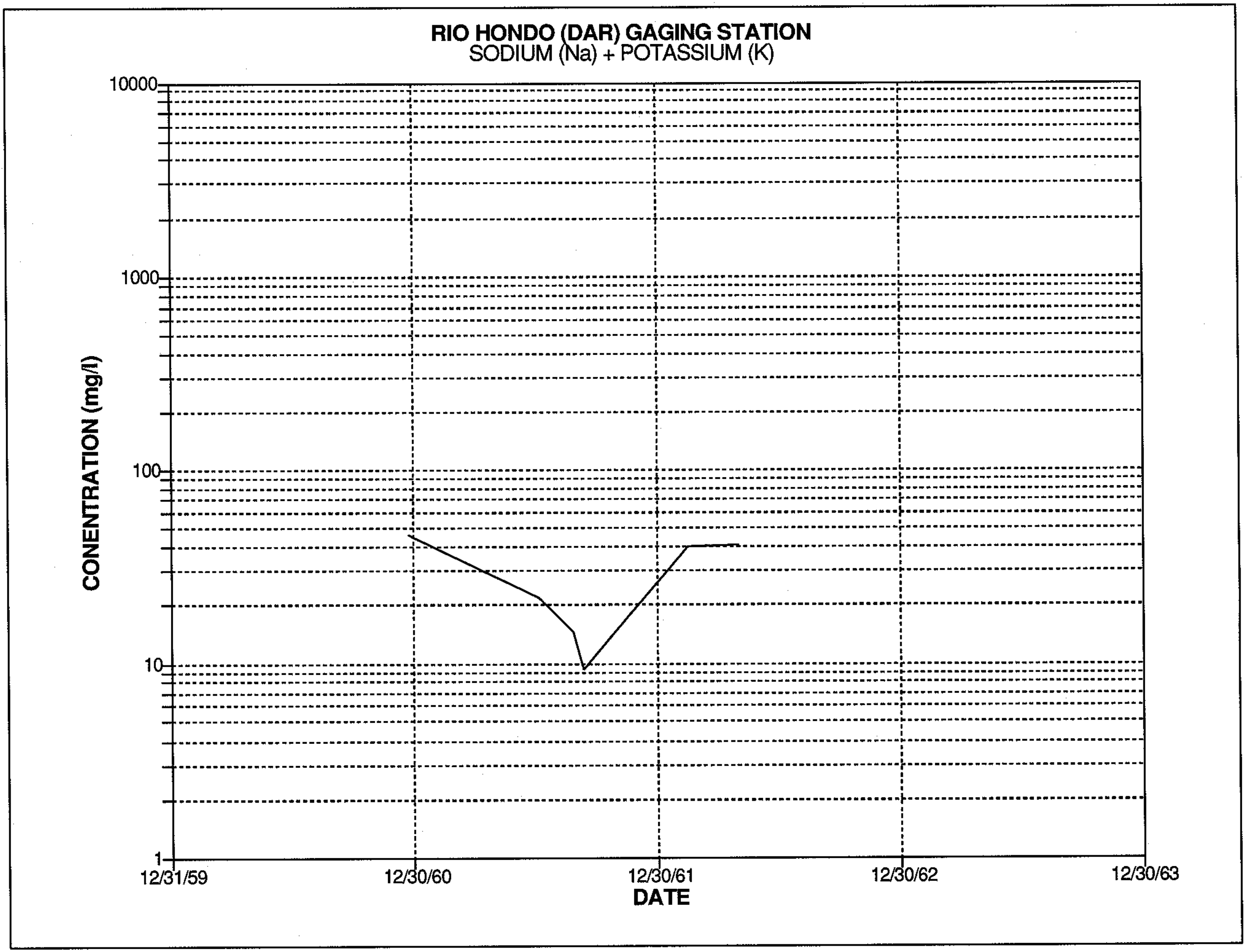

BELOW BRANTLEY DAM GAGING STATION
CHLORIDE (Cl)
10000
1000
100
10
1
CONENTRATION (mg/l)
01/01/78
01/01/80
01/01/82
01/01/84
01/01/86
01/01/88
01/01/90
01/01/92
01/01/94
DATE


BELOW BRANTLEY DAM GAGING STATION
BI-CARBONATE (HCO3)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
01/01/78
01/01/79
01/01/80
12/31/80
01/01/82
01/01/83
01/01/84
DATE

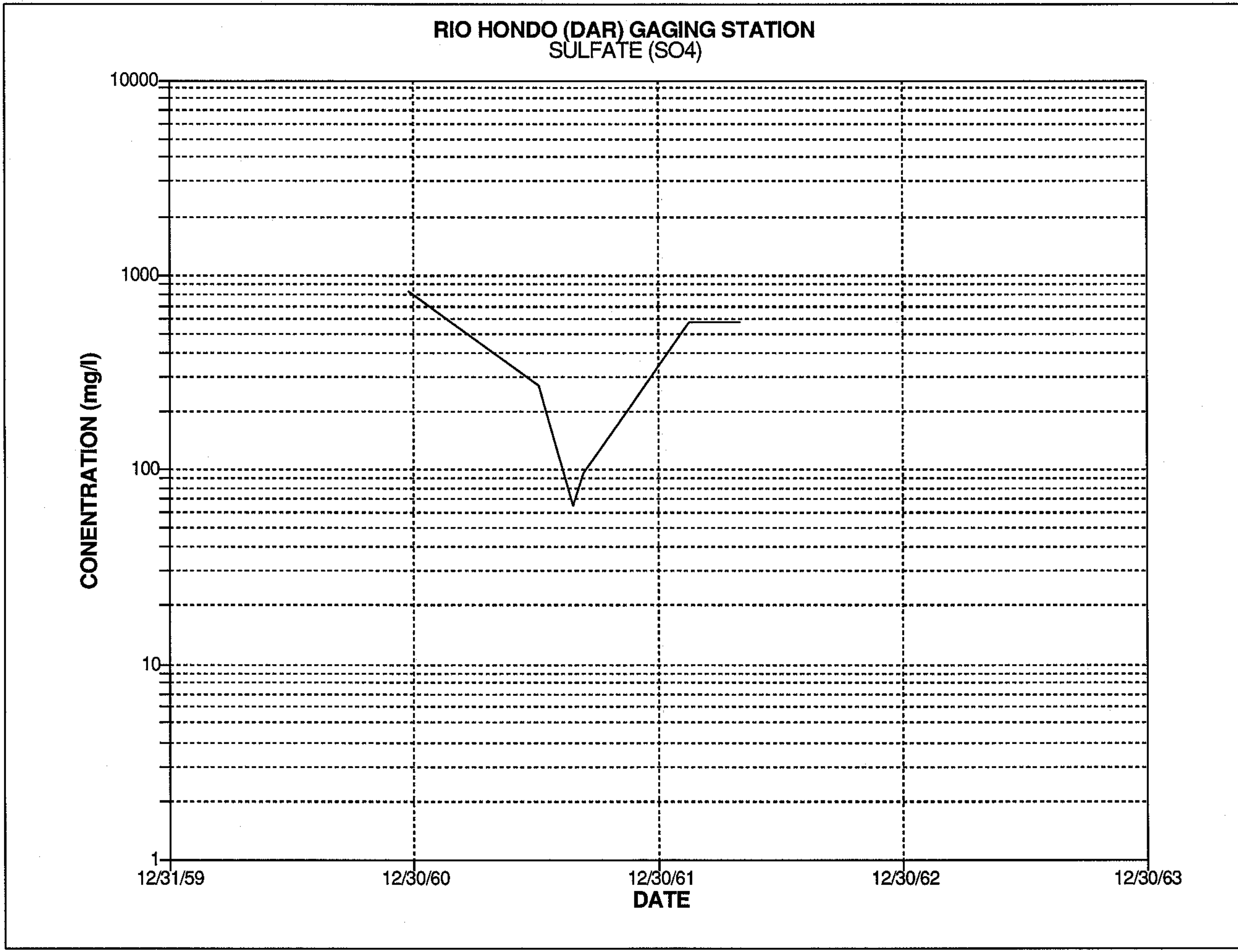

RIO HONDO (DAR) GAGING STATION
TOTAL DISSOLVED SOLIDS (TDS)
CONENTRATION (mg/l)
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE

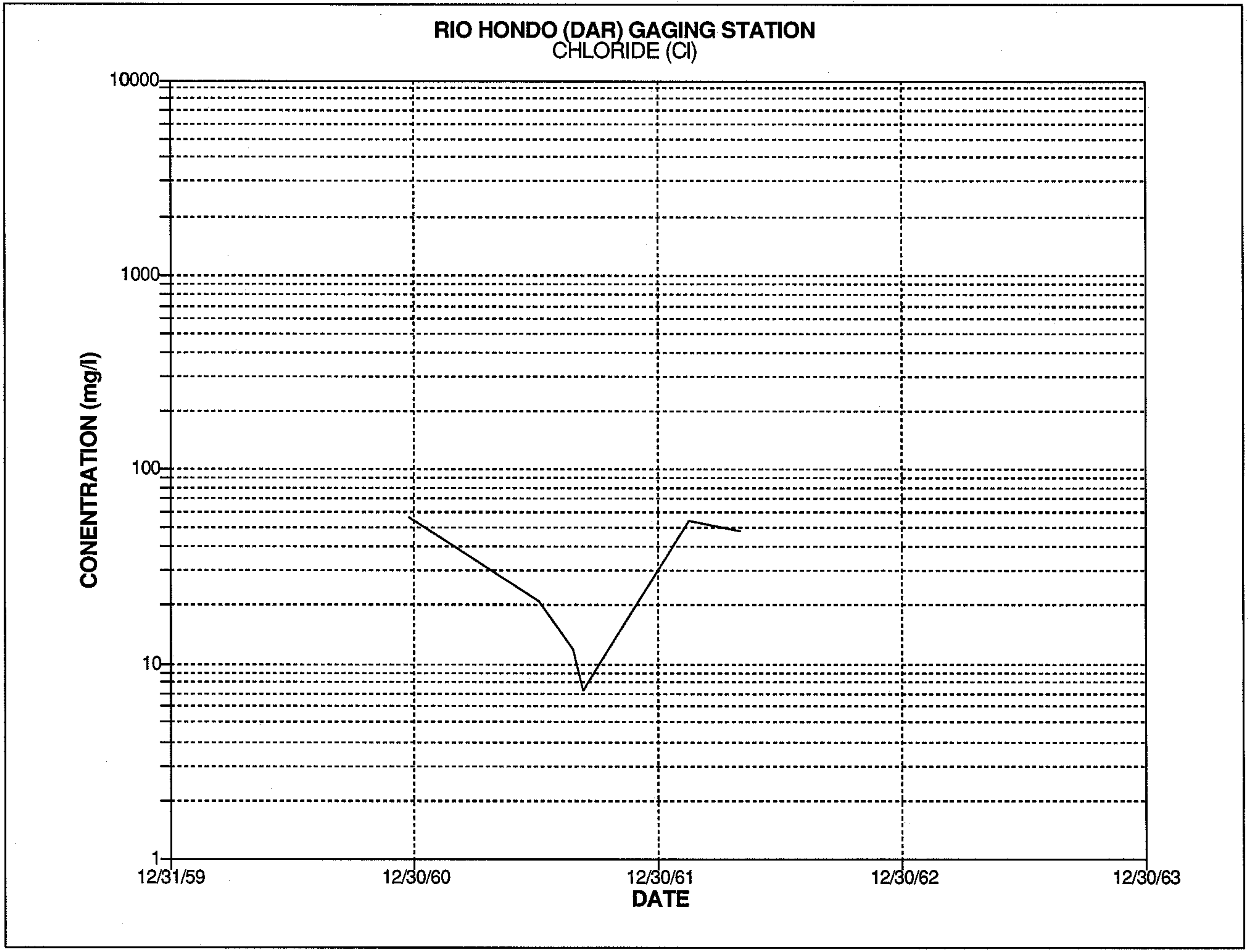

RIO HONDO (DAR) GAGING STATION
CALCIUM (Ca)
CONENTRATION (mg/l)
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE


RIO HONDO (DAR) GAGING STATION
MAGNESIUM (Mg)
CONENTRATION (mg/l)
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE

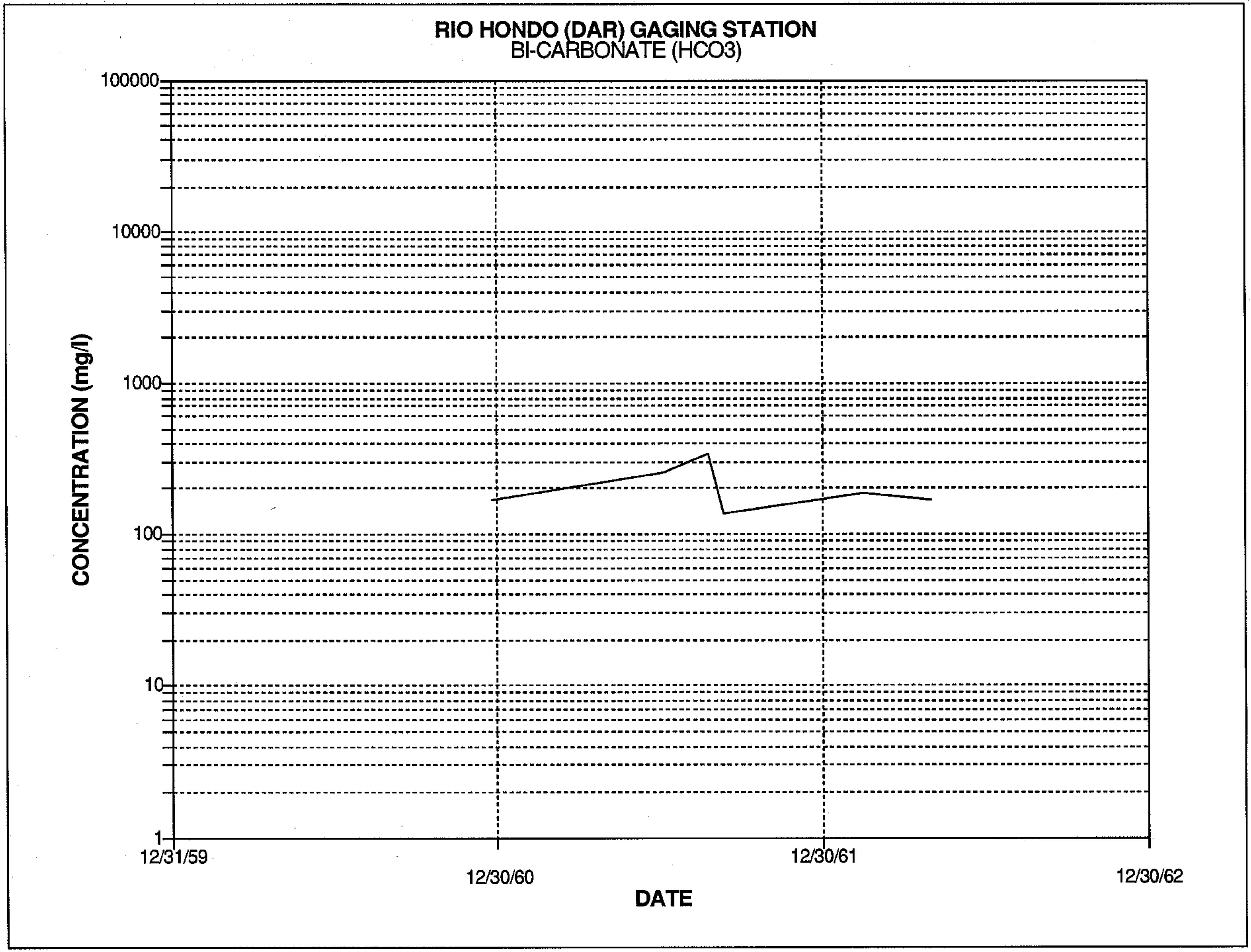


RIO HONDO (DAR) GAGING STATION
SODIUM (Na) + POTASSIUM (K)
10000
1000
100
10
1
CONENTRATION (mg/l)
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE


RIO HONDO (DAR) GAGING STATION
SULFATE (SO4)
CONENTRATION (mg/l)
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE



RIO HONDO (DAR) GAGING STATION
CHLORIDE (Cl)
CONENTRATION (mg/l)
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
12/30/63
DATE


RIO HONDO (DAR) GAGING STATION
BI-CARBONATE (HCO3)
CONCENTRATION (mg/l)
100000
10000
1000
100
10
1
12/31/59
12/30/60
12/30/61
12/30/62
DATE

Appendix E, Part 2

Stiff Diagrams for Selected Wells in the Roswell Basin

Table E-1. List of Wells Used to Create Trilinear and Stiff Diagrams

Site ID	Local Well Number	LSD (ft)	Well Depth (ft)	Aquifer Code*	Owner	Well Name
323542104385501	20S.23E.12.11	---	539	313SADR	---	---
324509104204901	18S.26E.14.23	---	756	313SADR	---	---
324612104213301	18S.26E.02.33333	3321	202	110AVMB	Juan Moreno	RA-1288, 1522, USGS#111
324654104220401	18S.26E.03.21111	3331	1102	313SADR	Jane C. Bujac	---
324850104434501	17S.23E.30.12	---	600	313SADR	---	---
325006104241301	17S.26E.17.233	---	1071	313SADR	---	---
325256104213501	16S.26E.35.113A	---	---	313SADR	---	---
331508104320401	12S.24E.27.21333	---	---	313SADR	---	---
331534104320401	12S.24E.22.41333	---	---	313SADR	---	---
331919104404901	11S.22E.25.331142	3895	410	313SADR	Mrs. J.E. Bloom	---
332125104285001	11S.24E.14.143334	3582	406	313SADR	F.B. Goodwin	RA-239
332231104273301	11S.24E.12.21333	3534	429	313SADR	J.P. White	RA-911
332243104373501	11S.23E.08.232222	3845	---	313SADR	E.T. Egger	Forsite Well
332351104250601	10S.25E.32.424333	3472.1	533	313SADR	City of Roswell	RA-4276, OSW#2
332429104280901	10S.24E.35.222113A	3510	438	313SADR	Hagerman Irrigation Co.	RA-360
332431104250601	10S.25E.29.443333	3474.9	721	313SADR	City of Roswell	RA-4227, OSW#1
332548104285401	10S.24E.23.32114	3534	377	313SADR	W.C. and B.W. Urton	RA-662,666
332549104311301	10S.24E.21.13333	3603	379	313SADR	Austin O. Crile	RA-343,982
332616104321401	10S.24E.17.33333	3612	420	313SADR	Mc Minn	RA-47
332628104294101	10S.24E.15.342121	3558	506	313SADR	Tow, Conner, Nicholas, etc.	RA-429,515,900,958
332921104313401	09S.24E.32.233324	3617	116	313SADR	Frank B. Martin	RA-3318

LSD = Land surface datum

--- = Information not available

See Appendix A for an explanation of aquifer codes.

Table E-1. List of Wells Used to Create Trilinear and Stiff Diagrams

Site ID	Local Well Number	LSD (ft)	Well Depth (ft)	Aquifer Code*	Owner	Well Name
332925104343401	09S.23E.36.133111	3696	820	313SADR	C.S. Marley	RA-2403
333411104310401	08S.24E.33.33311	3645	406	313SADR	E.A. Sanchez	RA-2575
333517104303401	08S.24E.28.413321	3651	416	313SADR	Poe Corn	RA-2417
333556104300401	08S.24E.28.222431	3594	410	313SADR	Geneva Spurrier	RA-2594
333557104293201	08S.24E.22.43313	3590	215	313SADR	Geneva Spurrier	RA-2593
333628104313701	08S.24E.20.233113	3661	358	313SADR	Poe Corn	RA-2418
333636104291801	08S.24E.22.232423	3590	315	313SADR	Bronson Corn	RA-2463
333636104294701	08S.24E.22.142113	3599	275	313SADR	Jess Corn	RA-2464
333755104334401	08S.23E.12.42323	3743	582	313SADR	Poe Corn	---
334439104320401	06S.24E.31.43343	4042	640	313SADR	El Paso Natural Gas Co.	SEO file 02-CH-2,
332734104240601	10S.25E.09.412441	3515	485	313ARTS	U.S. Bureau of F and W	RA-2653
332128104170201	11S.27E.18.33334	3644	30	313ARTS	George Ervin	---
332047104160001	11S.27E.20.331124	3668	37	313ARTS	David Carpenter	---
331927104151401	11S.27E.32.241321	3666	43	313ARTS	David Carpenter	---
331625104315401	12S.24E.15.43111	---	---	313ARTS	---	---
331558104315501	12S.24E.22.23111	---	---	313ARTS	---	---
333145104283001	09S.24E.14.34222	3580.9	192	110AVMB	Charles Wagner	RA-3133
332350104242001	10S.25E.33.431422	3466.25	47	110AVMB	NMSEO & USGS #6	---
332231104290701	11S.24E.10.22434	3567	129	110AVMB	C.E. Smith	USGS-428
324940104251501	17S.26E.18.433	---	170	110AVMB	---	---
324419104213301	18S.26E.23.213	---	48	110AVMB	---	---

LSD = Land surface datum

--- = Information not available

See Appendix A for an explanation of aquifer codes.

Table E-2. General Chemistry Data Used to Produce Stiff and Trilinear Diagrams for the San Andres Formation

Local Well Number	USGS Site ID	HCGRAMID	USGS Aquifer Code*	Date Sampled	Concentration (mg/L)								Cation/Anion Balance
					Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3	
06S.24E.31.43343 EL	334439104320401	S-1	313SADR	19590527	630	190	880	0	1500	1900	160	0	0.5
08S.23E.12.42323	333755104334401	S-2	313SADR	19590527	340	100	420	0	700	1000	160	0	0.3
08S.24E.20.233113	333628104313701	S-3	313SADR	19590526	550	150	660	0	1100	1700	180	0	-0.6
08S.24E.22.142113 J	333636104294701	S-4	313SADR	19590526	570	140	610	0	920	1800	190	0	0.0
08S.24E.22.232423 J	333636104291801	S-5	313SADR	19590526	730	250	1300	0	2400	2000	280	0	-0.2
08S.24E.22.43313 DO	333557104293201	S-6	313ARTS	19590526	510	140	420	0	910	1300	180	0	-0.4
08S.24E.28.222431 B	333556104300401	S-7	313SADR	19590526	440	120	360	0	690	1100	270	0	0.7
08S.24E.28.413321 D	333517104303401	S-8	313SADR	19590526	320	73	200	0	390	880	87	0	-0.1
08S.24E.33.33311 SA	333411104310401	S-9	313SADR	19590526	340	85	300	0	510	950	170	0	0.1
09S.23E.36.133111	332925104343401	S-10	313SADR	19590522	260	76	400	0	660	730	180	0	-0.2
09S.24E.32.233324 F	332921104313401	S-11	313SADR	19590527	200	54	220	0	340	510	220	0	0.4
10S.24E.15.342121	332628104294101	S-12	313SADR	19280510	200	64	440	5.2	690	560	210	0	-0.1
10S.24E.15.342121	332628104294101	S-13	313SADR	19400724	190	64	470	0	690	590	210	0	0.0
10S.24E.15.342121	332628104294101	S-14	313SADR	19480308	190	62	380	0	600	510	210	0	0.2
10S.24E.17.33333 B.	332616104321401	S-15	313SADR	19280510	180	54	150	4.8	250	450	210	0	0.5
10S.24E.21.13333 HS	332549104311301	S-16	313SADR	19420723	210	63	180	0	350	500	210	0	-0.5
10S.24E.23.32114 UR	332548104285401	S-17	313SADR	19400724	250	75	1000	0	1600	720	6	0	1.6
10S.24E.35.222113A	332429104280901	S-18	313SADR	19400308	290	67	1500	0	2300	750	200	0	0.9
10S.24E.35.222113A	332429104280901	S-19	313SADR	19400906	400	120	3000	0	4800	1100	220	0	-0.5
10S.24E.35.222113A	332429104280901	S-20	313SADR	19410331	270	83	1400	0	2100	750	210	0	1.8

* See Appendix A for an explanation of aquifer codes.

Table E-2. General Chemistry Data Used to Produce Stiff and Trilinear Diagrams for the San Andres Formation

Local Well Number	USGS Site ID	HCGRAMID	USGS Aquifer Code*	Date Sampled	Concentration (mg/L)								Cation/Anion Balance
					Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3	
10S.24E.35.222113A	332429104280901	S-21	313SADR	19470922	420	120	3600	0	5600	1200	210	0	0.3
10S.24E.35.222113A	332429104280901	S-22	313SADR	19480419	350	100	2600	0	4000	1000	190	12	0.6
10S.24E.35.222113A	332429104280901	S-23	313SADR	19481129	270	87	1700	0	2700	780	210	0	-0.7
10S.24E.35.222113A	332429104280901	S-24	313SADR	19490120	280	90	1800	0	2800	800	220	0	0.2
10S.24E.35.222113A	332429104280901	S-25	313SADR	19490319	270	78	1500	0	2300	800	210	0	0.1
10S.25E.29.443333 P	332431104250601	S-26	313SADR	19600718	940	190	7100	0	11000	2900	200	0	-0.3
10S.25E.29.443333 P	332431104250601	S-27	313SADR	19610221	600	130	3800	0	5800	1900	190	0	-0.1
10S.25E.29.443333 P	332431104250601	S-28	313SADR	19610720	490	120	2800	0	4100	1600	200	0	1.3
10S.25E.29.443333 P	332431104250601	S-29	313SADR	19620404	470	130	2600	0	3900	1500	200	0	0.9
10S.25E.32.424333 O	332351104250601	S-30	313SADR	19600819	930	220	7500	0	12000	3000	200	0	-1.7
10S.25E.32.424333 O	332351104250601	S-31	313SADR	19601027	920	190	6900	0	11000	2900	200	0	-1.7
10S.25E.32.424333 O	332351104250601	S-32	313SADR	19610720	940	200	7100	0	11000	2900	200	0	-0.2
10S.25E.32.424333 O	332351104250601	S-33	313SADR	19620630	1000	230	9000	59	14000	3100	190	0	-0.1
11S.22E.25.331142	331919104404901	S-34	313SADR	19470602	200	54	30	0	43	520	220	0	0.3
11S.23E.08.232222	332243104373501	S-35	313SADR	19470602	150	47	25	0	45	330	240	0	1.5
11S.24E.12.21333 JP	332231104273301	S-36	313SADR	19280510	180	57	400	11	600	470	230	0	1.4
11S.24E.14.143334 F	332125104285001	S-37	313SADR	19400530	160	48	51	0	79	390	230	0	0.1
12S.24E.22.41333	331534104320401	S-38	313SADR	19691221	140	32	1.4	0	30	270	170	0	2.2
12S.24E.22.41333	331534104320401	S-39	313SADR	19700226	150	39	17	0	53	270	250	0	1.0
12S.24E.27.21333	331508104320401	S-40	313SADR	19700122	120	36	26	0	30	270	230	0	-0.8

* See Appendix A for an explanation of aquifer codes.

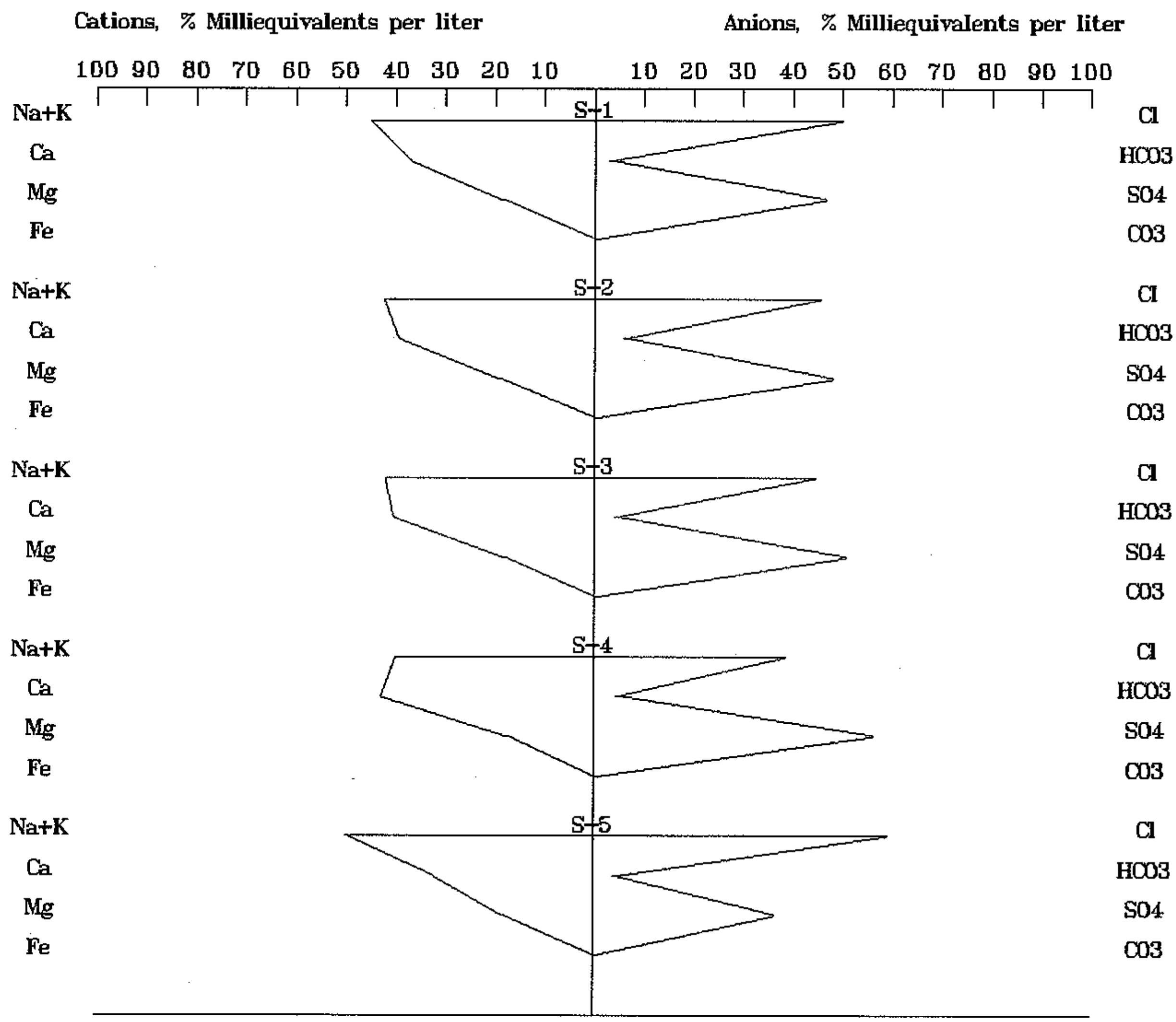
Table E-2. General Chemistry Data Used to Produce Stiff and Trilinear Diagrams for the San Andres Formation

Local Well Number	USGS Site ID	HCGRAMID	USGS Aquifer Code*	Date Sampled	Concentration (mg/L)								Cation/Anion Balance
					Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3	
16S.26E.35.113A FUL	325256104213501	S-41	313SADR	19640319	420	85	46	0	48	1200	180	0	1.1
17S.23E.30.12 HOPE	324850104434501	S-42	313SADR	19620206	150	32	13	0	16	290	240	0	1.2
17S.26E.17.233 HOSP	325006104241301	S-43	313SADR	19620308	190	44	9.4	0	16	440	230	0	0.5
18S.26E.02.33333	324612104213301	S-44	110AVMB	19400723	360	160	97	0	140	1300	200	0	1.5
18S.26E.03.21111	324654104220401	S-45	313SADR	19280521	490	180	820	14	1400	1600	200	0	-0.5
18S.26E.14.23	324509104204901	S-46	313SADR	19280521	260	81	61	4.8	95	760	220	0	0.7
20S.23E.12.11 JOYCE	323542104385501	S-47	313SADR	19270416	530	190	10	2.4	15	1700	280	0	2.6
09S.24E.14.34222 B	333145104283001	S-48	110AVMB	19590528	460	120	380	0	680	1300	170	0	0.3
10S.25E.33.431422 J	332350104242001	S-49	110AVMB	19561227	780	310	2400	0	4600	1700	260	0	-0.2
11S.24E.10.22434	332231104290701	S-50	110AVMB	19440209	120	38	35	0	39	270	240	0	-0.1
17S.26E.18.433 ARTE	324940104251501	S-51	110AVMB	19620308	160	37	22	0	22	380	210	0	0.0
18S.26E.23.213	324419104213301	S-52	110AVMB	19400723	490	200	180	0	400	1700	150	0	-0.4
10S.25E.09.412441 U	332734104240601	S-53	313ARTS	19510326	490	120	1200	0	1900	1400	190	0	0.4
11S.27E.18.33334	332128104170201	S-54	313ARTS	19710607	560	110	69	6.8	97	1600	130	0	2.5
11S.27E.20.331124	332047104160001	S-55	313ARTS	19710607	600	35	24	4	47	1500	160	0	-1.8
11S.27E.32.241321	331927104151401	S-56	313ARTS	19710607	530	310	41	2.6	51	2400	150	0	-0.1
12S.24E.15.43111	331625104315401	S-57	313ARTS	19700112	130	38	34	0	50	290	220	0	0.2
12S.24E.22.23111	331558104315501	S-58	313ARTS	19700107	140	38	34	0	30	280	240	0	4.4

*See Appendix A for an explanation of aquifer codes.

Roswell Basin San Andres Formation

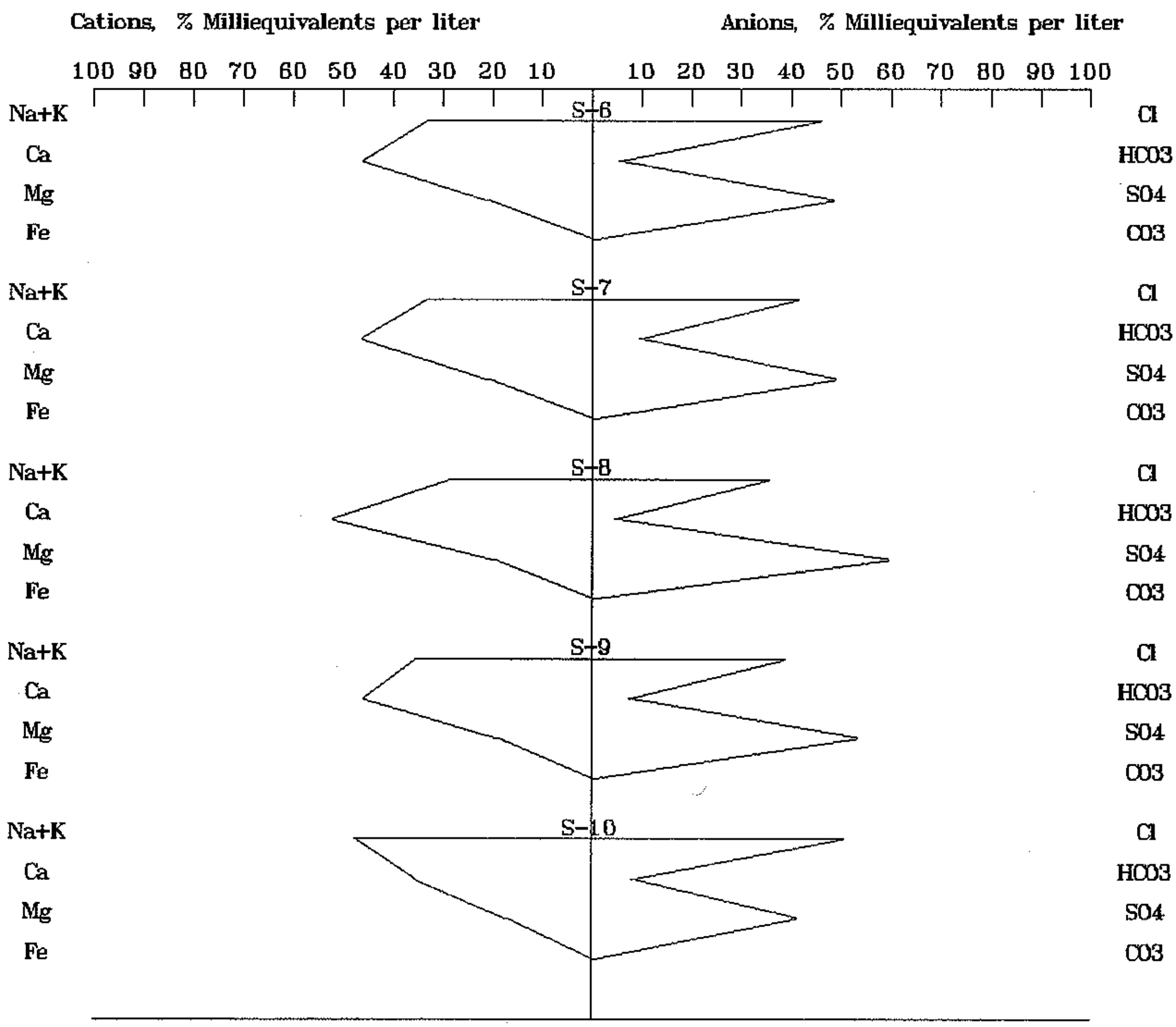
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
	Chemical Constituents in % Equivalents per Million											
S-1	27/ 5/1959	44.85	36.83	18.31	0.00	0.00	46.82	3.10	50.08	7.89	9.40	-44.44
S-2	27/ 5/1959	42.04	39.04	18.93	0.00	0.00	48.21	6.07	45.72	5.15	5.96	-22.57
S-3	26/ 5/1959	41.92	40.07	18.01	0.00	0.00	51.02	4.25	44.73	6.44	7.61	-36.83
S-4	26/ 5/1959	39.91	42.78	17.32	0.00	0.00	56.32	4.68	39.00	5.94	6.97	-36.85
S-5	26/ 5/1959	49.81	32.08	18.11	0.00	0.00	36.55	4.03	59.42	10.59	12.56	-52.40



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

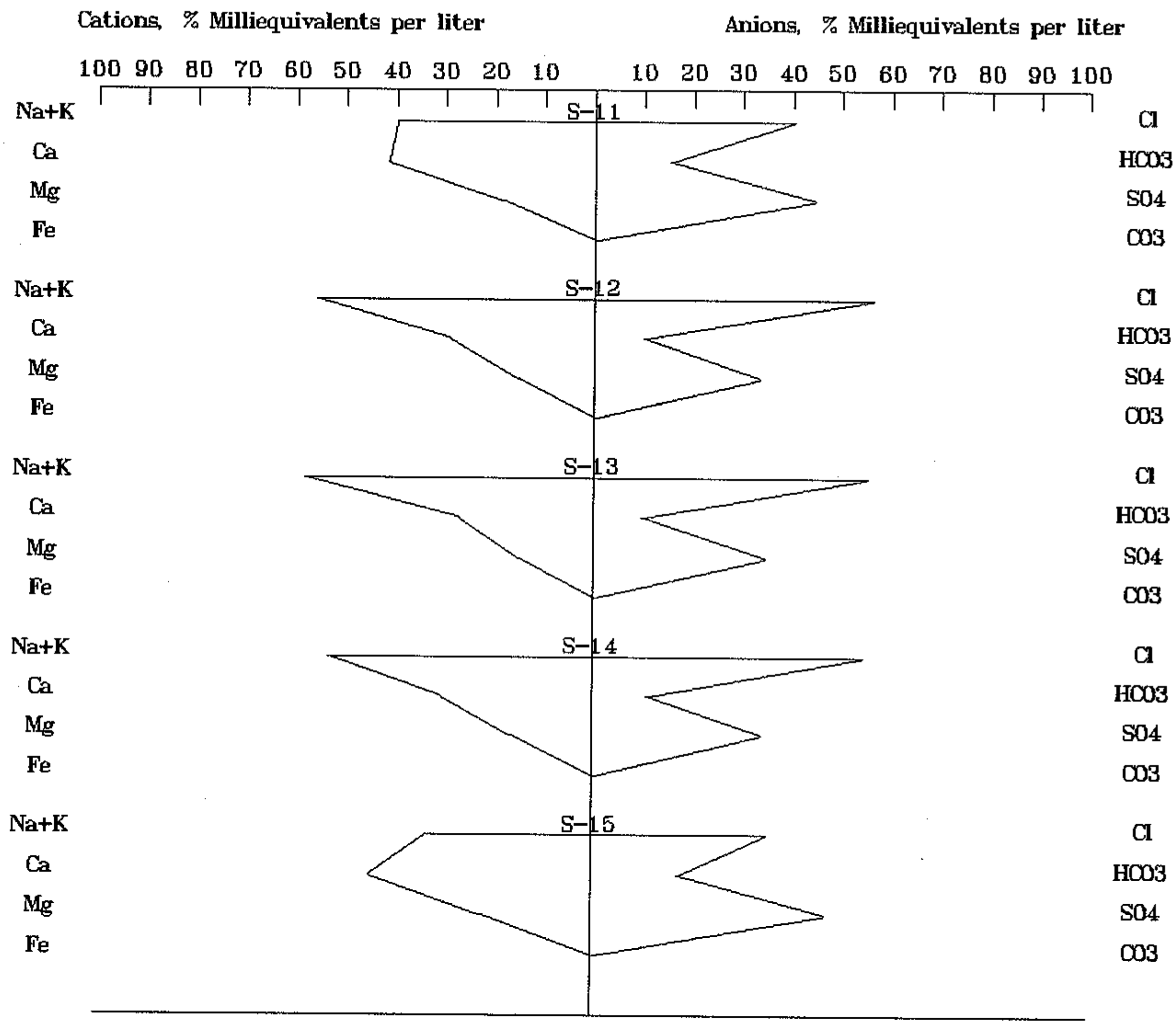
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-6	26/ 5/1959	33.08	46.07	20.85	0.00	0.00	48.60	5.30	46.10	4.25	4.77	-34.02
S-7	26/ 5/1959	32.98	46.24	20.79	0.00	0.00	48.94	9.46	41.60	3.93	4.33	-27.40
S-8	26/ 5/1959	28.36	52.06	19.58	0.00	0.00	59.58	4.64	35.78	2.62	2.55	-20.55
S-9	26/ 5/1959	35.26	45.84	18.89	0.00	0.00	53.53	7.54	38.93	3.77	4.12	-21.17
S-10	22/ 5/1959	47.51	35.42	17.07	0.00	0.00	41.34	8.02	50.64	5.61	6.56	-16.28



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

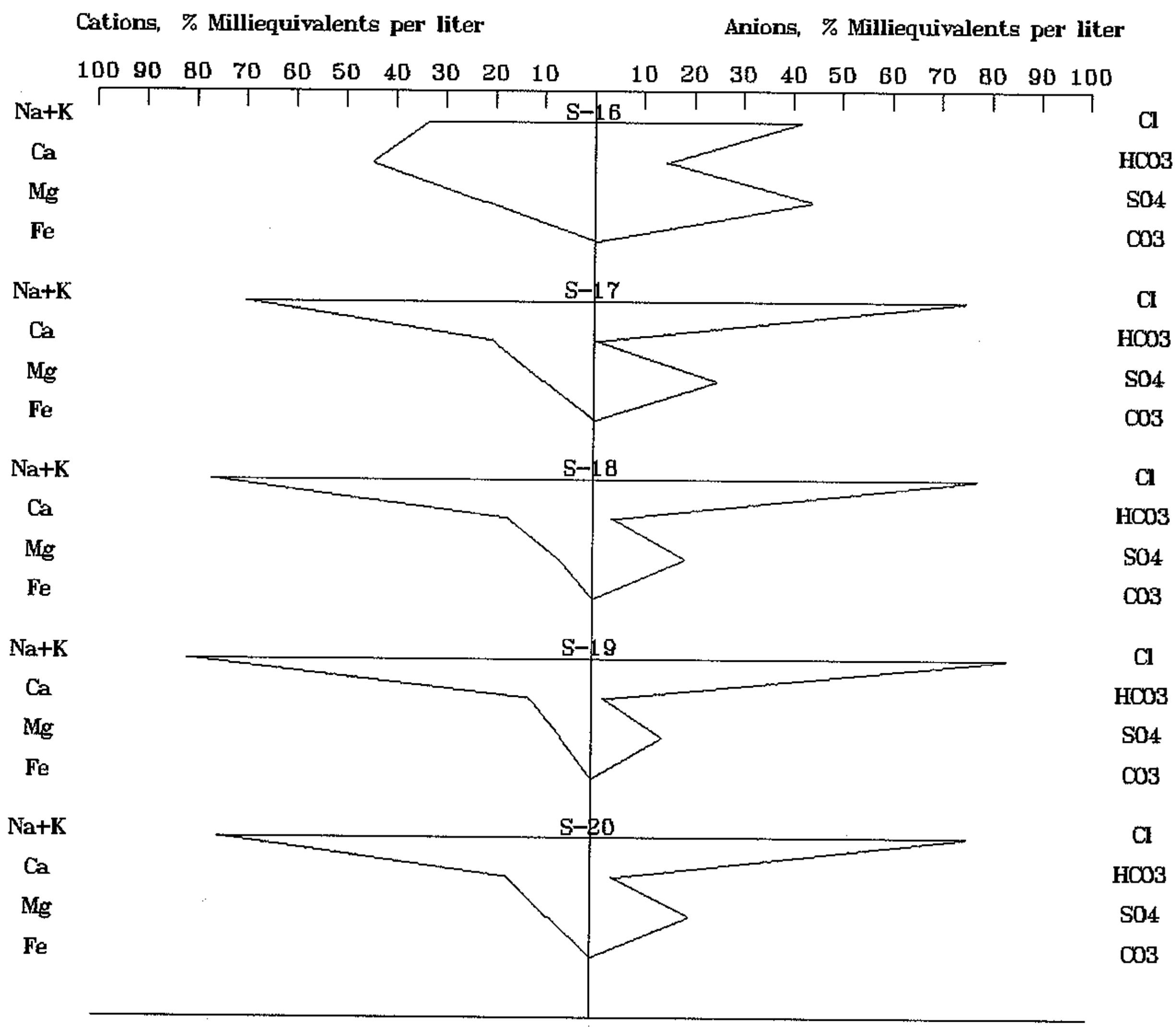
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-11	27/ 5/1959	39.89	41.60	18.51	0.00	0.00	44.59	15.14	40.27	3.56	3.84	-10.82
S-12	10/ 5/1928	55.84	28.91	15.25	0.00	0.00	33.73	9.96	56.31	6.93	8.23	-11.80
S-13	24/ 7/1940	58.10	26.94	14.96	0.00	0.00	34.91	9.78	55.31	7.53	8.96	-11.30
S-14	8/ 3/1948	53.13	30.47	16.39	0.00	0.00	34.27	11.11	54.62	6.12	7.21	-11.14
S-15	10/ 5/1928	33.12	44.75	22.13	0.00	0.00	47.17	17.33	35.50	2.52	2.40	-9.98



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

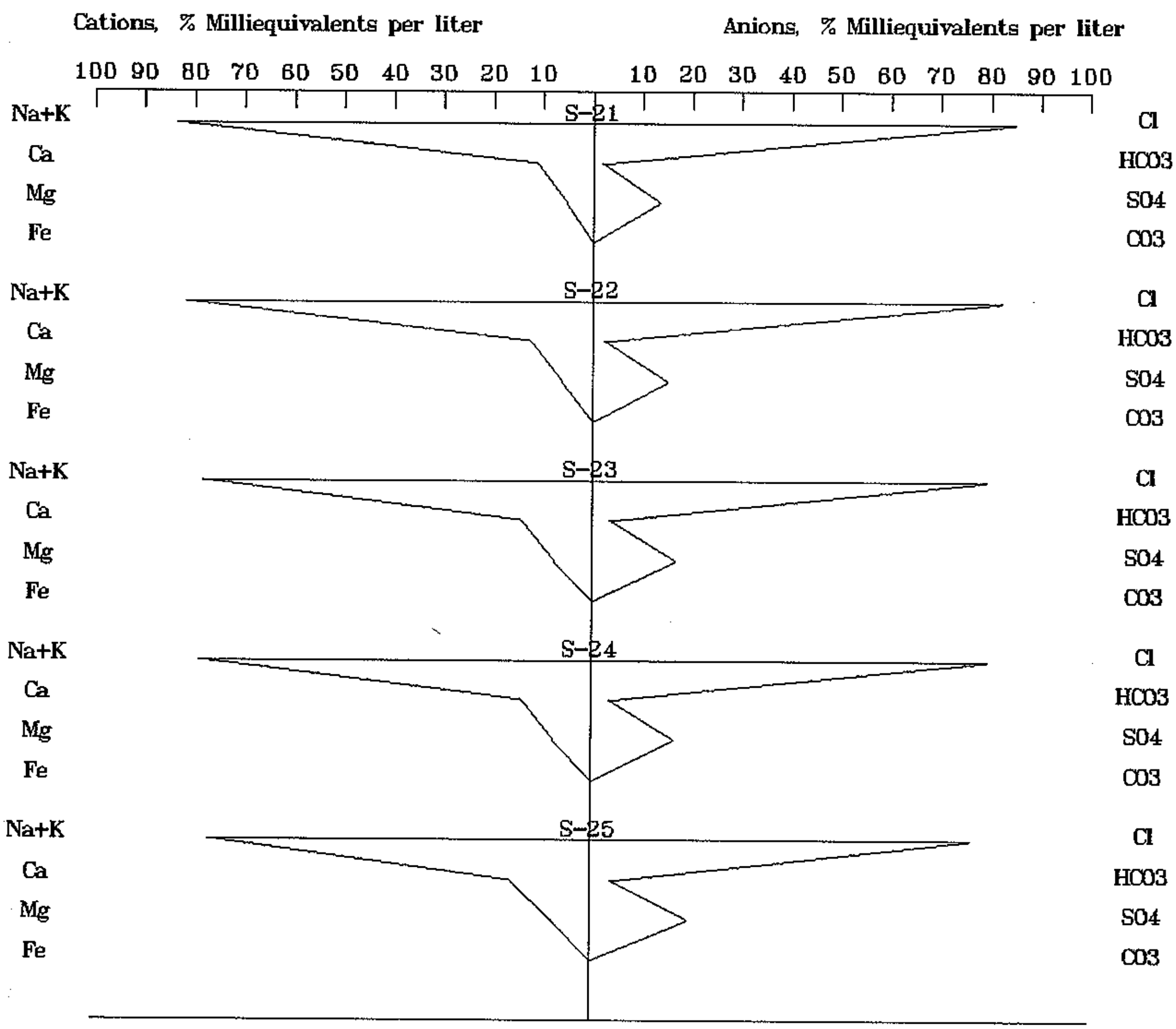
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-16	23/ 7/1942	33.33	44.61	22.06	0.00	0.00	43.88	14.51	41.62	2.80	2.79	-12.22
S-17	24/ 7/1940	70.00	20.07	9.93	0.00	0.00	24.89	0.16	74.95	14.25	16.50	-18.55
S-18	8/ 3/1940	76.56	16.98	6.47	0.00	0.00	18.64	3.91	77.45	20.64	22.59	-16.70
S-19	6/ 9/1940	81.39	12.45	6.16	0.00	0.00	14.14	2.23	83.63	33.79	32.70	-26.23
S-20	31/ 3/1941	75.00	16.59	8.41	0.00	0.00	19.94	4.40	75.66	19.12	21.22	-16.86



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

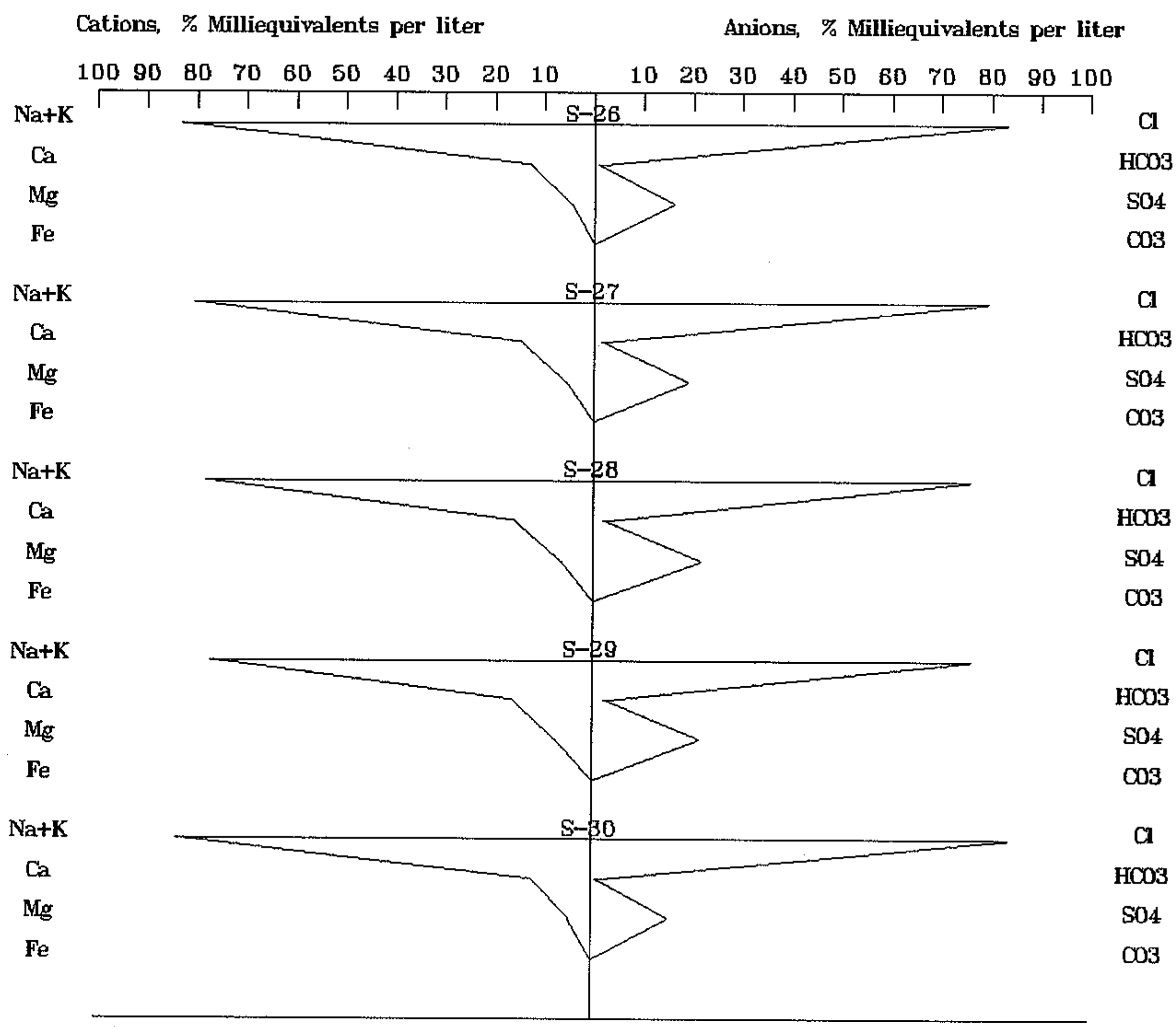
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-21	22/ 9/1947	83.55	11.18	5.27	0.00	0.00	13.40	1.85	84.75	39.89	36.54	-27.39
S-22	19/ 4/1948	81.49	12.58	5.93	0.00	0.29	15.18	2.27	82.26	31.56	31.17	-22.18
S-23	29/11/1948	78.19	14.25	7.57	0.00	0.00	16.94	3.59	79.47	23.03	24.64	-17.19
S-24	20/ 1/1949	78.55	14.02	7.43	0.00	0.00	16.78	3.63	79.59	23.95	25.41	-17.77
S-25	19/ 3/1949	76.64	15.82	7.54	0.00	0.00	19.60	4.05	76.35	20.69	22.64	-16.45



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

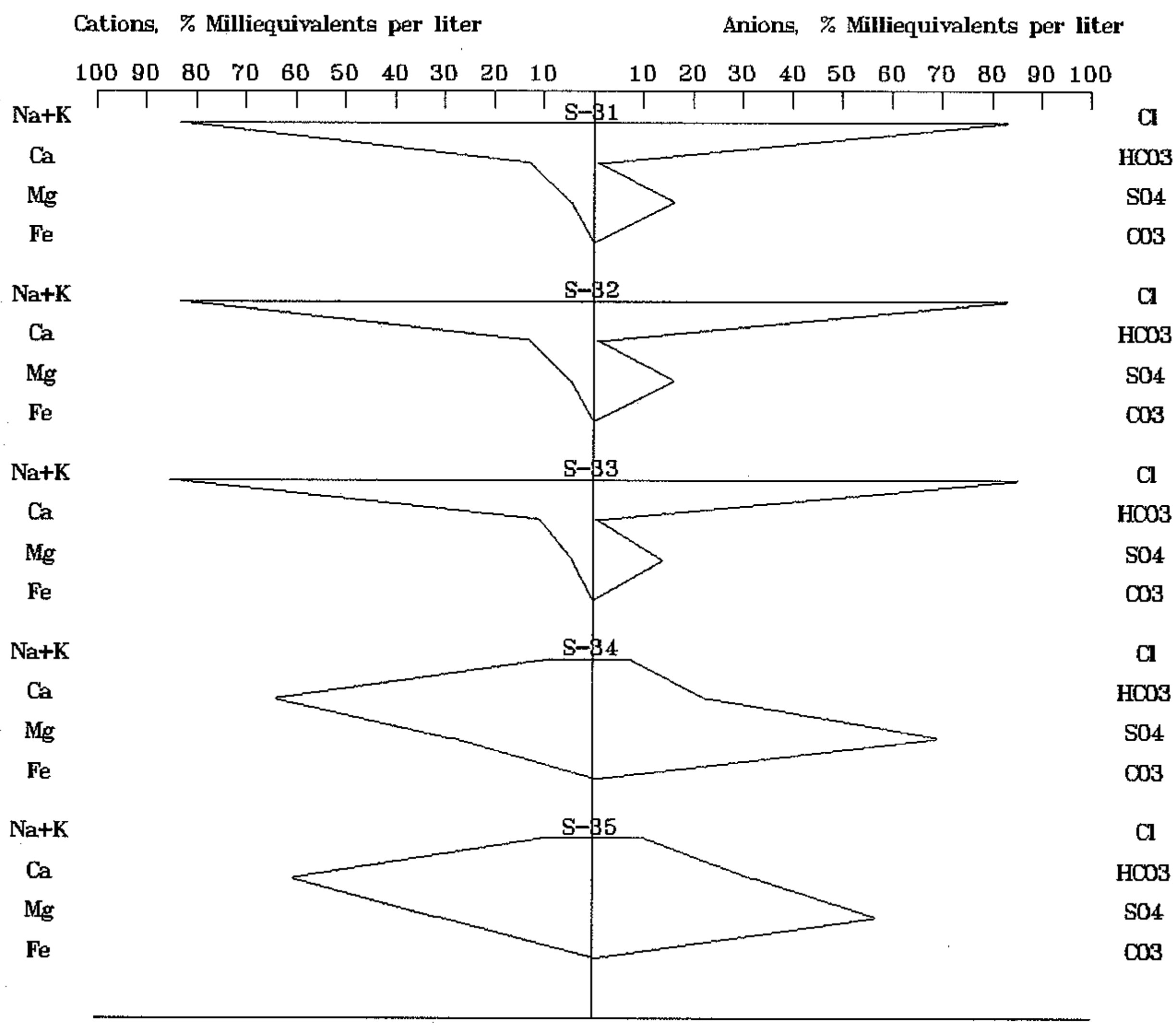
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-26	18/ 7/1960	83.16	12.63	4.21	0.00	0.00	16.15	0.88	82.98	55.23	44.51	-59.26
S-27	21/ 2/1961	80.27	14.54	5.19	0.00	0.00	19.18	1.51	79.31	36.67	34.57	-37.52
S-28	20/ 7/1961	78.02	15.66	6.32	0.00	0.00	21.88	2.15	75.97	29.40	29.63	-31.04
S-29	4/ 4/1962	76.81	15.93	7.26	0.00	0.00	21.61	2.27	76.12	27.37	28.12	-30.87
S-30	19/ 8/1960	83.49	11.88	4.63	0.00	0.00	15.45	0.81	83.74	57.45	45.50	-61.23



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

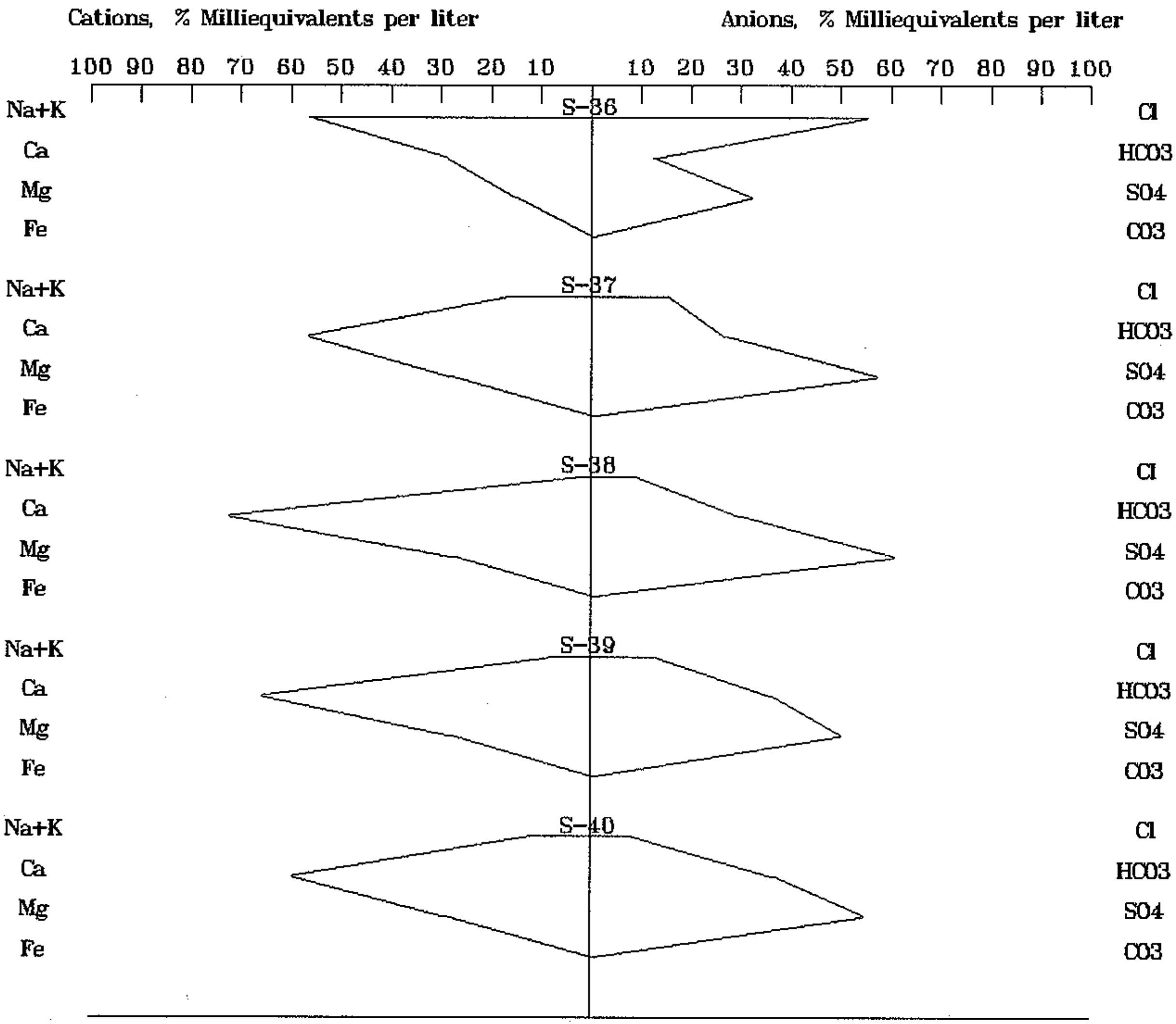
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-31	27/10/1960	82.99	12.69	4.32	0.00	0.00	16.15	0.88	82.98	54.11	43.99	-58.26
S-32	20/ 7/1961	82.98	12.60	4.42	0.00	0.00	16.15	0.88	82.98	54.87	44.34	-60.08
S-33	30/ 6/1962	85.10	10.80	4.10	0.00	0.00	13.95	0.67	85.37	66.74	49.29	-65.71
S-34	2/ 6/1947	8.30	63.46	28.24	0.00	0.00	69.20	23.05	7.75	0.49	-0.55	-10.82
S-35	2/ 6/1947	8.74	60.18	31.08	0.00	0.00	56.91	32.58	10.51	0.46	-0.59	-7.42



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

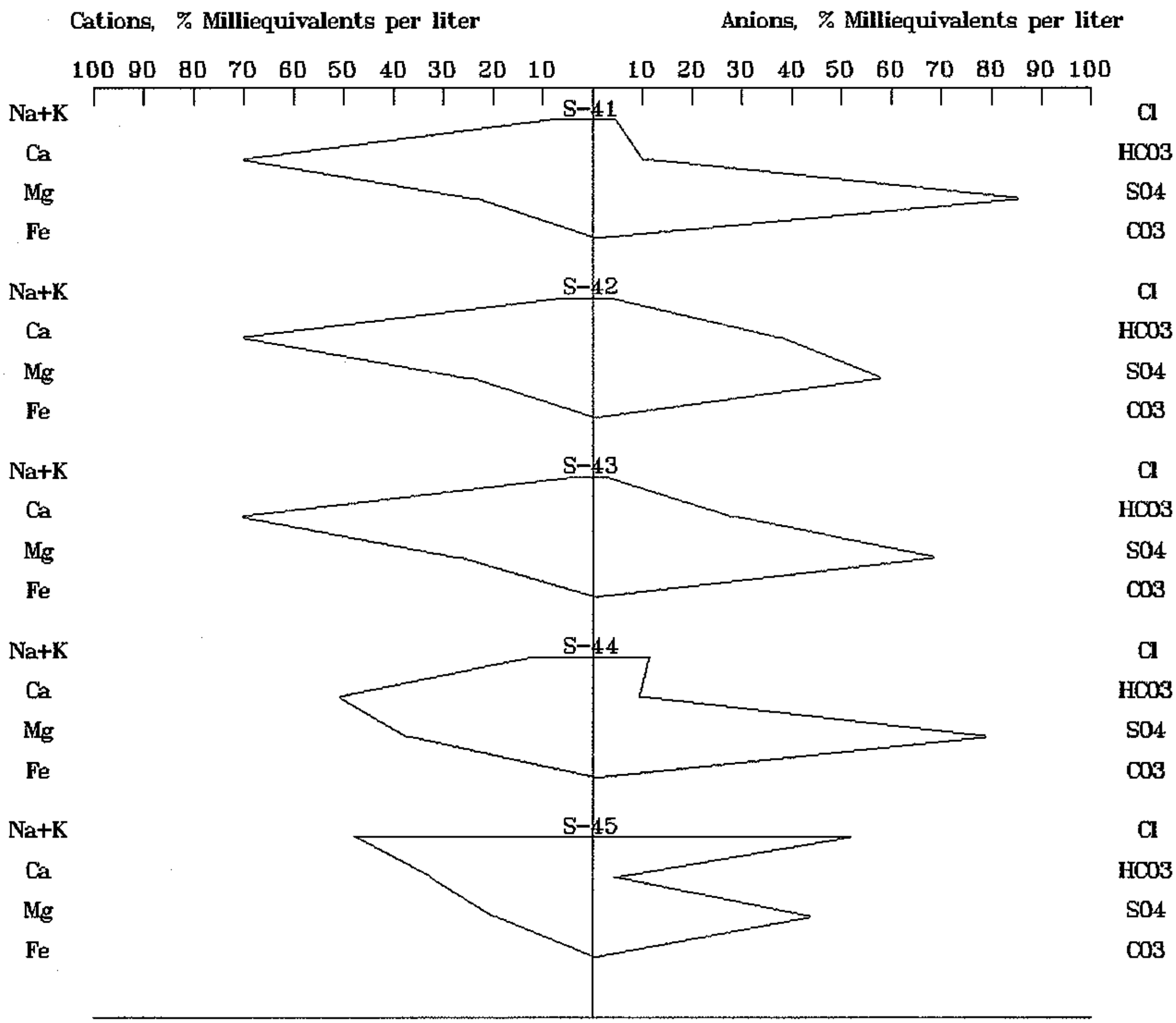
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-36	10/ 5/1928	56.40	28.65	14.96	0.00	0.00	32.10	12.37	55.53	6.66	7.88	-9.90
S-37	30/ 5/1940	15.68	56.42	27.90	0.00	0.00	57.51	26.70	15.79	0.91	0.08	-8.16
S-38	21/12/1969	0.63	72.18	27.20	0.00	0.00	60.75	30.11	9.15	0.03	-1.23	-6.83
S-39	26/ 2/1970	6.47	65.47	28.06	0.00	0.00	50.13	36.54	13.33	0.32	-0.79	-6.60
S-40	22/ 1/1970	11.22	59.40	29.38	0.00	0.00	54.91	36.82	8.27	0.53	-0.47	-5.18



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

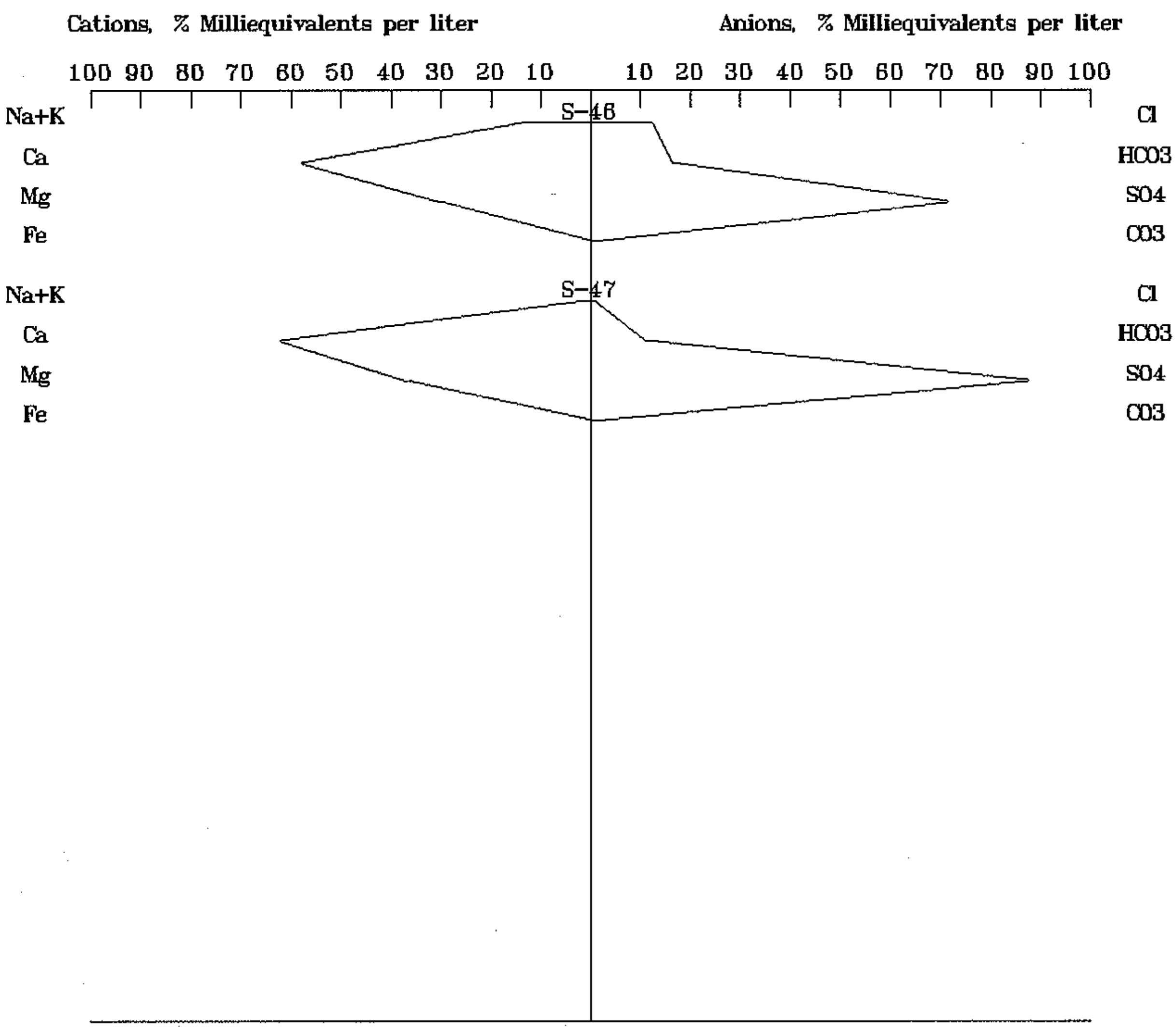
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-41	19/ 3/1964	6.68	69.97	23.35	0.00	0.00	85.30	10.07	4.62	0.54	-0.47	-25.00
S-42	6/ 2/1962	5.29	70.07	24.64	0.00	0.00	57.93	37.74	4.33	0.25	-0.90	-6.18
S-43	8/ 3/1962	3.03	70.18	26.79	0.00	0.00	68.46	28.17	3.37	0.16	-1.03	-9.33
S-44	23/ 7/1940	11.94	50.82	37.24	0.00	0.00	78.92	9.56	11.52	1.07	0.32	-27.85
S-45	21/ 5/1928	47.85	32.48	19.67	0.00	0.00	43.78	4.31	51.91	8.05	9.60	-35.98



Roswell Basin San Andres Formation

Chemical Constituents in % Equivalents per Million

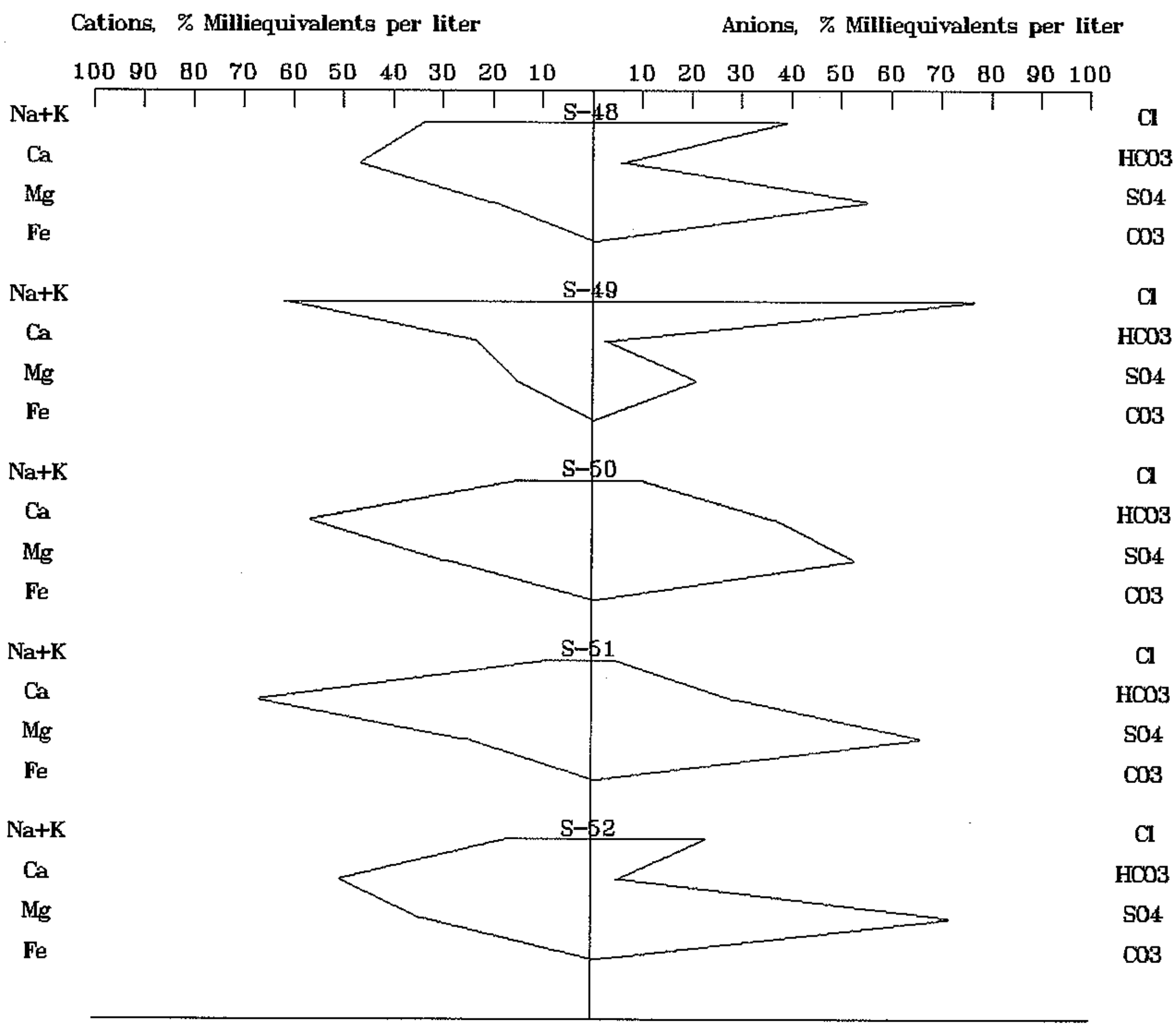
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-46	21/ 5/1928	12.39	57.89	29.73	0.00	0.00	71.57	16.31	12.12	0.85	-0.01	-16.03
S-47	16/ 4/1927	1.17	62.12	36.71	0.00	0.00	87.60	11.36	1.05	0.09	-1.13	-37.49



Roswell Basin Alluvial Aquifer

Chemical Constituents in % Equivalents per Million

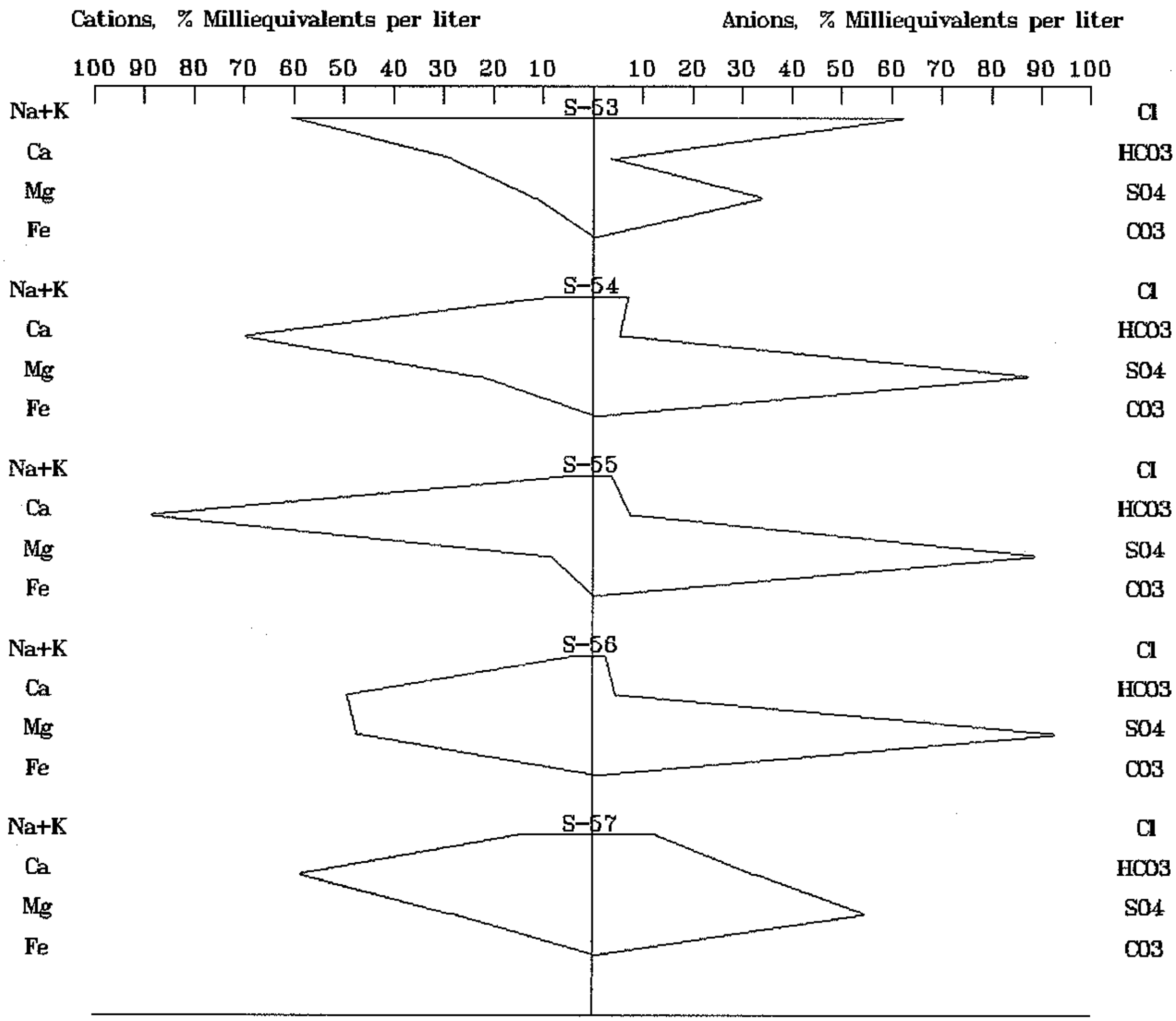
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-48	28/ 5/1959	33.49	46.51	20.00	0.00	0.00	55.20	5.68	39.12	4.08	4.54	-30.04
S-49	27/12/1956	61.84	23.05	15.10	0.00	0.00	20.89	2.52	76.59	18.39	20.55	-60.16
S-50	9/ 2/1944	14.31	56.30	29.39	0.00	0.00	52.76	36.92	10.33	0.71	-0.21	-5.18
S-51	8/ 3/1962	7.99	66.62	25.40	0.00	0.00	66.07	28.74	5.18	0.41	-0.66	-7.59
S-52	23/ 7/1940	16.07	50.17	33.76	0.00	0.00	72.03	5.00	22.96	1.73	1.28	-38.44



Roswell Basin Artesia Group

Chemical Constituents in % Equivalents per Million

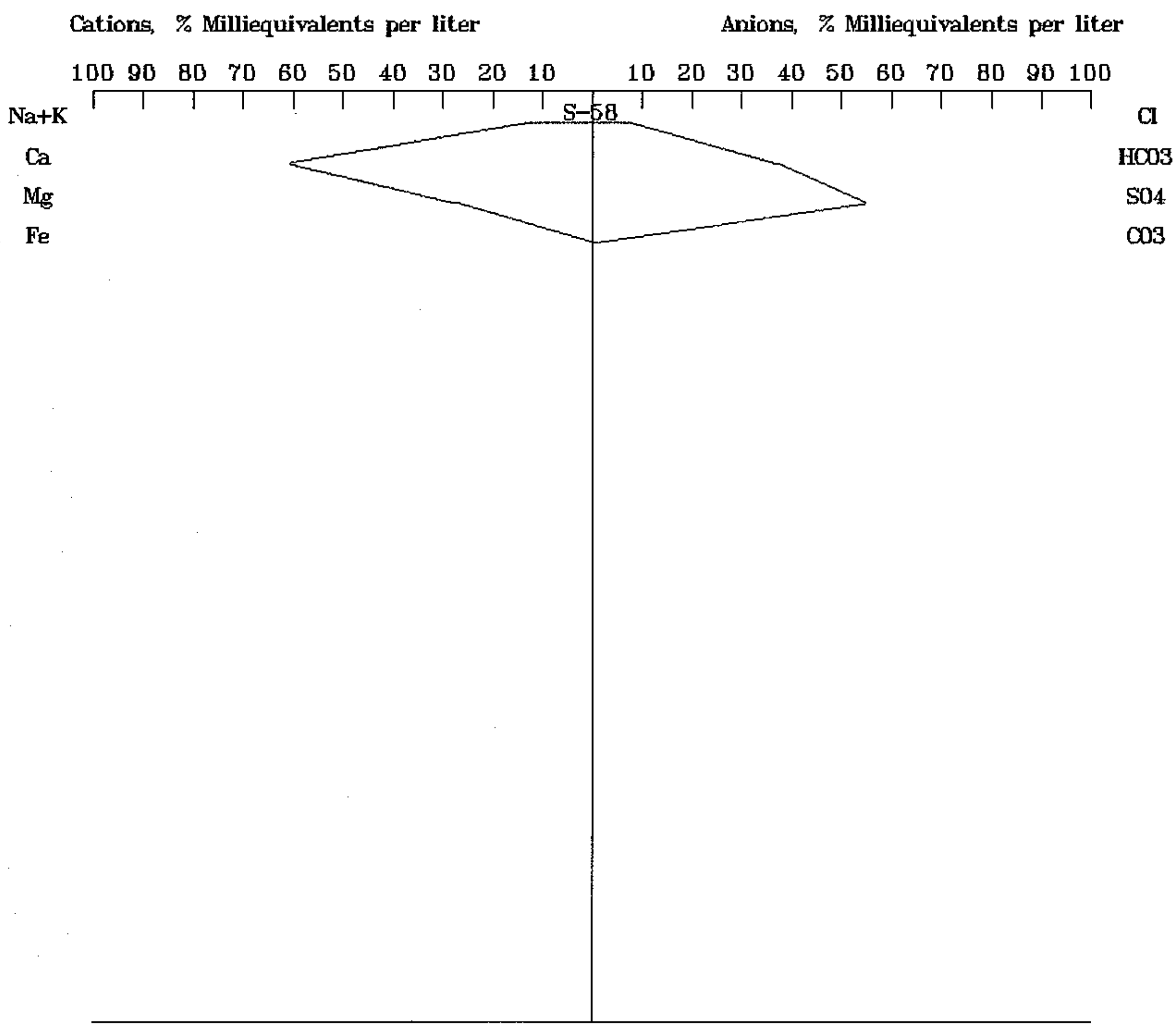
Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-53	26/ 3/1951	60.33	28.26	11.41	0.00	0.00	33.95	3.63	62.43	12.60	14.77	-31.21
S-54	7/ 6/1971	7.91	69.57	22.53	0.00	0.00	87.25	5.58	7.17	0.70	-0.23	-34.86
S-55	7/ 6/1971	3.37	88.15	8.48	0.00	0.00	88.78	7.45	3.77	0.26	-0.89	-30.20
S-56	7/ 6/1971	3.44	49.16	47.40	0.00	0.00	92.76	4.56	2.67	0.35	-0.75	-49.49
S-57	12/ 1/1970	13.33	58.48	28.18	0.00	0.00	54.62	32.62	12.76	0.67	-0.27	-6.01



Roswell Basin Artesia Group

Sample	Date	NaK	Ca	Mg	Fe	CO3	SO4	HCO3	Cl	SAR	ESP	RSC
S-58	7/ 1/1970	12.10	60.73	27.17	0.00	0.00	54.95	37.08	7.98	0.62	-0.35	-6.18

Chemical Constituents in % Equivalents per Million



Appendix E, Part 3

Isotope Data for Wells and Springs in the Roswell Basin

Table E-3. Summary of Tritium Data Available for the Roswell Basin
Page 1 of 6

USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3355271044502	04S	21E	33.111	PVACD#9	760	620-720	03/74-11/78	12	5	2.2 - 9.0	313SADR/310GLRT	540-720' Glorieta Sandstone
3341481045726	07S	20E	16.333	PVACD#1	750	464-475,530-750	04/74-11/78	8	5	0.2 - 11.8	313SADR/310YESO	515-750' Yeso Formation
3340461044138	07S	22E	26.131	Tom Corn Well	---	---	05/73-11/78	9	6	3.1 - 15.9	---	Intake area
3339421043943	07S	22E	36.422	Corn Windmill	---	---	03/74-08/76	5	6	2.3 - 13.5	---	Located in recharge area
3337241043953	08S	22E	13.223	Corn Windmill	450 to 500	---	03/73-08/76	11	9	2.7 - 27.3	---	Located in recharge area
3336311044156	08S	22E	22.223	Dick Corn Well	---	---	03/73-08/76	8	7	1.7 - 14.8	---	
3337351043732	08S	23E	16.111	RA-4680	585	14-585	03/73-04/76	8	9	0.1 - 37.9	---	Located in recharge area
3334311043058	08S	24E	33.311	RA-2601-A	---	---	1973	1	12	12.4	---	
3326211045638	10S	20E	16.444	PVACD#2	503	435-500	03/74-08/76	11	5	1.2 - 10.5	313SADR/310GLRT/310YESO	440-503' Yeso Formation
3327041044936	10S	21E	16.222	PVACD#3	672	585-668	12/74-10/76	8	5	0.6 - 8.3	313SADR/310GLRT/310YESO	630-672' Yeso Formation
3325191044725	10S	21E	25.111	Marley Whitney Well	703	60-703	01/72-03/73	2	21	19.6 - 21.8	---	
3326161042957	10S	24E	15.33	RA-5010	120	55-120	01/73-07/76	3	63	12.9 - 149.3	110AVMB/110GTUN	0-120' Alluvium and Gatuna Formation
3326031042957	10S	24E	22.11	RA-896-B	306	234-306	1973	1	14	14.3	110GTUN/313SADR	237-306' San Andres Formation
3325491043005	10S	24E	22.133	RA-896	260	233-260	03/72-08/76	3	23	4.8 - 53.9	110GTUN/313SADR	249-260' San Andres Formation
3326091042926	10S	24E	22.212	RA-4005	61	38-58,60-61	1973	1	28	28.4	110AVMB	0-60' Alluvium
3325371042320	10S	25E	22.324	Elk#1	650	621-650	01/67-03/75	6	10	1.0 - 20.8	313SADR	San Andres Formation
3323381042546	10S	25E	32.333	RA-4568-S	533	416-533	04/74-04/79	3	6	1.3 - 10.4	313SADR	393-533' San Andres Formation
3324051042421	10S	25E	33.144	RA-4304	---	---	1976	1	7	7.0	---	
3321191050919	11S	18E	15.313	RA-H-476	150	35-86,95-150	10/76-06/78	5	34	25.5 - 40.9	---	65-150' Thin layers (15') of clay and limestone
3320211050703	11S	18E	24.341	R.O. Anderson Well	---	---	1976	1	27	27.0	---	
3321551045613	11S	20E	16.222	Border Hill Well	---	---	03/73-10/76	7	22	12.3 - 41.6	---	Located in recharge area

TU = Tritium units --- = Information not available

Table E-3. Summary of Tritium Data Available for the Roswell Basin

USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3320181045714	11S	20E	20.44	RA-150-H	561	17-561	1973	1	50	50.1	313SADR/310GLRT	545-561' Sandstone San Andres
3321241044629	11S	21E	13.422	Middle (Pearl) Windmill	500 to 600	---	03/75-03/76	3	6	2.7 - 9.0	---	San Andres Formation
3321041045206	11S	21E	18.333	PVACD#8	524	410-489	03/74-11/78	18	39	21.2 - 58.0	310GLRT	0-524' San Andres Formation
3320311044652	11S	21E	24.411	Silver Maple Windmill	600	---	03/75-08/76	4	14	10.8 - 16.6	---	San Andres Formation
3322131044332	11S	22E	9.321	H.L. Woods Well	578	511-578	10/68-06/78	15	7	1.4 - 24.1	313SADR	San Andres Limestone
3321471044519	11S	22E	18.211	RA-3562	780	15-780	10/71-08/76	7	9	2.7 - 14.6	313SADR	20-780' San Andres Formation
3320561044245	11S	22E	22.111	Wright Well	---	---	01/71-01/72	2	15	3.9 - 25.7	---	
3322571043352	11S	23E	1.413	RA-1879	160	90-120,150-160	03/73-05/73	2	20	13.4 - 27.5	110AVMB/110GTUN	75-160' Gatuna Formation
3322441043352	11S	23E	1.433	RA-(1428/1879)	---	---	03/73-08/76	3	12	9.2 - 16.3	---	
3322371043337	11S	23E	12.221	RA-458	---	---	03/73-08/76	2	11	11.1 - 11.5	313SADR	
3321581043415	11S	23E	12.332	RA-1521-M	165	---	03/73-08/76	3	9	5.8 - 11.6	110AVMB	
3321451043532	11S	23E	15.222	RA-2555	649	0	03/73-07/76	2	18	10.0 - 25.3	313SADR	57-649' San Andres Formation
3322311043227	11S	24E	7.214	RA-55-AB	---	---	1973	1	20	20.2	313SADR	
3322381042907	11S	24E	10.222	PVACD Hendricks Well 1	425	273-425	1976	1	51	50.8	313ARTS/313SADR	298-425' San Andres Formation
3321121042852	11S	24E	14.314	RA-1920-S	205	0-205	03/73-07/76	2	12	12.2 - 12.5	110AVMB/110GTUN	118-205' Gatuna Formation
3320061043204	11S	24E	20.333	RA-(1771,2475)	90,175	35-90,35-175	1972	1	32	31.9	110AVMB/110GTUN	50-90,175' Gatuna Formation
3320061042805	11S	24E	23.44	RA-(986 (S-116))	535	388-535	03/73-03/76	5	9	4.3 - 19.1	313SADR	383-535' San Andres Formation
3320061042727	11S	24E	24.433	RA-986-A	581	382-581	1973	1	13	12.5	313ARTS/313SADR	398-581' San Andres Formation
3319331042750	11S	24E	25.312	RA-1015	669	369-669	03/73-08/76	7	7	2.3 - 13.0	313SADR	Producing horizon thought to be the San Andres
3319201042742	11S	24E	25.341	RA-(1015/1012-S-COMB-B)	678	413-678	03/68-04/78	18	9	0.5 - 28.6	313ARTS/313SADR	485-678' San Andres Formation
3319531042805	11S	24E	26.224	RA-1012	592	446-592	03/73-04/78	11	10	0.6 - 38.5	313SADR	395-592' San Andres Formation

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Table E-3. Summary of Tritium Data Available for the Roswell Basin

USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3321001042336	11S	25E	15.334	RA-(61,59-S)	780	613-780	05/73-11/78	18	7	1.8 - 26.4	313SADR	605-780' San Andres Formation
3321001042328	11S	25E	15.343	RA-(1102 (0-21))	843	643-843	05/73-10/76	13	7	3.0 - 10.8	313SADR	617-843' San Andres Formation
3320071042445	11S	25E	21.333	RA-(20-S4,651)	952	636-952	03/75-07/75	2	8	7.0 - 9.6	313SADR	112-260' Gatuna Formation
3320531042242	11S	25E	23.111	RA-62	847	629-847	05/73-10/76	15	7	2.3 - 12.6	313SADR	614-847' San Andres Formation
3319141042445	11S	25E	28.333	RA-1572-S2	89	24-89	03/73-07/76	4	20	10.8 - 28.3	110AVMB	0-89' Alluvium
3319141042453	11S	25E	29.444	RA-544	925	577-925	1973	1	13	12.5	313SADR	505-925' San Andres Formation
3317511043833	12S	23E	5.311	RA-2887	575	0-575	03/74-11/76	10	39	26.5 - 49.4	313SADR	455-575' San Andres Formation
3317441043833	12S	23E	5.313	House Well	390	---	12/72-06/78	16	23	15.9 - 34.1	---	Intake area
3317381043818	12S	23E	5.341	RA-2823	458	143-458	06/72-05/75	5	11	6.0 - 20.4	313SADR	90-458' San Andres Formation
3318101043856	12S	23E	6.214	RA-2888	655	0-655	05/73-08/76	10	11	2.1 - 22.2	313SADR	575-655' San Andres Formation
3318171043841	12S	23E	6.222	Red House Windmill	462	50-462	03/74-11/74	2	14	2.0 - 26.7	---	Located in recharge area
3317381043848	12S	23E	6.441	RA-1777-A	640	315-640	05/73-06/78	9	7	2.7 - 11.8	313SADR	88-640' San Andres Formation
3311271045429	13S	20E	12.443	Johnson Windmill	275	---	03/74-08/76	8	9	2.0 - 22.1	---	Located in alluvial-filled small valley
3311231045421	13S	20E	13.222	PVACD#4	386.5	238-386.5	03/74-11/78	12	4	0.3 - 9.7	313SADR/310GLRT/310YESO	380-386.5' Yeso Formation
3310331044654	13S	22E	20.113	McGee Well	620	---	1972	1	68	67.6	---	
3308281043140	13S	24E	34.441	RA-(4096,1017-A)	500	380-485	07/75-10/76	5	6	3.8 - 8.1	313SADR	380-500' San Andres Formation
3313241041950	13S	26E	3.114	RA-555	1150	794-1150	08/67-09/68	2	6	2.1 - 9.8	313SADR	767-1150' San Andres Formation
3309341042029	13S	26E	28.411	RA-2930	200	185-200	1975	1	9	9.2	110AVMB/110GTUN	0-200' Alluvium and Gatuna Formation
3308421042013	13S	26E	33.421	RA-1317	213	100-213	1974	1	7	7.4	110AVMB/110GTUN	0-213' Alluvium and Gatuna Formation
3307021044015	14S	23E	8.144	Made Tank	460	---	1972	1	12	12.2	---	
3304521043602	14S	23E	24.433	RA-3021-S	397	303-397	1972	1	44	43.5	313SADR	283-397' San Andres Formation
3306561042742	14S	25E	8.411	Windmill	---	---	1975	1	8	7.5	---	

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Table E-3. Summary of Tritium Data Available for the Roswell Basin
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USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3307241041907	14S	26E	10.222	Hagerman City Well	---	---	06/74-10/76	8	5	1.6 - 9.0	---	
3306261042001	14S	26E	15.113	RA-1333-F	150	45-150	04/74-08/76	6	44	17.7 - 160.4	110AVMB/110GTUN	0-150' Alluvium and Gatuna Formation
3300461051336	15S	17E	13.141	RA-4761-S2	---	---	06/74-10/76	3	9	4.0 - 11.9	---	
3300331051442	15S	17E	14.312	RA-4326	400	335-400	1974	1	7	7.0	313SADR	0-70' Clay and gravel
3300391051121	15S	18E	17.143	RA-4761-S	306	300-306	07/73-08/76	11	9	1.5 - 25.1	---	
3300451051222	15S	18E	18.141	RA-4761	---	---	06/74-08/76	9	7	1.6 - 12.9	---	Samples taken from storage tank
3300321051156	15S	18E	18.311	W.R. Joy Well	---	---	06/74-10/76	9	8	3.5 - 13.5	---	
3302071044528	15S	22E	9.122	F. Runyon Well	520	---	1972	1	16	15.6	---	
3302441042040	15S	26E	4.141	RA-633	1220	1023-1220	06/74-12/78	8	5	0.0 - 10.3	313SADR	851-1220' San Andres Formation
3301451042056	15S	26E	9.133	Windmill	---	---	1975	1	18	18.1	---	
3301131041737	15S	26E	13.121	RA-165	1381	1166-1381	07/67-04/78	18	9	0.9 - 45.6	313SADR	872-1381' San Andres Formation
3256251051947	16S	16E	8.121	Bates Windmill	140	---	04/74-01/77	12	13	3.7 - 18.4	313SADR	0-140' San Andres Formation
3255591051618	16S	16E	11.421	Mulcock Well	180	---	07/73-04/76	3	32	6.5 - 81.9	---	
3255181045333	16S	20E	16.241	R.H. McAshan Windmill	---	---	04/74-04/78	4	10	5.6 - 12.5	---	Located in recharge area
3254451045542	16S	20E	18.333	PVACD#5	767	555.5-610.5, 555.5-767	04/74-08/76	2	4	3.9 - 4.0	313SADR/310GLRT	675-767' Glorieta Sandstone
3254011042403	16S	26E	20.433	RA-(558-COMB-952)	1063	905-1063	1975	1	6	6.2	313SADR	750-1063' San Andres Formation
3254011042309	16S	26E	21.3	RA-1459	132	43-132	1975	1	16	16.0	110AVMB/110GTUN	0-132' Alluvium and Gatuna Formation
3253351042419	16S	26E	29.143	RA-1117	1079	0-1079	1975	1	8	7.6	110AVMB/110GTUN/313ARTS/	768-1079' San Andres Formation
3249381045549	17S	20E	18.434	PVACD#7	801	680-800	04/74-04/78	5	12	8.3 - 16.0	313SADR	0-801' San Andres Formation
3248381044346	17S	23E	30.12	RA-3081	600	498-558,498-600	01/72-09/78	25	7	1.6 - 37.5	313SADR	80-600' San Andres Formation
3250321042233	17S	26E	10.333	RA-1331	278	---	07/73-04/78	11	10	2.7 - 29.9	110AVMB/110GTUN	0-278' Alluvium and Gatuna Formation

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Table E-3. Summary of Tritium Data Available for the Roswell Basin

USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3250321042233	17S	26E	10.333	RA-307	1263	930-1263	07/73-04/78	12	8	3.0 - 21.7	313SADR	779-1263’ San Andres Formation
3250321042202	17S	26E	10.433	RA-397	1095	1035-1095	07/73-08/76	8	6	1.6 - 11.2	313SADR	798-1095’ San Andres Formation
3250321042100	17S	26E	11.433	RA-777	1034	760-1034	07/73-08/76	7	7	0.7 - 18.3	313SADR	751-1034’ San Andres Formation
3251051042006	17S	26E	12.142	Windmill	---	---	04/74-08/76	6	91	75.7 - 98.5	A	Hand-dug windmill
3250261042100	17S	26E	14.211	RA-895	1013	0-1013	07/73-04/78	8	5	0.8 - 8.9	110AVMB/110GTUN/313ARTS/	801-1013’ San Andres Formation
3250261042233	17S	26E	15.111	RA-1227	240	188-240	07/73-06/76	5	11	8.3 - 16.1	110AVMB/110GTUN	0-240’ Alluvium and Gatuna Formation
3250191042210	17S	26E	15.12	RA-1183	225	220-225	07/73-03/75	2	11	7.7 - 14.5	110AVMB/110GTUN	0-225’ Alluvium and Gatuna Formation
3250061042233	17S	26E	15.133	RA-(2050-COMB-2871)	1231	793-1012,1025-1231	07/73-06/74	2	9	2.3 - 15.8	313SADR	788-1231’ San Andres Formation
3250061042233	17S	26E	15.133	RA-1503-F	240	0-240	04/74-08/76	6	10	0.4 - 19.2	110AVMB/110GTUN	0-240’ Alluvium and Gatuna Formation
3249531042202	17S	26E	15.413	RA-1578	---	---	04/74-08/76	5	6	4.0 - 8.3	---	751-Bottom San Andres Formation
3248411042437	17S	26E	29.111	RA-1925-S	1150	0-1150	05/75-07/77	7	7	2.0 - 16.4	110AVMB/110GTUN/313ARTS/	666-1150’ San Andres Formation
3248411042508	17S	26E	30.211	RA-(1826,1826-AS)	200	140-200	03/75-07/77	3	5	3.1 - 6.8	110AVMB/110GTUN	0-200’ Alluvium and Gatuna Formation
3246171044301	18S	23E	5.333	Well	---	---	1971	1	15	15.4	---	
3245161042445	18S	26E	18.221	RA-3181-S5	258	60-258	1975	1	14	14.0	110AVMB/110GTUN	170-258’ Gatuna Formation
3244501042508	18S	26E	18.322	RA-3181	---	---	1975	1	13	12.7	---	
3244371042523	18S	26E	18.332	RA-747	1061	575-1061	03/75-07/75	2	6	5.7 - 6.5	313ARTS/313SADR	615-1061’ San Andres Formation
3244531042500	18S	26E	18.41124	RA-1167-A	1120	860-1120	05/75-04/78	3	5	0.5 - 10.7	313SADR	790-1120’ San Andres Formation
3241191042419	19S	26E	5.323	Powell Well	905	567-905	1972	1	19	19.0	---	
3342221052410	07S	16E	7.431	Macho Spring #2	---	---	1977	1	7	7.4	---	Issues from San Andres Limestone
3342161052402	07S	16E	7.434	Macho Spring #1	---	---	1977	1	9	9.3	---	Issues from alluvium
3340321052049	07S	16E	22.443	Kyle Harrison Spring	---	---	1977	1	5	5.1	---	Issues through soil cover
3329141054138	09S	13E	32.223	Lamay Spring	---	---	1977	1	8	7.8	---	Issues from alluvium

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Table E-3. Summary of Tritium Data Available for the Roswell Basin

USGS Siteid	Township	Range	Section	Well Name	Well Depth (ft)	Screen Interval (ft)	Period of Record	Number of Samples	Tritium Average (TU)	Tritium Range (TU)	Completion Zone	Remarks
3327001054353	10S	12E	12.413	Unknown	---	---	1977	1	54	54.0	---	Issues in an area of Quaternary colluvium
3325121054353	10S	12E	24.431	Little Creek Spring	---	---	1977	1	63	63.3	---	Issues in an area of Tertiary igneous rock
3324351052001	10S	16E	26.441	Peter Hurd Well	---	---	05/77-06/77	2	42	40.0 - 44.5	---	Issues from alluvium
3324421051658	10S	17E	29.4143	Colonel Fritz Spring	---	---	11/71-03/78	25	9	1.1 - 40.2	---	Rio Bonito Member of San Andres Limestone
3321121053906	11S	13E	14.312	Bogg Spring	---	---	1977	1	55	54.8	---	Issues from alluvium
3319311053501	11S	14E	28.312	Griffith (Ruidoso Downs) Spring	---	---	1977	1	5	4.9	---	Issues from probable collapsed limestone of Yeso Formation
3252591052859	16S	14E	26.343	Posey Springs	---	---	1977	1	7	7.2	---	Spring from large pond in Rio Peñasco valley bottom
3252461053237	16S	14E	31.113	Mickison Spring	---	---	1977	1	22	21.6	---	Issues from alluvium on stream terrace
3256441051648	16S	16E	2.323	Cleve's Spring	---	---	04/74-01/78	20	8	3.1 - 16.8	---	Issues from Rio Bonito Member of San Andres Limestone
3255491051647	16S	16E	11.34213	Paul Spring	---	---	07/73-04/78	31	7	0.9 - 21.6	---	Issues from brecciated San Andres Limestone
3250321054701	17S	11E	11.23	Penasco Head Spring	---	---	1977	1	19	19.2	---	Issues throughout large marshy area
3249161054256	17S	12E	16.431	---	---	---	1977	1	15	15.1	---	Issues 30' above base of Rio Bonito Member of San Andres
3247491053341	17S	13E	25.441	---	---	---	1977	1	17	17.2	---	Issues from joint in limestone
3245491054020	18S	12E	1.331	Boy Scout Camp Spring	---	---	1977	1	34	34.1	---	Issues from limestone
3242291054035	18S	12E	26.423	Barrel Spring	---	---	05/77-08/77	2	49	42.7 - 55.9	---	Issues from Glorieta Sandstone
3232431042213	20S	26E	27.1	Boiling (or Bubbling) Spring	---	---	06/76-04/78	7	46	34.6 - 61.2	---	On Pecos River

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Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
04S	21E	33.111	PVACD#9	19740323	7.4	+/-.8			313SADR/310GLRT
04S	21E	33.111	PVACD#9	19740613	3.7	+/-.6			
04S	21E	33.111	PVACD#9	19740825	2.2	+/-.4			
04S	21E	33.111	PVACD#9	19741218	3.5	+/-.5			
04S	21E	33.111	PVACD#9	19750327	9	+/-.6			
04S	21E	33.111	PVACD#9	19751004	5.1	+/-.4			
04S	21E	33.111	PVACD#9	19751220	2.5	+/-.5			
04S	21E	33.111	PVACD#9	19760410	4.2	+/-.5			
04S	21E	33.111	PVACD#9	19760612	6	+/-.6			
04S	21E	33.111	PVACD#9	19760826	3.8	+/-.8			
04S	21E	33.111	PVACD#9	19780624	3	+/-.6	-9		
04S	21E	33.111	PVACD#9	19781118	4	+/-.7	-8		
07S	16E	22.443	Kyle Harrison Spring	19770810	5.1	+/-.5			
07S	16E	7.431	Macho Spring #2	19770810	7.4	+/-.5			
07S	16E	7.434	Macho Spring #1	19770810	9.3	+/-.6			
07S	16E	7.434	Macho Spring #1	19790414			-10	-63	
07S	20E	16.333	PVACD#1	19740410	3.4	+/-.6			313SADR/310YESO
07S	20E	16.333	PVACD#1	19750920	11.8	+/-.7			
07S	20E	16.333	PVACD#1	19751220	4.7	+/-.4			
07S	20E	16.333	PVACD#1	19760410	5.4	+/-.5			
07S	20E	16.333	PVACD#1	19760613	4.2	+/-.6			
07S	20E	16.333	PVACD#1	19760827	5.5	+/-.9			
07S	20E	16.333	PVACD#1	19780624	5.3	+/-.9	-9		
07S	20E	16.333	PVACD#1	19781117	0.2	+/-.2	-9		
07S	22E	26.131	Tom Corn Well	19730526	8.4	+/-.8			
07S	22E	26.131	Tom Corn Well	19750520	15.9	+/-.8			
07S	22E	26.131	Tom Corn Well	19750921	3.3	+/-.3			
07S	22E	26.131	Tom Corn Well	19751220	3.2	+/-.4			
07S	22E	26.131	Tom Corn Well	19760410	7.3	+/-.6			
07S	22E	26.131	Tom Corn Well	19760612	3.1	+/-.6			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
07S	22E	26.131	Tom Corn Well	19760827	3.1	+/-.7			
07S	22E	26.131	Tom Corn Well	19780318	4.9	+/-.7	-9		
07S	22E	26.131	Tom Corn Well	19781117	4.2	+/-.6	-9		
07S	22E	36.422	Corn Windmill	19740324	5	+/-.6			
07S	22E	36.422	Corn Windmill	19750520	2.3	+/-.8			
07S	22E	36.422	Corn Windmill	19750721	13.5	+/-1.1			
07S	22E	36.422	Corn Windmill	19760612	4.2	+/-.4			
07S	22E	36.422	Corn Windmill	19760827	5.7	+/-.8			
08S	22E	13.223	Corn Windmill	19730324	14.3	+/-.7			
08S	22E	13.223	Corn Windmill	19730526	11.3	+/-.3			
08S	22E	13.223	Corn Windmill	19740324	6.1	+/-.6			
08S	22E	13.223	Corn Windmill	19740825	2.7	+/-.7			
08S	22E	13.223	Corn Windmill	19741102	27.3	+/-.9			
08S	22E	13.223	Corn Windmill	19741218	3.5	+/-.7			
08S	22E	13.223	Corn Windmill	19750520	6.4	+/-.8			
08S	22E	13.223	Corn Windmill	19750721	7.9	+/-.7			
08S	22E	13.223	Corn Windmill	19750921	9.4	+/-.4			
08S	22E	13.223	Corn Windmill	19760410	6.9	+/-.8			
08S	22E	13.223	Corn Windmill	19760827	4.1	+/-.8			
08S	22E	22.223	Dick Corn Well	19730324	14.8	+/-.5			
08S	22E	22.223	Dick Corn Well	19740825	1.7	+/-.5			
08S	22E	22.223	Dick Corn Well	19741218	4.9	+/-.6			
08S	22E	22.223	Dick Corn Well	19750721	9.8	+/-.8			
08S	22E	22.223	Dick Corn Well	19750921	8.4	+/-.4			
08S	22E	22.223	Dick Corn Well	19760410	6.9	+/-.4			
08S	22E	22.223	Dick Corn Well	19760612	2.9	+/-.5			
08S	22E	22.223	Dick Corn Well	19760827	5.6	+/-.9			
08S	23E	16.111	RA-4680	19730324	9	+/-.4			
08S	23E	16.111	RA-4680	19730526	2.5	+/-1.0			
08S	23E	16.111	RA-4680	19740323	7.1	+/-.8			
08S	23E	16.111	RA-4680	19740825	3.3	+/-.8			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
08S	23E	16.111	RA-4680	19741102	0.1	+/-.4			
08S	23E	16.111	RA-4680	19750520	7.9	+/-.8			
08S	23E	16.111	RA-4680	19750921	37.9	+/-1.5			
08S	23E	16.111	RA-4680	19760410	5.1	+/-.6			
08S	24E	33.311	RA-2601-A	19730324	12.4	+/-.6			
09S	13E	32.223	Lamay Spring						
09S	13E	32.223	Lamay Spring						
09S	13E	32.223	Lamay Spring	19770809	7.8	+/-.6			
10S	12E	12.413		19770809	54	+/-.5			
10S	12E	24.431	Little Creek Spring	19770809	63.3	+/-.5			
10S	15E		Nosker Spring	19730710	64.5	+/-1.4			
10S	16E	26.4413	Peter Hurd Well	19770506	44.5	+/-1.6			
10S	16E	26.4413	Peter Hurd Well	19770626	40	+/-1.7			
10S	17E	29.4143	Colonel Fritz Spring	19711029	8.1	+/-.6			
10S	17E	29.4143	Colonel Fritz Spring	19730527	40.2	+/-1.8			
10S	17E	29.4143	Colonel Fritz Spring	19740324	8.5	+/-.7			
10S	17E	29.4143	Colonel Fritz Spring	19740826	6.8	+/-.6			
10S	17E	29.4143	Colonel Fritz Spring	19741216	5	+/-.8			
10S	17E	29.4143	Colonel Fritz Spring	19750222	1.1	+/-.5			
10S	17E	29.4143	Colonel Fritz Spring	19750326	11.9	+/-.6			
10S	17E	29.4143	Colonel Fritz Spring	19750610	10.2	+/-.9			
10S	17E	29.4143	Colonel Fritz Spring	19750826	8.8	+/-.8			
10S	17E	29.4143	Colonel Fritz Spring	19751004	6.5	+/-.4			
10S	17E	29.4143	Colonel Fritz Spring	19751221	3.2	+/-.5			
10S	17E	29.4143	Colonel Fritz Spring	19760409	6	+/-.5			
10S	17E	29.4143	Colonel Fritz Spring	19760602	10	+/-.9			
10S	17E	29.4143	Colonel Fritz Spring	19760812	6.1	+/-.8			
10S	17E	29.4143	Colonel Fritz Spring	19761002	8.3	+/-.4			
10S	17E	29.4143	Colonel Fritz Spring	19761031	13.2	+/-.8			
10S	17E	29.4143	Colonel Fritz Spring	19761112	9.2	+/-.9			
10S	17E	29.4143	Colonel Fritz Spring	19761204	6.6	+/-.7			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
10S	17E	29.4143	Colonel Fritz Spring	19770108	7.5	+/-.9			
10S	17E	29.4143	Colonel Fritz Spring	19770129	10.1	+/-1.0			
10S	17E	29.4143	Colonel Fritz Spring	19770318	9	+/-.7			
10S	17E	29.4143	Colonel Fritz Spring	19770408	4.8	+/-.7			
10S	17E	29.4143	Colonel Fritz Spring	19770506	7.4	+/-1.0			
10S	17E	29.4143	Colonel Fritz Spring	19770622	4.3	+/-.7			
10S	17E	29.4143	Colonel Fritz Spring	19780319	6.9	+/-.7	-8	-42	
10S	17E	29.4143	Colonel Fritz Spring	19781116			-8	-51	
10S	20E	16.444	PVACD#2	19740322	3.6	+/-1.5			313SADR/310GLRT/310YESO
10S	20E	16.444	PVACD#2	19740612	3.1	+/-.6			
10S	20E	16.444	PVACD#2	19740826	3.6	+/-.8			
10S	20E	16.444	PVACD#2	19741217	1.2	+/-.8			
10S	20E	16.444	PVACD#2	19750327	9	+/-.5			
10S	20E	16.444	PVACD#2	19750826	10.5	+/-.8			
10S	20E	16.444	PVACD#2	19751221	2	+/-.5			
10S	20E	16.444	PVACD#2	19760329	6.5	+/-.5			
10S	20E	16.444	PVACD#2	19760602	6.3	+/-.5			
10S	20E	16.444	PVACD#2	19760826	4.4	+/-1.0			
10S	20E	16.444	PVACD#2	19781116			-8	-59	
10S	21/		Marley Whitney Windmill	19730323	23.9	+/-.8			
10S	21E	16.222	PVACD#3	19741216	0.6	+/-.9			313SADR/310GLRT/310YESO
10S	21E	16.222	PVACD#3	19750327	6.4	+/-.5			
10S	21E	16.222	PVACD#3	19750826	5.2	+/-.8			
10S	21E	16.222	PVACD#3	19751221	2.2	+/-.5			
10S	21E	16.222	PVACD#3	19760329	5.9	+/-.6			
10S	21E	16.222	PVACD#3	19760611	6.5	+/-.7			
10S	21E	16.222	PVACD#3	19760826	3.2	+/-.4			
10S	21E	16.222	PVACD#3	19761031	8.3	+/-.8			
10S	21E	16.222	PVACD#3	19781117			-8	-49	
10S	21E	25.111	Marley Whitney Well	19720112	19.6	+/-1.0			
10S	21E	25.111	Marley Whitney Well	19730323	21.8	+/-.6			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
10S	24E	15.330	RA-5010	19730105	149.3	+/-1.7			110AVMB/110GTUN
10S	24E	15.330	RA-5010	19730324	27	+/-.7			
10S	24E	15.330	RA-5010	19760721	12.9	+/-.5			
10S	24E	22.110	RA-896-B	19730324	14.3	+/-.5			110GTUN/313SADR
10S	24E	22.133	RA-896	197203	53.9	+/-1.5			110GTUN/313SADR
10S	24E	22.133	RA-896	19730105	4.8	+/-.7			
10S	24E	22.133	RA-896	19760812	9.6	+/-.8			
10S	24E	22.212	RA-4005	19730105	28.4	+/-.7			110AVMB
10S	25E	22.324	Elk#1	19671019	20.8	+/-1.4			313SADR
10S	25E	22.324	Elk#1	19681009	6.7	+/-1.3			
10S	25E	22.324	Elk#1	19740410	20.1	+/-.6			
10S	25E	22.324	Elk#1	19740612	3.4	+/-.8			
10S	25E	22.324	Elk#1	19741217	6.4	+/-1.0			
10S	25E	22.324	Elk#1	19750326	1	+/-1.1	-9	-52	
10S	25E	22.324	Elk#1	19781118			-8	-50	
10S	25E	32.333	RA-4568-S						
10S	25E	32.333	RA-4568-S	19740410	1.3	+/-1.4			313SADR
10S	25E	32.333	RA-4568-S	19750827	5.5	+/-.8	-9		
10S	25E	32.333	RA-4568-S	19790403	10.4	+/-.9	-8	-55	
10S	25E	33.144	RA-4304	19760604	7	+/-.8	-8	-53	
11S	13E	14.3120	Bogg Spring	19770812	54.8	+/-.5			
11S	14E	14.2(1,3)	Seeping Springs	19770812	39.4	+/-.5			
11S	14E	28.3120	Griffith (Ruidoso Downs) Spring	19770812	4.9	+/-.5			
11S	18E	15.313	RA-H-476	19761002	29.9	+/-.5			
11S	18E	15.313	RA-H-476	19761002	30.8	+/-.4			
11S	18E	15.313	RA-H-476	19761031	40.9	+/-1.5			
11S	18E	15.313	RA-H-476	19761119	40.4	+/-1.6			
11S	18E	15.313	RA-H-476	19780623	25.5	+/-.9	-9		
11S	18E	24.341	R.O. Anderson Well	19761002	27	+/-.4			
11S	20E	16.222	Border Hill Well	19730323	41.6	+/-.7			
11S	20E	16.222	Border Hill Well	19750520	25.5	+/-1.1			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
11S	20E	16.222	Border Hill Well	19750721	13.3	+/-.7			
11S	20E	16.222	Border Hill Well	19760409	12.3	+/-.5			
11S	20E	16.222	Border Hill Well	19760602	24.2	+/-.5			
11S	20E	16.222	Border Hill Well	19760827	20.9	+/-1.1			
11S	20E	16.222	Border Hill Well	19761001	18.6	+/-.5			
11S	20E	20.440	RA-150-H	19730323	50.1	+/-.4			313SADR/310GLRT
11S	21E	13.422	Middle (Pearl) Windmill	19750326	2.7	+/-.7			
11S	21E	13.442	Middle (Pearl) Windmill	19750826	9	+/-.4			
11S	21E	13.442	Middle (Pearl) Windmill	19760329	7.6	+/-.7			
11S	21E	18.333	PVACD#8	19740322	58	+/-.5			310GLRT
11S	21E	18.333	PVACD#8	19740616	44.9	+/-.5			
11S	21E	18.333	PVACD#8	19740826	49.1	+/-.8			
11S	21E	18.333	PVACD#8	19741217	43.5	+/-1.2			
11S	21E	18.333	PVACD#8	19750327	47.7	+/-.4			
11S	21E	18.333	PVACD#8	19750826	51.2	+/-1.6			
11S	21E	18.333	PVACD#8	19751221	40.8	+/-.5			
11S	21E	18.333	PVACD#8	19760329	45.6	+/-.6			
11S	21E	18.333	PVACD#8	19760611	31.1	+/-1.2			
11S	21E	18.333	PVACD#8	19760826	21.2	+/-1.3			
11S	21E	18.333	PVACD#8	19761112	41	+/-1.0			
11S	21E	18.333	PVACD#8	19770326	42.1	+/-1.6	-7		
11S	21E	18.333	PVACD#8	19770626	33	+/-1.3	-8		
11S	21E	18.333	PVACD#8	19770918	34	+/-1.5	-9		
11S	21E	18.333	PVACD#8	19771218	32.4	+/-1.3	-9		
11S	21E	18.333	PVACD#8	19780319	28.7	+/-1.1	-8		
11S	21E	18.333	PVACD#8	19780625	34.9	+/-1.5	-9		
11S	21E	18.333	PVACD#8	19781118	29	+/-1.3	-8		
11S	21E	24.411	Silver Maple Windmill	19750326	10.8	+/-.6			
11S	21E	24.411	Silver Maple Windmill	19750826	15.9	+/-.4			
11S	21E	24.411	Silver Maple Windmill	19760329	16.6	+/-.5			
11S	21E	24.411	Silver Maple Windmill	19760812	12.3	+/-1.1			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
11S	22E	18.211	RA-3562	19711026	8.2	+/-1.1			313SADR
11S	22E	18.211	RA-3562	19750326	2.7	+/-.7			
11S	22E	18.211	RA-3562	19750520	7.4	+/-.8			
11S	22E	18.211	RA-3562	19750826	11.3	+/-.5			
11S	22E	18.211	RA-3562	19760611	4.7	+/-.6			
11S	22E	18.211	RA-3562	19760812	14.6	+/-.9			
11S	22E	18.211	RA-3562	19760829	12.8	+/-.9			
11S	22E	22.111	Wright Well	19710114	3.9	+/-.7			
11S	22E	22.111	Wright Well	19720112	25.7	+/-1.3			
11S	22E	9.321	H.L. Woods Well	19681009	3.4	+/-1.5			313SADR
11S	22E	9.321	H.L. Woods Well	19720716	24.1	+/-1.0			
11S	22E	9.321	H.L. Woods Well	19740324	9.7	+/-.5			
11S	22E	9.321	H.L. Woods Well	19740613	8.2	+/-.6			
11S	22E	9.321	H.L. Woods Well	19740825	6.3	+/-.6			
11S	22E	9.321	H.L. Woods Well	19741216	3.7	+/-.8			
11S	22E	9.321	H.L. Woods Well	19750326	1.4	+/-.7			
11S	22E	9.321	H.L. Woods Well	19750826	10.4	+/-.9			
11S	22E	9.321	H.L. Woods Well	19751221	5.1	+/-.5			
11S	22E	9.321	H.L. Woods Well	19760329	6.4	+/-.6			
11S	22E	9.321	H.L. Woods Well	19760612	8.1	+/-.7			
11S	22E	9.321	H.L. Woods Well	19760812	5.8	+/-.8			
11S	22E	9.321	H.L. Woods Well	19761112	9.9	+/-1.0			
11S	22E	9.321	H.L. Woods Well	19771218	4.2	+/-.5	-9	-47	
11S	22E	9.321	H.L. Woods Well	19780625	5	+/-.8	-9	-42	
11S	23E	1.413	RA-1879	19730323	13.4	+/-.3			110AVMB/110GTUN
11S	23E	1.413	RA-1879	19730526	27.5	+/-1.8			
11S	23E	1.433	RA-(1428/1879)	19730323	16.3	+/-.3			
11S	23E	1.433	RA-(1428/1879)	19760721	9.4	+/-.4			
11S	23E	1.433	RA-(1428/1879)	19760811	9.2	+/-.7			
11S	23E	12.221	RA-458	19730323	11.1	+/-.3			
11S	23E	12.221	RA-458	19760812	11.5	+/-.8			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
11S	23E	12.332	RA-1521-M	19730323	11.6	+/-.5			
11S	23E	12.332	RA-1521-M	19730525	5.8	+/-.6			
11S	23E	12.332	RA-1521-M	19760812	9.6	+/-.8			
11S	23E	15.222	RA-2555	19730323	25.3	+/-.4			313SADR
11S	23E	15.222	RA-2555	19760707	10	+/-.5			
11S	24E	10.222	PVACD Hendricks Well 1	19760604	50.8	+/-.4			313ARTS/313SADR
11S	24E	11.333	RA-4239-S5	19790403			-7	-44	
11S	24E	14.314	RA-1920-S	19730324	12.2	+/-.6			110AVMB/110GTUN
11S	24E	14.314	RA-1920-S	19760721	12.5	+/-.4			
11S	24E	20.333	RA-(1771,2475)						
11S	24E	20.333	RA-(1771,2475)						
11S	24E	20.333	RA-(1771,2475)	19720112	31.9	+/-1.0			110AVMB/110GTUN
11S	24E	23.440	RA-(986 (S-116))	19730324	19.1	+/-.7			313SADR
11S	24E	23.440	RA-(986 (S-116))	19730526	4.9	+/-1.3			
11S	24E	23.440	RA-(986 (S-116))	19750721	10.5	+/-.8			
11S	24E	23.440	RA-(986 (S-116))	19751004	5.3	+/-.3			
11S	24E	23.440	RA-(986 (S-116))	19760328	4.3	+/-.8			
11S	24E	24.433	RA-986-A	19730526	12.5	+/-1.3			313ARTS/313SADR
11S	24E	25.312	RA-1015	19730324	2.3	+/-.9			
11S	24E	25.312	RA-1015	19740409	13	+/-1.2			
11S	24E	25.312	RA-1015	19740612	4.7	+/-.8			
11S	24E	25.312	RA-1015	19740824	4.9	+/-.8			
11S	24E	25.312	RA-1015	19750827	8.1	+/-.8			
11S	24E	25.312	RA-1015	19760604	7.1	+/-.5			
11S	24E	25.312	RA-1015	19760811	8.6	+/-.8			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19680318	22	+/-1.7			313ARTS/313SADR
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19681005	4.6	+/-1.7			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19720716	14.5	+/-.8			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19730324	7.7	+/-.3			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19730526	5.4	+/-1.0			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19740409	3.2	+/-.7			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19740612	28.6	+/-.6			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19740824	0.5	+/-.7			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19750328	11.6	+/-1.0			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19750520	12.1	+/-1.1			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19750721	10.2	+/-.9			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19750827	7.2	+/-.7			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19760328	4.3	+/-.8			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19760604	9.2	+/-.6			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19760721	7.8	+/-.5			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19760811	7.7	+/-.9			
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19770325	5.5	+/-.9	-8	-33	
11S	24E	25.341	RA-(1015/1012-S-COMB-B)	19780401	1.1	+/-.7	-8	-47	
11S	24E	26.224	RA-1012	19730324	7.9	+/-.5			313SADR
11S	24E	26.224	RA-1012	19730526	19.9	+/-1.2			
11S	24E	26.224	RA-1012	19740409	3.8	+/-1.0			
11S	24E	26.224	RA-1012	19740612	38.5	+/-.4			
11S	24E	26.224	RA-1012	19740824	0.6	+/-.5			
11S	24E	26.224	RA-1012	19750328	10.1	+/-.9			
11S	24E	26.224	RA-1012	19750721	8.3	+/-.8			
11S	24E	26.224	RA-1012	19760604	9.3	+/-.5			
11S	24E	26.224	RA-1012	19760811	5.6	+/-.7			
11S	24E	26.224	RA-1012	19770917	6.8	+/-.8	-9		
11S	24E	26.224	RA-1012	19780401	2.6	+/-.7	-10		
11S	24E	28.413	RA-1335-B	19790403			-9	-55	
11S	24E	7.214	RA-55-AB	19730323	20.2	+/-.4			
11S	25E	15.334	RA-(61,59-S)	19730525	10.9	+/-1.3			313SADR
11S	25E	15.334	RA-(61,59-S)	19740323	3.8	+/-.5			
11S	25E	15.334	RA-(61,59-S)	19740612	26.4	+/-.5			
11S	25E	15.334	RA-(61,59-S)	19740824	1.9	+/-.6			
11S	25E	15.334	RA-(61,59-S)	19741102	1.8	+/-.7			
11S	25E	15.334	RA-(61,59-S)	19750520	7.1	+/-1.0			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
11S	25E	15.334	RA-(61,59-S)	19751004	4.6	+/-.3			
11S	25E	15.334	RA-(61,59-S)	19751220	6.8	+/-.5			
11S	25E	15.334	RA-(61,59-S)	19760328	3.1	+/-.9	-4		
11S	25E	15.334	RA-(61,59-S)	19760604	9.7	+/-.6	-7		
11S	25E	15.334	RA-(61,59-S)	19761002	6.5	+/-.5	-7		
11S	25E	15.334	RA-(61,59-S)	19770105	9.4	+/-.9	-7		
11S	25E	15.334	RA-(61,59-S)	19770325	6.9	+/-.9	-8	-45	
11S	25E	15.334	RA-(61,59-S)	19770625	9.2	+/-.7	-7		
11S	25E	15.334	RA-(61,59-S)	19770917	8.1	+/-.7	-7		
11S	25E	15.334	RA-(61,59-S)	19780401	3.9	+/-.8	-9	-58	
11S	25E	15.334	RA-(61,59-S)	19780708	4.2	+/-.6	-7		
11S	25E	15.334	RA-(61,59-S)	19781118	5.6	+/-.7	-8		
11S	25E	15.343	RA-(1102 (0-21))	19730525	7.9	+/-1.3			313SADR
11S	25E	15.343	RA-(1102 (0-21))	19740323	4.4	+/-.6			
11S	25E	15.343	RA-(1102 (0-21))	19740612	4.2	+/-.6			
11S	25E	15.343	RA-(1102 (0-21))	19740824	3	+/-.6			
11S	25E	15.343	RA-(1102 (0-21))	19741102	3.6	+/-.8			
11S	25E	15.343	RA-(1102 (0-21))	19750221	5.6	+/-.8			
11S	25E	15.343	RA-(1102 (0-21))	19750721	5.1	+/-.6			
11S	25E	15.343	RA-(1102 (0-21))	19751004	6.2	+/-.3			
11S	25E	15.343	RA-(1102 (0-21))	19760328	9.1	+/-.9			
11S	25E	15.343	RA-(1102 (0-21))	19760604	10.8	+/-.5			
11S	25E	15.343	RA-(1102 (0-21))	19760811	10.5	+/-.9			
11S	25E	15.343	RA-(1102 (0-21))	19761002	7.8	+/-.6	-6		
11S	25E	15.343	RA-(1102 (0-21))	19761030	9.5	+/-.9			
11S	25E	15.343	RA-(1102 (0-21))	19771219			-7		
11S	25E	21.333	RA-(20-S4,651)	19750328	7	+/-.9			313SADR
11S	25E	21.333	RA-(20-S4,651)	19750721	9.6	+/-.8			
11S	25E	23.111	RA-62	19730525	10.4	+/-1.0			313SADR
11S	25E	23.111	RA-62	19740324	5	+/-.6			
11S	25E	23.111	RA-62	19740612	5.6	+/-.6			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
11S	25E	23.111	RA-62	19740824	4.2	+/-.4			
11S	25E	23.111	RA-62	19741102	12.2	+/-.7			
11S	25E	23.111	RA-62	19750221	4.1	+/-.6			
11S	25E	23.111	RA-62	19750222	8.6	+/-.8			
11S	25E	23.111	RA-62	19750520	8.4	+/-.9			
11S	25E	23.111	RA-62	19750721	7.8	+/-.7			
11S	25E	23.111	RA-62	19751004	6.1	+/-.3			
11S	25E	23.111	RA-62	19751220	3.4	+/-.4			
11S	25E	23.111	RA-62	19760328	8.7	+/-.7			
11S	25E	23.111	RA-62	19760604	12.6	+/-.7			
11S	25E	23.111	RA-62	19760811	6.2	+/-.8			
11S	25E	23.111	RA-62	19761002	2.3	+/-.5	-8		
11S	25E	28.333	RA-1572-S2	19730324	16.9	+/-.5			110AVMB
11S	25E	28.333	RA-1572-S2	19730324	22.7	+/-.7			
11S	25E	28.333	RA-1572-S2	19730324	28.3	+/-.9			
11S	25E	28.333	RA-1572-S2	19760721	10.8	+/-.4			
11S	25E	29.444	RA-544	19730324	12.5	+/-.6			313SADR
12S	23E	5.311	RA-2887	19740324	42.1	+/-.7			313SADR
12S	23E	5.311	RA-2887	19740614	49.4	+/-.6			
12S	23E	5.311	RA-2887	19740824	36.3	+/-.6			
12S	23E	5.311	RA-2887	19750326	40.8	+/-.7			
12S	23E	5.311	RA-2887	19750721	44.9	+/-1.6			
12S	23E	5.311	RA-2887	19750827	41.3	+/-1.3			
12S	23E	5.311	RA-2887	19751220	35.8	+/-.5			
12S	23E	5.311	RA-2887	19760328	37.8	+/-1.3			
12S	23E	5.311	RA-2887	19760827	26.5	+/-1.4			
12S	23E	5.311	RA-2887	19761112	38.5	+/-1.6			
12S	23E	5.313	House Well	19721229	24.5	+/-1.7			Intake Area
12S	23E	5.313	House Well	19730526	21.7	+/-1.2			
12S	23E	5.313	House Well	19740324	34.1	+/-.5			
12S	23E	5.313	House Well	19740614	16.1	+/-.5			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
12S	23E	5.313	House Well	19740824	19.6	+/-.6			
12S	23E	5.313	House Well	19741102	16.3	+/-1.0			
12S	23E	5.313	House Well	19750326	29.1	+/-.7			
12S	23E	5.313	House Well	19750425	25.2	+/-1.2			
12S	23E	5.313	House Well	19750721	28.2	+/-1.0			
12S	23E	5.313	House Well	19750827	24.9	+/-.9			
12S	23E	5.313	House Well	19751220	18	+/-.8			
12S	23E	5.313	House Well	19760328	17.8	+/-1.0			
12S	23E	5.313	House Well	19760612	26	+/-.9			
12S	23E	5.313	House Well	19760827	22	+/-.8			
12S	23E	5.313	House Well	19761112	31.9	+/-1.0			
12S	23E	5.313	House Well	19780624	15.9	+/-.7	-9		
12S	23E	5.341	RA-2823	19720616	20.4	+/-.9			313SADR
12S	23E	5.341	RA-2823	19740324	10	+/-1.1			
12S	23E	5.341	RA-2823	19740614	6	+/-.5			
12S	23E	5.341	RA-2823	19750425	9.5	+/-.8			
12S	23E	5.341	RA-2823	19750520	10.5	+/-.9			
12S	23E	6.214	RA-2888	19730526	16.3	+/-1.1			313SADR
12S	23E	6.214	RA-2888	19740614	5.6	+/-.5			
12S	23E	6.214	RA-2888	19750425	22.2	+/-.8			
12S	23E	6.214	RA-2888	19750520	19.6	+/-1.1			
12S	23E	6.214	RA-2888	19750721	11	+/-.9			
12S	23E	6.214	RA-2888	19750827	8.6	+/-.6			
12S	23E	6.214	RA-2888	19750912	5.4	+/-.4			
12S	23E	6.214	RA-2888	19760328	15.3	+/-.9			
12S	23E	6.214	RA-2888	19760612	7.6	+/-.8			
12S	23E	6.214	RA-2888	19760827	2.1	+/-.8			
12S	23E	6.222	Red House Windmill	19740324	26.7	+/-.5			
12S	23E	6.222	Red House Windmill	19741102	2	+/-.8			
12S	23E	6.441	RA-1777-A	19730526	8	+/-1.1			313SADR
12S	23E	6.441	RA-1777-A	19750425	10.1	+/-1.1			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
12S	23E	6.441	RA-1777-A	19750520	6.3	+/-.9			
12S	23E	6.441	RA-1777-A	19750827	11.8	+/-.9			
12S	23E	6.441	RA-1777-A	19750912	5	+/-.4			
12S	23E	6.441	RA-1777-A	19760328	7.7	+/-.7			
12S	23E	6.441	RA-1777-A	19760612	8.2	+/-.7			
12S	23E	6.441	RA-1777-A	19760827	5.3	+/-.7			
12S	23E	6.441	RA-1777-A	19780624	2.7	+/-.5	-9		
13S	20E	12.443	Johnson Windmill	19740322	8.9	+/-1.1			
13S	20E	12.443	Johnson Windmill	19740613	2.8	+/-.6			
13S	20E	12.443	Johnson Windmill	19741217	2	+/-.8			
13S	20E	12.443	Johnson Windmill	19750827	22.1	+/-.9			
13S	20E	12.443	Johnson Windmill	19750827	9.9	+/-.5			
13S	20E	12.443	Johnson Windmill	19760328	9.1	+/-.9			
13S	20E	12.443	Johnson Windmill	19760611	6.1	+/-.6			
13S	20E	12.443	Johnson Windmill	19760826	8.4	+/-.9			
13S	20E	13.222	PVACD#4	19740322	3.4	+/-.6			313SADR/310GLRT/310YESO
13S	20E	13.222	PVACD#4	19740613	8.6	+/-1.1			
13S	20E	13.222	PVACD#4	19740825	2.4	+/-.5			
13S	20E	13.222	PVACD#4	19741217	0.3	+/-.9			
13S	20E	13.222	PVACD#4	19750328	3.5	+/-.5			
13S	20E	13.222	PVACD#4	19750827	9.7	+/-.4			
13S	20E	13.222	PVACD#4	19751221	1.9	+/-.5			
13S	20E	13.222	PVACD#4	19760328	6.3	+/-.9			
13S	20E	13.222	PVACD#4	19760611	6.5	+/-.7			
13S	20E	13.222	PVACD#4	19760826	4	+/-1.0			
13S	20E	13.222	PVACD#4	19780625	1.2	+/-.5	-8		
13S	20E	13.222	PVACD#4	19781118	3.7	+/-.6	-9		
13S	22E	20.113	McGee Well	19720112	67.6	+/-1.5			
13S	24E	34.441	RA-(4096,1017-A)	19750721	5.5	+/-.9			313SADR
13S	24E	34.441	RA-(4096,1017-A)	19760328	3.8	+/-.7			
13S	24E	34.441	RA-(4096,1017-A)	19760604	6.1	+/-.5			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
13S	24E	34.441	RA-(4096,1017-A)	19760811	7.6	+/-.8			
13S	24E	34.441	RA-(4096,1017-A)	19761030	8.1	+/-.8			
13S	24E	34.441	RA-(4096,1017-A)	19780401			-7	-31	
13S	24E	34.441	RA-(4096,1017-A)	19781202			-8	-53	
13S	26E	28.411	RA-2930	19750520	9.2	+/-.7			110AVMB/110GTUN
13S	26E	3.114	RA-555	19670808	9.8	+/-1.8			313SADR
13S	26E	3.114	RA-555	19680906	2.1	+/-1.1			
13S	26E	33.421	RA-1317	19740409	7.4	+/-1.0			110AVMB/110GTUN
14S	23E	24.433	RA-3021-S	19720116	43.5	+/-1.0			313SADR
14S	23E	8.144	Made Tank	19720113	12.2	+/-1.2			
14S	25E	8.411	Windmill	19750721	7.5	+/-.7			
14S	26E	10.222	Hagerman City Well	19740614	5.6	+/-.5			
14S	26E	10.222	Hagerman City Well	19740824	4.1	+/-.6			
14S	26E	10.222	Hagerman City Well	19741218	1.9	+/-.7			
14S	26E	10.222	Hagerman City Well	19751220	3.8	+/-.5			
14S	26E	10.222	Hagerman City Well	19760328	1.6	+/-.7			
14S	26E	10.222	Hagerman City Well	19760604	6.8	+/-.7			
14S	26E	10.222	Hagerman City Well	19760811	9	+/-.9			
14S	26E	10.222	Hagerman City Well	19761030	5.1	+/-.8			
14S	26E	10.222	Hagerman City Well	19780401			-7	-57	
14S	26E	10.222	Hagerman City Well	19781202			-8	-54	
14S	26E	15.113	RA-1333-F	19740409	160.4	+/-1.1			110AVMB/110GTUN
14S	26E	15.113	RA-1333-F	19740614	17.7	+/-.5			
14S	26E	15.113	RA-1333-F	19740824	20.3	+/-.7			
14S	26E	15.113	RA-1333-F	19760328	19.7	+/-.9			
14S	26E	15.113	RA-1333-F	19760604	24.8	+/-1.1			
14S	26E	15.113	RA-1333-F	19760811	19.2	+/-1.5			
15S	17E	13.141	RA-4761-S2	19740615	4	+/-.5			
15S	17E	13.141	RA-4761-S2	19750828	11.9	+/-.7			
15S	17E	13.141	RA-4761-S2	19761029	11.9	+/-.8			
15S	17E	14.312	RA-4326	19730711	42.2	+/-.6			313SADR

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
15S	17E	14.312	RA-4326	19740615	7	+/-.7			
15S	18E	17.143	RA-4761-S	19730711	25.1	+/-.3			
15S	18E	17.143	RA-4761-S	19740408	6.1	+/-.7			
15S	18E	17.143	RA-4761-S	19740615	3.3	+/-.5			
15S	18E	17.143	RA-4761-S	19740823	10.1	+/-1.0			
15S	18E	17.143	RA-4761-S	19741219	1.5	+/-.5			
15S	18E	17.143	RA-4761-S	19750221	2.6	+/-.5			
15S	18E	17.143	RA-4761-S	19750828	11.7	+/-.9			
15S	18E	17.143	RA-4761-S	19751219	7.3	+/-.8			
15S	18E	17.143	RA-4761-S	19760327	24.5	+/-.6			
15S	18E	17.143	RA-4761-S	19760605	3.1	+/-.5			
15S	18E	17.143	RA-4761-S	19760810	6.2	+/-.6			
15S	18E	18.141	RA-4761	19740615	2.3	+/-.6			
15S	18E	18.141	RA-4761	19740823	6.2	+/-.6			
15S	18E	18.141	RA-4761	19741219	3.9	+/-1.0			
15S	18E	18.141	RA-4761	19750221	1.6	+/-.6			
15S	18E	18.141	RA-4761	19750828	12.9	+/-.5			
15S	18E	18.141	RA-4761	19751219	10.2	+/-.8			
15S	18E	18.141	RA-4761	19760327	7.9	+/-.6			
15S	18E	18.141	RA-4761	19760605	8.6	+/-.5			
15S	18E	18.141	RA-4761	19760810	6.9	+/-.6			
15S	18E	18.311	W.R. Joy Well	19740615	11.8	+/-.7			
15S	18E	18.311	W.R. Joy Well	19740823	6.5	+/-.4			
15S	18E	18.311	W.R. Joy Well	19741219	3.5	+/-.9			
15S	18E	18.311	W.R. Joy Well	19750828	13.5	+/-.8			
15S	18E	18.311	W.R. Joy Well	19751219	8.1	+/-.7			
15S	18E	18.311	W.R. Joy Well	19760327	6.7	+/-.6			
15S	18E	18.311	W.R. Joy Well	19760605	7.1	+/-1.0			
15S	18E	18.311	W.R. Joy Well	19760810	6.8	+/-1.4			
15S	18E	18.311	W.R. Joy Well	19761029	6.6	+/-.9			
15S	22E	9.122	F. Runyon Well	19720112	15.6	+/-1.0			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
15S	26E	13.121	RA-165	19670714	21.7	+/-1.3			313SADR
15S	26E	13.121	RA-165	19670816	28	+/-.9			
15S	26E	13.121	RA-165	19680126	0.9	+/-1.2			
15S	26E	13.121	RA-165	19681009	45.6	+/-.9			
15S	26E	13.121	RA-165	19740409	4.2	+/-.9			
15S	26E	13.121	RA-165	19740614	5.3	+/-.6			
15S	26E	13.121	RA-165	19740824	7.9	+/-.8			
15S	26E	13.121	RA-165	19741218	1.7	+/-.6			
15S	26E	13.121	RA-165	19750221	0.9	+/-.6			
15S	26E	13.121	RA-165	19750425	4	+/-.7			
15S	26E	13.121	RA-165	19750827	5	+/-.7			
15S	26E	13.121	RA-165	19751220	4.8	+/-1.3			
15S	26E	13.121	RA-165	19760328	5.4	+/-.8			
15S	26E	13.121	RA-165	19760604	6.6	+/-.8			
15S	26E	13.121	RA-165	19760811	3.1	+/-.8			
15S	26E	13.121	RA-165	19761030	4.5	+/-.7			
15S	26E	13.121	RA-165	19770917	4.1	+/-.8	-9	-51	
15S	26E	13.121	RA-165	19780401	1.9	+/-.6	-9	-55	
15S	26E	4.141	RA-633	19740614	2	+/-.5			313SADR
15S	26E	4.141	RA-633	19740824	4.6	+/-.6			
15S	26E	4.141	RA-633	19741218	0	+/-.6			
15S	26E	4.141	RA-633	19750221	2.9	+/-.7			
15S	26E	4.141	RA-633	19750827	10.3	+/-.6			
15S	26E	4.141	RA-633	19760604	6.3	+/-.8			
15S	26E	4.141	RA-633	19760811	5.5	+/-1.6			
15S	26E	4.141	RA-633	19781202			-8	-59	
15S	26E	9.133	Windmill	19750721	18.1	+/-.9			
16S	14E	26.3430	Posey Springs	19770603	7.2	+/-.5			
16S	14E	31.1130	Mickison Spring	19770603	21.6	+/-.4			
16S	16E	11.34213	Paul Spring	19730711	19	+/-.4			
16S	16E	11.34213	Paul Spring	19740408	9.7	+/-.6			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
16S	16E	11.34213	Paul Spring	19740615	12	+/-.9			
16S	16E	11.34213	Paul Spring	19740823	13.5	+/-.6			
16S	16E	11.34213	Paul Spring	19741219	1.6	+/-.7			
16S	16E	11.34213	Paul Spring	19750221	21.6	+/-1.4			
16S	16E	11.34213	Paul Spring	19750221	6.5	+/-.7			
16S	16E	11.34213	Paul Spring	19750828	10.8	+/-.8			
16S	16E	11.34213	Paul Spring	19751219	6.6	+/-.8			
16S	16E	11.34213	Paul Spring	19760327	10.8	+/-.6			
16S	16E	11.34213	Paul Spring	19760605	5.1	+/-.9			
16S	16E	11.34213	Paul Spring	19760810	4.8	+/-.7			
16S	16E	11.34213	Paul Spring	19761029	6.1	+/-.7			
16S	16E	11.34213	Paul Spring	19761203	9.4	+/-.9			
16S	16E	11.34213	Paul Spring	19761222	7.4	+/-1.0			
16S	16E	11.34213	Paul Spring	19770104	2.5	+/-.9			
16S	16E	11.34213	Paul Spring	19770129	3.7	+/-.9			
16S	16E	11.34213	Paul Spring	19770219	14.1	+/-1.2			
16S	16E	11.34213	Paul Spring	19770505	3.6	+/-.7	-6		
16S	16E	11.34213	Paul Spring	19770630	1.6	+/-.8			
16S	16E	11.34213	Paul Spring	19770715	1.5	+/-.9	-7		
16S	16E	11.34213	Paul Spring	19770817	12.1	+/-.9	-8	-43	
16S	16E	11.34213	Paul Spring	19770916	5.4	+/-.8	-6	-54	
16S	16E	11.34213	Paul Spring	19771007	2.1	+/-.7			
16S	16E	11.34213	Paul Spring	19771022	1.9	+/-.6			
16S	16E	11.34213	Paul Spring	19771120	1.4	+/-.7	-6		
16S	16E	11.34213	Paul Spring	19771216	2.3	+/-.7			
16S	16E	11.34213	Paul Spring	19780114	0.9	+/-.7	-6	-42	
16S	16E	11.34213	Paul Spring	19780211	2.5	+/-.7			
16S	16E	11.34213	Paul Spring	19780311	1.8	+/-.5	-6		
16S	16E	11.34213	Paul Spring	19780402	2	+/-.8			
16S	16E	11.34213	Paul Spring	19790603			-9	-47	
16S	16E	11.421	Mulcock Well	19730711	81.9	+/-.7			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
16S	16E	11.421	Mulcock Well	19740615	7.4	+/-.5			
16S	16E	11.421	Mulcock Well	19760404	6.5	+/-.8			
16S	16E	2.3230	Cleve's Spring	19740408	7.5	+/-.6			
16S	16E	2.3230	Cleve's Spring	19740615	6.1	+/-.7			
16S	16E	2.3230	Cleve's Spring	19740823	8.9	+/-1.1			
16S	16E	2.3230	Cleve's Spring	19741219	8.4	+/-.7			
16S	16E	2.3230	Cleve's Spring	19750221	9.8	+/-.5			
16S	16E	2.3230	Cleve's Spring	19750828	16.8	+/-.9			
16S	16E	2.3230	Cleve's Spring	19751219	7.1	+/-.3			
16S	16E	2.3230	Cleve's Spring	19760327	8.2	+/-.7			
16S	16E	2.3230	Cleve's Spring	19760605	6.1	+/-.5			
16S	16E	2.3230	Cleve's Spring	19760810	15.6	+/-1.1			
16S	16E	2.3230	Cleve's Spring	19761029	11.1	+/-1.0			
16S	16E	2.3230	Cleve's Spring	19761202	9.2	+/-.8			
16S	16E	2.3230	Cleve's Spring	19761222	4.5	+/-.8			
16S	16E	2.3230	Cleve's Spring	19770104	3.1	+/-.9			
16S	16E	2.3230	Cleve's Spring	19770128	7.7	+/-.9			
16S	16E	2.3230	Cleve's Spring	19770318	5.9	+/-.9			
16S	16E	2.3230	Cleve's Spring	19770505	6.5	+/-.8	-6		
16S	16E	2.3230	Cleve's Spring	19770630	6.2	+/-.8			
16S	16E	2.3230	Cleve's Spring	19770916	3.8	+/-.8			
16S	16E	2.3230	Cleve's Spring	19780115	3.6	+/-.6	-7		
16S	16E	8.121	Bates Windmill	18780707			-8	-73	
16S	16E	8.121	Bates Windmill	19740408	12.7	+/-.6			313SADR
16S	16E	8.121	Bates Windmill	19740615	14.5	+/-.7			
16S	16E	8.121	Bates Windmill	19740823	3.7	+/-.7			
16S	16E	8.121	Bates Windmill	19741219	13.1	+/-.6			
16S	16E	8.121	Bates Windmill	19750221	9.6	+/-.6			
16S	16E	8.121	Bates Windmill	19750828	17.4	+/-.8			
16S	16E	8.121	Bates Windmill	19751219	13.7	+/-.4			
16S	16E	8.121	Bates Windmill	19760327	18.4	+/-.5			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
16S	16E	8.121	Bates Windmill	19760605	10.8	+/-.5			
16S	16E	8.121	Bates Windmill	19760810	10.3	+/-.7			
16S	16E	8.121	Bates Windmill	19761029	14.5	+/-1.0			
16S	16E	8.121	Bates Windmill	19770104	15.6	+/-1.0			
16S	16E	8.121	Bates Windmill	19780402			-8	-62	
16S	20E	16.241	R.H. McAshan Windmill	19740408	12.5	+/-.5			
16S	20E	16.241	R.H. McAshan Windmill	19750221	10.3	+/-.7			
16S	20E	16.241	R.H. McAshan Windmill	19760810	9.9	+/-.9			
16S	20E	16.241	R.H. McAshan Windmill	19780402	5.6	+/-.8	-7		
16S	20E	18.333	PVACD#5	19740408	4	+/-.7			313SADR/310GLRT
16S	20E	18.333	PVACD#5	19760810	3.9	+/-.8			
16S	26E	20.433	RA-(558-COMB-952)	19750520	6.2	+/-.8			110AVMB/313SADR
16S	26E	21.300	RA-1459	19750520	16	+/-.9			110AVMB/110GTUN
16S	26E	29.143	RA-1117						
16S	26E	29.143	RA-1117						
16S	26E	29.143	RA-1117						313SADR
16S	26E	29.143	RA-1117	19750520	7.6	+/-.8			110AVMB/110GTUN/313ARTS/
17S	11E	11.23000	Penasco Head Spring	19770525	19.2	+/-.5			
17S	12E	16.43100		19770524	15.1	+/-.4			
17S	12E	17.(14,23)	Bluff Springs	19770524	27.4	+/-.4			
17S	13E	25.441		19770525	17.2	+/-.6			
17S	20E	18.434	PVACD#7	19740408	11.6	+/-.9			313SADR
17S	20E	18.434	PVACD#7	19741219	8.3	+/-1.0			
17S	20E	18.434	PVACD#7	19770917	16	+/-1.1	-7		
17S	20E	18.434	PVACD#7	19771217	11.1	+/-.9	-7		
17S	20E	18.434	PVACD#7	19780402	11.8	+/-.8	-9		
17S	23E	30.120	RA-3081	197502	9.1	+/-.9			
17S	23E	30.120	RA-3081	197503	5.3	+/-.7			
17S	23E	30.120	RA-3081	197504	4.9	+/-.7			
17S	23E	30.120	RA-3081	197505	7.6	+/-.6			
17S	23E	30.120	RA-3081	197509	6.2	+/-1.0			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
17S	23E	30.120	RA-3081	197510	5.4	+/-.5			
17S	23E	30.120	RA-3081	197511	8.7	+/-.6			
17S	23E	30.120	RA-3081	197512	8.8	+/-.6			
17S	23E	30.120	RA-3081	197601	3.2	+/-.7			
17S	23E	30.120	RA-3081	197603	7.5	+/-.8			
17S	23E	30.120	RA-3081	197801	3.6	+/-.6	-7	-47	
17S	23E	30.120	RA-3081	197809	6.2	+/-1.0			
17S	23E	30.120	RA-3081	19720112	37.5	+/-3.1			313SADR
17S	23E	30.120	RA-3081	19730711	14.2	+/-.4			
17S	23E	30.120	RA-3081	19740614	6.1	+/-.5			
17S	23E	30.120	RA-3081	19740722	1.7	+/-.6			
17S	23E	30.120	RA-3081	19740823	9.7	+/-.5			
17S	23E	30.120	RA-3081	19740925	3.4	+/-.7			
17S	23E	30.120	RA-3081	19741028	1.6	+/-.7			
17S	23E	30.120	RA-3081	19741128	4.6	+/-.6			
17S	23E	30.120	RA-3081	19741226	2.2	+/-.6			
17S	23E	30.120	RA-3081	19750212	6.3	+/-.8			
17S	23E	30.120	RA-3081	19750221	2.9	+/-.5			
17S	23E	30.120	RA-3081	19750317	8	+/-.6			
17S	23E	30.120	RA-3081	19770512	9.1	+/-.7	-7	-47	
17S	26E	10.333	RA-1331	19730711	29.9	+/-.7			110AVMB/110GTUN
17S	26E	10.333	RA-1331	19740409	16.5	+/-.7			
17S	26E	10.333	RA-1331	19740614	13.9	+/-.6			
17S	26E	10.333	RA-1331	19740824	8	+/-.9			
17S	26E	10.333	RA-1331	19750828	7.2	+/-.5	-6		
17S	26E	10.333	RA-1331	19760604	3.8	+/-.6	-8		
17S	26E	10.333	RA-1331	19760811	9.5	+/-1.1	-7		
17S	26E	10.333	RA-1331	19770325	6.6	+/-.7	-5		
17S	26E	10.333	RA-1331	19770701	6.3	+/-.7	-8		
17S	26E	10.333	RA-1331	19770917	8.1	+/-.9	-8		
17S	26E	10.333	RA-1331	19780401	2.7	+/-.7	-9		

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
17S	26E	10.333	RA-307	19730711	21.7	+/-.6			313SADR
17S	26E	10.333	RA-307	19740409	3	+/-.5			
17S	26E	10.333	RA-307	19740614	6.4	+/-.5			
17S	26E	10.333	RA-307	19740824	7.7	+/-.6			
17S	26E	10.333	RA-307	19750520	7	+/-.8			
17S	26E	10.333	RA-307	19750828	9.6	+/-.4	-5		
17S	26E	10.333	RA-307	19760604	4.2	+/-.7	-6		
17S	26E	10.333	RA-307	19760811	9.7	+/-1.0	-7		
17S	26E	10.333	RA-307	19770325	7.9	+/-.7	-7		
17S	26E	10.333	RA-307	19770701	7.1	+/-.5	-6		
17S	26E	10.333	RA-307	19770917	6.9	+/-.7	-7		
17S	26E	10.333	RA-307	19780401	4.9	+/-.6	-7	-77	
17S	26E	10.433	RA-397	19730711	3.4	+/-1.0			313SADR
17S	26E	10.433	RA-397	19740409	2.2	+/-.5			
17S	26E	10.433	RA-397	19740614	1.6	+/-.4			
17S	26E	10.433	RA-397	19750328	11.2	+/-1.0			
17S	26E	10.433	RA-397	19750828	8.1	+/-.4			
17S	26E	10.433	RA-397	19760327	8.5	+/-.7			
17S	26E	10.433	RA-397	19760604	1.7	+/-.6			
17S	26E	10.433	RA-397	19760811	7.9	+/-.8			
17S	26E	10.433	RA-397	19780401			-7	-43	
17S	26E	11.433	RA-777	19730712	18.3	+/-.6			313SADR
17S	26E	11.433	RA-777	19741218	0.7	+/-.9			
17S	26E	11.433	RA-777	19750328	5.6	+/-1.0			
17S	26E	11.433	RA-777	19750828	8.5	+/-.4			
17S	26E	11.433	RA-777	19760327	4.4	+/-.7			
17S	26E	11.433	RA-777	19760604	5.4	+/-.6			
17S	26E	11.433	RA-777	19760811	4.4	+/-.8			
17S	26E	12.142	Windmill	19740409	86.2	+/-.6			A
17S	26E	12.142	Windmill	19750328	93.9	+/-.5			
17S	26E	12.142	Windmill	19750827	98.5	+/-.4			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	018	Deuterium	Compzone
17S	26E	12.142	Windmill	19760327	94.4	+/-1.7			
17S	26E	12.142	Windmill	19760604	94.8	+/-1.7			
17S	26E	12.142	Windmill	19760811	75.7	+/-1.9			
17S	26E	12.142	Windmill	19780401			-4	-38	
17S	26E	14.211	RA-895	19730712	5.7	+/-1.1			110AVMB/110GTUN/313ARTS/
17S	26E	14.211	RA-895	19740409	6.1	+/-.6			313SADR
17S	26E	14.211	RA-895	19740614	0.8	+/-.6			
17S	26E	14.211	RA-895	19750828	8.9	+/-.4			
17S	26E	14.211	RA-895	19760604	4.4	+/-.4			
17S	26E	14.211	RA-895	19760811	5.2	+/-.8			
17S	26E	14.211	RA-895	19770917	3.8	+/-.8	-8		
17S	26E	14.211	RA-895	19780401	2.7	+/-.8	-8		
17S	26E	15.111	RA-1227	19730712	16.1	+/-.5			110AVMB/110GTUN
17S	26E	15.111	RA-1227	19740409	8.3	+/-.4			
17S	26E	15.111	RA-1227	19740614	9.5	+/-.4			
17S	26E	15.111	RA-1227	19740824	8.6	+/-.4			
17S	26E	15.111	RA-1227	19760604	10.9	+/-.7			
17S	26E	15.120	RA-1183	19730712	14.5	+/-.4			110AVMB/110GTUN
17S	26E	15.120	RA-1183	19750328	7.7	+/-1.0			
17S	26E	15.133	RA-(2050-COMB-2871)	19730712	15.8	+/-.9			313SADR
17S	26E	15.133	RA-(2050-COMB-2871)	19740614	2.3	+/-.5			
17S	26E	15.133	RA-1503-F	19740409	9.5	+/-.7			110AVMB/110GTUN
17S	26E	15.133	RA-1503-F	19740614	0.4	+/-.7			
17S	26E	15.133	RA-1503-F	19740824	19.2	+/-1.4			
17S	26E	15.133	RA-1503-F	19750326	11.8	+/-.9			
17S	26E	15.133	RA-1503-F	19760604	9.1	+/-1.1			
17S	26E	15.133	RA-1503-F	19760811	11.9	+/-.8			
17S	26E	15.413	RA-1578	19740409	6.3	+/-.4			
17S	26E	15.413	RA-1578	19740614	4	+/-.5			
17S	26E	15.413	RA-1578	19740824	5.2	+/-.5			
17S	26E	15.413	RA-1578	19760604	5.3	+/-.8			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
17S	26E	15.413	RA-1578	19760811	8.3	+/-.9			
17S	26E	29.111	RA-1925-S	19750520	6.6	+/-.7			110AVMB/110GTUN/313ARTS/
17S	26E	29.111	RA-1925-S	19750721	10.5	+/-1.1			313SADR
17S	26E	29.111	RA-1925-S	19760604	4.1	+/-.6			
17S	26E	29.111	RA-1925-S	19760811	2	+/-.7			
17S	26E	29.111	RA-1925-S	19760828	4.7	+/-.7			
17S	26E	29.111	RA-1925-S	19760828	7.4	+/-.4			
17S	26E	29.111	RA-1925-S	19770701	16.4	+/-.8	-8	-48	
17S	26E	30.211	RA-(1826,1826-AS)	19750328	3.1	+/-.5			110AVMB/110GTUN
17S	26E	30.211	RA-(1826,1826-AS)	19760811	5.9	+/-1.7			
17S	26E	30.211	RA-(1826,1826-AS)	19770701	6.8	+/-.7	-7	-51	
17S	26E	30.211	RA-(1826,1826-AS)	19780401			-7	-56	
18S	12E	1.331	Boy Scout Camp Spring						
18S	12E	1.331	Boy Scout Camp Spring						
18S	12E	1.331	Boy Scout Camp Spring	19770527	34.1	+/-.6			
18S	12E	26.423	Barrel Spring	19770527	55.9	+/-.5			
18S	12E	26.423	Barrel Spring	19770818	42.7	+/-1.5			
18S	23E	5.333	Well	19710119	15.4	+/-1.4			
18S	26E	18.221	RA-3181-S5	19750520	14	+/-.8			110AVMB/110GTUN
18S	26E	18.322	RA-3181	19750721	12.7	+/-.9			
18S	26E	18.332	RA-747	19750328	6.5	+/-.5			313ARTS/313SADR
18S	26E	18.332	RA-747	19750721	5.7	+/-.7			
18S	26E	18.41124	RA-1167-A	19750520	10.7	+/-.7			313SADR
18S	26E	18.41124	RA-1167-A	19770817	2.6	+/-.7	-9	-48	
18S	26E	18.41124	RA-1167-A	19780401	0.5	+/-.7	-8	-50	
19S	26E	5.323	Powell Well	19720111	19	+/-.9			
20S	26E	27.100	Boiling (or Bubbling) Spring	19760605	61.2	+/-.5			
20S	26E	27.100	Boiling (or Bubbling) Spring	19761030	44.1	+/-1.7			
20S	26E	27.100	Boiling (or Bubbling) Spring	19761203	53.5	+/-1.2			
20S	26E	27.100	Boiling (or Bubbling) Spring	19770105	44.9	+/-1.3			
20S	26E	27.100	Boiling (or Bubbling) Spring	19770325	44.4	+/-1.4			

Isotope Data for the Roswell Basin

Town	Range	Section	Well name	Sampdate	TU	TUacc	O18	Deuterium	Compzone
20S	26E	27.100	Boiling (or Bubbling) Spring	19770917	39.1	+/-1.6	-3	-39	
20S	26E	27.100	Boiling (or Bubbling) Spring	19780401	34.6	+/-1.6	-2	-30	
Unk			George Mayo Well	19740409	5.5	+/-.7			
Unk			George Mayo Well	19740614	0.1	+/-.6			
Unk			George Mayo Well	19740824	2.8	+/-.5			
Unk			George Mayo Well	19760327	6	+/-.8			
Unk			George Mayo Well	19760604	6.5	+/-.4			
Unk			George Mayo Well	19760811	2.8	+/-.8			
Unk			Kimbrell Well	19730527	28.3	+/-1.0			
Unk			Reso Reservoir Pump	19750425	4.6	+/-.6			
Unk			Stinking Mill Well	19750425	7.4	+/-.8			
Unk			The Flat Windmill	19740614	4.8	+/-.9			
Unk			North Well	19720616	17.5	+/-1.1			

APPENDIX F

STATISTICAL ANALYSIS OF AQUIFER TEST DATA

Appendix F, Part 1

Aquifer Test Data

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
08S	24E	28.123	---	---	300	---	---	---	15400	---	4e-05	0.003	---	2	L	51	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
08S	24E	28.222	276-461	---	300	3601	---	1	22900	---	4e-05	0.002	---	2	L	76	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
08S	24E	33.413	---	---	280	---	---	---	67700	---	4e-05	0.001	---	2	L	242	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
08S	24E	5.343	164-416	---	360	3647	RA-2456	1	37200	---	4e-05	0.002	---	2	L	103	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
09S	24E	34	---	---	430	---	---	---	15700	---	4e-05	0.006	---	2	L	37	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	23E	24.143	---	---	350	---	---	---	53400	---	4e-05	0.001	---	2	L	153	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	23E	27.222	170-565	---	300	3687	RA-2680	1	50000	---	4e-05	0.001	---	2	L	167	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	23E	34.432	180-568,180-563	---	260	3705	RA-4255	1	14400	---	4e-05	0.002	---	2	L	55	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different well completion values given for the same well.
10S	24E	15.131	196-294	---	400	3571	RA-905	1	387100	---	4e-05	0.000	---	2	L	968	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	15.323	---	---	400	---	---	---	13900	---	4e-05	0.006	---	2	L	35	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	15.332	194-300;200-253	---	400	3562,3565	RA-866?,RA-866B?	1	86400	---	4e-05	0.001	---	2	L	216	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
10S	24E	15.342	236-333,343-343	---	400	3555,3557	RA-429?,RA-3216?	1	16200	---	4e-05	0.005	---	2	L	41	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
10S	24E	17.141	---	---	400	---	---	---	27000	---	4e-05	0.003	---	2	L	68	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	17.324	---	---	400	---	---	---	33200	---	4e-05	0.002	---	2	L	83	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	20.234	126-237;146-218	---	350	3631,3609	RA-1138B?,RA-2031?	1	89000	---	4e-05	0.001	---	2	L	254	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
10S	24E	21.424	---	---	350	---	---	---	165900	---	4e-05	0.000	---	2	L	474	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	22.331	177-312	---	350	3581	RA-971A	1	40200	---	4e-05	0.001	---	2	L	115	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	22.343	255-340;244-365	---	350	3575,3572	RA-1701?,RA-2287?	1	102000	---	4e-05	0.001	---	2	L	291	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
10S	24E	27.421	254-312	---	300	3565	RA-125	1	11400	---	4e-05	0.004	---	2	L	38	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
10S	24E	9.333	753-777	---	400	3588	RA-3140	1	195900	1.8e-05	4e-05	0.000	2.9e-04	14	L	490	1	313SADR	Hantush (1957)	Recovery (14 hr)	One observation well was used in pump test analysis.
10S	24E	9.333	753-777	---	400	3588	RA-3140	1	189200	1.5e-05	4e-05	0.000	2.8e-04	10	L	473	1	313SADR	Hantush (1957)	Drawdown (10 hr @ 1500 gpm)	One observation well was used in pump test analysis.
10S	25E	32.423	493-533	---	260	3472	RA-4276	5	1600	5.7e-05	4e-05	0.020	1.9e-04	24	L	6	1	313SADR	Hantush (1961)	Drawdown (24 hr)	Welder's structure maps show well screened in 313SADR
10S	25E	33.441	554-595	---	260	3465	RA-4304	5	252700	6.7e-05	4e-05	0.000	1.5e-04	---	L	972	1	313SADR	Hantush (1961)	Recovery	
10S	25E	33.441	554-595	---	260	3465	RA-4304	5	252700	6.7e-05	4e-05	0.000	2.0e-04	20	L	972	1	313SADR	Hantush (1961)	Drawdown (20 hr @ 2500 gpm)	Five observation wells were utilized in transmissivity analysis
11S	23E	12.442	350-350	---	280	3635	RA-1913	1	198700	---	4e-05	0.000	---	2	L	710	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	23E	12.444	150-176	---	280	3638	RA-1472	1	43700	---	4e-05	0.001	---	2	L	156	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	23E	13.232	---	---	280	3650	---	3	38800	---	4e-05	0.001	---	2	L	139	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	23E	28.223	---	---	300	---	---	---	97200	---	4e-05	0.000	---	2	L	324	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	23E	3.1	20-215	---	260	3750	RA-3850	1	16900	---	4e-05	0.002	---	2	L	65	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	1.313	311-432	---	260	3544	RA-42?	1	13300	---	4e-05	0.002	---	2	L	51	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	11.243	329-454	---	280	3560	RA-924	1	68300	---	4e-05	0.001	---	2	L	244	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	12.113	374-439	---	280	3550	RA-3834	1	669600	---	4e-05	0.000	---	2	L	2391	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	12.231	127-150;160-190	---	280	3545	RA-3964?,RA-3965?	1	64900	---	4e-05	0.001	---	2	L	232	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
11S	24E	13.233	?-151;?;?	---	300	3552	RA-928?,RA-2336?, RA-1265?	1,3	18600	---	4e-05	0.002	---	2	L	62	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Three different wells completed at this location.
11S	24E	14.213	310-406	---	300	3566	RA-353	1	35900	---	4e-05	0.001	---	2	L	120	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	14.324	329-450	---	300	3577	RA-1175	1	639600	---	4e-05	0.000	---	2	L	2132	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	14.343	---	---	300	3580	---	1	27300	---	4e-05	0.002	---	2	L	91	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Four alluvial wells completed at this location: RA-3434,3020,1896,2621
11S	24E	15.431	---	---	300	---	---	1,3	10500	---	4e-05	0.004	---	2	L	35	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	RA-1470, identified at this location, does not match aquifer designation.
11S	24E	18.242	187-216	---	300	3631	RA-3981	1	98500	---	4e-05	0.000	---	2	L	328	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
11S	24E	18.333	126-167	---	300	3646,3655	RA-1626	1,3	19500	---	4e-05	0.002	---	2	L	65	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	18.333	---	---	260	---	---	---	19900	---	4e-05	0.002	---	2	L	77	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	No Artesia Group at this location
11S	24E	19	---	---	300	---	---	---	20900	---	4e-05	0.002	---	2	L	70	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	20.313	---	---	300	---	---	---	101100	---	4e-05	0.000	---	2	L	337	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	26.433	430-650	---	320	3590	RA-1011	1,3	194300	8.4e-06	4e-05	0.000	1.0e-04	31	L	607	1	313SADR	Hantush (1957)	Drawdown (31 hr at 1700 gpm)	Three observation wells used in pump test analysis.
11S	24E	26.433	430-650	---	320	3590	RA-1011	1,3	55300	---	4e-05	0.001	---	2	L	173	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	28	---	---	320	---	---	---	21600	---	4e-05	0.002	---	2	L	68	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	28.313	298-438	---	320	3634	RA-140C	1	7600	---	4e-05	0.006	---	2	L	24	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	36.211	---	---	320	3573	---	3	16700	---	4e-05	0.003	---	2	L	52	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	4.114	285-319;285-309; 113-319;238-335; 299-1471	---	260	3571	RA-99?,RA-101?, RA-501?,RA-102?, RA-100	1	224600	---	4e-05	0.000	---	2	L	864	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Five different wells completed at this location.
11S	24E	6.31	---	---	260	---	---	---	15000	---	4e-05	0.002	---	2	L	58	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	No Artesia Group at this location
11S	24E	6.31	---	---	260	---	---	---	15100	---	4e-05	0.002	---	2	L	58	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	6.423	---	---	260	---	---	---	184000	---	4e-05	0.000	---	2	L	708	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	No Artesia Group at this location
11S	24E	8.124	422-495	---	280	3609	RA-956A	1	410400	---	4e-05	0.000	---	2	L	1466	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	8.124	422-495	---	280	3609	RA-956A	1	15700	---	4e-05	0.002	---	2	L	56	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	14.332	---	---	280	---	---	---	320900	---	4e-05	0.000	---	---	L	1146	1	313SADR	Summers (1972)	Step Drawdown- Harrill's Equation	
11S	25E	29.333	644-826	---	320	3540	RA-108	1	17100	---	4e-05	0.003	---	2	L	53	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	32.133	615-822;555-759; 543-740	---	320	3548,3543	RA-271?,RA-272?, RA-273?	1	65800	---	4e-05	0.001	---	2	L	206	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Three different wells completed at this location.
12S	23E	1.413	---	---	320	---	---	---	71100	---	4e-05	0.001	---	2	L	222	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
12S	23E	6.214	?-665	---	320	3835,3830	RA-2888	1,3	21100	---	4e-05	0.002	---	2	L	66	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
12S	24E	21.333	---	---	380	---	---	---	37400	---	4e-05	0.002	---	2	L	98	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
12S	24E	22.41333	?-1260	---	380	3678	RA-2084-X-3	6	4500	---	4e-05	0.015	---	---	L	12	1	313SADR	USGS (87.4148),1970	Recovery (1300 gpm) City of Roswell	
12S	24E	22.41333	?-1260	---	380	3678	RA-2084-X-3	6	3600	---	4e-05	0.019	---	---	L	9	1	313SADR	USGS (87.4148),1970	Recovery (1300 gpm) City of Roswell	
12S	25E	13.111	120-895 (710-9003 also reported)	---	380	3523	RA-1813	1,3	204800	---	4e-05	0.000	---	2	L	539	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two alluvial wells also completed at this location: RA-2846,4758.
12S	25E	35.131	514-960	---	460	3536	RA-342	1,3	445000	---	4e-05	0.000	---	2	L	967	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
12S	26E	33.333	---	---	460	---	---	---	9700	---	4e-05	0.010	---	---	L	21	1	313SADR	Summers (1972)	Step Drawdown- Harrill's Equation	
13S	25E	13.133	825-1000	---	400	3509	RA-705?	1,3	16200	---	4e-05	0.005	---	2	L	41	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
13S	25E	23.311	---	---	380	---	RA-1352?,RA-994?, RA-57?	1	10000	1.3e-05	4e-05	0.007	8.7×10^{-6}	22	L	26	1	313SADR	Hantush (1957)	Drawdown (22 hr @ 540 gpm)	Three observation wells used in pump test analysis.
13S	25E	24.333	?-966;735-927	---	380	3504	RA-1353?,RA-563?	1,3	232400	---	4e-05	0.000	---	2	L	612	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two wells completed at this location.
13S	25E	26.411	728-950	---	360	3511	RA-378	1,3	60700	---	4e-05	0.001	---	2	L	169	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
13S	26E	3.144	880-1208	---	460	3431	RA-521	1	2300	---	4e-05	0.044	---	---	L	5	1	313SADR	Summers (1972)	S.D.-recovery- Harrill's Equation	
13S	26E	30.213	790-1005	---	350	3465	RA-410	1	59500	---	4e-05	0.001	---	2	L	170	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
13S	26E	31.211	822-1060	---	340	3467	RA-514	1	24600	---	4e-05	0.002	---	2	L	72	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
13S	26E	31.214	838-1045	---	340	3464	RA-513	1	387100	---	4e-05	0.000	---	2	L	1139	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
13S	26E	6.331	---	---	460	---	---	---	14600	---	4e-05	0.007	---	2	L	32	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
14S	25E	14.3111	---	---	320	---	---	---	10300	---	4e-05	0.005	---	---	L	32	1	313SADR	Summers (1972)	Step Drawdown- Harrill's Equation	

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
14S	26E	32.124	---	---	320	---	---	---	40800	---	4e-05	0.001	---	2	L	128	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	9.313	---	---	330	---	---	---	24400	---	4e-05	0.002	---	2	L	74	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	RA-1333E, located at this section, does not match aquifer designation.
15S	25E	23.122	757-1022	---	350	3430	RA-1065	1,3	19700	---	4e-05	0.003	---	---	L	56	1	313SADR	Summers (1972)	Step Drawdown-Harrill's Equation	One observation well used in transmissivity analyis
15S	25E	24.212	---	---	350	---	---	---	5700	---	4e-05	0.010	---	---	L	16	1	313SADR	Summers (1972)	S.D.-recovery-Harrill's Equation	One observation well used in transmissivity analysis
15S	25E	33.333	608-892,560-910?; 610-604	---	400	3450	RA-1128?,RA-1070?	1	44500	---	4e-05	0.002	---	---	L	111	1	313SADR	Summers (1972)	S.D.-recovery-Harrill's Equation	Two wells completed at this location. One observation well used in analysis
15S	25E	35.213	675-869,571-924?; 696-929,?-340	---	430	3406,3404	RA-1020?,RA-1021?	1,3	22200	---	4e-05	0.004	---	2	L	52	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
15S	25E	35.311	450-962	---	430	3414	RA-1443	1,3	9100	---	4e-05	0.010	---	2	L	21	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
15S	26E	13.222	1203-1428	---	350	3355	RA-1851	1	691200	---	4e-05	0.000	---	2	L	1975	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
15S	26E	4.123	---	---	300	---	---	---	55100	---	4e-05	0.001	---	2	L	184	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
16S	24E	2.324	---	---	430	---	---	---	95900	---	4e-05	0.001	---	2	L	223	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
16S	25E	7.111	470-837	---	430	3540	RA-623	1,3	62900	---	4e-05	0.001	---	2	L	146	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	20.433	905-1063	---	430	3378	RA-558	1,3	15000	---	4e-05	0.006	---	2	L	35	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	20.433	905-1063	---	430	3378	RA-558	1,3	18900	---	4e-05	0.005	---	2	L	44	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	17.233	668-1071	---	400	3388	RA-2155	1	10700	---	4e-05	0.007	---	2	L	27	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	17.233	668-1071	---	400	3388	RA-2155	1	9900	---	4e-05	0.008	---	2	L	25	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	20.431	748-1103	---	380	3394	RA-738	1	28300	---	4e-05	0.002	---	2	L	74	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	32.133	---	---	350	---	---	---	29400	---	4e-05	0.002	---	2	L	84	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	RA-4555, located at this section, does not match aquifer designation.
17S	26E	32.213	---	---	350	---	---	---	28600	---	4e-05	0.002	---	2	L	82	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Well completion for the well (RA-385) does not match aquifer designation.
17S	26E	8.431	662-1158	---	430	3370	RA-2231	1	44200	---	4e-05	0.002	---	2	L	103	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	8.431	662-1158	---	430	3370	RA-2231	1	12500	---	4e-05	0.007	---	2	L	29	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	8.444	657-1223	---	430	3367	RA-2397	1	14400	---	4e-05	0.006	---	2	L	33	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	9.113	859-1180;828-1005	---	430	3361	RA-602?,RA-3832?	1	22300	---	4e-05	0.004	---	2	L	52	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
18S	26E	10.313	649-863	---	350	3346	RA-302	1	72600	---	4e-05	0.001	---	2	L	207	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
18S	26E	34	---	---	380	---	---	---	17600	---	4e-05	0.004	---	2	L	46	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
18S	26E	34	---	---	380	---	---	---	21200	---	4e-05	0.003	---	2	L	56	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
19S	26E	27.221	---	---	380	---	---	---	2700	---	4e-05	0.026	---	2	L	7	2	313SADR	Saleem & Jacob (1971)	Step Drawdown	
20S	26E	6.431	---	---	380	---	RA-3202S3?,RA-324?	1,3	7500	---	4e-05	0.009	---	22	L	20	1	313SADR	Hantush (1957)	Recovery (22 hr)	Two observation wells used in pump test analysis.
20S	26E	6.431	---	---	380	---	RA-3202S3?,RA-324?	1,3	8900	1.1e-04	4e-05	0.008	1.3e-05	72	L	23	1	313SADR	Hantush (1957)	Drawdown (72 hr @ 1500 gpm)	Five observation wells used in pump test analysis.
08S	24E	35.224	---	---	50	---	---	---	4000	---	4e-05	0.000	---	2	L	80	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
08S	24E	35.343	115-140	---	50	3614	RA-3135	1	60300	---	4e-05	0.000	---	2	L	1206	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	
09S	24E	11.133	---	---	150	3597	---	3	49900	---	4e-05	0.000	---	2	L	333	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
09S	24E	2.414	---	---	100	---	---	---	62900	---	4e-05	0.000	---	2	L	629	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
09S	24E	2.421	---	---	100	---	---	---	15800	---	4e-05	0.000	---	2	L	158	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
10S	25E	31.413	154-154,-160	---	200	3512,3510	RA-1417D	1,3	10200	---	4e-05	0.002	---	2	L	51	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	
11S	24E	1.334	232-443;325-433	---	125	3546	RA-920A?,RA-921?	1	281700	---	4e-05	0.000	---	2	L	2254	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	
11S	24E	18.444	156-200	---	20	3638	RA-3174	1	42400	---	4e-05	0.000	---	2	L	2120	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	
11S	25E	28.234	?-198,?	---	425	3503	RA-1586S?,RA-1582?	1,3	8800	---	4e-05	0.010	---	2	L	21	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	
11S	25E	28.243	?-119	---	425	3502,3500	RA-1582	1,3	21500	---	4e-05	0.004	---	2	L	51	2	313ARTS	Saleem & Jacob (1971)	Shallow Step Drawdown	

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
11S	25E	8.123	---	---	200	---	---	1	8000	---	4e-05	0.002	---	2	L	40	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	RA-4238S, completed at this location is screened in the alluvium
12S	25E	36.111	---	---	500	---	---	---	4000	---	4e-05	0.030	---	2	L	8	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	RA-1449, identified at this location, does not match aquifer designation.
12S	25E	5.111	---	---	200	---	---	---	301500	---	4e-05	0.000	---	2	L	1508	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	RA-52B, identified for this location, does not match aquifer designation.
13S	24E	25.212	---	---	325	---	---	---	3100	---	4e-05	0.016	---	2	L	10	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
13S	25E	12	---	---	475	---	---	---	16500	---	4e-05	0.007	---	2	L	35	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
13S	25E	27.211	458-646;166-180; ?-194	---	425	3524	RA-1542?,RA-1542A? RA-1573A?	1,3	22800	---	4e-05	0.004	---	2	L	54	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	Three different wells completed at this location.
13S	25E	35.232	---	---	425	---	---	---	14900	---	4e-05	0.006	---	2	L	35	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
14S	24E	18.222	---	---	175	---	---	---	18600	---	4e-05	0.001	---	2	L	106	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	
14S	25E	12.331	---	---	475	---	---	1	12400	---	4e-05	0.009	---	2	L	26	2	313ARTS	Saleem & Jacob (1971)	Step Drawdown	RA-1159-S2, identified for this location, is completed in the alluvium
20S	26E	7.211	---	---	380	---	---	---	12200	---	1e-01	14.203	---	220	---	32	1	313ARTS	Hantush (1957)	Drawdown (220 hr @ 840 gpm)	Alluvium not present
20S	26E	7.423	153-187;148-250	200	380	3292	RA-1425,RA-1425-S	1	69200	---	1e-01	2.504	---	2	S	346	3	313ARTS	Saleem & Jacob (1971)	Step Drawdown	Alluvium not present
20S	26E	8.112	191-270	200	380	3284	RA-1397	1	3500	---	1e-01	49.509	---	2	S	18	3	313ARTS	Saleem & Jacob (1971)	Step Drawdown	Alluvium not present
20S	26E	8.122	---	---	380	---	---	---	12700	---	1e-01	13.644	---	222	---	33	1	313ARTS	Hantush (1957)	Drawdown (222 hr @ 1100 gpm)	Two observation wells used in pump test analysis.
10S	24E	36.413	---	100	200	---	---	---	2800	---	1e-01	17.143	---	2	S	28	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
10S	25E	33.341	14-44	30	260	---	---	4	100	---	1e-01	811.200	---	2		3	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 3 gpm)	Recovery data used
11S	24E	12.321	---	75	150	---	---	1	12600	---	1e-01	2.143	---	2	S	168	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	RA-276, identified at this location, does not match aquifer designation.
11S	24E	13.144	155-164;?-99; ?-178;?-103	---	150	3552	RA-1265?,RA-1246A, RA-1265A,RA-1265A	1,3	15000	---	1e-01	1.800	---	2	L	100	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Four different wells completed at this location.
11S	24E	14.314	---	75	150	---	---	---	3900	---	1e-01	6.923	---	2	S	52	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
11S	24E	2.221	---	100	200	---	---	1	1700	---	1e-01	28.235	---	2	S	17	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	RA-73, located in this section, does not match aquifer designation.
11S	24E	27.431	?-354	---	125	3605	RA-1334	---	9600	---	1e-01	1.953	---	24		77	1	110AVMB	Hantush (1957)	Drawdown (24 hr @ 1450 gpm)	Recovery data used
11S	25E	16	---	62	125	---	---	---	2100	---	1e-01	8.929	---	2	S	34	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	25.114	20-45	25	100	---	---	4	800	---	1e-01	15.000	---	2.1	---	32	1	110AVMB	Mower et al. (1964)	Aquifer Test (127 min @ 4.4 gpm)	Recovery data used
11S	25E	25.144	15-45	30	100	---	---	4	1600	---	1e-01	7.500	---	1.73	---	53	1	110AVMB	Mower et al. (1964)	Aquifer Test (104 min @ 4 gpm)	Recovery data used
11S	25E	34.113	?-140	---	75	3506	RA-1521N	1	8000	---	1e-01	0.844	---	2	L	107	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	34.311	?-110	37.5	75	3505	RA-1457	1	1800	---	1e-01	3.750	---	2	S	48	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	36.142	7-37	30	75	---	---	4	1700	---	1e-01	3.971	---	2		57	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 11.4 gpm)	Recovery data used
11S	25E	36.143	15-35	20	75	---	---	4	1600	---	1e-01	4.219	---	2		80	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 9.8 gpm)	Recovery data used
11S	25E	36.242	48-63	15	320	---	---	4	3100	---	1e-01	39.639	---	2		207	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 27.6 gpm)	Recovery data used
11S	25E	6.332	170-180	10	150	3532	RA-4033S	1	2900	---	1e-01	9.310	---	2	S	290	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
11S	25E	6.332	170-180	10	150	3532	RA-4033S	1	1900	---	1e-01	14.211	---	2	S	190	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
12S	25E	23.234	---	---	50	---	---	---	5000	---	1e-01	0.600	---	22.5	---	100	1	110AVMB	Hantush (1957)	Drawdown (22.5 hr @ 400 gpm)	
12S	25E	23.312	---	---	75	---	---	---	5300	---	1e-01	1.274	---	3	---	71	1	110AVMB	Hantush (1957)	Recovery (3 hrs)	

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
12S	25E	23.312	---	---	75	---	---	---	4200	5.6e-02	1e-01	1.607	---	29	---	56	1	110AVMB	Hantush (1957)	Drawdown (29 hr @ 260 gpm)	Two observation wells used in pump test analysis.
12S	25E	25.431	---	38	75	---	---	---	2400	---	1e-01	2.813	---	2	S	63	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
12S	25E	27.211	20-198,?-250	50	100	3550	RA-1447	1,3	4100	---	1e-01	2.927	---	2	S	82	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
12S	26E	32.133	?-118	50	100	3470	RA-1280	1,3	5700	---	1e-01	2.105	---	2	S	114	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
13S	25E	35.133	195-208	---	50	3508	RA-1280	1	8800	---	1e-01	0.341	---	2	L	176	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
13S	25E	35.322	150-210	---	50	---	RA-1280	1,3	14000	3.8e-02	1e-01	0.214	---	71	---	280	1	110AVMB	Hantush (1957)	Drawdown (71 hr @ 720 gpm)	Two observation wells used in pump test analysis.
13S	25E	35.322	150-210	---	50	---	RA-1280	1,3	13200	---	1e-01	0.227	---	78	---	264	1	110AVMB	Hantush (1957)	Recovery (78 hr)	Two observation wells used in pump test analysis.
13S	26E	10.123	5-17	12	50	---	---	4	1800	---	1e-01	1.667	---	2		150	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 3 gpm)	Recovery data used
13S	26E	16.114	---	---	200	3428	RA-1152?,RA-1123?	1,3	13200	---	1e-01	3.636	---	23	---	66	1	110AVMB	Hantush (1957)	Recovery (23 hr)	Two observation wells used in pump test analysis.
13S	26E	16.114	---	---	200	3428	RA-1152?,RA-1123?	1,3	18600	2.3e-02	1e-01	2.581	---	72	---	93	1	110AVMB	Hantush (1957)	Drawdown (72 hr @ 800 gpm)	Two observation wells used in pump test analysis.
13S	26E	22.313	227-230,?-226	3	225	3410	RA-1559S	1	5300	---	1e-01	11.462	---	2	S	1767	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different well completion values given for the same well.
13S	26E	27.313	---	112	225	---	---	---	2300	---	1e-01	26.413	---	2	S	21	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
13S	26E	28.221	?-184;?-123	112	225	3426,3420	RA-1368S?,RA-2988?	1,3	4600	---	1e-01	13.207	---	2	S	41	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
13S	26E	28.311	174-198,?	24	250	3439,3437	RA-1201?,RA-1201S?	1,3	3600	---	1e-01	20.833	---	2	S	150	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
13S	26E	3.343	11-21	10	50	---	---	4	600	---	1e-01	5.000	---	1.93	---	60	1	110AVMB	Mower et al. (1964)	Aquifer Test (116 min @ 4 gpm)	Recovery data used
14S	25E	13.311	?-250;45-238, 170-170	---	50	3507,3508	RA-1132S?,RA-1132?	1	12200	---	1e-01	0.246	---	2	L	244	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
14S	26E	10.133	153-190	---	175	3423	RA-1243C	1	181400	---	1e-01	0.203	---	2	L	1037	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	14.113	84-127,?-200, 60-200	43	150	3412	RA-1323?,RA-1323S?	1	3100	---	1e-01	8.710	---	2	S	72	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
14S	26E	17.233	?-200	---	25	3471	RA-1154	1	15200	---	1e-01	0.049	---	2	L	608	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	17.444	?-184;?-148	---	25	3472,3470	RA-1341?,RA-1341A?	1	286900	---	1e-01	0.003	---	2	L	11476	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
14S	26E	18.211	---	---	50	---	---	---	18500	---	1e-01	0.162	---	2	L	370	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	18.324	---	---	25	---	---	---	6400	---	1e-01	0.117	---	2	L	256	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	20	---	---	25	---	---	---	26800	---	1e-01	0.028	---	2	L	1072	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	23.23	---	75	150	---	---	---	5400	---	1e-01	5.000	---	2	S	72	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	25.331	8-28	20	100	---	---	4	800	---	1e-01	15.000	---	2	---	40	1	110AVMB	Mower et al. (1964)	Aquifer Test (120 min @ 2.6 gpm)	Recovery data used
14S	26E	26.423	16-42	26	125	---	---	4	2700	---	1e-01	6.944	---	0.23	---	104	1	110AVMB	Mower et al. (1964)	Aquifer Test (14 min @ 3.3 gpm)	Recovery data used
14S	26E	26.424	11-41	30	125	---	---	4	2900	---	1e-01	6.466	---	1.92	---	97	1	110AVMB	Mower et al. (1964)	Aquifer Test (115 min @ 4 gpm)	Recovery data used
14S	26E	3.433	89-95	---	150	3420,3417	RA-1333D	1,3	23100	---	1e-01	1.169	---	2	L	154	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	6.142	80-102,?-228, 90-130	88	175	3463,3467, 3464	RA-1269	1	9400	---	1e-01	3.910	---	2	S	107	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Three different well completion values given for the same well.
14S	26E	6.211	203-215,?-95	---	200	3465	RA-1223	1,3	39100	---	1e-01	1.228	---	2	L	196	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different well completion values given for the same well.
14S	26E	8.342	?-235	50	100	3470	RA-1213	1	1900	---	1e-01	6.316	---	2	S	38	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
14S	26E	8.433	?-231;137-204	---	100	3471,3472	RA-1282?,RA-1283?	1,3	6600	---	1e-01	1.818	---	2	L	66	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different wells completed at this location.
14S	26E	9.221	180-210	30	200	3426	RA-1316A	1	6200	---	1e-01	7.742	---	2	S	207	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	

Construction Details and Aquifer Parameters from Aquifer Tests in the Roswell Ground-Water Basin

Township	Range	Section	Screen Interval[1]	Screen Length[2]	Aquifer Thickness[3]	Elev_LSD (ft)	SEO File Number[4]	Data Source[5]	T (ft^2/day)	Storage	Storage Coef.[6]	Jactest[7] (hr)	Leakance (1/day)	Time[8] (hr)	Test Length[9]	K[10] (ft/day)	Quality[11]	Aquifer Code[12]	Aquifer Data Source	Test Type	Comments
15S	26E	10.112	---	---	100	---	---	1	21800	---	1e-01	0.550	---	2	L	218	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	RA-1503-AS & 1503-S are completed at this location, but are constructed in alluvium and Artesia Group
15S	26E	20	---	---	50	---	---	---	8300	---	1e-01	0.361	---	2	L	166	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
15S	26E	27.211	12-28	16	50	---	---	4	1400	---	1e-01	2.143	---	1.93	---	88	1	110AVMB	Mower et al. (1964)	Aquifer Test (116 min @ 3.8 gpm)	Recovery data used
15S	26E	29.321	?-143	---	50	3340	RA-3446	1	184000	---	1e-01	0.016	---	2	L	3680	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
15S	26E	29.344	?-213	---	50	3338	RA-3450	1	9800	---	1e-01	0.306	---	2	L	196	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
15S	26E	32.344	?-94	---	100	3330	---	3	11000	---	1e-01	1.091	---	2	L	110	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
16S	25E	25.211	?-205,?-165	38	75	3448,3440	RA-1588	1,3	2500	---	1e-01	2.700	---	2	S	66	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different well completion values given for the same well.
16S	25E	6.223	?-80	---	25	3530	RA-1427	1	15400	---	1e-01	0.049	---	2	L	616	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	19.411	191-206	50	100	3410	RA-1434	1,3	5000	---	1e-01	2.400	---	2	S	100	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	29.331	?-203	75	150	3403	RA-1411B	1	4800	---	1e-01	5.625	---	2	S	64	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	32.213	?-170	75	150	3390	RA-1258	1,3	3500	---	1e-01	7.714	---	2	S	47	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
16S	26E	32.311	?-238	75	150	3395	RA-1484	1	3000	---	1e-01	9.000	---	2	S	40	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	17.333	---	88	175	---	---	---	11700	---	1e-01	3.141	---	2	S	133	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	21	---	100	200	---	---	---	5400	---	1e-01	8.889	---	2	S	54	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	35.133	?-158	75	150	3302	RA-1900	1	6900	---	1e-01	3.913	---	2	S	92	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
17S	26E	8	---	88	175	---	---	---	10500	---	1e-01	3.500	---	2	S	119	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	
18S	26E	17.322	250-254,80-230	75	150	3394,3400	RA-3181	1	6700	---	1e-01	4.030	---	2	S	89	3	110AVMB	Saleem & Jacob (1971)	Step Drawdown	Two different well completion values given for the same well.
18S	26E	18.221	257-258	---	100	3404	RA-3181S5	1	20700	---	1e-01	0.580	---	2	L	207	2	110AVMB	Saleem & Jacob (1971)	Step Drawdown	

NOTES: (Refer to Appendix M for further explanations)

[1] Screen interval of well, in feet below land surface. Intervals separated by a semicolon indicate that more than one well was identified for the location from the data sources. The screen intervals are listed in order corresponding to the order listed in File Number. Intervals separated by a comma indicate that the well was screened in more than one section.

[2] The estimated screen length used to calculate K for pump tests that were too short to ignore the effects of partial penetration.

[3] The thickness of the aquifer at the location of the well as depicted by Welder (1983).

[4] Well number as designated by the SEO. Well numbers separated by a comma indicate that more than one well was identified at the designated location. The '?' alerts database user that well has not been identified.

[5] Denotes the source of the well completion data. Well completion data sources separated by a comma indicate that the data was acquired from more than one data source. The data source numbers correspond to the following sources:

1 - Summers. W.K. 1968. Records of wells in the Roswell Basin. Data from Dr. W. Gross, New Mexico Institute of Mining and Technology.

2 - Hantush. M.S. 1957. Preliminary quantitative study of the Roswell ground-water reservoir, New Mexico. New Mexico Institute of Mining and Technology, Research and Development Division, Socorro, New Mexico, 118p.

3 - Saleem Books I & II. Data from Dr. W. Gross. New Mexico Institute of Mining and Technology.

4 - Mower, R.W., J.W. Hood, R.L. Cushman, R.L. Borton, and S.E. Galloway. 1964. An appraisal of potential ground-water salvage along the Pecos River between Acme and Artesia New Mexico. U.S. Geological Survey Water-Supply Paper 1659, 98p., 10 plates.

5 - Hantush, M.S. 1961. Aquifer tests on saline water wells near Roswell. New Mexico Institute of Mining and Technology, Open-File Report, 21p.

6 - USGS. City of Roswell pump test data, 1970.

[6] The storage coefficient used to estimate quality of aquifer tests.

[7] Test to determine if aquifer test was long enough to ignore the effects of partial penetration (**Jactest**). If t > bS/2(T/b), then partial penetration can be ignored.

[8] Length of aquifer test (t) in hours.

[9] Test length evaluation. If t is greater than **Jactest**, then test length = L, if t is less than **Jactest**, then test length = S.

[10] Hydraulic conductivity of the aquifer obtained by dividing T by the aquifer thickness where **Tl** = L, or by screen length where test length = S.

[11] DBS&A evaluation of the overall reliability of the aquifer test.

1 - Excellent (where observation wells were utilized)
2 - Fair (where **Ttime** was greater than **Jactest**)
3 - Uncertain (where **Ttime** was less than **Jactest**)

[12] Identifies the primary aquifer unit from which the water is obtained based on construction details identified for each well and comparison to figures presented by Welder (1983). Only those wells with construction details could be verified. The primary aquifers identified in the vicinity of the Roswell Basin are as follows:

110AVMB - Alluvial fill
310YESO - Yeso Formation
312RSLR - Rustler Formation
313ARTS - Artesia Group
313SADR - San Andres Formation
313GRBG - Grayburg Formation
310GLRT - Glorieta Sandstone

Appendix F, Part 2

Statistical Analysis of Aquifer Test Data

APPENDIX F, PART 2

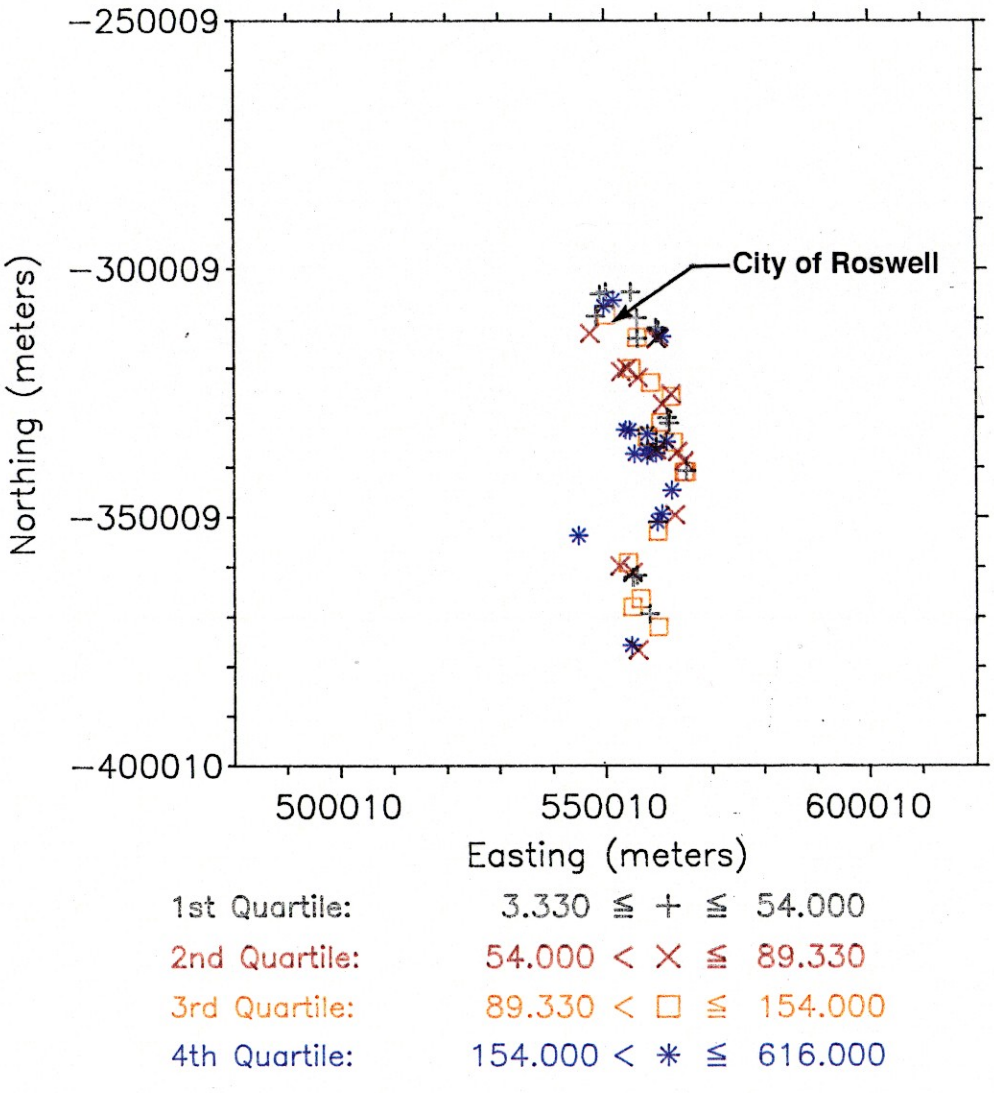
STATISTICAL ANALYSIS OF AQUIFER TEST DATA

A standard statistical analysis was performed on the T and K estimates from aquifer tests described in Section 4.6.2 in order to better understand the variability and spatial distribution of these parameters. Where more than one value was available for a well, either the results were averaged or the better-quality test results were used. From the outcome of the statistical analysis, DBS&A determined that the T and K data were lognormally distributed.

Shallow Aquifer. DBS&A conducted a statistical analysis of the K of the shallow aquifer in three data groups: (1) using all available data, (2) using data from excellent- and fair-quality tests, and (3) using data from uncertain-quality tests. A total of 70 tests were available; of those, 4 were eliminated because more than one result was available for the well location. In the evaluation of the first group of data, 5 tests that were about an order of magnitude higher than all other data were eliminated from the probability distribution analysis because the values were uncharacteristic of the aquifer material. The following is a discussion of the statistical analysis performed on the three groups of data.

Post plots: A post plot is used to facilitate, through a visual analysis, any spatial trends in the K field. Figure F-1 is a post plot of all the available K data. As shown on this figure, which illustrates the spatial distribution and the range of K, both high and low values are present throughout the shallow aquifer. The post plot of the excellent- and fair-quality tests (Figure F-2) indicates a generally higher K in the central portion of the shallow aquifer, although the full range of K's are also present in this area. The post plot of the uncertain-quality tests (Figure F-3) also shows a distribution of high and low K's throughout the aquifer.

Probability plots and histograms: The probability distribution of K is important in evaluating the mean properties and spatial variability of an aquifer. DBS&A plotted the remaining K values on probability paper for the three groups of data and determined from these plots, as did Rao (1991), that K appears lognormally distributed (Appendix F, Part 3). The histograms for the data sets also show this distribution (Appendix F, Part 4).

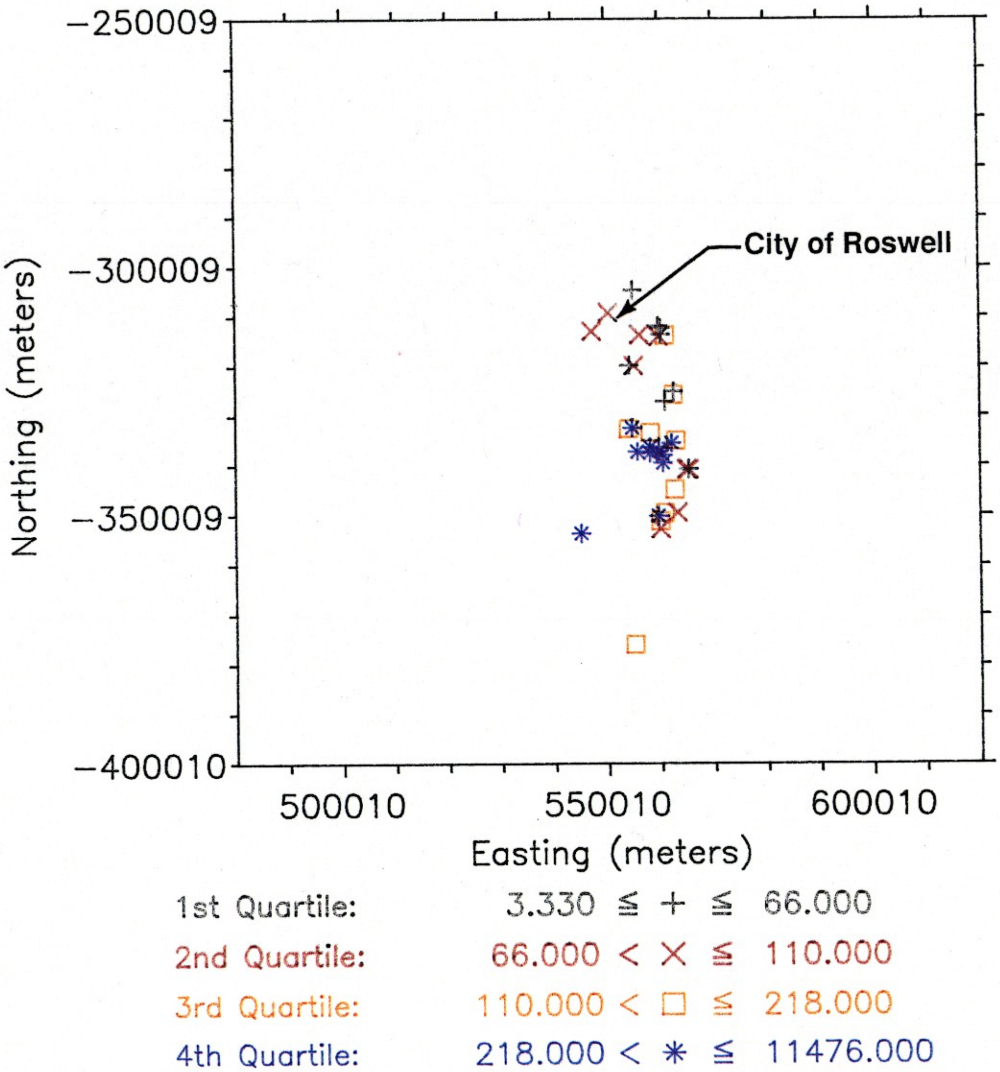


Excellent, fair and uncertain test data

Post Plot of Hydraulic Conductivity (ft/d) for the Shallow Aquifer

DANIEL B. STEPHENS & ASSOCIATES, INC.
11-92 JN 2200

Figure F-1



Excellent and fair test data

Post Plot of Hydraulic Conductivity (ft/d) for the Shallow Aquifer

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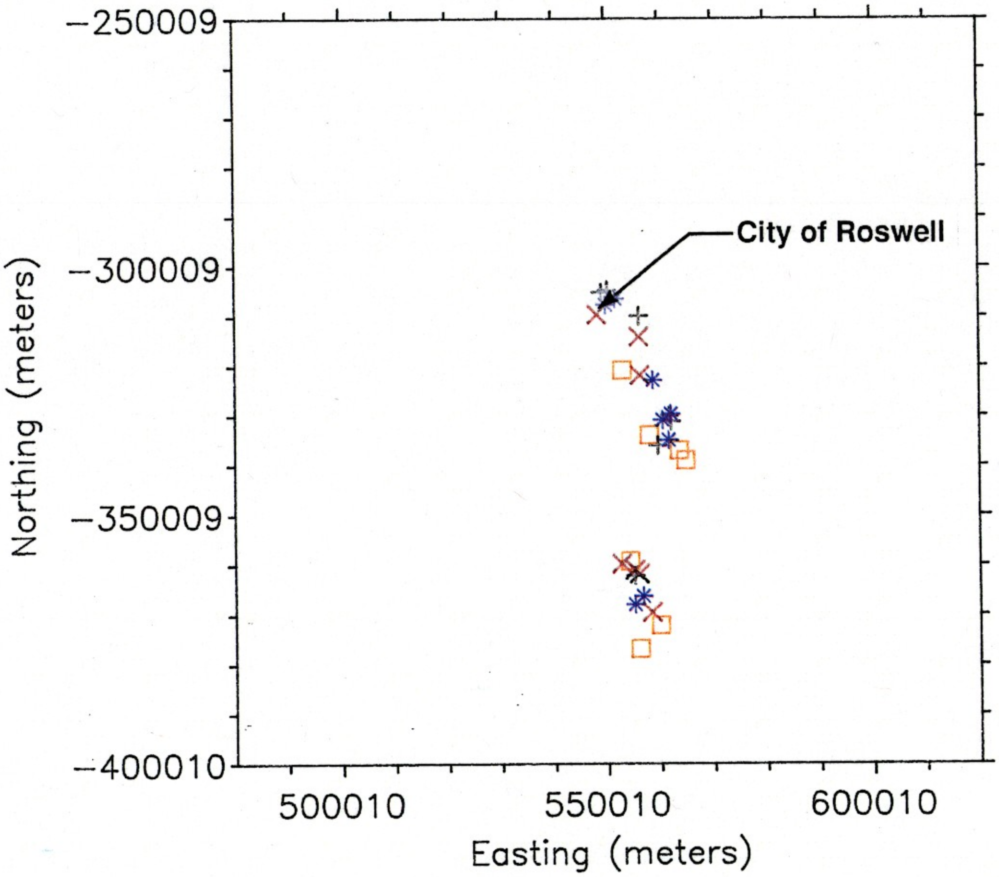
Figure F-2



1st Quartile: 17.000 ≦ + ≦ 41.070
2nd Quartile: 41.070 < × ≦ 65.790
3rd Quartile: 65.790 < □ ≦ 106.820
4th Quartile: 106.820 < ✳ ≦ 1766.670

Uncertain test data

Post Plot of Hydraulic Conductivity (ft/d) for the Shallow Aquifer

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Figure F-3

The mean and median values of K were calculated directly from the regular data sets, not the log values of the data sets. The mean and median values of the lognormal distribution were calculated as follows:

$$median = e^{\mu_{ln}}$$

$$mean = e^{\mu_{ln} + \frac{1}{2}\sigma^2_{ln}}$$

where: $\mu_{ln} = lognormal\ mean$

$\sigma^2_{ln} = lognormal\ variance$

The mean and median K values for all three groups of data are summarized in Table F-1. The mean and median K's determined for the lognormal distribution for all data are 130 ft/d and 90 ft/d. The mean and median K's determined for the lognormal distributions of the excellent- and fair-quality tests are 412 ft/d and 159 ft/d, respectively. The minimum is 3.3 ft/d, and the maximum is 11,500 ft/d. The mean and median K's determined for the lognormal distribution of the uncertain-quality tests are 112 ft/d and 76 ft/d, respectively, with a minimum of 17 ft/d and a maximum of 1,800 ft/d. The mean K derived from the uncertain-quality tests is predictably lower because the data set included low values of K that did not account for the influence of partial penetration. Furthermore, the K was obtained by assuming (in many of the wells) a screened interval that may have been too high, resulting in an underestimate of K.

Kolmogorov-Smirnov tests: The Kolmogorov-Smirnov nonparametric test (K-S test) was used to verify the lognormal distribution of the three K data groups. The K-S test compares the maximum deviation of a ranked set of observed values (in this case, the K data groups) to the maximum accepted deviation of the corresponding lognormal distribution with the same mean and variance as the observed values. For this series of K-S tests, a significance level of 0.05 was used. If the maximum observed deviation is less than the maximum accepted deviation, the lognormal distribution under consideration is verified (Davis, 1986).

Table F-1. Summary of the Mean and Median Values for Transmissivities and Hydraulic Conductivities

Aquifer Type	Test Data Group	Number of Samples	Transmissivity (ft^2/d)		Hydraulic Conductivity (ft/d)	
			Mean	Median	Mean	Median
Shallow	Excellent, fair, and uncertain quality	61			130	90
Shallow	Excellent and fair quality	37			412	159
Shallow	Uncertain quality	29			112	76
Carbonate	San Andres Formation	94	87,000	37,600		

Note: The mean and median values were calculated using the GEO-EAS 1.2.1 software (EPA, 1991).

A K-S test was run for all three groups of test data. The maximum observed deviation was less than the maximum accepted deviation for all three groups of test data (Appendix F, Part 5). Therefore, DBS&A concluded that the K values are lognormally distributed. The maximum observed deviations and maximum accepted deviations for the three groups of K data are summarized in Table F-2.

Scatter plots: Scatter plots were used to determine a relationship between the K values in each of the three data groups. Scatter plots of the three data groups (Appendix F, Part 6) in the northing and easting directions do not indicate a trend in either direction. The correlation coefficients range from 0.230 to −0.480 for all plots, indicating a lack of linear correlation. Correlation coefficients can range from +1 to −1 on scatter plots. A correlation of +1 indicates a perfect direct relationship between two variables; a correlation of −1 indicates that one variable changes inversely with relation to the other. Between the two extremes, a correlation coefficient near zero indicates the lack of any sort of linear correlation (Davis, 1986).

Variograms: Variograms were used to quantify the degree of spatial correlation among neighboring measurements of hydraulic conductivity. A total of 12 variograms were plotted for the three data groups (4 for each group) in varying directions, using a range of angle spans for the neighboring pairs. Results of these variograms indicate that the available data are randomly distributed (Appendix F, Part 7). This type of variogram produces what is known as the "nugget

Table F-2. Results of Kolmogorov-Smirnov Test for Lognormal Distribution

Aquifer Type	Test Data Groups	Number of Samples	Maximum Accepted Deviation[a]	Maximum Observed Deviation	Sample No. of Maximum Observed Deviation
Shallow	Excellent, fair, and uncertain quality	61	0.174	0.0564	58
Shallow	Excellent and fair quality	33	0.237	0.0983	30
Shallow	Uncertain quality	28	0.257	0.0430	28
Carbonate	San Andres Formation	94	0.140	0.0859	48

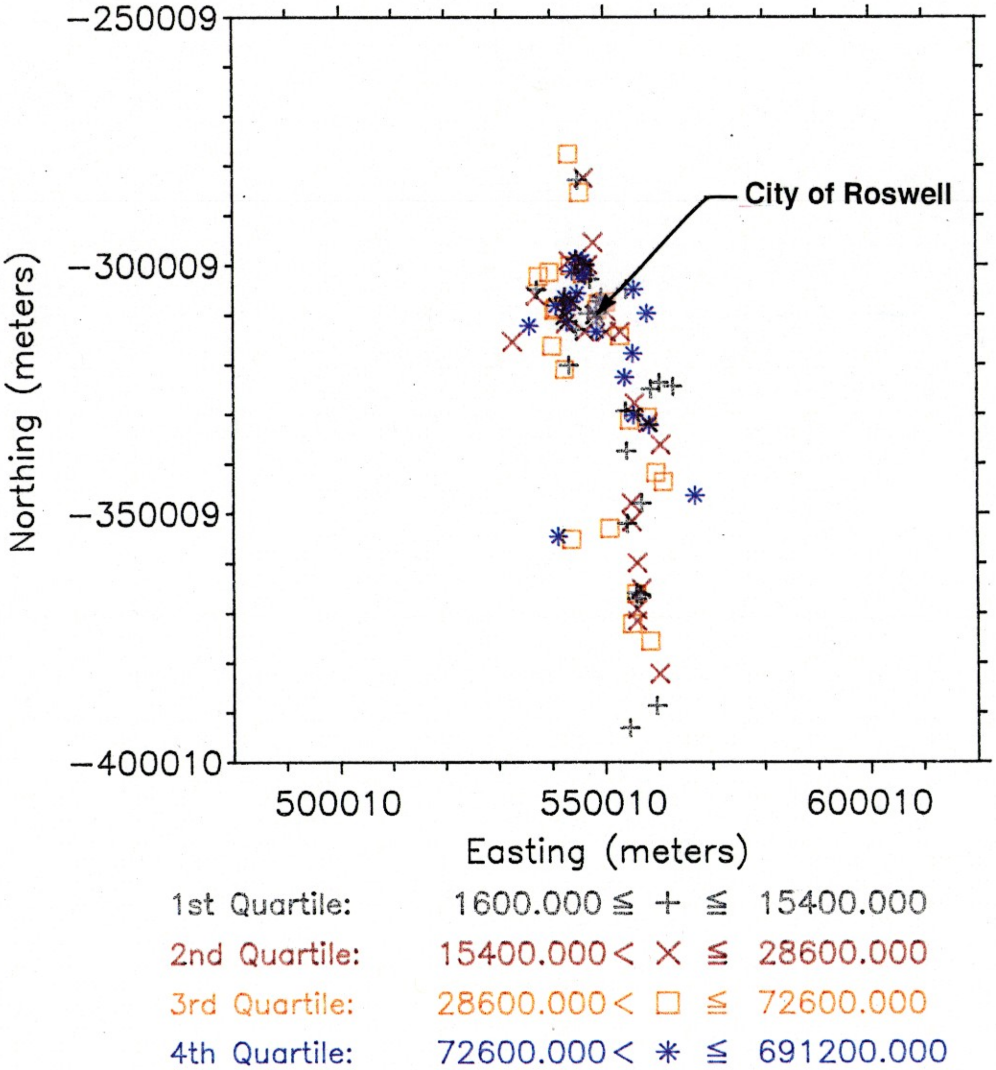
[a] Calculated for a significance level of 0.05. Maximum accepted deviation for a significance level of 0.05 equals $\frac{1.36}{\sqrt{n}}$ (Davis, 1986).

effect," which is interpreted as "total absence of spatial correlation" between the pairs at that present scale (Journel and Huijbregts, 1978). However, if there is spatial correlation within the aquifer, it is over a smaller distance between existing wells with aquifer tests.

Transmissivity vs. aquifer thickness: The aquifer thickness (b) was plotted against T as determined from aquifer tests in the shallow aquifer (Appendix F, Part 8). The correlation coefficients from the cross plots of b vs. lognormal (ln) T and b vs. T were −0.197 and -0.168, respectively, indicating lack of linear correlation between the two parameters. It appears that the aquifer tests may not represent the full thickness of the aquifer and/or the T distribution is dependent on the K distribution.

Carbonate Aquifer. The T distribution of 94 measurements in the carbonate aquifer was evaluated by DBS&A for tests conducted in the San Andres Formation. Since all values are from excellent- or fair-quality tests, the data are not grouped by quality. The following is a discussion of the statistical analysis of the data.

Post plots: The post plot (Figure F-4) indicates that, in general, all classes of T are represented almost equitably throughout the basin, and no obvious trend or grouping in T values is evident.



San Andres Formation Data

Post Plot of Transmissivity (ft^2/d) for the Carbonate Aquifer

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Figure 4-10

Probability plots and histograms: As concluded by Rao (1991), the probability plots and histograms (Appendix F, Part 9) show that the data appear lognormally distributed. The mean and median are 87,000 ft^2/d and 37,600 ft^2/d with a minimum of 1,600 ft^2/d and a maximum of 691,000 ft^2/d. The mean and median T values are summarized in Table F-1.

Kolmogorov-Smirnov tests: A K-S test was run for T test data. The maximum observed deviation was less than the maximum accepted deviation for both groups of test data (Appendix F, Part 10). Therefore, DBS&A concluded that the T values are lognormally distributed. The maximum observed deviations and maximum accepted deviations for the T aquifer test data are summarized in Table F-2.

Scatter plots: Scatter plots of the ln T (Appendix F, Part 11) in the east and north directions show no significant linear correlation, but a slightly higher correlation exists in the north direction. For both sets of data, the correlation coefficient is -0.1 in the east direction and 0.22 in the north direction.

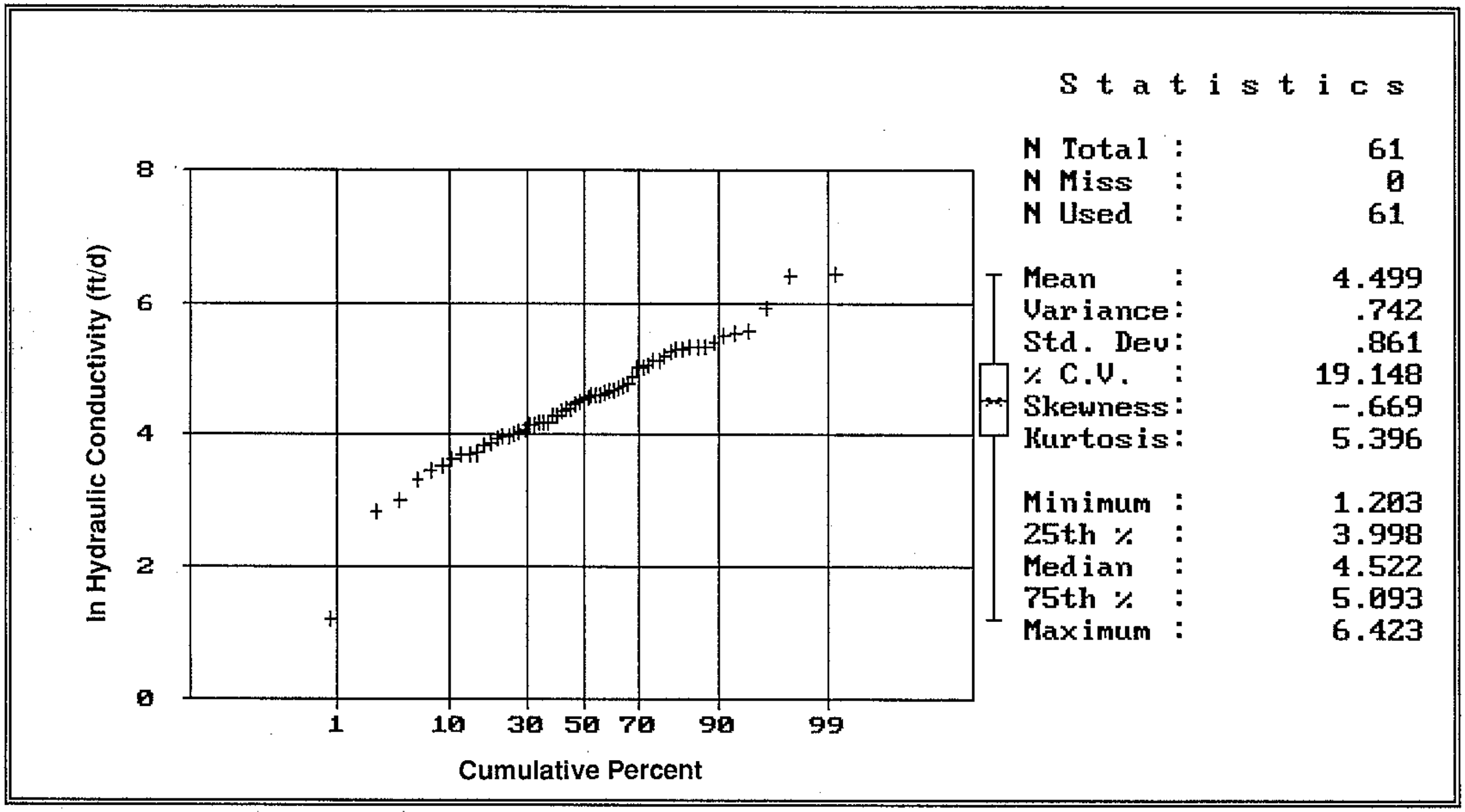
Variograms: Twelve variograms of ln T were plotted for varying directions and angle spans for the neighboring pairs of T values (Appendix F, Part 12). As suspected from examination of the data in the post plots, the data appear to be randomly distributed, showing very little spatial correlation.

Transmissivity vs. aquifer thickness: The aquifer thickness (b) was plotted against ln T and T to determine if a correlation exists between these two parameters (Appendix F, Part 13). The correlation coefficients are very low for both (−0.150 and −0.088, respectively), indicating lack of linear correlation between T and b in the carbonate aquifer. Again, it may be possible that the aquifer tests do not represent the full thickness of the aquifer and/or the T distribution is dependent on the K distribution.

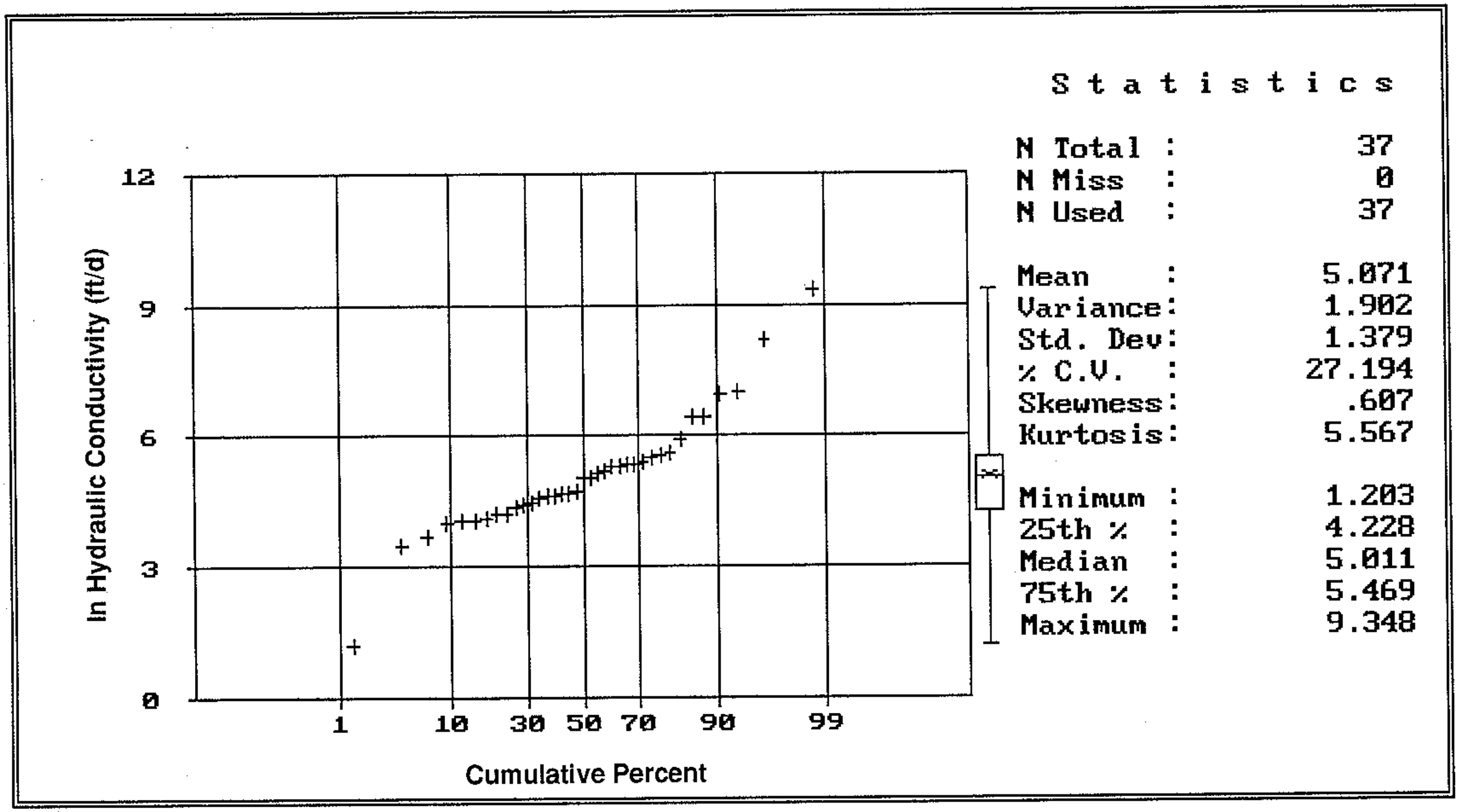
Regional log T: The log of T data was also plotted for the east-west and north-south directions for different regions of the basin to determine if a trend could be identified in various areas (Appendix F, Part 14). The randomness of the data is also evident in these plots, and only the north-south transect for T. 26 E. shows a slightly decreasing trend to the south.

Appendix F, Part 3

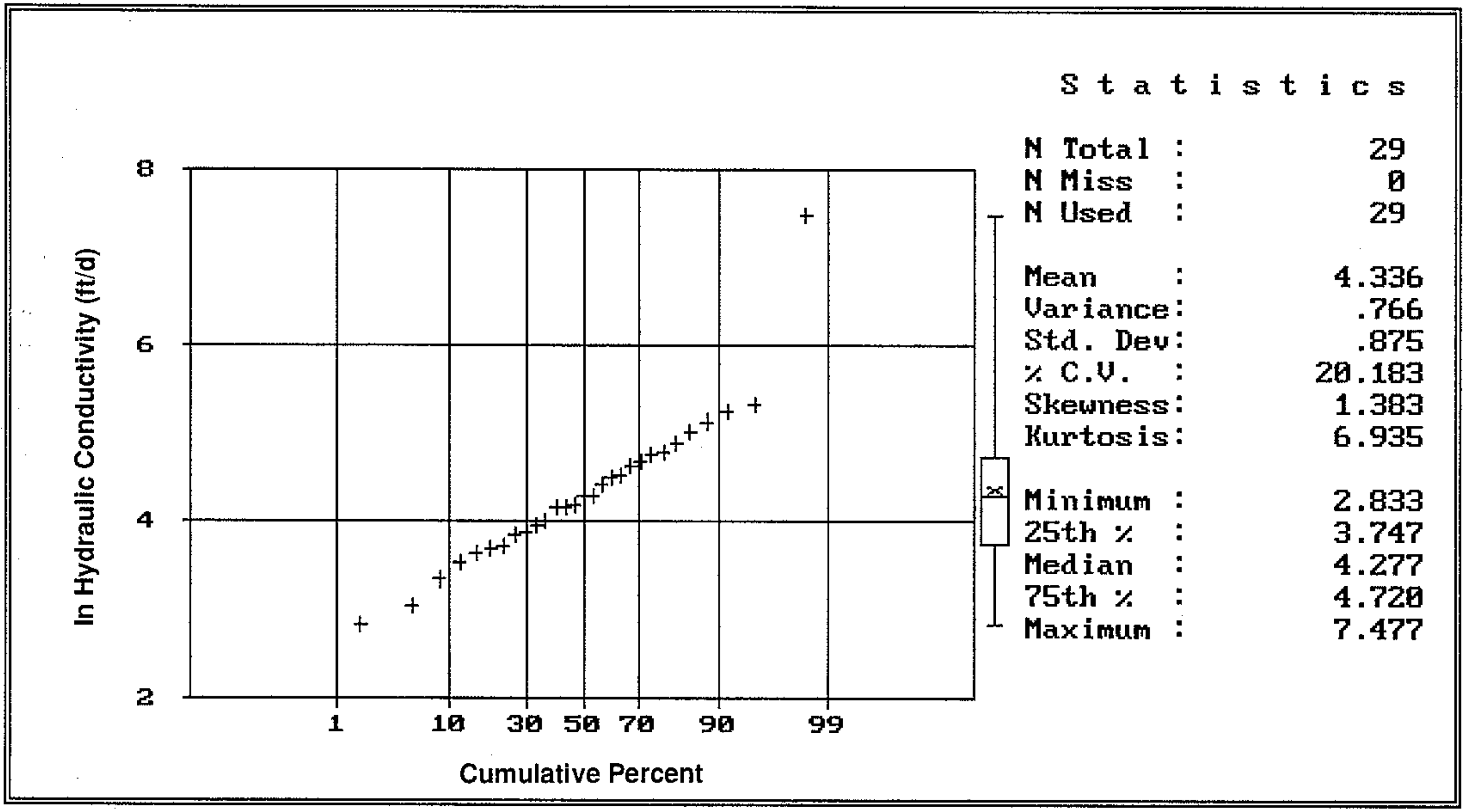
Probability Plots of In Hydraulic Conductivity for the Shallow Aquifer



Normal Probability Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



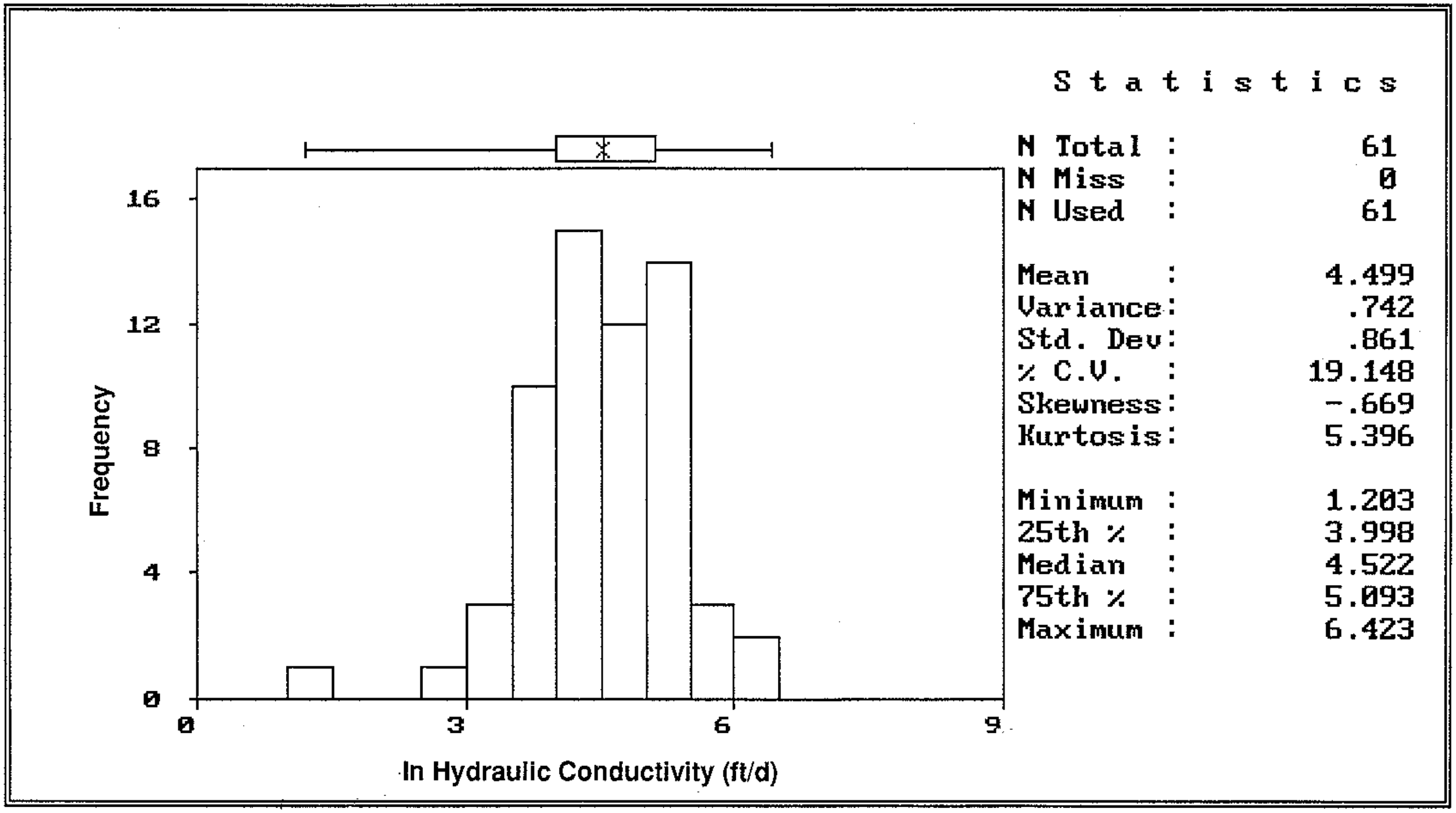
Normal Probability Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)



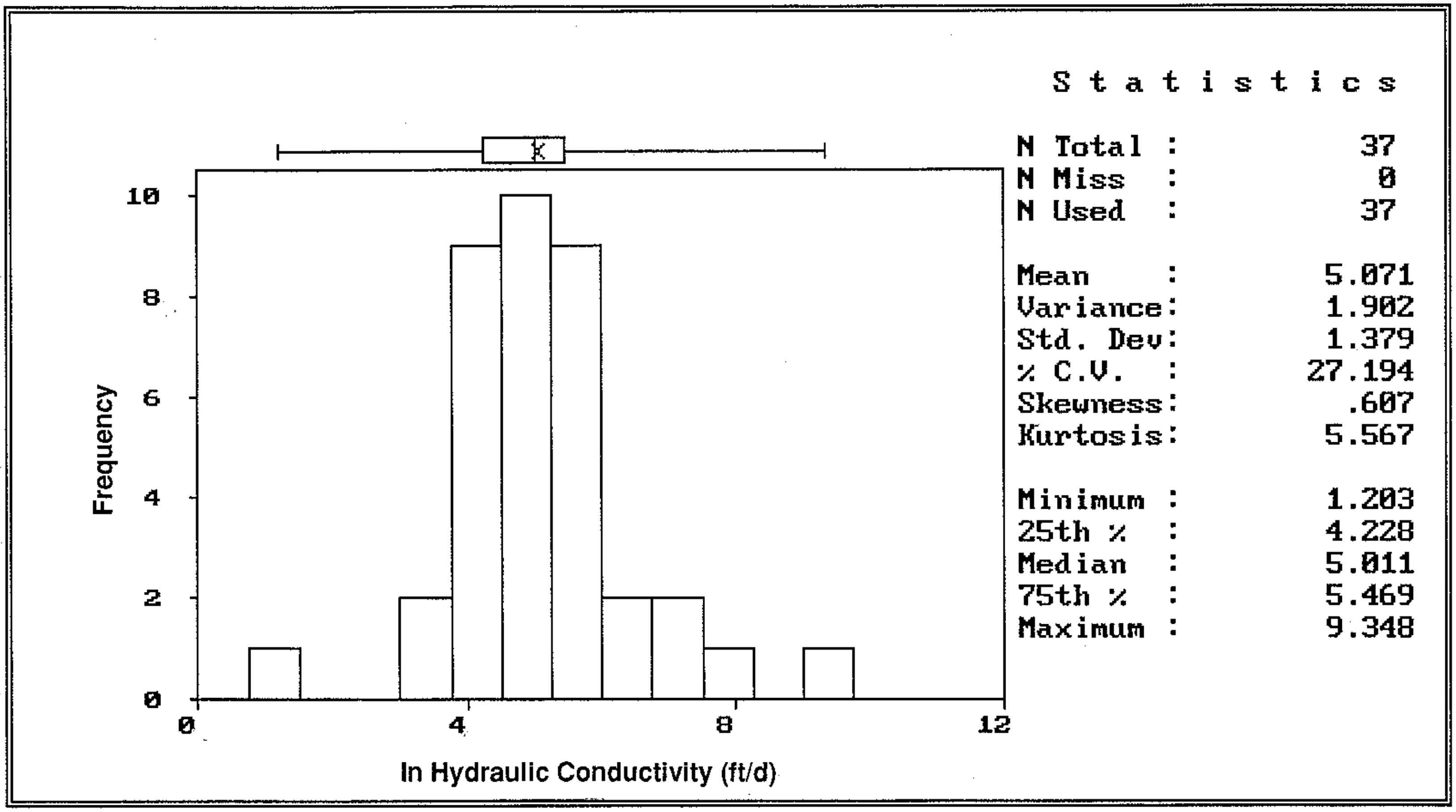
Normal Probability Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)

Appendix F, Part 4

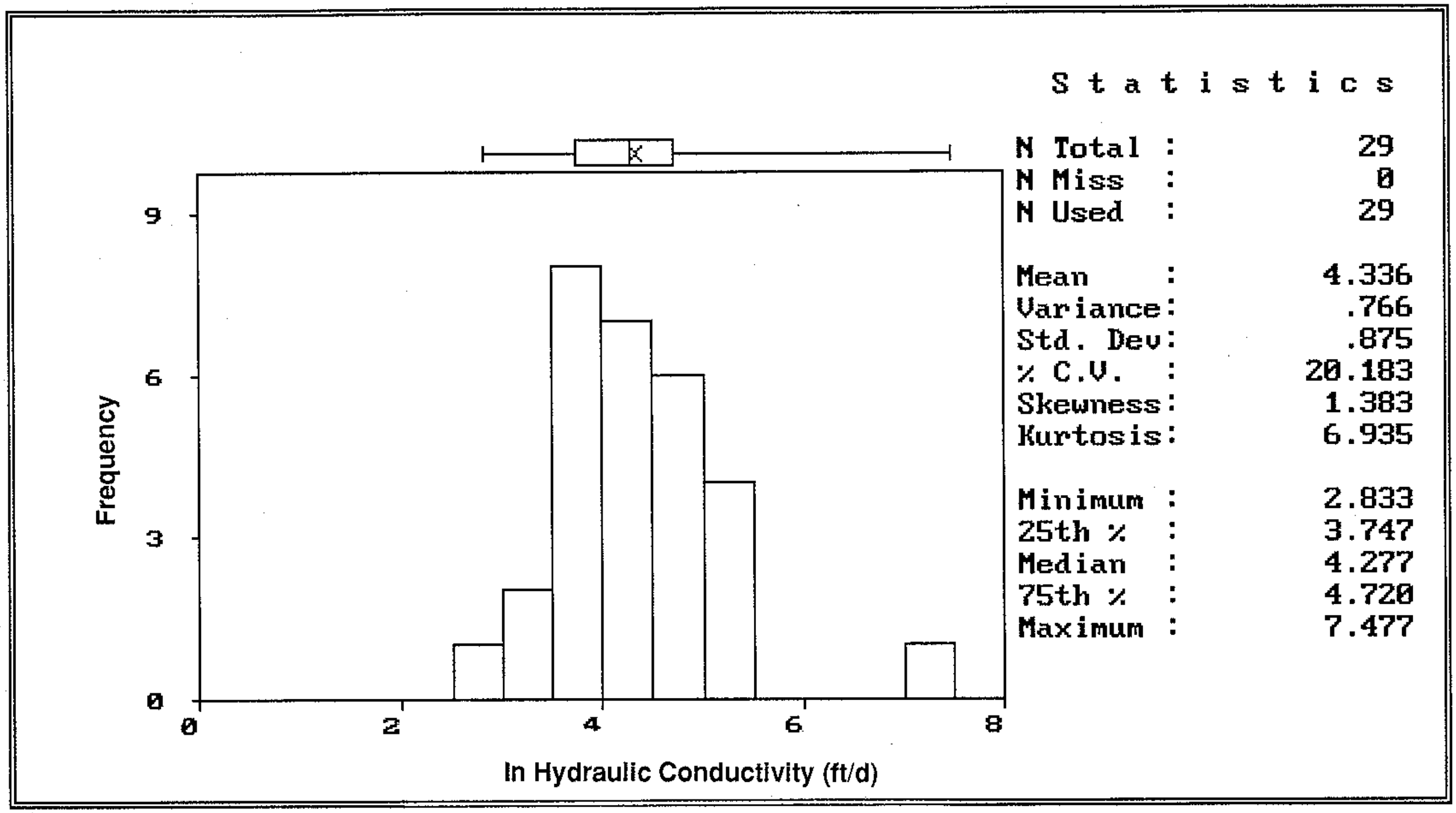
Histograms of ln Hydraulic Conductivity for the Shallow Aquifer



Histogram of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



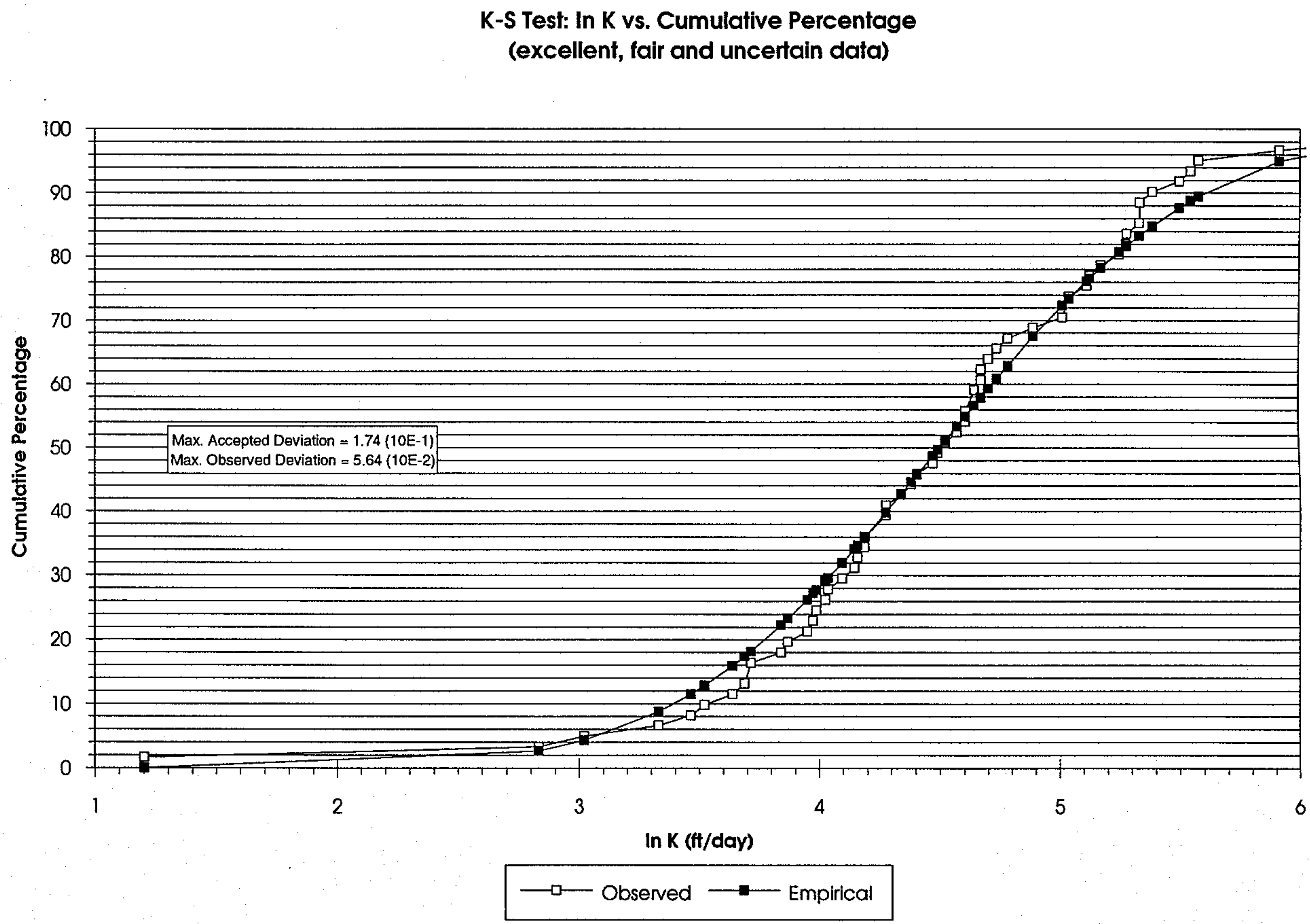
**Histogram of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)**



Histogram of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)

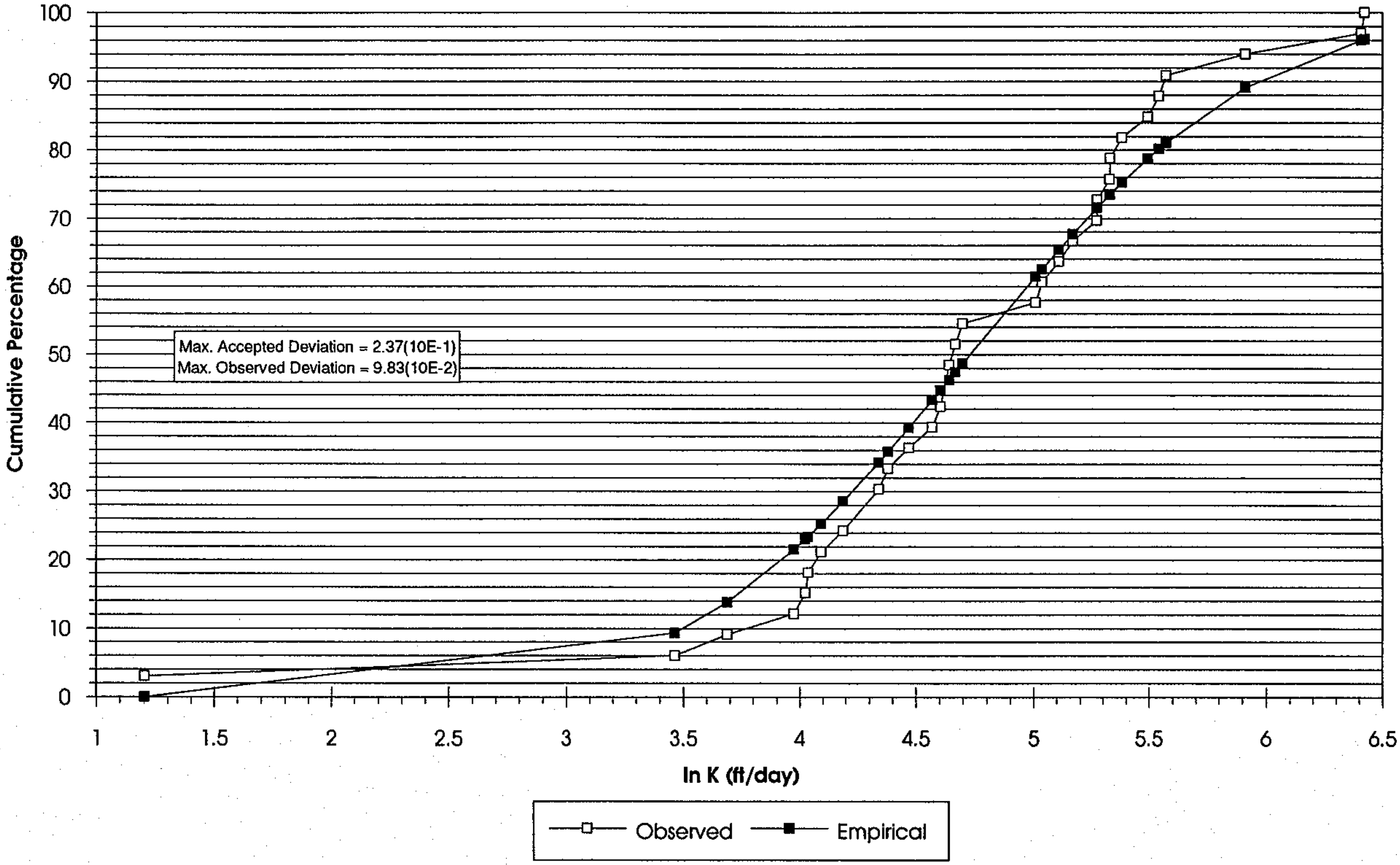
Appendix F, Part 5

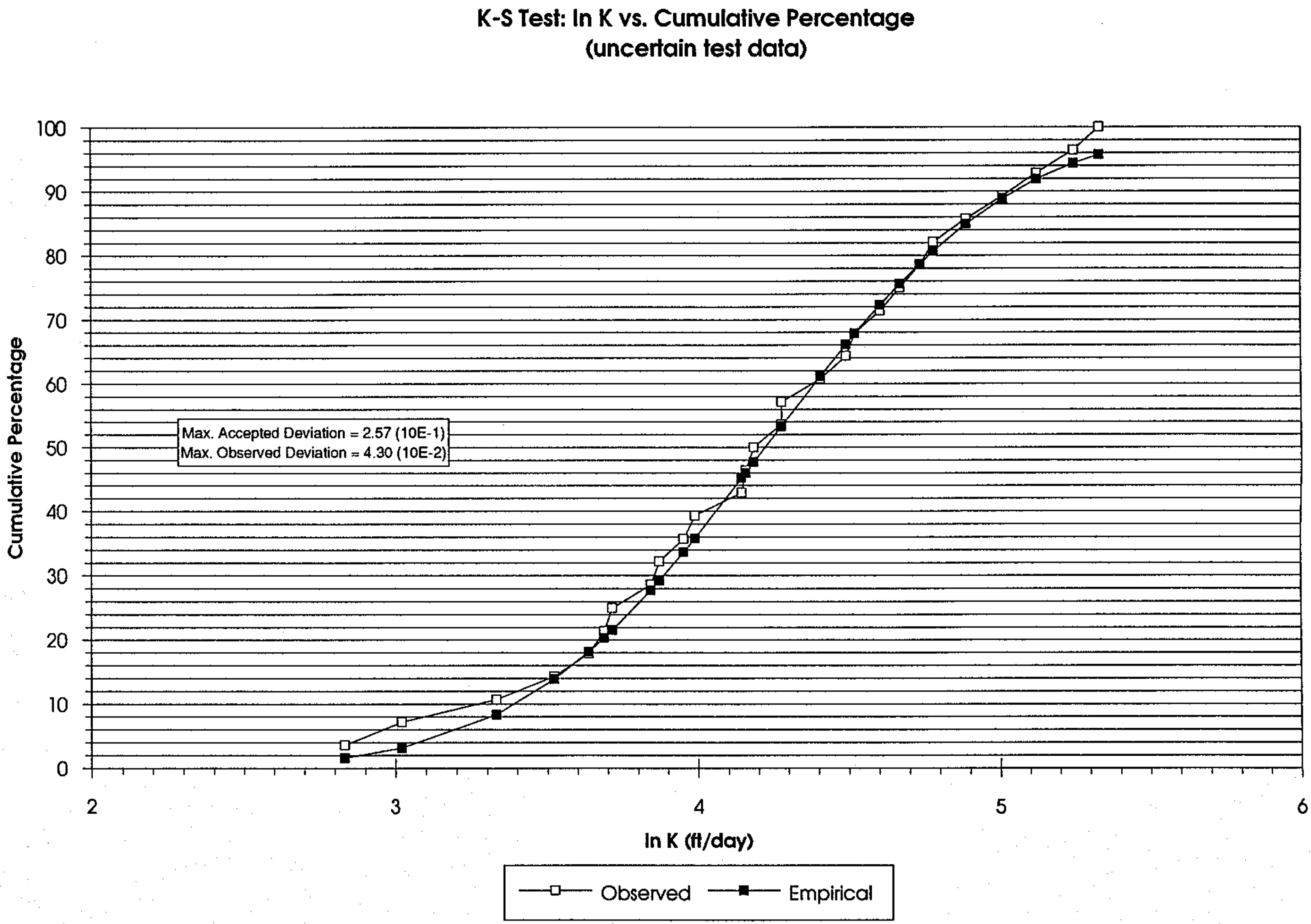
K-S Test Graphs of
In Hydraulic Conductivity
for the Shallow Aquifer



K-S Test: ln K vs. Cumulative Percentage
(excellent, fair and uncertain data)
Cumulative Percentage
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
ln K (ft/day)
Max. Accepted Deviation = 1.74 (10E-1)
Max. Observed Deviation = 5.64 (10E-2)
Observed
Empirical

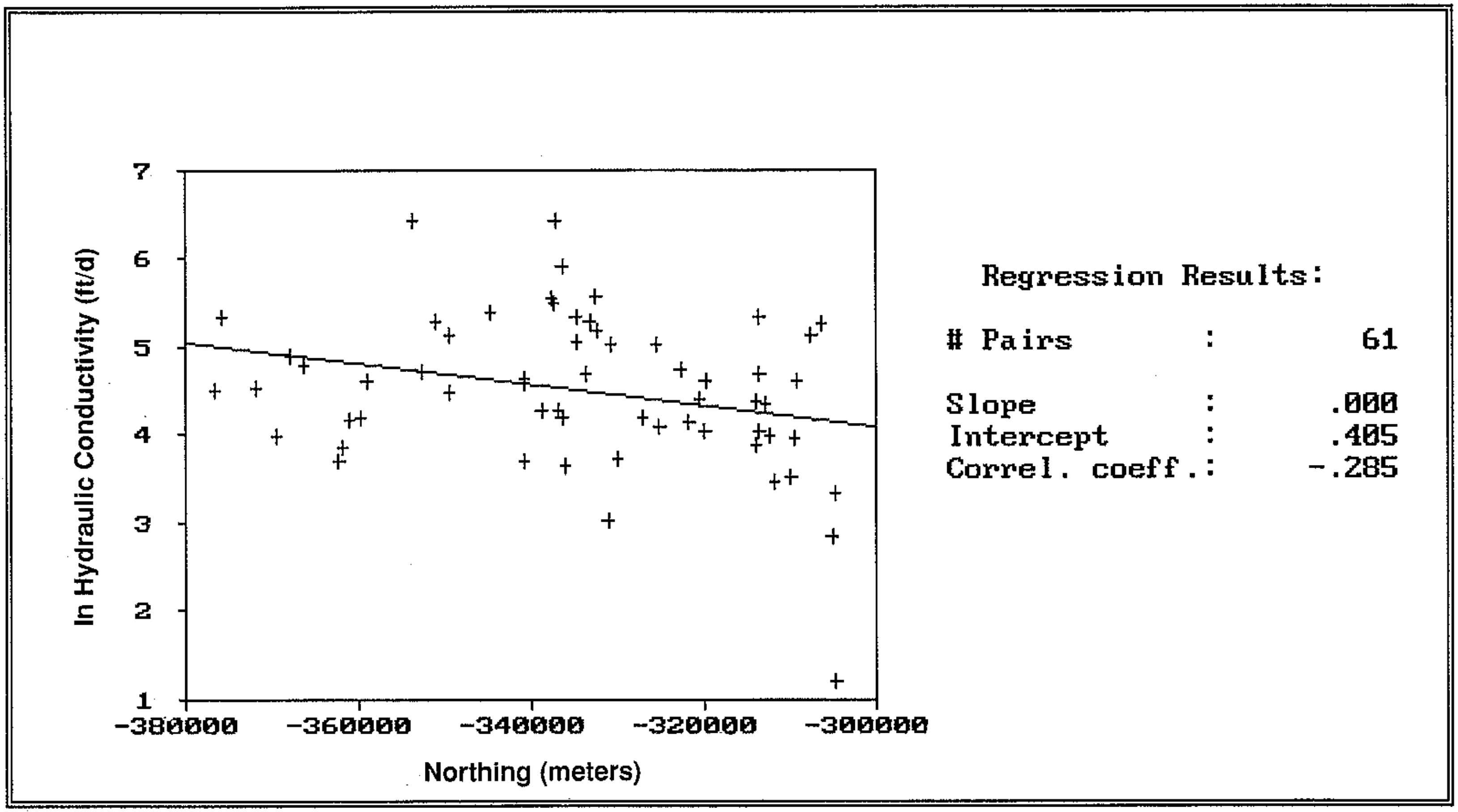
K-S Test: ln K vs. Cumulative Percentage
(excellent and fair test data)



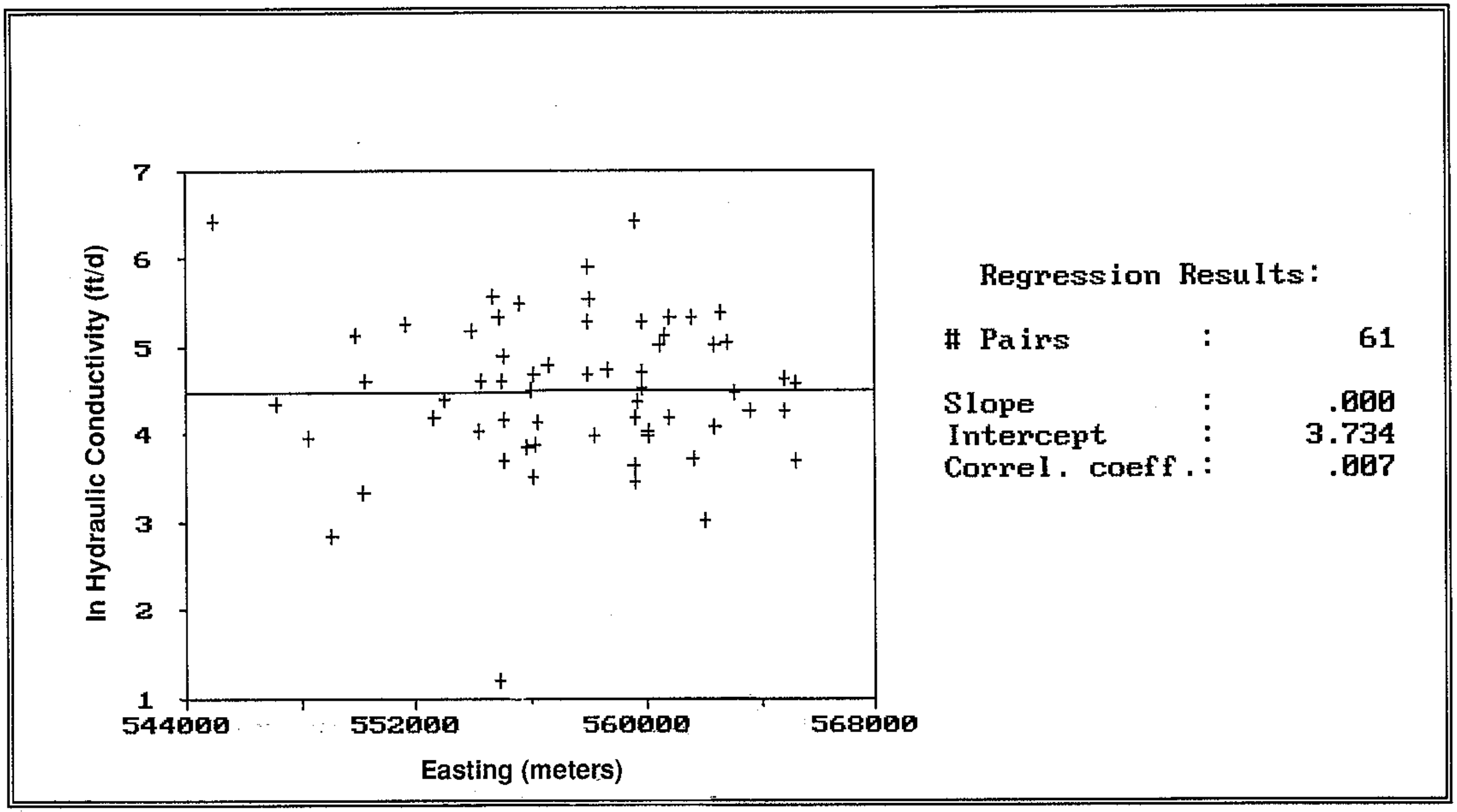

K-S Test: ln K vs. Cumulative Percentage
(uncertain test data)
Max. Accepted Deviation = 2.57 (10E-1)
Max. Observed Deviation = 4.30 (10E-2)
Cumulative Percentage
ln K (ft/day)
Observed
Empirical
0
10
20
30
40
50
60
70
80
90
100
2
3
4
5
6

Appendix F, Part 6

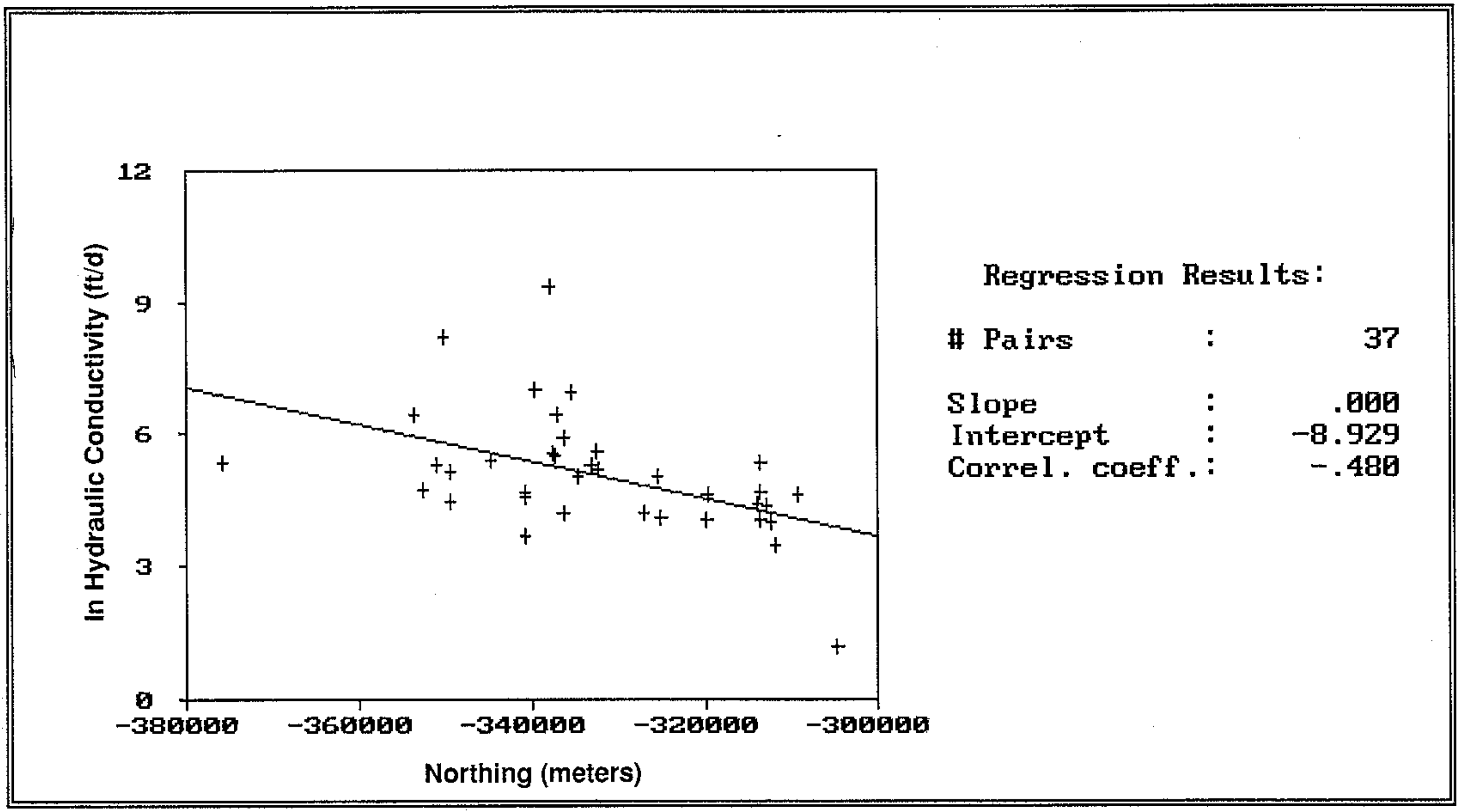
Scatter Plots of
In Hydraulic Conductivity
for the Shallow Aquifer



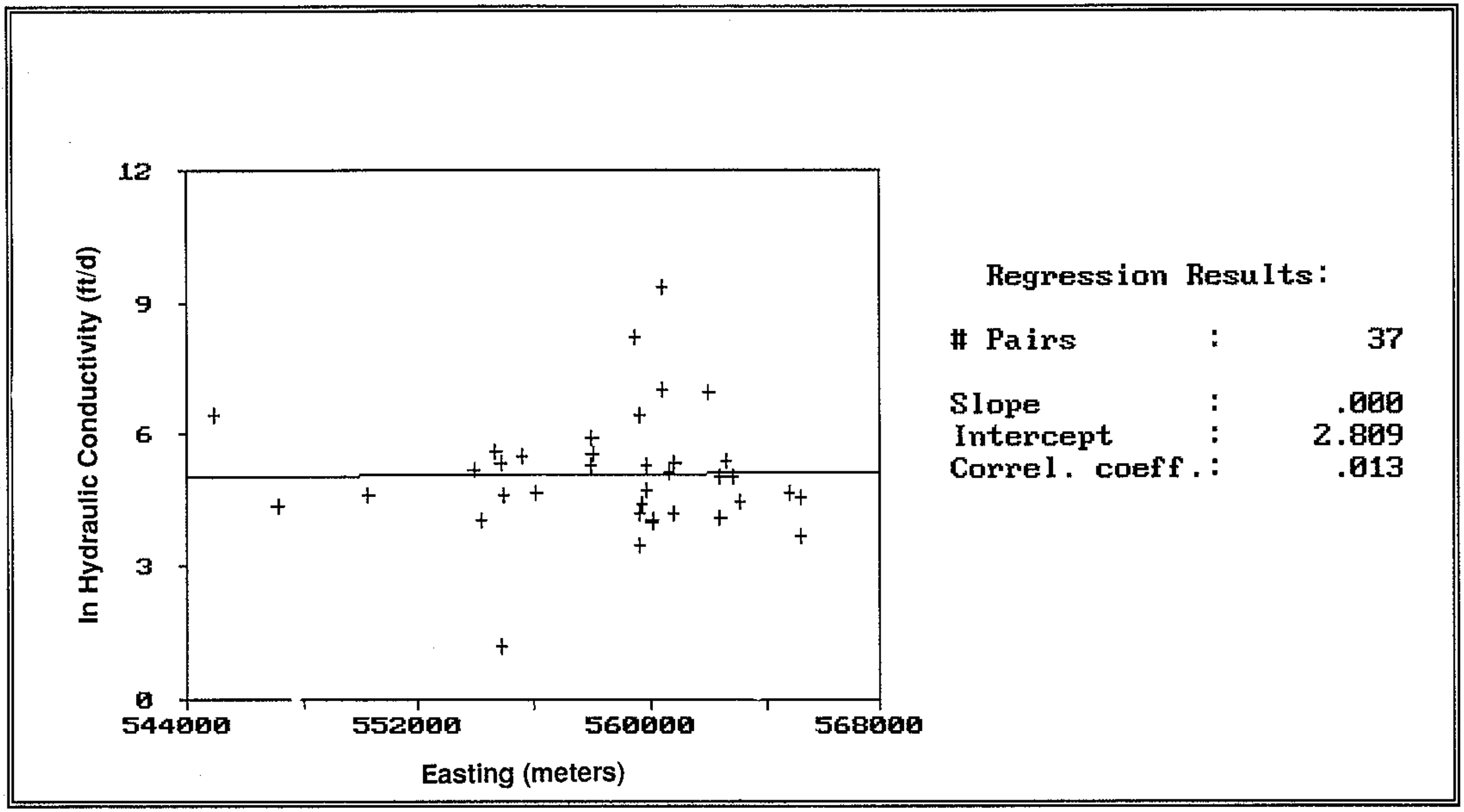
Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Northing Direction
(Excellent, Fair and Uncertain Test Data)



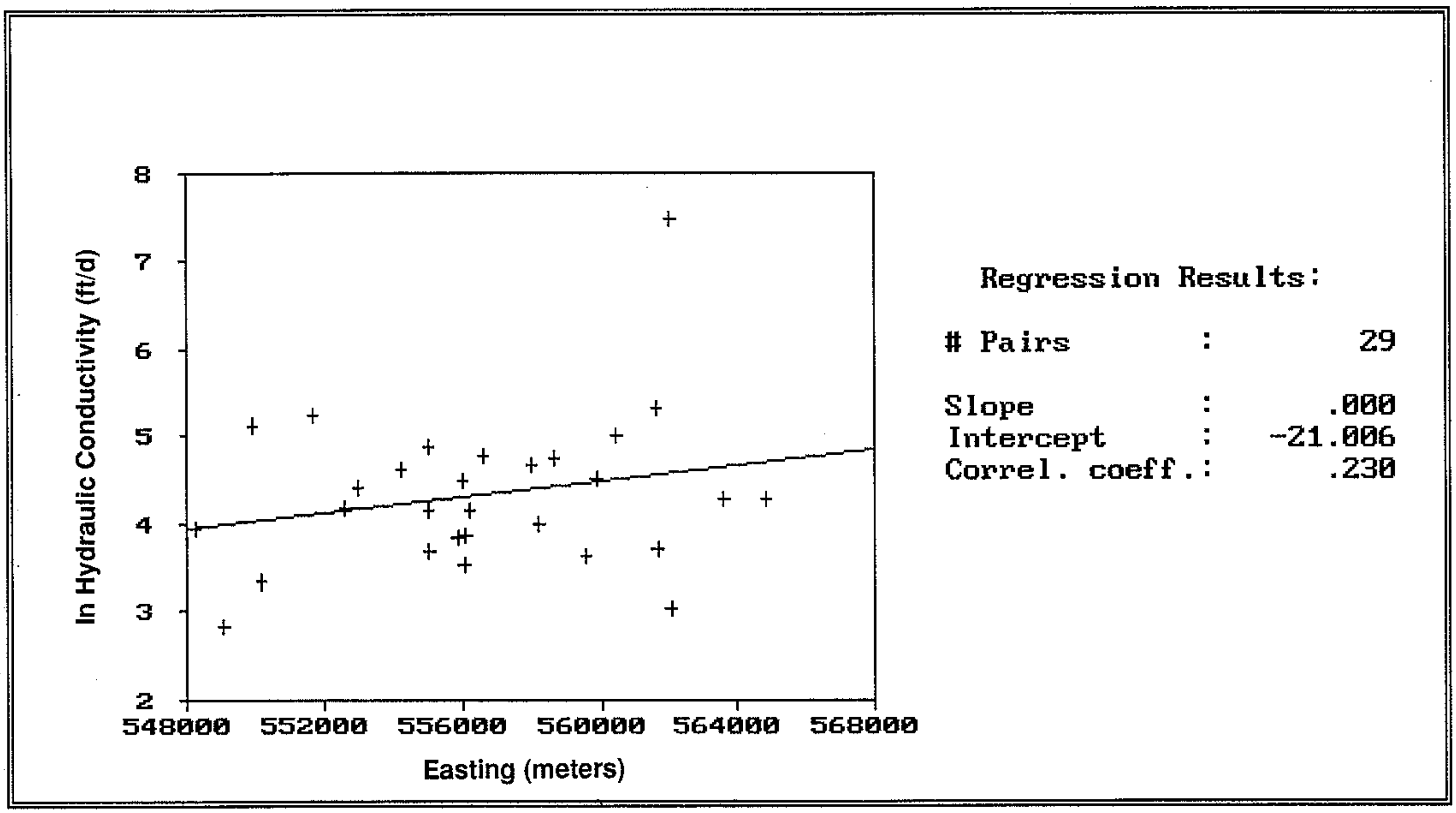
**Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Easting Direction
(Excellent, Fair and Uncertain Test Data)**



Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Northing Direction
(Excellent and Fair Test Data



Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Easting Direction
(Excellent and Fair Test Data)



Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Easting Direction
(Uncertain Test Data)

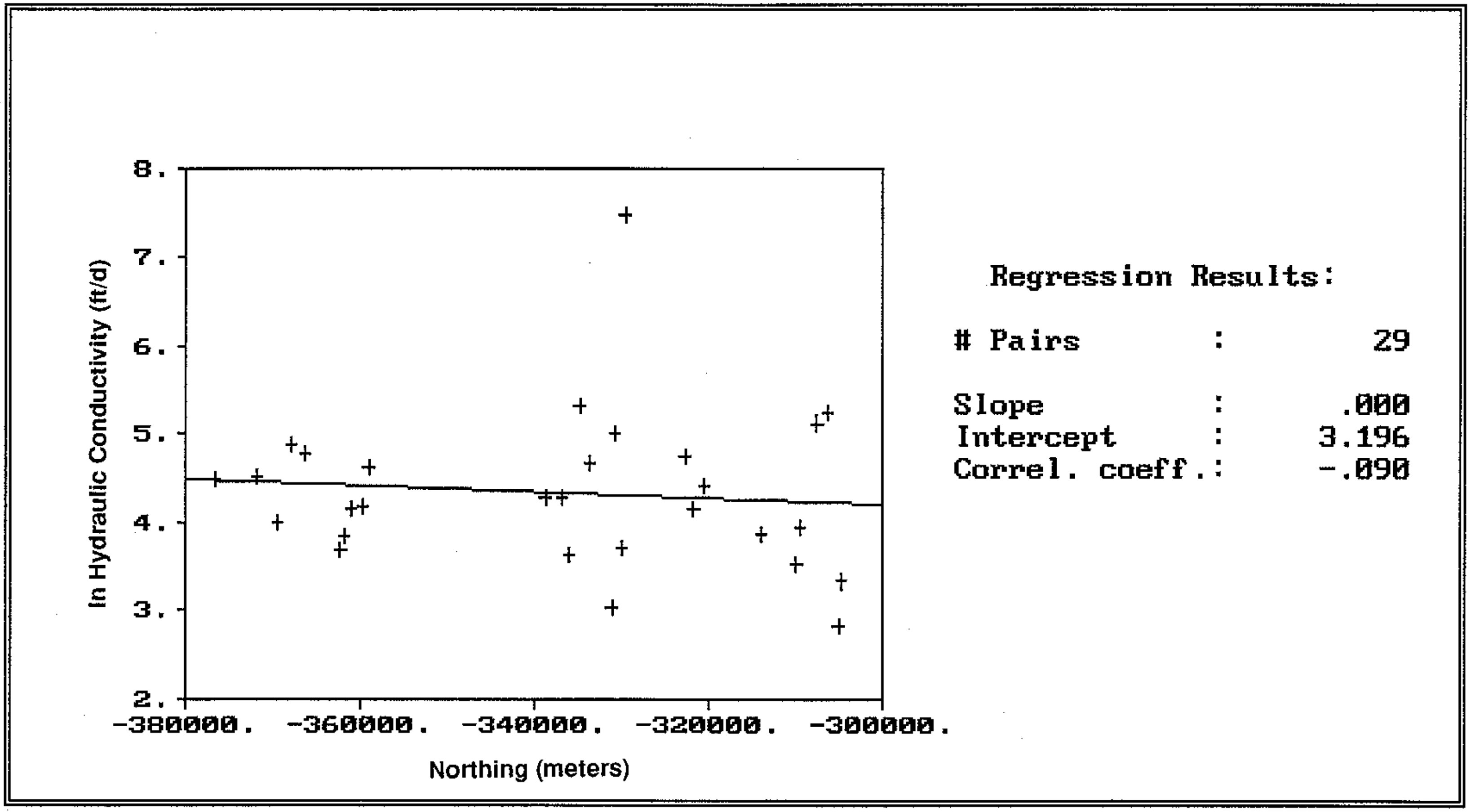
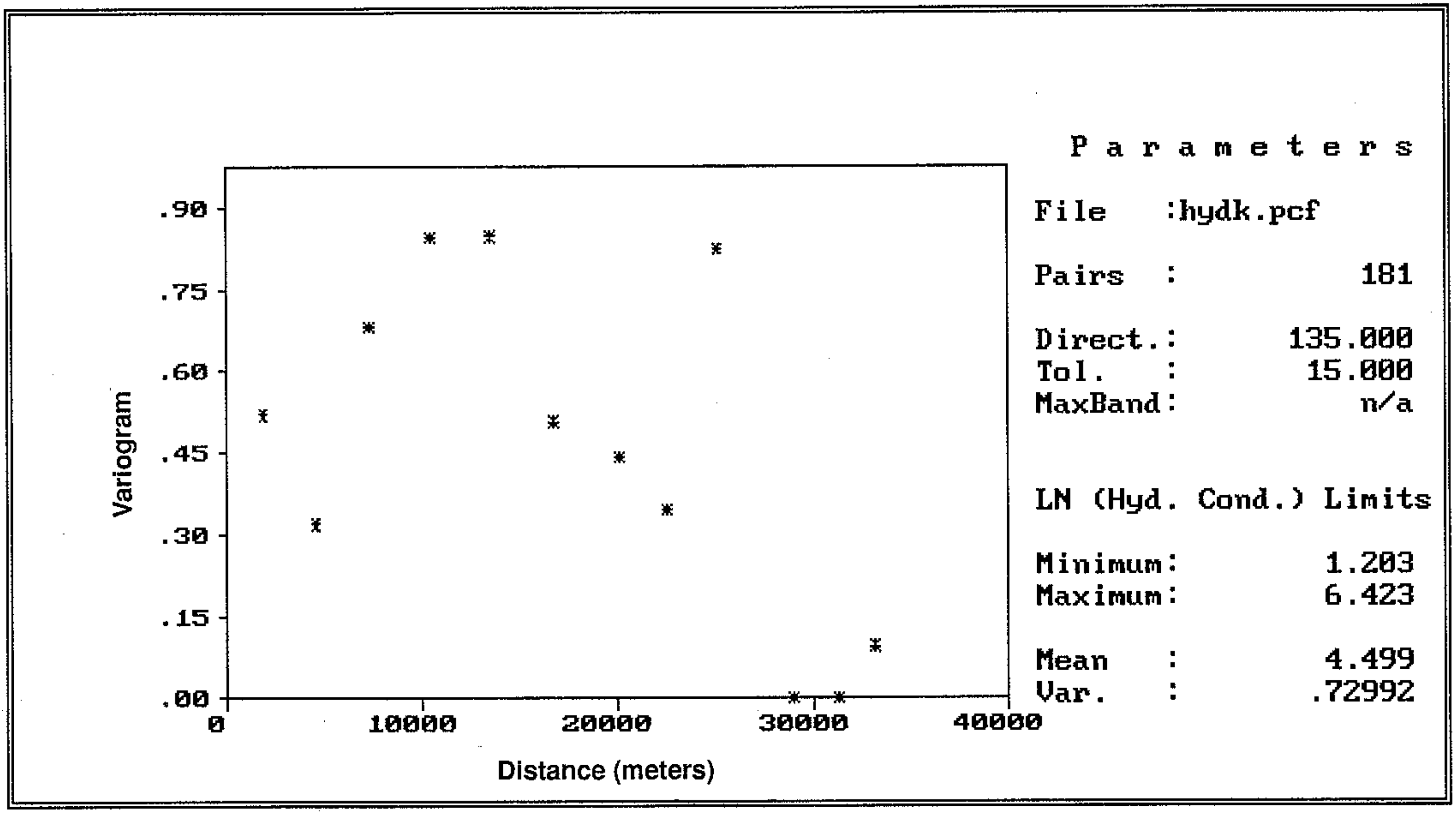


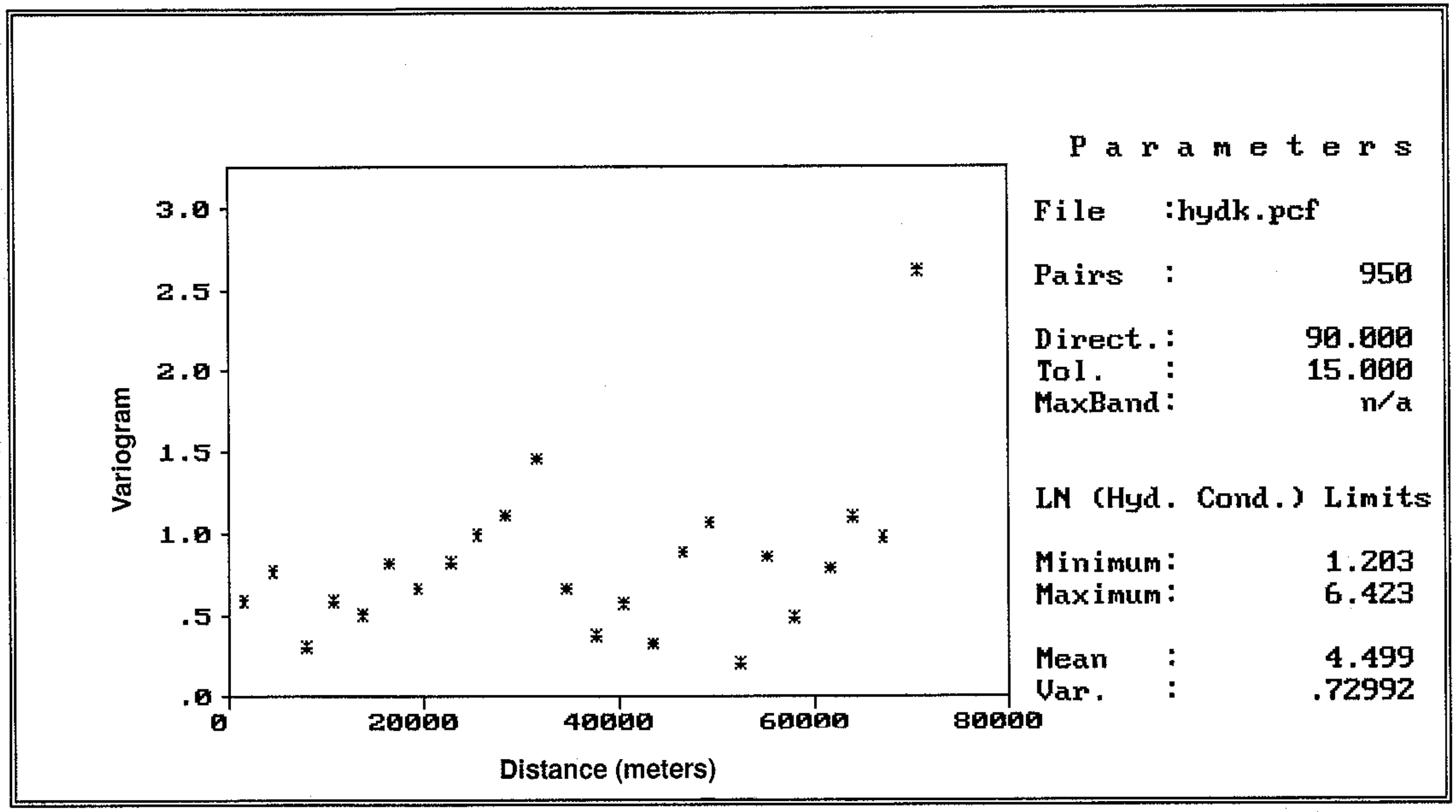
Figure
Scatter Plot of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer in the Northing Direction.
(Uncertain Test Data)

Appendix F, Part 7

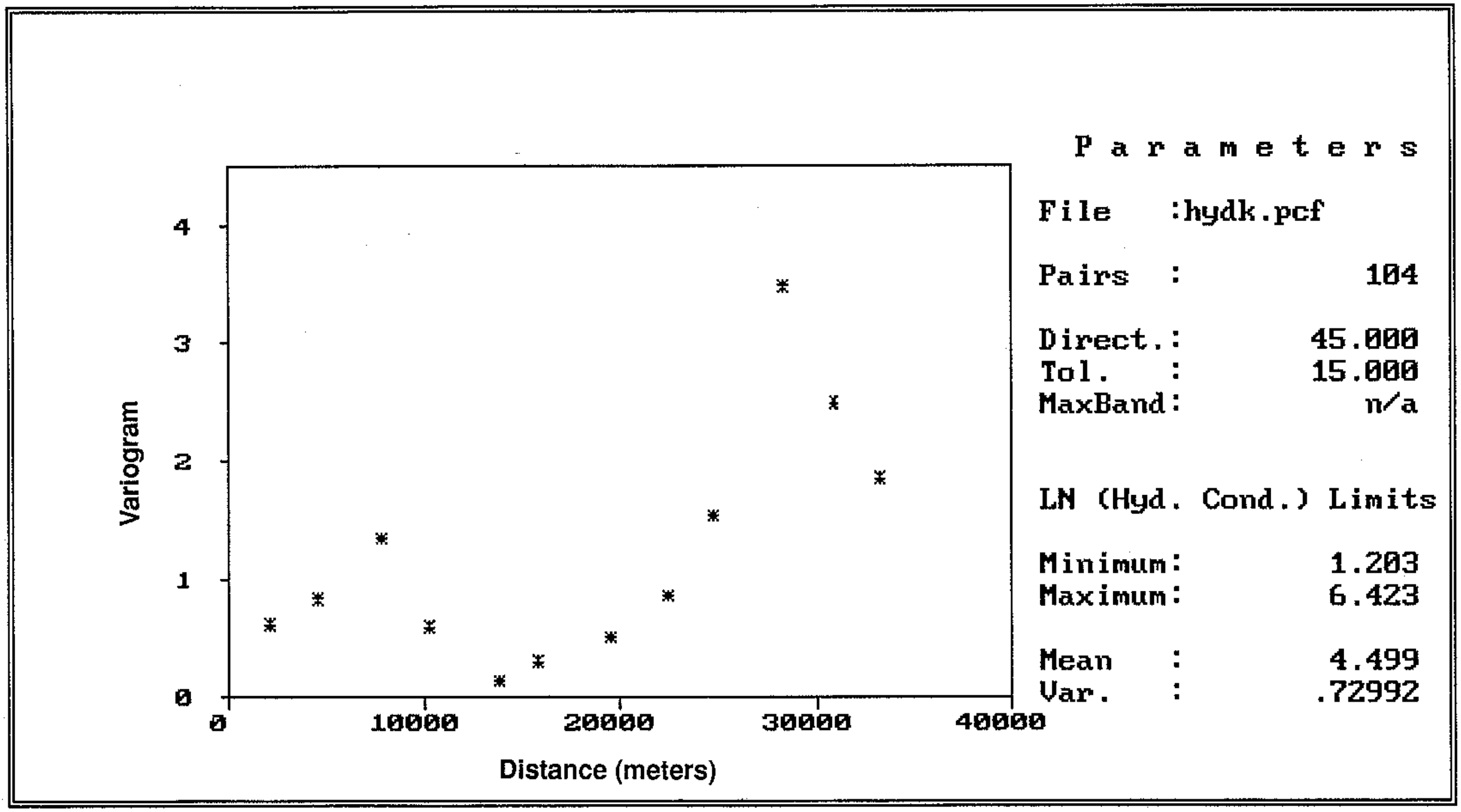
Variograms of ln Hydraulic Conductivity for the Shallow Aquifer



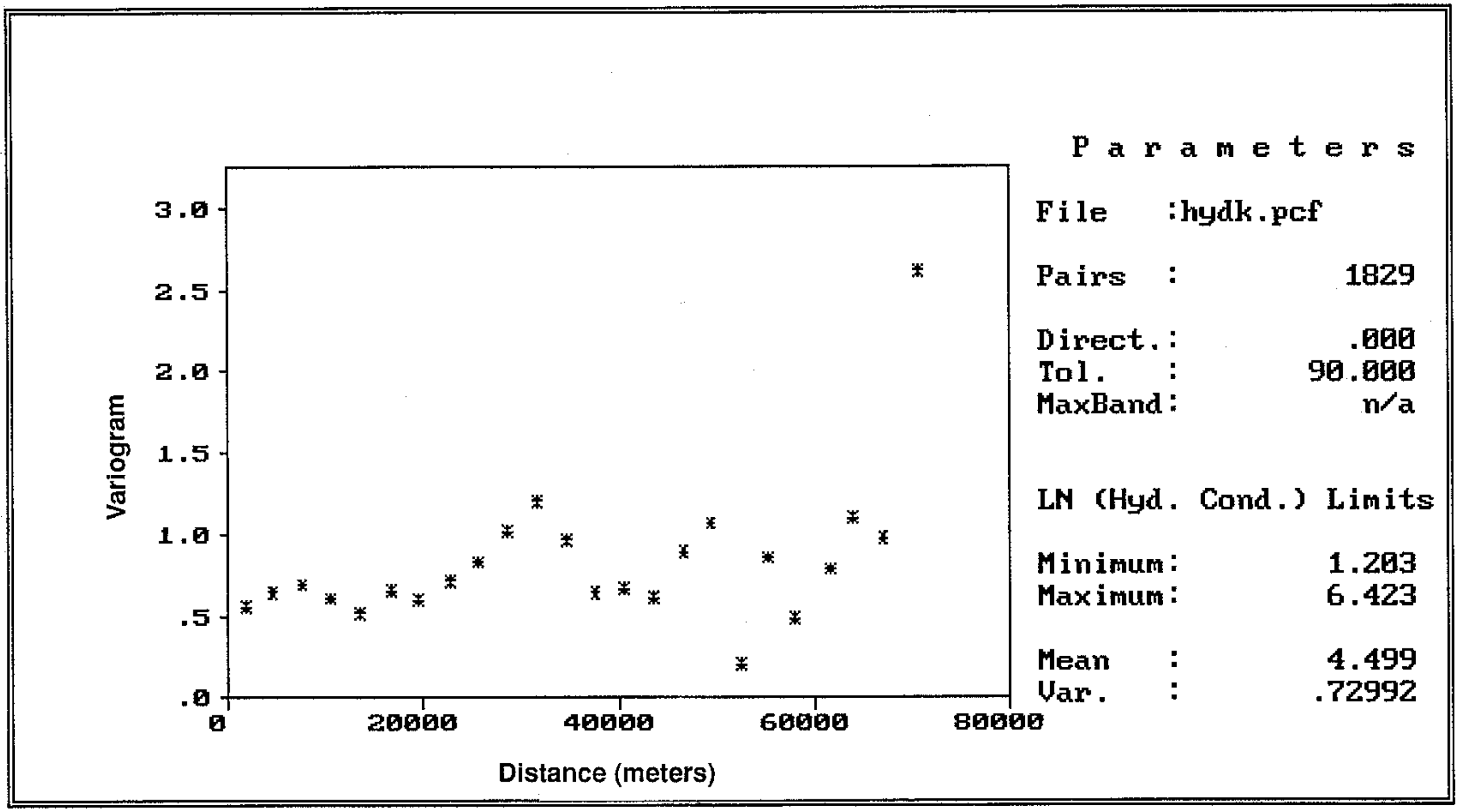
Variogram A of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



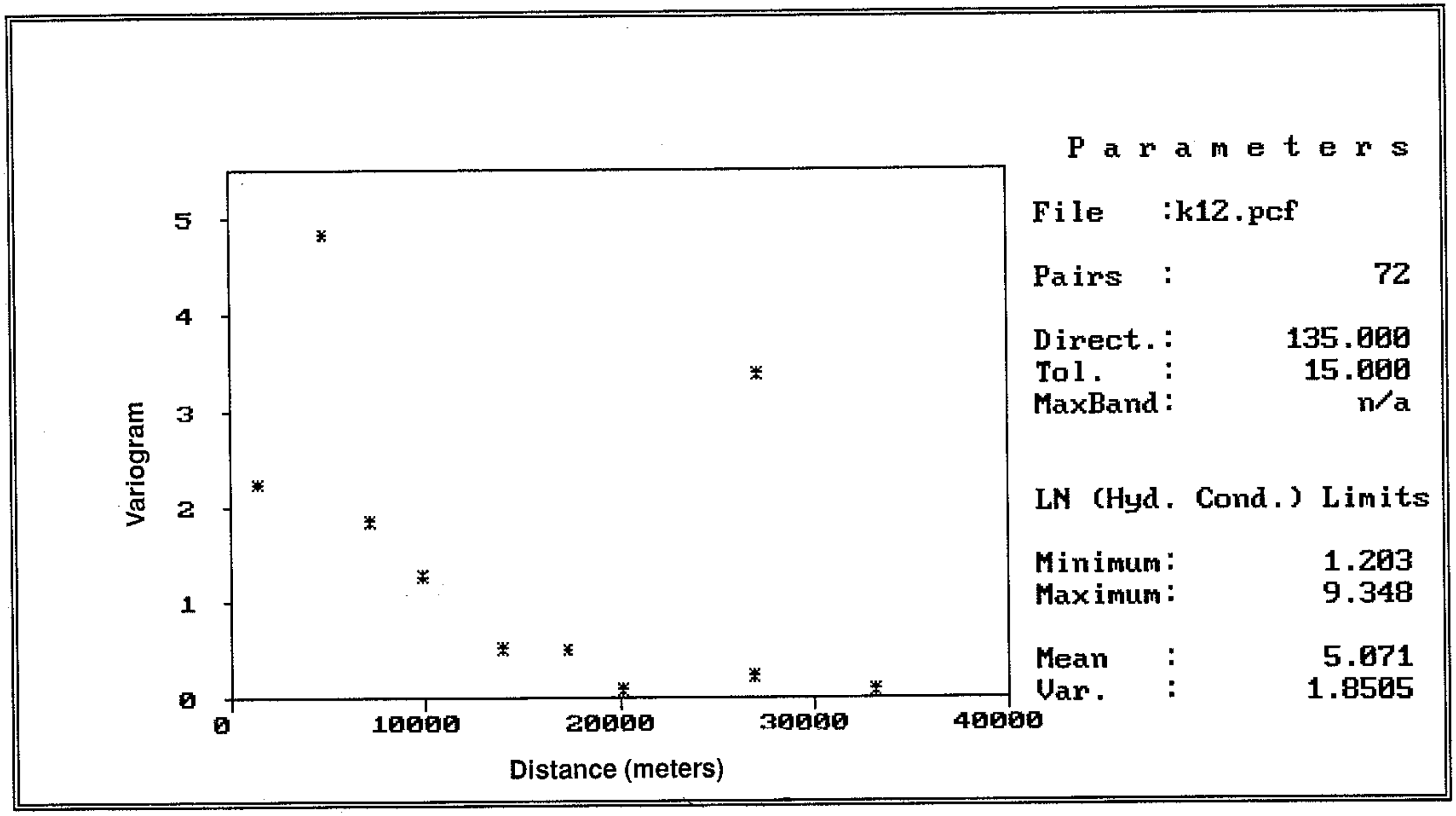
Variogram B of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



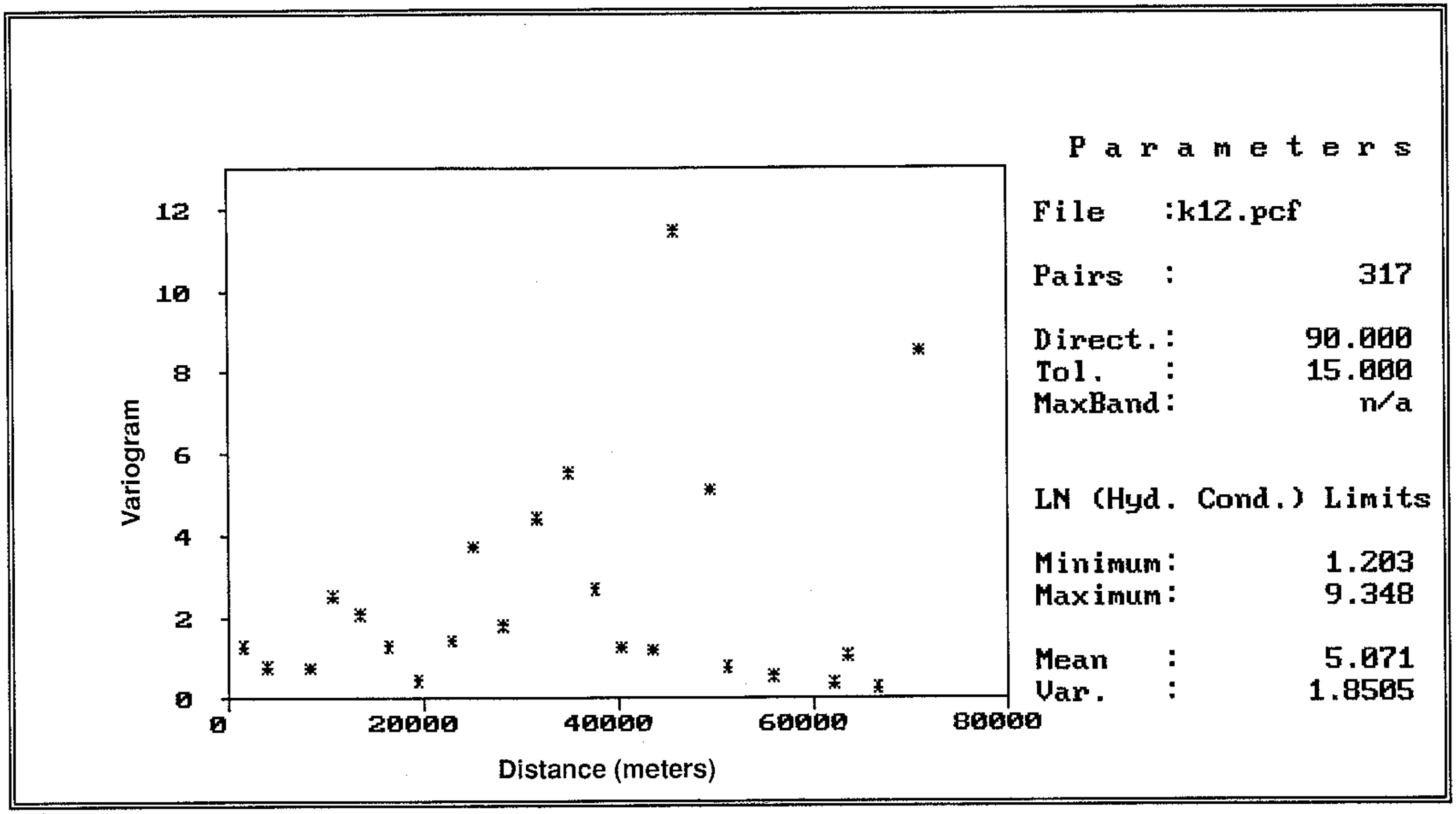
Variogram C of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



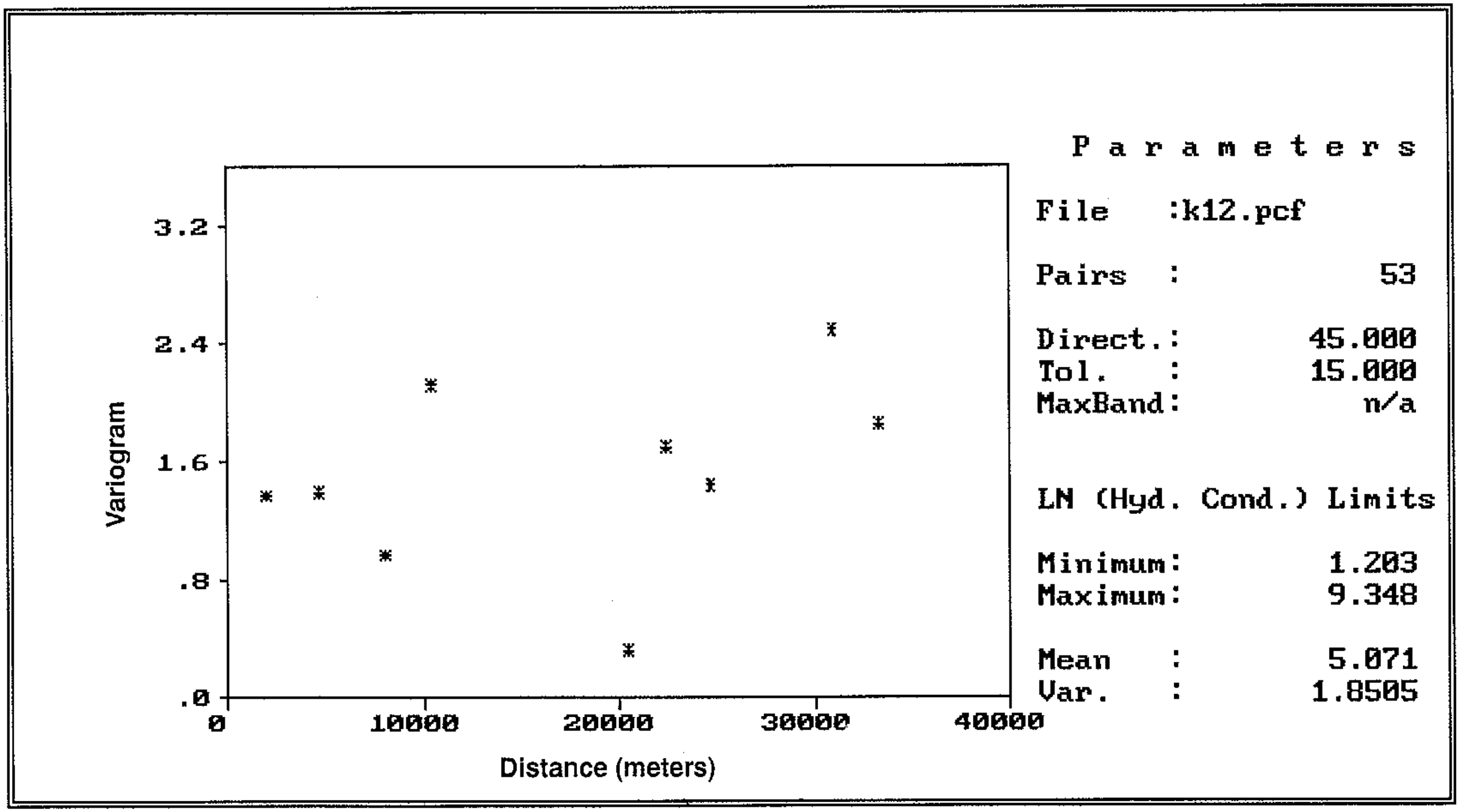
Variogram D of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent, Fair and Uncertain Test Data)



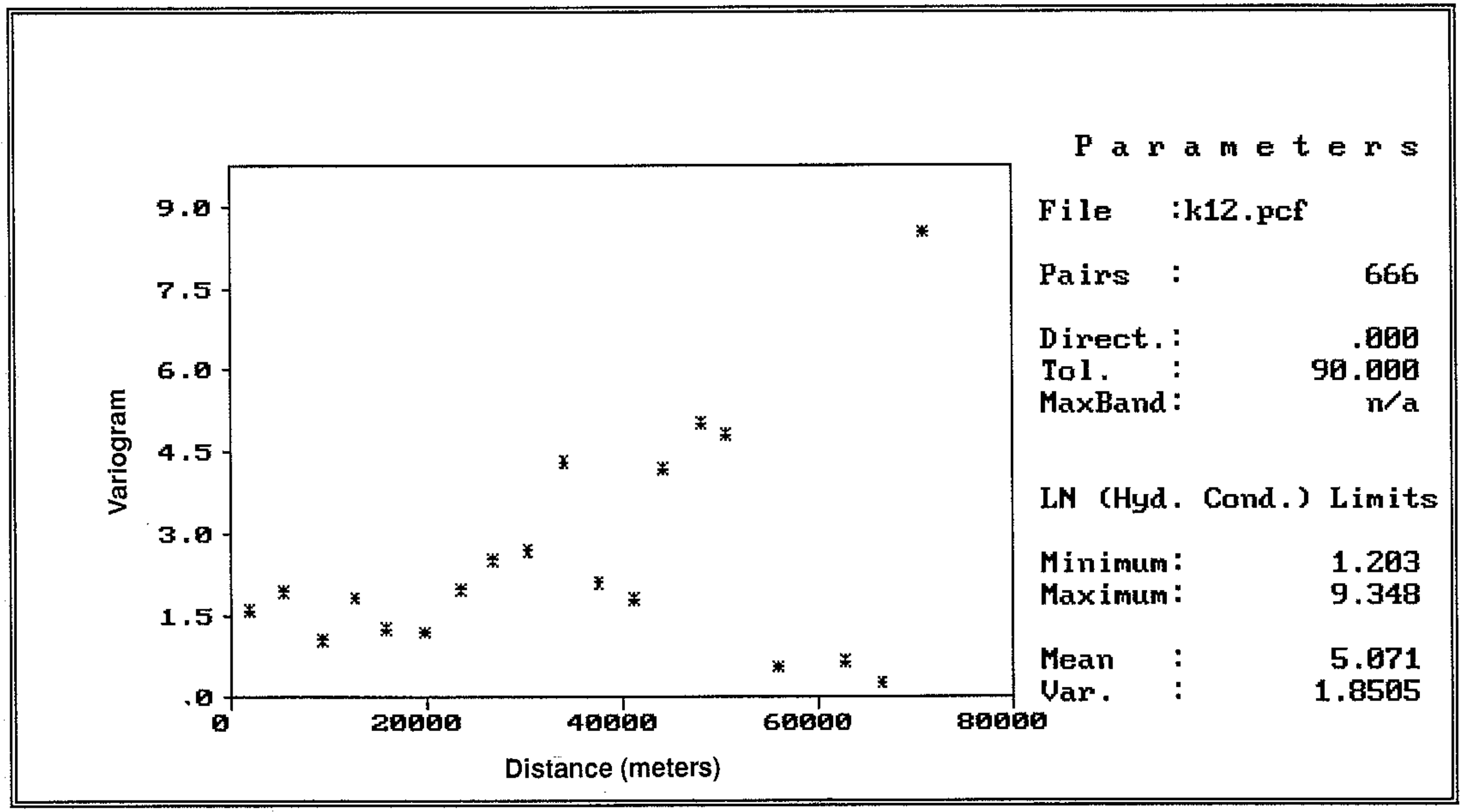
Variogram A of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)



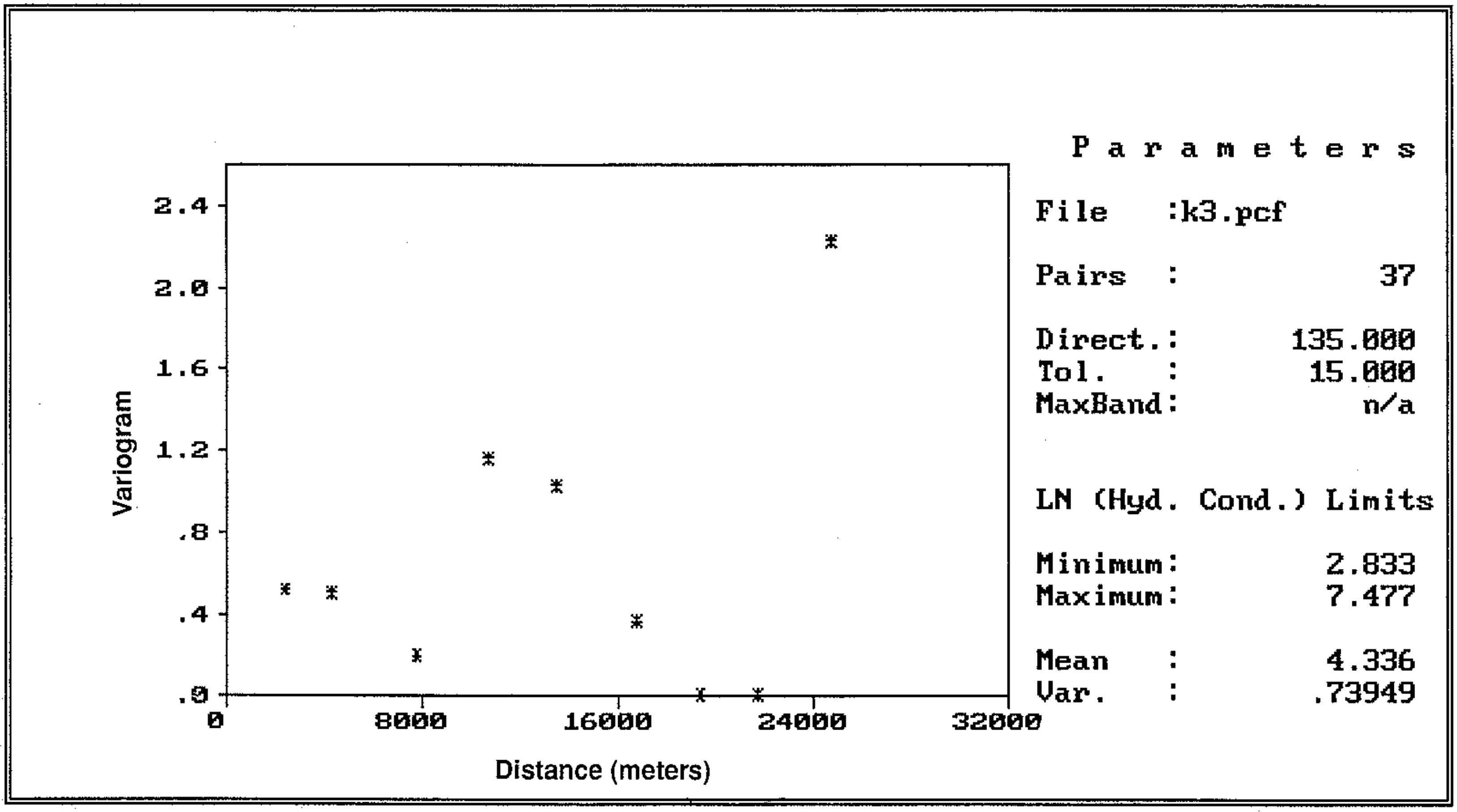
Variogram B of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)



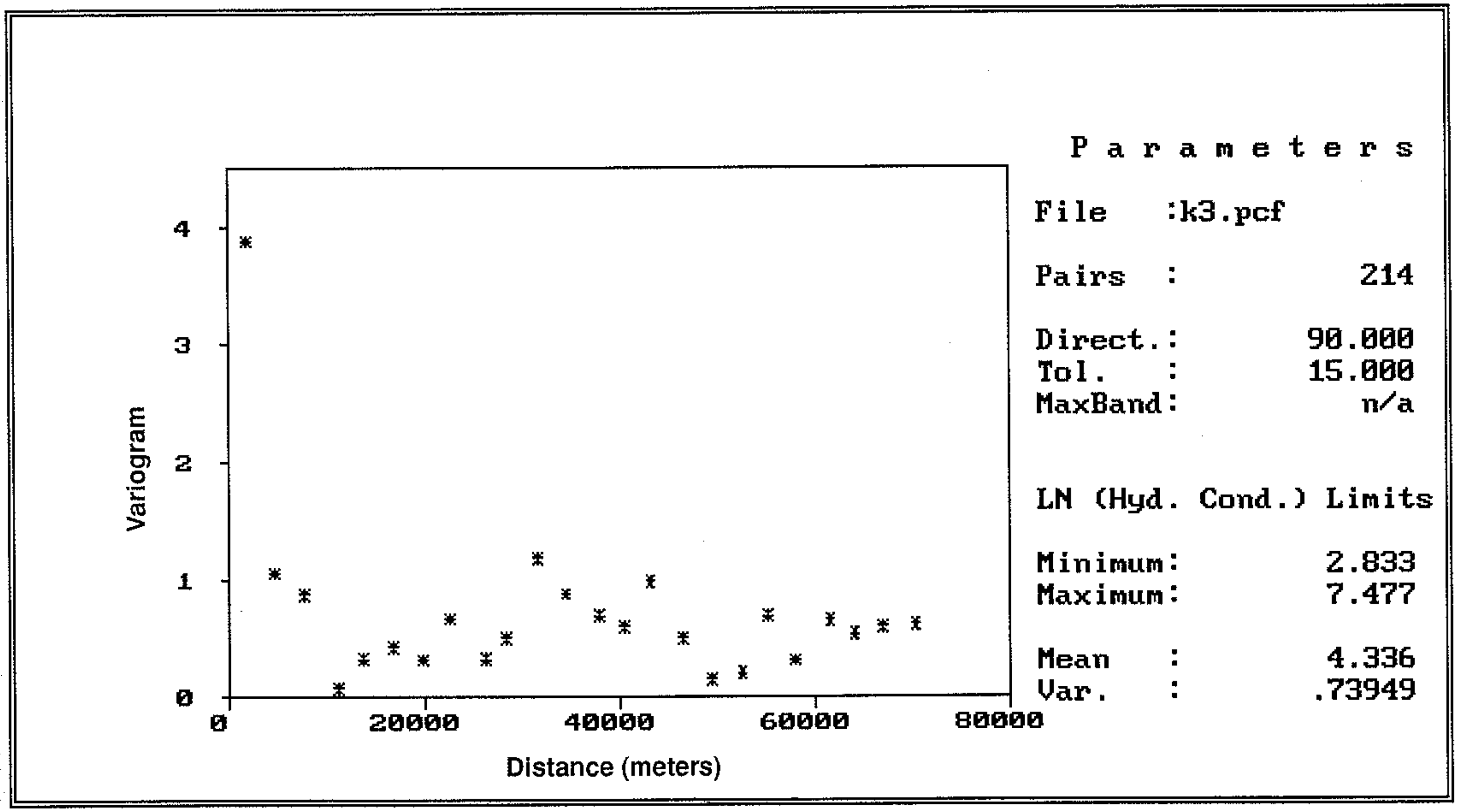
Variogram C of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)



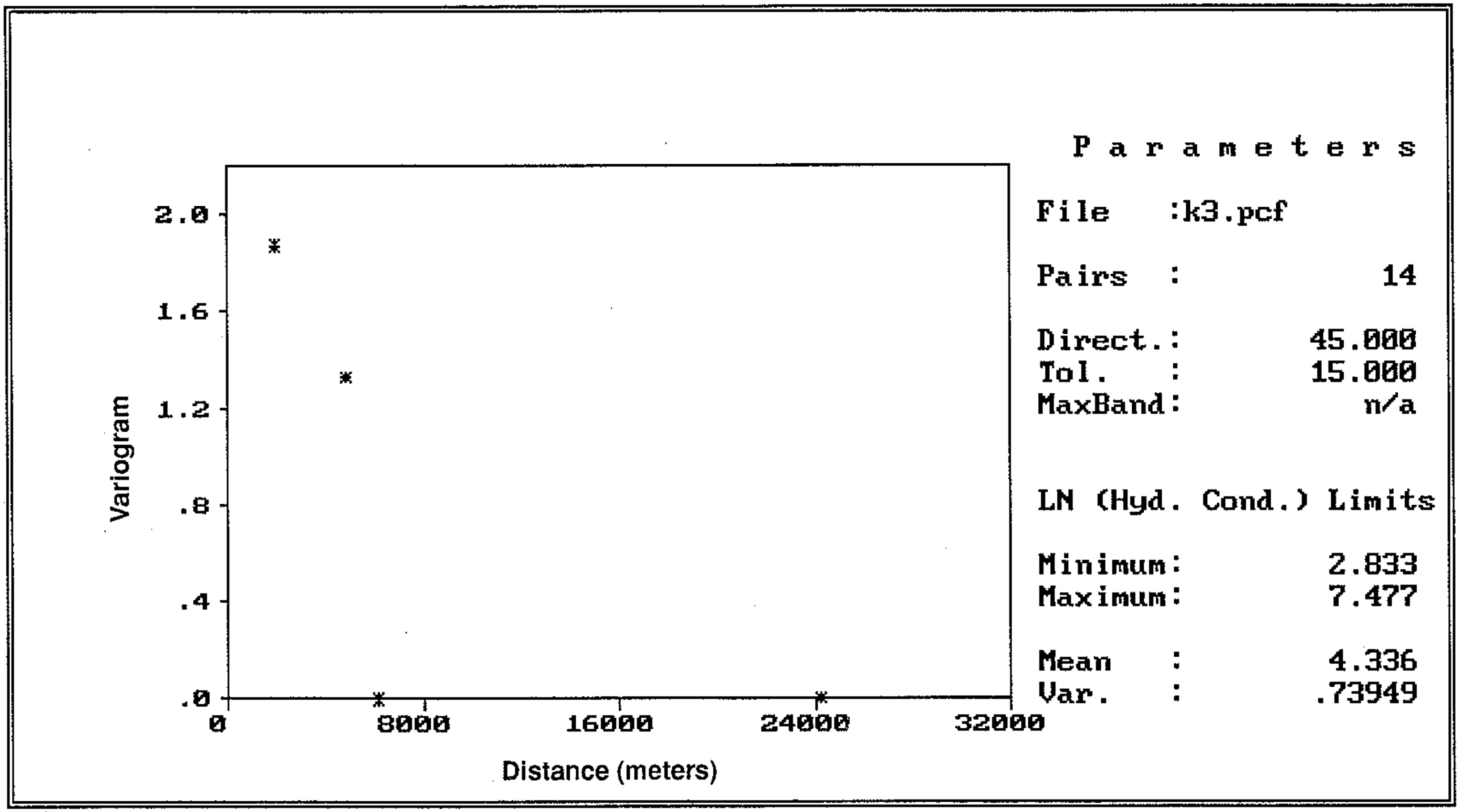
Variogram D of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Excellent and Fair Test Data)



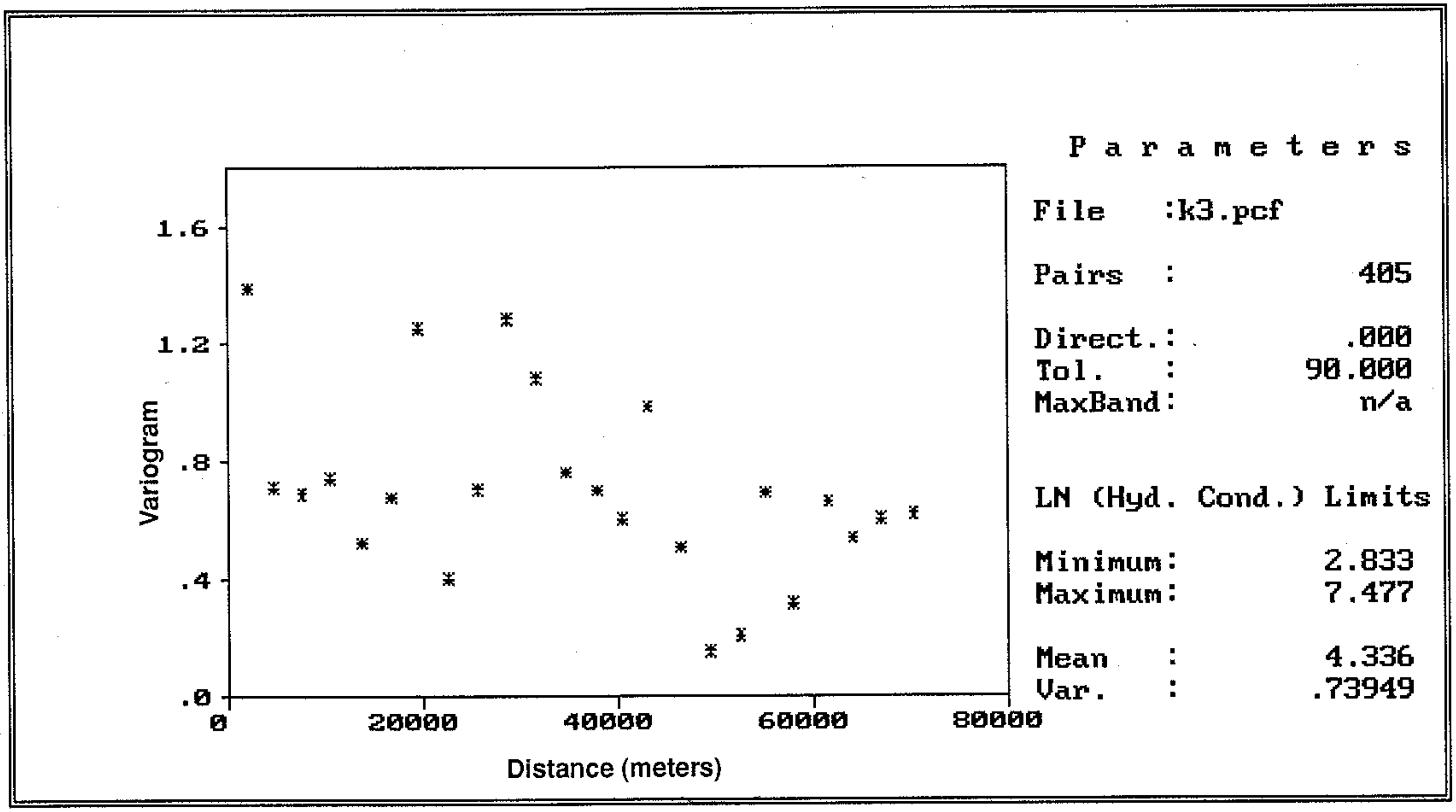
Variogram A of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)



Variogram B of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)



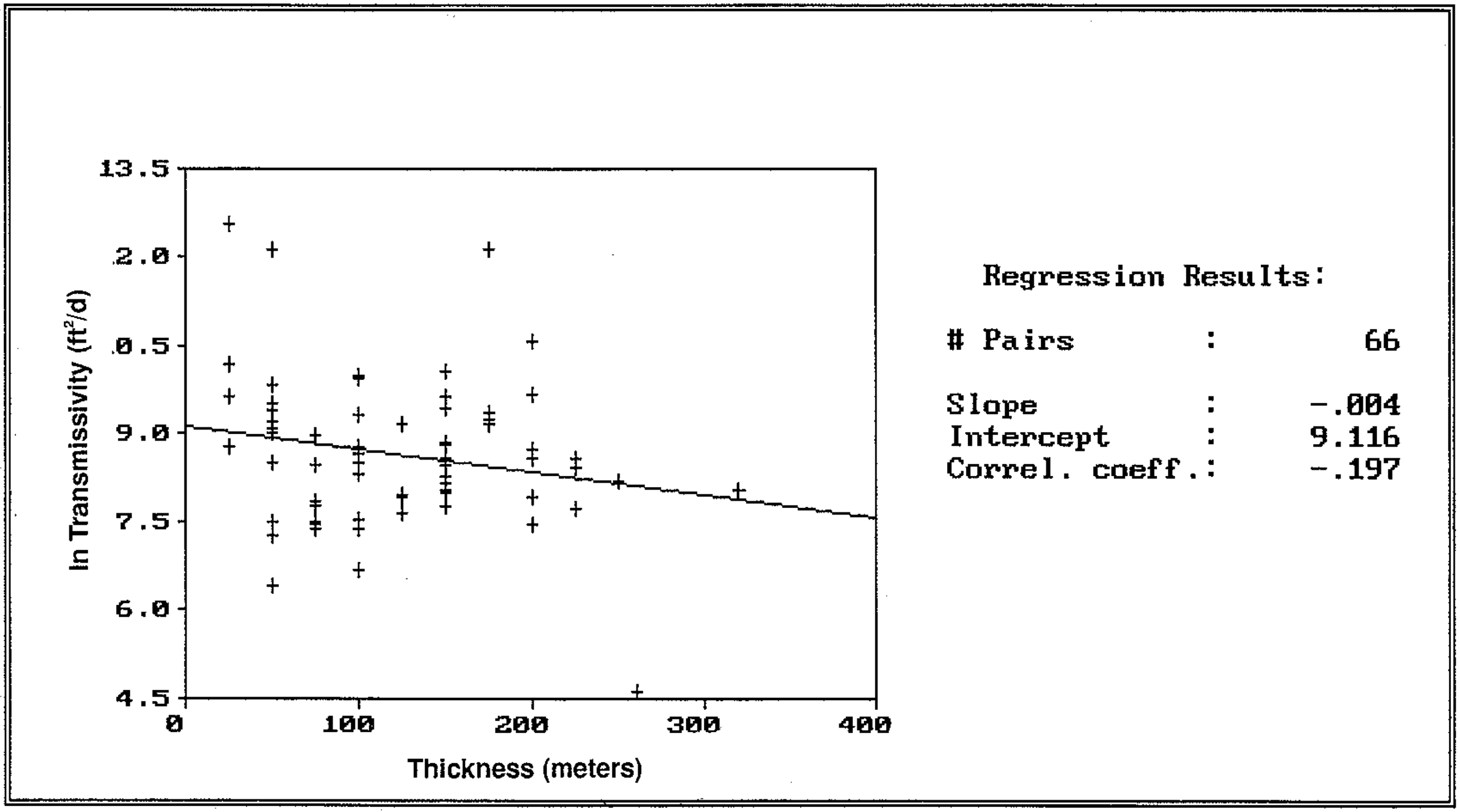
Variogram C of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)



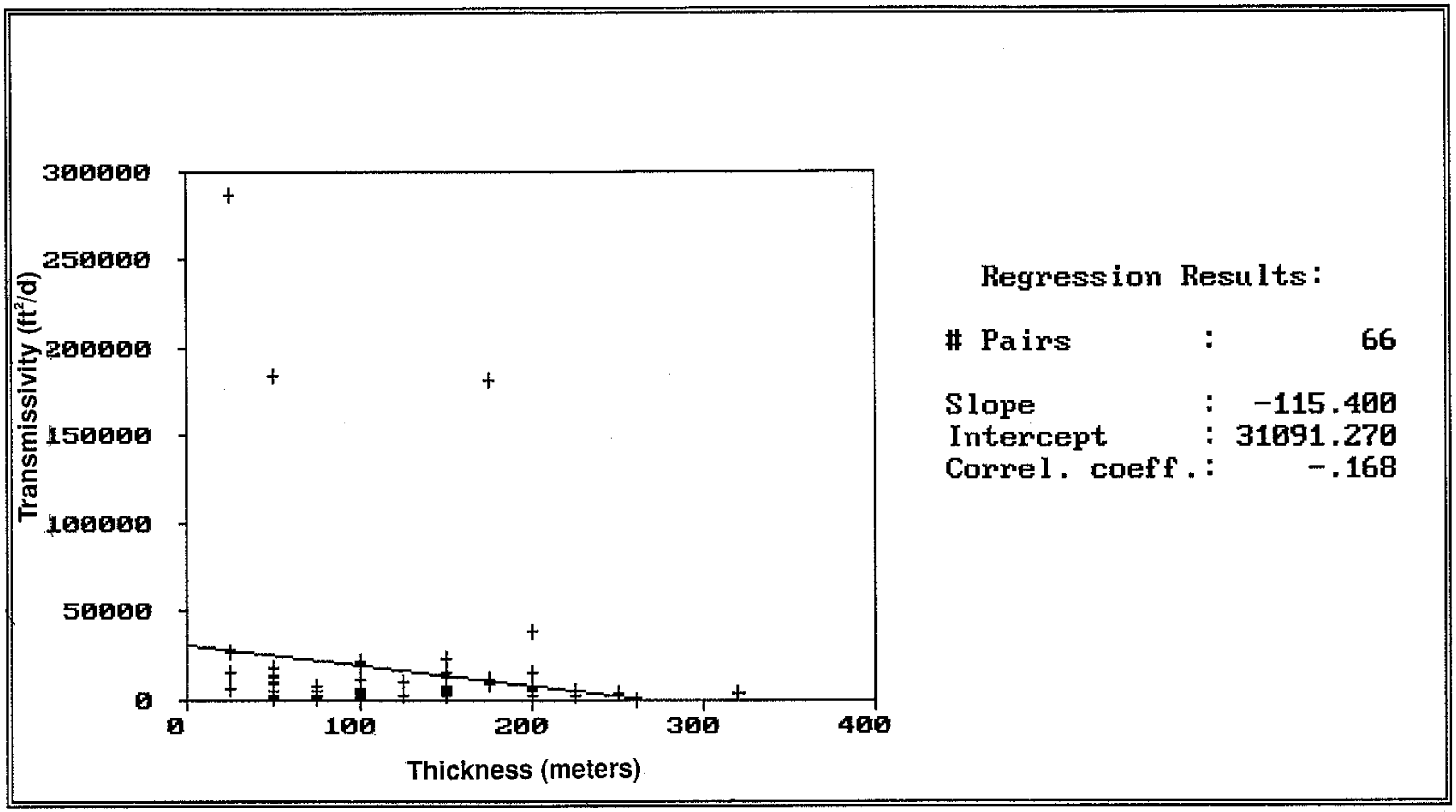
Variogram D of ln Hydraulic Conductivity (ft/d)
for the Shallow Aquifer
(Uncertain Test Data)

Appendix F, Part 8

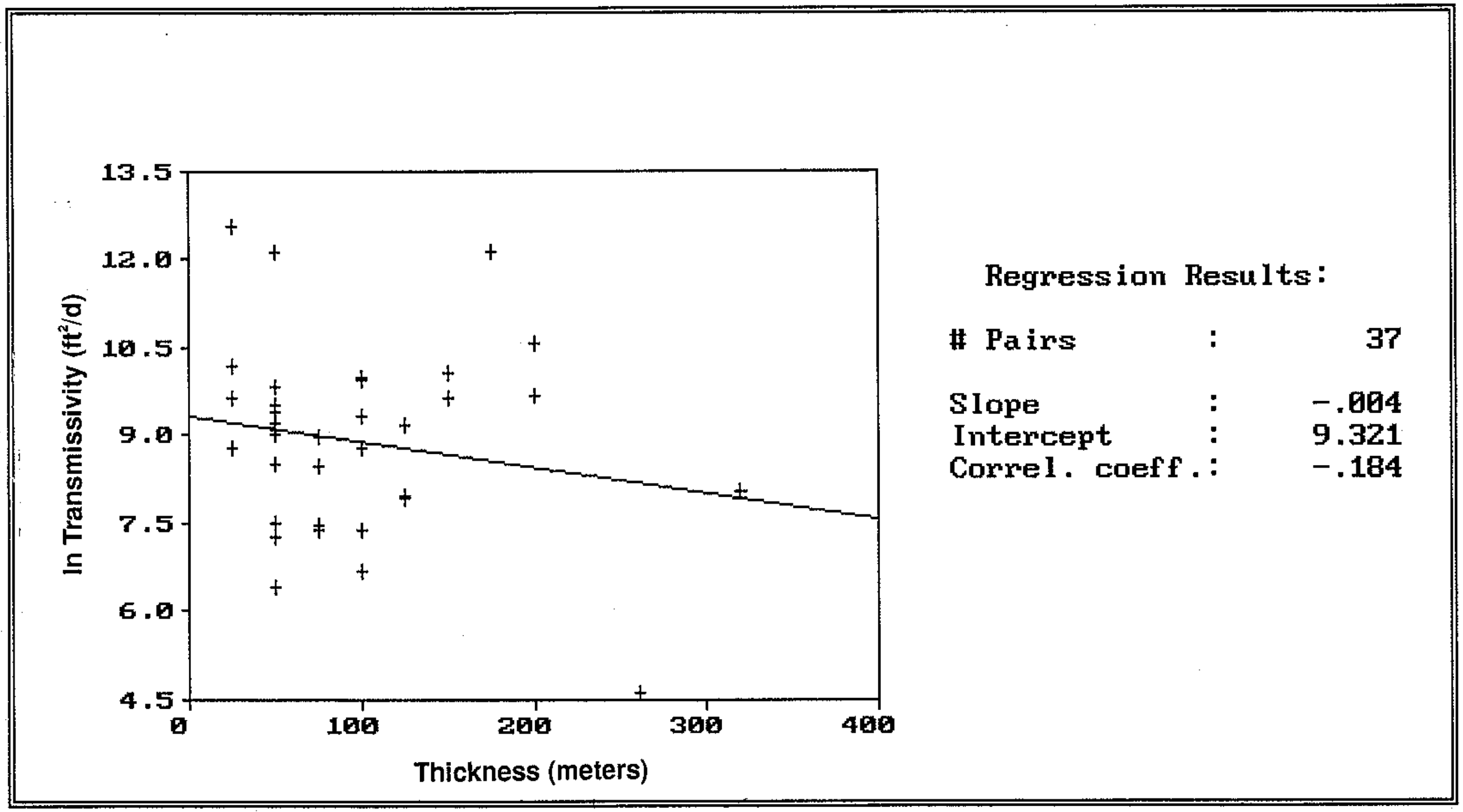
Scatter Plots of ln Transmissivity vs. Thickness for the Shallow Aquifer



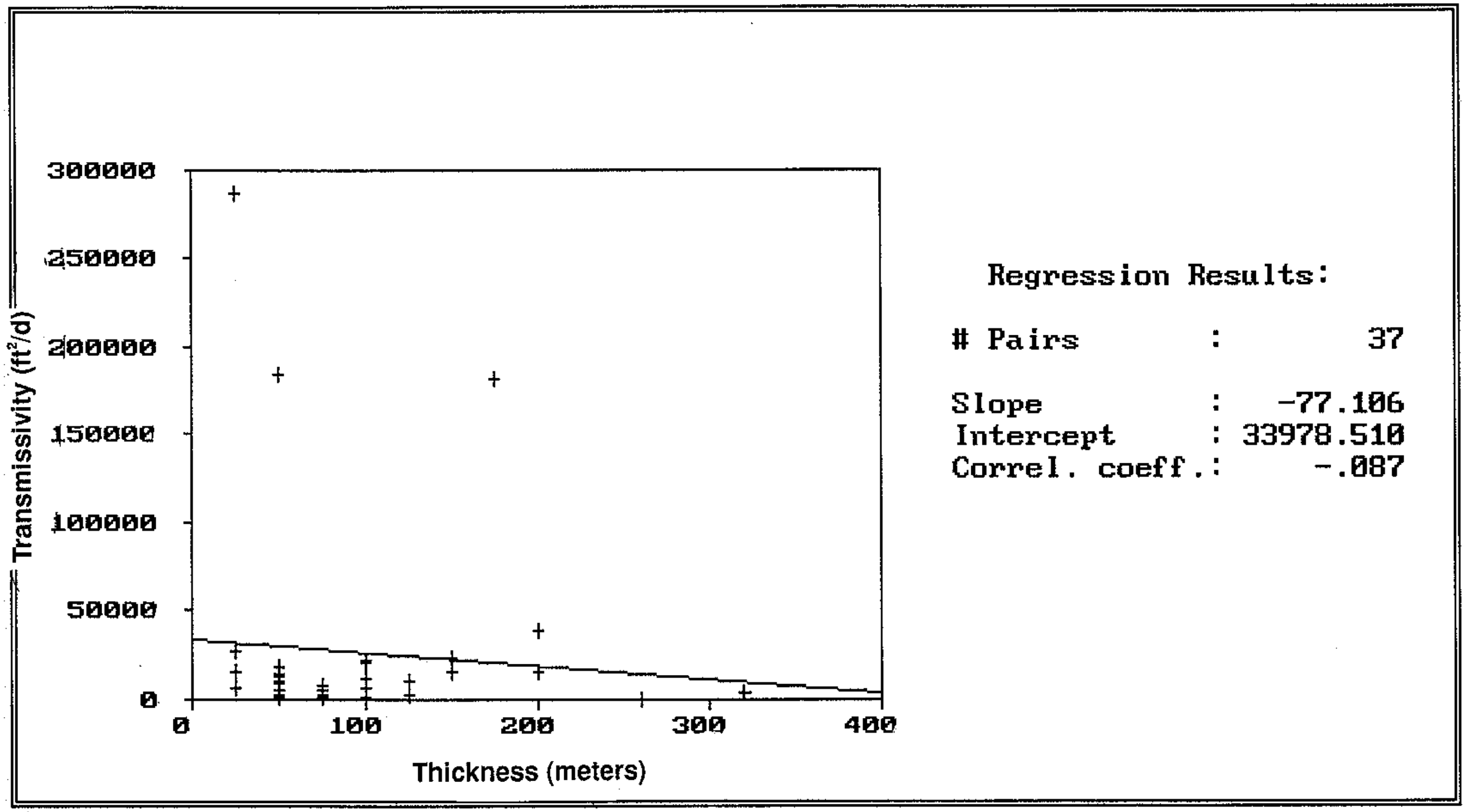
Scatter Plot of ln Transmissivity (ft^2/d) vs. Thickness (meters) for the Shallow Aquifer (Excellent, Fair and Uncertain Test Data)



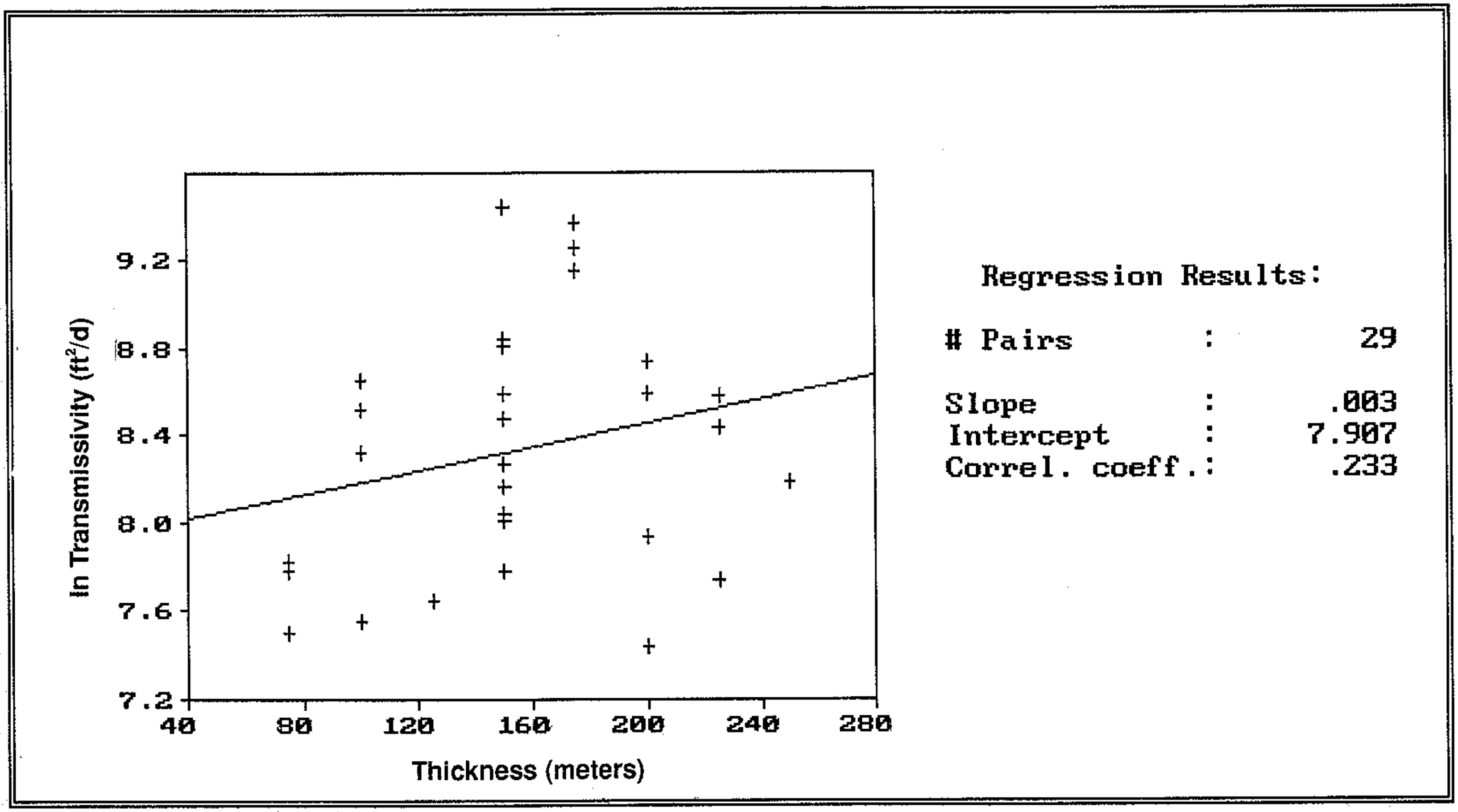
Scatter Plot of Transmissivity (ft²/d) vs. Thickness (meters) for the Shallow Aquifer (Excellent, Fair and Uncertain Test Data)



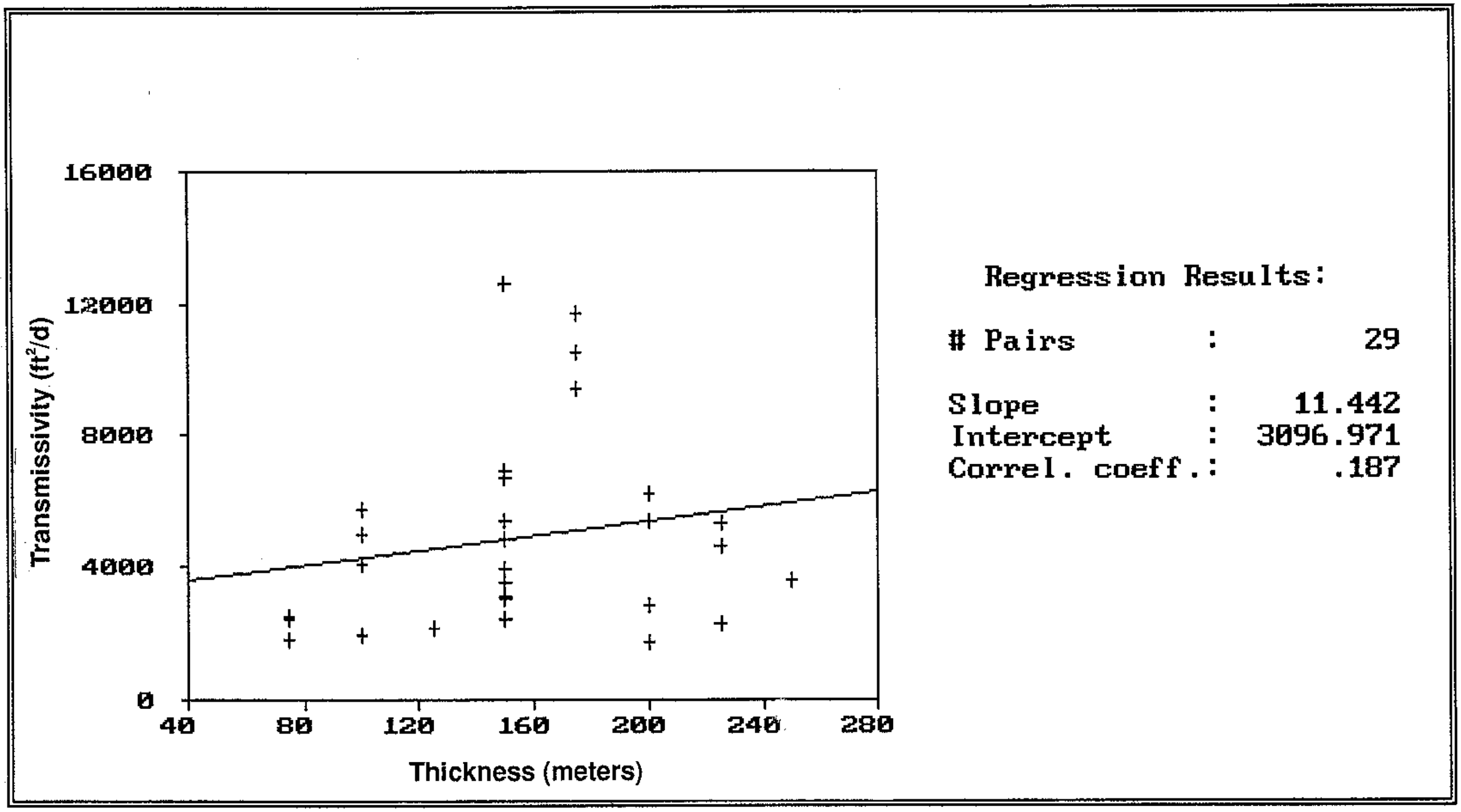
Scatter Plot of ln Transmissivity (ft^2/d) vs.
Thickness (meters) for the Shallow Aquifer
(Excellent and Fair Test Data)



Scatter Plot of Transmissivity (ft^2/d) vs.
Thickness (meters) for the Shallow Aquifer
(Excellent and Fair Test Data)



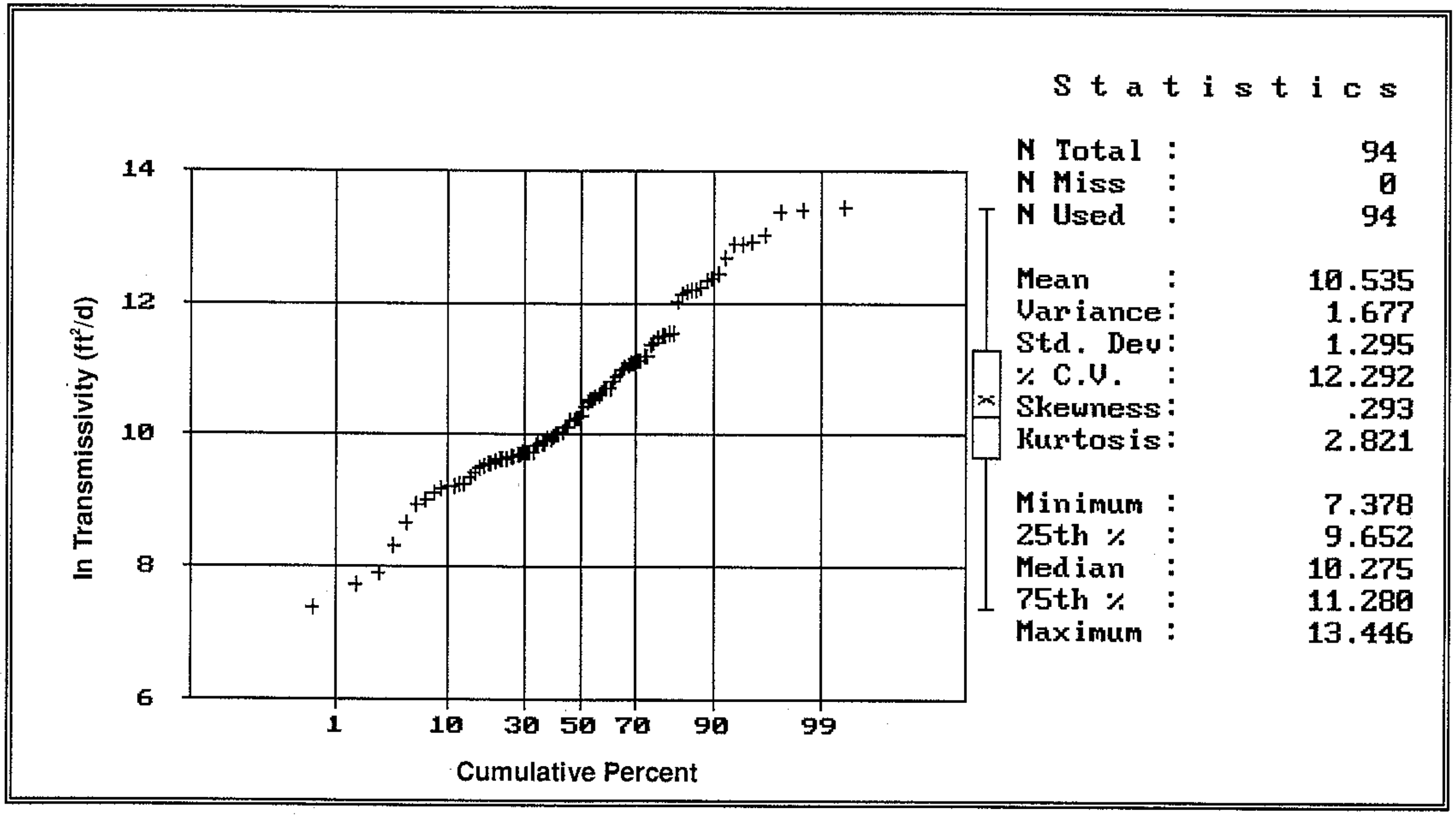
Scatter Plot of ln Transmissivity (ft^2/d) vs. Thickness (meters) for the Shallow Aquifer (Uncertain Test Data)



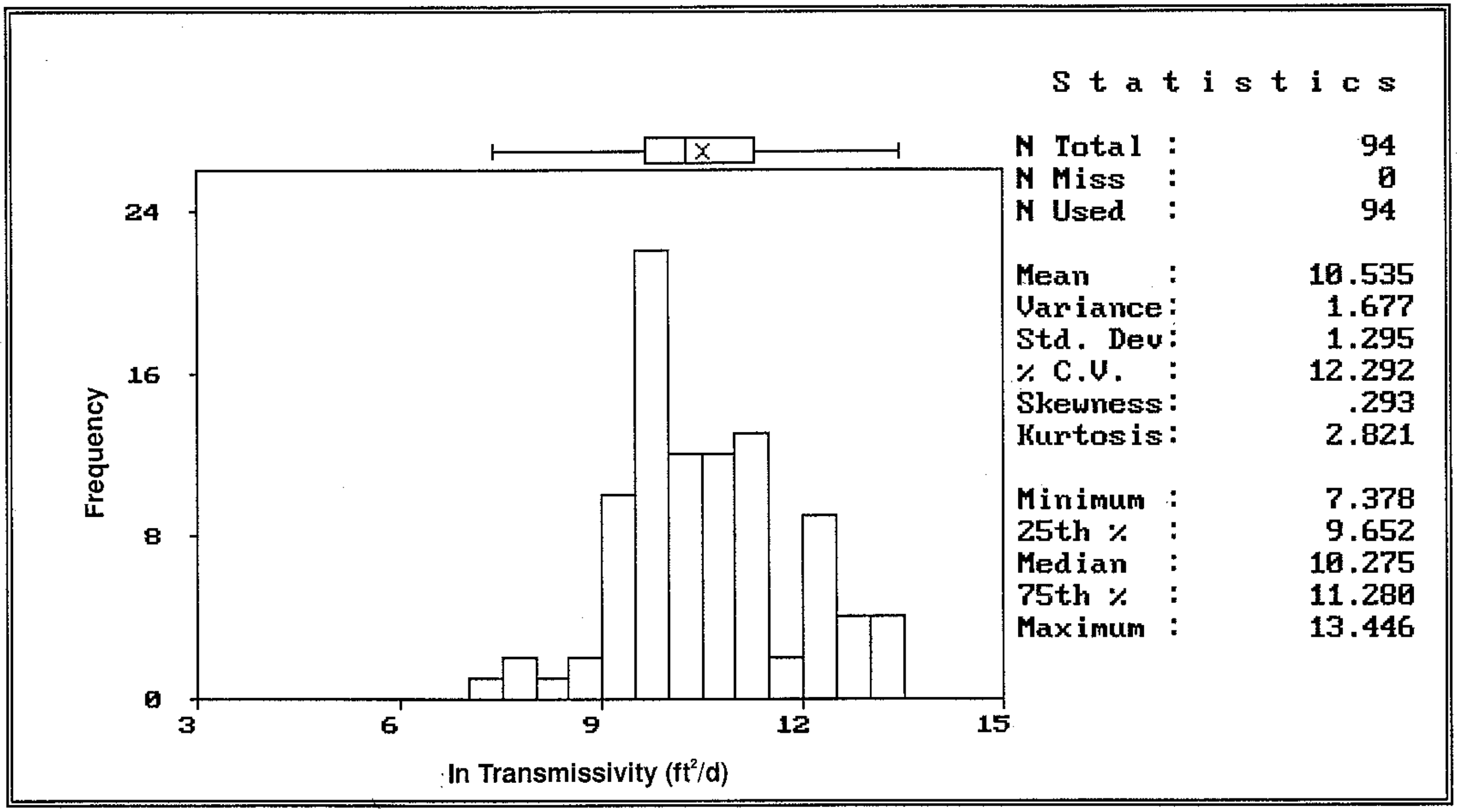
Scatter Plot of Transmissivity (ft^2/d) vs. Thickness (meters) for the Shallow Aquifer (Uncertain Test Data)

Appendix F, Part 9

Probability Plots and Histograms of ln Transmissivity for the Carbonate Aquifer



Normal Probability Plot of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)

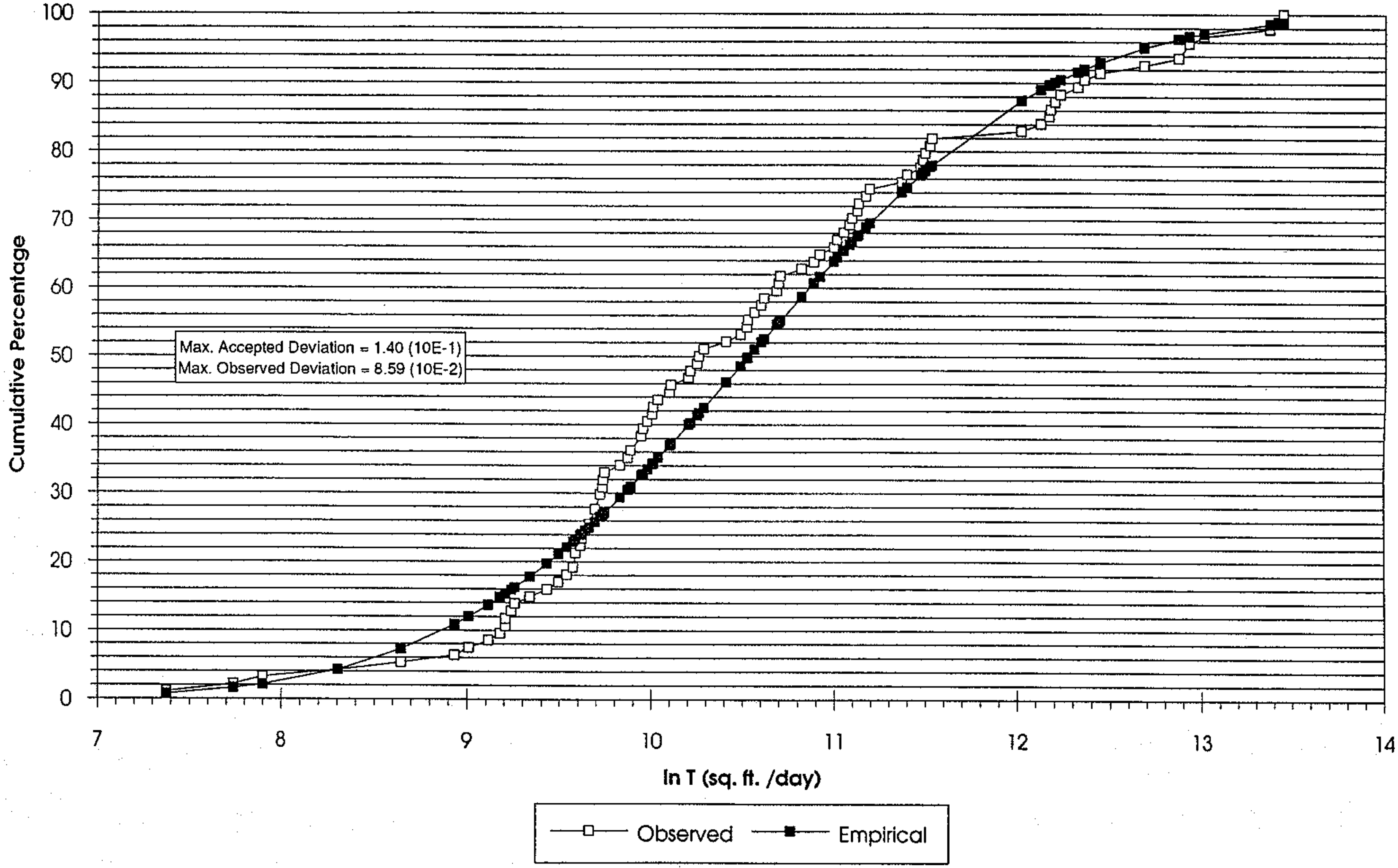


Histogram of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)

Appendix F, Part 10

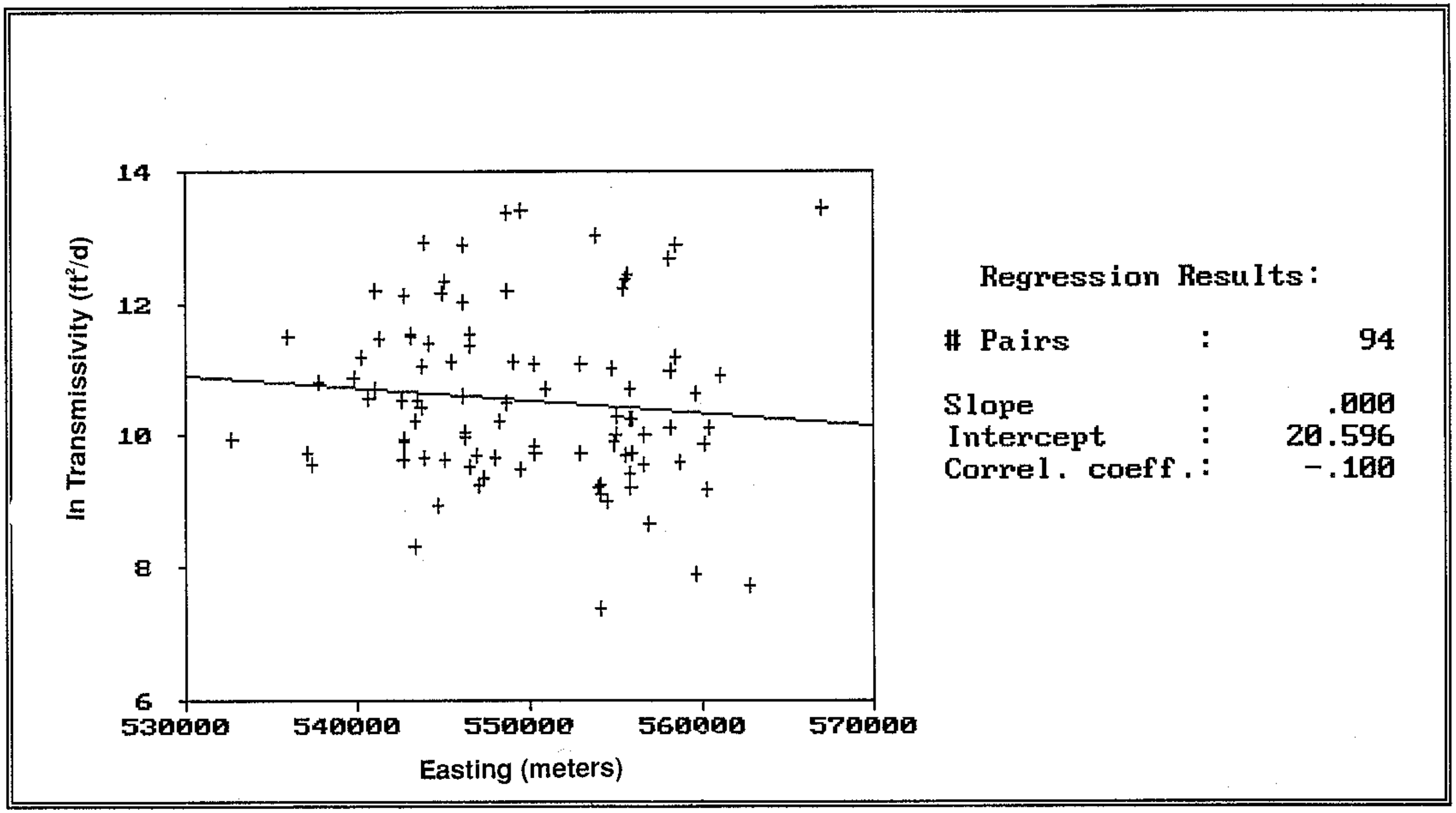
K-S Test Graphs of In Transmissivity for the Carbonate Aquifer

K-S Test: ln T vs. Cumulative Percentage
San Andres Formation

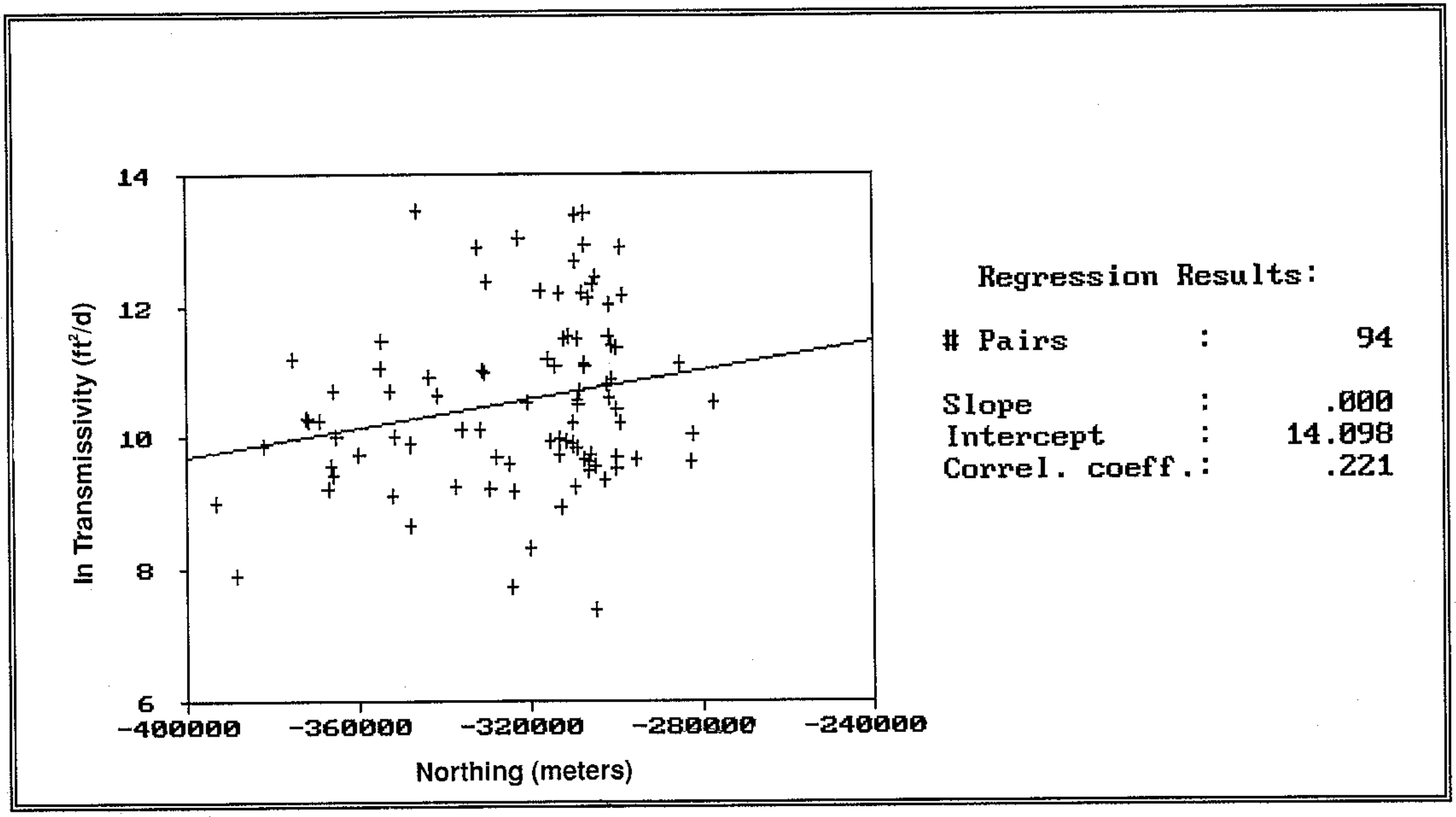


Appendix F, Part 11

Scatter Plots of In Transmissivity for the Carbonate Aquifer



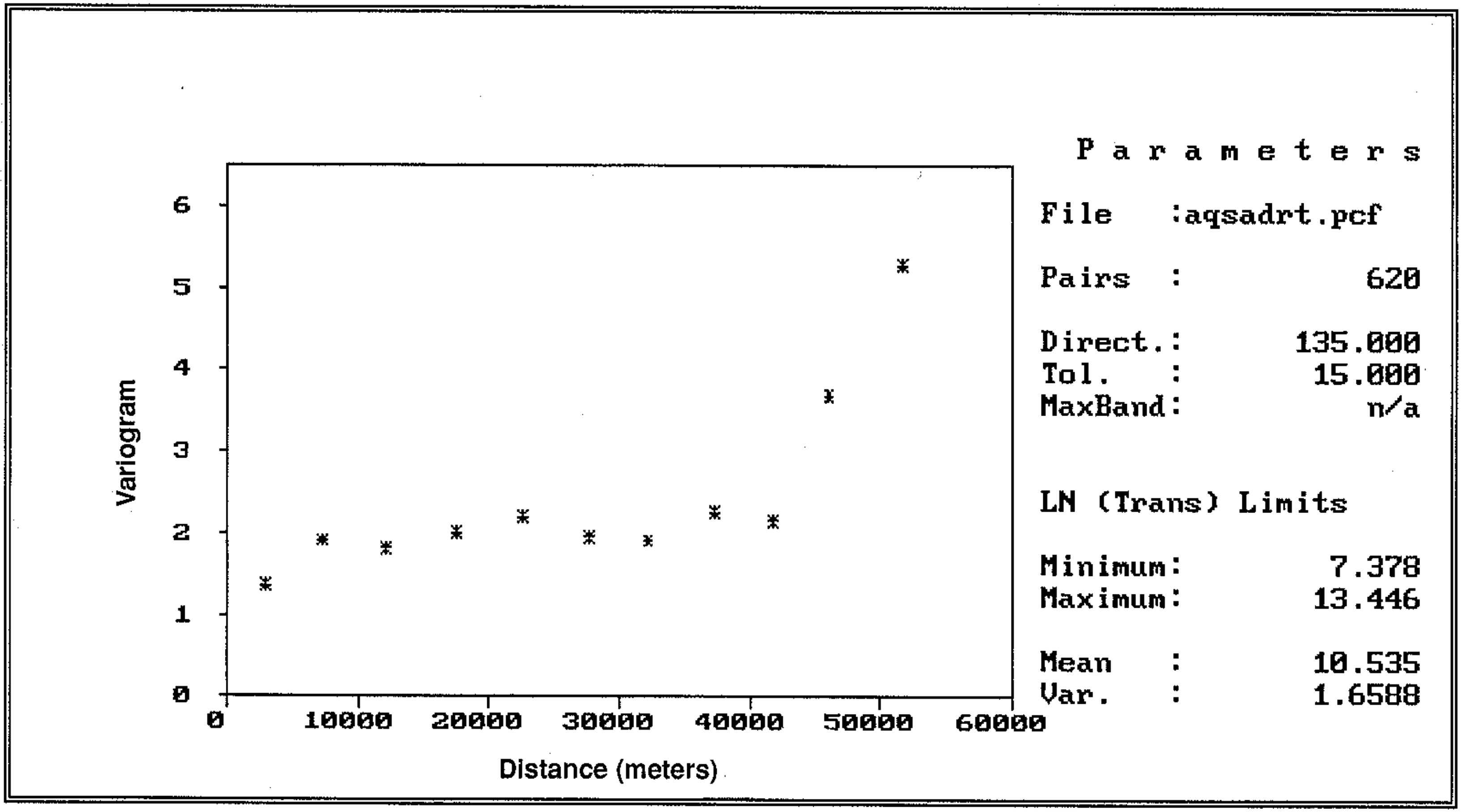
Scatter Plot of ln Transmissivity (ft^2/d) for the Carbonate Aquifer in the Easting Direction (San Andres Formation Test Data)



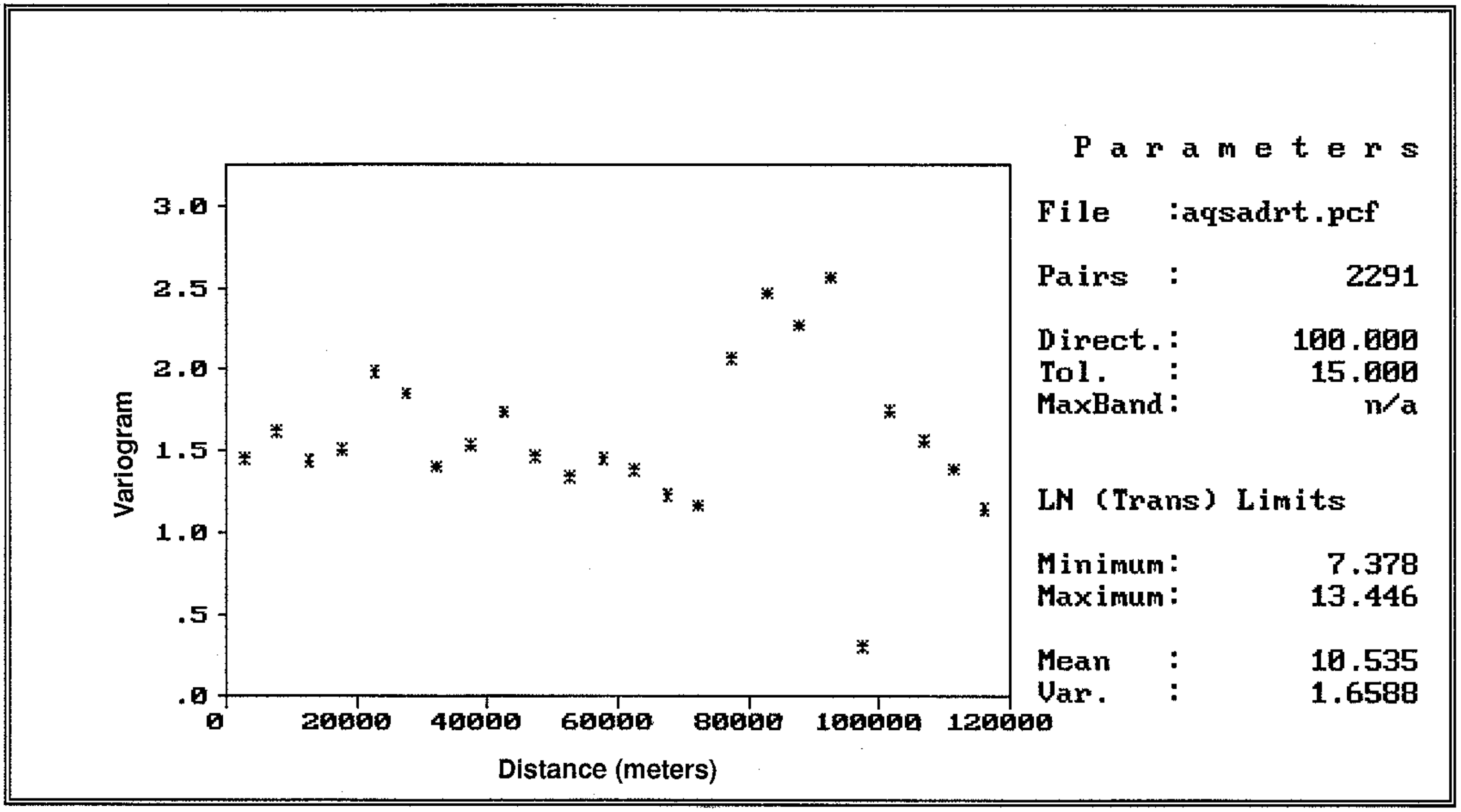
Scatter Plot of ln Transmissivity (ft^2/d) for the Carbonate Aquifer in the Northing Direction (San Andres Formation Test Data)

Appendix F, Part 12

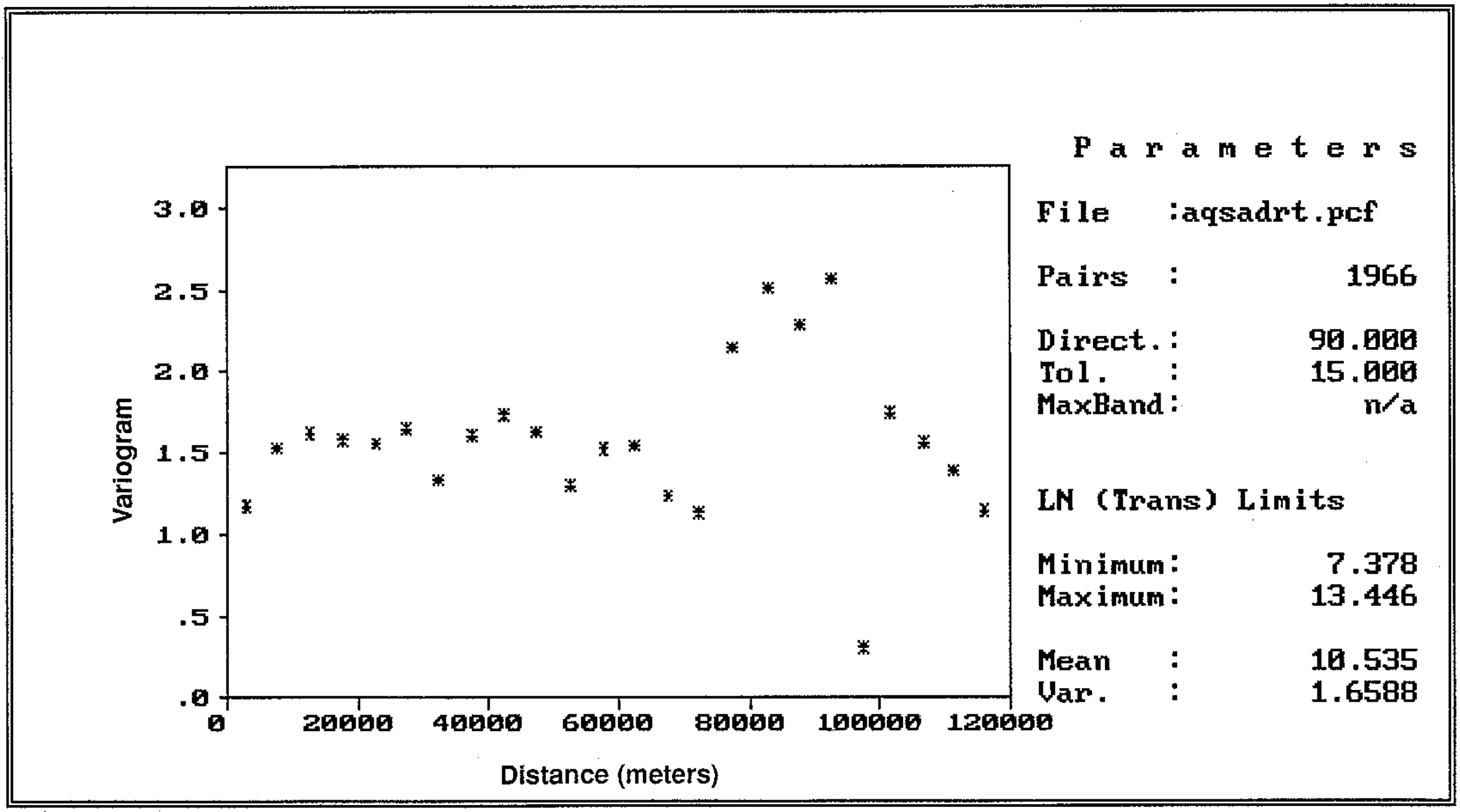
Variograms of In Transmissivity for the Carbonate Aquifer



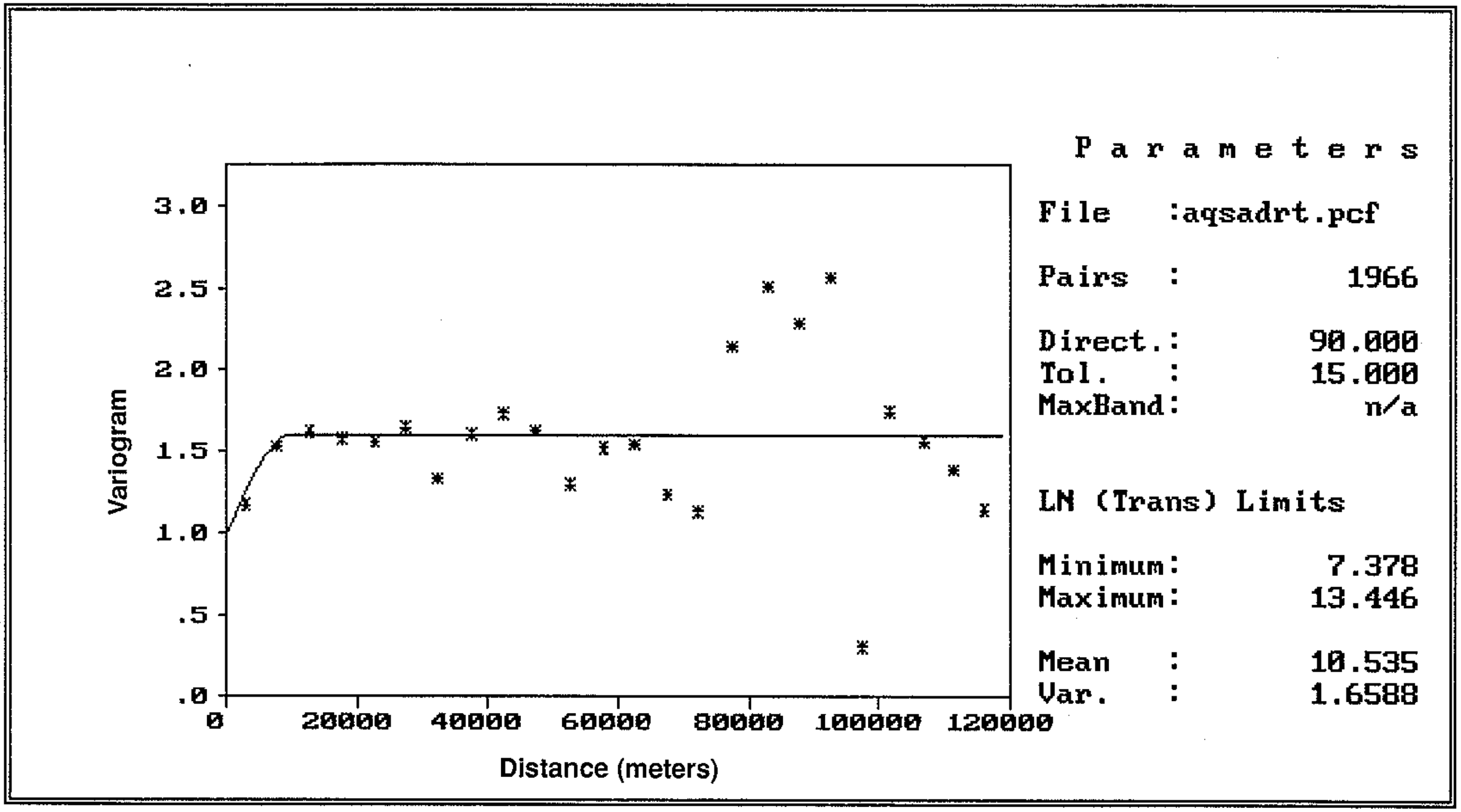
Variogram A of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)



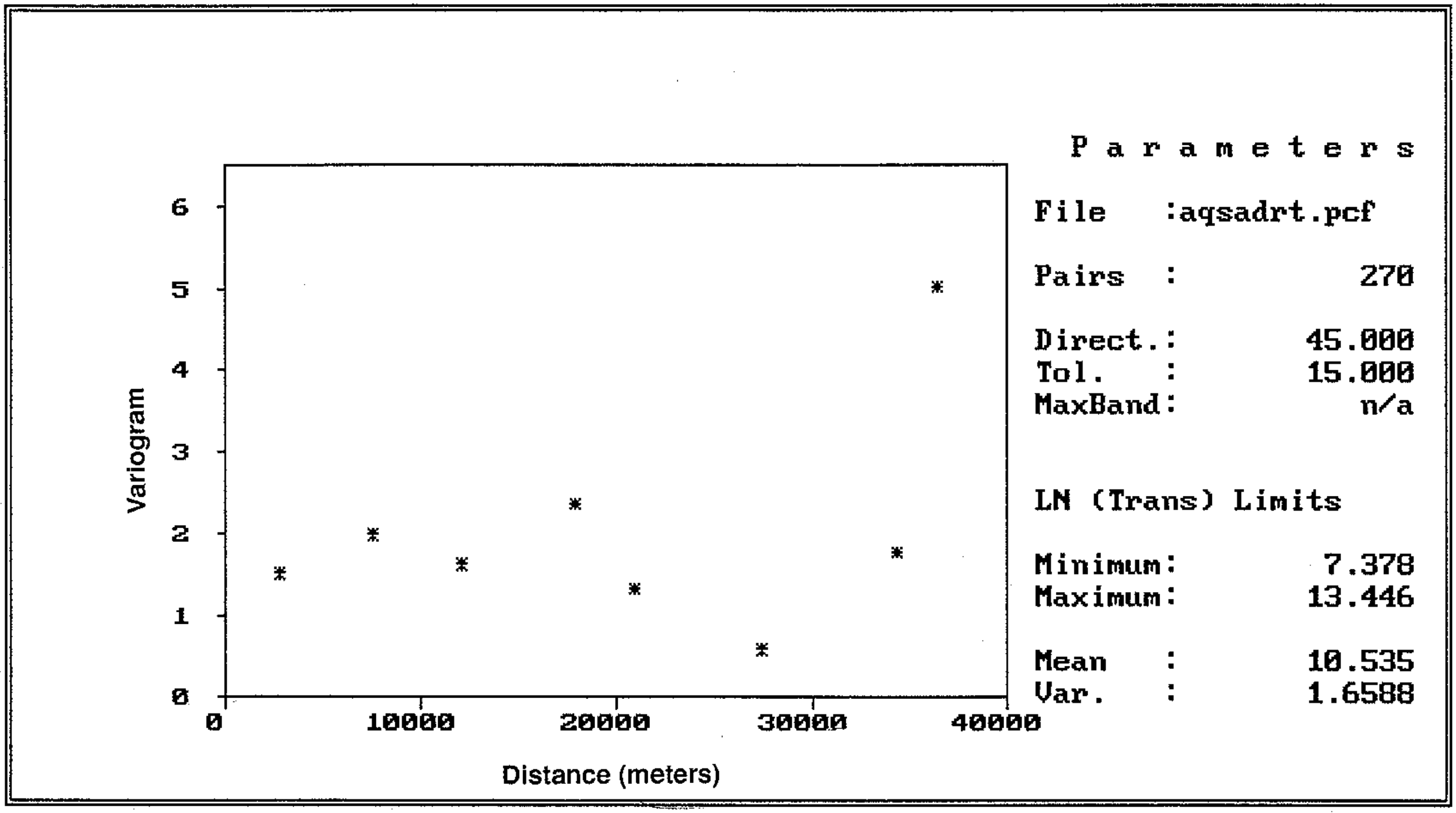
Variogram B of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)



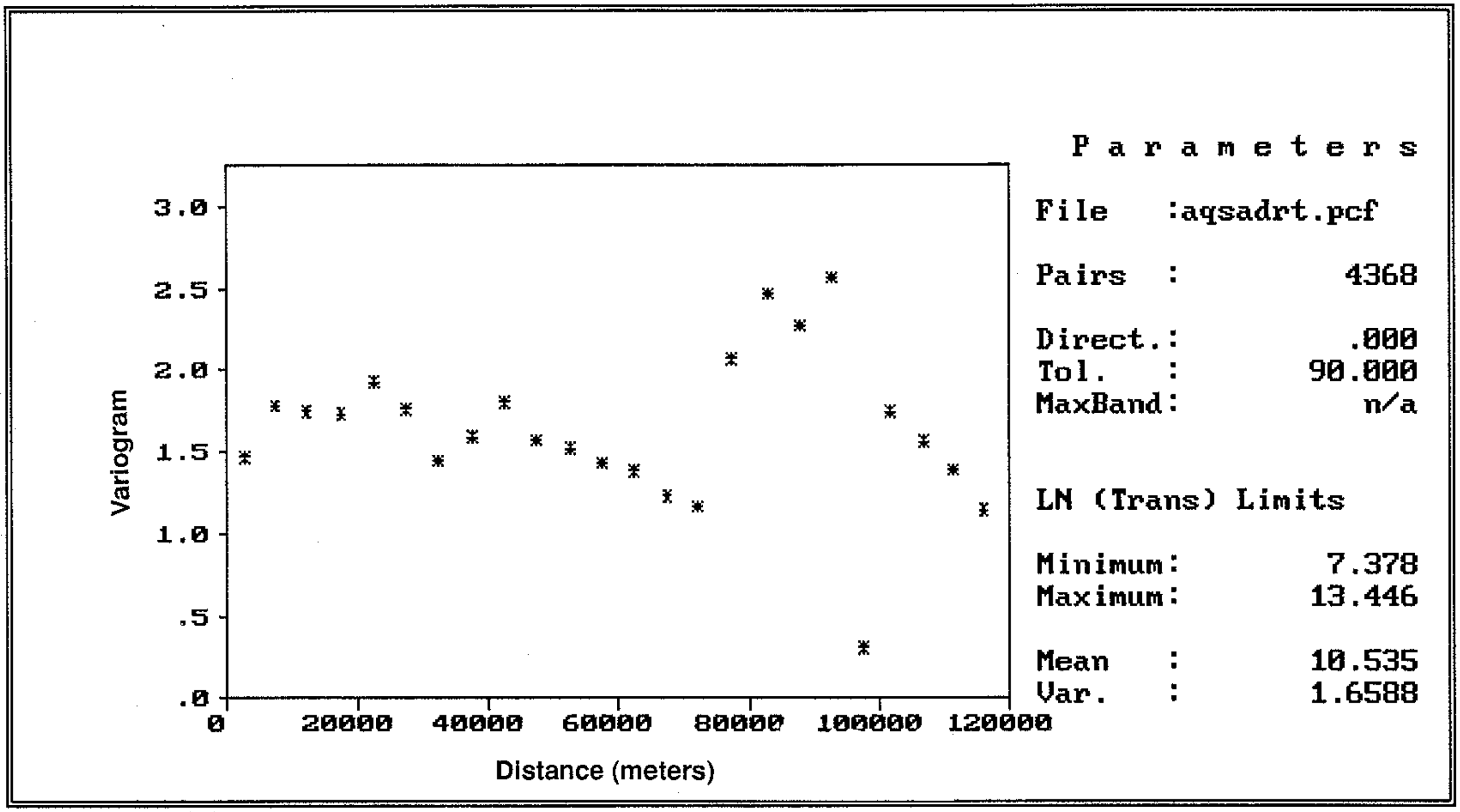
Variogram C of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)



Variogram D of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)



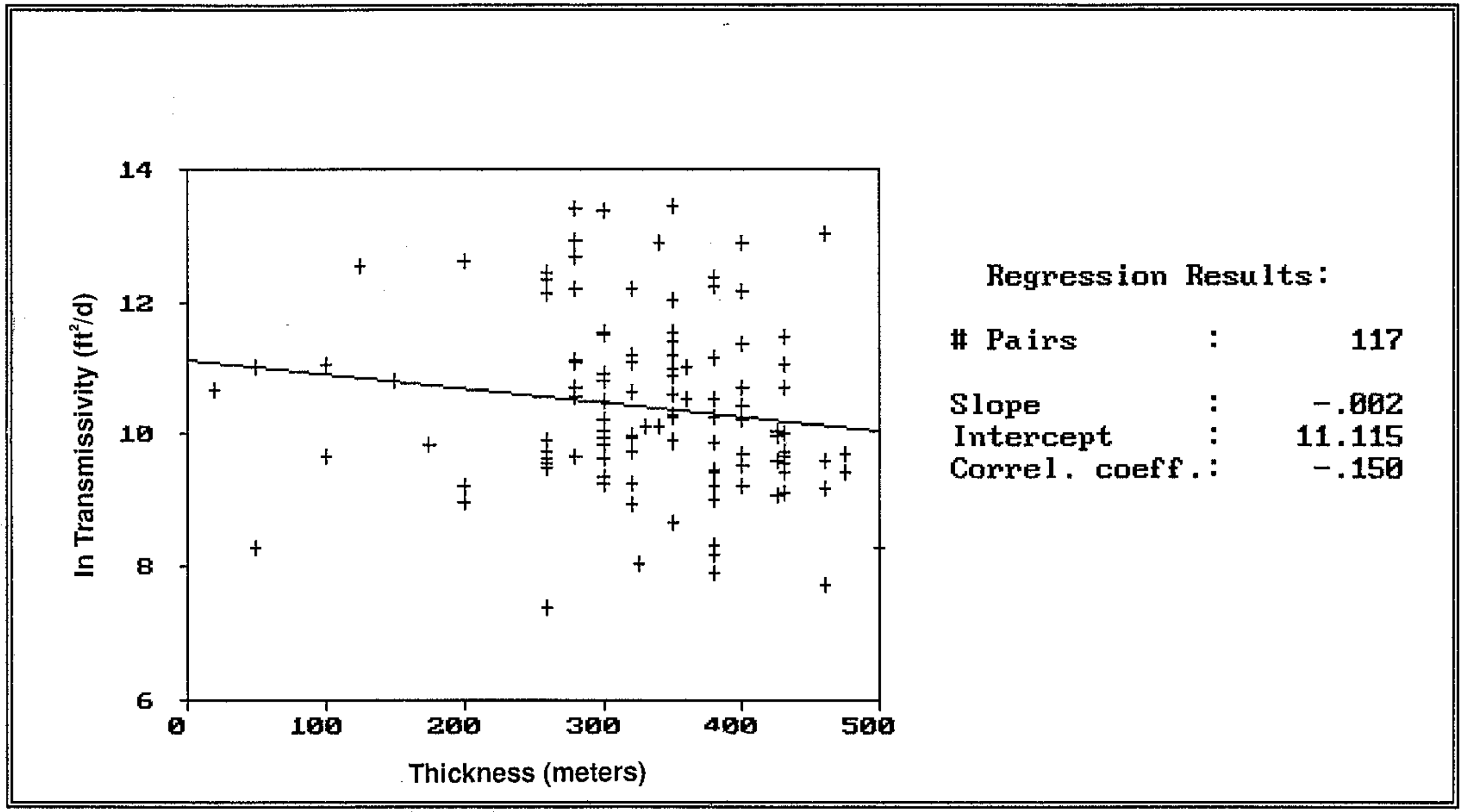
Variogram E of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)



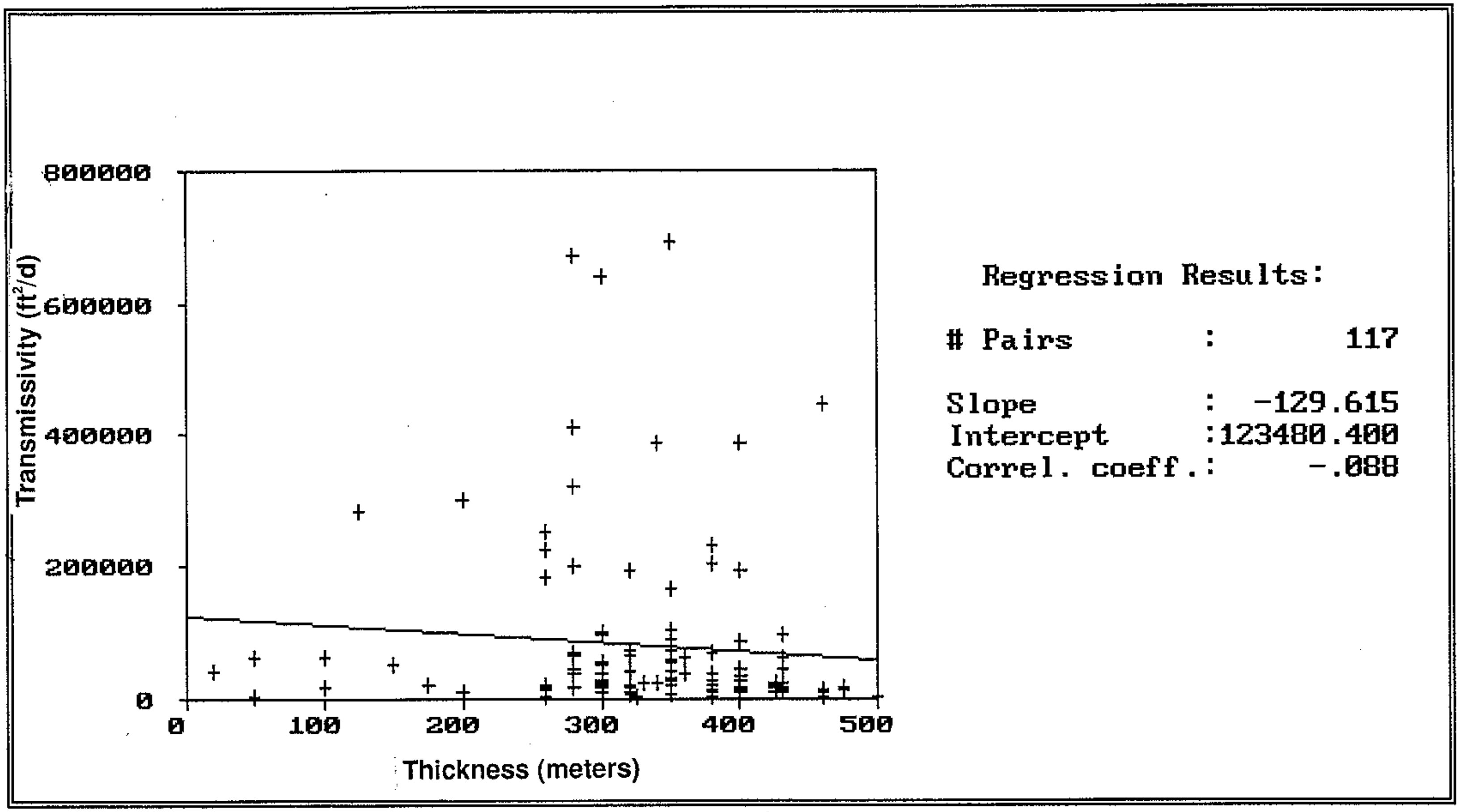
Variogram F of ln Transmissivity (ft^2/d)
for the Carbonate Aquifer
(San Andres Formation Test Data)

Appendix F, Part 13

Scatter Plots of In Transmissivity and Transmissivity vs. Thickness for the Carbonate Aquifer



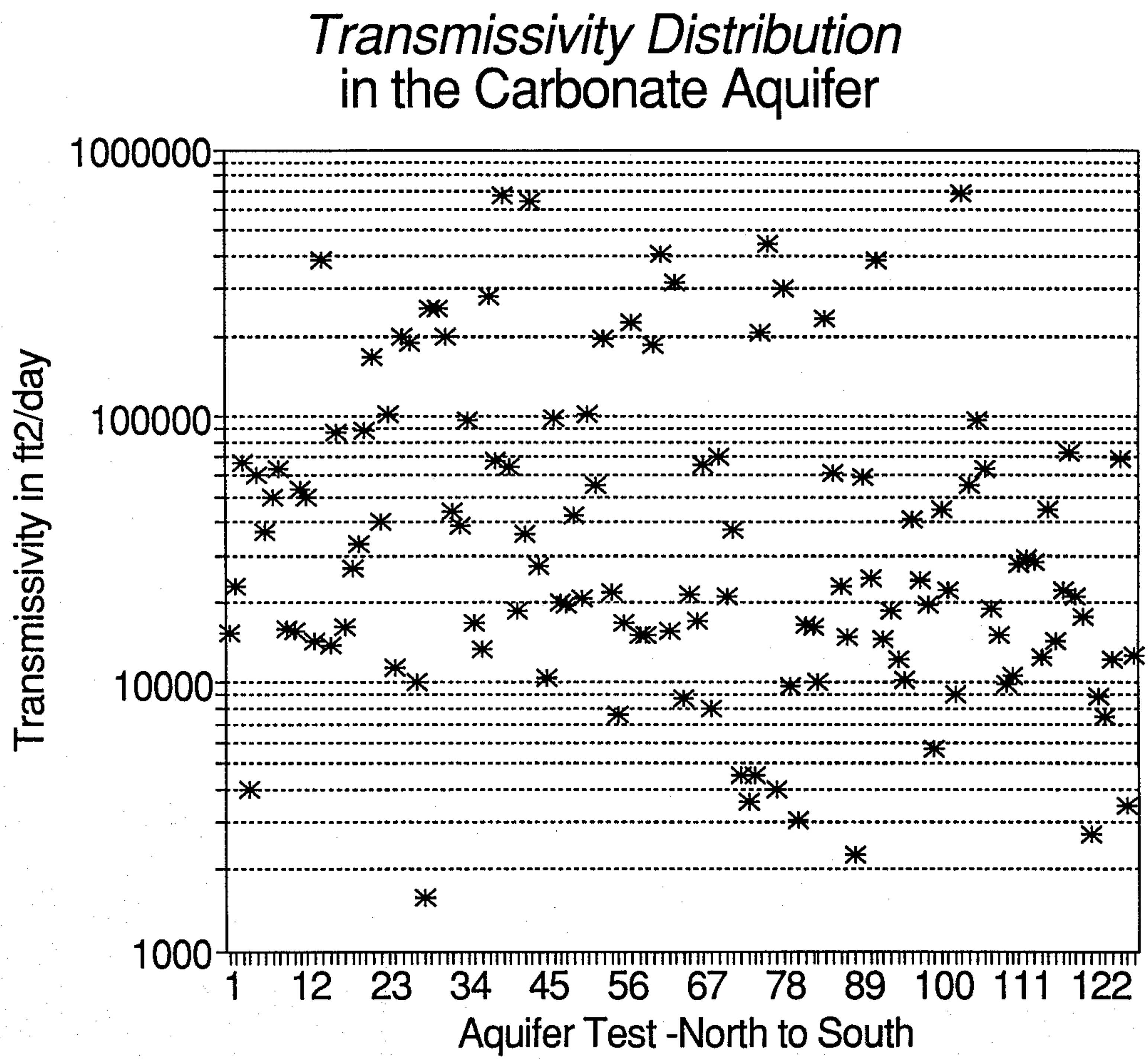
Scatter Plot of ln Transmissivity (ft^2/d) vs. Thickness (meters) for the Carbonate Aquifer (San Andres Formation and Artesia Group Test Data)



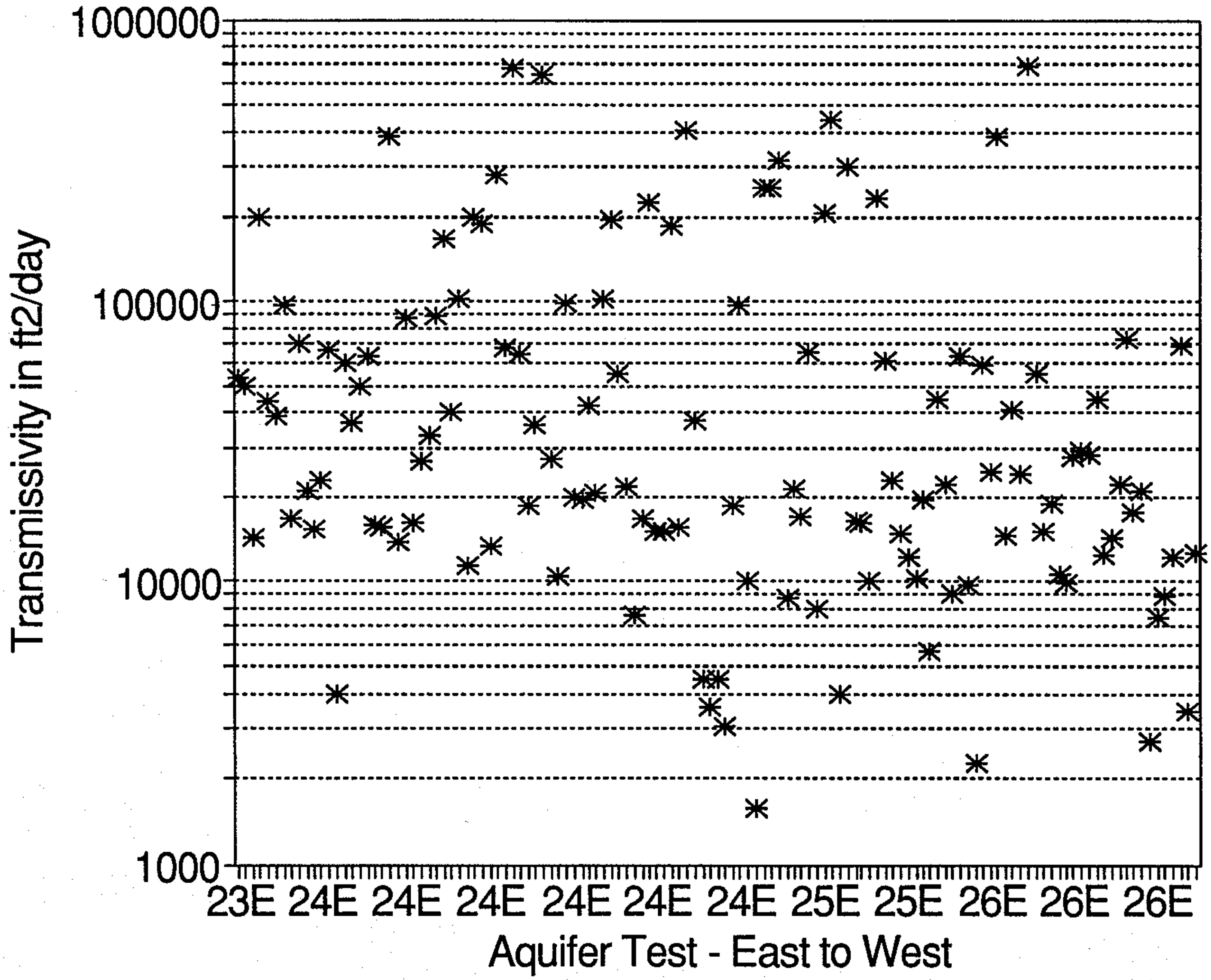
Scatter Plot of Transmissivity (ft^2/d) vs.
Thickness (meters) for the Carbonate Aquifer
(San Andres Formation and Artesia Group Test Data)

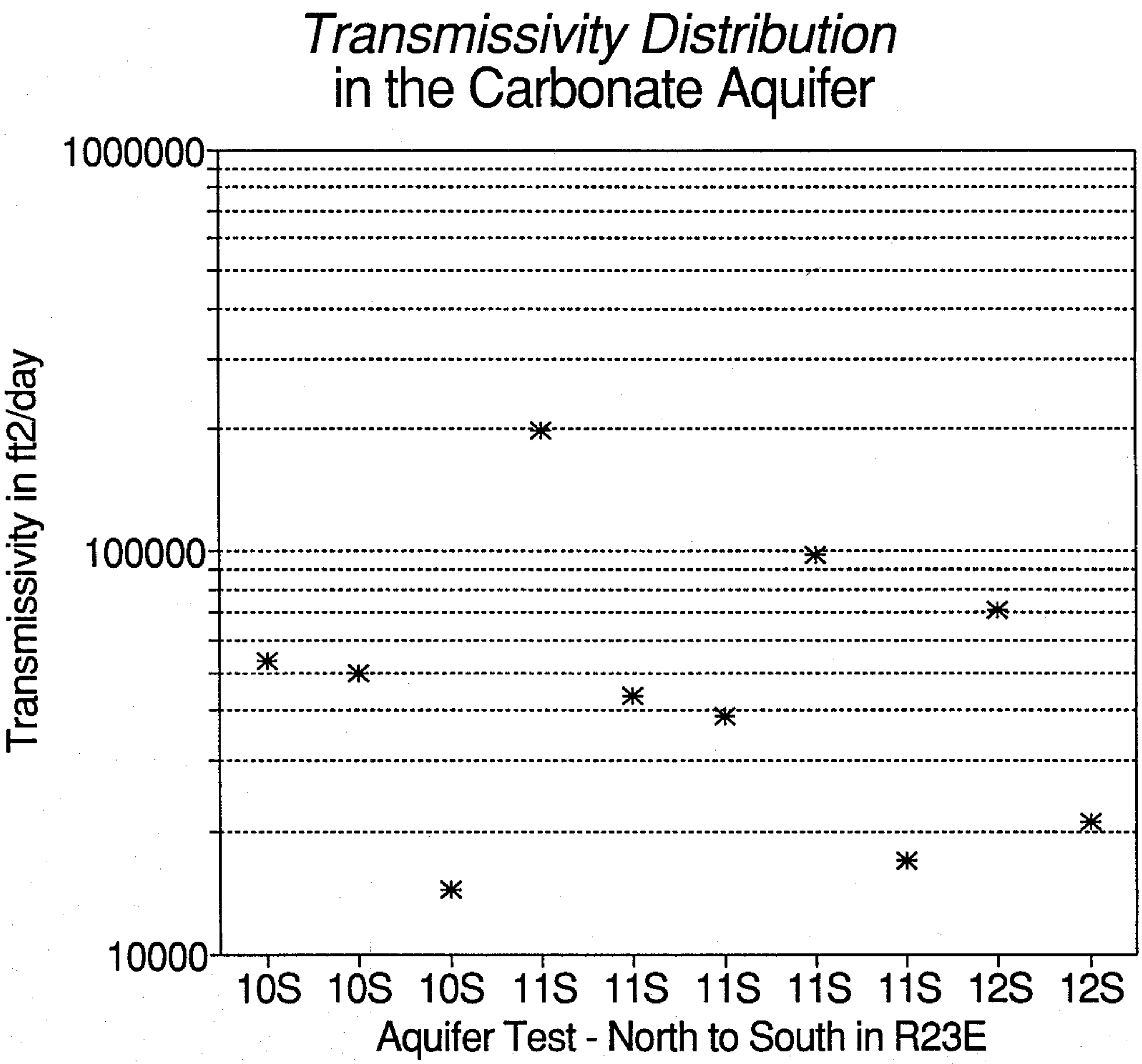
Appendix F, Part 14

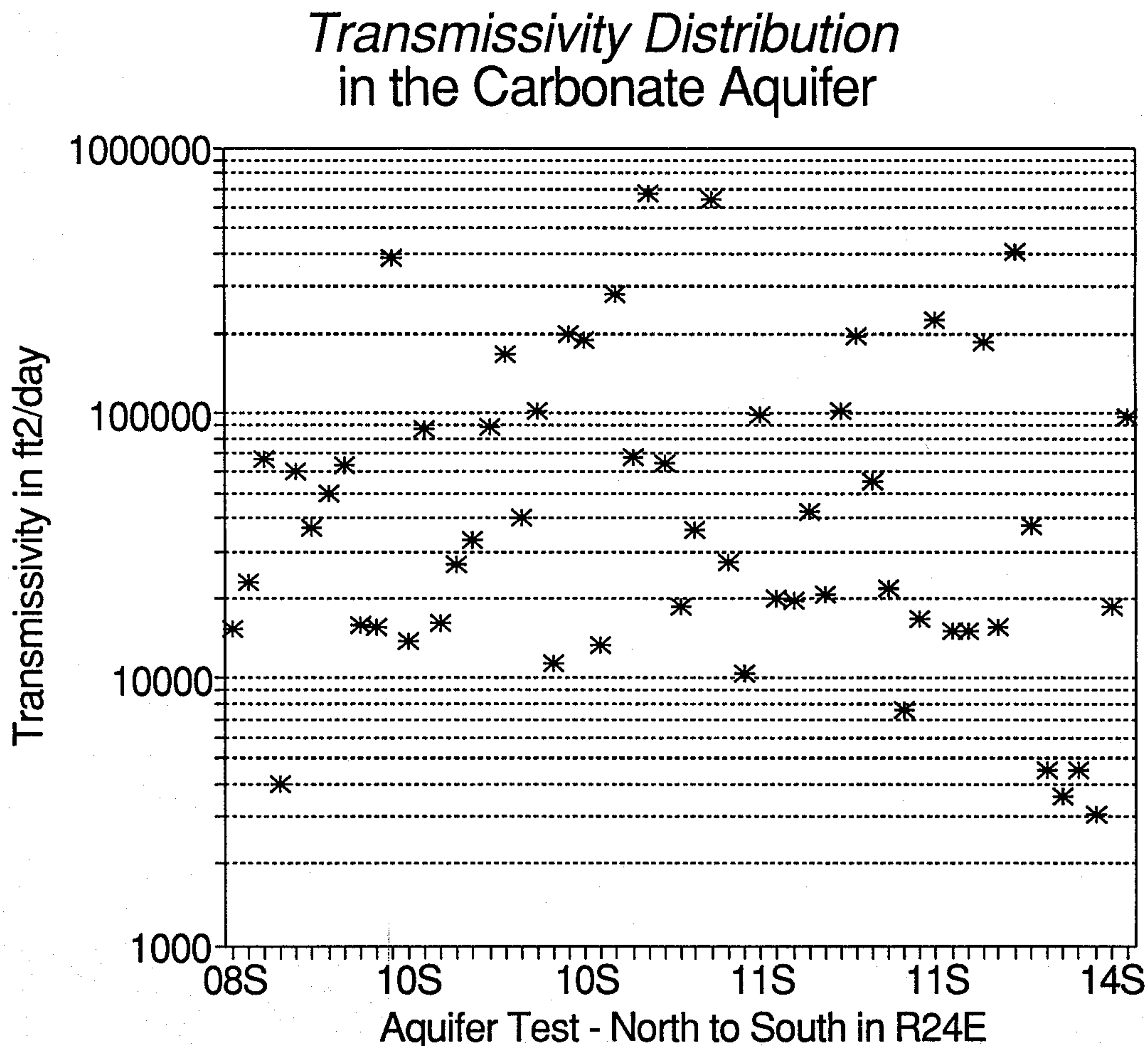
Regional Log Transmissivity Distribution for the Carbonate Aquifer


Transmissivity Distribution
in the Carbonate Aquifer
Transmissivity in ft2/day
1000000
100000
10000
1000
1
12
23
34
45
56
67
78
89
100
111
122
Aquifer Test -North to South

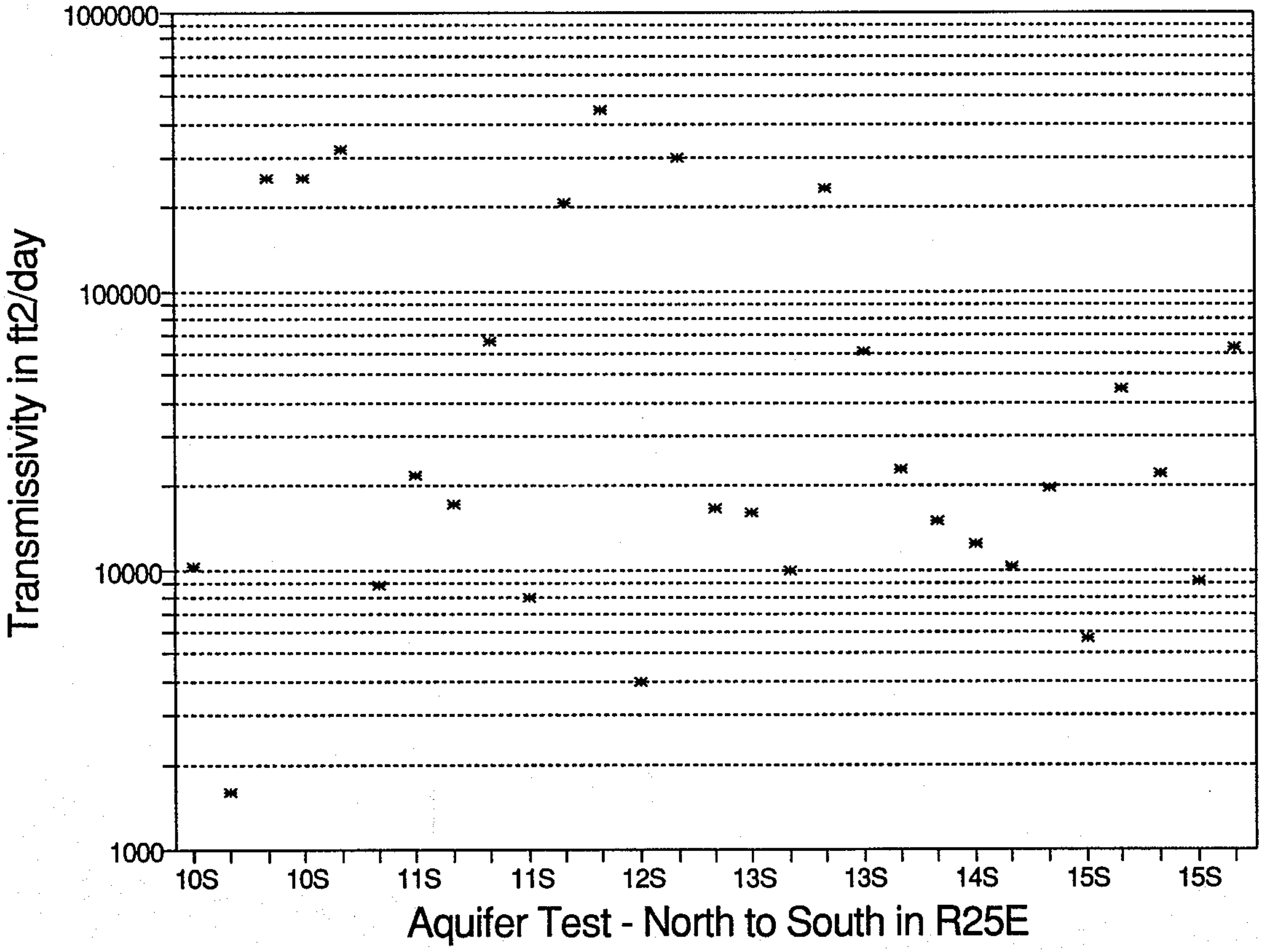
Transmissivity Distribution in the Carbonate Aquifer

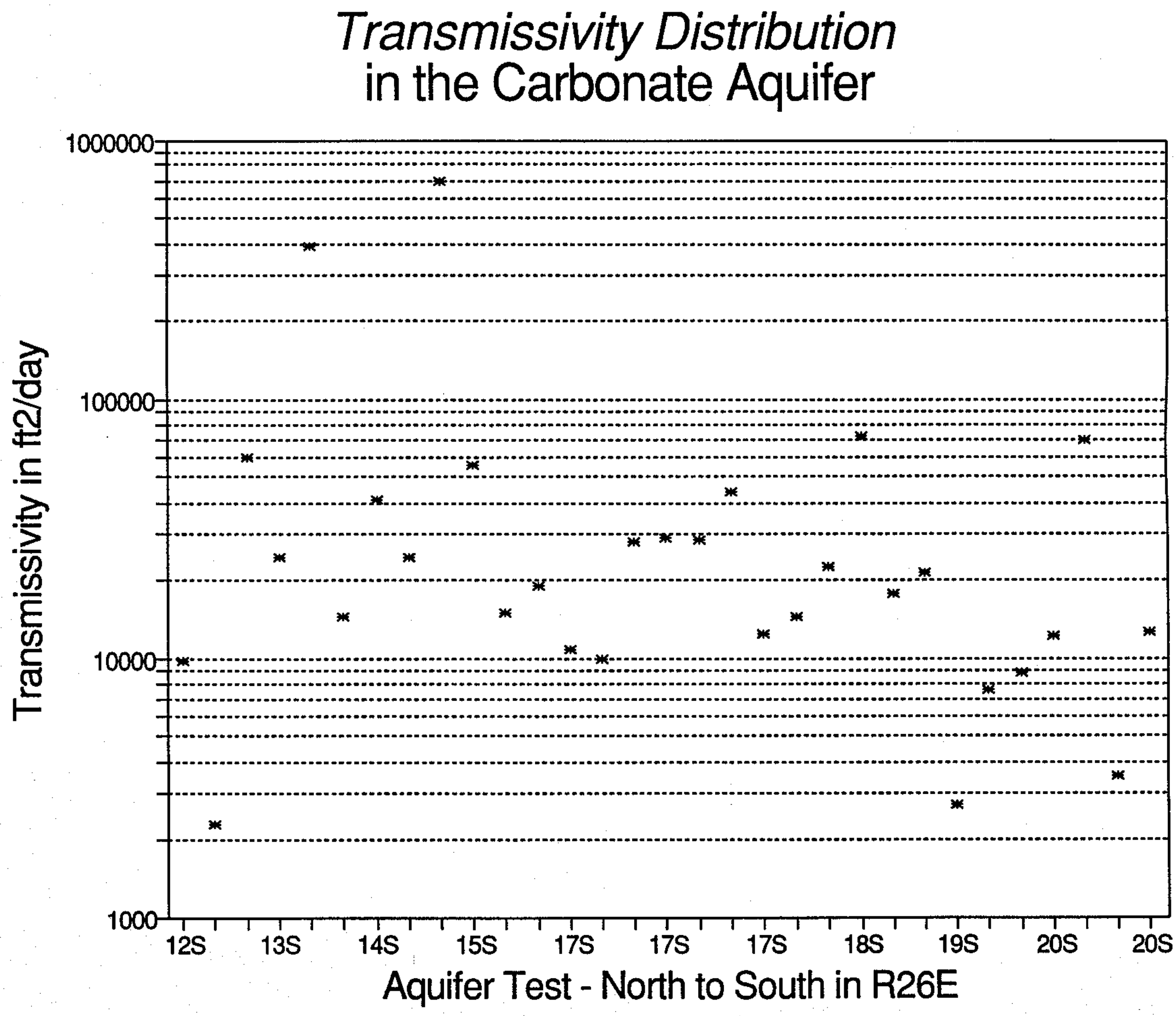



Transmissivity Distribution
in the Carbonate Aquifer
1000000
100000
10000
Transmissivity in ft2/day
10S
10S
10S
11S
11S
11S
11S
11S
12S
12S
Aquifer Test - North to South in R23E

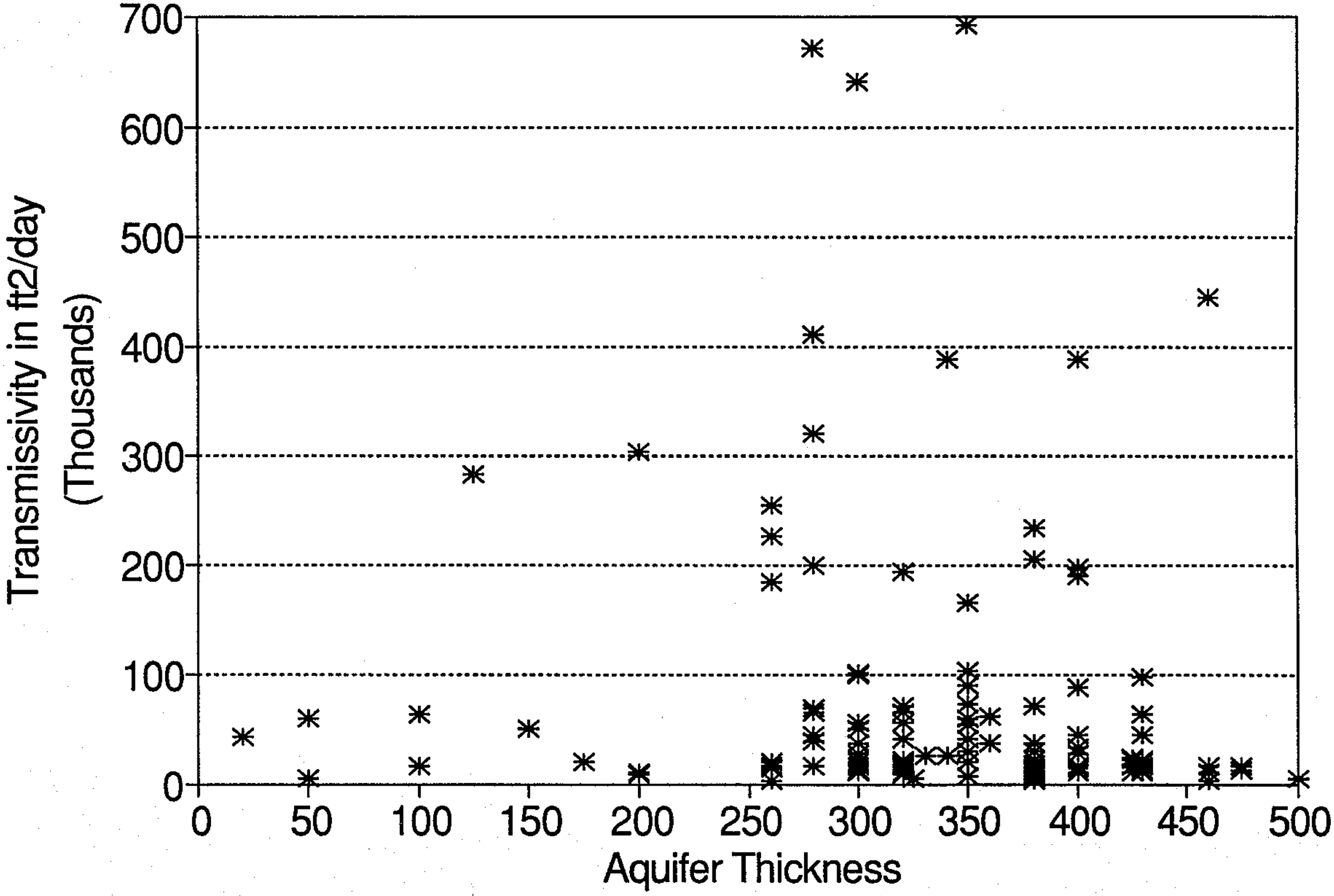

Transmissivity Distribution
in the Carbonate Aquifer
1000000
100000
10000
1000
Transmissivity in ft2/day
08S
10S
10S
11S
11S
14S
Aquifer Test - North to South in R24E

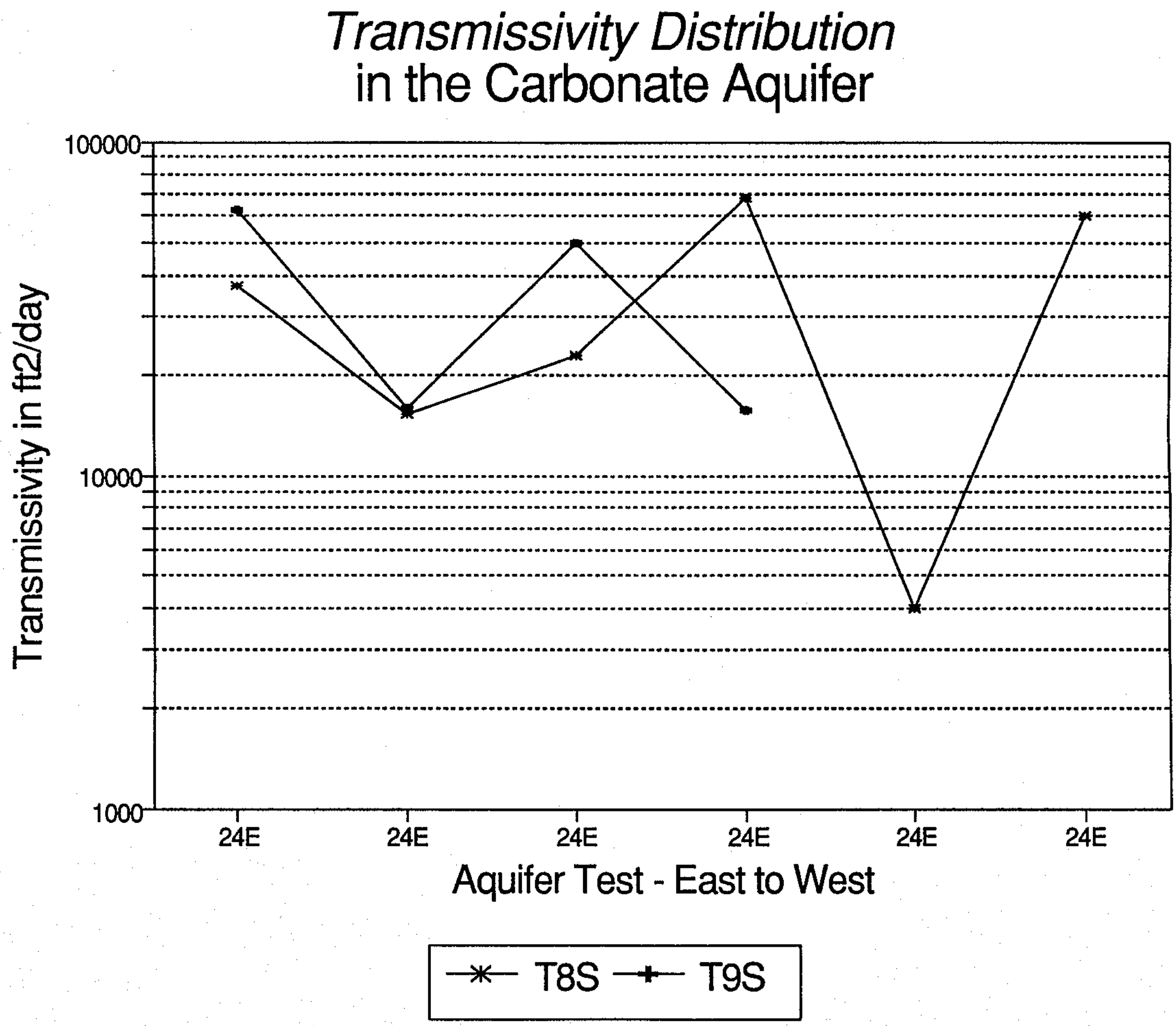
Transmissivity Distribution in the Carbonate Aquifer



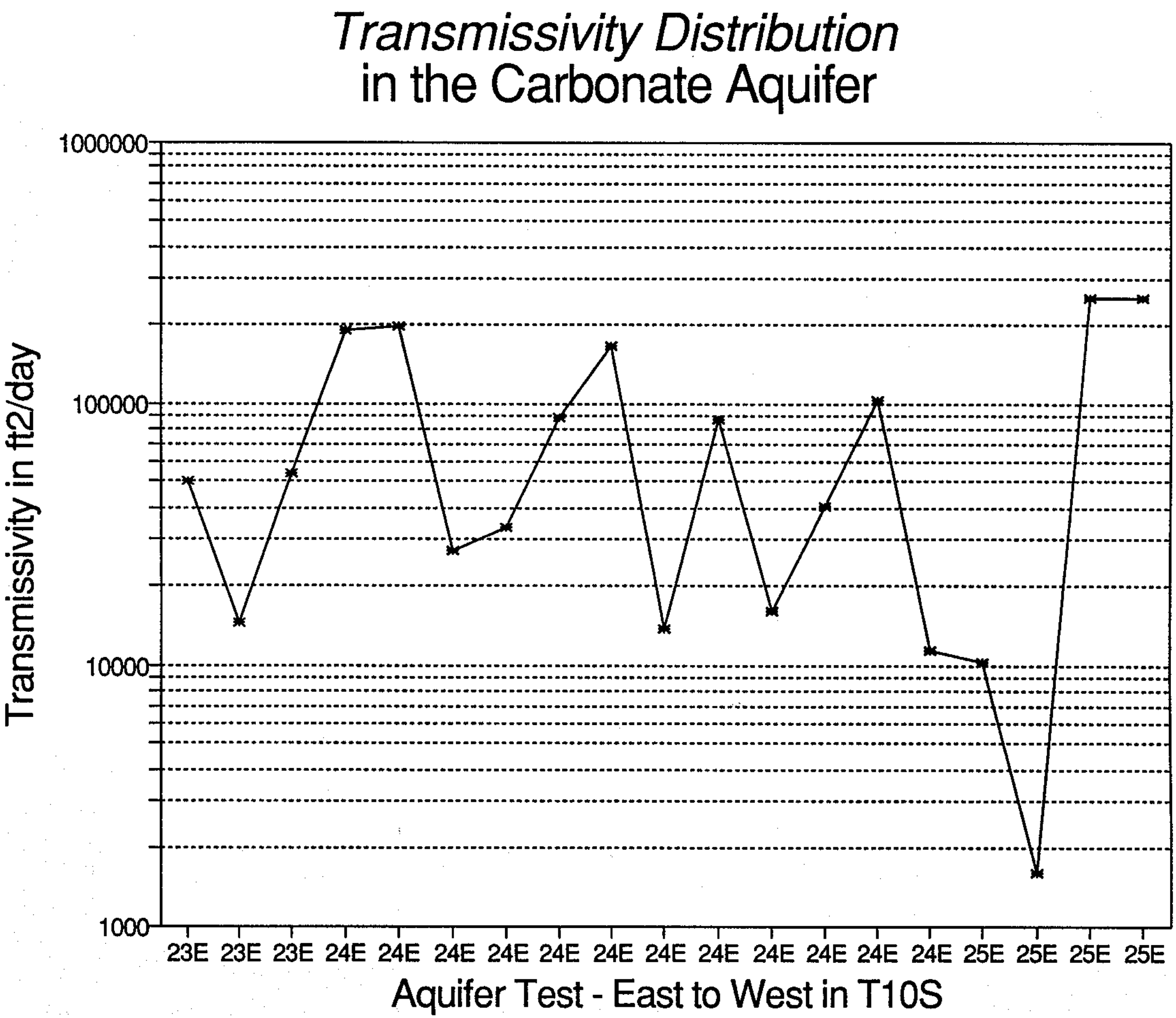

Transmissivity Distribution
in the Carbonate Aquifer
Transmissivity in ft2/day
1000000
100000
10000
1000
12S
13S
14S
15S
17S
17S
17S
18S
19S
20S
20S
Aquifer Test - North to South in R26E

Transmissivity vs. Aquifer Thickness in the Carbonate Aquifer

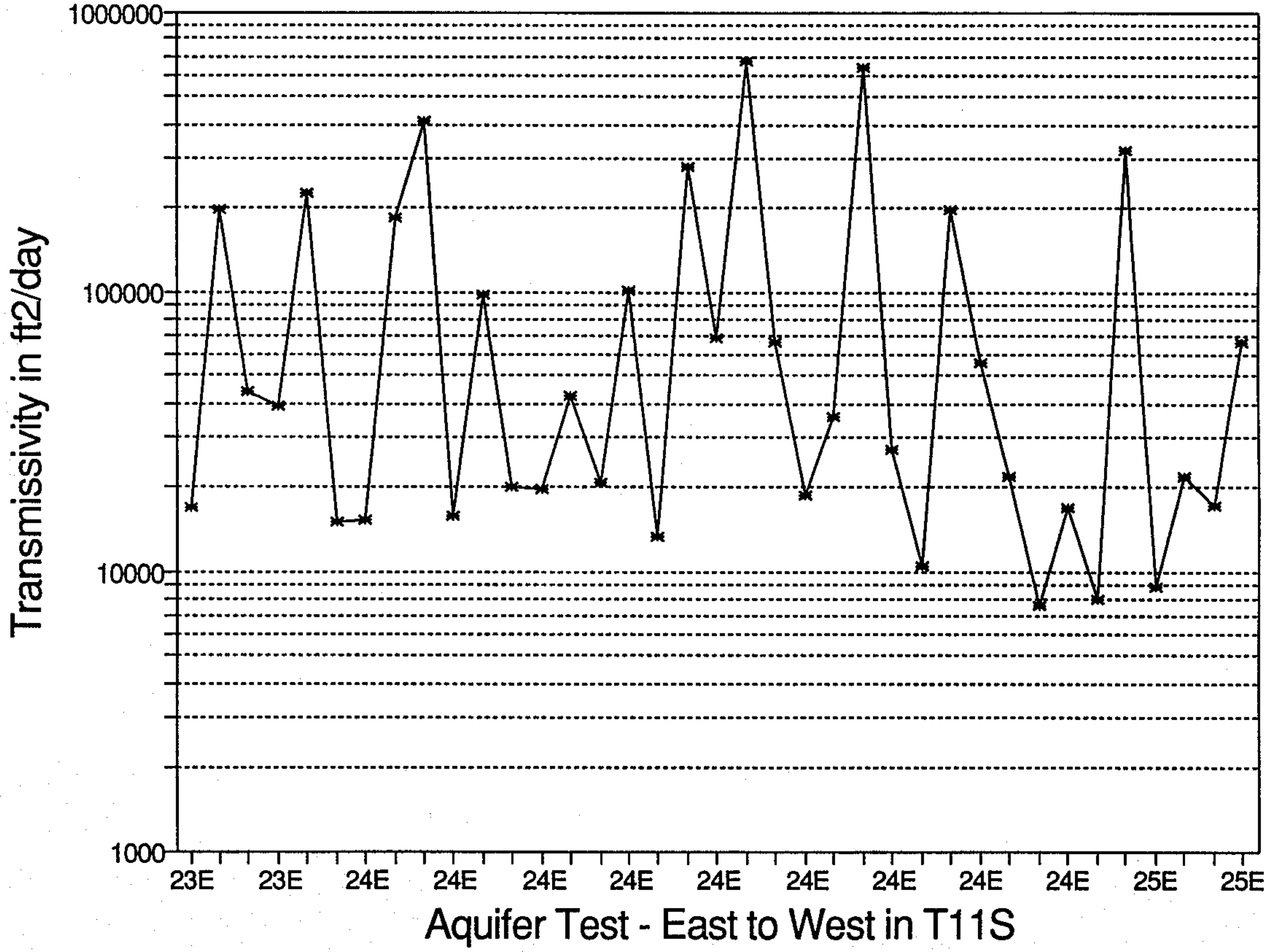


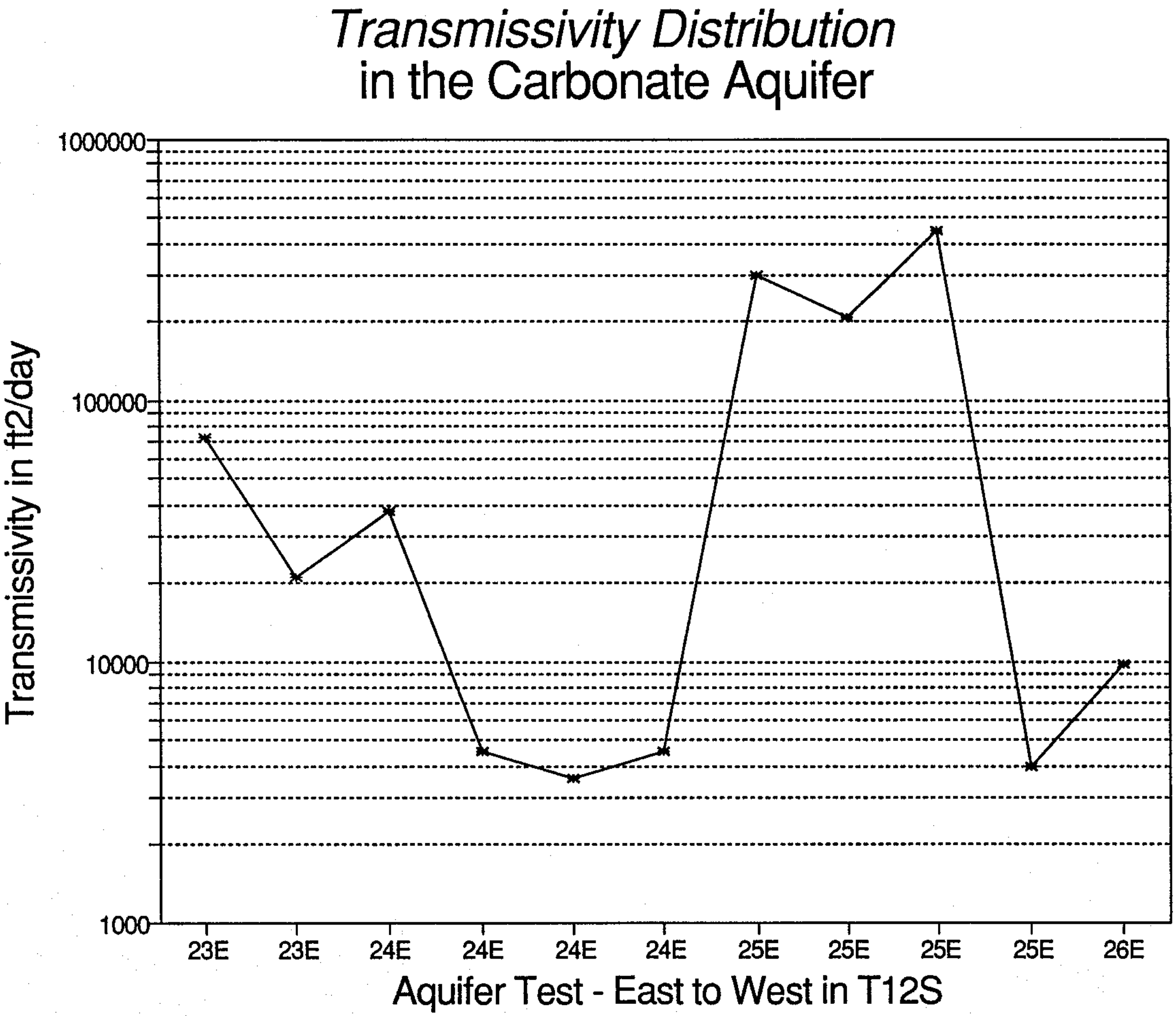


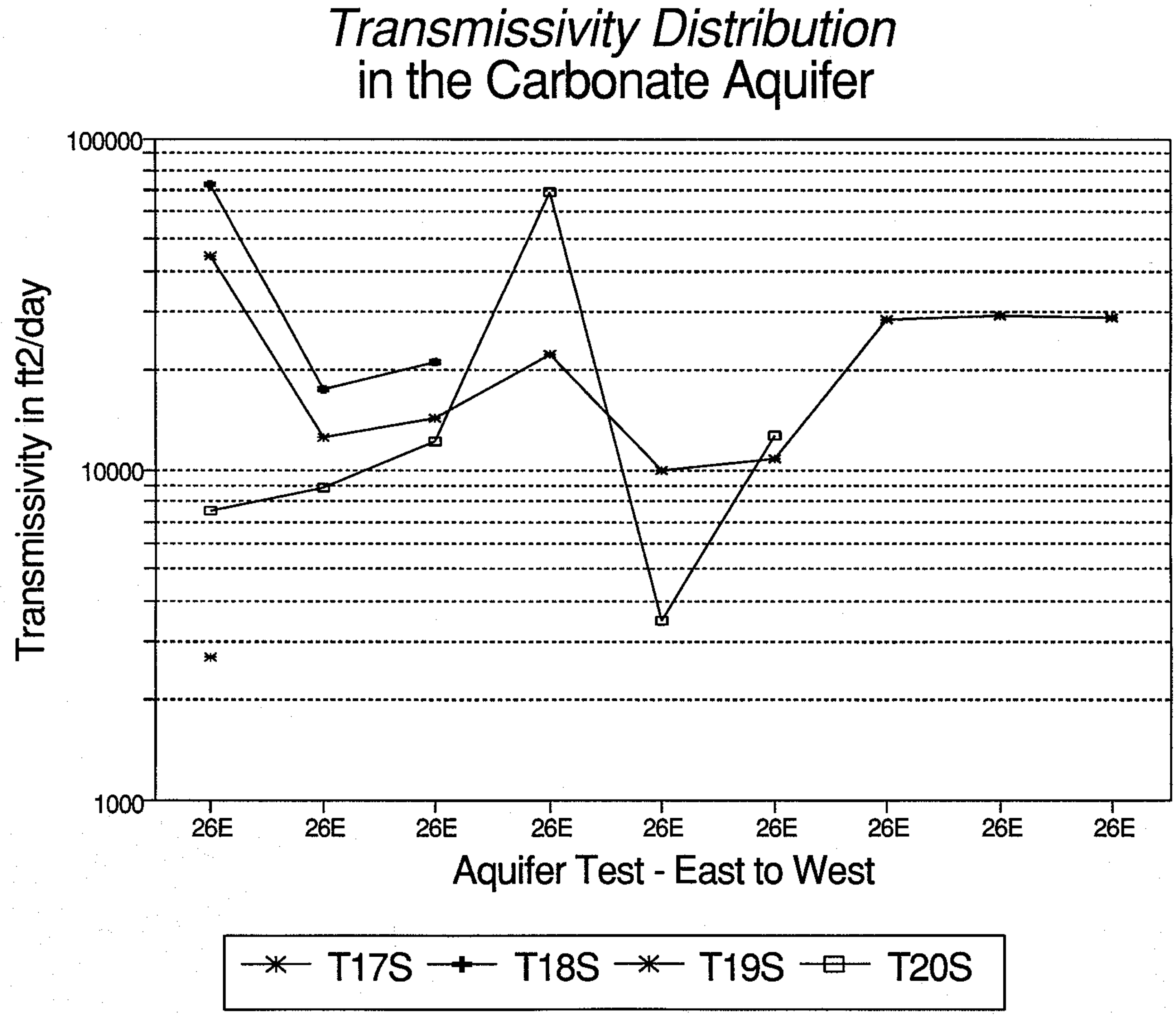
Transmissivity Distribution
in the Carbonate Aquifer
100000
10000
1000
Transmissivity in ft2/day
24E
24E
24E
24E
24E
24E
Aquifer Test - East to West
T8S
T9S


Transmissivity Distribution
in the Carbonate Aquifer
1000000
100000
10000
1000
Transmissivity in ft2/day
23E 23E 23E 24E 24E 24E 24E 24E 24E 24E 24E 24E 24E 24E 24E 25E 25E 25E 25E
Aquifer Test - East to West in T10S

Transmissivity Distribution in the Carbonate Aquifer




Transmissivity Distribution
in the Carbonate Aquifer
1000000
100000
10000
1000
Transmissivity in ft2/day
23E
23E
24E
24E
24E
24E
25E
25E
25E
25E
26E
Aquifer Test - East to West in T12S

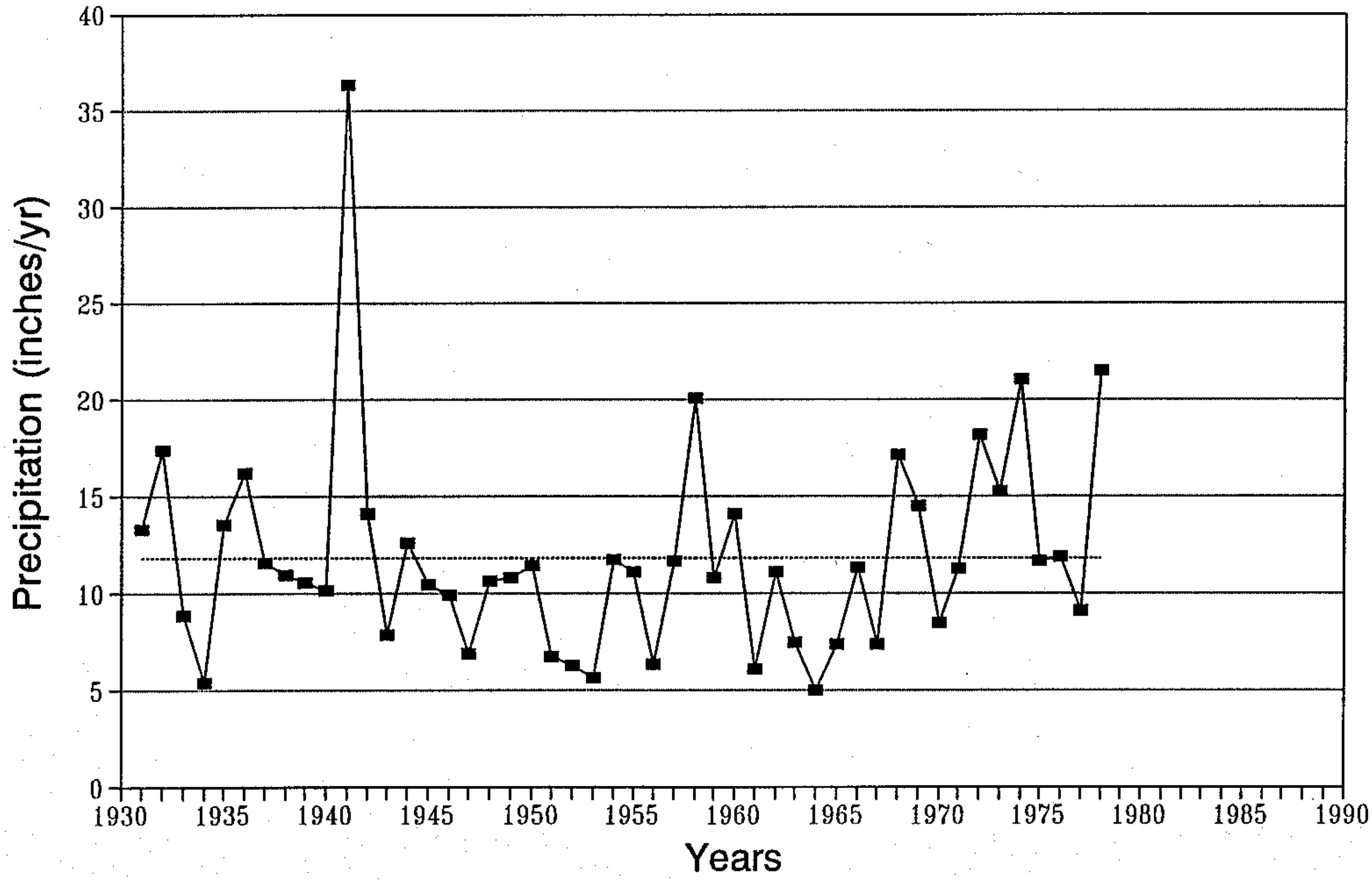


Transmissivity Distribution
in the Carbonate Aquifer
100000
10000
1000
Transmissivity in ft2/day
26E
26E
26E
26E
26E
26E
26E
26E
26E
Aquifer Test - East to West
T17S
T18S
T19S
T20S

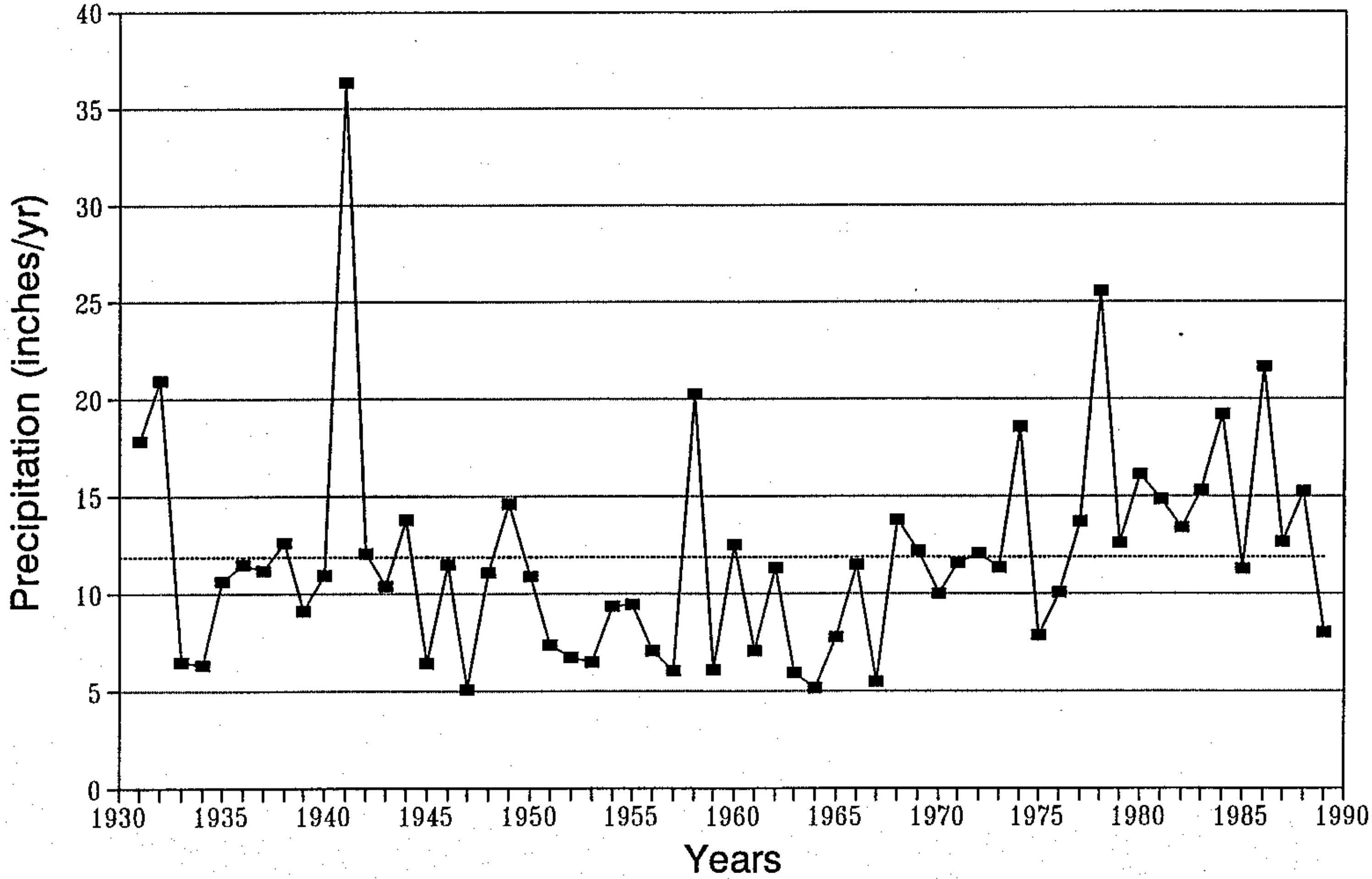
APPENDIX G

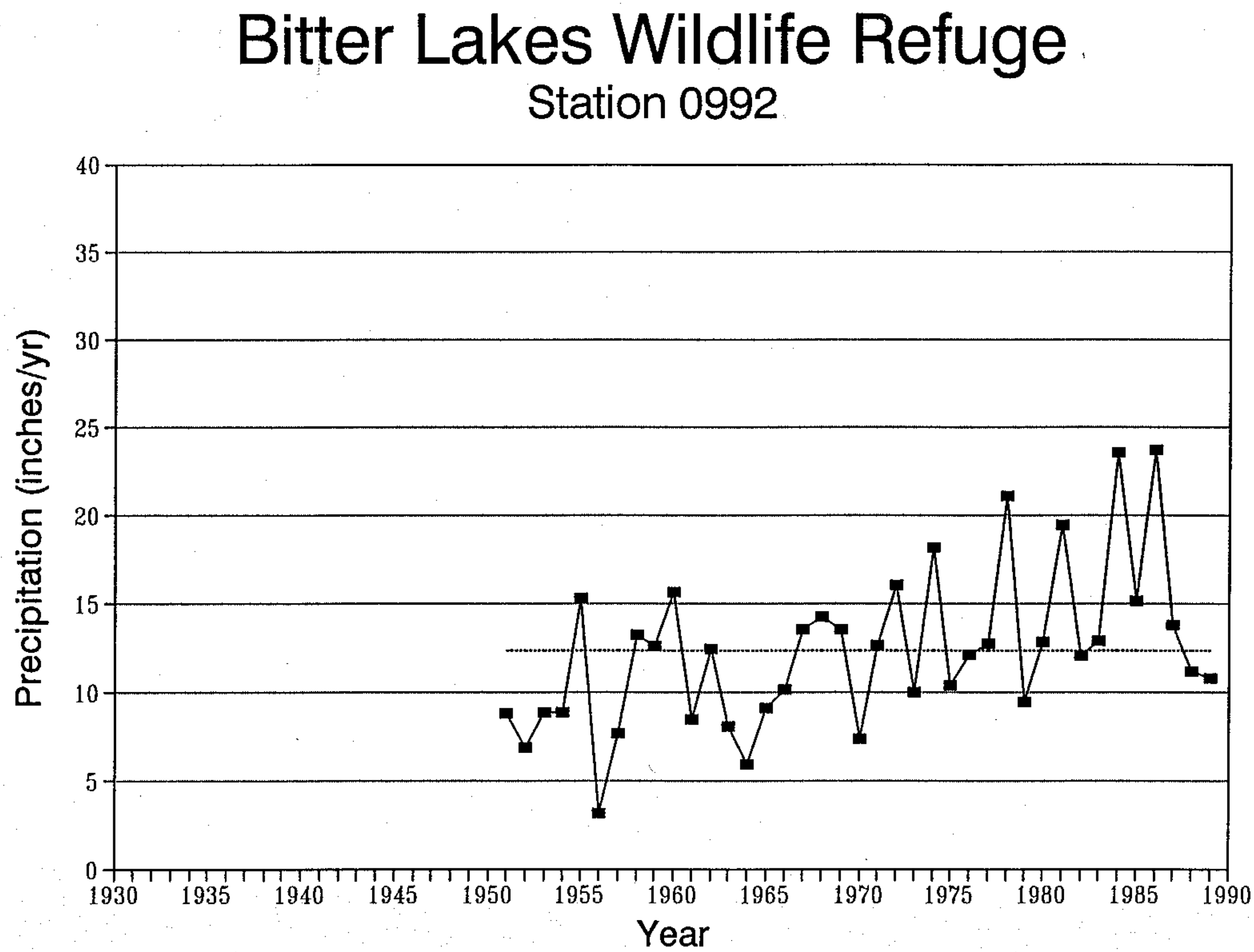
ANNUAL PRECIPITATION FOR SELECTED STATIONS

Lake Avalon
Station 4736



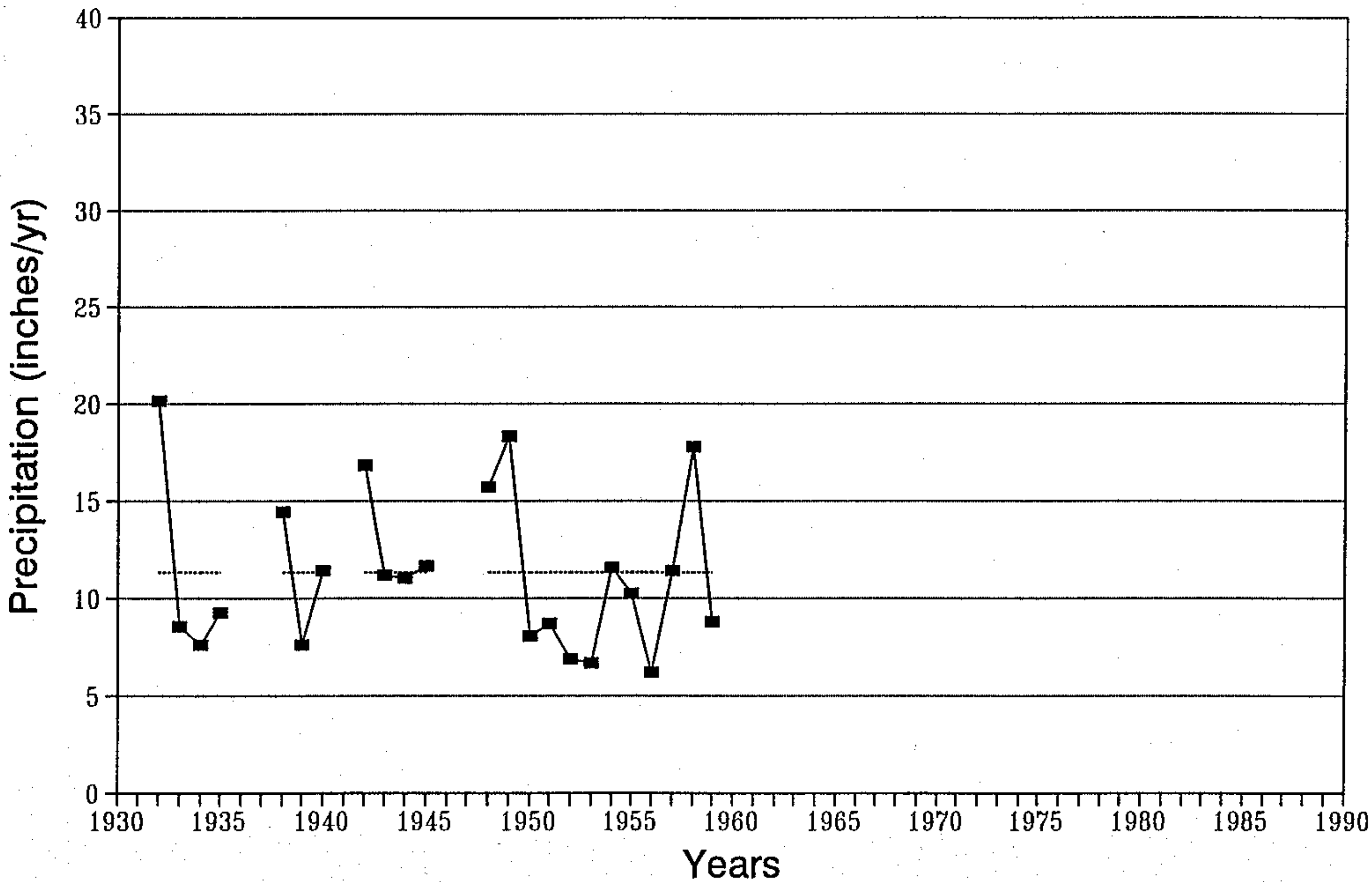
Artesia
Station 0600

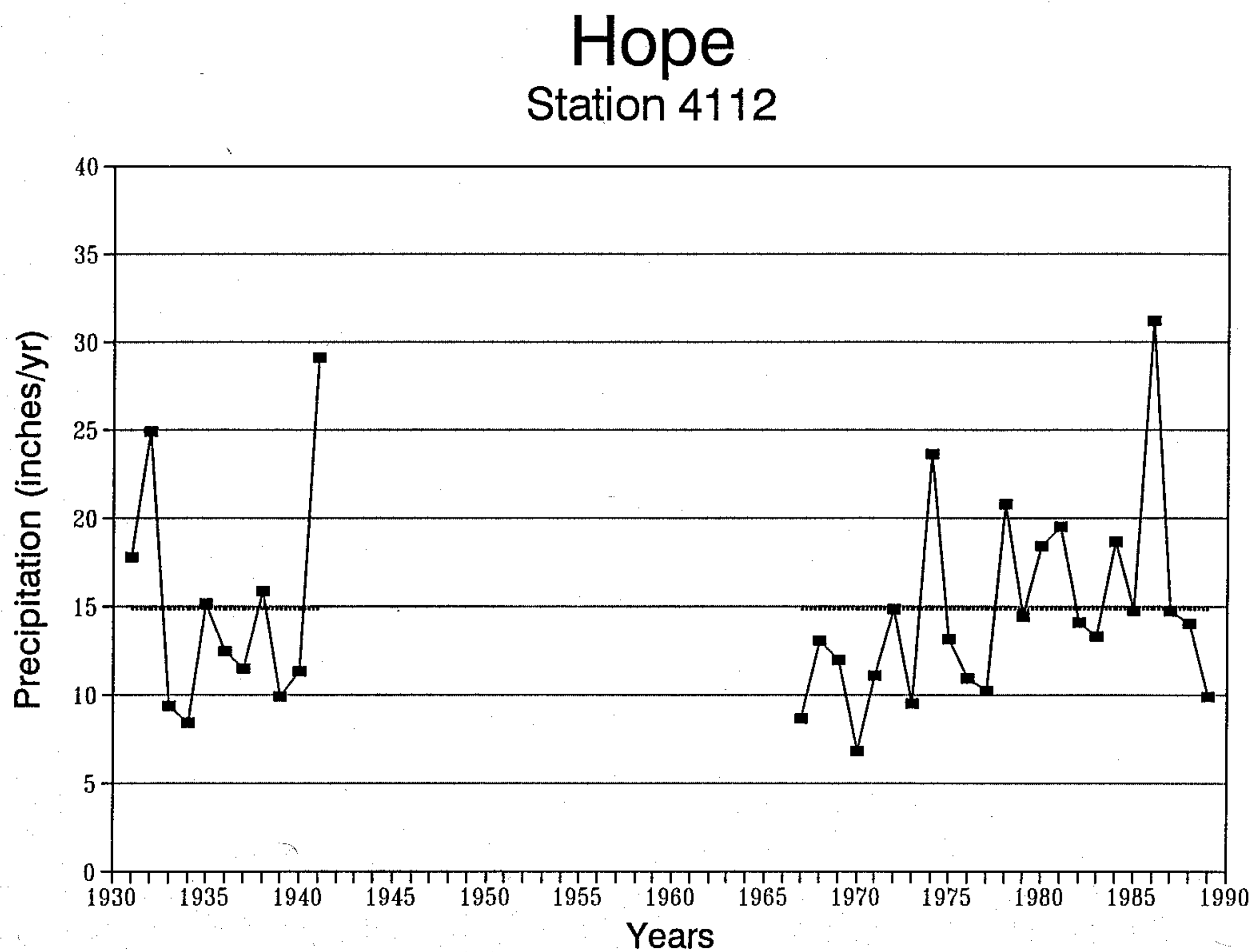




Bitter Lakes Wildlife Refuge
Station 0992
Precipitation (inches/yr)
0
5
10
15
20
25
30
35
40
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Year

Hagerman
Station 3792

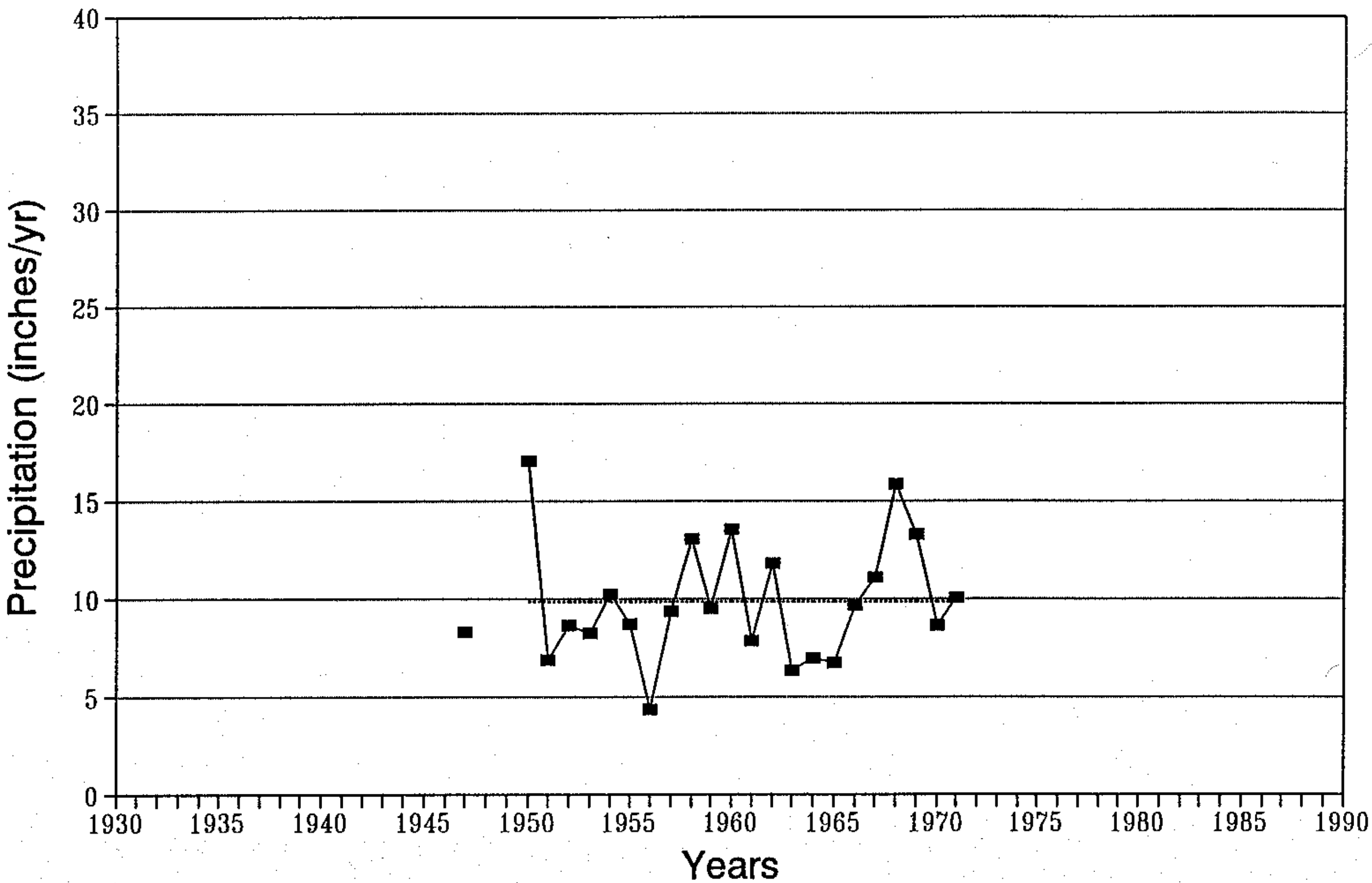




Hope
Station 4112
Precipitation (inches/yr)
Years
0
5
10
15
20
25
30
35
40
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990

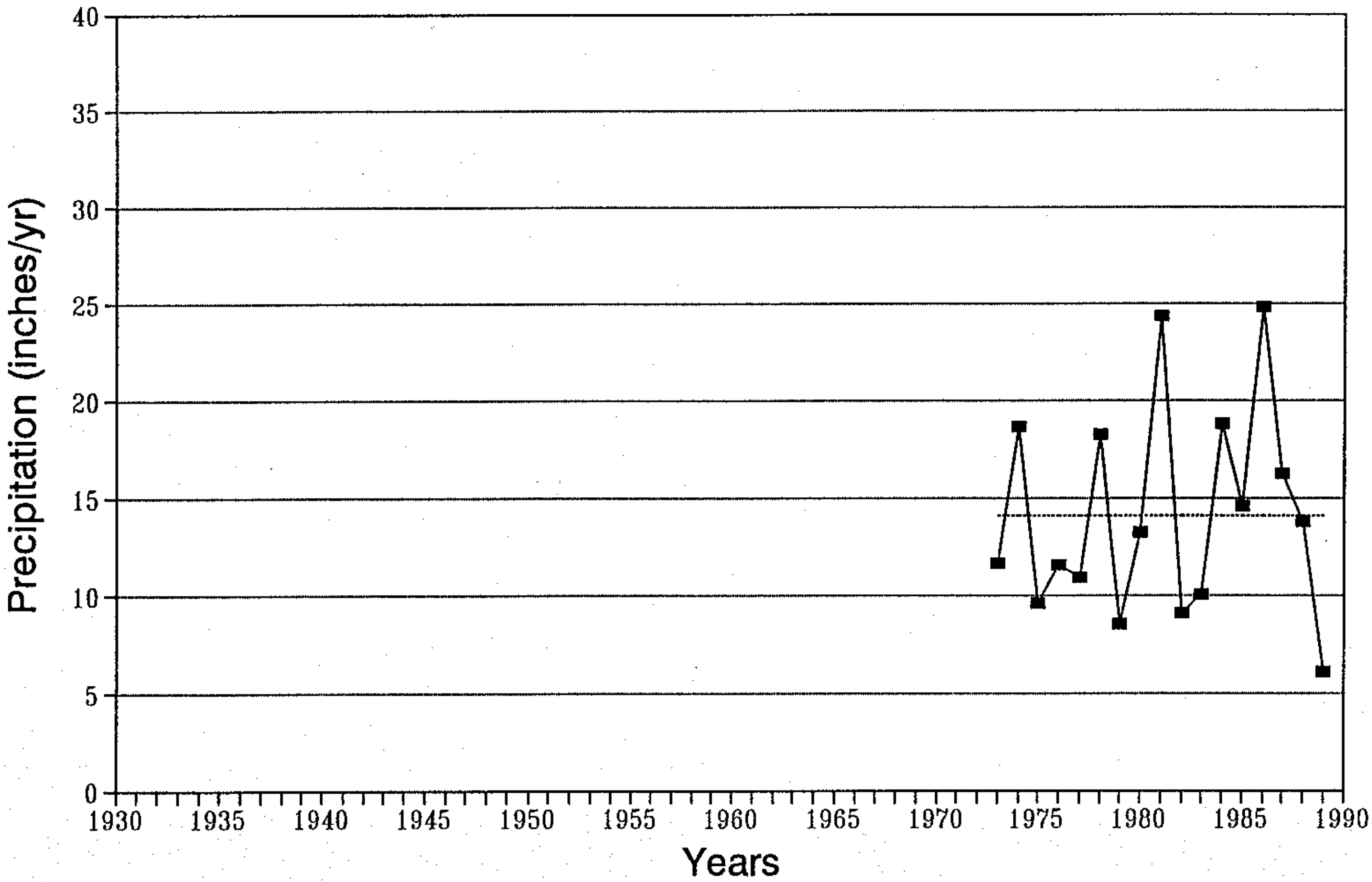
Roswell WB Airport

Station 7609



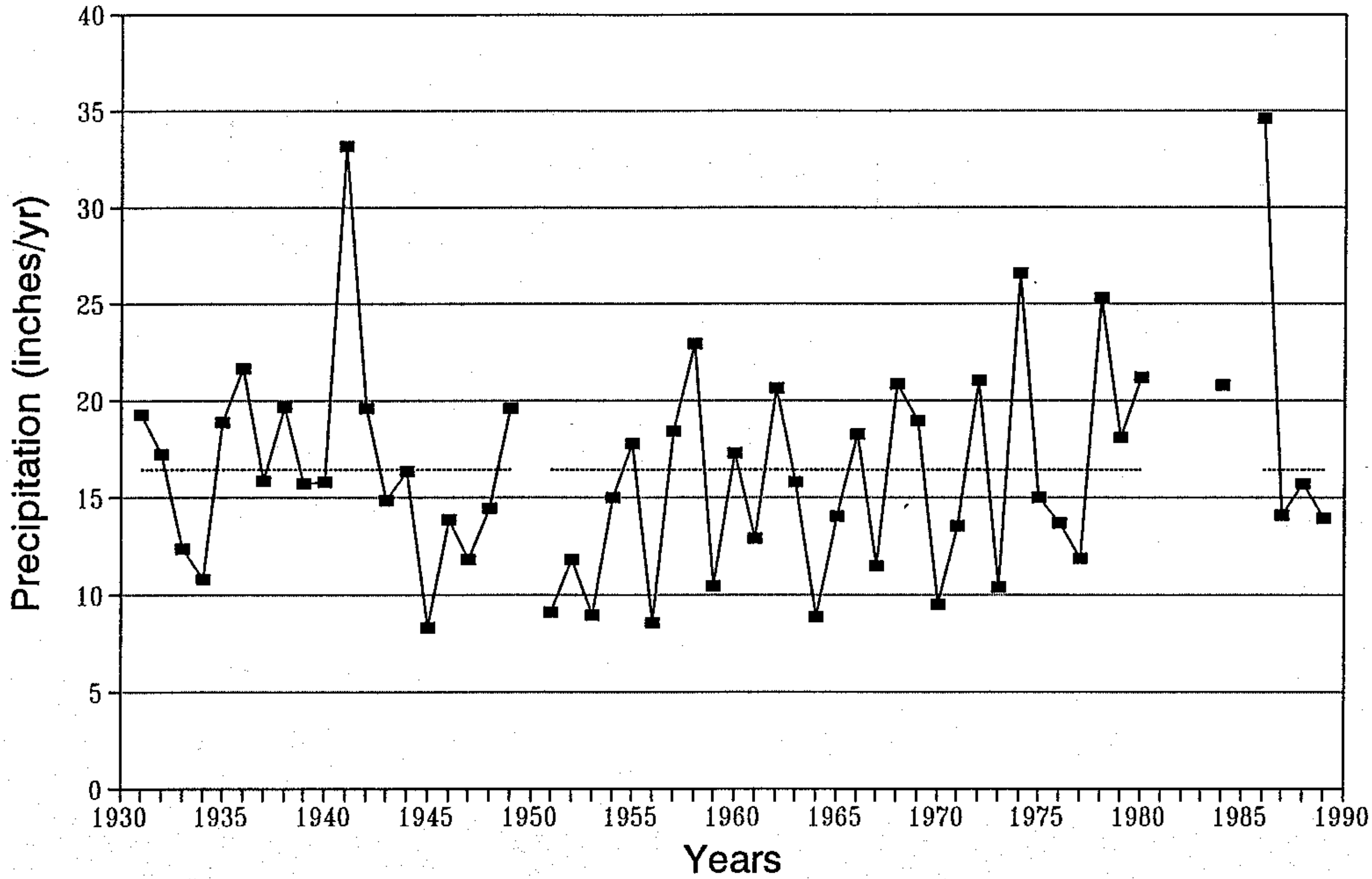
Roswell FAA Airport

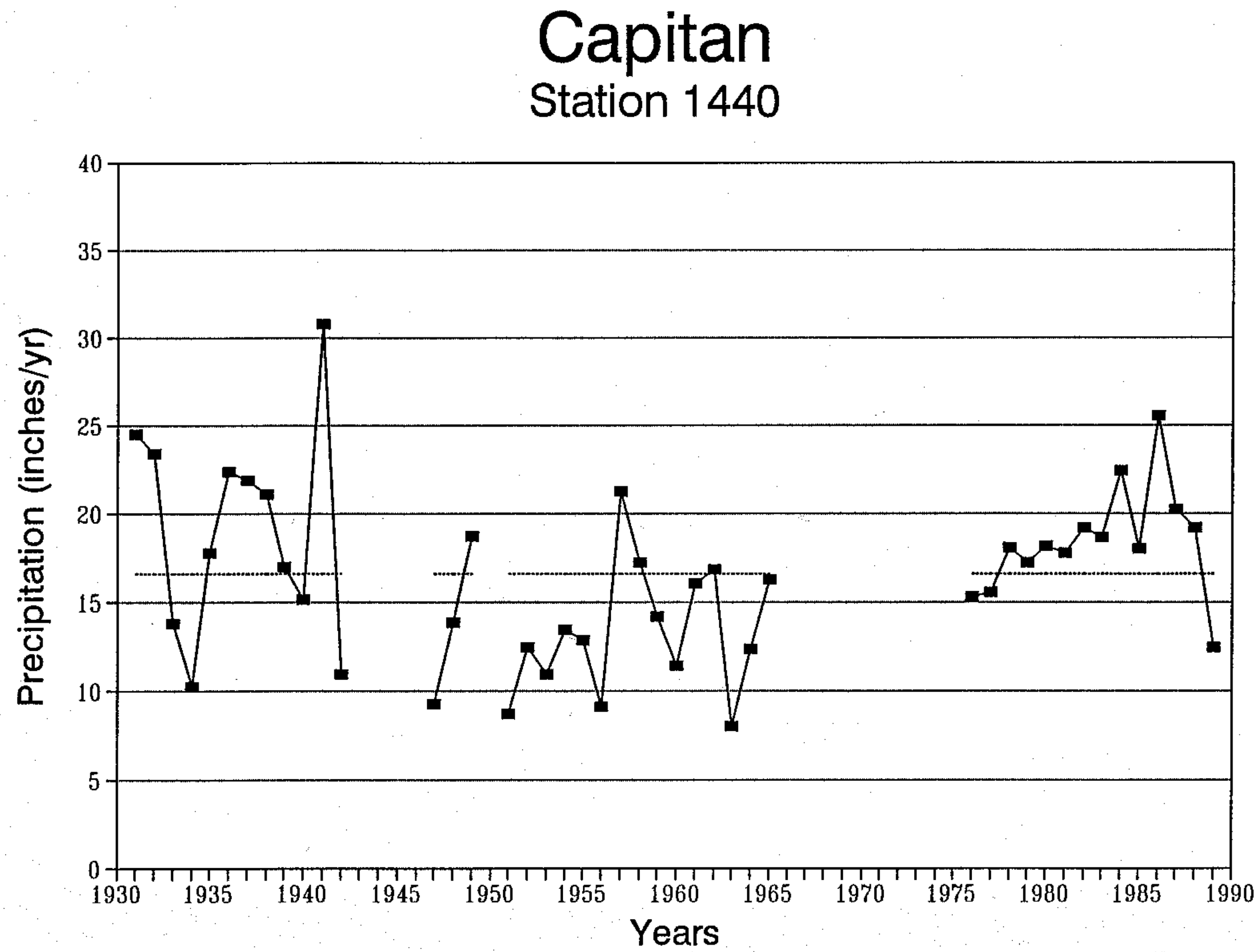
Station 7610

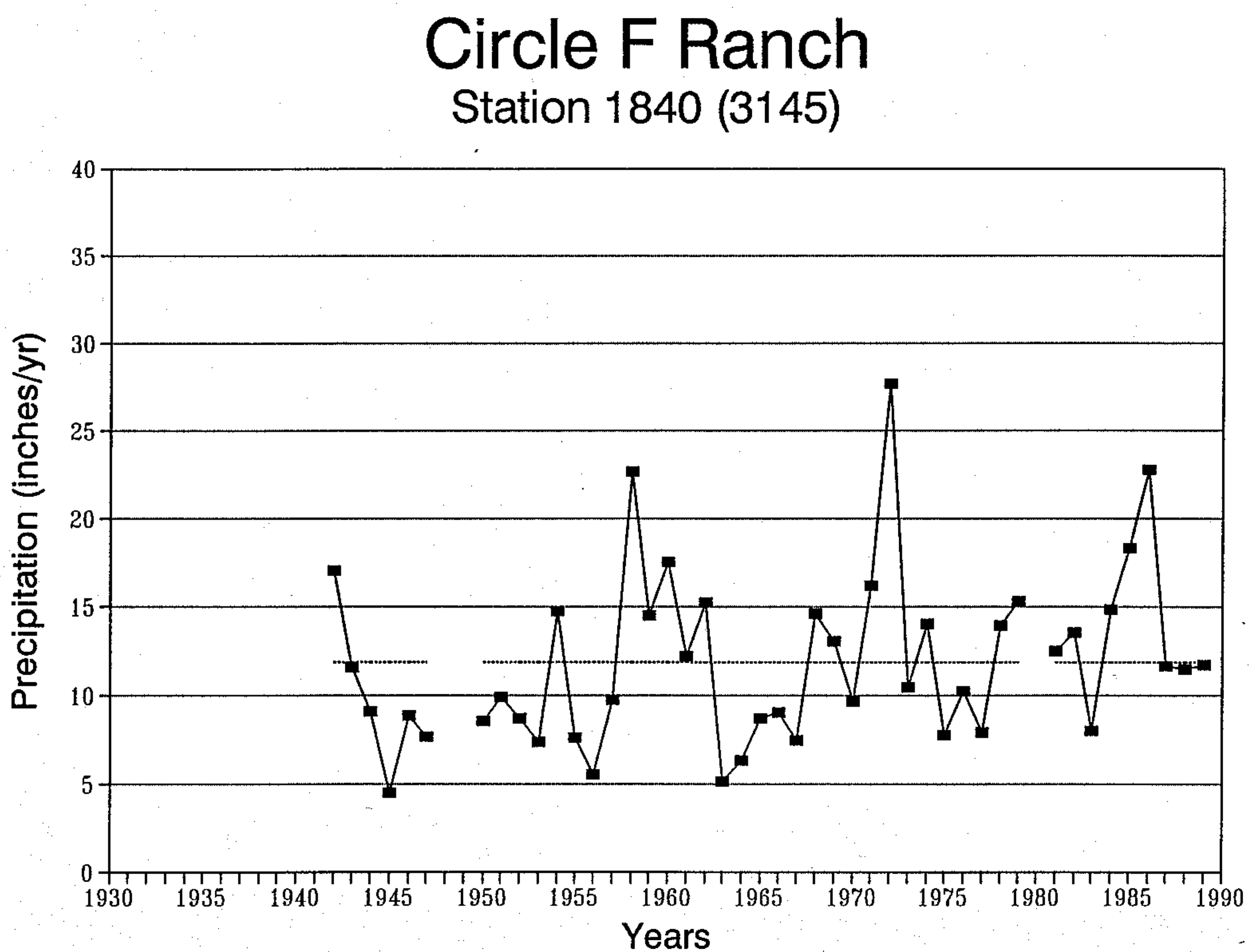


Elk 2 E

Station 2865

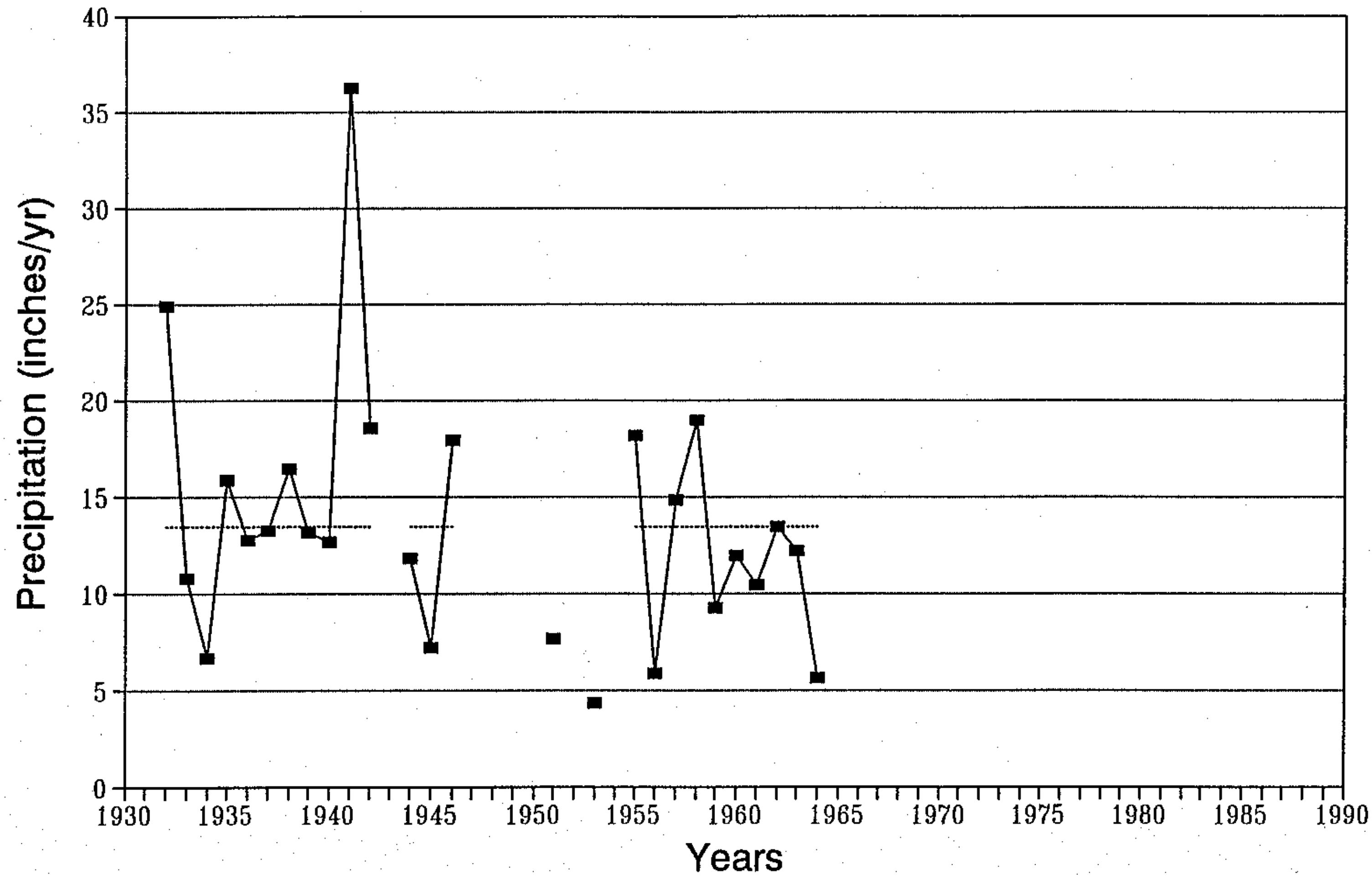



Capitan
Station 1440
Precipitation (inches/yr)
0
5
10
15
20
25
30
35
40
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Years

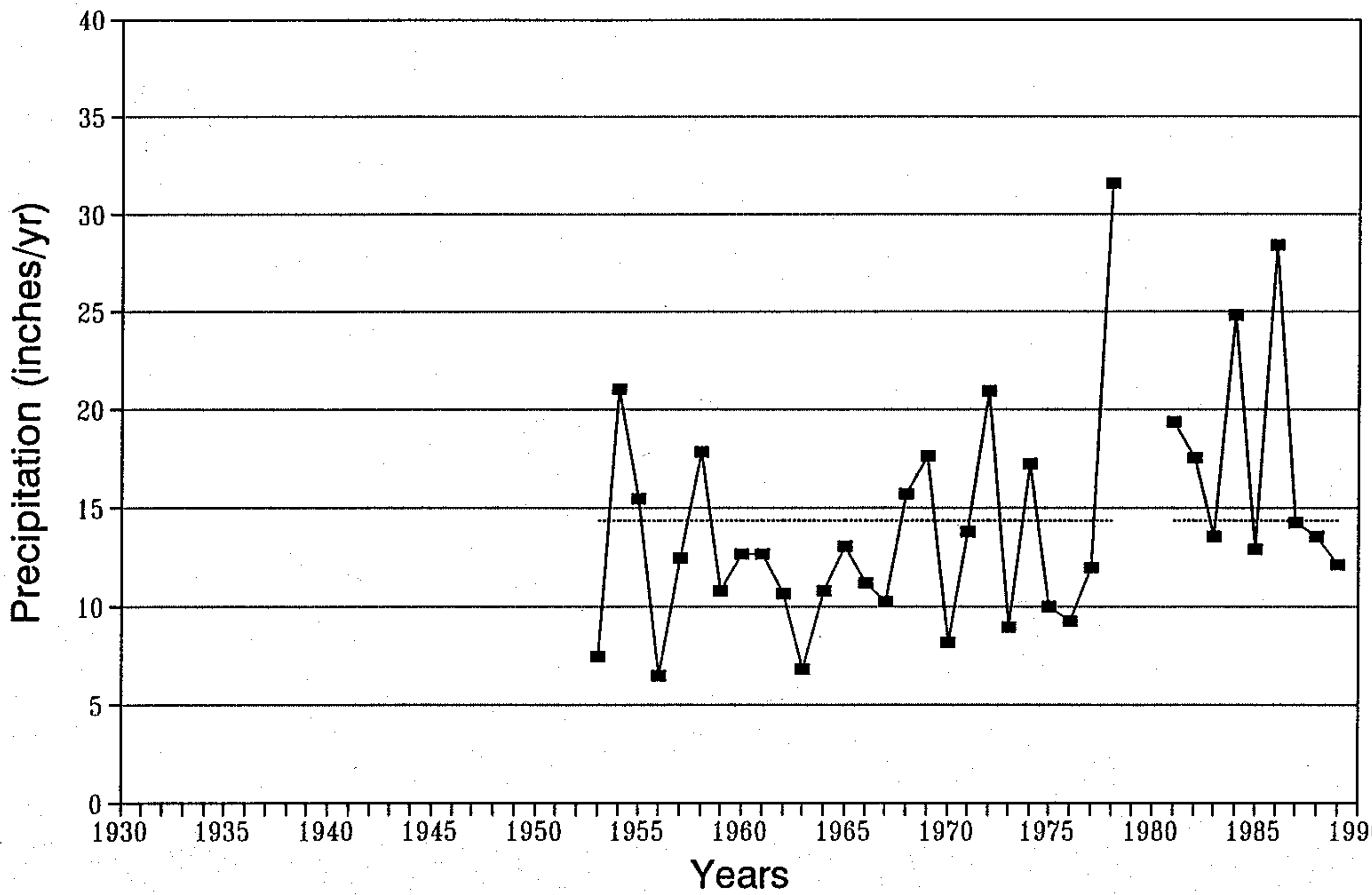

Circle F Ranch
Station 1840 (3145)
Precipitation (inches/yr)
Years
40
35
30
25
20
15
10
5
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990

Felix

Station 3174

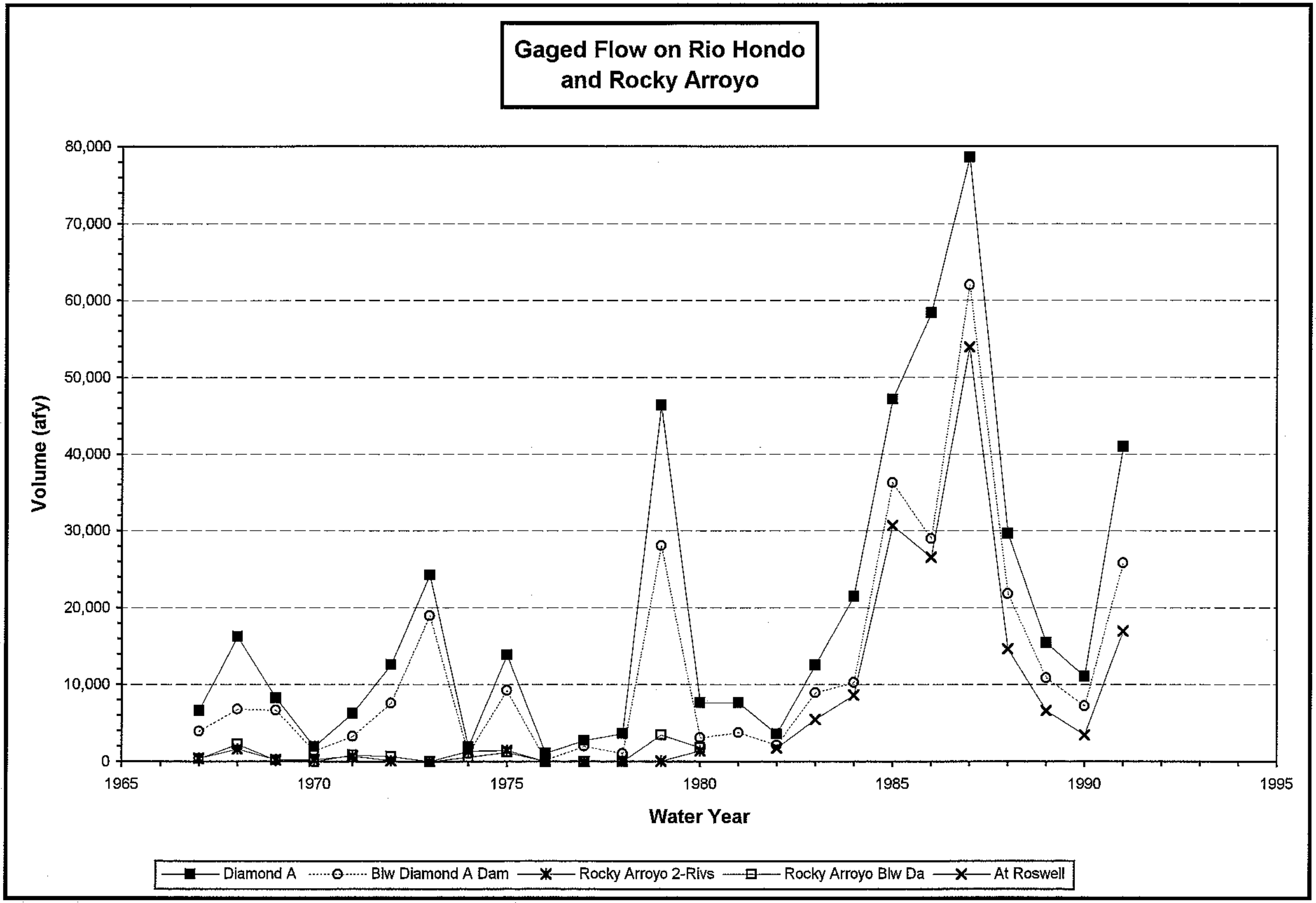


Picacho
Station 6804 (6803)

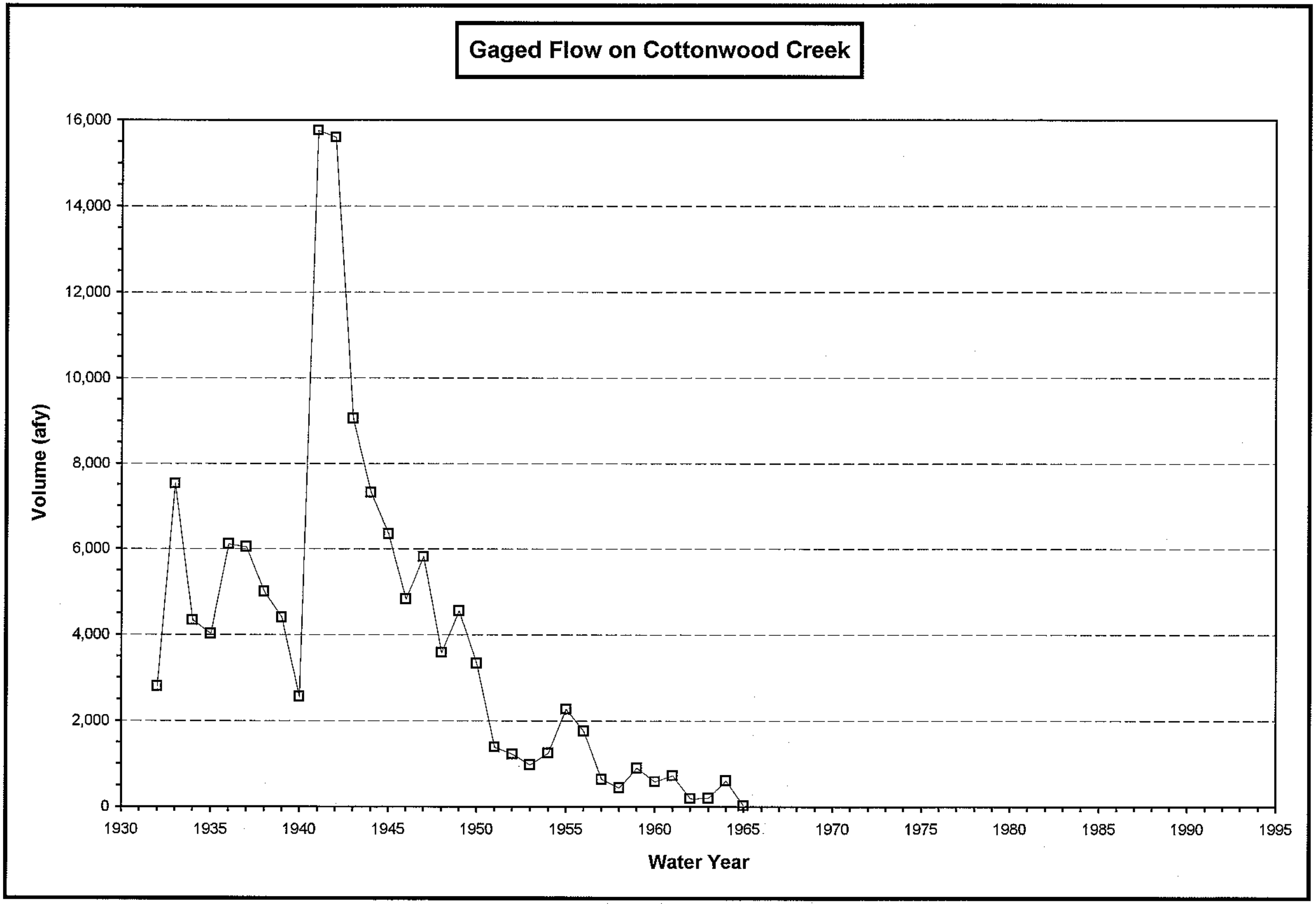


APPENDIX H

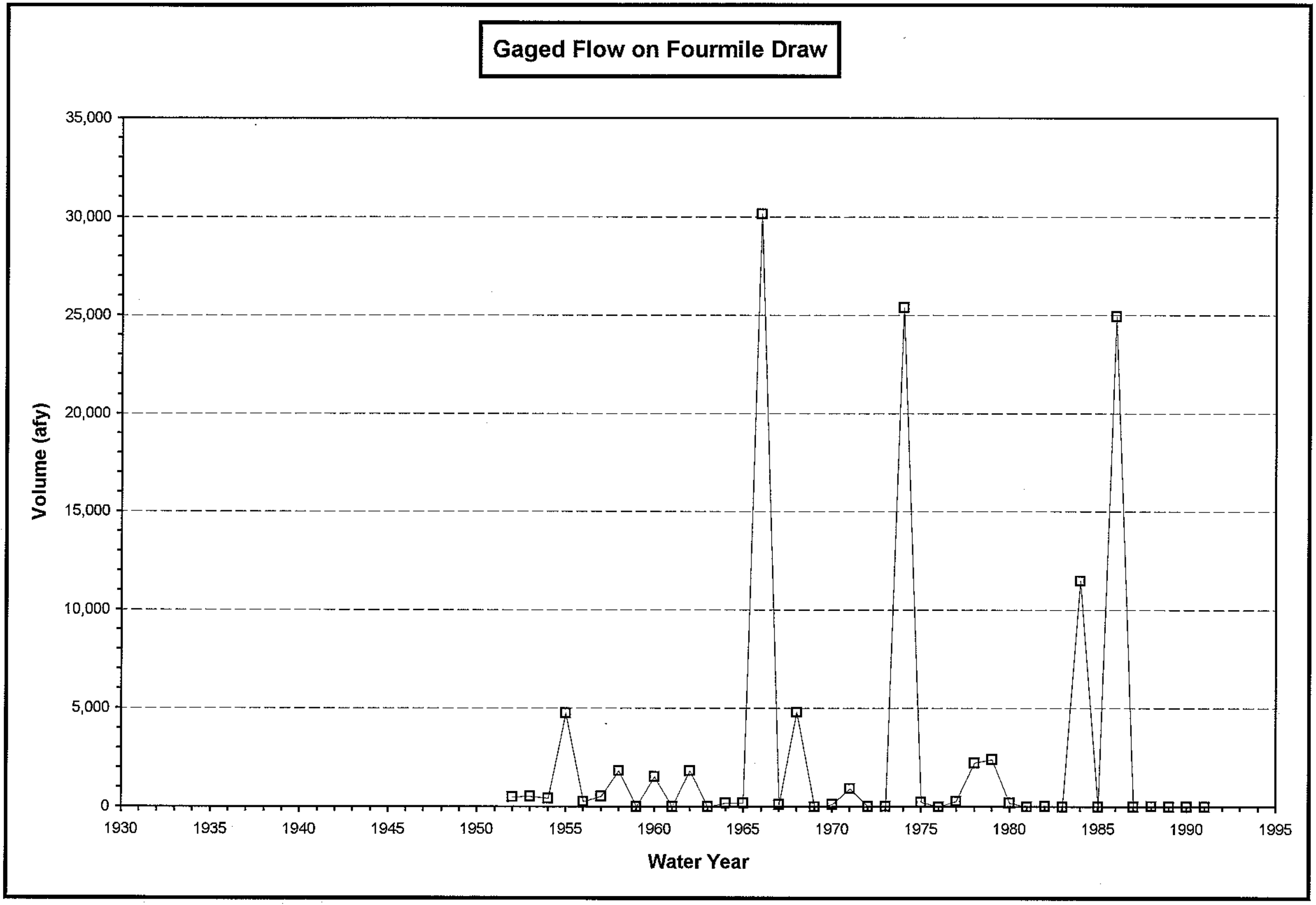
STREAMFLOW HYDROGRAPHS FOR TRIBUTARIES TO THE PECOS RIVER

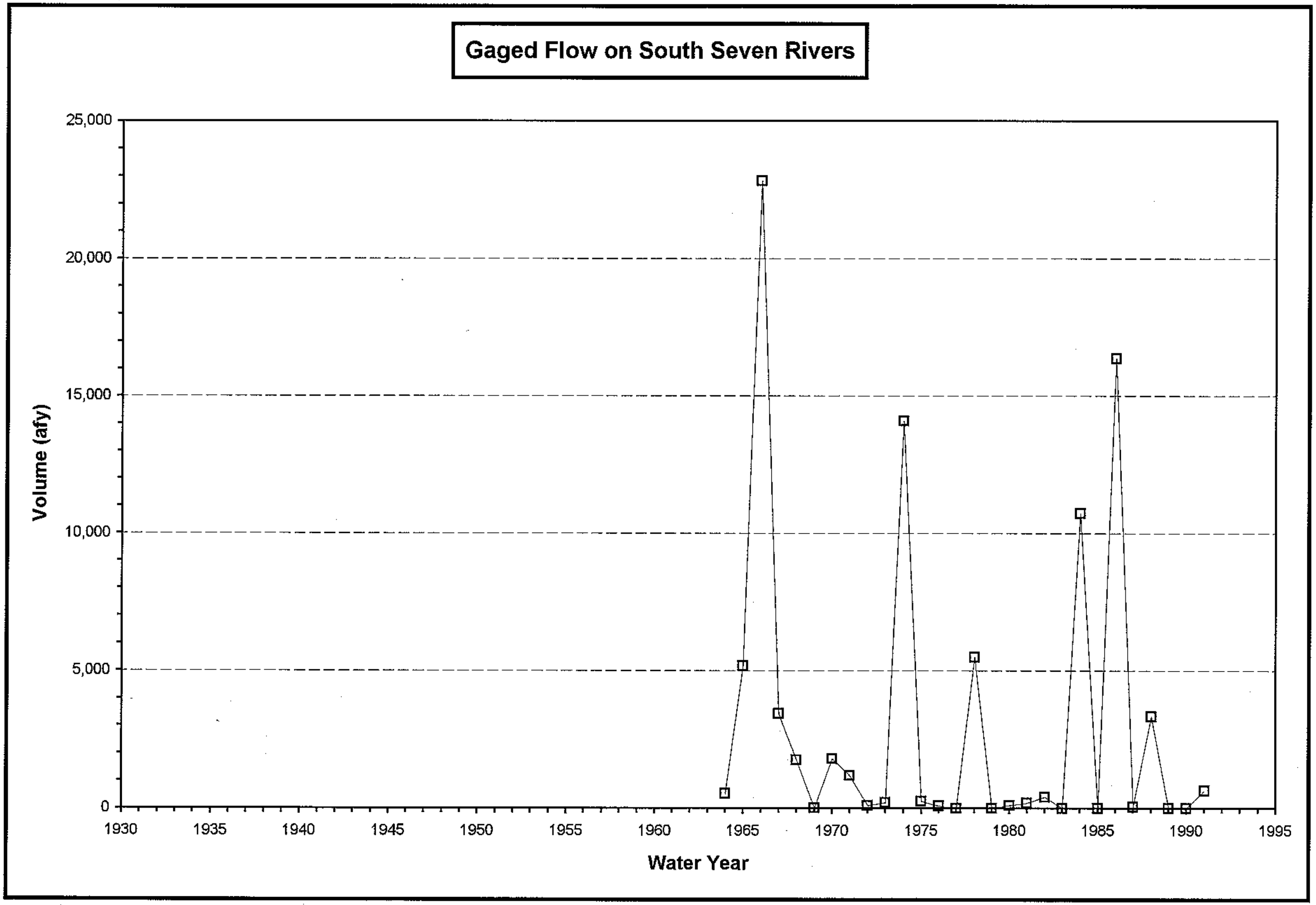


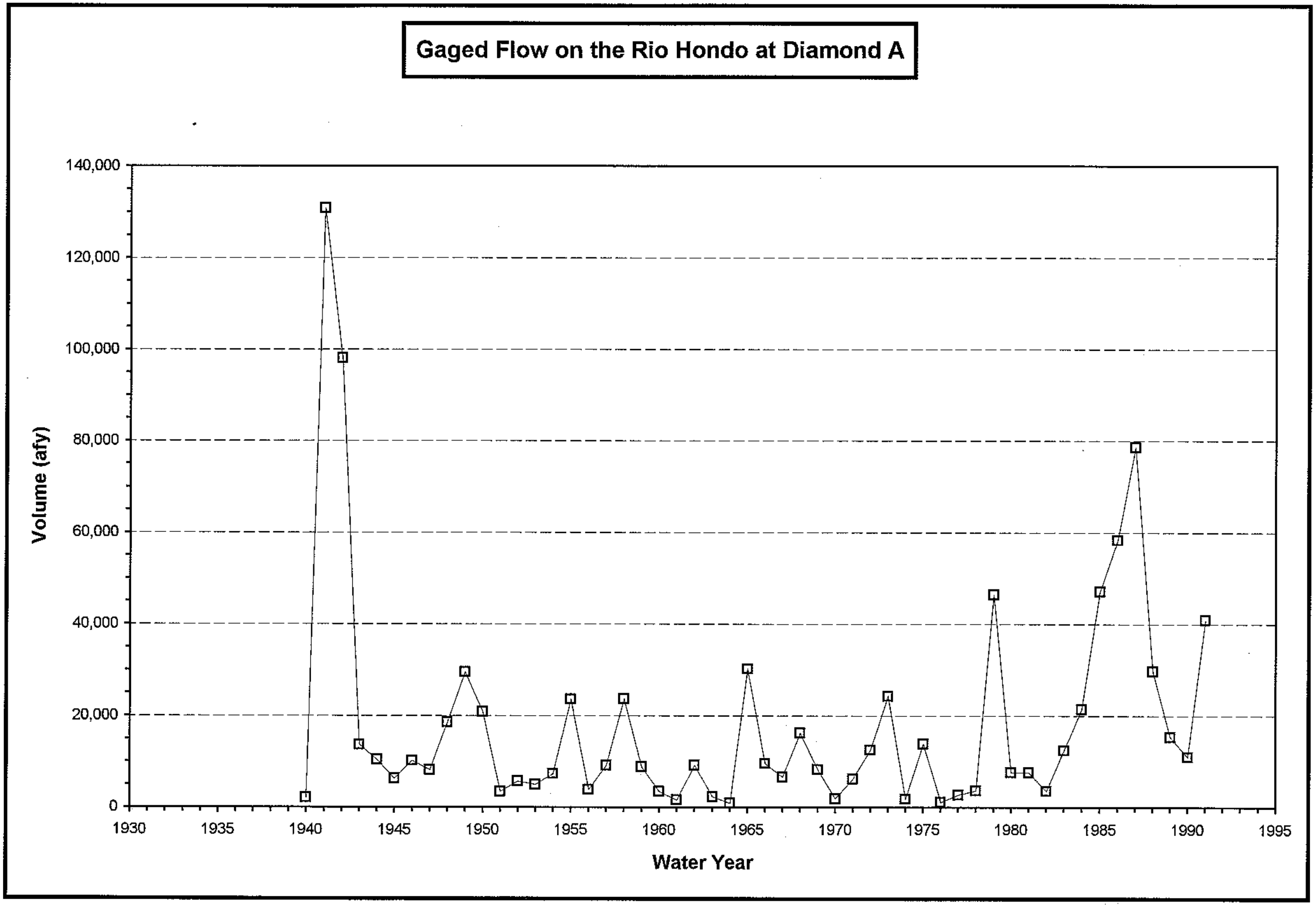
Gaged Flow on Rio Hondo and Rocky Arroyo
Volume (afy)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1965
1970
1975
1980
1985
1990
1995
Water Year
Diamond A
Blw Diamond A Dam
Rocky Arroyo 2-Rivs
Rocky Arroyo Blw Da
At Roswell

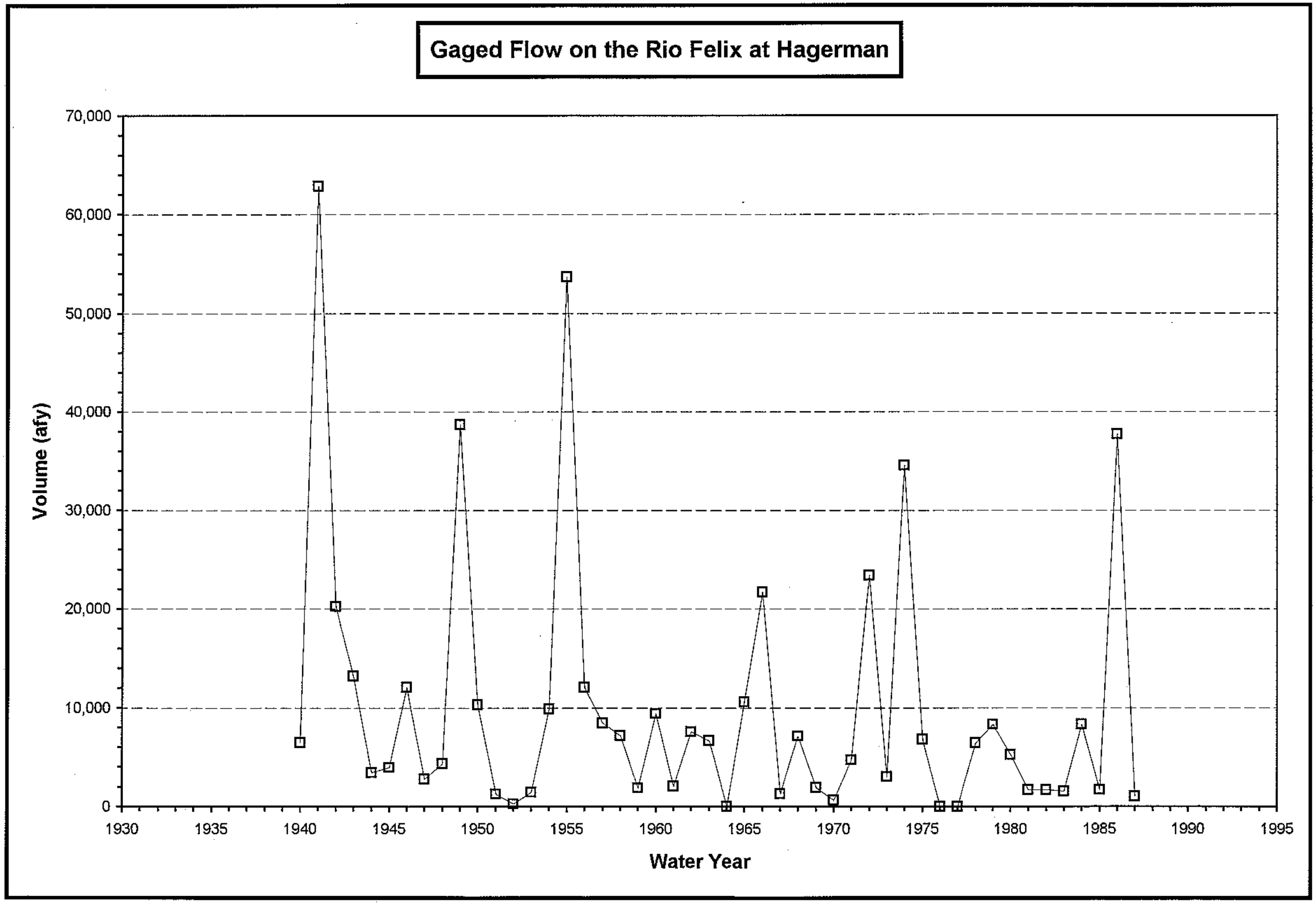


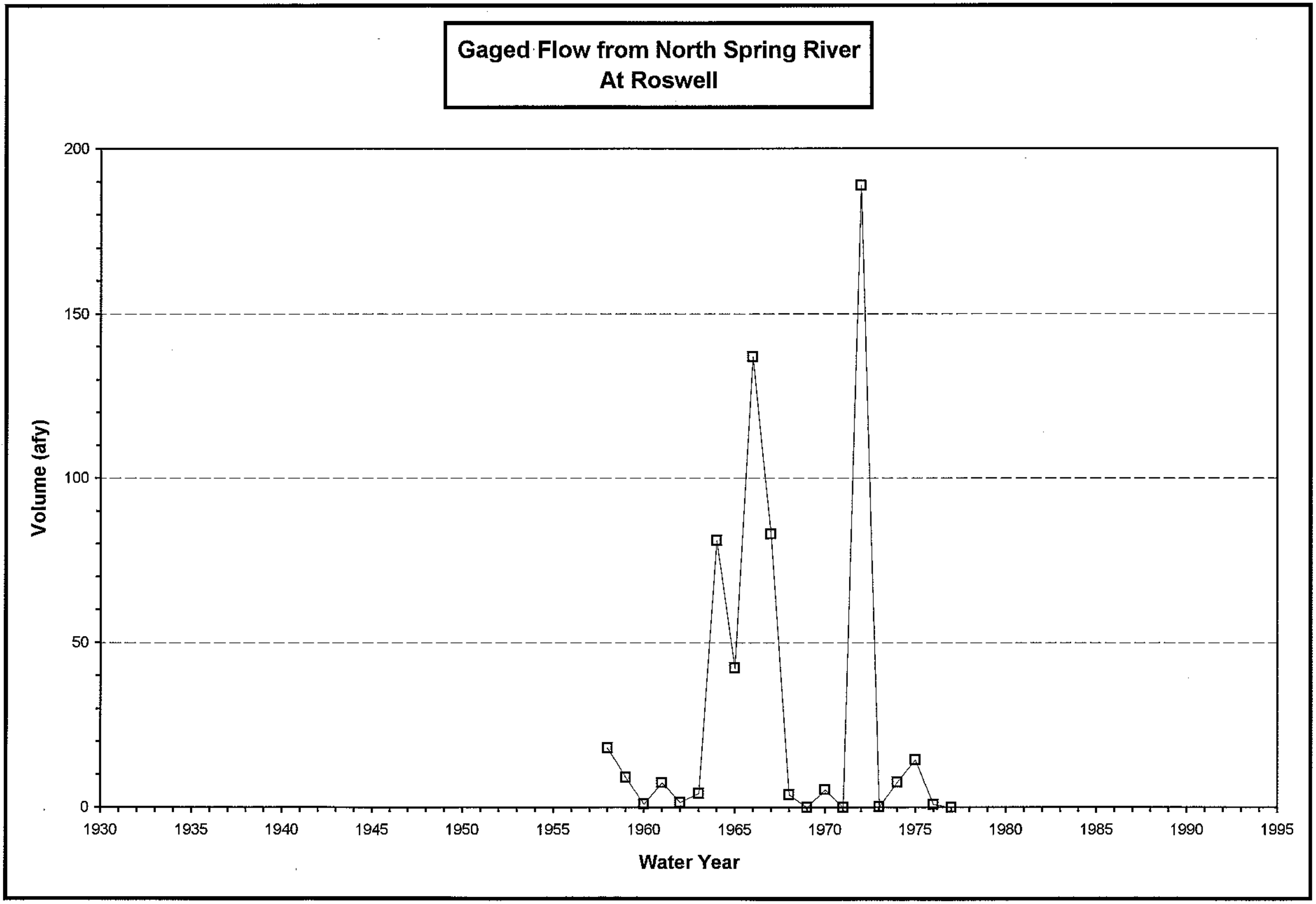
Gaged Flow on Cottonwood Creek
Volume (afy)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year

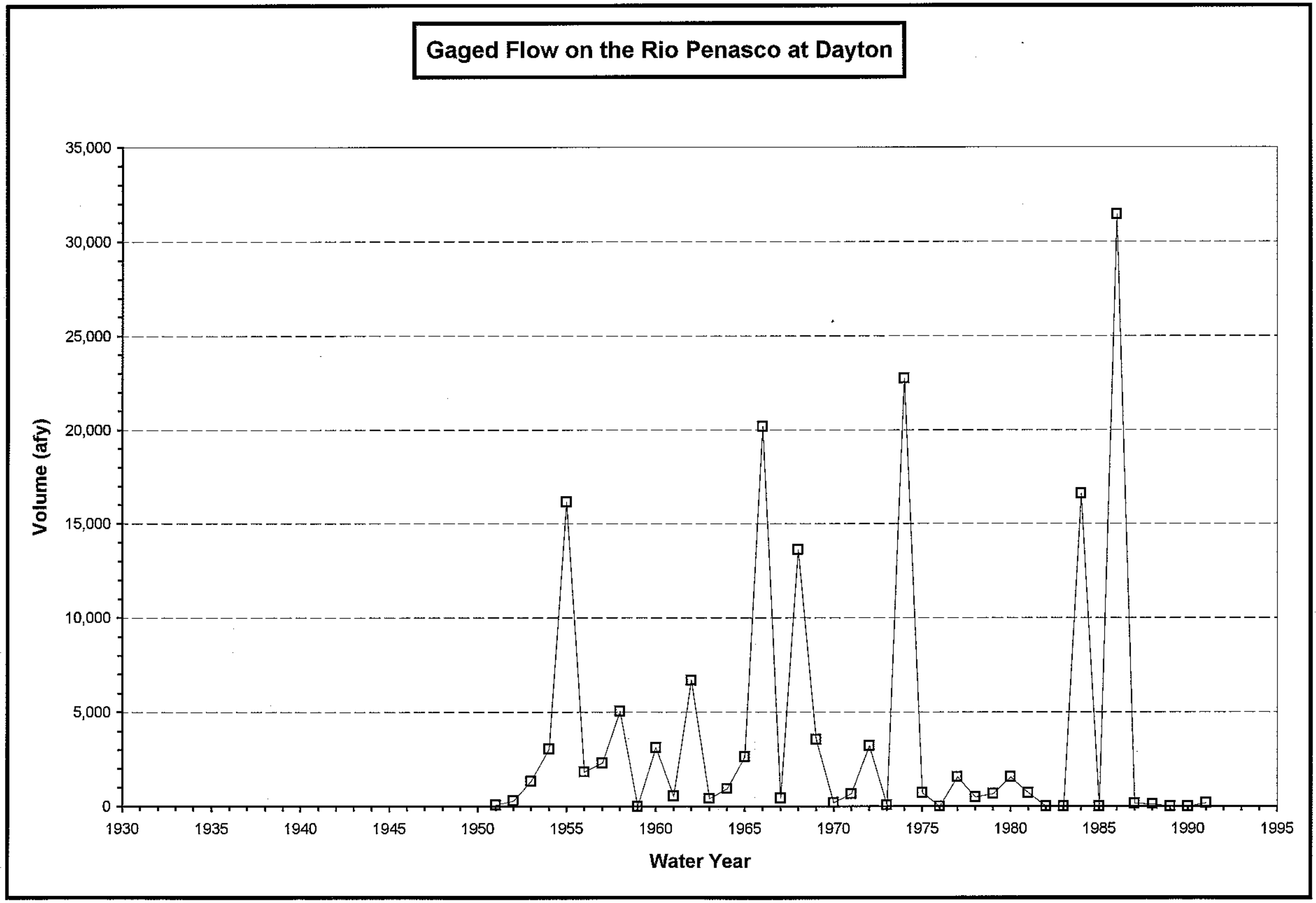

Gaged Flow on Fourmile Draw
Volume (afy)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year


Gaged Flow on South Seven Rivers
25,000
20,000
15,000
10,000
5,000
0
Volume (afy)
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year


Gaged Flow on the Rio Hondo at Diamond A
Volume (afy)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year


Gaged Flow on the Rio Felix at Hagerman
Volume (afy)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year


Gaged Flow from North Spring River
At Roswell
Volume (afy)
200
150
100
50
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year


Gaged Flow on the Rio Penasco at Dayton
Volume (afy)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Water Year

APPENDIX I

SUMMARY OF BASEFLOW STUDIES

APPENDIX I
SUMMARY OF BASEFLOW STUDIES

As part of the scope of work, the available baseflow studies were to be evaluated with respect to the validity of the baseflow estimates reported therein. To this end, a brief summary of each of the baseflow studies that comprise a portion of the database is presented in the following subsections.

I.1 PRJI Baseflow Estimates

The earliest baseflow estimates are presented in National Resources Planning Board (1942), herein referred to as the Pecos River Joint Investigation (PRJI). The PRJI presents estimates of historical baseflow for the period 1905-1937, although there were only three distinct periods of flow records during that time at the appropriate gages necessary for the baseflow calculations. The distinct periods during which the necessary concurrent flows were available are presented in Table I-1.

Table I-1. Distinct Periods and Gages Used to Determine Pecos River Baseflows

	Gages		Period of Record	
Period No.	Upstream	Downstream	From	To
1	Fort Sumner Fort Sumner	Dayton Dayton	July 1905 October 1912	February 1910 September 1913
2	Acme Acme	Dayton Dayton	August 1921 April 1925	July 1923 November 1925
3	Acme	Artesia	July 1937	September 1939

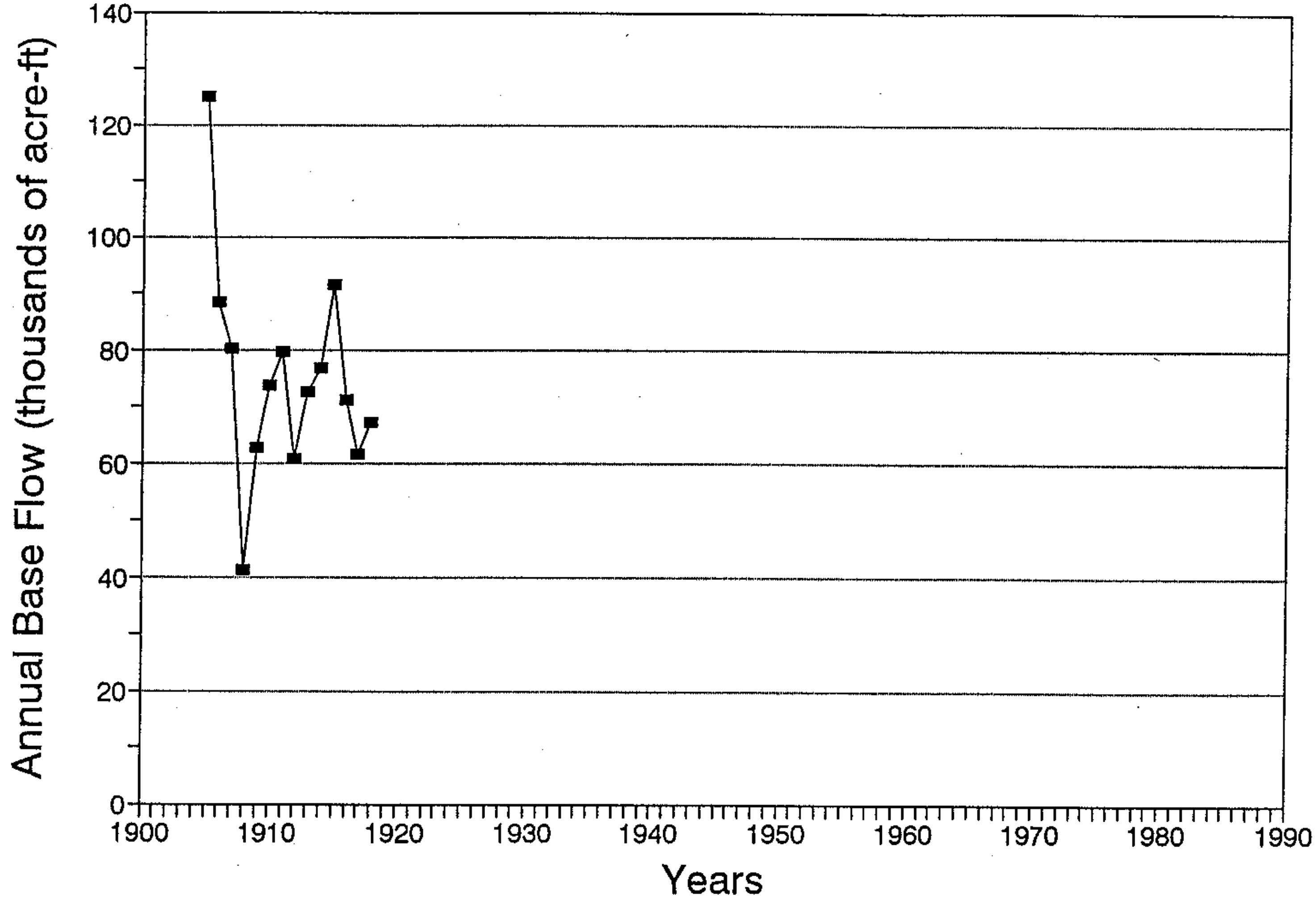
Source: National Resources Planning Board (1942, p. 48).

Based upon the period of record for the various gages presented in Table I-1, Pecos River baseflow estimates were derived in the PRJI using the following analysis. For Period 1, during which flow at the Acme gage was not available, flow at Acme was computed using the Fort

Sumner gage record in conjunction with the channel loss estimates developed for the Fort Sumner (Guadalupe)-Acme reach presented in the PRJI (p. 45, fig. 9). Next, for almost every month within the three periods of record, a period (several days) of uniform flow at the Acme and Artesia (or Dayton) gages was identified during which there was no apparent presence of flood inflow. During these periods, it was assumed that the difference in flow between the Acme and Artesia (or Dayton) gages was baseflow, and the baseflows calculated in this manner were subsequently summed up to give monthly and annual baseflow totals. This approach implicitly neglects the variation (if any) of baseflow within a given month.

The next step involved the application of the estimated baseflows for the three distinct periods to derive annual baseflows for the years between the three periods. By trial, PRJI discovered an empirical relation between average baseflow and the total of all side inflow as given by the difference in flow between the Guadalupe and Artesia (or Dayton) gages. Based on this information, a series of three lines were constructed by plotting the estimated baseflows for the three periods against the annual total side inflow as described above (PRJI, p. 49, fig. 11). Using the graph as constructed above in conjunction with the Guadalupe and Artesia (or Dayton) gage records, annual baseflow estimates were constructed for the years intervening the three periods.

At this point, one final set of additive adjustments was necessary to obtain the final annual baseflow estimates. First, a small inflow of water (2,100 acre-feet per year [afy]) from springs near the mouth of Salt Creek, which enters the river above the Acme gage, was added to the baseflow estimates. Secondly, for the period 1914-1936, during which the Dayton gage was used, estimated depletions due to salt cedars between Artesia and Dayton were added to the baseflow estimates. The additions for the initial period of 1914-1918 were relatively small (less than 4000 afy), but for the latter period (1919-1935) the corrections ranged from 6,100 to 17,700 afy. Finally, estimated pumping from the Pecos River from Acme to Artesia (or Dayton) was added to the baseflow estimates. This correction ranged from a low of 0 afy to a high of 6,200 afy, and averaged 2,530 afy for 1905-1939. The final baseflow estimates are listed in table 31 (p. 51) of the PRJI. However, these baseflow estimates were not incorporated into the USGS database. Instead, the baseflow estimates of Flook (1958) were incorporated into the USGS database, as discussed in Section I.2. Figure I-1 shows the PRJI baseflow estimates for 1905 through 1918, which precede Flook’s estimates.



Annual Baseflow vs. Time for the Acme to Artesia Reach (1905-1918)

DANIEL B. STEPHENS & ASSOCIATES, INC.
11-92 JN 2200

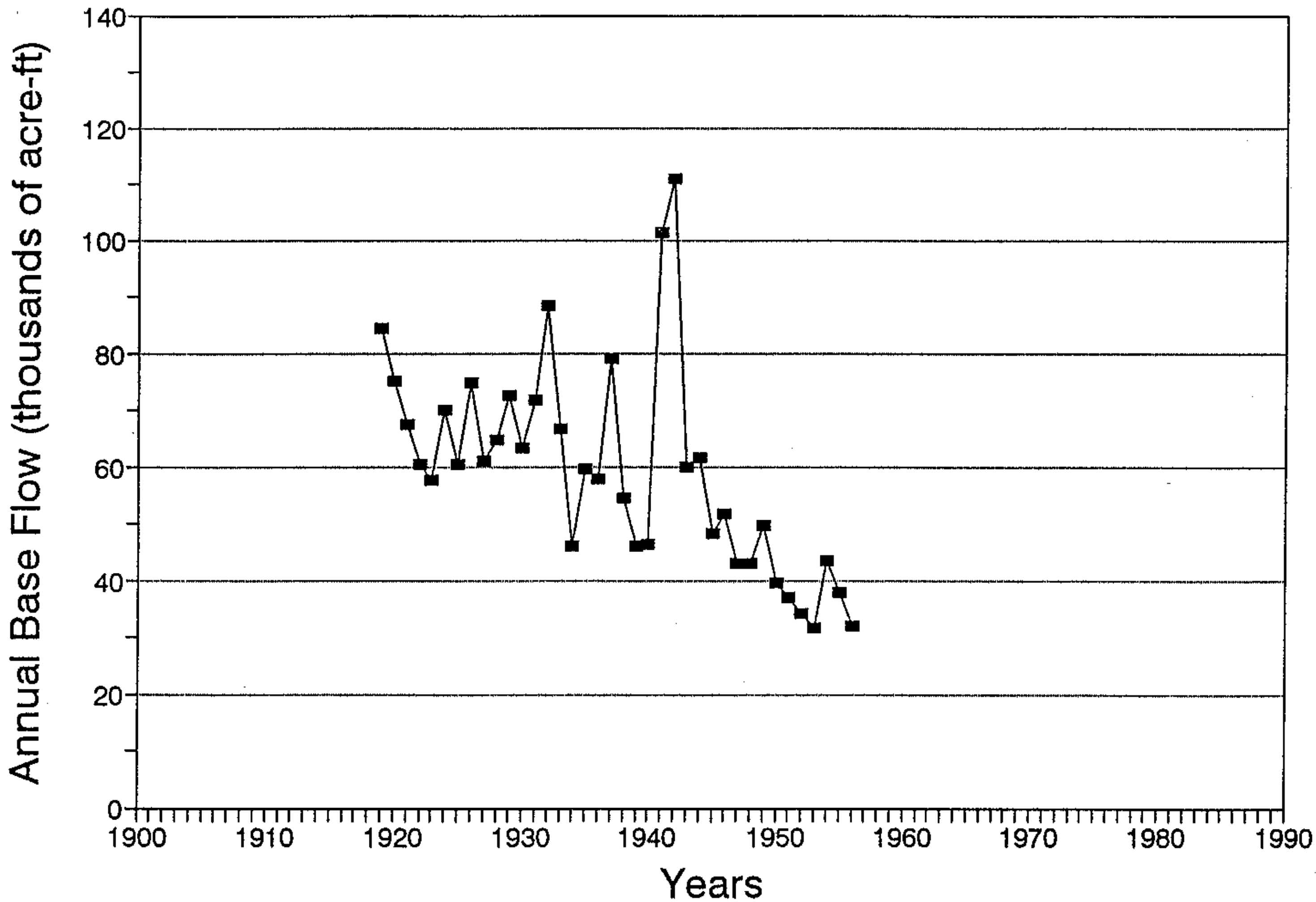
I.2 Flook (1958) Baseflow Estimates

Flook (1958) estimated Pecos River baseflow for the Acme to Artesia reach for the period 1919-1957 (Figure I-2). Where Flook's estimates overlapped those of the PRJI (1919-1939), Flook's data were incorporated into the USGS database, presumably because the USGS thought they were more accurate. Flook's (1958) study was conducted for the Pecos River Commission's Review of Basic Data (RBD) study and is the basis for appendix 8 of the final report of that study (Pecos River Commission, 1960).

Flook (1958) used a different method than that of the PRJI to estimate baseflows. For the initial portion of the study period during which the Acme station was not operable, Flook separated flood flows from the daily hydrograph of a single downstream station; he used the Dayton station for the period January 1, 1919 to February 20, 1936, and the Artesia station for the period February 21, 1936 through June 1937. For the same period, Flook also constructed a synthetic hydrograph at Acme using the Guadalupe station record and the depletion curves developed in the PRJI. However, he only used this synthetic Acme hydrograph, as well as two years of actual record in the early 1920s, as an "aid to judgement" in the separation of baseflows from the Dayton and Artesia hydrographs. Flook verified this method for the period 1937 through 1957 using actual gage data at Acme and found only minor differences in the two methods.

Flook did not adjust the Dayton record to account for depletions due to salt cedars between Artesia and Dayton: he contends that the depletions along this reach due to evapotranspiration and evaporation are approximately equal to the baseflow accretion. The baseflows obtained by graphical separation were increased by the estimated amount of river pumping to obtain the final baseflow estimates. Flook compared his 1919-1937 baseflow estimates with those of PRJI, and found that his values were generally smaller. He attributed the differences to "the slightly different method of approach and of individual interpretation of the available hydrographic records."

In July 1937 the Acme gage became operable and Flook estimated baseflows from July 1937 through December 1957 by deducting the daily flows at Acme from those at Artesia, allowing a suitable time lag. This procedure should be more accurate than those previously used for determining baseflows since the effects of all upstream flow fluctuations could be directly



Annual Baseflow vs. Time for the Acme to Artesia Reach (1919-1957)

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Figure I-2

eliminated. To ensure that a systematic bias did not occur in the estimated baseflows due to the change in the method of analysis, Flook conducted an independent baseflow analysis for the July 1937 to December 1957 period using the Artesia record alone. He found only small random differences in the estimated baseflows using the two methods.

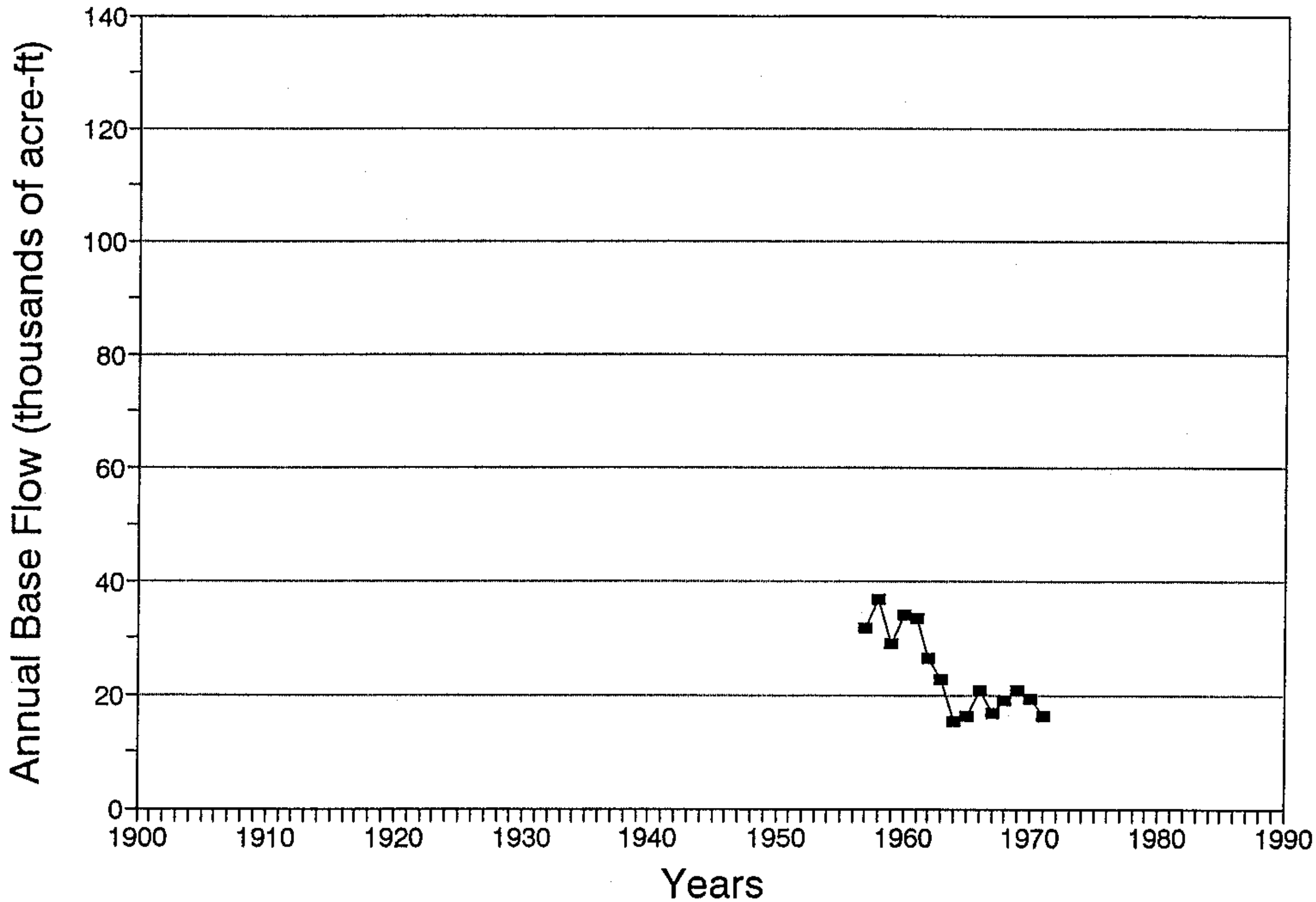
I.3 USGS Baseflow Estimates

The baseflow estimates for the period 1957 through 1989 were calculated by the USGS. Welder (1973, 1988) documents the baseflow estimates for the period 1957 through 1982, and McAda (1992) provides USGS baseflow estimates for 1983 through 1989. Figure I-3 shows the baseflow estimates from the earlier Welder report (1973), and Figure I-4 shows the USGS estimates from 1972 through 1989.

Daily streamflow records at the Acme and Artesia gages were available since 1937, and therefore Welder estimated baseflows in a manner similar to that of Flook (1958). Welder plotted the mean daily discharge at the Acme and Artesia gages together for the period 1957 through 1982; he assumed that the time lag between stations was sufficiently small (1 to 5 days) that the hydrographs did not have to be offset in time to obtain reasonable monthly baseflow estimates. Next, Welder added daily pumpage from the river and pertinent tributaries to the Artesia station flows. He then separated the baseflow at each station graphically, and the area between the two estimated baseflow curves for each month was computed to obtain a volume of baseflow.

I.4 Comparative Analysis of Baseflow Studies

Based upon detailed review of the various baseflow studies summarized above, a qualitative judgement was made as to the relative accuracy of each study. The baseflow estimates of Welder (1988) probably comprise the most accurate portion of the baseflow record, since both the Acme and Artesia gages were operational for the full period of study and more accurate information was available for river pumpage than was available to the authors of previous studies. Since the Artesia gage was operable for the period of study, there was no need to account for depletions due to salt cedars from Artesia to Dayton.



Annual Baseflow vs. Time for the Acme to Artesia Reach (1957-1971)

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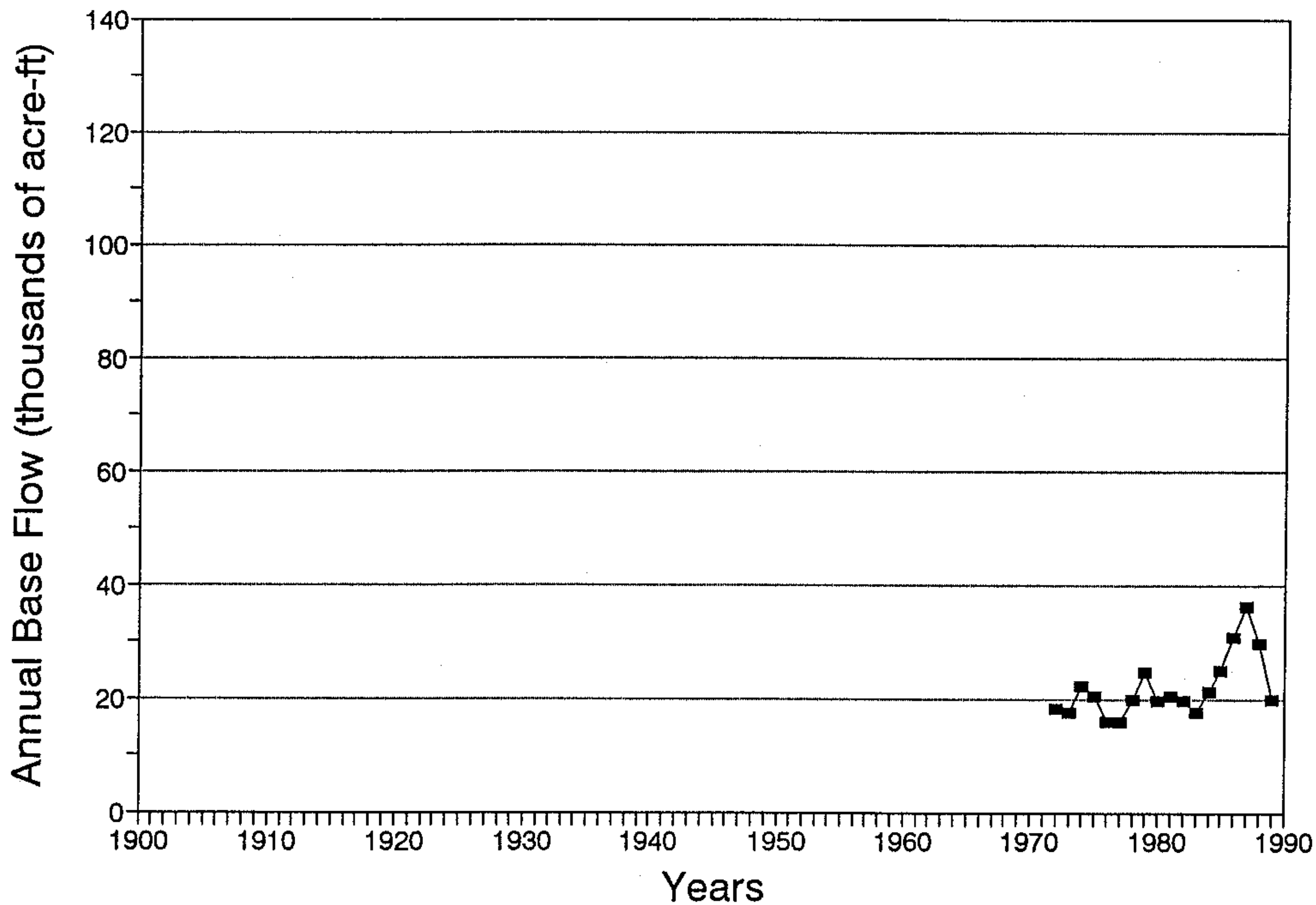
Figure I-3



Annual Baseflow vs. Time for the Acme to Artesia Reach (1972-1989)

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Figure I-4

A possible error in the methodology used by Welder is the exclusion of baseflows in the Rio Hondo during wet years that are diverted by the Hagerman Canal. Data are lacking to quantify the amount of aquifer discharge to the Rio Hondo in the reach downstream from the Roswell gage. However, using the available streamflow data and diversions measured on the Hagerman Canal, it appears that the reach downstream from the Roswell gage may be losing overall. The average measured flow at the Roswell gage from 1984 to 1988 (wet years) was 26,900 afy, whereas the measured diversion through the Hagerman Canal was 22,700 afy over the same period. If in the future studies are prepared that quantify the gains or losses on the Rio Hondo downstream from the Roswell gage, they should be incorporated in the simulation of the Rio Hondo (as recharge or discharge) in the appropriate reach and not added to the totals for the baseflow gain to the Pecos River.

Flook's (1958) baseflow estimates are probably similar in quality to those of Welder (1973) for the period July 1937 through 1957, during which time both the Acme and Artesia gages were operable. However, for the earlier period of his study (1919 to June 1937), Flook used a single downstream gage (Dayton or Artesia) to determine baseflows (Acme was not operable during this time). Flows at the Dayton gage were not adjusted for salt cedar depletions, based upon the argument that evapotranspiration and evaporative losses in the Artesia-Dayton reach were approximately equal to baseflow accretion. Flook (1958) states that only a minimal discrepancy between estimated baseflows was observed for 1937 through 1957, even though the analysis was done using a single downstream gage (Artesia) instead of upstream and downstream gages (Acme and Artesia). However, it seems obvious that baseflow analyses conducted using a single gage would be intrinsically less reliable than analyses using a pair of gages.

The baseflow estimates made during the PRJI (National Resources Planning Board, 1942) are probably the least accurate due to the lack of data and relatively crude estimation methods employed. The PRJI baseflow estimates were made using actual flow data for three distinct periods: 1905-1913, 1921-1925, and 1937-1940. For the first period of analysis, recorded flows at Acme were not available, and a synthetic Acme hydrograph was constructed using the Fort Sumner gage record (over 100 miles upstream from Acme) in conjunction with depletion curves developed for the Guadalupe-Acme reach. Additionally, for the first two periods of analysis, the Dayton gage record, adjusted for salt cedar depletions between Artesia and Dayton, was used in obtaining the baseflow estimates. Prior to 1925, therefore, the PRJI baseflow estimates are representative of baseflow accretion from Acme to Dayton, not Acme to Artesia. For the third period of time, the Artesia station was operable and the estimated baseflows are for the Acme to Artesia reach.

To estimate baseflows for the period of record for which concurrent flow data were not available, a series of empirical curves, apparently fit by eye, were used; they relate baseflow to the total of all side inflow as computed by the difference in flow between the Guadalupe and Artesia gages. The degree of inaccuracy embedded in the baseflow estimates because of these empirical curves is impossible to quantify, but it is noted that each of the three curves is based upon a limited number of data points (one line was constructed using only two data points), and some of the data points (those for 1905-1913) show a significant amount of scatter, casting some doubt upon the assumed linear relationship (see fig. 11, p. 49, of National Resources Planning Board, 1942). In summary, the PRJI baseflow estimates are based upon fewer data, and therefore more assumptions, than those of Flook (1958) for the period 1937-1957 and those of Welder (1973), and are therefore deemed less accurate.

APPENDIX J

SEEPAGE STUDIES

APPENDIX J
SEEPAGE STUDIES

The USGS has conducted numerous seepage studies for the Pecos River and its tributaries within or in the vicinity of the Roswell ground-water basin. The majority of these studies were conducted during the 1950s and 1960s. They are reported in the USGS Water Resources Data Reports (1965 and later), the USGS Surface Water Records of New Mexico (1961-1964), and the USGS Surface Water Supply of the United States series, Part 8 (1960 and earlier). A list of the available seepage studies for the Pecos River within the region of interest is provided in Table J-1.

Each seepage study listed in Table J-1 is simply a series of mass-balance calculations for various reaches (segments) of the Pecos River. Most of the studies were conducted in the fall or winter, during which time the evapotranspiration and evaporative losses should be minimal (these losses are not accounted for in the seepage studies). Gains or losses of water within a given reach are computed by taking the difference between the measured inflows to and outflows from the reach. Known diversions or inflows within the reach are duly accounted for. Each of the seepage studies in Table J-1 has been incorporated into a spreadsheet file named PRSEEP.WQ1. Only the reported gains and losses for a given reach of the Pecos River, rather than all of the discharge measurements conducted, are incorporated into the spreadsheet.

Table J-2, in conjunction with Figure J-1, provides an overview of the Pecos River seepage studies. All seepage studies reported start at Acme. River reaches indicated in Table J-2 can be located on Figure J-1 through the river mile classification. Each symbol indicates that a baseflow calculation was performed over the preceding reach. A plus sign in Table J-2 indicates that a particular reach was gaining during the seepage study, and a minus sign indicates that the reach was losing water. For example, for the first reported seepage study conducted in January 1955, the Pecos River reach from Acme (river mile 94.0) to above the Rio Hondo (river mile 74.7) was gaining ground water. Note, however, that although this reach as a whole was gaining, subsections of the reach may have actually been losing water. This point is illustrated by examining some of the later studies (i.e., 1959-1968), which illustrate that there are indeed losing subsections within the reach from Acme to above the Rio Hondo.

Table J-2 is based upon a condensed version of the original seepage study spreadsheet (the second set of data contained in spreadsheet PRSEEP.WQ1). To facilitate analysis of the data, the various seepage study results were condensed in the following fashion. First, for the seepage studies during which two runs were made, or for two seepage studies conducted during consecutive days, the observed gains and losses for a given reach were averaged to obtain a single representative value. Second, in some instances the reported measurement locations on the Pecos River changed slightly from one seepage study to the next; this occurred mostly during the later studies (1959-1968). To minimize the number of reported river reaches in the table, measurement points within 0.2 river miles of one another were assigned to the neighboring point that had the greatest number of reported values. For example, during many of the seepage studies (1956-1959) one of the reaches ended at river mile 50.8, called "above Rio Felix." However, for the 1955 seepage study, a measurement point at river mile 50.9 was reported, and for the 1960-1968 studies a measurement point at river mile 50.7 was reported. In the condensed set of data, the gains or losses reported for the reaches ending at river miles 50.9 or 50.7 were assigned to river mile 50.8. This procedure should have only a minimal effect on accuracy of the data, and it reduced significantly the number of river reaches to be listed.

In general, the Acme-Artesia reach of the Pecos River is a gaining one when taken as a whole, but significant portions of this reach could be losing at any given time. To illustrate this point, a series of three figures was constructed based upon the condensed seepage study data. Figures J-2 through J-4 represent the calculated Pecos River gain or loss as determined at various measurement locations within the Acme-Artesia reach for January 1960, January 1966, and January 1968, respectively. These three seepage runs were selected for plotting because they most closely coincide with the times for which the shallow aquifer water-table maps were constructed (January 1956 and 1967), and because they have a significant number of measurement locations for plotting gains and losses (the seepage runs conducted prior to September 1959 have significantly less detail in the number of reaches). To facilitate plotting of the data, the x-axis in the figures is presented as river mile downstream from Acme (Acme = 0.0 miles, Artesia = 94.0 miles).

It is evident from Figures J-2 through J-4 that for each of the three times plotted, there are significant losing portions of the Acme-Artesia reach. In general, upstream (about 5 miles below

Acme) and downstream (vicinity of Artesia) portions of the reach are consistently losing. In the middle of the reach, the Pecos River is generally gaining, except in the vicinity of Hagerman, which is about 50 miles downstream from Acme (Figures J-2 and J-4). It seems that the pronounced cone of depression due south of Hagerman caused by pumping may be responsible for the river water loss in this area (see, for example, Plate 3). However, as is indicated by Figure J-3, this reach fluctuates between gaining and losing conditions, depending probably upon local influences such as pumping and rainfall. This conclusion is supported by Table J-2, which indicates that the river reaches in the vicinity of Hagerman (Hagerman Bridge, river mile 46.7, to Section 25, river mile 43.0) have at various times had gaining and losing sections.

It should be noted that although it is possible to correlate most losing and gaining river reaches with the shallow aquifer water-table maps, at many locations the Pecos River may fluctuate between gaining and losing conditions over short distances. See, for example, the February 1964 seepage study results between river miles 50.8 and 43.0 (above Rio Felix to below Hagerman Bridge) in Table J-2. Within this 7.8-mile reach, the river changes from gaining to losing and back again two times. Although a water-table map was not constructed for February 1964, if one were available it is very doubtful that enough data exist to contour the water table in sufficient detail to correctly portray the gaining and losing sections in that reach.

A second set of figures was constructed for the river reaches that had the greatest number of gain/loss computations through time; the purpose of these figures is to illustrate how gains or losses for a given reach may have changed through time. The reaches for which the gains or losses are illustrated in Figures J-5 through J-10 can be identified using Figure J-1. Each of these figures was constructed based upon seepage study results obtained for January of the indicated year; this was done to be consistent with the shallow aquifer water-level maps we constructed and to provide a meaningful comparison of results from year to year, since Pecos River baseflow and losses fluctuate seasonally.

Figure J-5 illustrates the gains and losses indicated by various seepage studies conducted during 1955-1968 for the reach from Acme (river mile 94) to above Rio Hondo (river mile 74.4). In general, this reach is a gaining one, although gains decreased significantly from 1955 and 1956 values to those determined for later dates. For only two years (1959 and 1963) was there a net loss indicated for this reach. In 1956 a net gain of about 9 cubic feet per second (cfs) was measured for this reach; this observation is in good agreement with the shallow aquifer water-level map constructed for the same year (Plate 2) which shows ground-water inflow along this reach.

The indicated gains and losses for the next two reaches, above Rio Hondo to Dexter Bridge (river mile 58.1) and Dexter Bridge to above Rio Felix (river mile 50.8), are illustrated in Figures J-6 and J-7, respectively. The Rio Hondo to Dexter Bridge reach was consistently gaining, although indicated gains are highest for 1955 at 31 cfs and decrease to about 6 to 11 cfs for 1957 and later. The Dexter Bridge to Rio Felix reach (Figure J-7) was gaining for all studies except in 1963, when this reach was slightly (less than 1 cfs) losing. As with the Acme to Rio Hondo reach, significant decreases in gains to this reach were observed in 1959 and 1963. In 1956 each of these reaches is clearly gaining, which is consistent with the 1956 water-level map (Plate 2).

The next reach, from the Rio Felix to near Lake Arthur (Figure J-8) was gaining except for the 1957 and 1969 studies, during which small losses were observed. The Lake Arthur-Artesia reach (Figure J-9) fluctuated between gaining and losing from the late 1960s on. The Artesia to Kaiser Channel reach (Figure J-10) was observed to be losing about 2 to 4 cfs for 1964-1966, 1968, and 1969, but was gaining in 1970. The baseflow gain for the Rio Felix to Artesia reach is in agreement with the 1956 shallow aquifer water-table map (Plate 2). The 1956 water-table map also indicates that the Pecos River was losing from about the Rio Peñasco to south of Lake McMillan, which is in general agreement with the literature and the available seepage studies (Figure J-10), although a seepage study was not conducted for the reach below Artesia in 1956. The 1967 water-table map (Plate 3) indicates that the Pecos River is losing from several miles north of the Rio Peñasco to south of Lake McMillan, which is in good agreement with Figure J-10.

As a final analysis of the seepage study data, the seepage study results were compared to the monthly baseflow estimates of Flook (1959a; 1959b) and Welder (1973); the comparison is presented in Table J-3. For this comparison, it was assumed that the indicated seepage study gains for the Acme-Artesia reach were due solely to baseflow, and the gains computed during a seepage study for a 1- to 2-day period were multiplied by the appropriate number of days to derive monthly totals.

It is evident from Table J-3 that monthly baseflow computed by extrapolation of the 1- to 2-day seepage studies is consistently lower than the monthly baseflow estimates obtained through hydrograph separation. Overall trends (increases and decreases), however, are for the most part maintained. The observed discrepancies are probably due to two reasons. First, hydrograph separation is not an exact science and there is undoubtedly some error involved in determining baseflows through that procedure. For the short periods during which seepage studies are conducted, they should in general give more reliable estimates of baseflow than the hydrograph separation procedure. It should be noted, however, that seepage studies are also prone to certain sources of error, in particular, changes in flow at upstream stations prior to measurements at downstream stations. Second, probably the most significant source of discrepancy is the fact that baseflow would not be expected to occur at a constant rate throughout the month, but rather would fluctuate some unknown degree. It may not be meaningful, therefore, to extrapolate the results of a 1- to 2-day seepage study throughout the entire month.

Table J-1. Pecos River Seepage Studies Conducted by USGS Within or in the Vicinity of the RGWB

Year	Dates	Reach	Reference
1955	Jan. 5-6	Acme-Artesia	USGS Surface Water Supply of the United States Series, Part 8
1956	Jan. 4-5[a] Feb. 26-27[a] June 3 Oct. 17	Acme-Artesia Acme-Artesia Acme-Artesia Acme-Artesia	USGS Surface Water Supply of the United States Series, Part 8
1957	Jan. 2 March 4 June 19	Acme-Artesia Acme-Artesia Acme-Artesia	USGS Surface Water Supply of the United States Series, Part 8
1958	Jan. 23-24[a] Nov. 5 Nov. 6	Acme-Artesia Acme-Artesia Acme-Artesia	USGS Surface Water Supply of the United States Series, Part 8
1959	Jan. 8 March 6 Sept. 23 Sept. 24	Acme-Artesia Acme-Artesia Acme-Artesia Acme-Artesia	USGS Surface Water Supply of the United States Series, Part 8
1960	Jan. 27-28 March 1	Acme-Artesia Artesia-Kaiser Channel above Lake McMillan	USGS Surface Water Supply of the United States Series, Part 8
1962	Feb. 1-2	Acme-Artesia	USGS Surface Water Records of New Mexico
1963	Jan. 31-Feb. 1	Acme-Artesia	USGS Surface Water Records of New Mexico
1964	Feb. 18-19	Acme-Lake McMillan	USGS Surface Water Records of New Mexico
1965	Jan. 26-27	Acme-Lake McMillan	USGS Water Resources Data Reports for New Mexico
1966	Jan. 20-Feb. 2	Acme-Lake McMillan	USGS Water Resources Data Reports for New Mexico
1968	Jan. 31-Feb. 1	Acme-Lake McMillan	USGS Water Resources Data Reports for New Mexico
1969	Feb. 11	Acme-Kaiser Channel	USGS Water Resources Data Reports for New Mexico
1970	Jan. 27	Acme-Kaiser Channel	USGS Water Resources Data Reports for New Mexico

[a] Two separate sets of measurements were taken during this period.

Table J-2. Summary of Pecos River Gaining and Losing Reaches as Determined From Seepage Studies
Page 1 of 2

Location	Pecos River Mile	Gain (+)/Loss (−)																						
		1955 JAN	1956 JAN	1956 FEB	1956 JUNE	1956 OCT	1957 JAN	1957 MARCH	1957 JUNE	1958 JAN	1958 NOV	1959 JAN	1959 MARCH	1959 SEPT	1960 JAN	1960 MARCH	1962 FEB	1963 JAN-FEB	1964 FEB	1965 JAN	1966 JAN-FEB	1968 JAN-FEB	1969 FEB	1970 JAN
Acme	94.0																							
Pipeline crossing	91.7																		+	+	+	−		
Above Bitter Lakes	89.0													+	−		+	−	−	+	−	+		
Bitter Lakes	84.9													+	+		−	+	+	+	+	+		
Above Bitter Creek	78.4														+		+	+	+	+	+	+		
US 380 bridge	77.5													+	+		+	+	+	+	+	+		
Above Rio Hondo	74.7	+	+	+	+	+	+	+	+	+	+	−	+	−	+			+	+	−	+	−		
Below Rio Hondo	74.4													+	+		+	−	+	−	−	−	+	+
Sec. 13 T11S.R25E	71.4													−	+		+	+	+	+	+	−		
Below Bottomless Lake	68.0		+	+	+	+	+	+	+	+	+	−	+	+										
Oasis-Miller Drain	67.6														+		+	+	+	+	+	+		
Below Bottomless Lakes	67.4													+										
Pipeline crossing	64.5													−	+		+	−	+	+	0	+	+	+
Above Nine Mile Draw	61.7													−	+		−	+	+	−	+	+		
Sec. 33 T12S.R26E	60.9													0	+		+	+	+	+		+		
Dexter bridge	58.1	+	+	+	+	−	+	+	+	+	+	+	+	+	+		+	−	+	+	+	−		
Below Berry Drain	55.4													−	+		+	−	0	−	+	+		
Sec. 23 T13S.R26E	53.2														+		+	+		+	+	+	+	+
Above Rio Felix	50.8	+	+	+	+	+	+	+	+	+	−	+	+	+	+		−	+	+	+	+	+		

Note: Blank cells indicate data not available

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Table J-2. Summary of Pecos River Gaining and Losing Reaches as Determined From Seepage Studies
Page 2 of 2

Location	Pecos River Mile	Gain (+)/Loss (−)																						
		1955 JAN	1956 JAN	1956 FEB	1956 JUNE	1956 OCT	1957 JAN	1957 MARCH	1957 JUNE	1958 JAN	1958 NOV	1959 JAN	1959 MARCH	1959 SEPT	1960 JAN	1960 MARCH	1962 FEB	1963 JAN-FEB	1964 FEB	1965 JAN	1966 JAN-FEB	1968 JAN-FEB	1969 FEB	1970 JAN
At Rio Felix	50.0																		−					
Sec. 2 T14S.R26E	49.2													+	+		−	+	+	−	+	+		
Hagerman Bridge	46.7													+	+		+	−	+	+	+	+	−	+
Sec. 13 T14S.R26E	44.2													+	+		−	+	−	−	+	+		
Sec. 25 T14S.R26E	43.0																		+	+	+	+		
Near Prichard Lakes	41.9													−	−		−	−	+	−	+	+	+	+
Buffalo Valley pump	39.8													−	+		+	+	−	+	+	−		
Sec. 13 T15S.R26E	34.5													+	+		+	−	+	+	+	+		
Near Lake Arthur	30.6	+	+	+	−	+	+	+	+	+	+	+	+	+	+		−	+	−	+	+	+	−	+
Sec. 32 T15S.R26E	26.5													−	−		+	−	−	−	+	−		
Sec. 26 T16S.R26E	20.5																+	−	+	+	+	−		
Below Cottonwood Creek	19.8													+	−									
Sec. 12 T17S.R26E	16.0																−	−	+	−	−	+		
Artesia	12.4	+	+	+	+	+	+	−	+	−	−	−	−	−	−		0	+	−	+	+	−	+	+
Below Logan Draw	10.2															+								
Sec. 36 T17S.R26E	7.2															−								
Above Brainard Lake	3.4															−			−	+	−	+	−	−
Kaiser Channel	0															+			+	−	−	−	−	+

Note: Blank cells indicate data not available

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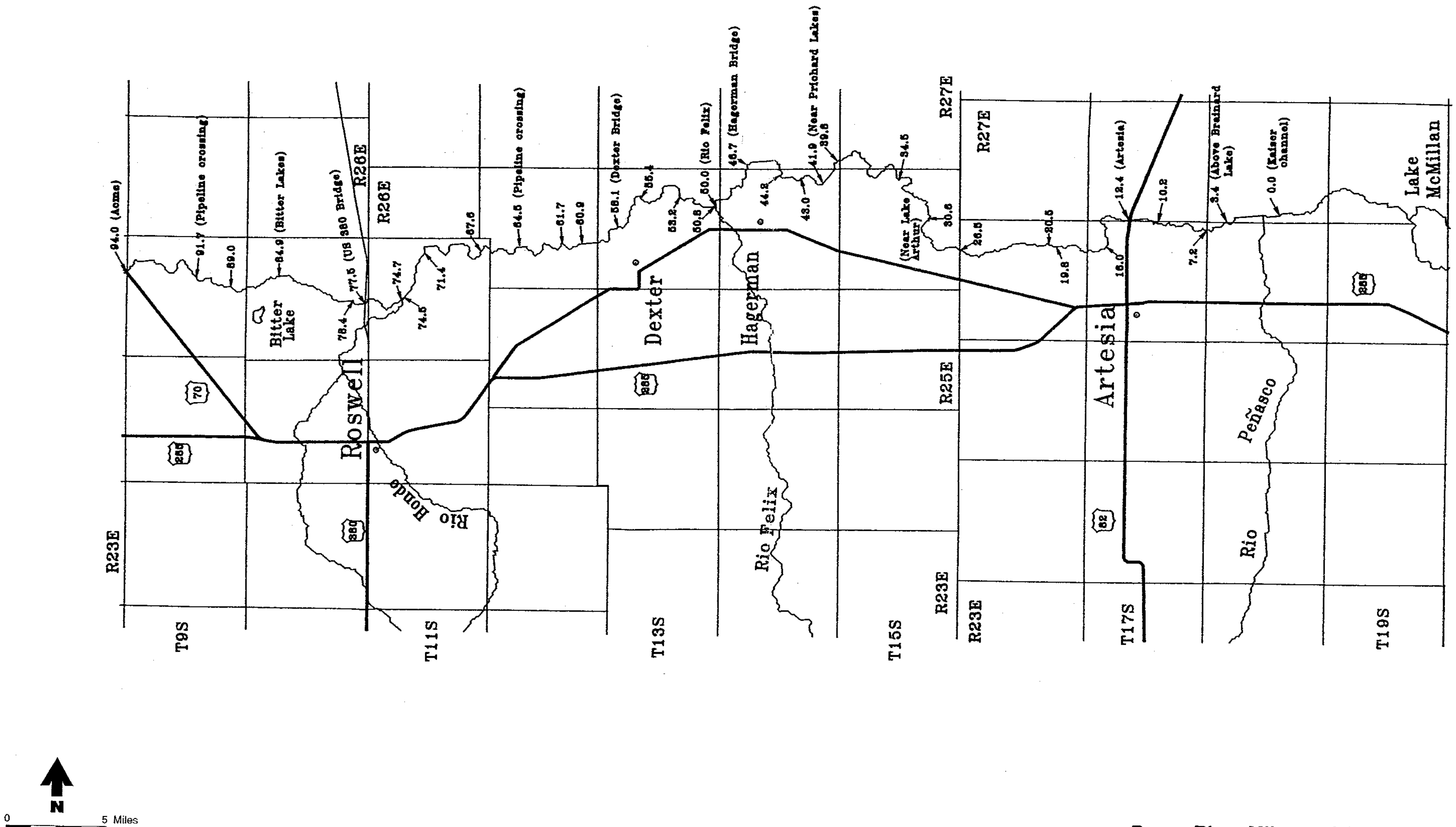
Table J-3. Comparison of Monthly Baseflows as Estimated from Seepage Studies and Baseflows Estimated by Flook (1959a) and Welder (1973) using Hydrograph Separation

Year	Month	Monthly Baseflow Acme-Artesia (af)	
		Seepage Study[1]	Flook and Welder[2]
1955	January	4,728	5,500
1956	January February June October	2,956 2,756 785 837	4,000 3,900 1,400 2,000
1957	January March June	1,478 2,081 537	3,740 3,120 2,010
1958	January November	1,522 2,080	3,860 4,320
1959	January March September	917 2,924 603	3,270 3,980 790
1960	January	2,250	4,150
1962	February	1,716	2,920
1963	January	86	3,220
1964	February	1,346	2,390
1965	January	1,216	2,030
1966	January	1,060	2,540
1968	January	1,350	2,540
1969	February	981	1,850
1970	January	1,390	3,150

[1] It is assumed that evapotranspiration losses are negligible and that the indicated gain during the seepage studies is baseflow. Seepage study gains computed for a 1- to 2-day period in each respective month were multiplied by the number of days in the month to get an estimate of total monthly baseflow.

[2] Baseflow estimates from Flook (1959a) for 1955-56; from Welder (1973) for 1957-1970.



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Pecos River Miles and Selected Descriptions for Acme to Lake McMillan Reach

Figure J-1

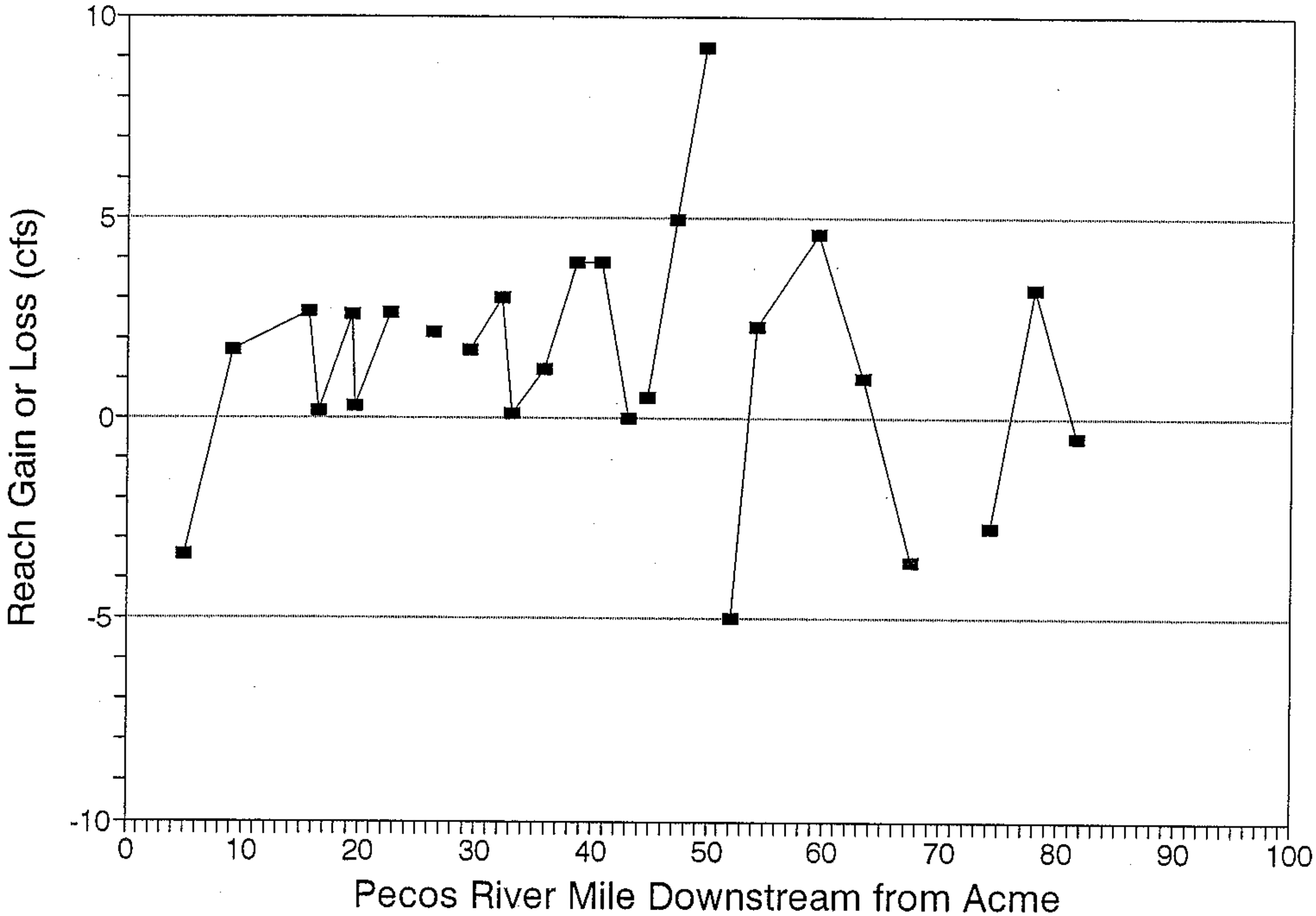

Figure J-2

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Indicated Pecos River Gains and Losses from January 1960 Seepage Study

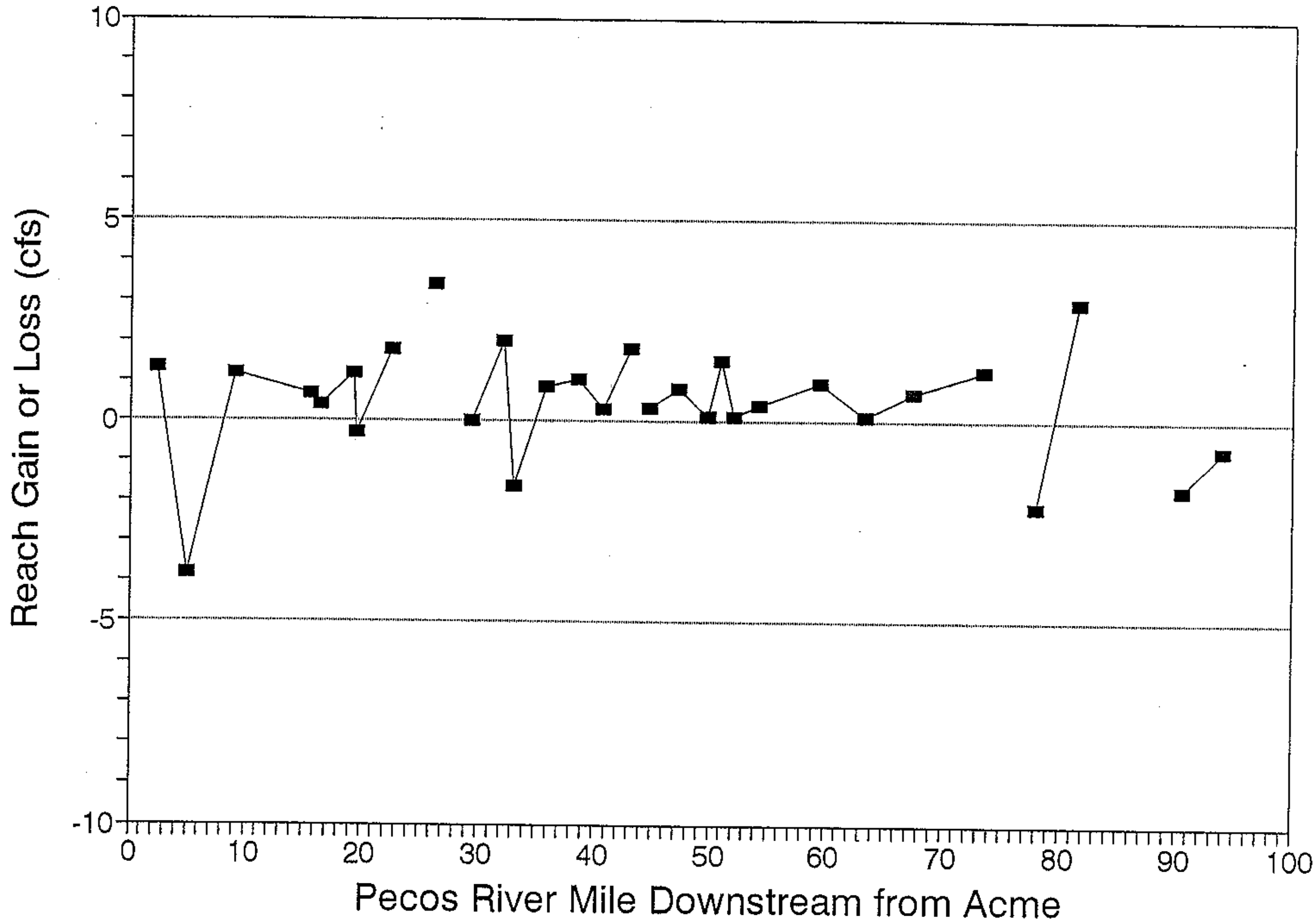

Figure J-3

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Indicated Pecos River Gains and Losses from January 1966 Seepage Study

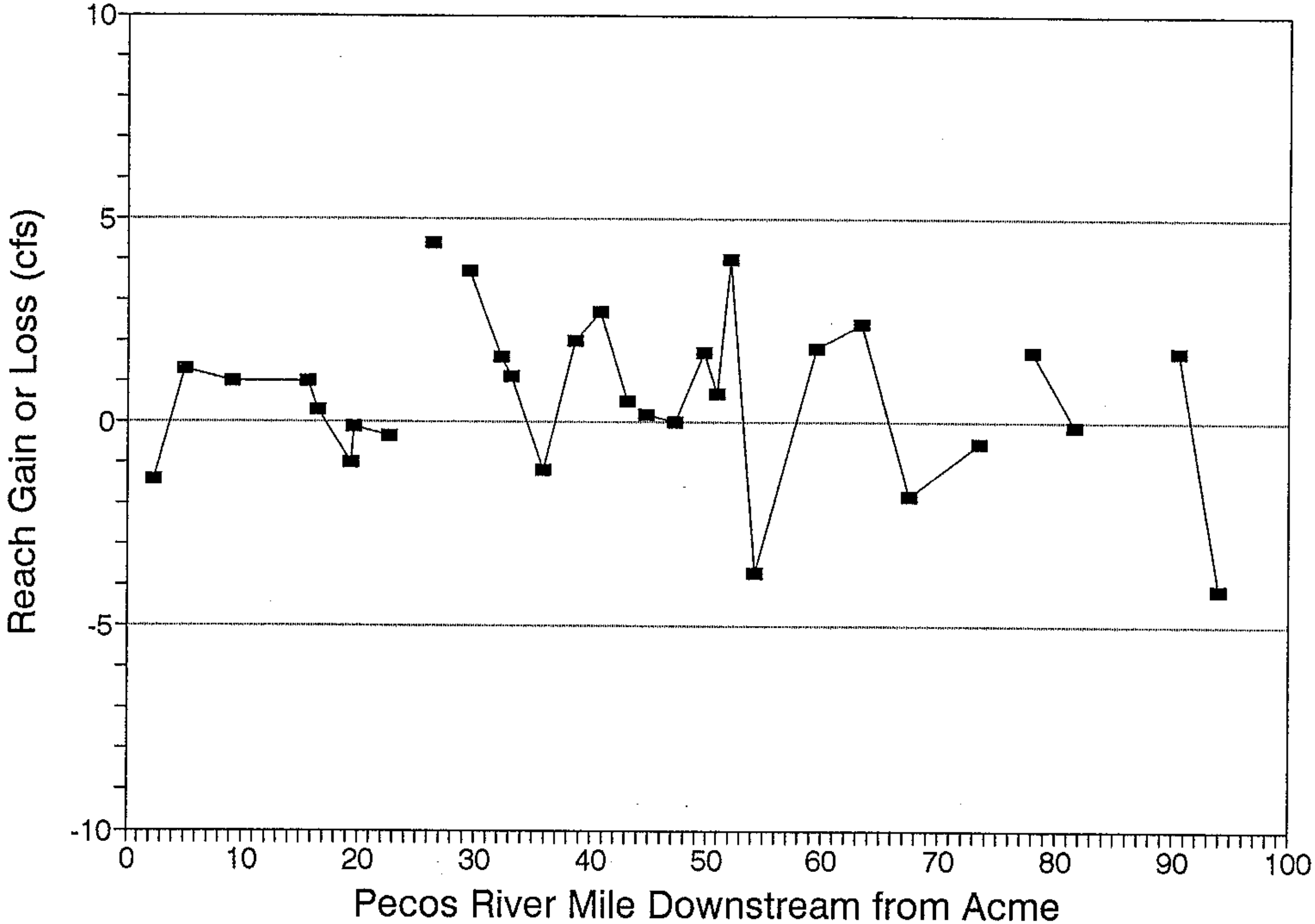

Figure J-4

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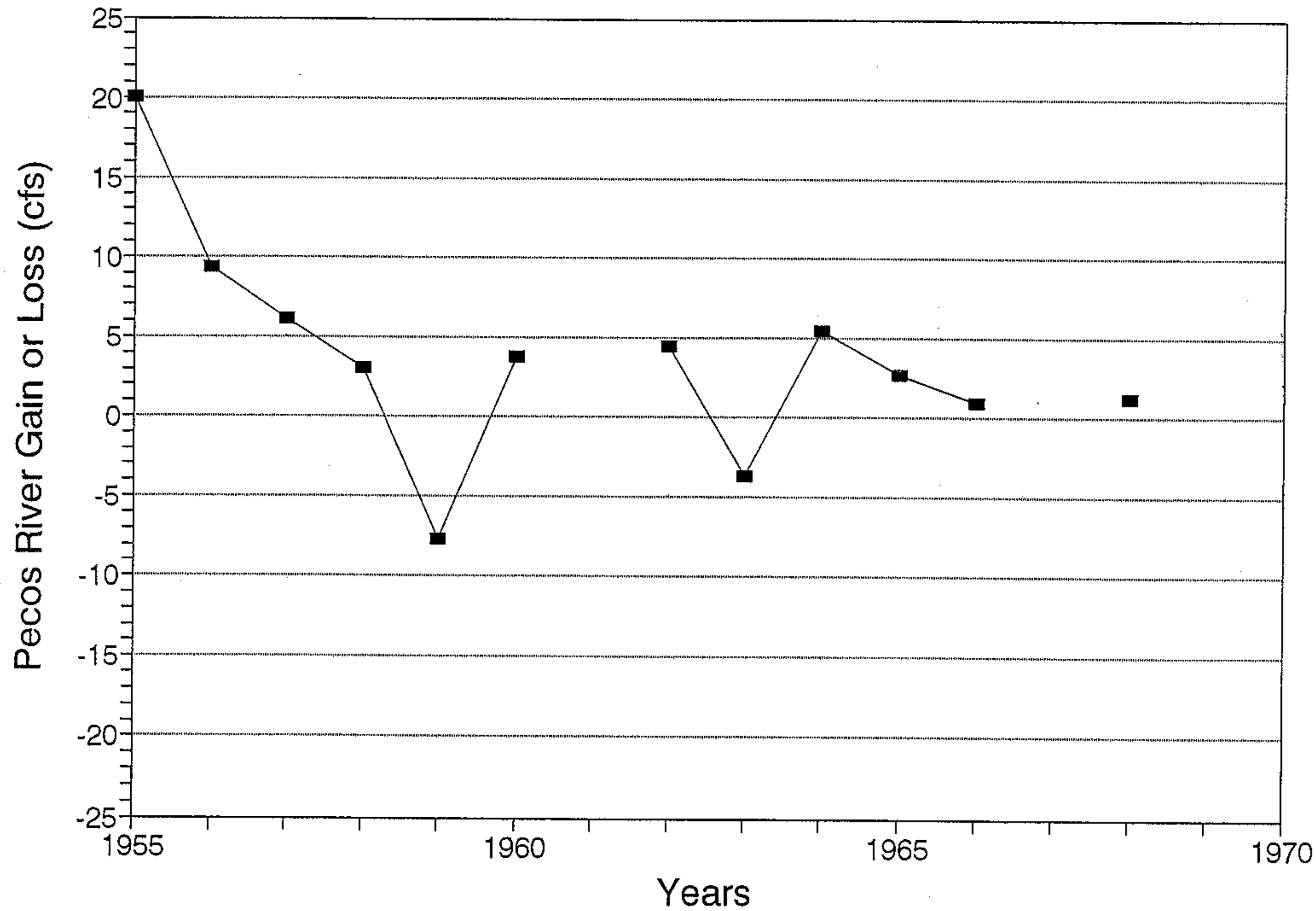
Indicated Pecos River Gains and Losses from January 1968 Seepage Study



Estimated Pecos River Gains and Losses in the Acme-Above Rio Hondo Reach as Determined by Various Seepage Studies Conducted from 1955-1968

Figure J-5

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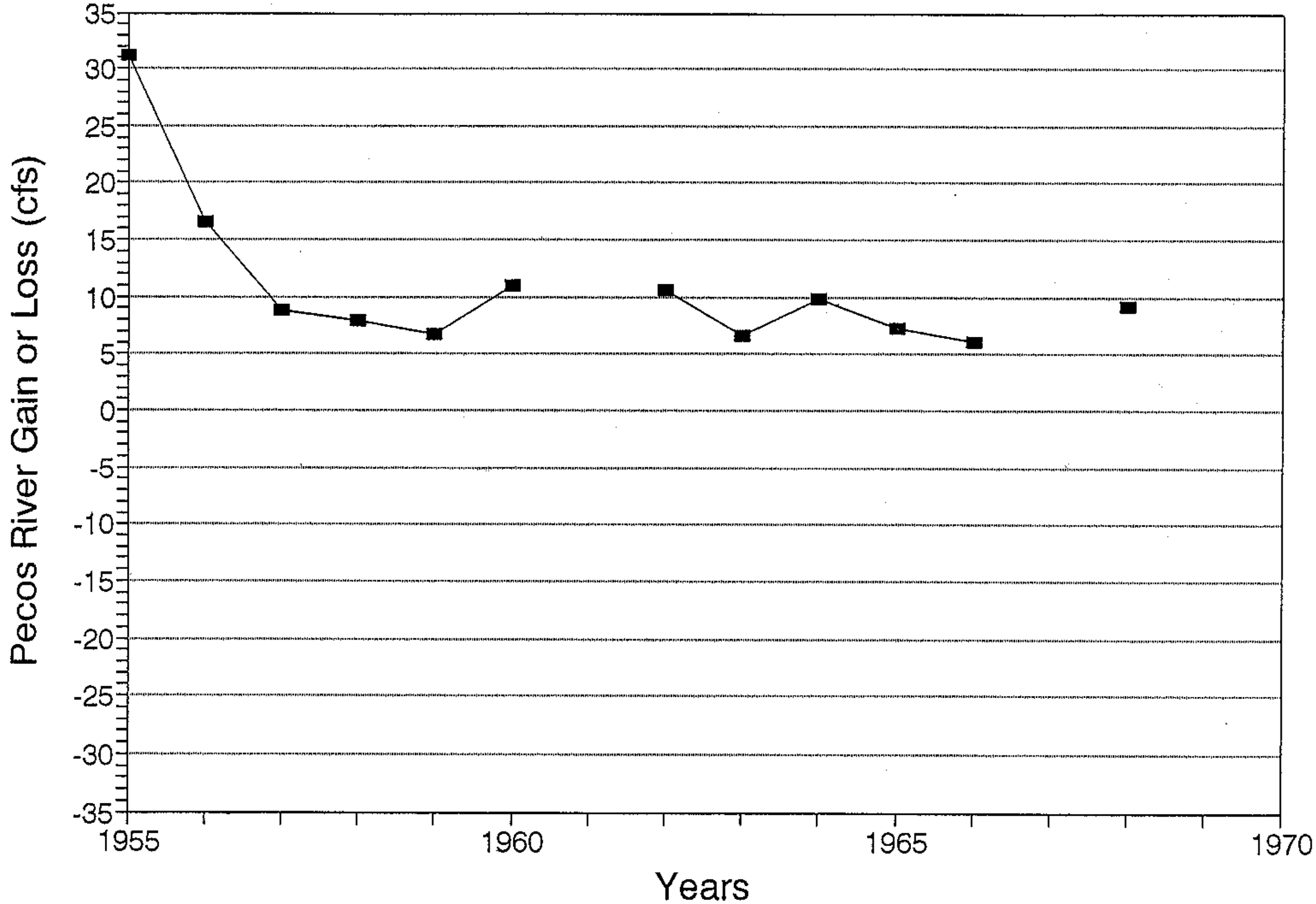

Estimated Pecos River Gains and Losses in the Above Rio Hondo-Dexter Bridge Reach as Determined by Various Seepage Studies Conducted from 1955-1968

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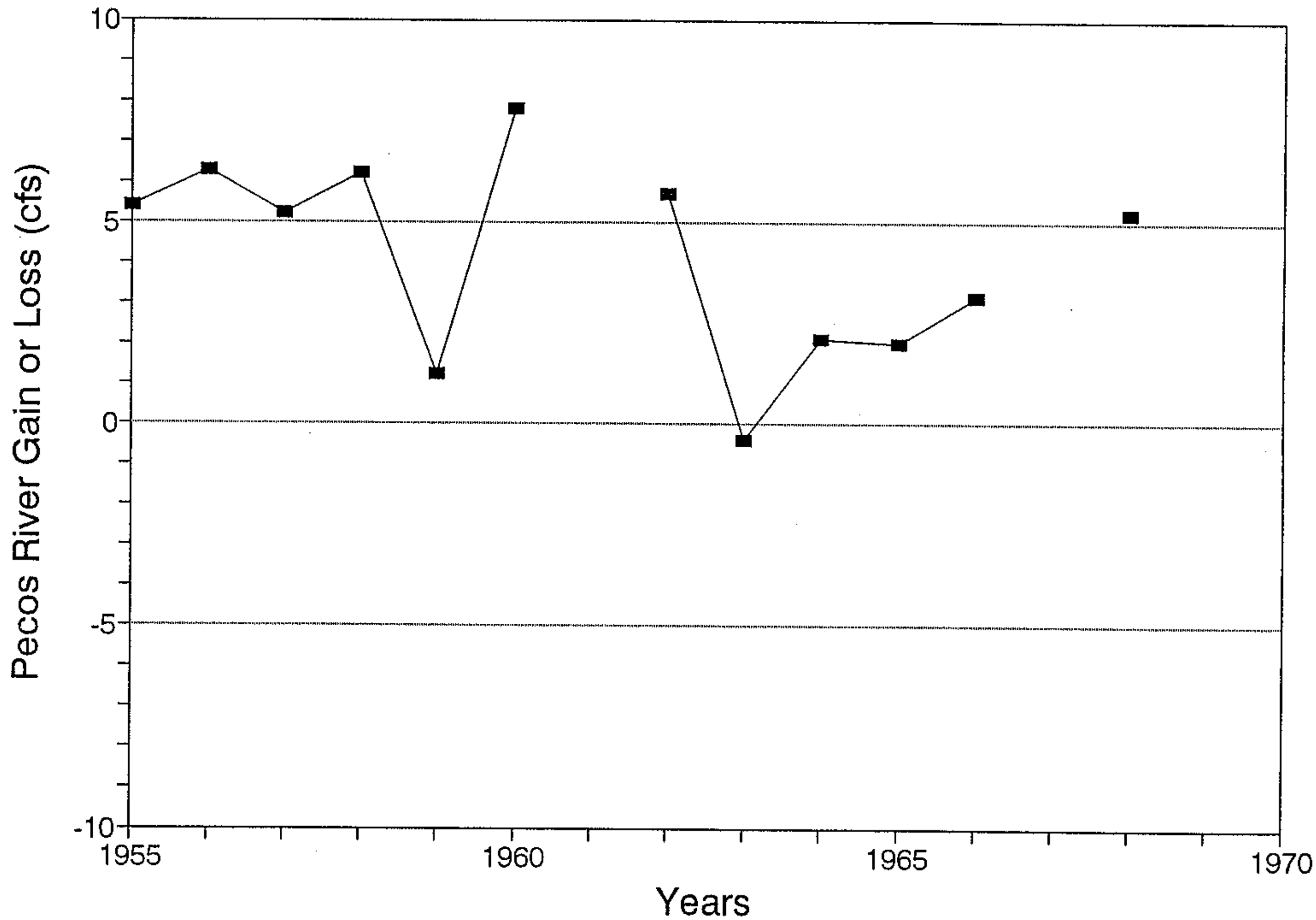
Figure J-6



Estimated Pecos River Gains and Losses in the Dexter Bridge-Above Rio Felix Reach as Determined by Various Seepage Studies Conducted from 1955-1968

Figure J-7

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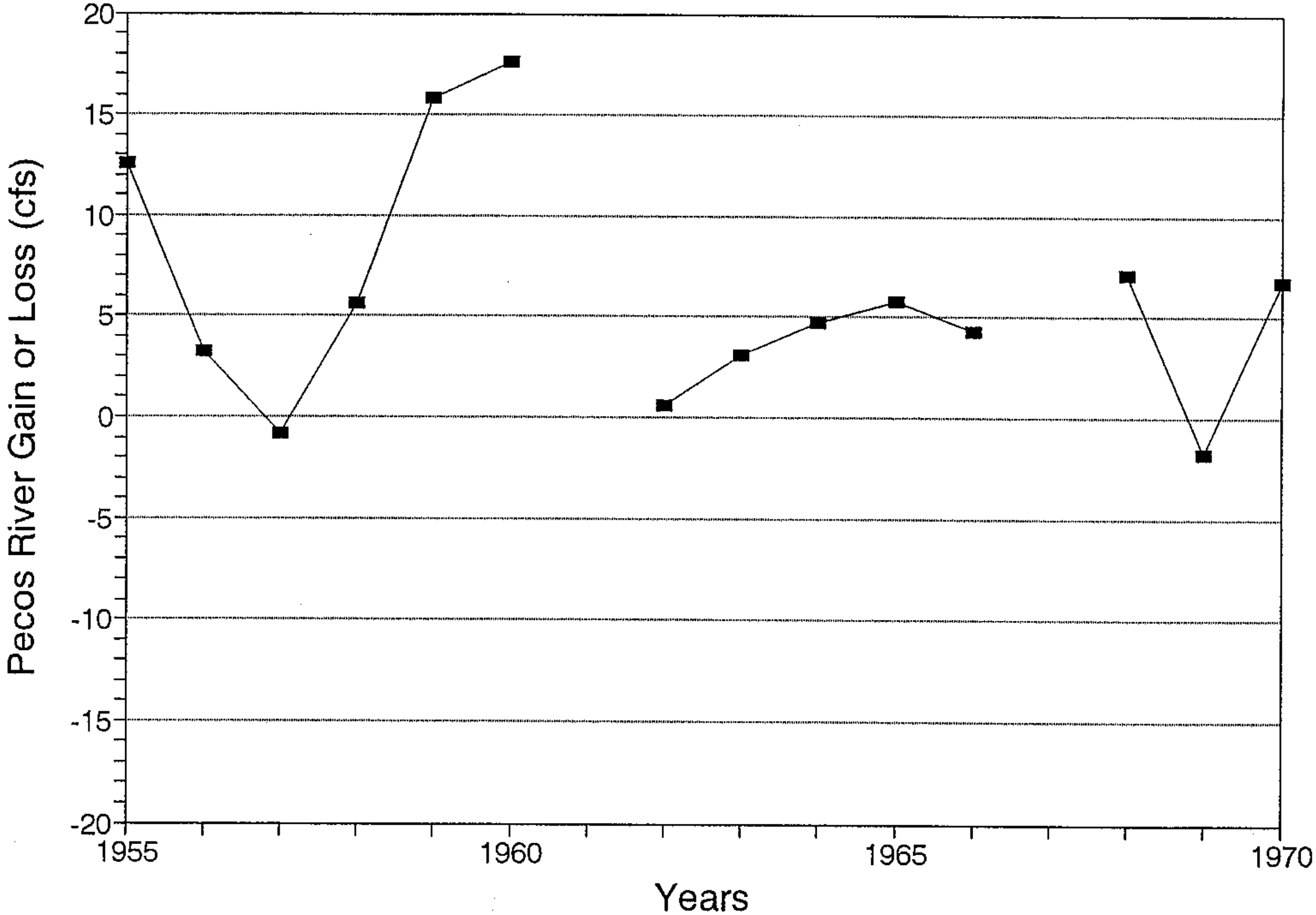

Estimated Pecos River Gains and Losses in the Above Rio Felix-Near Lake Arthur Reach as Determined by Various Seepage Studies Conducted from 1955-1970

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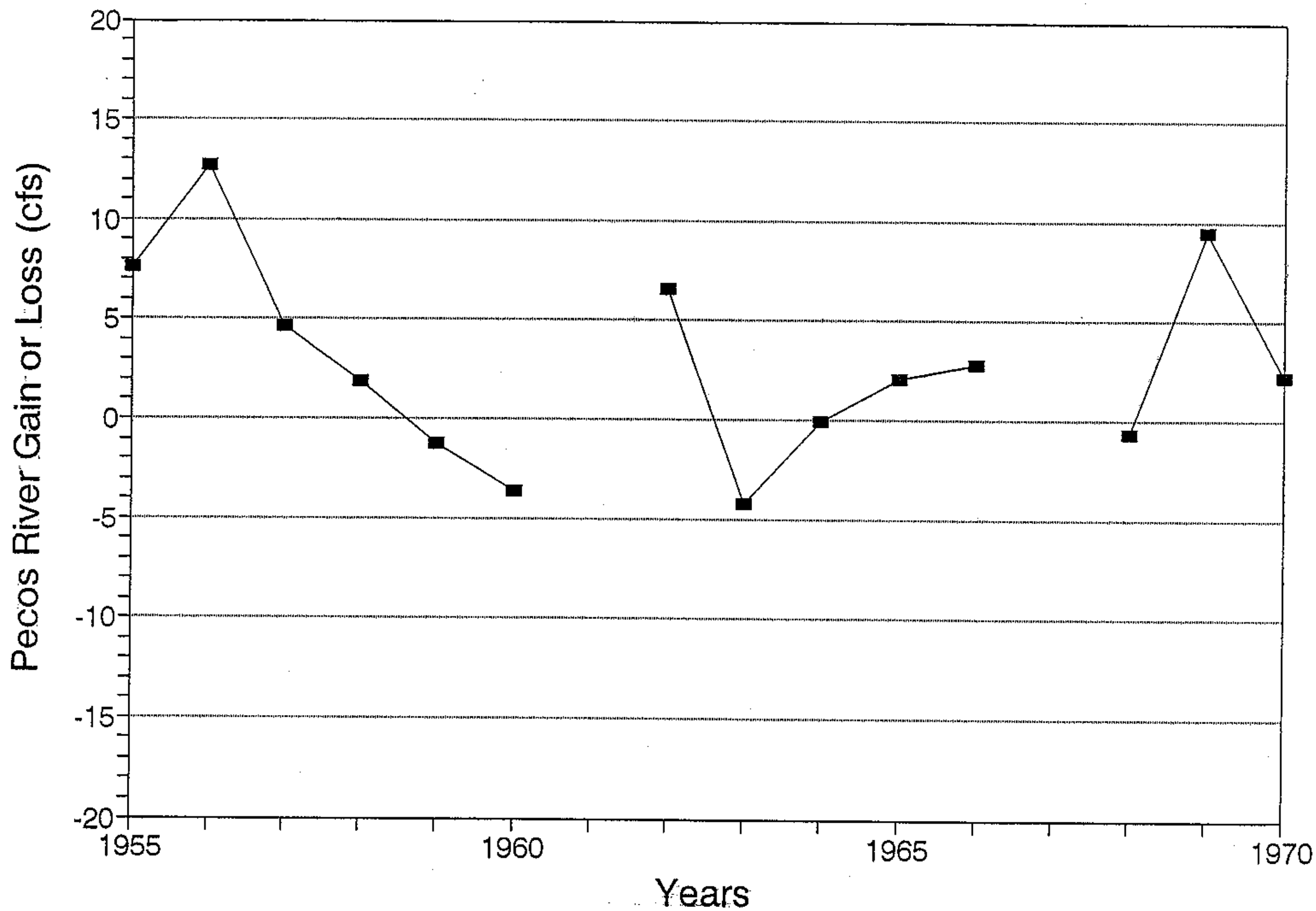
Figure J-8



Estimated Pecos River Gains and Losses in the Near Lake Arthur-Artesia Reach as Determined by Various Seepage Studies Conducted from 1955-1970

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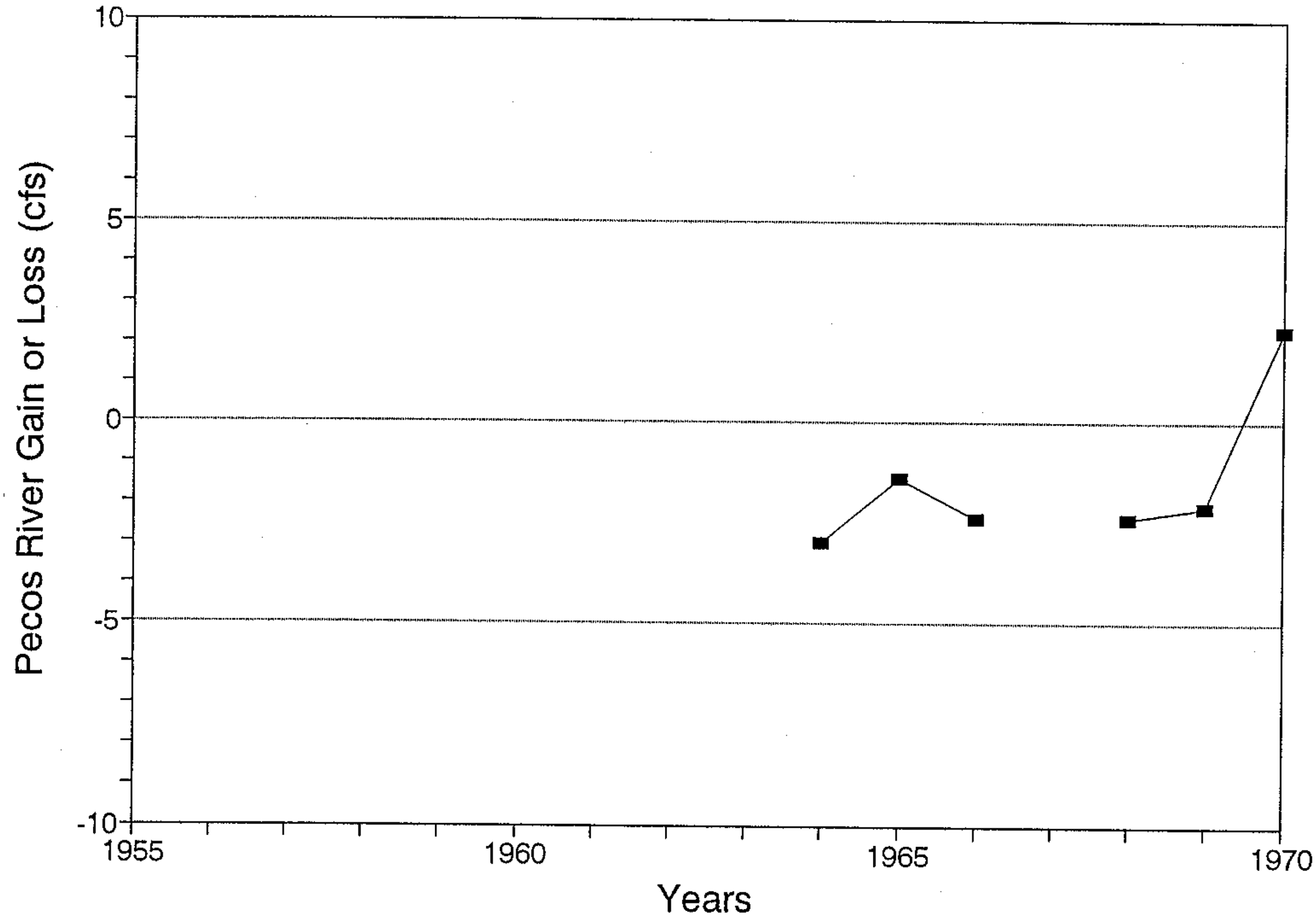
Figure J-9



Estimated Pecos River Gains and Losses in the Artesia-Kaiser Channel Reach as Determined by Various Seepage Studies Conducted from 1964-1970

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Figure J-10

APPENDIX K

QUANTIFICATION OF RETURN FLOW

APPENDIX K
QUANTIFICATION OF RETURN FLOW

K.1 Return Flow from Irrigation

Return flow from irrigation water is estimated in this appendix for diversion of surface and ground water in the Roswell Basin. The estimates are compared to previous estimates for the basin and to other basins in the Southwest. Here we also discuss the geologic conditions affecting the rate of return flow.

The total irrigation diversion for the basin includes pumpage from ground water (Div_{gw}) plus surface-water diversion (Div_{sw}). The return flow from irrigation (RF) has been estimated by subtracting the total depletion rate (TDep) from the quantity of pumped or diverted water. The TDep is the quantity of water that is not returned to the local hydrologic system (based on the consumptive irrigation requirement [CIR] and incidental depletions [ID]):

$$TDep = CIR + ID$$

where CIR is the amount of irrigation water consumed by the irrigated crops, and ID includes evaporation from canals and impoundments, for example.

Return flow from irrigation waters occurs both off- and on-farm, as seepage from canals and deep percolation from irrigated lands. The TDep is evaluated separately for surface- and ground-water sources.

It is assumed that the total quantity not consumed recharges the aquifers, so that on an annual basis there is no increase in the soil moisture content of the vadose zone. This assumption is valid for the calibration period (which begins in 1967), inasmuch as irrigation has existed since the turn of the century and almost all lands irrigated today have been irrigated since at least 1948. Therefore, the moisture content in the vadose zone should be relatively stable.

Given the lack of available data for quantifying flow in the vadose zone, the approach discussed here for evaluating return flow is considered the most practical for this modeling effort. This approach is commonly used in assessing return flow in regional modeling. Wilson et al. (1980) reviewed available models for assessing return flow in a massive study of ground-water basins in Arizona. They ultimately selected a method similar to the approach used in this study, which uses estimates of CIR obtained by the Blaney-Criddle (1962) method and water budget analyses, without accounting for soil moisture.

K.1.1 Return Flow from Irrigation with Ground Water

Return flow from ground water (RF_{gw}) diverted for irrigation is estimated as follows (Figure K-1 presents a schematic of the irrigation components):

$$RF_{gw} = Div_{gw} - TDep_{gw} \qquad (1)$$

and

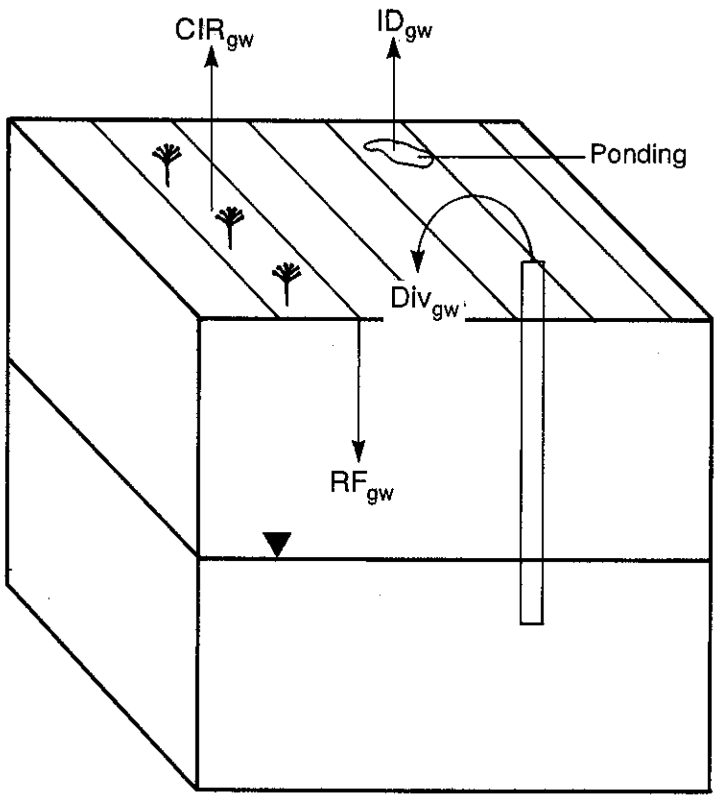
$$TDep_{gw} = (Div_{gw} \times E_f) + (Div_{gw} \times ID_{gw} \times E_f) \qquad (2)$$

where $TDep_{gw}$ = total depletion rate (acre-feet per acre [af/acre] or acre-feet per year [afy])
Div_{gw} = diversion rate (af/acre or afy) (obtained from pumping records)
E_f = on-farm irrigation efficiency (or CIR/Div_{gw})
ID_{gw} = incidental on-farm depletions (as percent of CIR)

Combining equations 1 and 2 gives:

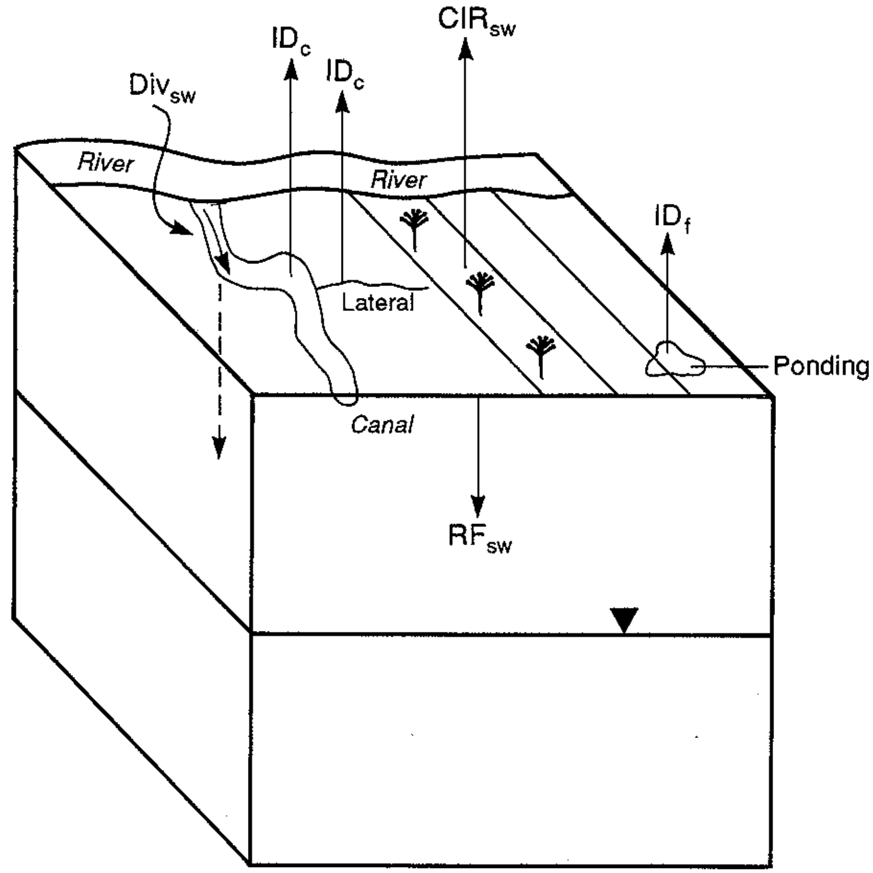
$$RF_{gw} = Div_{gw} (1 - (E_f \times (1 + ID_{gw}))) \qquad (3)$$

K.1.1.1 On-Farm Irrigation Efficiencies. E_f is used in the above equations instead of CIR in order to have the expression in terms of the quantity diverted, rather than acres irrigated. Since the CIR will change from year to year due to variations in precipitation, the E_f term is considered representative of average conditions. Previous estimates of on-farm irrigation efficiencies are discussed below and summarized in Table K-1. Although no standard has been established to define and measure on-farm irrigation efficiency, the following summary is provided in order to



$$Div_{gw} = CIR_{gw} + ID_{gw} + RF_{gw}$$

Components of Ground Water Diversions



$$Div_{sw} = ID_c + ID_f + RF_{sw} + CIR_{sw}$$

Components of Surface Water Diversions

Schematic of Irrigation Components

Figure K-1

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Table K-1. Summary of On-Farm Irrigation Efficiencies

Location/Method	E_f (%)	Reference
Roswell Basin		
12 locations	60	Blaney and Hansen, 1965
1967-1980 CIR	65	Sorenson, 1981
Used CIR estimates for different systems	70	Wilson, 1992
12 farms	61	Landford, 1969; Barnes, 1969
1990 CIR	79	Wilson (personal communication)
Southwest		
Arizona	70	Bouwer, 1980
22 irrigation projects	58	Erie, 1969 (as cited in Halderman, 1980)
Major irrigation	50-70	Interagency task force on irrigation water use and management, 1979 (as cited in Halderman, 1980)

present the range of estimates. Studies out of state may have used different criteria, and irrigation methods or hydrogeologic conditions may be much different, resulting in incomparable results.

The on-farm irrigation efficiency (E_f) for the Roswell Basin has been estimated by Blaney and Hansen (1965) as 60% of the diversion at the farm. They define the E_f as "the percentage of an application of irrigated water that is stored in the soil and which is available for consumptive use by crops." Their estimation was determined by measuring the moisture content of the soil before and after irrigation, as well as the quantity of water delivered to the field. Soil from 12 areas in Roswell and Artesia were tested to arrive at the average E_f of 60%. Individual E_f values ranged from 47 to 81%.

The E_f can also be obtained by dividing the CIR by the quantity diverted (Blaney and Hansen, 1965). Earl Sorenson (1981) of the New Mexico State Engineer Office (SEO) estimated the CIR for 1967 to 1980 using the Blaney-Criddle (1962) method (Table K-2). The weighted average CIR

Table K-2. Comparative Analysis of Blaney-Criddle Crop Irrigation Requirements and Actual Application of Water to Beneficial Use

Year	Blaney-Criddle Method		Metered Diversions (af per water-right acre)	Blaney-Criddle Method (% deviation from metered)[2]
	CIR (af per water-right acre)	Farm Delivery Requirement[1] (af per water-right acre)		
1967	1.90	2.92	2.85	+ 2.5
1968	1.62	2.49	2.53	− 1.6
1969	1.89	2.91	2.69	+ 8.2
1970	1.77	2.72	2.85	− 4.6
1971	1.88	2.89	3.05	− 5.2
1972	1.75	2.69	2.93	− 8.2
1973	1.91	2.94	3.08	− 4.5
1974	1.87	2.88	3.16	− 8.9
1975	2.00	3.08	2.98	+ 3.4
1976	1.93	2.97	3.41	− 12.9
1977	2.24	3.20	3.16	+ 1.3
1978	1.85	2.64	2.94	− 10.2
1979	2.10	3.00	2.91	+ 3.1
1980	2.02	2.89	2.96	− 2.4
Weighted Average	1.92	2.87	2.96	− 3.0

Source: Sorenson, 1981

[1] Farm delivery requirement determined by dividing the consumptive irrigation requirement (CIR) by a farm efficiency of 65% for the period 1967-1976 and 70% for the period 1977-1980.

[2] $$\text{Percent} = \frac{\text{farm delivery (Blaney-Criddle)} - \text{metered diversions}}{\text{metered diversions}}$$

for the 14-year period was 1.92 af/acre. The weighted average diversion was estimated from the measured and reported diversions published in the Roswell Basin Water Master reports to be 2.96 af/acre. The E_f based on these numbers is approximately 65%.

Wilson (1992) reports E_f for flood, sprinkler, and drip irrigation systems in the Roswell Basin for surface- and ground-water sources. These values are summarized in Table K-3. He obtained these values from unpublished work performed by Earl Sorenson (Wilson, personal communication, July 14, 1992). The E_f values ranged from 55 to 85%, with a weighted average of 70%.

Lansford et al. (1969) obtained information on crops, soil and water quality, types of irrigation systems, and amounts of water consumed in the Roswell Basin and analyzed these factors as to their relation to water requirements for crop production. These irrigation efficiencies were computed by dividing the CIR by the amount of diversion; these E_f values ranged from 43 to 84% and averaged 61% for 12 case study farms in the Roswell Basin.

Wilson (1992) also estimated the CIR (shown in Table K-3) for the cropping patterns of lands irrigated by flood, sprinkler, and drip methods, using the Blaney-Criddle method. However, Wilson reduced the original CIR estimates to reflect actual diversions and previous estimates of E_f. If his original estimates of CIR had been used, then the weighted E_f would be about 79% for 1990.

Since the majority of previous investigations arrive at a value at or close to 70%, DBS&A has used an E_f of 70% in the estimate of return flow. This value for E_f falls within the range of E_f estimated for other basins in the Southwest. Bouwer (1980) reports that average irrigation efficiencies throughout the United States are about 50%, but in Arizona, where water is less plentiful, irrigation efficiencies are higher, averaging 70%. The maximum permissible range without danger of salinity buildup is 80 to 90%. Bouwer defines irrigation efficiency as the crop evapotranspiration divided by the amount entering the soil.

Halderman (1980) reported irrigation efficiencies from several studies. For example, a Bureau of Reclamation document for 22 irrigation projects in the western United States had an average E_f of 58% (Erie, 1969). An Interagency Task Force on Irrigation Water Use and Management

Table K-3. Summary of Diversions and Depletions for Irrigation in the Roswell Basin for 1990 (Wilson, 1992)

LOCATION (Source)	Irrigation System[1]	Original CIR Estimate[2] (af/acre)	Adjusted CIR		ID					On-Farm Irrigation Efficiency E_f[1]	Off-Farm Conveyance Efficiency E_c[1]	Total Project Efficiency[1]	Acres Irrigated					Diversion Measured		Surface Diversion at Farm[1]	Surface Conveyance Losses[1]	Surface Water Diversion Div_{sw}[1]	Ground Water Diversion Div_{gw}[1]	Total Depletion		Total Return Flow		Percent Return Flow	
			CIR_{sw}[1] (af/acre)	CIR_{gw}[1] (af/acre)	Off-Farm ID_c[1]	On-Farm ID_f[1]	Below-Farm ID_{bf}[1]	Sum SW ID_{sw}[1]	Sum GW ID_{gw}[1]				Surface Only[1]	Ground Only[1]	Surface Part[1]	Ground Part[1]	Total Acreage[1]	Surface[1]	Ground Water[1]					SW $TDep_{sw}$[3] (afy)	GW $TDep_{gw}$[4] (afy)	SW (afy)[5]	GW (afy)[6]	SW RF_{sw}[7]	GW RF_{gw}[8]
Rio Hondo	F	2.21	2.21	---	0.01	0.05	0.024	0.084	---	0.55	0.7	0.385	300	0	0	0	300	N	---	1,205	517	1,722	0	745	0	977	0	0.57	---
Rio Peñasco (Chaves)	F	2.48	2.31	2.31	0.03	0.05	0.1	0.18	0.15	0.55	0.7	0.385	605	0	732	183	1,520	N	N	5,615	2,407	8,022	769	3,919	486	4,103	283	0.51	0.37
RB North	D	2.89	---	2.55	---	---	---	---	---	0.85	---	0.85	0	200	0	0	200	---	Y	0	0	0	600	0	510	0	90	---	0.15
RB North (part)	F	2.48	1.92	---	0.032	0.05	0.05	0.132	---	0.6	0.75	0.45	1,885	0	4,790	0	6,675	Y	---	21,382	7,128	28,510	0	15,224	0	13,286	0	0.47	---
RB North (part)	F	2.48	---	2.23	---	0.05	---	---	0.05	0.7	---	0.7	0	51,651	0	7,184	58,835	---	Y	0	0	0	187,767	0	138,009	0	49,758	---	0.26
RB North	S	2.83	---	2.55	---	0.243	---	---	0.243	0.7	---	0.7	0	20,490	0	0	20,490	---	Y	0	0	0	74,584	0	64,895	0	9,689	---	0.13
Scattered (Chaves)	F	2.48	2.44	2.99	0.032	0.05	0.05	0.132	0.1	0.6	0.9	0.54	0	50	250	500	800	N	N	1,017	113	1,130	2,741	710	1,809	419	932	0.37	0.34
Rio Peñasco (Eddy)	F	2.61	2.61	2.61	0.03	0.05	0.1	0.18	0.15	0.55	0.7	0.385	0	0	1,773	197	1,970	N	N	8,414	3,606	12,020	935	5,872	591	6,148	344	0.51	0.37
RB South	F	2.23	---	2.01	---	0.05	---	---	0.05	0.7	---	0.7	0	12,970	0	0	12,970	---	Y	0	0	0	37,150	0	27,373	0	9,777	---	0.26
RB South	S	2.41	---	2.17	---	0.243	---	---	0.243	0.7	---	0.7	0	18,230	0	0	18,230	---	Y	0	0	0	56,513	0	49,172	0	7,341	---	0.13
Total/Average		2.50	2.11	2.26	**0.03**	---	---	**0.15**	**0.12**	**0.69**	**0.73**	---	2,790	103,591	7,545	8,064	121,990			37,633	13,770	51,403	361,059	26,470	282,846	24,933	78,213	**0.49**	**0.22**

(ID_f+ID_{bf} for SW) = **0.12**

E_f for SW= **0.58**

E_f for GW= **0.70**

Weighted Average Return Flow from SW and GW[9] = **0.25**

[1] Wilson, 1992. Irrigation system: F=flood, D=drip, S=sprinkler

[2] Wilson, Pers. Comm., weighted ave. = CIR*Acres/total acres

[3] $Div_{sw}((E_c*E_f)+(E_c*ID_c)+(E_f*(ID_f+ID_{bf})))$

[4] Acres irrigated w/ GW * CIR * 1+ID_{gw}

[5] Total SW diversion - total SW depletions

[6] Total GW diversions - total GW depletions

[7] Total return flow from SW/Total SW diversions

[8] Total return flow from GW/ Total GW diversions

[9] Total return flow from GW & SW / Total diversions from GW & SW

Shaded numbers referred to in report.

(1979) reported that the E_f ranges from 50 to 70% for major irrigation areas in the Southwest. These values are consistent with those from the Roswell Basin.

K.1.1.2 Incidental Depletions. Wilson (1992) published incidental depletion values for various areas in the Roswell Basin as shown in Table K-3. Wilson obtained the estimates for ID from unpublished work by Sorenson. He explains that:

> *Incidental depletions associated with canals and laterals are generally estimated by determining (1) the total length of canals and laterals, (2) the top width of the water surface, (3) the fringe width on each side of the canal where phreatophytes consumptively use seepage water, (4) the percent of time during the irrigation season when water is flowing, and (5) the net evaporation rate during the irrigation season. Taking the product of all these elements and dividing by the normal CIR (total acre-feet) for the area under study yields the incidental depletion factor for canals and laterals expressed as a function of the CIR.*

Wilson divides the on-farm ID into two components: on-farm (ID_f) and below-farm (ID_{bf}). The two are combined in Table K-3 as ID_{gw}. The only difference between on-farm ID and below-farm ID as defined by Wilson is that on-farm accounts for the depletions that occur on the field and below-farm accounts for depletions that occur from field run-off. As shown in Table K-3, the weighted on-farm incidental depletion factor for ground-water diversions in the Roswell Basin (expressed as a function of the CIR) was estimated as 12% using Wilson's ID values for each area.

K.1.1.3 Return Flow Estimate. If this ID value along with an E_f value of 70% is substituted in equation 3, the calculated return flow from ground-water diversion is approximately 22% of the water diverted. This return flow estimate compares favorably with estimates used in previous investigations in the Roswell Basin. For example, Mower (1960) estimated that 20% of water diverted for irrigation in the Roswell Basin eventually reaches the alluvium. Hantush (1957) estimated return flow to the shallow aquifer as 20% of the ground-water diversions in the artesian and shallow aquifers. In Arizona, the range of maximum potential recharge expressed as a percentage of application was approximately 20 to 30% in a district using only ground water (Wilson et al., 1980).

However, in 1967 Carl Slingerland, SEO staff engineer, recommended to Steve Reynolds, the State Engineer, that a value of 30% should be used by the office for the evaluation of water right transfers (Slingerland, 1967). Slingerland summarized CIR estimates for the Roswell Basin of four different studies that used Blaney-Criddle and the cropping patterns for different periods from 1958 to 1965 (summarized in Table K-4). From these studies he estimated the average CIR as 1.8 af/acre and ID as 15% of CIR. This gave a total depletion of 2.07 af/acre out of a diversion of 3 af/acre, or 70%. Based on this, he recommended using a return flow value of 30%. Slingerland recognized that others have used a value of 20% for return flow in the Roswell Basin (Hantush, Mower, Motts and Cushman, Mower et al.). He suggested that all of these authors relied primarily on Hantush's estimate, which was based on percolation losses for similar soils and crops in other areas. He discounted Hantush's estimate, since no actual studies of return flow for the Roswell Basin were made.

The difference in Slingerland's estimate of return flow and the one presented here by DBS&A is primarily due to an increase in CIR for the basin. As shown on Table K-4, Wilson (1991) estimated CIR for 1940 to be 1.92 af/acre and for 1985 to be 2.32 af/acre. The average CIR (for surface and ground water) for the Roswell Basin in 1990 was estimated as 2.50 af/acre (Wilson, 1992). The CIR has increased since 1940 due primarily to an increase in the percentage of crops cultivated that have very high water requirements. For instance, alfalfa crops comprised about 33% of the irrigated acres from 1958 to 1962 and increased to 55% by 1985.

K.1.2 Return Flow from Irrigation with Surface Water

Return flow from canals and lands irrigated with surface water is estimated as follows:

$$RF_{sw} = Div_{sw} - TDep_{sw} \tag{4}$$

and

$$TDep_{sw} = CIR + ID_{sw} \tag{5}$$

or

$$TDep_{sw} = (Div_{sw} \times E_c \times E_f) + (Div_{sw} \times E_c \times ID_c) + (Div_{sw} \times E_f \times ID_f) \tag{6}$$

or

$$TDep_{sw} = Div_{sw}\,((E_c \times E_f) + (E_c \times ID_c) + (E_f \times ID_f)) \tag{7}$$

Table K-4. Crop Distributions and CIR Estimates for the Roswell Basin

Crop	Wilson (1991) Acres 1940	Wilson (1991) % 1940	Roswell Basin NMSU % 1958-62	Roswell Basin Sorenson % 1958-62	Chaves Co. ISC % 1959-65	Chaves Co. Hennighausen % 1964	Chaves Co. Hennighausen % 1965	Wilson (1991) Acres 1985	Wilson (1991) % 1985	Wilson (Pers. Comm., 1992) 1990
Spring small grain	4961	5.02	13.9	13.9	17	14.7	14.6	4016	3.52	---
Cotton	40450	40.93	29.8	29.8	38	34.7	34.8	15210	13.32	---
Misc. field crop*	19153	19.38	0.9	0.9	2	2.3	2.3	300	0.26	---
Alfalfa	32195	32.58	32.3	32.3	33	34.7	35.6	63290	55.41	---
Hay	2	0.00	---	---	---	---	---	---	---	---
Pasture	2059	2.08	---	---	---	---	---	4638	4.06	---
Sorghum	---	---	23.1	23.1	10	13.6	12.7	8348	7.31	---
Corn	---	---	---	---	---	---	---	4242	3.71	---
Winter wheat	---	---	---	---	---	---	---	9372	8.21	---
Pecan orchards	---	---	---	---	---	---	---	3390	2.97	---
Vineyards	---	---	---	---	---	---	---	45	0.04	---
Chile	---	---	---	---	---	---	---	1120	0.98	---
Misc. vegetables	---	---	---	---	---	---	---	240	0.21	---
Total irrigated	98820	---	---	---	---	---	---	114211	---	---
Idle and fallow	12824	---	---	---	---	---	---	16022	---	---
CIR (af/acre)	---	1.92	1.8	1.77	1.82	1.85	1.85	---	2.32	2.50

Sources: Slingerland, 1967; Wilson, 1991, 1992

Shaded numbers referred to in report.

* Includes sugar beets, sunflower and other oil seeds, melons, lettuce, onions, sod farms.
For 1940, also includes orchards, vineyards, beans, chili peppers.

--- = Not available

where Div_{sw} = surface-water diversion rate (af/acre or afy) (obtained from USGS records)

$TDep_{sw}$ = total surface-water depletion rate (af/acre or afy)

E_f = on-farm irrigation efficiency

E_c = off-farm conveyance efficiency

ID_f = incidental on-farm depletions

ID_c = incidental off-farm depletions

Combining equations 4 and 7 gives:

$$RF_{sw} = Div_{sw} (1 - ((E_c \times E_f) + (E_c \times ID_c) + (E_f \times ID_f)) \qquad (8)$$

The off-farm conveyance efficiency reported by Wilson (1992) ranges from 70 to 90%, and the weighted average based on acreage is equal to 73% (Table K-3). This estimate agrees well with Lauritzen and Terrell (1967), who estimate that one-quarter to one-third of all water diverted for irrigation is lost in conveyance (cited by Wilson et al., 1980). A value of 73% for conveyance efficiency is high but within the range of records reported for the Water and Power Resources Service. Conveyance losses for 46 irrigation projects in the United States ranged from 3 to 86% and averaged 40%, giving a conveyance efficiency of 60% (Kraatz, 1977, cited by Wilson et al., 1980). Halderman (1980) cites a study by Erie (1969) for 22 Bureau of Reclamation irrigation projects in the western United States, for which the average off-farm conveyance efficiency was 62%.

The on-farm irrigation efficiencies reported by Wilson (1992) from surface diversions ranged from 55 to 60%, with a weighted average of 58% (Table K-3). The combined incidental depletions, expressed as a function of the CIR, from on- and off-farm systems ranged from 8 to 18% with an average of 15%. The weighted average off-farm incidental depletions (ID_c) is 3 and 12% for on-farm (ID_f). Substituting these values into equation 7 results in a return flow estimate of 49% of surface-water diversions.

A value of 49% for return flow from surface-water sources agrees with the Arizona study by Wilson et al. (1980), which found that the range of maximum potential recharge expressed as a percentage of application was approximately 40 to 50% in districts with a surface-water source and only 20 to 30% for districts using only ground water. The high cost of power for ground-water pumping, which encourages efficiency, was given as an explanation for the difference in efficiencies between surface- and ground-water sources.

In a 1960 seepage study (SEO, 1960), off-farm conveyance efficiency on the Hagerman Canal, which is the primary surface-water diversion canal in the Roswell Basin, was estimated to be 64% of the total diverted

Barroll (June 11, 1993, SEO memorandum on Hagerman Canal and Diversions) estimates the off-farm conveyance efficiency to be 56% by comparing the 1962 lateral diversions to the total canal inflow. Barroll (1993) estimates E_c to be 64% and 40% in 1987 and 1991, respectively. Barroll concludes that "losses on the main stem of the Hagerman Canal, not counting losses on laterals, is about 45 percent of the water diverted into the canal from wells, springs, drains, and the Rio Hondo." With a loss of 45%, the E_c on the main stem of the canal would be 55%.

Using Barroll's (1993) estimate of E_c and Wilson's (1992) estimates of E_f and ID_{sw} (0.15), the return flow from surface water may be at least 60%. If losses on laterals were included, the value would be even higher.

K.1.3 Total Average Return Flow for the Roswell Basin

Based on the estimates presented in Table K-3, the overall weighted average (weighted on diversion source) of return flow for both surface- and ground-water sources is 25% of diversions. This is much lower than an estimate by the PRJ1 (1942, table 92) study of 50% for irrigation efficiency, which would yield a return flow of 44% (1 − ($E_{f \times 10}$)). The average diversion for both surface and ground water combined is 3.4 af/acre in 1990. Therefore, the average return flow is 0.85 af/acre per year. Consequently, the mean specified discharge beneath the irrigated area would be 0.85 feet per year (ft/yr).

Motts and Cushman (1964) questioned whether the soil was sufficiently permeable to transmit this seepage. They believed that the permeability of the soils in the lowland area, where most of the irrigation occurs, would be too low to accept the 20% return flow that Hantush estimated.

They stated that "most of the irrigated land in the Roswell-Artesia sector is on the Orchard Park terrace, and the low permeability of the soil prevents a high rate of recharge . . . ." They describe the B soil horizon of this area to consist of clay and caliche and estimate the permeability to be about 0.01 gallons per day per square foot (gpd/ft^2) (or about 0.49 ft/yr). It is unclear how they arrive at this permeability estimate. Using the particle size distribution published by Motts and Cushman for the Orchard Park terrace and empirical estimates of permeability, the permeability should be much greater than 0.49 ft/yr. In fact, the permeability with the Kozeny-Carmen equation (Carmen, 1956) is estimated at about 80 ft/yr, and with the Hazen method (1911), at about 12.4 ft/yr.

According to the *Soil Survey of Chaves County* (Hodson et al., 1980), the soil types of the B horizon in the vicinity of irrigation have hydraulic conductivities ranging from 0.6 to 2.0 inches per hour (in/hr), or 440 to 1,460 ft/yr. The mean flux from return flow (0.85 ft/yr) would be readily transmitted by soils having hydraulic conductivities of 440 ft/yr, but if soil conductivity was 0.49 ft/yr, perched or ponded conditions would have occurred that would adversely impact agricultural production. The soils in the Orchard Park terrace area are described as well-drained (Hodson et al., 1980), with moderate salinity being the only limitation to irrigation in some of the soil types. It is unlikely, therefore, that irrigation would be as successful as it has been if the permeability were as low as described by Motts and Cushman.

K.2 Return Flow from Public Water Supplies

Wilson (1992) compiled data for diversions and depletions of public water supplies in the Roswell Basin. The depletion rate (or consumptive use) for municipal uses was determined by subtracting the quantity discharged by sewage treatment facilities, regardless of ultimate disposal, from the quantity diverted. If the reported diversion was based on the quantity sold, then Wilson increased the diversion by 10% to account for losses in the conveyance system (Wilson, personal communication, 1992). The average calculated depletion for nine public water supply systems in the basin was 66%, giving a municipal return flow of 34% (see Table K-5). The total return flow may be less due to evaporation and evapotranspiration following discharge from the sewage treatment plant.

Table K-5. Summary of Diversions and Depletions for Non-Irrigation Uses in the Roswell Basin

User	Diversion (afy)		Depletion Rate (%)		Depletion Rate (afy)	
	SW	GW	SW	GW	SW	GW
MUNICIPAL USES						
Berrendo Water Users Association	---	855	---	0.5	---	427
Dexter Municipal Water System	---	997	---	0.4	---	399
Greenfield MDWCA	---	47	---	0.5	---	23
Hagerman Water System	---	436	---	0.5	---	218
Lake Arthur Water Co-Op	---	51	---	0.5	---	25
Roswell Municipal Water System	---	13733	---	0.69	---	9476
South Springs Acres	---	156	---	0.82	---	128
Artesia Domestic Water System	---	3392	---	0.7	---	2374
Artesia Rural Water Co-Op	---	343	---	0.5	---	172
Summary of Municipal Uses	---	20008	---	0.66	---	13242
OTHER USES						
Rural Domestic Homes	---	426	---	0.45	---	192
Livestock (Chaves Co.)	236	2889	1.00	0.93	236	2696
Commercial	---	2802	---	0.27	---	758
Industrial	---	622	---	0.79	---	494
Mining	---	131	---	0.78	---	102

Source: Wilson, 1992

afy = Acre-feet per year
SW = Surface water
GW = Ground Water

--- = Not available

This method of calculating the depletion does not account for the use of sewage effluent for irrigation. Mower (1960) reports that since 1952, about 2,200 af of reclaimed sewage water has been used for irrigation. Presently, approximately 3,000 af of Roswell sewage water is reclaimed (Art Torrez, personal communication, November 20, 1992). If we assume that the depletion rate of this sewage effluent is equal to the average weighted depletion of 75% discussed in Section 2.2.3 of this report, then an additional 1,650 afy is depleted from the diversions for municipal uses (2,200 x 0.75). This gives a total depletion of 14,900 afy out of a total diversion of 20,000 afy, resulting in a depletion rate of 75% and a return flow of 25%. In a Pecos basin planning study, d'Arge (1970) used a depletion rate of 45%, or return flow rate of 55%, based on estimates obtained from N. Wollman of the Economics Department of the University of New Mexico.

K.3 Return Flow from Other Uses

The total diversion from surface- and ground-water sources for livestock, commercial, industrial, and mining applications in the Roswell Basin was 6,680 af for 1990 (Wilson, 1992). Table K-5 shows the individual diversions and depletions for these uses. The total depletion of these diversions was estimated at 4,286 af, giving a depletion rate of 64%, or a return flow rate of 36%. Wilson's estimates differ from those of D'Arge (1970), who calculated the average consumptive use for manufacturing, mining, and electrical power generation at 48%. D'Arge's estimates were based in part on empirical formulas relating fresh water withdrawals and numbers of employees, which may not be well correlated to these uses. Although the difference in the two return flow estimates presented for this use category is 16%, the difference in the amount of return flow is only about 1,000 afy. Wilson's estimates were used in the modeling study.

APPENDIX L

DISCUSSION OF NON-BENEFICIAL CONSUMPTIVE USE

APPENDIX L

DISCUSSION OF NON-BENEFICIAL CONSUMPTIVE USE

This appendix provides a discussion of the various estimates for consumptive use of non-economically beneficial uses, such as evapotranspiration by salt cedars.

The Pecos River Joint Investigation (Blaney et al. *in* National Resources Planning Board, 1942, p. 201) estimated the consumptive use of salt cedars in the McMillan Delta by measuring the change in soil moisture and the drop in the water table. They determined that in successive fluctuations during the year the accumulated drop in the water level was approximately 36 feet. The change in soil moisture was measured as follows:

> *Soil samples of the 6 feet of soil above the water table were taken . . . and moisture content was determined at the Carlsbad laboratory. Samples were again taken of the same soil horizon when the water was near the ground surface. Assuming that no drainage occurs, the difference in moisture content of these samples indicates the amount of moisture lost through evaporation and transpiration by the salt cedars. The average moisture content of the soil with the water table at 6 feet was 21.7 percent, while soil samples taken when the water was at the surface indicated an average moisture content of 35.0 percent, a difference of 13.3 percent. Assuming an apparent specific gravity of 1.4, the amount of water lost for each foot of soil was 2.2 inches.* [The assumed specific gravity (or bulk density) of the soil was multiplied by the gravimetric moisture content to obtain a volumetric moisture content (13.3% x 1.4 = 18.6%). Therefore, for every 1-foot drop in head, 2.2 inches (0.186 x 12 inches) of water are consumed by salt cedars and direct evaporation]. *Assuming further that 10 percent of this was lost by seepage and that the annual accumulated fall in ground water was 36 feet, the consumptive use of water by salt cedar would be approximately 6 af/acre per year.*

Blaney et al. thought this consumptive use value was reasonable since it compared favorably to the estimates determined by the Carlsbad Evapo-Transpiration Station, where evapotranspiration was measured from salt cedars growing in tanks. Comparing the density and size of the plants in the two areas, they concluded that the optimum use of water by salt cedar is about 6 acre-feet per acre (af/acre) and average use is about 5 af/acre.

Blaney et al. extrapolated from the tank experiments in the Carlsbad area to estimate consumptive uses in Chaves County of grass and weeds at 2.3 af/acre, of salt cedars at 5.7 af/acre, and of trees at 2.8 af/acre. The total area of native vegetation in Chaves County was estimated at 62,237 acres, resulting in a total consumptive use (including precipitation) of 95,836 af, or 1.52 af/acre.

Mower et al. (1964) examined the potential salvage of water obtainable by eradicating phreatophytes. Salt cedars "infest" land along both sides of the Pecos River, primarily where the depth of water is less than 20 feet. From Acme to Artesia the width of the infested area ranges from a few feet to a maximum of 4 miles and averages 1½ miles. In 1956 and 1958, Mower et al. (1964) mapped 41,000 acres of phreatophytes and stated that "[r]esults of the 1958 phreatophyte survey showed that if each species were reduced to an area of 100% volume density, salt cedar would cover about 8,700 acres, grass about 17,000 acres and mesquite, 170 acres."

Mower et al. estimated the consumptive use for 1956 and 1958 by four methods. The results are summarized in Table 4-12 of this report. Mower et al. cite a study conducted in Arizona (Gatewood et al., 1950) which determined that for growths of 100% volume density the consumptive use (including precipitation) of water was 7.2 feet for salt cedar and 3.3 feet for mesquite. Adjusting for the differences in climate, Mower et al. arrived at an estimate of consumptive use of 6.0 feet per year (ft/yr) and 3.0 ft/yr, respectively, for salt cedar and mesquite, for growths of 100% density. The consumptive use of water by grasses in the Roswell Basin was estimated as 1.2 ft/yr by extrapolation from studies near Carlsbad, New Mexico.

The total consumptive use was estimated for the three groups of phreatophytes, and the portion consumed from ground water was determined by subtracting the effective precipitation. By evaluating the components of inflow and outflow to the bottomlands, Mower et al. estimated the quantity of ground water consumed in the phreatophyte area to be 44,500 af in 1956 and 47,400 af in 1958, with an average consumptive use of 1.09 af/acre and 1.16 af/acre for native vegetation.

By evaluating the reach between Bottomless Lakes and Dexter, where seepage studies were simplified due to few inflows and outflows, the depletion of ground water by phreatophytes was estimated. Using this value and calculating the effect of depletion from phreatophytes (simulated as wells), Mower et al. backed out a consumptive use of ground water for phreatophytes. These are summarized in Table L-1.

Table L-1. Consumptive Use of Ground Water by Phreatophytes

Year	Native Vegetation	Consumptive Use of Ground Water (af/acre)	Effective Precipitation (af/acre)	Total Consumptive Use (af/acre)
1956	Salt cedar grasses	3.71 0.62	0.43 0.43	4.14 1.05
1958	Salt cedar grasses	1.11 0.21	1.0 1.0	2.11 1.21

Source: Mower et al., 1964

Mower et al. evaluated water level fluctuations in four shallow "transpiration wells" to estimate evapotranspiration. For 1958 they computed that the consumptive use (excluding precipitation) by salt cedars was 4.8 feet per acre (ft/acre) (100% density) and by grasses 2.8 ft/acre. After adjusting for the average depth to water, they concluded that the consumptive use of ground water was about 1.4 af/acre for tracts of grass of 100% volume density. The overall total consumption of ground water in 1958 from the grasses and salt cedars was estimated at 66,000 af. Extrapolating to 1956, they estimated the total consumptive use to be 70,000 af. The average consumptive use of ground water per acre of phreatophytes in the Roswell Basin as determined by this method is 1.7 af/acre and 1.6 af/acre for 1956 and 1958, respectively.

By evaluating water level fluctuations in the floodplain, Cox and Havens (1974) estimated the evapotranspiration in 1960 from ground water (excluding precipitation) from Artesia to Rio Peñasco as 0.9 af/acre and from Rio Peñasco to Lake McMillan as 1.18 af/acre. The overall average was 1.05 af/acre, and a total consumptive use of ground water was estimated at 18,000 af with an average area density of 47%.

Cox and Havens (1974) summarized the consumptive use by salt cedars from four studies and prepared a graph of evapotranspiration versus depth to water for 100% volume density. Using this graph, they estimated the consumptive use of salt cedars based on the average depth to water in 1960. For the Artesia to Rio Peñasco reach, the average depth to water was 7 feet in 1960, corresponding to a consumptive use of 4.6 ft/yr. For the Rio Peñasco to Lake McMillan reach, the average depth to water was 15 feet, resulting in a consumptive use of 1.8 ft/yr. The total consumptive use for both reaches was estimated at 22,600 af, or an overall average of 1.3 af/acre.

Cox and Havens also examined the water budget in the reach from Artesia to Lake McMillan and estimated a total consumptive use by phreatophytes from ground-water sources during 1951 to 1960 as 38,000 acre-feet per year (afy), or an average of 2.2 af/acre. Using the Blaney-Criddle method, they arrived at a similar value for consumptive use of ground water by phreatophytes.

Weeks et al. (1987) estimated the consumptive use of salt cedars and replacement vegetation (weeds such as kochia and Russian thistle) by the eddy-correlation approach, which directly measures the heat flux from thickets or plots. From their study they were able to provide estimates of minimum and maximum values of water use from the two types of vegetation cover. The water use (including precipitation) by salt cedar thickets ranged between 2.0 ft/yr and 3.6 ft/yr, and for replacement vegetation ranged from 1.3 afy to 2.3 ft/yr. They concluded that savings of 0.7 to 1.3 ft/yr could have resulted from the clearing of salt cedar. They make no estimates of the overall average consumptive use of ground water from phreatophytes in the basin and therefore are not included in Table 4-12. However, their estimate of consumptive use of salt cedars (2 to 3.6 ft/yr) is in approximate agreement with Mower et al. (1964) who estimated 2.1 to 4.1 ft/yr.

Hantush (1959) estimated the potential evapotranspiration for areas along rivers in New Mexico using the Thornthwaite formula, which incorporates the mean monthly temperature. Hantush considered that the actual evapotranspiration in these areas was equal to the maximum or potential evapotranspiration due to the closeness of the water table to the land surface. Hantush's estimates of the potential evapotranspiration from 1951 to 1954 for several areas along the Pecos River in the Roswell Basin are shown in Table L-2.

Table L-2. Potential Evapotranspiration Along the Pecos River (Average for 1951 to 1954)

Station	Potential Evapotranspiration (ft)
Bitter Lakes Wildlife Refuge	2.79
Roswell W.B.	2.94
Hagerman	2.84
Artesia	3.12
Average	2.92

Source: Hantush, 1959

In summary, the overall average consumptive use of ground water by phreatophytes in the Roswell Basin, as computed from the 13 estimates presented in Table 4-12, is 1.3 af/acre. The average consumptive use estimates vary from a low of 0.33 af/acre to a maximum of 2.22 af/acre. These estimates are lower than the estimated potential evapotranspiration, which may account for the lack of any observed savings of the eradication program. Although salt cedars may lower the water table by consumption, at the same time they reduce the potential for evaporation from a water table near the ground surface. From review of these studies it appears that "non-beneficial" consumptive use in the Roswell Basin is a significant component of the overall water budget and should be considered in the modeling effort.

APPENDIX M

RELATIONSHIP BETWEEN BRANTLEY RESERVOIR AND THE SHALLOW GROUND-WATER SYSTEM

APPENDIX M

RELATIONSHIP BETWEEN BRANTLEY RESERVOIR AND THE SHALLOW GROUND-WATER FLOW SYSTEM

Brantley Dam is located about ½ mile downriver from Major Johnson Springs (see Figure 4-17 of this report). Brantley Dam was closed and initial filling of Brantley Reservoir began in late August 1988. Brantley Reservoir has since replaced Lake McMillan as the main terminal storage facility for the Carlsbad Irrigation Project. There has been no storage in Lake McMillan since the end of June 1989, and McMillan Dam was breached in February 1991.

The primary purpose of the Brantley project is storage for irrigation within the Carlsbad Irrigation District. The Brantley project also provides flood protection to Carlsbad and lands within the District. At the current minimum pool level (altitude 3,224.3 feet), the reservoir extends upstream from Brantley Dam along the Pecos River channel to a point about a mile or so below McMillan Dam. At the current full conservation pool level (altitude 3,253.75 feet), Brantley Reservoir covers a much larger area, primarily to the west of the Pecos River channel in the vicinity of the South Seven Rivers and North Seven Rivers ephemeral tributaries. At this level, Brantley Reservoir extends to the southern tip of Lake McMillan and covers much of the area within which the more permeable portion of the Major Johnson Springs aquifer resides, as well as small portions of the shallow alluvial aquifer to the north of Major Johnson Springs.

The top of conservation pool is adjusted annually for sedimentation in the reservoir so that there is maintained 40,000 acre-feet (af) of conservation storage capacity available to the District. As reservoir operations continue, the land surface inundated to fulfill the District's storage right and the size (surface area) of the reservoir will increase. The maximum water surface elevation for Brantley Reservoir is 3,303.5 feet, in which case the reservoir would completely inundate former Lake McMillan and extend about 12 miles up the Pecos River Valley to the vicinity of Artesia (Crouch and Welder, 1988). The maximum water surface elevation would only be reached if the spillway was passing the probable maximum flood that the dam was designed to safely pass.

Since Brantley Reservoir has been operational only for a relatively short time, there are no published studies available that rigorously quantify the observed reservoir/ground-water interaction. Haskett (1984) and Crouch and Welder (1988) estimated the effects of the reservoir prior to its completion. Whipple (1992) has performed data analyses on the reservoir/ground-water interactions using both piezometric and surface-water data. The following discussion concerning the relationship of Brantley Reservoir to the ground-water system is based primarily upon these three sources.

The most fundamental change that has occurred in response to the construction of Brantley Reservoir is that recharge to and discharge from the Major Johnson Springs aquifer is now primarily controlled by the stage in Brantley Reservoir, rather than the stage in Lake McMillan. The minimum Brantley Reservoir pool level of about 3,224 feet (2,000 af of reservoir storage) has submerged the immediate pre-Brantley orifice elevations of Major Johnson Springs, which ranged from about 3,208 feet to 3,210 feet. Historically, however, the springs were observed to discharge at elevations of up to 3,230 feet. When a hydraulic gradient from the aquifer to the reservoir exists, ground water discharges from the Major Johnson Springs aquifer into the reservoir through the original spring openings and other alluvial solutions or brecciated material.

When a hydraulic gradient from the reservoir to the aquifer exists, seepage from Brantley Reservoir will recharge the Major Johnson Springs aquifer and the alluvial aquifer. The flux of water between the shallow aquifer system and the reservoir, as well as changes in storage in the shallow aquifers, is highly dependent upon reservoir operations. Brantley Reservoir is expected to experience frequent (1- to 3-year) cycles of filling to full conservation pool storage (42,000 af) and drainage to minimum pool storage (2,000 af). It can be expected, therefore, that the shallow ground-water flow system in regions directly affected by Brantley Reservoir will generally exist in a dynamic state, continually adjusting to changes in Brantley Reservoir water levels. Water levels in the more permeable portion of the Major Johnson Springs aquifer adjust very quickly (within days or weeks) to changes in Brantley Reservoir storage, while water levels in the alluvial aquifer adjust more slowly. The very fast hydrologic response time of the Major Johnson Springs aquifer is a result of its very high permeability and its direct connection with the reservoir water body.

Although Major Johnson Springs is generally considered to be the southernmost discharge point of the shallow ground-water system, Haskett (1984) estimated that, under immediate pre-Brantley conditions, about 4 cubic feet per second (cfs) (2,900 afy) of ground water flowed underground from the Major Johnson Springs aquifer to the southeast (3.5 cfs through three discrete, high-permeability solution conduits and 0.5 cfs through the low-permeability carbonate facies of the Seven Rivers Formation). He further estimated that the rate of seepage could increase to 7.2 cfs (6.2 cfs through the conduits and 1.0 cfs through the carbonate facies) for a Brantley Reservoir level of 3,255 feet.

Finally, it is noted that since the operation of Brantley Reservoir will significantly influence the shallow ground-water flow system, it may consequently also influence the deep artesian aquifer. It is generally believed that prior to the filling of Brantley Reservoir, there was an upward gradient between the confined artesian aquifer and the shallow aquifer system in the vicinity of Major Johnson Springs. Although insufficient data are available to quantify the extent to which vertical leakage might be affected by Brantley Reservoir operations, Haskett (1984) predicted that there would be no significant downward leakage from Brantley Reservoir into the artesian aquifer. He based this prediction on the observed low permeability of the upper part of the Queen Formation (the confining unit) and his estimation that the added reservoir head would do little more than balance the existing pre-Brantley head differential between the shallow and deep aquifers.

Whipple (1992) performed daily mass-balance calculations for September 1988 through June 1991 to compute the "unidentified loss" from Brantley Reservoir, which is a net term indicative of ground-water fluxes between the reservoir and the shallow aquifer system and evapotranspiration losses due to phreatophytes around and near the reservoir shoreline. Although a phreatophyte survey for Brantley Reservoir has not been conducted to date, it would seem reasonable to assume that reservoir losses due to phreatophytes should have been relatively small for at least the first seven or eight months of reservoir operations (August 1988 to March or April of 1989), since it would have taken some time for the phreatophytes to establish themselves along the reservoir banks and since this initial period of reservoir operation was during the fall and winter. For this initial period, therefore, the unidentified losses computed for Brantley Reservoir should represent primarily the net volume of ground-water outflow (positive loss) or inflow (negative loss). For the later periods of Brantley Reservoir mass-balance computations, it is not known whether evapotranspiration losses are small compared to net ground-water fluxes into and out of the reservoir.

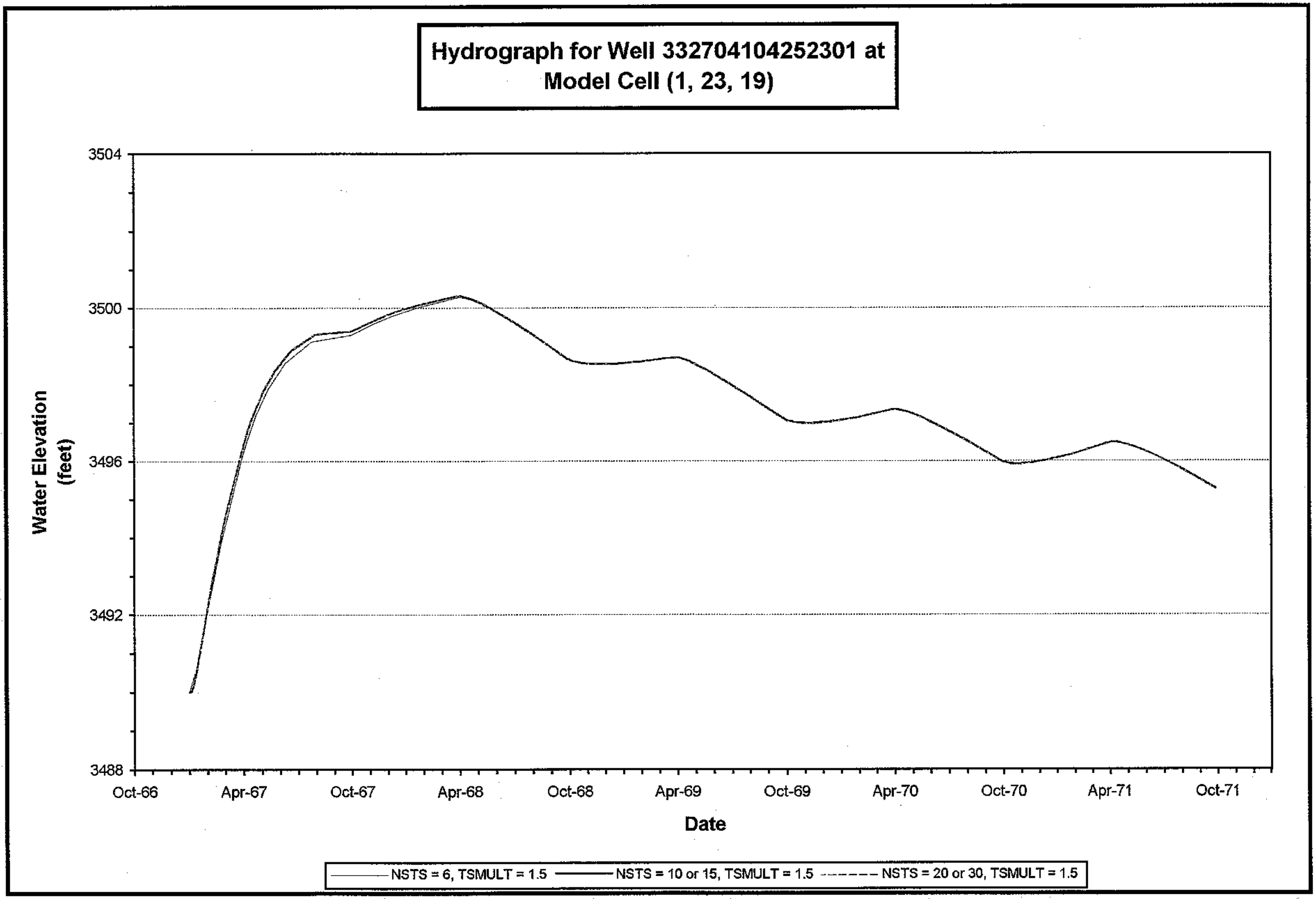
Given that significant evapotranspiration losses may be embedded within the computed unidentified losses for Brantley Reservoir and that some of the inputs for the mass-balance calculation are estimated or assumed, the reservoir mass-balance results should be viewed with a high degree of caution if they are used to help analyze the interaction between the reservoir and the shallow aquifer system. In general, however, the reservoir mass-balance computations and piezometric data clearly illustrate the existence and the transient nature of bank (aquifer) storage. As the reservoir fills, the reservoir generally loses water and bank storage increases, and as the reservoir is drawn down, the reservoir generally gains water and bank storage decreases.

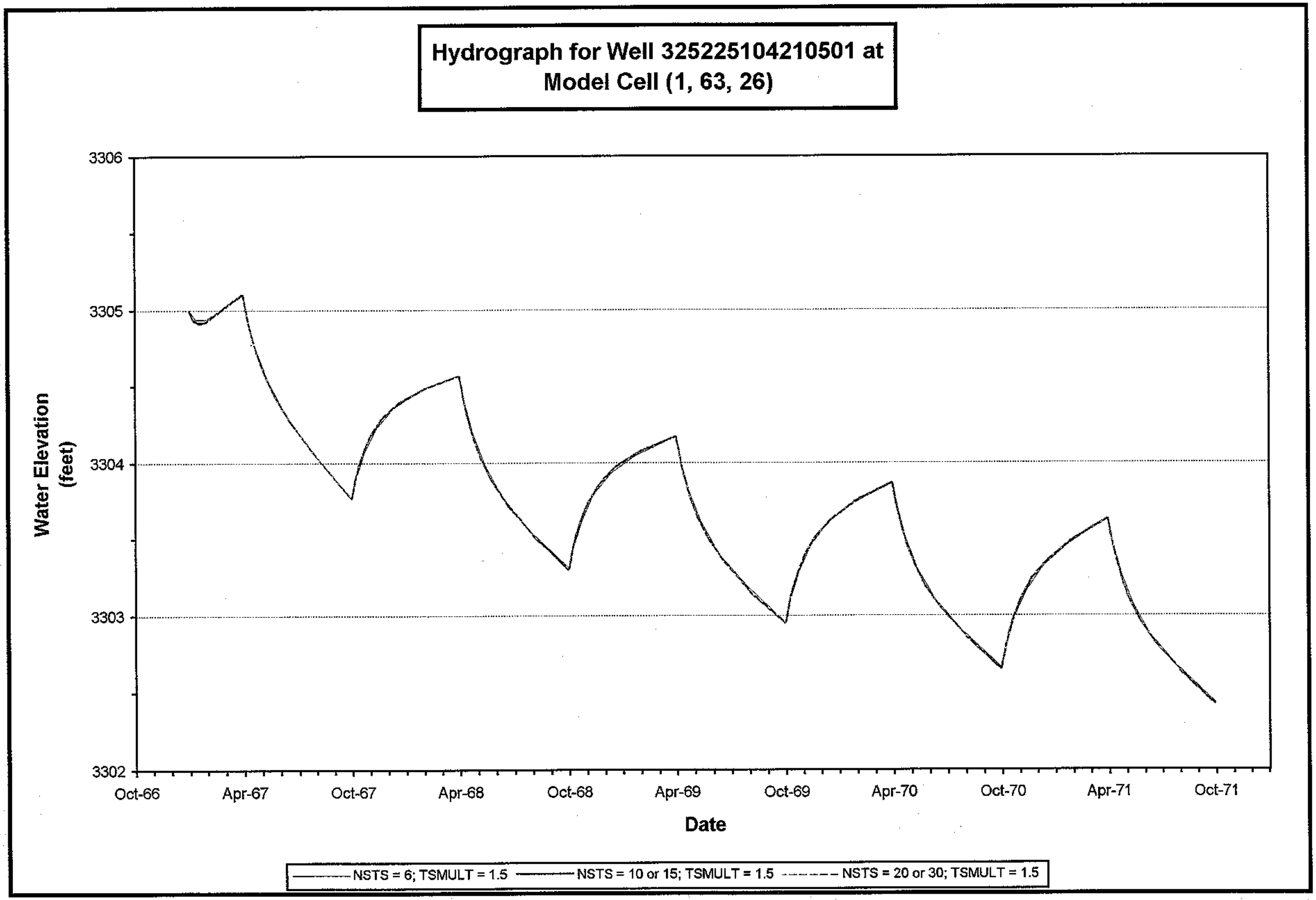
Whipple (1992) suggested that two linear relationships for unidentified reservoir losses versus change in storage may exist: one for reservoir storage levels less than 15,000 af and one for reservoir storage levels greater than 15,000 af. The first line, for storage less than 15,000 af, indicates that for a 100-af per day (af/d) change in storage, the unidentified loss or gain, depending on direction of the storage change, increases by about 66 af/d (slope of about ⅔). The second line, for storage greater than 15,000 af, indicates that for a 100-af/d change in reservoir storage, the unidentified reservoir loss or gain, depending on direction of the storage change, increases by about 28.5 af/d (slope of about ⅓). The different slopes are attributable to the difference in change in storage versus change in water surface elevation relations above and below 15,000 af of storage. A single relation would relate unidentified loss and gain to change in gage height.

The mass-balance calculations need to be revised, however, to reflect the revisions the Bureau of Reclamation made to the Brantley Reservoir area-capacity table based on a 1990 aerial survey of the reservoir area.

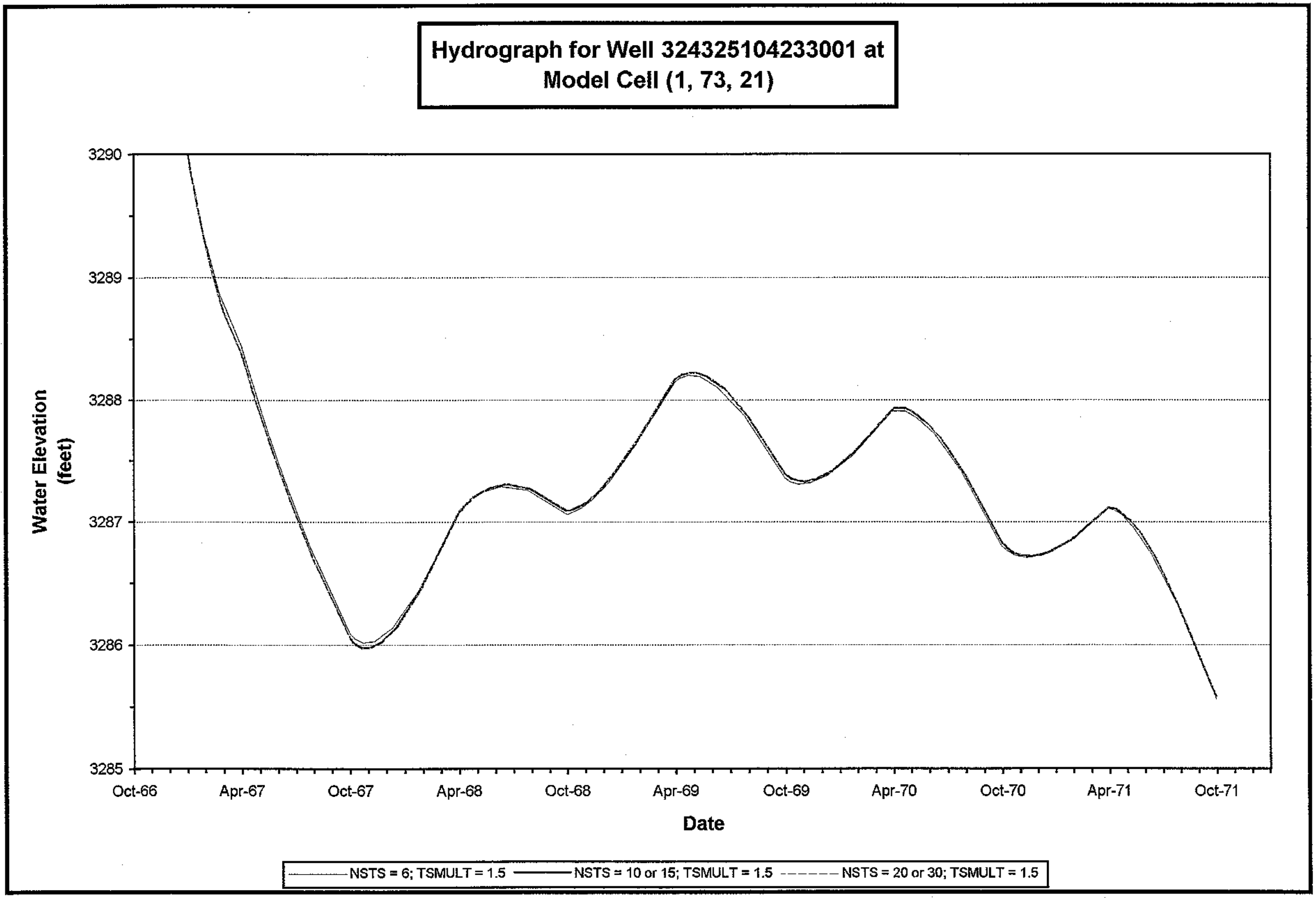
APPENDIX N

HYDROGRAPHS OF SIMULATED HEADS USING VARIOUS TIME DISCRETIZATION SCHEMES

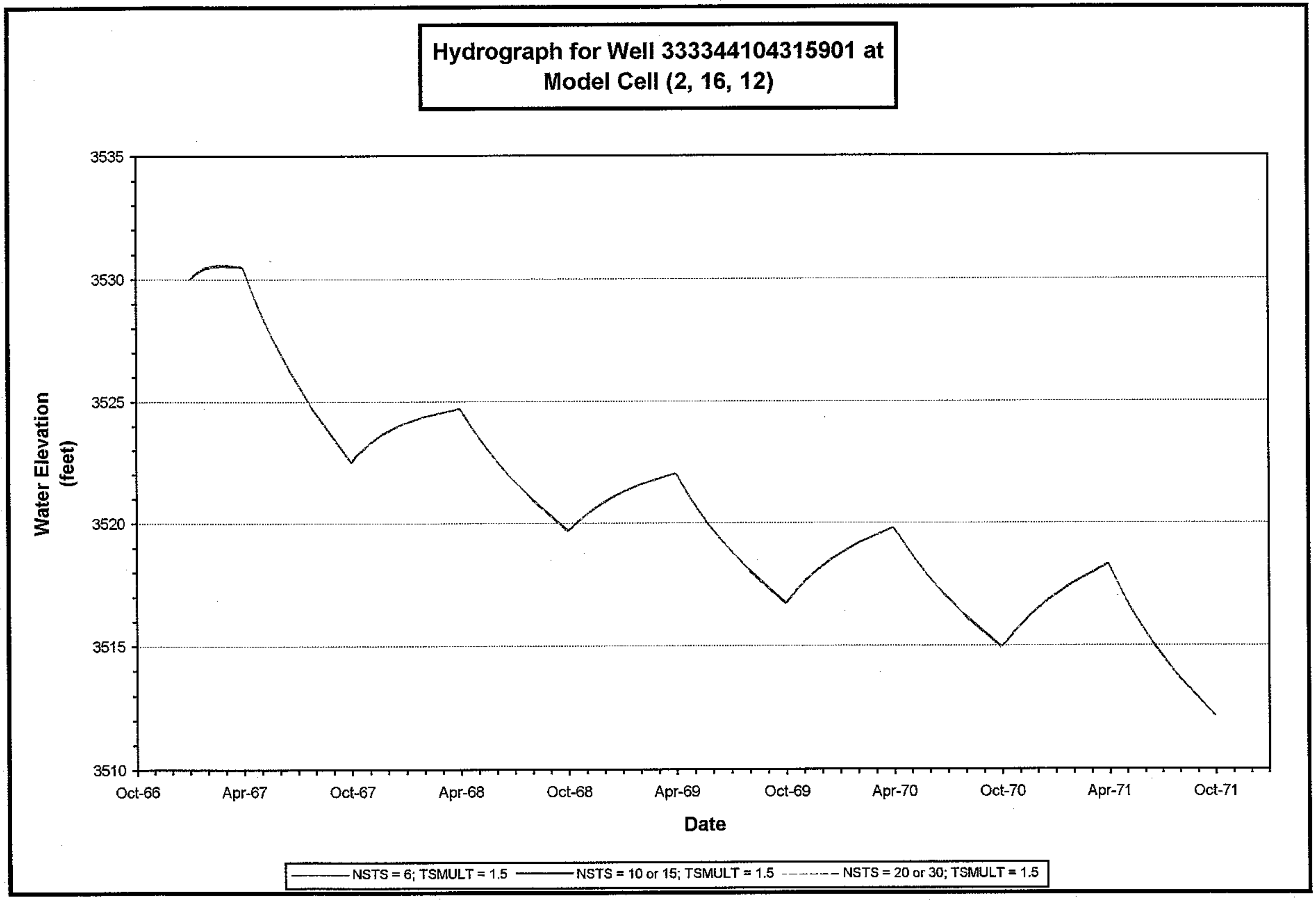

Hydrograph for Well 332704104252301 at Model Cell (1, 23, 19)
3504
3500
3496
3492
3488
Water Elevation (feet)
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6, TSMULT = 1.5
NSTS = 10 or 15, TSMULT = 1.5
NSTS = 20 or 30, TSMULT = 1.5

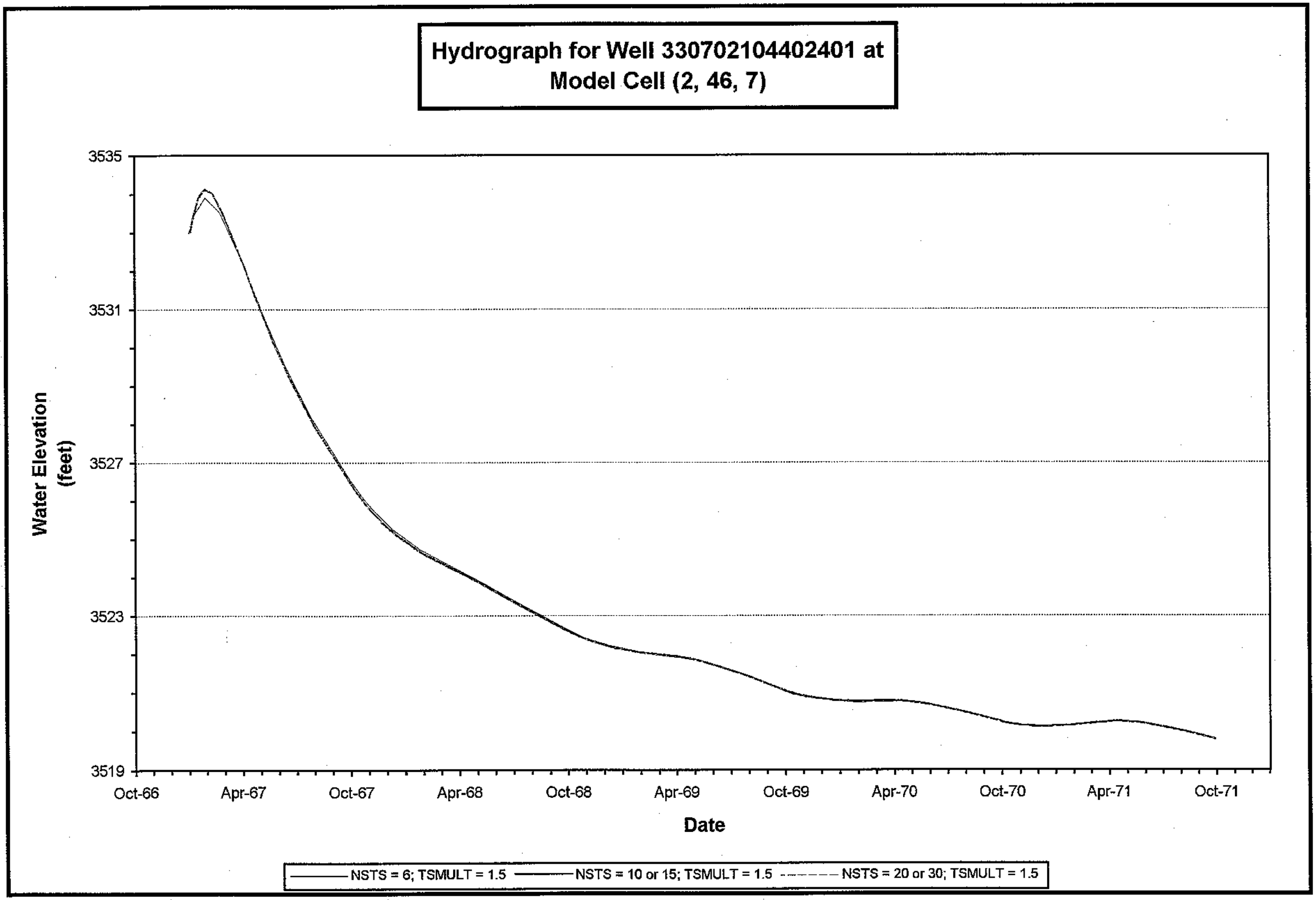


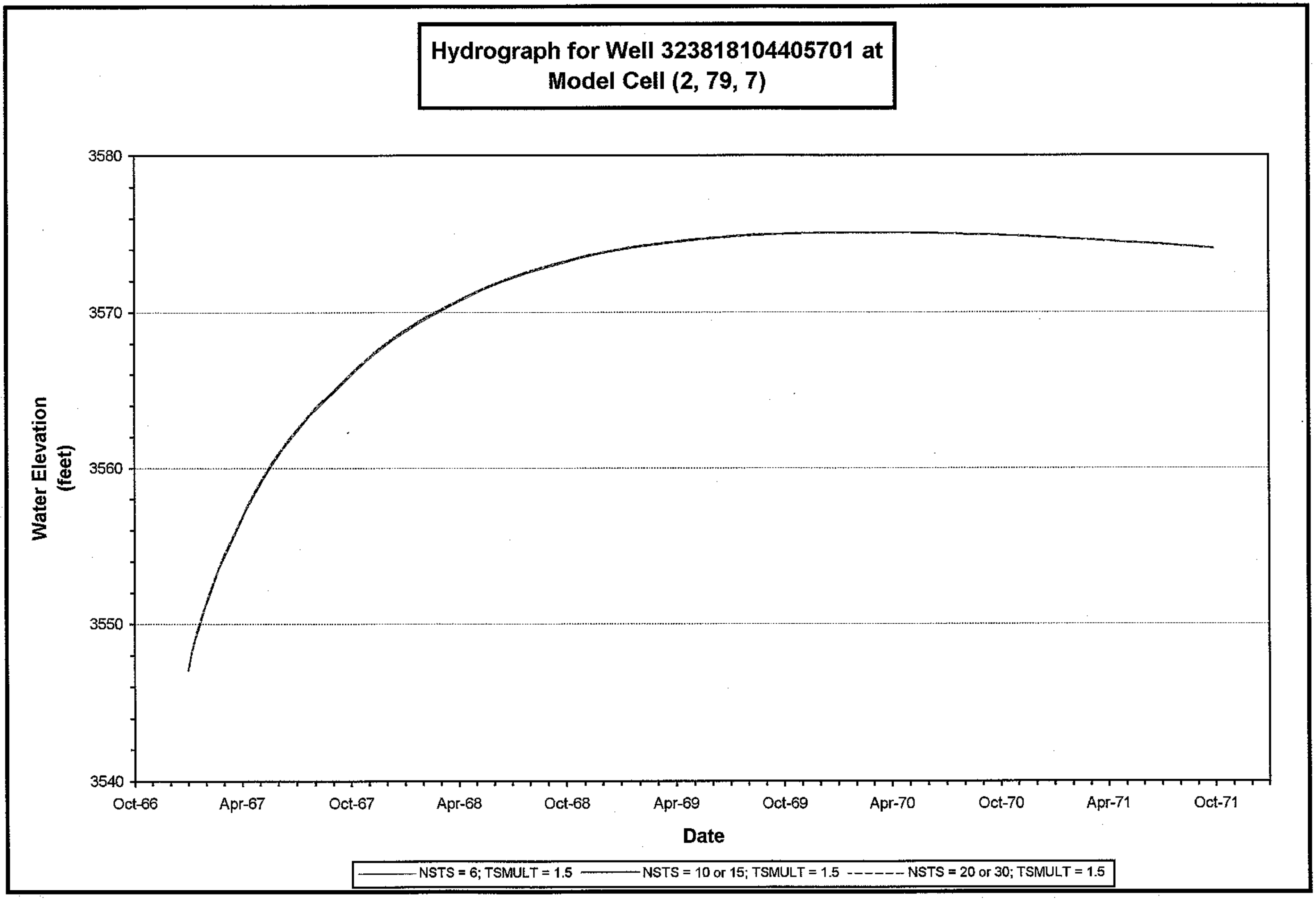
Hydrograph for Well 325225104210501 at
Model Cell (1, 63, 26)
3306
3305
3304
3303
3302
Water Elevation
(feet)
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6; TSMULT = 1.5
NSTS = 10 or 15; TSMULT = 1.5
NSTS = 20 or 30; TSMULT = 1.5



Hydrograph for Well 324325104233001 at Model Cell (1, 73, 21)
Water Elevation (feet)
3290
3289
3288
3287
3286
3285
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6; TSMULT = 1.5
NSTS = 10 or 15; TSMULT = 1.5
NSTS = 20 or 30; TSMULT = 1.5


Hydrograph for Well 333344104315901 at
Model Cell (2, 16, 12)
3535
3530
3525
3520
3515
3510
Water Elevation
(feet)
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6; TSMULT = 1.5
NSTS = 10 or 15; TSMULT = 1.5
NSTS = 20 or 30; TSMULT = 1.5


Hydrograph for Well 330702104402401 at
Model Cell (2, 46, 7)
Water Elevation
(feet)
3535
3531
3527
3523
3519
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6; TSMULT = 1.5
NSTS = 10 or 15; TSMULT = 1.5
NSTS = 20 or 30; TSMULT = 1.5



Hydrograph for Well 323818104405701 at Model Cell (2, 79, 7)
Water Elevation (feet)
3580
3570
3560
3550
3540
Oct-66
Apr-67
Oct-67
Apr-68
Oct-68
Apr-69
Oct-69
Apr-70
Oct-70
Apr-71
Oct-71
Date
NSTS = 6; TSMULT = 1.5
NSTS = 10 or 15; TSMULT = 1.5
NSTS = 20 or 30; TSMULT = 1.5

APPENDIX O

PRESCRIBED RECHARGE ESTIMATES FOR TRIBUTARY SEEPAGE

APPENDIX O. PRESCRIBED RECHARGE ESTIMATES FOR TRIBUTARY SEEPAGE

The general approach to calculating recharge from tributaries is described in Section 5.4.3. Deviations from the general approach were necessary for several years for which reported gaged flow appeared questionable. The specific adjustments to the prescribed recharge rates are outlined herein. Table O-1 lists the gaged flow data, simulated recharge rate, and prescribed rate applied to each cell.

The lengths of the reaches provided here were obtained using AutoCAD and are about 30% less than actual reach lengths. Only the lengths relative to the Rio Hondo reach are used, and therefore, little error should be introduced.

Rio Hondo (D-A to BD-A)

The Rio Hondo flows into the Two Rivers Reservoir and most of the flow passes the Below Diamond-A Dam gage, but in some years a portion of the flow exits the reservoir through Rocky Arroyo. Therefore, recharge from the Rio Hondo between the Diamond-A and Below Diamond A Dam gages was calculated by subtracting the flows at the two gages and adding the increased flow at the Rocky Arroyo gage at the Two Rivers Reservoir. No adjustments to the gaged losses were made to account for evapotranspiration.

The prescribed recharge for this reach was increased for several years. The recharge rate for 1972 and 1974 was set equal to the recharge estimated for 1984 rather than using the gaged loss for those years. Rainfall in 1972 and 1974 was much greater (about 4 inches above average) than in 1973 (about 3 inches below average), yet the gaged flow and losses in those years was lower than the flow and losses for 1973. The recharge for 1984 was selected for these years because the rainfall in 1984 approximates the amounts observed 1972 and 1974. Likewise, while rainfall was about 7 inches above average in 1978, the gaged flow and losses for that year were below average. Therefore, recharge was increased 8-fold over the gaged loss for 1978. Similarly, prescribed recharge was doubled in 1986, which was a very high flow year.

Table O-1. Gaged Flow and Simulated Seepage from Tributaries to the Pecos River

Gage	Row	Source [1]	Water Year 1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Average
Rio Hondo at Diamond A (8390500)																												
Gaged flow (afy)	R1	a	6594	16243	8252	1944	6255	12567	24254	1878	13841	1092	2749	3675	46350	7638	7660	3587	12485	21416	47151	58349	78575	29648	15413	11053	40927	
Simulated recharge (afy)	R2	b	2654	8829	1604	798	2911	11121	5323	11121	4824	917	770	21841	14880	4132	3919	1448	3574	11121	10893	58742	16558	7857	4541			9172
Flux per unit area upstream of dam (ft/d)	R3	c	9.47×10^{-4}	3.15×10^{-3}	5.72×10^{-4}	2.85×10^{-4}	1.04×10^{-3}	3.97×10^{-3}	1.90×10^{-3}	3.97×10^{-3}	1.72×10^{-3}	3.27×10^{-4}	2.75×10^{-4}	7.79×10^{-3}	5.31×10^{-3}	1.47×10^{-3}	1.40×10^{-3}	5.16×10^{-4}	1.28×10^{-3}	3.97×10^{-3}	3.89×10^{-3}	2.10×10^{-2}	5.91×10^{-3}	2.80×10^{-3}	1.62×10^{-3}			
Rio Hondo Below Diamond A Dam (8390800)																												
Gaged flow (afy)	R4	a	3963	6832	6669	1391	3251	7603	18931	1006	9260	175	1979	1032	28036	3119	3741	2139	8911	10295	36258	28978	62017	21791	10871	7231	25836	
Simulated recharge (afy)	R5	d	1168	3885	706	351	1281	9786	4684	9786	2123	403	339	19220	13095	1818	1724	637	1573	9786	9586	51693	14571	6914	1998			7018
Flux per unit area downstream of dam (ft/d)	R6	e	3.03×10^{-4}	1.01×10^{-3}	1.83×10^{-4}	9.11×10^{-5}	3.32×10^{-4}	2.54×10^{-3}	1.22×10^{-3}	2.54×10^{-3}	5.51×10^{-4}	1.05×10^{-4}	8.78×10^{-5}	4.99×10^{-3}	3.40×10^{-3}	4.72×10^{-4}	4.47×10^{-4}	1.65×10^{-4}	4.08×10^{-4}	2.54×10^{-3}	2.49×10^{-3}	1.34×10^{-2}	3.78×10^{-3}	1.79×10^{-3}	5.18×10^{-4}			
Rocky Arroyo 2-Rivers Reservoir (8393200)																												
Gaged flow (afy)	R7	a	398	1655	218	268	752	148	0	1363	1440	0	0	88	58	1409												
Rocky Arroyo Below Rocky Dam (8393300)																												
Gaged flow (afy)	R8	a	375	2237	197	23	845	671	0	552	1197	0	0	1	3492	1796												
Correction to Hondo loss	R9	f	-24	582	-21	-245	93	523	0	-812	-243	0	0	-88	3434	387												
Simulated recharge (afy)	R10	g	375	2237	197	23	845	671	0	552	1197	0	0	1	6984	1796	1063	1063	1063	3188	3188	3188	3188	3188	3188			1063
Flux per unit area (ft/d)	R11	h	2.67×10^{-4}	1.60×10^{-3}	1.41×10^{-4}	1.63×10^{-5}	6.03×10^{-4}	4.79×10^{-4}	0.00	3.93×10^{-4}	8.54×10^{-4}	0.00	0.00	4.99×10^{-7}	4.98×10^{-3}	1.28×10^{-3}	7.58×10^{-4}	7.58×10^{-4}	7.58×10^{-4}	2.27×10^{-3}	2.27×10^{-3}	2.27×10^{-3}	2.27×10^{-3}	2.27×10^{-3}	2.27×10^{-3}			
Rio Hondo at Roswell (8393500)																												
Gaged flow (afy)	R12	a																1786	5458	8642	30703	26571	53951	14634	6624	3460	16943	
Rio Felix at Highway Bridge (8394500)																												
Gaged flow (afy)	R13	a	1338	7151	1953	677	4740	23434	3018	34575	6812	0.04	19	6427	8328	5233	1680	1708	1550	8339	1701	37740	1021					
Simulated recharge (afy)	R14	i	1141	3945	1510	689	2910	9494	2083	25321	3805	1	49	29158	8831	3131	1351	1367	1272	8840	1363	54034	934	6980	6980			7678
Flux per unit area (ft/d)	R15	j	1.63×10^{-3}	5.63×10^{-3}	2.15×10^{-3}	9.84×10^{-4}	4.15×10^{-3}	1.35×10^{-2}	2.97×10^{-3}	3.61×10^{-2}	5.43×10^{-3}	7.31×10^{-7}	6.99×10^{-5}	4.16×10^{-2}	1.26×10^{-2}	4.47×10^{-3}	1.93×10^{-3}	1.95×10^{-3}	1.82×10^{-3}	1.26×10^{-2}	1.94×10^{-3}	7.71×10^{-2}	1.33×10^{-3}	9.96×10^{-3}	9.96×10^{-3}			
Rio Peñasco at Dayton (8398500)																												
Gaged flow (afy)	R16	a	456	13620	3545	188	658	3229	83	22748	712	0	1570	490	679	1568	708	3	0	16599	9	31430	151	114	1	1	164	
Simulated recharge (afy)	R17	k	438	10816	1997	228	574	1864	125	15809	609	0	1093	462	588	1092	607	11	0	12520	25	20082	194	157	4			2780
Flux per unit area (ft/d)	R18	l	1.83×10^{-4}	4.52×10^{-3}	8.34×10^{-4}	9.50×10^{-5}	2.40×10^{-4}	7.78×10^{-4}	5.20×10^{-5}	6.60×10^{-3}	2.54×10^{-4}	0.00	4.57×10^{-4}	1.93×10^{-4}	2.46×10^{-4}	4.56×10^{-4}	2.53×10^{-4}	4.55×10^{-6}	0.00	5.23×10^{-3}	1.03×10^{-5}	8.39×10^{-3}	8.08×10^{-5}	6.57×10^{-5}	1.82×10^{-6}			

[1] a = Gaged flow for water year
b = R1 − R4 − R9
c = R2 * 43560 / 365 / (2 * 5280 * 5280 * 6)
d = R2 * 0.44
e = R5 * 43560 / 365 / ((4 * 5280 * 5280 * 2) + (7620 * 5280 * 5) + (3 * 5280 * 5280))
f = R8 − R7
g = Gaged flow for water year to 1980; 1981-1983 = average gaged flow; 1984-1989 = 3 * average gaged flow
h = R10 * 43560 / 365 / (3 * 2 * 5280 * 5280)
i = 1.41 * exp(0.74 * (ln(R13) + 1.85))
j = R14 * 43560 / 365 / ((6 * 5280 * 5280) + (3960 * 5280) + (10 * 5280 * 2640))
k = 1.2 * exp(0.74 * (ln(R16) + 1.85))
l = R17 * 43560 / 365 / ((5 * 5280 * 5280) + (3960 * 5280) + (9 * 5280 * 2640))
m = 0.79 * exp(0.74 * (ln(R19) + 1.85))
n = R20 * 43560 / 365 / (8 * 5280 * 5280)
o = 0.23 * exp(0.74 * (ln(R22) + 1.85))
p = R23 * 43560 / 365 / ((3960 * 5280) + (2 * 5280 * 2640))
q = R23 * 0.21
r = R25 * 43560 / 365 / ((2 * 3960 * 5280) + (2640 * 5280 * 4))
s = Flux per unit area multiplied by area
t = R21
u = R21 * 0.5
v = R15

Table O-1. Gaged Flow and Simulated Seepage from Tributaries to the Pecos River

Gage	Row	Source [1]	Water Year																								
			1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Average
Fourmile Draw near Lakewood (8400000)																											
Gaged flow (afy)	R19	a	127	4790	0	112	930	20	27	25373	228	0	276	2236	2405	201	8	15	0	11472	0	24936	0	28	0			
Simulated recharge (afy)	R20	m	112	3286	0	102	488	28	36	11283	173	0	199	935	987	157	14	22	0	6271	0	11139	0	37	0			1411
Flux per unit area (ft/d)	R21	n	6.00×10^{-5}	1.76×10^{-3}	0.00	5.46×10^{-5}	2.61×10^{-4}	1.51×10^{-5}	1.91×10^{-5}	6.04×10^{-3}	9.24×10^{-5}	0.00	1.06×10^{-4}	5.00×10^{-4}	5.28×10^{-4}	8.41×10^{-5}	7.60×10^{-6}	1.20×10^{-5}	0.00	3.36×10^{-3}	0.00	5.96×10^{-3}	0.00	1.96×10^{-5}	0.00			
South Seven Rivers near Lakewood (8401200)																											
Gaged flow (afy)	R22	a	3439	1750	15	1805	1188	95	207	14090	250	86	2	5481	2	108	179	413	4	10720	3	16359	50	3334	0	0	642	
Simulated recharge (afy)	R23	o	374	227	7	232	170	26	47	2126	54	24	1	1057	2	29	42	78	3	1736	2	2374	16	366	0			364
Flux per unit area (ft/d)	R24	p	9.16×10^{-4}	5.55×10^{-4}	1.67×10^{-5}	5.68×10^{-4}	4.17×10^{-4}	6.41×10^{-5}	1.14×10^{-4}	5.20×10^{-3}	1.31×10^{-4}	5.97×10^{-5}	3.67×10^{-6}	2.59×10^{-3}	3.83×10^{-6}	7.07×10^{-5}	1.03×10^{-4}	1.91×10^{-4}	6.17×10^{-6}	4.25×10^{-3}	5.40×10^{-6}	5.81×10^{-3}	4.00×10^{-5}	8.95×10^{-4}	0.00			
North Seven Rivers (8401150)																											
Simulated recharge (afy)	R25	q	79	48	1	49	36	6	10	446	11	5	0	222	0	6	9	16	1	365	0	499	3	77	0			76
Flux per unit area (ft/d)	R26	r	9.61×10^{-5}	5.83×10^{-5}	1.76×10^{-6}	5.97×10^{-5}	4.38×10^{-5}	6.73×10^{-6}	1.20×10^{-5}	5.46×10^{-4}	1.38×10^{-5}	6.27×10^{-6}	3.85×10^{-7}	2.71×10^{-4}	4.02×10^{-7}	7.42×10^{-6}	1.08×10^{-5}	2.00×10^{-5}	6.48×10^{-7}	4.46×10^{-4}	5.67×10^{-7}	6.10×10^{-4}	4.20×10^{-6}	9.40×10^{-5}	0.00			
Eagle Creek																											
Simulated recharge (afy)	R27	s	116	3389	0	105	504	29	37	11636	178	1	205	3857	1018	162	15	23	0	6467	0	22975	0	38	0			2206.65
Flux per unit area (ft/d)	R28	t	6.00×10^{-5}	1.76×10^{-3}	0.00	5.46×10^{-5}	2.61×10^{-4}	1.51×10^{-5}	1.91×10^{-5}	6.04×10^{-3}	9.24×10^{-5}	7.31×10^{-7}	1.06×10^{-4}	2.00×10^{-3}	5.28×10^{-4}	8.41×10^{-5}	7.60×10^{-6}	1.20×10^{-5}	0.00	3.36×10^{-3}	0.00	1.19×10^{-2}	0.00	1.96×10^{-5}	0.00			
Cottonwood Creek																											
Simulated recharge (afy)	R29	s	165	4826	0	150	717	13724	52	16573	254	2	292	27464	2899	231	21	33	0	9210	0	32722	0	54	0			4755.98
Flux per unit area (ft/d)	R30	t	6.00×10^{-5}	1.76×10^{-3}	0.00	5.46×10^{-5}	2.61×10^{-4}	5.00×10^{-3}	1.91×10^{-5}	6.04×10^{-3}	9.24×10^{-5}	7.31×10^{-7}	1.06×10^{-4}	1.00×10^{-2}	1.06×10^{-3}	8.41×10^{-5}	7.60×10^{-6}	1.20×10^{-5}	0.00	3.36×10^{-3}	0.00	1.19×10^{-2}	0.00	1.96×10^{-5}	0.00			
Walnut Creek																											
Simulated recharge (afy)	R31	s	44	1284	0	40	191	3650	14	8815	67	1	78	7304	771	61	6	9	0	2450	0	8703	0	14	0			1456.54
Flux per unit area (ft/d)	R32	u	3.00×10^{-5}	8.79×10^{-4}	0.00	2.73×10^{-5}	1.31×10^{-4}	2.50×10^{-3}	9.53×10^{-6}	6.04×10^{-3}	4.62×10^{-5}	7.31×10^{-7}	5.32×10^{-5}	5.00×10^{-3}	5.28×10^{-4}	4.21×10^{-5}	3.80×10^{-6}	6.01×10^{-6}	0.00	1.68×10^{-3}	0.00	5.96×10^{-3}	0.00	9.78×10^{-6}	0.00			
Thirteenmile Draw																											
Simulated recharge (afy)	R33	s	61	1797	0	56	267	154	19	6171	94	1	109	2045	1079	86	8	12	0	3429	0	12184	0	20	0			1199.72
Flux per unit area (ft/d)	R34	u	3.00×10^{-5}	8.79×10^{-4}	0.00	2.73×10^{-5}	1.31×10^{-4}	7.54×10^{-5}	9.53×10^{-6}	3.02×10^{-3}	4.62×10^{-5}	7.31×10^{-7}	5.32×10^{-5}	1.00×10^{-3}	5.28×10^{-4}	4.21×10^{-5}	3.80×10^{-6}	6.01×10^{-6}	0.00	1.68×10^{-3}	0.00	5.96×10^{-3}	0.00	9.78×10^{-6}	0.00			
Eightmile Draw																											
Simulated recharge (afy)	R35	s	389	2682	514	235	990	12895	1420	8625	1299	0	17	4971	6008	1065	460	465	434	3009	464	18389	318	1196	1196			2914.75
Flux per unit area (ft/d)	R36	v	4.16×10^{-4}	2.87×10^{-3}	5.50×10^{-4}	2.51×10^{-4}	1.06×10^{-3}	1.38×10^{-2}	1.52×10^{-3}	9.23×10^{-3}	1.39×10^{-3}	1.87×10^{-7}	1.78×10^{-5}	5.32×10^{-3}	6.43×10^{-3}	1.14×10^{-3}	4.92×10^{-4}	4.98×10^{-4}	4.64×10^{-4}	3.22×10^{-3}	4.97×10^{-4}	1.97×10^{-2}	3.40×10^{-4}	1.28×10^{-3}	1.28×10^{-3}			

[1] a = Gaged flow for water year
b = R1 − R4 − R9
c = R2 ∗ 43560 / 365 / (2 ∗ 5280 ∗ 5280 ∗ 6)
d = R2 ∗ 0.44
e = R5 ∗ 43560 / 365 / ((4 ∗ 5280 ∗ 5280 ∗ 2) + (7620 ∗ 5280 ∗ 5) + (3 ∗ 5280 ∗ 5280))
f = R8 − R7
g = Gaged flow for water year to 1980; 1981-1983 = average gaged flow; 1984-1989 = 3 ∗ average gaged flow
h = R10 ∗ 43560 / 365 / (3 ∗ 2 ∗ 5280 ∗ 5280)
i = 1.41 ∗ exp(0.74 ∗ (ln(R13) + 1.85))
j = R14 ∗ 43560 / 365 / ((6 ∗ 5280 ∗ 5280) + (3960 ∗ 5280) + (10 ∗ 5280 ∗ 2640))
k = 1.2 ∗ exp(0.74 ∗ (ln(R16) + 1.85))
l = R17 ∗ 43560 / 365 / ((5 ∗ 5280 ∗ 5280) + (3960 ∗ 5280) + (9 ∗ 5280 ∗ 2640))
m = 0.79 ∗ exp(0.74 ∗ (ln(R19) + 1.85))
n = R20 ∗ 43560 / 365 / (8 ∗ 5280 ∗ 5280)
o = 0.23 ∗ exp(0.74 ∗ (ln(R22) + 1.85))
p = R23 ∗ 43560 / 365 / ((3960 ∗ 5280) + (2 ∗ 5280 ∗ 2640))
q = R23 ∗ 0.21
r = R25 ∗ 43560 / 365 / ((2 ∗ 3960 ∗ 5280) + (2640 ∗ 5280 ∗ 4))
s = Flux per unit area multiplied by area
t = R21
u = R21 ∗ 0.5
v = R15

Recharge from the upstream reach of the Rio Hondo averages 9,172 acre-feet per year (afy) to layer 2.

Rio Hondo (BD-A to Roswell)

Recharge from the Rio Hondo between the Below Diamond-A Dam and Roswell gages was set equal to 44% of the simulated recharge in the upstream reach. This proportion was based on a comparison of gaged losses in this reach with losses upstream for the period 1982 to 1991. Figure 5-24 shows the gaged and simulated losses for this reach. The greatest discrepancy is in the high flow year of 1986.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 12 cells representing this reach of the Rio Hondo.

Recharge was doubled in the years 1972, 1973, 1974, 1978, 1979, and 1984 through 1988. These are years in which rainfall or gaged flow was exceptionally high.

Recharge from the downstream reach of the Rio Hondo averages 7,018 afy to layers 1 and 2.

Rocky Arroyo

Recharge from Rocky Arroyo below the Below Rocky Arroyo Dam gage and its confluence with Rio Hondo was estimated as equal to the quantity of water passing the Below Rocky Arroyo Dam gage. Some of this water may have actually flowed to the Rio Hondo, in which case it should be added to the calculated losses on the Rio Hondo above the Roswell gage. In order to simplify the recharge estimates, all of the loss was applied to the area of Rocky Arroyo rather than partitioning a portion of the loss to the Rio Hondo.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 3 cells representing this reach of Rocky Arroyo.

Between 1967 and 1980 recharge averaged 1,063 afy to layer 2. This average value was applied to the years 1981 to 1989 because gage data were not available for these years.

Rio Felix

Recharge from the Rio Felix to layer 1 was estimated by the following equation:

$$R = 1.4\,(\exp(0.74 * (\ln GF + 1.85)))$$

where R = Recharge to layer 1 (afy)
GF = Gaged flow on the Rio Felix near Hagerman

The multiplier of 1.4 was obtained by dividing the length of the Rio Felix across the shallow aquifer (14.62 mi) by the length of the upstream reach of the Rio Hondo (10.4 mi) for which the equation was derived.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 6 cells representing this reach of the Rio Felix. The number of layer 1 cells receiving recharge from the Rio Felix was reduced during the calibration process, but the total amount of recharge remained the same. Recharge from the Rio Felix to the western side of layer 1 does not appear to occur. This conclusion is based on the lack of recovery of water levels during winter months within the vicinity of the Hagerman Depression (Garn, 1988).

To account for the possible errors in gage reading during wet years and to improve the calibration, recharge from the Rio Felix was doubled in 1974, 1979, and 1984, increased 8 times in 1978, and increased four times in 1986.

The average simulated recharge from the Rio Felix from 1967 to 1989 is 7,678 afy.

Rio Peñasco

Recharge from the Rio Peñasco to layer 1 was estimated by the following equation:

$$R = 1.2\ (\exp(0.74 * (\ln GF + 1.85)))$$

where R = Recharge to layer 1 (afy)
GF = Gaged flow on the Rio Peñasco near Dayton

The multiplier of 1.2 was obtained by dividing the length of the Rio Peñasco across the shallow aquifer (12.5 mi) by the length of the upstream reach of the Rio Hondo (10.4 mi) for which the equation was derived.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 15 cells representing this reach of the Rio Peñasco.

To account for possible errors in gage reading during wet years, recharge from the Rio Peñasco was doubled in 1968, 1974, 1984, and 1986.

The average simulated recharge from the Rio Peñasco from 1967 to 1989 is 2,780 afy.

Fourmile Draw

Recharge from Fourmile Draw to layer 1 was estimated by the following equation:

$$R = 0.79\ (\exp(0.74 * (\ln GF + 1.85)))$$

where R = Recharge to layer 1 (afy)
GF = Gaged flow on Fourmile Draw

The multiplier of 0.79 was obtained by dividing the length of the Rio Peñasco across the shallow aquifer (8.2 mi) by the length of the upstream reach of the Rio Hondo (10.4 mi) for which the equation was derived.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 8 cells representing this reach of Fourmile Draw.

To account for possible errors in gage reading during wet years, recharge from Fourmile Draw was doubled in 1968, 1974, 1984, and 1986.

The average simulated recharge from Fourmile Draw from 1967 to 1989 is 1,411 afy.

South Seven Rivers

Recharge from South Seven Rivers to layer 1 was estimated by the following equation:

$$R = 0.23 (\exp(0.74 * (\ln GF + 1.85)))$$

where R = Recharge to layer 1
GF = Gaged flow on South Seven Rivers

The multiplier of 0.23 was obtained by dividing the length of the South Seven Rivers across the shallow aquifer (2.35 mi) by the length of the upstream reach of the Rio Hondo (10.4 mi) for which the equation was derived.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 3 cells representing this reach of the South Seven Rivers.

To account for possible errors in gage reading during wet years, recharge from South Seven Rivers was doubled in 1968, 1974, 1984, and 1986.

The average recharge from South Seven Rivers from 1967 to 1989 is 364 afy.

North Seven Rivers

Recharge from North Seven Rivers to layer 1 was set equal to 21% of the recharge from South Seven Rivers, based on the percentage of gaged flow on North Seven Rivers compared to gaged flow on South Seven Rivers from 1989 to 1992.

The recharge flux per cell is estimated by dividing the total quantity of recharge by the total area of the 6 cells representing this reach of the North Seven Rivers.

To account for possible errors in gage readings during wet years, recharge from North Seven Rivers was doubled in 1968, 1974, 1984, and 1986.

The average recharge from North Seven Rivers from 1967 to 1989 is 76 afy.

Eagle Creek

Because the drainage areas are of similar size, recharge from Eagle Creek to layer 1 was set equal to the recharge flux per cell occurring from Fourmile Draw. In 1978, however, recharge was increased by four times over the value applied to Fourmile Draw because, whereas the flows in the Rio Felix (which is closer to Eagle Creek than Fourmile Draw) and rainfall were above average that year, flow in Fourmile Draw was not exceptional in that year. Further, recharge in 1986 was doubled to account for the wet year and the low simulated heads in the vicinity of Eagle Creek.

The average recharge from Eagle Creek from 1967 to 1989 is 2,207 afy.

Cottonwood Creek

Recharge from Cottonwood Creek to layer 1 was also initially set equal to the recharge flux per cell occurring from Fourmile Draw because gage data on Cottonwood Creek from 1932 to 1965 is similar in magnitude and fluctuations to the gaged flow on Fourmile Draw. Recharge was increased by 20 times in 1978 and 2 times in 1979 over the rate assigned to Fourmile Draw to account for the high flows in the Rio Felix (which is closer to Cottonwood Creek than Fourmile

Draw). Recharge was increased 2 times in 1986 to account for high rainfall and potential errors in gaged flows that year. Recharge in 1972 was increased to the rate for 1974 because while both years were very wet, flows (based on Fourmile Draw) were low for 1972.

The average recharge from Cottonwood Creek from 1967 to 1989 is 4,556 afy.

Walnut Creek

Based on its proximity to Cottonwood Creek and the size of the drainage area, recharge from Walnut Creek to layer 1 was set equal to half the recharge flux per cell occurring from Cottonwood Creek. Recharge was increased by 2 times in 1974 to account for the wet year and improve heads in the vicinity of Walnut Creek.

The average recharge from Walnut Creek from 1967 to 1989 is 1,457 afy.

Thirteenmile Draw

Based on the similarity in size, recharge from Thirteenmile Draw to layer 1 was initially set equal to the flux per cell for Walnut Creek (half of Fourmile Draw). To account for the high flows in the Rios Hondo and Felix, which are closer than Fourmile Draw, recharge was increased 10-fold in 1972, by 4 times in 1978, and by 2 times in 1979 and 1986.

The average recharge from Thirteenmile Draw from 1967 to 1989 is 1,200 afy.

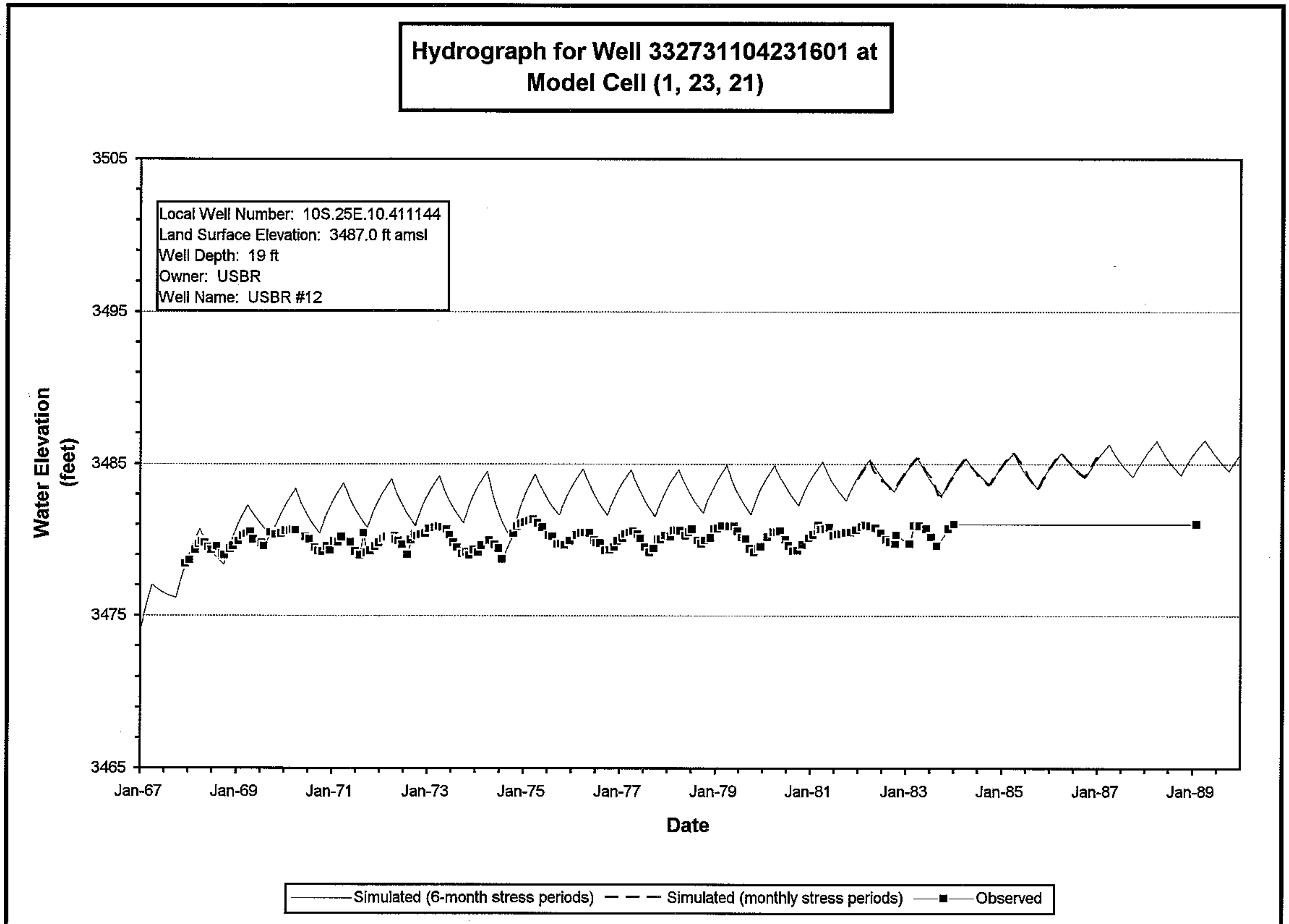
Eightmile Draw

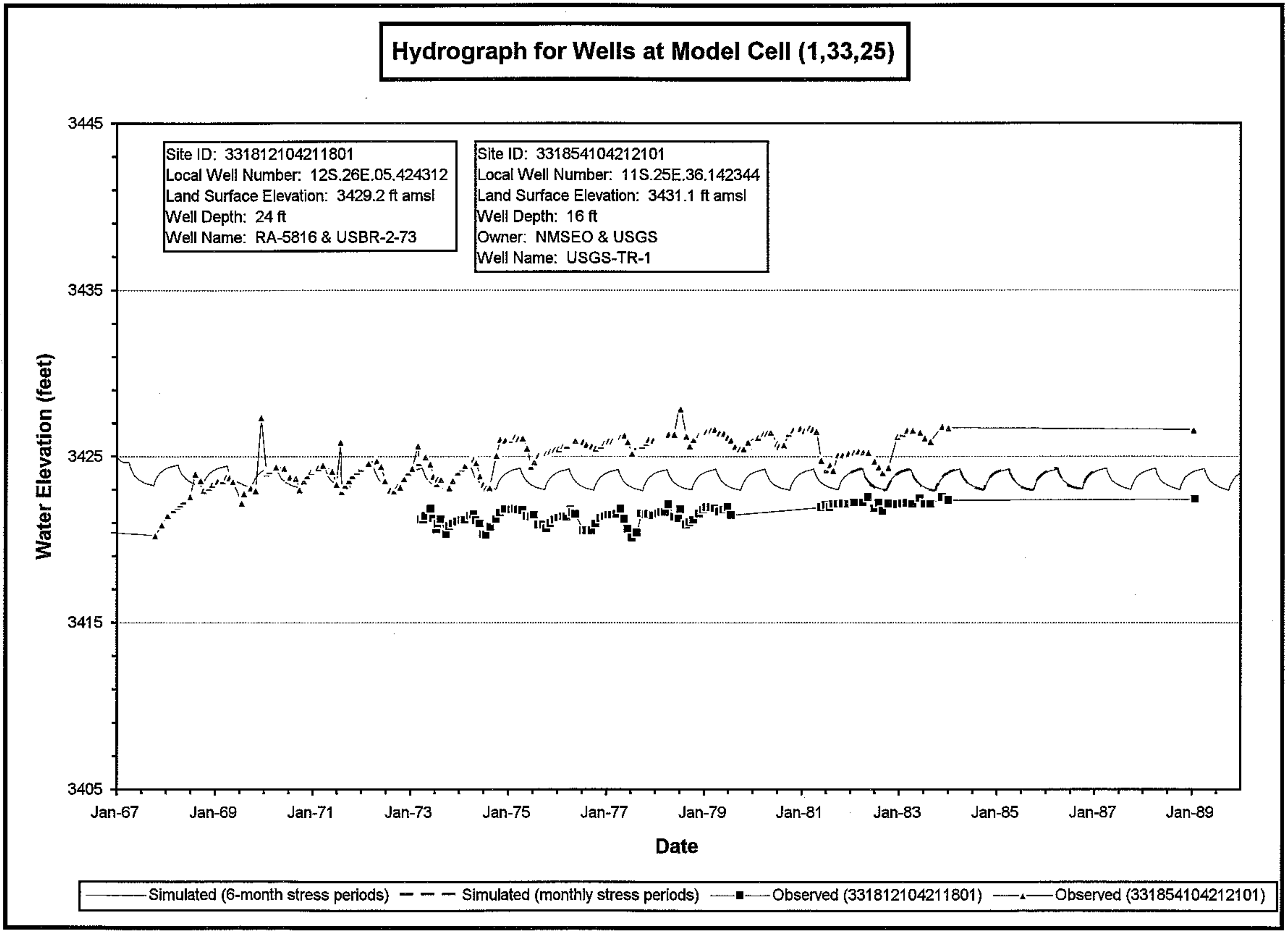
Because the drainage areas of Eightmile Draw and the Rio Felix are approximately equal in size, recharge from Eightmile Draw was set equal to the initial flux per cell from the Rio Felix (where recharge was distributed over 17 cells). The rate was increased by 4 times in 1978 and by 2 times in 1986 to account for the high rainfall in those years.

The average recharge from Eightmile Draw from 1967 to 1989 is 2,915 afy.

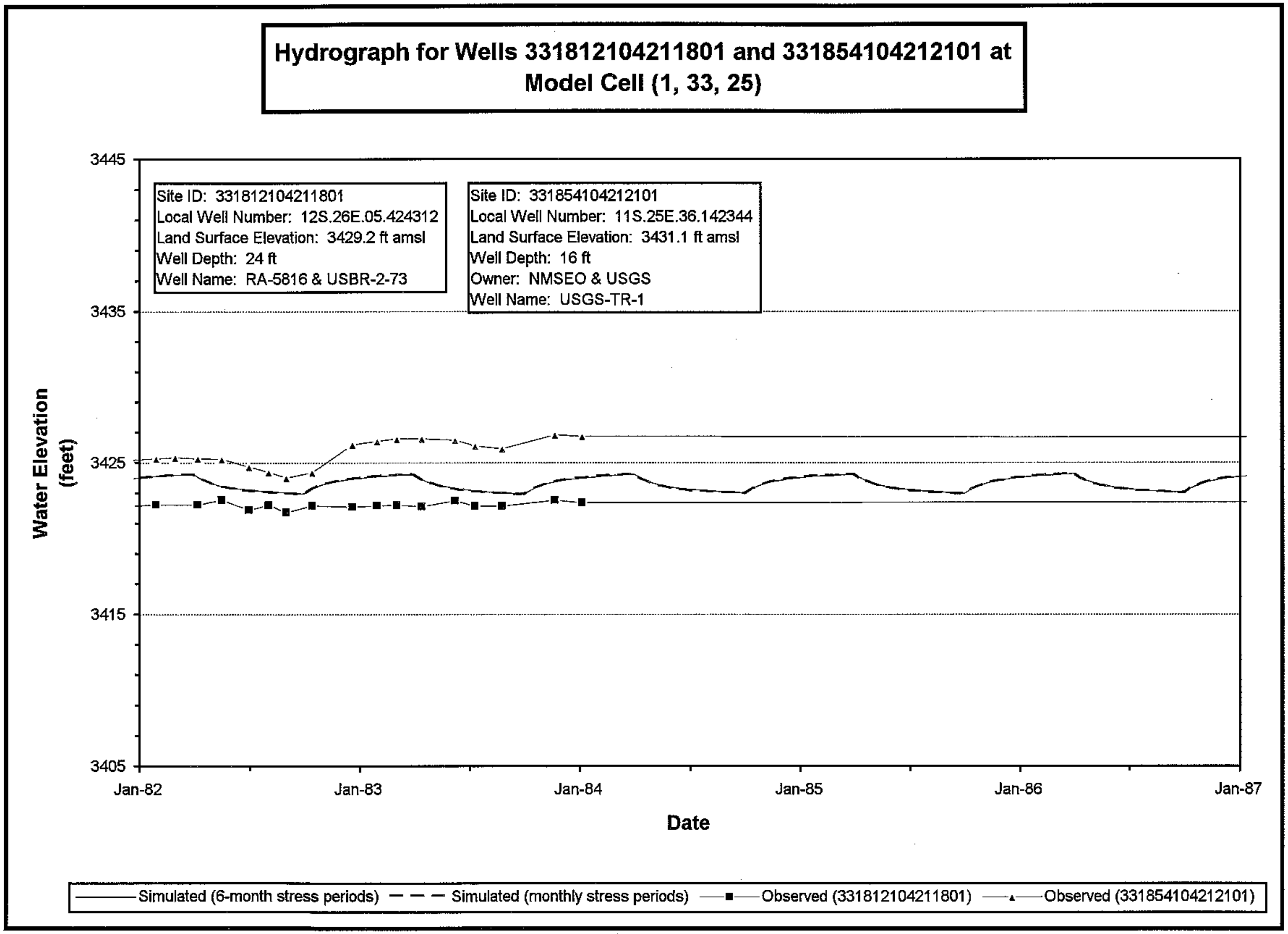
APPENDIX P

HYDROGRAPHS OF OBSERVED AND CALCULATED WATER LEVELS

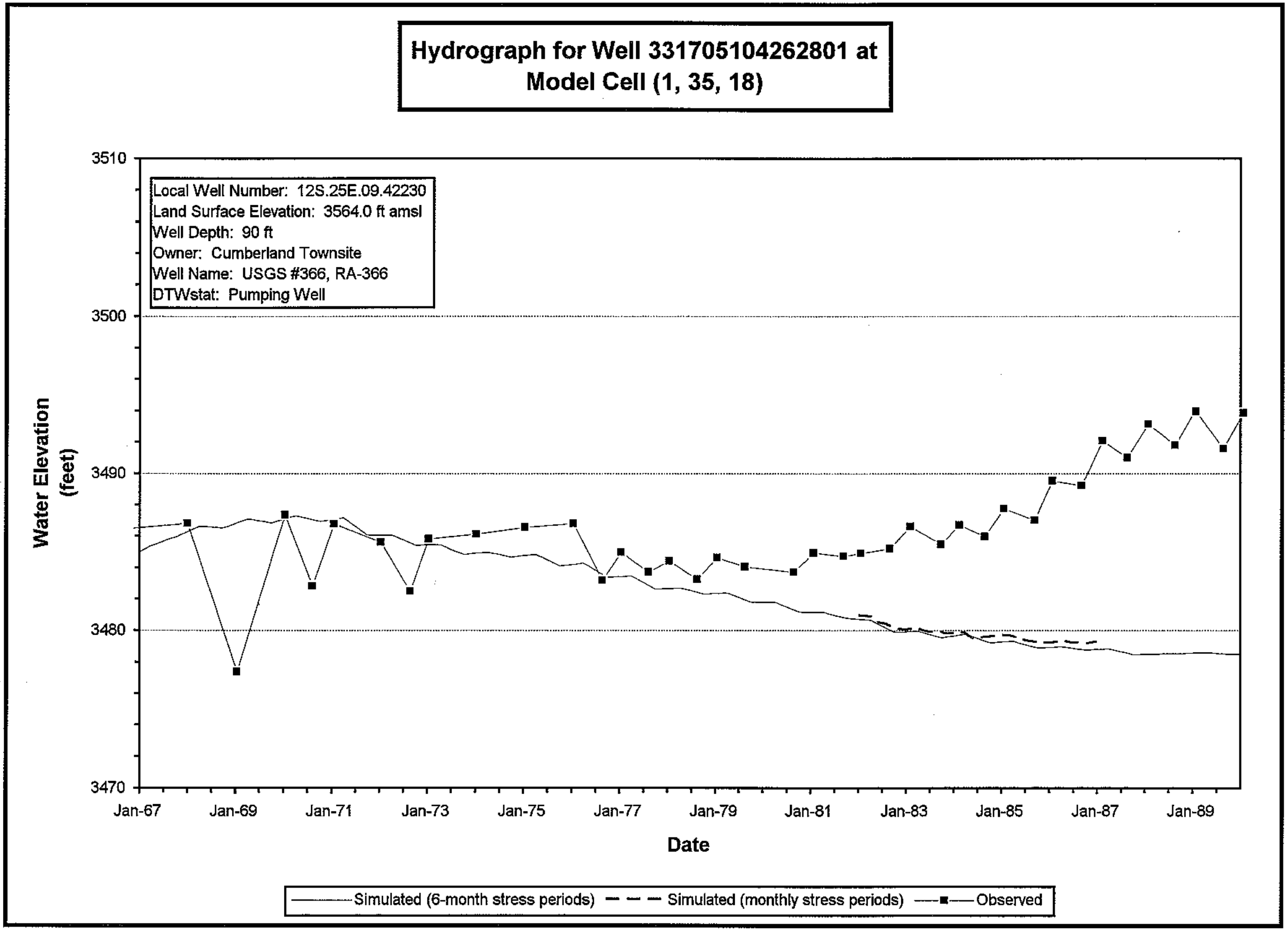

Hydrograph for Well 332731104231601 at Model Cell (1, 23, 21)
Local Well Number: 10S.25E.10.411144
Land Surface Elevation: 3487.0 ft amsl
Well Depth: 19 ft
Owner: USBR
Well Name: USBR #12
Water Elevation (feet)
3505
3495
3485
3475
3465
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

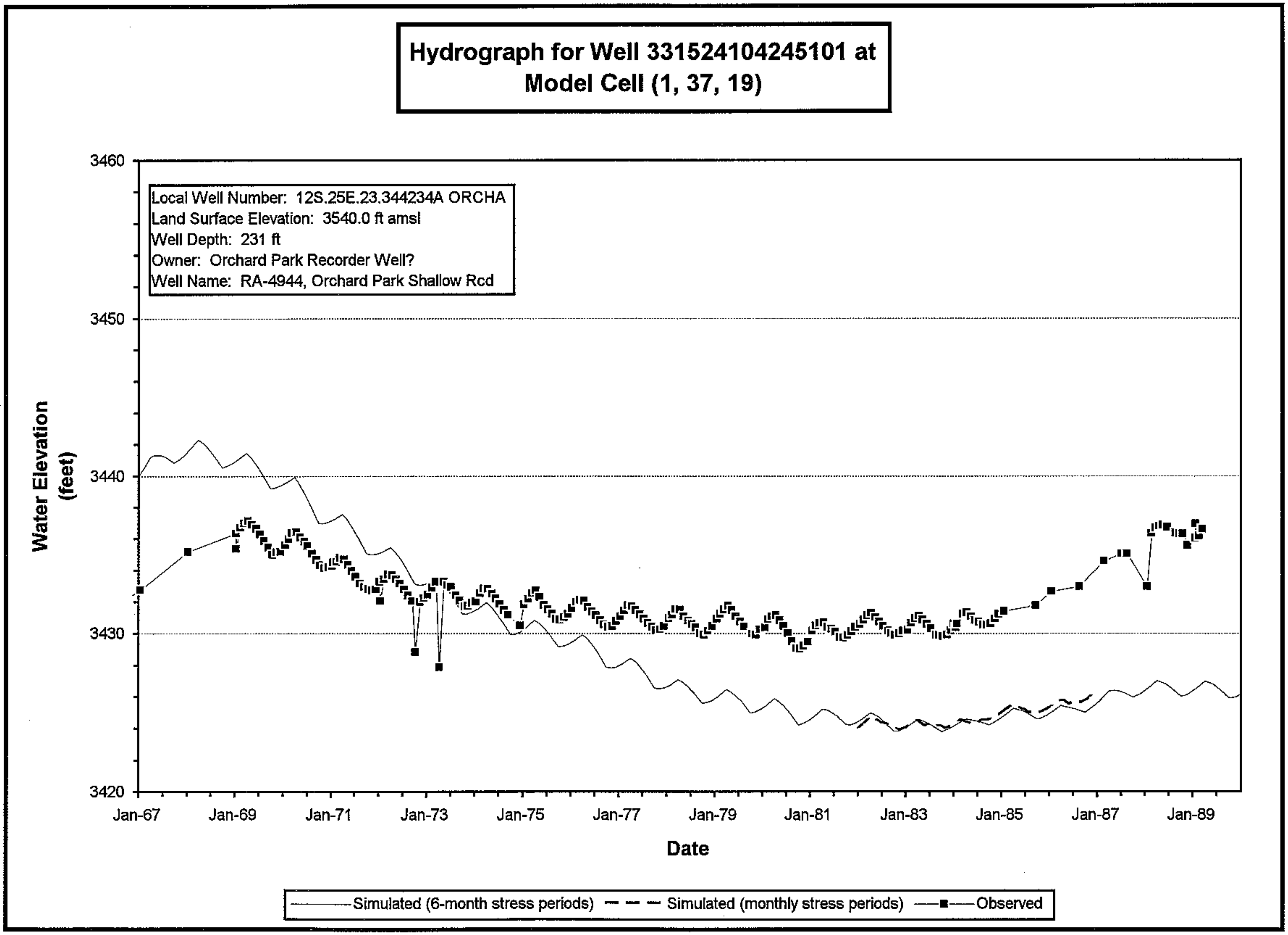


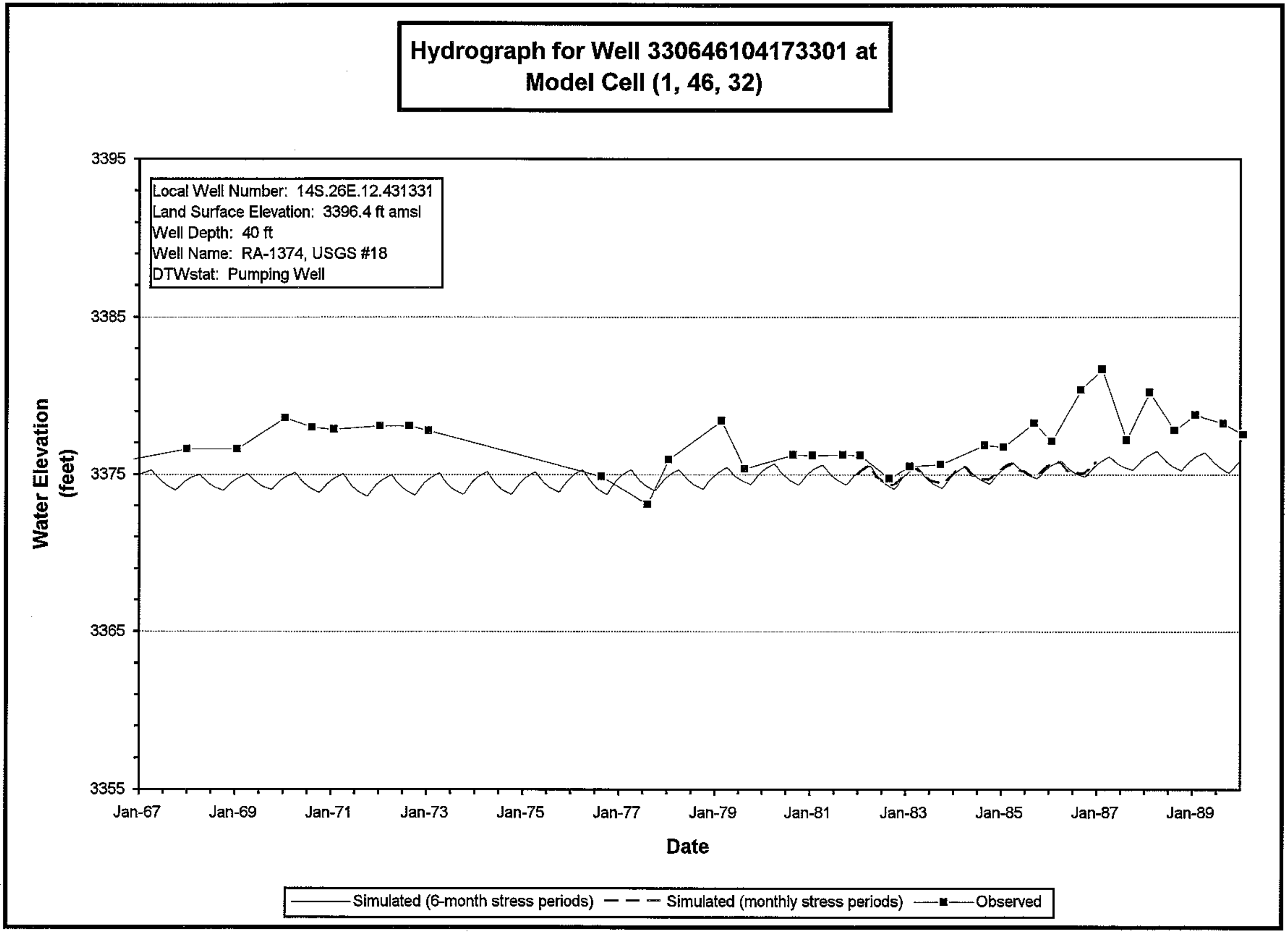
Hydrograph for Wells at Model Cell (1,33,25)
Site ID: 331812104211801
Local Well Number: 12S.26E.05.424312
Land Surface Elevation: 3429.2 ft amsl
Well Depth: 24 ft
Well Name: RA-5816 & USBR-2-73
Site ID: 331854104212101
Local Well Number: 11S.25E.36.142344
Land Surface Elevation: 3431.1 ft amsl
Well Depth: 16 ft
Owner: NMSEO & USGS
Well Name: USGS-TR-1
Water Elevation (feet)
3445
3435
3425
3415
3405
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed (331812104211801)
Observed (331854104212101)

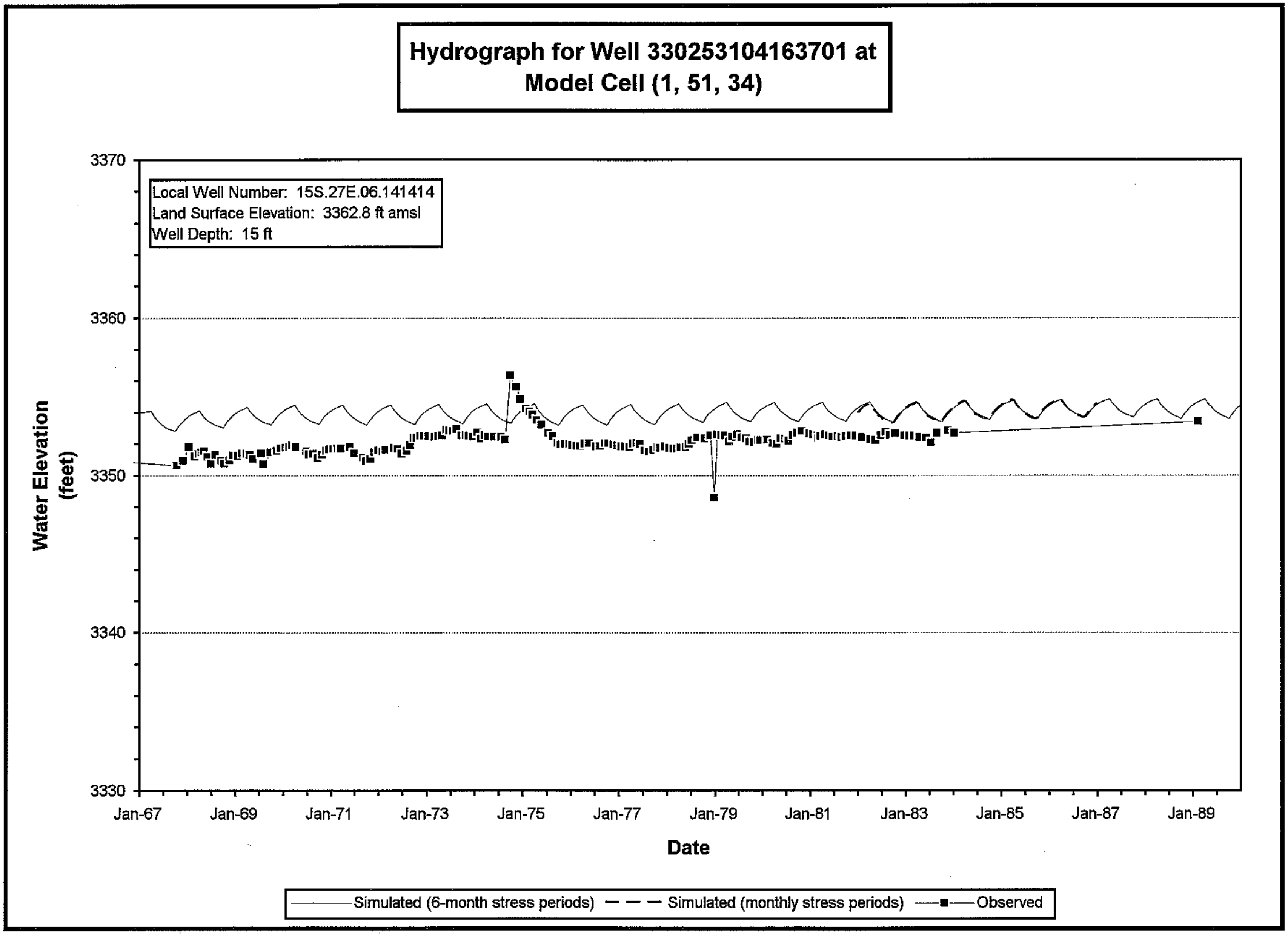


Hydrograph for Wells 331812104211801 and 331854104212101 at Model Cell (1, 33, 25)
Site ID: 331812104211801
Local Well Number: 12S.26E.05.424312
Land Surface Elevation: 3429.2 ft amsl
Well Depth: 24 ft
Well Name: RA-5816 & USBR-2-73
Site ID: 331854104212101
Local Well Number: 11S.25E.36.142344
Land Surface Elevation: 3431.1 ft amsl
Well Depth: 16 ft
Owner: NMSEO & USGS
Well Name: USGS-TR-1
Water Elevation (feet)
3445
3435
3425
3415
3405
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed (331812104211801)
Observed (331854104212101)

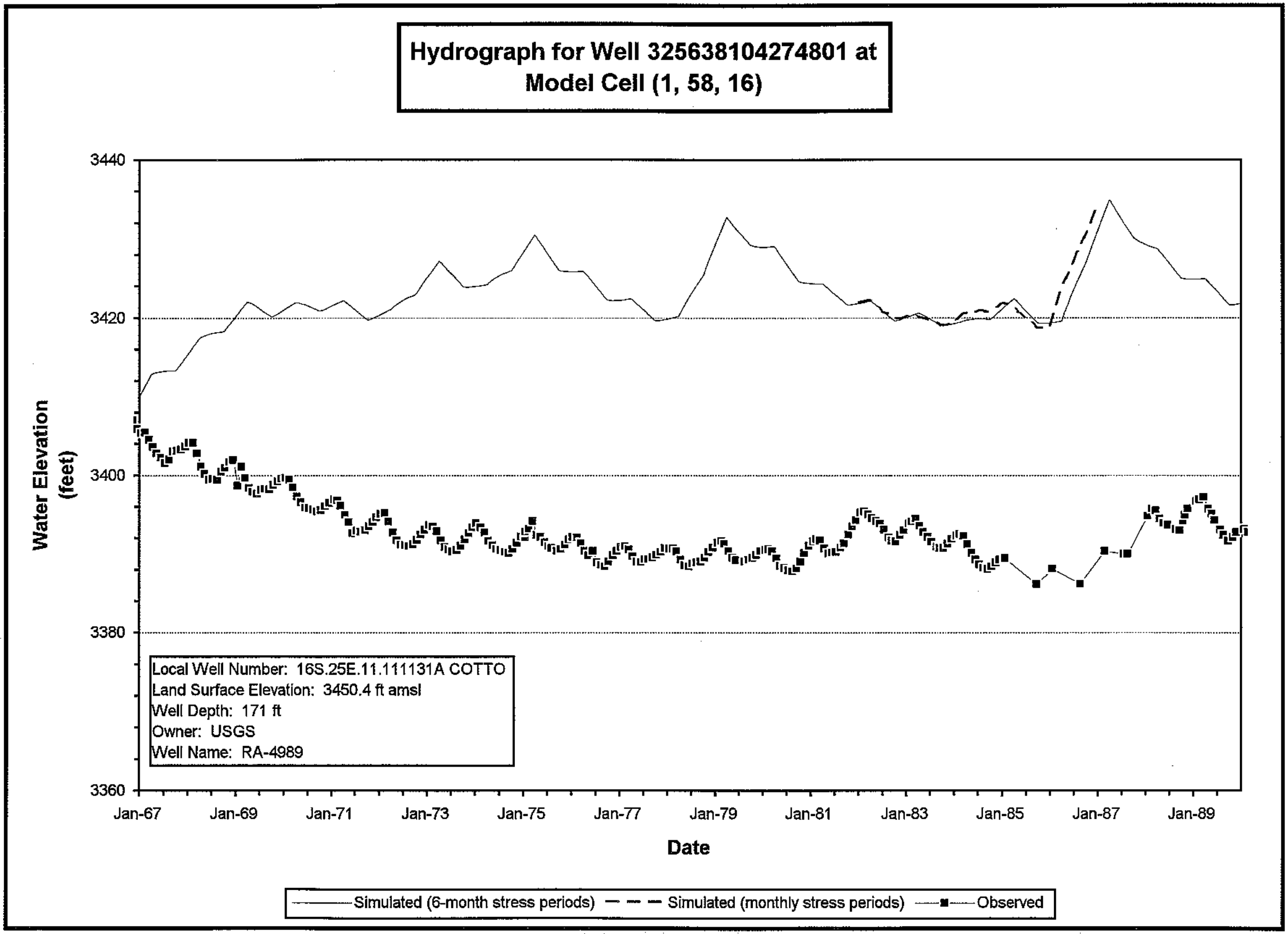

Hydrograph for Well 331705104262801 at Model Cell (1, 35, 18)
Local Well Number: 12S.25E.09.42230
Land Surface Elevation: 3564.0 ft amsl
Well Depth: 90 ft
Owner: Cumberland Townsite
Well Name: USGS #366, RA-366
DTWstat: Pumping Well
Water Elevation (feet)
3510
3500
3490
3480
3470
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed


Hydrograph for Well 331524104245101 at
Model Cell (1, 37, 19)
Local Well Number: 12S.25E.23.344234A ORCHA
Land Surface Elevation: 3540.0 ft amsl
Well Depth: 231 ft
Owner: Orchard Park Recorder Well?
Well Name: RA-4944, Orchard Park Shallow Rcd
Water Elevation (feet)
3460
3450
3440
3430
3420
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

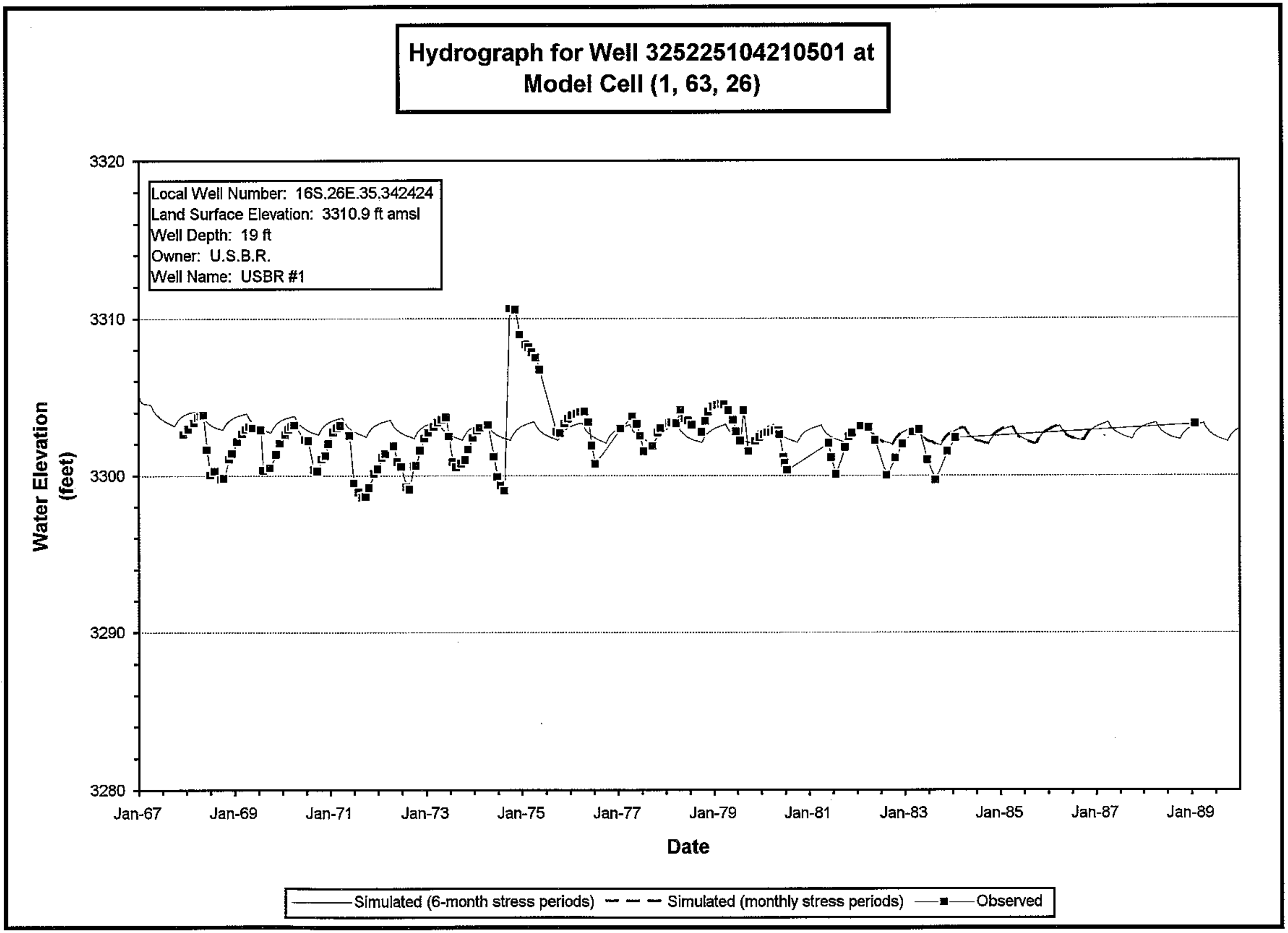

Hydrograph for Well 330646104173301 at Model Cell (1, 46, 32)
Local Well Number: 14S.26E.12.431331
Land Surface Elevation: 3396.4 ft amsl
Well Depth: 40 ft
Well Name: RA-1374, USGS #18
DTWstat: Pumping Well
Water Elevation (feet)
3395
3385
3375
3365
3355
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



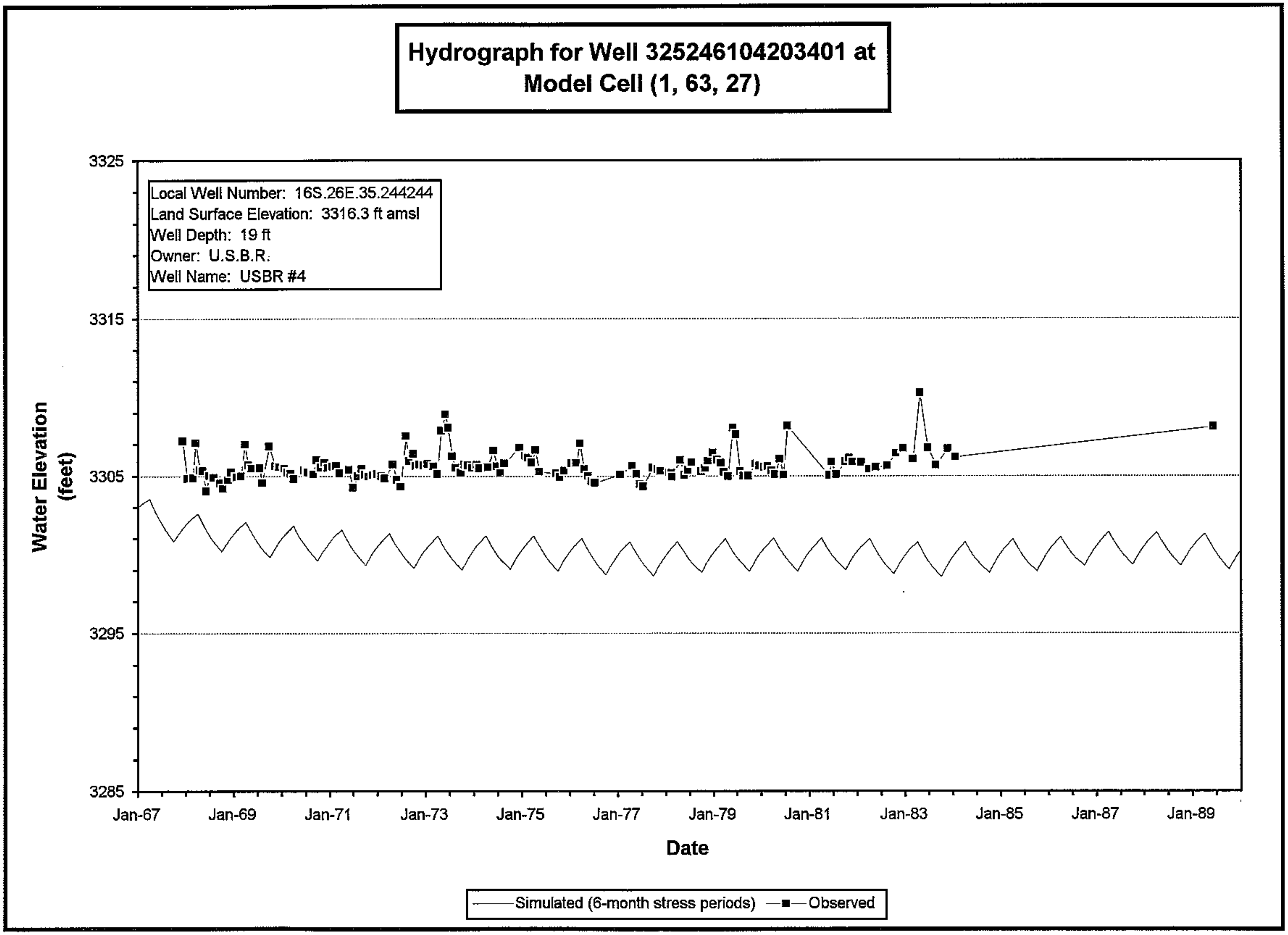
Hydrograph for Well 330253104163701 at
Model Cell (1, 51, 34)
Local Well Number: 15S.27E.06.141414
Land Surface Elevation: 3362.8 ft amsl
Well Depth: 15 ft
3370
3360
3350
3340
3330
Water Elevation (feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



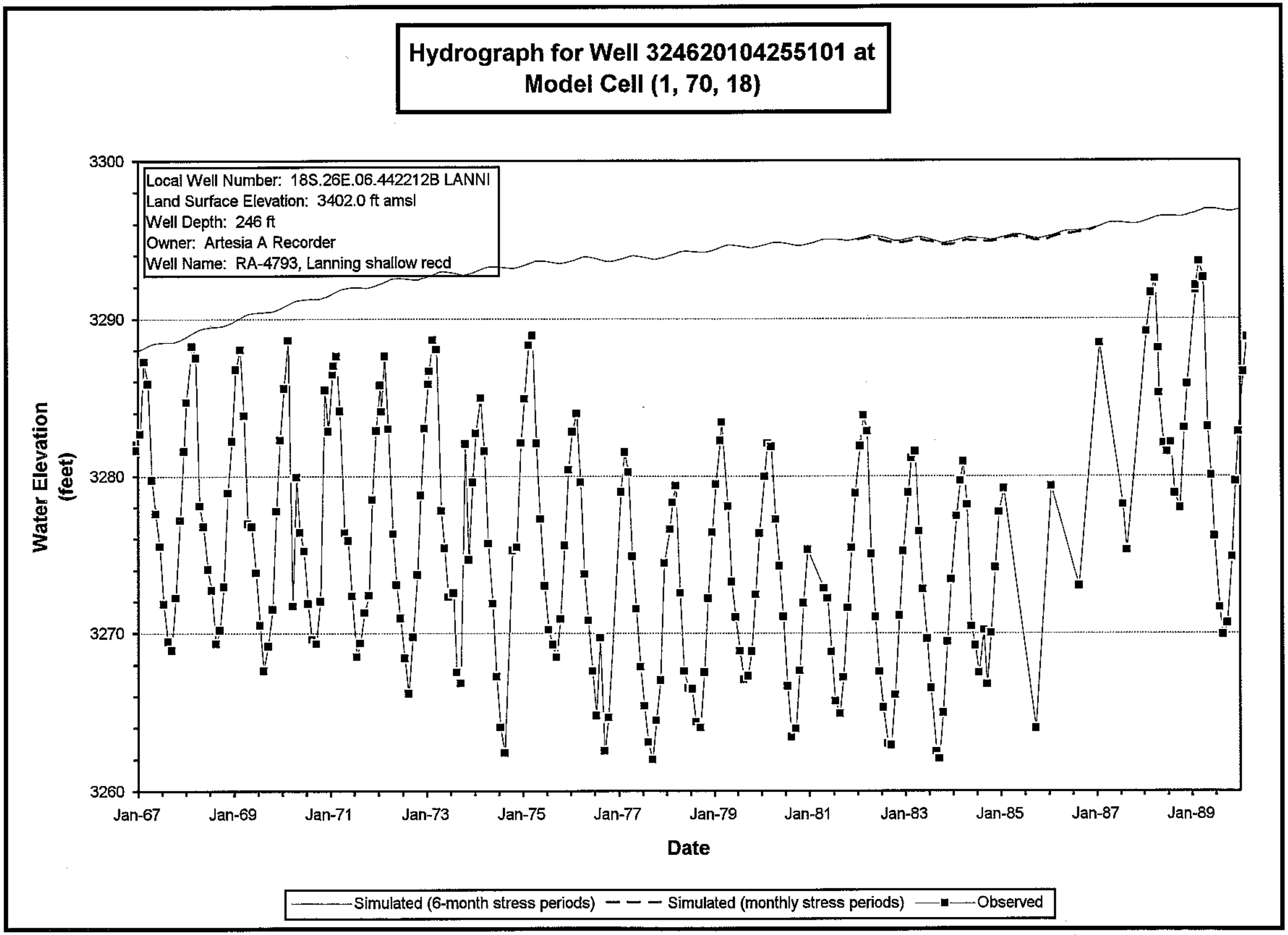
Note: Vertical scale is increased to 80 ft

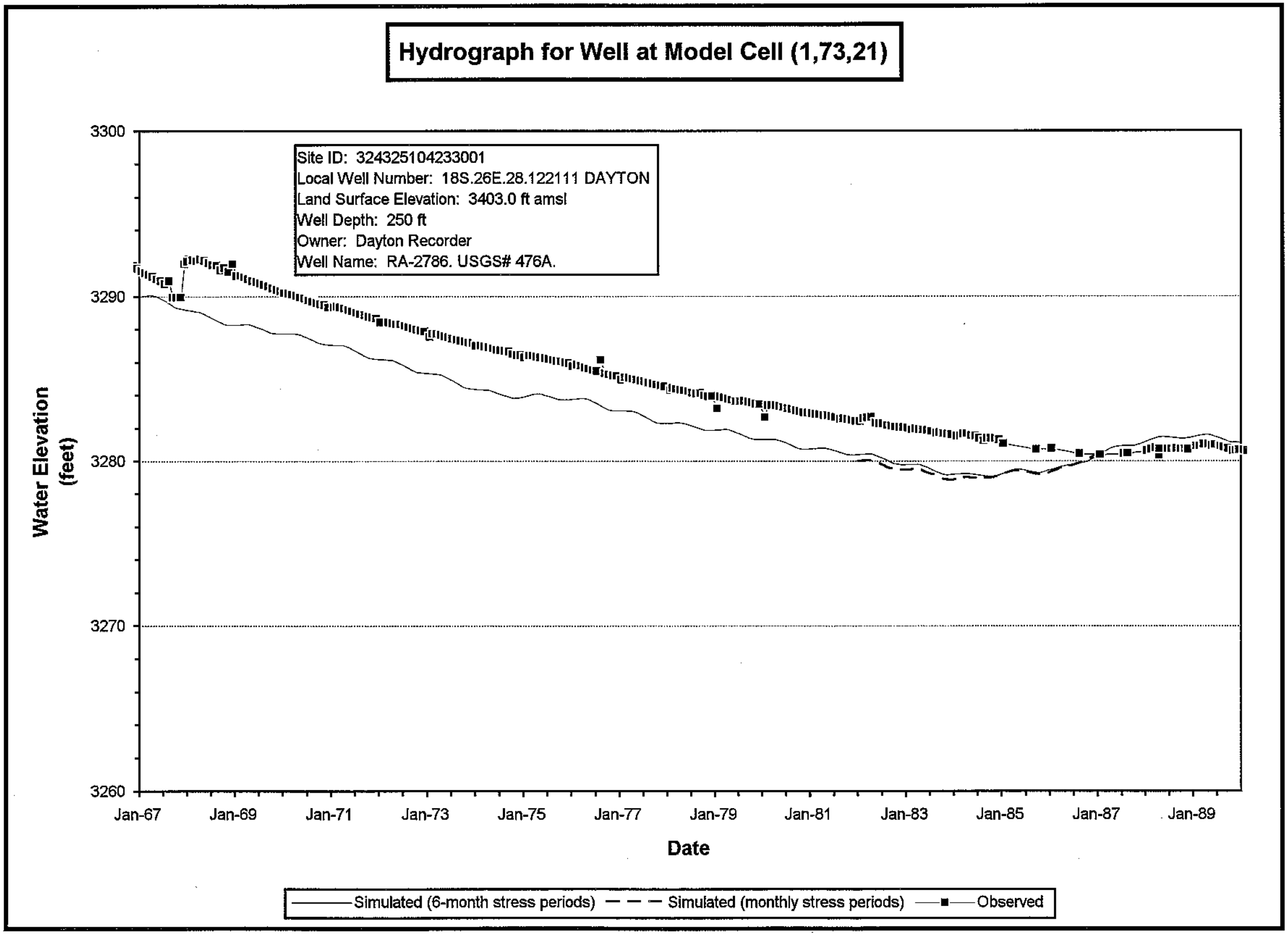


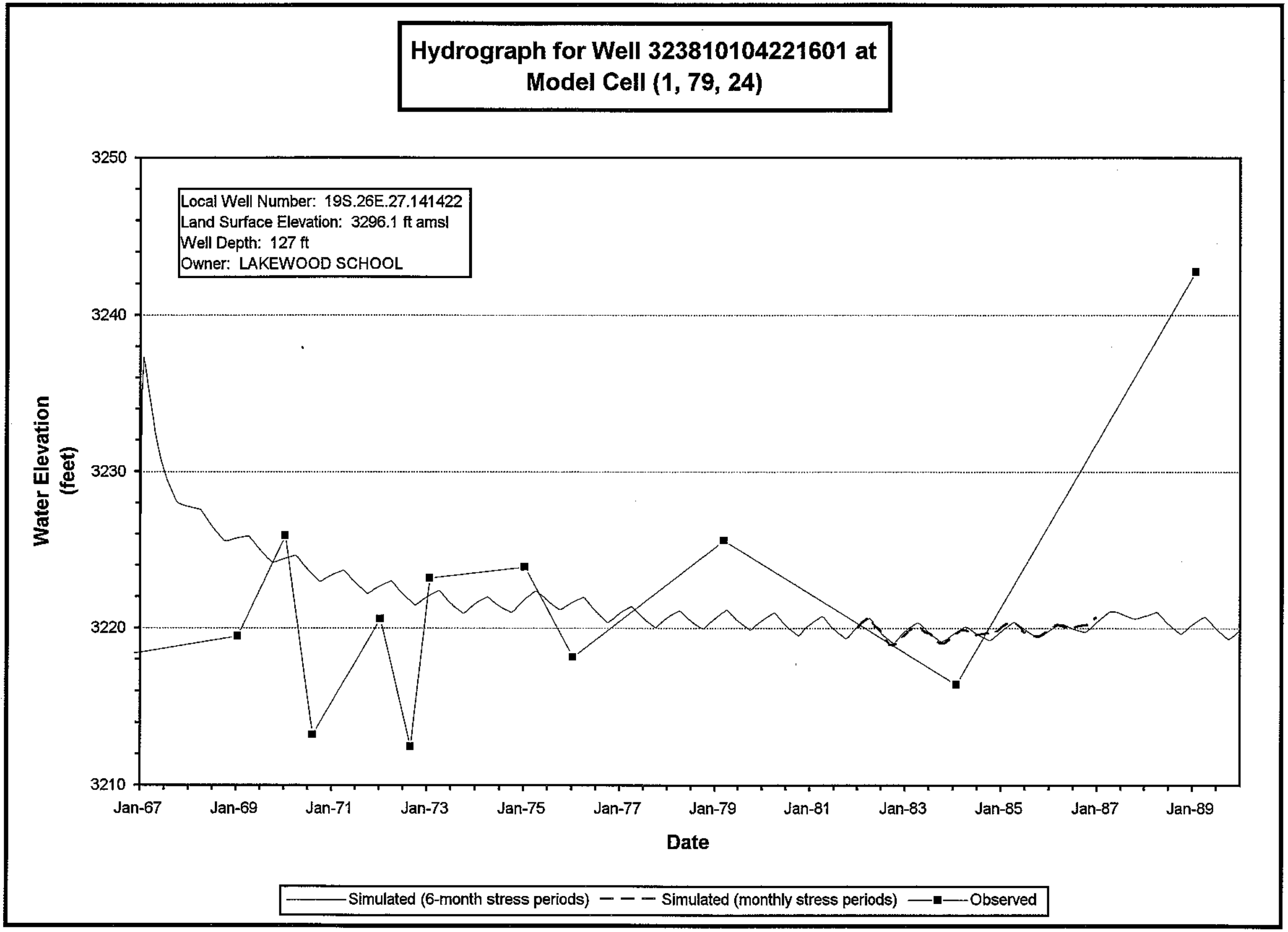
Hydrograph for Well 325225104210501 at Model Cell (1, 63, 26)
Local Well Number: 16S.26E.35.342424
Land Surface Elevation: 3310.9 ft amsl
Well Depth: 19 ft
Owner: U.S.B.R.
Well Name: USBR #1
Water Elevation (feet)
3320
3310
3300
3290
3280
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

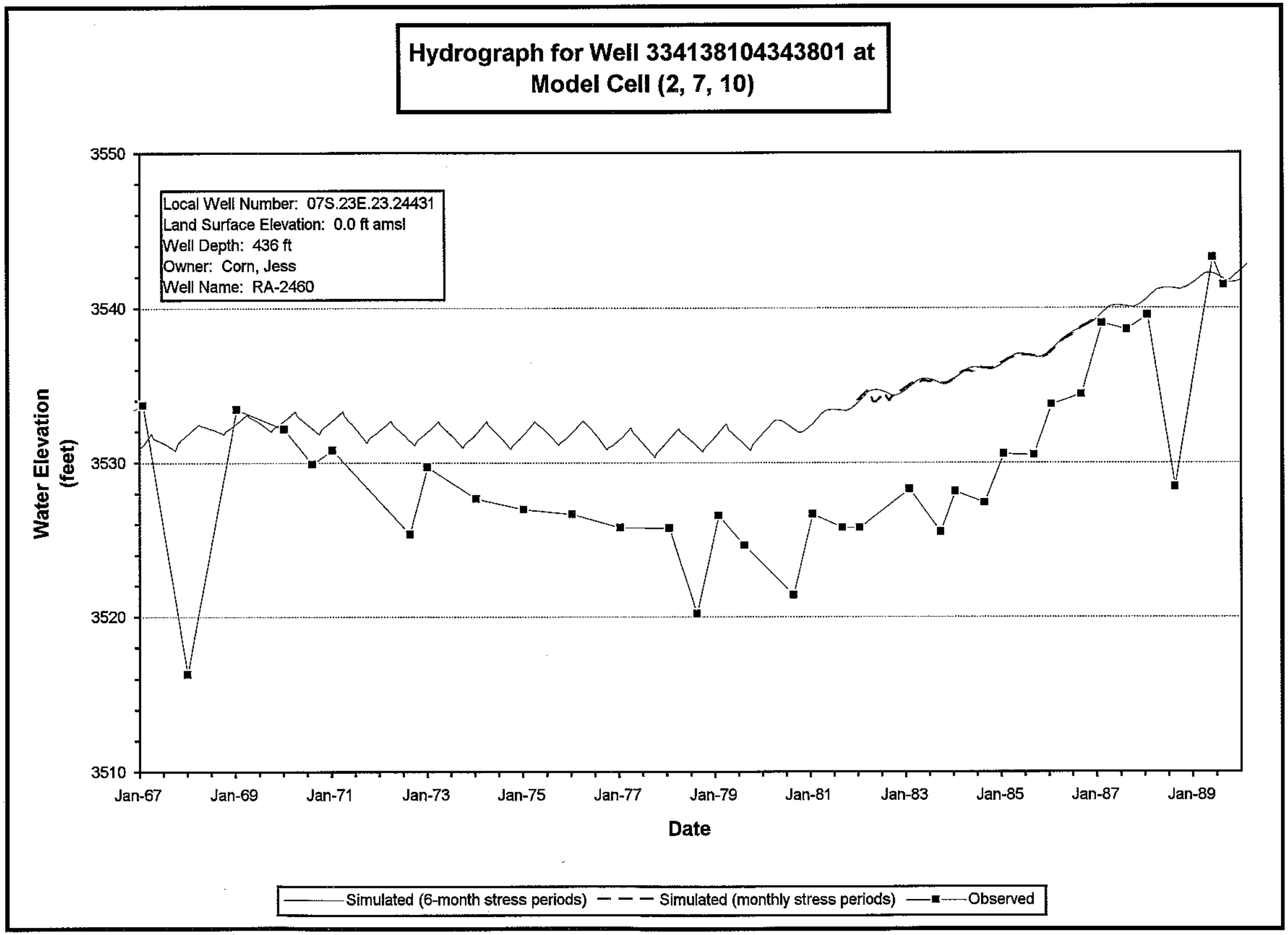


Hydrograph for Well 325246104203401 at
Model Cell (1, 63, 27)
Local Well Number: 16S.26E.35.244244
Land Surface Elevation: 3316.3 ft amsl
Well Depth: 19 ft
Owner: U.S.B.R.
Well Name: USBR #4
Water Elevation (feet)
3325
3315
3305
3295
3285
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Observed

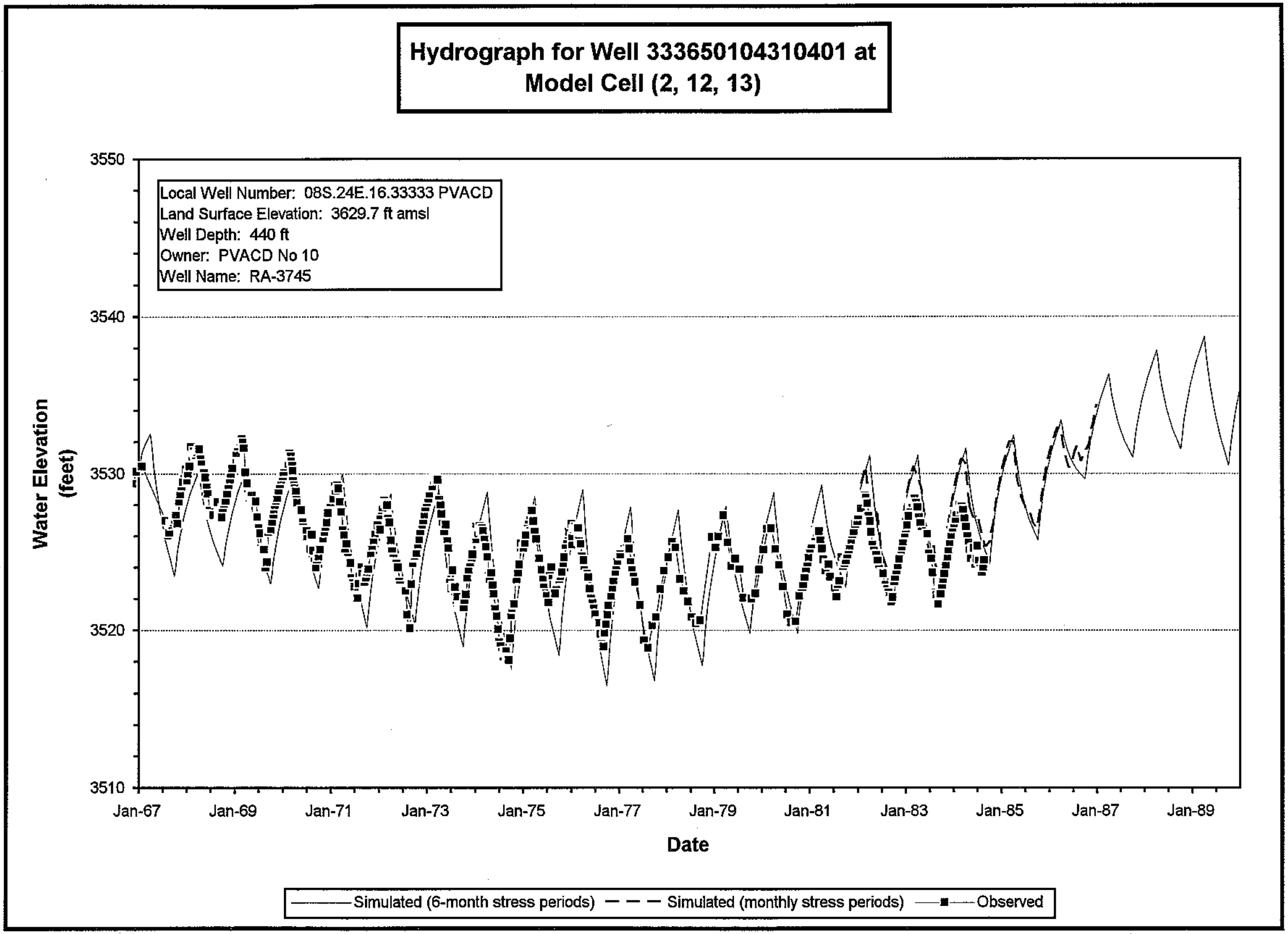

Hydrograph for Well 324620104255101 at
Model Cell (1, 70, 18)
Local Well Number: 18S.26E.06.442212B LANNI
Land Surface Elevation: 3402.0 ft amsl
Well Depth: 246 ft
Owner: Artesia A Recorder
Well Name: RA-4793, Lanning shallow recd
Water Elevation (feet)
3300
3290
3280
3270
3260
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed


Hydrograph for Well at Model Cell (1,73,21)
Site ID: 324325104233001
Local Well Number: 18S.26E.28.122111 DAYTON
Land Surface Elevation: 3403.0 ft amsl
Well Depth: 250 ft
Owner: Dayton Recorder
Well Name: RA-2786. USGS# 476A.
3300
3290
3280
3270
3260
Water Elevation (feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

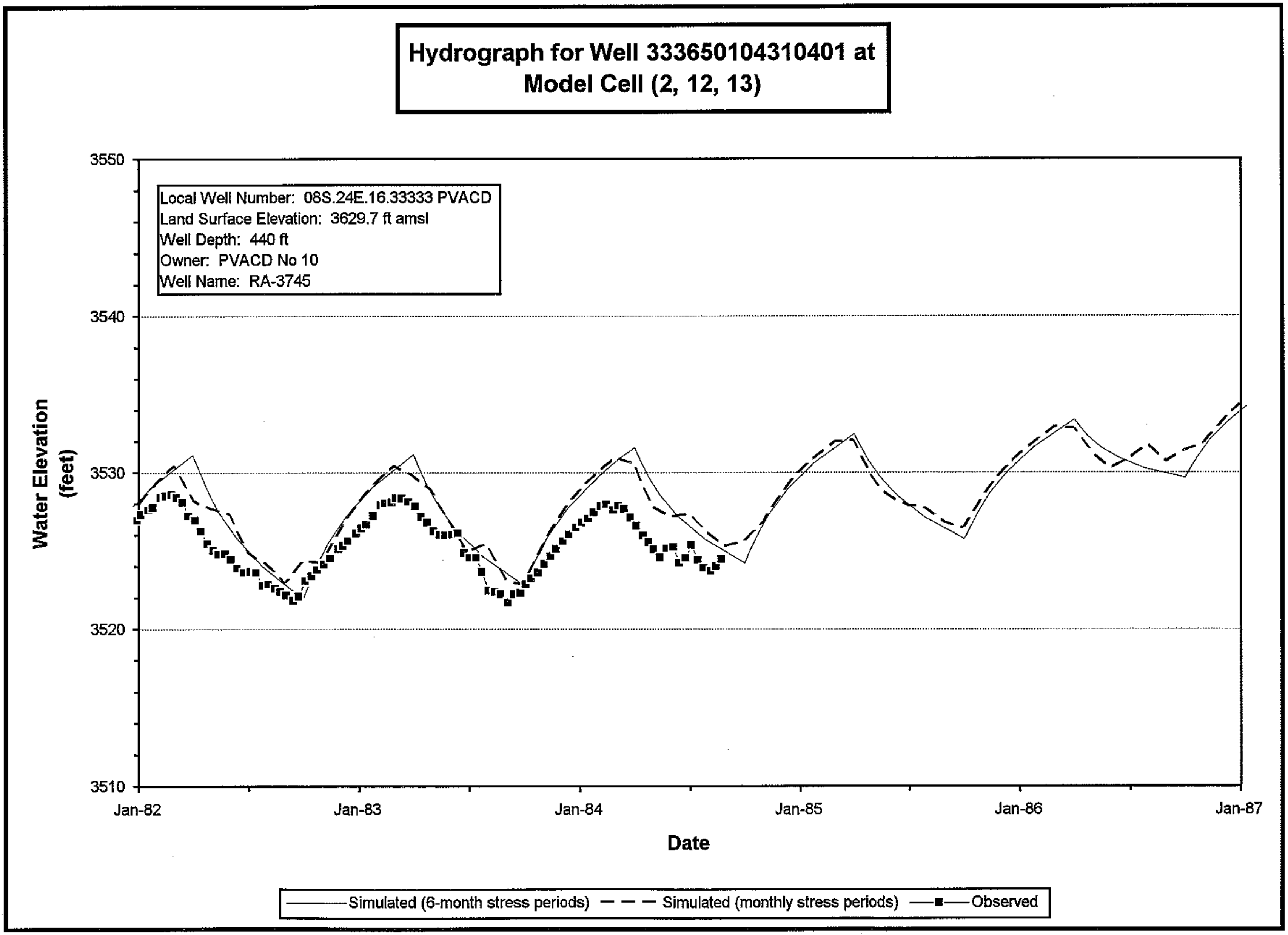

Hydrograph for Well 323810104221601 at
Model Cell (1, 79, 24)
Local Well Number: 19S.26E.27.141422
Land Surface Elevation: 3296.1 ft amsl
Well Depth: 127 ft
Owner: LAKEWOOD SCHOOL
Water Elevation (feet)
3250
3240
3230
3220
3210
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



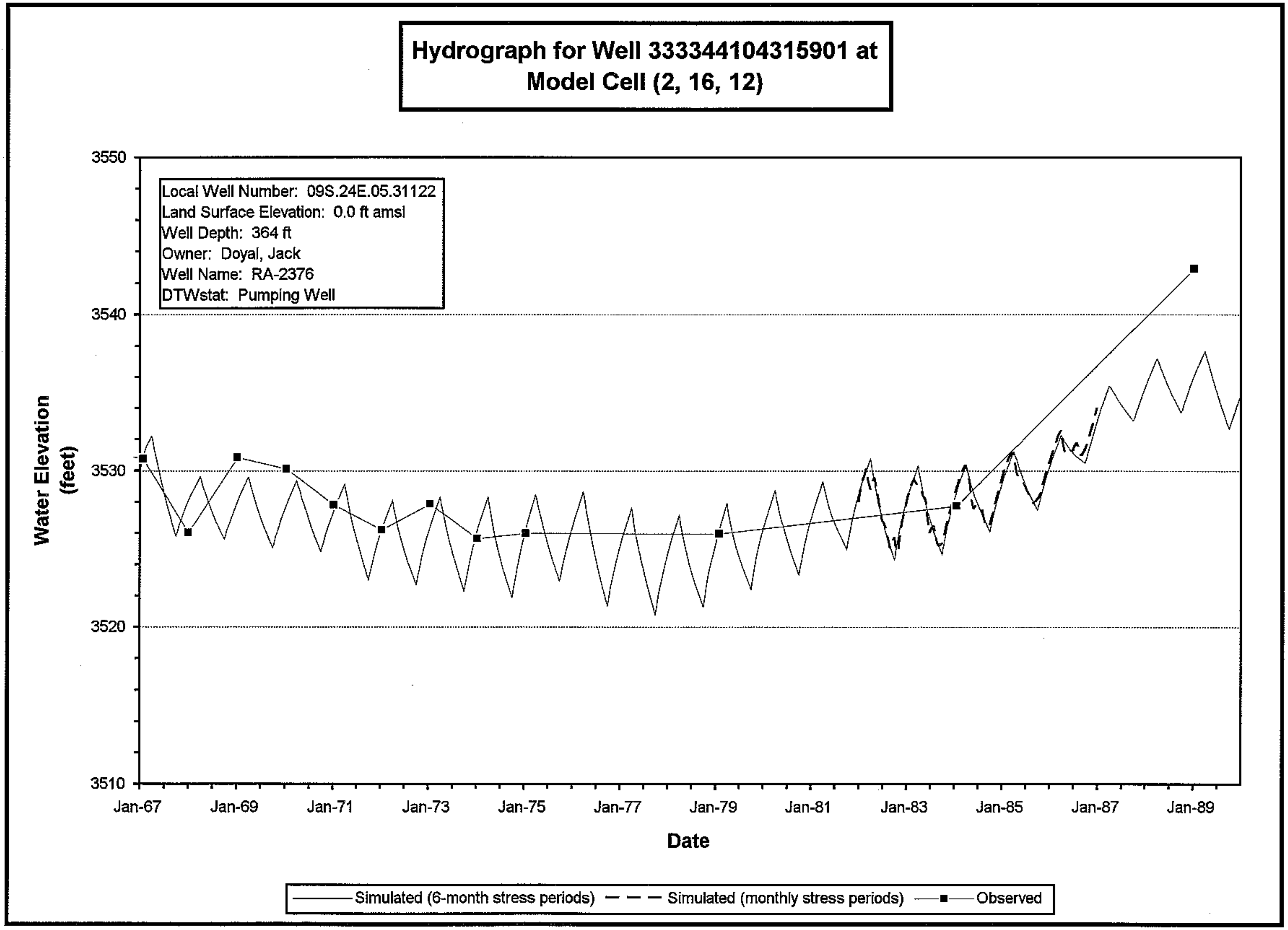
Hydrograph for Well 334138104343801 at Model Cell (2, 7, 10)
Local Well Number: 07S.23E.23.24431
Land Surface Elevation: 0.0 ft amsl
Well Depth: 436 ft
Owner: Corn, Jess
Well Name: RA-2460
3550
3540
3530
3520
3510
Water Elevation (feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



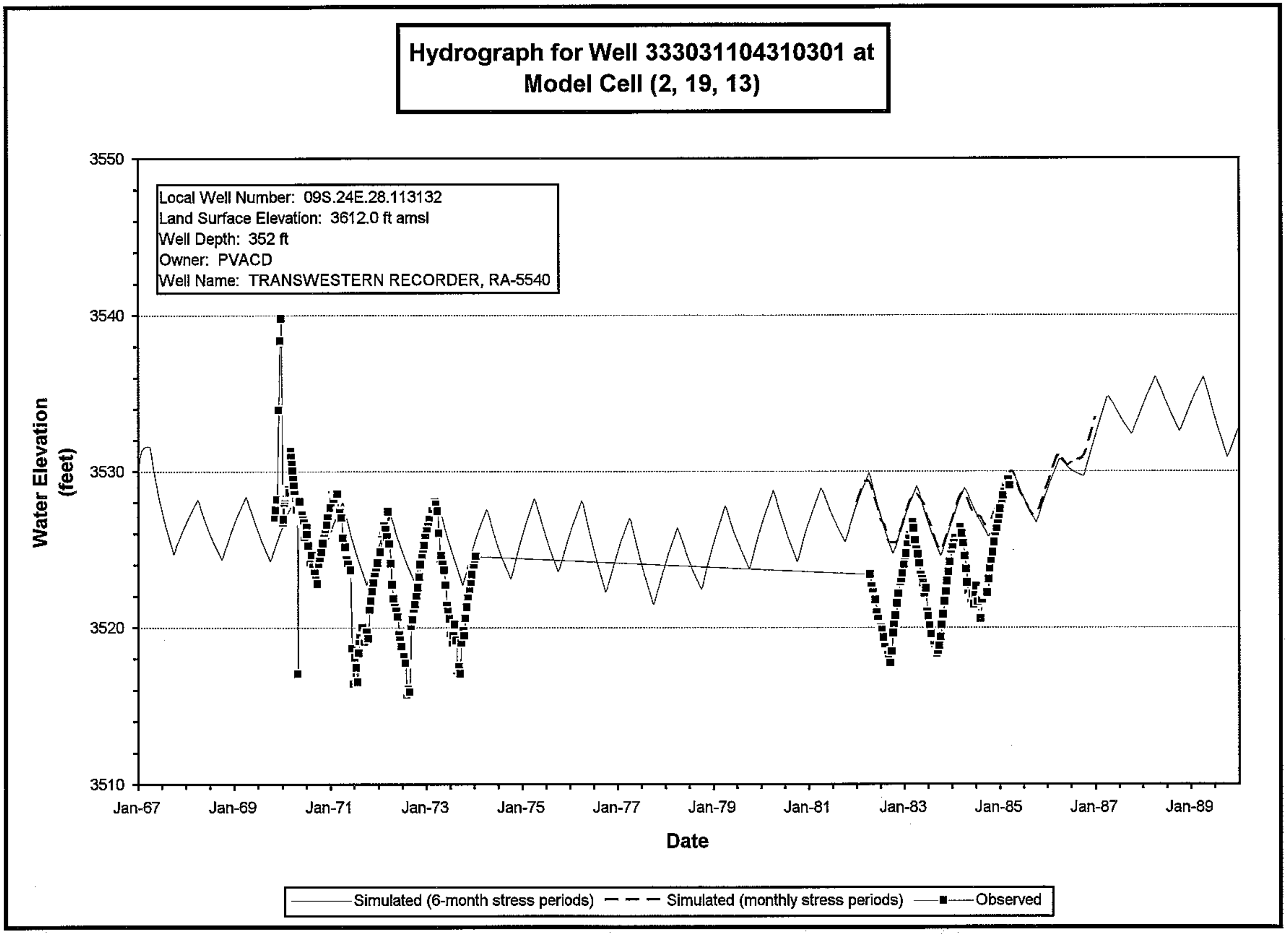
Hydrograph for Well 333650104310401 at Model Cell (2, 12, 13)
Local Well Number: 08S.24E.16.33333 PVACD
Land Surface Elevation: 3629.7 ft amsl
Well Depth: 440 ft
Owner: PVACD No 10
Well Name: RA-3745
Water Elevation (feet)
3550
3540
3530
3520
3510
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



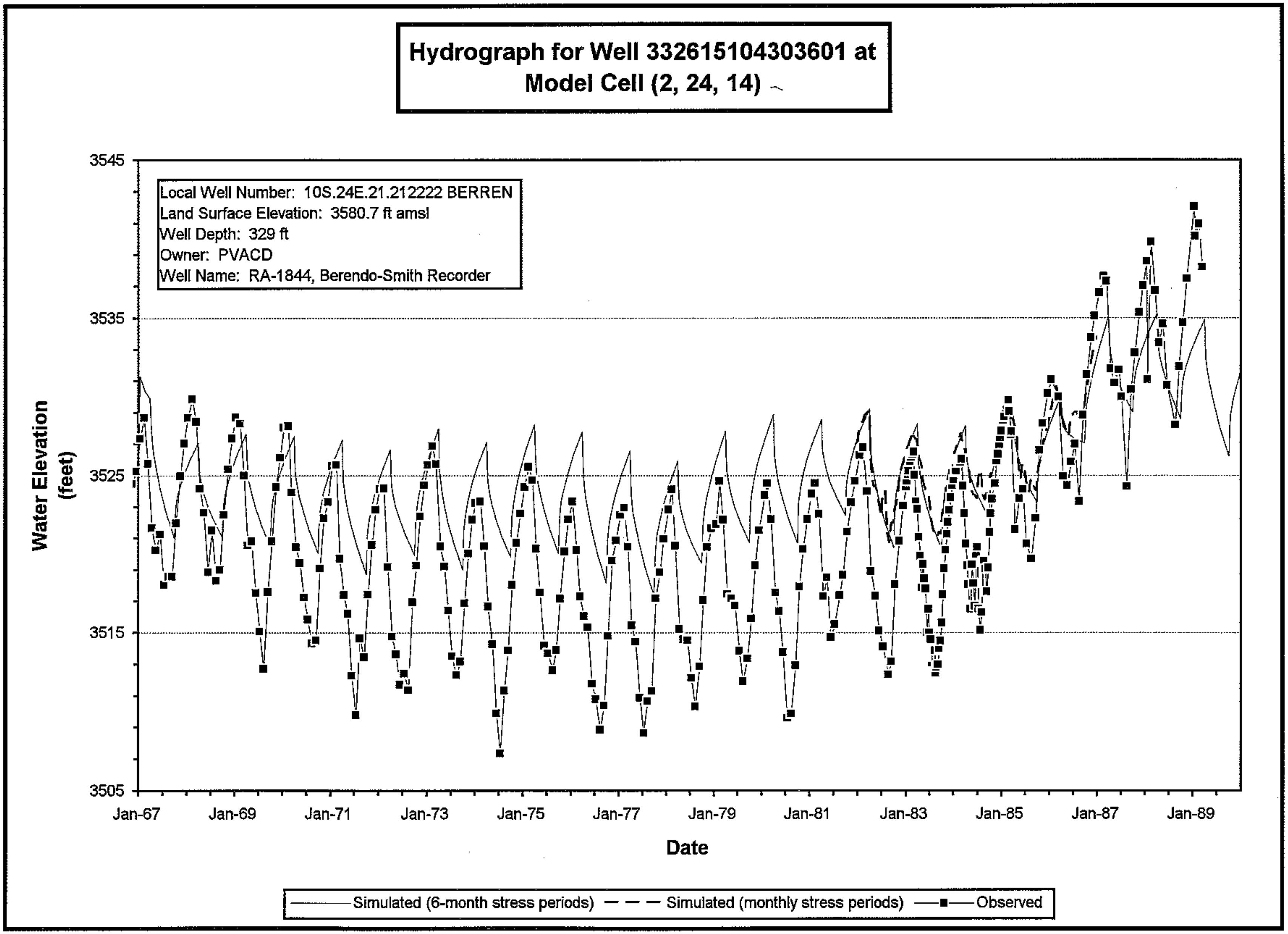
Hydrograph for Well 333650104310401 at Model Cell (2, 12, 13)
Local Well Number: 08S.24E.16.33333 PVACD
Land Surface Elevation: 3629.7 ft amsl
Well Depth: 440 ft
Owner: PVACD No 10
Well Name: RA-3745
Water Elevation (feet)
3550
3540
3530
3520
3510
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



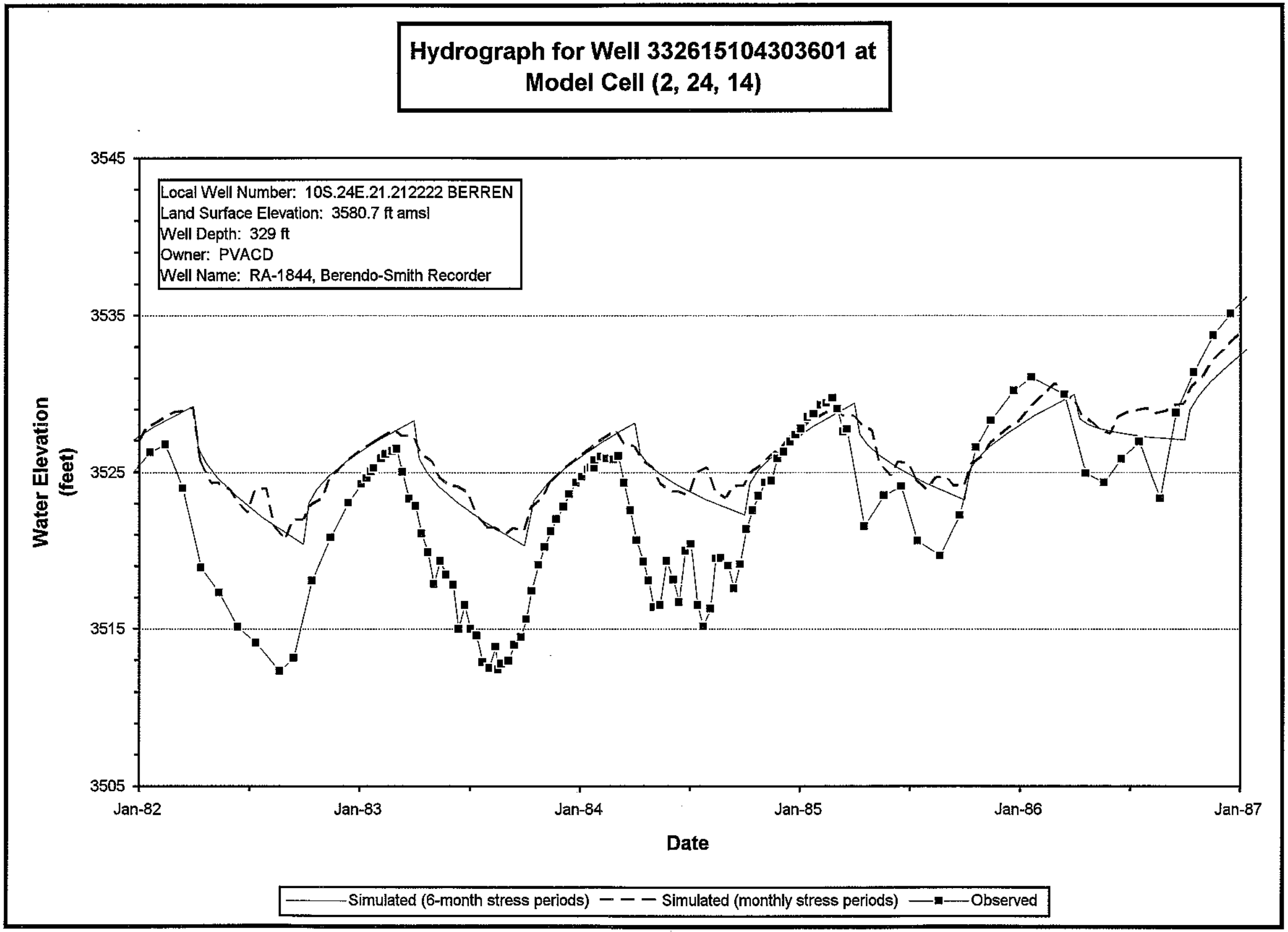
Hydrograph for Well 333344104315901 at
Model Cell (2, 16, 12)
Local Well Number: 09S.24E.05.31122
Land Surface Elevation: 0.0 ft amsl
Well Depth: 364 ft
Owner: Doyal, Jack
Well Name: RA-2376
DTWstat: Pumping Well
3550
3540
3530
3520
3510
Water Elevation (feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

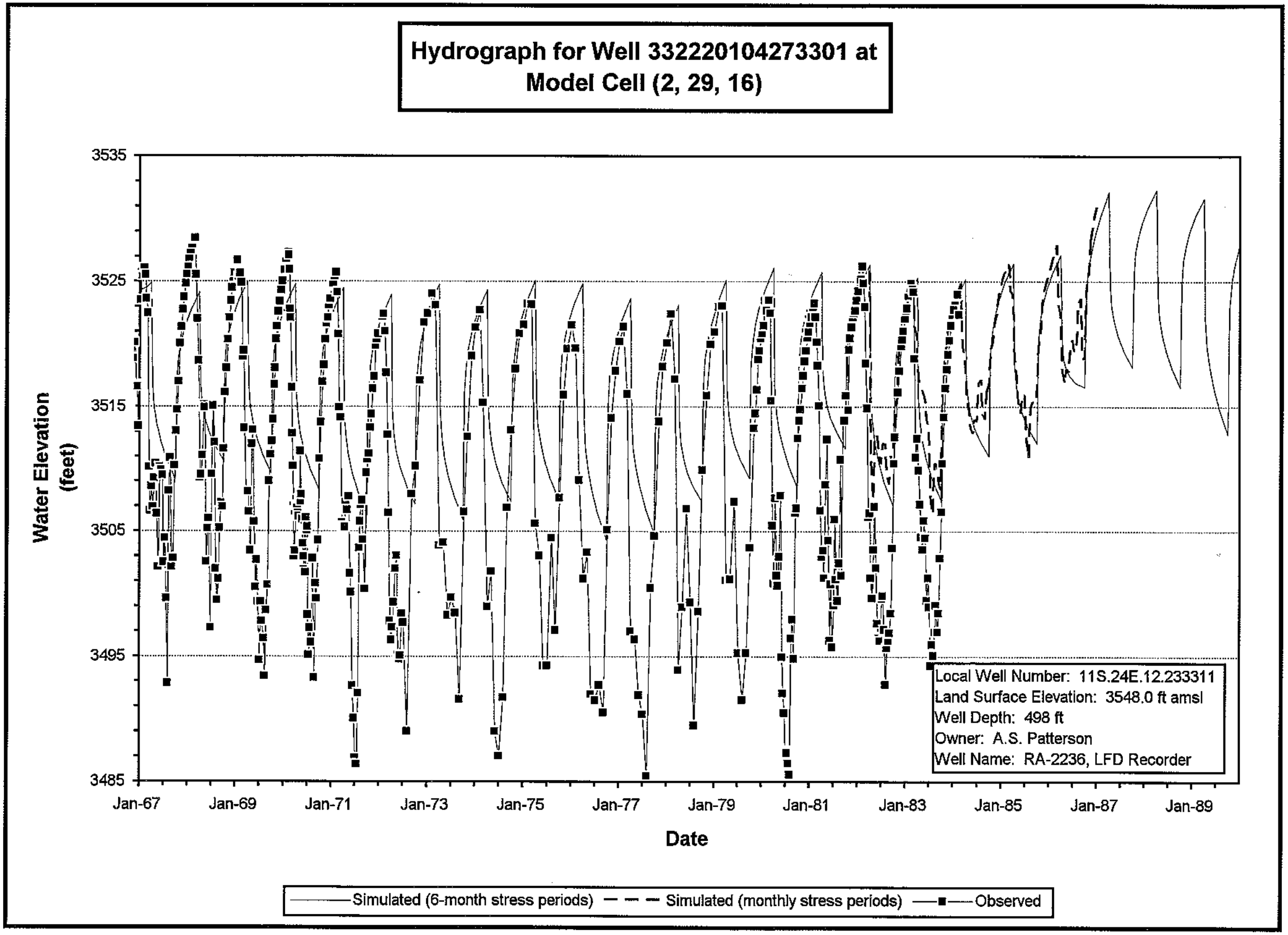


Hydrograph for Well 333031104310301 at Model Cell (2, 19, 13)
Local Well Number: 09S.24E.28.113132
Land Surface Elevation: 3612.0 ft amsl
Well Depth: 352 ft
Owner: PVACD
Well Name: TRANSWESTERN RECORDER, RA-5540
Water Elevation (feet)
3550
3540
3530
3520
3510
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

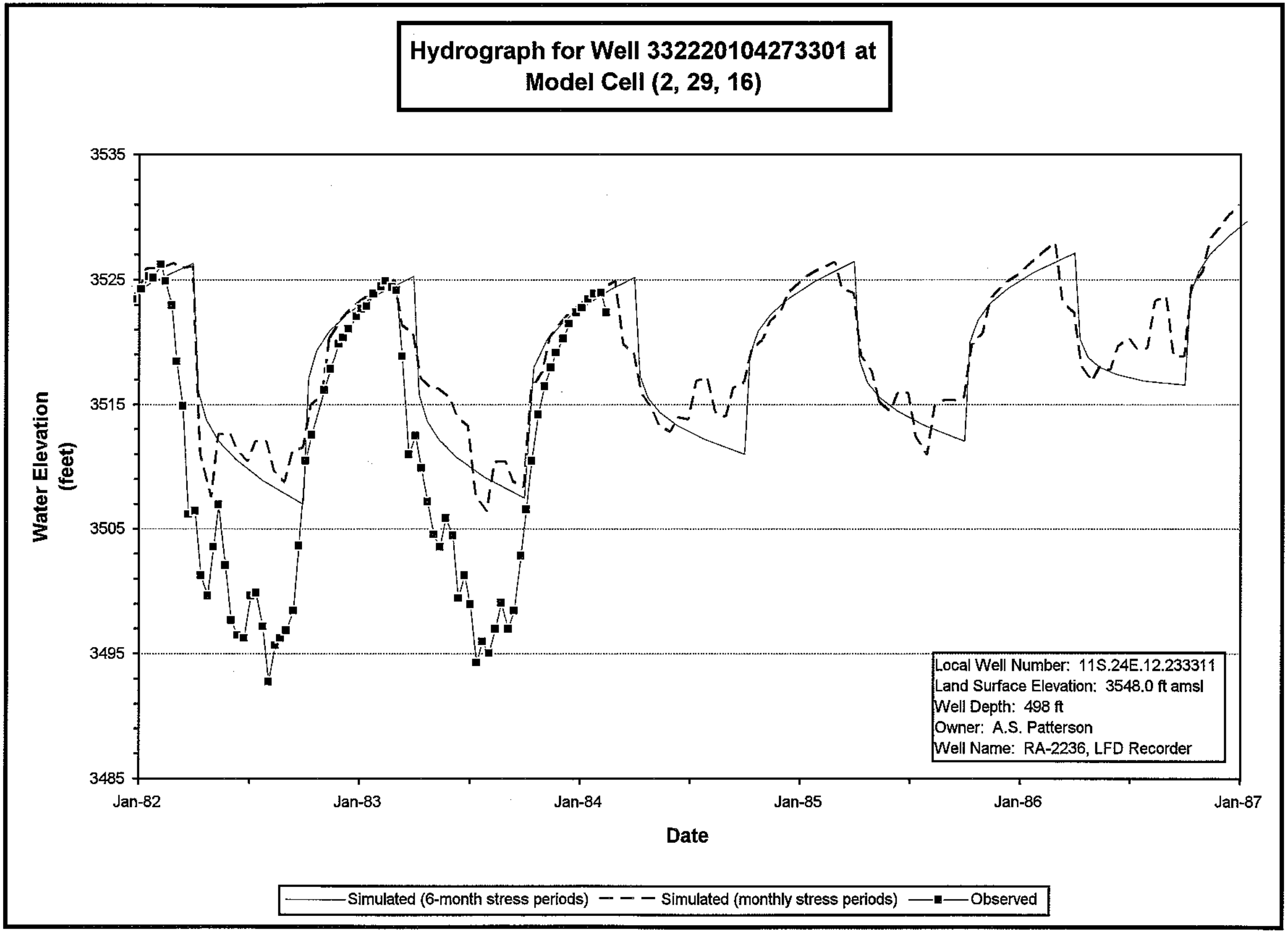


Hydrograph for Well 332615104303601 at
Model Cell (2, 24, 14)
Local Well Number: 10S.24E.21.212222 BERREN
Land Surface Elevation: 3580.7 ft amsl
Well Depth: 329 ft
Owner: PVACD
Well Name: RA-1844, Berendo-Smith Recorder
3545
3535
3525
3515
3505
Water Elevation
(feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed

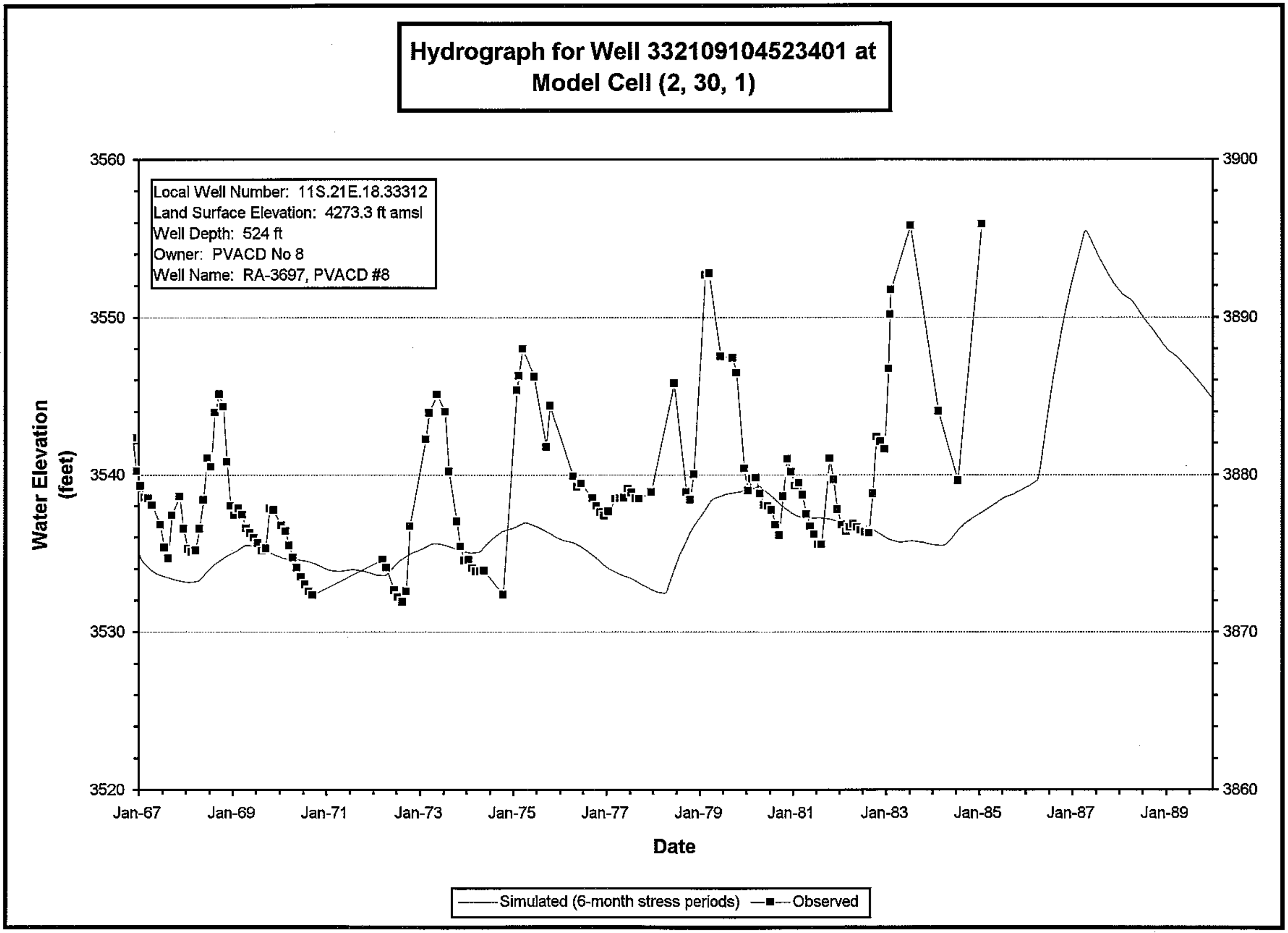

Hydrograph for Well 332615104303601 at Model Cell (2, 24, 14)
Local Well Number: 10S.24E.21.212222 BERREN
Land Surface Elevation: 3580.7 ft amsl
Well Depth: 329 ft
Owner: PVACD
Well Name: RA-1844, Berendo-Smith Recorder
Water Elevation (feet)
3545
3535
3525
3515
3505
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



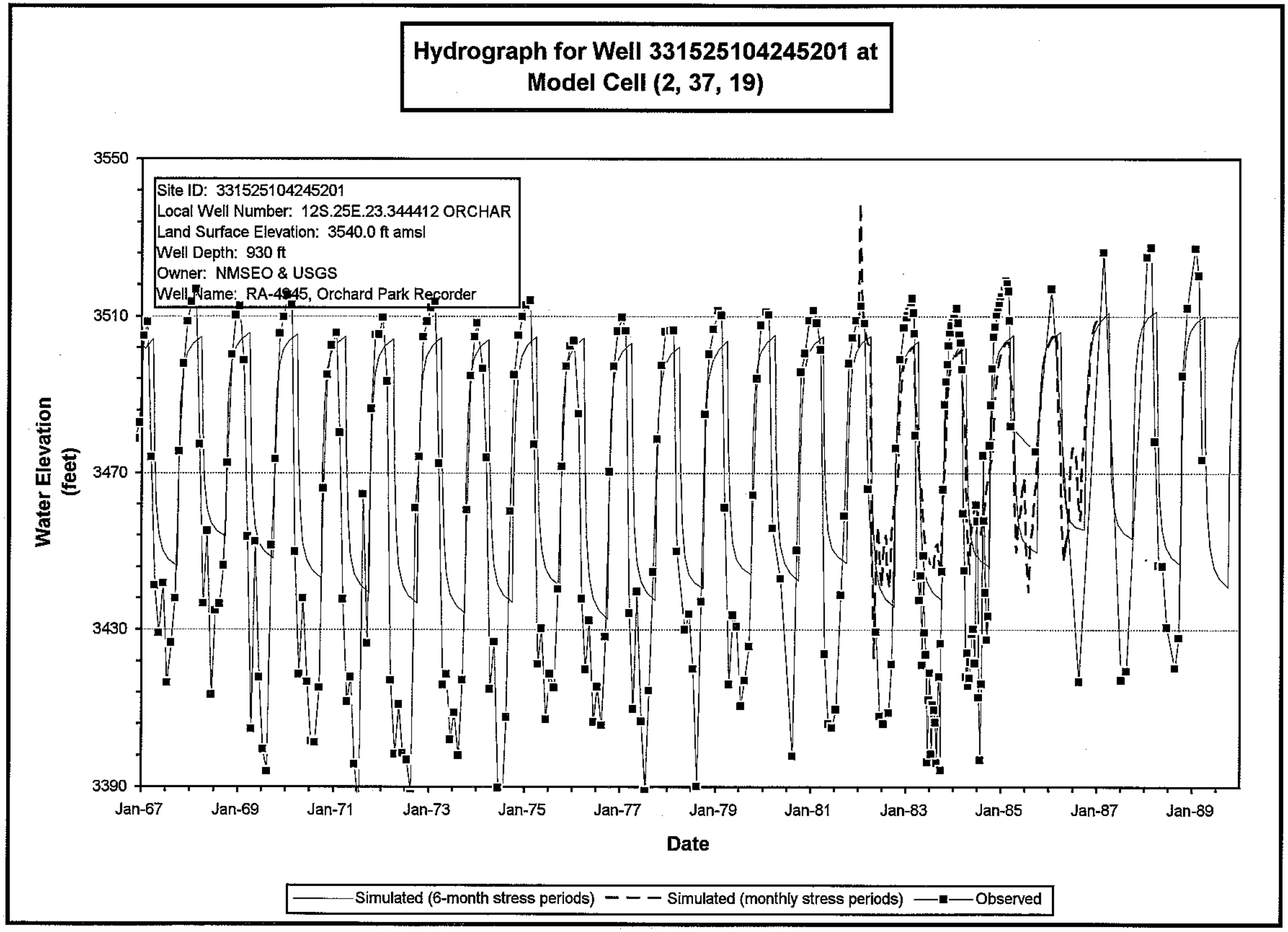
Note: Vertical scale is increased to 50 ft



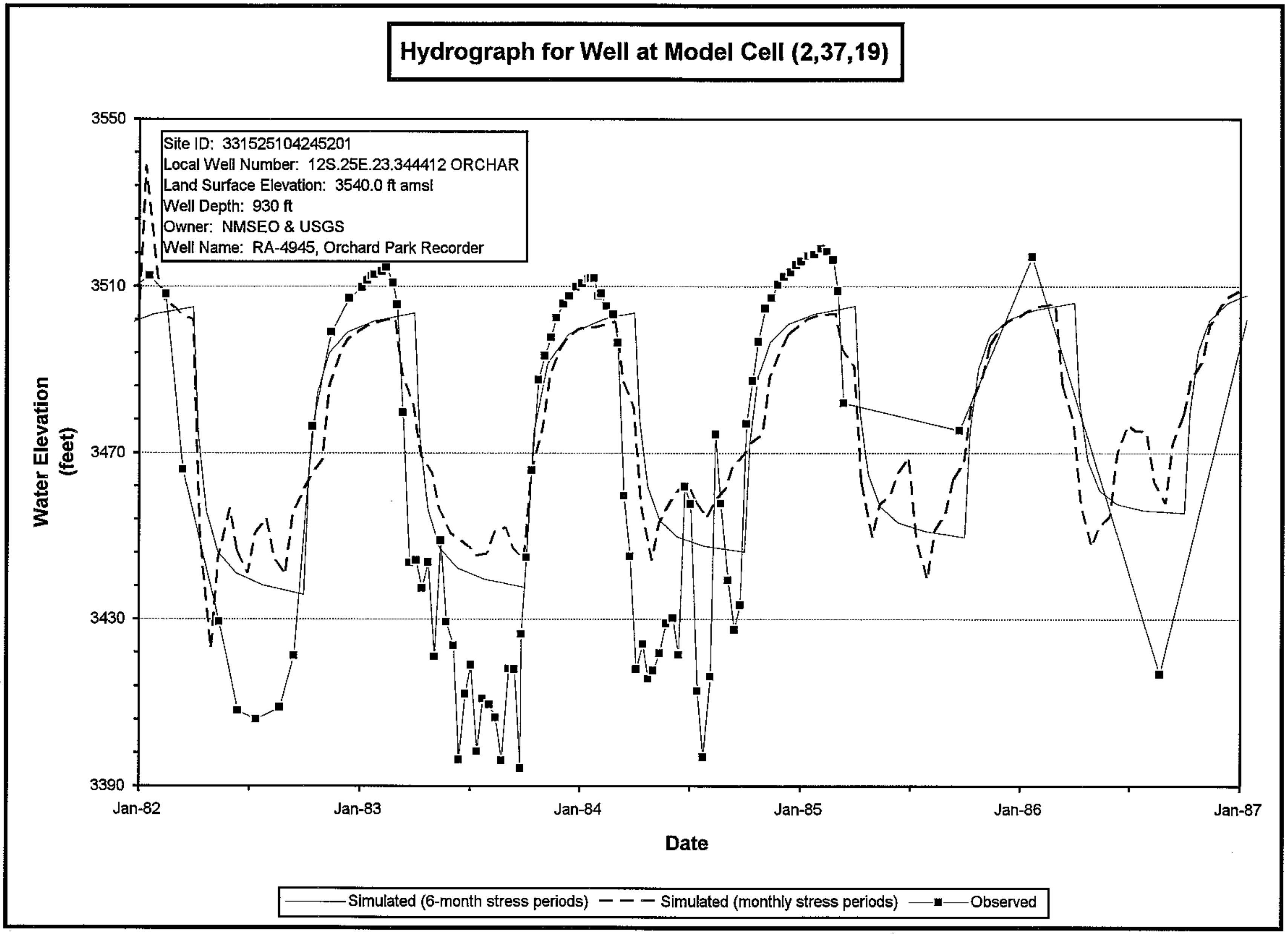
Note: Vertical scale is increased to 50 ft



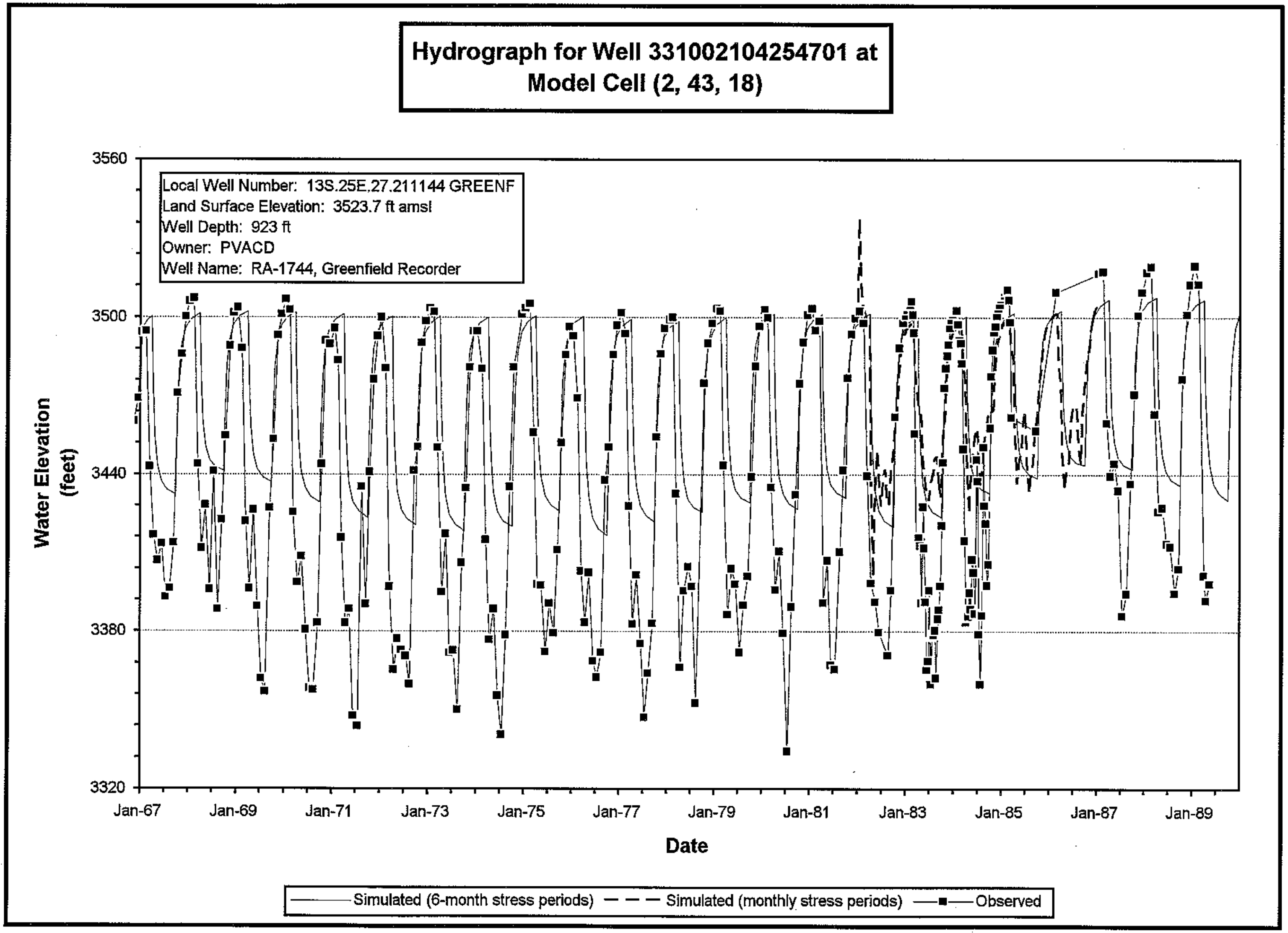
Note: Simulated results are taken from model cell (2, 30, 3) and are plotted on the 3520-3560 scale; observed results are plotted on the 3860-3900 scale



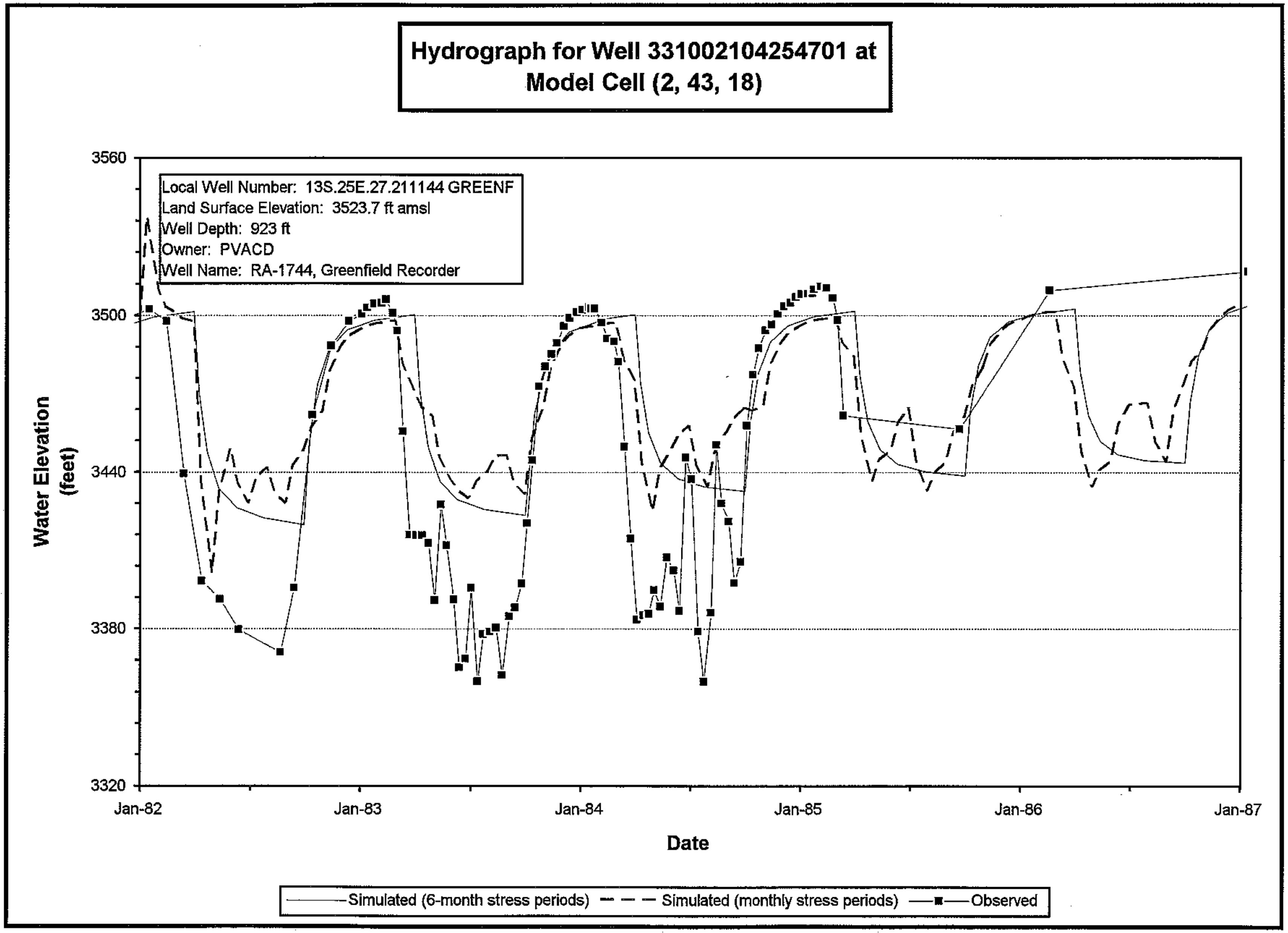
Note: Vertical scale is increased to 160 ft



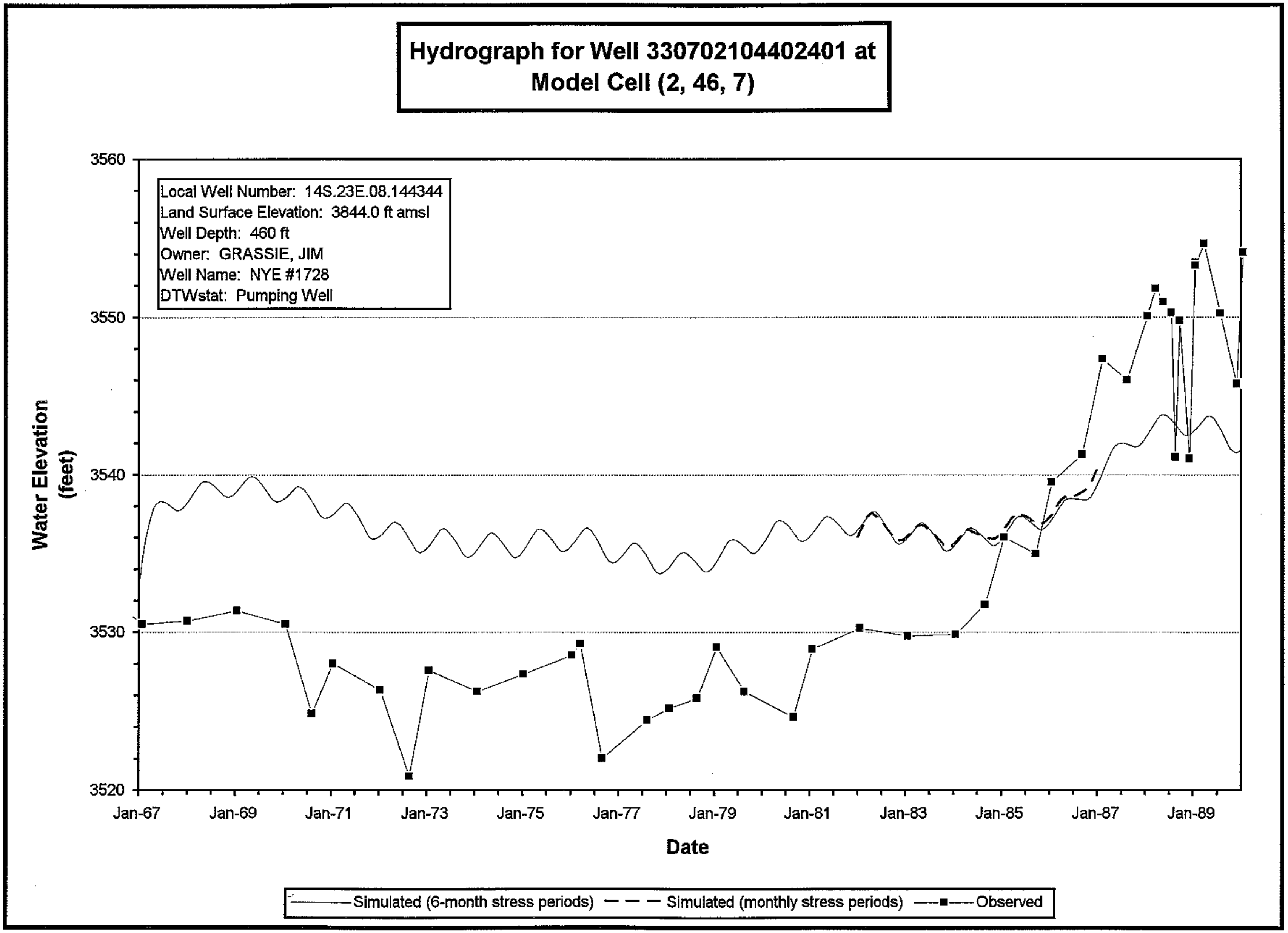
Note: Vertical scale is increased to 160 ft

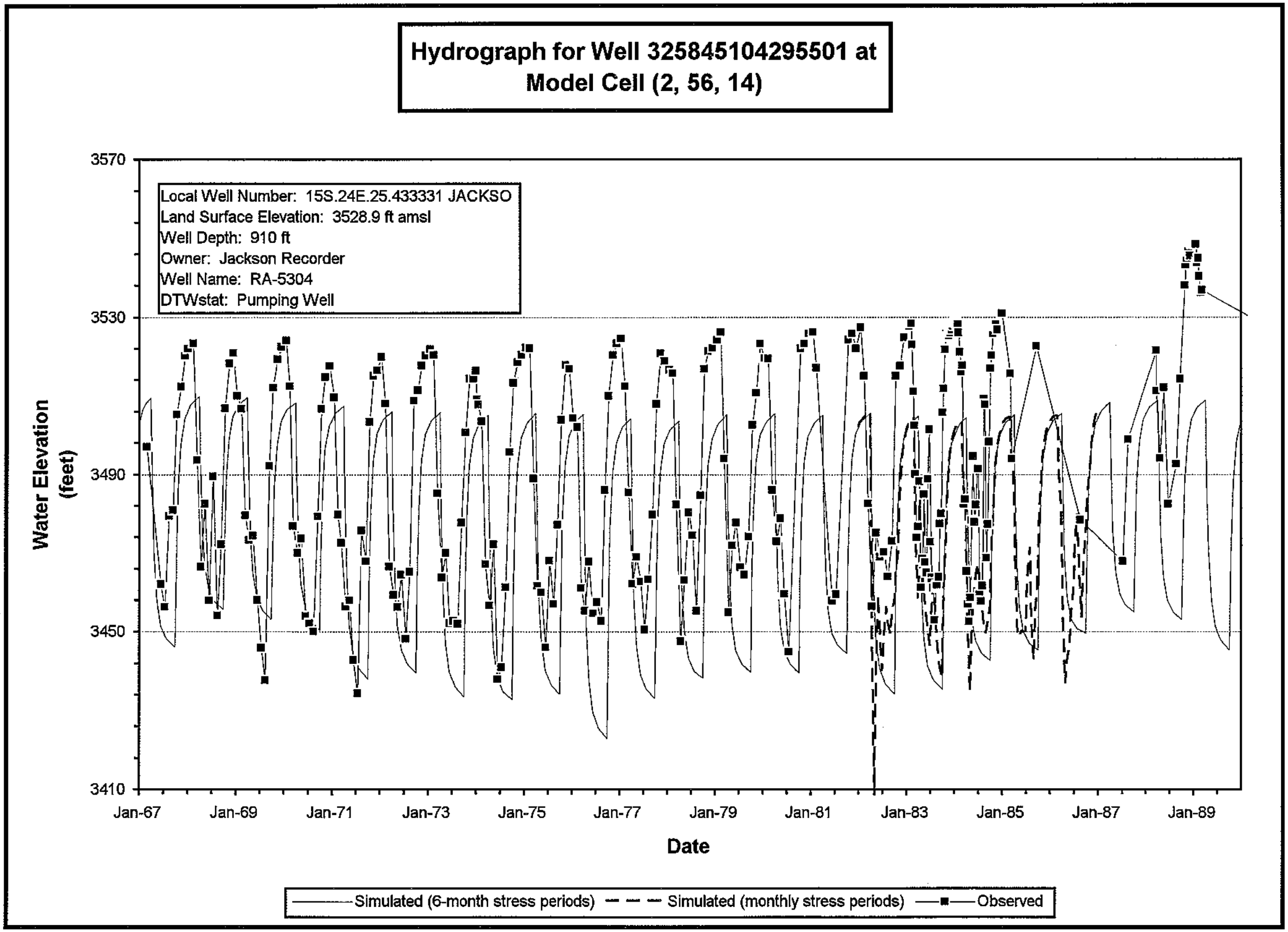


Note: Vertical scale is increased to 240 ft

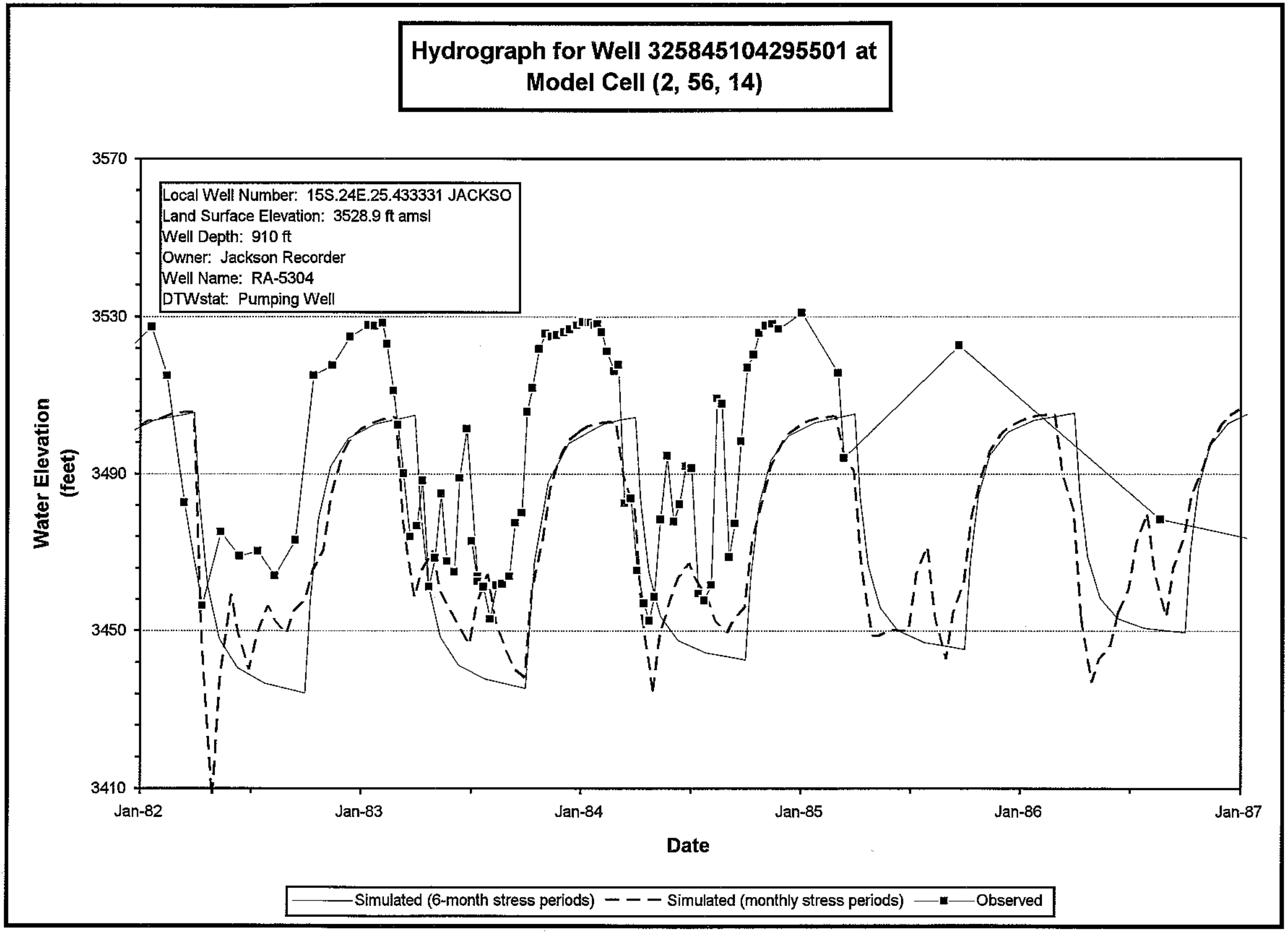


Note: Vertical scale is increased to 240 ft

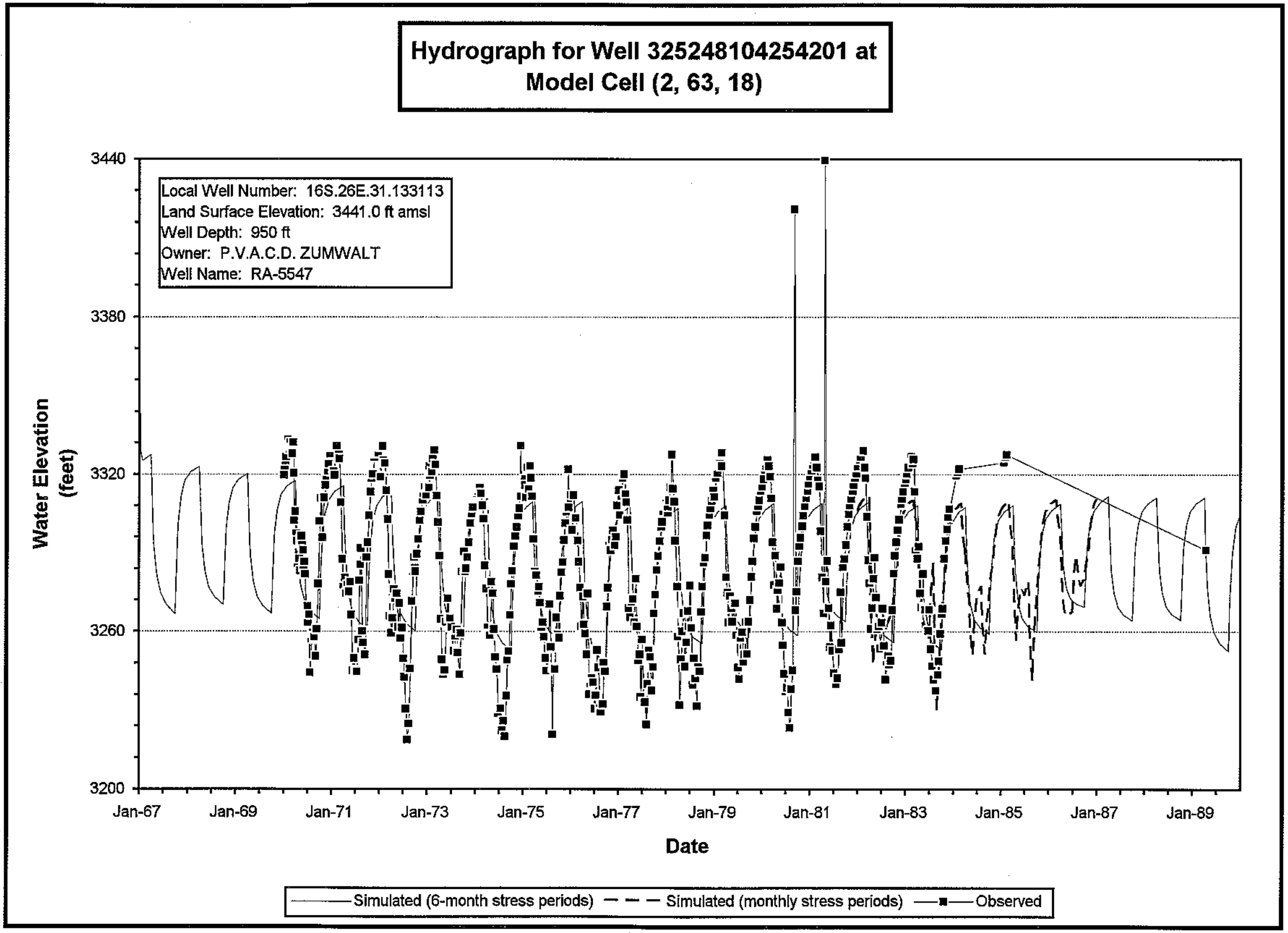

Hydrograph for Well 330702104402401 at
Model Cell (2, 46, 7)
Local Well Number: 14S.23E.08.144344
Land Surface Elevation: 3844.0 ft amsl
Well Depth: 460 ft
Owner: GRASSIE, JIM
Well Name: NYE #1728
DTWstat: Pumping Well
3560
3550
3540
3530
3520
Water Elevation (feet)
Jan-67
Jan-69
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Date
Simulated (6-month stress periods)
Simulated (monthly stress periods)
Observed



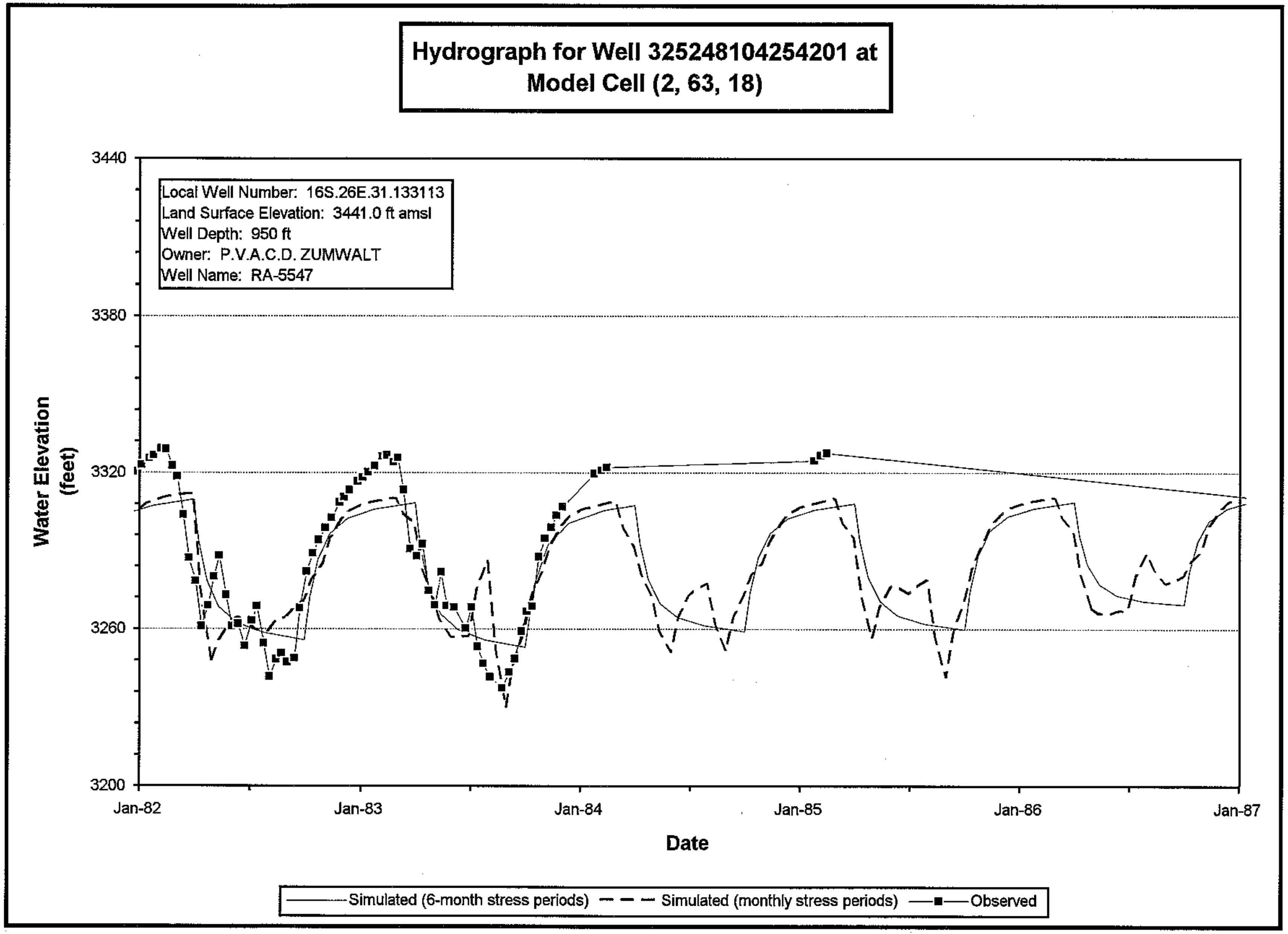
Note: Vertical scale is increased to 160 ft



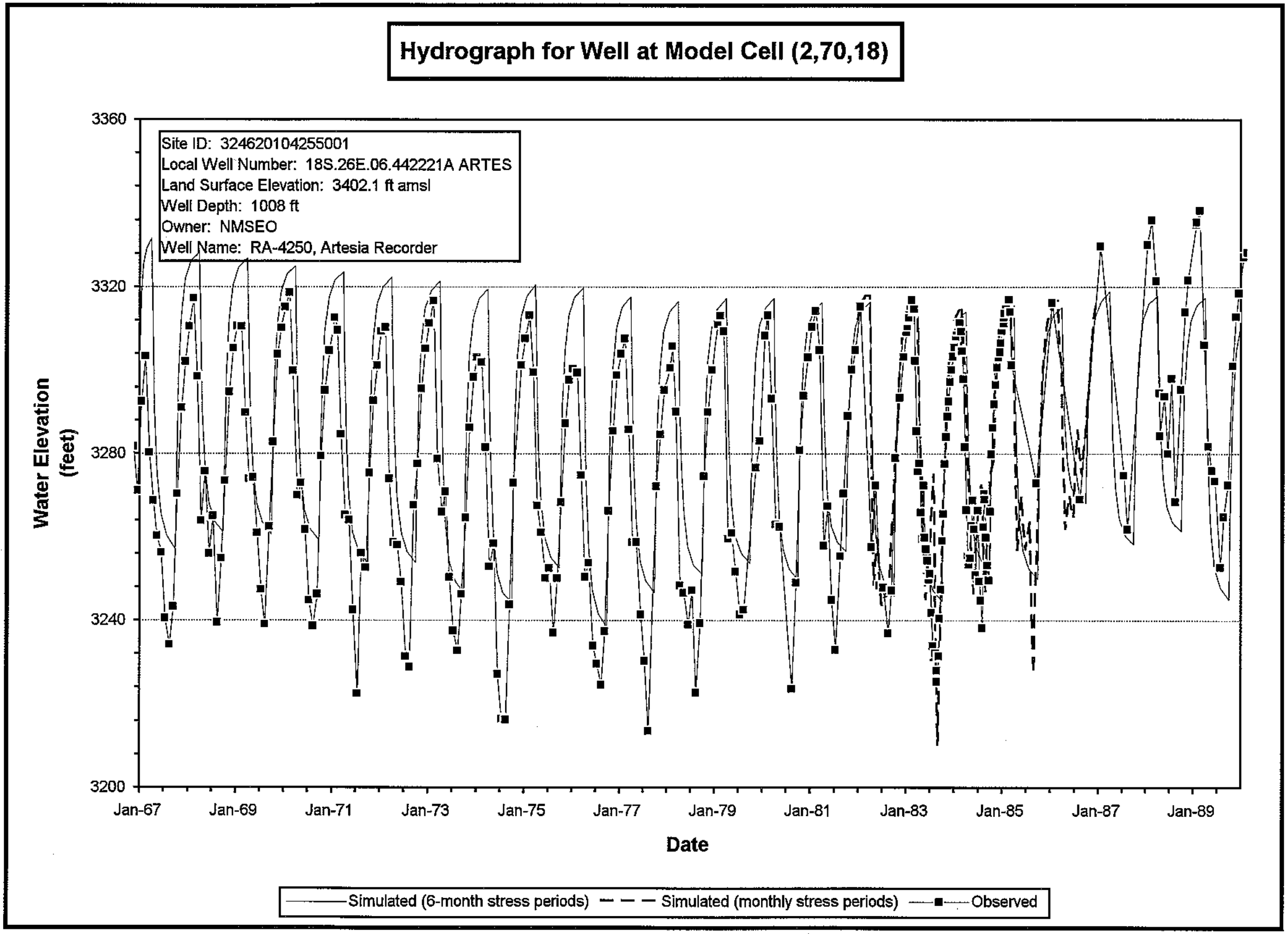
Note: Vertical scale is increased to 160 ft



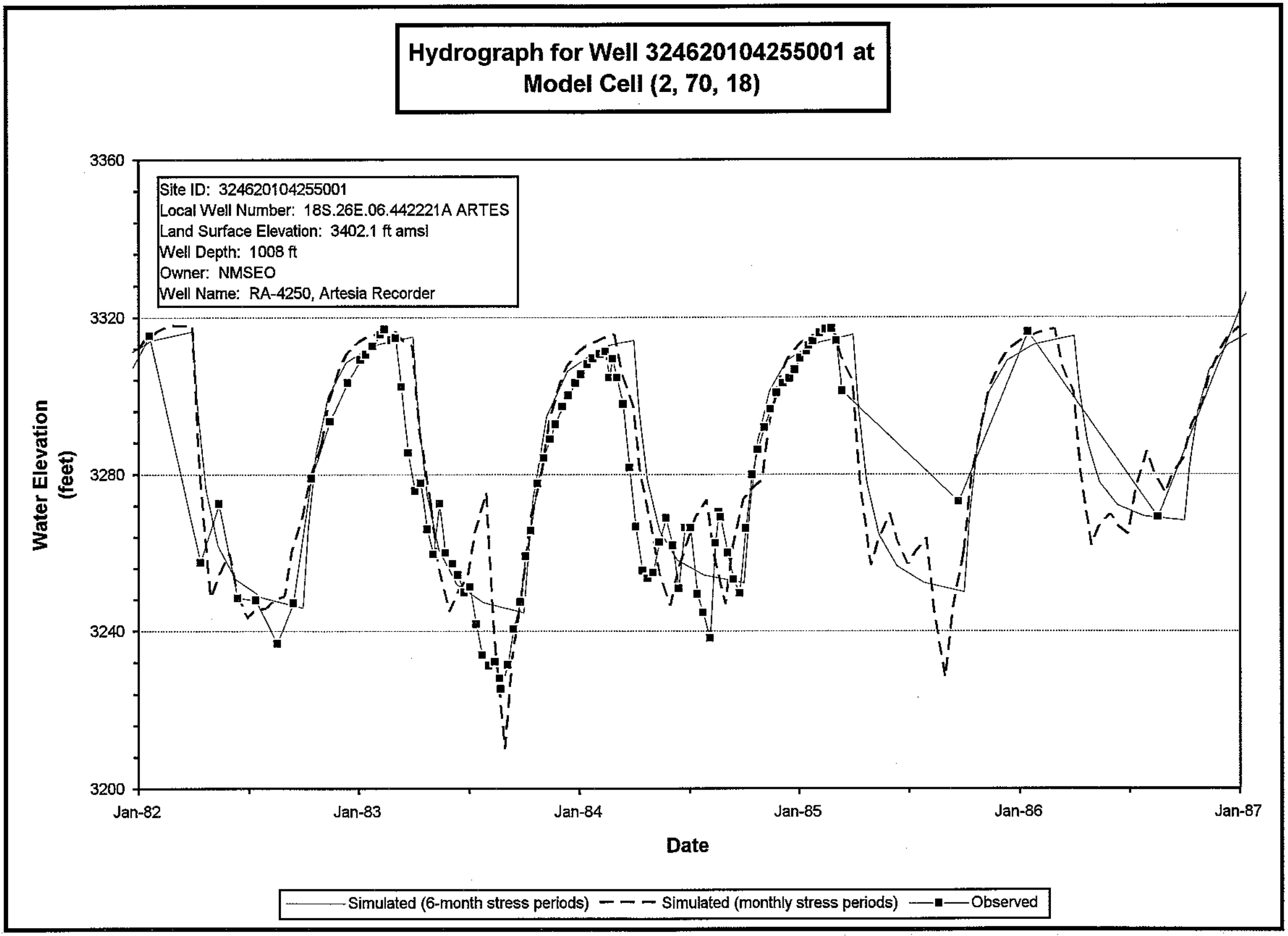
Note: Vertical scale is increased to 240 ft



Note: Vertical scale is increased to 240 ft



Note: Vertical scale is increased to 160 ft



Note: Vertical scale is increased to 160 ft