

ARIZONA WATER COMMISSION

BULLETIN 1



ANNUAL REPORT ON GROUND
WATER IN ARIZONA
SPRING 1970 TO SPRING 1971

PREPARED UNDER THE DIRECTION OF
H.M. BABCOCK, DISTRICT CHIEF
ARIZONA DISTRICT, WATER RESOURCES DIVISION

Annual report on ground water in Arizona



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ANNUAL REPORT ON GROUND WATER IN ARIZONA,
SPRING 1970 TO SPRING 1971

Prepared under the direction of H. M. Babcock,
District Chief, Arizona District, Water Resources Division,
U. S. Geological Survey

INTRODUCTION

The availability of adequate and potable water supplies has a great influence on the continuing development of Arizona. Agriculture is almost entirely dependent on irrigation because rainfall is inadequate for raising crops. Although some surface water is available for use in a few places in the State, the amount is not sufficient to meet the constantly increasing demand. For many years, nearly two-thirds of Arizona's water supply has been withdrawn from the ground-water reservoirs; the principal use of ground water is for the irrigation of crops. In many areas in the State the present rate of withdrawal far exceeds the rate of replenishment, and the ground-water reservoirs are gradually being depleted. It is of prime importance to protect these water supplies through effective management, which requires a comprehensive knowledge of the storage capacity of the aquifers and of the factors that control the transmission of water through them. Research programs, data collection, and comprehensive hydrologic analyses are tools that provide this knowledge.

Since 1939, a planned program of ground-water studies has been conducted by the U.S. Geological Survey in cooperation with the State of Arizona. From 1942 to April 1971 the State was represented by the State Land Department; the newly formed Arizona Water Commission now represents the State in the cooperative program. The program includes the collection and analysis of the geologic and hydrologic data necessary to evaluate the ground-water resources of the State and is under the immediate supervision of H. M. Babcock, district chief of the Water Resources Division of the U. S. Geological Survey in Arizona.

This report is a result of the cooperative program between the U.S. Geological Survey and the State of Arizona. The report contains

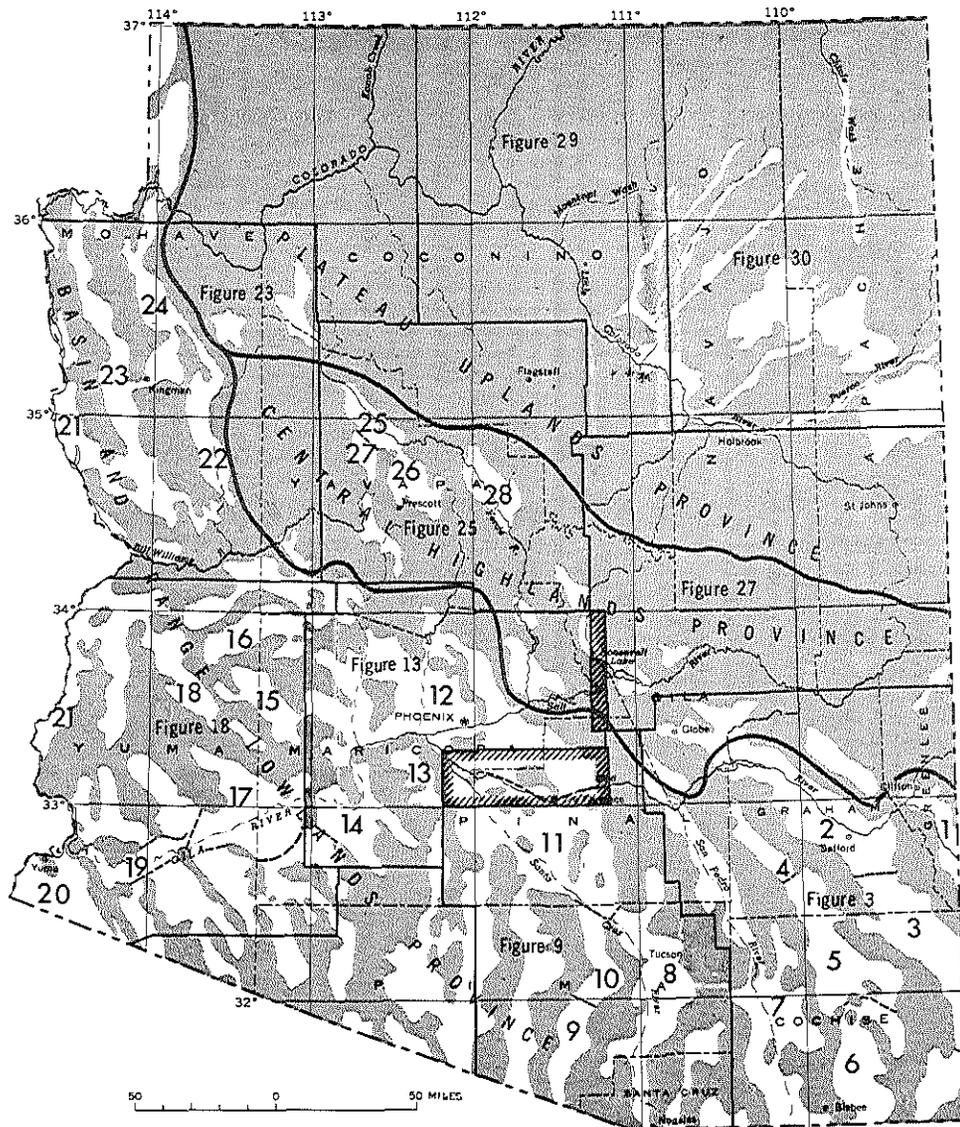
graphs showing water levels in selected wells and estimated annual ground-water pumpage in most of the developed areas in the State and maps showing (1) potential well production, (2) depth to water in selected wells in spring 1971, and (3) change in water levels in selected wells from 1966 to 1971 by areas. Figure 1 shows the areas for which ground-water data are given, and the well-numbering system used in Arizona is explained and illustrated on figure 2.

Scope of the Federal-State Cooperative Ground-Water Program

The Federal-State cooperative ground-water program in Arizona consists of three major parts—(1) the collection and analysis of basic hydrologic data under the statewide ground-water survey, (2) comprehensive areal ground-water investigations, and (3) research studies related to specific hydrologic problems. The three parts of the program are related closely and to a large extent are interdependent.

Collection and analysis of basic hydrologic data.--The statewide ground-water program provides for the collection of the basic hydrologic and geologic data that are necessary to study and analyze the ground-water resources of the State. The work includes well inventories, periodic water-level measurements, collection of water samples for chemical analysis, and collection and cataloging of drill cuttings from wells. The data collected annually are sufficient to monitor any significant changes in the ground-water regimen. Water-level measurements are made in about 860 wells, and the discharge from several hundred wells is measured each year. Samples of ground water for chemical-quality determinations are obtained on an annual basis from about 35 wells and from many other wells on an intermittent schedule. The program is set up so that individual basins will receive periodic intensive study as well as annual cursory examination. The number of water-level and discharge measurements made and the amount of other data collected in any given year depend on the basin selected for intensive study.

Individual basins for which reports currently are in preparation include the San Pedro River valley, lower Hassayampa area, and the Joseph City area. These reports will be published in the new Arizona Water Commission bulletin series, and copies will be available to the public. A report on the Harquahala Plains was published during the year (see section entitled "Current Publications of the Arizona District").



EXPLANATION

BASIN AND RANGE LOWLANDS PROVINCE

Ground water mostly from alluvial deposits; small amounts from fractures in consolidated rocks

- | | | |
|---------------------------|---|---|
| 1. DUNCAN BASIN | 11. LOWER SANTA CRUZ BASIN | 18. RANEGRAS PLAIN AREA |
| 2. SAFFORD BASIN | 12. SALT RIVER VALLEY | 19. WELLTON-MOHAWK AREA |
| 3. SAN SIMON BASIN | 13. WATERMAN WASH AREA | 20. YUMA AREA |
| 4. ARAVAIPA VALLEY | 14. GILA BEND BASIN | 21. COLORADO RIVER FLOOD PLAIN FROM DAVIS DAM TO IMPERIAL DAM |
| 5. WILLCOX BASIN | 15. HARQUAHALA PLAINS AREA | 22. BIG SANDY VALLEY |
| 6. DOUGLAS BASIN | 16. McMULLEN VALLEY | 23. SACRAMENTO VALLEY |
| 7. SAN PEDRO RIVER VALLEY | 17. GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL | 24. HUALAPAI VALLEY |
| 8. UPPER SANTA CRUZ BASIN | | |
| 9. ALTAR VALLEY | | |
| 10. AVRA VALLEY | | |

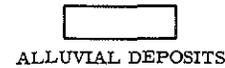
CENTRAL HIGHLANDS PROVINCE

Ground water from alluvial deposits in a few small valleys and from fractures and joints in consolidated rocks; many springs issue from fractures

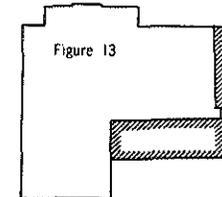
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| 25. BIG CHINO VALLEY | 27. WILLIAMSON VALLEY |
| 26. LITTLE CHINO VALLEY | 28. VERDE VALLEY |

PLATEAU UPLANDS PROVINCE

Ground water mostly from fine-grained sandstone units in consolidated rocks; siltstone and claystone layers act as aquicludes; moderate amounts of ground water from narrow alluvial deposits

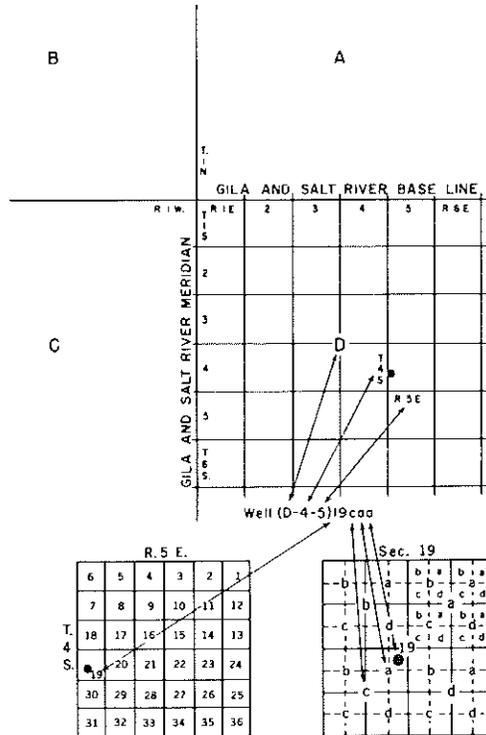


 AREA BOUNDARIES NOT DEFINED BY CONTACT BETWEEN ALLUVIAL DEPOSITS AND CONSOLIDATED ROCKS



GROUND-WATER DATA FOR AREA OUTLINED SHOWN ON INDICATED FIGURE; HACHURES INDICATE MAP OVERLAP AREA

FIGURE 1. --AREAS FOR WHICH GROUND-WATER DATA ARE GIVEN.



The well numbers used by the Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the State into four quadrants. These quadrants are designated counterclockwise by the capital letters A, B, C, and D. All land north and east of the point of origin is in A quadrant, that north and west in B quadrant, that south and west in C quadrant, and that south and east in D quadrant. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract, the second the 40-acre tract, and the third the 10-acre tract. These letters also are assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre tract, three lowercase letters are shown in the well number. In the example shown, well number (D-4-5)19caa designates the well as being in the $NE\frac{1}{4}NE\frac{1}{4}SW\frac{1}{4}$ sec. 19, T. 4 S., R. 5 E. Where more than one well is within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes.

FIGURE 2. --WELL-NUMBERING SYSTEM IN ARIZONA.

The "Annual Report on Ground Water in Arizona" is a result of the statewide ground-water program. The previous annual reports were published in the Arizona State Land Department water-resources report series; this report will be the first of the annual reports to be published in the new Arizona Water Commission bulletin series.

Comprehensive areal ground-water investigations. -- Areal studies are undertaken to develop the information and understanding required for the management of water in specific problem areas—areas where conditions are critical due to overdevelopment of the water supply, areas where water-supply development is beginning, or areas where there is some special problem or interest. Seven areal studies currently are in progress under the Federal-State ground-water cooperative program.

A report on the geohydrology of Sacramento and Hualapai Valleys is in the Government Printing Office for publication as U. S. Geological Survey Water-Supply Paper 1899-H, and a report on the electrical-analog analysis of the hydrologic system in Avra Valley is in the Government Printing Office for publication as U. S. Geological Survey Hydrologic Investigations Atlas HA-215. Reports are in preparation for the following projects: (1) Ground-water resources of the western part of the Salt River Valley (Beardsley area); (2) Water resources of southern Coconino County; (3) Hydrology of alluvial basins; and (4) Water resources of the Big Sandy Valley area. The fieldwork for an analysis of the ground-water resources in southern Navajo County is in progress.

Comprehensive areal investigations conducted in cooperation with other agencies also benefit the State. Studies are currently in progress in the Safford basin, Tonto basin, Lake Mead area, lower Colorado River region, and Tucson-Phoenix urban area.

Research programs. -- The research studies of the Water Resources Division in Arizona are directed toward developing a broader understanding of the hydrology of arid and semiarid lands. The national programs, which are supported by Federal funds, include basic research in hydrology and applied research in instrumentation and techniques. These programs, which directly benefit the State program, are (1) Effects of vegetation manipulation on surface runoff—Sycamore Creek; (2) Ground-water return flows to the lower Colorado River; (3) Environmental monitoring of Black Mesa coal development; and (4) Water-budget study in the Yuma area.

Programs in Cooperation with Other Agencies

In 1970-71 ground-water studies were being conducted in cooperation with the following agencies:

City of Flagstaff
City of Tucson
Navajo Tribal Council
Navajo Tribal Utility Authority
Salt River Valley Water Users' Association
University of Arizona
U. S. Army
U. S. Bureau of Indian Affairs
U. S. Bureau of Reclamation
U. S. National Park Service

Current Publications of the Arizona District

The following reports on the water resources and geology of Arizona were published or released to the open file from July 1, 1970, through June 30, 1971.

A method for relating infiltration rates to streamflow rates in perched streams, by D. E. Burkham, in Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-D, 1970. p. 266-271, 3 figs.

Annual report on ground water in Arizona, spring 1969 to spring 1970, prepared under the direction of H. M. Babcock, District Chief, Arizona District, Water Resources Division, U.S. Geological Survey: Arizona State Land Dept. Water-Resources Rept. 43, November 1970. 44 p., 30 figs., 1 table.

A proposed streamflow-data program for Arizona, by Otto Moosburner: U.S. Geol. Survey open-file report, 1970. 56 p., 5 figs., 9 tables.

Arizona floods—Labor Day weekend, by D. E. Click; Arizona Prof. Engineer, v. 22, no. 11, November 1970. p. 23-24.

Chemical quality of irrigation water in the northwestern part of the Gila River Indian Reservation, Maricopa County, Arizona, by L. R. Kister; U.S. Geol. Survey open-file report, 1970. 13 p., 4 figs., 2 tables.

Chemical quality of the water in the Tucson basin, Arizona, by R. L. Laney; U.S. Geol. Survey open-file report, 1970. 139 p., 17 figs., 6 tables.

Depletion of streamflow by infiltration in the main channels of the Tucson basin, southeastern Arizona, by D. E. Burkham; U.S. Geol. Survey Water-Supply Paper 1939-B, 1970. 36 p., 1 pl., 11 figs., 7 tables.

Evapotranspiration losses from flood plains in the Agua Fria River drainage above Lake Pleasant, Arizona, by T. W. Anderson; U.S. Geol. Survey open-file report, 1970. 39 p., 10 figs., 3 tables.

Floods from thunderstorms of July-September in Arizona, by Otto Moosburner and B. N. Aldridge, in Summary of floods in the United States during 1964, by J. O. Rostvedt and others; U.S. Geol. Survey Water-Supply Paper 1840-C, 1970. p. 57-64, 3 figs., 2 tables.

Floods of November 1965 to January 1966 in the Gila River basin, Arizona and New Mexico, and adjacent basins in Arizona, by B. N. Aldridge; U.S. Geol. Survey Water-Supply Paper 1850-C, 1970. 176 p., 6 pls., 2 figs., 9 tables.

Floods of November and December in Arizona and New Mexico, by B. N. Aldridge, in Summary of floods in the United States during 1965, by J. O. Rostvedt and others; U.S. Geol. Survey Water-Supply Paper 1850-E, 1970. p. 102-104, 1 fig.

Floods of September 9-11 in the Santa Cruz River basin, Arizona, by B. N. Aldridge and Otto Moosburner, in Summary of floods in the United States during 1964, by J. O. Rostvedt and others; U.S. Geol. Survey Water-Supply Paper 1840-C, 1970. p. 69-74, 2 figs., 2 tables.

- Geohydrology of the Yuma area, Arizona and California, by F. H. Olmsted, O. J. Loeltz, and Burdge Irelan: U.S. Geol. Survey open-file report, 1970. 758 p., 83 figs., 19 tables.
- Ground-water conditions in the Gila River Indian Reservation, Pinal and Maricopa Counties, Arizona, by H. M. Babcock: U.S. Geol. Survey open-file report, 1970. 14 p., 3 figs., 1 table.
- Land subsidence, earth fissures, and groundwater withdrawal in south-central Arizona, U.S.A., by H. H. Schumann and J. F. Poland, in *Land subsidence: Internat. Assoc. Sci. Hydrology, Pub. 88, v. 1, 1970.* p. 295-302, 5 figs.
- Salinity of surface water in the lower Colorado River-Salton Sea area, by Burdge Irelan: U.S. Geol. Survey open-file report, 1970. 149 p., 12 figs., 22 tables.
- Streamflow in the upper Santa Cruz River basin, Santa Cruz and Pima Counties, Arizona, by Alberto Condes de la Torre: U.S. Geol. Survey Water-Supply Paper 1939-A, 1970. 26 p., 6 pls., 14 figs., 8 tables.
- Water resources data for Arizona, 1968—Part 2. Water quality records, by U.S. Geological Survey: U.S. Geol. Survey open-file report, 1970. 85 p., 1 fig.
- Water resources data for Arizona, 1969—Part 1. Surface water records, by U.S. Geological Survey: U.S. Geol. Survey open-file report, 1970. 251 p., 4 figs.
- Channel changes of the Gila River in Safford Valley, Arizona, 1846-1970, by D. E. Burkham: U.S. Geol. Survey open-file report, 1971. 118 p., 14 figs., 3 tables.
- Floods of September 1970 in Arizona, Utah, and Colorado, by R. H. Roeske: Arizona State Land Dept. Water-Resources Rept. 44, April 1971. 20 p., 5 figs., 1 table.
- Geology of the Paleozoic rocks, Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, by J. H. Irwin, P. R. Stevens, and M. E. Cooley: U.S. Geol. Survey Prof. Paper 521-C, 1971. 32 p., 2 pls., 5 figs., 1 table.

Ground-water conditions in the Harquahala Plains, Maricopa and Yuma Counties, Arizona, by E. E. Denis; Arizona State Land Dept. Water-Resources Rept. 45, April 1971. 44 p., 2 pls., 7 figs., 4 tables.

Hydraulic effects of changes in bottom-land vegetation on two major floods, Gila River in southeastern Arizona [abs.], by D. E. Burkham, in Abstracts of papers, 47th Ann. Mtg. Am. Assoc. Advancement Sci., 15th Ann. Mtg. Arizona Academy Sci.: Tempe, April 21-24, 1971. p. 47.

Hydrogeology of the Cenozoic igneous rocks, Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, by J. P. Akers, J. C. Shorty, and P.R. Stevens: U.S. Geol. Survey Prof. Paper 521-D, 1971. 18 p., 2 pls., 2 figs., 3 tables.

Weathering of the granodioritic rocks in the Rose Canyon Lake area, Santa Catalina Mountains, Arizona, by R. L. Laney: U.S. Geol. Survey open-file report, 1971. 201 p., 44 figs., 13 tables.

SUMMARY OF GROUND-WATER CONDITIONS

The ground-water reservoirs are the source of nearly two-thirds of Arizona's water supply. Although municipal and industrial water uses are increasing, the greatest use is still for irrigation. For the last 18 years, the withdrawal of ground water has been more than 4 million acre-feet per year, and in 1970 nearly 4.9 million acre-feet of water was withdrawn. Table 1 shows the amount of water pumped in each of the major developed areas in 1970 and the accumulated total since the beginning of record. Through 1970, nearly 134 million acre-feet of ground water has been withdrawn in the State.

Ground water occurs under different conditions in each of the three water provinces in Arizona (fig. 1)—the Basin and Range lowlands province, the Central highlands province, and the Plateau uplands province. The use of ground water and current ground-water conditions in each of the three provinces are discussed separately in the following sections.

The Salt River Valley and the lower Santa Cruz basin are the largest agricultural areas in the State. Through 1970, more than 63 million acre-feet of ground water had been pumped from the aquifers in the Salt River Valley, and about 33 million acre-feet had been pumped from the lower Santa Cruz basin. The greatest water-level declines have taken place in these two areas although the rate of water-level decline has been less in the last few years than in previous years. Pumpage was greatest in these areas in the middle 1950's and early 1960's; since that time, pumpage and the resulting water-level declines have been somewhat less. Other areas in the Basin and Range lowlands province where withdrawal of ground water has caused large declines in water levels are the Willcox basin, upper Santa Cruz basin, Avra Valley, Gila Bend basin, McMullen Valley, and Harquahala Plains.

Figures 3, 9, 13, 18, and 23 show the depth to water in spring 1971 and the change in water levels from 1966 to 1971 in selected wells in the Basin and Range lowlands province. Graphs (figs. 4, 5, 6, 7, 8, 10, 11, 16, 17, 19, 20, 21, 22, and 24) showing the depth to water in selected wells and estimated annual pumpage are included for most areas in the province. Graphs showing the cumulative average change in water levels for areas in the lower Santa Cruz basin and the Salt River Valley and estimated annual pumpage are given in figures 12, 14, and 15.

Central Highlands Province

The main rock types in the Central highlands province are igneous and metamorphic rocks and well-consolidated sedimentary rocks that contain only small amounts of space for the storage of ground water. A few small valleys between the mountains contain varying thicknesses of alluvial deposits that store some ground water; these deposits yield water to irrigation wells.

Only a few thousand acres of land is under cultivation in the Central highlands province—the smallest of the three water provinces—and ground-water pumpage is small. The cultivated acreage is concentrated mainly in Chino and Verde Valleys. Some surface water also is available for irrigation in these areas. The small amount of ground-water withdrawal has not resulted in any notable declines in water level except in parts of Chino Valley. Figures 25 and 27 show the depth to water in spring 1971 and the change in water levels from 1966 to 1971 in selected wells in the area; graphs showing depth to water in selected wells and estimated annual pumpage in several areas in the province are given in figure 26.

Plateau Uplands Province

In the Plateau uplands province water-bearing sandstone constitutes a large storage reservoir for ground water, but well yields generally are small. Ground-water development in the province is small compared to that in the Basin and Range lowlands province, but it is somewhat greater than that in the Central highlands province. Only about 35,000 acres of land is under cultivation in the Plateau uplands province. Except for a few population centers, such as Flagstaff, Holbrook, and the White Mountains recreational areas, the use of ground water is confined to scattered farms and homesites. The Navajo and Hopi Indian Reservations make up a large part of the province.

Figures 25 and 27 show the depth to water in spring 1971 and the change in water levels from 1966 to 1971 in selected wells in the province; figures 29 and 30 show depth to water in spring 1971. Graphs showing water levels in selected wells are given in figure 28.

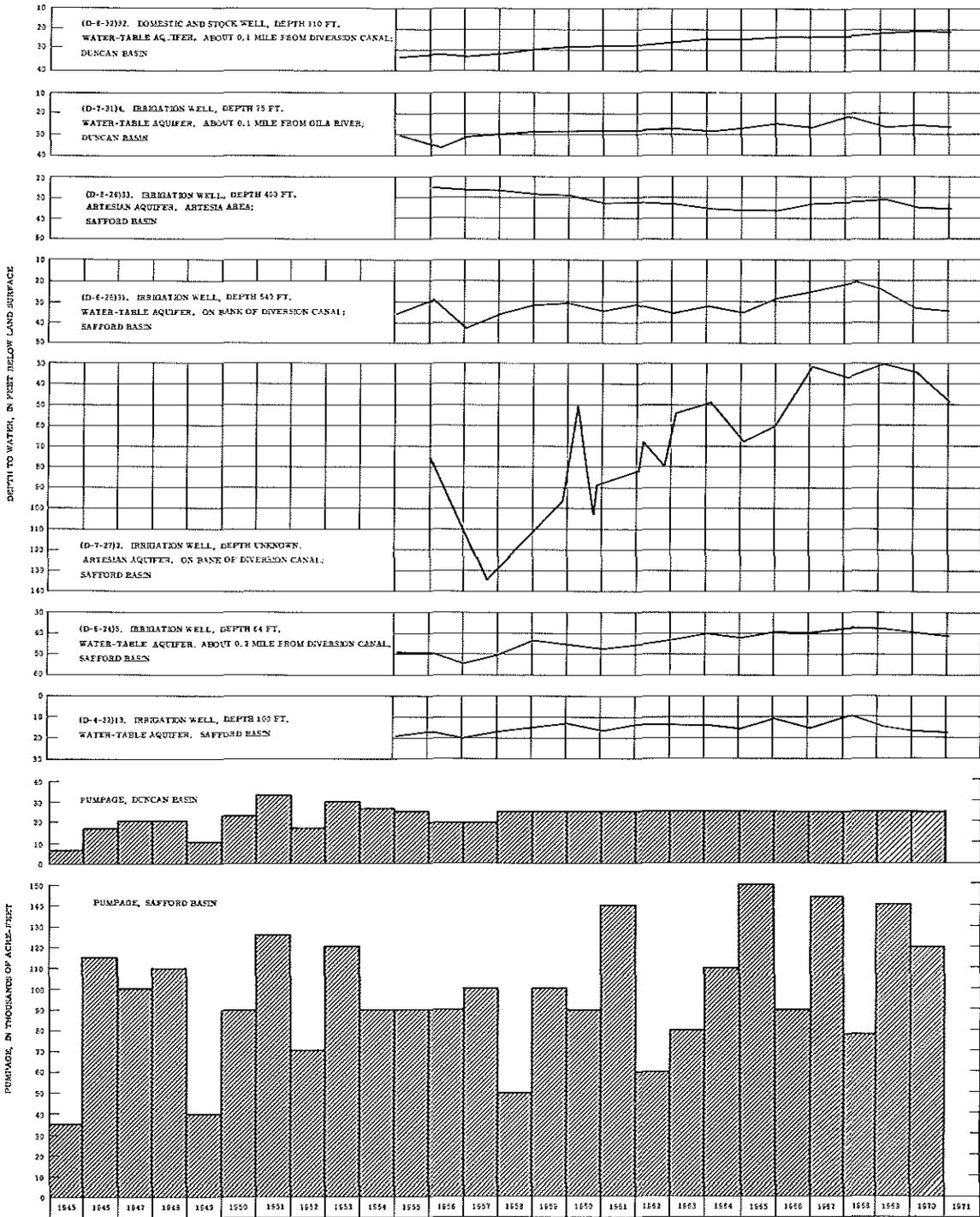


FIGURE 4. -- DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE DUNCAN AND SAFFORD BASINS.

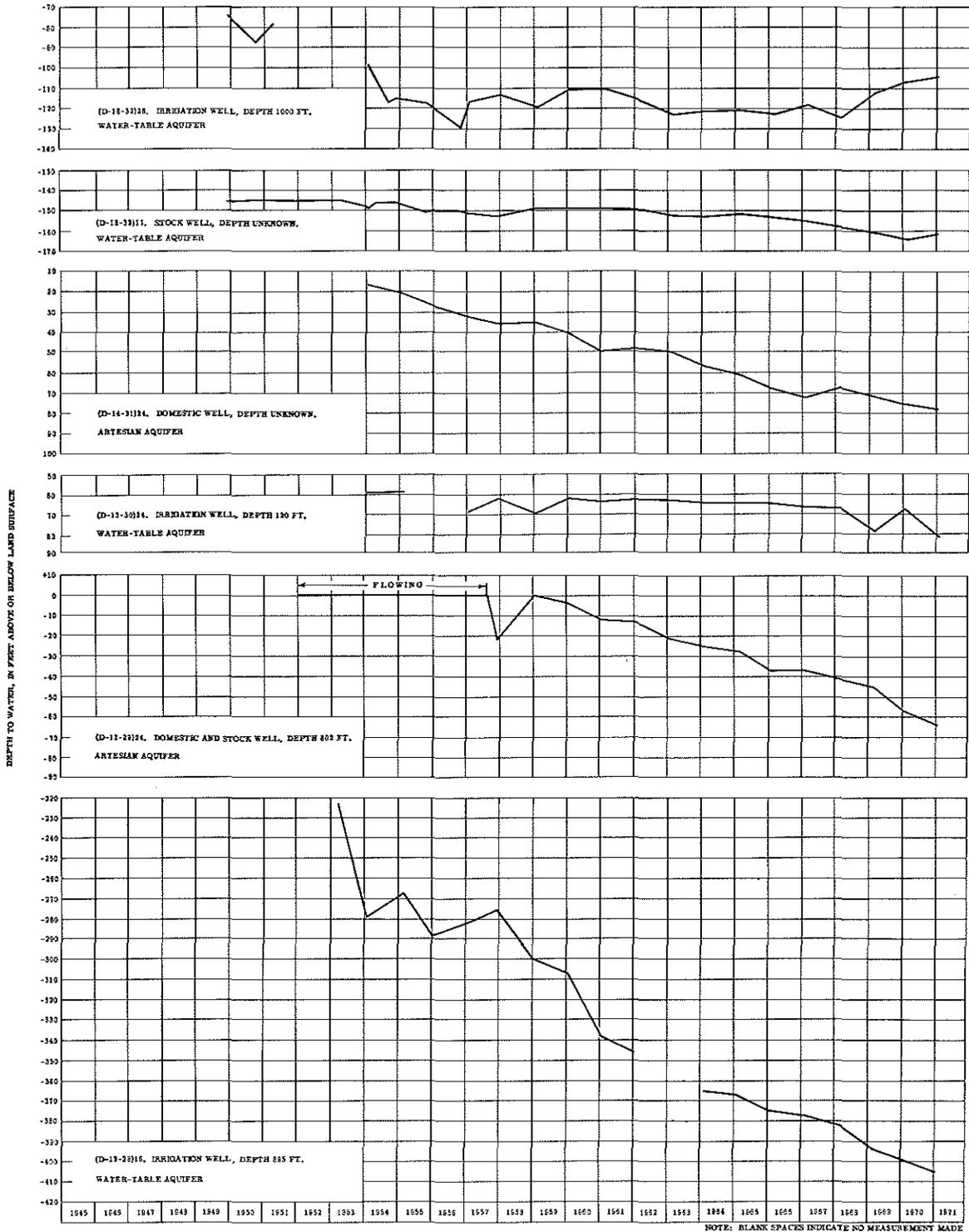


FIGURE 3.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SAN SIMON BASIN. (IN TWO SHEETS.)
SHEET 1 OF FIGURE 3

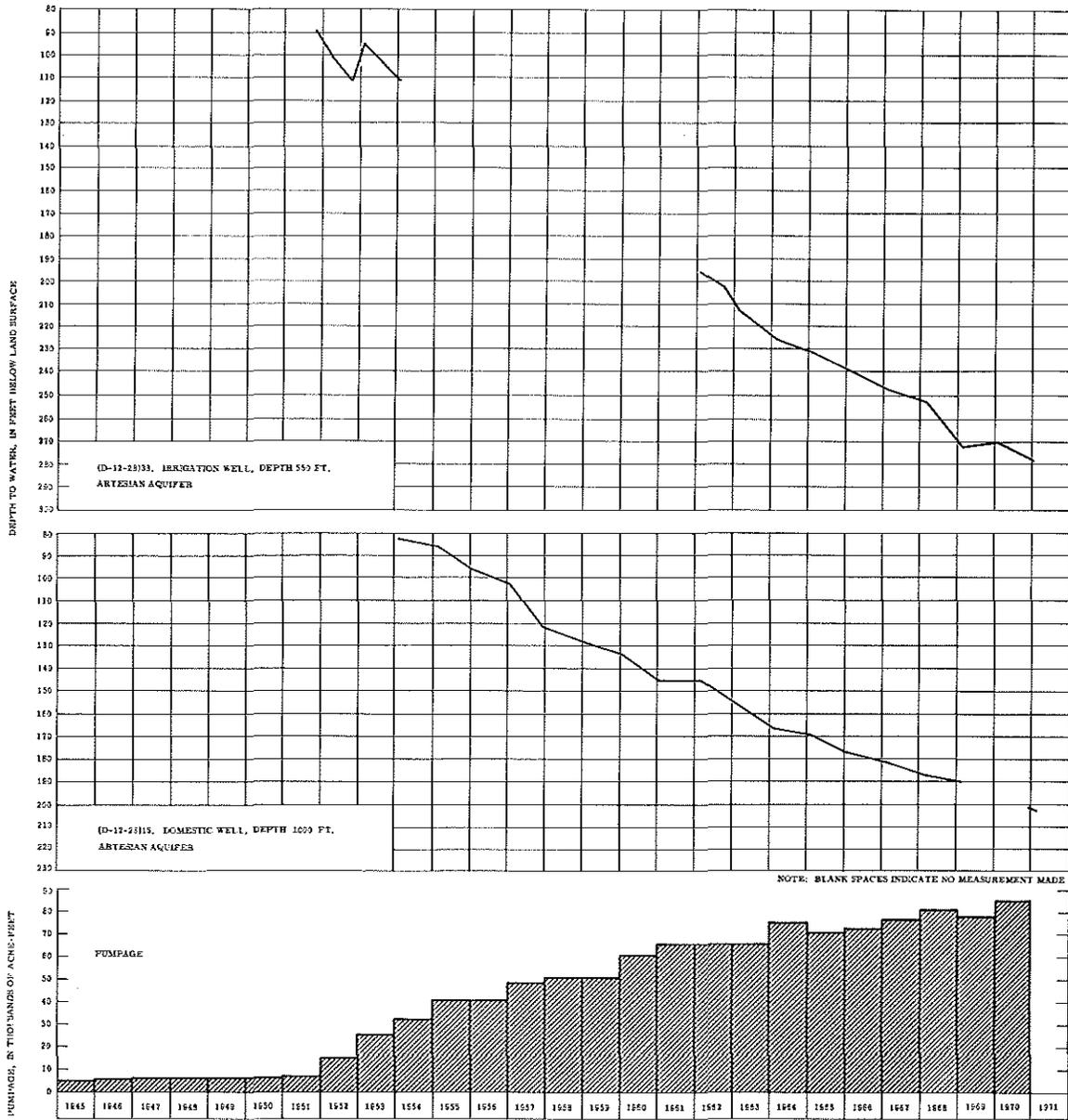


FIGURE 5.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SAN SIMON BASIN. (IN TWO SHEETS, 1 SHEET 2 OF FIGURE 5)

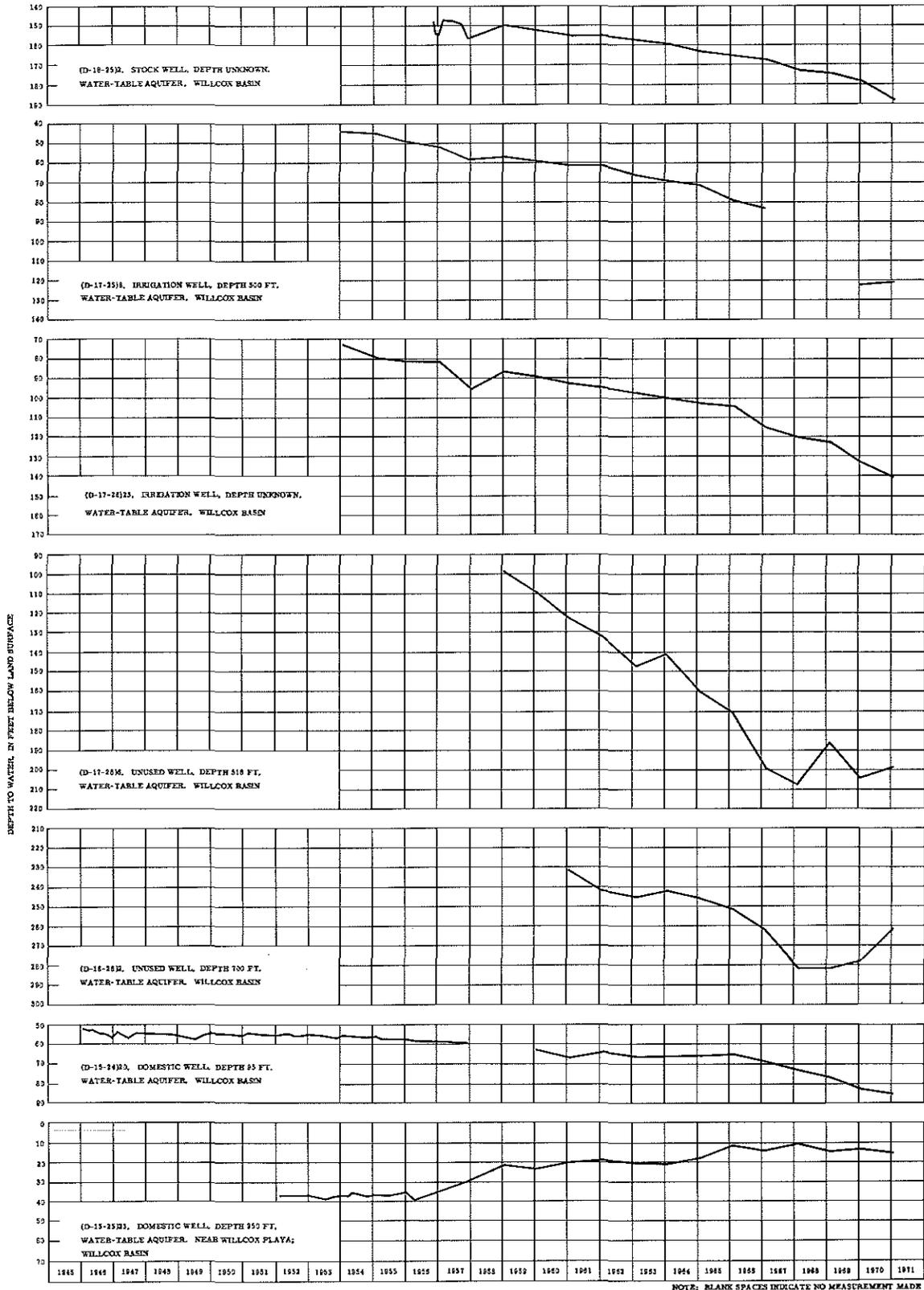


FIGURE 1.--DEPTH TO WATER IN SELECTED WELLS IN WILCOX BASIN AND ARAYAPA VALLEY AND ESTIMATED ANNUAL PUMPAGE IN WILCOX BASIN.
(ON TWO SHEETS.)

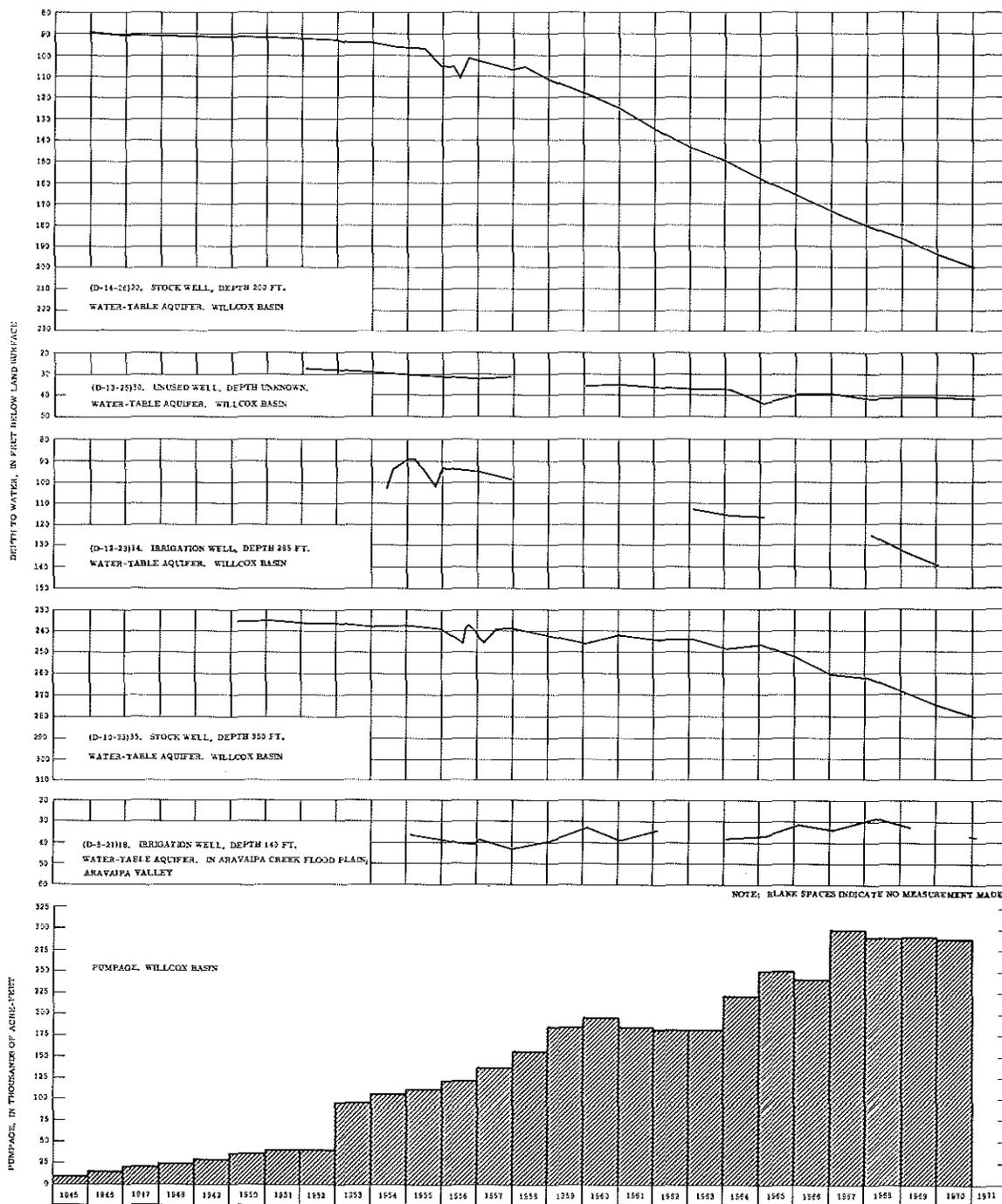


FIGURE 8. --DEPTH TO WATER IN SELECTED WELLS IN WILCOX BASIN AND ARAVAIPA VALLEY AND ESTIMATED ANNUAL PUMPAGE IN WILCOX BASIN.
(ON TWO SHEETS.)

SHEET 2 OF FIGURE 8.

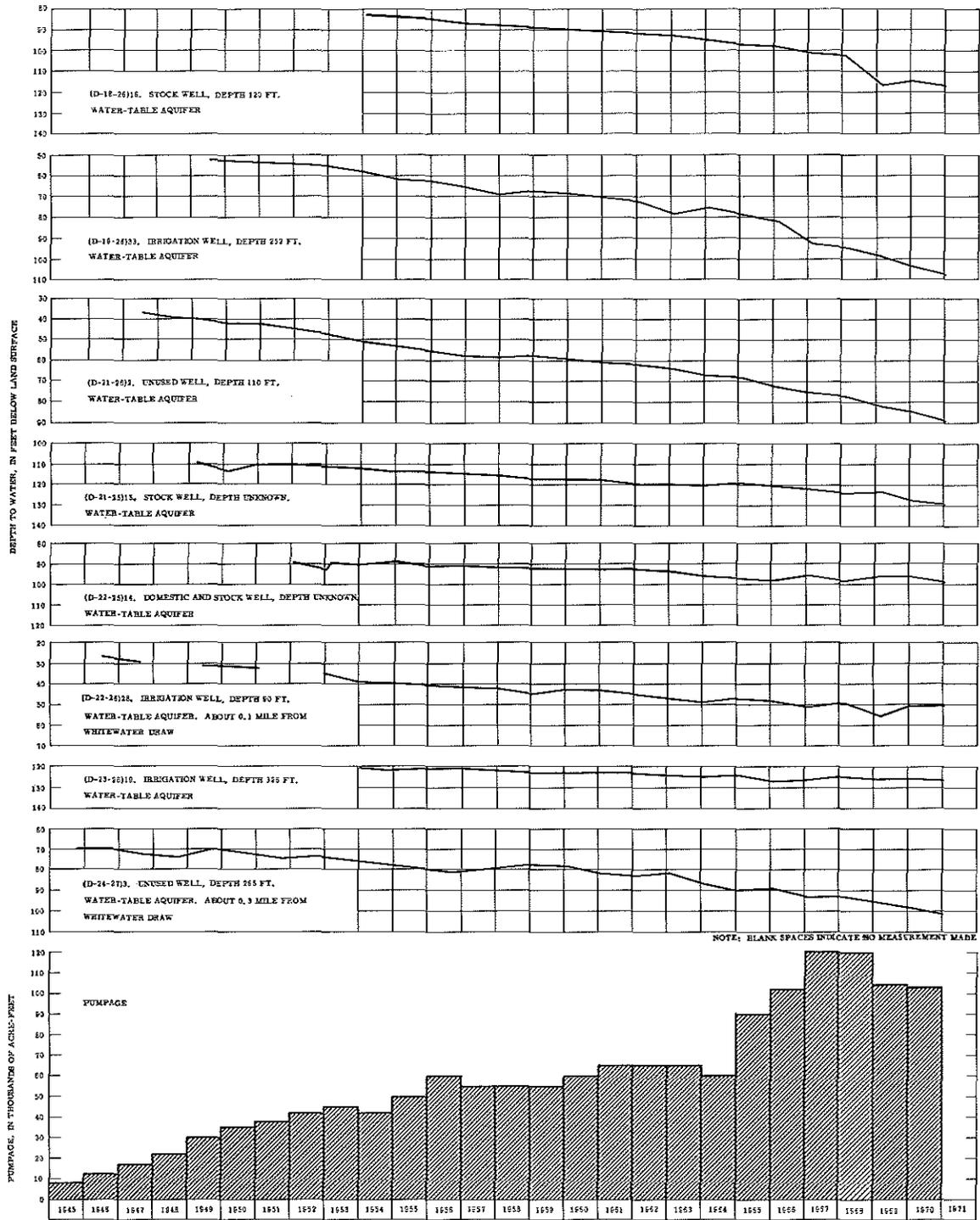


FIGURE 2. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN DOUGLAS BASIN.

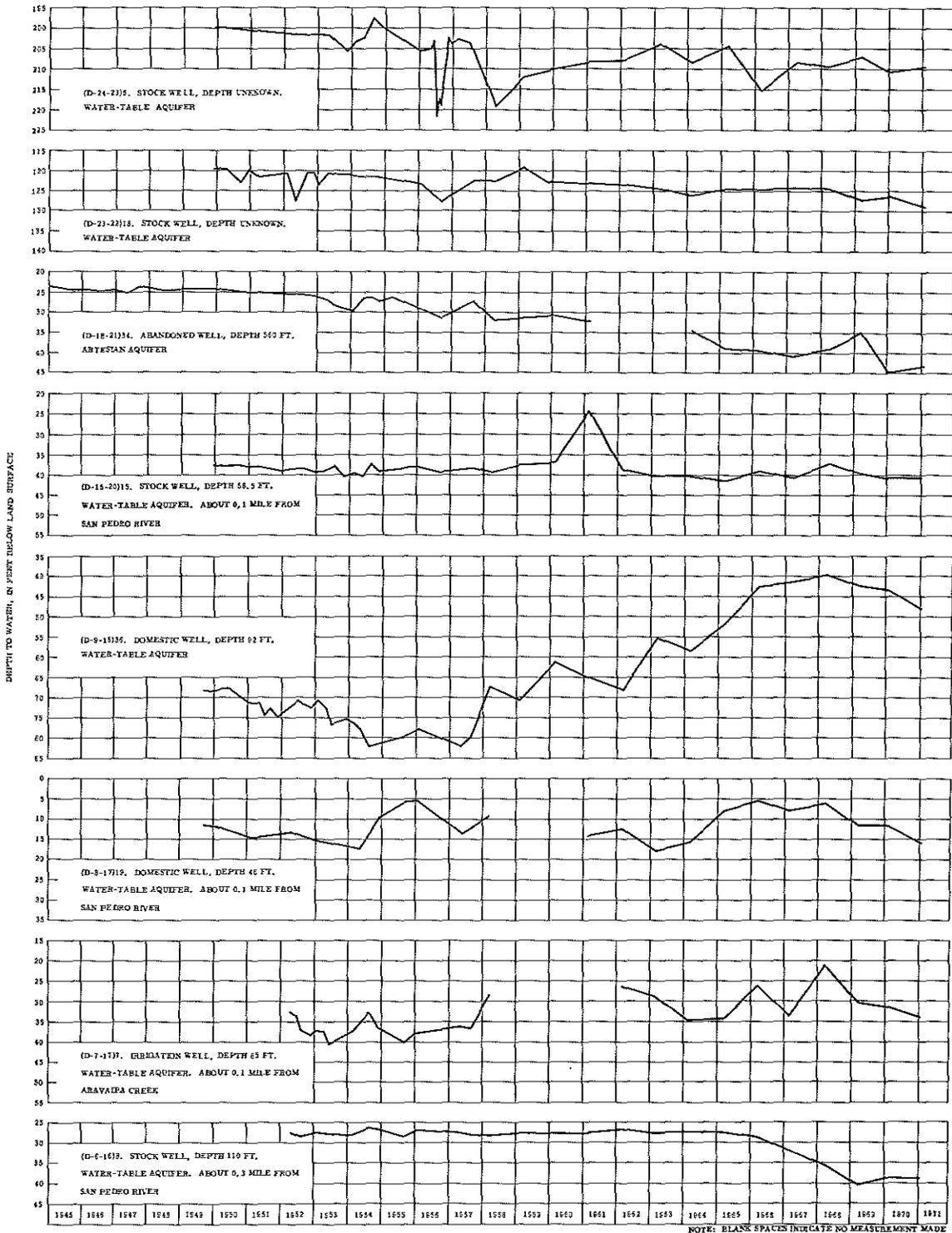


FIGURE 4. -- DEPTH TO WATER IN SELECTED WELLS IN THE SAN PEDRO RIVER VALLEY.

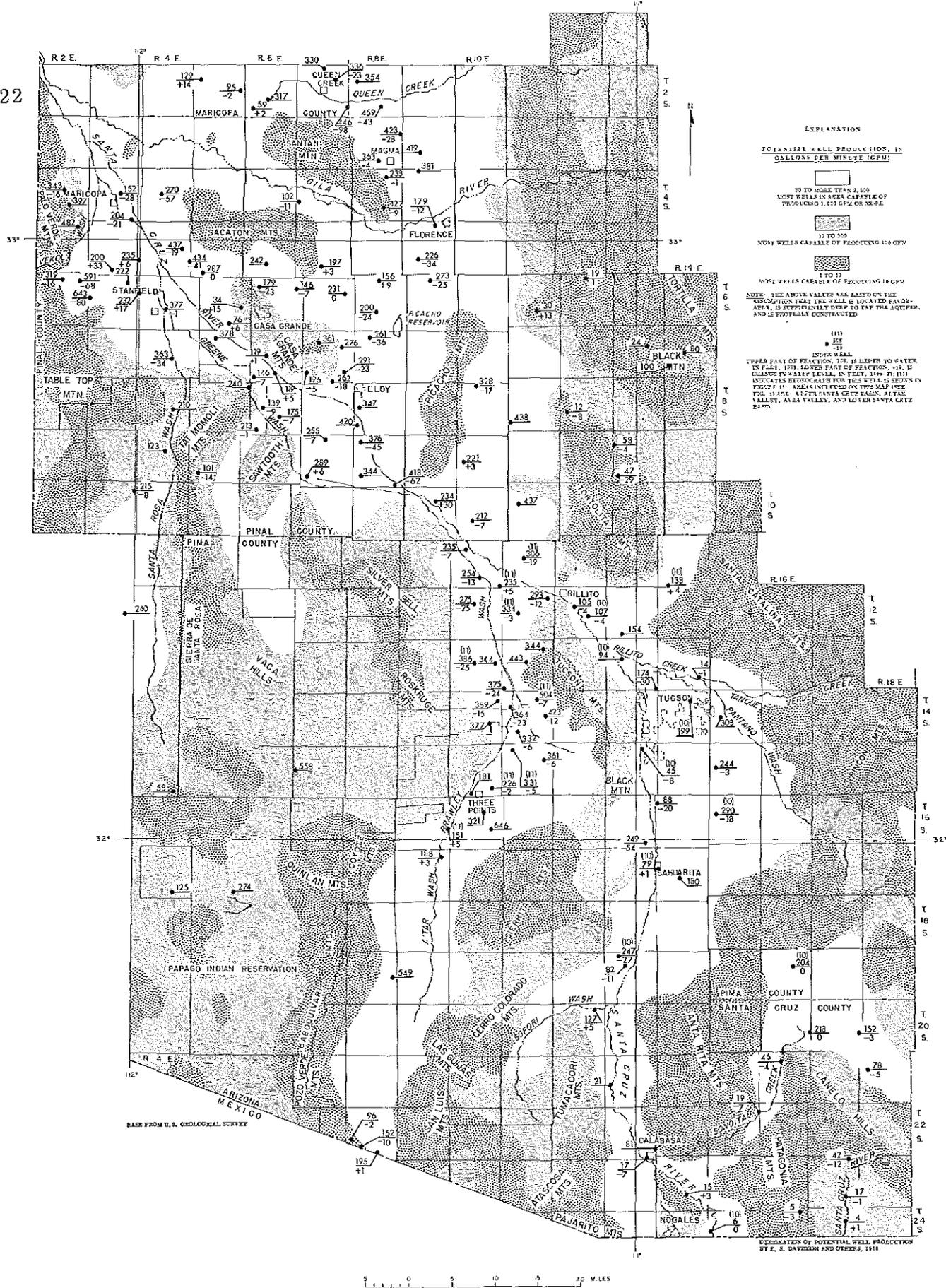


FIGURE 9. -- POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1971, AND CHANGE IN WATER LEVEL, 1966-71, IN SELECTED WELLS IN THE SOUTH-CENTRAL PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

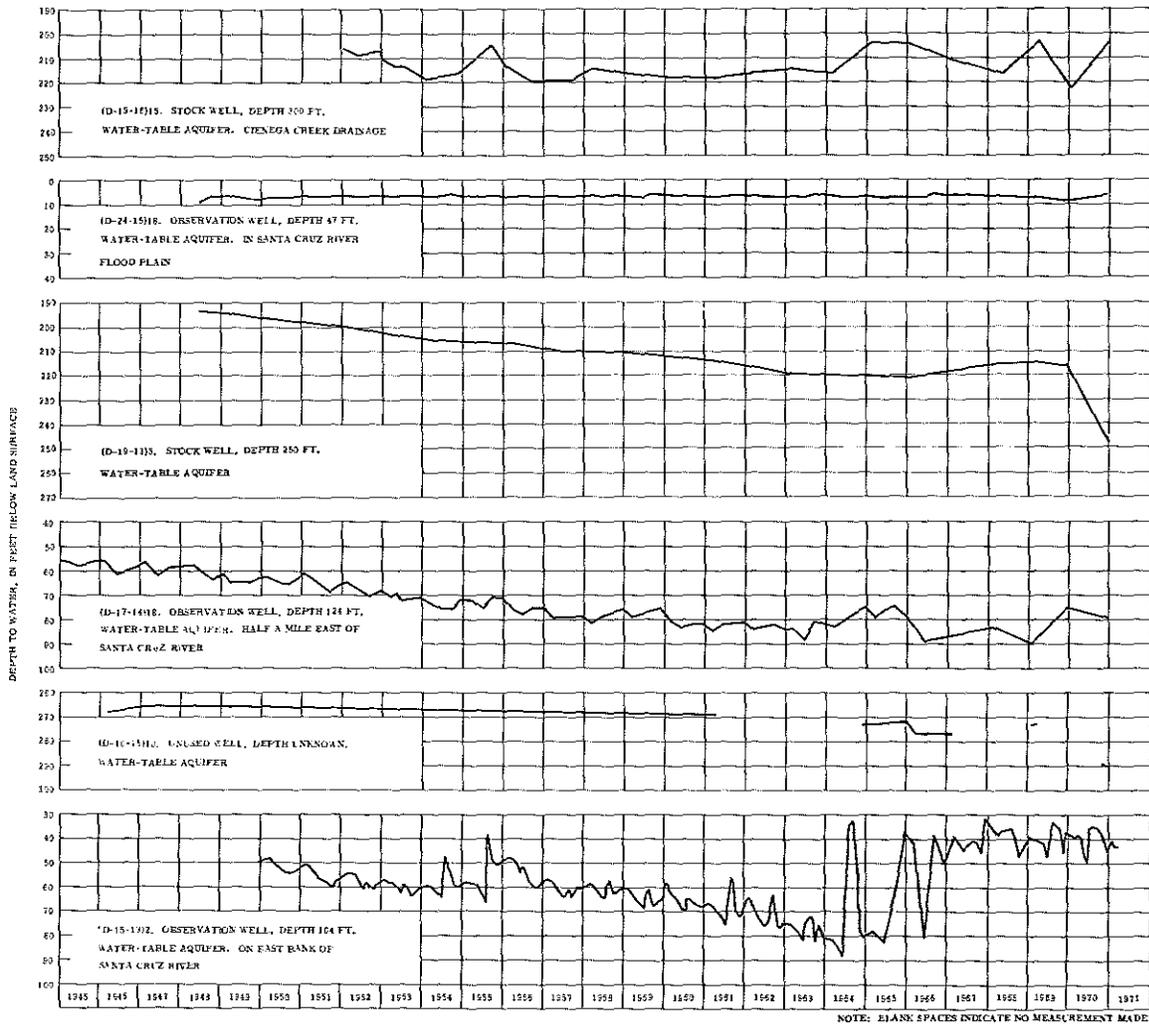


FIGURE 10. -- DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE UPPER SANTA CRUZ BASIN. (IN TWO SHEETS - SHEET 1 OF FIGURE 10)

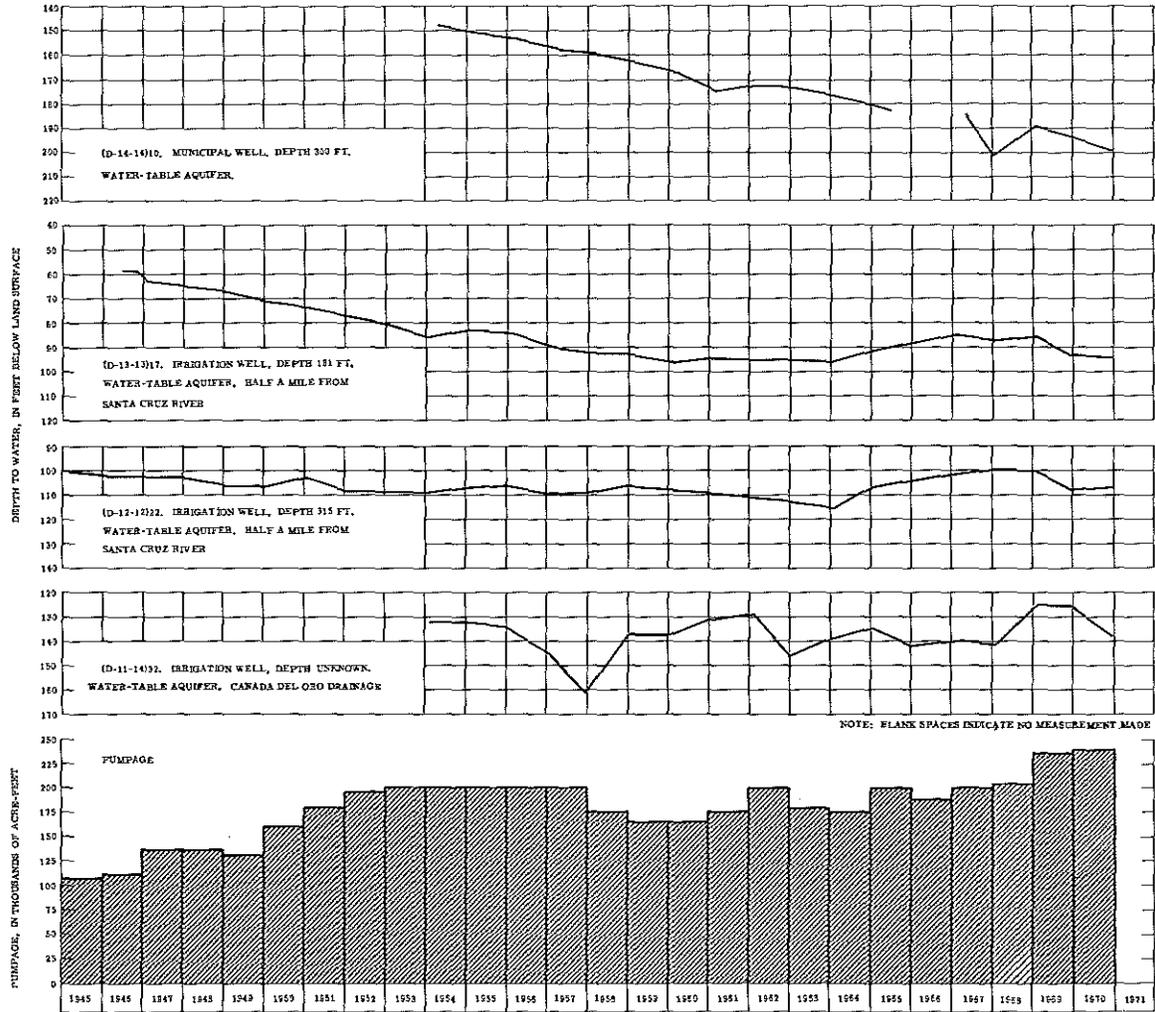


FIGURE 10.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE UPPER SANTA CRUZ BASIN. (IN TWO SHEETS.) SHEET 2 OF FIGURE 10

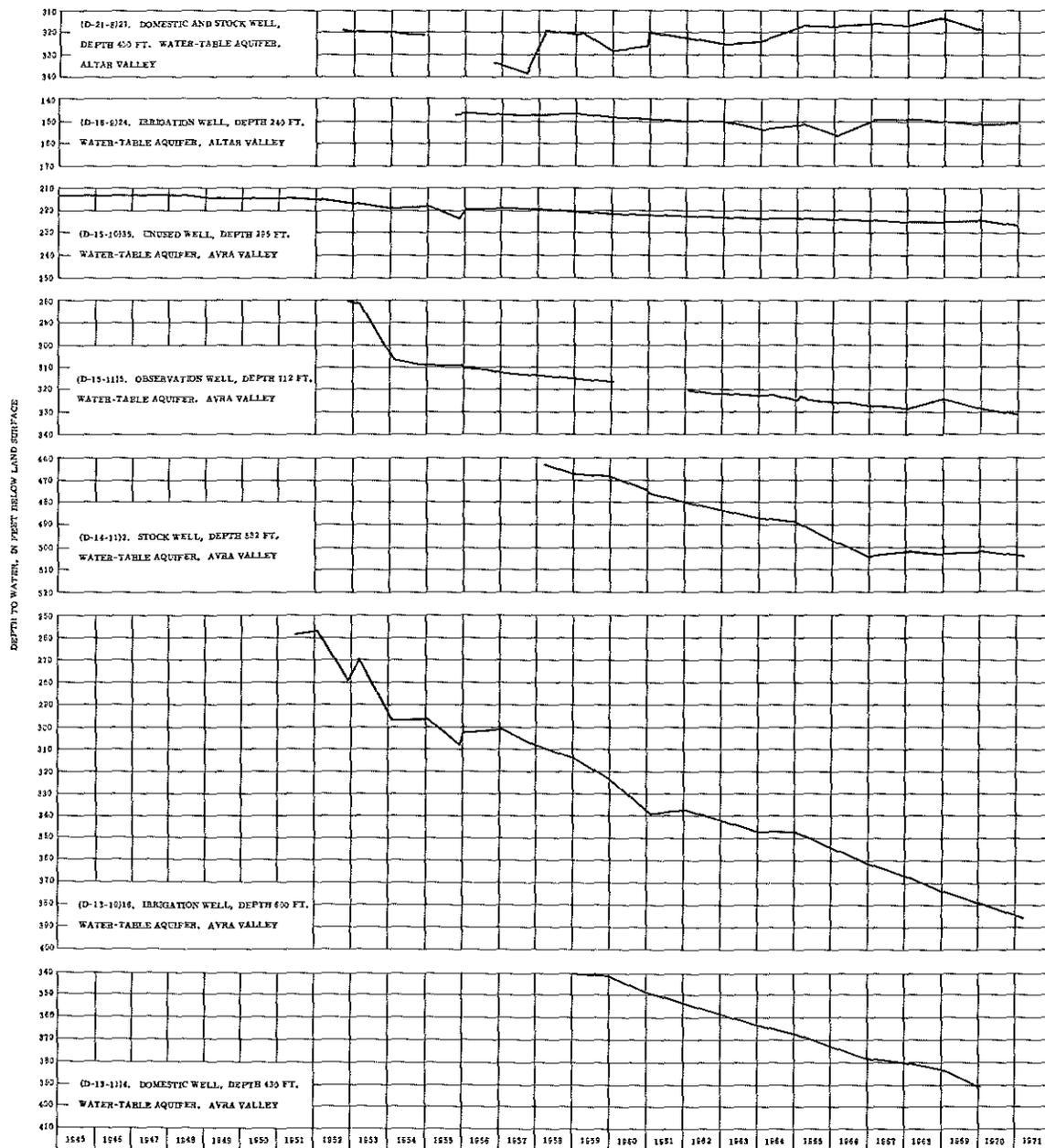


FIGURE 11. --DEPTH TO WATER IN SELECTED WELLS IN ALTAR AND AVRA VALLEYS AND ESTIMATED ANNUAL PUMPAGE IN AVRA VALLEY. (IN TWO SHEETS.)

SHEET 1 OF FIGURE 11

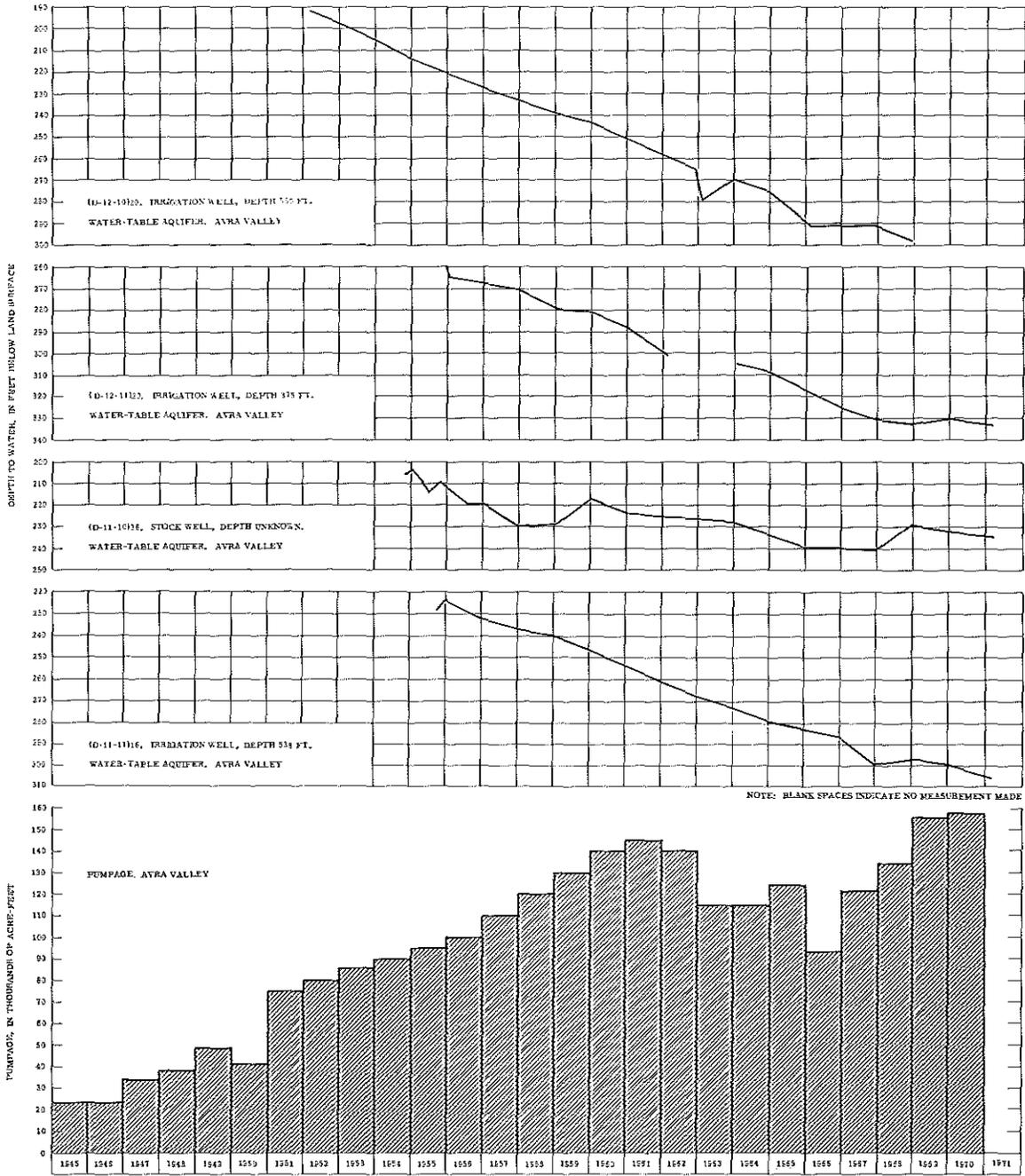


FIGURE 11. --DEPTH TO WATERS IN SELECTED WELLS IN ALTAR AND AVRA VALLEYS AND ESTIMATED ANNUAL PUMPAGE IN AVRA VALLEY. (ON TWO SHEETS.) SHEET 2 OF FIGURE 11

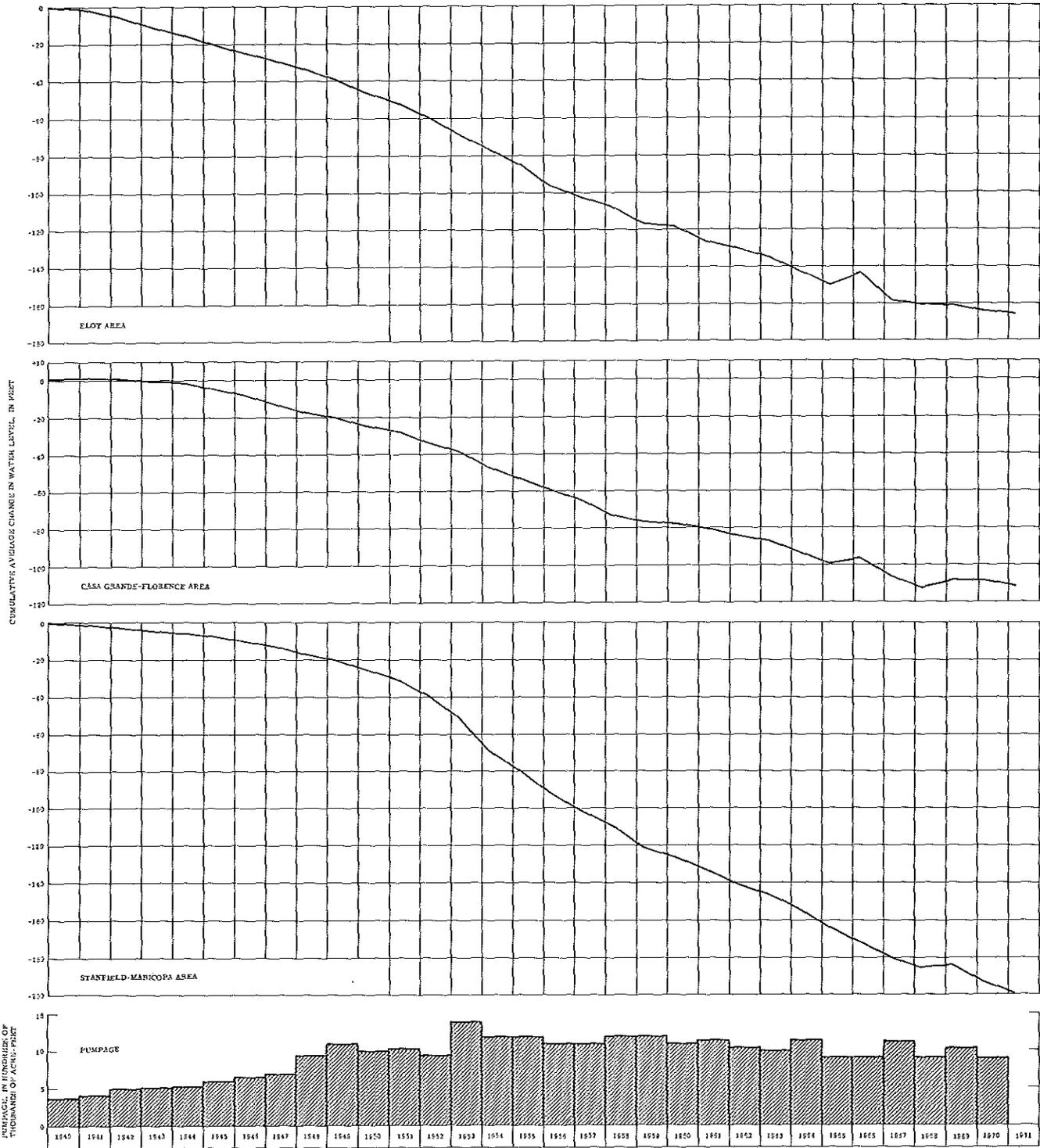


FIGURE 12. -- CUMULATIVE AVERAGE CHANGE IN WATER LEVEL BY AREAS AND ESTIMATED ANNUAL PUMPAGE IN THE LOWER SANTA CRUZ BASIN.

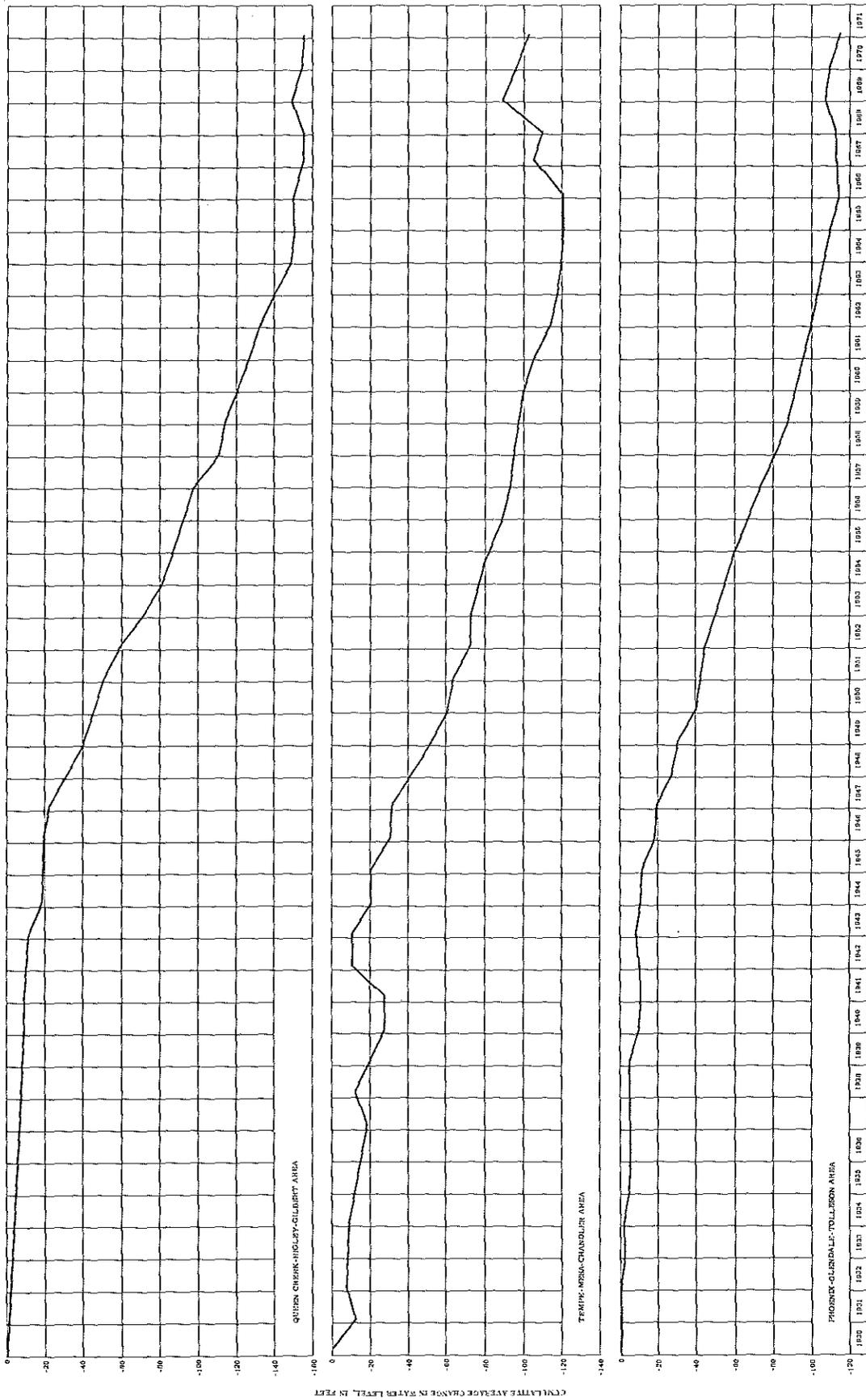


FIGURE 14. -- CUMULATIVE AVERAGE CHANGE IN WATER LEVEL IN THE QUEEN CREEK-HOLLY-CLEARMONT, TEMPE-MESA-CHANDLER, AND PHOENIX-GLENDALE-TOLLESON AREAS OF THE SALT RIVER VALLEY.

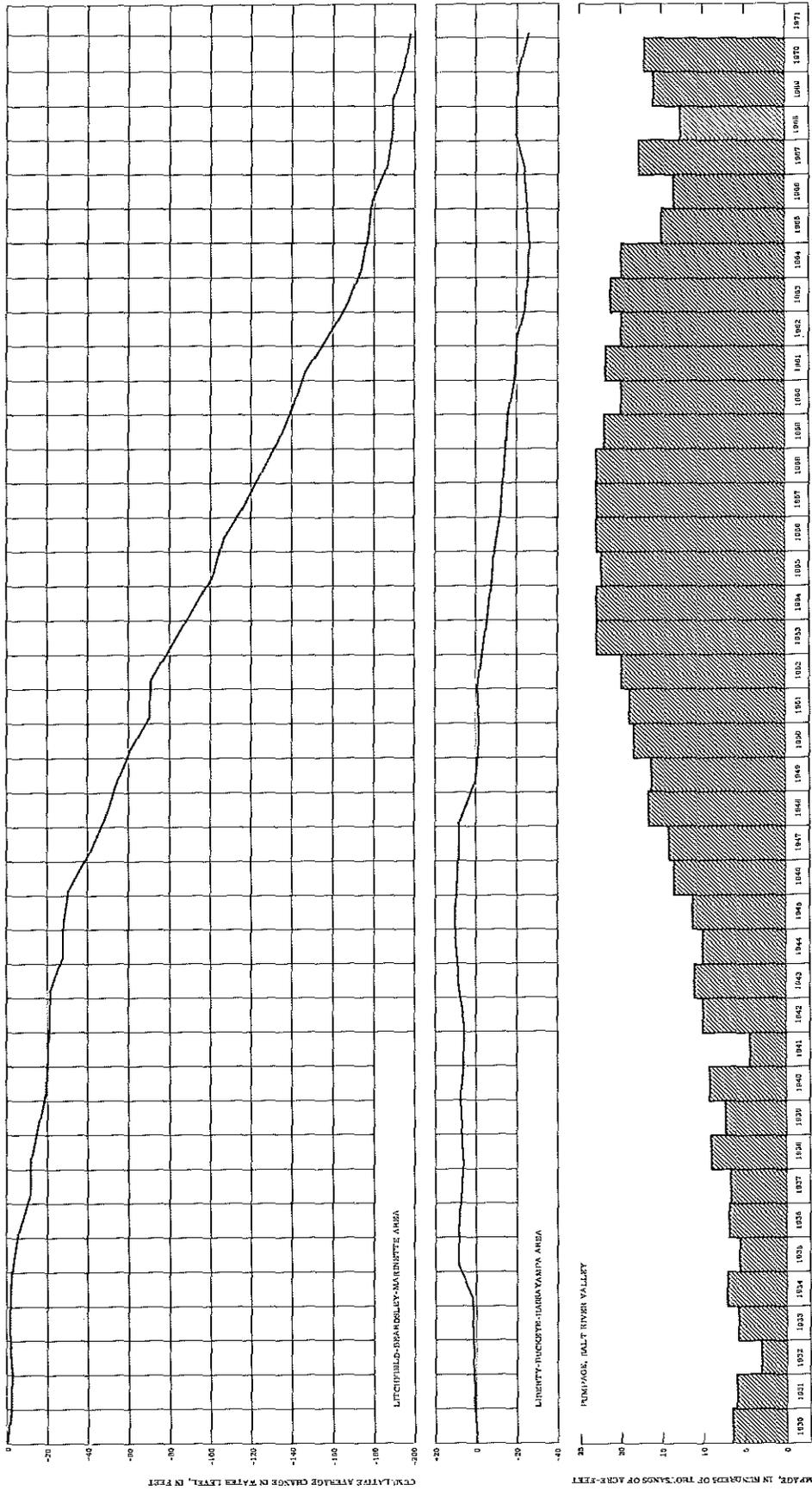


FIGURE 15. -- CUMULATIVE AVERAGE CHANGE IN WATER LEVEL IN THE LITCHFIELD-BEARLEY-MARQUETTE, AND LIBERTY-BUCKEYE-HARSANYI AREAS AND ESTIMATED ANNUAL PERCOLATION IN THE SALT RIVER VALLEY.

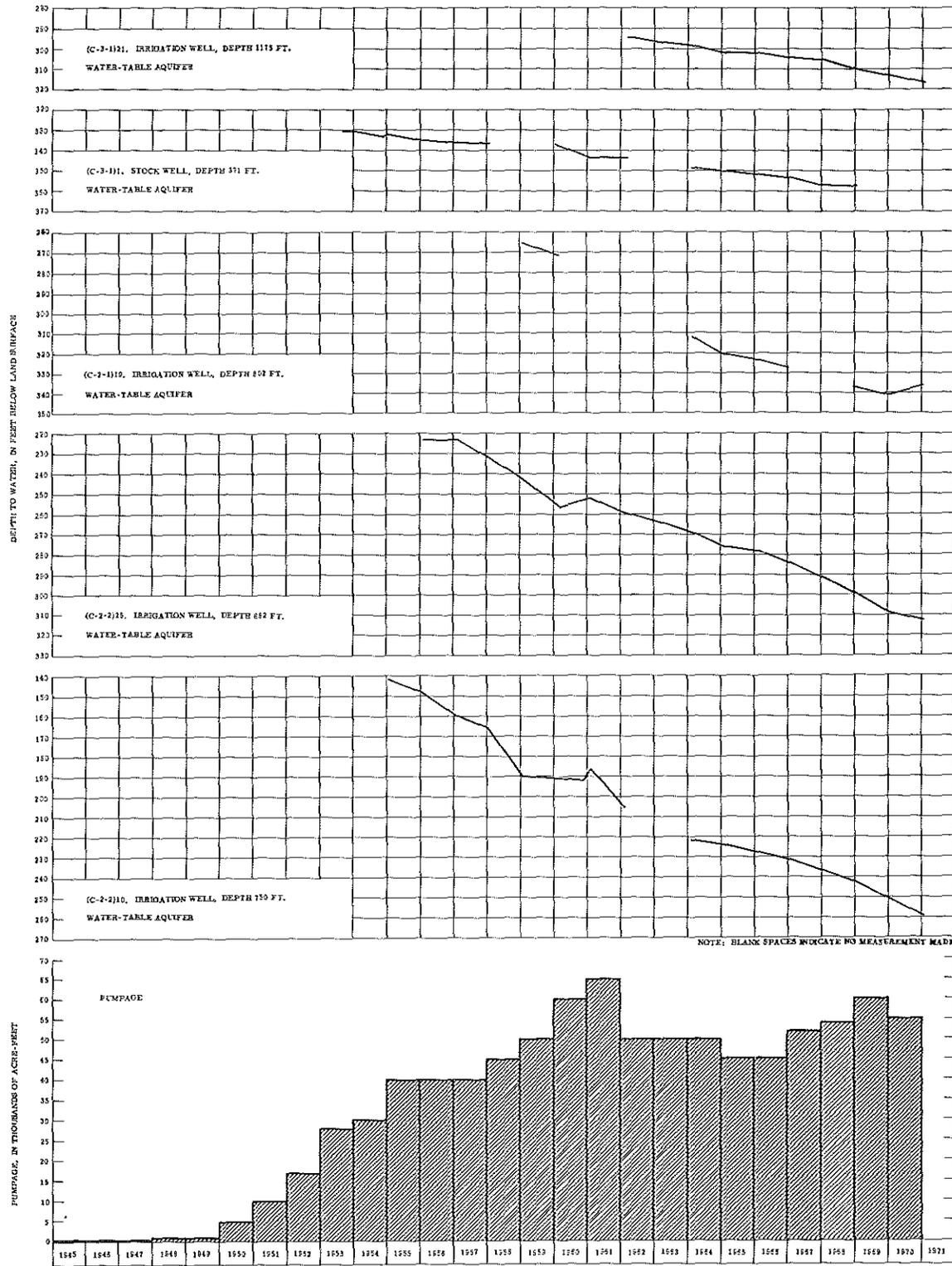


FIGURE 16.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE WATERMAN WASH AREA.

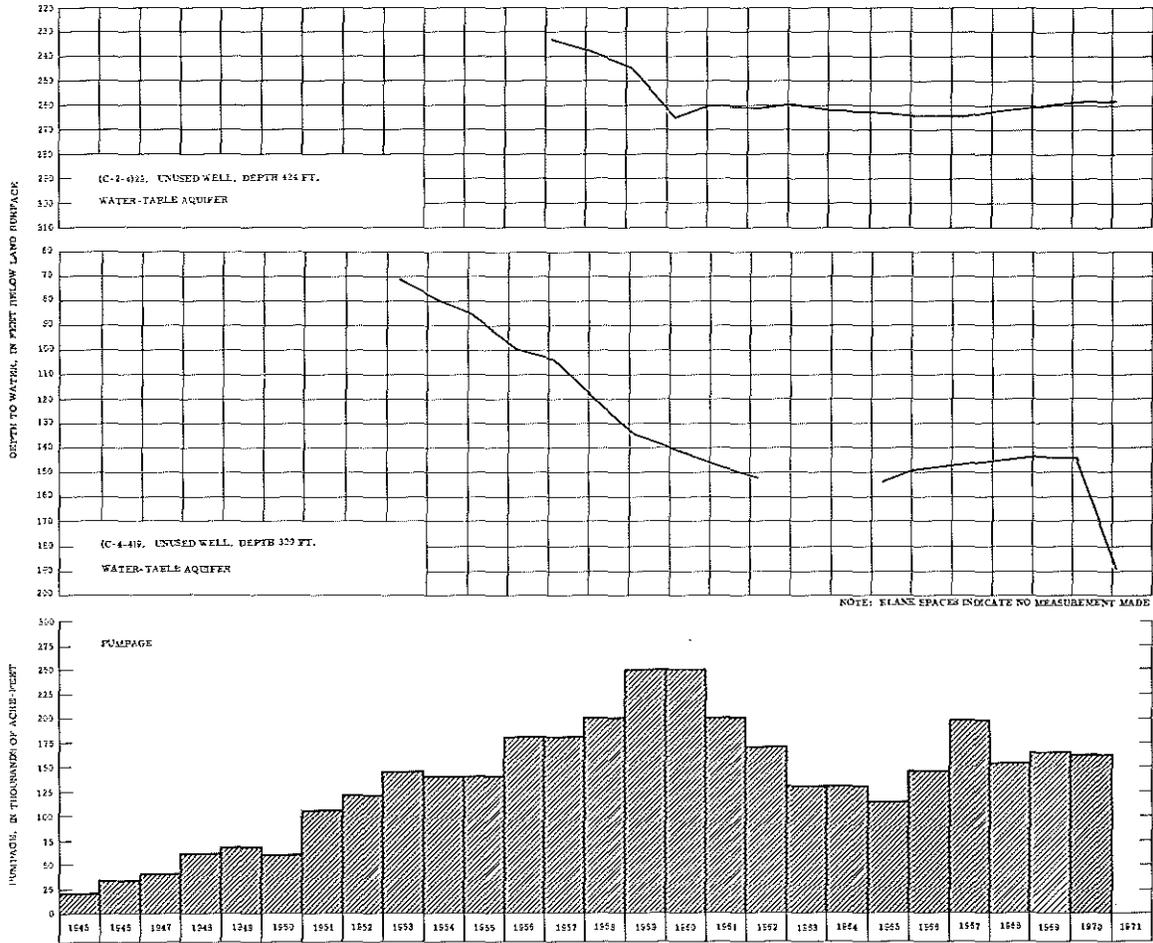


FIGURE 17. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE GILA BEND BASIN.

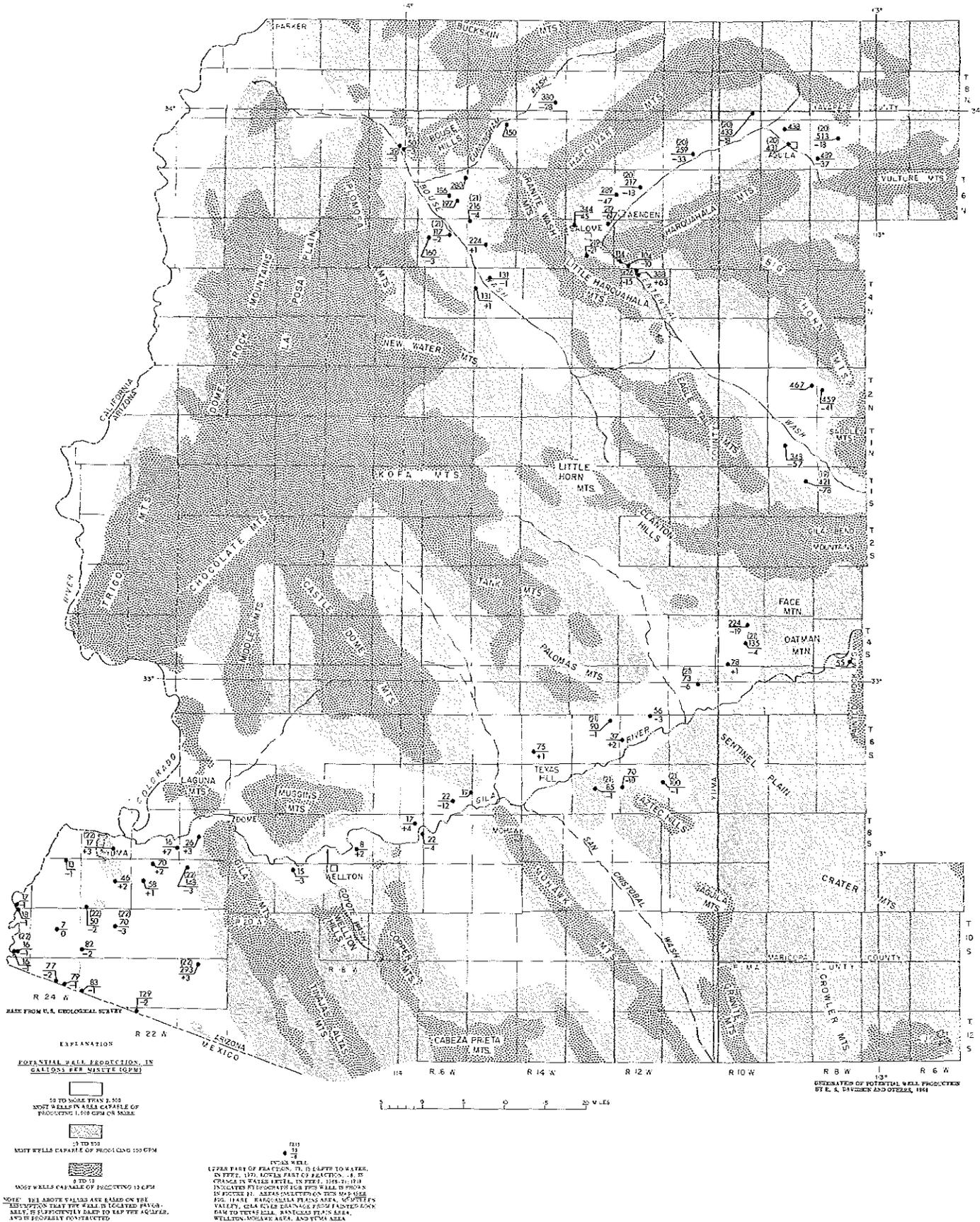


FIGURE 18. -- POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1971, AND CHANGE IN WATER LEVEL, 1966-71, IN SELECTED WELLS IN THE SOUTHWEST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

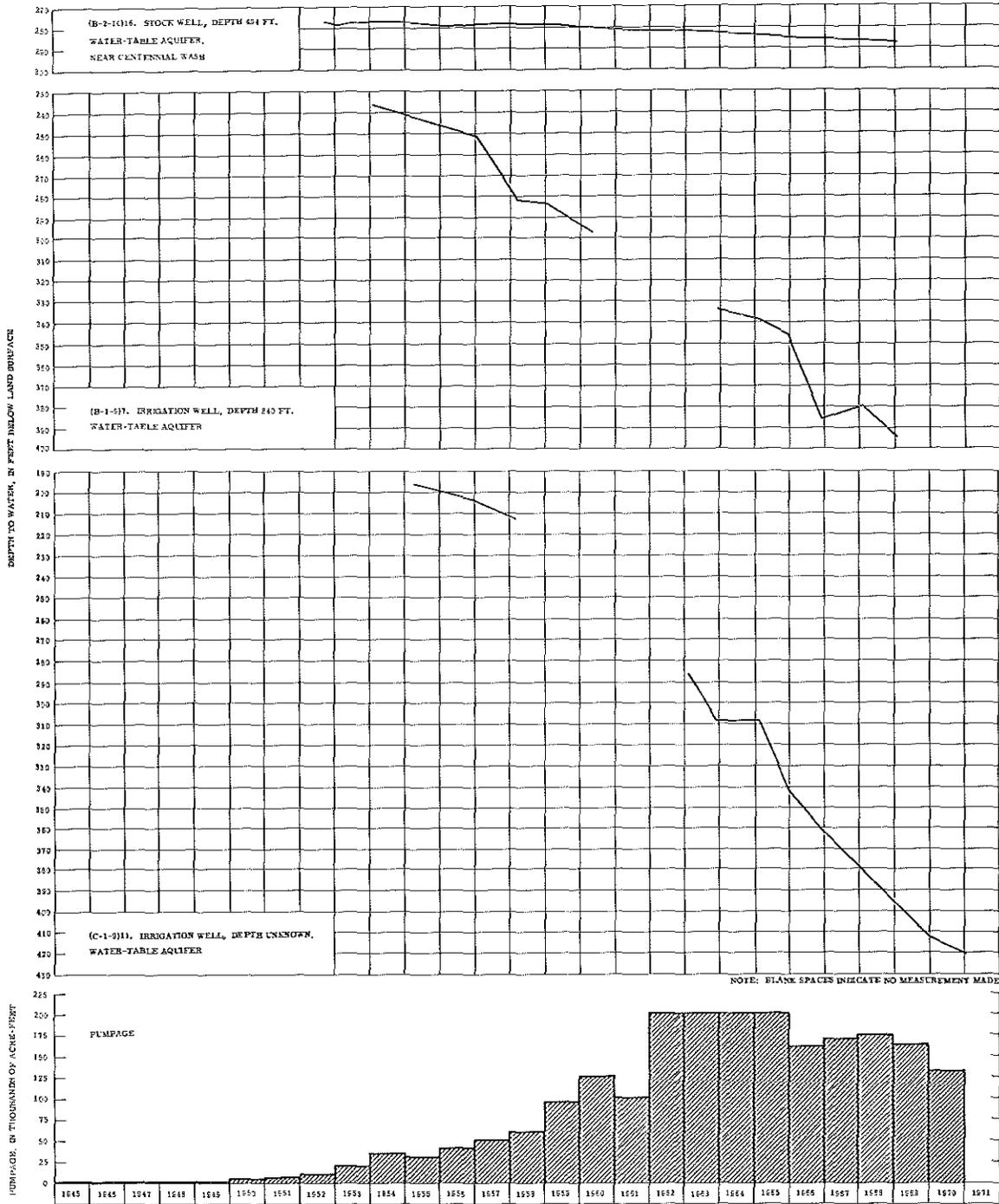


FIGURE 19. -- DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE RAFAQUABALA FLAINS AREA.

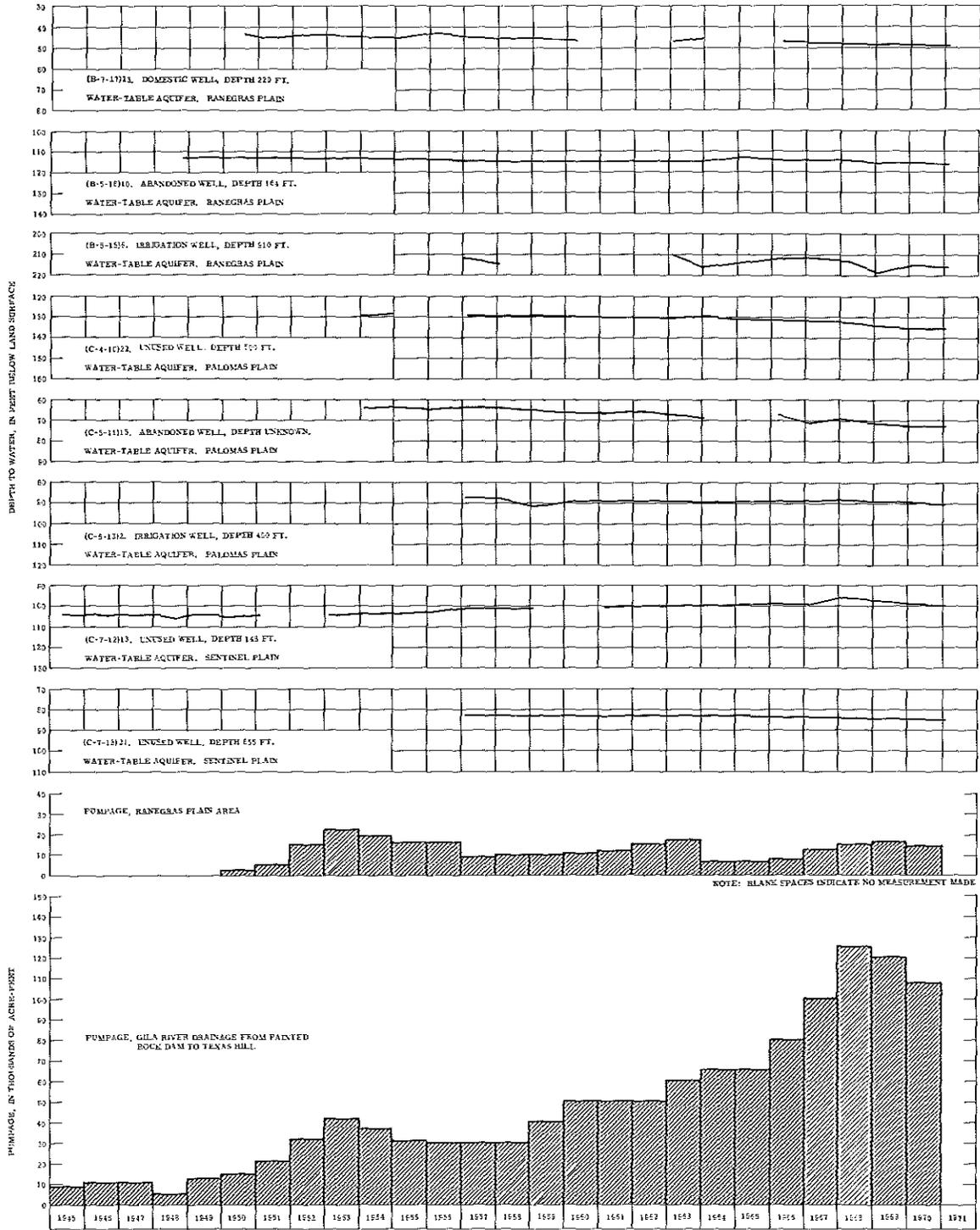


FIGURE 21. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL AND IN THE RANEGRAS PLAIN AREA

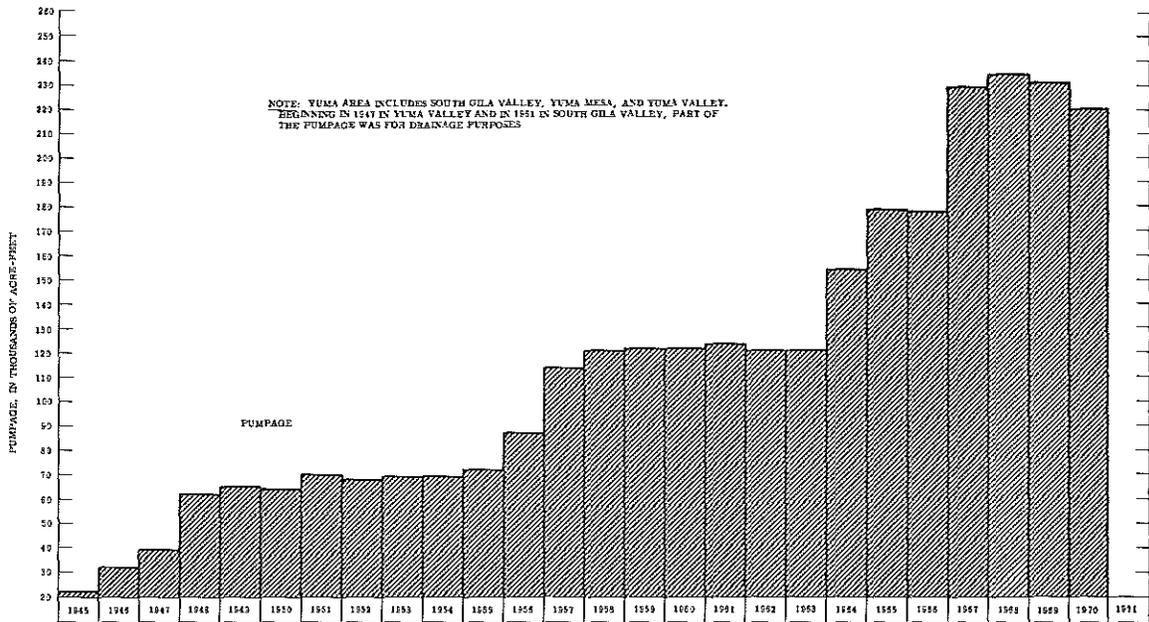
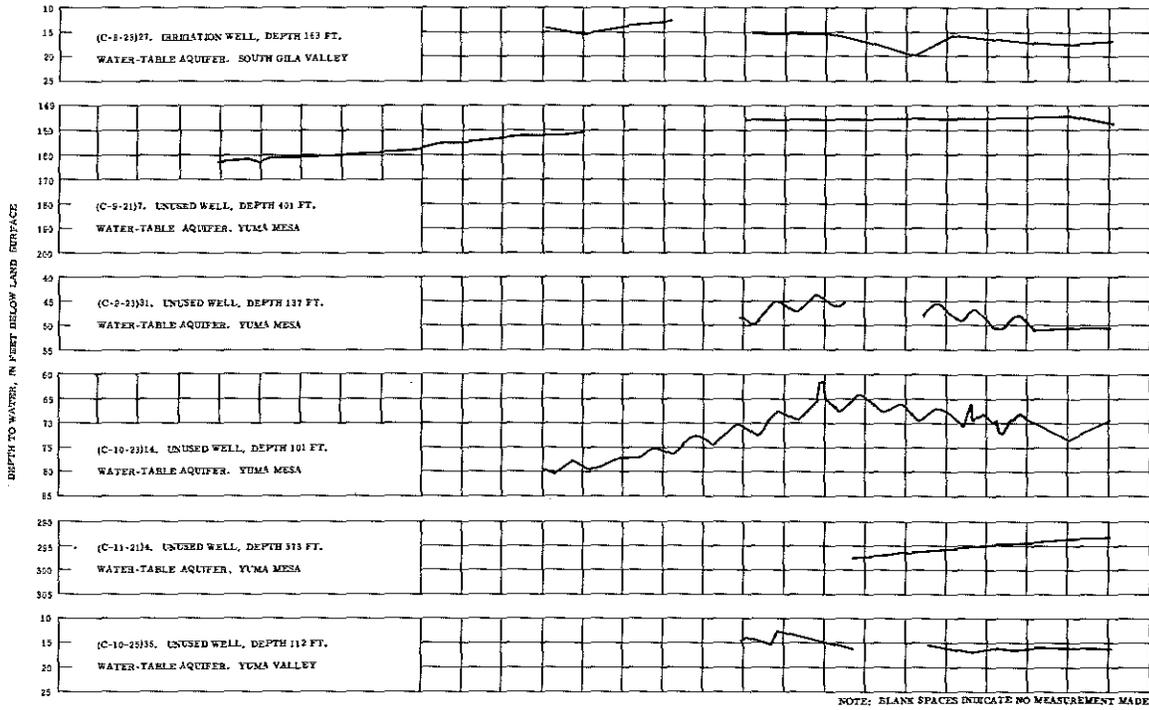


FIGURE 22. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE YUMA AREA.

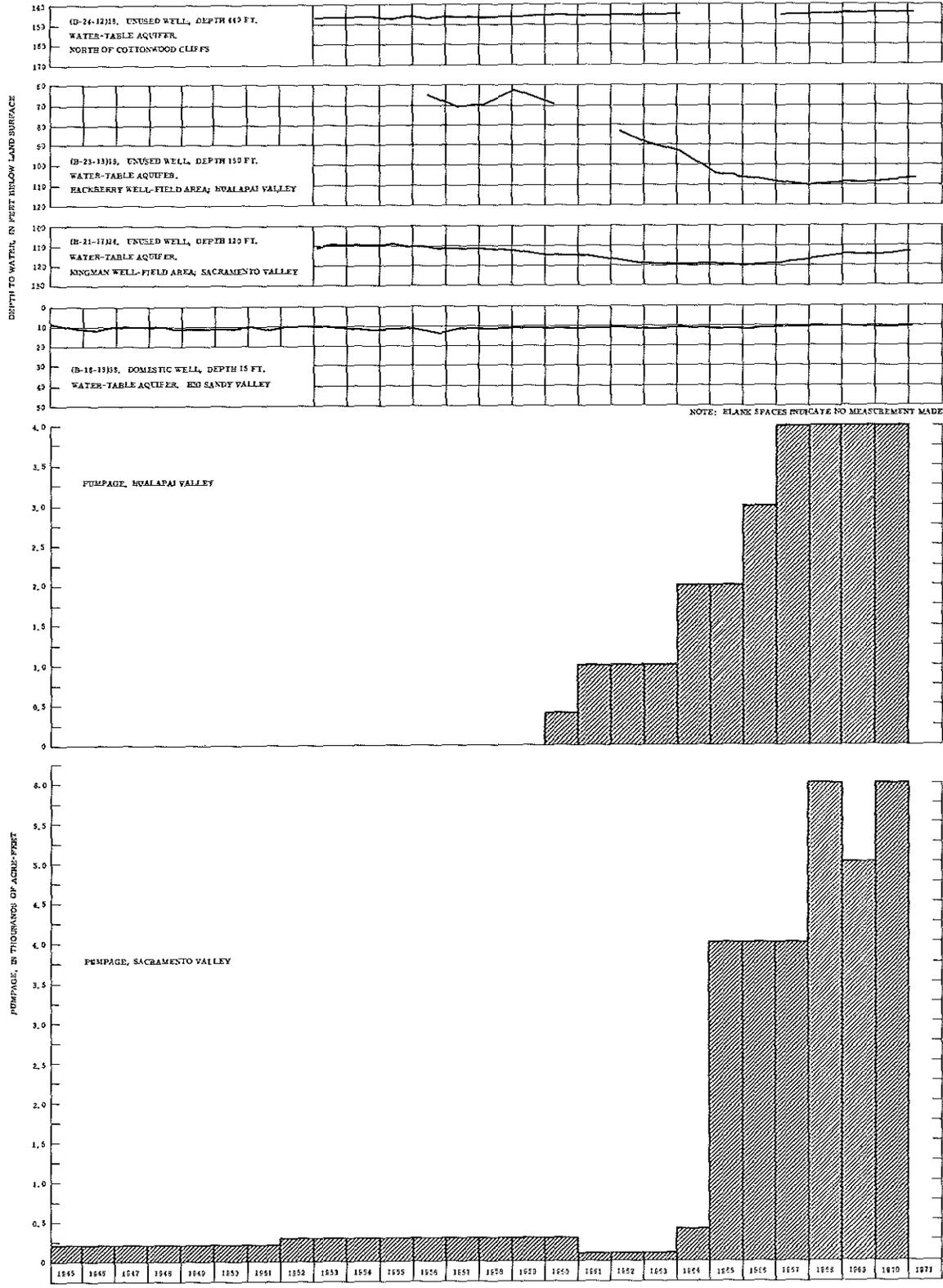


FIGURE 24.--DEPTH TO WATER IN SELECTED WELLS IN THE NORTHWEST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE AND ESTIMATED ANNUAL PUMPAGE IN HUALAPAI AND SACRAMENTO VALLEYS.

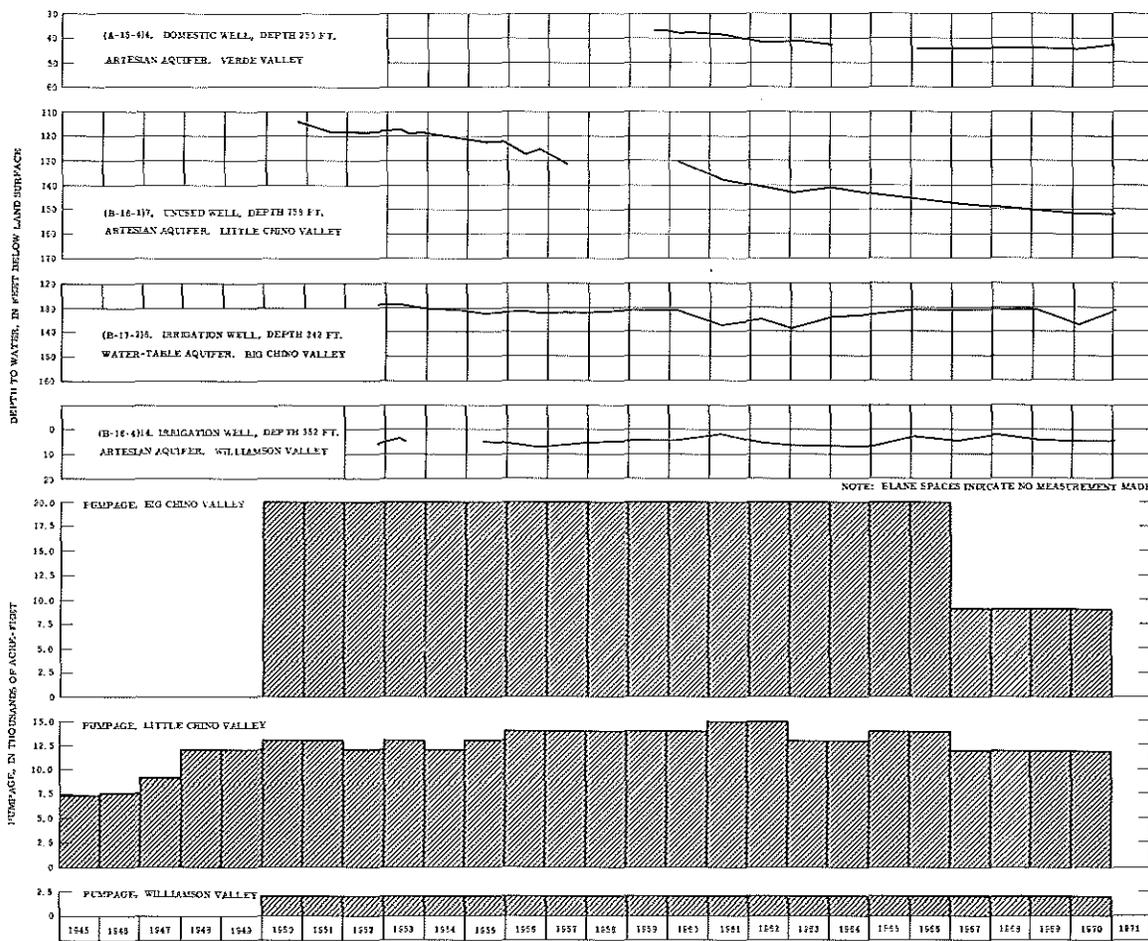


FIGURE 18. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SEVERAL AREAS IN THE CENTRAL HIGHLANDS PROVINCE.

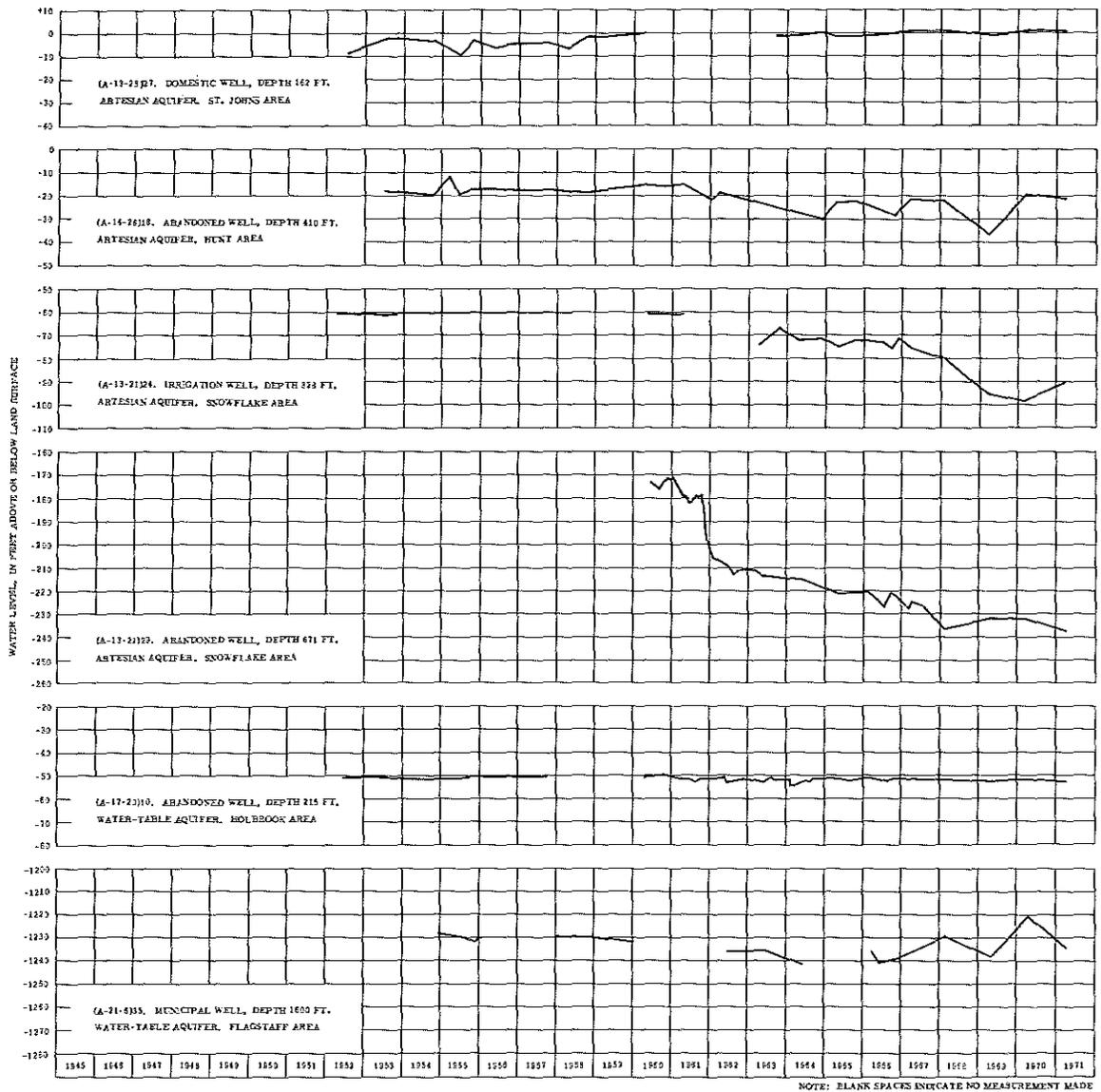


FIGURE 13.--DEPTH TO WATER IN SELECTED WELLS IN SEVERAL AREAS IN THE PLATEAU UPLANDS PROVINCE.

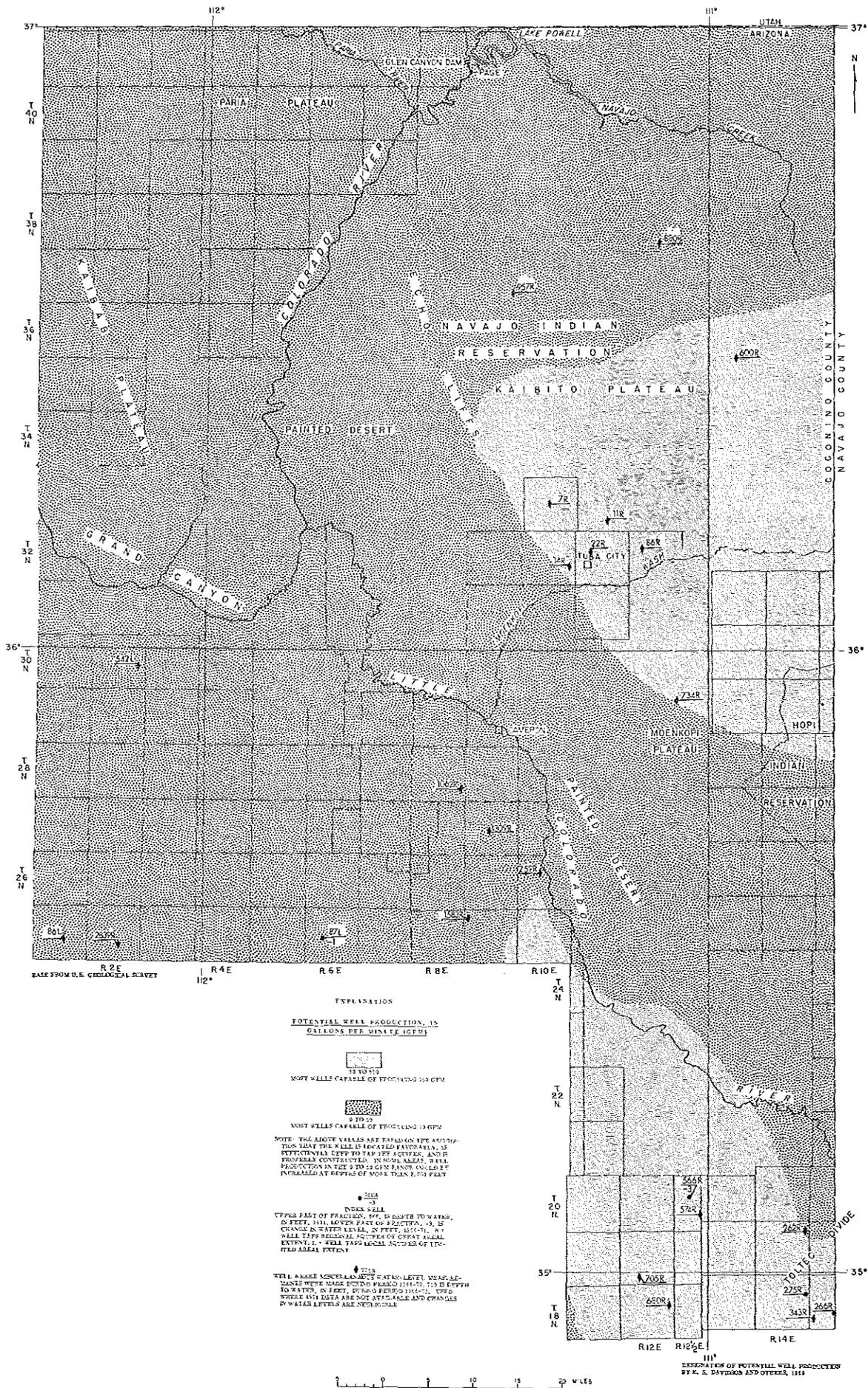
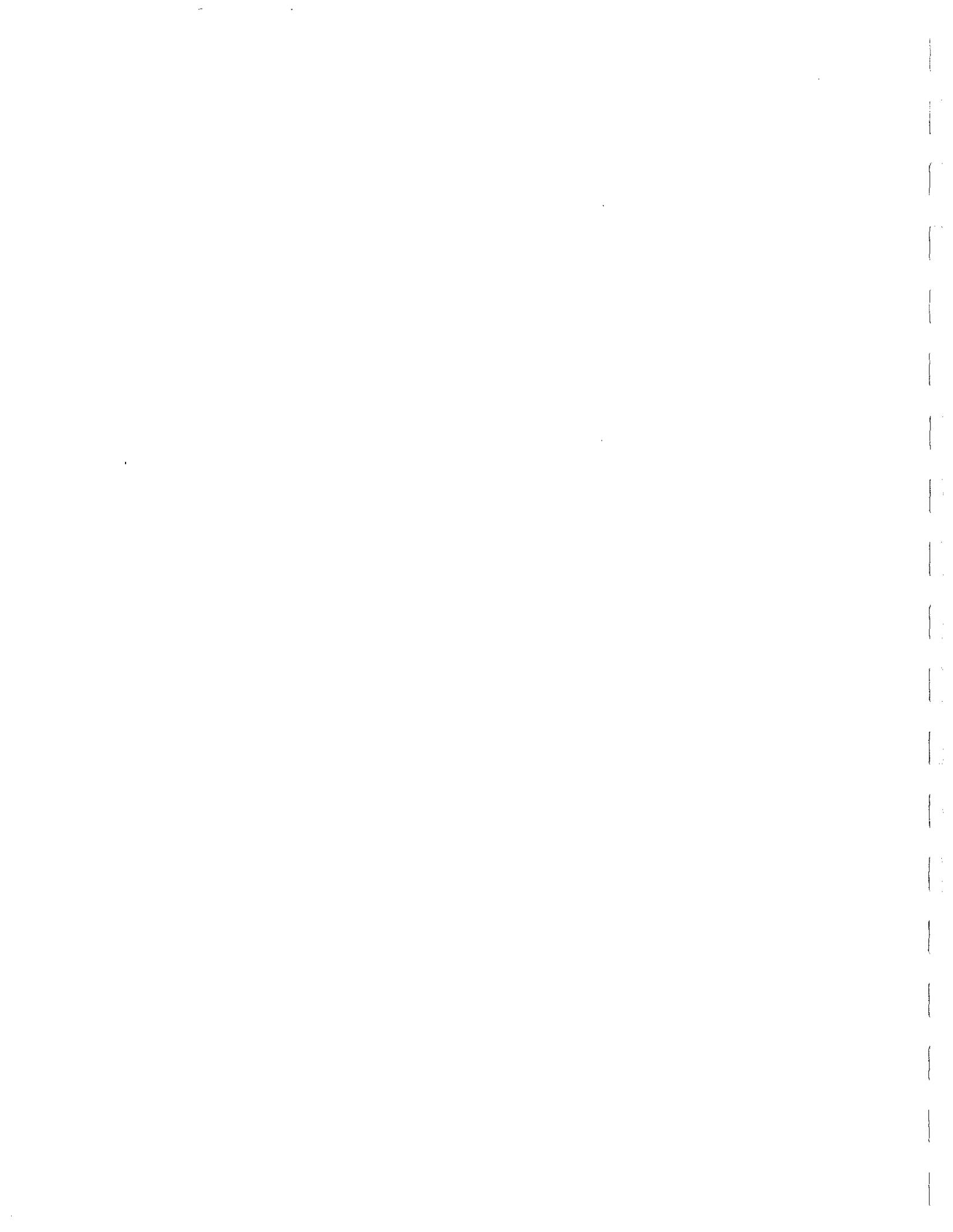


FIGURE 29. -- POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1971, AND CHANGE IN WATER LEVEL, 1966-71, IN SELECTED WELLS IN THE NORTH-CENTRAL PART OF THE PLATEAU UPLANDS PROVINCE.



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