Form 9-014

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Albuquerque



# MEMORANDUM ON GROUND-WATER CONDITIONS AND SUGGESTIONS FOR TEST DRILLING IN THE LOGAN HEIGHTS AREA, EL PASO, TEXAS

By

Edward R. Leggat



Prepared for
U. S. Army, Corps of Engineers

Open-file report

1960

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CONTENTS



ILLUSTRATIONS



TABLE

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## INTRODUCTION

In response to a request from the U. S. Army, Corps of Engineers, Albuquerque District, a brief investigation was made in March 1957 of the ground-water resources of the Logan Heights area, El Paso, Texas. The purpose of the investigation was to collect and evaluate pertinent available data on existing wells in the vicinity of Logan Heights and to determine the most promising locations for the installation of two wells capable of yielding a minimum of 800 gpm (gallons per minute) each. Most of the data used in the investigation have been published in Water-Supply Paper 1426 of the Geological Survey (Knowles and Kennedy, 1958).

The Logan Heights area is northeast of the main cantonment of Fort Bliss (fig. 1). It is bounded on the east by the Southern Pacific

Figure 1.--Location map showing Logan Heights and vicinity.

Railroad and on the west by the Franklin Mountains. The north line runs approximately through the intersection of Sheridan Road and U. S. Highway 54, and the south line is about half a mile north of Fred Wilson Road.

At the present time, Fort Bliss purchases a minimum of 500,000 gpd (gallons per day) from the city of El Paso for the water supply of Logan Heights. However, the Army is considering furnishing its installations in the Logan Heights area with water from its own wells rather than continuing to draw from the city supply.

During preliminary talks with officials at Fort Bliss, Mr. Baker, assistant Post Engineer, stated that the proposed wells preferably should be in the Logan Heights area. However, if conditions are unfavorable in the Logan Heights area, the wells should be installed near existing pump stations, distribution mains, or on U. S. Government property that is contiguous to Logan Heights. Mr. Baker further stated that if circumstances prevent the installation of wells in accordance with the foregoing conditions, land probably could be purchased or right-of-way obtained elsewhere.

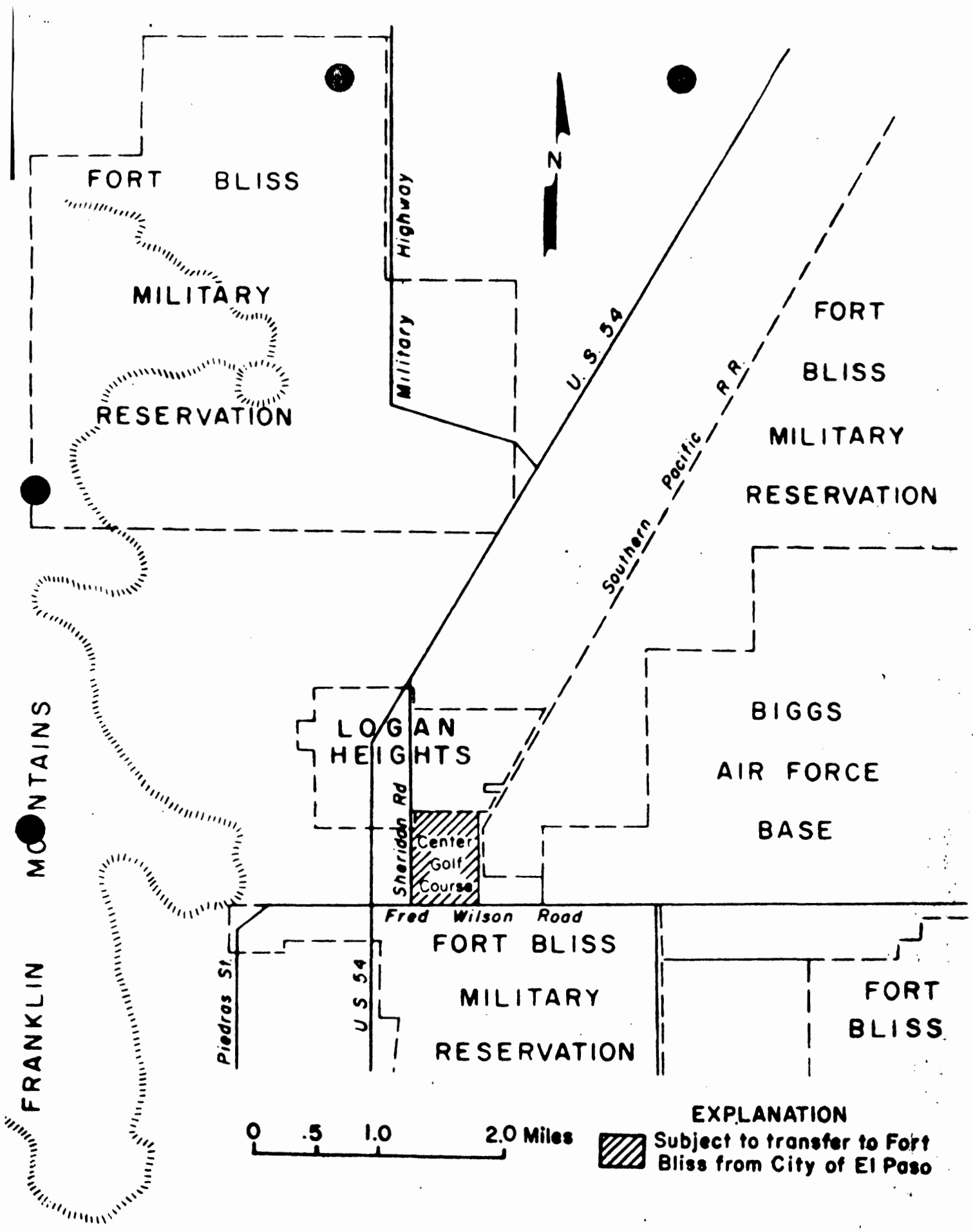


FIGURE 1.- Location map showing Logan Heights and vicinity. 2a

## GENERAL GEOLOGY AND OCCURRENCE OF GROUND WATER

Logan Heights is near the western edge of the Hueco Bolson. It is underlain by layers of sand, gravel, clay, and caliche. The individual layers, which range in thickness from 0 to possibly 100 feet or more, are lenticular and cannot be correlated over great distances. In general the sands and gravels are thickest and coarsest near the Franklin Mountains and become progressively thinner and finer eastward. According to well records, however, clay was predominant in several test wells drilled relatively close to the mountains. At well B in the vicinity of the Center Golf Course and at well A on the west side of Fort Bliss (fig. 2), insufficient water was encountered for public

Figure 2.--Saturated thickness of fresh water-bearing materials, Logan Heights and vicinity.

supply. The wells were drilled to depths of 1,800 and 800 feet, respectively. The electric log of well 37 (fig. 2), drilled near the Franklin Mountains, indicates only 70 feet of water-bearing sand in a total section of 800 feet of fresh water-bearing materials; whereas in well 33 more than 450 feet of sand and gravel was encountered in about 1,000 feet of fresh water-bearing materials. This emphasizes the fact that even in the area relatively close to the Franklin Mountains the percentage of sand varies considerably from place to place.

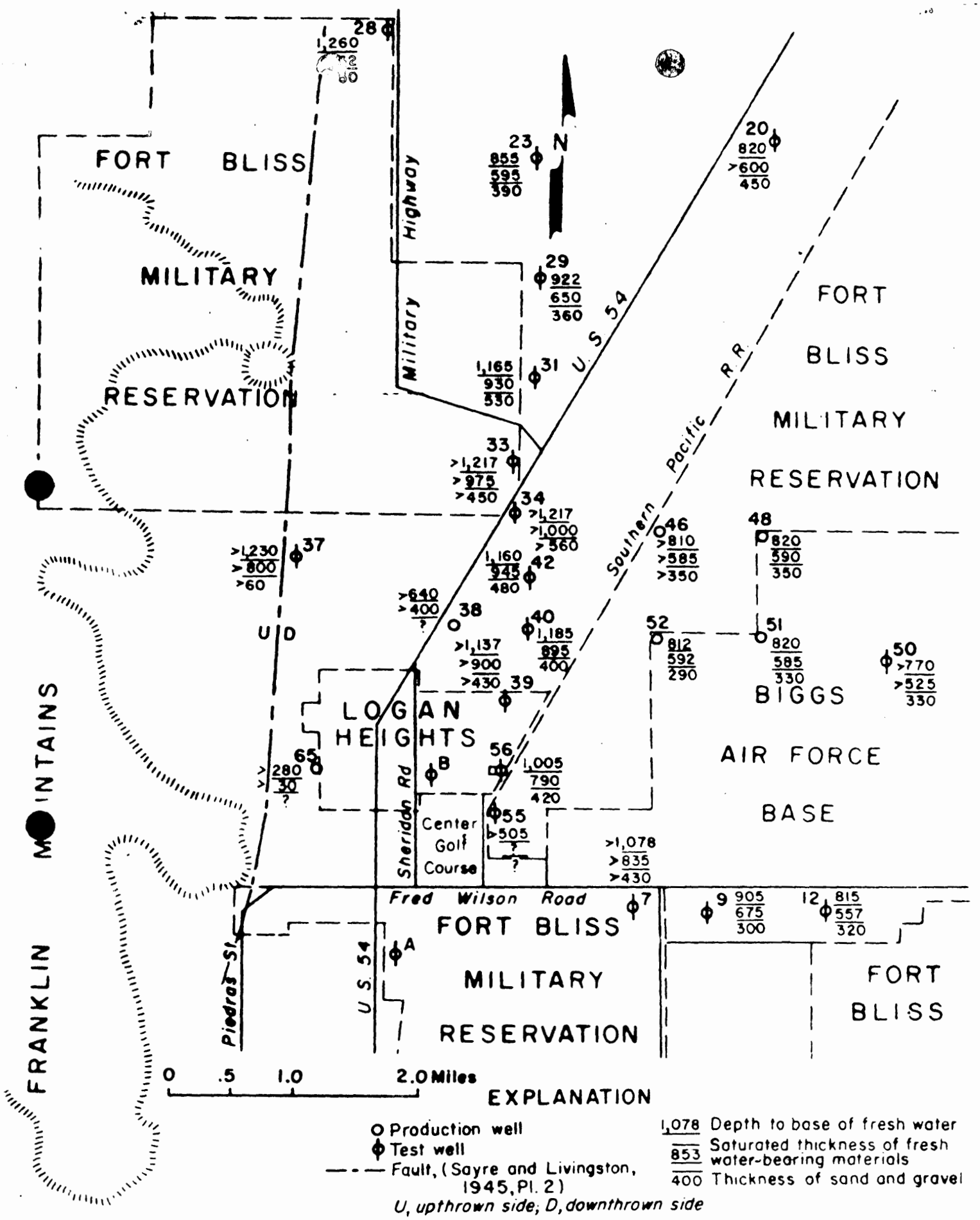


FIGURE 2.- Saturated thickness of fresh water-bearing materials, Logan Heights and vicinity.

Water containing more than 250 ppm (parts per million) of chloride underlies the water of better quality throughout most of the Hueco Bolson. Figure 2 shows the depth to which water of good quality extends in all wells for which data are available. These data indicate that the water of good quality occurs in a trough, the axis of which trends roughly slightly west of north from well 7 through well 34 toward well 28. In the Logan Heights area westward from Sheridan Road, data are not available to determine the depth to the base of the water of good quality. It is probable, however, that the base of the water of good quality slopes rapidly upward from the trough toward the mountains.

Of great importance in choosing sites for test wells is a consideration of the amount of sand and gravel in the fresh water-bearing materials. Figure 2 shows the aggregate thickness of sands and gravels at sites where data are available. The data indicate that the belt of greatest thickness approximately coincides with the trough of fresh water.

On the basis of available data, it does not appear that sufficient ground water can be developed in the Logan Heights area west of U. S. Highway 54. It is probable, however, that sufficient ground water can be obtained east of Sheridan Road at or near presently available pipeline facilities. In the intervening area between U. S. Highway 54 and Sheridan Road possibly one well capable of yielding as much as 800 gpm could be obtained. This is based on the data obtained from wells B, 37, and 39.

Data on several selected wells in the vicinity of Logan Heights are given in table 1.

Table 1.--Records of selected wells in the vicinity of Logan Heights, El Paso, Texas.

| No. | Owner | Year completed | Altitude of land surface datum above sea level (feet) | Depth (feet) | Depth to water: Feet below land surface datum | Depth to water: Date of measurement | Yield: Rate (gpm) | Yield: Date of measurement | Drawdown: Amount (feet) | Drawdown: Duration of test (hours) | Use of water 1/ | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V-7 | City of El Paso | 1938 | 3,899.8 | 1,078 | 221.8<br>238.5 | May 4, 1938<br>Mar. 2, 1954 | 1,130<br>1,120 | Mar. 3, 1954<br>1956 | 46 | 1 | P | Electric log and drill-stem tests indicate fresh-water sands extend to bottom of well. |
| V-9 | do. | 1938 | 3,913.2 | 905 | 232.0<br>227.6 | Oct. 14, 1938<br>Apr. 3, 1939 | 1,720<br>818 | 1938<br>1956 | 30 | 13 | P | Electric log of test well drilled to 1,211 ft. indicate fresh-water sands extend to 905 feet. |
| V-12 | do. | 1939 | 3,928.3 | 1,117 | 244.1<br>257.9<br>258.4 | July 16, 1936<br>Apr. 19, 1954<br>Jan. 23, 1957 | | | | | N | Electric log indicates fresh-water sands extend to 815 ft. Water levels measured in V-11. |
| R-20 | do. | 1940 | 3,911.6 | 1,007 | 210.8 | Dec. 12, 1940 | | | | | N | Drill-stem tests indicate fresh-water sands extend at least to 820 ft. |
| R-23 | do. | 1953 | 3,972.0 | 1,177 | 288.0 | Mar. 25, 1953 | 1,500<br>1,288 | Mar. 24, 1953<br>1956 | 56 | 24 | P | Electric log of test well drilled at this site in 1939 to 1,177 ft. indicates fresh-water sands extend to 855 ft. |
| R-28 | U.S.G.S. | 1953 | 4,120.1 | 1,635 | 423.1<br>428.0 | Jan. 7, 1954<br>Jan. 15, 1957 | | | | | N | Electric log and drill-stem tests indicate fresh-water sands extend to 1,260 ft. |
| R-29 | City of El Paso | 1952 | 3,942.3 | 832 | 258.5<br>266.3 | Jan. 15, 1953<br>Feb. 11, 1954 | 1,337<br>1,311 | Feb. 12, 1954<br>1956 | 55 | 24 | P | Electric log of test well drilled at this site in 1939 to 1,206 ft. indicates fresh-water sands extend to 922 ft. |
| R-31 | do. | 1952 | 3,907.9 | 790 | 233.6 | Jan. 15, 1953 | 1,515<br>1,258 | Nov. 9, 1952<br>1956 | 47 | 24 | P | Electric log of test well drilled at this site in 1939 to 1,357 ft. indicates fresh-water sands extend to 1,165 ft. |
| R-33 | do. | 1939 | 3,889.9 | 1,217 | | - | | | | | N | Electric log indicates fresh-water sands extend to bottom of well. |
| R-34 | do. | 1952 | 3,884.9 | 814 | 208.4<br>211.0 | Jan. 15, 1953<br>Feb. 9, 1954 | 1,396<br>1,255 | Feb. 10, 1954<br>1956 | 71 | 24 | P | Electric log of test well drilled at this location in 1939 to 1,217 ft. indicates fresh-water sands extend to bottom of test well. |
| R-37 | U.S.G.S. | 1953 | 4,094.0 | 1,220 | 416.6 | Sept. 4, 1953 | | | | | N | Electric log and drill-stem tests indicate fresh-water sands extend to bottom of well, but only 70 ft. of water-bearing sand encountered. |
| R-38 | Restlawn Cemetery | 1910 | | 640 | 213.3<br>211.7 | Aug. 29, 1937<br>Nov. 8, 1938 | | | | | | |
| R-39 | City of El Paso | 1939 | 3,875.4 | 1,137 | 198.3 | Apr. 8, 1939 | | | | | N | Electric log indicates fresh-water sands extend to bottom of well. |
| R-40 | do. | 1941 | 3,879.1 | 806 | 197.4<br>210.0<br>220.8 | June 25, 1941<br>Jan. 7, 1954<br>Jan. 23, 1957 | 1,585 | 1941 | 51 | 24 | P | Electric log of test well drilled at this location in 1939 to 1,237 ft. indicates fresh-water sands extend to 1,085 ft. |
| R-42 | do. | 1939 | 3,882.3 | 1,257 | 192.7<br>209.8<br>215.5 | June 20, 1939<br>Jan. 7, 1954<br>Jan. 23, 1957 | | | | | N | Electric log indicates fresh-water sands extend to 1,160 ft. |

4a

Table 1.--Records of selected wells in the vicinity of Logan Heights, El Paso, Texas.--Continued

| No. | Owner | Year completed | Altitude of land surface datum above sea level (feet) | Depth (feet) | Depth to water: Feet below land surface datum | Depth to water: Date of measurement | Yield: Rate (gpm) | Yield: Date of measurement | Drawdown: Amount (feet) | Drawdown: Duration of test (hours) | Use of water 1/ | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-46 | U. S. Army | 1953 | | 820 | 220.4<br>235.2 | Mar. 22, 1954<br>Jan. 13, 1957 | 1,200 | 1953 | 14 | | P | |
| R-48 | do. | 1953 | | 810 | 229.0<br>217.7 | Mar. 22, 1954<br>Jan. 26, 1956 | 1,200 | 1953 | 40 | | P | Pump: 8-stage, 12-inch bowls set at 360 ft. Zinc-coated shutter screen, ¼ x 15/16-inch openings set opposite sand from 235-781 ft. |
| R-50 | City of El Paso | 1941 | 3,932.6 | 950 | 242.3<br>243.7 | Dec. 13, 1940<br>Oct. 26, 1942 | | | | | N | Drill-stem test indicate fresh-water sands extend to at least 770 ft. |
| R-51 | U. S. Army | 1953 | | 820 | 229.8<br>236.3 | Mar. 22. 1954<br>Jan. 26. 1956 | 1,200 | 1953 | 33 | | P | Fresh-water sand extend to at least 790 ft. |
| R-52 | do. | 1953 | | 812 | 220.0 | Mar. 22, 1954 | 1,200 | 1953 | 47 | | P | Fresh-water sands extend to at least 756 ft. |
| R-54 | City of El Paso | 1937 | 3,869.9 | 698 | | | | | | | N | Estimated only 37 ft. of water-bearing sand encountered. |
| R-55 | do. | 1937 | 3,869.0 | 830 | 204.0 | July, 1937 | | | | | N | Drill-stem tests indicate fresh-water sands extend to at least 505 ft. |
| R-56 | do. | 1941 | 3,873.6 | 909 | 207.1<br>211.0<br>217.7 | June 21, 1941<br>Jan. 7, 1954<br>Jan. 17, 1957 | | | | | P | Electric log of test well drilled at this location in 1939 to 1,867 ft. indicates fresh-water sand extends to 1,005 ft. |
| R-65 | Baptist Spanish Publishing House | 1939 | 4,150 | 280 | 252.1 | May 25, 1955 | | | | | Ind | |
| A | City of El Paso | | | 800 | | | | | | | N | Mr. E. Nevins, driller, reported 0-350 feet sand and gravel, 350-800 feet clay. Insufficient water for public-supply well. |
| B | do. | | | 1,800 | | | | | | | N | Mr. E. Nevins, driller, reported sediments predominantly clay. Insufficient water for public-supply well. |

1/ Ind, industrial; N, none; P, public supply.

## SUGGESTIONS FOR TEST DRILLING

Suggested locations for five test wells are shown in figure 3.

Figure 3.--Suggested test-well locations in Logan Heights and vicinity.

The locations are numbered and discussed below in the recommended order of drilling which is based in part on general accessibility and in part on hydrologic and geologic factors.

It is suggested that drilling should be with a hydraulic rotary drill and that a pilot hole, approximately 8 inches in diameter, should be drilled as the initial phase of drilling at a particular site. Thus, an electric log may be obtained which will permit an accurate interpretation of the material penetrated and its water-bearing characteristics. The depth of pilot holes should be about 800 to 1,000 feet. If the pilot hole is developed as a well, the electric log will permit a more accurate placement of screens than would be possible without it. Further, a small-diameter pilot hole will permit the collection of a drill-stem sample of the water encountered at the bottom of the hole. Thus, it can be determined if drilling has reached below the fresh water. If the data obtained indicate that a successful well can be developed at the site, the pilot hole could be reamed to the desired diameter and depth for completion as a production well.

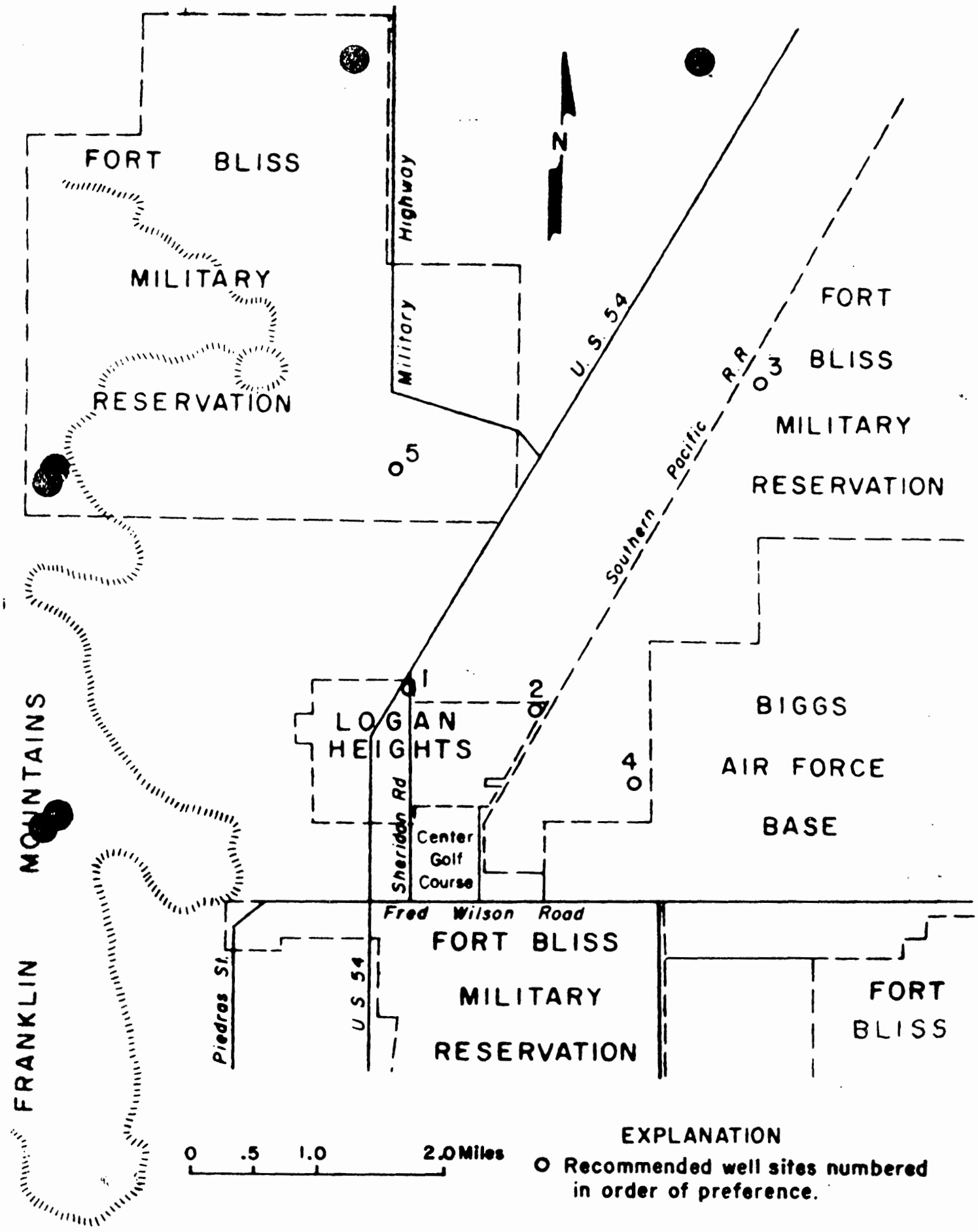


FIGURE 3.- Suggested test well locations in Logan Heights and vicinity.



Logan Heights

## Site 1

Location: NW¼ sec. 12, Blk. 81, at the intersection of Sheridan Road and U. S. Highway 54. This well would be in the Logan Heights area about 2,000 feet from an existing reservoir and pump station and about 500 feet from a 12-inch concrete-lined pipe.

Since 1949 the decline in the water table in this area has been 1 foot per year or less.

## Site 2

Location: SE cor. SW¼NW¼ sec. 11, Blk. 81. A well at this location would be about 3,000 feet from two producing wells and 6,000 feet from a well at site 1. Interference effects from the two nearest wells would be relatively small----probably less than 5 feet after 1 year of continuous pumping at the rate of 1,000 gpm.

During the period 1949-57 inclusive, the water table in the vicinity of site 2 declined about 9 feet, or an average of 1 foot per year.

## Site 3

Location: NE cor. sec. 6, Blk. 80. This site is 1 mile north of the Fort Bliss North Well Field and pump station. Because of the distance of the site from the Franklin Mountains, fine-grained sand may be encountered and special precautions may be required to insure the use of proper screens and gravel size to minimize sanding problems.

During the period 1949-57 inclusive, the water table in this area declined about 5 feet or about 0.5 foot per year.

## Site 4

Location: SE cor. magazine area, sec. 18, Blk. 81. A well at this location would be at least 1 mile from the nearest producing well and on a 20-inch concrete-lined steel pipe, which carries water from the Fort Bliss North Well Field to the main pumping station.

During the period 1949-57 inclusive, the water table in this area declined about 10 to 15 feet or an average decline of 1.5 to 2 feet per year. This average annual net decline is somewhat greater than at the other sites because of the proximity to an area of concentrated withdrawals. Biggs Air Force Base has indicated interest in locating a well about half a mile east of this site.

## Site 5

Location: WS sec. 2, Blk. 81, Castner Range. This location is the least satisfactory because it is separated from the Logan Heights area as well as from the main part of Fort Bliss by city and private property. Data indicated, however, that the well would be in an area where large yields may be expected.

During the period 1949-57 inclusive, the water table declined an average of about 1 foot per year in this area.

The estimated depth to water, saturated thickness of fresh water-bearing deposits, aggregate thickness of saturated fresh water-bearing sand and gravel, and depth to the base of the fresh water at each of the sites are given in the following table.

| Site | Estimated depth to water (feet below land surface) | Estimated thickness of fresh water-bearing deposits (feet) | Estimated aggregate thickness of saturated fresh water-bearing sand and gravel (feet) | Estimated depth to base of fresh water (feet below land surface) |
|---|---|---|---|---|
| 1 | 240 | 900 | 400 | 1,100 |
| 2 | 200 | 900 | 450 | 1,100 |
| 3 | 220 | 800 | 470 | 1,000 |
| 4 | 220 | 800 | 420 | 1,000 |
| 5 | 280 | 1,000 | 500 | 1,300 |

It should be emphasized that the figures in the above table are estimates based on a limited amount of control. However, it is believed that they may have a value for planning purposes, and they are therefore included here. It is possible that bedrock might be encountered at a depth of about 800 feet at site 1 (Sayre and Livingston, 1945). If so, of course, the above figures for site 1 would not be accurate. In any event, drilling should be terminated if bedrock or saline water is encountered.

## CONCLUSIONS

The results of the investigation indicate that wells capable of yielding a minimum of 800 gpm each probably can be constructed at the recommended locations. Although there is less certainty concerning the development of a well at Site 1 than at the other sites, it is suggested that this location be tested because of its location with respect to need for water.

The relatively large annual net decline of the water table in the vicinity of Site 4 should not be considered in itself as a deterrent to the development of a well at this site. Appreciable trouble has been experienced with sand entering some wells in the area. Considerable care will need to be exercised in the selection of gravel and screen in the completed wells to minimize sanding problems, especially at sites 3 and 4. The proper size of screen openings and gravel depends upon material encountered at the particular tests.

Site 5 should be considered as a last resort because of more than 10,000 feet of pipeline would be required to carry the water to Logan Heights and furthermore, intervening city property would have to be crossed. However, in the event that future plans provide for considerable expansion of base facilities and personnel, attention should be directed to obtaining the base water supply from wells along the Military Highway. Wells in this area probably will yield large quantities of water. Moreover, because it is an area of recharge and the thickness of fresh water is greater than to the east, the possibility of lateral encroachment of salt water is considered remote.

## REFERENCES

Knowles, D. B., and Kennedy, R. A., 1958, Ground-water resources of the Hueco Bolson northeast of El Paso, Texas: U. S. Geol. Survey Water-Supply Paper 1426.

Sayre, A. N., and Livingston, Penn, 1945, Ground-water resources of the El Paso area, Texas: U. S. Geol. Survey Water-Supply Paper 919.