

EDWARDS UNDERGROUND WATER DISTRICT

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QUANTITY AND QUALITY OF LOW FLOW IN THE HONDO CREEK BASIN, TEXAS

March 27-28, 1968

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**Prepared by the U. S. Geological Survey in cooperation
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CONTENTS

| | Page |
|--------------------------------------|------|
| Abstract | 1 |
| Purpose and scope of the study | 1 |
| Description of the basin | 2 |
| Conditions of flow | 2 |
| Gains and losses in flow | 4 |
| Chemical quality of the water | 4 |
| References cited | 9 |

ILLUSTRATIONS

| | Page |
|--|------|
| Figure 1. Map showing location of discharge-measurement sites, discharge, chemical-quality sampling sites, and chemical quality of the water, Hondo and Verde Creeks | 3 |
| 2. Graphs showing discharge for April 5-7, 1958, and discharge and dissolved solids for March 27-28, 1968, Hondo and Verde Creeks | 5 |

TABLES

| | |
|---|---|
| Table 1. Discharge measurements, Hondo and Verde Creeks | 6 |
| 2. Chemical analyses of water in Hondo and Verde Creeks | 8 |

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ABSTRACT

A determination of the gains and losses in a 29.5-mile reach of Hondo Creek near Hondo, Texas, was made on March 27-28, 1968. A net loss of 106 cfs (cubic feet per second) occurred in the reach (site 2 to site 8) that contributes recharge to the Edwards and associated limestones. These losses were greater than those that occurred during the previous low-flow investigation in April 1958. The quality of water showed a general improvement downstream except for sites on and downstream from Verde Creek.

PURPOSE AND SCOPE OF THE STUDY

This investigation was made to determine the changes in quantity and quality of low flow in the reach of Hondo Creek that contributes recharge to the Edwards and associated limestones.

Discharge measurements were made and water samples were collected at 12 sites on Hondo Creek and at one site on Verde Creek. These sites are generally the same as the ones used during a previous low-flow study in April 1958 (Texas Board of Water Engineers, 1960).

DESCRIPTION OF THE BASIN

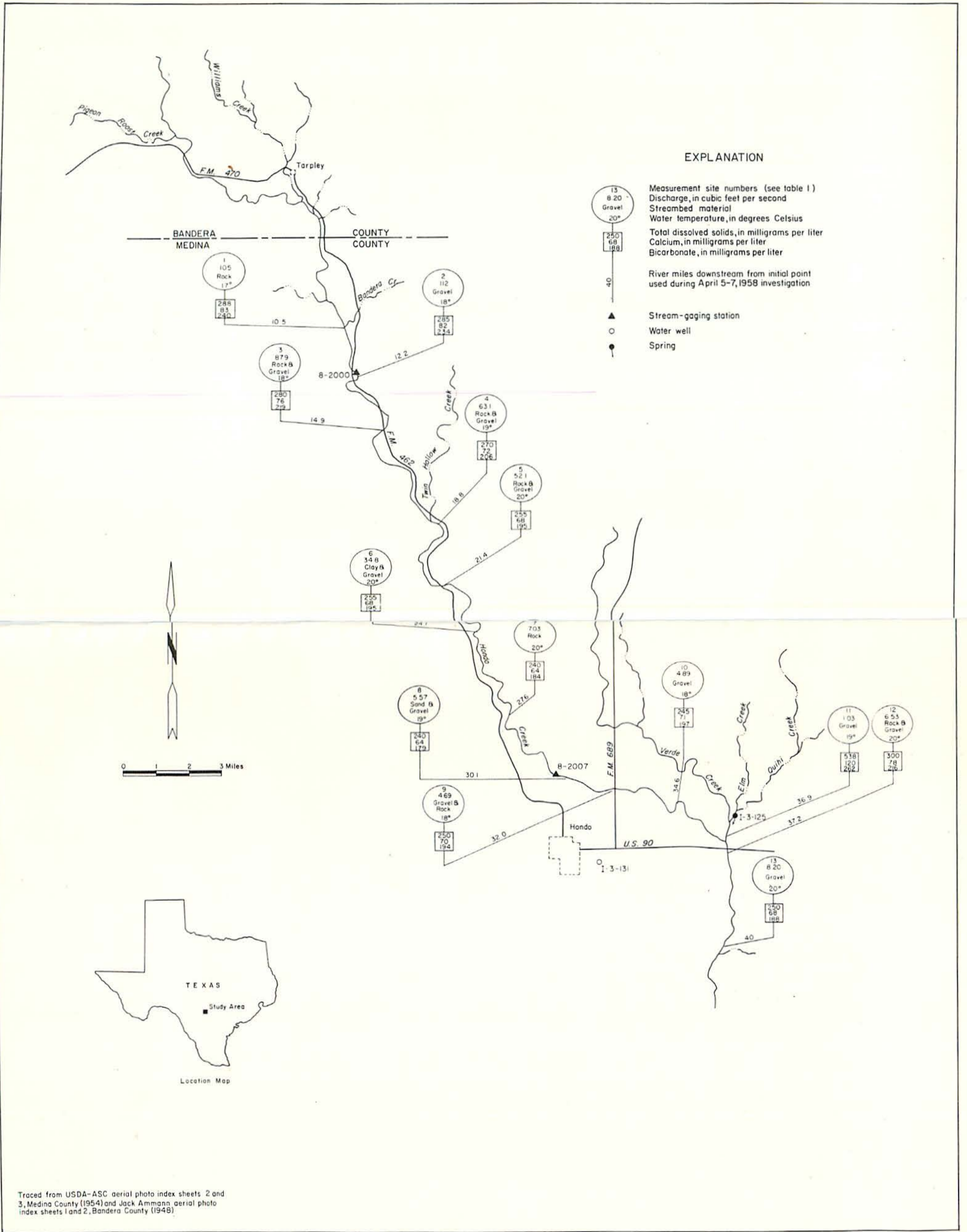
Hondo Creek rises near the center of Bandera County and flows generally south through Medina, Frio, and LaSalle Counties to the Frio River. The 29.5-mile reach investigated during this study (fig. 1) extends from Bandera Creek near the Bandera-Medina County line to near Hondo in central Medina County.

Altitudes range from about 1,170 feet above mean sea level in the upper end of the study area to about 750 feet above mean sea level in the lower end. The drainage area of Hondo Creek above site 13 (fig. 1) is about 400 square miles.

In the reach between site 1 and site 13, Hondo Creek flows over the Edwards and associated limestones of Cretaceous age. Quaternary alluvium, composed of clay, silt, sand, and gravel, forms highly permeable terrace deposits at some places along the stream. The area of recharge to the Edwards and associated limestones is between sites 2 and 8.

CONDITIONS OF FLOW

During this study, conditions were generally favorable for determining gains and losses in streamflow. No appreciable rainfall had occurred for 2 weeks prior to the investigation, and Verde Creek was the only flowing tributary. Streamflow was sustained almost entirely by ground-water effluent, and evapotranspiration was low. Hondo Creek was in a uniform and normal recession which became no-flow at site 8 a few days after the study.



Traced from USDA-ASC aerial photo index sheets 2 and 3, Medina County (1954) and Jack Ammann aerial photo index sheets 1 and 2, Bandera County (1948).

Figure 1—Discharge-measurement sites, discharge, chemical-quality, sampling sites, and chemical quality of the water, Hondo and Verde Creeks.

GAINS AND LOSSES IN FLOW

Upstream from site 2 (fig. 1), Hondo Creek generally gains in flow from ground-water seepage and springflow. From site 2 to site 8, there is a net loss as the Creek crosses an area of recharge to the Edwards and associated limestones. From site 9 to site 13 there is a small net gain. Discharge measurements are given in table 1.

The effluent ground water upstream from site 2 is derived mainly from Cretaceous rocks of the Edwards Plateau. Downstream from site 8, the effluent is probably derived from the Quaternary alluvium.

The ground-water effluent varies according to the amount of water in storage. A comparison of the gains and losses during the periods April 5-7, 1958, and March 27-28, 1968, is shown on figure 2.

CHEMICAL QUALITY OF THE WATER

The quality of the water in Hondo Creek during the study period (table 2) showed general improvement downstream from site 1 to site 10. Dissolved solids, chloride, and nitrate concentrations are increased by tributary inflow from Verde Creek. Tributary inflow is probably derived from the Quaternary alluvium as well 1-3-131 and spring 1-3-125 (fig. 1, table 2) have similar water quality (Holt, 1959).

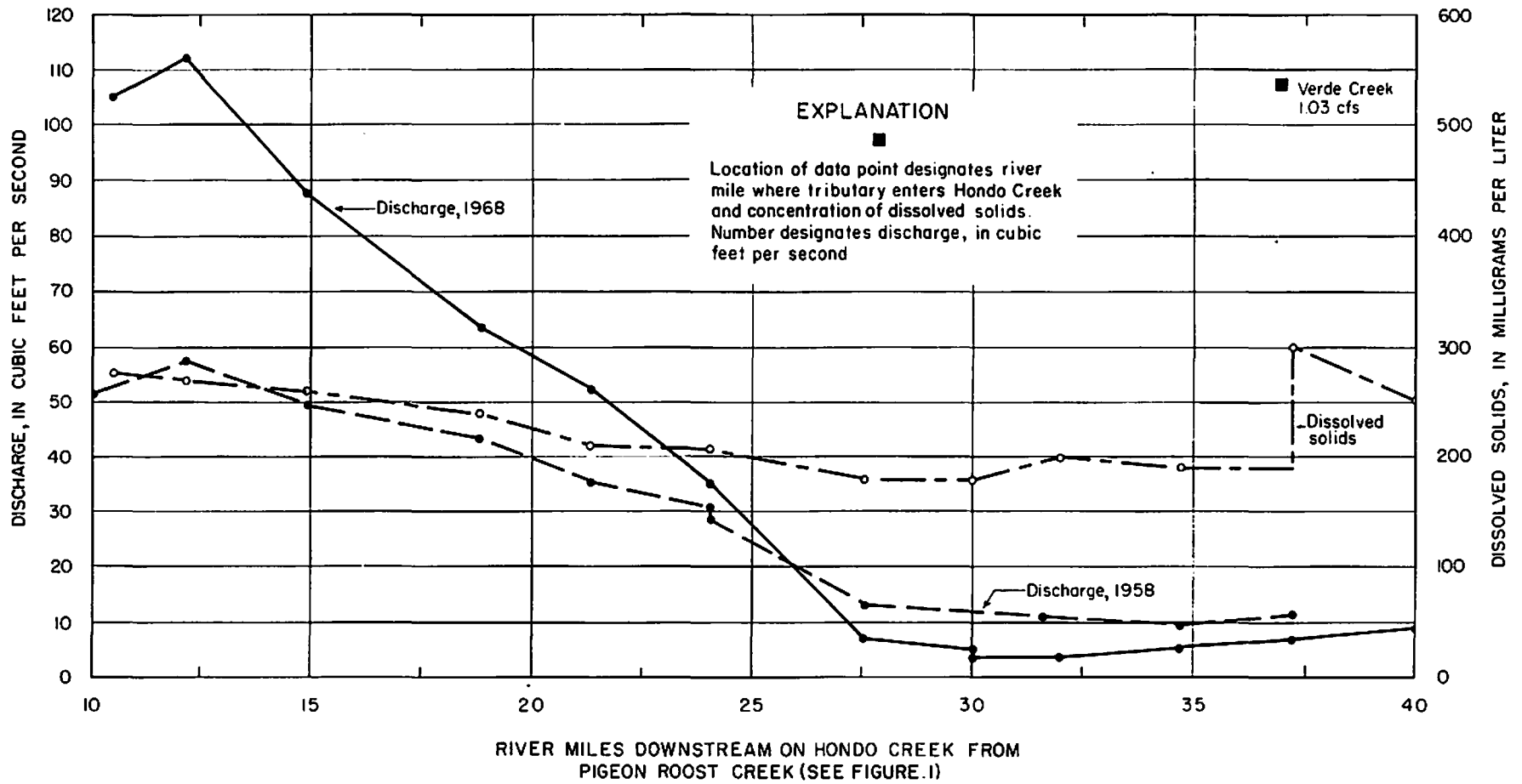


Figure 2—Discharge for April 5-7, 1958, and discharge and dissolved solids for March 27-28, 1968, Hondo and Verde Creeks.

Table 1.--Discharge measurements, Hondo Creek and Verde Creek

| Site No. | Date 1968 | Stream | Location | River miles 1/ | Water temp. | | Discharge in cfs | | Streambed material |
|----------|-----------|-------------|--|-------------------|-------------|----|------------------|-------------|----------------------|
| | | | | | °C | °F | Main stream | Tribu- tary | |
| Mar. | | | | | | | | | |
| 1 | 27 | Hondo Creek | 50 feet downstream from Bandera Creek. | 10.5 | 17 | 63 | 105 | - | Limestone |
| 2 | 27 | Hondo Creek | Lat 29°34', long 99°15', at stream-gaging station Hondo Creek near Tarpley (8-2000). | 12.2 | 18 | 64 | 112 | - | Gravel |
| 2 | 28 | Hondo Creek | Lat 29°34', long 99°15', at stream-gaging station Hondo Creek near Tarpley (8-2000). | 12.2 | 18 | 65 | 107 | - | Gravel |
| 3 | 27 | Hondo Creek | Lat 29°32', long 99°14', 1,500 feet downstream from Farm Road 462 crossing. | 14.9 | 18 | 64 | 87.9 | - | Limestone and gravel |
| 4 | 27 | Hondo Creek | Lat 29°30', long 99°13', 500 feet downstream from Twin Hollow Creek. | 18.8 | 19 | 66 | 63.1 | - | Limestone and gravel |
| 5 | 27 | Hondo Creek | Lat 29°28', long 99°13', 400 feet upstream from Farm Road 462 crossing. | 21.4 | 20 | 68 | 52.1 | - | Limestone and gravel |
| 6 | 27 | Hondo Creek | Lat 29°27', long 99°11', at discontinued stream- gaging station Hondo Creek near Hondo (8-2005). | 24.1 | 20 | 68 | 34.8 | - | Clay and gravel |
| 7 | 27 | Hondo Creek | Lat 29°24', long 99°10', 50 feet downstream from private gravel ranch road. | 27.6 | 20 | 68 | 7.03 | - | Limestone |
| 8 | 27 | Hondo Creek | Lat 29°23'16", long 99°08'50", 2,000 feet downstream from stream-gaging station Hondo Creek at King Waterhole near Hondo (8-2007). | 30.1 | 19 | 66 | 5.57 | - | Sand and gravel |

Table 1.--Discharge measurements, Hondo Creek and Verde Creek.--Continued

| Site No. | Date 1968 | Stream | Location | River miles 1/ | Water temp. | | Discharge in cfs | | Streambed material |
|----------|------------|-------------|--|-------------------|-------------|----|------------------|-------------|-----------------------|
| | | | | | °C | °F | Main stream | Tribu- tary | |
| 8 | Mar. 28 | Hondo Creek | Lat 29°23'16", long 99°08'50", 2,000 feet downstream from stream-gaging station Hondo Creek at King Waterhole near Hondo (8-2007). | 30.1 | 18 | 65 | 4.49 | - | Sand and gravel |
| 9 | 28 | Hondo Creek | Lat 29°23', long 99°07', 0.2 mile downstream from Farm Road 689. | 32.0 | 18 | 64 | 4.69 | - | Limestone and gravel |
| 10 | 28 | Hondo Creek | Lat 29°22', long 99°05', 0.2 mile upstream from county road. | 34.6 | 18 | 65 | 4.89 | - | Gravel |
| 11 | 28 | Verde Creek | Lat 29°22', long 99°03', 500 feet downstream from crossing and 0.5 mile upstream from mouth. | <u>2/</u> 36.9 | 19 | 66 | - | 1.03 | Gravel |
| 12 | 28 | Hondo Creek | Lat 29°21', long 99°03', 75 feet downstream from U.S. Highway 90. | 37.2 | 20 | 68 | 6.53 | - | Limestone and gravel. |
| 13 | 28 | Hondo Creek | Lat 29°19', long 99°03', 2.8 miles downstream from U.S. Highway 90. | 40.0 | 20 | 68 | 8.20 | - | Gravel |

1/ River miles taken from April 5-7, 1958, Base-Flow Study, Texas Board of Water Engineers, 1960.

2/ River miles on Hondo Creek at mouth of tributary.

Table 2.--Chemical analyses of water in the Hondo Creek watershed

(Results in milligrams per liter except as indicated)

| Site number | Source of sample | Date | Discharge (cfs) | Silica (SiO ₂) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate (HCO ₃) | Carbonate (CO ₃) | Sulfate (SO ₄) | Chloride (Cl) | Fluoride (F) | Nitrate (NO ₃) | Boron (B) | Dissolved solids (calculated) | Hardness as CaCO ₃ | | Sodium adsorption ratio | Specific conductance (micro-mhos at 25°C) | pH |
|-------------|------------------|---------------|-----------------|----------------------------|-----------|--------------|----------------|---------------|---------------|---------------------------------|------------------------------|----------------------------|---------------|--------------|----------------------------|-----------|-------------------------------|-------------------------------|---------------|-------------------------|---|-----|
| | | | | | | | | | | | | | | | | | | Calcium, Magnesium | Non-carbonate | | | |
| 1 | Hondo Creek | Mar. 27, 1968 | 105 | 9.1 | | 83 | 9.7 | 7.8 | 0.9 | 240 | | 29 | 17 | 0.2 | 13 | | 288 | 247 | 50 | 0.2 | 496 | 7.5 |
| 2 | do | do | 112 | -- | | 82 | 10 | -- | -- | 234 | | -- | -- | -- | -- | | 285 | 246 | 54 | -- | 495 | 7.4 |
| 3 | do | do | 87.9 | -- | | 76 | 10 | -- | -- | 219 | | -- | -- | -- | -- | | 280 | 231 | 51 | -- | 478 | 7.5 |
| 4 | do | do | 63.1 | -- | | 72 | 10 | -- | -- | 206 | | -- | -- | -- | -- | | 270 | 221 | 52 | -- | 461 | 7.5 |
| 5 | do | do | 52.1 | -- | | 68 | 10 | -- | -- | 195 | | -- | -- | -- | -- | | 255 | 211 | 51 | -- | 438 | 7.5 |
| 6 | do | do | 34.8 | 8.9 | | 68 | 10 | 8.1 | 1.0 | 195 | | 31 | 17 | .2 | 14 | | 254 | 211 | 51 | .2 | 436 | 7.8 |
| 7 | do | do | 7.03 | -- | | 64 | 9.8 | -- | -- | 184 | | -- | -- | -- | -- | | 240 | 200 | 49 | -- | 416 | 7.8 |
| 8 | do | do | 5.57 | -- | | 64 | 9.1 | -- | -- | 179 | | -- | -- | -- | -- | | 240 | 197 | 50 | -- | 419 | 7.7 |
| 9 | do | Mar. 28, 1968 | 4.69 | -- | | 70 | 7.7 | -- | -- | 194 | | -- | -- | -- | -- | | 250 | 206 | 47 | -- | 433 | 7.7 |
| 10 | do | do | 4.89 | -- | | 71 | 7.2 | -- | -- | 197 | | -- | -- | -- | -- | | 245 | 207 | 45 | -- | 425 | 7.7 |
| 11 | Verde Creek | do | 1.03 | 10 | | 120 | 7.8 | 62 | 2.8 | 262 | | 38 | 126 | .2 | 42 | | 538 | 332 | 117 | 1.5 | 953 | 7.4 |
| 12 | Hondo Creek | do | 6.53 | 8.4 | | 78 | 7.4 | 19 | 1.8 | 216 | | 27 | 34 | .2 | 18 | | 300 | 225 | 48 | .6 | 524 | 7.7 |
| 13 | do | do | 8.20 | 5.3 | | 68 | 7.0 | 13 | 1.8 | 188 | | 26 | 24 | .2 | 13 | | 250 | 198 | 44 | .4 | 444 | 7.7 |
| | Spring I-3-125 | Jan. 14, 1952 | -- | 15 | | 106 | 8.3 | <u>a</u> /47 | -- | 217 | | 22 | 124 | -- | 36 | | 465 | 298 | 120 | 1.2 | 895 | 7.6 |
| | Well I-3-131 | Jan. 26, 1951 | -- | 31 | | 172 | 21 | <u>a</u> /248 | -- | 356 | | 44 | 288 | -- | 387 | | 1370 | 516 | 224 | 4.7 | 2180 | 7.0 |

a/ Sodium and potassium (Na + K)

REFERENCES CITED

Holt, C. L. R., Jr., 1959, Geology and ground-water resources of Medina County, Texas: U.S. Geol. Survey Water-Supply Paper 1422, 213 p.

Texas Board of Water Engineers, 1960, Channel gain and loss investigations, Texas streams, 1918-1958: Texas Board Water Engineers Bull. 5807-D, p. 153-156.