WATER-RESOURCES APPRAISAL OF THE CAMP SWIFT LIGNITE AREA, CENTRAL TEXAS

By J. L. Gaylord, R. M. Slade, Jr., L. M. Ruiz,
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CONVERSION FACTORS

The inch-pound units of measurements used in this report may be converted to metric units by using the following conversion factors:

Multiply	By	To obtain
inch	25.40	millimeter
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
acre-foot	1,233	cubic meter
	0.001233	cubic hectometer
cubic foot per second	0.02832	cubic meter per second
gallons per minute	0.06308	liter per second
million gallons per day	0.04381	cubic meter per second
ton per day	0.9072	megagram per day
million short tons	0.9072	teragram
foot squared per day	0.09290	meter squared per day
foot per mile	0.189	meter per kilometer
foot per year	0.3048	meter per year
gallon per minute per foot	0.2070	liter per second per meter
acre-foot per square mile per year	476.1	cubic meter per square kilometer per year

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ABSTRACT

The Camp Swift lignite area was studied to describe the hydrogeology and to provide baseline data of the ground-water and surface-water resources that could be affected by the strip mining of lignite. The investigation was centered on the 18-square mile Camp Swift Military Reservation where a reported 80 to 100 million short tons of commercially mineable lignite occurs within 200 feet of the land surface.

Monthly ground-water levels from a network of 22 wells showed that water levels in wells in the Hooper, Simsboro, and Calvert Bluff Formations of the Wilcox Group had slight and generally insignificant water-level changes from May 1980 to May 1981. The water quality in the Calvert Bluff Formation, which contains the lignite, and in the Simsboro Formation, which is the major aquifer beneath the Calvert Bluff, generally is satisfactory for most uses. Hydraulic pressures in the Calvert Bluff are greater than in the Simsboro, and this pressure differential results in the potential for downward movement of water from the Calvert Bluff to the Simsboro. However, confining beds of lignite, clay, silt, and other fine-grained material at and near the base of the Calvert Bluff greatly retard this interformational movement of water but do not totally prevent downward leakage.

Data were collected from four streamflow stations and five automated rain gages to appraise the quantity and quality of the surface-water resources. Big Sandy Creek, which crosses Camp Swift, generally has a base flow of less than 0.5 cubic feet per second and infrequently is dry. Dogwood Creek, which originates on Camp Swift, normally is dry. The flow of both streams changes rapidly in response to rainfall in the watersheds. The quality of the water in both streams generally is suitable for most uses, but varies significantly in response to variations in discharge and related factors.

A lithologic examination of 255 feet of cored section that represents the overburden and the included lignite showed cyclic layering of fine sand, silt, clay, and lignite. Chemical analyses of the core were performed to determine the contents of major inorganic and trace constituents. These analyses indicate that the content of pyritic sulfur generally is small but variable.

1.0 INTRODUCTION

1.1 Objective

CAMP SWIFT REPORT SUBMITTED IN RESPONSE TO PROPOSED LIGNITE MINING

The hydrologic and geologic conditions prior to mining are presented

The objective of this report is to describe the hydrology and geology of an area of proposed lignite mining at Camp Swift and vicinity in central Texas (fig. 1.1-1), with emphasis on presenting baseline data of the ground-water and surface-water resources. The report provides general hydrologic information on individual water-resources topics (for example, ground-water quality) in a brief text with accompanying tables, maps, charts, graphs, or other illustrations. Such information should be useful to governmental and other officials, property owners in the area, and mine owners and operators.

This report also is designed to help meet the obligations of the Federal Government to insure the compatibility of the development of the lignite reserves at Camp Swift with environmental regulations. Hydrologic assessments are required by the "Surface Mining Control and Reclamation Act of 1977". Specifically, Public Law 95-81 requires: (1) That each mining permit applicant makes an analysis of the potential effects of the proposed mine on the hydrology of the mine site and adjacent area; (2) that "an appropriate Federal or State agency" provide to each mining-permit applicant "hydrologic information on the general area prior to mining"; and (3) that measures be taken by mining permittees to control adverse effects on the "hydrologic balance" and reclamation of the land.

Regulation of surface coal mining is being delegated to the States to insure environmental protection. On February 16, 1980, Texas became the first State to assume this responsibility. Enforcement in the State will be the responsibility of the Texas Railroad Commission.

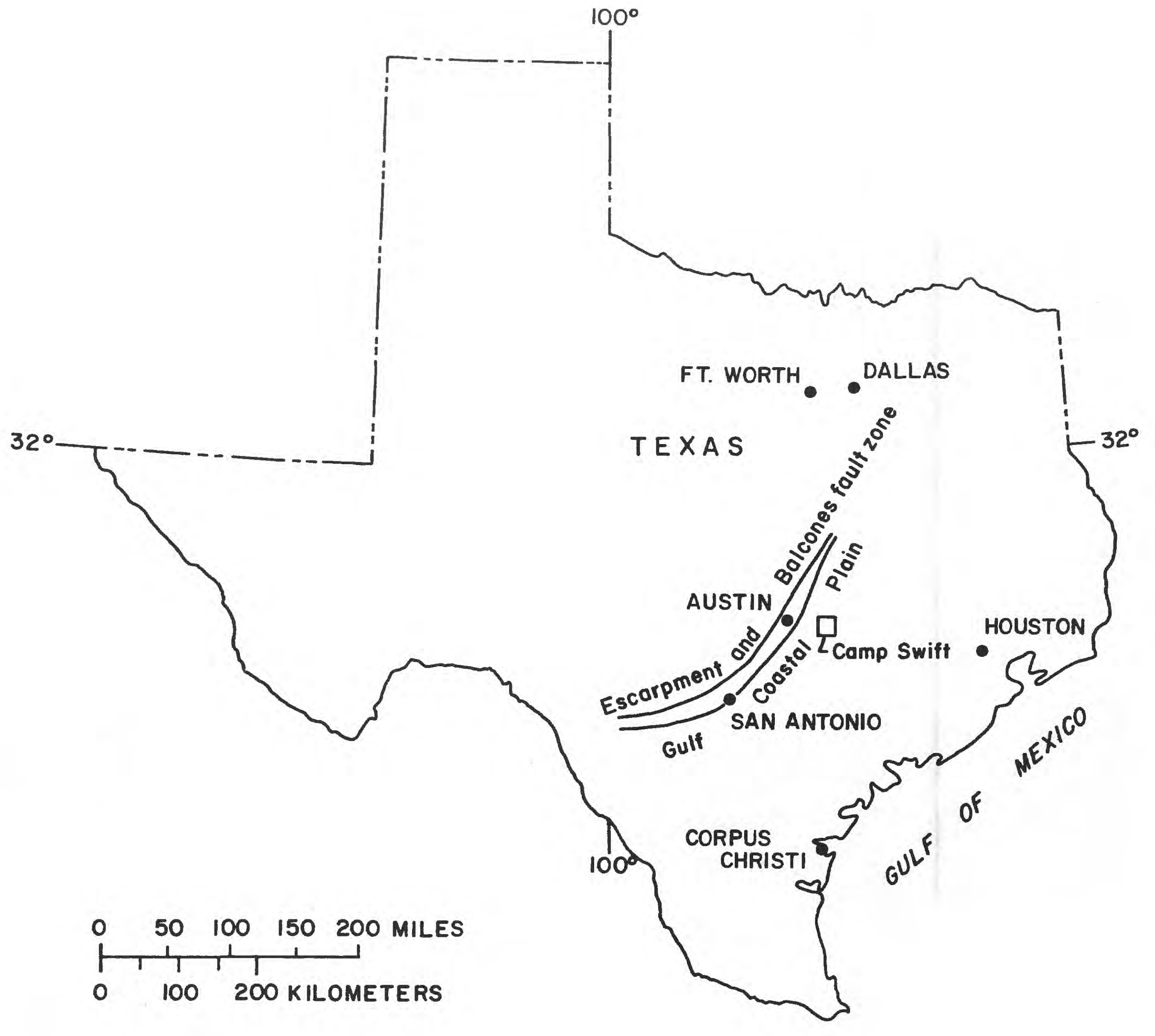


Figure 1.1-1.--Location of Camp Swift area.

1.2 Project Area

CAMP SWIFT, A MAJOR RESERVE OF FEDERALLY OWNED COAL, LOCATED IN COASTAL PLAIN NEAR URBAN AREAS

Estimated lignite reserves of 80 to 100 million short tons underlying Camp Swift could be used for electric-power generation in Austin and San Antonio

The Camp Swift area is located in Bastrop County, Texas, and is about 30 miles east of Austin and 100 miles northeast of San Antonio (fig. 1.1-1). The area is entirely in the Coastal Plain Province. Surface features include a gentle rolling topography fairly densely covered with cedar, post oak, and pine trees (fig. 1.2-1).

Figure 1.2-1--Areal view of Camp Swift. State Highway 95, which is seen crossing the lower half of the photograph, marks much of the western boundary of the area. Photograph courtesy of R. N. Mitchell Aerial Surveys, Austin, Texas, January 1983.

1.2 Project Area--Continued

The Camp Swift Military Reservation is leased from the U.S. Department of the Army by the Texas Army National Guard for military training exercises. This 18-square-mile area is one of the few tracts of Federal land in Texas underlain by commercially strippable lignite (figure 1.2-2). The quantity of lignite that underlies Camp Swift and that is economically recoverable by surface-mining methods is estimated by the Lower Colorado River Authority of Austin, Texas, one of the lease applicants, to be from 80 to 100 million short tons (U.S. Bureau of Land Management, 1980). The proximity of the lignite to the Austin and San Antonio metropolitan areas makes it an attractive potential fuel source for a lignite-fired power-generating facility.

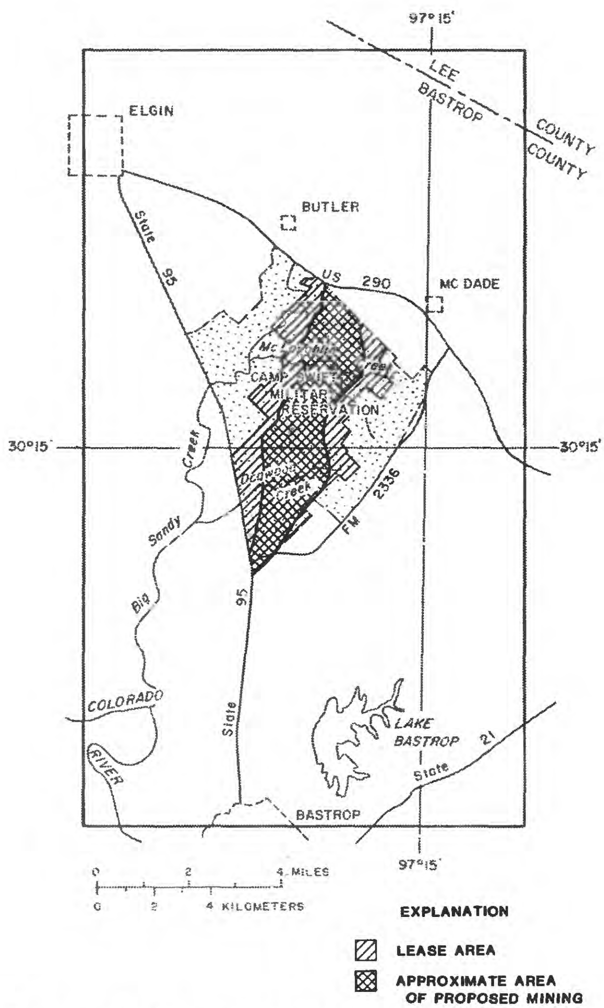


Figure 1.2-2.--Lease area and area of proposed mining.

1.0 INTRODUCTION--Continued

1.3 Hydrologic Problems Related to Surface Mining

HYDROLOGIC ENVIRONMENT MAY BE ADVERSELY ALTERED BY LIGNITE MINING

Effects on water-bearing charcteristics of the reclaimed spoil, quantity and quality of ground water including water levels, quantity and quality of surface runoff, and increased sediment yields are typical problems associated with surface mining of lignite

Strip mining drastically alters, at least temporarily, the environment of previously undisturbed lands. If a stripmined area remains unreclaimed, there might be long-term detrimental environmental consequences. The environmental concerns about strip mining in Texas are principally the effects of the mining operations on the water-bearing characteristics of the reclaimed spoil, effects on the spoil, quantity and quality of water in the mined and underlying aquifers including the declines in water levels in wells, changes in the quantity and quality of surface runoff, and sediment yield from the stockpiled spoil and reclaimed areas.

The horizontal and vertical hydraulic conductivities for each strata of the undisturbed overburden commonly differ before mining. After mining, the overburden sediments are mixed, the original stratification is destroyed, and the hydraulic conductivities of the mixed material in the spoil probably are more homogeneous. A study by Mathewson (1979) on a reclaimed area of a lignite mine in Milam County, 30 miles northeast of Camp Swift, shows that the groundwater table had not recovered 8 years after the area was mined and reclamation began (fig. 1.3-1). Mathewson attributed this absence of a water table to a lack of adequate recharge vertically through the surface or horizontally through the materials that have minimal hydraulic conductivity.

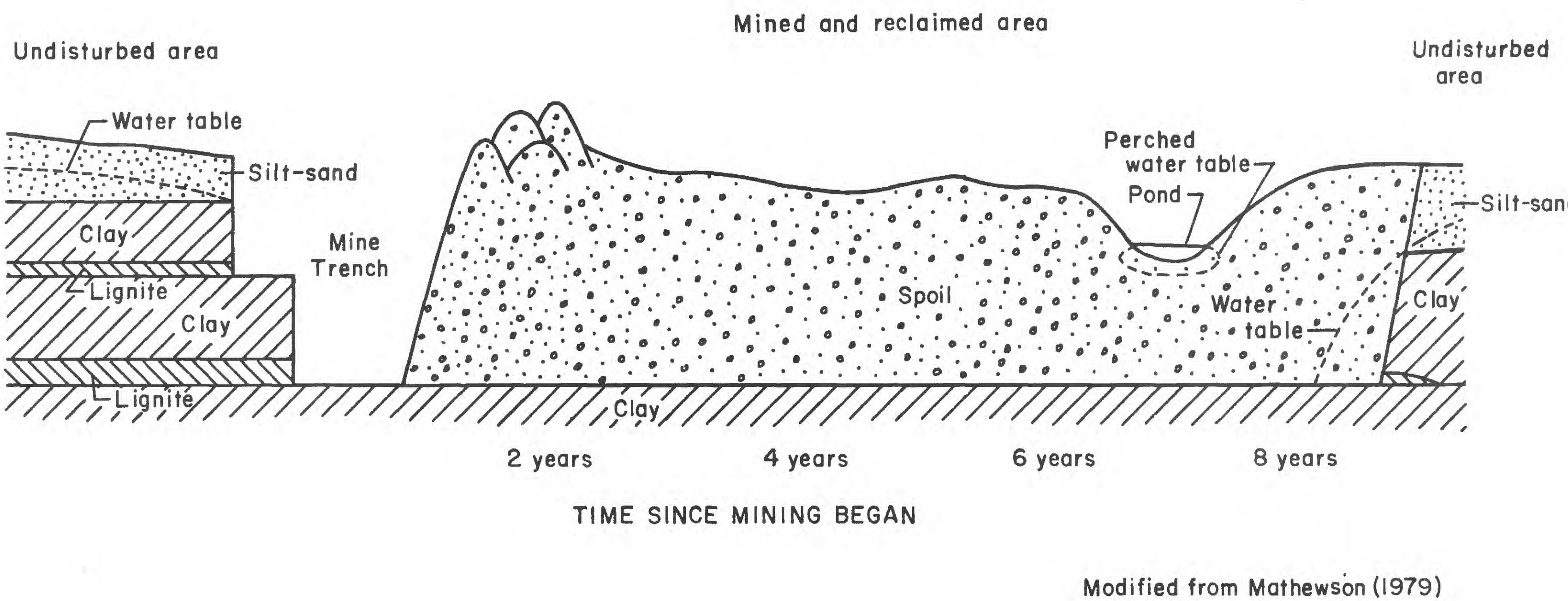


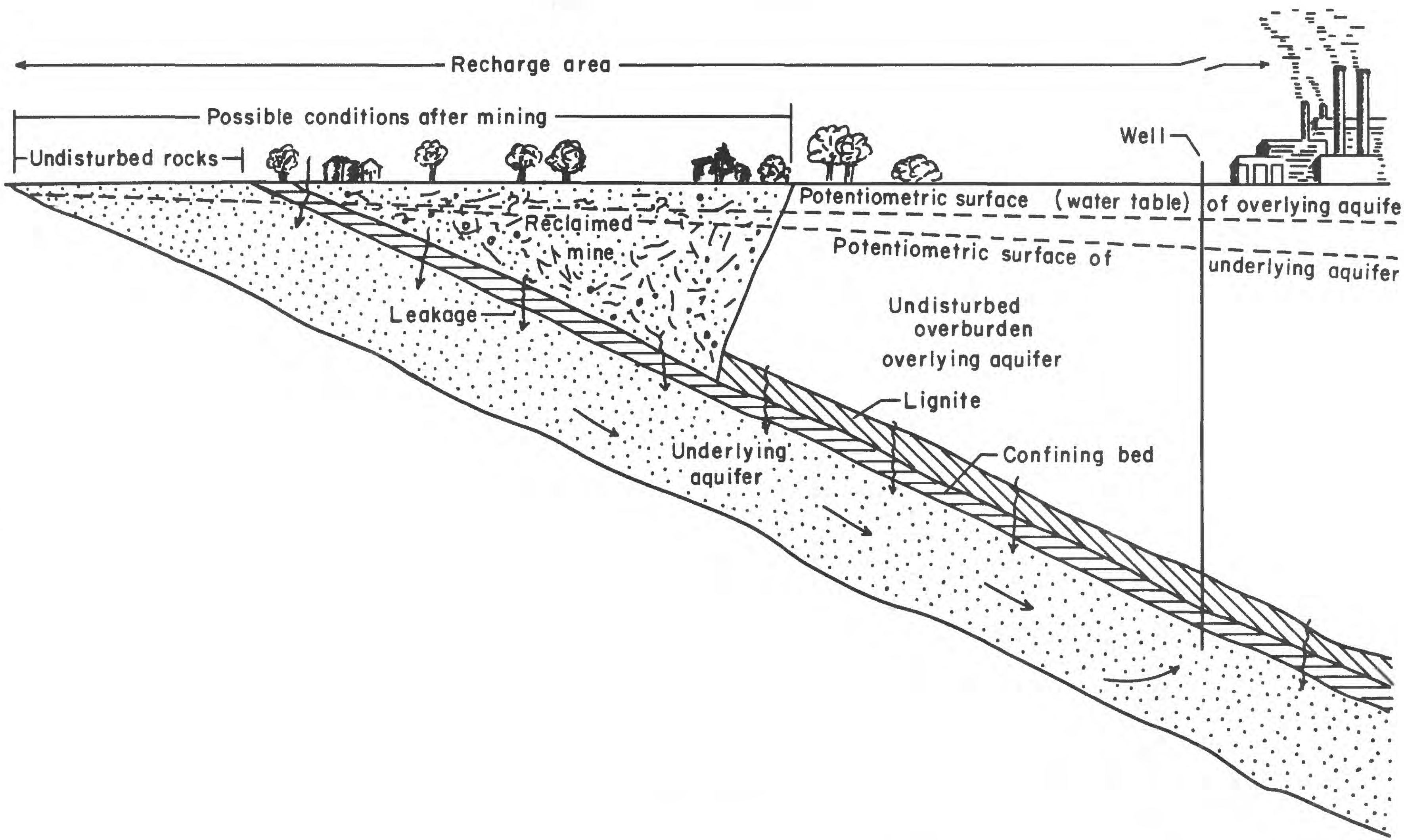
Figure 1.3-1.--Diagrammatic section showing actual ground-water conditions after mining began at a lignite mine in central Texas.

Strip mining in the Camp Swift area is expected to remove as much as 200 feet of overburden material. Dewatering or depressurizing probably will be necessary to maintain dry conditions during mining operations, and this will result in the decline in water levels in wells. Removal of the overburden will decrease the quantity of the shallow ground water, and possibly degrade its quality. Water of inferior quality could be introduced to the underlying aquifer after mining by leakage through the confining bed, as the potentiometric surface in the overlying aquifer above the confining bed is greater than the potentiometric surface in the underlying (major) aquifer (fig. 1.3-2). The hydraulic properties of the aquifer also could be adversely affected by the introduction of solutes from the surface-mining disturbance and from chemical precipitates that commonly form when waters of differing chemical composition intermix.

During mining, accelerated weathering of iron-bearing minerals (pyrite and marcasite) exposed in spoil materials and lignite beds may produce sulfuric acid and soluble mineral salts. Water draining such a mined area generally has pH values ranging from 2.5 to 5.0, and larger sulfate, and dissolved-solids concentrations. The acidic water may react with other minerals and commonly increases concentrations of aluminum, copper, lead, iron, manganese, zinc, and other trace elements.

The areal effects of dewatering also might affect local streams. The waters probably will be released into Big Sandy Creek or its tributaries. Small creek channels commonly are diverted or obliterated during mining. The aquatic life of the larger receiving streams might be adversely affected by changes in quantity or quality of flow and by changes in sediment yields.

Careful planning before mining begins is necessary if the effects of these problems are to be prevented or minized before they occur. For example, the entrapment of mine waters in holding ponds could decrease sediment yields and allow for treatment of the water so as to decrease the harmful effects. During mining, continuous monitoring of the water resources in the area will be needed to indicate the extent of any changes in the quantity and quality of the water.



Modified from Mathewson (1979)

Figure I.3-2.--Possible effects of surface mining on an underlying aquifer.

2.0 GENERAL FEATURES

2.1 Stratigraphy

ENTIRE PROJECT AREA IS UNDERLAIN BY THE WILCOX GROUP

The Wilcox Group is divided into three formations; from oldest to youngest, these are the Hooper, Simsboro, and Calvert Bluff Formations.

The stratigraphic nomenclature used in this report follows the usage of the Texas Bureau of Economic Geology as mapped on the Austin sheet of the Geologic Atlas of Texas (Barnes, 1974) and does not follow the usage of the U.S. Geological Survey. The Wilcox Group of Eocene age, as used by the U.S. Geological Survey in east-central Texas, includes (ascending) the Seguin Formation, the Rockdale Formation (includes rocks assigned to the Hooper, Simsboro, and Calvert Bluff Formation), and the Sabinetown Formation. The definitions of selected geological terms are given in section 11.1.

The Wilcox Group of Eocene age, which is underlain by older rocks (clay) of the Midway Group and overlain by younger rocks (sand and clay) of the Claiborne Group, has been divided into three formations between approximately the Colorado River and Trinity River (Barnes, 1974). Upsection, these formations are the Hooper Formation, the Simsboro Formation, and the Calvert Bluff Formation. These formations are identified by an electric-log shown in figure 2.1-1.

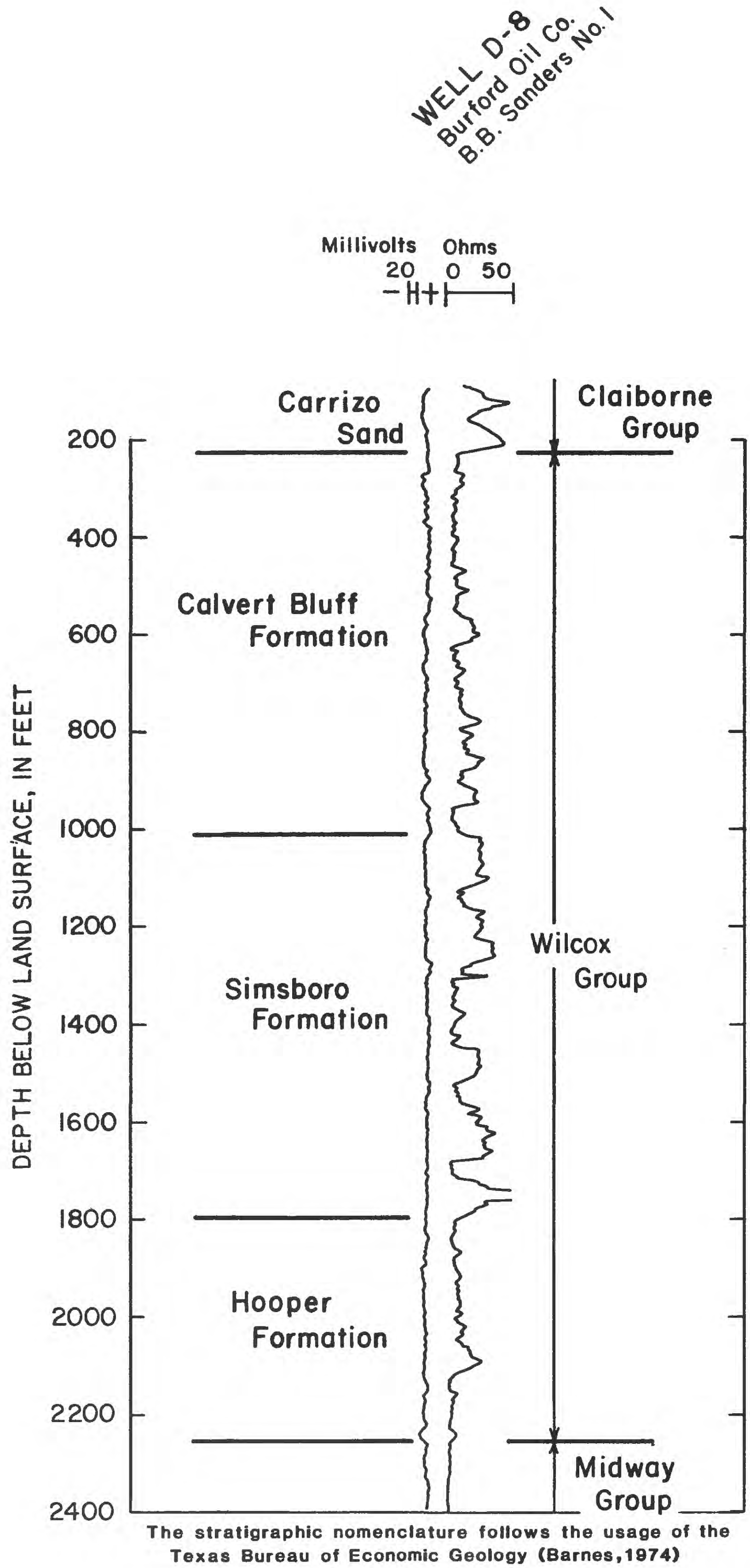


Figure 2.1-1.--Electric log of well D-8 penetrating the Wilcox Group.

All three formations crop out in northeast-trending bands in the study area; but according to Barnes (1974), only the Calvert Bluff crops out on the Camp Swift Military Reservation area (fig. 2.1-2).

The Hooper Formation is about 500-feet thick in the Camp Swift area and consists of mudstone, sand, sandstone, and a few beds of lignite. The mudstone is typically gray and weathers to a rusty-brown color. The sand and sandstone beds are light gray to tan and consist of very fine to medium grains. The sand usually is well sorted and subrounded. The lignite beds in the Hooper Formation at Camp Swift generally are dark brown, thin, discontinuous, and considered noncommercial to recover by surface mining.

The Simsboro Formation overlies the Hooper Formation and consists chiefly of fine to coarse unconsolidated sand, with thin discontinuous beds of mudstone and clay. The Simsboro commonly is light gray in fresh exposure but weathers to a rusty brown. The sand grains are moderately well sorted and subangular. Small-scale cross-bedding is common. Locally near its outcrop, the Simsboro is as much as 500 feet thick; however, the formation thickens downdip to more than 800 feet. A few miles southwest of the Colorado River, the Simsboro is undistinguishable from the Hooper and Calvert Bluff, and the three formations are mapped together as undivided Wilcox (Barnes, 1974).

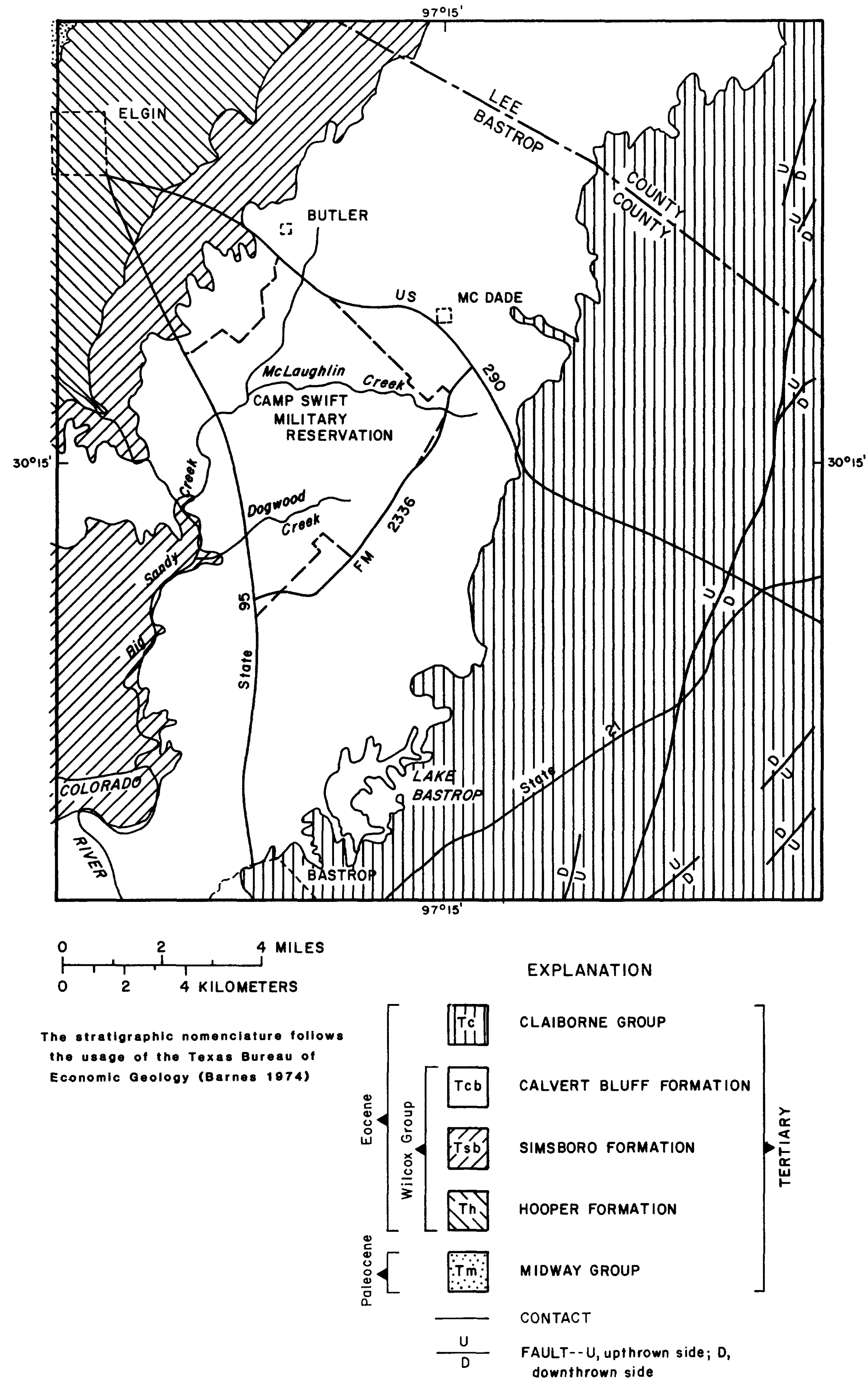


Figure 2.1-2.--Geologic map of the study area.

The Calvert Bluff Formation overlies the Simsboro Formation and consists of beds of mudstone, sand, clay, sandstone, and lignite. The color of the mudstone varies from buff to light gray. The clay generally is dark gray and occurs in small lenses. The sand beds are tan to light gray with grain size ranging from very fine to coarse. The sand is well sorted and subrounded. Small-scale cross-bedding is very common in the sand beds. The sandstone is in the form of "hard streaks" commonly cemented by iron minerals. The lignite is typically dark brown to black and friable and has a locally "woody" texture where fossil imprints of the organic material are visible. Pyrite commonly is associated with the lignite as a secondary mineral deposited by ground water.

There are at least 11 separate lignite beds of varying thickness and quality in the Calvert Bluff Formation in the Camp Swift area. The thickness of these beds ranges from less than 1 to about 12 feet. The two or three lignite beds being considered for mining are in the lower part of the formation, about 10 to 70 feet above the top of the Simsboro Formation. The response of lignite on an electric log of a well drilled on Camp Swift is shown in figure 2.1-3. The log was run in the freshwater part of the Calvert Bluff with the borehole filled with freshwater drilling mud. Under these conditions, many of the lignite beds typically are indicated by a negative deflection of the spontaneous-potential curve and a highly resistive deflection of the resistivity curve. The thickness of the Calvert Bluff varies, but averages about 800 to 1,000 feet near the downdip edge of the outcrop.

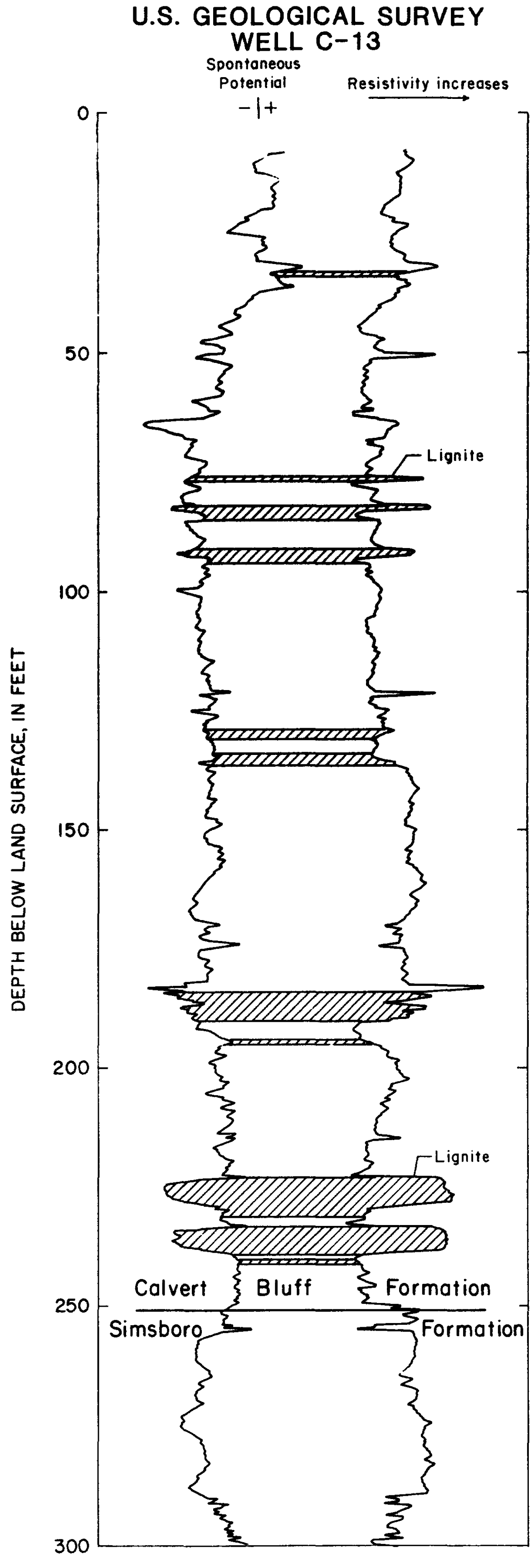


Figure 2.1-3.--The electrical response of lignite on an electric log of well C-13.

2.2 Depositional History

ENVIRONMENT OF DEPOSITION OF THE WILCOX GROUP IN THE CAMP SWIFT AREA WAS A FLUVIAL AND DELTAIC SYSTEM

Lignite formed in interchannel areas where paleo-swamps and marshes were filled with organic materials

The Hooper Formation was deposited as a series of delta front and interdistributary channel sequences. The definitions of selected geological terms are given in section 11.1. Coarsening-upward sequences of the prograding delta are visible on an electric log of the formation (fig. 2.2-1). The lignite beds in the Hooper are very thin, discontinuous, and not of immediate economic importance in this area (Fisher, 1963).

The Simsboro Formation was deposited in a fluvial environment after additional progradation of the delta system. The massive sands of the Simsboro were deposited from sediment-laden rivers that avulsed repeatedly, thus releasing their loads. This type of deposition was extensive in Bastrop County. On the Camp Swift Military Reservation total-sand accumulation in the Simsboro averages about 250 feet.

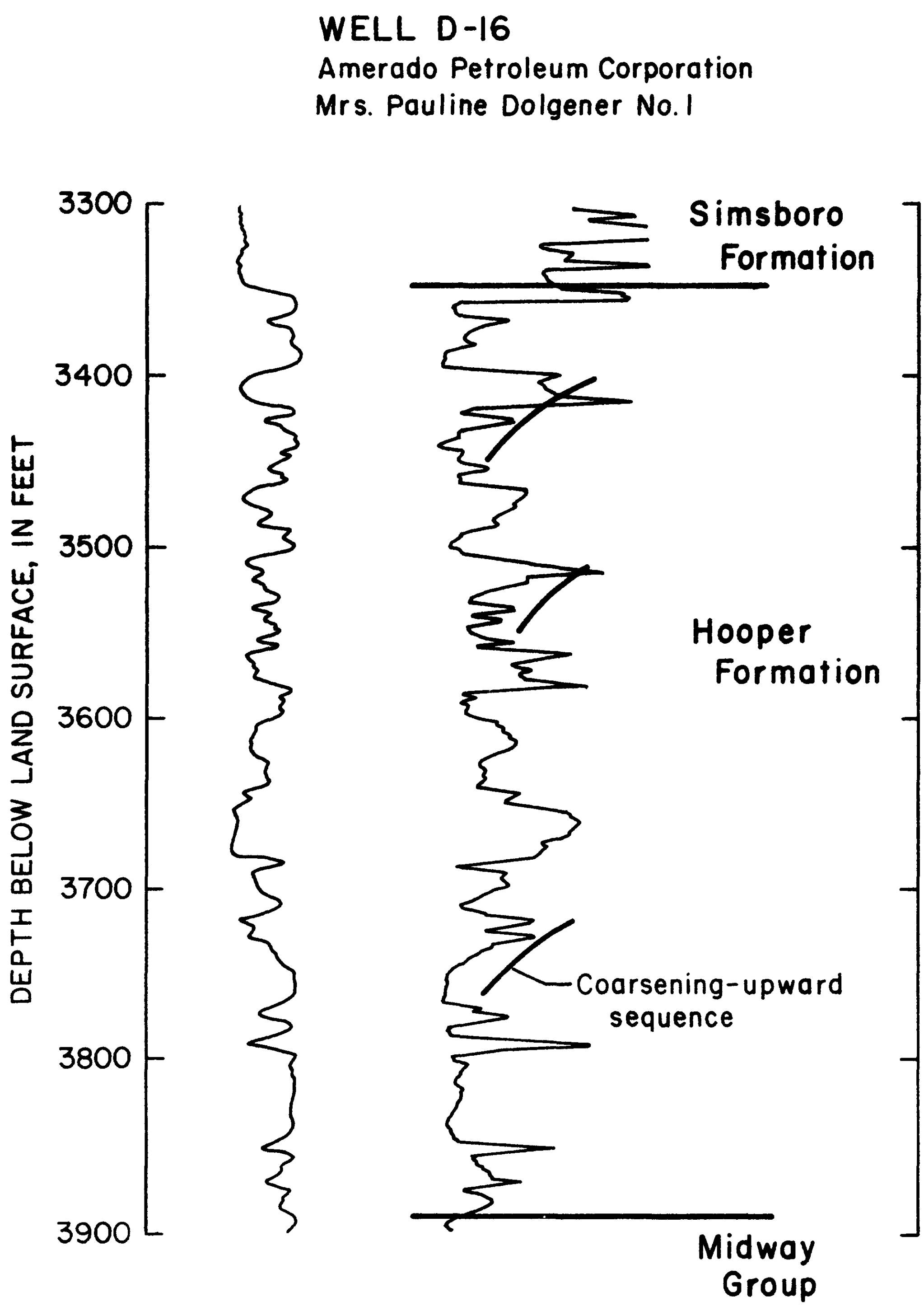


Figure 2.2-1.--Electric log of well D-16.

2.2 Depositional History--Continued

A total-sand map of the Simsboro Formation in Bastrop County (Kaiser and others, 1980), which gives an indication of channel geometry is shown in figure 2.2-2. In Bastrop County, the channel geometry of the Simsboro is straight to slightly dendritic. This type of geometry is common on modern fluvial and delta-front systems like that of the Mississippi River. Ancient channel geometry is important in terms of ground-water distribution and movement, which are discussed in section 6.1.

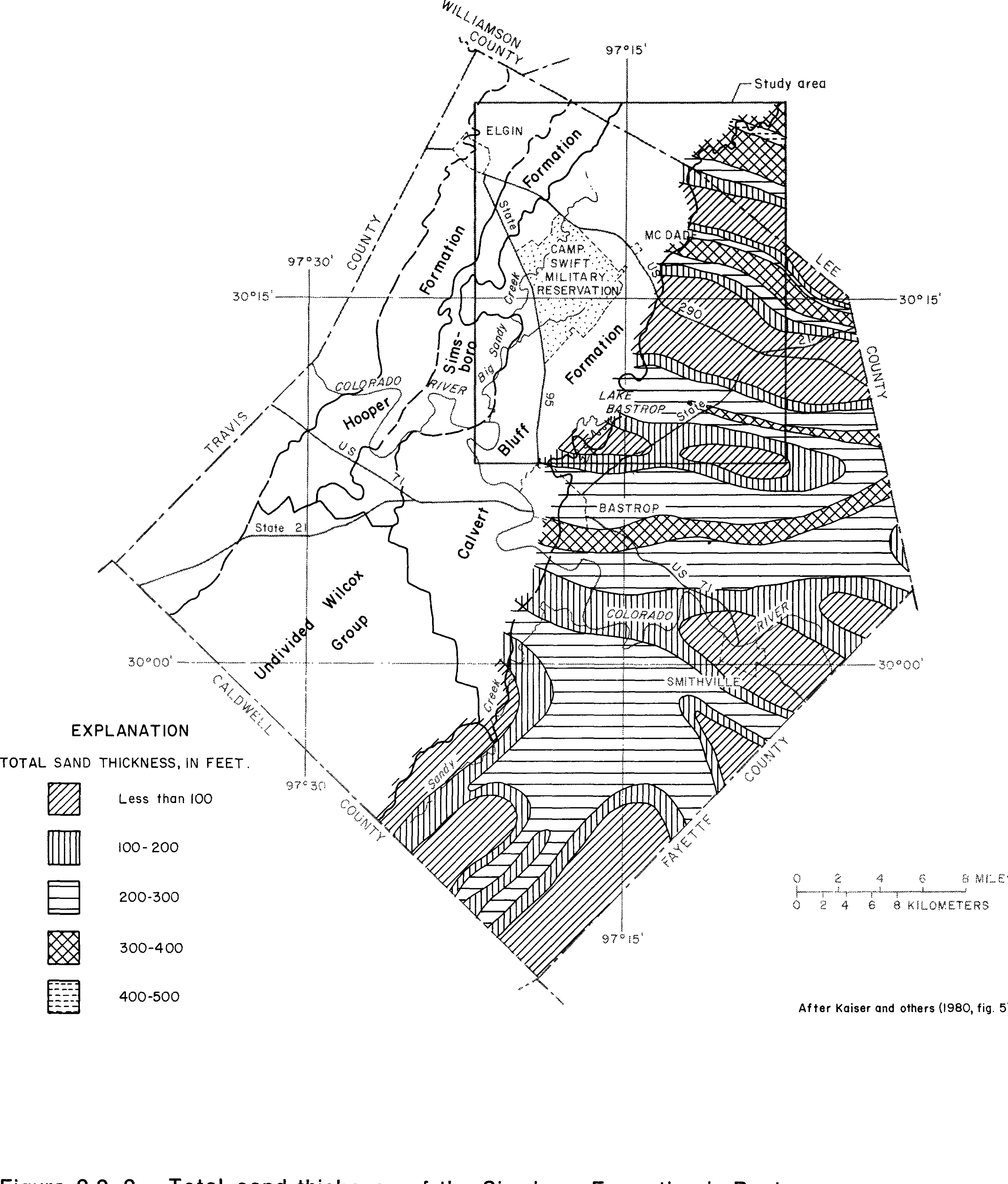


Figure 2.2-2.--Total-sand thickness of the Simsboro Formation in Bastrop and part of Lee Counties.

The Calvert Bluff Formation represents a transitional facies between a dendritic fluvial channel of the high alluvial plain and a bifurcating distributary channel facies of the lower delta plain (Kaiser and others, 1978). Large lignite occurrences correlate with the small-sand-percent areas, or interchannel areas, where organic material accumulated. Large-sand-percent areas represent ancient channels, which currently facilitate ground-water movement in the Calvert Bluff (fig. 2.2-3).

Fluvial and deltaic depositional systems commonly are complex sequences of transgressions and regressions of ancient seas. A common sequence of deposition is as follows (Bishop, 1977): (1) Avulsion occurs and a new channel course is established; (2) rapid subsidence of the avulsed channel commences creating interchannel lakes and swamps; (3) organic material accumulates until the rate of subsidence is greater than the rate of accumulation or until a major sediment influx occurs; (4) sediment influx is re-established with the advent of extensive overbank deposits; (5) the crevasse splays advance toward the lower part of the interchannel basin depositing upward-coarsening sequences; and (6) continued progradation and joining of crevasse splays and their abandonment repeat the cycle. In the Wilcox Group at Camp Swift, this sequence of events is preserved as a cyclic sequence of coarsening-upward interchannel basin cycles bounded by lignites.

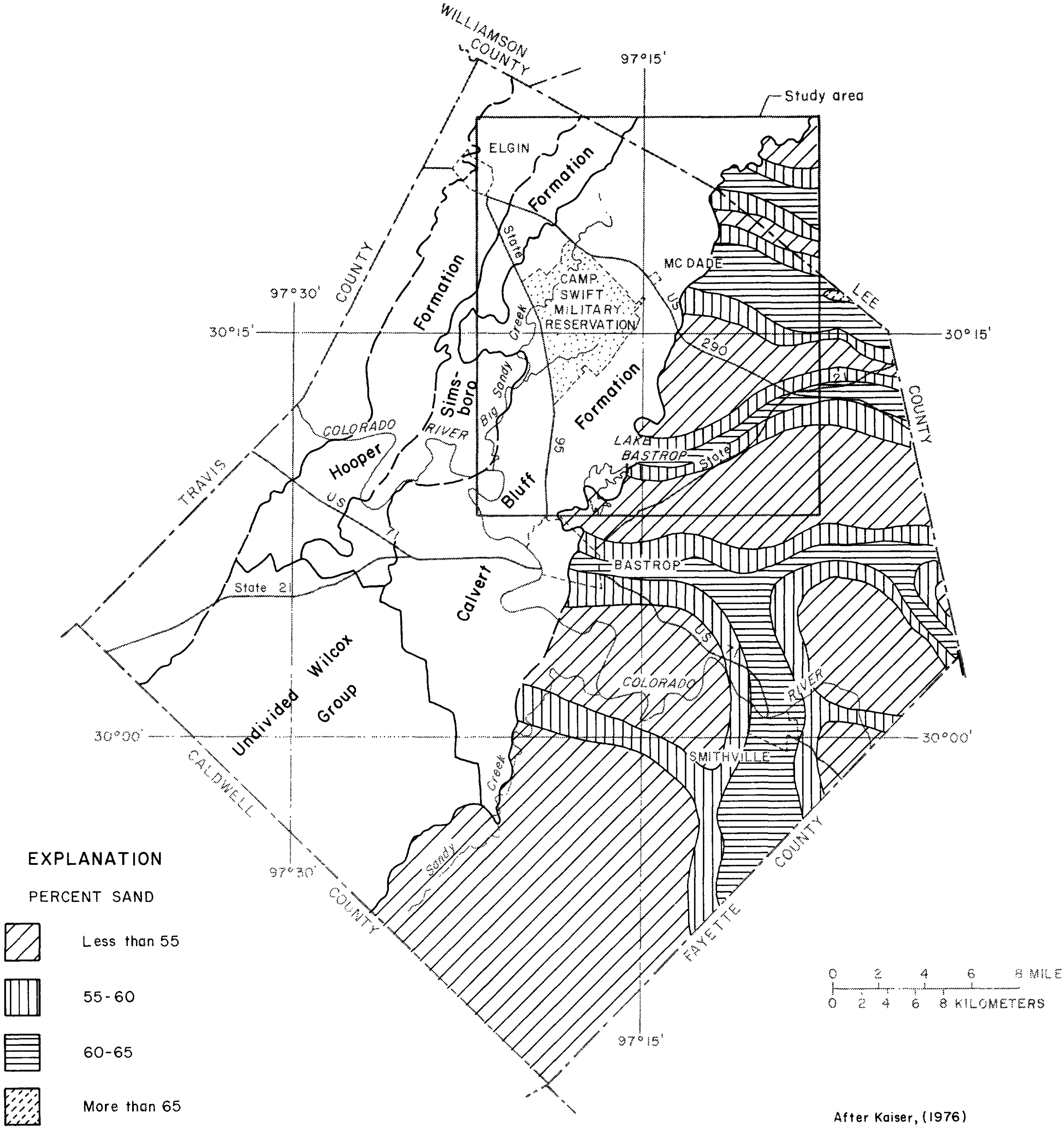


Figure 2.2-3.--Sand percent of the Calvert Bluff Formation in Bastrop and part of Lee Counties.

2.3 Structural Features

THE REGIONAL DIP OF THE FORMATIONS IS AFFECTED BY FAULTING

The structure of the Camp Swift area is affected by northeast-trending normal faults that are downthrown to the northwest.

The Hooper, Simsboro, and Calvert Bluff Formations of the Wilcox Group dip regionally from 90 to 170 feet per mile and have an average dip of about 130 feet per mile. A regional dip section in the study area is shown in figure 2.3-1.

The structure of the Camp Swift area is affected by several northeast-trending normal faults, which are downthrown to the northwest. The net slip on the faults along their trend varies from one end of an individual fault to the other end. The series or zone of faults in the study area is 20 to 30 miles east of, and approximately parallel to, the Balcones fault zone, a major structural feature of central Texas. Between these two zones of faulting, the area is a structurally down-dropped block or graben. All of this faulting occurred in the Miocene Epoch from 27 to 12 million years ago. Considering the depositional framework controlling the distribution of Calvert Bluff sediments, lateral discontinuities of strata in some places within the study area are the result of this faulting.

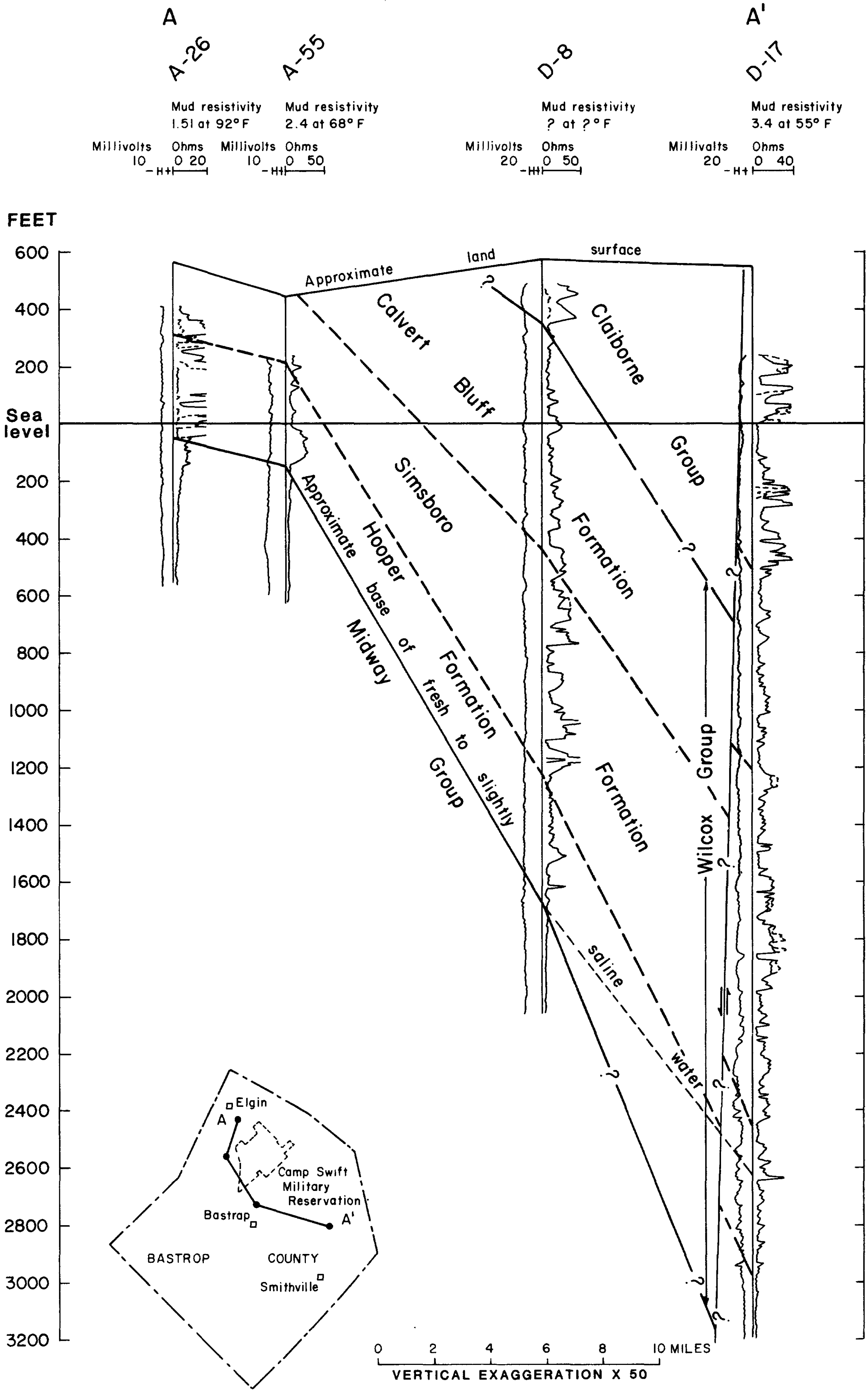


Figure 2.3-1.--Regional structural dip section A-A' in Bastrop County.

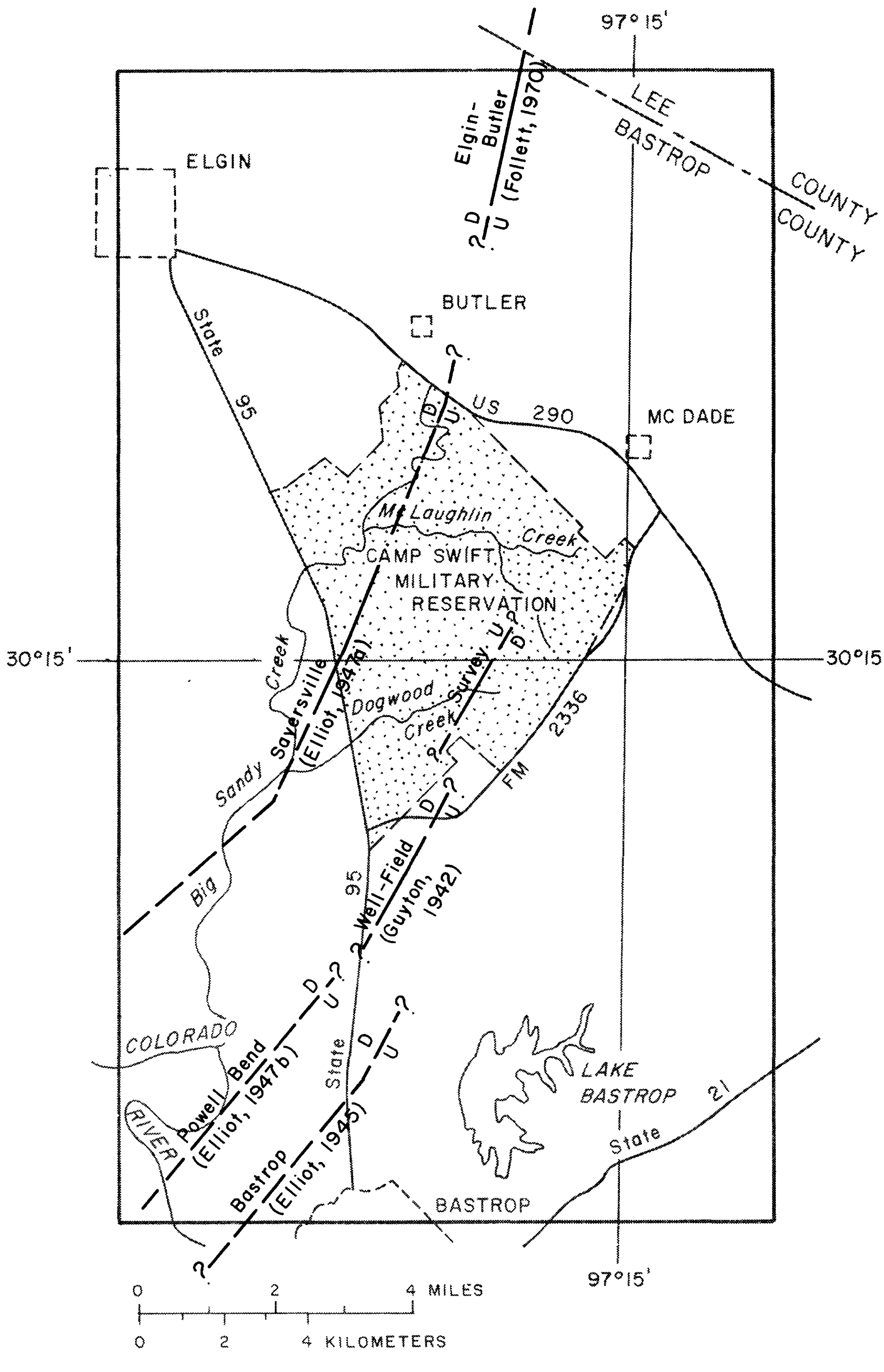
Faults have been identified and mapped during the present and previous geologic or hydrologic investigations. The locations of the faults that are in or near the Camp Swift Military Reservation are shown in figure 2.3-2. The faults are discussed briefly in the following paragraphs.

The U.S. Geological Survey in 1941 and 1942 (Guyton, 1942) conducted extensive pumping tests in the city of Bastrop well field (formerly the Camp Swift well field), 5 miles north of the city of Bastrop. Results of these tests indicated the nearby presence of a barrier to ground-water flow, which suggested a fault, between wells C-14 and C-15 in the well field. The throw of this fault which is termed the "well-field fault", is not known, but it probably is the continuation of the Powell Bend fault, Elliott (1947b).

Elliott (1945, 1947a, and 1947b), described the oil potential of southwestern Bastrop County. Based on surface and subsurface studies, Elliott identified three faults within the study area. These faults trend north-northeast and are downthrown to the northwest. Two of the faults, the Powell Bend fault and the Bastrop fault, are oriented toward Camp Swift and may continue further to the northeast than the mapping indicates. The Sayersville fault, which is the most prominent of the three faults, crosses the northwestern part of Camp Swift and has an estimated throw at this location of about 250 feet. Ten miles southwest of Camp Swift, its throw as reported by Elliott (1947a) is about 500 feet.

C. R. Follett (1970) noted that the formations in Bastrop County are transected by several faults or fault systems that trend northeastward across the county and generally are parallel to the strike of the formations. A fault identified by Follett (1970) in the area about 5 miles northeast of Elgin is termed the "Elgin-Butler fault" (fig. 2.3.-2). Its exposure in a clay pit shows sand to be faulted opposite mostly clay. The fault's southerly trend is toward the Camp Swift Military Reservation where it probably joins the Sayersville Fault.

In 1980, the Geological Survey drilled three closely-spaced test holes (50 feet apart) on Camp Swift for geologic and hydrologic purposes. A fault having a throw of 15 to 25 feet was indicated by differences in depths to key lignite beds in the test holes. The downthrown side is on the southeast. This fault is termed the "Survey fault" in figure 2.3-2. It is considered to be either one of a series of parallel faults or possibly an auxiliary or branch fault that may end diagonally against the Sayersville fault to the west and against a possible continuation of the Well-Field and Powell Bend faults to the south.



EXPLANATION

Well-Field / (Guyton, 1942) — U / D	FAULT-- U, upthrown side; D, downthrown side. Dashed where approximately located. Author and date refer to publication where fault has been mapped or reported. Fault name, for example, "Well-Field", refers to a designated name of the fault for identification

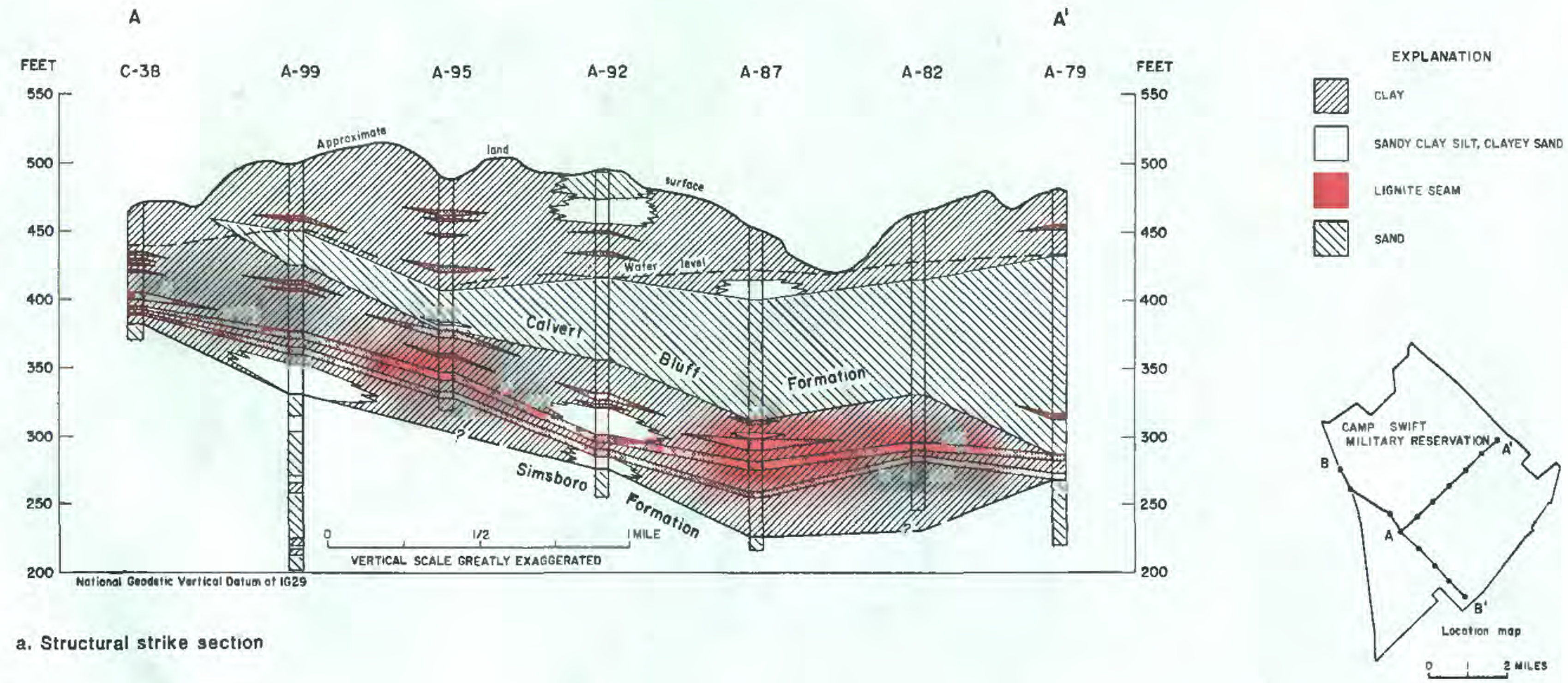
Figure 2.3-2.--Location of faults in or near Camp Swift.

The Lower Colorado River Authority drilled numerous test holes on the Camp Swift Military Reservation. Most of the test holes penetrated the Calvert Bluff Formation and the upper few feet of the Simsboro Formation. These test hole data were used to construct structural strike and dip sections shown in figure 2.3-3. These sections show a difference in lignite occurrence and geometry in the lower and upper parts of the Calvert Bluff.

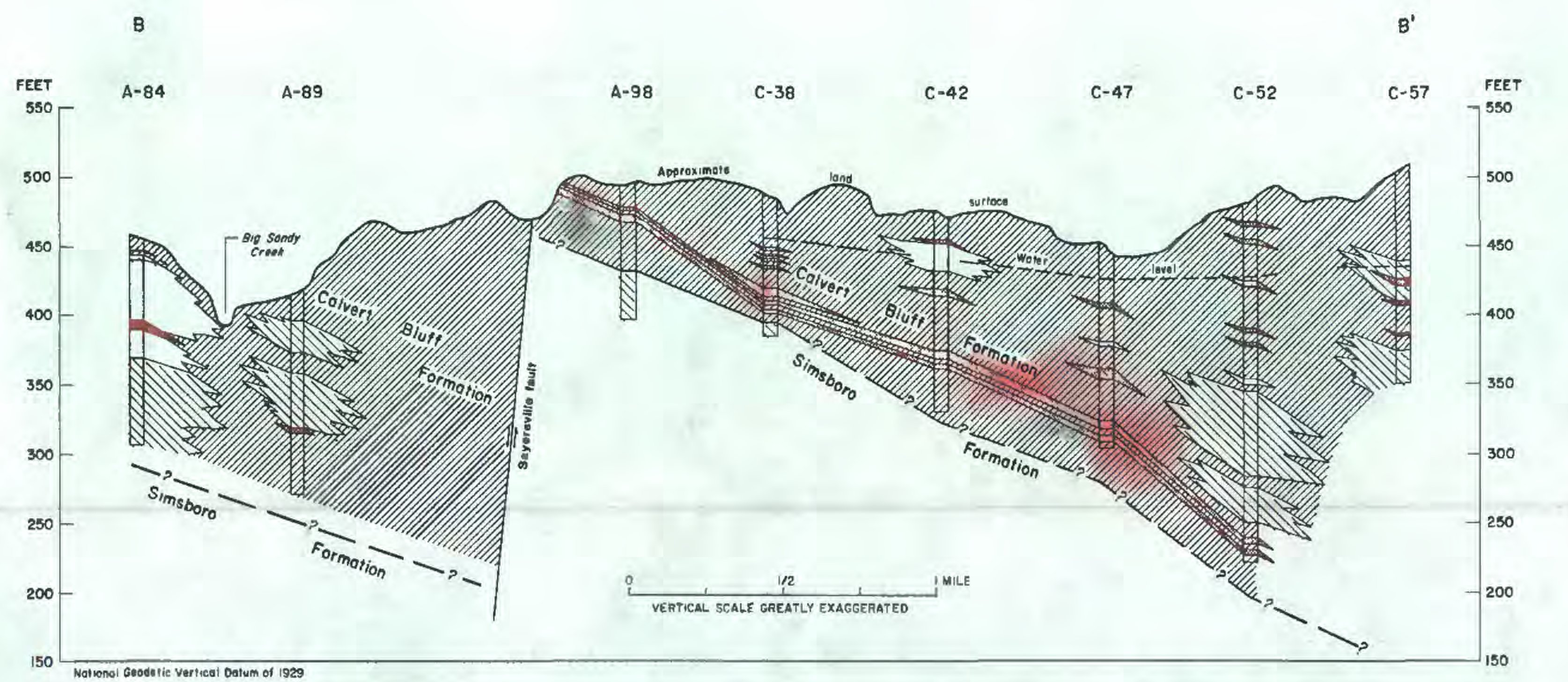
The lower part of the Calvert Bluff section contains two lignite seams, which usually occur from 6 to 35 feet above the top of the uppermost sand of the Simsboro Formation. Within the Camp Swift area, these lignite seams appear to be widespread in both the strike and dip directions. The confining beds of clay, which underlie these lignite seams in most places, appear to pinch out in some areas and grade into slightly more permeable beds such as sandy clay, silt, or clayey sand. In a few places the confining beds are absent and the lignite is in contact with the Simsboro Formation (see strike section A-A').

The upper part of the Calvert Bluff contains dip-oriented sand bodies which merge and become stacked. In this upper part, the lignite occurs in discontinuous seams in both strike and dip directions. The number of lignite seams increases with distance from the channel-sand deposits. The differences in lignite occurrence and geometry in the upper and lower parts of the Calvert Bluff section indicate a genetic break within the formation.

The dip section B-B' crosses the Sayersville fault, which here is estimated as having about 250 feet of throw. This interpretation of faulting is supported by the fact that the outcrop of the Calvert Bluff Formation is as much as 4 to 5 miles wider than would be expected from an unfaulted outcrop. The wider than normal outcrop indicates a repetition of the section by down-to-the-northwest faulting. About 250 feet of the lower part of the Calvert Bluff contacts about 250 feet of the upper part of the Simsboro at the fault plane.



a. Structural strike section



b. Structural dip section

Figure 2.3-3.--Structual strike and dip sections in Camp Swift.

2.4 Climate

CAMP SWIFT AREA CHARACTERIZED BY TEMPERATE CLIMATE

The climate of the Camp Swift area is controlled by its geographic location and physiography.

The climate of the Camp Swift area is affected by the Balcones Escarpment, a prominent topographic break in altitude about 30 miles west of Camp Swift. This escarpment separates the deeply dissected limestone terrain of the Edwards Plateau on the west from the lower-lying clay and sand terrain of the Gulf Coastal Plain on the east (Baker, 1975). The climate of areas to the east of the escarpment generally is classified as warm, humid, and subtropical.

In the study area, precipitation varies from month to month, but usually is greater during April, May, and September when mean monthly precipitation exceeds 4.0 inches. During these months, convective thunderstrom activity and movement of mositure-laden air along the tropical Gulf storm tract are responsible for much of the precipitation. The Balcones Escarpment is an orographic barrier to the warm, easterly, tropical air currents. As these air currents rise over the escarpment, they become less stable and produce rain. Severe storms commonly result when an atmospheric pressure surge from the northeast and a warm easterly trough of air arrive at the escarpment simultaneously. These types of storms have the potential of producing catastropic volumes of rain.

The 30-year mean-annual precipitation from 1941 to 1970, as recorded at the city of Smithville about 12 miles southeast of the study area, is 36.82 inches. Total annual precipitation, however, may vary considerably from year to year. The driest year on record was in 1956 with 17.94 inches of precipitation, and the wettest year was in 1957, with 59.35 inches. The distribution of mean monthly precipitation and mean monthly temperature for the Smithville weather station is shown in figure 2.4-1. The record monthly precipitation extremes (maximums and minimums) are also given to show the large variations amoung the means and extremes.

Daily precipitation data are published monthly as "Climatological data for Texas" by the National Oceanic and Atmospheric Administration, National Climatic Center, Asheville, North Carolina. Statistical information concerning analyses of rainfall data is presented in Hershfield (1961).

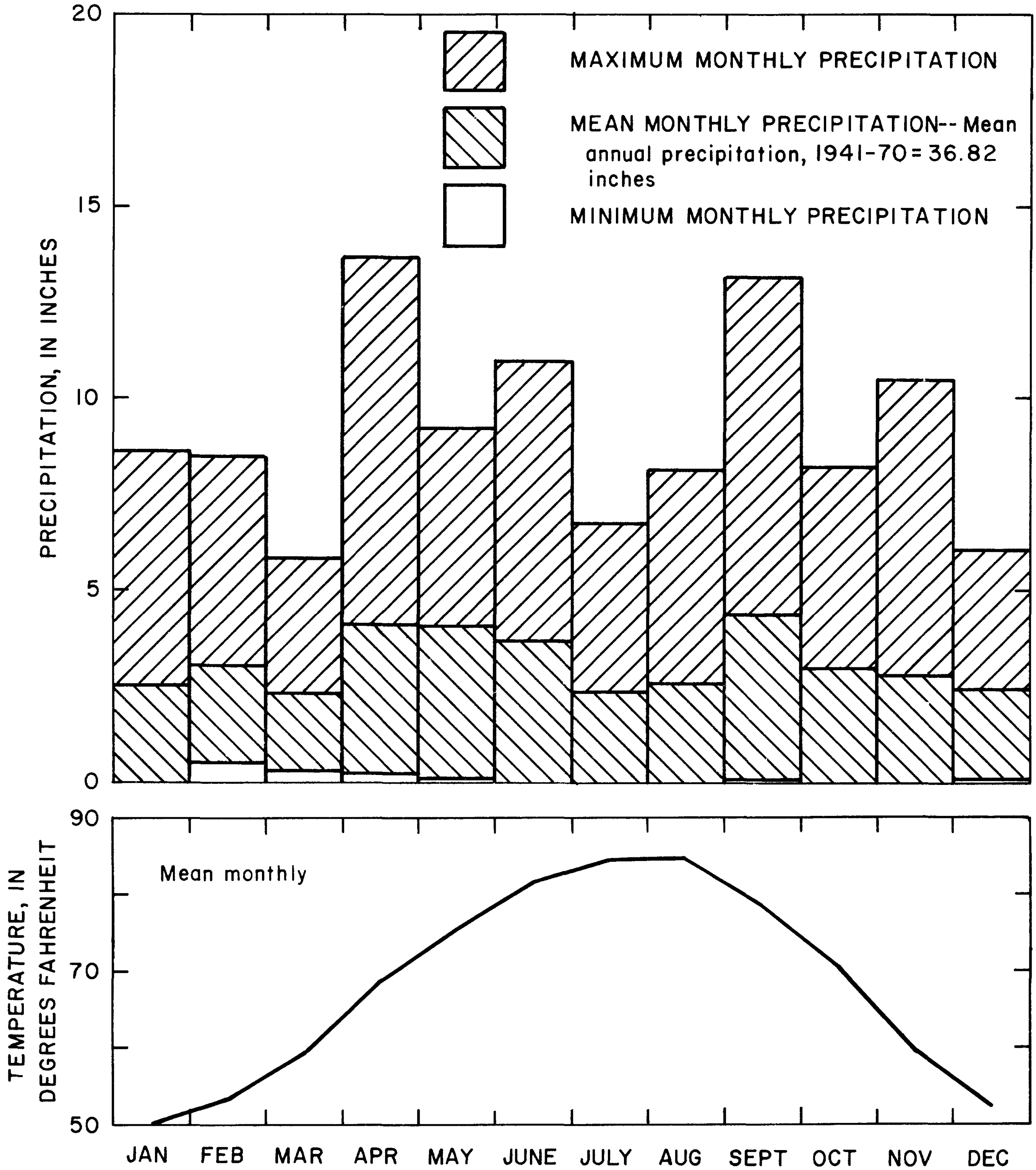


Figure 2.4-1.--Mean monthly temperature and precipitation at Smithville.

2.5 Soils

SOILS GENERALLY HAVE MODERATE TO SIGNIFICANT EROSION POTENTIAL

Two main soil groups, the Axtell-Tabor-Crockett group and the Patilo-Demona-Silstid group, overlie the Camp Swift Military Reservation.

Two main soil groups, the Axtell-Tabor-Crockett group in the southern part of Camp Swift and the Patilo-Demona-Silstid group in the northern part (fig. 2.5-1) overlie Camp Swift. Axtell-Tabor-Crockett soils are generally flat to steeply sloping soils. They are characterized by a loamy surface layer and slightly to very slightly permeable lower layers. These lower layers range in composition from clay to sandy clay, commonly are acidic, and have considerable shrink-swell potential. The hazard of erosion for the Axtell-Tabor-Crockett group is moderate to significant, and gullies commonly are formed. This group of soils generally is found on stream terraces and uplands. The Dogwood Creek and McLaughlin Creek drainage basins are in the area of Axtell-Tabor-Crockett soils.

Patilo-Demona-Silstid soils are slightly to steeply sloping. These soils have a sandy surface layer and lower layers of mostly mottled sandy clay loam. The lower layers tend to be acidic and have a minimal shrink-swell potential. The top layer of the soils in the Patilo-Demona-Silstid group is very permeable whereas the lower layers are less permeable. The hazard for erosion is slight to moderate. These soils commonly are found on the uplands. In the Camp Swift Reservation, Big Sandy Creek flows through an area dominated by the Patillo-Demona-Silstid soil group.

The soils along the downstream reaches of the creek beds consist of clay loam to fine sand. These soils generally have a reaction value (pH) close to neutral, a minimal shrink-swell potential, slopes less than 1°, and are subject to frequent flooding. Detailed descriptions of the soils in the Camp Swift area can be obtained from Baker (1979). Included with the descriptions are pertinent engineering properties of the soils.

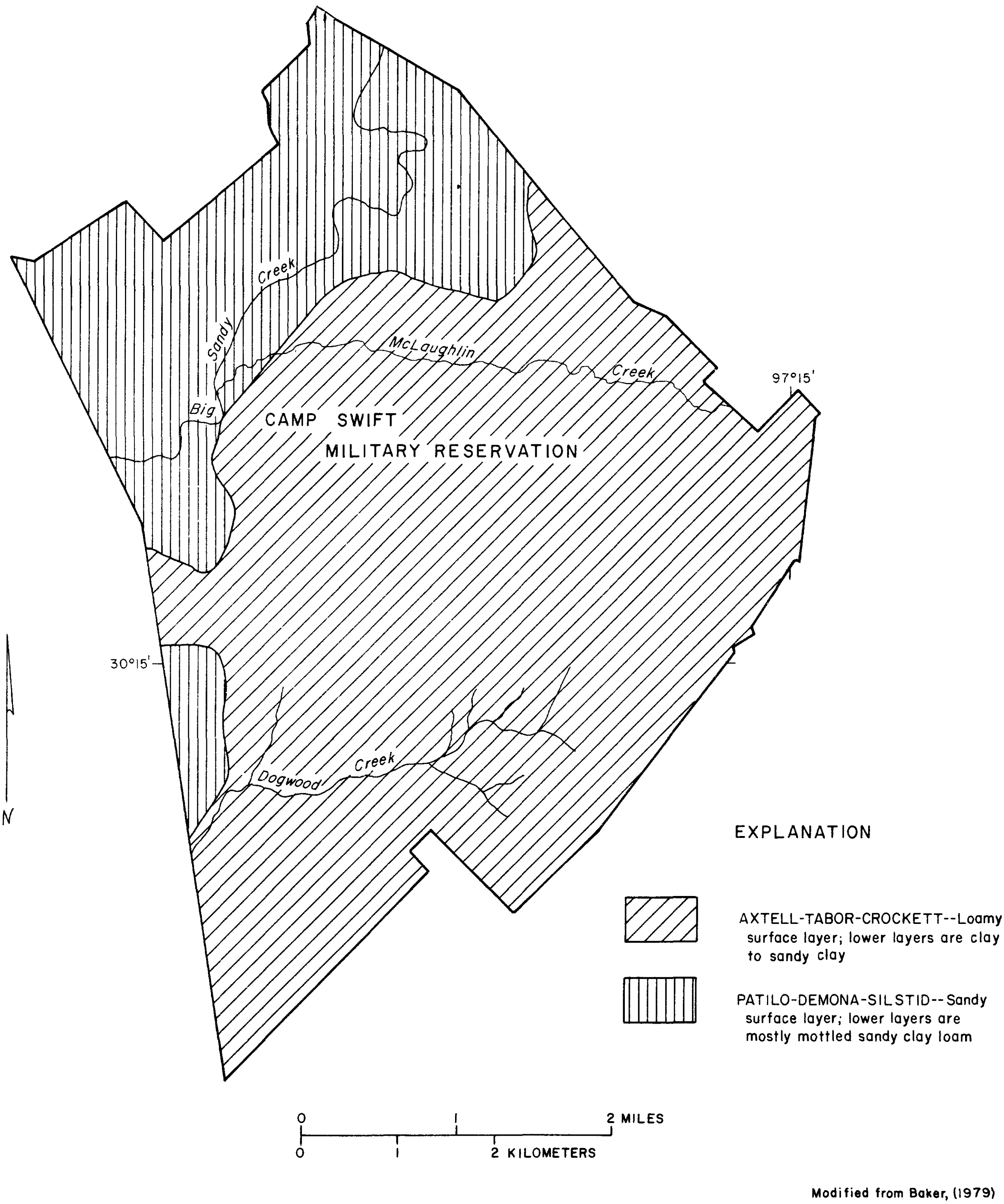


Figure 2.5-1.--Soils map.

2.6 Surface Drainage

VIRTUALLY ALL OF CAMP SWIFT IS IN THE BIG SANDY CREEK DRAINAGE BASIN

The drainage of Big Sandy Creek reaches the Colorado River about 8 miles south of the study area.

Most of the Camp Swift Military Reservation is within the Big Sandy Creek drainage basin. Only very small areas along the southeastern boundary of Camp Swift are drained by Piney Creek. Two tributaries, Dogwood Creek and McLaughlin Creek, convey runoff from the Camp Swift area to Big Sandy Creek (fig. 2.6-1).

Although Big Sandy Creek generally is regarded to be a perennial stream, it has stopped flowing during long periods of less-than-normal precipitation. As an example, record-setting temperatures and very dry conditions occurred during the summer of 1980, and the Geological Survey's streamflow station, Big Sandy Creek near Elgin, recorded 61 days of no flow during the 1980 water year (October 1979 to September 1980). Most of these no-flow periods were during July, August, and September. Additional information on stream discharge is presented in Sections 4.2 and 10.2.

Dogwood Creek, a small tributary to Big Sandy, originates in the Camp Swift Military Reservation. Dogwood Creek is intermittent, flowing only after storms. During the 1980 water year, Dogwood Creek flowed for only 25 days.

McLaughlin Creek also is intermittent. The flow of this creek is not gaged independently, but its flow is included in the runoff at the Geological Survey's gaging station, Big Sandy Creek near Elgin. (See section 4.2). McLaughlin Creek joins Big Sandy Creek about 0.7 mile up stream from this gage.

The major drainage areas within the Camp Swift Military Reservation slope southwesterly and westerly from altitudes of more than 500 feet near the headwaters of Dogwood and McLaughlin Creeks to an altitude of 400 feet where Big Sandy Creek crosses State Highway 95. The highest altitude is slightly more than 550 feet along the southeastern boundary of the Reservation near Farm-to-Market Road 2336 (fig. 2.6-1).

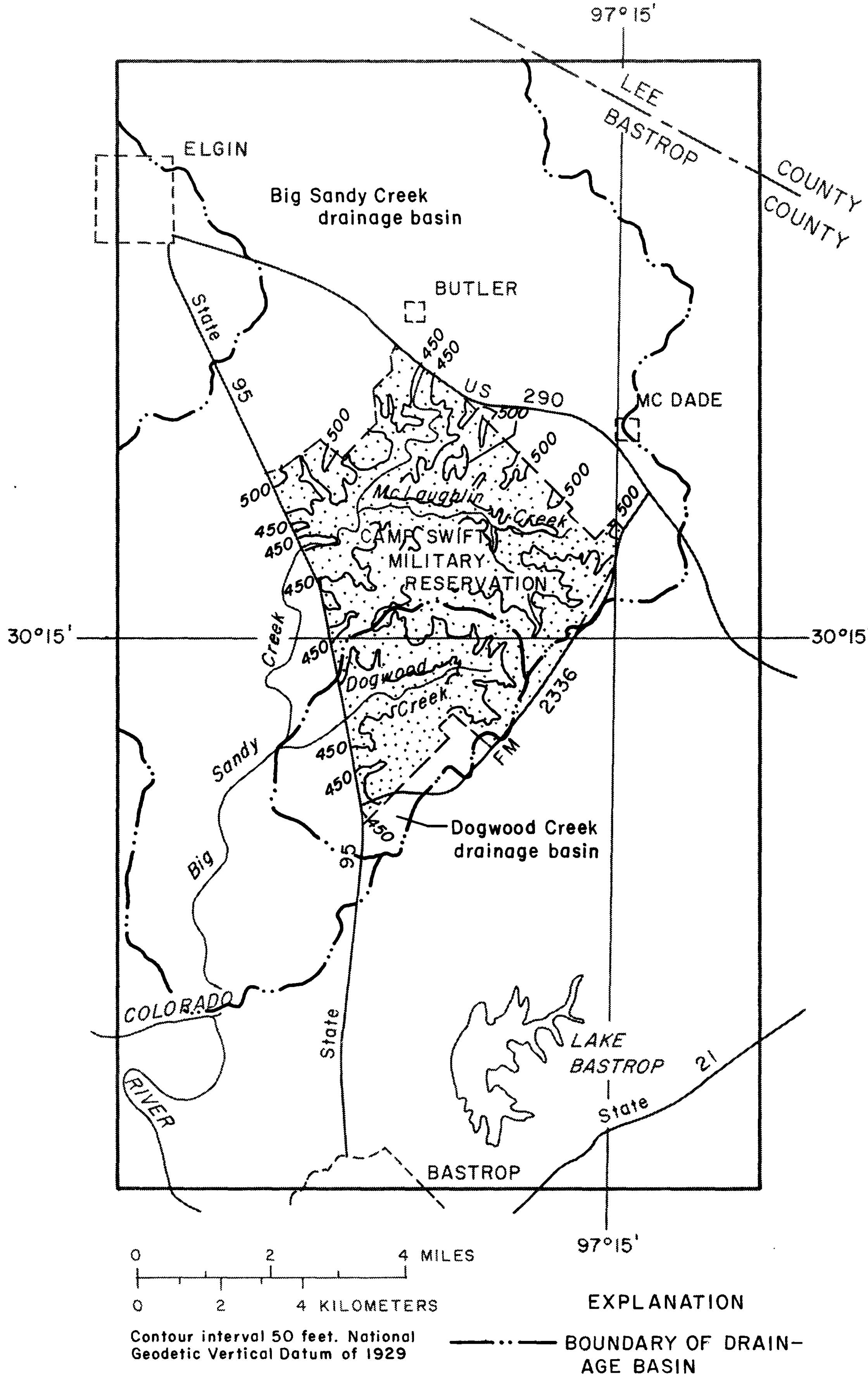


Figure 2.6-1.--Drainage basins in study area and topography in Camp Swift.

3.0 WATER USE

GROUND WATER IS THE SOLE SOURCE OF WATER FOR LOCAL CITIES

Ground-water consumers used 2.7 million gallons per day during 1980.

The source of water for domestic use in the study area is water from the Wilcox Group. The total water pumped from the Wilcox by major users in 1980 was 2.7 million gallons per day. About 50 percent of this total was for municipal use, 47 percent was for rural residents on water-supply systems, and 3 percent was for industry and research facilities. Ground-water withdrawals by the principal users from 1978-80 are given in table 3.0-1, and the location of these withdrawals is shown in figure 3.0-1.

Lake Bastrop is the only major artificial impoundment of surface water in the area. The lake is used for cooling-water supply and for recreation, and is not used as a municipal water supply. The average annual withdrawal of 10,750 acre-feet (9.6 million gallons per day) of water from the lake is used in a steam electric-generating plant (Dowell and Petty, 1971). Except for consumptive losses, the water is returned to the lake.

Future lignite mining in the Camp Swift area will be another principal use of ground water. Dewatering the lignite-bearing sediments adjacent to the mined area in order to lower water levels in the Calvert Bluff Formation will withdraw large volumes of water from this formation. Hydrologic depressuring of the Simsboro aquifer beneath the mined area also may be necessary to prevent upheaval of the mine floor. This depressuring would involve the removal of large quantities of water from the Simsboro. Using a two dimensional finite-difference ground-water model, Hall (1981) estimated that removal of as much as 7.3 million gallons per day during 30 years of mining may be necessary just to depressurize the Simsboro aquifer. Possibly much of this water that is withdrawn during the mining process could be transported to nearby cities or other places of need.

Table 3.0-1.--Annual ground-water pumpage by major users, 1978-80, in million gallons per day
[Pumpage is shown by user, to the nearest 0.01 million gallons per day. Totals are rounded to two significant figures]

User	Year 1978	Year 1979	Year 1980
Aqua Water Supply Corp.	--	0.96	1.28
City of Bastrop	1.56	.86	.82
City of Elgin	.42	.43	.53
Elgin-Butler Brick Co.	--	.03	.03
City of McDade (Bastrop Water Control and Improvement District)	.02	.02	.02
Texas Rendering Company, Inc.	.04	.04	.03
Totals	2.0	2.3	2.7

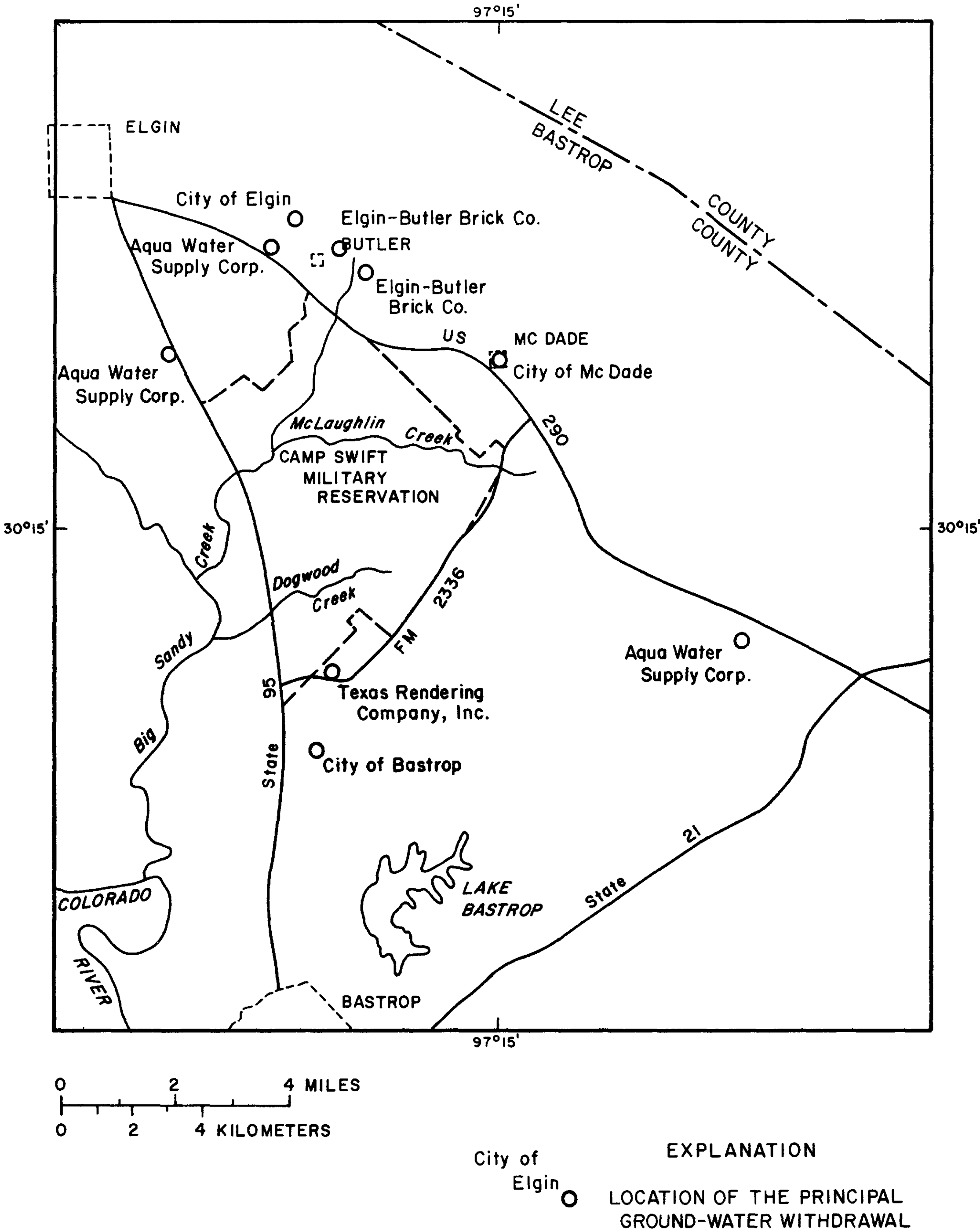


Figure 3.0-1.--Location of the principal ground-water withdrawal sites and user near Camp Swift.

4.0 HYDROLOGIC NETWORKS

4.1 Ground Water

INFORMATION ON GROUND WATER IS AVAILABLE FOR ABOUT 200 LOCATIONS

The U.S. Geological Survey established a network of 22 wells for obtaining monthly water-level information; previous investigations provide historical data on water levels.

The ground-water monitoring network in the study area provides water-level and ground-water-quality data prior to mining. These background data will aid the future mine owner and operator, consulting engineers, and the regulatory agencies in determining the effects of lignite mining on the ground-water resources of the area.

An inventory of about 200 wells and test holes is presented in section 10.1, and the location of these hydrologic sites is shown in figure 4.1-1. The site identification number, depth of well, producing formation, water level and date of water-level measurement, and other available information for each site are given in the section 10.1. Detailed water-quality information, which is available for 13 wells in the study area is presented in section 7.1.

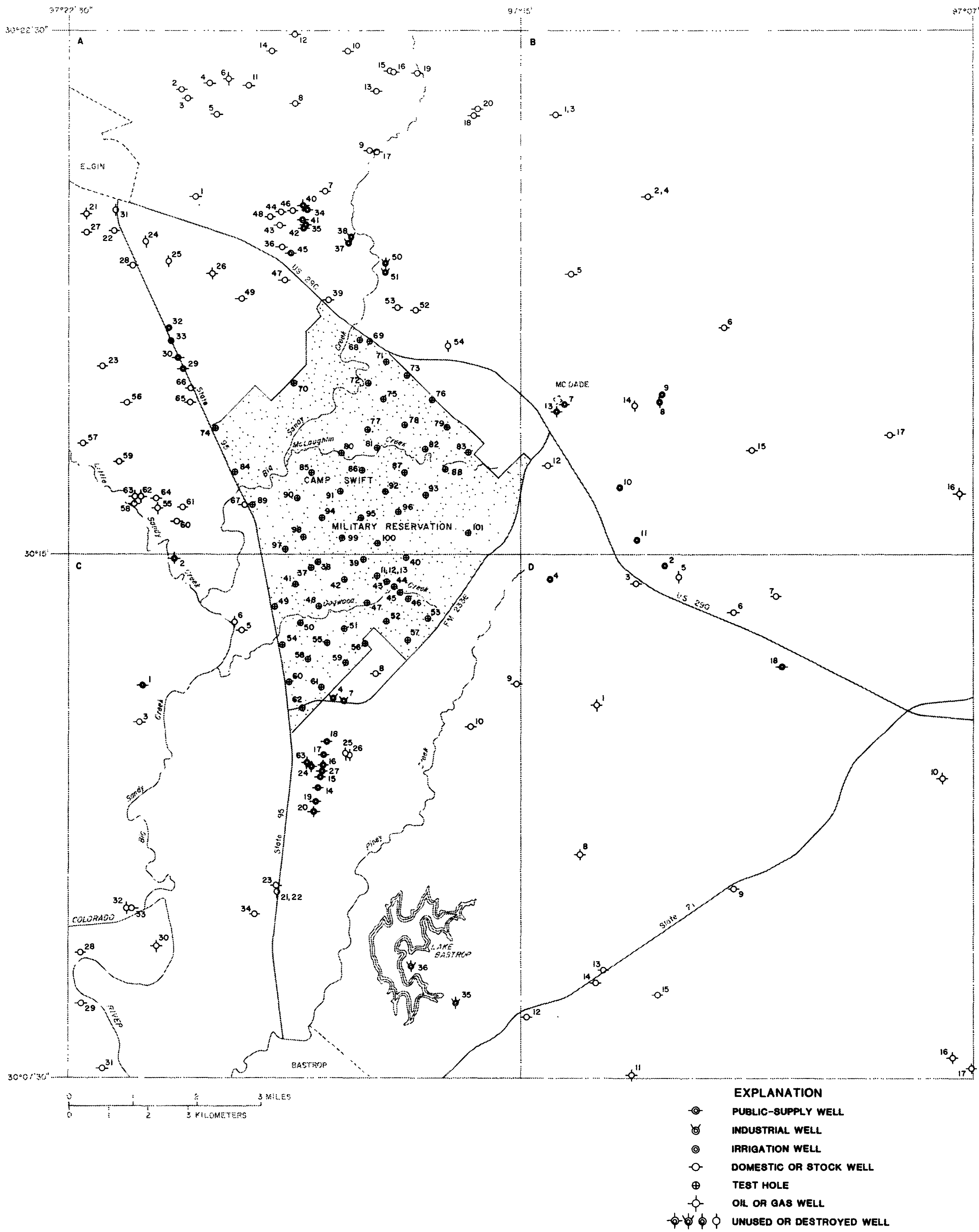


Figure 4.1-1.--Location of wells and test holes.

4.1 Ground Water--Continued

Twenty-two wells in the study area were monitored monthly by the Geological Survey for water-level fluctuations in the Hooper, Simsboro, and Calvert Bluff Formations. Most of the wells had slight and generally insignificant water-level changes from May 1980 to May 1981. This information is presented in table 4.1-1. Previous investigations and well inventories provided historical data on water levels and geological information.

Table 4.1-1.--Monthly water-level measurements of observation wells, 1980-81 1/

Well number	Depth below land surface (feet)												
	1980								1981				
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
A- 8	6.8	7.3	9.0	9.5	9.5	9.5	--	9.8	10.3	--	--	9.3	9.8
A-20	61.8	53.4	52.9	52.5	52.5	52.5	--	52.8	52.3	--	--	52.2	52.2
A-30	141.1	145.4	164.4	161.3	163.2	162.2	--	161.2	--	--	--	--	147.5
A-33	7.9	5.6	10.2	11.6	13.6	13.7	--	15.1	16.2	--	--	12.3	11.9
A-35	48.2	--	59.9	60.6	56.5	53.5	--	52.1	49.7	--	--	50.6	48.9
A-39	16.6	17.8	18.3	17.5	17.6	17.3	--	17.2	17.1	--	--	17.5	17.5
A-45	146.7	--	154.3	168.5	168.3	167.3	--	166.3	--	--	--	168.5	--
A-52	57.8	58.9	63.0	58.8	59.4	59.6	--	58.3	58.8	--	--	57.2	58.4
A-61	64.3	63.7	63.7	63.9	66.1	64.1	--	63.4	64.2	--	--	64.6	64.5
A-62	--	16.1	16.5	16.8	16.7	16.8	--	16.8	16.6	--	--	16.5	--
A-65	69.1	71.1	102.1	101.6	103.3	104.6	--	--	97.4	97.1	--	97.1	--
C- 2	49.1	54.4	59.3	49.5	52.3	47.0	--	43.8	45.1	--	--	55.1	58.8
C- 4	159.1	--	163.1	160.1	160.4	158.7	--	156.6	157.7	155.4	--	157.3	125.2
C- 7	145.3	148.6	152.2	149.5	148.7	147.5	--	145.1	146.8	145.6	--	146.8	--
C- 9	109.1	109.9	128.2	110.9	110.8	111.0	--	108.5	109.3	--	--	110.4	111.9
C-10	--	141.4	146.5	146.0	146.0	146.1	--	145.5	146.5	--	--	147.5	145.9
C-11	--	--	--	--	--	--	--	--	103.5	103.3	--	94.6	91.1
C-12	--	--	--	--	--	--	--	--	54.1	56.3	--	60.1	60.8
C-13	--	--	--	--	--	--	--	--	107.0	106.0	--	106.2	108.0
C-16	--	137.5	141.5	130.5	128.9	123.1	--	117.0	126.1	117.7	--	121.6	--
C-17	--	133.0	137.8	--	127.2	123.4	--	119.1	--	119.1	--	123.1	--
C-25	21.6	21.2	21.4	21.7	21.7	21.3	--	21.4	21.5	--	--	21.7	19.5

1/ See section 10.1 for water-level measurements of additional wells.

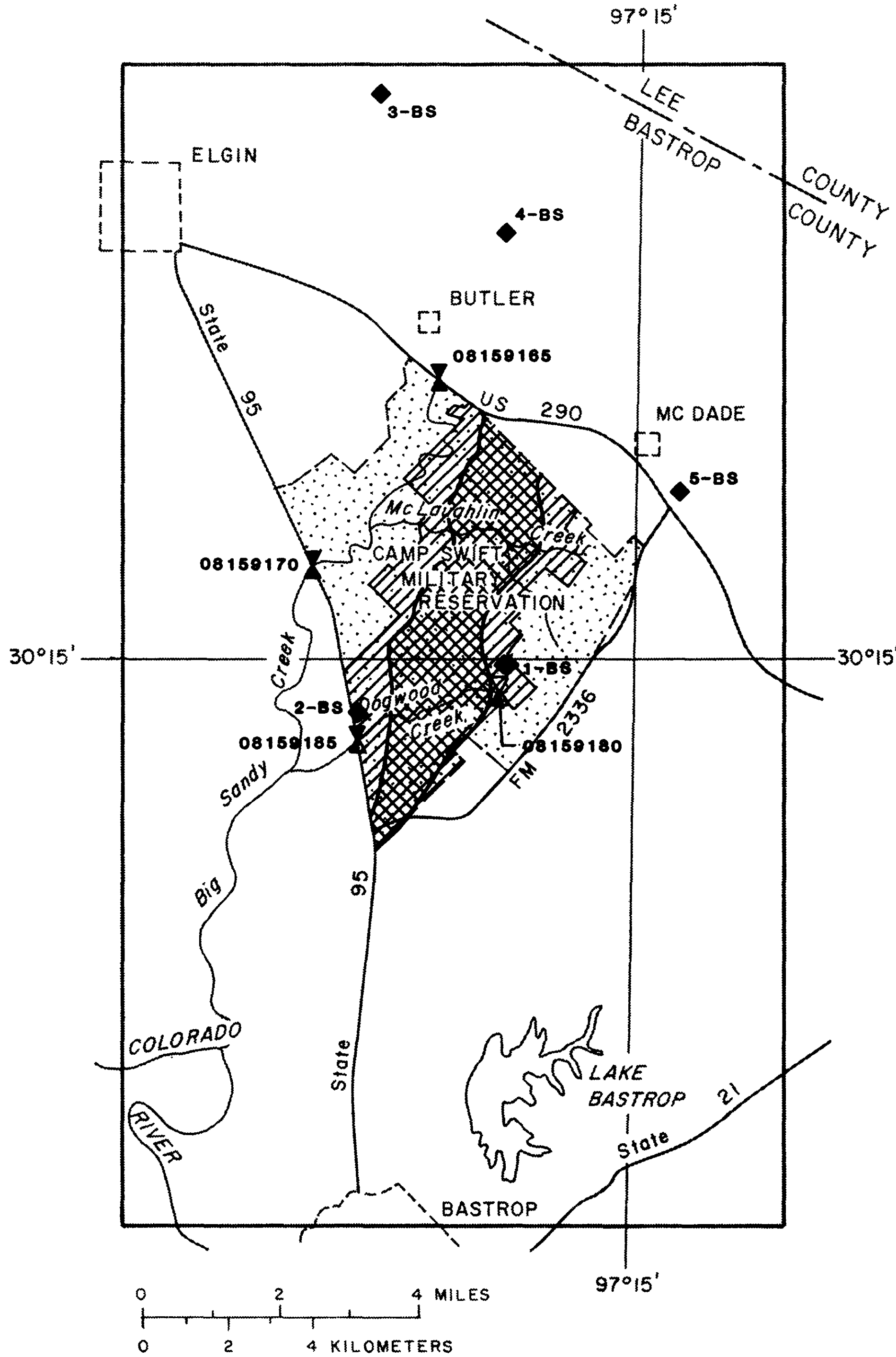
4.2 Surface Water

FOUR STREAMFLOW GAGES, FOUR AUTOMATED WATER-QUALITY SAMPLERS, AND FIVE RECORDING RAIN GAGES WERE OPERATED IN THE CAMP SWIFT AREA

The U.S. Geological Survey's surface-water data-collection network for the study area was established in 1979 to obtain background information in advance of mining at Camp Swift.

Information on streamflow and surface-water quality is available for four sites in the Camp Swift area. The location of the surface-water hydrologic instruments with relation to the proposed mining area is shown in figure 4.2-1. Each streamflow station marks the location of a surface-water-quality sampling site. Definitions for selected surface-water related terms are given in section 11.2.

The four streamflow gages are located on two creeks that cross Camp Swift. Two continuous-record streamflow stations are on Big Sandy Creek. Station 08159165 is upstream and station 08159170 is downstream from the proposed mining area. Two flood-hydrograph partial-record stations are on Dogwood Creek, a tributary to Big Sandy Creek. The flood-hydrograph partial-record stations record flow only above a predetermined base-flow, and thus do not record low flows. Station 08159180 is inside Camp Swift near the headwaters of Dogwood Creek, and station 08159185 is downstream from the proposed mining area. This network provides a means of comparing flow characteristics upstream and downstream from future mining activity. The daily mean discharges for the two continuous-record gaging stations are given in section 10.2.



EXPLANATION

08159165 ▲ CONTINUOUS-RECORD STREAMFLOW STATION AND NUMBER

08159185 ◭ FLOOD-HYDROGRAPH, PARTIAL-RECORD STATION AND NUMBER

08150180 ▽ PERIODIC WATER-QUALITY STATION WITH AUTOMATIC SAMPLER

08159165 ▼ PERIODIC WATER-QUALITY AND SEDMENT STATION WITH AUTOMATIC SAMPLER

4-BS ◆ RECORDING RAIN GAGE AND NUMBER

▨ LEASE AREA

⊠ APPROXIMATE AREA OF PROPOSED MINING

Figure 4.2-1.--Location of surface-water stations and rain gages.

Automated water samplers were activated at a predetermined stage and collected discrete water-quality samples at predetermined time intervals. This schedule of sampling defines the range of water-quality characteristics of the stream for the duration of a storm. Water-quality analyses for the four streamflow stations are presented in section 10.3.

Five recording rain gages are located in the study area. These gages record the depth of precipitation at time increments of 15 minutes. The rain gages are located strategically so that the rainfall may be compared with the corresponding runoff at the streamflow-gaging stations. The daily total rainfall for these gages is given in section 10.4. The monthly and annual weighted-mean precipitation that applies to the two continuous-record streamflow stations are shown with the streamflow data for those stations in section 10.2.

Weighted-mean precipitation factors for each streamflow station are shown in table 4.2-1 from which the weighted-mean precipitation for a streamflow station may be determined. For example, the weighted-mean precipitation for the watershed contributing to flow at the Big Sandy Creek near McDade streamflow station (08159165) could be computed as follows: Multiply the recorded precipitation at rain gage 3-BS by 0.57 and add the the recorded precipitation at rain gage 4-BS multiplied by 0.43.

Table 4.2-1.--Weighted-mean precipitation factors for watersheds monitored by streamflow gaging stations

Station number	Station name	Rain gage	Weighted-mean precipitation factor
08159165	Big Sandy Creek near McDade	3-BS	0.57
		4-BS	.43
08159170	Big Sandy Creek near Elgin	3-BS	.36
		4-BS	.38
		5-BS	.26
08159180	Dogwood Creek near McDade	1-BS	1.00
08159185	Dogwood Creek at State Highway 95 near McDade	1-BS	.70
		2-BS	.30

5.0 SURFACE-WATER HYDROLOGY

STREAMFLOW VARIES WITH RAINFALL AND SOIL MOISTURE

Variations in streamflow are related to the duration and intensity of rainfall and the antecedent precipitation index.

A typical pattern of daily streamflow for Big Sandy Creek near Elgin (08159170) for January through April 1981 is shown in figure 5.0-1. The daily total rainfall for that period also is shown in the figure. This figure shows that the flow of Big Sandy Creek fluctuates very rapidly in response to rainfall in the watershed. Because the drainage area of Big Sandy Creek is relatively small, the duration of surface runoff from most storms is short, and the base flow of Big Sandy Creek is small, usually less than 0.5 cubic foot per second. Consequently, evapotranspiration probably has very little effect on the floodflows of this creek.

The soil characteristics of this area, which are discussed in section 2.5, have a significant effect on streamflow. Because the shrink-swell potential, permeability, and moisture content of these soils vary greatly in relation to antecedent precipitation, the runoff characteristics for a given storm can vary accordingly. After prolonged dry periods, the absorption characteristics of the soils can be very large, and thus the surface runoff can be small. During wet periods, water storage capacity of the soils is greatly decreased, and thus surface runoff may be relatively large.

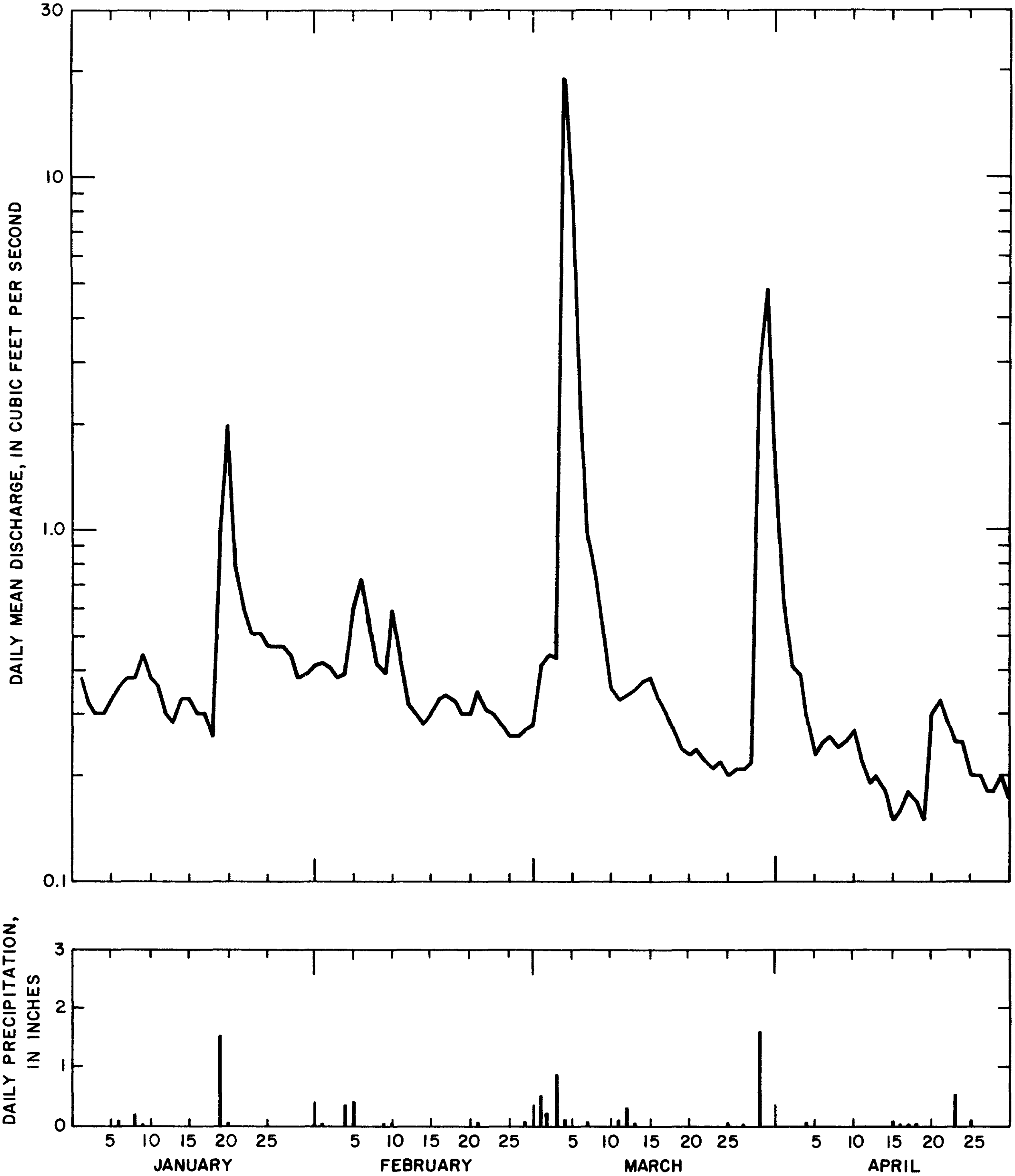


Figure 5.0-1.--Typical daily pattern of streamflow, Big Sandy Creek near Elgin (08159170), January-April 1981.

Hydrographs of incremental precipitation and runoff for eight selected storms at the four streamflow stations on Big Sandy and Dogwood Creeks are shown in figure 5.0-2. Three storms were analyzed for each of the two continuous-record streamflow stations on Big Sandy Creek, and one storm was analyzed for each of the two flood-hydrograph, partial-record streamflow stations on Dogwood Creek.

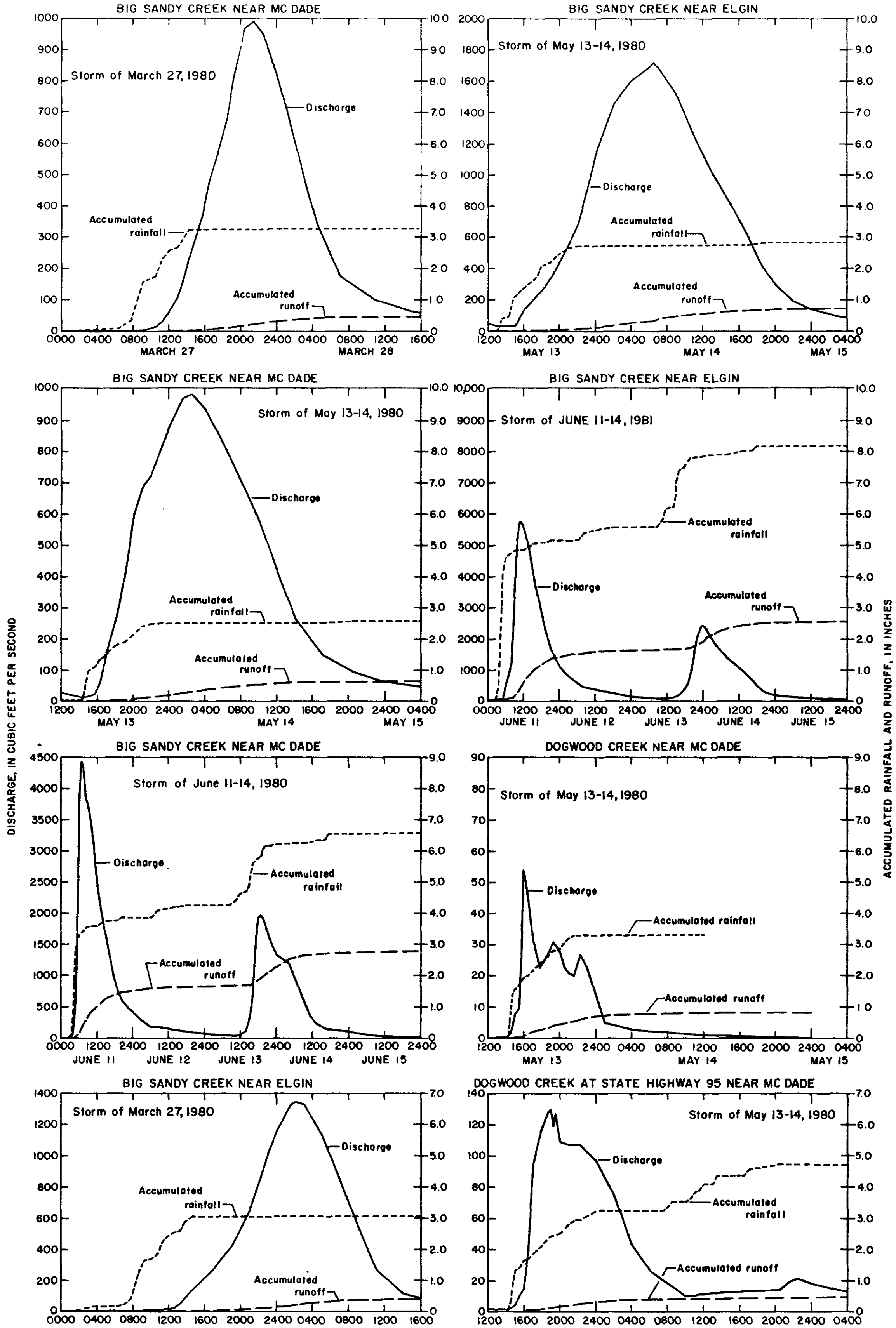


Figure 5.0-2.--Hydrographs and mass curves for four streamflow stations on Big Sandy and Dogwood Creeks.

Selected characteristics of the precipitation and runoff for these storms are summarized in table 5.0-1. The incremental values of precipitation and runoff for these storms are given in section 10.5. The incremental precipitation for selected storms at rain gages and the weighted-mean precipitation within the Big Sandy and Dogwood Creek watersheds also are shown in the table for each streamflow site. Also presented in the table are accumulated rainfall and runoff volumes expressed in inches of depth over the entire drainage watershed. Expression of precipitation and runoff in the same units allow direct comparison. For example, if a storm produces a weighted-mean precipitation of 1.00 inch and the accumulated runoff is 0.30 inch, then the runoff would be 30 percent of the precipitation.

Table 5.0-1.--Storm rainfall-runoff data, Big Sandy and Dogwood Creeks

Date of storm	Rainfall: Duration (hours)	Rainfall: Total (inches)	Rainfall: Maximum increment (inches) 15 minute	Rainfall: Maximum increment (inches) 30 minute	Rainfall: Maximum increment (inches) 60 minute	Runoff (inches)	Ratio of runoff to rainfall	Maximum discharge (cubic feet per second)
08159165 Big Sandy Creek near McDade (Drainage area--38.7 square miles)								
March 27, 1980	14	3.26	0.30	0.54	1.04	0.49	0.15	989
May 13-14, 1980	42	2.58	.49	.71	.98	.66	.26	984
June 11-14, 1981	88	6.57	.93	1.67	2.71	2.79	.42	4,410
08159170 Big Sandy Creek near Elgin (Drainage area--63.8 square miles)								
March 27, 1980	13	3.05	.41	.73	1.13	.43	.14	1,340
May 13-14, 1980	40	2.85	.71	1.08	1.15	.74	.26	1,720
June 11-14, 1981	88	8.13	1.35	2.51	3.76	2.53	.31	5,760
08159180 Dogwood Creek near McDade (Drainage area--0.53 square mile)								
May 13-14, 1980	18	3.33	.85	1.35	1.57	.83	.25	54
08159185 Dogwood Creek at State Highway 95 near McDade (Drainage area--5.03 square miles)								
May 13-14, 1980	40	4.72	.85	1.35	1.57	.50	.11	130

The streamflow stations on Big Sandy Creek are located immediately upstream and downstream from the proposed lignite-mining area. The surface runoff from the intervening area between the two gaging stations was computed by subtracting the streamflow occurring at the upstream gage from the streamflow occurring at the downstream gage. Runoff values for the intervening area are presented in table 5.0-2.

For the 3 years ending in September 1982, surface runoff accounted for only 6 inches of the 99 inches of precipitation occurring in the area; thus about 93 inches was absorbed within the watershed or was lost by evapotranspiration.

The effect of antecedent rainfall on runoff is exemplified by the analysis of storms for the drainage area of Big Sandy Creek near McDade. During the storm on March 27 and May 13-14, 1980, total rainfall for this drainage was 3.26 and 2.58 inches, respectively. Although differences in incremental rainfall during the storms were insignificant (table 5.0-1), the runoff produced by the storm on March 27 was significantly less than runoff produced by the storm on May 13-14. The storm on March 27 produced a total runoff of 0.49 inch (15 percent of the total rainfall), whereas the storm on May 13-14 produced a total runoff of 0.66 inch (26 percent of the total rainfall). Most of this difference in total runoff is attributed to antecedent rainfall. Total rainfall during the 2 weeks before the March storm was only about 0.4 inch. However, total rainfall during the 2 weeks before the May storm was about 2.7 inches, about 0.8 inch of which occurred on the day before the storm. The effects of antecedent rainfall on runoff as exemplified by these storms are typical for other storms in the drainage area of Big Sandy Creek.

Table 5.0-2.--Rainfall and runoff data, for the intervening area between the two streamflow gages on Big Sandy Creek

Water year	Runoff		Rainfall (inches)	Ratio of runoff to rainfall
	Acre-feet	Inches		
1980	2,080	1.55	31.21	0.05
1981	3,520	2.63	40.88	.06
1982	2,640	1.97	a/27.00	.07
Totals	8,240	6.15	99.09	0.06

a/ Rain gages inoperative during October and November; annual total estimated.

6.0 GROUND-WATER HYDROLOGY

6.1 Source, Recharge, and Movement of Ground Water

INFILTRATION OF PRECIPITATION RECHARGES THE AQUIFERS IN THE CAMP SWIFT AREA

The Calvert Bluff and Simsboro Formations receive direct recharge at their outcrops. The movement of ground water generally is to the southeast.

The source of ground water in the Camp Swift area is precipitation. Part of the precipitation returns to the atmosphere through evaporation and transpiration, part flows into streams as runoff, and part infiltrates through the soils and rocks to the zone of saturation. Definitions for selected ground-water terms are given in section 10.1.

Recharge to the Calvert Bluff and Simsboro Formations primarily is by direct infiltration of precipitation into the outcrops of these formations. Recharge also may result from infiltration of streamflow from the streams that flow over the outcrop of the aquifers. Where the water table is below the water level in the stream, such as the case with Dogwood Creek, water percolates through the stream channel and into the aquifer. The rate of this percolation depends on the permeability of the material below the stream channel.

Leakage from one aquifer to another through confining beds also is a source of recharge to some aquifers in the Camp Swift area. Water in the Calvert Bluff recharges the underlying Simsboro chiefly by leakage through the lignite and beds of clay, silt, or fine sand near the base of the Calvert Bluff. This interformational recharge is slow because of the small vertical hydraulic conductivity of these confining beds. The driving force is the different hydraulic pressure in the two formations on opposite sides of these beds, with the greater hydraulic pressure being in the Calvert Bluff and the lesser pressure in the Simsboro. The generalized source, recharge, and movement of ground water in the Camp Swift area are shown in figure 6.1-1.

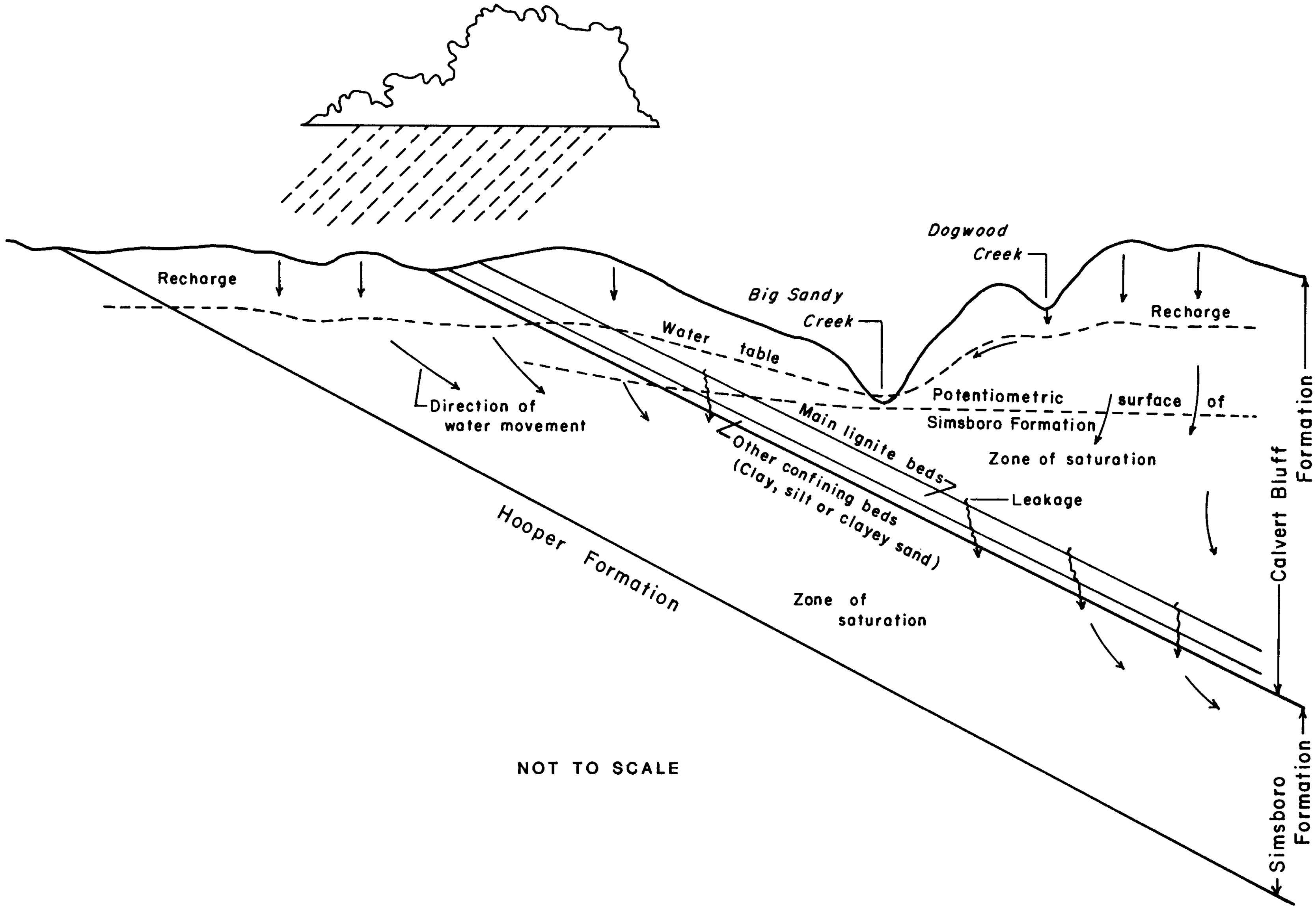


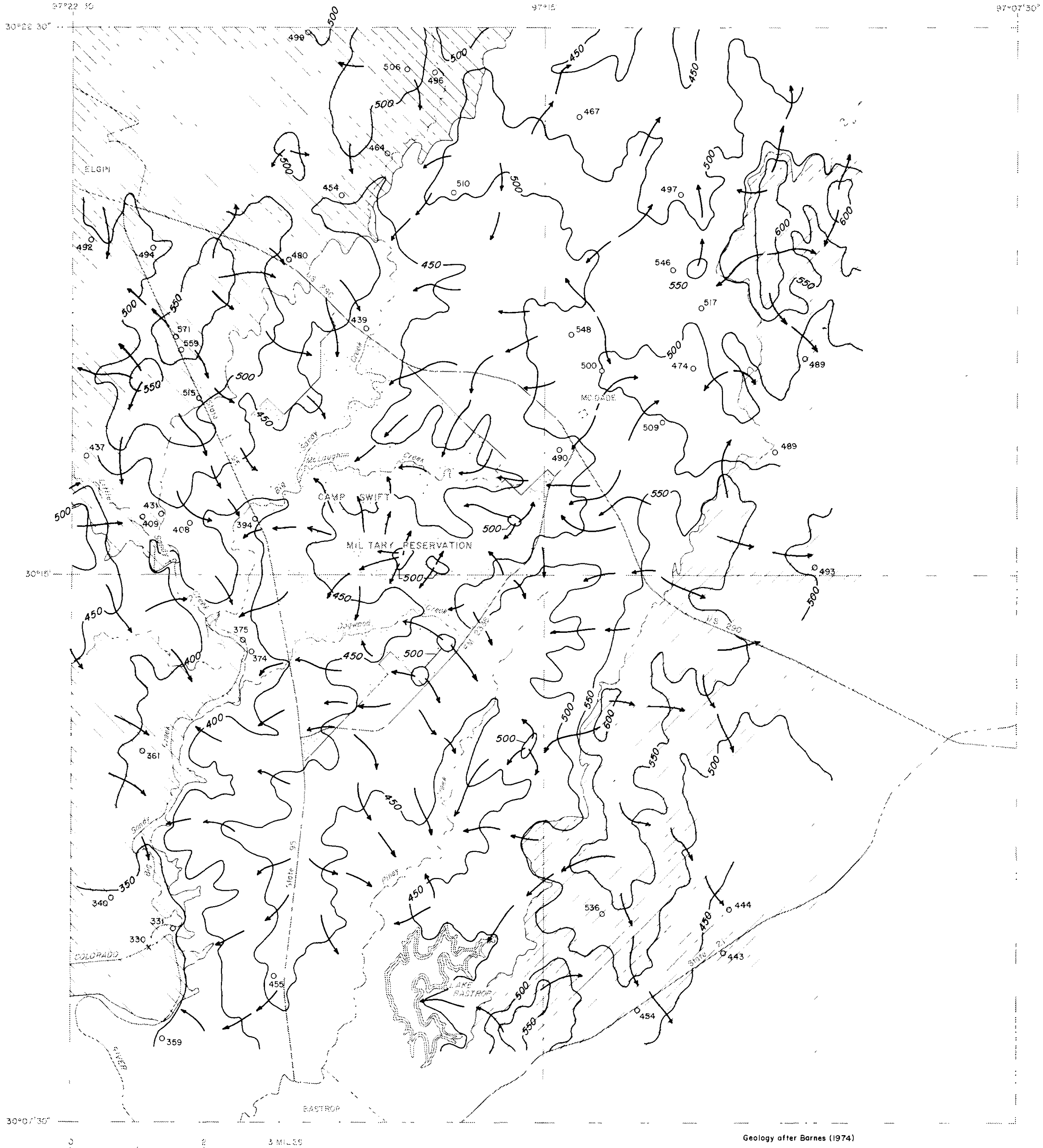
Figure 6.1-1.--Source, recharge, and movement of ground water.

Ground water moves in the Camp Swift area from the areas of recharge such as the outcrops of the Calvert Bluff, Simsboro, and Hooper Formations to areas of discharge such as deeply incised streams, well fields, and places where interformational leakage can occur. The rate at which the water moves probably varies from less than 10 feet per year in some places to several tens of feet per year in other places, and depends predominantly on porosity, hydraulic conductivity, and the hydraulic gradient of the aquifer. The unconsolidated sand beds in the Calvert Bluff, Simsboro, and Hooper Formations commonly have different hydraulic conductivities but are much more permeable than the clay, silt, well-cemented sandstone, and lignite beds in some of these formations.

The regional direction of movement of the ground water is to the southeast, but physical features alter the direction locally. In order to understand the local components of movement, the Calvert Bluff and Simsboro Formations need to be considered individually.

Water in the Calvert Bluff travels mainly through channel-sand deposits and upper-deltaic sand beds. The orientation of most of these channels and the hydraulic gradient is from northwest to southeast, which gives the water deep within the zone of saturation its dominant southeasterly movement. However, ground water at or near the water table at the top of the zone of saturation moves under the effect of gravity and the topography. A water-table map of the Calvert Bluff and adjacent formations, which illustrates the multidirectional movement of the shallow ground water is shown in figure 6.1-2. The shallow water moves in the direction of decreasing altitude of the water table and, for the most part, in the direction of decreasing altitude of the land surface.

Within the Camp Swift Military Reservation shallow-water movement is toward Big Sandy and Dogwood Creeks. A shallow ground-water divide occurs along the southeastern boundary of the reservation (along Farm-to-Market Road 2336 where a land-surface divide also occurs). Shallow water moves southeasterly from this divide toward Piney Creek and northwesterly from this divide toward Big Sandy and Dogwood Creeks.



Geology after Barnes (1974)

EXPLANATION

OUTCROP OF FORMATIONS THAT OVERLIE THE CALVERT BLUFF FORMATION	
OUTCROP OF CALVERT BLUFF FORMATION	
OUTCROP OF MOSTLY SIMSBORO AND HOOPER FORMATIONS THAT UNDERLIE THE CALVERT BLUFF FORMATION	
CONTACT	

NOTE: Exposure of Quaternary alluvium and terrace deposits not shown

○ 455 WELL USED FOR CONTROL--Number indicates altitude of water table, in feet above National Geodetic Vertical Datum of 1929

x 330 RIVER-STAGE SITE USED FOR CONTROL--Number is the approximate normal altitude of water level in river, in feet above National Geodetic Vertical Datum of 1929

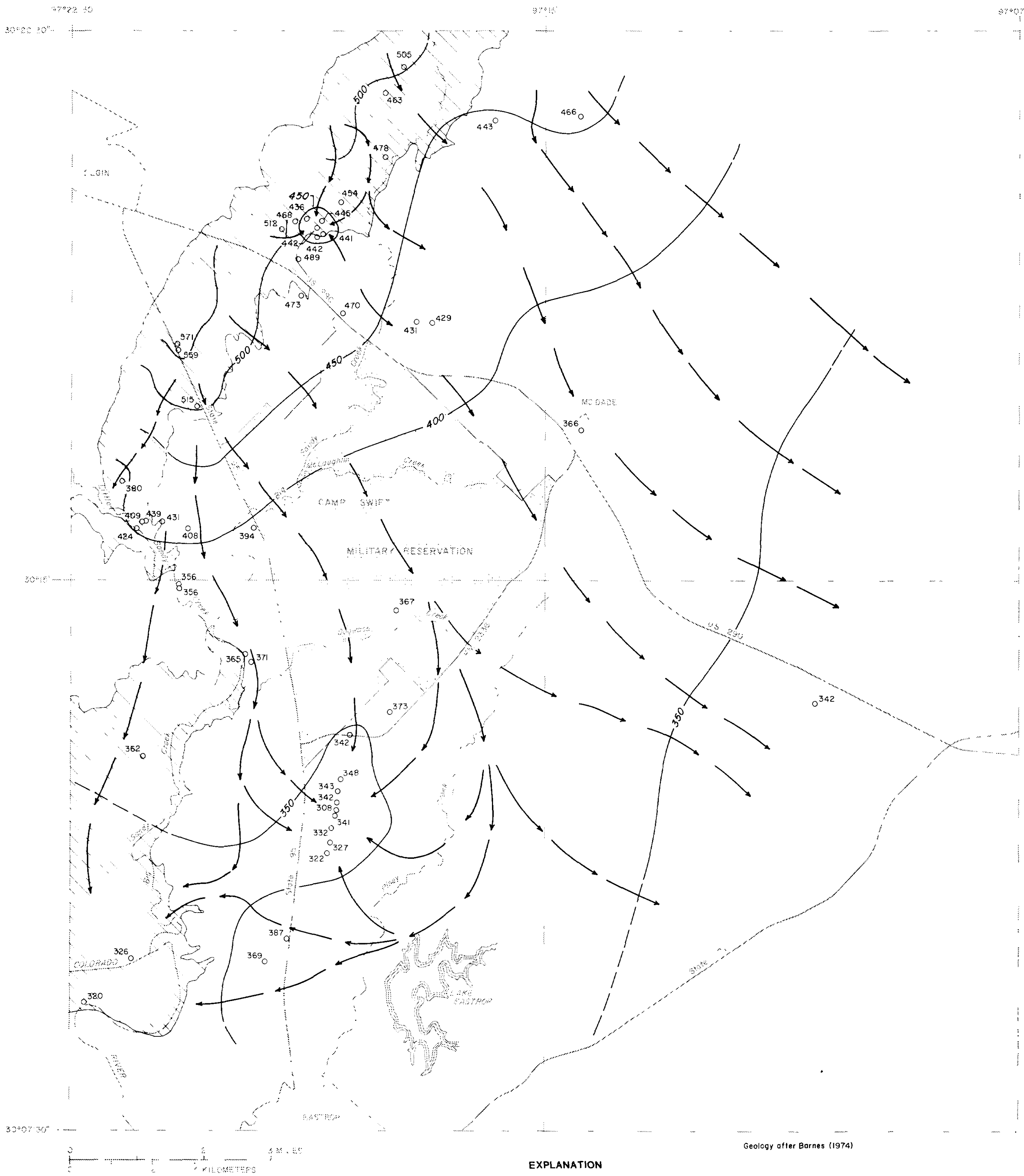
—450— WATER-TABLE CONTOUR--Shows altitude of water table. Contour interval 50 feet. National Geodetic Vertical Datum of 1929. In addition to well and river-stage control, the water-table contours were based on topography from 7 1/2- minute quadrangles.

⟶ GENERAL DIRECTION OF SHALLOW GROUND-WATER MOVEMENT IN CALVERT BLUFF AND ADJACENT FORMATIONS

Figure 6.1-2.--Altitude of the water table in the Calvert Bluff and adjacent formations.

Vertical water movement from the Calvert Bluff to the Simsboro occurs as leakage through the confining beds near the base of the Calvert Bluff. This process constitutes a natural means of water discharge from the Calvert Bluff and a source of recharge to the Simsboro.

Regional ground-water movement in the Simsboro also is to the southeast. A potentiometric-surface map of the Simsboro, which shows the altitude to which water levels in relatively deep wells in the Simsboro will rise is shown in figure 6.1-3. An analysis of the map indicates that ground water deep within the zone of saturation in the Simsboro is moving from the outcrop of the Simsboro in southeasterly and southerly directions. Localized, but extensive pumping has caused cones of depression east of Elgin and especially near the south corner of the Camp Swift Military Reservation. Some of the Simsboro water moves into these depressions from virtually all directions.



Geology after Barnes (1974)

EXPLANATION

OUTCROP OF SIMSBORO FORMATION

NOTE Exposures of Quaternary alluvium and terrace deposits not shown

CONTACT

367 WELL USED FOR CONTROL--Number indicates altitude of water level, in feet above National Geodetic Vertical Datum of 1929

350 WATER-LEVEL CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval 50 feet. National Geodetic Vertical Datum of 1929

GENERAL DIRECTION OF MOVEMENT OF RELATIVELY DEEP GROUND WATER IN SIMSBORO FORMATION

Figure 6.1-3.--Altitude of water levels in wells completed in the Simsboro Formation.

6.2 Aquifer Testing

U.S. GEOLOGICAL SURVEY PERFORMS GEOHYDROLOGIC TESTING IN CAMP SWIFT

Three exploratory holes were drilled in Camp Swift and extensive aquifer tests on nearby city of Bastrop wells were utilized to determine the geohydrologic characteristics of the Calvert Bluff and Simsboro Formations.

Because the principal source of ground-water for communities in the Camp Swift study area is the Simsboro Formation and because the lignite is included in the Calvert Bluff Formation, the U.S. Geological Survey drilled three test holes (fig. 4.1-1) in the Camp Swift Military Reservation to determine selected geologic and hydrologic properties of these formations. This information will be useful to companies and individuals that are involved in evaluating the area for environmental reasons and for lignite mining.

The three test holes that were drilled are near the southeast boundary of Camp Swift where the lignite seams in the proposed lease area are relatively deep. The test holes, which are designated C-11, C-12, and C-13 are spaced 50 feet apart (fig. 6.2-1). Well C-11 is 500 feet deep and is screened in the Simsboro Formation from 240 to 490 feet below land surface. Wells C-12 and C-13 are 220 and 330 feet deep, respectively. Well C-12 is screened in the Calvert Bluff Formation from 200 to 220 feet below land surface, whereas well C-13 is screened in the Simsboro from 250 to 330 feet.

Well C-11, with the pump set at a depth of 205 feet below land surface, was test pumped for 48 hours at an average rate of 110 gallons per minute. The water levels in all three wells were monitored for 48 hours during pumping to determine drawdown and for an additional 48 hours after pumping stopped to determine recovery. The maximum drawdown at well C-11 was about 94 feet, which translates into a specific capacity of 1.2 gallons per minute per foot of drawdown. This drawdown is considered to be excessive in relation to the pumping rate and is not considered be to representative of the Simsboro. The probable cause of the abnormal specific capacity is incomplete well-development, which resulted in fine sand, silt, and mud clogging much of the screen. The maximum drawdown at well C-13 which is 100 feet from C-11, was 1.4 feet.

The water level in well C-12, screened near the base of Calvert Bluff but above the basal confining layers including the two basal lignite beds, showed no appreciable change during and after the test pumping of the Simsboro well. This lack of change in the water level demonstrates that the lignite and other tight beds of fine sand or clay are effective confining beds to the Simsboro aquifer and that hydraulic connection between the Calvert Bluff and Simsboro is restricted. This situation of restricted hydraulic connection probably predominates throughout most of the area, except in places where the lignite and other tight beds are discontinuous. In such areas, water from the Calvert Bluff could move more easily into the Simsboro.

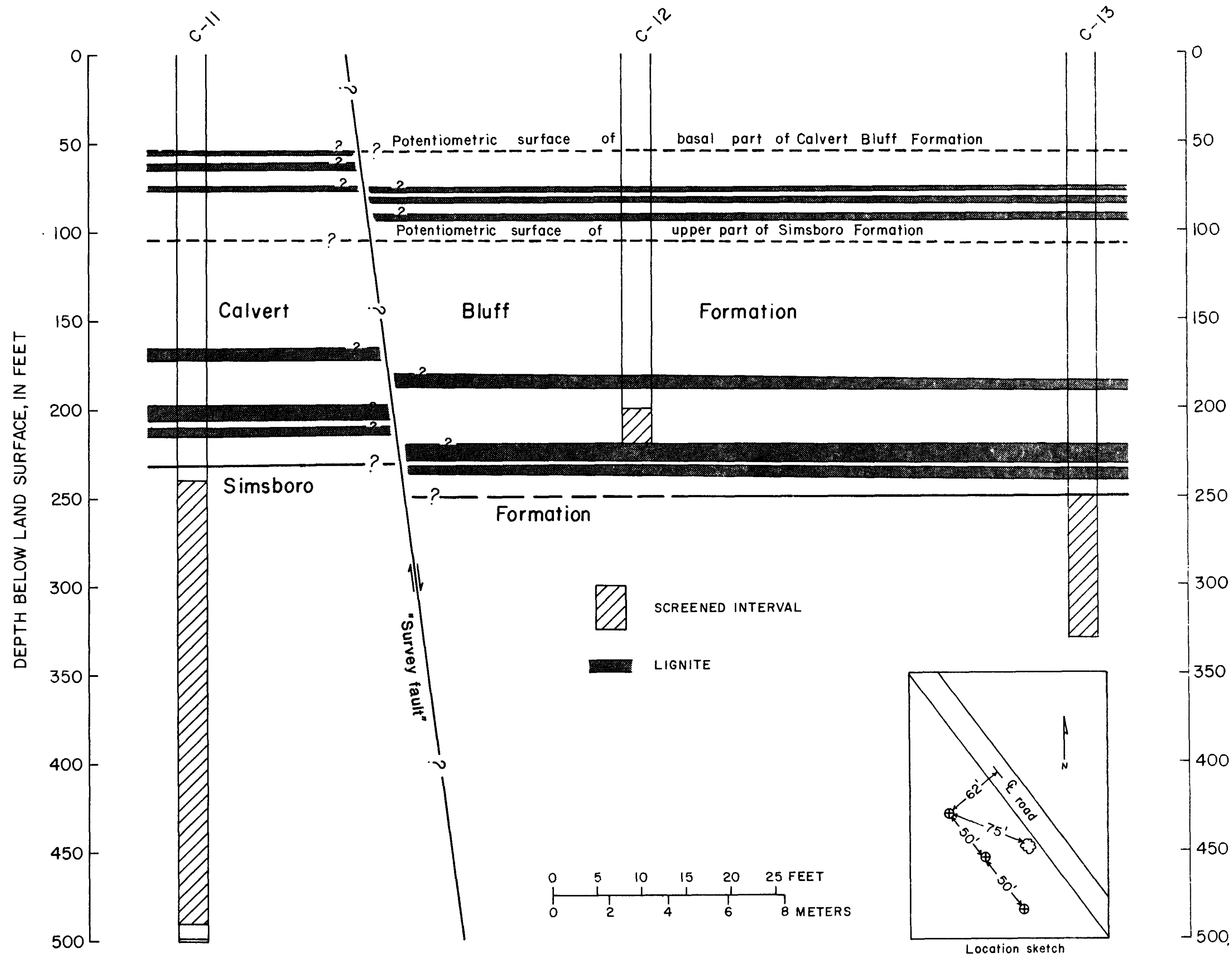


Figure 6.2.-1.--Generalized section through U.S. Geological Survey test holes.

The hydraulic properties of the Simsboro aquifer were derived from aquifer tests of several city of Bastrop municipal wells (formerly public-supply wells for the Camp Swift Military Reservation). The well field is located from 0.75 to 1.5 miles south of the south corner of Camp Swift (fig. 4.1-1). Because of this close proximity of the well field to the Camp Swift Military Reservation, the hydraulic properties of the Simsboro in the two areas should be similar.

Results of extensive aquifer testing of the Simsboro involving several wells (Guyton, 1942) are presented in section 10.6. The transmissivities and storage coefficients obtained from the tests were derived by the application of the Theis nonequilibrium formula and by the Thiem formula for artesian conditions. As a basis for computation, it is assumed from the data in section 10.6 that a transmissivity of 6,000 feet squared per day and a storage coefficient of 0.0004 may be considered to be average values. Specific capacities for six wells after 1.5 hours of pumping ranged from 9.5 to 21 gallons per minute per foot and averaged 17 gallons per minute per foot.

These average values of transmissivity and storage coefficient were used in the Theis nonequilibrium formula to prepare the curves in figure 6.2-2. The curves show the theoretical drawdown in water levels at various distances from a center of pumping at the rate of 1,000 gallons per minute after 1 month, 3 months, 6 months, and 1 year of continuous pumping. The theoretical drawdown is proportional to the pumping rate. For example, to compute the drawdown produced by pumping 500 and 5,000 gallons per minute, the drawdown indicated in the diagram should be multiplied by 0.5 and 5.0, respectively.

Inherent in the mathematical formulas from which the theoretical drawdown curves depicted in figure 6.2-2 were derived are several idealistic assumptions, among which that the aquifer is lithologically homogeneous and isotropic and is infinite in areal extent. Because these conditions are unrealistic in the case of the Simsboro, the values of drawdown are necessarily subject to varying degrees of error.

The presence of the Simsboro outcrop, which is from 1 to 7 miles west of Camp Swift, is a chief factor that affects the theoretical drawdown values. The outcrop is a recharge boundary that will have a mitigating effect on water-level drawdowns, in which case the actual drawdowns will be somewhat less than the theoretical curves show. Faults, in contrast, which usually are barriers to ground-water flow, could increase the theoretical drawdowns. Computer models of ground-water flow need to be considered if more precise effects of pumping are needed.

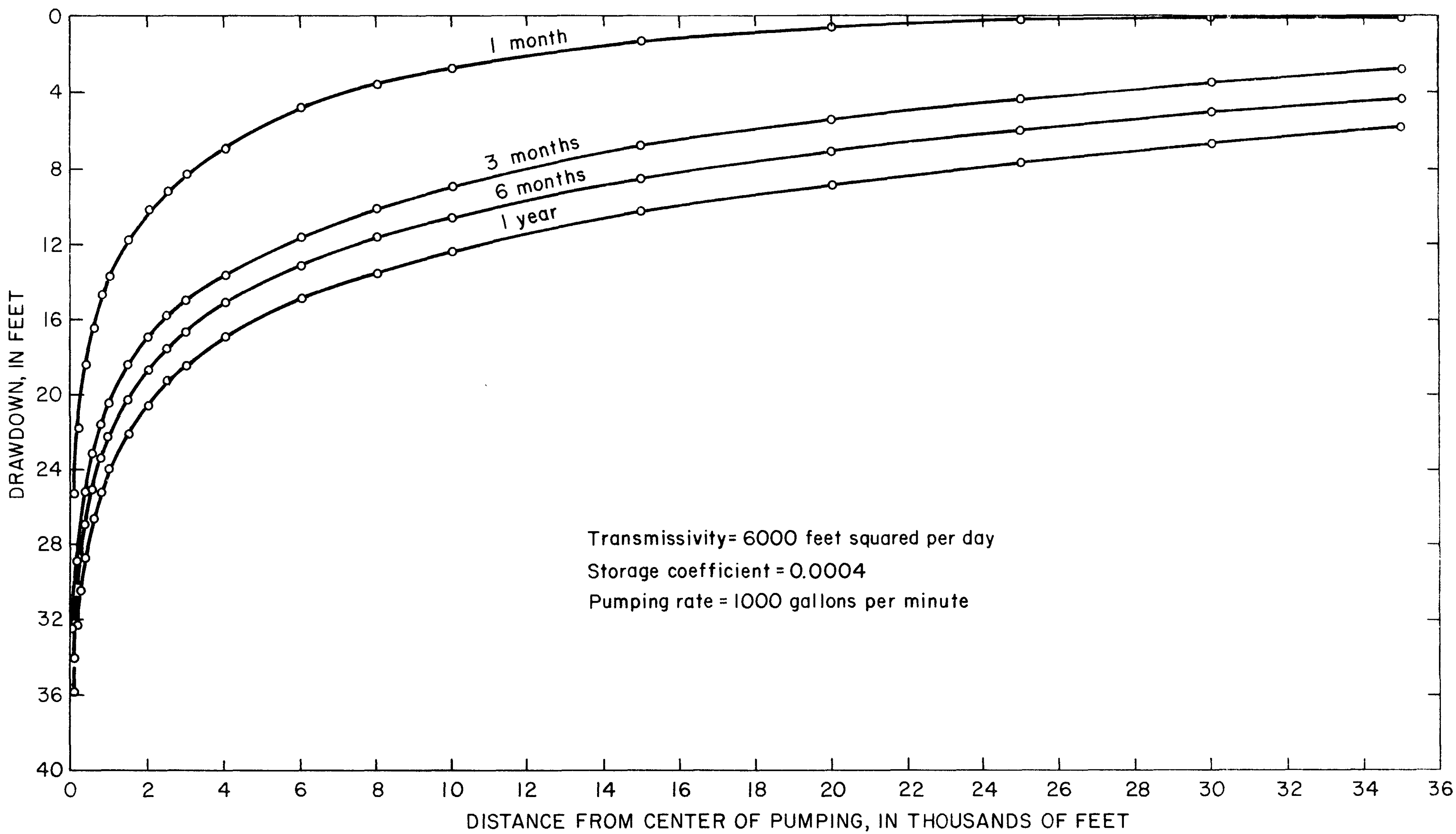


Figure 6.2-2.--Relation of drawdown to time and distance from a center of pumping.

7.0 WATER QUALITY

7.1 Surface-Water Quality

SURFACE-WATER SAMPLES WERE ANALYZED TO DEFINE PREMINING QUALITY

Water Samples were Collected During Different Seasons and During Different Flow Conditions to Depict the Variance in Quality

The concentrations and types of solutes dissolved in surface water that drains from areas where municipal and industrial effects are minimal principally depend on the chemical composition and physical structure of the rocks and soils contacted by the water and on the duration of the contact. The quantity of the soluble material in rocks and soils available for solution is decreased by leaching. Consequently, the rocks and soils near land surface in humid areas usually are well leached, and storm runoff from these areas usually contains small concentrations of most dissolved solutes. However, in headwater regions where much of the runoff in ephemeral streams result from flash floods, both the quantity and quality of the water may vary widely. During periods of sustained low or base flow, the water in many streams consists mostly of inflow of ground water, and the concentrations of most solutes are maximum. The concentrations usually decrease significantly during and after periods of storm runoff. However, some streams do not have this simple pattern because of other factors that affect the solute concentrations. Definitions of selected water-quality-related terms are given in section 11-3.

As part of this study to obtain background hydrologic data for the Camp Swift area prior to lignite mining, automatic water samplers were installed at the four streamflow stations. (See figure 4.2-1). These samplers were activated at a predetermined stage and collected discrete water samples at predetermined time intervals. Automatic sampling during some periods was supplemented by manual sampling. Selected samples collected during storm runoff were analyzed for a variety of constituents or properties including major dissolved inorganic constituents, selected dissolved trace constituents, total nutrients, total pesticides, and indicator bacteria. The results of these analyses are given in section 10.3.

The quality of surface water in the Camp Swift area generally is suitable for most uses, but varies significantly in response to variations in discharge and related factors. Low flows in Big Sandy Creek are sustained principally by the inflow of shallow ground water. During these periods, concentrations of major dissolved inorganic constituents in streamflow are large. During the early stages of storm runoff, the concentrations of the major constituents also are large due to the leaching of soluble weathered material that has accumulated at the land surface since the last storm. As the duration of the storm runoff continues and the soluble material is flushed from the land surface, the concentrations of the major dissolved constituents decrease. This "first flush" pattern also is typical for indicator bacteria. However, concentrations of some of the other constituents such as total nitrogen species and total phosphorus do not have the typical

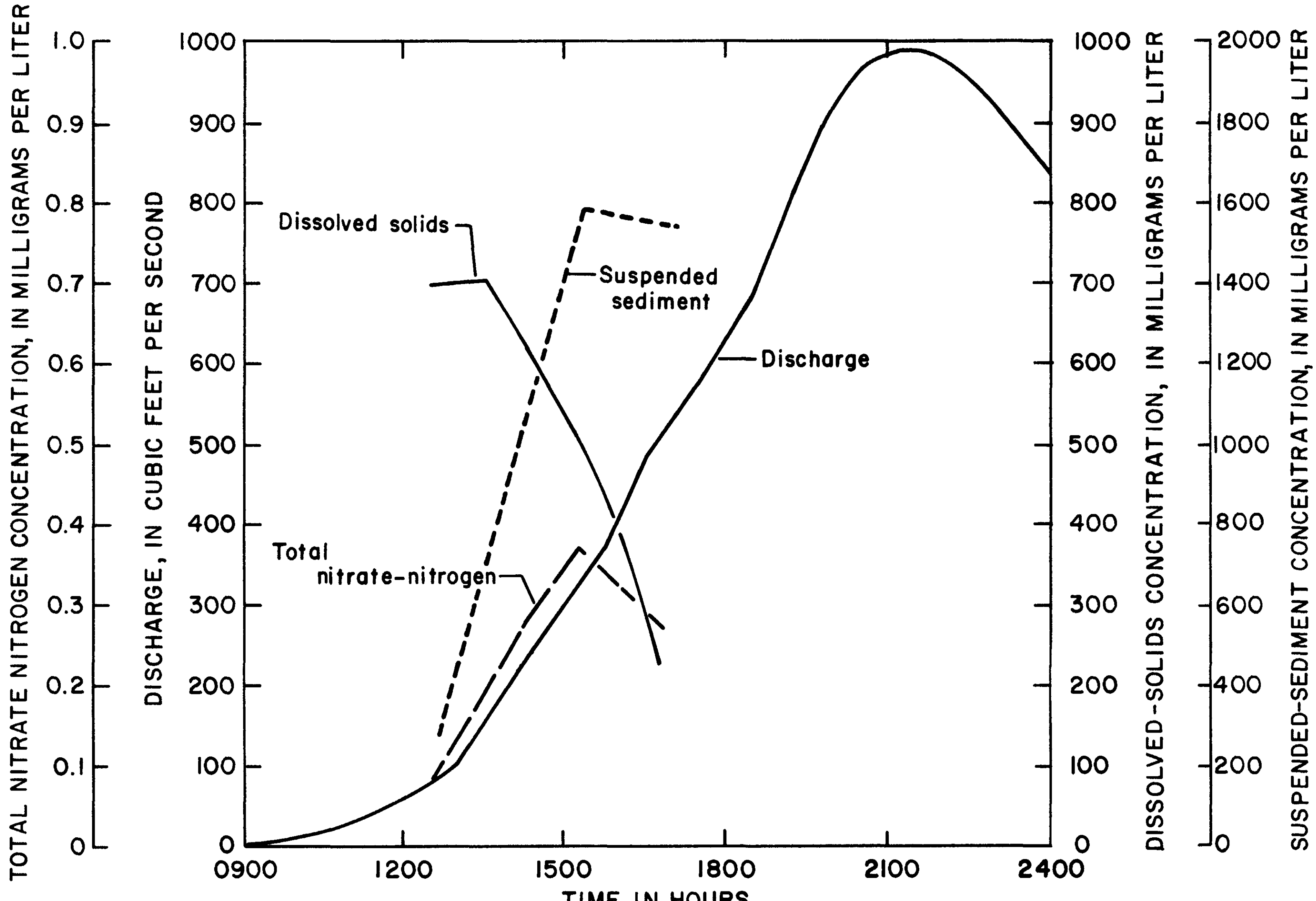


Figure 7.1-1.--Changes in water discharge, dissolved-solids, total nitrate nitrogen, and suspended sediment with time at the streamflow-gaging station, Big Sandy Creek near McDade, March 27, 1990.

7.2 Stream Sediment

LARGE SEDIMENT YIELDS MAY RESULT FROM SURFACE MINING

Suspended sediments in the lignite mining area are predominantly clay

Sediment yields are affected by numerous factors including physiography, soils, climate, and land use. Land-use activities such as forest clearing, cultivation, road construction, and surface mining may drastically increase natural erosion and sediment yields. During surface mining, large volumes of exposed unconsolidated spoil may be a major source of sediment. Definitions for sediment-related terms are given in section 11.4.

Suspended-sediment samples were collected by automated samplers and manually at three sites in the proposed mining area. Locations of the three sampling sites, 08159165 Big Sandy Creek near McDade; 08159170 Big Sandy Creek near Elgin; and 08159180 Dogwood Creek near McDade, are shown in figure 4.2-1. The results of suspended-sediment analyses for samples from these streams are presented in section 10.3. Continuous streamflow records are available for two of the sites, Big Sandy Creek near McDade and Big Sandy Creek near Elgin. The relation of stream discharge to suspended sediment is shown in figure 7.2-1; and particle-size distribution of the suspended sediment is shown in figure 7.2-2.

According to the U.S. Soil Conservation Service (1959) this area should yield approximately 0.54 acre-foot of sediment per square mile per year. The sediment yield during the short duration of this study was significantly smaller; but surface mining could greatly increase this yield.

Big Sandy Creek near McDade

Seventeen samples for the analysis of suspended-sediment concentrations were collected from Big Sandy Creek near McDade during the period of investigation. Most of the samples were collected during two floods in March and May 1980. The suspended-sediment concentrations ranged from 6 milligrams per liter during low flow to 2,680 milligrams per liter during flood runoff. The instantaneous suspended-sediment discharge ranged from virtually zero during low flow to 3,260 tons per day during flood runoff. The relation of instantaneous suspended-sediment discharge to water discharge is shown in figure 7.2-1a. These data and streamflow records indicate a sediment yield of about 0.1 acre-foot per square mile per year.

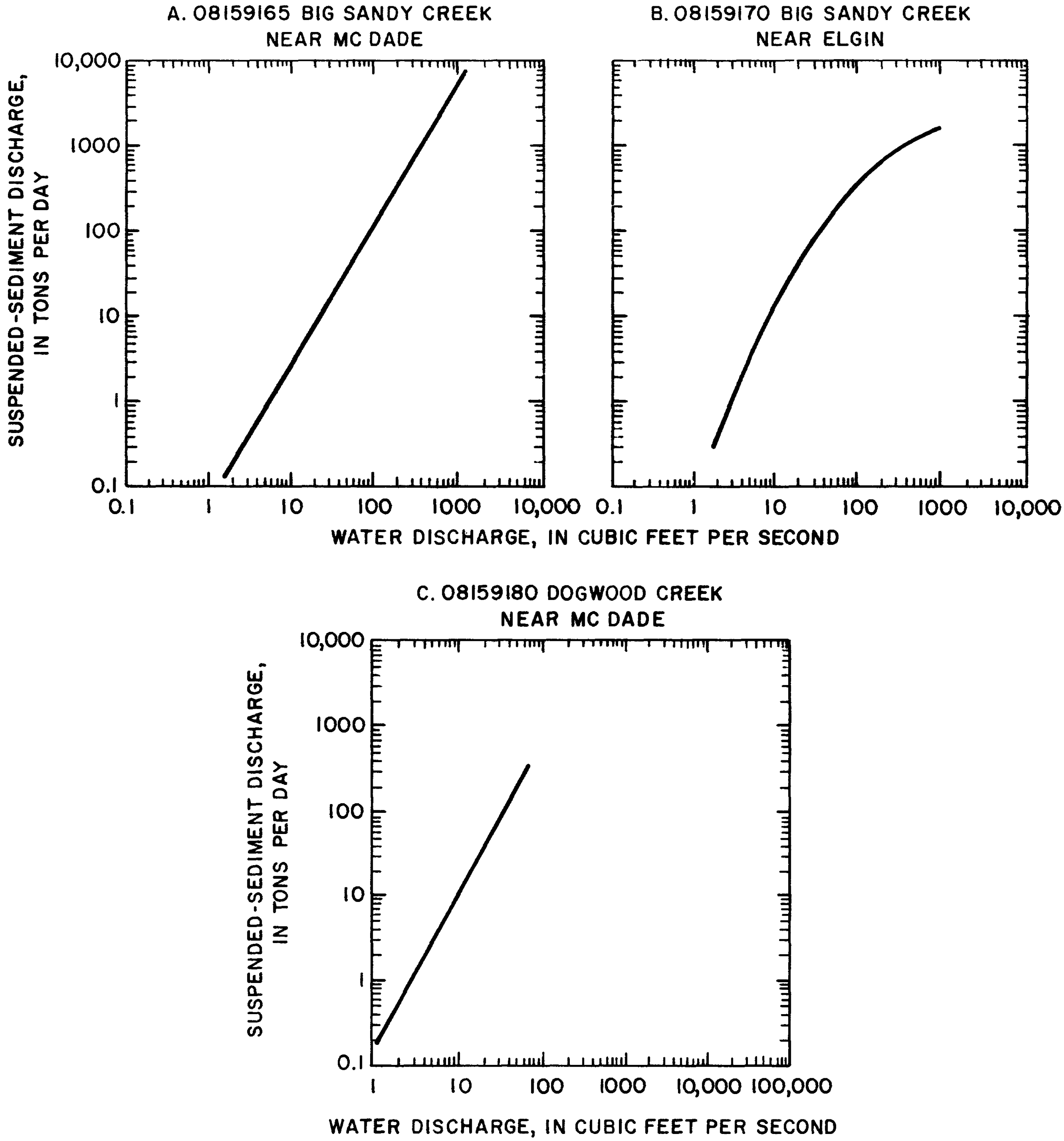


Figure 7.2-1.--Relationship between stream discharge and suspended sediment.

The particle-size distribution of seven samples was determined, and the discharge-weighted averages of the sizes were computed. These data, which are shown in figure 7.2.-2a, indicate that the suspended sediments at this station is composed of about 10 percent sand, 11 percent silt, and 79 percent clay.

The streambed is well defined, and the banks both upstream and downstream from the station are shallow and densely vegetated. Samples indicated that both the streambed and stream banks are composed mostly of fine-to-medium sand with some gravel and small rocks.

Big Sandy Creek near Elgin

Twenty-one samples for the analysis of suspended-sediment concentrations were collected from Big Sandy Creek near Elgin during the period from October 1979 to May 1981. Most of these samples were collected during floods in March and May 1980 and May 1981. The suspended-sediment concentrations ranged from 10 milligrams per liter during low flow to 2,100 milligrams per liter during flood runoff. Instantaneous suspended-sediment discharge ranged from 0.01 ton per day during low flow to 1,670 tons per day during flood runoff. The relation of instantaneous suspended-sediment discharge to water discharge is shown in figure 7.2-1b. These data and streamflow records indicate a sediment yield of about 0.07 acre-foot per square mile per year.

Particle-size distribution of three sediment samples, collected in March and May 1980 at flows between 27 and 178 cubic feet per second was determined, and the discharge-weighted averages of the individual sizes were computed. These data, which are shown in figure 7.2-2b, indicate that the suspended sediment is composed of about 14 percent sand, 22 percent silt, and 64 percent clay.

The streambed and banks at this site are similar to those of Big Sandy Creek near McDade. The channel is well defined and the banks are densely vegetated. The bed contains gravel, small rocks, and medium-to-fine sand. The shallow banks are composed of medium-to-fine sand.

Dogwood Creek near McDade

Ten samples for the analysis of suspended-sediment concentrations were collected from Dogwood Creek near McDade during January, March, and May 1980. The suspended-sediment concentration ranged from 54 to 701 milligrams per liter and instantaneous suspended-sediment discharge ranged from 0.22 to 51 tons per day. The relationship between suspended-sediment discharge and water discharge is shown in figure 7.2-1c. Sediment yield was not computed because the station is not a continuous-record streamflow station.

Selected particle-size distribution was determined for seven samples, but the distribution of silt and clay was determined for only two samples. Suspended sediment in these two samples averaged about 1 percent sand, 7-percent silt, and 92-percent clay (fig. 7.2-2c). The discharge-weighted concentration based on all seven samples consisted of 3 percent sand and 97 percent silt and clay.

The streambed upstream from the site is poorly defined and the banks are densely vegetated with small shrubs and trees. The streambed is composed of hard packed clay. The banks are easily eroded and are composed of clay and sand.

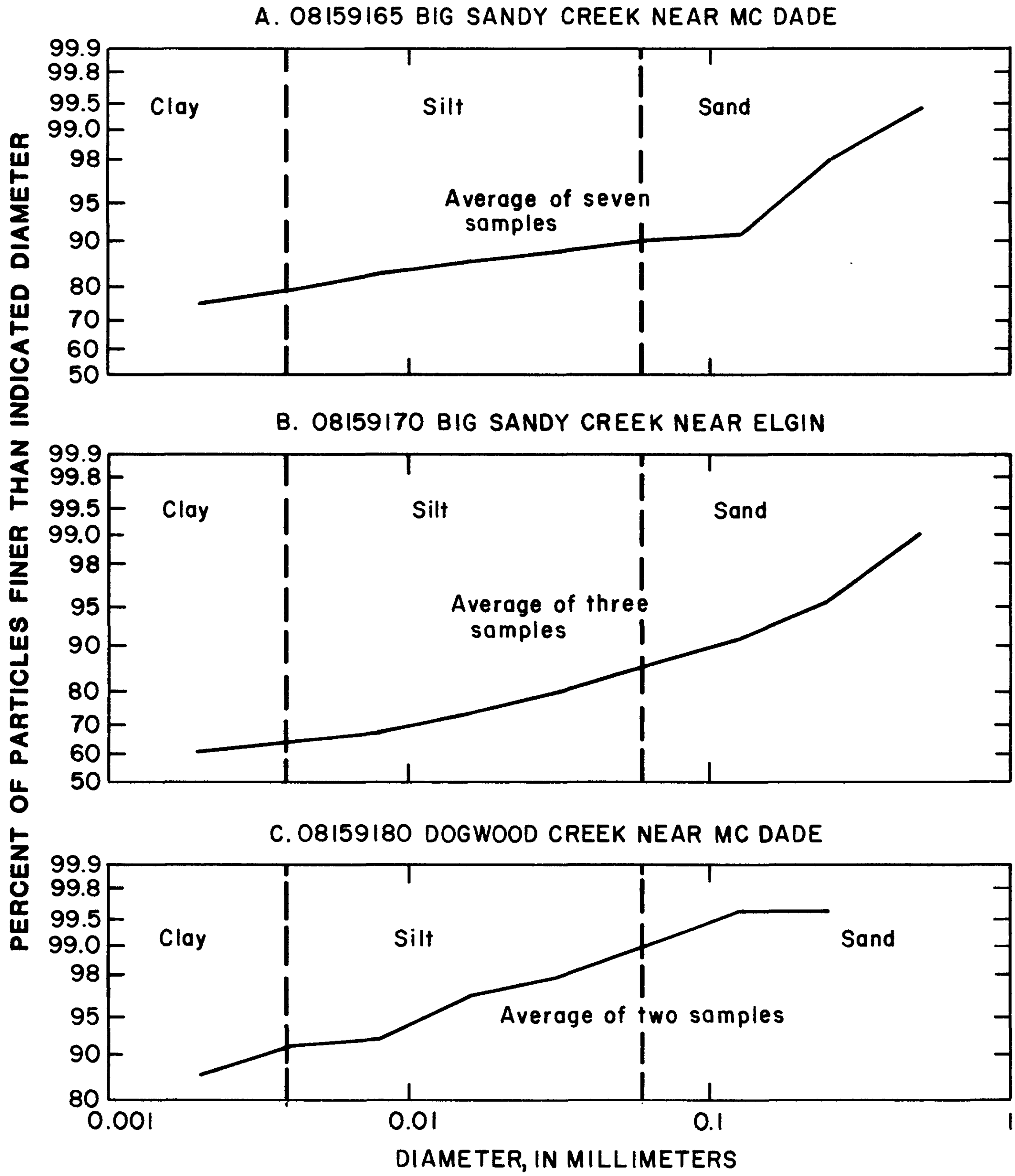


Figure 7.2-2.--Particle-size distribution of suspended sediment.

7.0 WATER QUALITY

7.3 Ground-Water Quality

GROUND-WATER SAMPLES WERE ANALYZED TO DEFINE PREMINING QUALITY

The chemical quality of ground water generally is suitable for most domestic uses with few exceptions

Ground water contains dissolved solutes from many sources. The sources and significance of selected constituents and properties commonly reported in water analyses are given in section 10.6. Analyses of water samples from 13 wells in the Camp Swift and surrounding areas included most of these major dissolved inorganic constitutents, selected dissolved trace constituents, total nutrients, and related properties. Analyses of samples from three wells also included selected total pesticides and related organic compounds. The results of these analyses to determine the quality of ground water prior to mining are given in table 7.3-1.

The results of the analyses for major inorganic constituents show that chemical composition of the water varies significantly from formation to formation and from place to place within each formation. Analyses of samples from two wells generally indicate that water in the Hooper Formation is a calcium bicarbonate type and very hard.

Analyses of samples from eight wells indicate that the chemical composition of water in the Simsboro Formation varies areally. Water from five wells completed in the Simsboro Formation is a calcium bicarbonate type; water from two wells is a sodium chloride type; and water from one well is a mixed calcium sodium bicarbonate type. The water in most areas of the formation is very hard.

Table 7.3-1.--Water-quality data for wells and test holes in the Camp Swift study area

[Water-yielding units: Twh, Hooper Formation; Tws, Simsboro Formation; Twcb, Calvert Bluff Formation. Unit abbreviations: min, minutes; µmho, micromhos per centimeter at 25° Celsius; cols. per 100 mL, colonies per 100 milliliters; mg/L, milligrams per liter; µg/L, micrograms per liter; K, based on non-ideal colony count; <, less than; >, greater than]

Well number and water-yielding unit	Date of sample	Time	Pump or flow period prior to sampling (min)	Specific conductance (µmho)	pH (units)	Temperature (°C)	Coliform, total, immed. (cols. per 100 mL)	Coliform, fecal, 0.7 µm-MF (cols./100 mL)	Streptococci fecal, KF agar (cols. per 100 mL)	Hardness (mg/L as $CaCO_3$)	Hardness noncarbonate (mg/L $CaCO_3$)	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium adsorption ratio	Potassium dissolved (mg/L as K)	Bicarbonate (field) (mg/L as HCO_3)	Carbonate (field) (mg/L as CO_3)	Sulfate dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)
A-29, Twh	9- 3-80	1015	30	599	7.2	25.5	K27	K1	<1	240	9	74	13	38	1.1	2.7	280	0	27	42	0.3	39
A-33, Tws	9- 9-80	1130	30	179	6.1	24.5	K130,000	27,000	>710	52	20	15	3.6	10	.6	5.8	40	0	10	14	--	26
A-35, Tws	9- 3-80	1055	60	650	5.4	23.0	<1	<1	<1	140	120	36	12	51	1.9	7.9	19	0	49	150	.1	35
A-37, Tws	9- 9-80	1245	--	567	7.1	26.0	K14	<1	<1	190	0	58	11	50	1.6	3.7	280	0	30	35	--	30
A-45, Twh	9- 3-80	1035	60	569	7.3	25.5	25	<1	<1	210	8	67	11	36	1.1	3.0	250	0	24	42	.4	38
A-47, Tws	9- 9-80	1215	60	108	5.3	23.5	K4	<1	K4	15	6	4.0	1.3	12	1.3	3.7	12	0	3.8	23	--	24
B- 7, Tws	9- 9-80	1030	120	754	7.2	27.0	<1	<1	<1	270	87	79	17	51	1.4	4.5	220	0	130	57	--	33
C- 1, Tws	9- 3-80	1245	20	656	7.4	25.0	<1	<1	<1	280	88	81	18	26	.7	4.0	230	0	73	49	.2	30
C- 9, Twcb	9- 3-80	1345	60	776	7.4	26.0	<1	<1	<1	240	0	60	22	74	2.1	3.6	370	0	69	31	.2	27
C-10, Twcb	9- 9-80	0950	30	984	7.3	24.0	K6	<1	18	280	0	69	26	100	2.6	5.0	380	0	140	46	--	24
C-11, Tws	12- 8-80	0900	--	492	7.1	25.0	8,800	210	180	190	27	62	7.7	24	.8	3.8	--	--	39	34	.2	32
C-17, Tws	9- 3-80	0935	30	683	7.3	25.0	<1	<1	K2	280	89	93	11	34	.9	3.4	230	0	72	58	.3	44
C-25, Twcb	9- 9-80	0915	--	4,750	6.6	23.0	<1	<1	K1	1,900	1,900	330	270	340	3.4	28	4	0	2,000	5.4	--	--

Well number	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrate total (mg/L as N)	Nitrogen, nitrate total (mg/L as N)	Nitrogen, ammonia total (mg/L as N)	Nitrogen organic total (mg/L as N)	Nitrogen ammonia + organic total (mg/L as N)	Nitrogen total (mg/L as N)	Phosphorus, total (mg/L as N)	Carbon, organic total (mg/L as N)	Arsenic dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Cadmium dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)	Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Manganese, dissolved (µg/L as Mn)	Mercury dissolved (µg/L as Hg)	Selenium, dissolved (µg/L as Se)	Silver, dissolved (µg/L as Ag)	Zinc, dissolved (µg/L as Zn)
A-29, Twh	374	0.00	0.000	0.090	1.7	1.80	1.8	0.170	--	0	200	<1	10	0	30	2	50	0.0	0	0	5
A-33, Tws	101	7.7	.010	.000	.62	.62	8.3	.040	2.0	0	70	<1	0	5	10	1	10	.0	0	0	30
A-35, Tws	357	.00	.000	.060	.31	.37	.37	.120	--	1	100	<1	0	0	6,100	3	380	.0	0	0	40
A-37, Tws	356	.00	.010	.050	.41	.46	.46	.030	3.1	0	90	<1	10	2	10	2	10	.0	0	0	<3
A-45, Twh	345	.00	.000	.100	.49	.59	.59	.130	--	0	100	<1	0	0	200	3	30	.0	0	0	6
A-47, Tws	78	.03	.000	.000	.23	.23	.26	.020	.0	0	30	<1	10	35	50	4	6	.0	3	0	60
B- 7, Tws	480	.00	--	--	.15	.28	.28	.100	1.8	0	100	<1	10	1	20	0	9	1.6	0	0	4
C- 1, Tws	395	0.00	0.000	0.290	0.26	0.55	55	0.090	--	0	100	<1	10	0	20	3	80	0.0	0	0	90
C- 9, Twcb	469	.00	.000	.000	.38	.38	.38	.130	--	0	60	<1	10	0	90	0	8	.0	0	0	50
C-10, Twcb	597	--	--	--	--	.41	--	--	3.5	0	30	<1	0	2	20	0	10	.0	0	0	4
C-11, Tws	299	.00	.000	.050	--	--	--	.110	2.3	0	100	<1	0	<10	60	35	120	.0	0	0	6
C-17, Tws	430	--	--	--	--	--	--	--	--	1	100	<1	0	0	40	2	260	.0	0	0	10
C-25, Twcb	--	.00	.010	8.20	7.8	16.0	16	.050	12	0	500	3	20	38	1,500	4	0	.0	0	0	0

Well number	Pcb. total (µg/L)	Naphthalenes, polychlor. total (µg/L)	Aldrin, total (µg/L)	Chlordane, total (µg/L)	DDD, total (µg/L)	DDE, total (µg/L)	DDT, total (µg/L)	Diazinon, total (µg/L)	Dieldrin total (µg/L)	Endosulfan, total (µg/L)	Endrin, total (µg/L)	Ethion, total (µg/L)	Heptachlor, total (µg/L)	Heptachlor epoxide total (µg/L)	Lindane total (µg/L)	Malathion, total (µg/L)	Methoxychlor, total (µg/L)	Methyl parathion total (µg/L)	Methyl trithion, total (µg/L)	Mirex, total (µg/L)	Parathion, total (µg/L)
A-29, Twh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-11, Tws	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-17, Tws	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Well number	Perthane total (µg/L)	Toxaphene, total (µg/L)	Trithion total (µg/L)	2,4-D, total (µg/L)	2,4-DP, total (µg/L)	2,4,5-T, total (µg/L)	Silvex, total (µg/L)
A-29, Twh	0.00	0.00	0.00	0.00	--	0.07	0.00
C-11, Tws	.00	.00	.00	.00	.00	.00	.00
C-17, Tws	.00	.00	.00	.00	.00	.02	.00

Analyses of samples from three wells indicate that the chemical composition of water in the Calvert Bluff Formation varies significantly. Water from two wells is a mixed sodium calcium bicarbonate type. Water from the other well is a mixed sulfate type in which no single cation predominated. The water generally is very hard.

Ground water in the Camp Swift area is being used principally for municipal and domestic purposes. Regulations for selected water-quality constituents and properties established by the U.S. Environmental Protection Agency (1977a, b) are summarized in table 7.3-2. Based on these regulations, quality of the ground water generally is suitable for most uses. Concentration of dissolved iron in two samples and the concentration of dissolved manganese in four samples exceeded the secondary standards of 300 and 50 micrograms per liter, respectively.

Bacteriological analysis of samples indicate that fecal contamination from warm-blooded animals or humans is degrading the ground-water quality in some areas. However, such contamination does not appear to be widespread and probably results from the infiltration of wastes into poorly-cased dug wells or incomplete development of recently drilled wells.

Table 7.3-2.--Summary of regulations for selected water-quality constituents and properties for public water systems

[μg/L, micrograms per liter; mg/L, milligrams per liter]

DEFINITIONS

Contaminant.--Any physical, chemical, biological, or radiological substance or matter in water.

Public water system.--A system for the provision of piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.

Primary (mandatory) standard.--The maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system. Primary standards are those set by the U.S. Environmental Protection Agency (1977a) in the National Interim Primary Drinking Water Regulations. These regulations deal with contaminants that may have a signicant direct effect on the health of the consumer and are enforceable by the Environmental Protection Agency.

Secondary (recommended) standard.--The recommended permissible concentration of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system. Secondary standards are those proposed by the Environmental Protection Agency (1977b) in the National Secondary Drinking Water Regulations. These regulations deal with contaminants that may not have a significant direct effect on the health of the consumer, but their presence in excessive quantities may affect the esthetic qualities and discourage the use of a drinking-water supply by the public.

INORGANIC CHEMICALS AND RELATED PROPERTIES

Contaminant	Primary standard	Secondary standard
Arsenic (As)	50 μg/L	--
Barium (Ba)	1,000 μg/L	--
Cadmium (Cd)	10 μg/L	--
Chloride (Cl)	--	250 mg/L
Chromium (Cr)	50 μg/L	--
Copper (Cu)	--	1,000 μg/L
Iron (Fe)	--	300 μg/L
Lead (Pb)	50 μg/L	--
Manganese (Mn)	--	50 μg/L
Mercury (Hg)	2 μg/L	--
Nitrate (as N)	10 mg/l	--
pH	--	6.5 - 8.5
Selenium (Se)	10 μg/L	--
Silver (Ag)	50 μg/L	--
Sulfate (SO_4)	--	250 mg/L
Zinc (Zn)	--	5,000 μg/L
Dissolved solids	--	500 mg/L

Fluoride.--The maximum permissible concentration for fluoride depends on the annual average of the maximum daily air temperatures for the location in which the community water system is situated. A range of annual averages of maximum daily air temperatures and corresponding maximum permissible concentration level for fluoride are given in the following tabulation:

Average of maximum daily air temperatures (degrees Celsius)	Primary standard (mg/L)
12.0 and below	2.4
12.1 - 14.6	2.2
14.7 - 17.6	2.0
17.7 - 21.4	1.8
21.5 - 26.2	1.6
26.3 - 32.5	1.4

ORGANIC CHEMICALS

Chlorinated Hydrocarbons

Contaminant	Primary standard (μg/L)
Endrin	0.2
Lindane	4
Methoxychlor	100
Toxaphene	5

Chlorophenoxys

Contaminant	Primary standard (μg/L)
2,4-D	100
Silvex	10

8.0 OVERBURDEN ANALYSIS

CHEMICAL ANALYSIS WAS PERFORMED ON CORE SAMPLES

The overburden at Camp Swift was analyzed for major inorganic constituents and trace elements

In December 1980 a continuous core was cut through the Calvert Bluff Formation into the upper part of the Simsboro Formation at well C-13. Core was recovered from 168 feet of the interval from the land surface to a depth of 255 feet, except for mainly unconsolidated sand beds. Gamma-gamma (formation density), natural gamma-ray, spontaneous-potential, and resistivity logs were obtained at a depth of 322 feet. The core samples from the overburden were analyzed for major inorganic constituents and trace elements. Core samples from the lignite beds also were analyzed for trace elements, percent moisture, percent ash, percent volatile material, percent fixed carbon, percent sulfur, and gross heat of combustion. These analyses were performed by the Southwestern Laboratories, Dallas, Texas, according to guidelines set by the Railroad Commission of Texas, whose authority includes the regulation of the exploration and surface mining of coal in Texas. Results of these analyses are shown in section 10.7. The results of the analyses for selected constituents also are shown in figure 8.0-1 to relate the chemical composition of the material to lithology, geophysical response, and depth.

The overburden consists of stacked packages of sand, silt, clay, and lignite (fig. 8.0-1). The recovered sand was very fine to fine and generally was well sorted. Most of the 87 feet of the section where core was not recovered occurred in unconsolidated coarse sand. Carbonaceous streaks, leaf impressions, and vertical burrows were observed in the finer-grained silts and clays. Thin "hard streaks" of sandstone with hematitic staining were infrequently present. Both the "hard streaks" and the lignite have high resistivity and negative spontaneous potential, but the gamma-gamma log can be used to distinguish the dense sandstone from the less dense lignite.

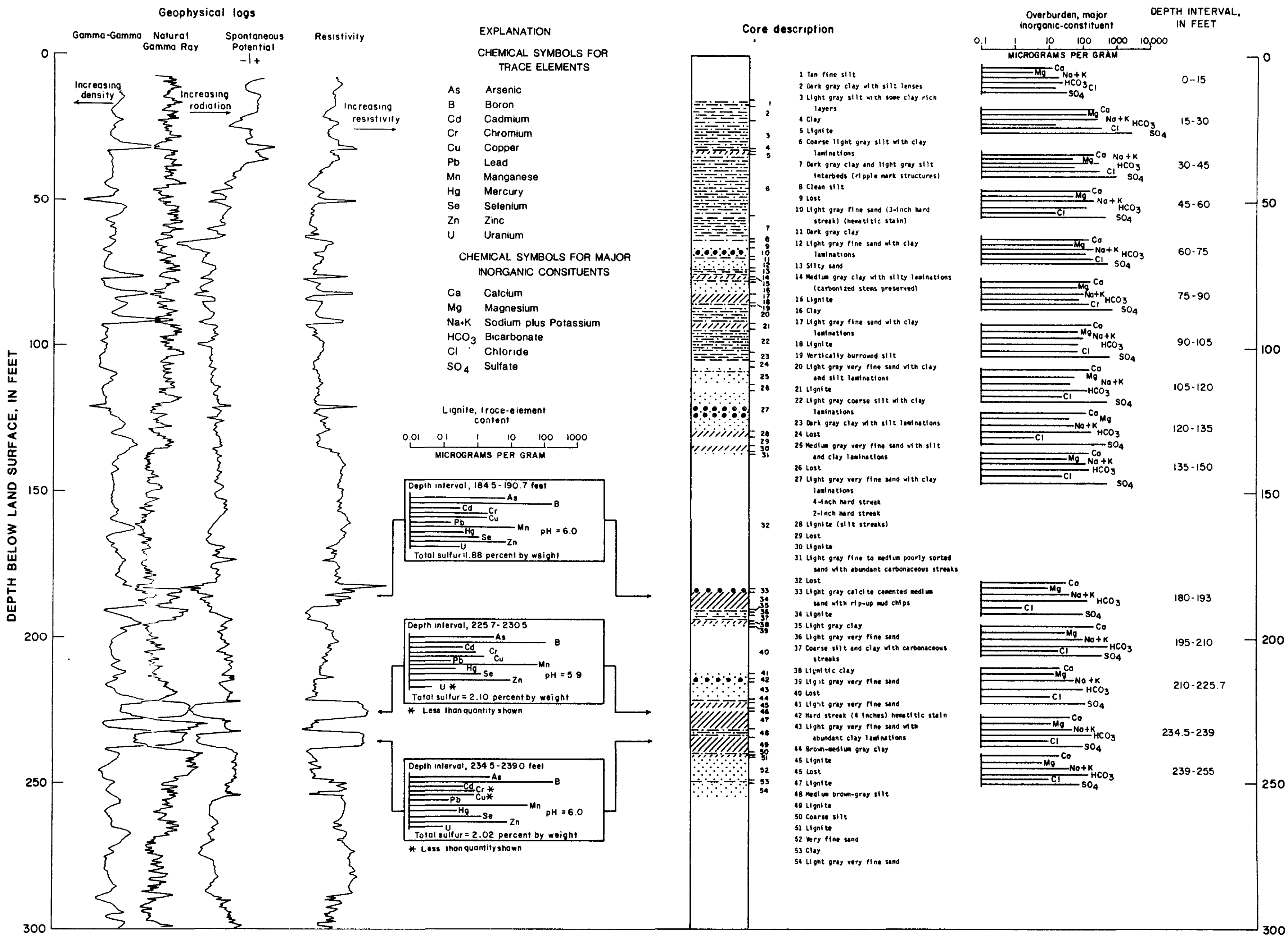


Figure 8.0-1.--Geophysical logs, content of selected constituents in lignite and overburden, and core description of Calvert Bluff Formation at well C-13.

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10.0 SUPPLEMENTAL DATA

10.1 Records of Test Wells and Test Holes

All wells are drilled unless otherwise noted in remarks column.

Water-bearing units : Hooper Formation, Twh; Simsboro Formation, Tws; Calvert Bluff Formation, Twcb.
Water level : Reported water levels given to nearest foot; measured water levels given in feet and tenths.
Method lift and type of power: B, bucket; C, cylinder; Cf, centrifugal; E, electric; G, gasoline, oil, butane, or diesel engine; H, hand; J, jet; N, none; T, turbine; W, windmill. Number indicates horsepower.
Use of water : D, domestic; Ind, industrial; Irr, irrigation; N, none; P, public supply; S, livestock.
Unit abbreviations : ft, feet; in, inches; °F, degrees Fahrenheit; gal/min, gallons per minute.

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A- 1	C. A. Barber	Terry Faulkenburg	1950	187	6.4	187	Twh	535	74	5- -50	J, E 1-1/2	D	Originally drilled to 700 ft. Cased to 187 ft; unknown to what depth hole is open.
2	Odell Morgan	Owens	1910	44	36	--	Twh	550	36.3	11- 2-79	J, E 1	D, S	Dug well; curbed with brick.
3	Mr. Shipley	--	1957	130	4	100	Twh	530	21.8	11- 2-79	J, E	D, S	Cased to 100 ft, part is slotted. 1/
4	C. B. Huff	Lloyd Ketha	1971	175	4	--	Twh	550	30.0	10-18-79	--	D	--
5	Allen George	do.	1971	225	4	--	Twh	515	30.0	6-30-71	--	D	--
6	J. D. King well 1	G. C. Schoomaker	1951	2,952	--	--	--	536	--	--	--	--	Oil test. 2/
7	B. Dougherty	--	--	43	32	--	Tws	490	36.3	11- 2-79	J, E 1/4	S	Dug well.
8	A. Y. McWilliams	Sterzing Drilling Co.	1963	200	4	200	Twh	485	8.1	10-30-79	J, E	D, S	Cased to bottom, part is slotted. 1/, 3/
9	Roy Skeekatz	--	--	16	36	--	Tws	475	11.2	11- 2-79	C, H	S	Dug well. Temperature, 78°F.
10	H. O. Jenkins	Sterzing Drilling Co.	1964	247	5	247	Twh	540	49.8	11- 9-79	Cf, E	D, S	Cased to bottom, part is slotted. 1/
11	Kay Hicks	do.	1964	127	4	--	Twh	540	43.3	11- 9-79	Cf, E	D, S	Casing slotted from 97 ft to bottom. 4/
12	Mr. Mosely	--	--	61	48	--	Twh	545	46.2	11- 9-79	J, E 1/2	D, S	Dug well, curbed with cement.
13	Ervin S. Stuard	Sterzing Drilling Co.	1965	270	5	260	Tws	540	89.0	11- 9-79	Cf, E	D, S	Cased to 260 ft. 1/, 4/

See footnotes at end of table.

10.0 SUPPLEMENTAL DATA--Continued

10.1 Records of Test Wells and Test Hole--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-14	Odell Morgan	Crisp Drilling Co.	1971	106	4	--	Twh	513	23.3	11- 9-79	--	D	--
15	Darryl McDonald	--	1936	63	36	--	Tws	560	53.5	11- 9-79	C, W	D, S	Dug well. Water from sand at 54 ft to bottom.
16	Do.	--	1955	--	4	--	--	560	83.3	11- 9-79	J, E	D, S	--
17	Roy Seekatz	--	1956	808	--	--	Twh	560	--	--	Flows	S	--
18	W. D. Behrend	Jordon Drilling Co.	1976	208	4	--	Tws	548	104.3	11-24-76	--	D	State observation well. 4/
19	John Weaver	--	1920	33	24	--	Tws	514	17.9 19.9	11- 9-79 1- 7-81	--	D	--
20	Joe Johnson	--	--	--	4	--	--	490	51.25	11- 9-79	--	D	3/
21	Ada Potts, well 1	H. W. Snowden	1945	2,073	--	--	--	545	--	--	--	--	Oil test. 2/
22	Veterans of Foreign Wars Club	Buck Jordan	1964	80	4	--	Twh	500	11.3	11- 9-79	Cf, E	D	Casing slotted from 68 ft to bottom.
23	Ray Hamilton	--	1964	200	4	--	Twh	520	72.0	11-15-79	Cf, E	S	--
24	O. K. Gruetzner	--	--	32	42	--	Twh	515	20.6	11- 9-79	N	N	Dug well.
25	Do.	--	--	17	42	--	Twh	545	5.4	11- 9-79	N	N	Dug well.
26	A. Kimball well 1	W. J. Dick	1964	3,335	--	--	--	573	--	--	--	--	Oil test. 2/
27	Mrs. Horace Meeks	--	--	40	36	--	Twh	520	27.9	11- 9-79	J, E	D, S	Dug well.
28	Bob Bostick	Sterzing Drilling Co.	1965	180	5	176	Twh	510	43.1	11- 9-79	Cf, E	D, S	Cased to 176 ft, open end. 1/
29	Aqua Water Supply Corp.	Lanford Drilling Co.	1978	642	8.6	--	Twh	549	145.7	10-10-79	--	P	2/, 5/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-30	Aqua Water Supply Corp.	Lansford Drilling Co.	1978	484	8.6	--	Twh	552	144.3	10-10-79	--	P	2/, 3/
31	Seventh Day Adentist Church	--	1957	90	4	--	Twh	538	28.53	3-12-80	--	N	--
32	Joe Mabry	--	1933	25	36	--	Tws	578	7.3	3-13-80	--	Irr.	Dug.
33	Do.	--	1933	45	36	--	Tws	570	10.7	3-13-80	--	Irr.	Dug. 3/, 5/
34	City of Elgin well 6	Layne-Texas Co.	1956	120	24 16	66 120	Tws	450	14.9 48.2	10-11-79 1-23-81	--	P	16-in screen from 66 to 120 ft; underreamed and gravel-packed. Reported discharge, 400 gal/min in 1966.
35	City of Elgin well 4	do.	1949	177	24 18	60 205	Tws	460	47.4	10-11-79	T, E 15	P	18-in screen from 60 to 205 ft; underreamed and gravel-packed from 60-205 ft. Test pumped at 500 gal/min in 1966. 3/, 5/
36	W. Muery	--	--	57	30	--	Tws	525	43.3	11-15-79	J, E	D	Dug well, curbed with brick.
37	Elgin Butler Brick Co.	Layne-Texas Co.	1951	368	10 5	199 368	Twh	470	57.0 154.0	10- 3-51 9- ?-60	T, E 15	Ind	Screen from 283 to 368 ft. Reported drawdown 52 ft, pumping 125 gal/min. 1/, 5/
38	Elgin Butler Brick Co., well 2	do.	1951	370	10 5	281 370	Twh	475	98.31	10-18-79	T, E 15	Ind	Screen from 292 to 362 ft. Underreamed and gravel-packed. Reported discharge 100 gal/min in 1966. 1/

Footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-39	J. K. Prewitt	J. K. Prewitt	1965	291	10	--	Tws	480	17.1	11- 6-79	--	S	Casing slotted from 90 to 160 ft, and 207 to 291 ft. Temperature 73°F. 1/, 3/
40	City of Elgin well 5	Layne-Texas Co.	1949	120	24 18	60 205	Tws	450	--	--	N	N	Reported 18 ft, drawdown pumping 500 gal/min.
41	City of Elgin well 7	do.	1967	149	24	--	Tws	490	47.9	10-10-79	--	P	--
42	City of Elgin well 8	do.	1973	155	24	--	Tws	497	55.3 55.0	10-11-79 1-23-81	--	P	4/
43	R. E. Janes	Central Texas Drilling Co.	1967	100	5	--	Tws	520	41.5	3-12-80	--	S	--
44	Lacy Feed	Jordan Drilling Co.	1977	118	4	--	Tws	528	59.8	3-12-80	--	S	--
45	Aqua Water Supply	Lansford Drilling Co.	1978	505	8.6	--	Tws	531	134.2	10-10-79	--	P	2/, 3/, 5/
46	R. E. Janes	Central Texas Drilling Co.	1967	126	5	--	Tws	500	64.1	3-12-80	--	S	--
47	M. Birran	Roggenkamp Drilling	1980	70	4	--	Tws	521	48.3	3- 3-80	--	D	5/
48	R. E. Janes	Central Texas Drilling Co.	1967	102	6	--	Tws	560	48.1	3-12-80	--	S	--
49	W. A. Spence	Baker Water Well	1977	390	4	--	Twh	580	115.0	1- 5-78	--	D	--
50	Elgin-Butler Brick Co. well 1	A. Bartrug	1947	293	7, 6, 5	--	Tws	455	80 65	10- -51 4-11-53	N	N	Casing slotted from 256 to 284 ft. 1/
51	Elgin-Butler Brick Co. well 2	Layne-Texas Co.	1952	404	7 4	0-340 275-397	Tws	455	97.7	9-15-60	T, E, 5	Ind.	Slotted from 340 to 397 ft. Underreamed to 20 in and gravel packed. 1/, 2/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-52	Harold Smith	Sterzing Drilling Co.	1964	417	7 3	0-293 293-417	Tws	485	55.7 58.8	10-30-79 1- 9-81	--	D	Slotted from 397-417 ft. Reported discharge 100 gal/min Irrigates 13 acres of vegetables. Temperature 75°F. 1/, 3/
53	Chester Jessen	do.	1964	212	5	--	Tws	483	51.9 28.5	10-30-79 1- 9-81	--	D	Casing slotted from 172 to bottom. 1/
54	Walter Kastner	--	1951	150	4	--	Twcb	520	69.3	2- 3-53	C, E	N	--
55	W. Mackey well 1	Riddle Oil Co.	1940	3,452	--	--	--	470	--	--	--	--	Oil test. 2/
56	H. M. Heine	Sterzing Drilling Co.	1963	245	4	--	Twh	515	118.4	11- 9-79	--	D	Casing slotted from 205-240 ft. 1/
57	Joe Justice	--	--	50	26	--	Twh	475	38.4	11- 9-79	--	D, S	Dug well, curbed with brick to bottom.
58	Vern Cummings	--	1964	78	4	--	Tws	420	6.0	11-15-79	--	D, S	--
59	Henry E. Stobbelbein	Sterzing Drilling Co.	1965	245	4	--	Tws	490	110	7- -65	Cf, E	D, S	Casing sloted from 200-240 ft. 1/
60	W. E. Tinsley	do.	1965	265	4	--	Tws	460	--	--	Cf, E 3/4	D	Casing slotted from 225 to 265 ft. Test hole drilled to 366 ft; plugged back to 265 ft. 1/, 2/
61	do.	--	--	70	36	--	Tws	471	62.7	11-20-79	C, W	S	Dug well, curbed with rock. 3/
62	Vern Cummings	Pomykal Drilling	1970	88	4	--	Tws	455	16.3	11-15-79	--	N	3/
63	do.	--	--	55	36	--	Tws	440	31.2	11-15-79	--	N	Dug well.
64	M. M. Brinkley	M. M. Brinkley	1963	18	36	--	Tws	440	9.2	11-15-79	--	D	Dug well.

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-65	Bill Webster	Pomykal Drilling	1972	399	4	--	Tws	505	102.1	7-17-80	--	D	3/
66	D. L. Flowers	--	1941	30	36	--	Tws	523	8.1	3- 7-80	--	D	Dug well.
67	Charles Hurst	--	1933	30	36	--	Twcb	412	18.3	3- 7-80	--	D	Dug well.
68	Lower Colorado River Authority	Bechtel Corp.	1974	120	--	--	--	455	--	--	--	--	6/
69	do.	do.	1974	320	--	--	--	464	50	6-10-74	--	--	6/
70	do.	do.	1974	150	--	--	--	499	--	--	--	--	6/
71	do.	do.	1974	99	--	--	--	471	28	5-24-74	--	--	6/
72	do.	do.	1974	120	--	--	--	424	14	5-29-74	--	--	6/
73	do.	do.	1974	240	--	--	--	495	--	--	--	--	6/
74	do.	do.	1974	150	--	--	--	515	--	--	--	--	6/
75	do.	do.	1974	160	--	--	--	499	--	--	--	--	6/
76	do.	do.	1974	235	--	--	--	482	--	--	--	--	6/
77	do.	do.	1974	160	--	--	--	466	14	5-24-74	--	--	6/
78	do.	do.	1974	200	--	--	--	466	--	--	--	--	6/
79	do.	do.	1974	260	--	--	--	482	58	5-24-74	--	--	6/
80	do.	do.	1974	120	--	--	--	433	29	5-24-74	--	--	6/
81	do.	do.	1974	160	--	--	--	444	--	--	--	--	6/
82	do.	do.	1974	220	--	--	--	467	36	5-24-74	--	--	6/
83	do.	do.	1974	277	--	--	--	470	14	6- 6-74	--	--	6/
84	do.	do.	1974	150	--	--	--	450	11	6- 7- 74	--	--	6/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date com-plet-ed	Depth of well (ft)	Casing: Diam-eter (in)	Casing: Depth or inter-val (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measure-ment	Method of lift	Use of water	Remarks
A- 86	Lower Colorado River Authority	Bechtel Corp.	1974	133	--	--	--	483	54	5-24-74	--	--	6/
87	do.	do.	1974	--	--	--	--	454	27	5-24-74	--	--	6/
88	do.	do.	1974	160	--	--	--	456	26	6- 6-74	--	--	6/
89	do.	do.	1974	150	--	--	--	425	--	--	--	--	6/
90	do.	do.	1974	90	--	--	--	462	47	4- 2-74	--	--	6/
91	do.	do.	1974	100	--	--	--	457	28	--	--	--	6/
92	do.	do.	1974	240	--	--	--	503	80	5-24-74	--	--	6/
93	do.	do.	1974	240	--	--	--	459	14	6- 6-74	--	--	6/
94	do.	do.	1974	160	--	--	--	464	--	--	--	--	6/
95	do.	do.	1974	169	--	--	--	496	--	--	--	--	6/
96	do.	do.	1974	300	--	--	--	482	--	--	--	--	6/
97	do.	do.	1974	90	--	--	--	454	--	--	--	--	6/
98	do.	do.	1974	100	--	--	--	494	--	--	--	--	6/
99	do.	do.	1974	300	--	--	--	511	--	--	--	--	6/
100	do.	do.	1974	212	--	--	--	524	62	6- 7-74	--	--	6/
101	do.	do.	1974	412	--	--	--	514	64	6- 6-74	--	--	6/
B- 1	Stuart Long and G. V. Sanders	--	1885	78	42	--	Twcb	540	76.3 73.2	3- 9-53 9-17-64	J, E	D, S	Dug well, curbed with rock to 6 ft. Weak well; failed in 1958.
2	Harry Nesselbeck	--	1953	41	60	--	Twcb	535	38.0	9-17-64	J, E	D, S	Dug well, curbed with brick to bottom

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
B- 3	Stuart Long and G. V. Sanders	Dunn Water Well Drilling Co.	1965	442	4	--	Tws	540	65.9	12- 6-79	Cf, E	D, S	Casing slotted from 442 ft to bottom.
4	Harry Nesslebeck	Nelson Drilling Co.	1972	267	7	--	Twcb	535	88.3	12- 6-79	--	D	--
5	Albert Rather	--	1902	147	8	--	Twcb	515	119.2 116.1	2-26-53 9-21-64	C, E	D, S	Cased to bottom.
6	C. C. Cayton	J. K. Prewitt	1960	613	6 4	300 0-613	Twcb	570	108	6- -60	Cf, E	D, S	Casing partly slotted.
7	Bastrop Water Control and Improvement District	Texas Water Wells, Inc.	1955	610	8 4	0-390 390-610	Tws	560	--	--	T, E 20	P	Casing cemented to 390 ft. Screen from 500 to 600 ft. Test hole to 746 ft; plugged back to 610 ft. Public water supply for city of McDade. 1/, 2/, 3/
8	Richard Neidig, Jr., well 1	L. D. Arrington	1954	355	8	355	Twcb	485	--	--	N	N	Casing slotted from 212 to 345 ft and 248 to 355 ft. Reported discharge 500 gal/min. Casing collapsed and well was replaced with well B-9. Gravel-walled.
9	Richard Neidig, Jr., well 2	do.	1963	365	10 7	275 365	Twcb	485	--	--	T, G	Irr	Slotted 7 in from 275 to 365 ft. Gravel-packed. Temperature 75°F.
10	Curtis Schmedes	H. W. Schubert	1964	600	8	600	Twcb	630	160	4-11-64	T, E 30	Irr	Casing slotted opposite sands between 398 and 600 ft. Reported discharge 368 gal/min. Temperature 76°F.

Footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
B-11	J. M. Clampit	Dunn Water Well Drilling Co.	1961	632	12	632	Twb	640	--	--	T, G	Irr	Casing slotted from 352 to 418 and 510 to 632 ft. Reported discharge 600 gal/min. Gravel-walled.
12	Wendell Wilson	Sterzing Drilling Co.	1964	347	5	347	Twcb	535	79.2	9-18-64	Cf, E	D, S	Casing slotted from 301 to 347 ft.
13	McDade Public School	Dunn Water Well Drilling Co.	1952	745	4	200	Tws	510	163.9	2- 4-53	--	N	Cased to 200 ft. Temperature 64°F. 5/
14	--	--	--	40	36	--	Twcb	528	18.9	12- 6-79	--	N	Dug well.
15	Mr. Mueller	Dunn Water Well Drilling Co.	1962	632	6 4	0-300 0-632	Twcb	550	121.53	12- 6-79	Cf, E	D	Slotted from 612 ft to bottom.
16	Henry Knoblock well 1	J. A. Morgn	1958	3,602	--	--	--	550	--	--	--	--	Oil test. 2/
17	Murphey Webb	Pomykal Drilling Co.	1965	1,220	4 2	254 1,220	Tws	525	119.1	9-28-65	Cf, E	D, S	Slotted 1,170 to 1,200 ft. Temperature 81°F.
C- 1	Greenbriar School	Richter Water Well Drilling	1969	209	4.5	--	Tws	402	46.3	12- 7-79	--	P	5/
2	do.	do.	1969	152	4.5	--	Tws	402	45.9	12- 7-79	--	N	3/
3	T. C. Stiener	Nelson Drilling Co.	1968	300	4	--	Tws	430	68.5	10-23-79	--	S	--
4	Texas Rendering Co., Inc.	Sterzing Drilling Co.	1960	360	6	360	Tws	500	158.0	10-22-79	--	Ind.	80 ft slotted opposite sands. Reported discharge 72 gal/min. 1/, 3/
5	H. N. Bell	--	--	52	31	--	Tws	415	41.4	3-12-80	B, H	D	Dug well, curbed to bottom with tile rings. Well rarely used. Temperature 70°F

See footnotes at end of table.

10.0 SUPPLEMENTAL DATA--Continued

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C- 6	Santa Fe Railroad	--	--	25	185	--	Tws	390	15.1	3-12-80	--	N	Dug well.
7	Texas Rendering Co., Inc.	Richter Water Well Drilling Co.	1975	535	18	--	Tws	495	148.7	10-22-79	--	Ind.	3/
8	do.	Stokes Drilling Co.	1964	658	12	--	Tws	525	157.1	8-15-65	--	S	Slotted 380-643 ft. Reported pumping level 238 ft after pumping 1,200 gal/min for 3 hours. 1/, 2/
9	Jack Fleming	Richter Water Well Drilling Co.	1977	519	4	--	Twcb	495	131.0	10-23-79	--	D	3/, 5/
10	A. J. Knowles	do.	1975	523	4	--	Twcb	495	143.5	12-17-79	--	D	3/, 5/
11	U.S. Geological Survey	Andrews and Foster Drilling Co.	1980	500	6	490	Tws	470	103. 5	1-26-81	N	N	Screened 240-490. Test well. 2/, 3/, 5/
12	do.	do.	1980	220	4	220	Twcb	470	54.1	1-26-81	N	N	Screened 200-220. Test well. 2/, 3/
13	do.	do.	1980	330	4	330	Tws	470	107.0	1-26-81	N	N	Screened 250-330. Test well. 2/, 3/
14	City of Bastrop (Camp Swift well 1)	Layne-Texas Co.	1942	584	20 12	253 153-573	Tws	472	140.2	10-12-79	--	P	Underreamed and gravel packed. Test 5-15-42, drawdown 31 ft while pumping 515 gal/min. Temperature 78°F. 4/, 5/
15	City of Bastrop (Camp Swift well 2)	do	1942	531	20 12	271 177-530	Tws	463	124.5 117.4	10-12-79 3-10-81	--	N	177 ft of screen opposite sands between 299 and 530 ft. Underreamed and gravel packed. Test 3-25-42, drawdown 44 ft, while pumping 480 gal/min. 4/, 5/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-16	City of Bastrop (Camp Swift well 3)	Layne-Texas Co.	1942	559	20 12	243 164-559	Tws	464	125.4	10-15-79	--	N	224 ft of screen opposite sands, between 273 and 549 ft. Underreamed and gravel packed. Test 4-23-42, drawdown 42 ft while pumping 520 gal/min. 1/, 2/, 3/, 4/
17	City of Bastrop (Camp Swift well 4)	do.	1942	535	20 12	237 156-535	Tws	468	127.5 118.9	10-17-79 3-10-81	--	P	232 ft of screen opposite sands, between 250 and 530 ft. Underreamed and gravel packed. Test 3-31-42, drawdown 29 ft while pumping 500 gal/min. 1/, 3/, 5/
18	City of Bastrop (Camp Swift well 5)	do.	1942	550	20 12	243 163-554	Tws	471	129.9	10-15-79	--	P	179 ft of screen opposite sands, between 260 and 549 ft. Underreamed and gravel packed. Test 4-30-42 drawdown 26 ft while pumping 525 gal/min. Temperature 80°F. 1/
19	City of Bastrop (Camp Swift well 6)	do.	1942	590	20 12	267 185-588	Tws	469	139.5	10-12-79	--	P	Well inside Federal Prison. 239 ft of screen opposite sands between 282 and 577 ft. Underreamed and gravel packed. Test 12-8-42, drawdown 66 ft while pumping 625 gal/min. 1/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-20	City of Bastrop (Camp Swift well 7)	Layne-Texas Co.	1942	672	10 8	302 272-672	Tws	462	140.0	4- -43	--	N	230 ft of screen opposite sands between 299 and 667 ft. Underreamed and gravel packed. Test 4-30-43, drawdown 53 ft while pumping 610 gal/min. 1/, 2/
21	H. L. Linenburger, well 1	Dunn Water Well Drilling Co.	1960	300	6	--	Tws	485	104.7	10-22-79	--	N	Casing slotted from 244 to 300 ft. Reported water was saline. Drilled well 2, in search of water of better quality. 2/
22	H. L. Linenburger, well 2	do.	1963	167	7	--	Twcb	485	112	8- -63	N	N	Casing slotted from 135 to 155 ft. Reported water was saline. Drilled well 3, in search of water of better quality. 1/
23	H. L. Linenburger, well 3	do.	1964	578	4 2-1/2	540 537-578	Tws	485	--	--	Cf, E	D, S	Slotted 2-1/2 inches from 537 ft to bottom. 1/
24	U.S. Government Camp Swift test well 1T	J. R. Johnson	1941	574	--	--	Tws	470	110	11- -41	N	N	Drilled as an observation well when well C-63 was pumped as part of the aquifer test study to obtain water for Camp Swift. 1/
25	Joe Echols	Lloyd Ketha Drilling	1969	190	4	--	Twcb	480	25.3	10-12-79	--	N	3/, 5/
26	do.	Nelson Drilling Co.	1971	414	4	--	Tws	481	71.0	5- 2-71	--	N	--
27	City of Bastrop	Layne-Western Co.	1978	644	10	--	Tws	468	160.0	4-24-78	--	P	--

See footnotes at end of table.

10.0 SUPPLEMENTAL DATA--Continued
10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-28	Mrs. Addie Mae Powell	Ray Hurst	1952	280	4	--	Tws	384	60.9	10-24-79	--	D	Cased to bottom, partly slotted. Formerly dug wells supplied water for plantation.
29	E. L. Moore	Mathew Bartsch	1948	185	7	--	Tws	370	53.6	10- 5-64	J, E	D, S	Casing slotted from 150 to 180 ft.
30	-- Powell well 1	General Crude Oil Co.	1945	3,638	--	--	--	362	--	--	--	--	Oil test. 2/
31	J. J. Hennesey	--	--	41	30	--	Tws	410	37.0	3-11-53	C, E	D, S	Dug well, curbed to bottom with bricks.
32	C. D. McCall	Lloyd Ketha	1967	170	4	--	Tws	360	38.1	6-14-67	--	--	Casing slotted from 80 to 170 ft. Casing pulled after test pumping. 2/
33	do.	do.	1967	440	7 2-1/2	307 307-440	Tws	360	36.2	12- 6-79	--	D	Slotted from 400 to 440 ft. 1/
34	H. H. Linenberger	Nelson Drilling Co.	1972	550	4	--	Tws	485	116.0	10-22-79	--	D	4/
35	Lower Colorado River Authority	M. E. Higdon	1962	600	8	600	Tws	480	3.5	10-16-79	--	N	Partly slotted. Supplied water used during construction of the Sim Gideon Steam Generating Plant. 2/
36	do.	do.	1963	662	10 7	300 300-662	Tws	475	19.0	10-16-79	--	N	Slotted opposite sands below 490 ft. Reported discharge about 550 gal/min. 1/
37	Lower Colorado River Authority	Bechtel Corp.	1974	80	--	--	--	464	4	6-10-74	--	--	6/

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-38	Lower Colorado River Authority	Bechtel Corp.	1974	100	--	--	--	482	29	6-10-74	--	--	6/
39	do.	do.	1974	180	--	--	--	490	62	6- 6-74	--	--	6/
40	do.	do.	1974	265	--	--	--	501	83	6- 7-74	--	--	6/
41	do.	do.	1974	190	--	--	--	457	--	--	--	--	6/
42	do.	do.	1974	140	--	--	--	468	--	--	--	--	6/
43	do.	do.	1974	215	--	--	--	463	51	6- 6-74	--	--	6/
44	do.	do.	1974	250	--	--	--	464	23	6-10-74	--	--	6/
45	do.	do.	1974	350	--	--	--	462	10	6- 7-74	--	--	6/
46	do.	do.	1974	260	--	--	--	487	--	--	--	--	6/
47	do.	do.	1974	140	--	--	--	442	22	6- 6-74	--	--	6/
48	do.	do.	1974	140	--	--	--	446	24	6- 6-74	--	--	6/
49	do.	do.	1974	100	--	--	--	450	3	6-10-74	--	--	6/
50	do.	do.	1974	120	--	--	--	451	50	6- 7-74	--	--	6/
51	do.	do.	1974	200	--	--	--	469	58	6- 6-74	--	--	6/
52	do.	do.	1974	265	--	--	--	483	54	6- 7-74	--	--	6/
53	do.	do.	1974	500	--	--	--	526	90	6- 7-74	--	--	6/
54	do.	do.	1974	100	--	--	--	408	48	6- 7-74	--	--	6/
55	do.	do.	1974	180	--	--	--	489	74	6- 6-74	--	--	6/
56	do.	do.	1974	260	--	--	--	475	18	6- 6-74	--	--	6/
57	do.	do.	1974	160	--	--	--	508	70	6- 6-74	--	--	6/

See footnotes at end of table.

10.0 SUPPLEMENTAL DATA--Continued

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-58	Lower Colorado River Authority	Bechtel Corp.	1974	125	--	--	--	444	--	--	--	--	6/
59	do.	do.	1974	260	--	--	--	483	--	--	--	--	6/
60	do.	do.	1974	100	--	--	--	453	--	6- 6-74	--	--	6/
61	do.	do.	1974	180	--	--	--	471	37	6- 6-74	--	--	6/
62	do.	do.	1974	200	--	--	--	470	64	--	--	--	6/
63	U.S. Government Camp Swift test well 2-T	J. R. Johnson	1941	550	10 8 7	341 461 550	Tws	478	119	11- -41	N	N	This well and C-24 were drilled for aquifer testing in the 1940's. Never used as supply well. Casings pulled and well abandened. Drawdown 30 ft while pumping 600 gal/min, 11-8-41. Casing originally slotted from 461 to 550 ft. 5/
D- 1	B. B. Sanders well 1	Burford Oil Co.	1952	5,030	--	--	--	599	--	--	--	--	Oil test. 2/
2	Martin Kanetzky	Dunn Water Well Drilling Co.	1952	618	12	--	Twcb	580	112.7	10-25-79	--	Irr.	Casing slotted from 355 to 375 and 466 to 618 ft. Reported discharge 500 gal/min. Temperature 75°F.
3	Cecil Sullivan	Richte Water Well Drilling	1974	302	4	--	Twcb	605	119.5	11-20-79	--	D	--
4	John A. Dube	W. S. Watson	1935	640	12 6	--	Twcb	550	115.5 125.4	9-28-60 9-18-64	T, G	Irr	Oil test; converted to water well. Discharge 350 gal/min.

See footnotes at end of table.

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in)	Casing: Depth or interval (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above (+) below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D- 5	Martin Canetzky	Dunn Water Well Drilling Co.	1947	628	4 2	216 212-628	Twcb	605	123.2	10-25-79	--	N	20 ft slotted. 4/
6	Hugh Holland	Crisp Drilling Co.	1971	735	8	--	Twcb	579	83.5	11-20-79	--	S	--
7	do.	Pomykal Drilling Co.	1978	671	6	--	Twcb	515	67.0	11-20-79	--	S	--
8	B. B. Sanders	Burford Oil Co.	1952	5,227	--	--	--	585	--	--	--	--	Oil test. 2/
9	B. F. Henneke	Dunn Water Well Drilling Co.	1965	630	4 3	--	Twcb	520	90	1965	T, E	D, S	3-in casing slotted from 600 to 630 ft. 4/
10	E. W. Jones well 1	Humble Oil and Refining Co.	1959	9,812	--	--	--	537	--	--	--	--	Oil test. 2/
11	J. G. Bryson well 1	E. J. Gracey	1947	3,342	--	--	--	428	--	--	--	--	Oil test. 2/
12	Joe R. Brown	Leroy Richter	1965	507	4	446	Twcb	540	146	4- -65	Cf, E	D	Open end. 1/, 4/
13	O. J. Gilson	Dunn Water Well Drilling Co.	1952	772	4	772	Tws	510	80.0	4- 9-53	J, E	S	Cased to bottom; slotted. Temperature 75°F.
14	Marvin Egger	Richter Water Well Drilling Co.	1975	769	4	--	Twcb	475	68.0	12- 6-79	--	D	--
15	Herman Hospipal	B. J. Swinehart Co.	--	434	4	--	Twcb	484	35.5	11- 7-79	--	S	--
16	Mrs. Pauline Dolgener, well 1	Amerada Petroleum Corp.	1951	6,808	--	--	--	465	--	--	--	--	Oil test. 2/
17	Bertha Altmann well 1	Shamrock Oil and Gas, and Seaboard Oil	1944	9,260	--	--	--	550	--	--	--	--	Oil test. 2/

See footnotes at end of table.

10.0 SUPPLEMENTAL DATA--Continued

10.1 Records of Test Wells and Test Holes--Continued

Well no.	Owner	Driller	Date com-plet-ed	Depth of well (ft)	Casing		Water-bearing unit	Altitude of land surface (ft)	Water level		Method of lift	Use of water	Remarks
					Diam-eter (in)	Depth or inter-val (ft)			Above (+) below land surface datum (ft)	Date of measure-ment			
18	Aqua Water Supply Corp.	Pomykal Drilling Co.	1982	1,558	--	--	Tws	610	268	7- -82	--	--	Reported drawdown 42 ft while pumping 200 gal/min. 2/

1/ Driller's log available for well.
2/ Electric log available for well
3/ Observation well. Monthly water levels available.
4/ Water quality samples collected by Texas Department of Water Resources.
5/ Water quality samples collected by U.S. Geological Survey.
6/ Lower Colorado River Authority test holes.

10.0 SUPPLEMENTAL DATA

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX

LOCATION.--Lat 30°18'18", long 97°17'48", Bastrop County, Hydrologic Unit 12090301, on left bank at upstream side of left abutment of U.S. Highway 290 bridge, 3.8 mi (6.1 km) northwest of McDade, and 5.3 mi (8.5 km) southeast of Elgin.

DRAINAGE AREA.--38.7 mi^2 (100.2 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 422 ft (128.6 m), from topographic map.

REMARKS.--Water-discharge records fair. No known regulation or diversion. Station is part of hydrologic-research project to study effects of lignite strip mining on the local water resources. Station has automatic water-quality sampler. Two recording rain gages are located in the watershed.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 989 ft^3/s (28.0 m^3/s) Mar. 27, 1980, gage height, 12.20 ft (3.719 m), from rating curve extended above 424 ft^3/s (12.0 m^3/s); no flow for many days each year.

EXTREMES FOR PERIOD JULY TO SEPTEMBER 1979.--Maximum discharge, 331 ft^3/s (9.37 m^3/s) July 27 at 2400 hours, gage height, 7.05 ft (2.149 m), no other peak above base of 325 ft^3/s (9.20 m^3/s); no flow Sept. 9-19.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 325 ft^3/s (9.20 m^3/s) and maximum (*):

Date	Time	Discharge (ft^3/s)	Discharge (m^3/s)	Gage height (ft)	Gage height (m)
Mar. 27	2115	*989	28.0	a12.20	3.719
May 14	0230	984	27.9	12.17	3.709

a From rating curve extended above 424 ft^3/s (9.20 m^3/s).

Minimum discharge, no flow for many days.

DISCHARGE, IN CUBIC FEET PER SECOND, JULY TO SEPTEMBER 1979
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1										---	.90	.03
2										---	.75	.03
3										---	.63	.03
4										---	.63	.03
5										---	.51	.63
6										---	.51	1.0
7										---	.40	.12
8										---	.51	.01
9										---	.63	.00
10										---	.63	.00
11										---	.51	.00
12										---	.51	.00
13										2.4	.51	.00
14										2.3	.51	.00
15										2.2	.40	.00
16										1.7	.30	.00
17										1.4	.40	.00
18										1.4	.63	.00
19										1.3	.63	.00
20										2.5	.30	.01
21										3.2	.22	.11
22										6.2	.14	.22
23										1.8	.06	.21
24										1.3	.14	.21
25										1.0	.06	.14
26										.90	.06	.06
27										58	.06	.03
28										63	.14	.05
29										3.8	.14	.06
30										1.8	.03	.03
31										1.2	.03	---
TOTAL										---	11.88	3.01
MEAN										---	.38	.10
MAX										---	.90	1.0
MIN										---	.03	.00
CFSM										---	.01	.003
IN.										---	.01	.00
AC-FT										---	24	6.0

WTR YR 1979 TOTAL - MEAN - MAX - MIN - CFSM - IN. - AC-FT -

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.04	.00	.03	.69	2.2	8.5	8.3	7.4	1.7	.02	.00	.00
2	.03	.00	.04	.63	2.1	4.0	6.6	4.1	1.5	.00	.00	.00
3	.04	.00	.06	.66	1.9	2.6	5.7	1.5	1.4	.00	.00	.00
4	.66	.00	.10	.63	1.9	2.4	4.6	.93	1.4	.00	.00	.00
5	.01	.00	.14	.55	1.8	2.1	3.3	.54	1.2	.00	.00	.00
6	.02	.00	.17	.64	1.8	1.8	2.7	.39	1.3	.00	.00	.00
7	.04	.00	.14	.73	1.9	1.8	2.9	.94	1.3	.00	.00	.00
8	.06	.00	.18	.63	2.0	1.8	2.8	2.8	1.1	.00	.00	.00
9	.03	.00	.22	.63	2.5	1.7	2.5	4.0	1.0	.00	.00	.00
10	.02	.00	.22	.63	2.3	1.6	2.2	2.2	1.1	.00	.00	.00
11	.04	.00	.25	.79	2.1	1.5	1.8	1.2	1.2	.00	.00	.00
12	.04	.00	.56	.64	1.8	1.6	1.7	14	1.2	.00	.00	.00
13	.03	.01	2.4	.52	2.6	1.7	4.5	193	1.1	.00	.00	.00
14	.03	.01	1.3	.56	2.1	1.5	2.7	469	.88	.00	.00	.00
15	.04	.00	.36	.69	2.1	1.5	2.0	136	.63	.00	.00	.00
16	.03	.01	.16	.81	6.1	1.6	1.0	78	.47	.00	.00	.00
17	.03	.02	.06	.89	7.5	1.9	1.2	23	.36	.00	.00	.00
18	.03	.02	.06	.89	4.2	1.7	.50	8.0	.24	.00	.00	.00
19	.01	.00	.06	1.2	3.9	1.8	.51	5.7	.17	.00	.00	.00
20	.00	.00	.19	6.7	2.7	2.0	.47	5.2	.14	.00	.00	.00
21	.01	.00	1.2	5.1	2.8	1.9	.41	3.8	.19	.00	.00	.00
22	.00	.00	1.8	42	2.2	1.7	.40	3.2	.18	.00	.00	.00
23	.00	.00	2.5	18	2.0	1.8	.46	2.5	.18	.00	.00	.00
24	.00	.00	3.3	5.2	1.8	1.9	.46	2.5	.04	.00	.00	.00
25	.01	.00	2.0	3.6	1.7	2.0	11	2.2	.03	.00	.00	.00
26	.00	.01	1.4	3.2	1.6	2.4	5.6	2.2	.01	.00	.00	.00
27	.00	.03	1.4	2.6	2.0	303	1.8	2.1	.01	.00	.00	.00
28	.00	.03	2.0	2.5	2.1	187	.95	1.9	.01	.00	.00	.00
29	.01	.02	11	2.5	2.1	20	.70	1.8	.03	.00	.00	.00
30	.03	.01	2.2	2.5	---	11	.66	1.9	.04	.00	.00	.00
31	.00	---	1.1	2.3	---	8.1	---	1.8	---	.00	.00	---
TOTAL	1.29	.17	36.60	109.61	73.8	585.9	80.42	983.80	20.11	.02	.00	.00
MEAN	.042	.006	1.18	3.54	2.54	18.9	2.68	31.7	.67	.001	.000	.000
MAX	.66	.03	11	42	7.5	303	11	469	1.7	.02	.00	.00
MIN	.00	.00	.03	.52	1.6	1.5	.40	.39	.01	.00	.00	.00
CFSM	.001	.000	.03	.09	.07	.49	.07	.82	.02	.000	.000	.000
IN.	.00	.00	.04	.11	.07	.56	.08	.95	.02	.00	.00	.00
AC-FT	2.6	.3	73	217	146	1160	160	1950	40	.04	.00	.00
(††)	1.46	.71	3.15	2.40	2.13	3.70	2.40	6.46	.64	.24	.93	3.07

CAL YR 1979 TOTAL - MEAN - MAX - MIN - CFSM - IN - AC-FT - †† -
WTR YR 1980 TOTAL 1891.72 MEAN 5.17 MAX 469 MIN .00 CFSM .13 IN 1.82 AC-FT 3750 †† 27.29

†† Weighted-mean rainfall on watershed, in inches, based on two rain gages.

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX

LOCATION.--Lat 30°18'18", long 97°17'48", Bastrop County, Hydrologic Unit 12090301, on left bank at upstream side of left abutment of U.S. Highway 290 bridge, 3.8 mi (6.1 km) northwest of McDade, and 5.3 mi (8.5 km) southeast of Elgin.

DRAINAGE AREA.--38.7 mi² (100.2 km²).

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 422 ft (128.6 m), from topographic map.

REMARKS.--Records fair. No known regulation or diversion. Station is part of hydrologic-research project to study effects of lignite strip mining on the local water resources. Station has automatic water-quality sampler. Two recording rain gages are located in the watershed.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,410 ft³/s (125 m³/s) June 11, 1981, gage height, 15.74 ft (4.798 m); no flow for many days each year.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 325 ft³/s (9.20 m³/s) and maximum (*):

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)	Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
May 31	0245	412	11.7	7.82	2.384	June 13	1830	1,970	55.8	12.70	3.871
June 11	0645	*4,410	125	15.74	4.798	June 16	1400	1,940	54.9	12.65	3.856

Minimum discharge, no flow for many days.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1980 TO SEPTEMBER 1981
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.06	.14	.09	.14	.24	.00	46	1.1	.05	.08
2	.00	.00	.06	.18	.09	.22	.22	.00	85	1.2	.02	.03
3	.00	.00	.06	.21	.09	1.3	.22	.00	6.5	1.5	.00	.05
4	.00	.00	.10	.14	.09	23	.22	.00	6.5	1.2	.00	.06
5	.00	.00	.14	.14	.09	3.4	.15	.00	68	7.4	.01	.06
6	.00	.00	.14	.14	.09	1.5	.03	.01	13	11	.03	.06
7	.00	.00	.14	.14	.09	1.0	.03	.15	3.6	3.8	.03	.06
8	.00	.00	.14	.18	.09	.63	.03	.30	1.8	2.4	.03	.06
9	.00	.00	.14	.23	.09	.30	.03	.09	1.4	1.9	.03	.03
10	.00	.00	.14	.14	.09	.22	.05	.00	1.2	1.3	.03	.03
11	.00	.00	.14	.14	.09	.22	.03	.00	1550	1.1	.04	.03
12	.00	.00	.14	.14	.09	.22	.03	.00	165	.94	.10	.00
13	.00	.00	.14	.14	.09	.36	.00	.00	605	.89	.14	.00
14	.00	.00	.14	.14	.09	.37	.00	.00	528	.89	.13	.02
15	.00	.00	.22	.14	.09	.30	.00	.00	44	.71	.06	.04
16	.00	.03	.30	.14	.09	.25	.00	1.2	866	.56	.06	.03
17	.00	.06	.50	.14	.09	.22	.00	1.2	85	.73	.06	.00
18	.00	.06	.51	.14	.09	.22	.00	.34	11	.89	.06	.00
19	.00	.06	.45	.26	.09	.10	.00	.00	5.3	1.4	.06	.00
20	.00	.06	.40	.22	.09	.06	.00	.00	3.1	1.7	.06	.00
21	.00	.06	.40	.14	.09	.06	.00	.00	2.1	1.2	.06	.00
22	.00	.06	.40	.09	.09	.06	.00	.00	1.9	.48	.05	.00
23	.00	.06	.46	.09	.09	.03	.05	.00	1.2	.23	.02	.00
24	.00	.06	.42	.09	.09	.03	.00	22	1.2	.14	.00	.00
25	.00	.14	.40	.09	.09	.13	.00	67	1.3	.08	.01	.01
26	.00	.06	.40	.09	.09	.30	.00	6.3	1.8	.06	.03	.03
27	.00	.03	.22	.09	.09	.30	.00	2.1	2.1	.10	.00	.03
28	.00	.03	.20	.09	.09	.30	.00	1.3	1.8	.19	.00	.03
29	.00	.03	.29	.09	---	4.5	.00	1.3	.90	.22	.00	.02
30	.00	.06	.14	.09	---	1.8	.00	38	.80	.22	.03	.02
31	.00	---	.14	.09	---	.60	---	129	---	.18	.06	---
TOTAL	.00	.86	7.53	4.28	2.52	42.14	1.33	270.29	4110.50	45.71	1.26	.78
MEAN	.000	.029	.24	.14	.090	1.36	.044	8.72	137	1.47	.041	.026
MAX	.00	.14	.51	.26	.09	23	.24	129	1550	11	.14	.08
MIN	.00	.00	.06	.09	.09	.03	.00	.00	.80	.06	.00	.00
CFSM	.000	.001	.006	.004	.002	.04	.001	.23	3.54	.04	.001	.001
IN.	.00	.00	.01	.00	.00	.04	.00	.26	3.95	.04	.00	.00
AC-FT	.00	1.7	15	8.5	5.0	84	2.6	536	8150	91	2.5	1.5
(††)	2.16	2.88	.84	1.88	1.03	4.01	.91	7.29	11.23	2.56	1.67	2.06

CAL YR 1980 TOTAL 1862.05 MEAN 5.09 MAX 469 MIN .00 CFSM .13 IN 1.79 AC-FT 3690 †† 27.85
WTR YR 1981 TOTAL 4487.20 MEAN 12.3 MAX 1550 MIN .00 CFSM .32 IN 4.31 AC-FT 8900 †† 38.52

†† Weighted-mean rainfall on watershed, in inches, based on two rain gages.

10.0 SUPPLEMENTAL DATA--Continued

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX

LOCATION.--Lat 30°18'18", long 97°17'48", Bastrop County, Hydrologic Unit 12090301, on left bank at upstream side of left abutment of U.S. Highway 290 bridge, 3.8 mi (6.1 km) northwest of McDade, 5.3 mi (8.5 km) southeast of Elgin, and 14.2 mi (22.8 km) upstream from mouth.

DRAINAGE AREA.--38.7 mi^2 (100.2 km^2).

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 422 ft (128.6 m), from topographic map.

REMARKS.--Records fair except those for Oct. 1 to Nov. 19, which are poor. No known regulation or diversion. Two recording rain gages are located in the watershed. Several observations of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,410 ft^3/s (125 m^3/s) June 11, 1981 and May 13, 1982, gage height, 15.74 ft (4.798 m); no flow for many days each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,410 ft^3/s (125 m^3/s) May 13 at 1115 hours, gage height, 15.74 ft (4.798 m), no other peak above base of 325 ft^3/s (9.20 m^3/s); no flow for many days.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	298	.90	.75	.94	.89	.83	1.6	.73	1.5	.00	.00
2	.00	459	.63	.75	.82	.89	.75	1.4	1.0	.75	.00	.00
3	.00	324	.63	1.4	1.0	.83	.75	1.2	1.1	.40	.00	.00
4	.00	65	.63	1.2	.92	.75	.75	1.2	1.2	.22	.00	.00
5	.00	26	.90	.90	.68	.75	.74	1.2	1.2	.14	.00	.00
6	.00	2.6	1.3	.89	.56	.75	.55	2.0	.76	.03	.00	.00
7	.00	1.8	1.3	.88	.51	.63	.51	2.1	.37	.00	.00	.00
8	.00	2.5	1.4	.75	.58	.63	.67	1.5	.30	.00	.00	.00
9	.00	74	1.3	.75	.75	.63	1.0	1.3	.51	.00	.00	.00
10	.00	144	1.3	.67	.75	.63	1.4	1.1	.63	.00	.00	.00
11	.00	83	1.2	.63	.94	.95	1.0	1.0	.30	.00	.00	.00
12	.00	9.4	.90	1.0	1.0	1.4	.76	1.0	.51	.00	.00	.00
13	.00	4.8	.90	1.3	.89	1.4	.66	1550	.75	.00	.00	.00
14	13	3.0	1.0	1.2	.63	1.1	.63	85	.63	.00	.00	.00
15	118	2.2	.90	1.1	.63	.89	.63	10	.40	.00	.00	.00
16	227	1.8	.40	.93	.68	.98	.63	6.4	.63	.00	.00	.00
17	405	1.5	.30	.55	.82	1.0	.56	4.7	.63	.00	.00	.00
18	395	1.3	.40	.59	.77	.76	.41	3.2	.51	.00	.00	.00
19	115	1.0	.51	.76	.75	.65	.40	3.1	.51	.00	.00	.00
20	29	.90	.63	.98	.79	.67	1.4	3.4	.40	.00	.00	.00
21	2.5	.90	.40	1.2	.97	.75	2.5	4.6	.40	.00	.00	.00
22	1.7	.90	.30	1.2	1.0	.75	13	3.8	.40	.00	.00	.00
23	1.3	1.0	.30	.99	.97	.86	16	2.3	.22	.00	.00	.00
24	1.2	.90	.40	.66	1.1	1.1	7.3	4.9	.22	.00	.00	.00
25	.99	.90	.51	.63	.77	1.2	7.4	3.8	.14	.00	.00	.00
26	.87	.63	.63	.63	.97	.92	4.5	2.8	.14	.00	.00	.00
27	.87	.51	.58	.68	1.0	1.4	2.9	2.1	.14	.00	.00	.00
28	.84	.51	.56	.81	.90	1.8	2.2	1.6	.03	.00	.00	.00
29	.72	.75	.64	.89	---	1.4	1.8	1.2	.03	.00	.00	.00
30	.67	.90	.75	1.2	---	1.3	1.7	.80	.30	.00	.00	.00
31	68	---	.75	1.4	---	1.3	---	.75	---	.00	.00	---
TOTAL	1381.66	1513.70	23.25	28.27	23.09	29.96	74.33	1711.05	15.09	3.04	.00	.00
MEAN	44.6	50.5	.75	.91	.82	.97	2.48	55.2	.50	.098	.000	.000
MAX	405	459	1.4	1.4	1.1	1.8	16	1550	1.2	1.5	.00	.00
MIN	.00	.51	.30	.55	.51	.63	.40	.75	.03	.00	.00	.00
CFSM	1.15	1.31	.02	.02	.02	.03	.06	1.43	.01	.003	.000	.000
IN.	1.33	1.45	.02	.03	.02	.03	.07	1.64	.01	.00	.00	.00
AC-FT	2740	3000	46	56	46	59	147	3390	30	6.0	.00	.00
(††)	-	-	.54	.63	.72	1.53	3.05	6.35	2.65	.07	1.18	2.93

CAL YR 1981 TOTAL 7397.42 MEAN 20.3 MAX 1550 MIN .00 CFSM .53 IN 7.11 AC-FT 14670 †† -
WTR YR 1982 TOTAL 4803.44 MEAN 13.2 MAX 1550 MIN .00 CFSM .34 IN 4.62 AC-FT 9530 †† -

†† Weighted-mean rainfall, in inches.

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX

LOCATION.--Lat 30°15'54", long 97°19'39", Bastrop County, Hydrologic Unit 12090301, on right bank at downstream side of bridge on State Highway 95, 6.1 mi (9.8 km) south of Elgin, and 10.7 mi (17.2 km) north of Bastrop.

DRAINAGE AREA.--63.8 mi² (165.2 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 392 ft (119.5 m), from topographic map.

REMARKS.--Water-discharge records fair. No known regulation or diversion. Station is part of hydrologic-research project to study effects of lignite strip mining on local water resources. Station has automatic water-quality sampler. Three recording rain gages are located in the watershed.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,720 ft³/s (48.7 m³/s) May 14, 1980, gage height, 15.78 ft (4.810 m); no flow July 30 to Sept. 6, Sept. 8-29, 1980.

EXTREMES FOR PERIOD JULY TO SEPTEMBER 1979.--Maximum discharge, 256 ft³/s (7.25 m³/s) July 28, gage height, 8.81 ft (2.685 m), no peak above base of 500 ft³/s (14.2 m³/s); minimum, 0.05 ft³/s (0.001 m³/s) Sept. 16, 17.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 500 ft³/s (14.2 m³/s) and maximum (*):

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
Mar. 28	0215	1,340	37.9	14.51	4.423
May 14	0615	*1,720	48.7	15.78	4.810

Minimum discharge, no flow July 30 to Sept. 6, Sept. 8-29.

DISCHARGE, IN CUBIC FEET PER SECOND, JULY TO SEPTEMBER 1979
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1										---	1.2	.18
2										---	.85	.16
3										---	.64	.14
4										---	.47	.13
5										---	.44	.12
6										---	.41	.14
7										---	.33	.16
8										---	.60	.33
9										---	.41	.20
10										---	.33	.15
11										---	.28	.12
12										8.5	.28	.10
13										4.3	.30	.07
14										2.9	.26	.07
15										2.6	.24	.07
16										2.2	.22	.06
17										1.6	.20	.05
18										1.3	.18	.06
19										1.4	.18	.13
20										1.4	.16	.37
21										4.2	.16	.17
22										7.1	.16	.10
23										3.8	.16	.08
24										1.9	.14	.07
25										1.2	.13	.07
26										1.0	.13	.06
27										2.8	.13	.06
28										92	.12	.07
29										9.4	.11	.08
30										3.1	.18	.08
31										2.0	.24	---
TOTAL										---	9.64	3.65
MEAN										---	.31	.12
MAX										---	1.2	.37
MIN										---	.11	.05
CFSM										---	.005	.002
IN.										---	.01	.00
AC-FT										---	19	7.2

WTR YR 1979 TOTAL - MEAN - MAX - MIN - CFSM - IN. - AC-FT -

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BSIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.08	.05	.10	1.8	2.6	6.1	8.5	8.9	2.3	.22	.00	.00
2	.08	.03	.11	1.5	2.5	7.6	7.3	11	2.0	.24	.00	.00
3	.07	.02	.16	1.3	2.4	3.7	6.5	4.9	1.7	.24	.00	.00
4	.25	.02	.16	.88	2.0	2.6	5.5	2.9	1.5	.26	.00	.00
5	.07	.03	.18	.85	1.8	2.1	4.7	2.1	1.3	.24	.00	.00
6	.07	.03	.22	.93	1.7	1.8	3.9	1.5	1.2	.24	.00	.00
7	.06	.04	.20	.74	1.5	1.5	3.8	1.7	1.1	.24	.00	.10
8	.06	.03	.23	.73	1.7	1.4	3.3	2.7	1.1	.23	.00	.00
9	.05	.06	.25	.69	2.4	1.3	2.7	9.2	1.1	.24	.00	.00
10	.06	.06	.26	.77	3.9	1.1	2.4	5.6	1.0	.24	.00	.00
11	.06	.07	.28	.77	2.6	.92	2.4	3.2	1.0	.23	.00	.00
12	.05	.06	.38	.74	2.0	1.2	2.1	8.3	.96	.22	.00	.00
13	.05	.06	.36	.74	1.9	.98	3.9	205	.86	.22	.00	.00
14	.04	.06	.25	.75	2.3	.88	4.4	1000	.71	.22	.00	.00
15	.05	.07	.25	.83	1.9	.80	3.0	184	.66	.22	.00	.00
16	.07	.08	.36	.87	5.1	.75	2.3	142	.53	.21	.00	.00
17	.05	.10	.26	.92	10	.77	1.9	37	.42	.18	.00	.00
18	.06	.13	.20	1.1	6.4	.75	1.7	16	.38	.17	.00	.00
19	.05	.14	.20	1.0	4.5	.76	1.6	11	.35	.16	.00	.00
20	.05	.13	.16	14	3.3	.84	1.4	10	.32	.15	.00	.00
21	.05	.27	.16	13	2.8	.79	1.2	7.8	.33	.15	.00	.00
22	.06	.22	.14	63	2.7	.75	1.1	6.0	.31	.14	.00	.00
23	.06	.14	.33	35	1.9	.77	1.1	4.8	.30	.13	.00	.00
24	.06	.11	.55	11	1.6	.67	1.1	4.1	.28	.12	.00	.00
25	.07	.12	.36	6.5	1.3	.76	13	3.8	.25	.10	.00	.00
26	.08	.13	.18	4.9	1.2	1.0	14	3.3	.22	.08	.00	.00
27	.09	.11	.11	3.8	1.1	216	6.0	3.0	.24	.06	.00	.00
28	.09	.09	.22	3.3	1.5	488	3.4	2.7	.23	.04	.00	.00
29	.07	.08	13	3.1	1.7	22	2.2	2.5	.22	.02	.00	.00
30	.25	.08	6.7	3.0	---	11	1.8	2.3	.24	.00	.00	.11
31	.33	---	2.9	2.9	---	8.8	---	2.3	---	.00	.00	---
TOTAL	2.59	2.62	29.22	181.41	78.3	788.39	118.2	1709.6	23.11	5.21	.00	.21
MEAN	.084	.087	.94	5.85	2.70	25.4	3.94	55.1	.77	.17	.000	.007
MAX	.33	.27	13	63	10	488	14	1000	2.3	.26	.00	.11
MIN	.04	.02	.10	.69	1.1	.67	1.1	1.5	.22	.00	.00	.00
CFSM	.001	.001	.02	.09	.04	.40	.06	.86	.01	.003	.000	.000
IN.	.00	.00	.02	.11	.05	.46	.07	1.00	.01	.00	.00	.00
AC-FT	5.1	5.2	58	360	155	1560	234	3390	46	10	.00	.4
(††)	1.61	.80	3.18	2.75	2.13	3.62	2.27	6.85	.58	.33	.80	2.74

CAL YR 1979 TOTAL - MEAN - MAX - MIN - CFSM - IN - AC-FT - †† -
WTR YR 1980 TOTAL 2938.86 MEAN 8.03 MAX 1000 MIN .00 CFSM .13 IN 1.71 AC-FT 5830 †† 27.66

†† Weighted-mean rainfall, in inches, based on three rain gages.

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX

LOCATION.--Lat 30°15'54", long 97°19'39", Bastrop County, Hydrologic Unit 12090301, on right bank at downstream side of bridge on State Highway 95, 6.1 mi (9.8 km) south of Elgin, and 10.7 mi (17.2 km) north of Bastrop.

DRAINAGE AREA.--63.8 mi² (165.2 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 392 ft (119.5 m), from topographic map.

REMARKS.--Water-discharge records fair. No known regulation or diversion. Station is part of hydrologic-research project to study effects of lignite strip mining on local water resources. Station has automatic water-quality sampler. Three recording rain gages are located in the watershed.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,760 ft³/s (163 m³/s) June 11, 1981, gage height, 21.54 ft (6.565 m); no flow for several days each year.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 500 ft³/s (14.2 m³/s) and maximum (*):

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
June 11	1100	*5,760	163	21.54	6.565
June 13	2345	2,400	68.0	17.32	5.279
June 16	1900	1,940	54.9	16.36	4.987

Minimum discharge, no flow Oct. 7-17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1980 TO SEPTEMBER 1981
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.10	.18	.26	.38	.42	.41	.64	.24	30	1.3	.11	.09
2	.08	.18	.26	.33	.41	.44	.41	.20	125	1.2	.10	.09
3	.07	.18	.26	.30	.38	.43	.39	.23	12	1.0	.09	.09
4	.05	.20	.26	.30	.39	19	.30	.25	14	1.1	.08	.15
5	.03	.20	.26	.33	.59	8.5	.23	.19	49	8.0	.08	.10
6	.01	.20	.30	.36	.73	2.2	.25	.16	30	15	.08	.07
7	.00	.24	.30	.38	.56	1.0	.26	.14	6.6	6.1	.07	.06
8	.00	.28	.30	.38	.42	.74	.24	.13	3.2	3.2	.06	.06
9	.00	.33	.36	.44	.39	.51	.25	.12	1.9	2.1	.05	.06
10	.00	.38	.38	.38	.59	.36	.27	.12	1.4	1.7	.05	.05
11	.00	.33	.33	.36	.43	.33	.22	.10	2350	1.2	.05	.05
12	.00	.30	.28	.30	.32	.34	.19	.10	413	.91	.05	.04
13	.00	.30	.28	.28	.30	.35	.20	.11	452	.74	.05	.05
14	.00	.30	.30	.33	.28	.37	.18	.09	1060	.67	.05	.04
15	.00	.30	.36	.33	.30	.38	.15	.09	68	.59	.05	.18
16	.00	.47	.36	.30	.33	.33	.16	.37	874	.49	.04	.14
17	.00	.80	.36	.30	.34	.30	.18	.23	339	.47	.04	.07
18	.11	.55	.30	.26	.33	.27	.17	.13	22	.41	.05	.05
19	.11	.38	.30	.97	.30	.24	.15	.11	11	.38	.05	.04
20	.09	.28	.30	2.0	.30	.23	.30	.09	6.3	.57	.05	.04
21	.09	.22	.28	.80	.35	.24	.33	.09	3.9	.62	.05	.03
22	.09	.22	.28	.60	.31	.22	.12	.09	3.2	.45	.05	.03
23	.09	.20	.30	.51	.30	.21	.25	.08	2.4	.33	.05	.04
24	.18	.26	.33	.51	.28	.22	.25	18	1.9	.24	.05	.04
25	.22	.30	.36	.47	.26	.20	.20	46	5.8	.19	.05	.05
26	.24	.85	.36	.47	.26	.21	.20	16	3.2	.15	.05	.04
27	.26	.64	.36	.47	.27	.21	.18	4.1	2.6	.20	.05	.04
28	.20	.36	.36	.44	.28	.22	.18	1.5	2.8	.20	.05	.03
29	.18	.28	.38	.38	---	2.8	.20	1.3	1.4	.14	.05	.03
30	.18	.28	.41	.39	---	4.8	.17	1.7	1.1	.12	.06	.03
31	.18	---	.38	.41	---	1.4	---	117	---	.12	.07	---
TOTAL	2.56	9.99	9.91	14.46	10.42	47.46	7.22	209.06	5896.7	49.89	1.83	1.88
MEAN	.083	.33	.32	.47	.37	1.53	.24	6.74	197	1.61	.059	.063
MAX	.26	.85	.41	2.0	.73	19	.64	117	2350	15	.11	.18
MIN	.00	.18	.26	.26	.26	.20	.12	.08	1.1	.12	.04	.03
CFSM	.001	.005	.005	.007	.006	.02	.004	.11	3.09	.03	.001	.001
IN.	.00	.01	.01	.01	.01	.03	.00	.12	3.44	.03	.00	.00
AC-FT	5.1	20	20	29	21	94	14	415	11700	99	3.6	3.7
(††)	2.21	2.80	.87	1.94	1.02	4.00	.99	7.07	12.47	2.29	2.00	1.72

CAL YR 1980 TOTAL 2926.89 MEAN 8.00 MAX 1000 MIN .00 CFSM .13 IN 1.71 AC-FT 5810 †† 27.95
WTR YR 1981 TOTAL 6261.38 MEAN 17.2 MAX 2350 MIN .00 CFSM .27 IN 3.65 AC-FT 12420 †† 39.44

†† Weighted-mean rainfall on watershed, in inches, based on three rain gages.

10.2 Daily-Mean Discharge for Gaging Stations: Big Sandy Creek near McDade and Big Sandy Creek near Elgin--Continued

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX

LOCATION.--Lat 30°15'54", long 97°19'39", Bastrop County, Hydrologic Unit 12090301, on right bank at downstream side of bridge on State Highway 95, 6.1 mi (9.8 km) south of Elgin, 10.7 mi (17.2 km) north of Bastrop, and 10.8 mi (17.4 km) upstream from mouth.

DRAINAGE AREA.--63.8 mi^2 (165.2 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 392 ft (119.5 m), from topographic map.

REMARKS.--Water-discharge records fair except those for Oct. 1 to Nov. 17 and June 10 to July 26, which are poor. No known regulation or diversion. Three recording rain gages are located in the watershed. Several observations of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,760 ft^3/s (163 m^3/s) June 11, 1981, gage height, 21.54 ft (6.565 m); no flow for several days each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,540 ft^3/s (157 m^3/s) May 13 at 1500 hours, gage height, 21.34 ft (6.504 m), no other peak above base of 500 ft^3/s (14.2 m^3/s); no flow for many days.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	300	.80	.80	1.6	1.5	1.3	2.8	1.5	.55	.03	.00
2	.00	490	.91	1.1	1.6	1.4	1.3	5.1	1.5	.51	.03	.00
3	.00	340	.74	.97	1.6	1.4	1.6	1.6	1.6	.47	.03	.01
4	.00	100	.64	1.1	1.7	1.5	1.4	.55	1.6	.41	.03	.01
5	.00	30	.64	.80	1.6	1.4	1.2	.38	1.5	.41	.03	.01
6	.00	5.2	.69	.74	1.4	1.4	.91	.64	1.6	.38	.03	.00
7	.00	2.3	.91	.64	1.3	1.3	.80	.80	1.2	.33	.03	.00
8	.00	4.0	1.3	.51	1.2	1.3	.74	.69	1.1	.33	.03	.00
9	.00	90	1.3	.60	1.2	1.2	.74	.44	.87	.28	.02	.00
10	.00	160	1.4	.74	1.2	1.2	.91	.33	.85	.26	.02	.00
11	.00	96	1.3	.47	1.2	1.2	.97	.24	.79	.24	.02	.00
12	.00	25	1.2	.80	1.5	1.3	.91	.20	.98	.24	.02	.00
13	.00	6.0	1.2	1.3	1.4	1.7	.80	2180	.92	.20	.02	.01
14	20	3.1	.97	1.6	1.3	1.9	.69	356	.78	.20	.02	.01
15	170	2.4	.80	1.8	1.3	1.8	.64	13	.70	.16	.01	.00
16	330	2.0	.91	1.7	1.3	1.6	.55	7.3	.74	.15	.01	.01
17	450	1.7	1.1	1.5	1.2	1.7	.51	5.4	.69	.13	.01	.02
18	390	1.5	.91	1.5	1.3	1.3	.44	3.8	.69	.12	.01	.01
19	90	1.3	.74	1.3	1.3	1.5	.44	3.4	.69	.11	.01	.01
20	38	1.1	.74	1.3	1.4	1.4	.64	3.2	.69	.10	.01	.02
21	5.0	1.1	.74	1.5	1.5	1.1	1.5	3.8	.69	.09	.01	.02
22	2.3	.97	.97	1.6	1.5	1.1	5.7	3.6	.64	.08	.01	.01
23	1.8	1.1	.91	1.4	1.4	1.3	19	3.0	.64	.06	.00	.01
24	1.6	.97	.74	1.3	1.4	1.4	9.3	4.3	.64	.06	.00	.01
25	1.4	.94	.64	1.3	1.3	1.4	8.9	5.6	.60	.05	.00	.02
26	1.3	1.0	.64	1.2	1.3	1.4	5.9	3.2	.60	.05	.00	.02
27	1.3	.99	.51	1.3	1.5	1.6	3.9	2.8	.60	.04	.00	.02
28	1.3	.89	.51	1.2	1.6	2.2	2.4	2.4	.55	.04	.00	.02
29	1.2	.90	.47	1.2	---	2.1	1.6	2.1	.55	.04	.00	.02
30	1.1	1.7	.51	1.3	---	1.7	1.1	1.9	.55	.03	.00	.02
31	80	---	.64	1.6	---	1.6	---	1.7	---	.03	.00	---
TOTAL	1586.30	1672.16	26.48	36.17	39.1	45.9	76.79	2620.27	27.05	6.15	.44	.29
MEAN	51.2	55.7	.85	1.17	1.40	1.48	2.56	84.5	.90	.20	.014	.010
MAX	450	490	1.4	1.8	1.7	2.2	19	2180	1.6	.55	.03	.02
MIN	.00	.89	.47	.47	1.2	1.1	.44	.20	.55	.03	.00	.00
CFSM	.80	.87	.01	.02	.02	.02	.04	1.32	.01	.003	.000	.000
IN.	.92	.97	.02	.02	.02	.03	.04	1.53	.02	.00	.00	.00
AC-FT	3150	3320	53	72	78	91	152	5200	54	12	.9	.6
(††)	-	-	.53	.82	.73	1.67	2.77	7.13	2.84	.06	1.37	2.42

CAL YR 1981 TOTAL 9523.86 MEAN 26.1 MAX 2350 MIN .00 CFSM .41 IN 5.55 AC-FT 18890 †† -
WTR YR 1982 TOTAL 6137.10 MEAN 16.8 MAX 2180 MIN .00 CFSM .26 IN 3.58 AC-FT 12170 †† -

†† Weighted-mean rainfall, in inches.

10.3 Water-Quality and Sediment Analysis at Streamflow Sites

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX

PERIOD OF RECORD.--Chemical, biochemical, radiochemical, and pesticide analyses: May to September 1979.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	COLOR (PLAT-INUM-COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)
MAY										
22...	1425	424	126	6.8	21.5	350	240	7.1	80	5.2
23...	1207	35	301	6.6	21.5	150	140	6.4	72	3.9
JUL										
17...	1308	1.4	326	7.1	29.5	120	38	--	--	3.4

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO
MAY									
22...	42000	14000	51000	35	7	10	2.5	7.8	.6
23...	44000	4100	19000	86	40	25	5.8	21	1.0
JUL									
17...	2000	64	180	88	29	28	4.4	23	1.1

DATE	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)
MAY									
22...	5.3	34	0	16	11	.2	6.8	77	.49
23...	6.2	57	0	39	32	.2	9.1	167	.59
JUL									
17...	6.8	72	0	39	34	.4	11	147	.13

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L)
MAY									
22...	.10	--	.15	1.4	--	1.5	17	2	.00
23...	.10	--	.16	1.2	--	.12	.1	0	.00
JUL									
17...	.02	.15	.06	1.0	1.1	.15	14	0	.00

DATE	TIME	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)
MAY							
22...	1425	2	100	1	0	2	240
23...	1207	1	100	1	0	4	280
JUL							
17...	1308	2	100	0	0	2	410

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, DIS-SOLVED (UG/L AS ZN)
MAY						
22...	0	40	.0	0	0	10
23...	0	70	.0	0	0	20
JUL						
17...	0	260	.0	0	0	30

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L)
MAY											
22...	1425	<.7	11	<1.1	16	6.1	11	5.6	11	.23	.11
23...	1207	<1.7	5.0	<2.5	7.4	6.2	<3.5	5.8	<3.5	.08	.24
JUL											
17...	1308	<1.7	2.4	<2.5	3.5	5.9	1.7	5.6	1.7	.04	.44

DATE	TIME	PCB, TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR-DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI-AZINON, TOTAL (UG/L)
MAY								
22...	1425	.0	.00	.0	.00	.00	.00	.01
23...	1207	.0	.00	.0	.00	.00	.00	.01
JUL								
17...	1308	.0	.00	.0	.00	.00	.00	.00

DATE	DI-ELDRIN TOTAL (UG/L)	ENDO-SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA-CHLOR, TOTAL (UG/L)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA-THION, TOTAL (UG/L)	METHYL PARA-THION, TOTAL (UG/L)
MAY									
22...	.00	.00	.00	.00	.00	.00	.00	.00	.00
23...	.00	.00	.00	.00	.00	.00	.00	.00	.00
JUL									
17...	.00	.00	.00	.00	.00	.00	.00	.00	.00

DATE	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
MAY								
22...	.00	.00	.00	0	.00	.72	.02	.00
23...	.00	.00	.00	0	.00	.23	.00	.00
JUL								
17...	.00	.00	.00	0	.00	.20	.03	.00

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Chemical, biochemical, and pesticide analyses: May 1979 to current year. Radiochemical analyses. May to September 1979.

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH FIELD (UNITS)	TEMPER-ATURE, WATER (DEG C)	COLOR (PLAT-INUM COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIOCHEM UNINHIB 5 DAY (MG/L)
OCT										
11...	1305	.02	703	7.4	23.5	10	8.0	4.9	58	2.1
11...	1315	.03	--	--	23.5	--	--	--	--	--
NOV										
28...	1225	.22	810	7.2	12.5	5	2.6	4.0	37	1.9
JAN										
09...	1315	.63	911	7.3	10.5	20	3.6	8.5	77	2.5
22...	1700	64	523	7.3	11.0	200	620	10.0	92	3.6
23...	1330	11	--	--	10.5	--	--	--	--	--
MAR										
27...	--	303	--	--	--	--	--	--	--	--
27...	1230	78	1240	--	--	--	--	--	--	--
27...	1330	152	1250	--	--	--	--	--	--	--
27...	1415	229	1100	--	--	--	--	--	--	--
27...	1515	294	900	--	--	--	--	--	--	--
27...	1650	518	393	7.2	15.0	120	720	8.1	78	5.2
27...	1702	552	--	--	15.0	--	--	--	--	--
28...	--	187	--	--	--	--	--	--	--	--
28...	1230	86	212	6.7	16.5	200	230	9.5	98	4.3
28...	1240	85	--	--	16.5	--	--	--	--	--
MAY										
13...	--	193	--	--	--	--	--	--	--	--
13...	1630	127	676	--	--	--	--	--	--	--
13...	1700	155	585	--	--	--	160	--	--	8.4
13...	1830	317	350	--	--	--	--	--	--	--
13...	1900	451	288	--	--	--	--	--	--	--
13...	2100	685	182	--	--	--	540	--	--	7.2
13...	2130	709	176	--	--	--	--	--	--	--
14...	--	469	--	--	--	--	--	--	--	--
14...	1320	140	--	--	21.0	--	--	--	--	--
27...	--	303	--	--	--	--	--	--	--	--

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)
OCT										
11...	1300	43	460	200	85	57	14	68	2.1	6.6
11...	--	--	--	--	--	--	--	--	--	--
NOV										
28...	1600	92	250	200	71	58	14	73	2.2	6.1
JAN										
09...	620	49	46	--	--	--	--	--	--	--
22...	--	--	--	130	85	37	10	43	1.6	5.2
23...	--	--	--	--	--	--	--	--	--	--
MAR										
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	88000	56000	310000	110	65	31	7.8	33	1.4	5.8
27...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
28...	50000	29000	91000	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
MAY										
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)
OCT										
11...	140	0	71	130	.4	21	438	.00	.020	.02
11...	--	--	--	--	--	--	--	--	--	--
NOV										
28...	160	0	64	130	.3	25	455	.00	.010	.01
JAN										
09...	--	--	--	--	--	--	--	.00	.020	.01
22...	60	0	87	79	.4	11	303	.32	.020	.34
23...	--	--	--	--	--	--	--	--	--	--
MAR										
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	.08	.010	.09
27...	--	--	--	--	--	--	--	.19	.040	.23
27...	--	--	--	--	--	--	--	.28	.060	.34
27...	--	--	--	--	--	--	--	.37	.090	.46
27...	54	0	59	54	.2	7.1	225	.27	.010	.28
27...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	.57	.030	.60
28...	--	--	--	--	--	--	--	--	--	--
MAY										
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	.23	.040	.27
13...	--	--	--	--	--	--	--	.23	.040	.27
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	.35	.040	.39
13...	--	--	--	--	--	--	--	.28	.030	.31
13...	--	--	--	--	--	--	--	.27	.030	.30
14...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT										
11...	.030	.51	.54	.020	9.9	1	.10	--	--	--
11...	--	--	--	--	--	--	--	6	.00	--
NOV										
28...	.010	.51	.52	.020	13	1	.00	16	.01	--
JAN										
09...	.030	.97	1.0	.050	6.8	0	.10	21	.04	--
22...	.070	1.5	1.6	.090	15	0	.00	--	--	--
23...	--	--	--	--	--	--	--	203	6.0	--
MAR										
27...	--	--	--	--	--	--	--	592	484	--
27...	.160	1.5	1.7	.160	19	--	--	268	56	64
27...	.250	1.7	1.9	.190	48	--	--	--	--	--
27...	.280	1.4	1.7	.170	--	--	--	--	--	--
27...	.200	2.2	2.4	.290	--	--	--	1590	1260	90
27...	.220	3.5	3.7	.330	27	0	.00	--	--	--
27...	--	--	--	--	--	--	--	1570	2340	96
28...	--	--	--	--	--	--	--	285	144	--
28...	.120	1.6	1.7	.220	14	2	.00	--	--	--
28...	--	--	--	--	--	--	--	181	42	--
MAY										
13...	--	--	--	--	--	--	--	945	492	--
13...	.210	1.3	1.5	.230	16	--	--	774	265	97
13...	.210	1.9	2.1	.300	--	--	--	--	--	--
13...	--	--	--	--	--	5	--	--	--	--
13...	.200	3.3	3.5	.560	65	--	--	2680	3260	92
13...	.160	2.7	2.9	.500	--	--	--	--	--	--
13...	.150	2.6	2.7	.460	39	--	--	1370	2620	84
14...	--	--	--	--	--	--	--	460	582	--
14...	--	--	--	--	--	--	--	362	137	89
27...	--	--	--	--	--	--	--	592	484	--

DATE	TIME	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)
OCT							
11...	1305	0	200	<1	0	0	10
NOV							
28...	1225	1	300	<1	0	0	<10
JAN							
22...	1700	1	200	<1	0	2	20
MAR							
27...	1650	1	200	<1	0	2	70

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, DIS-SOLVED (UG/L AS ZN)
OCT 11...	0	480	.0	0	0	<3
NOV 28...	0	5400	.0	0	0	4
JAN 22...	1	310	.2	2	0	20
MAR 27...	1	380	.1	1	0	8

DATE	TIME	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L)
OCT 11...	1305	<4.7	.3	<6.9	.4	6.3	.6	6.0	.6	.07	.46
NOV 28...	1225	<4.1	.5	<6.1	.7	4.7	<.6	4.5	<.6	1.1	.41

DATE	TIME	PCB TOTAL (UG/L)	NAPH-THA-LENES, POLY-CHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR-DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI-AZINON, TOTAL (UG/L)
OCT 11...	1305	.00	--	.00	.0	.00	.00	.00	.00
NOV 28...	1225	.00	--	.00	.0	.00	.00	.00	.00
JAN 22...	1700	.00	.0	.00	.0	.00	.00	.00	.00
MAR 27...	1650	--	--	.00	--	--	.00	--	.00

DATE	DI-ELDRIN TOTAL (UG/L)	ENDO-SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA-CHLOR, TOTAL (UG/L)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA-THION, TOTAL (UG/L)	METH-OXY-CHLOR, TOTAL (UG/L)
OCT 11...	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 28...	.00	.00	.00	.00	.00	.00	.00	.00	.00
JAN 22...	.00	.00	.00	.00	.00	.00	.00	.00	.00
MAR 27...	--	--	--	.00	.00	--	--	.00	--

DATE	METHYL PARA-THION, TOTAL (UG/L)	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
OCT 11...	.00	.00	.00	.00	0	.00	.00	.00	.00
NOV 28...	.00	.00	.00	.00	0	.00	.00	.00	.00
JAN 22...	.00	.00	.00	.00	0	.00	.00	.00	.00
MAR 27...	.00	.00	.00	.00	--	.00	.02	.00	.00

COLORADO RIVER BASIN

08159165 BIG SANDY CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE, WATER (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
OCT							
11...	1315	.03	23.5	6	.00	--	--
NOV							
28...	1225	.22	12.5	16	.01	--	--
JAN							
09...	1315	.63	10.5	21	.04	--	--
23...	1330	11	10.5	203	6.0	--	--
MAR							
27...	--	303	--	592	484	--	--
27...	1230	78	--	268	56	--	--
27...	1515	294	--	1590	1260	--	--
27...	1702	552	15.0	1570	2340	77	84
28...	--	187	--	285	144	--	--
28...	1240	85	16.5	181	42	--	--
MAY							
13...	--	193	--	945	492	--	--
13...	1630	127	--	774	265	55	62
13...	1900	451	--	2680	3260	80	81
13...	2130	709	--	1370	2620	74	77
14...	--	469	--	460	582	--	--
14...	1320	140	21.0	362	137	--	--
27...	--	303	--	592	484	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
OCT							
11...	--	--	--	--	--	--	--
NOV							
28...	--	--	--	--	--	--	--
JAN							
09...	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--
MAR							
27...	--	--	--	--	--	--	--
27...	--	--	--	64	72	92	99
27...	--	--	--	90	96	--	100
27...	90	93	95	96	97	99	100
28...	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--
MAY							
13...	--	--	--	--	--	--	--
13...	67	70	90	97	98	99	99
13...	88	88	89	92	93	98	99
13...	81	82	84	84	85	97	99
14...	--	--	--	--	--	--	--
14...	--	--	--	89	95	99	99
27...	--	--	--	--	--	--	--

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX

PERIOD OF RECORD.--Chemical, biochemical, radiochemical, and pesticide analyses: May to September 1979.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	COLOR (PLAT-INUM-COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L)
MAY 23...	1022	71	220	6.6	21.0	240	160	7.1	79	4.1
JUL 17...	1115	1.8	297	7.0	26.5	100	27	--	--	1.3

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO
MAY 23...	58000	6400	22000	63	27	18	4.4	15	.8
JUL 17...	6400	420	720	84	27	23	6.3	22	1.0

DATE	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)
MAY 23...	5.6	44	0	28	22	.2	9.1	125	.40
JUL 17...	5.7	69	0	24	39	.3	17	172	.20

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L)
MAY 23...	.08	.48	.11	.99	1.1	.15	16	1	.00
JUL 17...	.02	.22	.05	.83	.88	.10	9.4	0	.00

DATE	TIME	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)
MAY 23...	1022	1	100	1	10	3	430
JUL 17...	1115	1	200	1	0	2	560

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, DIS-SOLVED (UG/L AS ZN)
MAY 23...	0	20	.0	0	0	10
JUL 17...	0	140	.0	0	0	6

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L)
MAY 23...	1022	<1.3	7.5	<1.9	11	6.7	<7.1	5.2	<7.3	.08	.15
JUL 17...	1115	<1.6	1.6	<2.4	2.3	6.1	1.8	5.7	1.8	.08	<.01

DATE	TIME	PCB, TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR-DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI-AZINON, TOTAL (UG/L)
MAY 23...	1022	.0	.00	.0	.00	.00	.00	.01
JUL 17...	1115	.0	.00	.0	.00	.00	.00	.00

DATE	DI-ELDRIN TOTAL (UG/L)	ENDO-SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA-CHLOR, TOTAL (UG/L)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA-THION, TOTAL (UG/L)	METHYL PARA-THION, TOTAL (UG/L)
MAY 23...	.00	.00	.00	.00	.00	.00	.00	.00	.00
JUL 17...	.00	.00	.00	.00	.00	.00	.00	.00	.00

DATE	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
MAY 23...	.00	.00	.00	0	.00	.54	.02	.00
JUL 17...	.00	.00	.00	0	.00	.12	.02	.00

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Chemical, biochemical, and pesticide analyses: May 1979 to current year. Radiochemical analyses: May to September 1979.

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH FIELD (UNITS)	TEMPER-ATURE, WATER (DEG C)	COLOR (PLAT-INUM COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIOCHEM UNINHIB 5 DAY (MG/L)
OCT										
11...	1110	.30	416	6.9	16.0	20	7.6	2.9	30	2.4
NOV										
28...	1100	1.3	342	6.9	11.0	70	7.7	4.5	40	3.7
JAN										
09...	1100	.66	677	7.2	9.5	20	19	8.4	74	2.5
09...	1110	.69	--	--	8.5	--	--	--	--	--
22...	1530	108	431	7.3	11.5	120	220	9.3	85	3.8
23...	1210	29	--	--	9.5	--	--	--	--	--
MAR										
27...	--	216	--	--	--	--	--	--	--	--
27...	1456	163	187	6.9	15.0	200	370	10.9	105	5.2
27...	1510	178	--	--	15.0	--	--	--	--	--
28...	--	488	--	--	--	--	--	--	--	--
28...	1105	271	139	7.0	15.5	200	300	9.5	95	4.6
28...	1130	265	--	--	15.5	--	--	--	--	--
MAY										
12...	--	8.3	--	--	--	--	--	--	--	--
12...	2200	27	205	--	--	--	--	--	--	6.6
12...	2300	38	231	8.3	--	200	530	--	--	--
13...	--	205	--	--	--	--	--	--	--	--
13...	0015	43	218	--	--	--	--	--	--	--
13...	0200	51	143	--	--	--	--	--	--	5.1
13...	0300	54	135	7.4	--	--	--	--	--	--
14...	--	1000	--	--	--	--	--	--	--	--
14...	1400	1000	--	--	21.5	--	--	--	--	--

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)
OCT										
11...	2600	120	210	110	32	33	7.7	29	1.2	6.5
NOV										
28...	870	96	220	88	33	24	6.9	30	1.4	7.7
JAN										
09...	1800	270	390	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--
22...	--	--	--	110	75	30	8.4	32	1.3	6.1
23...	--	--	--	--	--	--	--	--	--	--
MAR										
27...	--	--	--	--	--	--	--	--	--	--
27...	27000	11000	62000	55	31	15	4.3	17	1.0	4.2
27...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
28...	28000	26000	100000	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
MAY										
12...	--	--	--	--	--	--	--	--	--	--
12...	--	--	--	--	--	--	--	--	--	--
12...	--	--	--	67	18	19	4.8	18	1.0	5.2
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	49	20	14	3.5	12	.7	5.3
14...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--

10.3 Water-Quality and Sediment Analysis at Streamflow Sites--Continued

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)
OCT										
11...	100	0	25	59	.3	24	235	.00	.020	.01
NOV										
28...	68	0	20	56	.2	30	210	.01	.010	.02
JAN										
09...	--	--	--	--	--	--	--	.00	.020	.02
09...	--	--	--	--	--	--	--	--	--	--
22...	42	0	76	51	.2	11	236	.15	.010	.16
23...	--	--	--	--	--	--	--	--	--	--
MAR										
27...	--	--	--	--	--	--	--	--	--	--
27...	30	0	30	26	.1	9.1	121	.19	.010	.20
27...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	.61	.040	.65
28...	--	--	--	--	--	--	--	--	--	--
MAY										
12...	--	--	--	--	--	--	--	--	--	--
12...	--	--	--	--	--	--	--	.21	.020	.23
12...	60	0	27	27	.2	12	143	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	.15	.020	.17
13...	36	0	16	26	.1	11	106	--	--	--
14...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L)
OCT							
11...	.000	.66	.66	.020	5.8	2	.00
NOV							
28...	.010	.12	.13	.120	8.1	3	.00
JAN							
09...	.030	.97	1.0	.070	5.9	0	.10
09...	--	--	--	--	--	--	--
22...	.040	.61	.65	.110	16	3	--
23...	--	--	--	--	--	--	--
MAR							
27...	--	--	--	--	--	--	--
27...	.100	2.5	2.6	.180	28	2	.00
27...	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--
28...	.110	4.7	4.8	.230	15	2	.00
28...	--	--	--	--	--	--	--
MAY							
12...	--	--	--	--	--	--	--
12...	.150	2.6	2.7	.240	42	--	--
12...	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	.00
13...	.110	2.2	2.3	.200	34	--	--
13...	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--

DATE	TIME	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)
OCT							
11...	1110	0	200	<1	0	0	110
NOV							
28...	1100	1	100	[illegible]	0	0	1200
JAN							
22...	1530	1	100	2	0	1	280
MAR							
27...	1456	1	60	1	0	4	560
MAY							
12...	2200	1	90	<1	0	27	190
13...	0200	1	60	<1	0	5	360

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, DIS-SOLVED (UG/L AS ZN)
OCT						
11...	0	1200	.0	0	0	3
NOV						
28...	0	650	.0	0	0	<3
JAN						
22...	1	160	.1	1	0	10
MAR						
27...	2	190	.3	0	0	20
MAY						
12...	5	7	.0	1	0	140
13...	3	6	.0	0	0	8

DATE	TIME	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (PCI/L AS U-NAT)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L)
OCT											
11...	1110	<2.0	<.3	<2.9	<.5	5.0	<.5	5.2	<.5	.65	.21
NOV											
28...	1100	<1.9	1.6	<2.8	2.4	7.3	2.7	6.9	2.8	.03	.19

DATE	TIME	PCB TOTAL (UG/L)	NAPH-THA-LENES, POLY-CHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR-DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI-AZINON, TOTAL (UG/L)
OCT									
11...	1110	.00	--	.00	.0	.00	.00	.00	.00
NOV									
28...	1100	.00	--	.00	.0	.00	.00	.00	.00
JAN									
22...	1530	.00	.0	.00	.0	.00	.00	.00	.00
MAR									
27...	1456	--	--	.00	--	--	.00	--	.00
MAY									
13...	0015	.00	.0	.00	.0	.00	.00	.00	.00

DATE	DI-ELDRIN TOTAL (UG/L)	ENDO-SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA-CHLOR, TOTAL (UG/L)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA-THION, TOTAL (UG/L)	METH-OXY-CHLOR, TOTAL (UG/L)
OCT									
11...	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV									
28...	.00	.00	.00	.00	.00	.00	.00	.00	.00
JAN									
22...	.00	.00	.00	.00	.00	.00	.01	.00	.00
MAR									
27...	--	--	--	.00	.00	--	--	.00	--
MAY									
13...	.00	.00	.00	.00	.00	.00	.00	.00	.00

DATE	METHYL PARA-THION, TOTAL (UG/L)	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
OCT									
11...	.00	.00	.00	.00	0	.00	.00	.00	.00
NOV									
28...	.00	.00	.00	.00	0	.00	.00	.00	.00
JAN									
22...	.00	.00	.00	.00	0	.00	.01	.01	.00
MAR									
27...	.00	.00	.00	.00	--	.00	.01	.00	.00
MAY									
13...	.00	.00	.00	.00	0	.00	.08	.02	<.01

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE, WATER (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
OCT							
11...	1110	.30	16.0	10	.01	--	--
NOV							
28...	1100	1.3	11.0	25	.09	--	--
JAN							
09...	1110	.69	8.5	22	.04	--	--
23...	1210	29	9.5	258	20	--	--
MAR							
27...	--	216	--	841	490	--	--
27...	1510	178	15.0	1280	615	63	65
28...	--	488	--	1270	1670	--	--
28...	1130	265	15.5	1240	887	--	--
MAY							
12...	--	8.3	--	373	8.4	--	--
12...	2200	27	--	2100	153	41	42
13...	--	205	--	1050	581	--	--
13...	0015	43	--	851	99	61	73
13...	0300	54	--	754	110	--	--
14...	--	1000	--	614	1660	--	--
14...	1400	1000	21.5	438	1180	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
OCT							
11...	--	--	--	--	--	--	--
NOV							
28...	--	--	--	--	--	--	--
JAN							
09...	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--
MAR							
27...	--	--	--	--	--	--	--
27...	69	75	81	85	90	95	99
28...	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--
MAY							
12...	--	--	--	--	--	--	--
12...	43	52	65	95	96	98	99
13...	--	--	--	--	--	--	--
13...	76	83	85	87	92	97	99
13...	--	--	--	74	78	83	85
14...	--	--	--	--	--	--	--
14...	--	--	--	67	74	86	99

COLORADO RIVER BASIN

08159170 BIG SANDY CREEK NEAR ELGIN, TX--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Chemical, biochemical, and pesticide analyses: May 1979 to September 1981 (discontinued). Radiochemical analyses: May to September 1979.

WATER QUALITY DATA, WATER YEAR OCTOBER 1980 TO SEPTEMBER 1981

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (UNITS)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO
MAY										
24...	1200	28	--	--	--	--	--	--	--	--
24...	1300	32	--	--	--	--	--	--	--	--
24...	1330	32	--	--	--	--	--	--	--	--
24...	1430	32	--	--	--	--	--	--	--	--
24...	1445	28	330	8.0	84	28	24	5.9	25	1.2
24...	1600	34	--	--	--	--	--	--	--	--
24...	1700	32	--	--	--	--	--	--	--	--

DATE	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY FIELD (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)
MAY							
24...	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--
24...	2.7	56	16	47	.3	18	173
24...	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--

COLORADO RIVER BASIN

08159180 DOGWOOD CREEK NEAR MCDADE, TX

LOCATION.--Lat 30°14'29", long 97°17'03", Bastrop County, Hydrologic Unit 12090301, at upstream side of culvert on unnamed gravel road in Camp Swift, 4 mi (6 km) southwest of McDade, and 9 mi (6 km) north of Bastrop.

DRAINAGE AREA.--0.53 mi² (1.37 km²).

PERIOD OF RECORD.--Chemical, biochemical, pesticide, and sediment analyses: January to September 1980.

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH FIELD (UNITS)	TEMPER-ATURE, WATER (DEG C)	COLOR (PLAT-INUM COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIOCHEM UNINHIB 5 DAY (MG/L)
JAN										
22...	0715	13	59	7.2	--	400	75	--	--	5.6
22...	0738	15	59	7.2	--	200	260	--	--	4.6
22...	1500	1.5	75	7.7	11.5	200	32	9.7	89	1.9
MAR										
27...	1000	18	--	--	--	200	370	--	--	5.0
27...	1022	28	45	--	--	250	400	--	--	4.6
27...	1600	12	--	--	15.0	--	--	--	--	--
27...	1806	4.9	--	--	15.0	--	--	--	--	--
27...	1810	4.4	61	7.4	15.0	200	130	10.2	98	3.8
MAY										
13...	1530	9.9	58	--	--	200	230	--	--	--
13...	1545	27	37	--	--	160	320	--	--	4.5
13...	1600	54	37	7.1	--	--	--	--	--	--
13...	1615	51	39	--	--	--	--	--	--	4.2
13...	1630	44	43	--	--	100	90	--	--	3.9
14...	1214	1.5	--	--	--	--	--	--	--	--

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)
JAN										
22...	--	--	--	20	0	5.3	1.6	4.8	.5	5.0
22...	--	--	--	17	0	4.6	1.3	4.1	.4	4.9
22...	--	--	--	31	0	8.5	2.3	3.1	.2	3.9
MAR										
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	4500	2600	17000	--	--	--	--	--	--	--
MAY										
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	14	0	3.9	1.1	2.5	.3	3.2
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--

DATE	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)
JAN										
22...	26	0	14	2.3	.2	13	60	.12	.010	.13
22...	26	0	2.1	2.2	.2	9.1	42	.11	.010	.12
22...	38	0	6.0	4.3	.1	8.5	56	.02	.010	.03
MAR										
27...	--	--	--	2.2	--	--	--	.14	.010	.15
27...	--	--	--	2.5	--	--	--	.15	.010	.16
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	2.5	--	--	--	.05	.010	.06
MAY										
13...	--	--	--	--	--	--	--	.07	.010	.08
13...	--	--	--	--	--	--	--	.09	.010	.10
13...	20	0	2.9	2.5	.0	5.8	32	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	.04	.010	.05
14...	--	--	--	--	--	--	--	--	--	--

COLORADO RIVER BASIN

08159180 DOGWOOD CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
JAN							
22...	.040	.87	.91	.070	19	2	.50
22...	.020	.73	.75	.060	19	1	--
22...	.000	.45	.45	.040	15	0	.00
MAR							
27...	.060	1.5	1.6	.090	16	--	.00
27...	.060	1.6	1.7	.070	15	0	.00
27...	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--
27...	.060	2.5	2.6	.070	16	4	.00
MAY							
13...	.070	1.3	1.4	.090	27	--	--
13...	.060	1.6	1.7	.090	31	--	--
13...	--	--	--	--	--	--	--
13...	--	--	--	--	--	7	--
13...	.070	1.3	1.4	.060	26	--	--
14...	--	--	--	--	--	--	--

DATE	TIME	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)
JAN							
22...	0715	1	50	<1	0	5	830
22...	0738	3	50	<1	0	3	300
22...	1500	0	60	<1	0	2	200
MAY							
13...	1600	2	40	<1	0	35	240

DATE	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JAN						
22...	0	20	.1	0	0	10
22...	0	5	2.3	0	0	9
22...	0	5	.1	0	0	7
MAY						
13...	5	8	.0	0	0	70

DATE	TIME	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)
JAN									
22...	1500	.00	.0	.00	.0	.00	.00	.00	.00
MAR									
27...	1000	.00	.0	.00	.0	.00	.00	.00	.00

DATE	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)
JAN									
22...	.00	.00	.00	.00	.00	.00	.00	.00	.00
MAR									
27...	.00	.00	.00	.00	.00	.00	.00	.00	.00

COLORADO RIVER BASIN

08159180 DOGWOOD CREEK NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	METHYL PARA-THION, TOTAL (UG/L)	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JAN									
22...	.00	.00	.00	.00	0	.00	.00	.00	.00
MAR									
27...	.00	.00	.00	.00	0	.00	.00	.00	.00

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE, WATER (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
JAN							
22...	0715	13	--	594	21	92	95
22...	1500	1.5	11.5	256	1.0	--	--
MAR							
27...	1000	18	--	661	32	82	89
27...	1022	28	--	404	31	--	--
27...	1600	12	15.0	161	5.2	--	--
27...	1806	4.9	15.0	109	1.4	--	--
MAY							
13...	1530	9.9	--	114	3.0	--	--
13...	1545	27	--	701	51	--	--
13...	1630	44	--	63	7.5	--	--
14...	1214	1.5	--	54	.22	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
JAN							
22...	96	98	99	99	99	99	100
22...	--	--	--	99	99	99	100
MAR							
27...	90	96	97	99	100	--	--
27...	--	--	--	98	99	99	100
27...	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--
MAY							
13...	--	--	--	89	95	99	100
13...	--	--	--	93	98	99	100
13...	--	--	--	98	98	99	100
14...	--	--	--	--	--	--	--

COLORADO RIVER BASIN

08159185 DOGWOOD CREEK AT HIGHWAY 95 NEAR MCDADE, TX

LOCATION.--Lat 30°13'49", long 97°19'03", Bastrop County, Hydrologic Unit 12090301, on right upstream end of bridge on State Highway 95, 5.7 mi (9.2 km) southwest of McDade, and 7.5 mi (12.1 km) south of Elgin.

DRAINAGE AREA.--5.03 mi² (13.03 km²).

PERIOD OF RECORD.--Chemical, biochemical, pesticide, and sediment analyses: March to September 1980.

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH FIELD (UNITS)	TEMPER-ATURE, WATER (DEG C)	COLOR (PLAT-INUM COBALT UNITS)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	OXYGEN DEMAND, BIOCHEM UNINHIB 5 DAY (MG/L)
MAR 27...	1543	48	72	6.9	15.0	200	130	11.3	109	4.1
MAY 15...	1220	21	222	7.5	20.5	300	3.6	--	--	2.6

DATE	COLI-FORM, TOTAL, IMMED. (COLS. PER 100 ML)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM AD-SORP-TION RATIO
MAR 27...	29000	4300	37000	27	6	7.2	2.3	4.0	.3
MAY 15...	46000	760	8000	72	54	18	6.5	13	.7

DATE	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)
MAR 27...	4.1	25	0	14	4.1	.1	9.6	58	.29
MAY 15...	5.5	22	0	62	13	.2	13	143	.06

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	PHENOLS (UG/L)	METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L)
MAR 27...	.010	.30	.070	1.5	--	.090	16	0	.00
MAY 15...	.010	.07	.040	1.3	1.3	.060	15	5	.00

DATE	TIME	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)
MAR 27...	1543	1	40	<1	0	2	310
MAY 15...	1220	1	90	<1	0	2	380

DATE	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, DIS-SOLVED (UG/L AS ZN)
MAR 27...	2	20	.0	0	0	7
MAY 15...	1	50	.0	0	0	8

COLORADO RIVER BASIN

08159185 DOGWOOD CREEK AT HIGHWAY 95 NEAR MCDADE, TX--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	ALDRIN, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DI-AZINON, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA-CHLOR, TOTAL (UG/L)	MALA-THION, TOTAL (UG/L)	METHYL PARA-THION, TOTAL (UG/L)
MAR								
27...	1543	.00	.00	.00	.00	.00	.00	.00

DATE	METHYL TRI-THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	PARA-THION, TOTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
MAR							
27...	.00	.00	.00	.00	.01	.00	.00

10.0 SUPPLEMENTAL DATA

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1980 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
OCT					
15	0.05	0.30	0.11	0.00	0.02
16	0.01	0.00	0.00	0.02	0.00
17	0.00	0.00	0.00	0.00	0.01
22	0.07	0.10	0.00	0.00	0.00
30	2.59	1.50	1.43	1.33	2.06
31	0.00	0.01	0.01	0.00	0.00
MTOT	2.72	1.91	1.55	1.35	2.09
NOV					
10	0.00	0.00	0.05	0.00	0.00
11	0.00	0.02	0.00	0.03	0.03
18	0.04	0.00	0.02	0.00	0.00
19	0.01	0.07	0.00	0.02	0.06
20	0.00	0.00	0.00	0.05	0.00
21	0.59	0.00	0.36	0.01	0.00
22	0.00	0.57	0.00	0.60	0.67
23	0.00	0.01	0.00	0.03	0.00
24	0.17	0.00	0.14	0.01	0.00
25	0.00	0.16	0.00	0.15	0.22
MTOT	0.81	0.83	0.57	0.90	0.98
DEC					
11	0.01	0.00	0.01	0.01	0.03
12	2.10	0.93	0.83	1.02	0.82
13	0.16	0.18	0.17	0.17	0.14
14	0.01	0.00	0.00	0.01	0.01
15	0.03	0.02	0.04	0.03	0.03
21	0.04	0.04	0.04	0.03	0.03
22	0.00	0.00	0.01	0.01	0.01
23	0.50	0.68	0.51	0.65	0.42
24	0.00	0.00	0.00	0.01	0.00
28	1.66	1.57	1.49	1.25	1.72
29	0.01	0.02	0.01	0.04	0.01
MTOT	4.52	3.44	3.11	3.23	3.22
CTOT	****	****	****	****	****
JAN					
2	0.00	0.00	0.02	0.04	0.09
4	0.00	0.00	0.00	0.00	0.01
10	0.03	0.03	0.04	0.03	0.03
11	0.01	0.01	0.00	0.01	0.00
15	0.09	0.05	0.00	0.02	0.20
16	0.10	0.00	0.00	0.09	0.09
17	0.19	0.17	0.05	0.08	0.15
20	2.62	1.30	1.19	1.17	1.75
21	1.24	0.26	0.24	0.28	0.32
22	0.04	0.87	0.65	0.80	0.91
28	0.00	0.00	0.01	0.03	0.01
29	0.11	0.05	0.05	0.02	0.09
30	0.05	0.02	0.02	0.01	0.03
MTOT	4.48	2.76	2.27	2.58	3.68

MTOT = Monthly totals
CTOT = Calendar year totals
**** = Incomplete calendar year totals

10.0 SUPPLEMENTAL DATA--Continued

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1980 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
FEB					
2	0.11	0.10	0.11	0.11	0.11
4	0.01	0.00	0.00	0.00	0.01
7	0.25	0.18	0.19	0.18	0.25
8	0.45	0.34	0.21	0.22	0.50
9	1.22	0.23	0.12	0.13	0.21
10	0.00	0.00	0.00	0.00	0.01
15	0.10	0.08	0.02	0.03	0.05
16	0.60	0.60	0.66	0.64	0.59
17	0.03	0.04	0.01	0.02	0.02
18	0.01	0.01	0.01	0.01	0.01
19	0.00	0.00	0.00	0.00	0.01
28	0.01	0.01	0.00	0.00	0.00
29	0.49	0.51	0.92	0.64	0.42
MTOT	3.28	2.10	2.25	1.98	2.19
MAR					
1	0.00	0.00	0.01	0.00	0.00
12	0.22	0.35	0.09	0.10	0.40
15	0.00	0.00	0.01	0.01	0.00
16	0.13	0.08	0.05	0.06	0.07
17	0.01	0.00	0.00	0.00	0.03
18	0.00	0.01	0.00	0.00	0.00
19	0.05	0.04	0.02	0.04	0.04
20	0.05	0.04	0.02	0.04	0.05
22	0.00	0.00	0.01	0.00	0.00
23	0.05	0.05	0.04	0.06	0.04
25	1.20	0.19	0.24	0.19	0.20
26	0.03	0.02	0.00	0.01	0.01
27	2.53	2.32	3.56	2.87	2.61
28	0.02	0.01	0.00	0.00	0.00
29	0.09	0.03	0.00	0.00	0.00
MTOT	4.38	3.14	4.05	3.38	3.45
APR					
1	0.00	0.01	0.00	0.00	0.01
2	0.00	0.00	0.00	0.01	0.00
3	0.00	0.00	0.03	0.00	0.01
7	0.00	0.00	0.28	0.00	0.00
11	0.19	0.00	0.00	0.00	0.10
12	0.10	0.04	0.09	0.10	0.09
13	0.48	0.66	0.65	0.60	0.38
25	1.41	1.42	1.56	1.42	1.43
MTOT	2.18	2.13	2.61	2.13	2.02

MTOT = Monthly totals
CTOT = Calendar year totals

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY PERIOD: 1980 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
MAY					
1	0.40	0.28	0.85	0.78	0.74
3	0.07	0.04	0.00	0.01	0.04
7	0.60	0.47	0.58	0.45	0.58
8	0.87	0.92	0.62	0.54	0.77
10	0.01	0.00	0.00	0.00	0.00
12	0.91	0.96	0.59	1.00	0.80
13	3.20	3.32	2.51	2.51	3.17
14	1.93	0.43	*0.07	0.07	0.15
15	0.60	0.35	*0.75	0.75	1.17
16	0.25	0.23	*0.20	0.20	0.24
17	0.01	0.03	*0.02	0.02	0.02
18	0.14	0.16	*0.14	0.14	0.09
19	0.07	0.12	*0.06	0.06	0.10
21	0.06	0.06	*0.02	0.02	0.06
28	0.00	0.01	*0.00	0.00	0.00
MTOT	9.12	7.38	*6.41	6.55	7.93
JUNE					
9	0.27	0.09	*0.27	0.27	0.15
21	0.25	0.30	*0.37	0.37	0.27
MTOT	0.52	0.39	*0.64	0.64	0.42
JULY					
26	0.15	0.02	0.00	0.00	0.00
28	0.03	0.18	0.36	0.07	0.67
MTOT	0.18	0.20	0.36	0.07	0.67
AUG					
5	0.00	0.00	0.04	0.00	0.00
6	0.14	*0.14	0.03	0.00	0.03
7	0.00	*0.00	0.35	0.02	0.17
9	0.00	*0.00	0.00	0.00	0.11
10	0.23	*0.23	0.13	0.16	0.23
11	0.00	*0.00	0.02	0.00	0.00
16	0.00	*0.00	0.00	0.06	0.11
17	0.06	*0.06	0.84	0.02	0.05
26	0.10	*0.10	0.00	0.00	0.00
28	0.00	*0.00	0.03	0.00	0.00
29	0.03	*0.03	0.00	0.00	0.00
MTOT	0.56	*0.56	1.44	0.26	0.70

MTOT = Monthly totals
CTOT = Calendar year totals
* = Estimated

10.0 SUPPLEMENTAL DATA--Continued

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1980 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
SEPT					
1	0.41	*0.41	0.00	0.00	0.00
2	0.22	*0.22	0.92	0.18	0.07
3	0.00	*0.00	0.01	0.00	0.00
6	0.78	*0.78	0.77	0.71	0.57
7	0.56	*0.56	0.68	0.88	0.42
8	0.04	*0.04	0.03	0.10	0.00
10	0.00	0.00	0.00	0.00	0.11
19	0.00	0.00	0.06	0.00	0.00
20	0.02	0.00	0.00	0.00	0.00
24	0.24	0.35	0.35	0.31	0.02
25	0.00	0.04	0.10	0.10	0.02
26	0.13	0.13	0.15	0.13	0.15
27	0.07	0.03	0.05	0.03	0.01
28	0.03	0.33	0.05	0.10	0.02
29	0.09	0.07	0.00	0.08	0.06
30	0.61	0.57	0.15	0.12	0.50
MTOT	3.20	*3.53	3.32	2.74	1.95
WTOT	35.95	*28.37	*28.58	25.81	29.30

MTOT = Monthly totals
CTOT = Calendar year totals
WTOT = Water year totals
* = Estimated

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1981 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
OCT					
14	0.00	0.00	0.00	0.09	0.00
16	0.26	0.04	0.02	0.02	0.30
17	0.00	0.01	0.05	0.00	0.01
18	1.41	1.48	1.67	1.50	1.42
19	0.01	0.00	0.00	0.00	0.01
23	0.00	0.00	0.00	0.33	0.00
24	0.30	0.32	0.42	0.00	0.56
26	0.00	0.00	0.00	0.01	0.00
27	0.05	0.03	0.02	0.07	0.06
28	0.04	0.05	0.02	0.07	0.04
29	0.00	0.00	0.01	0.00	0.00
MTOT	2.07	1.93	2.21	2.09	2.40
NOV					
14	0.00	0.02	0.01	0.00	0.00
15	0.08	0.09	0.14	0.10	0.18
16	1.34	1.40	1.62	1.45	1.35
17	0.10	0.06	0.02	0.04	*0.05
22	0.09	0.08	0.08	0.11	*0.11
23	0.00	0.00	0.02	0.02	*0.02
25	0.95	0.88	0.90	0.75	*0.75
26	0.26	0.23	0.26	0.19	*0.19
MTOT	2.82	2.76	3.05	2.66	*2.65
DEC					
5	0.38	0.17	0.10	0.20	*0.20
6	0.01	0.00	0.01	0.01	*0.00
8	0.37	0.25	0.25	0.29	*0.29
9	0.25	0.25	0.24	0.20	*0.20
10	0.00	0.00	0.01	*0.00	*0.00
11	0.00	0.00	0.00	*0.01	0.01
12	0.00	0.01	0.00	*0.01	0.01
14	0.00	0.00	0.03	*0.00	0.00
15	0.35	0.38	0.13	*0.21	0.21
MTOT	1.36	1.06	0.77	*0.93	*0.92
CTOT	34.15	27.93	29.37	*26.00	*28.98
JAN					
5	0.00	0.00	0.01	*0.00	0.00
6	0.09	0.08	0.10	*0.10	0.10
8	0.20	0.20	0.14	*0.22	0.22
9	0.01	0.01	0.01	*0.01	0.01
11	0.01	0.00	0.00	*0.00	0.00
19	0.38	1.61	1.51	*1.67	1.67
20	0.00	0.01	0.01	*0.02	0.02
31	0.01	0.00	0.00	*0.00	0.03
MTOT	0.70	1.91	1.78	*2.02	2.05

MTOT = Monthly totals
CTOT = Calendar year totals
* = Estimated

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1981 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
FEB					
1	0.12	0.06	0.13	* 0.04	0.05
2	0.00	0.00	0.00	* 0.01	0.01
4	0.40	0.38	0.39	* 0.37	0.37
5	0.54	0.52	0.38	* 0.51	0.51
7	0.00	0.02	0.00	* 0.00	0.00
9	0.05	0.03	0.03	* 0.03	0.03
10	0.00	0.00	0.04	* 0.00	0.00
21	0.00	0.00	0.08	* 0.00	0.00
26	0.01	0.00	0.00	* 0.00	0.01
27	0.02	0.00	0.02	0.00	0.01
28	0.00	0.00	0.00	0.02	0.00
MTOT	1.14	1.01	1.07	*0.98	0.99
MAR					
1	1.03	0.96	0.49	0.43	0.64
2	0.00	0.00	0.00	0.00	0.70
3	0.51	0.44	1.21	1.62	0.00
4	0.22	0.15	0.12	0.16	0.16
7	0.05	0.05	0.02	0.18	0.02
11	0.07	0.09	*0.09	0.06	0.06
12	0.35	0.31	*0.31	0.22	0.31
13	0.01	0.00	*0.00	0.01	0.01
25	0.03	0.00	*0.00	0.14	0.00
26	0.00	0.00	*0.00	0.01	0.00
28	0.01	0.00	*0.00	0.01	0.02
29	2.04	1.63	*1.63	1.36	1.98
MTOT	4.32	3.63	*3.87	4.20	3.90
APR					
3	0.07	0.00	*0.00	0.00	0.00
4	0.00	0.08	*0.08	0.08	0.09
9	0.00	0.00	0.01	0.00	0.00
15	0.00	0.03	0.20	0.16	0.09
16	0.00	0.02	0.03	0.03	0.01
17	0.00	0.00	0.00	0.07	0.08
18	0.12	0.04	0.03	0.00	0.11
22	0.01	0.00	0.00	0.00	0.00
23	0.62	0.65	0.42	0.62	0.60
25	0.18	0.20	0.03	0.10	0.17
26	0.00	0.02	0.00	0.00	0.00
28	0.00	0.05	0.00	0.00	0.00
MTOT	1.00	1.09	*0.80	1.06	1.15
MAY					
1	0.93	1.21	0.12	0.09	0.40
2	0.00	0.03	0.02	0.00	0.00
3	0.60	0.45	0.45	0.64	0.64
4	0.03	0.02	0.02	0.01	0.03
9	0.18	0.07	0.08	0.20	0.19
13	0.00	0.00	0.14	0.00	0.00
14	0.05	0.07	0.18	0.23	0.19
15	0.00	0.01	0.06	0.03	0.15
16	1.03	1.09	1.33	1.06	1.11
23	0.00	0.00	0.01	0.00	0.00
24	1.73	2.49	2.58	2.82	2.49
25	0.00	0.83	0.44	0.41	0.44
29	0.60	0.72	0.76	0.82	0.74
30	0.41	0.15	1.61	0.30	0.34
31	0.00	0.00	0.00	0.00	0.01
MTOT	5.56	7.14	7.80	6.61	6.73

MTOT = Monthly totals
CTOT = Calendar year totals
* = Estimated

10.0 SUPPLEMENTAL DATA--Continued

10.4 Daily and Monthly Rainfall Values for Five Recording Rainfall Gages, 1980 and 1981 Water Years--Continued

DAILY AND MONTHLY RAINFALL SUMMARY — PERIOD: 1981 WATER YEAR

DATE	GAGE NUMBER				
	BS-1	BS-2	BS-3	BS-4	BS-5
JUNE					
1	1.43	1.56	1.71	0.07	1.13
2	0.16	0.15	0.05	0.05	0.14
3	0.25	0.28	0.10	0.11	0.16
4	0.89	1.21	0.41	0.46	0.49
5	0.44	0.20	0.66	0.36	0.32
7	0.12	0.09	0.00	0.00	0.00
11	5.87	5.12	3.17	4.76	8.33
12	0.97	0.59	0.34	0.51	0.46
13	1.71	1.49	1.63	2.34	2.96
14	0.25	0.21	0.44	0.23	0.26
15	0.00	0.00	0.02	0.02	0.02
16	1.76	1.82	2.16	1.65	1.30
17	0.00	0.00	0.01	0.00	0.00
24	1.00	0.20	0.63	0.37	0.00
25	0.14	0.01	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.03
27	0.43	0.03	0.00	0.00	0.00
28	0.02	0.36	0.00	0.00	0.00
29	0.06	0.06	0.00	0.00	0.00
30	0.50	0.75	0.03	0.13	0.45
MTOT	16.00	14.13	11.36	11.06	16.05
JULY					
1	0.06	0.04	0.48	0.00	0.00
5	0.88	1.11	1.35	1.67	1.16
6	0.00	0.01	0.02	0.00	0.00
7	0.01	0.00	0.00	0.00	0.03
13	0.00	0.00	0.00	0.00	0.02
25	0.00	0.00	0.46	0.64	0.18
26	0.22	0.25	0.00	0.00	0.01
27	0.02	0.27	0.32	0.16	0.16
MTOT	1.19	1.68	2.63	2.47	1.56
AUG					
4	*0.00	0.00	0.00	0.00	0.10
17	*0.41	0.41	0.00	0.00	0.01
18	*0.06	0.06	0.36	0.15	0.00
19	*0.00	0.00	0.01	0.00	0.00
24	*0.00	0.00	0.02	0.01	0.13
25	*0.11	0.11	0.24	0.33	0.48
26	*0.00	0.00	0.02	0.00	0.01
28	*0.50	0.50	0.00	0.00	0.01
29	*0.02	0.02	0.03	0.03	0.15
30	*0.36	0.36	0.61	0.46	0.35
31	*0.73	0.73	0.41	0.66	1.71
MTOT	*2.19	2.19	1.70	1.64	2.95
SEPT					
1	*0.18	0.18	1.26	0.41	0.05
2	*0.03	0.03	0.17	0.31	0.06
3	*0.24	0.24	0.22	0.61	0.06
4	*0.00	0.00	0.01	0.01	0.01
14	*0.91	0.91	0.61	0.34	0.41
15	*0.40	0.40	0.04	0.04	0.31
MTOT	*1.76	1.76	2.31	1.72	0.90
WTOT	*40.11	40.29	*39.35	*37.44	*42.25

MTOT = Monthly totals
CTOT = Calendar year totals
WTCT = Water year totals
* = Estimated

10.0 SUPPLEMENTAL DATA

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years

STORM OF MARCH 27, 1980

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
	1980 water year				
Station 08159165, Big Sandy Creek near McDade, Texas					
	3-BS	4-BS			
March 27					
0000	0.0	0.0	0.0	2.2	0.0001
0215	.01	.01	.01	2.2	.0002
0300	.05	.09	.07	2.2	.0004
0615	.07	.13	.10	2.2	.0006
0745	.42	.28	.36	2.7	.0007
0800	.71	.38	.57	2.6	.0007
0815	.92	.63	.80	2.7	.0008
0830	1.22	.82	1.05	2.7	.0008
0845	1.46	1.04	1.28	3.3	.0008
0900	1.69	1.17	1.47	3.8	.0009
0915	1.84	1.32	1.62	4.3	.0010
1030	1.96	1.49	1.76	15.0	.0016
1115	2.72	1.75	2.30	31.0	.0025
1200	2.92	2.09	2.56	57.0	.0045
1300	2.98	2.26	2.67	105.0	.0077
1330	3.38	2.30	2.92	152.0	.0115
1415	3.55	2.81	3.23	229.0	.0218
1545	3.55	2.84	3.24	370.0	.0385
1630	3.55	2.84	3.24	483.0	.0554
1730	3.55	2.84	3.24	557.0	.0785
1830	3.55	2.84	3.24	681.0	.1023
1915	3.55	2.84	3.24	812.0	.1349
2030	3.55	2.84	3.24	968.0	.1785
2130	3.55	2.84	3.24	989.0	.2181
2230	3.56	2.87	3.26	952.0	.2657
2400	3.56	2.87	3.26	827.0	.3030
March 28					
0000	3.56	2.87	3.26	827.0	.3030
0130	3.56	2.87	3.26	672.0	.3557
0300	3.56	2.87	3.26	496.0	.3855
0430	3.56	2.87	3.26	343.0	.4130
0700	3.56	2.87	3.26	178.0	.4362
1100	3.56	2.87	3.26	102.0	.4525

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MARCH 27, 1980--Continued

Date and time	Gage number 3-BS	Gage number 4-BS	Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1980 water year		
Station 08159165, Big Sandy Creek near McDade, Texas--Continued					
March 28--Continued					
1500	3.56	2.87	3.26	64.0	0.4628
1900	3.56	2.87	3.26	44.0	.4707
2400	3.56	2.87	3.26	31.0	.4763
March 29					
0000	3.56	2.87	3.26	31.0	.4763
0800	3.56	2.87	3.26	21.0	.4855
1600	3.56	2.87	3.26	17.0	.4909
2400	3.56	2.87	3.26	13.0	.4930

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MARCH 27, 1980--Continued

Date and time	Gage number			Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1980 water year			
Station 08159170, Big Sandy Creek near Elgin, Texas						
	3-BS	4-BS	5-BS			
March 27						
0000	0.0	0.0	0.0	0.0	1.2	0.0000
0130	.0	.0	.01	.00	1.2	.0001
0230	.03	.05	.23	.09	1.3	.0001
0330	.06	.12	.30	.15	1.3	.0001
0615	.07	.13	.30	.15	1.4	.0002
0700	.19	.17	.32	.22	1.4	.0002
0745	.42	.28	.49	.38	1.8	.0003
0800	.71	.38	.90	.63	2.1	.0003
0815	.92	.63	1.19	.88	2.3	.0003
0830	1.22	.82	1.35	1.10	2.9	.0003
0845	1.46	1.04	1.62	1.34	3.0	.0003
0915	1.84	1.32	1.85	1.64	3.5	.0004
1000	1.85	1.41	1.87	1.69	7.3	.0005
1045	1.99	1.65	1.95	1.85	11.0	.0007
1115	2.72	1.75	2.09	2.19	13.0	.0008
1145	2.84	2.04	2.21	2.37	15.0	.0011
1230	2.95	2.26	2.31	2.52	21.0	.0014
1315	3.13	2.26	2.31	2.59	51.0	.0022
1345	3.51	2.47	2.48	2.85	84.0	.0035
1430	3.55	2.84	2.60	3.03	135.0	.0088
1700	3.55	2.84	2.60	3.03	278.0	.0240
1900	3.55	2.84	2.60	3.03	415.0	.0442
2100	3.55	2.84	2.60	3.03	652.0	.0679
2200	3.56	2.84	2.61	3.04	828.0	.0880
2300	3.56	2.87	2.61	3.05	1010.0	.1126
2400	3.56	2.87	2.61	3.05	1160.0	.1372
March 28						
0000	3.56	2.87	2.61	3.05	1160.0	.1372
0130	3.56	2.87	2.61	3.05	1320.0	.1799
0200	3.56	2.87	2.61	3.05	1340.0	.2043
0300	3.56	2.87	2.61	3.05	1330.0	.2527
0500	3.56	2.87	2.61	3.05	1140.0	.3081
0700	3.56	2.87	2.61	3.05	843.0	.3490

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MARCH 27, 1980--Continued

Date and time	Gage number			Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
				1980 water year		
Station 08159170, Big Sandy Creek near Elgin, Texas--Continued						
	3-BS	4-BS	5-BS			
March 28--Continued						
0900	3.56	2.87	2.61	3.05	556.0	0.3761
1100	3.56	2.87	2.61	3.05	278.0	.3929
1400	3.56	2.87	2.61	3.05	117.0	.4015
1700	3.56	2.87	2.61	3.05	72.0	.4071
2030	3.56	2.87	2.61	3.05	48.0	.4112
2400	3.56	2.87	2.61	3.05	36.0	.4136
March 29						
0000	3.56	2.87	2.61	3.05	36.0	.4136
0400	3.56	2.87	2.61	3.05	28.0	.4186
1200	3.56	2.87	2.61	3.05	20.0	.4234
2400	3.56	2.87	2.61	3.05	14.0	.4255

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980

Date and time	Gage number	Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
	1980 water year			
Station 08159165, Big Sandy Creek near McDade, Texas				
	4-BS			
May 13				
0000	0.0	0.0	70.0	0.0042
0300	.01	.01	60.0	.0138
0800	.02	.02	27.0	.0199
1415	.05	.05	13.0	.0216
1430	.27	.27	12.0	.0217
1445	.76	.76	15.0	.0219
1500	.98	.98	18.0	.0222
1545	1.13	1.13	26.0	.0229
1615	1.34	1.34	59.0	.0243
1700	1.51	1.51	155.0	.0298
1800	1.78	1.78	262.0	.0403
1900	1.89	1.89	400.0	.0563
2000	2.13	2.13	592.0	.0800
2100	2.40	2.40	685.0	.1074
2200	2.50	2.50	722.0	.1508
2400	2.51	2.51	874.0	.1989
May 14				
0000	2.51	2.51	874.0	.1989
0130	2.51	2.51	969.0	.2605
0230	2.51	2.51	984.0	.3098
0400	2.51	2.51	937.0	.3754
0600	2.51	2.51	823.0	.4413
0800	2.51	2.51	706.0	.4979
1000	2.51	2.51	578.0	.5442
1200	2.52	2.52	421.0	.5779
1400	2.52	2.52	266.0	.6045
1700	2.52	2.52	149.0	.6239
2030	2.58	2.58	94.0	.6371
2400	2.58	2.58	62.0	.6464
May 15				
0000	2.58	2.58	62.0	.6464
0800	2.58	2.58	37.0	.6580

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
	1980 water year				
Station 08159170, Big Sandy Creek near Elgin, Texas					
	4-BS	5-BS			
May 13					
0000	0.0	0.0	0.0	44.0	0.0016
0300	.01	.0	.01	54.0	.0101
1300	.04	.04	.04	36.0	.0146
1315	.04	.41	.17	35.0	.0148
1330	.04	1.12	.43	36.0	.0153
1415	.05	1.33	.51	35.0	.0157
1430	.27	1.39	.67	41.0	.0159
1445	.76	1.42	1.00	40.0	.0162
1500	.98	1.44	1.15	40.0	.0168
1600	1.27	1.71	1.43	139.0	.0202
1700	1.51	1.95	1.67	201.0	.0238
1730	1.63	2.17	1.82	235.0	.0260
1745	1.71	2.51	2.00	251.0	.0275
1800	1.78	2.72	2.12	267.0	.0315
1900	1.89	2.81	2.22	347.0	.0400
2000	2.13	3.11	2.48	448.0	.0508
2100	2.40	3.17	2.68	553.0	.0643
2200	2.50	3.17	2.74	686.0	.0809
2300	2.51	3.17	2.75	904.0	.1029
2400	2.51	3.17	2.75	1140.0	.1306
May 14					
0000	2.51	3.17	2.75	1140.0	.1306
0200	2.51	3.18	2.75	1460.0	.2154
0400	2.51	3.18	2.75	1610.0	.2936
0600	2.51	3.18	2.75	1690.0	.3449
0630	2.51	3.18	2.75	1720.0	.3658
0700	2.51	3.18	2.75	1690.0	.4171
0900	2.51	3.18	2.75	1520.0	.4909
1100	2.51	3.18	2.75	1250.0	.5516
1300	2.52	3.19	2.76	1010.0	.6007
1500	2.52	3.19	2.76	819.0	.6405
1700	2.52	3.19	2.76	604.0	.6661
1830	2.58	3.30	2.84	421.0	.6815

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
	1980 water year				
Station 08159170, Big Sandy Creek near Elgin, Texas					
	4-BS	5-BS			
May 14--Continued					
2000	2.58	3.32	2.85	298.0	0.6941
2200	2.58	3.32	2.85	195.0	.7036
2400	2.58	3.32	2.85	139.0	.7095
May 15					
0000	2.58	3.32	2.85	139.0	.7095
0300	2.58	3.32	2.85	93.0	.7245
1100	2.58	3.32	2.85	51.0	.7375

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980--Continued

Date and time	Gage number	Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
		1980 water year		
Station 08159180, Big Sandy Creek near McDade, Texas				
	2-BS			
May 13				
0000	0.0	0.0	0.0	0.0
0415	.01	.01	.0	.0
1400	.03	.03	.5	.0073
1415	.09	.09	1.0	.0080
1430	.59	.59	2.0	.0095
1445	1.44	1.44	4.0	.0124
1500	1.60	1.60	7.8	.0210
1530	1.71	1.71	9.9	.0318
1545	1.84	1.84	27.0	.0516
1600	1.93	1.93	54.0	.1108
1630	2.02	2.02	45.0	.1766
1700	2.16	2.16	32.0	.2350
1745	2.40	2.40	23.0	.2855
1830	2.57	2.57	26.0	.3425
1915	2.81	2.81	31.0	.4105
2000	2.84	2.84	28.0	.4616
2030	3.06	3.06	23.0	.4952
2100	3.22	3.22	21.0	.5259
2130	3.30	3.30	20.0	.5625
2215	3.32	3.32	27.0	.6217
2300	3.32	3.32	23.0	.6805
2400	3.32	3.32	14.0	.7112
May 14				
0000	3.32	3.32	14.0	.7112
0100	3.32	3.32	5.0	.7507
0400	3.32	3.32	3.0	.7990
1200	3.33	3.33	1.0	.8282

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1980 water year		
Station 08159185, Dogwood Creek at Hwy. 95 near McDade, Texas					
	1-BS	2-BS			
May 13					
0000	0.0	0.0	0.0	1.0	0.0007
0415	.0	.01	.00	1.0	.0028
1400	.02	.03	.01	1.0	.0044
1415	.02	.09	.04	1.0	.0044
1430	.16	.59	.29	2.0	.0046
1445	.69	1.44	.91	3.0	.0048
1500	1.18	1.60	1.31	4.0	.0053
1530	1.28	1.71	1.41	10.0	.0068
1600	1.49	1.93	1.62	15.0	.0091
1630	1.55	2.02	1.69	39.0	.0151
1700	1.70	2.16	1.84	94.0	.0369
1800	2.02	2.46	2.15	118.0	.0687
1845	2.23	2.65	2.36	128.0	.0884
1900	2.29	2.75	2.43	130.0	.0984
1915	2.30	2.81	2.45	119.0	.1076
1930	2.32	2.81	2.47	127.0	.1222
2000	2.34	2.84	2.49	109.0	.1474
2100	2.63	3.22	2.81	107.0	.1763
2145	2.78	3.32	2.94	107.0	.1969
2215	2.80	3.32	2.96	107.0	.2339
2400	3.20	3.32	3.24	97.0	.2750
May 14					
0000	3.20	3.32	3.24	97.0	.2750
0200	3.20	3.32	3.24	75.0	.3362
0400	3.20	3.32	3.24	43.0	.3627
0600	3.20	3.33	3.24	26.0	.3767
0730	3.20	3.33	3.24	20.0	.3829
0800	3.33	3.33	3.33	18.0	.3856
0830	3.60	3.33	3.52	16.0	.3906
1000	3.60	3.33	3.52	10.0	.3936
1030	3.73	3.33	3.61	10.0	.3952
1100	4.00	3.33	3.80	10.0	.3967
1130	4.13	3.33	3.89	11.0	.3984

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF MAY 13-14, 1980--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1980 water year		
Station 08159185, Dogwood Creek at Hwy. 95 near McDade, Texas--Continued					
	1-BS	2-BS			
May 14--Continued					
1200	4.40	3.33	4.08	11.0	0.4010
1300	4.40	3.33	4.08	12.0	.4037
1330	4.81	3.33	4.37	12.0	.4102
1630	4.81	3.34	4.37	13.0	.4172
1700	4.99	3.54	4.55	13.0	.4252
2030	5.13	3.75	4.72	14.0	.4349
2130	5.13	3.75	4.72	19.0	.4408
2230	5.13	3.75	4.72	21.0	.4489
2400	5.13	3.75	4.72	18.0	.4572
May 15					
0000	5.13	3.75	4.72	18.0	.4572
0300	5.13	3.75	4.72	14.0	.4743
0600	5.13	3.75	4.72	10.0	.4881
1200	5.13	3.75	4.72	5.0	.4974
1800	5.13	3.75	4.72	2.0	.5011
2400	5.13	3.75	4.72	1.0	.5020

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1981 water year		
Station 08159165, Big Sandy Creek near McDade, Texas					
	3-BS	4-BS			
June 11					
0000	0.0	0.0	0.0	0.9	.0000
0130	.01	.0	.01	.9	.0001
0315	.10	.01	.06	2.6	.0002
0330	.10	.17	.13	8.8	.0003
0345	.18	.73	.42	43.0	.0007
0400	.46	1.30	.82	117.0	.0019
0415	.83	1.71	1.21	246.0	.0043
0430	1.24	2.45	1.76	420.0	.0085
0455	1.72	3.38	2.43	659.0	.0151
0500	2.13	4.01	2.94	974.0	.0298
0530	2.33	4.20	3.13	2420.0	.0782
0600	2.53	4.33	3.30	3790.0	.1541
0630	2.58	4.40	3.36	4370.0	.2197
0645	2.61	4.43	3.39	4410.0	.2639
0700	2.63	4.46	3.42	4370.0	.3732
0800	2.69	4.52	3.48	3860.0	.5278
0900	2.81	4.56	3.56	3680.0	.7304
1045	2.83	4.58	3.58	3060.0	.9142
1200	2.83	4.58	3.58	2440.0	1.0241
1300	2.97	4.58	3.66	2100.0	1.1082
1400	3.06	4.58	3.71	1820.0	1.1993
1530	3.12	4.60	3.76	1420.0	1.2846
1700	3.14	4.61	3.77	1060.0	1.3482
1830	3.14	4.61	3.77	780.0	1.3951
2000	3.17	4.76	3.85	599.0	1.4370
2200	3.17	4.76	3.85	495.0	1.4767
2400	3.17	4.76	3.85	407.0	1.5032
June 12					
0000	3.17	4.76	3.85	407.0	1.5032
0230	3.17	4.76	3.85	299.0	1.5493
0600	3.17	4.81	3.88	180.0	1.5691
0800	3.32	5.08	4.08	185.0	1.5913
1200	3.42	5.17	4.17	143.0	1.6199

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1981 water year		
Station 08159165, Big Sandy Creek near McDade, Texas--Continued					
	3-BS	4-BS			
June 12--Continued					
1800	3.51	5.27	4.27	102.0	1.6444
2400	3.51	5.27	4.27	77.0	1.6560
June 13					
0000	3.51	5.27	4.27	77.0	1.6560
0300	3.51	5.27	4.27	62.0	1.6682
0800	3.52	5.27	4.27	40.0	1.6732
0915	3.61	5.34	4.35	37.0	1.6747
1000	3.64	5.41	4.40	37.0	1.6764
1130	3.79	5.71	4.62	52.0	1.6803
1345	3.88	5.80	4.71	123.0	1.6877
1430	3.96	5.98	4.83	248.0	1.6939
1500	4.13	6.60	5.19	345.0	1.7008
1530	4.36	6.86	5.43	509.0	1.7110
1600	4.50	7.14	5.64	746.0	1.7259
1630	4.55	7.19	5.69	1160.0	1.7491
1700	4.55	7.26	5.72	1580.0	1.7966
1800	4.65	7.33	5.80	1950.0	1.8551
1830	4.74	7.33	5.85	1970.0	1.8946
1900	4.99	7.39	6.02	1940.0	1.9431
1945	5.05	7.60	6.15	1860.0	2.0176
2100	5.10	7.60	6.17	1660.0	2.1090
2230	5.13	7.60	6.19	1460.0	2.1967
2400	5.14	7.61	6.20	1320.0	2.2892
June 14					
0000	5.14	7.61	6.20	1320.0	2.2892
0400	5.20	7.65	6.25	1190.0	2.5326
0800	5.20	7.66	6.26	710.0	2.6321
1100	5.23	7.67	6.28	366.0	2.6688
1300	5.23	7.80	6.34	241.0	2.6929
1600	5.25	7.82	6.36	159.0	2.7056
1700	5.57	7.83	6.54	142.0	2.7284
2400	5.58	7.84	6.55	106.0	2.7475

10.0 SUPPLEMENTAL DATA--Continued

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981--Continued

Date and time	Gage number		Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
			1981 water year		
Station 08159165, Big Sandy Creek near McDade, Texas--Continued					
	3-BS	4-BS			
June 15					
0000	5.58	7.84	6.55	106.0	2.7475
0400	5.58	7.84	6.55	73.0	2.7649
0900	5.58	7.84	6.55	47.0	2.7752
1500	5.60	7.85	6.57	27.0	2.7833
2400	5.60	7.86	6.57	16.0	2.7862

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981--Continued

Date and time	Gage number			Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
				1981 water year		
Station 08159170, Big Sandy Creek near Elgin, Texas						
	3-BS	4-BS	5-BS			
June 11						
0000	0.0	0.0	0.0	0.0	1.2	0.0000
0130	.01	.0	.0	.00	1.2	.0001
0230	.06	.0	.05	.03	1.2	.0001
0245	.08	.01	.17	.08	1.2	.0001
0300	.10	.01	.65	.21	1.2	.0001
0315	.10	.01	1.22	.36	1.2	.0001
0330	.10	.17	1.58	.51	1.2	.0001
0345	.18	.73	2.27	.93	2.0	.0001
0400	.46	1.30	3.62	1.60	2.2	.0001
0415	.83	1.71	4.78	2.19	2.1	.0001
0430	1.24	2.45	5.31	2.76	4.8	.0002
0445	1.72	3.38	6.03	3.47	9.9	.0002
0500	2.13	4.01	6.86	4.07	54.0	.0006
0515	2.27	4.12	7.20	4.25	180.0	.0027
0600	2.53	4.33	7.64	4.54	574.0	.0149
0700	2.63	4.46	7.83	4.68	886.0	.0338
0745	2.67	4.51	7.86	4.72	1200.0	.0556
0830	2.74	4.54	7.89	4.76	2470.0	.0931
0900	2.81	4.56	7.91	4.80	3650.0	.1485
0945	2.82	4.58	7.93	4.82	5060.0	.2407
1030	2.83	4.58	7.94	4.82	5640.0	.3263
1100	2.83	4.58	7.94	4.82	5760.0	.4313
1200	2.83	4.58	7.94	4.82	5590.0	.6179
1345	3.04	4.58	8.06	4.93	4860.0	.8245
1530	3.12	4.60	8.30	5.03	3820.0	.9985
1730	3.14	4.61	8.32	5.05	3010.0	1.1264
1900	3.14	4.66	8.32	5.06	2360.0	1.2267
2100	3.17	4.76	8.33	5.12	1680.0	1.3287
2400	3.17	4.76	8.33	5.12	1060.0	1.3867
June 12						
0000	3.17	4.76	8.33	5.12	1060.0	1.3867
0300	3.17	4.76	8.33	5.12	767.0	1.4665
0630	3.19	4.82	8.39	5.16	524.0	1.4983

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981--Continued

Date and time	Gage number			Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
				1981 water year		
Station 08159170, Big Sandy Creek near Elgin, Texas--Continued						
	3-BS	4-BS	5-BS			
June 12--Continued						
0800	3.32	5.08	8.51	5.34	428.0	1.5269
1200	3.42	5.17	8.66	5.45	348.0	1.5692
1800	3.51	5.27	8.79	5.55	218.0	1.6009
2400	3.51	5.27	8.79	5.55	120.0	1.6126
June 13						
0000	3.51	5.27	8.79	5.55	120.0	1.6126
0400	3.51	5.27	8.84	5.56	89.0	1.6247
0830	3.52	5.27	8.85	5.57	66.0	1.6287
0900	3.57	5.32	8.88	5.62	64.0	1.6295
0930	3.62	5.37	8.95	5.67	62.0	1.6302
1000	3.64	5.41	9.04	5.72	60.0	1.6310
1030	3.69	5.51	9.32	5.85	59.0	1.6317
1100	3.74	5.64	9.57	5.98	58.0	1.6324
1130	3.79	5.71	9.82	6.09	59.0	1.6335
1230	3.86	5.79	9.90	6.16	74.0	1.6357
1400	3.88	5.81	9.95	6.19	97.0	1.6381
1430	3.96	5.98	10.27	6.37	111.0	1.6391
1445	4.03	6.25	10.49	6.55	121.0	1.6398
1500	4.13	6.60	11.05	6.87	133.0	1.6410
1530	4.36	6.86	11.37	7.13	163.0	1.6430
1600	4.50	7.14	11.57	7.34	197.0	1.6466
1700	4.55	7.26	11.61	7.42	281.0	1.6534
1800	4.65	7.33	11.62	7.48	392.0	1.6629
1900	4.99	7.39	11.70	7.65	567.0	1.6767
2000	5.09	7.60	11.74	7.77	935.0	1.6994
2100	5.10	7.60	11.74	7.78	1560.0	1.7373
2200	5.12	7.60	11.74	7.78	2050.0	1.7995
2330	5.14	7.61	11.75	7.80	2390.0	1.8576
2400	5.14	7.61	11.75	7.80	2400.0	1.8867
June 14						
0000	5.14	7.61	11.75	7.80	2400.0	1.8867
0100	5.18	7.65	11.81	7.84	2290.0	2.0125
0400	5.20	7.65	11.84	7.86	1760.0	2.1622

10.5 Incremental Values of Rainfall and Runoff for Selected Storms, 1980 and 1981 Water years--Continued

STORM OF JUNE 11-14, 1981--Continued

Date and time	Gage number			Accumulated weighted precipitation (inches)	Discharge (cubic feet per second)	Accumulated runoff (inches)
				1981 water year		
Station 08159170, Big Sandy Creek near Elgin, Texas--Continued						
	3-BS	4-BS	5-BS			
June 14--Continued						
0800	5.20	7.66	11.84	7.86	1340.0	2.3086
1300	5.23	7.80	11.98	7.96	952.0	2.4069
1630	5.27	7.82	12.01	7.99	616.0	2.4405
1730	5.58	7.83	12.01	8.11	500.0	2.4618
2000	5.58	7.84	12.01	8.11	280.0	2.4839
2400	5.58	7.84	12.01	8.11	143.0	2.4943
June 15						
0000	5.58	7.84	12.01	8.11	143.0	2.4943
0400	5.58	7.84	12.01	8.11	107.0	2.5095
0900	5.58	7.84	12.01	8.11	77.0	2.5207
1600	5.60	7.85	12.03	8.13	45.0	2.5289
2400	5.60	7.86	12.03	8.13	27.0	2.5315

10.0 SUPPLEMENTAL DATA

10.6 Summary of Aquifer Tests at the City of Bastrop Well Field (Formerly Camp Swift Military Reservation Well Field) 1/

Date of test	Pumped well: Well number	Pumped well: On	Pumped well: Off	Observation wells (well number)	Transmissivity (feet squared per day)	Storage coefficient	Time since pumping (hours): Started	Time since pumping (hours): Stopped	Specific capacity after pumping 1.5 hours (gallons per minute per foot)
Nov. 8-9, 1941	2	X	--	1-T	2,900	0.0050	4- 8	--	--
Nov. 10-11, 1941	2-T	X	--	--	--	--	--	--	20
Nov. 14-17, 1941	2-T	--	X	--	7,800	--	--	0.3- 4	--
Do.	2-T	--	X	--	4,900	--	--	4-16	--
Do.	2-T	--	X	--	3,700	--	--	16-58	--
Mar. 31, 1942	4	X	--	--	--	--	--	--	a/ 17
Apr. 23, 1942	3	X	--	3	--	--	--	--	a/ 14
June 10-12, 1942	2	X	--	3	7,100	.0004	1- 3	--	--
Do.	2	X	--	3	3,700	.0005	3-54	--	--
Do.	2	X	--	4	6,300	.0003	1- 6	--	--
Do.	2	X	--	4	3,700	.0004	6-54	--	--
Do.	2	X	--	5	7,800	.0003	2- 5	--	--
Do.	2	X	--	5	3,900	.0003	5-54	--	--
June 10-13, 1942	2	X	--	3, 4	5,200	--	--	--	--
Do.	2	X	--	3, 5	5,200	--	--	--	--
Do.	2	X	--	4, 5	5,200	--	--	--	--

See footnotes at end of table.

10.6 Summary of Aquifer Tests at the City of Bastrop Well Field (Formerly Camp Swift Military Reservation Well Field) 1/--Continued

Date of test	Pumped well: Well number	Pumped well: On	Pumped well: Off	Observation wells (well number)	Transmissivity (feet squared per day)	Storage coefficient	Time since pumping (hours): Started	Time since pumping (hours): Stopped	Specific capacity after pumping 1.5 hours (gallons per minute per foot)
June 14-15, 1942	1	--	X	--	2,300	--	0.1 -12	--	--
Do.	5	--	X	--	11,200	--	.5 - 4	--	--
Do.	5	--	X	--	7,500	--	4 -11	--	--
June 23, 1942	1	X	--	--	--	--	--	--	19
Do.	2	X	--	--	--	--	--	--	9.5
Do.	5	X	--	--	--	--	--	--	21
July 25-27, 1942	5	X	--	4	8,700	.0005	--	--	--
Do.	5	X	--	4	6,200	.0006	--	--	--
Do.	5	X	--	4	3,600	.0010	--	--	--
Do.	5	X	--	2-T	8,000	.0004	--	--	--
Do.	5	X	--	2-T	6,200	.0004	--	--	--
Do.	5	X	--	2-T	11,600	.0005	--	--	--
Do.	5	X	--	4,2-T	7,400	--	--	--	--
July 27-29, 1942	5	--	X	--	12,000	--	.05- 2.5	--	--
Do.	5	--	X	--	8,200	--	2.5 -10	--	--
Do.	5	--	X	--	5,800	--	10 -41	--	--
Do.	5	--	X	--	3,900	.0006	41 -48	--	--
Do.	5	--	X	4	8,000	.0007	2.5 -16	--	--

See footnotes at end of table.

10.6 Summary of Aquifer Tests at the City of Bastrop Well Field (Formerly Camp Swift Military Reservation Well Field) 1/--Continued

Date of test	Pumped well: Well number	Pumped well: On	Pumped well: Off	Observation wells (well number)	Transmissivity (feet squared per day)	Storage coefficient	Time since pumping (hours): Started	Time since pumping (hours): Stopped	Specific capacity after pumping 1.5 hours (gallons per minute per foot)
July 27-29, 1942	5	--	X	4	3,200	0.0012	16 -48	--	--
Do.	5	--	X	2-T	7,800	.0005	2 - 6	--	--
Do.	5	--	X	2-T	5,200	.0005	6 -12	--	--
Do.	5	--	X	2-T	3,200	.0005	12 -48	--	--
Do.	5	--	X	4, 2-T	7,600	--	--	--	--
July 31, 1942-Aug. 1, 1942	1	--	X	--	3,300	--	.5 -19	--	--
Aug. 1, 1942	2-T	--	X	--	4,900	--	.08- 1.5	--	--

1/ From Guyton (1942).
a/ From tests by Layne-Texas Company.

10.7 Source and Significance of Selected Constituents and Properties Commonly Reported in Water Analyses 1/

(mg/L - milligrams per liter)

Constituent or property	Source or cause	Significance
Silica (SiO_2)	Silicon ranks second only to oxygen in abundance in the Earth's crust. Contact of natural waters with silica-bearing rocks and soils usually results in a concentration range of about 1 to 30 mg/L; but concentrations as large as 100 mg/L are common in waters in some areas.	Although silica in some domestic and industrial water supplies may inhibit corrosion of iron pipes by forming protective coatings, it generally is objectionable in industrial supplies, particularly in boiler feedwater, because it may form hard scale in boilers and pipes or deposit in the tubes of heaters and on steam-turbine blades.
Iron (Fe)	Iron is an abundant and widespread constituent of many rocks and soils. Iron concentrations in natural waters are dependent upon several chemical equilibria processes including oxidation and reduction; precipitation and solution of hydroxides, carbonates, and sulfides; complex formation especially with organic material; and the metabolism of plants and animals. Dissolved iron concentrations in oxygenated surface waters seldom are as as much 1 mg/L. Some ground waters, unoxygenated surface waters such as deep waters of stratified lakes and reservoirs, and acidic waters resulting from discharge of industrial wastes or drainage from mines may contain considerably more iron. Corrosion of iron casings, pumps, and pipes may add iron to water pumped from wells.	Iron is an objectionable constituent in water supplies for domestic use because it may adversely affect the taste of water and beverages and stain laundered clothes and plumbing fixtures. According to the National Secondary Drinking Water Regulations proposed by the U.S. Environmental Protection Agency (1977b), the secondary maximum contamination level of iron for public water systems is 300 ug/L. Iron also is undesirable in some industrial water supplies, particularly in waters used in high-pressure boilers and those used for food processing, production of paper an chemicals, and bleaching or dyeing of textiles.
Calcium (Ca)	Calcium is widely distributed in the common minerals of rocks and soils and is the principal cation in many natural freshwaters, especially those that contact deposits or soils originating from limestone, dolomite, gypsum, and gypsiferous shale. Calcium concentrations in freshwaters usually range from zero to several hundred milligrams per liter. Larger concentrations are not uncommon in waters in arid regions, especially in areas where some of the more soluble rock types are present.	Calcium contributes to the total hardness of water. Small concentrations of calcium carbonate combat corrosion of metallic pipes by forming protective coatings. Calcium in domestic water supplies is objectionable because it tends to cause incrustations on cooking utensils and water heaters and increases soap or detergent consumption in waters used for washing, bathing, and laundering. Calcium also is undesirable in some industrial water supplies, particularly in waters used by electroplating, textile, pulp and paper, and brewing industries and in waters used in high-pressure boilers.
Magnesium (Mg)	Magnesium ranks eight among the elements in order of abundance in the Earth's crust and is a common constituent in natural water. Ferromagnesian minerals in igneous rocks and magnesium carbonate in carbonate rocks are two of the more important sources of magnesium in natural waters. Magnesium concentrations in freshwaters usually range from zero to several hundred milligrams per liter; but larger concentrations are not uncommon in waters associated with limestone or dolomite.	Magnesium contributes to the total hardness of water. Large concentrations of magnesium are objectionable in domestic water supplies because they can exert a cathartic and diuretic action upon unacclimated users and increase soap or detergent consumption in waters used for washing, bathing, and laundering. Magnesium also is undesirable in some industrial supplies, particularly in waters used by textile, pulp and paper, and brewing industries and in water used in high-pressure boilers.
Sodium (Na)	Sodium is an abundant and widespread constituent of many soils and rocks and is the principal cation in many natural waters associated with argillaceous sediments, marine shales, and evaporites and in sea water. Sodium salts are very soluble and once in solution tend to stay in solution. Sodium concentrations in natural waters vary from less than 1 mg/L in stream runoff from areas of high rainfall to more than 100,000 mg/L in ground and surface waters associated with halite deposits in arid areas. In addition to natural sources of sodium, sewage, industrial effluents, oilfield brines, and deicing salts may contribute sodium to surface and ground waters.	Sodium in drinking water may impart a salty taste and may be harmful to persons suffering from cardiac, renal, and circulatory diseases and to women with toxemias of pregancy. Sodium is objectionable in boiler feedwaters because it may cause foaming. Large sodium concentrations are toxic to most plants; a large ratio of sodium to total cations in irrigation waters may decrease the permeability of the soil, increase the pH of the soil solution, and impair drainage.

10.7 Source and Significance of Selected Constituents and Properties Commonly Reported in Water Analyses 1/--Continued

Constituent or property	Source or cause	Significance
Potassium (K)	Although potassium is only slightly less common than sodium in igneous rocks and is more abundant in sedimentary rocks, the concentration of potassium in most natural waters is much smaller than the concentration of sodium. Potassium is liberated from silicate minerals with greater difficulty than sodium and is more easily adsorbed by clay minerals and reincorporated into solid weathering products. Potassium concentrations more than 20 mg/L are unusual in natural freshwaters, but much larger concentrations are not uncommon in brines or in water from hot springs.	Large concentrations of potassium in drinking water may impart a salty taste and act as a cathartic, but the range of potassium concentrations in most domestic supplies seldom cause these problems. Potassium is objectionable in boiler feedwaters because it may cause foaming. In irrigation water, potassium and sodium act similarly upon the soil, although potassium generally is considered less harmful than sodium.
Alkalinity	Alkalinity is a measure of the capacity of a water to neutralize a strong acid, usually to pH of 4.5, and is expressed in terms of an equivalent concentration of calcium carbonate ($CaCO_3$). Alkalinity natural waters usually is caused by the presence of bicarbonate and carbonate ions and to a lesser extent by hydroxide and minor acid radicals such as borates, phosphates, and silicates. Carbonates and bicarbonates are common to most natural waters because of the abundance of carbon dioxide and carbonate minerals in nature. Direct contribution to alkalinity in natural waters by hydroxide is rare and usually can be attributed to contamination. The alkalinity of natural waters varies widely but rarely exceeds 400 to 500 mg/L as $CaCO_3$.	High alkaline waters may have a distinctive unpleasant taste. Alkalinity is detrimental in several industrial processes, especially those involving the production of food and carbonated or acid-fruit beverages. The alkalinity of irrigation waters in excess of alkaline earth concentrations may increase the pH of the soil solution, leach organic material, decrease permeability of the soil, and impair plant growth.
Sulfate (SO_4)	Sulfur is a minor constituent of the Earth's crust but is widely distributed as metallic sulfides in igneous and sedimentary rocks. Weathering of metallic sulfides such as pyrite by oxygenated water yields sulfate ions to the water. Sulfate is dissolved also from soils and evaporite sediments containing gypsum or anhydrite. The sulfate concentration in natural freshwaters may range from zero to several thousand milligrams per liter. Drainage from mines may add sulfate to waters by virtue of pyrite oxidation.	Sulfate in drinking water may impart a bitter taste and act as a laxative on unacclimated users. According to the National Secondary Drinking Water Regulations proposed by the Environmental Protection Agency (1977b) the secondary maximum contaminant level of sulfate for public water systems is 250 mg/L. Sulfate also is undesirable in some industrial supplies, particularly in waters used for the production of concrete, ice, sugar, and carbonated beverages and in waters used in high-pressure boilers.
Chloride (Cl)	Chloride is relatively scarce in the Earth's crust but is the predominant anion in sea water, most petroleum-associated brines, and in many natural freshwaters, particularly those associated with marine shales and evaporites. Chloride salts are very soluble and once in solution tend to stay in solution. Chloride concentrations in natural waters vary from less than 1 mg/L in stream runoff from humid areas of high rainfall to more than 100,000 mg/L in ground and surface waters associated with evaporites in arid areas. The discharge of human, animal, or industrial wastes and irrigation return flows may add significant quantities of chloride to surface and ground waters.	Chloride may impart a salty taste to drinking water and may accelerate the corrosion of metals used in water-supply systems. According to the National Secondary Drinking Water Regulations proposed by the Environmental Protection Agency (1977b) the secondary maximum contaminant level of chloride for public water systems is 250 mg/L. Chloride also is objectionable in some industrial supplies, particularly those used for brewing and food processing, paper and steel production, and textile processing. Chloride in irrigation waters generally is not toxic to most crops but may be injurious to citrus and stone fruits.

10.7 Source and Significance of Selected Constituents and Properties Commonly Reported in Water Analyses 1/--Continued

Constituent or property	Source or cause	Significance
Fluoride (F)	Fluoride is a minor constituent of the earth's crust. The calcium fluoride mineral fluorite is a widespread constituent of resistate sediments and igneous rocks, but its solubility in water is negligible. Fluoride commonly is associated with volcanic gases, and volcanic emaniations may be important sources of fluoride in some areas. The fluoride concentration in fresh surface waters usually is less than 1 mg/L; but larger concentrations are not uncommon in saline water from oil wells, ground water from a wide variety of geologic terranes, and water from areas affected by volcanism.	Fluoride in drinking water reduces the incidence of tooth decay when the water is consumed during the period of enamel calcification. Excessive quantities in drinking water consumed by children during the period of enamel calcification may cause a characteristic discoloration (mottling) of the teeth. According to the National Interim Primary Drinking Water Regulations established by the Environmental Protection Agency (1977a) the maximum contaminant level of fluoride in drinking water varies from 1.4 to 2.4 mg/L, depending upon the annual average of the maximum daily air temperature for the area in which the water system is located. Excessive fluoride is also objectionable in water supplies for some industries, particularly those involved in the production of food, beverages, and pharmaceutical items.
Nitrogen (N)	A considerable part of the total nitrogen of the earth is present as nitrogen gas in the atmosphere. Small amounts of nitrogen are present in rocks, but the element is concentrated to a greater extent in soils or biological material. Nitrogen is a cyclic element and may occur in water in several forms. The forms of greatest interest in water in order of increasing oxidation state, include organic nitrogen, ammonia nitrogen (NH_4-N), nitrite nitrogen (NO_2-N) and nitrate nitrogen (NO_3-N). These forms of nitrogen in water may be derived naturally from the leaching of rocks, soils, and decaying vegetation; from rainfall; or from biochemical conversion of one form to another. Other important sources of nitrogen in water include effluent from waste-water treatment plants, septic tanks, and cesspools and drainage from barnyards, feed lots, and fertilized fields. Nitrate is the most stable form of nitrogen in an oxidizing environment and is usually the dominant form of nitrogen in natural waters and in polluted waters that have under gone self-purification or aerobic treatment processes. Significant quantities of reduced nitrogen often are present in some ground waters, deep unoxygenated waters of stratified lakes and reservoirs, and waters containing partially stabilized sewage or animal wastes.	Concentrations in water of any of thee forms of nitrogen significantly greater than the local average may suggest pollution. Nitrate and nitrite are objectionable in drinking water because of the potential risk to bottle-fed infants for methemoglobinemia, a sometimes fatal illness related to the impairment of the oxygen-carrying ability of the blood. According to the National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1977a), the maximum contaminant level of nitrate (as N) in drinking water is 10 mg/L. Although a maximum contaminant level for nitrite is not specified in the drinking water regulations, Appendix A to the regulations (U.S. Environmental Protection Agency, 1977a) indicates that waters with nitrite concentrations (as N) greater than 1 mg/L should not be used for infant feeding. Excessive nitrate and nitrite concentrations are also objectionable in water supplies for some industries, particularly in waters used for the dyeing of wool and silk fabrics and for brewing.
Phosphorus (P)	Phosphorus is a major component of the mineral apatite, which is widespread in igneous rock and marine sediments. Phosphorus also is a component of household detergents, fertilizers, human and animal metabolic wastes, and other biological material. Although small concentrations of phosphorus may occur naturally in water as a result of leaching from rocks, soils, and decaying vegetation, larger concentrations are likely to occur as a result of pollution.	Phosphorus stimulates the growth of algae and other nuisance aquatic plant growth, which may impart undesirable tastes and odor to the water, become aesthetically unpleasant, alter the chemistry of the water supply, and affect water treatment processes.

10.7 Source and Significance of Selected Constituents and Properties Commonly Reported in Water Analyses [1]--Continued

Constituent or property	Source or cause	Significance
Dissolved solids	Theoretically, dissolved solids are anhydrous residues of the dissolved substance in water. In reality, the term "dissolved solids" is defined by the method used in the determination. In most waters, the dissolved solids consist predominantly of silica, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, and sulfate with minor or trace amounts of other inorganic and organic constituents. In regions of high rainfall and relatively insoluble rocks, waters may contain dissolved-solids concentrations of less than 25 mg/L; but saturated sodium chloride brines in other areas may contain more than 300,000 mg/L.	Dissolved-solids values are used widely in evaluating water quality and in comparing waters. The following classification based on the concentrations of dissolved solids commonly is used by the Geological Survey. Classification — Dissolved-solids concentration (mg/L) Fresh — <1,000 Slightly saline — 1,000 - 3,000 Moderately saline — 3,000 - 10,000 Very saline — 10,000 - 35,000 Brine — >35,000 The National Secondary Drinking Water Regulations (U.S. Environmental Protection Agency, 1977b) set a dissolved-solids concentration of 500 mg/L as the secondary maximum contaminant level for public water systems. This level was set primarily on the basis of taste thresholds and potential physiological effects, particularly the laxative effect on unacclimated users. Although drinking waters containing more than 500 mg/L are undesirable, such waters have been used in many areas where less mineralized supplies are not available without any obvious ill effects. Dissolved solids in industrial water supplies can cause foaming in boilers; interfere with clearness, color, or taste of many finished products; and accelerate corrosion. Uses of water for irrigation also are limited by excessive dissolved-solids concentrations. Dissolved solids in irrigation water may adversely affect plants directly by the development of high osmotic conditions in the soil solution and the presence of phytoxins in the water or indirectly by their effect on soils.
Specific conductance (micromhos at 25°C)	Specific conductance is a measure of the ability of a water to carry an electrical current and depends on the concentrations of ionized constituents dissolved in the water. Many natural waters in contact only with granite, well-leached soil, or other sparingly soluble material have a conductance of less than 50 micromhos. The specific conductance of some brines exceed several hundred thousand micromhos.	The specific conductance is an indication of the degree of mineralization of a water and may be used to estimate the concentration of dissolved solids in the water.
Hardness as $CaCO_3$	Hardness of water is attributable to all polyvalent metals but principally to calcium and magnesium ions expressed as $CaCO_3$ (calcium carbonate). Water hardness results naturally from the solution of calcium and magnesium, both of which are widely distributed in common minerals of rocks and soils. Hardness of waters in contact with limestone often exceeds 200 mg/L. In waters from gypsiferous formations, 1,000 mg/L is not uncommon.	Hardness values are used in evaluating water quality and in comparing waters. The following classification is commonly used by the Geological Survey. Hardness (mg/L as $CaCO_3$) — Classification 0 - 60 — Soft 61 - 120 — Moderately hard 121 - 180 — Hard >180 — Very Hard Excessive hardness of water for domestic use is objectionable because it causes incrustations on cooking utensils and water heaters and increased soap or detergent consumption. Excessive hardness is undesirable also in many industrial supplies. (See discussions concerning calcium and magnesium.)

10.7 Source and Significance of Selected Constituents and Properties Commonly Reported in Water Analyses [1]--Continued

Constituent or property	Source or cause	Significance
pH	The pH of a solution is a measure of its hydrogen ion activity. By definition, the pH of pure water at a temperature of 25°C is 7.00. Natural waters contain dissolved gases and minerals, and the pH may deviate significantly from that of pure water. Rainwater not affected significantly by atmospheric pollution generally has a pH of 5.6 due to the solution of carbon dioxide from the atmosphere. The pH range of most natural surface and ground waters is about 6.0 to 8.5. Many natural waters are slightly basic (pH >7.0) because of the prevalence of carbonates and bicarbonates, which tend to increase the pH.	The pH of a domestic or industrial water supply is significant because it may affect taste, corrosion potential, and water-treatment processes. Acidic waters may have a sour taste and cause corrosion of metals and concrete. The Environmental Protection Agency National Secondary Drinking Water Regulations (1977b) set a pH range of 6.5 to 8.5 as the secondary maximum contaminant level for public water systems.

1/ Most of the material in this table has been summarized from several references. For a more thorough discussion of the source and significance of these and other water-quality properties and constituents, the reader is referred to the following additional references: American Public Health Association and others (1975); Hem (1970); McKee and Wolf (1963); National Academy of Science, National Academy of Engineering (1974); National Technical Advisory Committee to the Secretary of the Interior (1968); and U.S. Environmental Protection Agency (1976, 1977a,b).

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/

OVERBURDEN

[µg/g, micrograms per grams; meq/L, milliequivalents per liter; %, percent; %/wt., percent per weight; lb, pound]

Chemical parameters 1:1 water extract 2/	Depth Interval (feet) 0 to 15	15 to 30	30 to 45	45 to 60	60 to 75	75 to 90	90 to 105
PH (units)	6.3	6.0	6.2	7.5	7.3	6.8	6.4
Salinity µg/g	230	3,600	3,000	2,100	1,900	2,000	1,840
Calcium	11	276	212	159	154	215	202
Magnesium	3.9	109	83.5	63.1	59.0	79.0	74.2
Sodium	39	362	292	185	224	91	74
Potassium	5.9	32.3	26.9	27.4	24.6	24.6	26.7
Carbonate	0	0	0	0	0	0	0
Bicarbonate	49	20	59	171	171	93	88
Chloride	24	417	350	24.8	256	176	86
Sulfate	60	1,300	960	580	620	800	780
Cation exchange capacity, meq/100g	14.0	19.9	20.4	25.5	19.4	29.4	19.7
Total exchangeable basis, meq/100g	4.5	9.0	8.6	15.7	9.1	9.5	8.5
Total sulfur, %/wt.	<.01	.06	.34	.26	.20	.71	.65
Sulfate sulfur, %/wt.	<.01	.08	.02	.05	.02	.04	.10
Pyritic sulfur, %/wt.	<.01	.42	.26	.17	.14	.39	.46
Organic sulfur, %/wt.	<.01	.10	.06	.04	.04	.28	.09
Neutralization potential, tons of $CaCO_3$/1,000 tons soil	1	<.1	1.5	4	2.5	2.0	1.5

See footnotes at end of section.

10.0 SUPPLEMENTAL DATA--Continued

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

OVERBURDEN--Continued

Chemical parameters 1:1 water extract 2/	Depth interval (feet)							
	105 to 120	120 to 135	135 to 150	180 to 193	195 to 210	210 to 225.7	234.5 to 239	239 to 255
PH (units)	6.9	7.9	6.6	7.2	7.4	7.3	7.7	6.7
Salinity, µg/g	1,500	1,190	1,600	430	1,320	560	510	380
Calcium	186	131	188	37	240	51	50	33
Magnesium	63.8	49.4	45.2	10.3	38.0	14.3	13.8	8.0
Sodium	27	48	84	36	56	45	39	35
Potassium	26.3	21.5	40.0	11.7	36.8	13.4	13.8	11.2
Carbonate	0	0	0	0	0	0	0	0
Bicarbonate	122	239	176	146	508	137	205	132
Chloride	30	4	32	2	32	12	10	10
Sulfate	650	442	640	100	356	164	100	80
Cation exchange capacity, meq/100g	20.2	23.4	33.5	11.6	25.0	18.9	21.4	23.5
Total exchangeable basis, meq/100g	9.4	11.1	11.7	17.5	17.5	9.1	9.8	8.4
Total sulfur, %/wt.	.42	.59	.74	.31	.42	.43	.32	.23
SO_4 - S	.02	.08	.16	.01	.13	.14	.09	.02
Pyritic sulfur, %/wt.	.33	.39	.36	.19	.13	.23	.11	.17
Neutralization potential, tons of $CaCO_3$/1,000 tons soil	1.0	3.0	2.0	8.5	13.5	1.0	2.0	2.5

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

OVERBURDEN--Continued

Trace elements 2/	Depth interval (feet)						
	0 to 15	15 to 30	30 to 45	45 to 60	60 to 75	75 to 90	90 to 105
Cadmium, µg/g	0.1	0.2	0.1	0.3	0.1	0.3	0.2
Copper	9	7	8	10	11	9	8
Chromium	8	7	8	7	9	8	8
Lead	.51	.21	.14	.43	.42	.09	.16
Manganese	135	163	122	559	413	37	49
Molybdenum	<2	<2	3	<2	<2	<2	2
Zinc	27	62	46	52	57	47	50
Arsenic	9.2	7.4	9.3	6.2	7.7	7.6	9.5
Selenium	.87	.88	.84	1.7	.82	1.0	1.1
Boron	4.6	9.3	15	9.8	11	24	13
Physical parameters							
Texture							
% sand	65	40	37	25	22	36	31
% silt	18	34	43	57	62	46	52
% clay	17	26	20	18	10	18	17
Water holding capacity, %/wt.							
1/3 bar	19.4	28.4	26.0	28.7	24.6	28.5	26.0
15 bar	11.9	16.3	14.8	16.5	14.8	17.6	15.0
Available moisture	7.5	12.1	11.2	12.2	9.8	11.0	11.0

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

OVERBURDEN--Continued

Trace elements 2/	Depth interval (feet)							
	105 to 120	120 to 135	135 to 150	180 to 193	195 to 210	210 to 225.7	234.5 to 239	239 to 255
Cadmium, µg/g	0.2	0.2	0.1	0.9	1.0	0.6	0.5	0.4
Copper	4	5	9	12	11	9	18	13
Chromium	7	4	5	4	1	5	9	7
Lead	.13	.60	.08	.44	.67	.49	.16	.16
Manganese	50	760	27	415	524	463	56	39
Molybdnum	3	<2	<2	2	2	2	2	<2
Zinc	38	32	36	47	31	45	78	57
Arsenic	8.0	4.9	7.8	3.7	3.1	9.3	14	11
Selenium	1.1	.45	.89	1.8	1.8	.87	1.1	.86
Boron	17	30	34	18	29	23	22	17
Physical parameters								
Texture								
% sand	36	45	60	28	46	26	19	25
% silt	49	39	26	50	36	58	55	49
% clay	15	16	14	22	18	16	26	26
Water holding capacity, %/wt.								
1/3 bar	25.1	25.1	29.4	29.8	27.1	26.8	34.4	27.5
15 bar	14.7	15.8	17.4	17.7	18.3	15.0	22.1	16.4
Available moisture	10.4	9.3	12.0	12.1	8.9	11.8	12.2	11.1

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

LIGNITE

Trace elements 2/	Depth interval (feet)					
	91.5 to 93.1	135.2 to 136.2	184.5 to 190.7	223.3 to 225.7	225.7 to 230.5	234.5 to 239
Arsenic, µg/g	5.5	10	6.4	2.7	3.6	2.5
Boron	170	43	140	164	189	194
Cadmium	.5	.2	.3	.3	.4	.4
Chromium	6	16	2	3	1	<1
Copper	5	2	2	3	2	<1
Lead	.13	.15	.16	.13	.19	.15
Manganese	11	26	13	21	91	33
Molybdenum	<2	<2	<2	<2	<2	<2
Mercury	.35	.07	.14	.43	.31	.26
Selenium	1.3	.83	1.1	1.3	1.2	1.3
Zinc	14	31	7	7	11	8
Uranium	1.4	1.3	.3	.1	<.05	.1
PH	5.9	6.4	6.0	6.0	5.9	6.0
Sulphur forms						
Sulfate-S, %/wt.	.01	.02	.02	.02	.01	.01
Pyritic-S, %/wt.	.16	.60	.60	.35	.63	.31
Organic-S, %/wt.	.98	.26	1.26	1.50	1.46	1.70
Total sulfur, %/wt.	1.15	.88	1.88	1.87	2.10	2.02

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

LIGNITE

Proximate	As received	Dry basis
Identification: Camp Swift, Tex. Depth interval (feet): 91.5 to 93.1		
Moisture, %/wt.	35.04	---
Ash, %/wt.	15.78	24.28
Sulfur, %/wt.	.76	1.17
Gross heat of combustion, BTU/lb	6,849	10,540
Identification: Camp Swift, Tex. Depth interval (feet): 135.2 to 136.2		
Moisture, %/wt.	21.67	---
Ash, %/wt.	54.92	70.13
Sulfur, %/wt.	.656	.838
Gross heat of combustion, BTU/lb	6,053	7,730

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

LIGNITE

Proximate	As received	Dry basis
Identification: Camp Swift, Tex. Depth interval (feet): 184.5 to 190.7		
Moisture, %/wt.	42.84	---
Ash, %/wt.	16.56	28.56
Sulfur, %/wt.	.98	1.71
Gross Heat of Combustion, BTU/Lb.	5.709	9,986
Identification: Camp Swift, Tex. Depth interval (feet): 223.3-225.7		
Moisture, %/wt.	35.69	---
Ash, %/wt.	11.73	18.23
Sulfur, %/wt.	1.48	2.30
Gross heat of combustion, BTU/lb	7,667	11,921

See footnotes at end of section.

10.8 Chemical Analysis of the Overburden and Lignite from 0 to 255 Feet at Well C-13 1/--Continued

LIGNITE

Proximate	As received	Dry basis
Identification: Camp Swift, Tex. Depth interval (feet): 225.7 to 230.5		
Moisture, %/wt.	33.94	---
Ash, %/wt.	11.37	17.21
Sulfur, %/wt.	1.62	2.44
Gross Heat of Combustion, BTU/Lb.	7,807	11,820
Identification: Camp Swift, Tex. Depth interval (feet): 234.5-239		
Moisture, %/wt.	36.79	---
Ash, %/wt.	10.71	16.95
Sulfur, %/wt.	1.30	2.06
Gross heat of combustion, BTU/lb	7,121	11,266

1/ Analyses by Southwestern Laboratories, Dallas, Texas.
2/ All results are figured on a dry basis, acid soluble.

11.0 GLOSSARY

The glossary is composed of four separate sections:

- 11.1 Geological- and Ground-Water-Related Terms
- 11.2 Surface-Water and Related Terms
- 11.3 Water-Quality-Related Terms
- 11.4 Sediment-Related Terms

Definitions used in these glossaries are derived from the following publications:

Glossary of geology, second edition (American Geological Institute, 1980);
Handbook of applied hydrology (Chow, ed., 1964);
A dictionary of mining, mineral, and related terms (Thrush, 1968);
General introduction and hydrologic definitions (Langbein and Iseri, 1960); and
Water data for Texas (U.S. Geological Survey, 1982).

11.1 Geological- and Ground-Water-Related Terms

Alluvium or alluvial deposits.--Sediments deposited by streams; includes flood-plain deposits.

Aquifer.--A formation, group of formations, or part of a formation that will yield water in sufficient quantity to be of value as a source of supply.

Artesian aquifer (confined aquifer).--An aquifer which is overlain (confined) by confining layer so that the water is under hydrostatic pressure. The water level in an artesian well will rise above the top of the aquifer to the level of the potentiometric surface; however, the well may or may not flow.

Avulsion.--A sudden separation of land by a flood or by an abrupt change in the course of a stream, as by a stream breaking through a meander or by a sudden change in current whereby the stream deserts its old channel for a new one.

Bifurcation.--(a) The separation or branching of a stream into two parts.
(b) A stream branch produced by bifurcation.

Cone of depression.--Depression of the water table or potentiometric surface surrounding a discharge well which is more or less the shape of an inverted cone.

Confining bed or formation.--One which, because of its position and its minimal impermeability relative to that of the aquifer, confines the water in the aquifer under artesian pressure.

Crevasse splay (flood-plain splay).--A small alluvial fan or other outspread deposit formed where a stream breaks through a levee (artificial or natural) and deposits its material (commonly coarse-grained) on the flood plain.

Delta.--The low, nearly flat, alluvial tract of land at or near the mouth of a river, commonly forming a triangular or fan-shaped plain of considerable area, crossed by many distributaries of the main river, perhaps extending beyond the general trend of the coast, and resulting from the accumulation of sediment supplied by the river in such quantities that it is not removed by tides, waves, and currents.

Dendritic drainage pattern.--A drainage pattern in which the streams branch randomly in all directions and at almost any angle, resembling in plan the branching habit of certain trees; it is produced where a consequent stream receives several tributaries which in turn have smaller tributaries. It is indicative of insequent streams flowing across horizontal and homogeneous strata or complex crystalline rocks with uniform resistance to erosion.

Dip of rocks.--The angle of slope at which a bed is inclined from the horizontal; direction also is expressed (such as 1.0°, southeast; or 90 feet per mile, southeast).

Drawdown.--The lowering of the water table or potentiometric surface caused by pumping or artesian flow. It is the difference, in feet, between the static level and the pumping level.

Electric log.--A geophysical log showing the electrical properties of the rocks and their fluid contents penetrated in a well. The electrical properties are natural potentials and resistivities to induced electrical currents, some of which are modified by the presence of the drilling mud in and near the borehole.

Fault.--A fracture or fracture zone in a rock or body of rock along which there has been displacement of the two sides relative to one another parallel to the surface of the fracture.

Fluvial.--(a) Of or pertaining to a river or rivers. (b) Existing, growing, or living in or about a stream or river. (c) Produced by the action of a stream or river.

Formation.--A body of rock that is sufficiently homogeneous or distinctive to be regarded as a mappable unit.

Graben.--A elongate, relatively depressed crustal unit or block that is bounded by faults on its long sides. It is a structural form that may or may not be geomorphologically expressed as a rift valley. Etymol: German, "ditch". CF: horst. Syn: Trough [fault].

Ground water.--Water in the ground that is in the zone of saturation from which wells, springs, and seeps are supplied.

Head, or hydrostatic pressure.--The height of the water table or potentiometric surface above the base of the aquifer.

Hydraulic conductivity. --The rate of flow of water, in gallons per day, through a cross sectional area of 1.0 square foot under a unit hydraulic gradient.

Hydraulic gradient.--The slope of the water table or potentiometric surface, usually given in feet per mile.

Infiltration.--The flow of a fluid into a substance through pores or small openings. It connotes flow into a substance in contradistinction to the word percolation, which connotes flow through a porous substance.

Lithology.--The description of rocks, usually from observation of hand specimen or outcrop.

Outcrop.--That part of a rock layer which appears at the land surface.

Percolation.--The movement, under hydrostatic pressure, of water through the interstices of a rock or soil, except the movement through large openings such as caves.

Permeable.--Pervious or having a texture that permits water to move through it perceptibly under the head differences ordinarily found in subsurface water. A permeable rock has connecting interstices of capillary or super-capillary size.

Porosity.--The ratio of the aggregate volume of interstices (openings) in a rock or soil to its total volume, usually stated as a percentage.

Recharge of ground water.--The process by which water is absorbed and is added to the zone of saturation. Also used to designate the quantity of water that is added to the zone of saturation.

Resistivity (electrical log).--The resistance of the rocks and their fluid content penetrated in a well to induced electrical currents. Permeable rocks containing freshwater have high resistivities.

Slip.--(a) The relative displacement of formerly adjacent points on opposite sides of a fault, measured in the fault surface. Partial syn: Shift. Syn: Total displacement. (b) A small fracture along which there has been some displacement.

Specific capacity.--The rate of yield of a well per unit of drawdown, usually expressed as gallons per minute per foot of drawdown. If the yield is 250 gallons per minute and the drawdown is 10 feet, the specific capacity is 25 gallons per minute per foot.

Specific yield.--The quantity of water that an aquifer will yield by gravity if it is first saturated and then allowed to drain; the ratio expressed in percentage of the volume of water drained to volume of the aquifer that is drained.

Storage.--The volume of water in an aquifer, usually reported in acre-feet.

Storage coefficient.--The volume of water an aquifer releases from or takes into storage per unit of surface area of the aquifer per unit change in the component of head normal to that surface.

Strike.--The direction or trend taken by a structural surface, for example a bedding or fault plane, as it intersects the horizontal.

Throw.--The amount of vertical displacement caused by a fault.

Transmissivity.--The volume of water that will move in 1 day through a vertical strip of the aquifer 1.0-foot wide and having the height of the aquifer when the hydraulic gradient is unity. It is the product of the hydraulic conductivity and the saturated thickness of the aquifer expressed in feet squared per day.

Water level.--Usually expressed as the altitude of the water table or potentiometric surface above sea level. Under artesian conditions the water level may be below or above the land surface.

Water table.--The upper surface of a zone of saturation except where the surface is formed by a confining bed.

Water-table aquifer (unconfined aquifer).--An aquifer in which the water is unconfined; the upper surface of the zone of saturation is under atmospheric pressure only and the water is free to rise or fall in response to the changes in the volume of water in storage. A well penetrating an aquifer under water-table conditions becomes filled with water to the level of the water table.

Yield of a well.--The rate of discharge, usually expressed in gallons per minute. In this report, yields are classified as small, less than 50 gallons per minute; moderate, 50 to 500 gallons per minute; and large, more than 500 gallons per minute.

Zone of saturation.--The zone in which the functional permeable rocks are saturated with water under hydrostatic pressure. Water in the zone of saturation will flow into a well, and is called ground water.

11.2 Surface-Water and Related Terms

Acre-foot.--The quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons.

Cubic foot per second per square mile.--The average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second.--The rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second. This rate is equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute.

Discharge.--The volume of water (or more broadly, volume of fluid plus suspended sediment), that passes a given point within a given time.

Mean discharge.--The arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge.--The discharge at a particular instant of time.

Drainage area.--The area of a stream at a specified location, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream upstream from the specified location. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

Drainage basin.--A part of the surface of the Earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Evaporation.--The process by which water is changed from the liquid or the solid state into the vapor state. In hydrology, evaporation is vaporization that takes place at a temperature less than the boiling point.

Evapotranspiration.--Water withdrawn from a land area by evaporation from water surfaces and moist soil and plant transpiration.

Gage height.--The water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station.--A particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hydrograph.--A graph showing stage, flow, velocity, or other property of water with respect to time.

Mass curve.--A graph of the cummulative values of a hydrologic quantity (such as precipitation or runoff), generally as ordinate, plotted against time or date as abscissa.

Runoff.--That part of the precipitation that appears in surface streams. It is the same as streamflow unaffected by artificial diversions, storage, or other works of man in or on the stream channels.

Runoff in inches.--The depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Streamflow.--The discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Transpiration.--The quantity of water absorbed and transpired and used directly in the building of plant tissue, in a specified time. It does not include soil evaporation. The process by which water vapor escapes from the living plant, principally the leaves, and enters the atmosphere.

Watershed.--Drainage basin.

11.3 Water-Quality-Related Terms

Bacteria.--Microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, commonly clumped into colonies. Some bacteria cause disease, others perform an essential role in nature in the recycling of materials; for example by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria.--A particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35° Celsius. In the laboratory these bacteria are defined as the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35° $\pm$ 0.2° Celsius on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 milliliters of sample.

Fecal streptococcal bacteria.--Bacteria found in intestines of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35° $\pm$ 1.0° Celsius on M-enterrococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 milliliters of sample.

Biochemical oxygen demand (BOD).--A measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by microorganisms, such as bacteria.

Dissolved.--That material in a representative water sample which passes through a 0.45 micrometer membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Hardness.--A physical-chemical characteristic of water that is commonly recognized by the increased quantity of soap required to produce lather. It is attributable to the presence of alkaline earths (principally calcium and magnesium) and is expressed as equivalent calcium carbonate ($CaCO_3$).

Micrograms per gram (µg/g).--A unit expressing the concentration of a chemical element as the mass (micrograms) of the element per unit mass of sediment.

Micrograms per liter (UG/L, µg/L).--A unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter.

Milligrams per liter (MG/L, mg/L).--A unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represent the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in milligrams per liter, and is based on the mass of sediment per liter of water-sediment mixture.

Specific conductance.--A measure of the ability of a water to conduct an electrical current. It is expressed in micromhos per centimeter at 25° Celsius. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids concentration in the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in micromhos). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Suspended, total.--The total concentration of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 micrometer membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total." Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

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11.4 Sediment-Related Terms

Sediment.--Solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are affected by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land use, and quantity and intensity of precipitation.

Particle-size classification.--American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size (millimeters)
Clay	0.00024 - 0.004
Silt	0.004 - 0.062
Sand	0.062 - 2.0
Gravel	2.0 - 64.0

Suspended sedimant.--The sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration.--The velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point about 0.3 foot above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture.

Suspended-sediment discharge (tons/day).--The rate at which dry weight of sediment passes a section of a stream, or is the quantity of sediment, as measured by dry weight or volume, that passes a section during a given time. It is computed by multiplying discharge (in cubic feet per second) times concentration (in milligrams per liter) times 0.0027.

Suspended-sediment load.-- The quantity of suspended sediment passing a section in a specified period.

Total sediment discharge (tons/-day).--The sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry weight or volume that passes a section during a given time.