TEXAS WATER DEVELOPMENT BOARD

REPORT 39

HYDROLOGIC STUDIES OF SMALL WATERSHEDS

ESCONDIDO CREEK, SAN ANTONIO RIVER BASIN

TEXAS, 1955-63

By

F. W. Kennon, J. T. Smith, and C. T. Welborn
United States Geological Survey

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ABSTRACT

A study was made of the hydrologic effects of a group of 11 floodwater-retarding structures in Escondido Creek watershed, Karnes County. The storage capacity behind the structures ranged from 437 to 3,050 acre-feet. Monthly water budgets for each floodwater-retarding structure completed were prepared for the period October 1, 1954, to September 30, 1963.

The structures, as a group, were found to release 60 percent of the inflow above them (40 percent would be consumed at the pools) as surface outflow to the stream channels below during a year of average precipitation (32 inches). During the water years 1955-63 pool consumption ranged from 23 percent of inflow including rainfall on pools in 1957 (rainfall 38.00 inches) to 189 percent in 1956 (rainfall 11.84 inches). Half of pool consumption was attributed to evaporation; most of the remainder was probably seepage which may have supplied moisture to alluvial deposits adjacent to downstream channels, consequently reducing subsequent channel transmission losses of surface flow downstream.

The sediment-production rate upstream from one of the floodwater-retarding structures was found to be 0.59 acre-foot per square mile of drainage area per year, 97 percent of which was trapped behind the floodwater-retarding structure. Most of the sediment came from headcuts and banks of the stream channels. Flocculation of clay particles was aided by the considerable quantities of calcium and bicarbonate present in the inflow.

HYDROLOGIC STUDIES OF SMALL WATERSHEDS ESCONDIDO CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1955-63

INTRODUCTION

Background and Objectives of Watershed Studies

Developing measures for the reduction of flood and soil erosion in Texas is a project in which the U.S. Soil Conservation Service is actively engaged under the authority of the Flood Control Acts of 1936 and 1944 and the Watershed Protection and Flood Prevention Act (Public Law 566), as amended. Constructing a series of upstream floodwater-retarding structures is part of the Soil Conservation Service's plan for flood and soil-erosion reduction in a watershed. These structures are designed to release floodwater at a rate that will not normally exceed the stream-channel capacity immediately below the structures (Figure 1).

This watershed development program will have variable but important effects on the natural surface- and ground-water resources of river basins, particularly where a large number of the floodwater-retarding structures are built. Therefore, a comparison of the hydrology of small watersheds under natural conditions and under developed conditions is desirable to determine the effect of floodwater-retarding structures on yield and mode of occurrence of natural water supplies.

The U.S. Geological Survey began hydrologic studies on three small watersheds in 1951. Flood protection for these three watersheds had been authorized under the Flood Control Acts of 1936 and 1944. In 1954, four other studies were begun under authority granted by the Department of Agriculture Appropriation Act of 1954, Public Law 156, 83rd Congress, item Watershed Protection. In 1956, four more small-watershed studies were initated, as authorized by the Hope-Aiken Watershed Protection and Flood Prevention Act (Public Law 566, approved August 4, 1944). At present, 11 small watersheds are under study in Texas. In Table 1 the watersheds are listed and in Figure 2 their respective locations are shown.

As of September 30, 1964, the floodwater-retarding structures in Texas totalled 881. These partly control the flow from an area of about 3,590 square miles. According to reports of the U.S. Study Commission-Texas, 1962, and of the Soil Conservation Service, 1963, the number of structures physically and economically feasible for installation in Texas was 3,438. Thus, only about 26 percent of the feasible structures had been built at the end of the 1964 water year.

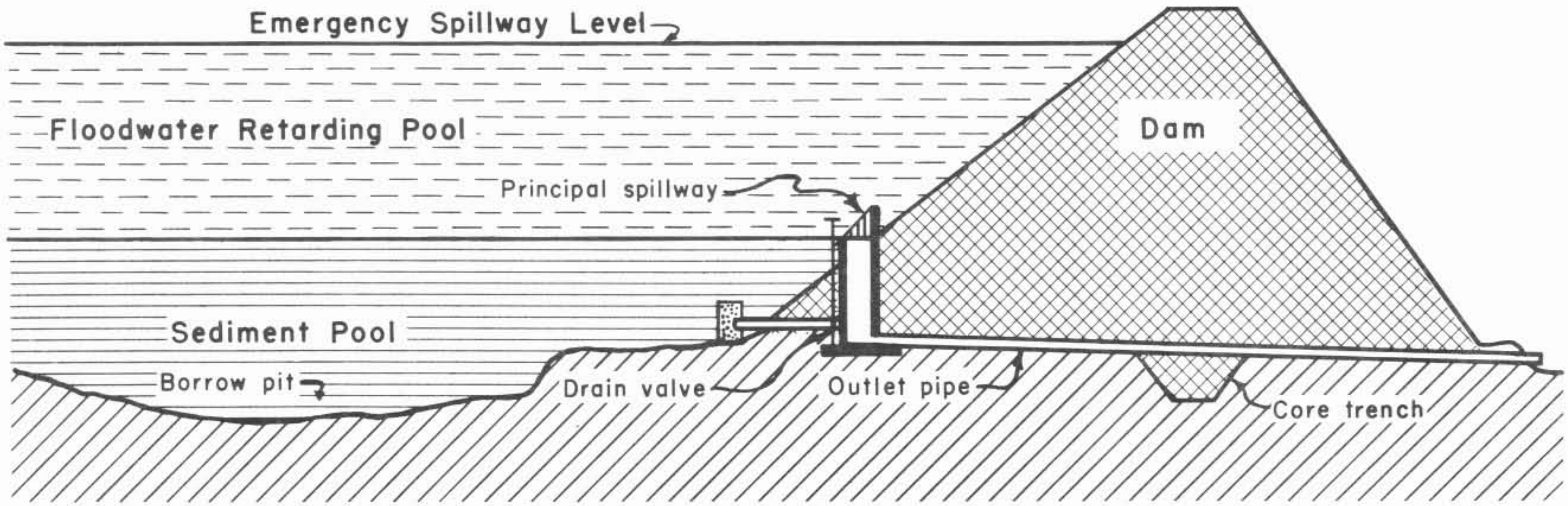


Figure 1

Typical Floodwater-Retarding Structure with Outlet Works

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

Table 1.--Small-watershed study areas, September 30, 1964

Watershed	Drainage area above stream-gaging station (sq mi)	Date hydrologic data collection began	Floodwater-retarding structures above stream-gaging station	Period the structures were built
Trinity River basin:				
North Creek near Jacksboro	21.6	Aug. 1956	None	--
Elm Fork Trinity River Near Muenster	46.0	July 1956	11	1954-57
Little Elm Creek near Aubrey	75.5	June 1956	None	--
Honey Creek near McKinney	39.0	July 1951	12	1951-57
Pin Oak Creek near Hubbard	17.6	Sept. 1956	5	1962-63
Brazos River basin:				
Green Creek near Alexander	45.5	Oct. 1954	8	1954-56
Cow Bayou near Mooreville	79.6	Sept. 1954	9	1955-58
Colorado River Basin:				
Deep Creek near Mercury	43.9[a]	June 1951	6	1951-53
Mukewater Creek near Trickham	70.0	Aug. 1951	5	1961
San Antonio River basin:				
Calaveras Creek near Elmendorf	77.2	Aug. 1954	9	1954-58
Escondido Creek at Kenedy	72.4[b]	July 1954	10	1954-58

a/ 8.31 sq mi above Dry Prong Deep Creek near Mercury not included.
b/ 8.43 sq mi above Escondido Creek subwatershed No. 11 (Dry Escondido Creek) near Kenedy not included.

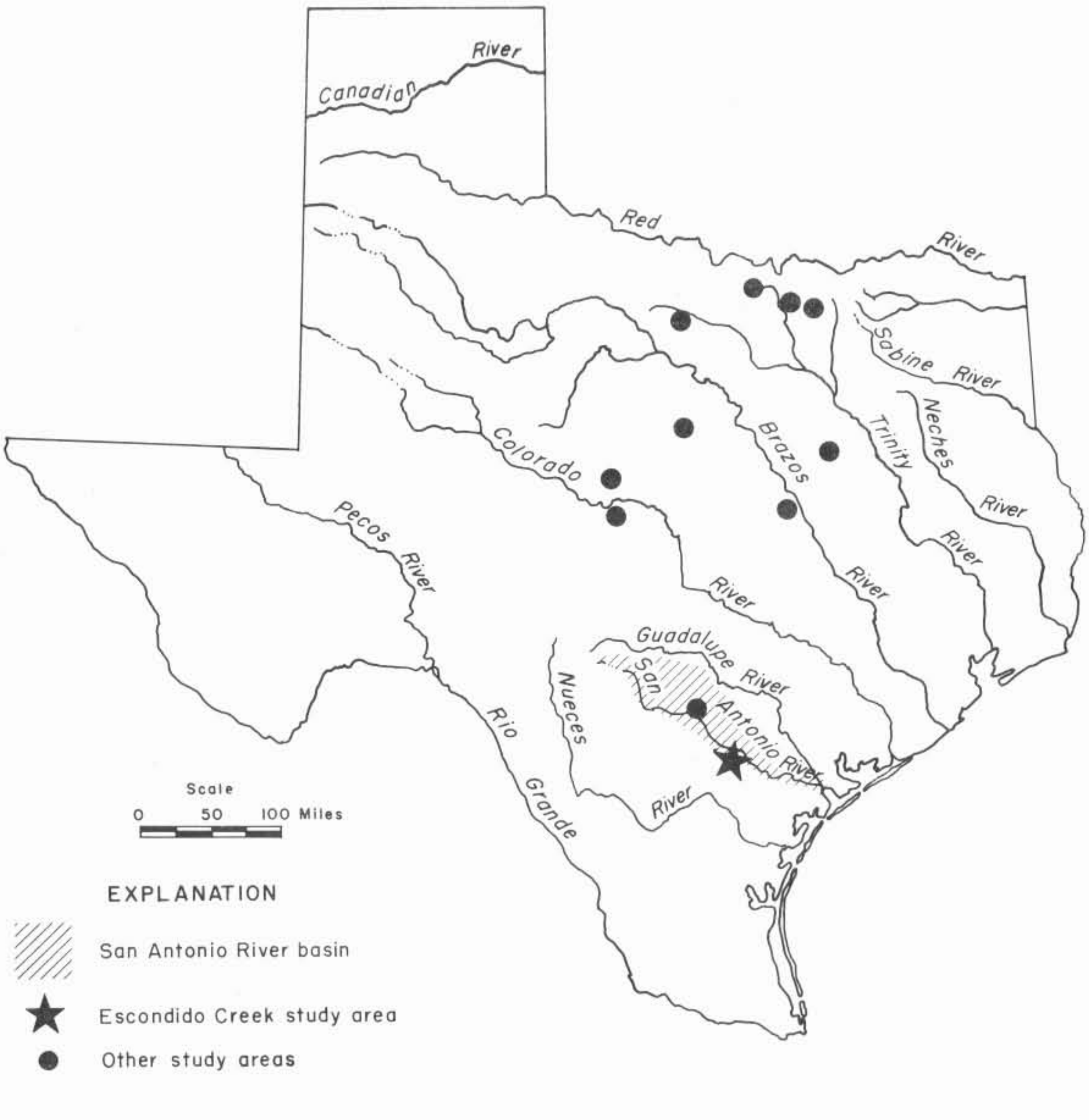


Figure 2

Location of Escondido Creek Study Area

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

San Antonio River Authority, Texas Water Development Board, Soil Conservation Service, city of Dallas, and Tarrant County Water Control and Improvement District No. 1 are cooperating with the Geological Survey in the investigations. The 11 study areas are distributed to cover the range of rainfall, topography, geology, and soil conditions in Texas where most of the watershed development is planned. Study begun on four of the areas prior to construction of the floodwater-retarding structures afforded opportunity for analyses of the conditions before and after development. A summary of the development of floodwater-retarding structures on each study area, as of September 30, 1964, is shown in Table 1.

The broad purpose of the statewide investigations is to collect sufficient data for interpretations currently needed, and also to make hydrologic interpretations from the available data.

Following are nine general objectives of these studies:

1. To obtain the basic hydrologic data on small watersheds needed for general use in the design of drainage structures and in water yield and other studies.

2. To obtain basic data which will aid in determining the net effect of floodwater-retarding structures on the regimen of streamflow at downstream points.

3. To determine the effect of the structures on the underlying groundwater reservoir.

4. To determine not only the effect of the structures on the sediment yield of the basin but also the trap efficiency of the structures.

5. To develop computation techniques that will give more accurate estimates of the runoff resulting from a given amount of rainfall on small watersheds.

6. To develop relationships between maximum rates of runoff and rainfall in small watersheds so that more accurate design of small storm-drainage structures will be possible.

7. To check the applicability of flood-routing procedures and techniques for small watersheds.

8. To determine the minimum instrumentation necessary for making reliable estimates of total storm inflow to the structures.

9. To determine the quality of the water as ralated to its suitability for possible uses and to the effect of its flocculating characteristics on the sediment-trap efficiency of the pools.

Periodic evaluation reports on the investigations in each of the 11 regional small-watershed study areas are essential to insure that the basic data-collection program fulfills the purposes of the state investigations. This series of reports will be published to provide data and interpretations which expand the information available in Geological Survey annual water-supply papers.

So far, five study-area reports have been prepared under the main title "Hydrologic Studies of Small Watersheds." Subtitles of the respective reports include: "Honey Creek Basin, Collin and Grayson Counties, Texas, 1953-59"; "Deep Creek, Colorado River Basin, Texas, 1951-61"; "Elm Fork Trinity River Basin, Montague and Cooke Counties, Texas, 1956-60"; "Mukewater Creek, Colorado River Basin, Texas, 1952-60"; and "Little Elm Creek, Trinity River Basin, Texas, 1956-62." (See References.) The first three reports involve study areas where floodwater-retarding structures were constructed prior to or near the beginning of the data-collection program. The last two reports cover a period prior to construction of floodwater-retarding structures.

Purpose and Scope of the Report

The purpose of this report is to present and evaluate results of hydrologic investigations conducted in the Escondido study area during the period 1955-63. Of the nine objectives already stated for the small-watershed studies program, this report is limited in scope to four--numbers 1, 2, 4, and 9-which deal respectively with the presentation of basic hydrologic data, the effects of small reservoirs on streamflow at downstream points, reservoir-trap efficiency, and the chemical quality of water.

Studies to determine the minimum rain-gage density needed to evaluate individual storm rainfall on a watershed have been made at five locations in central and north-central Texas. The results of these studies have been published in the reports listed above. The results indicate that the rain-gage density existing at the Escondido study area is adequate for the accurate evaluation of storm rainfall on the watershed. Therefore, no additional rain-gage density analysis was made for this area.

Acknowledgments

The fieldwork was done by the respective engineering staffs of the U.S. Geological Survey subdistrict office in San Antonio, A. E. Hulme, engineer-in-charge, and of the U.S. Soil Conservation Service office in Kenedy.

The sections of the report describing the location, topography, geology, geohydrology, and soils of the basin were prepared by J. T. Smith, geologist, Geological Survey, Austin. The sections on sedimentation were prepared by C. T. Welborn, engineer, Geological Survey, Austin. The compilation and the preparation of the other sections of the report were made by F. W. Kennon, engineer, Geological Survey, Austin.

Grateful acknowledgment is made for the financial assistance and the cooperation of the Texas Water Development Board, J. J. Vandertulip, chief engineer; the Soil Conservation Service, H. N. Smith, State conservationist, Temple; and the San Antonio River Authority, V. H. Braunig, manager.

This report was prepared under the direct supervision of Trigg Twichell, district chief, Water Resources Division, Geological Survey, Austin.

DESCRIPTION OF THE AREA

Location

Escondido Creek rises in Karnes County approximately 8 miles west of Karnes City, flows easterly through the south-central section of the county and empties into the San Antonio River. Major intermittent tributaries to Escondido Creek in the study area are: Panther Creek, Nichols Creek, Doe Branch, Bucker Creek, and Olmos Creek, all of which are above the stream-gaging station; and Dry Escondido Creek which joins the main stem below the stream-gaging station. With the exception of structure No. 11, on Dry Escondido Creek, all the floodwater-retarding structures are located on tributaries above the stream-gaging station (Figure 3). The area of the watershed is approximately 117 square miles, of which 72.4 square miles is above the stream-gaging station.

Topography

Portions of the watershed are almost flat in areas adjacent to the channel and in some areas along the upland divides; however, most of the watershed is moderately hilly to rolling. Elevations above mean sea level range from 550 feet on the extreme southwestern divide to 200 feet at the mouth of Escondido Creek. From the headwater area to the stream-gaging station at Kenedy, the slope of the streambed averages about 12 feet per mile. Between the stream-gaging station and the San Antonio River, the channel slope averages about 5.4 feet per mile.

Geology

The Escondido watershed area is in the northeastward-trending outcrop area of the Catahoula Tuff and the Oakville Sandstone. Some Largarto Clay crops out along the southeast border of the watershed. All of these formations are of Miocene or probable Miocene age (Figure 4). The Catahoula Tuff overlaps the underlying Oligocene(?) Frio Clay and the upper part of the Eocene Jackson Group. The Oakville Sandstone overlies and partly overlaps the Catahoula Tuff. The unconformities were probably caused by the oscillating shoreline during the middle Tertiary. At that time, alternating periods of vulcanism, erosion, and deposition resulted in volcanic, detrital, and reworked material being deposited near the unstable shoreline.

The outcrop of the Catahoula Tuff varies in width from about 5 miles where traversed by the San Antonio River, immediately north of the study area, to about 9 miles in the vicinity of floodwater-retarding structures 5, 6, 7, and 10 (Figure 4). Approximately 35 percent of the watershed is composed of the outcrop area of the Catahoula Tuff.

The lithologic properties of the Catahoula Tuff vary greatly. The formation consists predominantly of tuff, tuffaceous clay, sandy clay, bentonitic clay interbedded with volcanic ash, and irregular discontinuous sandstone lenses. The Catahoula also contains thin lignite and limestone beds, and irregularly distributed beds of conglomerate. The conglomerate is composed of chunky scoriaceous lava, other igneous rock pebbles, opalized wood, and irregular masses of chalcedony, quartz, and chert. Generally, the sand and conglomerate beds are about 10 feet thick at the outcrop area. Interpretations of electric logs indicate

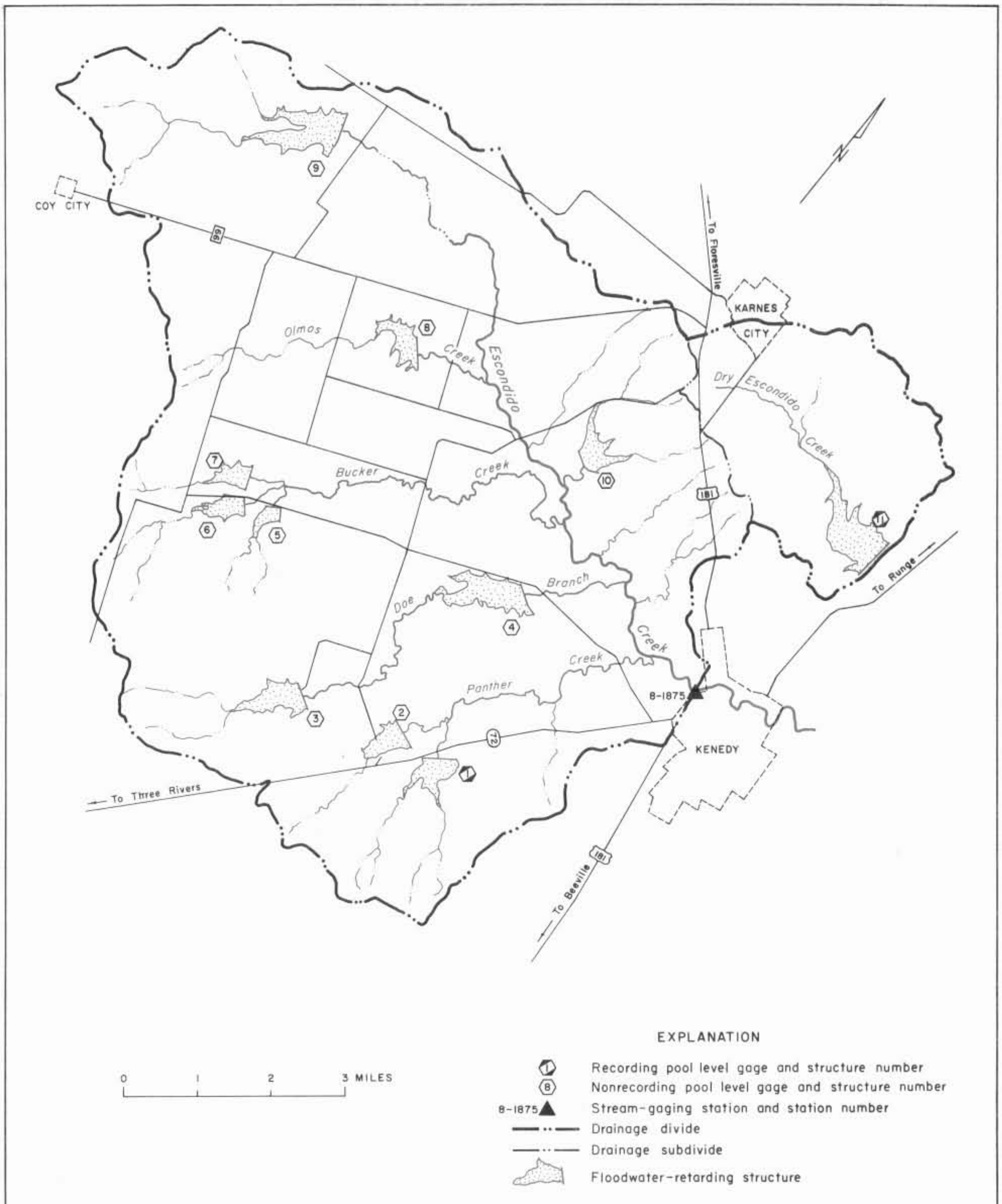


Figure 3

Escondido Creek Study Area Showing Locations of Floodwater-Retarding Structures and Hydrologic Instrument Installations

Base from U.S. Geological Survey topographic quadrangles

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

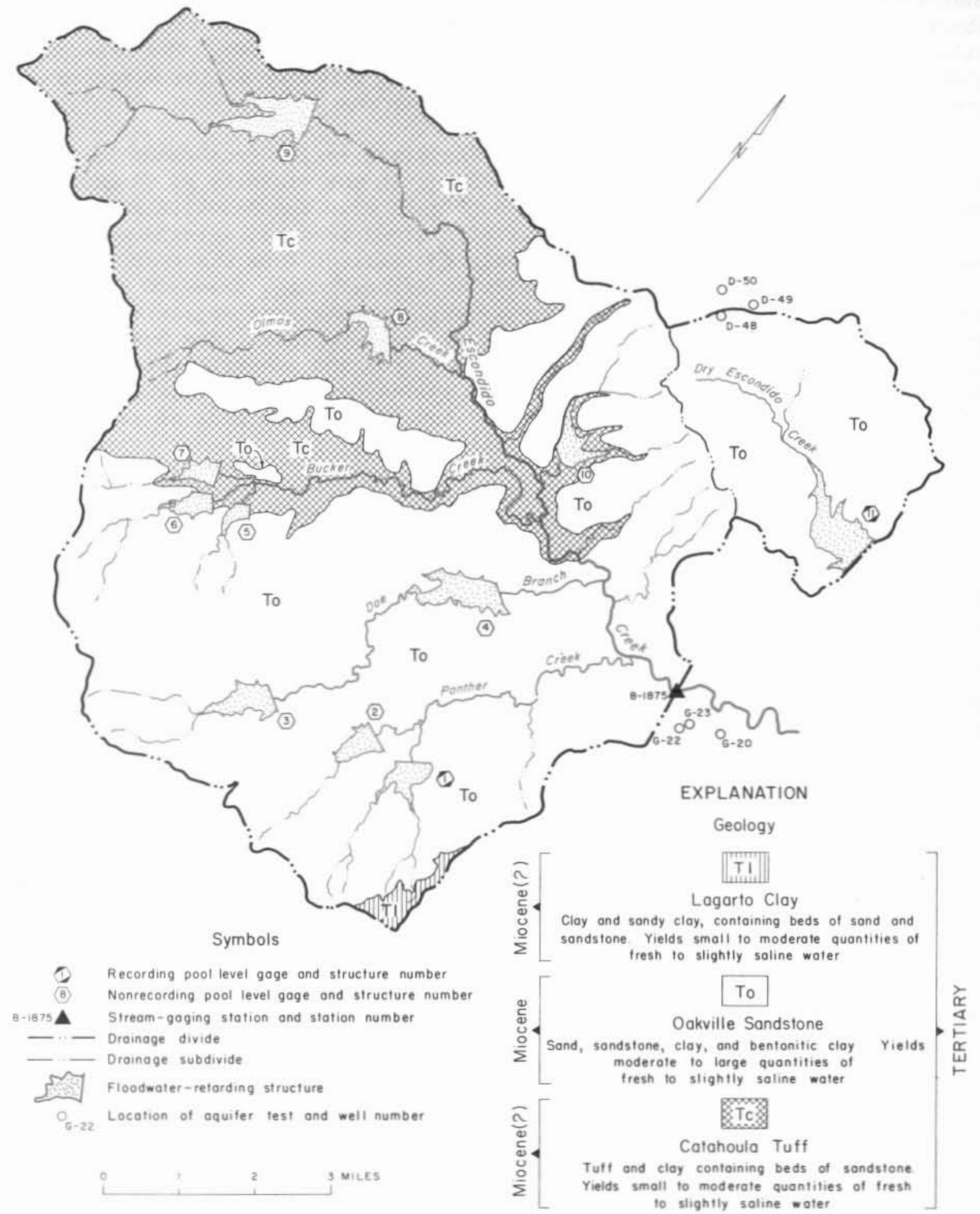


Figure 4

Geology of Study Area and Location of Test Wells and Floodwater - Retarding Structures

Base from U.S. Geological Survey topographic quadrangles

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

that water-bearing sand, or sand and conglomerate interbedded with clay, is about 100 feet thick in the subsurface. At its contact with the overlying Oakville Sandstone, the Catahoula Tuff is about 700 feet thick. The Catahoula yields small to moderate quantities of fresh to slightly saline water to wells and is the only shallow water source in its outcrop area.

The outcrop width of the Oakville Sandstone varies from about 12 miles along the San Antonio River to about 5 miles in the vicinity of floodwater-retarding structures 1, 2, 3, 5, and 6 (Figure 4). The Oakville Sandstone is composed of cross-bedded medium- to fine-grained sand and sandstone, and of sandy, ashy, and bentonitic clay. Chalk and caliche form the caprock on the hills. In the study area, the Oakville Sandstone ranges from 500 to 600 feet in thickness. The outcrop area of the Oakville comprises approximately 65 percent (all of the downstream section) of the watershed. The Oakville Sandstone is the principal aquifer in the study area and generally yields moderate to large quantities of fresh to slightly saline water to wells. In the vicinity of floodwater-retarding structures 1, 2, and 3, the thin beds of sand yield only small quantities of moderately saline water.

Geohydrologic Conditions

The ability of an earth material to transmit water depends upon its permeability and extent. The coefficient of permeability is defined as the number of gallons of water per day which will percolate, under prevailing aquifer conditions, through each mile of a water-bearing unit for each foot of thickness and for each foot per mile of hydraulic gradient. The coefficient of transmissibility is the number of gallons of water which will move in 1 day through a vertical strip of the aquifer, this strip being 1 foot wide and having the height of the aquifer when the hydraulic gradient is unity.

Aquifer tests were made in Karnes City in wells tapping the Catahoula Tuff and in the city of Kenedy in wells tapping the Oakville Sandstone. These tests (Anders, 1962) indicate that the field coefficients of permeability and transmissibility for the wells at Karnes City in the Catahoula Tuff are lower than the same coefficients determined in wells tapping the Oakville Sandstone. The Karnes County aquifer-test results are shown in Table 2.

Coefficients of transmissibility and permeability as determined from these tests represented only the more porous sand zones in the tested area. However, the magnitude of variation of the coefficients may generally be representative for the geologic formations in this study area.

Porosity, permeability, and transmissibility of natural earth material may vary greatly even in the same locality. Usually the finer materials (such as fine sands, silts, tuffs, and clays) are much less permeable and transmit less water per equal cross-sectional area under the same hydraulic conditions than the coarser-grained sands and gravels. Other factors, such as cementation, solution cavities, and geologic structures (for example, fractures and faults) affect the porosity, permeability, and transmissibility of the earth material. Any number of combinations of these geologic influences may occur locally and affect the hydrology of an area.

Table 2.--Results of aquifer tests, Karnes County, Texas

Well [a]	Owner	Length of effective aquifer section (feet)	Stratigraphic unit	Field coefficient of transmissibility (gallons per day per foot)	Field coefficient of permeability (gallons per day per square foot)
D48 and D49	Karnes City	40	Catahoula Tuff	1,400	35
D50	Karnes City	93	Catahoula Tuff and Jackson Group	2,100	23
G20, G22, G23	City of Kenedy	62	Oakville Sandstone	14,000	225

[a] Well numbers refer to those in report by Anders (1962, p. G5).

Soils

Upland soils in the watershed are primarily deep, dark-colored, and fine- to medium-textured derived from chalky marl, clay, and sand which are the parent materials of the Catahoula Tuff and Oakville Sandstone. Soil formed on the Oakville Sandstone is moderately to highly permeable, whereas the finer-textured soil derived from the Catahoula Tuff is slightly to moderately permeable. Scattered alluvial sand and gravel deposits are found adjacent to the main channel and in narrow interstream terraces. Generally, the alluvial deposits are less than 20 feet in thickness and are of local extent only.

Land Use

Forty-six percent of the land is under cultivation, 46 percent is in pasture, 4 percent is formerly cultivated land reverting to pasture, and 4 percent is under miscellaneous usage.

Climate

The mean annual precipitation at Karnes City is 31.93 inches. Rainfall is fairly well distributed through the year with the large average monthly amounts occurring in April, May, June, and September. The minimum recorded annual rainfall at Karnes City was 16.68 inches in the 1956 calendar year and the maximum was 56.57 inches in 1935. During the study period, annual rainfall ranged from 11.84 inches during the 1956 water year (October 1, 1955 to September 30, 1956) to 39.14 inches during the 1958 water year. Mean annual precipitation for the period was 27.40 inches. The average annual temperature is 70°F, and average frost-free growing period is 285 days.

EROSION CONTROL AND FLOOD-RETARDATION MEASURES

Measures to reduce rates of runoff and to retard soil erosion, as of December 31, 1963, are summarized in the following table. Land-management practice data are given for only the watersheds for which the rates of runoff are accurately gaged by recording instruments.

Summaries of Land-Management Practices
Escondido Creek Watershed*

Total district cooperators as of December 31, 1963: 291 (68,337 acres).

Total area of watershed: 74,880 acres.

Practice	Unit	On the land as of December 31, 1963
Total Watershed		
Brush and weed control	Acres	12,348
Contour farming	Acres	53,862
Cover and green manure crop	Acres	12,688
Rotation hay and pasture	Acres	10,093
Diversion	Feet	100,320
Farm pond	Number	142
Floodwater-retarding structure	Number	11
Grassed waterway or outlet	Acres	839
Pasture planting and hayland planting	Acres	6,320
Range and pasture improvement	Acres	43,037
Terraces	Feet	11,288,640
Site No. 1		
Brush and weed control	Acres	0
Contour farming	Acres	2,046
Cover and green manure crop	Acres	1,336
Rotation hay and pasture	Acres	569
Diversion	Feet	1,584
Farm pond	Number	6
Floodwater-retarding structure	Number	1
Grassed waterway or outlet	Acres	41
Pasture planting and hayland planting	Acres	265
Range and pasture improvement	Acres	1,451
Terraces	Feet	288,288

*Data furnished by the U.S. Soil Conservation Service.

The 10 structures upstream from the gaging station have a combined capacity of 13,910 acre-feet and control an area of 36.5 square miles, or 50 percent of the drainage area. Table 3 gives pertinent physical data for each of the floodwater-retarding structures in the area studied.

INSTRUMENTATION

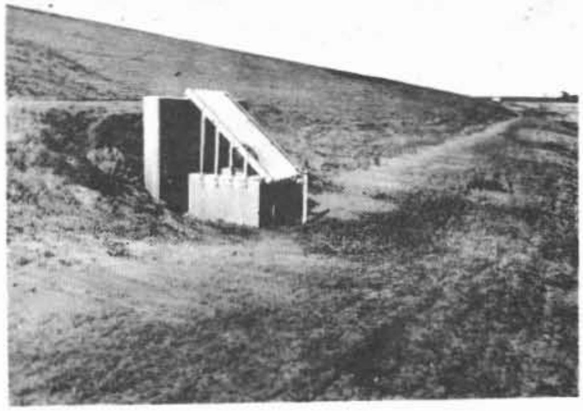
Precipitation was measured at two recording and six nonrecording rain gages. Water stage was recorded continuously at two floodwater-retarding pools (sites 1 and 11). These water-stage recorder installations are shown in Figure 5. Water stages at the remaining reservoirs were obtained by weekly readings of staff gages; the determination of the elevations of high-water marks was

Table 3.--Floodwater-retarding structure data, Escondido Creek study area

Site	Drainage area (sq mi)	Date dam completed	Date pool-level gage established	Datum of gage above mean sea level	Emergency spillway			Drop outlet		Portholes			Controlled opening		Pipe diameter through dam (in.)	Range of staff gages
					Number and width (ft)	Gage height (ft)	Contents (acre-feet)	Gage height (ft)	Pool contents (acre-feet)	Number and size (in.)	Gage height at bottom (ft)	Pool contents (acre-feet)	Gage height at bottom (ft)	Pool contents (acre-feet)		
1	3.29	9-21-54	10-11-54	350.0	1;250	27.7	905	18.0	220	1;10 dia.	16.0	150	9.2	23.2	12	0 -30.0
2	2.69	6-17-55	9-11-55	352.2	1;225	27.7	1,010	18.0	260	1;10x17	16.6	200	10.51	46.8	22	6.8-33.9
3	4.78	2-18-56	7- 5-56	381.0	1;350	36.0	1,730	23.0	447	2;10x10	18.0	189	11.23	14[a/]	17	6.8-40.7
4	6.24	11-17-56	2- 6-57	299.1	1;500	29.0	2,280	18.0	532	4;10x10 3; 8x10	13.5	200	7.25	18.2	28	3.4-33.9
5	1.48	5- 1-56	7- 5-56	373.7	1;150	28.6	580	18.0	115	Plugged	--	--	8.5	1.0	17	0 -30.5
6	2.29	3- 4-55	3-14-55	383.0	1;225	30.0	1,200	18.0	204	Plugged	--	--	6.5	10.5	14	3.4-33.9
7	2.12	2-18-56	7- 4-56	378.7	1;150	27.2	824	18.5	220	1; 6x18	18.0	199	7.2	10[a/]	17	0 -32.6
8	3.95	2-17-57	2- 5-57	338.7	2;150 150	29.1	1,470	18.0	400	2; 8x8	13.6	194	8.5	53.6	17	10.2-33.9
9	6.90	2-17-57	6- 5-58	385.0	1;450	29.5	3,050[a/]	18.0	601	4;10x10	13.8 12.0	190	6.3	40[a/]	19	10.2-33.9
10	2.75	10- 6-54	3-15-55	305.2	1;250	28.4	860	18.0	183	1;10	16.9	149	6.5	4[a/]	14	6.8-33.9
11	8.43	1-31-58	1-31-58	285.1	2;200 200	32.8	2,720	18.0	250	4;10x10	15.7	148	9.4	35.2	28	11.3-39.1

[a/] Estimated.

(a) Stream-gaging station
at Kenedy, Tex.

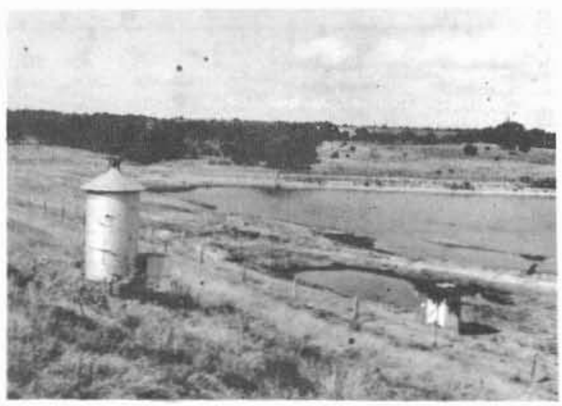


(b) Drop-outlet structure at
subwatershed No. I

(c) Subwatershed No. I
(after construction)

(d) Subwatershed No. I during flood
of Oct. 26, 1960

(e) Subwatershed No. II
(Dec. 2, 1958)



(f) Subwatershed No. II
(Dec. 29, 1959)

Figure 5

Typical Hydrologic Instruments and Structures

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included in the readings. Streamflow, made up of runoff from the Escondido Creek watershed, was measured at the gaging station, Escondido Creek at Kenedy, which was equipped with a continuous water-stage recorder. Suspended-sediment data were obtained at three stations in the site 1 watershed (Figure 6). Standard DH-48 hand samplers were used at each sampling point shown. In addition, automatic single-stage samplers were used for sampling the rising-stage floodwaters at stations A and B. Stream stages were obtained at stations A and B from readings of staff gages and crest-stage gages.

COMPUTATION OF INFLOW TO FLOODWATER-RETARDING POOLS

Inflow to all floodwater-retarding pools was computed from the relation: Inflow = outflow + evaporation + other pool consumption - precipitation on the pool ± change in pool contents, all quantities being expressed in acre-feet. The several items of this water budget were derived as follows.

Pool Outflow

All reservoir outflow was confined to discharge through the service outlet pipes except during the storm of October 24-26, 1960, when pond levels rose above the emergency spillway at sites 1 and 3. Maximum head on the spillway was 1.38 feet at site 1 and 0.46 foot at site 3. A curve of relation between head and pipe discharge was prepared for each floodwater-retarding outflow structure by making current-meter measurements of pipe discharge at various values of head. This curve, together with the reservoir-stage record, was used to compute pipe discharge. Emergency-spillway discharge for floodwater-retarding structures 1 and 3 was determined by current-meter measurements of flow in the spillway.

Pool Evaporation

Estimates of monthly evaporation in inches were prepared by the Texas Water Development Board and are shown in Table 4. These values were multiplied by the average monthly water-surface areas of the floodwater-retarding pools to obtain monthly values of evaporation in acre-feet.

Texas Water Development Board's evaporation estimates were made in accordance with the method described in Evaporation from Pans and Lakes (Kohler, Nordenson, and Fox, 1955), which relates lake evaporation to mean values of solar radiation, dewpoint temperature, wind movement, and air temperature. These climatologic parameters were derived for the study site by interpolation between observed values at the nearest Weather Bureau stations. For the 1955-63 period, the estimated annual evaporation for Escondido Creek ranged from 50.8 inches (for 1960) to 64.5 inches (for 1956). The estimated average annual evaporation for the period was 55.9 inches. Weather Bureau Technical Paper 37 (Kohler, 1959) indicates that average annual lake evaporation for the area is 56 inches.

Precipitation on the Pool

Monthly precipitation in feet on the floodwater-retarding pool was obtained from records of the nearest rain gage or combination of rain gages.

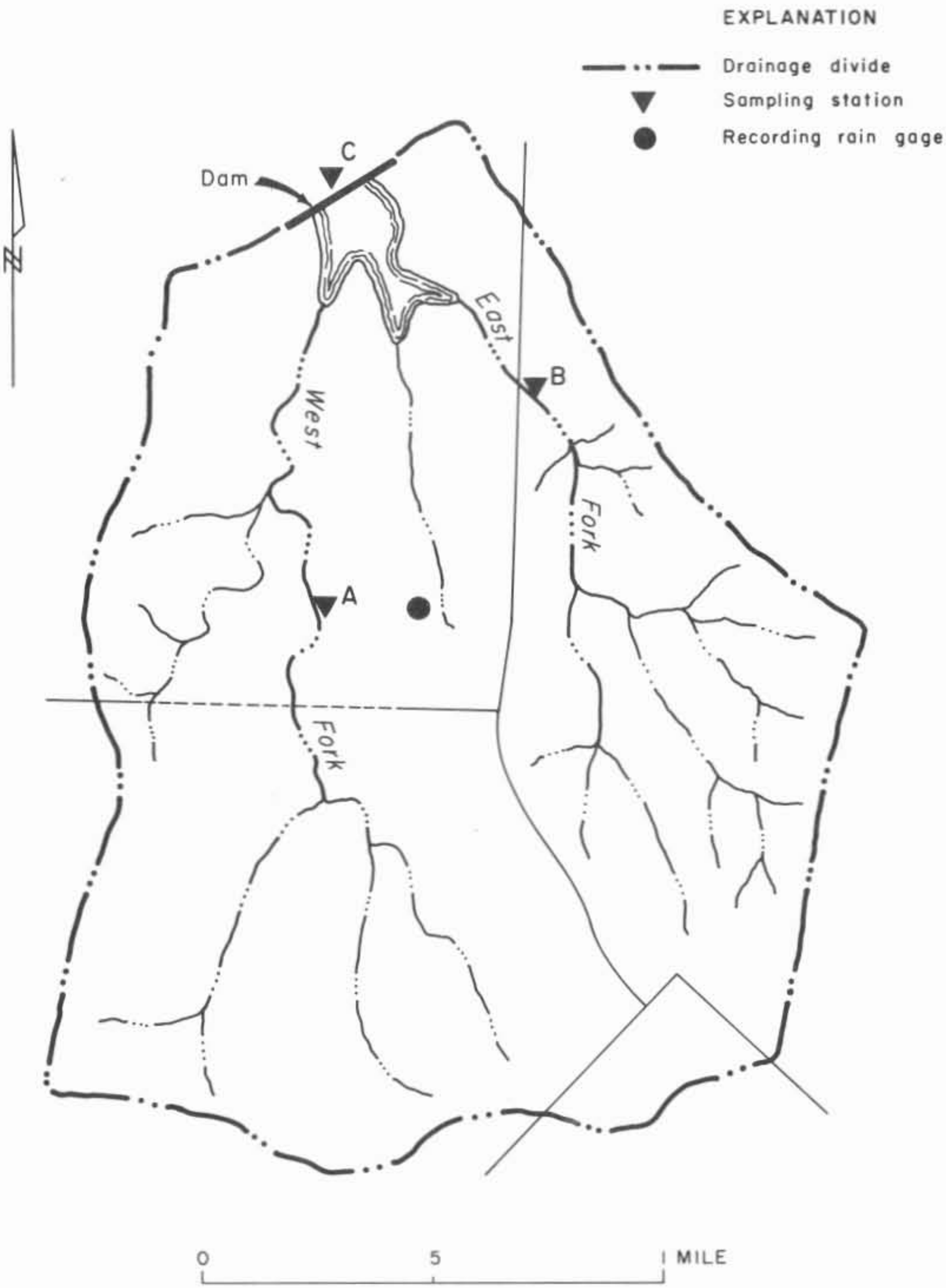


Figure 6

Locations of Sediment-Sampling Stations in Subwatershed No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

Table 4.--Estimated monthly lake-surface evaporation, in inches, for Escondido Creek watershed, October 1954 to September 1963

Water year \ Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual total
1955	4.6	3.4	3.1	2.2	2.5	3.9	5.5	6.7	8.0	7.4	6.5	4.9	58.7
1956	5.1	2.9	2.3	2.2	3.0	4.9	5.2	7.3	8.3	8.1	8.2	7.0	64.5
1957	4.8	2.8	2.9	1.9	2.4	3.7	3.8	5.5	6.4	8.3	7.6	5.5	55.6
1958	4.1	1.9	2.1	2.2	2.0	3.2	4.4	6.0	6.9	7.7	7.5	4.0	52.0
1959	2.7	2.4	2.0	1.9	1.7	4.8	4.3	5.7	6.7	7.1	6.4	5.4	51.1
1960	3.8	2.4	1.8	1.7	2.5	3.2	3.8	5.8	7.3	7.4	5.9	5.2	50.8
1961	3.5	2.1	1.4	1.8	2.7	4.8	5.4	7.0	6.5	6.5	6.7	6.0	54.4
1962	4.6	2.5	2.3	2.1	3.1	4.1	4.9	6.6	6.2	8.4	7.6	5.2	57.6
1963	4.6	2.8	1.8	2.5	2.8	4.6	5.2	6.2	7.0	7.8	7.5	5.7	58.5

This value multiplied by the average monthly pool surface area provides monthly values of precipitation on the pool in acre-feet.

Pool Contents

Pool contents were derived from capacity tables prepared from data supplied by the Soil Conservation Service for each reservoir. The data supplied by the Soil Conservation Service was based on topographic maps (4-foot contour interval) of the pool area.

Other Pool Consumption

Total monthly pool consumption in acre-feet was computed by multiplying the observed water-stage recession in feet by the monthly average pool surface area in acres. During periods of inflow or pipe outflow, total pool losses were interpolated between values of these losses preceding and following the inflow or outflow periods.

In the inflow equation "other pool consumption" is simply the difference between total pool consumption and evaporation. The term may apply to any combination of consumption, by seepage under or around the dam, by evapotranspiration from land peripheral to the pool, or by simple vertical seepage downward to the regional water table (in which case the consumption is, of course, beneficial in that ground-water supplies are augmented).

No appreciable seepage appeared as surface flow immediately below Escondido dams except during a few short periods of time following heavy inflow above the dams. Furthermore, no flow was recorded at the stream-gaging station at Kenedy for long periods of time; for example, 1962 had 328 days of no flow, and 1963 had 302 days of no flow. Thus, seepage water did not appear at the stream-gaging station as surface flow. The water-budget item "other pool consumption" must then be attributed jointly to evapotranspiration and seepage, the latter moving either vertically downward to the water table or as underflow through the valley alluvium. No data are available for the separate evaluation of evapotranspiration and seepage.

WATER BUDGET

Monthly water budgets were prepared for each of the floodwater-retarding structures (Table 12). The water-budget items are given to the nearest 0.1 acre-foot for sites 1 and 11, and to the nearest acre-foot for the remaining sites. This difference in figures reflects the relative refinement of the water-stage records collected at the two groups of study sites. For example, the record for sites 1 and 11 is accurate to 0.01 foot, and that for sites 2-10 is accurate to 0.1 foot. The combined annual budgets for all floodwater-retarding structures is shown in Table 5. The inflow shown in Tables 5 and 12 does not include rainfall on the pools.

Table 5.--Annual combined water budgets for floodwater-retarding structures 1-11 (in acre-feet)

[Inflow does not include rainfall on pools]

Water year	Change in content	Evapo-ration	Other pool consumption	Rainfall on pools	Discharge through outlets[a]	Inflow[b]
1955	+200	74	248	29	13	506
1956	-157	100	233	18	0	158
1957	+2,337	1,212	1,341	838	6,275	10,327
1958	-1,255	1,778	1,840	1,323	10,110	11,150
1959	-896	1,478	1,170	909	1,483	2,326
1960	+236	1,280	1,013	783	451	2,197
1961	-255	1,778	1,677	1,340	11,306	13,166
1962	-376	1,209	992	462	271	1,634
1963	+508	1,731	1,556	674	610	3,731
Total	+342	10,640	10,070	6,376	30,519	45,195

[a] Discharge from site 3 is not included.
[b] Inflow to site 4 was corrected for discharge from site 3 outlet.

Data shown in Table 5 indicate that a large percentage of the total inflow accounted for at the structures (inflow plus rainfall on pool) is often lost to evaporation, evapotranspiration, and seepage. The following shows the range of this pool consumption, along with the precipitation, for the period of study:

Water year	Pool consumption (percent of inflow) [a]	Precipitation (inches)
1955	60	18.36
1956	189	11.84
1957	23	38.00
1958	29	39.14
1959	82	30.71
1960	77	29.22
1961	24	35.11
1962	105	22.19
1963	75	22.01

[a] Inflow includes rainfall on pools.

More comprehensive analyses are made using data from Table 5 and 12 in the section of this report entitled: "Hydrologic Effects of the Floodwater-Retarding Structures."

SEDIMENT REGIMEN

As an index to the sediment regimen in the study area, data were collected for the determination of the sediment inflow, storage, and outflow at floodwater-retarding structure 1. The locations of the three sampling stations involved (A, B, and C) have already been shown in Figure 6. The drainage area upstream from sampling station A is about 1 square mile, or 30 percent of the total area upstream from floodwater-retarding site 1. The suspended-sediment concentrations of the inflow and the outflow as well as particle-size distributions were determined. Also, estimates were made of the initial specific weight and of the specific weight after compaction of sediment deposited in the reservoir. Water discharge was not measured at the inflow sampling stations, but was determined as the residual of the water budget for the reservoir as discussed in the preceding report section.

Sediment Yields

Primarily, two forks drain the watershed above the reservoir. The upper tributaries of the west fork end in deep headcuts; downstream from the headcuts, the channels are entrenched and have steep, eroded banks (Figure 7). In contrast, the channel of the east fork is subdued and most of the channel is overgrown with grasses and weeds (Figure 8).

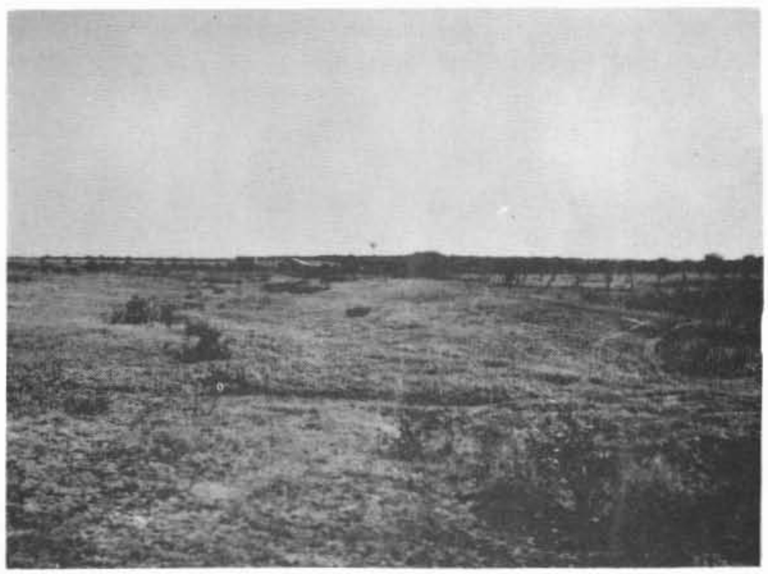
The west fork was degrading at the sampling station from the beginning of the study in 1955 until the spring of 1956 when the channel at and below the sampling station began to aggrade. About 4 feet of sand was deposited in the immediate area around the sampling platform between 1956 and 1960. Deposition of several feet of sand also occured between the sampling station and a point about a quarter of a mile above the reservoir. Only a small amount of sand reached the reservoir. At most places the deposits have now been covered with grasses, weeds, and shrubs.

At the beginning of the study, the suspended-sediment concentrations in the west fork frequently exceeded 10,000 ppm (parts per million). Sediment concentrations of 20,000 to 30,000 ppm were not uncommon and one suspended-sediment sample had a concentration of 66,000 ppm. Most of the sediment apparently came from headward erosion of gullies, rather than from sheet erosion of the cultivated fields. Near the end of the study period, the sediment concentrations were somewhat lower, approximately 5,000 ppm.

Sediment samples of the inflow on both forks were collected for particle-size analyses (Table 6), and the results of these analyses were plotted on a triangular coordinate graph (Figure 9). The samples contained 2 to 46 percent sand, 14 to 49 percent silt, and 33 to 84 percent clay.

Arithmetic averages of the results of particle-size analyses of inflow samples that were chemically dispersed before analysis are shown in Figure 10. The particle-size distribution of the suspended-sediment discharge was about

(a) At upper end of the west fork.



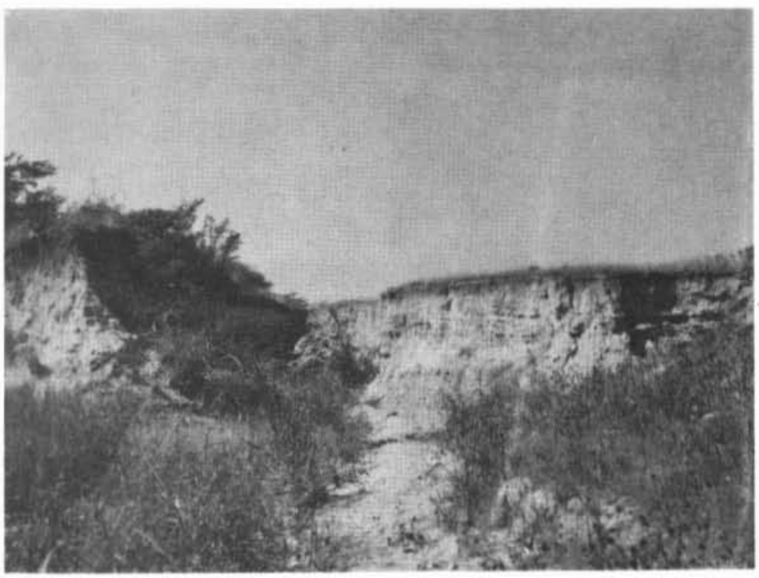
(b) On tributary to the lower end of the west fork.

Figure 7

Headcutting Gullies on the West Fork Above Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

(a) Channel of the east fork, looking upstream from county crossing at sediment-sampling station B.



(b) Channel of the east fork, looking upstream from head of reservoir.

Figure 8

East Fork Channel Above Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

22 percent sand (>0.062 mm), 24 percent silt (<0.062 mm; >0.004 mm), and 54 percent clay (<0.004 mm).

The relation between the percentages of clay and silt and the sediment concentration of inflow is shown in Figure 11. Data indicate that the clay fraction decreases and the silt fraction increases as the sediment concentration increases.

In addition to the sediment samples analyzed for particle-size distribution (Table 6), many other samples collected during storms at sampling station A (Figure 6), were analyzed for suspended-sediment concentration only. Results of these analyses were then plotted along with the inflow hydrograph and accumulated rainfall. Typical graphs are in Figures 12 and 13. Although extensive suspended-sediment concentration data on inflow were obtained at sampling stations A and B, estimates were not made of total sediment infow to reservoir No. 1 because of the absence of water discharge at those stations.

Samples of the outflow were collected at the outlet of the reservoir and analyzed both for sediment concentration and for size distribution (Table 7 and Figure 9). From 87 to 100 percent of the suspended-sediment discharge was in the clay-size range.

Table 8 shows the quantity of sediments in tons per month discharged from the reservoir. During water years 1956, 1962, and 1963 no sediment was discharged from the reservoir, and in water years 1955, 1959, and 1960 only minor amounts were discharged. Most of the sediment was discharged during the period October 25 to December 25, 1960, when the reservoir spilled 1,106 acre-feet of water following the 11.5-inch rain of October 24-26.

Specific Weight

The specific weight of a deposit formed from the suspended sediment that is carried into the reservoir can be computed by a formula derived by Lane and Koelzer (1943), in which the particle-size distribution, compaction time, and reservoir operation are considered. According to this formula, which has been modified to express the size distribution by weight rather than volume (Wark and others, 1961), the

$$\text{initial specific weight} = \frac{100}{\frac{\text{percent clay}}{30} + \frac{\text{percent silt}}{65} + \frac{\text{percent sand}}{93}}.$$

The percentages of clay, silt, and sand are 54, 24, and 22, respectively (Figure 10); therefore, the initial specific weight is 41 pounds per cubic foot. In a reservoir that is normally dry, compaction of the deposits reaches a maximum in a short time. Under this condition the approximate specific weight would be:

$$W = \frac{100}{\frac{\text{percent clay}}{78} \quad \frac{\text{percent silt}}{82} \quad \frac{\text{percent sand}}{93}}.$$

So, $W = \frac{100}{1.22} = 82$ pounds per cubic foot.

Table 6.--Particle-size analyses of suspended-sediment samples, west fork inflow to Escondido Creek reservoir No. 1 sampling station A

(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection	Time (24 hour)	Sediment concentration (ppm)	Suspended sediment: Percent finer than size indicated, in millimeters									Method of analysis
			0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	
EAST FORK												
Apr. 15, 1955	(a)	--	--	69	79	80	85	88	91	96	100	SPWC
Aug. 11	(a)	9,980	--	53	62	75	78	85	92	98	100	SPWC
June 18, 1956	(a)	6,300	--	68	79	83	89	94	97	99	100	SPWC
Apr. 1, 1957	(a)	32,000	--	52	64	76	85	91	95	99	100	SPWC
Apr. 20	(a)	13,100	41	56	68	78	86	94	98	99	100	SBWC
Feb. 10, 1958	(a)	26,300	40	49	56	62	69	76	88	98	100	SBWC
WEST FORK												
May 12, 1955	(a)	30,000	48	59	68	78	89	95	99	100	--	SPWC
Do.	(a)	19,200	46	51	59	67	74	80	90	95	100	SPWC
June 10	1930	5,260	62	72	82	89	95	97	99	100	--	SPWC
Do.	1940	4,840	58	74	82	90	94	97	99	100	--	SPWC
Do.	1950	4,180	57	72	77	82	86	90	96	100	--	SPWC
Do.	--	2,940	67	84	88	91	92	98	100	--	--	SPWC
July 9	(a)	18,700	--	57	68	81	90	92	96	100	--	SPWC
Do.	0945	20,100	--	50	61	74	82	91	98	100	--	SPWC
Do.	0945	20,100	--	2	17	64	80	88	98	100	--	SPN
Do.	1007	13,700	--	56	69	82	91	97	99	100	--	SPWC
Do.	1007	13,700	--	3	28	75	87	96	99	100	--	SPN
July 12	1815	15,700	--	54	58	67	76	82	92	99	100	SPWC
Do.	1833	11,800	--	51	58	67	73	79	85	96	100	SPWC
Do.	1850	11,000	--	57	64	74	79	88	92	99	100	SPWC
Aug. 11	(a)	34,000	--	49	57	68	76	87	95	99	100	SPWC
Do.	(a)	16,000	--	47	57	64	73	82	92	99	100	SPWC
Do.	(a)	10,300	--	52	61	68	77	86	93	99	100	SPWC
Do.	2020	6,000	--	9	52	64	69	74	85	97	100	SPN
Do.	2023	4,960	--	61	68	70	78	83	90	98	100	SPWC
Do.	2055	3,750	--	28	62	75	85	87	94	99	100	SPN
Do.	2100	4,000	--	68	73	75	80	91	95	100	--	SPWC
Aug. 14	(a)	22,600	--	45	50	56	63	94	99	100	--	SPWC
Do.	2020	6,470	--	59	69	74	80	88	95	100	--	SPWC
Do.	2023	6,190	--	57	64	72	79	86	95	100	--	SPWC
Aug. 30	(a)	24,300	--	51	59	69	78	86	95	100	--	SPWC
May 2, 1956	(a)	23,400	--	53	61	70	79	87	96	100	--	SPWC
May 15	1355	5,900	--	57	61	65	71	78	89	99	100	SPWC
Do.	1345	6,840	--	58	64	69	73	78	89	98	100	SPWC
June 18	(a)	29,000	--	44	51	58	65	73	85	99	100	SPWC
Do.	(a)	14,800	--	44	47	54	62	85	92	99	100	SPWC
Do.	(a)	11,500	--	52	60	68	75	84	92	100	--	SPWC
July 24	1630	17,400	--	66	73	86	94	99	100	--	--	SPWC
Dec. 18	--	3,020	--	52	53	55	60	65	78	99	100	SPWC
Feb. 23, 1957	0905	28,800	--	42	47	54	60	67	76	92	99	SPWC
Mar. 3	1650	66,400	--	33	39	44	51	62	79	94	99	SPWC
Mar. 31	1035	22,900	--	36	46	47	51	54	64	87	98	SPWC
Apr. 15	1730	42,100	--	43	52	59	67	74	81	94	100	SPWC
Apr. 27	--	4,620	--	68	69	73	77	84	89	94	95	SPWC
May 4	1530	11,000	--	43	58	62	69	74	85	95	99	SPWC
May 18	1343	22,300	--	38	45	48	54	63	72	87	99	SPWC
May 31	1042	14,000	--	50	56	64	71	78	85	97	100	SPWC
Nov. 11	1015	9,340	44	54	64	70	77	81	87	96	100	SBWC
Do.	1017	7,420	--	--	8	83	85	87	93	99	100	SBN
Jan. 5, 1958	1400	6,360	35	41	46	49	54	61	78	98	100	SBWC
Do.	1404	6,070	5	7	50	53	58	63	79	95	99	SBN
Feb. 22	0906	3,140	56	62	66	72	79	88	97	100	--	SBWC
Do.	0940	4,660	11	20	47	53	58	66	83	98	100	SBN
Do.	1040	4,490	35	41	44	48	51	56	74	95	100	SBWC
May 3	1155	7,950	41	48	56	60	65	74	87	99	100	SBWC
Do.	1200	7,390	5	10	56	61	67	77	91	99	100	SBN
June 25, 1959	1225	1,650	--	66	71	72	74	78	79	88	100	SPWC
Do.	1230	6,030	--	70	72	85	95	96	96	98	100	SPWC
Oct. 4	0855	8,550	--	51	58	64	70	76	89	99	100	SPWC
Do.	0959	7,130	--	54	60	66	72	77	90	99	100	SPWC
Do.	1121	5,950	--	56	63	69	76	82	94	100	--	SPWC
July 17, 1960	--	14,100	45	61	67	75	82	89	95	100	--	SBWC
July 18	--	8,390	--	64	--	76	--	80	88	98	100	SPWC
Aug. 28	1749	7,010	--	63	--	71	--	84	93	99	100	SPWC
Aug. 29	1658	6,800	--	65	--	76	--	89	96	100	--	SPWC
Oct. 14	0932	8,080	--	63	--	72	--	81	89	99	100	SPWC

a Sample taken by automatic single-stage sampler.

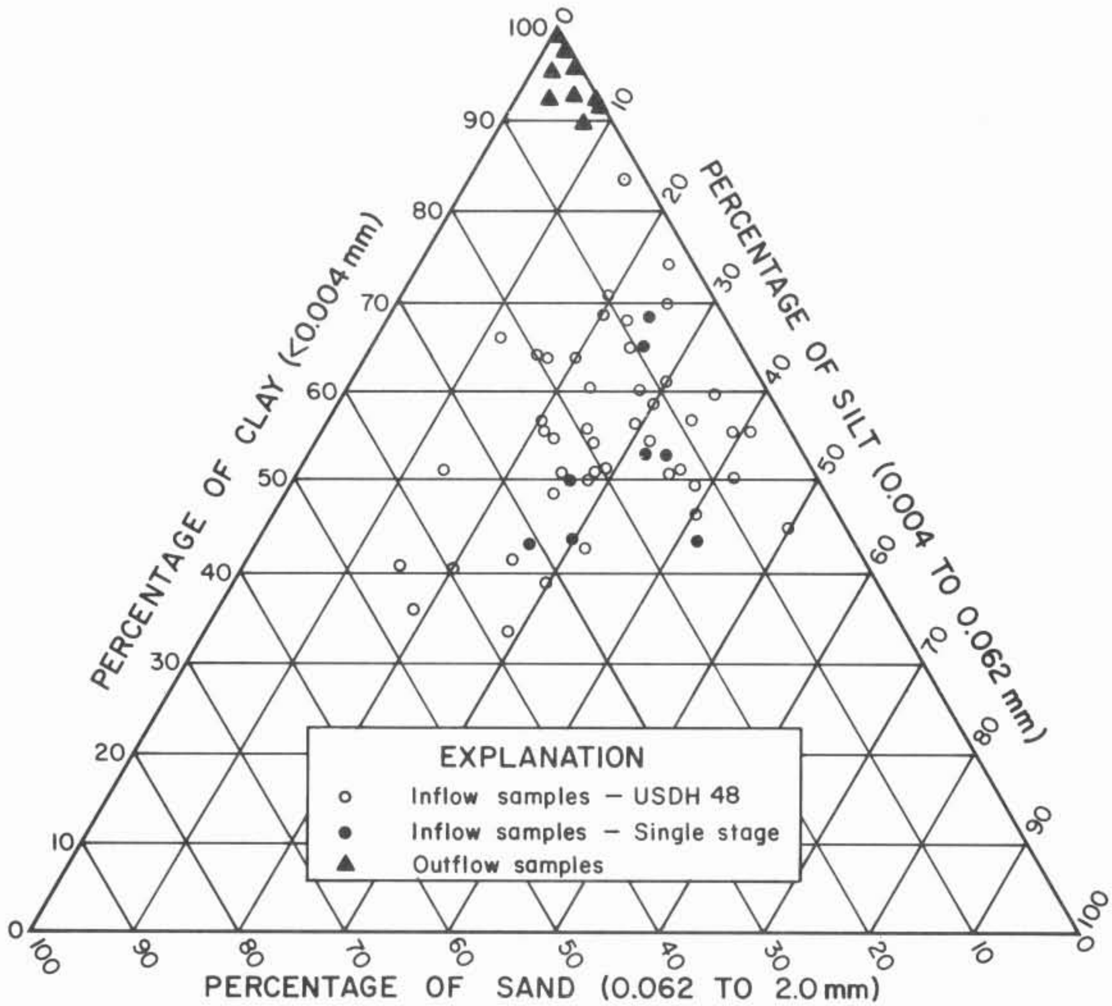


Figure 9

Percentages of Clay, Silt, and Sand in Suspended-Sediment Samples of Inflow and Outflow at Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

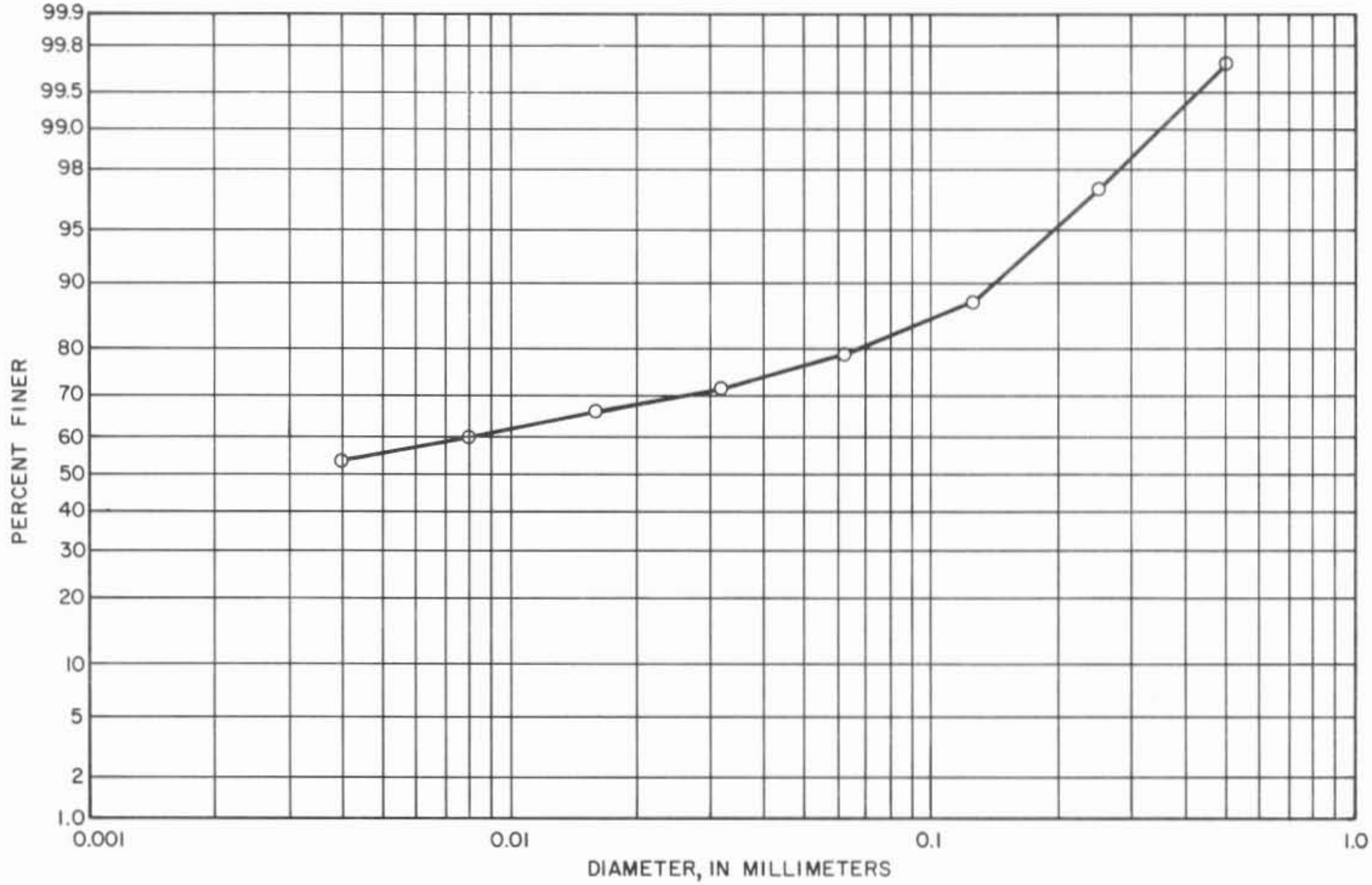


Figure 10

Arithmetic Average of Particle-Size Analyses, West Fork Above Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

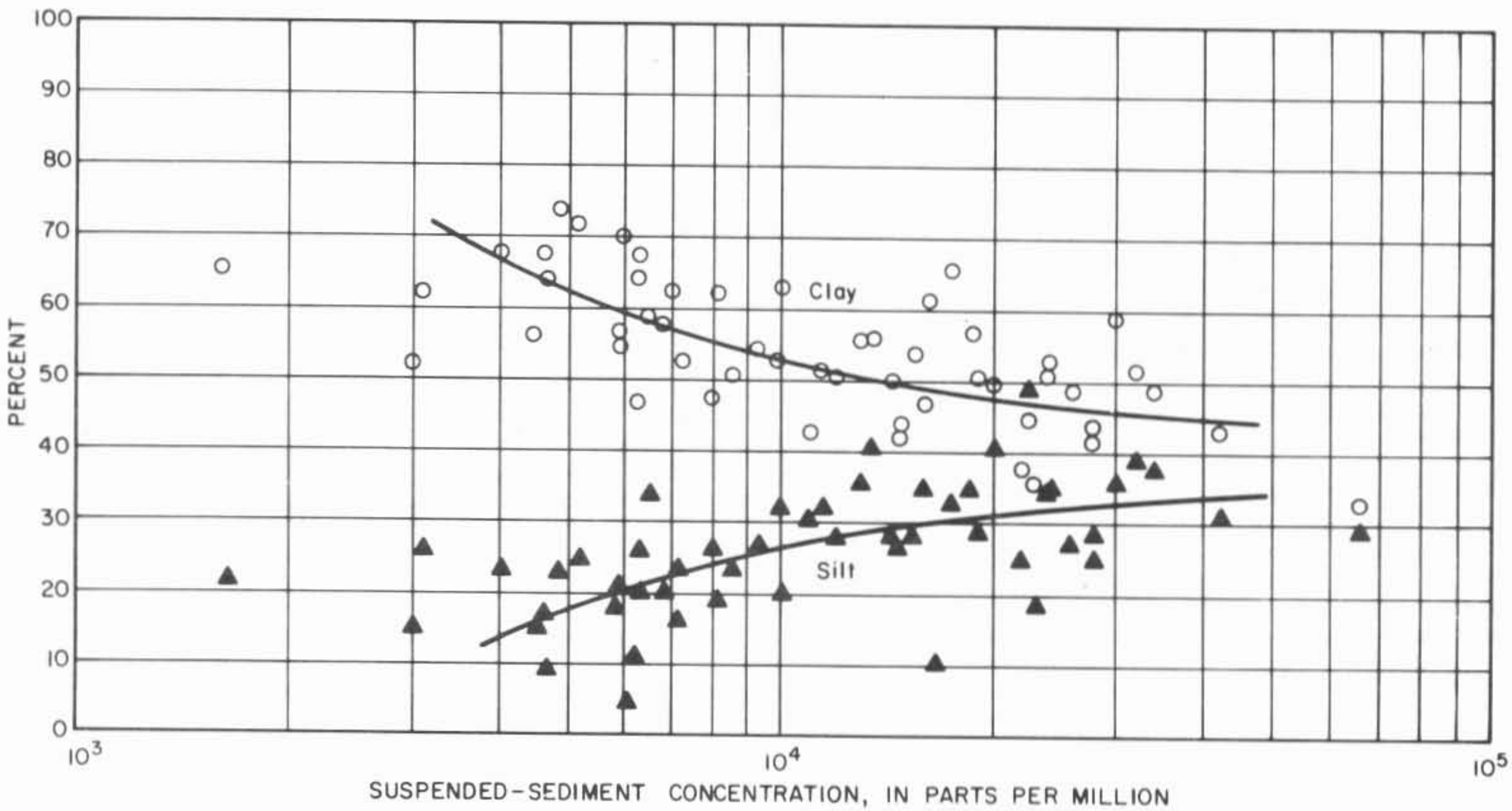


Figure 11

Relation of Percentages of Clay and Silt to Suspended-Sediment Concentration of Inflow Samples, Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

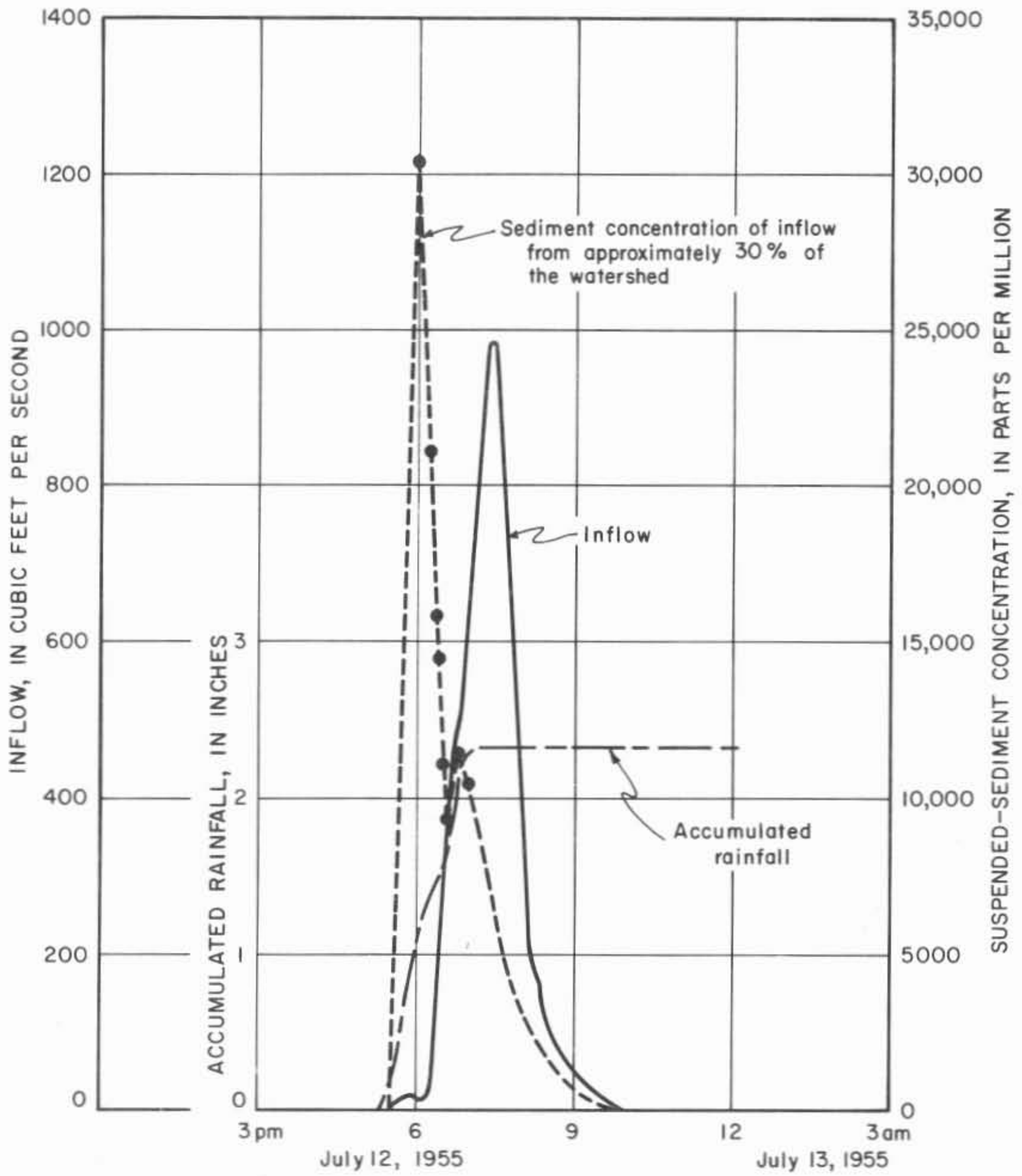


Figure 12

Inflow Hydrograph, Suspended-Sediment Concentration Graph, and Accumulated Rainfall for Storm of July 12-13, 1955, at Reservoir No. 1

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

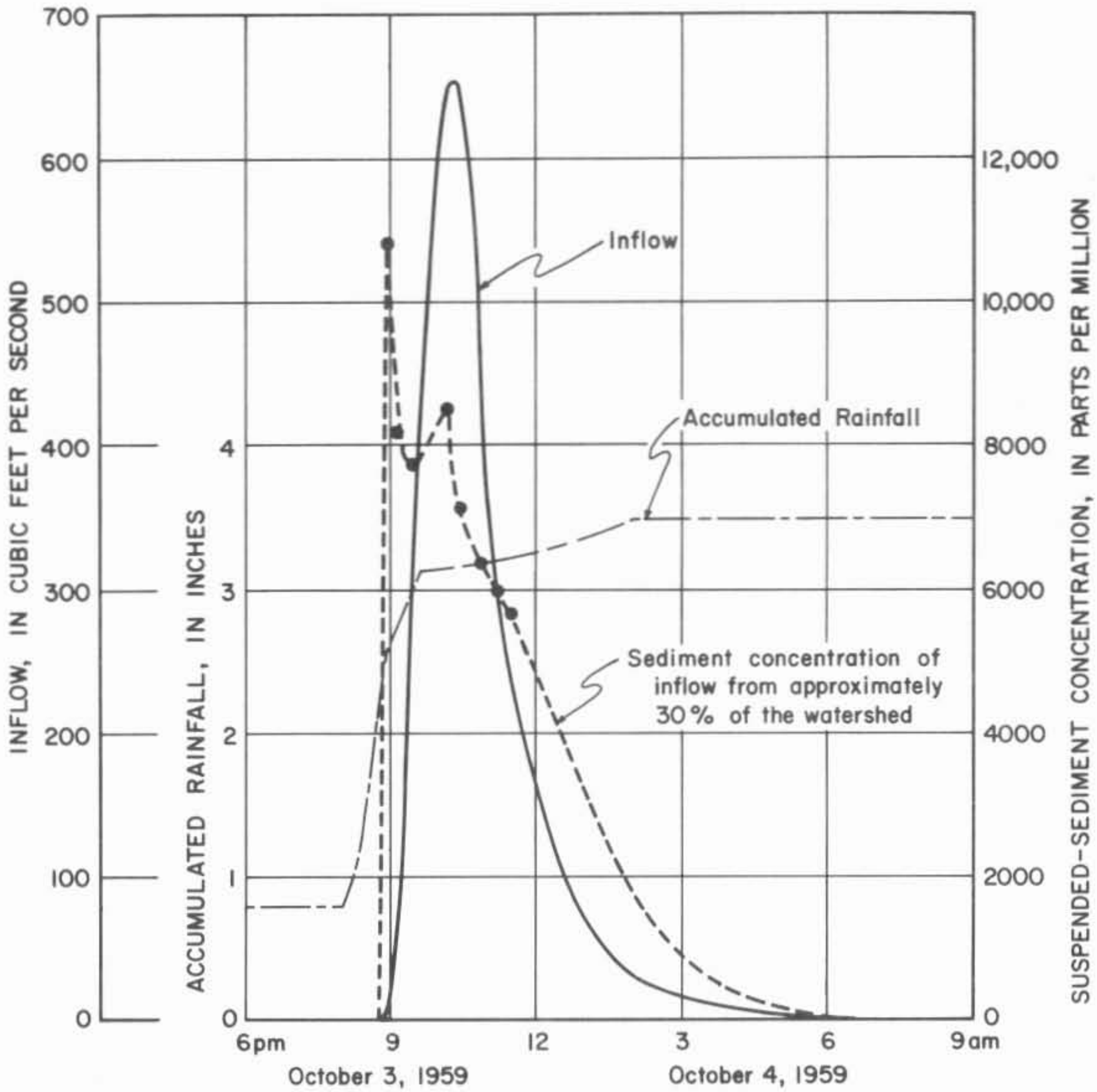


Figure 13

Inflow Hydrograph, Suspended-Sediment Concentration Graph, and Accumulated Rainfall for Storm of October 3-4, 1959, at Reservoir No. 1

U. S. Geological Survey in cooperation with the Texas Water Development Board and others

Table 7.--Particle-size analyses of suspended sediment in outflow from Escondido Creek reservoir No. 1

(Methods of analysis: B, bottom withdrawal tube; P, pipette; S, sieve; N, in native water; W, in distilled water; C, chemically dispersed)

Date of collection	Time	Discharge (cfs)	Suspended sediment										Methods of analysis
			Concentration of sample (ppm)	Percent finer than indicated size, in millimeters									
				0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	
May 13, 1957------	1833	2.5	123	98	100	--	--	--	--	--	--	--	BWC
June 10-----------	--	7.3	130	99	100	--	--	--	--	--	--	--	BWC
Jan. 6, 1958------	1435	2.0	222	92	99	--	--	--	100	--	--	--	SBWC
Do.-------------	1445	2.0	227	14	29	84	100	--	--	--	--	--	SBN
Jan. 12, 13-------	--	3.0	174	95	96	97	--	--	98	99	100	--	SBWC
Do.-------------	--	3.0	165	33	68	96	99	99	100	--	--	--	SBN
Jan. 27-----------	1450	.7	151	80	90	93	95	97	99	99	100	--	SBWC
Do.-------------	1450	.7	169	64	83	87	96	98	99	99	100	--	SBN
Feb. 21-26--------	--	6.0	113	42	72	97	--	--	99	99	100	--	SBN
Do.-------------	--	6.0	113	93	96	98	--	--	99	99	100	--	SBWC
Mar. 4-7----------	--	1.8	110	86	87	88	90	93	96	98	99	100	SBWC
May 4-------------	--	8.0	207	97	98	--	--	--	100	--	--	--	SBWC
Do.-------------	--	8.0	207	92	99	--	--	--	100	--	--	--	SBN
May 8-------------	--	7.8	289	92	94	96	--	--	98	100	--	--	SBWC
Do.-------------	--	7.8	289	51	88	92	95	97	99	100	--	--	SBN
Oct. 26, 1960-----	1100	10	1,250	--	93	--	97	--	100	--	--	--	SPWC
Do.-------------	1315	12	1,290	—	92	96	99	--	100	--	--	--	SPWC
Do.-------------	1350	a164	329	91	93	94	94	95	96	98	100	--	SBWC
Oct. 27-----------	1335	12	828	93	97	98	99	100	--	--	--	--	BWC

a Spillway flow.

Table 8.--Suspended-sediment discharge and volume of outflow from reservoir No. 1

Month	Water outflow (acre-feet)	Suspended-sediment discharge (tons)
1955		
July	12.9	1[a]
1957		
April	.2	.1
May	80.0	20.3
June	192	33.0
November	1.0	1[a]
1958		
January	77.0	14.5
February	112	12.8
March	36.0	2.5
May	194	34.1
1959		
January	.3	[b]
February	1.0	.1[a]
March	1.9	.1[a]
September	.8	.1[a]
October	10.4	1[a]
1960		
July	10.5	1[a]
October	334	191.9
November	575	23.0
December	200	12.5
1961		
January	32.0	1.2
February	32.0	1.9
May	.7	[b]
1963		
April	2.3	[b]
August	1.3	[b]
Total	1,907.3	352.1

[a] Estimated.
[b] Less than 0.05 ton.

Trap Efficiency

The Soil Conservation Service surveyed reservoir No. 1 on June 21, 1964, and found that 18.5 acre-feet of sediment had been trapped in the reservoir. From October 1954 to September 1963, approximately 0.5 acre-foot of sediment was discharged from the reservoir. Thus, 19 acre-feet of sediment was produced on the upstream watershed during a 9.7-year period. This amount is equivalent to a sediment production rate of 0.59 acre-foot per square mile of drainage area per year. The trap efficiency for the period of operation, October 1954 to June 1964, was 97.4 percent.

CHEMICAL QUALITY

Sixteen water samples from reservoir No. 1 were analyzed for chemical quality, and the results were recorded (Table 9). The water contained considerable quantities of calcium and bicarbonate, which usually have a flocculating effect on the clay particles and speed their settlement in a reservoir. The relatively high trap efficiency of reservoir No. 1 has been attributed in part to the chemical content of the inflow. The dissolved-solids concentration ranged from 71 to 183 ppm.

HYDROLOGIC EFFECTS OF THE FLOODWATER-RETARDING STRUCTURES

Change in Runoff-Rainfall Ratios

During the study period October 1, 1954, to September 30, 1963, annual rainfall on the basin above the stream-gaging station ranged from 11.84 inches in the 1956 water year to 39.14 inches in the 1958 water year. Monthly and annual precipitation are shown in Table 10.

The annual runoff response to such variable rainfall has been summarized (Table 11) for each of the 11 drainage areas above floodwater-retarding structures and also for the drainage area between the structures and the stream-gaging station. Runoff for the area between the structures and the stream-gaging station was computed as the total runoff gaged at the station less the outflow from the structures. Above the floodwater-retarding structures, as a group, runoff ranged from only 1 percent of rainfall in the dry year of 1956 to 20 percent of the rainfall in the wet year of 1958; below the structures, runoff ranged from 2 percent of the rainfall in 1956 to 16 percent in 1961.

Considerable difference exists in the runoff-rainfall ratios above and below floodwater-retarding structures during the two periods 1955-58 and 1959-63. During the former period, the average annual runoff-rainfall ratio above the structures was considerably higher than that below the structures, averaging 0.12 above and 0.05 below; whereas, during the latter period, the runoff-rainfall ratios above and below the structures were approximately equal, averaging 0.08 above and 0.07 below. Figure 14 shows the average annual runoff-rainfall ratios for the watershed above each structure for water years 1959-63.

There is a possible explanation for the anomalous runoff-rainfall ratios observed. Seepage from the floodwater-retarding structures, since their increase in number from 4 to 9 in 1957, may be supplying moisture to the

Table 9.--Chemical analyses of water, Escondido Creek reservoir No. 1

(Results in parts per million except as indicated)

Date of collection	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25° C)	pH
												Calcium, magnesium	Noncarbonate			
July 13, 1955----------	10	32	1.5	4.5	4.9	114	2.9	2.0	0.4	3.8	123	86	0	0.2	230	7.5
Jan. 4, 1956----------	3.0	24	2.7	12	--	108	1.5	3.8	.5	1.4	115	72	0	.6	184	7.3
Feb. 25, 1957----------	5.0	21	1.7	12		83	7.2	4.5	.5	3.5	96	59	0	.7	143	7.5
Mar. 12---------------	11	22	1.3	10		87	3.4	3.2	.5	3.0	97	61	0	.6	164	7.8
Apr. 17---------------	12	30	1.6	4.9	6.2	111	2.8	2.5	.5	3.2	119	81	0	.2	166	6.9
Apr. 22---------------	18	42	2.3	14		143	5.4	10	.8	5.0	183	113	0	.6	285	7.5
Apr. 27---------------	7.8	19	.8	4.9		71	.6	.0	.5	2.0	71	51	0	.3	127	7.9
Sept. 30--------------	6.0	23	1.6	6.8	8.0	96	3.8	4.5	.2	1.0	102	64	0	.4	174	7.4
Nov. 18---------------	--	--	--	--	--	118	--	2.5	--	--	--	88	0	--	205	7.2
Jan. 6, 1958----------	--	--	--	--	--	104	--	2.4	--	--	--	77	0	--	170	7.6
Jan. 27---------------	--	--	--	--	--	106	--	3.0	--	--	--	75	0	--	155	8.2
May 28----------------	--	--	--	--	--	104	--	3.0	--	--	--	77	0	--	180	7.9
Oct. 26, 1959----------	12	36	2.0	3.8	7.4	131	.6	3.0	.4	.8	143	98	0	.2	233	7.0
Mar. 10, 1960----------	8.7	36	2.0	5.0	6.3	126	3.8	3.0	.2	4.0	131	98	0	.2	228	7.0
Aug. 2----------------	8.0	43	2.2	12		163	.6	4.8	.3	.2	151	116	0	.5	271	7.0
Mar. 9, 1961----------	1.0	42	3.0	15		134	6.8	22	.2	.8	157	117	7	.6	303	7.0

Table 10.--Monthly and annual precipitation, in inches, on the Escondido Creek study area

Water year \ Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual total
1955	0.27	1.77	0	1.09	1.86	0.01	0.05	4.28	1.14	1.93	4.74	1.22	18.36
1956	.43	1.77	0	.32	.52	.32	.98	2.86	.87	.43	1.29	2.05	11.84
1957	2.41	1.30	2.43	.20	1.91	4.37	6.51	6.52	1.19	0	2.13	9.03	38.00
1958	1.04	6.14	1.11	5.91	4.94	1.06	.58	6.08	2.36	1.59	0	8.30	39.14
1959	6.47	.99	1.46	.27	3.55	.19	3.49	2.45	4.13	1.07	2.97	3.67	30.71
1960	4.33	.66	2.26	1.11	2.16	2.07	1.63	1.54	3.96	2.68	5.74	1.08	29.22
1961	12.45	3.91	3.89	1.53	2.29	.31	1.85	.79	2.86	1.64	1.09	2.50	35.11
1962	2.35	3.10	.45	.70	1.15	1.26	3.74	1.39	3.97	0	.14	3.94	22.19
1963	1.72	3.44	3.96	.48	2.05	.11	2.66	.18	4.16	1.07	.22	1.96	22.01
Average	3.50	2.56	1.77	1.29	2.27	1.08	2.39	2.90	2.74	1.16	2.04	3.75	27.40
24-year average Karnes City	2.82	2.01	2.20	2.05	1.89	1.58	2.50	4.07	2.99	2.39	3.11	4.32	31.93

Table 11.--Comparison and average of annual runoff-rainfall ratios above and below floodwater-retarding structures

Drainage area considered	Runoff-rainfall ratio, by water year									Average 1959-63
	1955	1956	1957	1958	1959	1960	1961	1962	1963	
Site 1	0.09	0.03	0.14	0.11	0.01	0.05	0.18	0.02	0.07	0.07
Site 2			.12	.18	.01	.02	.18	.01	.10	.06
Site 3				.17	.02	.05	.28	.03	.09	.09
Site 4				.14	.02	.02	.24	.02	.06	.07
Site 5				.24	.05	.04	.25	.02	.08	.09
Site 6		[a]	.27	.26	.08	.04	.32	.04	.07	.11
Site 7				.24	.09	.06	.12	.02	.08	.07
Site 8				.22	.08	.09	.13	.05	.06	.08
Site 9					.01	.01	.05	.02	.06	.03
Site 10		[a]	.18	.22	.09	.03	.11	.05	.10	.08
Site 11					.02	.01	.04	.04	.05	.03
Gaged sites	0.09	0.01	0.17	0.20	0.05	0.04	0.19	0.03	0.08	0.08
Gaging station less sites 1-10	0.04	0.02	0.09	0.04	0.04	0.04	0.16	0.03	0.06	0.07

[a] Less than 0.005.

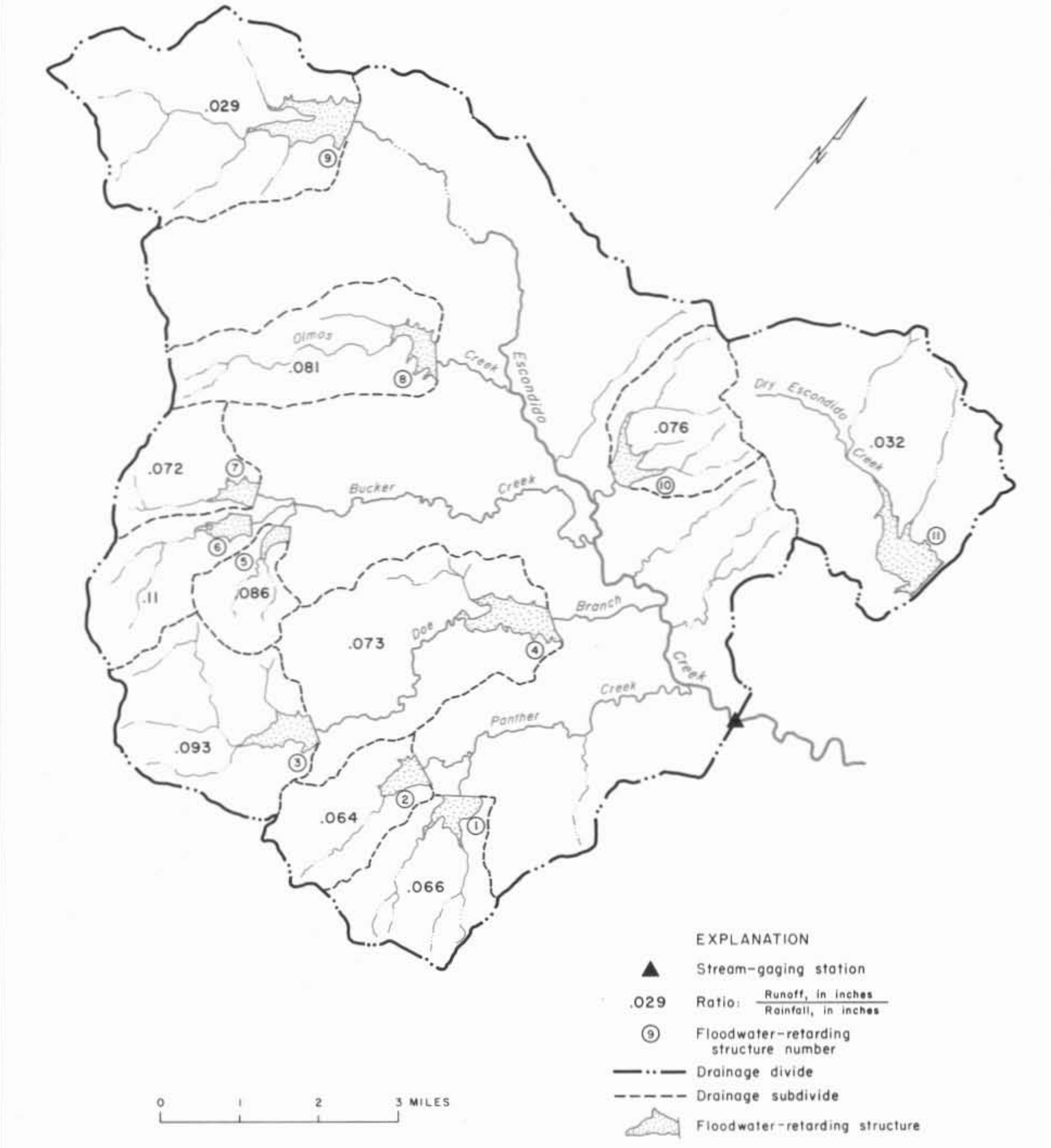


Figure 14

Average Annual Runoff-Rainfall Ratios Above Floodwater-Retarding Structures for Water Years 1959-63

U.S. Geological Survey in cooperation with the Texas Water Development Board and others

formation and to the sediments under and bordering the stream channels, thereby reducing stream-channel transmission losses. This assumption implies that prior to 1959 considerable amounts of water entering stream channels above the stream-gaging station were lost to valley rocks and alluvium which were largely dehydrated between storms. With the building of additional reservoirs in 1957 and 1958, the increased seepage from the floodwater-retarding structures may have created a continuously wetted volume of rock and alluvuim along the stream channels, thus lowering the subsequent channel transmission losses.

Pool Discharge-Inflow Ratios

Another interesting aspect of the runoff observed is the relation between the ratio of annual pool discharge, from the floodwater-retarding structures through the outlet pipes, to the inflow above them and the annual precipitation on the basin. The ratio of annual pool discharge to annual pool inflow is perhaps the best available measure of the effects the structures have on downstream streamflow. Relating this ratio to the annual precipitation affords a convenvenient picture of what to expect under different climatic cycles. The annual pool discharge to pool inflow ratios for the group of floodwater-retarding structures 1-11 and the annual precipitation are as follows:

Water year	Ratios: Pool discharge / Pool inflow [a]	Precipitation (inches)
1955	0.03	18.36
1956	0	11.84
1957	.61	38.00
1958	.91	39.14
1959	.64	30.71
1960	.21	29.22
1961	.86	35.11
1962	.17	22.19
1963	.16	22.01

[a] Pool inflow does not include rainfall on pools.

Data in the preceding tabulation are presented graphically in Figure 15. On the basis of the relation shown in this graph, the pool discharge from floodwater-retarding structures 1-11 is 60 percent of the inflow above the structures for an annual precipitation of 32 inches on the watershed, the latter figure being the 24-year average annual precipitation at Karnes City. With an annual precipitation of 40 inches, the pool discharge may exceed 90 percent of the inflow, whereas drought years of less than 20 inches of rainfall may result in no pool discharge at all from the floodwater-retarding structures.

Flood Control by the Structures

As stated in the introduction the primary purpose of the Soil Conservation Service floodwater-retarding structures is to impound temporarily the runoff from the upstream drainage areas and release it through drop-outlet pipes designed to carry flow which will not exceed the capacity of the stream channel

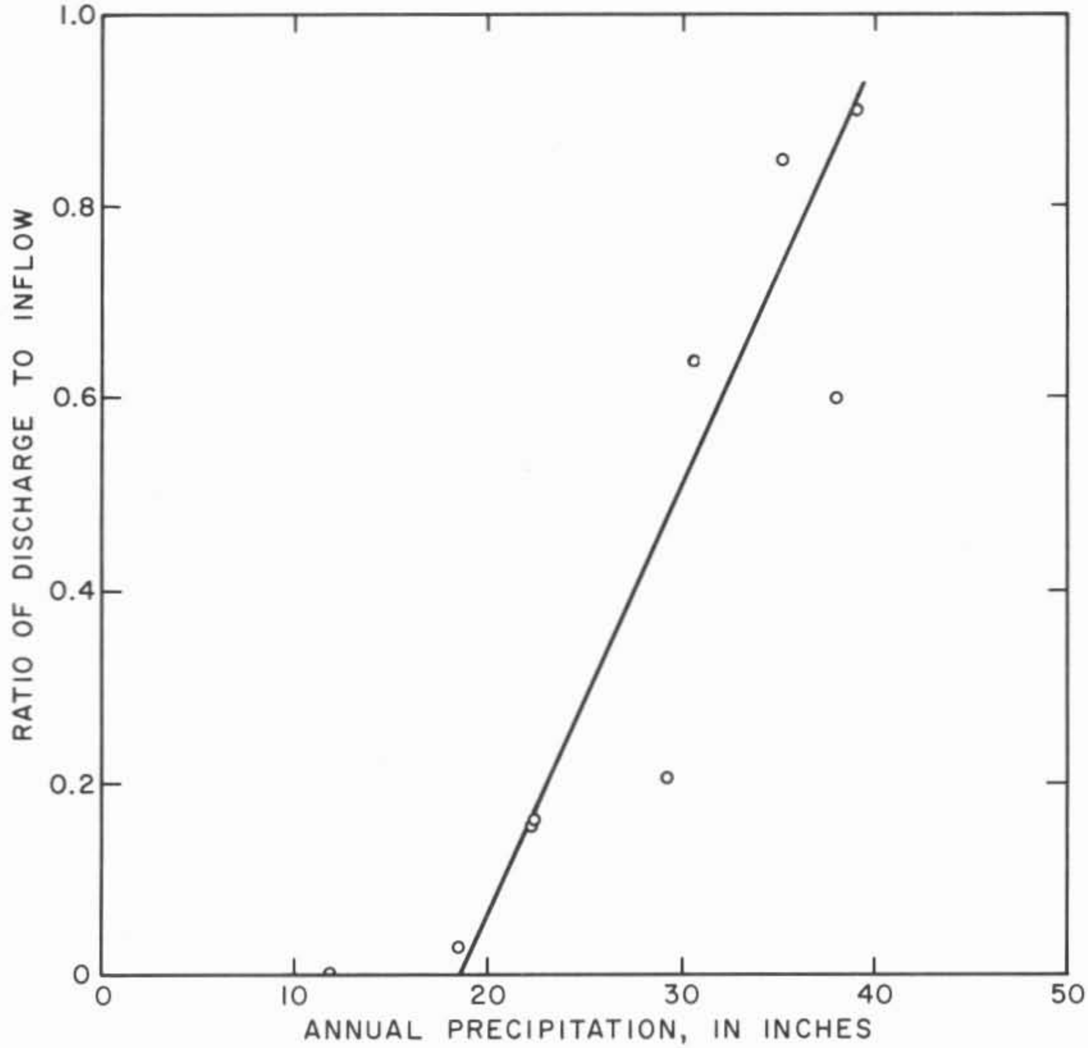


Figure 15

Relation Between the Ratio of Annual Discharge to Inflow at Floodwater-Retarding Structures 1-11 and the Annual Precipitation

U. S. Geological Survey in cooperation with the Texas Water Development Board and others below. During the 9-year period (1955-63), no floodwater-retarding pool was filled above spillway elevation except during one storm, that of October 24-26, 1960, when as much as 11.5 inches of rain fell in 51 hours. Two of the 11 floodwater-retarding pools rose above spillway level, 1.38 feet at site 1 and 0.46 foot at site 3. The peak inflow at site 1 was 4,990 cfs (cubic feet per second) whereas the peak outflow was only 183 cfs. With these two exceptions all other runoff from above the structures was passed through the drop-outlet pipes at controlled rates.

Sediment-Runoff Reduction

On the basis of sediment studies at 1 of the 11 floodwater-retarding structures, a considerable reduction in sediment transport from the controlled watersheds is indicated. The trap efficiency of 97 percent computed for reservoir No. 1 could be used safely at any of the other reservoirs. Although total sediment production from all the controlled watersheds was not determined, watershed practices indicate similar results could be expected in each. Not known at this time is the extent to which the relatively clean water discharged from the floodwater-retarding structures picks up sediment downstream. Continued studies in the watershed are expected to give results on the downstream effects that the structures have on the sediment regimen.

CONCLUSIONS

In the Escondido Creek study area a system of 11 floodwater-retarding structures which control the runoff from 44.9 square miles was found to release an average of 60 percent of the surface inflow above them (40 percent apparently would be consumed at the ponds) as surface flow to the stream channels below during a year of average annual precipitation (32 inches). The apparent pool consumption ranged from 23 percent of inflow in 1957 (rainfall 38.00 inches) to 189 percent in 1956 (rainfall 11.84 inches). About half of the consumption was due to evaporation from the flood-retarding-pond water surfaces, and the other half was attributed to seepage and some evapotranspiration from land areas peripheral to the ponds. The seepage may help to sustain surface flow at downstream points by supplying moisture to the alluvium and rock adjacent to the stream channels and consequently reducing subsequent stream-channel losses between the floodwater-retarding structures and the stream-gaging station.

Studies relating total runoff and rainfall showed that during the water years 1955-58 annual runoff-rainfall ratios averaged 0.12 for the area above the structures and 0.05 below; for the period 1959-63 similarly computed ratios were 0.08 above and 0.07 below. Relative values of the ratios for the latter period are contrary to the usual in that headwater drainage areas generally have a unit yield that is greater than for those along the flood plains. Additional studies are needed before any real significance can be attached to the near equality of the runoff-rainfall ratios for controlled and uncontrolled areas.

According to sediment studies, only a small part of the sediment eroded from the headcuts and banks of upstream tributaries appears to have been deposited in floodwater-retarding site 1. A sediment survey showed that 18.5 acre-feet of mostly silt and clay was deposited in reservoir No. 1, while suspended-sediment data showed that 0.5 acre-foot was discharged. The trap efficiency of 97 percent was due in part to the fact that the water contained considerable quantities of calcium and bicarbonate which usually flocculate the clay particles.

The arithmetic average of particle-size analyses of inflow samples was 22 percent sand, 24 percent silt, and 54 percent clay. The particle-size analyses of the outflow samples showed that 87 to 100 percent of the suspended-sediment discharge was in the clay range. The initial specific weight of a deposit formed from the suspended sediment carried into the reservoir was 41 pounds per cubic foot.

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Table 12.--Monthly water budgets
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1954							
Oct.	0	0	0	0	0	0	0
Nov.	5.0	+5.0	1.0	16.1	.2	0	21.9
Dec.	0	-5.0	.3	4.7	0	0	0
1955							
Jan.	0	0	0	.1	0	0	.1
Feb.	.1	+.1	.2	2.9	.1	0	3.1
Mar.	0	-.1	0	.1	0	0	0
Apr.	0	0	0	0	0	0	0
May	1.5	+1.5	.8	7.3	.3	0	9.3
June	0	-1.5	.2	1.4	.1	0	0
July	45.1	+45.1	7.2	36.2	.2	1/ 12.9	101.2
Aug.	118.9	+73.8	13.1	69.9	9.3	0	147.5
Sept.	68.5	-50.4	9.4	46.8	2.3	0	3.5
Water year		+68.5	32.2	185.5	12.5	12.9	286.6

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1955							
Oct.	33.0	-35.5	5.7	29.8	0	0	0
Nov.	16.3	-16.7	2.0	16.6	1.2	0	.7
Dec.	7.7	-8.6	.8	7.8	0	0	0
1956							
Jan.	2.7	-5.0	.5	4.6	.1	0	0
Feb.	.3	-2.4	.3	2.1	0	0	0
Mar.	0	-.3	0	.3	0	0	0
Apr.	0	0	0	0	0	0	0
May	6.2	+6.2	1.9	16.2	.5	0	23.8
June	27.6	+21.4	2.6	13.0	1.6	0	35.4
July	9.4	-18.2	3.7	14.9	.3	0	.1
Aug.	3.5	-5.9	2.0	5.5	.2	0	1.4
Sept.	.8	-2.7	.8	2.0	.1	0	0
Water year		-67.7	20.3	112.8	4.0	0	61.4

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1956							
Oct.	3.8	+3.0	1.3	8.9	0.4	0	12.8
Nov.	3.2	-.6	.7	5.8	.3	0	5.8
Dec.	9.9	+6.7	.8	5.3	.4	0	12.4
1957							
Jan.	3.8	-6.1	.5	6.4	.1	0	.7
Feb.	5.8	+2.0	.4	3.0	.3	0	5.1
Mar.	34.6	+28.8	1.5	10.8	1.9	0	39.2
Apr.	273.4	+238.8	6.8	71.4	13.3	.2	303.9
May	434.2	+160.8	21.6	69.3	31.4	80.0	300.3
June	222.2	-212.0	24.2	48.4	5.7	192.0	46.9
July	153.1	-69.1	23.4	45.7	0	0	0
Aug.	102.7	-50.4	18.7	39.5	2.0	0	5.8
Sept.	249.3	+146.6	13.7	42.2	18.6	0	183.9
Water year		+248.5	113.6	356.7	74.4	272.4	916.8

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	191.4	-57.9	12.8	51.5	6.4	0	0
Nov.	209.4	+18.0	5.4	41.5	18.5	1.0	47.4
Dec.	171.7	-37.7	5.9	38.0	3.8	0	2.4
1958							
Jan.	241.1	+69.4	7.4	43.3	21.0	77.0	176.1
Feb.	267.7	+26.6	6.6	44.1	18.0	112.0	171.3
Mar.	192.8	-74.9	9.8	32.9	3.5	36.0	.3
Apr.	147.2	-45.6	11.9	35.3	1.6	0	0
May	203.5	+56.3	21.0	40.6	17.0	194.0	294.9
June	161.2	-42.3	19.4	31.8	6.8	0	2.1
July	121.2	-40.0	20.2	33.7	2.8	0	11.1
Aug.	83.2	-38.0	14.6	23.4	0	0	0
Sept.	70.7	-12.5	6.2	18.2	9.1	0	2.8
Water year		-178.6	141.2	434.3	108.5	420.0	708.4

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	62.0	-8.7	3.7	13.4	8.4	0	0
Nov.	47.1	-14.9	2.8	14.1	2.0	0	0
Dec.	37.5	-9.6	1.9	9.6	1.8	0	.1
1959							
Jan.	26.2	-11.3	1.5	12.9	.2	2/.3	3.2
Feb.	20.2	-6.0	1.0	8.5	2.2	2/1.0	2.3
Mar.	10.2	-10.0	2.1	6.0	0	2/1.9	0
Apr.	6.1	-4.1	1.6	5.2	.6	0	2.1
May	2.8	-3.3	1.6	2.9	.5	0	.7
June	8.2	+5.4	2.4	7.6	1.5	0	13.9
July	2.6	-5.6	2.2	4.1	.1	0	.6
Aug.	0	-2.6	.8	2.1	.3	0	0
Sept.	15.2	+15.2	.1	.2	.3	1/.8	16.0
Water year		-55.5	21.7	86.6	17.9	4.0	38.9

1/ Water released through valve. 2/ Water pumped from pool.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	54.2	+39.0	5.9	36.9	3.4	1/ 10.4	88.8
Nov.	28.0	-26.2	2.7	24.1	.6	0	0
Dec.	19.2	-8.8	1.3	15.4	1.5	0	6.4
1960							
Jan.	24.6	+5.4	1.4	18.5	.6	0	24.7
Feb.	12.1	-12.5	1.7	13.1	1.4	0	.9
Mar.	4.7	-7.4	1.3	7.5	.4	0	1.0
Apr.	1.8	-2.9	.7	3.7	.2	0	1.3
May	0	-1.8	.4	1.9	.1	0	.4
June	0	0	0	0	0	0	0
July	33.8	+33.8	4.5	24.0	1.6	1/ 10.5	71.2
Aug.	70.2	+36.4	5.4	21.6	4.0	0	59.4
Sept.	35.3	-34.9	6.8	29.9	1.8	0	0
Water year		+20.1	32.1	196.6	15.6	20.9	254.1

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	873.2	+837.9	10.6	72.8	51.5	334.0	1,203.8
Nov.	382.5	-490.7	13.8	144.7	21.9	575.0	220.9
Dec.	199.9	-182.6	5.0	73.8	12.8	200.0	83.4
1961							
Jan.	156.1	-43.8	5.1	50.0	3.6	32.0	39.7
Feb.	158.3	+2.2	7.9	34.2	5.0	32.0	71.3
Mar.	118.4	-39.9	11.8	29.3	.9	0	.3
Apr.	83.3	-35.1	10.9	29.7	3.5	0	2.0
May	46.6	-36.7	10.6	26.3	.7	1/ .7	.2
June	22.1	-24.5	6.6	22.3	1.6	0	2.8
July	5.9	-16.2	3.5	13.9	1.2	0	0
Aug.	.6	-5.3	1.2	4.7	.6	0	0
Sept.	.2	-.4	.2	.8	.1	0	.5
Water year		-35.1	87.2	502.5	103.4	1,173.7	1,624.9

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	0	-0.2	0.1	0.1	0	0	0
Nov.	0	0	0	0	0	0	0
Dec.	0	0	0	0	0	0	0
1962							
Jan.	0	0	0	0	0	0	0
Feb.	.5	+.5	.2	1.8	.1	0	2.4
Mar.	0	-.5	.1	.4	0	0	0
Apr.	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0
June	45.1	+45.1	9.2	47.9	5.9	0	96.3
July	13.5	-31.6	7.6	24.0	0	0	0
Aug.	1.1	-12.4	2.2	10.6	.4	0	0
Sept.	0	-1.1	.4	1.8	.3	0	.8
Water year		-0.2	19.8	86.6	6.7	0	99.5

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 1

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	38.4	+38.4	0.6	1.4	0.6	0	39.8
Nov.	118.2	+79.8	3.0	24.9	4.1	0	103.6
Dec.	129.8	+11.6	4.0	47.1	8.2	0	54.5
1963							
Jan.	91.1	-38.7	5.2	33.9	.4	0	0
Feb.	70.3	-20.8	4.9	18.9	2.5	0	.5
Mar.	43.8	-26.5	6.5	20.1	.1	0	0
Apr.	82.5	+38.7	5.2	16.2	1.7	1/2.3	60.7
May	49.4	-33.1	9.6	23.6	.1	0	0
June	40.4	-9.0	8.1	16.0	4.6	0	10.5
July	23.5	-16.9	8.0	14.1	.3	0	4.9
Aug.	8.1	-15.4	4.5	10.1	.1	1/1.3	.4
Sept.	3.4	-4.7	1.8	4.8	.9	0	1.0
Water year		+3.4	61.4	231.1	23.6	3.6	275.9

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1956							
Sept.	10						
Oct.	13	+3	0	2	0	0	5
Nov.	14	+1	1	1	0	0	3
Dec.	32	+18	1	3	0	0	22
1957							
Jan.	27	-5	1	4	0	0	0
Feb.	22	-5	1	5	1	0	0
Mar.	55	+33	2	5	3	0	37
Apr.	202	+147	6	19	17	0	155
May	270	+68	18	25	26	216	301
June	187	-83	22	23	5	73	30
July	145	-42	24	18	0	0	0
Aug.	107	-38	18	23	3	0	0
Sept.	185	+78	13	19	19	0	91
Water year		+175	107	147	74	289	644

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	159	-26	12	19	5	0	0
Nov.	204	+45	6	29	18	3	65
Dec.	185	-19	7	18	4	0	2
1958							
Jan.	220	+35	8	27	23	515	562
Feb.	232	+12	7	28	19	72	100
Mar.	196	-36	11	18	4	11	0
Apr.	168	-28	14	15	1	0	0
May	192	+24	21	13	19	190	229
June	166	-26	21	16	10	0	1
July	138	-28	22	10	4	0	0
Aug.	104	-34	18	16	0	0	0
Sept.	98	-6	8	17	10	0	9
Water year		-87	155	226	117	791	968

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	91	-7	5	16	13	0	1
Nov.	87	-4	5	5	1	0	5
Dec.	74	-13	3	13	2	0	1
1959							
Jan.	69	-5	3	7	1	0	4
Feb.	74	+5	3	9	6	0	11
Mar.	60	-14	6	9	1	0	0
Apr.	49	-11	5	7	4	1/ 5	2
May	38	-11	5	7	2	1/ 2	1
June	36	-2	6	4	4	0	4
July	27	-9	4	6	0	0	1
Aug.	22	-5	2	4	1	0	0
Sept.	18	-4	1	4	1	0	0
Water year		-80	48	91	36	7	30

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	55	+37	4	6	5	0	42
Nov.	46	-9	3	8	1	0	1
Dec.	41	-5	2	6	2	0	1
1960							
Jan.	43	+2	2	4	1	0	7
Feb.	38	-5	2	5	2	0	0
Mar.	37	-1	2	5	2	0	4
Apr.	29	-8	2	7	1	0	0
May	25	-4	2	3	1	0	0
June	21	-4	2	3	1	0	0
July	31	+10	2	4	3	0	13
Aug.	40	+9	3	4	4	0	12
Sept.	33	-7	4	5	1	0	1
Water year		+15	30	60	24	0	81

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo- ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	410	+377	6	14	61	418	754
Nov.	220	-190	8	17	15	335	155
Dec.	228	+8	5	20	14	28	47
1961							
Jan.	200	-28	6	19	6	9	0
Feb.	196	-4	9	16	7	55	69
Mar.	173	-23	15	10	2	0	0
Apr.	152	-21	16	10	5	0	0
May	122	-30	18	14	2	0	0
June	103	-19	14	10	5	0	0
July	85	-18	13	9	2	0	2
Aug.	73	-12	11	7	3	0	3
Sept.	56	-17	8	7	4	1/6	0
Water year		+23	129	153	126	851	1,030

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	48	-8	5	7	2	0	2
Nov.	45	-3	2	7	3	0	3
Dec.	38	-7	2	7	0	0	2
1962							
Jan.	33	-5	1	5	0	0	1
Feb.	31	-2	2	2	1	0	1
Mar.	25	-6	2	5	1	0	0
Apr.	22	-3	1	5	1	0	2
May	17	-5	1	4	0	0	0
June	38	+21	5	5	3	0	28
July	27	-11	5	6	0	0	0
Aug.	19	-8	2	6	0	0	0
Sept.	14	-5	1	5	1	0	0
Water year		-42	29	64	12	0	39

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 2

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	82	+68	5	5	4	0	74
Nov.	170	+88	3	17	5	0	103
Dec.	212	+42	2	32	12	8	72
1963							
Jan.	189	-23	2	28	1	1	7
Feb.	177	-12	3	17	6	0	2
Mar.	152	-25	5	21	1	0	0
Apr.	162	+10	5	23	7	0	31
May	135	-27	6	22	1	0	0
June	181	+46	7	25	9	0	69
July	145	-36	8	31	3	0	0
Aug.	111	-34	8	27	1	0	0
Sept.	98	-13	6	13	6	0	0
Water year		+84	60	261	56	9	358

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Feb.	29						
Mar.	309	+280	13	27	12	0	308
Apr.	459	+150	18	39	26	148	329
May	502	+43	27	32	35	207	274
June	418	-84	32	18	7	76	35
July	368	-50	39	11	0	0	0
Aug.	319	-49	34	19	3	0	1
Sept.	453	+134	25	18	47	165	295
Water year		+424	188	164	130	596	1,242

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	433	-20	20	10	5	44	49
Nov.	441	+8	9	15	29	212	215
Dec.	283	-158	9	15	6	1/ 140	0
1958							
Jan.	453	+170	11	13	30	419	583
Feb.	508	+55	10	20	29	200	256
Mar.	436	-72	16	24	6	38	0
Apr.	413	-23	21	4	2	0	0
May	424	+11	30	3	28	303	319
June	411	-13	33	4	11	0	13
July	220	-191	34	6	4	1/ 155	0
Aug.	164	-56	27	9	0	1/ 20	0
Sept.	168	+4	14	11	20	0	9
Water year		-285	234	134	170	1,531	1,444

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	156	-12	10	16	20	1/ 6	0
Nov.	181	+25	9	13	2	0	45
Dec.	177	-4	7	10	7	0	6
1959							
Jan.	177	0	7	6	1	0	12
Feb.	185	+8	6	14	14	0	14
Mar.	160	-25	17	2	1	2/ 8	1
Apr.	156	-4	15	1	8	2/ 2	6
May	141	-15	19	5	7	0	2
June	148	+7	23	3	13	0	20
July	122	-26	23	7	3	0	1
Aug.	111	-11	19	6	8	0	6
Sept.	96	-15	15	3	9	1/ 6	0
Water year		-72	170	86	93	22	113

1/ Water released through valve. 2/ Water pumped from pool.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	130	+34	12	6	11	0	41
Nov.	118	-12	7	11	2	0	4
Dec.	118	0	5	10	7	0	8
1960							
Jan.	148	+30	6	10	4	0	42
Feb.	152	+4	8	8	8	0	12
Mar.	173	+21	11	7	7	0	32
Apr.	160	-13	13	7	7	0	0
May	148	-12	20	2	6	0	4
June	133	-15	24	4	8	0	5
July	198	+65	26	9	16	0	84
Aug.	346	+148	23	14	27	0	158
Sept.	314	-32	23	17	5	0	3
Water year		+218	178	105	108	0	393

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	1,460	+1,146	18	22	69	509	1,626
Nov.	459	-1,001	15	25	28	1,310	321
Dec.	465	+6	7	23	19	186	203
1961							
Jan.	441	-24	9	16	6	146	141
Feb.	436	-5	13	12	12	183	191
Mar.	418	-18	23	2	28	1/ 21	0
Apr.	396	-22	26	4	8	1/ 5	5
May	352	-44	32	3	2	1/ 11	0
June	325	-27	29	6	12	1/ 4	0
July	299	-26	28	3	5	1/ 5	5
Aug.	263	-36	28	7	6	1/ 7	0
Sept.	244	-19	25	5	10	0	1
Water year		-70	253	128	205	2,387	2,493

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	230	-14	19	5	9	0	1
Nov.	225	-5	10	13	16	0	2
Dec.	216	-9	9	2	2	0	0
1962							
Jan.	212	-4	8	2	2	0	4
Feb.	194	-18	12	18	6	0	6
Mar.	173	-21	15	15	5	0	4
Apr.	173	0	18	12	14	0	16
May	141	-32	23	16	7	0	0
June	239	+98	25	18	16	0	125
July	189	-50	33	17	0	0	0
Aug.	144	-45	27	19	1	0	0
Sept.	137	-7	17	23	12	0	21
Water year		-107	216	160	90	0	179

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 3

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	126	-11	14	14	6	0	11
Nov.	216	+90	9	15	11	0	103
Dec.	398	+182	8	16	14	0	192
1963							
Jan.	379	-19	12	10	2	0	1
Feb.	374	-5	13	10	9	0	9
Mar.	352	-22	21	13	1	0	11
Apr.	453	+101	23	20	16	0	128
May	407	-46	30	20	1	30	33
June	368	-39	32	25	18	0	0
July	357	-11	36	9	10	0	24
Aug.	319	-38	33	11	2	0	4
Sept.	293	-26	24	13	11	0	0
Water year		+156	255	176	101	30	516

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow 3/
1957							
Jan.	0						
Feb.	7	+7	0	1	0	0	9
Mar.	237	+230	7	23	10	0	250
Apr.	581	+344	23	37	42	217	579
May	681	+100	45	15	57	989	1,092
June	496	-185	51	19	11	227	101
July	416	-80	61	19	0	0	0
Aug.	360	-56	50	16	10	0	0
Sept.	541	+181	37	33	54	272	469
Water year		+542	274	163	184	1,705	2,500

3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo- ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow 3/
1957							
Oct.	496	-45	32	40	5	21	43
Nov.	551	+55	15	55	42	323	406
Dec.	496	-55	17	48	9	125	126
1958							
Jan.	541	+45	18	42	52	1,093	1,146
Feb.	591	+50	16	34	37	400	463
Mar.	505	-86	25	25	11	60	13
Apr.	469	-36	33	7	3	0	1
May	514	+45	49	1	46	803	852
June	473	-41	53	17	29	0	0
July	514	+41	60	10	12	1/ 48	147
Aug.	360	-154	55	5	0	1/ 114	20
Sept.	200	-160	21	29	31	1/ 141	0
Water year		-341	394	313	277	3,128	3,217

1/ Water released through valve.
3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow 3/
1958							
Oct.	165	-35	10	40	22	1/ 12	5
Nov.	160	-5	9	11	3	0	12
Dec.	165	+5	7	13	5	0	20
1959							
Jan.	137	-28	7	22	1	0	0
Feb.	155	+18	6	14	14	0	24
Mar.	137	-18	17	2	1	0	0
Apr.	190	+53	18	17	15	0	73
May	205	+15	24	6	15	0	30
June	200	-5	30	10	21	0	14
July	141	-59	27	13	1	1/ 20	0
Aug.	141	0	22	18	11	0	29
Sept.	125	-16	18	12	9	0	5
Water year		-75	195	178	118	32	212

1/ Water released through valve. 3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow[3/]
1959							
Oct.	141	+16	15	5	25	0	11
Nov.	180	+39	9	9	3	0	54
Dec.	175	-5	7	11	10	0	3
1960							
Jan.	190	+15	7	8	5	0	25
Feb.	185	-5	10	5	9	0	1
Mar.	195	+10	13	12	7	0	28
Apr.	170	-25	15	17	7	0	0
May	150	-20	22	3	5	0	0
June	118	-32	24	20	12	0	0
July	150	+32	24	16	11	0	61
Aug.	155	+5	21	9	24	0	11
Sept.	145	-10	19	1	3	0	7
Water year		+20	186	116	121	0	201

3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo- ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow 3/
1960							
Oct.	1,450	+1,305	22	38	75	1,380	2,670
Nov.	561	-889	19	31	35	2,590	1,716
Dec.	581	+20	11	39	34	339	375
1961							
Jan.	532	-49	15	35	15	237	223
Feb.	523	-9	22	28	17	375	399
Mar.	478	-45	37	13	3	0	2
Apr.	469	-9	41	14	13	2/ 5	38
May	408	-61	50	20	8	2/ 10	11
June	352	-56	43	26	9	2/ 2	6
July	324	-28	40	0	8	0	4
Aug.	275	-49	38	22	9	0	2
Sept.	268	-7	32	8	16	0	17
Water year		+123	370	274	242	4,938	5,463

2/ Water pumped from pool. 3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow 3/
1961							
Oct.	249	-19	23	12	11	0	5
Nov.	237	-12	12	18	14	0	4
Dec.	220	-17	11	9	2	0	1
1962							
Jan.	210	-10	10	5	3	0	2
Feb.	190	-20	14	11	3	0	2
Mar.	155	-35	16	25	6	0	0
Apr.	150	-5	17	23	12	0	23
May	185	+35	21	19	4	0	71
June	200	+15	29	11	18	0	37
July	133	-67	32	35	0	0	0
Aug.	107	-26	24	4	1	0	1
Sept.	103	-4	15	15	12	0	14
Water year		-165	224	187	86	0	160

3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 4

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow[3]
1962							
Oct.	89	-14	12	7	5	0	0
Nov.	324	+235	8	12	7	0	248
Dec.	486	+162	12	38	28	0	184
1963							
Jan.	442	-44	18	29	3	0	0
Feb.	442	0	20	25	16	0	29
Mar.	400	-42	32	11	1	0	0
Apr.	408	+8	34	11	18	0	35
May	360	-48	41	8	1	0	0
June	324	-36	43	17	24	0	0
July	275	-49	44	9	4	0	0
Aug.	231	-44	38	7	1	0	0
Sept.	205	-26	26	15	15	0	0
Water year		+102	328	189	123	0	496

3/ Inflow includes drop-outlet pipe discharge from site 3.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Mar.	37						
Apr.	114	+77	4	16	8	5	94
May	124	+10	10	10	10	126	146
June	104	-20	12	6	4	102	96
July	87	-17	14	3	0	0	0
Aug.	76	-11	11	1	1	0	0
Sept.	117	+41	8	7	13	103	146
Water year		+80	59	43	36	336	482

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	111	-6	8	2	3	5	6
Nov.	117	+6	4	8	11	96	103
Dec.	111	-6	4	8	2	7	11
1958							
Jan.	115	+4	4	8	13	210	213
Feb.	139	+24	4	8	9	83	110
Mar.	111	-28	6	4	2	50	30
Apr.	102	-9	8	2	1	0	0
May	113	+11	12	1	11	131	144
June	105	-8	12	2	4	0	2
July	94	-11	13	0	1	0	1
Aug.	78	-16	11	5	0	0	0
Sept.	103	+25	6	14	11	0	34
Water year		-14	92	62	68	582	654

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	116	+13	5	7	11	20	34
Nov.	110	-6	4	6	2	7	9
Dec.	108	-2	4	4	3	0	3
1959							
Jan.	108	0	3	1	1	0	3
Feb.	110	+2	3	5	6	0	4
Mar.	102	-8	8	0	0	0	0
Apr.	110	+8	8	2	7	18	29
May	102	-8	10	2	4	0	0
June	106	+4	12	2	6	9	21
July	92	-14	12	4	2	0	0
Aug.	88	-4	10	7	5	0	8
Sept.	74	-14	8	10	4	0	0
Water year		-29	87	50	51	54	111

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	81	+7	6	2	6	0	9
Nov.	76	-5	4	3	1	0	1
Dec.	76	0	3	3	3	0	3
1960							
Jan.	87	+11	3	3	2	0	15
Feb.	90	+3	4	3	4	0	6
Mar.	114	+24	5	3	4	9	37
Apr.	112	-2	7	3	3	1	6
May	104	-8	10	2	3	0	1
June	98	-6	12	4	7	0	3
July	88	-10	12	4	5	0	1
Aug.	90	+2	9	5	9	0	7
Sept.	87	-3	8	0	1	0	4
Water year		+13	83	35	48	10	93

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	236	+149	7	3	29	280	410
Nov.	114	-122	4	6	9	198	77
Dec.	118	+4	3	5	7	75	80
1961							
Jan.	114	-4	4	4	3	31	32
Feb.	112	-2	5	5	5	87	90
Mar.	102	-10	9	2	1	0	0
Apr.	94	-8	9	3	3	0	1
May	87	-7	11	1	1	0	4
June	78	-9	10	4	5	0	0
July	68	-10	9	5	4	0	0
Aug.	63	-5	9	1	2	0	3
Sept.	58	-5	8	2	3	0	2
Water year		-29	88	41	72	671	699

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	53	-5	6	4	3	0	2
Nov.	52	-1	3	5	4	0	3
Dec.	49	-3	3	1	1	0	0
1962							
Jan.	46	-3	2	2	1	0	0
Feb.	46	0	3	2	1	0	4
Mar.	40	-6	4	3	1	0	0
Apr.	39	-1	5	2	4	0	2
May	46	+7	7	1	2	0	13
June	40	-6	7	3	4	0	0
July	30	-10	9	1	0	0	0
Aug.	22	-8	7	1	0	0	0
Sept.	20	-2	4	4	3	0	3
Water year		-38	60	29	24	0	27

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 5

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	22	+2	4	2	2	0	6
Nov.	91	+69	2	2	2	0	73
Dec.	115	+24	3	4	5	10	36
1963							
Jan.	109	-6	4	3	1	0	0
Feb.	111	+2	5	3	4	0	6
Mar.	100	-11	8	3	0	0	0
Apr.	92	-8	8	7	6	0	1
May	94	+2	10	0	0	0	12
June	92	-2	11	3	6	0	6
July	74	-18	12	9	3	0	0
Aug.	61	-13	10	3	0	0	0
Sept.	58	-3	7	1	2	0	3
Water year		+38	84	42	31	10	143

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
<u>1955</u>							
Aug.	0						
Sept.	48	+48	6	2	1	0	55

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1955							
Oct.	36	-12	5	7	0	0	0
Nov.	33	-3	2	4	1	0	2
Dec.	30	-3	2	1	0	0	0
1956							
Jan.	28	-2	1	1	0	0	0
Feb.	25	-3	2	1	0	0	0
Mar.	19	-6	2	4	0	0	0
Apr.	15	-4	2	3	0	0	1
May	12	-3	2	3	1	0	1
June	8	-4	2	2	0	0	0
July	2	-6	2	4	0	0	0
Aug.	0	-2	1	1	0	0	0
Sept.	0	0	0	0	0	0	0
Water year		-48	23	31	2	0	4

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1956							
Oct.	0	0	0	0	0	0	0
Nov.	0	0	0	0	0	0	0
Dec.	7	+7	1	0	0	0	8
1957							
Jan.	6	-1	0	1	0	0	0
Feb.	19	+13	1	1	1	0	14
Mar.	115	+96	5	10	6	0	105
Apr.	234	+119	11	9	18	240	361
May	239	+5	18	12	17	243	261
June	187	-52	20	15	6	103	80
July	150	-37	23	14	0	0	0
Aug.	125	-25	18	9	2	0	0
Sept.	212	+87	14	6	21	211	297
Water year		+212	111	77	71	797	1,126

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	194	-18	13	10	5	0	0
Nov.	207	+13	6	14	19	122	136
Dec.	194	-13	7	10	4	0	0
1958							
Jan.	205	+11	8	12	23	333	341
Feb.	234	+29	7	13	16	196	229
Mar.	196	-38	10	19	4	13	0
Apr.	179	-17	13	5	1	0	0
May	201	+22	21	3	18	318	346
June	184	-17	21	3	7	0	0
July	157	-27	22	7	2	0	0
Aug.	131	-26	19	7	0	0	0
Sept.	154	+23	10	15	18	0	30
Water year		-58	157	118	117	982	1,082

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo- ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	208	+54	8	7	18	86	137
Nov.	197	-11	8	7	3	1	2
Dec.	187	-10	6	9	5	0	0
1959							
Jan.	183	-4	6	2	1	0	3
Feb.	142	-41	5	5	10	1/ 50	9
Mar.	131	-11	12	0	0	0	1
Apr.	201	+70	12	3	11	19	93
May	183	-18	17	7	6	0	0
June	188	+5	21	5	11	2	22
July	162	-26	20	10	4	0	0
Aug.	149	-13	17	8	8	0	4
Sept.	146	-3	14	6	6	0	11
Water year		-8	146	69	83	158	282

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	172	+26	10	8	11	0	33
Nov.	159	-13	7	8	2	0	0
Dec.	155	-4	5	10	6	0	5
1960							
Jan.	194	+39	5	7	4	0	47
Feb.	196	+2	8	2	7	0	5
Mar.	204	+8	10	2	8	30	42
Apr.	194	-10	12	6	5	0	3
May	179	-15	17	3	5	0	0
June	168	-11	20	5	11	0	3
July	172	+4	21	1	8	0	18
Aug.	165	-7	16	8	17	0	0
Sept.	155	-10	14	6	3	0	7
Water year		+9	145	66	87	30	163

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	840	+685	13	7	50	318	973
Nov.	212	-628	10	8	16	829	203
Dec.	212	0	5	10	13	25	27
1961							
Jan.	208	-4	6	6	5	12	15
Feb.	201	-7	9	5	8	123	122
Mar.	187	-14	15	0	1	0	0
Apr.	172	-15	16	4	4	0	1
May	155	-17	19	0	2	0	0
June	139	-16	17	9	10	0	0
July	124	-15	15	6	6	0	0
Aug.	112	-12	15	0	3	0	0
Sept.	100	-12	12	8	5	0	3
Water year		-55	152	63	123	1,307	1,344

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	102	+2	9	2	5	0	8
Nov.	117	+15	5	5	6	0	19
Dec.	110	-7	5	3	1	0	0
1962							
Jan.	102	-8	5	4	1	0	0
Feb.	100	-2	6	1	2	0	3
Mar.	91	-9	8	4	2	0	1
Apr.	93	+2	9	1	7	0	5
May	79	-14	11	5	2	0	0
June	128	+49	14	6	9	0	60
July	102	-26	19	7	0	0	0
Aug.	85	-17	14	3	0	0	0
Sept.	83	-2	9	6	7	0	6
Water year		-17	114	47	42	0	102

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 6

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	75	-8	7	5	3	0	1
Nov.	194	+119	5	9	5	0	128
Dec.	205	+11	6	8	10	8	23
1963							
Jan.	194	-11	8	5	2	0	0
Feb.	191	-3	9	1	4	0	3
Mar.	179	-12	14	-2	0	0	0
Apr.	214	+35	15	2	10	0	42
May	187	-27	20	2	1	6	0
June	168	-19	20	9	10	0	0
July	142	-26	21	9	4	0	0
Aug.	120	-22	18	4	0	0	0
Sept.	107	-13	12	5	4	0	0
Water year		+24	155	57	53	14	197

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Feb.	0						
Mar.	89	+89	4	20	3	0	110
Apr.	247	+158	10	22	23	176	343
May	237	-10	20	20	19	265	276
June	180	-57	22	23	8	113	93
July	139	-41	25	16	0	0	0
Aug.	108	-31	19	14	2	0	0
Sept.	220	+112	14	16	22	236	356
Water year		+220	114	131	77	790	1,178

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	187	-33	14	20	5	4	0
Nov.	211	+24	7	18	21	127	155
Dec.	187	-24	7	13	4	8	0
1958							
Jan.	205	+18	8	12	25	354	367
Feb.	220	+15	7	13	15	183	203
Mar.	191	-29	11	17	4	5	0
Apr.	165	-26	14	13	1	0	0
May	197	+32	21	12	20	233	278
June	169	-28	22	14	8	0	0
July	130	-39	22	20	3	0	0
Aug.	106	-24	18	6	0	0	0
Sept.	136	+30	10	10	20	0	30
Water year		-84	161	168	126	914	1,033

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	195	+59	8	11	18	0	60
Nov.	183	-12	8	8	3	0	1
Dec.	172	-11	6	10	4	0	1
1959							
Jan.	165	-7	6	4	1	0	2
Feb.	162	-3	5	10	10	0	2
Mar.	139	-23	14	9	0	0	0
Apr.	199	+60	14	13	15	78	150
May	176	-23	19	10	6	0	0
June	183	+7	22	10	13	3	29
July	142	-41	21	23	3	0	0
Aug.	152	+10	17	22	8	0	41
Sept.	113	-39	14	11	7	1/ 21	0
Water year		-23	154	141	88	102	286

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	165	+52	11	3	13	0	53
Nov.	152	-13	7	8	2	0	0
Dec.	145	-7	5	8	6	0	0
1960							
Jan.	155	+10	5	8	3	0	20
Feb.	155	0	7	11	7	0	11
Mar.	172	+17	9	9	6	0	29
Apr.	155	-17	11	11	5	0	0
May	142	-13	16	1	4	0	0
June	142	0	19	6	12	0	13
July	165	+23	21	9	10	0	43
Aug.	180	+15	17	8	17	0	23
Sept.	159	-21	16	8	3	0	0
Water year		+46	144	90	88	0	192

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	220	+61	11	8	38	206	248
Nov.	207	-13	7	14	14	84	78
Dec.	216	+9	5	11	14	14	25
1961							
Jan.	195	-21	6	14	6	7	0
Feb.	199	+4	9	12	10	79	94
Mar.	180	-19	16	4	0	0	0
Apr.	165	-15	17	6	5	0	3
May	152	-13	20	0	2	0	5
June	124	-28	17	13	9	1/7	0
July	111	-13	16	9	8	0	4
Aug.	103	-8	16	2	4	0	6
Sept.	89	-14	13	7	6	0	0
Water year		-70	153	100	116	397	463

1/ Water released through valve.

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo- ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	84	-5	9	3	5	0	2
Nov.	87	+3	5	5	6	0	7
Dec.	80	-7	4	4	1	0	0
1962							
Jan.	71	-9	4	6	1	0	0
Feb.	67	-4	5	2	2	0	1
Mar.	59	-8	6	4	2	0	0
Apr.	55	-4	8	4	6	0	2
May	43	-12	9	5	2	0	0
June	61	+18	10	4	6	0	26
July	45	-16	12	4	0	0	0
Aug.	34	-11	9	2	0	0	0
Sept.	33	-1	6	2	4	0	3
Water year		-56	87	45	35	0	41

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 7

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	36	+3	5	3	2	0	9
Nov.	116	+80	4	6	4	0	86
Dec.	130	+14	5	11	7	0	23
1963							
Jan.	133	+3	6	5	2	0	12
Feb.	123	-10	7	8	5	0	0
Mar.	111	-12	11	3	0	0	2
Apr.	169	+58	11	3	7	0	65
May	145	-24	18	7	1	0	0
June	124	-21	18	17	9	0	5
July	101	-23	18	7	2	0	0
Aug.	84	-17	15	2	0	0	0
Sept.	73	-11	11	3	3	0	0
Water year		+40	129	75	42	0	202

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Jan.	121						
Feb.	108	-13	6	10	3	0	0
Mar.	214	+106	12	13	14	44	161
Apr.	498	+284	15	20	23	490	786
May	341	-157	21	19	22	300	161
June	190	-151	21	19	6	127	10
July	151	-39	23	16	0	0	0
Aug.	127	-24	19	11	4	0	2
Sept.	418	+291	17	13	43	390	668
Water year		+297	134	121	115	1,351	1,788

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	190	-228	14	21	5	198	0
Nov.	244	+54	7	33	25	369	438
Dec.	182	-62	6	39	3	20	0
1958							
Jan.	202	+20	8	17	21	385	409
Feb.	293	+91	7	13	15	153	249
Mar.	194	-99	10	15	4	80	2
Apr.	177	-17	13	5	1	0	0
May	198	+21	23	7	21	412	442
June	201	+3	21	9	10	59	82
July	179	-22	24	6	3	49	54
Aug.	151	-28	21	7	0	0	0
Sept.	194	+43	12	13	26	74	116
Water year		-224	166	185	134	1,799	1,792

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	210	+16	9	11	18	70	88
Nov.	194	-16	8	12	3	20	21
Dec.	186	-8	6	9	4	0	3
1959							
Jan.	178	-8	6	9	1	0	6
Feb.	198	+20	5	10	11	16	40
Mar.	182	-16	14	2	0	2	2
Apr.	194	+12	14	6	11	139	160
May	186	-8	17	8	8	6	15
June	194	+8	22	6	17	150	169
July	165	-29	21	11	3	0	0
Aug.	145	-20	17	13	8	0	2
Sept.	127	-18	13	15	8	0	2
Water year		-67	152	112	92	403	508

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	190	+63	12	15	20	110	180
Nov.	179	-11	7	13	2	1	8
Dec.	171	-8	5	13	6	0	4
1960							
Jan.	182	+11	5	11	3	0	24
Feb.	182	0	7	8	8	4	11
Mar.	194	+12	9	7	5	6	29
Apr.	179	-15	11	11	5	0	2
May	161	-18	16	10	4	0	4
June	266	+105	21	7	18	101	216
July	186	-80	23	6	7	58	0
Aug.	231	+45	17	11	16	26	83
Sept.	182	-49	16	10	2	25	0
Water year		+55	149	122	96	331	561

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	388	+206	12	12	37	270	463
Nov.	235	-153	8	14	14	315	170
Dec.	223	-12	4	15	13	87	81
1961							
Jan.	190	-33	6	9	5	40	17
Feb.	194	+4	9	6	10	160	169
Mar.	179	-15	14	1	0	0	0
Apr.	171	-8	16	0	5	1	4
May	158	-13	17	0	2	0	2
June	145	-13	17	5	9	0	0
July	142	-3	17	5	5	0	14
Aug.	121	-21	16	8	3	0	0
Sept.	110	-11	14	6	6	0	3
Water year		-72	150	81	109	873	923

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	113	+3	10	6	6	0	13
Nov.	142	+29	6	9	8	0	36
Dec.	130	-12	6	7	1	0	0
1962							
Jan.	121	-9	5	7	2	0	1
Feb.	116	-5	7	3	3	0	2
Mar.	105	-11	10	5	3	0	1
Apr.	102	-3	11	5	8	0	5
May	139	+37	14	6	2	0	55
June	186	+47	19	11	9	31	99
July	148	-38	24	14	0	0	0
Aug.	118	-30	19	11	0	0	0
Sept.	121	+3	12	8	6	0	17
Water year		+11	143	92	48	31	229

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 8

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	124	+3	11	9	4	8	27
Nov.	244	+120	7	13	12	17	145
Dec.	218	-26	6	14	12	50	32
1963							
Jan.	190	-28	8	18	2	4	0
Feb.	202	+12	9	13	6	8	36
Mar.	182	-20	14	4	0	2	0
Apr.	202	+20	15	7	8	1	35
May	179	-23	18	6	1	0	0
June	175	-4	20	10	12	0	14
July	133	-42	21	23	2	0	0
Aug.	108	-25	18	8	1	0	0
Sept.	92	-16	12	9	5	0	0
Water year		-29	159	134	65	90	289

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
May	541						
June	437	-104	49	1	25	100	21
July	343	-94	44	1	4	70	17
Aug.	260	-83	34	6	0	43	0
Sept.	581	+321	22	18	68	150	443
Water year		+40	149	26	97	363	481

Table 12--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	561	-20	22	18	62	100	58
Nov.	469	-92	17	23	10	70	8
Dec.	423	-46	13	12	8	30	1
1959							
Jan.	416	-7	12	2	2	0	5
Feb.	402	-14	10	25	20	0	1
Mar.	355	-47	27	0	0	20	0
Apr.	349	-6	23	7	17	0	7
May	319	-30	29	1	14	20	6
June	307	-12	34	0	18	10	14
July	277	-30	33	7	9	10	11
Aug.	265	-12	29	6	12	0	11
Sept.	250	-15	23	7	14	0	1
Water year		-331	272	108	186	260	123

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	283	+33	18	7	20	10	48
Nov.	265	-18	11	11	4	0	0
Dec.	255	-10	8	12	9	0	1
1960							
Jan.	255	0	7	3	2	0	8
Feb.	245	-10	10	10	10	0	0
Mar.	240	-5	13	2	6	0	4
Apr.	215	-25	15	16	6	0	0
May	190	-25	22	9	6	0	0
June	205	+15	26	4	20	0	25
July	185	-20	27	3	7	0	3
Aug.	215	+30	21	4	25	0	30
Sept.	180	-35	19	3	3	16	0
Water year		-70	197	84	118	26	119

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	265	+85	13	7	35	200	270
Nov.	200	-65	8	12	14	110	51
Dec.	205	+5	5	15	14	10	21
1961							
Jan.	195	-10	7	13	5	10	15
Feb.	190	-5	10	10	10	150	155
Mar.	170	-20	17	4	1	0	0
Apr.	215	+45	20	3	8	0	60
May	195	-20	27	1	3	0	5
June	175	-20	23	10	13	0	0
July	141	-34	22	20	8	0	0
Aug.	119	-22	20	3	1	0	0
Sept.	101	-18	16	10	6	0	2
Water year		-79	188	108	118	480	579

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	116	+15	12	10	7	0	30
Nov.	137	+21	8	12	10	0	31
Dec.	125	-12	7	9	2	0	2
1962							
Jan.	119	-6	6	6	3	0	3
Feb.	116	-3	9	3	4	0	5
Mar.	101	-15	11	9	3	0	2
Apr.	98	-3	12	8	9	0	8
May	106	+8	16	9	3	0	30
June	133	+27	20	10	14	0	43
July	101	-32	24	8	0	0	0
Aug.	79	-22	18	4	0	0	0
Sept.	101	+22	12	8	11	0	31
Water year		0	155	96	66	0	185

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 9

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	101	0	11	14	4	0	21
Nov.	349	+248	9	21	10	0	268
Dec.	514	+165	11	19	31	10	174
1963							
Jan.	477	-37	18	12	5	12	0
Feb.	477	0	19	11	15	0	15
Mar.	445	-32	31	22	1	0	0
Apr.	409	-36	32	8	12	10	2
May	343	-66	35	5	1	27	0
June	313	-30	35	5	21	20	9
July	265	-48	36	4	4	12	0
Aug.	225	-40	31	10	1	0	0
Sept.	200	-25	22	8	4	0	1
Water year		+99	290	139	109	91	490

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
<u>1955</u>							
Apr.	14						
May	39	+25	4	11	2	0	38
June	27	-12	6	7	1	0	0
July	70	+43	8	12	1	0	62
Aug.	58	-12	9	13	10	0	0
Sept.	99	+41	9	16	2	0	64
Water year		+85	36	59	16	0	164

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1955							
Oct.	75	-24	8	17	1	0	0
Nov.	65	-10	4	11	2	0	3
Dec.	57	-8	3	5	0	0	0
1956							
Jan.	49	-8	2	6	0	0	0
Feb.	44	-5	3	3	1	0	0
Mar.	35	-9	4	5	0	0	0
Apr.	24	-11	4	8	1	0	0
May	44	+20	5	9	2	0	32
June	30	-14	7	7	0	0	0
July	19	-11	5	6	0	0	0
Aug.	34	+15	4	8	2	0	25
Sept.	58	+24	8	4	3	0	33
Water year		-41	57	89	12	0	93

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1956							
Oct.	58	0	6	6	4	0	8
Nov.	50	-8	3	9	2	0	2
Dec.	61	+11	3	5	3	0	16
1957							
Jan.	54	-7	2	5	0	0	0
Feb.	64	+10	3	4	2	0	15
Mar.	70	+6	5	5	7	0	9
Apr.	226	+156	9	11	14	290	452
May	205	-21	17	13	16	200	193
June	157	-48	18	29	4	5	0
July	121	-36	19	17	0	0	0
Aug.	101	-20	14	16	5	0	5
Sept.	197	+96	12	18	20	240	346
Water year		+139	111	138	77	735	1,046

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1957							
Oct.	163	-34	12	23	5	4	0
Nov.	186	+23	5	20	18	60	90
Dec.	151	-35	6	32	3	0	0
1958							
Jan.	170	+19	7	23	18	340	371
Feb.	183	+13	6	14	15	230	248
Mar.	153	-30	8	12	3	35	22
Apr.	134	-19	11	9	1	0	0
May	157	+23	17	8	14	230	264
June	139	-18	17	9	8	5	5
July	121	-18	17	5	2	0	2
Aug.	99	-22	14	8	0	0	0
Sept.	173	+74	9	11	22	227	299
Water year		-24	129	174	109	1,131	1,301

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1958							
Oct.	179	+6	7	13	18	42	50
Nov.	154	-25	6	13	2	36	28
Dec.	139	-15	5	13	3	0	0
1959							
Jan.	134	-5	4	6	1	0	4
Feb.	128	-6	4	12	8	0	2
Mar.	113	-15	10	5	0	0	0
Apr.	163	+50	11	9	12	89	147
May	157	-6	15	5	7	18	25
June	160	+3	20	4	23	157	161
July	134	-26	17	8	2	3	0
Aug.	116	-18	14	11	6	0	1
Sept.	104	-12	10	10	6	0	2
Water year		-69	123	109	88	345	420

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	145	+41	9	9	13	33	79
Nov.	134	-11	6	10	2	0	3
Dec.	126	-8	4	11	4	0	3
1960							
Jan.	131	+5	4	8	4	0	13
Feb.	123	-8	5	8	5	0	0
Mar.	113	-10	6	8	4	0	0
Apr.	101	-12	7	8	3	0	0
May	89	-12	10	5	3	0	0
June	106	+17	12	6	8	0	27
July	90	-16	13	7	4	0	0
Aug.	83	-7	9	11	10	0	3
Sept.	67	-16	8	9	1	0	0
Water year		-37	93	100	61	33	128

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	173	+106	6	9	22	91	190
Nov.	166	-7	6	9	11	142	139
Dec.	173	+7	4	11	10	33	45
1961							
Jan.	151	-22	5	10	4	25	14
Feb.	151	0	7	8	5	49	59
Mar.	139	-12	12	4	0	0	4
Apr.	134	-5	13	5	5	0	8
May	116	-18	15	5	2	0	0
June	101	-15	12	10	5	0	2
July	81	-20	11	11	2	0	0
Aug.	67	-14	10	7	2	0	1
Sept.	61	-6	8	4	3	0	3
Water year		-6	109	93	71	340	465

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	58	-3	6	4	3	0	4
Nov.	64	+6	3	7	5	0	11
Dec.	58	-6	3	5	1	0	1
1962							
Jan.	51	-7	2	6	1	0	0
Feb.	49	-2	3	5	1	0	5
Mar.	41	-8	4	6	2	0	0
Apr.	38	-3	4	8	4	0	5
May	47	+9	6	6	1	0	20
June	131	+84	15	5	7	6	103
July	104	-27	17	10	0	0	0
Aug.	79	-25	13	12	0	0	0
Sept.	73	-6	8	12	4	0	10
Water year		+12	84	86	29	6	159

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 10

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	62	-11	6	9	2	0	2
Nov.	163	+101	4	16	6	6	121
Dec.	179	+16	5	15	8	100	128
1963							
Jan.	145	-34	6	14	2	16	0
Feb.	142	-3	7	8	5	0	7
Mar.	126	-16	10	6	0	0	0
Apr.	116	-10	11	7	4	0	4
May	94	-22	11	11	0	0	0
June	101	+7	11	11	6	0	23
July	81	-20	13	8	1	0	0
Aug.	64	-17	11	6	0	0	0
Sept.	52	-12	7	10	3	0	2
Water year		-21	102	121	37	122	287

Table 12.--Monthly water budgets-Continued
Water budget in acre-feet for site 11

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
<u>1958</u>							
Sept.	149.1						
Oct.	174.4	+25.3	7.6	16.3	17.9	67.0	98.3
Nov.	133.6	-40.8	6.7	15.3	2.2	51.2	30.2
Dec.	117.1	-16.5	4.9	15.2	2.6	0	1.0
<u>1959</u>							
Jan.	103.1	-14.0	4.2	11.2	.5	0	1.0
Feb.	101.2	-1.9	3.5	7.8	7.2	0	2.2
Mar.	86.1	-15.1	9.4	6.0	.2	0	.1
Apr.	123.5	+37.4	10.2	9.8	6.1	0	51.3
May	107.7	-15.8	13.0	12.7	5.2	0	4.7
June	113.5	+5.8	16.3	13.7	7.7	0	28.1
July	88.6	-24.9	14.6	10.9	.5	0	.1
Aug.	74.6	-14.0	10.8	10.2	5.2	0	1.8
Sept.	63.6	-11.0	8.1	8.4	1.0	0	4.5
Water year		-85.5	109.3	137.6	56.3	118.2	223.3

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 11

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1959							
Oct.	58.7	-4.9	5.3	5.4	3.4	0	2.4
Nov.	52.3	-6.4	3.0	5.4	1.3	0	.7
Dec.	49.8	-2.5	2.1	4.8	1.7	0	2.7
1960							
Jan.	43.9	-5.9	1.9	5.6	.9	0	.7
Feb.	40.7	-3.2	2.7	2.5	1.7	0	.3
Mar.	36.9	-3.8	3.3	1.8	.8	0	.5
Apr.	32.8	-4.1	3.6	1.9	1.1	0	.3
May	27.7	-5.1	5.0	1.4	1.3	0	0
June	23.7	-4.0	5.4	1.6	1.7	0	1.3
July	19.1	-4.6	4.7	2.3	.7	0	1.7
Aug.	15.1	-4.0	3.2	2.8	.9	0	1.1
Sept.	10.5	-4.6	2.2	2.8	.4	0	0
Water year		-53.1	42.4	38.3	15.9	0	11.7

Table 12.--Monthly water budgets--Continued
Water budget in acre-feet for site 11

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1960							
Oct.	149.7	+139.2	2.7	12.3	14.5	84.7	224.4
Nov.	147.5	-2.2	5.9	23.2	10.3	104.5	121.1
Dec.	148.1	+.6	3.9	21.7	9.1	0	17.1
1961							
Jan.	141.6	-6.5	5.0	18.0	4.4	8.9	21.0
Feb.	140.4	-1.2	7.9	14.9	5.1	76.9	93.4
Mar.	119.7	-20.7	12.4	9.1	.2	0	.6
Apr.	103.5	-16.2	12.2	9.0	5.0	0	0
May	83.5	-20.0	13.8	6.9	.7	0	0
June	71.9	-11.6	10.8	5.9	5.1	0	0
July	56.1	-15.8	9.4	7.2	.8	0	0
Aug.	45.8	-10.3	8.2	3.6	1.5	0	0
Sept.	39.1	-6.7	6.6	1.9	1.8	0	0
Water year		+28.6	98.8	133.7	58.5	275.0	477.6

Table 12.--Monthly water budget--Continued
Water budget in acre-feet for site 11

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1961							
Oct.	33.3	-5.8	4.5	5.8	1.4	0	3.1
Nov.	29.5	-3.8	2.3	9.4	1.9	0	6.0
Dec.	23.9	-5.6	2.0	3.8	.2	0	0
1962							
Jan.	19.8	-4.1	1.6	5.3	.4	0	2.4
Feb.	16.0	-3.8	2.1	3.3	.4	0	1.2
Mar.	12.1	-3.9	2.3	2.5	.6	0	.3
Apr.	9.9	-2.2	2.4	2.6	1.5	0	1.3
May	13.0	+3.1	2.6	1.3	.6	0	6.4
June	136.3	+123.3	17.8	29.5	10.1	234.2	394.7
July	102.0	-34.3	18.2	16.1	0	0	0
Aug.	77.1	-24.9	13.2	9.7	0	0	0
Sept.	67.6	-9.5	7.7	8.6	5.6	0	1.2
Water year		+28.5	76.7	99.9	22.7	234.2	416.6

Table 12.--Monthly water budget--Continued
Water budget in acre-feet for site 11

Period	Month end content	Change in content	Evapo-ration	Other pool consumption	Rainfall on pool	Discharge through outlets	Inflow
1962							
Oct.	55.1	-12.5	6.0	8.8	0.6	0	1.7
Nov.	58.9	+3.8	3.3	7.0	2.6	0	11.5
Dec.	129.8	+70.9	3.9	9.2	6.5	0	87.5
1963							
Jan.	112.4	-17.4	5.5	13.1	.4	0	.8
Feb.	107.3	-5.1	5.7	8.2	3.9	0	4.9
Mar.	89.9	-17.4	8.7	9.4	.3	0	.4
Apr.	73.2	-16.7	8.3	9.7	1.0	0	.3
May	56.8	-16.4	8.5	8.3	.3	0	.1
June	183.9	+127.1	10.4	14.7	9.6	231.6	374.2
July	131.3	-52.6	21.2	23.9	3.1	33.1	22.5
Aug.	94.2	-37.1	15.2	17.6	1.0	1/ 5.4	.1
Sept.	80.2	-14.0	9.9	11.3	3.9	0	3.3
Water year		+12.6	106.6	151.2	33.2	270.1	507.3

1/ Water released through valve.