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# Compilation of Hydrologic Data, Pin Oak Creek Trinity River Basin, Texas 1968

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY - WATER RESOURCES DIVISION
Texas District
Trigg Twichell, District Chief

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*Prepared in Cooperation with Texas Water Development Board*

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UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

# COMPILATION OF HYDROLOGIC DATA, PIN OAK CREEK TRINITY RIVER BASIN, TEXAS 1968-1972

300399

Prepared in cooperation with the Texas Water Development Board

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# COMPILATION OF HYDROLOGIC DATA, PIN OAK CREEK
# TRINITY RIVER BASIN, TEXAS
# 1968

## INTRODUCTION

### History of Small Watershed Projects in Texas

The U.S. Soil Conservation Service is actively engaged in the installation of flood and soil erosion reducing measures in Texas under the authority of "The Flood Control Act of 1936 and 1944" and "Watershed Protection and Flood Prevention Act" (Public Law 566), as amended. In June 1968, the Soil Conservation Service estimated approximately 3,500 structures to be physically and economically feasible for installation in Texas. As of September 30, 1968, 1,271 of these structures had been built.

This watershed-development program will have varying but important effects on the surface- and ground-water resources of river basins, especially where a large number of the floodwater-retarding structures are built. Basic hydrologic data are needed to appraise the effects of structures on water yield and mode of occurrence of runoff.

Hydrologic investigations of these small watersheds were begun by the U.S. Geological Survey in 1951 and are now being made in 11 areas (fig. 1). These studies are being made in cooperation with the Texas Water Development Board, the Soil Conservation Service, the San Antonio River Authority, the city of Dallas, and the Tarrant County Water Control and Improvement District No. 1. The 11 study areas were chosen to sample watersheds having different rainfall, topography, geology, and soils. In four of the study areas (Mukewater, North, Little Elm, and Pin Oak Creeks), streamflow and rainfall records were collected prior to construction of the floodwater-retarding structures, thus affording the opportunity for analyses of the conditions "before and after" development. Structures have now been built in three of these study areas. A summary of the development of the floodwater-retarding structures on each study area as of September 30, 1968, is shown in table 1.

### Purpose and Scope of this Basic-Data Report

This report, which is the ninth in a series of basic-data reports published annually for the Pin Oak Creek study area, contains the rainfall and runoff data collected during the 1968 water year for the 17.6-square-mile area above the stream-gaging station Pin

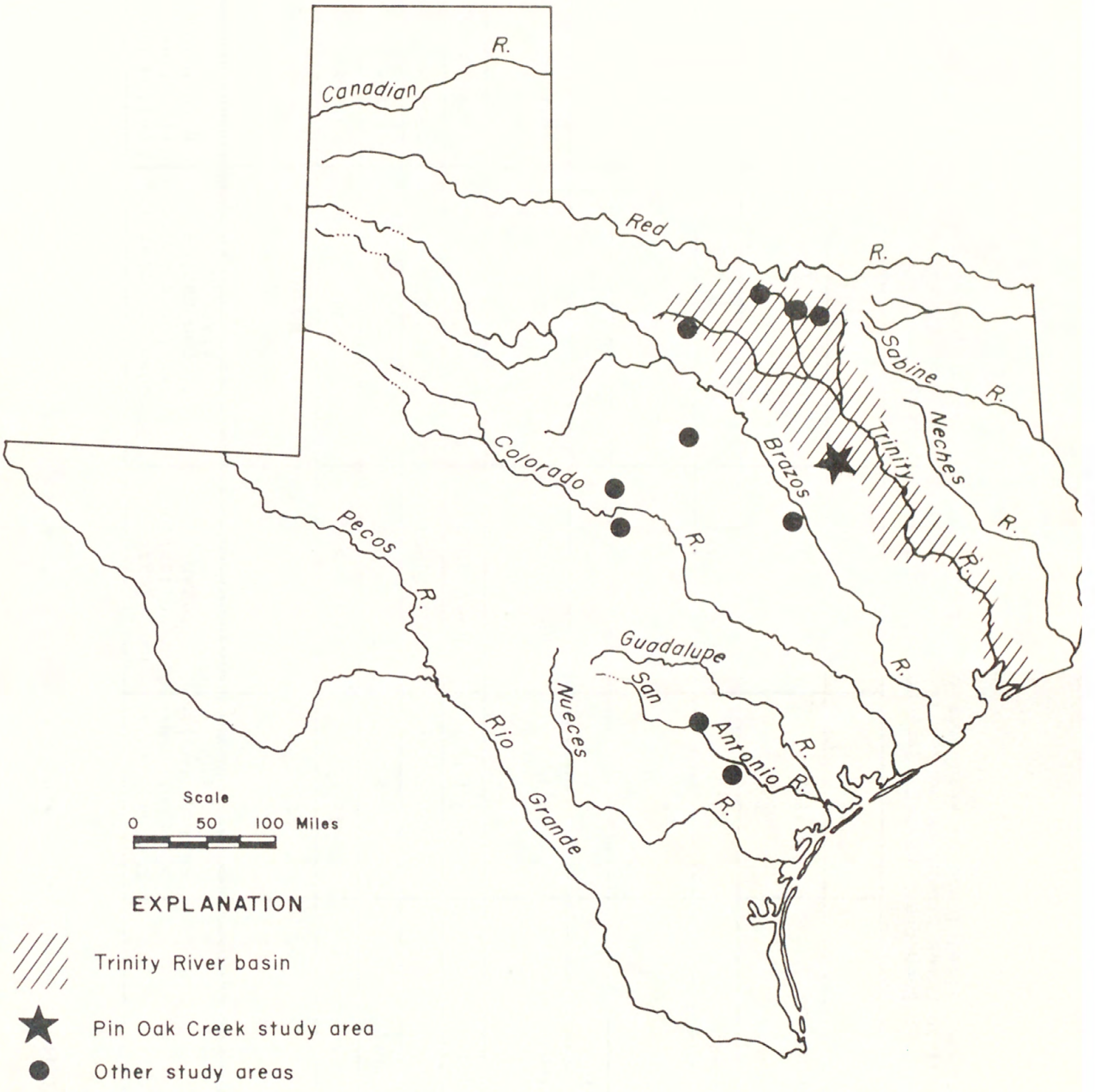



FIGURE 1.–Location of the Pin Oak Creek study area

Table 1.--Small watershed study areas in Texas as of Sept. 30, 1968

| Watershed | Drainage area above stream-gaging station (sq mi) | 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 | 14 | 1954-57, 63 |
| Little Elm Creek near Aubrey | 75.5 | June 1956 | 8 | 1966 |
| Honey Creek near McKinney | 39.0 | July 1951 | 12 | 1951-57 |
| Pin Oak Creek near Hubbard | 17.6 | Sept. 1956 | 6 | 1962-63, 65 |
| Brazos River basin: | | | | |
| Green Creek near Alexander | 46.1 | Oct. 1954 | 8 | 1954-56 |
| Cow Bayou near Mooreville | 79.6 | Sept. 1954 | 26 | 1955-58, 64-65 |
| Colorado River basin: | | | | |
| Deep Creek near Mercury | *43.9 | June 1951 | 5 | 1951-53 |
| Mukewater Creek at Trickham | 70.0 | Aug. 1951 | 6 | 1961-62, 65 |
| San Antonio River basin: | | | | |
| Calaveras Creek near Elmendorf | 77.2 | Aug. 1954 | 7 1/ | 1954-58 |
| Escondido Creek at Kenedy | **72.4 | July 1954 | 10 | 1954-58 |

* 8.31 sq mi above Dry Prong Deep Creek near Mercury not included in this total.
** 8.43 sq mi above Escondido Creek subwatershed No. 11 (Dry Escondido Creek) near Kenedy not included in this total.
1/ Two additional structures, sites 1 and 4, were destroyed during the 1968 water year due to construction of Calaveras Dam.

Oak Creek near Hubbard, Texas. The location of floodwater-retarding structures (ungaged) and hydrologic instruments in the area are shown on figure 2.

The investigation is scheduled to continue through a period of both above- and below-normal precipitation to define the various factors used in the analyses of rainfall-runoff relationships before and after floodwater-retarding structures were built.

To facilitate the publication and distribution of this report at the earliest feasible time, certain material contained herein does not conform to the formal publication standards of the U.S. Geological Survey.

## DESCRIPTION OF THE WATERSHED

Pin Oak Creek originates south of Hubbard in Hill County. The creek flows eastward for approximately 14 miles adjacent to the Limestone-Navarro County line. Turning northeastward it flows an additional 14 miles in Navarro County and empties into Richland Creek near Richland. Pin Oak Creek drains a triangular shaped basin of about 171 square miles at the mouth and 17.6 square miles above the Geological Survey stream-gaging station at the bridge on State Highway 171 near Hubbard, Texas.

Land in the basin above the reservoir sites consists of about 70 percent pasture with the remaining 30 percent in cultivation, much of it contour terraced. In the reach downstream from the reservoir sites, about 80 percent of the land is cultivated with 1/2 of the cultivation terraced. A small portion, 15 percent, of the land is wooded, primarily along the stream channel.

Basically the rural watershed economy is agricultural, with cotton, grain sorghums, corn, and Johnson grass hay being the predominant crops. Beef cattle production is the major source of income.

The topography of the Pin Oak Creek watershed is gently rolling with broad flat valleys and some flattened hilltop areas. Primarily the watershed is a plain with numerous intermittent streams which have cut narrow shallow valleys in a dendritic pattern. The topographic plain slopes southeastward at approximately 17 feet per mile. Maximum relief is about 210 feet, ranging from an altitude of 460 feet above mean sea level at the stream-gaging station to an altitude of about 670 feet on the divide above reservoir site No. 1. The channel gradient averages about 20 feet per mile; generally, the tributaries above the floodwater-retarding structures have a gradient of 60 to 100 feet per mile.

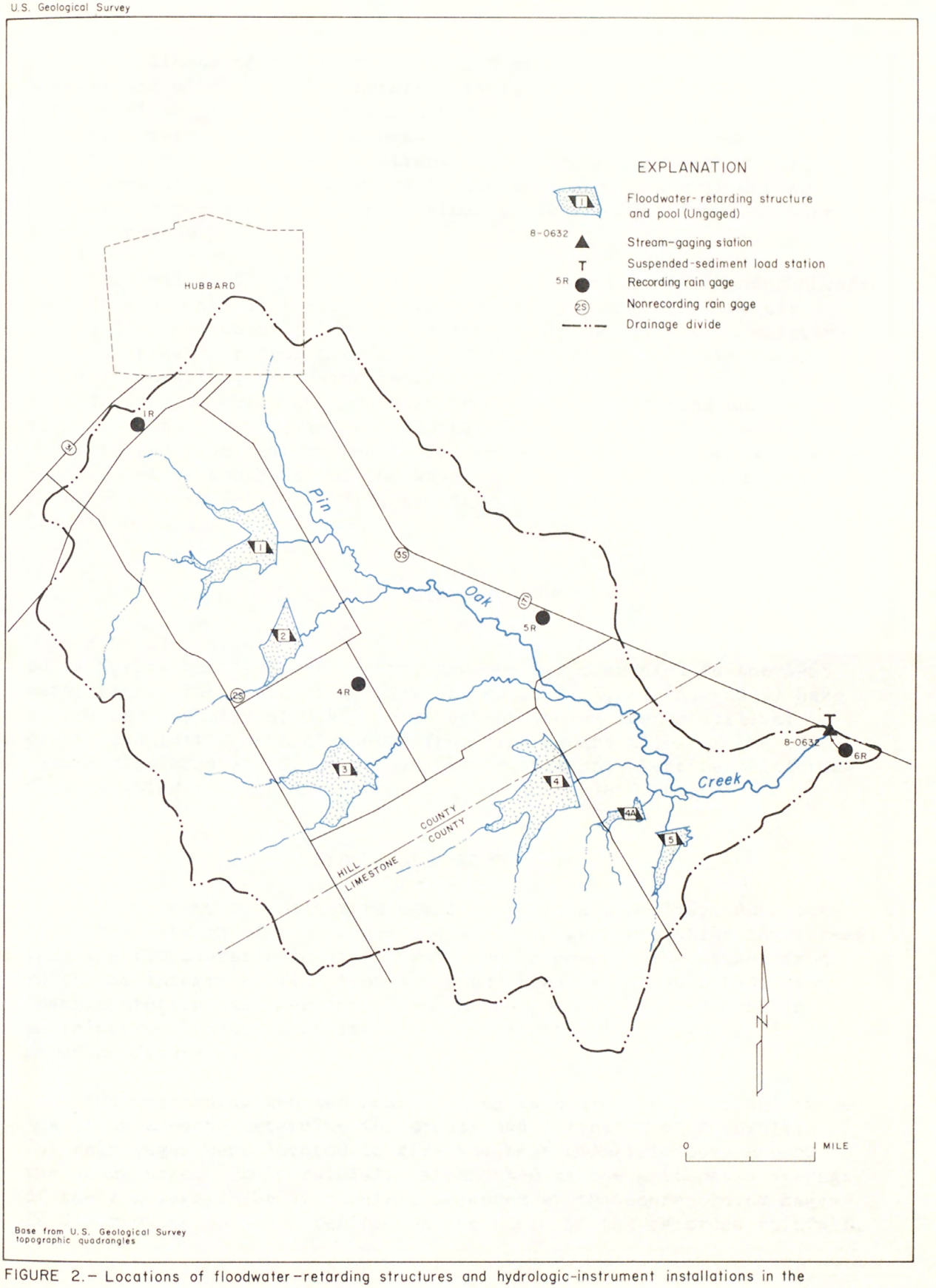



FIGURE 2.– Locations of floodwater-retarding structures and hydrologic-instrument installations in the Pin Oak Creek study area

The climate of the study area is humid subtropical with hot summers and mild winters. Rainfall is fairly evenly distributed throughout the year, except for a midsummer minimum. Tropical maritime air masses dominate the area almost completely from early May to late September and have a strong influence on the weather during other seasons. Prevailing winds in the area are southerly during most of the year, with northerly winds quite frequent from November through February.

Rainfall in the study area is mostly the result of thundershowers. Amounts are heaviest in late spring and early summer as a result of the interaction of polar air masses colliding with warm, moisture laden tropical air from the Gulf of Mexico. High-intensity rains of short duration, producing rapid runoff may occur at almost any time during the year, but are most frequent in the spring and early summer. Considerable variation in rainfall may occur from month to month and from year to year. The wettest year of record at Corsicana (28 miles northeast of the study area) was 1957, when a total of 61.50 inches fell. In 1917, the dryest year of record, only 19.36 inches occurred.

## FLOODWATER-RETARDING STRUCTURES

Five floodwater-retarding structures in the study area were built during the 1963 water year, and one was completed in the 1965 water year. These six structures (sites 1, 2, 3, 4, 4A, and 5) have a combined capacity of 3,480 acre-feet at the emergency spillway crests and partly control runoff from 9.68 square miles of the 17.6-square-mile area above the stream-gaging station. Pertinent information relating to each structure is given in table 2.

## HYDROLOGIC INSTRUMENTS

Instruments to collect rainfall, runoff, and sediment data consist of a network of rain gages and a stream-gaging station downstream from the floodwater-retarding structures to measure the stage, from which the integrated flow from the study area can be computed. No instrumentation has been installed on the pool sites, and none is anticipated. Location of instruments presently in operation is shown on figure 2.

Four recording and two nonrecording rain gages are located in the study area to determine the amount and intensity of rainfall. The rain gages were located to give the best geometric coverage of the study area. Basin rainfall is computed as the arithmetic average of the six gages. Daily rainfall observed at the nonrecording gages is distributed to storm periods on the basis of the recorded rainfall.

Table 2.--Floodwater-retarding structures in Pin Oak Creek study area, 1968 water year

| Site number | Drainage area (sq mi) | Date dam completed | Capacity, in acre-feet | | |
|---|---|---|---|---|---|
| | | | Total | Floodwater-retarding pool | Sediment pool |
| 1 | 2.66 | April 1963 | 836 | 769 | 67 |
| 2 | 0.99 | April 1963 | 354 | 303 | 51 |
| 3 | 2.13 | April 1963 | 791 | 641 | 150 |
| 4 | 2.39 | November 1964 | 943 | 744 | 199 |
| 4A | 0.51 | December 1962 | 165 | 111 | 54 |
| 5 | 1.00 | December 1962 | 391 | 283 | 108 |

The stream-gaging station, Pin Oak Creek near Hubbard, continuously records the stage, which together with measurements of streamflow allows the computation of the total runoff from the study area. Streamflow records at this gage began September 1, 1956.

Suspended-sediment load is computed from daily or more frequent sediment samples collected at the gaging station. The collection of sediment data began in October 1956 and continued until September 1960 when the sediment station was discontinued. The sediment station was reestablished in September 1962, and data have been collected to the present time.

## SUMMARY OF DATA FOR THE 1968 WATER YEAR

### Rainfall and Runoff

Average rainfall over the study area for the 1968 water year was 52.22 inches, or 141 percent of the long-term normal (1931-60) rainfall of 37.06 inches recorded by the U.S. Weather Bureau of Corsicana (28 miles northeast). Rainfall was scattered throughout the year with every month receiving some rainfall. The monthly rainfall totals ranged from 0.28 inch in August to 8.72 inches in May. The mean daily discharge at the stream-gaging station Pin Oak Creek near Hubbard was 33.6 cfs (cubic feet per second), compared with the 12-year average of 12.2 cfs. The annual runoff at the stream-gaging station was 24,430 acre-feet. This runoff represents an equivalent depth of 22.93 inches.

A storm event is defined as a period of rainfall separated by at least 6 hours from other rainfall. Storms are selected for detailed rainfall-runoff computations on the basis of rainfall totals and distribution, the peak discharge produced from the rainfall at the stream-gaging station, and the assurance of good rainfall and runoff records for the storm periods selected.

For the 1968 water year, eight storm periods were selected for detailed computations and analyses. These computations include detailed time breakdown of rainfall and discharge, hydrographs, and mass curves. The storms selected occurred on October 29-30, 1967; November 9-10, 1967; March 10-11, 1968; April 26, 1968; May 9-10, 1968; May 11, 1968; June 2-3, 1968; and June 23-24, 1968. A summary of rainfall-runoff data for these storms is shown in table 3. Computations along with hydrograph and mass curves for each storm are shown in the compilation of data.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY-TEXAS DISTRICT

ANNUAL STORM RAINFALL-RUNOFF SUMMARY DATA

Table 3.--Storm rainfall-runoff data, 1968 water year.

| Date of Storm | Rainfall (inches) | | | | | Runoff (inches) | Ratio runoff to rainfall | Maximum discharge (cfs) |
|---|---|---|---|---|---|---|---|---|
| | Duration (hours) | Total | Maximum increment | | | | | |
| | | | 15-minute | 30-minute | 60-minute | | | |
| Pin Oak Creek near Hubbard, Tex. (Drainage area, 17.6 sq mi, of which 9.68 sq mi is above floodwater-retarding structures) | | | | | | | | |
| Oct. 29-30, 1967 | 13 | 3.47 | 0.33 | 0.60 | 0.91 | 1.42 | 0.41 | 1,280 |
| Nov. 9-10, 1967 | 26 | 3.30 | .19 | .30 | .53 | 1.35 | .41 | 1,140 |
| Mar. 10-12, 1968 | 10 | 2.09 | .15 | .27 | .49 | 1.01 | .48 | 1,050 |
| Apr. 26-27, 1968 | 3.0 | 2.42 | .43 | .83 | 1.09 | .92 | .38 | 1,320 |
| May 9-10, 1968 | 14 | 4.08 | .76 | 1.10 | 1.74 | 2.38 | .58 | 3,300 |
| June 2-4, 1968 | 38 | 3.60 | .66 | 1.18 | 1.62 | 1.62 | .45 | 1,550 |
| June 23-24, 1968 | 15 | 3.02 | .26 | .46 | .82 | 1.09 | .36 | 1,550 |

## Chemical Quality and Sedimentation

During the 1968 water year, chemical-quality or sediment data were collected at the stream-gaging station near Hubbard or at each reservoir in the watershed; the results of the chemical analyses for the reservoir sites are given in table 4. The water in the reservoirs contained calcium and bicarbonate as the predominant ions. The dissolved solids ranged from 100 mg/l (milligrams per liter) at site 1 to 216 mg/l at site 5. No samples were collected at the stream-gaging station during the year.

The annual total sediment discharge during the 1968 water year at the stream-gaging station near Hubbard was 23,043.2 tons. The maximum daily sediment concentration of 998 mg/l occurred on March 11, 1968, and the maximum daily sediment load of 2,560 tons occurred on May 10, 1968. There was no flow for many days. The daily suspended-sediment loads are given in table 5. Seven sediment samples collected at the stream-gaging station were analyzed for size distribution; the results are given in table 6 and indicate that the suspended sediment is composed mostly of silt and clay (table 6).

Table 4.--Chemical analyses of surface water, Pin Oak Creek study area, 1968 water year.

(Results in milligrams per liter except as indicated)

| Date of collection | Silica ($SiO_2$) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Carbonate ($CO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Boron (B) | Dissolved solids: Milligrams per liter (mg/l) | Hardness as $CaCO_3$: Calcium, Magnesium | Hardness as $CaCO_3$: Noncarbonate | Sodium adsorption ratio | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIN OAK SUBWATERSHED NO. 1 NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 9.6 | 23 | 2.3 | 9.3 | | 90 | 0 | 4.8 | 3.8 | 0.4 | 2.4 | | 100 | 67 | 0 | | 170 | 7.7 |
| PIN OAK SUBWATERSHED NO. 2 NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 6.9 | 31 | 2.6 | 7.8 | | 114 | 0 | 4.0 | 3.6 | 0.5 | 1.3 | | 114 | 88 | 0 | | 203 | 7.6 |
| PIN OAK SUBWATERSHED NO. 3 NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 5.4 | 34 | 2.8 | 6.8 | | 117 | 0 | 7.4 | 3.4 | 0.4 | 2.2 | | 120 | 96 | 0 | | 212 | 8.0 |
| PIN OAK SUBWATERSHED NO. 4 NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 7.6 | 44 | 2.9 | 8.9 | | 135 | 0 | 20 | 4.4 | 0.5 | 2.6 | | 157 | 122 | 11 | | 270 | 8.1 |
| PIN OAK SUBWATERSHED NO. 4-A NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 11 | 47 | 3.0 | 18 | | 117 | 0 | 58 | 5.6 | 0.9 | 1.6 | | 203 | 130 | 34 | | 326 | 7.7 |
| PIN OAK SUBWATERSHED NO. 5 NEAR HUBBARD, TEXAS | | | | | | | | | | | | | | | | | | |
| Aug. 12, 1968 | 3.1 | 52 | 3.4 | 23 | | 159 | 0 | 47 | 8.4 | 0.9 | 0.6 | | 216 | 144 | 14 | | 365 | 8.2 |

Table 5.--Daily, monthly, and yearly summary of water and suspended-sediment discharge, Pin Oak Creek near Hubbard, 1968 water year.

| Day | October | | | November | | | December | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean discharge (cfs) | Suspended sediment | | Mean discharge (cfs) | Suspended sediment | | Mean discharge (cfs) | Suspended sediment | |
| | | Mean concentration (ppm) | Tons per day | | Mean concentration (ppm) | Tons per day | | Mean concentration (ppm) | Tons per day |
| 1.. | 0 | -- | 0 | 116 | 223 | 70 | 0.10 | 9 | T |
| 2.. | 0 | -- | 0 | 79 | 145 | 31 | 1.2 | 26 | .1 |
| 3.. | 0 | -- | 0 | 52 | 102 | 14 | .79 | 28 | .1 |
| 4.. | 0 | -- | 0 | 37 | 88 | 8.8 | .10 | 22 | T |
| 5.. | 0 | -- | 0 | 24 | 45 | 2.9 | 2.2 | 71 | .7 |
| 6.. | 0 | -- | 0 | 11 | 34 | 1.0 | 3.8 | 67 | .7 |
| 7.. | 0 | -- | 0 | 4.7 | 28 | .4 | 1.5 | 24 | .1 |
| 8.. | 0 | -- | 0 | 2.6 | 30 | .2 | .79 | 22 | .1 |
| 9.. | 0 | -- | 0 | 1.8 | 23 | .1 | .10 | 24 | T |
| 10.. | 0 | -- | 0 | 495 | 729 | S 1170 | .10 | 14 | T |
| 11.. | 0 | -- | 0 | 144 | 274 | 107 | .10 | 16 | T |
| 12.. | 0 | -- | 0 | 119 | 167 | 54 | .08 | 16 | T |
| 13.. | 0 | -- | 0 | 98 | 127 | 34 | .13 | 16 | T |
| 14.. | 0 | -- | 0 | 64 | 85 | 15 | 6.4 | 100 | 1.7 |
| 15.. | 48 | 329 | 188 | 42 | 47 | 5.3 | 333 | 753 | S 1020 |
| 16.. | 80 | 383 | 121 | 29 | 39 | 3.1 | 115 | 250 | 78 |
| 17.. | 26 | 105 | 7.4 | 18 | 26 | 1.3 | 146 | 218 | 88 |
| 18.. | 13 | 50 | 1.8 | 9.2 | 22 | .6 | 70 | 157 | 30 |
| 19.. | 5.2 | 36 | .5 | 5.1 | 24 | .3 | 44 | 145 | 17 |
| 20.. | 2.3 | 22 | .1 | 2.7 | 18 | .1 | 31 | 115 | 9.6 |
| 21.. | 1.1 | 17 | .1 | 1.8 | 14 | .1 | 40 | 112 | 14 |
| 22.. | .58 | 23 | T | 1.2 | 13 | T | 26 | 97 | 6.8 |
| 23.. | .37 | 14 | T | .70 | 16 | T | 11 | 42 | 1.2 |
| 24.. | .20 | 20 | T | .22 | 16 | T | 4.6 | 37 | .5 |
| 25.. | .10 | 24 | T | .10 | 17 | T | 2.7 | 22 | .2 |
| 26.. | .08 | 12 | T | .10 | 24 | T | 1.2 | 24 | .1 |
| 27.. | .05 | 8 | T | .04 | 22 | T | .70 | 30 | .1 |
| 28.. | .02 | 8 | T | .10 | 21 | T | .35 | 15 | T |
| 29.. | 15 | 18 | S 8.3 | .22 | 11 | T | .22 | 15 | T |
| 30.. | 524 | 897 | S1830 | .35 | 13 | T | 4.4 | 38 | S 2.1 |
| 31.. | 134 | 305 | 110 | -- | -- | -- | 31 | 112 | S 10 |
| Total | 850.00 | -- | 2267.3 | 1358.93 | -- | 1519.3 | 878.56 | -- | 1281.1 |

| | January | | | February | | | March | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.. | 13 | 90 | 3.2 | 94 | 537 | S 260 | 16 | 42 | 1.8 |
| 2.. | 8.9 | 170 | 4.1 | 53 | 164 | 23 | 9.6 | 48 | 1.2 |
| 3.. | 46 | 145 | S 19 | 27 | 102 | 7.4 | 5.9 | 65 | 1.0 |
| 4.. | 26 | 70 | 4.9 | 14 | 77 | 2.9 | 3.6 | 57 | .6 |
| 5.. | 39 | 48 | 5.0 | 8.9 | 44 | 1.1 | 2.7 | 48 | .4 |
| 6.. | 22 | 55 | 3.3 | 5.6 | 28 | .4 | 2.9 | 44 | .3 |
| 7.. | 10 | 28 | .8 | 2.7 | 24 | .2 | 2.4 | 25 | .2 |
| 8.. | 7.0 | 25 | .5 | 1.4 | 22 | .1 | 1.9 | 21 | .1 |
| 9.. | 42 | 115 | S 18 | 1.0 | 20 | .1 | 2.0 | 21 | .1 |
| 10.. | 64 | 180 | S 32 | .79 | 20 | T | 2.0 | 9 | .1 |
| 11.. | 36 | 260 | 25 | .79 | 20 | T | 370 | 998 | S 1440 |
| 12.. | 22 | 220 | 13 | .70 | 20 | T | 107 | 351 | S 107 |
| 13.. | 12 | 195 | 6.3 | .61 | 15 | T | 76 | 196 | 40 |
| 14.. | 7.2 | 180 | 3.5 | 45 | 255 | S 43 | 48 | 167 | 22 |
| 15.. | 5.3 | 173 | 2.5 | 45 | 86 | S 13 | 30 | 122 | 9.9 |
| 16.. | 4.0 | 165 | 1.8 | 21 | 32 | 1.8 | 20 | 78 | 4.2 |
| 17.. | 2.9 | 152 | 1.2 | 12 | 27 | .9 | 13 | 50 | 1.8 |
| 18.. | 40 | 453 | S 88 | 6.7 | 16 | .3 | 8.3 | 58 | 1.3 |
| 19.. | 54 | 125 | 18 | 13 | 59 | S 3.4 | 6.6 | 38 | .7 |
| 20.. | 26 | 100 | 7.0 | 12 | 55 | 1.8 | 28 | 312 | 42 |
| 21.. | 121 | 675 | S 461 | 9.2 | 30 | .8 | 22 | 110 | 6.5 |
| 22.. | 144 | 431 | S 228 | 7.8 | 35 | .7 | 9.9 | 69 | 1.8 |
| 23.. | 71 | 207 | S 39 | 6.2 | 30 | .5 | 6.3 | 55 | .9 |
| 24.. | 39 | 140 | 15 | 6.2 | 18 | .3 | 5.0 | 55 | .7 |
| 25.. | 23 | 72 | 4.5 | 4.3 | 22 | .3 | 4.1 | 54 | .6 |
| 26.. | 12 | 62 | 2.0 | 3.1 | 21 | .2 | 2.9 | 44 | .3 |
| 27.. | 8.6 | 46 | 1.1 | 2.3 | 21 | .1 | 2.0 | 43 | .2 |
| 28.. | 5.3 | 36 | .5 | 66 | 277 | S 74 | 1.8 | 39 | .2 |
| 29.. | 3.6 | 32 | .3 | 32 | 46 | S 4.4 | 1.7 | 32 | .2 |
| 30.. | 6.2 | 57 | S 1.4 | -- | -- | -- | 1.5 | 37 | .2 |
| 31.. | 17 | 87 | S 4.3 | -- | -- | -- | 1.4 | 39 | .2 |
| Total | 938.0 | -- | 1014.2 | 502.29 | -- | 440.8 | 814.5 | -- | 1686.5 |

GPO 872-455

S Computed by subdividing day.
T Less than 0.05 ton.

Form 9-265-a Rev.
(January 1964)

Table 5.--Daily, monthly, and yearly summary of water and suspended-sediment discharge, Pin Oak Creek near Hubbard, 1968 water year.--Continued

| Day | April | | | May | | | June | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean discharge (cfs) | Suspended sediment | | Mean discharge (cfs) | Suspended sediment | | Mean discharge (cfs) | Suspended sediment | |
| | | Mean concentration (ppm) | Tons per day | | Mean concentration (ppm) | Tons per day | | Mean concentration (ppm) | Tons per day |
| 1.. | 3.1 | 50 | 0.4 | 20 | 90 | 4.9 | 12 | 37 | 1.2 |
| 2.. | 233 | 636 | S 567 | 12 | 82 | 2.7 | 219 | 716 | S 1120 |
| 3.. | 173 | 650 | S 454 | 36 | 861 | S 305 | 402 | 896 | S 1060 |
| 4.. | 88 | 246 | S 64 | 41 | 776 | S 184 | 148 | 325 | S 133 |
| 5.. | 54 | 138 | 20 | 16 | 85 | 3.7 | 108 | 208 | 61 |
| 6.. | 30 | 70 | 5.7 | 11 | 87 | 2.6 | 72 | 145 | 28 |
| 7.. | 18 | 48 | 2.3 | 10 | 65 | 1.8 | 49 | 110 | 15 |
| 8.. | 7.8 | 59 | 1.2 | 88 | 871 | S 261 | 30 | 86 | 7.0 |
| 9.. | 5.7 | 32 | .5 | 80 | 681 | S 476 | 25 | 70 | 4.7 |
| 10.. | 4.5 | 35 | .4 | 1050 | 791 | S 2560 | 23 | 62 | 3.8 |
| 11.. | 3.7 | 35 | .4 | 296 | 733 | S 840 | 21 | 70 | 4.0 |
| 12.. | 119 | 806 | S 826 | 140 | 270 | 102 | 19 | 60 | 3.1 |
| 13.. | 134 | 405 | S 202 | 130 | 172 | 60 | 18 | 47 | 2.3 |
| 14.. | 64 | 210 | 36 | 122 | 148 | 49 | 17 | 43 | 2.0 |
| 15.. | 43 | 120 | 14 | 117 | 135 | 43 | 18 | 32 | 1.6 |
| 16.. | 27 | 64 | 4.7 | 109 | 113 | 33 | 18 | 30 | 1.5 |
| 17.. | 17 | 60 | 2.8 | 227 | 663 | S 683 | 17 | 29 | 1.3 |
| 18.. | 12 | 38 | 1.2 | 130 | 235 | 82 | 16 | 30 | 1.3 |
| 19.. | 8.1 | 48 | 1.0 | 92 | 145 | 36 | 16 | 35 | 1.5 |
| 20.. | 6.5 | 40 | .7 | 68 | 107 | 20 | 15 | 65 | 2.6 |
| 21.. | 5.8 | 32 | .5 | 47 | 97 | 12 | 15 | 78 | 3.2 |
| 22.. | 5.8 | 32 | .5 | 39 | 84 | 8.8 | 14 | 72 | 2.7 |
| 23.. | 5.5 | 32 | .5 | 33 | 60 | 5.4 | 14 | 63 | 2.4 |
| 24.. | 4.9 | 32 | .4 | 26 | 44 | 3.1 | 503 | 839 | S 2270 |
| 25.. | 4.5 | 37 | .4 | 20 | 36 | 1.9 | 86 | 220 | 51 |
| 26.. | 33 | 404 | S 273 | 18 | 35 | 1.7 | 59 | 152 | 24 |
| 27.. | 409 | 870 | S 1610 | 15 | 36 | 1.5 | 33 | 78 | 7.0 |
| 28.. | 63 | 230 | 39 | 14 | 37 | 1.4 | 22 | 60 | 3.6 |
| 29.. | 41 | 150 | 17 | 13 | 36 | 1.3 | 18 | 54 | 2.6 |
| 30.. | 30 | 115 | 9.3 | 13 | 35 | 1.2 | 15 | 40 | 1.6 |
| 31.. | -- | -- | -- | 13 | 28 | 1.0 | -- | -- | -- |
| Total | 1653.9 | -- | 4154.9 | 3046 | -- | 5789.0 | 2042 | -- | 4823.0 |

| | July | | | August | | | September | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.. | 14 | 38 | 1.4 | 7.9 | 63 | S 1.5 | | | |
| 2.. | 14 | 91 | S 4.5 | .71 | 42 | .1 | | | |
| 3.. | 20 | 122 | 6.6 | .16 | 42 | T | | | |
| 4.. | 19 | 115 | 5.9 | 0 | -- | 0 | | | |
| 5.. | 18 | 113 | 5.5 | 0 | -- | 0 | | | |
| 6.. | 17 | 110 | 5.0 | 0 | -- | 0 | | | |
| 7.. | 15 | 98 | 4.0 | 0 | -- | 0 | | | |
| 8.. | 14 | 113 | 4.3 | 0 | -- | 0 | | | |
| 9.. | 13 | 134 | 4.7 | 0 | -- | 0 | | | |
| 10.. | 11 | 130 | 3.9 | 0 | -- | 0 | | | |
| 11.. | 9.3 | 127 | 3.2 | 0 | -- | 0 | | | |
| 12.. | 8.4 | 125 | 2.8 | 0 | -- | 0 | | | |
| 13.. | 9.0 | 160 | 3.9 | 0 | -- | 0 | | | |
| 14.. | 6.6 | 128 | 2.3 | 0 | -- | 0 | | | |
| 15.. | 3.8 | 95 | 1.0 | 0 | -- | 0 | | | |
| 16.. | 2.7 | 107 | .8 | 0 | -- | 0 | | | |
| 17.. | 2.7 | 110 | .8 | 0 | -- | 0 | | | |
| 18.. | 2.7 | 88 | .6 | 0 | -- | 0 | | | |
| 19.. | 2.7 | 84 | .6 | 0 | -- | 0 | | | |
| 20.. | 2.7 | 98 | .7 | 0 | -- | 0 | | | |
| 21.. | 2.4 | 75 | .5 | 0 | -- | 0 | | | |
| 22.. | 2.0 | 63 | .3 | 0 | -- | 0 | | | |
| 23.. | 2.0 | 55 | .3 | 0 | -- | 0 | | | |
| 24.. | 1.7 | 72 | .3 | 0 | -- | 0 | | | |
| 25.. | 1.7 | 46 | .2 | 0 | -- | 0 | | | |
| 26.. | 1.7 | 46 | .2 | 0 | -- | 0 | | | |
| 27.. | 1.5 | 50 | .2 | 0 | -- | 0 | | | |
| 28.. | 1.2 | 58 | .2 | 0 | -- | 0 | | | |
| 29.. | .88 | 45 | .1 | 0 | -- | 0 | | | |
| 30.. | .16 | 35 | T | 0 | -- | 0 | | | |
| 31.. | 1.5 | 54 | .7 | 0 | -- | 0 | | | |
| Total | 222.34 | -- | 65.5 | 8.77 | -- | 1.6 | 0 | -- | 0 |

Total discharge for year (cfs-days) ..... 12315.29
Total load for year (tons) ..... 23043.2

S Computed by subdividing day.
T Less than 0.05 ton.

Form 9-265-a Rev.
(January 1964)

Table 6.--Particle-size analyses of suspended sediment, Pin Oak Creek near Hubbard, 1968 water year.

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

| Date of collection | Time | Water temperature (°C) | Discharge (cfs) | Suspended sediment | | | | | | | | | | | | Methods of analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Concentration of sample (mg/l) | Discharge (tons per day) | 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 | 1.000 | |
| Dec. 15, 1967..... | 0830 | 6 | 808 | 1640 | | 54 | 55 | 60 | 61 | 73 | 84 | 98 | 100 | -- | | SPWC |
| Jan. 18, 1968..... | 1600 | 13 | 43 | 988 | | 90 | 90 | 92 | 97 | 99 | 99 | 100 | -- | -- | | SPWC |
| Jan. 18..... | 1800 | 12 | 72 | 998 | | 87 | 89 | 93 | 96 | 96 | 100 | 100 | -- | -- | | PWC |
| Jan. 18..... | 2000 | 13 | 154 | 969 | | 87 | 90 | 93 | 94 | 96 | 99 | 100 | -- | -- | | SPWC |
| Feb. 28..... | 0900 | 10 | 58 | 882 | | 63 | 72 | 75 | 81 | 85 | 96 | 99 | 100 | -- | | SBWC |
| Mar. 11..... | 0700 | 14 | 417 | 2560 | | 49 | 48 | 55 | 60 | 71 | 83 | 96 | 99 | 100 | | SPWC |
| Mar. 11..... | 1200 | 14 | 917 | 1300 | | 60 | 61 | 62 | 67 | 73 | 83 | 97 | 99 | 100 | | SPWC |

# C O M P I L A T I O N  O F  D A T A

## 8-0632. Pin Oak Creek near Hubbard, Tex.

Location.--Lat 31°48'05", long 96°43'10", on right bank 85 ft downstream from bridge on State Highway 171, 5.8 miles southeast of Hubbard, Hill County, and 9 miles upstream from Elm Creek.

Drainage area.--17.6 sq mi.

Records available.--September 1956 to September 1968.

Gage.--Digital water-stage recorder. Datum of gage is 463.08 ft above mean sea level, datum of 1929, Fort Worth supplementary adjustment of 1942. Prior to May 1, 1965, graphic water-stage recorder at same site and datum.

Average discharge.--12 years, 12.2 cfs (8,800 acre-ft per year).

Extremes.--Maximum discharge during year, 3,300 cfs May 10 (gage height, 13.03 ft); no flow for many days.
1956-68: Maximum discharge, 4,340 cfs Aug. 24, 1958 (gage height, 13.86 ft); no flow at times each year.
Maximum stage known since at least 1900, about 17 ft in August 1919, from information by local resident.

Remarks.--Records good. At end of year, flow from 9.68 sq mi above this station was partly controlled by 6 floodwater-retarding structures with a total combined capacity of 3,480 acre-ft below the flood-spillway crests, of which 2,850 acre-ft is floodwater-retarding capacity and 630 acre-ft is sediment-pool capacity. The capacity in these pools allocated to sediment storage will be used for conservation storage until eliminated by sedimentation. Three recording and two standard rain gages are located in the basin above the station, and one recording rain gage is located at the station. Records of suspended sediment loads and water temperatures for the water year 1968 are published in Part 2 of this report.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 116 | .10 | 13 | 94 | 16 | 3.1 | 20 | 12 | 14 | 7.9 | 0 |
| 2 | 0 | 79 | 1.2 | 8.9 | 53 | 9.6 | 233 | 12 | 219 | 14 | .71 | 0 |
| 3 | 0 | 52 | .79 | 46 | 27 | 5.9 | 173 | 36 | 402 | 20 | .16 | 0 |
| 4 | 0 | 37 | .10 | 26 | 14 | 3.6 | 88 | 41 | 148 | 19 | 0 | 0 |
| 5 | 0 | 24 | 2.2 | 39 | 8.9 | 2.7 | 54 | 16 | 108 | 18 | 0 | 0 |
| 6 | 0 | 11 | 3.8 | 22 | 5.6 | 2.9 | 30 | 11 | 72 | 17 | 0 | 0 |
| 7 | 0 | 4.7 | 1.5 | 10 | 2.7 | 2.4 | 18 | 10 | 49 | 15 | 0 | 0 |
| 8 | 0 | 2.6 | .79 | 7.0 | 1.4 | 1.9 | 7.8 | 88 | 30 | 14 | 0 | 0 |
| 9 | 0 | 1.8 | .10 | 42 | 1.0 | 2.0 | 5.7 | 80 | 25 | 13 | 0 | 0 |
| 10 | 0 | 495 | .10 | 64 | .79 | 2.0 | 4.5 | 1,050 | 23 | 11 | 0 | 0 |
| 11 | 0 | 144 | .10 | 36 | .79 | 370 | 3.7 | 296 | 21 | 9.3 | 0 | 0 |
| 12 | 0 | 119 | .08 | 22 | .70 | 107 | 119 | 140 | 19 | 8.4 | 0 | 0 |
| 13 | 0 | 98 | .13 | 12 | .61 | 76 | 134 | 130 | 18 | 9.0 | 0 | 0 |
| 14 | 0 | 64 | 6.4 | 7.2 | 45 | 48 | 64 | 122 | 17 | 6.6 | 0 | 0 |
| 15 | 48 | 42 | 333 | 5.3 | 45 | 30 | 43 | 117 | 18 | 3.8 | 0 | 0 |
| 16 | 80 | 29 | 115 | 4.0 | 21 | 20 | 27 | 109 | 18 | 2.7 | 0 | 0 |
| 17 | 26 | 18 | 146 | 2.9 | 12 | 13 | 17 | 227 | 17 | 2.7 | 0 | 0 |
| 18 | 13 | 9.2 | 70 | 40 | 6.7 | 8.3 | 12 | 130 | 16 | 2.7 | 0 | 0 |
| 19 | 5.2 | 5.1 | 44 | 54 | 13 | 6.6 | 8.1 | 92 | 16 | 2.7 | 0 | 0 |
| 20 | 2.3 | 2.7 | 31 | 26 | 12 | 28 | 6.5 | 68 | 15 | 2.7 | 0 | 0 |
| 21 | 1.1 | 1.8 | 40 | 121 | 9.2 | 22 | 5.8 | 47 | 15 | 2.4 | 0 | 0 |
| 22 | .58 | 1.2 | 26 | 144 | 7.8 | 9.9 | 5.8 | 39 | 14 | 2.0 | 0 | 0 |
| 23 | .37 | .70 | 11 | 71 | 6.2 | 6.3 | 5.5 | 33 | 14 | 2.0 | 0 | 0 |
| 24 | .20 | .22 | 4.6 | 39 | 6.2 | 5.0 | 4.9 | 26 | 503 | 1.7 | 0 | 0 |
| 25 | .10 | .10 | 2.7 | 23 | 4.3 | 4.1 | 4.5 | 20 | 86 | 1.7 | 0 | 0 |
| 26 | .08 | .10 | 1.2 | 12 | 3.1 | 2.9 | 33 | 18 | 59 | 1.7 | 0 | 0 |
| 27 | .05 | .04 | .70 | 8.6 | 2.3 | 2.0 | 409 | 15 | 33 | 1.5 | 0 | 0 |
| 28 | .02 | .10 | .35 | 5.3 | 66 | 1.8 | 63 | 14 | 22 | 1.2 | 0 | 0 |
| 29 | 15 | .22 | .22 | 3.6 | 32 | 1.7 | 41 | 13 | 18 | .88 | 0 | 0 |
| 30 | 524 | .35 | 4.4 | 6.2 | ------ | 1.5 | 30 | 13 | 15 | .16 | 0 | 0 |
| 31 | 134 | ------ | 31 | 17 | ------ | 1.4 | ------ | 13 | ------ | 1.5 | 0 | ------ |
| TOTAL | 850.00 | 1,358.93 | 878.56 | 938.0 | 502.29 | 814.5 | 1,653.9 | 3,046 | 2,042 | 222.34 | 8.77 | 0 |
| MEAN | 27.4 | 45.3 | 28.3 | 30.3 | 17.3 | 26.3 | 55.1 | 98.3 | 68.1 | 7.17 | .28 | 0 |
| MAX | 524 | 495 | 333 | 144 | 94 | 370 | 409 | 1,050 | 503 | 20 | 7.9 | 0 |
| MIN | 0 | .04 | .08 | 2.9 | .61 | 1.4 | 3.1 | 10 | 12 | .16 | 0 | 0 |
| AC-FT | 1,690 | 2,700 | 1,740 | 1,860 | 996 | 1,620 | 3,280 | 6,040 | 4,050 | 441 | 17 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAL YR | 1967 | TOTAL | 4,513.36 | MEAN | 12.4 | MAX | 524 | MIN | 0 | AC-FT | 8,950 |
| WTR YR | 1968 | TOTAL | 12,315.29 | MEAN | 33.6 | MAX | 1,050 | MIN | 0 | AC-FT | 24,430 |

9-220 c
(Oct. 1951)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Sheet 1 of 1 Sheets

Monthly and yearly weighted mean rainfall ~~annual discharge~~, in inches, of Pin Oak Creek ~~River~~ ~~at~~ near Hubbard, Tex. 8-0632

[Drainage area, 17.6 square miles]

16—26489-5 U. S. GOVERNMENT PRINTING OFFICE

| YEAR | OCT. | NOV. | DEC. | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | | | | | | | | | | | | 0 | ---- |
| 1957 | | | | 1.76 | 2.55 | 4.26 | 16.09 | 8.53 | 3.39 | 0.03 | 0.66 | 5.59 | ---- |
| 1958 | 5.36 | 4.02 | 0.83 | 2.36 | 1.95 | 1.70 | 3.97 | 3.66 | 2.11 | 1.16 | 9.16 | 4.67 | 40.95 |
| 1959 | 2.60 | 2.10 | 1.20 | .37 | 2.90 | 1.23 | 4.66 | 5.98 | 9.01 | 3.12 | 1.24 | 1.11 | 35.52 |
| 1960 | 8.41 | 1.51 | 4.76 | 2.23 | 1.96 | 1.58 | 3.01 | 2.45 | 4.46 | .20 | 5.95 | 1.35 | 37.87 |
| 1961 | 6.48 | 1.90 | 7.87 | 6.07 | 4.65 | 3.17 | 1.94 | 2.02 | 9.69 | 1.49 | .45 | 4.24 | 49.97 |
| 1962 | 3.02 | 5.62 | 2.90 | .86 | 2.94 | 1.07 | 5.54 | 2.80 | 5.96 | .14 | .10 | 3.78 | 34.73 |
| 1963 | 1.06 | 2.22 | .98 | .58 | .71 | .41 | 3.71 | 2.29 | 1.71 | .12 | 1.65 | 1.27 | 16.71 |
| 1964 | .31 | 3.36 | 1.21 | 2.76 | 1.68 | 2.13 | 1.37 | 1.42 | 1.31 | .22 | 2.10 | 3.56 | 21.43 |
| 1965 | .72 | 2.27 | 1.00 | 2.86 | 3.97 | 3.29 | .97 | 13.10 | 1.07 | .11 | 1.84 | 4.36 | 35.56 |
| 1966 | 1.97 | 3.24 | 1.88 | 1.66 | 3.00 | 1.79 | 14.80 | 1.62 | .81 | 1.31 | 5.64 | 4.92 | 42.64 |
| 1967 | .19 | .08 | 1.22 | .47 | .75 | 1.44 | 5.31 | 3.46 | 4.38 | 1.70 | 1.38 | 7.52 | 27.90 |
| 1968 | 6.17 | 4.10 | 4.10 | 3.72 | 2.74 | 3.06 | 6.98 | 8.72 | 7.48 | 1.34 | .28 | 3.26 | 51.95 |

9-220 c
(Oct. 1951)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Sheet 1 of 1 Sheets

Monthly and yearly mean ~~annual~~ discharge, in cfs, of 8-0632 Pin Oak Creek ~~River~~ at near Hubbard, Tex.
[Drainage area, 17.6 square miles]

16—26489-5 U. S. GOVERNMENT PRINTING OFFICE

| YEAR | OCT. | NOV. | DEC. | JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | Station established Sept. 1, 1956 | | | | | | | | | | | 0 | |
| 1957 | 0 | 29.2 | 0.21 | 0.74 | 7.11 | 12.7 | 166 | 57.9 | 23.2 | 0 | 0 | 0.19 | 24.6 |
| 1958 | 10.5 | 5.69 | 0 | .93 | 1.09 | .14 | 4.09 | 19.4 | 0 | 0 | 37.5 | 10.9 | 7.59 |
| 1959 | 1.60 | .71 | .61 | .19 | 13.4 | .69 | 18.4 | 26.3 | 72.7 | 1.30 | 0 | 0 | 11.2 |
| 1960 | 30.8 | 1.41 | 25.4 | 16.2 | 3.03 | 2.11 | 3.70 | 2.27 | 4.36 | 0 | 4.43 | 0 | 7.89 |
| 1961 | 16.1 | 1.75 | 72.4 | 75.1 | 43.2 | 10.5 | 3.70 | .35 | 52.6 | .29 | 0 | 1.94 | 23.1 |
| 1962 | .18 | 31.8 | 12.3 | .41 | 9.60 | 1.84 | 25.6 | 2.72 | 13.3 | .003 | 0 | .87 | 8.09 |
| 1963 | 0 | 0 | 0 | 0 | 0 | 0 | .74 | .07 | .05 | 0 | 0 | 0 | .07 |
| 1964 | 0 | 0 | 0 | .003 | 0 | .17 | 0 | 0 | 0 | 0 | 0 | 1.30 | .12 |
| 1965 | 0 | 0 | 0 | 1.84 | 6.14 | 12.3 | 8.10 | 99.3 | 4.18 | 0 | 0 | .30 | 11.1 |
| 1966 | .001 | 2.59 | .40 | .27 | 7.21 | .62 | 114 | 37.8 | .04 | 0 | 1.42 | 9.54 | 14.3 |
| 1967 | .22 | 0 | 0 | 0 | 0 | .003 | 11.5 | 2.02 | 26.2 | 0 | 0 | 11.1 | 4.20 |
| 1968 | 27.4 | 45.3 | 28.3 | 30.3 | 17.3 | 26.3 | 55.1 | 98.3 | 68.1 | 7.17 | 0.28 | 0 | 33.6 |

Form A-68
Rev. 1-63

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY--TEXAS DISTRICT

# RAINFALL DATA SUMMARY

STUDY AREA *Pin Oak Creek Basin* — *1968* — 24 HR YEAR

RAIN GAGES

By: BBH, HHW

| Date of storm | 1-R | 2-S | 3-S | 4-R | 5-R | 6-R | | Avg. |
|---|---|---|---|---|---|---|---|---|
| 1967 | | | | | | | | |
| Oct 7 | 0.35 | 0 | 0.27 | 0.25 | 0.28 | 0.25 | | |
| 15 | 2.36 | 2.43 | 2.60 | 2.85 | 2.55 | 1.82 | | |
| 29-30 | 4.64 | 3.65 | 3.45 | 3.05 | 3.30 | 2.72 | | |
| 31 | .05 | 0 | .05 | 0 | .05 | .05 | | |
| Oct. Total | 7.40 | 6.08 | 6.37 | 6.15 | 6.18 | 4.91 | | 6.18 |
| Nov. 9-10 | 3.32 | 3.59 | 4.29 | 3.00 | 3.05 | 2.58 | | |
| 27 | ↑ | 1.10 | .35 | .30 | ↑ | .26 | | |
| 28-29 | .76 | .45 | .45 | .32 | .58 | .32 | | |
| Nov. Total | 4.08 | 5.14 | 5.09 | 3.62 | 3.63 | 3.16 | | 4.12 |
| Dec. 2 | 0 | .12 | 0 | .20 | .18 | .36 | | |
| 5 | .40 | 0 | .06 | .40 | .42 | .36 | | |
| 10 | .10 | .52 | .11 | .06 | 0 | .05 | | |
| 11 | 0 | 0 | 0 | 0 | 0 | .05 | | |
| 13-14 | .45 | .55 | .59 | .65 | .45 | .52 | | |
| 14-15 | 1.70 | 1.41 | 1.79 | 1.60 | 1.55 | 1.61 | | |
| 16-17 | .44 | .54 | .44 | .40 | .41 | .30 | | |
| 21 | .70 | .35 | .28 | .18 | .20 | .05 | | |
| 23 | 0 | 0 | .38 | 0 | 0 | 0 | | |
| 28 | .10 | .13 | 0 | .06 | .07 | 0 | | |
| 30 | .55 | .96 | 0 | .54 | .57 | .58 | | |
| 31 | 0 | 0 | .10 | 0 | 0 | 0 | | |
| Dec. Total | 4.44 | 4.58 | 3.75 | 4.09 | 3.85 | 3.88 | | 4.10 |
| 1967 Calendar year total | | | | | | | | 40.81 |
| 1968 | | | | | | | | |
| Jan. 1 | .17 | 0 | .75 | .13 | .14 | .10 | | |
| 3 | .30 | 0 | ↑ | ↑ | .38 | .57 | | |
| 5 | .20 | 0 | | | .16 | .20 | | |
| 8 | .05 | 0 | | | .10 | .18 | | |
| 9-10 | .60 | 1.40 | 1.28 | 1.15 | .60 | .92 | | |
| 11 | .05 | .60 | ↓ | ↓ | 0 | 0 | | |
| 18-19 | .66 | .78 | .74 | .70 | .66 | .69 | | |
| 19 | .05 | 0 | .05 | .05 | 0 | 0 | | |
| 20 | .08 | 0 | .09 | .08 | .09 | .08 | | |
| 21-22 | .90 | .93 | 1.04 | 1.02 | .80 | 1.02 | | |
| 22 | .04 | 0 | 0 | 0 | 0 | 0 | | |
| (continued) | | | | | | | | |

| | Date of storm | 1-R | 2-S | 3-S | 4-R | 5-R | 6-R | | Avg. |
|---|---|---|---|---|---|---|---|---|---|
| | Jan continued | | | | | | | | |
| | 23 | .06 | 0 | 0 | .08 | .10 | .05 | | |
| | 30 | .45 | .48 | .57 | .36 | (.5) | .28 | | |
| Jan. | Total | 3.61 | 4.19 | 4.52 | 3.57 | 3.53 | 4.09 | | 3.92 |
| | Feb. 1 | (.40) | .58 | .53 | .65 | (1.00) | .76 | | |
| | 13-14 | (.85) | 1.56 | .90 | .90 | (.95) | .88 | | |
| | 19 | .25 | .30 | .35 | .30 | .34 | .21 | | |
| | 21 | .12 | .08 | T | .14 | .15 | .07 | | |
| | 23 | .07 | 0 | .13 | 0 | .05 | .06 | | |
| | 28 | .56 | .86 | .64 | .65 | .60 | .58 | | |
| Feb. | Total | 2.25 | 3.38 | 2.55 | 2.64 | 3.09 | 2.56 | | 2.74 |
| | Mar. 5-6 | .21 | .20 | .26 | .26 | .25 | .26 | | |
| | 8-9 | .08 | .07 | .12 | .08 | .12 | .22 | | |
| | 10-11 | 1.70 | 1.60 | 2.63 | 2.05 | 2.50 | 1.78 | | |
| | 19-20 | .75 | .70 | .72 | .58 | .70 | .62 | | |
| Mar. | Total | 2.74 | 2.57 | 3.73 | 2.97 | 3.57 | 2.88 | | 3.08 |
| | Apr. 1-2 | 1.92 | 2.00 | 1.85 | 1.94 | 1.75 | 1.65 | | |
| | 3 | .50 | .71 | .84 | .85 | .78 | .58 | | |
| | 8 | .09 | 0 | .10 | (.05) | .05 | 0 | | |
| | 12 | 1.70 | 1.82 | 1.85 | 1.80 | 1.75 | 1.93 | | |
| | 19 | .18 | T | .08 | .07 | .06 | .15 | | |
| | 21 | 0 | 0 | T | 0 | 0 | .20 | | |
| | 26 | 3.52 | 1.86 | 3.51 | 1.65 | 2.05 | 1.92 | | |
| | 27 | .03 | .03 | .05 | 0 | 0 | .04 | | |
| Apr. | Total | 7.94 | 6.42 | 8.28 | 6.36 | 6.44 | 6.47 | | 6.98 |
| | May 3 | .55 | .92 | 1.25 | 1.21 | 1.05 | 1.08 | | |
| | 7 | .84 | .80 | .88 | .82 | .74 | 1.20 | | |
| | 9-10 | 5.36 | 4.03 | 4.38 | 3.87 | 3.36 | 3.60 | | |
| | 11 | 1.26 | .92 | .88 | .85 | .78 | .78 | | |
| | 16 | .15 | 0 | 0 | 0 | 0 | 0 | | |
| | 17 | 1.59 | 1.32 | 1.35 | 1.28 | 1.21 | 1.08 | | |
| | 25 | .26 | .58 | .50 | .45 | .42 | .13 | | |
| | 27 | .17 | 0 | .13 | .05 | .15 | .08 | | |
| May | Total | 10.18 | 8.57 | 9.37 | 8.53 | 7.71 | 7.95 | | 8.72 |

Form A-88
Rev. 1-63

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY--TEXAS DISTRICT

RAINFALL DATA SUMMARY

STUDY AREA Pin Oak Creek Basin

1968 WATER YEAR

RAIN GAGES

| Date of storm | 1-R | 2-S | 3-S | 4-R | 5-R | 6-R | | Avg. | By BBH HAW |
|---|---|---|---|---|---|---|---|---|---|
| June 2 | 2.72 | 2.19 | 3.20 | 4.33 | 3.25 | .98 | | | |
| 3 | .60 | .90 | .81 | 1.05 | .70 | .86 | | | |
| 5 | .03 | 0 | .32 | .23 | .46 | 0 | | | |
| 16 | .10 | 0 | .02 | 0 | 0 | .11 | | | |
| 20 | .35 | 0 | T | .24 | .24 | .36 | | | |
| 21 | .06 | 0 | T | 0 | 0 | 0 | | | |
| 22 | .23 | .58 | T | .08 | .05 | .30 | | | |
| 23-24 | 2.62 | 2.95 | 3.35 | 2.92 | 3.40 | 2.90 | | | |
| 25 | .40 | .35 | .32 | .40 | .23 | .30 | | | |
| June Total | 7.11 | 6.97 | 8.02 | 9.25 | 8.33 | 5.81 | | 7.58 | |
| | | | | | | | | | |
| July 8 | .48 | .51 | .92 | .50 | .23 | (.30) | | | |
| 12 | .05 | .10 | .10 | ↑ | .15 | .30 | | | |
| 13 | .52 | .68 | .88 | (.95) | .99 | .35 | | | |
| July Total | 1.05 | 1.29 | 1.90 | 1.45 | 1.37 | .95 | | 1.34 | |
| | | | | | | | | | |
| August 4 | .05 | 0 | 0 | 0 | 0 | .08 | | | |
| 12 | .10 | 0 | .33 | .08 | .12 | .30 | | | |
| 17 | 0 | 0 | 0 | 0 | 0 | .08 | | | |
| 30 | .25 | 0 | .09 | .10 | .08 | 0 | | | |
| August Total | .40 | 0 | .42 | .18 | .20 | .46 | | .28 | |
| | | | | | | | | | |
| Sept. 2-3 | .62 | .57 | .49 | .45 | .36 | .10 | | | |
| 4 | .18 | .15 | .09 | .05 | .03 | .10 | | | |
| 14-15 | 1.50 | 1.76 | 1.70 | 1.67 | 2.04 | 1.45 | | | |
| 17 | .10 | .47 | .49 | .55 | .45 | .35 | | | |
| 24 | .38 | .59 | .58 | .55 | .50 | .74 | | | |
| Sept Total | 2.78 | 3.54 | 3.35 | 3.27 | 3.38 | 2.74 | | 3.18 | |
| | | | | | | | | | |
| Water Year Total | | | | | | | | 52.22 | |

A-65
(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record October 29-31, 1967 Drainage Area 17.6 sq mi

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | October 29 | | | | |
| 0000 | 1.73 | 0 | .04 | 6 | 0 | 0 | 0 |
| 1200 | 1.72 | | .03 | 10.5 | 0 | 0 | 0 |
| 2100 | 1.73 | | .04 | 4.75 | 0 | 0 | 0 |
| 2130 | 1.74 | | .06 | .5 | 0 | 0 | 0 |
| 2200 | 1.90 | | 1.2 | .5 | .0001 | .0001 | .0001 |
| 2230 | 3.55 | | 79 | .5 | .0069 | .0035 | .0036 |
| 2300 | 5.50 | | 185 | .5 | .0163 | .0082 | .0118 |
| 2330 | 6.98 | | 265 | .5 | .0233 | .0117 | .0235 |
| 2400 | 8.05 | 0 | 382 | .25 | .0336 | .0084 | .0319 |
| | | | 371.370 | 24 | | | |
| | | | 15 | | | | |
| | | | October 30 | | | | |
| 0000 | 8.05 | 0 | 382 | .25 | .0336 | .0084 | .0403 |
| 0030 | 9.00 | | 560 | .5 | .0492 | .0246 | .0649 |
| 0100 | 9.57 | | 710 | .75 | .0624 | .0468 | .1117 |
| 0200 | 10.11 | | 889 | 1.5 | .0782 | .1173 | .2290 |
| 0400 | 10.87 | | 1,240 | 1.25 | .1090 | .1363 | .3653 |
| 0430 | 10.95 | | 1,280 | .50 | .1125 | .0563 | .4216 |
| 0500 | 10.97 | | 1,280 | .5 | .1125 | .0563 | .4779 |
| 0530 | 10.93 | | 1,260 | .5 | .1108 | .0554 | .5333 |
| 0600 | 10.87 | | 1,240 | 1.25 | .1090 | .1363 | .6696 |
| 0800 | 10.25 | | 945 | 2. | .0831 | .1662 | .8358 |
| 1000 | 9.00 | | 560 | 1.5 | .0492 | .0738 | .9096 |
| 1100 | 8.13 | | 394 | 1.0 | .0346 | .0346 | .9442 |
| 1200 | 7.20 | | 284 | 1.0 | .0250 | .0250 | .9692 |
| 1300 | 6.37 | | 224 | 1.5 | .0197 | .0296 | .9988 |
| 1500 | 5.17 | | 175 | 2.5 | .0154 | .0385 | 1.0373 |
| 1800 | 4.58 | 0 | 157 | 3. | .0138 | .0414 | 1.0787 |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| 2100 | 4.38 | 0 | 151 | 3 | .0133 | .0399 | 1.1186 |
| 2400 | 4.27 | 0 | 145 | 1.5 | .0127 | .0191 | 1.1377 |
| | | | 12,578 | 24 | | | |
| | | | 524 | | | | |
| | | | October 31 | | | | |
| 0000 | 4.27 | 0 | 145 | 6 | .0127 | .0762 | 1.2139 |
| 1200 | 4.09 | | 132 | 12 | .0116 | .1392 | 1.3531 |
| 2400 | 4.03 | 0 | 126 | 6 | .0111 | .0666 | 1.4197 |
| | | | 3210 | 24 | | | |
| | | | 134 | | | | |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet ____ of 1

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: BBH
Date: May 6, 1969
Check by: HHN
Date: June 17, 1969

# WEIGHTED PRECIPITATION RECORD

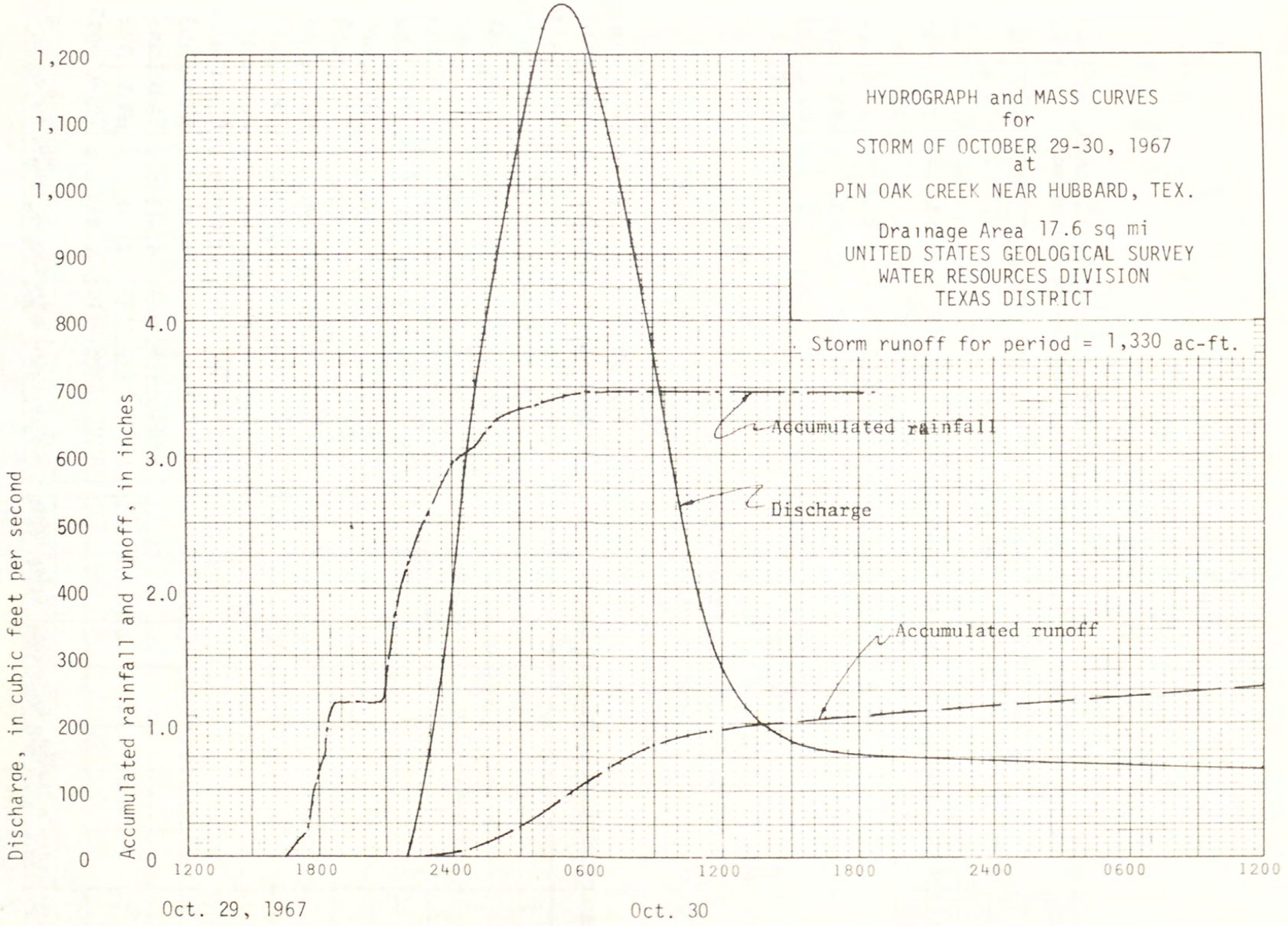
Area: Pin Oak Creek near Hubbard, Tex. Date of storm Oct. 23-30, 1967

| Date & Time | Gage 1-R Recorded (Weight Factor .3333) | x Factor | Gage 4-R Recorded | x Factor | Gage 5-R Recorded (Weight Factor .3333) | x Factor | Gage 6-R Recorded (Weight Factor .3333) | x Factor | Gage Recorded | x Factor | Gage Recorded | x Factor | Accumulated Weighted Precipitation: Recording Gages | Accumulated Weighted Precipitation: (Rec. Gages x K) All Gages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 29, 1967 | | | | | | | | | | | | | | |
| 00.00 | 0 | | | | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 16.00 | 0 | | | | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 16.30 | 0 | | | | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 16.45 | .05 | .017 | | | .15 | .050 | .02 | .007 | | | | | .074 | .07 |
| 17 00 | .09 | .030 | | | .22 | .073 | .03 | .010 | | | | | .113 | .11 |
| 17 15 | .19 | .063 | | | .26 | .087 | .04 | .013 | | | | | .163 | .16 |
| 17 30 | .33 | .110 | | | .32 | .107 | .04 | .013 | | | | | .230 | .22 |
| 17 45 | .85 | .283 | | | .51 | .170 | .07 | .023 | | | | | .476 | .46 |
| 18 00 | 1.42 | .473 | | | .51 | .170 | .08 | .027 | | | | | .670 | .65 |
| 18 15 | 1.52 | .507 | | | .71 | .237 | .11 | .037 | | | | | .781 | .76 |
| 18 30 | 1.97 | .657 | | | .90 | .300 | .47 | .157 | | | | | 1.114 | 1.09 |
| 18 45 | 2.15 | .717 | | | .91 | .303 | .47 | .157 | | | | | 1.177 | 1.15 |
| 20 30 | 2.15 | .717 | | | .91 | .303 | .47 | .157 | | | | | 1.177 | 1.15 |
| 20 45 | 2.15 | .717 | | | .92 | .307 | .47 | .157 | | | | | 1.181 | 1.15 |
| 21 00 | 2.22 | .740 | | | 1.10 | .367 | .47 | .157 | | | | | 1.264 | 1.23 |
| 21 15 | 2.61 | .870 | | | 1.46 | .487 | .70 | .233 | | | | | 1.590 | 1.55 |
| 21 30 | 2.90 | .967 | | | 1.70 | .567 | 1.03 | .343 | | | | | 1.877 | 1.83 |
| 22 00 | 3.13 | 1.043 | | | 1.94 | .647 | 1.52 | .507 | | | | | 2.197 | 2.14 |
| 22 30 | 3.43 | 1.143 | | | 2.25 | .750 | 1.73 | .577 | | | | | 2.470 | 2.41 |
| 23 00 | 3.58 | 1.193 | | | 2.42 | .807 | 1.90 | .633 | | | | | 2.633 | 2.57 |
| 24 00 | 4.02 | 1.340 | | | 2.81 | .937 | 2.15 | .717 | | | | | 2.994 | 2.92 |
| Oct. 30 | | | | | | | | | | | | | | |
| 01 00 | 4.21 | 1.403 | | | 2.34 | .980 | 2.27 | .757 | | | | | 3.140 | 3.06 |
| 02 00 | 4.42 | 1.473 | | | 3.14 | 1.047 | 2.47 | .823 | | | | | 3.343 | 3.26 |
| 04 00 | 4.59 | 1.530 | | | 3.22 | 1.073 | 2.60 | .867 | | | | | 3.470 | 3.33 |
| 05 00 | 4.64 | 1.547 | | | 3.26 | 1.087 | 2.65 | .883 | | | | | 3.517 | 3.43 |
| 06 00 | 4.64 | 1.547 | | | 3.30 | 1.100 | 2.72 | .907 | | | | | 3.554 | 3.47 |
| 12 00 | 4.64 | 1.547 | 3.05 | | 3.30 | 1.100 | 2.72 | .907 | | | | | 3.554 | 3.47 |

No intensity recorded; gage not working

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | | 4.64 | 6-R | | | 2.72 | | | | |
| 2-S | | | 3.65 | | | | | | | | |
| 3-S | | | 3.45 | | | | | | | | |
| 4-R | | | 3.05 | | | | 6 Lac. Sl | | | | |
| 5-R | | | 3.30 | | | | 3.47 | | | | |
| | | | | | | | | | | WMR: | |

WMP = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 3.47 / 3.554 = .976


HYDROGRAPH and MASS CURVES
for
STORM OF OCTOBER 29-30, 1967
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 1,330 ac-ft.
Accumulated rainfall
Discharge
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4.0
3.0
2.0
1.0
0
1200
1800
2400
0600
1200
1800
2400
0600
1200
Oct. 29, 1967
Oct. 30

A-65
(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record November 9-11, 1967 Drainage Area 17.6

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | November 9 | | | | |
| 0000 | 1.98 | -.02 | 2.0 | 10 | .0001 | .0010 | .0010 |
| 2000 | 1.93 | | 1.3 | 10.5 | .0001 | .0011 | .0021 |
| 2100 | 1.95 | | 1.5 | 1 | .0001 | .0001 | .0022 |
| 2200 | 1.99 | | 2.2 | 1 | .0002 | .0002 | .0024 |
| 2300 | 2.03 | | 2.9 | 1 | .0003 | .0003 | .0027 |
| 2400 | 2.18 | -.02 | 6.4 | .5 | .0006 | .0003 | .0030 |
| | | | 43.45 | 24 | | | |
| | | | 1.8 | | | | |
| | | | November 10 | | | | |
| 0000 | 2.18 | -.02 | 6.4 | .5 | .0006 | .0003 | .0033 |
| 0100 | 2.52 | -.02 | 19 | 1.5 | .0017 | .0026 | .0059 |
| 0300 | 3.02 | 0 | 42 | 1.25 | .0037 | .0046 | .0105 |
| 0330 | 4.05 | | 128 | .5 | .0113 | .0057 | .0162 |
| 0400 | 5.25 | | 178 | .5 | .0156 | .0078 | .0240 |
| 0430 | 6.27 | | 218 | .5 | .0192 | .0096 | .0336 |
| 0500 | 7.10 | | 275 | .5 | .0242 | .0121 | .0457 |
| 0530 | 8.05 | | 382 | .5 | .0336 | .0168 | .0625 |
| 0600 | 9.07 | | 577 | .75 | .0507 | .0380 | .1005 |
| 0700 | 10.05 | | 868 | 1.5 | .0763 | .1145 | .2150 |
| 0900 | 10.53 | | 1,070 | 1.5 | .0941 | .1412 | .3562 |
| 1000 | 10.68 | | 1,140 | .75 | .1002 | .0752 | .4314 |
| 1030 | 10.69 | | 1,140 | .5 | .1002 | .0501 | .4815 |
| 1100 | 10.67 | | 1,140 | .75 | .1002 | .0752 | .5567 |
| 1200 | 10.48 | | 1,050 | 1.5 | .0923 | .1385 | .6952 |
| 1400 | 9.58 | | 713 | 2 | .0627 | .1254 | .8206 |
| 1600 | 8.37 | | 432 | 2 | .0380 | .0760 | .8966 |
| 1800 | 7.50 | | 315 | 2 | .0277 | .0554 | .9520 |
| 2000 | 6.87 | 0 | 257 | 2 | .0226 | .0452 | .9972 |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| 2200 | 5.93 | 0 | 202 | 2 | .0178 | .0356 | 1.0328 |
| 2400 | 5.18 | 0 | 175 | 1 | .0154 | .0154 | 1.0482 |
| | | | 11882.25 | 24 | | | |
| | | | 495 | | | | |
| | | | November 11 | | | | |
| 0000 | 5.18 | 0 | 175 | 3 | .0154 | .0462 | 1.0944 |
| 0600 | 4.39 | | 152 | 6 | .0134 | .0804 | 1.1748 |
| 1200 | 4.19 | | 139 | 9 | .0122 | .1098 | 1.2846 |
| 2400 | 4.04 | 0 | 127 | 6 | .0112 | .0672 | 1.3518 |
| | | | 3450 | 24 | | | |
| | | | 144 | | | | |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet 1 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: HHW
Date: JUNE 19, 1969
Check by: BBH
Date: 6-24-69

# WEIGHTED PRECIPITATION RECORD

Area: Pin Oak Creek near Hubbard, Tex. Date of storm Nov. 9-10, 1967

| Weight Factor | .250 | | .250 | | .250 | | .250 | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| Nov. 9, 1967 | | | | | | | | | | | | | | |
| 00 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 14 00 | .13 | .032 | .17 | .042 | .15 | .038 | .04 | .010 | | | | | .122 | .13 |
| 15 00 | .17 | .042 | .17 | .042 | .17 | .043 | .05 | .013 | | | | | .140 | .15 |
| 16 00 | .23 | .058 | .21 | .052 | .23 | .058 | .10 | .025 | | | | | .193 | .21 |
| 18 00 | .31 | .078 | .26 | .065 | .30 | .075 | .15 | .038 | | | | | .256 | .28 |
| 20 00 | .58 | .145 | .37 | .092 | .39 | .098 | .25 | .063 | | | | | .398 | .44 |
| 21 00 | .76 | .190 | .46 | .115 | .56 | .140 | .31 | .078 | | | | | .523 | .58 |
| 22 00 | .93 | .232 | .73 | .182 | .71 | .178 | .60 | .150 | | | | | .742 | .82 |
| 23 00 | 1.17 | .292 | .81 | .202 | .90 | .225 | .66 | .165 | | | | | .884 | .98 |
| 24 00 | 1.33 | .332 | 1.10 | .275 | 1.07 | .268 | .70 | .175 | | | | | 1.050 | 1.16 |
| Nov. 10, 1967 | | | | | | | | | | | | | | |
| 01 00 | 1.40 | .350 | 1.20 | .300 | 1.11 | .278 | .86 | .215 | | | | | 1.143 | 1.26 |
| 02 00 | 1.56 | .390 | 1.21 | .302 | 1.19 | .298 | .88 | .220 | | | | | 1.210 | 1.34 |
| 02 30 | 1.68 | .420 | 1.30 | .325 | 1.35 | .338 | .99 | .248 | | | | | 1.331 | 1.47 |
| 02 45 | 1.75 | .438 | 1.39 | .348 | 1.40 | .350 | 1.05 | .263 | | | | | 1.399 | 1.55 |
| 03 00 | 1.95 | .488 | 1.47 | .368 | 1.44 | .360 | 1.10 | .275 | | | | | 1.491 | 1.65 |
| 03 30 | 2.17 | .542 | 1.55 | .388 | 1.60 | .400 | 1.18 | .295 | | | | | 1.625 | 1.80 |
| 04 00 | 2.39 | .598 | 1.71 | .428 | 1.71 | .428 | 1.27 | .318 | | | | | 1.772 | 1.96 |
| 04 30 | 2.55 | .638 | 1.82 | .455 | 1.84 | .460 | 1.32 | .330 | | | | | 1.883 | 2.08 |
| 05 00 | 2.75 | .688 | 1.92 | .480 | 1.98 | .495 | 1.47 | .368 | | | | | 2.031 | 2.25 |
| 05 15 | 2.83 | .708 | 2.04 | .510 | 2.18 | .545 | 1.59 | .398 | | | | | 2.161 | 2.39 |
| 05 30 | 2.85 | .712 | 2.14 | .535 | 2.38 | .595 | 1.69 | .423 | | | | | 2.265 | 2.50 |
| 05 45 | 2.92 | .730 | 2.39 | .598 | 2.48 | .620 | 1.93 | .483 | | | | | 2.431 | 2.69 |
| 06 00 | 2.95 | .738 | 2.45 | .612 | 2.50 | .625 | 2.15 | .538 | | | | | 2.513 | 2.78 |
| 06 30 | 2.98 | .745 | 2.61 | .652 | 2.60 | .650 | 2.26 | .565 | | | | | 2.612 | 2.89 |
| 07 00 | 3.13 | .782 | 2.62 | .655 | 2.70 | .675 | 2.26 | .565 | | | | | 2.677 | 2.96 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | 3.32 | | 6-R | | 2.58 | | | | | |
| 2-S | | 3.59 | | | | | | | | | |
| 3-S | | 4.29 | | | TOTAL | 19.83 | | | | | |
| 4-R | | 3.00 | | | AVERAGE | 3.305 | | | | | |
| 5-R | | 3.05 | | | | | | | | | |
| | | | | | | | | | | WMR: 3.305 | |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 3.305 / 2.988 = 1.106

A-78 (Revised Feb. 1960)

Sheet 2 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: HHW
Date: JUNE 19, 1969
Check by: BBH
Date: 6-24-69

# WEIGHTED PRECIPITATION RECORD

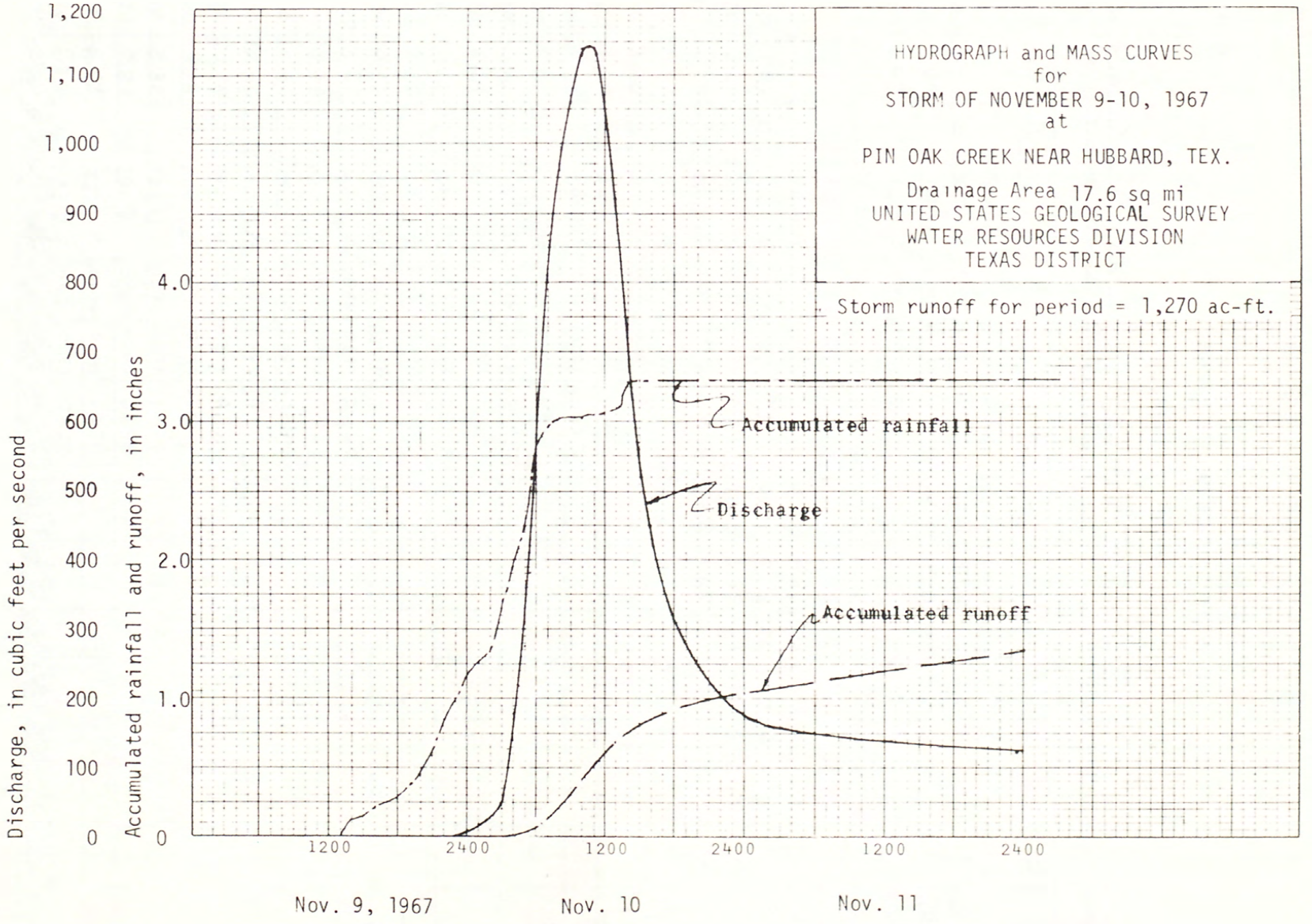
Area: Pin Oak Creek near Hubbard, Tex.

Date of storm Nov 9-10 1967 (cont.)

| Weight Factor | | | | | | | | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| Nov. 10 cont | | | | | | | | | | | | | | |
| 0730 | 3.13 | .782 | 2.76 | .690 | 2.75 | .688 | 2.26 | .565 | | | | | 2.725 | 3.01 |
| 0800 | 3.13 | .782 | 2.76 | .690 | 2.75 | .688 | 2.27 | .568 | | | | | 2.728 | 3.02 |
| 1000 | 3.13 | .782 | 2.76 | .690 | 2.75 | .688 | 2.28 | .570 | | | | | 2.730 | 3.02 |
| 1030 | 3.20 | .800 | 2.76 | .690 | 2.78 | .695 | 2.28 | .570 | | | | | 2.755 | 3.05 |
| 1100 | 3.20 | .800 | 2.76 | .690 | 2.80 | .700 | 2.28 | .570 | | | | | 2.760 | 3.05 |
| 1200 | 3.20 | .800 | 2.76 | .690 | 2.80 | .700 | 2.32 | .580 | | | | | 2.770 | 3.06 |
| 1245 | 3.20 | .800 | 2.76 | .690 | 2.81 | .703 | 2.32 | .580 | | | | | 1.106 | 3.07 |
| 1300 | 3.26 | .815 | 2.76 | .690 | 2.82 | .705 | 2.32 | .580 | | | | | 2.790 | 3.08 |
| 1315 | 3.28 | .820 | 2.76 | .690 | 2.83 | .708 | 2.33 | .583 | | | | | 2.801 | 3.10 |
| 1330 | 3.30 | .825 | 2.90 | .725 | 2.97 | .743 | 2.37 | .593 | | | | | 2.886 | 3.19 |
| 1345 | 3.31 | .828 | 2.97 | .725 | 3.02 | .755 | 2.44 | .611 | | | | | 2.919 | 3.23 |
| 1400 | 3.32 | .830 | 3.00 | .750 | 3.04 | .760 | 2.55 | .638 | | | | | 2.978 | 3.29 |
| 2400 | 3.32 | .830 | 3.00 | .750 | 3.05 | .763 | 2.58 | .645 | | | | | 2.988 | 3.30 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | WMR: | |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation =


HYDROGRAPH and MASS CURVES
for
STORM OF NOVEMBER 9-10, 1967
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 1,270 ac-ft.
Accumulated rainfall
Discharge
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4.0
3.0
2.0
1.0
0
1200
2400
1200
2400
1200
2400
Nov. 9, 1967
Nov. 10
Nov. 11

A-65
(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record March 10-12, 1968 Drainage Area 17.6 sq. mi.

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | March 10 | | | | |
| 0000 | 1.97 | 0 | 2.2 | 11.5 | .0002 | .0023 | .0023 |
| 2300 | 1.95 | | 1.8 | 12. | .0002 | .0024 | .0047 |
| 2400 | 1.97 | 0 | 2.2 | .5 | .0002 | .0001 | .0048 |
| | | | 48.00 | 24 | | | |
| | | | 2.0 | | | | |
| | | | March 11 | | | | |
| 0000 | 1.97 | 0 | 2.2 | .5 | .0002 | .0001 | .0049 |
| 0100 | 2.00 | | 2.7 | .75 | .0002 | .0002 | .0051 |
| 0130 | 2.27 | | 10 | .5 | .0009 | .0005 | .0056 |
| 0200 | 2.72 | | 28 | .75 | .0025 | .0019 | .0075 |
| 0300 | 3.10 | | 47 | 1 | .0041 | .0041 | .0116 |
| 0400 | 3.18 | | 52 | 1 | .0046 | .0046 | .0162 |
| 0500 | 3.43 | | 69 | 1 | .0061 | .0061 | .0223 |
| 0600 | 5.00 | | 170 | .75 | .0149 | .0112 | .0335 |
| 0630 | 6.70 | | 245 | .5 | .0215 | .0108 | .0443 |
| 0700 | 8.28 | | 417 | .5 | .0367 | .0184 | .0627 |
| 0730 | 9.32 | | 640 | .5 | .0563 | .0282 | .0909 |
| 0800 | 9.70 | | 749 | .75 | .0659 | .0494 | .1403 |
| 0900 | 10.23 | | 937 | .75 | .0824 | .0618 | .2021 |
| 0930 | 10.41 | | 1,010 | .5 | .0888 | .0444 | .2465 |
| 1000 | 10.48 | | 1,050 | .5 | .0923 | .0462 | .2927 |
| 1030 | 10.46 | | 1,040 | .5 | .0914 | .0457 | .3384 |
| 1100 | 10.40 | | 1,010 | .75 | .0888 | .0666 | .4050 |
| 1200 | 10.18 | | 917 | 1.5 | .0806 | .1209 | .5259 |
| 1400 | 9.18 | | 604 | 1.5 | .0531 | .0797 | .6056 |
| 1500 | 8.32 | | 423 | 1 | .0372 | .0372 | .6428 |
| 1600 | 7.32 | 0 | 296 | 1 | .0260 | .0260 | .6688 |
| 1700 | 6.42 | -.10 | 221 | 1.5 | .0194 | .0291 | .6979 |
| 1900 | 5.33 | -.22 | 173 | 2.5 | .0152 | .0380 | .7359 |
| BBH DBU | BBH DBU | BBH DBU | BBH DBU | BBH DBU | HHW BBH | HHW BBH | HHW BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| 2200 | 5.04 | -.22 | 165 | 2.5 | .0145 | .0363 | .7722 |
| 2400 | 4.88 | -.22 | 160 | 1 | .0141 | .0141 | .7863 |
| | | | 8884.75 | 24 | | | |
| | | | 370 | | | | |
| | | | March 12 | | | | |
| 0000 | 4.88 | -.22 | 160 | 3 | .0141 | .0423 | .8286 |
| 0600 | 4.16 | -.22 | 117 | 6 | .0103 | .0618 | .8904 |
| 1200 | 3.95 | -.22 | 96 | 9 | .0084 | .0756 | .9660 |
| 2400 | 3.65 | 0 | 88 | 6 | .0077 | .0462 | 1.0122 |
| | | | 2574 | 24 | | | |
| | | | 107 | | | | |
| BBH DBU | BBH DBU | BBH DBU | BBH DBU | BBH DBU | HHW BBH | HHW BBH | HHW BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet 1 of 1

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: BBH
Date: May 6, 1969
Check by: HHW
Date: JUNE 18, 1969

# WEIGHTED PRECIPITATION RECORD

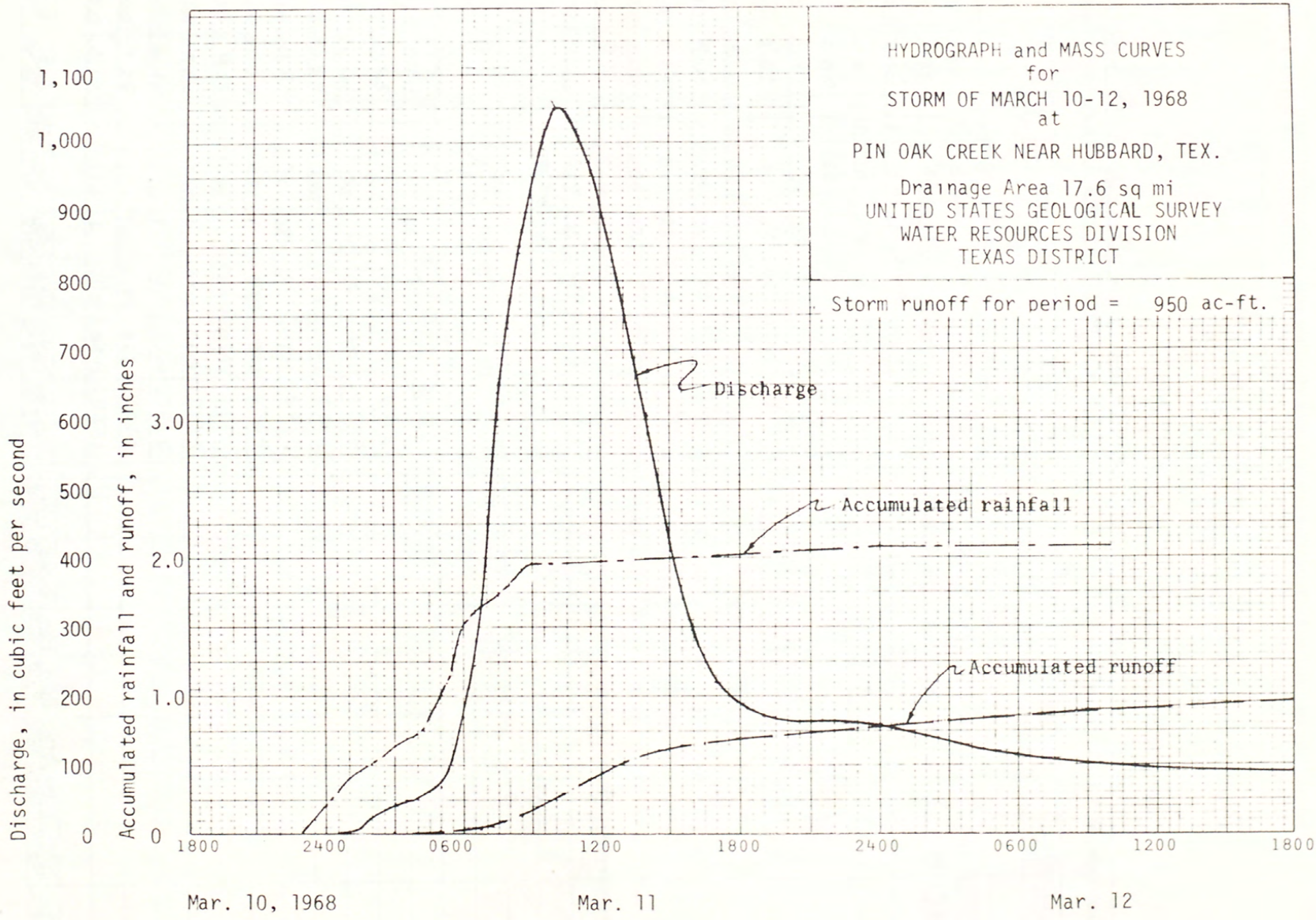
Area: Pin Oak Creek near Hubbard, Tex.

Date of storm Mar 10-12, 1968

| Weight Factor | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .250 | | .250 | | .250 | | .250 | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| Mar. 10, 1968 | | | | | | | | | | | | | | |
| 1200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 2200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 2230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 2300 | .08 | .020 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | .020 | .02 |
| 2330 | .16 | .040 | 0 | 0 | .13 | .033 | .13 | .038 | | | | | .106 | .11 |
| 2400 | .24 | .060 | .05 | .013 | .24 | .060 | .26 | .065 | | | | | .198 | .21 |
| Mar. 11 | | | | | | | | | | | | | | |
| 0100 | .40 | .100 | .25 | .063 | .39 | .098 | .53 | .133 | | | | | .394 | .41 |
| 0200 | .45 | .113 | .41 | .103 | .49 | .123 | .62 | .155 | | | | | .494 | .51 |
| 0230 | .61 | .153 | .44 | .110 | .52 | .130 | .62 | .155 | | | | | .548 | .57 |
| 0300 | .64 | .160 | .44 | .110 | .71 | .178 | .67 | .168 | | | | | .616 | .64 |
| 0400 | .70 | .180 | .66 | .165 | .74 | .185 | .72 | .180 | | | | | .710 | .74 |
| 0415 | .75 | .188 | .66 | .165 | .76 | .190 | .73 | .183 | | | | | .726 | .75 |
| 0430 | .87 | .218 | .66 | .165 | .98 | .245 | .81 | .203 | | | | | .831 | .86 |
| 0445 | .92 | .230 | .68 | .170 | 1.12 | .280 | .85 | .213 | | | | | .893 | .93 |
| 0500 | .95 | .238 | .70 | .175 | 1.25 | .313 | 1.00 | .250 | | | | | .976 | 1.02 |
| 0515 | 1.00 | .250 | .77 | .193 | 1.39 | .348 | 1.06 | .265 | | | | | 1.056 | 1.10 |
| 0530 | 1.05 | .263 | 1.02 | .255 | 1.65 | .413 | 1.10 | .275 | | | | | 1.206 | 1.25 |
| 0545 | 1.15 | .288 | 1.15 | .288 | 1.78 | .445 | 1.20 | .300 | | | | | 1.321 | 1.37 |
| 0600 | 1.27 | .318 | 1.25 | .313 | 1.92 | .480 | 1.35 | .338 | | | | | 1.449 | 1.51 |
| 0630 | 1.28 | .320 | 1.43 | .358 | 2.08 | .520 | 1.45 | .363 | | | | | 1.561 | 1.62 |
| 0700 | 1.28 | .320 | 1.60 | .400 | 2.08 | .520 | 1.50 | .375 | | | | | 1.615 | 1.68 |
| 0730 | 1.36 | .340 | 1.69 | .423 | 2.08 | .520 | 1.50 | .375 | | | | | 1.658 | 1.72 |
| 0800 | 1.49 | .373 | 1.73 | .433 | 2.15 | .538 | 1.60 | .400 | | | | | 1.744 | 1.81 |
| 0830 | 1.49 | .373 | 1.77 | .443 | 2.38 | .595 | 1.74 | .435 | | | | | 1.846 | 1.92 |
| 0900 | 1.49 | .373 | 1.93 | .483 | 2.38 | .595 | 1.74 | .435 | | | | | 1.886 | 1.96 |
| 1200 | 1.52 | .380 | 1.93 | .483 | 2.40 | .600 | 1.74 | .435 | | | | | 1.898 | 1.37 |
| 2400 | 1.70 | .425 | 2.05 | .513 | 2.50 | .625 | 1.78 | .445 | | | | | 2.008 | 2.09 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | 1.70 | | 6-R | | 1.78 | | | | | |
| 2-S | | 1.87 | | | | | | | | | |
| 3-S | | 2.63 | | | | | | | | | |
| 4-R | | 2.05 | | | Average | | 6 \| 12.53 | | | | |
| 5-R | | 2.56 | | | | | 2.088 | | | | |
| | | | | | | | | | | WMR: 2.088 | |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 2.088 / 2.008 = 1.040


HYDROGRAPH and MASS CURVES
for
STORM OF MARCH 10-12, 1968
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 950 ac-ft.
Discharge
Accumulated rainfall
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
1,100
1,000
900
800
700
600
500
400
300
200
100
0
3.0
2.0
1.0
0
1800
2400
0600
1200
1800
2400
0600
1200
1800
Mar. 10, 1968
Mar. 11
Mar. 12

A-65
(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record April 26-27, 1968 Drainage Area 17.6 sq. mi.

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | April 26 | | | | |
| 0000 | 1.95 | +.14 | 4.6 | .10 | .0004 | .0040 | .0040 |
| 2000 | 1.95 | | 4.6 | 10.25 | .0004 | .0041 | .0081 |
| 2030 | 2.10 | +.14 | 8.9 | .5 | .0008 | .0004 | .0085 |
| 2100 | 2.60 | +.13 | 28 | .375 | .0025 | .0009 | .0094 |
| 2115 | 2.80 | | 38 | .375 | .0033 | .0012 | .0106 |
| 2145 | 2.37 | | 19 | .375 | .0017 | .0006 | .0112 |
| 2200 | 2.52 | | 25 | .25 | .0022 | .0006 | .0118 |
| 2215 | 3.10 | +.13 | 55 | .25 | .0048 | .0012 | .0130 |
| 2230 | 4.05 | 0 | 128 | .25 | .0113 | .0028 | .0158 |
| 2245 | 5.50 | | 185 | .25 | .0163 | .0041 | .0199 |
| 2300 | 7.20 | | 284 | .375 | .0250 | .0093 | .0292 |
| 2330 | 9.00 | | 560 | .5 | .0492 | .0246 | .0538 |
| 2400 | 9.66 | 0 | 737 | .25 | .0648 | .0016 | .0554 |
| | | | 793.975 | 24 | | | |
| | | | 33 | | | | |
| | | | April 27 | | | | |
| 0000 | 9.66 | 0 | 737 | 1 | .0648 | .0648 | .1202 |
| 0200 | 10.48 | | 1,050 | 1.5 | .0923 | .1385 | .2587 |
| 0300 | 10.95 | | 1,280 | 1 | .1125 | .1125 | .3712 |
| 0400 | 11.04 | | 1,320 | .75 | .1161 | .0871 | .4583 |
| 0430 | 10.97 | | 1,280 | .5 | .1125 | .0563 | .5146 |
| 0500 | 10.80 | | 1,200 | .75 | .1055 | .0791 | .5937 |
| 0600 | 10.24 | | 941 | 1 | .0827 | .0827 | .6764 |
| 0700 | 9.25 | | 622 | 1 | .0547 | .0547 | .7311 |
| 0800 | 7.85 | | 356 | 1 | .0313 | .0313 | .7624 |
| 0900 | 6.45 | | 229 | 1 | .0201 | .0201 | .7825 |
| 1000 | 5.22 | | 177 | 1.50 | .0156 | .0234 | .8059 |
| 1200 | 4.12 | 0 | 134 | 4 | .0118 | .0472 | .8531 |
| | | | | | | | |
| BBH DBU | BBH DBU | BBH DBU | BBH DBU | BBH DBU | HHW BBH | HHW BBH | HHW BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1800 | 3.60 | +.05 | 88 | 6 | .0077 | .0462 | .8993 |
| 2400 | 3.41 | +.05 | 72 | 3 | .0063 | .0189 | .9182 |
| | | | 9815.50 | 24 | | | |
| | | | 409 | | | | |
| BBH DBU | BBH DBU | BBH DBU | BBH DBU | BBH DBU | HHW BBH | HHW BBH | HHW BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet _____ of _____

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: BBH
Date: May 6, 1969
Check by: HHW
Date: JUNE 17, 1969

# WEIGHTED PRECIPITATION RECORD

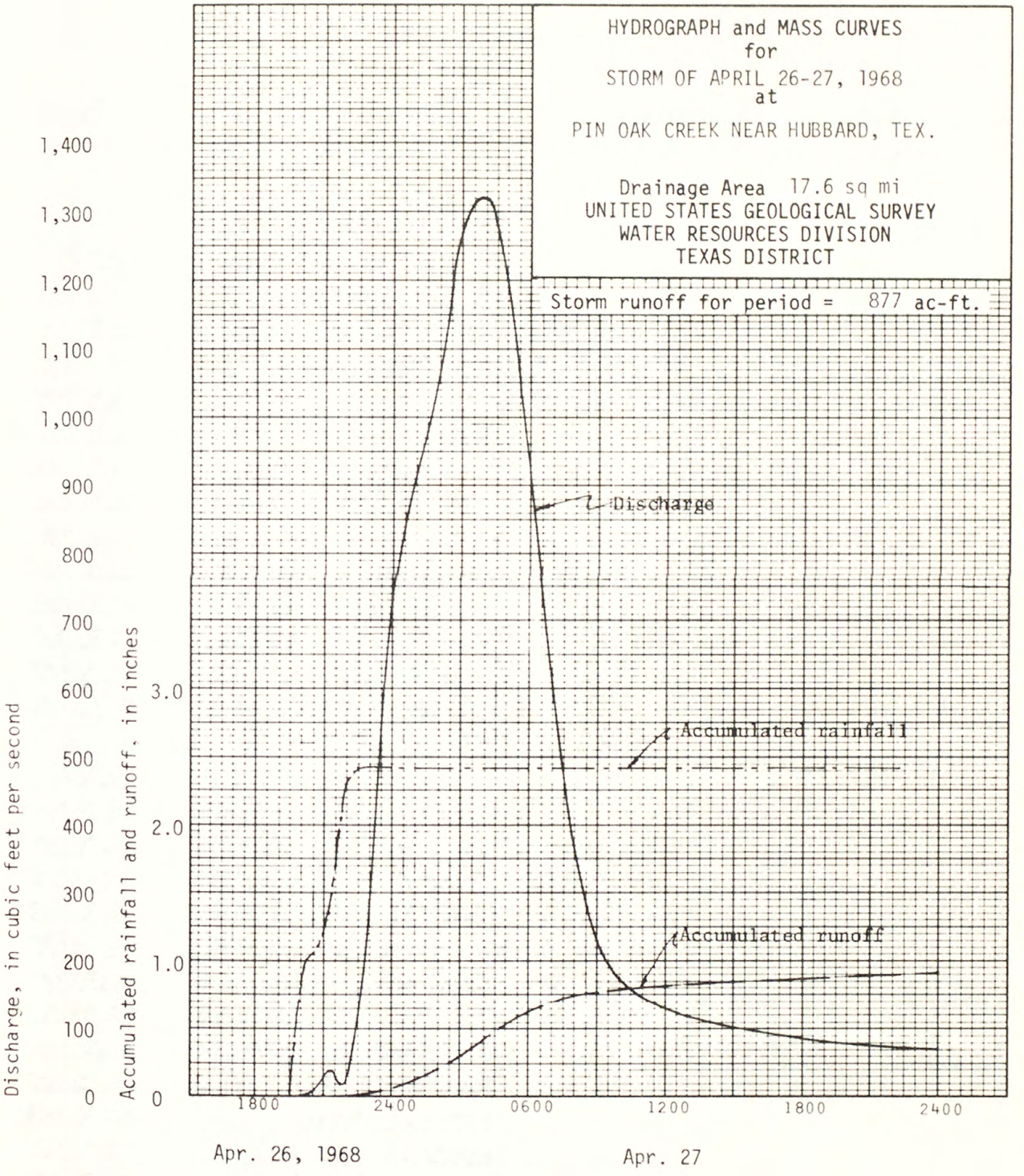
Area: Pin Oak Creek near Hubbard, Tex.

Date of storm April 26-27, 1968

| Weight Factor | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .250 | | .250 | | .250 | | .250 | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| April 26, 1968 | | | | | | | | | | | | | | |
| 0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 1900 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 1930 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 1945 | 1.20 | .300 | .25 | .062 | .05 | .012 | 0 | 0 | | | | | .374 | .40 |
| 2000 | 1.78 | .445 | .52 | .130 | .84 | .210 | 0 | 0 | | | | | .785 | .83 |
| 2015 | 1.84 | .460 | .58 | .145 | .86 | .215 | .49 | .122 | | | | | .942 | 1.00 |
| 2030 | 1.87 | .468 | .63 | .158 | .89 | .223 | .55 | .138 | | | | | .987 | 1.05 |
| 2045 | 1.95 | .488 | .70 | .175 | .96 | .240 | .58 | .145 | | | | | 1.048 | 1.11 |
| 2100 | 2.13 | .533 | .70 | .175 | .96 | .240 | .73 | .183 | | | | | 1.131 | 1.20 |
| 2115 | 2.67 | .668 | .70 | .175 | .97 | .243 | .73 | .183 | | | | | 1.269 | 1.35 |
| 2130 | 3.30 | .825 | 1.00 | .250 | 1.35 | .338 | .73 | .183 | | | | | 1.596 | 1.69 |
| 2145 | 3.52 | .880 | 1.63 | .408 | 1.83 | .458 | .76 | .190 | | | | | 1.936 | 2.05 |
| 2200 | 3.52 | .880 | 1.65 | .413 | 2.05 | .513 | 1.43 | .358 | | | | | 2.164 | 2.29 |
| 2230 | 3.52 | .880 | 1.65 | .413 | 2.05 | .513 | 1.92 | .480 | | | | | 2.286 | 2.42 |
| 2400 | 3.52 | .880 | 1.65 | .413 | 2.05 | .513 | 1.92 | .480 | | | | | 2.286 | 2.42 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | | 3.52 | 6-R | | | 1.92 | | | | |
| 2-S | | | 1.86 | | | TOTAL | 14.51 | | | | |
| 3-S | | | 3.51 | | | AVERAGE | 2.42 | | | | |
| 4-R | | | 1.65 | | | | | | | | |
| 5-R | | | 2.05 | | | | | | | | |
| | | | | | | | | | | WMR: | 2.42 |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 2.42/2.286 = 1.059


HYDROGRAPH and MASS CURVES
for
STORM OF APRIL 26-27, 1968
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 877 ac-ft.
Discharge
Accumulated rainfall
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
3.0
2.0
1.0
0
1800
2400
0600
1200
1800
2400
Apr. 26, 1968
Apr. 27

TX-65 (Rev. 7-69)

# UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY - TEXAS DISTRICT

### RUNOFF COMPUTATIONS

Station 8-0632 Pin Oak Creek near Hubbard, Tex.

Period of Record May 9-10, 1968 Drainage Area 17.6 sq. mi.

| Time | G. Ht. Feet | Sh. Adj. | Discharge C.f.s. | Discharge Inc. | Discharge In/Hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| May 9, 1968 | | | | | | | |
| 0000 | 2.81 | +.13 | 38 | 8.5 | .0033 | .0281 | .0281 |
| 1700 | 2.50 | +.13 | 24 | 9.0 | .0021 | .0189 | .0470 |
| 1800 | 2.74 | +.13 | 34 | .75 | .0030 | .0023 | .0493 |
| 1830 | 3.24 | +.10 | 63 | .75 | .0055 | .0041 | .0534 |
| 1930 | 3.65 | +.05 | 93 | .75 | .0082 | .0062 | .0596 |
| 2000 | 3.67 | +.05 | 95 | 1.25 | .0084 | .0105 | .0701 |
| 2200 | 4.53 | 0 | 156 | 1.25 | .0137 | .0171 | .0872 |
| 2230 | 4.74 | | 162 | .375 | .0142 | .0053 | .0925 |
| 2245 | 5.85 | | 199 | .25 | .0175 | .0044 | .0969 |
| 2300 | 7.56 | | 322 | .25 | .0283 | .0071 | .1040 |
| 2315 | 9.25 | | 622 | .25 | .0547 | .0137 | .1177 |
| 2330 | 10.00 | | 850 | .375 | .0747 | .0280 | .1457 |
| 2400 | 10.39 | 0 | 1,010 | .25 | .0888 | .0222 | .1679 |
| May 10 | | | | | | | |
| 0000 | 10.39 | 0 | 1,010 | .50 | .0888 | .0444 | .2123 |
| 0100 | 10.68 | | 1,140 | 1.0 | .1002 | .1002 | .3125 |
| 0200 | 11.27 | | 1,470 | 1.0 | .1292 | .1292 | .4417 |
| 0300 | 12.35 | | 2,480 | .75 | .2180 | .1635 | .6052 |
| 0330 | 12.87 | | 3,100 | .50 | .2726 | .1363 | .7415 |
| 0400 | 13.03 | | 3,300 | .50 | .2901 | .1451 | .8866 |
| 0430 | 12.98 | | 3,240 | .50 | .2849 | .1425 | 1.0291 |
| 0500 | 12.85 | | 3,080 | 1.25 | .2708 | .3385 | 1.3676 |
| 0700 | 12.00 | | 2,100 | 2.0 | .1846 | .3692 | 1.7368 |
| 0900 | 11.24 | | 1,450 | 2.0 | .1275 | .2550 | 1.9918 |
| 1100 | 10.27 | 0 | 953 | 1.75 | .0838 | .1467 | 2.1385 |
| 1230 | 9.07 | -.20 | 530 | 1.25 | .0466 | .0583 | 2.1968 |
| 1330 | 7.95 | -.62 | 297 | 1.0 | .0261 | .0261 | 2.2229 |
| 1430 | 7.00 | -.35 | 242 | 1.25 | .0213 | .0266 | 2.2495 |
| 1600 | 5.73 | 0 | 194 | 2.25 | .0171 | .0385 | 2.2880 |
| 1900 | 4.58 | 0 | 157 | 4.0 | .0138 | .0552 | 2.3432 |
| 2400 | 4.13 | +.14 | 145 | 2.5 | .0127 | .0318 | 2.3750 |

Computed by BBH & HHW Date _____ Checked by DBU & BBH Date _____

TX-78a July 1969

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY - WATER RESOURCES DIVISION
TEXAS DISTRICT
AVERAGE PRECIPITATION RECORD

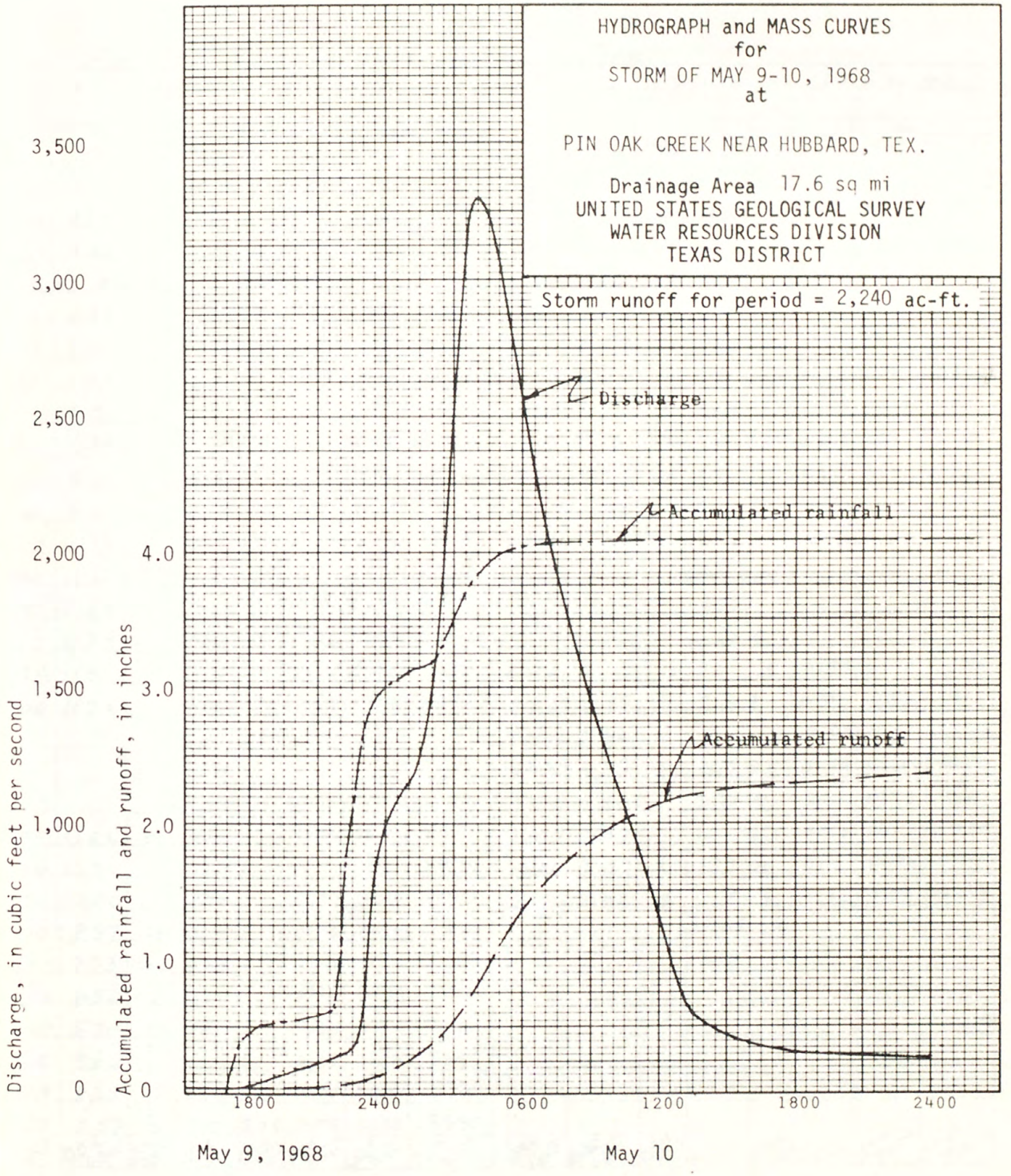
Sheet 1 of 1
Comp. by HHW
Date 6-19-69
Check by: BJH
Date 6-24-69

Study Area: 8-0632. Pin Oak Creek near Hubbard, Tex. Date of Storm. May 9-10, 1968

| Date & Time | Accumulated Precipitation in Inches for Recording Rain Gages: Gage 1-R Recorded | Gage 4-R Recorded | Gage 5-R Recorded | Gage 6-R Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Gage Recorded | Accumulated Average Precipitation: Avg. Recording Gages | Recording Gages x K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 9, 1968 | | | | | | | | | | | | | | |
| 1630 | .00 | .00 | .00 | .00 | | | | | | | | | .00 | .00 |
| 1700 | .00 | .08 | .00 | .00 | | | | | | | | | .020 | .02 |
| 1715 | .00 | .46 | .25 | .02 | | | | | | | | | .183 | .19 |
| 1730 | .18 | .56 | .34 | .30 | | | | | | | | | .345 | .35 |
| 1745 | .20 | .58 | .43 | .43 | | | | | | | | | .411 | .42 |
| 1800 | .24 | .60 | .45 | .44 | | | | | | | | | .433 | .44 |
| 1830 | .35 | .66 | .53 | .45 | | | | | | | | | .499 | .51 |
| 1900 | .37 | .67 | .54 | .50 | | | | | | | | | .521 | .53 |
| 2130 | .65 | .70 | .55 | .50 | | | | | | | | | .601 | .61 |
| 2145 | .80 | .71 | .57 | .50 | | | | | | | | | .646 | .65 |
| 2200 | 2.10 | .73 | .58 | .50 | | | | | | | | | .978 | .99 |
| 2215 | 3.46 | 1.92 | 1.05 | .50 | | | | | | | | | 1.733 | 1.76 |
| 2230 | 3.71 | 2.19 | 1.66 | .50 | | | | | | | | | 2.016 | 2.04 |
| 2245 | 3.98 | 2.44 | 1.99 | 1.07 | | | | | | | | | 2.371 | 2.40 |
| 2300 | 4.18 | 2.55 | 2.08 | 1.75 | | | | | | | | | 2.641 | 2.68 |
| 2330 | 4.34 | 2.71 | 2.23 | 2.22 | | | | | | | | | 2.876 | 2.91 |
| 2400 | 4.43 | 2.76 | 2.30 | 2.34 | | | | | | | | | 2.958 | 3.00 |
| May 10 | | | | | | | | | | | | | | |
| 0100 | 4.53 | 2.89 | 2.41 | 2.48 | | | | | | | | | 3.079 | 3.12 |
| 0200 | 4.67 | 2.94 | 2.44 | 2.50 | | | | | | | | | 3.138 | 3.18 |
| 0300 | 5.00 | 3.27 | 2.78 | 2.70 | | | | | | | | | 3.438 | 3.48 |
| 0330 | 5.21 | 3.48 | 2.97 | 2.96 | | | | | | | | | 3.656 | 3.70 |
| 0400 | 5.27 | 3.62 | 3.12 | 3.17 | | | | | | | | | 3.796 | 3.84 |
| 0500 | 5.32 | 3.75 | 3.28 | 3.40 | | | | | | | | | 3.938 | 3.99 |
| 0600 | 5.34 | 3.77 | 3.30 | 3.55 | | | | | | | | | 3.991 | 4.04 |
| 0700 | 5.35 | 3.79 | 3.35 | 3.58 | | | | | | | | | 4.019 | 4.07 |
| 1200 | 5.36 | 3.87 | 3.36 | 3.60 | | | | | | | | | 4.048 | 4.10 |

| Rain Gage | Precipitation | Rain Gage | Precipitation | Rain Gage | Precipitation | Rain Gage | Precipitation | Rain Gage | Precipitation | Rain Gage | Precipitation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | 5.36 | 5-R | 3.36 | | | | | | | | |
| 2-S | 4.03 | 6-R | 3.60 | | | | | | | | |
| 3-S | 4.38 | Total | 24.60 | | | | | | | | |
| 4-R | 3.87 | Avg. | 4.10 | | | | | | | Avg. Rainfall: | 4.10 |

Average = Sum of Precipitation ÷ Total Number Rain Gages  K = Average of all Rain Gages / Average of all Recording Rain Gages  4.10/4.048 = 1.013


HYDROGRAPH and MASS CURVES
for
STORM OF MAY 9-10, 1968
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 2,240 ac-ft.
Discharge
Accumulated rainfall
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
3,500
3,000
2,500
2,000
1,500
1,000
0
4.0
3.0
2.0
1.0
0
1800
2400
0600
1200
1800
2400
May 9, 1968
May 10

A-65
(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record June 2-4, 1968 Drainage Area 17.6 sq. mi.

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | June 2 | | | | |
| 0000 | 2.13 | 0 | 12 | 3 | .0011 | .0033 | .0033 |
| 0600 | 2.20 | | 14 | 5.5 | .0012 | .0066 | .0099 |
| 1100 | 2.15 | | 12 | 4.5 | .0011 | .0050 | .0149 |
| 1500 | 2.27 | | 17 | 3.5 | .0015 | .0053 | .0202 |
| 1800 | 2.25 | | 16 | 1.75 | .0014 | .0025 | .0227 |
| 1830 | 2.35 | | 20 | .5 | .0018 | .0009 | .0236 |
| 1900 | 4.00 | 0 | 141 | .5 | .0124 | .0062 | .0298 |
| 1930 | 6.45 | -10 | 223 | .5 | .0196 | .0098 | .0396 |
| 2000 | 8.25 | -60 | 332 | .5 | .0292 | .0146 | .0542 |
| 2030 | 9.30 | -10 | 609 | .5 | .0535 | .0268 | .0810 |
| 2100 | 10.13 | 0 | 897 | .75 | .0789 | .0592 | .1402 |
| 2200 | 11.12 | | 1,370 | .75 | .1205 | .0904 | .2306 |
| 2230 | 11.32 | | 1,500 | .5 | .1319 | .0660 | .2966 |
| 2300 | 11.38 | | 1,550 | .5 | .1368 | .0684 | .3650 |
| 2330 | 11.35 | | 1,520 | .5 | .1336 | .0668 | .4318 |
| 2400 | 11.22 | 0 | 1,430 | .25 | .1257 | .0314 | .4632 |
| | | | 525975 | 24 | | | |
| | | | 219 | | | | |
| | | | June 3 | | | | |
| 0000 | 11.22 | 0 | 1,430 | .5 | .1257 | .0629 | .5261 |
| 0100 | 10.70 | | 1,150 | 1 | .1011 | .1011 | .6272 |
| 0200 | 10.00 | 0 | 850 | 1 | .0747 | .0747 | .7019 |
| 0300 | 8.97 | -15 | 519 | 1 | .0456 | .0456 | .7475 |
| 0400 | 7.73 | -60 | 278 | 1 | .0244 | .0244 | .7719 |
| 0500 | 6.50 | -20 | 220 | 1 | .0193 | .0193 | .7912 |
| 0600 | 5.38 | 0 | 181 | 1 | .0159 | .0159 | .8071 |
| 0700 | 4.60 | | 158 | 2 | .0139 | .0278 | .8349 |
| 1000 | 3.88 | | 137 | 3.5 | .0120 | .0420 | .8769 |
| 1400 | 3.57 | 0 | 112 | 2.25 | .0098 | .0221 | .8990 |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Discharge Inc. | Discharge In/hr. | Runoff Inches | Runoff Acc. In. |
|---|---|---|---|---|---|---|---|
| 1430 | 3.85 | 0 | 135 | .5 | .0119 | .0060 | .9050 |
| 1500 | 5.42 | 0 | 183 | .5 | .0161 | .0081 | .9131 |
| 1530 | 6.60 | -20 | 226 | .5 | .0199 | .0100 | .9231 |
| 1600 | 7.53 | -60 | 261 | .75 | .0229 | .0172 | .9403 |
| 1700 | 8.87 | -20 | 488 | 1.50 | .0429 | .0644 | 1.0047 |
| 1900 | 9.77 | 0 | 771 | 1.25 | .0678 | .0848 | 1.0895 |
| 1930 | 9.79 | 0 | 778 | .5 | .0684 | .0342 | 1.1237 |
| 2000 | 9.76 | 0 | 768 | 1.25 | .0675 | .0844 | 1.2081 |
| 2200 | 8.86 | -20 | 486 | 1.50 | .0427 | .0641 | 1.2722 |
| 2300 | 8.03 | -60 | 307 | 1 | .0270 | .0270 | 1.2992 |
| 2400 | 7.18 | -20 | 265 | .5 | .0233 | .0117 | 1.3109 |
| | | | 964150 | 24 | | | |
| | | | 402 | | | | |
| | | | June 4 | | | | |
| 0000 | 7.18 | -20 | 265 | .5 | .0233 | .0117 | 1.3226 |
| 0100 | 6.35 | -10 | 218 | 1 | .0192 | .0192 | 1.3418 |
| 0200 | 5.62 | 0 | 190 | 1.5 | .0167 | .0251 | 1.3669 |
| 0400 | 4.79 | | 164 | 2.5 | .0144 | .0360 | 1.4029 |
| 0700 | 4.30 | | 150 | 4 | .0132 | .0528 | 1.4557 |
| 1200 | 3.97 | | 140 | 5.5 | .0123 | .0677 | 1.5234 |
| 1800 | 3.80 | | 132 | 6 | .0116 | .0696 | 1.5930 |
| 2400 | 3.62 | 0 | 117 | 3 | .0103 | .0309 | 1.6239 |
| | | | 35585 | 24 | | | |
| | | | 148 | | | | |
| BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | BBH/DBU | HHW/BBH | HHW/BBH | HHW/BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet 1 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: HH.W.
Date: JUNE 18, 1969
Check by: BBH
Date: June 24, 1969

# WEIGHTED PRECIPITATION RECORD

Area: Pin Oak Creek near Hubbard, Tex.

Date of storm June 2-4, 1968

| Weight Factor | .250 | | .250 | | .250 | | .250 | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec Gages x K) All Gages |
| JUNE 2 | | | | | | | | | | | | | | |
| 0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 0100 | .03 | .008 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | .008 | .01 |
| 0115 | .07 | .018 | .10 | .025 | (.10) | .025 | 0 | 0 | | | | | .068 | .07 |
| 0130 | .12 | .030 | .18 | .045 | (.18) | .045 | 0 | 0 | | | | | .120 | .12 |
| 0145 | .15 | .038 | .26 | .065 | (.26) | .065 | 0 | 0 | | | | | .168 | .17 |
| 0200 | .42 | .105 | .47 | .118 | (.47) | (.118) | 0 | 0 | | | | | .340 | .34 |
| 0230 | .57 | .143 | .55 | .138 | (.55) | (.138) | .07 | .018 | | | | | .437 | .43 |
| 0300 | .73 | .183 | .70 | .175 | (.65) | (.163) | .35 | .088 | | | | | .609 | .60 |
| 0400 | .85 | .213 | .80 | .200 | (.70) | (.175) | .55 | .138 | | | | | .726 | .72 |
| 0500 | .85 | .213 | .80 | .200 | .70 | .175 | .62 | .155 | | | | | .743 | .74 |
| 0600 | .85 | .213 | .80 | .200 | .70 | .175 | .62 | .155 | | | | | .743 | .74 |
| 0700 | .85 | .213 | .80 | .200 | .70 | .175 | .62 | .155 | | | | | .743 | .74 |
| 1600 | .85 | .213 | .80 | .200 | .70 | .175 | .63 | .158 | | | | | .746 | .74 |
| 1615 | 1.03 | .258 | .80 | .200 | .70 | .175 | .63 | .158 | | | | | .816 | .81 |
| 1630 | 1.22 | .305 | .80 | .200 | .83 | .208 | .63 | .158 | | | | | .871 | .86 |
| 1645 | 1.31 | .328 | 1.20 | .300 | 1.00 | .250 | .63 | .158 | | | | | 1.036 | 1.03 |
| 1700 | 1.60 | .400 | 2.50 | .625 | 2.08 | .520 | .63 | .158 | | | | | 1.703 | 1.69 |
| 1715 | 2.07 | .518 | 3.63 | .908 | 2.55 | .638 | .63 | .158 | | | | | 2.222 | 2.21 |
| 1730 | 2.14 | .535 | 4.10 | 1.025 | 3.02 | .755 | .75 | .183 | | | | | 2.503 | 2.48 |
| 1745 | 2.15 | .538 | 4.17 | 1.043 | 3.17 | .793 | .78 | .195 | | | | | 2.569 | 2.55 |
| 1800 | 2.15 | .538 | 4.22 | 1.055 | 3.22 | .805 | .80 | .200 | | | | | 2.598 | 2.58 |
| 1900 | 2.17 | .543 | 4.24 | 1.060 | 3.24 | .810 | .95 | .238 | | | | | 2.651 | 2.63 |
| 1915 | 2.27 | .568 | 4.25 | 1.063 | 3.25 | .813 | .97 | .243 | | | | | 2.687 | 2.67 |
| 1930 | 2.68 | .670 | 4.33 | 1.083 | 3.25 | .813 | .97 | .243 | | | | | 2.809 | 2.79 |
| 2000 | 2.70 | .675 | 4.33 | 1.083 | 3.25 | .813 | .97 | .243 | | | | | 2.814 | 2.79 |
| 2400 | 2.72 | .678 | 4.33 | 1.083 | 3.25 | .813 | .98 | .245 | | | | | 2.819 | 2.80 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | 3.32 | | 6-R | | 1.84 | | | | | |
| 2-S | | 3.09 | | | | | | | | | |
| 3-S | | 4.01 | | | TOTAL | 21.59 | | | | | |
| 4-R | | 5.38 | | | AVERAGE | = 3.598 | | | | | |
| 5-R | | 3.95 | | | | | | | | | |
| | | | | | | | | | | WMR: | 3.598 |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 3.598 / 3.623 = .993

( ) estimated

A-78 (Revised Feb. 1960)

Sheet 2 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: H.H.W.
Date: 6/18/69
Check by: BBH
Date: 6/24/69

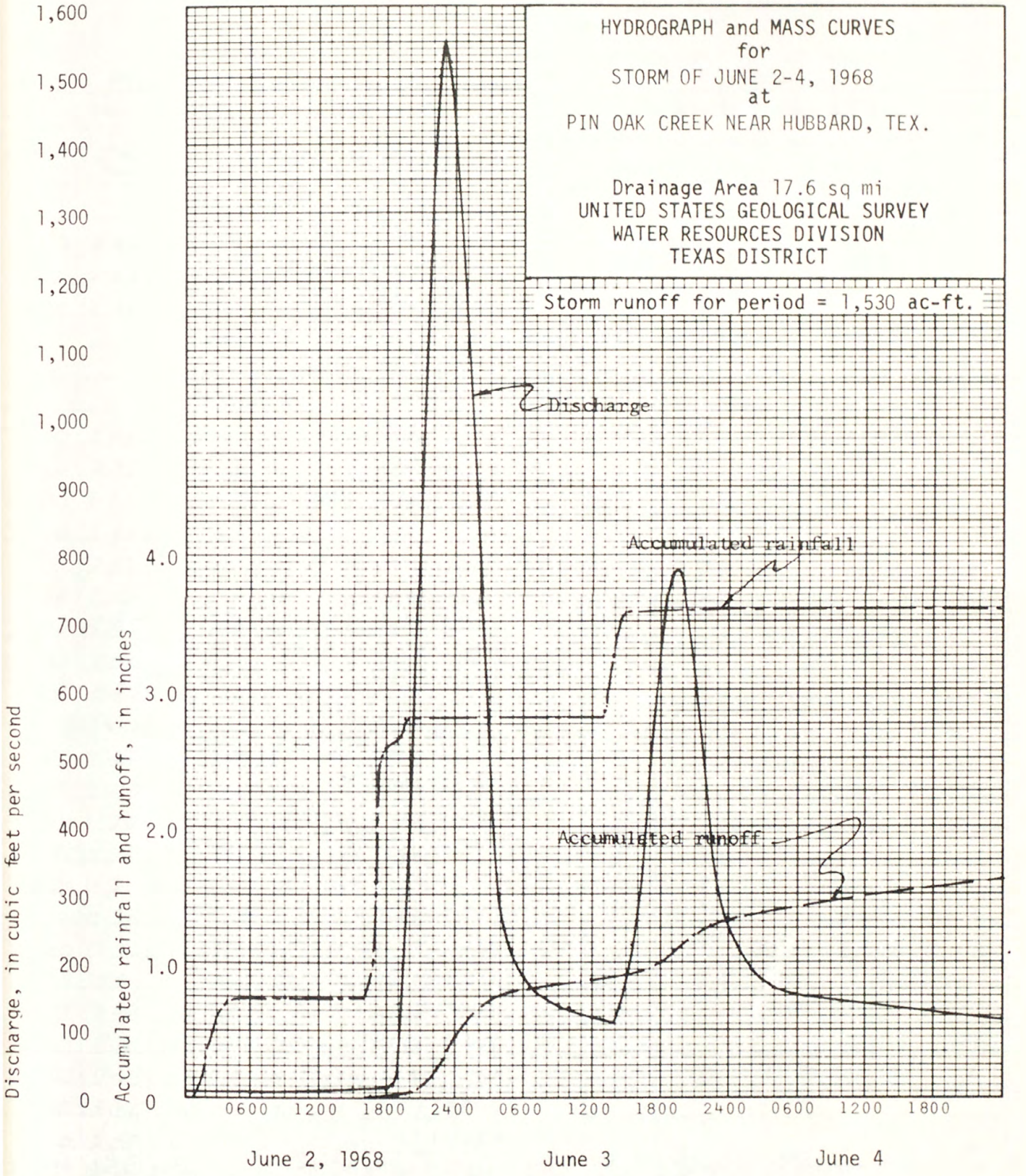
# WEIGHTED PRECIPITATION RECORD

Area: Pin Oak Creek, near Hubbard, Tex. Date of storm June 2-4, 1968 (cont.)

| Weight Factor | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| JUNE 3 | | | | | | | | | | | | | | |
| 1200 | 2.74 | .685 | 4.33 | 1.083 | 3.25 | .813 | .98 | .245 | | | | | 2.826 | 2.81 |
| 1300 | 2.74 | .685 | 4.33 | 1.083 | 3.25 | .813 | .98 | .245 | | | | | 2.826 | 2.81 |
| 1315 | 3.05 | .763 | 4.34 | 1.085 | 3.25 | .813 | .98 | .245 | | | | | 2.906 | 2.89 |
| 1330 | 3.16 | .790 | 4.84 | 1.210 | 3.25 | .813 | .98 | .245 | | | | | 3.058 | 3.04 |
| 1345 | 3.19 | .798 | 5.17 | 1.293 | 3.50 | .875 | .98 | .245 | | | | | 3.211 | 3.19 |
| 1400 | 3.22 | .805 | 5.23 | 1.308 | 3.78 | .945 | 1.01 | .253 | | | | | 3.311 | 3.29 |
| 1430 | 3.30 | .825 | 5.30 | 1.325 | 3.85 | .963 | 1.68 | .420 | | | | | 3.533 | 3.51 |
| 1500 | 3.32 | .830 | 5.38 | 1.345 | 3.92 | .980 | 1.78 | .445 | | | | | 3.600 | 3.57 |
| 2400 | 3.32 | .830 | 5.38 | 1.345 | 3.95 | .988 | 1.84 | .460 | | | | | 3.623 | 3.60 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | WMR: | |

WMR = Sum of Precipitation x Weight Factor K = WMR / Total Recording Gages Weighted Precipitation =


HYDROGRAPH and MASS CURVES
for
STORM OF JUNE 2-4, 1968
at
PIN OAK CREEK NEAR HUBBARD, TEX.
Drainage Area 17.6 sq mi
UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
TEXAS DISTRICT
Storm runoff for period = 1,530 ac-ft.
Discharge
Accumulated rainfall
Accumulated runoff
Discharge, in cubic feet per second
Accumulated rainfall and runoff, in inches
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4.0
3.0
2.0
1.0
0
0600
1200
1800
2400
0600
1200
1800
2400
0600
1200
1800
June 2, 1968
June 3
June 4

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(Rev. 6-63)

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY-AUSTIN DISTRICT

RUNOFF COMPUTATIONS

Station Pin Oak Creek near Hubbard, Tex.

Period of Record June 23-24, 1968 Drainage Area 17.6

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| | | | June 23 | | | | |
| 0000 | 2.20 | 0 | 14 | 6 | .0012 | .0072 | .0072 |
| 1200 | 2.20 | | 14 | 12 | .0012 | .0144 | .0216 |
| 2400 | 2.20 | 0 | 14 | 6 | .0012 | .0072 | .0288 |
| | | | 336 | 24 | | | |
| | | | 14 | | | | |
| | | | June 24 | | | | |
| 0000 | 2.20 | 0 | 14 | 1 | .0012 | .0012 | .0300 |
| 0200 | 2.25 | | 16 | 1.5 | .0014 | .0021 | .0321 |
| 0300 | 2.32 | | 19 | .75 | .0017 | .0013 | .0334 |
| 0330 | 2.55 | | 28 | .5 | .0025 | .0013 | .0347 |
| 0400 | 2.87 | | 48 | .5 | .0042 | .0021 | .0368 |
| 0430 | 3.85 | | 135 | .375 | .0119 | .0045 | .0413 |
| 0445 | 5.45 | 0 | 184 | .25 | .0162 | .0041 | .0454 |
| 0500 | 7.00 | -.30 | 245 | .25 | .0215 | .0054 | .0508 |
| 0515 | 8.55 | -.20 | 428 | .25 | .0376 | .0094 | .0602 |
| 0530 | 9.45 | -.10 | 648 | .375 | .0570 | .0214 | .0816 |
| 0600 | 10.60 | 0 | 1,100 | .5 | .0967 | .0484 | .1300 |
| 0630 | 11.08 | | 1,350 | .5 | .1187 | .0594 | .1894 |
| 0700 | 11.20 | | 1,420 | .75 | .1248 | .0936 | .2830 |
| 0800 | 11.23 | | 1,440 | 1. | .1266 | .1266 | .4096 |
| 0900 | 11.36 | | 1,530 | .75 | .1345 | .1009 | .5105 |
| 0930 | 11.38 | | 1,550 | .5 | .1363 | .0682 | .5787 |
| 1000 | 11.32 | | 1,500 | 1.25 | .1319 | .1649 | .7436 |
| 1200 | 10.50 | 0 | 1,060 | 1.5 | .0932 | .1398 | .8834 |
| 1300 | 9.48 | -.10 | 657 | 1. | .0578 | .0578 | .9412 |
| 1400 | 8.18 | -.60 | 324 | .75 | .0285 | .0214 | .9626 |
| 1430 | 7.47 | -.60 | 257 | .5 | .0226 | .0113 | .9739 |
| 1500 | 6.80 | -.20 | 238 | .75 | .0209 | .0157 | .9896 |
| 1600 | 5.48 | 0 | 184 | 1. | .0162 | .0162 | 1.0058 |
| BBH / DBU | BBH / DBU | BBH / DBU | BBH / DBU | BBH / DBU | HHW / BBH | HHW / BBH | HHW / BBH |

| Time | G. Ht. Feet | Sh. Adj. | Discharge c.f.s. | Inc. | In/hr. | Runoff Inches | Acc. In. |
|---|---|---|---|---|---|---|---|
| 1700 | 4.47 | 0 | 154 | 1. | .0135 | .0135 | 1.0193 |
| 1800 | 4.06 | | 143 | 1.5 | .0126 | .0189 | 1.0382 |
| 2000 | 3.75 | | 128 | 2. | .0113 | .0226 | 1.0608 |
| 2200 | 3.59 | | 114 | 2. | .0100 | .0200 | 1.0808 |
| 2400 | 3.49 | 0 | 104 | 1 | .0091 | .0091 | 1.0899 |
| | | | 2063/25 | 24 | | | |
| | | | 503 | | | | |
| BBH / DBU | BBH / DBU | BBH / DBU | BBH / DBU | BBH / DBU | HHW / BBH | HHW / BBH | HHW / BBH |

Computed by _____ Date _____ Computed _____ Date _____

A-78 (Revised Feb. 1960)

Sheet 1 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: HHW
Date: JUNE 18, 1969
Check by: BBH
Date: 6/24/69

# WEIGHTED PRECIPITATION RECORD

Area: Pin Oak Creek near Hubbard, Tex

Date of storm June 23-24, 1968

| Weight Factor | .250 | | .250 | | .250 | | .250 | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| JUNE 23, 1968 | | | | | | | | | | | | | | |
| 0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 1200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 |
| 1600 | .01 | .003 | 0 | 0 | 0 | 0 | .18 | .045 | | | | | .048 | .05 |
| 1615 | .01 | .003 | .03 | .008 | 0 | 0 | .19 | .048 | | | | | .059 | .06 |
| 1700 | .03 | .008 | .03 | .008 | 0 | 0 | .20 | .050 | | | | | .066 | .07 |
| 1800 | .04 | .010 | .04 | .010 | 0 | 0 | .23 | .058 | | | | | .078 | .08 |
| 2000 | .09 | .023 | .06 | .015 | .02 | .005 | .30 | .075 | | | | | .118 | .12 |
| 2200 | .13 | .033 | .11 | .028 | .07 | .018 | .45 | .113 | | | | | .192 | .20 |
| 2230 | .23 | .058 | .12 | .030 | .09 | .023 | .63 | .158 | | | | | .269 | .27 |
| 2300 | .35 | .088 | .14 | .035 | .11 | .028 | .96 | .240 | | | | | .391 | .40 |
| 2315 | .43 | .108 | .15 | .038 | .11 | .028 | 1.03 | .258 | | | | | .432 | .44 |
| 2330 | .62 | .155 | .15 | .038 | .11 | .028 | 1.10 | .275 | | | | | .496 | .51 |
| 2345 | .82 | .205 | .15 | .038 | .11 | .028 | 1.16 | .290 | | | | | .561 | .57 |
| 2400 | .93 | .233 | .15 | .038 | .12 | .030 | 1.23 | .308 | | | | | .609 | .62 |
| JUNE 24 | | | | | | | | | | | | | | |
| 0015 | 1.02 | .255 | .16 | .040 | .13 | .033 | 1.38 | .345 | | | | | .673 | .69 |
| 0030 | 1.07 | .268 | .22 | .055 | .15 | .038 | 1.50 | .375 | | | | | .736 | .75 |
| 0045 | 1.21 | .303 | .27 | .068 | .21 | .053 | 1.61 | .403 | | | | | .827 | .84 |
| 0100 | 1.37 | .343 | .34 | .085 | .26 | .065 | 1.81 | .453 | | | | | .946 | .97 |
| 0115 | 1.50 | .375 | .41 | .103 | .35 | .088 | 2.17 | .543 | | | | | 1.109 | 1.13 |
| 0130 | 1.62 | .405 | .56 | .140 | .45 | .113 | 2.69 | .673 | | | | | 1.331 | 1.36 |
| 0145 | 2.03 | .508 | .74 | .185 | .60 | .150 | 2.70 | .675 | | | | | 1.518 | 1.55 |
| 0200 | 2.51 | .628 | .90 | .225 | .78 | .195 | 2.82 | .705 | | | | | 1.753 | 1.79 |
| 0215 | 2.56 | .640 | .99 | .248 | .88 | .220 | 2.87 | .718 | | | | | 1.826 | 1.86 |
| 0230 | 2.56 | .640 | 1.06 | .265 | .96 | .240 | 2.87 | .718 | | | | | 1.863 | 1.90 |
| 0245 | 2.56 | .640 | 1.12 | .280 | 1.01 | .253 | 2.90 | .725 | | | | | 1.898 | 1.94 |
| 0300 | 2.60 | .650 | 1.31 | .328 | 1.15 | .288 | 2.90 | .725 | | | | | 1.991 | 2.03 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-R | | 2.62 | | 6-R | | 2.90 | | | | | |
| 2-S | | 2.95 | | | | | | | | | |
| 3-S | | 3.35 | | | TOTAL | 18.14 | | | | | |
| 4-R | | 2.92 | | | AVERAGE | 3.023 | | | | | |
| 5-6 | | 3.40 | | | | | | | | | |
| | | | | | | | | | | WMR: 3.023 | |

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation = 3.023 / 2.960 = 1.021

A-78 (Revised Feb. 1960)

Sheet 2 of 2

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY, SURFACE WATER BRANCH
AUSTIN DISTRICT

Comp. by: HHW
Date: 6/18/69
Check by: BBH
Date: 6/24/69

# WEIGHTED PRECIPITATION RECORD

Area:

Date of storm

| Weight Factor | .250 | | .250 | | .250 | | .250 | | | | | | Accumulated Weighted Precipitation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accumulated Precipitation in Inches for Recording Gages | | | | | | | | | | | | | |
| | Gage 1-R | | Gage 4-R | | Gage 5-R | | Gage 6-R | | Gage | | Gage | | | |
| Date & Time | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recorded | x Factor | Recording Gages | (Rec. Gages x K) All Gages |
| JUNE 24 cont | | | | | | | | | | | | | | |
| 0315 | 2.60 | .650 | 1.42 | .355 | 1.25 | .313 | 2.90 | .725 | | | | | 2.043 | 2.09 |
| 0330 | 2.61 | .653 | 1.51 | .378 | 1.35 | .338 | | | | | | | 2.094 | 2.14 |
| 0345 | 2.61 | .653 | 1.74 | .435 | 1.51 | .378 | | | | | | | 2.191 | 2.24 |
| 0400 | 2.62 | .655 | 2.26 | .565 | 1.75 | .438 | | | | | | | 2.383 | 2.43 |
| 0415 | 2.62 | .655 | 2.80 | .700 | 2.22 | .555 | | | | | | | 2.635 | 2.69 |
| 0430 | 2.62 | .655 | 2.87 | .718 | 2.94 | .735 | | | | | | | 2.833 | 2.89 |
| 0445 | 2.62 | .655 | 2.87 | .718 | 2.96 | .740 | | | | | | | 2.838 | 2.90 |
| 0500 | 2.62 | .655 | 2.88 | .720 | 3.07 | .768 | | | | | | | 2.868 | 2.93 |
| 0515 | 2.62 | .655 | 2.90 | .725 | 3.24 | .810 | | | | | | | 2.915 | 2.98 |
| 0530 | 2.62 | .655 | 2.92 | .730 | 3.35 | .838 | | | | | | | 2.948 | 3.01 |
| 0600 | 2.62 | .655 | 2.92 | .730 | 3.40 | .850 | | | | | | | 2.960 | 3.02 |
| 1200 | 2.62 | .655 | 2.92 | .730 | 3.40 | .850 | 2.90 | .725 | | | | | 2.960 | 3.02 |

| Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor | Rain Gage | Weight Factor | Precipitation | Precipitation x Weight Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

WMR: 

WMR = Sum of Precipitation x Weight Factor  K = WMR / Total Recording Gages Weighted Precipitation =