DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
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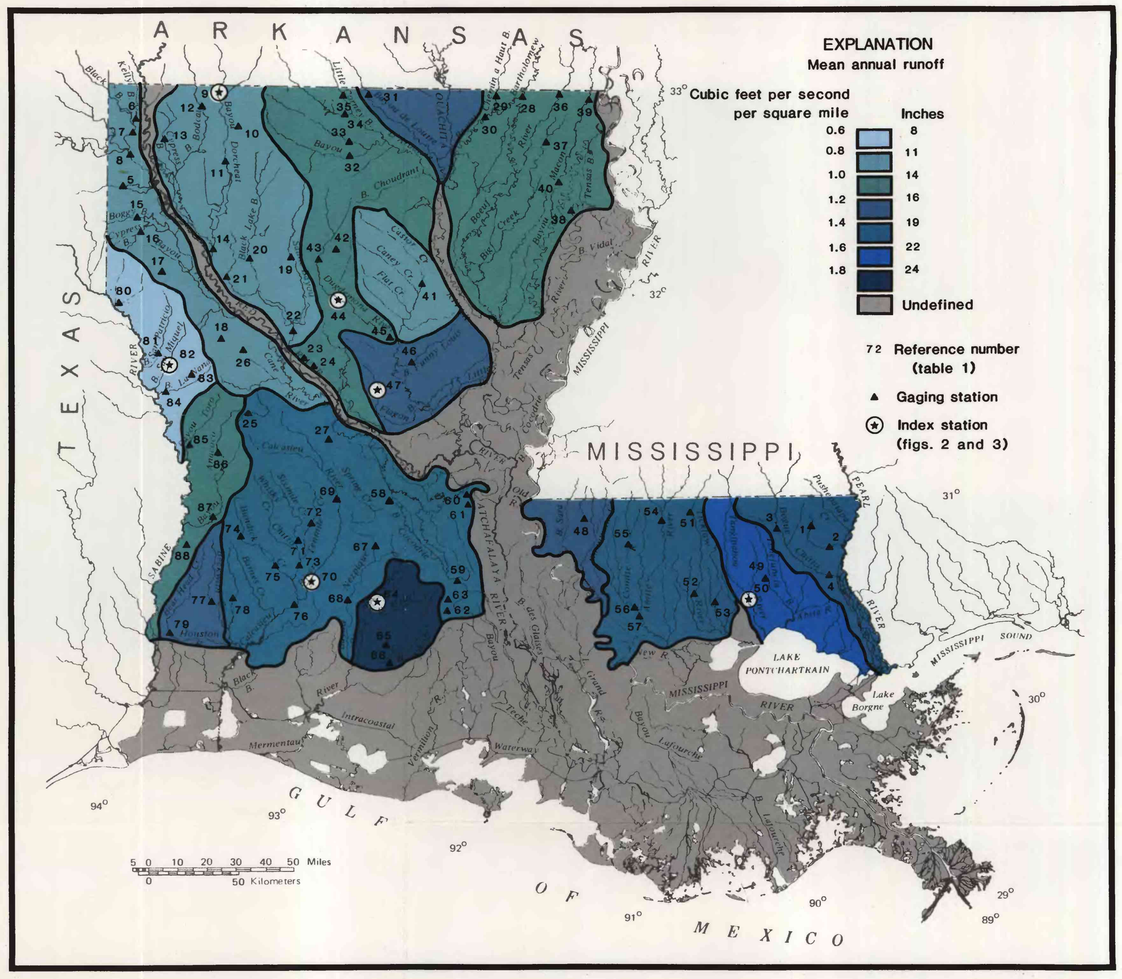
WATER-RESOURCES INVESTIGATIONS
REPORT 86-4149



INTRODUCTION

This map is one of a series of map reports designed to provide a general description of various aspects of the hydrologic cycle as it applies to Louisiana. The map shows the mean annual runoff from drainage basins exclusive of those in the coastal zone of southern Louisiana and the alluvial valleys of the Mississippi, Ouachita, and Red Rivers.

Runoff is that part of precipitation that appears in surface streams and is the same as streamflow unaffected by artificial diversions, storage, or other works of man, in or on the stream channel (Langbein and Iseri, 1960). Works of man undertaken within the drainage basin but not in or on the channels, such as land-use practices, may affect the amount of runoff from a given amount of precipitation, but the runoff is still equivalent to the streamflow. The quantity of runoff from an area is commonly expressed in terms of inches of water uniformly distributed over the area that contributes the water. In other words, an inch of runoff represents a 1-inch layer of water covering the drainage basin that contributed the water. Another useful way to express runoff is in terms of cubic feet per second per square mile [$(ft^3/s)/mi^2$].

RUNOFF CHARACTERISTICS IN LOUISIANA

The mean annual runoff for the State of Louisiana varies from about 0.7 $(ft^3/s)/mi^2$ in the Sabine and Red River basins of western and northwestern Louisiana to over 2.0 $(ft^3/s)/mi^2$ in the upper reaches of the Mermentau River in south-central Louisiana (table 1). Generally, runoff is lower in the northern sections of the State and higher in the southern sections.

Runoff is not measured in the coastal areas of southern Louisiana and the alluvial valleys primarily because the streams in these areas do not have flow characteristics that fit the traditional stage-discharge relationship. In addition, in coastal areas, tides can affect the flow of streams. Louisiana also has an extensive system of diversion canals, interconnecting waterways, and levees in the coastal areas and in the alluvial valleys. For many streams in these areas, flow can occur in either direction (Sauer, 1964).

Numerous factors account for the three-fold variation in runoff across Louisiana. Regional differences in rainfall are important. Mean annual rainfall ranges from less than 48 inches in the northwestern part of the State to greater than 64 inches in the southeastern delta region (fig. 1). Two areas that receive greater annual rainfall than other parts of the State, the "Florida Parishes," east of the Mississippi River and north of Lake Pontchartrain, and the central part of the State, generally coincide with the areas of greater runoff.

Physical characteristics of the land also affect runoff. In northern and western Louisiana, the pine hills, or uplands, have greater topographic relief and greater slopes than in the south, which tend to increase the rate of runoff. However, the generally permeable soils and the extensive stands of mixed hardwood and softwood trees tend to reduce the rate of runoff. On the prairies of southwestern Louisiana, the flat relief and lesser slopes tend to decrease the rate of runoff, but the treeless landscape in conjunction with highly impermeable soils tend to increase runoff. It is difficult to generalize over large areas which physical characteristics affect runoff more than other characteristics because their relative significance varies greatly from place to place.

Characteristic features of the "Florida Parishes" of southeastern Louisiana are extensive pine forests, small patches of cultivated land, and many small ponds. Topography ranges from gently rolling hills in the northern part to flat, swampy lands in the southern part. Soils in the hills are generally permeable sandy loams that allow rather rapid percolation of rainfall. Swamp areas in the southern part are characterized by heavy clay soils, poor drainage, and high water tables, but these areas form only a small part of this region and have little effect on runoff (Calandro, 1967).

Land use can affect the rate of runoff. Many of man's activities increase the rate; large areas are deforested for agriculture, and urbanization creates impervious surfaces. Other activities, such as the irrigation of crops and the construction of stormwater impoundments and reservoirs, reduce runoff by controlling the release of water to the streams and by increasing evapotranspiration.

Runoff varies greatly with time as well as with location. The annual runoff from a stream basin can vary several fold between extremely wet and dry years. For example, as shown in figure 2, runoff from the Dugdemona River basin in north-central Louisiana ranged from 0.096 $(ft^3/s)/mi^2$ in 1963 to 2.71 $(ft^3/s)/mi^2$ in 1958. Within any given year, seasonal fluctuations in runoff also can be considerable. For example, in figure 3, the monthly mean runoff from the Bayou San Miguel basin ranges from 1.63 $(ft^3/s)/mi^2$ in February to 0.034 $(ft^3/s)/mi^2$ in July.

Computation of Mean Annual Runoff

The mean annual runoff is determined on the basis of continuing measurements of stage (water-surface elevation) and discharge (volume rate of flow) of uncontrolled (unregulated) streams. The periods of record from 88 stations shown on this map vary from 5 to 50 years. Although the periods of record are not of the same length, all are of sufficient length to be representative for the respective drainage basin.

The 88 stations were grouped into seven categories of runoff. The seven categories are 0.6-0.8, 0.8-1.0, 1.0-1.2, 1.2-1.4, 1.4-1.6, 1.6-1.8, and 1.8 $(ft^3/s/mi^2$ and greater. The boundaries for each region generally correspond to drainage boundaries or physiographic boundaries.

One station from each of the seven runoff categories was selected as an index station to illustrate the annual variability of runoff (fig. 2) and the seasonal variability by month (fig. 3) within each category.

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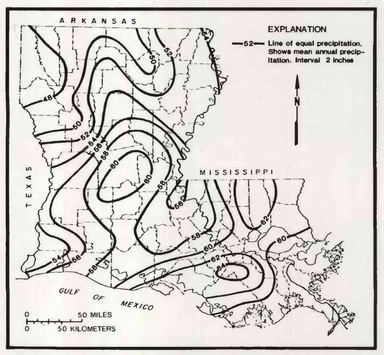

Figure 1.--Mean annual precipitation in Louisiana for the base period 1951-80. (See Muller and others, 1984.)

Table 1.--Continuous-gaging stations in Louisiana used to determine mean annual runoff

[Reference, Ref.; cubic foot per second per square mile, $(ft^3/s)/mi^2$]

Ref. no.	Station no.	Name	Drainage area (mi^2)	Mean annual runoff [$(ft^3/s)/mi^2$]	Mean annual runoff (inches)	Period of record for computing runoff (month-year)
1	02490000	Bogue Lusa Creek near Franklinton--	12.1	1.49	20.24	10-48 to 9-68
2	02490105	Bogue Lusa Creek at State Hwy 439 at Bogalusa.	72.7	1.62	22.00	10-63 to 9-83
3	02491500	Bogue Chitto at Franklinton--------	990	1.61	22.00	10-28 to 9-31 10-38 to 9-57
4	02492000	Bogue Chitto near Bush------------	1,213	1.58	21.44	10-37 to 9-83
5	07344450	Raw Paw Bayou near Greenwood-------	80.5	.80	10.90	10-55 to 9-83
6	07347000	Kelly Bayou near Hosston-----------	116	.82	11.11	10-44 to 9-68
7	07347500	Black Bayou near Gilliam-----------	364	1.04	14.18	10-42 to 9-59
8	07348000	Twelve mile Bayou near Dixie-------	3,137	.81	11.03	10-42 to 9-83
9	07348700	Bayou Dorcheat near Springhill-----	605	.91	12.30	10-57 to 9-83
10	07348800	Flat Lick Bayou near Leton---------	66.9	.90	12.16	10-56 to 9-77
11	07349000	Bayou Dorcheat near Minden---------	1,097	1.01	13.75	10-28 to 9-31 10-36 to 9-79
12	07349500	Bodcau Bayou near Sarepta----------	546	1.04	14.13	10-38 to 9-83
13	07349795	Cypress Bayou above Benton---------	88.9	.82	11.15	10-74 to 9-83
14	07350000	Loggy Bayou near Minock------------	2,628	.87	11.84	10-48 to 9-60
15	07351000	Boggy Bayou near Keithville--------	79	.87	11.86	10-39 to 9-82
16	07351500	Cypress Bayou near Keithville------	66	1.16	15.76	10-38 to 9-57 10-82 to 9-83
17	07351700	Bayou Na Bonchasse near Mansfield--	19.5	.68	9.26	10-58 to 9-68
18	07351900	Bayou Dupont near Robeline---------	35.1	.79	10.72	10-57 to 9-69
19	07352000	Saline Bayou near Lucky------------	154	1.05	14.29	10-40 to 9-83
20	07352500	Black Lake Bayou near Castor-------	423	1.29	17.47	10-40 to 9-57
21	07352800	Grand Bayou near Coushatta---------	93.9	.95	12.86	10-56 to 9-77 10-79 to 9-83
22	07353000	Saline Bayou near Clarence---------	1,386	.84	11.42	10-49 to 9-72
23	07353500	Nantachie Creek near Montgomery----	47	1.14	15.46	10-42 to 9-68
24	07353520	Nantachie Lake near Aloha----------	80.4	.90	12.26	10-69 to 9-72 10-73 to 9-79
25	07354000	Little Sandy Creek at Kisatchie----	21.4	1.38	18.72	10-49 to 9-79
26	07354500	Horsepen Creek near Provencal------	5.3	.90	12.28	10-49 to 9-68
27	07355000	Hemphill Creek near Hot Wells------	18.0	1.51	20.53	10-48 to 9-64
28	07364200	Bayou Bartholomew near Jones-------	1,187	1.07	14.52	10-57 to 9-83
29	07364300	Chemin a Haut Bayou near Beekman---	271	1.08	14.74	10-55 to 9-79
30	07364500	Bayou Bartholomew near Beekman-----	1,645	1.09	14.82	10-27 to 9-31 10-38 to 9-59
31	07364700	Bayou de Loutre near Laran---------	141	1.31	17.82	10-55 to 9-77
32	07365000	Bayou D'Arbonne near Dubach--------	355	1.14	15.54	10-40 to 9-68
33	07365500	Middle Fork Bayou D'Arbonne near Bernice.	178	1.20	16.33	10-40 to 9-57 10-64 to 9-70
34	07366000	Corney Bayou near Lillie-----------	462	1.02	13.88	10-40 to 9-57
35	07366200	Little Corney Bayou near Lillie----	208	.89	12.14	10-55 to 9-83
36	07367700	Boeuf River near Ark-La State Line-	785	1.21	16.47	10-57 to 9-68
37	07368500	Big Colewa Bayou near Oak Grove----	42	1.09	14.81	10-49 to 9-77
38	07369500	Tensas River at Tendal-------------	309	1.11	15.03	10-35 to 9-83
39	07369700	Bayou Macon near Kilbourne---------	504	1.01	13.69	10-57 to 9-68
40	07370000	Bayou Macon near Delhi-------------	782	1.27	17.28	10-35 to 9-83
41	07370500	Castor Creek near Grayson----------	271	.89	12.13	10-40 to 9-70
42	07371000	Garrett Creek at Jonesboro---------	2.1	1.03	14.02	10-52 to 9-70
43	07371500	Dugdemona River near Jonesboro-----	355	1.17	15.92	10-38 to 9-57 10-77 to 9-83
44	07372000	Dugdemona River near Winnfield-----	654	1.09	14.83	10-39 to 9-77
45	07372200	Little River near Rochelle---------	1,899	1.12	15.17	10-57 to 9-83

Table 1.--Continued

Ref. no.	Station no.	Name	Drainage area (mi^2)	Mean annual runoff [$(ft^3/s)/mi^2$]	Mean annual runoff (inches)	Period of record for computing runoff (month-year)
46	07372500	Bayou Funny Louis near Trout-------	92	1.34	18.16	10-39 to 9-70
47	07373000	Big Creek at Pollock---------------	51	1.20	16.35	10-42 to 9-83
48	07373500	West Fork Thompson Creek near Wakefield.	35.3	1.22	16.50	10-50 to 9-70
49	07375000	Tchefuncta River near Folsom-------	95.5	1.70	23.06	10-43 to 9-83
50	07375500	Tangipahoa River at Robert---------	646	1.77	24.26	10-38 to 9-83
51	07375800	Tickfaw River at Liverpool---------	89.7	1.29	17.56	10-56 to 9-68 10-79 to 9-83
52	07376000	Tickfaw River at Holden------------	247	1.51	20.56	10-40 to 9-83
53	07376500	Natalbany River at Baptist---------	79.5	1.47	19.98	10-43 to 9-83
54	07377000	Amite River near Darlington--------	580	1.59	21.63	10-49 to 9-83
55	07377500	Comite River near Olive Branch-----	145	1.62	22.01	10-42 to 9-83
56	07378000	Comite River near Comite-----------	284	1.67	22.71	10-45 to 9-83
57	07378500	Amite River near Denham Springs----	1,280	1.58	21.44	10-38 to 9-83
58	07382000	Bayou Cocodrie near Clear Water----	240	1.74	23.60	10-22 to 9-24 10-38 to 9-83
59	07382500	Bayou Courtableau at Washington----	715	1.50	20.31	10-46 to 9-83
60	07383500	Bayou des Glaises Diversion Channel at Moreauville.	270	1.55	21.08	10-43 to 9-83
61	07384000	West Protection Levee Borrow Pit channel near Plaucheville.	321	1.65	22.39	10-44 to 9-57
62	07386000	Bayou Carencro near Sunset---------	37.1	1.46	19.84	10-43 to 9-61
63	07386500	Bayou Bourbeau at Shuteston--------	19.0	1.36	18.44	10-42 to 9-70
64	08010000	Bayou des Cannes near Eunice-------	131	2.05	27.89	10-38 to 9-83
65	08010300	Long Point Gully near Crowley------	25.7	1.77	24.05	10-49 to 9-58
66	08011000	Bayou Plaquemine Brule near Crowley.	254	2.14	29.08	10-42 to 9-47
67	08011500	Boggy Bayou near Pine Prairie------	51.3	1.65	22.40	10-48 to 9-51 10-65 to 9-79
68	08012000	Bayou Nezpique near Basile---------	527	1.56	21.18	10-38 to 9-83
69	08013000	Calcasieu River near Glenmora------	499	1.45	19.65	10-43 to 9-83
70	08013500	Calcasieu River near Oberlin-------	753	1.52	20.69	10-22 to 9-24 10-38 to 9-83
71	08014000	Sixmile Creek near Sugartown-------	171	1.43	19.46	10-56 to 9-65
72	08014200	Ternmile Creek near Elizabeth------	94.2	1.32	17.88	10-49 to 9-65
73	08014500	Whisky Chitto Creek near Oberlin---	510	1.58	21.49	10-39 to 9-83
74	08014800	Bundick Creek near De Ridder-------	120	1.37	18.56	10-56 to 9-79
75	08015000	Bundick Creek near Dry Creek-------	238	1.51	20.48	10-39 to 9-70
76	08015500	Calcasieu River near Kinder--------	1,700	1.51	20.52	10-22 to 9-24 10-38 to 9-57 10-61 to 9-83
77	08016400	Beckwith Creek near De Quincy------	148	1.34	18.26	10-45 to 9-83
78	08016600	Hickory Branch at Kernan-----------	82.2	1.55	20.98	10-45 to 9-57
79	08016800	Bear Head Creek near Starks--------	177	1.29	17.57	10-56 to 9-83
80	08023000	Bayou Castor near Logansport-------	96.5	.72	9.75	10-55 to 9-71
81	08023500	Bayou San Patricio near Noble------	154	.68	9.17	10-51 to 9-67
82	08024000	Bayou San Miguel near Zwolle-------	111	.78	10.65	10-48 to 9-67
83	08024060	Blackwell Creek at Many------------	3.2	.80	10.91	10-59 to 9-68
84	08024200	Bayou La Nana near Zwolle----------	130	.67	9.04	10-55 to 9-66
85	08025500	Bayou Toro near Toro---------------	148	.97	13.21	10-55 to 9-83
86	08027500	Bayou Anacoco near Leesville-------	119	1.23	16.67	10-48 to 9-64
87	08028000	Bayou Anacoco near Rosepine--------	365	1.23	16.71	10-51 to 9-83
88	08028700	Hoosier Creek near Merryville------	13.1	1.06	14.41	10-55 to 9-81

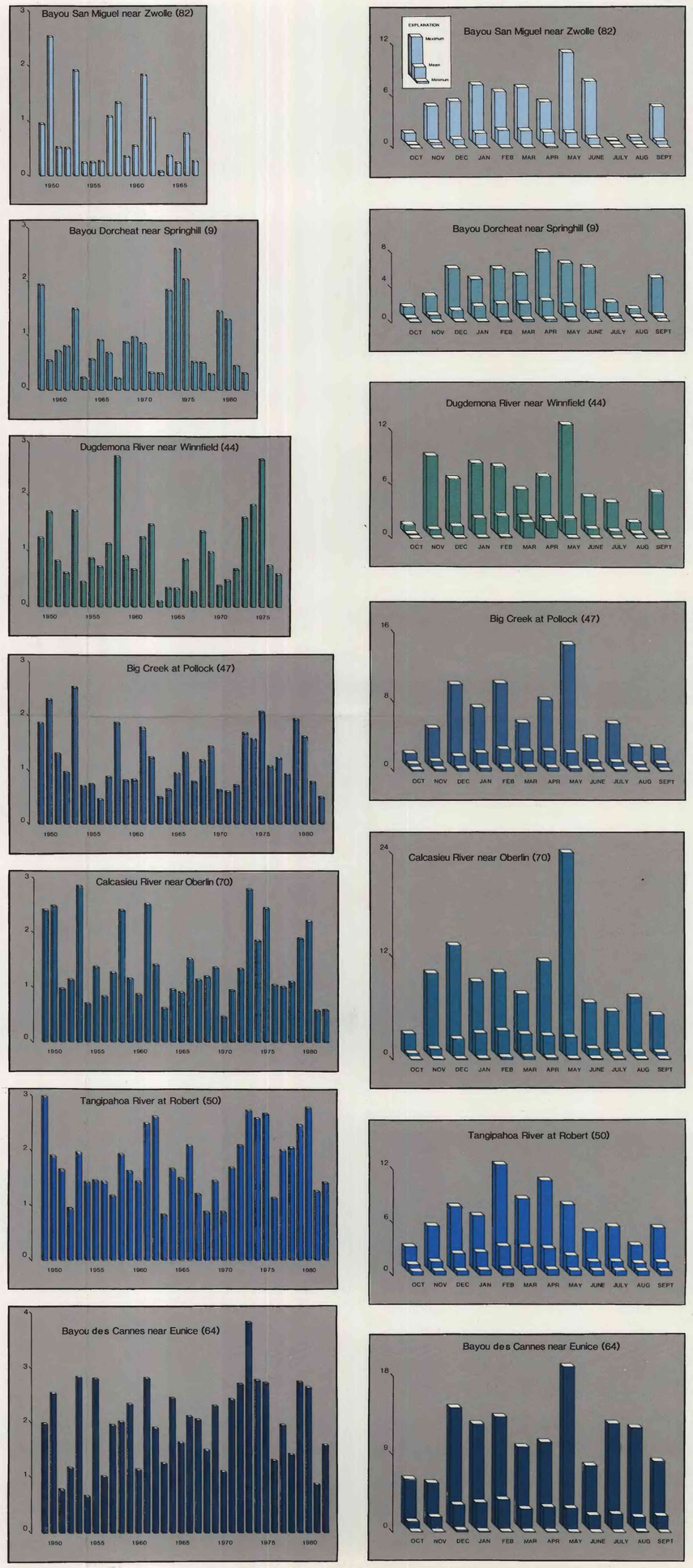

Figure 2.--Mean annual runoff for the seven index stations, in cubic feet per second per square mile.

Figure 3.--Monthly maximum, mean, and minimum runoff for the seven index stations, in cubic feet per second per square mile.

LOUISIANA HYDROLOGIC ATLAS MAP NO. 1 : MEAN ANNUAL RUNOFF IN LOUISIANA

By

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