

FRIO RIVER

STATE	Texas
PROJECT NO.	F6R3 - Job A-1
PERIOD	July 1, 1955 - June 30, 1956

Job Completion Report

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TITLE

Basic Survey of the Nueces, Frio, and Atascosa Rivers.

OBJECTIVES

To gather fundamental data on the chemical and physical characters of the waters entering Lake Corpus Christi.

PROCEDURE

During July 1953 eighteen stations on the Atascosa River were visited, located mostly at road crossings. Water samples were taken and tested for the principle chemical factors and Stream Survey Forms were filled out from observations of the physical nature of the streams and surrounding territory. Due to the schedule of other jobs, no further work was done on this job until January, 1956 when 11 stations were visited between Uvalde and Cotulla on the Frio and Nueces Rivers. Two stations were visited in April 1956 and a trip to 19 stations between Cotulla and Lake Corpus Christi was made in June 1956. Seining and netting collections for a fish inventory of the streams (Job B-1) were made on the same trips that the basic data was gathered. Much information was obtained from the Texas Almanac, 100 Edition, 1955-1956 published by the Dallas Morning News and from a Report on Sedimentation in Lake Corpus Christi and the Water Supply of Corpus Christi, Texas, SCS-TP-74, December 1948, published by the U. S. Department of Agriculture, Soil Conservation Service.

PHYSICAL CHARACTERISTICS

The Nueces River drainage basin covers about 16,800 square miles in South-Central Texas. (See Map 1). It is bounded on the south by small coastal streams, on the west by the Rio Grande and Devils Rivers, on the north by the Llano (Colorado Drainage System) and on the east by the San Antonio and Aransas Rivers. Except for the Trinity basin it is the largest drainage basin entirely within the boundaries of the State of Texas.

The main Nueces River heads in Edwards and Real Counties in the southern part of the Edwards Plateau and flows southward through Kinney, Uvalde, Zavala, and Dimmit Counties. From Carrizo Springs the river takes an easterly course through LaSalle, McMullen and Live Oak Counties where it is joined by its two principle tributaries, the Frio and Atascosa Rivers. The Main stream then flows southeasterly to Corpus Christi Bay forming the boundary between San Patricio and Nueces Counties.

The Frio River likewise heads in the Edwards Plateau in Real and Bandera Counties and flows southeasterly through Uvalde, Frio, McMullen and Live Oak Counties. The Atascosa River heads just below the Balcones Escarpment in northern Atascosa County and flows southward into Live Oak County where it joins the Frio River near the city of Three Rivers just before both streams join the Nueces.

The head water region of the Nueces and Frio Rivers is not included in this report; the northern limits of Region B-8 includes Maverick, Zavala, Frio and Atascosa Counties whose northern boundaries are just south of the Balcones Escarpment. The streams of the plateau, however, are in deeply cut limestone canyons. They are spring fed and usually run all year around. These spring waters, as well as most flood waters, enter the faults of the Balcones Escarpment and the three rivers in Region B-8 are dependent almost entirely on rains in the Region south of the escarpment. Needless to say, the type of water and the fish populations of the head-water areas of the Nueces and Frio Rivers are almost entirely different from those found downstream below the escarpment.

The flow of the Nueces is very erratic, due to its reliance on rainfall. According to a Soil Conservation Service report of 1948, "Report on Sedimentation in Lake Corpus Christi and the Water Supply of Corpus Christi, Texas", the average annual discharge below the Mathis Dam was 680,722 acre-feet from 1942 through 1946. The average annual discharge at the Three River's gauge (15,600 square miles drainage) was about 630,589 acre-feet from 1916 through 1946. The peak recorded annual flow was 2,547,000 acre-feet in 1935 and the minimum was 54,200 acre-feet in 1917. After severe dry spells, much of the water entering the drainage below the Balcones Escarpment is lost by evaporation, and seepage into permeable sandy formations. Normal rainfall, temperatures and altitudes for the various counties in the watershed in Region B-8 are given in Table 1. Population density of the area is rather low. Except in Nueces county with 197 people per square mile, the other counties range from 1 to 52 persons per square mile with an average of 13.5 per square mile (see Table 1.). A large part of the population is Latin-American. San Antonio, Laredo and Corpus Christi are the only cities of consequence near the watershed.

Most of the surface formations in the watershed of Region B-8 are of Eocene Age but the main Nueces River flows through Oligocene to Quaternary deposits nearer the coast. The whole area is included in the Rio Grande Plain or Embayment. Soil types in the drainage basin are varied; the eastern part is mostly of sands and sandy loams while the western part is of thin shaly soils over caliche as well as sandy soils. Only about a third of the area is in cultivation, mostly in the eastern part but around Crystal City there is a considerable amount of irrigated truck vegetable farming. Most of the area is devoted to pasture for stock raising. The western limit of the Post Oak Belt is found in the Atascosa River drainage but the Frio and Nueces Rivers drainage are in the South-Texas Brushlands. Mesquite, huisache, and live oak are the dominate trees with many areas covered by thorny brush and prickly pear. Hackberry trees are very common along the water courses. Erosion is reportedly not very serious over much of the drainage because the area is mostly in native pasture and there is a low rainfall. However, increasing dry farming, overgrazing and drought periods have caused the loss of much of the top soil over most of the area.

Almost all the small tributary creeks in the region are normally dry except during run-off rains. Their banks are sharp slopes not covered by terrace deposits. Occasional small holes of more or less permanent water are found. The Frio and

Atascosa Rivers are also normally dry with sharply cut banks of terrace or natural dike deposits. Scattered long narrow pools are found along these rivers and in a few places small riffles over gravel bars are found. Deep well irrigation developments around Crystal City and Pleasanton have apparently lowered the water table and greatly reduced the natural flow of the Nueces and Atascosa Rivers. On the Atascosa near Campbellton, the City of Corpus Christi has drilled several large artesian wells for an auxiliary water supply. There is flowing water in that river from Campbellton to Lake Corpus Christi when the lake is low and the wells are opened.

The Nueces River is composed of a series of many long narrow pools with little or no flow between them except during flood stages. The banks are typically sharply cut and composed of terrace deposits of silt and fine sands. Large trees, live oak and hackberry, and dense growths of mesquite, huisache, shrubs and forbs cover the terraces almost to the water line. The water is usually turbid and warm and contains large populations of rough fish. Due to the high turbidity and the scouring action floods, there is little development of aquatic vegetation. Several channel dams, some of concrete and others of dirt fill, have been built along the Nueces River to maintain a higher water level in the river between floods. The water is used for irrigation of farms along the river and a little development of fishing camps has taken place. West and South of Crystal City, Comanche Lake (83 acres) and Espintosa Lake have been impounded on Comanche Creek. These are quite large lakes for this type and they are used considerably for boating and fishing. Several smaller lakes east of Crystal City have been formed by dams built on the Nueces River by the water district. About 15 miles southeast of Cotulla, Holland Dam forms Holland Lake on the Nueces River. There is a very small lake formed by a channel dam at Cotulla on the Nueces and another on the Frio at Three Rivers. Lake Corpus Christi, about 5000 acres, is the only lake of major proportions on the Nueces watershed. Basic and fish inventory reports have already been submitted on this lake. A new dam is now under construction which will increase the size of Lake Corpus Christi to about 21,700 acres and 302,000 acre-feet capacity. Proposed completion date is December 31, 1957.

#### WATER ANALYSIS

Although 50 stations were visited on the three rivers, water analysis was run at only 19 of them. At the other stations either seining or netting collections were made or Stream Survey Forms were filled out. Table 2 shows the results of the water analyses made. Samples were usually taken at the surface of the water and run immediately. In many cases, the chart shows "no test"; this was usually due to a lack of chemicals or glassware. Water temperatures ran much as would be expected except for the influence of the hot artesian wells on the Atascosa River at Campbellton. Four wells were drilled by the City of Corpus Christi to help maintain the water level in Lake Corpus Christi. When the lake level reaches about 71 feet above sea level (three feet below spillway level) the wells are opened and the water flows down the Atascosa and Nueces Rivers to the lake. Flowing salt water from an oil well was found at one station on the Atascosa River and oil slicks were found at Station 27 on the Frio River.

#### AQUATIC VEGETATION

Little aquatic vegetation was found in the Nueces River Watershed. Wash-outs by floods, choking by silt, turbid waters and cropping by rough fish seem to be the main factors which keep such growths down. Green algae is spread throughout the watershed, usually in small amounts in shallow water areas, but occasionally forming dense mats which entirely blanket an area. Chara, Potamogeton, Sagittaria and Myriophyllum were

found in small amounts usually where there was running water over gravel bars. The only such areas noted during the survey were at Stations 1 and 2 and at Cotulla on the Nueces, and at Poteet, Pleasanton and Campbellton on the Atascosa. Scattered beds of bulrush and cattail were found and willow trees were scattered along most of the water courses. About five acres of water hyacinths were found at Three Rivers and on Lake Corpus Christi about 700 acres of these weed seriously hamper boating and fishing. Project FLD is in progress to try to reduce or eradicate the water hyacinths from the lake.

#### SUMMARY

A basic survey to find the physical and chemical properties of the Nueces, Frio, and Atascosa Rivers was made during the period July 1, 1953 through June 30, 1956. A total of 50 stations on the three rivers, mostly at road crossings, was visited and physical descriptions, chemical analysis or seining collections were made at each place. This report is a description of the drainage basin of the three rivers and of the waters found in the streams. A map of the area and two tables are included.

Table 1. Normal Rainfall, Temperatures, Population and Altitude for the Counties in the Nueces River Drainage Basin.

County	Town	Length of Record	Normal Jan.	Temperature July	Max.	Min.	Length Of Record	Normal Annual	Population per square Mile	Altitude
Atascosa	Rossville	18	53.5	85.5	108	13	19	26.88	16.6	200-700
Dimmit	Carrizo Springs	25	54.0	86.3	114	13	24	21.69	7.9	500-800
Duval								24.10	8.6	250-800
Frio	Dilley	31	53.2	85.4	111	14	36	21.81	9.3	400-700
Jim Wells	Alice	37	56.5	83.5	111	17	38	26.17	33.1	100-400
*Kinney	Brackettville	35	50.8	84.3	109	9	74	22.00	1.9	1000-2000
La Salle	Encinal	37	55.1	86.5	115	10	36	21.30	5.0	300-600
Live Oak	Whitsett						32	25.70	8.4	70-400
Maverick	Eagle Pass	77	52.7	87.3	115	7	79	20.94	9.6	550-1000
*Medina	Hondo	44	52.9	84.7	112	10	51	28.61	12.6	600-1900
McMullen								26.68	1.0	150-500
Nueces	Corpus Christi	66	55.9	82.7	105	11	66	28.00	197.5	0-180
San Patricio	Sinton						23	30.67	52.0	0-150
*Val Verde	Sabinal	39	53.6	84.0	111	9	52	23.94	10.1	700-2000
Webb	Ft. McIntosh	80	56.3	87.1	115	5	67	19.27	17.0	400-700
Zavala	La Pryor	29	52.0	85.0	112	10	28	22.01	8.7	550-900

\* - Not in Region B-8.

Adapted from the Texas Almanac, 1956-57, 100th Edition, Dallas Morning News, Dallas, Texas.

Table 2. Results of Chemical Analyses on the Nueces, Frio and Atascosa Rivers.

Station No.	Date	OP	O <sub>2</sub> PPM	CO <sub>2</sub> PPM	Ph-Th Alk.	M.O. Alk.	Jackson Turbidity	Salinity	pH
1	1-4-56	59	-	5.0	.0	176	-	-	8.0
2	1-5-56	54	-	.0	8.0	56	-	-	9.2
3	1-17-56	55	-	5.0	.0	256	-	-	7.7
6	4-24-56	83	13.0	-	.0	148	230	-	8.7
12	4-27-56	71	5.6	4.0	.0	160	50	-	8.0
*12	4-27-56	69	1.6	9.0	.0	170	75	-	7.4
21	6-12-56	84	-	-	38.0	.0	-	-	8.6
26	6-12-56	85	-	-	30.0	87	-	-	8.8
27	6-11-56	82	-	15	.0	141	-	-	8.6
31	7-22-53	84	-	-	.0	176	-	-	8.6
32	7-22-53	97	-	-	.0	136	-	-	7.9
35	7-22-53	86	-	-	.0	1270	-	-	8.8
37	7-22-53	82	-	-	.0	1392	-	-	9.7
39	7-27-53	137	-	-	.0	366	25	-	8.2
42	7-27-53	96	-	-	288.0	1488	-	-	9.5
43	7-27-53	111	-	-	.0	320	25	-	9.0
44	7-27-53	91	-	-	.0	624	-	-	8.9
45	7-27-53	88	-	-	40.0	390	-	-	9.2
47	6-11-56	86	10.6	8.0	.0	216	-	-	8.6
50	6-11-56	88	-	-	.0	198	-	-	8.4

\* - 8 foot depth; all others at water surface.  
 - indicates lack of chemicals or glassware.



Sta. 1. Clear water pool in heavy gravel bank.



Sta. 1. Clear running water seeping from gravel bed.





Sta. 27. Frio River above small channel dam.

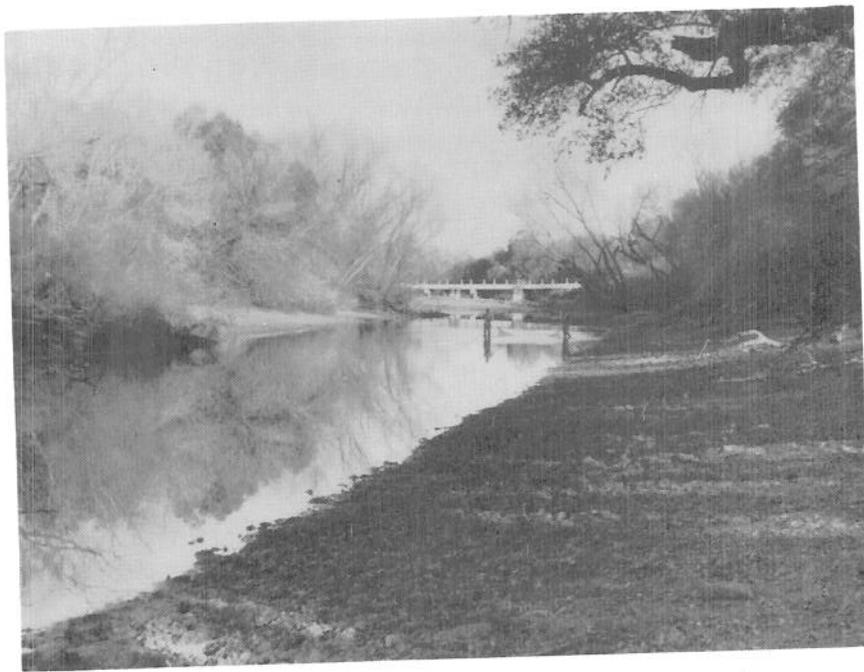


Sta. 28. Frio River at Three Rivers, small lake above a channel dam.





Sta. 2. Overflow cut around a dirt-filled dam.



Isolated pool on Chaparosa Creek.





Sta. 49. Nueces River from highway 59 bridge, looking upstream.

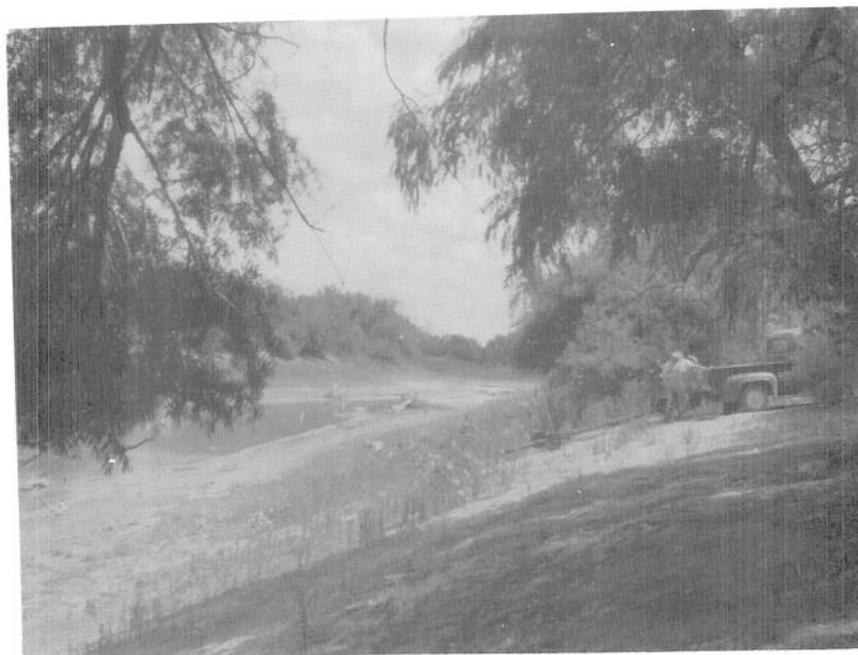


Sta. 49. Nueces River from highway 59 bridge, Looking downstream.



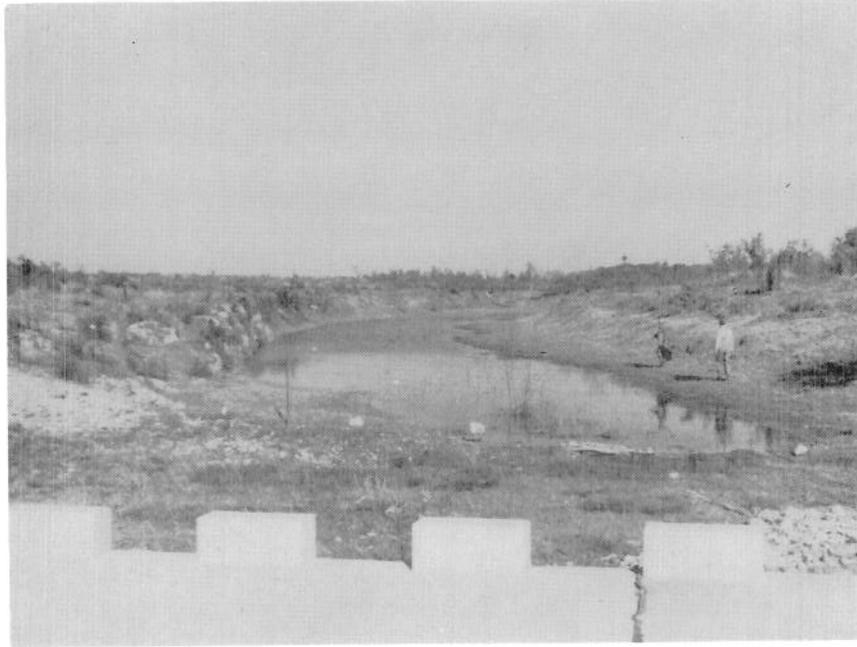


Sta. 5. Long deep pool on the Nueces pumped down for irrigation



Sta. 8. Espintosa Lake pumped down for irrigation.





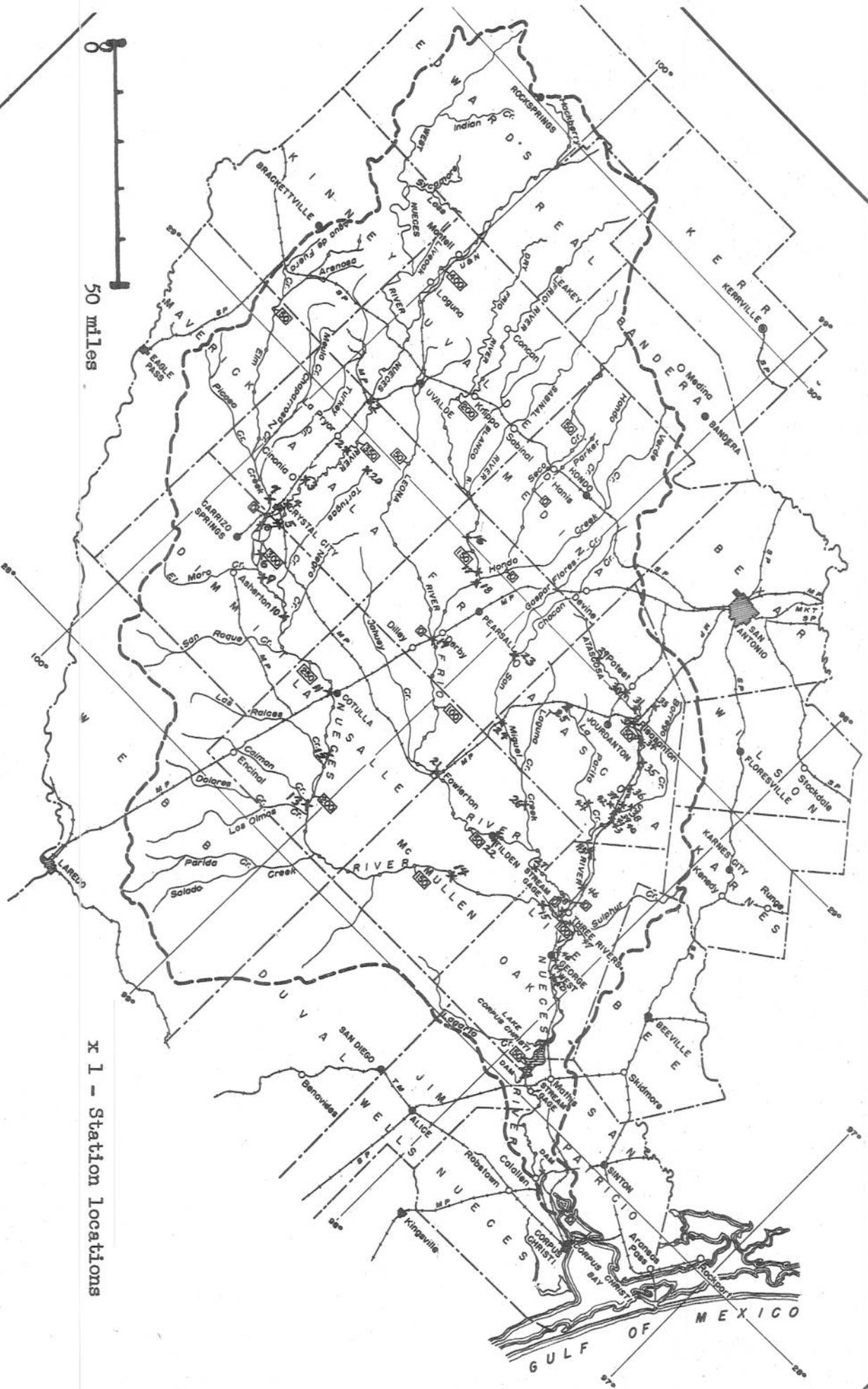
Sta. 20. Isolated clear Water pool on Galina Creek.



Sta. 21. Frio River at Fowlerton.



MAP I. THE WATERSHED OF THE NUECES, FRIJO AND ATASCOSA RIVERS.



x 1 - Station locations

Map adapted from "Report on Sedimentation in Lake Corpus Christi and the Water Supply of Corpus Christi, Texas". Brown, Jones and Rogers, U. S. Dept of Agriculture, Soil Conservation Service, SCS - TP - 74, December, 1948

