TEXAS WATER COMMISSION

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BULLETIN 6408

DAMS AND RESERVOIRS IN TEXAS

Historical and Descriptive Information

By

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DEFINITIONS AND ABBREVIATIONS

Definitions and abbreviations in this list are intended to explain terms as used in this report.

acre-foot (feet). The quantity of water required to cover one acre to a depth of one foot; equivalent to 43,560 cubic feet.

application. A written request to the Texas Water Commission for a permit to appropriate public waters for beneficial use.

appropriation. The process or series of operations by which an appropriative water right is acquired.

Certified Filing. Any declaration of appropriation or affidavit filed with the Texas Water Commission in accordance with the provisions of Section 14 of Chapter 171, Acts of the Thirty-Third Legislature of Texas, 1913, and amendments thereto, which gives such filer an appropriative water right.

conservation storage space. The space available in a reservoir between the lowest outlet level and normal maximum operating level to store water for subsequent release or withdrawal to serve the needs for man's various beneficial uses.

country spillway. The term applied to a natural graded or upgraded section of a reservoir bank used as an emergency spillway for discharging floodflow.

cu ft cubic foot (feet).

cfs cubic feet per second. A unit rate of discharge of a flowing liquid, in a stream channel or through a conduit or other structure, which is equivalent to flow at a velocity of one foot per second through a section having a cross-sectional area of one square foot.

cu yd cubic yard(s)

dead storage space. That part of a reservoir capacity below the lowest outlet level from which water cannot be released by gravity flow.

Declaration of Appropriation. One of the formal documents required for a Certified Filing (see earlier definition of Certified Filing).

drainage area. The area measured in a horizontal plane which is so enclosed by a topographic divide that direct surface runoff from precipitation normally would drain by gravity into the stream above the specified point.

elevation. The vertical distance in feet of a point or object above msl unless otherwise stated.

flood-control storage space. That part of a reservoir capacity allocated to store floodwater below the uncontrolled spillway crest or top of gates of a dam from which water can be released at a controlled rate as rapidly as channel capacities permit without causing damage downstream.

fuse plug. An earthfill placed in a prepared spillway area that is designed to wash out when overtopped with water or otherwise be removed to permit the passage of floodwater.

gage height. Height in feet above zero of a gage arbitrarily referenced and set to some datum.

gpm gallons per minute. A rate of discharge of a flowing liquid.

hp horsepower. A unit of power.

kw kilowatt(s). A unit of electrical power.

Maximum design-flood stage. The maximum reservoir water level expected as determined from the hypothetical routing of a spillway-design flood through a reservoir.

msl mean sea level. The mean plane about which the tide oscillates--the mean level in Texas is referenced to the average height of the sea for all hourly tide heights over a long period of time at Galveston. The level in current use is designated mean sea level datum of 1929.

no(s). Number(s).

Permit. The specific authorization to make an appropriation of water which is issued by the Texas Water Commission to one whose Application for a Permit has been granted.

right bank, left bank. A designation of respective right-hand and left-hand stream banks when the observer is looking downstream.

river mile. The centerline distance in miles along a river channel from its mouth to any designated point upstream.

run-of-river plant. The term used to designate a hydroelectric generating plant that uses the flow of the river as it occurs without benefit of storage.

sediment reserve space. That part of a reservoir capacity allocated for storage of sediment expected to be deposited over a certain period of time.

surcharge. The floodwater temporarily retained in a reservoir above the uncontrolled service spillway level or uncontrolled emergency spillway level of a dam.

Sworn Statement of Work Done. One of the formal documents required for a Certified Filing (see earlier definition of Certified Filing).

Tainter (or tainter or taintor). A certain type of gate patented by Mr. Jeremiah Burnham Tainter in 1886. As a descriptive term the "T" is often used as lower case and in some books the spelling is taintor.

Water Right. A right to the use of water, accorded by law.

D A M S A N D R E S E R V O I R S I N T E X A S

H i s t o r i c a l a n d D e s c r i p t i v e I n f o r m a t i o n

INTRODUCTION

Purpose and Scope

Reports prepared by numerous individuals, engineering firms, State, Federal and local agencies, and others through the past four decades have contained data on dams and reservoirs. In the day-to-day use of these sources of information, it was often apparent that several sets of conflicting data were available for the same project. This bulletin is the result of studies to resolve these differences and to obtain the most accurate and accepted data for each project. These data have been compiled into a handbook for ready reference by engineers, students and individuals interested in water supply and water conservation. It is the intent to provide historical and general descriptive information and some of the important technical details about all dams creating a reservoir of 5,000 acre-feet capacity or greater. The information presented includes the name, ownership, location, drainage area, authorization, purpose, history of development, and physical description.

Organization of Report

Project descriptions of major dams and reservoirs are arranged chronologically to show their historical development in Texas through December 31, 1963. A chronological listing of projects by the year that construction began follows the introduction. The locations of the projects are contained on Plate 1. The project descriptions for dams under construction on December 31, 1963 are in a section of the bulletin separate from those for the completed dams. Photographs of some of the typical dams are included with the project descriptions. Tabular comparisons of the 20 largest reservoirs as to total storage capacity, conservation storage capacity, and surface area follow the project descriptions. An index at the end of the report lists alphabetically names of all major dams, reservoirs, and lakes, and refers to the description number and page number of the project description. Where names of facilities have been changed, or where a facility is known by more than one name, all of the names are included in the index. The index also includes listings of dams by river basins and coastal areas.

The name of the State Board of Water Engineers was changed to Texas Water Commission in January 1962. Both names are used in this bulletin depending upon whether the chronological sequence of the description material is prior to January 1962.

Sources of Data

The descriptions were prepared from data considered as the best available and were checked where possible by Commission personnel. The checking process included determinations made from original field data, extensive correspondence with agencies, individuals directly concerned with the construction, and others, and numerous conferences with engineers and administrators of the projects. Information about the earlier projects is often inadequate and may conflict with other published data; however, even where data could not be confirmed for these projects, it is included for historical purposes.

The Water Rights File of the Texas Water Commission, which includes reported annual water use, descriptive material, and correspondence about the dams, was the beginning point of the investigation. Accurate data is available for the recently completed projects from the inspection reports of the Engineering Review Section, Surface Water Division, Texas Water Commission. The U. S. Geological Survey "Field Station Descriptions" were used to check data on the projects where gaging stations are installed. Previous publications of the Texas Water Commission and the U. S. Geological Survey were consulted as well as publications prepared by other agencies and individuals. For the larger projects the construction drawings were used where available. The information on the projects built by agencies of the U. S. Government was obtained from data bulletins by the Corps of Engineers, U. S. Army; Bureau of Reclamation, Department of the Interior; and Soil Conservation Service, Department of Agriculture. Descriptive information pamphlets by the river authorities and cities were also used where available.

The Commission wishes to express its appreciation to the owners of the facilities for furnishing information and photographs and to the numerous agencies and individuals who furnished basic data.

Personnel

This report was prepared in Engineering Services of the Texas Water Commission under the general supervision of John J. Vandertulip, Chief Engineer, and Seth D. Breeding, Director of the Surface Water and Permits Division.

The initial work on this compilation was begun during preparation of this agency's 1961 planning report by B. R. Bogan and P. B. Jones and continued by S. R. Lemmons. Engineering Services' staff personnel, particularly F. A. Godfrey and I. G. Janca, assisted by furnishing information and abstracted data from the files. S. D. Breeding, L. L. McDaniels, P. B. Jones, and A. F. Cunningham aided in checking and editing the manuscript.

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater

(Listed in Chronological order by year that construction began. For obsolete names, see Index.)

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of Dam	Maximum height (feet)
1	Miller (Tom)	9	Lake Austin	Colorado River	Colorado	1890 1911 1937	1893 1915 1939	1893 1915 1939	49,300 32,000 21,000	Concrete gravity, pier and deck type	100
2	Eagle Lake	13	Eagle Lake	Colorado River (off-channel)	Colorado	1899	1900	1900	9,600	Earth dike	--
3	Wichita	14	Lake Wichita	Holliday Creek	Red	1900	1901	1901	14,000	Earthfill	23
4	Randall	15	Lake Randall	Shawnee Creek	Red	1909	1909	1909	5,400	Earthfill	60
5	White Rock	16	White Rock Lake	White Rock Creek	Trinity	1910	1911	1911	12,300	Earthfill	40
6	San Estaban	18	San Estaban Lake	Alamito Creek	Rio Grande	1910	1911	1911	18,770	Concrete pier and deck	68
7	Medina	20	Medina Lake	Medina River	San Antonio	1912	1913	1913	254,000	Concrete	164
8	Peytons Creek	23	Lake Austin	Peyton Creek	Brazos-Colorado Coastal Area	1912	1912	1912	12,630	Earth dike	--
9	Lake Worth	23	Lake Worth	West Fork Trinity River	Trinity	1912	1914	1914	33,300	Earthfill and concrete	--
10	Caddo	25	Caddo Lake	Cypress Creek	Cypress Creek	1913	1914	1914	175,000	--	--
11	Balmorhea	26	Lake Balmorhea	Sandia Creek	Rio Grande	--	1917	--	6,500	Earthfill and concrete	47
12	Mineral Wells	27	Lake Mineral Wells	Rock Creek	Brazos	1918	1920	--	8,420	Earthfill and concrete	30
13	Abilene	28	Lake Abilene	Elm Creek	Brazos	1919	1921	1921	9,790	Earthfill	50
14	Halbert	29	Lake Halbert	Elm Creek	Trinity	1920	1921	1921	7,420	Earthfill	49
15	Kemp Diversion	30 30	Lake Kemp Division Lake	Wichita River Wichita River	Red Red	1922 --	1922 1924	1923 1924	461,800 40,000	Hydraulic earthfill Earthfill	100 85
16	Williamson	33	Lake Cisco	Sandy Creek	Brazos	--	1923	1923	26,000	Concrete	133.5
17	Crook	34	Lake Crook	Pine Creek	Red	1923	1923	1923	9,960	Earthfill	38
18	Garza (See Lewisville)	35	Lake Dallas (See Garza-Little Elm Reservoir)	Elm Fork Trinity River	Trinity	1924	1928	1927	194,000	Hydraulic earthfill	80
19	Olmos	36	Olmos Reservoir	Olmos Creek	San Antonio	1925	1926	1926	15,500	Concrete	90
20	Trinidad	37	Trinidad Lake	Trinity River (off channel)	Trinity	1925	1925	1925	7,800	Earthfill	--
21	Bivins	38	Bivins Lake	Palo Duro Creek	Red	1926	1926	1927	5,120	Earthfill	48.5
22	Buchanan	39	Buchanan Reservoir	Colorado River	Colorado	1926	1937	1938	992,000	Concrete	150

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater--Continued

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of Dam	Maximum height (feet)
23	Nueces (Upper)	44	Upper Nueces Reservoir	Nueces River	Nueces	1926 1947	1926 1948	1927 1948	-- 7,590	Earthfill Earthfill	-- 60
24	Abbott (TP-3)	46	Lake McQueeney	Guadalupe River	Guadalupe	1927	1928	1928	5,000	Earthfill and concrete core well	40
25	TP-1	47	Lake Dunlap	Guadalupe River	Guadalupe	1927	1928	1928	5,900	Earthfill and concrete core well	41
26	Devils Lake	48	Devils Lake	Devils River	Rio Grande	1927	1928	1928	9,200	Masonry	42
27	Kirby	49	Kirby Lake	Cedar Creek	Brazos	1927	1928	1928	7,620	Earthfill	50
28	Mathis (See Wesley E. Seale)	50	Lake Corpus Christi	Nueces River	Nueces	1928	1929 1934	1929 1934	54,430	Earth and concrete	--
29	Eddleman (See Graham)	52	Lake Eddleman (See Graham Lake)	Flint Creek	Brazos	1928 1957	1929 1929	1929 1958	-- 13,200	Earthfill Earthfill	35 57
30	Lake Walk	53	Lake Walk	Devils River	Rio Grande	1928	1929	1929	5,400	Concrete	34
31	Sweetwater	54	Lake Sweetwater	Bitter and Cottonwood Creeks	Brazos	1928	1930	1930	11,900	Earthfill	50
32	Waco (old) (See Waco, new)	55	Lake Waco (See Waco Reservoir Enlargement)	Bosque River	Brazos	1928	1929	1929	22,030	Earthfill	65
33	H-4	57	H-4 Reservoir	Guadalupe River	Guadalupe	1929	1931	1931	6,700	Earthfill and concrete	42
34	Santa Rosa	58	Santa Rosa Lake	Beaver Creek	Red	1929	1929	1929	11,570	Earthfill	44
35	Nasworthy	59	Lake Nasworthy	South Concho River	Colorado	1929	1930	1930	12,390	Earthfill and concrete	50
36	Mountain Creek	62	Mountain Creek Lake	Mountain Creek	Trinity	1929	1937	1936	27,000	Rolled earthfill	36
37	Brownwood	63	Brownwood Reservoir	Pecan Bayou	Colorado	1930	1933	1933	143,400	Earthfill	120
38	Bridgeport	65	Bridgeport Reservoir	West Fork Trinity River	Trinity	1930	1932	1931	270,900	Rolled earthfill	100
39	Eagle Mountain	68	Eagle Mountain Reservoir	West Fork Trinity River	Trinity	1930	1934	1932	182,700	Earthfill	--
40	Red Bluff	72	Red Bluff Reservoir	Pecos River	Rio Grande	1934	1936	1937	310,000	Earthfill	100
41	Monte Alto	75	Monte Alto Reservoir	Rio Grande (off channel)	Nueces-Rio Grande Coastal Area	1936	1939	1939	25,000	Earth dike	Avg. 17
42	Inks	75	Inks Lake	Colorado River	Colorado	1936	1938	1938	17,000	Concrete	--
43	Mansfield	78	Lake Travis	Colorado River	Colorado	1937	1940	1942	1.950,000	Concrete	270
44	Fort Phantom Hill	82	Fort Phantom Hill Reservoir	Elm Creek	Brazos	1937	1938	1938	74,310	Rolled earthfill	70

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater--Continued

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of dam	Maximum height (feet)
45	Umbarger	84	Buffalo Lake	Tierra Blanca Creek	Red	1938	1938	1938	18,150	Earthfill	37
46	Morris Sheppard	85	Possum Kingdom Reservoir	Brazos River	Brazos	1938	1941	1941	724,700	Concrete	189
47	Rita Blanca	88	Rita Blanca Lake	Rita Blanca Creek	Canadian	1938	1939	1939	12,100	Rolled earthfill	75
48	Coffee Mill Creek	89	Coffee Mill Creek Lake	Coffee Mill Creek	Red	1938	1938	1938	8,000	Earthfill	42
49	Denison	89	Lake Texoma	Red River	Red	1939	1943	1943	5,530,300	Rolled earthfill	165
50	Highlands	92	Highlands Reservoir	Goose Creek (off channel)	Trinity-San Jacinto Coastal Area	1942	1943	1943	5,580	Levee (earthfill)	14
51	Ellison Creek	93	Ellison Creek Reservoir	Ellison Creek	Cypress Creek	1942	1943	1943	24,700	Rolled earthfill	48.5
52	William Harris	95	William Harris Reservoir	Brazos River (off channel)	San Jacinto-Brazos Coastal Area	--	1947	1943	12,000	Levee (dike)	--
53	Sheldon	96	Sheldon Reservoir	Carpenters Bayou	San Jacinto	1942	1943	1943	5,420	Earthfill concrete (spillway)	8
54	Barker	97	Barker Reservoir	Buffalo Bayou	San Jacinto	--	1945	1946	204,800	Rolled earthfill	37
55	Addicks	98	Addicks Reservoir	South Mayde Creek and Langham Creek	San Jacinto	--	--	1948	204,500	Rolled earthfill	49
56	Kickapoo	99	Lake Kickapoo	North Fork Little Wichita River	Red	1945	1946	1945	106,000	Rolled earthfill	62
57	Dam B	101	Dam B Reservoir	Neches River	Neches	1947	1951	1951	124,700	Earthfill	45
58	San Angelo	102	San Angelo Reservoir	North Concho River	Colorado	1947	1952	1951	396,400	Earthfill	128
59	Country Club	104	Casa Blanca Lake	Chacon Creek	Rio Grande	1947	1951	1951	20,000	Earthfill	76
60	Hords Creek	105	Hords Creek Reservoir	Hords Creek	Colorado	1947	1948	1948	8,640	Earthfill	91
61	Benbrook	107	Benbrook Reservoir	Clear Fork Trinity River	Trinity	1947	1952	1950	164,800	Earthfill	130
62	Gonzales Creek	109	Lake Daniel	Gonzales Creek	Brazos	1947	1948	1948	10,000	Earthfill	38
63	Whitney	110	Whitney Reservoir	Brazos River	Brazos	1947	1951	1951	2,017,500	Concrete gravity	159
64	Grapevine	112	Grapevine Reservoir	Denton Creek	Trinity	1948	1952	1952	435,500	Rolled earthfill	137
65	Lavon	114	Lavon Reservoir	East Fork Trinity River	Trinity	1948	1953	1952	423,400	Rolled earthfill	69
66	Cherokee	117	Lake Cherokee	Cherokee Bayou	Sabine	1948	1948	1948	46,700	Rolled earthfill	45
67	Camp Creek	119	Camp Creek Lake	Camp Creek	Brazos	1948	1948	1949	8,550	Earthfill	49
68	Whitehouse	120	Lake Tyler	Prairie Creek	Neches	1948	1948	1949	43,400	Rolled earthfill	50
69	Texarkana	121	Texarkana Reservoir	Sulphur River	Sulphur	1948	1956	1957	2,654,300	Rolled earthfill	100

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater--Continued

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of Dam	Maximum height (feet)
70	Lewisville	124	Garza-Little Elm Reservoir	Elm Fork Trinity River	Trinity	1948	1954	1955	1,002,900	Compacted earthfill	125
71	Baylor Creek	128	Baylor Creek Reservoir	Baylor Creek	Red	1949	1949	1950	9,220	Rolled earthfill	64
72	Belton	129	Belton Reservoir	Leon River	Brazos	1949	1954	1954	1,097,600	Rolled earthfill	192
73	Wirtz (Alvin)	131	Granite Shoals Lake	Colorado River	Colorado	1949	1951	1951	138,200	Earthfill and concrete	100
74	Colorado City	133	Lake Colorado City	Morgan Creek	Colorado	1949	1949	1949	31,000	Rolled earthfill	85
75	Starcke (Max)	134	Marble Falls Lake	Colorado River	Colorado	1949	1951	1951	8,760	Concrete	90
76	Falcon	137	International Falcon Reservoir	Rio Grande	Rio Grande	1950	1953	1953	3,280,700	Compacted earthfill	150
77	Oak Creek	140	Oak Creek Reservoir	Oak Creek	Colorado	1950	1953	1952	39,360	Rolled earthfill	90
78	Colorado River	142	Lake J. B. Thomas	Colorado River	Colorado	1951	1952	1952	203,600	Rolled earthfill	105
79	Valley Acres	145	Valley Acres Reservoir	Rio Grande (off channel)	Nueces-Rio Grande Coastal Area	--	1947	1951	7,840	Earthfill	12
80	Stamford	146	Lake Stamford	Paint Creek	Brazos	1951	1953	1953	60,000	Earthfill	78
81	Lake Creek	147	Lake Creek Reservoir	Manos Creek	Brazos	1951	1952	1953	8,400	Earthfill	50
82	Gladewater	148	Lake Gladewater	Glade Creek	Sabine	1951	1952	1952	6,950	Rolled earthfill	48
83	San Jacinto	149	Lake Houston	San Jacinto River	San Jacinto	1951	1954	1953	158,200	Earthfill and concrete	48
84	Alcoa	151	Alcoa Lake	Sandy Creek	Brazos	1952	1952	1952	10,500	Earthfill	50
85	Leon	152	Leon Reservoir	Leon River	Brazos	1953	1954	1954	27,290	Rolled earthfill	90
86	Anahuac	154	Anahuac Lake	Turtle Bay	Trinity	1953	--	1954	35,300	Hydraulic fill	10
87	Brazoria	155	Brazoria Reservoir	Brazos River (off channel)	Brazos	1953	1954	1954	21,970	Dike	Avg. 16
88	River Crest	156	River Crest Reservoir	Sulphur River (off channel)	Sulphur	1953	1953	1953	7,200	Earthfill	23
89	Ferrells Bridge	157	Lake O' the Pines	Cypress Creek	Cypress Creek	1955	1958	1959	842,100	Rolled earthfill	97
90	Terrell	160	Terrell Reservoir	Muddy Cedar Creek	Trinity	1955	1955	1955	8,300	Earthfill	45
91	Amon G. Carter	161	Lake Amon G. Carter	Big Sandy Creek	Trinity	1955	1956	1956	20,050	Rolled earthfill	71
92	Wesley E. Seale	162	Lake Corpus Christi	Nueces River	Nueces	1955	1958	1958	302,100	Earthfill and concrete	--
93	South Prong	165	Lake Waxahachie	South Prong Waxahachie Creek	Trinity	1956	1956	1956	13,500	Earthfill	66

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater--Continued

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of Dam	Maximum height (feet)
94	Weatherford	166	Weatherford Lake	Clear Fork Trinity River	Trinity	1956	1957	1957	19,600	Rolled earthfill	75
95	Striker Creek	167	Striker Creek Reservoir	Striker Creek	Neches	1956	1957	1957	26,700	Earthfill	41
96	Smithers Lake	168	Smithers Lake	Dry Creek	Brazos	1956	1957	1957	18,000	Earthfill	12
97	Graham (Also see Eddleman)	170	Graham Lake (Also see Lake Eddleman)	Salt Creek	Brazos	1956	1958	1958	52,500	Rolled earthfill	82
98	Murvaul	171	Murvaul Lake	Murvaul Bayou	Sabine	1956	1957	1958	45,840	Rolled earthfill	51
99	Gum Creek	172	Lake Jacksonville	Gum Creek	Neches	1956	1957	1957	30,500	Earthfill	72
100	North Lake	173	North Lake	South Fork Grapevine Creek	Trinity	1956	1957	1957	17,000	Compacted earthfill	65
101	Arlington	175	Lake Arlington	Village Creek	Trinity	1956	1957	1957	45,710	Earthfill	83
102	Sam Rayburn	211	Sam Rayburn Reservoir	Angelina River	Neches	1956	under construction		4,478,800	Earthfill	120
103	Iron Bridge	176	Lake Tawakoni	Sabine River	Sabine	1958	1960	1960	936,200	Rolled earthfill	75
104	Canyon	212	Canyon Reservoir	Guadalupe River	Guadalupe	1958	under construction		740,900	Earthfill	224
105	Champion Creek	179	Champion Creek Reservoir	Champion Creek	Colorado	1958	1959	1959	42,500	Rolled earthfill	114
106	Buffalo Springs	181	Lake Buffalo Springs	Double Mountain Fork Brazos River	Brazos	1958	1959	1959	5,360	Earthfill	68
107	Waco (new)	214	Waco Reservoir (enlargement)	Bosque River	Brazos	1958	under construction		732,300	Earthfill and concrete	140
108	Loma Alta	182	Loma Alta Reservoir	Rio Grande (off channel)	Nueces-Rio Grande Coastal Area	1958	1962	1963	26,500	Earthfill	18
109	Kurth	183	Lake Kurth	Angelina River (off channel)	Neches	1959	1961	1961	16,200	Earthfill	Avg. 36
110	Big Hill	216	Big Hill Reservoir	Big Hill Bayou	Neches-Trinity Coastal Area	1959	1960	under construction	32,000	Earthfill	6
111	Farmers Creek	184	Farmers Creek Reservoir	Farmers Creek	Red	1959	1961	1960	25,400	Rolled earthfill	77
112	Navarro Mills	185	Navarro Mills Reservoir	Richland Creek	Trinity	1959	1963	1963	212,200	Rolled earthfill	83
113	Brushy Creek	187	Brushy Creek Reservoir	Brushy Creek	Red	1960	1960	1961	16,800	Earthfill	57
114	Blackburn Crossing	188	Lake Palestine	Neches River	Neches	1960	1961	1962	57,550	Rolled earthfill	53
115	Twin Buttes	190	Twin Buttes Reservoir	South and Middle Concho Rivers and Spring Creek	Colorado	1960	1962	1963	600,000	Earthfill	131
116	Johnson Creek	194	Johnson Creek Reservoir	Johnson Creek	Cypress Creek	1960	1961	1961	10,100	Rolled earthfill	60
117	Proctor	217	Proctor Reservoir	Leon River	Brazos	1960	under construction		374,200	Rolled earthfill	86

Chronological listing of dams in Texas creating reservoirs with capacities of 5,000 acre-feet or greater--Continued

Description No.	Dam	Page No.	Reservoir	Stream	River basin	Year construction began	Deliberate impoundment of water began	Dam completed	Total capacity (acre-feet)	Type of Dam	Maximum height (feet)
118	Bistone	195	Lake Mexia	Navasota River	Brazos	1960	1961	1961	10,000	Earthfill	50
119	Joe B. Hogsett	219	Joe B. Hogsett Reservoir	Cedar Creek	Trinity	1961	under construction		678,900	Rolled earthfill	91
120	Hubbard Creek	196	Hubbard Creek Reservoir	Hubbard Creek	Brazos	1961	1962	1962	320,000	Earthfill	111
121	Wood County No. 1	198	Lake Quitman	Dry Creek	Sabine	1961	1962	1962	7,440	Earthfill	42
122	Victor Braunig Plant	199	Victor Braunig Lake	Arroyo Seco	San Antonio	1961	1962	1962	26,500	Rolled earthfill	80
123	Wood County No. 3	200	Lake Hawkins	Little Sandy Creek	Sabine	1961	1962	1962	10,340	Earthfill	58
124	Wood County No. 4	201	Lake Winnsboro	Big Sandy Creek	Sabine	1961	1962	1962	6,580	Rolled earthfill	44.5
125	Wood County No. 2	202	Lake Holbrook	Keys Creek	Sabine	1961	1962	1962	7,990	Earthfill	49
126	Flat Creek	203	Flat Creek Reservoir	Flat Creek	Neches	1961	1962	1963	32,840	Rolled earthfill	67
127	Brady Creek	204	Brady Creek Reservoir	Brady Creek	Colorado	1961	1963	1963	30,430	Compacted earthfil	104
128	Sanford	220	Lake Meredith	Canadian River	Canadian	1962	under construction		1,408,000	Earthfill	199
129	Somerville	222	Somerville Reservoir	Yegua Creek	Brazos	1962	under construction		507,500	Earthfill	80
130	Stillhouse Hollow	223	Stillhouse Hollow Reservoir	Lampasas River	Brazos	1962	under construction		630,400	Earthfill	200
131	White River	205	White River Reservoir	White River	Brazos	1962	1963	1963	38,200	Rolled earthfill	84
132	Amistad	224	Amistad Reservoir	Rio Grande	Rio Grande	1963	under construction		5,325,000	Concrete and earthfill	253
133	Toledo Bend	226	Toledo Bend Reservoir	Sabine River	Sabine	1963	under construction		4,661,000	Earthfill	110
134	Palo Pinto Creek	227	Palo Pinto Creek Reservoir	Palo Pinto Creek	Brazos	1963	under construction		34,250	Rolled earthfill	94
135	Bastrop	228	Lake Bastrop	Spicer Creek	Colorado	1963	under construction		16,590	Rolled earthfill	80
136	Bardwell	230	Bardwell Reservoir	Waxahachie Creek	Trinity	1963	under construction		140,000	Concrete and earthfill	82
137	Cleburne	231	Cleburne Reservoir	Nolands River	Brazos	1963	under construction		25,600	Rolled earthfill	76
138	Alice	232	Alice Terminal Reservoir	Chiltipin Creek	Nueces-Rio Grande Coastal Area	1963	under construction		7,050	Earthfill	23

PROJECT DESCRIPTIONS OF COMPLETED DAMS

1. Miller (Tom) Dam and Lake Austin

Location

The renamed Tom Miller Dam and Lake Austin (formerly Austin Dam and McDonald Lake) are in the Colorado River Basin in Travis County inside the western city limits of Austin on the Colorado River at river mile 297.6.

Ownership and History of Development

The present project is owned by the city of Austin, but was built and is operated by the Lower Colorado River Authority under a long-term lease and depreciation program.

The present project was constructed under authority of the water right claimed by the city of Austin under Certified Filing No. 330 filed June 30, 1914 with the State Board of Water Engineers. The Filing was signed by Mayor A. P. Wooldridge. Prior rights were said to be established before 1890 when the first Austin Dam was started. The prior water rights renewed by this Certified Filing were for the purposes of: furnishing water, lights, and power to the inhabitants of Austin and State institutions; appropriating the flow and underflow and the storm and rainwaters of the Colorado River; and storing the flood and rainwaters of the Colorado River for generating power, for domestic uses, and for general municipal and State purposes. The Certified Filing further states that water may be diverted from the river or sand beaches at various places along the riverbank for domestic purposes and for general municipal and State uses through certain filtration systems located upon a described "Sandy Beach Reserve."

The original Austin Dam was built following many reports advocating its construction as early as 1880. In 1888, Mayor A. P. Wooldridge urged the actual beginning of construction. In 1889, John McDonald was elected Mayor on the issue of building a dam. Money was appropriated, the dam was designed, bids were received, and the contract was finally awarded October 15, 1890. Actual construction began November 5, 1890 on what was said to be the largest masonry dam in the world across a flowing stream. The total length, including the spillway, was 1,275 feet, and the height of the dam was 60 feet. Many difficulties were encountered during construction resulting from poor foundation and lack of adequate procedures for drilling and grouting the rock. Many changes were made in the design as construction progressed. The main structure was completed May 2, 1893 with the laying of the last rock in the dam. Impoundment began on this closure date, and water flowed over the spillway during the

month. Work continued thereafter on the powerhouse and installation of equipment. The lake created was referred to as "Lake McDonald" in some early stories of the project.

The main features of the first structure are recorded as follows:

Length of spillway	1,125	feet
Total length of dam	1,275	feet
Height above low water	60	feet
Height above foundation	68	feet
Width of base	66	feet
Power available	14,500	hp
*Minimum riverflow	1,000	cfs
*Maximum riverflow	250,000	cfs
Length of lake	25	miles
Capacity of lake	49,300	acre-feet
Area of lake	2,000	acres
Masonry used	95,000	cu yd
Minimum size granite block	93.5	cu ft

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* Estimated by Joseph P. Frizell, Consulting Hydraulic Engineer, Boston, in March 1890.

A survey made by Dean T. U. Taylor of The University of Texas in 1893 revealed a capacity of 49,300 acre-feet. A resurvey made in 1900 indicated that in 7 years the capacity was reduced by sedimentation from 49,300 acre-feet to 25,741 acre-feet.

On April 7, 1900, during a large flood, part of the structure gave way, and two sections of the gravity dam were moved 70 feet downstream. This aroused much discussion as to whether it was advisable to rebuild at this site or to move upstream for better foundation. The problem of securing money for further work was significant to the future of the project. Finally on July 29, 1911 a contract was made with William D. Johnson for rebuilding the dam at the same location with a modified design.

The reconstructed dam was 5 feet higher than the original crest, and was to be fully equipped in accordance with new plans, which included headgate masonry, headgates, forebay racks, flumes, turbines and generators, draft tubes, and tailrace. The floodgates raised the water level 5 feet higher than the old dam, and had a capacity to discharge 200,000 cfs (cubic feet per second). Mr. Johnson pursued the work by force account until June 1912 when he entered into a contract with the William P. Carmichael Company of St. Louis. Changes were made in some of the plans, reducing the width of the dam from 125.75 feet to 93.0 feet and changing the shape of the crest. In 1915, with the work nearly completed, four crest gates were washed out, but were immediately replaced. The new dam was short-lived as a flood in September 1915 carried away 24 of the crest gates, filled the tailrace with debris, and blocked the draft tubes. In 1917 engineer Daniel W. Mead made an investigation and report on the dam, but no action was taken on the reconstruction. The flood of April 1918 caused additional damage to the gate sections, and the flood of June 15, 1935 swept

away most of the remaining gates and gate piers, and destroyed part of the concrete ogee spillway. A sedimentation survey by T. U. Taylor[1] shows that the storage capacity of 32,000 acre-feet in May 1915 was reduced by sedimentation to 2,900 acre-feet by 1924. Such were the conditions in 1937 when the Lower Colorado River Authority started the design and construction of the present structure at the same site. For a complete report of the early structures, see D. W. Mead's report[2] concerning the Austin Dam. For a description of the old remaining structure and how it was incorporated into the present dam, see accounts by C. H. Vivian[3] and Clarence McDonough.[4] For information about underpinning the Austin Dam, see the article by G. L. Freeman and R. B. Alsop.[5]

Construction of the present dam and power facilities was begun in 1937 by the Lower Colorado River Authority, and was completed in 1939. Deliberate impoundment began in 1939, and the first generation of electric energy occurred March 31, 1940.

This is one of six Lower Colorado River Authority projects on the Colorado River, and is immediately downstream from Lake Travis, which supplies the water to Lake Austin for almost constant level reservoir operation. The other five are: Buchanan Dam and Buchanan Reservoir, Inks Dam and Inks Lake, Wirtz (Alvin) Dam and Granite Shoals Lake, Starcke (Max) Dam and Marble Falls Lake, and Mansfield Dam and Lake Travis. All of these are described in this bulletin. The output of the Austin generating plant is governed by the downstream water requirements, unless Lake Travis is near maximum operating elevation and it is desirable to release water.

Physical Description

The present Austin Dam has a length of 1,590 feet made up of a gravity overflow section, rebuilt hollow dam with gated spillway, powerhouse, and earth and rockfill sections. Extensive excavating, grouting, repairs to foundations, and underbuilding of the old piers made it possible to build a safe structure with an entirely new design of the dam, spillway, and power plant. The dam has a maximum height of 100 feet to the top of the bridge across the spillway. For a list of pertinent data on the dam, see page 13.

The present reservoir, known as Lake Austin, has a capacity of 21,000 acre-feet with a surface area of 1,830 acres at uncontrolled spillway crest elevation of 492.8 feet above msl (mean sea level). Lake Austin is operated at practically constant level as electrical generation at this plant is coordinated

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[1] Taylor, T. U., 1924, Silting of the lake at Austin, Texas: University of Texas Bull. 2439, 23 p.

[2] Mead, D. W., 1917, Report on the dam and water power development at Austin, Texas: Madison, Wisconsin, Daniel W. Mead and Charles V. Seastone, consulting engineers, 205 p. (Available in Texas Water Commission library.)

[3] Vivian, C. H., 1939, Reconstructing the Austin Dam: Compressed Air Mag., v. 44, p. 5895-5902.

[4] McDonough, Clarence, 1940, Historic Austin Dam rebuilt: Eng. News-Rec., v. 124, no. 23, p. 844-847.

[5] Freeman, G. L., and Alsop, R. B., 1941, Underpinning Austin Dam: Eng. News-Rec., v. 126, no. 1, p. 180-185.

with the turbine discharge at the Marshall Ford Powerplant at Mansfield Dam, 21 miles upstream.

The shoreline of Lake Austin has developed into a favorable residential area with many facilities for boating, fishing, and other recreational activities.

The drainage area above the dam is approximately 38,240 square miles, of which 11,900 square miles is probably noncontributing. The runoff is largely controlled by reservoirs upstream.

Records of daily lake elevations and discharge are maintained by the Lower Colorado River Authority as unpublished data.

Water is diverted from Lake Austin by the city of Austin for municipal supply and by many home owners for domestic purposes. The water discharged for use downstream is used for generation of power. The discharge is into Town Lake, which is operated by the city of Austin for additional municipal water supply, recreation, and condenser-cooling water for two steam-electric generating plants.

For floodflow regulation the controlled spillway has nine taintor gates, each 51 feet long. Four of the gates are 12 feet high and five are 18 feet high; the top of all gates is at elevation 494.8 feet above msl. With all gates open the spillway discharge at a lake surface elevation of 492.8 feet is 100,000 cfs.

The uncontrolled spillway on the right end of the dam is 442 feet long with the crest at elevation 492.8 feet above msl.

Water released for downstream requirements is controlled by varying the load on the power plant generators.

For method of flood regulation see the operating plan included in the description of Lake Travis (page 78).

There are two generators with all necessary auxiliaries, in the powerhouse, having a capacity of 6,750 kw (kilowatts) each. The turbines are Newport-News automatic adjustable-blade propeller-type. The electrical power can be delivered directly to the city of Austin distribution system or to the Lower Colorado River Authority interconnected transmission system.

Pertinent data on the Miller (Tom) Dam and Lake Austin are as follows:

Height of dam	100	feet
Length of dam	1,590	feet
Controlled spillway crest elevation in feet above msl	482.8 and 476.8	
Top of taintor gates in feet above msl	494.8	
Uncontrolled spillway crest elevation in feet above msl	492.8	
Tailwater elevation (operating) in feet above msl	429.0	
Reservoir area at elevation 492.8 feet above msl	1,830	acres
Reservoir capacity at elevation 492.8 feet above msl	21,000	acre-feet
Length of lake	20	miles
Maximum width of lake	0.5	mile
Shoreline	100	miles
Generators	2	(6,750 kw each)

2. Eagle Lake Dam and Eagle Lake

Location

Eagle Lake Dam and Eagle Lake are in the Colorado River Basin in Colorado County at the town of Eagle Lake. Eagle Lake is a reservoir off channel from the Colorado River.

Ownership and History of Development

The project is presently owned by the Lakeside Irrigation Company. It was first owned by Wilham Dunovant, then by Rineyard-Walker and Company, and later by Eagle Lake Rice Irrigation Company, which is now Lakeside Irrigation Company.

Water rights were obtained by Certified Filing No. 376 filed January 29, 1901 in Colorado County and with the State Board of Water Engineers June 29, 1914. The Filing states that 10,000 acres of land is irrigated annually. A further statement filed March 21, 1918 is that 10,000 acres of land was irrigated, and that 4 acre-feet of water per acre of land was required. This statement gave details of the canal system and pumping equipment. Permit No. 1493 (Application No. 1600) dated May 2, 1949, from the State Board of Water Engineers, allows an annual diversion of 60,000 acre-feet of water by release from the Lower Colorado River Authority's reservoirs to irrigate 25,000 acres of land and use of the bed and banks of the Colorado River for transporting diverted water to pumping plants of the Lakeside Irrigation Company. Contracts were made with the Lower Colorado River Authority for purchase and release of this water.

The project was begun in 1899, and was completed in 1900 with impoundment beginning in that year. Water was diverted for the irrigation season of 1900.

Physical Description

The present dam is 5,300 feet long and has an average height of 6 feet. The embankment has been altered over the years resulting in various cross-sectional areas and heights.

Eagle Lake has a capacity of 9,600 acre-feet and a surface area of 1,200 acres at elevation 170.0 feet above msl. The lake provides means of storing water diverted from the river when excess floodflows occur for use in time of deficient flow. Today, with the riverflow regulated by the Lower Colorado River Authority's upstream reservoirs, the lake is not so important as a conservation reservoir as in the early days of operation. The amount of water in storage varies with the season of the year.

The early pumping installation consisted of pumps rope-driven from Corlis steam engines. Now modern pumps driven by electric motors lift water from the Colorado River to a canal system that supplies water to the lake, or directly to the land to be irrigated, through a relift pumping station.

The drainage area to the lake is about 20 square miles, but the area is relatively unimportant as a source of water supply. Water is pumped from the Colorado River when excess flow is available.

An emergency spillway for discharging excessive runoff from rainfall is located at the southeast corner of the lake.

There are no low-flow outlet pipes since the water is pumped from the lake into the canal system when needed.

3. Wichita Dam and Lake Wichita

Location

Wichita Dam and Lake Wichita are in the Red River Basin in Wichita County, 6 miles southwest of Wichita Falls on Holliday Creek, a tributary of the Wichita River, which is tributary to the Red River.

Ownership and History of Development

This project has been in operation since 1901, and is now owned by the city of Wichita Falls.

Certified Filing No. 559, filed June 30, 1914 with the State Board of Water Engineers, declared the right of Wichita Falls Electric Company to construct a reservoir to store 23,000 acre-feet of water and to divert therefrom at the rate of 100 cfs. Certified Filing No. 792 filed June 30, 1914 declared the right of the Lake Wichita Irrigation and Water Company to irrigate 2,850 acres of land with 5,700 acre-feet of water from Lake Wichita. The city of Wichita Falls purchased the dam and lake from the Wichita Falls Electric Company in 1920. Records indicate that the irrigation company was dissolved and its rights obtained by Wichita County Water Control and Improvement District No. 1 by quitclaim deed in 1924. Some of the land became residential area. Conflict over irrigation rights developed in the early 1950's.

The city practically discontinued use of water from Lake Wichita for domestic purposes after September 1947 when the Lake Kickapoo water supply became available. The Lake Wichita project, begun in 1900, was completed the next year. Impoundment of water by the Wichita Falls Electric Company was begun in 1901.

At the present time, the city sells some water from the old canal system to the Texas Electric Service Company for cooling purposes and other needs at its steam-electric generating plant.

For information on other water-supply sources of Wichita Falls, refer to descriptions of Lake Kemp, Diversion Lake, and Lake Kickapoo.

Physical Description

The dam is an earthfill structure 6,250 feet long and 23 feet high with the top of the dam at elevation 987.5 feet above msl. Top width of dam is 20 feet.

The lake has a total capacity of 14,000 acre-feet and a surface area of 2,200 acres at elevation 980.5 feet above msl; 3,000 acre-feet is considered dead storage.

The drainage area above the dam is 143 square miles.

An uncontrolled spillway 400 feet long is used for floodflow discharge. Two 36-inch-diameter, gated, low-flow outlet pipes at streambed elevation provide means for releasing water for use.

The U. S. Army Corps of Engineers, Tulsa District Office, has prepared several proposals for protecting Wichita Falls from flooding by Holliday Creek. One proposal is to increase the height of Wichita Dam to provide additional flood-control storage.

A second proposal is to straighten and enlarge the channel of Holliday Creek below Wichita Dam to form a leveed floodway. This proposal would include improvements to the Wichita Dam and spillway without increasing the capacity of Lake Wichita.

A third proposal is to divert floodflows out of Lake Wichita into Lake Creek, which is a tributary of the Little Wichita River. Under this proposal some modification of Wichita Dam and its spillway would be required, which would not change the capacity of the lake.

4. Randall Dam and Lake Randall

Location

Randall Dam and Lake Randall are in the Red River Basin in Grayson County, 4 miles northwest of Denison on Shawnee Creek, a tributary of the Red River.

Ownership and History of Development

The project is owned and operated by the city of Denison for municipal water supply, and was built in 1909. Permit No. 1622 (Application No. 1752) dated May 27, 1952, issued by the State Board of Water Engineers, approved the construction of the dam and authorized storage of 5,400 acre-feet and an annual diversion of 5,280 acre-feet from Shawnee Creek for municipal water supply. The Permit further allows diversion of 24,400 acre-feet of water annually from Lake Texoma to supplement the flow of Shawnee Creek.

The project was started and completed in 1909. Deliberate impoundment of water began in 1909.

Water for Denison is also diverted from Lake Texoma, and is pumped to a small lake at elevation 700.0 feet above msl, from which it flows by gravity in an unnamed creek channel 3,600 feet to Lake Randall. Lake Randall may be filled several times a year as needed by pumping from Lake Texoma. This water diversion was begun on July 17, 1962 when the pumps were first placed in operation.

Physical Description

Randall Dam is an earthfill structure 1,109 feet long and 60 feet high. It has a bottom width of 280 feet and top width of 20 feet. The elevation of the top of the dam is 647.0 feet above msl. Part of the upstream face is protected with rock riprap.

The lake has a capacity of 5,400 acre-feet and a surface area of 172 acres at elevation 640.0 feet above msl. The length of the lake is 6,800 feet.

The drainage area above the dam is only 11 square miles. This small area does not produce the needed runoff, which is the reason for the supplementary water supply from Lake Texoma.

An uncontrolled spillway 350 feet long with crest elevation of 640.0 feet above msl is located at the left end of the dam.

The outlet structure, located near the right end of the dam, is equipped with a vertical section of 24-inch pipe with a sluice gate inlet at elevation 605.0 feet above msl, which is the elevation of the lowest outlet. The 24-inch vertical pipe then reduces to a 14-inch pipe with a sluice gate at elevation 627.0 feet above msl. A derrick-type tower supports this pipe and a platform from which the valves are operated. The regulated flow discharges into a 24-inch cast iron pipe encased in concrete that projects through the base of the embankment to the city supply line at the pumping plant. From here water is pumped through an 18-inch pipeline to the water-treatment plant.

5. White Rock Dam and White Rock Lake

Location

White Rock Dam and White Rock Lake are in the Trinity River Basin in Dallas County in northeast Dallas on White Rock Creek, a tributary of the Trinity River.

Ownership and History of Development

White Rock Dam and White Rock Lake are owned and operated by the city of Dallas.

The project was authorized by Certified Filing No. 75, which was filed April 29, 1914 with the State Board of Water Engineers by the city of Dallas for a municipal water supply water right. This Filing covers other water rights of the city of Dallas and water-supply reservoirs as follows: Record Crossing Dam built in 1895, California Crossing Dam built in 1912, and Carrollton Dam built in 1912--all on the Elm Fork Trinity River. The total capacity of the three on Elm Fork was about 2,280 acre-feet. Under this same Filing another project, Bachman Dam Reservoir located on Bachman Branch, was included with a capacity of 2,300 acre-feet. All of these reservoirs supplied water to the Turtle Creek filtration and treatment plant either by gravity flow or by pumping. The Record Crossing Dam is no longer in use because the river has been diverted into another channel.

White Rock Dam was started in 1910 by the city of Dallas and completed in 1911, with impoundment of water beginning at that time. Diversion of water for use began July 9, 1911. The cost of the dam and spillway was $765,000.

White Rock Lake is still being used, but lost its importance as a water supply reservoir upon the completion of Lake Dallas in 1930, which had a much larger capacity. From 1930 until May 1953, White Rock Lake was used mainly as a recreation lake. Because of severe drought after that time, equipment was reinstalled and diversion of water for municipal use was resumed. Dallas Power and Light Company uses the water for condenser cooling of a steam-electric generating plant. White Rock Lake is one of several reservoirs now supplying the increased water demands of Dallas, and is used during periods of peak demand for water. The city diverts water directly from the lake.

Physical Description

White Rock Dam is an earthfill structure containing 333,680 cu yd (cubic yards) of earth, and is 2,100 feet long with maximum height of 40 feet. The top of the dam is at elevation 469.2 feet above msl. The upstream side of the dam is faced with concrete. A concrete spillway is located at the left end of the structure.

The reservoir had an original capacity of 18,160 acre-feet and a surface area of 1,254 acres at elevation 458.1 feet above msl. A survey by the U. S. Soil Conservation Service in 1956 determined the capacity as 12,300 acre-feet with a surface area of 1,095 acres at the same elevation. This shows a reduction in capacity of 5,860 acre-feet in 45 years by sedimentation. In 1930, a dredge was used to remove 362 acre-feet of sediment by pumping.

The drainage area is 100 square miles.

Records of contents from September 1, 1962 are contained in Water-Supply Papers of the U. S. Geological Survey.

An uncontrolled, broad-crested, concrete spillway section near the left end of the dam has a crest length of 450 feet at elevation 458.1 feet above msl. The spillway contains 9,327 cu yd of concrete. There is no control of the discharge after the water level reaches the uncontrolled spillway crest.

Provisions were made for use of flashboards to increase reservoir level by 2 feet, but these are not used at present.

6. San Estaban (or Esteban) Dam and San Estaban Lake

Location

San Estaban Dam and San Estaban Lake are in the Rio Grande Basin in Presidio County, 10 miles south of Marfa on Alamito Creek, which is tributary to the Rio Grande.

Ownership and History of Development

The project was started by the St. Stephens Land and Irrigation Company. Ownership has changed several times. Mrs. Pearl M. Robinson's estate was listed as the owner in 1963. Previous owners listed were Reese Turpin, C. A. Duncan estate, and James H. Kirk estate.

Water rights were established by Certified Filing No. 455 filed June 29, 1914 with the State Board of Water Engineers. This Filing allows use of 25,500 acre-feet of water annually for irrigation of 8,500 acres of land. Because of lack of runoff the lake has been empty most of the time; and, by order of the Texas Water Commission dated July 16, 1962, the water rights were reduced from the original 25,500 acre-feet of water to 400 acre-feet to irrigate 200 acres of land. This 200 acres belongs to Mrs. Robinson's estate.

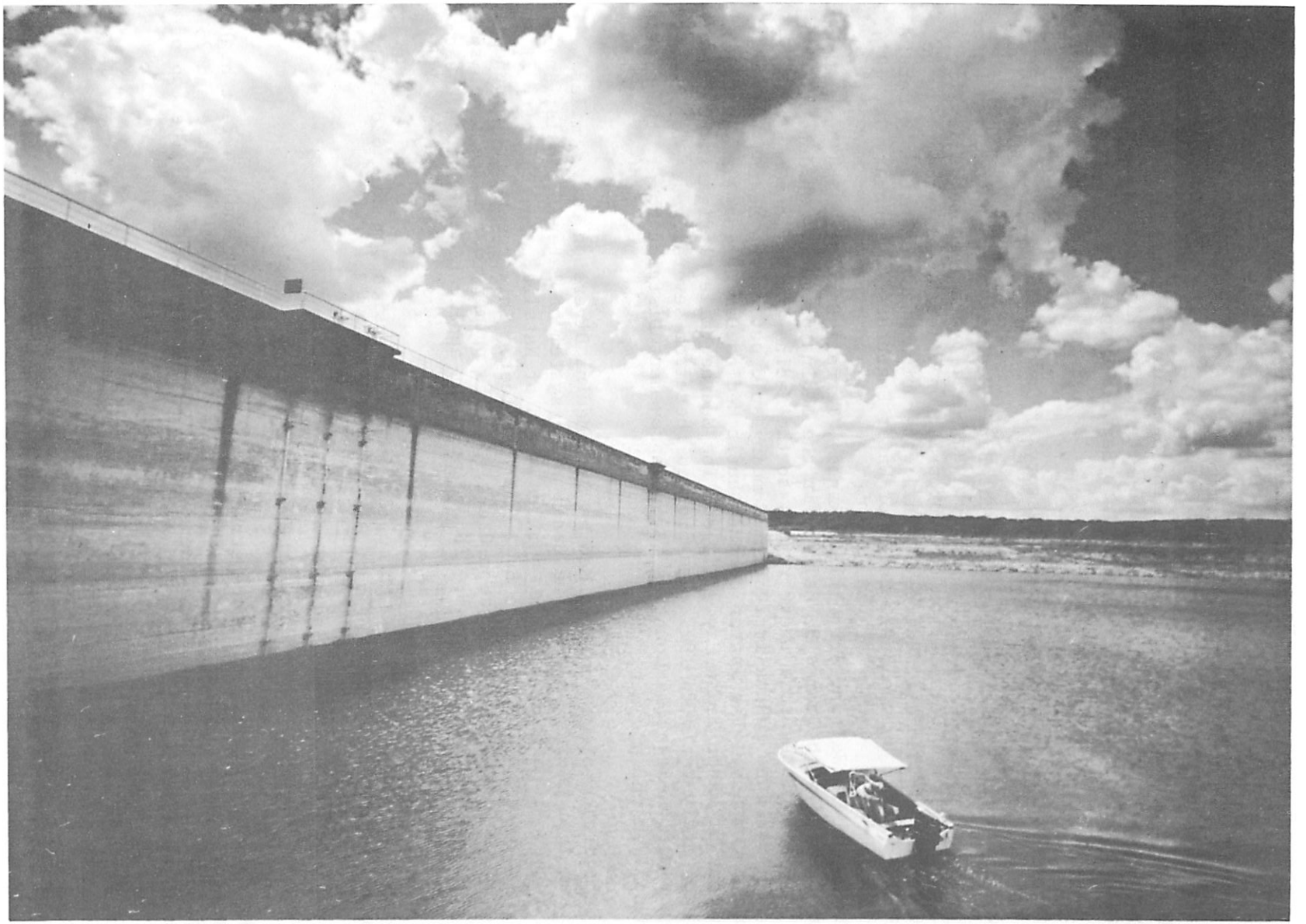
Construction of the dam was begun in 1910, and was completed in 1911 with storage of water beginning that year.

Physical Description

The dam is a concrete pier and deck type structure 400 feet long and 68 feet high with the top of the dam at elevation 4,451.0 feet above msl. Provisions were made in the original design to permit increasing the height 35 feet. This is one of the earliest Ambursen-type dams built, and it remains in good condition today. The dam was first named Alamito Dam after the creek on which it is located. The present name was adopted after the dam was constructed. Spelling of the name on water service reports submitted to the Texas Water Commission is two ways--San Estaban and San Esteban.

The reservoir had an original capacity of 18,770 acre-feet and a surface area of 762 acres at elevation 4,451.0 feet above msl.

Details of the outlet works for regulating the flow to the canal system are not available. Originally 7 miles of canals were constructed.



Medina Dam and Medina Lake. Furnished by Bexar-Medina-Atascosa Counties Water Improvement District No. 1.

7. Medina Dam and Medina Lake

Location

Medina Dam and Medina Lake are in the San Antonio River Basin in Medina County, 8 miles northwest of Riomedina on the Medina River, a tributary of the San Antonio River. The lake extends into Bandera County.

Ownership and History of Development

Medina Dam and Lake are owned by the Bexar-Medina-Atascosa Counties Water Improvement District No. 1. The project was built by the Medina Valley Irrigation Company under a Declaration of Appropriation filed November 16, 1910 in Medina County by Thomas B. Palfrey. This water right was converted to Certified Filing No. 18 by the State Board of Water Engineers on February 14, 1914.

Alexander Y. Walton, Jr., Willis Ranney, Terrell Bartlett, and Duval West were associated with Thomas B. Palfrey in the Medina project. On June 17, 1911, these five associates sold their rights to the Medina Irrigation Company. On March 21, 1912, the Medina Irrigation Company sold out to The Medina Valley Irrigation Company. The latter company built Medina Dam during 1912 and 1913. Impoundment of water began May 7, 1913. The Medina Valley Irrigation Company went into receivership in 1917, and emerged therefrom several years later as the Bexar-Medina-Atascosa Counties Water Improvement District No. 1, the present owners of the project.

The Medina project includes Medina Dam; Medina Diversion Dam, 4 miles downstream from Medina Dam; Medina Canal and a system of lateral canals; and Chacon Reservoir on Chacon Creek, 4 miles north of Natalia. The capacity of Chacon Reservoir is estimated to be 2,000 acre-feet. This reservoir impounds small amounts of runoff from Chacon Creek, but its primary use is to store surplus water from the Medina Canal. The water right applicable to Chacon Reservoir is Certified Filing No. 19.

Medina Dam cost $2,696,000 to build, Medina Diversion Dam cost $288,000, and the main canal and laterals cost $1,120,000.

Physical Description

The dam is a gravity concrete structure 1,580 feet long and 164 feet high containing 205,000 cu yd of concrete. It is 128 feet thick at its base and 25 feet wide at the top, along which there is a 23-foot-wide roadway. The top of the dam is at elevation 1,076.5 feet above msl.

The drainage area of the Medina River watershed at Medina Dam is 634 square miles.

Medina Dam Spillway Section. Furnished by Bexar-Medina-Atascosa Counties Water Improvement District No. 1.

Capacities of the lake at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,076.5	327,250	--
Spillway crest	1,064.5	254,000	5,575
Invert of 60-inch-diameter outlet	959.0	4,780	--
Invert of 30-inch-diameter outlet	912.5	0	--

Records of the contents of Medina Lake from May 1913 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers, and since May 1913 in Water-Supply Papers of the U. S. Geological Survey.

Sedimentation surveys of Medina Lake were made in 1925, 1937, and 1948. The results of the 1925 survey are published in U. S. Department of Agriculture Technical Bulletin No. 382. On page 22 of the bulletin, the following statement is made:

> The total silt volume was found to be 2,692 acre-feet, equivalent to a yearly average of 207 acre-feet or 0.35 acre-foot per square mile of drainage area per year. At this rate of accumulation it would require over 1,200 years for the silt of the nature of that found at the time of the survey to occupy the entire storage capacity.

The 1937 and 1948 surveys were made under the direction of Victor H. Jones, Geologist, Water Conservation Division, Soil Conservation Service, U. S. Department of Agriculture. The results have not been published. According to a letter written by Mr. Jones on October 15, 1948, the average depletion of storage of Medina Lake from 1913 to 1948 is 0.09 percent per year. Also, by using the segmentation method of volumetric computation, the original capacity of the lake at spillway crest was 274,000 acre-feet or 8 percent greater than that determined by topographic surveys at the time the dam was built. According to the U. S. Geological Survey, sedimentation has reduced the lake storage capacity 3 percent in the 35-year period 1913-48.

The uncontrolled spillway, with crest length of 880 feet at elevation 1,064.5 feet above msl, is a cut through rock at the right end of the dam. It is unpaved except for a concrete cutoff wall at ground level, 3 feet wide, to maintain elevation of spillway crest at 1,064.5 feet above msl.

Water released through Medina Dam is diverted for irrigation at the Medina Diversion Dam, 4 miles downstream. Three 60-inch-diameter steel pipes equipped with lift-type gates with elevation of invert at 959.0 feet above msl are used to release water into Medina Diversion Lake for irrigation. Two 30-inch-diameter steel sluice pipes equipped with lift-type gates with elevation of invert at 912.5 feet above msl are used to drain the lake.

Considerable water leaves Medina Lake and Medina Diversion Lake, going to underground storage and later appearing downstream.

8. Peytons Creek Dam and Lake Austin

Location

Peytons Creek Dam and Lake Austin are in the Brazos-Colorado Coastal Area in Matagorda County, 10 miles southeast of Wadsworth on Peytons Creek, which flows into East Matagorda Bay.

Ownership and History of Development

The water right for the project was declared by a filing in Matagorda County on August 6, 1912 and filed as Certified Filing No. 747 with the State Board of Water Engineers on June 30, 1914. Water rights amounted to 18,300 acre-feet of water for irrigating 5,500 acres of land planted in rice. The original Certified Filing was in the name of John W. Garner, then transferred to Peytons Creek Irrigation District, then to Gulf Coast Water Company, and finally to the Lower Colorado River Authority.

Part of the project was in use in 1912 while other areas were added in 1914 and later. In 1926 the rice crop was destroyed by salt water encroachment, and only small acreage has been planted since that time. The project is included in this report for its historical value.

Physical Description

The dam is a levee across a natural lake creating a larger reservoir for off-channel storage in the Peytons Creek area. The embankment was damaged in 1930 from heavy rains and further destroyed in the August 1932 hurricane. It was never rebuilt.

The lake was in two sections, the upper lake and lower lake, having a total capacity of 12,630 acre-feet and a combined surface area of 2,535 acres. At the present time, the depth is less than 3 feet, and is used solely as a hunting reserve for ducks and geese.

In the early days, there was sufficient depth of water for sailing vessels to come up the river and enter the lake. The original Hawkins ranch house on the shore of this lake was built from timbers from a wrecked sailing vessel. The home has been restored and is in use today.

The land in this area was a grant--Abstract Number A-1 (Matagorda County)--to empresario Stephen F. Austin from the government of Mexico, dated October 27, 1830.

9. Lake Worth Dam and Lake Worth

Location

Lake Worth Dam and Lake Worth are in the Trinity River Basin in Tarrant County in northwest Fort Worth on the West Fork Trinity River, a tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Fort Worth.

The project was authorized by Certified Filing No. 757 filed June 27, 1914 with the State Board of Water Engineers. There were already five small dams in service on the Clear Fork and West Fork Trinity River and Lake Worth was number 6 of 6 covered by the Filing. Detailed information on the small dams and reservoirs is not available, but it is known that they all supplied water for municipal and industrial use for the city of Fort Worth. The five small projects were completed before 1911.

In 1911 a committee recommended that a dam be built on the West Fork Trinity River. Lake Worth Dam was probably started in 1912, completed in October 1914, and impoundment began in June 1914 with the lake reported as full on August 19, 1914. Water diversion to the Holly filtration and treatment plant began in May 1916.

The water supply for the city has been increased by construction of Bridgeport Reservoir and Eagle Mountain Reservoir, and through purchase of water from Benbrook Reservoir.

Physical Description

The dam consists of an earth embankment and concrete spillway with a total length of 3,200 feet. The structure is about 50 feet high above the streambed with the top of the dam at elevation 606.3 feet and the crest of the spillway at 594.3 feet above msl. Volume content of the dam is 240,000 cu yd.

The lake has a capacity of 33,660 acre-feet and a surface area of 3,267 acres at the spillway crest elevation of 594.3 feet above msl, as determined from a survey made in October 1952 by the engineering firm of Freese and Nichols, Fort Worth. Other capacities are given in the table below:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	606.3	--	--
Spillway crest	594.3	33,660	3,267
Reference point	590.0	21,800	2,360
Reference point	585.0	11,360	1,840
Reference point	562.0	0	0

Sedimentation has depleted some of the original storage capacity, but the upstream reservoirs now retain most of the sediment. An estimate made in 1957 by the U. S. Army Corps of Engineers lists 1,512 acre-feet annual sediment retention at Eagle Mountain Reservoir, 900 acre-feet at Bridgeport Reservoir, but only 95 acre-feet at Lake Worth. The storage capacity is no longer a major factor since normal maximum water elevation is maintained through releases from larger storage reservoirs upstream.

The concrete spillway is a 700-foot-long uncontrolled section with crest at elevation 594.3 feet above msl. In 1953, repair of the spillway crest by adding a concrete cap raising the elevation 1.7 feet was contemplated but was

never done. Floodwater retention by the upstream reservoirs has reduced the rate of floodflow through Lake Worth and over its spillway so that it is now considered to have adequate floodflow capacity.

The outlet works consist of two parallel conduits; one is 60 inches in diameter, the other 72 inches in diameter. These conduits were completed and first used to transport water from Lake Worth to the Holly filter plant in May 1916. In the beginning, one 48-inch pipe with a 36-inch valve controlled the releases to the filter plant, but in 1958 a 36-inch valve was attached to the downstream end of this same 48-inch pipe to regulate low-flow releases.

10. Caddo Dam and Caddo Lake

Location

Caddo Dam and Caddo Lake are in the Cypress Creek Basin in Caddo Parish, Louisiana, 29 miles northeast of Marshall in Harrison County, Texas, on Cypress Creek. The lake extends into Harrison and Marion Counties, Texas.

Ownership and History of Development

The project is owned by the U. S. Government and operated by the U. S. Army Corps of Engineers, New Orleans District. Federal authorization was the Act of June 25, 1910 giving 4-foot navigation depth above the dam to Jefferson, Texas. The project was started in 1913, completed, and placed in operation in 1914.

Physical Description

Data on the present dam are not contained in the Texas Water Commission files. However, in the files is a letter from the U. S. Army Corps of Engineers dated March 27, 1963 announcing public hearings to be held in Shreveport, Louisiana on April 30, 1963 and May 1, 1963 in Marshall, Texas regarding plans to replace the present structure because of excessive maintenance cost. It was proposed that Caddo Dam be replaced with a fixed-crest structure with the crest at elevation 168.5 feet above msl, the same elevation as that of the present structure.

The present lake has a capacity of 175,000 acre-feet and a surface area of 32,700 acres at elevation 168.5 feet above msl. Of this total, 58,000 acre-feet of the capacity and 11,000 acres of the surface area are in Texas. The present lake has been used for navigation from Mooringsport, Louisiana to Jefferson, Texas.

The drainage area for the portion of the reservoir in Texas is 2,639 square miles.

11. Balmorhea Dam and Lake Balmorhea

Location

Balmorhea Dam and Lake Balmorhea (Lower Parks Dam and Reservoir) are in the Rio Grande Basin in Reeves County, 3 miles southeast of Balmorhea on or adjacent to Sandia Creek, a tributary to Toyah Creek, which is a tributary to the Pecos River, which is tributary to the Rio Grande.

Ownership and History of Development

The present owner is Reeves County Water Improvement District No. 1, which was organized in 1914-15. The District obtained the water rights from the original owner, the Toyah Valley Irrigation Company, which was organized in 1909 by the consolidation of several smaller irrigation systems. These rights were established by Permit No. 57 (Application No. 60) dated March 6, 1915 from the State Board of Water Engineers. This Permit allocates 41,400 acre-feet of water annually to irrigate 13,800 acres of land. Prior to this Permit, several Certified Filings provided the water right to irrigate an additional 7,500 acres of land. Land was irrigated in this area as early as 1870 to raise feed for cattle.

In 1945 the U. S. Bureau of Reclamation assisted the project with financial aid. The Bureau purchased certain lands and water rights from the Kingston family, and built canals and other facilities on behalf of the District. The Bureau of Reclamation obtained Permit No. 1392 (Application No. 1491) dated October 2, 1946 from the State Board of Water Engineers. This Permit authorizes water to be diverted to the lake by canals from Phantom Lake Springs and Madera Diversion Dam reservoir on Toyah Creek. In all, 18,000 acre-feet of additional water was to be developed to irrigate 10,640 acres of land out of the 21,300 acres included in Permit No. 57 and the early Certified Filings.

Lake Balmorhea was created in 1917 by the construction of the main dam and Rentz Dike. In a 1953 report, the Bureau of Reclamation referred to the project as "Lower Parks Dam and Reservoir."

Physical Description

The dam is earthfill with a clay core about 4,000 feet long and 46 feet high and crest at elevation 3,192.0 feet above msl. The upstream face has a 1-foot thickness of rock riprap for protection against wave action. A cutoff dam known as Rentz Dike, located on the opposite side of the lake from the dam, was built as part of the project.

The Bureau of Reclamation 1953 report gives the 1948 lake capacity as 6,350 acre-feet with surface area of 573 acres at elevation 3,187.0 feet above msl. This report further states that total sediment accumulation from 1917 through 1948 was 1,357 acre-feet, which is at the rate of 44.6 acre-feet per year.

The drainage area is 22 square miles including Sandia Creek and the Madera Canal drainage area.

Water is delivered to the lake from Toyah Creek by the Madera Diversion Dam and canals. Surplus water from Phantom Lake Canal (fed by several springs) is also stored in the lake until needed for irrigation.

A spillway at the right end of the embankment discharges over natural ground to the creek below the dam.

The outlet to the main canal is a circular-top conduit, 4 feet wide by 5 feet high, through the dam near the left end. The discharge is controlled by a sluice gate operated by a hand operated lift rod extending from the conduit through a vertical shaft to the top of the dam.

12. Mineral Wells Dam and Lake Mineral Wells

Location

Mineral Wells Dam and Lake Mineral Wells are in the Brazos River Basin in Parker County, 4 miles east of Mineral Wells on Rock Creek, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Mineral Wells for municipal water supply. The dam has undergone several changes from the original structure authorized by Permit No. 530A (Application No. 530) dated October 7, 1922 from the State Board of Water Engineers. This Permit allowed storage of 7,300 acre-feet and an annual use of 1,680 acre-feet of water. Permit No. 1352 (Application No. 1445) dated August 16, 1943 authorized increasing the height of the spillway 2 feet, thereby increasing the lake capacity to 8,140 acre-feet and the annual diversion to 2,520 acre-feet. Permit No. 1663 (Application No. 1791) dated February 9, 1953 authorized the pumping of water from the Brazos River in Palo Pinto County to the lake. This water is pumped through a 21-inch pipeline, 48,500 feet long. The authorized annual diversion from the Brazos River is 3,500 acre-feet at a rate not to exceed 10 cfs, and diversion is allowed only during the period between September 30 of each year and May 1 of the following year. The city contracted with the Brazos River Authority for the purchase of water from Possum Kingdom Reservoir in the event that water is required from the Brazos River during the months diversion is prohibited by Permit No. 1663.

The original dam was begun in 1918, and was completed in September 1920. Impoundment of water began earlier than September 1920. In 1921 a contract was let for improving the spillway and installing pumps, pipeline, and filter-plant equipment.

The 1943 improvement began with the award of a contract on August 18, 1943. The work was completed January 31, 1944. The contract for the pumping plant and pipeline from the Brazos River was awarded May 7, 1953. The work was completed and the pumps tested in December 1953.

Physical Description

The original dam, with clay core, was an earthfill structure, 675 feet long plus the spillway section, and 71 feet high above streambed, with the top of the dam at elevation 871.0 feet above msl. The embankment has a bottom width of 455 feet and a top width of 30 feet, with sandstone riprap on the upstream face.

The flood of October 1918 damaged the embankment under construction; 10,000 cu yd of earth were washed out and some equipment was buried under the earthfill. The work was delayed until the summer of 1919 when construction was resumed and subsequently completed.

The dam was enlarged in 1943 by raising the spillway 2 feet and extending the spillway length at both ends. The embankment was raised and a concrete wall constructed on the crest with top at elevation 876.1 feet above msl. Additional rock riprap was placed over certain areas of the earthfill, and the roadway on top of the dam was raised to elevation 873.9 feet above msl.

The lake created in 1943 has a capacity of 8,420 acre-feet and a surface area of 646 acres at elevation 863.0 feet above msl. The capacity before enlargement was 7,300 acre-feet.

The drainage area above the dam is 63 square miles.

The original spillway was located on a natural earth embankment, and was of mass masonry and concrete construction about 6 feet high, with a base width of about 5 feet. This base was widened and the crest raised 2 feet. The spillway was extended in length to 932 feet in 1943. The crest elevation has been established at elevation 863.0 feet above msl.

The outlet for low-flow releases is a concrete conduit, 4 feet by 5 feet, through the base of the dam, which is controlled by a sluice gate. Diversion for municipal water supply is accomplished by pumping from the lake. The number and size of pumps have varied through the years.

13. Abilene Dam and Lake Abilene

Location

Abilene Dam and Lake Abilene are in the Brazos River Basin in Taylor County, 6 miles northwest of Tuscola on Elm Creek, a tributary to Clear Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Abilene for municipal and industrial water supply and for recreational purposes.

Authorization to build a dam that would create a reservoir of 45,000 acre-feet capacity was granted by Permit No. 253 (Application No. 259) dated September 7, 1918 from the State Board of Water Engineers. The Permit allows an

annual use of 1,675 acre-feet of water. The anticipated storage was not reached, hence the actual capacity is 9,790 acre-feet.

The project was started in 1919. The earthwork was completed in May 1921. The entire project was reported complete, and deliberate impoundment was begun, on August 1, 1921.

In 1941 extensive repairs were made to the embankment, additional riprap was placed, and the spillway was improved. In 1957 additional work was done on the emergency spillway section.

Other projects operated by the city for water supply are Kirby Dam and Kirby Lake on Cedar Creek (see page 49), and Fort Phantom Hill Dam and Fort Phantom Hill Reservoir on Elm Creek (see page 82).

Physical Description

The present dam is an earthfill structure about 3,400 feet long and 51 feet high above the creekbed, with the top of the dam at elevation 2,031.3 feet above msl. The volume content of the dam is 470,000 cu yd. A low fill extends from the main embankment to the spillway. The embankment has a maximum bottom width of 220 feet and top width of 20 feet.

The lake has a capacity of 9,790 acre-feet and a surface area of 641 acres at spillway elevation, 2,018.8 feet above msl, according to a 1948 sedimentation survey by the U. S. Soil Conservation Service.

The drainage area of Elm Creek above the dam is 102 square miles.

The drawings for the 1943 improvements show a concrete-paved emergency spillway located near the left bank, with a crest length of 2,000 feet at elevation 2,023.0 feet above msl.

The drawings available do not show sufficient details of the service spillway and low flow outlet to describe these features.

14. Halbert Dam and Lake Halbert

Location

Halbert Dam and Lake Halbert are in the Trinity River Basin in Navarro County, 4 miles southeast of Corsicana on Elm Creek, a tributary to Chambers Creek, which is tributary to Richland Creek, which is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Corsicana for municipal water supply, industrial water supply, and recreational purposes.

Permit No. 803 (Application No. 841) dated July 1, 1925 was issued to the city of Corsicana by the State Board of Water Engineers. This Permit approved the dam as built with the right to impound 7,653 acre-feet and appropriate annually 7,653 acre-feet of water for municipal purposes. Later, under authority of Permit No. 1534 (Application No. 1644) dated April 14, 1950, the spillway elevation was raised 1 foot to increase the storage. The same Permit gave the city of Corsicana a water right to divert 3,650 acre-feet of water annually from Chambers Creek. This water is pumped to Lake Halbert as required to maintain desired storage.

Construction of the dam was started in 1920, and was completed in 1921 when impoundment and diversion of water for municipal use began.

Physical Description

The dam is an earthfill structure, 2,780 feet long, with top elevation of 375.0 feet above msl. The height above the foundation is 49 feet with a maximum base width of 250 feet and top width of 16 feet. In 1950 the spillway was raised 1 foot.

The lake had an original capacity of 8,010 acre-feet with a surface area of 593 acres at spillway elevation 368.0 feet above msl. The total length of the lake was 11,700 feet. A survey by the U. S. Soil Conservation Service in 1949 showed that the capacity had been reduced by 1,355 acre-feet by sedimentation, which is an average of 48.4 acre-feet per year. Several small dams located on creeks contributing runoff to Lake Halbert act as retention structures. In 1950 when the spillway was raised 1 foot to elevation 368.0 feet above msl, the capacity was estimated to be 7,420 acre-feet, with a surface area of 650 acres.

The drainage area above the dam is 12 square miles. The yield from this lake was not adequate for the city supply so water is now pumped to Lake Halbert from Chambers Creek as demand requires, between October 1 and June 1. The city is now investigating other sources of water supply to meet future requirements.

A concrete spillway located on the left end of the dam has a crest length of 175 feet at elevation 368.0 feet above msl, with sloping sides, to give a 520-foot-long opening at the embankment elevation. The discharge capacity is 13,500 cfs at a water depth of 5 feet over the spillway.

A 24-inch valve-controlled outlet pipe near the bottom of the lake admits water to the city's filter and treatment plant located immediately below the dam. Treated water is pumped about 3 miles to the water distribution system. Water can also be released downstream from this supply line.

15. Kemp Dam and Lake Kemp and Diversion Dam and Diversion Lake

Location

Kemp Dam and Lake Kemp are in the Red River Basin in Baylor County, about 6 miles north of Mabelle on the Wichita River, a tributary of the Red River.

Diversion Dam, downstream from Kemp Dam, is in Archer County, 14 miles west of Holliday. Diversion Lake is in Archer and Baylor Counties.

Ownership and History of Development

The projects are owned by the city of Wichita Falls and Wichita County Water Improvement District No. 2.

The project was constructed under authority of the water right granted by Permit No. 504 (Application No. 516) issued by the State Board of Water Engineers to the Wichita County Water Improvement District No. 1 on March 22, 1921. The Permit granted an appropriation of 1,000,000 acre-feet per annum for irrigation of 92,327 acres of land in Wichita County, for the development of electric or other power, and for the municipal water supply of Wichita Falls, Iowa Park, Kemp City, Holliday and other towns on the proposed system. Further, it granted the construction of two reservoirs, one with capacity of 444,168 acre-feet (Lake Kemp) and one with capacity of 45,000 acre-feet (Diversion Lake).

In April 1923 certain water rights were sold to Wichita County Water Improvement District No. 2 for irrigation of additional land. District No. 1 transferred its interests in the project to the city of Wichita Falls on July 24, 1961. District No. 2 retains ownership of some of the canals and irrigation systems and water rights.

Construction began February 25, 1922, and was completed August 25, 1923. Deliberate impoundment of water began October 1, 1922. The first water for irrigation use was delivered for the 1924 season.

Physical Description

Kemp Dam is a hydraulic earthfill structure, 7,500 feet long, with maximum height of 100 feet. The top of the dam is at elevation 1,166.8 feet above msl. The foundation is protected with a sheet-steel-piling cutoff wall in the old river channel area. The maximum base width is 573 feet and the top width is 25 feet, with a roadway across the top of the embankment. The upstream face is protected with an 18-inch thickness of rock riprap laid on an 8-inch-thick gravel base. The volume content of the dam is 1,500,000 cu yd.

Lake Kemp has a capacity of 461,800 acre-feet and a surface area of 20,620 acres at elevation 1,153.0 feet above msl. Diversion Lake, about 20 miles downstream in Archer and Baylor Counties, is part of this project, and it is covered by the same Permit. This lake has a capacity of 40,000 acre-feet and a surface area of 3,419 acres at elevation 1,051.5 feet above msl. Water released from Lake Kemp travels by river channel to Diversion Lake for distribution by two canal systems for irrigation. Municipal and industrial water is diverted by a pumping plant and by pipeline systems. Water is released from Lake Kemp to maintain surface elevation at desired height in Diversion Lake for discharge to the canals.

Data on elevations and capacities of Kemp Dam, provided by the U. S. Geological Survey, are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,166.8	--	--
Top of design flood	1,163.0	648,000	--
Service spillway crest	1,153.0	461,800	20,620
Invert of low-flow outlet (outlet works)	1,069.4	0	--

The drainage area of the Wichita River above Kemp Dam is 2,086 square miles.

The reservoir capacity data for Lake Kemp is from a 1958 survey by the U. S. Soil Conservation Service. No previous survey is available to determine loss of storage from sedimentation.

Records of contents of Lake Kemp from October 1922 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and in Water-Supply Papers of the U. S. Geological Survey since October 1922.

Kemp Dam has a semicircular, uncontrolled, concrete service spillway located near the left end of the dam, which has a crest length of 564 feet at elevation 1,153.0 feet above msl. The discharge slope of the spillway is paved with large rocks laid in concrete. Two uncontrolled emergency spillways are located between the left end of the dam and the service spillway. One is 70 feet long with crest at elevation 1,161.5 feet above msl. The other one is 335 feet long with a crest elevation that varies between 1,162.0 feet and 1,165.3 feet above msl.

Kemp Dam has two outlet conduits 7 feet in diameter and 430 feet long with invert at elevation 1,069.4 feet above msl. The discharge is controlled by lift gates operated from the control house. Four additional conduits that were used to pass water during construction have been plugged.

The District Engineer, Tulsa District, U. S. Army Corps of Engineers ("Survey Report on Lake Kemp," November 15, 1961), stated that the existing Lake Kemp is a potential hazard to the valley below because of deterioration of the spillway and outlet works, and that major reconstruction is required to make the facility safe for future operation. The Texas Water Commission, in response to Governor Price Daniel's request for a study of a proposed Federal project to modify and rehabilitate the existing Lake Kemp, on June 22, 1962 found that the proposed changes in the structure were feasible and in the public interest. The proposal is to plug the two uncontrolled emergency spillways and the six outlet conduits at the right abutment. The plan includes a new service spillway near the center of the dam with 10 taintor gates 40 feet wide by 35 feet high for controlled discharge to a maximum of 450,000 cfs, and, as a part of the spillway structure, a sluiceway 5 feet 8 inches wide by 7 feet high for control of the low-flow discharge.

Diversion Dam is 85 feet high and has an overall length of 7,000 feet. Construction was completed in 1924.

16. Williamson Dam and Lake Cisco

Location

Williamson Dam and Lake Cisco are in the Brazos River Basin in Eastland County, 4 miles north of Cisco on Sandy Creek, a tributary of Hubbard Creek, which is tributary to Clear Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Cisco for its municipal water supply. The city obtained Permit No. 439 (Application No. 455) dated June 16, 1920 from the State Board of Water Engineers to construct a dam 65 feet high to impound 9,363 acre-feet of water and to divert this amount annually for municipal water use. The dam was built higher than was first planned, so Permit No. 1131 (Application No. 1207) dated December 20, 1959 from the State Board of Water Engineers was granted to amend Permit No. 439. This Permit authorized creation of a reservoir to impound 45,000 acre-feet of water, and increased the authorized appropriation by 35,637 acre-feet to 45,000 acre-feet. This anticipated capacity was greater than that actually obtained (26,000 acre-feet with surface area of 1,050 acres at an elevation of 1,520.0 feet above msl). However, because of damage to the roadbed of the Missouri-Kansas-Texas Railroad resulting from backwater from Lake Cisco, the railroad obtained a court injunction against the city of Cisco ordering the operating level of the lake to be reduced to elevation 1,496.0 feet above msl. At this elevation the capacity of Lake Cisco is 8,800 acre-feet, and the surface area is 1,050 acres. With the reduction of capacity of Lake Cisco a new source of water supply was necessary. Permit No. 1738 (Application No. 1870) dated January 25, 1955 was obtained from the State Board of Water Engineers. This Permit authorized the construction of a small channel dam on Battle Creek to store 110 acre-feet and to divert 1,000 acre-feet of water annually. The water is pumped through a 24-inch pipeline over a divide into an unnamed creek, thence to Sandy Creek, then to Lake Cisco.

Construction of the dam was completed September 7, 1923 with impoundment beginning about that time. Water use began in 1925. The diversion from Battle Creek started in May 1956.

Physical Description

The dam is a reinforced concrete structure of the slab and buttress type. It is 1,060 feet long and 133.5 feet high from the foundation to the top of the roadway at elevation 1,535.0 feet above msl. The top of the dam is at elevation 1,528.5 feet above msl. The concrete roadway is supported by columns with its base on the deck and piers of the dam.

The drainage area is 26 square miles, but the yield from this area is insufficient to give a water supply that justifies the expense of rerouting the railroad to utilize the entire storage capacity of the lake.

The spillway at elevation 1,520.0 feet above msl is 270 feet long. The discharge is to the channel below the dam. However, it has never been necessary to discharge water over this spillway, and the downstream area is used as a municipally operated swimming pool.

Water is withdrawn from the lake by a gravity supply line to the water treatment plant immediately downstream from the dam. The water is settled, but not filtered or treated, and pumped to the city storage and distribution system.

Water can be released downstream from this same supply line.

17. Crook Dam and Lake Crook

Location

Crook Dam and Lake Crook are in the Red River Basin in Lamar County, 5 miles north of Paris on Pine Creek, a tributary to the Red River.

Ownership and History of Development

The project is owned and operated by the city of Paris for municipal water supply.

Permit No. 646 (Application No. 679) dated February 26, 1923 from the State Board of Water Engineers authorized the construction of a dam to impound and use 12,000 acre-feet of water annually for municipal purposes.

Construction was started at the time the Permit was issued, and the dam was completed and impoundment of water was begun that same year.

Physical Description

The dam is an earthfill structure 3,100 feet long with a maximum height of 38 feet above streambed and the top of the dam at elevation 488.0 feet above msl. A concrete slab protects the upstream face of the embankment from wave action. A concrete weir spillway section in the center of the dam is 300 feet long with crest at elevation 476.0 feet above msl. Volume content of the dam is 193,200 cu yd.

The capacity of the lake at the time of construction was 11,487 acre-feet. This had been reduced to 10,755 acre-feet by 1936 and to 9,960 acre-feet by July 1956 through sedimentation, according to surveys by the U. S. Soil Conservation Service. This is a capacity reduction of 13.2 percent in 32.8 years. The surface area is 1,226 acres at elevation 476.0 feet above msl. The lake is 2.7 miles long with a shoreline of 12 miles.

The drainage area above the dam is 52 square miles.

A low-flow, valve-controlled, 18-inch pipe, which is located at the low point in the reservoir, regulates downstream releases when required.

The municipal water supply is diverted directly from the lake by various size pumps. In 1954 the city acquired the water treatment plant formerly used by Camp Maxey, and it is now their main filtration and water treatment plant. This plant is located 300 feet east of the old city plant.

18. Garza Dam and Lake Dallas

Lake Dallas no longer exists after Garza Dam was breached October 28, 1957 upon the completion of Lewisville Dam. The old lake is now part of Garza-Little Elm Reservoir. Description is included here for historical information.

Location

Garza Dam and Lake Dallas are in the Trinity River Basin in Denton County, 11 miles southeast of Denton on Elm Fork Trinity River, a tributary of the Trinity River.

Ownership and History of Development

The project was owned by the city of Dallas, and was authorized by Permit No. 798 (Application No. 843) dated August 8, 1924 from the State Board of Water Engineers. The Permit allowed storage of 214,000 acre-feet and use of 300,000 acre-feet of water annually for municipal water supply. In addition, the permittee was authorized to install two turbines to develop about 1,000 hp (horsepower) each. The city owns the water rights described in the Permit for municipal water supply. Other water rights are covered in the description of White Rock Dam and White Rock Lake (page 16).

The construction of the dam began August 15, 1924, and was completed in November 1927, but was not accepted by the city until November 1928. Deliberate impoundment of water began February 16, 1928.

This was one of several reservoirs supplying water to the city of Dallas. Other projects in use in 1928 were White Rock Lake and other small reservoirs.

Physical Description

The dam was a hydraulic earthfill structure 11,400 feet long including a concrete spillway section with crest length of 567 feet at elevation 525.1 feet above msl. The dam had a maximum height of 80 feet above the streambed with a top width of 30 feet, which supported a roadway along the full length of the dam. The elevation of the top of the dam was 564.1 feet above msl. The dam contained about 2,600,000 cu yd of earthfill and 21,000 cu yd of concrete. The upstream face was protected by an 18-inch thickness of rock riprap placed on an 8-inch-thick gravel base.

The lake had an original capacity of 194,000 acre-feet and a surface area of 10,995 acres at spillway elevation 525.1 feet above msl. This capacity figure was included in the Permit and in the first water service reports to the State Board of Water Engineers, also in descriptive data of an engineer by the name of O. N. Floyd.

The drainage area above Garza Dam is 1,165 square miles.

Sedimentation surveys in 1951-52 by the U. S. Army Corps of Engineers and others indicate that the capacity of the reservoir had been reduced to 156,600 acre-feet from the original capacity of 194,000 acre-feet.

Records of contents from December 1928 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and in Water-Supply Papers of the U. S. Geological Survey from December 1928.

Because of insufficient runoff, water was diverted into Lake Dallas from the Red River by pumping during the period February 1954 to April 1957. The amount diverted, by water years, was 27,080 acre-feet in 1954, 4,370 acre-feet in 1955, 37,200 acre-feet in 1956, and 29,820 acre-feet in 1957. This diversion was authorized by Permit No. 1670 (Application No. 1799) dated April 30, 1953 granted to the city of Dallas by the State Board of Water Engineers. Permit No. 1670 authorized the appropriation of 112,000 acre-feet of water annually from the Red River in Cooke County by pumpage into Pecan Creek to flow by gravity to Elm Fork Trinity River and into Lake Dallas.

The concrete service spillway had a crest length of 567 feet at elevation 525.1 feet above msl. There were two emergency spillways beyond the right end of the dam with crest elevation of 536.1 feet above msl.

Water was withdrawn through one 18-inch outlet and one 6-inch pipe with inverts at elevation 474.1 feet above msl, and four 48-inch pipes with invert at elevation 463.1 feet above msl.

As stated above, this lake no longer exists, and is now part of Garza-Little Elm Reservoir.

19. Olmos Dam and Olmos Reservoir

Location

Olmos Dam and Olmos Reservoir are in the San Antonio River Basin in Bexar County and in Alamo Heights in north-central San Antonio on Olmos Creek, a tributary of the San Antonio River.

Ownership and History of Development

The project is owned and operated by the city of San Antonio for flood protection of the city's business section. It was justified because of the great damage caused by the flood of September 1921.

The project is a floodwater retention reservoir initiated following the 1921 flood. Construction was started in 1925 and was completed in 1926. It has been used advantageously several times for retention of floodwater. The content in storage reached 4,500 acre-feet during the September 26, 1946 flood, and releases were made during the next 2 days when the downstream water had receded.

Physical Description

The dam is a concrete gravity type with a maximum height of 60 feet and length of 1,740 feet. At the maximum section the base width is 70 feet and top width is 12 feet. There is a 24-foot-wide roadway along the top of the dam at elevation 728.0 feet above msl. The roadway is partially supported by columns with footings at elevation 698.0 feet above msl on the downstream sloping face of the dam.

The reservoir has a capacity of 15,500 acre-feet and a surface area of 1,050 acres at the top of the dam elevation 728.0 feet above msl. The reservoir basin is maintained empty, and the area is used for parks and playgrounds except when needed for floodwater storage.

The drainage area above Olmos Dam is 32 square miles.

The outlet structure consists of six vertical slide-gate-controlled concrete conduits with entrance dimensions 6 feet 6 inches wide by 8 feet 6 inches high, with invert at elevation 679.5 feet above msl. The conduits discharge onto a concrete apron at elevation 661.0 feet above msl and then to the creek channel. The gates are maintained open, and are operated by the city of San Antonio Fire Department as required to control downstream floodflow.

20. Trinidad Dam and Trinidad Lake

Location

Trinidad Dam and Trinidad Lake are in the Trinity River Basin in Henderson County, 2 miles south of Trinidad on an unnamed slough creating an off-channel lake near the Trinity River.

Ownership and History of Development

The project is owned and operated by Texas Power and Light Company for condenser-cooling water purposes for a steam-electric generating plant.

Water rights were obtained by Permit No. 818 (Application No. 862) dated July 1, 1925 from the State Board of Water Engineers. This Permit allows the diversion and annual use of 2,500 acre-feet of water from the Trinity River. This Permit was amended by Permit No. 1078 (Application No. 1150) dated August 15, 1928, which allowed the annual diversion of water from the Trinity River to be increased to 4,000 acre-feet.

The project was started and completed in 1925. The exact date is not known, but diversion of water by pumping into the lake also was started in 1925.

Physical Description

The dam or dike is an earthfill structure 12,000 feet long, including a spillway section. The average height is 20 feet with a bottom width of 140 feet and top width of 20 feet. The top of the dike is at elevation 290.0 feet above msl.

The lake formed has a capacity of 7,800 acre-feet and a surface area of 753 acres at elevation 285.0 feet above msl. Water is pumped from the river to keep the level near elevation 283.0 feet above msl. The water is used for condenser-cooling water purposes by circulating the lake water through the condensers. The only industrial consumption of water is the forced evaporation from the lake caused by the addition of heat to the lake from the condensers.

There is no significant drainage area to contribute material runoff to this off-channel storage.

The spillway is part of the levee, and is equipped with one taintor gate. In 1946 a flume 16 feet wide and 6 feet deep was constructed to discharge the water from the gate over the embankment for drainage into the river. This prevents damage to the berm of the earthfill in the area of the spillway.

The only water diverted is for the plant use, and being an off-channel reservoir, low-flow releases are not required.

This is one of the main generating plants of the Texas Power and Light Company's interconnected electric system. There are five units installed with a total capacity of 187,900 kw. When this plant was built lignite was used as fuel, but at the present time natural gas is used.

21. Bivins Dam and Bivins Lake

Location

Bivins Dam and Bivins Lake, known also as Amarillo City Lake, are in the Red River Basin in Randall County, 8 miles northwest of Canyon on Palo Duro Creek, a tributary of Prairie Dog Town Fork Red River, which is tributary to the Red River.

Ownership and History of Development

The project is owned and operated by the city of Amarillo for municipal water supply to recharge the ground-water reservoir supplying the city's water-well field.

Permit No. 2010 (Application No. 2213) issued March 15, 1962 by the Texas Water Commission to the city of Amarillo authorizes the present structure, which was built in 1926-27. This Permit authorized the storage of 5,122 acre-feet of water and annual diversion of 1,000 acre-feet by the city of Amarillo for recharging the underground water supply.

The project was started in 1926, and was completed in 1927. Deliberate impoundment of water began in 1926. The lake has been full only a few times, and has been empty on several occasions, too.

Physical Description

The dam is a compacted earthfill structure, 1,600 feet long and 48 feet high above the streambed, with the top of the embankment at elevation 3,639.7 feet above msl. The maximum bottom width is about 330 feet and the top width is 20 feet.

The lake has a capacity of 5,120 acre-feet and a surface area of 379 acres at elevation 3,634.7 feet above msl. Water is not diverted directly from the lake, but the water in storage recharges, by infiltration, a series of 10 wells that are pumped for the city supply. Runoff is insufficient to keep the lake full, and on several occasions there has been no storage. There is no water used directly from the lake, but the well system produces over 3,000 acre-feet of water per year.

The drainage area above the dam is 982 square miles, of which 920 square miles is probably noncontributing.

Records of contents are contained in State Board of Water Engineers Bulletin 5807-A and in U. S. Geological Survey Water-Supply Paper No. 1341 for the period August 1942 to December 1954 under the name "Palo Duro Creek at Amarillo City Lake near Canyon, Tex." This report shows that the lake was empty at the end of 78 months during this period.

A spillway with crest length of 500 feet at elevation 3,634.7 feet above msl provides floodwater escape. The upstream and downstream faces of the spillway section are paved with rock riprap.

A 24-inch (valve-controlled) cast iron pipe extends through the embankment for release of low flow, if required.

22. Buchanan Dam and Buchanan Reservoir

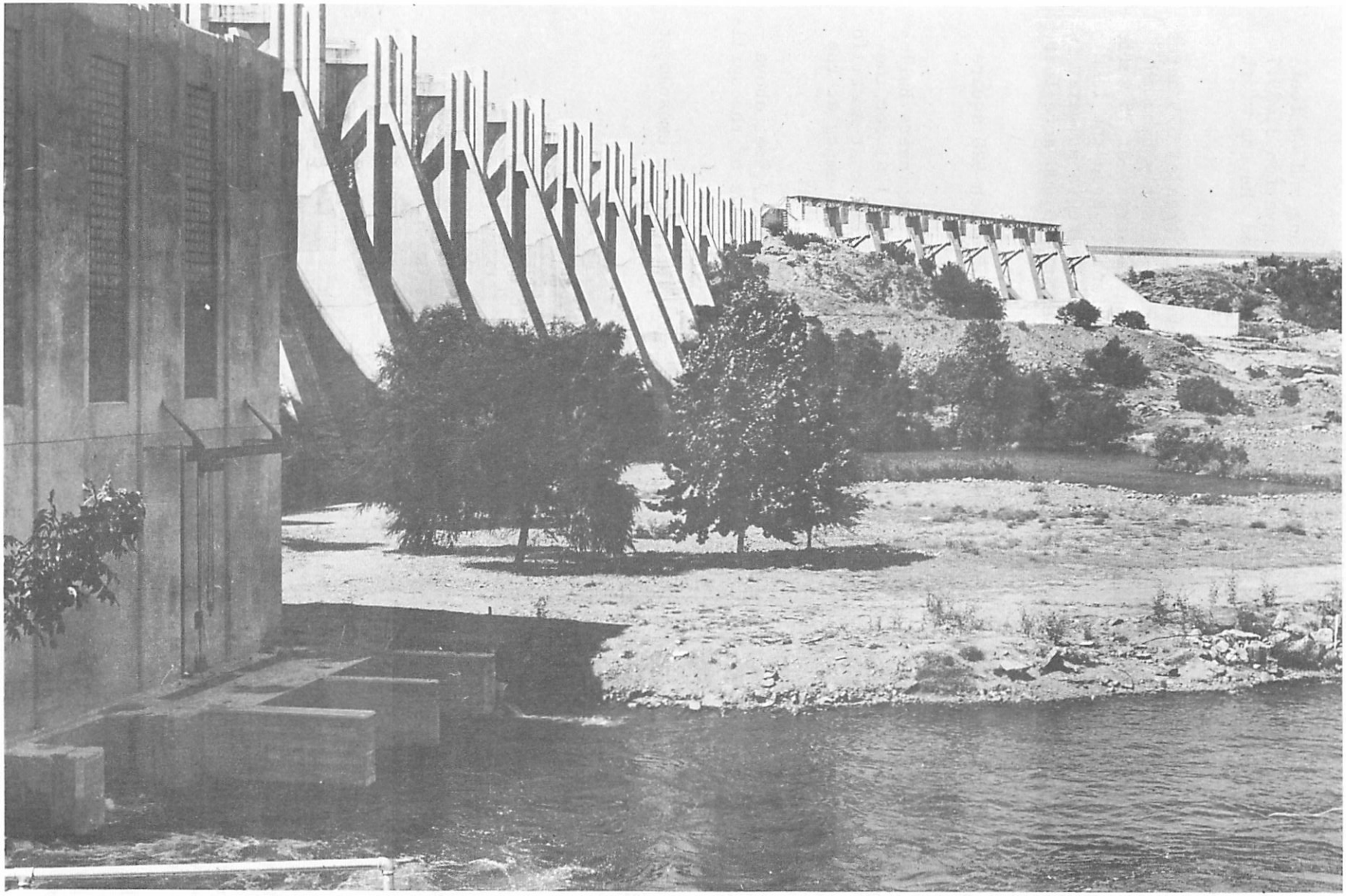
Location

Buchanan Dam and Buchanan Reservoir are in the Colorado River Basin in Burnet and Llano Counties, 11 miles west of Burnet on the Colorado River at river mile 413.6. The upper end of the reservoir extends into San Saba County.

Ownership and History of Development

The project is owned and operated by the Lower Colorado River Authority as one of a series of six dams and reservoirs on the Colorado River. The other five are: Inks Dam and Inks Lake, Wirtz (Alvin) Dam and Granite Shoals Lake, Starcke (Max) Dam and Marble Falls Lake, Mansfield Dam and Lake Travis, and Miller (Tom) Dam and Lake Austin. All of these are described in this bulletin.

The project was authorized by Permit No. 1259 (Application No. 1345) dated May 25, 1938 granted by the State Board of Water Engineers to the Lower Colorado River Authority. This Permit authorizes an annual appropriation of 1,391,530 acre-feet of water for municipal, irrigational, mining, and hydroelectric power



Buchanan Dam and Power House. Furnished by Lower Colorado River Authority

uses. Permits were granted for one or two applications for various stretches of the Colorado River in the vicinity of Buchanan Reservoir.

Several other water rights are included in Permit No. 1259 that recognize earlier water rights of the Lower Colorado River Authority. These water rights and the history of their acquisition are as follows:

> Certified Filing No. 423 filed with the State Board of Water Engineers on June 30, 1914 by E. C. Alexander refers to ownership of rights by virtue of prior filings and applications in connection with which water is to be utilized for mining, milling, manufacturing, power, waterworks, and stock raising and which prior filings and applications were renewed for the construction of a dam at Lohman Narrows. This project, known as Alexander Dam, was located below Marble Falls. Between 1914 and 1919 these rights passed to C. H. Alexander and the Syndicate Power Company. All these C. H. Alexander interests seem to be in a partnership with John N. Simpson of Dallas, who also had early water rights and owned considerable land on the Colorado River. The Alexander and Simpson Project is mentioned in some of the letters in the files of the Texas Water Commission. For later permits, Permit Nos. 951-55 and 998, the Syndicate Power Company claimed the exclusive prior rights to the appropriation and use of such waters within the area covered by six applications for water permits pertaining to the appropriation and use of such waters as existed prior to June 29, 1913.

The Lower Colorado River Authority is owner of Permit Nos. 951-55 and 998 by virtue of the following conveyances: (a) from Syndicate Power Company to Ward Arnold and Jay Alexander dated July 30, 1928 (Permit Nos. 951 and 952 only); (b) from Syndicate Power Company to Emery, Peck & Rockwood Development Company dated July 19, 1929; (c) from Ward Arnold and Jay Alexander to Emery, Peck & Rockwood Development Company dated July 19, 1929; (d) from Emery, Peck & Rockwood Development Company to Central Texas Hydro-Electric Company dated November 5, 1931; (e) from A. J. Wirtz, Receiver for Central Texas Hydro-Electric Company, to Colorado River Company dated October 5, 1934; (f) from A. J. Wirtz, Receiver for Central Texas Hydro-Electric Company, to C. G. Malott dated October 5, 1934; (g) from Colorado River Company to Lower Colorado River Authority dated August 9, 1935; (h) from C. G. Malott to Lower Colorado River Authority dated August 9, 1935.

The project was started by Samuel Insull interests in 1926 under the name of Central Texas Hydro-Electric Company. Work was stopped in 1926 because of financial difficulties. Reconstruction by the Lower Colorado River Authority began in 1935 and was completed in 1938. Deliberate impoundment of water began May 20, 1937. The flood of July 1938 filled the reservoir for the first time resulting in a large floodflow discharge from the reservoir. The first generating unit was placed in operation in January 1938.

Buchanan Dam and Buchanan Reservoir is the first of the series of six projects; water released from Buchanan Reservoir is subsequently used at Inks, Granite Shoals, Marble Falls, Marshall Ford (Mansfield), and Austin plants for generation of power and for municipal and irrigation purposes. Excess

floodwater released may be stored in Lake Travis (Mansfield Dam) depending on the elevation of the water in that lake.

Physical Description

The dam is a concrete arch and gravity structure with a total length of 11,200 feet. The maximum height is 150 feet with the top of the dam at elevation 1,025.5 feet above msl. Beginning at the left end, the various features are as follows: a concrete gravity overflow spillway section 1,100 feet long with crest at elevation 1,020.5 feet above msl; a gated spillway section with an ogee crest at elevation 1,005.5 feet above msl with sixteen taintor gates, each 33 feet wide by 15.5 feet high; a non-overflow section of natural rock and concrete gravity section 1,000 feet long; a gated spillway section with an ogee crest at elevation 1,005.5 feet above msl with fourteen taintor gates, each 33 feet wide by 15.5 feet high; a section of natural rock and concrete gravity non-overflow section 1,750 feet long; a gated spillway section with an ogee crest at elevation 995.5 feet above msl with seven taintor gates, each 40 feet long by 25.5 feet high; a section of twenty-nine 70-foot-span multiple concrete arches with top elevation of 1,025.5 feet above msl (the power plant penstocks and control gatehouses are located in this part of the dam); a 650-foot length of rock and concrete gravity section; a section of twenty-three 35-foot-span multiple arches of concrete with top elevation 1,025.5 feet above msl; and a gravity section at the extreme right end of the structure 238 feet long.

The reservoir has a capacity of 992,000 acre-feet at spillway crest elevation of 1,020.5 feet above msl. Other areas and capacities are given in the table below. This is an important storage reservoir as water released is used six times for generation of power and for municipal and irrigation purposes. Normal water releases are controlled by the operation of the turbines in the powerhouse. Floodwater releases are from one or more sections of the gated spillways. The reservoir shore has developed into an important recreational and residential area.

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of arches	1,025.5	1,125,000	24,660
Top of gravity overflow	1,020.5	992,000	23,200
Sill of 15-foot gates	1,005.5	678,000	18,770
Sill of 25-foot gates	995.5	505,000	15,820
Invert to penstocks	937.5	36,800	2,100

The drainage area is 31,250 square miles, of which 11,900 square miles is probably noncontributing.

Some sediment is being deposited in the reservoir, but surveys to determine the volume have not been made.

Records of the contents of Buchanan Reservoir from May 1937 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from May 1937 in Water-Supply Papers of the U. S. Geological Survey.

Allocation of water in acre-feet for the various purposes is not set out in Permit No. 1259. All water released except floodflow is first used to generate power and later used downstream for municipal, industrial, and irrigational purposes in varying amounts.

There are no outlets required for conservation releases since this is accomplished by the operation of the turbines for generation of power. Water is passed through the other five reservoirs before it is released into the Colorado River channel below Austin for delivery to downstream users. When the volume of floodwater in the river above the dam is greater than the available storage capacity of Buchanan Reservoir, the gates are operated to release water for retention in Lake Travis. (See operation of Lake Travis under Mansfield Dam on page 78.)

There are three generating units and allied equipment with a rated capacity of 11,250 kw each. In addition to the three generating units, there is installed a pump-back unit. The pump has a capacity of 840 cfs for returning water from the Buchanan tailrace (Inks Lake) into Buchanan Reservoir. The pump is driven by a 14,500 hp motor. This unit operates at off-peak times for power requirements when electric energy can be purchased at a lower rate than its cost during the time of greatest demand. The generating units and the pump are all located in the powerhouse structure.

A compilation of pertinent data on Buchanan Dam and Buchanan Reservoir is as follows:

Height of dam	150	feet
Length of dam	11,200	feet
Maximum elevation	1,025.5	feet above msl
Uncontrolled spillway crest elevation	1,020.5	feet above msl
Controlled spillway: Crest elevation	1,005.5	feet above msl
Top of gates elevation	1,021.0	feet above msl
Controlled spillway: Crest elevation	995.5	feet above msl
Top of gates elevation	1,021.0	feet above msl
Tailwater elevation	888.5	feet above msl
Maximum operating head .	132	feet
Reservoir area at crest of uncontrolled spillway	23,205	acres
Maximum length of lake	32	miles
Maximum width of lake	8	miles
Maximum depth of lake	132	feet
Shoreline	192	miles
Generator capacity	33,750	kw--three 11,250 kw generating units
One pump back unit	840	cfs (14,500 hp motor)

23. Nueces (Upper) Dam and Upper Nueces Reservoir

Location

The Nueces (Upper) Dam and Upper Nueces Reservoir are in the Nueces River Basin in Zavala County, 6 miles north of Crystal City on the Nueces River.

Ownership and History of Development

The present dam and reservoir, located upstream from an earlier dam, was built by the Zavala and Dimmit Counties Water Improvement District No. 1 under Permit No. 1419 (Application No. 1525) dated September 15, 1947 from the State Board of Water Engineers. The original dam was authorized by Permit No. 929 (Application No. 979) dated November 14, 1927 from the State Board of Water Engineers to the Zavala and Dimmit Counties Water Improvement District No. 1. Permit No. 1419 increased the water right from 10,000 acre-feet to 14,000 acre-feet annually for irrigation use. Other water rights were obtained by the District as follows: A Certified Filing No. 136 filed May 23, 1913 with the State Board of Water Engineers by the Winter Garden Irrigation Company authorizes the diversion of 10,000 acre-feet of water annually for irrigation use and the construction of three small reservoirs. The District purchased this water right in 1929. To further clarify the water rights, the District in 1952 purchased the water rights of Mr. Mars McLean, which were obtained by Permit No. 1382 (Application No. 1473) dated March 20, 1946 from the State Board of Water Engineers, for the storage and annual use of 375 acre-feet of water for irrigation purposes. This water right was first obtained by Certified Filing No. 128 filed June 12, 1914 with the State Board of Water Engineers by Mars McLean and the Nueces Valley Irrigation Company. This Certified Filing (No. 128) and No. 136 were in conflict in many ways, but the differences regarding storage use and release of water were worked out under an agreement between the two contestants. The Nueces Valley Irrigation Company water rights and other property were sold at a sheriff's sale January 6, 1925 to the Kenneth Cunningham estate. Cunningham conveyed the property to W. T. Eldridge prior to August 15, 1925. Eldridge deeded the property to Nueces Lands Irrigation Company between 1940 and 1944. In 1944 the Sugarland Industries claimed the property through a deed from the Nueces Land Irrigation Company. By a letter dated March 31, 1945 Sugarland Industries reported the sale of the property to Mars McLean. The dam, known as Bookout Dam, and all water rights of Mars McLean were then transferred to the District. This and other water rights purchased or granted by permits give the District water rights for storage and diversion of the Nueces River water in this area.

The original dam built in 1926 was damaged by high water in October 1927, and was repaired.

The construction contract for the present dam and spillway was awarded October 16, 1947, and the project was completed in March 1948 with impoundment of water beginning at that time. The facilities of the District include, besides the main dam, two projects known as Boynton and Bookout Dams on the Nueces River and Espantosa Dam on Turkey Creek. This Espantosa Dam lake can be filled by diverting floodwaters discharged from the main reservoir. The District stores water only, and each taxpaying member pumps and distributes water according to the amount of land rendered for taxes in the District.

An item of historical interest is an unsigned penciled note dated 1945 on one of the drawings that says a road was surveyed across the Nueces River in 1737 and that an old sign at a location near Bookout Dam known as Presidio Crossing said, "Santa Anna crossed here in 1836 on his way to invade San Antonio." The drawing is in the water rights files of the Texas Water Commission.

Physical Description

The dam is an earthfill structure 550 feet long and 60 feet high with the top of the dam at elevation 616.0 feet above msl. The embankment has a maximum base width of 360 feet and top width of 20 feet. Farm-to-Market Road No. 1025 crosses the top of the dam. An earthen embankment, protected with a concrete slab, was built on the right bank of the river upstream from the dam to channel the floodwater to a concrete slab spillway.

The reservoir has a capacity of 7,590 acre-feet and a surface area of 316 acres at spillway crest elevation of 598.0 feet above msl. Storage in this reservoir is used for irrigation purposes.

The drainage area above the dam is estimated to be 2,160 square miles.

The lowest water outlet is at the bottom of the channel with invert at elevation 559.5 feet above msl.

A concrete flat-type uncontrolled spillway with crest length of 270 feet at elevation 598.0 is located upstream on the right bank of the earth dike. Concrete wingwalls on each side of the spillway, with top at elevation 608.0 feet above msl, support the earth dikes. The first spillway discharges into a channel where a second concrete spillway, with crest length of 200 feet at elevation 589.7 feet above msl, acts as a retarding structure. The water then passes downstream under and over (in flood periods) the Farm-to-Market Road No. 1025. The water continues in this channel to a third retarding structure with a spillway crest length of 200 feet at elevation 580.0 feet above msl. The floodwater can be diverted to Espantosa Lake on Turkey Creek or allowed to re-enter the Nueces River and flow to the reservoir at Boynton and Bookout Dams.

An emergency spillway of the main reservoir is located a short distance to the right and upstream from the built-up dike, and is known as the West Channel Relief Floodway. The crest length is 320 feet at elevation 606.0 feet above msl with discharge to the same creek channel as the regular spillway.

During extreme floods the water will break across the left bank of the Nueces River about 2 miles upstream from the dam causing flooding to a very large area of farm lands.

The outlet structure is a 6-foot 6-inch square, reinforced concrete tower with a drop inlet lip at elevation 610.0 feet above msl. The discharge is to a 42-inch concrete pipe extending through the embankment with invert at elevation 559.5 feet above msl. Water entrance to the vertical shaft is controlled by three slide gates with inverts at elevations 559.5, 574.5, 589.5 feet above msl. A steel footbridge from the bank to the top of the tower gives access for operating the slide gates.

24. Abbott Dam (TP-3) and Lake McQueeney

Location

Abbott Dam and Lake McQueeney are in the Guadalupe River Basin in Guadalupe County, 5 miles west of Seguin on the Guadalupe River.

Ownership and History of Development

The project is owned and operated by the Guadalupe Blanco River Authority for generation of power. The authority purchased this and five other projects located on the Guadalupe River by a contract that became effective May 1, 1963. This and two other projects, TP-5 Dam (forming Lake Noltes) and TP-1 Dam (Lake Dunlap), were owned by the Texas Power Corporation. The other three, TP-4 Dam (Lake Placid), H-4 Dam (H-4 Reservoir), and H-5 Dam (H-5 Reservoir), were purchased from the Texas Hydro Electric Corporation.

All these projects were authorized by Permit No. 1096 (Application No. 1163) dated June 12, 1929 from the State Board of Water Engineers. The Permit allows impoundment of 33,550 acre-feet of water in six reservoirs, of which Lake McQueeney is one, and the annual use of 941,200 acre-feet of water for generation of hydroelectric power. This Permit includes the water right granted by Permit No. 21 (Application No. 21) dated July 25, 1914 from the State Board of Water Engineers to the Guadalupe Water Power Company.

Construction of the dam was begun in 1927, and was completed in 1928 with the impoundment of water and beginning of generation occurring at that time.

Physical Description

The dam is an earthfill structure with a concrete core wall, concrete gate controlled spillway section, and powerhouse. The dam is 1,900 feet long and 40 feet high with the top of the dam at elevation 540.0 feet above msl.

The lake has a capacity of 5,000 acre-feet and a surface area of 396 acres at elevation 528.0 feet above msl. The lake is maintained at nearly constant level by regulating the power output to the water inflow.

The drainage area above this dam is 1,684 square miles.

The controlled spillway is regulated by three automatic, roof-weir-type gates, each 85 feet wide by 12 feet high.

Water release is controlled by operation of the turbines while generating power, and by spillway gates. The water released here is used by other downstream plants. All six of the projects are run-of-river plants as there is only a small amount of regulating storage in each reservoir.

The power plant for this project is part of the dam structure containing two generating units with all auxiliaries. The total generating capacity is 2,800 kw.

25. TP-1 Dam and Lake Dunlap

Location

TP-1 Dam and Lake Dunlap are in the Guadalupe River Basin in Guadalupe County, 9 miles northwest of Seguin on the Guadalupe River.

Ownership and History of Development

The project is owned and operated by the Guadalupe Blanco River Authority for generation of power. The authority purchased this and five other projects located on the Guadalupe River by a contract that became effective May 1, 1963. This and two other projects, TP-3 Dam (Abbott Dam) forming Lake McQueeney and TP-5 Dam forming Lake Noltes, were owned by Texas Power Corporation. The other three, TP-4 Dam (Lake Placid), H-4 Dam (H-4 Reservoir) and H-5 Dam (H-5 Reservoir), were purchased from the Texas Hydro Electric Corporation.

All these projects were authorized by Permit No. 1096 (Application No. 1163) dated June 12,1929 from the State Board of Water Engineers. The Permit allows impoundment of 33,550 acre-feet of water in six reservoirs and an annual use of 941,200 acre-feet of water for generation of hydroelectric power. This Permit includes water rights granted by Permit No. 21 dated July 25, 1914 from the State Board of Water Engineers to the Guadalupe Power Company.

Construction of TP-1 Dam was begun in 1927, and was completed in 1928 with impoundment of water and generation of power beginning at that time.

Physical Description

The dam is an earthfill structure with concrete core wall 2,000 feet long, including the concrete spillway section. It is 41 feet high with the top of the dam at elevation 588.0 feet above msl.

The lake has a capacity of 5,900 acre-feet and a surface area of 406 acres at elevation 575.0 feet above msl. The water is diverted by a canal to the powerhouse about 2 miles downstream from the dam. Usable storage above the canal invert is 3,550 acre-feet leaving 2,350 acre-feet of dead storage capacity; however, the lake is maintained at nearly constant level.

The drainage area above the dam is 1,653 square miles.

The controlled spillway is regulated by three automatic, roof-weir-type gates, each 85 feet wide by 12 feet high.

Water release is controlled by operation of the turbines while generating power, and by spillway gates. The water released here is used through the series of five other plants. All six of the projects are run-of-river plants as there is only a small amount of regulating storage in each reservoir.

The power plant for this project contains two generating units with all auxiliaries, and has a total capacity of 3,600 kw.

26. Devils Lake Dam and Devils Lake

Location

Devils Lake Dam and Devils Lake are in the Rio Grande Basin in Val Verde County, 16 miles northwest of Del Rio on the Devils River, a tributary to the Rio Grande.

Ownership and History of Development

The project is owned and operated by Central Power & Light Company for generation of power, and was authorized by Permit No. 1049 (Application No. 1125) dated November 2, 1927 from the State Board of Water Engineers for development of hydroelectric power. The Permit allows use of all the flow of the river by construction of a dam to create a hydrostatic head, and impounding 10,750 acre-feet of water with the rate of use not to exceed 550 cfs.

Construction of the dam was begun in 1927, and was completed in December 1928 with impoundment of water and power generation beginning at that time.

Physical Description

The dam is a solid gravity type, built of limestone blocks quarried from the adjacent hills and laid with cement mortar. The dam contains 132,000 cu yd of masonry. It is 42 feet high with provisions for 5 feet of flashboards across the 650-foot-long spillway. The total length is 960 feet, which includes the non-overflow section, powerhouse, and intake structure. The powerhouse sub-structure is of reinforced concrete, and the walls are of native stone.

The reservoir has a capacity of 9,200 acre-feet and a surface area of 406 acres at elevation 1,042.3 feet above msl (top of masonry dam). The flashboards are no longer used since the increased power potential does not justify their frequent replacement. This is a run-of-river plant with only day-to-day fluctuation in lake level.

The drainage area above the dam is 4,053 square miles.

The spillway is 650 feet long with crest at elevation 1,042.3 feet above msl. With 11 feet depth of water over the crest, the discharge is 80,000 cfs. The floods of 1932, 1948, and 1954 were greatly in excess of any predicted flow, and considerable damage was done to equipment. The plant was repaired and returned to operating condition within a short time after each of these floods.

The only outlet from the lake is the penstock to the turbine, which is controlled by a headgate operated from a platform upstream from the powerhouse. This plant discharges water into Lake Walk immediately downstream, so that Lake Walk Plant releases govern the downstream flow from Devils Lake.

The project was built for generation of hydroelectric power, and is a one-unit plant with capacity of 1,800 kw. The plant utilizes the total flow of the river except during flood periods. The generator is connected to the transmission system supplying the area with electric service.

This project will be inundated when the reservoir formed by Amistad Dam on the Rio Grande is completed.

27. Kirby Dam and Kirby Lake

Location

Kirby Dam and Kirby Lake are in the Brazos River Basin in Taylor County, 5 miles south of Abilene on Cedar Creek, a tributary of Clear Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

This project is owned and operated by the city of Abilene for municipal water supply, but was used for irrigation of a small acreage of land in the beginning.

The city obtained Permit No. 1051 (Application No. 1126) dated January 23, 1928 from the State Board of Water Engineers to build a dam and impound 8,500 acre-feet of water. Water rights were for an appropriation of 14,000 acre-feet annually for municipal water supply and for 284 acre-feet for irrigating 142 acres of land.

Construction was started in 1927, and the dam was completed in 1928 with impoundment and diversion of water beginning at that time. This project was built to supplement the supply from Lake Abilene (see page 28). Another project, Fort Phantom Hill Dam and Fort Phantom Hill Reservoir, built in 1938, further increased the water supply for the city of Abilene.

Physical Description

The dam is an earthfill structure 4,200 feet long and 50 feet high with the top of the dam at elevation 1,795.5 feet above msl. The embankment has a maximum base width of 272 feet and a top width of 16 feet. The upstream face is protected by a 1-foot thickness of rock riprap.

The lake has a capacity of 7,620 acre-feet and a surface area of 740 acres at elevation 1,785.0 feet above msl. This is a decrease in capacity of 880 acre-feet from the estimate made at the time the application was submitted, according to a 1941 sedimentation survey by the U. S. Soil Conservation Service.

The drainage area above the dam is 44 square miles.

The spillway, at the right end of the dam, is an uncontrolled structure with crest length of 500 feet at elevation 1,785.0 feet above msl. The discharge from the spillway is routed between levee structures into the creek channel below the dam.

The low flow and service outlet consists of two 24-inch pipes extending through the embankment. The invert of the 24-inch pipes is at elevation 1,747.0 feet above msl; however, the lowest elevation that water can enter the 24-inch

pipes is at 1,755.0 feet above msl, which is the inlet elevation of a screened box. Another 18-inch-pipe inlet, with inlet invert at elevation 1,771.75 feet above msl, has a wye connection to each of the 24-inch pipes. A concrete vertical shaft contains the valve-operating stems so that water can be withdrawn at either elevation. Water from these outlet pipes can be discharged downstream or diverted to the pumping plant for delivering water to the city.

28. Mathis Dam and Lake Corpus Christi

Mathis Dam and the former Lake Corpus Christi are now submerged by the present Lake Corpus Christi impoundment formed by the Wesley E. Seale Dam. Mathis Dam was submerged on April 26, 1958. The description is included here as historical information.

Location

Mathis Dam and the former Lake Corpus Christi were located in the Nueces River Basin about 4 miles southwest of Mathis on the Nueces River. The new dam is in San Patricio and Jim Wells Counties. The new lake borders these two counties, and extends into Live Oak County.

Ownership and History of Development

Mathis Dam and Lake Corpus Christi were constructed by the city of Corpus Christi under the water right granted to the city by Permit No. 933 (Application No. 995) issued by the State Board of Water Engineers on October 31, 1927. Permit No. 933 authorized the annual appropriation of 500,000 acre-feet of water from the Nueces River for power and municipal purposes. Of this authorized appropriation, a maximum of 280,000 acre-feet per annum could be used to irrigate a maximum of 140,000 acres of land. There was a stipulation in the Permit that water could be used for generation of hydroelectric power when the water was released for irrigation. Permit No. 933 authorized the construction of a dam that would create a reservoir of 500,000 acre-feet capacity to supply the water for the above-described uses. Construction of Mathis Dam began in 1928, and was completed in 1929. Mathis Dam created Lake Lovenskiold, which was also known as Lake Corpus Christi. A partial failure occurred in late 1930. The structure was rebuilt in 1934. At that time the dam was called La Fruta Dam. Construction was completed and impoundment was begun on July 24, 1934.

Permit No. 933 was amended by Permit No. 1463 (Application No. 1571) dated August 19, 1948. Permit No. 1463 amended the uses and places of use of the original appropriation under Permit No. 933 without changing the amount of water appropriated. The uses as amended are as follows: 220,000 acre-feet per annum for domestic and municipal purposes; 180,000 acre-feet per annum for manufacturing; 20,000 acre-feet per annum for mining purposes; 30,000 acre-feet per annum for recreational purposes; 50,000 acre-feet per annum for irrigation not to exceed 25,000 acres of land within the limit of the 140,000 acres of land described in Permit No. 933. The city of Corpus Christi was authorized, without increasing the appropriative rights under Permit No. 933, to furnish water to several cities, corporations, and areas.

Permit No. 1604 (Application No. 1726) dated December 3, 1951 authorized the city to use the bed and banks of the Atascosa, Frio, and Nueces Rivers to convey water that the city obtained from wells in Atascosa County to the lake created by Mathis Dam.

Physical Description

The original Mathis Dam, completed in 1929, was an earthfill and concrete structure about 4,000 feet long. An uncontrolled, concrete, ogee spillway made up 1,100 feet of the total length of the dam. The crest of the spillway was at elevation 74 feet above msl. The top of the earthfill section of the structure was 16 feet wide with elevation of 99 feet above msl. Cutoff under the structure was provided by steel sheet piling.

The structure rebuilt in 1934, following the 1930 failure, utilized much of the original dam. An earthfill berm was added to the downstream side of the original embankment. Part of the uncontrolled spillway was replaced by a controlled spillway having a crest at elevation 54 feet above msl and being equipped with five taintor gates, 35 feet long, with the top of the gate at elevation 74 feet above msl. Water released from the lake was regulated by a 7-foot-square butterfly valve supplied by a double conduit, equipped with two 6-foot-square sluice gates with invert at elevation 43 feet above msl, and two 48-inch-diameter pipes with invert at elevation 53 feet above msl controlled by 48-inch-diameter gate valves.

The drainage area above the Mathis Dam was 16,656 square miles.

The U. S. Soil Conservation Service made sedimentation surveys of Lake Corpus Christi in 1942 and 1948. The original capacity as estimated from the 1942 survey was 54,430 acre-feet at spillway crest elevation of 74 feet above msl. A tabulation of capacities and surface areas as determined from the sedimentation surveys are as follows:

Feature	Year	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Spillway crest	1934	74.0	54,430	5,493
Spillway crest	1942	74.0	43,800	5,493
Spillway crest	1948	74.0	39,390	5,484

Mathis Dam was submerged on April 26, 1958 by the lake (present Lake Corpus Christi) created by Wesley E. Seale Dam. Mathis Dam was breached by removing several feet of the embankment. The Mathis Dam taintor gates were removed prior to inundation.

Records of the contents of both the former and present Lake Corpus Christi from September 1948 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and in Water-Supply Papers of the U. S. Geological Survey since September 1948.

29. Eddleman Dam and Lake Eddleman

Location

Eddleman Dam and Lake Eddleman are in the Brazos River Basin in Young County, 2 miles northwest of Graham on Flint Creek, a tributary to Salt Creek, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Graham for providing a municipal and industrial water supply.

Authorization for construction was Permit No. 1061 (Application No. 1136) dated May 1, 1928 from the State Board of Water Engineers to the city of Graham. Water rights authorized the construction of a dam to impound 6,500 acre-feet of water and the annual use of 5,000 acre-feet for municipal water supply. This was amended by Permit No. 1747A (Application No. 2064) dated February 27, 1958 from the State Board of Water Engineers, which authorized enlarging Lake Eddleman to a storage capacity of 13,386 acre-feet. There was no increase in authorized appropriation of water under Permit No. 1747A, but 1,000 acre-feet of the original permitted use was changed from municipal to industrial for use by Texas Electric Service Company's electrical power generating plant.

Construction of the original dam began in 1928. It was completed, and impoundment of water was begun, in 1929. The enlargement was begun in 1957, and was completed in 1958.

This lake is no longer identified as Lake Eddleman as it is connected with a reservoir on Salt Creek to form Graham Lake, which is the official name of the combined reservoirs. For information on Graham Lake and Graham Dam, see page 170.

Physical Description

The original dam was an earthfill structure 1,400 feet long and 35 feet high with a bottom width of 190 feet and top width of 20 feet, and the top of the dam is at elevation 1,075.5 feet above msl. Rock riprap was placed on the upstream face of the dam.

The 1958 enlargement raised the spillway elevation 13 feet. The embankment was rebuilt to a height of 57 feet. The new dam is 4,495 feet long, 321 feet wide at the base, and 20 feet wide at the top. Elevation of the top of the dam is 1,090.0 feet above msl. A 2-foot thickness of rock riprap laid on a gravel base protects the upstream face. Some of the old riprap was re-used.

The original lake had a capacity of 6,580 acre-feet and a surface area of 373 acres at elevation 1,062.0 feet above msl. The enlargement increased the capacity to 13,200 acre-feet at elevation 1,075.0 feet above msl; the surface area at this elevation is 6,100 acres. This lake has been connected to a

reservoir on Salt Creek formed by Graham Dam with an excavated equalizing channel. The combined enlarged reservoir is known as Graham Lake.

The drainage area above the dam is 42 square miles, and the combined drainage area of Flint Creek and Salt Creek for the combined lake is 212 square miles.

A sedimentation survey of original Lake Eddleman in 1954 by the U. S. Soil Conservation Service showed the capacity had been reduced by 666 acre-feet through sedimentation during the period 1929 to 1954.

The spillway and water-diversion facilities for the combined project are described on page 170 under Graham Dam and Graham Lake.

30. Lake Walk Dam and Lake Walk

Location

Lake Walk Dam and Lake Walk are in the Rio Grande Basin in Val Verde County, 11 miles northwest of Del Rio on the Devils River, a tributary to the Rio Grande.

Ownership and History of Development

The project is owned and operated by Central Power & Light Company for generation of power, and was authorized by Permit No. 1077 (Application No. 1149) dated September 17, 1928 from the State Board of Water Engineers for the development of hydroelectric power. The Permit authorizes the use of water at the rate of 550 cfs, or 401,500 acre-feet per year. The usual flow is much less than this amount.

The project was started in December 1928, and was completed in May 1929. Impoundment of water began with the closure of the dam in May 1929, and power generation started May 17, 1929.

Physical Description

The dam is a slab and buttress-type reinforced concrete structure, 34 feet high and 650 feet long, including the powerhouse and non-overflow section. There is a walkway through the entire length of the dam with entrance above normal high water level at each end.

The lake has a capacity of 5,400 acre-feet with an area of 380 acres at spillway crest elevation of 1,001.0 feet above msl. At the beginning of operation, flashboards were installed on the spillway crest, but they are no longer used as the increased power potential did not justify their frequent replacement.

The drainage area above the dam is 4,104 square miles, but the supply of water to this lake is regulated by the operation of the power plant upstream at Devils Lake.

The spillway is an ogee apron over the piers, and is about 600 feet long. Moderate floods can be discharged without damage to the power plant or equipment; however, the floods of 1932, 1948, and 1954 were greatly in excess of any predicted flow, and considerable damage to the powerhouse and equipment occurred. The plant was repaired and placed in operating condition within a short time after each of these floods.

The only means of releasing water downstream from Lake Walk is either through the turbine or over the spillway. The turbine has automatic adjustable blades so that it can be operated efficiently with low flow. Water is required downstream for ranch use and for condenser-cooling purposes at the Devils River steam-electric generating plant where there is a small retention dam; continuous flow from Lake Walk is not required.

The project was built for production of hydroelectric power, and is a one-unit plant with a capacity of 1,350 kw. The turbine uses the total flow of the river except during flood periods. The plant is connected to the transmission system supplying the area with electric service. The S. Morgan Smith turbine in this plant was the first automatic adjustable blade turbine installed in the United States, and it is still giving good service.6/

This project, like Devils Lake, will be inundated when the reservoir formed by Amistad Dam on the Rio Grande is constructed.

31. Sweetwater Dam and Lake Sweetwater

Location

Sweetwater Dam and Lake Sweetwater are in the Brazos River Basin in Nolan County, 6 miles southeast of Sweetwater on Bitter and Cottonwood Creeks, tributaries of Clear Fork Brazos River, which is a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Sweetwater.

The dam was authorized by Permit No. 1053 (Application No. 1128) dated January 23, 1928 from the State Board of Water Engineers. The Permit authorizes impoundment of 10,000 acre-feet of water with diversion and use of 10,000 acre-feet per year for municipal and industrial purposes. Construction of Sweetwater Dam was begun in 1928, and was completed in 1930. Impoundment began in 1930. The lake was first filled to spillway level in 1936. Water was first diverted to the city filtration plant on June 14, 1935.

6/ Dowell, C. L., 1929, At last America accepts the Kaplan turbine: Power Plant Eng., v. 33, p. 757-760.
_____1930, Hydro efficiency increased 10 percent: Elec. World, v. 95, p. 684-686.
_____1931, Adjustable-blade turbine proves efficient at reduced loading: Elec. World, v. 97, p. 776-777.

Before the construction of Sweetwater Dam, water for the city of Sweetwater came from Lake Trammel and from wells located on the Watt Estate south of Roscoe. After June 14, 1935, water was obtained from both Lake Trammel and Lake Sweetwater. The wells were abandoned in 1936. In 1954, Oak Creek Reservoir became the main source of supply for Sweetwater and several other towns; Lake Trammel and Lake Sweetwater came to be used for recreation and as standby storage to meet peak demand. Make-up water for these two reservoirs can be pumped from Oak Creek.

See also the description of Oak Creek Dam and Oak Creek Reservoir on page 140.

Physical Description

The dam is a rolled-earth structure 2,600 feet long and 50 feet high with the top of the dam at elevation 2,128.8 feet above msl. The embankment has a top width of 20 feet. A spillway is located near the left end of the dam. The dam contains 662,000 cu yd of earth.

The lake has a capacity of 11,900 acre-feet and a surface area of 630 acres at elevation 2,116.5 feet above msl. One plan to increase Sweetwater's water supply is to raise the height of this dam, thereby increasing the capacity to 19,400 acre-feet. A reconnaissance survey of sedimentation of the reservoir was made in 1941 by the U. S. Soil Conservation Service, but a complete survey has not been made to determine the depletion of storage capacity by sedimentation.

The drainage area above the dam is 104 square miles.

Records of reservoir contents are contained in Bulletin 5807-A of the State Board of Water Engineers for the period January 1936 through September 30, 1957 and since January 1936 in Water-Supply Papers of the U. S. Geological Survey.

The spillway located near the left end of the dam has an uncontrolled, ogee, concrete crest 607.5 feet long at elevation 2,116.5 feet above msl. The discharge is to a channel cut in natural ground about 800 feet long.

An 18-inch outlet leads from the intake structure in the lake to the pump station downstream from the dam. The water is diverted for municipal supply, and is pumped through 14- and 12-inch pipelines about 36,200 feet to the filtration plant.

32. Waco Dam (Old) and Lake Waco

Location

Waco Dam and Lake Waco are in the Brazos River Basin in McLennan County, 2 miles west of Waco on the Bosque River, a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Waco for municipal water supply.

Water rights were obtained by the city with Permit No. 1115 (Application No. 1187) dated August 15, 1929 from the State Board of Water Engineers. This Permit authorized impoundment of 39,000 acre-feet of water with annual diversion of 85,000 acre-feet. Permit No. 1115 was amended by Permit No. 1931 (Application No. 2082) dated June 6, 1957 to allow the 39,000 acre-feet to be stored in the new Waco Reservoir described on page 214. By agreement with the U. S. Army Corps of Engineers, the city will have rights to 13,026 acre-feet (estimated capacity of present lake) of storage in the new reservoir, without cost, in exchange for land now owned by the city as part of the reservoir.

By an order of the State Board of Water Engineers dated October 13, 1960, which was accepted by the City Council of Waco, the annual diversion of 85,000 acre-feet authorized by Permit No. 1115 was reduced to 40,000 acre-feet. The order states that the 39,000 acre-feet of storage would not yield 85,000 acre-feet annual diversion; furthermore, the city of Waco had never used over 40,000 acre-feet annually. This order allowed contracts to be made regarding storage and water use in the new reservoir.

The project was started by the city of Waco in 1928, and was completed with impoundment of water in 1929. This lake will become a part of the new reservoir created when the Waco Dam, now under construction, is completed.

Physical Description

The dam is an earthfill structure 4,700 feet long and 65 feet high above the river channel with the top of the dam at elevation 442.0 feet above msl. The embankment has a maximum bottom width of 443 feet and top width of 20 feet. The upstream face of the embankment is paved with concrete placed on a sand base. A concrete spillway section and outlet works are part of the dam.

The reservoir had an original capacity of 39,378 acre-feet at spillway elevation 430.0 feet above msl. In 1936 the capacity had been reduced by sedimentation to 31,588 acre-feet, and by 1947 to 22,030 acre-feet with an area of 2,742 acres. Information in Permit No. 1931 (Application No. 2082) dated April 10, 1958 shows that the capacity of Lake Waco is estimated to be 13,026 acre-feet at the time of intentional impoundment of water in the new reservoir.

The drainage area above the dam is 1,649 square miles.

The spillway control consists of sixteen taintor gates, 25 feet wide by 15 feet high. The spillway crest elevation is 415.0 feet above msl. Over the years considerable damage has occurred to the area below the spillway section.

The outlet is a 6-foot by 7.5-foot arch-roof conduit through the dam with invert at elevation 382.6 feet above msl. The release is controlled by two broome-type gates. These outlets were to discharge sediment, but they have not been satisfactory for that purpose.

33. H-4 Dam and H-4 Reservoir

Location

H-4 Dam and H-4 Reservoir are in the Guadalupe River Basin in Gonzales County, 4 miles southeast of Belmont on the Guadalupe River.

Ownership and History of Development

The project is owned and operated by the Guadalupe Blanco River Authority for generation of power. The Authority purchased this and five other projects located on the Guadalupe River by a contract that became effective May 1, 1963. This and two other projects, TP-4 Dam (Lake Placid) and H-5 Dam (H-5 Reservoir), were owned by the Texas Hydro Electric Corporation. The other three projects--TP-1 Dam (Lake Dunlap), TP-3 Dam (Abbott Dam) forming Lake McQueeney, and TP-5 Dam (Lake Noltes)--were purchased from the Texas Power Corporation.

All these projects were authorized by Permit No. 1096 (Application No. 1163) dated June 12, 1929 from the State Board of Water Engineers. The Permit allows impoundment of 33,550 acre-feet of water in six reservoirs and annual use of 941,200 acre-feet for generation of hydroelectric power. This Permit includes water rights granted by Permit No. 21 (Application No. 21) dated July 25, 1914 from the State Board of Water Engineers to the Guadalupe Power Company.

Construction of the dam was begun in 1929 and completed in 1931 with impoundment of water and generation of power beginning at that time.

Physical Description

The dam is an earthfill structure with a steel, sheet-pile, core wall; concrete, gate-controlled, spillway section; and powerhouse. The structure is 5,100 feet long and 42 feet high with the top of the dam at elevation 345.0 feet above msl.

The reservoir has a capacity of 6,700 acre-feet and a surface area of 800 acres at elevation 331.0 feet above msl. Of this 6,700 acre-feet storage capacity, 5,400 acre-feet is conservation storage capacity and 1,300 acre-feet is dead storage capacity. The reservoir is maintained at practically constant level by regulating the power output to the water inflow.

The drainage area above the dam is 2,038 square miles.

The controlled spillway is regulated by two 85-foot-wide by 12-foot-high, automatic, roof-weir-type gates. An uncontrolled section provides excess flood flow discharge.

Water release is controlled by operation of the turbine for generation of power or from the spillway gates. This project like the others in the series of six developments is a run-of-river plant as there is only a small amount of regulating storage in each reservoir.

The power plant for this project is part of the dam structure. The power plant consists of one generating unit with all auxiliaries. Total generating capacity is 2,400 kw.

34. Santa Rosa Dam and Santa Rosa Lake

Location

Santa Rosa Dam and Santa Rosa Lake are in the Red River Basin in Wilbarger County, 15 miles south of Vernon on Beaver Creek, a tributary of the Wichita River, which is tributary to the Red River.

Ownership and History of Development

The project is presently owned and operated by the W. T. Waggoner estate.

Permit No. 976 (Application No. 1043) dated November 4, 1927 from the State Board of Water Engineers to the Waggoner Refining Company authorized construction of a concrete dam 16 feet high to impound 75 acre-feet of water. This structure was replaced by a new dam under Permit No. 1124 (Application No. 1198) dated August 15, 1929 from the State Board of Water Engineers to the Waggoner Refining Co. This Permit authorized impoundment of 7,000 acre-feet of water and the annual use of 3,000 acre-feet for stock raising and mining. Construction of the dam was started and completed in 1929. On January 1, 1931, the property and water rights were transferred by deed to the Santa Rosa Water Company. This company failed as a business, the company was dissolved, and the rights and title reverted back to the Waggoner estate (owner of Santa Rosa Water Company's stock) on June 30, 1934. Permit No. 1189 (Application No. 1245) dated September 22, 1931 to the W. T. Waggoner estate authorized the appropriation of 3,100 acre-feet of water annually for mining, milling, and manufacturing and 3,900 acre-feet for irrigation. The irrigation project was not developed, and water was not used for the purpose stated. With the approval of the Waggoner estate, Permit No. 1189 was cancelled November 17, 1947 by order of the State Board of Water Engineers. Water rights under Permit Nos. 976 and 1124 remain in use and in effect.

Physical Description

The dam described on the application for Permit No. 1124 is an earthfill structure 2,400 feet long with a maximum height above streambed of 41 feet. The upstream face has a slope of 3 to 1, and is paved with rock riprap. The average width of the base is 123 feet, and the dam is 15 feet wide at the top.

The lake has an estimated capacity of 11,570 acre-feet with a surface area of 1,500 acres at elevation 1,150.0 feet above msl. The water is used for oilfield operation, domestic use, and irrigation.

The drainage area above the dam is 336 square miles.

The water used is pumped directly from the lake.

35. Nasworthy Dam and Lake Nasworthy

Location

Nasworthy Dam and Lake Nasworthy are in the Colorado River Basin in Tom Green County, 6 miles southwest of San Angelo. The dam is on the South Concho River, which is tributary to the Concho River, which is tributary to the Colorado River.

Ownership and History of Development

Nasworthy Dam and Lake Nasworthy are presently owned by the city of San Angelo. The project was originally constructed by the West Texas Utilities Company under the water right granted to the company by Permit No. 1120 (Application No. 1196) issued by the State Board of Water Engineers on December 17, 1941. Permit No. 1120 authorized the construction of a dam across the South Concho River that would create a reservoir with a capacity of 10,500 acre-feet. It also provided for diversion from the reservoir of 25,000 acre-feet of unappropriated water per annum from the South and Middle Concho Rivers for industrial purposes, to meet the domestic requirements of the city of San Angelo, and to irrigate up to 5,000 acres of land. The irrigation provision was cancelled by the State Board of Water Engineers by an order dated February 10, 1961 pursuant to a cancellation waiver executed by the city of San Angelo, which had previously purchased the water right from the West Texas Utilities Company. Construction of Nasworthy Dam was begun in early 1929, and was completed in June 1930. Deliberate impoundment of water began March 28, 1930.

West Texas Utilities Company filed Application No. 1196 with the State Board of Water Engineers on March 11, 1929. The Concho Water Development Company filed Application No. 1175 on November 30, 1928. Since the two applications were overlapping, the State Board of Water Engineers entered an order on April 15, 1929 setting down the conditions and terms by which permits would be issued to the two applicants. Although Permit No. 1120 was not issued to the West Texas Utilities Company until 12 years later (December 1941), the provisions of the 1929 order were incorporated therein. In substance, the 1929 order provided that:

1. Permit No. 1120 be granted to West Texas Utilities Company (as finally written) on the condition that the company's dam may be submerged by and become a part of the project of the Concho Water Development Company.

2. A permit would be issued to the Concho Water Development Company to appropriate 200,000 acre-feet per annum from the South Concho River for irrigation, the operation of waterworks for cities and towns, the development of water supply and power for industrial and irrigation purposes, and the construction of a dam across the South Concho River creating a reservoir with capacity of 200,000 acre-feet. The permit would be granted on the condition that the Concho Water Development Company pay the West Texas Utilities Company for its dam, reservoir, and improvements; that the Concho Water Development Company enter into a contract with the West Texas Utilities Company to sell it the water necessary to satisfy commitments of the utilities company to supply water for the then present and future industrial and domestic needs of the city of San Angelo.

3. As the West Texas Utilities Company was granted a permit to appropriate water for the sole purpose of establishing a present and future adequate water supply for the city of San Angelo that, upon request, the excess water that it is permitted to store and impound for irrigation be sold to the Concho Water Development Company for irrigation.

The Concho Water Development Company's project wasn't constructed, so the State Board of Water Engineers on January 7, 1942 rescinded its order of April 15, 1929, relating to Application No. 1175.

Permit No. 1446 (Application No. 1551) was issued to the West Texas Utilities Company on April 9, 1948. This Permit amended Permit No. 1120 by authorizing raising of Nasworthy Dam to increase the impoundment to 12,500 acre-feet, providing additional storage water for domestic and industrial use for San Angelo and replacing storage capacity lost through sedimentation without increasing the amount of water allowed to be diverted under Permit No. 1120. The construction was completed in 1948.

Permit Nos. 1120 and 1446 were sold to the city of San Angelo in May 1950.

The cancellation order of February 10, 1961, partially cancelling Permit No. 1120 as amended by Permit No. 1446, included the further provision that the remaining authorized appropriation of 25,000 acre-feet per annum for municipal and industrial purposes is the same allowable appropriation included in Permit No. 1949 (Application No. 2122) issued to the San Angelo Water Supply Corporation on February 3, 1960 by the State Board of Water Engineers. The 25,000 acre-feet, authorized as a part of the 29,000 acre-feet of water to be appropriated annually under Permit No. 1949 for municipal purposes. The cancellation order is not intended to in any way increase or diminish the appropriation authorized under Permit No. 1949. Further information about Permit No. 1949 will be found under the description of Twin Buttes Dam and Twin Buttes Reservoir on page 190.

Nasworthy Dam and Lake Nasworthy, considered as one project, are among three major water development projects providing water supply, flood control, and recreation for the San Angelo area. The other two are San Angelo Dam and San Angelo Reservoir and Twin Buttes Dam and Twin Buttes Reservoir.

Physical Description

The Nasworthy Dam is an earthfill and concrete structure having a total length of 5,480 feet. The earthfill center section is 3,780 feet long with a top width of 20 feet and maximum height of about 50 feet. The center section is flanked by two emergency spillways, a service spillway, and an auxiliary spillway as described below.

The drainage area at Nasworthy Dam is 3,833 square miles, of which 1,178 square miles is probably noncontributing. After completion of Twin Buttes Dam, the flow to Lake Nasworthy will be regulated by the new reservoir.

Capacities and surface areas of the present lake at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,883.5	--	--
Crest of 600-foot emergency spillway	1,880.1	--	--
Crest of 300-foot emergency spillway	1,879.1	27,470	--
Top of service spillway taintor gates	1,873.2	13,990	--
Top of automatic floodgate (auxiliary spillway)	1,872.2	12,390	1,596
Top of base of automatic flood gate (auxiliary spillway)	1,869.2	8,210	1,210
Invert of two 24-inch outlet pipes	1,860.0	1,580	350
Crest of service spillway	1,855.3	435	160
Invert of 36-inch diameter low-flow outlet (outlet works)	1,836.0	0	--

Records of the contents of Lake Nasworthy from March 1930 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers, and in Water-Supply Papers of the U. S. Geological Survey since March 1930. Beginning in 1955 the figures for the lake contents have been adjusted for sedimentation.

Sedimentation surveys made by the U. S. Soil Conservation Service in December 1938 and May 1953 show that for the period March 1930 to December 1938, 1,191 acre-feet of sediment was deposited and from December 1938 to May 1953 an additional 1,023 acre-feet was deposited, making a total sedimentation of 2,214 acre-feet. Originally the lake had a usable capacity of 14,604 acre-feet, but the 1953 sedimentation survey indicates that this has been reduced to 12,390 acre-feet at elevation 1,872.2 feet above msl.

The service spillway is a concrete ogee section located on the left side of the earthfill dam section. The spillway is presently equipped with 15 taintor gates, 25 feet wide by 18 feet high. The taintor gate height was increased from 15 feet to 18 feet in 1948 under the terms of Permit No. 1446. This was accomplished by adding 3-foot-high rigid steel flashboards to the taintor gates. This permitted a 2-foot increase in the normal maximum lake level, and allowed a 1-foot freeboard as protection against erosion from wave action on the back of the gates. The flood discharge is controlled by one or more of the 15 taintor gates. On September 17, 1936, all gates were open and discharging at a combined peak rate of 111,000 cfs.

To the left of the service spillway is located a 25-foot-wide auxiliary spillway equipped with a 3-foot-high collapsible floodgate set to open automatically when the water in the lake reaches an elevation of 1,872.4 feet above msl.

To the right of the earthfill dam section are located two emergency spillways. The first one is 300 feet wide with a crest elevation of 1,879.1 feet

above msl. The second is 600 feet wide with a crest elevation of 1,880.1 feet above msl.

The outlet works consist of two, 36-inch, sluice gates located near the center of the service spillway. Invert elevation is 1,836.0 feet above msl. In addition there are two 24-inch pipes with invert elevation of 1,860.0 feet above msl that are located near the ends of the dam. The one at the right end is used to furnish water for a fish hatchery, and the one near the left end is used to help control the lake level.

36. Mountain Creek Dam and Mountain Creek Lake

Location

Mountain Creek Dam and Mountain Creek Lake are in the Trinity River Basin in Dallas County, 4 miles southeast of Grand Prairie on Mountain Creek, a tributary to the West Fork Trinity River, which is tributary to the Trinity River.

Ownership and History of Development

Mountain Creek Dam and Lake are presently owned by the Dallas Power and Light Company. The water right under which the dam was constructed was Permit No. 1167 (Application No. 1243) originally issued to E. S. Heyser by the State Board of Water Engineers October 20, 1931. E. S. Heyser transferred his rights and interest in the Permit prior to its issuance to Joe A. Worsham, who transferred his rights and interest in the Permit to the Dallas Power and Light Company about August 1930.

Permit No. 1167 authorizes construction of a dam across Mountain Creek that will create a lake with a capacity of 40,000 acre-feet. It also authorizes appropriation of 15,000 acre-feet of water per annum for cooling and condensing purposes for the Dallas Power and Light Company's Mountain Creek Steam-Electric Station.

Construction of the dam began in 1929. The State Board of Water Engineers, upon petition by the Dallas Power and Light Company, granted two extension-of-time permits prolonging the construction deadline under Permit No. 1167 from October 20, 1933 to October 20, 1937. By 1934 the construction of the dam was complete except for installation of the gates in the spillway. The gates were installed in December 1936, and impoundment was begun about January 1937. The steam-electric generating station went into operation in June 1938.

The Dallas Power and Light Company requested an order clarifying Permit No. 1167 concerning losses of water by seepage or natural evaporation. Accordingly, the State Board of Water Engineers on April 24, 1937 ordered that the Dallas Power and Light Company was entitled to the beneficial use of 15,000 acre-feet of water per annum, exclusive of any water lost from its reservoir by seepage or natural evaporation.

In 1953 the level of the lake was raised. This will be described in the following section.

Physical Description

The dam is a rolled-earth structure 8,200 feet long of trapezoidal cross section with a maximum height of 36 feet, top width of 21 feet, and maximum base width of 167 feet. A railroad spur is built on the top of the dam that runs its full length.

The drainage area of the Mountain Creek watershed at the dam is 295 square miles.

Capacities of the present lake at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	467.0	--	--
*Top of spillway taintor gates	458.0	27,000	2,940
Spillway crest	431.0	--	--

* Elevation of top of taintor gates was raised in 1953 from 457.0 to 458.0 feet above msl.

Records of elevation of water level of Mountain Creek Lake since March 24, 1937 are contained in the files of the U. S. Geological Survey.

Sedimentation surveys of Mountain Creek Lake were made in 1946 and 1952 for the Dallas Power and Light Company by Ebasco Services Incorporated. Ebasco's report "Mountain Creek Reservoir 1952 Siltation Survey" (March 1953) presents the results of the surveys, and compares them with the lake at the time of gate closure in 1937. The results show that the volume of the lake decreased 10,400 acre-feet (below elevation 457 feet above msl) between 1937 and 1952. Of this amount, 8,230 acre-feet of sedimentation occurred from 1937 to 1946, and 2,170 acre-feet from 1946 to 1952. This is an average annual rate of 850 acre-feet per year from 1937 to 1946, and 360 acre-feet per year from 1946 to 1952.

Outflow from the lake is controlled by a concrete spillway located near the center of the dam, which is equipped with six taintor gates 34 feet long by 27 feet high.

37. Brownwood Dam and Brownwood Reservoir

Location

Brownwood Dam and Brownwood Reservoir are in the Colorado River Basin in Brown County, 8 miles north of Brownwood on Pecan Bayou, a tributary of the Colorado River.

Ownership and History of Development

The project is owned and operated by the Brown County Water Improvement District No. 1.

The dam was built under Permit No. 1036 (Application No. 1085) issued to the Brown County Water Improvement District No. 1 on December 3, 1929 by the State Board of Water Engineers. This Permit authorizes construction of a reservoir of 125,000 acre-feet capacity, and allows diversion of 16,800 acre-feet of water annually for municipal, industrial, and domestic purposes and the use of 50,590 acre-feet of water to irrigate land not to exceed 25,295 acres. Any amount of the above allotments may be used for the generation of hydroelectric power. The water for municipal use supplies the cities of Brownwood, Bangs, Early, and Santa Anna.

The project was started in 1930, and was completed in 1933. The reservoir was filled during a large flood in 1932, but the water was released to enable completion of the dam. Deliberate impoundment began in July 1933.

During the drouth of 1934, water was released from Brownwood Reservoir for irrigation use near Bay City, about 500 miles downstream. See the full account of the results of this release in Texas Board of Water Engineers Bulletin 5807-D.

Physical Description

The dam is of earthfill construction, 1,580 feet long and 120 feet high with the top of the dam at elevation 1,449.5 feet above msl. The top width is 21 feet and maximum bottom width is 600 feet. An uncontrolled spillway is located about 800 feet to the left of the structure.

The reservoir has a capacity of 143,400 acre-feet and a surface area of 7,300 acres at spillway crest elevation 1,424.6 feet above msl. Other features are given in the following tabulation:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,449.5	--	--
Spillway crest	1,424.6	143,400	7,300
Invert to irrigation outlet	1,405.5	46,510	3,150
Invert to 12-foot outlet	1,329.5	--	--

Sedimentation surveys were made by the U. S. Soil Conservation Service in 1934, 1940, 1948, and 1959. The volume of sediment deposited during the period July 1, 1932 to September 7, 1959 was computed to be 13,962 acre-feet.

Records of contents from July 1933 to May 1941 and November 1944 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from July 1933 to May 1941 and since November 1944 in Water-Supply Papers of the U. S. Geological Survey.

The drainage area above the dam is 1,535 square miles.

The spillway is through a deep cut to the left end of the dam. The crest is a 2-foot-wide concrete wall forming a broad-crested weir section 479 feet long at elevation 1,424.6 feet above msl.

Near the center of the dam are located the service outlets, which are two, 12-foot, horseshoe-shaped concrete conduits controlled by broome-type gates operated from the gate tower, that provide regulated release to Pecan Bayou. Invert elevation is 1,329.5 feet above msl.

The Brown County Water Improvement District No. 1 withdraws water from the reservoir for municipal, industrial, and irrigational use through a 5-foot-diameter, circular, concrete conduit that feeds a concrete-lined canal. The District owns and operates the filtration plant that supplies water for municipal use to the cities of Brownwood, Bangs, Early, and Santa Anna. The water is obtained from the concrete canal starting at Brownwood Reservoir. Diversion into the canal began on April 9, 1939.

Brownwood project has a Federal authorization under the Flood Control Act of August 18, 1941 for enlargements of the existing dam, improvement of the present spillway, and increase of the reservoir capacity. The proposal is to use the increased capacity for flood control, conservation, recreation, and wildlife purposes. A restudy of the project design is under consideration by the U. S. Army Corps of Engineers, Fort Worth District. The study was impelled by endangerment of the safety of the dam through deterioration of the spillway. In addition, the Corps of Engineers considers the present spillway to have inadequate discharge capacity.

38. Bridgeport Dam and Bridgeport Reservoir

Location

Bridgeport Dam and Bridgeport Reservoir are in the Trinity River Basin in Wise County, 4 miles west of Bridgeport on the West Fork Trinity River, which is tributary to the Trinity River. Most of the reservoir area is in Wise County, but the upper end extends into Jack County.

Ownership and History of Development

Bridgeport Dam and Bridgeport Reservoir are presently owned and operated by Tarrant County Water Control and Improvement District No. 1. The project was constructed by the District under the water right granted by Permit No. 1073 (Application No. 1144), which was issued to the District on May 1, 1928 by the State Board of Water Engineers. The Permit bears a priority date of July 6, 1926 (10:00 A.M.) derived from the filing time of a presentation submitted by the District. Permit No. 1073 authorizes: impoundment, for beneficial use, of 290,000 acre-feet of water by construction of a dam across the West Fork Trinity River; appropriation of 52,000 acre-feet of water per annum for irrigation of 26,000 acres of land within Wise County Water Control and Improvement District No. 1 at the maximum rate of 2 acre-feet per annum per acre; transportation of 93,000 acre-feet of water per annum by the bed and banks of the West Fork Trinity River to Eagle Mountain Reservoir. This reservoir was authorized for construction by Permit No. 1074 (Application No. 1145), which was also issued on May 1, 1928 to Tarrant County Water Control and Improvement District No. 1 by the State Board of Water Engineers. From Eagle Mountain Reservoir the water continues downstream to the city of Fort Worth's Lake Worth and other points for beneficial use.

Bridgeport Dam and Bridgeport Reservoir. Furnished by Tarrant County Water Control and Improvement District No. 1.

The contract for construction of Bridgeport Dam and Eagle Mountain Dam was awarded January 23, 1930. Bridgeport Dam was accepted as being completed on December 15, 1931. Impoundment began April 1, 1932.

Permit No. 1253 (Application No. 1338) was issued to the District on February 28, 1938 by the State Board of Water Engineers as an amendment to Permit No. 1073. Permit No. 1253 grants the additional use of water in Bridgeport Reservoir--without any additional diversion of water--for "recreation and pleasure, and to serve as parks, pleasure resorts, and fishing and game preserves."

Bridgeport Reservoir is operated in conjunction with Eagle Mountain Reservoir and Lake Worth for flood control and as a municipal and industrial water supply for Fort Worth and surrounding areas. According to annual water service reports filed with the Texas Water Commission, no water has been used for irrigation.

Physical Description

Bridgeport Dam is a rolled-earth dam that, together with a 60-foot-wide concrete spillway at the right end of the earthen embankment, makes up a total length of 1,900 feet. The dam is about 100 feet high, 25 feet wide at the top, and 600 feet wide at the bottom. A paved roadway is built along the top of the dam.

The drainage area of the West Fork Trinity River at Bridgeport Dam is 1,111 square miles.

Capacities and surface areas based on a survey made in 1956 at elevations shown are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	863.1	--	--
Crest of left emergency spillway	859.1	--	--
Crest of right emergency spillway	853.1	665,900	18,200
Crest of service spillway	826.2	270,900	10,400
Invert of one 48-inch low-flow-outlet valve (outlet works) that is higher than the other three 48-inch valves	752.2	--	--
Invert of three 48-inch diameter low-flow-outlet valves (outlet works)	751.5	0	0

Records of the contents of Bridgeport Reservoir from May 1932 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and since April 1932 in Water-Supply Papers of the U. S. Geological Survey.

The service spillway is a concrete section, located to the right of the earthfill dam section, and consists of three 20-foot-wide bays with crest at elevation 826.2 feet above msl. The left and middle bays are controlled by vertical lift gates while the third is uncontrolled.

There are two natural-ground emergency spillways. One is 1.6 miles to the right of the main dam with crest elevation of about 853.1 feet above msl. The other is 0.4 mile to the left of the main dam with crest elevation of about 859.1 feet above msl.

The outlet works consist of a double-barreled concrete conduit extending through the dam. Each barrel is approximately 12 feet in diameter. There are two 48-inch valves in each conduit, operated from a control house above the conduit and upstream from the top of the dam. The invert elevation of one of the valves is slightly higher than the other three.

There is a levee dam (Berkshire Levee) 4,100 feet long located on the right side of the river about 3.5 miles south of the main dam. Water will reach this levee at a stage above 835.1 feet above msl.

Sedimentation surveys were made by the U. S. Army Corps of Engineers and others in 1952 and 1956.

39. Eagle Mountain Dam and Eagle Mountain Reservoir

Location

Eagle Mountain Dam and Eagle Mountain Reservoir are in the Trinity River Basin in Tarrant County, 14 miles northwest of Fort Worth on the West Fork Trinity River, which is tributary to the Trinity River. Most of the reservoir area is in Tarrant County, but the upper end extends into Wise County.

Ownership and History of Development

Eagle Mountain Dam and Eagle Mountain Reservoir are presently owned and operated by the Tarrant County Water Control and Improvement District No. 1. The project was constructed by the District under the water right granted by Permit No. 1074 (Application No. 1145), which was issued to the District on May 1, 1928 by the State Board of Water Engineers. The Permit bears a priority date of July 13, 1925 (10:00 A.M.) derived from the filing time of a presentation submitted by the District. Permit No. 1074 authorizes: impoundment, for beneficial use, of 210,000 acre-feet of water by construction of a dam across the West Fork Trinity River; and appropriation of 162,000 acre-feet of water per annum for supplying the present and potential needs of the city of Fort Worth, the supply of industrial demands within the District, and the irrigation of lands situated in the District and in Tarrant County. The Permit authorizes irrigation of 20,880 acres of land at the maximum rate of 2 acre-feet per acre per annum. The Permit further authorizes the use of the bed and banks of the West Fork Trinity River to transport water from Eagle Mountain Reservoir to Lake Worth. From Lake Worth water is delivered for municipal uses for the city of Fort Worth, and for industrial uses within the District. The water for irrigation is distributed by gravity canals.

Eagle Mountain Dam. Furnished by Tarrant County Water Control and Improvement District No. 1.

The contract for construction of Eagle Mountain Dam and Bridgeport Dam was awarded January 23, 1930. Eagle Mountain Dam was accepted as completed on October 24, 1932. Impoundment began on February 28, 1934.

Permit No. 1254 (Application No. 1339) was issued to the District on February 28, 1938 by the State Board of Water Engineers as an amendment to Permit No. 1074. Permit No. 1254 grants the additional use of water in Eagle Mountain Reservoir--without any additional diversion of water--for the purpose of "recreation and pleasure, and to serve as parks, pleasure resorts and fishing and game preserves."

Permit No. 1682 (Application No. 1812) was issued to the District by the State Board of Water Engineers on September 30, 1953 as an amendment to Permit No. 1074. Permit No. 1682 authorizes, in addition to that granted under Permit No. 1074, the following: to furnish water to any municipality or community now created or existing within the boundaries of the District; to furnish irrigation water to individual irrigators, whose lands are within the area described in the original Permit No. 1074 as covered for irrigation, either through the bed and banks of the West Fork Trinity River or through raw water conduits, to use the bed and banks of the West Fork Trinity River to flow water to any user having a lawful right thereto, after approval by the State Board of Water Engineers of the contemplated diversion facilities; to take water for municipalities, industries, and irrigators from intakes located at Eagle Mountain Reservoir in Tarrant County, as well as at points in the bed and banks of the West Fork Trinity River, with the limitation that diversions will not be made until approval is given by the State Board of Water Engineers.

The Texas Water Commission issued a special minute order on October 9, 1962 approving application for amendment to construction plans under Permit No. 1074. The order granted permission to the District to construct an emergency spillway known as the Burgess Gap Spillway. The spillway construction consists of excavation and fill to widen and realign the existing country spillway, to improve its discharge characteristics, and to increase the discharge capacity. The emergency spillway will have a 6-foot-high fuse plug that will increase the floodwater retarding capabilities of the structure, without jeopardizing the dam, by providing an additional 106,640 acre-feet of surcharge storage.

Eagle Mountain Reservoir regulates floodflow through coordination with Bridgeport Reservoir upstream. Water is released from Eagle Mountain Reservoir to Lake Worth to maintain it at normal maximum operating level as water is withdrawn from Lake Worth for use by the city of Fort Worth. Water is taken directly from Eagle Mountain Reservoir for condenser-cooling water for a 290,000 kw, steam-electric, generating plant belonging to Texas Electric Service Company.

Physical Description

Eagle Mountain Dam is a composite rolled-earth and hydraulic-fill earth structure with the fills being separated by the intervening high ground of Eagle Mountain and Burgess Gap. The main dam is to the left of Eagle Mountain. A concrete service spillway is located in the section to the right of Eagle Mountain. The Burgess Gap emergency spillway is located approximately 1,000 feet to the left of the service spillway.

The drainage area of the West Fork Trinity River at Eagle Mountain Dam is 1,970 square miles.

Capacities and surface areas of the reservoir at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	682.0	--	--
Crest of Burgess Gap emergency spillway	676.0	547,900	19,000
Base of Burgess Gap emergency spillway fuse plug	670.0	441,200	--
Crest of service spillway	649.1	182,700	8,500
Invert of low-flow outlet (outlet works)	599.9	0	0

The original capacity of the reservoir was 214,000 acre-feet at the crest of the service spillway (elevation 649.1 feet above msl). A survey made in October 1952 by the U. S. Army Corps of Engineers and others revealed that this capacity had been reduced by sedimentation to 182,700 acre-feet.

Records of the contents of Eagle Mountain Reservoir from February 1934 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and since February 1934 in Water-Supply Papers of the U. S. Geological Survey.

The service spillway, located to the right of Eagle Mountain, is a concrete section consisting of four 25-foot-wide bays with crest at elevation 649.1 feet above msl. All except the extreme left bay, which is uncontrolled, are equipped with vertical-lift gates.

The present emergency spillway, Burgess Gap Spillway, is 1,300 feet wide with a crest elevation of 676.0 feet above msl (top of fuse plug). The fuse plug levee runs the full width of the spillway with base elevation of 670.0 feet above msl.

The outlet works consist of four 48-inch outlet gates located in a gate house near the left end of the main dam. The invert elevation of all of the outlet conduits is at 599.9 feet above msl.

40. Red Bluff Dam and Red Bluff Reservoir

Location

Red Bluff Dam and Red Bluff Reservoir are in the Rio Grande Basin in Reeves and Loving Counties, 5 miles north of Orla on the Pecos River, a tributary to the Rio Grande. The reservoir extends into Eddy County, New Mexico.

Ownership and History of Development

The project is owned and operated by the Red Bluff Water Power Control District under the water right granted by Permit No. 1217 (Application No. 1295), which was issued to the District by the State Board of Water Engineers on January 15, 1934. Permit No. 1217 authorized the construction of a reservoir to impound 300,000 acre-feet of water with annual use of 300,000 acre-feet for hydroelectric power generation and irrigation of 145,000 acres of land in Reeves, Loving, Ward, and Pecos Counties.

The development of irrigation in the Lower Pecos River Basin (that portion of the Pecos River Basin in Texas between the Texas-New Mexico state line and the mouth of the Pecos River) by diversion from the main stream of the Pecos River began in the middle 1870's. However, there was no important activity until 1888. Beginning in that year there was an era of dam and canal building that by 1914 resulted in work having been completed or started on 10 projects for irrigating directly from the Pecos River. These 10 projects or river systems were: (1) Imperial (Buenavista) Irrigation Company System, now the Pecos County Water Improvement District No. 2; (2) Arno System, now abandoned; (3) Porterville Irrigation System, now the Loving County Water Improvement District No. 1; (4) Farmers' Independent Canal Company System, now the Reeves County Water Improvement District No. 2; (5) Cedarvale (Biggs) Irrigation System, now the Ward County Water Improvement District No. 3; (6) Barstow Irrigation Company System, now the Ward County Irrigation District No. 1; (7), (8) Grandfalls Irrigation Company System and Big Valley Irrigation Company System, which are now in the Ward County Water Improvement District No. 2; (9) Zimmerman Irrigation Company System, now the Pecos County Water Improvement District No. 3; and (10) Victor Pumping Plant, now abandoned.

In January 1914 the 10 river systems organized the West Texas Reclamation Association and retained P. M. Fogg, a Reclamation Service Engineer, to investigate the Texas development and make recommendations concerning project rehabilitation, including the provision of storage. Fogg recommended the construction of a dam that would create a reservoir to supply all 10 of the irrigation systems. The site for the dam was in New Mexico about 2 miles north of the state line.

On the basis of Fogg's recommendations, the 10 river systems organized into the Pecos Valley of Texas Water Users Association. In 1916, the Association petitioned the Secretary of the Interior to grant aid from the U. S. Reclamation Service in constructing Red Bluff Dam and Red Bluff Reservoir and for loans to finance the rehabilitation of deteriorated project works. The Association requested engineering services and $2,500,000 in financial aid for construction of the dam and general rehabilitation of project works. In addition, they requested that the U. S. Government supervise the apportionment of Pecos

River water not only between New Mexico and Texas, but among users in Texas itself. The petition was not acted upon for several years.

In 1917, the seven surviving lower basin systems (Porterville, Farmers' Independent, Cedarvale, Barstow, Big Valley-Grandfalls, Imperial, and Zimmerman) dissolved the water users association and reincorporated as a water improvement district. On November 30, 1927, the Red Bluff Water Improvement District was created by the State Board of Water Engineers. The water improvement district became the Red Bluff Water Power Control District in 1933.

The District began studies on the Red Bluff project and enlisted State and Federal agencies in preparing additional studies. In the early 1930's, the District sought to obtain funds from one of the Federal emergency-spending agencies to finance the construction of the proposed Red Bluff Dam and Red Bluff Reservoir. In 1933 the construction was approved as a project of the U. S. Public Works Administration. Subsequently, the District's bonds were purchased by the Reconstruction Finance Corporation.

Actual construction began in November 1934, and was completed in September 1936 at a cost of $2,600,000. The final site of the dam was located about 8 miles south of the Texas-New Mexico state line instead of 2 miles north of the state line as recommended by Fogg. Impoundment began upon completion of construction in September 1936. Water use began in 1937. The reservoir was first filled in June 1937. Power generation began June 6, 1937.

The division and apportionment of the use of the waters of the Pecos River is provided for by the Pecos River Compact of 1948 between Texas and New Mexico. The Compact created an interstate agency known as the Pecos River Commission for administration of the provisions of the Compact. The Commission is composed of one commissioner representing each of the States of New Mexico and Texas, and, if designated by the President, one commissioner representing the United States.

Physical Description

Red Bluff Dam consists of three sections: a main earthfill embankment across the Pecos River, an uncontrolled emergency spillway to the right of the main embankment, and a concrete controlled spillway located in a cut to the right of the emergency spillway and against the hills on the right side of the valley. The main embankment is 9,200 feet long and 102 feet high with a 25-foot crown width. The upstream slope of the embankment is 3 to 1; the downstream slope is 2 to 1. The earth embankment has rock riprap on both upstream and downstream embankments at critical areas.

The reservoir has a capacity of 310,000 acre-feet and a surface area of 11,700 acres at elevation 2,841.7 feet above msl. The inflow varies greatly. Some years there is no water for power generation, and the irrigation supply is limited.

Other capacities are given in the following tabulation:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Crest of emergency spillway	2,844.7	345,000	--
Top of taintor gates	2,841.7	310,000	11,700
Crest of service spillway	2,826.7	166,500	--
Invert of concrete outlet conduits	2,763.7	3,000*	--

* Dead storage.

The drainage area above Red Bluff Dam is 20,720 square miles.

Record of contents from February 1937 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from February 1937 in Water-Supply Papers of the U. S. Geological Survey.

The concrete service spillway is equipped with twelve taintor gates 25 feet wide by 15 feet high. The spillway is an ogee section with crest at elevation of 2,826.7 feet above msl.

The emergency spillway has a crest length of 790 feet at elevation 2,844.7 feet above msl. The spillway was excavated from natural-earth.

The outlet structure consists of a surge tower supplied by two parallel concrete outlet conduits 7.5 feet wide by 9.0 feet high each, which draw water from the reservoir. From this surge tower water can be bypassed for irrigation purposes through two parallel concrete conduits 7.75 feet wide by 7.0 feet high, which are controlled by 48-inch gate valves. Two circular, steel penstocks extend from the surge tower to the turbines. The penstock for turbine 1 is 6.5 feet in diameter, and is controlled by a 7-foot butterfly valve. The penstock for turbine 2 is 5.5 feet in diameter, and is controlled by a 6-foot butterfly valve.

The power plant contains two generating units and all auxiliaries. The two generating units have a combined capacity of 2,300 kw.

All irrigation releases from the reservoir are made at continuous, uniform rates through the bypass valves or the turbines, but no releases are made solely for the generation of power. Reservoir releases are withdrawn from the Pecos River at seven diversion dams ranging between a site near Menton and one about 11 miles above Grand Falls. Electricity generated at Red Bluff Dam is transmitted to the District's electrical distribution system center at Grand Falls. The sale of electric power is a major source of income to the District.

41. Monte Alto Dam and Monte Alto Reservoir

Location

Monte Alto Dam and Monte Alto Reservoir are in the Nueces-Rio Grande Coastal area in Hidalgo County, 4 miles north of Monte Alto. The reservoir, shown on early maps as Mestenas Reservoir, also is known as Willacy Reservoir. It is an off-channel storage reservoir to the Rio Grande.

Ownership and History of Development

The project is owned and operated by the Hidalgo-Willacy Counties Water Control and Improvement District No. 1 of Edcouch.

The water rights were obtained by Permit No. 1110 (Application No. 1174) dated January 9, 1930 from the State Board of Water Engineers. Originally the Permit was issued to the Union Irrigation District. The Permit allows diversion from the Rio Grande floodwaters of a flow of 260,000 acre-feet of water annually for irrigation of 129,000 acres of land. The reservoir is to store excess water that otherwise would be wasted.

The project was built over a period of years with many delays during the early stage of financing and sale of bonds. The first canals were built in 1936. Monte Alto Reservoir was constructed in 1939, and deliberate impoundment of water began that year. The water service report filed with the Texas Water Commission for 1962 indicates that 72,920 acre-feet of water was diverted from the Rio Grande into the canal system.

Physical Description

The dike creating the reservoir is about 12 miles long with an average height of 17 feet with a freeboard of 5 feet. The dike and reservoir are in Hidalgo County, but the diversion from the Rio Grande is in Cameron County.

Monte Alto Reservoir has a capacity of 25,000 acre-feet and a surface area of 2,371 acres at elevation 56.5 feet above msl. Water is diverted from the Rio Grande, in Cameron County, by a gravity canal system. From this main canal, water is diverted to another canal known as Mestenas Canal for distribution to land during the irrigation season or to a pumping plant that lifts surplus water to Monte Alto Reservoir for storage. When needed for irrigation, this water is released by gravity from the reservoir back to the Mestenas Canal for distribution.

42. Inks Dam and Inks Lake

Location

Inks Dam and Inks Lake are in the Colorado River Basin in Burnet and Llano Counties, 10 miles west of Burnet on the Colorado River, 3 miles below Buchanan Dam at river mile 499.4.

Ownership and History of Development

The project is owned and operated by the Lower Colorado River Authority as one of a series of six dams and reservoirs on the Colorado River. The other five are: Buchanan Dam and Buchanan Reservoir, Wirtz (Alvin) Dam and Granite Shoals Lake, Starcke (Max) Dam and Marble Falls Lake, Mansfield Dam and Lake Travis, and Miller (Tom) Dam and Lake Austin. All of these are described in this bulletin.

The dam was authorized by Permit No. 1259A (Application No. 1345) dated May 28, 1938 from the State Board of Water Engineers to the Lower Colorado River Authority. The Permit authorizes the use of 1,391,530 acre-feet of water annually for municipal, irrigational, mining, and hydroelectric power uses (same as Buchanan Dam Permit). Several other water rights are included in Permit No. 1259A, which recognizes earlier water rights of the Lower Colorado River Authority. These water rights and the history of their acquisition are as follows:

> Certified Filing No. 423 filed with the State Board of Water Engineers on June 30, 1914 by E. C. Alexander refers to ownership of rights by virtue of prior filings and applications in connection with which water is to be utilized for mining, milling, manufacturing, power, waterworks, and stock raising and which prior filings and applications were renewed for the construction of a dam at Lohman Narrows. (The project became known as Alexander Dam located below Marble Falls.) Between 1914 and 1919 these rights passed to C. H. Alexander and the Syndicate Power Company. All these C. H. Alexander interests seem to be in a partnership with John N. Simpson of Dallas, who also had early water rights and owned considerable land on the Colorado River. The Alexander and Simpson Project is mentioned in some of the letters in the files of the Texas Water Commission. For later permits, Permit Nos. 951-55 and 998, the Syndicate Power Company claimed the exclusive prior rights to the appropriation and use of such waters within the area covered by six applications for water permits pertaining to the appropriation and use of such waters as existed prior to June 29, 1913.

The Lower Colorado River Authority is owner of Permit Nos. 951-55 and 998 by virtue of the following conveyances: (a) From Syndicate Power Company to Ward Arnold and Jay Alexander dated July 30, 1928 (Permit Nos. 951 and 952 only); (b) from Syndicate Power Company to Emery, Peck & Rockwood Development Company dated July 19, 1929; (c) from Ward Arnold and Jay Alexander to Emery, Peck & Rockwood Development Company dated July 19, 1929; (d) from Emery, Peck & Rockwood Development Company to Central Texas Hydro-Electric Company dated November 5, 1931; (e) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to Colorado River Company dated October 5, 1934; (f) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to C. G. Malott dated October 5, 1934; (g) from Colorado River Company to Lower Colorado River Authority dated August 9, 1935; (h) from C. G. Malott to Lower Colorado River Authority dated August 9, 1935.

Construction of the dam began in 1936, and was completed in 1938 with impoundment of water beginning at that time. The power unit began operation in June 1938.

Physical Description

The dam is a concrete gravity structure with an uncontrolled ogee spillway with crest length of 780 feet at elevation 888.0 feet above msl. A non-overflow section with top at elevation 992.0 feet above msl is 620 feet long, and contains the penstock, headgate, and equipment for operating the headgate.

The lake has a capacity of 17,000 acre-feet and a surface area of 830 acres at spillway crest elevation of 888.0 feet above msl. This lake is considered a constant level one because the normal turbine discharge is coordinated with the inflow from Buchanan Reservoir so that the day-to-day fluctuation is small. However, during periods of floods the lake level will vary considerably.

The drainage area is 31,290 square miles, of which 11,900 square miles is probably noncontributing. However, Buchanan Reservoir, 3 miles upstream, is a storage reservoir, and regulates the riverflow to a considerable extent.

Sedimentation studies have not been made for this lake, and are unimportant from the standpoint of power generation since storage is maintained by water released from Buchanan Reservoir.

Records of daily lake elevations are maintained by the Lower Colorado River Authority as unpublished data.

The water in Inks Lake is used principally for power generation, but the lake shoreline has developed into recreational and residential areas with some water being diverted directly from the lake for domestic purposes.

The spillway is an uncontrolled, ogee, gravity section of the dam with a crest length of 780 feet at elevation 888.0 feet above msl. It is designed to pass the maximum discharge from the Buchanan Dam floodgates.

There are no low-flow outlets required because water releases are made through the turbine as normal operation; the water released enters Granite Shoals Lake immediately downstream.

The power plant contains one 12,500 kw generating unit with all auxiliary equipment. It is operated by remote control from Buchanan Plant and the output coordinated with the discharge from that plant.

Listed below are pertinent data on Inks Dam and Inks Lake.

Height of dam	98.5	feet
Length of dam	1,550	feet
Top of dam	992.0	feet above msl
Spillway crest elevation	888.0	feet above msl
Lake area	830	acres
Lake volume	17,000	acre-feet
Length of lake	3	miles
Maximum width of lake	0.57	mile
Shoreline	20	miles

43. Mansfield Dam and Lake Travis

Location

Mansfield Dam (originally Marshall Ford Dam) and Lake Travis are in the Colorado River Basin in Travis County, 12 miles northwest of Austin on the Colorado River at river mile 318.0. Lake Travis extends into Burnet and Llano Counties.

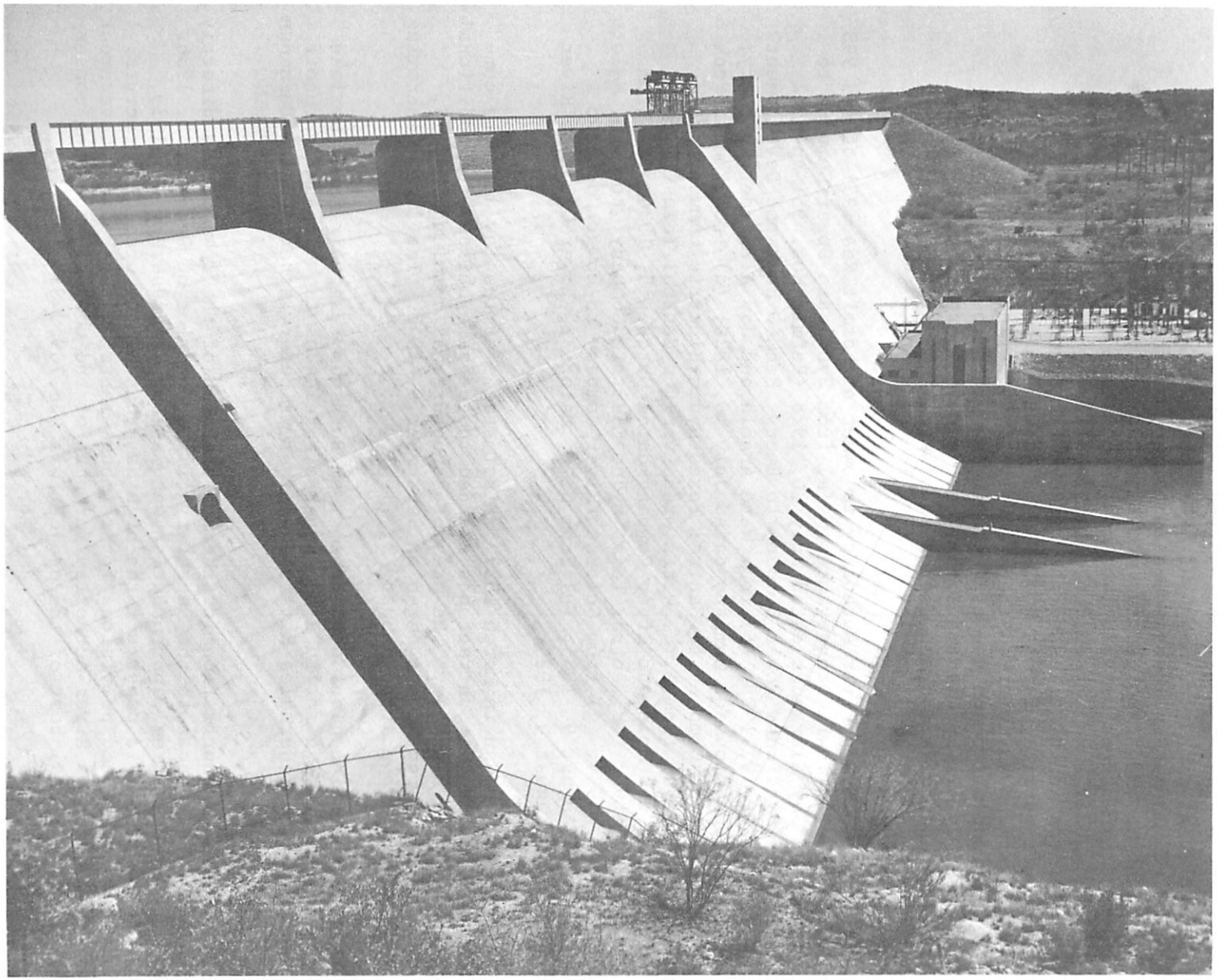
Ownership and History of Development

The dam was built by the U. S. Bureau of Reclamation for the purposes set forth in the Permit No. 1260 (described below) but with the additional purpose of flood control. The Lower Colorado River Authority built and owns the power facilities. It operates the project in coordination with five other projects on the Colorado River for generating hydroelectric power and for supplying water for municipal, industrial, and irrigational purposes. The other five are: Buchanan Dam and Buchanan Reservoir, Inks Dam and Inks Lake, Wirtz (Alvin) Dam and Granite Shoals Lake, Starcke (Max) Dam and Marble Falls Lake, and Miller (Tom) Dam and Lake Austin. The lake provides the main flood-control storage on the Colorado River.

The project was authorized by Permit No. 1260 (Application No. 1346) dated May 25, 1938 from the State Board of Water Engineers to the Lower Colorado River Authority. The Permit grants the right to appropriate 1,500,000 acre-feet of water annually for municipal, irrigation, mining, recreation, and hydroelectric power uses.

Several other water rights are included in Permit No. 1260, which recognizes earlier water rights of the Lower Colorado River Authority. These water rights and the history of their acquisition are as follows:

> Certified Filing 423 filed with the State Board of Water Engineers on June 30, 1914 by E. C. Alexander refers to ownership of rights by virtue of prior filings and applications in connection with which water is to be utilized for mining, milling, manufacturing, power, waterworks, and stock raising and which prior filings and applications were renewed for the construction of a dam at Lohman Narrows. (The project became known as Alexander Dam located below



Mansfield Dam and Power House. Furnished by Lower Colorado River Authority.

Marble Falls.) Between 1914 and 1919 these rights passed to C. H. Alexander and Syndicate Power Company. All these C. H. Alexander interests seem to be a partnership with John N. Simpson of Dallas who also had early water rights and owned considerable land on the Colorado River. The Alexander and Simpson Project is mentioned in some of the letters in the files of the Texas Water Commission. For later permits, Permit Nos. 951-55 and 998, the Syndicate Power Company claimed the exclusive prior rights to the appropriation and use of such waters within the area covered by six applications for water permits pertaining to the appropriation and use of such waters as existed prior to June 29, 1913.

The Lower Colorado River Authority is owner of Permit Nos. 951-55 and 998 by virtue of the following conveyances: (a) from Syndicate Power Company to Ward Arnold and Jay Alexander dated July 30, 1928 (Permit Nos. 951 and 952 only); (b) from Syndicate Power Company to Emery, Peck & Rockwood Development Company dated July 19, 1929; (c) from Ward Arnold and Jay Alexander to Emery, Peck & Rockwood Development Company dated July 19, 1929; (d) from Emery, Peck & Rockwood Development Company to Central Texas Hydro-Electric Company dated November 5, 1931; (e) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to Colorado River Company dated October 5, 1934; (f) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to C. G. Malott dated October 5, 1934; (g) from Colorado River Company to Lower Colorado Authority dated August 9, 1935; (h) from C. G. Malott to Lower Colorado River Authority dated August 9, 1935.

Construction began in March 1937. First stages of the low dam were completed in July 1939. A contract was awarded to the same builder for additional foundation and the high dam. The present structure was completed May 17, 1942. Deliberate impoundment began on September 9, 1940. The first generating unit was placed in operation January 27, 1941.

This is the fifth plant downstream from Buchanan Reservoir, and the lake is a controlled storage for Buchanan Reservoir releases as well as for runoff from the Llano and Pedernales Rivers and other tributary streams below Buchanan Reservoir.

The Federal authorization for the construction of the low dam was directly from the funds available to the Secretary of the Interior on December 3, 1936. Amendment to the original appropriation was made by Congress May 10, 1939, allocating the money to construct the high dam that is the present structure. This Act also contained provisions for reimbursements to the Federal Government by the Lower Colorado River Authority for part of the cost of providing conservation storage. Total cost of the project was $28,709,948.

Physical Description

The dam consists of a concrete gravity spillway section, a long earth and rockfill embankment section on the left of the main dam, and a short approach embankment section on the right end. Both the upstream and downstream sides of the earth and rockfill embankments are protected by rock riprap. The total length is 7,333 feet. The concrete section is one of the largest gravity-type

dams in the United States with a maximum height of 270 feet and a length of 2,423 feet. In addition to the uncontrolled spillway section, this concrete dam contains twenty-four 8.5-foot-diameter conduits for release of floodwaters. Each conduit is double gated with the controls located in tunnels through the dam. This section also contains the three 16-foot-diameter penstocks, headgates, and hoisting equipment for control of the water to the turbines in the powerhouse.

At the top of the power storage space at elevation 681.1 feet above msl, the reservoir capacity is 1,172,000 acre-feet. The capacity between elevations of 681.1 and 714.1 feet (crest of uncontrolled spillway) above msl is 778,000 acre-feet, and is reserved for flood control. In special cases where danger of flooding downstream is not present, the water in storage between elevations 681.1 and 691.1 feet above msl may be released by operating the turbines to generate power instead of discharging the water through the floodgates. This reservoir, known as Lake Travis, provides the principal flood-control storage on the Colorado River. Much of the shoreline of 270 miles has been developed as residential and recreational areas. Additional capacities are listed on the following page.

The drainage area above the dam is 38,130 square miles, of which 11,900 is probably noncontributing. Runoff is partly regulated by Buchanan Reservoir and other reservoirs upstream.

Records of the reservoir elevations and contents from September 1940 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and since September 1940 in Water-Supply Papers of the U. S. Geological Survey.

The uncontrolled spillway is a concrete ogee section 700 feet long with crest elevation at 714.1 feet above msl. The emergency spillway has not been used as all floodwater releases have been through the controlled outlets. A roadway bridge at elevation 750.1 feet above msl crosses the spillway on piers, thereby dividing the spillway into five bays of 140 feet each.

Water for domestic and irrigational requirements is released through the turbines at times when generation is necessary to satisfy power requirements. Lake Austin, immediately downstream, acts as a regulating reservoir from which water is discharged downstream after passing through the turbines in the powerhouse at the Miller (Tom) Dam.

Floodwater is released through one or more of the twenty-four 8.5-foot-diameter conduits. Each of these conduits is controlled by two ring-follow-type (paradox) gates located in the two operating galleries. Each conduit has a capacity of about 5,000 cfs at normal flood-control storage space level. Water is released when Lake Travis reaches elevation 681.1 or 691.1 feet above msl depending on the volume of floodflow in the upper and lower river. The rate of release is determined by the U. S. Army Corps of Engineers, Fort Worth District, to hold the river stage at Columbus, Texas within specified limits. The maximum elevation of the lake as of July 1963 was 707.4 feet, which occurred on May 18, 1957. The discharge point of the conduits is at the bottom of the spillway apron.

The power installation consists of three generating units with a rated capacity of 22,500 kw each with all the allied equipment for connecting to the transmission system. Due to the higher operating head from that originally

designed, the units can be overloaded for peak power requirements to 29,000 kw each. The power facilities were designed and built by the Lower Colorado River Authority. The first unit was placed in commercial operation January 27, 1941.

Listed below are pertinent data on Mansfield Dam and Lake Travis.

Type of dam ..... earthfill and concrete gravity
Length of dam ..... 7,333 feet (4910 earth section)
Maximum height of dam ..... 270 feet
Top width of dam ..... 35 feet
Spillway crest elevation ..... 741.1 feet above msl
Spillway length ..... 700 feet (net)
Spillway control ..... none

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of parapet wall	754.1	--	--
Top of dam	750.1	--	--
Maximum design flood stage	748.9	3,223,000	44,448
Top of flood-control storage space at spillway crest	714.1	1,950,000	29,000
Top of power storage space	681.1	1,172,000	18,930
Bottom of power storage space	618.1	361,100	8,050
Bottom of penstocks	552.1	54,800	--
Bottom of twenty-four 8.5-foot-diameter paradox gates	535.9	27,900	--

44. Fort Phantom Hill Dam and Fort Phantom Hill Reservoir

Location

Fort Phantom Hill Dam and Fort Phantom Hill Reservoir are in the Brazos River Basin in Jones County, 5 miles south of Nugent on Elm Creek, a tributary of Clear Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Abilene for municipal water supply and recreation. Permit No. 1249 (Application No. 1332) dated August 9, 1937 from the State Board of Water Engineers to the city of Abilene authorized the construction of a dam on Elm Creek to create a reservoir capacity of about 73,960 acre-feet of water and an annual diversion of 30,690 acre-feet of water for municipal water supply. The reservoir is also used for recreational purposes.

Construction started June 26, 1937 was completed and deliberate impoundment began in October 1938.

Other projects owned and operated by the city for water supply are Lake Abilene on Elm Creek and Kirby Lake on Cedar Creek. These projects are described on pages 28 and 49.

Additional information regarding water rights is available from the various permits issued by the State Board of Water Engineers to the city of Abilene. Permit No. 1481 (Application No. 1629) dated October 31, 1949 authorized diversion of 30,000 acre-feet from Clear Fork Trinity River at a rate not exceeding 250 cfs. The 30,000 acre-feet is to be part of the 46,365 acre-feet already authorized for appropriation under Permit Nos. 253, 1051, and 1249. Permit No. 1806 (Application No. 1926) dated December 20, 1955 amended Permit No. 1481 to allow the creation of a diversion pool with capacity of 608 acre-feet and an increase in the rate of diversion from 250 to 275 cfs without additional appropriation. Permit No. 1840 (Application No. 1984) dated September 13, 1956 amended Permit No. 1806 to allow an increase in diversion and pumping rate from the river without an increase in the total amount to be appropriated. Permit 1726 (Application No. 1858) issued November 1, 1954 allowed construction of a dam and the diversion of 3,000 acre-feet annually from Deadman Creek by a channel to Fort Phantom Hill Reservoir.

The city of Abilene also has the right to purchase water from the Hubbard Creek Reservoir described on page 196.

Physical Description

The dam is a rolled-earth structure 3,200 feet long and 70 feet high with the top of the dam at elevation 1,650.0 feet above msl. The embankment has a maximum base width of 360 feet and is 25 feet wide at the top. A roadway is built along the top of the dam. The upstream face of the dam is protected with rock riprap.

The reservoir has a capacity of 74,310 acre-feet and a surface area of 4,246 acres at spillway crest elevation of 1,635.9 feet above msl. The U. S. Soil Conservation Service made a sedimentation survey in 1953, and reported that the reservoir had trapped 2,654 acre-feet of sediment in 14.8 years. Water is diverted for the city by pumps located about 2 miles upstream from the dam and delivered to the filtration plant and from there to the city water mains. Beginning in May 1952 the city began pumping water from Clear Fork Brazos River into the reservoir.

Diversion of water from Deadman Creek into Fort Phantom Hill Reservoir was started in May 1955 to further supplement the water supply for the city of Abilene.

The drainage area above Fort Phantom Hill Dam is 478 square miles.

An uncontrolled service spillway, located about 0.7 mile from the right end of the dam, has a crest length of 900 feet at elevation 1,635.9 feet above msl. The natural spillway surface was capped with a concrete weir with each end about 1 foot higher than the center elevation of 1,635.9 feet above msl. Floodwater inflow is partly regulated by three upstream reservoirs.

The service outlet is a 4-foot by 7-foot concrete conduit 310 feet long extending through the embankment to the downstream channel. This conduit connects to a vertical shaft within the reservoir having openings at five

elevations that are controlled by slide gates operated from the top of the tower. Water is released only when required by downstream users. Elevation of invert of lowest outlet is 1,582.4 feet above msl. Dead storage is negligible.

45. Umbarger Dam and Buffalo Lake

Location

Umbarger Dam and Buffalo Lake are in the Red River Basin in Randall County, 2 miles south of Umbarger on Tierra Blanca Creek, a tributary to Prairie Dog Town Fork Red River, which is tributary to the Red River.

Ownership and History of Development

Umbarger Dam and Buffalo Lake are owned by the Fish and Wildlife Service, U. S. Department of Interior. The dam was built by the Federal Farm Securities Administration under Permit No. 1258 (Application No. 1343) granted to the United States of America on January 20, 1938 by the State Board of Water Engineers, which provided for the impoundment of 18,121 acre-feet of water for recreation. Construction of the dam was started in February 1938, and was completed June 15, 1938. Impoundment began June 9, 1938. The project was operated by the Soil Conservation Service, U. S. Department of Agriculture until 1953 when the operation was assumed by the Forest Service, U. S. Department of Agriculture. In 1958, operation of the project was transferred to the Fish and Wildlife Service, U. S. Department of Interior.

According to a court order dated January 14, 1941 the operators of the reservoir are required to release 3 cfs during flood periods and the natural inflow of Tierra Blanca Creek when less than 3 cfs.

Physical Description

The dam is a rolled-earth structure 882 feet long and 37 feet high with a base width of 325 feet and top width of 16 feet. The top of the dam is at elevation 3,652.6 feet above msl. A concrete ogee spillway adds 350 feet additional length to the dam.

The drainage area is 2,075 square miles, of which 1,500 square miles is probably noncontributing.

The capacity of the lake is 18,150 acre-feet at spillway crest elevation of 3,642.6 feet above msl. Surface area at this elevation is 1,900 acres. The capacity of the lake is zero at the invert of the low-flow outlet, which is at elevation 3,612.6 feet above msl.

Records of the contents of Buffalo Lake for the period June 1938 to September 1954 are contained in Bulletin 5807-A of the State Board of Water Engineers and for the same period in Water-Supply Papers of the U. S. Geological Survey.

The spillway is a concrete ogee section with curved crest 350 feet long at elevation 3,642.6 feet above msl. The spillway discharges to a concrete

channel and stilling basin, thence to the original creek channel downstream from the dam.

The low-flow outlet is a square concrete conduit, 5 feet by 5 feet, with elevation of invert at 3,612.6 feet above msl, which discharges to the streambed downstream from the dam. The release through the low-flow outlet is controlled by a gate operated from an intake structure.

46. Morris Sheppard Dam and Possum Kingdom Reservoir

Location

Morris Sheppard Dam and Possum Kingdom Reservoir are in the Brazos River Basin in Palo Pinto County, 11 miles southwest of Graford and 18 miles northwest of Mineral Wells on the Brazos River at river mile 687. The reservoir shoreline is in Palo Pinto, Stephens, Young, and Jack Counties.

Ownership and History of Development

The project is owned and operated by the Brazos River Authority as part of its regulation for the Brazos River.

The project was authorized by Permit No. 1262 (Application No. 1351) dated May 9, 1938 from the State Board of Water Engineers to the Brazos River Authority. The Permit allows an appropriation of 1,500,000 acre-feet of water annually for municipal, industrial, mining, irrigation, recreational, and power generation uses. No differentiation of uses was specified in the Permit thereby allowing the future water demands to govern the distribution.

Construction of the dam was started May 29, 1938, but was delayed by litigation and a court injunction for about a year. It was not until March 21, 1941 that the dam was completed and deliberate storage was begun. On April 17, 1941 runoff had filled the reservoir with sufficient water to start power generation, and on May 5, 1941 water was discharged over the spillway for the first time.

Physical Description

The dam is a reinforced concrete, Ambursen-type, massive buttress with flat-slab deck, a section of nine roof-weir gates, two bulkhead sections, and an earthen dike. The total length is 2,740 feet with a maximum height of 189 feet with the top of the dam at elevation 1,024.1 feet above msl. The dam has a volume of 325,000 cu yd.

The reservoir has a capacity of 724,700 acre-feet at the top of the gates, elevation 1,000.1 feet above msl, with an area of 19,800 acres. Other elevations and capacities are listed following this section.

The drainage area above the dam is 22,550 square miles, of which 9,240 is probably noncontributing.

Morris Sheppard Dam and Possum Kingdom Reservoir. Furnished by Brazos River Authority.

Records of contents from March 1941 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from March 1941 in Water-Supply Papers of the U. S. Geological Survey.

This is the first of several projects proposed by the Brazos River Authority for the regulation of the Brazos River. The U. S. Army Corps of Engineers has built dams and planned other projects on the Brazos River and its tributaries for flood regulation and conservation storage.

The spillway consists of nine roof-weir type gates 73 feet 8 inches wide by 13 feet high with top of gate elevation of 1,000.1 feet above msl. Flood-control releases are from one or more of these gates having a total discharge capacity of 550,000 cfs for the nine at design elevation of 1,000.1 feet above msl.

There are two 12-foot-diameter penstocks with gates and control tower for water supply to the turbines in the powerhouse; turbine operation provides regulated releases.

Necessary low-flow releases, when turbines are not operating, are controlled by a 54-inch valve that discharges water into the outlet conduit through the face of the dam.

The power facilities consist of two 11,250 kw generating units with all necessary auxiliary equipment. Sale of electrical energy is to the Brazos River Transmission Electric Cooperatives.

The following is pertinent data on the dam and reservoir:

Type of dam	Ambursen, hollow, massive buttress type
Length of concrete bulkhead and spillway	1,600 feet
Length of earth dike with concrete core wall	1,147 feet
Total length of dam	2,747 feet
Maximum height of dam	189 feet
Nine crest gates	73 feet 8 inches long by 13 feet high
Length of lake	65 miles
Maximum width of lake	3.5 miles
Maximum depth of lake	145 feet
Shoreline	310 miles
Power installation	two 11,250 kw generating units

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,024.1	--	--
Top of gates (raised)	1,000.1	724,700	19,800
Bottom of gates (crest of spillway)	987.1	504,100	--
Invert of penstock	911.6	25,810	--
Invert of 54-inch valve outlet	874.9	236	--

47. Rita Blanca Dam and Rita Blanca Lake

Location

Rita Blanca Dam and Rita Blanca Lake are in the Canadian River Basin in Hartley County, 3 miles south of Dalhart on Rita Blanca Creek, a tributary of the Canadian River.

Ownership and History of Development

The project is owned by the U. S. Soil Conservation Service. In June 1951 the city of Dalhart obtained a 99-year lease for operation of the project as a recreational facility without any right of diversion. The administrative agency was transferred in 1960 to the U. S. Fish and Wildlife Service from the U. S. Soil Conservation Service.

Construction of the dam was authorized by Permit No. 1267 (Application No. 1355) dated September 26, 1938 from the State Board of Water Engineers to the U. S. Soil Conservation Service. The Permit authorizes storage of 12,100 acre-feet and use of that amount for recreational purposes.

The project was started in 1938 and completed in 1939. Very little water was impounded until the floodflow of September 1941.

Physical Description

The dam is a rolled-earth structure 2,880 feet long, including a concrete spillway, and is 75 feet high with the top of the dam at elevation 3,880.0 feet above msl. The embankment has a bottom width of 486 feet and top width of 26 feet. The upstream face is protected with rock riprap from elevation 3,845.0 to elevation 3,872.0 feet above msl.

A flood in September 1941 filled the lake, and the spillway was used for the first time. Considerable damage to the spillway retaining walls and floor slab occurred. The lake retained some of the floodflow as this was the first time storage reached normal maximum level. Repairs were made according to plans dated December 1946, and the water service reports filed with the Texas Water Commission indicate that operation has been satisfactory since then.

The lake has a capacity of 12,100 acre-feet and a surface area of 524 acres at elevation 3,860.0 feet above msl. The lake is used for recreational purposes only.

The drainage area above the dam is 1,062 square miles.

A concrete spillway located between two earth embankments has a circular crest length of 191.5 feet at elevation 3,860.0 feet above msl. The discharge is through a concrete chute, with bottom width of 130 feet, to a stilling basin and thence downstream. An emergency spillway located on the right end of the embankment has a crest length of 600 feet at elevation 3,870.0 feet above msl.

There is one, gate-controlled, low-flow outlet, 5 feet by 4 feet, extending through the embankment with invert at elevation 3,810.0 feet above msl.

48. Coffee Mill Creek Dam and Coffee Mill Creek Lake

Location

Coffee Mill Creek Dam and Coffee Mill Creek Lake are in the Red River Basin in Fannin County, 12 miles northwest of Honey Grove on Coffee Mill Creek, a tributary of Bois d'Arc Creek, which is tributary to the Red River.

Ownership and History of Development

The project is owned and operated by the U. S. Forest Service for recreational purposes.

The record indicates that the project was started and completed in 1938. Deliberate impoundment of water probably started at the time of completion in 1938.

Physical Description

The dam is an earthfill structure 3,600 feet long and 42 feet high with the top of the dam at elevation 505.0 feet above msl. The embankment has a maximum bottom width of 205 feet and top width of 16 feet.

The reservoir has a capacity of 8,000 acre-feet and a surface area of 704 acres at the service spillway crest elevation of 496.0 feet above msl.

The drainage area above the dam is 39 square miles.

The uncontrolled service spillway has a crest length of 150 feet at elevation 496.0 feet above msl, and discharges into a concrete chute-type structure. An emergency spillway, with a crest length of 1,290 feet, has variable crest elevation from 2 to 4 feet higher than the service spillway.

The low-flow outlet is a 24-inch-diameter cast-iron pipe, 252 feet long, extending through the embankment; the discharge is regulated by a valve operated from a concrete control tower.

49. Denison Dam and Lake Texoma

Location

Denison Dam and Lake Texoma are in the Red River Basin in Grayson County, 5 miles north of Denison on the Red River between Texas and Oklahoma. The reservoir is in Grayson and Cooke Counties, Texas, and Marshall, Love, and Bryan Counties, Oklahoma.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, Tulsa District. It was authorized

Denison Dam and Lake Texoma. Furnished by U. S. Army Corps of Engineers, Tulsa District.

by the Flood Control Act of 1938 for flood control, power generation, conservation, and recreational purposes. Conservation storage space has been sold as follows: city of Denison--21,300 acre-feet; city of Sherman--41,000 acre-feet; Texas Power & Light Company--16,400 acre-feet; and Sinclair Oil Company--1,150 acre-feet.

The project was started with clearing of the lake basin on August 22, 1939, and all of the construction was completed in 1943 with deliberate impoundment beginning October 31, 1943. Maximum power storage space elevation of 617.0 feet was first reached March 15, 1945. The maximum content to July 1963 was 5,991,300 acre-feet on June 5, 1957 at elevation 643.18 feet above msl.

Physical Description

The dam is a rolled-earth embankment 15,200 feet long and 165 feet high above streambed with the top of the dam at elevation 670.0 feet above msl. The spillway crest is at an elevation of 640.0 feet above msl (storage capacity, 5,530,300 acre-feet). The embankment contains over 18.8 million cu yd of earthfill. Texas State Highway 75-A is built along the top of the dam.

The lake at elevation 617.0 feet above msl, top of the power storage space, has a storage capacity of 2,836,300 acre-feet and a surface area of 91,200 acres. When the contents drop below 2,250,100 acre-feet, the lake is divided into two pools by levees around the Cumberland oil field. Other capacities are given in the tabulation that follows this section.

The drainage area is 39,719 square miles, of which 5,936 square miles is probably noncontributing.

Records of contents from July 1942 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from July 1942 in Water-Supply Papers of the U. S. Geological Survey.

The uncontrolled spillway structure is located to the right of the right abutment of the dam. It is a low ogee-weir section with crest elevation of 640.0 feet above msl, and is 2,000 feet long. Controlled flood storage extends from elevation 617.0 feet above msl to spillway crest; the maximum flood elevation is estimated to be 661.0 feet above msl.

The outlet works are located within the embankment on the Texas side, and consist of an approach channel, intake structure, and service bridge. There are eight reinforced concrete conduits 20 feet in diameter and 800 feet long with invert at elevation 523.0 feet above msl. Three are gate-controlled for floodwater discharge. Five are steel-lined penstocks for delivery of water to the present and future power units. There are surge tanks installed on the penstocks in use. All of the conduits are protected from troublesome debris by trash racks.

As of June 30, 1963 there were two turbines and generator units with all auxiliaries installed with a capacity of 35,000 kw each. This plant was placed in operation during March 1945. The plans call for additional units to be installed in the future.

Information on Denison Dam and Lake Texoma, published by the U. S. Army Corps of Engineers, is as follows:

Total length of dam ..... 15,200 feet
Spillway length ..... 2,000 feet
Maximum height of dam ..... 165 feet
Earthfill ..... 18,800,000 cu yd
Shoreline at elevation
640.0 feet above msl ..... 1,100 miles
Shoreline at elevation
617.0 feet above msl ..... 580 miles
Power development ..... Five penstocks 20 feet in diameter
Generators (installed) ..... two 35,000 kw each
Generators (proposed) ..... three 35,000 kw each

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	670.0	--	--
Crest of spillway	640.0	5,530,300	144,100
Top of power storage space	617.0	2,836,300	91,200
Dead and sediment storage space	590.0	1,106,000	--

Estimated cost $74,976,000.00
Flood damage prevented since 1944 ..... $27,760,000.00
Visitors estimated at 6 million annually.

50. Highlands Dam and Highlands Reservoir

Location

Highlands Dam and Highlands Reservoir are in the Trinity-San Jacinto Coastal Area in Harris County, 2 miles east of Highlands, and are an off-channel project on Goose Creek, which empties into Galveston Bay.

Ownership and History of Development

The project is owned and operated by the San Jacinto River Authority for the sale of water for municipal, industrial, and irrigation use, and is part of an extensive canal system. It was purchased in 1944 from the United States Federal Works Administration, which built the system for wartime water supply for industry in the Houston area.

Water right to appropriate 165,000 acre-feet of water per annum for municipal, mining, milling, domestic, industrial, irrigational, and recreational purposes was obtained by the San Jacinto River Conservation District by Permit No. 1342 (Application No. 1433) dated March 8, 1943 from the State Board of Water Engineers. The amount of annual diversion was increased to 224,000 acre-feet by Permit No. 1422 (Application No. 1505) dated December 13, 1947 from the

State Board of Water Engineers. In 1951, by act of the Texas Legislature, the San Jacinto River Conservation District was changed to the San Jacinto River Authority.

Construction was started in 1942, completed in 1943, and the reservoir was first filled with water pumped from the San Jacinto River during the fall and winter of 1943.

This project was built by the U. S. Government because of the critical need for water supply for wartime industry at a time when private and municipal bodies could not obtain the necessary materials for construction. At the end of the critical period, the city of Houston and the Conservation District agreed on the part of the system each would purchase from the U. S. Government. This agreement also covered water rights in various proposed future storage projects to be constructed by either party.

Physical Description

The dam is an earthfill levee with an average height of 14 feet.

The rectangular-shaped reservoir has a capacity of 5,580 acre-feet and a surface area of 1,407 acres at spillway crest elevation of 48.0 feet above msl. This reservoir is also used for hunting, fishing, and other recreational purposes.

The drainage area is negligible, therefore water is pumped from the San Jacinto River.

Since the completion of San Jacinto Dam creating Lake Houston, water is being delivered by canal from Lake Houston to Highlands Reservoir. Excess streamflow is pumped from the river and later released to the canal for distribution when needed for any of the purposes covered in the permits.

A small controlled outlet is provided for fluctuation in canal operations. This control structure allows water to enter the reservoir from the canal or be discharged from the reservoir into the canal for distribution.

51. Ellison Creek Dam and Ellison Creek Reservoir

Location

Ellison Creek Dam and Ellison Creek Reservoir are in the Cypress Creek Basin in Morris County, 8 miles south of Daingerfield on Ellison Creek, a tributary of Cypress Creek.

Ownership and History of Development

Ellison Creek Dam and Ellison Creek Reservoir are owned and operated by the Lone Star Steel Company. It was originally owned by Defense Plant Corporation, a corporation created by the Reconstruction Finance Corporation Act during World War II, for which Lone Star Steel Company was agent. Southwest

Gas & Electric Company uses water from the reservoir for condenser-cooling purposes for a steam-electric generating plant. Construction of the dam began in 1942, and was completed in April 1943. Storage began January 14, 1943.

Permit No. 1405 (Application No. 1437) was issued to the Lone Star Steel Company on March 15, 1947 by the State Board of Water Engineers. The Permit authorizes construction of a dam across Ellison Creek, thereby creating a reservoir with capacity of 26,000 acre-feet and appropriation of 80,000 acre-feet per annum for industrial purposes from Ellison and Cypress Creeks.

Physical Description

Ellison Creek Dam is a rolled-earth structure 4,000 feet long with a maximum height of 48.5 feet. The top of the dam is at elevation 280.1 feet above msl. The embankment has a maximum bottom width of 250 feet and top width of 18 feet. The upstream face of the embankment is protected with a 2-foot thickness of rock riprap laid on an 8-inch-thick gravel blanket between elevations 255.1 and 280.1 feet above msl.

The drainage area of the Ellison Creek watershed at Ellison Creek Dam is 37 square miles.

Capacities of the reservoir at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam	280.1	--
Maximum design flood stage	275.1	36,600
Top of emergency spillway crest	273.1	33,020
Service spillway crest	268.1	24,700*
Top of conduit discharge box (36-inch-diameter emergency supply pipe)	235.1	196

* Surface area of the reservoir at this elevation is 1,516 acres.

When the flow into the reservoir is inadequate, water is pumped into the reservoir from Cypress Creek. In order to have water at the pump intake, a small log-channel dam is built across Cypress Creek to back water up to elevation 229.1 feet above msl. The water is pumped to the reservoir through a 36-inch-diameter conduit terminating in the pump intake channel of the reservoir pumphouse. This same pipe can be used to release water from the reservoir if necessary.

There is a relief or fuse plug dam located near the reservoir pumphouse that will not be used except in the event all outlets from the reservoir are unable to pass the floodflow. In this case, the relief dam will be blasted out. This dam is approximately 125 feet long with crest at elevation 275.1 feet above msl.

Records of the contents of Ellison Creek Reservoir from January 1943 through September 30, 1957 are contained in Bulletin 5807-A of the Board of Water Engineers and from January 1943 to September 1962 in Water-Supply Papers of the U. S. Geological Survey. The U. S. Geological Survey discontinued the station known as Ellison Creek Reservoir near Daingerfield, Texas, on September 30, 1962.

The concrete service spillway section has a crest length of 300 feet at elevation 268.1 feet above msl. Energy of the flow over the service spillway is dissipated in a stilling basin, then the flow continues to the creek channel over a low dam with crest at elevation 248.6 feet above msl.

The emergency spillway has an overall crest length of 1,500 feet at elevation 273.1 feet.

The water from Ellison Creek Reservoir is used for power plant condenser-cooling, ore-washing, and general plant use. Water not consumed is returned to the reservoir as inflow down Barnes Creek channel. Water is delivered to the points of use by means of pumps located in the reservoir pumphouse.

In connection with the steel plant, a separate dam and lake known as Sorrell Reservoir was built for storage of tailings from the ore-mining process. Water storage or use is not involved.

52. William Harris Dam and William Harris Reservoir

Location

William Harris Dam and William Harris Reservoir are in the San Jacinto-Brazos Coastal Area in Brazoria County, 8 miles northwest of Angleton, and are an off-channel project between the Brazos River and Oyster Creek.

Ownership and History of Development

The project is owned and operated by the Dow Chemical Company for industrial water supply to several affiliated plants near Freeport.

Permit No. 1345 (Application No. 1431) dated February 19, 1943 from the State Board of Water Engineers to Dow Chemical Company allows diversion of 40,000 acre-feet of water annually from Oyster Creek and 150,000 acre-feet annually from the Brazos River for industrial purposes. To confirm their right to the water supply from the Brazos River, Dow Chemical Company contracted with the Brazos River Authority for conservation storage in their upstream reservoirs. This stored floodwater is to be released on demand by using the river channel to convey the water to the place of diversion.

The pumping plant on Oyster Creek was completed and diversion started April 16, 1943. The small reservoir at this lower diversion site was completed May 1, 1943. Difficulty in getting equipment during the war period delayed installation of the pumping plant for diverting water directly from the Brazos River. This was not completed until July 2, 1947. This plant delivers water to a settling basin, thence to a canal system and/or William Harris Reservoir, thence to Oyster Creek as needed.

The system for delivering the water to the point of use is a complicated series of pumping plants and canals. William Harris Reservoir stores appropriable water from the Brazos River, when available, for later release to the water system as needed.

Physical Description

The rectangular reservoir is created by a levee with a top width of 10 feet and a bottom width that varies with the changing ground contours.

The reservoir has a capacity of 12,000 acre-feet and a surface area of 1,663 acres at normal maximum water surface elevation of 43.0 feet above msl.

Water is released from the reservoir by gravity flow to Oyster Creek. From there it flows through the winding channel to a pumping plant that lifts the water to a canal system and small retention reservoir. The water is then distributed by a gravity canal system to the various places of use at the industrial plants.

No drainage area contributes runoff to this reservoir, so the reservoir level is regulated by pumping from the Brazos River and releases to Oyster Creek.

53. Sheldon Dam and Sheldon Reservoir

Location

Sheldon Dam and Sheldon Reservoir are in the San Jacinto River Basin in Harris County, 2 miles southwest of Sheldon on Carpenters Bayou, a tributary to Buffalo Bayou (Houston Ship Channel), which is a tributary of the San Jacinto River.

Ownership and History of Development

The reservoir is now owned by the Texas Parks and Wildlife Commission, and is used for a game preserve, fish hatchery, and recreational purposes. The project was built by the U. S. Government Federal Works Agency. Construction started in 1942, and was completed in December 1943 with impoundment of water beginning at that time. The purpose of the project was to provide an adequate water supply for wartime industries in the Houston area. The Sheldon Reservoir was used as an impounding reservoir for storing water in times of excess flow in the San Jacinto River for use when the flow of the river was less than the demand for water. The city of Houston purchased the pumping plant, reservoir, and the canal in 1947. Permit No. 1413 (Application No. 1512) dated July 19, 1947 from the State Board of Water Engineers to the city of Houston authorized the storage of 6,950 acre-feet and the annual diversion of 10,500 acre-feet of water for municipal, domestic, industrial, and irrigational purposes. When the city obtained a new water supply from Lake Houston, Sheldon Reservoir and Permit No. 1413 were sold to the then Texas Game and Fish Commission (now part of the Texas Parks and Wildlife Commission) effective October 1, 1954.

Physical Description

The dam is mainly a system of levees and an earth embankment with a concrete spillway. The total length is 6.1 miles with a maximum height of 8 feet. The levees were enlarged and rebuilt when obtained by the Texas Game and Fish Commission, and now have a maximum bottom width of 60 feet and top width of 12 feet, and vary in height from 6 to 8 feet.

The reservoir now has a capacity of 5,420 acre-feet and a surface area of 1,200 acres at elevation 50.5 feet above msl. Water was diverted by gravity to a canal system for distribution when the project was owned by the city of Houston, but now there is no diversion except to spill excess water. Originally make-up water was pumped from the San Jacinto River. Under present management, however, there is no consumptive use. Therefore, runoff from the 9-square-mile drainage area is adequate to keep the reservoir at the desired level. The capacity of the reservoir was reduced when the city of Houston built its canal through one section, from the new Lake Houston. The area cut off from the original reservoir is used for a fish hatchery and experimental rice growing.

A concrete spillway, with a crest length of 150 feet at elevation 50.5 feet above msl, is used to discharge excess water during periods of heavy runoff.

There are three 36-inch pipes with sluice valves that are used for low-flow releases and to drain sections of the reservoir as needed.

54. Barker Dam and Barker Reservoir

Location

Barker Dam and Barker Reservoir are in the San Jacinto River Basin in Harris County near Addicks on Buffalo Bayou, a tributary to the San Jacinto River and Houston Ship Channel. The reservoir area extends into Fort Bend County.

Ownership and History of Development

The project is owned by the U. S. Government, and was authorized by the River and Harbor Act of June 1938 as amended August 11, 1939. This reservoir and nearby Addicks Reservoir are operated by the U. S. Army Corps of Engineers, Galveston District, for flood protection to the Houston area.

The dam was completed February 3, 1946, but was used for flood control in the spring of 1945.

Physical Description

The dam is a rolled-earth structure 72,844 feet long and 37 feet high at the concrete outlet works located near the old river channel. Embankment slopes are 3 to 1. At the upstream end the embankment is 4 to 5 feet higher than the adjacent natural prairie land. The elevation of the top of the dam is about 111.5 feet above msl.

The reservoir is for floodwater retention only, with a capacity of 204,800 acre-feet and a surface area of 17,225 acres at the emergency spillway crest elevation of 107.0 feet above msl.

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam (varies)	109.0 to 114.0	--
Emergency spillway crest	107.0	204,800
Invert of conduits	74.7	2

The drainage area is 134 square miles above the outlet works.

Records of stage and reservoir contents from August 1945 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from August 1945 in Water-Supply Papers of the U. S. Geological Survey.

There is no conservation storage or use of water as this is a floodwater-retention reservoir only.

There are no constructed emergency spillways, but runoff in excess of the designed capacity will be discharged around the ends of the dam to the open prairie at elevation 107.0 feet above msl.

The outlet works consist of five reinforced concrete conduits, 9 feet wide by 7 feet high, with invert at elevation 74.7 feet above msl. Originally only the center outlet was controlled by two vertical slide gates separated by a pier in center. In 1949 the two outermost outlets were equipped with slide gates spanning the entire width of the opening. Then in May 1962, the same type of slide gates were installed on the other two conduits.

The gate operation is controlled by the U. S. Army Corps of Engineers, Galveston District, and the operation will vary with the magnitude of the flood inflow and downstream conditions. During minor floods the gates will remain closed, and the reservoir is allowed to function as a temporary storage basin.

55. Addicks Dam and Addicks Reservoir

Location

Addicks Dam and Addicks Reservoir are in the San Jacinto River Basin in Harris County near Addicks on South Mayde and Langham Creeks, tributaries to Buffalo Bayou, which is tributary to the San Jacinto River and Houston Ship Channel.

Ownership and History of Development

The project is owned by the U. S. Government, and was authorized by the River and Harbor Act of June 1938 as amended August 11, 1939. This and nearby Barker Reservoir are operated by the U. S. Army Corps of Engineers, Galveston District, for flood protection of the Houston area.

The dam was completed in the fall of 1948.

Physical Description

The dam is a rolled-earth structure 61,166 feet long with a maximum height of 49 feet near the concrete outlet works, with the top of the dam at elevation 123.5 feet above msl. At the upstream end, the height is about 5 feet higher than the adjacent natural prairie land. Volume content of the dam is 4,794,000 cu yd.

The reservoir is for floodwater retention only, with a capacity of 204,460 acre-feet and a surface area of 16,780 acres at the emergency spillway crest elevation of 114.0 feet above msl.

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam	123.5	--
Emergency spillway crest	114.0	204,460
Invert of conduits	73.0	0

The drainage area is 133 square miles above the outlet works.

Records of reservoir stage and contents from June 8, 1948 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from June 8, 1948 in Water-Supply Papers of the U. S. Geological Survey.

There is no conservation storage or use of water as this is a floodwater-retention reservoir only.

There are no constructed emergency spillways, but runoff in excess of the design capacity will discharge around the end of the dam to the open prairie at elevation 114.0 feet above msl.

The outlet works consist of five reinforced concrete conduits, each 8 feet wide by 6 feet high, with invert at elevation 73.0 feet above msl. Originally only the center outlet was controlled. There were two vertical slide gates separated by a pier in the center. In 1949 the two outermost outlets were equipped with gates spanning the entire width of the openings. Then in June 1962 the same type of slide gates were installed on the other two conduits.

The gate operation is controlled by the U. S. Army Corps of Engineers, Galveston District, and the operation will vary with the magnitude of the flood inflow and downstream conditions. During minor floods the gates will remain closed, and the reservoir is allowed to function as a temporary storage basin.

56. Kickapoo Dam and Lake Kickapoo

Location

Kickapoo Dam and Lake Kickapoo are in the Red River Basin in Archer County, 10 miles northwest of Archer City on the North Fork of the Little Wichita River, which is a tributary of the Red River.

Ownership and History of Development

The project is owned and operated by the city of Wichita Falls.

Construction of the dam was authorized by Permit No. 1363 (Application No. 1456) granted September 16, 1944 by the State Board of Water Engineers to the city of Wichita Falls. The Permit allows diversion of 40,000 acre-feet per year for municipal water supply.

Construction of the dam was started early in 1945, and completed December 15, 1945. Deliberate impoundment of water began February 1, 1946. The pipeline to Wichita Falls was completed, and diversion for municipal use began September 24, 1947.

This project together with Lake Kemp, Diversion Lake, and Lake Wichita are sources of water supply for the city of Wichita Falls.

Physical Description

The dam is a rolled-earth structure 6,800 feet long, including the spillway, and is 62 feet high, with the top of the dam at elevation 1,062.0 feet above msl. The embankment has a top width of 16 feet and maximum bottom width of 300 feet. The upstream face of the embankment is paved with rock riprap. A reinforced concrete spillway is located near the right end of the dam.

The lake has a capacity of 106,000 acre-feet and a surface area of 6,200 acres at spillway crest elevation of 1,045.0 feet above msl; other capacities are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam	1,062.0	--
Maximum design flood stage	1,060.0	220,000
Crest of uncontrolled spillway	1,045.0	106,000
Invert of outlets	1,000.92	0

The drainage area above the dam is 275 square miles.

Records of reservoir contents from February 1946 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers from February 1946 in Water-Supply Papers of the U. S. Geological Survey.

A reinforced concrete ogee spillway is located at the right end of the dam, with a crest length of 482.7 feet at elevation 1,045.0 feet above msl.

The outlet structure consists of a concrete tower near the left end of the dam and two, 4-foot by 5-foot, concrete conduits, each controlled by a sluice gate. The left outlet diverts metered water to the city pumping plant. The right outlet discharges into the creekbed for emergency use downstream. The sluice gates are open for normal operating conditions, and the discharge is regulated by valves in the pump control room where water is pumped to the filter and treatment plant.

57. Dam B and Dam B Reservoir

Location

Dam B and Dam B Reservoir are in the Neches River Basin in both Tyler and Jasper Counties, 1 mile north of Town Bluff on the Neches River at river mile 113.7.

Ownership and History of Development

The project is owned by the United States Government, and was authorized by the River and Harbor Act of March 2, 1945 in the first session of the 79th Congress. It was built and is operated by the U. S. Army Corps of Engineers, Fort Worth District.

The Lower Neches Valley Authority, the cooperative State agency, has purchased the right for use of the 77,600 acre-feet of conservation storage with a maximum rate of diversion of 2,000 cfs.

Construction started in March 1947. The dam and outlet works were completed, and deliberate impoundment of water began April 16, 1951.

Physical Description

The dam is a compacted-earth structure with a concrete section across the river channel. The embankment serves as an uncontrolled spillway, and is protected from wave action by a 6-inch concrete slab. Overall length is 6,698 feet, and the maximum height is 45 feet. The top of the dam is 25 feet wide at an elevation of 95.0 feet above msl.

The reservoir is designed for surge regulation in a system operation, and is used currently for conservation storage, recreation, wildlife management, and partial flood regulation. The Texas Parks and Wildlife Commission has licensed 13,200 acres for wildlife management.

Data on elevations and capacities in the following table are from U. S. Army Corps of Engineers' publications:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	95.0	365,500	30,800
Maximum design flood stage	93.0	306,400	28,210
Top of taintor gates and uncontrolled spillway crest	85.0	124,700	16,830
Normal water level	83.0	94,200	13,700
Invert of low-flow outlets	52.0	20	20
Sill of six taintor gates	50.0	0	0
Sediment reserve in conservation storage space	--	16,600	--

The drainage area above the dam is 7,573 square miles.

Records of reservoir elevation and contents from April 16, 1951 through September 30, 1957 are contained in the State Board of Water Engineers Bulletin 5807-A and from April 16, 1951 in Water-Supply Papers of the U. S. Geological Survey.

The service spillway at the right end of the dam has a net crest length of 240 feet at elevation 50.0 feet above msl, which is controlled by six taintor gates, 40 feet long by 35 feet high. The discharge capacity of the spillway is 80,000 cfs with reservoir water level at elevation 85.0 feet above msl.

The uncontrolled spillway is 6,100 feet long with crest elevation of 85.0 feet above msl. The embankment is protected by a 6-inch-thick layer of reinforced concrete. The total discharge capacity of the two spillways at maximum design flood-stage elevations of 93.0 feet above msl is 218,300 cfs.

There are two, 4-foot by 6-foot, gate-controlled conduits for low-flow releases, with invert at elevation 52.0 feet above msl.

Water is released from the reservoir to maintain a supply of water in the lower Neches River for irrigation, municipal, and industrial uses in Beaumont and other areas. Floodwaters are released from one or more of the spillway taintor gates without further use or control.

Power installation is not a feature of this project at the present time, but may be considered at a later date.

58. San Angelo Dam and San Angelo Reservoir

Location

San Angelo Dam and San Angelo Reservoir are in the Colorado River Basin in Tom Green County, 3 miles northwest of San Angelo on the North Concho River at river mile 6.6. The North Concho River is a tributary of the Concho River, which is tributary to the Colorado River.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, Fort Worth District. Construction was authorized under the Flood Control Act of August 18, 1941, 77th Congress, first session, and 78th Congress, second session.

The Upper Colorado River Authority has purchased conservation storage space in the reservoir for $775,000 payable over a fifty-year period. Permit No. 1516 (Application No. 1627) dated April 29, 1949 from the State Board of Water Engineers granted the Upper Colorado River Authority the use of 80,400 acre-feet of water annually for municipal, industrial, irrigational, mining, and recreational purposes. This water supplements San Angelo's water supply, which previously has been obtained solely from Lake Nasworthy. The Twin Buttes Reservoir on the South and Middle Concho Rivers and Spring Creek will also supply water for this area's future needs.

Construction started in May 1947, closure was completed March 7, 1951, and deliberate impoundment began February 1, 1952. The dedication was in May 1951, but the project was not completed until 1960. Seepage studies and grouting were still in progress at the end of 1962.

Physical Description

The dam is a compacted-earth structure 40,885 feet long, including the spillway, with a maximum height of 128 feet, with the top of the dam at elevation 1,964.0 feet above msl. The embankment has a top width of 20 feet, and the upstream face is protected with stone riprap. Other information is listed following this section.

The reservoir is for flood control, conservation, and recreation purposes. The capacity of the conservation storage space is 119,200 acre-feet, and has a surface area of 5,440 acres at elevation 1,908.0 feet above msl. The flood-control storage capacity is 277,200 acre-feet between the top of the conservation storage space and the uncontrolled spillway crest at elevation 1,938.5 feet above msl. Additional surcharge of 299,900 acre-feet storage is provided at the maximum design elevation. Studies have been made for persistent seepage, and corrective grouting was in progress in 1962 to stop this leakage.

Drainage area is 1,488 square miles, of which 105 square miles is probably noncontributing.

As shown below, 38,800 acre-feet capacity is allocated to sediment reserve storage.

Records of contents from February 1952 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from February 1952 in Water-Supply Papers of the U. S. Geological Survey.

The spillway to the right of the dam is an uncontrolled, off-channel, concrete-gravity ogee weir with crest length of 1,150 feet at elevation 1,938.5 feet above msl. The spillway is designed to discharge 356,000 cfs with reservoir water level at 1,958.0 feet above msl.

There are two 30-inch, gate-controlled outlets for water-supply releases with invert at elevation 1,878.5 feet above msl. Six gate-controlled outlets, 7.5 feet by 14.5 feet, discharge to two 18-foot-diameter conduits for flood-water releases.

San Angelo Dam and San Angelo Reservoir are described further in the following compilation.

Length of dam including spillway	40,885 feet
Height of dam above streambed	128 feet
Width of crown	20 feet
Width of base (maximum)	680 feet
Earthfill	About 12 million cu yd
Six gate-controlled outlets 7.5 feet wide by 14.5 feet high	
Two circular discharge conduits 18 feet in diameter	
Two gate-controlled water supply conduits of 30-inch diameter	
Spillway	1,150 feet crest length
Shoreline at elevation 1,908.0 feet above msl	27 miles

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,964.0	813,400	20,630
Maximum design flood stage	1,958.0	696,300	18,390
Spillway crest	1,938.5	396,400	12,700
Top of conservation storage space	1,908.0	119,200	5,440
Invert to intake to wet well for 30-inch outlets	1,878.5	22,970	--
Invert of six gate-controlled outlets	1,840.0	5	3
Streambed	1,836.0	--	--
Sediment reserve	--	38,800	--

59. Country Club Dam and Casa Blanca Lake

Location

Country Club Dam and Casa Blanca Lake are in the Rio Grande Basin in Webb County, 3 miles northeast of Laredo on Chacon Creek, a tributary to the Rio Grande.

Ownership and History of Development

Country Club Dam and Casa Blanca Lake are owned and operated by Webb County for recreational purposes.

The first dam was built in 1946, with top elevation at 455.0 feet above msl, by the county using its own equipment and men. The dam was damaged by the first floodwaters impounded by piping underneath the earth embankment occurring at the creek channel. Before undertaking reconstruction, Mr. Terrell Bartlett of San Antonio and Mr. Royce Tipton were engaged to prepare the design for a new dam. The present dam and spillway were built from the resulting plans, though with considerable modification, by the county over a period of several years as equipment and men were available. Construction began in 1947, and the dam was completed during 1951 with impoundment of water beginning about that time.

Physical Description

The dam is an earthfill structure about 5,300 feet long with maximum height of 76 feet at the old creekbed. The height varies from 35 feet to 76 feet at various cross sections. The top of the dam is at elevation 465.0 feet above msl. The top width is 20 feet, and maximum bottom width is 240 feet. A 20-foot berm supports a paved roadway along the entire length of the upstream slope of the embankment at elevation 450.0 feet above msl. A core trench was excavated in blue shale under most of the dam, but under one section 600 lineal feet of steel sheet piling was used to cut off a gravel stratum.

The lake has a capacity of 20,000 acre-feet and a surface area of 1,656 acres at elevation 446.5 feet above msl. Among its recreational uses, the lake supplies water to a golf course owned by the county.

The drainage area above the dam is about 117 square miles.

Some irregular records of elevation of the water surface of the lake are available in unpublished data in the International Boundary and Water Commission office at Laredo.

The uncontrolled emergency spillway is about 3,000 feet to the left of the dam. It is excavated in natural earth and rock with crest length of about 260 feet at elevation 446.5 feet above msl. The outflow is through a partially-graded channel about 3,000 feet long to a downstream creek channel. This channel turns back and runs parallel to the dam before crossing under State Highway No. 59.

There are no outlet pipes, and the only diversion is by a small pumping plant supplying water to the park and golf course.

60. Hords Creek Dam and Hords Creek Reservoir

Location

Hords Creek Dam and Hords Creek Reservoir are in the Colorado River Basin in Coleman County, 5 miles northwest of Valera on Hords Creek, a tributary of Jim Ned Creek, which is a tributary of Pecan Bayou, which in turn is a tributary of the Colorado River.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, Fort Worth District, for conservation water and flood regulation. Federal authorization was the Flood Control Act of August 18, 1941, first session of the 76th Congress, and December 22, 1944, second session of the 78th Congress.

The city of Coleman purchased the conservation space by the contribution of $100,000 toward the first cost of the project that gave the city the use of that space for the useful life of the reservoir. The water right for the appropriation of 2,240 acre-feet of water annually for municipal purposes was obtained by Permit No. 1387 (Application No. 1487) dated June 6, 1946 from the State Board of Water Engineers to the city of Coleman.

The dam was started in February 1947, and was completed in June 1948 with deliberate impoundment of water beginning in April 1948.

Physical Description

The dam consists of an earth embankment, emergency spillway, service spillway, and outlet works. The structure is 6,800 feet long, 91 feet high, with

a top width of 24 feet at elevation 1,939.0 feet above msl. A 16-foot roadway extends across the top of the dam. The upstream side is protected with rock riprap and the downstream by a 6-inch-thick layer of gravel.

The reservoir has a conservation capacity of 8,640 acre-feet and a surface area of 510 acres at elevation 1,900.0 feet above msl, crest of the service spillway. Other capacities at various elevations are listed following this section.

The drainage area above the dam is 48 square miles.

The sediment reserve is 2,860 acre-feet.

Record of elevations and contents from April 1948 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers, and from April 1948 in Water-Supply Papers of the U. S. Geological Survey.

The project has flood-regulation capacity, and the conservation water is used by the city of Coleman for municipal purposes. Before this supply became available, it was necessary at times for the city to haul its water by tank cars. The reservoir is also used for recreational purposes and wildlife benefits.

The emergency spillway is a channel excavated on the right bank of Hords Creek with the centerline 607 feet from the embankment. The spillway is a broad-crested weir with crest length of 500 feet at elevation 1,920.0 feet above msl.

An intake structure provides regulation of floodwater and conservation water releases. Two slide-gate-controlled intakes, 4 feet by 6 feet with invert at elevation 1,856.0 feet above msl, and one uncontrolled intake, 4 feet by 6 feet with invert at elevation 1,900.0 feet above msl, discharge into a conduit 8 feet in diameter.

A separate intake structure has three slide-gate-controlled outlets, each 1.5 feet by 1.5 feet, with inverts at elevations 1,893.2, 1,886.2, and 1,876.5 feet above msl. These discharge into a 24-inch conduit through the dam, and connect to a pipeline for the city of Coleman water supply.

Pertinent data on Hords Creek Dam and Hords Creek Reservoir are listed as follows:

Length of dam, including spillway	6,800	feet
Height of dam, above streambed	91	feet
Width of crown	24	feet
Top elevation of dam in feet above msl	1,939.0	

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,939.0	63,150	2,810
Crest of emergency spillway	1,920.0	25,310	1,260
Top of conservation storage space (crest of service spillway)	1,900.0	8,640	510
Invert of lowest water supply outlet	1,876.5	1,690	160
Invert of slide-gates	1,856.0	--	--
Streambed	1,850.0	0	0
Sediment reserve	--	2,860	--

61. Benbrook Dam and Benbrook Reservoir

Location

Benbrook Dam and Benbrook Reservoir are in the Trinity River Basin in Tarrant County, 10 miles southwest of Fort Worth on Clear Fork Trinity River, a tributary of the Trinity River.

Ownership and History of Development

The project is owned by the U. S. Government, and is operated by the U. S. Army Corps of Engineers, Fort Worth District. The dam was built under the River and Harbor Act of March 2, 1945, 79th Congress, first session; and was modified by Public Law 782, 84th Congress, second session.

In 1956 Congress passed legislation enabling the city of Fort Worth to purchase conservation storage space in the reservoir for municipal water supply purposes until such time as the storage space should be required for Trinity River navigation. The contract had not been executed and water rights had not been allocated by the Texas Water Commission as of June 30, 1963.

Construction of the dam began May 27, 1947, and the dam was completed in December 1950 with deliberate impoundment of water starting September 29, 1952. Acquisition of land for recreation facilities was in progress as late as 1963. Construction costs were $12,065,000.

Physical Description

The dam is 9,130 feet long, and consists of a compacted-earth embankment and a concrete spillway section. The embankment has a maximum height of 130 feet with the top width of 20 feet supporting a roadway across the top of the dam at elevation 747.0 feet above msl. The major construction material quantities are 60,500 cu yd of concrete and 5,811,000 cu yd of earthfill.

The reservoir storage capacity is used for flood control, flood regulation, and conservation uses, including navigation and recreational purposes. The capacity is 88,250 acre-feet and the surface area is 3,770 acres at the top of

conservation storage space elevation of 694.0 feet above msl. Space allocated to sediment reserve is 15,750 acre-feet. Other capacities are listed at the close of this section.

The drainage area above the dam is 429 square miles.

Records of contents from September 1952 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from September 1952 in Water-Supply Papers of the U. S. Geological Survey.

An uncontrolled concrete emergency spillway is located near the left end of the dam with a crest length of 500 feet at elevation of 724.0 feet above msl. A 100-foot-long notch in the center of this section has a crest 4 feet lower than the main spillway.

The outlet for release of floodwaters is located in the base of the dam near the right abutment. Two gated openings (broome-type gates) admit water to a 13-foot circular conduit that discharges to a stilling basin below the dam.

Two 30-inch, gate-controlled, steel pipes, with invert at elevation 656.0 feet above msl, control the low-flow releases.

Pertinent data on Benbrook Dam and Benbrook Reservoir are as follows:

Length of dam	9,130 feet
Height of dam above streambed	130 feet
Maximum width of base	700 feet
Width of top	20 feet

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	747.0	475,200	11,470
Maximum design flood stage	741.0	410,000	10,300
Emergency spillway crest	724.0	258,600	7,630
Notch crest of emergency spillway	710.0	164,800	5,820
Top of conservation storage space	694.0	88,250	3,770
Invert of intakes to wet wells	656.0	6,550	730
Invert of two 6.5 feet by 13 feet broome-type gates	622.0	12	7
Streambed	617.0	0	0
Sediment reserve	--	15,750	--
Shoreline	694.0	--	24 miles

62. Gonzales Creek Dam and Lake Daniel

Location

Gonzales Creek Dam and Lake Daniel are in the Brazos River Basin in Stephens County, 7 miles south of Breckenridge on Gonzales Creek, a tributary of Clear Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned by the city of Breckenridge for municipal and industrial water supply. Water rights for the storage of 11,400 acre-feet and annual use of 2,500 acre-feet were obtained by M. E. Daniel through Permit No. 1388 (Application No. 1488) dated June 10, 1946 from the State Board of Water Engineers. On October 5, 1948, the water rights and facilities were transferred by deed to the city of Breckenridge.

Construction of the dam began December 15, 1947, and was completed on September 1, 1948. Deliberate impoundment began at that time with only small inflow available. The lake was first filled in June 1949. A small diversion dam and pumping equipment installed near the city were placed in operation March 1951.

Physical Description

The dam is an earthfill structure 2,500 feet long and 38 feet high with the top of the dam at elevation 1,293.0 feet above msl. The embankment has a maximum bottom width of 250 feet and top width of 18 feet. The upstream surface is protected with 15 inches of rock riprap on a 6-inch gravel base.

The lake has a capacity of 10,000 acre-feet and a surface area of 950 acres at operating level elevation of 1,278.0 feet above msl. The water for municipal use is released to the creek channel below the dam, and travels down Gonzales Creek to the pumping plant diversion lake for the city filter plant. Untreated industrial water is pumped from this same diversion lake.

The drainage area above the dam is 115 square miles.

An emergency spillway near the left end of the dam has a crest length of 1,500 feet at elevation 1,282.0 feet above msl. The discharge is over natural ground to the creek channel below the dam.

The service spillway is a rectangular concrete drop-inlet structure discharging to a double-barrel concrete conduit, each barrel of which is 8 feet wide by 8 feet high with a circular top. Eighteen-inch, slide-gate-controlled inlets at elevation 1,272.0 and 1,257.0 feet above msl are used to supply the required downstream releases. Two gates in the interior walls of the structure, with invert at elevation 1,250.0 feet above msl, regulate the flow to each of the large conduit barrels. When the water level is above the lip of the inlet at elevation 1,278.0 feet above msl, the flow is uncontrolled through both barrels of the large conduit.

63. Whitney Dam and Whitney Reservoir

Location

Whitney Dam and Whitney Reservoir are in the Brazos River Basin in Hill and Bosque Counties, 7 miles southwest of Whitney and 38 miles upstream from Waco on the Brazos River at river mile 442.4. The reservoir extends into Johnson County.

Ownership and History of Development

The project is owned by the U. S. Government and operated by the U. S. Army Corps of Engineers, Fort Worth District. It was built under authority of the Flood Control Acts of August 18, 1941, 77th Congress, and December 22, 1944, 78th Congress, and the Civil Functions Appropriations Act of 1953.

Construction began May 12, 1947. The main dam and spillway were completed in April 1951, and deliberate impoundment started December 10, 1951.

The U. S. Army Corps of Engineers gives the cost of the Whitney project as $41,390,000, and states that the stored floodwaters were used in August 1952 to save a $5 million rice crop in the lower Brazos River Valley. They further estimated that control of the 1957 flood prevented $14 million damage that would have occurred had the reservoir not been built. They report that during 1960 over 3 million visitors were attracted to the lake.

Physical Description

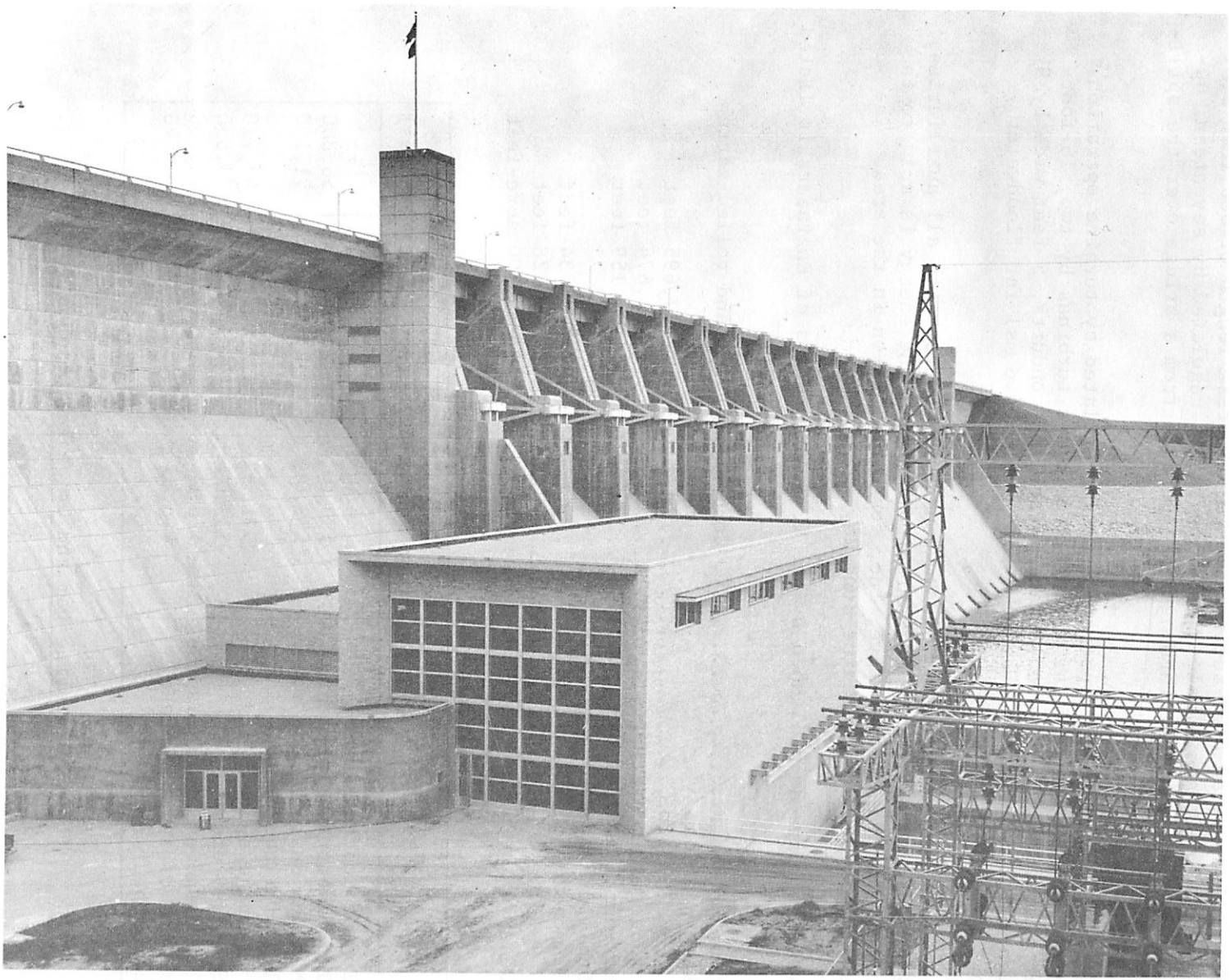
The dam is a concrete structure flanked on both ends by compacted earthfill embankments with a total length of 17,695 feet. It is 159 feet high with the top of the dam at elevation 584.0 feet above msl. The embankment has a maximum bottom width of 640 feet and top width of 34 feet with a roadway across the top of the dam. The upstream face is protected by rock riprap. The dam contains 518,300 cu yd of concrete and 1,735,000 cu yd of earth.

The reservoir has a total capacity of 387,000 acre-feet and a surface area of 15,800 acres at the top of the power storage space at elevation of 520.0 feet above msl. The top volume of the reservoir is used for flood control with allocation as shown in the list that follows this section.

The drainage area above the dam is 26,170 square miles, of which 9,240 square miles is probably noncontributing.

The reservoir design data shows that 255,300 acre-feet of storage capacity below normal power storage level is reserved for sediment and power head, and 5,140 acre-feet of this is below the invert of the lowest outlet.

Records of contents from December 1951 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from December 1951 in Water-Supply Papers of the U. S. Geological Survey.



Whitney Dam and Power House. Furnished by U. S. Army Corps of Engineers, Fort Worth District.

The spillway is an ogee section with a net crest length of 680 feet at elevation 533.0 feet above msl. The discharge is regulated by seventeen, 40-foot-wide by 38-foot-high taintor gates, operated from a bridge over the spillway piers.

Release of water for downstream uses is regulated by turbine operation for generation of power. Water is supplied to the turbines by two, 16-foot-diameter penstocks. There are 16 gate-controlled conduits, 5 feet wide by 9 feet high, with invert at elevation 448.83 feet above msl for floodwater release.

The power plant has two 15,000 kw generating units, with all auxiliaries, for delivery of energy to the transmission system. The energy is sold to the Brazos Electric Power Cooperative, Inc. for distribution in the area. The first unit was placed on the line June 25, 1953.

Pertinent data as published by the U. S. Army Corps of Engineers is listed below.

Type of dam	Concrete gravity and rolled-earth
Length of dam	
Total	17,695 feet
Concrete section	1,674 feet
Maximum height of dam	159 feet
Top width of dam	
Embankment	34 feet
Spillway	28 feet
Reserve for power head and sediment storage	255,300 acre-feet

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of concrete dam	584.0	--	--
Top of earth embankment	580.0	2,494,800	56,360
Maximum design flood stage	573.0	2,118,400	51,190
Top of flood-control storage space	571.0	2,017,500	49,710
Spillway crest	533.0	642,200	23,550
Top of power storage space	520.0	387,000	15,800
Invert of lowest intake	448.83	5,140	543
Streambed	425.0	--	--

64. Grapevine Dam and Grapevine Reservoir

Location

Grapevine Dam and Grapevine Reservoir are in the Trinity River Basin in Tarrant County, 2 miles northeast of Grapevine on Denton Creek, a tributary to Elm Fork Trinity River, which is tributary to the main Trinity River. The reservoir extends into Denton County.

Ownership and History of Development

The project is owned by the U. S. Government, and is operated by the U. S. Army Corps of Engineers, Fort Worth District. It was authorized by the River and Harbor Act approved March 2, 1945, first session of the 77th Congress, and Public Law 14, first session of the 79th Congress.

Conservation storage space has been purchased by the cities of Dallas, Grapevine, and Dallas County Park Cities Water Control and Improvement District No. 2, with appropriations authorized by the State Board of Water Engineers as follows: Permit No. 1603 (Application No. 1728) dated November 23, 1951 to the city of Grapevine for the diversion of 1,250 acre-feet of water annually for municipal purposes; Permit No. 1464 (Application No. 1572) dated August 19, 1948 to the city of Dallas for the diversion of 85,000 acre-feet of water annually for municipal, industrial, manufacturing, and recreational purposes; Permit No. 1465 (Application No. 1573) dated August 19, 1948 to Dallas County Park Cities Water Control and Improvement District No. 2 for the diversion of 50,000 acre-feet of water annually for municipal, industrial, manufacturing, and recreational purposes.

Construction began in January 1948, and was completed in June 1952. Deliberate impoundment of water began July 3, 1952.

Grapevine is one of several reservoirs--Garza-Little Elm being one of the largest--supplying water to Dallas and other cities in the area. The U. S. Corps of Engineers gives the project cost as $10,827,000, and states that more than 1,600,000 persons visited the project in 1960.

Physical Description

The dam is a rolled-earth structure 12,850 feet long including concrete spillway section, which has a 500-foot crest length located on the left bank. The height is 137 feet above streambed with a top width of 28 feet and a public road across the top at elevation 588.0 feet above msl. The upstream face of the embankment is protected with stone riprap.

The reservoir has a conservation storage capacity of 188,500 acre-feet and a surface area of 7,389 acres at elevation 535.0 feet above msl. The shoreline is 60 miles long at this storage level.

Other storage space in the reservoir is allocated for flood control, conservation, navigation, sedimentation reserve, and recreational purposes.

The drainage area above the dam is 695 square miles.

Records of contents from July 1952 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from July 1952 in Water-Supply Papers of the U. S. Geological Survey.

An uncontrolled, emergency, concrete-gravity spillway is located at the left end of the dam. The ogee-weir section has a crest length of 500 feet at elevation 560.0 feet above msl.

Outlet works for release of floodwater consist of a concrete structure having two intake openings with invert at elevation 475.0 feet above msl controlled by two 6.5-foot by 13.0-foot, broome-type gates. Water released through these gates will flow through a 13-foot-diameter conduit located in the base of the embankment, then discharge into a stilling basin below the dam.

There are two, 30-inch, steel pipes paralleling the flood-control conduit for low-flow releases. There are two gated outlets with invert at elevation 500.5 feet above msl, and one gated outlet each at elevations 512.5 and 520.0 feet above msl discharging to these pipes.

The following is pertinent data on Grapevine Dam and Grapevine Reservoir. Data on the reservoir were revised in 1961 by the U. S. Army Corps of Engineers.

Length of dam including spillway	12,850 feet
Height of dam above streambed	137 feet
Width of crown	28 feet
Volume of earthfill	6,678,400 cu yd
Two gate-controlled intakes	6.5 feet wide by 13.0 feet high
One circular discharge conduit	13 feet diameter
Two gate-controlled conduits	30-inch-diameter
Uncontrolled spillway	500 feet long

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)	Shoreline (miles)
Top of dam	588.0	915,700	22,500	--
Emergency spillway crest	560.0	435,500	12,740	146
Top conservation storage space	535.0	188,500	7,380	60
Intake wet well	500.0	24,750	2,190	--
Invert lowest intake	475.0	830	126	--
Streambed	451.0	--	--	--
Sediment reserve	--	36,000	--	--

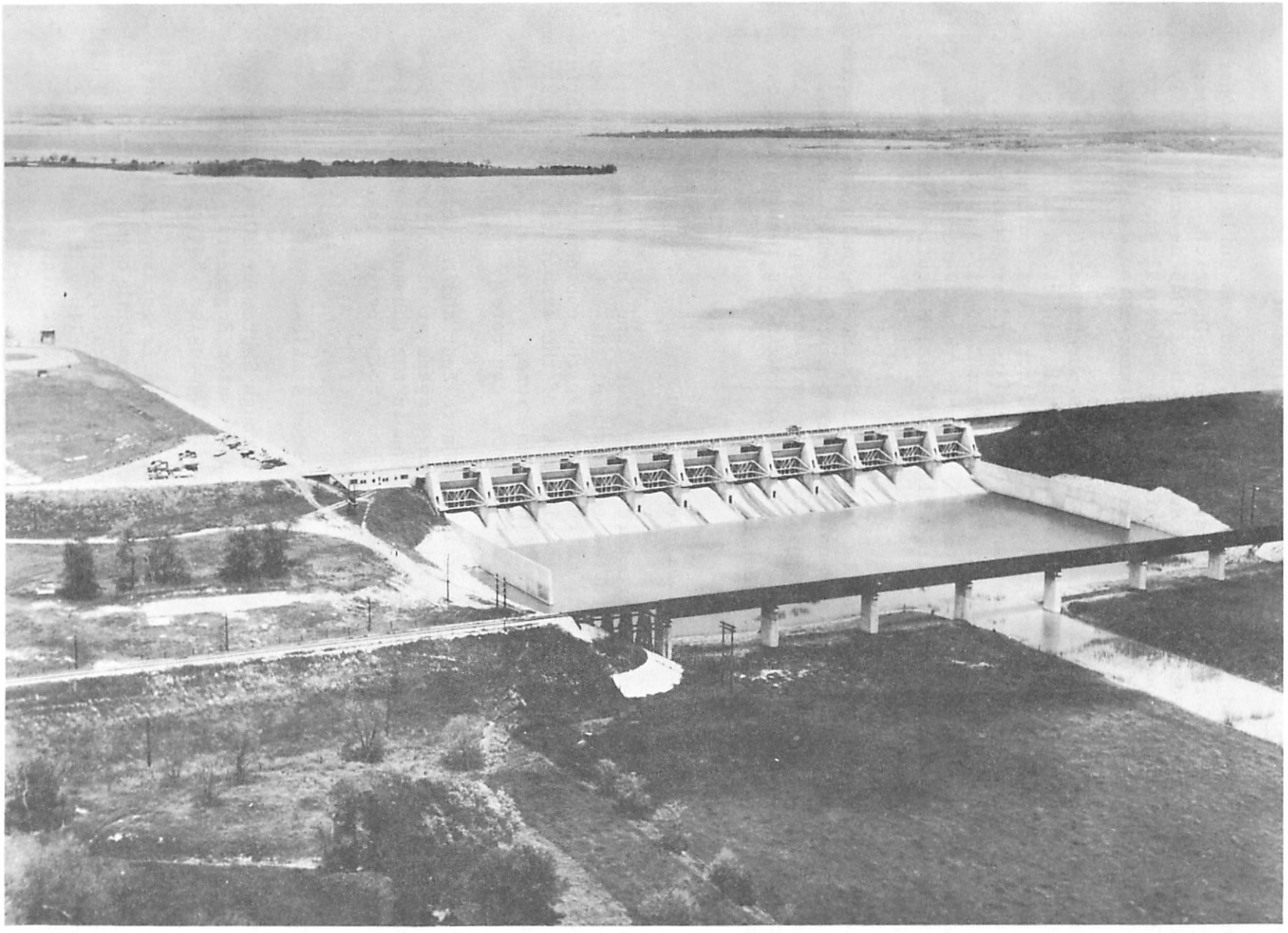
The 161,250 acre-feet of usable conservation storage capacity is allocated as follows:

City of Dallas	85,000 acre-feet
Dallas County Park Cities Water Control and Improvement District No. 2	50,000 acre-feet
Grapevine	1,250 acre-feet
Navigation	25,000 acre-feet

65. Lavon Dam and Lavon Reservoir

Location

Lavon Dam and Lavon Reservoir are in the Trinity River Basin in Collin County, 2 miles west of Lavon and 22 miles northeast of Dallas on the East Fork Trinity River, a tributary of the Trinity River.



Lavon Dam and Lavon Reservoir. Furnished by U. S. Army Corps of Engineers, Fort Worth District.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, Fort Worth District. The project was authorized by the River and Harbor Act of March 2, 1945 as amended July 24, 1946, 79th Congress, second session. This is one of several projects in the Upper Trinity River Basin for flood control and conservation water supply.

The North Texas Municipal Water District has purchased the 100,000 acre-feet of conservation space in the reservoir. Total authorized use is 60,000 acre-feet annually designated as follows: 50,000 acre-feet for municipal use, 8,000 acre-feet for industrial use, and 2,000 acre-feet for domestic use. This water right was obtained by the District under Permit No. 1720 (Application No. 1820) dated September 1, 1954 from the State Board of Water Engineers. The District supplies water by pumping to Garland, Dallas, Mesquite, McKinney, and several small towns in the area.

Construction of the dam began in January 1948, and the main dam was completed in 1952. Deliberate impoundment of water began September 14, 1953. Some recreational features and land acquisition were not completed until 1962. Project cost was about $12,200,000. The Corps of Engineers reports that over 2 million persons visited the project in 1960.

Physical Description

The dam is a rolled-earth structure 9,499 feet long including the spillway. The maximum height is 69 feet with the top width of the embankment of 28 feet at elevation 502.0 feet above msl. A roadway over the embankment and a bridge across the spillway provide access to all parts of the structure. The upstream face of the embankment is protected with stone riprap. Volume content of the dam is 3,689,200 cu yd, of which 49,200 cu yd is concrete.

The reservoir has a capacity of 143,600 acre-feet and a surface area of 11,080 acres at the top of conservation storage space at elevation 472.0 feet above msl. Other reservoir features are given in the tabulation that follows this text. The features show that the flood-control storage capacity at the top of the taintor gates is 279,800 acre-feet.

The drainage area above the dam is 770 square miles.

Records of contents from October 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers, and from September 1953 in Water-Supply Papers of the U. S. Geological Survey.

A controlled spillway for floodwater discharge is located at the right end of the embankment. It is a concrete ogee section with crest length of 480 feet at elevation 462.0 feet above msl. The discharge capacity is 255,800 cfs with reservoir elevation at 290.0 feet above msl. Spillway discharge is controlled by twelve taintor gates, 40 feet long by 28 feet high.

Low-flow releases for downstream requirements are controlled by five 36-inch-diameter, gated sluices through the centermost piers of the spillway with invert at elevation 453.0 feet above msl.

A water-supply intake structure is located 1,200 feet upstream from the dam to supply water to the pumping plant of the District for distribution to the participating cities. Withdrawals are controlled by six 4-foot-diameter gates located at various elevations in the structure and can be made to elevation 453.0 feet above msl.

Pertinent data on Lavon Dam and Lavon Reservoir are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	502.0	713,700	28,390
Maximum design flood stage	496.0	556,100	24,190
Top of taintor gates	490.0	423,400	20,050
Top of conservation storage space	472.0	143,600	11,080
Spillway crest	462.0	56,290	6,430
Invert of lowest intake	453.0	14,330	3,050
Streambed	433.0	0	0
Sediment reserve	--	47,800	--
Shoreline	490.0	130 miles	--
Shoreline	472.0	83 miles	--

Discharge capacities	Elevation (feet above msl)	Low-flow outlet works (cfs)	Spillway discharge (cfs)
Top of dam	502.0	--	--
Maximum design flood stage	496.0	--	347,500
Top of taintor gates	490.0	1,230	255,800
Top of conservation storage space	472.0	845	50,400
Spillway crest	462.0	515	0

Authorization has been made by the Flood Control Act of 1952 to modify this project to increase conservation storage space to elevation 489.0 feet above msl with a capacity of 403,600 acre-feet. The top of the dam would be raised to 512.5 feet above msl. Funds have not been appropriated to begin advance planning.

66. Cherokee Dam and Lake Cherokee

Location

Cherokee Dam and Lake Cherokee are in the Sabine River Basin in Gregg and Rusk Counties, 12 miles southeast of Longview on Cherokee Bayou, a tributary of the Sabine River.

Ownership and History of Development

Cherokee Dam and Lake Cherokee are owned and operated by the Cherokee Water Company with offices at Longview.

The project was authorized by Permit No. 1396 (Application No. 1497) dated November 27, 1946 from the State Board of Water Engineers to Clyde E. Hill, trustee, Cherokee Water Company, and authorizes diversion of 62,400 acre-feet of water per year for municipal and recreational purposes. Permit No. 1427 (Application No. 1530) dated December 11, 1947 from the State Board of Water Engineers to the Cherokee Water Company authorized these uses to be extended to include industrial and manufacturing uses.

To clarify ownership, all rights and obligations of Clyde E. Hill as trustee were transferred by deed, dated July 24, 1948, to the Cherokee Water Company.

Land purchases began in December 1946. Construction was started soon after the bid opening on February 26, 1948, and was completed November 19, 1948. Deliberate impoundment began in October 1948.

Physical Description

The dam is a rolled-earth structure 4,000 feet long and 45 feet high with top width of 20 feet and maximum bottom width of 340 feet. The top of the dam is at elevation 295.0 feet above msl. An uncontrolled service spillway is located at the left end of the dam, and the emergency spillway of natural ground is located at the right end of the dam.

The lake has a capacity of 46,700 acre-feet and a surface area of 3,987 acres at elevation 280.0 feet above msl, based on the April 1960 sedimentation survey by the U. S. Soil Conservation Service. The city of Longview is diverting water for municipal use. The Southwestern Power Company is circulating water from the lake for condenser-cooling for steam-turbine generating units in the Knox Lee Power Plant. The water for this purpose is returned to the lake at a distant point. Losses are seepage and evaporation from the lake.

Other capacities given in the following tabulation are taken from data obtained in 1960 by the U. S. Soil Conservation Service survey.

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	295.0	--	--
Maximum design flood stage	291.0	--	--
Crest of emergency spillway	285.0	68,700	4,900
Crest of service spillway	280.0	46,700	3,987
Invert of 18-inch outlet	260.0	4,510	800

The drainage area above the dam is 158 square miles.

The Water Company estimates that the sedimentation inflow will be about 1.6 acre-feet per square mile of drainage area annually or 13,600 acre-feet in a fifty-year period.

Records of elevations from April 1951 and contents since January 1961 are contained in Water-Supply Papers of the U. S. Geological Survey.

The service spillway is an uncontrolled concrete structure located at the left end of dam, with crest length of 828 feet at elevation 280.0 feet above msl. It is the chute type, and is designed to discharge 100,000 cfs under 11 feet of head.

An emergency spillway is located about 200 feet from the right end of the dam. It is a cut graded in the natural earth, with crest length of 600 feet at elevation 285.0 feet above msl. The emergency spillway was deepened to lower the lake for spillway repairs after the October 1957 flood caused considerable damage to the concrete chute and wingwalls of the service spillway. Eight sluice gates were installed to regulate the flow during repairs. An earth and cement-filled sandbag closure was put across this emergency spillway upstream from the gates, which are still in place but which cannot be used unless the channel is reopened.

The water supply and low-flow outlet is an 18-inch-diameter pipe controlled by a gate valve operated from a tower upstream from the dam. The invert is at elevation 260.0 feet above msl.

67. Camp Creek Dam and Camp Creek Lake

Location

Camp Creek Dam and Camp Creek Lake are in the Brazos River Basin in Robertson County, 13 miles east of Franklin on Camp Creek, a tributary of the Navasota River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned by the Camp Creek Water Company with offices in Bryan. Permit No. 1460 (Application No. 1567) dated July 23, 1948 from the State Board of Water Engineers was issued to T. N. Kelley and J. H. Fox. This Permit allows the storage of 8,400 acre-feet of water and annual use of 8,400 acre-feet of water for recreational use. In 1949 the owners organized the Camp Creek Water Company; water rights and facilities were transferred to this new company. The water may be sold to the city of Bryan for future municipal water supply.

The project was started in August 1948, and was completed January 3, 1949 with deliberate impoundment beginning in November 1948. The lake was first filled during 1951.

Physical Description

The dam is an earthfill structure with a puddled core trench and is 1,855 feet long and 49 feet high with the top of the dam at elevation 325.0 feet above msl. The bottom width is about 237 feet, and the top width is 15 feet.

The lake has a total capacity of 8,550 acre-feet and a surface area of 750 acres at elevation 310.0 feet above msl. Dead storage is 270 acre-feet. At the present time, the lake is used only for recreational purposes.

The drainage area above the dam is 40 square miles.

The service spillway is an uncontrolled drop-inlet type structure with entrance elevation at 310.0 feet above msl. The outflow is through an 8-foot-diameter conduit extending through the embankment, with outlet invert at elevation 277.5 feet above msl. The water discharges to a stilling basin, and then to Camp Creek.

An uncontrolled emergency spillway is about 2,000 feet from the right end of the dam. It has a crest length of 400 feet with the low point at elevation 318.0 feet above msl.

The low-flow outlet is a valve-controlled, 18-inch, concrete pipe, with invert at elevation 291.8 feet above msl. The discharge is to the service spillway conduit.

68. Whitehouse Dam and Lake Tyler

Location

Whitehouse Dam and Lake Tyler are in the Neches River Basin in Smith County, 12 miles southeast of Tyler on Prairie Creek, a tributary of Mud Creek, which is tributary to the Angelina River, which in turn is tributary to the Neches River.

Ownership and History of Development

The project is owned and operated by the city of Tyler.

Water rights to 30,000 acre-feet of water annually for municipal, domestic, and industrial use was obtained by Permit No. 1435 (Application No. 1546) dated March 25, 1945 from the State Board of Water Engineers. This authorization was amended by Permit No. 1843 (Application No. 1988) dated October 1, 1956 increasing total diversion to 50,000 acre-feet of water, including the proposed Mud Creek Dam on Mud Creek. This Permit also authorized raising the dam and spillway 1 foot, which increased the storage capacity of Lake Tyler 1,100 acre-feet. As planned, Tyler would be connected to the proposed Mud Creek Reservoir by a canal, and the two reservoirs operated as one unit. Construction work was started at the Mud Creek Dam site, but was abandoned.

Construction of Whitehouse Dam began April 30, 1948 with deliberate impoundment of water beginning January 8, 1949. The structure was completed and accepted May 13, 1949.

Physical Description

The dam is a rolled-earth structure 4,708 feet long and 50 feet high with the top of the dam at elevation 390.0 feet above msl. The upstream face of the

embankment is protected with 24 inches of rock riprap on a 9-inch gravel base from elevation 355.0 feet above msl to the top of the dam. The spillway height has been raised 1 foot above the original design.

The lake has a capacity of 43,400 acre-feet and a surface area of 2,450 acres at spillway crest level of 375.5 feet above msl. It is used for the city of Tyler's water supply and for public recreation. If Mud Creek Dam is built, Lake Tyler will be joined to that reservoir by an interconnecting canal, and the combined projects will be operated as one reservoir. Additional capacities of Lake Tyler are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam	390.0	92,000
Maximum design flood stage	384.3	68,000
Spillway crest	375.5	43,400
Invert of upper sluice gate	362.0	17,000
Invert of middle sluice gate	356.0	9,700
Invert of lower sluice gate	350.0	4,400

The drainage area above the dam is 45 square miles.

Records of contents from March 1949 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from March 1949 in Water-Supply Papers of the U. S. Geological Survey.

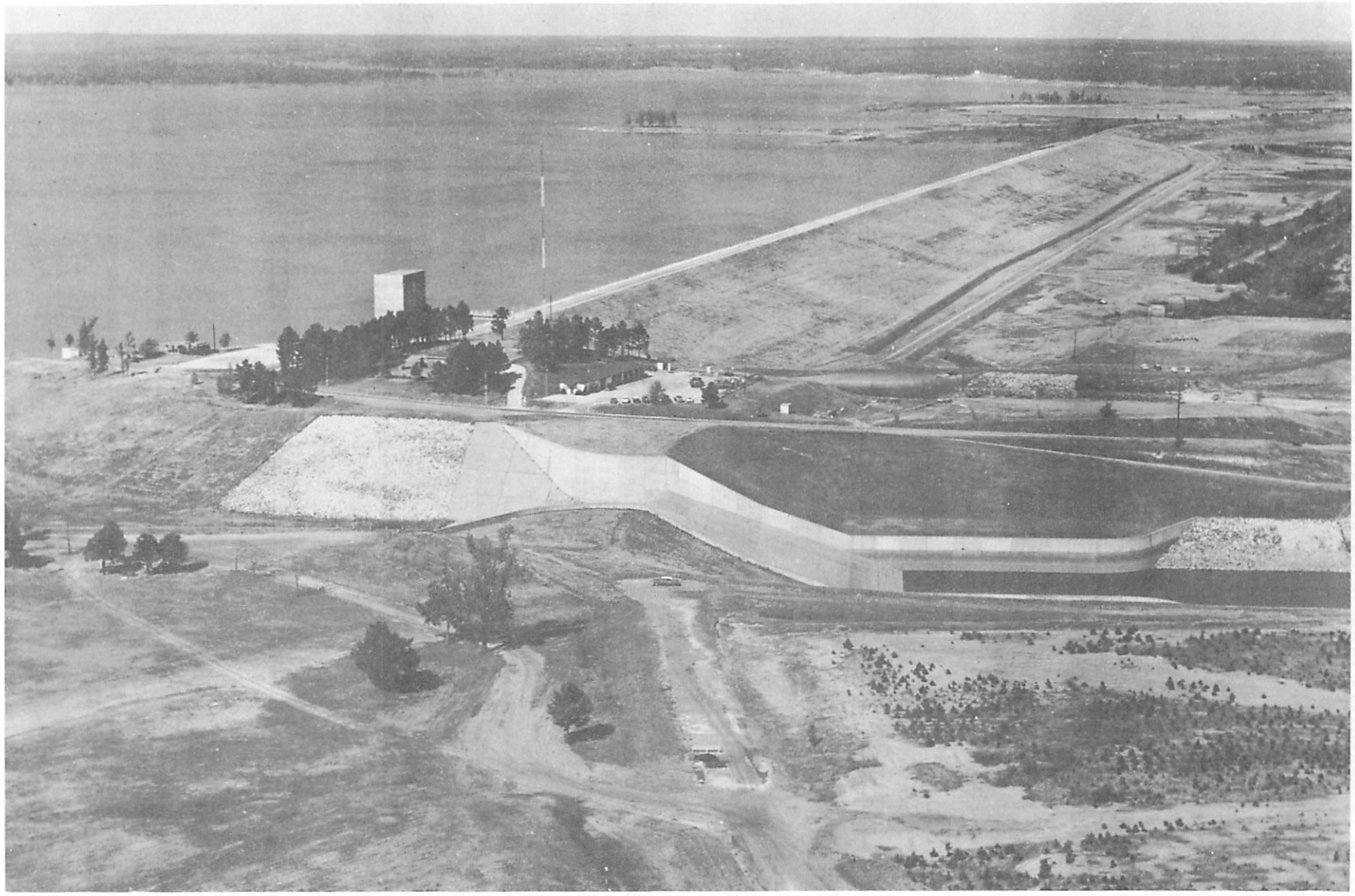
The service spillway is about 800 feet from the left end of the dam. It is an uncontrolled concrete chute flume with crest length of 200 feet at elevation 375.5 feet above msl. Water discharges to a stilling basin, then through a channel to the creek 1,800 feet downstream from the dam. The maximum design discharge is 17,500 cfs with lake elevation at 384.3 feet above msl.

The diversion facility for Tyler's water supply is located about 2 miles upstream from the dam. The intake tower is equipped with three pairs of circular sluice gates: one pair at elevation 362.0, one pair at elevation 356.0, and one pair at elevation 350.0 feet above msl. The water flows from the intake through a 48-inch concrete pipe, 660 feet long, to the pumphouse and then delivered through a pipeline to the filter plant or to a raw-water storage lake 8 miles away. Two 12-inch, cast iron pipes are installed through the base of the dam for future municipal water supply to Troup and Whitehouse.

69. Texarkana Dam and Texarkana Reservoir

Location

Texarkana Dam and Texarkana Reservoir are in the Sulphur River Basin in Bowie and Cass Counties, 11 miles southwest of Texarkana on the Sulphur River. The reservoir borders Bowie and Cass Counties and extends into Morris, Titus, and Red River Counties.



Texarkana Dam and Texarkana Reservoir. Furnished by U. S. Army Corps of Engineers, New Orleans District.

Ownership and History of Development

The project is owned by the U. S. Government and operated by the U. S. Army Corps of Engineers, New Orleans District. This reservoir is a part of the comprehensive plan for flood control in the Red River Basin, and was authorized by the Flood Control Act approved July 24, 1946, Public Law No. 526, 79th Congress, second session.

The cities of Texarkana, Texas and Arkansas, are authorized to divert 14,572 acre-feet of water annually from Texarkana Reservoir for municipal use under Permit No. 1563 (Application No. 1684) dated April 18, 1951 from the Stae State Board of Water Engineers. A contract with the Federal Government for use of stored water is contingent upon the reservoir being maintained between elevations 218.0 and 225.0 feet above msl.

Construction began September 1948 with final completion in December 1957 at a cost of $34,200,000. The reservoir was operated for temporary floodwater detention from July 2, 1953 to June 27, 1956, and floodwaters were first discharged July 18, 1953. Deliberate impoundment began June 27, 1956, and the water level reached elevation 220.0 feet above msl in February 1957. Water diversion was begun in December 1958 by the city of Texarkana.

Physical Description

The dam consists of a rolled-earth structure 18,500 feet long with a maximum height of 100 feet and the top of the dam at elevation 286.0 feet above msl. The embankment contains about 7,370,000 cu yd of earthfill. The crown of the dam is used as a roadway. The upstream face is protected with 33 inches of rock riprap on a 15-inch sand and gravel blanket. A concrete spillway is located near the right abutment with crest elevation at 259.5 feet above msl.

The reservoir has a capacity of 145,300 acre-feet at conservation storage level elevation 220.0 feet above msl, and 2,654,300 acre-feet capacity at spillway crest elevation of 259.5 feet above msl. The reservoir is designed for the retention of floodwaters during periods of high water in the Red River.

The drainage area above the dam is 3,443 square miles.

Records of contents from July 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from July 1953 in Water-Supply Papers of the U. S. Geological Survey.

The Texas Parks and Wildlife Commission has been granted a license by the Secretary of the Army to manage all fish and wildlife reservoirs of the area.

An uncontrolled concrete spillway, with crest length of 200 feet, is located at the right end of the main embankment with crest elevation 259.5 feet above msl. Flow over the spillway discharges into an excavated channel and then to the Sulphur River.

A reinforced concrete structure, located on the upstream side of the dam, houses the flood-control outlet gates and operating machinery. There are two 20-foot-diameter conduits with invert at elevation 200.0 feet above msl controlled by four broome-type gates, 10 feet by 20 feet. The low-flow outlet

consists of one 14-inch-diameter pipe with control valve discharging into a 20-foot flood conduit.

Pertinent data on Texarkana Dam and Texarkana Reservoir are listed below.

Feature	Elevation (feet above msl)	Total capacity (acre-feet)	Area (acres)
Top of dam	286.0	--	--
Maximum design flood stage	278.9	5,730,800	--
Spillway crest	259.5	2,654,300	119,700
Top conservation storage space	220.0	145,300	20,000
Streambed	180.0	0	0
Shoreline: 102 miles at	220.0	--	--

Elevations in feet above msl of flood-control outlet works:

Top of structure	331.5
Operating floor	286.0
Service room floor	258.0
Gate sill	200.0

Discharge of spillway and conduits with all gates open*:

Feature	Elevation (feet above msl)	Flood control outlets (cfs)	Spillway (cfs)
Top of dam	286.0	--	--
Maximum design flood stage	278.9	--	63,200
Spillway crest	259.5	27,600	0

* Generally the flood releases are controlled to 10,000 cfs.

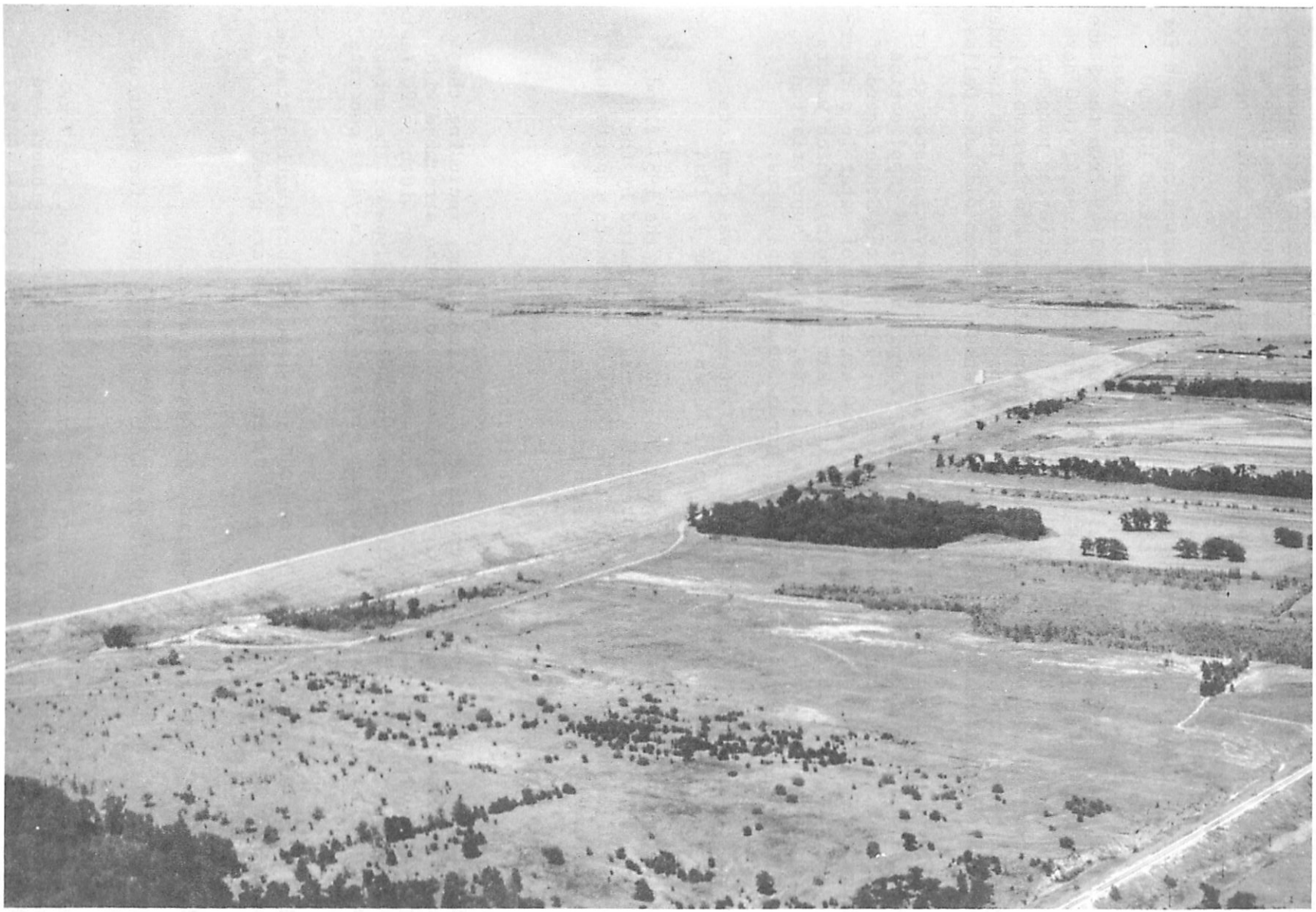
70. Lewisville Dam and Garza-Little Elm Reservoir

Location

Lewisville Dam and Garza-Little Elm Reservoir are in the Trinity River Basin in Denton County, 2 miles northeast of Lewisville on Elm Fork Trinity River, a tributary of the Trinity River. For earlier information, see descriptions of Garza Dam and Lake Dallas (page 35), which were inundated by the Garza-Little Elm Reservoir.

Ownership and History of Development

The project is owned by the U. S. Government, and is operated by the U. S. Army Corps of Engineers, Fort Worth District. Garza-Little Elm Dam (now Lewisville Dam) was authorized under the River and Harbor Act of March 2, 1945, Public Law 14, 79th Congress, first session, for flood control and conservation



Lewisville Dam and Garza-Little Elm Reservoir. Furnished by U. S. Army Corps of Engineers, Fort Worth District.

purposes. By act of the 84th Congress, August 9, 1955, the name of the dam was changed from Garza-Little Elm Dam to Lewisville Dam. The reservoir inundated and incorporated Lake Dallas when the old Garza Dam was breached on October 28, 1957. This is one of several developments in the Trinity River Basin for flood control, conservation storage, and recreational purposes.

The city of Dallas purchased 310,000 acre-feet of conservation storage for $3,400,000 plus annual operational costs, and in addition reserved 105,000 acre-feet of storage in exchange for existing rights in the old Lake Dallas. By Permit No. 1476 (Application No. 1579) dated January 20, 1949 from the State Board of Water Engineers, the city of Dallas is authorized to use 415,000 acre-feet of water annually for municipal, industrial, and manufacturing purposes from a reservoir of 436,000 acre-feet capacity (Garza-Little Elm Reservoir), which was to be constructed by the U. S. Army Corps of Engineers. This includes the permitted appropriation of 300,000 acre-feet annually from old Lake Dallas.

The city of Denton purchased 21,000 acre-feet of conservation storage for $235,000 and certain annual operational costs. Permit No. 1706 (Application No. 1590) issued to the city of Denton on June 17, 1954 by the State Board of Water Engineers authorizes the storage of 21,000 acre-feet of water in a reservoir of 436,000 acre-feet capacity (Garza-Little Elm Reservoir), which was to be constructed by the U. S. Army Corps of Engineers, and the appropriation therefrom of 11,000 acre-feet of water per annum for municipal uses.

Construction began November 28, 1948, and the main dam was completed in August 1955. Deliberate impoundment of water began November 1, 1954.

The total cost of the project was $21,756,500. During the 1957 flood, this project and the Dallas Floodway prevented damage estimated by the U. S. Army Corps of Engineers as $72,600,000. The Corps of Engineers reports that during 1960 over 2 million persons visited the lake.

Physical Description

The dam is a compacted earth structure 32,888 feet long, including the spillway section, with a maximum height of 125 feet above the streambed with the top of the dam at elevation 560.0 feet above msl. The top width is 20 feet with a maximum bottom width of 700 feet, and the upstream slope of the embankment is protected by stone riprap. The dam contains 44,400 cu yd of concrete and 13,165,000 cu yd of earthfill.

The reservoir has a capacity of 482,000 acre-feet at conservation storage space elevation of 515.0 feet above msl. Other capacities are given in the list that follows this section.

The drainage area above the dam is 1,660 square miles.

The reservoir data shows 46,000 acre-feet of storage space for sediment reserve.

Records of contents from November 1954 through September 30, 1957 are contained in Bulletin No. 5807-A of the State Board of Water Engineers and since November 1954 in Water-Supply Papers of the U. S. Geological Survey.

The emergency spillway is located near the left end of the embankment. This is an uncontrolled gravity ogee weir with a crest length of 560 feet at elevation 532.0 feet above msl, with a combined paved and excavated chute-type discharge channel to the river about 1.5 miles downstream from the dam.

Outlet works for release of floodwaters are located about 3,200 feet to the left of the old river channel. This is a reinforced concrete structure with three openings controlled by broome-type gates, 6.5 feet wide by 13 feet high, with invert at elevation 448.0 feet above msl. The water is discharged through a 16-foot-diameter conduit into a stilling basin below the dam.

Two 60-inch, gate-controlled, steel pipes for release of water for conservation use are located on each side of the 16-foot, flood-control conduit. There are two gated outlets with invert at elevation 481.0 and one each at elevations 496.0 and 503.0 feet above msl discharging into these pipes.

Denton diverts its water supply from the upper part of the reservoir with facilities constructed by the city.

Pertinent data on the dam and reservoir are listed below.

Length of dam including spillway	32,888	feet
Maximum height of dam above streambed	125	feet
Width of dam at crown	20	feet
Maximum width of dam at base	700	feet
Top elevation of dam	560.0	feet above msl
One circular conduit 16 feet in diameter		
Three gate-controlled inlets 6.5 feet wide by 13 feet high with invert elevation of 448.0 feet above msl		
Gate-controlled water supply outlets for the 60-inch diameter steel pipes. Inverts: Two at 481.0 feet above msl, one at 496.0 feet above msl, and one at 503.0 feet above msl.		
Length of ogee type spillway	560	feet
Crest elevation	532.0	feet above msl
Shoreline	183	miles
Reserve for sedimentation	46,000	acre-feet

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	560.0	2,588,400	75,900
Maximum design flood stage	553.0	2,019,400	66,100
Spillway crest	532.0	1,002,900	38,900
Top of conservation storage space	515.0	482,000	22,970
Invert of one low-flow outlet	503.0	260,300	14,440
Invert of one low-flow outlet	496.0	172,800	11,340
Invert of two low-flow outlets	481.0	49,010	5,310
Invert of three 6.5 feet by 13.0 feet broome-type gates	448.0	240	37
Streambed	435.0	--	--

71. Baylor Creek Dam and Baylor Creek Reservoir

Location

Baylor Creek Dam and Baylor Creek Reservoir are in the Red River Basin in Childress County, 10 miles northwest of Childress on Baylor Creek, a tributary to Prairie Dog Town Fork Red River, which is tributary to the Red River.

Ownership and History of Development

The project is owned and operated by the city of Childress for municipal water supply and recreational purposes. Right to impound 9,200 acre-feet of water with annual diversion of 2,164 acre-feet was obtained by the city by Permit No. 1480 (Application No. 1601) dated March 17, 1949 from the State Board of Water Engineers.

Construction of the dam was started by the city April 1, 1949 and completed in February 1950. Deliberate impoundment was begun at the end of 1949. Use of impounded water began in 1954. Adjacent to this reservoir is Lake Childress, which was built on a tributary to Baylor Creek in 1923. This lake had an original capacity of 4,600 acre-feet, and is still part of the city's water supply system.

Physical Description

Baylor Creek Dam is a rolled-earth structure, 3,383 feet long and 66 feet high above the creekbed, with the top of the dam at elevation 2,019.0 feet above msl. The maximum bottom width is 276 feet and the top width 16 feet. The upstream face has 12 inches of rock riprap on a 6-inch gravel blanket from elevation 450.0 to the top of the dam. The dam contains 434,000 cu yd of earth.

The reservoir has a capacity of 9,220 acre-feet and a surface area of 610 acres at operating elevation of 2,010.0 feet above msl.

The drainage area above the dam is 40 square miles.

One spillway is an uncontrolled, open-channel cut in the natural bank with a bottom width of 200 feet with crest elevation 2,010.0 feet above msl. The discharge is to Lake Childress. The second or emergency spillway is a cut through the embankment with crest length of 500 feet at elevation 2,010.0 feet above msl. This section has a 5-foot-high earth fuse plug with top at elevation 2,015.0 feet above msl designed to wash out during extreme floods.

Service water releases are provided by a concrete, controlled, inlet tower connected to a 36-inch cast iron pipe that extends through the dam. Inflow to the 36-inch pipe is regulated by slide gates at several elevations in the vertical walls of the inlet tower, which are operated from the top of the tower.

72. Belton Dam and Belton Reservoir

Location

Belton Dam and Belton Reservoir are in the Brazos River Basin in Bell County, 4 miles north of Belton at river mile 16.7 on the Leon River, a tributary to the Little River, which is a tributary of the Brazos River. The upper part of the reservoir extends into Coryell County.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, Fort Worth District. It was authorized by the Flood Control Act approved July 24, 1946 (Public Law 526), 79th Congress, second session, and modified by the Flood Control Act of September 3, 1954. Belton Dam is one of several projects in the Brazos River Basin for flood control, conservation storage, and recreational purposes.

Permit No. 1689 (Application No. 1815) dated October 29, 1953 from the State Board of Water Engineers allows the U. S. Government to divert 10,000 acre-feet per year for use at Fort Hood. Permit No. 1725 (Application No. 1815A) dated October 27, 1954 increases this diversion to 12,000 acre-feet annually. The U. S. Government leased all the facilities to Bell County Water Control and Improvement District in January 1956 for 50 years. This District supplies Fort Hood, Killeen, and other areas with municipal water. Another 113,700 acre-feet of conservation storage space has been sold to the Brazos River Authority for $1,602,822 and certain operational costs. The Brazos River Authority has the right to purchase additional storage capacity from the Federal Government if the conservation storage capacity is enlarged.

Construction began in July 1949; the main structure was completed in April 1954, and deliberate impoundment began March 8, 1954. Some land for recreational purposes remained to be purchased as late as 1962.

Total construction cost was $13,570,000. The U. S. Army Corps of Engineers estimated that in the spring floods of 1957 the project prevented $10,900,000 in damages.

Physical Description

The dam is a rolled-earth structure 5,524 feet long, including the spillway and a 418-foot-long dike. The embankment is 192 feet high above the streambed with a top width of 30 feet at elevation 662.0 feet above msl; the upstream face is protected from erosion by stone riprap. The dam contains 49,400 cu yd of concrete and 5,112,000 cu yd of earthfill.

The reservoir has a capacity of 210,600 acre-feet and a surface area of 7,400 acres at the top of conservation storage space at elevation 569.0 feet above msl. Storage capacities at various elevations follow this section in a list that shows 84,900 acre-feet as being allocated to sediment reserve.

The drainage area above the dam is 3,560 square miles.

Records of contents from March 1954 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from March 1954 in Water-Supply Papers of the U. S. Geological Survey.

An emergency spillway is located near the left end of the dam. It is an uncontrolled, broad-crested weir with crest length of 1,300 feet at elevation 631.0 feet above msl. The spillway has a discharge capacity of 472,500 cfs with the reservoir at the maximum design flood stage at elevation 656.9 feet above msl. The discharge is through a pilot channel to the Leon River about 1/2 mile below the dam.

Outlet works for the release of floodwater consist of a reinforced concrete structure with three intake openings controlled by three broome-type gates, 7 feet wide by 22 feet high. The water is discharged through a 22-foot-diameter conduit, 790 feet long with invert at elevation 483.0 feet above msl.

Outlet works for the release of water for conservation use is controlled by a 36-inch by 36-inch, gated outlet discharging into the flood-outlet conduit with invert at elevation 540.0 feet above msl.

Pertinent data on Belton Dam and Belton Reservoir are listed below.

Type of dam ..... Rolled-earth
Length of dam ..... 5,524 feet including spillway and dike
Maximum height of dam ..... 192 feet
Top width of dam ..... 30 feet
One 22-foot-diameter outlet conduit for floodwater release with three 7-foot by 22-foot openings controlled by three broome-type gates
One 36-inch by 36-inch gated outlet for conservation water release
Shoreline at elevation ..... 569.0 feet above msl - 110 miles

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	622.0	2,075,000	40,420
Maximum design flood stage	656.9	1,876,700	37,340
Spillway crest	631.0	1,097,600	23,620
Top of conservation storage space	569.0	210,600	7,400
Outlet for conservation water release	540.0	--	--
Invert of lowest intake	483.0	278	42
Streambed	470.0	0	0
Sediment reserve	--	84,900	--

Reassignment of storage capacity in Belton Reservoir is an integral part of the development of Proctor Reservoir. It is planned to provide an exchange of flood-control storage space and to allow an increase in the usable conservation storage capacity of Belton Reservoir to 457,320 acre-feet at elevation 594.0 feet above msl. It is also intended to increase the flood-control storage capacity to 640,000 acre-feet.

73. Wirtz (Alvin) Dam and Granite Shoals Lake

Location

Wirtz (Alvin) Dam and Granite Shoals Lake are in the Colorado River Basin in Burnet and Llano Counties, 4 miles southwest of Marble Falls on the Colorado River.

Ownership and History of Development

The project is owned and operated by the Lower Colorado River Authority for the main purpose of generating hydroelectric power, and is one of six projects on the Colorado River. The other five are: Buchanan Dam and Buchanan Reservoir, Inks Dam and Inks Lake, Starcke (Max) Dam and Marble Falls Lake, Mansfield Dam and Lake Travis, and Miller (Tom) Dam and Lake Austin. All of these are described in this bulletin. It is the second project downstream from Buchanan Reservoir and uses the controlled discharge of water from the Buchanan electrical-generating plant together with the added flow of the Llano River for power generation.

The project was authorized by Permit No. 953 (Application No. 1023) dated May 15, 1926 from the State Board of Water Engineers to the Syndicate Power Company. The Permit allocates 1,305,000 acre-feet of water for conservation, irrigation, and power generation uses. This is one of several permits issued for projects on the Colorado River during the beginning of the Colorado River development.

All the water rights and the history of their acquisition were obtained as follows:

> Certified Filing No. 423 dated June 30, 1914 by E. C. Alexander refers to ownership of rights by virtue of prior filings and applications in connection with which water is to be utilized for mining, milling, manufacturing, power, waterworks, and stock raising and which prior filings and applications were renewed for the construction of a dam at Lohman Narrows. (The project became known as Alexander Dam located below Marble Falls.) Between 1914 and 1919 these rights passed to C. H. Alexander and Syndicate Power Company. All these C. H. Alexander interests seem to be a partnership with John N. Simpson of Dallas who also had early water rights and owned considerable land on the Colorado River. The Alexander and Simpson Project is mentioned in some of the letters in the files of the Texas Water Commission. For later permits, Permit Nos. 951-55 and 998, the Syndicate Power Company claimed the exclusive prior rights to the appropriation and use of such waters within the area covered by six applications for water permits pertaining to the appropriation and use of such waters as existed prior to June 29, 1913.

The Lower Colorado River Authority is owner of Permit Nos. 951-55 and 998 by virtue of the following conveyances: (a) from Syndicate Power Company to

Ward Arnold and Jay Alexander dated July 30, 1928 (Permit Nos. 951 and 952 only); (b) from Syndicate Power Company to Emery, Peck & Rockwood Development Company dated July 19, 1929; (c) from Ward Arnold and Jay Alexander to Emery, Peck & Rockwood Development Company dated July 19, 1929; (d) from Emery, Peck & Rockwood Development Company to Central Texas Hydro-Electric Company dated November 5, 1931; (e) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to Colorado River Company dated October 5, 1934; (f) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to C. G. Malott dated October 5, 1934; (g) from Colorado River Company to Lower Colorado River Authority dated August 9, 1935; (h) from C. G. Malott to Lower Colorado River Authority dated August 9, 1935.

Construction was begun in September 1948, and was completed in November 1951 with deliberate impoundment of water beginning in May 1951. Power generation started June 25, 1951.

Physical Description

The dam is a concrete and earthfill structure, 4,816 feet long and 100 feet high. The concrete section is 1,146 feet long with a gated spillway and powerhouse facilities. The earthfill section with a concrete core wall, is 3,670 feet long with crest elevation at 835.0 feet above msl. The earth embankment is protected on the upstream side by rock riprap.

Additional data on the structure are as follows:

Height of dam	100	feet
Length of dam (total)	4,816	feet
Length of dam (concrete)	1,146	feet
Length of dam (rolled-earth and rock)	3,670	feet
Operating elevation	825.0	feet above msl
Maximum elevation of structure	838.0	feet above msl
Maximum operating head	87	feet
Power plant capacity	Two 22,500 kw units	

The reservoir, at normal operating elevation of 825.0 feet above msl, has a capacity of 138,500 acre-feet and a surface area of 6,200 acres. Under normal conditions the water level fluctuates over a small range because the power plant operation is coordinated with the inflow. Water from this reservoir is used for generation of power, and water is released to Marble Falls Lake for use at the Starcke (Max) Dam electrical-generating plant. Except during floods, the only water released is through the turbines for generation of power. This lake is the most popular of the series for recreational purposes.

Drainage area is 36,290 square miles, of which 11,900 square miles is noncontributing. However, the riverflow is determined by the controlled discharge of Buchanan Reservoir and Inks Lake plants upstream on the Colorado River, plus the entire unregulated flow from the Llano River.

Records of daily elevations are maintained by the Lower Colorado River Authority as unpublished data.

The spillway is an ogee section with crest elevation 796.0 feet above msl. There are nine taintor gates, 50 feet wide by 30 feet high, operated by two

hoists. The top of the gates is 1 foot higher than the normal operating lake level of 825.0 feet above msl. At normal lake level elevation the nine gates will discharge 293,000 cfs. At elevation 835.0 feet above msl, the top of the embankment, the nine gates will discharge 475,000 cfs.

There are no low-flow outlets required as water releases are made through the turbines for normal operation, and the water enters Marble Falls Lake immediately downstream.

The power plant contains two 22,500 kw generating units with auxiliary equipment for connecting to the transmission system. This plant is used for peak power during the time when the electrical demand is the greatest.

74. Colorado City Dam and Lake Colorado City

Location

Colorado City Dam and Lake Colorado City are in the Colorado River Basin in Mitchell County, 6 miles southwest of Colorado City on Morgan Creek, a tributary of the Colorado River.

Ownership and History of Development

The project is owned and operated by the Texas Electric Service Company.

The project was authorized by Permit No. 1475 (Application No. 1587) dated December 21, 1948 from the State Board of Water Engineers to Texas Electric Service Company, which allows 5,500 acre-feet annual diversion for municipal, domestic, industrial, and power uses. The 1961 water service report filed with the Texas Water Commission shows 1,643 acre-feet diverted for municipal use and 1,272 acre-feet used for cooling purposes.

Construction started on April 20, 1949, and the dam was completed in September 1949. Deliberate impoundment of water began in April 1949. Water use for condenser-cooling purposes began in June 1950.

Physical Description

The dam is a rolled-earth structure, 4,800 feet long and 85 feet high above streambed with a spillway and controlled outlets. Maximum bottom width is 455 feet and top width is 28 feet with the top of the dam at elevation 2,090.0 feet above msl. The upstream face has a gravel blanket and 36-inch rock riprap for protection from wave action.

The lake has a capacity of 31,000 acre-feet and a surface area of 1,655 acres at elevation 2,070.1 feet above msl, which is the crest of the service spillway.

Other capacities are given in the following table:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	2,090.0	--	--
Crest of emergency spillway	2,073.7	37,460	1,945
Crest of service spillway	2,070.1	31,000	1,655
Low outlet invert	2,024.3	198	65
Streambed	2,002.0	0	0

The drainage area above the dam is 322 square miles, of which 32 square miles is probably noncontributing.

Records of contents from April 1949 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from April 1949 in Water-Supply Papers of the U. S. Geological Survey.

The water is allocated as municipal supply for Colorado City and for condenser-cooling and plant use by the Texas Electric Service Company. Water for Colorado City is pumped from a concrete stilling-basin well, 11 feet in diameter, about 2 miles upstream from the dam. Water enters the well through three 18-inch pipes at elevations 2,045.0, 2,055.0, and 2,065.0 feet above msl. Water for cooling is diverted at the power plant, and is discharged back into the lake some distance away to create circulation and cooling. The only consumptive use of water by the Texas Electric Service Company is forced evaporation caused by heat added to the reservoir and a small amount for plant use.

An emergency spillway is located 600 feet from the left end of the dam, and discharges into the Colorado River. It is cut from the natural-earth embankment with a crest length of 1,200 feet at elevation 2,073.7 feet above msl.

The service spillway is an uncontrolled, double-rectangular-drop inlet that is located 100 feet upstream from the dam. Each opening is 10 feet by 12 feet. The service spillway is designed to discharge a maximum of 5,000 cfs.

The spillway discharges into a double-horseshoe concrete conduit, each barrel of which is 10 feet wide by 10 feet high, with semi-circular tops. The conduit is 400 feet long, extending through the dam and discharging into Morgan Creek.

The outlet for low-flow release is a 30-inch-diameter pipe through the dam, controlled by two 24-inch valves with invert at elevation 2,024.3 feet above msl, which is the elevation of lowest drawdown.

75. Starcke (Max) Dam and Marble Falls Lake

Location

Starcke (Max) Dam and Marble Falls Lake are in the Colorado River Basin in Burnet and Llano Counties near Marble Falls on the Colorado River at the upper reaches of Lake Travis.

Ownership and History of Development

The project is owned and operated by the Lower Colorado River Authority for the main purpose of generating hydroelectric power, and is one of six Lower Colorado River Authority projects on the Colorado River. The other five are: Buchanan Dam and Buchanan Reservoir, Inks Dam and Inks Lake, Wirtz (Alvin) Dam and Granite Shoals Lake, Mansfield Dam and Lake Travis, and Miller (Tom) Dam and Lake Austin. All of these are described in this bulletin. It is the third plant downstream from Buchanan Reservoir, and uses the controlled discharge from Buchanan electrical plant together with the added flow of the Llano River and further regulation by the Wirtz (Alvin) Dam power plant for power generation.

The project was authorized by Permit No. 998 (Application No. 1022) dated November 4, 1927 from the State Board of Water Engineers to Syndicate Power Company. The Permit allocates 1,305,000 acre-feet of water for conservation, irrigation, and power generation. This is one of several permits issued for projects on the Colorado River at the beginning of the Colorado River development.

The water rights and history of their acquisition were obtained as follows:

> Certified Filing No. 423 dated June 30, 1914 by E. C. Alexander refers to ownership of rights by virtue of prior filings and applications in connection with which water is to be utilized for mining, milling, manufacturing, power, waterworks, and stock raising, and which prior filings and applications were renewed for the construction of a dam at Lohman Narrows. (The project became known as Alexander Dam located below Marble Falls.) Between 1914 and 1919 these rights passed to C. H. Alexander and Syndicate Power Company. All these C. H. Alexander interests seem to be a partnership with John N. Simpson of Dallas who also had early water rights and owned considerable land on the Colorado River. The Alexander and Simpson Project is mentioned in some of the letters in the files of the Texas Water Commission. For later permits, Permit Nos. 951-55 and 998, the Syndicate Power Company claimed the exclusive prior rights to the appropriation and use of such waters within the area covered by six applications for water permits pertaining to the appropriation and use of such waters as existed prior to June 29, 1913.

The Lower Colorado River Authority is owner of Permit Nos. 951-55 and 998 by virtue of the following conveyances: (a) from Syndicate Power Company to Ward Arnold and Jay Alexander dated July 30, 1928 (Permit Nos. 951 and 952 only); (b) from Syndicate Power Company to Emery, Peck & Rockwood Development Company dated July 19, 1929; (c) from Ward Arnold and Jay Alexander to Emery, Peck & Rockwood Development Company dated July 19, 1929; (d) from Emery, Peck & Rockwood Development Company to Central Texas Hydro-Electric Company dated November 5, 1931; (e) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to Colorado River Company dated October 5, 1934; (f) from A. J. Wirtz, receiver for Central Texas Hydro-Electric Company, to C. G. Malott dated October 5, 1934; (g) from Colorado River Company to Lower Colorado River Authority dated August 9, 1935; (h) from C. G. Malott to Lower Colorado River Authority dated August 9, 1935.

Construction was begun in November 1949, and was completed in October 1951. Deliberate impoundment of water began in July 1951 when the Marble Falls Mill Dam upstream was breached July 30, 1951. Power generation started September 25, 1951. Starcke (Max) Dam is just downstream from the site of the Alexander Dam, one of the early structures on the river. It is not known whether this dam was ever put to beneficial use, but parts of the old concrete structure had to be blasted out of the river before the closure was made and the new lake formed.

The old Marble Falls Dam and power plant upstream from Alexander Dam furnished power originally to a textile mill and later to several small industries. It was used for generation of power by the Lower Colorado River Authority up to a short time before the dam was breached for the new lake.

Physical Description

The dam is a concrete gravity structure 860 feet long including the spillway, powerhouse, and other facilities for operating the plant and crest gates. The maximum height of the structure is 90 feet. Tunnels and operating galleries extend through the length of the dam with entrances from the powerhouse and gate piers.

The lake is operated at a nearly constant level as the turbine discharge is correlated with the inflow from Granite Shoals plant. Except during floods, the only water released to Lake Travis immediately downstream is through the turbines for generation of power. There are no downstream requirements as this demand is regulated by Marshall Ford and Austin power plants. The lake has a capacity of 8,760 acre-feet and a surface area of 780 acres at elevation 738.0 feet above msl. Other dimensions are listed at the close of this section.

The drainage area is 36,325 square miles, of which 11,900 square miles is noncontributing; however, the riverflow is regulated by upstream reservoirs and power plant operation.

Sedimentation studies have not been made for this lake, and are unimportant from the standpoint of power generation as storage is maintained by water released from upstream reservoirs.

Records of daily lake elevations are maintained by the Lower Colorado River Authority as unpublished data.

The spillway is an ogee section with crest elevation of 725.0 feet above msl. Floodflow is controlled by ten roof-weir-type crest gates, 60 feet 10 inches long by 13 feet high. Any one or all of these gates can be operated in any position from raised to fully lowered. When the gates are in lowered position, the elevation of the crest is 725.0 feet above msl. When in raised position, the lake is at normal operating level of 738.0 feet above msl. At maximum flood elevation of 758.0 feet above msl, and with all gates lowered, the discharge capacity is rated at 421,000 cfs.

There are no low-flow outlets required as water releases are made through the turbines for normal operation, and the water enters Lake Travis for storage and future use.

There is no flood-control storage in this small lake so any excess water from Granite Shoals Lake is discharged over the crest-type gates to Lake Travis.

The power plant contains two 16,000 kw generating units with auxiliary equipment for connecting to the transmission system. This plant is operated in series with Granite Shoals plant, and the turbines are rated for the same water requirements as those at Granite Shoals.

Pertinent data follows on Starcke Dam and Marble Falls Lake.

Maximum height of structure	90	feet
Length of dam and powerhouse	860	feet
Lake operating elevation	738.0	feet above msl
Spillway elevation with gates down	725.0	feet above msl
Gates	ten, 60 feet 10 inches by 13 feet high	
Spillway capacity at lake elevation of 738.0 feet above msl	104,000	cfs
Spillway capacity at lake elevation of 758.0 feet above msl	421,000	cfs
Lake capacity at elevation 738.0 feet above msl	8,760	acre-feet
Lake area at elevation 738.0 feet above msl	780	acres
Generator capacity	two at 16,000 kw each	

76. Falcon Dam and International Falcon Reservoir

Location

Falcon Dam and International Falcon Reservoir are in the Rio Grande Basin in Starr County, 3 miles west of Falcon Heights on the Rio Grande at river mile 270.5, 80 miles downstream from Laredo. The reservoir is in Starr and Zapata Counties, Texas and in Estado de Tamaulipas, Mexico.

Ownership and History of Development

The project is owned by the United States and Mexico, and is operated by the International Boundary and Water Commission.

In 1944 the United States and Mexico signed the most recent of a series of treaties affecting the land and water boundary between the two countries. Among the most important clauses of the Water Treaty of 1944 are those providing for equitable distribution, between the two nations, of the waters of the two principal international streams, the Rio Grande (below Fort Quitman) and the Colorado River, which empties into the Gulf of California. The treaty provides for the construction of necessary works for the maximum conservation and utilization of the waters of the Rio Grande. On the Rio Grande the treaty authorizes the necessary international storage dams to be jointly constructed by the two governments through the International Boundary and Water Commission.

Falcon Dam was authorized by the International Boundary and Water Commission--United States and Mexico. Its development was for conservation, irrigation, power, recreation, and flood control uses. Under the terms of the treaty,

Falcon Dam and International Falcon Reservoir. Furnished by International Boundary and Water Commission.

the United States will receive 58.6 percent of the conservation storage and Mexico will receive 41.4 percent. The United States' share of the cost was 35 million dollars.

Plans for the dam and two power plants were approved in the fall of 1949, construction began in 1950, and the completion date was April 18, 1954. Deliberate impoundment began August 25, 1953, and the project was dedicated October 19, 1953.

Falcon is one of several projects under the jurisdiction of the International Boundary and Water Commission, and is one of the most important to Texas.

Physical Description

The dam is a compacted, rolled-earth structure with a controlled spillway on the United States' side of the river with a total length of 26,294 feet and a height of 150 feet with the top of the dam at elevation 323.0 feet above msl. The maximum width of the base is 1,000 feet, and the crown width is 35 feet with a roadway across the top of the entire structure. The embankment contains over 12.6 million cu yd of earthfill. The upstream face is protected by a 3-foot blanket of riprap, and the downstream face is protected by dumped rock.

The reservoir has a summer storage capacity of 2,371,220 acre-feet and a surface area of 78,340 acres at conservation storage level at elevation 296.4 feet above msl, which is the top of the conservation storage space. Above this elevation there is 909,480 acre-feet of flood-control storage capacity. An additional 400,000 acre-feet of conservation storage is allowed during the winter, which reduces the flood-control capacity accordingly. Other capacities are listed at the close of this section.

The drainage area above the dam is 164,482 square miles, of which 87,760 is in the United States and 76,722 is in Mexico.

Of the reservoir capacity, 300,000 acre-feet was allocated for sediment reserve.

Records of contents from January 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from January 1953 in Water Bulletins of the International Boundary and Water Commission, United States and Mexico.

The gated spillway is on the United States' side and has a net opening of 300 feet with crest elevation 256.7 feet above msl controlled by six fixed-wheel-type lift gates, 50 feet wide by 50 feet high. The spillway discharge capacity is 456,000 cfs with maximum design flood stage at elevation 314.2 feet above msl. The water enters a chute 1,300 feet long, and is dissipated before entering a control channel leading to the Rio Grande.

There are two 72-inch outlets for water release for each nation, when the turbines are not operating, to supply the downstream requirements. Invert on the United States' side is at elevation 225.0 and on the Mexican side at 205.0 feet above msl.

A power plant with auxiliary equipment is built on each side of the river, and each plant has three 10,500 kw generating units with provision for the fourth unit when justified. The first generation of electricity was October 11, 1954. Power from the United States plant is distributed by Central Power & Light Company.

Pertinent data on Falcon Dam and International Falcon Reservoir are listed below.

Length of dam in Mexico	16,161 feet
Length of dam in United States	10,133 feet
Height of dam above streambed	150 feet
Base width	1,000 feet
Crown width	35 feet
Earth and rockfill	12,600,000 cu yd
Riprap	360,000 cu yd
Concrete	282,000 cu yd
Reinforcing steel	10,300 tons
Total crest length of spillway including piers	350 feet
Chute length	1,300 feet
Maximum discharge capacity	456,000 cfs

Capacities as of July 1956 sedimentation survey by the International Boundary and Water Commission

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	323.0	--	--
Maximum design flood stage	314.2	4,150,000	113,000
Top of spillway gates	306.7	3,280,700	98,960
Top of conservation storage space (winter)	301.2	2,771,220	87,700
Top of conservation storage space (summer)	296.4	2,371,220	78,340
Bottom of power storage space	248.0	258,910*	12,300
Invert of low outlet	204.4	2,820†	--
Riverbed at axis of dam	175.0	0	0

* Sedimentation storage
† Dead storage

77. Oak Creek Dam and Oak Creek Reservoir

Location

Oak Creek Dam and Oak Creek Reservoir are in the Colorado River Basin in Coke County, 5 miles southeast of Blackwell on Oak Creek, a tributary of the Colorado River.

Ownership and History of Development

The project is owned and operated by the city of Sweetwater.

The project was authorized by Permit No. 1519 (Application No. 1623) issued August 29, 1949 to the city of Sweetwater by the State Board of Water Engineers for water supply to Sweetwater and Blackwell in Nolan County, Robert Lee and Bronte in Coke County, and other communities. The Permit authorizes annual diversion of 10,000 acre-feet of water for municipal and industrial purposes with 3,000 acre-feet allocated to Bronte and Robert Lee and 7,000 acre-feet to Sweetwater and Blackwell. This project supplements the water supply from Lake Sweetwater and Lake Trammel.

Construction began July 10, 1950, and the project was completed in May 1952. Deliberate impoundment of water began May 12, 1953 when runoff was first available, and use of water began in September 1953.

Physical Description

The dam is a rolled-earth embankment 3,800 feet long and 95 feet high. The maximum bottom width is 445 feet, and the top width is 36 feet with a 22-foot roadway across the top at elevation 2,014.0 feet above msl. The upstream slope is 3 to 1 and the downstream slope 2.5 to 1.

The reservoir has a capacity of 39,360 acre-feet and a surface area of 2,375 acres at the service spillway crest elevation of 2,000.0 feet above msl. Other capacities are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	2,014.0	--	--
Crest of emergency spillway	2,005.0	52,940	2,900
Crest of service spillway	2,000.0	39,360	2,375
Invert of service outlet	1,951.0	100	65

The drainage area above the dam is 244 square miles.

Records of reservoir elevations from September 15, 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from September 15, 1953 in Water-Supply Papers of the U. S. Geological Survey.

Water is used for municipal supply, oil-field use, and for recreational purposes.

The service spillway is a cut channel located beyond the right end of the dam. The crest length is 300 feet at elevation 2,000.0 feet above msl with the discharge to a channel about 2,700 feet long. Provisions have been made to install 4-foot-high crest gates to raise the normal reservoir level and to increase the capacity as water demands increase.

The emergency spillway, located between the service spillway and main dam, has a crest length of 800 feet at elevation 2,005.0 feet above msl. This spillway was formed by placing a soft earthfill in a saddle of the natural ground, and is designed to wash out when the water level reaches the top.

The service outlet is a 24-inch concrete pipe with valve control, and is located 1,200 feet from the right end of the dam with invert at elevation 1,951.0 feet above msl. This outlet releases water to Oak Creek.

One pumping plant delivers water to Sweetwater and Blackwell through a 21-inch pipeline. Another pumping plant delivers water through an 8-inch pipeline to Bronte and other towns.

78. Colorado River Dam and Lake J. B. Thomas

Location

Colorado River Dam and Lake J. B. Thomas are in the Colorado River Basin in Scurry County, 7 miles northeast of Vincent and 16 miles southwest of Snyder on the Colorado River. The lake extends into Borden County.

Ownership and History of Development

The project is owned by the Colorado River Municipal Water District, which was created in July 1949, and was built to furnish water to the cities of Big Spring, Odessa, and Snyder.

The project was authorized by Permit No. 1394 (Application No. 1492) dated August 19, 1946 from the State Board of Water Engineers to Colorado City. This Permit gives the right to impound 111,000 acre-feet and to divert 30,000 acre-feet of water annually for municipal and industrial use. Permit No. 1394B authorizes change in the location of the dam, increases the lake capacity to 204,000 acre-feet, and adds recreation to the water use. Permit No. 1394B also authorizes the construction of a dam across nearby Bull Creek, together with a canal to divert the flow of Bull Creek by gravity into Lake J. B. Thomas. The original permit was issued to Colorado City and transferred to the District February 13, 1950.

The project was started March 26, 1951, and was completed in September 1952. Deliberate impoundment of water began in July 1952, but there was little storage until July 1953. The canal from Bull Creek is 13,000 feet long. It was completed and diversion of water to Lake J. B. Thomas was begun in November 1953. The diversion dam on Bull Creek was washed out by the April 1954 flood, and repairs were completed May 30, 1954.

Physical Description

The dam is a rolled-earth embankment 14,500 feet long and 28 feet wide at the top with a 20-foot-wide roadway along the top at elevation 2,280.0 feet above msl. The maximum height above the riverbed is 105 feet.

Colorado River Dam and Lake J. B. Thomas. Furnished by Colorado River Municipal Water District.

The lake has a capacity of 203,600 acre-feet and a surface area of 7,820 acres at service spillway crest elevation of 2,258.0 feet above msl. The lake is also used for recreational purposes. Other elevations and capacities are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	2,280.0	430,600	--
Crest of right emergency spillway	2,267.0	283,600	9,760
Crest of left emergency spillway	2,264.0	255,000	9,100
Crest of service spillway	2,258.0	203,600	7,820
Invert of service outlet	2,200.0	1,300	210
Streambed	2,175.0	0	0

The drainage area above the dam is 3,524 square miles, of which 2,590 is probably noncontributing. The drainage area includes 426 square miles above Bull Creek diversion dam, of which 32 square miles is probably noncontributing.

Dead storage is 1,300 acre-feet.

Records ot contents from October 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from October 1953 in Water-Supply Papers of the U. S. Geological Survey.

The service spillway is a reinforced-concrete, drop inlet structure located in the lake about 2,500 feet from the left end of the dam. The inlet is a rectangular opening 38 feet by 53 feet at the top decreasing to two openings, 14 feet by 14 feet, that feed the two 10-foot by 10-foot, horseshoe-shaped, concrete conduits. These conduits are 467 feet long, and discharge through a pilot channel into the river about half a mile below the dam.

There are two emergency spillways. The north, or left, spillway is located at the left abutment of the dam with a crest length of 500 feet at elevation 2,264.0 feet above msl. The south, or right, spillway is a cut channel, 3,500 feet to the right end of the dam with crest length of 1,600 feet at elevation 2,267.0 feet above msl.

The service spillway is designed to discharge 10,000 cfs and the emergency spillways 161,000 cfs at maximum design flood stage of 2,275.0 feet above msl.

The service outlet located near the center of the dam is a 30-inch, reinforced-concrete pipe controlled by a 24-inch valve with invert at elevation 2,200.0 feet above msl. Water for the city of Snyder's pumping plant is released through this outlet and pumped through a 21-inch pipeline to the city and the Sharon Ridge oil field. Water is diverted directly from the lake by a pump station that supplies water through a 33-inch pipeline to Big Spring and then to Odessa through a 27-inch pipeline.

79. Valley Acres Dam and Valley Acres Reservoir

Location

Valley Acres Dam, actually a dike, and Valley Acres Reservoir are in the Nueces-Rio Grande Coastal Area in Hidalgo County, 7 miles north of Mercedes. The reservoir is an off-channel storage, diverting water from the North Floodway, which carries floodflows from the Rio Grande to Laguna Madre.

Ownership and History of Development

The project is owned and operated by the Valley Acres Water District.

The present water rights were obtained by Valley Acres, Inc. by Permit No. 1560 (Application No. 1667) dated March 30, 1951 from the State Board of Water Engineers. The Permit authorizes storage of 7,840 acre-feet of water in a reservoir already in use and annual diversion of 5,000 acre-feet for irrigation and municipal purposes.

Water is to be diverted from the North Floodway when excess water is available for storage. The land to be irrigated is part of a tract of the American Rio Grande Land and Irrigation Company, which holds certain rights under Certified Filing No. 27.

In May 1951 the Texas 52nd Legislature created the Valley Acres Water District, which incorporated the 10,202 acres of land mentioned in Permit No. 1560; this District now owns the water rights granted under that Permit. The reservoir was in operation in 1947, but additional work was completed July 15, 1951 by the District after receipt of the Permit.

Physical Description

The levee is about 28,300 feet long with an average base width of 87 feet and top width of 12 feet. The average height is 15 feet above the natural ground with the top of the embankment at elevation 73.0 feet above msl.

The reservoir has a capacity of 7,840 acre-feet and a surface area of 906 acres at elevation 62.0. Water is diverted by pumping from the North Floodway channel to this off-channel storage whenever available as there is no inflow contributing to storage.

There is a 36-inch, low-flow outlet with a valve that is controlled from a concrete gate house.

In times of low flow in the Rio Grande, water is diverted from this storage reservoir to the canals when needed.

80. Stamford Dam and Lake Stamford

Location

Stamford Dam and Lake Stamford are in the Brazos River Basin in Haskell County, 10 miles southeast of Haskell on Paint Creek, a tributary of Clear Fork Brazos River, which is a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the city of Stamford for its own water supply and for several other communities. The water rights were obtained by Permit No. 1542 (Application No. 1650) dated July 10, 1950 from the State Board of Water Engineers to the city of Stamford. The Permit allows the storage of 60,000 acre-feet and annual use of 10,000 acre-feet of water, of which 2,519 acre-feet was from rights obtained under Permit No. 344 (Application No. 361) to the city of Stamford. The allocation permits water to be supplied to other towns and to be used for industrial purposes by the West Texas Utility Company's electrical-generating plant.

Construction of the project started July 14, 1951, and was completed in March 1953. Deliberate impoundment began in June 1953, and delivery of water to the filter plant began in September 1953.

Physical Description

The dam is an earthfill structure about 6,600 feet long, including the spillway, and 78 feet high with the top of the dam at elevation 1,426.8 feet above msl. The maximum bottom width is 600 feet and the top width is 24 feet with a roadway over part of the embankment. The upstream face is protected with a 2-foot thickness of rock riprap on an 8-inch-thick gravel base.

The lake has a capacity of 60,000 acre-feet and a surface area of 5,125 acres at spillway crest elevation of 1,416.8 feet above msl. Below elevation 1,382.8 feet above msl there is a dead storage capacity of 430 acre-feet.

The drainage area above the dam is 360 square miles.

Records of contents from July 1953 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from July 1953 in Water-Supply Papers of the U. S. Geological Survey.

A steam-electric generating plant owned by the West Texas Utility Company is located on the lake, and uses the water for condenser-cooling and general plant purposes. The water is returned from the condenser at a place to cause circulation in the lake, and the only consumptive use is forced evaporation caused by heat added to the reservoir.

A service spillway is located 900 feet to the left of the dam. It is a rectangular channel excavated in natural rock with a crest length of 169 feet with elevation varying from 1,416.8 to 1,417.3 feet above msl. An emergency spillway at the right end of the dam, over natural ground without a confined channel, has a crest elevation of about 1,425.8 feet above msl.

The low-water discharge is a 24-inch concrete pipe encased in concrete with invert at elevation 1,382.8 feet above msl. The valve control tower is a 6-foot-diameter concrete shaft with the top at elevation 1,436.8 feet above msl. Two 20-inch valves with connection to the 24-inch pipe are in the control tower. The pipe is 442 feet long, extends through the embankment, and discharges to an outlet structure below the dam.

Water is pumped directly from the lake by the city of Stamford for municipal water supply.

81. Lake Creek Dam and Lake Creek Reservoir

Location

Lake Creek Dam and Lake Creek Reservoir are in the Brazos River Basin in McLennan County, 4 miles southwest of Riesel on Manos Creek, a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the Texas Power & Light Company, and is used to provide condenser-cooling water for a steam-electric generating station.

Water rights to impound 8,000 acre-feet of water and annual use of 10,000 acre-feet by pumping from the Brazos River were granted by Permit No. 1566 (Application No. 1685) dated May 10, 1951 from the State Board of Water Engineers to the Texas Power & Light Company. This authorization was amended by Permit No. 1616 (Application No. 1748) dated April 25, 1952 to increase the storage to 9,500 acre-feet, without any increase in diversion. However, latest reservoir area-capacity curves indicate 8,400 acre-feet is the present capacity at elevation 405.0 feet above msl authorized by Permit No. 1616.

Construction began September 8, 1951, and the dam was completed in May 1952 except for the taintor gates. Impoundment of water began in June 1952 by inflow from runoff from local rains. All construction was completed May 6, 1953, and pumping from the river began in November 1952. The first generating unit at this plant began commercial operation April 2, 1953.

Physical Description

The dam is a compacted earthfill structure 1,850 feet long and 50 feet high with the top at elevation 410.0 feet above msl. It has a maximum base width of 300 feet and top width of 15 feet, and the upstream slope is protected by 1 foot of rock riprap on a 1-foot gravel base. The dam contains 241,000 cu yd of earth.

The reservoir has a capacity of 8,400 acre-feet, which is an increase above the amount granted by Permit No. 1566 when the reservoir level was raised from elevation 402.0 to 405.0 feet above msl in accordance with Permit No. 1616. Likewise, the reservoir area was increased from 475 to 550 acres. The reservoir is maintained at operating level by pumping water from the Brazos River as

authorized by Permit No. 1566. Water is circulated from the reservoir to the condenser and back to the reservoir; the consumptive use consists of a small amount of water for plant services and of forced evaporation caused by heat added to the reservoir.

The drainage area above the dam is 17 square miles; runoff is conserved to supplement the amount pumped from the Brazos River.

Records of contents are maintained as unpublished data in the plant operating records.

The service spillway is a concrete section on the left end of the dam with two taintor gates, 32 feet 9 inches long by 20 feet high. The top of the gates are at normal maximum conservation storage level at elevation 405.0 feet above msl. The discharge is through a paved chute to the channel below the dam.

There are no low-flow outlets. The low point of control is the crest of the service spillway at elevation 385.0 feet above msl.

An uncontrolled emergency spillway on the right end of the dam is 700 feet long with crest at elevation 406.0 feet above msl.

82. Gladewater Dam and Lake Gladewater

Location

Gladewater Dam and Lake Gladewater are in the Sabine River Basin in Upshur County in northwest Gladewater on Glade Creek, a tributary of the Sabine River.

Ownership and History of Development

The project is owned and operated by the city of Gladewater for municipal water supply and recreation. Permit No. 1587 (Application No. 1710) dated August 30, 1951, granted by the State Board of Water Engineers to the city of Gladewater, authorized the storage of 6,950 acre-feet of water and annual use of 1,679 acre-feet.

Construction was started October 15, 1951 by the city and completed August 29, 1952. Deliberate impoundment of water began August 29, 1952, and the new filter and treatment plant was in operation July 1953.

Physical Description

The dam is a rolled-earth structure 1,203 feet long and 48 feet high above the creekbed. The embankment has a maximum base width of 195 feet and top width of 16 feet with the top of the dam at elevation 312.0 feet above msl. The upstream face has rock riprap from elevation 290.0 to 308.0 feet above msl. There are two spillways near the right end of the dam.

The lake has a capacity of 6,950 acre-feet and a surface area of 800 acres at the service spillway elevation of 300.0 feet above msl.

The drainage area above the dam is 35 square miles.

The uncontrolled service spillway is a concrete structure with a crest length of 200 feet at elevation 300.0. The discharge is to the creek channel below the dam.

An uncontrolled emergency spillway is a concrete structure with a crest length of 200 feet at elevation 304.0 feet above msl.

A vertical concrete outlet structure near the left end of the dam has openings at several elevations controlled by slide gates operated from the top of the tower. The discharge is to a 24-inch concrete pipe, 168 feet long, extending through the embankment, with invert at elevation 278.0 feet above msl. An outlet from this pipe connects to a raw-water pumping plant for transmission to the city filter plant, and another outlet allows low-flow releases downstream if required. Access to the operating platform on top of the tower from the embankment is by a walkway that is constructed of timber supported on wood piles.

83. San Jacinto Dam and Lake Houston

Location

San Jacinto Dam and Lake Houston are in the San Jacinto River Basin in Harris County, 4 miles north of Sheldon and 18 miles northeast of Houston on the San Jacinto River.

Ownership and History of Development

The project is owned and operated by the city of Houston. The water rights were obtained by Permit No. 1323 (Application No. 1394) dated November 26, 1941 from the State Board of Water Engineers to the city of Houston. The Permit authorizes impoundment of 152,000 acre-feet and the use of 112,000 acre-feet of water annually for municipal, industrial, recreation, mining, and irrigation purposes. Permit No. 1411 (Application No. 1510) dated July 19, 1947 authorizes an increase in the capacity of the lake to 160,000 acre-feet and appropriation by 56,000 acre-feet to 168,000 acre-feet, and also allows irrigation of 1,500 acres of land out of a 6,000-acre tract.

Construction began in November 1951. The dam was completed in December 1953, except for minor details, and deliberate impoundment of water began April 9, 1954. The filter plant and other items were not completed until much later.

Physical Description

The dam is a slab and buttress, Ambursen-type spillway structure 3,160 feet long between two compacted earthfill embankments; the left section is 4,000 feet long and the right section is 4,600 feet long with a maximum height of 48 feet.

The lake has a capacity of 158,200 acre-feet and a surface area of 12,500 acres at the spillway crest elevation of 43.8 feet above msl.

San Jacinto Dam and Lake Houston. Furnished by City of Houston.

Other capacities are shown as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)
Top of dam	62.3	--
Maximum design flood stage	56.3	--
Spillway crest	43.8	158,200
Sill of flashboard gates	38.8	103,800
Sill of taintor gates	27.3	24,700
Invert of 72-inch conduits	23.3	11,500
Invert of 36-inch sluice gate	21.3	7,300

The drainage area above the dam is 2,828 square miles.

Records of contents from April 1954 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from April 1954 in Water-Supply Papers of the U. S. Geological Survey.

The city of Houston supplies raw water to various industries from the canal that delivers water to the filtration plant for municipal use. The San Jacinto River Authority has rights to the low flow of the river. Through an agreement with the city, however, this amount is diverted directly from the lake and delivered to users in the Baytown area.

The uncontrolled concrete spillway has a crest length of 3,160 feet at elevation 43.8 feet above msl. It is an overflow diffusion grill discharging into a stilling pool. The maximum design flood stage is at elevation 56.3 feet above msl with a discharge of 525,000 cfs. There are two taintor gates and two flashboard-type gates at the left end of the spillway section for release of water when the lake level is below spillway-crest elevation. The two taintor gates are 18 feet wide by 20.5 feet high with the sill at elevation 27.3 feet above msl. The two flashboard-type gates are each 18 feet wide by 6 feet high with sill at elevation 38.8 feet above msl.

The lowest outlet is a 36-inch, hand-operated sluice gate built into the spillway structure at the right abutment with invert at 21.3 feet above msl. Water for the city of Houston is diverted by means of an intake structure where two 72-inch conduits connect to the pumping plant with inverts at 23.3 feet above msl. This plant is located at the extreme right end of the dam and discharges to a canal, which transmits the water to the city's filtration plant and to other users. The San Jacinto River Authority diverts water from the lake with pumps located on the left side of the lake.

84. Alcoa Dam and Alcoa Lake

Location

Alcoa Dam and Alcoa Lake are in the Brazos River Basin in Milam County, 7 miles southwest of Rockdale on Sandy Creek, a tributary to Yegua Creek, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the Aluminum Company of America for industrial and recreational purposes. Water rights were obtained by Permit No. 1608 (Application No. 1733) dated February 13, 1952 from the State Board of Water Engineers to Sandow Water Company, which was later transferred to the Aluminum Company of America. The Permit allows storage of 12,000 acre-feet and annual use of 18,000 acre-feet of water by pumping from Little River. Pumping is limited to the period of September 15 to May 15, which is the off-season for other requirements.

Construction was started February 17, 1952, and the dam and spillway were completed in October 1952; the gates were not installed until January 31, 1953. Impoundment of water began with inflow from runoff in early 1952. The 12.5-mile pipeline from the Little River pumping plant to the lake was placed in operation January 13, 1953.

Physical Description

The dam is an earthfill structure 5,430 feet long and 50 feet high with a maximum bottom width of 265 feet and crest width of 15 feet with the top of the dam at elevation 470.0 feet above msl. The upstream surface is protected with 1 foot of rock riprap laid on an 8-inch thickness of gravel base between elevations 450.0 and 470.0 feet above msl. A concrete spillway section is part of the total length.

The lake has a capacity of 10,500 acre-feet and a surface area of 703 acres at the top of the spillway gates, elevation 464.0 feet above msl. The lake is maintained at near spillway level by pumping from Little River when necessary, and the water is used for condenser-cooling purposes for a steam-electric generating station. Water is pumped directly from Alcoa Lake through the turbine condenser, and discharges into a pond divided by dikes to provide circulation and cooling. The only consumptive use is from forced evaporation caused by heat added to the lake and a small amount for plant use. The lake has become a favorite fishing place for many people.

The drainage area is only 6 square miles, but this is an off-channel storage. Most of the water is pumped from Little River.

A gate-controlled spillway, the only outlet from the lake, is a concrete structure with crest at elevation 444.0 feet above msl. The discharge is controlled by two taintor gates, 20 feet long and 20 feet high, with the top of the gates at elevation 464.0 feet above msl.

85. Leon Dam and Leon Reservoir

Location

Leon Dam and Leon Reservoir are in the Brazos River Basin in Eastland County, 7 miles south of Ranger on the Leon River, a tributary of the Little River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the Eastland County Water Supply District for municipal and industrial water supply for Ranger, Olden, and Eastland.

Permit No. 1629 (Application No. 1753) dated July 8, 1952 from the State Board of Water Engineers to the District authorized appropriation of 12,000 acre-feet of water annually.

Construction began January 13, 1953, the dam was completed in June 1954, and deliberate impoundment of water began in April 1954.

Physical Description

The dam is a rolled-earth embankment 3,700 feet long, 90 feet high, and 20 feet wide with the top at elevation 1,398.0 feet above msl. The maximum bottom width is 540 feet, and the upstream embankment is faced with sandstone riprap.

The reservoir has a capacity of 27,290 acre-feet and a surface area of 1,590 acres at service spillway elevation of 1,375.0 feet above msl. Other capacities are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,398.0	--	--
Crest of emergency spillway	1,382.0	40,210	--
Crest of service spillway	1,375.0	27,290	1,590
Invert of low outlet	1,335.0	870	--

The drainage area above the dam is 252 square miles.

Records of contents from January 1955 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and from January 1955 in Water-Supply Papers of the U. S. Geological Survey.

The uncontrolled service spillway is located near the center of the dam with crest elevation at 1,375.0 feet above msl. It is a circular drop inlet 34.5 feet in diameter reducing to an 11-foot-diameter conduit through the dam.

The emergency spillway has a crest length of 1,200 feet at elevation 1,382.0 feet above msl. This is a cut through natural ground at the left end of the dam with a channel 800 feet long.

A concrete control tower near the center of the dam permits release of water through a 24-inch concrete pipe to a pump station below the dam where it is pumped to the filter plant, 4 miles north of the dam. Filtered water is then delivered to Ranger through a 12-inch pipeline, and to Eastland and Olden through a 14-inch pipeline. Water can be released from the reservoir down to elevation 1,335.0 feet above msl.

86. Anahuac Dam and Anahuac Lake

Location

Anahuac Dam, actually a levee, and Anahuac Lake are in the Trinity River Basin in Chambers County near Anahuac on Turtle Bay, a tributary to the Trinity River near its mouth.

Ownership and History of Development

The project is owned and operated by the Chambers-Liberty Counties Navigation District, as a result of many transfers of land and water rights. The latest, Permit No. 1647 (Application No. 1780) dated December 4, 1952 from the State Board of Water Engineers to the District, authorizes an increase in lake storage from 17,000 to 35,300 acre-feet without changing water rights for annual use of 35,300 acre-feet, which was obtained as follows:

> Certified Filing No. 246 filed June 26, 1914 with the State Board of Water Engineers by Trinity River Irrigation Company for irrigating 30,000 acres of land was transferred to the District in 1950; Certified Filing 254 filed by Lone Star Canal Corporation February 12, 1914 for a water right to irrigate 20,000 acres of land that have been irrigated since 1904 was sold at a trustee sale in 1931 to W. C. Tyrrel Trust, then transferred to several individuals in 1933 who organized the Lone Star Canal Corporation, then transferred on August 15, 1947 to the District; Certified Filing No. 531 filed June 30, 1914 with the State Board of Water Engineers by Stowell Canal Company for irrigation of 10,000 acres of land was transferred to the District on September 13, 1947; Permit No. 1244 (Application No. 1328) dated February 28, 1938, owned by Lone Star Canal Corporation and transferred to Chambers-Liberty Counties Navigation District September 13, 1947, granted the right to appropriate 800 acre-feet of water annually for mining and industrial use.

Construction of the dam, levee, and spillway for the enlarged project began March 17, 1953, and was completed in July 1954. Impoundment of water had already started, and the water was in use from the smaller lake.

Physical Description

The dam or embankment is a hydraulic fill 59,000 feet long including a concrete spillway and emergency spillway. The height is 10 feet with variable base width up to 200 feet and a top width of 8 feet at elevation 9.0 feet above msl. The old structure was enlarged by additional sections of embankment, levee, and new spillway.

The enlarged lake has a capacity of 35,300 acre-feet and a surface area of 5,300 acres at elevation 5.0 feet above msl. Water is pumped from the Trinity River into the lake at a point near its upper end. In addition, a contract was made for purchase of 50,000 acre-feet of water annually or when needed from

Lavon Reservoir, and permission was obtained for the use of the Trinity River channel for transportation to the point of diversion.

The drainage area is 199 square miles, but the main source of water is pumpage from the Trinity River.

A concrete slab-type uncontrolled spillway has a crest length of 700 feet at elevation 5.0 feet above msl. An emergency spillway is part of the embankment with a crest length of 1,200 feet at elevation 8.0 feet above msl.

The service outlet consists of four, 6-foot by 6-foot, gated sluiceways. Water is discharged to a forebay and pumping plant intake structure where it is pumped to the canal system. Water can also enter the forebay from the backwater of the Trinity River through a gate-controlled structure; however, at times of prolonged high tide the water at this point is brackish, and the gates are closed to prevent the fresh water from the storage lake being contaminated. Excess water, before the lake reaches spillway level, can be discharged through these gates to the river channel if necessary.

87. Brazoria Dam and Brazoria Reservoir

Location

Brazoria Dam, actually a levee, and Brazoria Reservoir, an off-channel reservoir, are in the Brazos River Basin in Brazoria County, 1 mile northeast of Brazoria.

Ownership and History of Development

The project is owned and operated by Dow Chemical Company for industrial water supply.

This project was built under Permit No. 1631 (Application No. 1756) dated July 8, 1952 from the State Board of Water Engineers to Dow Chemical Company. The purpose is to provide 21,970 acre-feet of reservoir storage without any further appropriation of water to be pumped from the Brazos River. This reservoir allows water to be stored when available from the river for use in time of deficient riverflow. Right to appropriate 150,000 acre-feet of water annually was authorized by Permit No. 1345 (Application No. 1431) dated February 19, 1943 from the State Board of Water Engineers to Dow Chemical Company. Part of this appropriation will be used at this diversion point. Permit No. 1631 further allows the use of the channel of Buffalo Camp Bayou to convey water from this reservoir to a pumping plant downstream. This pumping plant and canal for delivering water to the various Dow Chemical Company plants was constructed under Permit No. 1630 (Application No. 1755) dated July 8, 1952 from the State Board of Water Engineers to the Company.

Construction of the reservoir storage project began March 1, 1953, and was completed May 1, 1954. Diversion by pumping from the river began in April 1954. This reservoir is part of a large system of reservoirs and canals to insure industrial water to the owner's various manufacturing plants in the area.

Physical Description

The dam or levee is of varied height and cross-sectional area, and is about 40,000 feet long with the top at elevation 37.3 to 39.2 feet above msl. The base width varies, but maximum width is about 140 feet. The crown width is 16 feet. The top of the dike is used for a private road around the reservoir. The average height of the levee is about 16 feet.

The reservoir has a capacity of 21,970 acre-feet and a surface area of 1,865 acres at elevation 32.5 feet above msl.

This is an off-channel pumped storage without drainage area, and has no low-flow release conduit or spillway. However, water can be released by gated siphon conduits to Buffalo Camp Bayou for either consumptive use or waste if need occurs. A channel was constructed that allows flow from Buffalo Camp Bayou to bypass the reservoir, so there is no diversion from the Bayou at this point.

The water is pumped from the Brazos River by motor-driven pumps through two 66-inch concrete pipes, 3,000 feet long, to a stilling basin. From this point the water flows by gravity to the reservoir for storage. Water and sediment from the settling basin can be discharged as waste back to the river below the pumping plant.

88. River Crest Dam and River Crest Reservoir

Location

River Crest Dam and River Crest Reservoir, an off-channel reservoir, are in the Sulphur River Basin in Red River County, 7 miles southeast of Bogata.

Ownership and History of Development

The project is owned and operated by the Texas Power & Light Company for steam turbine, condenser-cooling purposes. Rights for the storage of 7,100 acre-feet and annual use of 10,000 acre-feet of water were obtained by Permit No. 1617 (Application No. 1747) dated April 22, 1952 from the State Board of Water Engineers to the Texas Power & Light Company. The Permit allows the water to be diverted from the Sulphur River to this off-channel reservoir by motor-driven pumps.

Construction began April 22, 1953, and the project was completed in November 1953. Impoundment by pumping began in November 1953, and the reservoir level reached normal operating elevation May 31, 1954. The electrical generating plant was in operation June 1, 1954. The present plant has one generating unit of 110,000 kw capacity with additional units proposed.

Physical Description

The dam, or dike, is an earth embankment of circular shape 14,770 feet long with a maximum height of 23 feet. The dike has a maximum bottom width of 136 feet and top width of 10 feet at elevation 335.0 feet above msl.

The reservoir has a capacity of 7,200 acre-feet and a surface area of 560 acres at elevation 328.0 feet above msl. Water is pumped from the Sulphur River to maintain the elevation at this operating level. Water is circulated by pumps from the reservoir through the condensers, thence to a diked channel that takes the water about a third of the distance around the rim of the reservoir before returning it to storage. This travel time provides cooling and allows the coldest water to be pumped to the condensers. Forced evaporation caused by heat added to the reservoir and a small amount of water for plant services are the only consumptive uses of water.

A small spillway with gate control returns any surplus water to the Sulphur River downstream from the pumping plant intake. This is a pumped storage so a low-flow outlet is not necessary.

89. Ferrells Bridge Dam and Lake O' the Pines

Location

Ferrells Bridge Dam and Lake O' the Pines are in the Cypress Creek Basin in Marion and Harrison Counties, 9 miles west of Jefferson on Cypress Creek. The lake extends into Morris, Camp, and Upshur Counties.

Ownership and History of Development

The project is owned by the U. S. Government, and was built and is operated by the U. S. Army Corps of Engineers, New Orleans District. The lake is used for flood control, water conservation, wildlife, and recreation purposes.

Federal authorization for the project was the Flood Control Act approved July 24, 1946, Public Law No. 526, 79th Congress, second session. Authorization for storage and diversion of water by the Northeast Texas Municipal Water District was obtained by Permit No. 1897 (Application No. 2065) dated November 22, 1957 from the State Board of Water Engineers. The Permit authorizes 250,000 acre-feet of conservation storage and annual use of 42,000 acre-feet of water for municipal purposes and 161,800 acre-feet for industrial use.

Construction was started in January 1955 and completed December 11, 1959. The cofferdam closure was made August 21, 1957, and water flowed through the conduits September 25, 1957. Deliberate impoundment began in August 1958, and the lake was in full use by December 1959.

The U. S. Army Corps of Engineers estimated the cost of the project as $14,300,000 as of July 1, 1960, of which $2,000,000 is local-interest cost for water supply.

Ferrells Bridge Dam and Lake O' the Pines. Furnished by U. S. Army Corps of Engineers, New Orleans District.

Physical Description

The dam consists of a rolled-earth structure 10,600 feet long with an uncontrolled concrete spillway at the left end of the dam. The embankment is 97 feet high above streambed, and contains about 4 million cu yd of compacted earth. The maximum base width is 590 feet, and the top width is 30 feet with the top of the dam at elevation 277.0 feet above msl. A roadway is built on top of the dam. The upstream surface is paved with rock riprap laid on a gravel base.

The lake has a capacity of 254,900 acre-feet and a surface area of 18,680 acres at elevation 228.5 feet above msl, top of conservation storage space. Other capacities are listed at the close of this section.

The drainage area above the dam is 850 square miles.

Records of contents from August 1957 are contained in Water-Supply Papers of the U. S. Geological Survey.

The uncontrolled, concrete, spillway structure is located on the left end of the dam with a crest length of 200 feet at elevation 249.5 feet above msl. Flow over the spillway discharges into a channel and then to Cypress Creek. A concrete bridge 24 feet wide spans the structure to facilitate the operation, and is part of Farm-to-Market Road No. 726 across the top of the dam.

The Northeast Texas Municipal Water District's diversion is from two intake structures in the lake about 1.5 and 11.0 miles from the dam, respectively.

A reinforced-concrete intake structure located on the upstream side of the dam houses the flood-control outlet gates and operating machinery. The outlet consists of twin 10-foot-diameter conduits controlled by two electrically-operated, broome-type gates, 8 feet by 12.5 feet. A low-flow outlet consists of one 14-inch-diameter pipe with control valve discharging into the flood-control conduits.

Listed below is pertinent information on Ferrells Bridge Dam and Lake O' the Pines.

Feature	Elevation (feet above msl)	Storage capacity (acre-feet)	Area (acres)
Top of dam	277.0	2,341,900	--
Maximum design flood stage	269.9	1,856,000	63,400
Spillway crest	249.5	842,100	38,200
Top of conservation storage space	228.5	254,900	18,680
Dead storage space	200.0	2,860	826

Elevations of the Flood Control Works:

Top of structure	313.0 feet above msl
Main operating deck	277.0 feet above msl
Service deck	258.5 feet above msl
Low-flow outlet invert	202.5 feet above msl
Flood-control outlet works (inverts at intakes)	200.0 feet above msl

Discharge ratings of conduits and spillway are as follows:

Feature	Elevation (feet above msl)	Outlet capacity (cfs)	Spillway capacity (cfs)
Top of dam	277.0	--	--
Maximum design flood stage	269.9	--	68,200
Spillway crest	249.5	6,400	--

The maximum release under usual control conditions is expected to be 3,000 cfs.

An increase in the conservation storage level to 230.0 feet above msl is allowed by the Corps of Engineers during summer months for recreational purposes.

90. Terrell Dam and Terrell Reservoir

Location

Terrell Dam and Terrell Reservoir are in the Trinity River Basin in Kaufman County, 6 miles east of Terrell on Muddy Cedar Creek, a tributary of Cedar Creek, which is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Terrell for municipal water supply and for recreation. Permit No. 1700 (Application No. 1831) dated April 20, 1954 from the State Board of Water Engineers to the city of Terrell authorizes storage of 8,300 acre-feet and annual diversion of 6,000 acre-feet of water. The new supply was needed because the small reservoir east of town was not adequate for required supply during dry periods. The old reservoir supply is still used when water is available. Permit No. 1700 was amended November 15, 1962 to allow sale of 40 acre-feet of raw water annually to the town of Elmo for municipal use.

Construction of the project began in February 1955, and was completed in November 1955 with deliberate impoundment of water beginning at that time. Little runoff occurred in 1956, and water was obtained from wells and from the North Texas Municipal Water District. It was not until May 1957 that the reservoir was full. Diversion of water began in 1960 according to the annual water service reports filed with the Texas Water Commission.

Physical Description

The dam is an earthfill structure with a concrete service spillway and earth-trench emergency spillway. The structure is 4,700 feet long and 45 feet high with maximum bottom width of 282 feet and crown width of 20 feet with the top of the dam at elevation 512.0 feet above msl. The upstream slope is paved with 12 inches of rock riprap on a 6-inch gravel base from elevation 493.0 to 507.0 feet above msl. The dam has a clay core along the center line extending at least 3 feet into impervious subsoil.

The reservoir has a capacity of 8,300 acre-feet and a surface area of 885 acres at service spillway crest elevation of 503.0 feet above msl. At the emergency spillway crest elevation of 507.0 feet above msl, the capacity is 12,400 acre-feet with a surface area of 1,150 acres.

The drainage area above the dam is 14 square miles.

The uncontrolled emergency spillway has a crest length of 500 feet at elevation 507.0 feet above msl. It is an earth trench cut through natural ground near the right end of the dam. The downstream face is sodded in various layers to protect the surface.

The service spillway is a concrete weir section, 40 feet long at crest elevation 503.0 feet above msl. The discharge is through a chute to a stilling basin to the channel below the dam.

The service outlet consists of a 4-foot-square intake shaft with top elevation at 509.0 feet above msl, having an approach walkway from the embankment. There are three 30-inch-square inlet gates at elevation 481.0, 488.0 and 495.0 feet above msl to admit water to this vertical shaft and then to a 30-inch, concrete-encased steel pipe through the embankment. The discharge is controlled on the downstream end with a 30-inch valve for wasting water and a 20-inch reducing tee and valve for diverting water to the pumping plant. This plant is located immediately east from the outlet valve. The raw water is pumped through a 21,000-foot-long, 21-inch-diameter, concrete-encased steel pipeline to the present reservoir and filter plant in Terrell.

91. Amon G. Carter Dam and Lake Amon G. Carter

Location

Amon G. Carter Dam and Lake Amon G. Carter are in the Trinity River Basin in Montague County, 6 miles south of Bowie on Big Sandy Creek, a tributary of West Fork Trinity River, which is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Bowie. Water rights were obtained by Permit No. 1719 (Application No. 1853) dated August 19, 1954 from the State Board of Water Engineers to the city of Bowie. This Permit allows storage of 20,050 acre-feet of water and annual use of 3,500 acre-feet for municipal and 1,500 acre-feet for industrial purposes.

Construction bids were received July 11, 1955, and work began soon thereafter. The work was completed in August 1956 with deliberate impoundment of water starting in May 1956. Diversion and use of water began in June 1956, and the lake was full with water flowing over the service spillway in May and June 1957.

Physical Description

The dam is a rolled-earth structure 2,540 feet long and 71 feet high above the streambed with the top of the embankment at elevation 938.0 feet above msl. The maximum width of the base is 400 feet, the top width is 20 feet, and the upstream face is protected with 2 feet of rock riprap on an 8-inch gravel blanket.

The lake has a capacity of 20,050 acre-feet and a surface area of 1,540 acres at service spillway crest elevation of 920.0 feet above msl. There is 10,000 acre-feet of surcharge storage between the service and emergency spillway for temporary floodflow retention.

The drainage area above the dam is 100 square miles.

The emergency spillway is a cut through a natural saddle, about 800 feet from the left abutment of the dam, with a crest length of 700 feet at elevation 927.0 feet above msl.

The service spillway is a box-type drop inlet with crest elevation of 920.0 feet above msl. This drops vertically to a horizontal, 96-inch, concrete-pipe, outlet conduit extending through the embankment, with invert at 908.0 feet above msl, which discharges into a graded channel to the streambed.

The low-flow outlet consists of an 18-inch, concrete-lined steel pipe encased in concrete extending through the embankment. The discharge is controlled by a plug valve with operating rod extending up the embankment to above normal water level. The pipe is reduced at the discharge end where a 12-inch gate valve is installed for further regulating the flow. Invert of the pipe is at elevation 885.3, and invert of the plug valve is at elevation 888.3 feet above msl.

The pumping plant for diverting water from the lake is a concrete structure located on the north side of the lake with the motors mounted on a platform for driving the vertical pumps. A house is erected over the platform for protecting the motors and electrical equipment.

92. Wesley E. Seale Dam and Lake Corpus Christi

Location

Wesley E. Seale Dam and Lake Corpus Christi are in the Nueces River Basin on the Nueces River, 4 miles southwest of Mathis. The dam is in San Patricio and Jim Wells Counties. The lake borders these two counties, and extends into Live Oak County.

Wesley E. Seale Dam and Lake Corpus Christi (with old Mathis Dam in foreground before it was breached April 26, 1958). Furnished by Lower ~~Neches~~ Nueces River Water Supply District.

For information on Mathis Dam and Lake Corpus Christi, see page 50.

Ownership and History of Development

The Wesley E. Seale Dam and Lake Corpus Christi are owned by the Lower Nueces River Water Supply District who constructed the dam under the water right granted by Permit No. 1656 (Application No. 1776) issued to the District by the State Board of Water Engineers on January 20, 1953. Permit No. 1656 and extension of time amendments (Permit Nos. 1656 A, B, C) authorized the construction of a dam on the Nueces River that would create a lake of 300,000 acre-feet capacity for the city of Corpus Christi. The lake would supply water to the city for uses authorized under existing water rights held by the city. Permit No. 1656 allows use of the bed and banks of the Nueces River for conveying water released from the lake to the city pumping plant at Calallen.

The pertinent existing water rights held by the city of Corpus Christi, for which Lake Corpus Christi will be the source of water, are: Permit No. 933 (Application No. 995) issued to the city of Corpus Christi on October 31, 1927; Permit No. 1463 (Application No. 1571) issued to the city of Corpus Christi on August 19, 1948; Permit No. 1604 (Application No. 1726) issued to the city of Corpus Christi on December 3, 1951. A later water right granted by Permit No. 2026 (Application No. 2219) was issued to the city of Corpus Christi on October 3, 1962. It amends the place of use and other conditions not affecting the total appropriation, type, or use authorized by Permit Nos. 933 and 1463. See Dam Mathis and Lake Corpus Christi for a description of the provisions of Permit Nos. 933, 1463, and 1604.

Several plans were considered for the Wesley E. Seale Dam. The plan selected was for a single large reservoir at a new site near Mathis, which would submerge the Mathis Dam and cover the old Lake Corpus Christi. Construction began November 19, 1955, and was completed and impoundment began on April 26, 1958 submerging the old Mathis Dam.

Physical Description

The Wesley E. Seale Dam is an earthfill and concrete structure making up a composite length of 5,930 feet with a height of 75 feet. A description of the main sections are as follows (looking downstream towards the dam and proceeding from right to left): an earthfill section 500 feet long; a concrete gravity overflow section that serves as a spillway, 1,080 feet long; an earthfill section 400 feet long; a concrete gravity overflow section that serves as a spillway, 1,320 feet long; an earthfill section 2,200 feet long. The earthfill sections are trapezoidal of varying base widths, some as great as 280 feet. Top widths vary from 15 to 51 feet.

The drainage area of the Nueces River watershed at Wesley E. Seale Dam is 16,656 square miles.

Capacities and surface areas of the lake at indicated elevations are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	106.0	--	--
Top of spillway gates (when closed)	94.0	302,100	22,050
Spillway crest	88.0	185,900	15,500
Invert of low-flow outlet	55.5	140	--

Records of the contents of both the former and present Lake Corpus Christi from September 1948 through September 30, 1957 are contained in Bulletin 5807-A of the State Board of Water Engineers and in Water-Supply Papers of the U. S. Geological Survey since September 1948.

The spillways are equipped with sixty gates, 37.5 feet long by 6 feet high. These gates are Ambursen, floating-crest-type gates that will automatically open when the lake water level reaches elevation 94.0 feet above msl. However, the water level in the lake is currently maintained at the normal maximum operating elevation of 88.0 feet above msl by leaving the gates bolted open in the shorter spillway.

The outlet works, which provide the means for releasing water for use, consist of one 5-foot-diameter cylinder valve and three rectangular openings, 2.5 feet by 4 feet, with invert elevations at 55.5 feet above msl. The water flows in the Nueces River channel to the city's water treatment plant at Calallen. Water released and discharged over the spillways is measured at the Texas Water Commission-U. S. Geological Survey cooperative streamflow gaging station (Nueces River) near Mathis, Texas, located at the highway bridge 0.6 mile downstream from the dam.

93. South Prong Dam and Lake Waxahachie

Location

South Prong Dam and Lake Waxahachie are in the Trinity River Basin in Ellis County, 4 miles southeast of Waxahachie on South Prong Waxahachie Creek, a tributary of Chambers Creek, which is a tributary to Richland Creek, which in turn is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by Ellis County Water Improvement District No. 1 for a water supply to the city of Waxahachie. Water rights were obtained by Permit No. 1742 (Application No. 1874) dated March 14, 1955 from the State Board of Water Engineers to the District. This Permit authorizes storage of 13,500 acre-feet of water and annual use of 2,810 acre-feet for municipal purposes and 760 acre-feet for industrial use.

The contract was let and construction began April 18, 1956, and the dam was completed and deliberate impoundment of water began in November 1956. The

lake was full, and water spilled in May 1957. Diversion began for municipal use in August 1957.

Physical Description

The dam is an earthfill structure 4,100 feet long, including the spillway, with a maximum height of 66 feet with the top of the dam at elevation 541.5 feet above msl. The embankment has a maximum bottom width of 400 feet and top width of 18 feet, and the upstream surface is protected by 5 feet of rock riprap laid on a 12-inch gravel and sand base. A roadway is built on a berm of the downstream embankment. A bridge spans the spillway.

The lake has a capacity of 13,500 acre-feet and a surface area of 645 acres at the spillway crest elevation of 531.5 feet above msl. This includes 1,500 acre-feet of the dead storage.

The drainage area above the dam is 30 square miles.

The spillway located at the left abutment is cut through rock with a crest length of 300 feet at elevation 531.5 feet above msl.

The service outlet facilities consist of a vertical concrete intake structure with two 3-foot by 3-foot, gated inlets at two intake elevations. The invert elevation of the low intake is at elevation 501.5 feet above msl. A 24-inch, valve-controlled pipe connects the bottom of this intake structure to a pump intake well in the raw-water pump station below the dam. From here the water is pumped to the city's filtration and treatment plant. This pipe can also act as low-flow release for downstream requirements.

94. Weatherford Dam and Weatherford Lake

Location

Weatherford Dam and Weatherford Lake are in the Trinity River Basin in Parker County, 7 miles east of Weatherford on Clear Fork Trinity River, which is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Weatherford for municipal and industrial water supply. Water rights were obtained by Permit No. 1771 (Application No. 1880) dated July 21, 1955 from the State Board of Water Engineers to the city of Weatherford. The Permit allows storage of 19,470 acre-feet of water and annual diversion of 4,500 acre-feet for municipal and 1,500 acre-feet for industrial purposes.

Construction of the project began in June 1956, and was completed March 15, 1957. Deliberate impoundment of water began in March, and the lake was filled in April and early May 1957. Diversion from the lake for municipal supply began in July 1957.

Physical Description

The dam is a rolled-earth structure 4,055 feet long with 75 feet maximum height with the top of the dam at elevation 914.0 feet above msl. The embankment has a maximum base width of 415 feet and crown width of 20 feet. A clay core of variable depth extends under the center of the fill. The upstream face is protected with 24 inches of rock riprap laid on an 8-inch sand base.

The lake has a capacity of 19,600 acre-feet and a surface area of 1,280 acres at the spillway crest elevation of 896.0 feet above msl. Water is diverted from the lake by a pumping plant and pipeline.

The drainage area above the dam is 109 square miles.

The uncontrolled emergency spillway is located on the right end of the dam and is a two-level spill over a natural-earth section. A 500-foot crest length is at elevation 903.0 and another 500-foot crest length section is at elevation 906.0 feet above msl.

The service spillway consists of a semicircular, uncontrolled, concrete weir with crest length of 162 feet at elevation 896.0 feet above msl. The discharge is to a 9-foot by 9-foot, reinforced concrete conduit 425 feet long extending through the dam with invert of discharge end at elevation 840.0 feet above msl.

The low-flow outlet is an 18-inch, valve-controlled, steel-lined concrete pipe 352 feet long extending through the embankment with invert at elevation 857.0 feet above msl. However, the valve controlling the flow is at elevation 860.4 feet above msl. The operating rod is supported on piers on the embankment at a point above normal maximum water level.

95. Striker Creek Dam and Striker Creek Reservoir

Location

Striker Creek Dam and Striker Creek Reservoir are in the Neches River Basin in Rusk County, 18 miles southwest of Henderson on Striker Creek, a tributary to the Angelina River, which is tributary to the Neches River. The reservoir extends into Rusk and Cherokee Counties.

Ownership and History of Development

The project is owned and operated by the Angelina and Nacogdoches Counties Water Control and Improvement District No. 1. Water rights were obtained by Permit No. 1808 (Application No. 1946) dated January 25, 1956 from the State Board of Water Engineers to the District. The Permit allows annual diversion of 5,600 acre-feet of water for municipal and 15,000 acre-feet for industrial purposes from an authorized storage of 26,500 acre-feet. Permit No. 1830 (Application No. 1974) dated June 18, 1956 from the State Board of Water Engineers to the District amended the original permit by changing the location of the dam slightly and increasing the storage capacity by 460 acre-feet to an estimated total capacity of 26,960 acre-feet.

The industrial water is used by the Texas Power & Light Company for condenser-cooling water for a steam-electric generating station and by the Southland Paper Company, which has contracted to purchase 10,000 acre-feet of water annually.

Construction began July 23, 1956, and was completed in July 1957. Closure was made and impoundment of water started in the early part of May 1957. Actual use began later in May 1957 at which time the reservoir was almost full.

Physical Description

The dam is an earthfill structure with an impervious earth core, 2,400 feet long and 42 feet high, with the top of the dam at elevation 309.0 feet above msl. The embankment has a maximum bottom width of 250 feet and top width of 25 feet. The embankment contains about 376,000 cu yd of fill. The upstream face is protected by 24 inches of rock riprap.

The reservoir has a capacity of 26,700 acre-feet and a surface area of 2,400 acres at normal operating elevation of 292.0 feet above msl (top of taintor gates). This includes about 9,000 acre-feet of storage below the spillway or lowest gravity release. The power plant water is pumped from the reservoir through the turbine condenser and back to the reservoir at a distant point from the intake for circulation and cooling. The only consumptive use of water is forced evaporation caused by heat added to the reservoir and plant-service water supply.

The drainage area is 182 square miles.

The service spillway is a concrete, ogee-type structure with net crest length of 140 feet at elevation 282.0 feet above msl. The discharge through the service spillway is controlled by four 35-foot-wide by 10-foot-high taintor gates.

The emergency spillway, located at the right end of the dam, has a crest length of 600 feet at elevation 294.0 feet above msl.

The low-flow outlet is a valve-controlled, 24-inch concrete pipe with invert at elevation 282.0 feet above msl, with discharge to the channel of the service spillway structure.

96. Smithers Lake Dam and Smithers Lake

Location

Smithers Lake Dam and Smithers Lake are in the Brazos River Basin in Fort Bend County, 10 miles southeast of Richmond on Dry Creek, a tributary of Big Creek, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the Houston Lighting & Power Company as the cooling-water supply for a steam-electric generating station. Water rights were obtained by Permit No. 1812 (Application No. 1950) dated February 2, 1956 from the State Board of Water Engineers to the Houston Lighting & Power Company. This Permit allows increasing the storage capacity of a small lake by 12,000 acre-feet to 16,500 acre-feet and annual use of 8,000 acre-feet for condenser-cooling water purposes. This small lake was on land purchased for the plant site. Water may be purchased up to 12,000 acre-feet annually from the Richmond Rice Association. This company obtained water rights under Permit No. 1041 (Application No. 1112) dated March 29, 1932 from the State Board of Water Engineers for use of 40,000 acre-feet for irrigation purposes. Then by Permit No. 1814 (Application No. 1951) dated March 13, 1956, 12,000 acre-feet of the 40,000 acre-feet was transferred to industrial use so it could be sold to the Houston Lighting & Power Company.

The enlarged lake project was started August 22, 1956 and was completed July 1, 1957. Water had already been impounded in the small lake, and the date for beginning of impoundment in the new lake was October 15, 1957. The first electrical generating unit was placed in operation in March 1958 with space provided for future units.

Physical Description

The main dam is an earthfill structure about 3,000 feet long with a height of 18 feet, maximum bottom width of 206 feet, and top width of 12 feet. A dike about 14,000 feet long of variable height and cross-sectional area completes the embankment with top elevation at 71.0 feet above msl. Some areas of the upstream face of the embankment are protected with asphaltic concrete pavement. A small dam and lake were incorporated into this project.

The lake has a capacity of 18,000 acre-feet and a surface area of 2,140 acres at elevation 66.0 feet above msl. Runoff will be supplemented by water purchased from the canal system of the Richmond Rice Association as needed to keep the lake elevation at normal level for the plant operation.

The drainage area above the dam is 24.2 square miles.

A spillway is provided to return any excess water to Dry Creek. This is a gated, concrete, ogee section with wingwalls near the right end of the dam and crest elevation at 56.0 feet above msl. The discharge is controlled by three taintor gates, 30 feet long and 15 feet high. A bridge over the gate piers supports the hoisting apparatus for raising and lowering the gates.

Water is diverted from the lake through an intake structure by pumps located in the power plant building, circulated through the condenser, and returned to the lake by a canal to a distant point from the intake to provide circulation and cooling. Some water is used for plant services and yard watering, but otherwise forced evaporation caused by heat added to the lake is the only consumptive use of water.

97. Graham Dam and Graham Lake

Location

Graham Dam and Graham Lake are in the Brazos River Basin in Young County, 2 miles northwest of Graham on Salt Creek, a tributary of the Brazos River. See Eddleman Dam and Lake Eddleman, page 52, for related information.

Ownership and History of Development

The project is owned and operated by the city of Graham in connection with Lake Eddleman for municipal water supply. Water rights were obtained by Permit No. 1747 (Application No. 1871) dated May 10, 1955 from the State Board of Water Engineers to the city of Graham. The Permit allows storage of 39,000 acre-feet of floodwater and annual diversion of 15,000 acre-feet with 7,000 acre-feet for municipal use and 8,000 acre-feet for industrial use. The water requirements for the city increased beyond the supply available from Lake Eddleman so the combined lakes were created. The official name of the combined lakes is Graham Lake.

The original water right for Lake Eddleman, located on Flint Creek, was Permit No. 1061 (Application No. 1136) dated May 1, 1928 from the State Board of Water Engineers to the city of Graham. Permit No. 1061 authorized the construction of a dam 35 feet high and 11,400 feet long to impound 4,503 acre-feet of water with annual diversion of 5,000 acre-feet of water for municipal purposes. This project was completed in September 1930. To increase the height of the dam so that Lake Eddleman would connect with the new lake created by Graham Dam, request for change in storage was made by the city and approved by the State Board of Water Engineers with Permit No. 1747A (Application No. 2064) dated February 27, 1958. This Permit changes Lake Eddleman's allowable storage from 4,503 to 13,386 acre-feet by increasing the height of the dam to raise the level of the lake 13 feet. The Permit approved transfer in water use of 1,000 acre-feet from municipal to industrial purposes.

Construction of Graham Dam began September 17, 1956, was completed June 15, 1958, and impoundment of water began in June 1958. The date that the two lakes became one was sometime later than June 1959.

Physical Description

Graham Dam is a rolled-earth structure 3,700 feet long with 82 feet maximum height; the top of the dam is at elevation 1,092.0 feet above msl. The embankment has a maximum bottom width of 537 feet and a top width of 20 feet with the upstream side protected with 24 inches of rock riprap on an 8-inch gravel base.

Eddleman Dam after enlargement is a rolled-earth structure 4,495 feet long and 57 feet high with the top of the dam at elevation 1,092.0 feet above msl, the same as Graham Dam. The embankment has a bottom width of 321 feet and a top width of 20 feet, and the upstream side is protected with rock riprap. Some of the rock was salvaged from the old dam.

The new Graham Lake is connected with the enlarged Eddleman Lake by a canal forming one lake called Graham Lake. The combined capacity is 52,500 acre-feet with an area of 2,550 acres at spillway elevation 1,075.0 feet above msl. It is proposed that 7,400 acre-feet of the lake storage space be allocated to sediment reserve. Water will be used for municipal purposes and for condenser-cooling water for a steam-electric generating plant of the Texas Electric Service Company.

The drainage area above Graham Dam is 170 square miles; above Eddleman Dam it is 42 square miles, so the new lake has a contributing drainage area of 212 square miles.

A spillway is cut from the natural ground with a crest length of 800 feet at elevation 1,075.0 feet above msl. There is also an emergency spillway with crest length of 1,000 feet at elevation 1,084.0 feet above msl.

Water for the electrical generating plant is pumped directly from one lake through the condensers and returned to the other lake providing circulation and cooling. The power plant consumptive use of water is forced evaporation caused by heat added to the lake. Water for municipal use is diverted directly from the lake by equipment installed in the new pumping plant and delivered to the filter plant. The original pumping plant located below the dam had to be removed because of the widening of the base for the increased height of the enlarged structure.

For low-flow release, a 24-inch pipe with invert at elevation 1,020.0 feet above msl extends through the structure, and connects to a vertical concrete shaft with a screened circular-inlet weir at elevation 1,050.0 feet above msl. At the bottom of this shaft there is an 18-inch pipe inlet with a flap valve operated by a chain extending from the valve to the top of the intake structure. This is to provide release of water when the level is below the inlet weir.

The controlled discharge is by two 20-inch valves and pipe reducers located in a vertical concrete manhole, 256 feet from the inlet weir. This provides control as well as change in direction of the 24-inch pipe that continues through the embankment 320 feet to discharge below the dam.

98. Murvaul Dam and Murvaul Lake

Location

Murvaul Dam and Murvaul Lake are in the Sabine River Basin in Panola County, 10 miles southwest of Carthage on Murvaul Bayou, a tributary to the Sabine River.

Ownership and History of Development

The project is owned and operated by the Panola County Fresh Water Supply District No. 1 with offices in Carthage. Water rights were obtained by Permit No. 1837 (Application No. 1985) dated September 10, 1956 from the State Board of Water Engineers to the District. The Permit authorizes storage of 44,650

acre-feet of water with annual use of 6,700 acre-feet for municipal and 15,700 acre-feet for industrial purposes. The lake is also used for recreational purposes.

Construction began September 26, 1956, and the dam was completed and dedicated June 1, 1958. Deliberate impoundment of water began in November 1957, and the storage level reached the service spillway elevation in May 1958.

Physical Description

The dam is a rolled-earth structure, with a volume of 800,000 cu yd, 8,300 feet long with a maximum height above the streambed of 46 feet with the top of the dam at elevation 280.0 feet above msl. The maximum base width is 200 feet, and the top width is 10 feet with a roadway along the top of the dam.

The lake has a capacity of 45,840 acre-feet and a surface area of 3,820 acres at the spillway crest elevation of 265.3 feet above msl.

The drainage area above the dam is 115 square miles.

Records of contents since December 1957 are contained in Water-Supply Papers of the U. S. Geological Survey.

The service spillway near the right end of the dam is an uncontrolled, broad-crested weir with crest length of 270 feet at elevation 265.3 feet above msl. The discharge capacity is 26,700 cfs under a 10-foot head. Discharge is through a tapered chute to a stilling basin.

The outlet structure has openings at three levels controlled by 48-inch by 48-inch slide gates, which are open under usual operating conditions. The invert of the lowest slide gate is at elevation 235.0 feet above msl. The outlet discharges through a 36-inch cast-iron pipe, 456 feet long, into a pilot channel and streambed below the dam. The flow is regulated by a 36-inch valve on the downstream end of the pipe. A 36-inch by 20-inch reducing wye was added to the end of the pipe in 1959, with the 36-inch outlet capped, causing the outflow to discharge through the 20-inch opening. The 36-inch outlet will be used for future municipal supply.

99. Gum Creek Dam and Lake Jacksonville

Location

Gum Creek Dam and Lake Jacksonville are in the Neches River Basin in Cherokee County, 5 miles southwest of Jacksonville on Gum Creek, a tributary of Tails Creek, which is a tributary to the Neches River.

Ownership and History of Development

The project is owned and operated by the city of Jacksonville for municipal water supply and for recreation. Water rights were obtained by Permit No. 1784 (Application No. 1928) dated October 10, 1955 from the State Board of Water Engineers to the city of Jacksonville. The Permit allows storage of

30,500 acre-feet of water and annual use of 5,000 acre-feet for municipal and 10,000 acre-feet for recreational use.

Construction of the dam began early in 1956, and was completed in June 1957 with impoundment of water beginning before that date. The lake was full for the first time, and water discharged through the service spillway on December 2, 1957.

Physical Description

The dam is an earthfill structure about 2,700 feet long and 72 feet high above the streambed with top elevation at 438.0 feet above msl. The embankment has a maximum bottom width of 436 feet and top width of 16 feet, with a volume of 655,400 cu yd of earthfill. Between elevations 412.0 and 432.0 feet above msl, the upstream face is paved with 18 inches of rock riprap placed on a sand bed.

The lake has a capacity of 30,500 acre-feet and a surface area of 1,320 acres at the service spillway crest elevation of 422.0 feet above msl. At elevation 431.0 feet above msl, the capacity is 46,500 acre-feet with a surface area of 1,760 acres.

The drainage area is 41 square miles.

The service spillway is a rectangular box-type inlet with the entrance lip at elevation 422.0 feet above msl. The discharge is to a 6-foot-square conduit through the embankment to a pilot channel and thence to Gum Creek.

The uncontrolled emergency spillway, located a short distance beyond the right end of the dam, is an earth section with crest length of 350 feet at elevation 431.0 feet above msl.

The low-flow outlet, with invert at 372.0 feet above msl, is an 18-inch concrete pipe encased in concrete. The discharge is controlled by a plug valve with the operating rod extending up the embankment to above normal, maximum water level.

100. North Lake Dam and North Lake

Location

North Lake Dam and North Lake are in the Trinity River Basin in Dallas County, 2 miles southeast of Coppell on South Fork Grapevine Creek, a tributary of Elm Fork Trinity River, which is tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the Dallas Power & Light Company for condenser-cooling water for the North Lake Steam-Electric Generating Station.

The project is authorized by Permit No. 1864 (Application No. 1993) dated April 23, 1957 from the State Board of Water Engineers to the Dallas Power & Light Company. The Permit allows storage of 16,000 acre-feet of water and annual use of 1,000 acre-feet. In addition, a purchase contract with the city of Dallas allows diversion of 9,550 acre-feet of water annually, by pumping from Elm Fork Trinity River into North Lake, to be released by the city from one or more upstream reservoirs.

Construction of the dam was begun by the Dallas Power & Light Company in 1956, and was completed in August 1957. Deliberate impoundment of water began in March 1957, and the lake was filled during the year. Actual water use began in 1960 when the first generating unit was placed in operation.

Physical Description

The dam is a compacted earthfill structure, 7,000 feet long and 65 feet high, with the top of the dam at elevation 515.0 feet above msl. The embankment has a clay fill cutoff trench through the center. The maximum base width is 410 feet and the top width is 12 feet with a service roadway along the top of the dam. The upstream face is protected with rock riprap from elevation 490.0 to the top elevation of 515.0 feet above msl.

The lake has a capacity of 17,000 acre-feet and a surface area of 820 acres at normal operating elevation of 510.0 feet above msl. Make-up water to maintain the lake at operating level is pumped through a pipeline from the Elm Fork Trinity River with the diversion point near the Carrollton Dam about 3 miles from the lake.

The drainage area above the dam is 3 square miles.

An uncontrolled concrete spillway is located at the right end of the dam, with a crest length of 200 feet at elevation 510.0 feet above msl. Discharge from the concrete spillway is carried away from the downstream toe of the embankment through a concrete chute that is parallel to the dam for some distance before discharging to the stream a safe distance below the main embankment section.

Water is diverted from the lake through an intake structure to a pump suction well. From here the water is circulated through the condenser and back to the canal that carries the discharge water to the opposite side of the lake. This circulation provides travel time and mixing of the water for cooling. The only consumptive use of water is forced evaporation caused by heat added to the lake and plant service supply.

The low-flow outlet is a valve-controlled 12-inch pipe through the embankment that discharges into the main spillway chute.

101. Arlington Dam and Lake Arlington

Location

Arlington Dam and Lake Arlington are in the Trinity River Basin in Tarrant County, 7 miles west of Arlington on Village Creek, a tributary to West Fork Trinity River, which is a tributary to the Trinity River.

Ownership and History of Development

The project is owned and operated by the city of Arlington. The Texas Electric Service Company has a contract with the city to use the lake water for condenser cooling in the Handley Steam-Electric Generating Plant.

Water rights were obtained by the city to store 25,000 acre-feet of water and to divert annually 4,000 acre-feet for industrial purposes and 9,000 acre-feet for municipal use by Permit No. 1716 (Application No. 1850) dated July 12, 1954 from the State Board of Water Engineers. The project was further studied when the Texas Electric Service Company desired to contract for water for a steam-electric generating plant. The original Permit was amended by Permit No. 1797 (Application No. 1932) dated December 5, 1955, which authorized moving the dam 4,500 feet downstream, increasing the storage capacity from 25,000 to 47,500 acre-feet, and increasing the industrial use water right from 4,000 to 14,000 acre-feet per annum without changing the water right to 9,000 acre-feet of water per annum for municipal use.

Construction of the dam began May 15, 1956, and was completed on July 19, 1957. Deliberate impoundment began March 31, 1957.

Physical Description

The dam is an earthfill structure 6,482 feet long and 83 feet high with the top of the dam at elevation 572.0 feet above msl. The maximum width at the base is 490 feet, the top width is 24 feet, and the upstream face is protected with 24-inch rock riprap on an 8-inch gravel blanket.

The lake has a capacity of 45,710 acre-feet with a surface area of 2,275 acres at spillway crest elevation of 550.0 feet above msl. Water is diverted from the lake for water supply to Arlington. The Texas Electric Service Company circulates water from the lake to a power plant for condenser-cooling water and back to the lake through a canal to a distant point of the lake to provide circulation and cooling.

The only consumptive use of water by the Texas Electric Service Company is forced evaporation caused by heat added to the reservoir and a small amount for plant use.

Pertinent data on Arlington Dam and Lake Arlington are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	572.0	--	--
Crest of emergency spillway	559.7	70,140	--
Crest of service spillway	550.0	45,710	2,275
Invert of low-flow outlet	505.0	180	--

The drainage area above the dam is 143 square miles.

Records of contents from March 1957 are contained in Water-Supply Papers of the U. S. Geological Survey.

The emergency spillway is a cut through the natural earth located 500 feet upstream from the dam on the right bank. It is uncontrolled with a crest length of 882 feet at elevation of 559.7 feet above msl.

A service spillway is located upstream from the right end of the dam. It is an uncontrolled circular drop-inlet type structure, 32 feet in diameter, with the crest at elevation 550.0 feet above msl. The water enters a 10-foot-diameter concrete conduit with invert at elevation 490.0 feet above msl, which is 455 feet long, and discharges to the old channel 200 feet below the dam.

The city's pump-station structure is a 29-foot by 29-foot, vertical, concrete well with two 4-foot by 4-foot inlet conduits from the lake. Two 36-inch valves mounted on the inside of the vertical wall regulate the flow from the conduits to the well. These valves have inverts at elevation 505.0 and 530.0 feet above msl with the control wheel on the operating flood of the pumphouse.

Two vertical pumps, driven by electric motors located in a control house on top of this concrete well structure, deliver water through two 27-inch-diameter, cast-iron pipes to the Arlington filter and treatment plant.

A 24-inch low-flow outlet connects from the bottom of this pump-station well to the service spillway conduit and allows the lake to be drained down to elevation 505.0 feet above msl. A 24-inch valve mounted on the vertical wall controls the discharge through this pipe.

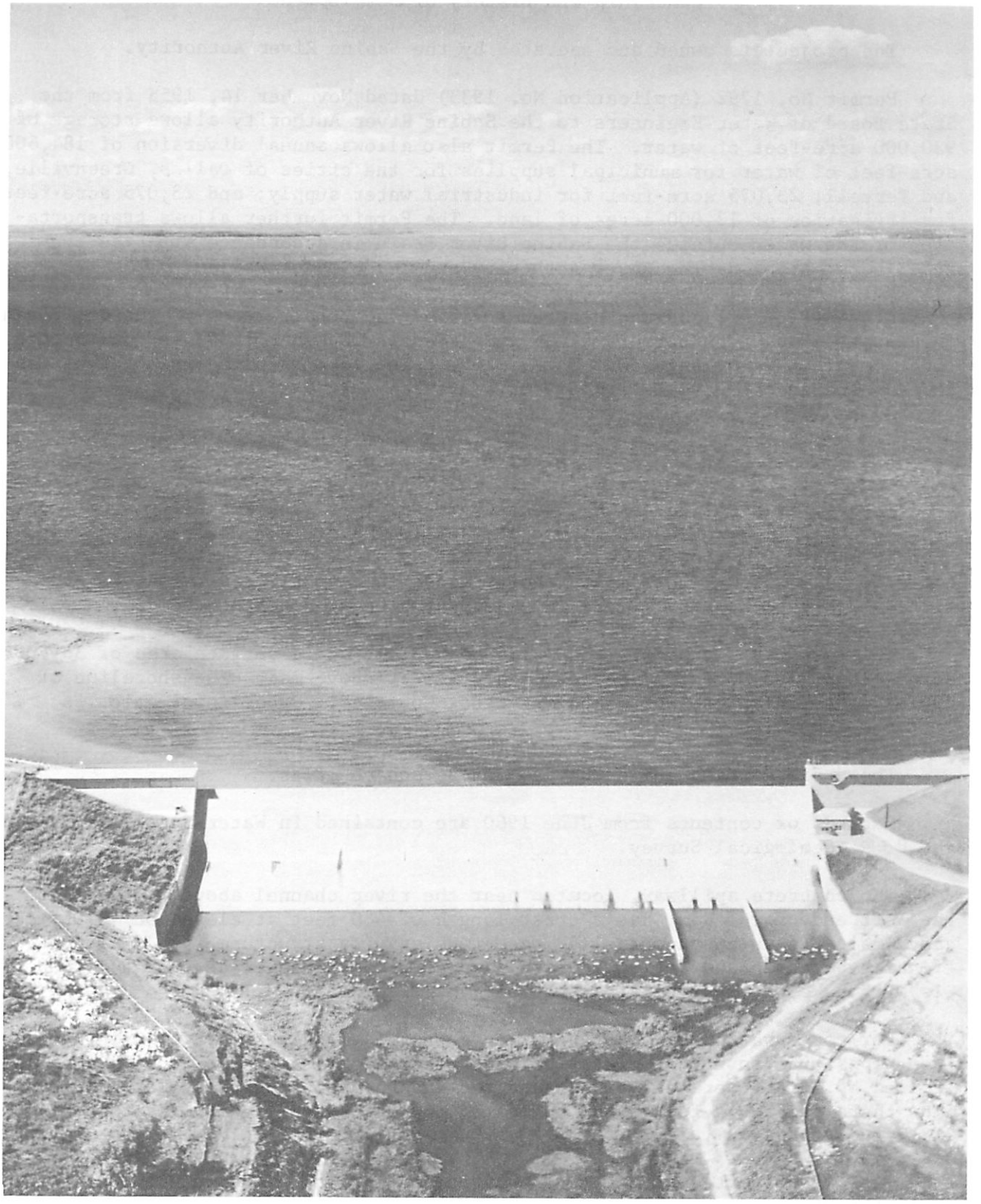
102. Sam Rayburn Dam and Sam Rayburn Reservoir

This project, formerly known as McGee Bend Dam and McGee Bend Reservoir, is under construction; further discussion of it is given on page 211.

103. Iron Bridge Dam and Lake Tawakoni

Location

Iron Bridge Dam and Lake Tawakoni are in the Sabine River Basin in Rains and Van Zandt Counties, 9 miles northeast of Wills Point on the Sabine River at river mile 514. The lake extends into Hunt County.



Iron Bridge Dam and Lake Tawakoni. Furnished by Sabine River Authority

Ownership and History of Development

The project is owned and operated by the Sabine River Authority.

Permit No. 1792 (Application No. 1933) dated November 14, 1955 from the State Board of Water Engineers to the Sabine River Authority allows storage of 930,000 acre-feet of water. The Permit also allows annual diversion of 184,600 acre-feet of water for municipal supplies for the cities of Dallas, Greenville, and Terrell; 23,075 acre-feet for industrial water supply; and 23,075 acre-feet for irrigation of 12,000 acres of land. The Permit further allows transportation of the water outside the Sabine River Basin in accordance with the contract between the Sabine River Authority and the city of Dallas.

Acquisition of land was started in 1956, and construction of the dam began in January 1958. The structure was completed in December 1960, and deliberate impoundment of water began October 7, 1960. The lake is named in honor of the ancient Indian tribe that lived in this area as late as 1760.

Physical Description

The dam is a rolled-earth structure 29,000 feet long including a 480-foot-long, uncontrolled, ogee-type, concrete spillway section. The dam is 75 feet high, with a maximum base width of 504 feet, and a top width of 22 feet at elevation 454.0 feet above msl. The upstream face of the embankment is protected with rock riprap. There is a roadway along the top of the dam.

The lake has a capacity of 936,200 acre-feet and a surface area of 36,700 acres at spillway crest elevation of 437.5 feet above msl. The shoreline of 200 miles is in Rains, Hunt, and Van Zandt Counties. Other information is listed at the close of this section.

The drainage area above the dam is 756 square miles.

Records of contents from June 1960 are contained in Water-Supply Papers of the U. S. Geological Survey.

The concrete spillway, located near the river channel about 2 miles from the left end of the dam, has a crest length of 480 feet at elevation 437.5 feet above msl. It is an uncontrolled ogee-type gravity structure with a conventional-type chute and stilling basin, and it is designed to discharge 50,000 cfs with lake water level at elevation 446.2 feet above msl.

For conservation releases required downstream, there are two 20-inch cast-iron pipes with invert at elevation 416.5 feet above msl. The flow is controlled by motor-operated valves, and the discharge is metered. For greater flow there are two 4-foot by 6-foot gated openings with invert elevation of 378.0 feet above msl.

Water is diverted from the lake by pumping plants owned by various cities using the water.

Pertinent data on the dam and lake are listed below.

Length of dam	29,000	feet
Height of dam	75	feet
Width of base	504	feet
Width of crown	22	feet
Length of spillway	480	feet
Elevation of spillway above msl	437.5	feet
Spillway design discharge	50,000 cfs at lake water level elevation of 446.2 feet above msl.	
Two gate-controlled 20-inch-diameter pipe outlets with invert at elevation 416.0 feet above msl.		
Two gate-controlled 4-foot by 6-foot outlets with invert at elevation 378.0 feet above msl.		
Shoreline at elevation 437.5 feet above msl	200	miles

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	454.0	--	--
Spillway crest	437.5	936,200	36,700
Invert of lower sluice gate to 20-inch pipes	416.5	342,700	20,614
Invert of two 4-foot by 6-foot conduits	378.0	0	0

Discharge capacities	Elevation (feet above msl)	Conservation outlets (cfs)	Sluiceway (cfs)	Spillway (cfs)
Maximum design flood stage	446.2	165	2,600	50,000
Spillway crest	437.5	150	2,400	0
Invert lowest outlet	378.0	0	0	0

104. Canyon Dam and Canyon Reservoir

This project is under construction; further discussion of it is given on page 212.

105. Champion Creek Dam and Champion Creek Reservoir

Location

Champion Creek Dam and Champion Creek Reservoir are in the Colorado River Basin in Mitchell County, 7 miles south of Colorado City on Champion Creek, a tributary of the Colorado River.

Ownership and History of Development

The project is owned and operated by the Texas Electric Service Company.

Water rights for storage of approximately 42,000 acre-feet and annual diversion of 4,050 acre-feet for industrial use and 2,700 acre-feet for municipal use were obtained by the Electric Company through Permit No. 1874 (Application No. 2037) dated May 28, 1957 from the State Board of Water Engineers. The dam was built with the spillway 5 feet lower than first planned with corresponding reduction in storage capacity. This reservoir is required because water demands exceeded the yield of the Lake Colorado City project owned and operated by the Electric Company. Water will be diverted by pumping from this new reservoir to Lake Colorado City as required.

Land acquisition started in 1957, and construction began May 5, 1958. The closure was made and impoundment of water started in February 1959. Construction was completed April 30, 1959.

Physical Description

The dam is a rolled-earth structure 6,800 feet long with a maximum height of 114 feet above the streambed and the top of the dam at elevation 2,109.0 feet above msl. The embankment has a maximum bottom width of 690 feet and top width of 20 feet with rock riprap on the upstream face and a gravel blanket on the downstream side. There are two earthen fuse plugs with a total length of 1,400 feet, located to the left of the main dam, to be washed out when floods greater than the spillway capacity occur.

The reservoir has a capacity of 42,500 acre-feet and a surface area of 1,560 acres at the service spillway crest elevation of 2,083.0 feet above msl. Other elevations and capacities are given in the following table:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	2,109.0	--	--
Maximum design flood stage	2,104.1	90,020	--
Emergency spillway crest	2,091.0	56,800	2,020
Service spillway crest	2,083.0	42,500	1,560
Invert of inlet structure	2,020.0	880	--

The drainage area above the dam is 203 square miles.

Records of contents from April 1959 are contained in Water-Supply Papers of the U. S. Geological Survey.

The emergency spillway is an uncontrolled cut channel at the extreme left of the embankment with a crest length of 450 feet at elevation 2,091.0 feet above msl. Fifty feet of this same cut channel is the service spillway that is excavated an additional 8 feet to elevation 2,083.0 feet above msl. The discharge channel for both of these spillways is about 1,800 feet long.

The two spillways have a combined discharge of 85,290 cfs with the reservoir level at maximum design flood stage elevation of 2,104.1 feet above msl.

Water is released downstream and to the pump station by a 30-inch pipe through the dam. The discharge is controlled by valves located in a concrete structure in the upstream slope of the dam. A valve on the end of the 30-inch line releases water downstream when open, and is closed to divert water to the pump station where water will be pumped through a 24-inch pipeline about 4 miles long to Lake Colorado City. Water is diverted only when Lake Colorado City needs it for either municipal supply or cooling purposes for a steam-electric generating station.

106. Buffalo Springs Dam and Lake Buffalo Springs

Location

Buffalo Springs Dam and Lake Buffalo Springs are in the Brazos River Basin in Lubbock County, 9 miles southeast of Lubbock on the Double Mountain Fork Brazos River, a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the Lubbock County Water Improvement District No. 1, and water may be sold to the cities of Lubbock and Slaton. Water rights were obtained by the District through Permit No. 1875 (Application No. 2038) dated May 29, 1957 from the State Board of Water Engineers. The Permit allows storage of 4,730 acre-feet of water and annual diversion of 300 acre-feet for municipal use, 200 acre-feet for industrial use, and 1,000 acre-feet for recreational purposes.

Construction of the dam began in early 1958, and the dam and spillway were completed at the end of 1959. Deliberate impoundment started September 15, 1959, and on July 6, 1960 water was flowing over the spillway for the first time. All parts of the project were accepted as complete July 15, 1960.

Physical Description

The dam is a compacted earthfill structure 1,600 feet long and 68 feet high with the top of the dam at elevation 3,029.4 feet above msl. The embankment has a maximum bottom width of 360 feet and top width of 20 feet with a clay core extending the length of the embankment. The upstream face of the embankment is protected with 24 inches of rock riprap from elevation 2,991.9 feet above msl to the top. A service road spans the spillway, and continues on the crown of the embankment to various points on the dam.

The drainage area above the dam covers a large area, 6,000 square miles, but only about 340 square miles contributes to runoff.

The lake has a capacity of 5,360 acre-feet and a surface area of 225 acres at spillway elevation 3,011.8 feet above msl.

The concrete spillway is near the right end of the dam. Wingwalls guide the water to a chute-type structure with a crest length of 138 feet at elevation 3,011.9 feet above msl. Rock riprap protects the sides and slope of the

embankment adjacent to the concrete walls both above and below the spillway. The discharge is to a stilling basin with concrete blocks at the lower end for breaking up the high velocity flow.

The low-flow release is a 12-inch prestressed concrete pipe through the embankment with invert at elevation 2,976.9 feet above msl. The discharge is controlled by a valve at the bottom of a 42-inch circular manhole. This vertical shaft has a screened inlet and slide gate at the bottom.

107. Waco Dam (New) and Waco Reservoir

This project is under construction; for further discussion see page 214.

108. Loma Alta Dam and Loma Alta Reservoir

Location

Loma Alta Dam and Loma Alta Reservoir are in the Nueces-Rio Grande Coastal Area in Cameron County, 8 miles northeast of Brownsville. The reservoir is off-channel from the Rio Grande.

Ownership and History of Development

The project is owned and operated by the Brownsville Navigation District. Construction was started November 10, 1958 and substantially completed in March 1963.

Water right to store only surplus water flowing in the Rio Grande was granted by Permit No. 1838 (Application No. 1980) dated November 16, 1956 from the State Board of Water Engineers to the District. The Permit allows storage of 26,500 acre-feet of water, annual use of 37,500 acre-feet for industrial needs, and 2,500 acre-feet for municipal purposes.

Physical Description

The embankment is a compacted earthen dike system with variable height and cross section. The average bottom width is 90 feet and the top width is 18 feet, with the top at elevation 21.5 feet above msl. A concrete outlet section is provided for emergency spill to lower the reservoir if needed.

The reservoir has a capacity of 26,500 acre-feet and a surface area of 2,490 acres at spillway crest elevation of 17.5 feet above msl. The level is maintained by pumping from the Rio Grande during off-season irrigation demands. The pumping plants of the city of Brownsville and Cameron County Water Improvement District No. 5 are used to deliver water to the canal system and reservoir when they would not otherwise be pumping water from the river. There is a secondary or lower reservoir operated in connection with this project that is supplied with water from the canal system or from Loma Alta Reservoir. Water is then delivered to a canal system for distribution to industrial customers.

There is no natural drainage to the reservoir.

The spillway is a concrete structure with wingwalls and uncontrolled circular-shaped ogee overflow section with crest length of 105 feet at elevation 17.5 feet above msl. The discharge is to a drainage area outside the levee system.

There is a 7-foot by 7-foot concrete conduit through the embankment with invert at elevation 5.0 feet above msl. Waterflow is controlled by a slide gate with invert at elevation 6.5 feet above msl. This outlet will be used to control releases to the lower pool and thence to the canal system for commercial use or for emergency release. The gate is operated from a concrete intake structure with a platform at elevation 22.0 feet above msl.

109. Kurth Dam and Lake Kurth

Location

Kurth Dam and Lake Kurth in the Neches River Basin in Angelina County, 8 miles north of Lufkin, are an off-channel storage project of the Angelina River, which is a tributary to the Neches River.

Ownership and History of Development

The project is owned and operated by the Southland Paper Mills, Inc. for industrial use in producing paper. A large part of the water diverted is returned to the Angelina River.

Water rights were obtained by Southland Paper Mills, Inc. through Permit No. 1912 (Application No. 2063) dated June 3, 1958 from the State Board of Water Engineers. This Permit allows the construction of an off-channel lake to store 16,200 acre-feet of water, and it allows the annual use of 19,100 acre-feet. In addition to the water allocated under this Permit, 10,000 acre-feet of water may be purchased annually from Striker Creek Reservoir of the Angelina and Nacogdoches Counties Water Control and Improvement District No. 1.

The construction contract was awarded and work was begun May 26, 1959. It was completed July 21, 1961. Water pumping started in September 1961, and the lake was full at the end of that year, but use of water did not start until 1962.

Physical Description

The dam or levee is 8,600 feet long with an average height of 37 feet and top elevation at 206.0 feet above msl. The earth embankment has a maximum bottom width of 242 feet and a top width of 16 feet. The upstream face is protected with a 6-inch concrete slab on a 10-inch gravel base from elevation 185.0 to 203.0 feet above msl. The dam contains 1,624,000 cu yd of earth.

The lake has a capacity of 16,200 acre-feet and a surface area of 800 acres at spillway crest elevation 197.5 feet above msl. The lake is held at normal level by pumping from the riverflow or from water purchased from Striker Creek Reservoir, which is released to the river channel. This pumped storage makes the 4-square-mile drainage area to the lake unimportant.

The pumping installation at the river is a vertical concrete shaft with four vertical pumps having a total capacity of 53,000 gpm (gallons per minute) at a pumping head of 50 feet. The discharge is to a lined canal 1,900 feet long leading to the lake.

The spillway is a 25-foot by 15-foot, uncontrolled, rectangular intake with the crest at elevation 197.5 feet above msl. The discharge is through two concrete conduits, 10 feet wide by 5 feet high, with invert at elevation 180.0 feet above msl. Since this is a pumped storage project, a low-flow release conduit is not required.

110. Big Hill Dam and Big Hill Reservoir

This project is under construction; for further discussion see page 216.

111. Farmers Creek Dam and Farmers Creek Reservoir (Lake Nocona)

Location

Farmers Creek Dam and Farmers Creek Reservoir, also known as Lake Nocona, are in the Red River Basin in Montague County, 8 miles northeast of Nocona on Farmers Creek, a tributary to the Red River.

Ownership and History of Development

The project is owned and operated by the North Montague County Water Supply District for municipal, industrial, and mining purposes. Permit No. 1922 (Application No. 2104) dated March 10, 1959 from the State Board of Water Engineers to the District allowed the construction of a dam creating a reservoir to impound 25,389 acre-feet of water. The Permit allows annual use of 2,500 acre-feet of water for municipal use, 1,000 acre-feet for industrial use, and 1,000 acre-feet for mining use.

Construction of the dam began in September 1959, and was completed in October 1960. Deliberate impoundment of water began in the spring of 1961 when the first runoff was available for storage. Water was first diverted for use by the city of Nocona in September 1961.

Physical Description

The dam is a rolled-earth structure, 3,720 feet long and 77 feet high above the streambed, with a maximum base width of 423 feet and a top width of 20 feet. The top of the dam is at elevation 847.0 feet above msl. The upstream face is protected with 24-inch rock riprap on an 8-inch gravel blanket.

The lake has a capacity of 25,400 acre-feet and a surface area of 1,470 acres at elevation 827.0 feet above msl, which is the low spillway elevation and operating level. At elevation 835.0 feet above msl, the crest of the second level spillway, the capacity is 40,000 acre-feet with a surface area of 1,920 acres.

Drainage area above the dam is 94 square miles.

A two-level, three-section, uncontrolled spillway discharging into Farmers Creek channel is located near the left end of the structure. A center section, with crest length of 100 feet at elevation 827.0 feet above msl, is the primary source of spill. On each side of this center spillway is a higher section, each with crest length of 400 feet, at elevation 835.0 feet above msl for extreme floodflow.

The outlet for low-flow release is an 18-inch steel pipe encased in concrete extending through the embankment near the center of the dam with invert at elevation 797.0 feet above msl. A manhole structure provides access to the dual control valves.

The pump station structure for municipal water supply is located on the left shore of the lake. This is a vertical concrete shaft with a platform at elevation 842.0 feet above msl for mounting the motors that drive the vertical pump. Water enters this pump structure through a 24-inch pipe that connects to a vertical concrete intake, which also extends above the normal lake level. Water enters this intake through a 24-inch pipe at elevation 800.0 feet above msl and through an opening in the vertical wall at elevation 830.0 feet above msl. Both openings are controlled by slide gates operated by lift chains from the top of the shaft. Two pumps are installed (with provisions for a third) to deliver water by pipeline to Nocona.

112. Navarro Mills Dam and Navarro Mills Reservoir

Location

Navarro Mills Dam and Navarro Mills Reservoir are in the Trinity River Basin in Navarro County, 16 miles southwest of Corsicana on Richland Creek, a tributary of the Trinity River. The reservoir extends into Hill County.

Ownership and History of Development

The project is owned by the U. S. Government, and will be operated for flood control and recreational purposes by the U. S. Army Corps of Engineers, Fort Worth District. The Trinity River Authority has purchased the conservation storage space of 63,300 acre-feet, and will control diversion and uses according to the Permit (No. 1948) granted by the State Board of Water Engineers.

The Trinity River Authority obtained the right to appropriate 19,400 acre-feet of water annually by Permit No. 1948 (Application No. 2134) dated January 13, 1960 from the State Board of Water Engineers. The water will be sold to the city of Corsicana and other towns for municipal purposes. The Navarro

Mills project was authorized by the Flood Control Act of September 3, 1954, 83rd Congress, second session, and modified by the Flood Control Act of July 3, 1958, 85th Congress, second session.

Construction of the project began December 23, 1959. Closure was made and water diverted through the outlets on October 8, 1962. At the end of 1962 the spillway was completed, and the embankment section was completed September 6, 1963. Deliberate impoundment of water began March 15, 1963.

Physical Description

The dam is a rolled-earth embankment 7,570 feet long, including the concrete spillway section, and 82 feet high with the top of the dam at elevation 457.0 feet above msl. The maximum bottom width is 560 feet and the top width is 20 feet. The embankment contains about 2,131,000 cu yd of earthfill, and the upstream face is protected with 2 feet of stone riprap on a 9-inch gravel base.

The reservoir will be used for flood control, conservation storage, and recreational purposes. It has a total capacity of 63,300 acre-feet at elevation 424.5 feet above msl with a surface area of 5,070 acres and shoreline of 38 miles (2,400 acre-feet of this capacity is allocated to dead storage). Other capacities are given in the table below. This reservoir will reduce flooding along Richland Creek, and the temporary retention will reduce the flood peaks in the Trinity River.

The drainage area above the dam is 320 square miles.

The spillway is a gate-controlled concrete ogee structure with crest length of 240 feet at elevation 414.0 feet above msl. Release of water is controlled by six hoist-operated taintor gates. Each gate is 40 feet long and 29 feet high. The spillway discharge capacity with all gates open and water elevation at 451.9 feet above msl will be 224,000 cfs.

The outlet works for low-flow releases consists of two 36-inch-diameter gate-controlled conduits with invert at elevation 400.0 above msl.

Pertinent data on the dam and reservoir are as follows:

Type of dam	Compacted earthfill
Length of dam	7,570 feet (including the spillway)
Maximum height of dam	82 feet
Maximum bottom width of dam	560 feet
Top width of dam	20 feet
Length of spillway	240 feet (net)
Type of spillway	Concrete ogee
Control	Six 40-foot long by 29-foot-high taintor gates

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	457.0	--	--
Maximum design water surface	451.9	335,700	15,950
Top of flood-control storage	443.0	212,200	11,700
Top of conservation storage	424.5	63,300*	5,070
Spillway crest (sill of gates)	414.0	22,100	2,690
Low-flow outlets	400.0	2,370	--
Streambed	375.3	--	--

* Includes 10,100 acre-feet reserved for sediment.

113. Brushy Creek Dam and Brushy Creek Reservoir

Location

Brushy Creek Dam and Brushy Creek Reservoir are in the Red River Basin in Fannin County, 3 miles north of Savoy on Brushy Creek, a tributary to the Red River. The reservoir extends into Grayson County.

Ownership and History of Development

The project is owned and operated by the Texas Power & Light Company for the purpose of condenser cooling and other power plant uses for its Valley Creek steam-electric generating station.

Permit No. 1939 (Application No. 2131) dated November 3, 1959 from the State Board of Water Engineers to the Texas Power & Light Company authorized the construction of a dam creating a reservoir on Brushy Creek and appropriation of a total of 10,000 acre-feet annually of the floodwaters of Brush Creek, Sand Creek, and the Red River. The flow from Brushy Creek is a small amount of this total. When the flow is deficient, water is pumped to the reservoir from a plant located on the Red River at the mouth of Sand Creek, utilizing the flood or excess flow of either of these streams. In order to assure 10,000 acre-feet annually during dry periods, the Texas Power & Light Company entered into a contract with the U. S. Government through the U. S. Army Corps of Engineers for storage space for 16,400 acre-feet and annual diversion of 10,000 acre-feet of water from Lake Texoma. Amended Permit No. 1939A (Application No. 2168) dated October 31, 1960 from the State Board of Water Engineer authorizes appropriation of water in accordance with the terms of this contract as a supplemental source of water. It also authorizes the use of the bed and banks of the Red River in Grayson and Fannin Counties to transport water from Lake Texoma to the point of diversion described in Permit No. 1939. The water may be diverted at some future time by pumping directly from Lake Texoma through a pipeline to the storage reservoir on Brushy Creek. This is an alternate method to the use of the Red River to transport the water to a pumping plant. With all these sources of supply, the total annual diversion is not to exceed the 10,000 acre-feet authorized for appropriation by Permit No. 1939.

The project was started April 18, 1960, and was completed September 5, 1961. Impoundment of water began in December 1960, and at the end of the year the reservoir water level elevation was 588.0 feet above msl with about 3,000 acre-feet of storage in the reservoir. Elevation of the water level in the reservoir on December 31, 1961 was 604.0 feet above msl with storage of 10,000 acre-feet. On December 1, 1962 the elevation was 610.7 feet above msl.

Physical Description

The dam is an earthfill structure 2,500 feet long and 57 feet high with the top of the dam at elevation 617.5 feet above msl. The maximum bottom width of the embankment is 330 feet and the top width is 15 feet.

The reservoir has a capacity of 16,800 acre-feet and a surface area of 1,180 acres at service spillway crest elevation of 610.0 feet above msl. Other reservoir capacities are given in the following table:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	617.5	--	--
Crest of emergency spillway	612.0	17,170	--
Crest of service spillway	610.0	16,800	1,180
Low-flow outlet invert	605.0	10,550	760

The drainage area is 8 square miles but is unimportant as the water level is maintained by diversion from the Red River by two pumps installed in the plant at the mouth of Sand Creek.

A service spillway is located on the right end of the dam with a crest length of 200 feet at elevation 610.0 feet above msl. The discharge is to Brushy Creek channel. An emergency spillway of unknown capacity has a crest elevation at 612.0 feet above msl.

The low-flow release is a valve-controlled 18-inch-diameter pipe through the dam with invert at elevation 605.0 feet above msl.

The Valley Creek electric-generating station was placed in commercial operation in November 1962, and was completed January 1963. The capacity of the first unit is 175,000 kw and provisions are made for additional units. The generator is connected to the transmission network for serving the power needs of the area.

114. Blackburn Crossing Dam and Lake Palestine

Location

Blackburn Crossing Dam and Lake Palestine are in the Neches River Basin in Anderson and Cherokee Counties, 4 miles east of Frankston on the Neches River. The lake extends into Henderson and Smith Counties.

Ownership and History of Development

The project is owned and operated by the Upper Neches River Authority for industrial, municipal, and recreational purposes. Water rights were obtained by the Authority through Permit No. 1832 (Application No. 1975) dated July 12, 1956 from the State Board of Water Engineers. The Permit authorized the construction of a dam in three stages: the first stage covered planning; the second stage covered building a dam creating a reservoir of 30,500 acre-feet capacity; and the third stage covered enlarging a dam to create a reservoir of 410,000 acre-feet capacity. The State Board of Water Engineers extended time of starting construction by Permit No. 1832A dated June 13, 1958 and Permit No. 1832B dated December 30, 1959. The Permits allow an ultimate storage of 410,000 acre-feet of floodwaters and unappropriated waters of the Neches River with an annual use of 84,000 acre-feet for industrial use and 112,000 acre-feet for municipal use. As of July 1962 none of the allocated water had been used, but contracts are being negotiated with the cities of Palestine and Tyler for municipal water supply.

Construction of the dam began May 30, 1960, and the second phase of the project was completed June 13, 1962 when the final payment was made to the contractor. Actual storage of water began in June 1961 with the completion of the outlet works, but the deliberate impoundment date is recorded as May 1, 1962. The lake was at spillway crest elevation in February 1962, and several floods have occurred since that time causing water to be discharged through both spillways.

Physical Description

The present dam is a rolled-earth structure 4,000 feet long, including the spillway, and 53 feet high above steambed with the top of the dam at elevation 343.4 feet above msl. The present maximum bottom width is 332 feet and the top width is 65 feet, which allows for a future enlargement raising the top of the dam to elevation 364.0 feet above msl. Part of the upstream face is protected with rock riprap on a 9-inch sand base.

The present lake has a capacity of 30,500 acre-feet and a surface area of 4,000 acres at elevation 317.0 feet above msl, the design operating level. At the emergency spillway crest elevation of 322.0 feet above msl, the capacity is 57,550 acre-feet with a surface area of 6,800 acres. The future enlarged capacity will be 410,000 acre-feet. Other capacities of the present lake are given in the following tabulation:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	343.4	--	--
Emergency spillway crest	322.0	57,550	6,800
Design operating level	317.0	30,500	4,000
Invert of low-flow outlet	309.5	10,600	1,700
Invert of 8.5-foot-conduit	298.0	550	400

The drainage of the Neches River above the Blackburn Crossing Dam is 839 square miles.

Records of contents from February 1, 1962 are contained in Water-Supply Papers of the U. S. Geological Survey.

The present emergency spillway near the left end of the dam is an uncontrolled, broad-crested weir section excavated into the natural rock bank with a crest length of 450 feet at elevation 322.0 feet above msl. With the enlargement of this project, the spillway will be raised by constructing a concrete ogee weir section at elevation 345.0 feet above msl.

The outlet works near the right end of the dam consist of a gated concrete tower connected to an 8.5-foot-diameter conduit through the dam with invert at elevation 298.0 feet above msl. A concrete and steel walkway at elevation 355.0 feet above msl connects the dam with the top of the tower. Floodwater release through two 5-foot by 7-foot openings at the base of the tower at elevation 298.0 feet above msl is controlled by two 6-foot by 8-foot gates. These gates are located in a rectangular section upstream from where the transition to one circular conduit is located. The discharge from the conduit is through a chute or Parshall flume with measuring equipment and thence to the river channel.

The low-flow outlets are two 36-inch, valve-controlled, cast-iron pipes connecting to compartments in the tower structure. Inlet to these compartments are at various elevations--the lowest one with invert at elevation 309.5 feet above msl. The other inlets are at elevations 312.5, 322.5, and 332.5 feet above msl. The bottom two have slide gates for control of inlet water; gates for the other two will be installed when the dam is enlarged. These 36-inch pipes discharge into the 8.5-foot-diameter conduit and thence to the river channel.

115. Twin Buttes Dam and Twin Buttes Reservoir

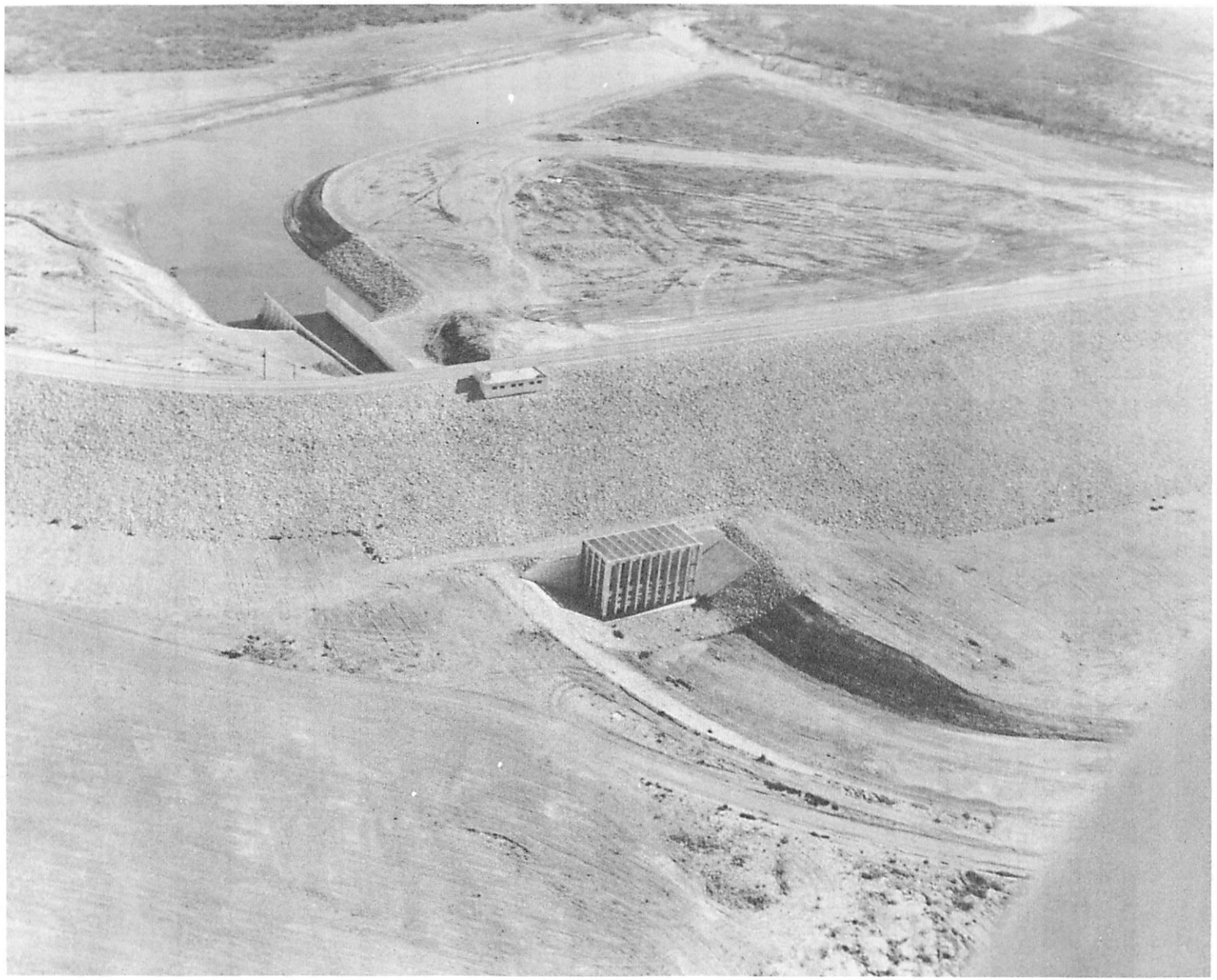
Location

Twin Buttes Dam and Twin Buttes Reservoir are in the Colorado River Basin in Tom Green County, 8 miles southwest of San Angelo on the South Concho River, Spring Creek, and Middle Concho River, tributaries to the Concho River, which is tributary to the Colorado River.

Ownership and History of Development

The project is owned by the U. S. Government, and will be operated by the U. S. Bureau of Reclamation, Amarillo Office, for flood control, conservation uses, irrigation, and recreation. Local agencies cooperating in the project are the San Angelo Water Supply Corporation for municipal water supply and Tom Green County Water Control and Improvement District No. 1 for irrigation water.

Federal authorization was Public Law 85-152 dated August 16, 1957 passed by the 85th Congress. Water rights were obtained by Permit No. 1949 (Application No. 2122) dated February 3, 1960 from the State Board of Water Engineers to the San Angelo Water Supply Corporation. This corporation has contracted with the U. S. Government for storage space in the reservoir. The Permit allows storage of 170,000 acre-feet of water in the Twin Buttes Reservoir, annual use of 29,000 acre-feet of water for municipal supply, and 25,000 acre-feet of water



Twin Buttes Dam and Twin Buttes Reservoir. Furnished by U. S. Bureau of Reclamation, Austin Development Office.

for irrigation of 10,000 acres of land. The municipal water is for the city of San Angelo, which has a contract with the Water Supply Corporation whereby the city is assured an adequate supply for foreseeable future needs. This appropriation, issued in 1950 under Permit No. 1120 (Application No. 1196) and Permit No. 1446 (Application 1551), includes water diversion rights for 25,000 acre-feet from the West Texas Utilities Company. Permit No. 1949 is subject to rights of downstream appropriators, and stipulates that a certain minimum flow must be maintained either by releases from the reservoir or discharge from the city's sewerage or water system.

Construction started May 3, 1960, and deliberate impoundment began December 1, 1962. The dam was completed February 13, 1963 when the project was accepted from the contractor by the Bureau of Reclamation.

This project is above Lake Nasworthy and will release water from storage to keep Lake Nasworthy at a constant level; downstream requirements will be further regulated by this reservoir.

Physical Description

The dam is the second longest earthfill structure and third largest in volume constructed by the U. S. Bureau of Reclamation. It is 8.1 miles long and 131 feet maximum height with the top of the dam at elevation 1,991.0 feet above msl. The embankment has a maximum width at the base of 760 feet with a crest width of 30 feet, and contains 21 million cu yd of material. The upstream face is protected with 36 inches and 24 inches of rock riprap on a 12-inch gravel base. The spillway and intake structure for the outlet conduits are located near the left abutment.

The reservoir has a controlled capacity of 600,000 acre-feet allocated as shown in the list following this section. Because of different elevations of the three streams on which the dam is built, an equalizing channel 3.22 miles long with a bottom width of 250 feet was built connecting the South Concho and Middle Concho Rivers and Spring Creek impoundments into one common reservoir. At the top of the flood-control storage elevation of 1,969.1 feet above msl the reservoir will have an area of 22,680 acres. There has been 20,000 acre-feet of storage space allocated to sediment reserve.

The drainage area above the dam is 3,724 square miles, of which 1,178 square miles is probably noncontributing.

Records of contents from March 1, 1963 are contained in Water-Supply Papers of the U. S. Geological Survey.

The spillway near the left end of the dam is an uncontrolled ogee-weir type with crest length of 200 feet at elevation 1,969.1 feet above msl having a discharge capacity of 47,000 cfs with water surface at elevation 1,985.0 feet above msl. A concrete chute 320 feet long extends from the crest to a stilling basin where the water then discharges into a channel and thence into Lake Nasworthy.

The outlet works located near the left abutment includes an approach channel from the Middle Concho River, a concrete intake structure, a three-barreled concrete conduit with gates, a chute, and a stilling basin. The 210-foot upstream leg of the conduit, from the intake structure to the gate

chamber, consists of three 15.5-foot-diameter tunnels. The 183-foot long downstream section is of circular-top horseshoe-shape, 17 feet wide by 17 feet high. A concrete chute 180 feet long conveys the water to the stilling basin. The outflow from the stilling basin or reservoir is controlled by a 15-foot by 12-foot fixed wheel gate and a 15-foot by 12-foot radial gate in each of the three conduits. The capacity of the conduits is 26,000 cfs with the reservoir at conservation storage elevation of 1,940.2 feet above msl.

There is a 2-foot by 2-foot regulating gate for low-flow releases located in the center of each of the fixed wheel gates.

The irrigation system consists of the main canal, 16 miles long with a capacity of 165 cfs. The headgate for control of the flow to the canal is located at the right abutment of Nasworthy Dam. The distribution system consists of 39 miles of laterals. The main canal and laterals are lined with concrete.

Pertinent data on the dam and reservoir are listed below.

Type of dam	Earthfill
Length of dam	8.1 miles
Crest width of dam	30.0 feet
Bottom width of dam (maximum)	760.0 feet
Height of dam (maximum)	131.0 feet
Type of spillway	Ogee weir (uncontrolled)
Crest length of spillway	200 feet
Crest elevation	1,969.1 feet above msl
Discharge	47,000 cfs at maximum design flood stage elevation of 1,985.0 feet above msl
Type of outlet works	Triple-barreled conduit
Upstream conduits	15.5-foot-diameter
Downstream conduits	17 feet by 17 feet horseshoe-shaped
Discharge at elevation 1,940.2	26,000 cfs
Invert elevation	1,885.0 feet above msl

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,991.0	--	--
Maximum design flood stage	1,985.0	1,034,020	31,830
Top of flood storage space	1,969.1	600,000	22,700
Top of conservation storage space	1,940.2	170,060	8,400
Bottom of equalizing channel	1,925.0	74,470	--
Invert of low intake structure	1,885.0	760	--
Streambed (Middle Concho)	1,861.0	0	0

The 600,000 acre-feet of controlled capacity is allocated as follows: 20,000 acre-feet for 20 years of sedimentation; 40,000 acre-feet for municipal supply; 110,000 acre-feet for joint irrigation, municipal, and industrial supply, and 430,000 acre-feet for flood control. Total dead storage in all three branches of the reservoir is 5,100 acre-feet.

116. Johnson Creek Dam and Johnson Creek Reservoir

Location

Johnson Creek Dam and Johnson Creek Reservoir are in the Cypress Creek Basin in Marion County, 13 miles northwest of Jefferson on Johnson Creek, a tributary to Cypress Creek.

Ownership and History of Development

The project is owned and operated by the Southwestern Electric Company, and is used for cooling water for a steam-electric generating station to be in operation in 1963 or 1964. It will also provide recreation for employees of the Company.

Water rights were obtained by the Southwestern Electric Company through Permit No. 1963 (Application 2161) dated June 13, 1960 from the State Board of Water Engineers. This Permit is for construction of a dam and storage of 10,100 acre-feet of water with annual use of 7,318 acre-feet. Water will be used for condenser-cooling purposes, and the consumptive use will be limited to forced evaporation caused by heat added to the reservoir and to a small amount for plant services. The Johnson Creek yield will not be sufficient for make-up water for future needs. A contract has been made with the Northwest Municipal Water District to purchase water from nearby Lake O' the Pines. The contract calls for the purchase of as much as 6,668 acre-feet of water per year, which will be pumped directly from the lake to Johnson Creek Reservoir as needed to maintain desired water level.

Construction of the dam began June 16, 1960, and was completed August 4, 1961. Impoundment of water began August 4, 1961. In July 1962 the elevation of the reservoir water level was 278.0 feet above msl, or 2 feet below normal operating level. Water will not be diverted for use until the installation of the first 150,000 kw generating unit in 1963 or 1964.

Physical Description

The dam is a rolled-earth structure 2,530 feet long with a maximum height above streambed of 60 feet with the top of the dam at elevation 296.0 feet above msl. The embankment has a maximum bottom width of 364 feet and a top width of 20 feet, and the upstream face is protected with a concrete slab on a sand blanket.

The reservoir has a storage volume of 10,100 acre-feet with a surface area of 650 acres at elevation 280.0 feet above msl. Water will be diverted for steam-condenser-cooling purposes and returned to the reservoir.

The drainage area of Johnson Creek above the dam is 11 square miles.

An emergency spillway with crest length of 300 feet at elevation 286.0 feet above msl discharges to an unlined channel, but will have little use owing to the small drainage area above the dam.

Diversion of water from Johnson Creek Reservoir for cooling purposes will be by pumps directly from the reservoir to the condensers and back to the reservoir, with the discharge located to cause circulation away from the intake structure.

An 18-inch valve-controlled pipe is provided for low-flow discharge.

The first generating unit of 150,000 kw capacity is one of several for a total future plant capacity of 600,000 kw. This plant will supply energy to the transmission system serving the area with electric power.

117. Proctor Dam and Proctor Reservoir

This project is under construction; for further discussion of it see page 217.

118. Bistone Dam and Lake Mexia

Location

Bistone Dam and Lake Mexia are in the Brazos River Basin in Limestone County, 7 miles southwest of Mexia on the Navasota River, a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the Bistone Municipal Water Supply District. Water is sold to Mexia and Mexia State School. Future delivery to Groesbeck is expected.

Water rights were obtained by Permit No. 1955 (Application No. 2150) dated May 4, 1960 from the State Board of Water Engineers. The Permit issued to the District allows storage of 10,000 acre-feet of water, annual use of 5,000 acre-feet for municipal purposes, and 4,000 acre-feet for industrial use.

Construction of the dam began July 26, 1960, and the dam was completed June 5, 1961. Deliberate impoundment of water began June 5, 1961, and heavy rains caused water to flow over the spillway on June 18, 1961. Water use began on June 5, 1961, and total demand for Mexia was furnished after June 21, 1961.

Physical Description

The dam is an earthfill structure 1,645 feet long with a concrete spillway section. The embankment has a maximum base width of 290 feet, and is 20 feet wide at the top. The height above streambed is 50 feet with the top of the dam at elevation 462.3 feet above msl. The upstream surface of the embankment is protected with 2 feet of rock riprap laid on a 1-foot gravel base.

The lake has a capacity of 10,000 acre-feet and a surface area of 1,200 acres at spillway elevation of 448.3 feet above msl.

Drainage area above the dam is 198 square miles.

Records of contents from July 1961 are contained in Water-Supply Papers of the U. S. Geological Survey.

The only spillway is a concrete structure near the left end of the dam. The uncontrolled ogee-type crest has a length of 520 feet at elevation 448.3 feet above msl. Wingwalls from the top of the embankment slope each way to form an inlet and discharge channel. The discharge is over a concrete apron extending downstream, and thence through an excavated channel to the Navasota River.

The low-water outlet is a 24-inch steel pipe encased in concrete with invert at elevation 422.1 feet above msl. The sluice-gate control of the discharge is located in a concrete shaft on the downstream side of the embankment.

A 36-inch raw-water intake with invert at elevation 425.3 feet above msl delivers water directly from the lake to a 12-foot-diameter, concrete, intake well on the bank near the filter plant. Vertical pumps located in this structure deliver the raw water to the filter and treatment plant, from which the treated water is pumped to the city of Mexia and to other users.

119. Joe B. Hogsett Dam and Joe B. Hogsett Reservoir

This project is under construction; for further discussion see page 219.

120. Hubbard Creek Dam and Hubbard Creek Reservoir

Location

Hubbard Creek Dam and Hubbard Creek Reservoir are in the Brazos River Basin in Stephens County, 6 miles northwest of Breckenridge on Hubbard Creek, a tributary of Clear Fork Brazos River, which is a tributary of the Brazos River.

Ownership and History of Development

The project is owned and operated by the West Central Texas Municipal Water District for supplying water to Abilene, Albany, Anson, and Breckenridge.

Water rights were obtained by Permit No. 1890 (Application No. 2053) dated August 9, 1957 and Permit No. 1890A (Application No. 2053) dated June 23, 1959 from the State Board of Water Engineers. Permit No. 1890 allows diversion of 44,800 acre-feet of water annually for municipal use, 5,600 acre-feet for mining use, and 5,600 acre-feet for industrial use by impounding 320,000 acre-feet of water.

The contract for construction was awarded by the District January 26, 1961, and the official construction starting date was May 1, 1961. The dam was completed December 18, 1962, and impoundment of water began that same date.

Physical Description

The dam is an earthfill structure 15,150 feet long and 112 feet high above streambed with the top of dam elevation at 1,208.0 feet above msl. The top width is 20 feet with a maximum bottom width of 850 feet. The upstream face is protected with 3 feet of rock riprap on a 9-inch gravel base. The dam contains 5,870,000 cu yd of earth.

The reservoir has a capacity of 320,000 acre-feet and a surface area of 15,250 acres at elevation 1,183.0 feet above msl with a shoreline at this elevation of 100 miles. A highway bridge crosses the upper end of the reservoir. Other pertinent data are given in the following table:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,208.0	--	--
Top of earth fuse plug	1,197.0	584,000	22,000
Crest of emergency spillway	1,194.0	521,000	20,500
Top of gates of outlet structure (service spillway)	1,183.0	320,000	15,250
Crest of outlet structure	1,176.5	225,000	12,300
Invert of 48-inch valve	1,134.0	4,000	700

The drainage area above the dam is 1,107 square miles.

Records of contents from August 1, 1962 are contained in Water-Supply Papers of the U. S. Geological Survey.

An emergency spillway near the left end of the dam is an excavated area forming a broad-crested uncontrolled weir, 2,000 feet long at elevation 1,194.0 feet above msl. Additional protection is provided with an earthen fuse plug at the extreme left end of the dam. The plug is 4,200 feet long with the top elevation at 1,197.0 feet above msl, and is designed to wash out at extremely high floods to protect the main dam. The bottom contour of the fuse plug varies from elevation 1,175.0 to 1,197.0 feet above msl.

The main outlet is a circular-shaped, drop-inlet, concrete structure, 69.3 feet in diameter, with gate control. The discharge is to a 22-foot-diameter concrete conduit through the dam with invert at elevation 1,108.0 feet above msl. The crest of this outlet is 1,176.5 feet above msl, but the gates raise normal water level to elevation 1,183.0 feet above msl. After construction was completed, an additional 5-foot by 7-foot opening was cut with the invert at elevation 1,138.0 feet above msl with a gate control. This is for more rapid drawdown when the chloride content increases above normal. A valve in the same structure controls low-flow releases through a 48-inch pipeline with invert at elevation 1,134.0 feet above msl.

121. Wood County Dam No. 1 and Lake Quitman

Location

Wood County Dam No. 1 and Lake Quitman are in the Sabine River Basin in Wood County, 4 miles north of Quitman on Dry Creek, a tributary of Lake Fork Sabine River, which is tributary to the Sabine River.

Ownership and History of Development

The project is owned and operated by Wood County for flood regulation and recreational purposes.

Authorization to build a dam and store 7,440 acre-feet of floodwater for recreational use was obtained by Permit No. 1982 (Application No. 2178) dated March 23, 1961 from the State Board of Water Engineers to Wood County.

Construction of the dam began June 1, 1961, and was completed June 1, 1962. Deliberate impoundment of water began May 15, 1962, and at the end of October 1962 the water level was within 7 feet of the service spillway crest.

Physical Description

The dam is an earthfill structure 2,500 feet long with a maximum height of 42 feet and the top of the dam at elevation 413.0 feet above msl. The maximum bottom width is 256 feet, and the top width is 20 feet. The upstream face is protected with a 4-inch concrete slab laid on an 8-inch sand base between elevations 385.0 and 405.0 feet above msl.

The lake has a capacity of 7,440 acre-feet and a surface area of 814 acres at service spillway crest elevation of 395.0 feet above msl, and is used for flood retardation and recreational purposes. There is approximately 10,600 acre-feet of flood surcharge capacity between the crests of the service spillway and the emergency spillway.

The drainage area of Dry Creek above the dam is 31 square miles.

An emergency spillway, located on the right end of the dam, is an excavated, broad-crested weir with crest length of 600 feet at elevation 405.0 feet above msl.

The service spillway is a rectangular drop-inlet structure near the left end of the dam with crest elevation of 395.0 feet above msl with the discharge to a 7-foot by 7-foot concrete conduit with invert at elevation 370.0 feet above msl.

The low-flow outlet is an 18-inch, valve-controlled concrete pipe with invert at elevation 370.0. The discharge is through the service spillway conduit.

122. Victor Braunig Plant Dam and Victor Braunig Lake

Location

Victor Braunig Plant Dam and Victor Braunig Lake, formerly known as East Lake, are in the San Antonio River Basin in Bexar County, 15 miles southeast of San Antonio on Arroyo Seco, a tributary of the San Antonio River.

Ownership and History of Development

The project is owned and operated by the City Public Service Board of San Antonio for condenser-cooling water for a steam-electric generating plant. Water rights were obtained by Permit No. 1990 (Application No. 2189) dated August 21, 1961 from the State Board of Water Engineers to the City Public Service Board. Permit No. 1990 grants permission to construct a dam creating a lake on Arroyo Seco to store 26,500 acre-feet of water and annual use of 12,000 acre-feet. After the lake is filled, the 12,000 acre-feet of water for annual use will consist of runoff of Arroyo Seco supplemented by water pumped from the San Antonio River into the lake to maintain normal operating level.

Construction began June 6, 1961, and was completed in December 1962 when pumping from the San Antonio River and impoundment of water began. Water use will not start until the steam-electric generating plant is in operation in 1966.

Physical Description

The dam is a rolled earth structure 9,543 feet long with a maximum height of 80 feet and the top of the dam at elevation 515.0 feet above msl. The earth embankment has a maximum base width of 496 feet and top width of 18 feet, and contains 1,900,000 cu yd of earth. The upstream side of the embankment is protected with rock riprap from elevation 500.0 feet above msl to the top of the dam.

The lake has a capacity of 26,500 acre-feet and a surface area of 1,350 acres at operating water level elevation of 507.0 feet above msl. The pumping plant for diverting water from the river to the lake contains two units with a capacity of 7,500 gpm each driven by 350 hp motors.

The water for condenser cooling will be pumped directly from the lake and returned at a distant point to give circulation for cooling. The only consumptive use will be forced evaporation caused by heat added to the lake and plant use. The City Public Service Board installed instruments and gages for obtaining a record of contents, water circulated, temperatures, and other data to determine monthly water loss due to forced evaporation caused by heat added to the lake.

The spillway is a concrete structure with a gated ogee section with crest elevation at 493.0 feet above msl. The discharge is controlled by two 33-foot long by 14-foot high taintor gates. The spillway will discharge into the Arroyo Seco and then to the San Antonio River. The maximum design flood stage at elevation 511.2 feet above msl will give a spillway discharge of 20,750 cfs with freeboard of 3.8 feet.

As this lake is adjacent to and obtains water from the San Antonio River, no low-flow release is required.

The first generating unit of 230,000 kw capacity is scheduled for operation in April 1966, and will tie into the transmission system connecting other plants of the Public Service Board and neighboring utility companies. The ultimate capacity of this plant will be 1,215,000 kw.

123. Wood County Dam No. 3 and Lake Hawkins

Location

Wood County Dam No. 3 and Lake Hawkins are in the Sabine River Basin in Wood County, 3 miles northwest of Hawkins on Little Sandy Creek, a tributary to the Sabine River.

Ownership and History of Development

The project is owned and operated by Wood County for flood regulation and recreational purposes.

Authorization to build a dam and store 10,400 acre-feet of floodwater for recreational use was obtained by Permit No. 1984 (Application No. 2180) dated March 27, 1961 from the State Board of Water Engineers by Wood County.

Construction began June 9, 1961, and the dam was completed September 17, 1962 with deliberate impoundment of water beginning August 1, 1962.

Physical Description

The dam is an earthfill structure 1,265 feet long and 58 feet high with the top of the dam at elevation 363.0 feet above msl. The maximum bottom width is 347 feet and the top width is 20 feet with the upstream face protected with a 4-inch concrete slab laid on an 8-inch sand blanket.

The lake has a capacity of 10,340 acre-feet and a surface area of 716 acres at service spillway crest elevation of 342.0 feet above msl. Additional flood retardation surcharge capacity of 9,750 acre-feet is provided between the crests of the service spillway and the emergency spillway. Dead storage space is 300 acre-feet.

The drainage area of Little Sandy Creek above the dam is 30 square miles.

An emergency spillway near the right end of the dam is 300 feet long with crest at elevation 353.0 feet above msl with the discharge through an unpaved area.

The service spillway outlet is a rectangular drop-inlet structure with crest at elevation 342.0 feet above msl. The discharge is through a 7-foot by 7-foot concrete conduit through the embankment with invert at elevation 314.0 feet above msl.

The low-flow outlet is a valve-controlled, 18-inch concrete pipe with invert at elevation 312.6 feet above msl with the discharge through the service spillway conduit.

124. Wood County Dam No. 4 and Lake Winnsboro

Location

Wood County Dam No. 4 and Lake Winnsboro are in the Sabine River Basin in Wood County, 6 miles southwest of Winnsboro on Big Sandy Creek, a tributary of the Sabine River.

Ownership and History of Development

The project is owned and operated by Wood County for flood regulation and recreational purposes.

Permit No. 1985 (Application No. 2181) dated March 27, 1961 from the State Board of Water Engineers authorized Wood County to build a dam and store 6,600 acre-feet of floodwater for recreational use.

Construction began June 15, 1961, and the dam was completed September 17, 1962 with deliberate impoundment of water beginning July 15, 1962.

Physical Description

The dam is a rolled-earth structure 2,570 feet long with maximum height of 44.5 feet with the top of the dam at elevation 436.5 feet above msl. The maximum bottom width is 268 feet, and the top width is 20 feet. The upstream face is protected with a 4-inch concrete slab laid on an 8-inch sand blanket.

The lake has a capacity of 6,580 acre-feet and a surface area of 720 acres at service spillway crest elevation of 417.0 feet above msl, and is used for flood retardation and recreational purposes. There is surcharge capacity of 9,680 acre-feet between the crests of the service spillway and the emergency spillway.

Drainage area of Big Sandy Creek above the dam is 31 square miles.

An emergency spillway at the right end of the dam is a broad-crested weir with crest length of 300 feet at elevation 427.0 feet above msl.

The service spillway outlet is a rectangular drop-inlet structure with crest at elevation 417.0 feet above msl with the discharge to a 7-foot by 7-foot concrete conduit through the embankment with invert at elevation 392.0 feet above msl.

The low-flow outlet is a valve-controlled, 18-inch concrete pipe with invert at elevation 392.2 feet above msl. The discharge is through the service-spillway conduit.

125. Wood County Dam No. 2 and Lake Holbrook

Location

Wood County Dam No. 2 and Lake Holbrook are in the Sabine River Basin in Wood County, 4 miles northwest of Mineola on Keys Creek, a tributary of the Sabine River.

Ownership and History of Development

The project is owned and operated by Wood County for flood regulation and recreational purposes.

Authorization to build a dam and store 7,990 acre-feet of floodwater for recreational use was obtained by Permit No. 1983 (Application No. 2179) dated March 23, 1961 from the State Board of Water Engineers to Wood County.

Construction began June 20, 1961, and the dam was completed November 28, 1962 with deliberate impoundment of water beginning September 15, 1962.

Physical Description

The dam is an earthfill structure 3,100 feet long and 49 feet high with the top of the dam at elevation 387.0 feet above msl. The embankment has a maximum bottom width of 300 feet and top width of 20 feet with the upstream face protected by a 4-inch concrete slab laid on a 4-inch sand base from elevation 364.0 to elevation 380.0 feet above msl.

The lake has a capacity of 7,990 acre-feet and a surface area of 653 acres at service spillway crest elevation of 372.0 feet above msl. Dead storage capacity is 200 acre-feet. There is surcharge capacity of 6,390 acre-feet between the crests of the service spillway and the emergency spillway.

The drainage area of Keys Creek above the dam is 15 square miles.

An emergency spillway is located near the left end of the dam with crest length of 400 feet at elevation 380.0 feet above msl. The discharge is through an unpaved area 900 feet long.

The service spillway is a rectangular drop-inlet structure with crest at elevation 372.0 feet above msl. The discharge is through a 7-foot by 7-foot concrete conduit through the embankment with invert at elevation 344.0 feet above msl.

The low-flow outlet is a valve-controlled, 18-inch concrete pipe with invert at elevation 343.5 feet above msl. The discharge is through the service spillway conduit.

126. Flat Creek Dam and Flat Creek Reservoir

Location

Flat Creek Dam and Flat Creek Reservoir are in the Neches River Basin in Henderson County, 8 miles east of Athens on Flat Creek, a tributary of the Neches River.

Ownership and History of Development

The project is owned and operated by the Athens Municipal Water Authority for municipal water supply, flood regulation, and recreation.

Permit No. 1915 (Application No. 2079) dated September 26, 1958 from the State Board of Water Engineers authorized the Authority to construct a dam and store storm, flood, and unappropriated waters of Flat Creek. The Permit allows storage of 32,840 acre-feet of water and annual diversion of 8,500 acre-feet of water for municipal use. Time for beginning construction was extended to September 26, 1960 by Permit No. 1915B, dated November 3, 1960, by order of the State Board of Water Engineers.

Construction began September 25, 1961, and the dam closure was made and deliberate impoundment of water started November 1, 1962. The project was completed at the end of May 1963 for a total cost of $766,292. Of this amount $360,500 was allocated as cost of the dam with the remainder being the cost of treating plant, pipelines, land, etc.

Physical Description

The dam is a rolled-earth structure 2,940 feet long and with maximum height of 67 feet and the top of the dam at elevation 453.0 feet above msl. The embankment has a maximum bottom width of 528 feet, top width of 20 feet, and contains about 650,000 cu yd of material. The upstream face is protected with 18-inches of rock riprap from elevation 433.0 to 448.0 feet above msl.

The reservoir has a capacity of 32,840 acre-feet and a surface area of 1,520 acres at the service spillway crest elevation of 440.0 feet above msl. Between the crests of the service and emergency spillways, 10,160 acre-feet of flood surcharge space is available. The conservation storage is reduced to 26,990 acre-feet because of allocation of 5,850 acre-feet to dead storage space.

The drainage area of Flat Creek above the dam is 21 square miles.

The emergency spillway located to the left of the dam is an uncontrolled, broad-crested weir with crest length of 300 feet at elevation 446.0 feet above msl with the discharge through a graded unpaved area.

The service spillway consists of an uncontrolled, rectangular, box-type, drop inlet with crest at elevation 440.0 feet above msl, which connects to a 6-foot by 6-foot concrete box culvert extending through the dam with outlet end at elevation 382.0 feet above msl. The discharge enters a prepared channel and thence to the creekbed.

The low-flow outlet is an 18-inch prestressed concrete pipe encased in concrete extending through the embankment with invert at elevation 396.5 feet above msl. The flow is controlled by a slide valve on the entrance end operated by a 164-foot-long rod supported on concrete blocks on the embankment slope up to the top of the dam. A gate valve is installed on the discharge end of the pipe for further control of the discharge.

Water is pumped from the reservoir to the filter and treatment plant in Athens through an 18-inch pipeline by deep-well-type turbine pumps installed in the suction pipes at an angle to the horizontal. Provisions are made for two additional pumps when required. The intakes are located on the right bank of the reservoir about 2 miles upstream from the dam.

127. Brady Creek Dam and Brady Creek Reservoir

Location

Brady Creek Dam and Brady Creek Reservoir are in the Colorado River Basin in McCulloch County, 3 miles west of Brady on Brady Creek, a tributary of the San Saba River, which is tributary to the Colorado River.

Ownership and History of Development

The project is owned and operated by the city of Brady for municipal and industrial water supply.

Permit No. 1953 (Application No. 2137) dated May 2, 1960 was granted to the city by the State Board of Water Engineers. This authorized the construction of a dam to create a reservoir for storing 30,000 acre-feet of storm and floodwaters from Brady Creek with annual use of 3,000 acre-feet for municipal and 500 acre-feet for industrial purposes. Water will be sold to Eden and other communities in the area for municipal use. The U. S. Soil Conservation Service assisted in the financing of the project for the flood regulation. There are 48 flood-retarding structures in the watershed above the dam with a total storage capacity of 5,000 acre-feet in sediment pools; in addition, there are 600 farm and ranch ponds.

Construction began December 27, 1961, and the embankment closure was made January 7, 1963 with impoundment beginning May 22, 1963. Completion date was May 14, 1963 when the project was accepted from the contractors at a total cost of $1,075,600.

Physical Description

The dam is a compacted earthfill structure 8,400 feet long and 104 feet high with the top of the dam at elevation 1,783.0 feet above msl. The embankment has a maximum bottom width of 640 feet and top width of 36 feet, and contains about 2,300,000 cu yd of material. The upstream face of the embankment is paved with 6 feet of rock riprap for protection against wave action.

The reservoir has a conservation storage capacity of 30,430 acre-feet and a surface area of 2,020 acres at the service spillway crest elevation of

1,743.0 feet above msl. At the emergency spillway crest elevation of 1,762.4 feet above msl the reservoir capacity is 90,480 acre-feet and the surface area is 4,464 acres. This gives 60,050 acre-feet of surcharge space for temporary retention of floodwaters between the crests of the service and emergency spillways. It was necessary to re-route a section of the tracks of the Gulf, Colorado & Santa Fe Railroad and to raise a portion of Farm-to-Market Road No. 2028 to clear the reservoir.

The drainage area of Brady Creek above the dam is 508 square miles, but a considerable portion of the runoff from the watershed is controlled by the U. S. Soil Conservation Service structures.

The emergency spillway on the right end of the dam is a broad-crested weir with crest length of 1,000 feet at elevation 1,762.4 feet above msl, which discharges through a 2,600-foot-long channel section with caliche and limestone bottom.

The service spillway is a rectangular, concrete, drop-inlet structure with an inside crest length of 22 feet at elevation 1,743.0 feet above msl. The discharge is to a 7-foot by 7-foot, concrete, box-type conduit that extends through the embankment to the channel below the dam.

The low-flow outlet is a 36-inch cast-iron pipe extending through the embankment parallel to the service-spillway conduit that is equipped with an inlet control gate. The lower end of the pipe is fitted with a tee having a 24-inch valve for control of water to a future filter plant, and an 18-inch valve for the low-flow release.

128. Sanford Dam and Lake Meredith

This project is under construction; for further discussion see page 220.

129. Somerville Dam and Somerville Reservoir

This project is under construction; for further discussion see page 222.

130. Stillhouse Hollow Dam and Stillhouse Hollow Reservoir

This project is under construction; for further discussion see page 223.

131. White River Dam and White River Reservoir

Location

White River Dam and White River Reservoir are in the Brazos River Basin in Crosby County, 16 miles southeast of Crosbyton, on the White River, a tributary of Salt Fork Brazos River, which is tributary to the Brazos River.

Ownership and History of Development

The project is owned and operated by the White River Municipal Water District to supply water to Post, Spur, Ralls, and Crosbyton.

Water rights were obtained by the District through Permit No. 1920 (Application No. 2101) dated November 3, 1958 from the State Board of Water Engineers. Permit No. 1920 was amended at the request of the District by Permit No. 1920A (Application 2175) dated January 18, 1961 from the State Board of Water Engineers to relocate the dam 3,500 feet downstream and increase reservoir capacity from 33,160 to 38,232 acre-feet. There was no change in the water allocation or diversion of 4,000 acre-feet for municipal use, 1,000 acre-feet for industrial use, and 2,000 acre-feet for mining purposes.

Construction began September 12, 1962, and the dam was completed November 21, 1963. Impoundment of water began in May 1963.

Physical Description

The dam is a rolled-earth structure 3,230 feet long and 84 feet high with the top of the dam at elevation 2,395.0 feet above msl. The embankment has a maximum bottom width of 598 feet and top width of 24 feet with the upstream face protected with 8 feet of rock riprap from elevation 2,330.0 feet above msl to the top. The extra amount of rock was available from the excavation. A roadway will be built on the downstream berm of the embankment at elevation 2,338.0 feet above msl.

The reservoir has a total capacity of 38,200 acre-feet (200 acre-feet is dead storage) and a surface area of 1,808 acres at service spillway crest elevation of 2,369.0 feet above msl. Floodwater surcharge of about 33,000 acre-feet is available between the crests of the service spillway and the emergency spillway.

The drainage area of the White River above the dam is 172 square miles.

The emergency spillway located at the right end of the dam is an excavated area in rock with crest length of 1,100 feet at elevation 2,384.0 feet above msl.

The service spillway is a concrete, rectangular, drop-inlet structure with uncontrolled crest at elevation 2,369.0 feet above msl. The discharge is to a 5-foot by 5-foot concrete conduit through the dam to a stilling basin, then over a rock-paved area to the river channel.

The low-flow outlet is a rectangular, concrete, drop-inlet tower with crest elevation of 2,330.7 feet above msl that discharges to an 18-inch concrete pipe that connects to the service spillway outlet conduit. A valve is installed on this pipe at the junction structure to regulate the low-flow discharge.

A concrete rectangular-shaped tower located to the right of the emergency spillway with top at elevation 2,391.5 will provide a service outlet to the raw-water pumps. This tower has two gate-controlled openings at elevation 2,340.0 and 2,356.0 feet above msl and a pipe inlet at the bottom. A 48-inch, horizontal, concrete conduit from the bottom of this tower extends 180 feet

into the embankment and connects to the bottom of a 12-foot by 20-foot, three-compartment, concrete structure located in the embankment. From each of these compartments a 36-inch-diameter vertical shaft extends to elevation 2,391.5 feet above msl. Three vertical pumps are installed in these shafts with the motors located on top of the shaft platform. The pumps discharge to the nearby filter- and water-treatment plant. The treated water will be pumped through pipelines to the several towns in the area to be supplied with water.

132. Amistad Dam and Amistad Reservoir

This project is under construction; for further discussion see page 224.

133. Toledo Bend Dam and Toledo Bend Reservoir

This project is under construction; for further discussion see page 226.

134. Palo Pinto Creek Dam and Palo Pinto Creek Reservoir

This project is under construction; for further discussion see page 227.

135. Bastrop Dam and Lake Bastrop

This project is under construction; for further discussion see page 228.

136. Bardwell Dam and Bardwell Reservoir

This project is under construction; for further discussion see page 230.

137. Cleburne Dam and Cleburne Reservoir

This project is under construction; for further discussion see page 231.

138. Alice Dam and Alice Terminal Reservoir

This project is under construction; for further discussion see page 232.

PROJECT DESCRIPTIONS OF DAMS UNDER CONSTRUCTION

December 31, 1963

PROJECT DESCRIPTIONS OF DAMS UNDER CONSTRUCTION

December 31, 1963

102. Sam Rayburn Dam and Sam Rayburn Reservoir

Location

Sam Rayburn Dam and Sam Rayburn Reservoir, formerly known as McGee Bend Dam and McGee Bend Reservoir, are in the Neches River Basin in Jasper County, 11 miles northwest of Jasper on the Angelina River, a tributary of the Neches River. The reservoir will extend into Angelina, Sabine, San Augustine, and Nacogdoches Counties.

Ownership and History of Development

The project is owned by the U. S. Government, and will be operated by the U. S. Army Corps of Engineers, Fort Worth District. The local agency to purchase water storage rights is the Lower Neches Valley Authority, but a permit for appropriation of water has not been issued by the Texas Water Commission. The marketing agency for electric power to be generated at the dam is Southwestern Power Administration.

This is the second project in the plan of improvement of the watershed (Dam B is in operation; Dam A and Rockland Dam on the Neches River are authorized). Sam Rayburn Dam was authorized under the name McGee Bend Dam by the River and Harbor Act approved March 2, 1945, 79th Congress, first session, and modified by River and Harbor Act of June 30, 1948 (Public Law 858), 80th Congress, second session. The development is designed to control and regulate floods, generate power, and conserve water for municipal, industrial, agricultural, and recreational purposes.

Construction of the project started in September 1956. At the end of 1963 it was about 76 percent complete, with completion scheduled for June 1966.

Physical Description

The dam will consist of an earth embankment, concrete power-intake structure, and flood-control outlet works located near the right end of the dam. The total length is about 19,430 feet with a height of 120 feet and the top of the dam at elevation 190.0 feet above msl. The upstream slope of the embankment is protected by 27 inches of rock riprap. Other features are listed at the close of this section. A State highway will be constructed along the top of the dam.

The reservoir has a total capacity of 2,891,900 acre-feet and a surface area of 114,500 acres at the top of the power storage space at an elevation of 164.0 feet above msl. It will have flood-control storage as shown in the table that follows. The conservation storage has not been allocated at this time. Recreation facilities will be part of this development.

The drainage area is 3,449 square miles.

An uncontrolled broad-crested weir spillway, with crest length of 2,200 feet at elevation 176.0 feet above msl, has a discharge capacity of 125,300 cfs with water surface level at elevation 183.0 feet above msl. The two outlet structures at this reservoir level will discharge 22,100 cfs.

The outlets for floodwater releases are two tractor-type gate-controlled conduits each 10 feet by 20 feet and 180 feet long. Conservation water may be released by these gates or through the operation of the power units at variable capacity to meet the water requirements.

It is proposed to install two power units with a capacity of 26,000 kw each with all necessary auxiliary equipment.

Pertinent data on the dam and reservoir are listed as follows:

Type of dam ..... Earthfill
Length of dam ..... 19,430 feet including spillway
Maximum height of dam ..... 120 feet
Top width of dam ..... 42 feet
Crest elevation of spillway ..... 176.0 feet above msl
Length of spillway (net) ..... 2,200 feet
Type of spillway ..... Broad-crested weir (uncontrolled)

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	190.0	--	--
Maximum design flood stage	183.0	5,611,000	172,770
Spillway crest	176.0	4,478,800	150,730
Top flood-control storage space	173.0	4,040,800	141,290
Top power-storage space	164.0	2,891,900	114,550
Power-head and sediment-storage space	149.0	1,508,400	70,360

Estimated Cost ..... $60,900,000 (U. S. Army Corps of Engineers)
Estimated Annual Benefits .....$ 5,664,200 (U. S. Army Corps of Engineers)

104. Canyon Dam and Canyon Reservoir

Location

Canyon Dam and Canyon Reservoir are in the Guadalupe River Basin in Comal County, 12 miles northwest of New Braunfels on the Guadalupe River. The project currently is under construction.

Ownership and History of Development

The project will be owned by the U. S. Government and operated by the U. S. Army Corps of Engineers, Fort Worth District. The Guadalupe-Blanco River Authority is the local cooperative agency. Their Permit No. 1886 (Application No. 1964) dated January 22, 1959 from the State Board of Water Engineers allocates 50,000 acre-feet of water annually for municipal, industrial, irrigation, and hydroelectric power. Guadalupe-Blanco River Authority, by paying part of the cost, will have rights for the conservation storage space and control over the use and release of conservation water.

Federal authorization of the project was the River and Harbor Act of March 2, 1945, 79th Congress, first session, and Flood Control Act of September 3, 1954, 83rd Congress, second session.

Construction was started April 8, 1958. Closure was completed with river diversion August 5, 1962; deliberate impoundment began in late 1963 with completion scheduled for 1964.

Physical Description

The dam will be the highest earthen embankment built by the U. S. Army Corps of Engineers in Texas. It will be 224 feet high with the top of the dam at elevation 974.0 feet above msl. The main embankment will be 4,410 feet long and 1,400 feet wide at the base and 20 feet wide at the top, and will contain 9,300,000 cu yd of material. The upstream face will be protected by 18 inches of rock riprap on a 6-inch gravel base.

The reservoir is for flood control, conservation storage, and recreation. The conservation storage capacity will be 386,200 acre-feet with a surface area of 8,240 acres and a shoreline of 60 miles at elevation 909.0 feet above msl. Other capacities are given in the list that follows this section.

The drainage area above the dam is 1,418 square miles.

The spillway will be a broad-crested weir 1,260 feet long with crest at elevation 943.0 feet above msl. It is located in a saddle on the right bank between concrete retaining walls. The discharge will be to a pilot channel entering the main river about a mile downstream.

The outlet works will be a reinforced-concrete structure 225 feet high with a 10-foot-diameter conduit through the dam with invert at elevation 775.0 feet above msl. The discharge is controlled by two hydraulically operated slide gates, each 5 feet 8 inches wide by 10 feet high. This outlet will be used for conservation and low floodwater releases.

The Flood Control Act of September 3, 1954 permits installation of power facilities at non-Federal expense, but none is planned at this time.

Pertinent data on Canyon Dam and Canyon Reservoir are listed below.

Length of dam (main embankment)	4,410 feet
Maximum height of dam	224 feet
Maximum bottom width of dam	1,400 feet
Top width of dam	20 feet
Length of spillway (net)	1,260 feet
Capacity of spillway	502,800 cfs with reservoir water level at elevation 969.1
Type of outlet works	10-foot-diameter conduit
Control of outlet	two 5-foot 8 inch by 10-foot slide gates
Capacity of outlet	5,200 cfs with reservoir water level at elevation 969.1

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Sediment reserve (acre-feet)	Area (acres)
Top of dam	974.0	--	--	--
Maximum design flood stage	969.1	1,129,300	--	17,120
Top flood control storage space	943.0	740,900	--	12,890
Spillway crest	943.0	740,900	8,300	12,890
Top conservation storage space	909.0	386,200	19,800	8,240
Maximum tailwater	813.9	--	--	--
Streambed	750.0	--	--	--

Estimated cost ..... $17,300,000 (U. S. Army Corps of Engineers)
Annual benefits ..... $ 2,636,600 (U. S. Army Corps of Engineers)

107. Waco Dam (new) and Waco Reservoir

Location

Waco Dam and Waco Reservoir (enlargement) are in the Brazos River Basin in McLennan County, 2 miles west of Waco on the Bosque River, a tributary of the Brazos River. The project currently is under construction.

Ownership and History of Development

The project is owned and operated jointly by the U. S. Army Corps of Engineers, Fort Worth District; the city of Waco; and the Brazos River Authority. Water rights owned by the city of Waco in connection with the old Waco Dam were modified by Permit No. 1930 (Application No. 2081) dated March 9, 1960 from the State Board of Water Engineers. See description of the old Waco Dam on page 55. This Permit allows additional storage of 65,100 acre-feet of floodwaters and increase of the authorized annual diversion by 19,100 acre-feet at the same location and manner as authorized by Permit No. 1115 (Application No. 1187) issued August 15, 1929 by the State Board of Water Engineers to the city of Waco. Permit No. 1115 authorized impoundment of 39,000 acre-feet of

water with annual diversion of 85,000 acre-feet. This brings the total allowed storage to 104,100 acre-feet and the annual diversion to 59,100 acre-feet. City of Waco Permit No. 1932, amended 1931, (Application No. 2082) dated July 16, 1959 from the State Board of Water Engineers allows the 39,000 acre-feet authorized to be stored in the old Lake Waco to be part of the storage in the new reservoir and to be diverted by pumping or by gravity. Also because of impending inundation of the present lake, the U. S. Government granted the city 13,026 acre-feet in the new reservoir, which is estimated as the amount of storage in the old lake at time of impoundment in the new reservoir. The Brazos River Authority, with consent of the city of Waco, negotiated for reservoir storage capacity between elevations 427.0 and 455.0 feet above msl and use of water until such time as the city needs the water. The Authority will contract for the sale of this water to other users on a limited time basis. Federal authorization for the project was the Flood Control Act by the 83rd Congress, second session, (Public Law 780) dated September 3, 1954.

The new dam was started June 13, 1958 with the award of a contract for the first section of the embankment. The dam is under construction, and was about 80 percent complete at the end of 1963.

Physical Description

The dam will consist of an earth embankment, a concrete outlet works, and a concrete gate-controlled spillway located to the left of the main embankment. The overall length is 24,618 feet with maximum height of 140 feet and the top of the dam at elevation 510.0 feet above msl. The embankment has a maximum bottom width of 990 feet with a top width of 20 feet, and contains 12 million cu yd of material. The upstream face will be protected by 2 feet of rock riprap on a 9-inch gravel blanket. Difficulty was encountered in construction due to a foundation condition causing sliding and damage to the embankment. This required change in plans and additional volume of materials for completion.

The reservoir will serve for flood control, conservation storage, and recreational purposes. At the top of conservation storage elevation of 455.0 feet above msl, the capacity will be 157,700 acre-feet with a surface area of 7,260 acres. Other data are listed following this section. This reservoir will inundate old Lake Waco when the old Waco Dam is breached upon completion of the new structure.

The drainage area above the dam is 1,652 square miles.

The spillway is an ogee concrete section with crest elevation at 456.0 feet above msl and net length of 560 feet, which is controlled by fourteen 40-foot wide by 35-foot high taintor gates. The spillway discharge capacity with water level at the top of flood-control storage space at elevation 500.0 feet above msl will be 458,000 cfs. The outlet works will discharge an additional 20,300 cfs at this same elevation.

The outlet conduit is 20 feet in diameter passing through the dam with invert at elevation 400.0 feet above msl. The discharge will be controlled by three broome-type tractor sluice gates, 6 feet 8 inches wide by 20 feet high, operated from the control tower adjacent to the upstream face of the dam.

Pertinent data on the dam and reservoir, obtained from the U. S. Army Corps of Engineers, is listed below.

Length of dam including spillway	24,618 feet
Height of dam above streambed	140 feet
Width of crown of dam	20 feet
Maximum width of base of dam	990 feet
Type of spillway	Ogee gate-controlled
Net length of spillway at crest	560 feet
Control	Fourteen taintor gates, 40 feet wide by 35 feet high
Shoreline	60 miles at elevation 455.0

Sediment reserve space:

Below elevation 427.0 feet above msl	19,600 acre-feet
Between elevations 427.0 and 455.0 feet above msl	34,000 acre-feet
Between elevations 455.0 and 500.0 feet above msl	21,300 acre-feet
Total	74,900 acre-feet

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	510.0	--	--
Maximum design flood stage	505.0	834,300	21,390
Top flood control storage space (or top of gates)	500.0	732,300	19,440
Spillway crest	465.0	239,200	9,220
Top conservation storage space	455.0	157,700	7,260
Invert of 20-foot-diameter outlet	400.0	--	--

Cost estimate ..... $37,550,000 (U. S. Army Corps of Engineers)
Annual benefit estimate .... $ 3,150,400 (U. S. Army Corps of Engineers)

110. Big Hill Dam and Big Hill Reservoir

Location

Big Hill Dam (levee) and Big Hill Reservoir are in the Neches-Trinity Coastal Area in Jefferson County at Port Acres on Big Hill Bayou, a tributary of Taylor Bayou.

Ownership and History of Development

The project is owned and operated by the Texas Parks and Wildlife Commission, formerly Texas Game and Fish Commission, for a wildlife refuge and recreational purposes. Permit No. 1932 (Application No. 2111) dated July 9, 1959

from the State Board of Water Engineers allows the Texas Parks and Wildlife Commission to store 32,000 acre-feet of water.

Water is pumped from the Big Hill Bayou or from the canal system of the Lower Neches Valley Authority. Because of complaints from several holders of permits for appropriation and use of water from Big Hill Bayou, the Game and Fish Commission entered an agreement (dated July 2, 1959) with these appropriators to limit pumping to meet certain conditions. This agreement incorporated in Permit No. 1932 states that "...water can be diverted only when the level in the Bayou is above 0 feet msl during the month of January from August 15 through December. For the period June to August 15 the level must be 1.5 feet above msl before water can be diverted and for the period February through May the level must be 2.0 feet above msl before diversion can be made." This limitation is to prevent lowering the water level in the bayou below sea level thereby causing salt-water intrusion, which would be detrimental to irrigation.

Construction of the levee work began September 7, 1959, and parts of the development were completed at various times with impoundment of water starting in 1960 when some of the interior ponds were placed in service. The total project was about 95 percent complete at the end of December 1963. A new headquarters building is under construction.

Physical Description

The dam or levee system is built on marsh land with flat slopes. Embankment height is 4 to 6 feet with the top at elevation 5.0 to 6.0 feet above msl.

The reservoir area consists of one main levee system with fourteen interior compartments so that any one compartment can be drained. In order to have vegetation for wildfowl feed, some of the compartments are drained each year on a 3-year rotational basis to allow growth to be replenished. The reservoir maximum capacity is 32,000 acre-feet at elevation of 6.0 feet above msl with a total area of all ponds of about 7,284 acres. In periods of extreme high tides, the entire reservoir area is submerged with sea water.

Various sizes of hand-operated gates are installed on the levee at several points for release of water to and from the various compartments and for drainage to the bayou.

117. Proctor Dam and Proctor Reservoir

Location

Proctor Dam and Proctor Reservoir are in the Brazos River Basin in Comanche County, 9 miles northeast of Comanche on the Leon River, a tributary to the Brazos River.

Ownership and History of Development

The project is owned by the U. S. Government, and will be operated by the U. S. Army Corps of Engineers, Fort Worth District, for flood control and water conservation. It was constructed under the Flood Control Act of September 3,

1954, Public Law 780, 83rd Congress, second session. The Brazos River Authority is the local cooperative agency, and has contracted to purchase the conservation storage by paying $1,707,700 with interest over a 50-year period.

Construction began June 28, 1960, and at the end of 1963 the progress was on schedule. Deliberate impoundment began September 30, 1963. When the project is completed in 1964 the operation of Proctor Reservoir will make possible the modification of Belton Reservoir to convert 247,000 acre-feet of flood-control storage in that reservoir to conservation storage without detriment to flood control on the lower Brazos River.

Physical Description

The dam is a rolled-earth structure 13,460 feet long and 86 feet high with the top of the dam at elevation 1,206.0 feet above msl. The embankment has a maximum base width of 445 feet and a top width of 20 feet. The upstream face is protected with 21 inches of rock riprap laid on 9 inches of bedding material. The dam will contain 3,060,000 cu yd of earth.

The reservoir has a capacity of 59,400 acre-feet and a surface area of 4,610 acres at the top of conservation storage space at elevation 1,162.0 feet above msl, and will provide flood control, conservation storage, and recreational facilities. Additional features of the reservoir are listed at the close of this section.

The drainage area of the Leon River above Proctor Dam is 1,265 square miles.

Pertinent data show that 32,700 acre-feet of capacity in the reservoir will be reserved for sediment.

The spillway is a concrete gravity ogee section with net crest length of 440 feet at elevation 1,162.0 feet above msl, with eleven taintor gates, 40 feet wide by 35 feet high, to control the discharge. The spillway will have a capacity of 431,800 cfs at maximum design flood stage elevation of 1,201.0 feet above msl. The embankment adjacent to the spillway is protected by wingwalls and rock riprap, and the area below the spillway will have double rows of concrete dissipating blocks in the stilling basin.

The low-flow outlet works consist of two 36-inch-diameter conduits with manually operated slide gates with invert at elevation 1,128.0 feet above msl.

Pertinent data on Proctor Dam and Proctor Reservoir are as follows:

Type of dam	Earthfill
Length of dam	13,460 feet
Maximum height of dam	86 feet
Maximum base width of dam	445 feet
Top width of dam	20 feet
Crest elevation of spillway	1,162.0 feet above msl
Length of spillway (net at crest)	440 feet
Type of spillway	Concrete ogee section
Control	eleven 40-foot long by 35-foot high taintor gates
Maximum design tailwater elevation	1,172.7 feet above msl

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)	Sediment (reserve)
Top of dam	1,206.0	--	--	--
Maximum design flood stage	1,201.0	433,000	15,410	--
Top of flood-control storage space	1,197.0	374,200	14,010	4,700
Top of conservation storage space (spillway crest)	1,162.0	59,400	4,610	28,000
Streambed	1,120.0	--	--	--

119. Joe B. Hogsett Dam and Joe B. Hogsett Reservoir

Location

Joe B. Hogsett Dam and Joe B. Hogsett Reservoir, formerly known as Cedar Creek Dam and Cedar Creek Reservoir, are in the Trinity River Basin in Henderson County, 3 miles northeast of Trinidad on Cedar Creek, a tributary to the Trinity River.

Ownership and History of Development

The project is owned and will be operated by the Tarrant County Water Control and Improvement District No. 1 for municipal water supply.

The dam was authorized by Permit No. 1909 (Application No. 2058) dated April 25, 1958 from the State Board of Water Engineers to the District. The Permit allows storage of 678,900 acre-feet and annual use of 175,000 acre-feet per year for municipal use by the city of Fort Worth.

Acquisition of land and reservoir clearing began in August 1960. Construction started in April 1961, and is in progress as of December 31, 1963.

Physical Description

The dam will be a rolled-earth structure 17,539 feet long with a maximum height of 91 feet and the top of the dam at elevation 340.0 feet above msl. The embankment will have a maximum bottom width of 579 feet and a top width of 20 feet with a roadway across the top. The upstream face will be protected with a 24-inch layer of rock riprap on a 10-inch sand blanket from elevation 314.0 to elevation 330.0 feet above msl.

The reservoir will have a capacity of 678,900 acre-feet and a surface area of 34,000 acres at operating elevation of 322.0 feet above msl.

The drainage area above the dam is 1,007 square miles.

The spillway, located about 6 miles upstream on the right side of the reservoir, is a gated concrete ogee section with net crest length of 400 feet at elevation 302.0 feet above msl. There are eight taintor gates, 40 feet long, with top at elevation 325.0 feet above msl and two 40-foot-long, automatic,

hydraulically-operated bascule gates with crest elevation at 316.0 and top elevation at 322.0 feet above msl, which is the normal water level. A service roadway crosses the spillway on the gate piers.

The pumping plant will be located adjacent to the spillway section.

The service outlet is a valve-controlled, 60-inch concrete pipe with invert at elevation 260.0 feet above msl. The discharge is to an excavated channel below the dam where the outlet will be reduced to a 48-inch pipe with additional valve controls. This service pipe will be installed in the partially blocked 10-foot-diameter conduit used to pass the riverflow during construction. The valve will be controlled from a vertical concrete gate vault with top at elevation 340.0 feet above msl.

128. Sanford Dam and Lake Meredith

Location

Sanford Dam and Lake Meredith are in the Canadian River Basin in Hutchinson County, 10 miles northwest of Borger on the Canadian River. The lake will extend into Hutchinson, Moore, and Potter Counties.

Ownership and History of Development

The project is being built and financed by the U. S. Government under the jurisdiction of the U. S. Bureau of Reclamation, and will later be owned and operated by the Canadian River Municipal Water Authority.

The project was authorized by Permit No. 1815 (Application No. 1957) issued April 11, 1956 to the Canadian River Municipal Water Authority by the State Board of Water Engineers. Federal authorization for the U. S. Bureau of Reclamation planning and financing was Public Law No. 897 passed by the second session of the 81st Congress, December 29, 1950. Permit No. 1815B dated April 1, 1958 extended the time for beginning of construction until April 11, 1960, and Permit No. 1815C dated March 23, 1960 further extended the starting time until April 11, 1962. On March 27, 1962 the State Board of Water Engineers issued an order approving construction plans and the additional storage space of 504,000 acre-feet allocated to flood control. The order amended the original appropriation to allow 500,000 acre-feet of conservation storage capacity and 405,000 acre-feet of reservoir storage capacity to be allocated for 50-year sediment reserve. Permit No. 1815 authorizes an annual diversion of 100,000 acre-feet of water for municipal use and 51,200 acre-feet for industrial use. The water is to be treated and pumped through pipelines to 11 cities and many industrial firms in the area. This water will replace ground-water supply, and in case of emergency or interruption of delivery of water the ground-water supply will act as an alternate supply for the various towns.

The plan for this project is consistent with provisions of the compact, which provides for the division of water of the Canadian River among the states of New Mexico, Oklahoma, and Texas.

Construction of the dam began March 11, 1962, and was about 60 percent complete at the end of December 1963. It is expected that impoundment of water will start in 1965.

Physical Description

The dam will be an earthfill structure about 6,400 feet long and 200 feet high above the streambed containing over 14 million cu yd of material. The maximum bottom width will be 1,900 feet and the top width will be 40 feet with the top of the dam at elevation 3,011.0 feet above msl. The upstream face of the embankment will be protected with 4 feet of rock riprap laid on gravel and sand bedding from elevation 2,890.0 feet above msl to the top. The downstream face and many areas in the channel section will be paved with rock riprap and drainage systems will be installed in the foundation and embankment area.

The reservoir, officially named Lake Meredith, will have a total storage capacity of 1,408,000 acre-feet and a surface area of 21,600 acres at elevation 2,965.0 feet above msl.

This capacity is allocated 43,100 acre-feet to dead storage, 544,000 to flood control, 820,900 acre-feet to conservation (includes 361,900 acre-feet for 50 year sediment reserve).

Water will be diverted, filtered, treated, and pumped to cities and towns in the area for municipal supply. The pumping plants and pipelines make up a major item of investment of the project's total estimated costs of $103,230,000.

The drainage area of the Canadian River above the dam is 20,220 square miles, but the Bureau of Reclamation in its report on the project states that the contributing drainage area is only 9,090 square miles.

The service spillway will be an uncontrolled, circular, drop inlet structure with crest elevation of 2,965.0 feet above msl with a 22-foot-diameter circular conduit through the dam discharging to a chute and stilling basin. The flood-control outlet works will consist of an approach channel; concrete intake structure; and a three-barreled, gate-controlled, circular-topped, horseshoe-shaped conduit, 17 feet by 17 feet, that discharges to the outlet channel.

The river-outlet works for conservation water releases will consist of an approach channel and a concrete intake tower with twelve 5-foot by 5-foot slide gates at several elevations. A structural steel access bridge will extend from the dam to the operating room on top of the tower. The discharge conduit will be a 12-foot-diameter concrete tube that increases to 16 feet in diameter at the gate chamber. From here 46-inch- and 108-inch-diameter pipes branch off to the water treatment plant. Excess water can be spilled from this outlet to a stilling basin and river channel.

129. Somerville Dam and Somerville Reservoir

Location

Somerville Dam and Somerville Reservoir are in the Brazos River Basin in Burleson and Washington Counties, 2 miles south of Somerville on Yegua Creek, a tributary of the Brazos River.

Ownership and History of Development

The project is owned by the U. S. Government and operated by the U. S. Army Corps of Engineers, Fort Worth District. A contract has been made by the Government whereby the Brazos River Authority will pay $4,871,000 for the conservation storage together with a percentage of the operating cost. Payment will be over a 50-year period. The Brazos River Authority has not yet obtained water rights from the Texas Water Commission to appropriate or use water. Government authorization for the construction was the Flood Control Act of September 3, 1954, Public Law 780, 83rd Congress, second session.

Construction began in June 1962 with construction progress on schedule at the end of 1963. The cost estimated by the U. S. Army Corps of Engineers is $16,300,000.

Physical Description

The dam will be an earthfill structure 20,210 feet long (plus a dike 4,715 feet long) and 80 feet high with the top of the dam at elevation 280.0 feet above msl. Top width of the embankment is 20 feet.

The reservoir will have a capacity of 160,100 acre-feet and a surface area of 11,460 acres at conservation storage space elevation of 238.0 feet above msl, and will be used for conservation storage, recreational, and other beneficial uses. Other areas and capacities are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	280.0	1,267,400	47,400
Maximum design flood stage	274.5	1,028,800	39,800
Spillway crest	258.0	507,500	24,400
Top of conservation storage space	238.0	160,100	11,460
Streambed	200.0	--	--

Sediment reserve:

Below elevation 238.0	16,200 acre-feet
Between elevation 238.0 and 258.0	9,700 acre-feet
Total	25,900 acre-feet

The drainage area above Somerville Dam is 1,006 square miles.

The outlet works will consist of a concrete conduit, 10 feet in diameter, extending through the dam with invert at elevation 206.0 feet above msl controlled by two 5-foot by 10-foot tractor-type gates.

The spillway is an uncontrolled concrete ogee section with crest length of 1,250 feet at elevation 258.0 feet above msl, and will have a discharge capacity of 286,000 cfs with reservoir level at maximum design flood stage of 274.5 feet above msl.

130. Stillhouse Hollow Dam and Stillhouse Hollow Reservoir

Location

Stillhouse Hollow Dam (formerly Lampasas Dam) and Stillhouse Hollow Reservoir are in the Brazos River Basin in Bell County, 5 miles southwest of Belton on the Lampasas River, a tributary of the Little River, which is tributary of the Brazos River.

Ownership and History of Development

The project is owned by the U. S. Government, and will be operated by the U. S. Army Corps of Engineers, Fort Worth District. The Brazos River Authority has purchased the conservation storage space, and will make application to the Texas Water Commission for appropriation of water.

Federal authorization was the Flood Control Act of September 3, 1954 (Public Law 780) approved by the 83rd Congress, second session, the Public Works Act of 1958 (Public Law 85-167) and Public Law 86-307, September 21, 1959. The cost of the project is estimated by the U. S. Army Corps of Engineers as $20,600,000. As of December 31, 1963, the project was in the early stages of construction and land acquisition, with the scheduled completion date set for June 1965.

Physical Description

The dam will be an earthfill structure 7,850 feet long (plus 5,850 feet of dike) and 200 feet high with the top of the dam at elevation 698.0 feet above msl. The main embankment will have a top width of 42 feet, and the dike will have a top width of 10 feet.

The reservoir will have a capacity of 235,700 acre-feet and a surface area of 6,430 acres at conservation storage space elevation of 622.0 feet above msl. The capacity at the top of the flood-control storage space, at spillway crest elevation of 666.0 feet above msl, will be 630,400 acre-feet and the surface area will be 11,830 acres.

Other reservoir data are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	698.0	--	--
Maximum design flood stage	693.2	1,013,300	16,370
Spillway crest	666.0	630,400	11,830
Top conservation storage space	622.0	235,700	6,430
Sediment reserve	--	34,900*	--
Streambed	498.0	--	--

* 30,800 acre-feet below elevation 622.0--4,100 acre-feet between elevation 662.0 and 666.0.

The drainage area above the dam is 1,318 square miles.

The uncontrolled spillway will be a broad-crested weir with net crest length of 1,650 feet at elevation 666.0 feet above msl with a discharge capacity of 673,500 cfs at maximum design flood stage of 693.2 feet above msl.

The outlet works consist of a 12-foot-diameter concrete conduit with invert at elevation 515.0 feet above msl. The discharge will be controlled by two 5-foot 8-inch wide by 12-foot high, hydraulically operated slide gates.

132. Amistad Dam and Amistad Reservoir

Location

Amistad Dam and Amistad Reservoir are in the Rio Grande Basin, 12 miles northwest of Del Rio on the Rio Grande between the U. S. and Mexico. The dam and reservoir will be in Val Verde County, Texas, and Estado de Coahuila, Mexico.

Ownership and History of Development

The project will be owned by the United States and Mexico and operated by the International Boundary and Water Commission.

The project was authorized by the International Boundary and Water Commission, United States and Mexico, for the purpose of flood control, conservation, irrigation, power, and recreation. Under terms of the treaty the United States will get 56.2 percent of the conservation storage and Mexico will get 43.8 percent.

Physical Description

The dam will be a concrete section in the river channel flanked with earth embankments. The structure will be 34,792 feet long, including a 700-foot long dike, and 253 feet high above the streambed with the top of the dam at

elevation 1,151.3 feet above msl. The earth embankments will have various bottom widths with a top width of 35 feet. Both the upstream and downstream surfaces will be protected with rock riprap.

The reservoir will have a conservation storage capacity of 3,550,000 acre-feet and a surface area of 67,000 acres at elevation 1,117.0 feet above msl. Other capacities are listed as pertinent data at the close of this section.

The total contributing drainage area below Fort Quitman is 65,466 square miles, of which 34,102 square miles is in Mexico and 31,364 square miles is in the United States. The total above the dam is 126,423 square miles with 82,690 square miles in the United States.

The spillway on the concrete section of the dam will have a net crest length of 900 feet at elevation 1,086.4 feet above msl, and the discharge will be controlled by eighteen 50-foot-wide by 54-foot-high radial gates.

The conservation releases will be from three 98-inch-diameter conduits on each side of the river with the center line at elevation of 994.0 feet above msl. In addition, there will be three 18-foot-diameter power penstocks with the center line at elevation 985.0 feet above msl to discharge water when generation is required. Equal power facilities will be installed on each side of the river.

The preliminary work of relocating highways, railroads, pipelines, etc., began in October 1961. Construction was begun August 1963 and completion is expected by 1968.

There are two power plants of 66,000 kw capacity each, together with auxiliary equipment for connection to the transmission system, one of which is on the United States side and the other on the Mexican side of the river.

International Boundary and Water Commission preliminary data on the dam and reservoir are as follows:

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	1,151.3	--	--
Maximum design flood stage	1,144.3	5,660,000	87,400
Top flood-control storage space	1,140.4	5,325,000	84,000
Top conservation storage space	1,117.0	3,550,000	67,000
Dead storage space	--	15,000	--

3,000,000 acre-feet conservation storage:
United States Share ..... 1,686,000 acre-feet
Mexico Share ..... 1,314,000 acre-feet

133. Toledo Bend Dam and Toledo Bend Reservoir

Location

Toledo Bend Dam and Toledo Bend Reservoir in the Sabine River Basin are in Newton County, Texas, and Sabine Parish, Louisiana, 14 miles northeast of Burkeville, Texas, on the Sabine River. The reservoir will extend into Newton, Sabine, Shelby, and Panola Counties, Texas and Sabine and DeSoto Parishes, Louisiana.

Ownership and History of Development

The project is owned and will be operated by the Sabine River Authority of Texas for the use of the Texas share of the waters of the Sabine River. A compact has been made for the division of the waters between Texas and Louisiana and necessary approval has been received from the Federal Power Commission for the development and sale of power.

Priority of water rights was established by the Sabine River Authority through Presentation No. 1403 filed March 5, 1958 with the State Board of Water Engineers. This Presentation led to Permit No. 1994 (Application No. 2191) dated September 21, 1961 from the Board of Water Engineers, which authorized construction of a reservoir to impound 4,661,000 acre-feet of water. This Permit authorizes appropriation of 750,000 acre-feet of water annually with 100,000 acre-feet for municipal use, 600,000 acre-feet for industrial use, and 50,000 acre-feet for irrigation use. Water will be used for generation of power as it is released for downstream purposes. The Permit grants the right to use the bed and banks of the Sabine River for transporting the water to the point of diversion and stipulates that the release through the power units is not to exceed a rate of 16,000 cfs and that water for power will be subordinate to higher priority use. Any additional water yield is to be held in trust by the Sabine River Authority for future authorization of appropriation from the Texas Water Commission.

As of December 1963 the project was in the final design stage ready for calling for bids. Acquisition of land was also in progress at this time.

Physical Description

The dam will consist of a rolled-earth embankment 9,068 feet long with a top width of 25 feet and maximum height of 112 feet above streambed (90 feet above the average natural-ground elevation) with the top of the dam at elevation 185.0 feet above msl. In addition, there will be a concrete spillway section 838 feet long and three dikes with a total length of 2,175 feet. The upstream face of the embankment will be protected by rock riprap and the downstream face will be sodded. There is also a concrete, ogee, gated-spillway section with service bridge and a powerhouse section.

The reservoir will have a capacity of 4,661,000 acre-feet and a surface area of 186,500 acres at maximum operating level at elevation 173.0 feet above msl. Of this, 1,668,200 acre-feet will be for power generation and conservation use, and the remainder will be for power-head storage and emergency water supply.

The drainage area above the dam is 7,178 square miles.

The spillway on the left end of the dam will consist of an approach channel and a concrete, gravity-type, gated weir with a total length of 530 feet. The crest of the weir will be at elevation 145.0 feet above msl, and the flow will be controlled by eleven taintor gates, each 40 feet wide by 28 feet high. The discharge will be to a concrete chute and stilling basin extending downstream about 300 feet.

For low-water releases, an 8.33-foot by 12-foot slide-gate-controlled sluiceway, with invert at elevation 100.0 feet above msl, will be located in the center gate pier. This outlet will be used for diversion during construction and for downstream releases when the turbines are not discharging water. In addition, there will be two 20-inch-diameter valve-controlled conduits for low-flow releases.

The proposed power installation will consist of two generating units, with all auxiliary equipment, having a total installed capacity of 80,750 kw. The energy will be sold to power companies now serving the area.

Pertinent data on the project are listed below.

Feature	Elevation (feet above msl)	Capacity (acre-feet)	Area (acres)
Top of dam	185.0	7,264,450	248,600
Maximum design flood stage	175.27	5,281,550	197,600
Top of gates	173.0	4,661,000	186,500
Top of conservation storage space	172.0	4,477,000	181,600
Top of power-head storage	162.0	2,922,800	136,300
Spillway crest	145.0	1,161,800	71,000
Streambed	73.0	0	0

134. Palo Pinto Creek Dam and Palo Pinto Creek Reservoir

Location

Palo Pinto Creek Dam and Palo Pinto Creek Reservoir are in the Brazos River Basin in Palo Pinto County, 15 miles southwest of Mineral Wells on Palo Pinto Creek, a tributary of the Brazos River.

Ownership and History of Development

The project is owned by the Palo Pinto County Municipal Water District No. 1.

Permit No. 2031 (Application No. 2231) dated October 1, 1962 was issued by the Texas Water Commission to the District. The Permit authorized the construction of a dam to impound 34,250 acre-feet of water with an annual diversion of 10,000 acre-feet for municipal and 6,000 acre-feet for industrial purposes. The Permit further allows the use of the bed and banks of Palo Pinto

Creek to deliver stored water to a diversion dam and lake about 11 miles south of Mineral Wells and 12 miles downstream from the main dam.

Construction of the dam was started March 21, 1963, with completion scheduled for early 1964.

Physical Description

The dam is a rolled-earth structure 1,255 feet long with a maximum height of 94 feet. The embankment has a base width of 550 feet and a top width of 20 feet at elevation 896.0 feet above msl.

The upstream face of the embankment is protected with 6 feet of rock riprap, and the downstream face has 6 feet of rock riprap from the bottom to a 30-foot berm at elevation 835.0 feet above msl.

The reservoir will have a conservation capacity of 32,350 acre-feet with dead storage capacity of 1,900 acre-feet and a surface area of 2,275 acres as spillway crest at elevation 863.0 feet above msl.

The drainage area above the dam is 471 square miles.

The spillway is an uncontrolled, broad-crested, concrete weir founded on rock at the left end of the dam, with a crest 500 feet long at elevation 863.0 feet above msl. The discharge is to a pilot channel, thence to Palo Pinto Creek below the dam.

The service outlet is a 30-inch-diameter concrete pipe encased in concrete with a concrete box inlet with invert at elevation 835.0 feet above msl. The pipe has invert at elevation 830.0 feet above msl. The discharge is controlled by two 30-inch motor-operated valves located in a concrete structure on the downstream side of the dam. The top of this 8-foot by 10-foot shaft is at elevation 857.0 feet above msl. A steel building will be erected on top of this concrete structure to protect the equipment.

The water released from this reservoir travels in the streambed about 12 miles to a diversion dam and lake. The diversion dam is a concrete, gravity, ogee section with crest at elevation 753.0 feet above msl. A 42-inch pipe delivers water from this diversion lake to a vertical shaft. The motors for the vertical pumps for delivering water to the city of Mineral Wells will be located on a concrete roof slab over this shaft.

135. Bastrop Dam and Lake Bastrop

Location

Bastrop Dam and Lake Bastrop are in the Colorado River Basin in Bastrop County, 3 miles northeast of Bastrop on Spicer Creek, a tributary of Piney Creek, which is a tributary of the Colorado River.

Ownership and History of Development

The project is owned and will be operated by the Lower Colorado River Authority as a source of cooling water for the Sim Gideon Steam Generating Station.

The dam was authorized by Permit No. 2054 (Application No. 2265) dated May 6, 1963 from the Texas Water Commission. This Permit allows the construction of a dam to create a reservoir with a capacity of 16,590 acre-feet of water with an annual use not to exceed 10,750 acre-feet. The Permit further refers to diversion of water from the Colorado River by pumping to this lake when the runoff from Spicer Creek is not sufficient to maintain the lake at operating elevation. This water will be released from Lake Travis under Permit No. 1260, and the use of the bed and banks of the Colorado River for transporting the water is authorized under this Permit No. 2054.

Construction of the dam was started in May 1963 with completion scheduled for early 1964.

Physical Description

The dam is a rolled-earth structure 4,000 feet long including the spillway and approach section. The embankment will have side slopes of 3 to 1 both upstream and downstream and a maximum height of 80 feet with the top of the dam at elevation 458.0 feet above msl. A clay cutoff wall is provided with additional protection of steel sheet piling in certain areas. The upstream face of the embankment is protected by 2 feet of rock riprap on a 9-inch filter blanket from elevation 445.0 feet above msl to the top.

The lake will have a capacity of 16,590 acre-feet and surface area of 906 acres at operating elevation of 450.0 feet above msl. The lake level will be maintained near a constant elevation as the only consumptive use is heat loss and plant service. In addition to furnishing industrial water, the lake will provide recreational facilities to the public.

The drainage area above the dam is 9 square miles, but runoff is supplemented by pumping from the Colorado River.

The spillway at the left end of the embankment is a concrete ogee section with crest at elevation 425.0 feet above msl. The discharge will be controlled by two 45-foot-long by 25-foot-high taintor gates.

Required downstream flow can be supplied by operation of the taintor gates as there is no low-flow outlet in this structure.

In connection with this project there will be a river intake structure on the Colorado River with three vertical pumps. The discharge will be through a 33-inch concrete pipe, 18,000 feet long, extending from the river intake structure to the lake.

The first 125,000 kw generating unit in the Sim Gideon Power Plant is scheduled for operation early in 1965.

136. Bardwell Dam and Bardwell Reservoir

Location

Bardwell Dam and Bardwell Reservoir are in the Trinity River Basin in Ellis County, 3 miles southeast of Bardwell on Waxahachie Creek, a tributary of Chambers Creek, which is a tributary to the Trinity River.

Ownership and History of Development

The project is owned by the U. S. Government, and is being built by the U. S. Army Corps of Engineers, Fort Worth District. It was authorized by the Flood Control Act of March 31, 1960 for flood control, water conservation, recreation, and other beneficial use. The Trinity River Authority has entered into contract with the U. S. Government and obtained Permit No. 2068 (Application No. 2250) dated March 18, 1963 from the Texas Water Commission for the use of the conservation storage and yield of the reservoir. The Permit authorizes the storage of 54,900 acre-feet and annual use of 9,600 acre-feet of water.

The project was started August 7, 1963 when the contractor began work on access roads and other facilities.

Physical Description

The dam will be an earth and concrete structure 15,400 feet long with a maximum height of 82 feet. The top of the dam will be at elevation 460.0 feet above msl. The embankment has a top width of 20 feet with the upstream face protected by rock riprap placed on a gravel blanket.

The reservoir will have a total capacity of 140,000 acre-feet at top of flood-control storage at spillway crest elevation of 439.0 feet above msl including 53,550 acre-feet conservation storage, 1,320 acre-feet dead storage, and 85,130 acre-feet allocated to flood control. The top of conservation storage will be at elevation 421.0 feet above msl. The surface area will be 6,040 acres at elevation 439.0 feet above msl. The water yield from this reservoir will supply the cities of Waxahachie, Ennis, and possibly others.

The drainage area above the dam is 176 square miles.

The spillway will be an uncontrolled, broad-crested, concrete weir at the right end of the dam with crest length of 350 feet at elevation 439.0 feet above msl. The discharge will be to an excavated channel.

A concrete outlet structure with one 10-foot-diameter conduit will extend through the embankment with invert at elevation 391.0 feet above msl. The discharge will be controlled by two 5-foot by 10-foot sluice gates.

137. Cleburne Dam and Cleburne Reservoir

Location

Cleburne Dam and Cleburne Reservoir are in the Brazos River Basin in Johnson County, 6 miles south of Cleburne on Nolands River, a tributary of the Brazos River.

Ownership and History of Development

The project will be owned and operated by the city of Cleburne for a municipal water supply.

The project was authorized by Permit No. 2027 (Application No. 2233) dated October 1, 1962 from the Texas Water Commission. The Permit authorized construction of a dam to create a reservoir with a storage capacity of 25,600 acre-feet and to divert 6,000 acre-feet of water annually for municipal use.

Construction started August 9, 1963 with completion scheduled for the summer of 1964.

Physical Description

The dam will be a rolled-earth structure 5,500 feet long, including the service spillway, and 76 feet high with the top of the dam at elevation 753.0 feet above msl. The embankment has a top width of 25 feet with 3 to 1 slope both upstream and downstream. The upstream slope will be protected from elevation 700.0 feet above msl to the top with 24 inches of rock riprap on an 8-inch gravel blanket.

The reservoir will have a capacity of 25,600 acre-feet and a surface area of 1,545 acres at the service spillway crest elevation of 733.5 feet above msl. All of this capacity is allocated to conservation storage.

The drainage area above the dam is 92 square miles.

The emergency spillway will be an excavated channel in a natural saddle at the right end of the dam. The crest length will be 500 feet at elevation 744.0 feet above msl.

A service spillway, at the left end, will be part of the dam. This will be a concrete structure with approach channel, spillway chute, and stilling basin. The uncontrolled concrete ogee section will have a crest length of 138 feet at elevation 733.5 feet above msl.

The outlet works will consist of a vertical, octagon-shaped shaft with top elevation of 745.0 feet above msl. A walkway will extend from the embankment to this structure. A 36-inch-diameter steel cylinder concrete pipe, with invert at elevation 690.0 feet above msl, extends from the bottom of the shaft through the embankment. At a junction near the downstream toe of the dam, two 30-inch-diameter pipes branch from this conduit. One will discharge downstream with a control valve installed on the end. The other will be the raw-water

line to a pumping plant. The pumps in this plant will deliver the raw water through a pipeline to the filtration and treating plant.

138. Alice Dam and Alice Terminal Reservoir

Location

Alice Dam and Alice Terminal Reservoir are in the Nueces-Rio Grande Coastal Area in Jim Wells County, 3 miles north of Alice on Chiltipin Creek, a tributary of San Fernando Creek, which empties into Grullo Bayou and to Baffin Bay.

Ownership and History of Development

The project is owned by the Alice Water Authority, and will be operated for a municipal water supply for the city of Alice.

The project was authorized by Permit No. 2056 (Application No. 2253) dated March 25, 1963 from the Texas Water Commission. The Permit authorizes the construction in two stages of a reservoir with an ultimate capacity of 7,050 acre-feet. The water is to be obtained from the flow of Chiltipin Creek, supplemented by water from the Nueces River purchased by contract from the city of Corpus Christi. The Permit states that the maximum diversion shall be 7,500 acre-feet per annum from this reservoir.

Construction started September 27, 1963 with completion scheduled for the summer of 1964.

Physical Description

The dam will consist of earth levees of various heights and cross-sectional area with a maximum height of 23 feet with the top of the dam at elevation 205.0 feet above msl. Both the upstream and downstream embankments will be on a 3 to 1 slope.

The maximum base width will be 160 feet and top width will be 15 feet. The upstream face will be protected with 1 foot of rock riprap laid on a 6-inch gravel blanket.

The initial reservoir will have a capacity of 3,250 acre-feet and area of 700 acres at operating elevation of 196.0 feet above msl. In the future enlargement the capacity will be 7,050 acre-feet with an area of 880 acres at an operating elevation of 201.0 feet above msl. The level of this reservoir will be maintained at desired height by purchased water delivered by pipeline from Lake Corpus Christi on the Nueces River. The lake will also be used for recreational purposes.

The drainage area above the dam is approximately 157 square miles. There are six flood-detention structures built by the U. S. Soil Conservation Service on the watershed upstream from the dam.

Three types of spillways will be used. The one for low-flow regulation is a siphon-type spillway with a crest length of 10 feet to maintain the water level at elevation 196.0 feet above msl. The uncontrolled service spillway has a crest length of 414 feet at elevation of 196.5 feet above msl with discharge to a stilling basin. The emergency spillway has a crest length of 1,000 feet at elevation 196.0 feet above msl with fifty 20-foot flashboard sections with the top at elevation 199.5 feet above msl. The flashboards are designed to fail when the water level reaches the top of the board.

When the project is enlarged and the reservoir capacity increased to 7,050 acre-feet, the vent on the siphon spillway will be raised to elevation 201.0 feet above msl, gates will be added to the service spillway, and the emergency spillway will be relocated.

Water will be diverted from this terminal reservoir to a pumping plant by gravity and thence to the nearby filtration and treating plant by pumps.

In connection with this project there will be an intake structure and pumping plant at Lake Corpus Christi to deliver purchased water through 20.4 miles of 20-inch pipeline.

TABLES OF COMPARISON

Comparison of the 20 reservoirs with greatest total storage capacity

Name of dam	Name of reservoir	Total capacity (acre-feet)	Surface area (acres)
Denison	Lake Texoma	5,530,300	144,100
Amistad*	Amistad	5,325,000	84,000
Toledo Bend*	Toledo Bend	4,661,000	186,500
Sam Rayburn*	Sam Rayburn	4,478,800	150,730
Falcon	International Falcon	3,280,700	98,960
Texarkana	Texarkana	2,654,300	119,700
Whitney	Whitney	2,017,500	49,710
Mansfield	Lake Travis	1,950,000	29,000
Sanford*	Lake Meredith	1,408,000	21,630
Belton	Belton	1,097,600	23,620
Lewisville	Garza-Little Elm	1,002,900	38,900
Buchanan	Buchanan	992,000	23,200
Iron Bridge	Lake Tawakoni	936,200	36,700
Ferrells Bridge	Lake O' the Pines	842,100	38,200
Canyon*	Canyon	740,900	12,890
Waco (new)*	Waco (enlargement)	732,300	19,440
Morris Sheppard	Possum Kingdom	724,700	19,800
Joe B. Hogsett*	Joe B. Hogsett	678,900	34,000
Stillhouse Hollow*	Stillhouse Hollow	630,400	11,830
Twin Buttes	Twin Buttes	600,000	22,700

* Under construction on December 31, 1963

Comparison of the 20 reservoirs with greatest conservation storage capacity.
(includes dead storage & sediment reserve)

Name of dam	Name of reservoir	Conservation storage capacity (acre-feet)	Surface area (acres)
Toledo Bend*	Toledo Bend	4,477,000	181,600
Amistad*	Amistad	3,550,000	67,000
Sam Rayburn*	Sam Rayburn	2,891,900	114,550
Denison	Lake Texoma	2,836,300	91,200
Falcon	International Falcon	2,771,220	87,700
Mansfield	Lake Travis	1,172,000	18,930
Buchanan	Buchanan	992,000	23,200
Iron Bridge	Lake Tawakoni	926,200	36,700
Sanford*	Lake Meredith	864,000	16,500
Morris Sheppard	Possum Kingdom	724,700	19,800
Joe B. Hogsett*	Joe B. Hogsett	678,900	34,000
Lewisville	Garza-Little Elm	482,000	22,970
Kemp	Lake Kemp	461,800	20,620
Belton	Belton	457,600	12,300
Whitney	Whitney	387,000	15,800
Canyon*	Canyon	386,200	8,240
Hubbard Creek	Hubbard Creek	320,000	12,800
Red Bluff	Red Bluff	310,000	11,700
Bridgeport	Bridgeport	270,900	10,400
Ferrells Bridge	Lake O' the Pines	254,900	18,680

* Under construction on December 31, 1963

Comparison of the 20 reservoirs with greatest surface area corresponding to elevation of total storage capacity

Name of dam	Name of reservoir	Surface area (acres)	Total capacity (acre-feet)
Toledo Bend*	Toledo Bend	186,500	4,661,000
Sam Rayburn*	Sam Rayburn	150,730	4,478,800
Denison	Lake Texoma	144,100	5,530,300
Texarkana	Texarkana	119,700	2,654,300
Falcon	International Falcon	98,960	3,280,700
Amistad*	Amistad	84,000	5,325,000
Whitney	Whitney	49,710	2,017,500
Lewisville	Garza-Little Elm	38,900	1,002,900
Ferrells Bridge	Lake O' the Pines	38,200	842,100
Iron Bridge	Lake Tawakoni	36,700	936,200
Joe B. Hogsett*	Joe B. Hogsett	34,000	678,900
Caddo	Lake Caddo	32,700	175,000
Mansfield	Lake Travis	29,000	1,950,000
Somerville*	Somerville	24,400	507,500
Belton	Belton	23,620	1,097,600
Buchanan	Buchanan	23,200	992,000
Twin Buttes	Twin Buttes	22,700	600,000
Wesley E. Seale	Lake Corpus Christi	22,050	302,100
Kemp	Lake Kemp	20,620	461,800
Lavon	Lavon	20,050	423,400

* Under construction on December 31, 1963

INDEX OF DAMS AND RESERVOIRS

Including Obsolete Names and Unofficial Names in Common Usage

INDEX OF DAMS AND RESERVOIRS

Note: Figures shown in parentheses are project description numbers; those appearing second are page references.

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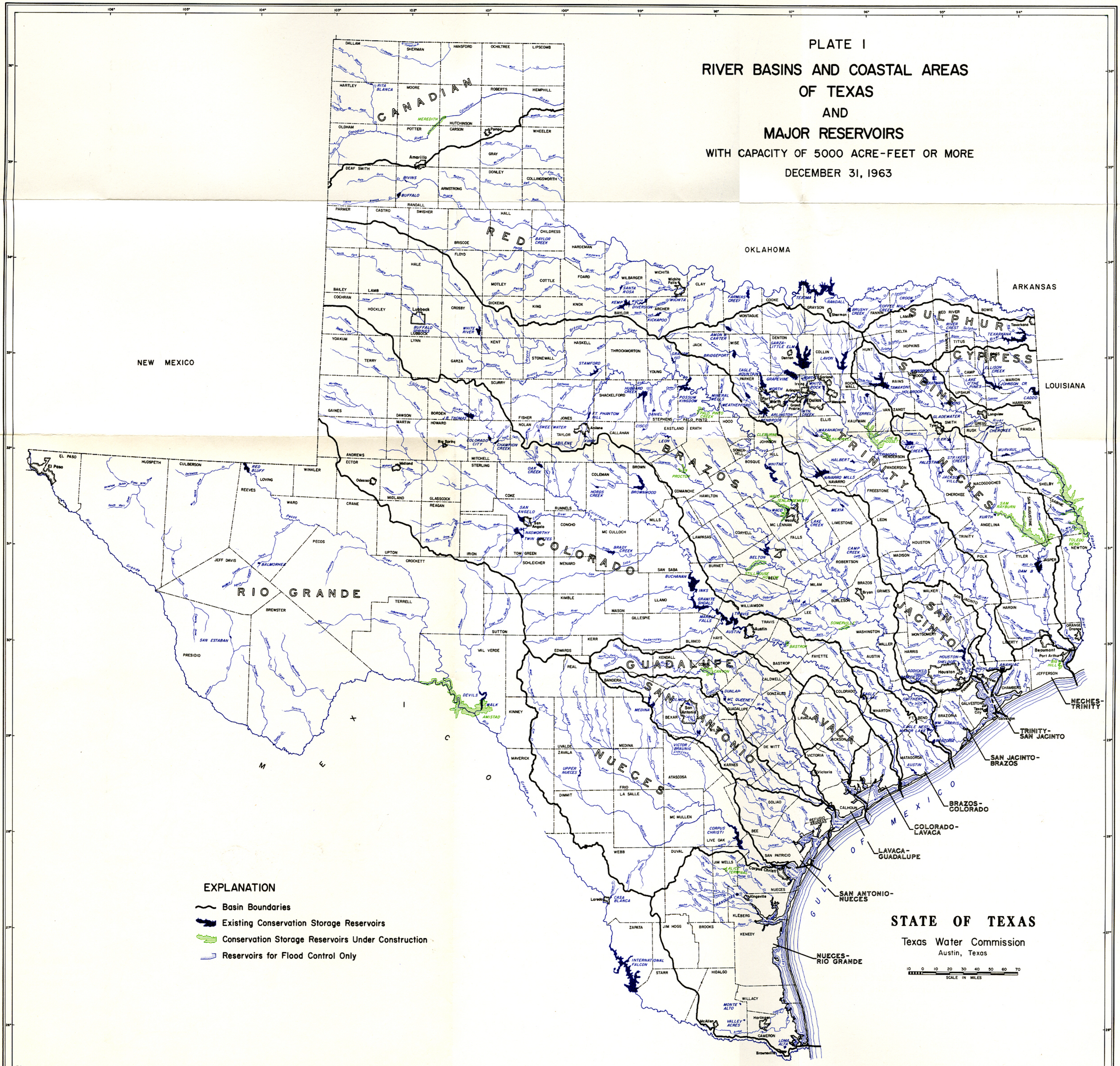
* Tranquitas Dam and Tranquitas Reservoir (in Kleberg County) and Eagle Nest-Manor Lake (in Brazoria County) are shown on Plate 1 for their historical value only. No written descriptions are offered in the text, owing to the scarcity of detailed information.

PLATE I

RIVER BASINS AND COASTAL AREAS OF TEXAS AND MAJOR RESERVOIRS

WITH CAPACITY OF 5000 ACRE-FEET OR MORE

DECEMBER 31, 1963



EXPLANATION

- Basin Boundaries
- Existing Conservation Storage Reservoirs
- Conservation Storage Reservoirs Under Construction
- Reservoirs for Flood Control Only

STATE OF TEXAS

Texas Water Commission

Austin, Texas

10 0 10 20 30 40 50 60 70

SCALE IN MILES