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COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER AND TRIBUTARIES, T--ETC(U)

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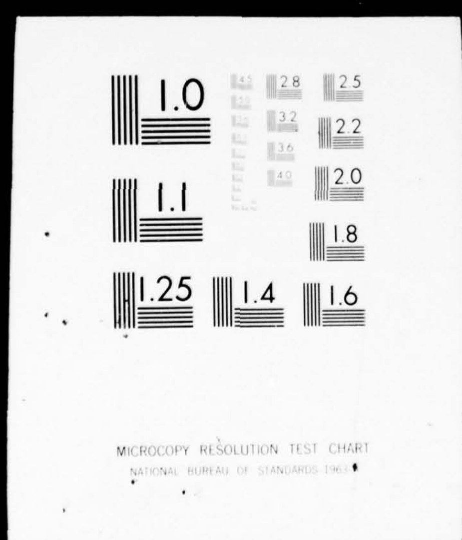

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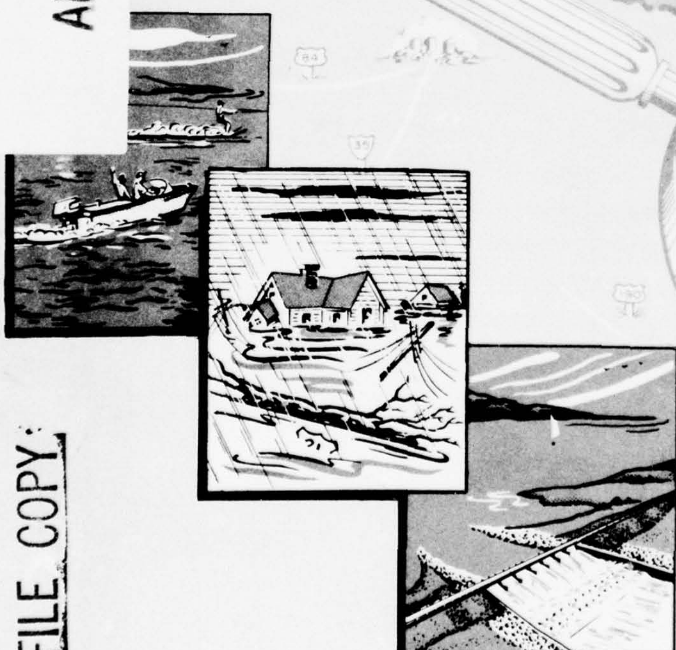

VOLUME 4

APPENDIX VI-COST ESTIMATES, GEOLOGY, AND DESIGN INFORMATION

U.S. ARMY ENGINEER DISTRICTS
FORT WORTH AND GALVESTON, TEXAS
JUNE 1962

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COMPREHENSIVE SURVEY REPORT
ON
TRINITY RIVER AND TRIBUTARIES, TEXAS.

Volume 4.

APPENDIX VI.

COST ESTIMATES, GEOLOGY, AND DESIGN INFORMATION.

U.S. ARMY ENGINEER DISTRICTS
FORT WORTH AND GALVESTON
CORPS OF ENGINEERS
FORT WORTH AND GALVESTON, TEXAS

JUNE 1962

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ON
TRINITY RIVER AND TRIBUTARIES, TEXAS

This volume comprises Appendix VI - Cost Estimates, Geology, and Design Information. The complete report consists of the following volumes:

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APPENDIX VI

COST ESTIMATES, GEOLOGY, AND DESIGN INFORMATION

GENERAL

1. INTRODUCTION.- This appendix presents the general geologic features of the basin, foundation conditions, and the availability of construction materials with respect to the projects recommended in this report for authorization. Also presented herein are the pertinent design information, detailed cost estimates, and annual charges for appropriate elements of the recommended projects for the Trinity River Basin.

2. RELATIONSHIP OF THIS APPENDIX TO OTHER PARTS OF THE REPORT.- This appendix is related primarily to Appendix I - Project formulation, Appendix II - Hydrology, hydraulic design, and water resources, and Appendix V - Recreation and fish and wildlife. In general the cost estimates given in this appendix have been adapted and adjusted for use in determining the cost allocation analysis of projects considered in the project formulation processes presented in appendix I. Hydraulic design information given herein is based on the detailed information contained in appendix II. Recreation and fish and wildlife cost estimates given herein have been used or have been adapted for use for projects covered in appendix V.

3. BASIS OF COST ESTIMATES AND SUMMARY.- Unit prices used in this appendix are based on January 1962 price levels for comparable construction work in this area. The cost of lands, including improvements and damages, is based on field results of inspection and appraisal of individual areas. Estimates of annual charges for the multiple purpose channel are included in project formulation studies given in appendix I. Estimates of annual charges for all other recommended projects are contained in this appendix. The annual charges were computed using an interest rate of 2-7/8% for Federal work and 3% for non-Federal work. The first cost of the recommended projects were amortized over a 100-year period. The total first cost of the projects recommended in this report for authorization is estimated at $900,747,000 of which $164,797,000 is for contingency allowances. The locations of the individual projects are shown on plate 1, page 2.

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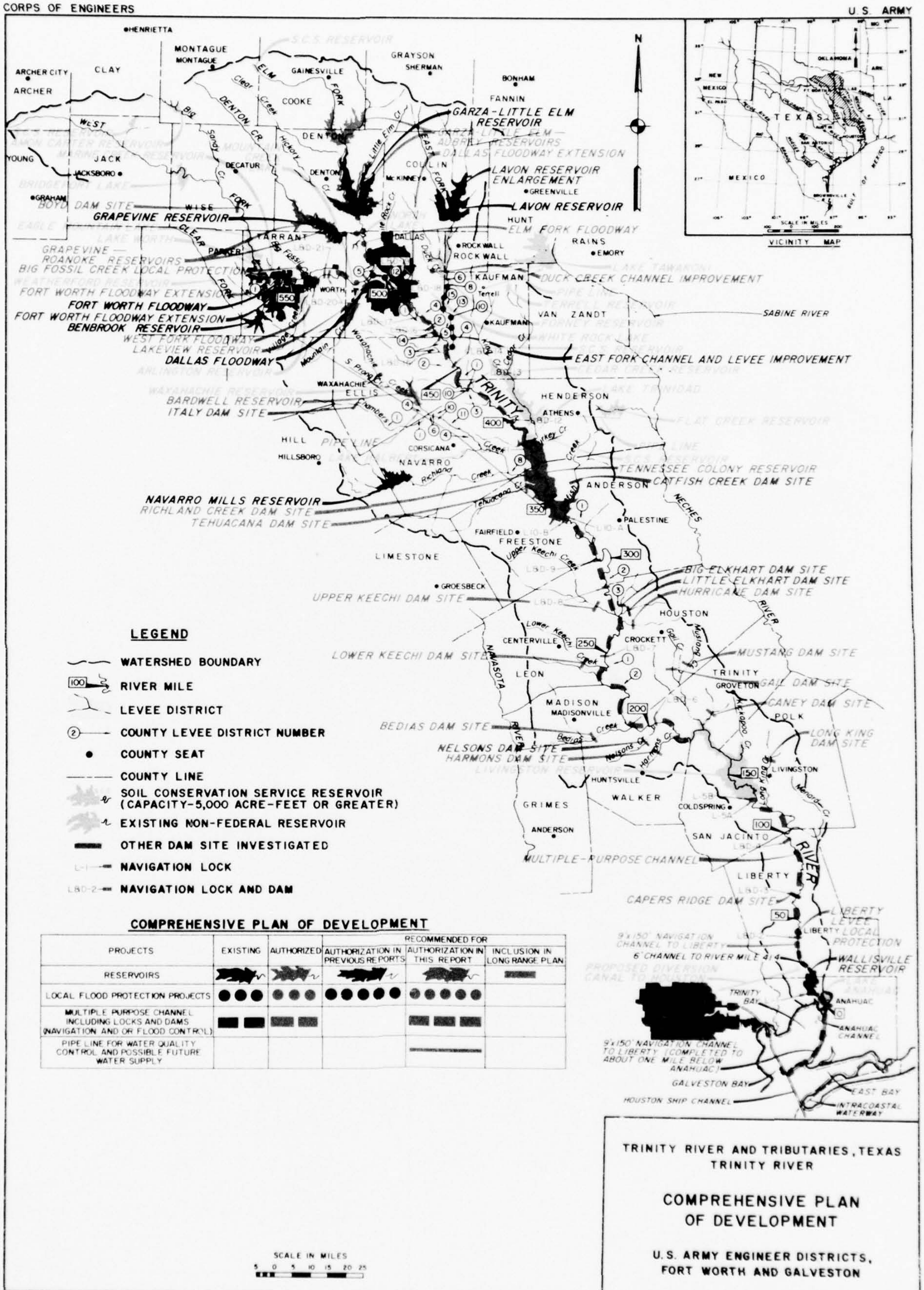


PLATE I

4. The following tabulation is a summary of first costs including contingencies, engineering and design costs, and supervision and inspection costs for projects recommended in this report.

Project	First cost
Multiple purpose channel, including locks and dams	$568,738,000 (1)
Lakeview Reservoir	31,180,000
Aubrey Reservoir	34,073,000
Roanoke Reservoir	16,900,000
Tennessee Colony Reservoir	137,138,000 (2)
West Fork Floodway	17,809,000
Elm Fork Floodway	16,823,000
Dallas Floodway Extension	14,327,000
Duck Creek Channel	5,024,000
Liberty Levee	2,091,000
Transmission and pumping facilities	56,643,000
Total	$900,746,000

(1) Excludes cost of locks, dams, channel and appurtenant facilities required for navigation through the Tennessee Colony Reservoir, estimated at $42,884,420.

(2) Includes an estimated cost of $42,884,420 for navigation facilities in reservoir.

5. AVAILABILITY OF CONSTRUCTION MATERIALS.- Sources considered herewith are relevant to the availability of concrete aggregates, riprap, and bedding material. The upper region of the Trinity River Basin, from the northern extremities of the watershed, through Dallas and Tarrant Counties, to the intersection of the Trinity River with State Highway 34, has an abundance of construction materials. Crushed stone is available from a number of commercial sources in Wise County near Bridgeport at the northwest edge of the basin, and from quarries in Kaufman County near Terrell to the east. That portion of the Trinity River traversing Tarrant and Dallas Counties is flanked at various points by sand and gravel companies producing from the Trinity River or its tributaries. The upper

central region of the Trinity River from State Highway 34 on the north, along the Navarro-Henderson and Freestone-Anderson County boundary lines, to Long Lake, Texas, has limestone formations in Navarro and Freestone Counties that could supply ample quantities of crushed limestone. Current production is limited, being utilized primarily for highway construction; however, the potential exists in these areas for production on a much larger scale. In addition there are potential sources of sand and gravel along the Trinity River in these counties which could be developed for construction of the proposed locks, dams, roads, etc. The lower central region from Long Lake, Texas, to the junction of the Trinity River with the northern Polk County line lacks any sizable commercial materials presently being worked; however, a potential source of sandstone exists in northern Walker County which could be used as a source for road and riprap material. Hauling of materials would be required from the existing resources now being mined near Hearne, Temple, Waco, or from the previously mentioned sources in Navarro, Freestone and Walker Counties, depending upon the specific portion of the region in which construction is being accomplished. Haul distances would range from 50 to 70 miles for sand and gravel, and from 25 to 70 miles for crushed stone. Projects to be constructed in the lower region from the northern Polk County line to Galveston Bay would utilize potential sand and gravel sources located adjacent to the Trinity River in Liberty and San Jacinto Counties, involving maximum hauls of about 50 miles. Sand and gravel materials could also be obtained from resources now being mined about 50 miles west of Houston, or from near Lake Charles, Louisiana. Either resource would entail a haul of about 100 miles.

MULTIPLE PURPOSE CHANNEL

6. OVERALL SUMMARY.- The total cost of the multiple purpose channel extending from the Houston Ship Channel to the Riverside Drive bridges in Fort Worth, Texas, in accordance with the plan of improvement described in appendix III, is estimated at $568,737,710, as summarized in table 1, which excludes the cost of channel, locks, dams and appurtenant facilities required for navigation through the Tennessee Colony Reservoir. The cost of the channel and navigation features in the Tennessee Colony Reservoir is estimated at $42,884,420, as shown in table 1. The cost of the navigation features in the Tennessee Colony Reservoir are included in the estimated cost of the Tennessee Colony Reservoirs for the purpose of determining the allocation of cost to the reservoir project purposes, which is considered in appendix I. The estimated cost of the multiple purpose channel in designated reaches between the Houston Ship Channel and Fort Worth, as given in table 1, is presented for use in determining the allocation of cost of the multiple purpose channel, which is also considered in appendix I.

TABLE 1

SUMMARY ESTIMATE OF FIRST COST FOR PROPOSED

MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH

Cost classification number	Item of cost	Houston Ship Channel to upper reach of Wallisville Reservoir (0.0 to 35.5)	Upper reach of Wallisville reservoir to head of authorized channel to Liberty (35.5 to 47.4)	Head of authorized channel to Liberty to Tennessee Colony dam (47.4 to 233.5)	Tennessee Colony dam to Lock & Dam No. 12 (233.5 to 274.4)	Lock & Dam No. 12 to Five-mil Creek (274.4 to 322.0)
(01.0)	Lands & damages	$ 51,300	$ 218,670	$ 3,666,710	$ 34,900	$ 1,970,35
	Contingenceis 25%	12,830	54,670	916,680	8,800	492,59
	Acquisition costs	7,300	40,510	483,730	3,700	119,47
	Total cost	71,430	313,850	5,067,120	47,400	2,582,41
(02.0)	Relocations					
	Railroads	None	None	12,127,000	(2)	None
	Highways	1,926,000	None	10,915,000	(2)	4,392,00
	Pipelines	419,960	54,240	1,799,790	(2)	55,00
	Powerlines	None	69,800	332,200	(2)	32,00
	Communication lines	None	5,870	68,200	(2)	None
	Water & sewer lines	None	None	None	(2)	None
	Total relocations	2,345,960	129,910	25,242,190	(2)	4,479,00
(04.0)	Navigation dams	None	None	19,774,350	2,112,930	12,941,09
(05.0)	Navigation locks	None	None	90,702,570	19,946,060	45,098,07
(08.0)	Roads, railroads & bridges	None	None	2,878,170	163,330	1,313,94
(09.0)	Channels and canals	2,254,490	5,176,940	72,234,380	8,287,290	18,317,37
(14.0)	Recreation facilities	287,300	66,600	1,177,400	168,200	777,80
(19.0)	Buildings, grounds & utilities	None	None	1,276,000	255,200	765,60
(20.0)	Permanent operating equipment	2,950	5,000	488,840	120,380	266,16
	Subtotal construction cost	4,890,700	5,378,450	213,773,900	31,053,390	83,958,9
	Contingencies 25%	1,222,670	1,344,610	53,443,480	7,763,350	20,989,7
	Total construction cost	6,113,370	6,723,060	267,217,380	38,816,740	104,948,7
(30.0)	Engineering & design	232,310	255,480	10,154,260	1,475,040	3,988,0
(31.0)	Supervision & administration	354,580	389,940	15,498,610	2,251,240	6,087,0
	Total including lands & damages	6,771,690	7,682,330	297,937,370	42,590,420	117,606,2
	U.S. Coast Guard navigation aids	None	None	418,500	294,000	47,00
	Total first cost including cost of navigation facilities in Tennessee Colony reservoir	6,771,690	7,682,330	298,355,870	42,884,420	117,653,2
	Total first cost excluding cost of navigation facilities in Tennessee Colony reservoir	6,771,690	7,682,330	298,355,870	(excluded)	117,653,2

(1) All costs for authorized channel to Liberty are excluded.

(2) Costs for lands and relocations within the Tennessee Colony reservoir are excluded.

NOTE: Costs of $435,000 were expended on the multiple purpose channel studies.

TABLE 1
ATE OF FIRST COST FOR PROPOSED
ITY RIVER CHANNEL TO FORT WORTH, TEXAS

d o o n 3.5)	Tennessee Colony dam to Lock & Dam No. 12 (233.5 to 274.4)	Lock & Dam No. 12 to Five-mile Creek (274.4 to 322.0)	Five-mile Creek to & including Dallas terminus (322.0 to 326.7)	Dallas terminus to Dallas floodway (326.7 to 331.1)	Dallas floodway (331.1 to 338.8)	Dallas floodway to & including Fort Worth terminus (338.8 to 362.8)	Fort Worth terminus to & including Riverside Drive bridges (362.8 to 369.8)	Total (0.0 to 369.8)
710	$ 34,900	$ 1,970,350	$ 292,460	$ 281,150	$ 402,590	$ 1,356,760	$ 167,000	$ 8,441,890
680	8,800	492,590	73,110	70,290	100,600	339,190	41,750	2,110,510
730	3,700	119,470	9,870	9,490	8,140	38,550	6,320	727,080
120	47,400	2,582,410	375,440	360,930	511,330	1,734,500	215,070	11,279,480
000	(2)	None	None	4,119,000	5,578,000	3,574,000	None	25,398,000
000	(2)	4,392,000	2,079,000	2,764,000	12,855,000	8,431,000	662,000	44,024,000
790	(2)	55,000	72,630	147,130	52,880	202,450	24,690	2,828,770
200	(2)	32,000	None	52,200	24,200	200,400	None	710,800
200	(2)	None	59,250	None	770,140	38,100	None	941,560
	(2)	None	146,820	169,360	217,650	54,460	None	588,290
190	(2)	4,479,000	2,357,700	7,251,690	19,497,870	12,500,410	686,690	74,491,420
350	2,112,930	12,941,090	None	None	2,356,080	8,306,550	None	45,491,000
570	19,946,060	45,098,070	None	None	5,973,800	19,985,060	None	181,705,560
170	163,330	1,313,940	None	None	107,050	556,500	None	5,018,990
380	8,287,290	18,317,370	1,343,220	1,232,000	1,836,390	9,631,980	3,815,100	124,129,110
400	168,200	777,800	None	None	101,600	287,300	None	2,866,200
000	255,200	765,600	None	None	127,600	382,800	None	2,807,200
340	120,380	266,160	1,530	1,430	56,010	168,420	2,280	1,113,000
900	31,053,390	83,958,980	3,702,450	8,485,120	30,056,400	51,819,020	4,504,070	437,622,480
480	7,763,350	20,989,740	925,610	2,121,250	7,514,100	12,954,750	1,126,020	109,405,580
380	38,816,740	104,948,720	4,628,060	10,606,370	37,570,500	64,773,770	5,630,090	547,028,060
260	1,475,040	3,988,050	175,870	403,040	1,427,680	2,461,400	213,940	20,787,070
510	2,251,240	6,087,030	268,430	615,170	2,179,090	3,756,880	326,550	31,727,520
370	42,590,420	117,606,210	5,447,800	11,985,510	41,688,600	72,726,550	6,385,650	610,822,130
500	294,000	47,000	4,500	4,500	7,500	24,000	None	800,000
370	42,884,420	117,653,210	5,452,300	11,990,010	41,696,100	72,750,550	6,385,650	611,622,130
370	(excluded)	117,653,210	5,452,300	11,990,010	41,696,100	72,750,550	6,385,650	568,737,710

7. The total estimated first cost including 25% contingencies engineering, design, supervision and administration costs, and annual charges of the multiple purpose channel are as follows:

ESTIMATED FIRST COST
MULTIPLE PURPOSE CHANNEL
(Including Recreation)

Item	Houston Ship Channel to Dallas	Dallas to Ft.Worth	Total
Lands & damages	$8,410,250	$ 2,821,830	$ 11,232,080
Channel & canals	136,077,100	22,626,190	158,703,290
Navigation locks	186,046,900	35,563,600	221,610,500
Navigation dams	44,820,150	14,607,800	59,427,950
Highways and bridges	26,457,480	33,855,400	60,312,880
Railways and bridges	16,614,000	18,181,260	34,795,260
Pipelines	3,290,230	585,180	3,875,410
Powerlines	594,600	379,200	973,800
Communication lines	182,540	1,107,400	1,289,940
Water and sewer lines	201,160	604,800	805,960
Access roads to locks and dams	5,743,150	909,100	6,652,250
Permanent operating equipment	1,047,340	312,550	1,359,890
Buildings, grounds and utilities	2,797,040	699,200	3,496,240
Aids to navigation	470,000	36,000	506,000
Recreation	3,163,460	532,800	3,696,260
Total first cost	$435,915,400	$132,822,310	$568,737,710

ESTIMATED ANNUAL CHARGES
MULTIPLE PURPOSE CHANNEL
(Including Recreation)

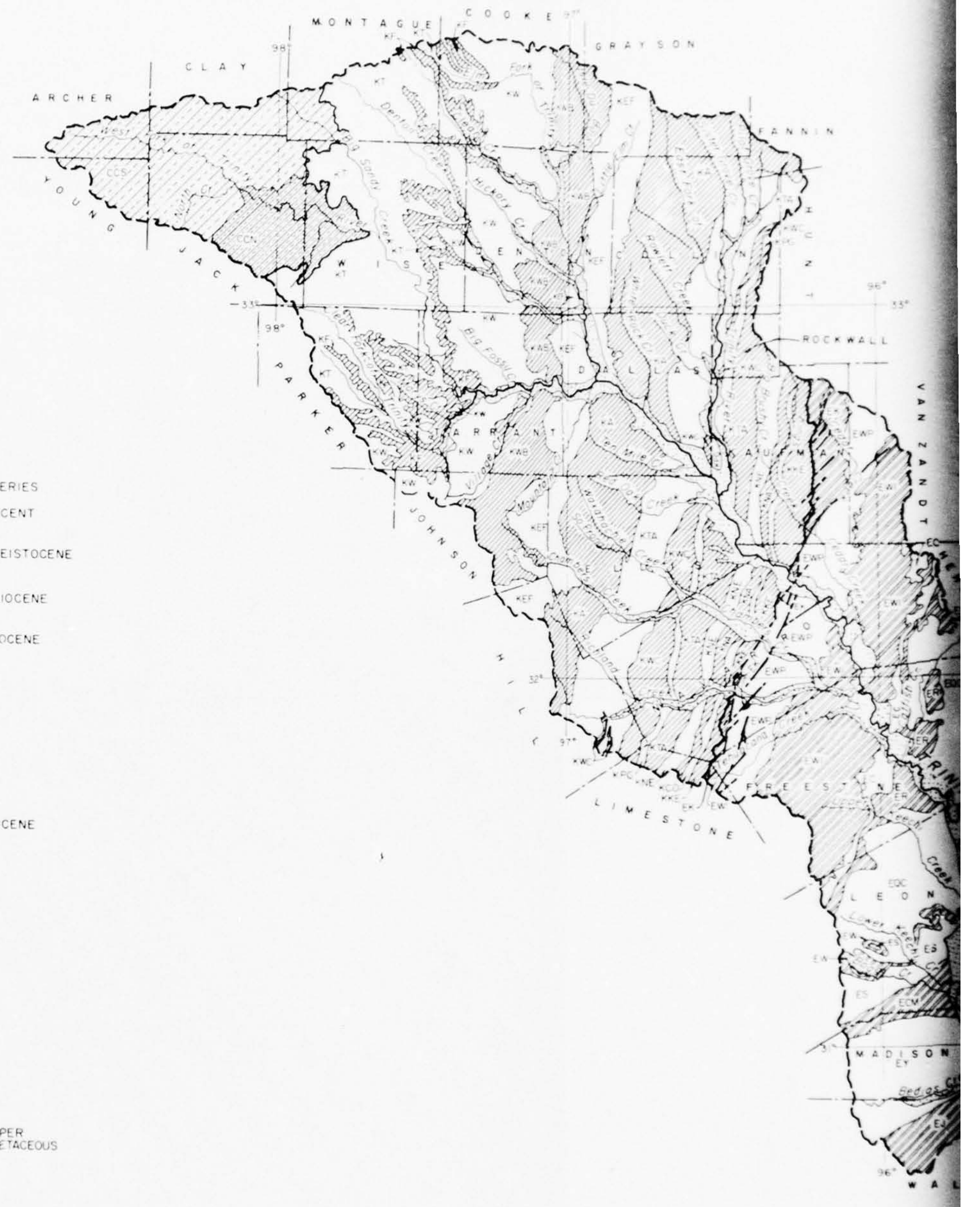
Item	Houston Ship Channel to Dallas	Dallas to Ft.Worth	Total
	(10 yr.constr.period)	(4 yr.constr period)	
Federal Investment			
First cost	$419,428,100	$117,601,000	$537,029,100
Interest during construction	60,292,800	6,762,100	67,054,900
Total investment	479,720,900	124,363,100	604,084,000
Non Federal Investment			
First cost	16,487,300	15,221,300	31,708,600
Interest during construction	2,473,100	913,300	3,386,400
Total investment	18,960,400	16,134,600	35,095,000

ESTIMATED ANNUAL CHARGES (CONT'D)
MULTIPLE PURPOSE CHANNEL
(Including Recreation)

Item	:Houston Ship :Channel to Dallas (10 yr.constr.period)	:Dallas to: :Ft.Worth : (4 yr.constr period)	Total
Federal annual charges			
Interest on investment	$13,792,000	$3,575,400	$17,367,400
Amortization (100 yr life)	858,700	222,600	1,081,300
Operation, maintenance and major replacement	3,121,700	741,500	3,863,200
Total investment	17,772,400	4,539,500	22,311,900
Non-Federal annual charges			
Interest on investment	568,800	484,000	1,052,800
Amortization (100 yr life)	31,300	26,600	57,900
Operation, maintenance and major replacement	145,000	144,900	289,900
Total Federal annual charges	745,000	655,500	1,400,600
Total annual charges	$18,517,500	$5,195,000	$23,712,500

Note: Interest rates are 2-7/8% for Federal and 3% for non-Federal.

8. **AREAL GEOLOGY AND TOPOGRAPHY.-** The Trinity River Basin includes the outcrops of formations belonging to the following geologic periods: Pennsylvanian, Lower and Upper Cretaceous, Eocene, Miocene, Pliocene, and Pleistocene. The larger stream valleys contain deposits of alluvium of Quaternary age, which includes Pleistocene and recent deposits. The Pennsylvanian formations outcrop in the northwest corner of the basin and dip stratographically to the northwest. The remaining formations, which lie unconformably on the Pennsylvanian, dip easterly and southeasterly following roughly the general direction of the Trinity River from Fort Worth to the mouth. The southeasterly dip of the strata is greater than the general slope of the land and consequently, the outcrops of successively younger formations are encountered progressing downstream. These formations outcrop in zones of varying width which traverse the basin in a northeasterly direction as shown on plate 2. The topography of the basin is depicted on plate 3, which shows that the general land elevation rises gradually from a few feet above sea level near the mouth of the Trinity River to about 550 feet on the interstream divides in the vicinity of Dallas, thence the slope of the land increases to elevation 1250 on the divide in the northwest corner of the basin. Unless otherwise stated, elevations given hereinafter refer to U. S. Coast and Geodetic Survey mean sea level datum, which is established 1.36 feet above U. S. Corps of Engineers mean low tide datum near Anahuac, Texas.



LEGEND

	FORMATION	GROUP	SERIES
Q	ALLUVIUM	----------	RECENT
QB	BEAUMONT CLAY	HOUSTON	PLEISTOCENE
QL	LISSIE		
PW	WILLIS SAND	CITRONELLE	PLIOCENE
ML	LAGARTO CLAY	----------	MIOCENE
MC	CATAHOULA	----------	
EJ	JACKSON (UNDIFFERENTIATED)	JACKSON	EOCENE
EY	YEGUA	CLAIBORNE	
ECM	COOK MOUNTAIN		
ES	SPARTA SAND		
EW	MOUNT SELMAN: WECHES GREENSAND MEMBER		
EQC	MOUNT SELMAN: QUEEN CITY SAND MEMBER		
ER	MOUNT SELMAN: REKLAW MEMBER		
EC	CARRIZO SAND		
EWI	UNDIFFERENTIATED	WILCOX	
EWP	WILLS POINT CLAY	MIDWAY	
EK	KINCAID		
KKE	KEMP CLAY	NAVARRO	UPPER CRETACEOUS
KCO	CORSICANA MARL		
KNA	NACATOCH SAND		
KNE	NEYLANDVILLE MARL		
KTA	UPPER TAYLOR	TAYLOR	
KPG	PECAN GAP CHALK		
KWC	WOLFE CITY SAND		
KTA	LOWER TAYLOR		
KA	AUSTIN CHALK	AUSTIN	
KEF	EAGLE FORD SHALE	----------	
KWB	WOODBINE SAND	----------	
KW	GRAYSON, MAIN STREET, PAWPAW, WENO, DENTON, FORT WORTH, DUCK CREEK, KIAMICHI	WASHITA	LOWER CRETACEOUS
KF	EDWARDS LIMESTONE, COMANCHE PEAK LS, WALNUT CLAY	FREDERICKSBURG	
KT	PALUXY SAND, GLEN ROSE LS, TRAVIS PEAK	TRINITY	
CCN	----------	CANYON	PENNSYLVANIAN
CCS	----------	CISCO	

TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

AREAL GEOLOGY

SCALE IN MILES

FORT WORTH DISTRICT FORT WORTH, TEXAS JUNE 1962

RECOMMENDED W. E. Wood — APPROVAL RECOMMENDED C. P. Swenson — APPROVED

SUBMITTED

DRAWN BY

CHECKED BY

TRIN

PLATE 2

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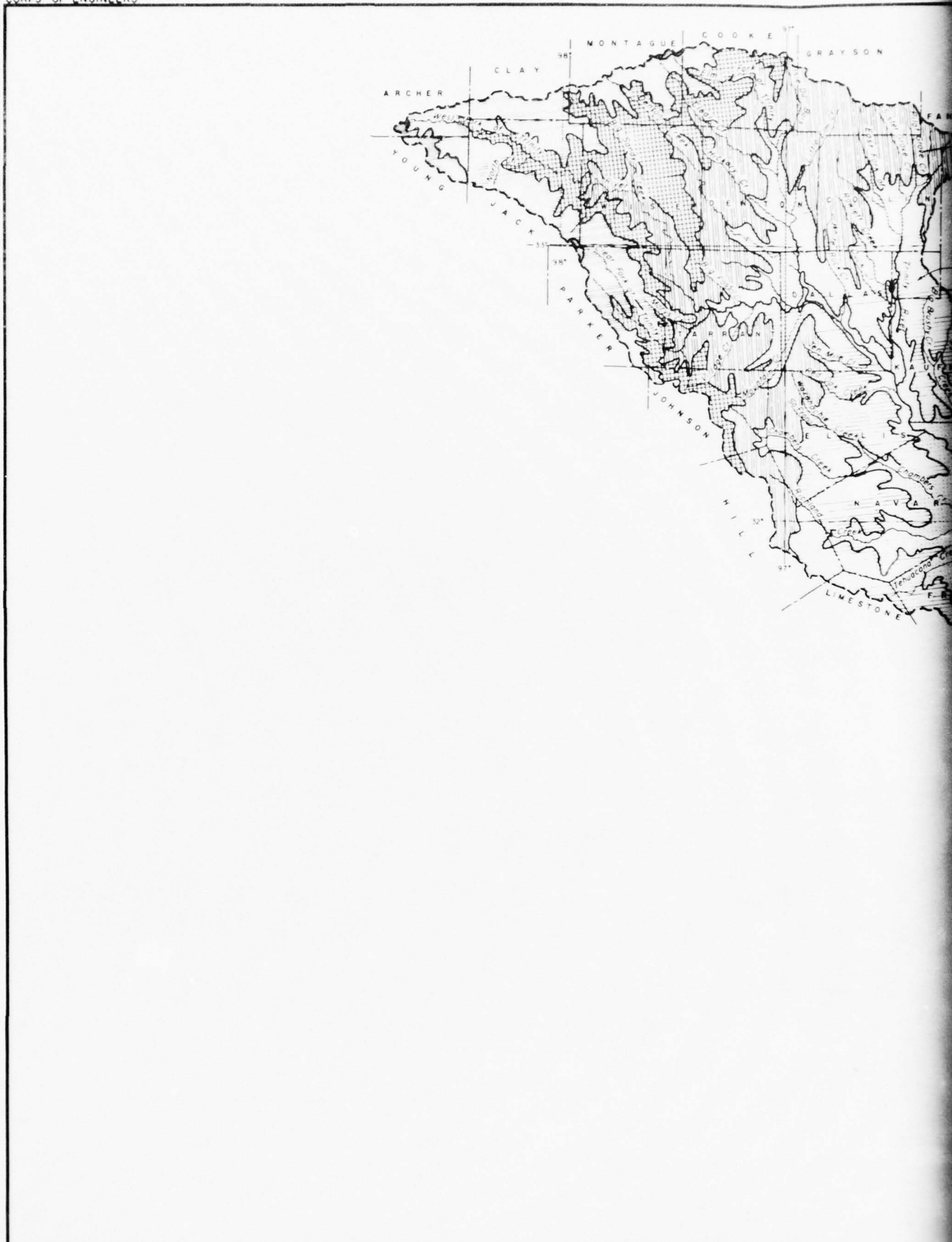
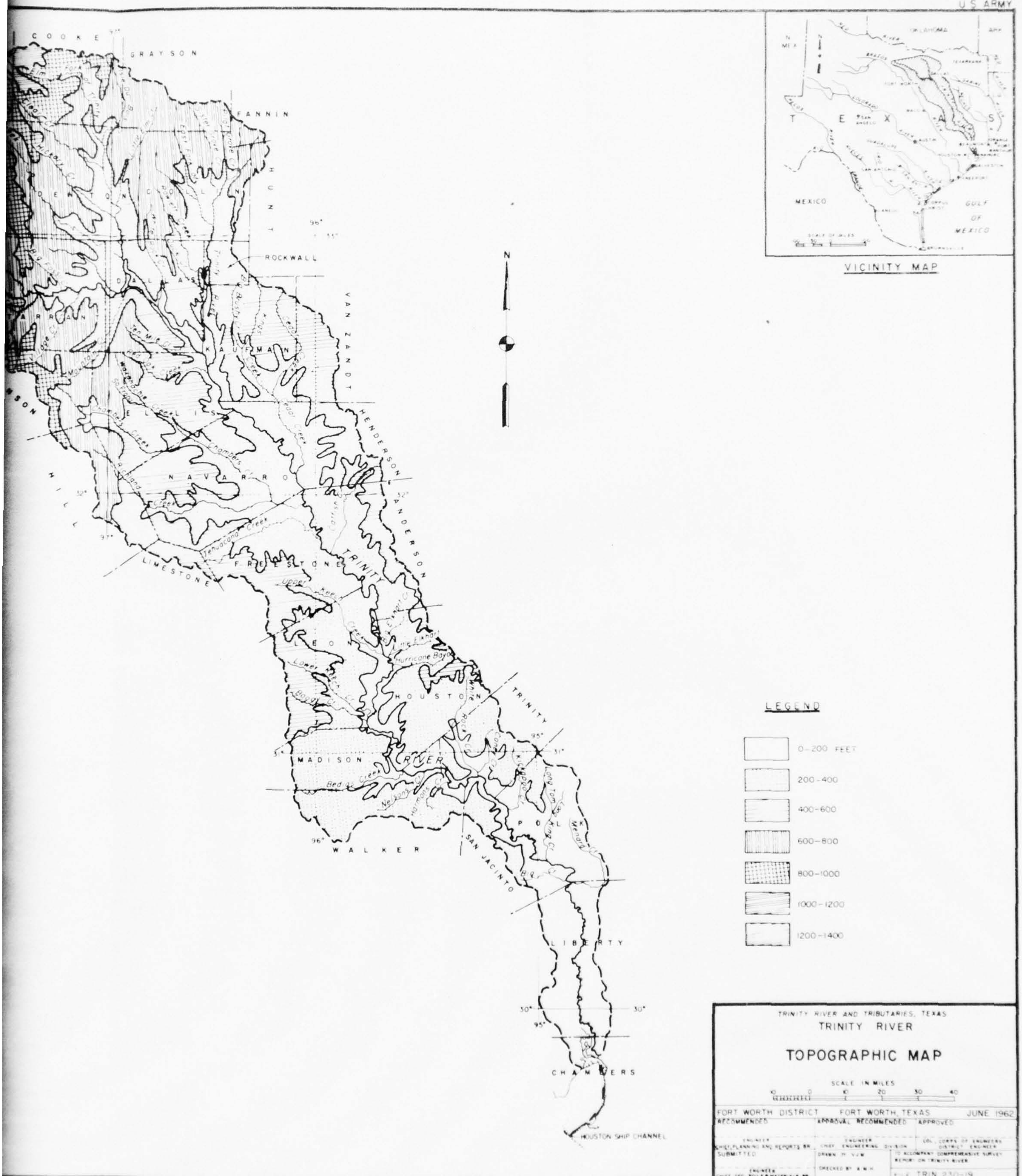
CORPS OF ENGINEERS




U.S. ARMY
VICINITY MAP
OKLAHOMA
MEXICO
GULF OF MEXICO
T E X A S
COOKE
GRAYSON
FANNIN
HUNT
ROCKWALL
KAUFMAN
VAN ZANDT
HENDERSON
ANDERSON
NAVARRO
ELLIS
HILL
LIMESTONE
FREESTONE
TRINITY
LEON
HOUSTON
MADISON
RIVER
WALKER
SAN JACINTO
POLK
LIBERTY
CHAMBERS
HOUSTON SHIP CHANNEL
Chambers Cr.
Tehuacana Creek
Upper Keechi Creek
Hurricane Bayou
Little Elkhart
Bedias Creek
Nelsons Cr.
Long Tom Cr.
N
LEGEND
0-200 FEET
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
TOPOGRAPHIC MAP
SCALE IN MILES
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FORT WORTH DISTRICT FORT WORTH, TEXAS JUNE 1962
RECOMMENDED
APPROVAL RECOMMENDED
APPROVED
SUBMITTED
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19

PLATE 3

9. LANDS AND DAMAGES.- The lands required for construction and maintenance of the multiple purpose channel from the Houston Ship Channel to the Riverside Drive bridges in Fort Worth, Texas, includes lands for channel rights-of-way, construction and maintenance spoil areas, access road rights-of-way, lock and dam sites and public-use areas. The multiple purpose channel involves all types of land from heavily timbered areas used for limited grazing to highly improved farming and grazing lands as well as areas classified as potential industrial lands in the Dallas-Fort Worth area. The land values for the multiple purpose channel project are based on the findings of a gross real estate appraisal made in 1961. The channel was divided into 88 segments and each segment was investigated by a survey team to determine the present fair market value of all required lands.

10. INTEREST TO BE ACQUIRED.- Real estate interests for rights-of-way, spoil areas, and access roads would be acquired on a perpetual easement basis with mineral exploration subordinated to the Government's right to regulate such development in a manner that will not interfere with the primary purpose of the project. A fee less mineral interest with mineral exploration prohibited thereon should be acquired for the lock and dam sites and public use areas. Since there are several oil and gas producing areas within this project area, it is considered to be in the best interest of the Government to place a moratorium on exploration rather than acquire ownership of the minerals.

11. CRITERIA RELATED TO LAND REQUIREMENTS.- Channel rights-of-way were computed on the basis of providing right-of-way limits 50 feet beyond the top of cut of the multiple purpose channel. Where the channel is partly or wholly within a section of the river it was assumed that a minimum of 50 feet of right-of-way would be acquired on each bank of the river. Channel excavation is based on side slopes of 2 horizontal to 1 vertical and the additional 50 feet of right-of-way on both sides of the channel should be sufficient to take care of flatter slopes where needed and also provide for probable future erosion of the channel banks. The proposed channel alignment would sever many bends of the river leaving areas of severed lands. These severed lands would be used as spoil areas whenever practicable. Severance damages would be paid to owners of severed lands.

12. Rights-of-way for lock and dam sites includes lands for the locks, dams, esplanades, reservation buildings and service roads. Access roads would be provided from existing all weather roads to lock and dam sites. Land requirements for the access roads were based on providing rights-of-way 100 to 120 feet wide where required for new road construction. Where existing roads are to be improved, additional rights-of-way for the improved roads were based on the consideration that existing rights-of-way would be made available at no additional cost.

13. A land area of two acres is required for the light attendant stations to be located in the Livingston and Tennessee Colony Reservoirs, as requested by Commander, Eighth Coast Guard District, New Orleans, Louisiana. The cost of providing these land areas is negligible, and is not explicitly included as a separate item in table 2 on page 10.

TABLE 2

LAND REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL FROM HOUSTON SHIP CHANNEL TO FORT WORTH, TEXAS

Pool Number	Rights-of-way (acres) Channel	Lock & dam sites	Access roads	Public use	Spoil areas (acres)(1)	Severed lands (acres)	Total (acres)
Tidal	18	-	-	205	200	-	423
1	288	-	-	125	1,715	442	2,570
2	408	48	6	134	1,467	578	2,641
3	596	48	83	50	1,221	1,410	3,408
4	585	50	15	112	1,284	1,014	3,060
5A	170	30	21	137	80	-	438
5B	1,116	30	-	134	3,346	-	4,626
6	965	43	67	171	2,377	79	3,702
7	747	58	79	184	2,495	836	4,399
8	483	44	27	50	1,236	2,427	4,267
9	518	40	72	50	1,344	1,252	3,276
10A	58	30	122	137	40	-	387
10B	-	-	-	-	-	-	-
11	-	-	44	187	-	-	231
12	529	49	61	112	1,000	142	1,893
13	431	48	23	137	843	66	1,548
14	303	45	2	-	586	668	1,604
15	149	43	46	62	311	85	696
16	217	44	24	124	444	107	960
17	565	51	6	124	375	845	1,966
18	291	38	2	137	330	73	871
19	308	37	7	59	261	192	864
20	267	42	22	59	238	71	699
21	166	41	2	112	138	23	482
(2)	151					244	395
Total	9,329	859	731	2,602	21,331	10,554	45,406

(1) Provides for both construction and channel maintenance requirements.
(2) Requirements for flood control purpose upstream of the spur channel to the Fort Worth terminus.

14. The plan of improvement for the canalized multiple purpose channel to Fort Worth, Texas, proposes that public-use areas with access roads thereto, including necessary recreational facilities be provided along the route of the channel. Preliminary investigation indicates that a total of 2,350 acres of land would be required for the public-use areas and about 250 acres would be required for access roads exclusively related thereto.

15. The lands required in addition to the lands for the authorized channel to Liberty as modified by the recommended Wallisville Reservoir project have been included in the multiple purpose channel estimate. Lands now under perpetual easement to the Federal Government for the completed portion of the 9 X 150-foot channel to Liberty project, from the Houston Ship Channel to its upstream ending at channel mile 23.2 are sufficient for the proposed deepening of the channel to 12 feet. From channel mile 23.2 to Lock No. 1 located in the Wallisville Dam at mile 28.3, approximately 18 acres of additional rights-of-way would be required to provide for easing of a bend in the river. The bend easing was not provided for in the authorized channel project because the river channel was then considered adequate for navigation to Liberty. An additional 34 acres of rights-of-way would be required for the multiple purpose channel river cut-off alignment at Wallisville proposed in this report. Excluding the proposed bend easing and cut-off channel alignment at Wallisville, additional lands would not be required for the proposed deepening to 12 feet of the uncompleted channel from channel mile 23.2 to 35.5. Between mile 35.5 and 47.4, the authorized head of the channel to Liberty, lands would be required for the multiple purpose channel in addition to the lands to be provided under the authorized channel to Liberty project.

16. For the purpose of this report, it was considered that channel rights-of-way through the non-Federal Livingston Reservoir would be required for the multiple purpose channel. The areal extent of the required lands through the reservoir were determined on the same basis as other sections of the channel. The values of lands in the reservoir required for the multiple purpose channel were estimated as though the reservoir were not to be constructed by local interests.

17. Rights-of-way for the Dallas spur channel and turning basin are included in the rights-of-way estimate for navigation pool No. 17. Rights-of-way for the Fort Worth spur channel and turning basin are included in the estimate for navigation pool No. 21.

18. The channel rights-of-way and spoil areas within the Tennessee Colony Reservoir are included in the lands required for the Tennessee Colony Reservoir.

19. Construction spoil area requirements vary with the method of construction. Studies show that hydraulic dredging would be the most economic and practicable means of excavating the multiple purpose channel in the tidal section and pools No. 1, 2 and 5. Hydraulic spoil area requirements were computed on the consideration that hydraulic spoil can be economically placed to an average depth of 5 feet over the spoil area. This would amount to about 8,066 cubic yards per acre of spoil area.

20. The existing spoil disposal areas for the completed portion of the channel to Liberty would be used for disposition of spoil dredged in deepening the existing channel between the Houston Ship Channel and channel mile 23.2. No spoil would be placed on live oyster beds and 1500-foot openings between spoil areas would be provided at intervals of 3500 feet for the channel reach between the Houston Ship Channel and Smith Point. Spoil dredged from the channel in Wallisville Reservoir would be deposited in adjacent low areas in the reservoir. Spoil from the cut-off below the Wallisville dam and the river cut-off channel at the town of Wallisville would be deposited on 124 acres of spoil area adjoining the Wallisville Reservoir adjacent to the proposed cut-off channels.

21. Spoil dredged from the channel through the Livingston reservoir would be deposited in the reservoir at separated areas located a minimum distance of 500 feet from the channel. Land requirements for spoil disposal areas in the Livingston reservoir were based on the assumption that 8066 cubic yards of spoil can be placed on each acre of spoil area.

22. Excavation of the multiple purpose channel in pools No. 3, 4 and 6 thru 21 would be accomplished by land based dragline equipment. Below channel mile 268 the spoil would be cast into spoil areas adjacent to the channel, with the exception that some of the spoil would be used to construct river diversion dams across the upstream end of river bends severed by the proposed channel. Land requirements for dragline spoil areas were computed on the basis that the spoil would be deposited to an average depth of 15 feet in the spoil areas or approximately 24,200 cubic yards of spoil would be placed on each acre of spoil area.

23. Between channel miles 286 and 322, the channel is located within existing agricultural floodway levees. In this reach the spoil would be used to fill severed river bends and low lying areas, or placed inside and adjacent to the levees to a height of about 15 feet.

24. Above channel mile 322, the channel would be located within existing and proposed leveed floodways. Spoil in this reach would be used for construction of new levees, filling low areas of the flood-plain or used to fill severed river bends in the floodway. No construction spoil areas would be required above channel mile 322.

25. SUMMARY OF REQUIRED LANDS.- The interest in land required for various purposes to provide for the multiple purpose channel from the Houston Ship Channel to Fort Worth, Texas, would involve about 45,406 acres summarized for the various navigation pools in table 2. A summary of the estimated first costs for the lands and damages excluding costs of public-use areas is given in table 3. Table 4 gives a summary of land requirements for public-use areas that would be provided in connection with the multiple purpose channel. The costs of these lands and damages given in table 3 and 4 totals $11,279,480, including a contingency cost item of 25 percent and an estimated $727,080 for acquisition costs.

TABLE 3
SUMMARY OF ESTIMATED FIRST COST FOR LANDS & DAMAGES REQUIRED
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Pool No.	Channel R. O. W.		Lock & Dam Sites		Access Roads R. o. W.		Construction Spoil		Maintenance Spoil		Severance Damages		Total	Acquisition
	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Cost	Cost
Houston Ship Channel to Upper reach of Wallisville Reservoir (Mile 0.0 to 35.5)														
Tidal	18	$1,800	-	$0(1)	-	$0(1)	200	$15,000	-	$0(1)	-	$0(1)	$16,800	$3,490
1	32	3,200	-	0(1)	-	0(1)	-	0(1)	-	0(1)	-	0(1)	3,200	510
Total Cost - (Mile 0.0 to 35.5)													20,000	4,000
Upper Reach of Wallisville Reservoir to head of Authorized Channel to Liberty (Mile 35.5 to 47.4)														
1	256	25,600	-	0(1)	-	0(1)	1,715	123,620	-	0(1)	442	33,150	187,370	38,610
Head of Authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)														
2	408	63,240	48	10,800	6	1,350	1,467	176,040	-	(2)	578	75,140	326,570	40,110
3	596	71,520	48	6,000	83	10,370	762	57,150	459	34,430	1,410	112,800	292,270	53,730
4	585	78,970	50	7,500	15	2,250	667	63,360	617	58,620	1,014	86,190	296,890	47,170
5A	170	34,000	30	6,000	21	4,200	None	None	80	7,600	None	None	51,800	4,820
5B	1,116	172,980	30	6,000	-	(3)	3,346	434,980	-	(2)	None	None	613,960	71,870
6	965	139,920	43	8,600	67	13,400	1,344	154,560	1,033	118,800	79	13,040	448,320	56,500
7	747	89,640	58	5,800	79	7,900	1,818	172,710	677	63,370	836	83,600	423,020	67,440
8	483	82,110	44	4,400	27	4,050	940	126,900	296	39,960	2,427	351,920	609,340	67,470
9	518	75,110	40	6,000	72	10,800	919	101,090	425	46,750	1,252	112,680	352,430	51,620
10A	58	8,410	30	4,500	122	18,300	None	None	40	4,400	None	None	35,610	4,000
Total Cost -(Mile 47.4 to 233.5)													3,450,210	464,730
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)														
10B	-	0(4)	-	0(4)	-	-	-	0(4)	-	0(4)	-	0(4)	0(4)	0(4)
11	-	0(4)	-	0(4)	44	6,600	-	0(4)	-	0(4)	-	0(4)	6,600	700
Total Cost - (Mile 233.5 to 274.4)													6,600	700
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)														
12	529	124,320	49	8,570	61	9,150	648	106,920	352	58,080	142	22,720	329,760	28,500
13	431	73,270	48	7,200	23	5,750	510	107,100	333	69,930	66	9,240	272,490	22,580
14	303	45,450	45	6,750	2	600	356	74,760	230	48,300	668	76,820	252,680	25,660
15	149	52,150	43	15,050	46	23,000	167	62,620	144	54,000	85	22,530	229,350	10,140
16	217	108,500	44	22,000	24	12,000	257	96,370	187	70,130	107	40,130	349,130	13,380
17	182	106,470	51	38,250	6	4,500	-	(5)	121	53,240	272	112,880	315,340	10,110
Total Cost - (Mile 274.4 to 322.0)													1,748,750	110,370
Five-mile Creek to and including Dallas Terminus (Mile 322.0 to 326.7)														
17	195	114,080	-	-	-	-	-	0(5)	130	57,200	292	121,180	292,460	9,870
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)														
17	188	109,980	-	-	-	-	-	0(5)	124	54,560	281	116,610	281,150	9,490
Dallas Floodway (Mile 331.1 to 338.8)														
18	187	138,950	38	32,300	2	1,700	-	0(5)	118	75,400	26	16,640	284,990	5,940
Dallas Floodway to and including Ft. Worth Terminus (Mile 338.8 to 362.8)														
18	104	88,400	-	-	-	-	-	0(5)	212	135,800	47	30,080	254,280	5,810
19	308	215,600	37	25,900	7	4,900	-	0(5)	261	137,030	192	100,800	484,230	12,880
20	267	133,500	42	21,000	22	11,000	-	0(5)	238	89,250	71	26,630	281,380	10,240
21	166	83,000	41	20,500	2	1,000	-	0(5)	138	51,750	23	8,620	164,870	5,920
Total Cost - (Mile 338.8 to 362.8)													1,184,760	34,850
Fort Worth Terminus to and including Riverside Drive Bridges (Mile 362.8 to 369.8)														
Flood Control Channel	151	75,500	-	-	-	-	-	-	-	-	244	91,500	167,000	6,320
Total - Mile 0.0 to 368.9													7,623,290	684,380

Note: Prices are as of January 1962

(1) Costs of lands for authorized channel to Liberty ad modified by the Wallisville Reservoir have been excluded.
(2) Maintenance spoil will be placed in hydraulic spoil areas acquired for construction of channel
(3) Access roads to Lock 5B will be constructed on lock & dam rights-of-way.
(4) Lands required are within the Tennessee Colony reservoir.
(5) Spoil will be used in construction of proposed levees or placed in low areas of floodway.

TABLE 4
SUMMARY OF FIRST COST FOR LANDS AND DAMAGES REQUIRED FOR PUBLIC-USE AREAS FOR MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Item	Quantity	Unit	Unit cost	Total cost
Houston Ship Channel to head of Wallisville Reservoir (Mile 0.0 to 35.5)				
Public-use area	175	Acres	$150	$26,300
Access roads	30	Acres	150	4,500
Severance area	3	Acres	150	500
Total				31,300
Acquisition costs				3,300
Total				34,600
Head of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)				
Public-use area	125	Acres	250	31,300
Acquisition cost				1,900
Total				33,200
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)				
Public Use area	125	Acres	300	37,500
"	50	"	225	11,300
"	350	"	200	70,000
"	450	"	150	67,500
"	50	"	135	6,800
"	50	"	125	6,300
Access road	9	"	300	2,700
"	21	"	200	4,200
"	9	"	225	2,000
"	33	"	150	5,000
"	12	"	135	1,600
Severance area	8	"	200	1,600
Total				216,500
Acquisition costs				19,000
Total				235,500
Tennessee Colony to Lock & Dam No. 12 (Mile 233.5 to 274.4)				
Public use area	175	Acres	150	26,300
Access road	12	Acres	150	1,800
Severance area	1	Acres	150	200
Total				28,300
Acquisition cost				3,000
Total				31,300

TABLE 4(CONT'D)
SUMMARY OF FIRST COST FOR LANDS AND DAMAGES REQUIRED FOR PUBLIC-USE AREAS FOR MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Item	Quantity	Unit	Unit cost	Total cost
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)				
Public-use area	100	Acres	$750	$75,000
"	50	"	500	25,000
"	50	"	350	17,500
"	50	"	300	15,000
"	125	"	250	31,300
"	50	"	175	8,800
"	50	"	150	7,500
Access roads	24	"	750	18,000
"	12	"	500	6,000
"	12	"	350	4,200
"	24	"	300	7,200
"	12	"	175	2,100
Severance area	10	"	400	4,000
Total				221,600
Acquisition cost				9,100
Total				230,700
Five-mile Creek to and including Dallas Terminus (Mile 322.0 to 326.7) -				None
Dallas Terminus to existing Dallas Floodway(Mile 326.7 to 331.1)-				None
Dallas Floodway (Mile 331.1 to 338.8)				
Public use area	125	Acres	850	106,500
Access road	12	Acres	850	10,200
Severance area	1	Acres	850	900
Total				117,600
Acquisition cost				2,200
Total				119,800
Dallas Floodway to & including Fort Worth Terminus(Mile 338.8 to 362.8)				
Public use area	50	Acres	850	42,500
"	150	"	700	105,000
Access road	9	"	850	7,700
"	21	"	700	14,700
Severance area	3	"	700	2,100
Total				172,000
Acquisition cost				3,700
Total				175,700
Fort Worth Terminus to Riverside bridges (Mile 362.8 to 369.8)				None
Total (Mile 0.0 to 369.8)				860,800

26. SUMMARY OF CHANNEL AND CANALS (INCLUDING COST).- This section includes information regarding the design and cost of the multiple purpose channel to Fort Worth, Texas, considered in determining the cost for clearing and grubbing of the channel rights-of-way, clearing of spoil areas, snagging in river sections, removal of abandoned structures, construction of tributary inflow drop structures, channel excavation, navigation pools Nos. 5A and 10A, river diversion dams, channel bank revetment works. The cost of the multiple purpose channel work totals $124,129,110, as shown in table 5. Plates 4 through 15 show the plan and profile of subject channel and location of locks and dams.

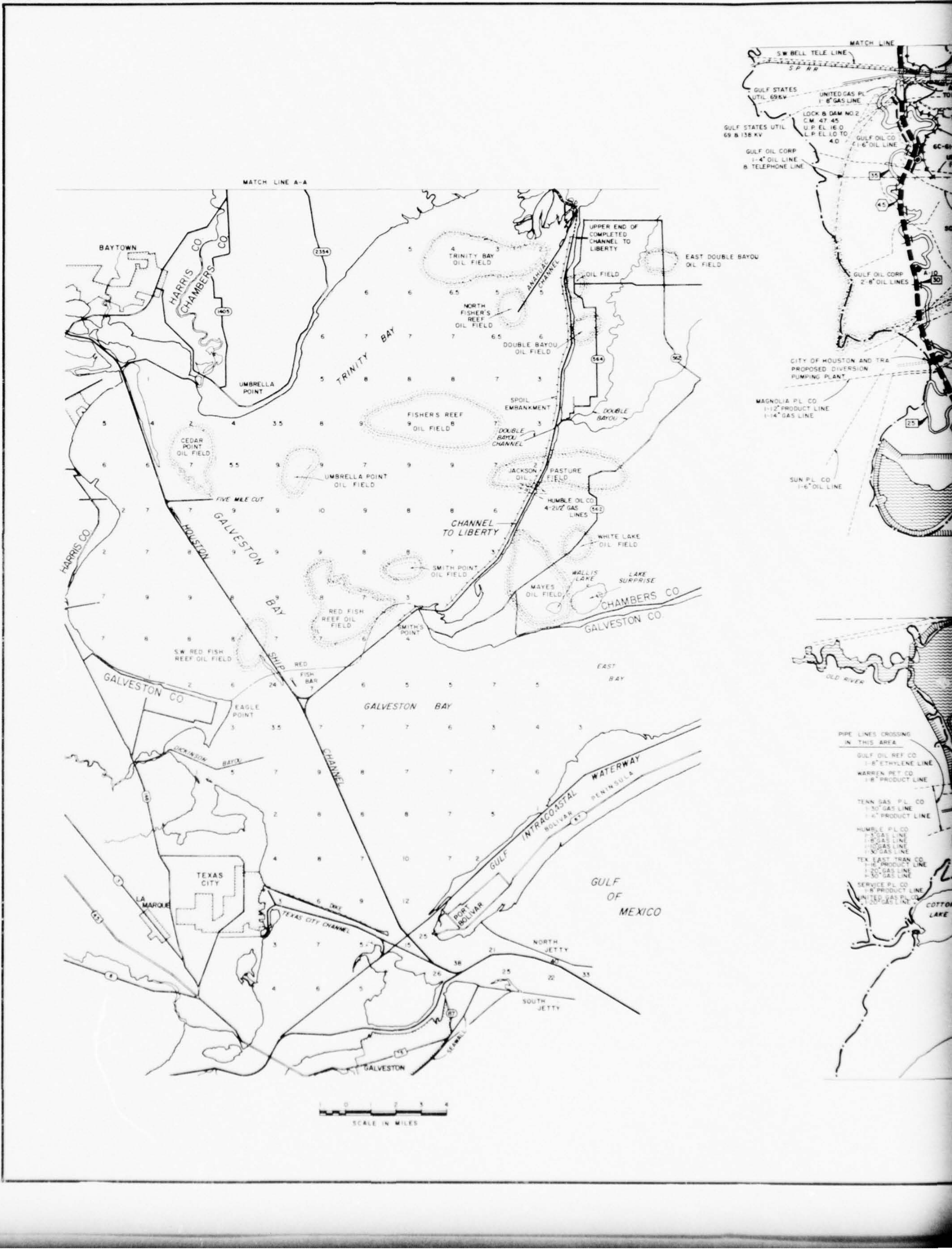
27. CANAL DESIGN INFORMATION.- The design of the multiple purpose channel is based primarily on the requirements for navigation and flood control. Channel-size formulation studies for navigation show that a channel having dimensions of 12 feet deep and 150 feet bottom width would be the most economical for modern barge navigation required to transport the prospective commerce on the channel. Detailed channel design information is given in table 3 of appendix II, Hydrology, hydraulic design, and water resources. The channel capacities for various reaches of the multiple purpose channel from the head of Wallisville reservoir to the lower end of the Fort Worth floodway are as follows:

Reach	Length in miles	Design discharge capacity (C.F.S.)
Head of Wallisville reservoir to Tennessee Colony reservoir	199.1	45,000
Head of Tennessee Colony reservoir to East Fork junction	29.5	32,000
East Fork junction to White Rock Creek junction	22.0	27,000
White Rock Creek junction to Elm Fork junction	11.3	23,000
Elm Fork junction to Fort Worth floodway	32.5	15,000

TABLE 5
SUMMARY OF ESTIMATED FIRST COST OF MULTIPLE PURPOSE
CHANNEL WORK REQUIRED FOR TRINITY RIVER CHANNEL TO FORT WORTH

Pool No.	Clearing & grubbing of R. O. W. Acres	Clearing & grubbing of R. O. W. Cost	Clearing of Spoil areas Acres	Clearing of Spoil areas Cost	Method of excavation	Common Excavation C. Y.	Common Excavation Cost	Rock Excavation C. Y.	Rock Excavation Cost	River Diversion Dams Quantity	River Diversion Dams Cost	Total cost
Houston Ship Channel to upper reach of Wallisville reservoir (Mile 0.0 to 35.5)												
Tidal	-	0(1)	-	(1)	Hydraulic	2,812,000	$731,170(1)	-	-	-	-	$ 731,170(1)
1	-	0(1)	-	(1)	Hydraulic	5,077,900	1,523,370(1)	-	-	-	-	1,523,370(1)
Total - Mile 0.0 to 35.5												2,254,540(1)
Upper reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)												
1	2[illegible]5	$78,750	-	0(1)	Hydraulic	15,528,300	4,658,640	-	-	8	103,200	4,840,590(1)
Bank stabilization												336,350
Total - Mile 35.5 to 47.4												5,176,940
Head of authorized channel to Liberty to Tennessee Colony dam (Mile 47.4 to 233.5)												
2	351	122,850	-	0(2)	Dragline	11,832,100	3,549,330	-	-	8	103,200	3,775,380
3	536	107,200	762	76,200	Dragline	13,431,300	4,607,830	-	-	8	103,200	4,894,430
4	400	60,000	667	50,030	Dragline	15,732,480	4,719,740	-	-	7	90,300	4,920,070
5A	50	7,500	-	(3)	Dragline	399,420	119,830	-	-	-	-	127,330
5B	-	0 (3)	-	0(2)	Hydraulic	36,004,290	16,561,930	-	-	4	51,600	16,613,530
6	774	54,400	1,344	134,400	Dragline	32,511,600	9,753,480	1,502,000	$2,252,500	11	141,900	12,336,680
7	642	160,500	1,818	272,700	Dragline	25,599,600	8,579,880	467,300	584,130	8	103,200	9,700,410
8	362	72,400	940	94,000	Dragline	22,749,800	7,962,080	1,872,500	2,340,630	2	25,800	10,494,910
9	415	89,000	919	91,900	Dragline	22,047,300	7,055,140	-	-	4	51,600	7,287,640
10A	50	10,000	-	0(3)	Dragline	192,500	61,600	-	-	-	-	71,600
Removal of abandoned lock at mile 129.2												20,000
Bank stabilization												1,932,400
Tributary inflow drop structures												60,000
Total - Mile 47.4 to 233.5												72,234,380
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.7)												
10B	887	310,450	2,234	446,800	Dragline	15,017,300	4,864,670	-	-	-	-	5,621,920
11	330	66,000	344	34,400	Dragline	6,334,900	2,500,470	-	-	5	64,500	2,665,370
Total - Mile 233.5 to 274.4												8,287,290
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)												
12	487	97,400	648	64,800	Dragline	15,674,900	5,486,210	1,013,500	1,266,880	7	90,300	7,005,590
13	418	83,600	510	51,100	Dragline	12,337,800	3,701,340	-	-	5	64,500	3,900,540
14	288	57,600	356	35,600	Dragline	8,607,300	2,582,190	-	-	4	51,600	2,726,990
15	143	28,600	167	16,700	Dragline	4,042,500	1,212,750	-	-	-	-	1,258,050
16	215	43,000	257	25,700	Dragline	6,225,200	2,178,820	-	-	-	-	2,247,520
17	162	32,400	-	(4)	Dragline	3,217,500	1,126,230	-	-	-	-	1,158,630
Removal of abandoned lock at mile 311.0												20,000
Total - Mile 274.4 to 322.0												13,317,380
Five-mile Creek to & including Dallas Terminus (Mile 322.0 to 326.7)												
17	177	35,400	-	(4)	Dragline	3,679,450	1,287,820	-	-	-	-	1,323,220
Removal of abandoned lock at mile 325.0												20,000
Total - Mile 322.0 to 326.7												1,343,220
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)												
17	130	26,000	-	(4)	Dragline	3,445,750	1,206,000	-	-	-	-	1,232,000
Dallas Floodway (Mile 331.1 to 338.8)												
18	35	3,500	-	(4)	Dragline	5,236,840	1,832,890	-	-	-	-	1,836,390
Dallas Floodway to & including Fort Worth Terminus (Mile 338.8 to 36[illegible].8)												
18	20	2,000	-	(4)	Dragline	2,689,350	941,280	-	-	-	-	943,280
19	216	21,600	-	(4)	"	7,780,000	2,723,000	-	-	-	-	2,744,600
20	232	34,800	-	(4)	"	8,474,000	2,966,110	89,400	178,800	-	-	3,179,710
21	80	12,000	-	(4)	"	5,457,100	1,909,990	421,200	842,400	-	-	2,764,390
Total -(Mile 338.8 to 36[illegible].8)												9,631,980
Fort Worth Terminus to & including Riverside Drive Bridges (Mile 3[illegible].8 to 369.3)												
Flood Control Channel	117	11,700	-	(4)	Dragline	6,740,000	2,359,000	722,200	1,444,400	-	-	3,815,100
Total - Mile 0.0 to 369.3												12[illegible],[illegible]29,110

(1) Lands for uncompleted portion of authorized channel to Liberty are excluded.
(2) No clearing necessary due to Hydraulic dredging.
(3) Clearing and grubbing are included in cost of dredging.
(4) Based on using spoil for construction of new levees and/or for spoil in river bend cut-offs.


MATCH LINE A-A
BAYTOWN
HARRIS CO
CHAMBERS CO
UMBRELLA POINT
TRINITY BAY
TRINITY BAY OIL FIELD
ANAHUAC CHANNEL
UPPER END OF COMPLETED CHANNEL TO LIBERTY
EAST DOUBLE BAYOU OIL FIELD
OIL FIELD
NORTH FISHER'S REEF OIL FIELD
DOUBLE BAYOU OIL FIELD
SPOIL EMBANKMENT
DOUBLE BAYOU
FISHERS REEF OIL FIELD
DOUBLE BAYOU CHANNEL
CEDAR POINT OIL FIELD
UMBRELLA POINT OIL FIELD
JACKSON PASTURE OIL FIELD
HUMBLE OIL CO 4-2 1/2" GAS LINES
FIVE MILE CUT
CHANNEL TO LIBERTY
WHITE LAKE OIL FIELD
HOUSTON GALVESTON BAY SHIP CHANNEL
HARRIS CO
SMITH POINT OIL FIELD
WALLIS LAKE
LAKE SURPRISE
MAYES OIL FIELD
CHAMBERS CO
GALVESTON CO
RED FISH REEF OIL FIELD
SMITH'S POINT
S.W. RED FISH REEF OIL FIELD
RED FISH BAR
EAST BAY
GALVESTON CO
EAGLE POINT
GALVESTON BAY
DICKINSON BAYOU
GULF INTRACOASTAL WATERWAY
BOLIVAR PENINSULA
TEXAS CITY
LA MARQUE
DIKE
TEXAS CITY CHANNEL
PORT BOLIVAR
GULF OF MEXICO
NORTH JETTY
SOUTH JETTY
SEAWALL
GALVESTON
SCALE IN MILES
MATCH LINE
S.W. BELL TELE LINE
S.P. RR
GULF STATES UTIL 69 KV
UNITED GAS PL 1-8" GAS LINE
LOCK & DAM NO. 2
GULF STATES UTIL 69 & 138 KV
GULF OIL CO 1-6" OIL LINE
GULF OIL CORP 1-4" OIL LINE & TELEPHONE LINE
GULF OIL CORP 2-8" OIL LINES
CITY OF HOUSTON AND TRA PROPOSED DIVERSION PUMPING PLANT
MAGNOLIA P.L. CO. 1-12" PRODUCT LINE 1-14" GAS LINE
SUN P.L. CO 1-6" OIL LINE
OLD RIVER
PIPE LINES CROSSING IN THIS AREA
GULF OIL REF CO 1-8" ETHYLENE LINE
WARREN PET CO 1-8" PRODUCT LINE
TENN GAS P.L. CO 1-30" GAS LINE
HUMBLE P.L. CO
TEX EAST TRAN CO
SERVICE P.L. CO
COTTON LAKE

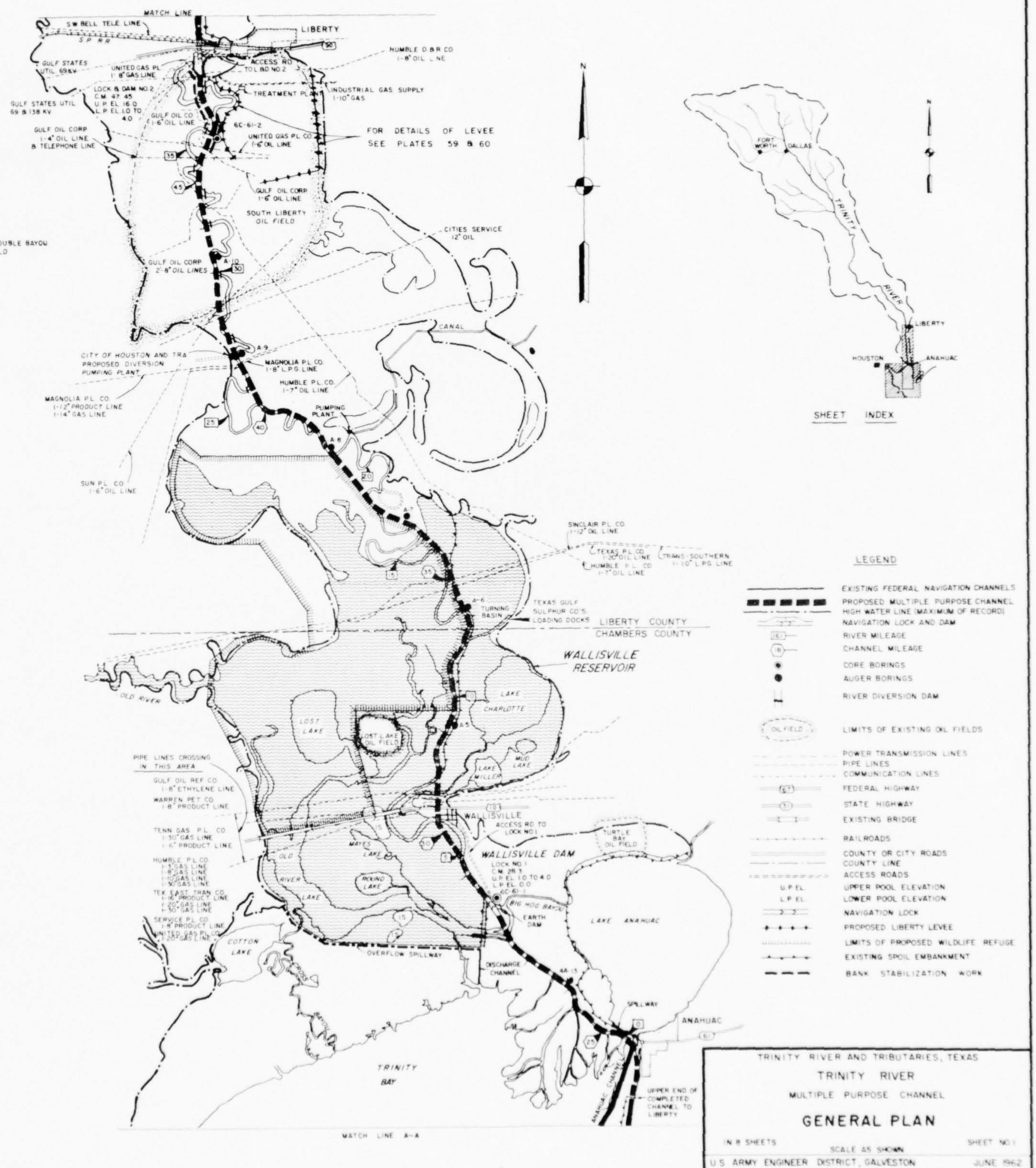
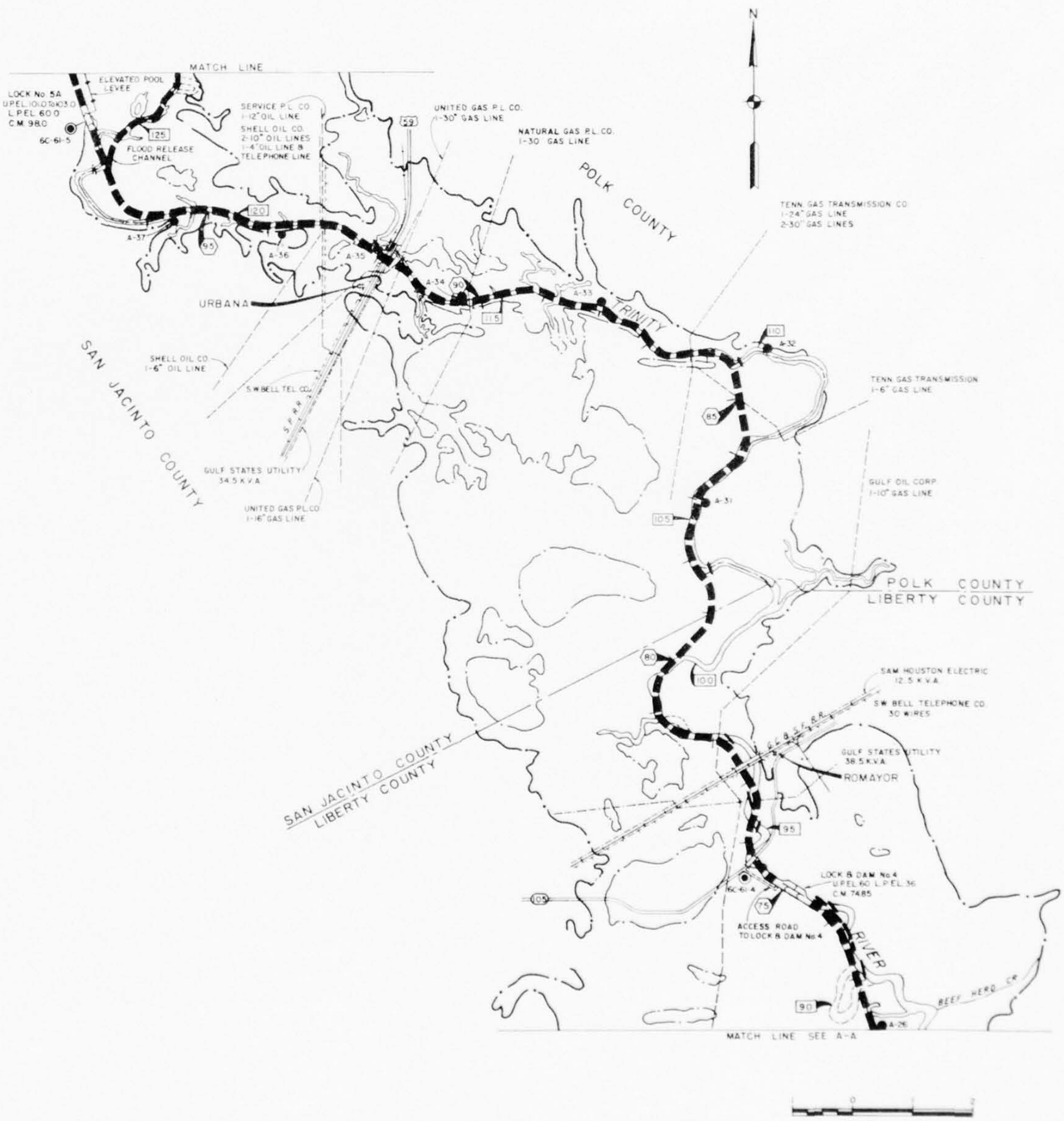

MATCH LINE
S.W. BELL TELE. LINE
S.P. R.R.
LIBERTY
HUMBLE O.& R. CO. 1-8" OIL LINE
ACCESS RD TO L.& D. NO. 2
GULF STATES UTIL. 69 KV
UNITED GAS P.L. 1-8" GAS LINE
LOCK & DAM NO. 2
TREATMENT PLANT
INDUSTRIAL GAS SUPPLY 1-10" GAS
GULF STATES UTIL 69 & 138 KV
GULF OIL CO 1-6" OIL LINE
GULF OIL CORP 1-4" OIL LINE & TELEPHONE LINE
UNITED GAS P.L. CO. 1-6" OIL LINE
FOR DETAILS OF LEVEE SEE PLATES 59 & 60
GULF OIL CORP 1-6" OIL LINE
SOUTH LIBERTY OIL FIELD
EAST DOUBLE BAYOU OIL FIELD
CITIES SERVICE 12" OIL
GULF OIL CORP 2-8" OIL LINES
CANAL
CITY OF HOUSTON AND TRA PROPOSED DIVERSION PUMPING PLANT
MAGNOLIA P.L. CO. 1-8" L.P.G. LINE
HUMBLE P.L. CO. 1-7" OIL LINE
MAGNOLIA P.L. CO. 1-12" PRODUCT LINE 1-14" GAS LINE
PUMPING PLANT
SUN P.L. CO. 1-6" OIL LINE
SINCLAIR P.L. CO. 1-12" OIL LINE
TEXAS P.L. CO. 1-20" OIL LINE
HUMBLE P.L. CO. 1-7" OIL LINE
TRANS-SOUTHERN 1-10" L.P.G. LINE
TURNING BASIN
TEXAS GULF SULPHUR CO.'S LOADING DOCKS
LIBERTY COUNTY
CHAMBERS COUNTY
WALLISVILLE RESERVOIR
OLD RIVER
LOST LAKE
LOST LAKE OIL FIELD
LAKE CHARLOTTE
LAKE MILLER
MUD LAKE
PIPE LINES CROSSING IN THIS AREA
GULF OIL REF CO. 1-8" ETHYLENE LINE
WARREN PET CO. 1-8" PRODUCT LINE
TENN GAS P.L. CO. 1-30" GAS LINE 1-6" PRODUCT LINE
HUMBLE P.L. CO.
TEX EAST TRAN CO.
SERVICE P.L. CO. 1-8" PRODUCT LINE
UNITED GAS P.L. CO. 1-20" GAS LINE
WALLISVILLE
ACCESS RD TO LOCK NO. 1
TURTLE BAY OIL FIELD
WALLISVILLE DAM
LOCK NO. 1
MAYES LAKE
ROUND LAKE
OLD RIVER LAKE
BIG HOG BAYOU
EARTH DAM
LAKE ANAHUAC
COTTON LAKE
OVERFLOW SPILLWAY
DISCHARGE CHANNEL
SPILLWAY
ANAHUAC
TRINITY BAY
ANAHUAC CHANNEL
UPPER END OF COMPLETED CHANNEL TO LIBERTY
MATCH LINE A-A
SCALE IN MILES
FORT WORTH
DALLAS
TRINITY RIVER
LIBERTY
HOUSTON
ANAHUAC
SHEET INDEX
LEGEND
EXISTING FEDERAL NAVIGATION CHANNELS
PROPOSED MULTIPLE PURPOSE CHANNEL
HIGH WATER LINE (MAXIMUM OF RECORD)
NAVIGATION LOCK AND DAM
RIVER MILEAGE
CHANNEL MILEAGE
CORE BORINGS
AUGER BORINGS
RIVER DIVERSION DAM
LIMITS OF EXISTING OIL FIELDS
POWER TRANSMISSION LINES
PIPE LINES
COMMUNICATION LINES
FEDERAL HIGHWAY
STATE HIGHWAY
EXISTING BRIDGE
RAILROADS
COUNTY OR CITY ROADS
COUNTY LINE
ACCESS ROADS
UPPER POOL ELEVATION
LOWER POOL ELEVATION
NAVIGATION LOCK
PROPOSED LIBERTY LEVEE
LIMITS OF PROPOSED WILDLIFE REFUGE
EXISTING SPOIL EMBANKMENT
BANK STABILIZATION WORK
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL
GENERAL PLAN
IN 8 SHEETS
SCALE AS SHOWN
SHEET NO. 1
U.S. ARMY ENGINEER DISTRICT, GALVESTON
JUNE 1962
SUBMITTED
APPROVAL RECOMMENDED
APPROVED
PREPARED
FILE: TRIN 230-19

PLATE 4


MATCH LINE
LOCK No 5A
U.P.EL.101.0 To 103.0
L.P.EL 60.0
C.M. 98.0
6C-61-5
ELEVATED POOL LEVEE
FLOOD RELEASE CHANNEL
SERVICE P.L. CO.
1-12" OIL LINE
SHELL OIL CO.
2-10" OIL LINES
1-4" OIL LINE & TELEPHONE LINE
UNITED GAS P.L. CO.
1-30" GAS LINE
NATURAL GAS P.L. CO.
1-30 GAS LINE
POLK COUNTY
TENN. GAS TRANSMISSION CO.
1-24" GAS LINE
2-30" GAS LINES
URBANA
TRINITY
SAN JACINTO COUNTY
SHELL OIL CO.
1-6" OIL LINE
S.W. BELL TEL. CO.
S.P.R.R.
GULF STATES UTILITY
34.5 K.V.A.
UNITED GAS P.L. CO.
1-16" GAS LINE
TENN. GAS TRANSMISSION
1-6" GAS LINE
GULF OIL CORP.
1-10" GAS LINE
POLK COUNTY
LIBERTY COUNTY
SAN JACINTO COUNTY
LIBERTY COUNTY
SAM HOUSTON ELECTRIC
12.5 K.V.A.
SW BELL TELEPHONE CO.
30 WIRES
G.C. & S.F. R.R.
GULF STATES UTILITY
38.5 K.V.A.
ROMAYOR
LOCK & DAM No 4
U.P.EL. 60 L.P.EL. 36
C.M. 74.85
6C-61-4
ACCESS ROAD
TO LOCK & DAM No 4
RIVER
BEEF HEAD CR.
MATCH LINE SEE A-A
SCALE IN MILES

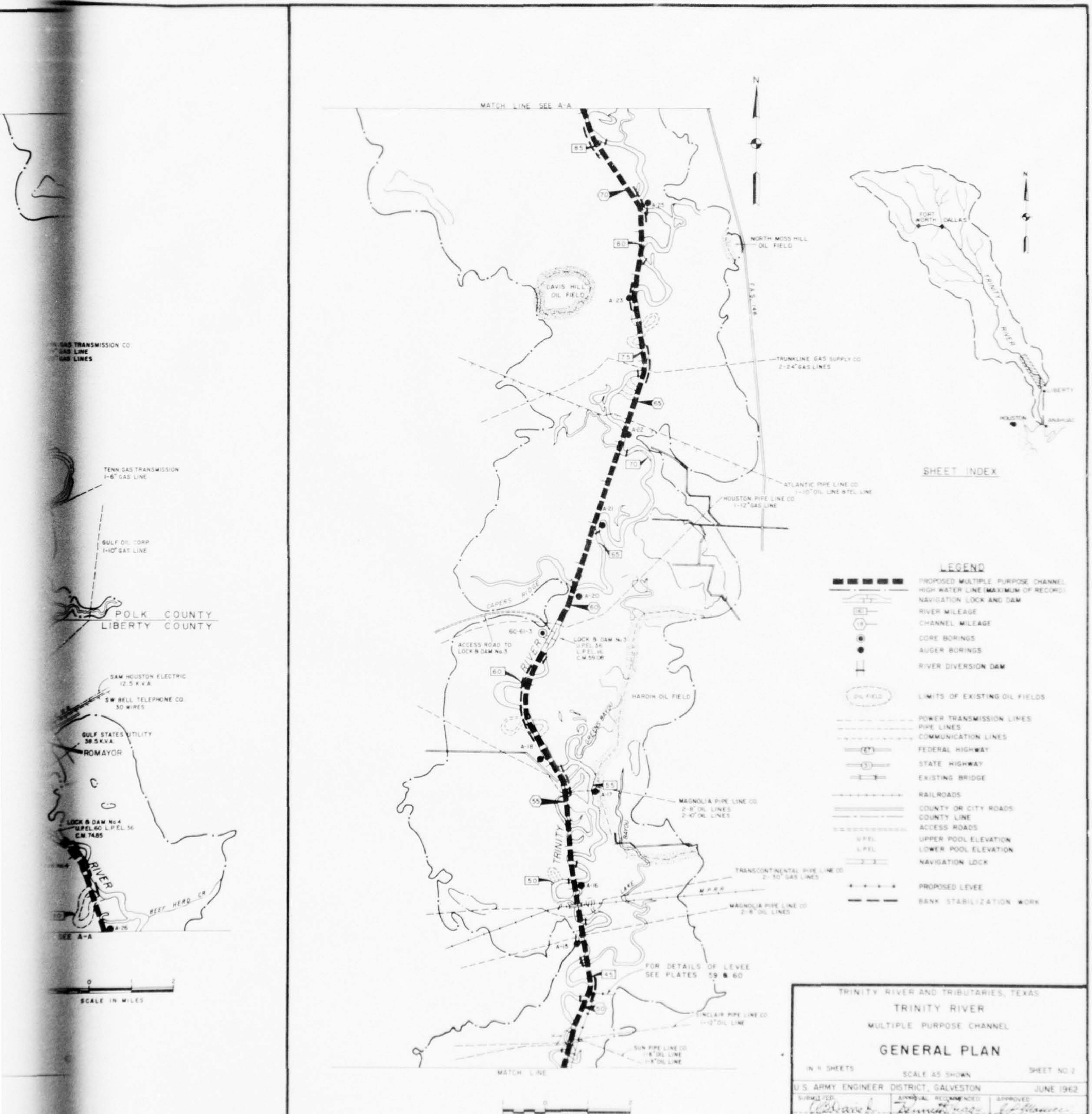
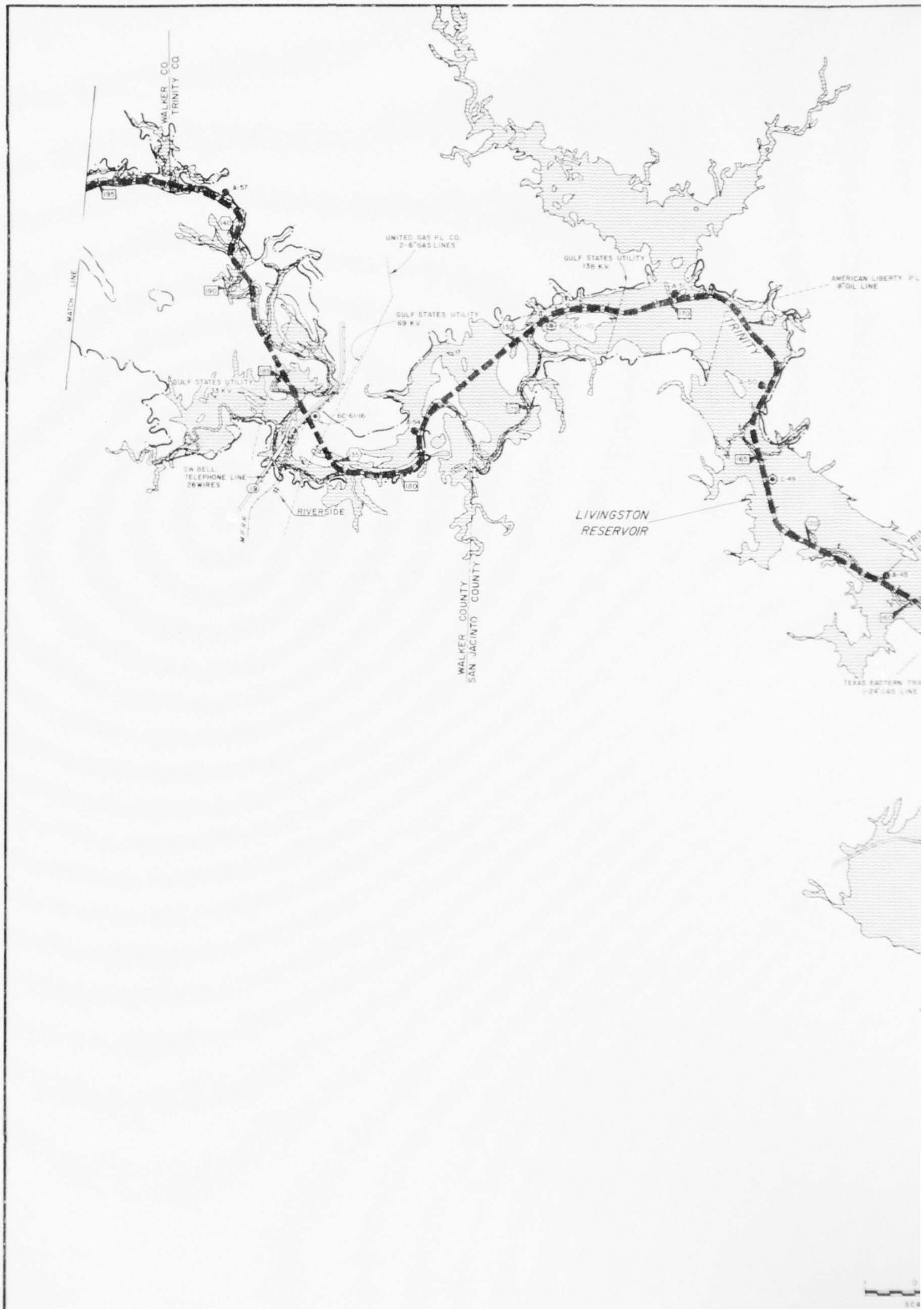
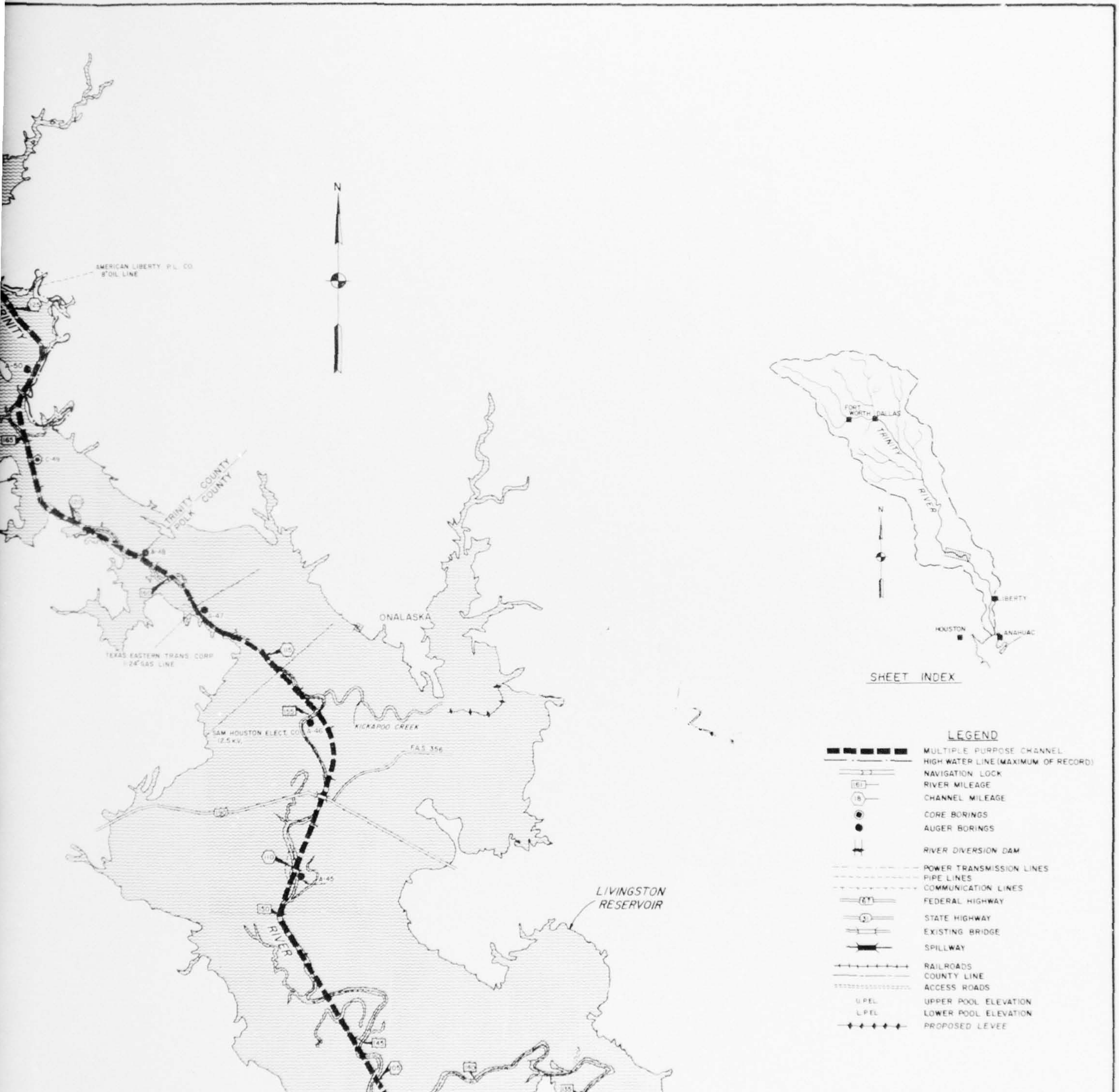

MATCH LINE SEE A-A
NORTH MOSS HILL OIL FIELD
DAVIS HILL OIL FIELD
TRUNKLINE GAS SUPPLY CO. 2-24" GAS LINES
ATLANTIC PIPE LINE CO. 1-10" OIL LINE & TEL. LINE
HOUSTON PIPE LINE CO. 1-12" GAS LINE
CAPERS RIDGE
ACCESS ROAD TO LOCK & DAM No. 3
LOCK & DAM No. 3
HARDIN OIL FIELD
MAGNOLIA PIPE LINE CO. 2-8" OIL LINES 2-10" OIL LINES
TRINITY
RIVER
TRANSCONTINENTAL PIPE LINE CO. 2-30" GAS LINES
MAGNOLIA PIPE LINE CO. 2-8" OIL LINES
FOR DETAILS OF LEVEE SEE PLATES 59 & 60
SINCLAIR PIPE LINE CO. 1-12" OIL LINE
SUN PIPE LINE CO. 1-6" OIL LINE 1-8" OIL LINE
MATCH LINE
SCALE IN MILES
TENN GAS TRANSMISSION 1-6" GAS LINE
GULF OIL CORP. 1-10" GAS LINE
POLK COUNTY
LIBERTY COUNTY
SAM HOUSTON ELECTRIC 12.5 K.V.A.
S.W. BELL TELEPHONE CO. 30 WIRES
GULF STATES UTILITY 38.5 K.V.A.
ROMAYOR
LOCK & DAM No. 4 U.P.EL. 60 L.P.EL. 36 C.M. 74.85
BEEF HEAD CR.
FORT WORTH
DALLAS
TRINITY RIVER
LIBERTY
HOUSTON
ANAHUAC
SHEET INDEX
LEGEND
PROPOSED MULTIPLE PURPOSE CHANNEL
HIGH WATER LINE (MAXIMUM OF RECORD)
NAVIGATION LOCK AND DAM
RIVER MILEAGE
CHANNEL MILEAGE
CORE BORINGS
AUGER BORINGS
RIVER DIVERSION DAM
LIMITS OF EXISTING OIL FIELDS
POWER TRANSMISSION LINES
PIPE LINES
COMMUNICATION LINES
FEDERAL HIGHWAY
STATE HIGHWAY
EXISTING BRIDGE
RAILROADS
COUNTY OR CITY ROADS
COUNTY LINE
ACCESS ROADS
UPPER POOL ELEVATION
LOWER POOL ELEVATION
NAVIGATION LOCK
PROPOSED LEVEE
BANK STABILIZATION WORK
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL
GENERAL PLAN
IN 11 SHEETS
SCALE AS SHOWN
SHEET NO. 2
U.S. ARMY ENGINEER DISTRICT, GALVESTON
JUNE 1962
SUBMITTED
APPROVAL RECOMMENDED
APPROVED
FILE: TRIN. 230-19

PLATE 5

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

GENERAL PLAN

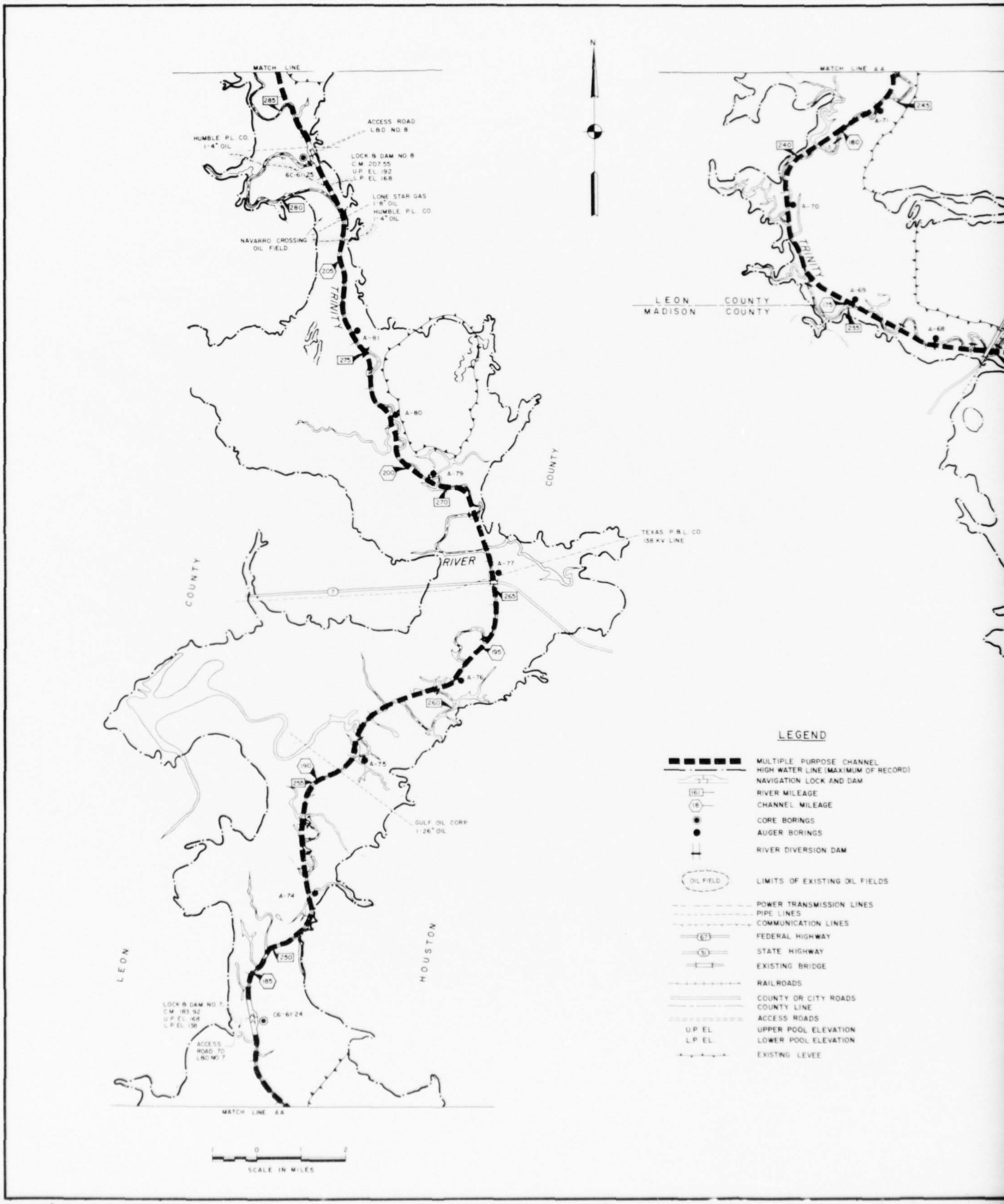
IN 8 SHEETS — SCALE AS SHOWN — SHEET NO. 3

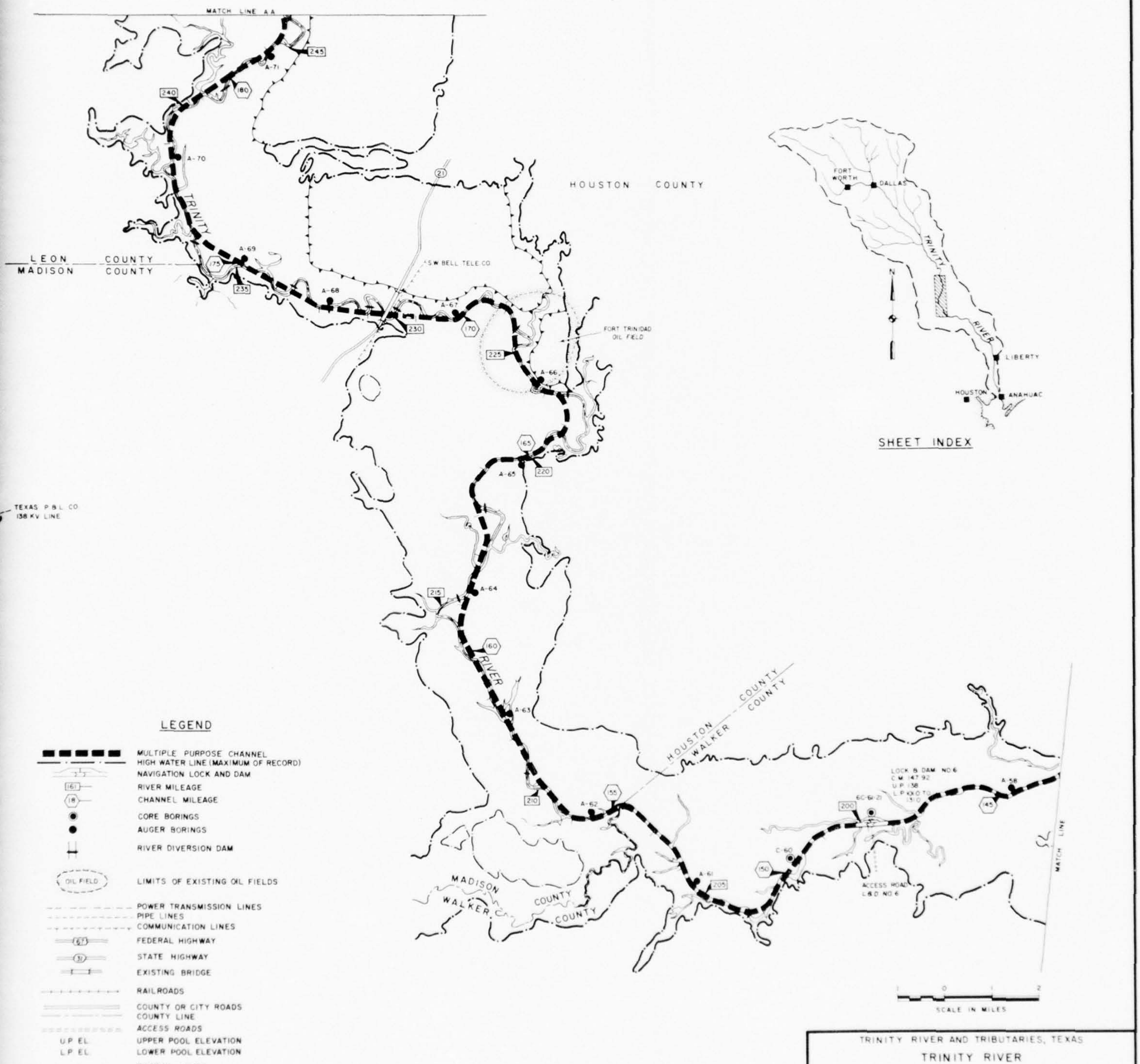
U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED:	APPROVAL RECOMMENDED:	APPROVED:
ENGINEER CHIEF, PLANNING & REPORTS BRANCH	ENGINEER CHIEF, ENGINEERING DIVISION	COL. CORPS OF ENGINEERS DISTRICT ENGINEER
PREPARED: ENGINEER HEAD, SPECIAL STUDIES SECTION	DRAWN BY: CHECKED BY:	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962 FILE: TRIN 230-19

PLATE 6

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

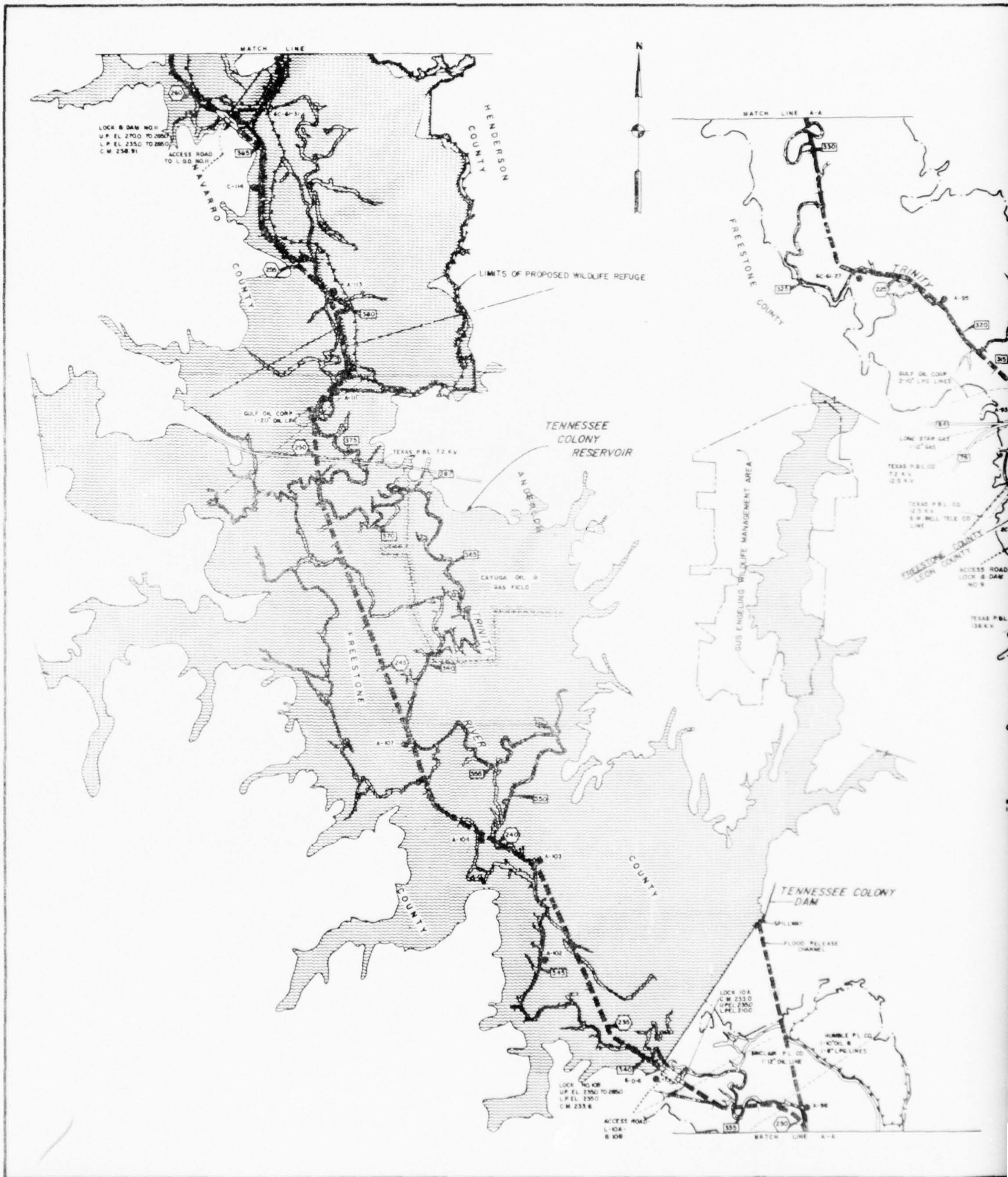
MULTIPLE PURPOSE CHANNEL

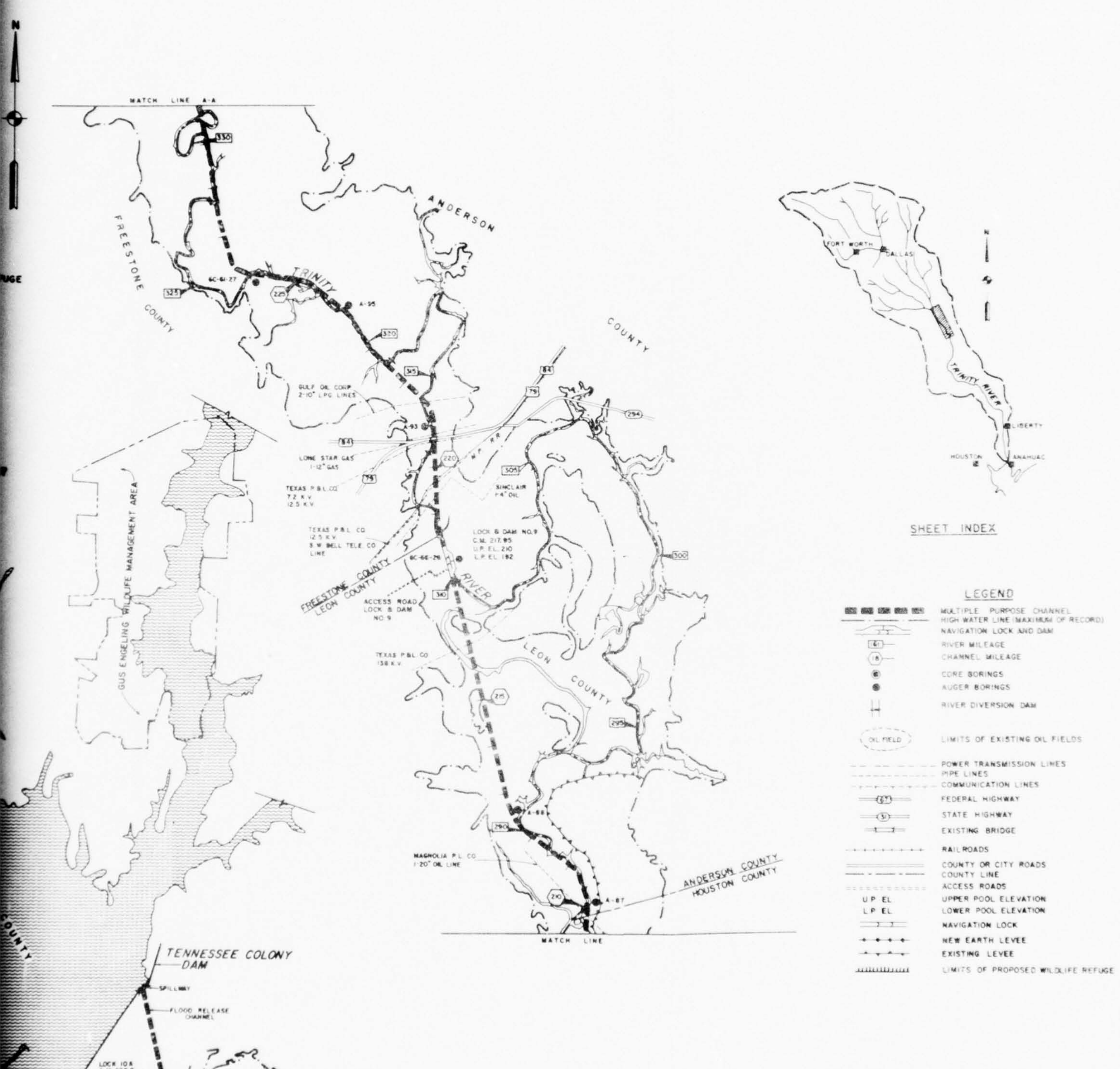
GENERAL PLAN

IN 6 SHEETS — SCALE AS SHOWN — SHEET NO. 4

U.S. ARMY ENGINEER DISTRICT, GALVESTON		JUNE 1962
SUBMITTED A.B. Davis Jr. ENGINEER CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED Kenneth Nagy ENGINEER CHIEF, ENGINEERING DIVISION	APPROVED CORPS OF ENGINEERS DISTRICT ENGINEER
PREPARED Arthur J. Nall HEAD, SPECIAL STUDIES SECTION	DRAWN BY CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962 FILE TRIN 230-19

PLATE 7


MATCH LINE
N
HENDERSON COUNTY
NAVARRO COUNTY
LIMITS OF PROPOSED WILDLIFE REFUGE
TENNESSEE COLONY RESERVOIR
ANDERSON
FREESTONE COUNTY
TRINITY RIVER
COUNTY
TENNESSEE COLONY DAM
SPILLWAY
FLOOD RELEASE CHANNEL
GUS ENGELING WILDLIFE MANAGEMENT AREA
MATCH LINE A-A
FREESTONE COUNTY
TRINITY
FREESTONE COUNTY
LEON COUNTY
ACCESS ROAD LOCK & DAM NO. 9



TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

GENERAL PLAN

IN 8 SHEETS — SCALE AS SHOWN — SHEET NO. 5

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED: CHIEF PLANNING & REPORTS BRANCH — APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION — APPROVED: COL. CORPS OF ENGINEERS, DISTRICT ENGINEER

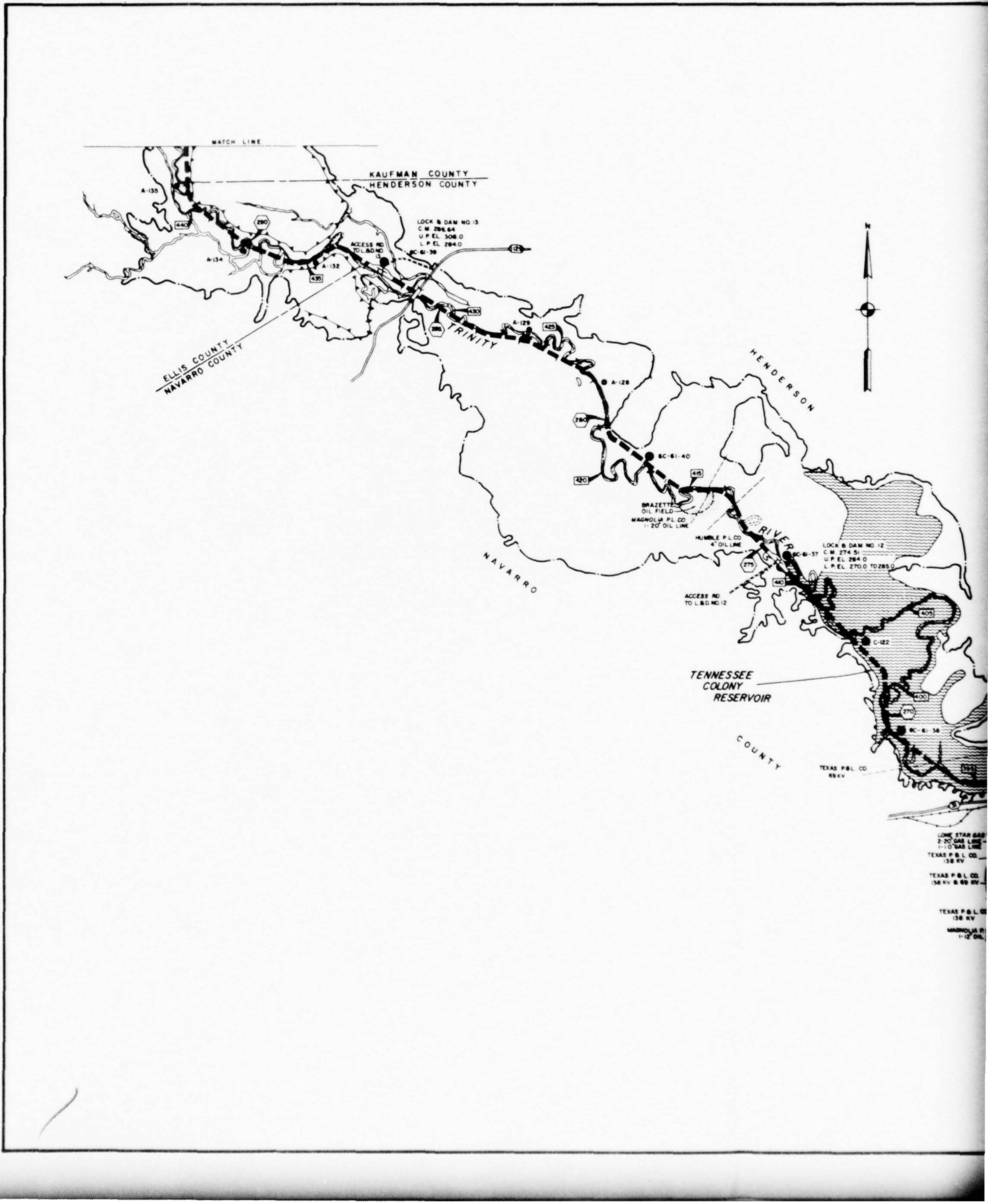
PREPARED: HEAD, SPECIAL STUDIES SECTION — DRAWN BY: — CHECKED BY:

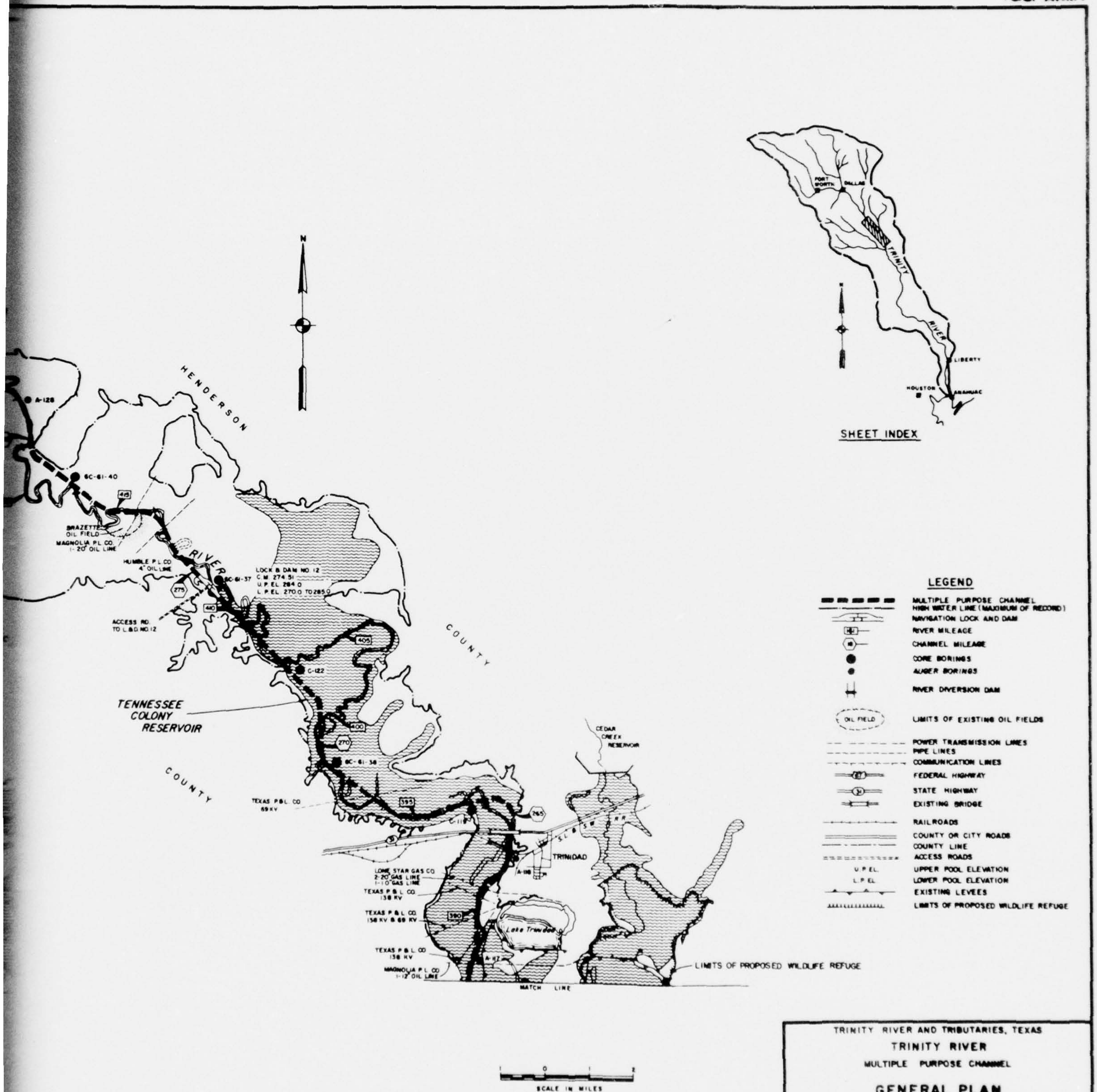
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962

FILE: TRIN. 230-19

PLATE 8

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL

GENERAL PLAN

IN 8 SHEETS — SCALE AS SHOWN — SHEET NO. 6

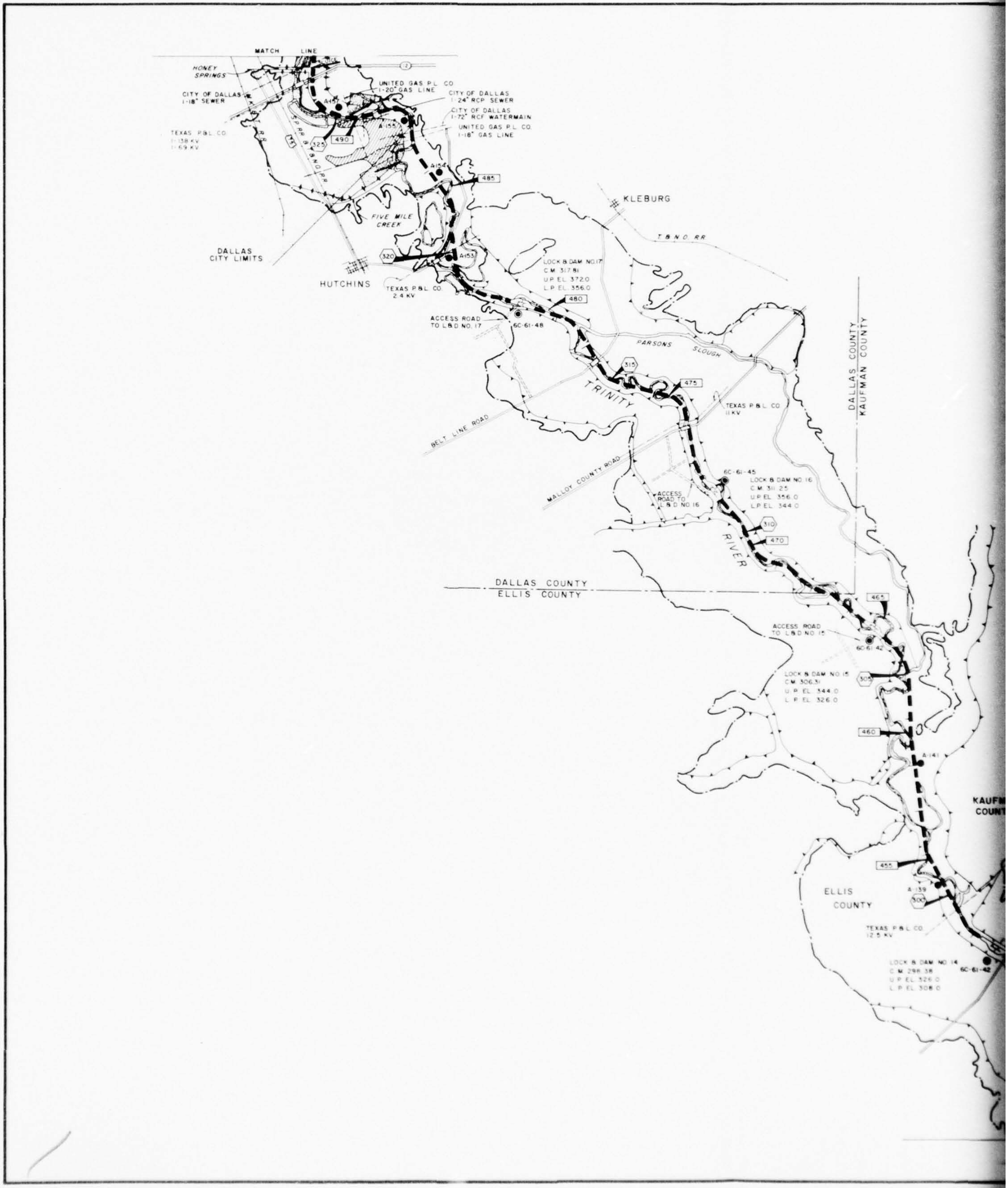
U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER; FILE TRIN. 230-18

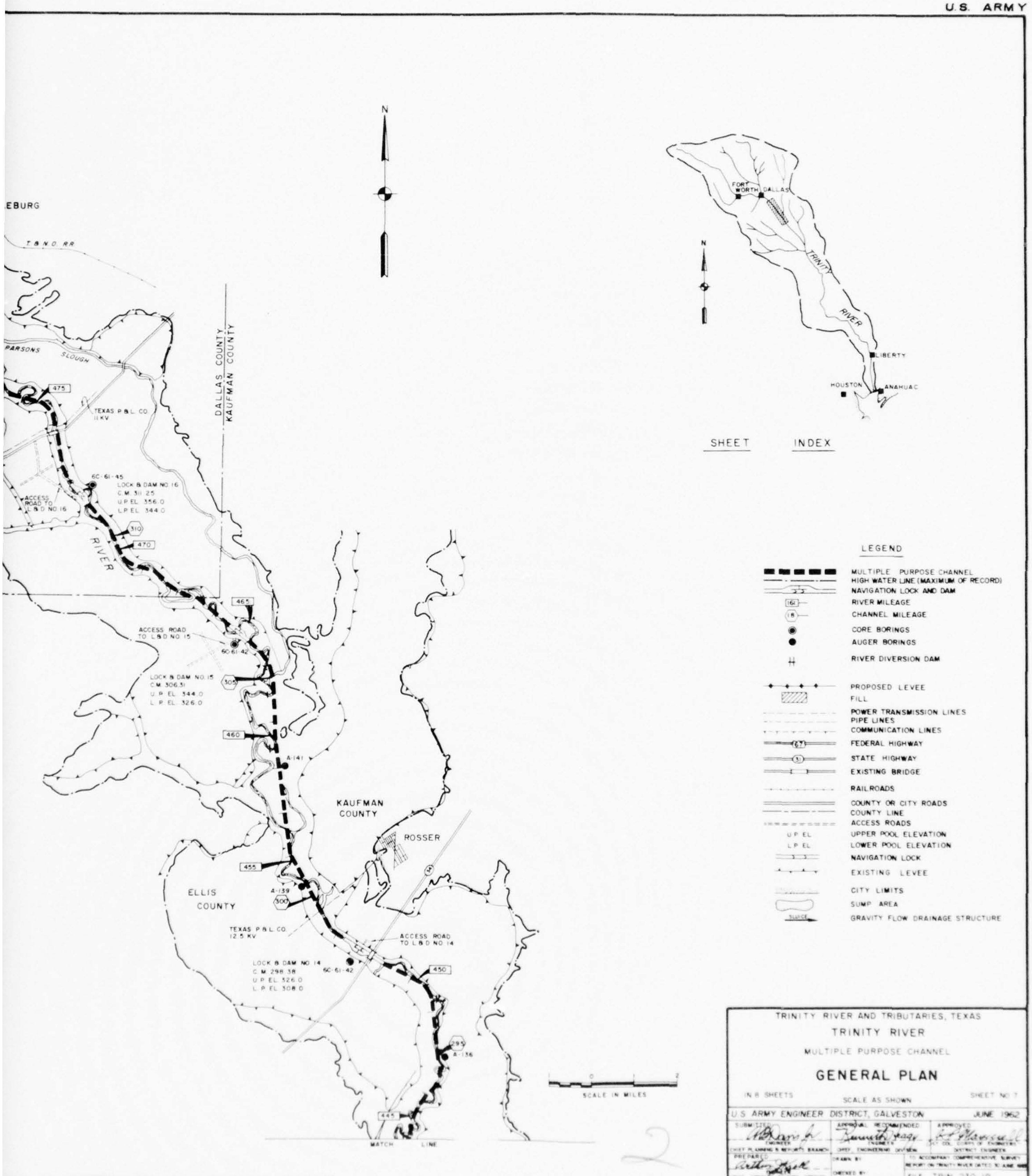
2

PLATE 9

CORPS OF ENGINEERS



U.S. ARMY



2

PLATE 10


FORT WORTH
HALTOM
ARLINGTON-SMITHFIELD RD
ARLINGTON-BEDFORD RD
MAGNOLIA PL CO 1-16" OIL LINE
UNITED GAS PL CO 1-16" GAS LINE
LOCK & DAM NO. 20
C.M. 351.91
U.P. EL. 452.0
L.P. EL. 424.0
ACCESS RD
AMON CARTER FIELD
CHICAGO ROCK ISLAND & PACIFIC R.R.
TEXAS P.&L. CO 138 KV
TRINITY
RIVER
FIRST ST
LONE STAR GAS CO 1-10" GAS LINE
TEX. ELECT. SERV. CO 6.6 KVA
TEXAS ELECT. SERV. CO 12.5 KV
LOCK & DAM NO. 21
SINCLAIR PL CO 1-10" PRODUCTS LINE
LONE STAR GAS CO 1-10" GAS LINE
DALLAS-FORT WORTH TURNPIKE
VILLAGE CR
ARLINGTON
TARRANT CO
DALLAS CO
GRAND PRAIRIE
TEX. ELECT. SERV. CO 12.5 KV
BEAR CR
BELTLINE RD
TEXAS P&L CO 12.5 KV
CITY OF GRAND PRAIRIE 1-36" WATERMAIN
LOCK & DAM NO. 19
C.M. 342.51
U.P. EL. 424.0
MOUNTAIN CREEK RESERVOIR


N
FORT WORTH
DALLAS
TRINITY
RIVER
LIBERTY
HOUSTON
ANAHUAC

SHEET INDEX

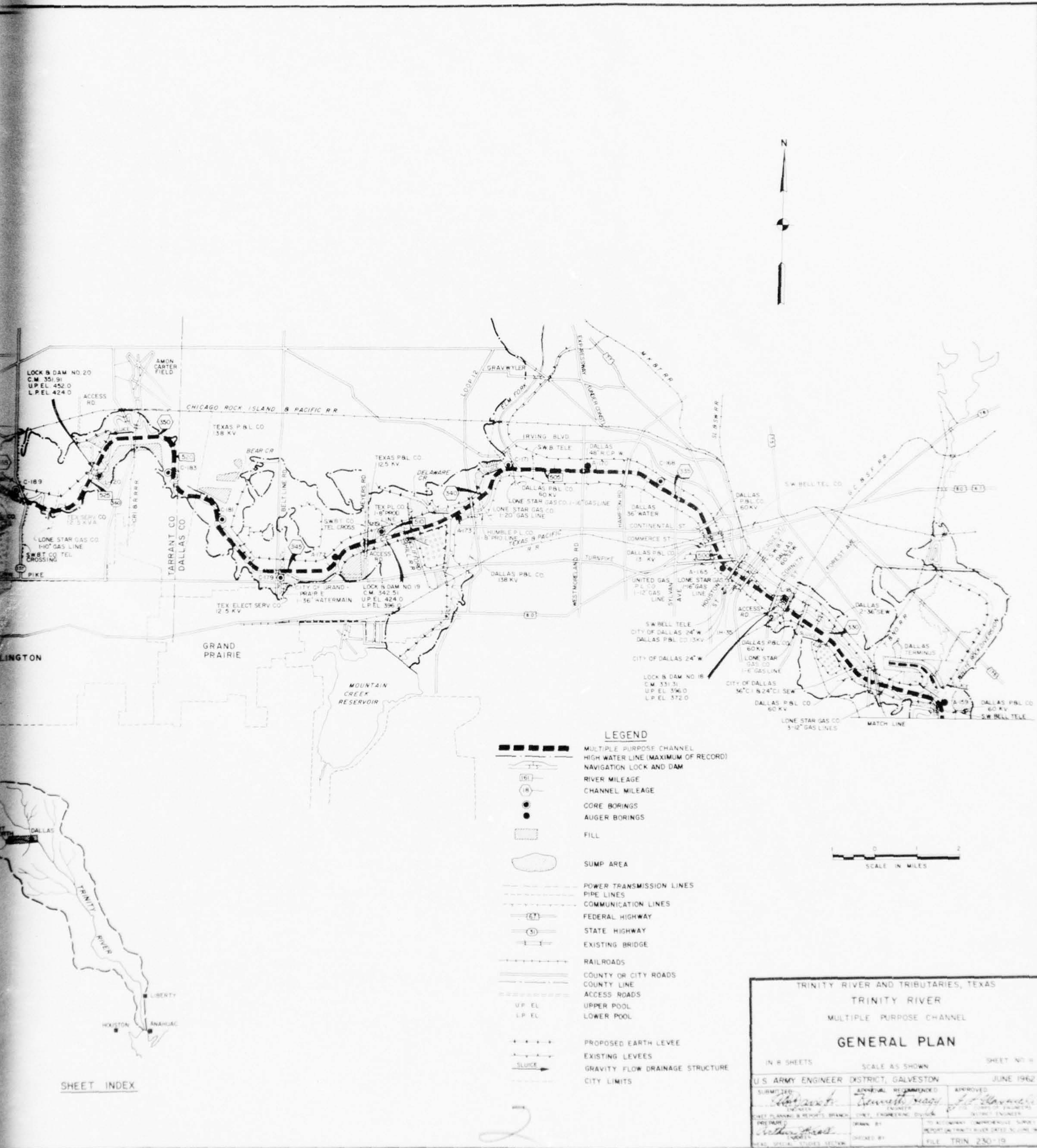
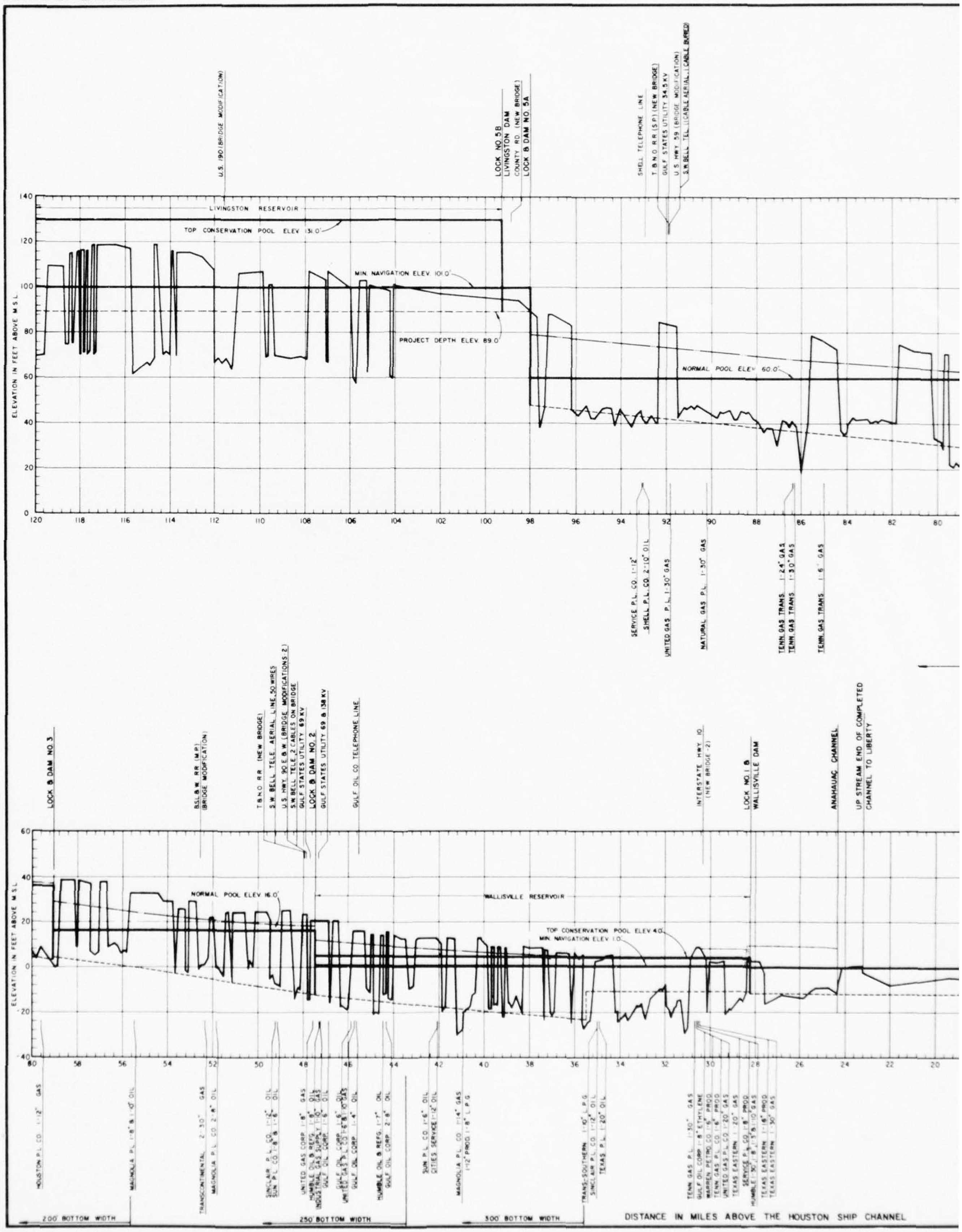
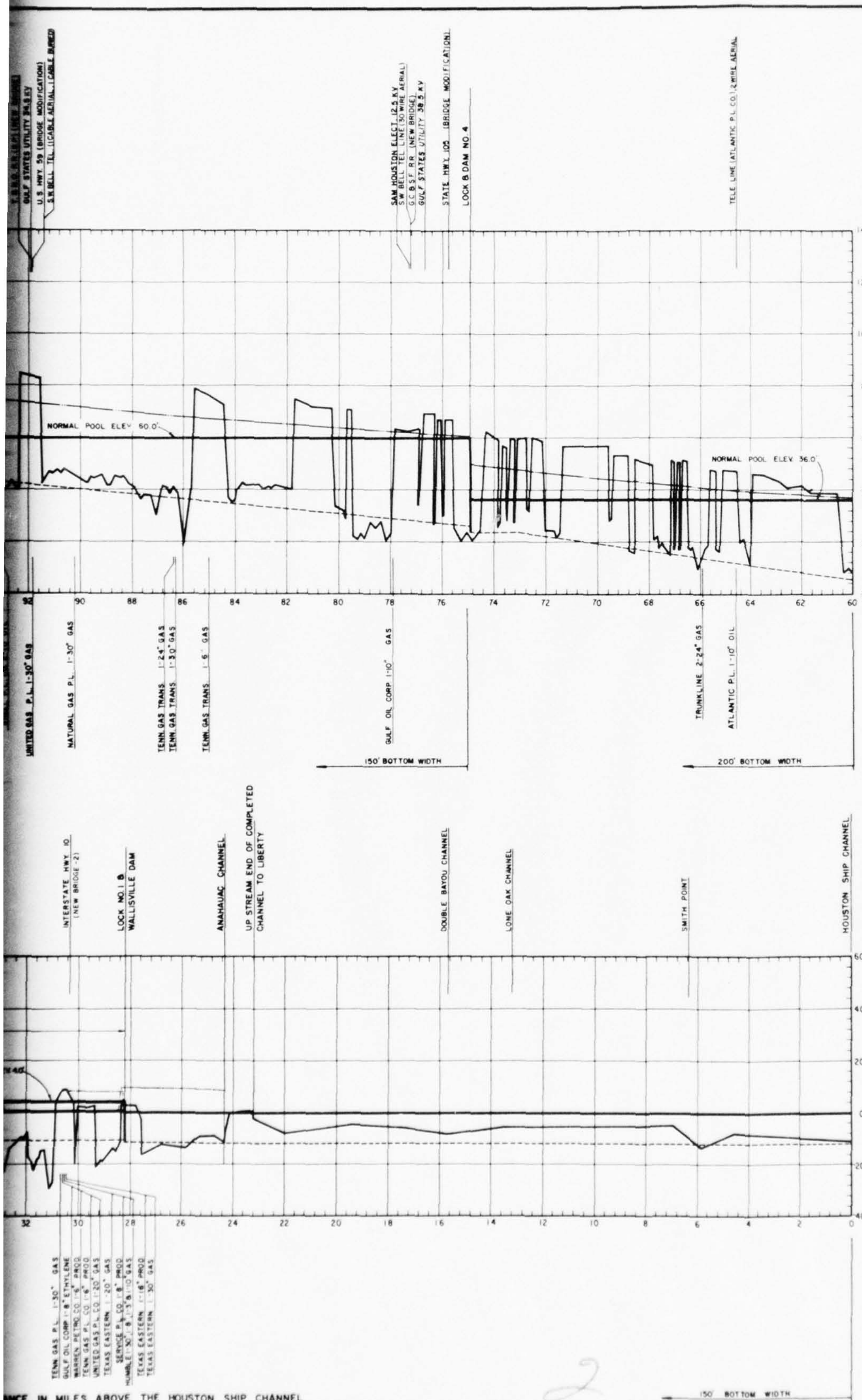

N
LOCK & DAM NO. 20
C.M. 351.91
U.P. EL. 452.0
L.P. EL. 424.0
ACCESS RD.
AMON CARTER FIELD
CHICAGO ROCK ISLAND & PACIFIC R.R.
TEXAS P.&L. CO. 138 KV
BEAR CR.
TEXAS P.&L. CO. 12.5 KV
DELAWARE CR.
GRAYWYLER
LOOP 12
ELM FORK
IRVING BLVD.
S.W.B. TELE.
DALLAS 48" R.C.P. W.
DALLAS P.&L. CO. 60 KV
LONE STAR GAS CO. 1-16" GAS LINE
LONE STAR GAS CO. 1-20" GAS LINE
DALLAS 36" WATER
CONTINENTAL ST.
COMMERCE ST.
HUMBLE P.L. CO. 8" PROD. LINE
TEXAS & PACIFIC R.R.
TURNPIKE
DALLAS P.&L. CO. 13 KV
DALLAS P.&L. CO. 138 KV
DALLAS P.&L. CO. 60 KV
S.W. BELL TEL. CO.
FOREST AVE.
TARRANT CO.
DALLAS CO.
BELT LINE RD.
WESTMORELAND RD.
HAMPTON RD.
SWB.T. CO. TEL. CROSS
TEX. P.L. CO. 1-8" PROD. LINE
LONE STAR GAS CO. 1-10" GAS LINE
S.W.B.T. CO. TEL. CROSSING
TEX. SERV. CO. 12.5 KVA
PIKE
CITY OF GRAND PRAIRIE 1-36" WATERMAIN
LOCK & DAM NO. 19
C.M. 342.51
U.P. EL. 424.0
L.P. EL. 396.0
TEX. ELECT. SERV. CO. 12.5 KV
GRAND PRAIRIE
LINGTON
MOUNTAIN CREEK RESERVOIR
UNITED GAS P.L. CO. 1-12" GAS LINE
LONE STAR GAS CO. 1-16" GAS LINE
SYLVAN AVE.
HOUSTON ST.
S.W. BELL TELE.
CITY OF DALLAS 24" W.
DALLAS P.&L. CO. 13 KV
CITY OF DALLAS 24" W.
ACCESS RD.
DALLAS P.&L. CO. 60 KV
LONE STAR GAS CO. 1-6" GAS LINE
LOCK & DAM NO. 18
C.M. 331.31
U.P. EL. 396.0
L.P. EL. 372.0
CITY OF DALLAS 36" C.I. & 24" C.I. SEW.
DALLAS P.&L. CO. 60 KV
LONE STAR GAS CO. 3-12" GAS LINES
DALLAS 2-36" SEW.
DALLAS TERMINUS
MATCH LINE
DALLAS P.&L. CO. 60 KV
S.W. BELL TELE.
LEGEND
MULTIPLE PURPOSE CHANNEL
HIGH WATER LINE (MAXIMUM OF RECORD)
NAVIGATION LOCK AND DAM
RIVER MILEAGE
CHANNEL MILEAGE
CORE BORINGS
AUGER BORINGS
FILL
SUMP AREA
POWER TRANSMISSION LINES
PIPE LINES
COMMUNICATION LINES
FEDERAL HIGHWAY
STATE HIGHWAY
EXISTING BRIDGE
RAILROADS
COUNTY OR CITY ROADS
COUNTY LINE
ACCESS ROADS
U.P. EL. UPPER POOL
L.P. EL. LOWER POOL
PROPOSED EARTH LEVEE
EXISTING LEVEES
SLUICE
GRAVITY FLOW DRAINAGE STRUCTURE
CITY LIMITS
SCALE IN MILES
DALLAS
TRINITY RIVER
LIBERTY
HOUSTON
ANAHUAC
SHEET INDEX
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL
GENERAL PLAN
IN 8 SHEETS
SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, GALVESTON
JUNE 1962
FILE TRIN 230-19

PLATE II

CORPS OF ENGINEERS



U. S. ARMY



LEGEND

(solid heavy line)	CENTERLINE PROFILE
(dashed line)	BOTTOM OF PROPOSED CHANNEL
	EXISTING PRIVATE LEVEES, RIGHT BANK
	EXISTING PRIVATE LEVEES, LEFT BANK
	EXISTING COUNTY LEVEES, RIGHT BANK
	EXISTING COUNTY LEVEES, LEFT BANK
	TWO PERCENT FLOOD DISCHARGE (REGULATED)

TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

PROFILE

IN 4 SHEETS | SCALE AS SHOWN | SHEET NO. 1

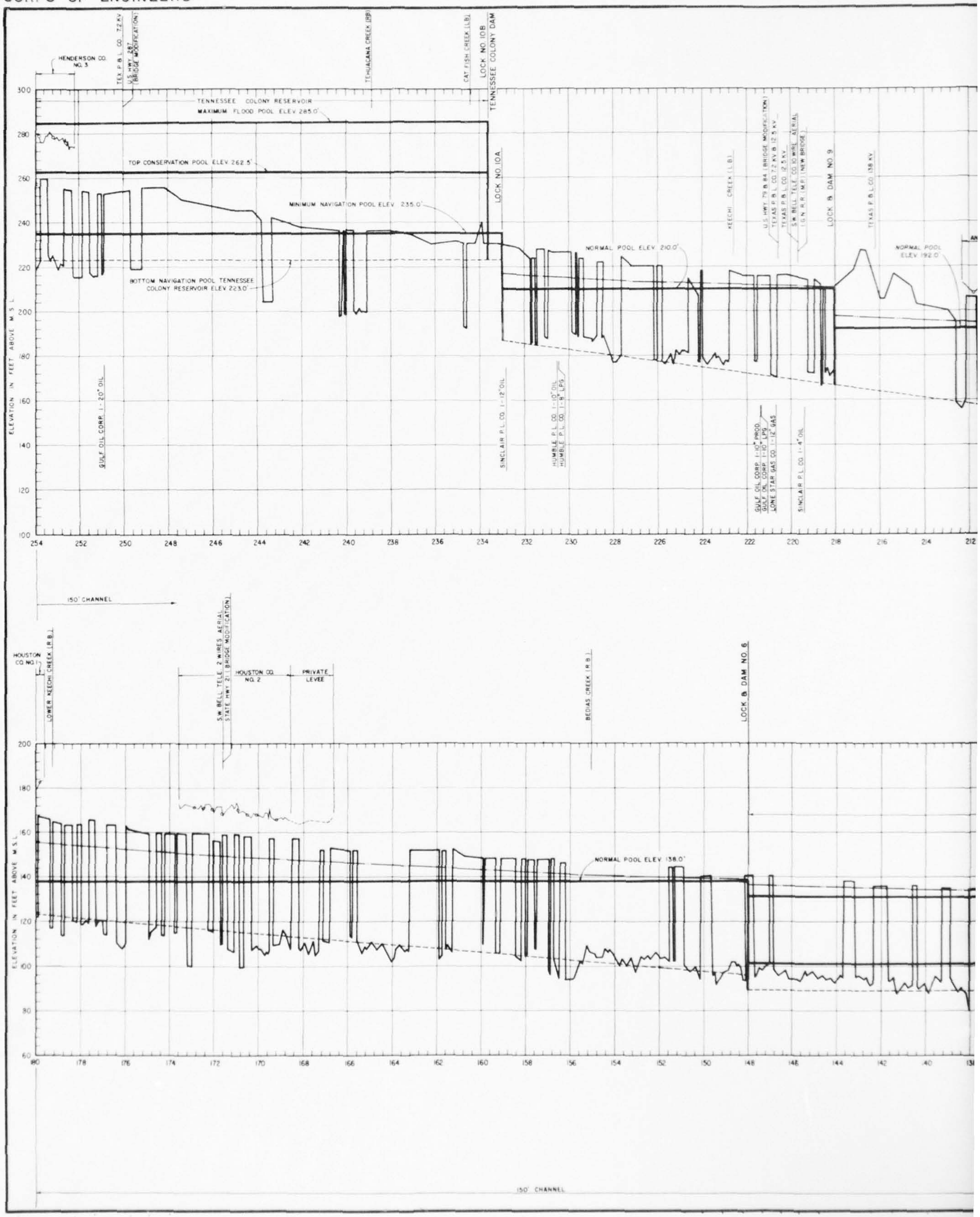
U.S. ARMY ENGINEER DISTRICT, GALVESTON | JUNE 1962

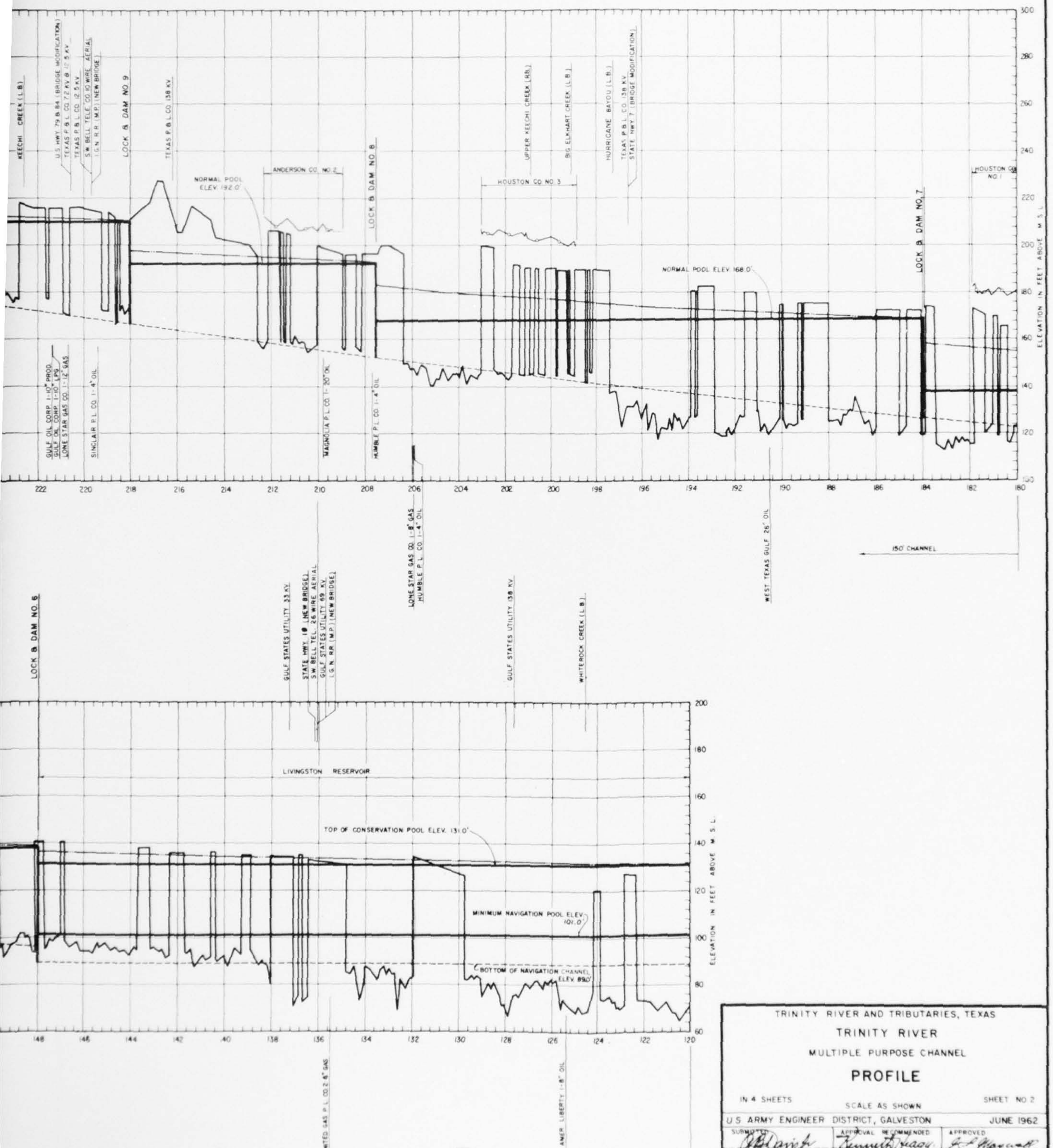
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	Kenneth ... Engineer, CHIEF, ENGINEERING DIVISION	LT. COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED Arthur ... ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962
		FILE TRIN 230-19

2

PLATE 12

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

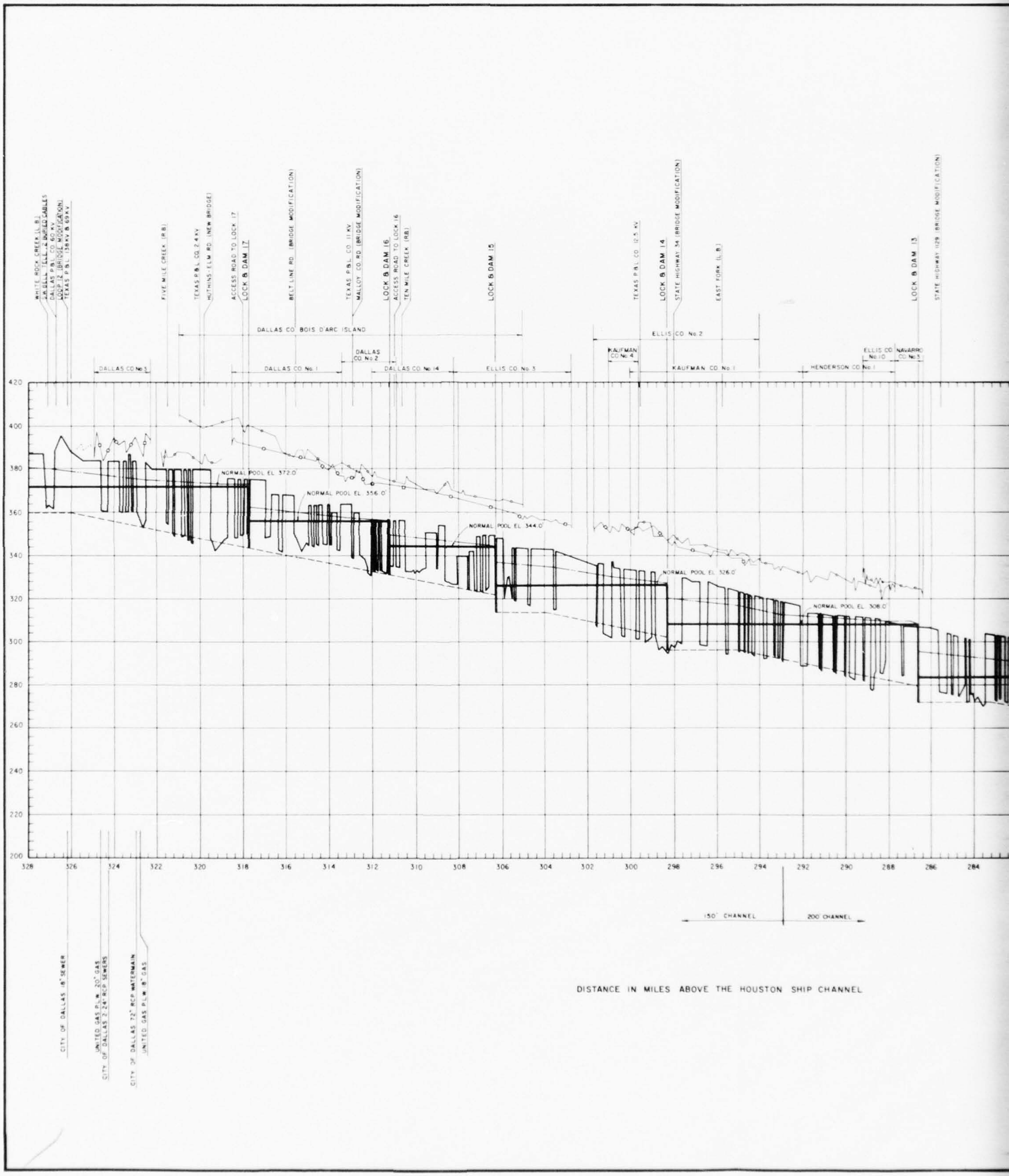
MULTIPLE PURPOSE CHANNEL

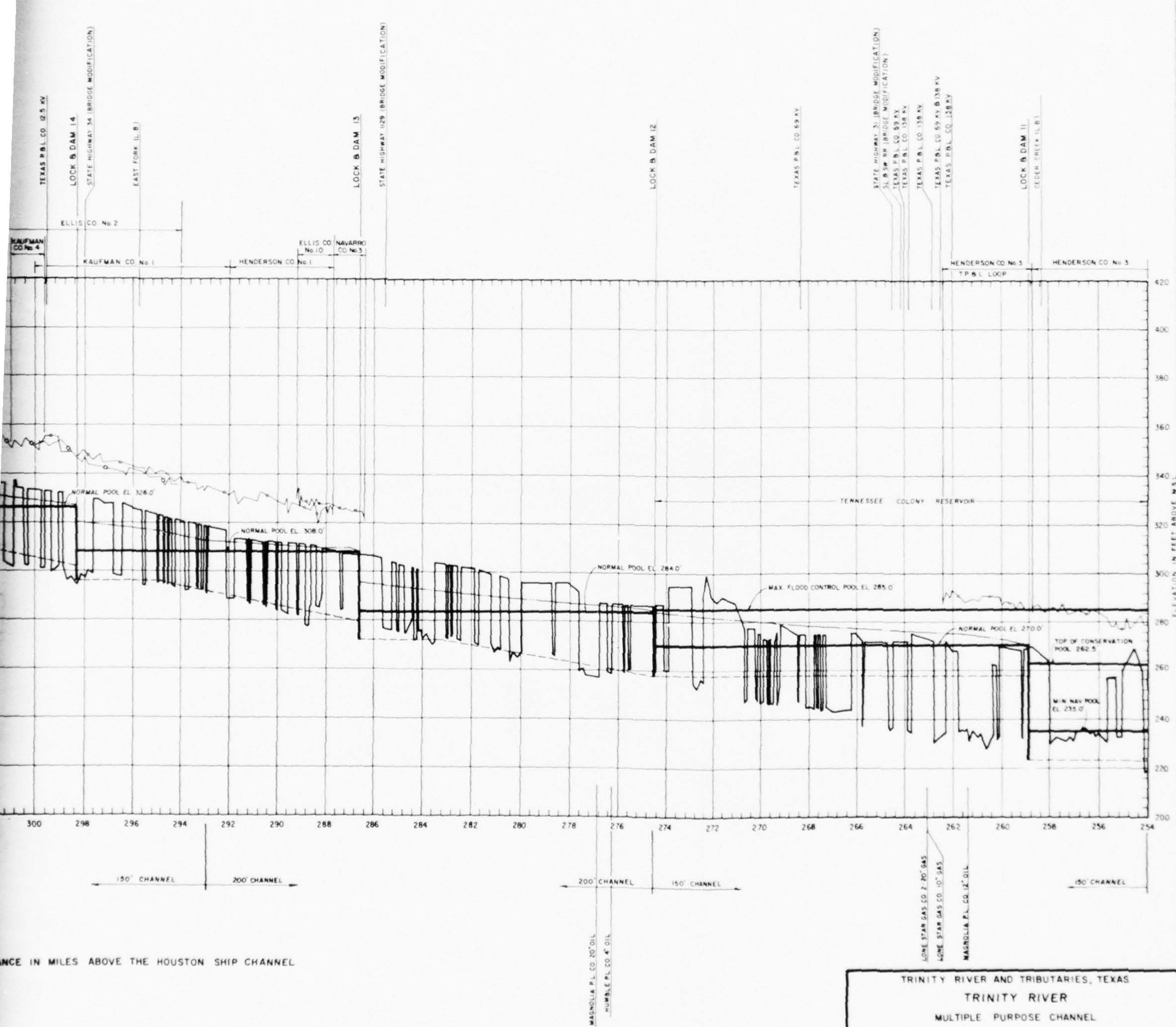
PROFILE

IN 4 SHEETS	SCALE AS SHOWN	SHEET NO. 2
U.S. ARMY ENGINEER DISTRICT, GALVESTON		JUNE 1962
SUBMITTED: CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED: ENGINEER, CHIEF, ENGINEERING DIVISION	APPROVED: LT. COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962
		FILE TRIN 230-19

PLATE 13

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

PROFILE

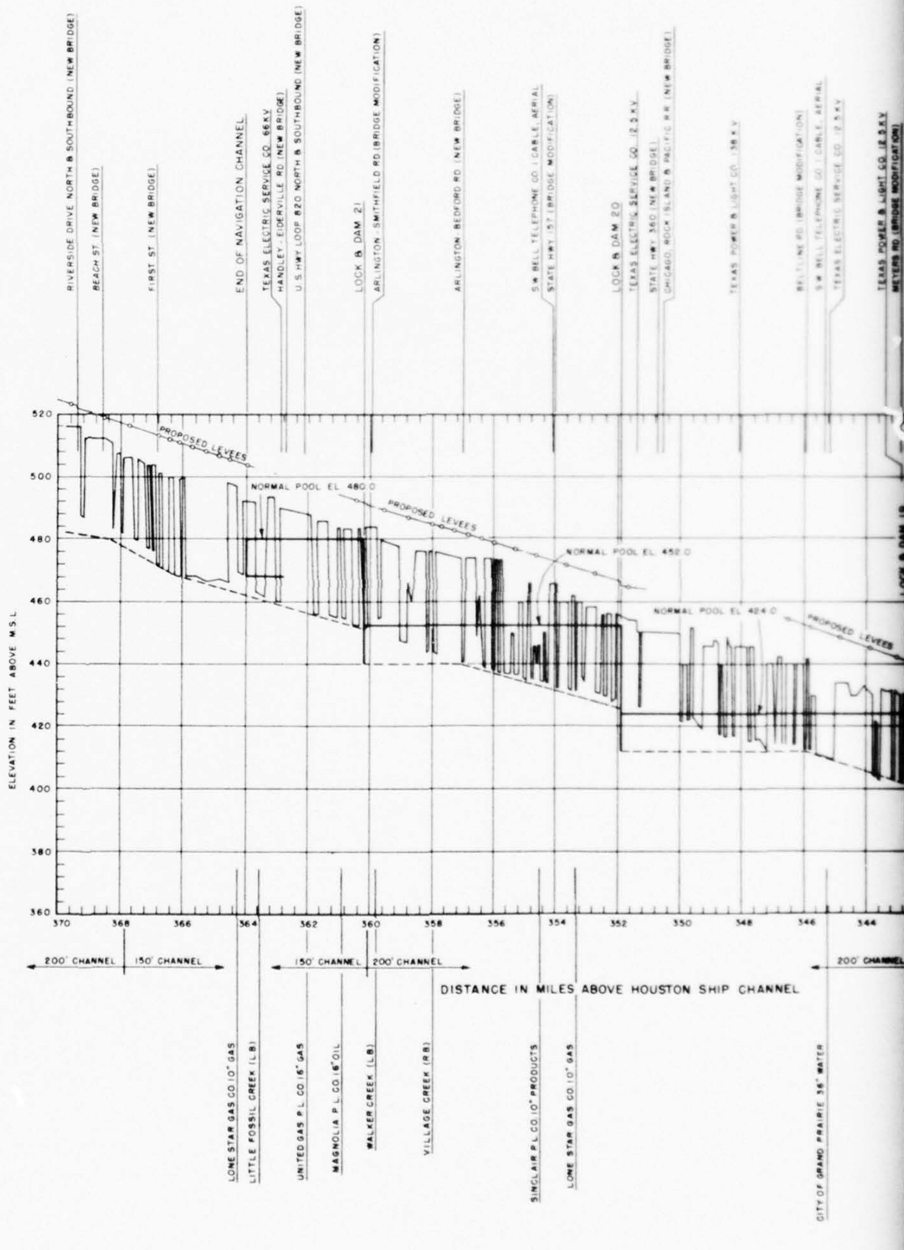
IN 4 SHEETS — SCALE AS SHOWN — SHEET NO. 3

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

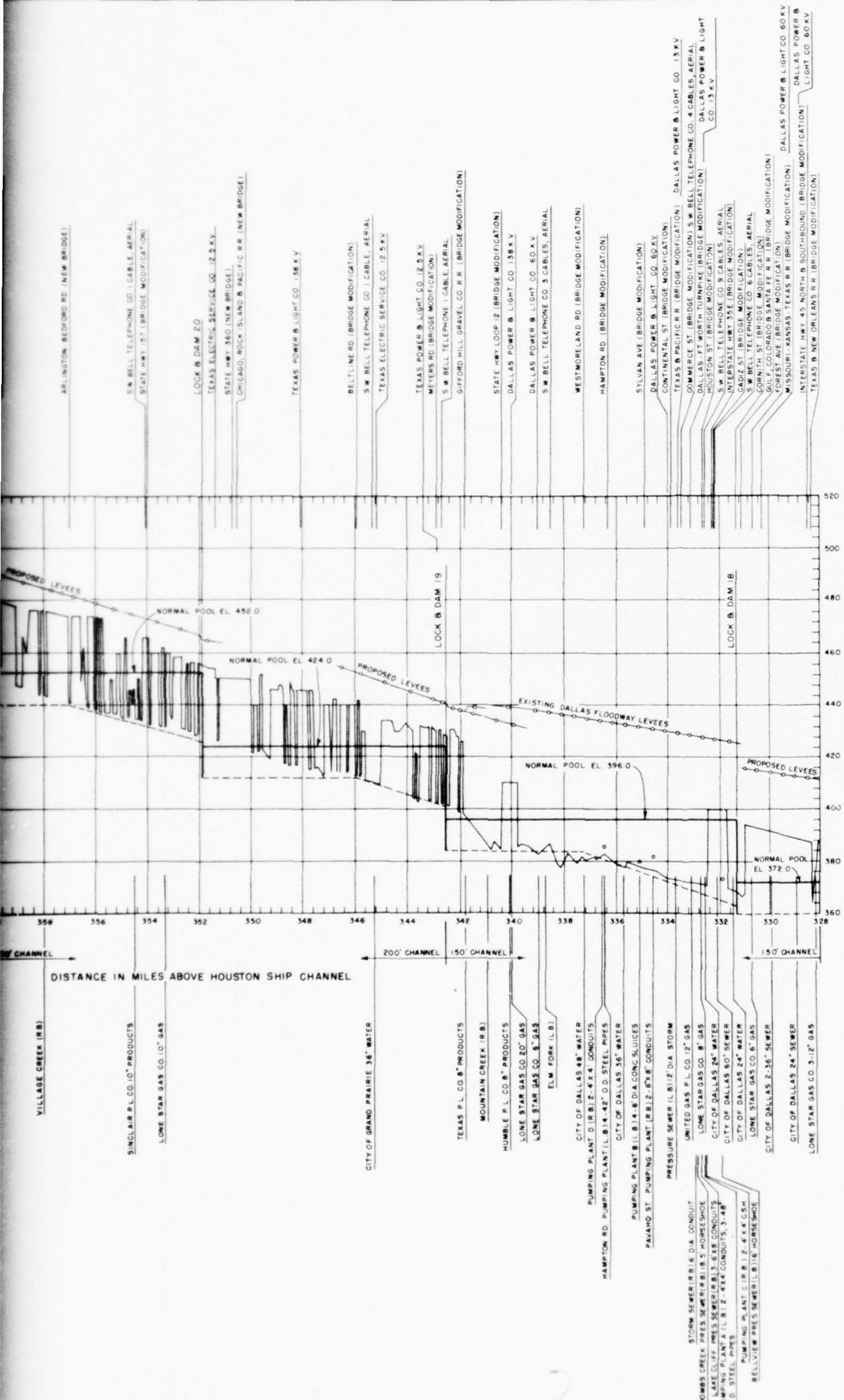
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	ENGINEER, CHIEF, ENGINEERING DIVISION	LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962
		FILE TRIN 230-19

PLATE 14

CORPS OF ENGINEERS



U. S. ARMY



TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

PROFILE

IN 4 SHEETS | SCALE AS SHOWN | SHEET NO. 4

U.S. ARMY ENGINEER DISTRICT, GALVESTON | JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	ENGINEER, CHIEF, ENGINEERING DIVISION	LT. COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY: P.K. / CHECKED BY: J.S.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962 / FILE TRIN. 230-19

PLATE 15

28. The plan of improvement provides for modification of the authorized channel to Liberty project by deepening to 12 feet the existing and uncompleted portion of the 9 × 150-foot project channel from the Houston Ship Channel to channel mile 35.5 at the upper limits of the recommended Wallisville Reservoir. In this reach the plan provided for realignment of the channel to Liberty project in the vicinity of channel mile 25.8 to provide a channel 12 feet deep and 150 feet wide across a bend in the river to meet the minimum channel alignment criteria of 2500-foot radius at adjoining tangent reaches. Curve easing of the river channel for navigation to Liberty was not provided for in connection with the channel to Liberty project. The plan also proposes a major river bend cut-off at Wallisville, Texas, extending between channel miles 29.3 and 31.2 as shown on plate 4, and provides for a channel 12 feet deep below elevation 1.0 and 150 feet wide on the proposed river cut-off alignment. The Wallisville Reservoir project provides for conservation storage between elevation 1.0 to 4.0 above mean sea level, which constitutes a modification of the authorized sea-level channel to Liberty by establishing the minimum elevation of 1.0 for the project channel from the Wallisville dam at channel mile 28.3 to the head of authorized project at channel mile 47.4.

29. At channel mile 35.5, the proposed 12 × 150-foot uncompleted channel to Liberty project joins with the proposed multiple purpose channel which would have a width of 300 feet at bottom elevation minus 23. Below mile 35.5, the proposed 12 × 150-foot channel to Liberty is located generally in the Trinity River channel and no enlargement of the Trinity River is proposed. Flows from the multiple purpose channel at mile 35.5 would discharge into and flow in the Trinity River channel through the Wallisville Reservoir to a gate controlled river diversion channel leading to Trinity Bay, as shown on plate 4.

30. The multiple purpose channel upstream of channel mile 35.5 to the Tennessee Colony Dam would have a capacity to pass a maximum discharge of 45,000 cubic feet per second. The bottom width of the channel would be decreased to a minimum width of 150 feet at the Livingston Dam, and upstream thereof excepting several reaches where the channel would have a bottom width of 200 feet. The plan of improvement proposes that the multiple purpose channel be formed at channel mile 96.94 below the Livingston Reservoir Dam by the joining of the flood release channel extending from the spillway near the east end of the Livingston Dam and the navigation channel extending from the west end of the dam as shown on plates 5 and 6. The plan provides for the navigation channel, 12 feet deep and 150-foot bottom width at elevation 89 to extend throughout the Livingston Reservoir to lock and dam No. 6 at channel mile 147.92, where it would join with the multiple purpose channel.

31. A similar divergence of channels would be provided below the Tennessee Colony Dam at channel mile 229.70 as shown on plate 8. The navigation channel, 12 feet deep and 150-foot bottom at elevation 223 would extend throughout the conservation pool of the Tennessee Colony Reservoir, thence, 12 feet deep and 150-foot bottom at elevation 258 throughout the navigation pool No. 11 in the flood storage pool of the Tennessee Colony Reservoir to lock and dam No. 12 at channel mile 274.5 where it would join with the multiple purpose channel.

32. The plan provides for spur channels, 12 feet deep by 150 feet wide, extending to and including turning basin, 400 feet square, at Dallas and at Fort Worth. A floodway channel with no provisions for navigation would extend from channel mile 362.8 upstream to the lower end of the Fort Worth floodway extension at Riverside Drive bridges over the West Fork.

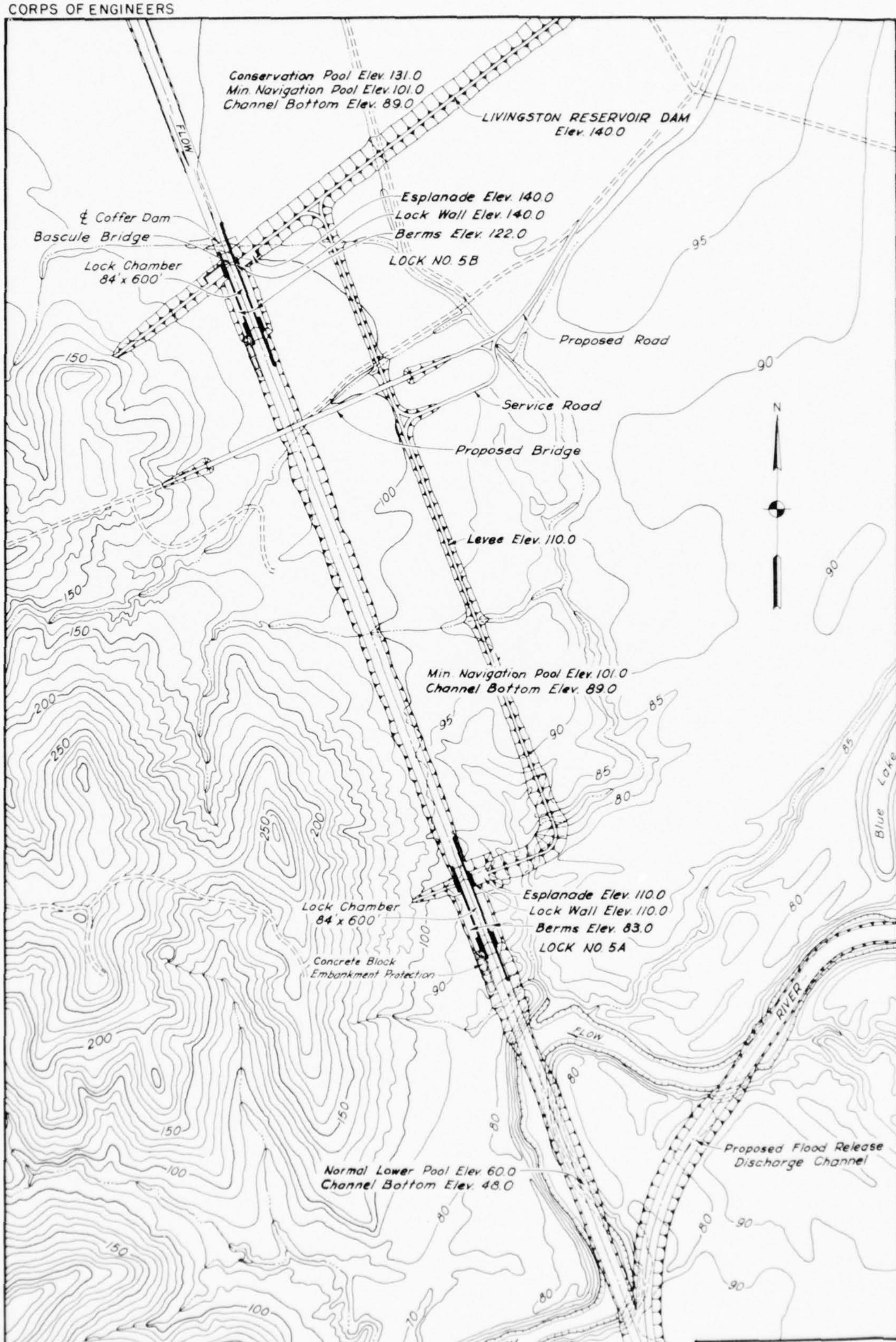
33. NAVIGATION POOLS NOS. 5A & 10A.- The plan of improvement for the multiple purpose channel proposes two locks to overcome a total lift of 71 feet at the Livingston Reservoir dam to provide for 100 percent navigation through the reservoir when conservation storage is full to elevation 131.0 or depleted to elevation 101.0. Preliminary subsurface investigation indicates that foundation conditions are inadequate to support adjoining tandem locks and furthermore the tandem locks would cause delays in transits of barge tows through the locks. The plan provides for the upper lock No. 5B to be located in the Livingston Dam and the lower lock No. 5A to be located about 6300 feet downstream of the upper lock, with an earth levee extending between the locks to form navigation pool No. 5A, generally as shown on plate 16 on page 32.

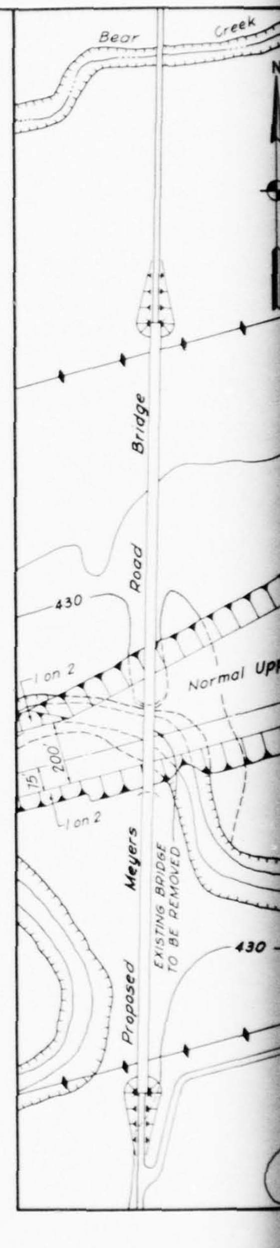
34. The levee would have a top elevation of 110 and be constructed of channel spoil material. A service road would extend on the levee to both locks. In conjunction with the side hills on the opposite side of the channel the levee would create a small reservoir providing a minimum navigation elevation of 101.0, and a maximum elevation of 103.0. Storage between these elvations would provide a water supply for adverse lock operation that may occur at lock No. 5A. When conservation storage in Livingston Reservoir is depleted to elevation 103, the gates of lock No. 5B would remain open and barge tows would be able to traverse pools No. 5A and 5B without delay to navigation. During the drought period when the gates of lock No. 5B are open, water supply for operation of lock No. 5A would be drawn from the Livingston Reservoir.

35. The reservoir would average about 1200 feet in width and have a length of about 6000 feet. The navigation channel would be 12 feet deep below elevation 101 and have a bottom width of 150 feet. It is considered that barge tows would not encounter any unusual delays in navigating locks Nos. 5A and 5B and the intervening navigation pool No. 5A.

36. The reservoir would serve to dampen any adverse surges resulting from the emptying of lock No. 5B. It would also provide temporary storage for run-off from the side hill drainage area of about 630 acres until such storage could be released through lock No. 5A. The cost to shape the spoil materials into graded levee form is provided for in the cost of channel excavation.

CORPS OF ENGINEERS





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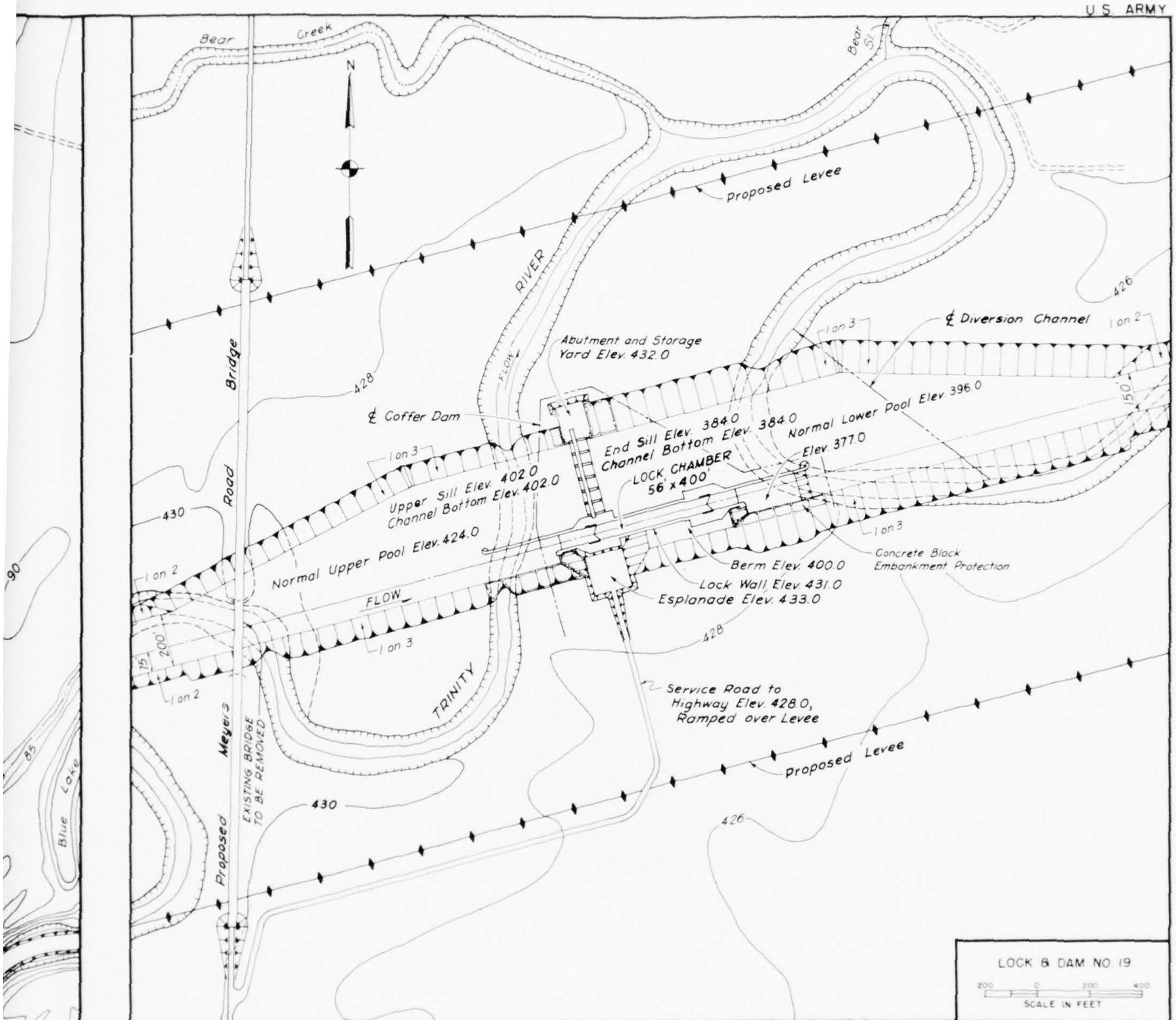


TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

SITE PLAN

LOCK NO. 5A & NO. 5B
LOCK AND DAM NO. 19

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	ENGINEER, CHIEF, ENGINEERING DIVISION	COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY W.E.D. / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED / FILE TRIN. 230-19

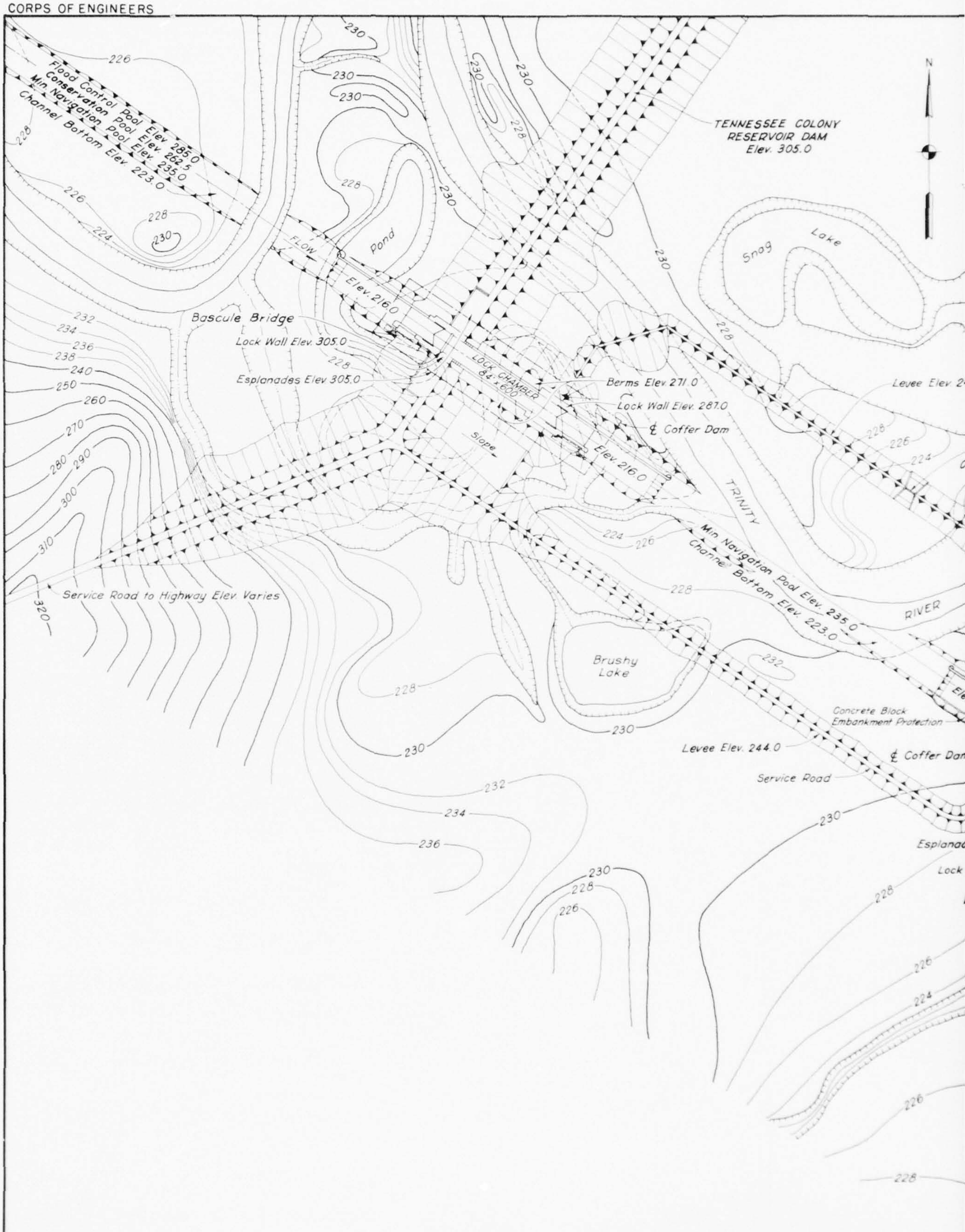
37. The plan provides for navigation pool No. 10A, to be contained within a leveed reservoir area as shown on plate 17. The reservoir would be about 1100 feet wide and 2600 feet long providing storage to a minimum navigation elevation of 235 and a maximum elevation of 237. Storage between these elevations would provide a water supply for adverse lock operation that may occur at lock No. 10A. When conservation storage in Tennessee Colony Reservoir is depleted to elevation 237, the gates in lock No. 10B would remain open and barge tows would be able to traverse pools 10A and 10B without delay. During the drought period when the gates of lock No. 10B are open, water supply for operation of lock No. 10A would be drawn from the Tennessee Colony Reservoir.

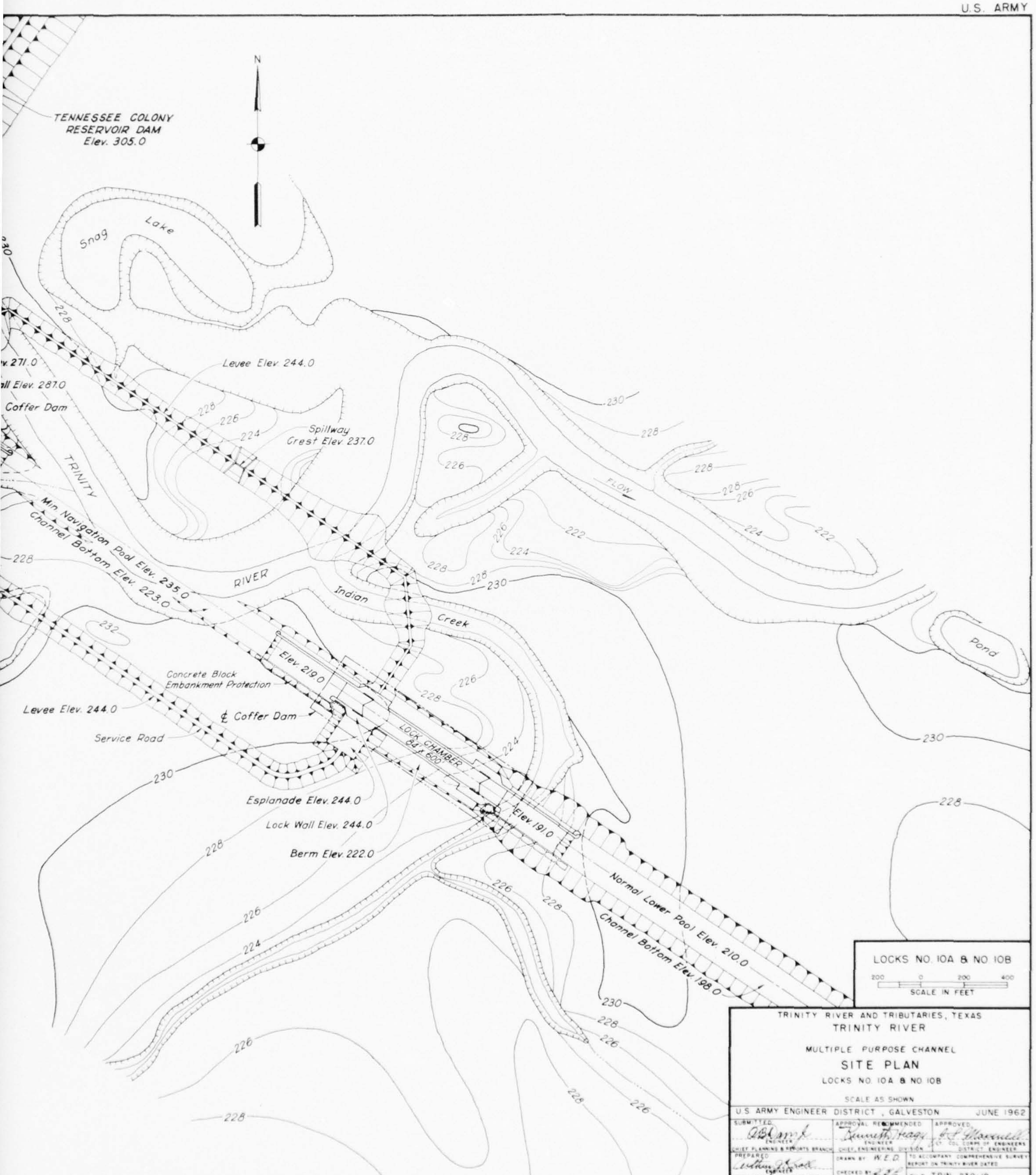
38. The proposed reservoir would be constructed of channel spoil materials to a top elevation of 244 and of sufficient width to dispose of the spoil materials. The navigation channel would be 12 feet deep below elevation 235 and have a bottom width of 150 feet. The reservoir would be of variable depth, averaging about 10 feet deep below elevation 235, and would serve to dampen any adverse surges resulting from the emptying of lock 10B under all conditions of storage in the Tennessee Colony Reservoir.

39. DIVERSION DAMS.- Eighty-one dams would be required for the multiple purpose channel. Construction of each dam would require approximately 86,000 cubic yards of channel spoil material. River diversion dam costs include the cost of hauling and placing spoil in the dam. The estimate is based on a unit price of $0.15 per cubic yard. Top of dams would be constructed to the elevation of the flood of record. Dams will have a length of two hundred feet greater than the distance between tops of bank of the river measured along the alignment of the dam. Plates 4 through 10 show the location of the proposed river diversion dams.

40. CHANNEL BANK REVETMENT WORKS.- Based on the analysis of channel bank revetment works considered for the multiple purpose channel as discussed in appendix III, it is proposed that the outside banks of the sharper curves and adjoining short length of tangents on each end of the curves be protected to prevent erosion of the channel banks. The protection would consist of 24-inch thickness of quarry-run stone ranging from one-half inch to 200 pound stone extending from two feet above normal pool elevation to bottom gradient of proposed channel. The channel from mile 45 to lock and dam No. 2 traverses a reach of the river that is now actively eroding the river banks. Extensive bank revetment works in this reach are proposed extending for a distance of about a mile below lock & dam No. 2, as shown on plate 18. Plates 4 and 5 show the locations of all proposed bank revetment works.

CORPS OF ENGINEERS




N
TENNESSEE COLONY
RESERVOIR DAM
Elev. 305.0
Snag Lake
v. 271.0
all Elev. 287.0
Coffer Dam
Levee Elev. 244.0
Spillway
Crest Elev. 237.0
TRINITY
RIVER
Min Navigation Pool Elev. 235.0
Channel Bottom Elev. 223.0
Indian
Creek
FLOW
Pond
Elev. 219.0
Concrete Block
Embankment Protection
Levee Elev. 244.0
℄ Coffer Dam
Service Road
LOCK CHAMBER
84 x 600
Esplanade Elev. 244.0
Lock Wall Elev. 244.0
Berm Elev. 222.0
Elev. 191.0
Normal Lower Pool Elev. 210.0
Channel Bottom Elev. 198.0
222
224
226
228
230
232
LOCKS NO. 10A & NO. 10B
200 0 200 400
SCALE IN FEET
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL
SITE PLAN
LOCKS NO. 10A & NO. 10B
SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, GALVESTON JUNE 1962
SUBMITTED
ENGINEER
CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED
ENGINEER
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LT. COL. CORPS OF ENGINEERS
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FILE TRIN. 230-19

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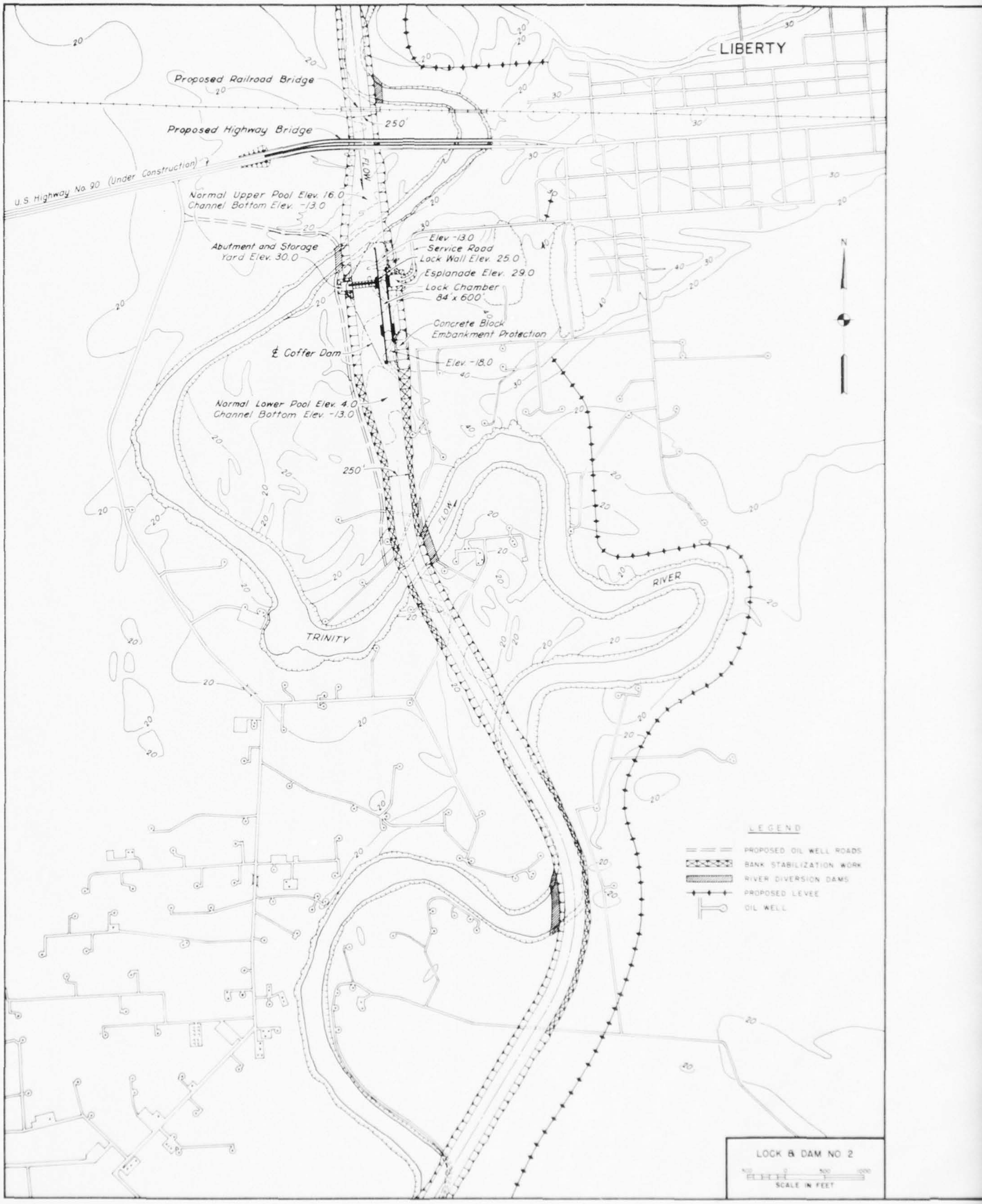
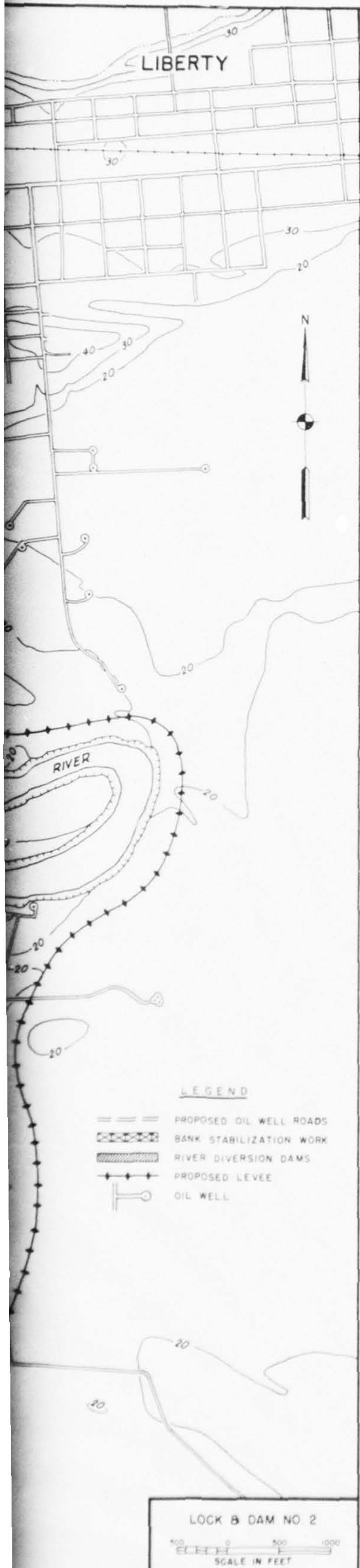
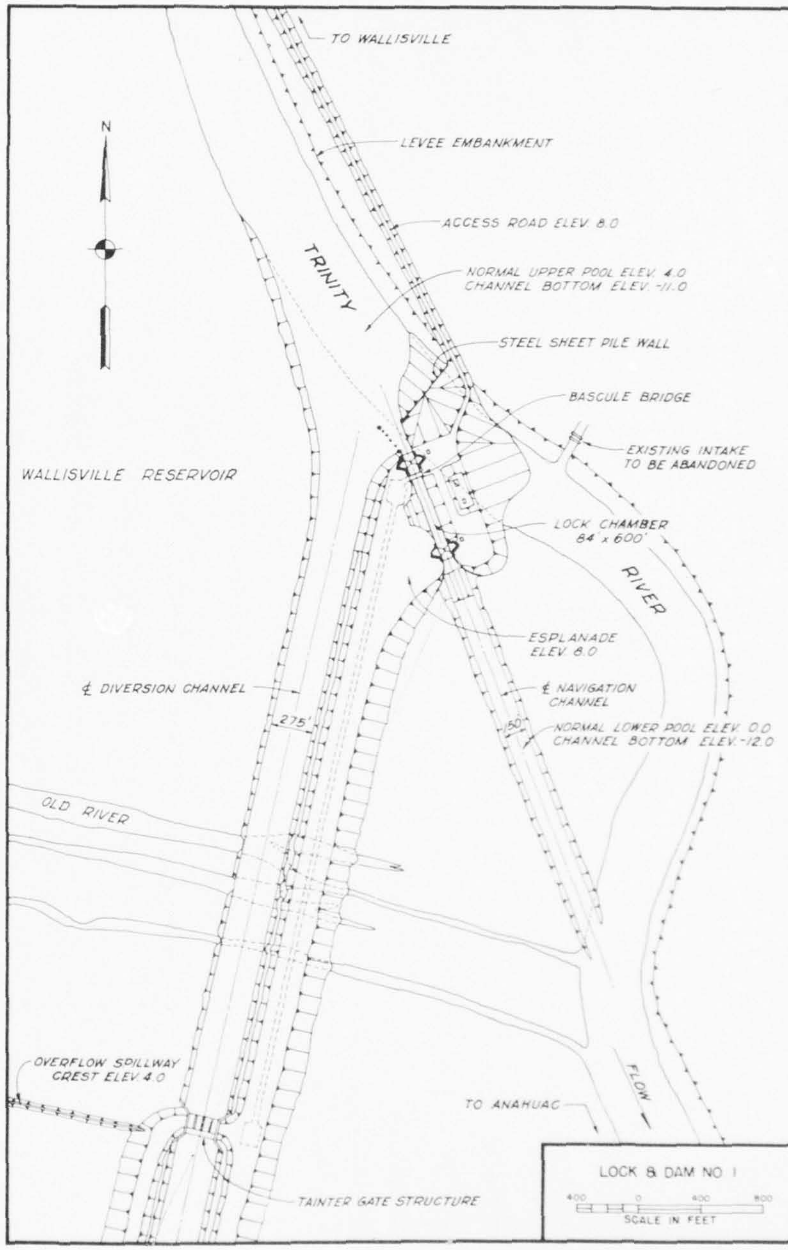






TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

SITE PLAN

LOCK AND DAM NO. 1 & NO. 2

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	ENGINEER, CHIEF, ENGINEERING DIVISION	LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY W.E.D. CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRIN. RIVER DATED
		FILE TRIN. 230-19

41. SUMMARY OF NAVIGATION LOCKS (INCLUDING COST).- The plan of improvement for the multiple purpose channel provides for construction of 22 navigation locks in addition to the lock provided for in the recommended Wallisville Reservoir project to serve in conjunction with the proposed navigation dams and the Wallisville, Livingston and Tennessee Colony Reservoirs to provide for navigation to Fort Worth, Texas. The locations of the proposed locks are shown on general plans, plates 4 thru 11, and in profile on plates 12 thru 15, page 18 to 29. The first cost of the proposed 22 locks is estimated at $181,705,560, as shown in table 6.

TABLE 6
SUMMARY OF FIRST COST OF NAVIGATION LOCKS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Lock number	Size of lock (ft.)	Normal lift (ft.)	Cost
Houston Ship Channel to upper reach of Wallisville Reservoir (Mile 0.0 to 35.5)			
1	84 x 600	4	(1)
Upper reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)			None
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)			
2	84 x 600	12	$ 8,240,500
3	84 x 600	20	8,885,720
4	84 x 600	24	9,575,610
5A	84 x 600	41	9,673,700
5B	84 x 600	30	11,328,120
6	84 x 600	7	8,757,490
7	84 x 600	30	9,338,030
8	84 x 600	24	8,580,720
9	84 x 600	18	7,504,280
10A	84 x 600	25	8,818,400
Total			90,702,570
Tennessee Colony Dam to lock & dam No. 12 (Mile 233.5 to 274.4)			
10B	84 x 600	27.5	10,424,090
11	84 x 600	7.5	9,521,970
Total			19,946,060
Lock & dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)			
12	84 x 600	14	7,170,470
13	84 x 600	24	8,801,880
14	84 x 600	18	7,973,280
15	84 x 600	18	7,563,650
16	84 x 600	12	6,546,180
17	84 x 600	16	7,042,610
Total			45,098,070

TABLE 6 (CONT'D)
SUMMARY OF FIRST COST OF NAVIGATION LOCKS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Lock number	Size of lock (ft.)	Normal lift (ft.)	Cost
Five-mile Creek to Dallas terminus (Mile 322.0 to 326.7) -			None
Dallas terminus to Dallas floodway (Mile 326.7 to 331.1) -			None
Dallas floodway (mile 331.1 to 338.8)			
18	56 X 400	24	$5,973,800
Dallas floodway to Fort Worth terminus (Mile 338.8 to 362.8)			
19	56 X 400	28	6,353,500
20	56 X 400	28	6,859,340
21	56 X 400	28	6,772,220
Total			19,985,060
Fort Worth terminus to and including Riverside bridges (Mile 362.8 to 369.8).-			None
Total - Mile 0.0 to 369.8			$181,705,560

Note: Estimated first costs are based on prices as of January 1962.
(1) Costs for a lock 84 feet wide by 600 feet long are included in Wallisville reservoir project recommended in separate report.

42. LOCK DESIGN INFORMATION.- The lock sizes selected for the proposed multiple purpose channel are based on a project formulation lock-size study, given in appendix III. The study considered the size of barges and probable make-up of the barge tows that would be used for movement of the prospective commerce on the channel, the water demand of the locks on the available water supply for lockages and the lockage time required for transits of the standard barge tows through the locks. The study shows that locks with clear basin dimensions of 84 feet wide by 600 feet long would be the most feasible lock size for transits of tows moving on the channel below Dallas, and that locks with clear basin dimensions of 56 feet wide by 400 feet long would be most feasible for the channel upstream of Dallas.

43. A lock 56 feet wide by 400 feet long is recommended for Wallisville Dam in the Chief of Engineers report contained in House Document No. 215, 87th Congress, 1st Session, to serve the needs of navigation to Liberty, Texas, with such modification thereof as in the discretion of the Chief of Engineers may be advisable, including a large lock if found justified. The project formulation lock-size study shows that the prior recommended 56- x 400-foot lock would not serve the needs of prospective commerce on the multiple purpose channel at the Wallisville Reservoir Dam, and that a 84- x 600-foot lock would be most feasible at the Wallisville Dam. Accordingly, the plan of improvement for the multiple purpose channel provides for an 84- x 600 foot

multiple purpose channel provides for an 84- x 600-foot lock at the Wallisville Dam. The cost of the recommended Wallisville Reservoir project is estimated at $9,162,000, which includes the cost of providing a lock, 84 feet wide by 600 feet long, in the Wallisville Dam, as set forth in the report of the District Engineer, accompanying House Document No. 215, 87th Congress, 1st Session.

44. The plan of improvement proposes that 18 locks be of the Arkansas River gravity wall type design, and that four locks, Nos. 5A, 6, 10B and 11, be of the U-frame type design. Pertinent data regarding the proposed navigation locks are given in table 7. Plates 19 and 20 show a plan layout and sections of a typical gravity type lock, having clear basin dimensions of 84 feet wide by 600 feet long. Locks providing clear dimensions of 56 feet wide by 400 feet long are of similar design as shown on plates 19 and 20. Plates 21 and 22 show a plan layout and sections of the U-frame type lock 10B, which illustrates the typical features of the other U-frame type locks Nos.5A, 6 and 11. Plates 23 and 24 show the log of borings made at the lock sites which were considered in determining the foundation requirements of the respective locks. The plan proposes that the Arkansas River type of locks be founded on steel bearing piles, battered in two directions to withstand lateral loads. With respect to the "U"-frame type of lock, the design does not preclude the use of piling, should detail foundation explorations show the need for such piling. Available data, however, does not indicate the need for such piling and they are not provided in the design. To reduce seepage losses under and around the lock structures, adequate steel sheet-pile walls, 20 feet maximum in length have been provided.

45. The requirements for diversion and care of water during construction of the several locks and dams varies at the several sites because of topographic differences, character of subsurface materials, and frequency of high river flows. Based on preliminary investigation, it is considered that earth levee coffer dams providing protection against a flood having a minimum frequency of occurrence of once in 10 years, would be adequate to serve the needs of estimating the cost of coffer dam construction for this report.

46. Typical illustrations of the extent of coffer dams considered in determining the estimated first cost of the proposed Trinity River locks and dams are shown on site maps as follows:

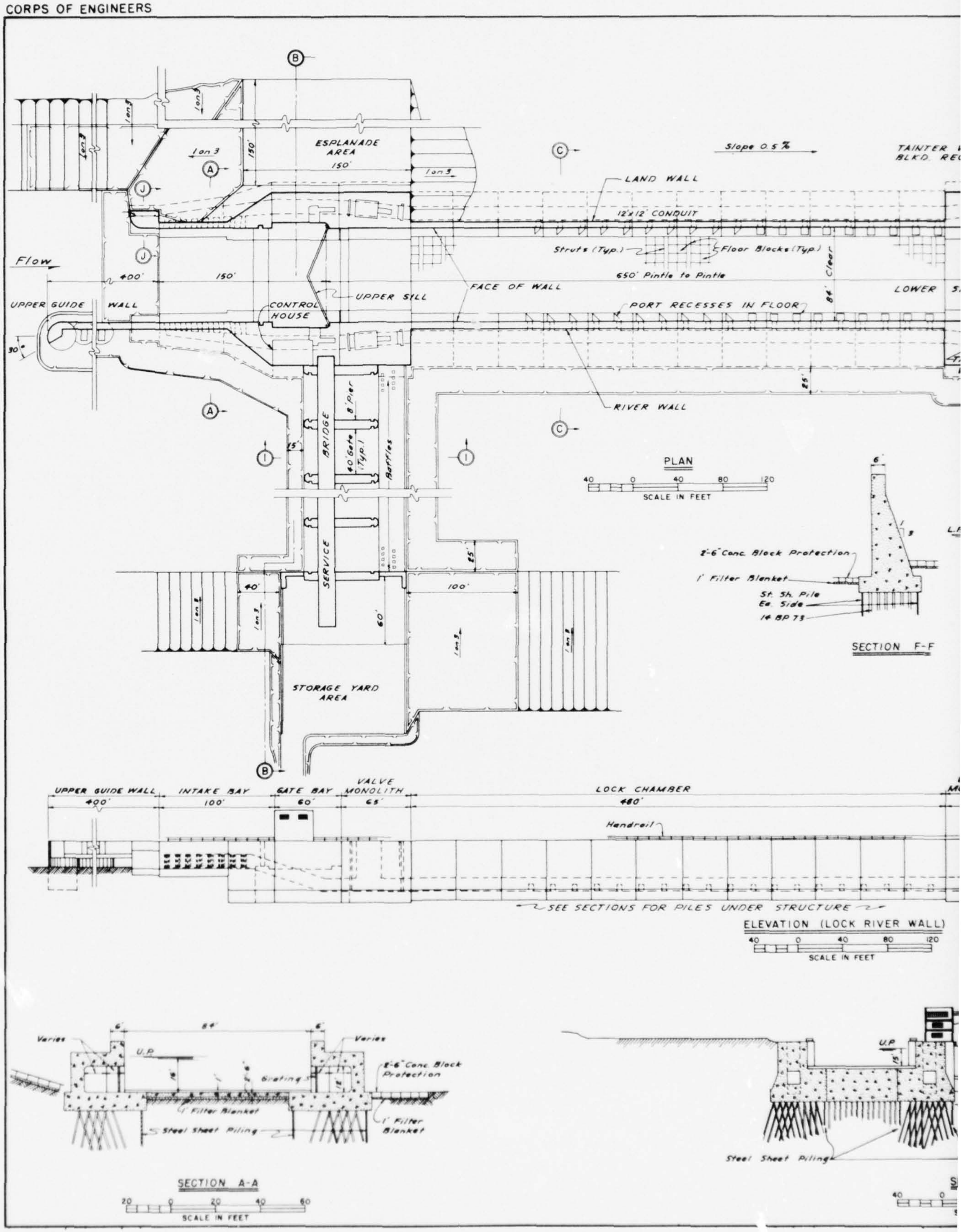
Lock and Dams No. 1 and No. 2, plate 18, page 35.
Lock No. 5B and Lock and Dam No. 19, plate 16, page 32.
Lock No. 10A and 10B, plate 17, page 34.
Lock and Dam Nos. 6 and 11, plate 25, page 46.

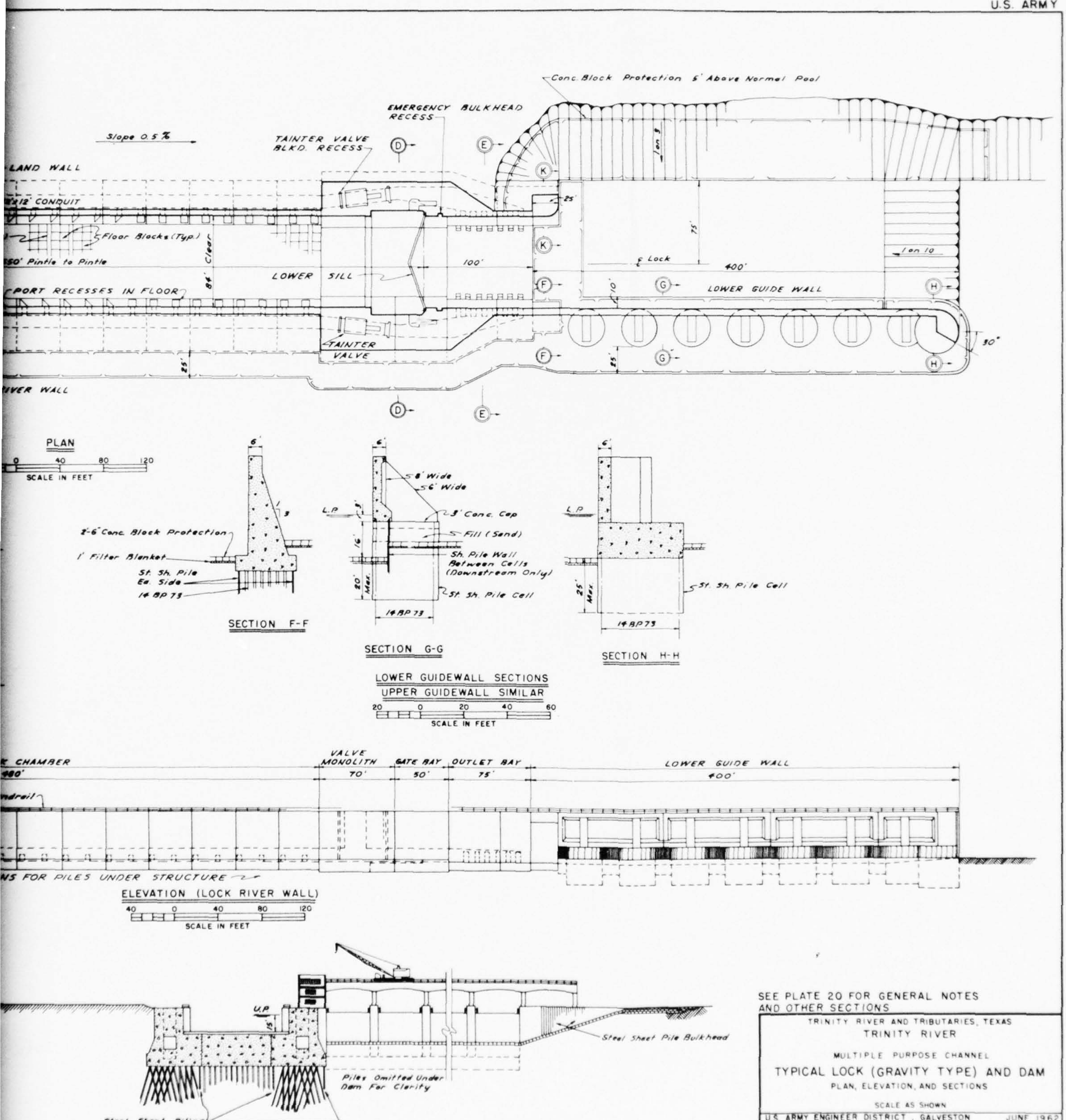
TABLE 7
PERTINENT DATA - NAVIGATION LOCKS
MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Lock No.	Size	Channel Mile	Normal (MSL) Pool elevation Lower	Normal (MSL) Pool elevation Upper	Lift in feet	Maximum design navigation stage Upper pool(1)	Maximum design navigation stage Lower pool(2)	Elevation top of Lock walls	Elevation top of esplanade	Free-board feet (3)	Height of wall in feet(4)	Type of foundation	Elevation of sills Lower	Elevation of sills Upper	Height of Lock gates in feet Lower	Height of Lock gates in feet Upper	Top elevation of guide walls Lower	Top elevation of guide walls Upper	Guidewall freeboard(9) Lower	Guidewall freeboard(9) Upper	Guidewall freeboard(10) Lower	Guidewall freeboard(10) Upper
1(5)	84x600	28.30	0.0	4.0	4.0	5.0	5.0	8.0	8.0	4.0	24.0	Piling	-16.0	-16.0	24.0	24.0	8.0	8.0	8.0	4.0	3.[illegible]	3.0
2(5)	84x600	47.45	4.0	16.0	12.0	17.0	11.5	25.0	29.0	9.0	42.0	"	-14.0	1.0	33.0	18.0	25.0	25.0	21.0	9.0	13.[illegible]	[illegible]
3	84x600	59.08	16.0	36.0	20.0	37.0	27.5	43.0	46.0	7.0	45.0	"	1.0	21.0	38.0	18.0	43.0	43.0	27.0	7.0	15.[illegible]	6.0
4	84x600	74.85	36.0	60.0	24.0	61.0	51.0	67.0	75.0	7.0	49.0	"	21.0	45.0	42.0	18.0	67.0	67.0	31.0	7.0	16.[illegible]	6.0
5A	84x600	98.00	60.0	101.0	41.0	103.0	79.0	110.0	110.0	9.0	68.0	U-Frame	45.0	86.0	61.0	20.0	86.0	110.0	26.0	9.0	7.[illegible]	[illegible]
5B(6)	84x600	99.20	101.0	131.0	30.0	131.0	103.0	140.0	140.0	7.0	57.0(11)	Piling	86.0	86.0	48.0	54.0	110.0	138.0	9.0	7.0	7.[illegible]	[illegible]
6 (6)	84x600	147.92	131.0	138.0	7.0	139.0	136.0	145.0	145.0	7.0	62.0	U-Frame	36.0	123.0	55.0	18.0	138.0	145.0	7.0	7.0	2.[illegible]	[illegible]
7	84x600	183.92	138.0	168.0	30.0	169.0	159.0	175.0	182.0	7.0	55.0	Piling	123.0	153.0	48.0	18.0	175.0	175.0	37.0	7.0	16.[illegible]	[illegible]
8	84x600	207.55	168.0	192.0	24.0	193.0	183.0	199.0	208.0	7.0	49.0	"	153.0	177.0	42.0	18.0	199.0	199.0	36.0	7.0	16.0	[illegible]
9	84x600	217.95	192.0	210.0	18.0	211.0	199.0	217.0	225.0	7.0	43.0	"	177.0	195.0	36.0	18.0	217.0	217.0	25.0	7.0	18.0	[illegible]
10A	84x600	233.0	210.0	235.0	25.0	237.0	218.5	244.0	244.0	7.0	52.0	"	195.0	220.0	45.0	20.0	226.0	244.0	16.0	9.0	7.5	[illegible]
10B(7)	84x600	233.61	235.0	262.5	27.5	285.0	237.0	305.0	305.0	24.5	88.0(11)	U-Frame	220.0	220.0	67.0	35.0	244.0	[illegible]	9.0	7.0	7.0	[illegible]
11(7)	84x600	258.91	[illegible]	270.0	7.5	285.0	259.5	287.0	287.0	17.0	70.0	"	220.0	255.0	53.0	18.0	268.0	287.0	6.5	17.0	8.5	[illegible]
12(8)	84x600	274.51	270.0	284.0	14.0	286.0	285.0	294.0	305.0	10.0	42.0	Piling	255.0	269.0	32.0	18.0	294.0	294.0	24.0	10.0	9.0	[illegible]
13	84x600	286.64	284.0	308.0	24.0	309.0	297.0	315.0	325.0	7.0	49.0	"	269.0	293.0	42.0	18.0	315.0	315.0	31.0	7.0	18.0	[illegible]
14	84x600	298.38	308.0	326.0	18.0	327.0	321.0	333.0	348.0	7.0	43.0	"	293.0	311.0	36.0	18.0	333.0	333.0	25.0	7.0	12.0	[illegible]
15	84x600	306.31	326.0	344.0	18.0	345.0	338.0	351.0	361.0	7.0	43.0	"	311.0	329.0	36.0	18.0	351.0	351.0	25.0	7.0	13.0	6.0
16	84x600	311.25	344.0	356.0	12.0	357.0	350.5	363.0	369.0	7.0	37.0	"	329.0	341.0	30.0	18.0	363.0	363.0	19.0	7.0	12.5	6.0
17	84x600	317.31	356.0	372.0	16.0	373.0	363.5	379.0	394.0	7.0	41.0	"	341.0	357.0	34.0	18.0	379.0	379.0	23.0	7.0	15.5	6.0
18	56x400	331.31	372.0	396.0	24.0	397.0	385.5	403.0	419.0	7.0	49.0	"	357.0	381.0	42.0	18.0	403.0	403.0	31.0	7.0	17.5	6.0
19	56x400	342.51	396.0	424.0	28.0	425.0	406.0	431.0	433.0	7.0	53.0	"	381.0	409.0	46.0	18.0	431.0	431.0	35.0	7.0	25.0	6.0
20	56x400	351.91	424.0	452.0	28.0	453.0	430.0	459.0	463.0	7.0	53.0	"	409.0	437.0	46.0	18.0	459.0	459.0	35.0	7.0	29.0	8.0
21	56x400	360.17	452.0	480.0	28.0	481.0	457.0	487.0	488.0	7.0	53.0	"	437.0	465.0	46.0	18.0	487.0	487.0	35.0	7.0	30.0	6.0

(1) Mean sea level elevation under maximum operation discharge.
(2) Mean sea level tailwater elevation under maximum operation discharge.
(3) Top of lock wall above normal upper pool elevation.
(4) Measured from top of lock floor.
(5) Locks No. 1 and 2 provide for navigation through Wallisville reservoir between pool elevation 4.0 to 1.0.
(6) Locks No. 5B and 6 provide for navigation through Livingston reservoir between pool elevation 131.0 to 101.0.
(7) Locks No. 10B and 11 provide for navigation through Tennessee Colony reservoir between pool elevation 262.5 to 235.0.
(8) Locks No. 10B, 11, and 12 provide for navigation through Tennessee Colony reservoir when flood control pool is full to elevation [illegible]
(9) Freeboard in feet between top of guidewall and normal pool elevation.
(10) Freeboard in feet between top of guidewall and maximum design navigation stage equal to tailwater elevation under operating discharge
(11) At upper gate bay and valve monolith only.

CORPS OF ENGINEERS





SEE PLATE 20 FOR GENERAL NOTES AND OTHER SECTIONS

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

TYPICAL LOCK (GRAVITY TYPE) AND DAM

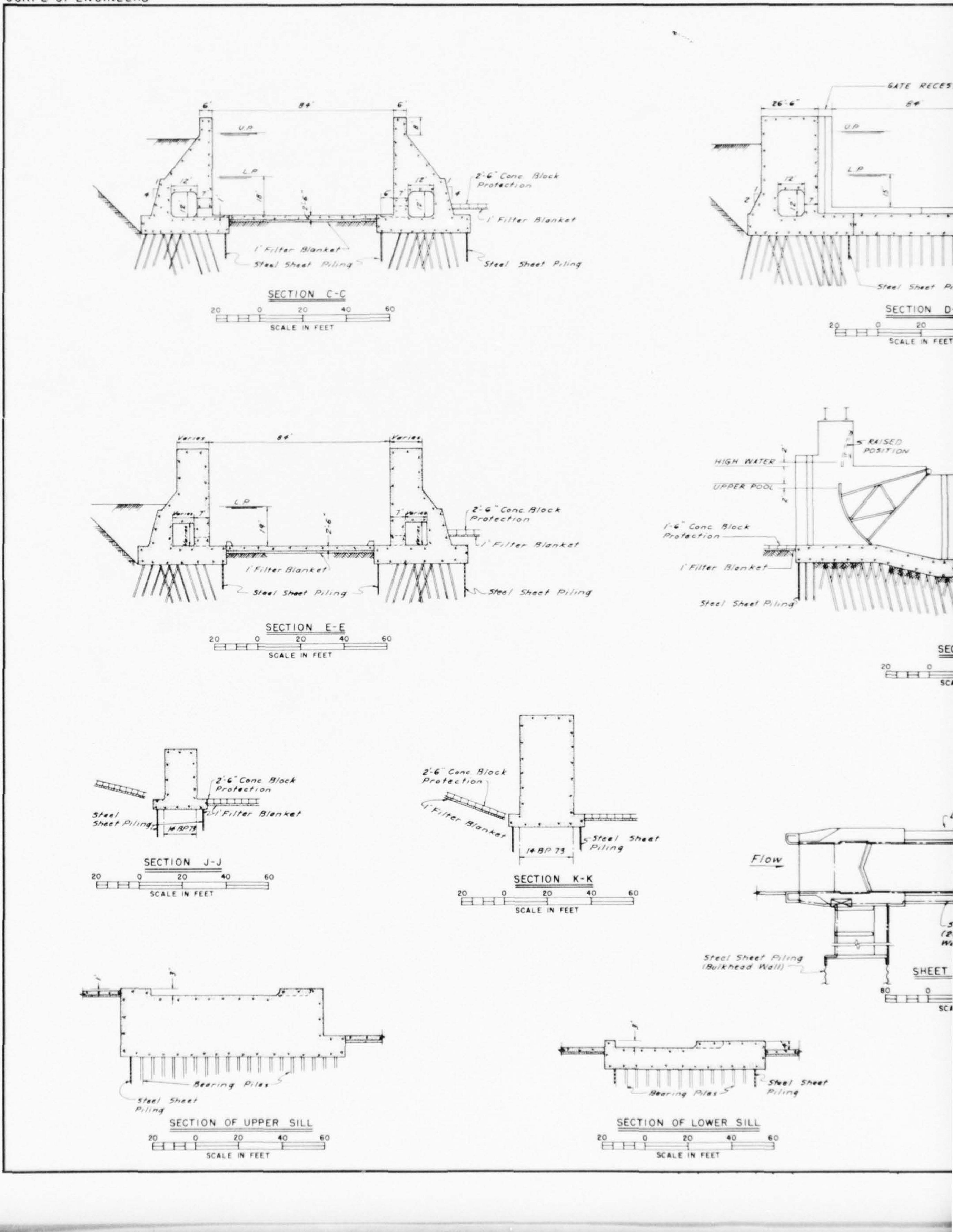
PLAN, ELEVATION, AND SECTIONS

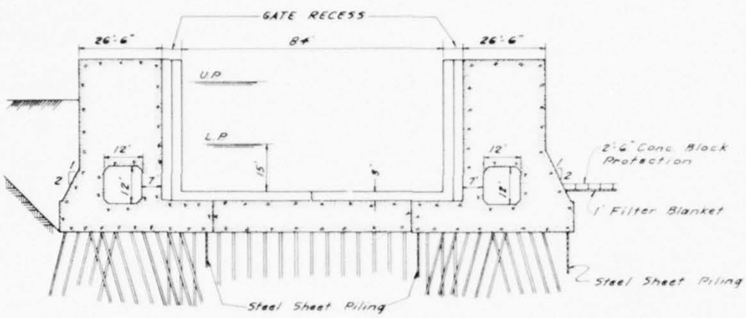
SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER
PREPARED — HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED — FILE TRIN 230-19

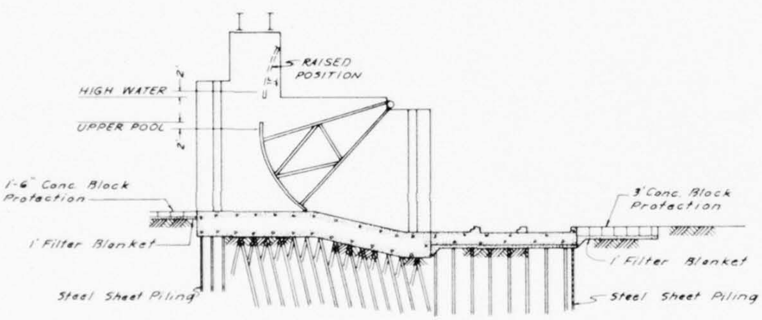
CORPS OF ENGINEERS





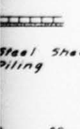
SECTION D-D

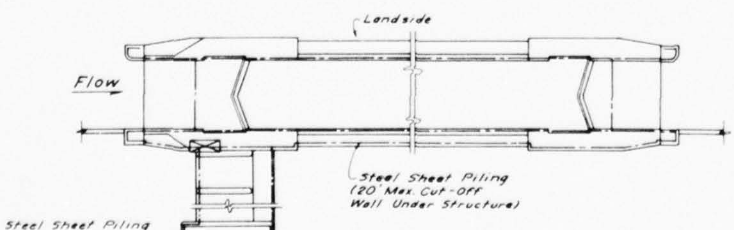
20 0 20 40 60
SCALE IN FEET



SECTION I-I

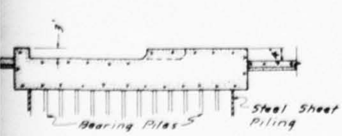
20 0 20 40 60
SCALE IN FEET





SHEET PILE LAYOUT

80 0 80 160 240
SCALE IN FEET



SECTION OF LOWER SILL

20 0 20 40 60
SCALE IN FEET

GENERAL NOTES

LOCKS

1. THE 84'x600' LOCK SHOWN ON PLATES 17 AND 18 IS REPRESENTATIVE OF LOCKS 2, 3, 4, 7, 8, 9, 10A, 12, 13, 14, 15, 16, AND 17.
2. OTHER LOCKS ARE SIMILAR EXCEPT FOR THE FOLLOWING FEATURES:
   a. LOCKS 5A, 6, 10B, AND 11 ARE U-FRAME LOCKS (WITHOUT BEARING PILES, SEE PLATES 19 AND 20).
   b. LOCKS 5B AND 10B (REFER TO PLATES 19 AND 20).
      (1) CHAMBER IS APPROXIMATELY 20 FEET LONGER TO ACCOMMODATE THE GATE GUARD.
      (2) A SINGLE LANE BASCULE BRIDGE IS PROVIDED.
      (3) LOCK WALLS AT DAM SECTION ARE EXTENDED TO PROVIDE RETAINING WALLS. UPPER GATE HEIGHTS ARE ADJUSTED ACCORDINGLY.
   c. LOCKS 18, 19, 20, AND 21 - SMALLER LOCKS (56'x 400' CHAMBER IN LIEU OF 84'x 600' AND 300-FOOT GUIDEWALL LENGTHS IN LIEU OF 400-FOOT).
3. THE FOLLOWING CRITERIA APPLIES TO LOCKS 2 THROUGH 21, EXCEPT AS NOTED.
   a. DEPTH AT SILLS - 15 FEET BELOW RESPECTIVE POOLS.
   b. TOP OF WALLS - 7 FEET ABOVE NORMAL UPPER POOL OR 2 FEET ABOVE MAXIMUM NAVIGATION POOL WHICHEVER IS HIGHER, EXCEPT FOR 5B & 10B.
   c. BOTTOM OF CHAMBER FLOOR - 18 FEET BELOW LOWER POOL.
   d. BOTTOM OF CULVERT - 19 FEET BELOW LOWER POOL.
   e. SIZE OF CULVERTS - 12' x 12'.
   f. HEIGHT OF GATES - 1 FOOT BELOW TOP OF SILL TO 2 FEET ABOVE UPPER POOL, EXCEPT UPPER GATES AT LOCKS 5B AND 10B.
4. THE FOLLOWING CRITERIA IS USED WHERE APPLICABLE:
   a. STEEL BEARING PILE CAPACITY - 90 TONS MAX, UNDER EXTREME LOADING.
   b. SHEET PILE CUTOFF WALL LENGTH - 20 FEET MAXIMUM.
   c. EMBANKMENT PROTECTION - 5 FEET ABOVE NORMAL POOL ON EARTH SLOPES OPPOSITE GUIDE WALLS AND AT BASE OF WALLS AS SHOWN.
5. GUIDE WALL AND GUARD WALL SECTIONS ARE TYPICAL FOR LOCKS 2 THROUGH 21.
6. GRAVITY TYPE WALLS ON BEARING PILES ARE DESIGNED TO BE INDEPENDENTLY STABLE.

DAMS

1. THE CONTROL DAM SHOWN IS REPRESENTATIVE OF DAMS 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20, AND 21.
2. CONTROL DAMS ARE NOT REQUIRED AT SITES 5A, 5B, 10A, AND 10B.
3. A CONCRETE SPILLWAY IS PROVIDED FOR DAM 11.
4. THE FOLLOWING CRITERIA APPLIES TO ALL CONTROL DAMS.
   a. WIDTH OF GATES - 40 FEET.
   b. WIDTH OF PIERS - 8 FEET.
   c. WIDTH OF MONOLITHS - 48 FEET.
   d. TOP OF GATES - 2 FEET ABOVE UPPER POOL.
   e. TOP OF PIERS, ABUTMENTS AND STORAGE YARD - 2 FEET ABOVE HIGH WATER.
   f. SILL ELEVATION - 12 FEET BELOW UPPER POOL ELEVATION OR DESIGN APPROACH CHANNEL BOTTOM, WHICHEVER IS THE LOWER ELEVATION.

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

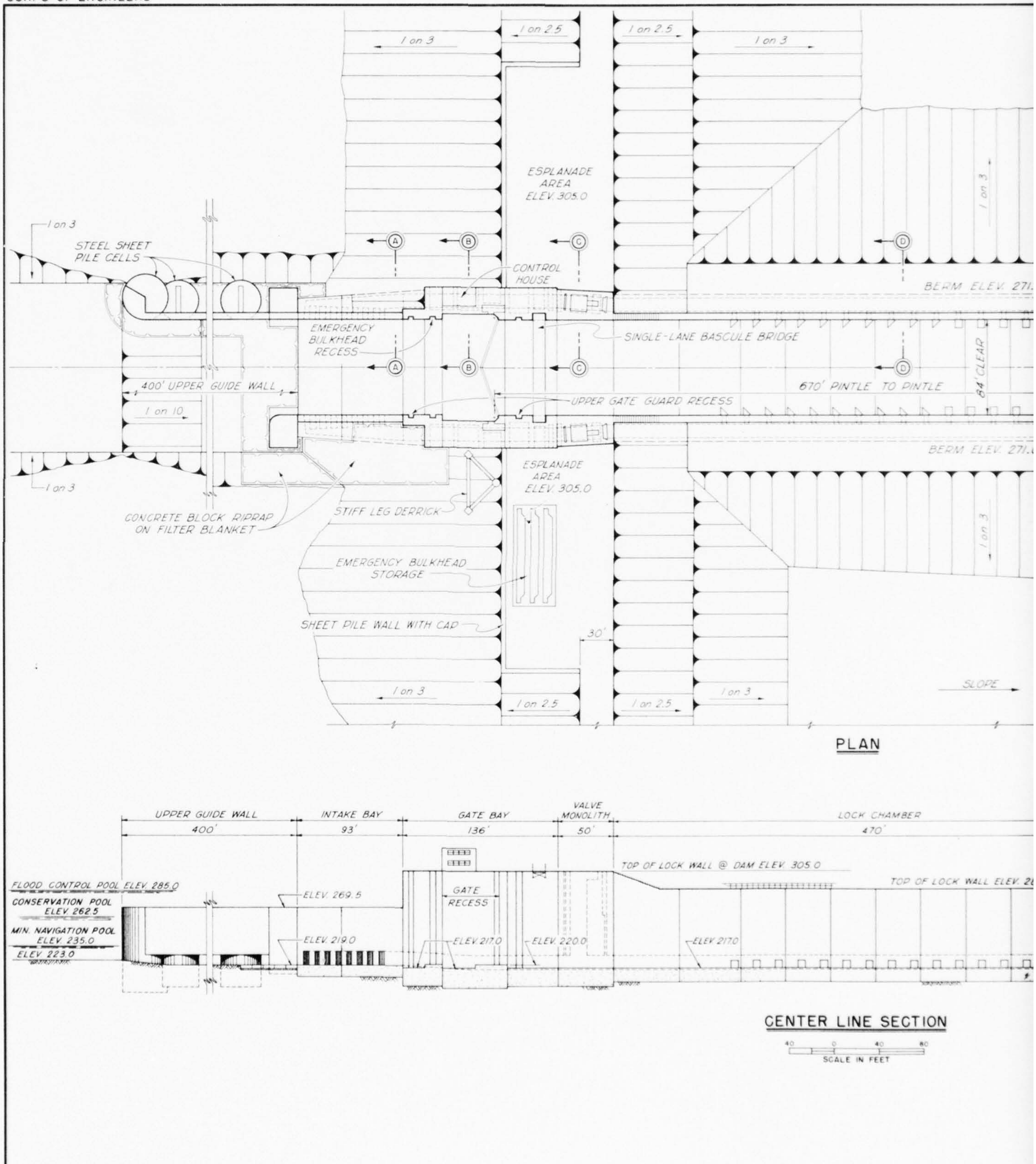
MULTIPLE PURPOSE CHANNEL

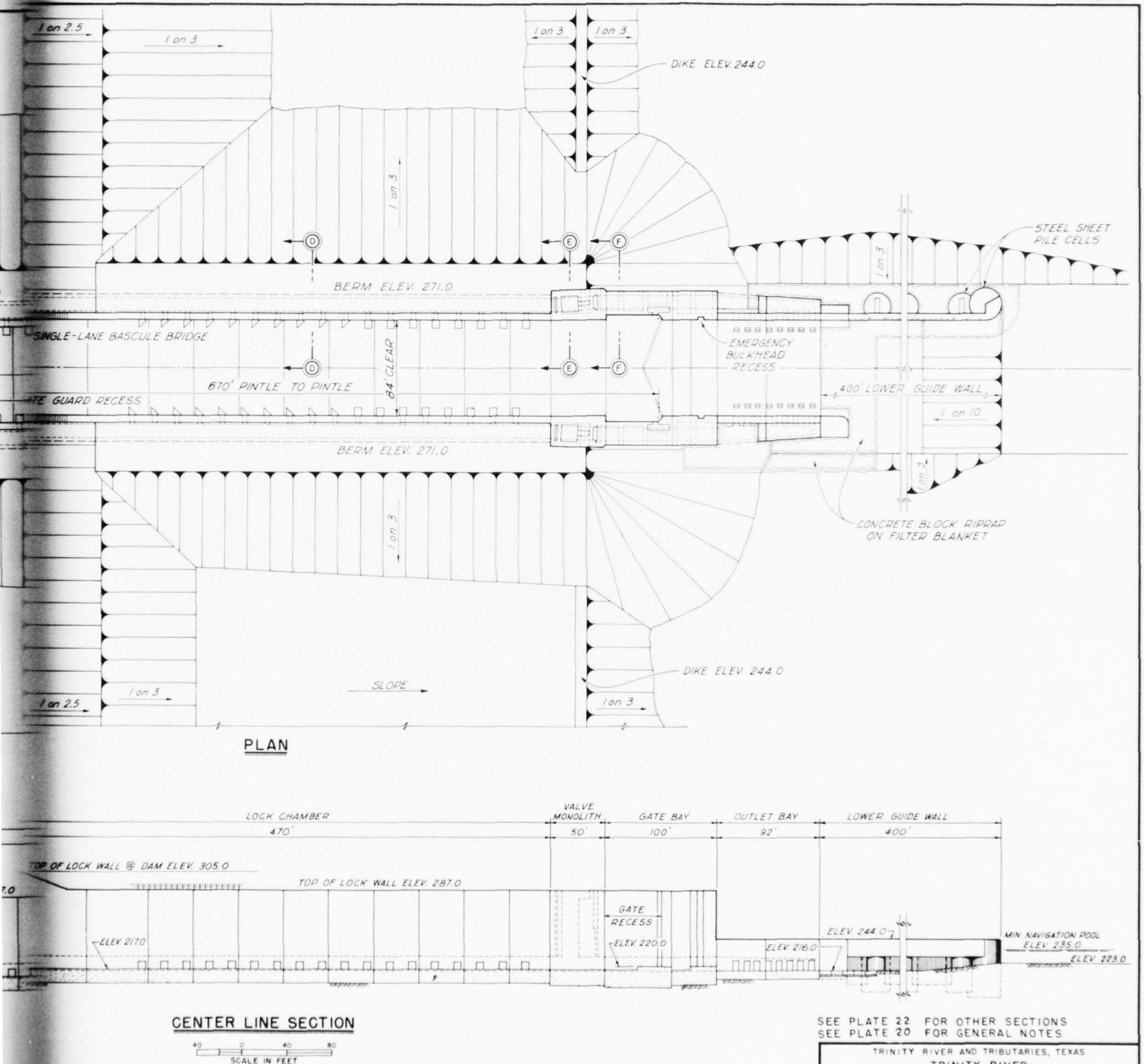
TYPICAL LOCK (GRAVITY TYPE) AND DAM
SECTIONS

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON		JUNE 1962
SUBMITTED: [signature] ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED: [signature] ENGINEER, CHIEF, ENGINEERING DIVISION	APPROVED: [signature] LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: Arthur J. Koll, ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY: BAC / CHECKED BY: [illegible]	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED / FILE TRIN 230-19

CORPS OF ENGINEERS



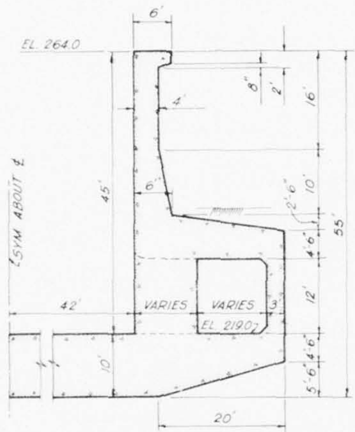


SEE PLATE 22 FOR OTHER SECTIONS
SEE PLATE 20 FOR GENERAL NOTES

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL
TYPICAL LOCK (U-FRAME TYPE - LOCK 10B)
PLAN AND ELEVATION
SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

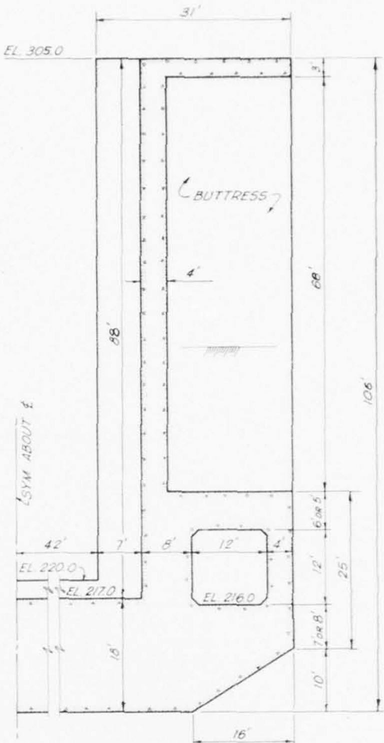
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	LT. COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY W.E.D. CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED; FILE TRIN. 230-19

CORPS OF ENGINEERS



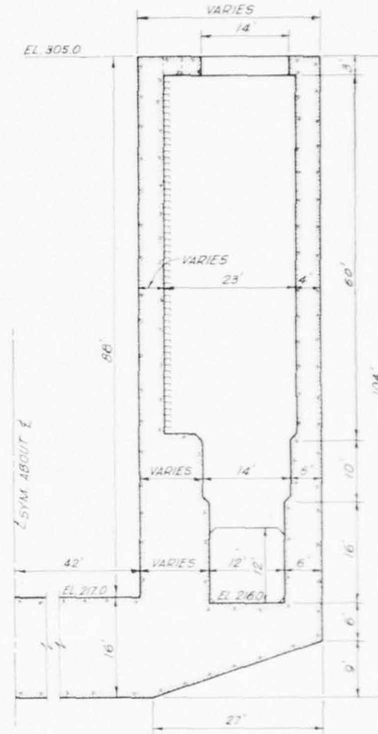
SECTION A-A

10 0 10 20 30
SCALE IN FEET



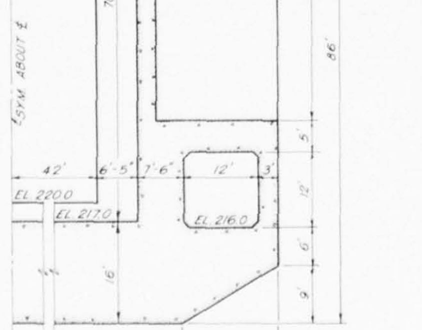
SECTION B-B

10 0 10 20 30
SCALE IN FEET



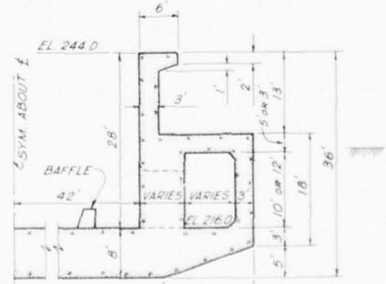
SECTION C-C

10 0 10 20 30
SCALE IN FEET



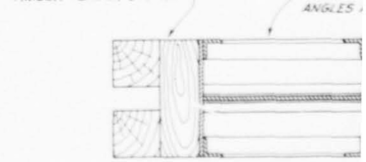
SECTION F-F

10 0 10 20 30
SCALE IN FEET



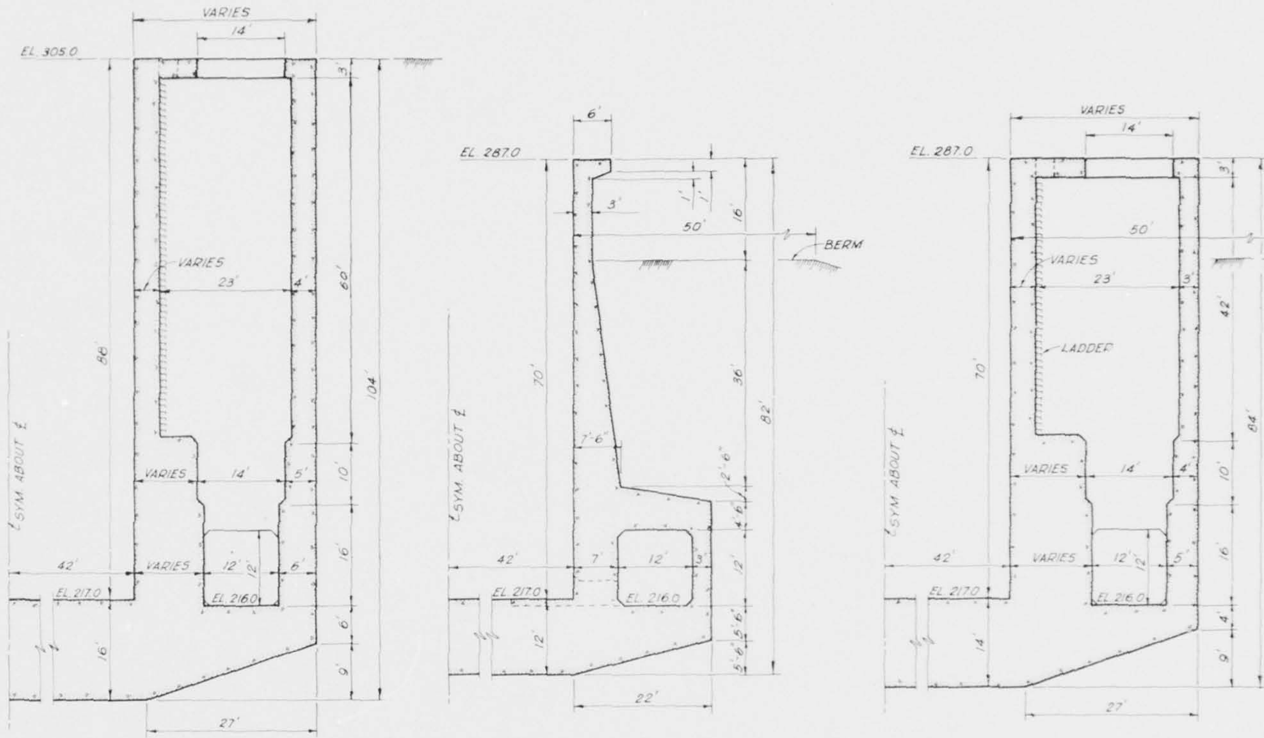
SECTION G-G

10 0 10 20 30
SCALE IN FEET



GATE GUARD SECTION

1 0 1 2 3 4
SCALE IN FEET



SECTION C-C

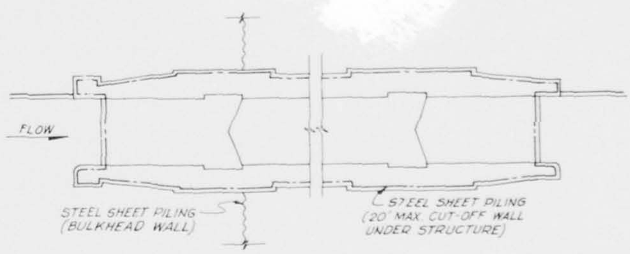
10 0 10 20 30
SCALE IN FEET

SECTION D-D

10 0 10 20 30
SCALE IN FEET

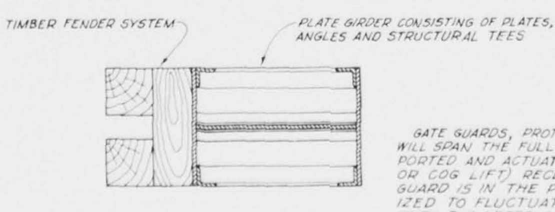
SECTION E-E

10 0 10 20 30
SCALE IN FEET



SHEET PILE LAYOUT

80 0 80 160 240
SCALE IN FEET



GATE GUARD SECTION

1 0 1 2 3 4
SCALE IN FEET

GATE GUARDS, PROTECTING THE UPPER GATES AT LOCKS 5B & 10B, WILL SPAN THE FULL WIDTH OF THE LOCK. THEY WILL BE SUPPORTED AND ACTUATED BY A MECHANIZED DEVICE (HYDRAULIC OR COG LIFT) RECESSED IN EACH WALL. WHEN THE GATE GUARD IS IN THE PROTECTIVE POSITION IT WILL BE MECHANIZED TO FLUCTUATE WITH THE RESPECTIVE POOL LEVEL. WHEN THE UPPER GATE IS IN THE OPEN POSITION THE GATE GUARDS WILL REST ON THE BOTTOM OF THE LOCK. GATE GUARDS WILL BE MECHANICALLY SYNCHRONIZED WITH THE UPPER GATE TO BE IN THE PROTECTIVE POSITION BEFORE AND AFTER THE UPPER GATE IS OPENED.

SEE PLATE 20 FOR GENERAL NOTES

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

MULTIPLE PURPOSE CHANNEL
TYPICAL LOCK (U-FRAME TYPE - LOCK

SECTIONS

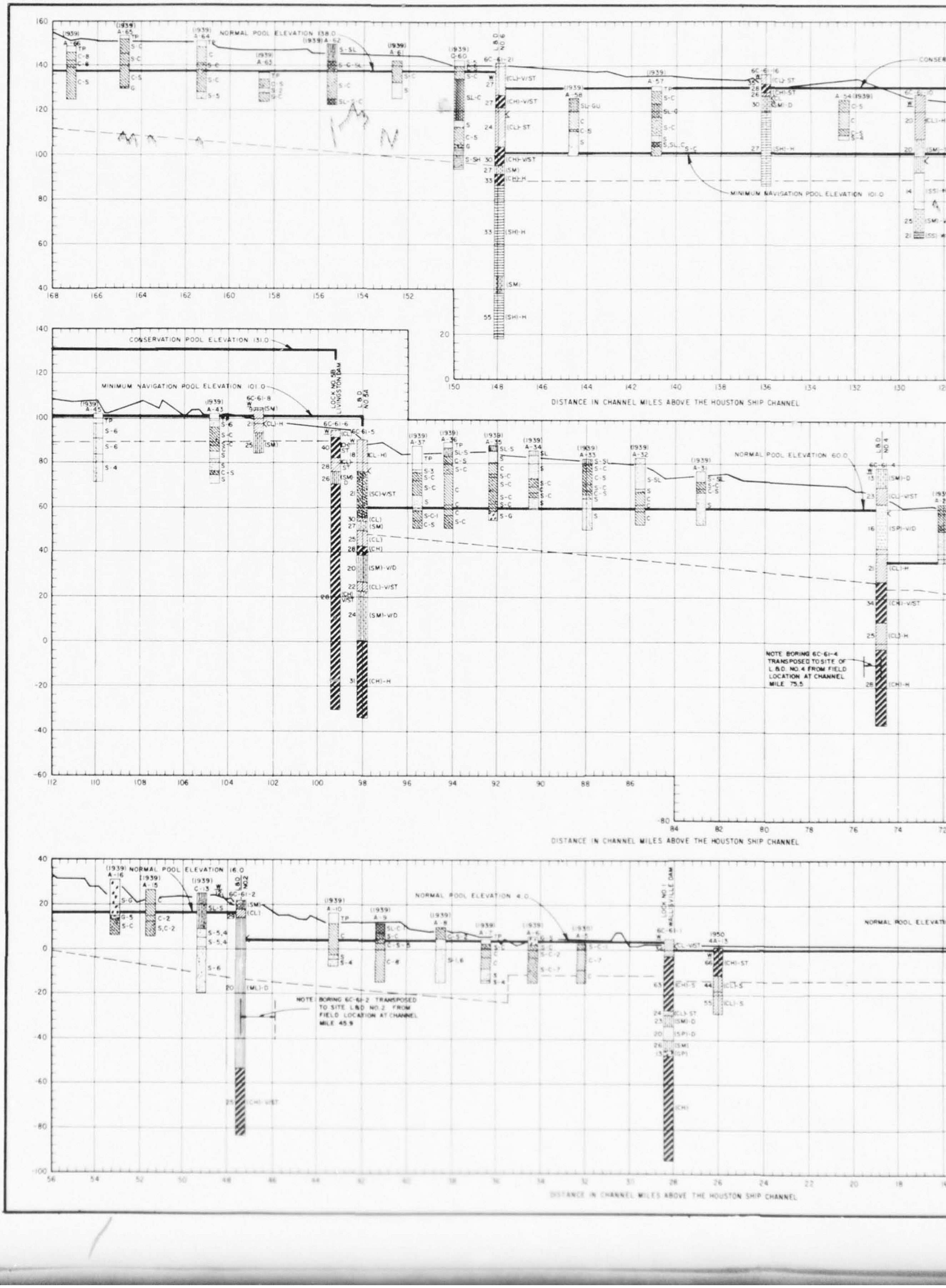
SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON JU

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT
PREPARED: HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPRE... REPORT ON TRINITY RIVER... / FILE TRIN 230-

2

CORPS OF ENGINEERS



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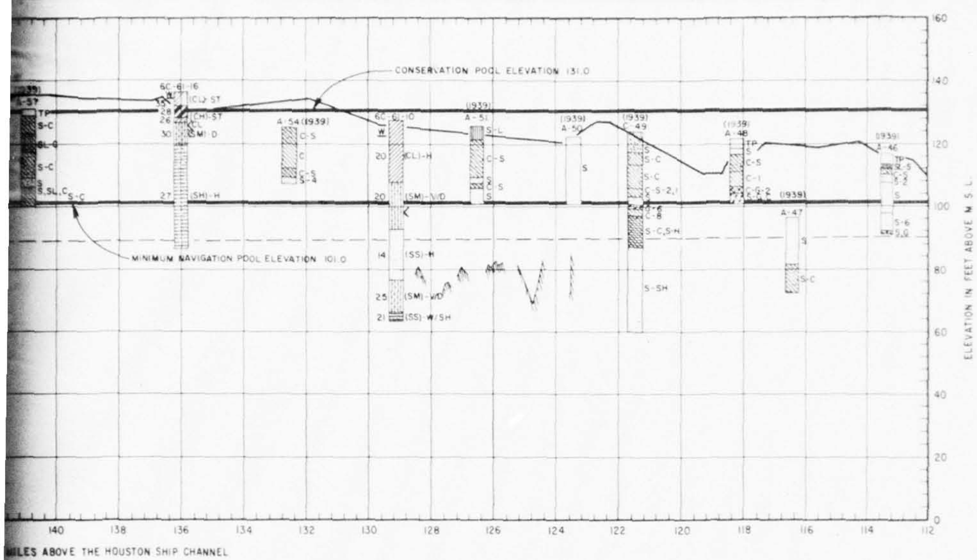
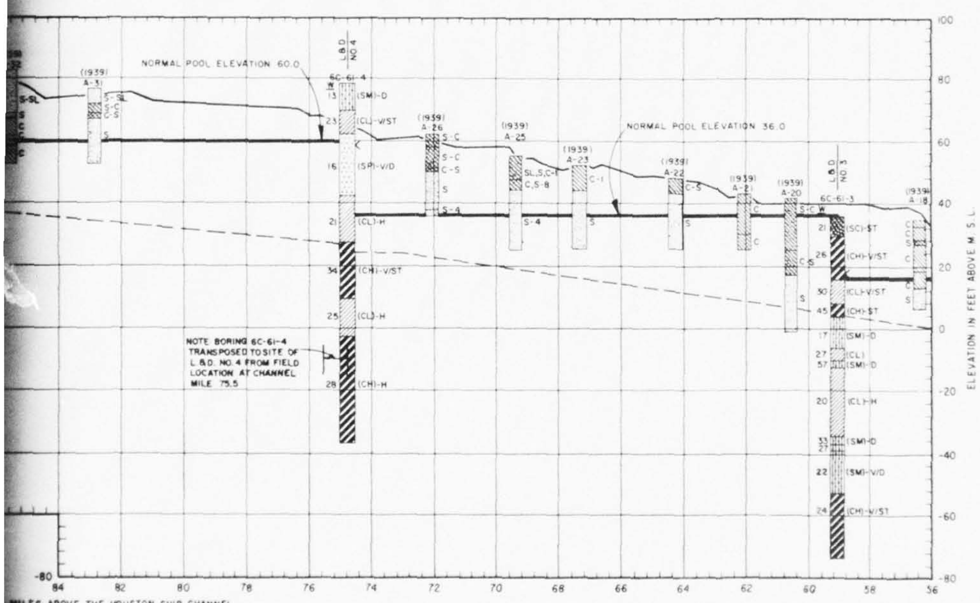
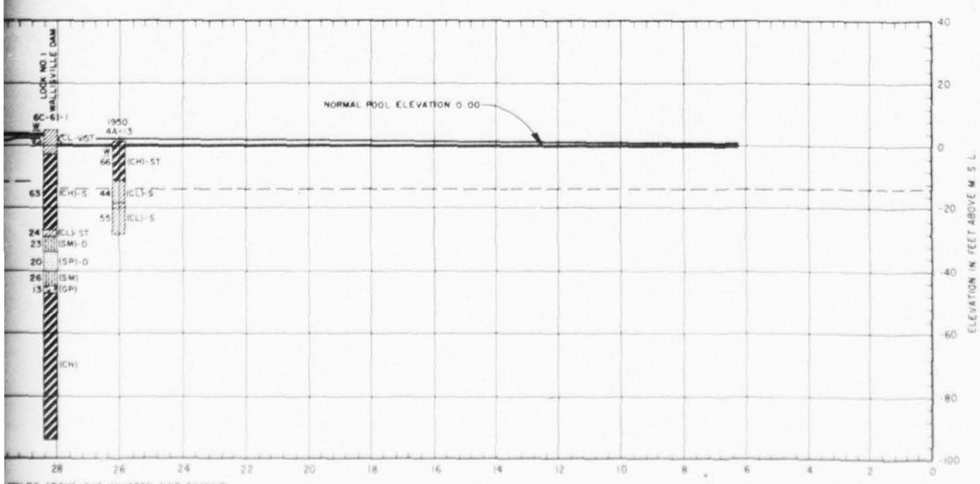






BORING LEGEND

1939		1961	
LS	LIMESTONE	LS	LIMESTONE
SS	SANDSTONE	SH	SHALE
SH	SHALE	SS	SANDSTONE
S	SAND	SH CL	SHALEY CLAY
SL	SILT	CH	FAT CLAY
C	CLAY	CL	LEAN CLAY
G	GRAVEL	SC	CLAYEY SAND SAND-CLAY MIXTURE
L	LIGNITE	ML	SILTY OR CLAYEY SAND
GU	GUMBO	SP	SAND POORLY GRADED
TP	TOP SOIL	SM	SILTY SAND SAND-SILT MIXTURE
		GP	SANDY GRAVEL POORLY GRADED

ABBREVIATIONS FOR BORING LOGS

1939	1961
1 - DARK	< - WATER TABLE
2 - LIGHT	W 60 MOISTURE CONTENT
3 - DRY	H - HARD
4 - SATURATED	S - SOFT
5 - FINE	D - DENSE
6 - COARSE	V/D - VERY DENSE
7 - SOFT	ST - STIFF
8 - HARD	V/ST - VERY STIFF
9 - FOSSILIFEROUS	F - FINE

LEGEND

- TOP OF LOW BANK
- NORMAL POOL ELEVATION
- BOTTOM OF PROPOSED CHANNEL
- ROCK SHOALS, LEDGES, AND ISLANDS

NOTE: 1939 BORING PROJECTED TO CENTER LINE OF PROPOSED CHANNEL

TRINITY RIVER AND TRIBUTARIES, TEX

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

PROFILES AND LOGS OF BOR

IN 2 SHEETS

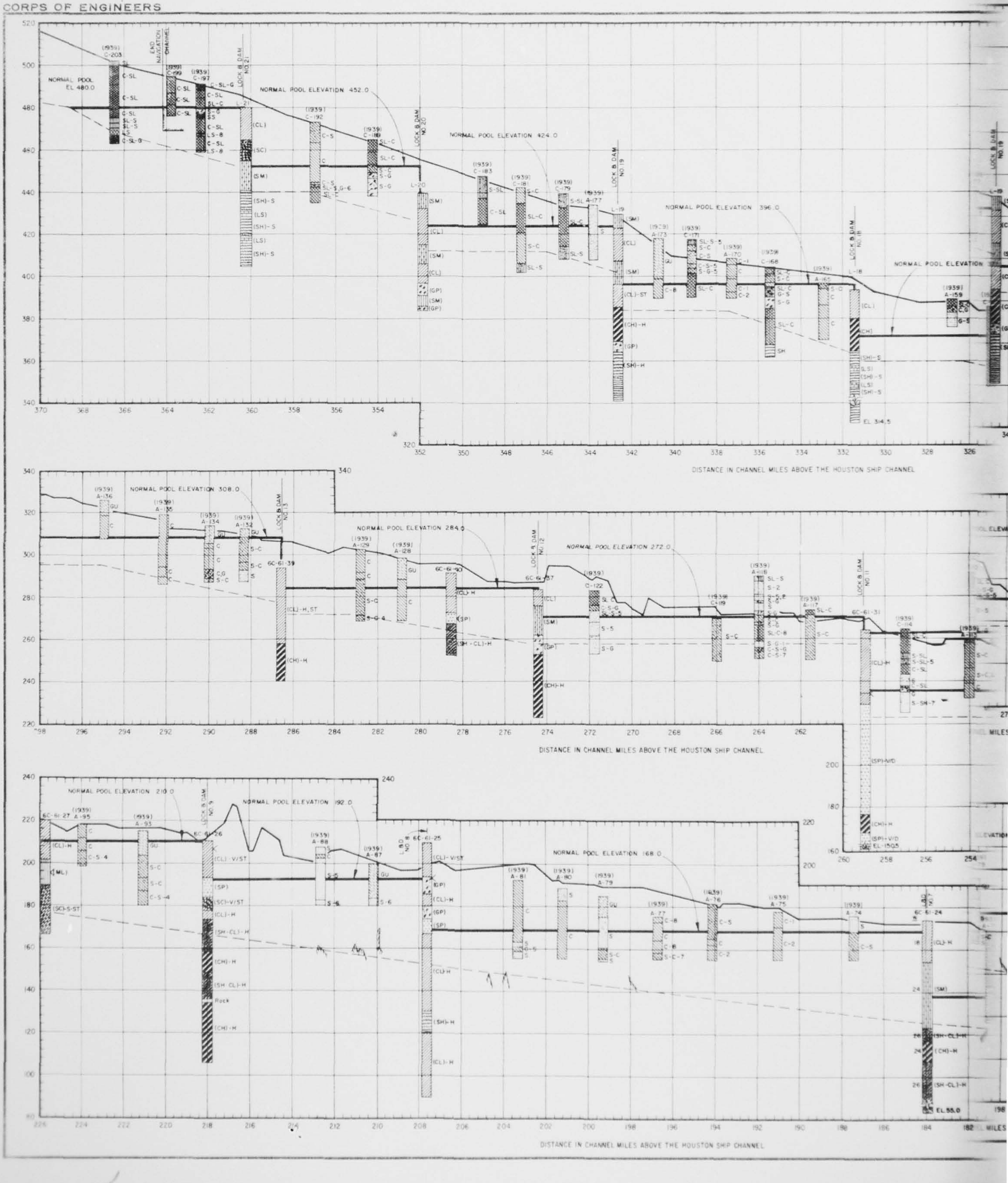
SCALE AS SHOWN

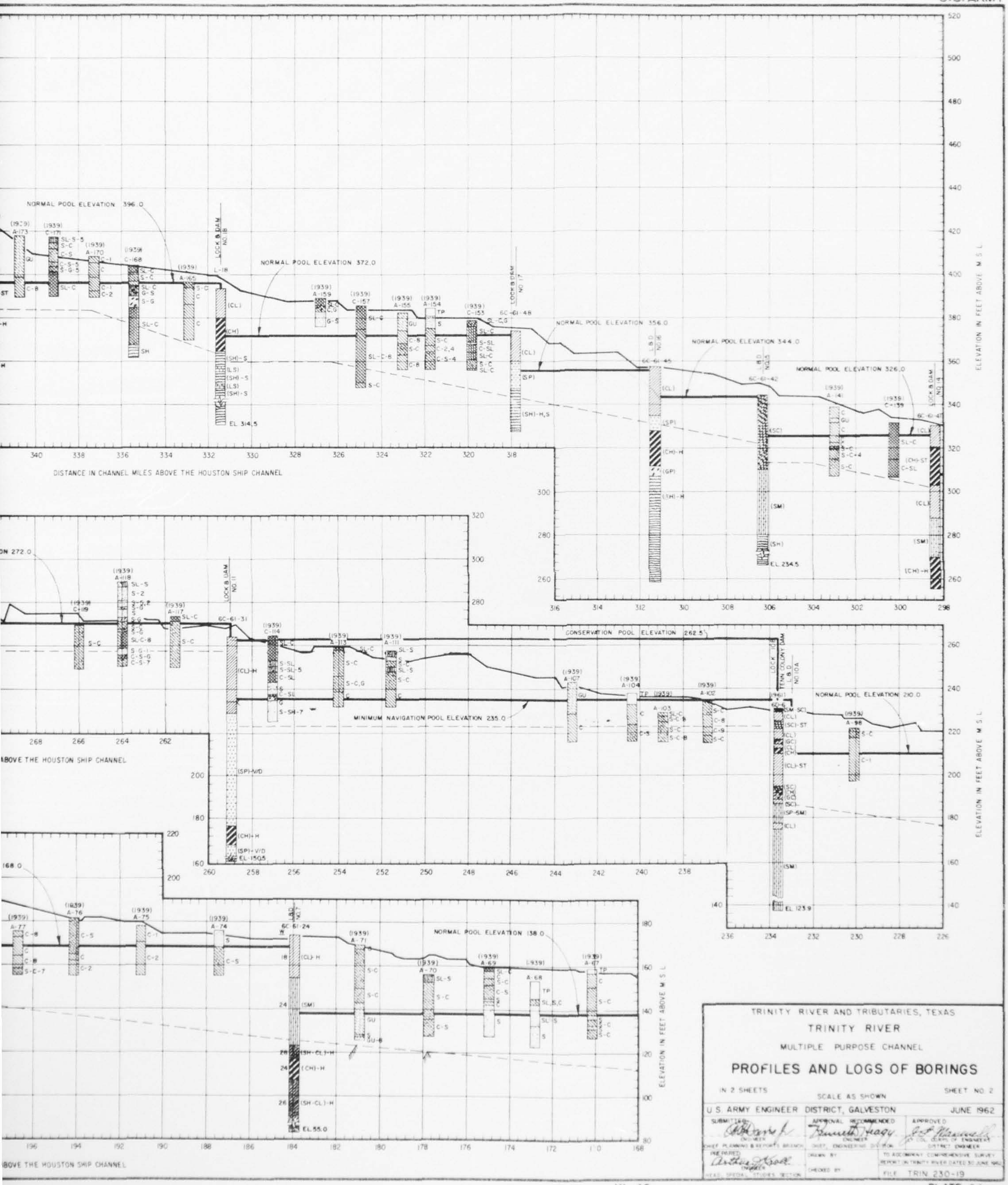
U.S. ARMY ENGINEER DISTRICT, GALVESTON

SUBMITTED	APPROVAL RECOMMENDED	APPROVE
ENGINEER CHIEF, PLANNING & REPORTS BRANCH	ENGINEER CHIEF, ENGINEERING DIVISION	LT COL CO
PREPARED Arthur J. Koll ENGINEER HEAD, SPECIAL STUDIES SECTION	DRAWN BY / CHECKED BY	TO ACCOMPANY REPORT ON TRINITY RIV / FILE TRIN 2

PL

CORPS OF ENGINEERS





TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

PROFILES AND LOGS OF BORINGS

IN 2 SHEETS | SCALE AS SHOWN | SHEET NO. 2

U.S. ARMY ENGINEER DISTRICT, GALVESTON | JUNE 1962

SUBMITTED: ENGINEER, CHIEF, PLANNING & REPORTS BRANCH

APPROVAL RECOMMENDED: ENGINEER, CHIEF, ENGINEERING DIVISION

APPROVED: LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER

PREPARED: HEAD, SPECIAL STUDIES SECTION

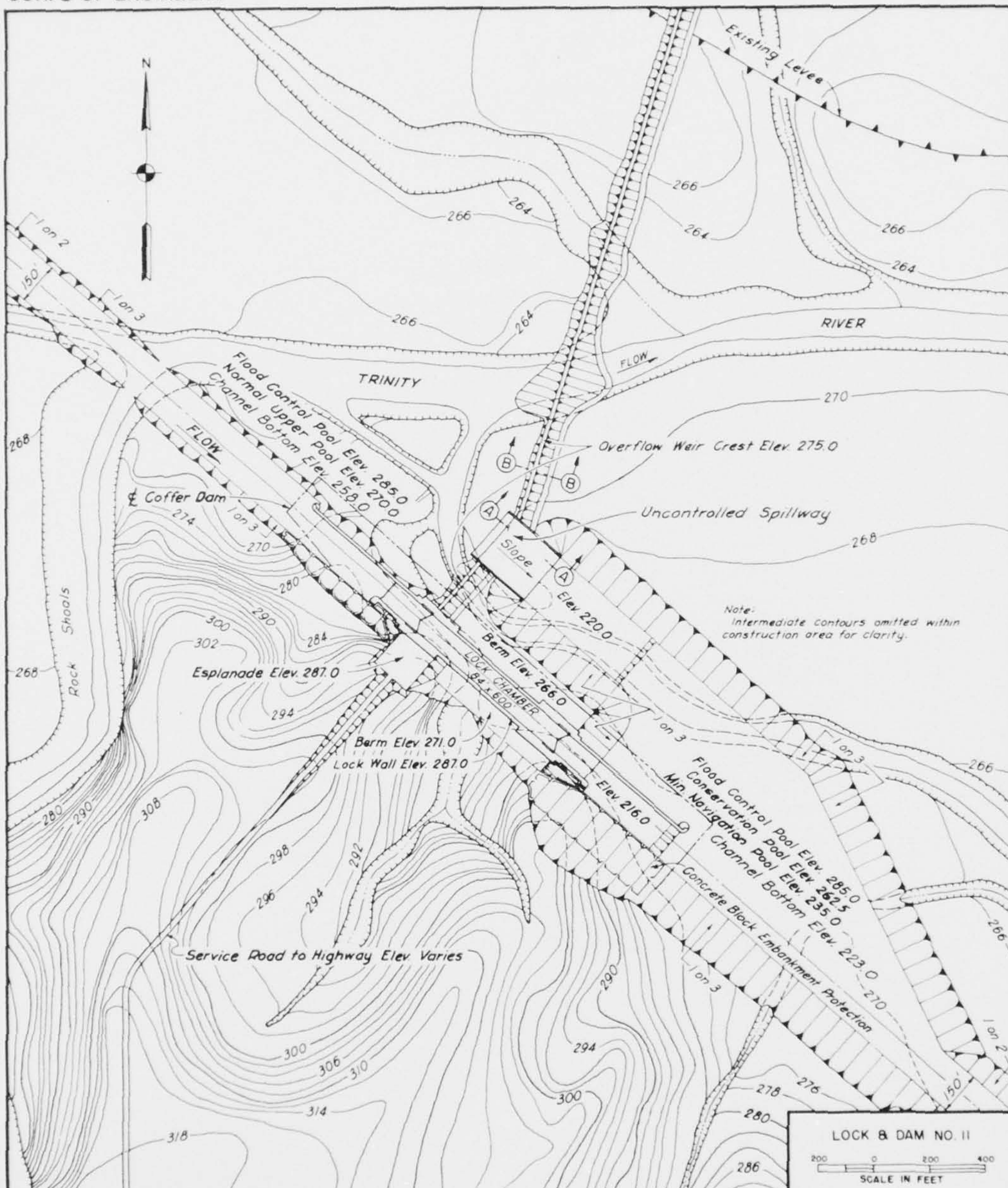
DRAWN BY

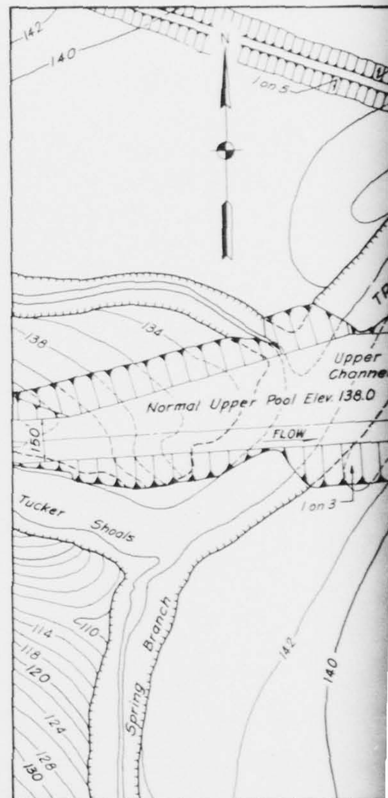
CHECKED BY

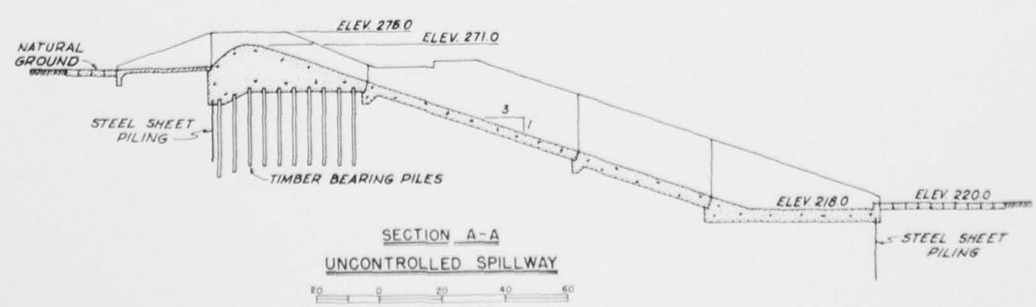
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962

FILE TRIN 230-19

PLATE 24





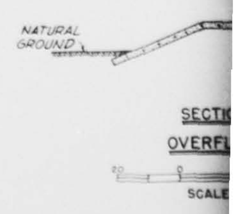


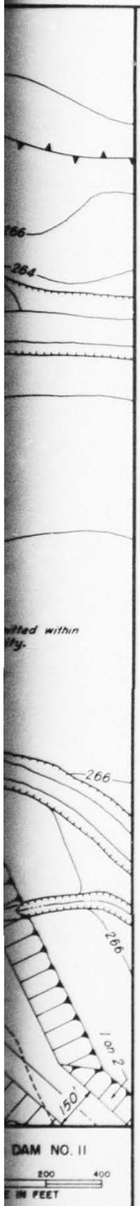
SECTION A-A

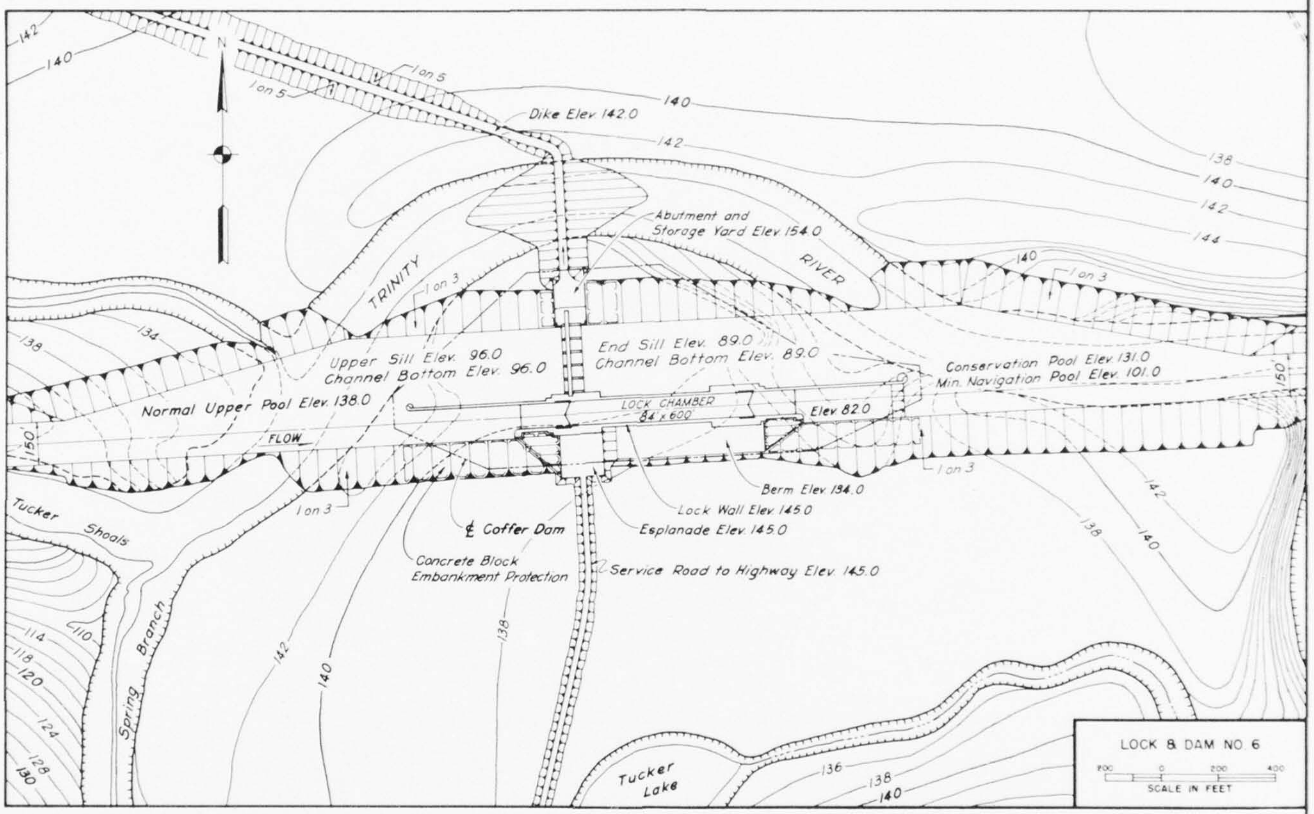
UNCONTROLLED SPILLWAY

20 0 20 40 60

SCALE IN FEET





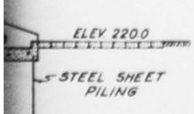


SECTION B – B

OVERFLOW WEIR

20 0 20 40 60

SCALE IN FEET



TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

SITE PLAN

LOCK AND DAM NO. 6 & NO. 11

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, GALVESTON		JUNE 1962
SUBMITTED A.B. Davis Jr. ENGINEER CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED Kenneth Heagy ENGINEER CHIEF, ENGINEERING DIVISION	APPROVED LT. COL. CORPS OF ENGINEERS DISTRICT ENGINEER
PREPARED ENGINEER HEAD, SPECIAL STUDIES SECTION	DRAWN BY W.E.D. CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRIN. RIVER DATED FILE TRIN 230-19

2

47. The estimate of cofferdam cost is also based on the proposal that one cofferdam be provided for construction of both lock and dam with cost of cofferdam construction and dewatering proportionally to the lock and dam on the following basis:

a. Allocate to lock cost, the estimated cost of providing a separate cofferdam and dewatering required for construction of the proposed lock.

b. Allocate to dam cost, the difference in estimated cost of providing a cofferdam and dewatering required for construction of the proposed lock and dam compared to the cost of providing the cofferdam and dewatering determined in "a" above for lock construction.

48. The estimates of costs for diversion of river flows during construction are based on available topographic maps. An outline of the lock and dam unit was located at the proposed lock site on the alignment of the proposed multiple purpose channel shown on the topographic map. Where it apperared that the existing river channel would provide for river flows during construction of the lock and dam, no costs were provided in the estimates for such purpose. Where a river diversion channel was required, the cost of providing the channel was charged to construction of the lock. The care of water during construction of the locks and dams was based on the cost of pumpage required to remove the estimated amount of seepage from the subsurface earth materials.

49. The plan of improvement provides for both upstream and downstream guide walls to be 400 feet long for the 84 x 600-foot locks and 300 feet long for the 56 x 400-foot locks. Concrete block or riprap paving on filter blanket would be provided at the base of the guide walls to prevent erosion and scour, also on the sloping banks extending both upstream and downstream of the landward lock wall to the ends of the guide walls to a height of 5 feet above the respective pools. The guide walls for all locks would be of similar design as proposed for the Arkansas River locks. Plate 19 shows a plan and section of the proposed guide walls.

50. The upper guide wall of lock 5B would extend to elevation 138.0 or 7 feet above maximum conservation storage in the Livingston reservoir. The upper guide wall of lock 10B would extend to elevation 269.5, or 7 feet above maximum conservation storage in the Tennessee Colony reservoir. The upper guide walls would be inundated by floods having a frequency of once in six years. Flood storage to elevation 285.0 would occur once in 100 years, and it was considered uneconomical to provide guide walls to elevation 285.0.

51. Upstream and downstream guide walls would be of similar construction, the downstream wall differing from upstream wall in that it is a larger wall and would have a sheet pile cutoff wall provided between the cells. The first monolith of the guide walls adjacent to lock structure would be a conventional gravity type. Remainder of the wall would be of the cellular type having a reinforced concrete wall supported by bearing piles contained in steel sheet pile cell spaced at 50-foot intervals. The concrete walls would be continuous with keys spaced at 100-foot intervals through which the impact loads would be distributed to adjacent supports. Each key serves as an expansion joint. Cells would be filled with sand and capped with concrete and would protect the bearing piles from being damaged by debris and to dampen the vibrations from impact loads.

52. Both the upper and lower miter sills of the proposed 22 locks excluding lock No. 1 in the Wallisville dam, would be set a minimum of 15 feet below normal pool elevations. The length of lock between pintles are as follows:

a. Six hundred and fifty (650) feet for the 84 x 600-foot U-frame type locks 5A, 6 and 11 and the gravity type locks, excepting lock No. 5B.

b. Six hundred and seventy (670) feet for the 84 x 600-foot gravity type lock No. 5B in the Livingston dam and the U-frame lock No. 10B in the Tennessee Colony dam to provide for the proposed prtective gate guards at these locks, as subsequently described.

c. Four hundred and thirty-five (435) feet for the 56 x 400-foot gravity type locks at and upstream of Dallas, Texas.

53. In connection with the design of locks No. 5B and 10B in the Livingston and Tennessee Colony dams, respectively, consideration was given to the advisability of hinged gates or special designed bulkhead gate which could be installed at the upper end of the locks to prevent loss of conservation storage from the reservoirs in the event that the upper gates were damaged or sprung apart by accidental collision of a barge tow. Investigation reveals that the cost of providing a set of sector gates upstream of the lock gates would be almost prohibitive and that special designed bulkheads would be less expensive but could not be easily installed under high head flow conditions. As a protective measure to prevent collision of barge tow and gate, the plan provides that a specially designed gate guard be provided on both sides of the upper gate.

54. Gate guards would be trussed structures, approximately 2.5 feet deep and designed to withstand an impact load of 250,000 pounds. The guards would be located approximately 20 feet clear on each side of the upper gate and would span the full width of the locks. The gate guards would be supported and actuated by a mechanized device recessed 10 inches in each wall. When the gate guards are in protective position, they would be mechanized to fluctuate with the

respective pool levels. When the upper gate is in open position, the gate guards would rest on the lock floor. The gate guards would be synchronized with the upper gate. The plan also provides for a complete set of stop logs and stiff leg derrick at each lock for use in maintenance of the upper gate, which could also be used in an extreme emergency in the event of a gate guard failure and subsequent damage to the upper gate.

55. All miter gates would be horizontally framed. For estimating purposes the heights of the gates were considered from one foot below the top of the sills to two feet above the upper pools. The majority of upper gates are identical in height and would be interchangeable with locks of corresponding widths. Spare lower gates may be sectionalized to permit later assembly into complete gates of heights required. This planning is desirable to provide spare gates to shorten the time navigation would be stopped in the event of serious damage to a set of gates. While it is not practical to provide spare gates for each set of service gates, standardizing the upper gates and sectionalizing the lower gates would permit a limited number of spare gates for the navigation system. Hydraulic equipment is used to operate tainter valves and miter gates with electric motors providing power.

56. Trussed stop log bulkheads have been selected as the type of closure equipment to be used at the locks. Excepting locks 5B and 10B, closure systems for Trinity River locks are not required to prevent loss of pools. It is therefore, not essential that closure equipment be available at each lock site. To meet this requirement it is proposed to provide each lock with the necessary fixed equipment and to provide closure equipment at selected storage points. This plan anticipates division of the system into groups of locks. Central storage yards would provide transporting and lifting equipment, and a sufficient number of stop logs to close one end of any lock in the group of locks served by that storage point. Spare gates, valves, valve bulkheads, pintle, hinges, etc., may also be located at central storage yards. Guide walls on the land side would be gravity walls similar to the first monoliths of the guide walls beyond the ends of the intake and outlet monoliths.

57. The plans for lock Nos. 5B and 10B, located in the Livingston and Tennessee Colony Reservoir dams, respectively, provide for extending the upper gate bays and a portion of the lock walls to the top of respective dams at elevation 140 and 305, generally as shown on plate 21. The top of the dams would be widened to form esplanade, 100 feet wide by 200 feet long, on both sides of the lock structure. A single lane bascule bridge would be provided at top of the gate bay walls to provide a crossing of the locks for such purposes, as operation and maintenance of the lock structures, and inspection, maintenance and repair of the earth dams, as may be required.

58. Excluding locks Nos. 5B and 10B, the other locks would have a 150-foot square esplanade adjoining the upper gate bay landwall which would have a top elevation equal to or greater than the lock wall elevation and would connect with the access road to the lock sites.

59. The plan provides for minimum berm filling behind the land wall of the gravity type locks from the esplanade on a gradient of 0.5 percent to an elevation three feet above the tailwater elevation of the design operating discharge of the multiple purpose channel at the downstream end of the landwall. Typical illustrations of the berm behind the land lockwall are indicated on site maps shown on plates 16, 17, 18 and 25.

60. ESTIMATED COST OF LOCKS.- Detailed estimates of first costs of a 84 x 600-foot gravity type lock No. 4, a 84 X 600-foot U-frame type lock No. 6, and a 56 x 400-foot gravity type lock No. 19 are shown in table 8. The gate and valve machinery and electrical costs were established by application of the Engineering News Record Cost index factors to costs of similar items of construction of prior projects. The detailed estimates of costs shown in table 8 are typical illustrations of determing the estimated first cost of the other proposed locks, copies of which are excluded from this report to eliminate more or less repetitious material. A summary of the estimated first costs for each of the 22 proposed locks is given in table 6, page 36.

TABLE 8
ESTIMATED FIRST COST OF NAVIGATION LOCKS NOS. 4, 6, & 19
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH

Item No.	Designation	Unit	Lock No. 4 84' X 600' Gravity type Unit Price	Quantity	Amount	Lock No. 6 84' X 600' "U" Frame type Unit Price	Quantity	Amount	Lock No. 19 56' X 400' Gravity type Unit Price	Quantity	Amount
1.	Coffer dam (fill)	LF	$0.25	117,000	$29,250	$ 0.25	106,300	$ 26,580	$ 0.25	31,300	$ 7,830
1A.	Coffer dam, steel sheet piling	LF	3.00	62,000	186,000	3.00	78,000	234,000	3.00	20,000	60,000
2.	Clearing	Acre	-	None	-	200.00	8	1,600	150.00	1	150
3.	Excavation, common	CY	0.50	50,000	25,000	0.50	530,000	265,000	0.55	438,000	240,900
4.	Excavation, rock	CY	0.00	None	-	-	None	-	2.00	19,800	39,600
5.	Fill, (Incl. esplanade)	CY	0.35	20,900	7,320	0.35	207,270	72,550	0.35	26,800	9,380
6.	Fill, Cellular guidewall cells	CY	0.35	3,180	1,110	0.35	3,850	1,350	0.35	2,600	910
7.	Timber Y.P. Creosoted	MFBM	600.00	25.0	15,000	600.00	23.2	13,920	600.00	17.9	10,740
8.	Piling, steel-H(14BP-73)	LF	8.00	375,000	3,000,000	8.00	2,170	17,360	8.00	130,800	1,046,400
10.	Piling, steel-H(14BP-73)Cellular guidewalls	LF	8.00	27,900	223,200	8.00	19,400	155,200	8.00	13,700	109,600
11.	Piling, steel sheet	SF	3.00	64,100	192,300	3.00	43,560	130,680	3.00	15,900	47,700
12.	Piling, steel sheet, cellular guidewalls	SF	3.00	45,550	136,650	3.00	33,300	99,900	3.00	30,400	91,200
13.	Concrete block, riprap	CY	30.00	14,780	443,400	30.00	12,640	379,200	30.00	13,040	391,140
14.	Filter Blanket	CY	5.50	5,960	32,780	5.50	5,100	28,050	5.50	5,200	28,600
15.	Concrete, walls	CY	26.00	89,000	2,314,000	28.00	46,500	1,302,000	26.00	79,000	2,054,000
16.	Concrete floors, struts and sills	CY	22.00	17,400	382,800	22.00	57,000	1,254,000	22.00	11,400	250,800
17.	Concrete, cellular guidewall	CY	45.00	8,300	373,500	35.00	9,300	325,500	45.00	6,600	297,000
18.	Cement	Bbls.	5.00	145,500	727,500	5.00	169,200	846,000	5.00	100,300	501,500
19.	Steel, str., wall armor	Lb.	0.20	250,000	50,000	0.20	304,000	60,800	0.20	257,000	51,400
20.	Steel, str., wall armor, cellular guidewall"	Lb.	0.20	209,000	41,800	0.20	110,000	22,000	0.20	166,000	33,200
21.	Steel, str., miter gates (MP)	Lb.	0.45	450,000	202,500	0.45	540,000	243,000	0.45	300,000	135,000
23.	Steel, str., Tainter valves (MP)	Lb.	0.45	73,230	32,950	0.45	73,230	32,950	0.45	73,230	32,950
24.	Steel, str., miscellaneous	Lb.	0.22	307,000	67,540	0.22	324,000	71,280	0.22	195,600	43,030
25.	Steel, concrete reinf.	Lb.	0.13	1,013,000	131,690	0.15	15,606,000	2,340,900	0.13	930,000	120,930
26.	Steel, corrosion resist.	Lb.	0.80	6,850	5,480	0.80	6,850	5,480	0.80	6,850	5,480
27.	Steel, Str. chromium	Lb.	0.80	4,940	3,950	0.80	4,940	3,950	0.80	4,940	3,950
28.	Forgings, steel carbon	Lb.	0.80	80,000	64,000	0.80	98,000	78,400	0.80	91,000	72,800
29.	Forgings, Alloy steel	Lb.	0.80	5,110	4,090	0.80	5,110	4,090	0.80	5,110	4,090
30.	Castings, steel, grade "[illegible]"	Lb.	0.60	19,200	11,520	0.60	19,200	11,520	0.60	14,700	8,820
31.	Castings, steel, grade 1,2,& 3	Lb.	0.60	40,610	24,370	0.60	40,610	24,370	0.60	40,610	24,370
32.	Castings, alloy steel	Lb.	0.60	6,570	3,940	0.60	6,570	3,940	0.60	6,570	3,940
33.	Castings, iron	Lb.	0.60	5,970	3,580	0.60	5,970	3,580	0.60	5,970	3,580
34.	Bronze and brass	Lb.	2.50	2,230	5,580	2.50	2,230	5,580	2.50	2,230	5,580
35.	Misc., non-ferrous	Lb.	0.80	2,070	1,660	0.80	2,070	1,660	0.80	2,070	1,660
36.	Conduit, fibre 3" D	LF	1.50	9,600	14,400	1.50	9,600	14,400	1.50	6,890	10,340
37.	Conduit, Metal 1"D	LF	0.85	150	130	0.85	150	130	0.85	140	120
38.	Conduit, metal 3"D	LF	3.75	155	580	3.75	155	580	3.75	145	540
39.	Elec. system	Job	-	Sum	120,000	-	Sum	120,000	-	Sum	120,000
40.	Handrail, steel pipe	LF	4.00	5,700	22,800	4.00	5,800	23,200	4.00	4,400	17,600
41.	Floor plating, steel	SF	5.00	90	450	5.00	90	450	5.00	90	450
42.	Floor grating, steel	SF	4.65	8,810	40,970	4.65	8,810	40,970	4.65	7,810	36,320
43.	Rubber, seals, moulded	Lb.	2.50	1,100	2,750	2.50	1,100	2,750	2.50	980	2,450
44.	Tile gages	LF	14.00	60	840	14.00	73	1,020	14.00	64	900
45.	Operating machines, miter gates	Ea.	27,500.00	4	110,000	27,500.00	4	110,000	27,500.00	4	110,000
46.	Double 4-way valves	Ea.	900.00	2	1,800	900.00	2	1,800	900.00	2	1,800
47.	Operating machine tainter valve	Ea.	17,500.00	4	70,000	17,500.00	4	70,000	17,500.00	4	70,000
48.	3-way control valve	Ea.	700.00	4	2,800	700.00	4	2,800	700.00	4	2,800
49.	3-way automatic valve	Ea.	500.00	4	2,000	500.00	4	2,000	500.00	4	2,000
50.	Oil piping system	Job	-	Sum	90,000	-	Sum	90,000	-	Sum	90,000
51.	Field Office	Job	-	Sum	5,000	-	Sum	5,000	-	Sum	5,000
52.	Central control structure	Job	-	Sum	35,000	-	Sum	36,000	-	Sum	36,000
53.	Stop logs	Job	-	Sum	45,000	-	Sum	45,000	-	Sum	45,000
54.	Diversion channel	CY	0.25	862,500	215,630	0.25	None	[illegible]	[illegible]	[illegible]	[illegible]

61. SUMMARY OF NAVIGATION DAMS (INCLUDING COSTS).- The plan of improvement for the multiple purpose channel provides for the constru tion of 17 movable dams and one overflow dam, to serve in conjunction with the proposed navigation locks and the Wallisville, Livingston and Tennessee Colony Reservoir Dams, to form and maintain navigation pools that would overcome the fall of the river to provide for naviga tion to Fort Worth and facilitate the passage of river flows and dri The locations of the proposed dams are shown on the general plans, plates 4 through 11, and in profile on plates 12 through 15, pages 1 to 29 . The first costs of the proposed 17 movable dams and the over flow spillway dam No. 11 is estimated at $45,491,000, as shown in tab

TABLE 9
SUMMARY OF FIRST COSTS OF NAVIGATION DAMS REQUIRED FOR THE MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Dam No.	Number and size of tainter gates (ft.)	Cost
Houston Ship Channel to upper reach of Wallisville Reservoir (Mile 0 to 35.5)		
1	4 - 40x20(1)	(2)
Upper reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)		None
Head of authorized channel to Liberty to Tennessee Colony dam (Mile to 233.5)		
2	7 - 40x31	$2,277,280
3	6 - 40x34.5	2,623,340
4	6 - 40x36	3,565,170
5A & 5B Livingston Dam (3)		-
6	5 - 40x44	3,003,580
7	5 - 40x44	2,672,950
8	5 - 40x42	2,520,250
9	6 - 40x46	3,111,780
Total		19,774,350
Tennessee Colony Dam to lock & dam No. 12 (Mile 233.5 to 274.4)		
10A & 10B Tennessee Colony Dam (4)		-
11	(5)	2,112,930
Total		2,112,930
Lock & dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)		
12	5 - 40x28	2,030,710
13	6 - 40x32	2,758,760
14	5 - 40x26	2,042,640
15	5 - 40x24	2,071,750
16	5 - 40x27	1,859,300
17	5 - 40x30	2,177,930
Total		12,941,090
Five-mile Creek to Dallas Terminus (Mile 322.0 to 326.7) - None		

TABLE 9 (CONT'D)
SUMMARY OF FIRST COSTS OF NAVIGATION DAMS REQUIRED FOR
THE MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Dam No.	Number and size of tainter gates (ft.)	Cost
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1) - None		
Dallas Floodway (Mile 331.1 to 338.8)		
18	5 - 40x34.5	$ 2,356,080
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)		
19	6 - 40x24	2,813,170
20	6 - 40x28	2,802,610
21	6 - 40x31	2,690,770
Total		8,306,550
Fort Worth Terminus to and including Riverside bridges (Mile 362.8 369.8) -		
Total Mile 0.0 to 369.8		$45,491,000

Note: Estimated first costs are based on prices as of January 196
(1) In addition, the recommended Wallisville Reservoir Dam would provide an overflow spillway about 20,100 feet long having a crest at elevation 4.0.
(2) Costs are included in the Wallisville Reservoir report.
(3) Gated spillway of Livingston Reservoir would control the river discharges passing lock 5A & 5B.
(4) Gated spillway of Tennessee Colony Reservoir would control the river discharges passing lock 10A & 10B.
(5) Dam No. 11 would consist of an overflow spillway without movab gates having a length of about 5,500 feet with crest at elevat 275.0 and a low flow spillway 200 feet long with crest at elev 271.0.

62. DESIGN INFORMATION ON DAMS.- A preliminary study mov-able dams with non-submersible tainter gates 80, 60, and 40 feet l indicates that the 40-foot gates provide more desirable proportion offers greater economy in bulkheads, hoisting equipment and handli bulkheads. Accordingly, for the purpose of this report, the plan for non-submersible tainter gates, 40 feet long, for all movable d It also provides for the tainter gate sills to be set at the desig tom elevation of the multiple purpose approach channel at each sit prevent silting of the upstream pool. The top of gates are set tw higher than the upper pool elevation to provide one foot of freebo an additional one foot of storage over and above the normal pools variations in water demand. The number of gates at each dam were by the criterion that the swell head should not exceed one foot wh charging the capacity of the channel at that point. Pertinent data cerning design elevations, type of foundation and the number and s tainter gates for each dam are given in table 10.

TABLE 10

PERTINENT DATA - NAVIGATION DAMS
MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Dam No.	Channel mile	Pool elevation		Lift in feet	Elevation maximum navigation(1)	Elevation of storage yard & abutment	Elevation of gate sill	Tainter gates	
		Lower	Upper					No.	Size(ft.)
1(2)	28.30	0.0	4.0	4.0	5.0	8.0	-16.0	4	40x21
2	47.45	4.0	16.0	12.0	17.0	30.0	-13.0	7	40x31
3	59.08	16.0	36.0	20.0	37.0	45.0	3.5	6	40x34.5
4	74.85	36.0	60.0	24.0	61.0	73.0	26.0	6	40x36
(3)									
6	147.92	131.0	138.0	7.0	139.0	154.0	96.0	5	40x44
7	183.92	138.0	168.0	30.0	169.0	180.0	126.0	5	40x44
8	207.55	168.0	192.0	24.0	193.0	207.0	152.0	5	40x42
9	217.95	192.0	210.0	18.0	211.0	224.0	166.0	6	40x46
(4)									
11(5)	258.91								
12	274.51	270.0	284.0	14.0	286.0	305.0	258.0	5	40x28
13	286.64	284.0	308.0	24.0	309.0	323.0	278.0	6	40x32
14	298.38	308.0	326.0	18.0	327.0	346.0	302.0	5	40x26
15	306.31	326.0	344.0	18.0	345.0	359.0	322.0	5	40x24
16	311.25	344.0	356.0	12.0	357.0	368.0	331.0	5	40x27
17	317.81	356.0	372.0	16.0	373.0	391.0	344.0	5	40x30
18	331.31	372.0	396.0	24.0	397.0	417.0	363.5	5	40x34.5
19	342.51	396.0	424.0	28.0	425.0	432.0	402.0	6	40x24
20	351.91	424.0	452.0	28.0	453.0	462.0	426.0	6	40x28
21	360.17	452.0	480.0	28.0	481.0	487.0	451.0	6	40x31

(1) Assumed to be elevation of maximum operating discharge of the multiple purpose channel at navigation dams.

63. Based on preliminary subsurface investigation at lock site, consisting of one core boring, it was concluded all dams be founded on bearing piles battered in two direc to withstand lateral loads. Steel bearing piles (14BP73) selected as foundation piling because of the anticipated h driving conditions at many sites. The foundation bearing were considered to be driven to a sufficient depth to deve friction to resist the imposed loads. Steel sheet pile cu walls would be provided at the upstream edge of the gate s and the downstream edge of the stilling basin, with wall e to the steel piling wall beneath the lock structure and th off wall beneath the storage yard. Information concerning diversion and care of water during construction of the dam given in paragraph 48 of this appendix. Plates 23 and 24 the log of borings made at lock sites which were considere connection with the foundation requirements for the severa navigation dams.

64. The plan proposes that gate sill monoliths be di on the center line of gate width to provide 48-foot sill m liths to serve as foundation for each pier. All piers wou 8 feet wide and their lengths would provide for both upstr and downstream bulkhead recesses, service bridge supports gate trunnion anchorages. The trunnions are set in horizo position above the regulated two percent flood discharge e tion at the dam and the radius of the gate is long enough permit the bottom of the skin plate to meet the horizontal at an angle of not less than 40 degrees and provide 5 feet clearance above maximum high water. The top elevation of stream nose of the pier and the abutment would be at least above highwater at the dam site.

65. The service bridge would be centered on a vertic to the arc of the gate and set high enough so that low ste clear the arc of the gate in raised position. Electric ho raising the gates would be mounted between the service bri girders. The crane provided for handling emergency bulkhe been estimated as a "locomotive crane" on rails, but futur should include consideration of mobile cranes which could at more than one dam. Upstream bulkheads were estimated o basis of providing each dam with bulkheads to close one ga one foot above the maximum navigation stage. Downstream b are estimated on the basis that one complete set of downst bulkheads (for one gate only) would be provided to serve t with closure of one gate bay being provided for a height r between the low pool and the maximum navigation stage.

66. Excavation for the dams includes the excavation required to provide both an upstream approach channel and a downstream discharge channel. The upstream approach channel would have a width equal to the width of the dam extending upstream to 200 feet above the upstream and of the riverside lock guidewall, then a 1000-foot transition to join with the multiple purpose channel, all with channel bottom at the gate sill elevation. The discharge channel would have a width equal to the width of the dam, extending to 200 feet below the downstream end of the guidewall then a 1000-foot transition to join with the multiple purpose channel. Downstream from the dam the channel bottom elevation would be the same as the stilling basin end sill elevation to near the end of the lock wall, then sloped to the multiple purpose channel bottom elevation at the junction of the two channels. All permanent earth slopes were assumed to be 1 on 3. Precast concrete blocks on a gravel filter blanket would be provided to protect earth slopes adjacent to the storage yard, the approach channel for 15 feet upstream from the gate sill, and the discharge channel for 25 feet downstream from the stilling basin, as shown on plates 19 and 21, pages 40 and 42.

67. The plan of improvement proposes that dam No. 11 be located within the Tennessee Colony Reservoir upstream of the mouth of Cedar Creek to form and maintain pool No. 11 at normal elevation of 270 feet, generally as shown on plate 25, page 46. When conservation storage in Tennessee Colony Reservoir is fully depleted, the top of lower navigation pool below dam No. 11 would be at elevation 235.0 with bottom at elevation 223. Under maximum flood storage conditions in Tennessee Colony Reservoir to elevation 285, pool No. 11 would be inundated to a depth of 15 feet. Preliminary investigations indicate that an overflow spillway dam at this location would be more economical than a movable dam with either submersible or non-submersible tainter gates. Accordingly, the plan of improvement proposes that dam No. 11 consist of an overflow dam about 5,700 feet long extending from lock No. 11 across the Trinity River flood plain. The dam would consist of an uncontrolled spillway 5,500 feet long of paved earth embankment with crest at elevation 275.0, and a low-water uncontrolled concrete spillway 200 feet long with crest at elevation 271.0, or one foot above proposed normal elevation of pool No. 11, and a stilling basin at elavation 218. The low-water spillway would be founded on timber piling and would be of design similar to that shown on plates 4 and 5 accompanying engineering manual 1110-2-2400.

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68. ESTIMATED COST OF DAMS.- Detailed estimates of first cost for dams Nos. 4, 6 and 19 are shown in table 11. The estimated quantities of construction materials were determined for about 20 items that varied with site conditions and design requirements. The other items of costs were based on curves or formulae which were either derived from similar items of dam construction considered in the 1938-39 Trinity River studies made in connection with House Document No. 403, 77th Congress, 1st session, or directly from the cost items for the Mississippi River dam No. 24, with appropriate adjustments made to reflect the quantities required for the 40-foot gates in lieu of the 80 foot gates used at dam No. 24 and in the 1938-39 Trinity River studies. The detailed estimates shown in table 11 are considered to be typical illustration for determining the estimated first cost of the other proposed movable dams, copies of which are excluded from this report to eliminate repetitious material. The estimated cost of dam No. 11 is based on a detailed quantity survey of the construction items required for the proposed dam. Cost for dam No. 11 and other dams are shown in table 9, page 52 .

TABLE 11
ESTIMATED FIRST COST OF NAVIGATION DAMS NOS. 4, 6 & 19
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Item No.	Designation	Unit	Dam No. 4 (Six gates, 40'x36') Unit Price	Quantity	Amount	Dam No. 6 (Five gates, 40'x44') Unit Price	Quantity	Amount	Dam No. 19 (Six gates 40'x24') Price	Quantity	Amount
1A.	Coffer Dam (Fill)	CY	$ 0.25	5,220	$ 1,310	0.25	27,100	$ 6,750	0.25	400	$ 100
1B.	De-watering	Job	-	Sum	25,000	-	Sum	25,000	-	Sum	25,000
1C.	Steel sheet piling, Coffer dam	SF	3.00	12,000	36,000	3.00	15,000	45,000	3.00	8,000	24,000
2.	Clearing	Acre	-	-	-	200.00	8	1,600	150.00	1	150
3.	Excavation, Common	CY	0.50	990,000	495,000	0.55	1,104,000	607,200	0.55	1,551,000	853,050
6.	Fill (Incl.Storage Yard)	CY	0.35	8,700	3,050	0.35	10,700	3,750	0.35	18,700	6,550
7.	Embankment, Dike	CY	-	-	-	0.25	180,000	45,000	-	-	-
11.	Piling (14 BP-73) Sill	LF	8.00	52,000	416,000	8.00	30,900	247,200	8.00	30,100	240,800
12.	Piling (14 BP-73) Apron	LF	8.00	5,180	41,440	8.00	2,200	17,600	8.00	4,610	36,880
13.	Piling, Steel Sheet, Type "MA-31"	SF	3.00	6,560	19,680	3.00	2,800	8,400	3.00	3,280	9,840
14.	Piling, Steel Sheet, (MA-22)	SF	2.85	8,250	23,510	2.85	3,650	10,400	2.85	4,130	11,770
15.	Piling, Steel Sheet, Type "Z-38"	SF	4.00	16,800	67,200	4.00	28,700	114,300	4.00	11,000	44,000
16.	Timber, Soft Wood Treated	MFBM	600.00	3.2	1,920	600.00	3.9	2,340	600.00	2.32	1,390
17.	Riprap, Conc. Block	CY	30.00	3,100	93,000	30.00	3,500	105,000	30.00	3,080	92,430
18.	Gravel, Filter Blanket	CY	5.50	1,620	8,910	5.50	1,200	6,600	5.50	1,320	7,260
19.	Concrete, Apron	CY	22.00	1,710	37,620	22.00	974	21,430	22.00	1,170	25,740
20.	Concrete, Sill	CY	22.00	6,450	141,900	22.00	6,800	149,600	22.00	10,200	224,400
21.	Concrete, Pier	CY	26.00	7,150	185,320	26.00	8,770	228,020	26.00	4,340	114,140
21A.	Concrete, Abutment Ftg. & Walls	CY	26.00	3,340	86,840	26.00	3,800	98,800	26.00	2,950	75,700
21B.	Concrete, 6" Stor.Yd.Paving & Slope Prot.	CY	20.00	234	4,680	20.00	258	5,160	20.00	183	3,660
21C.	Cement	Bbls.	5.00	154,000	770,000	5.00	30,100	150,500	5.00	27,400	137,000
22.	Steel, Structural, Service Bridge	LB	0.26	202,000	52,520	0.26	172,800	44,930	0.26	201,000	52,250
23.	Steel, Structural Tainter Gates Anchorage & Head Plate	Lb	0.22	190,000	41,800	0.22	193,600	42,590	0.22	127,000	27,940
24.	Steel, Structural Phos.Chromium Tainter gates (Movable parts)	Lb.	0.40	821,000	328,400	0.40	836,000	334,400	0.40	547,000	218,800
26.	Steel, Structural, Miscellaneous	Lb.	0.22	53,200	11,700	0.22	54,000	11,880	0.22	39,000	8,580
27.	Steel, Structural High Tensile	Lb.	0.22	149,000	32,780	0.22	211,000	46,420	0.22	63,000	13,860
28.	Steel, Structural Phos.Chromium Miscl.	Lb.	0.40	92,200	36,880	0.40	91,200	36,480	0.40	66,200	26,480
29.	Steel, Concrete Reinf.	Lb.	0.13	566,400	73,630	0.13	618,100	80,350	0.13	471,600	61,310
30.	Steel, Corrosion Resistant	Lb.	0.80	10,600	8,480	0.80	10,500	8,400	0.80	7,500	6,000
31.	Steel, Cold Rolled	Lb.	0.20	1,400	280	0.20	1,200	240	0.20	1,400	280
32.	Forgings, Steel	Lb.	0.80	141,000	112,800	0.80	145,000	116,000	0.80	94,100	75,280
33.	Forgings, Alloy Steel	Lb.	0.80	1,980	1,580	0.80	2,300	1,840	0.80	1,500	1,200
34.	Forgings, Phos. Chromium Steel	Lb.	0.80	2,930	2,340	0.80	2,960	2,370	0.80	2,400	1,920
35.	Forgings, Aluminum Alloy	Lb.	1.50	150	230	1.50	150	230	1.50	150	230
36.	Castings, Steel, Class "C"	Lb.	0.60	4,750	2,850	0.60	4,840	2,900	0.60	3,170	1,900
37.	Castings, Steel, Class 1, 2 & 3	Lb.	0.60	64,000	38,400	0.60	65,000	39,000	0.60	46,000	27,600
38.	Castings, Alloy Steel	Lb.	0.60	600	360	0.60	500	300	0.60	600	360
40.	Aluminum Alloy, Structural (High Strength)	Lb.	1.20	7,020	8,420	1.20	19,200	23,040	1.20	6,300	7,560
41.	Aluminum Alloy, Structural(Med. Strength)	Lb.	1.20	350	420	1.20	960	1,150	1.20	320	380
42.	Bronze, (Incl. other non-ferrous metals)	Lb.	2.50	7,200	18,000	2.50	6,000	15,000	2.50	7,200	18,000
43.	Copper	Lb.	2.50	1,200	3,000	2.50	1,000	2,500	2.50	1,200	3,000
45.	Electrical system	Job	-	LS	30,000	-	LS	30,000	-	LS	30,000
46.	Crane Track - 80# Rail	TR & Ft	15.00	336	5,040	15.00	290	4,350	15.00	340	5,040
47.	Storage Yard Track-60#Rail	TR & Ft	12.00	110	1,320	12.00	110	1,320	12.00	110	1,320
48.	Handrailing, Steel pipe	LF	4.00	900	3,600	4.00	800	3,200	4.00	900	3,600
49.	Floor grating, steel	SF	4.65	970	4,510	4.65	830	3,860	4.65	970	4,510
50.	Floor plate	SF	5.00	4,680	23,400	5.00	3,930	19,300	5.00	4,680	23,400
51.	Rubber Seals, Moulded	Lb.	2.50	6,000	15,000	2.50	5,480	13,700	2.50	3,580	8,950
52.	Operating machinery, Tainter Gate mechanical equipment	Ea	25,000.00	6	150,000	25,000.00	5	125,000	25,000.00	6	150,000
53.	Operating machinery, Tainter Gate electrical equipment	Ea	6,500.00	6	39,000	6,500.00	5	32,500	6,500.00	6	39,000
54.	Tainter Gate operating machinery spare parts & misc. equipment	Lot	-	LS	10,000	-	LS	10,000	-	LS	10,000
55.	12-Ton Truck Crane (Installed)	Job	-	1	39,750	-	LS	39,750	-	LS	39,750
56.	Storage Yard Cars	Ea.	500.00	6	3,000	500.00	6	3,000	500.00	6	3,000
57.	Pick Up Device	Ea.	300.00	1	300	300.00	1	300	300.00	1	300
58.	Storage yard pier super structure	Job	-	LS	6,500	-	LS	6,500	-	LS	6,500
	Total estimated first cost (Excluding contingencies)				3,503,170			3,003,560			2,8[illegible],170

Note: Prices are as of January 1962

APPENDIX

69. SUMMARY OF HIGHWAY RELOCATIONS (INCLUDING COSTS).- The estimated cost of highway relocations within Tennessee Colony Reservoir are included in the cost estimate of Tennessee Colony Reservoir given in this appendix. The construction of the multiple-purpose channel would require 48 bridge relocations of which 20 would be partial modification of existing bridges, 10 would be complete replacement of existing bridges and 18 would be new bridges over land-cut channels. The relocation cost for individual alterations varies from $1,866,000 to $116,000 and totals $44,024,000. Data and cost thereon are shown in table 12. The Texas Highway Department reports that its present long-range plan includes construction of up to 12 additional highway crossings of the Trinity River within the next 15 years. The Highway Department states that two bridges on the planned Interstate Highway 635 loop crossing at Dallas have been authorized and funded for preliminary engineering this year and one bridge on Farm to Market Road 162 in Liberty County has been authorized. The other nine crossings are in various stages of program planning. Definite information as to the exact location, size and type of construction of these crossings was not available at the time this report was prepared and costs were not estimated for any modification that might be required for project purposes. However, the contingency item in the cost estimate is considered adequate to cover such modification of additional bridges that might be built prior to construction of the multiple-purpose channel.

70. HIGHWAY DESIGN INFORMATION.- All highway bridges over the proposed multiple purpose channel including the highway bridge in the Tennessee Colony reservoir are based on providing a minimum vertical clearance of 50 feet above maximum navigation elevation and a minimum horizontal clearance of 250 feet between fenders for bridges located between the mouth of the Houston Ship Channel and the Dallas Terminus. A minimum horizontal clearance of 225 feet between fenders would be provided for bridges located between the Dallas and Fort Worth Termini. A side slope of two horizontal to one vertical was assumed for embankments. Based on these clearance requirements, the length of span required for the channel would be 300 feet for bridges located below Dallas and 274 feet for bridges located above Dallas. In general, the design loads used for highway bridges were H20-S-16 for interstate highways and H20-S12 for state highway bridges. Maximum grades used were 3.5% for interstate highway bridges and 5.0% for state highway bridges. A typical bridge is shown on plate 26.

71. Earth fill approaches to bridges would be provided to a maximum height of 20 feet above natural ground. Earth embankments will not be used in floodways. Trestles consisting of concrete girder-spans on concrete piles would be used in floodway in place of earth embankments. Approach spans would consist of prestressed concrete beams and concrete deck. The center span of a three-span continuous plate girder with concrete deck would span the project channel. Timber pile fender systems would be provided on the channel side of bridge piers adjacent to the navigation channel. Table 13 gives information concerning design data considered in determining the estimated first cost of the hgihway bridges for the multiple-purpose Trinity River channel to Fort Worth, Texas. Table 14 gives information concerning the

TABLE 12
SUMMARY OF ESTIMATED FIRST COST AND COMPONENT LENGTH
OF HIGHWAY BRIDGES REQUIRED FOR MULTIPLE PURPOSE
TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of bridge	Channel mile	Left embankment (ft.)	Left approach spans (ft.)	Channel span (feet)	Right approach spans (ft.)	Right embankment (ft.)	Total length (feet)	Total estimated first cost
Houston Ship Channel to upper reach of Wallisville Reservoir (Mile 0.0 to 35.5)								
Interstate Hwy 10 (Eastbound)	30.36	600	770	780	770	600	2,320	$ 963,000
Interstate Hwy 10 (Westbound)	30.37	600	770	780	770	600	2,320	963,000
Total - Mile 0.0 to 35.5								1,926,000
Upper Reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)								
None	-	-	-	-	-	-	-	
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)								
U. S. Hwy No. 90 (Eastbound)	47.84	-	900	780	950	250	2,630	1,083,000
U. S. Hwy No. 90 (Westbound)	47.90	-	900	780	950	250	2,630	1,086,000
State Hwy No. 105	75.78	140	940	780	605	400	2,325	1,093,000
U. S. Hwy No. 59	91.86	400	500	780	550	-	1,830	907,000
County Road	98.90	250	550	715	900	400	2,165	874,000
U. S. Hwy No. 190	111.54	-	2,145	780	2,145	-	5,070	1,866,000
State Hwy No. 19	136.15	400	880	780	880	400	2,540	1,071,000
State Hwy No. 21	171.63	150	605	780	770	-	2,155	937,000
State Hwy No. 7	196.68	300	572	780	572	300	1,924	876,000
U.S. Hwy 79 & 84	220.55	-	950	780	750	200	2,480	1,122,000
Total - Mile 47.4 to 233.5								10,915,000
Tennessee Colony Dam to Lock & dam No. 12 (Mile 233.5 to 274.4)								
U.S. Hwy No. 287	249.99	See cost estimate for Tennessee Colony Reservoir.						
State Hwy No. 31	264.52	See cost estimate for Tennessee Colony Reservoir.						

TABLE 12
SUMMARY OF ESTIMATED FIRST COST AND COMPONENT LENGTH
OF HIGHWAY BRIDGES REQUIRED FOR MULTIPLE PURPOSE
TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of bridge	Channel mile	Left embankment (ft.)	Left approach spans (ft.)	Channel span (feet)	Right approach spans (Ft.)	Right embankment	Total length (feet)	Total estimated First Cost
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)								
State Hwy No. 1129	285.60	400	400	780	600	200	1,780	$861,000
State Hwy No. 34	298.04	50	650	780	600	150	2,030	890,000
Malloy County Road	312.84	260	700	780	650	-	2,130	909,000
Belt Line Road	315.57	100	605	780	505	-	1,990	884,000
Dowdy Ferry	319.92	-	700	780	300	400	1,780	848,000
Total - Mile 274.4 to 322.0								4,392,000
Five-mile Creek to & including Dallas Terminus (Mile 322.0 to 326.7)								
State Hwy Loop 12 (Eastbound)	326.19	100	500	780	1,400	200	2,680	1,037,000
State Hwy Loop 12 (Westbound)	326.20	100	500	780	1,400	200	2,680	1,042,000
Total - Mile 322.0 to 326.7								2,079,000
Dallas Terminus to existing Dallas Floodway (Mile 326.7 to 331.1)								
Interstate No. 45 (Northbound)	328.46	-	500	780	700	-	1,980	857,000
Interstate No. 45 (Southbound)	328.47	-	400	780	550	-	1,730	794,000
Forest Avenue	330.65	200	350	715	350	-	1,415	1,113,000
Total-Mile 326.7 to 331.1								2,764,000
Dallas Floodway (Mile 331.1 to 338.8)								
Corinth St.	331.41	-	650	715	700	-	2,065	1,214,000
Cadiz St.	332.22	-	650	715	650	-	2,015	1,163,000
Interstate Hwy 35E	332.28	-	600	715	650	-	1,965	1,325,000
Houston St.	332.61	-	450	715	700	-	1,865	1,189,000
Dallas Ft.Worth Turnpike	333.12	-	550	715	550	-	1,815	2,151,000
Commerce St.	333.50	150	500	715	550	-	1,765	1,607,000
Continental St.	333.93	-	500	715	500	-	1,715	1,106,000
Sylvan Avenue	334.89	-	700	715	800	-	2,215	892,000
Hampton Road	336.33	-	450	715	450	-	1,615	1,226,000
Westmoreland Road	337.26	-	950	715	1,000	-	2,615	982,000
Total-Mile 331.1 to 338.8								$12,855,000

TABLE 12 (CONT'D)
SUMMARY OF ESTIMATED FIRST COST AND COMPONENT LENGTH
OF HIGHWAY BRIDGES REQUIRED FOR MULTIPLE PURPOSE
TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of bridge	Channel mile	Left embankment (ft.)	Left approach spans (ft.)	Channel span (feet)	Right approach spans (ft.)	Right embankment (ft.)	Total length (feet)	Total estimated first cost
Dallas Floodway to & including Fort Worth Terminus (Mile 338.8 to 362.8)								
State Hwy Loop 12	340.39	-	750	715	650	-	2,115	$ 860,000
Meyers Road	342.94	400	550	715	1,040	160	2,305	892,000
Belt Line Road	345.25	250	650	715	650	250	2,015	823,000
State Hwy No. 360	350.75	250	550	715	350	400	1,615	708,000
F. M. Rd. No. 157	354.00	400	350	715	850	175	1,915	831,000
Arlington-Bedford Road	357.00	300	1,150	715	1,150	300	3,015	1,075,000
Arlington-Smithfield Rd.	359.95	200	1,330	715	950	200	2,995	990,000
U. S. Hwy Loop 820 (Northbound)	362.11	-	700	715	550	200	1,965	734,000
U. S. Hwy Loop 820 (Southbound)	362.12	-	700	715	550	200	1,965	734,000
Handley-Ederville Rd.	362.70	400	600	715	550	300	1,760	784,000
Total - Mile 338.8 to 362.8								$8,431,000
Fort Worth Terminus to and including Riverside Drive bridges (Mile 362.8 to 369.8)								
First St.	366.80	350	480	325	330	350	1,135	247,000
Beach St.	368.60	250	200	230	800	275	1,200	129,000(1)
Riverside Drive(Northbound)	369.40	-	210	333	510	200	1,053	170,000(2)
Riverside Drive(Southbound)	369.41	-	210	292	570	200	1,072	116,000(3)
Total - Mile 362.8 to 369.8								662,000
Total - Mile 0.0 to 369.8								$44,024,000

(1) Estimated cost of adding 3-30' concrete girder spans on left approach and 23-30' concrete girder spans on right approach plus earth fill approaches.
(2) Estimated cost of adding seven 30-foot concrete girder spans on left approach and nineteen 30-foot concrete girder spans on right approach plus earth fill approach at the right end of bridge.
(3) Estimated cost of adding seven 30-foot concrete girder spans on left approach and nineteen 30-foot concrete girder spans on the right approach plus earth embankment at the right end of bridge.

TABLE 13
PERTINENT DESIGN DATA OF PROPOSED HIGHWAY BRIDGES REQUIRED
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of Bridge	Channel Mile	Proposed design of: Channel bottom: Width (Feet)	Proposed design of: Channel bottom: Grade (MSL)	Normal Pool elevation (MSL)	Elevation of design navigation stage (MSL)(1)	Maximum high water elevation(2) (MSL)	Fenders required between elevation(3)	Design 3-span low steel elevation(MSL)	Leveed floodway (4): top of levees elev.(MSL)	Leveed floodway (4): Width in feet c. to c. of levees
Houston Ship Channel to Dallas Terminus										
Interstate Hwy 73(Westbound)	30.36	150	-11.0	4.0	4.1	8.0	1.0 to 11.1	54.1		
Interstate Hwy 73(Eastbound)	30.37	150	-11.0	4.0	4.1	8.0	1.0 to 11.1	54.1		
U.S. Hwy 90(Eastbound)	47.84	250	-13.0	16.0	17.1	28.0	16.0 to 24.1	67.1		
U.S. Hwy 90(Westbound)	47.90	250	-13.0	16.0	17.1	28.0	16.0 to 24.1	67.1		
State Hwy 105	75.78	150	26.9	60.0	61.3	72.0	60.0 to 68.3	111.3		
U. S. Hwy 59	91.86	150	42.7	60.0	74.0	91.0	60.0 to 81.0	124.0		
County Road (4)	98.90	150	89.0	101.0	103.0	-	101.0 to 110.0	153.0		
U. S. Hwy 190	111.54	150	89.0	131.0	131.0	131.0	101.0 to 138.0	181.0		
State Hwy 19	136.15	150	89.0	131.0	131.0	133.0	101.0 to 138.0	183.0		
State Hwy 21	171.63	150	116.0	138.0	149.7	167.7	138.0 to 156.7	199.7		
State Hwy 7	196.68	150	141.0	168.0	175.0	175.4	168.0 to 182.0	225.0		
Interstate Hwy 35E	220.55	150	170.0	210.0	211.5	244.0	210.0 to 218.5	261.5		
U.S. Hwy 287	249.99	150	223.0	285.0	285.0	266.0	235.0 to 292.0	335.0		
State Hwy 31	264.52	150	258.0	270.0	285.0	289.5	270.0 to 292.0	335.0		
State Hwy 1129	285.60	200	272.0	284.0	295.2	319.5	284.0 to 302.2	345.2		
State Hwy 34	298.04	150	296.0	308.0	320.5	343.0	308.0 to 327.5	370.2	345.0	1800
Malloy County Road	312.84	150	334.1	356.0	357.8	370.0	356 to 364.8	407.8	376.0	2000
Belt Line Road	315.57	150	339.5	356.0	356.0	377.8	356 to 363.0	406.0	385.0	2200
Dowdy Ferry Road (4)	319.92	150	347.0	372.0	373.8	396.0	372 to 380.8	423.8	-	-
Proposed Dallas Terminus										
State Hwy Loop 12(Eastbound)	326.19	150	360.0	372.0	379.2	405.5	372.0 to 386.2	429.2	409.5	2150
State Hwy Loop 12(Westbound)	326.20	150	360.0	372.0	379.2	405.5	372.0 to 386.2	429.2	409.5	2150
Interstate Hwy 45(Northbound)	328.46	150	360.0	372.0	380.8	406.7	372.0 to 387.8	430.8	412.7	2000
Interstate Hwy 45(Southbound)	328.47	150	360.0	372.0	380.8	406.7	372.0 to 387.8	430.8	412.7	2000
Forrest Avenue	330.65	150	360.0	372.0	382.3	411.6	372.0 to 389.3	432.3	415.6	2400
Corinth Street	331.41	150	364.2	396.0	396.7	413.3	396.0 to 403.7	446.7	425.7	2300
Cadiz Street	332.22	150	366.8	396.0	397.0	414.7	396.0 to 404.0	447.0	427.2	1950
Interstate Hwy 35E	332.28	150	367.0	396.0	397.0	414.8	396.0 to 404.0	447.0	427.4	2000
Houston Street	332.61	150	368.1	396.0	397.2	415.3	396.0 to 404.2	447.2	427.9	2000
Dallas-Ft.Worth Toll Road	333.12	150	369.8	396.0	397.3	416.3	396.0 to 404.3	447.3	428.8	1950
Commerce Street	333.50	150	371.2	396.0	397.3	416.8	396.0 to 404.3	447.3	430.7	1800
Continental Street	333.93	150	372.4	396.0	397.8	417.5	396.0 to 404.8	447.8	430.3	1900
Sylvan Road	334.89	150	375.7	396.0	398.2	418.7	396.0 to 405.2	448.2	431.4	2600
Hampton Road	336.33	150	381.6	396.0	399.9	421.4	396.0 to 406.9	449.9	434.4	3070
Westmoreland Road (4)	337.26	150	384.0	396.0	400.2	422.6	396.0 to 407.2	450.2	433.6	2900
State Hwy Loop 12	340.39	150	384.0	396.0	402.2	429.1	396.0 to 409.2	452.2	431.1	2100
Meyers Road	342.94	200	402.8	424.0	424.9	438.0	424.0 to 431.9	474.9	442.0	2100
Belt Line Road	345.25	200	409.7	424.0	425.1	444.9	424.0 to 432.1	475.1	448.9	2000
State Hwy 360	350.75	200	412.0	424.0	426.1	459.5	424.0 to 433.1	476.1	463.5	3200
FM Road 157	354.00	200	431.7	452.0	452.9	470.1	452.0 to 459.9	502.9	474.1	1600
Arlington-Bedford Road	357.00	200	440.0	452.0	453.2	477.0	452.0 to 460.2	503.2	482.3	3000
Arlington-Smithfield Road	359.95	200	440.0	452.0	453.7	483.8	452.0 to 460.7	503.7	487.8	3000
U.S.Hwy Loop 820(5)(Northbound)	362.11	150	456.0	480.0	481.0	493.8	480.0 to 488.0	531.0	-	None
U.S.Hwy Loop 820(5)(Southbound)	362.12	150	456.0	480.0	481.0	493.8	480.0 to 488.0	531.0	-	None
Handley-Ederville Road	362.70	150	458.3	480.0	480.9	496.8	480.0 to 487.9	530.9	500.8	2300
Proposed Fort Worth Terminus										
East First Street	366.80	150	472.0	480.0	None	510.4		514.4	514.4	1050
Beach Street	368.60	200	480.1			517.6		521.6	521.6	1700
Riverside Drive (Northbound)	369.40	200	482.0			520.2		524.2	524.2	1120
Riverside Drive (Southbound)	369.41	200	482.0			520.2		524.2	524.2	1120

(1) Refers to stage of river which is equalled or exceeded 2 percent of time providing for navigation 98 percent of time.
(2) Refers to elevation of maximum high water of record at and below channel mile 286.5 and the standard project flood design water surface in proposed or existing leveed floodways upstream of channel mile 286.5.
(3) Based on providing bridge fenders extending from normal pool elevation to 7 feet above elevation of design navigation stage.
(4) Under construction as of January 1962.
(5) Under construction February 1962 requires new bridge on land-cut channel for both the north- and southbound lanes.

TABLE 14

DATA RELATIVE TO INCREASED
HEIGHT OF HIGHWAY BRIDGES REQUIRED
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL

Name of bridge	Channel mile	Elevation of roadway: Existing	Elevation of roadway: Proposed	Increased bridge height
Interstate Hwy 10 (Eastbound)	30.36	14	58	44
Interstate Hwy 10 (Westbound)	30.37	14	58	44
U. S. Hwy No. 90 (Eastbound)	47.84	29	77	48
U. S. Hwy No. 90 (Westbound)	47.90	29	77	48
State Hwy No. 105	75.78	72	121	49
U. S. Hwy No. 59	91.86	98	134	36
County Road	98.90	103	163	60
U. S. Hwy No. 190	111.54	140	191	51
State Hwy No. 19	136.15	148	196	48
State Hwy No. 21	171.63	176	210	34
State Hwy No. 7	196.68	202	235	33
U. S. Hwy No. 79 & 84	220.55	239	271	32
U. S. Hwy No. 287 (1)	249.99	294	349	45
State Hwy No. 31 (1)	264.52	294	349	45
State Hwy No. 1129	285.60	322	355	33
State Hwy No. 34	298.04	349	381	32
Malloy County Road	312.84	391	418	27
Belt Line Road	315.57	396	420	24
Dowdy Ferry Road	319.92	400	434	34
State Hwy Loop 12 (Eastbound)	326.19	410	439	29
State Hwy Loop 12 (Westbound)	326.20	410	439	29
Interstate Hwy No. 45 (Northbound)	328.46	429	441	12
Interstate Hwy No. 45 (Southbound)	328.47	432	441	9
Forest Avenue	330.65	425	442	17
Corinth St.	331.41	429	457	28
Cadiz Street	332.22	429	457	28
Interstate Hwy 35 E	332.28	432	457	25
Houston St.	332.61	433	457	24
Dallas-Ft. Worth Turnpike	333.12	436	457	21
Commerce St.	333.50	434	457	23
Continental St.	333.93	435	458	23
Sylvan Ave.	334.89	408	458	50
Hampton Road	336.33	440	460	20
Westmoreland Road	337.26	415	460	45
State Hwy Loop 12	340.39	445	462	17
Meyers Road	342.94	440	485	45
Belt Line Road	345.25	454	485	31
State Hwy No. 360	350.75	450	486	36
F.M. Road No. 157	354.00	474	513	39
Arlington-Bedford Road	357.00	481	513	32
Arlington-Smithfield Road	359.95	487	514	27
U. S. Hwy Loop 820 (Northbound)	362.11	510	541	31
U. S. Hwy Loop 820 (Southbound)	362.12	510	541	31
Handley-Ederville Road	362.70	500	541	41

(1) Based on highway bridge required for single purpose Tennessee Colony flood control reservoir and its modification to provide clearance for navigation.

TABLE 15
DETAILED ESTIMATES OF FIRST COST
FOR U.S. HIGHWAY BRIDGE NO. 90(WESTBOUND)
AT CHANNEL MILE 47.88 OVER MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH

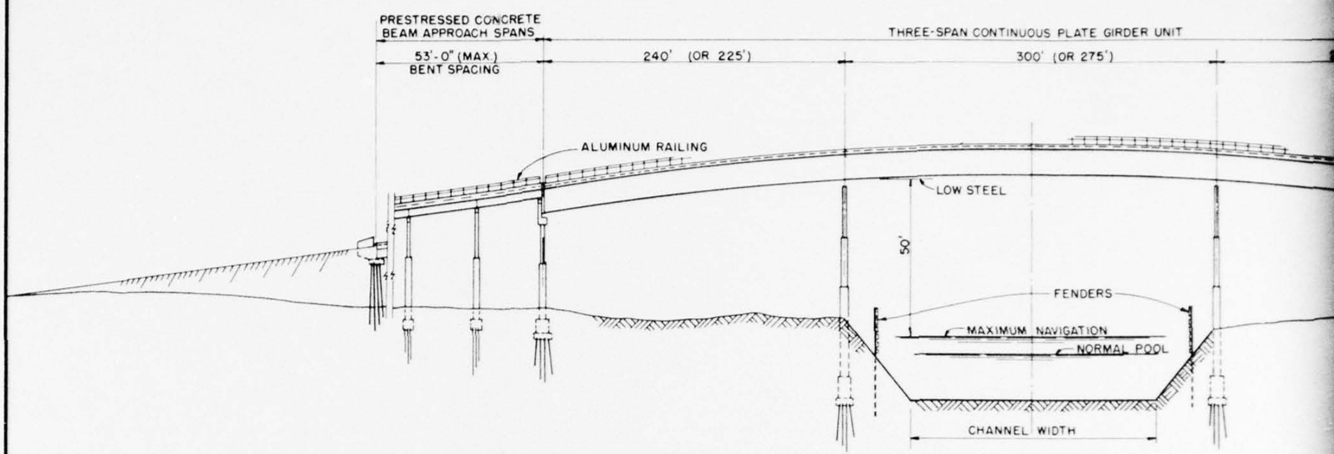
The U. S. Highway No. 90 (westbound) new bridge would be constructed over cutoff channel at mile 47.88 consisting of 780-foot continuous plate girder unit (240-300-240), thirty-seven 50-foot prestressed concrete beam approach spans and earth fill approaches to a maximum height of 20' above natural ground. The bridge was designed for H20-S16 loading with a 28-foot roadway on 3.5% grade. Fender system would be provided for pier protection. Approximately 850' of approach spans on west end of existing bridge over Trinity River and entire relief structure located 0.5 miles west of the river would be removed. Eastbound bridge would be used for maintaining traffic during construction of new bridge.

Item No.	Description	Quantity	Unit	Price	Amount
1.	Earth fill approaches (1)				
	a. Earth fill	8,880	CY	$ 0.85	$7,550
	b. Approach Rd(Conc pvmt. and sub-base)	250	LF	18.85	4,710
	Subtotal				12,260
2.	Abutment Bents (1)				
	a. Structural excavation	25	CY	2.50	60
	b. Class "A" concrete	30	CY	40.00	1,200
	c. Reinforcing steel	4,550	Lbs	0.13	590
	d. Concrete piling	440	LF	7.50	3,300
	e. Conc. riprap(Class"B")	115	CY	30.00	3,450
	f. Cement	45	Bbl	5.00	230
	Subtotal				8,830
3.	Interior Bents (35)				
	a. Structural excavation	1,225	CY	2.50	3,060
	b. Class "A" concrete	1,505	CY	40.00	60,200
	c. Reinforcing steel	240,000	Lbs	0.13	31,200
	d. Concrete piling	17,325	LF	7.50	129,940
	e. Cement	2,258	Bbl	5.00	11,290
	Subtotal				235,690
4.	Transition Bents (2)				
	a. Structural excavation	100	CY	2.50	250
	b. Class "A" concrete	197	CY	40.00	7,880
	c. Reinforcing Steel	31,200	Lbs	0.13	4,060
	d. Concrete piling	2,310	LF	7.50	17,320
	e. Cement	296	Bbl	5.00	1,480
	Subtotal				30,990

TABLE 15 (CONT'D)
DETAILED ESTIMATES OF FIRST COST
FOR U.S. HIGHWAY BRIDGE NO. 90 (WESTBOUND)
AT CHANNEL MILE 47.88 OVER MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH

Item No.	Description	Quantity	Unit	Price	Amount
5.	Main piers (2)				
	a. Structural excavation	315	CY	$2.50	$ 790
	b. Class "A" concrete	456	CY	42.50	19,380
	c. Reinforcing steel	62,000	Lbs	0.13	8,060
	d. Concrete piling	4,620	LF	7.50	34,650
	e. Cement	684	Bbl	5.00	3,420
	Subtotal				66,300
6.	Prestressed conc. beam spans (37)				
	a. Class "A" concrete (Slab)	1,590	CY	42.50	67,580
	b. Reinforcing steel	307,000	Lbs	0.13	39,910
	c. Struct. steel (Armor plates)	5,100	Lbs	0.14	710
	d. Type "C" prestressed concrete beams	7,400	LF	13.50	99,900
	e. Aluminum railing	3,700	LF	5.00	18,500
	f. Cement	2,385	Bbl	5.00	11,920
	Subtotal				238,520
7.	Plate girder spans (3)				
	a. Class "A" concrete (Slab)	610	CY	42.50	25,930
	b. Reinforcing steel	121,800	Lbs	0.13	15,830
	c. Structural steel	1,747,200	Lbs	0.22	384,380
	d. Aluminum railing	1,560	LF	5.00	7,800
	e. Cement	915	Bbl	5.00	4,580
	f. Navigation light		LS		2,500
	Subtotal				441,020
8.	Fender system				
	a. Structural steel (Guard plates)	2,250	Lbs	0.14	320
	b. Treated timber(Creosoted)	15,550	FBM	0.60	9,330
	c. Treated piling(Creosoted)	6,500	LF	3.25	21,120
	Subtotal				30,770
9.	Removal of existing bridge slab & girder spans	1,420	LF	15.00	21,300
10.	Salvage value, existing bridge to be removed.				None
	Total construction cost				1,085,680
	Rounded				1,086,000

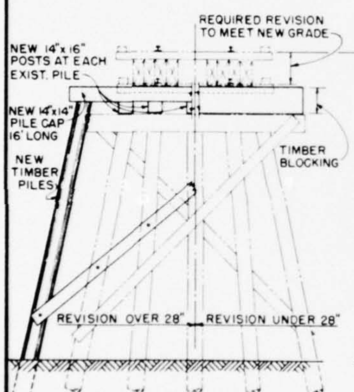
Note: Prices are as of January 1962



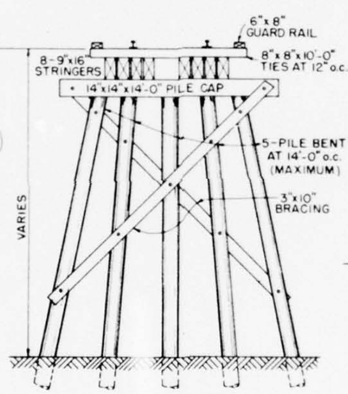
ELEVATION

TYPICAL HIGH-LEVEL FIXED-SPAN HIGHWAY BRIDGE

HORIZONTAL SCALE IN FEET 50 0 50 100 VERTICAL SCALE IN FEET 20 0 20 30



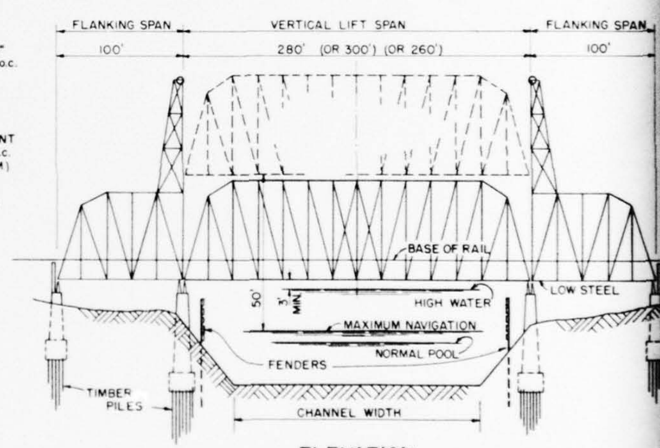
MODIFICATION TO EXISTING TRESTLE



NEW TIMBER TRESTLE

TYPICAL RAILROAD TRESTLE

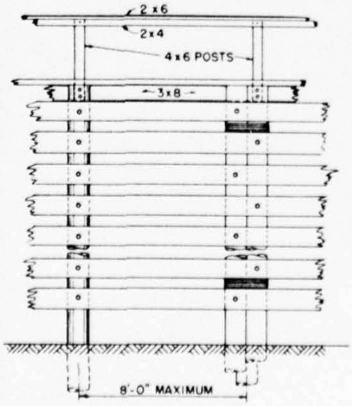
SCALE IN FEET 4 0 4 8



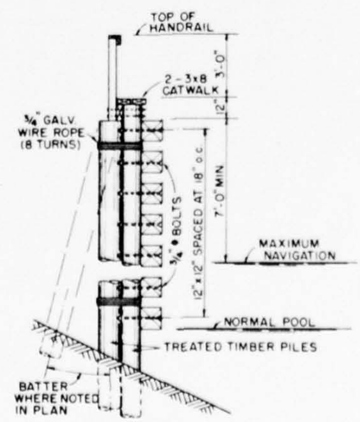
ELEVATION

TYPICAL VERTICAL LIFT SPAN RAILROAD BRIDGE

HORIZONTAL SCALE IN FEET 50 0 50 100 VERTICAL SCALE IN FEET 20 0 20 30

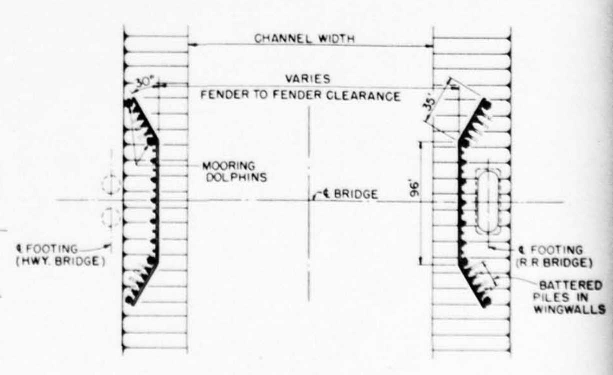


ELEVATION



SECTION

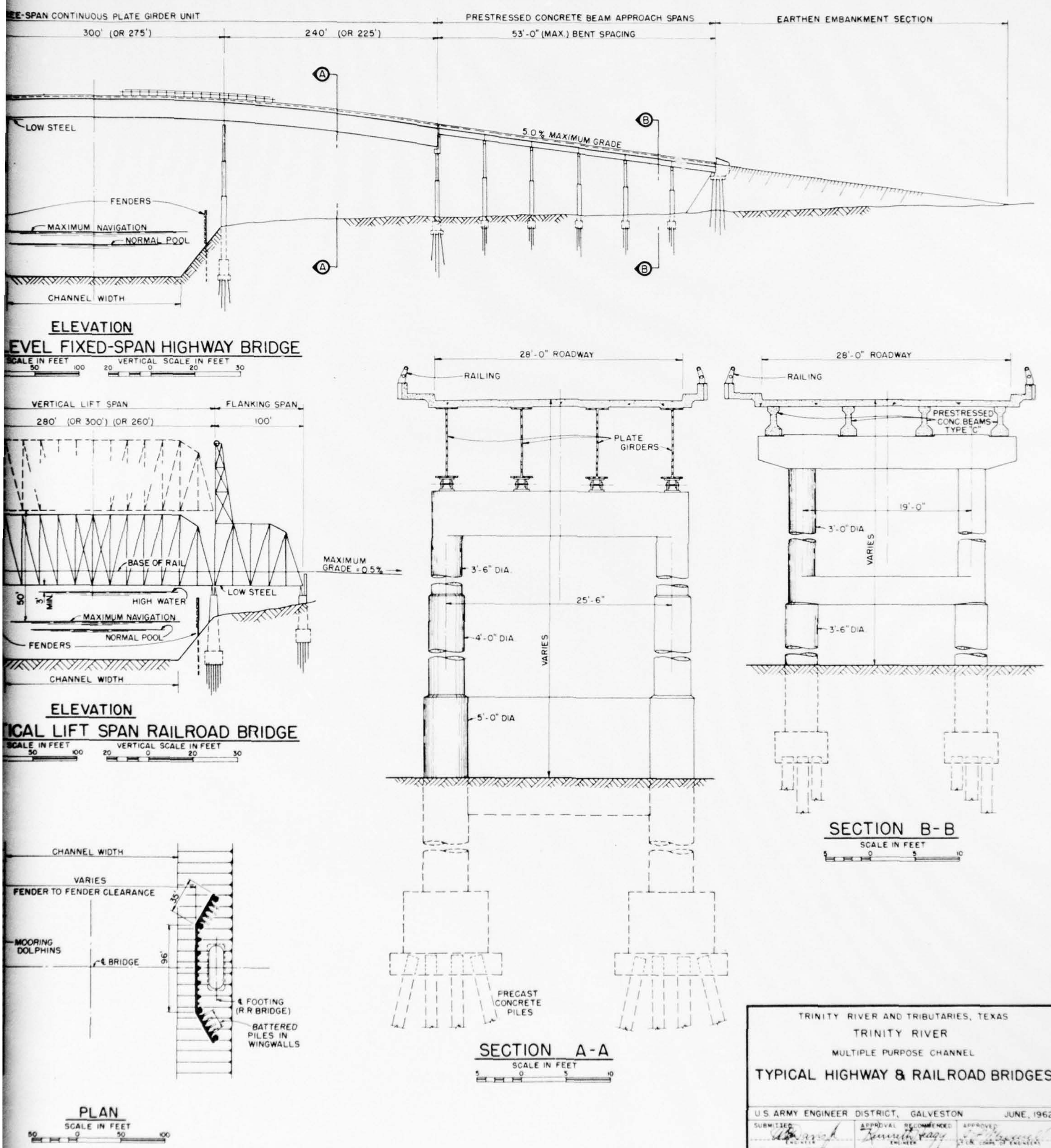
SCALE IN FEET 3 0 3 6



PLAN

SCALE IN FEET 50 0 50 100

TYPICAL FENDER SYSTEM



TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

TYPICAL HIGHWAY & RAILROAD BRIDGES

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE, 1962

SUBMITTED — CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED — CHIEF, ENGINEERING DIVISION
APPROVED — DISTRICT ENGINEER
PREPARED — HEAD, SPECIAL STUDIES SECTION
DRAWN BY
CHECKED BY
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED 30 JUNE 1962
FILE: TRIN 230-19

pertinent data relative to increased height of highway bridges. Plate 26 shows typical views of the high level fixed bridge and timber pile fender system proposed for bridges crossing the navigable reaches of the multiple-purpose channel.

72. ESTIMATE OF FIRST COSTS OF HIGHWAY RELOCATIONS.- The estimated material quantities for the proposed highway bridges over the project channel were determined from curves based on the newly constructed Aransas Pass, Texas, two-lane bridge across the Gulf Intracoastal Waterway. A detailed estimate of first cost for U. S. Highway Bridge No. 90 (westbound) at channel mile 47.88 is given in table 15. This estimate is a typical example of cost of similar type high level fixed highway bridges required for the project channel.

73. SUMMARY OF RAILROAD RELOCATIONS (INCLUDING COSTS).- Existing railroads cross the multiple purpose channel at 13 locations. Eight of the existing bridge crossing would be affected to some degree by the multiple purpose channel and would have to be modified to provide the clearances considered necessary for navigation on the channel. Four other bridges would not be affected as the project channel crosses the railroad embankments on cut-off alignment; however, new bridges providing necessary clearances would be required at the cut-off crossings. The estimated cost for modification of the St. Louis Southwestern Railroad crossing the project channel at mile 264.14 near Trinidad, Texas, is considered in the cost estimate for the proposed Tennessee Colony reservoir. Pertinent data and cost of the required railroad bridge alterations, estimated at a first cost of $25,398,000, are shown in table 16.

74. New bridges required for the project channel are listed as item No. 1, 5, 6, and 13 in the following tabulation, which shows the average daily (1961) traffic crossing the existing bridges over the multiple purpose channel:

Item No.	Railroad owner	Channel mile	Traffic crossing existing bridges: Passenger	Freight	Switching	Total
1	Texas & New Orleans(SP)	47.94	4	6	-	10
2	Missouri Pacific	52.57	4	6	-	10
3	Gulf,Colorado & Santa Fe	77.28	-	-	-	3(1)
4	Texas & New Orleans(SP)	91.93	-	4	-	4
5	Missouri Pacific	136.08	4	3	-	7
6	Missouri Pacific	219.70	4	4	-	8
7	St.Louis & Southwestern	264.14	-	9	-	9
8	Texas & New Orleans(SP)	328.30	-	6	12	16
9	Missouri-Kansas-Texas	330.28	8	6	4	18
10	Gulf,Colorado & Santa Fe	331.09	-	4	6	10
11	Texas & Pacific	333.66	-	-	-	42(1)
12	Gifford Hill Gravel Co.	341.86	-	-	-	(2)
13	Chicago, Rock Island & Pacific	350.54	1	-	-	1

(1) Composition of total traffic not reported.
(2) Traffic not reported.

TABLE 16
SUMMARY OF ESTIMATED FIRST COSTS AND PERTINENT DATA
CONCERNING RAILROAD BRIDGES REQUIRED FOR MULTIPLE PURPOSE
TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of railroad	Channel Mile	Bridgework Required	Component lengths of required bridges: Left trestle approach	Lift bridge & flanking spans	Right trestle approach	Total length	Grade revision: Grade raise	Lineal feet of revision(1)	Estimated total cost
Houston Ship Channel to Upper Reach of Wallisville Reservoir (Mile 0.0 to 35.5)									None
None									
Upper Reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)									
None									None
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)									
Texas & New Orleans RR (SP)	47.94	New bridge	None	500	None	500	None	None	$2,043,000
Missouri Pacific	52.57	Modification	-	500	-	500	None	None	2,028,000
Gulf, Colorado & Santa Fe RR (AT & SF)	77.28	Modification	None	480	None	480	None	None	1,971,000
Texas & New Orleans RR (SP)	91.93	Modification	None	480	None	480	1.0(ft.)	1,550	1,976,000
Missouri Pacific	136.08	New bridge	None	500	None	500	None	None	2,056,000
Missouri Pacific	219.70	New bridge	None	500	None	500	None	None	2,053,000
Total - Mile 47.4 to 233.5									12,127,000
Tennessee Colony dam to Lock & Dam No. 12 (mile 233.5 to 274.4)									
St. Louis Southwestern of Texas	264.14	Considered in the plan of improvement for the Tennessee Colony reservoir.							
Lock & Dam No. 12 to Five-mile creek (Mile 274.4 to 322.0)									
None									None
Five-mile Creek to & including Dallas Terminus (Mile 322.0 to 326.7)									
None									None
Dallas Terminus to existing Dallas Floodway (Mile 326.7 to 331.1)									
Texas & New Orleans RR (SP)	328.30	Modification	1,275	480	1,090	2,845	8.8(ft.)	5,710	2,109,000
Missouri-Kansas-Texas RR (MKT)	330.28	Modification	1,570	460	270	2,300	13.4(ft.)	6,640	2,010,000
Total - Mile 326.7 to 331.1									4,119,000
Dallas Floodway (Mile 331.1 to 338.8)									
Gulf, Colorado & Santa Fe RR (AT & SF)	331.09	Modification	40	460	40	460	.2(ft.)	540	1,916,000
Texas and Pacific RR (TP)	333.66	Modification	None	480	None	480	None	None	3,662,000
Total - Mile 331.1 to 338.8									5,578,000
Dallas Floodway to & including Fort Worth Terminus (Mile 338.8 to 362.8)									
Gifford Hill Gravel Co. RR	341.86	Modification	1,080	460	460	2,000	13.4	6,220	1,834,000
Chicago, Rock Island & Pacific RR	350.54	New bridge	570	460	570	1,600	11.6(ft.)	5,100	1,740,000
Total Mile 338.8 to 362.8									3,576,000
Fort Worth Terminus to & including Riverside Drive Bridges (Mile 362.8 to 369.8)									
None									None
Total - Mile 0.0 to 369.8									$25,398,000

75. RAILROAD BRIDGE DESIGN INFORMATION - The plan of improvement provides for all railroad bridges over the project channel to be of the vertical lift type, with 100-foot flanking spans designed for Coopers E-65 loading. Timber trestle and/or earth embankment approaches to the flanking spans would be provided where necessary for new bridge crossings. Modification of existing bridges provides for the removal of the portion of bridge affected by the lift bridge and flanking spans and modifying the remaining portion of the existing bridge to meet the lift bridge requirements. A timber pile fender system would be provided on the channel side of the lift bridge piers as shown on plate 26, page 67. A timber trestle and/or earth embankment by-pass would be provided to maintain rail traffic during construction of the required bridge work.

76. The lift bridge would provide a minimum vertical clearance of 50 feet in open position above the stage that is equalled or exceeded 2 percent of time and a minimum vertical clearance of three feet in closed position above elevation of high water below channel mile 286.5 and three feet above standard project flood design water surface elevation in leveed floodways at the bridge site. The plans provide for minimum horizontal clearance between bridge fenders of 250 feet for bridges below the Dallas terminus and 225 feet for bridges between the Dallas and Fort Worth termini. Plate 26 shows typical views of the vertical lift and trestle bridges proposed for the multiple purpose channel.

77. Table 17 gives pertinent design data considered in determining the estimated first costs of the required railroad bridges. The data shows that grade modification is required for seven lift bridges to provide three feet of vertical clearance above the elevation of maximum highwater or standard project flood design water surface in leveed floodways as may be applicable. The grade revisions are based on 0.5 percent grades. Earth fill approaches are provided to a maximum height of 20 feet above natural ground with side slopes of two horizontal to one vertical with timber approach trestles to the flanking spans of the lift bridge as may be required, excepting floodways. Where railroads cross existing or proposed floodways, the plan provides for a vertical lift bridge over the project channel and the modification of the existing trestles or new trestles as may be required. All trestles across floodways provide a minimum of four feet of vertical clearance between bottom of stringers and the standard project design water surface elevation.

78. ESTIMATES OF FIRST COST OF RAILROAD RELOCATIONS.- The estimated material quantities for the proposed railroad lift bridges over the project channel are based on "Estimating Data for Bridges and Miscellaneous Structures," prepared in 1932 for Calument-Sag Board, by First Chicago District, United States Engineers. The material quantities for all other bridge work were based on available plans of similar railroad bridges as modified and site-adapted. Detailed estimates of first cost for the new Texas and New Orleans Railroad bridge at channel mile 91.93 and for the modification of the Gulf, Colorado and Santa Fe Railroad bridge at channel mile 331.09 are given in tables 18 and 19, respectively, as typical examples for estimating the cost of all railroad bridges required for the project channel.

TABLE 17
PERTINENT DESIGN DATA OF PROPOSED RAILROAD BRIDGES REQUIRED
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of Bridge	Channel Mile	Proposed design of channel bottom: Width (Feet)	Proposed design of channel bottom: Grade (MSL)	Normal pool elevation (MSL)	Elevation of design navigation stage (MSL)(1)	Maximum high water elevation(2) (MSL)	Fenders required between elevation(3)	Desi… Lift … over … Close…
Houston Ship Channel to Dallas Terminus								
T. & N. O. RR	47.94	250	-13.0	16.0	17.1	26.3	16.0 to 24.1	29.
Missouri Pacific RR	52.57	250	5.6	16.0	20.2	34.5	16.0 to 27.2	38.
G. C. & S. F. RR	77.28	150	28.3	60.0	62.7	73.8	60.0 to 69.7	83.
T. & N.O. RR	91.93	150	42.8	60.0	73.9	91.0	60.0 to 80.9	94.
Missouri Pacific RR	136.08	150	89.0	131.0(7)	131.0	133.0	101.0 to 138.9	142.
Missouri Pacific RR	219.70	150	167.0	210.0	211.1	223.0	210.0 to 218.1	228.
S. L. & S. W. RR	264.14	150	258.0	270.0	285.0	289.0	270.0 to 282.0	292.
Proposed Dallas Terminus								
T. & N. O. RR	328.30	150	360.0	372	380.8	408.2	372.0 to 387.8	411.
M. K. & T. RR	330.28	150	360.0	372	382.2	411.0	372.0 to 389.2	414.
G. C. & S. F. RR	331.09	150	360.0	372	382.5	412.0	372.0 to 389.5	416.
T. & P. RR	333.66	150	371.5	396	397.6	417.0	396.0 to 404.6	428.
Gifford Hill Gravel Co. RR	341.86	150	384.0	396	402.2	433.3	396.0 to 409.2	436.
C. R. I. & P. RR	350.54	200	412.0	424	426.1	459.3	424.0 to 433.1	462.

(1) Refers to stage of river which is equalled or exceeded 2 percent of time providing for navigation 98 percent of time.
(2) Refers to elevation of maximum highwater of record at and below channel mile 322.0, and the standard project flood des
in proposed or existing leveed floodways upstream of channel mile 322.0.
(3) Based on providing bridge fenders extending from normal pool elevation to 7 feet above elevation of design navigation
(4) Elevation of base of rail on existing bridge or of railroad at proposed location of bridge over land cut channel.
(5) Total length of grade revision including lift bridge and flanking spans.
(6) Based on maintaining existing grade of railroad at bridge crossing.
(7) Top of conservation storage in Livingston Rexervoir which may be depleted to elevation 101.0.

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n ater ion(2))	Fenders required between elevation(3)	Design low steel elevation (MSL) Railroad bridges: Lift span over channel: Closed	Lift span over channel: Open	Flanking spans (fixed)	Leveed floodway approach bridge: Design Low-steel elevation(MSL)	Length of approaches: Left bank	Length of approaches: Right bank	Length of approaches: Total	Proposed railroad grade modification: Elevation base of rail: Proposed bridge	Elevation base of rail: Existing track (4)	Grade raise (feet)	Lineal feet of grade revision(5)
3	16.0 to 24.1	29.3	67.1	29.3	-	-	-	-	37.3	33.5	3.8	1100
5	16.0 to 27.2	38.2(6)	70.2	38.2	-	-	-	-	44.5	44.5	0.0	0
8	60.0 to 69.7	83.5(6)	112.7	83.5	-	-	-	-	89.8	89.8	0.0	0
0	60.0 to 80.9	94.0	124.0	94.0	-	-	-	-	100.3	99.3	1.0	1070
0	101.0 to 138.9	142.7	183.0	142.7	-	-	-	-	149.0	149.0	0.0	0
0	210.0 to 218.1	228.9(6)	261.1	228.9	-	-	-	-	235.2	235.2	0.0	0
0	270.0 to 282.0	292.0	335.0	292.0	-	-	-	-	298.3	296.1	2.2	880
2	372.0 to 387.8	411.2	430.8	411.2	412.2	720	900	1620	417.6	408.8	8.8	4000
.0	372.0 to 389.2	414.0	432.2	414.0	415.0	1570	270	1840	420.3	407.3	13.0	6640
.0	372.0 to 389.5	416.6	432.0	416.6	416.0	1270	1190	2460	421.3	421.1	0.2	80
.0	396.0 to 404.6	428.8	447.6	428.8	428.0	980	540	1520	435.1	435.1	0.0	0
.3	396.0 to 409.2	436.3	452.2	436.3	437.3	1080	460	1540	442.6	430.3	12.3	6220
.3	424.0 to 433.1	462.3	476.1	462.3	463.3	570	570	1140	468.6	457.0	11.6	5100

gation 98 percent of time.
standard project flood design water surface

ation of design navigation stage.
over land cut channel.

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TABLE 18
DETAILED ESTIMATES OF FIRST COSTS FOR THE T.& N.O.RR(SP)
BRIDGE AT CHANNEL MILE 91.93 OVER MULTIPLE PURPOSE TRINITY RIVER
CHANNEL TO FORT WORTH

A new bridge would be constructed over cutoff channel at mile 91.93 replacing approximately 500 feet of timber trestle and earthen embankment. The new bridge would consist of 280-foot vertical lift span with two 100-foot approach spans and is designed for single track E-65 loading. Base of rail would be raised approximately one foot. Fender system would be provided for pier protection. A temporary by-pass of timber trestle and earth fill would be constructed for maintaining traffic during construction of the new bridge.

Item No.	Description	Quantity	Unit	Price	Amount
1.	Excavation (for all piers)	34,000	CY	$2.50	$85,000
	Subtotal				85,000
2.	Abutment piers(2)				
	a. Concrete	820	CY	42.50	34,850
	b. Reinforcing steel	41,000	Lbs	0.13	5,330
	c. Cement	1,025	Bbl	5.00	5,130
	d. Timber piles,untr.45'cl."B"	5,310	LF	1.85	9,820
	Subtotal				55,130
3.	Main piers (2)				
	a. Concrete	2,360	CY	42.50	100,300
	b. Reinforcing steel	118,000	Lb.	0.13	15,340
	c. Cement	2,950	Bbl.	5.00	14,750
	d. Timber,piles, untr.45'cl"B"	20,430	LF	1.85	37,800
	Subtotal				168,190
4.	Superstructure				
	a. Struct. steel in spans	2,125,560	Lb.	0.30	637,670
	b. Struct. st. in towers & cwt	863,372	Lb.	0.35	302,170
	c. Counterweight chains	46,489	Lb.	0.35	16,270
	d. Ropes & machinery	358,631	Lb.	1.00	358,630
	e. Conc. in counterweights	404	CY	40.00	16,160
	f. Reinforcing	20,900	Lb.	0.13	2,720
	g. Cement	520	Bbl.	5.00	2,600
	h. Electrical equipment		LS		75,000
	i. Signal system		LS		13,000
	j. Auxiliary power		LS		7,500
	k. Hsg. (For pr. & machinery)		LS		12,000
	l. Shoes, cast. & sheaves		LS		24,000
	m. Ballast	284	CY	5.00	1,420
	n. Ties	75,000	FBM	0.15	11,250
	o. Rail	21,300	Lb	0.15	3,200
	Subtotal				1,483,590

TABLE 18 (CONT'D)
DETAILED ESTIMATES OF FIRST COSTS FOR THE T.& N.O. RR(SP)
BRIDGE AT CHANNEL MILE 91.93 OVER MULTIPLE PURPOSE TRINITY RIVER
CHANNEL TO FORT WORTH

Item No.	Description	Quantity	Unit	Price	Amount
5.	Fender system				
	a. Timber piles, treat. cl."B"	8,500	LF	$3.25	$27,620
	b. Guard timbers (Wales)				
	Brac. & catwalk - treated	61,500	FBM	0.60	36,900
	c. Steel tangent plates	11,000	Lb	0.14	1,540
	d. Bolts & spikes	7,200	Lb	0.20	1,440
	Subtotal				67,500
6.	Removal of exist. structure				
	Remove pile trestle	320	LF	10.00	3,200
	Subtotal				3,200
7.	Rev. elev. of exist. track to meet new bridge				
	a. Earthen embankment (770 LF)				
	1.Fill	2,700	CY	0.25	680
	2.Ballast	880	CY	5.00	4,400
	b. Trestle (300 LF)				
	Timber blocking	24,000	FBM	0.40	9,600
	c. Hardware (Galvanized)	900	Lb	0.30	270
	d. Spikes, plates, bolts	8,000	Lb	0.20	1,600
	e. Ties	20,800	FBM	0.10	2,080
	f. Reinstall exist. track	1,070	LF	1.00	1,070
	Subtotal				19,700
8.	Temporary by-pass				
	a. Earthen embankment (421 LF)				
	1. Fill	9,000	CY	0.25	2,250
	2. Ballast	760	CY	5.00	3,800
	3. Ties	20,300	FBM	0.10	2,030
	b. Trestle(1,100 LF)				
	1. Timber, piles, treat.cl."B"	2,210	LF	3.25	7,180
	2. Timber (Dimensional)	89,700	Lb	0.40	35,880
	c. Hardware (Galvanized)	7,900	Lb	0.30	2,370
	d. Rail (New)	116,800	Lb	0.15	17,520
	e. Spikes, plates, bolts	12,200	Lb	0.20	2,440
	f. Ties (Switch)	136,200	FBM	0.15	20,430
	Subtotal				93,900
9.	Salvage value				None
	Total construction cost				1,976,210
	Rounded				1,976,000

Note: Prices are as of January 1962

TABLE 19
DETAILED ESTIMATES OF FIRST COSTS FOR THE G. C.& S.F. RR
BRIDGE AT CHANNEL MILE 331.09 OVER MULTIPLE PURPOSE TRINITY RIVER
CHANNEL TO FORT WORTH

A new bridge would be constructed over the proposed channel at mile 331.09 replacing the existing 198-foot thru truss span and about 280 feet of open deck pile trestle. The new bridge would consist of a 260-foot vertical lift span and two 100-foot flanking spans. The new bridge would be designed for single track E-65 loading. Existing approaches would be raised 0.2-foot on 0.5% grades to meet the new bridge elevation. A fender system would be provided for pier protection. Temporary by-pass of earth fill and timber trestle would be constructed for maintaining traffic during construction of the new bridge.

Item No.	Description	Quantity	Unit	Price	Amount
1.	Excavation (for all piers)	20,000	CY	2.50	$50,000
	Subtotal				50,000
2.	Abutment piers (2)				
	a. Concrete	978	CY	42.50	41,560
	b. Reinforcing steel	48,900	Lbs.	0.13	6,360
	c. Cement	1,220	Bbl	5.00	6,100
	d. Timber piles, untreat.45'cl."B"	6,210	LF	1.85	11,490
					65,510
3.	Main piers (2)				
	a. Concrete	2,764	CY	42.50	117,470
	b. Reinforcing steel	138,200	Lb	0.13	17,970
	c. Cement	3,455	Bbl.	5.00	17,270
	d. Timber piles,untr.45' cl."B"	22,140	LF	1.85	40,960
	Subtotal				193,670
4.	Superstructure				
	a. Struct. steel in spans	1,931,976	Lb	0.30	579,590
	b. Struct. st. in towers & cwt.	742,210	Lb	0.35	259,770
	c. Counterweight chains	40,000	Lb	0.35	14,000
	d. Ropes & machinery	296,883	Lb	1.00	296,880
	e. Conc. in counterweight	348	CY	40.00	13,920
	f. Reinforcing	17,400	Lb	0.13	2,260
	g. Cement	435	Bbl	5.00	2,180
	h. Electrical equipment		LS		75,000
	i. Signal system		LS		13,000
	j. Auxiliary power		LS		7,500
	k. Hsg. (Operator & machinery)		LS		12,000
	l. Shoes, castings & sheaves		LS		24,000
	m. Ballast	265	CY	5.00	1,330
	n. Ties	70,000	FBM	0.15	10,500
	o. Rail	19,800	Lb	0.15	2,970
	Subtotal				1,314,900

TABLE 19 (CONT'D)
DETAILED ESTIMATES OF FIRST COSTS FOR THE G. C. & S.F. RR
BRIDGE AT CHANNEL MILE 331.09 OVER MULTIPLE PURPOSE TRINITY RIVER
CHANNEL TO FORT WORTH

Item No.	Description	Quantity	Unit	Price	Amount
5.	**Fender system**				
	a. Timber piles, treat.cl."B"	6,600	LF	$ 3.25	$21,450
	b. Guard timbers (Wales) treat.	38,400	FBM	0.60	23,040
	c. Brac. & Catwalk - treat	3,900	FBM	0.60	2,340
	d. Steel tangent plates	6,930	Lb	0.14	970
	e. Bolts & spikes	4,800	Lb	0.20	960
					48,760
6.	Removal of exist. structure				
	a. Remove thru truss span	200	LF	18.50	3,700
	b. Remove pile trestle	280	LF	10.00	2,800
	Subtotal				6,500
7.	Temporary by-pass 2,116 LF				
	a. Earthen embankment 335 LF				
	1. Fill	18,000	CY	0.25	4,500
	2. Ballast	350	CY	5.00	1,750
	3. Ties	9,100	FBM	0.10	910
	b. Trestle (1,781 LF)				
	1. Timber piles treat. cl."B"	33,750	LF	3.25	109,690
	2. Timber (Dimensional)	217,900	FBM	0.40	87,160
	c. Hardware (Galv)	19,000	Lb	0.30	5,700
	d. Rail	162,000	Lb	0.15	24,300
	e. Spikes, plates, bolts	16,900	Lb	0.20	3,380
	f. Ties	57,800	FBM	0.15	8,670
	Subtotal				246,060
8.	Salvage value thru truss span, estimated $9,000				-9,000
	Total construction cost				$1,916,400
	Rounded				1,916,000

Note: Prices are as of January 1962

79. SUMMARY OF PIPELINE RELOCATIONS(INCLUDING COSTS).- The estimated costs of pipeline relocations required for the multiple purpose channel are based on providing the same number and size of pipes which the respective companies installed at their pipeline crossings of the Trinity River. Accordingly, a total of 111 pipeline crossings would be required for the multiple purpose channel between the Houston Ship Channel and Fort Worth, Texas, of which 37 are required below Liberty and 74 are required above Liberty. Four gathering lines of 2.5-inch size cross the completed portion of the channel to Liberty in the vicinity of Double Bayou, channel mile 15.7. These lines would not require relocation to provide for deepening to 12 feet the existing 9 x 150-foot channel to Liberty project.

80. Fifteen of the 37 pipeline crossings required below Liberty are located in the vicinity of channel mile 30.6 on the multiple purpose cut-off channel alinement proposed in this report near Wallisville, Texas. The cost of relocating these lines are assigned to the multiple purpose project because these lines need not be relocated at the river crossing to provide for the authorized channel to Liberty project.

81. From channel mile 30.6 to channel mile 47.4, the multiple purpose channel alinement generally coincides with the authorized alinement of the uncompleted channel to Liberty project. In this reach, 22 pipe lines would be relocated to provide for either the multiple purpose channel or the authorized channel to Liberty. Since the authorized channel to Liberty project provides for relocating the pipelines affected by the 9 x 150-foot channel, the cost of any additional length of pipeline relocation over that required for the 9 x 150-foot channel is assigned to the multiple purpose channel. The cost of pipeline relocations upstream of Liberty are assigned to the multiple purpose channel project. Alteration costs for the pipeline relocations in the Tennessee Colony Reservoir are contained in the estimate of cost of Tennessee Colony Reservoir.

82. The estimated costs of pipeline relocations are based on the pipelines extending 25 feet beyond the bottom width of the channel at a depth of either 25 feet below normal pool to provide for probable deepening of the navigation sections of the channel, or five feet below the bottom of the multiple purpose channel, whichever is deeper. The estimate of costs also provides for a pipeline valve to be installed on each side of the channel, with manifold headers if required, and the pipelines to be coated or wrapped and secured with sufficient weights. The unit cost of excavation and backfill is estimated at 55 cents per cubic yard. The unit installed costs for the various size of pipes and valves are shown in the following tabulation.

Size of pipe,	Unit costs (Installed)	
diameter(inches)	Pipeline (LF)	Valves (each)
3"	$ 7.10	$ 250.00
4"	8.00	290.00
6"	12.00	360.00
7"	13.50	400.00
8"	15.00	430.00
10"	18.00	500.00
12"	24.00	610.00
14"	24.30	1,160.00
16"	30.00	1,510.00
18"	39.00	1,880.00
20"	46.00	2,260.00
24"	58.00	3,520.00
26"	66.00	4,180.00
30"	84.00	5,480.00

A summary of the cost of pipeline relocations required for the multiple purpose channel to Fort Worth is given in table 20.

TABLE 20
SUMMARY OF COST OF PIPELINE RELOCATIONS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Name of owner	Channel mile	Number of pipe size & commodity	Excavation	Pipeline		Weights costing & misc. items	Valves		Total costs
				LF	Cost		No.	Cost	
Houston Ship Channel to upper reach of Wallisville Reservoir (Mile 0.0 to 35.5)									
Texas Eastern	30.6	2-30" Gas	$7,140	850	$71,400	$10,200	2	$10,960	$99,700
Texas Eastern	30.6	1-16" Prod.	2,975	425	12,750	4,245	2	3,020	22,990
Texas Eastern	30.6	2-20" Gas	5,950	850	39,100	9,000	4	9,040	63,090
Service P.L. Co.	30.6	1-8" Prod.	4,165	425	6,375	5,060	2	860	16,460
Humble P.L. Co.	30.6	1-30" Gas	3,400	425	35,700	6,440	2	10,960	56,500
Humble P.L. Co.	30.6	1-3" Gas	3,892	425	3,018	1,500	2	500	8,910
Humble P.L. Co.	30.6	1-8" Gas	1,184	405	6,075	2,321	2	860	10,440
Humble P.L. Co.	30.6	1-10" Gas	1,462	475	8,550	3,948	2	1,000	14,960
United Gas P.L. Co.	30.6	1-20" Gas	2,430	405	18,630	10,000	2	4,520	35,580
Tennessee Gas P.L.Co.	30.6	1-6" Prod.	(1)	425	5,100	1,770	2	720	7,590
Tennessee Gas P.L.Co.	30.6	1-30" Gas	4,080	425	35,700	3,440	2	10,960	54,180
Warren Pet Co.	30.6	1-8" Ethylene	2,550	425	6,375	5,955	2	860	15,740
Gulf Oil Corp.	30.6	1-8" "	3,544	405	6,075	3,341	2	860	13,820
Sinclair P.L. Co.	34.8	1-12" Oil	No charge-cost included in authorized project						
Texas P.L. Co.	34.8	1-20" Oil	No charge-cost included in authorized project						
Trans.Southern P.L.Co	35.0	2-10" L.P.	No charge-cost included in authorized project						
Total-Mile 0.0 to 35.5									419,960

TABLE 20 (CONT'D)
SUMMARY OF COST OF PIPELINE RELOCATIONS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Name of owner	Channel mile	Number of pipe size & commodity	Excavation	Pipeline LF	Pipeline Cost	Weights costing & misc. items	Valves No.	Valves Cost	Total costs
Upper reach of Wallisville Reservoir to head of authorized Channel to Liberty (Mile 47.4)									
Magnolia P.L. Co.	41.0	1-12" Prod.	$2,070	150	$4,000	$300	-	-	$6,370
Magnolia P.L. Co.	41.0	5-8" Gas	2,390	150	2,250	1,650	-	-	6,290
Cities Service	42.9	1-12" Oil	800	150	3,600	290	-	-	4,690
Sun P.L. Co.	42.1	1-6" Oil	1,860	150	1,800	550	-	-	4,210
Gulf Oil Corp.	44.5	2-8" Oil	1,210	200	3,000	1,630	-	-	5,840
Humble P.L. Co.	44.6	1-7" Gas	625	100	1,350	535	-	-	2,510
Gulf Oil Corp.	45.9	1-4" Oil	1,740	100	800	250	-	-	2,790
United Gas P.L. Co.	45.7	1-6" Gas	1,510	100	1,200	1,070	-	-	3,780
United Gas P.L. Co.	45.7	1-10" Gas	1,160	100	1,800	1,000	-	-	3,960
Gulf Oil Corp.	45.7	1-6" Oil	1,340	100	1,200	250	-	-	2,790
Industrial Gas Sup.Co	46.4	1-10" Gas	2,000	100	1,800	280	-	-	4,080
Gulf Oil Corp.	47.4	1-6" Oil	1,340	100	1,200	250	-	-	2,790
Humble Oil Co.	47.4	1-8" Oil	2,390	100	1,500	250	-	-	4,140
Total - Mile 35.5 to 47.4)									$54,240

TABLE 20 (CONT'D)
SUMMARY OF COST OF PIPELINE RELOCATIONS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Name of owner	Channel mile	Number of pipe size & commodity	Excavation	Pipeline LF	Pipeline Cost	Weights Coating & misc. items	Valves No.	Valves Cost	Total costs
Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)									
United Gas P.L. Co.	47.8	1-8" Gas	$9,488	1,140	$34,260	$1,442	2	$ 860	$46,050
Sun P.L. Co.	49.1	1-6" Oil	11,530	640	7,680	1,600	2	720	21,530
Sinclair P.L.Co.	49.1	1-12" Oil	9,973	626	15,024	1,873	2	1,220	28,090
Sun P.L. Co.	49.3	1-8" Oil	11,520	640	9,600	1,760	2	860	23,740
Magnolia P.L. Co.	51.9	2-8" Oil	8,698	1,216	18,240	2,132	4	1,720	30,790
Trans.Cont.Gas P.L.Co	52.4	2-24" Gas	9,417	1,232	71,456	5,557	4	14,080	100,510
Trans.Cont.Gas P.L.Co	52.4	1-30" Gas	9,417	616	51,744	3,079	2	10,960	75,200
Magnolia P.L. Co.	55.2	2-10" LPG	9,977	626	11,268	1,565	2	1,000	23,810
Magnolia P.L. Co.	55.2	2-8" Oil	9,975	626	9,390	1,565	2	860	21,790
Houston P.L. Co.	59.6	1-18" Gas	80,000(1)	800	31,200	1,200	-	10,000(4)	122,400
Houston P.L. Co.	59.6	1-12" Gas	5,011	514	12,336	1,543	2	1,220	20,110
Atlantic P.L. Co.	64.6	2-10" Oil	8,751	1,156	35,258(2)	2,021	4	2,000	48,030
Trunkline Gas Sup.Co.	65.9	2-24" Gas	9,719	1,156	67,048	4,913	4	14,080	95,760
Gulf Oil Corp.	77.9	1-10" LPG	7,526	528	9,504	1,320	2	1,000	19,350
Tennessee Gas P.L.Co.	85.0	1-6" Gas(12")	11,428	728	17,472	1,820	2	1,220	31,940
Tennessee Gas P.L.Co.	86.3	1-30" Gas	11,428	728	61,152	3,640	2	10,960	87,180
Tennessee Gas P.L.Co.	86.3	1-26" Gas	11,428	728	48,048	3,274	2	8,360	71,110
Tennessee Gas P.L.Co.	86.3	3-16" Gas	14,800	2,184	65,520	7,640	6	9,060	97,020
Natural Gas P.L.Co.	90.2	2-24" Gas	14,295	1,204	69,832	5,113	4	14,080	103,320
United Gas P.L. CO.	91.8	5-8" Gas	17,535	2,990	44,850	7,475	10	4,300	68,160
United Gas P.L. Co.	91.8	3-20" Gas	15,893	1,794	82,524	7,173	6	13,560	119,150
Service P.L. Co.	93.0	1-12" Oil	10,937	572	13,728	1,715	2	1,220	27,600
Shell P.L. Co.	93.0	2-10" Oil	11,287	1,156	20,808	2,895	4	2,000	36,990
Shell P.L. Co.	93.0	1-6" Oil	11,039	578	6,936	1,445	2	720	20,140
United Gas P.L. Co	135.7	2-6" Gas	26,374	1,668	20,016	4,170	2	720	51,280
Gulf Oil Corp.	190.6	1-26" Oil	13,331	1,216	80,256	5,473	4	16,720	115,780

TABLE 20 (CONT'D)
SUMMARY OF COST OF PIPELINE RELOCATIONS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Name of Owner	Channel mile	Number of pipe size & commodity		Excavation	Pipeline LF	Pipeline Cost	Weights coating & Misc. items	Valves No.	Valves Cost	Total Costs
Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)(Cont'd)										
Lone Star Gas Co.	205.9	2-6"	Gas	$11,950	608	$9,120	$1,510	2	$ 860	$23,440
Humble P.L.Co.	205.9	1-4"	Oil	12,338	604	4,832	1,510	2	580	19,260
Humble P.L. Co.	207.8	1-4"	Oil	12,338	604	4,832	1,510	2	580	19,260
Magnolia P.L. Co.	209.8	1-20"	Oil	12,750	1,156	53,176	4,624	4	9,040	79,590
Lone Star Gas Co.	220.8	1-12"	Gas	4,520	470	11,280	1,410	2	1,220	18,430
Gulf Oil Corp.	221.4	2-10"	LPG	2,922	1,196	21,528	2,990	4	2,000	29,440
Humble P.L. Co.	230.5	1-10"	Oil	10,548	578	10,404	1,448	2	1,000	23,400
Humble P.L. Co.	230.5	2-8"	LPG	10,548	1,156	17,340	2,532	4	1,720	32,140
Sinclair P.L. Co.	231.5	2-12"	Oil	9,752	1,104	26,496	3,312	4	2,440	42,000
Total - Mile 47.4 to 233.5										1,799,790
Tennessee Colony Dam & Reservoir (Mile 233.5 to 274.4)										
Note: Estimated cost of all pipeline relocations in this reach are included in estimated cost of Tennessee Colony reservoir.										
Tennessee Colony Reservoir to Five-mile Creek (Mile 274.4 to 322.0)										
Humble P.L. Co.	276.2	1-4"	Oil	7,491	558	4,464	1,395	2	580	13,930
Magnolia P.L. Co.	277.0	1-20"	Oil	8,245	566	26,036	2,269	2	4,520	41,070
Total - Mile 274.4 to 322.0										55,000
Five-mile Creek to & including Dallas Terminus (Mile 322.0 to 326.7)										
United Gas P.L. Co.	322.8	1-18"	Gas	6,355	502	19,578	1,757	2	3,760	31,450
United Gas P.L. Co.	324.6	1-20"	Gas	8,660	540	24,840	3,160	2	4,520	41,180
Total - Mile 322.0 to 326.7										72,630
Dallas Terminus to Dallas Floodway (Mile 326.8 to 331.1)										
Lone Star Gas Co.	328.1	3-12"	Gas	14,490	4,000	96,000	10,390	6	3,660	124,540
Lone Star Gas Co.	330.7	1-6"	Gas	10,039	678	8,136	3,695	2	720	22,590
Total - Mile 326.8 to 331.1										147,130

TABLE 20 (CONT'D)
SUMMARY OF COST OF PIPELINE RELOCATIONS
REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Name of owner	Channel mile	Number of pipe size & commodity	Excavation	Pipeline LF	Pipeline Cost	Weights: Coating: & misc. Items	Valves No.	Valves Cost	Total Costs
Dallas Floodway (Mile 331.1 to 338.8)									
Lone Star Gas Co.	332.7	1-16" Gas	$ 6,355	602	$18,060	$4,105	2	$3,020	$31,540
United Gas P.L.Co.	333.1	1-12" Gas	5,110	482	11,568	3,442	2	1,220	21,340
Total - (Mile 331.1 to 338.8)									52,880
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)									
Lone Star Gas Co.	339.0	1-6" Gas	8,743	646	7,752	2,655	2	720	19,870
Lone Star Gas Co.	340.0	1-20" Gas	10,720	730	33,580	1,000	2	4,520	49,820
Humble Pipeline Co.	340.1	1-8" Prod.	9,530	584	8,760	1,460	2	860	20,610
Texas P.L. Co.	341.8	1-8" Prod.	5,455	428	6,420	1,325	2	860	14,060
Lone Star Gas Co.	353.3	1-10" Gas	7,104	652	11,736	2,630	2	1,000	22,470
Sinclair P.L. Co.	354.5	1-10" Prod.	5,960	540	9,720	1,450	2	1,000	18,130
Magnolia P.L. Co.	360.9	1-16" Oil	9,660	546	16,380	1,910	2	3,020	30,970
United Gas P.L. Co.	362.0	1-16" Gas	6,734	508	15,240	1,526	2	3,020	26,520
Total - (Mile 338.8 to 362.8)									202,450
Fort Worth Terminus to & Including Riverside Drive bridges (Mile 362.8 to 369.8)									
Lone Star Gas Co.	364.2	1-10" Gas	10,080	664	11,952	1,658	2	1,000	24,690
Total - Mile 0.0 to 369.8									2,828,770

Note: Prices are as of January 1962
(1) Estimate covers 2-100-foot towers and suspension bridges to carry elevated pipeline providing 50-foot clearance above pose.
(2) Estimate provides for installing pipelines in 14-inch casings.
(3) Includes 520' of 12" sleeve @ 48.00 per LF.
(4) Includes costs of valves and fitting for overhead line.

83. SUMMARY OF POWER TRANSMISSION LINE RELOCATIONS (INCLUDING COSTS).- This item includes the alteration of all power transmission lines crossing the navigable portion of the multiple purpose channel between the Houston Ship Channel and Fort Worth with the exception of the reach located in Tennessee Colony reservoir. Alteration costs for the power transmission lines crossing the Tennessee Colony reservoir are contained in the estimate of cost for the Tennessee Colony reservoir. Powerlines crossing the navigable portion of the channel would be raised to conform with minimum clearance requirements given in information pamphlet entitled "Permits for Work in Navigable Waterways of the United States." In general all transmission lines crossing the multiple purpose channel, having voltages of 115 KV or less would have a minimum vertical clearance of 70 feet, and lines having voltages greater than 115 KV and not more than 138 KV would have minimum vertical clearances of 75 feet above the backwater elevation of the operating discharge at the crossing. Where the transmission lines cross the multiple purpose channel in river cut-off alinement, and extends across the Trinity River, the lines crossing the Trinity River would have a minimum clearance of 25 feet above the 50-year flood elevation at the river crossing.

84. FIRST COST.- Power line alteration costs total $710,800. The costs for alteration of power transmission lines include in general the cost of constructing towers on each side of the channel and installing new cable between towers. Salvage value of old cable has been subtracted from the construction cost. The estimated first costs and other data for relocation of the individual power transmission lines required for the multiple purpose channel are given in table 21.

TABLE 21
SUMMARY OF FIRST COSTS OF MODIFICATION TO ELECTRIC-POWER TRANSMISSION LINES TO PROVIDE FOR THE MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Owner of power line	Location (Channel mile)	Voltage (K.V.)	Total costs
Houston Ship Channel to upper reach of Wallisville Reservoir-(Mile 0.0 to 35.5)			
None	-	-	None
Upper reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)			
Gulf States Utilities	47.30	69	$22,000
Gulf States Utilities	47.30	138	47,800
Total - Mile 35.5 to 47.4			69,800

TABLE 21 (CONT'D)
SUMMARY OF FIRST COSTS OF MODIFICATION TO ELECTRIC-POWER TRANSMISSION LINES TO PROVIDE FOR THE MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Owner of Power Line	Location (Channel mile)	Voltage (K.V.)	Total Costs
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)			
Gulf States Utilities	47.66	69	$22,000
Gulf States Utilities	76.70	38.5	21,800
Sam Houston Electric Co.	77.27	12.5	19,800
Gulf States Utilities	91.91	34.5	16,800
Sam Houston Electric Co.	114.5	12.5	31,400
Gulf States Utilities	127.72	138	38,800
Gulf States Utilities	136.05	69	34,600
Gulf States Utilities	137.28	33	34,200
Texas Power & Light Co.	196.69	138	34,000
Texas Power & Light Co.	216.19	138	31,800
Texas Power & Light Co.	219.70	12.5	27,000
Texas Power & Light Co.	220.57	7.5	8,000
Texas Power & Light Co.	220.57	12.5	12,000
Total-Mile 47.4 to 233.5			332,200
Tennessee Colony Dam to Lock and Dam No. 12(Mile 233.4 to 274.4)			
Note: Estimated cost of relocation of power lines within this reach are included in estimated cost of Tennessee Colony Reservoir.			
Lock No. 12 to Five-mile Creek (Mile 274.4 to 322.0)			
Texas Power & Light Co.	299.70	12.5	12,000
Texas Power & Light Co.	312.91	11	12,000
Texas Power & Light Co.	320.0	2.4	8,000
Total-Mile 274.4 to 322.0			32,000
Five-Mile Creek to Dallas Terminus (Mile 322.0 to 326.7)			
None			None
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)			
Dallas Power & Light Co.	326.7	60	$10,600
Dallas Power & Light Co.	328.8	60	34,600
Dallas Power & Light Co.	331.1	60	7,000
Total-Mile 326.7 to 331.1			52,200
Dallas Floodway (Mile 331.1 to 338.8)			
Dallas Power & Light Co.	332.6	13	6,600
Dallas Power & Light Co.	333.5	13	6,600
Dallas Power & Light Co.	334.0	60	11,000
Total Mile 331.1 to 338.8			24,200

TABLE 21 (CONT'D)
SUMMARY OF FIRST COSTS OF MODIFICATION TO ELECTRIC-POWER TRANSMISSION LINES TO PROVIDE FOR THE MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Owner of power line	Location (channel mile)	Voltage (K.V.)	Total costs
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)			
Dallas Power & Light Co.	339.0	60	12,000
Dallas Power & Light Co.	340.0	138	32,000
Texas Power & Light Co.	342.9	12.5	12,000
Texas Electric Service	345.2	12.5	21,000
Texas Power & Light Co.	348.1	138	29,000
Texas Electric Service Co.	351.4	12.5	48,600
Texas Electric Service Co.	362.8	66	45,800
Total Mile 338.8 to 362.8			200,400
Fort Worth Terminus to and including Riverside Drive bridges (Mile 362.8 to 369.8)			
None			None
Total - Mile 0.0 to 362.8			$710,800

85. SUMMARY OF COMMUNICATION LINE RELOCATIONS (INCLUDING COSTS).- The plan of improvement for the multiple purpose channel provides for modification of 17 existing communication lines, one of which is a proposed crossing. The proposed crossing at Westmoreland Road, channel mile 338.5, is to be installed in 1962 and for this report is considered as existing. The proposed crossing along with 14 other existing crossings are owned by Southwestern Bell Telephone Company, seven of which lie below Dallas. The other two existing crossings on the Trinity River are the 7-wire telephone crossings at channel mile 45.6 owned by the Gulf Oil Corporation and the 2-wire telephone crossing at channel mile 64.6 owned by Atlantic Pipe Line Co. Of the total 17 crossings, 5 are aerial crossings attached to existing bridges, 11 are aerial lines on poles and one is a buried armoured cable at channel mile 326.6. The existing aerial lines on poles are on 35 to 40-foot poles and are to be modified by installing taller poles of sufficient height to provide a vertical clearance of 70 feet above normal pool elevation of the proposed channel at maximum sag. The existing aerial lines attached to bridges will be modified and attached to new or modified bridges at the same location. The buried cable crossing will be modified to provide a minimum depth below the normal pool elevation of 25 feet, or 5 feet below the bottom of the proposed channel, whichever is deeper. Alteration costs for communication relocations in the Tennessee Colony Reservoir are contained in the estimate of cost for the Tennessee Colony Reservoir.

86. A detailed estimate of two typical communication line crossings are given in table 22.

TABLE 22

ESTIMATED FIRST COST FOR RELOCATION OF BELL TELEPHONE COMPANY'S SIX CABLE CROSSING AT MODIFIED CADIZ STREET BRIDGE AT CHANNEL MILE 332.2 and NINE CABLE CROSSING AT MODIFIED HOUSTON STREET BRIDGE, MILE 332.6

Item of construction	Unit	Quantity	Unit cost	Total cost
Cadiz Street bridge (Channel mile 332.2)				
One cable, 200 pair 19 gauge and 500 pair 22 gauge	LF	2000	$14.00	$28,000
One cable, 1400 pair 24 gauge and	LF	2000	30.00	60,000
2 pair video	LF	2000	5.00	10,000
One cable, 900 pair 22 gauge	LF	2000	18.00	36,000
One cable, 455 pair 19 gauge	LF	2000	8.10	16,200
One cable, 200 pair 19 gauge and 800 pair 24 gauge	LF	2000	20.00	40,000
One cable 900 pair 27 gauge	LF	2000	18.00	36,000
Splicing and checking	M.Hr.	1080	10.00	10,800
Miscellaneous items	LS			6,400
Transportation & plant	LS			11,500
Total				$254,900
Houston Street bridge, (Channel mile 332.6)				
One cable, 200 pair 19 gauge and 400 pair 24 gauge	LF	2000	12.00	24,000
One cable, 400 pair 22 gauge	LF	2000	8.00	16,000
One cable, 25 pair 16 gauge and 250 pair 19 gauge	LF	2000	5.50	11,000
One cable, 900 pair 22 gauge	LF	2000	18.00	36,000
One cable, 54 pair 19 gauge (toll)	LF	2000	1.10	2,200
One cable, 64 pair 16 gauge (toll)	LF	2000	1.30	2,600
One cable, 6 pr 16 gauge, 296 pair 19 gauge and 2 pr. 22 gauge (toll)	LF	2000	6.30	12,600
One cable, 168 pr. 19 gauge (toll)	LF	2000	3.40	6,800
One cable, 8 pr. 16 gauge, 8 pr 19 gauge and 8 co-axials (toll)	LF	2000	1.00	2,000
Splicing and checking	M Hr.	560	10.00	5,600
Miscellaneous items	LS			5,000
Transportation & plant	LS			10,000
Total				133,800

Note: Prices are as of January 1962.

87. Table 23 gives pertinent data and costs of communication lines required to be alterated or relocated. The estimate first cost is $1,176,950.

TABLE 29

SUMMARY OF ESTIMATED FIRST COST TO RELOCATE COMMUNICATION LINES
REQUIRED FOR MULTIPLE-PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Owner	Location (Channel Mile)	Type of crossing	Estimated cost of relocation: Poles (1)	Miscel. (2)	Wire (L.F.)	Cost	Cable: Type	L.F.	Cost	Splicing & Checking	Trans. & Plant	Total Cost
Houston Ship Channel to Upper Reach of Wallisville Reservoir (Mile 0.0 to 35.5)												
None												None
Upper Reach of Wallisville Reservoir to head of Authorized channel to Liberty (mile 35.5 to 47.4)												
Gulf Oil Corp.	45.6	7-wire, aerial	$1,800	$1,000	9,000	$ 270	-	-		$300	$500	$5,870
Head of Authorized Channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)												
S. W. Bell Telephone Co.	47.8	2-cable, aerial	-	2,700	-	-	24QD-19 Ga.	1,500	$3,000	200	3,000	8,900
S. W. Bell Telephone Co.	47.9	1-cable, aerial	1,800	2,000	100,000	3,000	76Pr-19 Ga.	2,000	6,000	800	2,500	16,100
Atlantic P. L. Co.	64.6	2-wire, aerial	1,800	1,000	3,600	110	-	-	-	200	2,500	5,610
S. W. Bell Telephone Co.	77.3	30-wire, aerial	1,800	1,890	60,000	1,800	-	-	-	700	2,500	8,690
S. W. Bell Telephone Co.	91.9	1-cable, aerial	600	1,000	-	-	75Pr-19 Ga.	1,000	3,000	250	2,500	7,350
S. W. Bell Telephone Co.	136.1	26-wire, aerial	1,800	2,300	33,800	1,000	-	-	-	1,000	2,500	8,600
S. W. Bell Telephone Co.	171.6	2-wire, aerial	1,800	1,000	3,600	110	-	-	-	200	2,500	5,610
S. W. Bell Telephone Co.	219.0	10-wire, aerial	1,800	2,000	18,000	540	-	-	-	500	2,500	7,340
Total - Mile 47.4 to 233.5												68,200
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)												
None			-									None
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)												
None			-									None
Five-mile Creek to Dallas Terminus (Mile 322.0 to 326.7)												
S. W. Bell Telephone Co.	326.6	2-cables, buried	-	22,250	-	-	(3)	800	26,400	5,600	5,000	59,250
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)												
None			-									None
Dallas Floodway (Mile 331.1 to 338.8)												
S. W. Bell Telephone Co.	332.2	6-cables, aerial	-	6,000	-	-	(4)	-	226,200	10,800	11,500	254,500
S. W. Bell Telephone Co.	332.6	9-cables, aerial	-	5,000	-	-	(5)	-	113,200	5,600	10,000	133,800
S. W. Bell Telephone Co.	333.5	4-cables, aerial	-	3,500	-	-	(6)	-	163,000	7,540	5,000	179,040
S. W. Bell Telephone Co.	338.5	3-cables, aerial	-	5,000	-	-	(7)	-	180,000	10,800	7,000	202,800
Total - Mile 331.1 to 338.8												770,140
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)												
S. W. Bell Telephone Co.	342.7	1-cable, aerial	1,200	1,000	-	-	200pr.-22 ga.	1,300	6,500	400	1,500	10,600
S. W. Bell Telephone Co.	345.3	1-cable, aerial	1,200	1,200	-	-	400pr.-24 ga.	1,300	10,400	800	1,800	15,400
S. W. Bell Telephone Co.	354.1	1-cable, aerial	1,200	1,000	-	-	300pr.-22 ga.	1,300	7,800	600	1,500	12,100
Total - Mile 338.8 to 362.8												38,100
Fort Worth Terminus to & including Riverside Drive Bridges (Mile 362.8 to 369.9)												
None												None
Total - Mile 0.0 to 369.8												941,560

Note: Prices are as of January 1962

(1) Installed cost of timber pile "H" frames and bracing.
(2) Miscellaneous items such as insulation, X-arms, hardware, hangers and excavation.
(3) One cable 200 pair, 19 gauge, and one cable 500 pair, 22 gauge.
(4) Cables to be suspended from modified Cadiz Street Bridge, see detailed estimate Table 27.
(5) Cables to be suspended from modified Houston Street Bridge, see detailed estimated Table 27.
(6) Cables to be suspended from modified Commerce Street Bridge consisting of 1-1200 pair, 24 gauge, 1-900 pair, 22 gauge, 1-1500 pair, 22 gauge, and 1-168 pair, 19 gauge (toll) cables.
(7) Cables to be suspended from modified Westmoreland bridge, consisting of 1-2100 pair, 26 gauge, 1-900 pair, 22 gauge, and 1-1500 pair, 24 gauge cables.

88. SUMMARY OF WATER AND SEWER LINE RELOCATION (INCLUDING COSTS).- Modification of six existing water lines and seven sewer lines crossing the multiple-purpose channel to Fort Worth would be required. Twelve of the lines are owned by the City of Dallas and one water line is owned by the City of Grand Prairie. All lines are single lines except at channel mile 328.92, a 24" and 36" sewer line crossing the river joins into one 84" line on each side of the river and would require replacement of 25' of 84" line beyond the junction of 24" and 36" lines in addition to the modification of the two lines crossing the river. The cost of modifying the water and sewer lines is based on placing each line at a minimum elevation of 25 feet below the normal pool elevation or 5 feet below the bottom of the proposed channel, whichever is deeper, and extending the line 25 feet beyond the bottom width of the proposed channel. Table 24 gives data and cost on required alteration of water and sewer lines. The estimated first cost is $588,290.

89. SUMMARY OF ACCESS ROADS TO LOCKS AND DAMS (INCLUDING COSTS).- The proposed alignments of the access roads were selected after field reconnaissance and consultation with local personnel familiar with each lock and dam location. The proposed 21 access roads would connect with the nearest improved all weather road and would have a 20-foot wide double bituminous type pavement and 6-foot wide flexible base shoulders. The alignments of existing graded roads would be used whenever they are favorably located.

90. Road embankments within the Trinity River flood plain would have a top elevation 5 feet above maximum highwater of record. At locations where road alignments cross perpendicular to the direction of flood flows approximately one-fourth of the roadway would be made of timber trestles to provide relief during flooding. The creosoted timber trestles with asphaltic concrete covered decks would have a 22-foot wide roadway. Pertinent data for each access road are given in table 25.

91. Estimates of first cost to provide the proposed access roads are based on unit costs as shown in the following tabulation:

Item	Unit	Unit cost
Clearing and grubbing (light)	Ac	$150.00
Clearing and grubbing (heavy)	Ac	300.00
Excavation	CY	0.60
Select material base	CY	2.75 to 3.00
Flexible base	CY	3.50
Prime coat	Gal.	0.20
Double bituminous treatment	SY	0.85
Timber trestle(relief bridges)	LF	150.00
Small drainage structures	DA	500.00
Fencing	LF	0.80
Marking traffic signs	Sum	50.00 to 350.00
Rework existing road crown	SY	0.15
Bridge approach fill	CY	0.85

Table 26, that follows, shows cost of access roads to lock and dam sites estimated at $5,018,990.

TABLE 24

SUMMARY OF FIRST COSTS OF WATER AND SEWER LINE MODIFICATIONS REQUIRED FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Name of owner	Channel mile	Utility	Size and kind of pipe	Excavation cost	LF	Pipe cost	Coat & wrap	Weights & misc. items	Total costs
Houston Ship Channel to Five-mile Creek (Mile 0.0 to 322.0) - None									
Five-mile Creek to Dallas Terminus (Mile 322.0 to 326.7)									
Dallas City Water Works	322.85	Water	1-72" RCP	$12,900	452	$67,800	-	$ 1,500	$ 82,200
Dallas City Water Works	324.27	Sewer	1-24" Steel	7,945	426	25,560	$855	1,000	35,360
Dallas City Water Works	326.2	Sewer	1-18" CI	8,740	460	18,400	920	1,200	29,260
Total-Mile 322.0 to 326.7									$146,820
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)									
Dallas City Water Works	328.92	Sewer	1-24" CI	-	300	17,400	600	-	-
Dallas City Water Works	328.92	Sewer	1-36" CI	-	300	30,000	600	-	-
Dallas City Water Works	328.92	Sewer	1-84" RCP	11,225	50	5,000	-	22,075	86,900
Dallas City Water Works	329.9	Sewer	2-36" CI	13,195	892	66,900	1,115	1,250	82,460
Total Mile 326.7 to 331.1									169,360
Dallas Floodway (Mile 331.1 to 338.8)									
Dallas City Water Works	331.43	Water	1-24" CI	6,600	394	22,852	788	8,290	38,530
Dallas City Water Works	332.05	Sewer	1-60" Conc.	8,000	384	38,400	-	2,000	48,400
Dallas City Water Works	332.59	Water	1-24" CI	3,876	358	17,184	1,520	-	22,580
Dallas City Water Works	335.70	Water	1-36" Steel	6,335	394	39,400	785	1,200	47,720
Dallas City Water Works	337.23	Water	1-48" Steel	7,720	402	50,250	1,200	1,250	60,420
Total-Mile 331.1 to 338.8									217,650
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)									
City of Grand Prairie	345.21	Water	1-36" Steel	10,960	435	43,500	-	-	54,460
Fort Worth Terminus to & including Riverside Drive Bridges (Mile 362.8 to 369.76) - None									
Total - Mile 0.0 to 369.76									$588,290

Note: Prices are as of January 1962.

TABLE 25
PERTINENT DATA CONCERNING PROPOSED ACCESS ROADS
TO LOCK SITES

Lock site No.	Location (channel mile)	Rights-of way (acres)	Type and length of access road: Construct new road (miles)	Construct new bridge (feet)	Improve existing road (miles)	Total length (miles)	Access road to connect with
1	28.30(1)	-	-	-	-	-	
2	47.45	6	.5	0	-	.5	Washington St. (Liberty)
3	59.08	83	5.7	-	-	5.7	FM 1008
4	74.85	15	1.0	24	-	1.0	Tex. 105
5A	98.00	21	.3	-	1.7	2.0	FM 222
5B	99.20	-	.5	-	-	0.5	Access Rd 5A
6	147.92	67	1.5	1500	4.0	5.5	FM 980
7	183.92	79	2.5	1500	4.0	6.5	FM 811
8	207.55	27	-	24	2.2	2.2	FM 227
9	217.95	72	-	3275	5.9	5.9	FM 542
10A	233.00	122	1.0	-	8.1	9.1	St.Hwy 84
10B(2)	233.61	-	-	-	-	-	
11	258.91	44	1.6	-	2.0	3.6	FM 635
12	274.51	61	2.0	550	3.0	5.0	FM 636
13	286.64	23	1.2	4000	-	1.2	FM 1129
14	298.38	2	.2	-	-	.2	St.Hwy 34
15	306.31	46	.8	24	3.0	3.8	FM 780
16	311.25	24	1.6	-	.4	2.0	Malloy Rd.
17	317.81	6	.5	-	-	.5	Post Oak Rd.
18	331.31	2	.2	700	-	.2	Montgomery St. (Dallas)
19	342.51	7	.6	-	-	.6	Meyers Rd.
20	351.91	22	1.2	3000	.6	1.8	FM 157
21	360.17	2	.2	-	-	.2	Randol Mill Rd.

(1) New road from Wallisville to lock No. 1 provided for in Wallisville reservoir project recommended in Chief of Engineers report dated April 18, 1961.

(2) Lock No. 10B to be served by road extending from lock No. 10A.

TABLE 26
SUMMARY OF ESTIMATED FIRST COST OF ACCESS ROADS TO LOCKS & DAMS
REQUIRED FOR MULTIPLE-PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH

Lock No.	Clearing & Grubbing	Excavation	Select Base Material	Flexible Base	Prime Coat	Double Bituminous Treatment	Bridge Structure	Bridge Approach Fill	Drainage Structure	Fencing	Marking & Traffic Signs	Rework Exist. Road Crown	Total
Houston Ship Channel to Upper Reach of Wallisville Reservoir (Mile 0.0 to 35.5)													
None													None
Upper Reach of Wallisville Reservoir to head of Authorized Channel to Liberty (Mile 35.5 to 47.4)													
1													None
Head of Authorized Channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)													
2	$2,280	$2,220	$5,970	$4,310	$390	$5,240	-	0	$1,000	$4,440	$200	$60	$26,110
3	24,870	24,000	100,200	58,450	4,210	56,860	-	0	11,500	48,160	550	0	328,800
4	2,180	87,300	17,610	10,270	730	9,960	$3,600	0	2,000	8,450	300	0	142,400
5A	3,090	7,180	15,960	12,810	1,260	16,960	0	0	3,500	14,370	320	240	75,690
5B	0	0	5,970	4,310	390	5,240	0	0	0	0	50	0	15,960
6	20,100	16,900	50,120	39,270	2,960	39,910	225,000	0	10,000	46,480	450	5,630	456,820
7	23,620	27,450	61,760	46,130	4,800	64,860	225,000	8,960	12,500	54,880	580	560	531,100
8	7,990	9,300	28,350	16,590	1,630	21,930	3,600	0	4,300	18,560	350	0	112,800
9	10,720	23,310	47,460	41,550	4,080	55,080	491,100	18,920	11,000	49,840	550	780	734,390
10A	36,600	34,900	116,600	62,200	6,100	82,500	0	0	18,000	76,900	300	0	434,100
Total-Mile 47.4 to 233.5	131,450	232,560	450,000	295,890	26,550	350,540	948,300	27,880	74,000	322,080	3,650	7,270	2,676,170
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)													
10B	-	-	-	-	-	-	-	-	-	-	-	-	-
11	6,540	15,210	41,310	27,130	2,660	35,900	0	0	3,500	30,409	400	280	163,330
Lock and Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)													
12	18,180	21,120	56,340	37,620	3,700	49,900	82,500	6,480	10,000	43,120	500	420	329,880
13	6,890	4,800	16,020	8,550	840	11,320	600,000	0	2,500	16,000	300	0	667,220
14	340	8,120	2,670	1,430	140	1,890	0	0	500	1,600	200	0	16,890
15	6,900	16,050	39,420	28,610	2,180	37,900	3,600	0	7,500	32,100	500	4,220	179,610
16	3,600	8,400	26,130	14,980	1,470	19,850	0	0	4,000	16,800	250	530	96,010
17	1,800	2,000	6,680	3,570	350	4,730	0	0	1,000	4,000	200	0	24,330
Total-Mile 274.4 to 322.0	37,710	60,490	147,260	94,760	9,310	125,590	686,100	6,480	25,500	113,620	1,950	5,170	1,313,940
Five-Mile Creek to Dallas Terminus (Mile 322.0 to 326.7)													
None													None
Dallas Terminus to Existing Dallas Floodway (Mile 326.7 to 331.1)													
None													None
Dallas Floodway (Mile 338.8 to 362.8)													
18	670	810	140	90	10	130	150,000	0	0	0	200	-	107,050
Dallas Floodway to & including Fort Worth Terminus (Mile 338.8 to 362.8)													
19	1,050	2,490	8,280	4,450	430	5,860	0	0	1,500	4,960	200	-	29,220
20	6,600	5,230	14,580	9,310	910	12,960	450,000	0	3,500	15,200	300	850	519,440
21	300	640	2,160	1,140	110	1,510	0	0	500	1,280	200	0	7,840
Total-Mile 338.8 to 362.8	7,950	8,360	25,020	14,900	1,450	20,330	450,000	0	5,500	21,440	700	850	556,500
Fort Worth Terminus to & including Riverside Bridges (Mile 362.8 to 369.8)													
None													None
Total-Mile 0.0 to 369.8	184,320	317,430	663,730	432,770	39,980	540,940	2,189,400	34,360	108,500	487,540	6,900	13,570	5,018,990

Note: Prices are as of January 1962.
(1) Costs for access road to lock No. 1 are contained in estimated cost of recommended Wallisville Reservoir.
(2) Access road to lock 10A passes through lock site 10B - All cost of road has been assigned to lock 10A.

92. SUMMARY OF PERMANENT OPERATING EQUIPMENT (INCLUDING COST).- The estimated first cost of permanent operating equipment for the canalized multiple purpose channel includes the cost of 20 sets of lock and dam equipment, four sets of heavy duty maintenance equipment and a system of river observation gages and recorders. The estimate of cost excludes the operating equipment required at lock No. 1, which is provided for in the recommended Wallisville reservoir project. One set of operating equipment would be provided to serve both locks Nos. 5A and 5B, also both locks Nos. 10A and 10B. It is proposed that each set of operating equipment to be provided at the lock sites consist of the equipment listed in table 27, which also shows the estimated unit costs and first cost of the equipment for each installation.

TABLE 27
ESTIMATED FIRST COST OF ONE SET OF LOCK AND DAM
PERMANENT OPERATING EQUIPMENT

Item of equipment	Unit cost
Truck (1/2 ton pick-up)	$ 2,000
Truck (Carry-all)	2,500
Lawn mowers, 2 @ $150	300
Small derrick barge for removal of logs and debris	12,000
Tractor with mowing equipment, and blade scrapper	2,000
Work boat, capable of moving small derrick barge	10,000
Skiffs, survey type, 2 @ $700	1,400
Outboard motor	300
Portable radio, 2 @ $500	1,000
Office equipment	
Desk, 3 @ $96.50	300
Map case (5 drawers)	100
File cabinets, 3 @ $104	300
Chairs 6 @ $37	200
Adding machine and/or calculator	800
Typewriter	300
Wind direction, velocity indicator and rain gage	500
Radio transmitter and receiver	900
Misc. supplies and equipment	1,000
Total - one set	35,900

93. It is proposed that a set of heavy duty maintenance equipment be provided at four lock sites along the multiple purpose channel to be used by permanent maintenance crews performing ordinary maintenance work on the locks and dams as may be required. The heavy duty maintenance equipment to be provided in each set would consist of the equipment listed in table 28, which also shows the unit and total cost of the equipment.

TABLE 28
ESTIMATED FIRST COST OF ONE SET OF HEAVY DUTY
EQUIPMENT

Item of equipment	Unit cost
Dump trucks 2 @ $3,575 (1 radio equipped)	$ 7,150
Stake body truck with 1,000 gal. water tank and pumps	2,800
Pumps (3 in. gasoline operated) 2 @ $175	350
Mobile Crane (15 ton capacity)	26,000
Dozer, with winch and hydraulic blade	18,000
Low-boy equip., trailer and cab	10,000
Combination road maintainer and heavy-duty front end loader	6,200
Total - one set	70,500

94. The proposed river observation system is required for the collation of basic precipitation and river stage data required to forecast the operation of the navigation dams on the multiple purpose channel to pass flood rises and reservoir releases and at the same time maintain normal pool elevation for navigation. The existing precipitation and stream recording gages on the watershed would be augmented by 26 standard precipitation gages and 40 waterstage recorders.

95. The unit cost of the new precipitation gages and waterstage recorders in place is estimated at $500 and $2,500, respectively. The total first costs of the 26 gages and 40 recorders are estimated at $113,000 excluding contingencies. A summary of the estimated first cost of the proposed permanent operating equipment is given in table 29.

TABLE 29
SUMMARY OF ESTIMATED FIRST COST OF PERMANENT
OPERATING EQUIPMENT REQUIRED FOR MULTIPLE
PURPOSE CHANNEL TO FORT WORTH, TEXAS

Item of equipment	Estimated first cost
Houston Ship Channel to upper reach of Wallisville Reservoir - (Mile 0.0 to 35.5)	
Operation equipment for lock No. 1	None(1)
Heavy duty maintenance equipment	None(1)
River observation system	$ 2,950
Upper Reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)	
Operation equipment for lock No. 1	None(1)
Heavy duty maintenance equipment	None(1)
River observation system	5,000
Head of authorized channel to Tennessee Colony Dam (Mile 47.4 to 233.5)	
Operation equipment for locks No. 2,3,4,5A,6,7,8 & 9	287,200
Heavy duty maintenance equipment (2 sets)	141,000
River observation system	60,640
Total-Mile 47.4 to 233.5	488,840
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.4 to 274.4)	
Operation equipment for locks No. 10B & 11	71,800
Heavy duty maintenance equipment (1/2 set)(2)	35,250
River observation system	13,330
Total-Mile 233.5 to 274.4	120,380
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)	
Operation equipment for locks No. 12 thru 17	215,400
Heavy duty maintenance equipment (1/2 set)(2)	35,250
River observation system	15,510
Total-Mile 274.4 to 322.0	266,160
Five-mile Creek to Dallas Terminus (Mile 322.0 to 326.7)	
Operation equipment for locks	None
Heavy duty maintenance equipment	None
River observation system	1,530
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)	
Operation equipment for locks	None
Heavy duty maintenance equipment	None
River observation system	1,430

TABLE 29 (Cont'd)
SUMMARY OF ESTIMATED FIRST COST OF PERMANENT
OPERATING EQUIPMENT REQUIRED FOR MULTIPLE
PURPOSE CHANNEL TO FORT WORTH, TEXAS

Item of equipment	Estimated first cost
Dallas Floodway (Mile 331.1 to 338.8)	
Operation equipment for lock No. 18	$ 35,900
Heavy duty maintenance equipment (1/4 set)(2)	17,630
River observation system	2,480
Total-Mile 331.1 to 338.8	56,010
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)	
Operation equipment for locks 19, 20 & 21	107,700
Heavy duty maintenance equipment (3/4 set)(2)	52,870
River observation system	7,850
Total-Mile 338.8 to 362.8)	168,420
Fort Worth Terminus to & including Riverside Drive bridges (Mile 362.8 to 369.8)	
Operation equipment for locks	None
Heavy duty maintenance equipment	None
River observation system	2,280
Total cost permanent operation equipment Houston Ship Channel to Fort Worth - Mile 0.0 to 369.8	1,113,000

(1) Cost of operating equipment for Lock No. 1 is included in cost of Wallisville Reservoir project.
(2) Costs of unit assigned for economic analysis of project.

NOTE: Prices are as of January 1962.

96. SUMMARY OF BUILDINGS, GROUNDS AND UTILITIES.- Each lock of the multiple purpose channel to Fort Worth would be provided, lockmaster's quarters, garage, storage shed, boathouse, fencing and lighting facilities in addition to the necessary utility distribution systems. A detailed estimate of first cost for each lock installation is given in the following tabulation:

COST OF BUILDINGS, GROUNDS & UTILITIES AT EACH LOCK SITE

Lockmaster's quarters 1 @ 13,000	$13,000
Garage & storage shed 1 @ 7,800	7,800
Utilities	
(1) Electrical distribution & lighting system	50,000
(2) Heating gas - butane	5,000
(3) Water supply & distribution	10,800
(4) Sanitary sewer system	12,500
(5) Telephone facilities	6,000
Boathouse & appurtenances	19,200
Fence 4 ft. stock, chain link	3,300
Unit cost for one lock site	127,600

97. A summary of first costs for buildings, grounds, and utilities is given in table 30.

TABLE 30
ESTIMATED FIRST COST OF BUILDINGS, GROUNDS, & UTILITIES
REQUIRED FOR MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

No. of units required	Unit cost	Cost
Houston Ship Channel to upper reach of Wallisville reservoir (Mile 0.0 to 35.5)		
1	127,600	(1)
Upper reach of Wallisville reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4) -		None
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)		
10	127,600	1,276,000
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)		
2	127,600	255,200
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)		
6	127,600	765,600
Five-mile Creek to Dallas Terminus (Mile 322.0 to 326.7) -		None
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1) -		None
Dallas Floodway (Mile 331.1 to 338.8)		
1	127,600	127,600
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)		
3	127,600	382,800
Fort Worth Terminus to and including Riverside Drive Bridges, (Mile 362.8 to 369.8) -		None
Total - Mile 0.0 to 369.8		2,807,200

Note: Estimated first costs are based on prices as of January 1962.
(1) Costs are included in Wallisville reservoir project.

98. SUMMARY OF AIDS TO NAVIGATION (INCLUDING COSTS).- Estimates of unit costs and total first cost of aids to navigation for the section of the multiple purpose Trinity River channel from Liberty to Fort Worth, Texas, was furnished by letter dated October 30, 1961, from the Commander, Eighth Coast Guard District, New Orleans, Louisiana. The aids to navigation would consist of single pile daybeacons installed on the channel bank at the lower ends of river cut-offs and along the channel route as may be necessary, and 3rd class radar reflecting buoys in Livingston and Tennessee Colony reservoirs. In addition it is proposed that a light attendant station complete with wharf, vehicles, and 45-foot buoy boat be provided at each reservoir. Two sites of approximately 2 acres each would be required for the light attendant stations. The total cost of the required aids to navigation is estimated at $800,000. Table 31 shows a summary of the estimated first cost of the required aids to navigation for the multiple purpose channel, excluding land costs for the light attendant station which would be located within the reservoir limits.

TABLE 31
SUMMARY OF ESTIMATED FIRST COST OF AIDS TO NAVIGATION
REQUIRED FOR THE MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Section of channel and aids to navigation	Unit	Quantity	Unit cost(1)	Estimated first cost(1)
Houston Ship Channel to upper reach of Wallisville Reservoir - (Mile 0.0 to 35.5)				
None	-	-	-	None
Upper reach of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)				
None	-	-	-	None
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)				
Single pile daybeacons	ea.	285	500	$142,500
Third Class (RR) buoys	ea.	40	650	26,000
Light attendant station	ea.	1	100,000	100,000
Buoy boat, 45-foot	ea.	1	150,000	150,000
Total				418,500
Tennessee Colony dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)				
Third class (RR) buoys	ea.	68	650	44,000
Light attendant station	ea.	1	100,000	100,000
Buoy boat-45-foot	ea.	1	150,000	150,000
Total				294,000

TABLE 31 (Cont'd)
SUMMARY OF ESTIMATED FIRST COST OF AIDS TO NAVIGATION
REQUIRED FOR THE MULTIPLE PURPOSE TRINITY RIVER CHANNEL
TO FORT WORTH, TEXAS

Section of channel and aids to navigation	Unit	Quantity	Unit cost (1)	Estimated first cost (1)
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)				
Single pile daybeacond	ea.	94	500	47,000
Five-mile Creek to and including Dallas Terminus (Mile 322.0 to 326.7)				
Single pile daybeacons	ea.	9	500	4,500
Dallas Terminus to existing Dallas Floodway (Mile 326.7 to 331.1)				
Single pile daybeacons	ea.	9	500	4,500
Dallas Floodway (Mile 331.1 to 338.8)				
Single pile daybeacons	ea.	15	500	7,500
Dallas Floodway to & including Ft. Worth Terminus (Mile 338.8 to 362.8)				
Single daybeacons	ea.	48	500	24,000
Fort Worth Terminus to & including Riverside Drive bridges - (Mile 362.8 to 369.8)				
None	-	-	-	None
Total - Mile 0.0 to 369.8				$800,000

(1) Cost furnished by Commander, U. S. Coast Guard.

99. SUMMARY OF RECREATION FACILITIES (INCLUDING COST).- A summary of first cost of recreation facilities provided in connection with the multiple purpose channel estimated at $2,866,200 is shown in table 32.

TABLE 32

SUMMARY OF ESTIMATED FIRST COST OF RECREATIONAL FACILITIES FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO FORT WORTH, TEXAS

Item	Quantity	Unit	Unit Cost	Total Cost
Houston Ship Channel to head of Wallisville Reservoir (Mile 0.0 to 35.5)				
Access roads	2.5	Miles	$35,000	$ 87,500
Recreation facilities	3	Each	66,600	199,800
Total construction				287,300
Head of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)				
Recreation facilities	1	Each	66,600	66,600
Head of authorized channel to Liberty to Tennessee Colony Dam (Mile 47.4 to 233.5)				
Access roads	7	Miles	35,000	245,000
Recreation facilities	14	Each	66,600	932,400
Total construction				1,177,400
Tennessee Colony Dam to Lock & Dam No. 12 (Mile 233.5 to 274.4)				
Access road	1.0	Mile	35,000	35,000
Recreation facilities	2	Each	66,600	133,200
Total construction				168,200
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)				
Access roads	7	Miles	35,000	245,000
Recreation facilities	8	Each	66,600	532,800
Total construction				777,800
Five-mile Creek to and including Dallas Terminus (Mile 322.0 to 326.7) -				None
Dallas Terminus to existing Dallas Floodway (Mile 326.7 to 331.1) -				None
Dallas Floodway (Mile 331.1 to 338.8)				
Access	1.0	Mile	35,000	35,000
Recreation facilities	1	Each	66,600	66,600
Total construction				101,600
Dallas Floodway to & including Fort Worth Terminus (Mile 338.8 to 362.8)				
Access roads	2.5	Miles	35,000	87,500
Recreation facilities	3	Each	66,600	199,800
Total Construction				287,300
Fort Worth Terminus to Riverside bridges (Mile 362.8 to 369.8)				None
Total (Mile 0.0 to 369.8)				$2,866,200

100. **SUMMARY OF ANNUAL MAINTENANCE, OPERATION AND MAJOR REPLACEMENT COSTS.**- *The following paragraphs give information and* supporting data considered in determining the annual costs of maintenance, operation and major replacements, based on a 100-year amortization period. The total annual cost of maintenance operation and major replacements for various features of the multiple purpose channel is estimated at $4,438,200, as summarized in table 33, which excludes an estimated cost of $272,000 annually, for maintenance and operation of recreational facilities proposed for the multiple purpose channel.

101. *LOCKS, DAMS, AND RIVER OBSERVATION SYSTEM.*- The annual maintenance, operation and replacement cost for lock No. 1, is provided for in the Wallisville Reservoir project as recommended in prior report and accordingly is excluded from further consideration in this report. Also excluded from consideration are the costs of maintenance and operation of the spillway gates and outlet works at the Livingston and Tennessee Colony reservoirs dams, which costs are considered as a function of the respective reservoirs. The annual costs of operating personnel, maintenance supplies, major repair and painting, and major replacements for the proposed 22 locks and 18 navigation dams and river observation system, are set forth in the following paragraphs.

102. *OPERATING PERSONNEL.- The yearly operation* of each lock and dam would be accomplished with a crew of 9 men consisting of lock master and an assistant lock master on a yearly basis and seven lockmen working 40 hours per week. Lockmasters would reside in houses at the lock sites. Grounds maintenance would be performed by lock personnel when operation of the locks is not pending. Ordinary maintenance of all locks and navigation dams would be performed by four crews consisting of 8 men each. These maintenance crews would also maintain the river observation system. Personnel required for maintenance and operation of locks, dams and river observation system is proposed as follows:

Personnel	Number required	Average yearly cost	Total yearly cost
Lockmaster, S-06	22	$ 8,090	$177,980
Asst. lockmaster, W-08	22	6,340	139,480
Lockmen, W-07	154	6,050	931,700
Maintenance foreman, S-06	4	8,090	32,360
Heavy equip. operator, W-12	12	6,220	74,640
Laborers, W-02	16	4,160	66,560
Sub-total			$ 1,422,720
Supervision and overhead, 12%			170,780
Total			$ 1,593,500

TABLE 33
ESTIMATED ANNUAL COST OF MAINTENANCE, OPERATION AND REPLACEMENT
FOR DESIGNATED REACHES OF MULTIPLE PURPOSE CHANNEL
FROM HOUSTON SHIP CHANNEL TO FORT WORTH, TEXAS

Item of annual costs	Estimated annual cost for designated reaches of multiple purpose channel										Total
	0.0 to 35.5 (1)	35.5 to 47.4 (2)	47.4 to 233.5 (3)	233.5 to 274.4 (4)	274.4 to 322.0 (5)	322.0 to 326.7 (6)	326.7 to 331.1 (7)	331.1 to 338.7 (8)	338.7 to 362.8 (9)	362.8 to 369.8 (10)	
Locks, dams and river observation system											
Operating personnel	-	-	$724,300	$144,900	$434,600	-	-	$ 72,400	217,300	-	$1,593,500
Ordinary maintenance supplies	-	-	76,200	15,500	46,300	-	-	7,700	23,200	-	168,900
Major repair and painting	-	-	165,500	33,100	99,300	-	-	16,500	49,600	-	364,000
Major replacements:											
Dams	-	-	39,200	-	33,400	-	-	5,600	16,800	-	95,000
Locks	-	-	64,200	13,500	38,500	-	-	6,300	19,200	-	141,700
Permanent operating equipment	-	-	42,700	8,600	25,600	-	-	4,300	12,900	-	94,100
Access roads											
Maintenance	-	-	29,000	13,000	13,000	-	-	-	3,000	-	58,000
Major replacement	-	-	61,100	26,300	26,100	-	-	-	5,700	-	119,200
Railroad bridges											
Maintenance & operation	-	-	126,000	21,000	-	-	42,000	42,000	42,000	-	273,000
Major replacement	-	-	19,000	3,200	-	-	6,300	6,300	6,300	-	41,100
Channel dredging	-	30,000	577,800	232,600	224,200	28,800	33,000	35,600	153,400	17,500	1,332,900
Channel revetment	-	8,000	42,000	-	-	-	-	-	-	-	50,000
Aids to navigation	-										
Maintenance	-	-	42,400	42,400	-	-	-	-	-	-	84,800
Major replacement	-	-	12,900	3,000	3,300	300	300	500	1,700	-	22,000
Total	-	38,000	2,022,300	557,100	944,300	29,100	81,600	197,200	551,100	17,500	4,438,200

(1) Houston Ship Channel to upper reach of Wallisville reservoir.
(2) Upper reach of Wallisville reservoir to head of authorized channel to Liberty.
(3) Head of authorized channel to Liberty to Tennessee Colony reservoir dam.
(4) Tennessee Colony Dam to Lock and Dam No. 12.
(5) Lock and Dam No. 12 to Five-mile Creek.
(6) Five-mile Creek to Dallas Terminus
(7) Dallas terminus to Dallas Floodway.
(8) Dallas Floodway.
(9) Dallas Floodway to Fort Worth Terminus.
(10) Fort Worth Terminus to and including Riverside Drive bridges.

103. ORDINARY MAINTENANCE SUPPLIES.- Based on experienced cost of ordinary maintenance supplies for existing locks and dams in the Galveston and Mobile Districts, it is estimated that ordinary maintenance supplies would cost $4000 per year for each lock and dam. The cost includes $1000 per year for electric power. The total annyal cost of ordinary maintenance supplies for the 22 locks and 18 navigation dams is estimated at $160,000. Cost of ordinary maintenance supplies for the river observation system is estimated at $10,000 annually. The total annual cost of ordinary maintenance supplies for the lock, dams, and river observation system is estimated at $170,000.

104. MAJOR REPAIR AND PAINTING.- It is estimated that major repair and complete painting of lock and dam gates would be performed on a contract basis every 10 years. The average cost of major repair and painting of the gates at each lock and the gates of each dam is estimated at $150,000 and $50,000, respectively. The total cost for major repair and painting of gates at the 22 locks and 18 dams is estimated at $4,200,000. Average annual cost of major repairs and painting is estimated at $364,000.

105. MAJOR REPLACEMENTS.- In determining the cost of major replacements, it was considered that the replacement costs of specific items in the future would equal the present construction first cost less salvage. The average annual replacement cost was computed by discounting to present worth all replacement costs and mjltiplying the present worth value by the capital recovery factor for a uniform annual series having a period of 100 years. The estimated annual replacement costs for operating equipment and machinery for the 18 navigation dams, 22 locks and permanent operating equipment are given in table 34.

106. ACCESS ROADS.- Maintenance of access roads would include patching of bituminous surfaces, policing of rights-of-way, mowing of rights-of-way, grading of shoulders, repainting center strip, repairing signs, and cleaning of drainage structures. The annual cost of access road maintenance is estimated at $1,000 per mile of road, or a total of $58,000 for the proposed 21 access roads. The annual maintenance cost is influenced by the consideration that the crown of the road would be replaced every 10 years. The cost of crown replacement on the combined total of 58 miles of access roads is estimated at $119,000 annually as shown in table 34.

TABLE 34
ESTIMATED ANNUAL COST OF MAJOR REPLACEMENTS
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL
(100 YR. PROJECT LIFE 2-7/8% INTEREST RATE)

Designation	Estimated life in years	Estimated single replacement cost (1)	Estimated salvage value	Single replacement cost less salvage	Average annual replacement cost factor(2)	Estimated Annual replacement cost(3)
Dams						
Tainter gates	40	$9,723,000	$4,834,000	$3,889,000	0.01209	$47,000
Operating machinery (mech.)	40	3,243,000	1,946,000	1,297,000	0.01209	16,000
Crane	25	933,000	560,000	373,000	0.02609	10,000
Pier, storage yard	25	152,000	91,000	61,000	0.02609	2,000
Electrical system	25	704,000	422,000	282,000	0.02609	7,000
Operating machinery (elect.)	25	840,000	504,000	336,000	0.02609	9,000
Stop logs	40	883,000	530,000	353,000	0.01209	4,000
Total Dams						95,000
Locks						
Miter gates and tainter valves	40	11,041,000	6,626,000	4,415,000	0.01209	53,000
Operating machinery	40	5,465,000	3,279,000	2,186,000	0.01209	26,000
Valves	40	200,000	120,000	80,000	0.01209	1,000
Oil piping system	40	2,732,000	1,639,000	1,093,000	0.01209	13,000
Stop logs	40	2,318,000	1,391,000	927,000	0.01209	11,000
Electrical system	25	3,574,000	2,144,000	1,430,000	0.02609	37,000
Total locks						141,000
Permanent operating equipment	10	1,220,000	122,000	1,098,000	0.08594	94,000
Railroad bridges (machinery)	40	8,405,000	5,043,000	3,362,000	0.01209	41,000
Access roads to lock sites	10	6,876,000	5,488,000	1,388,000	0.08594	119,000
Aids to navigation						
Buoys, radar reflecting	20	70,000	None	70,000	0.03590	3,000
Day beacons	12	230,000	None	230,000	0.06924	16,000
Buoy boats	25	300,000	180,000	120,000	0.02609	3,000
Total aids to navigation						22,000
Total						512,000

(1) Based on assumption that replacement costs will equal construction first costs - Estimates contains 25% contingencies and engineering, design, supervision and administration costs.
(2) Accumulated present worth factor multiplied by capital recovery factor.
(3) Replacement cost less salvage multiplied by annual replacement cost factor.

107. RAILROAD BRIDGES.- The plan of improvement provides for the construction of a vertical lift railroad bridge at each of the 13 railroad crossings of the multiple purpose channel. The total annual maintenance and operation cost for the 13 bridges is estimated at $273,000, based on the estimated cost of $21,000 per year for 24 hour daily operation, utilities, painting and repairs for single lift bridge as shown below.

Item	Annual Cost
Bridge tenders - 4 @ $4,000 a year	$ 16,000
Utilities	1,000
Painting and miscellaneous repairs	2,000
Operating equipment repairs	2,000
Total	$ 21,000

It is further considered that the machinery for each lift bridge would have an average life of about 40 years. The total annual replacement costs for the 13 lift bridges machinery is estimated at $41,000.

108. CHANNEL DREDGING.- In determining the estimated annual cost of maintaining project depths in the proposed multiple purpose channel from the Houston Ship Channel to Fort Worth, Texas, consideration was given to the proposed enlargement of the authorized channel to Liberty project, the sediment load that would enter the channel from various sources and the requirements to maintain project depths for navigation and regulated flood releases.

109. With respect to the enlargement of the channel to Liberty project, the plan provides for deepening to 12 feet the 9 x 150-foot channel from the Houston Ship Channel to the upper end of the Wallisville Reservoir at channel mile 35.5 in the interest of navigation. Thence, for deepening and widening of the channel to the head of the authorized project at channel mile 47.4 in the interest of both navigation and flood control. The following concerns maintenance dredging of the channel from the Houston Ship Channel to channel mile 35.5.

110. The plan of improvement for the Wallisville Reservoir project (House Document No. 215, 87th Congress, 1st Session) provides for diversion of all Trinity River flows to a new outlet on the north shore of Trinity Bay. Since sediment inflow into the channel below the Wallisville dam would be eliminated, maintenance dredging of the project channel below the dam would be largely confined to the reach from the Houston Ship Channel to near Smith Point, a distance of 6.5 to 9 miles depending on tidal influences on the channel. Some maintenance dredging would also be required in the vicinity of the Double Bayou channel crossing of the project channel. It is considered that maintenance of the proposed 12 x 150-foot channel below the Wallisville dam would not increase materially the maintenance of the 9 x 150-foot project channel. The cost of maintaining the 9 x 150-foot project channel from the Houston

Ship Channel to the Anahuac Channel, a distance of 24.3 miles, is estimated at $114,000 annually as given in appendix II accompanying the District Engineer's report in House Document No. 215, 87th Congress, 1st Session. It is considered that the presently estimated annual cost of $114,000 for the project channel to the Anahuac Channel is also adequate to maintain the proposed 12 x 150-foot channel below the Wallisville Dam including maintenance of the adjacent protective (spoil) embankment below the Anahuac Channel.

111. Maintenance of the authorized 9 x 150-foot channel to Liberty project from Lock No. 1, in the Wallisville Dam to the Texas Gulf Sulphur Company's channel at channel mile 33.8 is provided for in the Wallisville Reservoir project. Appendix II accompanying the project document (HD 215, 87th Congress, 1st Session) reports that "Maintenance dredging of the upper lock forebay, the navigation channel in the reservoir area, and some maintenance and snagging of the river diversion channel would average about $20,000 per year". In addition to deepening of the project channel through the Wallisville Reservoir, the plan of improvement for the multiple purpose channel provides for the channel to be located in a river cut-off alignment at Wallisville, Texas. A review of the probable shoaling in the 12 x 150-foot channel from lock No. 1, to channel mile 35.5 indicates that the required annual dredging in this reach would be approximately equal to the dredging required for the 9 x 150-foot channel terminating at mile 33.8. Accordingly, no increase in annual cost of channel maintenance for the 12 x 150-foot channel to channel mile 35.5 is proposed.

112. Information concerning the sediment inflow into the multiple purpose channel from the areas above the Tennessee Colony, Livingston and Wallisville Reservoirs is given in appendix II of this report. The study indicates that sediment deposition in the 95.27-mile reach of multiple purpose channel upstream of lock and dam No. 12, located at the upper end of the Tennessee Colony reservoir, would be about 425 acre feet per annum (685,000 cubic yards) and that the net inflow and deposition in the channel in the vicinity of Tennessee Colony reservoir would be 1,100 acre-feet per annum (1,775,000 cubic yards).

113. The sediment inflow in the 85.7-mile reach of channel between the Tennessee Colony dam and lock and dam No. 6, at the upper end of the Livingston Reservoir, is estimated at 522 acre feet per annum (845,000 cubic yards). It was considered that flood release discharge from the Tennessee Colony reservoir and flood flows from the uncontrolled drainage area in this reach would be largely contained in the enlarged multiple purpose channel. The sediment load in this reach would be transported into the Livingston Reservoir during the periods of high flood release from the Tennessee Colony Reservoir.

114. The sediment inflow in the 51.75-mile of channel from the Livingston Dam to the upper end of the Wallisville Reservoir, is estimated at 277 acre-feet per annum (447,000 cubic yards). It was considered that all of the sediment produced in this reach would be transported to the Wallisville reservoir because the channel conditions in

this reach are similar to those in the Tennessee Colony - Livingston reach.

115. Quantities of sediment resulting from channel bank erosion or slides and degradation of channel bed cannot be precisely determined because of unknown factors at this time. Such factors include: (a) The ability of the bank materials to withstand the erosion action of stream flow, wave and propeller wash from passing waterborne craft, rainfall and run-off from small areas along the route of the channel, and (b) the formation of shoals or bars on the channel bed by sediment deposition and degradation of the channel bed whereby the flows would be diverted to the channel banks causing erosion and/or large bank slides to occur.

116. The entire Trinity River valley is composed of alluvial materials of Quaternary origin consisting of sands, clays, silts or their mixtures. In the reach of the channel upstream of the Livingston reservoir the alluvial material is of moderate depth to bed rock, and are considered to be quite firm and resistant to stream flow. In the lower reaches of the river the alluvial material deepens to depths of 30 feet and greater. From about channel mile 87.0 to 35.5 the channel banks are relatively unstable within comparatively narrow widths in certain reaches resulting generally from natural cut-offs. The character of the bank materials along the Trinity River is shown on plates 23 and 24. The plan for the multiple purpose channel provides for bank stabilization works on the outer curves of the channel in the reach from about the Livingston Dam to the upper reach of the Wallisville Reservoir.

117. In view of the foregoing, it appears reasonable to consider that maintenance dredging of the several channel reaches providing a project depth of 12 feet below normal pool elevation be expected on an annual basis to assure adequate depth for navigation, and that maintenance dredging of the channel reaches having depths greater than 12 feet be anticipated on a three-year basis to prevent serious encroachment of the channel capacity for flood storage releases and meandering of stream flow within the channel resulting from the formation of large bars or shoals.

118. It is further anticipated that during flood rises on the channel, a considerable amount of sediment may be deposited in the upper and lower forebays at each lock. The removal of such sediment deposits would probably be on an expedited basis to prevent serious delays to navigation. Accordingly, for estimating purposes, it is considered that such dredging would be required at each lock on an annual basis.

119. During infrequent periods of drought, conservation storage in the Livingston and Tennessee Colony reservoirs would be withdrawn. During these drought periods, condition surveys would be made of the 12 x 150-foot navigation channels located at the bottom of the conservation pools. When full depletion of the conservation storage appeared imminent, expedited dredging of the navigation channel may be required. The occurrence of the severe droughts would be very infrequent, possibly not more often than once in 50 years. For estimating purposes, it is proposed that dredging of the navigation channels below the conservation pools in

the Livingston and Tennessee Colony Reservoirs be envisioned on an annual basis.

120. Dredging of the navigation channel below the conservation pool of the Wallisville Reservoir would not be required based on study given in Appendix I accompanying the District Engineer's report contained in House Document No. 215, 87th Congress, 1st Session. The study of probable sediment storage in the Wallisville Reservoir concluded that practically all of the sediment load entering the Wallisville Reservoir would be passed out of the reservoir by high flood flows. The multiple purpose channel would carry regulated discharges of 35,000 second-feet for extended periods, and these flows with their accompanying silt loads would require the same operation of the Wallisville gated river diversion channel proposed in the design of the Wallisville Reservoir project. Accordingly, it is considered that practically all of the presently estimated sediment load of 277 acre-feet produced in the Livingston-Wallisville reach would be passed out of the Wallisville reservoir and only a small amount of channel maintenance dredging would be required, annually.

121. The sediment load entering the Livingston Reservoir, estimated at 845,000 cubic yards, annually, would pass lock and dam No. 6, located at channel mile 147.92, and enter into the deeply entrenched navigation pool No. 5B. Pool 5B would have a bottom width of 150 feet at a constant elevation 89 and would be about 18 miles long to the upper reach of inundated lands of the Livingston Reservoir. During high flood releases from the Tennessee Colony Reservoir and/or flood flows from the uncontrolled area above the Livingston Reservoir, the conservation storage in Livingston Reservoir would be full to elevation 131, which would extend to lock and dam No. 6. In view thereof all sediment load passing lock and dam No. 6 would enter into pool No. 5B having a depth of 42 feet and would be trapped in its upper reaches. In order to provide an adequate channel for flood releases and navigation, it is proposed that channel dredging involving 845,000 cubic yards, annually, be anticipated for in the upper reaches of pool 5B.

122. Similar conditions would exist below lock and dam No. 12 located at channel mile 274.51 in the upper reach of the flood control storage pool of the Tennessee Colony Reservoir, as shown on plate 13. Pool No. 11 would have a bottom width of 150 feet at a constant elevation of 158 throughout its length of 15.6 miles, and would be entrenched generally in the upper 8 miles. However, pool No. 11 would ordinarily have a 12-foot depth of water below normal pool elevation 270 and it would be necessary to provide that depth constantly for navigation. The sediment inflow passing lock and dam No. 12 would be deposited in the navigation channels, pools No. 11 and 10B, in the adjacent overbank area in the lower portion of pool No. 11, and the conservation pool of the Tennessee Colony Reservoir, depending on the largeness of the flood inflow. It is considered condition surveys of pools No. 11 and 10B would be required after recession of the flood inflows and that emergency dredging be performed to maintain adequate depth for navigation in these pools. The distribution, pattern, frequency, and quantity of sediment deposition in the

pools are not precisely known at this time. However, because of their possibility, the unit cost of maintenance dredging may be higher than regular maintenance dredging costs. To allow for these unknown factors, it is proposed that the annual cost of channel dredging in pools 10B and 11 be based on the removal of 1,500,000 cubic yards, annually.

123. The materials to be encountered in the maintenance dredging of the multiple purpose channel would consist of sand, sandy clay, clay, silt and some gravel. These materials should offer no unusual dredging difficulties, however, to overcome the higher banks of the deeply entrenched channel in certain reaches, it may be necessary to provide booster pumps for disposal of the earth materials on lands adjacent to the channel.

124. The estimated cost of maintenance dredging to remove the sediment load of 1,500,000 cubic yards from pools No. 10B and 11, in the Tennessee Colony reservoir and the 845,000 cubic yards from pool No. 5B in the Livingston reservoir is based on the use of a modern 27-inch pipeline dredge with an average daily output of 22,000 cubic yards of material from a 20-hour dredging day. The cost of operating a large dredge is estimated at $3,000 per day, which includes contingencies, engineering and design, and supervision and inspection. The annual cost of dredging the 1,500,000 and 845,000 cubic yards is estimated at $205,000 and $115,000, respectively.

125. The cost of maintenance dredging of the multiple purpose channel upstream from channel mile 35.5 to 362.8, excluding dredging in the Livingston and Tennessee Colony reservoirs and at lock sites, is based on the consideration that the sediment deposits in the channel would not be sufficient to delay a steady upstream advance of the dredge and therefore the cost of dredging the channel would depend largely on the amount of time required for the dredge to move through the reach. The 27-inch dredge has a maximum rate of progress of about 2,500 to 3,000 feet per day. However, for the purpose of this report, it was estimated that the dredge would advance about 2,100 feet per day, or at a cost of $7,500 per mile of channel. The estimated annual cost of dredging channel having a 12-foot project depth below normal pool is based on $7,500 per mile of channel assuming the channel to be dredged yearly. For channel depths greater than 12 feet, the estimated annual cost of dredging is based on $2,500 per mile of channel, assuming the channels to be dredged every three years.

126. It is considered that expedited dredging at the lock forebays would not involve a large amount of dredging and that such dredging could be performed efficiently by small dredges designed for such purposes. The cost of dredging both forebays of each lock is estimated at $10,000 annually.

127. The cost of expedited dredging of the 12 x 150-foot channels below the conservation pools in the Livingston and Tennessee Colony reservoirs is estimated at $300 per mile on an annual basis. Maintenance dredging in the reach of flood control channel between mile 362.8 and

369.8, would probably be performed by land based equipment because the channel diminishes from a depth of about 21 feet at mile 362.8 to zero at about mile 368. For the purpose of this report, the cost of maintaining project depth in this reach is estimated at $2,500 per mile. The total annual cost of maintenance dredging of the multiple purpose channel upstream of lock No. 1 in the Wallisville reservoir is estimated at $1,332,900, a summary of which is given in table 35.

TABLE 35
ESTIMATE OF ANNUAL MAINTENANCE DREDGING COSTS
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO
FORT WORTH, TEXAS

Reach	Miles of channel	Estimated annual dredging cost per mile	Estimated annual dredging cost
Houston Ship Channel to upper reach of Wallisville reservoir (Mile 0.0 to 35.5)			
Mile 0.0 to 6.5	6.5	-	None (1)
Mile 6.5 to 35.5	28.9	-	None (1)
Upper reach of Wallisville reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)			
Mile 35.5 to 47.4	12.0	$2,500	$ 30,000
Total mile 35.5 to 47.4			30,000
Head of authorized channel to Tennessee Colony Dam (Mile 47.4 to 233.5)			
Mile 47.4 to 73.1	25.7	2,500	64,300
Mile 73.1 to 74.9	1.8 (2)	7,500	13,500
Mile 74.9 to 99.1	24.2	2,500	60,500
Mile 99.1 to 134.8	35.7	300	10,700
Mile 134.8 to 148.0	13.2	8,700	115,000
Mile 148.0 to 233.5	85.5	2,500	213,800
Emergency dredging at locks No. 2 thru 10A			100,000
Total Mile 47.4 to 233.5			577,800
Tennessee Colony Dam to lock and dam No. 12 (Mile 233.5 to 274.4)			
Mile 233.5 to 258.9	25.4	300	7,600
Mile 258.9 to 274.4	15.5		205,000
Emergency dredging at locks No. 10B & 11			20,000
Total - Mile 233.5 to 274.4			232,600
Lock and dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)			
Mile 274.4 to 283.3	8.9	2,500	22,300
Mile 283.3 to 286.6	3.3 (2)	7,500	24,800
Mile 286.6 to 295.0	8.4	2,500	21,000
Mile 295.0 to 298.3	3.3 (2)	7,500	24,800
Mile 298.3 to 303.9	5.6	2,500	14,000
Mile 303.9 to 306.3	2.4 (2)	7,500	18,000
Mile 306.3 to 322.0	15.7	2,500	39,300
Emergency dredging at locks No. 12 thru 17			60,000
Total - Mile 274.4 to 322.0			224,200

TABLE 35 (Cont'd)
ESTIMATE OF ANNUAL MAINTENANCE DREDGING COSTS
FOR MULTIPLE PURPOSE TRINITY RIVER CHANNEL TO
FORT WORTH, TEXAS

Reach	Miles of channel	Estimated annual dredging cost per mile	Estimated annual dredging cost
Five-mile Creek to Dallas Terminus (322.0 to 326.7)			
Mile 322.0 to 326.0	4.0	2,500	$ 10,000
Mile 326.0 to 326.7	0.7 (2)	7,500	5,300
Dallas Terminus	-	-	13,500
Total - Mile 322.0 to 326.7			28,800
Dallas Terminus to Dallas Floodway (Mile 326.7 to 331.1)			
Mile 326.7 to 331.1	4.4 (2)	7,500	33,000
Dallas Floodway (Mile 331.1 to 338.8)			
Mile 331.1 to 337.4	6.3	2,500	15,800
Mile 337.4 to 338.8	1.3	7,500	9,800
Emergency dredging at Lock No. 18			10,000
Total - Mile 331.1 to 338.8			35,600
Dallas Floodway to Fort Worth Terminus (Mile 338.8 to 362.8)			
Mile 338.8 to 342.5	3.8 (2)	7,500	28,500
Mile 342.5 to 346.0	3.5	2,500	8,800
Mile 346.0 to 351.9	5.9 (2)	7,500	44,300
Mile 351.9 to 357.3	5.4	2,500	13,500
Mile 357.3 to 360.2	2.9 (2)	7,500	21,800
Mile 360.2 to 362.8	2.6	2,500	6,500
Emergency dredging at locks No. 19, 20 & 21			30,000
Total - Mile 338.8 to 362.8			153,400
Fort Worth Terminus to and including Riverside Drive bridges (Mile 362.8 to 369.8)			
Mile 362.8 to 369.8	7.0	2,500	17,500
Total - Mile 0.0 to 369.8			$1,332,900

(1) Maintenance costs for the proposed 12 x 150-foot channel to Liberty in this reach considered to be the same as for the 9 x 150-foot channel.
(2) Reach of channel having 12-foot project depth below normal pool elevation.

128. CHANNEL REVETMENT.- The plan for the multiple purpose channel includes bank revetment works at 34 separate curves totalling about 57,000 lineal feet in a total channel length of about 52 miles. The proposed revetment works would consist of 24-inch thickness of quarry run stone ranging from 1/2 inch to 200-pound stone placed on the outer-banks of the curves from two feet above normal pool elevation to the channel bottom gradient. Maintenance of the stone revetment works would consist of occasional replacing and/or reshaping the stone blanket along the top of the revetment works or at the up and downstream ends of the

blanket disturbed by erosion and wave action. Maintenance of the stone blanket below the waterline would be to replace the stone blanket in the event of a "washout" or damage caused by floating craft. For the purpose of this report the cost of maintaining the 57,000 lineal feet of channel revetment works is estimated at $50,000 annually.

129. AIDS TO NAVIGATION.- The Commander, Eighth Coast Guard District, New Orleans, Louisiana, by letter dated October 30, 1961, file H2/L-1 Ser 1557, advises that annual maintenance of the aids to navigation proposed for the multiple purpose channel is estimated at $84,800, annually, and that the estimated life of daybeacons and buoys is estimated to be 12 years and 20 years, respectively. The life of the buoy boats is estimated to be 25 years. The annual cost of replacing the aids to navigation required for the multiple purpose channel is estimated at $22,000.

130. OPERATION AND MAINTENANCE OF RECREATION FACILITIES.- The cost of maintenance and operation of the recreational facilities proposed for the multiple purpose channel is estimated at $272,000 annually. The annual cost is based on the proposal that general supervision and maintenance of four recreational areas be accomplished by a ranger and a four-man crew, working 40-hour week, performing maintenance of access and park roads, signs and public-use facilities including rental of maintenance and transportation equipment. The cost also provides for contract work for mowing, clean up and repair of public-use buildings and facilities, as may be necessary, resulting from damage through general use, vandalism, storm or other causes. For purposes of economic analyses, the total annual cost of $272,000 is allocated to various reaches of the channel on the basis of first costs of the construction items shown in table 36.

TABLE 36
ESTIMATED ANNUAL COST OF MAINTENANCE AND OPERATION OF RECREATIONAL FACILITIES IN DESIGNATED REACHES OF THE MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Designated reach of channel	Estimated annual cost
Houston Ship Channel to head of Wallisville Reservoir (Mile 0.0 to 35.5)	
Maintenance & operation - 3 recreational areas	$ 29,000
Head of Wallisville Reservoir to head of authorized channel to Liberty (Mile 35.5 to 47.4)	
Maintenance & operation - 1 recreational area	7,000
Head of authorized channel to Liberty & Tennessee Colony Dam (Mile 47.4 to 233.5)	
Maintenance & operation - 14 recreational areas	118,500

TABLE 36 (Cont'd)
ESTIMATED ANNUAL COST OF MAINTENANCE AND OPERATION
OF RECREATIONAL FACILITIES IN DESIGNATED REACHES OF
THE MULTIPLE PURPOSE CHANNEL TO FORT WORTH, TEXAS

Designated reach of channel	Estimated annual cost
Lock & Dam No. 12 to Five-mile Creek (Mile 274.4 to 322.0)	
Maintenance & operation - 8 recreational areas	$ 78,500
Five-mile Creek to and including Dallas Terminus (Mile 322.0 to 326.7)	
Maintenance & operation	None
Dallas Terminus to existing Dallas Floodway (Mile 326.7 to 331.1)	None
Dallas Floodway (Mile 331.1 to 338.8)	
Maintenance & operation - 1 recreational area	10,000
Dallas Floodway to & including Fort Worth Terminus, (Mile 338.8 to 362.8)	
Maintenance & operation - 3 recreational areas	29,000
Fort Worth Terminus to & including Riverside Drive bridges (Mile 362.8 to 369.8)	
Maintenance & operation	None
Total - Maintenance & operation	$272,000

RESERVOIRS

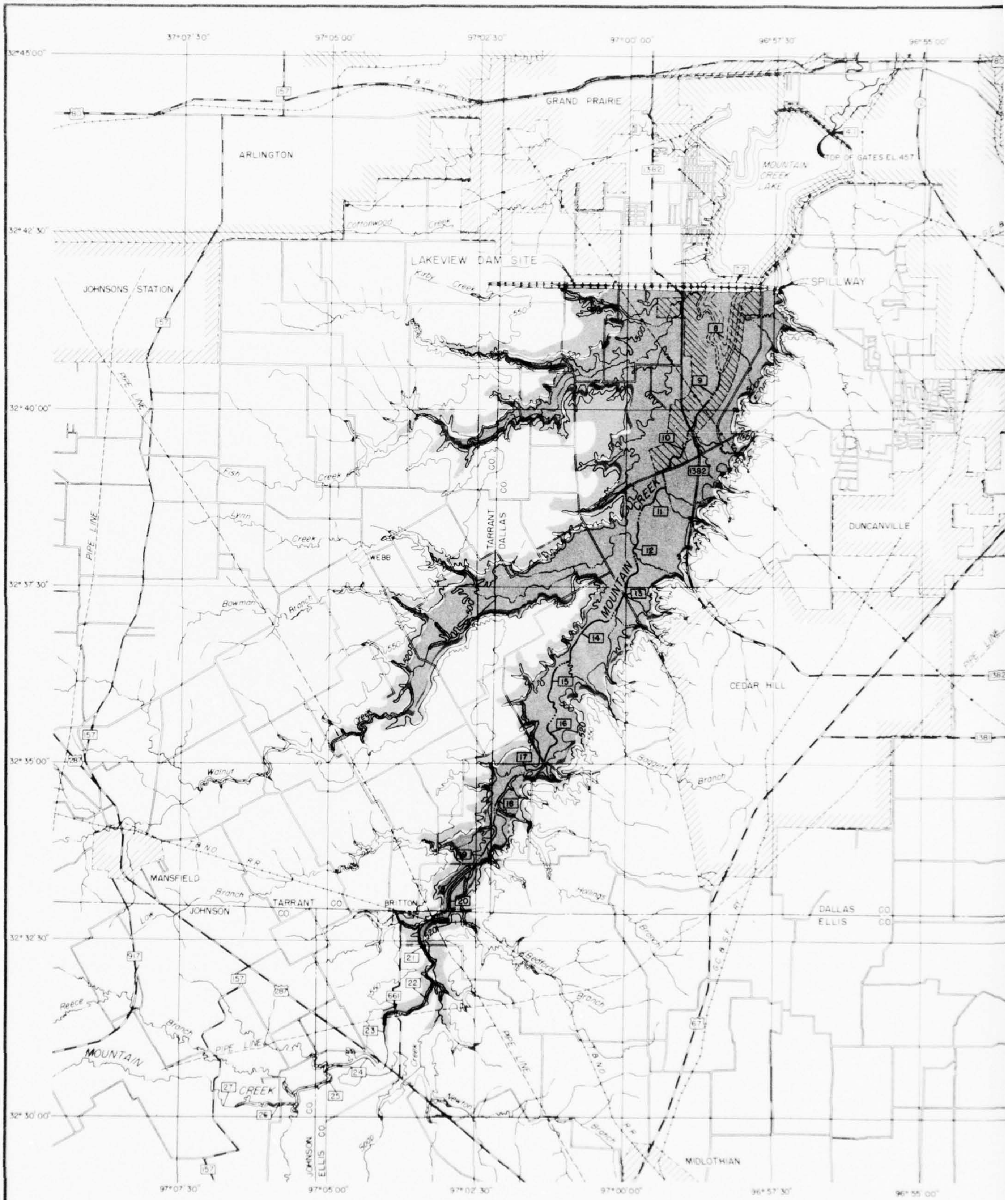
131. LAND ACQUISITION CRITERIA.- The criteria for land acquisition in reservoirs as contained herein is based on the "Joint Policies of the Departments of the Interior and of the Army Relative to Reservoir Project Lands" which was published in the Federal Register, Volume 27, Page 1734, dated 22 February 1962 and Change 9 of EM 405-2-150 dated 9 March 1962. The fee acquisition line is based on blocking-out the area beneath the upper guide contour or a strip of land 300 feet horizontally from the static full pool elevation, whichever is the greatest, except in remote areas. The fee acquisition line also includes remainders of ownerships having no access or remainders of ownerships where provision of access would cost more than the value of the land. It further includes lands required for public access. Flowage easements are proposed in small remote areas of tributary streams which sever ownerships and are subject to occasional floods.

132. LAKEVIEW RESERVOIR PROJECT.- The Lakeview dam site is located at river mile 7.2 on Mountain Creek in Dallas County about 3.1 miles above the existing Mountain Creek Dam. The Lakeview Dam site is just south of the city limit of Grand Prairie, about 14 miles from downtown Dallas and 22 miles from downtown Fort Worth. The proposed reservoir would be constructed for flood control, water conservation, fish and wildlife, and general recreation purposes. Subsequent to completion of project formulation studies, local interests proposed a minor revision in the site selection made by the Corps of Engineers for the Lakeview Reservoir project. This revision will be considered in the preconstruction planning of the Lakeview Reservoir project.

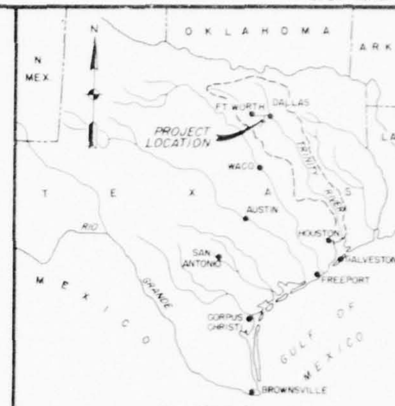
133. DAM.- The Lakeview Reservoir would be formed by a main earth dam with a maximum height above streambed of about 91 feet and a total length of about 22,620 feet including a 136-foot concrete spillway. The spillway located in a saddle on the right abutment, would be a gate-controlled ogee flip-bucket type with three 40 by 28-foot tainter gates. The net opening of the spillway would be 120 feet. The outlet works would consist of one 12-foot diameter conduit controlled by two 5-foot 6-inch by 12-foot gates. The location and area are shown on plate 27, and the typical sections and detailed layout are shown on plate 28. The general hydraulic design data are shown on plate 29.

134. RESERVOIR.- The Lakeview Reservoir will have a total controlled storage of 488,700 acre-feet and an area of 15,650 acres at elevation 528.0, top of spillway gates or top of flood control pool. At top of conservation pool, elevation 518.0, the reservoir will have an area of 12,300 acres and a storage capacity of 349,500 acre-feet, including a portion of the sediment reserve. Lands required for reservoir operation, construction of the proposed dam, and for fish, wildlife, and recreation purposes will be

CORPS OF ENGINEERS

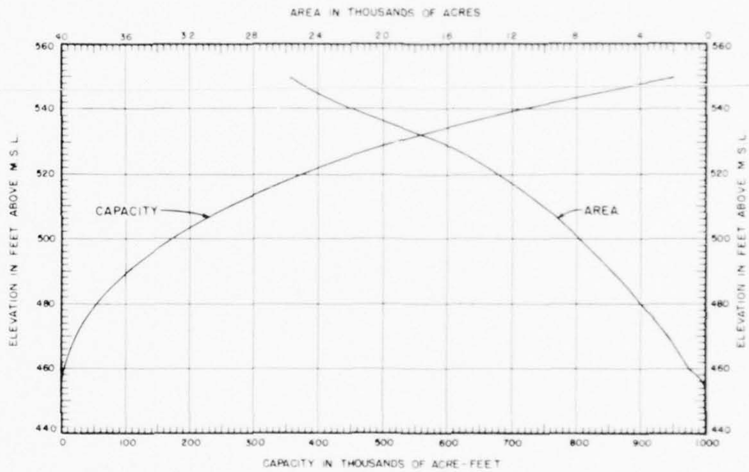


U.S. ARMY



VICINITY MAP

SCALE OF MILES



AREA-CAPACITY CURVES

LEGEND

- 80 — U.S. HIGHWAY AND ROUTE NUMBER
- 12 — STATE HIGHWAY AND ROUTE NUMBER
- 918 — FARM TO MARKET HIGHWAY AND ROUTE NUMBER
- COUNTY ROAD
- 7.2 — RIVER MILE (MILE ABOVE MOUTH)
- RAILROAD
- PIPE LINE
- POWER TRANSMISSION LINE
- TOP OF CONSERVATION POOL - EL. 518.0
- TOP OF FLOOD CONTROL - EL. 528.0

TRINITY RIVER AND TRIBUTARIES, TEXAS
MOUNTAIN CREEK
LAKEVIEW RESERVOIR

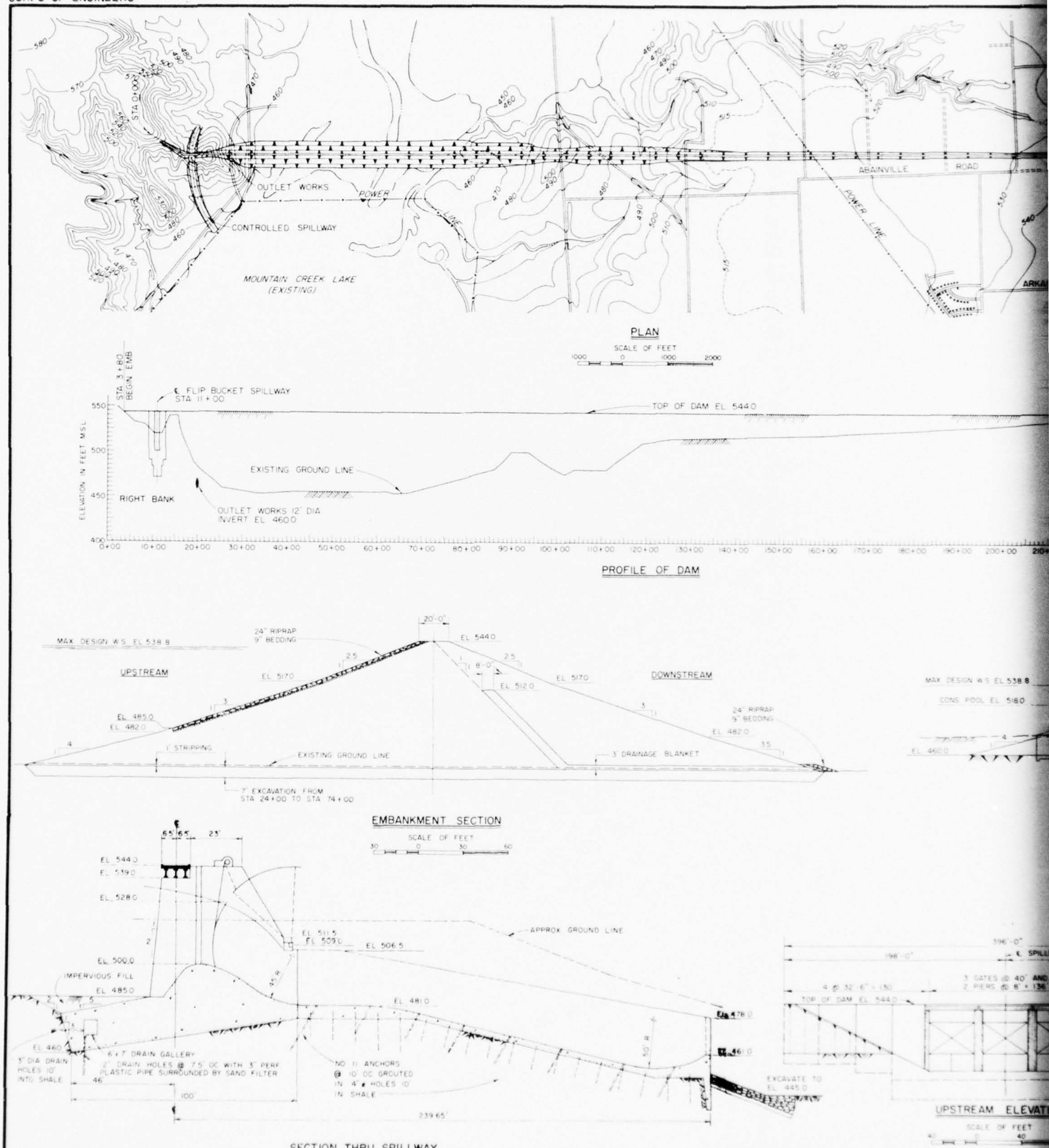
RESERVOIR MAP

SCALE IN FEET
4000 0 4000 8000

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Reed, CHIEF, PLANNING & REPORTS BRANCH	C. J. Swenson, CHIEF, ENGINEERING DIVISION	D. D. West, DISTRICT ENGINEER
PREPARED: A. W. Hawley	DRAWN BY: B.S. / CHECKED BY: W.W.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER; FILE TRIN 230-19

CORPS OF ENGINEERS



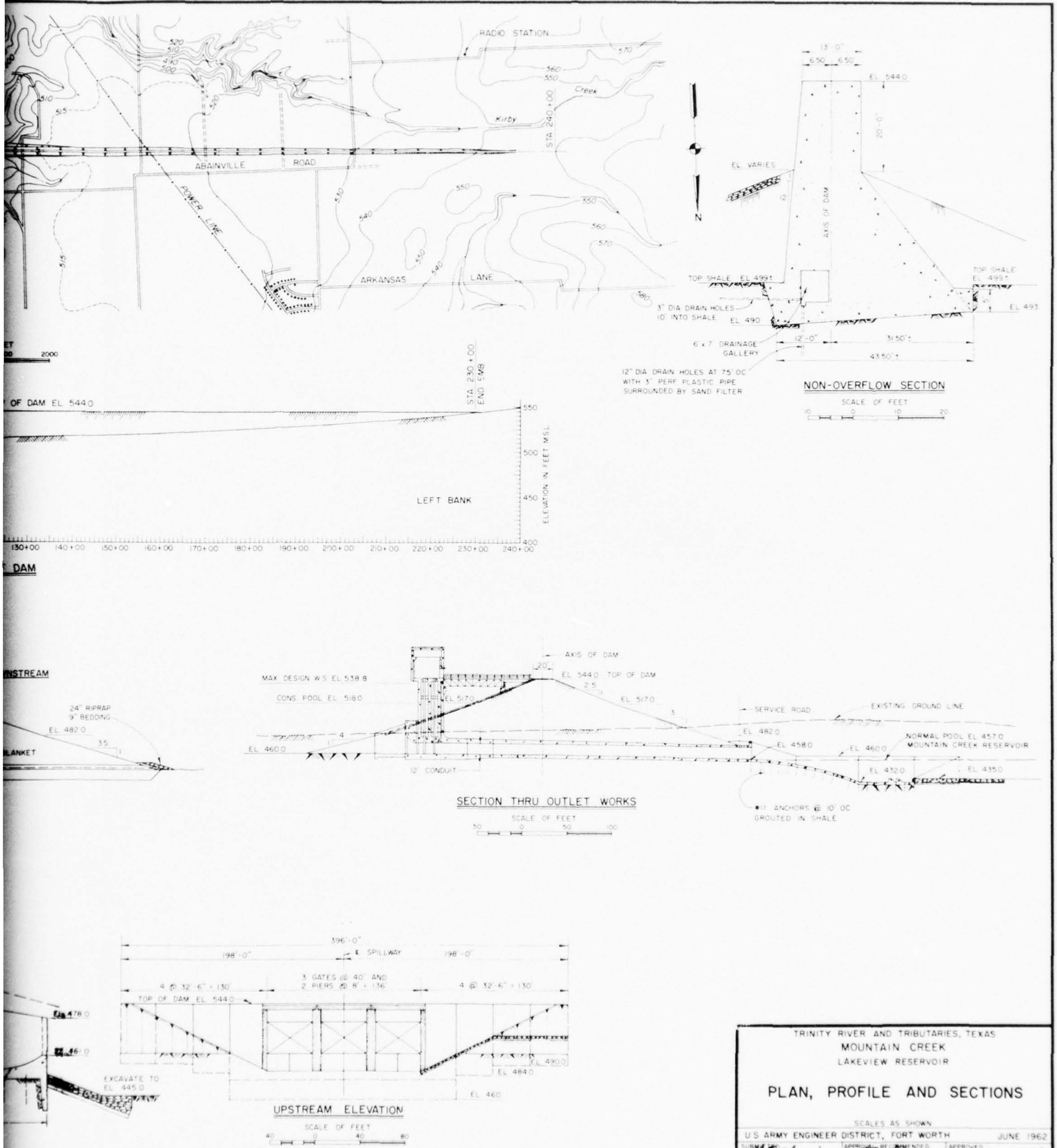
PLAN

PROFILE OF DAM

EMBANKMENT SECTION

SECTION THRU SPILLWAY

UPSTREAM ELEVATI



TRINITY RIVER AND TRIBUTARIES, TEXAS
MOUNTAIN CREEK
LAKEVIEW RESERVOIR

PLAN, PROFILE AND SECTIONS

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood, ENGINEER, CHIEF PLANNING & REPORTS BRANCH	C. D. Swenson, ENGINEER, CHIEF ENGINEERING DIVISION	COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: W. L. Pondwell, ENGINEER, HEAD, CIVIL DESIGN BRANCH	DRAWN BY: D.E.L. / CHECKED BY: W.R.B.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER / FILE TRIN 230-19

CORPS OF ENGINEERS

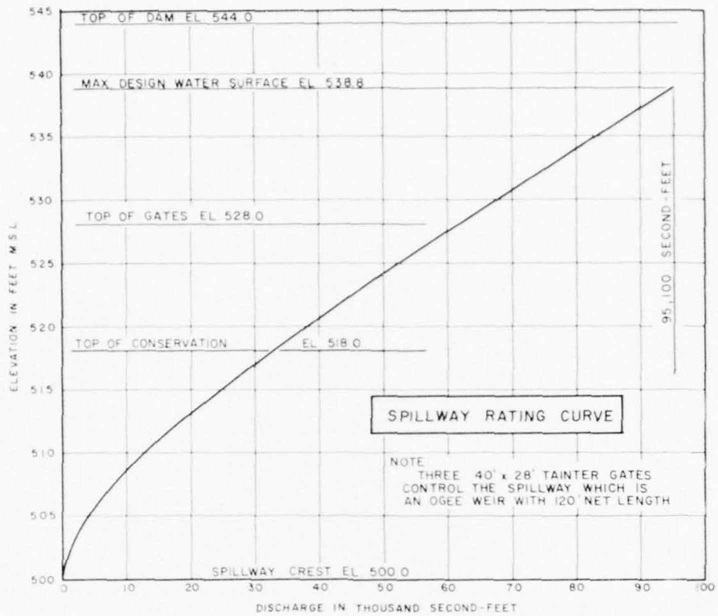
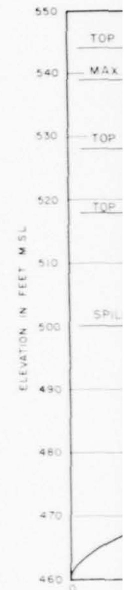


FIG - 1



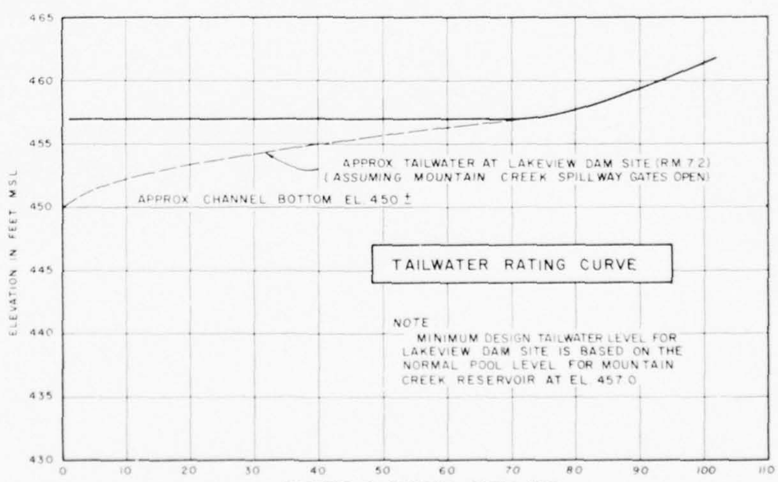
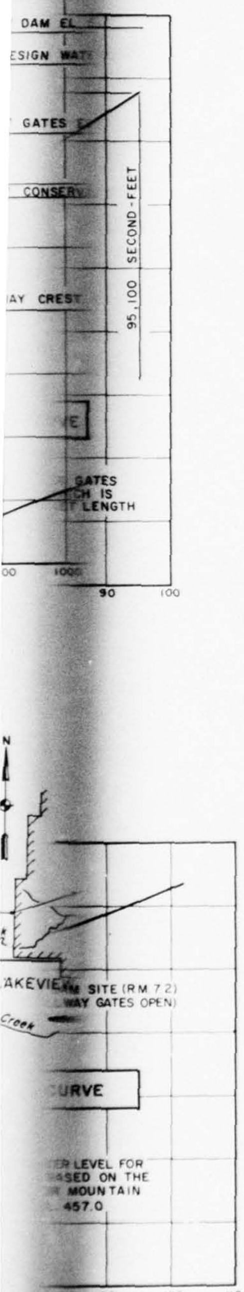


FIG - 3



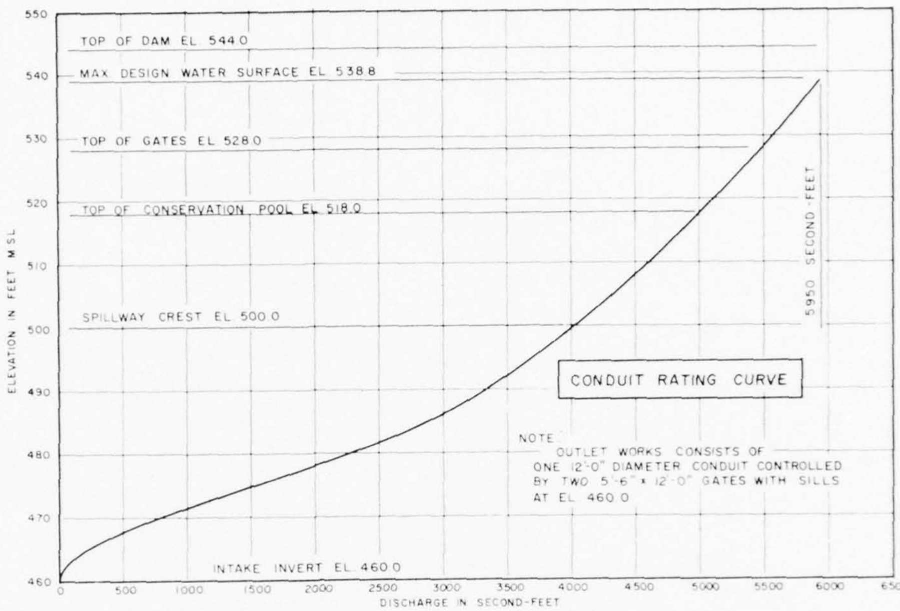


FIG. 2

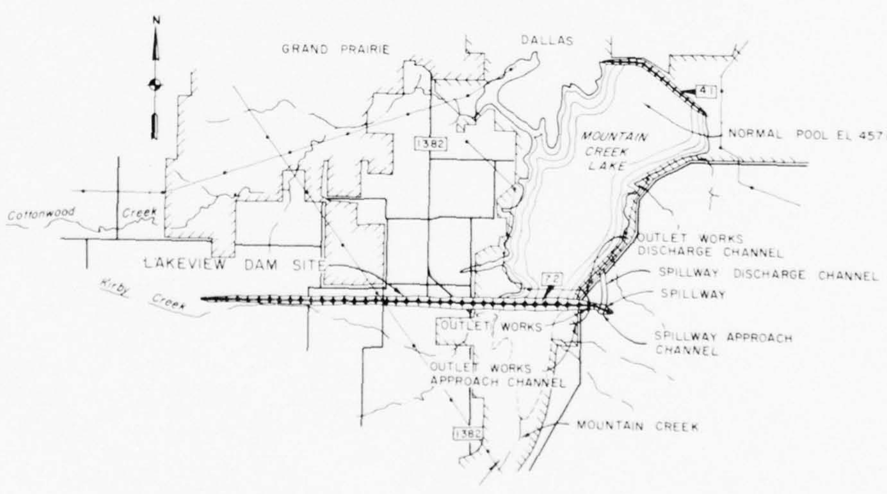


FIG - 4

TRINITY RIVER AND TRIBUTARIES, TEXAS
MOUNTAIN CREEK
LAKEVIEW RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE, 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood	C. J. Swanson	W. West
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER
PREPARED	DRAWN BY: K.R.W.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
HEAD, HYDRAULIC DESIGN SECTION	CHECKED BY: R.W.D.	FILE TRIN 230-19

about 20,360 acres in fee simple and 800 acres in flowage easements. This land is classified as 9 percent home site, acreage tracts, and potential subdivisions; 43 percent cropland; 40 percent pasture; and 8 percent as floodwater storage for Dallas Power and Light Company. Construction of Lakeview Reservoir would require relocation of 9.7 miles of farm to market highways, 12.0 miles of county roads, 1.2 miles of railroad, 1.5 miles of pipeline, 33 miles of telephone lines, 33 miles of REA (138KV) distribution lines, and 7.4 miles of electrical transmission and distribution lines. There are no known cemeteries in the reservoir area. No oil or mineral activity of any kind is in evidence anywhere in the reservoir area. Two recognized, but unincorporated, subdivisions are located within the proposed reservoir area. Other pertinent data for the proposed Lakeview Reservoir are shown in table 37 while the location of the appurtenant channel improvement works is shown on plate 43 on page 178.

135. GEOLOGY.- The dam site was investigated by drilling and augering seven borings as shown on plate 30. Ten feet of residual clay were penetrated by the boring located in a natural spillway saddle immediately to the east of the crest of the right abutment. The boring, on the slope of the right abutment, encountered 10.6 feet of residual clay overburden overlying 3.6 feet of weathered primary strata. The contact indicated at 10.6 feet is transitional between the residuum and the underlying bedrock. Three hand auger borings were drilled along the axis where it crosses the swampy flood plain area at the upper end of Mountain Creek Lake. None of the three borings reached primary strata although one of the holes was augered to a depth of 20.7 feet. The three hand auger borings penetrated an average of about 6 feet of organic, mucky, silty clay overlying a soft and variable silty and sandy clay which, in places, contained traces of gravel. The clay overburden varies between 20 feet and 23-1/2 feet in thickness beneath the proposed embankment area along the relatively gentle slopes of the left abutment west of the alluvial filled bottom lands.

136. Primary strata, immediately underlying the overburden at the Lakeview dam site, are represented by the Eagle Ford shale formation of Upper Cretaceous age. In an unweathered condition, the Eagle Ford is a dark gray, or black, firm laminated shale. The formation contains occasional thin lenses of flaggy limestone and concretionary septeria, but apparently none of the borings were drilled deep enough to reach any of these characteristic components which normally occur in the lower section of the formation.

137. FOUNDATION CONDITIONS.- Overburden and primary strata consist of impervious materials which will inhibit leakage of impounded water beneath an embankment. Unweathered Eagle Ford shale strata have a bearing capacity adequate to support the required appurtenant structures. At the upper end of Mountain Creek Lake, a significant quantity of organic, silty, clayey muck should be removed from an embankment foundation in the existing flood plain area. This may necessitate the construction of a dike, which can be incorporated into the downstream toe of the embankment. Dewatering provisions should be employed during the foundation excavation in the bottom land area and while placing embankment fill back to, or above, the elevation of the original ground surface.

TABLE 37
PERTINENT DATA
PROPOSED LAKEVIEW RESERVOIR
TRINITY RIVER

Item	Flood control, water conservation, and recreation
Miscellaneous	
Dam location, river mile	7.2
Drainage area, square miles	272
Flood control storage, acre-feet	136,700
Water conservation storage, acre-feet	306,400
Sediment storage	45,600
Yield, CFS	47
Million gallons daily	30
Spillway design flood	
Peak inflow, CFS	372,400
Volume, acre-feet	413,400
Volume, inches	28.50
Peak outflow, CFS	101,000(1)

Reservoir	Elevation (feet)	Area (Acres)	Capacity (Acre-feet)
Spillway crest	500.0	7,910	170,700
Top of conservation storage	518.0	12,300	349,500
Top of gates	528.0	15,650	488,700
Maximum design water surface	538.8	21,210	686,300
Top of dam	544.0	-	-
Maximum tailwater at dam	462.6	-	-

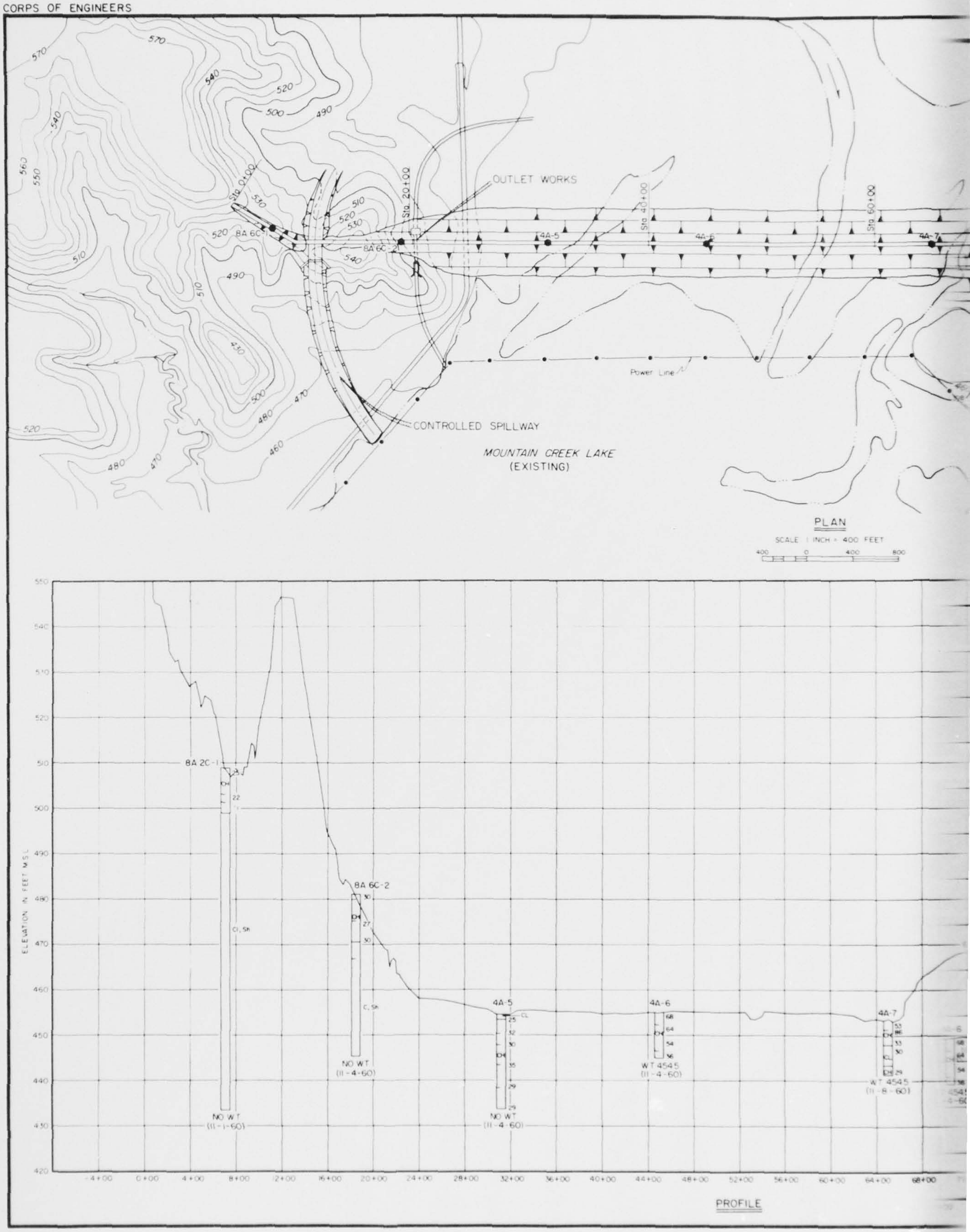
Dam	
Type of dam	Earth fill
Total length, feet (including spillway)	22,620
Embankment section:	
Type	Compacted earth fill
Total length, feet (minus spillway)	22,224
Height above streambed, feet	91
Freeboard, feet	5.2
Crown width, feet	20
Side slopes:	
Upstream	2-1/2:1, 3:1, 4:1
Downstream	2-1/2:1, 3:1, 3-1/2:
Non-overflow sections:	
Type	Concrete gravity
Total length, feet	260
Height above end sill, feet	83
Top width, feet	13
Spillway section:	
Type	Conc. ogee, flip buc
Gross length, feet	136
Net length, feet	120
Crest height above apron, feet	39

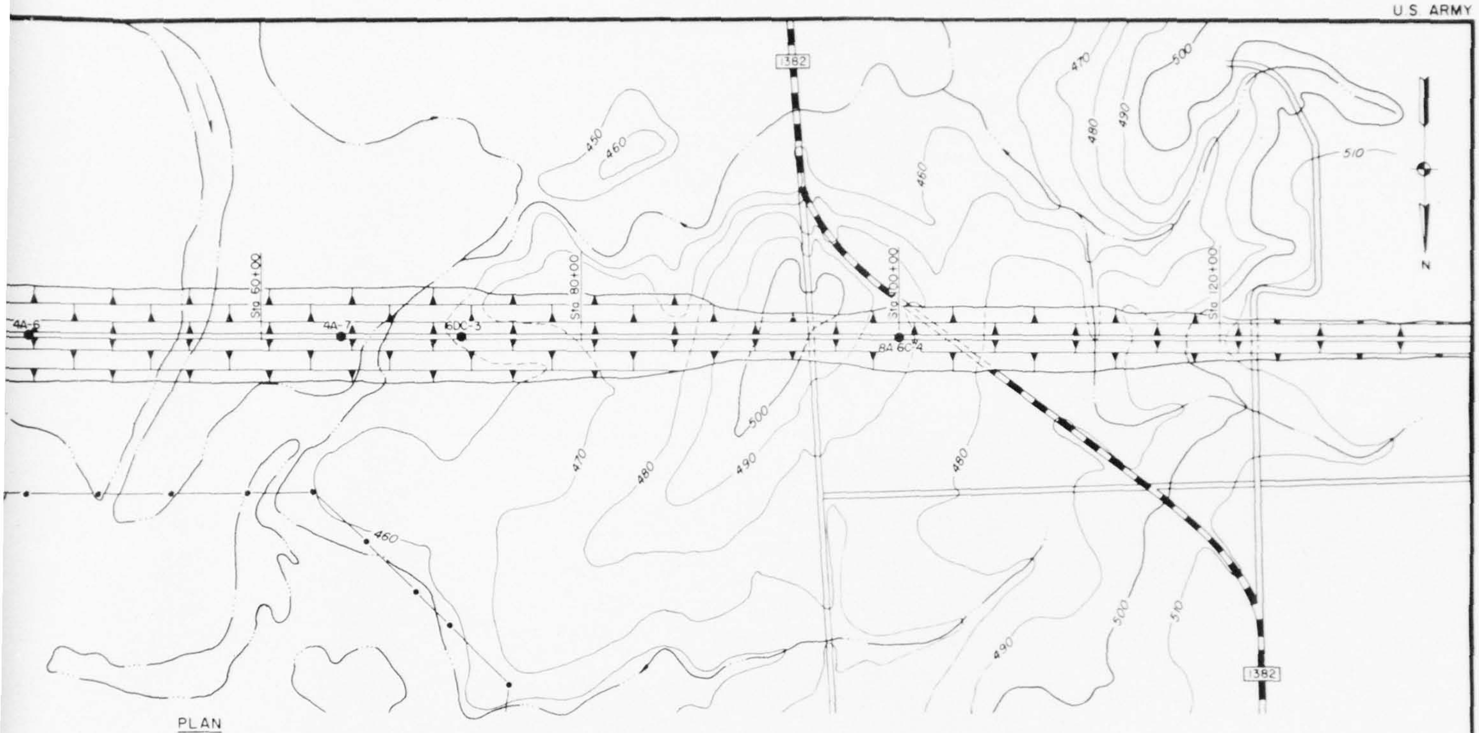
TABLE 37 (CONT'D)
PERTINENT DATA
PROPOSED LAKEVIEW RESERVOIR
TRINITY RIVER

Item	Flood control, water conservation, and recreation
Gates:	
Type	Tainter
Number	3
Size (Width x height), feet	40x28
Spillway discharge, CFS:	
Top of gates	61,600
Maximum water surface	95,100
Outlet works	
Type	Conduit with 2 gated inlets
Number of conduits	1
Diameter, feet	12
Invert elevations, feet	460.0
Conduit control	Two 5'6"x12' gates
Relocations	
Highways, miles	9.7
County roads, miles	12.0
Railroads, miles	1.2
Power lines (138KV), miles	7.4
REA distribution line, miles	33.0
Telephone lines, miles	33.0
Pipelines, miles	1.5
Cemeteries, number	-
Towns, number	None
Lands	
Dam and reservoir:	
Clearing, acres	2,765
Land acquisition:	
Fee simple, acres	19,600
(Top control elevation)	531.0
Flood easement, acres	800
(Top control elevation)	531.0
Recreation:	
Clearing, acres	8,500
Land acquisition:	
Fee simple, acres	760

(1) Includes 5,900 CFS discharge through the outlet works.

CORPS OF ENGINEERS

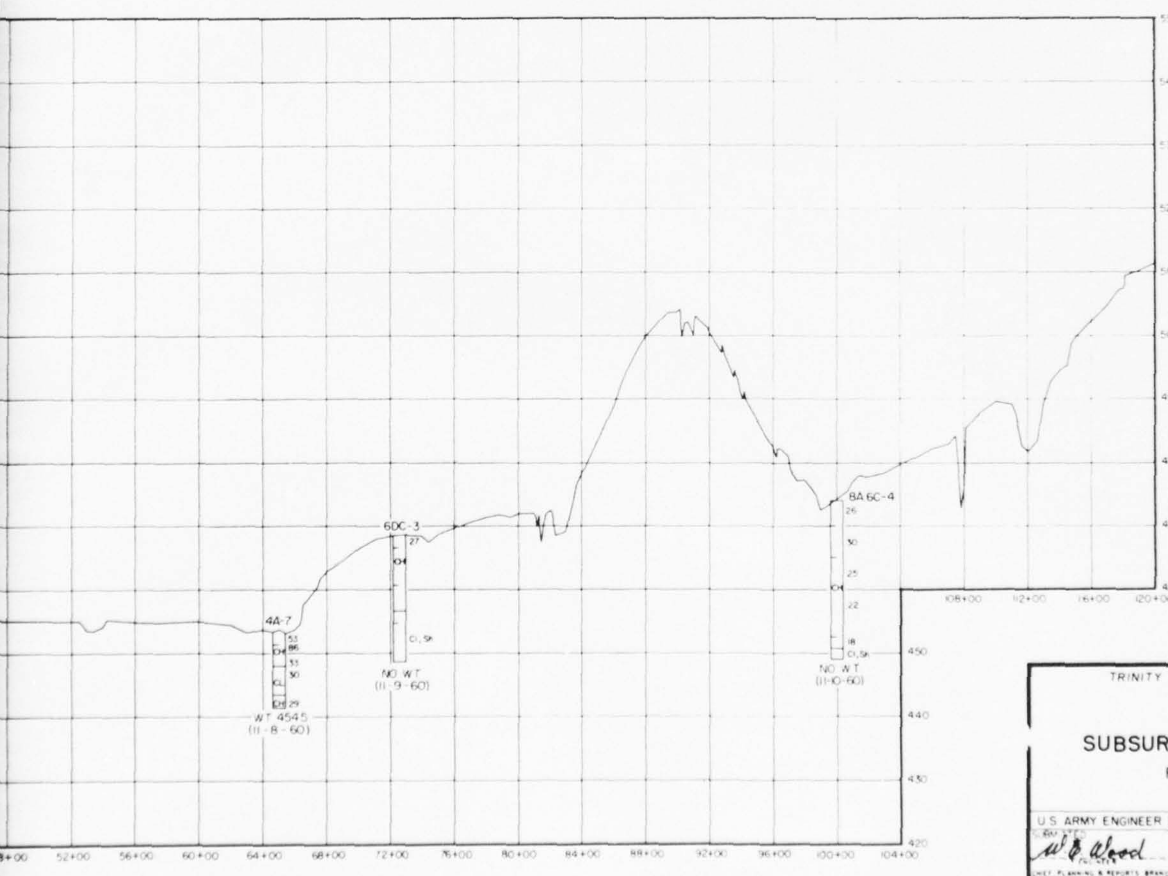




PLAN

SCALE 1 INCH = 400 FEET

400 0 400 800



PROFILE

LEGEND

LABORATORY CLASSIFICATION

CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity, fat clays

VISUAL CLASSIFICATION

Cl	Clay or clayey
Sh	Shale or shaley
WT	Water table

TYPES OF BORING

4A	4 inch hand auger
8A	8 inch core boring
2C	2 inch core boring
6C	6 inch core boring
6D	6 inch denison barrel boring

NOTES

1. Figure to right of boring logs are water content in percent of dry weight.
2. Absence of ground water levels opposite boring logs does not mean necessarily that ground water will not be encountered at the locations or with the verticle reaches of the borings.
3. Visual classifications were taken from drillers log.

TRINITY RIVER AND TRIBUTARIES, TEXAS
MOUNTAIN CREEK
LAKEVIEW RESERVOIR

SUBSURFACE INVESTIGATIONS

PLAN AND PROFILE

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH		JUNE 1962
SUBMITTED: W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED: C. J. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION	APPROVED: [signature], COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: [signature], ENGINEER, CHIEF, FOUNDATION & MATERIALS BR.	DRAWN BY: D.W.F. CHECKED BY: W.R.B.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER. FILE TRIN 230-19

138. AVAILABILITY OF CONSTRUCTION MATERIALS.- Adequate quantities of impervious materials for the embankment are available in the immediate vicinity of the dam site. Pervious materials which can be used for a drainage blanket, are being produced from pits along the Trinity River within about 15 miles of the dam site. Fine aggregate can be obtained from the same sources. Coarse aggregate and riprap are not available locally and will have to be shipped by railroad or truck. Four sources of acceptable coarse aggregate and riprap are near Bridgeport, Texas, and an acceptable riprap source is near Tehuacana, Texas. Railroad facilities exist within approximately three miles of the dam site.

139. COST ESTIMATE.- The detailed estimate shows the separation of first costs for the dam and reservoir and for recreation included in the project. A summary of first costs and annual charges for the Lakeview Reservoir project are shown in table 38. The detailed cost estimate for the Lakeview Reservoir project is shown in table 39.

TABLE 38
SUMMARY OF FIRST COST AND ANNUAL CHARGES
PROPOSED LAKEVIEW RESERVOIR
MOUNTAIN CREEK

Item	Costs
FIRST COST	
1. Federal First Cost	
Lands and damages	$14,354,000
Relocations	2,038,000
Reservoir (clearing)	493,000
Dam	
a. Earth embankment	5,396,000
b. Concrete, dam and spillway	2,168,000
c. Outlet works	1,201,000
Access roads	244,000
Recreation facilities	3,250,000
Buildings, grounds, and utilities	200,000
Permanent operating equipment	91,000
Engineering and design	716,000
Supervision and administration	1,029,000
Total estimated Federal first cost	31,180,000
2. Non-Federal First Cost	None
3. Total Estimated First Cost of Project	31,180,000
ANNUAL CHARGES	
(Construction period-5 years) (100 yr. amortization)(2-7/8% interest rate)	
1. Federal Investment	
a. Federal first cost	$31,180,000
b. Interest during construction	2,241,100
Total Federal investment	33,421,100
2. Non-Federal Investment	None
3. Federal Annual Charges	
a. Interest on investment	960,900
b. Amortization charge	59,800
c. Operation and maintenance (including replacement of parts)	351,300
Total-Federal annual charges	1,372,000
4. Total-Non-Federal Annual Charges	None
5. Total Estimated Annual Charges	$ 1,372,000
Preauthorization cost $70,000	

Note: Prices are as of January 1962

TABLE 39
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

PERTINENT INFORMATION

Top of dam, elevation	544.0
Top of gates, elevation	528.0
Spillway crest, elevation	500.0
Storage capacity (top of gates less sediment) acre-feet	443,100

Item	Unit	Unit cost	Quantity	Cost
A. DETAILED ESTIMATE OF FIRST COST-DAM AND RESERVOIR				
(01.0) Lands and damages				
a. Land costs				
(1) Fee simple lands	Acre		19,600	$7,733,875
(2) Flood easement lands	Acre		800	256,500
(3) Severance damage	LS			310,000
(4) Improvements	LS			2,280,000
(5) Resettlement reimbursement	LS			42,000
Subtotal - land costs				10,622,375
Contingencies, 25% ±				2,655,625
Total - land costs				13,278,000
b. Land acquisition expense				271,000
Total - lands and damages				13,549,000
(02.0) Relocations				
a. Roads and railroad				
(1) F.M. Highway 661				
Embankment	CY	$ 0.32	22,000	7,040
Flexible base	CY	4.50	4,400	19,800
Surfacing	SY	0.40	9,900	3,960
Bridge (28' roadway)	LF	150.00	202	30,300
Riprap	CY	6.00	2,500	15,000
Bedding	CY	3.00	1,300	3,900
Subtotal - F.M. Highway 661				80,000
(2) F.M. Highway 1382				
New road	Mile	50,000.00	9	450,000
Spillway channel bridge	LF	150.00	152	22,800
Embankment	CY	0.32	85,000	27,200
Subtotal - F.M. Highway 1382				500,000
(3) County roads	Mile	12,500.00	12	150,000
(4) T.&N.O. Railroad				
Embankment	CY	0.32	125,000	40,000
Ballast	CY	6.00	4,400	26,400
Cross ties	Each	4.00	4,000	16,000
Tracklaying and surfacing	Mile	6,600.00	1.23	8,118
Relocate signal system	LS			7,500
Ballast deck trestle	LF	150.00	1,336	200,400
Bridge	LF	125.00	100	12,500
Riprap	CY	6.00	14,000	84,000
Bedding	CY	3.00	5,000	15,000
Subtotal - T. & N.O. R.R.				409,918
Subtotal - roads and railroad				1,139,918

TABLE 39 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

Item	Unit	Unit cost	Quantity	Cost
b. Utilities				
(1) Electric lines				
138 K.V. transmission lines	Mile	$30,000.00	7.4	$222,000
R.E.A. distribution lines	Mile	2,000.00	33	66,000
Subtotal electric lines				288,000
(2) Telephone lines	Mile	1,000.00	33	33,000
(3) Pipelines				
Lone Star Gas Co. 18" line	Mile	120,000.00	1	120,000
Magnolia 16" line	Mile	100,000.00	0.5	50,000
Subtotal - pipelines				170,000
Subtotal - utilities				491,000
Subtotal - relocations				1,630,918
Contingencies, 25% ±				407,082
Total - relocations				2,038,000
(03.0) Reservoir clearing	Acre	35.00	2,765	96,775
Contingencies, 25% ±				24,225
Total-reservoir clearing				$121,000
(04.0) Dams				
a. Earth embankment				
(1) Diversion and care of water	LS			29,800
(2) Clearing and grubbing	Acre	200.00	148	29,600
(3) Excavation, stripping	CY	0.25	222,000	55,500
(4) Excavation, common	CY	0.25	698,000	174,500
(5) Excavation, borrow	CY	0.24	7130,000	1,711,200
(6) Compacted fill	CY	0.07	6560,000	459,200
(7) Drainage blanket	CY	2.50	319,450	798,625
(8) Riprap	CY	6.00	137,215	823,290
(9) Bedding	CY	3.00	51,455	154,365
(10) Flexible base	CY	4.50	8,470	38,115
(11) Aggregate	CY	6.00	690	4,140
(12) Asphalt treatment	Gal.	0.16	24,700	3,952
(13) Timber guide posts	Each	5.00	1,744	8,720
(14) Slope protection, turfing	Acre	400.00	64	25,600
Subtotal - earth embankment				4,316,607

TABLE 39 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

Item	Unit	Unit cost	Quantity	Cost
b. Concrete dam and spillway				
(1) Care of water during construction	LS			30,000
(2) Clearing	Acre	$150.00	3	450
(3) Excavation, common	CY	0.30	95,000	28,500
(4) Excavation, shale	CY	0.60	330,000	198,000
(5) Structural backfill	CY	1.00	43,000	43,000
(6) Drilling and grouting anchor holes	LF	2.25	2,530	5,693
(7) Drilling drain holes	LF	2.00	3,060	6,120
(8) Asphalt, shale treatment	SY	0.90	2,240	2,016
(9) Concrete, weir	CY	18.00	11,340	204,120
(10) Concrete, non-overflow	CY	20.00	15,120	302,400
(11) Concrete, pier	CY	25.00	3,335	83,375
(12) Concrete, slab	CY	20.00	3,980	79,600
(13) Concrete, wall	CY	35.00	780	27,300
(14) Concrete, bridge deck	CY	60.00	35	2,100
(15) Cement	Bbl	5.00	35,000	175,000
(16) Steel, reinforcing	Lb	0.13	1,397,000	181,610
(17) Steel, structural	Lb	0.20	37,900	7,580
(18) Pipe railing (aluminum)	Lb	1.50	2,870	4,305
(19) Pipe railing, bridge "	Lb	1.50	4,500	6,750
(20) Metals, miscellaneous	Lb	0.40	5,000	2,000
(21) Ladders, gratings, & grills	Lb	1.50	4,000	6,000
(22) Water stop, copper	Lb	1.75	860	1,505
(23) Water gages, tile	LF	14.00	60	840
(24) Tainter gates	Lb	0.30	239,000	71,700
(25) Tainter gate hoists, shafts, & hangers	Lb	1.00	58,500	58,500
(26) Trunnion anchorages & seals	Lb	1.00	73,000	73,000
(27) Emergency bulkheads	Lb	0.32	63,000	20,160
(28) Precast bridge girders	Each	700.00	9	6,300
(29) Crane	Each	75,000.00	1	75,000
(30) Electrical facilities	LS			7,000
(31) Standby power unit	Each	5,000.00	1	5,000
(32) Riprap	CY	7.00	1,316	9,212
(33) Bedding	CY	4.50	475	2,138
(34) 12" drain holes 3" plastic pipe & sand filter	LS			8,500
Subtotal-concrete dam and spillway				1,734,774

TABLE 39 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

Item	Unit	Unit cost	Quantity	Cost
c. Outlet works				
(1) Care of water during construction	LS			20,000
(2) Clearing	Acre	150.00	4	600
(3) Excavation, common	CY	0.50	18,700	9,350
(4) Excavation, shale	CY	0.90	48,000	43,200
(5) Backfill, structural	CY	1.00	11,000	11,000
(6) Drilling & grouting anchor holes	LF	2.25	790	1,778
(7) Drilling drain holes	LF	2.00	790	1,580
(8) Asphalt, shale treatment	SY	1.00	170	170
(9) Operating house	LS			50,000
(10) Concrete, control tower	CY	40.00	495	19,800
(11) Concrete, tower base & transition	CY	38.00	1,625	61,750
(12) Concrete, conduit	CY	30.00	1,610	48,300
(13) Concrete, slab	CY	24.00	955	22,920
(14) Concrete, walls	CY	35.00	2,470	86,450
(15) Concrete, bridge	CY	60.00	95	5,700
(16) Cement	Bbl	5.00	9,080	45,400
(17) Steel, reinforcing	Lb	0.13	937,000	121,810
(18) Steel, structural	Lb	0.22	46,000	10,120
(19) Metal, miscellaneous	Lb	0.60	1,180	708
(20) Ladders, gratings, & grills	Lb	0.60	1,680	1,008
(21) Spiral stairs	Set	1,530.00	1	1,530
(22) Conduit liner	Lb	0.30	529,000	158,700
(23) Rubber water stop	LF	3.00	440	1,320
(24) Water gages, tile	LF	14.00	25	350
(25) Gates & operating equipment	LS			185,000
(26) Bulkhead	Lb	0.25	56,000	14,000
(27) Overhead crane	Each	16,000.00	1	16,000
(28) Electrical facilities	LS			4,000
(29) Riprap	CY	7.00	2,120	14,840
(30) Bedding	CY	4.50	750	3,375
Subtotal - outlet works				960,759
Subtotal - Dams				7,012,140
Contingencies, 25% ±				1,752,860
Total - Dams				8,765,000
(08.0) Access road	Mile	40,000	1	40,000
Contingencies, 25% ±				10,000
Total - Access road				50,000

TABLE 39(CONT'D)
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

Item	Unit	Unit cost	Quantity	Cost
(19.0) Buildings, grounds and utilities				
(1) Maintenance facilities	LS			100,000
(2) Water supply	LS			30,000
(3) Powerline & substation	LS			10,000
(4) Visitors overlook facilities	LS			20,000
Subtotal-Buildings, grounds, & utilities				160,000
Contingencies, 25%±				40,000
Total-Buildings, grounds & utilities				200,000
(20.0) Permanent operating equipment				
(1) Radio-telephone equipment	LS			5,000
(2) Boats	LS			9,200
(3) Miscellaneous furniture & equipment	LS			23,800
(4) Stream gages	LS			8,000
(5) Evaporation & rain gages	LS			2,000
(6) Sediment & degradation ranges	LS			25,000
Subtotal-Permanent operating equipment				73,000
Contingencies, 25%±				18,000
Total-Permanent operating equipment				91,000
(30.0) Engineering and design				428,000
(31.0) Supervision and administration				676,000
Subtotal-estimated first cost-dam and reservoir				25,918,000
B. DETAILED ESTIMATE OF FIRST COST - RECREATION				
(01.0) Lands and damages				
(1) Fee simple lands	Acre		760	$494,000
(2) Severance damage	LS			63,000
(3) Improvements	LS			75,000
Subtotal				632,000
Contingencies, 25%±				158,000
(4) Acquisition expense				15,000
Total lands and damages				805,000
(03.0) Reservoir clearing	Acre	35.00	8,500	297,500
Contingencies, 25%±				74,500
Total - Reservoir clearing				372,000

TABLE 39 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
LAKEVIEW RESERVOIR - MULTIPLE PURPOSE
MOUNTAIN CREEK

Item	Unit	Unit cost	Quantity	Cost
(08.0) Access roads	Mile	31,000	5	$ 155,000
Contingencies, 25%±				39,000
Total-access roads				194,000
(14.0) Facilities				
(1) Gravel roads	LS			728,000
(2) Paved roads	LS			364,000
(3) Parking areas	LS			260,000
(4) Boat launching ramps	LS			52,000
(5) Sanitary facilities	LS			234,000
(6) Water supply system	LS			260,000
(7) Picnic facilities	LS			546,000
(8) Site improvements	LS			104,000
(9) Signs and buoys	LS			52,000
Subtotal				2,600,000
Contingencies, 25%±				650,000
Total-facilities				3,250,000
(30.0) Engineering and design				288,000
(31.0) Supervision and administration				353,000
Subtotal-estimated first cost of recreation				5,262,000
TOTAL - ESTIMATED PROJECT FIRST COST				$31,180,000

Note: Prices are as of January 1962

140. AUBREY RESERVOIR.- The Aubrey dam site is at mile 60.0 on the Elm Fork of the Trinity River in northeast Denton County. The site is between the towns of Sanger and Aubrey and is 30 river miles upstream from the Corps of Engineers' Lewisvill Dam (Garza-Little Elm Reservoir). The Aubrey Reservoir would contain 899,900 acre-feet of controlled storage capacity of which 258,300 acre-feet would be for flood-control, 603,800 acre-feet would be for water conservation, and 37,800 acre-feet for sediment reserve. The flood-control storage in Aubrey Reservoir would permit a reallocation of storage in the Garza-Little Elm Reservoir and increase that storage presently allocated to water conservation purposes. Under 2020 conditions of watershed development and a recurrence of the 1950-1957 drought period, the dependable yield from the proposed Aubrey-Garza-Little Elm Reservoir system is estimated to be 151.3 million gallons per day. This system will produce an increased dependable yield of 65.3 MGD over that which would be produced by Garza-Little Elm Reservoir alone. State Highway 10, FM Highways 372 and 455, county roads, the Texas and Pacific Railroad, and a pipe line would require relocation or alteration. The estimated first cost of this project is $34,073,000. Pertinent data on the Aubrey Dam and Reservoir are contained in table 40. Plates 31 thru 33 show the reservoir area; plan, profile and sections; subsurface investigations and general hydraulic data for Aubrey Reservoir.

TABLE 40
PERTINENT DATA PROPOSED AUBREY RESERVOIR
ELM FORK OF TRINITY RIVER

Item	Water conservation, and recreation (1)
Miscellaneous	
Dam location, river mile	60.0
Drainage area, square miles	682
Flood control storage, acre-feet	258,300
Water conservation storage, acre feet	603,800
Sediment storage, acre-feet	37,800
Yield, CFS	75
Million gallons daily	116
Spillway design flood	
Peak inflow, CFS	483,100
Volume, acre-feet	952,000
Volume, inches	26.18
Peak outflow, CFS	350,800

TABLE 40 (CONT'D)
PERTINENT DATA PROPOSED AUBREY RESERVOIR
ELM FORK OF TRINITY RIVER

Item	Elevation (feet)	Water conservation, and recreation (1) Area (acres)	Capacity (acre-ft.)
Reservoir			
Spillway crest	600.0	10,800	203,300
Top of conservation storage	625.5	24,340	639,000
Top of gates	635.0	30,750	899,900
Maximum design water surface	640.3	34,530	1,072,800
Top of dam	646.0	38,800	1,281,800

Dam	
Type of dam	Earth fill
Total length, feet(including spillway)	13,660
Embankment section:	
Type	Compacted earth fill
Total length, feet (minus spillway)	12,972
Height above streambed, feet	116
Freeboard, feet	5.7
Crown width, feet	20
Side slopes:	
Upstream	1 on 3
Downstream	1 on 3
Non-overflow sections:	
Type	Concrete gravity
Total length, feet	328
Height above apron, feet	122
Top width, feet	13
Spillway section:	
Type	Concrete ogee
Gross length, feet	688
Net length, feet	360
Crest height above apron, feet	76
Gates:	
Type	Tainter
Number	9
Size (width x height), feet	40 x 35
Spillway discharge, CFS:	
Top of gates	278,000
Maximum design water surface	350,800

TABLE 40 (CONT'D)
PERTINENT DATA PROPOSED AUBREY RESERVOIR
ELM FORK OF TRINITY RIVER

Item	Water conservation, and recreation (1)
Outlet works	
Type	Gate-controlled sluices through spillway piers
Number of sluices	2
Diameter, inches	36
Invert elevations, feet	550.0
Sluice control	Power operated slide gates
Relocations	
Highways, miles	16.0
County roads, miles	6.0
Railroads, miles	5.0
Power lines, miles	12
Telephone lines, miles	10
Pipelines, miles	1.0
Cemeteries, number	0
Towns, number	0
Lands	
Dam and reservoir:	
Clearing, acres	5,900
Land acquisition:	
Fee simple, acres	37,700
(top control elevation)	638.0
Flood easement, acres	1,500
Recreation:	
Clearing, acres (2)	16,000
Land acquisition:	
Fee simple, acres (2)	1,400
Conversion, easement to fee, acres (3)	2,800

(1) Aubrey Reservoir has a primary purpose of water conservation; however, the reservoir contains flood-control storage to enable a comparable amount of flood-control storage in the downstream reservoir, Garza-Little Elm, to be reallocated to water conservation.
(2) Includes requirements for additional general recreation at Garza-Little Elm Reservoir.
(3) In Garza-Little Elm Reservoir.

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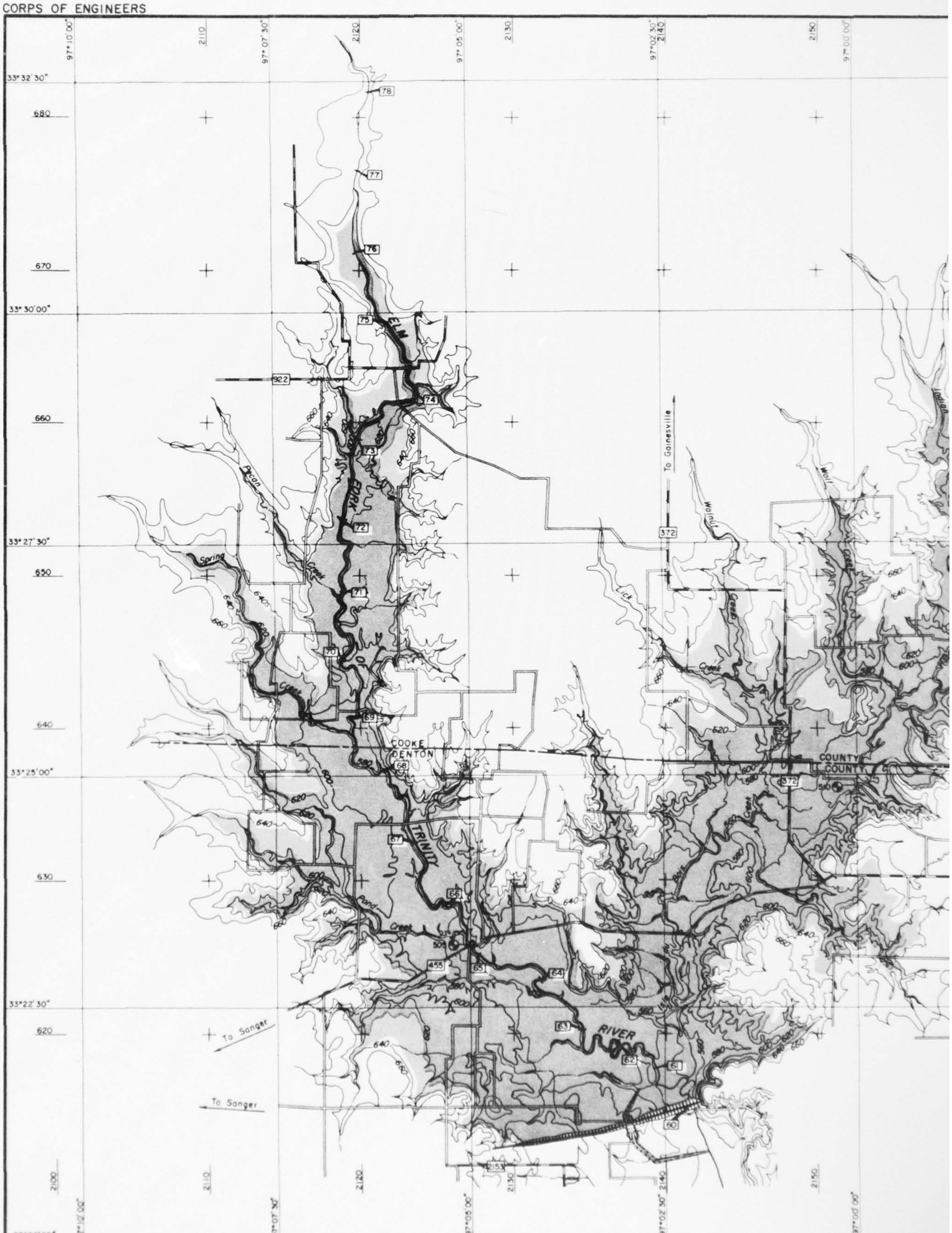

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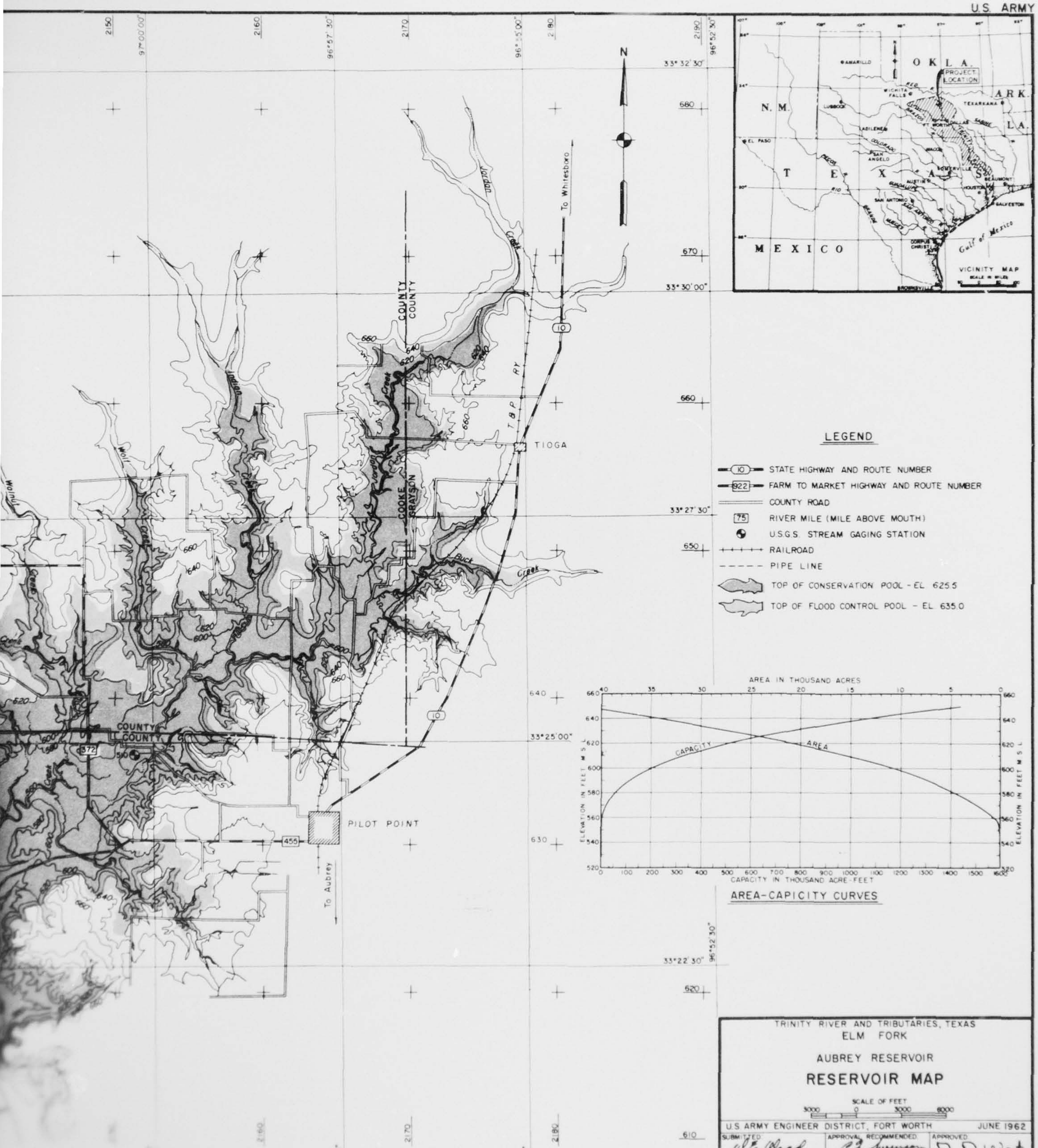
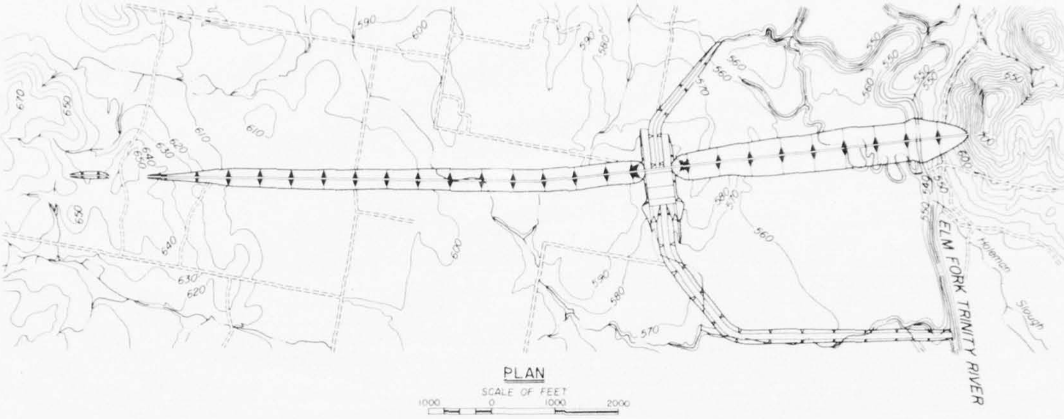


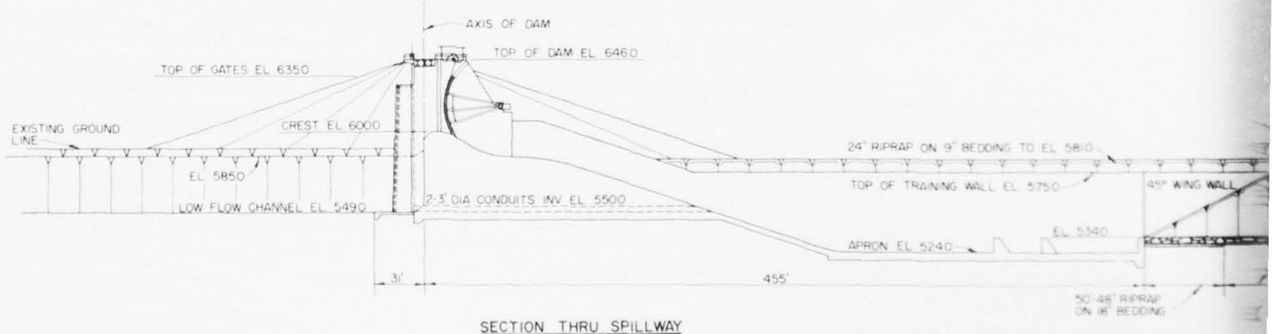
N
To Whitesboro
TIOGA
PILOT POINT
To Aubrey
COOKE COUNTY
GRAYSON COUNTY
T&P RY
33° 32' 30"
33° 30' 00"
33° 27' 30"
33° 25' 00"
33° 22' 30"
33° 20' 00"
97° 00' 00"
96° 57' 30"
96° 55' 00"
96° 52' 30"
VICINITY MAP
SCALE IN MILES
OKLA.
ARK.
LA.
N.M.
TEXAS
MEXICO
PROJECT LOCATION
Gulf of Mexico
LEGEND
STATE HIGHWAY AND ROUTE NUMBER
FARM TO MARKET HIGHWAY AND ROUTE NUMBER
COUNTY ROAD
RIVER MILE (MILE ABOVE MOUTH)
U.S.G.S. STREAM GAGING STATION
RAILROAD
PIPE LINE
TOP OF CONSERVATION POOL - EL. 625.5
TOP OF FLOOD CONTROL POOL - EL. 635.0
AREA IN THOUSAND ACRES
CAPACITY
AREA
ELEVATION IN FEET M.S.L.
CAPACITY IN THOUSAND ACRE-FEET
AREA-CAPICITY CURVES
TRINITY RIVER AND TRIBUTARIES, TEXAS
ELM FORK
AUBREY RESERVOIR
RESERVOIR MAP
SCALE OF FEET
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
JUNE 1962
SUBMITTED
CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COL, CORPS OF ENGINEERS
DISTRICT ENGINEER
PREPARED
HEAD, SPECIAL STUDIES SECTION
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE



PLAN

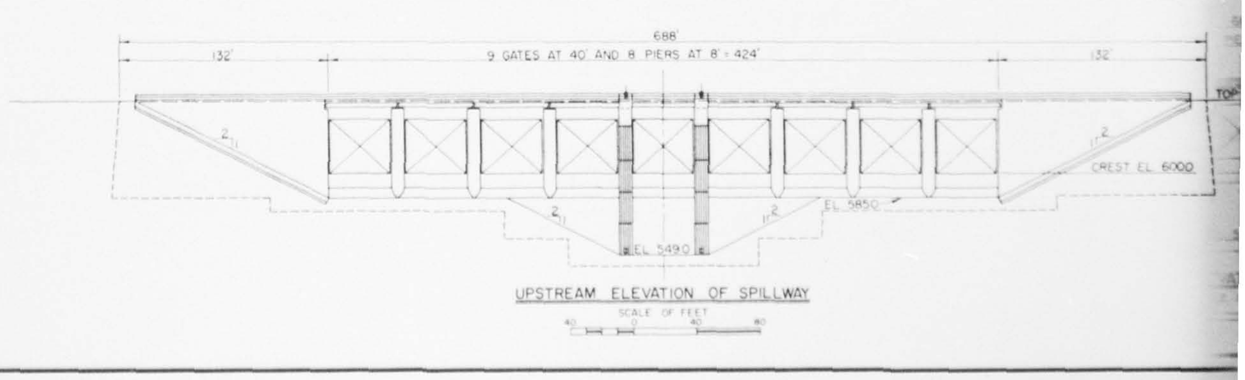
SCALE OF FEET

PROFILE



SECTION THRU SPILLWAY

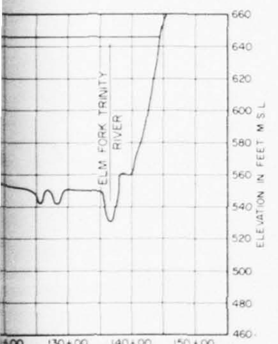
SCALE OF FEET

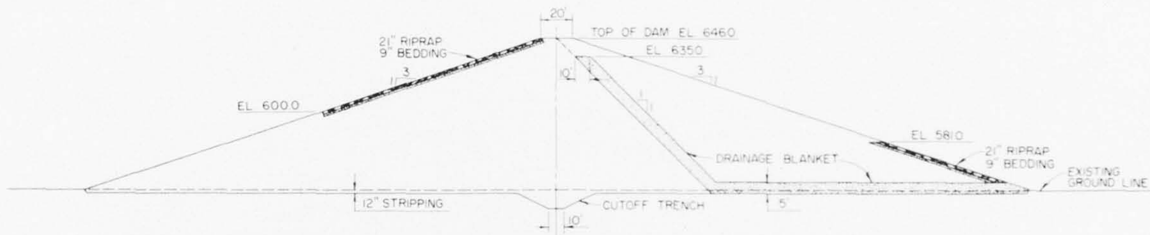


UPSTREAM ELEVATION OF SPILLWAY

SCALE OF FEET

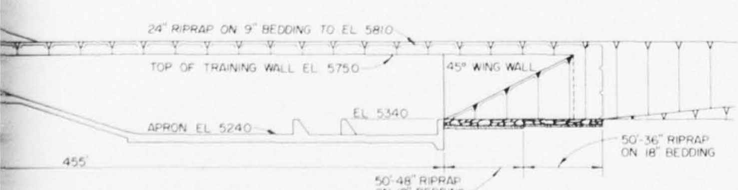
U.S. ARMY

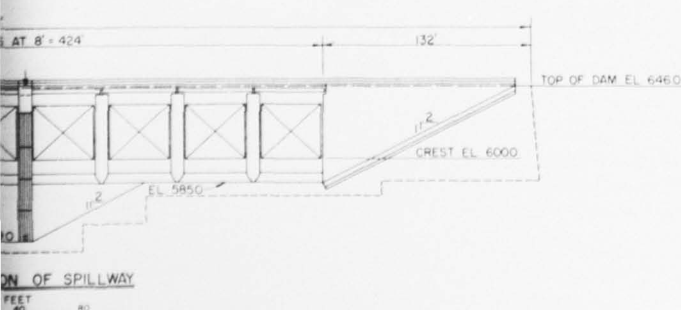




TYPICAL EMBANKMENT SECTION

SCALE OF FEET





ON OF SPILLWAY

FEET

TRINITY RIVER AND TRIBUTARIES, TEXAS
ELM FORK
AUBREY RESERVOIR

PLAN, PROFILE AND SECTIONS

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH		JUNE 1962
SUBMITTED: W.E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED: C.E. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION	APPROVED: D.D. West, COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: W.K. Andrews, ENGINEER, HEAD, CIVIL DESIGN BRANCH	DRAWN BY: D.E.C. / CHECKED BY: J.W.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER / FILE: TRIN 230-19

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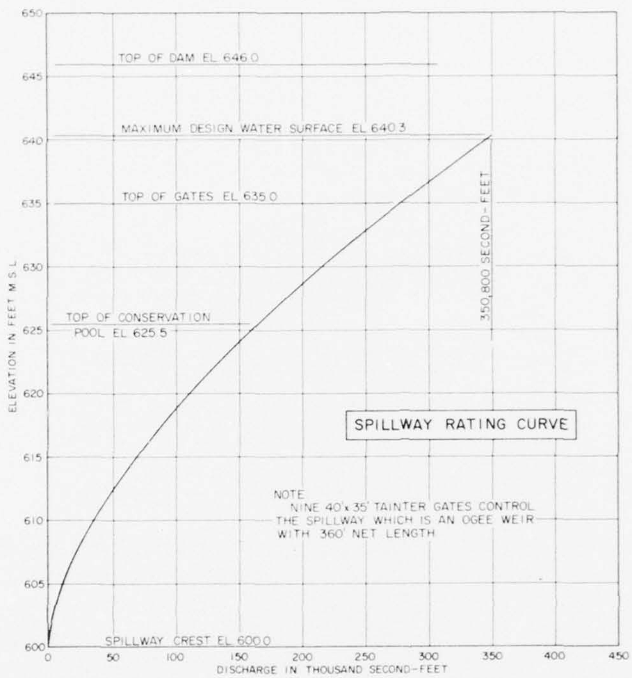


FIG. I

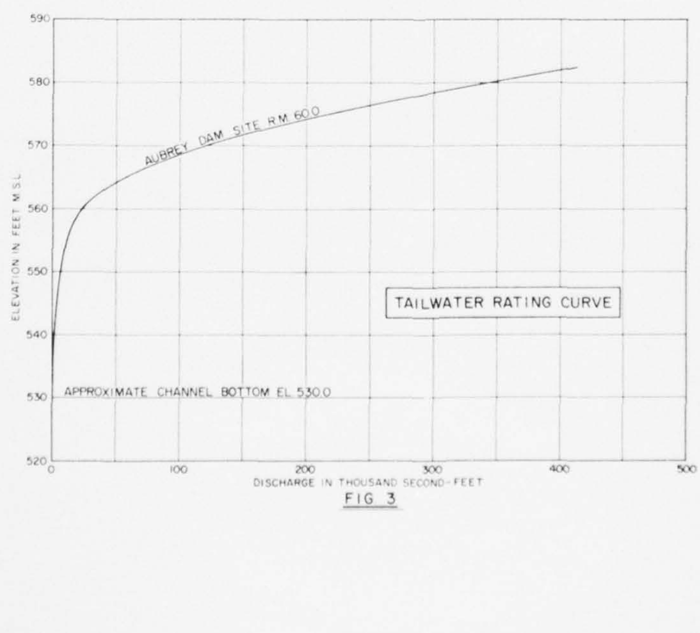
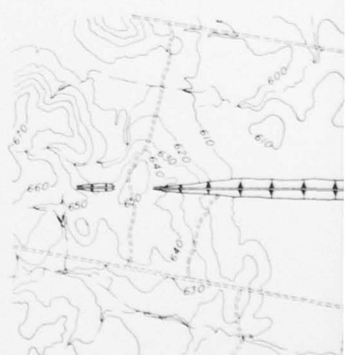


FIG 3



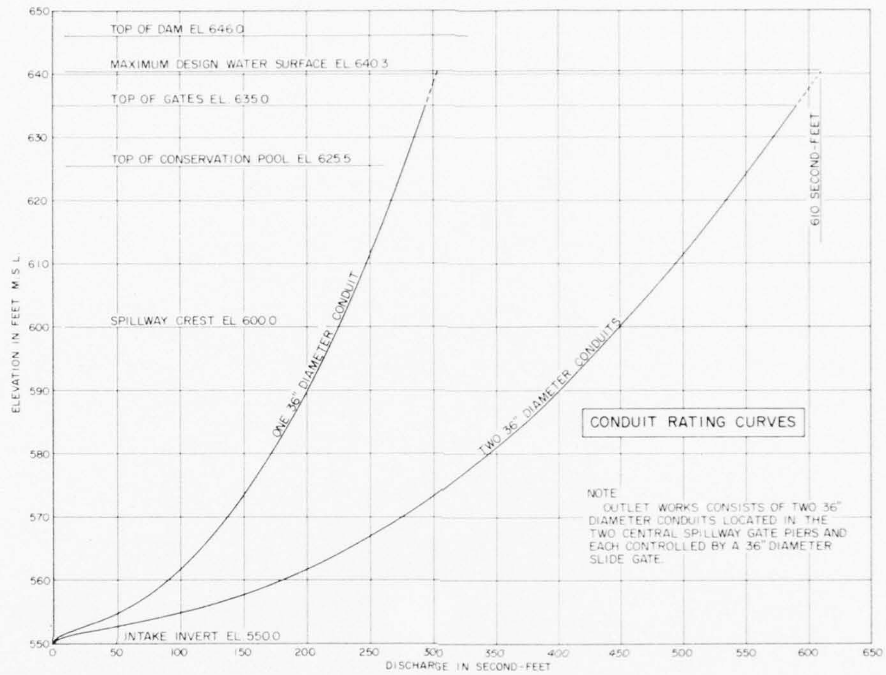
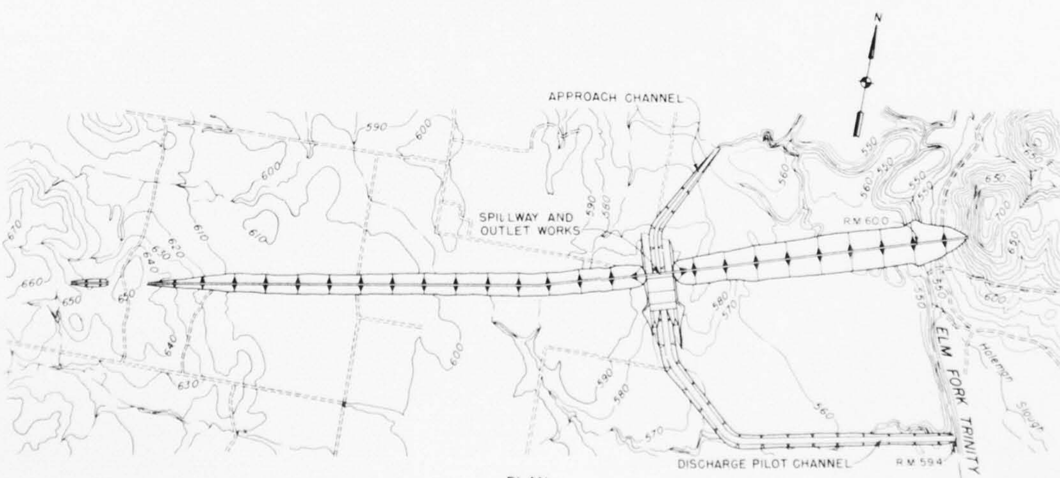


FIG 2



PLAN

SCALE OF FEET

1000 0 1000 2000

TRINITY RIVER AND TRIBUTARIES, TEXAS

ELM FORK

AUBREY RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood ENGINEER CHIEF, PLANNING & REPORTS BRANCH	ENGINEER CHIEF, ENGINEERING DIVISION	COL. CORPS OF ENGINEERS DISTRICT ENGINEER
ENGINEER HEAD, HYDRAULIC DESIGN SECTION	DRAWN BY W.B.F. CHECKED BY G.W.D.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER FILE TRIN 230-19

141. GEOLOGY.- The general upland area in the vicinity of the Aubrey Dam site is overlain with a thin mantle of residual material originating from the underlying Washita group and the Woodbine sand. Foundations in the reservoir area are made up of alternating layers of limestone, marl, and shale. Because these materials are impervious practically no water would be lost from the reservoir by percolation. Strata of the Upper and Lower Cretaceous divisions occur in the vicinity of the dam site. The only formation outcropping in this area is the Upper Cretaceous, Woodbine sand. The Elm Fork follows very closely the contact between the Upper and Lower Cretaceous rocks, thus the east bank of the proposed dam site is composed of Woodbine sand while the west bank is composed of the Grayson formation. As in the reservoir area, foundation materials at the site are composed of alternating layers of shale, marl, and soft limestone. The shale and marl disintegrate easily when exposed to the atmosphere and, although these materials are watertight and structurally sound, they erode rapidly. A layer of sand and gravel lies on the top of the primary rock below the valley floor. No geological structures such as faults, caverns, or folds are present either at the dam site or in the reservoir. Subsurface investigation locations, plan and profile are shown in plate 34.

142. AVAILABILITY OF CONSTRUCTION MATERIALS.- Four stone quarries in the Bridgeport-Chico area are suitable sources for riprap and coarse concrete aggregate. Fine concrete aggregate may be obtained from any one of five natural sand and gravel pits in the Dallas area. Embankment material should be available near the dam site.

143. COST ESTIMATE.- A summary of the estimated first cost and annual charges of the Aubrey Reservoir project is shown in table 41. This summary includes the cost of recreation in Aubrey Reservoir, additional recreation in Garza-Little Elm Reservoir, and alteration of existing recreation facilities in Garza-Little Elm Reservoir, particularly as the exchange in storage effects the real estate acquisition and the existing recreation facilities.

TABLE 41
SUMMARY OF FIRST COST AND ANNUAL CHARGES
PROPOSED AUBREY RESERVOIR
ELM FORK

Item	Costs
FIRST COST	
1. Federal first cost	
Lands and damages	$12,047,000
Relocations (1)	2,351,000
Reservoir (clearing)	1,647,000
Dam	
a. Embankment	4,850,000
b. Spillway and outlet facilities	3,900,000
Access roads	323,000
Recreation facilities	6,250,000
Buildings, grounds and utilities	163,000
Permanent operating equipment	100,000
Engineering and design	939,000
Supervision and administration	1,503,000
Total estimated Federal first cost	34,073,000 (1)
2. Non-Federal first cost	None
3. Total estimated first cost of project	34,073,000
ANNUAL CHARGES (Construction period - 5 years) (100 yr. amortization) (2-7/8% interest rate)	
1. Federal investment	
a. Federal first cost	34,073,000
b. Interest during construction	2,449,000
Total Federal investment	36,522,000
2. Non-Federal investment	None
3. Federal annual charges	
a. Interest on investment	1,050,000
b. Amortization charge	65,400
c. Operation and maintenance (including replacement of parts)	509,000
Net Federal annual charges	1,624,400
4. Net non-Federal annual charges	None
5. Total estimated annual charges	1,624,400
Preauthorization cost = $60,000	

Note: Prices are as of January 1962
(1) Includes $101,000, alterations to existing recreation facilities in Garza-Little Elm Reservoir.
(2) Includes additional recreation in Garza-Little Elm Reservoir.

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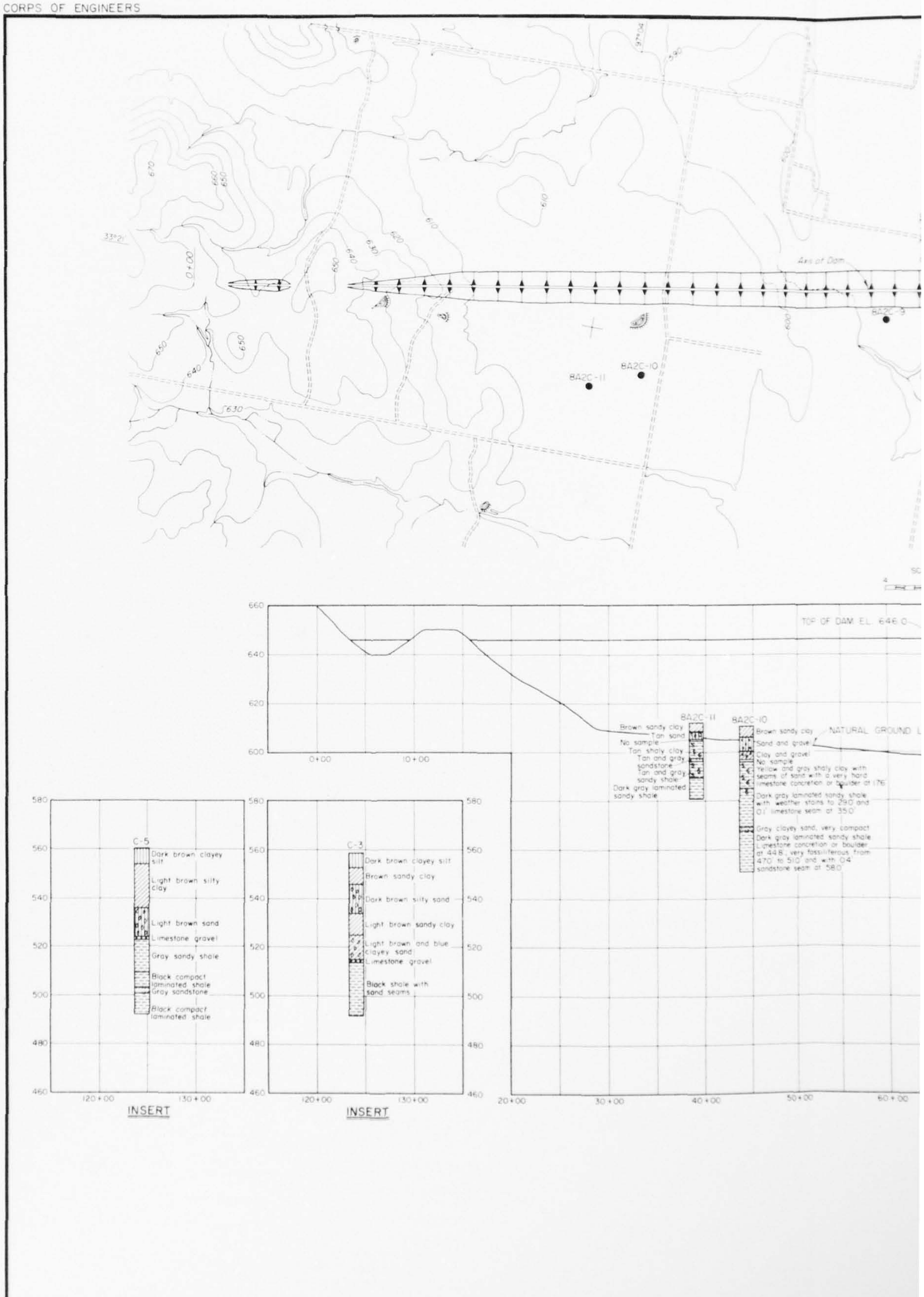
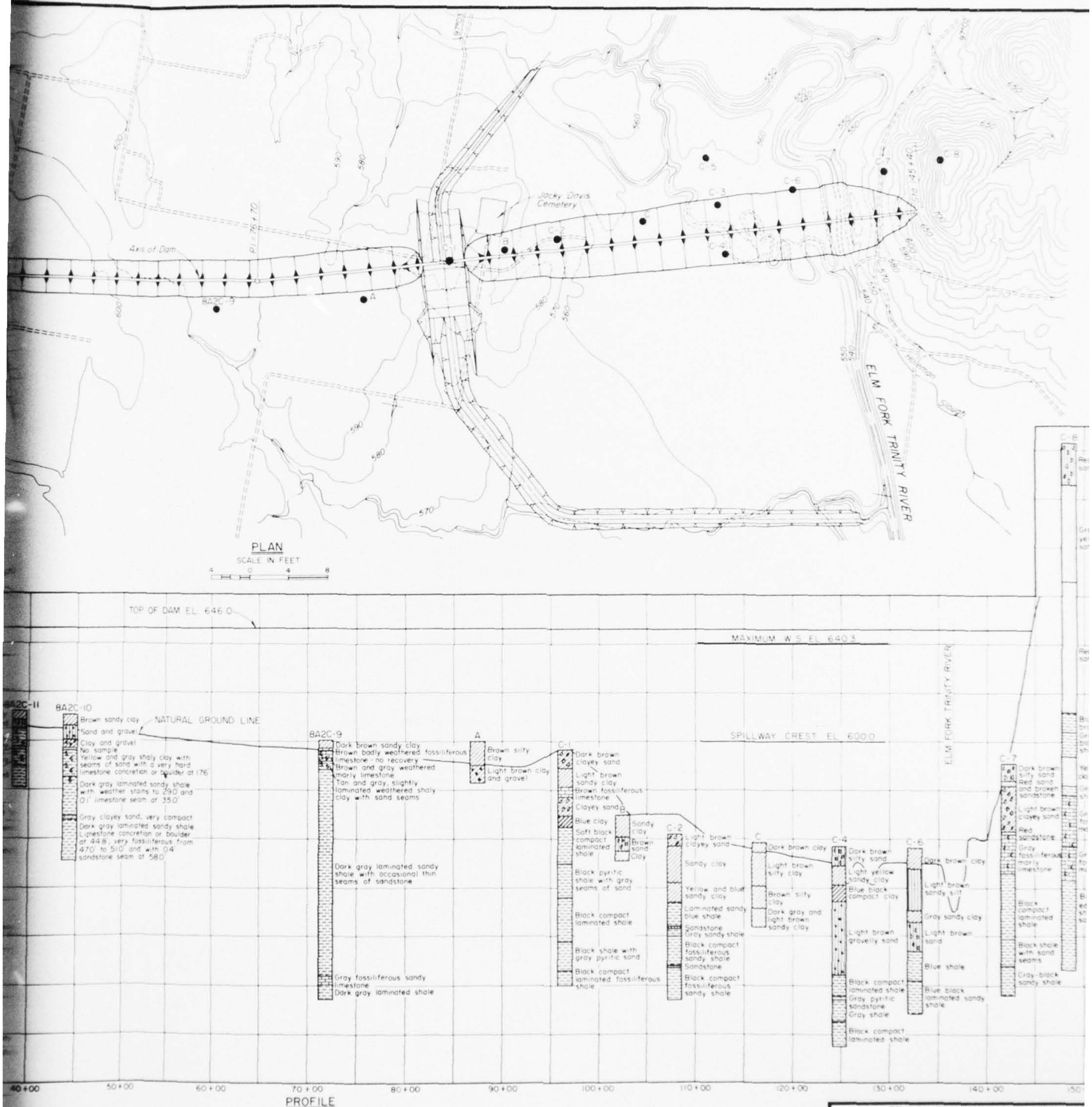




TRINITY RIVER AND TRIBUTARIES, TE

ELM FORK

AUBREY RESERVOIR

SUB-SURFACE INVESTIGAT

PLAN AND PROFILE

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

SUBMITTED: W. F. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH

APPROVAL RECOMMENDED: C. J. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION

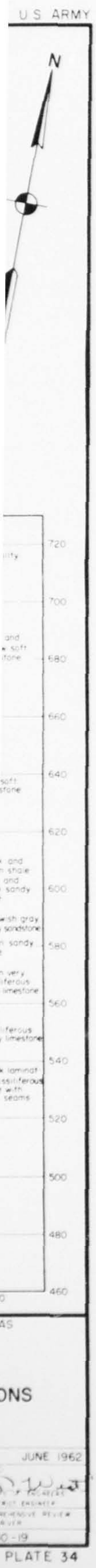
ENGINEER, CHIEF, FOUNDATION & MATERIALS BR.

DRAWN BY

CHECKED BY

TO ACCOMPANY REPORT ON

FILE TRIN



144. ROANOKE RESERVOIR.- The Roanoke dam site is located at river mile 32.0 on Denton Creek, a tributary to the Elm Fork of the Trinity River. The dam site is located in Denton County, Texas, and the right abutment of the dam would be about one-half mile northwest of the town of Roanoke. The dam site crosses Denton Creek about 4,000 feet upstrea along the axis of the Denton Creek Valley, from the Texas and Pacific Railroad. The dam site is near the upstream limits of the Corps of Engineers' Grapevine Reservoir. Roanoke Reservoir would have a total storage capacity of 249,900 acre-feet, of which 223,700 acre-feet are for flood control and 26,200 acre-feet are for sediment reserve. The flood-control storage provided in the Roanoke Reservoir would permit a reallocation of the storage in the Grapevine Reservoir and increase tha storage presently allocated to water conservation purposes. The depend yield from the Grapevine Reservoir, with the reallocation made possible by the flood-control storage in Roanoke Reservoir, under 2020 conditio of watershed development and a recurrence of the 1950-1957 drought per is 42 million gallons per day. This is an increase of 23.9 MGD over that which would be produced by Grapevine Reservoir. Requiring reloca tion or alteration would be State Highway 114, FM Highways 156 and 407 county roads, and the Gulf-Colorado and Santa Fe Railroad. The estima first cost of this project is $16,900,000 as shown in table 43. Other pertinent data on the Roanoke Dam and Reservoir are contained in the following table 42. Plates 35, 36 and 37 show the reservoir area; pla profile and sections; and general hydraulic data for Roanoke Reservoir

TABLE 42
PERTINENT DATA
PROPOSED ROANOKE RESERVOIR
DENTON CREEK

Item	Flood control
Miscellaneous	
Dam location, river mile	32.0
Drainage area, square miles	604
Flood control storage, acre-feet	223,700
Water conservation storage, acre-feet	None
Sediment storage	26,200
Yield, CFS	-
Million gallons daily	-
Spillway design flood	
Peak inflow, CFS	325,600
Volume, acre-feet	780,000
Volume, inches	24.21
Peak outflow, CFS	297,000

TABLE 42 (Cont'd)
PERTINENT DATA
PROPOSED ROANOKE RESERVOIR
DENTON CREEK

Item	Flood control (1)		
Reservoir	Elevation (Feet)	Area (Acres)	Capaci (Acre-
Spillway crest	584.0	3,180	29,60
Top of gates	619.0	9,720	249,90
Maximum design water surface	625.7	11,420	320,60
Top of dam	631.0	12,570	384,20

Dam	
Type of dam	Earth fill
Total length, feet (including spillway)	15,200
Embankment section:	
Type	Compacted earth f
Total length, feet (minus spillway)	14,600
Height above streambed, feet	97
Freeboard, feet	5.3
Crown width, feet	20
Side slopes:	
Upstream	1 on 3
Downstream	1 on 3
Non-overflow sections:	
Type	Concrete gravity
Total length, feet	272
Height above apron, feet	111
Top width, feet	13
Spillway section:	
Type	Concrete ogee
Gross length, feet	328
Net length, feet	280
Crest height above apron, feet	64
Gates:	
Type	Tainter
Number	7
Size (width x height), feet	40 x 35
Discharge, CFS:	
Top of gates	217,000
Maximum design water surface	287,900

TABLE 42 (Cont'd)
PERTINENT DATA
PROPOSED ROANOKE RESERVOIR
DENTON CREEK

Item	Flood control
Outlet works	
Type	Gate-controlle
Number of sluices	1
Diameter, feet	15
Invert elevations, feet	560.0
Sluice control	3 - 4.5' x 15' operated sli
Relocations	
Highway, miles	12.1
County roads, miles	1.0
Railroads, miles	4.5
Power lines; miles	15
Telephone lines, miles	10
Pipelines, miles	5
Cemeteries, number	-
Towns, number	0
Lands	
Dam and reservoir:	
Clearing, acres (3)	4800
Land acquisition:	
Fee simple, acres (3)	1210
Flood easement, acres	11,990
(Top control elevation)	624.0
Conversion, easement to fee, acres (4)	600.0

(1) Roanoke Reservoir contains flood-control storage to enable control storage in Grapevine Reservoir to be reallocated t conservation.

(2) Includes 9,100 CFS discharge through the outlet works.

(3) Includes requirements for additional general recreation at Reservoir.

(4) In Grapevine Reservoir.

(1)

d conduit

power
de gates

flood
water

Grapevine

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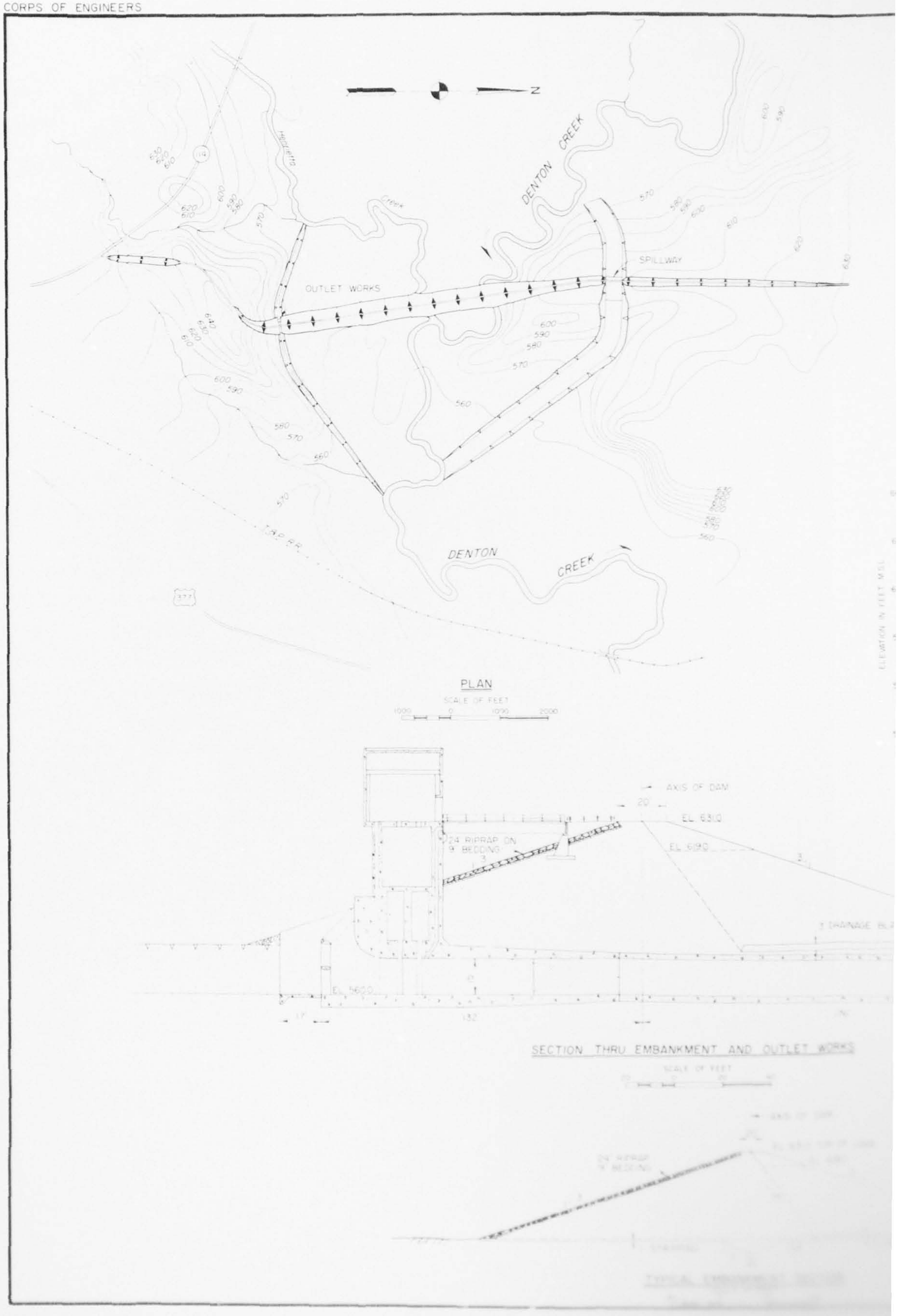

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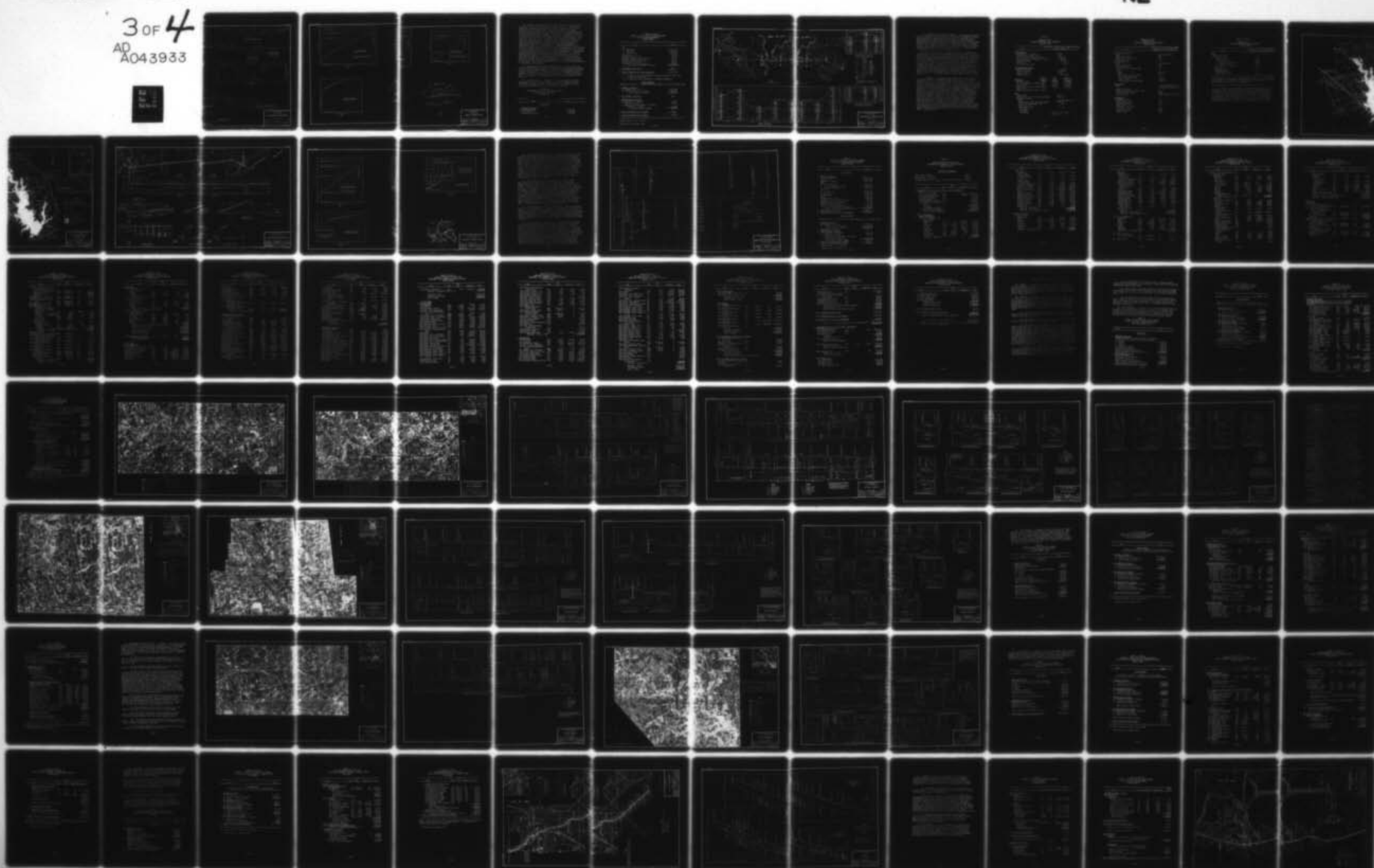

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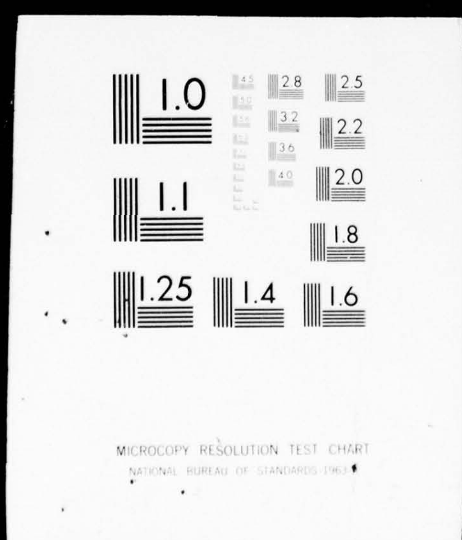

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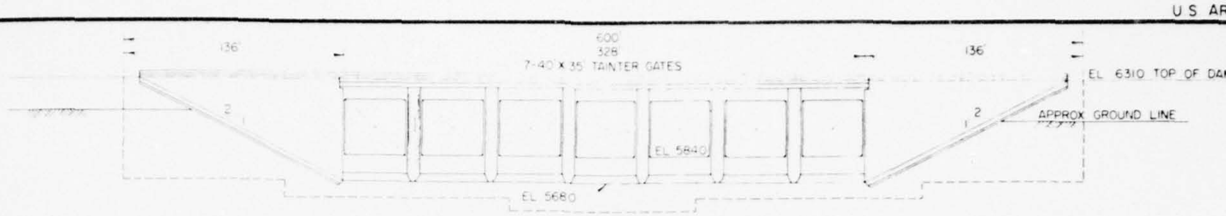
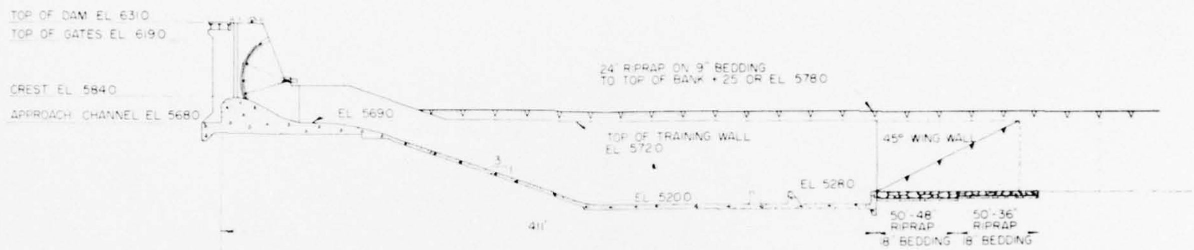
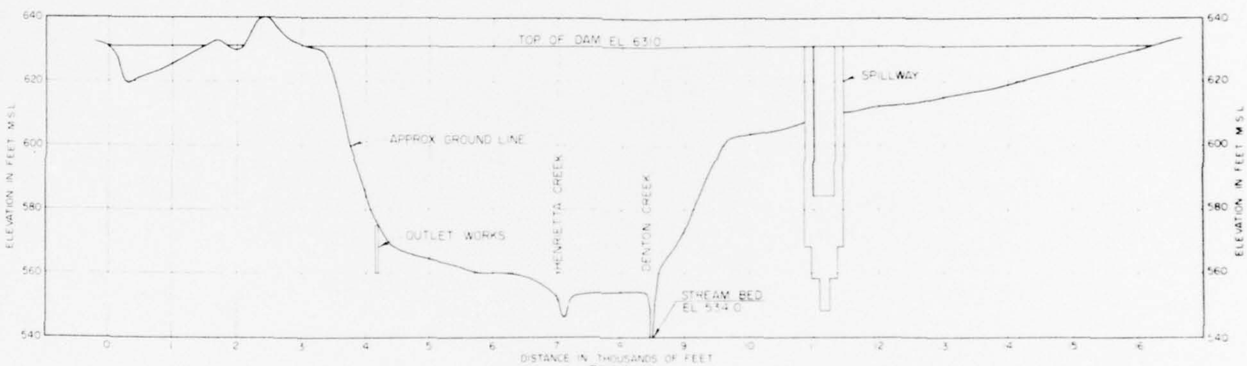


UPSTREAM ELEVATION OF SPILLWAY

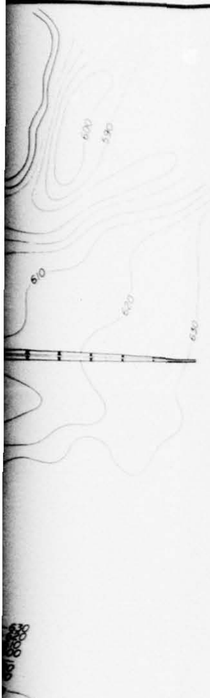


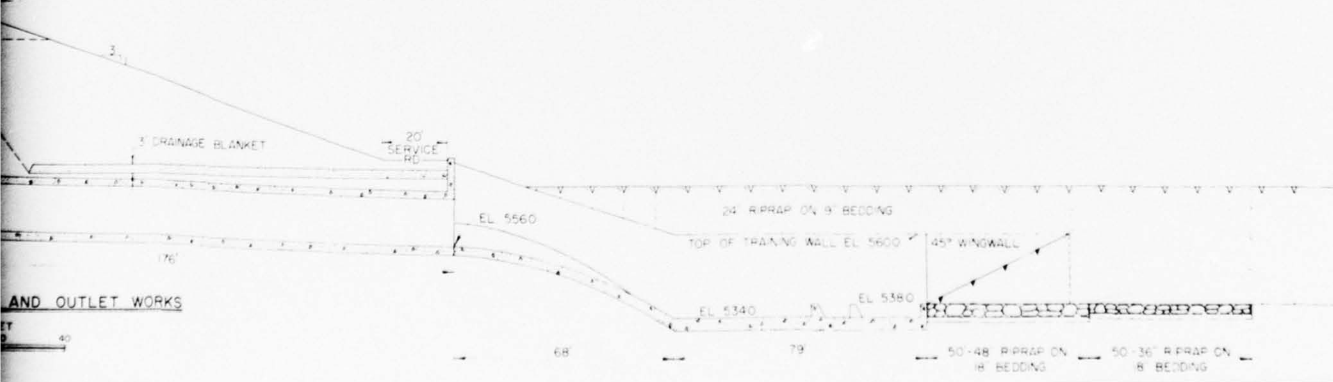
SECTION THRU SPILLWAY

SCALE OF FEET
40 0 40 80

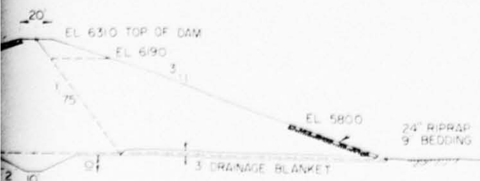


PROFILE





AND OUTLET WORKS



ANKMENT SECTION

TRINITY RIVER AND TRIBUTARIES, TEXAS
DENTON CREEK
ROANOKE RESERVOIR

PLAN, PROFILE AND SECTIONS

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

JUNE 1962

TRIN 230-19

CORPS OF ENGINEERS

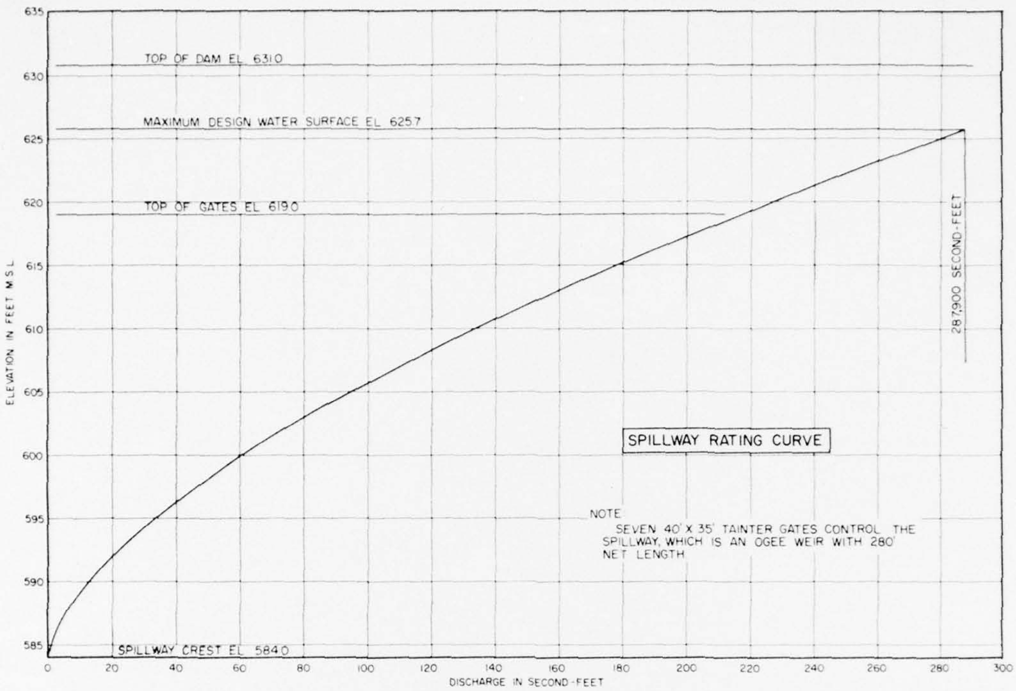
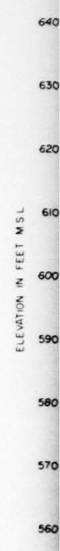


FIG. 1



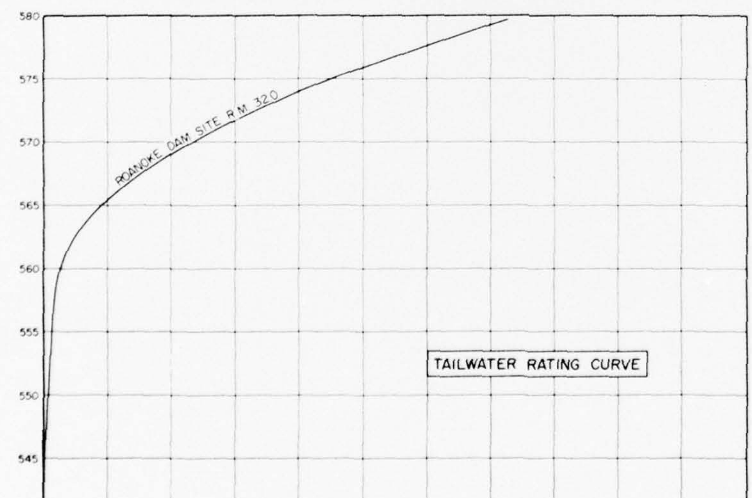
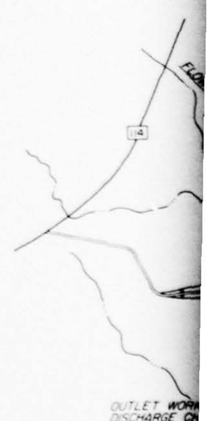
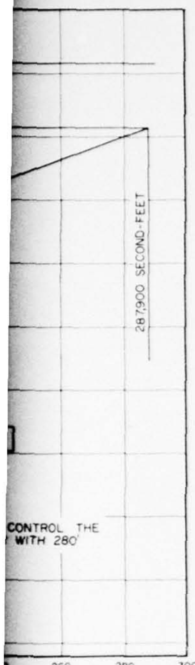


FIG 3



U.S. ARMY



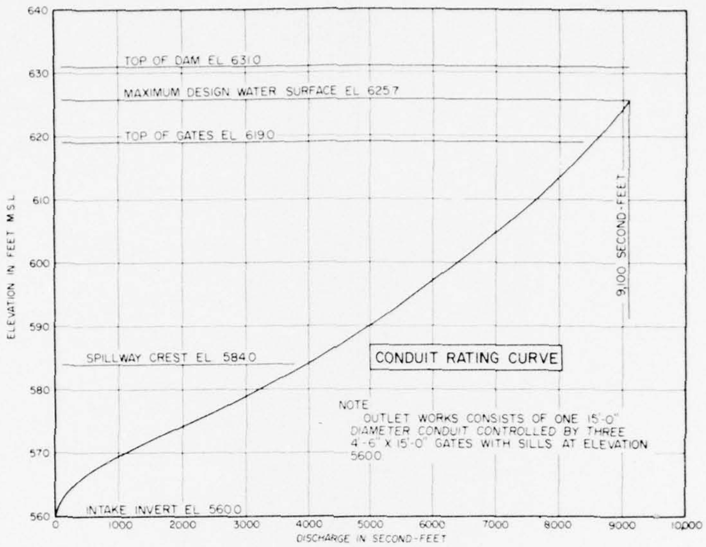


FIG 2

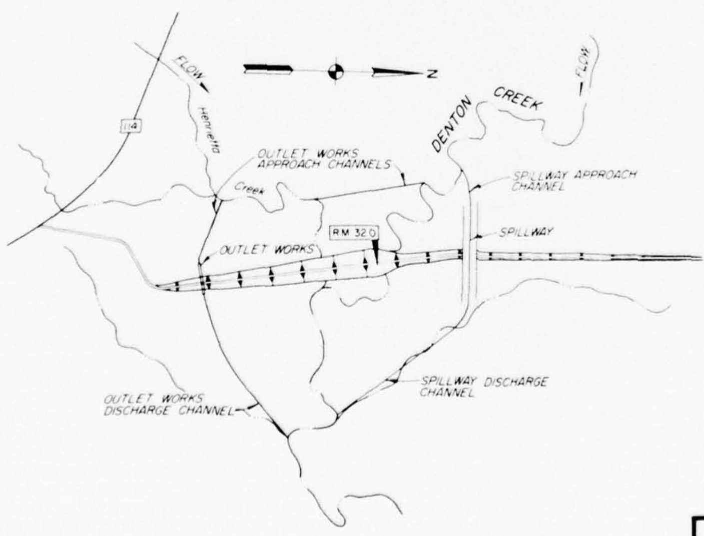


FIG 4

TRINITY RIVER AND TRIBUTARIES, TEXAS
DENTON CREEK
ROANOKE RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	C. J. Swanson, ENGINEER, CHIEF, ENGINEERING DIVISION	Wart, COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: ENGINEER, HEAD, HYDRAULIC DESIGN SECTION	DRAWN BY: D.E.C. / CHECKED BY: G.W.B.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER / FILE TRIN 230-19

2

145. GEOLOGY.- Formations of the Washita series of Lower Cretaceous age underlie the reservoir area of the Roanoke Dam site. The specific formations, listed in ascending order (oldest to youngest) are: Duck Creek, Fort Worth, Denton, Weno, Paw Paw, Main Street, and Grayson. The Duck Creek and the Fort Worth formations consist of alternating beds of argillaceous limestone and marl. The Denton is predominantly marl with occasional bands of shelly limestone. The Weno is composed of a section of marly clay overlain by a zone characterized by marl and bands of soft limestone. The Paw Paw is a calcareous clay containing occasional ironstone concretions and thin, lenticular bands of sandstone. The Main Street is a bedded limestone, and the overlying Grayson formation is predominantly marly clay. The Main Street limestone provides the principal outcrop at the Roanoke Dam site. Erosional outliers of the overlying Grayson formation are found capping isolated knobs in the vicinity of the site, but primary strata of the Grayson have been removed by erosion on the abutments at the location of the proposed embankment. Consequently, foundation materials underlying the dam will consist of a thin section (approximately 10 to 15 feet) of Main Street limestone on the crest of each abutment underlain, in the following order, by the Paw Paw, Weno, Denton, Fort Worth, and Duck Creek formations. It is probable that the foundation for the spillway will extend into the Weno formation to about 40 foot depth. The Weno is about 60 feet thick. Plate 38 shows information on subsurface investigations.

146. AVAILABILITY OF CONSTRUCTION MATERIALS.- Riprap, coarse aggregate, drainage blanket material, and bedding material could be produced at any of four operating commercial quarries in the Bridgeport-Chico area. Drainage blanket material, bedding material, and fine aggregate could be produced at any one of several operating sources in the Fort Worth-Dallas area. It is expected that embankment material can be obtained near the dam site.

147. COST ESTIMATE.- A summary of the estimated first cost and annual charges for the Roanoke Reservoir project is shown in table 43. The summary includes the cost of additional recreation and alteration to existing recreation facilities in Grapevine Reservoir.

TABLE 43
SUMMARY OF FIRST COST AND ANNUAL CHARGES
PROPOSED ROANOKE RESERVOIR
DENTON CREEK

Item	Cost
FIRST COST	
1. Federal first cost	
Lands and damages	$ 3,496,000
Relocations (1)	3,370,000
Reservoir (clearing)	450,000

TABLE 43 (Cont'd)
SUMMARY OF FIRST COST AND ANNUAL CHARGES
PROPOSED ROANOKE RESERVOIR
DENTON CREEK

Item	Cost
Dam	
a. Embankment	$3,165,000
b. Spillway	3,250,000
c. Outlet works	1,300,000
Access road	13,000
Recreation facilities	375,000
Buildings, grounds, and utilities	163,000
Permanent operating equipment	80,000
Engineering and design	482,000
Supervision and administration	756,000
Total estimated Federal first cost	16,900,000 (2)
2. Non-Federal first cost	None
3. Total estimated first cost of project	$16,900,000

(1) Includes $170,000 alterations to existing recreation facilities in Grapevine Reservoir.
(2) Includes additional recreation in Grapevine Reservoir.

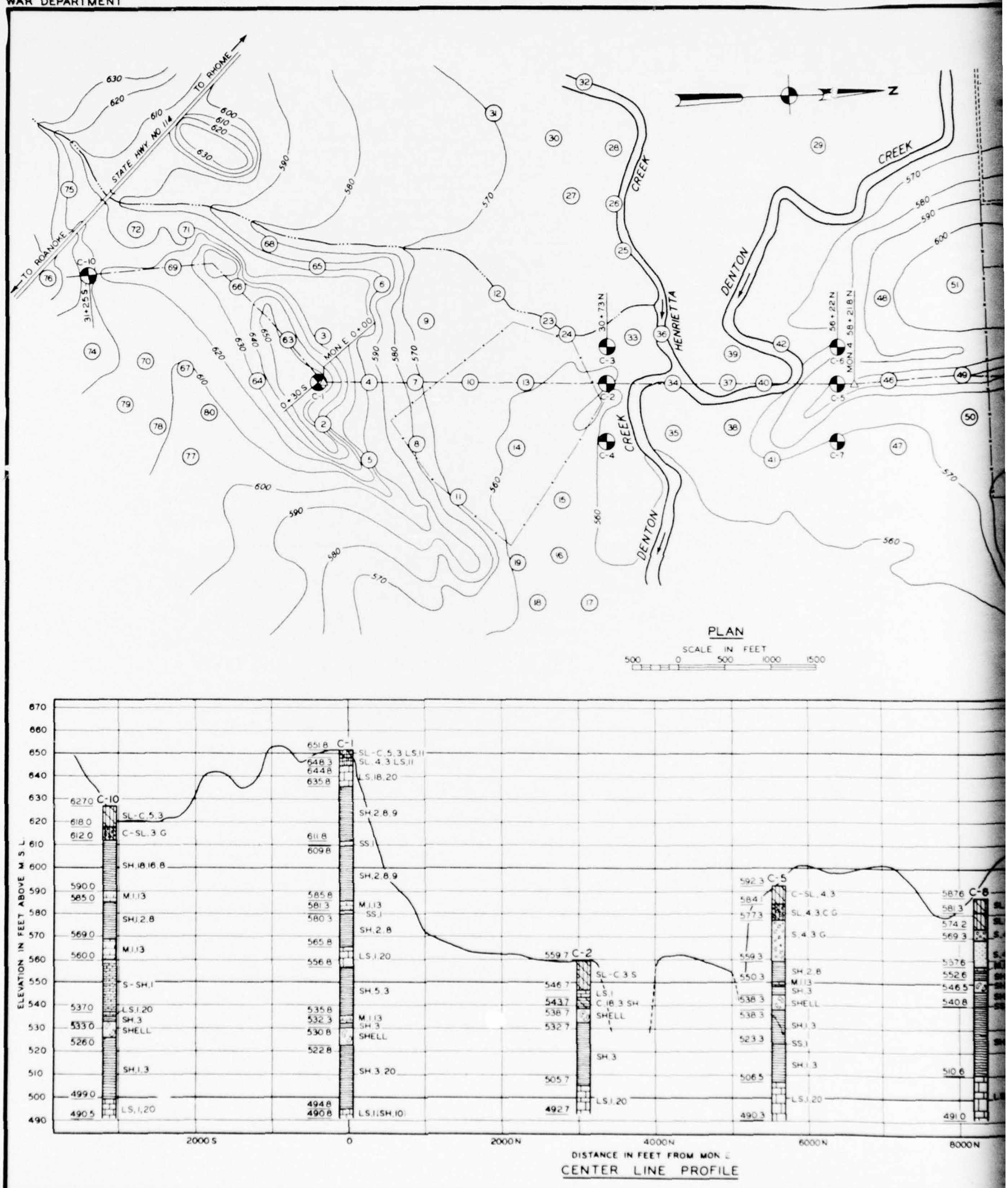
ANNUAL CHARGES
(Construction period - 4 years)(100 yr. amortization)(2-7/8% interest rate)

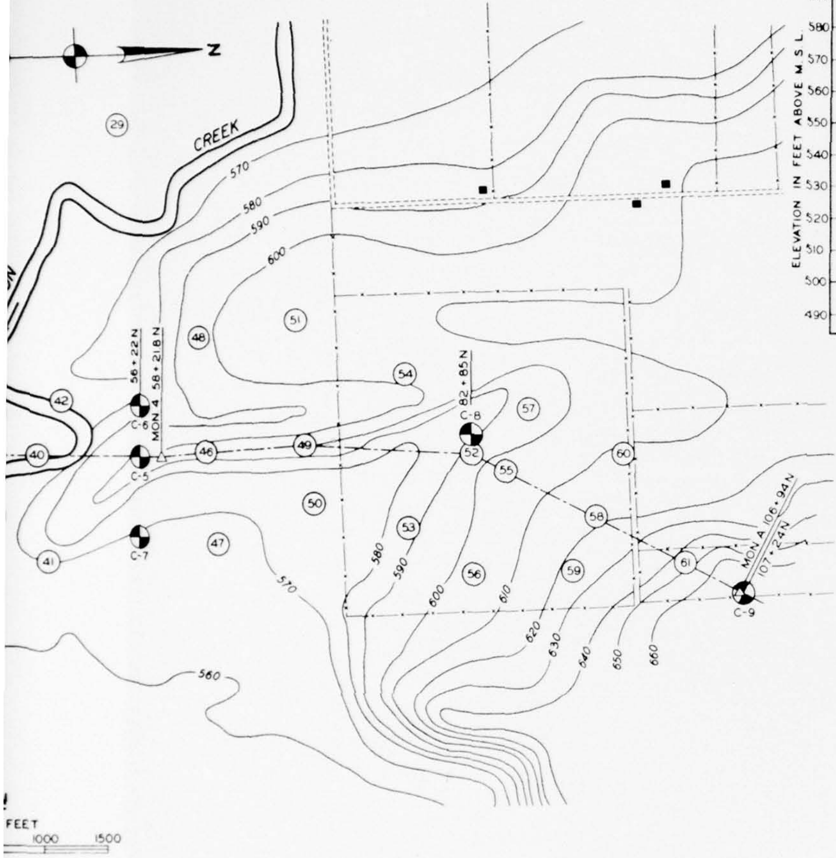
Item	Cost
1. Federal investment	
a. Federal first cost	16,900,000
b. Interest during construction	971,800
Total Federal investment	17,871,800
2. Non-Federal investment	None
3. Federal annual charges	
a. Interest on investment	513,800
b. Amortization charge	32,000
c. Operation and maintenance (including replacement of parts)	78,000
Net Federal annual charges	623,800
4. Net Non-Federal annual charges	None
5. Total estimated annual charges	$ 623,800

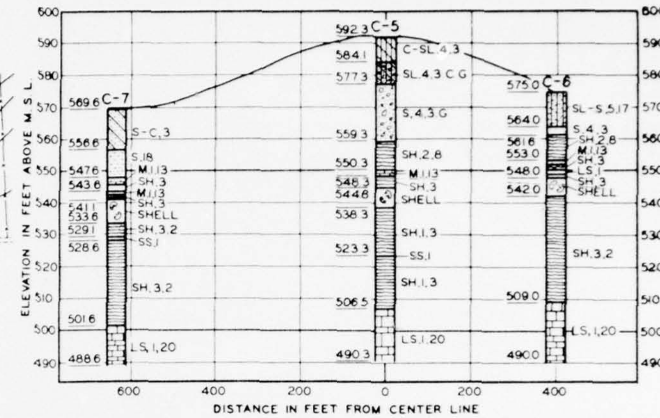
Preauthorization cost = $40,000

Prices are as of January 1962

WAR DEPARTMENT

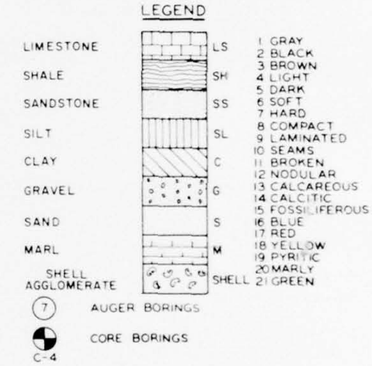




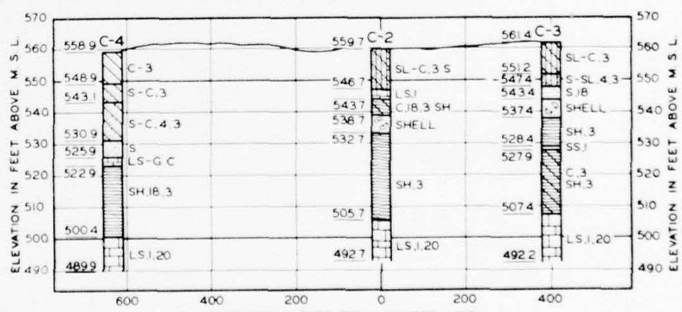


CROSS SECTION - STA 56+22N

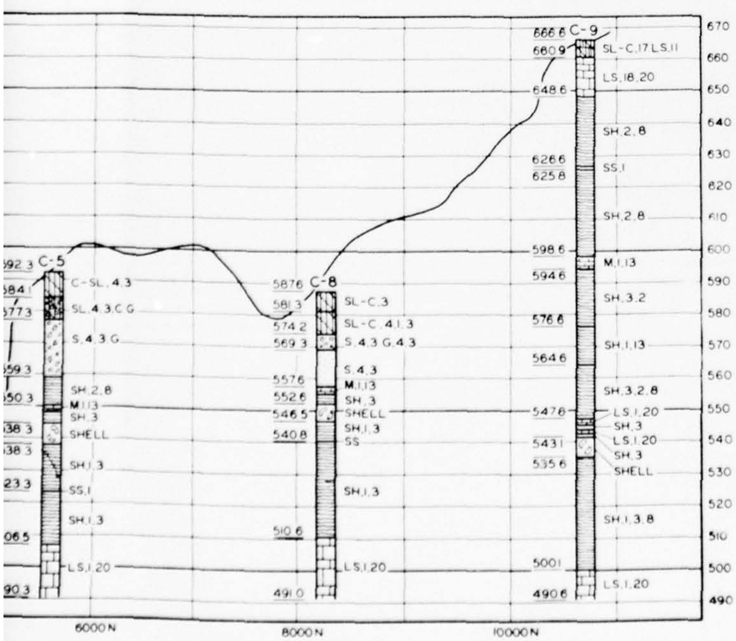
LEGEND



NOTES:
COMBINATIONS OF BORING SYMBOLS REPRESENT COMBINATIONS OF MATERIALS. CENTER LINE OF BORING IS CENTER LINE OF SYMBOL.



CROSS SECTION - STA 30+73N



TRINITY RIVER AND TRIBUTARIES, TEXAS
ROANOKE RESERVOIR
DENTON CREEK

SUBSURFACE INVESTIGATIONS

PLAN AND PROFILE

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH — APPROVAL RECOMMENDED: C. B. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION — APPROVED: [signature], COL., CORPS OF ENGINEERS, DISTRICT ENGINEER

PREPARED: [signature], ENGINEER, CHIEF, FOUNDATION & MATERIALS BR. — DRAWN BY: H.T.B. — CHECKED BY: W.W.

TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER

FILE: TRIN 230-19

148. TENNESSEE COLONY RESERVOIR PROJECT.- The Tennessee Colony Dam site is located at river mile 339.2 on the Trinity River about 16 miles west of Palestine, Texas, and 7 miles southwest of Tennessee Colony. The proposed dam crosses the Trinity River with its east abutment in Anderson County and its west abutment in Freestone County. The proposed reservoir for navigation, flood control, water conservation, fish and wildlife, and recreation purposes will be located in Anderson, Freestone, Henderson and Navarro Counties. The total contributing drainage area above Tennessee Colony Dam is 12,687 square miles.

149. DAM.- The structure consists of an earth fill dam with a maximum height of 114 feet above streambed and a total length of 29,500 feet including a 520-foot controlled concrete spillway. The concrete ogee spillway located in a natural saddle near the left abutment is controlled by 11 tainter gates, each 40 feet wide and 35 feet high, and has a net opening of 440 feet. Low flow releases are made through four 3-foot by 6-foot sluices located in the spillway piers and controlled by power operated slide gates. Navigation locks numbers 10A and 10B will be located near the right abutment of the dam. The locations and details of these locks are shown on plates 17, 21 and 22 on pages 34, 42 and 43, respectively. Other pertinent data for Tennessee Colony are shown in table 44, and the detailed layout and typical sections of the dam are shown on plate 40. The general hydraulic design data are shown on plate 41.

150. RESERVOIR.- Tennessee Colony Reservoir will have a total controlled storage of 3,366,800 acre-feet and an area of 119,500 acres at elevation 285.0, top of spillway gates or top of flood control pool. At top of conservation pool, elevation 262.5, the reservoir will have an area of 73,540 acres and a storage capacity of 1,193,000 acre-feet, including a portion of the sediment reserve. Lands required for reservoir operation, construction of the proposed dam, and for recreation purposes will be about 168,151 acres in fee simple and 7,000 acres in flowage easements. Construction of Tennessee Colony Reservoir would require relocation of 21 miles of highway, 10 miles of county roads, 1.8 miles of railroads, 44 miles of pipelines, and 21 miles of electrical transmission and distribution lines. There are no known cemeteries in the reservoir area. Relocations would extend into the proposed Richland Creek and Tehuacana Reservoirs, anticipating that Tennessee Colony Reservoir would be built first. However, the runoff from the drainage areas above the Richland Creek and Tehuacana Reservoirs have not been included in estimating the yield of Tennessee Colony Reservoir. Other pertinent data on the proposed reservoir are listed in table 44 and the reservoir area is shown on plate 39.

TABLE 44

PERTINENT DATA
PROPOSED TENNESSEE COLONY RESERVOIR
TRINITY RIVER

Item	Navigation, flood control, water conservation and recreation		
Miscellaneous			
Dam location, river mile	339.2		
Drainage area, square miles	12,687		
Flood control storage, acre-feet	2,144,300		
Water conservation storage, acre-feet	1,032,500		
Sediment storage	190,000		
Yield, CFS	450(1)		
Million gallons daily	291		
Spillway design flood			
Peak inflow, CFS	951,800		
Volume, acre-feet	10,033,400		
Volume, inches	14.83		
Peak outflow, CFS	556,000(2)		
Reservoir	Elevation (Feet)	Area (Acres)	Capacity (Acre-ft)
Spillway crest	250.0	42,190	470,200
Top of conservation storage	262.5	73,540	1,193,000
Top of gates	285.0	119,500	3,366,800
Maximum design water surface	297.8	151,920	5,109,200
Top of dam	305.0	-	-
Maximum tailwater at dam	250.9	-	-
Dam			
Type of dam	Earth fill		
Total length, feet (including spillway)	29,500		
Embankment section:			
Type	Compacted earth fill		
Total length, feet (minus spillway)	28,736		
Height above streambed, feet	113		
Freeboard, feet	7.2		
Crown width, feet	20		
Side slopes:			
Upstream			
Downstream	2-1/2:1, 3:1, 3-1/2:1		
	2-1/2:1, 3:1		

TABLE 44 (Cont'd)
PERTINENT DATA
PROPOSED TENNESSEE COLONY RESERVOIR
TRINITY RIVER

Item	Navigation, flood control, water conservation, and recreation
Non-overflow sections:	
Type	Concrete gravity
Total length, feet	244
Height above apron, feet	112
Top width, feet	13
Spillway section:	
Type	Concrete ogee
Gross length, feet	520
Net length, feet	440
Crest height above apron, feet	57
Gates:	
Type	Tainter
Number	11
Size (width x height), feet	40 x 35
Spillway discharge CFS:	
Top of gates	330,000
Maximum design water surface	552,600
Outlet works	
Type	Gate-controlled sluices through spillway piers
Number of sluices	4
Dimensions (width x height), feet	3 x 6
Invert elevation, fee	225.0
Sluice control	Power operated slide gates
Relocations	
Highways, miles	21.0
County roads, miles	10.0
Railroads, miles	1.8
Power lines, miles	21.0
Telephone lines, miles	-
Pipelines, miles	44.0
Cemeteries, number	None
Towns, number	None

TABLE 44 (Cont'd)

PERTINENT DATA
PROPOSED TENNESSEE COLONY RESERVOIR
TRINITY RIVER

Item	Navigation, flood control, water conservation, and recreation
Lands	
Dam and reservoir:	
Clearing, acres	6,209
Land acquisition:	
Fee simple, acres	166,244
(top control elevation)	288.0
Flood easement, acres	7,000
(top control elevation)	288.0
Recreation:	
Clearing, acres	20,000
Land acquisition:	
Fee simple, acres	1,907

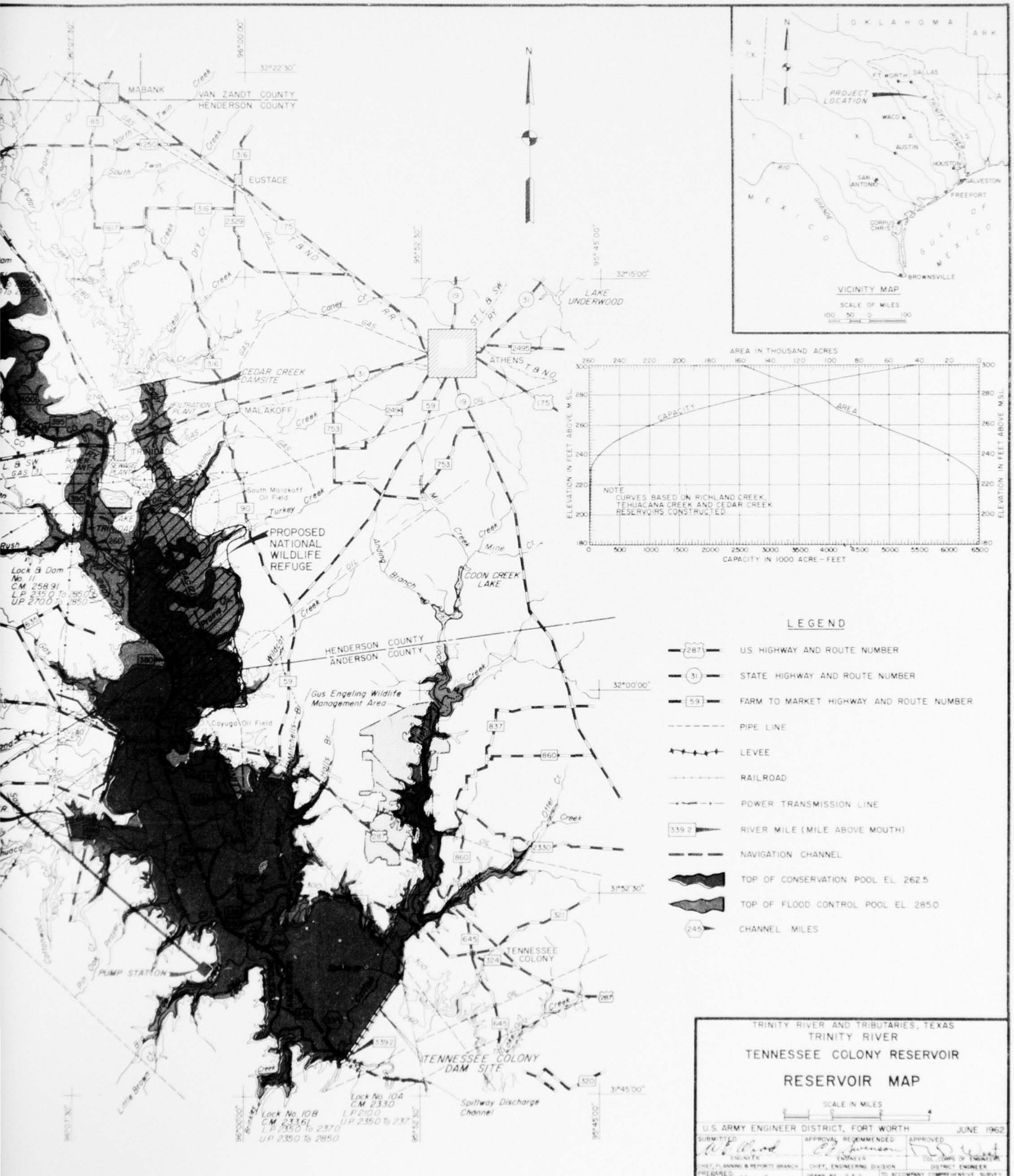
(1) Of the 450 c.f.s. yield from the reservoir, 124 c.f.s. initially has been assigned for the purpose of water quality control and 326 c.f.s. has been assigned for municipal and industrial use.

(2) Includes 3400 c.f.s. discharge through the outlet works.

151. GEOLOGY.- The subsurface investigations at river mile 340.2 consisted of seven borings as shown on plate 40. Two were drilled in the proposed spillway area; three were located between the spillway and the left bank of the river; one on the right bank of the stream and one boring was drilled at a navigation lock site between the river and the right abutment. Two additional borings were made at the selected dam site river mile 339.2. One boring is located at the top of the right bank abutment, and one is located at or near the location of lock No. 10B.


KAUFMAN COUNTY
HENDERSON COUNTY
MABANK
FLAG POND
HERVEY LAKE
TRINITY
RIVER
Lock & Dam No. 12
84" PIPELINE TO BENBROOK RESERVOIR
POWELL
KERENS
CORSICANA
LAKE CORSICANA
LAKE HALBERT
Lock & Dam No. 11
CM 258.91
RICHLAND
TEHUACANA CR DAM SITE
STREETMAN
NAVARRO COUNTY
FREESTONE COUNTY
PUMP STATION
32°22'30"
32°15'00"
32°07'30"
32°00'00"
31°52'30"
31°45'00"
96°30'00"
96°22'30"
96°15'00"
96°07'30"
96°00'00"

U.S. ARMY



TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
TENNESSEE COLONY RESERVOIR

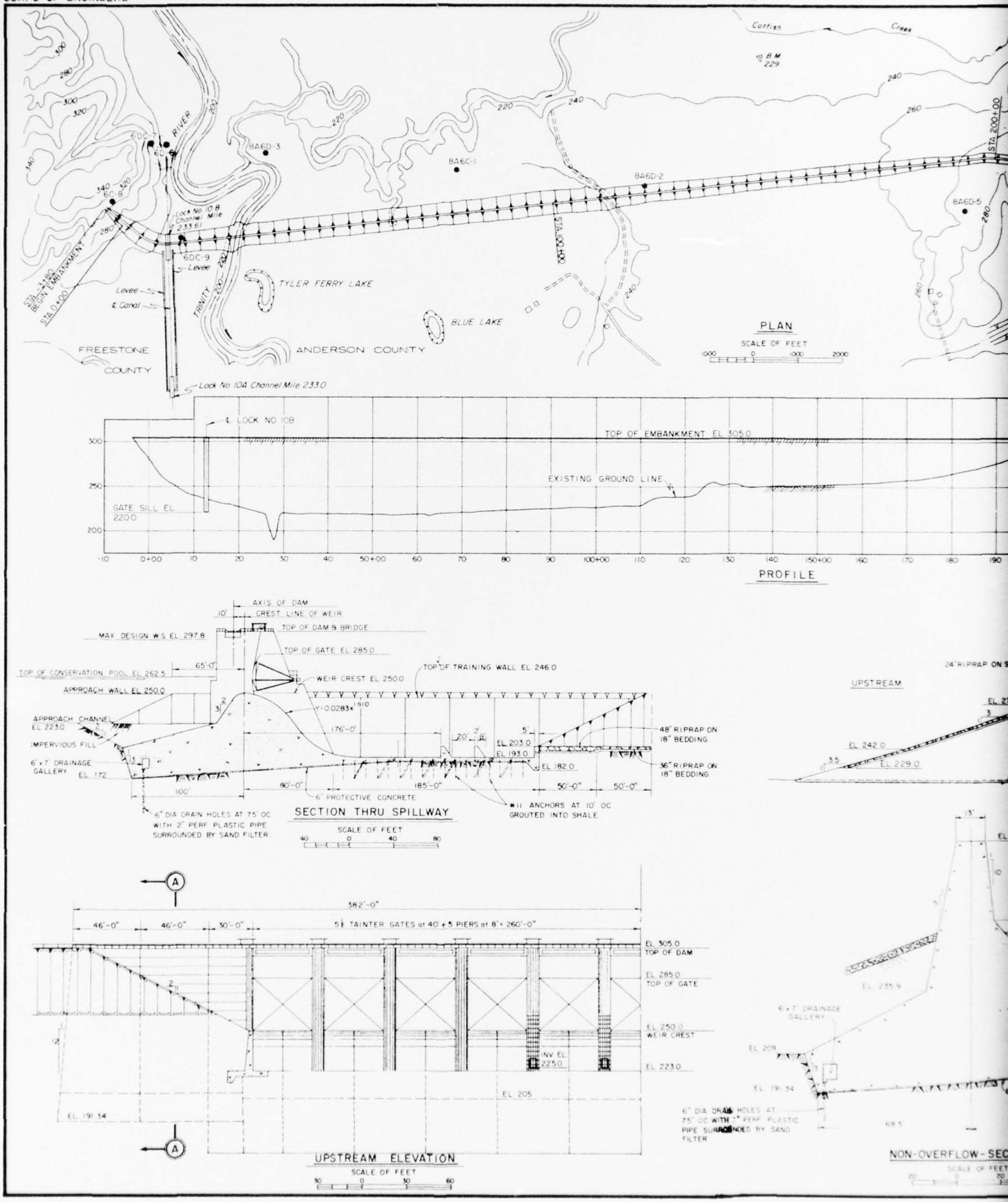
RESERVOIR MAP

SCALE IN MILES

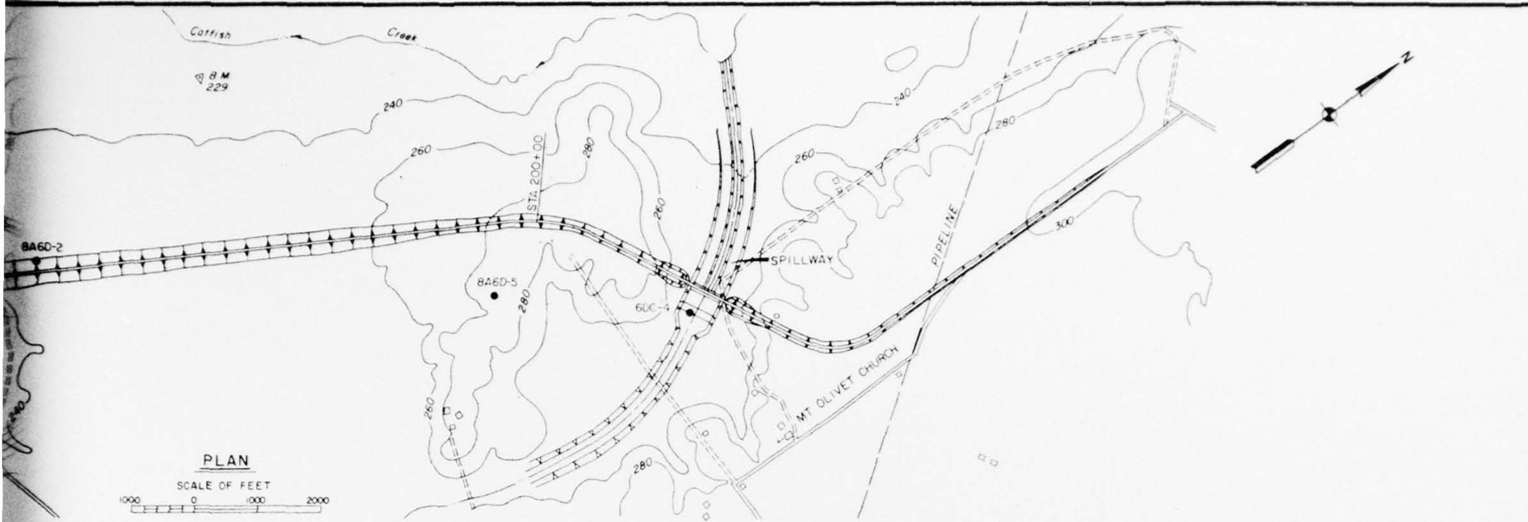
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

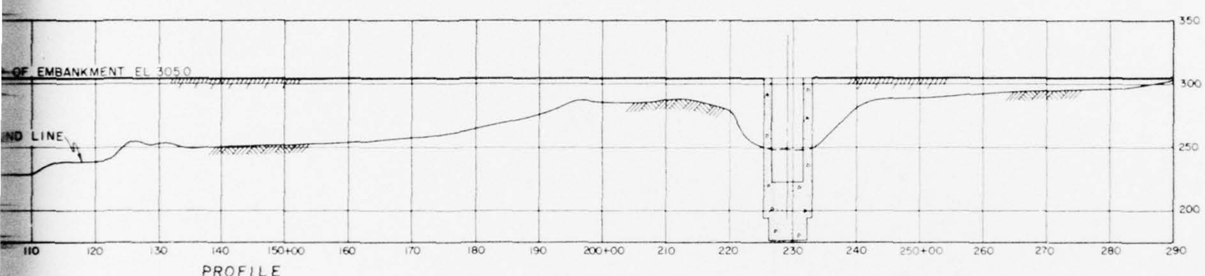
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	E. J. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION	COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY: O.E.C. CHECKED BY: W.W.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER. FILE TRIN 230-19

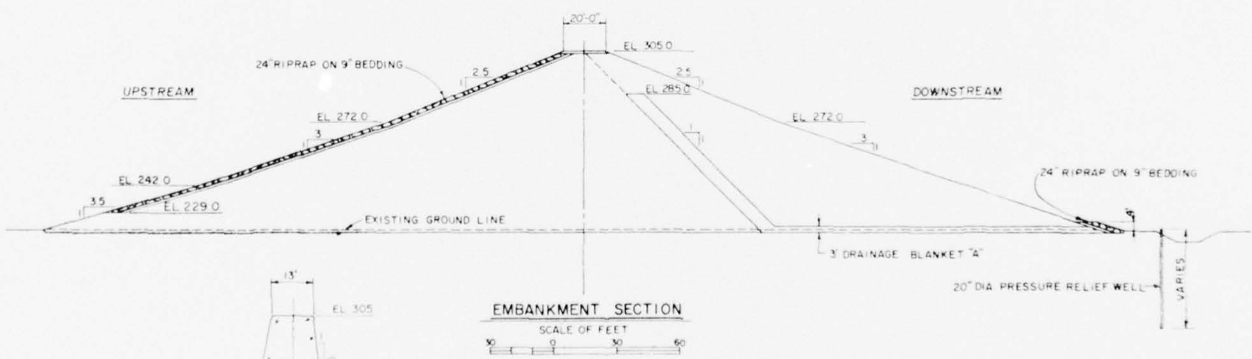
CORPS OF ENGINEERS



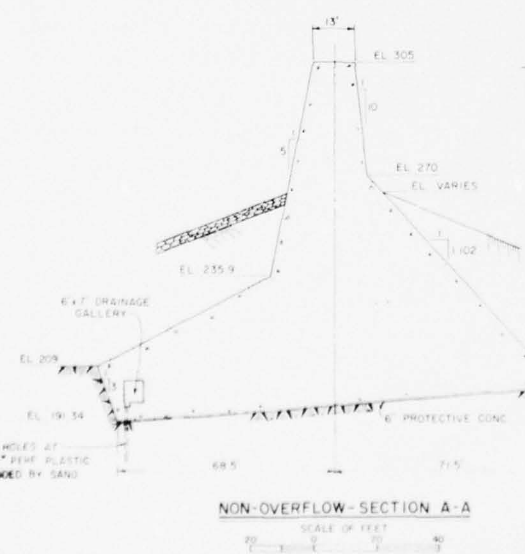
U.S. ARMY







NOTE:
SEE PLATE 42 FOR BORING PROFILE



TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
TENNESSEE COLONY RESERVOIR

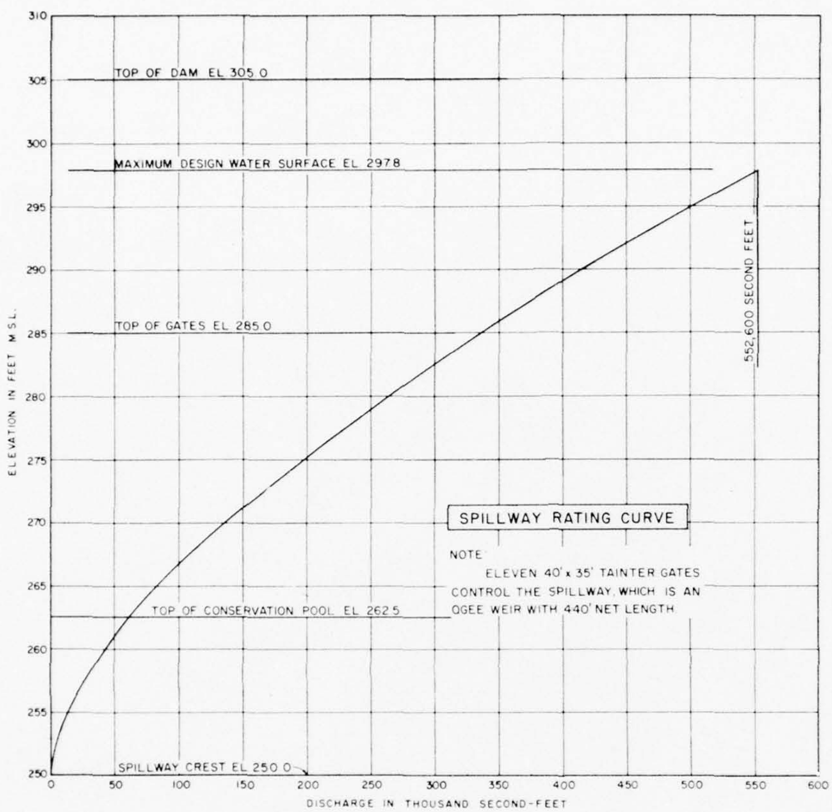
PLAN, PROFILE AND SECTIONS

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

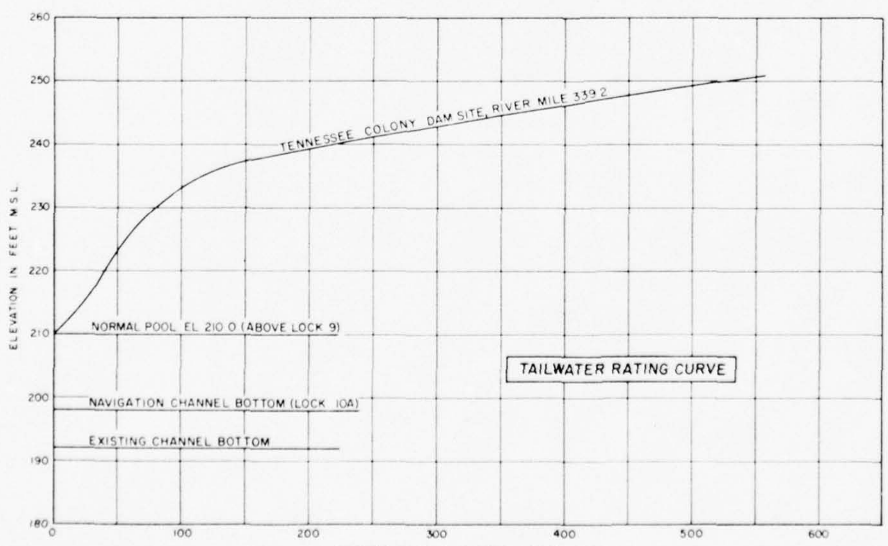
SUBMITTED:	APPROVED:	APPROVED:
W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	C. J. Simmons, ENGINEER, CHIEF, ENGINEERING DIVISION	R. P. West, COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: W. R. Bankwell, ENGINEER, HEAD, CIVIL DESIGN BRANCH	DRAWN BY: W.B.T. / CHECKED BY: W.R.B.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER / FILE TRIN 230-19

PLATE 40



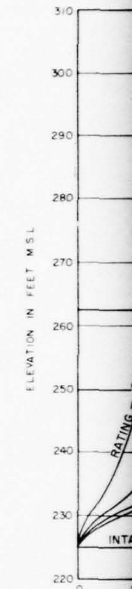
TOP OF DAM EL 305.0
MAXIMUM DESIGN WATER SURFACE EL 297.8
TOP OF GATES EL 285.0
552,600 SECOND FEET
SPILLWAY RATING CURVE
NOTE
ELEVEN 40' x 35' TAINTER GATES CONTROL THE SPILLWAY, WHICH IS AN OGEE WEIR WITH 440' NET LENGTH
TOP OF CONSERVATION POOL EL 262.5
SPILLWAY CREST EL 250.0
ELEVATION IN FEET M.S.L.
DISCHARGE IN THOUSAND SECOND-FEET

FIG. - 1



TENNESSEE COLONY DAM SITE, RIVER MILE 339.2
NORMAL POOL EL 210.0 (ABOVE LOCK 9)
TAILWATER RATING CURVE
NAVIGATION CHANNEL BOTTOM (LOCK 10A)
EXISTING CHANNEL BOTTOM
ELEVATION IN FEET M.S.L.
DISCHARGE IN THOUSAND SECOND-FEET

FIG.- 3



ELEVATION IN FEET M.S.L.

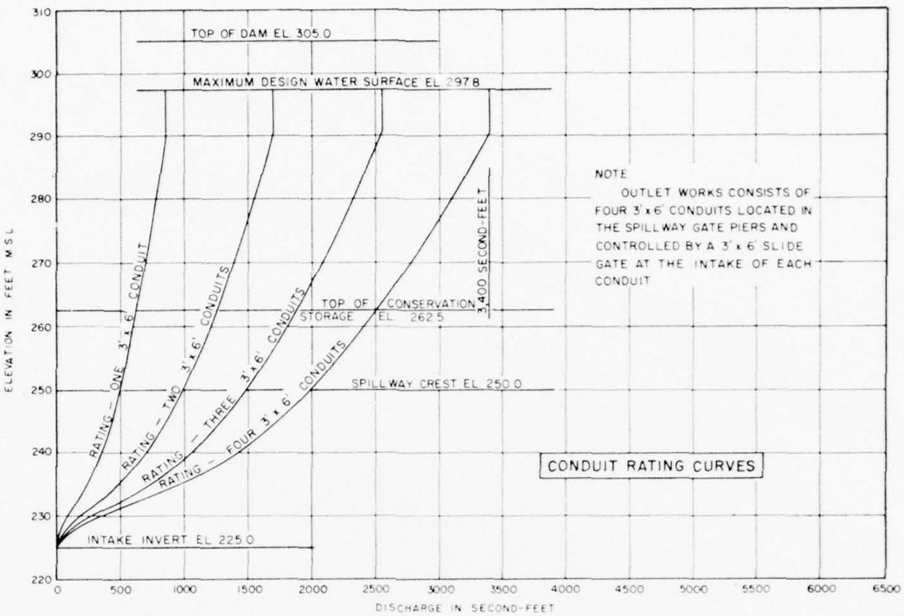


FIG. 2

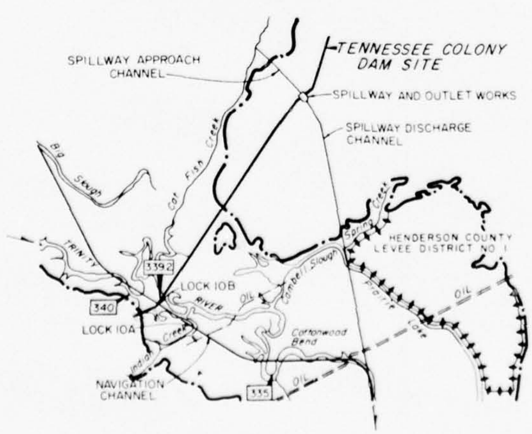


FIG - 4

TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

TENNESSEE COLONY RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH		JUNE, 1962
SUBMITTED: W. E. Wood, CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED: C. D. Simmons, CHIEF, ENGINEERING DIVISION	APPROVED: D. S. West, DISTRICT ENGINEER
PREPARED: HEAD, HYDRAULIC DESIGN SECTION	DRAWN BY: V.J.M. CHECKED BY: R.W.D.	TO ACCOMPANY COMPREHENSIVE REPORT ON TRINITY RIVER. FILE: TRIN 230-19

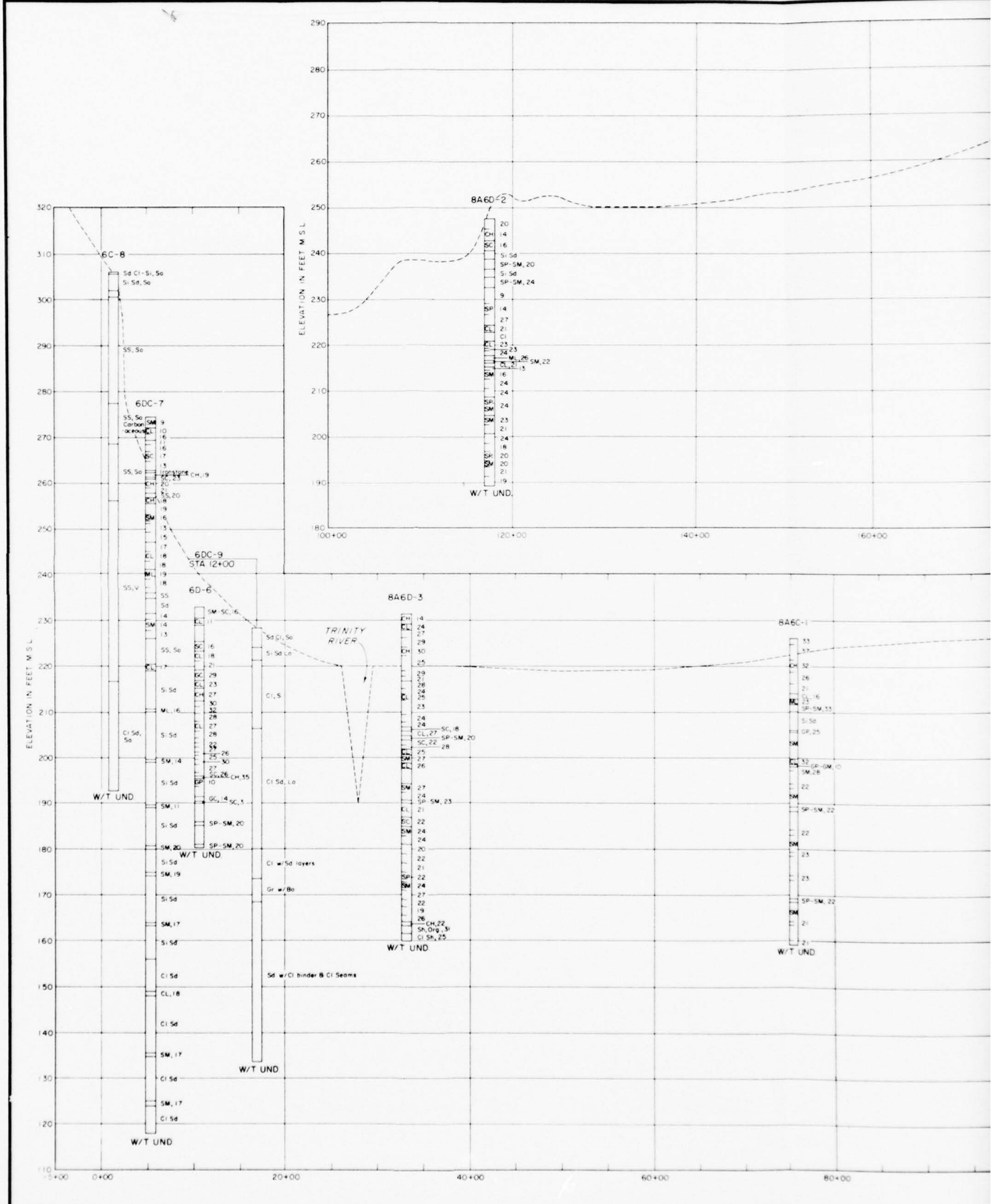
152. The alluvial overburden varies in thickness from about 24 feet to 28 feet in the wide flood plain area to the left of the river and between 55 and 56 feet in depth beneath the crest of the left abutment. The thickness of the overburden approximates 22-1/2 feet in the spillway saddle. At the boring location on the right bank of the river, the overburden extends to a depth of about 42-1/2 feet. The boring at the lock site, located on a promontory between the right bank of the river and the crest of the right abutment, penetrated only a few feet of residual overburden which is almost indistinguishable from the underlying primary strata. All of the overburden, with the exception of that at the lock site and on the crest of the right abutment, appears to be alluvium and consists of silty and sandy clays and sand with some gravel with the latter generally being found immediately overlying primary strata. No fault zones were located in the area.

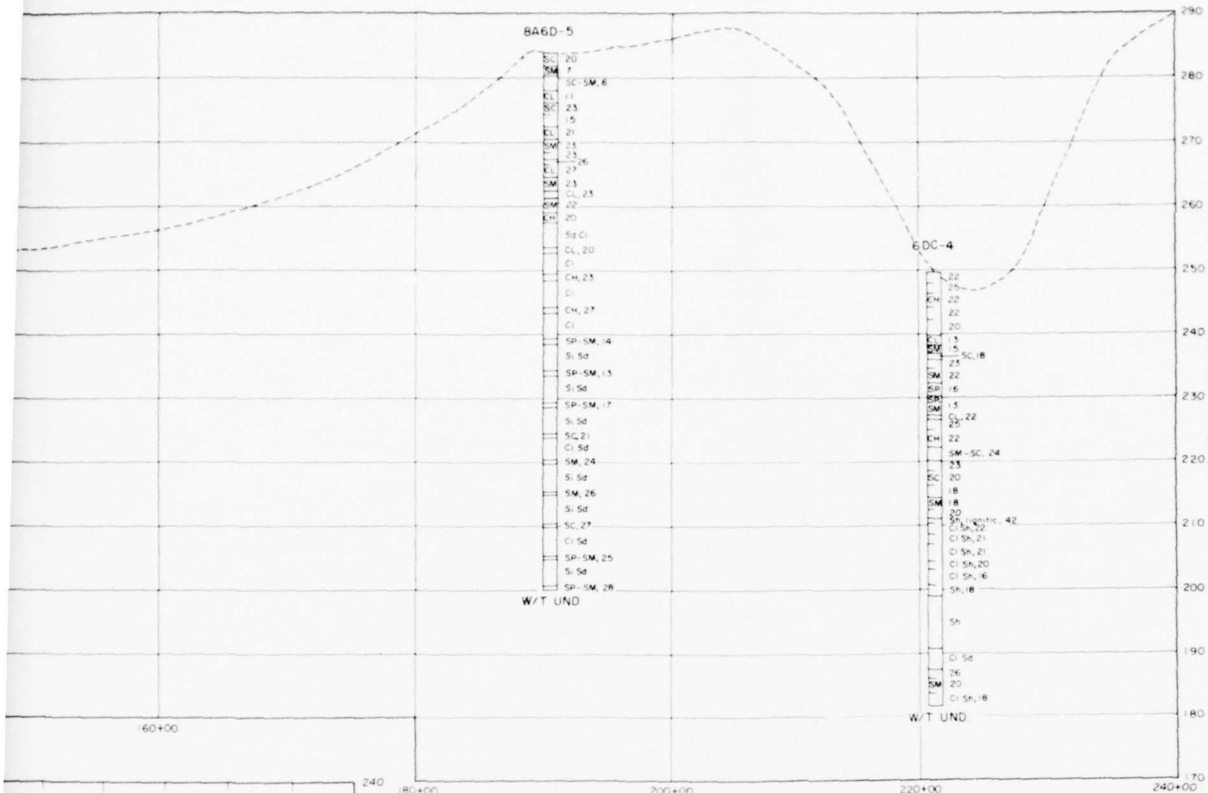
153. All primary sediments in the area of the dam site were deposited during the Eocene Epoch of the Tertiary Period and are represented by the Reklaw formation to the left of the river and by the Reklaw conformably overlying the Carrizo sand formation in the right abutment. The Reklaw is predominantly clay and sandy clay with occasional thin lentils of ferruginous sandstone, whereas the underlying Carrizo is composed principally of silty or clayey sands and lesser amounts of clay. The foundation for that portion of the embankment on and along both abutments can be prepared with a minimum amount of stripping. Foundation design for appurtenant facilities will provide for placing such structures on uncemented materials. The distinct stratification of impervious and underlying pervious foundation materials will require pressure relief wells at the toe of the embankment and in the spillway area. Subsurface investigations are shown on plate 42.

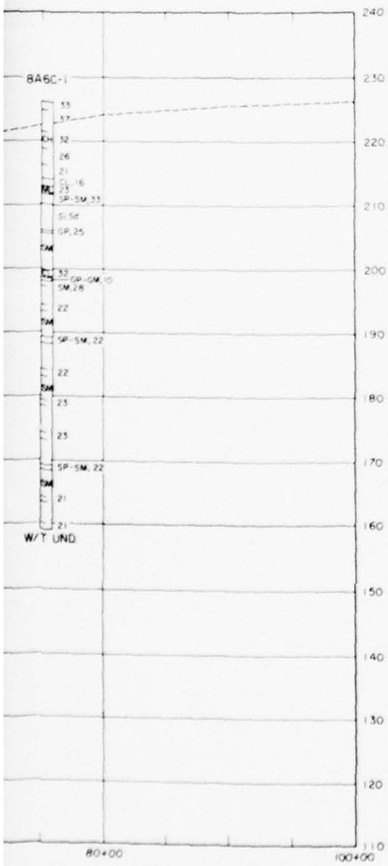
154. AVAILABILITY OF CONSTRUCTION MATERIALS.- Impervious material required for the embankment is available in the immediate vicinity of the dam site. Pervious materials, penetrated by the borings, can be used in the drainage blanket. Fine aggregate is not available locally and probably would be shipped by rail from Waco to Palestine, Texas, and trucked the remaining approximate 16 miles to the project area. Coarse aggregate and riprap are available at the Blue Mountain quarry, less than 20 miles from the dam site.

155. COST ESTIMATE.- A summary of first costs and annual charges for the Tennessee Colony Reservoir is shown in table 45. The detailed cost estimate for the Tennessee Colony Reservoir project is shown in table 46. The detailed estimate shows the separation of costs for the dam and reservoir and for recreation included in the project. Included in the estimate is the cost of lock No. 10B and all other navigation costs up to Lock and Dam No. 12, which is at the upstream end of the reservoir. The estimate also includes a portion of land and relocation costs in the proposed Richland Creek and Tehuacana Reservoirs as well as provision for protecting these dams should they be constructed. Protection of the Cedar Creek Dam, presently under construction is also provided. Summary and detailed estimates of first cost and annual charges for Tennessee Colony Reservoir are shown in tables 45 and 46, respectively.

CORPS OF ENGINEERS







LEGEND

LABORATORY CLASSIFICATION

SP – Poorly-graded sands, gravelly sands, little or no fines
SM – Silty sands, sand-silt mixtures
SC – Clayey sands, sand-clay mixtures
ML – Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL – Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH – Inorganic clays of high plasticity, fat clays

VISUAL CLASSIFICATION

Bo – Boulders
Gr – Gravel or Gravelly
Sd – Sand or Sandy
Si – Silt or Silty
Cl – Clay or Clayey
SS – Sandstone
Sh – Shale or Shaly
S – Stiff
So – Soft
V – Very Soft
WT – Water Table
Lo – Loose

NOTE:
Figures to the right of boring logs are water contents in percent of the dry weight.

BORING TYPE
6C – 6" Core
6D – 6" Denison barrel
8A – 8" Auger

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
TENNESSEE COLONY RESERVOIR

SUBSURFACE INVESTIGATIONS - SOILS

CENTERLINE PROFILE

SCALE AS SHOWN

U S ARMY ENGINEER DISTRICT, FORT WORTH JUNE 1962

W. E. Wood — Chief, Planning & Reports Branch
C. J. Swinson — Engineer, Chief, Engineering Division
Wert — District Engineer
Russell — Chief, Foundation & Materials Br.

TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER

TRIN 230-19

2

TABLE 45
SUMMARY OF FIRST COST AND ANNUAL CHARGES
PROPOSED TENNESSEE COLONEY RESERVOIR
TRINITY RIVER

Item	Costs
First cost	
1. Federal first cost	
Lands and damages	$ 22,505,000
Relocations	27,283,000
Reservoir (clearing)	2,457,000
Dams	
a. Earth embankment	10,349,000
b. Concrete dam and spillway	16,414,000
c. Navigation dam No. 11	2,641,000
Locks	
a. Lock No. 10B	13,030,000
b. Lock No. 11	11,902,000
Access roads	775,000
Channel	10,359,000
Recreation facilities	7,666,000
Buildings, grounds, and utilities	548,000
Permanent operating equipment	345,000
Engineering and design	4,113,000
Supervision and administration	6,457,000
U. S. Coast Guard-aids to navigation	294,000
Total estimated Federal first cost (1)	137,138,000
2. Non-Federal first cost	None
3. Total estimated first cost of project	137,138,000
Annual charges	
(Construction period-8 years)(100 yr. amortization)(2-7/8% interest rate)	
1. Federal investment	
a. Federal first cost	137,138,000
b. Interest during construction	15,770,900
Total-Federal investment	152,908,900
2. Non-Federal investment	None
3. Federal annual charges	
a. Interest on investment	4,396,100
b. Amortization charge	273,700
c. Operation and maintenance (including replacement of parts)	1,367,400
Total Federal annual charges	6,037,200
4. Total Non-Federal annual charges	None
5. Total estimated annual charges	6,037,200

Preauthorization cost $183,000

Prices are as of January 1962

TABLE 46

DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

PERTINENT INFORMATION

Top of dam, elevation	305.0
Top of gates, elevation	285.0
Spillway crest, elevation	250.0
Storage capacity (top of gates less sediment) acre-feet	3,176,800

Item	Unit	Unit cost	Quantity	Cost
A. DETAILED ESTIMATE OF FIRST COST - DAM AND RESERVOIR				
(01.0) Lands and damages				
(1) Fee simple lands	Acre		166,244	$13,428,600
(2) Flood easement lands	Acre		7,000	175,000
(3) Severance damage	L.S.			250,000
(4) Improvements	L.S.			150,000
(5) Mineral subordination	L.S.			2,493,000
(6) Resettlement reimbursement	L.S.			28,000
Subtotal				16,524,600
Contingencies, 25%±				4,131,400
(7) Land acquisition expense				1,398,000
Total - lands and damages				$22,054,000
(02.0) Relocations				
a. Roads and railroad				
(1) U. S. Highway No. 287				
Reservoir arms				
Embankment	C.Y.	$ 0.75	1,200,000	900,000
Base	C.Y.	4.50	32,000	144,000
Surfacing	Mile	10,000.00	3.6	36,000
Riprap	C.Y.	6.00	104,000	624,000
Bedding	C.Y.	4.50	39,000	175,500
Guard rail	L.F.	2.50	36,000	90,000
Bridge	L.F.	250.00	400	100,000
Detour road	Sta.	378.00	119	44,982
New road	Mile	80,000.00	4.2	336,000
Subtotal - reservoir				2,450,482

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PRUPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
Main stem				
Embankment	C.Y.	0.85	213,000	$ 181,050
Approach road flex pavement	L.F.	12.10	4,000	48,400
Riprap, 12" conc. blocks	C.Y.	30.00	3,310	99,300
Gravel blanket under riprap	C.Y.	5.50	1,650	9,080
Structural excavation	C.Y.	2.50	8,240	20,600
Class "A" concrete	C.Y.	41.20	24,566	1,012,120
Reinforcing steel	Lbs.	0.13	4,050,640	526,580
Conc. piling 14" sq.	L.F.	7.50	115,340	865,050
Cement	Bbl.	5.00	36,850	184,250
Structural steel	Lbs.	0.14	38,430	5,380
Structural steel	Lbs.	0.22	1,747,200	384,380
Type "C" conc. beams	L.F	13.50	49,700	670,950
Aluminum railing	L.F.	5.00	26,400	132,000
Treated timbers	FBM	0.60	77,800	46,680
Treated piling	L.F.	3.25	9,750	31,690
Navigation lights	Ea.	2,500.00	1	2,500
Detour road	L.F.	1.25	4,000	5,000
Remove existing bridge	L.S.	-	-	12,990
Subtotal - main stem				$ 4,238,000
Subtotal - U.S. Highway No. 287				6,688,482
(2) State Highway No. 31				
Reservoir arms				
Embankment	C.Y.	0.75	112,000	84,000
Base	C.Y.	4.50	11,000	49,500
Surfacing	Mile	10,000.00	1.3	13,000
Riprap	C.Y.	6.00	25,000	150,000
Bedding	C.Y.	4.50	8,000	36,000
Guard rail	L.F.	2.50	11,000	27,500
Bridge	L.F.	250.00	2,140	535,000
Subtotal - reservoir arms				895,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
Main stem				
Embankment	C.Y.	0.85	15,700	$ 13,340
Approach road flex base	L.F.	12.10	400	4,840
Structural excavation	C.Y.	2.50	1,760	4,400
Class "A" concrete	C.Y.	41.20	5,220	215,060
Reinforcing steel	Lb.	0.13	809,544	105,240
Piling conc. 14" sq.	L.F.	7.50	21,130	158,470
Concrete riprap (Class B)	C.Y.	30.00	166	4,980
Cement	Bbl.	5.00	7,836	39,180
Structural steel	Lbs.	0.14	11,010	1,540
Structural steel	Lbs.	0.22	1,747,200	384,380
Aluminum railing	L.F.	5.00	5,260	26,300
Type "C" conc. beams	L.F.	13.50	7,400	99,900
Treated timber	FBM	0.60	46,700	28,020
Treated piling	L.F.	3.25	6,500	21,120
Navigation light	Each	2,500.00	1	2,500
Detour road	L.F.	1.25	4,400	4,500
Timber trestle, detour road	L.F.	150.00	300	45,000
Remove existing bridge	L.S.			21,230
Subtotal - main stem				$ 1,180,000
Subtotal - State Highway No. 31				2,075,000
(3) F. M. Highway 488				
Embankment	C.Y.	0.75	970,000	727,500
Base	C.Y.	4.50	11,000	49,500
Surfacing	Mile	7,040.00	2.0	14,080
Bridge	L.F.	200.00	3,370	674,000
Riprap	C.Y.	6.00	80,000	480,000
Bedding	C.Y.	4.50	30,000	135,000
Guard rail	L.F.	2.50	19,000	47,500
Subtotal - F. M. Highway 488				2,127,580
(4) F.M. Highway 321				
New road, complete	Mile	50,000.00	4.4	220,000
(5) County roads	Mile	12,500.00	10.0	125,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(6) St. Louis & Southwestern R.R.				
Reservoir arms				
Embankment	C.Y.	0.75	115,000	86,250
Ballast	C.Y.	3.50	2,300	8,050
Cross ties	Each	4.00	2,000	8,000
Track laying and surfacing	Mile	7,920.00	0.62	4,910
Track hardware	Mile	2,640.00	0.62	1,637
Bridge	L.F.	500.00	700	350,000
Trestle	L.F.	125.00	3,900	487,500
Riprap	C.Y.	6.00	6,000	36,000
Bedding	C.Y.	4.50	2,000	9,000
Communication line, relocations	Mile	10,500.00	1.5	15,750
Subtotal - reservoir arms				1,007,097
Main stem				
Structural excavation	C.Y.	2.50	700	1,750
Concrete	C.Y.	42.50	1,900	80,750
Reinforcing steel	Lb.	0.13	94,850	12,330
Cement	Bbl.	5.00	2,370	11,850
Treated piles (Class B)	L.F.	3.25	25,050	81,410
Structural steel in spans	Lb.	0.30	2,202,620	660,790
Structural steel in tower & cwt.	Lb.	0.35	1,098,200	384,370
Steel tangent plate	Lb.	0.14	8,600	1,200
Rails	Lb.	0.14	24,430	3,420
Ropes & machinery	Lb.	1.00	396,900	396,900
Electrical equipment	L.S.	-	-	75,000
Signal system	L.S.	-	-	13,000
Auxiliary power	L.S.	-	-	7,500
Housing (oper & mach)	L.S.	-	-	12,000
Shoes, castings & sheaves	L.S.	-	-	24,000
Ballast	C.Y.	5.00	306	1,530
Ties	FBM	0.15	81,000	12,150
Bolts & spikes	Lb.	0.20	5,600	1,120
Treated timbers	FBM	0.60	48,700	29,220
Removal of existing bridge	L.S.	-	-	6,300

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
Temporary by-pass				
Excavation	C.Y.	0.20	5,200	1,040
Ballast	C.Y.	5.00	655	3,270
Treated timber trestle	FBM	0.40	97,400	38,960
Treated piling (Class B)	L.F.	3.25	13,800	44,850
Hardware	Lb.	0.30	8,600	2,580
Rails	Lb.	0.15	110,000	16,500
Spikes, bolts, etc.	Lb.	0.20	11,500	2,300
Ties	FBM	0.15	26,100	3,910
Total temporary by-pass				113,410
Subtotal - reservoir mainstem				$ 1,930,000
Subtotal - reservoir main stem & arms				2,937,097
Subtotal - roads and railroads				14,173,159
b. Utilities				
(Pipelines)				
(1) Lone Star Gas Co. 2-20" and 1-16" parallel lines	Mile	420,000.00	1.5	630,000
(2) Lone Star Gas Co. 20" and 12" parallel lines				
New lines outside reservoir	Mile	190,000.00	10.7	2,033,000
Reservoir crossing	Mile	230,000.00	1.3	299,000
Subtotal				2,332,000
(3) Lone Star Gas Co. 12" line	Mile	70,000.00	0.98	68,600
(4) Lone Star Gas Co. 1-20" and 1-16" parallel lines				
Reservoir crossing	Mile	260,000.00	1.75	455,000
New line between crossing	Mile	210,000.00	0.34	71,400
Subtotal				526,400
(5) Lone Star Gas Co. 2" line to dehydration plant				
Relocate existing line	Mile	12,000.00	1.5	18,000
Additional line	Mile	12,000.00	0.25	3,000
Subtotal				21,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(6) Lone Star Gas Co. 20" line S.E. of Cayuga Field				
New line outside reservoir	Mile	130,000.00	3.0	390,000
Reservoir crossings	Mile	160,000.00	1.5	240,000
Subtotal				630,000
(7) Texas Co. 8" oil line	Mile	40,000.00	1.7	68,000
(8) Texas Co. 16" oil line	Mile	124,000.00	4.5	558,000
(9) West Texas Gulf 20" oil line	Mile	190,000.00	9.3	1,767,000
(10) Magnolia 20" oil line	Mile	50,000.00	0.5	25,000
(11) Magnolia 12" O.l line	Mile	75,000.00	5.1	382,500
(12) Pipelines crossing spillway outlet channel 1-10" & 2-8" oil lines				
Excavation	C.Y.	0.50	36,000	18,000
10" pipe) Coated, wrapped	L.F.	12.00	320	3,840
8" pipe) & weighted	L.F.	7.00	640	4,480
10" valves	Each	750.00	2	1,500
8" valves	Each	600.00	4	2,400
2-12" oil lines				
Excavation	C.Y.	0.50	34,000	17,000
12" pipe, coated, wrapped & weighted	L.F.	28.00	320	8,960
12" valves	Each	900.00	2	1,800
Subtotal - pipelines crossing spillway channel				57,980
Subtotal - pipelines				7,066,480
(Electric lines)				
(1) T.P.&L. 69 KV line @ RM 398	Mile	8,300.00	1	8,300
(2) T.P.&L. 69 KV line E.S.E. from Trinidad plant	Mile	8,300.00	1.1	9,130
(3) T.P.&L. 69 KV & 138 KV lines @ RM 389.9	Mile	46,500.00	2.0	93,000
(4) T.P.&L. 138 KV line @ Rm 390.2	Mile	48,750.00	1.4	68,250
(5) T.P.&L. 138 KV line @ RM 389.6	Mile	48,750.00	1.7	82,875
(6) Chambers & Tehuacana Cr. crossing	Mile	48,750.00	1.3	63,375
Relocate H-frame line	Mile	20,000.00	6.9	138,000
New H-frame line	Mile	15,000.00	2.5	37,500
T.P.&L. 7.2 KV line @ Hwy. 287	Mile	2,500.00	3.1	7,750
Subtotal - electric lines				508,180
Subtotal - utilities				7,574,660

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
c. Other items				
(1) Project dam - T.P. & L plant @ Trinidad				
Riprap	C.Y.	6.00	800	4,800
Bedding	C.Y.	4.5	300	1,350
Slope preparation	Sta.	85.00	8	680
Subtotal - dam protection				6,830
(2) Trinidad sewage plant protection				
Levee embankment	C.Y.	0.50	16,000	8,000
Riprap	C.Y.	6.00	2,300	13,800
Bedding	C.Y.	4.50	800	3,600
Pumping facilities	L.S.			10,000
Subtotal - sewage plant protection				35,400
(3) Trinidad water filtration plant protection				
Levee embankment	C.Y.	0.50	33,000	16,500
24" CMP	L.F.	6.50	76	494
Flap gate, 24"	Each	150.00	1	150
Metal headwall, 24"	Each	38.00	1	38
Riprap	C.Y.	6.00	2,500	15,000
Bedding	C.Y.	4.50	800	3,600
Subtotal water filtration plant protection				35,782
Subtotal - other items				78,012
Subtotal - relocations				21,825,831
Contingencies 25%				5,457,169
Total - relocations				27,283,000
(03.0) Reservoir - clearing	Acre	75.00	6,209	465,675
Contingencies, 25% ±				116,325
Total - reservoir				582,000
(04.0) Dams				
a. Earth embankment				
(1) Diversion and care of water	L.S.			30,000
(2) Clearing and grubbing	Acre	250.00	215	53,750
(3) Excavation, stripping	C.Y.	0.25	161,000	40,250
(4) Excavation, borrow	C.Y.	0.26	3,080,000	800,800
(5) Compacted fill	C.Y.	0.07	10,091,000	706,370
(6) Overhaul	C.Y.	0.05	6,000,000	300,000
(7) Drainage blanket	C.Y.	3.50	580,700	2,032,450
(8) Riprap	C.Y.	6.00	316,350	1,898,100

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(9) Bedding	C.Y.	3.50	118,630	415,205
(10) Flexible base	C.Y.	4.50	9,800	44,100
(11) Aggregate	C.Y.	6.00	560	3,360
(12) Asphalt treatment	Gal.	0.20	30,000	6,000
(13) Timer guard posts	Each	5.00	2,090	10,450
(14) Slope protection, turfing	Acre	500.00	100	50,000
(15) Relief well and paved ditch	L.S.			530,000
(16) Downstream riprap on Tehuacana, Richland Cr., & Cedar Cr. dams	C.Y.	6.00	185,710	1,114,260
(17) Downstream bedding on Tehuacana, Richland Cr. & Cedar Cr. dams	C.Y.	3.50	69,640	243,740
Subtotal - earth embankment				8,278,835
b. Concrete dam and spillway				
(1) Care of water during construction	L.S.			20,000
(2) Clearing	Acre	175.00	8	1,400
(3) Excavation, common	C.Y.	0.25	606,000	151,500
(4) Excavation, shale	C.Y.	0.60	148,400	89,040
(5) Structural backfill	C.Y.	1.00	95,000	95,000
(6) Drilling and grouting anchor holes	L.F.	2.25	10,250	23,063
(7) Drilling drain holes	L.F.	2.00	11,270	22,540
(8) Line drilling	S.F.	1.50	35,000	52,500
(9) Asphalt shale treatment	S.Y.	0.75	4,550	3,413
(10) Concrete, weir	C.Y.	22.00	163,820	3,604,040
(11) Concrete, non-overflow	C.Y.	25.00	63,340	1,583,500
(12) Concrete, pier	C.Y.	27.00	14,890	402,030
(13) Concrete, slab	C.Y.	20.00	17,010	340,200
(14) Concrete, wall	C.Y.	35.00	9,420	329,700
(15) Concrete, bridge deck	C.Y.	60.00	160	9,600
(16) Cement	Bbl.	5.00	335,800	1,679,000
(17) Steel, reinforcing	Lb.	0.13	8,510,000	1,106,300
(18) Steel, structural	Lb.	0.30	162,000	48,600
(19) Pipe railing, aluminum	Lb.	1.50	8,400	12,600
(20) Pipe railing bridge, aluminum	Lb.	1.50	10,800	16,200
(21) Metals, miscellaneous	Lb.	0.40	18,300	7,320
(22) Ladders, gratings, and grills	Lb.	0.75	14,700	11,025

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(23) Walkways	Lb.	0.50	9,600	4,800
(24) Waterstop, copper	Lb.	1.75	2,330	4,078
(25) Water gages, tile	L.F.	14.00	100	1,400
(26) Tainter gates	Lb.	0.26	1,096,000	284,960
(27) Tainter gate hoists, shafts, & hangers	Lb.	1.00	253,000	253,000
(28) Trunnion anchorages and seals	Lb.	0.26	326,000	84,760
(29) Sluice gates & operating equipment	Each	5,700.00	8	45,600
(30) Trash racks and guides	Lb.	0.30	15,400	4,620
(31) Emergency bulkheads	Lb.	0.30	42,600	12,780
(32) Precast bridge girders	Each	528.00	33	17,424
(33) Crane	Each	85,000.00	1	85,000
(34) Electrical facilities	L.S.			15,000
(35) Standby power unit	Each	7,000.00	1	7,000
(36) Riprap	C.Y.	6.00	8,530	51,180
(37) Bedding	C.Y.	4.50	3,680	16,560
(38) Channel excavation	C.Y.	0.26	10,070,000	2,618,200
(39) 12" drain holes, plastic pipe, filter	L.F.			16,700
Subtotal - concrete				13,131,633
c. Navigation dam No. 11				
(1) Care of water	L.S.			25,000
(2) Clearing	Acre	200.00	22	4,400
(3) Excavation, common	C.Y.	0.60	394,000	236,400
(4) Stripping for dike	C.Y.	2.00	14,500	29,000
(5) Fill (incl. Str. backfill)	C.Y.	0.35	2,000	700
(6) Embankment, dike	C.Y.	0.25	122,000	30,500
(7) Piling, timber, treated	L.F.	3.25	26,200	85,150
(8) Piling, timber, untreated	L.F.	2.85	5,000	14,250
(9) Pipe, 6" V.C., perforated	L.F.	2.00	1,080	2,160
(10) Piling, steel sheet, MA-31	S.F.	3.00	5,600	16,800
(11) Piling, steel sheet, MA-22	S.F.	2.85	5,200	14,820
(12) Riprap, concrete block	C.Y.	30.00	5,040	151,200
(13) Gravel, filter blanket	C.Y.	5.50	7,760	42,680
(14) Concrete, apron	C.Y.	22.00	2,730	60,060
(15) Concrete, spillway sill	C.Y.	22.00	30,000	660,000
(16) Concrete, 2" stabilizer	C.Y.	26.00	200	5,200
(17) Concrete, walls	C.Y.	26.00	500	13,000
(18) Concrete, 6" paving	C.Y.	20.00	11,900	238,000
(19) Cement	Bbl.	5.00	63,000	315,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(20) Steel, reinforcing	Lb.	0.13	1,297,000	168,610
Subtotal - navigation dam No. 11				2,112,930
Subtotal - dams				23,523,398
Contingencies, 25% ±				5,880,602
Total - dams				29,404,000
(05.0) Locks				
a. Lock No. 10B				
(1) Cofferdam	C.Y.	0.25	64,400	16,100
(2) Clearing	Acre	300.00	10	3,000
(3) Excavation, common	C.Y.	0.50	210,200	105,100
(4) Fill (incl. esplanade)	C.Y.	0.35	191,800	67,130
(5) Fill, cellular guidewall cells	C.Y.	0.35	3,070	1,075
(6) Timber, Y.P., creosoted	MFBM	600.00	45.6	27,360
(7) Piling, steel H, 14 BP-73	L.F.	8.00	27,500	220,000
(8) Piling, steel sheet	S.F.	3.00	90,460	271,380
(9) Riprap, concrete block	C.Y.	30.00	5,789	173,670
(10) Filter blanket	C.Y.	5.50	2,260	12,430
(11) Concrete, walls and floor	C.Y.	20.00	1,372	27,440
(12) Concrete, walls	C.Y.	28.00	58,300	1,632,400
(13) Concrete, floors and sills	C.Y.	22.00	64,800	1,425,600
(14) Concrete, cellular guide-wall	C.Y.	45.00	8,100	364,500
(15) Cement	Bbl.	5.00	198,515	992,575
(16) Steel, str., wall armor	Lb.	0.20	459,140	91,828
(17) Steel, str., miter gates	Lb.	0.45	1,080,000	486,000
(18) Upper gate guards	L.S.			250,000
(19) Steel, str., tainter valves	Lb.	0.45	73,230	32,954
(20) Steel, str., miscellaneous	Lb.	0.22	314,000	69,080
(21) Steel, reinforcing	Lb.	0.13	82,300	10,699
(22) Steel, reinforcing	Lb.	0.15	18,206,000	2,730,900
(23) Steel, corosion resistant	Lb.	0.80	6,850	5,480
(24) Steel, str., chromium	Lb.	0.80	4,940	3,952
(25) Forgings, steel, carbon	Lb.	0.80	197,000	157,600
(26) Forgings, steel, alloy	Lb.	0.80	5,110	4,088
(27) Castings, steel, grade "0"	Lb.	0.60	19,200	11,520
(28) Castings, steel, grade 1, 2 & 3	Lb.	0.60	40,610	24,366
(29) Castings, steel, alloy	Lb.	0.60	6,570	3,942
(30) Castings, iron	Lb.	0.60	5,970	3,582
(31) Bronze and brass	Lb.	2.50	2,230	5,575

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(32) Metals, miscellaneous, non-ferrous	Lb.	0.80	2,070	1,656
(32) Conduit, fibre, 3" D	L.F.	1.50	9,600	14,400
(34) Conduit, metal, 1" D	L.F.	0.85	150	128
(35) Conduit, metal, 3" D	L.F.	3.75	155	581
(36) Electrical facilities	L.S.			120,000
(37) Pipe railing, steel	L.F.	4.00	5,800	23,200
(38) Floor plating, steel	S.F.	5.00	90	450
(39) Floor grating, steel	S.F.	4.65	8,810	40,967
(40) Rubber seals, moulded	Lb.	2.50	1,100	2,750
(41) Gages, tile	L.F.	14.00	148	2,072
(42) Operating machines, miter gates	Each	27,500.00	4	110,000
(43) Valves, double 4-way	Each	900.00	2	1,800
(44) Operating machine, tainter valve	Each	17,500.00	4	70,000
(45) Valve, control, 3-way	Each	700.00	4	2,800
(46) Valve, automatic, 3-way	Each	500.00	4	2,000
(47) Oil piping system	L.S.			90,000
(48) Field office	L.S.			5,000
(49) Central control structure	L.S.			36,000
(50) Stop logs	L.S.			150,000
(51) Care of water during construction	L.S.			250,000
(52) Derrick, stiff leg	L.S.			37,500
(53) Bascule bridge	L.S.			120,000
(54) Piling, steel sheet	S.F.	4.00	27,800	111,200
Subtotal - lock No. 10B				10,423,830
b. Lock No. 11				
(1) Cofferdam	C.Y.	0.25	132,000	33,000
(2) Clearing	Acre	200.00	10	2,000
(3) Excavation, common	C.Y.	0.50	698,100	349,050
(4) Fill (incl. esplanade)	C.Y.	0.35	213,700	74,795
(5) Fill cellular guidewall cells	C.Y.	0.35	7,450	2,608
(6) Timber, Y.P. creosoted	MFBM	600.00	29	17,400
(7) Piling, steel-H, (14BP-73)	L.F.	8.00	29,110	232,880
(8) Piling, steel sheet	S.F.	3.00	89,660	268,980
(9) Riprap, concrete block	C.Y.	30.00	14,780	443,400
(10) Filter blanket	C.Y.	5.50	5,960	32,780
(11) Concrete, walls	C.Y.	28.00	55,500	1,554,000
(12) Concrete, floors and sills	C.Y.	22.00	63,000	1,386,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(13) Concrete, cellular guidewall	C.Y.	35.00	8,600	301,000
(14) Cement	Bbl.	5.00	189,600	948,000
(15) Steel, str., wall armor	Lb.	0.20	339,500	67,900
(16) Steel, str., miter gates	Lb.	0.45	432,000	194,400
(17) Steel, str., tainter values	Lb.	0.45	73,230	32,954
(18) Steel, str., miscellaneous	Lb.	0.22	366,100	80,542
(19) Steel, reinforcing	Lb.	0.15	17,622,000	2,643,300
(20) Steel, corrosion resistant	Lb.	0.80	6,850	5,480
(21) Steel, str., chromium	Lb.	0.80	4,940	3,952
(22) Forgings, steel, carbon	Lb.	0.80	96,500	77,200
(23) Forgings, steel, alloy	Lb.	0.80	5,110	4,088
(24) Castings, steel, grade "O"	Lb.	0.60	19,200	11,520
(25) Castings, steel, grades 1, 2, & 3	Lb.	0.60	40,610	24,366
(26) Castings, steel, alloy	Lb.	0.60	6,570	3,942
(27) Castings, iron	Lb.	0.60	5,970	3,582
(28) Bronze and brass	Lb.	2.50	2,230	5,575
(29) Metal, miscellaneous, non-ferrous	Lb.	0.80	2,070	1,656
(30) Conduit, fibre, 3" D	L.F.	1.50	9,600	14,400
(31) Conduit, metal, 1" D	L.F.	0.85	150	128
(32) Conduit, metal, 3" D	L.F.	3.75	155	581
(33) Electrical facilities	L.S.			120,000
(34) Pipe railing, steel	L.F.	4.00	5,700	22,800
(35) Floor plating, steel	S.F.	5.00	90	450
(36) Floor grating, steel	S.F.	4.65	8,810	40,967
(37) Rubber seals, moulded	Lb.	2.50	1,100	2,750
(38) Gages, tile	L.F.	14.00	69	966
(39) Operating machines, miter gates	Each	27,500.00	4	110,000
(40) Valve, double, 4-way	Each	900.00	2	1,800
(41) Operating machine, tainter valve	Each	17,500.00	4	70,000
(42) Valve, control, 3-way	Each	700.00	4	2,800
(43) Valve, automatic, 3-way	Each	500.00	4	2,000
(44) Oil piping system	L.S.			90,000
(45) Field office	L.S.			5,000
(46) Central control structure	L.S.			36,000
(47) Stop logs	L.S.			45,000
(48) Care of water during construction	L.S.			150,000
Subtotal - lock No. 11				9,521,992
Subtotal - locks				19,945,822
Contingencies, 25% ±				4,986,178
Total - locks				24,932,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(08.0) Access roads				
(1) Access road to main dam	L.S.			112,000
(2) Access road to lock No. 11	L.S.			163,000
Subtotal - access roads				275,000
Contingencies, 25% ±				69,000
Total - access roads				344,000
(09.0) Channel				
(1) Clearing and grubbing, pool 10-B	Acre	350.00	887	310,450
(2) Clearing and grubbing, pool 11	Acre	200.00	330	66,000
(3) Clearing spoil area, pool 10-B	Acre	200.00	2,234	446,800
(4) Clearing spoil area, pool 11	Acre	100.00	344	34,400
(5) Excavation, common, pool 10-B	C.Y.	0.27	18,017,300	4,864,671
(6) Excavation, common, pool 11	C.Y.	0.30	8,334,900	2,500,470
(7) River diversion dams, pool 11	L.S.			64,500
Subtotal - channel				8,287,291
Contingencies, 25% ±				2,071,709
Total - channel				10,359,000
(19.0) Buildings, grounds, and utilities				
(1) Maintenance facilties @ main dam	L.S.			100,000
(2) Water supply	L.S.			30,000
(3) Power line and substation	L.S.			25,000
(4) Visitors overlook facilties	L.S.			28,000
(5) Facilties @ lock 10B	L.S.			127,600
(6) Facilties @ lock 11	L.S.			127,600
Subtotal - buildings				438,200
Contingencies, 25% ±				109,800
Total - buildings, grounds, and utilities				548,000
(20.0) Permanent operating equipment				
(1) Radio-telephone equipment	L.S.			5,000
(2) Boats	L.S.			9,200
(3) Miscellaneous furniture and equipment	L.S.			23,800

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(4) Stream gages	L.S.			$ 21,000
(5) Evaporation and rain gages	L.S.			2,000
(6) Sedimentation and degradation ranges	L.S.			95,000
(7) Equipment @ lock 10B	L.S.			35,900
(8) Equipment @ lock 11	L.S.			35,900
(9) Heavy duty equipment	L.S.			35,250
(10) River observation system	L.S.			13,330
Subtotal - permanent operating equipment				276,380
Contingencies, 25% ±				68,620
Total - permanent operating equipment				345,000
(30.0) Engineering and design				3,480,000
(31.0) Supervision and administration				5,430,000
U. S. Coast Guard - aids to navigation				294,000
Subtotal - estimated first cost - dam and reservoir				$125,055,000
B. DETAILED ESTIMATE OF FIRST COST - RECREATION				
(01.0) Lands and damages				
(1) Fee simple lands	Acre		1,907	$243,050
(2) Severance damage	L.S.			27,150
(3) Improvements	L.S.			70,000
Subtotal				340,200
Contingencies, 25% ±				84,800
(4) Acquisition expense				26,000
Total - lands and damages				451,000
(03.0) Reservoir clearing	Acre	75.00	20,000	1,500,000
Contingencies, 25% ±				375,000
Total - reservoir clearing				1,875,000
(08.0) Access road	Mile		11	345,000
Contingencies, 25% ±				86,000
Total - access roads				431,000
(14.0) Facilities				
(1) Gravel roads				1,717,000
(2) Paved roads				859,000
(3) Parking areas				613,000
(4) Boat launching ramps				123,000

TABLE 46 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
TENNESSEE COLONY RESERVOIR MULTIPLE PURPOSE
TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(5) Sanitary facilities				$ 552,000
(6) Water supply system				613,000
(7) Picnic facilities				1,288,000
(8) Site improvements				245,000
(9) Signs and buoys				123,000
Subtotal - facilities				6,133,000
Contingencies, 25% ±				1,533,000
Total - facilities				7,666,000
(30.0) Engineering and design				633,000
(31.0) Supervision and administration				1,027,000
Total - estimated first cost of recreation				$12,083,000
Total - Estimated project first cost				$137,138,000

Prices are as of January 1962.

LOCAL PROTECTION UNITS

156. GENERAL.- The local flood protection projects proposed in this report are designed to supplement and operate in conjunction with the existing and authorized local flood protection projects. These projects are the existing Fort Worth and Dallas Floodways and the authorized Big Fossil channel improvement and Fort Worth Floodway extension (West Fork) and the Liberty levee project.

157. WEST FORK.- The plan of improvement for the West Fort of the Trinity River consists of a multiple purpose channel and floodway for navigation and flood control from the mouth of the West Fork in the Dallas Floodway upstream, a distance of about 31 miles, to the end of the existing Fort Worth Floodway. The navigation features of the multiple-purpose channel are presented in the first part of this appendix. The flood control features of the West Fork project include the following items:

(a) Sufficient realignment and enlargement of the West Fork channel to provide within-bank capacity of at least 15,000 cubic feet per second in this reach of the river.

(b) The enlargement and realignment or diversion of about 16.74 miles of tributary channels through the leveed areas.

(c) The construction of a parallel levee system through the low areas consisting of about 34.0 miles of levee along the left bank, 9.1 miles of new levee and the rehabilitation of 1.5 miles of existing levee on the right bank of the proposed enlarged and realigned channel of the West Fork and tributary channels. The floodway along the West Fork would be a dedicated floodway maintained free of encroachments and would vary in width from 1,000 feet to 3,000 feet between centerline of levees. It would have sufficient capacity of contain the standard project flood which varies from about 95,000 cubic feet per second at Fort Worth to about 160,000 cubic feet per second at the mouth of West Fork. The levees would be constructed with 1 on 2.5 side slopes, with a 10-foot crown width and have 4 feet of freeboard above the design discharge water surface.

(d) The provision of appurtenant interior-drainage facilities consisting of permanent sump areas to provide an aggregate storage capacity of 9,900 acre-feet below the damaging stage elevations of the various locations through the levee system, and low interior areas to be filled with excess excavated material to raise damaging elevations.

(e) The modification of 14 main stem and 5 tributary channel bridges and the construction of one new road in connection with the proposed improvements along the West Fork.

(f) The filling of eight areas outside the proposed leveed areas to elevations about 2 feet, and one area about four feet, above the design water surface by utilizing the excess material from the channel-excavation work.

(g) The acquisition of rights-of-way consisting of about 8,430 acres of land in fee simple for the construction of the excavated channels, levees, floodway, and permanent sump areas. The proposed plan for the West Fork is shown on plates 43 and 44 and the detailed profiles are shown on plates 45 through 48.

158. COST ESTIMATES.- A summary of first costs and annual charges for the West Fork Floodway project is shown in table 47. The detailed cost estimate for the West Fork Floodway project is shown in table 48. The estimate shows the separation of Federal and non-Federal costs and does not include the flood control portion of the multiple-purpose channel.

TABLE 47
SUMMARY OF FIRST COST AND ANNUAL CHARGES
WEST FORK FLOOD PROTECTION PROJECT
WEST FORK TRINITY RIVER

Item	Cost
First cost	
1. Federal first cost	
Railroad alterations (none on diversion channels)	-
Levees, sluices, sumps, and diversion channels	
a. Levees	$ 1,676,000
b. Sluices	732,000
c. Sumps	4,763,000
d. Diversion channels	2,596,000
Engineering and design	371,000
Supervision and administration	581,000
Total estimated Federal first cost (1)	10,719,000
2. Non-Federal first cost	
Lands and damages	6,570,000
Relocations and alterations	470,000
Engineering and design	18,000
Supervision and administration	32,000
Total estimated non-Federal first cost	7,090,000
3. Total estimated first cost of project	17,809,000

TABLE 47 (CONT'D)
SUMMARY OF FIRST COST AND ANNUAL CHARGES
WEST FORK FLOOD PROTECTION PROJECT
WEST FORK TRINITY RIVER

Item	Cost
Annual charges	
(Construction period-4 years) (100 yr. amortization) (2-7/8% Federal interest rate) (3% Non-Federal interest rate)	
1. Federal investment	
a. Federal first cost	$10,719,000
b. Interest during construction	616,300
c. Total Federal investment	11,335,300
2. Non-Federal investment	
a. Non-Federal first cost	7,090,000
b. Interest during construction	425,400
c. Total non-Federal investment	7,515,400
3. Federal annual charges	
a. Interest on Federal investment	325,900
b. Amortization charge	20,300
c. Operation and maintenance	-
Total Federal annual charge	346,200
4. Non-Federal annual charges	
a. Interest on non-Federal investment	225,500
b. Amortization charge	12,400
c. Operation and maintenance	224,000
Total non-Federal annual charges	461,900
5. Total estimated annual charges	808,100

(1) $70,000 preauthorization cost excluded.

Prices are as of January 1962.

TABLE 48
DETAILED ESTIMATE OF FIRST COST
WEST FORK FLOOD PROTECTION PROJECT
WEST FORK TRINITY RIVER

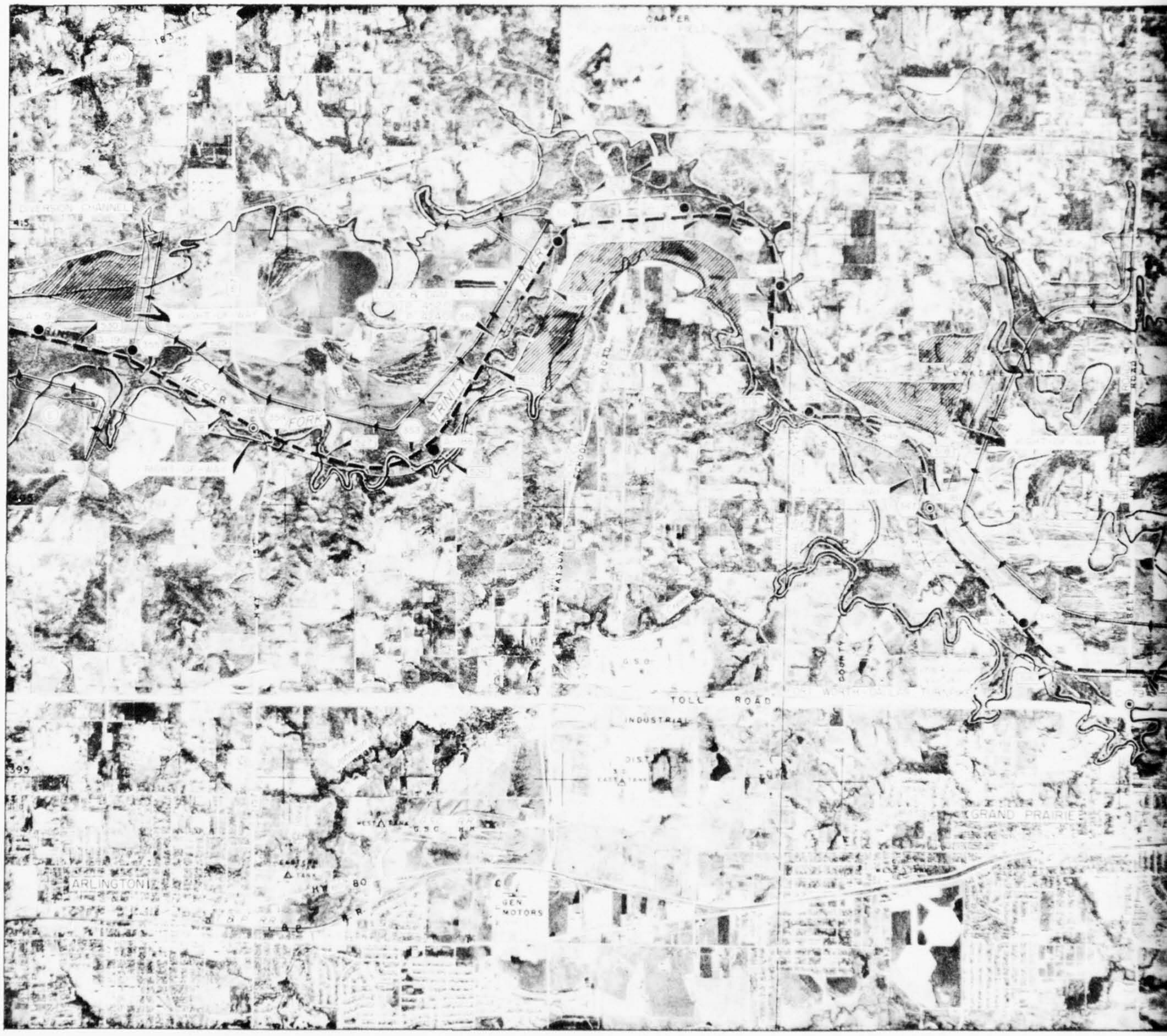
Item	Unit	Unit cost	Quantity	Cost
1. FEDERAL FIRST COST				
02.0 Railroad alterations (None on diversion channels)				
(11.0) Levees, sluices, sumps and diversion channels				
a. Levees				
(1) Clearing main stem berms	Acre	$ 100.00	3,500	$ 350,000
(2) Clearing & grubbing	Acre	150.00	525	78,750
(3) Excavation, stripping	C.Y.	0.25	734,000	183,500
(4) Compacted fill	C.Y.	0.07	7,140,000	499,800
(5) Slope protection	Acre	500.00	457	228,500
Subtotal - levees				1,340,550
b. Sluices				
(1) Care of water	L.S.			20,000
(2) Excavation, structural	C.Y.	1.50	68,000	102,000
(3) Excavation, discharge channels	C.Y.	0.30	495,000	148,500
(4) Structural backfill	C.Y.	0.50	62,000	31,000
(5) Concrete (Incl. cement)	C.Y.	50.00	2,950	147,500
(6) Steel, reinforcing	Lb.	0.13	295,000	38,350
(7) Flap gates - 4'x4'	Ea.	800.00	3	2,400
(8) Flap gates - 5'x5'	Ea.	1,250.00	3	3,750
(9) Flap gates - 6'x6'	Ea.	1,800.00	7	12,600
(10) Sluice gates, shafts, & stands - 4'x4'	Ea.	1,600.00	6	9,600
(11) Sluice gates, shafts, & stands - 5'x5'	Ea.	2,500.00	6	15,000
(12) Sluice gates, shafts, & stands - 6'x6'	Ea.	3,600.00	14	50,400
(13) Miscellaneous metals	Lb.	0.40	5,330	2,132
(14) Riprap	C.Y.	6.00	290	1,740
(15) Bedding	C.Y.	5.00	120	600
Subtotal - sluices				585,572
c. Sumps				
(1) Care of water	L.S.			15,000
(2) Clearing	Acre	100.00	453	45,300
(3) Excavation, common	C.Y.	0.25	15,000,000	3,750,000
Subtotal - Sumps				3,810,300
d. Diversion channels				
(1) Care of water	L.S.			15,000
(2) Clearing	Acre	100.00	1,185	118,500
(3) Excavation, common	C.Y.	0.25	4,315,000	1,078,750
(4) Excavation, shale	C.Y.	0.75	1,080,000	810,000
(5) Slope protection	Acre	500.00	110	55,000
Subtotal - diversion channels				2,077,250

TABLE 48 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
WEST FORK FLOOD PROTECTION PROJECT
WEST FORK TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
Subtotal - levees, sluices, sumps and diversion channels				$7,813,672
Contingencies 25% ±				1,953,328
Total - levees, sluices, sumps and diversion channels				9,767,000
(30.0) Engineering and design				371,000
(31.0) Supervision and administration				581,000
Total - estimated Federal first cost (1)				10,719,000
2. Non-Federal first cost				
a. Lands and damages				
(1) Fee simple lands and improvements	Acres		8,430	5,119,000
Contingencies, 25% ±				1,281,000
Subtotal - lands and damages				6,400,000
(2) Acquisition expense				170,000
Total - lands and damages				6,570,000
b. Relocations and alterations				
(1) Bridges and roads				
Connection E. end Elliot-Reeder Rd. to Midway Rd.	Mile	25,000.00	0.5	12,500
Hurst Sewage Plant Rd., bridge	L.F.	175.00	250	43,750
Trammel-Davis Rd., bridge	L.F.	175.00	300	52,500
Sulpher Branch, bridge	L.F.	175.00	500	87,500
Jefferson Ave., bridge	L.F.	250.00	700	175,000
(2) Utilities				
Fort Worth Sewage plant protection	L.S.			5,000
Subtotal - relocations and alterations				376,250
Contingencies, 25% ±				93,750
Total - relocations and alterations				470,000
c. Engineering and design				18,000
d. Supervision and administration				32,000
Total - estimated non-Federal first cost				7,090,000
3. Total estimated first cost of project				$17,809,000

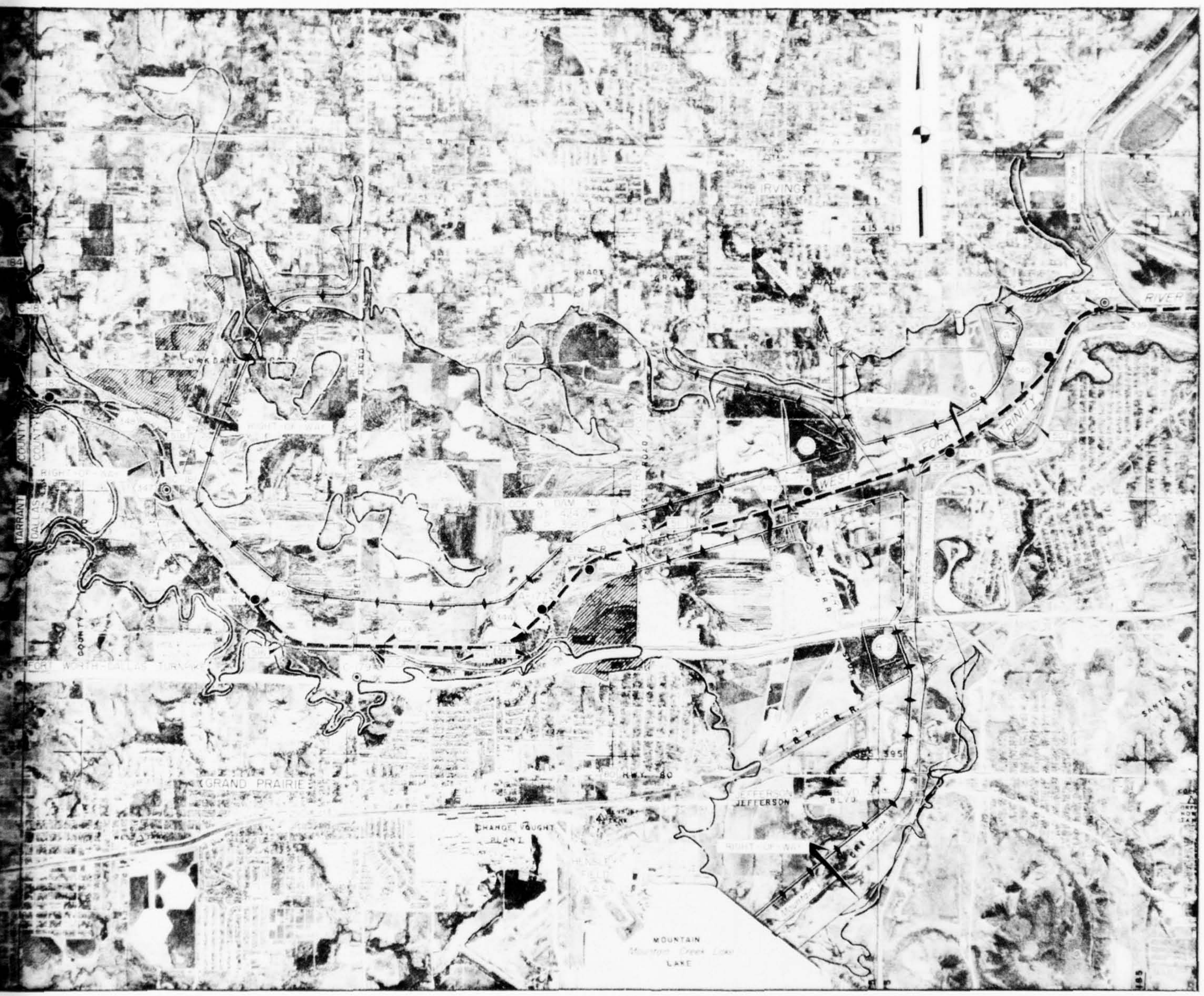
(1) $70,000 preauthorization cost excluded.

Prices are as of January 1962



LEGEND

NAVIGATION AND FLOOD CONTROL CHANNEL	NEW EARTH LEVEES
DESIGN WATER SURFACE	EXISTING LEVEES
HIGH WATER LINE (MAXIMUM OF RECORD)	STRENGTHEN EXISTING LEVEES
NAVIGATION LOCK AND DAM	FEDERAL HIGHWAY
RIVER MILEAGE	STATE HIGHWAY
CHANNEL MILEAGE	INTERSTATE HIGHWAY
CORE BORINGS	FARM TO MARKET ROAD
AUGER BORINGS	EXISTING BRIDGE
FILL AREA	COUNTY LINE
SUMP AREA	GRAVITY FLOW DRAINAGE STRUCTURE



NEW EARTH LEVEES
EXISTING LEVEES
STRENGTHEN EXISTING LEVEES
FEDERAL HIGHWAY
STATE HIGHWAY
INTERSTATE HIGHWAY
FARM TO MARKET ROAD
EXISTING BRIDGE
COUNTY LINE
GRAVITY FLOW DRAINAGE STRUCTURE

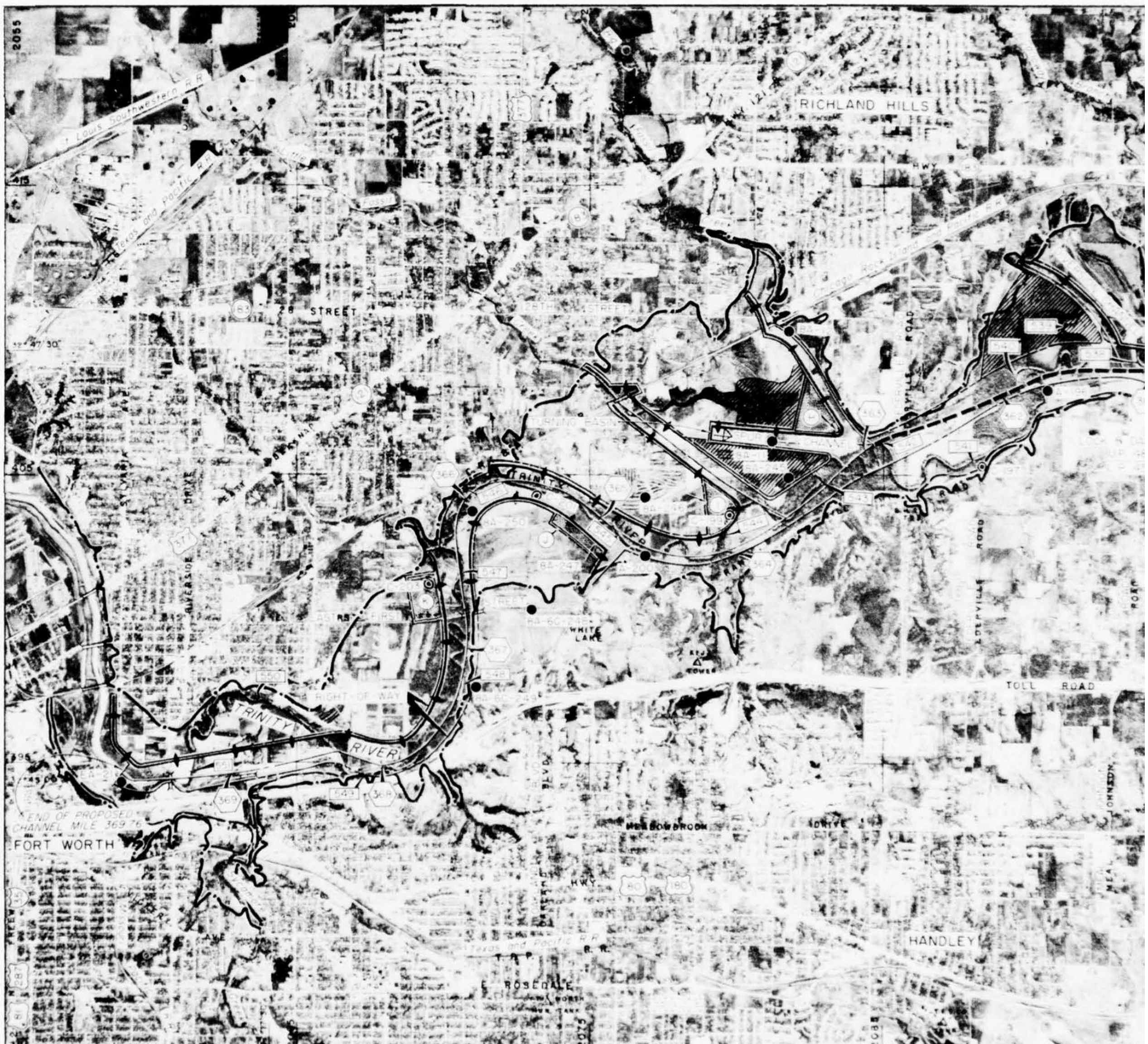
TRINITY RIVER AND TRIBUTARIES, TEXAS
WEST FORK AND TRIBUTARIES
MULTIPLE PURPOSE CHANNEL
AND FLOODWAY

PLAN OF IMPROVEMENT

IN 2 SHEETS — SCALE OF FEET 2000 0 2000 4000 — SHEET NO. 1

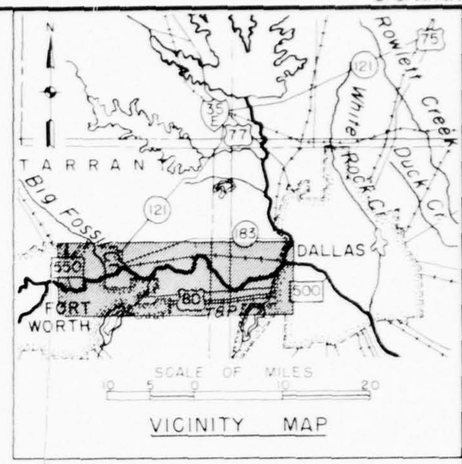
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: W. E. Wood, CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: C. B. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION
APPROVED: [signature], COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: C. W. Hanley, ENGINEER
DRAWN BY: C.E.C.
CHECKED BY: J.H.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19



DRAINAGE AREA AND SUMP	DRAINAGE AREA		SLUICES			SUMPS			
	ACRES	SQ MI	NO REQ'D	SIZE	INVERT EL	DAMAGING STAGE EL	BOTTOM EL	CAP AT DAMAGING STAGE EL AC-FT	DESIGN FLOOD WATER SURFACE EL
A	861	1.35	1	5'x5'	399.0	415.0	398	450	413.7
B-1	672	1.05	1	4'x4'	399.0	422.0	398	350	419.2
B-2	2,317	3.62	1	6'x6'	401.0	422.0	400	1,150	421.9
C	5,000	7.81	2	6'x6'	399.0	426.0	398	2,350	425.5
D	2,273	3.55	1	6'x6'	427.0	456.0	426	1,100	454.7
E	1,488	2.33	1	5'x5'	455.0	477.0	454	750	475.7
F	1,951	3.05	1	6'x6'	455.0	474.0	454	1,000	473.1
G	1,176	1.84	1	4'x4'	455.0	478.0	454	600	477.9
H	1,104	1.73	1	6'x6'	483.0	495.0	482	550	494.8
I	1,324	2.07	1	6'x6'	483.0	500.0	482	650	499.0
J	495	0.77	1	4'x4'	483.0	500.0	482	250	498.0
K	1,467	2.29	1	5'x5'	483.0	505.0	482	700	503.7

U.S. ARMY



VICINITY MAP

LEGEND

NAVIGATION AND FLOOD CONTROL CHANNEL
DESIGN WATER SURFACE
HIGH WATER LINE (MAXIMUM OF RECORD)
NAVIGATION LOCK AND DAM
RIVER MILEAGE
CHANNEL MILEAGE
CORE BORINGS
AUGER BORINGS
FILL AREA
SUMP AREA
NEW EARTH LEVEES
EXISTING LEVEES
STRENGTHEN EXISTING LEVEES
FEDERAL HIGHWAY
STATE HIGHWAY
INTERSTATE HIGHWAY
FARM TO MARKET ROAD
EXISTING BRIDGE
COUNTY LINE
GRAVITY FLOW DRAINAGE STRUCTURE

SUMPS			
BOTTOM EL.	CAP. AT DAMAGING STAGE EL. AC-FT	DESIGN FLOOD WATER SURFACE EL.	
398	450	413.7	
398	350	419.2	
400	1,150	421.9	
398	2,350	425.5	
426	1,100	454.7	
454	750	475.7	
454	1,000	473.1	
454	600	477.9	
482	550	494.8	
482	650	499.0	
482	250	498.0	
482	700	503.7	

TRINITY RIVER AND TRIBUTARIES, TEXAS
WEST FORK AND TRIBUTARIES
MULTIPLE PURPOSE CHANNEL
AND FLOODWAY

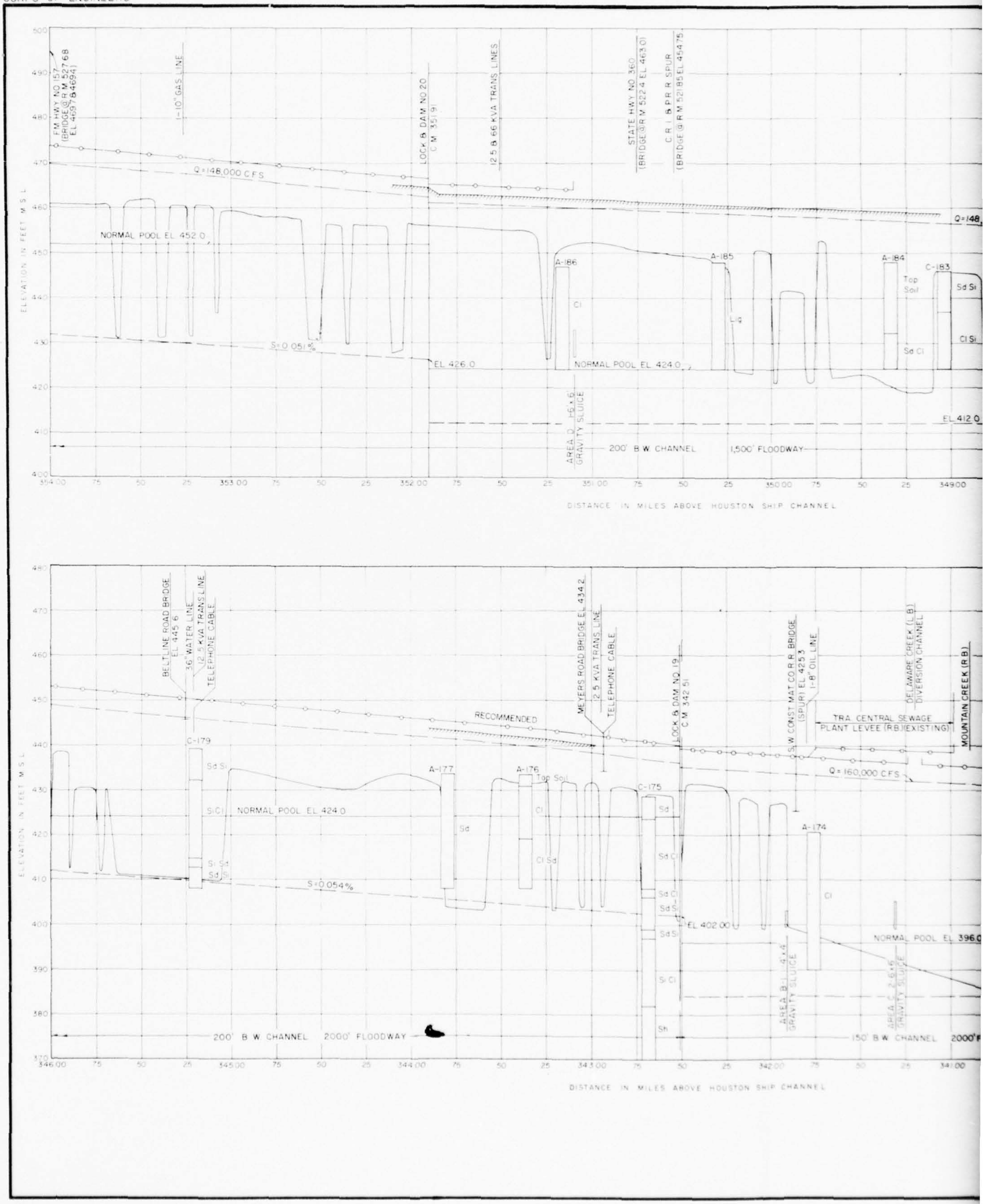
PLAN OF IMPROVEMENT

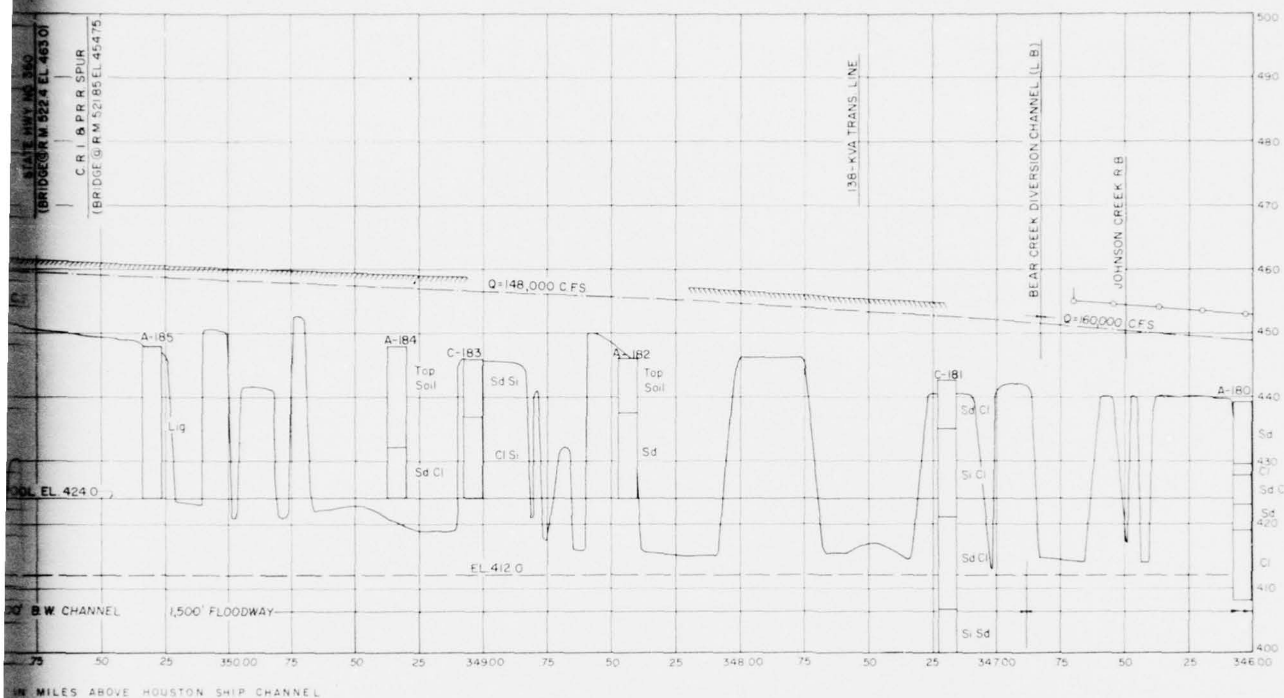
IN 2 SHEETS — SCALE OF FEET 2000 0 2000 4000 — SHEET NO.

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 196

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER
PREPARED: ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY: M.E.S. CHECKED BY: J.H.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER — FILE TRIN 230-19

CORPS OF ENGINEERS





BORING LEGEND

LABORATORY CLASSIFICATION

- SM Silty Sands, Sand-Silt mixtures
- SC Clayey Sand, Sand-Clay mixtures
- ML Inorganic Silts and very fine Sands, Rock Flour, Silty or Clayey fine Sands or Clayey Silts with slight plasticity
- CL Inorganic Clays of low plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
- CH Inorganic Clays of high plasticity, Fat Clays

VISUAL CLASSIFICATION

- Gr Gravel or Gravelly
- Sd Sand or Sandy
- Si Silt or Silty
- Cl Clay or Clayey
- FE Fuller's Earth
- SS Sandstone
- SiS Siltstone
- CS Claystone
- Sh Shale or Shaly
- Lig Lignite
- Ls Limestone
- H Hard
- BA Machine Auger Boring, 8" diameter
- 6C Core Boring, 6" diameter
- W.T. Water Table
- H.D. Texas Highway Dept. boring
- R.D. Dallas County Road District No. 1 Borings

Absence of ground water levels opposite boring logs does not mean necessarily that ground water will not be encountered at the locations or within the vertical reaches of the borings.

Figures to the right of boring logs are water contents in percent of the dry weight.

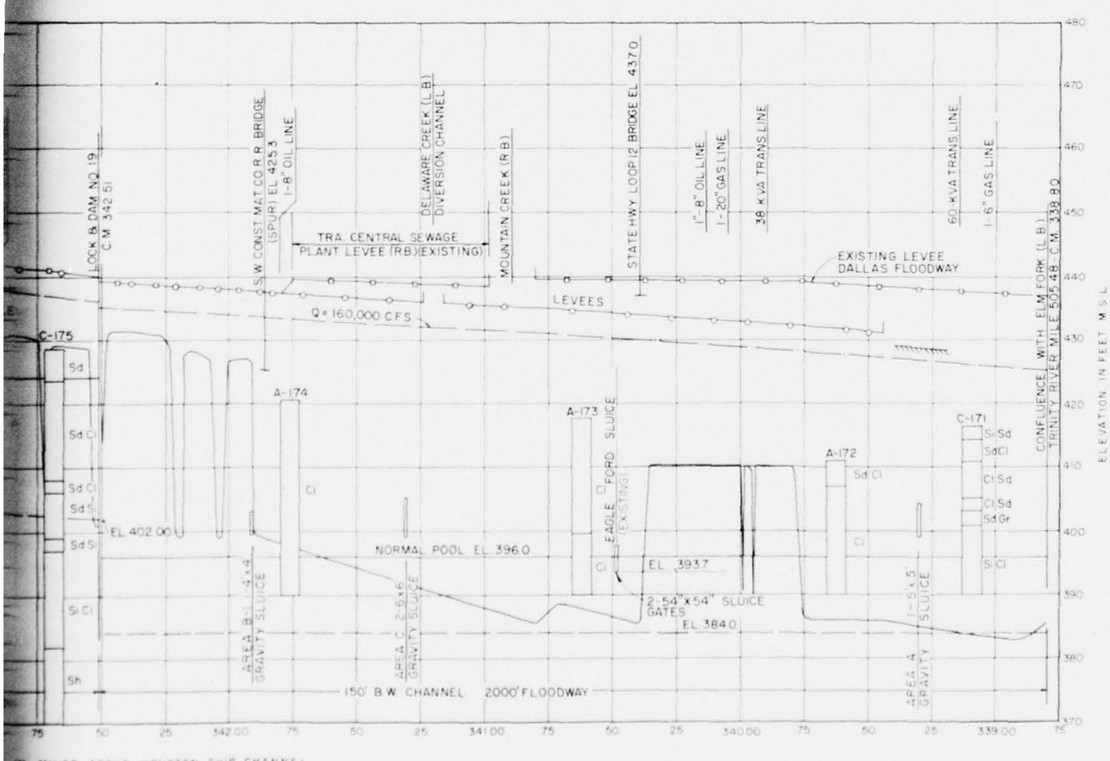
NOTES

Floodway dimensions shown are minimum requirements measured from centerline of levees, or from centerline of levee to natural bank or fill area.

Channel side slopes are 1 vertical on 2 horizontal.
Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

Refer to Plate 56 for typical channel and levee sections.



LEGEND

- DESIGN WATER SURFACE
- LEVEE, RIGHT BANK
- LEVEE, LEFT BANK
- CENTERLINE PROFILE
- BOTTOM GRADE
- RECOMMENDED FILL AREAS, LEFT BANK
- RECOMMENDED FILL AREAS, RIGHT BANK
- B.W. BOTTOM WIDTH
- L.B. LEFT BANK
- R.B. RIGHT BANK

TRINITY RIVER AND TRIBUTARIES, TEXAS
WEST FORK
MULTIPLE PURPOSE CHANNEL

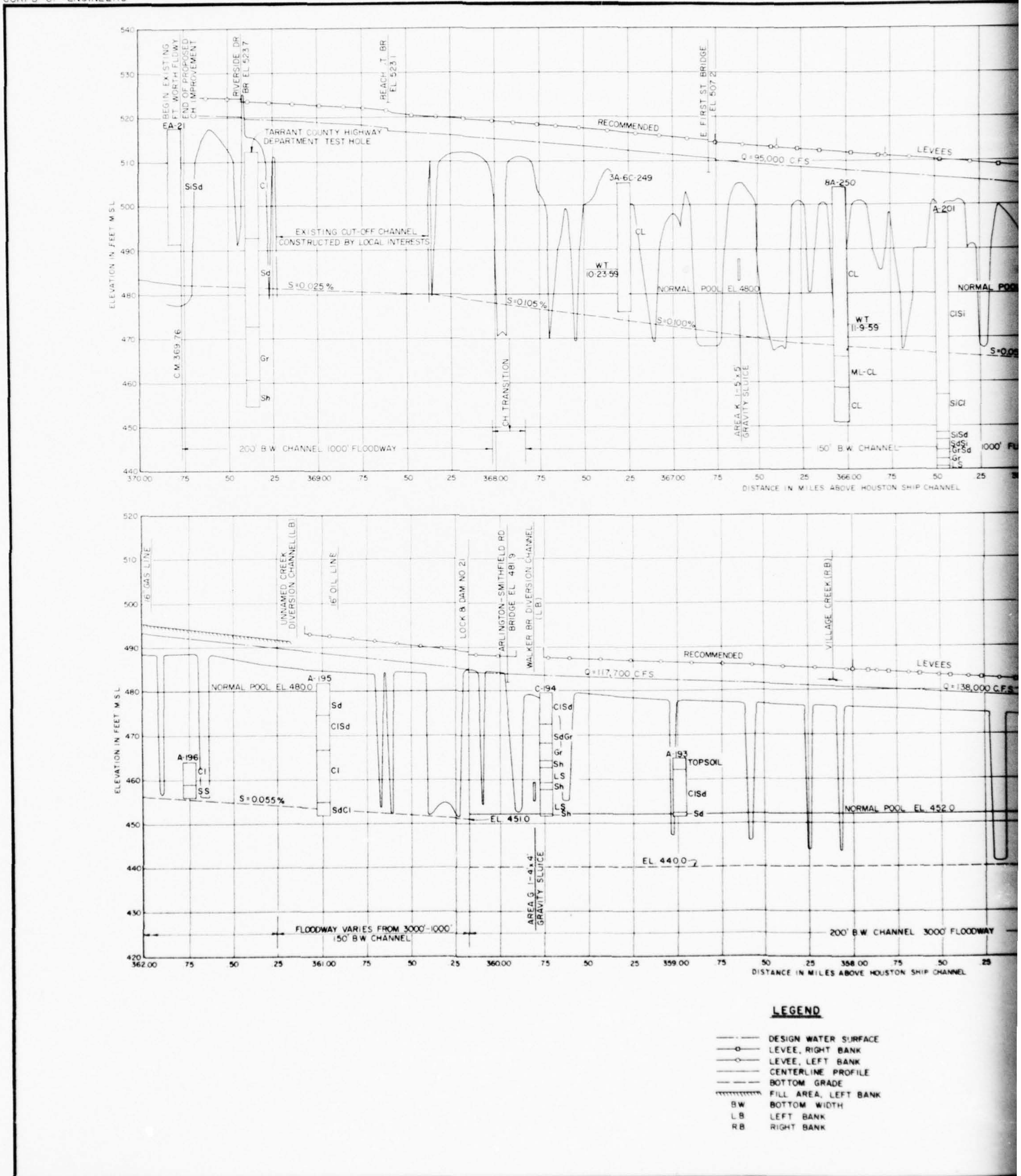
DETAILED PROFILES

IN 2 SHEETS — SCALES AS SHOWN — SHEET NO. 1

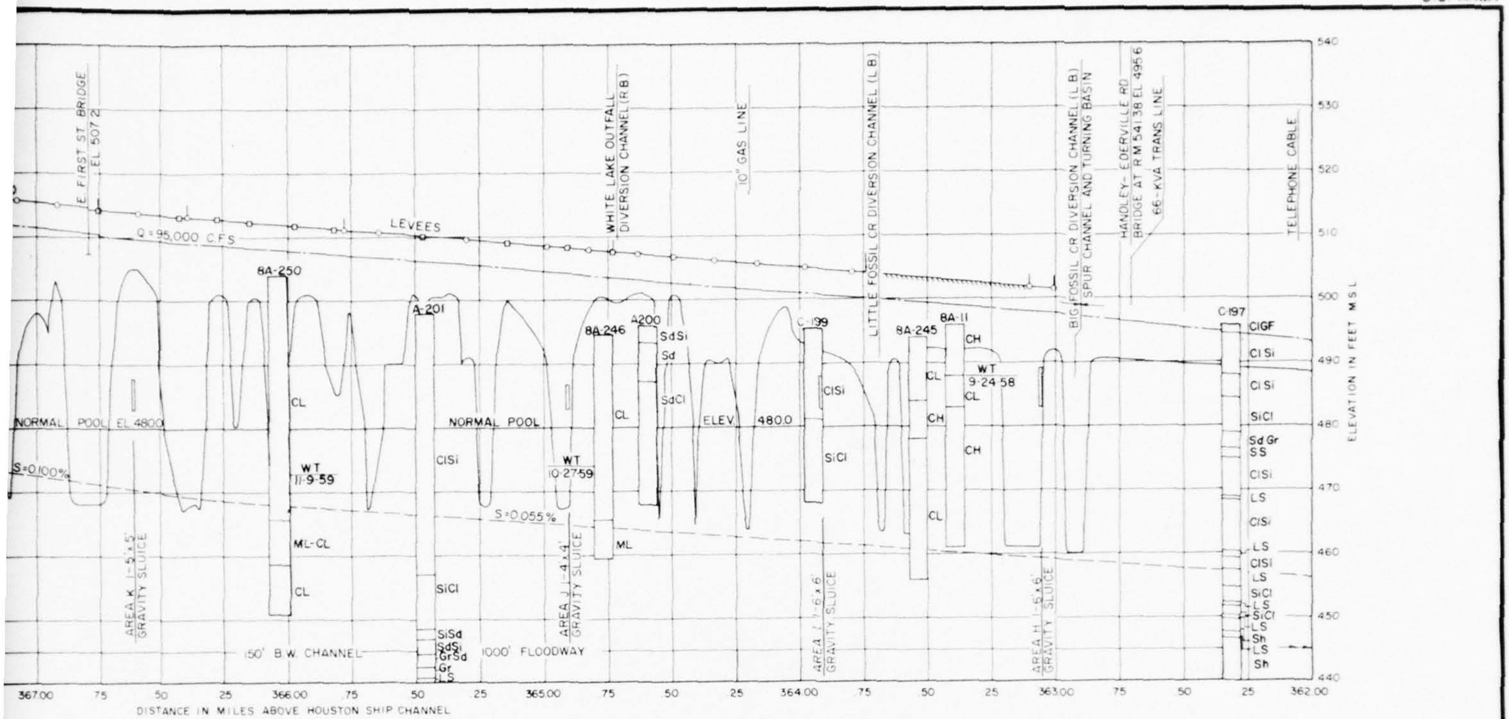
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

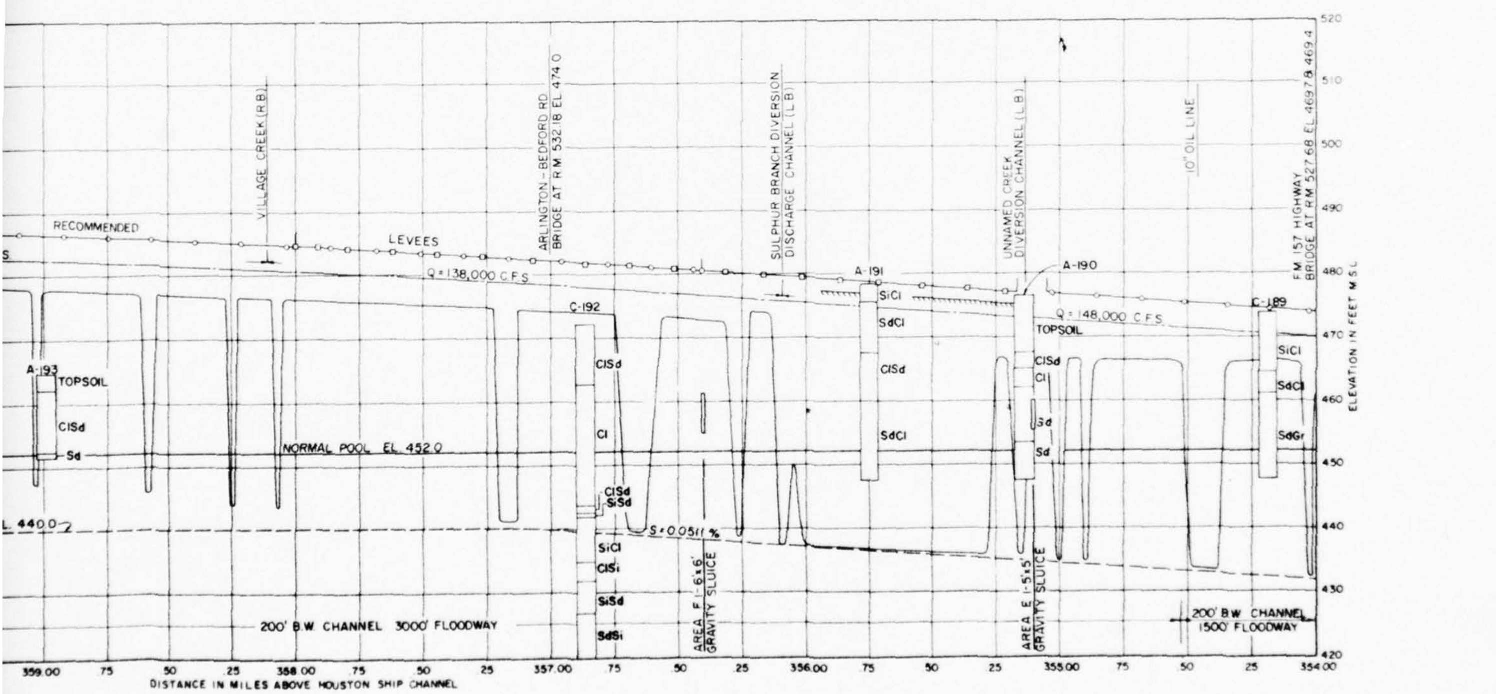
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
A. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	C. P. [illegible], ENGINEER, CHIEF, ENGINEERING DIVISION	[illegible], COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
A. W. Hawley, ENGINEER, HEAD SPECIAL STUDIES SECTION	DRAWN BY: V.J.M. / CHECKED BY: J.M.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER; FILE: TRIN. 230-19

CORPS OF ENGINEERS



U S ARMY





LEGEND

— · —	DESIGN WATER SURFACE
—o—	LEVEE, RIGHT BANK
—o—	LEVEE, LEFT BANK
———	CENTERLINE PROFILE
— — —	BOTTOM GRADE
,,,,,,,,,	FILL AREA, LEFT BANK
BW	BOTTOM WIDTH
LB	LEFT BANK
RB	RIGHT BANK

NOTES:

Floodway dimensions shown are minimum requirements measured from centerline of levees, or from centerline of levee to natural bank or fill area.

All channel side slopes are 1 vertical on 2 horizontal. Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

Refer to Plate 45 for Boring Legend.

Refer to Plate 56 for Typical Channel and Levee Sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS

WEST FORK

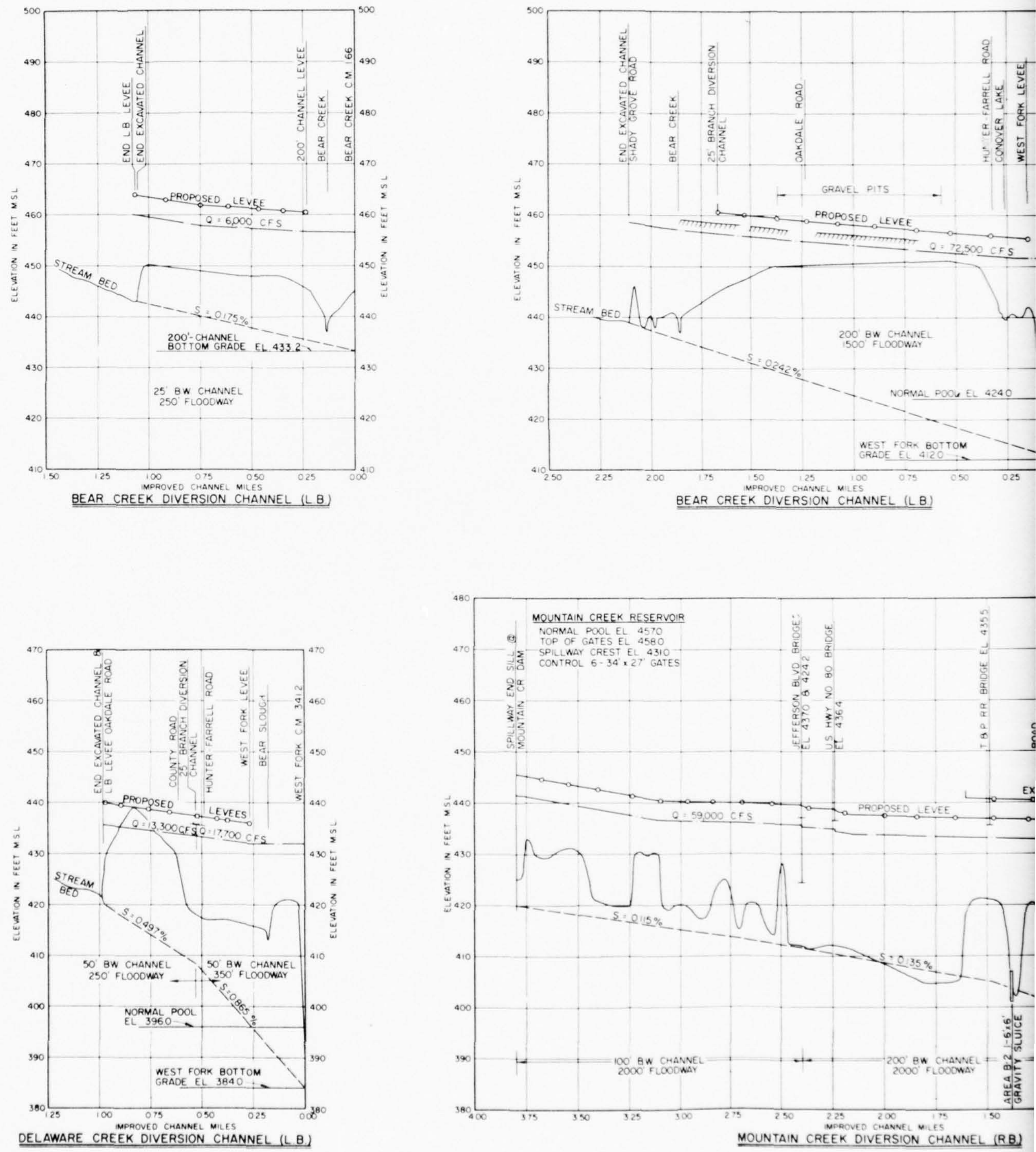
MULTIPLE PURPOSE CHANNEL

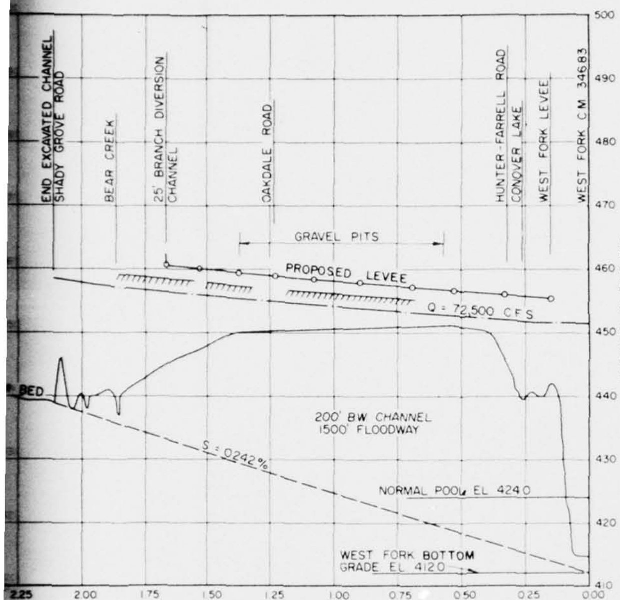
DETAILED PROFILES

IN 2 SHEETS — SCALES AS SHOWN — SHEET NO 2

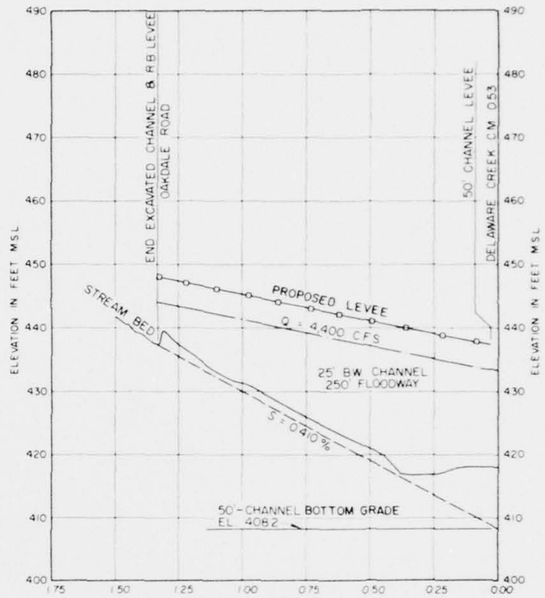
U S ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: W. E. Wood, CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: C. G. ..., CHIEF, ENGINEERING DIVISION
APPROVED: ..., DISTRICT ENGINEER
PREPARED: G. W. Hawley, ENGINEER, HEAD SPECIAL STUDIES SECTION
DRAWN BY: M&F — CHECKED BY: J.W.L.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19


END L.B. LEVEE
END EXCAVATED CHANNEL
200' CHANNEL LEVEE
BEAR CREEK
BEAR CREEK C.M. 1.66
PROPOSED LEVEE
Q = 6,000 CFS
STREAM BED
S = 0.175%
200'-CHANNEL BOTTOM GRADE EL. 433.2
25' B.W. CHANNEL 250' FLOODWAY
ELEVATION IN FEET M.S.L.
IMPROVED CHANNEL MILES
BEAR CREEK DIVERSION CHANNEL (L.B.)
END EXCAVATED CHANNEL SHADY GROVE ROAD
BEAR CREEK
25' BRANCH DIVERSION CHANNEL
OAKDALE ROAD
GRAVEL PITS
HUNTER-FARRELL ROAD
CONOVER LAKE
WEST FORK LEVEE
PROPOSED LEVEE
Q = 72,500 CFS
STREAM BED
S = 0.242%
200' BW CHANNEL 1500' FLOODWAY
NORMAL POOL EL. 424.0
WEST FORK BOTTOM GRADE EL. 412.0
BEAR CREEK DIVERSION CHANNEL (L.B.)
END EXCAVATED CHANNEL & L.B. LEVEE OAKDALE ROAD
COUNTY ROAD
25' BRANCH DIVERSION CHANNEL
HUNTER-FARRELL ROAD
WEST FORK LEVEE
BEAR SLOUGH
WEST FORK C.M. 34.12
PROPOSED LEVEES
Q = 13,300 CFS
Q = 17,700 CFS
STREAM BED
S = 0.497%
S = 0.865%
50' BW CHANNEL 250' FLOODWAY
50' BW CHANNEL 350' FLOODWAY
NORMAL POOL EL. 396.0
WEST FORK BOTTOM GRADE EL. 384.0
DELAWARE CREEK DIVERSION CHANNEL (L.B.)
MOUNTAIN CREEK RESERVOIR
NORMAL POOL EL. 457.0
TOP OF GATES EL. 458.0
SPILLWAY CREST EL. 431.0
CONTROL 6 - 34' x 27' GATES
SPILLWAY END SILL @ MOUNTAIN CR. DAM
JEFFERSON BLVD. BRIDGES EL. 437.0 & 424.2
U.S. HWY. NO. 80 BRIDGE EL. 436.4
T.&P. RR. BRIDGE EL. 435.5
Q = 59,000 CFS
PROPOSED LEVEE
S = 0.115%
S = 0.135%
100' BW CHANNEL 2000' FLOODWAY
200' BW CHANNEL 2000' FLOODWAY
AREA B-2 1-6'x6' GRAVITY SLUICE
MOUNTAIN CREEK DIVERSION CHANNEL (R.B.)



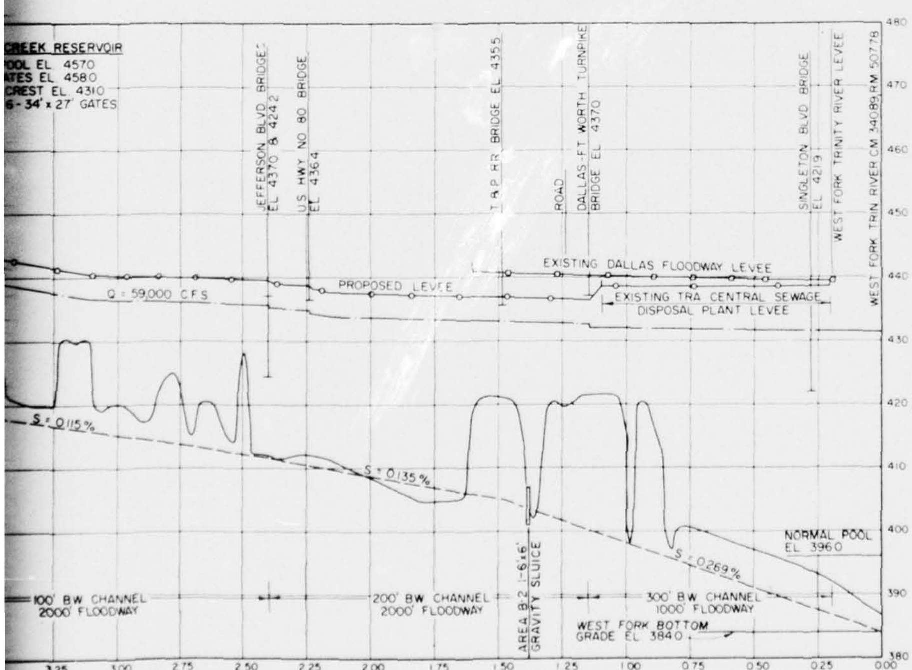
BEAR CREEK DIVERSION CHANNEL (L.B.)



DELAWARE CREEK DIVERSION CHANNEL (L.B.)

LEGEND

— —	DESIGN WATER SURFACE
—o—	LEVEE, RIGHT BANK
—o—	LEVEE, LEFT BANK
——	CENTERLINE PROFILE
— — —	BOTTOM GRADE
	FILL AREA, RIGHT BANK
	FILL AREA, LEFT BANK
B.W.	BOTTOM WIDTH
L.B.	LEFT BANK
R.B.	RIGHT BANK



MOUNTAIN CREEK DIVERSION CHANNEL (R.B.)

NOTES:

Floodway dimensions shown are minimum requirements measured from centerline of levees, or from centerline of levee to natural bank or fill area.

All channel side slopes are 1 vertical on 2 horizontal. Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

Refer to plate 56 for typical channel and levee sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS
WEST FORK TRIBUTARIES
FLOOD CONTROL CHANNELS AND FLOODWAYS

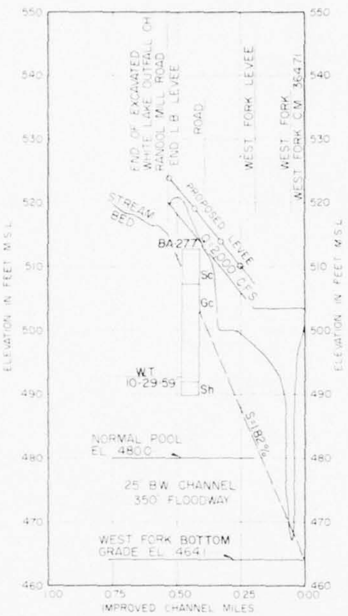
DETAILED PROFILES

IN 2 SHEETS — SCALES AS SHOWN — SHEET NO. 1

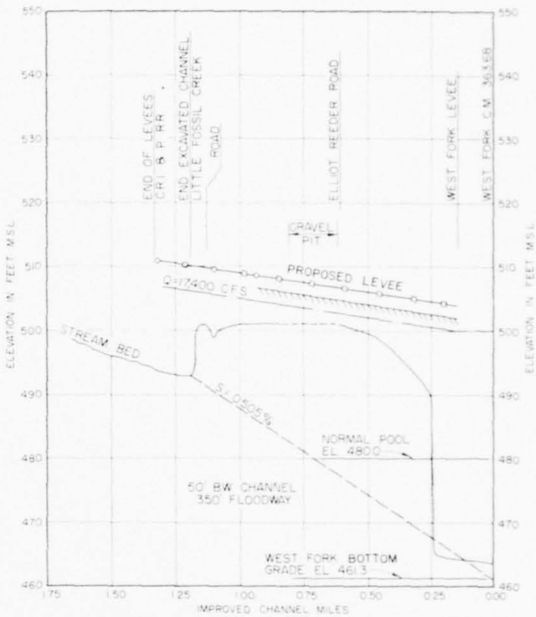
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: W. E. Wood, ENGINEER, CHIEF PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: [signature], ENGINEER, CHIEF, ENGINEERING DIVISION
APPROVED: [signature], LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: A. W. Hawley, ENGINEER, HEAD, SPECIAL STUDIES SECTION
DRAWN BY: D.E.C. — CHECKED BY: J.W.L.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19

CORPS OF ENGINEERS

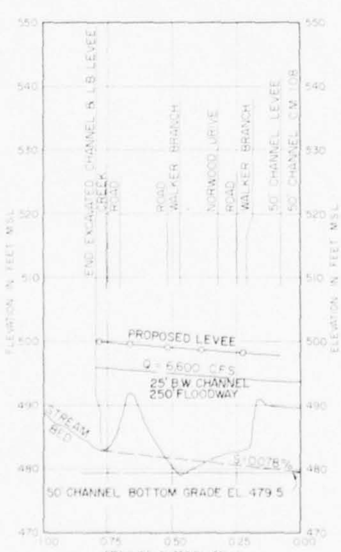


WHITE LAKE OUTFALL DIVERSION CHANNEL (R.B.)

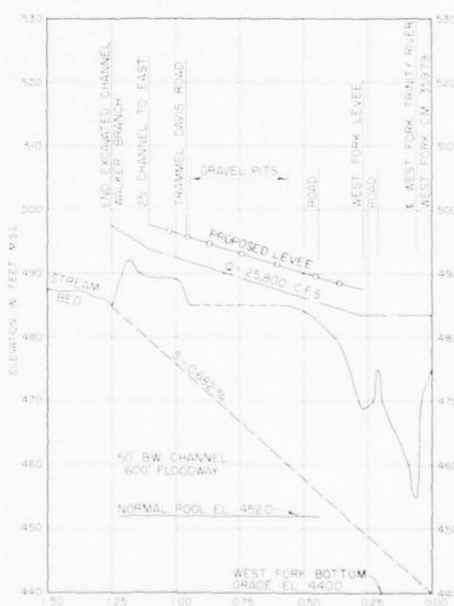


LITTLE FOSSIL CREEK DIVERSION CHANNEL (L.B.)

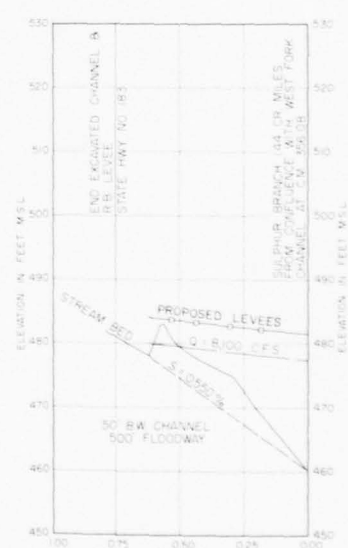
BIG FOSSIL CR



WALKER BRANCH DIVERSION CHANNEL (L.B.)

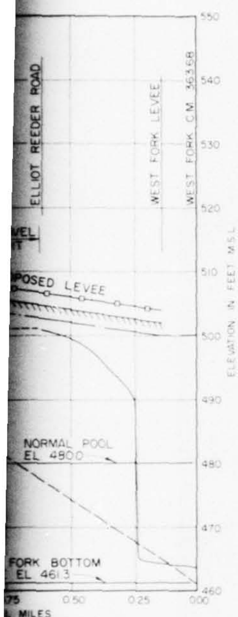


WALKER BRANCH DIVERSION CHANNEL (L.B.)

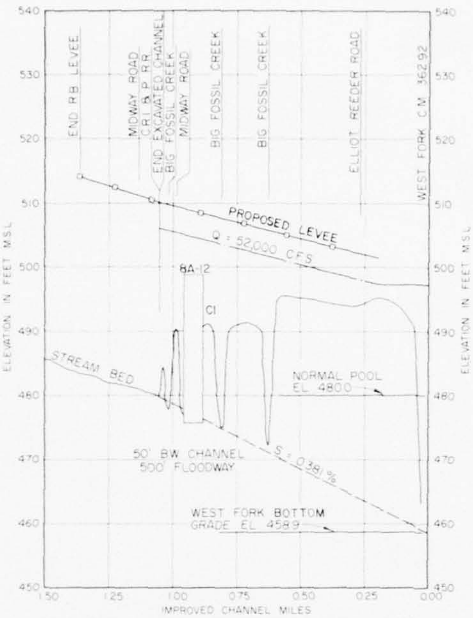


SULPHUR BRANCH DIVERSION CHANNEL (L.B.)

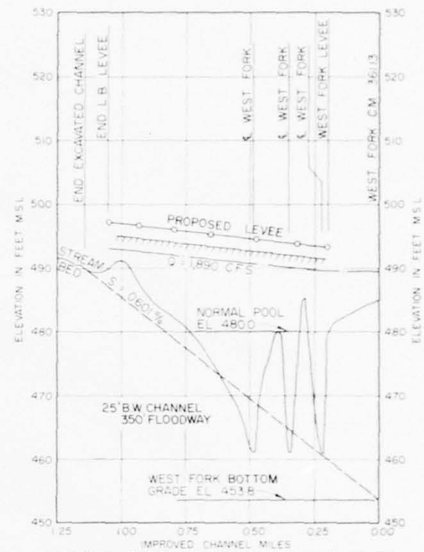
U.S. ARMY



SION CHANNEL (L.B.)



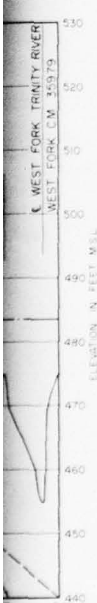
BIG FOSSIL CREEK DIVERSION CHANNEL (L.B.)



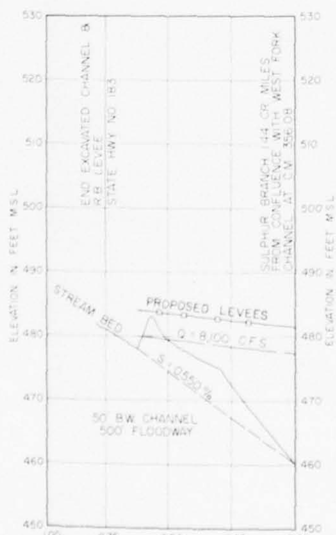
UNNAMED CREEK DIVERSION CHANNEL (L.B.)

LEGEND

- DESIGN WATER SURFACE
- LEVEE, RIGHT BANK
- LEVEE, LEFT BANK
- CENTERLINE PROFILE
- BOTTOM GRADE
- FILL AREA, RIGHT BANK
- FILL AREA, LEFT BANK
- B.W. BOTTOM WIDTH
- L.B. LEFT BANK
- R.B. RIGHT BANK



(L.B.)



SULPHUR BRANCH DIVERSION CHANNEL (L.B.)

UNNAMED CREEK DIVERSION CHANNEL (L.B.)

NOTES

Floodway dimensions shown are minimum requirements measured from centerline of levees, or from centerline of levee to natural bank or fill area.

All channel side slopes are 1 vertical on 2 horizontal. Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

New or modified bridge openings are to provide 3 feet minimum vertical clearance above design water surface, and unobstructed horizontal clearance in dedicated floodway exclusive of bridge piers.

Refer to plate 56 for typical channel and levee sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS
WEST FORK TRIBUTARIES
FLOOD CONTROL CHANNELS AND FLOODWAYS

DETAILED PROFILES

IN 2 SHEETS — SCALES AS SHOWN — SHEET NO. 2

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 196[illegible]

FILE TRIN 230-19

159. ELM FORK.- The plan of improvement in the Elm Fork watershed extends along the main channel from its mouth upstream to Grapevine and Lewisville Dams as shown on plates 49 and 50 and on detailed profiles, plates 51 through 53. The project includes the following principal features:

(a) The realignment and enlargement of the Elm Fork channel from Lewisville Dam outlet works channel downstream to the mouth of Denton Creek, a distance of about 7.5 miles, to provide a within-banks channel capacity discharge of at least 10,000 cubic feet per second.

(b) Clearing the existing Denton Creek channel and flood plain to a width of 200 feet from Grapevine Dam outlet works channel downstream to river mile 3.7, a distance of about 7.0 miles, and realignment and enlargement of the channel from river mile 3.7 downstream to the Elm Fork, about 1.9 miles, to provide a within-banks channel capacity discharge of at least 7000 cubic feet per second.

(c) The realignment and enlargement of the Elm Fork channel from Denton Creek downstream to its confluence with the West Fork, about 14.3 miles, to provide a within-banks channel capacity discharge of at least 15,000 cubic feet per second.

(d) The enlargement and realignment or diversion of about 11.2 miles of tributary channels through the leveed areas between channel miles 4.0 and 12.8 along the Elm Fork.

(e) The construction of a parallel levee system through the low areas consisting of about 24.8 miles of levee along the left bank, 14.1 miles of new levee and the rehabilitation of 1.8 miles of existing levee on the right bank of the proposed enlarged and realigned channel of the Elm Fork and tributary channels between channel miles 2.7 and 15.2. The floodway along the main stem would be a dedicated floodway maintained free of encroachments and would have a minimum width of 1,100 feet between centerline of levees and have sufficient capacity to contain the standard project flood which varies from about 50,000 cubic feet per second at the Carrollton gage to about 61,000 cubic feet per second at the mouth of Elm Fork. The levees would be constructed with 1 on 2.5 side slopes with a 10-foot crown width and have 4 feet of freeboard above the design discharge water surface.

(f) The provision of appurtenant interior-drainage facilities consisting of permanent sump areas to provide an aggregate storage capacity of 5,260 acre-feet below the damaging-stage elevations of the various interior-drainage areas, gate-controlled gravity sluices at various locations through the levee system, and low interior areas to be filled with excess material to raise damaging elevations.

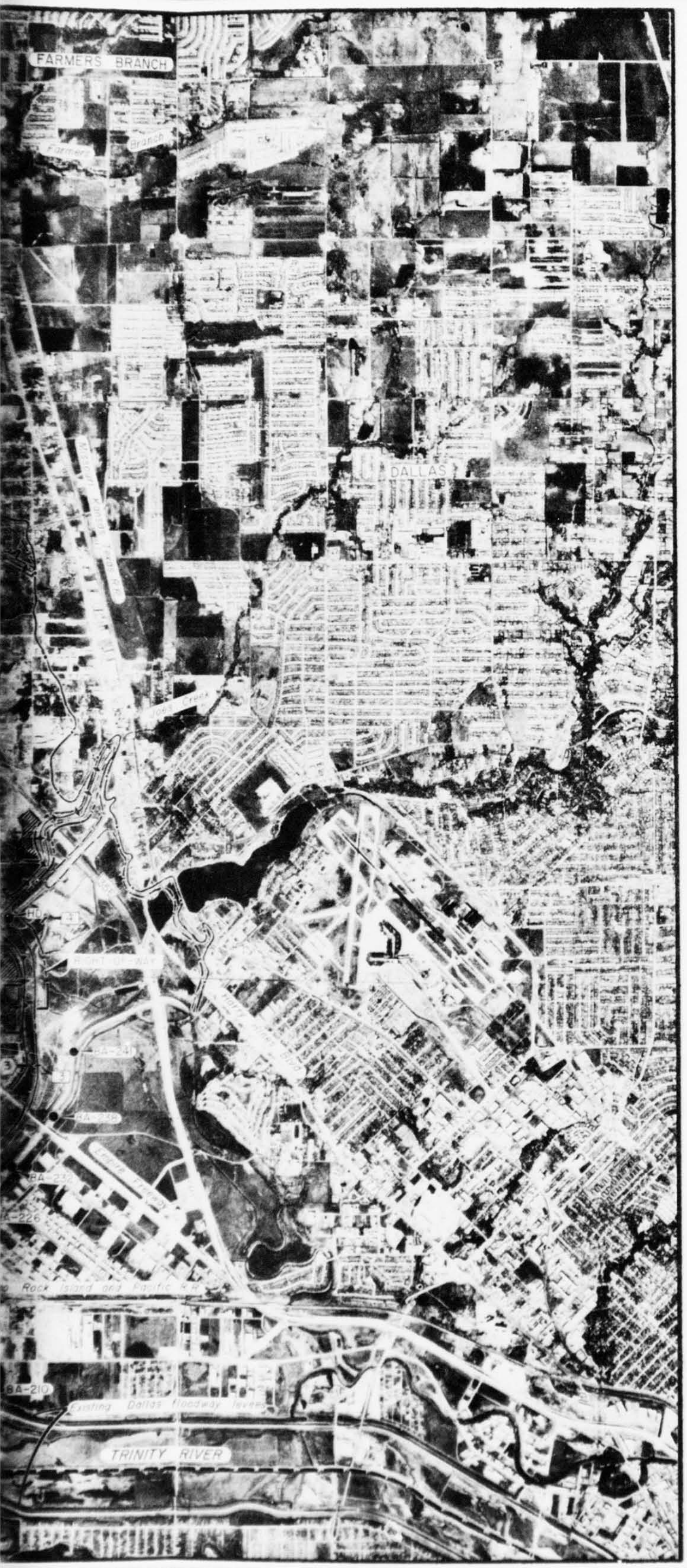
(g) The modification of 18 bridges and the construction of two new streets in connection with improvements in the Elm Fork Watershed.

(h) The filling of four areas outside the proposed leveed areas to elevations about 2 feet above design water surface by utilizing the excess material from the channel excavation work.

(i) The relocation and alteration of various urban utilities and of oil, gas, and power lines of private companies.

(j) The acquisition of rights-of-way, consisting of about 3,294 acres of land in fee simple and 129 acres in clearing easement, for the construction of the excavated and cleared channels, levees, floodway, and permanent sump areas.

CORPS OF ENGINEERS



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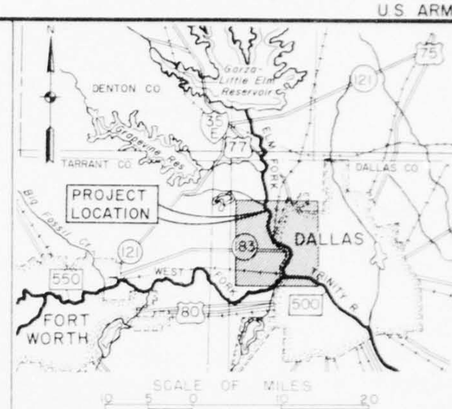


VICINITY MAP

DRAINAGE AREA AND SUMP	DRAINAGE AREA		SLUICES			SUMPS			
	ACRES	SQ. MI.	NO. REQ'D	SIZE	INVERT EL.	DAMAGING STAGE EL.	BOTTOM EL.	CAP. AT DAMAGING STAGE EL. AC.-FT.	DESIGN FLOOD WATER SURFACE EL.
A	905	1.41	3	5'X5'	401	415	400	250	414.2
B	2,952	4.61	6	5'X5'	401	416	400	800	415.9
C	1,273	1.99	3	5'X5'	405	421	404	350	421.0
D	2,381	3.72	3	6'X6'	406	423	405	650	422.8
E	3,738	5.84	5	6'X6'	408	425	407	1,000	424.4
F	3,724	5.82	5	6'X6'	411	430	410	1,000	428.6
G	2,720	4.25	5	5'X5'	417	435	416	750	434.8
H	1,700	2.66	3	6'X6'	418	437	417	460	435.2

LEGEND

- NAVIGATION AND FLOOD CONTROL CHANNEL
- DESIGN WATER SURFACE
- HIGH WATER LINE (MAXIMUM OF RECORD)
- NAVIGATION LOCK AND DAM
- 64 RIVER MILEAGE
- 64 CHANNEL MILEAGE
- CORE BORINGS
- AUGER BORINGS
- FILL AREA
- SUMP AREA
- NEW EARTH LEVEES
- EXISTING LEVEES
- STRENGTHEN EXISTING LEVEES
- 80 FEDERAL HIGHWAY
- 121 STATE HIGHWAY
- 35E INTERSTATE HIGHWAY
- 157 FARM TO MARKET ROAD
- EXISTING BRIDGE
- COUNTY LINE
- GRAVITY FLOW DRAINAGE STRUCTURE

TRINITY RIVER AND TRIBUTARIES, TEXAS

ELM FORK AND TRIBUTARIES

FLOOD CONTROL CHANNEL AND FLOODWAY

PLAN OF IMPROVEMENT

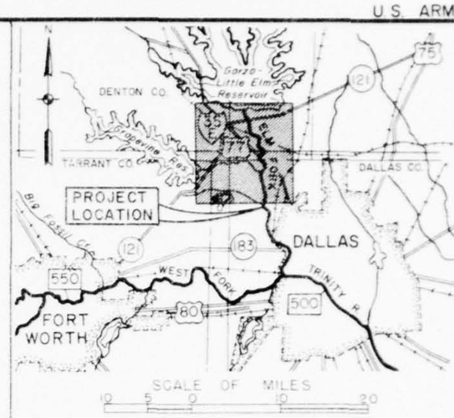
IN 2 SHEETS — SCALE OF FEET 2000 0 2000 4000 — SHEET NO. 1

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

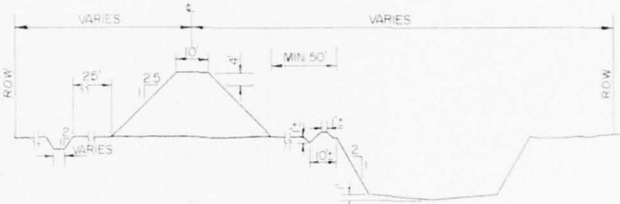
SUBMITTED: A. E. Wood, CHIEF, PLANNING & REPORTS BRANCH — APPROVAL RECOMMENDED: C. B. Swenson, CHIEF, ENGINEERING DIVISION — APPROVED: [illegible] West, DISTRICT ENGINEER

PREPARED: A. W. Hawley — DRAWN BY — CHECKED BY — TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER — FILE TRIN 230-19


LEWISVILLE

VICINITY MAP



TYPICAL CHANNEL & LEVEE SECTION

NOT TO SCALE

LEGEND

- DESIGN WATER SURFACE
- HIGH WATER LINE (MAXIMUM OF RECORD)
- 54 RIVER MILEAGE
- 64 CHANNEL MILEAGE
- CORE BORINGS
- AUGER BORINGS
- FILL AREA
- SUMP AREA
- NEW EARTH LEVEES
- EXISTING LEVEES
- STRENGTHEN EXISTING LEVEES
- 80 FEDERAL HIGHWAY
- 121 STATE HIGHWAY
- 35E INTERSTATE HIGHWAY
- 1567 FARM TO MARKET ROAD
- EXISTING BRIDGE
- COUNTY LINE
- GRAVITY FLOW DRAINAGE STRUCTURE

TRINITY RIVER AND TRIBUTARIES, TEXAS

ELM FORK AND TRIBUTARIES

FLOOD CONTROL CHANNEL AND FLOODWAY

PLAN OF IMPROVEMENT

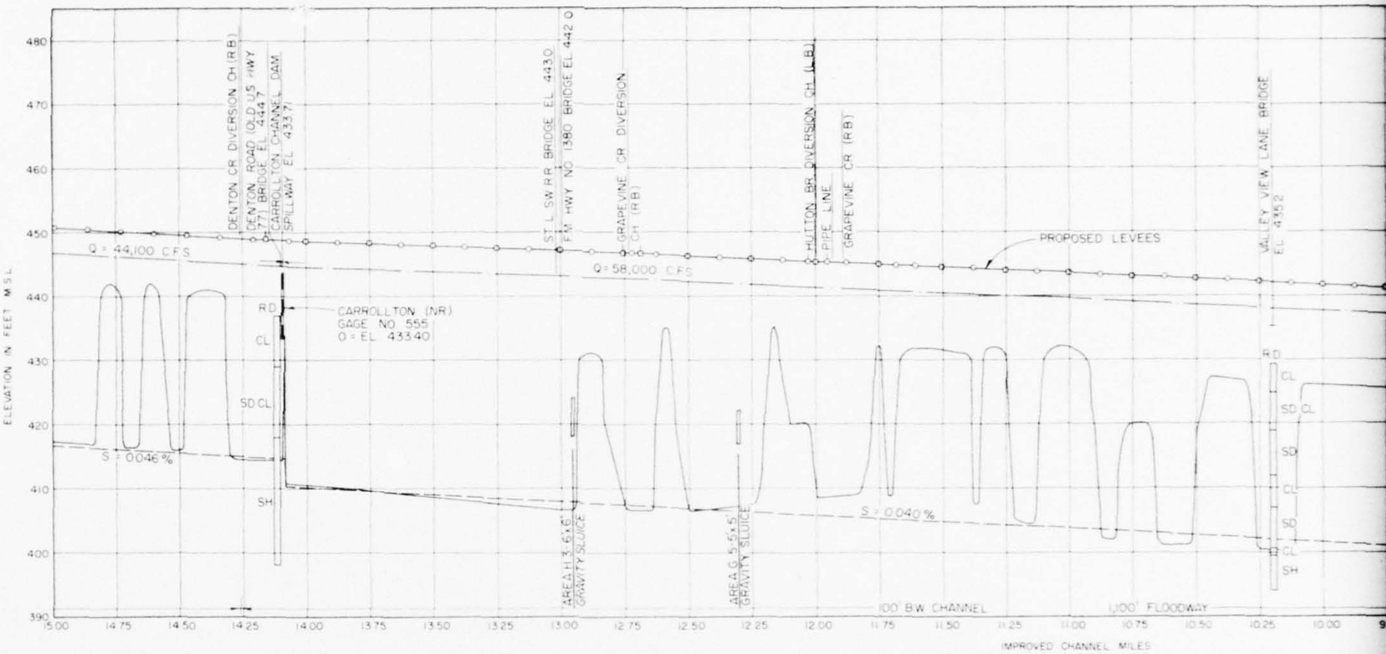
IN 2 SHEETS — SCALE OF FEET 2000 0 2000 4000 — SHEET NO. 2

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

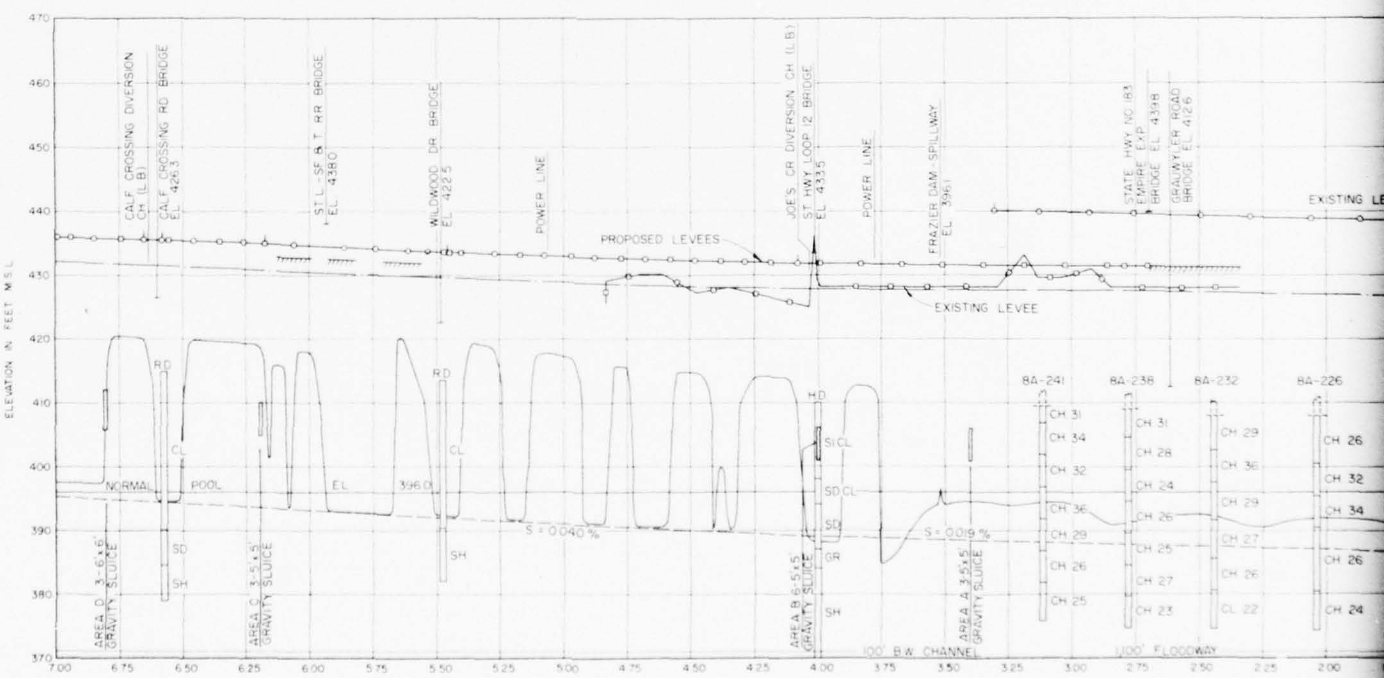
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood ENGINEER CHIEF, PLANNING & REPORTS BRANCH	C. F. Swenson ENGINEER CHIEF, ENGINEERING DIVISION	West COL. CORPS OF ENGINEERS DISTRICT ENGINEER
PREPARED A. W. Hawley ENGINEER HEAD, SPECIAL STUDIES SECTION	DRAWN BY: M.E.C. CHECKED BY: J.M.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER FILE

2

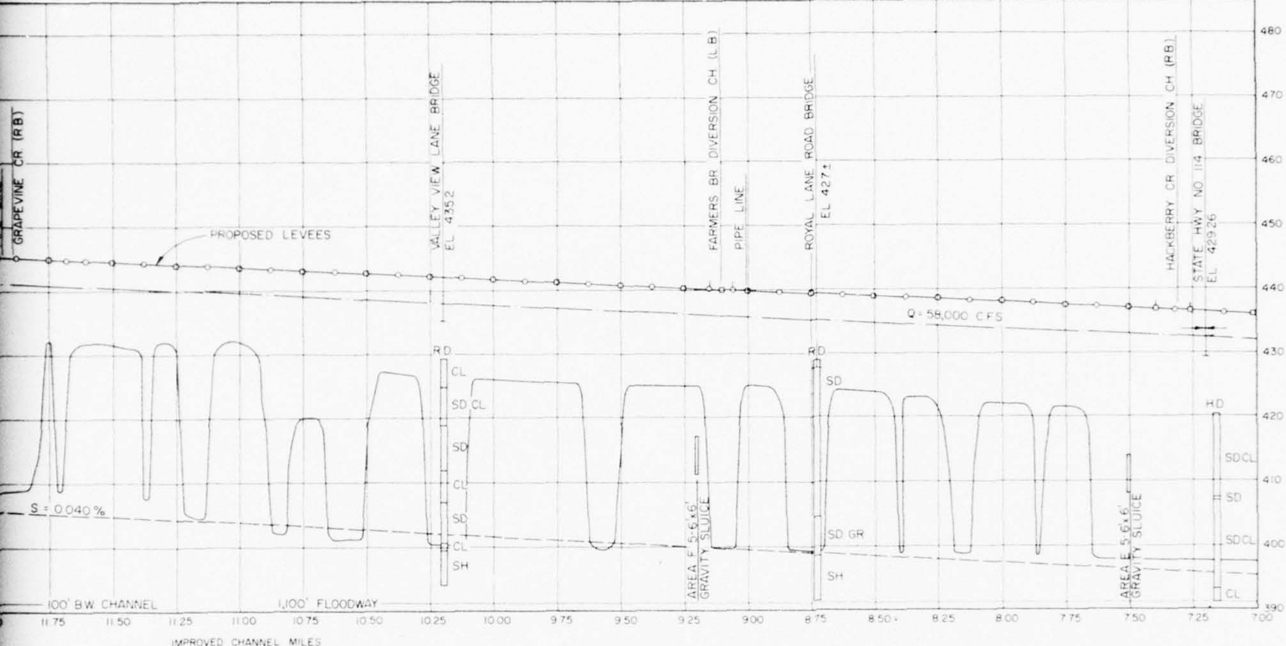
CORPS OF ENGINEERS



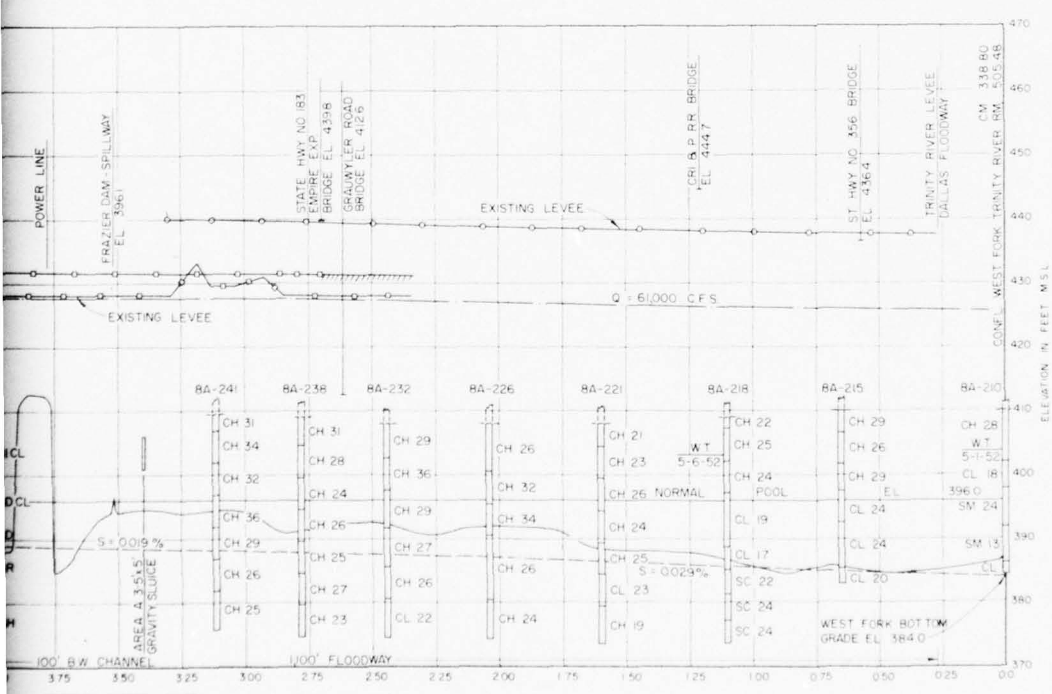
ELM FORK TRINITY RIVER



ELM FORK TRINITY RIVER



ELM FORK TRINITY RIVER



ELM FORK TRINITY RIVER

LEGEND

- DESIGN WATER SURFACE
- LEVEE, RIGHT BANK
- LEVEE, LEFT BANK
- CENTERLINE PROFILE
- BOTTOM GRADE
- FILL AREA, RIGHT BANK
- B.W. BOTTOM WIDTH
- L.B. LEFT BANK
- R.B. RIGHT BANK

NOTES:

Floodway dimensions shown are minimum requirments measured from centerline of levees, or from centerline of levee to natural bank or fill area.

All channel side slopes are 1 vertical on 2 horizontal. Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

New or modified bridge openings are to provide 3 feet minimum vertical clearance above design water surface, and unobstructed horizontal clearance in dedicated floodway exclusive of bridge piers.

Refer to plate 45 for boring legend.

Refer to plate 56 for typical channel and levee sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS
ELM FORK AND TRIBUTARIES
FLOOD CONTROL CHANNELS AND FLOODWAYS

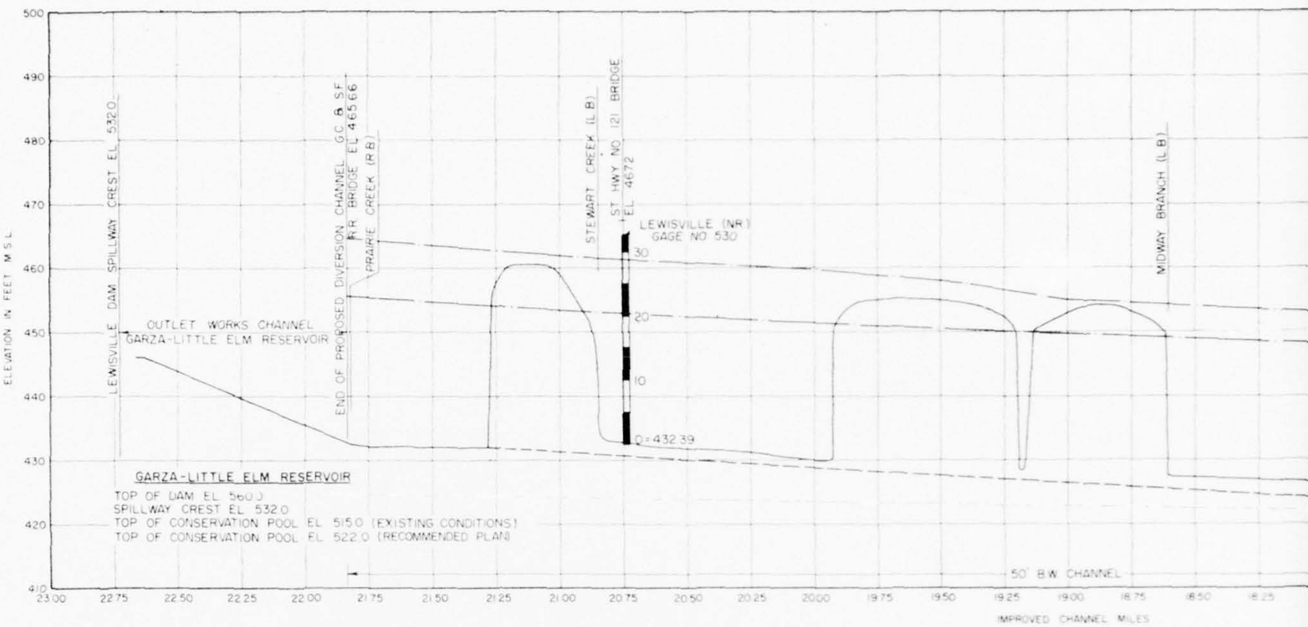
DETAILED PROFILES

IN 3 SHEETS — SCALES AS SHOWN — SHEET NO. 1

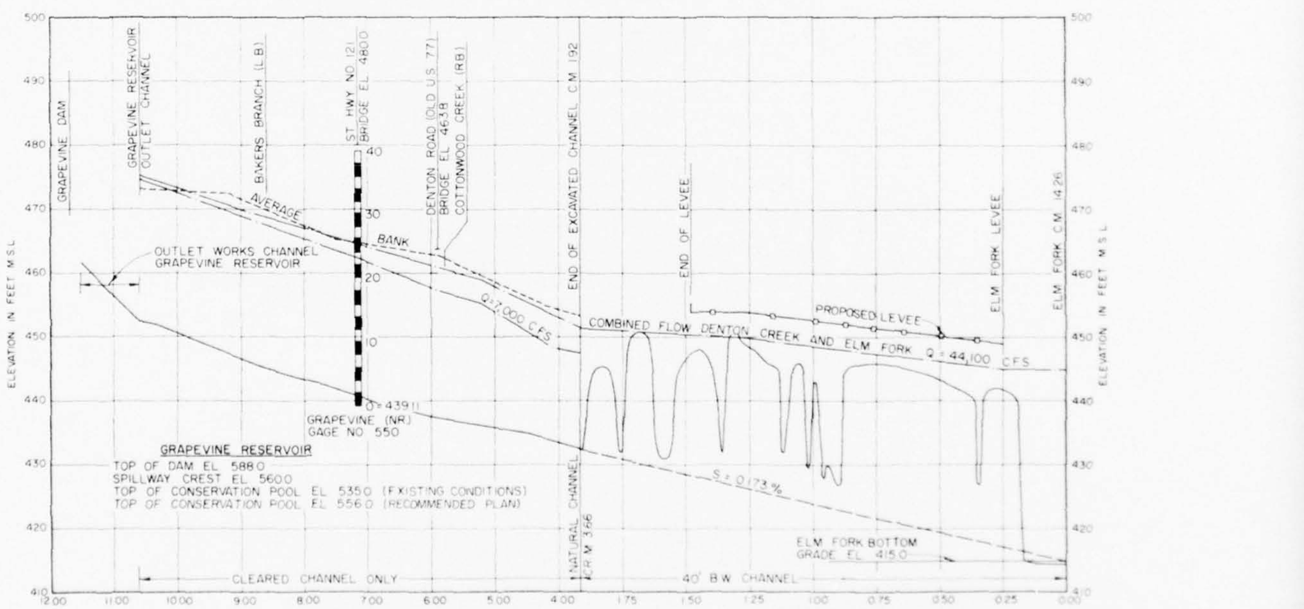
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
W. E. Wood, ENGINEER, CHIEF PLANNING & REPORTS BRANCH	C. J. Swenson, ENGINEER, CHIEF ENGINEERING DIVISION	R. D. Watt, COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: A. W. Hawley, ENGINEER, HEAD SPECIAL STUDIES SECTION	DRAWN BY: D.E.C. / CHECKED BY: J.R.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER / FILE TRIN 230-19

CORPS OF ENGINEERS



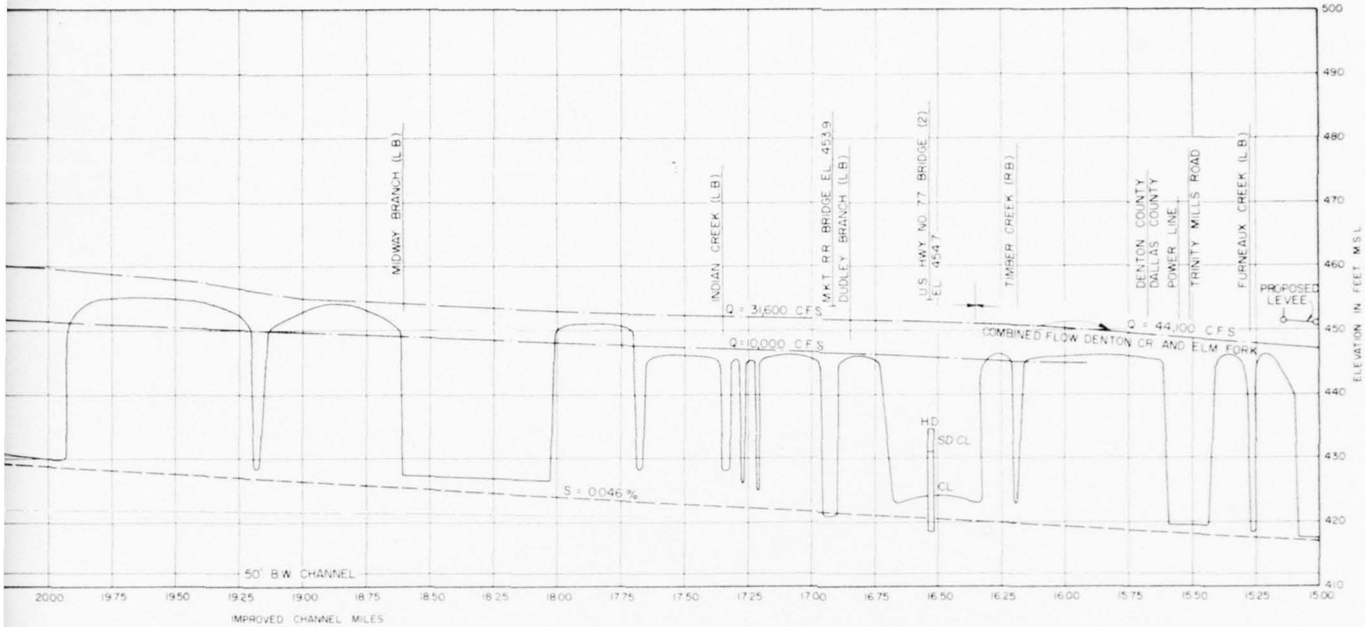
ELM FORK TRINITY RIVER



DENTON CREEK NATURAL MILES

DENTON CREEK DIVERSION CHANNEL (R.B.)

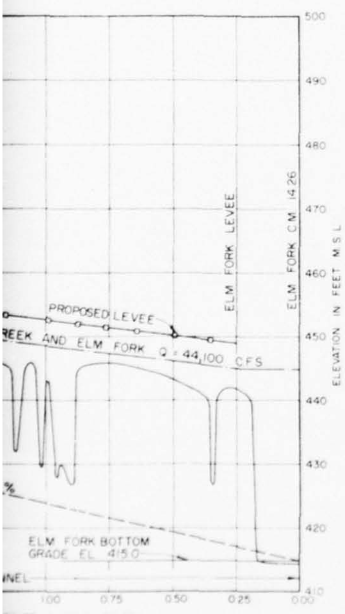
U.S. ARMY



ELM FORK TRINITY RIVER

LEGEND

	DESIGN WATER SURFACE
	LEVEE, RIGHT BANK
	LEVEE, LEFT BANK
	CENTERLINE PROFILE
	BOTTOM GRADE
	FILL AREA, RIGHT BANK
B.W.	BOTTOM WIDTH
L.B.	LEFT BANK
R.B.	RIGHT BANK



(DIVERSION CHANNEL (R.B.)

NOTES:

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New or modified bridge openings are to provide 3 feet minimum vertical clearance above design water surface, and unobstructed horizontal clearance in dedicated floodway exclusive of bridge piers.

Refer to plate 45 for boring legend.

Refer to plate 56 for typical channel and levee sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS
ELM FORK AND TRIBUTARIES
FLOOD CONTROL CHANNELS AND FLOODWAYS

DETAILED PROFILES

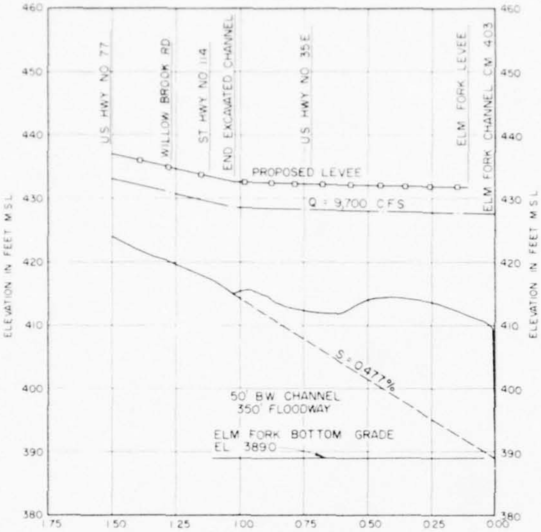
IN 3 SHEETS — SCALES AS SHOWN — SHEET NO. 2

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

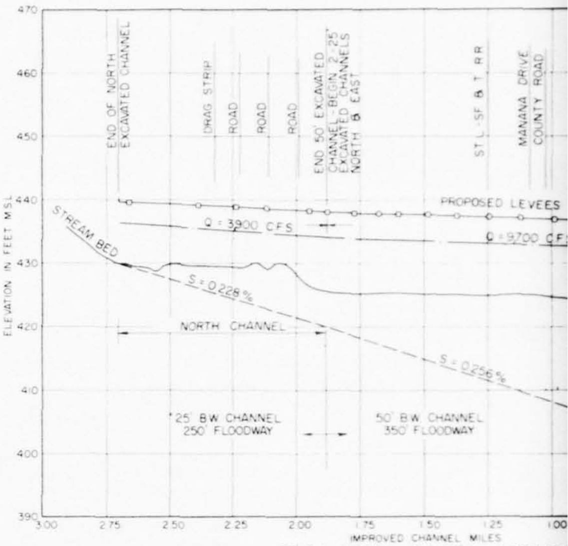
SUBMITTED: D.E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: C.J. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION
APPROVED: R.D. West, COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: A. W. Hawley, ENGINEER, HEAD, SPECIAL STUDIES SECTION
DRAWN BY: D.E.C.
CHECKED BY: J.H.L.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE: TRIN. 230-19

2

CORPS OF ENGINEERS

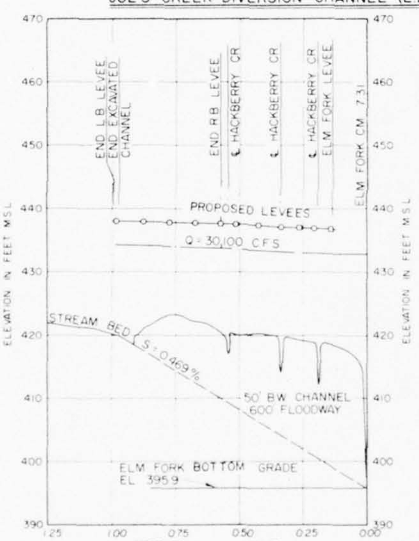


JOE'S CREEK DIVERSION CHANNEL (L.B.)

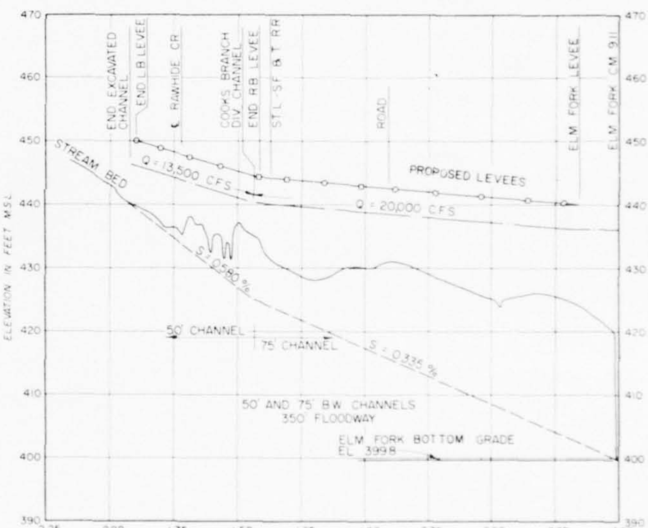


50' B.W. CHANNEL AND 25' B.W. NORTH CHA

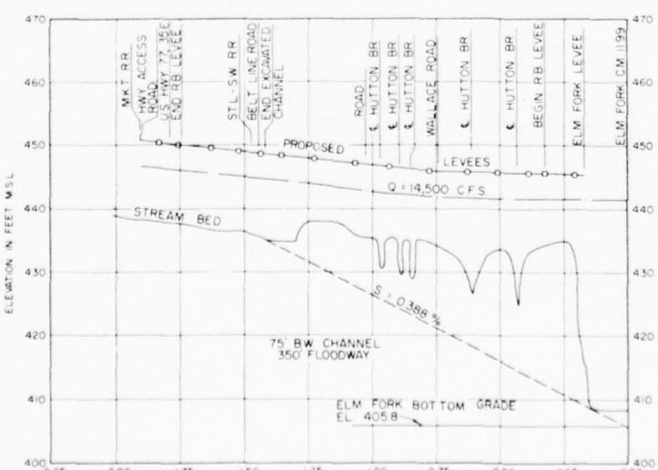
CALIFORNIA



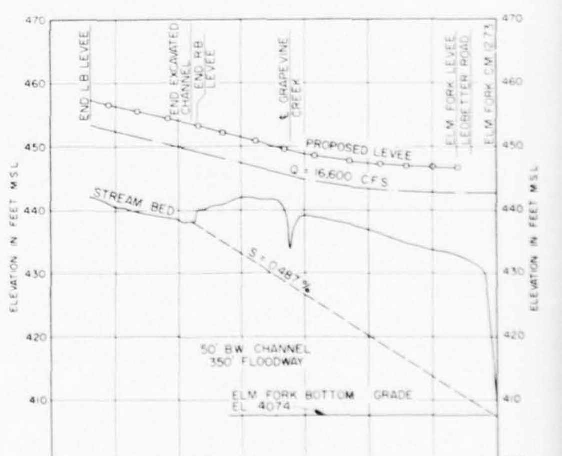
HACKBERRY CREEK DIVERSION (R.B.)



FARMERS BRANCH DIVERSION (L.B.)

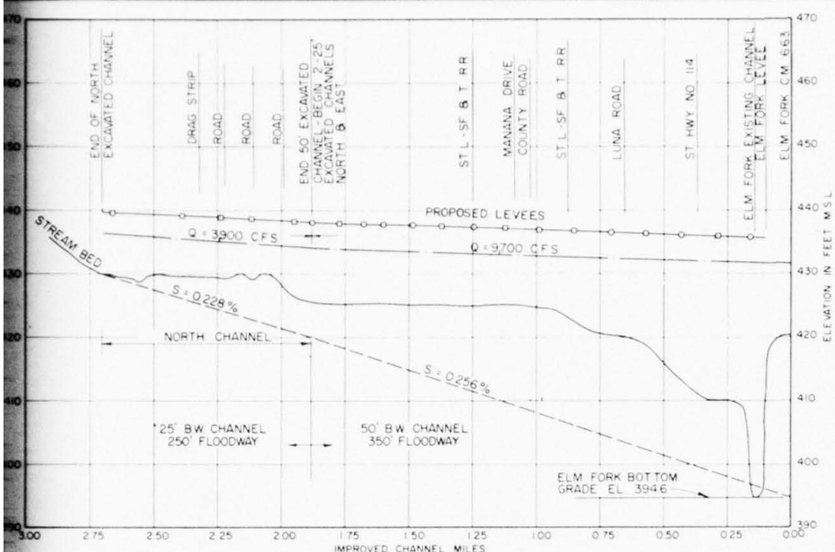


HUTTON BRANCH DIVERSION (L.B.)

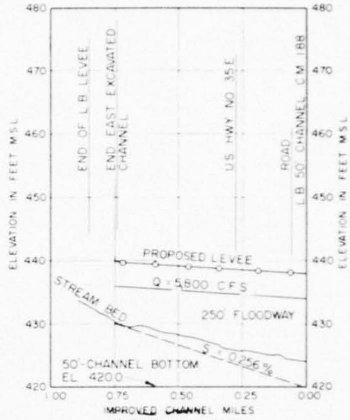


GRAPEVINE CREEK (R.B.)

U.S. ARMY

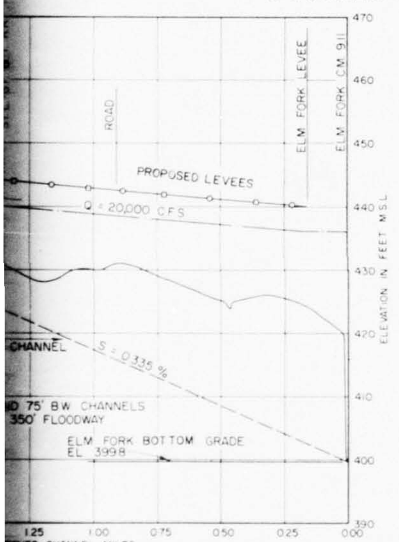


50' B.W. CHANNEL AND 25' B.W. NORTH CHANNEL

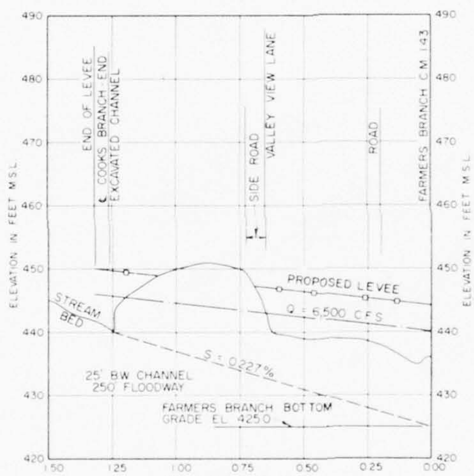


25' B.W. EAST CHANNEL

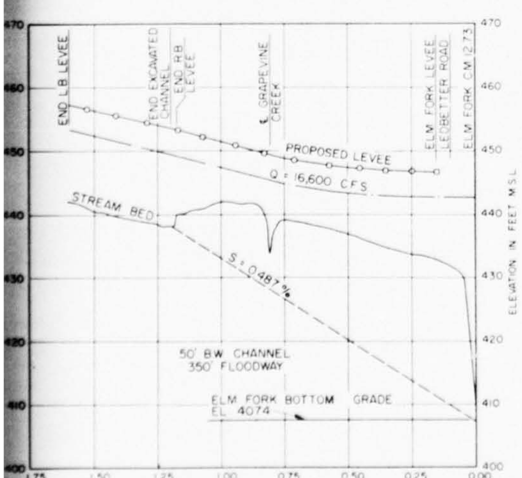
CALIFORNIA CROSSING DIVERSION CHANNEL L.B.



BRANCH DIVERSION (L.B)



COOKS BRANCH DIVERSION (R.B.)



GRAPEVINE CREEK (R.B.)

LEGEND

———	DESIGN WATER SURFACE
—o—	LEVEE, RIGHT BANK
—o—	LEVEE, LEFT BANK
———	CENTERLINE PROFILE
— — —	BOTTOM GRADE
....	FILL AREA, RIGHT BANK
BW	BOTTOM WIDTH
L.B.	LEFT BANK
RB	RIGHT BANK

NOTES

Floodway dimensions shown are minimum requirments measured from centerline of levees, or from centerline of levee to natural bank or fill area.
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Refer to plate 45 for boring legend.
Refer to plate 56 for typical channel and levee sections.

TRINITY RIVER AND TRIBUTARIES, TEXAS
ELM FORK AND TRIBUTARIES
FLOOD CONTROL CHANNELS AND FLOODWAYS

DETAILED PROFILES

IN 3 SHEETS — SCALES AS SHOWN — SHEET NO 3

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: C. J. Swenson, ENGINEER, CHIEF, ENGINEERING DIVISION
APPROVED: ... COL, CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: A. W. Hawley, ENGINEER, HEAD SPECIAL STUDIES SECTION
DRAWN BY: D.E.C.
CHECKED BY: A.W.L.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19

160. COST ESTIMATE.- A summary of first cost and annual charges for the Elm Fork Local Protection project is shown in table 49. The detailed estimate for the Elm Fork Local Protection project is shown in table 50. The estimate shows the separation of Federal and non-Federal costs. The cost of constructing the main item channel of the Elm Fork from Lewisville Dam downstream and on Denton Creek from Grapevine downstream is a Federal cost since it is essential for the proper functioning of these two reservoirs.

TABLE 49
SUMMARY OF FIRST COST AND ANNUAL CHARGES
ELM FORK FLOOD PROTECTION PROJECT
ELM FORK TRINITY RIVER

Item	Cost
First cost	
1. Federal first cost	
Lands and damages	600,000
Relocations and alterations	536,000
Main channel	3,163,000
Levees, sluices, sumps, and diversion channels	
a. Levees	1,332,000
b. Sluices	885,000
c. Sumps	2,416,000
d. Diversion channels	1,317,000
Engineering and design	367,000
Supervision and administration	575,000
Total estimated Federal first cost (1)	11,191,000
2. Non-Federal first cost	
Lands and damages	3,203,000
Relocations and alterations	2,211,000
Engineering and design	84,000
Supervision and administration	134,000
Total estimated non-Federal first cost	5,632,000
3. Total estimated first cost of project	16,823,000

TABLE 49 (CONT'D)
SUMMARY OF FIRST COST AND ANNUAL CHARGES
ELM FORK FLOOD PROTECTION PROJECT
ELM FORK TRINITY RIVER

Item	Cost
Annual charges (Construction period - 4 years)(100 yr. amortization) (2-7/8% Federal interest rate)(3% non-Federal interest rate)	
1. Federal investment	
a. Federal first cost	$11,191,000
b. Interest during construction	643,500
c. Total Federal investment	11,834,500
2. Non-Federal investment	
a. Non-Federal first cost	5,632,000
b. Interest during construction	337,900
c. Total non-Federal investment	5,969,900
3. Federal annual charges	
a. Interest on Federal investment	340,200
b. Amortization charge	21,200
c. Operation and maintenance	70,000
Total Federal annual charge	431,400
4. Non-Federal annual charges	
a. Interest on non-Federal investment	179,100
b. Amortization charge	9,900
c. Operation and maintenance	103,000
Total non-Federal annual charges	292,000
5. Total estimated annual charges	$ 723,400

(1) $50,000 preauthorization cost excluded

Prices are as of January 1962.

TABLE 50
DETAILED ESTIMATE OF FIRST COST
ELM FORK FLOOD PROTECTION PROJECT
ELM FORK TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
1. Federal first cost				
(01.0) Lands and damages				
a. Land costs				
(1) Fee lands	Acre		840	$ 420,0
(2) Clearing easement lands	Acre		129	29,0
(3) Severance damage	L.S.			19,1
Subtotal				468,1
Contingencies, 25% ±				118,3
b. Requisition expense				13,5
Total - Lands and damages				600,0
(02.0) Relocations and alterations				
a. Roads and railroads				
(1) Gravwyler Road	Mile	150,000.00	0.21	31,5
(2) Wildwood Drive, bridge	L.F.	175.00	50	8,7
(3) Trinity Mills Rd., bridge	L.F.	175.00	200	35,0
(4) Trestle - St.L.-S.W. R.R.	L.F.	140.00	900	126,0
(5) Trestle - St.L.-S.F.&T. R.R.	L.F.	130.00	350	45,5
(6) Trestle - spur - St.L.-S.F.&T. R.R.	L.F.	130.00	600	78,0
(7) Trestle - St.L.-S.F.&T. R.R.	L.F.	140.00	400	56,0
Subtotal - roads and railroads				380,7
b. Utilities and channel dam.				
(1) Lone Star Gas Co. - pipeline	Mile	100,000.00	0.1	10,0
(2) Power lines	Mile	10,000.00	0.2	2,0
(3) Remove and rebuild Frazier channel dam	L.S.			36,0
Subtotal - utilities and channel dam				48,0
Subtotal - relocations and alterations				428,7
Contingencies, 25%				107,2
Total - relocations and alterations				536,0
(09.0) Main channel				
(1) Care of water	L.S.			41,0
(2) Clearing (Including berms)	Acre	100.00	785	78,5
(3) Excavation, common	C.Y.	0.25	5,341,000	1,335,2
(4) Excavation, shale	C.Y.	0.75	1,335,500	1,001,6
(5) Slope protection	Acre	500.00	147	73,5
Subtotal - main channel				2,529,8
Contingencies, 25%				633,1
Total - main channel				3,163,0

TABLE 50 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
ELM FORK FLOOD PROTECTION PROJECT
ELM FORK TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(11.0) Levees, sluices, sumps, and diversion channels				
a. Levees				
(1) Clearing berms	Acre	100.00	840	$ 84,00
(2) Clearing and grubbing	Acre	150.00	438	65,70
(3) Excavation, stripping	C.Y.	0.25	686,500	171,62
(4) Compacted fill	C.Y.	0.07	7,492,000	524,44
(5) Slope protection	Acre	500.00	439	219,50
Subtotal - levees				1,065,26
b. Sluices				
(1) Care of water	L.S.			10,00
(2) Excavation, structural	C.Y.	1.50	55,000	82,50
(3) Excavation, channel	C.Y.	0.30	125,000	37,50
(4) Structural backfill	C.Y.	0.50	40,000	20,00
(5) Concrete (Incl. cement)	C.Y.	50.00	4,750	237,50
(6) Steel, reinforcing	Lb.	0.13	475,000	61,75
(7) Flapgates, 5'x5'	Ea.	1,250.00	17	21,25
(8) Flapgates, 6'x6'	Ea.	1,800.00	16	28,80
(9) Sluice gates, shafts, & stands, 5'x5'	Ea.	2,500.00	34	85,00
(10) Sluice gates, shafts, & stands, 6'x6'	Ea.	3,600.00	32	115,20
(11) Miscellaneous metals	Lb.	0.40	13,878	5,55
(12) Riprap	C.Y.	6.00	354	2,12
(13) Bedding	C.Y.	5.00	117	58
Subtotal - sluices				707,76
c. Sumps				
(1) Care of water	L.S.			10,00
(2) Clearing	Acre	100.00	357	35,70
(3) Excavation, common	C.Y.	0.25	7,547,000	1,886,75
Subtotal - sumps				1,932,4
d. Diversion channels				
(1) Care of water	L.S.			10,0
(2) Clearing	Acre	100.00	600	60,0
(3) Excavation, common	C.Y.	0.25	2,140,000	535,0
(4) Excavation, shale	C.Y.	0.75	535,000	401,2
(5) Slope protection	Acre	500.00	94	47,0
Subtotal - diversion channels				1,053,2
Subtotal - levees, sluices, sumps, and diversion channels				4,758,7
Contingencies, 25%				1,191,2
Total - levees, sluices, sumps, and diversion channels				5,950,0

TABLE 50 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
ELM FORK FLOOD PROTECTION PROJECT
ELM FORK TRINITY RIVER

Item	Unit	Unit cost	Quantity	Cost
(30.0) Engineering and design				$367,000
(31.0) Supervision and administration				575,000
Total - estimated Federal first cost (1)				11,191,000
2. Non-Federal first cost				
a. Land and damages				
(1) Fee simple lands	Acre		2,454	2,208,600
(2) Severance damage	L.S.			55,900
(3) Improvements	L.S.			255,000
Contingencies, 25%				644,000
Acquisition expense				39,500
Total - lands and damages				3,203,000
b. Relocations and alterations bridges, roads, and power lines				
Gravwyler Road, new street	Mile	150,000.00	0.09	13,500
Wildwood Dr., bridge	L.F.	175.00	750	131,250
California crossing, bridge	L.F.	175.00	1,250	218,750
State Hwy. 14, bridge	L.F.	250.00	1,600	400,000
Royal Lane, bridge	L.F.	175.00	1,150	201,250
Valley View Lane, bridge	L.F.	175.00	1,300	227,500
Belt Line Road, bridge	L.F.	175.00	1,100	192,500
Sandy Lake Road, bridge	L.F.	175.00	1,200	210,000
Ledbetter Road, new road	Mile	80,000.00	0.5	40,000
Ledbetter Road, bridge	L.F.	175.00	350	61,250
Luna Road, bridge	L.F.	175.00	400	70,000
Power lines	Mile	10,000.00	0.3	3,000
Subtotal - relocations and alterations				1,769,000
Contingencies, 25%				442,000
Total - relocations and alterations				2,211,000
c. Engineering and design				84,000
d. Supervision and administration				134,000
Total - estimated non-Federal first cost				5,632,000
3. Total - Estimated first cost of project				$16,823,000

(1) $50,000 preauthorization cost excluded.
Prices are as of January 1962.

161. EXTENSION OF DALLAS FLOODWAY.- An element of the multiple purpose channel and floodway for navigation and flood control in the Dallas area is the extension of the existing Dallas Floodway downstream to Five Mile Creek, including the lower end of White Rock Creek. The navigation features of the multiple purpose channel are covered in the first paragraph of the appendix. The flood control features of this project include the following items:

(a) Sufficient enlargement and realignment of the Trinity River in this area, from about river mile 496.3 downstream to river mile 487.7, to provide within-banks channel capacity of at least 27,000 cubic feet per second.

(b) The enlargement and realignment or diversion of about 10.5 miles of tributary channels through the leveed areas.

(c) The construction of a parallel levee system through the low areas consisting of about 10.2 miles of levee on the left bank, 14.6 miles of new levee and the rehabilitation of 0.6 mile of existing levee on the right bank of the proposed enlarged and realigned channel of the main stem and tributary channels. The plan provides for a dedicated floodway maintained free of encroachments. The floodway along the main stem would have a minimum width of 2,000 feet between centerline of levees and have sufficient capacity to contain the standard project flood which varies from about 163,000 cubic feet per second at Dallas to about 171,000 cubic feet per second in the lower reach just upstream from the mouth of Five Mile Creek. The levees would be constructed with 1 on 2.5 side slopes, with a 10-foot crown width and have 4 feet of freeboard above the design discharge water surface.

(d) The provision of appurtenant interior drainage facilities consisting of permanent sump areas to provide an aggregate storage capacity of 6,820 acre-feet below the damaging stage elevations of the various interior-drainage areas, gate controlled gravity sluices at various locations through the levee system, and low interior areas to be filled with excess material to raise damaging elevations.

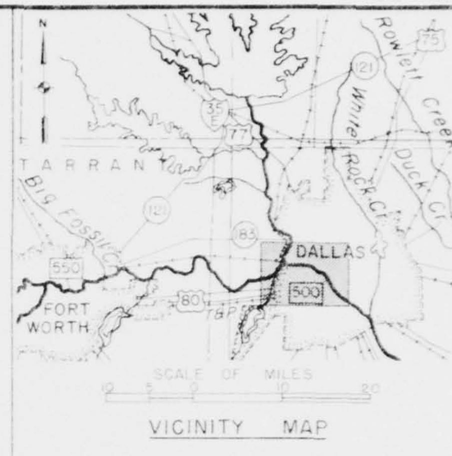
(e) The modification of 13 bridges in connection with the proposed improvements for the extension of the Dallas Floodway.

(f) The filling of one area outside the proposed leveed areas to elevations about 4 feet above the design water surface by utilizing the excess material from the channel excavation work.

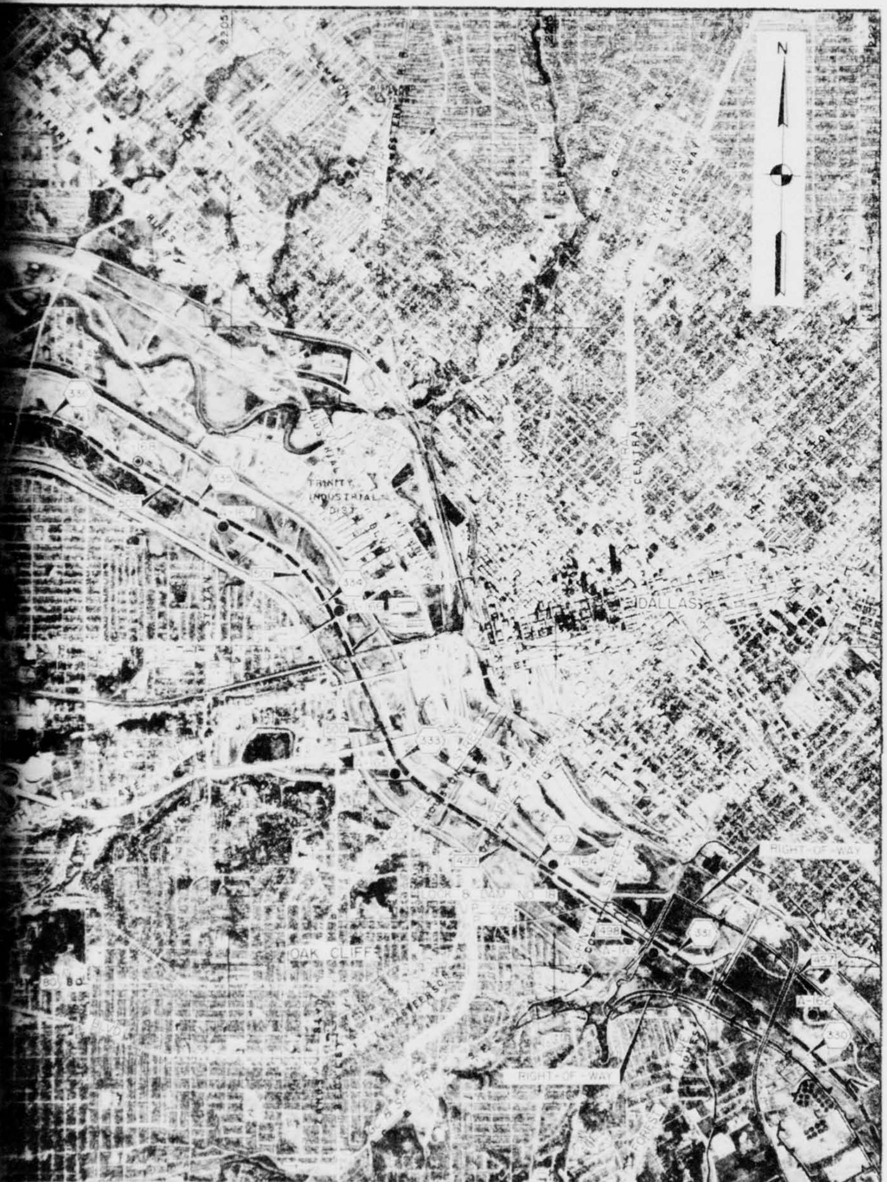
(g) The acquisition of rights-of-way consisting of about 4,030 acres of land in fee simple for the construction of the excavated channels, levees, floodway, and permanent sump area.

(h) The plan of improvement is shown on plates 54 and 56, and the detailed profiles are shown on plates 55 and 57.


BROOKHOLLOW
INDUSTRIAL
DIST.
STEMMONS EXP. (CONST.)
IRVING BLVD.
TRINITY
RIVER
EXISTING DALLAS FLOODWAY LEVEES
TRINITY
INDUSTRIAL
DIST.
RIGHT-OF-WAY
SINGLETON
BLVD.
WESTMORELAND
TOLL ROAD
SANTA FE
OAK CLIFF
425
415
395
2185
2195
339
338
340
341
506
505
504
503
507
508
335
334
352



VICINITY MAP



LEGEND

- NAVIGATION AND FLOOD CONTROL CHANNEL
- DESIGN WATER SURFACE
- HIGH WATER LINE (MAXIMUM OF RECORD)
- NAVIGATION LOCK AND DAM
- 64 RIVER MILEAGE
- 64 CHANNEL MILEAGE
- CORE BORINGS
- AUGER BORINGS
- FILL AREA
- SUMP AREA
- NEW EARTH LEVEES
- EXISTING LEVEES
- STRENGTHEN EXISTING LEVEES
- 80 FEDERAL HIGHWAY
- 121 STATE HIGHWAY
- 35E INTERSTATE HIGHWAY
- 157 FARM TO MARKET ROAD
- EXISTING BRIDGE
- COUNTY LINE
- GRAVITY FLOW DRAINAGE STRUCTURE

TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY
MULTIPLE PURPOSE CHANNEL

PLAN OF IMPROVEMENT

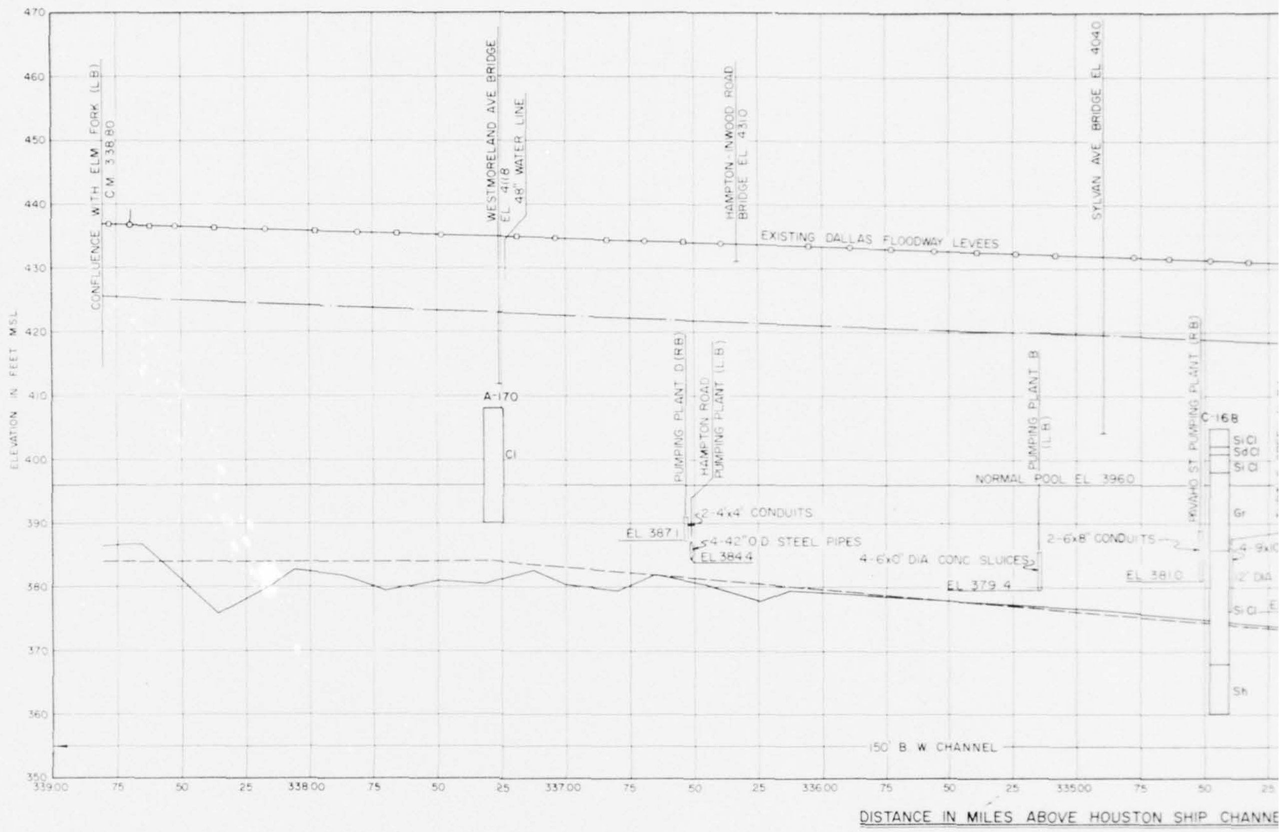
SCALE OF FEET
2000 0 2000 4000

U.S. ARMY ENGINEER DISTRICT, FORT WORTH JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER CHIEF, PLANNING & REPORTS BRANCH	ENGINEER CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER
PREPARED ENGINEER HEAD, SPECIAL STUDIES SECTION	DRAWN BY: [illegible] CHECKED BY: [illegible]	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER FILE: TRIN 230-19

2

CORPS OF ENGINEERS



U.S. ARMY

LEGEND

	DESIGN WATER SURFACE
	LEVEE, RIGHT BANK
	LEVEE, LEFT BANK
	CENTERLINE PROFILE
	BOTTOM GRADE
L.B.	LEFT BANK
B.W.	BOTTOM WIDTH
R.B.	RIGHT BANK

NOTES:
All channel side slopes are 1 vertical on 2 horizontal.
All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.
Pumping plants and drainage structures shown are those of the existing Dallas Floodway.
Refer to plate 45 for boring legend.

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
MULTIPLE PURPOSE CHANNEL

DETAILED PROFILE

DALLAS FLOODWAY

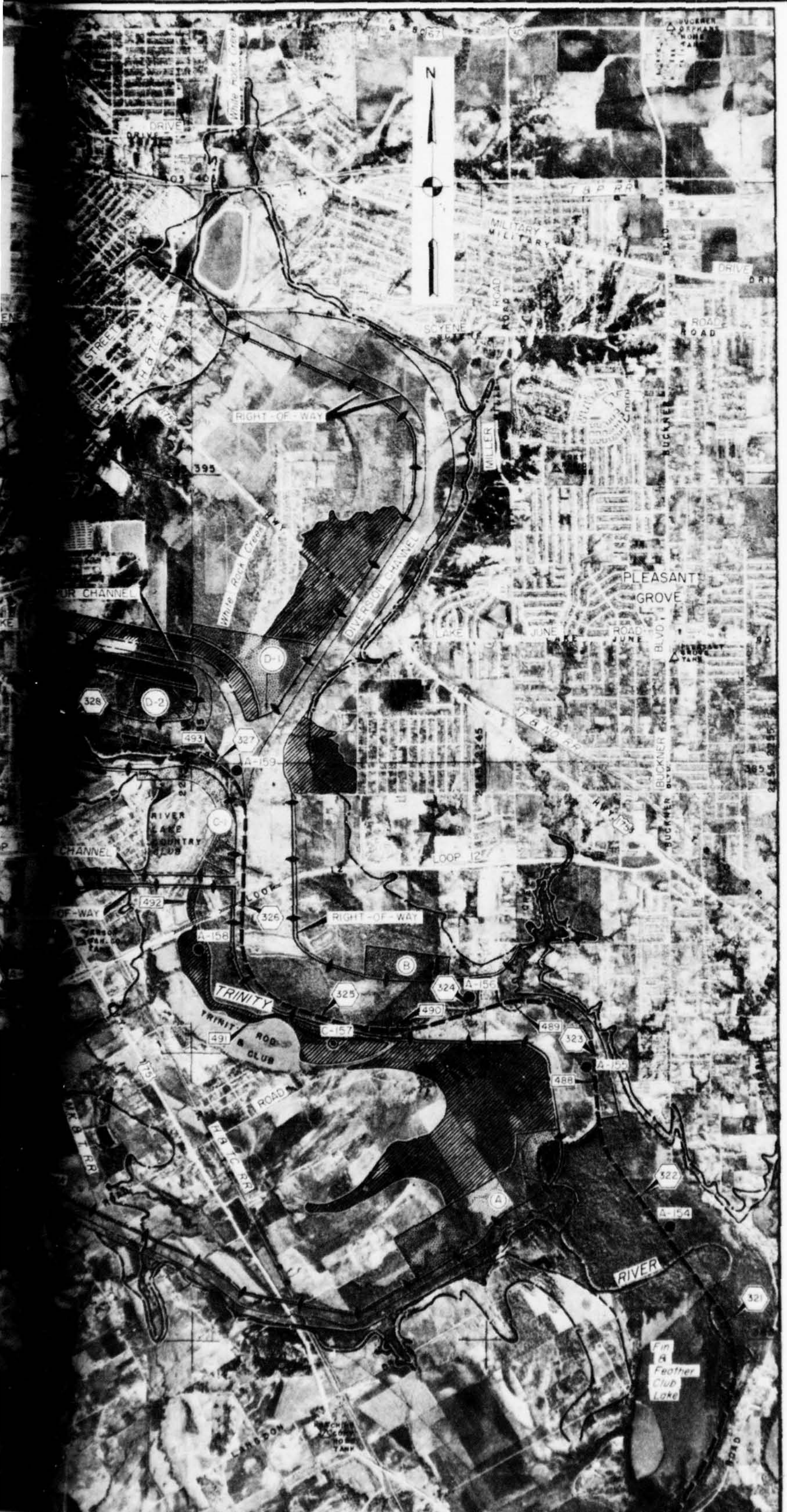
SCALES AS SHOWN

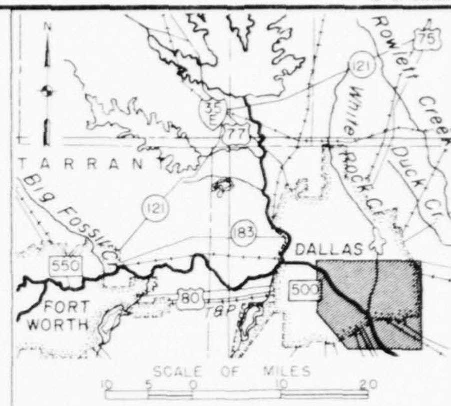
U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

SUBMITTED: H. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH
APPROVAL RECOMMENDED: C. J. Swanson, ENGINEER, CHIEF, ENGINEERING DIVISION
APPROVED: COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED: C. W. Hawley, ENGINEER, HEAD, SPECIAL STUDIES SECTION
DRAWN BY: D.E.C. CHECKED BY: J.H.L.
TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
FILE TRIN 230-19

TYPICAL CHANNEL & LEVEE SECTION

NOT TO SCALE





VICINITY MAP

DRAINAGE AREA AND SUMP	DRAINAGE AREA		SLUICES			SUMPS			
	ACRES	SQ.MI.	NO. REQ'D	SIZE	INVERT EL.	DAMAGING STAGE EL.	BOTTOM EL.	CAP. AT DAMAGING STAGE EL. AC-FT	DESIGN FLOOD WATER SURFACE EL.
A	5,114	7.99	5	6' X 6'	375	385	374	2,250	385.0
B	1,376	2.15	3	5' X 5'	375	385	374	620	384.5
C-1	2,411	3.77	4	5' X 5'	375	390	374	1,100	389.0
C-2	535	0.84	1	4' X 4'	375	400	374	250	393.2
D-1	3,736	5.84	3	5' X 5'	375	390	374	1,800	389.7
D-2	1,634	2.55	1	5' X 5'	375	390	374	800	388.0

LEGEND

- NAVIGATION AND FLOOD CONTROL CHANNEL
- DESIGN WATER SURFACE
- HIGH WATER LINE (MAXIMUM OF RECORD)
- NAVIGATION LOCK AND DAM
- RIVER MILEAGE
- CHANNEL MILEAGE
- CORE BORINGS
- AUGER BORINGS
- FILL AREA
- SUMP AREA
- NEW EARTH LEVEES
- EXISTING LEVEES
- STRENGTHEN EXISTING LEVEES
- FEDERAL HIGHWAY
- STATE HIGHWAY
- INTERSTATE HIGHWAY
- FARM TO MARKET ROAD
- EXISTING BRIDGE
- COUNTY LINE
- GRAVITY FLOW DRAINAGE STRUCTURE

TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
MULTIPLE PURPOSE CHANNEL

PLAN OF IMPROVEMENT

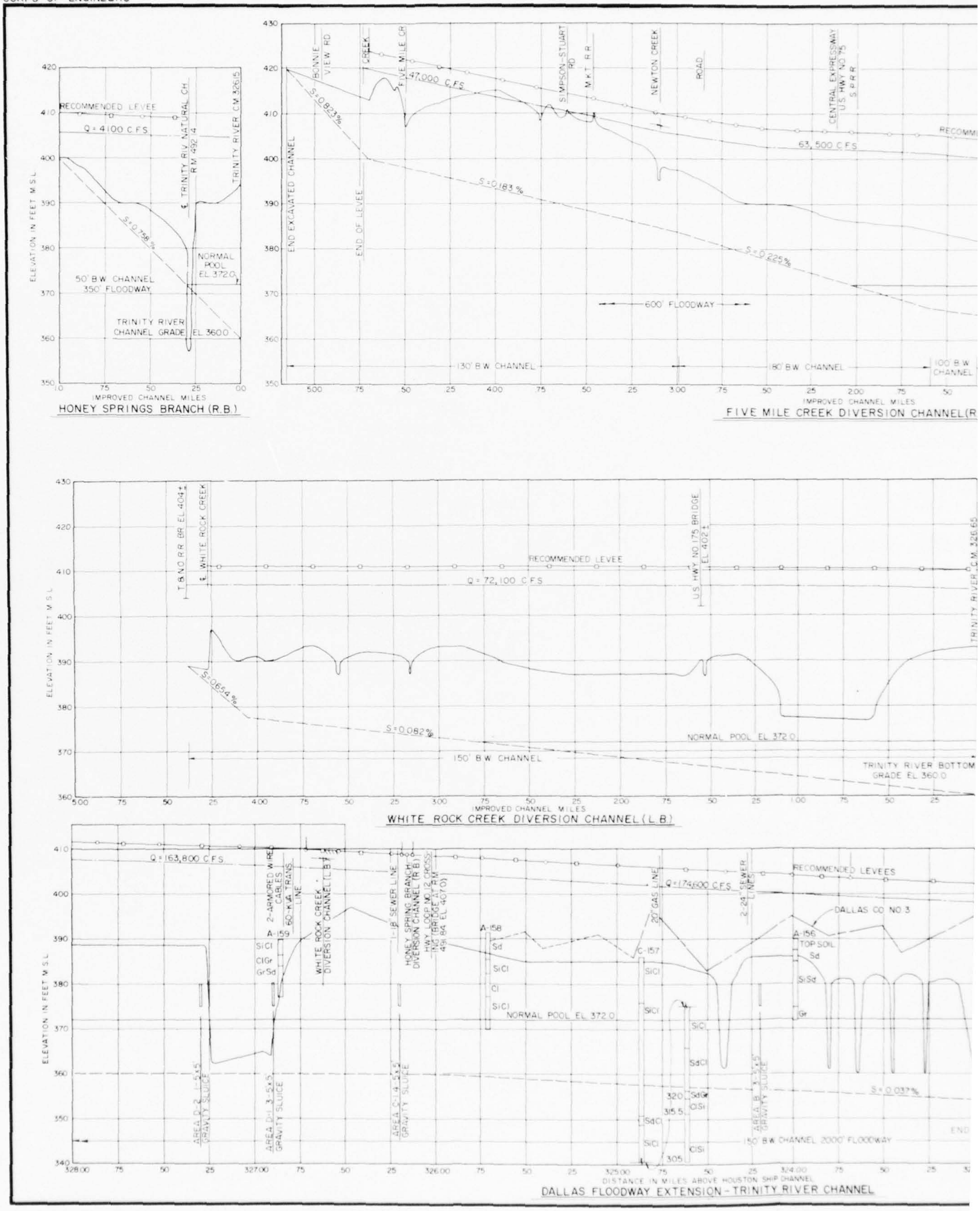
SCALE OF FEET
2000 0 2000 4000

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

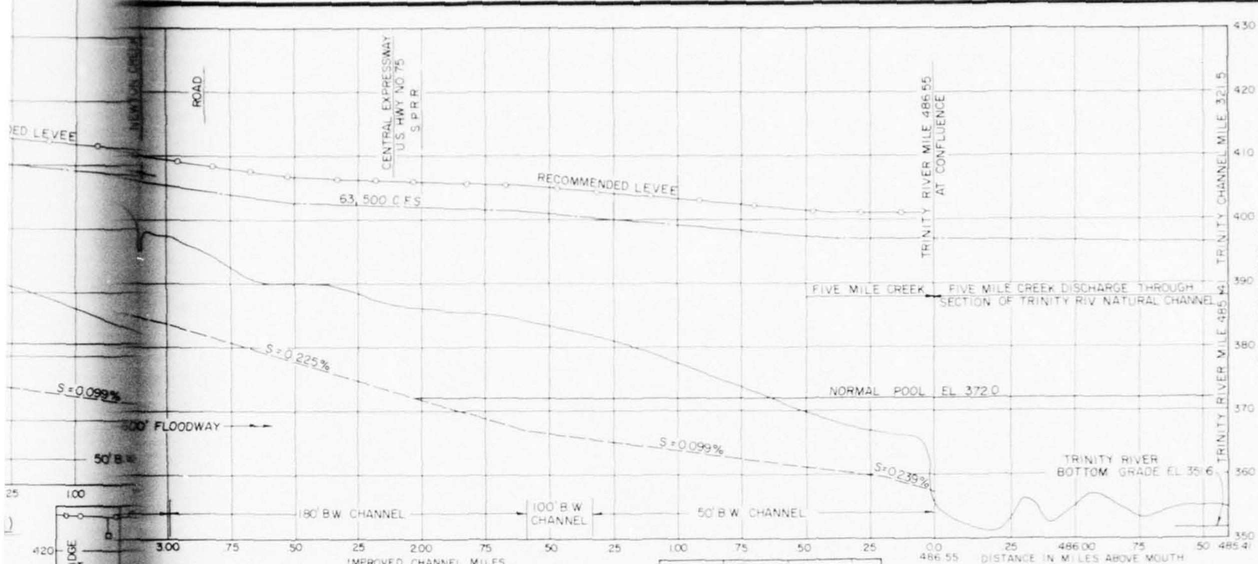
SUBMITTED	APPROVAL RECOMMENDED	APPROVED
ENGINEER	ENGINEER	
CHIEF, PLANNING & REPORTS BRANCH	CHIEF, ENGINEERING DIVISION	DISTRICT ENGINEER

PREPARED	DRAWN BY: D.E.C.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER
ENGINEER, HEAD, SPECIAL STUDIES SECTION	CHECKED BY: J.H.L.	FILE TRIN 230-19

CORPS OF ENGINEERS

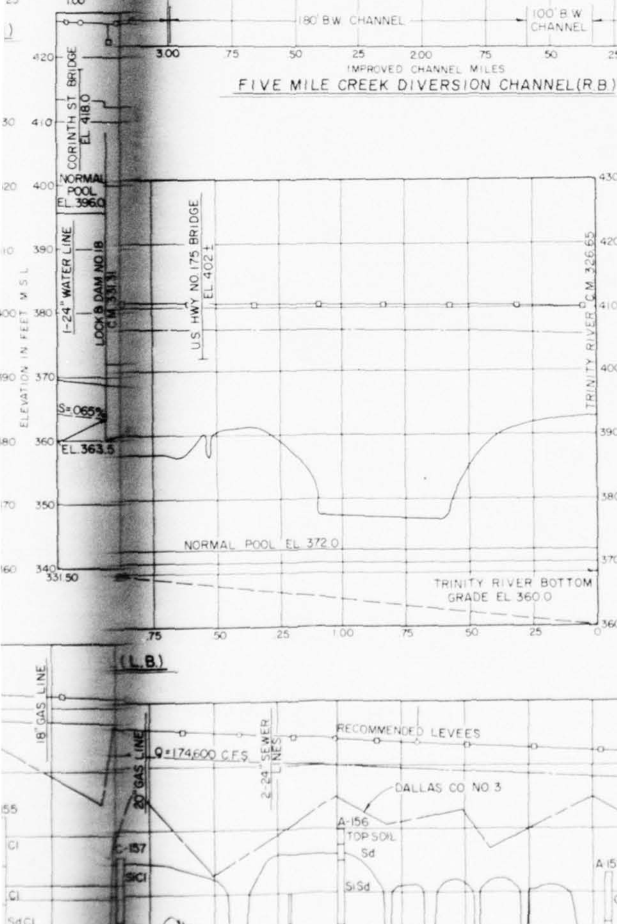


U.S. AR

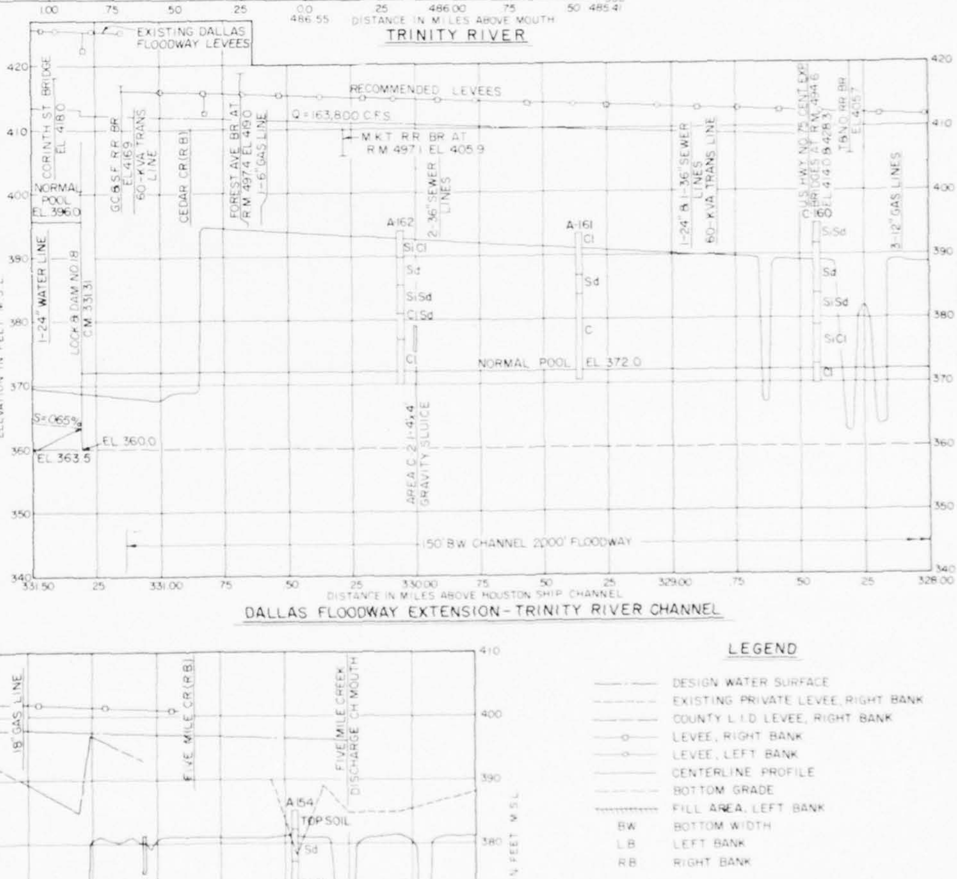


FIVE MILE CREEK DIVERSION CHANNEL (R.B.)

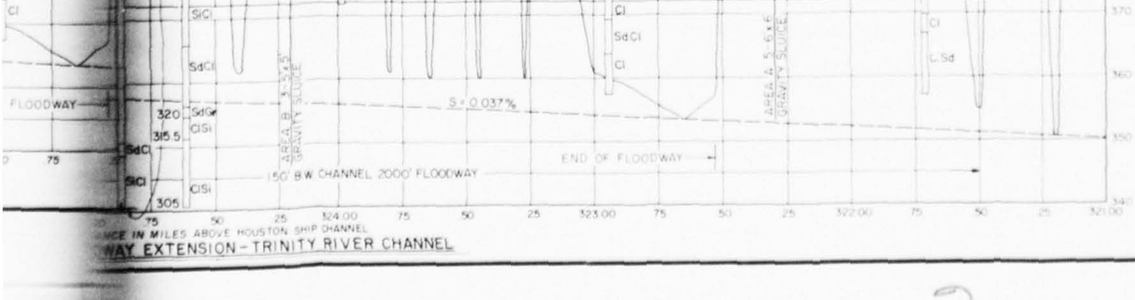
TRINITY RIVER



(L.B.)



DALLAS FLOODWAY EXTENSION - TRINITY RIVER CHANNEL



...WAY EXTENSION - TRINITY RIVER CHANNEL

NOTES:

Floodway dimensions shown are minimum requirements measured from centerline of levees, or from centerline of levee to natural bank.

All channel side slopes are 1 vertical on 2 horizontal, except those for Five Mile Creek, which are 1 vertical on 2½ horizontal. Levee side slopes are 1 vertical on 2½ horizontal.

All bridges shown are existing structures. Elevations of bridges refer to existing low steel elevations.

Refer to plate 45 for boring legend.

Refer to plate 56 for typical channel and levee sections.

LEGEND

	DESIGN WATER SURFACE
	EXISTING PRIVATE LEVEE, RIGHT BANK
	COUNTY L.I.D. LEVEE, RIGHT BANK
	LEVEE, RIGHT BANK
	LEVEE, LEFT BANK
	CENTERLINE PROFILE
	BOTTOM GRADE
	FILL AREA, LEFT BANK
BW	BOTTOM WIDTH
LB	LEFT BANK
RB	RIGHT BANK

TRINITY RIVER AND TRIBUTARIES, TEXAS

TRINITY RIVER

MULTIPLE PURPOSE CHANNEL

DETAILED PROFILES

DALLAS FLOODWAY EXTENSION

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH JUNE

TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER

FILE TRIN 230-19

2

162. COST ESTIMATE.- A summary of first cost and annual charges for th Dallas Floodway Extension project is shown in table 51. The detailed cost estimate for the Dallas Floodway Extension project is shown in table 52. The estimate shows the separation of Federal and non-Federal costs and does not include the flood-control portion of the multiple purpose channel.

TABLE 51
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
DALLAS FLOODWAY EXTENSION FLOOD PROTECTION PROJECT
TRINITY RIVER

Item	Cost
First cost	
1. Federal first cost	
Railroad alterations (On diversion channels)	$ 195,000
Levees, sluices, sumps, and diversion channels	
a. Levees	1,137,000
b. Sluices	645,000
c. Sumps	3,511,000
d. Diversion channels	2,665,000
Engineering and design	310,000
Supervision and administration	486,000
Total estimated Federal first cost (1)	8,949,000
2. Non-Federal first cost	
Lands and damages	4,000,000
Relocations and alterations	1,256,000
Engineering and design	48,000
Supervision and administration	74,000
Total estimated non-Federal first cost	5,378,000
3. Total estimated first cost of project	$14,327,000

TABLE 51 (CONT'D)
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
DALLAS FLOODWAY EXTENSION FLOOD PROTECTION PROJECT
TRINITY RIVER

Item	Cost
Annual charges	
(Construction period - 4 years)(100 yr. amortization) (2-7/8% Federal interest rate)(3% non-Federal interest rate)	
1. Federal investment	
a. Federal first cost	$8,949,000
b. Interest during construction	514,600
c. Total Federal investment	9,463,600
2. Non-Federal investment	
a. Non-Federal first cost	5,378,000
b. Interest during construction	322,700
c. Total non-Federal investment	5,700,700
3. Federal annual charges	
a. Interest on Federal investment	272,100
b. Amortization charge	16,900
c. Operation and maintenance	-
Total Federal annual charges	289,000
4. Non-Federal annual charges	
a. Interest on non-Federal investment	171,000
b. Amortization on charge	9,400
c. Operation and maintenance	135,500
Total non-Federal annual charges	315,900
5. Total estimated annual charges	604,900

(1) $30,000 preauthorization cost excluded.

Prices are as of January 1962.

TABLE 52
DETAILED ESTIMATE OF FIRST COST
DALLAS FLOODWAY EXTENSION FLOOD PROTECTION PROJECT
TRINITY RIVER

Item	Unit	Unit cost	Quantity	C
1. Federal first cost				
(02.0) Railroad alterations				
(1) M.K.T.-R.R., trestle	L.F.	$130.00	1,000	$ 1
(2) S.P.-R.R., trestle	L.F.	130.00	200	
Subtotal-railroad alterations				1
Contingencies, 25%				
Total - railroad alterations				1
(11.0) Levees, sluices, sumps, and diversion channels				
a. Levees				
(1) Clearing main stem berms	Acre	100.00	1,500	1
(2) Clearing and grubbing	Acre	150.00	378	
(3) Excavation, stripping	C.Y.	0.25	511,000	1
(4) Compacted fill	C.Y.	0.07	5,805,000	4
(5) Slope protection	Acre	500.00	338	1
Subtotal - levees				9
b. Sluices				
(1) Care of water	L.S.			
(2) Excavation, structural	C.Y.	1.50	37,000	
(3) Excavation, discharge channels	C.Y.	0.30	424,000	1
(4) Structural backfill	C.Y.	0.50	31,000	
(5) Concrete (Incl. cement)	C.Y.	50.00	2,960	1
(6) Steel, reinforcing	Lb.	0.13	296,000	
(7) Flap gates, 4'x4'	Ea.	800.00	1	
(8) Flap gates, 5'x5'	Ea.	1,250.00	11	
(9) Flap gates, 6'x6'	Ea.	1,800.00	5	
(10) Sluice gates, shafts & stands-4'x4'	Ea.	1,600.00	2	
(11) Sluice gates, shafts & stands-5'x5'	Ea.	2,500.00	22	
(12) Sluice gates, shafts & stands-6'x6'	Ea.	3,600.00	10	
(13) Miscellaneous metals	Lb.	0.40	5,300	
(14) Riprap	C.Y.	6.00	170	
(15) Bedding	C.Y.	5.00	70	
Subtotal - sluices				[illegible]

TABLE 52 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
DALLAS FLOODWAY EXTENSION FLOOD PROTECTION PROJECT
TRINITY RIVER

Item	Unit	Unit cost	Quantity	
c. Sumps				
(1) Care of water	L.S.			
(2) Clearing	Acre	100.00	489	
(3) Excavation, common	C.Y.	0.25	11,010,000	2
Subtotal - sumps				2
d. Diversion channels				
(1) Care of water	L.S.			
(2) Clearing	Acre	100.00	345	
(3) Excavation, common	C.Y.	0.25	4,030,000	1
(4) Excavation, shale	C.Y.	0.75	1,345,000	1
(5) Slope protection	Acre	500.00	149	
Subtotal-diversion channels				2
Subtotal-levees, sluices, sumps and diversion channels				6
Contingencies, 25% ±				1
Total-levees, sluices, sumps and diversion channels				7
(30.0) Engineering and design				
(31.0) Supervision and administration				
Subtotal-estimated Federal first cost (1)				8
2. Non-Federal first cost				
a. Lands and damages				
(1) Fee simple lands and improvements	Acre		4,032	3
Contingencies, 25% ±				
Subtotal-lands and damages				3
(2) Acquisition expense				
Total-lands and damages				4

TABLE 52 (CONT'D)
DETAILED ESTIMATE OF FIRST COST
DALLAS FLOODWAY EXTENSION FLOOD PROTECTION PROJECT
TRINITY RIVER

	Item	Unit	Unit cost	Quantity	Cost
b.	Relocations and alterations				
	Bridges				
	Simpson-Stuart Rd. bridge	L.F.	175.00	600	$ 105,000
	Interstate Hwy #45, bridge	L.F.	500.00	800	400,000
	U.S. Hwy #75, bridge	L.F.	500.00	1,000	500,000
	Subtotal - bridges				1,005,000
	Contingencies, 25%				251,000
	Total - relocations and alterations				1,256,000
c.	Engineering and design				48,000
d.	Supervision and administration				74,000
	Total estimated non-Federal first cost				5,378,000
3.	Total estimated first cost of project				14,327,000

(1) $30,000 preauthorization cost excluded.

Prices are as of January 1962.

163. DUCK CREEK.- The plan of improvement for Duck Creek consists of a channel improvement project along the main channel in the vicinity of Garland, Texas, from river mile 10.38 upstream to river mile 17.53 as shown on plate 58 and the detailed profile, plate 59. The project includes the following principal features:

(1) The realignment and enlargement of 6.6 miles of Duck Creek channel including 0.58 mile of concrete gravity wall section, to provide sufficient within-banks capacity to contain the standard project flood which varies from about 21,500 cubic feet per second at the upstream end near Buckingham Road to 40,700 cubic feet per second at the downstream end near Oates Drive.

(2) The modification of 10 bridges.

(3) The acquisition of rights-of-way for the construction of the excavated channel and for disposal of excess material.

164. COST ESTIMATES.- A summary of first cost and annual charges for the Duck Creek Local Protection project is shown in table 53. The detailed estimate for the project is shown in table 54. The estimate shows the separation of Federal and non-Federal costs as generally specified for such projects.

TABLE 53
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
LOCAL FLOOD PROTECTION PROJECT - GARLAND, TEXAS
DUCK CREEK

Item	Cost
First cost	
1. Federal first cost	
Railroad alterations	$ 236,000
Channel	3,568,000
Engineering and design	145,000
Supervision and administration	227,000
Total - estimated Federal first cost (1)	4,176,000
2. Non-Federal first cost	
Lands and damages	443,000
Relocations and alterations	369,000
Engineering and design	14,000
Supervision and administration	22,000
Total - estimated non-Federal first cost	848,000
3. Total estimated first cost of project	$5,024,000

TABLE 53 (CONT'D)
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
LOCAL FLOOD PROTECTION PROJECT - GARLAND, TEXAS
DUCK CREEK

Item	Cost
Annual charges (Construction period - 2 years) (100 yr. amortization) (2-7/8% Federal interest rate) (3% non-Federal interest rate)	
1. Federal investment	
a. Federal first cost	$4,176,000
b. Interest during construction	None
c. Total - Federal investment	4,176,000
2. Non-Federal investment	
a. Non-Federal first cost	848,000
b. Interest during construction	None
c. Total - non-Federal investment	848,000
3. Federal annual charges	
a. Interest on Federal investment	120,100
b. Amortization charge	7,500
c. Operation and maintenance	None
Total - Federal annual charge	127,600
4. Non-Federal annual charges	
a. Interest on non-Federal investment	25,400
b. Amortization charge	1,400
c. Operation and maintenance	6,000
Total - non-Federal annual charges	32,800
5. Total - Estimated annual charges	$ 160,400

(1) $10,000 preauthorization cost excluded

Prices are as of January 1962.

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TABLE 54
DETAILED ESTIMATE OF FIRST COST
LOCAL FLOOD PROTECTION PROJECT - GARLAND, TEXAS
DUCK CREEK

Item	Unit	Unit cost	Quantity	Cost
1. Federal first cost				
(02.0) Railroad alterations				
(1) GC&SF RR	L.F.	$350.00	240	$ 84,000
(2) MKT RR	L.F.	350.00	300	105,000
Subtotal-railroad alterations				189,000
Contingencies, 25% ±				47,000
Total - railroad alterations				236,000
(09.0) Channel				
(1) Care of water	L.S.			30,000
(2) Clearing	Acre	150.00	185	27,750
(3) Excavation, common	C.Y.	0.50	868,000	434,000
(4) Excavation, rock	C.Y.	2.25	790,000	1,777,500
(5) Drilling & grouting anchor holes	L.F.	1.60	10,200	16,320
(6) Line drilling	S.F.	1.25	66,300	82,875
(7) Concrete	C.Y.	35.00	9,170	320,950
(8) Cement	Bbl.	5.00	11,460	57,300
(9) Steel, reinforcing	Lb.	0.13	755,000	98,150
(10) Slope protection	Acre	300.00	33	9,900
Subtotal - channel				2,854,745
Contingencies, 25% ±				713,255
Total - channel				3,568,000
(30.0) Engineering and design				145,000
(31.0) Supervision and administration				227,000
Subtotal - estimated Federal first cost				4,176,000
2. Non-Federal first cost				
a. Lands and damages				
(1) Fee simple lands and improvements	Acres		190	350,600
Subtotal - lands and damages				350,600
Contingencies, 25% ±				87,700
(2) Acquisition expense				4,700
Total - lands and damages				443,000

TABLE 54 (Cont'd)
DETAILED ESTIMATE OF FIRST COST
LOCAL FLOOD PROTECTION PROJECT - GARLAND, TEXAS
DUCK CREEK

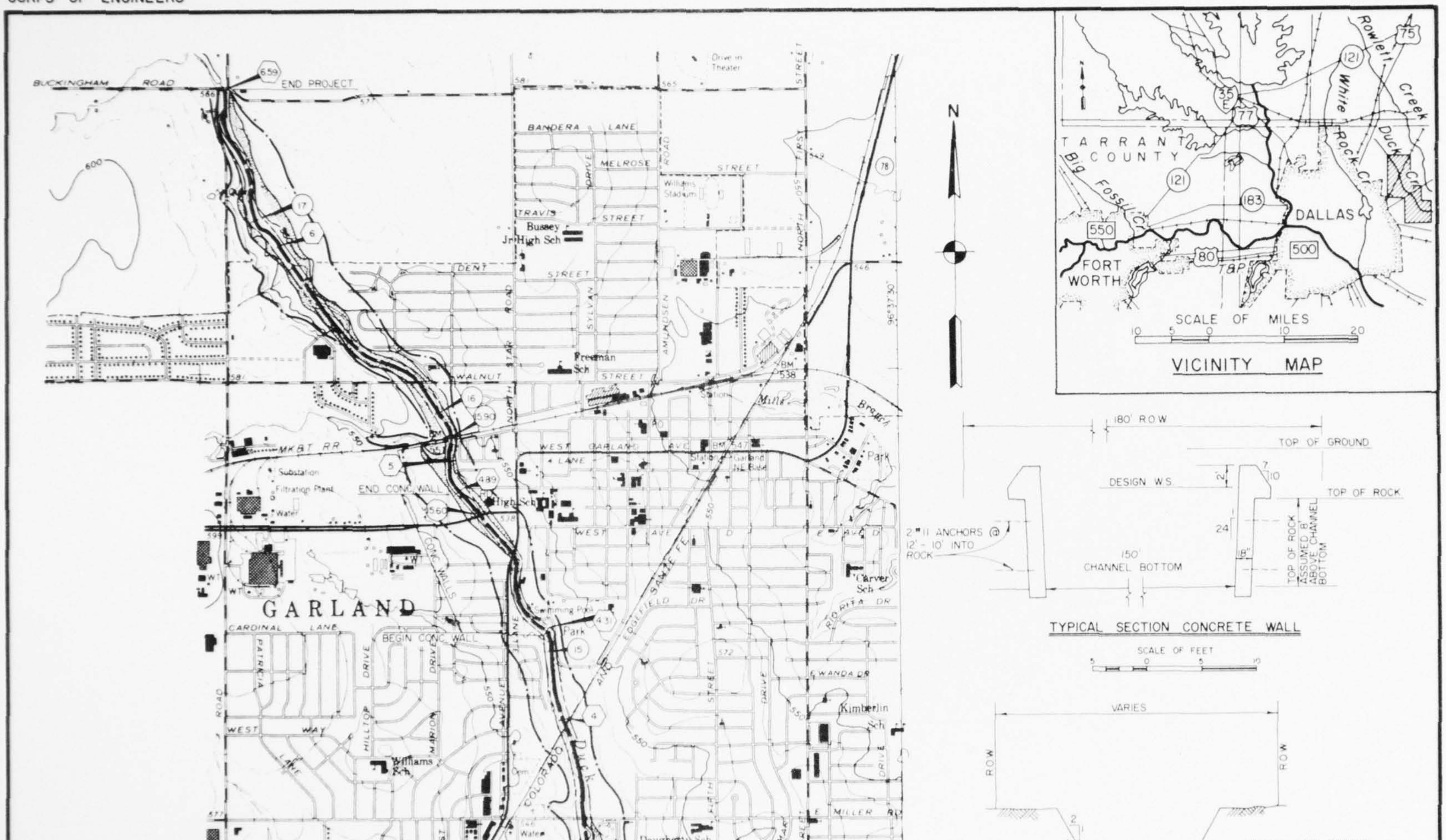
Item	Unit	Unit cost	Quantity	Cost
b. Relocations and alterations				
Bridges and utilities				
(1) Centerville Rd, bridge	L.F.	$200.00	$ 210	$ 42,000
(2) Kingsley Rd, bridge	L.F.	200.00	200	40,000
(3) Briarwood Dr, bridge	L.F.	175.00	210	36,750
(4) Miller Rd, bridge	L.F.	200.00	145	29,000
(5) Park Ave, bridge	L.F.	300.00	80	24,000
(6) Garland Rd, bridge	L.F.	200.00	210	42,000
(7) Forest Lane, bridge	L.F.	350.00	75	26,250
(8) Walnut St, bridge	L.F.	200.00	130	26,000
(9) Telephone cable	L.F.	32.00	250	8,000
(10) Rearrange sewer laterals	L.S.			21,000
Subtotal -				295,000
Contingencies, 25% ±				74,000
Total - relocations and alterations				369,000
c. Engineering and design				14,000
d. Supervision and administration				22,000
Subtotal - estimated non-Federal first cost				848,000
3. Total - Estimated first cost of project				$5,024,000

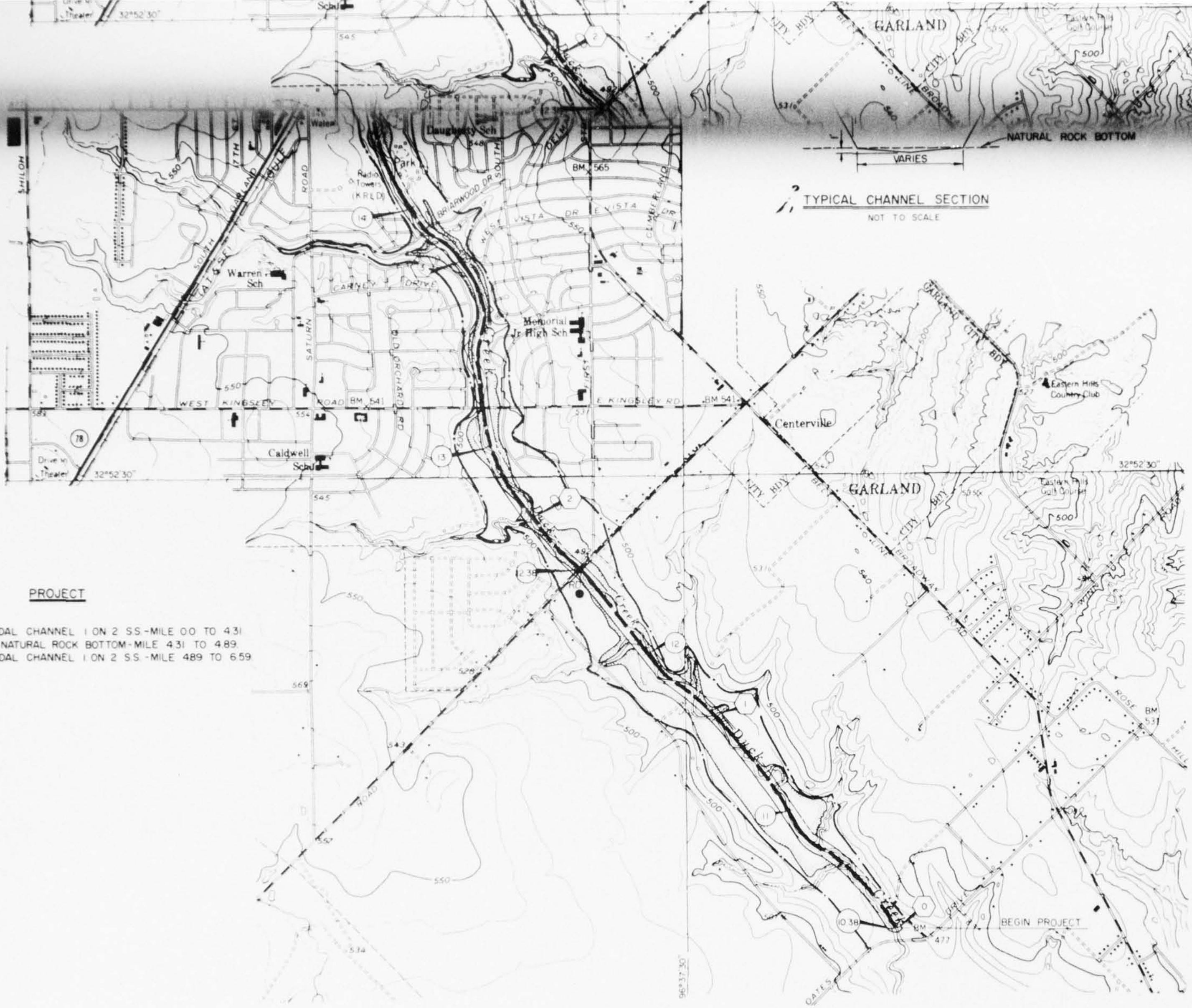
Note: Unit prices for excavation sufficient for disposal of excavated material and placement of all riprap required. It is proposed to supply riprap from rock excavation.

Prices are as of January 1962

CORPS OF ENGINEERS

U.S. ARMY





PROJECT

150' BOTTOM WIDTH TRAPEZOIDAL CHANNEL 1 ON 2 S.S.-MILE 0.0 TO 4.31
150' CONCRETE WALL SECTION NATURAL ROCK BOTTOM-MILE 4.31 TO 4.89
135' BOTTOM WIDTH TRAPEZOIDAL CHANNEL 1 ON 2 S.S.-MILE 4.89 TO 6.59

LEGEND

- FLOOD CONTROL CHANNEL
- DISPOSAL AREA (2' ABOVE DESIGN WATER SURFACE)
- RIGHT-OF-WAY
- CREEK MILEAGE (15)
- CHANNEL MILEAGE (4)
- MAXIMUM FLOOD OF RECORD

NOTE:
Refer to Plate 45 for Boring Legend

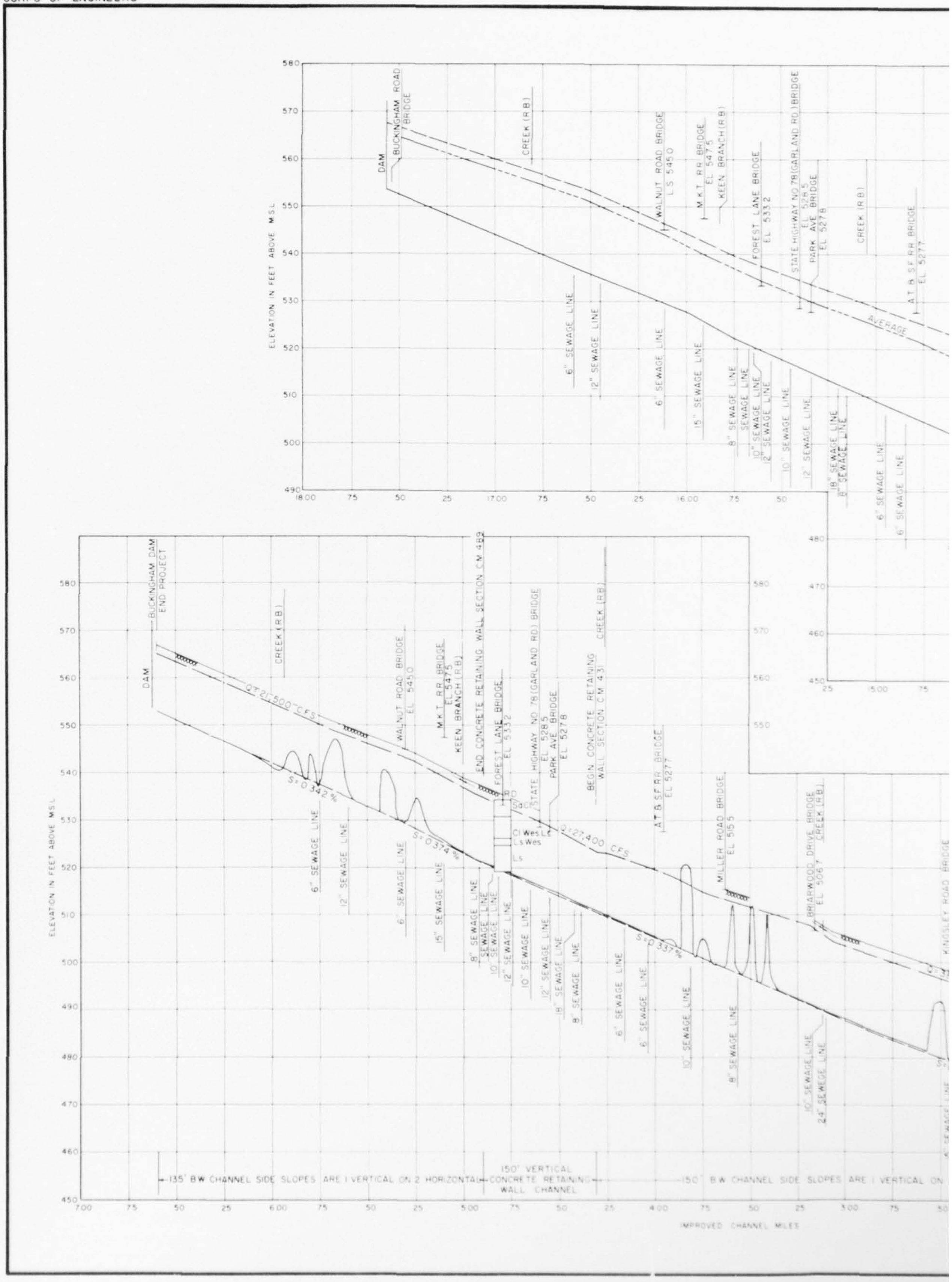
TRINITY RIVER AND TRIBUTARIES, TEXAS
DUCK CREEK

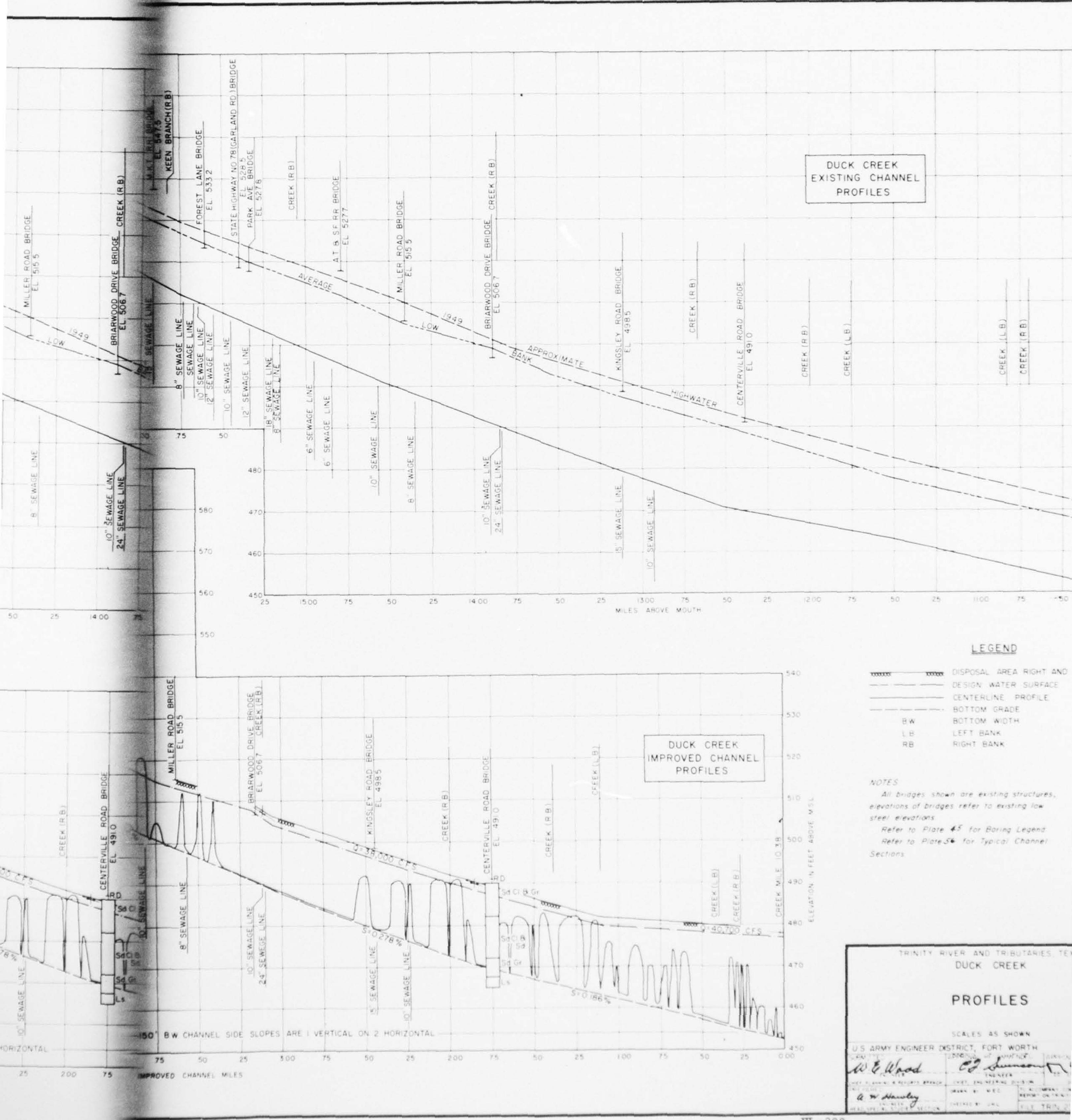
PLAN OF IMPROVEMENT

SCALE OF FEET
1000 0 1000 2000

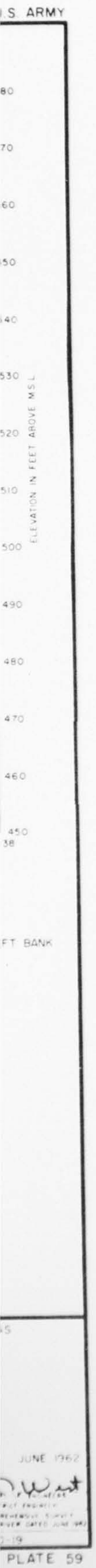
U.S. ARMY ENGINEER DISTRICT, FORT WORTH		JUNE 1962
SUBMITTED W. E. Wood, ENGINEER, CHIEF, PLANNING & REPORTS BRANCH	APPROVAL RECOMMENDED C. J. Swanson, ENGINEER, CHIEF, ENGINEERING DIVISION	APPROVED R. S. West, COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
PREPARED R. W. Hawley, ENGINEER, HEAD, SPECIAL STUDIES SECTION	DRAWN BY: D.E.C. CHECKED BY: J.H.L.	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER DATED JUNE 1962 FILE TRIN 230-19

CORPS OF ENGINEERS





DUCK CREEK
EXISTING CHANNEL
PROFILES
DUCK CREEK
IMPROVED CHANNEL
PROFILES
MILES ABOVE MOUTH
IMPROVED CHANNEL MILES
ELEVATION IN FEET ABOVE MSL
150' B.W. CHANNEL SIDE SLOPES ARE 1 VERTICAL ON 2 HORIZONTAL
Q=38,000 CFS
Q=40,700 CFS
S=0.278%
S=0.186%
LEGEND
DISPOSAL AREA RIGHT AND L
DESIGN WATER SURFACE
CENTERLINE PROFILE
BOTTOM GRADE
B.W. BOTTOM WIDTH
L.B. LEFT BANK
RB RIGHT BANK
NOTES
All bridges shown are existing structures, elevations of bridges refer to existing low steel elevations.
Refer to Plate 45 for Boring Legend.
Refer to Plate 56 for Typical Channel Sections.
TRINITY RIVER AND TRIBUTARIES, TE
DUCK CREEK
PROFILES
SCALES AS SHOWN
U.S. ARMY ENGINEER DISTRICT, FORT WORTH



165. LIBERTY.- The plan of improvement in the vicinity of Liberty consists of levees with appurtenant interior drainage facilities extending along the left bank of the Trinity River as shown on plate 60. The water surface and levee profiles are show on plate 61. The project includes the following principal featur

(1) Enlargement and realignment of the Trinity River t provide within-banks channel capacity of 45,000 cubic feet per se for the multiple purpose channel project.

(2) Construction of about 53,500 feet of levee of whic approximately 31,400 feet would be constructed by controlled spoi of material hydraulically dredged from the multiple purpose chann The levees constructed with land based equipment would have side slopes of 1 vertical on 3 horizontal and a minimum crown width of 10 feet. The hydraulically constructed levees would have side sl varying from 1 vertical on 20 horizontal to 1 vertical on 3 horiz depending upon the natural repose of the hydraulically placed mat and a minimum crown width of 20 feet. All levees would have a minimum of 4 feet of freeboard above the design discharge water s

(3) The provision of appurtenant interior drainage facilities consisting of permanent sump areas, gated gravity drai and two pump stations having capacities of 40,000 and 150,000 gallons per minute for the Big Bayou (north) and Clayton Bayou (south) drainage areas, respectively.

166. COST ESTIMATE.- The cost estimate for the Liberty Loca Protection project is shown in table 55. The following tabulatic does not include costs for spoil embankment rights-of-way or cost of placing spoil in spoil embankments. These costs were included in costs for the multiple purpose channel. Costs of clearing and grubbing the spoil embankment areas and final shaping of embankme are included in the costs for the local protection project.

TABLE 55
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
FLOOD PROTECTION
LIBERTY, TEXAS

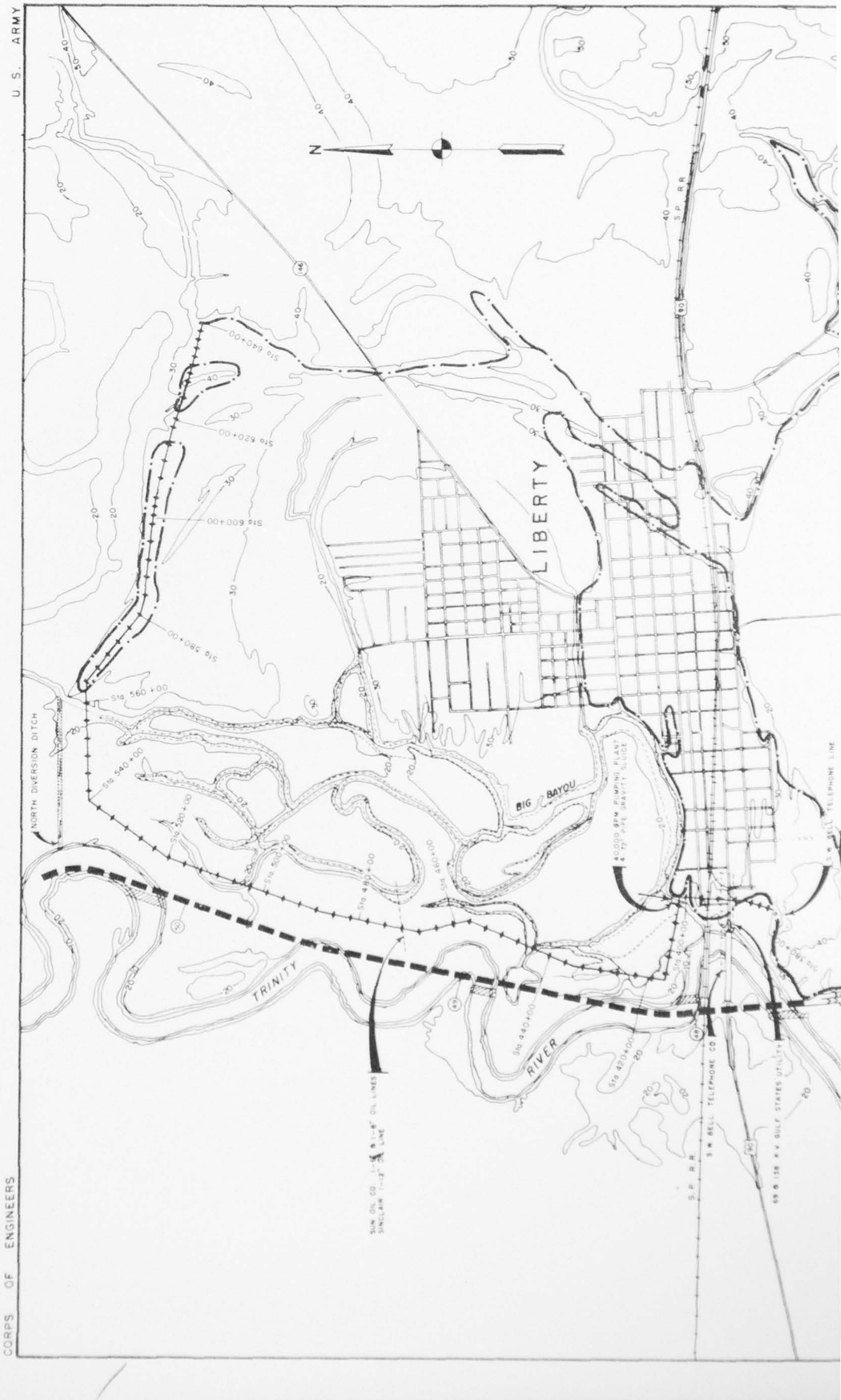
Item	Unit	Quantity	Unit cost	T c
Federal first cost:				
09.0 Channels				
North diversion ditch				
Excavation	CY	44,444	$0.35	$1
Clearing and grubbing	Ac	482	450.00	
11.0 Levees				
Embankment	CY	671,230	0.75	50
Clearing and grubbing	Ac	534.4	450.00	24
Stripping	CY	79,430	0.25	1
Sprigging	Ac	460.9	300.00	13
Shaping spoil embankment	LF	31,400	1.00	3
Pumping plants				
North plant	MGPM	40	1500.00	6
South plant	MGPM	150	1500.00	22
Drain structures thru levees				
North sluice	72" pipe w/gate	4	6667.50	2
South sluice	"	7	6667.50	4
Subtotal				1,30
Contingencies, 25%				32
Total - Construction cost				1,63
30.0 Engineering and design				6
31.0 Supervision and administration				9
Total estimated Federal first cost				1,79
		Rounded		1,79
Non-Federal first cost:				
01.0 Lands and damages				
Rights-of-way	Ac	556	200.00	11
Ponding areas	Ac	493	100.00	4
Contingencies				4
Acquisition cost	L.S.			1
Total - lands and damages				22

TABLE 55 (CONT'D)
SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
LOCAL FLOOD PROTECTION PROJECT
LIBERTY, TEXAS

Item	Unit	Quantity	Unit cos
Non-Federal costs, (Cont'd)			
02.0 Relocations			
Pipelines			
Gulf Oil Corp. 4" oil line	LF	380	$ 8.00
3 Humble Oil & Refg. Corp 8" oil lines	LF	1050	15.00
2 Gulf Oil Corp. 8" oil lines	LF	700	15.00
Gulf Oil Corp. 6" oil lines	LF	700	12.00
Texas Co. 6" oil line	LF	380	12.00
Texas Co. 4" oil line	LF	380	8.00
Liberty sewage effluent line	LF	200	50.00
Gulf Oil Corp. telephone line	LF	500	1.00
Subtotal - Relocations			
Contingencies			
Total - Relocations			
30.0 Engineering and design			
31.0 Supervision and administration			
Total estimated non-Federal first cost			
Total estimated project cost			
Annual charges			
Federal			
Interest and amortization (2-7/8% interest rate & 100 yr. amort.)			
Total Federal annual charges			
Non-Federal			
Interest and amortization (3% interest rate & 100 yr. amort.)			
Operation and maintenance			
Major replacement			
Total non-Federal annual charges			
Total annual charges			

Note: Prices are as of January 1962.

Total cost
$ 3,040
15,750
10,500
8,400
4,560
3,040
10,000
500
55,790
13,950
69,740
2,650
4,040
296,660
2,090,670
54,800
54,800
9,400
13,000
2,000
24,500
79,300



69 & 138 K.V. GULF STATES UTILITY
LOCK & DAM NO. 2
S.W. BELL TELEPHONE LINE
HUMBLE OIL & REFG. CO. 1-8" OIL LINE
INDUSTRIAL GAS SUPPLY 1-10" GAS LINE
GULF STATES UTILITY POWER TRANSMISSION LINE 69 K.V.
LIBERTY SEWAGE EFFLUENT LINE
TRINITY
RIVER
GUM BAYOU
SNAG LAKE
DUNCAN LAKE
SOUTH LIBERTY ROAD
UNITED GAS P.L. CO. 1-6" OIL LINE
GULF OIL CORP. TELEPHONE LINE & 1-4" OIL LINE
GULF OIL CORP. 2-8" OIL LINES
TELEPHONE LINE
2-36" PIPE
TEXAS CO. 1-4" OIL LINE
GULF STATES UTILITY LINE
INTERIOR DRAINAGE DITCH
CLAYTON BAYOU
CLAYTON BAYOU DIVERSION DITCH
GULF TELEPHONE LINE
GULF 1-4" OIL LINE
HUMBLE 3-8" OIL LINES
GULF 2-8" & 1-6" OIL LINES
TEXAS CO. 1-6" OIL LINE
SOUTH PUMPING PLANT (150,000 GPM)
GRAVITY SLUICE 7-72" PIPES
Sta. 0+00
Sta. 20+00
Sta. 40+00
Sta. 60+00
Sta. 80+00
Sta. 100+00
Sta. 120+00
Sta. 200+00
Sta. 220+00
Sta. 240+00
Sta. 260+00
Sta. 280+00
Sta. 300+00
Sta. 320+00
Sta. 340+00
Sta. 360+00
Sta. 380+00
LEGEND
MULTIPLE PROPOSE CHANNEL
LIMITS OF DESIGN FLOOD
NAVIGATION LOCK AND DAM
CHANNEL MILEAGE
SUMP AREA
PROTECTIVE (SPOIL) EMBANKMENT
NEW EARTH LEVEE
POWER TRANSMISSION LINES
PIPE LINES
COMMUNICATION LINES
FEDERAL HIGHWAY
STATE HIGWAY
EXISTING BRIDGE
RAILROADS
RIVER DIVERSION DAMS
SCALE OF FEET
1000 500 0 1000 2000 3000 4000
TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
LIBERTY LEVEE
PLAN OF IMPROVEMENT
IN 2 SHEETS
SCALE AS SHOWN
SHEET NO. 1
U.S. ARMY ENGINEER DISTRICT, GALVESTON
JUNE 1962
SUBMITTED:
APPROVAL RECOMMENDED
APPROVED

AD-A043 933 ARMY ENGINEER DISTRICT FORT WORTH TEX F/G 8/6
COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER AND TRIBUTARIES, T--ETC(U)
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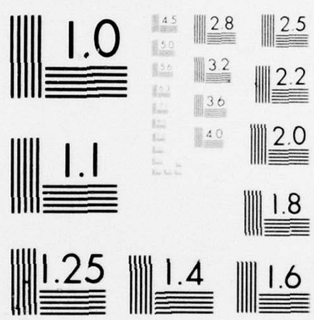
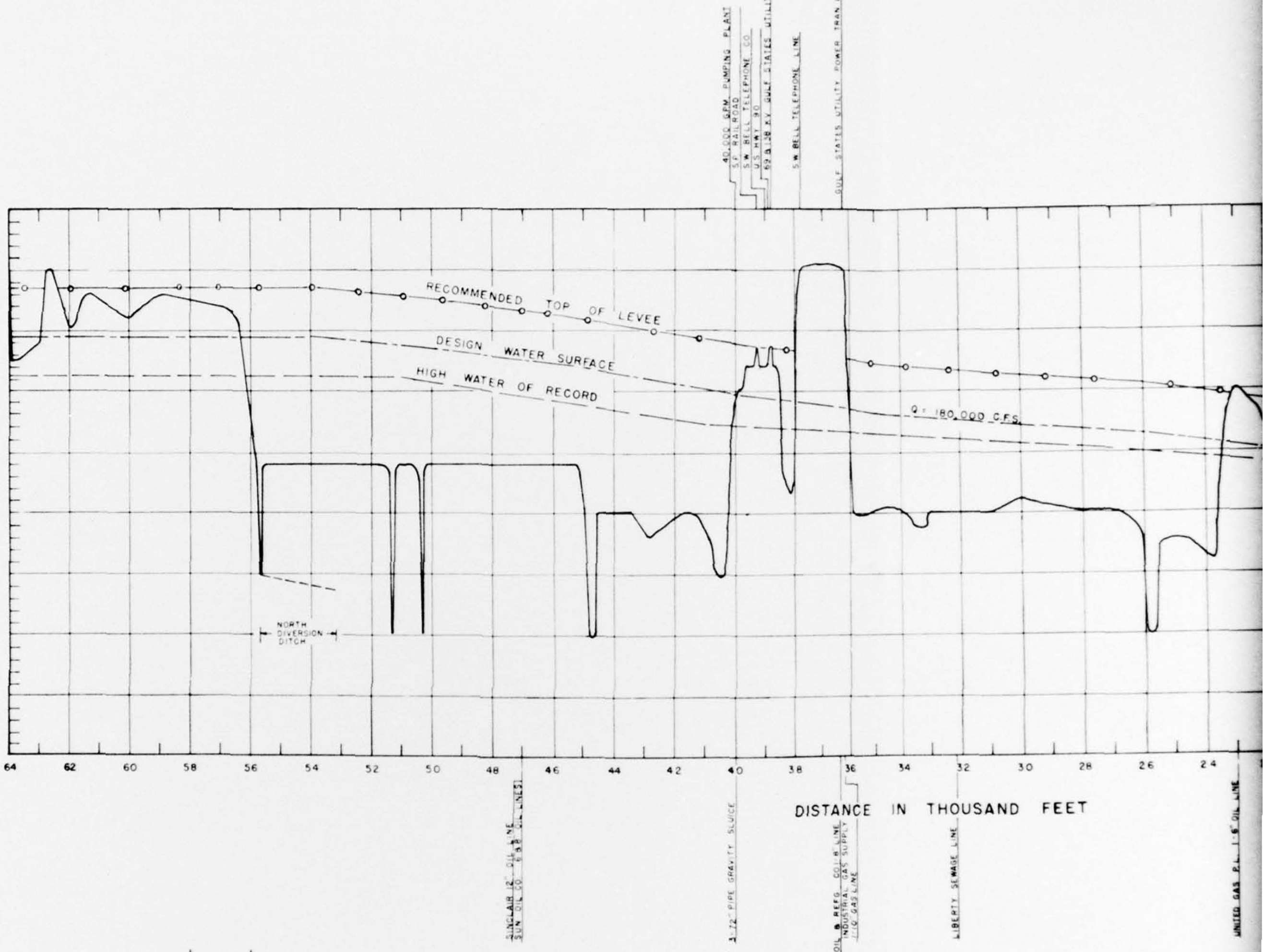
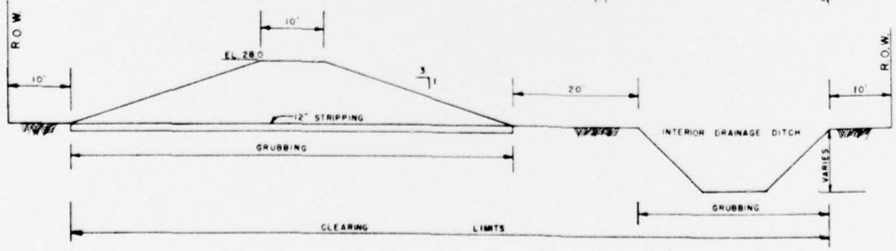


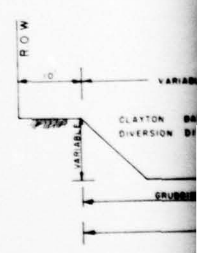
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

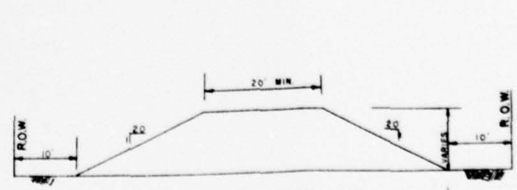
CORPS OF ENGINEERS





TYPICAL SECTION STATION 120+00 TO 189+00

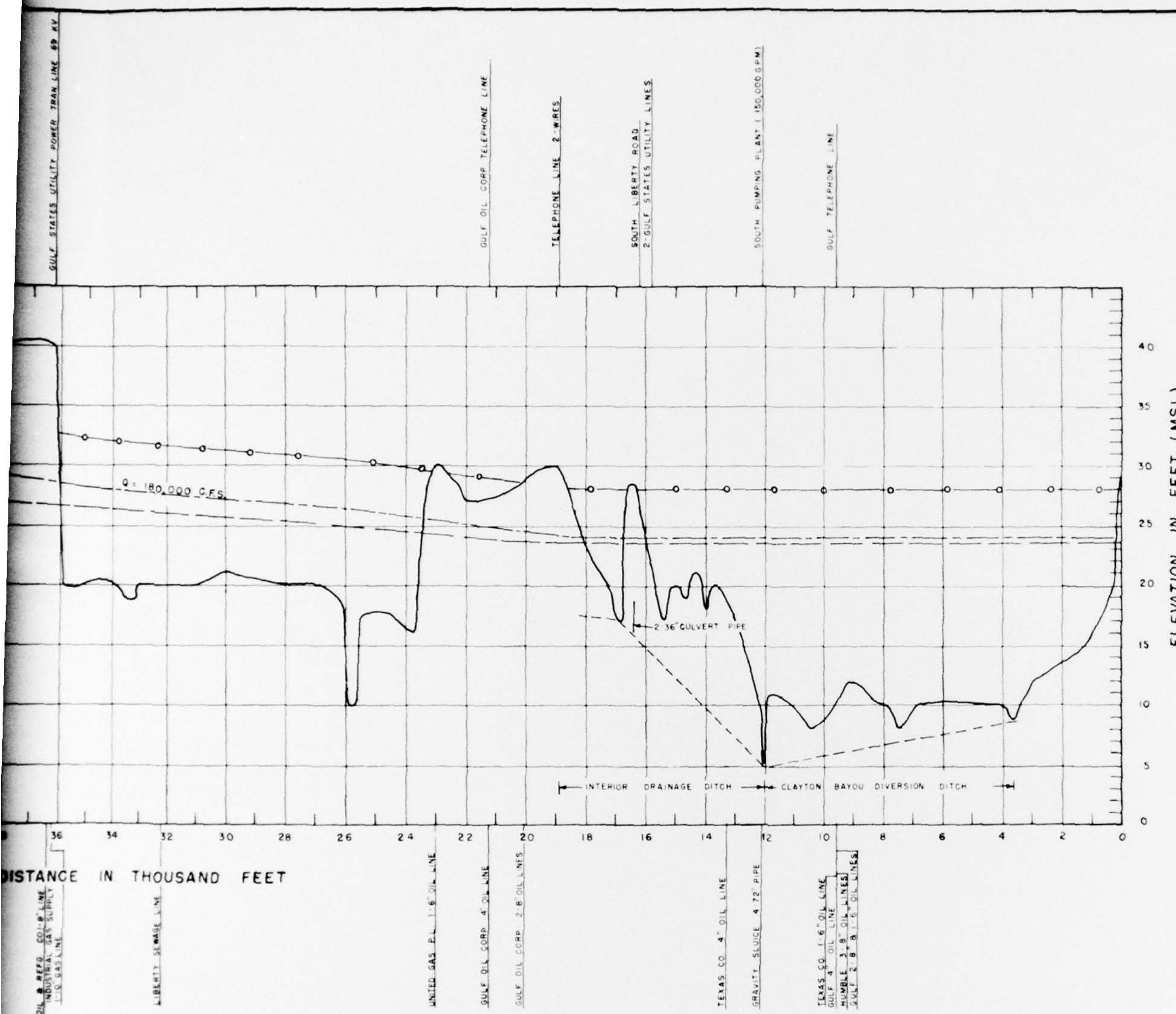


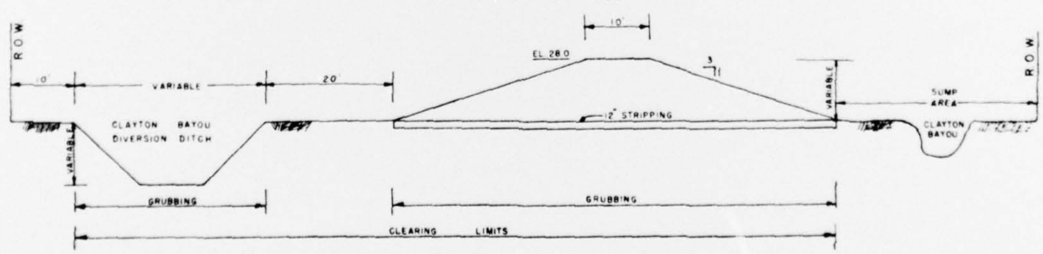


TYPICAL SECTION HYDRAULIC SPOIL EMBANKMENT

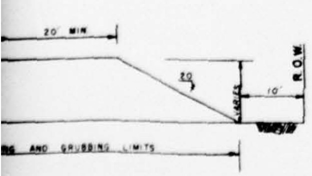
STA. 210+00 TO 560+00

U.S. ARMY





TYPICAL SECTION STATION 0+00 TO 120+00



HYDRAULIC SPOIL EMBANKMENT

STA. 210+00 TO 560+00

LEGEND

- HIGH WATER OF RECORD
- DESIGN WATER SURFACE
- CENTERLINE OF PROFILE
- GRADE OF DITCHES

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER
LIBERTY LEVEE

PROFILE

IN 2 SHEETS — SCALE AS SHOWN — SHEET NO. 2

U.S. ARMY ENGINEER DISTRICT, GALVESTON — JUNE 1962

SUBMITTED	APPROVAL RECOMMENDED	APPROVED
Engineer, Chief, Planning & Reports Branch	Kenneth Hagy, Engineer, Chief, Engineering Division	Lt. Col. Corps of Engineers, District Engineer
PREPARED: Arthur J. Kralle, Head, Special Studies Section	DRAWN BY / CHECKED BY	TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER; FILE TRIN. 230-19

2

TRANSMISSION AND PUMPING FACILITIES

167. GENERAL.- In order to facilitate pollution abatement along the Trinity River from Fort Worth downstream to the vicinity of Rosser, Texas, a supply of about 80 million gallons per day of fresh water of acceptable quality would be necessary at Fort Worth. This water is available from Tennessee Colony Reservoir and will be delivered by pipeline to Benbrook Reservoir, 14 miles upstream from Fort Worth on the Clear Fork of the Trinity River. Plate 62 shows a preliminary location and profile of the proposed pipeline. The use of Benbrook Reservoir for terminal storage will enable the pipeline to be sized for average demand rather than for a higher peak demand and will also enable the regulation of the flows in the river in contrasting periods of drought and excessive runoff.

168. PIPELINE.- The water from Tennessee Colony Reservoir would be conveyed to Benbrook Reservoir through an 84-inch pipeline sized to carry the average demand of 80 million gallons per day. This pipeline would be approximately 98 miles long and would cross three major watershed divides. Two of the divides crossed by the pipelines, one near Midlothian and one near Burleson, Texas, are about elevations 800 feet and 750 feet, respectively. The highest of the three divides at elevation 840 is the Clear Fork of the Trinity River eastern watershed divide. The pipeline would terminate just past this divide and would discharge into an unnamed tributary of the Clear Fork that enters Benbrook Reservoir from the east about one mile upstream from the dam. The static head will vary with the level of Tennessee Colony Reservoir from 577.5 feet with a full conservation pool in the reservoir to 615 feet with maximum drawdown to elevation 225.0. The static head with the conservation pool half full would be about 596 feet. The friction head developed in the pipeline while pumping 80 MGD would be about 229 feet. Therefore, the total pumping head would be about 825 feet when the conservation pool in Tennessee Colony Reservoir was half full.

169. PUMPING PLANTS.- The Tennessee Colony pumping plant would be located about 6 miles above the dam and near Big Brown Creek, sufficiently in the main body of the reservoir where the silt load from the river and its major tributaries will be considerably less by the time the water reaches the pump station. Because of the length of the pipeline and the large pumping head, three additional booster pumping stations will be required. The plants will be equipped with pumping facilities having a capacity of 80 million gallons per day.

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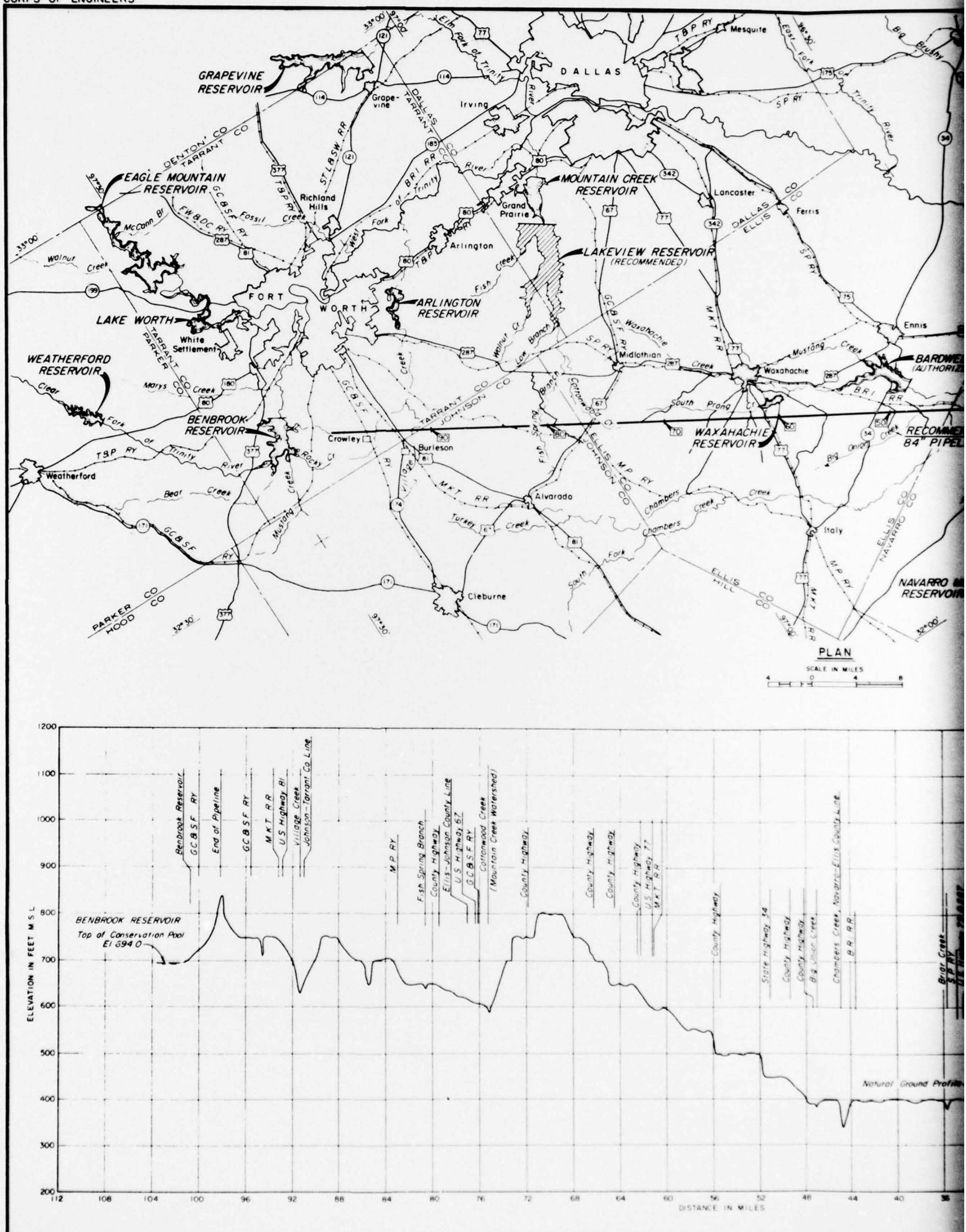

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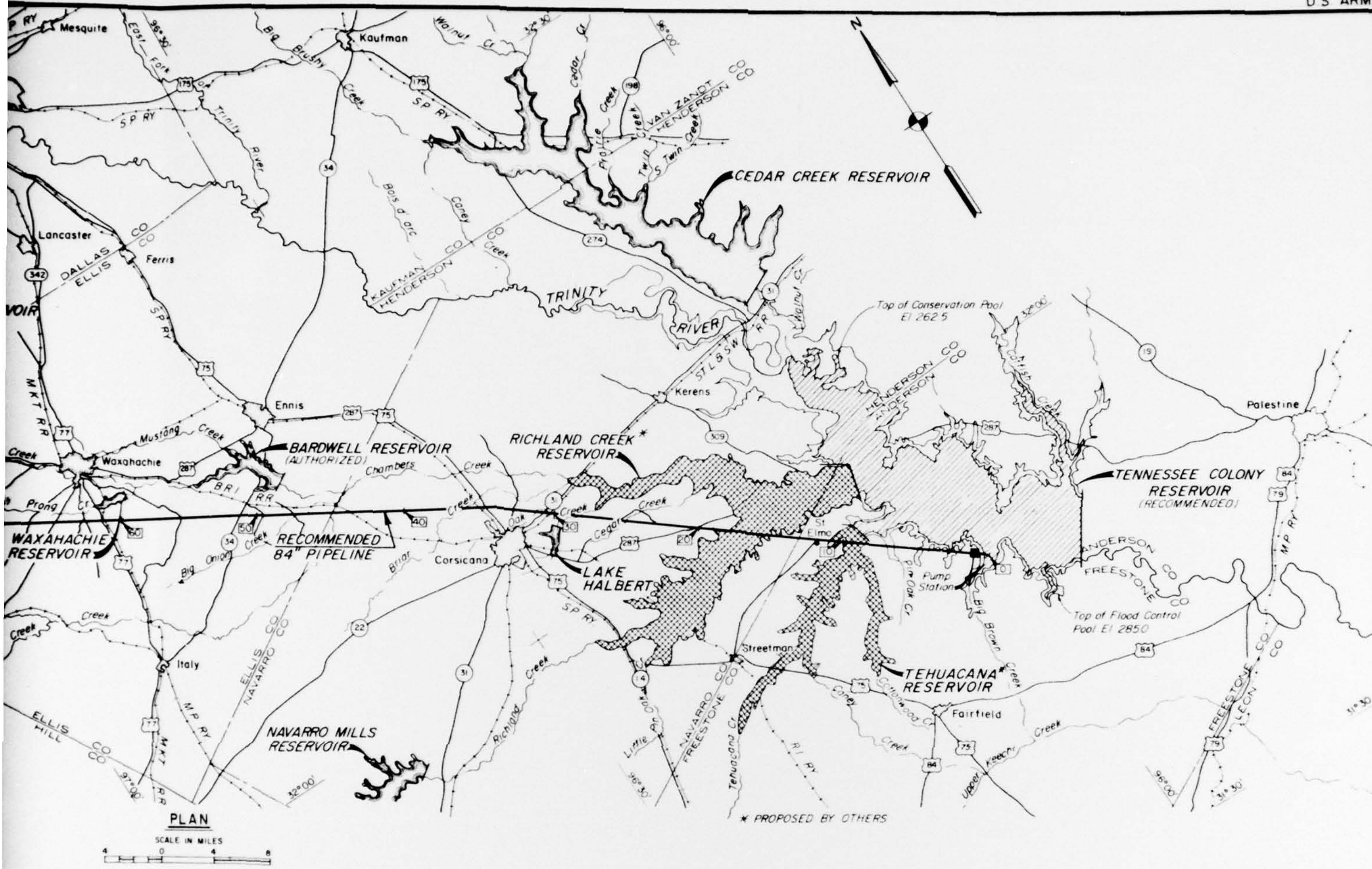

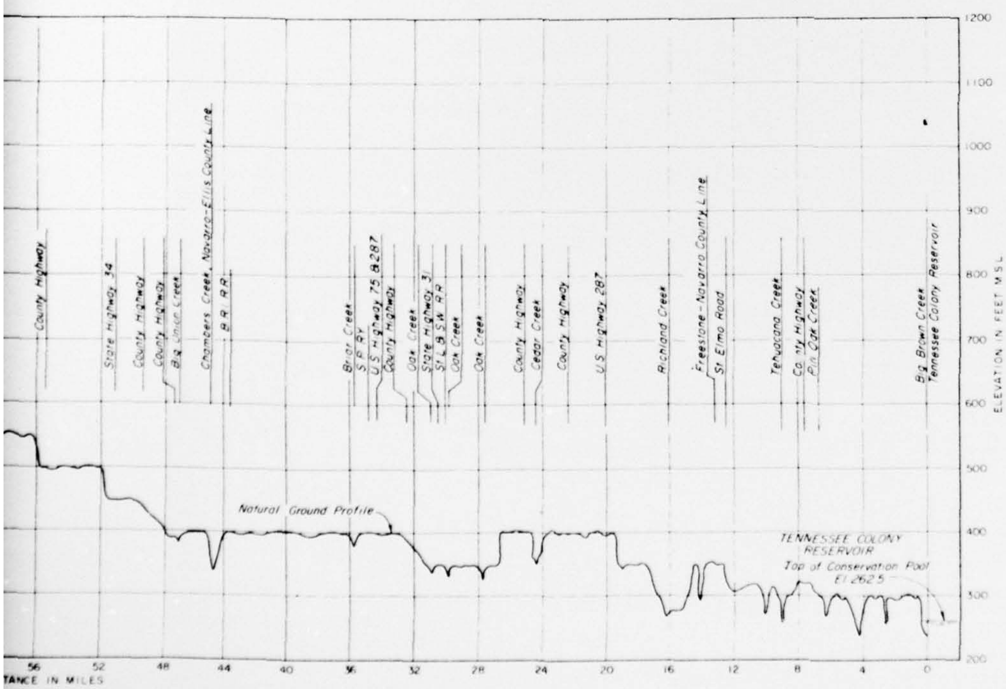

TRINITY RIVER AND TRIBUTARIES, TEXAS
TRINITY RIVER

PIPE LINE FOR WATER QUALITY CONTROL

AND POSSIBLE FUTURE WATER SUPPLY

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH — JUNE 1962

A. F. Wood — C. F. Swenson

C. W. Hawley

HEAD, SPECIAL STUDIES SECTION

TO ACCOMPANY COMPREHENSIVE SURVEY REPORT ON TRINITY RIVER

TRIN 230-19

170. ESTIMATED COST.- Based on January 1962 price level, the total capital investment for the pipeline and the four pumping stations is estimated to be $56,644,000 as shown in the following tabulation:

SUMMARY OF FIRST COSTS AND ANNUAL CHARGES
FOR TRANSMISSION AND PUMPING FACILITIES

Item	Unit	Quantity	Unit cost	Total cost
Pipeline	Mile	98	$427,700	$41,914,600
Pumping plant	Each	4	850,000	3,400,000
Subtotal				45,314,600
Contingencies				11,329,400
Total first cost				56,644,000
Interest during construction				None
Total investment				56,644,000
Annual charges				
Interest on investment (2-7/8%)				1,628,500
Amortization (100 yrs)				101,400
Power costs 89,346,000 KWH @ 9 mills/KWH				804,100
OM&R costs				
Pipelines (1% x first cost)				523,900
Pumping plant (2-1/2% x first cost)				106,300
Total annual charges				3,164,200

The total annual charges are estimated to be $3,164,200. This includes interest and amortization at the rate of 2-7/8 percent for 100 years; the estimated power costs based on a rate of 9 mills per kilowatt hour; and the estimated annual operation, maintenance and replacement costs. The transmission costs for delivery of 80 million gallons per day from Tennessee Colony Reservoir to Benbrook Reservoir are estimated to be $35.24 per acre-foot or 10.8 cents per 1000 gallons.