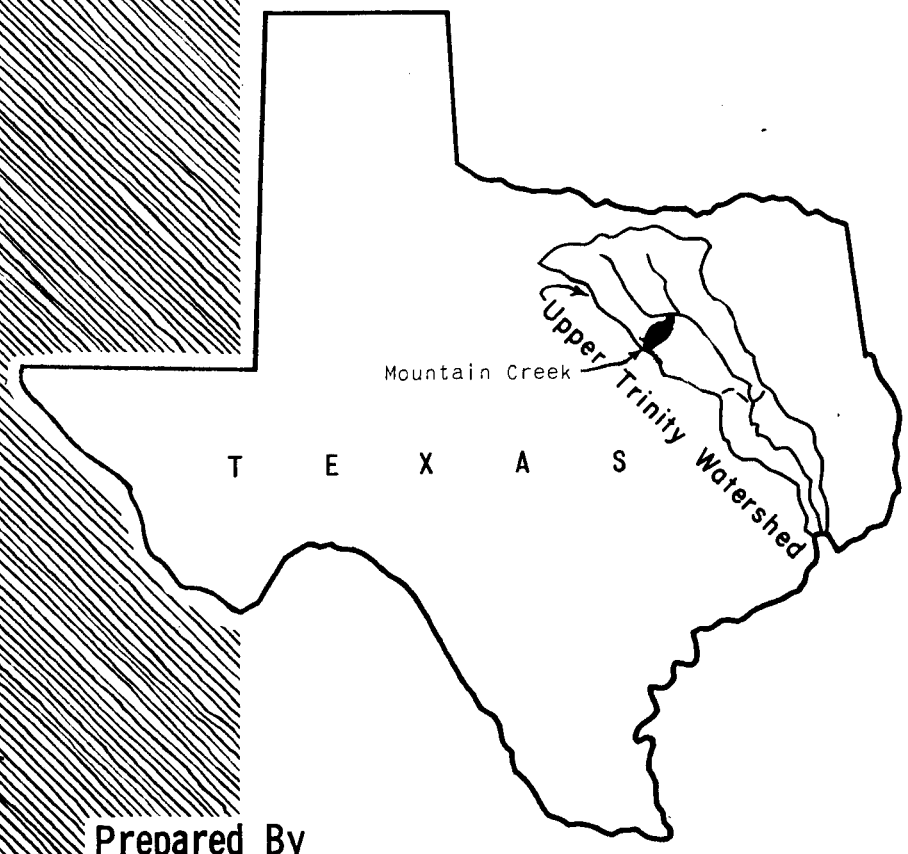
SUPPLEMENTAL WORK PLAN

MOUNTAIN CREEK WATERSHED

OF THE TRINITY RIVER WATERSHED
DALLAS, ELLIS, TARRANT,
AND JOHNSON COUNTIES, TEXAS



Prepared By
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Temple, Texas
JULY 1963

SUPPLEMENTAL

WATERSHED WORK PLAN AGREEMENT

between the

Dalworth Soil Conservation District
Local Organization

Ellis-Prairie Soil Conservation District
Local Organization

Johnson County Commissioners Court
Local Organization

Tarrant County Commissioners Court
Local Organization

City of Mansfield
Local Organization

State of Texas
(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Soil Conservation Districts have heretofore entered into a Flood Control Supplemental Memorandum of Understanding with the Soil Conservation Service for assistance in constructing works of improvement for prevention of floods in the Walnut Creek portion of Mountain Creek Watershed, State of Texas, under the authority of the Flood Control Act of 1944 (58 Stat.887); and

Whereas, the responsibility for carrying out a portion of the work of the United States Department of Agriculture on the watershed has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for

works of improvement for the Walnut Creek portion of Mountain Creek Watershed, State of Texas, hereinafter referred to as the Supplemental Watershed Work Plan, which plan is annexed to and made a part of this agreement; and

Whereas, the Counties will benefit from installation of works of improvement through the reduction of damages to property, including county roads and bridges located in the flood plain of the watershed;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the Supplemental Work Plan, and further agree that the works of improvement as set forth in said plan can be installed in about 5 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the Supplemental Watershed Work Plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such lands, easements, or rights-of-way as will be needed in connection with works of improvement. (Estimated cost $440,450.)

   The percentages of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Cost (dollars)
Multiple-Purpose Structure No. 28 and Basic Recreational Facilities			
Payment to landowners for 1,199 acres 1/ and cost of relocation or modification of improvements.	59.90	40.10	318,450
Legal Fees, Survey Costs, and Other Costs	100.00	0	15,900
All Other Structural Measures	100.00	0	106,100 2/

1/ 1,082 acres fee simple title and 117 acres flood easements.
2/ Includes $1,050 legal fees.

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
Multiple-Purpose Structure No. 28	44.28	55.72	343,080
Basic Recreational Facilities	50.00	50.00	57,190
Municipal Outlet Structure	100.00	0	13,610
Single-Purpose Floodwater Retarding Structures Nos. 16A, 17, 18, 19A, and 20	0	100.00	361,627

4. The percentages of the cost for installation services to be bo by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	I S
Multiple-Purpose Structure No. 28	31.39	68.61	
Municipal Outlet Structure	100.00	0	
Basic Recreational Facilities (By Consulting Firm)	50.00	50.00	
Single-Purpose Floodwater Retarding Structures Nos. 16A, 17, 18, 19A, and 20	0	100.00	

5. The Service will award and administer the contracts covering t construction of all works of improvement. The contract admini tration costs for multiple-purpose structure No. 28, estimated be $1,000, will be shared, the Sponsoring Local Organization bearing 31.39 percent based on the cost sharing percentages fo installation services.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each floodwater retarding structure that they will carry out conser vation farm or ranch plans on their land.

7. The Sponsoring Local Organization will provide assistance to land owners and operators to assure the installation of the la treatment measures shown in the Supplemental Watershed Work Pl

8. The Sponsoring Local Organization will encourage land owners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the Supplemental Watershed Work Plan are contingent on the appropriation of funds for this purpose.

Prior to the issuance of an invitation to bid, separate agreements will be entered into between the Service and the Sponsoring Local Organization setting forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement. These agreements will cover Federal financial assistance on construction of water resource improvements, engineering services to be furnished by Sponsoring Local Organization, assistance in the cost of land rights, and assistance on construction of minimum basic facilities.

An Operation and Maintenance Agreement will be executed in advance of, or concurrently with, land rights, facilities, or project agreements.

12. The Sponsoring Local Organization will not sell or otherwise dispose of land on which cost sharing has been provided for a period of 50 years, except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement. Land may be leased for concessions or other essential purposes, such as lunch stands, boat rental docks, etc.

13. The Supplemental Watershed Work Plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Dalworth Soil Conservation District
Local Organization

By A. T. Anderson

Title Chairman

Date Dec. 17 1963

The signing of this agreement was authorized by a resolution of the governing body of the Dalworth Soil Conservation District
Local Organization

adopted at a meeting held on December 17, 1963

H. P. Grimes
(Secretary, Local Organization)

Date 12-17-63

Ellis-Prairie Soil Conservation District
Local Organization

By Mike Hastings

Title Chairman

Date January 14, 1964

The signing of this agreement was authorized by a resolution of the governing body of the Ellis-Prairie Soil Conservation District
Local Organization

adopted at a meeting held on 1-14-64

Marvin Borden
(Secretary, Local Organization)

Date January 14, 1964

Johnson County Commissioners Court
Local Organization

By Ted W. Myatt

Title County Judge

Date February 1, 1964

The signing of this agreement was authorized by a resolution of the governing body of the Johnson County Commissioners Court
Local Organization

adopted at a meeting held on February 1, 1964

Louis B Lee
(Secretary, Local Organization)
Louis B. Lee, County Clerk
Date February 6, 1964

Tarrant County Commissioners Court
Local Organization

By Marvin B. Simpson Jr

Title County Judge, Tarrant County

Date 1/9/64

The signing of this agreement was authorized by a resolution of the governing body of the Tarrant County Commissioners Court
Local Organization

adopted at a meeting held on January 9, 1964

Maurine Glover M.G.
(Secretary, Local Organization)

Date January 9, 1964

City of Mansfield
Local Organization

By Billy Walker

Title Mayor

Date 1-20-64

The signing of this agreement was authorized by a resolution of the governing body of the City of Mansfield
Local Organization

adopted at a meeting held on 1-20-1964

(Secretary, Local Organization)

Date

Soil Conservation Service
United States Department of Agriculture

By

Date

SUPPLEMENTAL WORK PLAN

MOUNTAIN CREEK WATERSHED
Of the Trinity River Watershed
Dallas, Ellis, Tarrant and Johnson Counties, Texas

Plan Prepared and Works of Improvement
to be Installed Under the Authority
of the Flood Control Act of 1944
as Amended and Supplemented

Participating Agencies

Dalworth Soil Conservation District
Ellis-Prairie Soil Conservation District
City of Mansfield, Texas
Johnson County Commissioners Court
Tarrant County Commissioners Court

Prepared By:

Soil Conservation Service
U. S. Department of Agriculture
July 1963

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Of the Trinity River Watershed
Dallas, Ellis, Tarrant and Johnson Counties, Texas
July 1963

INTRODUCTION

Authority

The Mountain Creek Watershed Flood Prevention Project will be carried out under the authority of the Soil Conservation Act of 1935 (Public Law No. 46, 74th Congress), the Flood Control Act of 1936 (Public Law No. 738, 74th Congress), and the Flood Control Act of 1944 (Public Law No. 534, 78th Congress), as amended and supplemented.

Purpose and Scope of Supplemental Plan

The purpose of this supplemental work plan is to provide municipal water storage for the city of Mansfield, Texas, and to incorporate recreational development as a project purpose in the Mountain Creek Watershed Work Plan of March 1955.

This supplement concerns the Walnut Creek portion of the Mountain Creek watershed. One multiple-purpose structure is added which results in some changes in the system of floodwater retarding structures.

The Mountain Creek Watershed Work Plan of March 1955 includes a combination of land treatment measures for watershed protection and structural works of improvement for flood prevention. The planning and application of the land treatment measures and structural measures, except those in the Walnut Creek portion, will be carried out in accordance with provisions of the original plan. Three floodwater retarding structures (Nos. 9, 10, and 11) of the 27 originally planned have been installed (table 1A).

The Walnut Creek portion of the watershed was reevaluated in order to determine the feasibility of the proposed project, and to make a single construction unit of structural measures in the area.

SUMMARY OF PLAN
(As Supplemented)

The supplemental work plan provides for adding one multiple-purpose structure and the deletion of floodwater retarding structures 21, 22, 23, 24, and 25, and relocating and renumbering structures 16 and 19 to 16A and 19A. The multiple-purpose structure, No. 28, will provide storage capacity for

recreational development, municipal water, flood prevention, and sediment.

As supplemented the work plan will include 22 floodwater retarding structures and 1 multiple-purpose structure (figure 8).

The installation period for the works of improvement is 5 years.

The estimated total installation cost of the structural measures is $3,459,062. Of this amount, $2,490,240 will be borne by Federal funds and $968,822 will be paid from other funds (tables 1 and 1A).

The sponsoring local organizations for the supplemented watershed work plan are:

Dalworth Soil Conservation District
Ellis-Prairie Soil Conservation District
City of Mansfield, Texas
Johnson County Commissioners Court
Tarrant County Commissioners Court

DESCRIPTION OF THE WATERSHED (WALNUT CREEK PORTION)

Physical Data

The Walnut Creek portion of this watershed consists of Walnut Creek and its tributaries. Walnut Creek rises near the town of Alvarado, Johnson County, Texas. This creek flows in a northeasterly direction and joins Mountain Creek at a point approximately 10 miles above the confluence of Mountain Creek and West Fork of the Trinity River. Mountain Creek Lake, with a surface area of about 3,586 acres, is located approximately 5 miles below the confluence of Walnut and Mountain Creeks.

The incorporated town of Mansfield, and several smaller communities are located wholly or partly within the watershed.

The watershed drained by Walnut Creek at Valley Section No. 1 (figure 7) contains an area of 53,888 acres (84.2 square miles), of which 51,258 acres are in farms and the remaining 2,630 acres, about 5 percent, are in urban areas, railroads, roads, and other miscellaneous uses.

The land use on the flood plain, exclusive of area in channels and proposed pool areas, is as follows:

Land Use	Acres	Percent
Cropland	1,011	28
Pasture	2,522	71
Miscellaneous 1/	35	1
Total	3,568	100

1/ Includes roads, railroads, and urban areas.

Land use in the Walnut Creek portion of the watershed is estimated as follows: cropland, 54 percent; pasture, 41 percent; and 5 percent in roads, urban, and miscellaneous uses.

Economic Data

The agricultural economy of the watershed is dependent largely upon livestock farming. Beef cattle enterprises consist primarily of cow and calf operations.

Oats and other small grains used for winter pasture and sorghum for hay are the predominant crops. Some alfalfa, clover, and truck crops are grown. Cotton production is mainly limited to the Blackland soil in the lower portion of Walnut Creek watershed. Pecans are grown in connection with pasture in the flood plain.

Census data for Tarrant and Johnson Counties show an increase in rural population from 1950 to 1960. An increasing number of people employed in industry reside in outlying or rural areas. Many located on tracts classed as farms but which are not economic units. Employment in the Fort Worth-Dallas area largely replaces farm income on these units.

The average size commercial farm in the watershed is estimated to be 175 acres. The price of agricultural land is influenced by its proximity to the Fort Worth-Dallas metropolitan area.

Two railroads and U. S. Highways 81 and 287 cross Walnut Creek watershed. Farm Roads 157, 917, and 1187, as well as numerous county roads, make all parts of the watershed easily accessible.

Land Treatment Data

The Dalworth and the Ellis-Prairie Soil Conservation Districts have assisted farmers and ranchers in preparing basic soil and water conservation plans on 286 of the 413 operating units. This represents 69 percent of the farms and 62 percent of the area within Walnut Creek watershed. Work units located at Burleson, Dallas, and Fort Worth are working with the soil conservation districts by providing the technical assistance necessary to plan, establish, and maintain the conservation measures. Application of planned land treatment practices has been under way for the past several years, and it is estimated that the planned land treatment program is 80 percent applied.

WATERSHED PROBLEMS

Floodwater Damage

The flood plain of the Walnut Creek tributary consists of 3,568 acres, excluding 651 acres in stream channels and floodwater retarding structure sites (figure 7). This area will be inundated by the runoff from the largest storm

considered in the 22-year evaluation series. This storm was a 7.47-inch rain that lasted for two days, September 26-27, 1936. It produced 4.92 inches of runoff under average soil moisture conditions and has a 2.5 percent chance of occurrence.

During the 22-year evaluation period (1923 through 1944), 17 major floods inundated more than half the flood plain in the Walnut Creek portion of the watershed. An additional 63 minor floods inundated less than half the flood plain. The cumulative acreage flooded by recurring damaging floods during an average year totals 4,187 acres. This is equivalent to flooding the entire flood plain 1.2 times. There were 11 major floods and 38 minor floods that occurred during April, May, June, September, and October. Floods which occurred in these months caused widespread crop damage.

The greatest amount of damage is to crops and pasture, amounting to $28,472 annually. This represents approximately 27 percent of the damageable value of crops and pasture. The most frequent flooding is experienced during the growing season. Damage to fences, loss of livestock, and other agricultural damage is estimated to average $5,905 annually. Damage to roads and bridges averages $3,693 annually, making total floodwater damages amount to $38,070 annually in Walnut Creek watershed (table 5). This includes minor agricultural damage within the city limits of Mansfield.

Sediment Damage

Sediment damage consists primarily of deposition on the flood plain and in Mountain Creek Lake.

Erosion in the upland area has resulted in the deposition of predominantly silty sand and lesser amounts of clayey sand and fine sand on the flood plain. The productive capacity of 1,980 acres has been reduced as follows: 170 acres damaged 10 percent; 905 acres damaged 20 percent; 569 acres damaged 30 percent; and 336 acres damaged 40 percent. The estimated average annual monetary damage by overbank deposition is $15,073 at long-term price levels.

An estimated 55 acre-feet of sediment is deposited annually in Mountain Creek Lake from the Walnut Creek watershed. The estimated annual damage to the lake by depletion of its capacity is $7,810 (table 5).

Erosion Damage

Upland erosion rates range from 0.99 acre-foot per square mile annually in range and pasture land areas to 4.44 acre-feet per square mile annually in cropland areas. Of this, sheet erosion accounts for about 92 percent and gully and streambank erosion for 8 percent of the annual gross erosion.

Flood plain scour damage is low. It is estimated that an average of 72 acres is being damaged by this process. The productive capacity of the

72 acres has been reduced as follows: 57 acres damaged 10 percent; 4 acres damaged 20 percent; 2 acres damaged 30 percent; 3 acres damaged 40 percent; 1 acre damaged 50 percent; and 5 acres damaged 60 percent. The estimated annual monetary damage by flood plain scour is $277 at long-term price levels (table 5).

Stream channel erosion is generally low in the watershed. The average annual loss to streambank erosion is 0.23 acre.

Problems Relating to Water Management

The city of Mansfield depends upon wells for municipal water, and a critical shortage would result with failure of the largest producing well. Such shortages retard industrial development, subject the city to potentially high losses from fire, and cause a curtailment in residential water use.

The population of Mansfield increased from 964 in 1950 to 1,375 in 1960 according to census reports. This was projected to 7,115 in 1990 for estimating water needs in the future. Needs for and adequacy of the multiple-purpose structure to supply municipal water to the city of Mansfield, have been determined by a consulting engineering firm employed by the city.

The city of Mansfield is interested in developing recreational facilities in connection with municipal water supply development in a multiple-purpose reservoir. Metropolitan areas with a combined population in excess of one million people lie within a 30-mile radius of the proposed multiple-purpose reservoir. Several large reservoirs provide recreation for residents of this watershed and the metropolitan areas of Dallas and Fort Worth. Because of the large population to be served the existing facilities are often crowded during the summer season. A development is needed in this watershed to make recreation more available to residents of the watershed and will contribute to relieving some of the crowded conditions at existing developments. A development of this size will be complementary rather than competitive to the major reservoirs.

PROJECTS OF OTHER AGENCIES

Mountain Creek Lake, located in the lower portion of the watershed, is owned by the Dallas Power and Light Company and is used as a cooling basin in the generation of electricity. This facility is not open to the general public for recreational purposes. Structural measures in this watershed will not materially reduce the water yield to Mountain Creek Lake.

There are no known plans by other agencies for additional works of improvements for water resource development in the foreseeable future which would affect or be affected adversely by the works of improvement included in this supplemented work plan.

BASIS FOR PROJECT FORMULATION

The sponsoring local organizations asked that the Mountain Creek Watershed Work Plan of 1955 be modified. The basis for the request was to include recreation and municipal water supply in a multiple-purpose structure and to maintain an acceptable level of protection from floodwater and sediment damages on the Walnut Creek portion of the watershed.

Specific objectives of the local sponsors for the supplemented work plan are:

1. Include land treatment measures based on current needs which can be applied during the project installation period and which contribute directly to watershed protection and flood prevention.

2. Provide for municipal water storage for the city of Mansfield.

3. Provide for the establishment of water-based recreational facilities.

4. Attain a reduction of at least 70 percent in average annual floodwater and sediment damages.

It was agreed to study the possibility of adding a multiple-purpose structure and to evaluate the required system of floodwater retarding structures on the Walnut Creek portion of the watershed to attain the desired objectives.

The flood of September 26-27, 1936 inundated undeveloped portions of the city of Mansfield and caused little or no urban damage. However, the population increased by over 40 percent from 1950 to 1960. If this rate of development is continued into the flood plain area, and the flood were to be repeated at a later date, significant damage would occur. This was considered at the time of project formulation, and it was decided to provide only the level of protection adequate for agricultural needs. It is expected that the city will discourage urban encroachment into the flood plain by limiting the extension of streets and utilities, or zoning.

Action has been taken by local interests to carry out the legal and financial requirements necessary for planning, installing, operating, and maintaining works of improvement.

The city of Mansfield voted revenue bonds to provide funds for its share of the costs.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures are being applied under the leadership of the soil conservation districts. Approximately 23,495 acres of the 53,888 acres in the Walnut Creek watershed lie above planned floodwater retarding structures. Land treatment is especially important for protection of these watershed lands to support and protect the structural measures. On the remainder of the watershed, 30,393 acres, which has no structural control, the establishment and maintenance of land treatment constitutes the only planned measures.

Land treatment measures on the flood plain below floodwater retarding structures are important in reducing scour damage.

Emphasis will be placed on accelerating the establishment of those land treatment measures which will have a measurable effect on reduction of damages from floodwater and sediment and in reducing the cost of providing sediment storage capacity in the floodwater retarding structures.

A study of the current land treatment needs for the entire Mountain Creek watershed was made, and those measures expected to be installed during the installation period are shown in table 1. The cost of installing land treatment measures in the Walnut Creek portion of the watershed during the project period is $52,385.

Structural Measures

On the Walnut Creek portion of the watershed a system of five floodwater retarding structures and one multiple-purpose structure has been included in this supplemental work plan. (See Project Map, figure 8). Floodwater retarding structure Sites 16A, 17, 18, and 19A are in series with and located above the multiple-purpose site. Structures at these sites will provide the desired protection to the flood plain. The multiple-purpose structure will provide storage for flood prevention, a municipal water supply for the city of Mansfield, and recreational development. (Recreational Development Map, figure 6).

Figure 1 shows a section of a typical floodwater retarding structure.

The cost of installing these works of improvement is $1,268,851, exclusive of basic recreational facilities.

The storage capacity of the five floodwater retarding structures, and the multiple-purpose structure totals 19,517 acre-feet. Of this total, 1,788 acre-feet are provided for sediment accumulation over a 50-year period, 4,200 acre-feet for municipal water supply, 3,450 acre-feet for recreational development, and 10,079 acre-feet for floodwater detention. Runoff from 44

percent of the Walnut Creek drainage area will be retarded by structural measures included in this supplemental work plan. The structures will detain an average of 5.15 inches of runoff from the area lying above them, which is equivalent to 2.24 inches of runoff from the area drained by Walnut Creek. The amount of runoff controlled by each structure is shown in table 3.

Basic facilities for recreational use will be installed at selected locations adjacent to Site No. 28. They will include access roads, parking areas, boat launching ramps, boat docks, water supply, sanitary facilities, beach development, picnicking facilities, and camping areas. Schedule of the proposed facilities is shown in table A. Figure 6 shows the location of these facilities. The estimated installation cost of these facilities is $113,205 (table 2).

The multiple-purpose structure contains 1,017 acres up to the maximum flow line. Water surface and land areas available for recreational activities fluctuate with changes in the water surface elevation. The normal water surface area designated for recreational use is 440 acres. There are 235 additional surface acres available at the maximum elevation of the conservation pool.

The land area above the maximum flow line to be purchased for development and use of basic recreational facilities is 182 acres. An additional area of 185 acres lies between the top of the municipal water supply pool and the maximum flow line and may be used for recreational activities as water levels permit.

The total cost of structural measures on Walnut Creek is estimated to be $1,382,056 (table 2).

Details on quantities, costs, and design features of structural measures are shown in tables 1, 2, and 3.

EXPLANATION OF INSTALLATION COSTS

The estimated cost of planning and installing land treatment measures on Walnut Creek, exclusive of expected reimbursement by Agricultural Conservation Program Service or other Federal funds, is $52,385, based on current program criteria. Technical assistance will be provided to landowners and operators by the Soil Conservation Service at an estimated cost of $8,710 from Federal funds. These land treatment costs are based on present prices paid by landowners and operators to establish the individual measures.

Estimates of the kinds, amounts, and costs of land treatment measures were furnished by the Dalworth and the Ellis-Prairie Soil Conservation Districts.

Land, easements, and rights-of-way for the single-purpose floodwater retarding structures will be furnished by local interests at no cost to the Federal government.

The local cost for the five floodwater retarding structures, estimated to be $106,100, consists of land value ($98,350), relocating and clearing obstacles ($6,700), and legal fees ($1,050).

Construction costs, estimated to be $361,627, include the engineer's estimate and a 10 percent allowance for contingencies. The engineer's estimates were based on unit costs of floodwater retarding structures constructed in similar areas and modified by special conditions inherent to each individual site location.

The cost of installation services is estimated to be $89,999, including engineering and administrative costs.

The total of the construction and installation services costs is $451,626 and will be borne by Federal funds. The total cost of the floodwater retarding structures is estimated to be $557,726.

Costs estimates and preliminary designs for the multiple-purpose structure No. 28 were made jointly by the consulting engineering firm and the Soil Conservation Service.

Joint costs for the multiple-purpose structure were allocated by the Use of Facilities method, as follows:

Purpose	Acre-Feet	Percentages
Flood Prevention	5,732 1/	42.83
Recreational	3,450	25.78
Municipal	4,200	31.39
Total	13,382	100.00

1/ Includes 737 acre-feet of sediment storage.

All costs of legal fees, land easements and rights-of-way and relocation and modification of existing improvements were allocated between municipal water supply and recreation. The percentage allocated to recreation was determined on the basis of the total area required for the dam and reservoir minus the reservoir area for the municipal water supply divided by the total area for the dam and reservoir (76.89 percent). The remainder, 23.11 percent, was allocated to municipal water supply.

The municipal outlet structure is a specific cost and is allocated to municipal water supply.

Cost of minimum basic facilities and associated land was allocated to recreation as a specific cost.

The $406,165 joint cost (construction and installation services), was allocated, $104,715 to recreation, $173,960 to flood prevention, $127,490

to water supply and $16,110 specific cost to water supply. All of the cost of $113,205 for minimum basic facilities were allocated to recreation.

The cost for land, easements and rights-of-way, legal fees, and relocation and modification of existing improvements, $288,850, was allocated $222,095 to recreation, and $66,755 to water supply.

The cost allocated to recreation is $440,015, to water supply $210,355, to flood prevention $173,960, for a total of $824,330 (table 2).

The sponsors' share of the cost of multiple-purpose structure No. 28, and minimum basic facilities is as follows:

Water Supply	Percent of Total Cost	Estimated Sponsors Cost (dollars)
Construction		
Multiple-Purpose Structure	31.39	107,690
Municipal-Outlet Structure	100.00	13,610
Installation Services 1/		
Multiple-Purpose Structure	31.39	19,800
Municipal-Outlet Structure	100.00	2,500
Land, Easements and Rights-of-way	23.11	52,260
Relocations and Modification of Existing Improvements	23.11	10,820
Legal Fees 2/	23.11	3,675
Subtotal		210,355
Recreational Development		
Construction	3/ 12.89	44,225
Land, Easements and Rights-of-way	3/ 38.44	86,935
Relocations and Modification of Existing Improvements	3/ 38.44	18,000
Legal Fees 2/	76.89	12,225
Subtotal		161,385
Minimum Basic Facilities		
Construction	50.00	28,595
Installation Services	50.00	5,258
Land, Easements and Rights-of-way	50.00	22,750
Subtotal		56,603
Total Sponsors' Cost		428,343

1/ Includes $314 for administration of contract.
2/ Total legal fees $15,900 allocated to municipal water supply and recreational development.
3/ Fifty percent of the cost allocated to recreation.

Federal funds will not bear any of the costs allocated to municipal water supply, or any legal fees or engineering services needed to obtain land, easements, rights-of-way, and water rights.

Federal funds will bear the construction cost allocated to flood prevention ($146,940), 50 percent of that allocated to recreation ($44,225), all the installation services allocated to these two purposes ($43,285), and 50 percent of the land costs ($86,935) and cost of relocation and modification of existing improvements ($18,000), allocated to recreation. The Federal share is 50 percent of the cost of basic recreational facilities ($33,852), and associated land ($22,750, Table 2). The Federal share of the multiple-purpose structure and minimum basic facilities is $395,987, of which $173,960 is for flood prevention and $222,027 is for recreational development.

The Federal share of land, easements, and rights-of-way will be based on the actual payments made by the sponsors and not on assessed or estimated values.

The estimated schedule of obligations for the installation period for the Walnut Creek portion of the watershed, including installation of both land treatment and structural measures, is as follows:

Fiscal Year	Measures	Federal Funds 1/	Non-Federal Funds	Total
		(dollars)	(dollars)	(dollars)
First	Floodwater Retarding Structures 16A, 17, 18, 19A, and 20	451,626	106,100	557,726
	Multiple-Purpose Structure No. 28	339,385	371,740	711,125
	Land Treatment	1,742 2/	8,735	10,477
	Subtotal	792,753	486,575	1,279,328
Second	Recreational Facilities	56,602	56,603	113,205
	Land Treatment	1,742 2/	8,735	10,477
	Subtotal	58,344	65,338	123,682
Third	Land Treatment	1,742 2/	8,735	10,477
Fourth	Land Treatment	1,742 2/	8,735	10,477
Fifth	Land Treatment	1,742 2/	8,735	10,477
Total for Installation Period		856,323	578,118	1,434,441

1/ Flood prevention funds.
2/ Includes only accelerated technical assistance.

This schedule may be adjusted on the basis of any significant changes in the plan found to be mutually desired and in the light of appropriations and actual accomplishments.

EFFECTS OF WORKS OF IMPROVEMENT

If the combined program of land treatment and structural measures included in this supplemental work plan had been installed, flooding would not have occurred from 23 of the 63 minor floods, and 14 of the 17 major floods would have been reduced to minor floods.

Average annual flooding, excluding the flood plain inundated by floodwater retarding pools, would be reduced as shown in the following table:

Average Annual Area Inundated

Evaluation Reach (Figure 7)	Without Project (acres)	With Project (acres)	Reduction (percent)
1 and 2	3,553	1,261	65
4	634	181	71
Total	4,187	1,442	66

The following shows by reaches the expected reduction in area flooded resulting from the combined program, by storms of 33 percent, 10 percent, and 4 percent chance of occurrence:

Area Inundated

Evaluation Reach (Figure 7)	Average Recurrence Interval: 33 Percent Chance: Without Project (acres)	33 Percent Chance: With Project (acres)	10 Percent Chance: Without Project (acres)	10 Percent Chance: With Project (acres)	4 Percent Chance: Without Project (acres)	4 Percent Chance: With Project (acres)
1 and 2	2,126	755	2,752	1,683	3,042	2,522
4	312	133	436	257	526	310
Total	2,438	888	3,188	1,940	3,568	2,832

Many landowners have indicated that if most of the flooding is eliminated they would use formerly cultivated pasture and idle land to produce more valuable crops. A conservative estimate of 162 acres of Walnut Creek flood plain is expected to be restored to its former productivity.

Annual flood plain scour damage is expected to be reduced about 74 percent. Eight percent will be attributable to land treatment and 66 percent to the structural measures.

Land treatment measures will reduce the present average annual damage from

sediment deposition by 18 percent. Structural measures will reduce this damage an additional 57 percent, for a total reduction of 75 percent in damage.

Sediment deposition in Mountain Creek Lake from Walnut Creek is estimated at 55 acre-feet annually under present conditions. With land treatment measures, this would be reduced to 45 acre-feet annually, and with the complete program installed, the sediment contributed by Walnut Creek would be reduced to 26 acre-feet annually.

The project will directly benefit approximately 60 owners of 3,568 acres of flood plain on which benefits were claimed for project justification.

The proposed multiple-purpose structure located near Mansfield in the Fort Worth-Dallas metropolitan area will provide facilities for recreational activities to an estimated 30,000 people annually. Considering the number of repeat visits, it is estimated that there will be at least 75,000 visitor days annually. Very intensive use of recreational facilities is expected since there is a population in excess of one million people within 30 miles.

It was estimated that the facilities would be used on an average by 5,000 people per week during the summer period. Peak daily use will be approximately 4,000 people. It is expected that the peak use will occur on holidays and special occasions. Minimum use will be probable during the winter months.

Recreational uses for the planned facilities include boating, fishing, water skiing, swimming, and picnicking. Swimming and water skiing will be heaviest during the warmer months. All activities will be available throughout the year.

The municipal water supply storage in the multiple-purpose site will supplement the present supply provided by wells. The present water system serves an estimated 1,625 people, including 250 residing outside the city limits. Although the population of Mansfield is listed as 1,375 in the 1960 census, the expected growth is projected to 7,115 by 1990. The report of the consulting engineers indicates that the proposed site will be adequate to meet the projected need.

Reservoir operation studies indicate that during the critical drought period, withdrawals for municipal use would encroach upon storage allocated to recreational use. This occurred during a time of the year when demand for recreational use would be at a minimum. However, such encroachment will be offset by use of existing municipal wells.

PROJECT BENEFITS

The estimated average annual floodwater, erosion, sediment, and indirect damages in the Walnut Creek portion of the watershed will be reduced from

$67,353 to $18,579, a reduction of 72 percent (table 5). Ten percent of reduction will accrue due to land treatment, while the other 62 percent reduction will result from the structural measures. Annual damage reductions attributable to the project, including those from land treatment, average $20,328 for crop and pasture damages, which includes $5,128 from restoration of former productivity (table B), $4,952 for other agricultur damage, $3,370 for road and bridge damage, $204 for flood plain scour, $11,368 for damage from overbank deposition, $4,118 for sediment depositi to Mountain Creek Lake, and $4,434 for indirect damage (table 5).

The total average annual flood damage reduction benefits, including flood water damage reduction, reduction of sediment deposition on flood plain lands, reduction of sediment deposition in Mountain Creek Lake, the reduc tion in flood plain scour damage, and the reduction of indirect damages, are estimated to average $48,774 annually, of which $41,585 will be the result of structural measures.

Secondary benefits stemming from and induced by the recreation and flood prevention aspects of the project are estimated to average $15,365 annual Secondary benefits of national significance were not considered pertinent to the economic evaluation.

The value of municipal water storage was determined as equal to the cost of an alternate single-purpose reservoir. The amortized value of the consulting engineer's estimate for such a structure is $20,855 annually for a 50-year life.

Consideration was given to the effect of critical drought periods on recreational water supply, and surface area. It was estimated that 75,00 visitor days of use of the recreational facilities would be expected annually. At $1.50 per visitor-day, the recreation benefits are estimate to be $112,500 annually.

COMPARISON OF BENEFITS AND COSTS

The average annual equivalent cost of the structural measures (amortized total installation cost, plus operation and maintenance) is estimated to be $65,002 (table 4). When the structures are installed, they are expect to produce average annual benefits from storage of municipal water, recre tion, and reduction of primary flood damages of $174,940, a benefit of $2.69 for each dollar of cost.

Total benefits, including secondary benefits, amount to $190,305 annually giving a benefit-cost ratio of 2.9:1 (table 6).

PROJECT INSTALLATION

Land treatment measures will be installed during a 5-year period by indiv dual landowners through the leadership of the soil conservation districts

The cost of applying these measures will be borne by the owners and operators of the land. Flood prevention funds will be used for technical assistance in the planning and application of conservation measures at an accelerated rate. Planning and application of land treatment measures in Walnut Creek watershed will be carried out in accordance with provisions of the 1955 Watershed Work Plan, as supplemented.

The Soil Conservation Service will prepare plans and specifications, contract for and supervise construction, prepare contract payment estimates, make final inspections, certify completion, and perform related tasks for the installation of the five floodwater retarding structures.

The sponsoring local organizations will furnish necessary land, easements, and rights-of-way, and arrange for necessary road and utility changes for the five floodwater retarding structures at no cost to the Federal government.

The Soil Conservation Service will prepare plans and specifications, contract for and supervise construction, prepare contract payment estimates, make final inspections, certify completion and perform related tasks for the installation of the multiple-purpose structure including the municipal outlet structure. The city of Mansfield will reimburse the Soil Conservation Service for the city's share of the construction and installation services costs (table 2). The consulting engineer employed by the city will have no responsibility for the multiple-purpose structure other than to furnish criteria for the design of the municipal outlet structure.

Land, easements, rights-of-way, and water rights necessary for the installation of the multiple-purpose structure (No. 28) and the basic recreational facilities will be furnished by the city of Mansfield, Texas. The payments for land, easements, and rights-of-way will be shared by the Federal government and the city of Mansfield (table 2).

The city of Mansfield will employ a consulting engineer for the construction and installation of the basic recreational facilities. The Soil Conservation Service will assist in the general layout and make inspections to insure that the facilities are installed as planned. The Service will reimburse the city of Mansfield for 50 percent of the payments made for construction and installation services.

The various features of cooperation between the cooperating parties have been covered in appropriate memoranda of understanding and working agreements.

The project consists of one construction unit which includes Sites 16A, 17, 18, 19A, 20, and 28. It is required that Sites 16A, 17, 18, and 19A be constructed prior to or simultaneously with construction of Site 28.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement on non-Federal land, as described in this supplemental work plan, will be provided under the authority of the Flood Control Act of 1944, as amended and supplemented.

Federal assistance for installation of structural measures will be made available pursuant to the following conditions:

1. The requirements for land treatment in the drainage area above structures have been satisfied.

2. Land, easements, and rights-of-way have been obtained for all structural measures, or written statements are furnished by the appropriate sponsoring local organizations that their rights of eminent domain will be used, if needed, to secure any remaining easements within the project installation period, and that sufficient funds are available and will be used to pay for these easements, permits, and rights-of-way.

3. Project and operation and maintenance agreements have been executed.

4. Flood prevention funds are available.

5. Before construction of multiple-purpose structure No. 28 is begun, the city of Mansfield will have funds available to cover its obligations for installation of this structure and the basic recreational facilities.

The qualified voters of the city of Mansfield, Texas, have voted revenue bonds to provide their share of the funds needed in acquiring rights-of-way, construction of works of improvement for Site No. 28, and basic recreational facilities (table 2).

The majority of the landowners were contacted by the local sponsors during the development of the work plan, and it is expected that the major portion of the land, easements and rights-of-way for the floodwater retarding structures will be donated. Donations will be supplemented by private or public funds as needed. The city of Mansfield will provide funds necessary to obtain land, easements and rights-of-way for the five floodwater retarding structures not otherwise donated. The Commissioners Court of the county in which the structure is located will exercise its power of eminent domain to secure this needed rights-of-way, using funds donated by the city of Mansfield.

The County Agricultural Stabilization Conservation Committee will cooperate with the sponsoring organizations by selecting and providing financial assistance for those land treatment measures which will meet the conservation objectives in the shortest possible time.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies to outline the services available and eligibility requirements. Present clients will be encouraged to cooperate in the project.

The sponsoring organizations do not plan to use a Farmers Home Administration loan for this project.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the landowners or operators of the farms on which the measures are installed under agreement with the Dalworth and Ellis-Prairie Soil Conservation Districts. Representatives of the soil conservation districts will make or cause to be made periodic inspection of the completed land treatment measures to determine maintenance needs and to encourage landowners and operators to perform needed maintenance. They will make district-owned equipment available for this purpose.

The estimated annual operation and maintenance cost is $500 for the five floodwater retarding structures, $600 for the multiple-purpose structure, and $10,182 for basic recreational facilities.

Each year, the County Commissioners Courts will transfer to the Road and Bridge Funds sufficient moneys for operation and maintenance of floodwater retarding structural measures.

The city of Mansfield will be responsible for operation and maintenance of the multiple-purpose structure, including recreational facilities, in accordance with provisions as specified in the Operation and Maintenance Agreement. Maintenance will be accomplished through the use of contributed labor and equipment, by contract, by force account, or a combination of these methods. Funds to be used for operation and maintenance of the structure will be taken from city revenues which may include income from recreational development.

Use and admission fees charged by the city will be limited to those necessary to amortize the initial investment and provide adequate funds for operation and maintenance. Initial fees will be commensurate with those for comparable facilities at existing recreation areas in the general vicinity. Adjustments may be made in fee rates as warranted.

It is estimated that the average annual cost of operation and maintenance for recreational facilities will be $10,182. This amount will be needed to operate the facilities and repair or replace such items as boat docks, sanitary facilities, water supply at recreational areas, roads, picnic equipment, equipment at the beach, renewal of the beach, and safety equipment. These

funds also will provide for custodial, policing, sanitation, safety and other operation services.

Preventive actions will be taken as necessary to correct conditions likely to result in damage to recreational facilities. In the event damages occur to the recreational facilities or equipment, prompt corrective actions will be taken in an effort to minimize maintenance costs.

The Johnson County Commissioners Court will be responsible for operation and maintenance of floodwater retarding structures Nos. 16A, 17, 18, and 19A. Maintenance will be accomplished through the use of contributed labor, by contract, by force account, or by a combination of these methods. The court will establish a permanent reserve fund to be used for operation and maintenance of the structural measures from tax revenue being collected by the county.

Responsibility for operation and maintenance of floodwater retarding structure No. 20 will be assumed by the Tarrant County Commissioners Court. Maintenance will be accomplished through the use of contributed labor, by contract, by force account, or by a combination of these methods. A permanent reserve fund will be established for use in operation and maintenance of this structure.

The structural measures will be inspected jointly by representatives of the appropriate soil conservation district and county commissioners courts or the city of Mansfield after each heavy streamflow. The Soil Conservation Service representative will participate in these inspections at least annually. Inspection items which may require attention will include, but will not be limited to, the condition of the principal spillway and its appurtenances, the earth fill, the emergency spillway, and the fences and gates installed as a part of the structure.

Representatives of the city of Mansfield will inspect the recreational facilities of the multiple-purpose structure following each major storm, period of heavy use, event likely to produce damage, or at least monthly. Inspections during the season of heavy usage will be made as often as necessary to prevent deterioration of the facilities. A representative of the Soil Conservation Service will participate in the inspections of the recreational facilities as often as may be required to assure their proper maintenance, but not less frequently than once a year.

The Soil Conservation Service, through the soil conservation districts, will participate in operation and maintenance only to the extent of furnishing technical assistance to aid in inspections and technical guidance and information necessary for the operation and maintenance program.

Provisions will be made for free access of representatives of sponsoring local organizations and Federal representatives to inspect and provide maintenance for all structural measures and their appurtenances at any time.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Mountain Creek Watershed, Texas
(Trinity River Watershed)

Installation Cost Item	Unit	Number To Be Applied 2/	Estimated Cost (Dollars) 1/ Federal	Non-Federal 3/	Total
LAND TREATMENT					
Soil Conservation Service					
Conservation Cropping System	Acre	3,680	-	-	-
Contour Farming	Acre	1,500	-	1,500	1,500
Cover and Green Manure Crop	Acre	2,547	-	17,829	17,829
Crop Residue Use	Acre	5,163	-	10,326	10,326
Range Deferred Grazing	Acre	270	-	945	945
Firebreak	Foot	1,597	-	16	16
Hayland Planting	Acre	27	-	405	405
Pasture and Hayland Renovation	Acre	1,538	-	15,380	15,380
Pasture Planting	Acre	5,520	-	82,800	82,800
Pasture Proper Use	Acre	3,155	-	9,465	9,465
Range Proper Use	Acre	363	-	1,089	1,089
Rotation Grazing	Acre	3,475	-	10,425	10,425
Brush and Weed Control	Acre	1,040	-	20,800	20,800
Diversion	Foot	30,880	-	1,081	1,081
Farm Pond	No.	141	-	35,250	35,250
Grade Stabilization Structures	No.	16	-	16,000	16,000
Grassed Waterway or Outlet	Acre	274	-	15,070	15,070
Terrace, Gradient	Foot	346,930	-	6,939	6,939
Terrace, Parallel	Foot	3,689	-	92	92
Trough or Tank	No.	3	-	90	90
Technical Assistance (Accelerated)			25,000	-	25,000
Subtotal			25,000	245,502	270,502
TOTAL LAND TREATMENT			25,000	245,502	270,502
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	19	1,565,028	-	1,565,028
Multiple-Purpose Structure	No.	1	191,165	151,915	343,080
Municipal Outlet Structure	No.	1	-	13,610	13,610
Basic Recreational Facilities			28,595	28,595	57,190
Subtotal - Construction			1,784,788	194,120	1,978,908
Installation Services					
Soil Conservation Service					
Engineering Services			261,889	14,990	276,879
Other			159,395	12,568	171,963
Subtotal - Installation Services			421,284	27,558	448,842
Other Costs					
Land, Easements, and Rights-of-Way			127,685	657,092	784,777
Legal Fees			-	19,750	19,750
Subtotal - Other Costs			127,685	676,842	804,527
TOTAL STRUCTURAL MEASURES			2,333,757	898,520	3,232,277
Work Plan Preparation Cost			16,237	-	16,237
TOTAL PROJECT			2,374,994	1,144,022	3,519,016
SUMMARY					
Subtotal - SCS			2,374,994	1,144,022	3,519,016
TOTAL PROJECT			2,374,994	1,144,022	3,519,016

1/ Price Base: 1963.

2/ There are no Federal lands in the watershed.

3/ Excludes costs reimbursed from other Federal funds.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(At Time of Supplemental Work Plan Preparation)
Mountain Creek Watershed, Texas
(Trinity River Watershed)

Installation Cost Item	Unit	Number Applied To Date 2/	Estimated Cost (Dollars) 1/ Federal	Non-Federal 3/	Total
LAND TREATMENT					
Soil Conservation Service					
Conservation Cropping System	Acre	29,383	-	-	-
Contour Farming	Acre	31,938	-	31,938	31,938
Cover and Green Manure Crop	Acre	35,513	-	248,591	248,591
Crop Residue Use	Acre	28,698	-	57,396	57,396
Range Deferred Grazing	Acre	3,764	-	13,174	13,174
Firebreak	Foot	22,160	-	223	223
Hayland Planting	Acre	376	-	5,640	5,640
Pasture and Hayland Renovation	Acre	21,447	-	214,470	214,470
Pasture Planting	Acre	18,979	-	284,685	284,685
Pasture Proper Use	Acre	28,704	-	86,112	86,112
Range Proper Use	Acre	3,734	-	11,202	11,202
Rotation Grazing	Acre	25,417	-	76,251	76,251
Brush and Weed Control	Acre	9,803	-	196,060	196,060
Diversion	Foot	459,360	-	16,078	16,078
Farm Pond	No.	497	-	124,250	124,250
Grade Stabilization Structures	No.	23	-	23,000	23,000
Grassed Waterway or Outlet	Acre	1,137	-	62,535	62,535
Terrace, Gradient	Foot	6,938,610	-	138,772	138,772
Terrace, Parallel	Foot	36,891	-	922	922
Trough or Tank	No.	34	-	1,020	1,020
Technical Assistance (Accelerated)			98,400	-	98,400
Subtotal			98,400	1,592,319	1,690,719
TOTAL LAND TREATMENT			98,400	1,592,319	1,690,719
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	3	118,819 4/	-	118,819
Subtotal - Construction			118,819 4/	-	118,819
Installation Services					
Soil Conservation Service					
Engineering Services			25,736	-	25,736
Other			11,928	-	11,928
Subtotal - Installation Services			37,664	-	37,664
Other Costs					
Land, Easements, and Rights-of-Way			-	69,852	69,852
Legal Fees			-	450	450
Subtotal - Other Costs			-	70,302	70,302
TOTAL STRUCTURAL MEASURES			156,483	70,302	226,785
Work Plan Preparation Cost			14,763	-	14,763
TOTAL PROJECT			269,646	1,662,621	1,932,267
SUMMARY					
Subtotal - SCS			269,646	1,662,621	1,932,267
TOTAL PROJECT			269,646	1,662,621	1,932,267

1/ Price Base: 1963.

2/ There are no Federal lands in the watershed.

3/ Excludes costs reimbursed from other Federal funds.

4/ Actual construction cost.

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION 1/
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)

(Dollars) 2/

Structure Site Number or Name	Installation Cost - Federal Funds					Installation Cost - Other Funds					Total Installation Cost
	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Federal	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Non-Federal	
Floodwater Retarding Structures											
16A	67,528	10,129	5,922	-	83,579	-	-	-	19,650	19,650	103,229
17	75,196	11,279	6,594	-	93,069	-	-	-	31,100	31,100	124,169
18	57,432	10,442	5,168	-	73,042	-	-	-	19,100	19,100	92,142
19A	100,332	15,050	8,798	-	124,180	-	-	-	20,200	20,200	144,380
20	61,139	11,116	5,501	-	77,756	-	-	-	16,050	16,050	93,806
Subtotal	361,627	58,016	31,983	-	451,626	-	-	-	106,100	106,100	557,726
Multiple-Purpose Structure 28	191,165	23,540	19,745	104,935	339,385	151,915	10,770	9,030	183,915 3/	355,630	695,015
Municipal Outlet	-	-	-	-	-	13,610	1,360	1,140	-	16,110	16,110
Basic Recreational Facilities	28,595	2,860	2,397	22,750	56,602	28,595	2,860	2,398	22,750	56,603	113,205
Subtotal	219,760	26,400	22,142	127,685	395,987	194,120	14,990	12,568	206,665	428,343	824,330
GRAND TOTAL	581,387	84,416	54,125	127,685	847,613	194,120	14,990	12,568	312,765	534,443	1,382,056

1/ Does not include work plan preparation cost.

2/ Price Base: 1963.

3/ Includes $15,900 for legal fees.

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES AND MULTIPLE-PURPOSE STRUCTURE

Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER 16A	17	18	19A	20	28	Total
Drainage Area	Sq.Mi.	2.98	4.99	2.32	3.48	3.75	1/ 19.19	36.71
Storage Capacity								
Sediment Pool	Ac.Ft.	181	176	100	199	82	200	938
Sediment Reserve Below Riser	Ac.Ft.	0	0	0	118	0	373	491
Sediment in Detention Pool	Ac.Ft.	33	50	29	59	24	164	359
Water Supply	Ac.Ft.	0	0	0	0	0	2/ 7,650	7,650
Floodwater Detention	Ac.Ft.	887	1,464	842	997	894	4,995	10,079
Total	Ac.Ft.	1,101	1,690	971	1,373	1,000	13,382	19,517
Surface Area								
Sediment Pool 3/	Acre	37	39	19	53	19	140	307
Water Supply Pool	Acre	-	-	-	-	-	675	3/ 675
Floodwater Pool	Acre	116	195	113	109	122	920	1,575
Volume of Fill	Cu.Yd.	117,620	134,410	103,170	197,100	123,440	438,900	1,114,640
Elevation Top of Dam	Foot	745.1	719.9	708.1	668.2	632.7	647.5	xxx
Maximum Height of Dam 4/	Foot	41	36	39	43	33	50.4	xxx
Emergency Spillway								
Crest Elevation	Foot	739.7	715.0	703.1	663.3	628.0	640.5	xxx
Bottom Width	Foot	210	285	130	300	120	500	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Percent Chance of Use 5/		3.6	2.5	1.7	3.5	3.7	2.7	xxx
Average Curve No. - Condition II		84	77	77	82	77	77	xxx
Emergency Spillway Hydrograph								
Storm Rainfall (6-hour) 6/	Inch	9.81	9.59	9.90	9.75	6.47	8.26	xxx
Storm Runoff	Inch	7.85	6.75	7.04	7.51	3.90	5.51	xxx
Velocity of Flow (V_c) 7/	Ft./Sec.	3.8	3.0	1.8	2.7	0	3.1	xxx
Discharge Rate 7/	C.F.S.	1,020	400	30	965	0	348	xxx
Maximum Water Surface Elevation 7/	Foot	741.6	715.9	703.3	664.8	-	641.1	xxx
Freeboard Hydrograph								
Storm Rainfall (6-hour) 8/	Inch	22.24	21.73	22.44	22.10	15.14	18.72	xxx
Storm Runoff	Inch	20.05	17.45	19.20	19.80	12.07	15.56	xxx
Velocity of Flow (V_c) 7/	Ft./Sec.	10.0	9.5	9.7	9.5	9.4	10.8	xxx
Discharge Rate 7/	C.F.S.	6,620	7,570	3,577	8,375	3,010	23,988	xxx
Maximum Water Surface Elevation 7/	Foot	745.1	719.9	708.1	668.2	632.7	647.5	xxx
Principal Spillway Capacity (Maximum)	C.F.S.	40	63	29	44	47	412	xxx
Capacity Equivalents								
Sediment Volume	Inch	1.35	0.85	1.04	2.03	0.53	0.72	xxx
Water Supply Volume	Inch	0	0	0	0	0	7.47	xxx
Detention Volume	Inch	5.58	5.50	6.81	5.37	4.47	4.88	xxx
Spillway Storage 9/	Inch	4.57	4.35	5.45	3.20	3.50	7.23	xxx
Class of Structure		B	B	B	B	A	B	xxx

1/ Exclusive of area controlled by other floodwater retarding structures.

2/ Consists of 3,450 acre-feet of recreational water storage and 4,200 acre-feet of municipal water supply storage.

3/ Includes the 140-acre sediment pool surface area of multiple-purpose structure No. 28. The total surface area of the sediment and water supply pools is 842 acres.

4/ Measured from centerline of stream channel to effective top of dam.

5/ Based on regional analysis of gaged runoff. All structures exceed minimum requirements in Washington Engineering Memorandum SCS-27.

6/ .5P for Class (A) structures and .75P for Class (B) structures. Value of P taken from Figure 3.21-1, Supplement A, Section 4, National Engineering Handbook.

7/ Maximum during passage of hydrograph.

8/ 1.17P for Class (A) structures and 1.70P for Class (B) structures. Value of P taken from Figure 3.21-1, Supplement A, Section 4, National Engineering Handbook, as modified by Engineering and Watershed Planning Unit Technical Letter Code EWP-H-3, dated June 8, 1959.

9/ Storage from emergency spillway crest to top of dam.

TABLE 4 - ANNUAL COST
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Floodwater Retarding Structures 16A, 17, 18, 19A, and 20 and Multiple-Purpose Structure No. 28, and Basic Recreational Facilities	53,720	11,282 3/	65,002
TOTAL	53,720	11,282	65,002

1/ Installation costs based on 1963 prices amortized for 50 years at 3.0 percent.

2/ Long-term prices as projected by ARS, September 1957.

3/ Include $10,182 for Operation and Maintenance for basic recreational facilities.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	28,472	8,144	20,328
Other Agricultural	5,905	953	4,952
Nonagricultural (road and bridge)	3,693	323	3,370
Subtotal	38,070	9,420	28,650
Sediment			
Overbank Deposition	15,073	3,705	11,368
Mountain Creek Lake	7,810	3,692	4,118
Subtotal	22,883	7,397	15,486
Erosion			
Flood Plain Scour	277	73	204
Indirect	6,123	1,689	4,434
TOTAL	67,353	18,579	48,774

1/ Price Base: Long-term as projected by ARS, September 1957.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/					Average Annual Cost 2/	Benefit-Cost Ratio
	Flood Prevention: Damage Reduction	Recreation	Municipal Water	Secondary	Total		
Floodwater Retarding Structures 16A, 17, 18, 19A and 20 and Multiple-Purpose Structure No. 28	41,585	112,500	20,855	15,365	190,305	65,002	2.9
GRAND TOTAL	3/ 41,585	112,500	20,855	15,365	190,305	65,002	2.9

1/ Price Base: Long-term prices as projected by ARS, September 1957.

2/ From Table 4.

3/ In addition, it is estimated that land treatment measures will provide additional flood prevention benefits of $7,189.

INVESTIGATIONS AND ANALYSES

Land Use and Treatment Investigations

The status of land treatment measures for the watershed was developed by the soil conservation districts assisted by personnel from the Soil Conservation Service work units at Burleson, Dallas, and Fort Worth.

Conservation needs data for the watershed were studied and the quantity of each land treatment practice which contributes directly to watershed protection and flood prevention that will be applied during the 5-year installation period was estimated (table 1).

Engineering Investigations

The following steps were taken in making the engineering investigations:

1. A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads, and other pertinent information. A stereoscopic study of consecutive 4-inch aerial photographs was used to locate possible floodwater retarding structure sites. Locations of structure sites and valley cross sections were placed on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations (figure 7).

2. A field examination was made of all possible floodwater retarding structure sites located stereoscopically. Sites which did not show good storage possibilities or in which obstacles were encountered, making the site unfeasible from an economic standpoint, were dropped from further consideration.

   A system of floodwater retarding structures was selected from the remaining sites for further consideration and detailed survey. Plans of a floodwater retarding structure typical of those planned for the watershed are illustrated by figures 2 and 2A.

3. Topographic maps with 4-foot contour intervals and a scale of 1 inch = 660 feet were developed on aerial photographs from engineering surveys of the pool area of each site. The height of the dams and the size of the pools were determined by the storage volume needed to detain the runoff from the principal spillway design storm and to provide storage needed for sediment in the single-purpose floodwater retarding structures, plus additional storage for water supply in Site 28.

4. Structure data tables were developed to show drainage area, storage capacity planned for floodwater detention, sediment, and water supply storage, release rate of the principal spillway, emergency spillway capacity, area inundated by the pools, and other pertinent data for each structure (table 3).

5. The minimum floodwater detention capacity required for Class (a) floodwater retarding structures is that needed to detain temporarily the runoff from a 6-hour, 25-year frequency storm and for Class (b) structures, the runoff from a 6-hour, 50-year frequency storm. Additional capacity was planned in Site 20 to detain the expected runoff from a 25-year frequency storm event and in Site 18 the expected runoff from a 50-year frequency storm event as determined from a regional analysis of stream gage records. Although additional detention capacity was planned in Sites 16A, 17, 19A, and 28, limitations precluded providing capacity for the runoff from the 50-year frequency event. All detention volumes exceed the above minimums as set forth in Engineering Memorandum SCS-27.

   Floodwater retarding structures 16A, 17, 18, and 19A were planned above Site 28 because of site limitations of the multiple-purpose site.

   The percent chance of use of the emergency spillway as shown in table 3 is based on a regional analysis of gaged runoff.

6. Appropriate spillway design and freeboard storms were selected from figures 3.21-1 and 3.21-4, National Engineering Handbook, Section 4, Supplement A, in accordance with criteria contained in Engineering Memorandum SCS-27 and modified by Engineering and Watershed Planning Unit Technical Letter EWP-H-3.

   Spillway design and freeboard inflow hydrographs were developed for each of the floodwater retarding structures and the multiple-purpose structure by the distribution graph method. Various combinations of spillway widths and depths were computed in order to determine the most economical structure. All floodwater retarding structures and the multiple-purpose structure were graphically routed using the Goodrich flood routing method described on page 5.8-12 of the National Engineering Handbook, Section 5, to determine the effective top of dam.

7. Estimates were made of the volume of fill in the dams and the costs of the structures. Total costs were determined from a preliminary design and cost estimate of significant individual

items such as embankment, principal spillway, clearing, and fencing. Unit prices were determined from recent contracts of structures in similar sites. Conditions peculiar to an individual site such as wet excavation and clearing of dense timber were considered.

Cost distribution tables were developed (table 2).

Hydraulic and Hydrologic Investigations

Steps taken, together with investigations and determinations made during the preparation of the Mountain Creek Watershed Work Plan of March 1955, were utilized in this supplement to the work plan. Due to changes in floodwater retarding structures and the request for inclusion of the multiple-purpose site, it was necessary that additional steps be taken and more detailed information be developed during preparation of the supplement.

The following additional steps were taken as part of the hydrologic and hydraulic investigations and determinations:

1. Present and future soil-cover complex conditions were established using current procedures and based on a 44 percent sample of the Walnut Creek portion of the watershed.

2. Plan and profile sheets were prepared showing the limits and the area of the flood plain, points where valley cross sections were taken, and profiles of the stream channel and flood plain.

3. Additional valley cross sections which permitted a more detailed evaluation of flooding were surveyed.

4. Data developed from cross sections were used to compute the peak discharge-damage relationship for various flood flows.

5. Studies of population trends and water use requirements for the city of Mansfield were prepared by the consulting engineering firm.

6. Prior water rights downstream from the proposed multiple-purpose structure were considered and found to be served.

7. Determinations were made of the area by depth increments that would have been inundated by each storm in the evaluation series under conditions that would exist due to:

    a. Present conditions of the watershed.

    b. The installation of land treatment measures.

c. The installation of land treatment measures and floodwater retarding structures.

Reservoir Operation

Reservoir operation studies were made on the multiple-purpose reservoir considering the following:

1. Storage data tables developed and plotted as shown in figure 4.

2. The most critical drought period of record (calendar years 1951 through February 1957).

3. Gaged inflow records for Mountain Creek Lake.

4. Monthly rainfall records maintained at Mansfield, Texas.

5. Gross lake surface evaporation from Texas Water Commission data (Texas Board of Water Engineers' Bulletin 6006) with adjustment for pan coefficient to conform with data in U. S. Department of Commerce, Weather Bureau, Technical Paper No. 37.

6. Monthly future water requirements as developed by the consulting engineering firm and based on the projected population for the city of Mansfield, as shown in the following tabulation:

Monthly Water Demands
Mansfield, Texas
(1990 Population)

Month	Gallons	Acre-Feet
January	16,900,000	52
February	15,000,000	46
March	16,300,000	50
April	21,200,000	65
May	20,500,000	63
June	28,700,000	88
July	31,300,000	96
August	30,600,000	94
September	29,000,000	89
October	17,900,000	55
November	18,200,000	56
December	14,700,000	45

The operation studies, considering evaporation from the sediment pools of the sites in series above, were made through the selected period assuming each purpose individually and both purposes combined to determine the following:

a. Minimum storage and surface area reached due to loss by evaporation from the recreation pool.

b. Minimum storage reached due to loss by evaporation and use by the city of Mansfield.

c. Minimum storage and surface area of the combined purposes due to loss by evaporation and use by the city of Mansfield.

The results of these operations were plotted and are shown in figure 5.

Sedimentation Investigations

Sedimentation investigations for the work plan were made in accordance with procedures as outlined in Technical Release No. 17, "Geologic Investigations for Watershed Planning", March 1961, and Technical Release No. 12, "Procedures for Computing Sediment Requirements for Retarding Reservoirs", September 1959, U. S. Department of Agriculture, Soil Conservation Service.

Sediment Source Studies

Sediment source studies to determine the 50-year sediment storage requirements were made in the drainage areas of the six planned structure sites according to the following procedures:

1. Field surveys to determine gross sheet erosion included: mapping soil units by slope in percent, slope length in feet, present land use, present land treatment on cropland, present cover condition classes on pasture and woodland, and land capability classes. Gully and stream channel investigations included mapping lengths, depths, and estimated annual lateral erosion of stream channels and gullies, and the estimated annual headward erosion of gullies.

2. Computations included summarizing erosion by sources (sheet, gully, and streambank erosion), and the use of appropriate formulae to compute the annual gross erosion in tons.

3. The gross erosion rates were then adjusted to reflect the effect of land treatment above the planned structures. The computed sediment storage requirement for each structure is based on a gradual improvement of watershed conditions as

a result of the expected application of needed land treatment measures during the installation period and maintaining these measures at 75 percent effectiveness for the remainder of the project period.

4. Sediment storage requirements for structures were determined by adjusting annual gross erosion for expected delivery ratios and trap efficiency.

5. The ratio of sediment storage volume in the pools to soils in place was based on volume weights ranging from 84 to 95 pounds per cubic foot (soil in place) and 62 to 82 pounds per cubic foot (sediment).

6. The allocation of sediment to the structure pools ranged from 20 to 30 percent deposition in the detention pool and 70 to 80 percent in the sediment pool.

Flood Plain Sedimentation and Scour Damages

The following sedimentation and scour damage investigations were made to determine the nature and extent of physical damage to the flood plain land:

1. Hand auger borings were made along each of the valley cross sections (figure 7), making note of the depth and texture of the deposit, soil conditions, scour channels, stream channel aggradation or degradation, and other pertinent factors contributing to flood plain damage.

2. Estimates of past physical flood plain damage were obtained through interviews with land owners and operators and by comparing crops on damaged and undamaged land.

3. A damage table was developed to show percent of damage by texture and depth increments for deposition and percent of damage by depth and width for scour channels.

4. The depth and area of damaging sediment deposits and scour areas were measured and tabulated.

5. The damage to the productive capacity of the flood plain was assessed by percent for each type damage.

6. The sedimentation and scour damages were summarized by evaluation reaches for the entire flood plain. Estimates of recoverability of productive capacity were developed as a result of field studies and interviews with farmers.

7. Using the average annual erosion rates as a basis, the average annual sediment yields to selected reaches of the flood plain were estimated for present conditions, with land treatment, and with structural measures installed. The results were compared to show the average annual reduction of overbank deposition. The reduction of scour damage is based on reductions in depth and area inundated.

Sedimentation in Mountain Creek Lake

The estimate of the present annual sediment yield to Mountain Creek Lake from Walnut Creek watershed is based on a detailed study of sediment sources and the use of delivery ratio curves developed by the Soil Conservation Service. The estimated present annual sediment yield of 0.65 acre-foot per square mile from Walnut Creek watershed is considerably lower than the sediment yield of the remaining contributing area above Mountain Creek Lake. The estimated annual contribution from Walnut Creek watershed with the project installed and functioning effectively will be 0.31 acre-foot per square mile, a reduction of 52 percent.

Geologic Investigations

Preliminary geologic investigations were made at each of the proposed structural sites. These included studies of valley slopes, alluvium, channel banks, and exposed geologic formations. Borings with a hand auger were made to obtain preliminary information on the nature and extent of embankment materials, foundation conditions, and emergency spillway excavation that might be encountered in construction. Core drilling equipment was utilized in the investigations of Site 28 (multiple-purpose structure).

All the planned structural sites are in the outcrop of the Woodbine group of Upper Cretaceous age. The Woodbine consists of packsands and fine-grained sandstones interbedded with sandy shales and clays. Foundation and borrow materials are SM, SC, CL, and CH, as classified under the Unified Soil Classification System. Ample embankment materials are available at all sites. Foundation drainage measures may be necessary on Sites 17 and 18 where thick deposits of SM are present. Core drill investigations revealed permeable foundation materials on Site 28. A nearly positive cutoff with a maximum depth of 22 feet can be obtained into underlying impermeable shale, eliminating any serious seepage problems.

Emergency spillway areas are erodible when stripped of vegetative cover. Embankments and emergency spillways will be vegetated as soon as possible after construction. A low percentage of rock excavation was estimated in the emergency spillway of Site 28. Little or no rock excavation will be encountered on the other five sites. All these factors were considered in arriving at construction costs.

Detailed investigations, including exploration with core drilling equipment and field permeability tests, will be made at all sites prior to their construction. Laboratory tests will be performed to determine the suitability and handling of embankment and foundation materials.

Economic Investigations

Selection of Evaluation Reaches

In order to simplify evaluation of the effects that various combinations of structural measures would have on the reduction of damages, the flood plain of Walnut Creek was divided into four evaluation reaches.

Reach I included the flood plain involved in the Lakeview site which has been under consideration by the U. S. Corps of Engineers. After it was determined that probability for construction of the Lakeview Reservoir is in the remote future, Reaches I and II were combined for evaluation purposes.

Feasibility of floodwater retarding structures without the multiple-purpose reservoir was evaluated, and the flood plain involved in Site 28 comprised Reach III.

Reach IV consists of the flood plain above the pool area of Site 28 and extends to the uppermost floodwater retarding structures of Walnut Creek.

Determination of Damages

Flood damage information for approximately 90 percent of the flood plain area of Walnut Creek was obtained from land owners or operators. Current land use and crop distribution was mapped in the field and changes in cropping pattern were noted. Estimates of normal flood-free yields were based on data given by land owners and operators and other agricultural workers familiar with the area. Crop and pasture damage and other agricultural damage were determined for each flood in a historical storm series covering the 22-year period (1923-1944).

Information concerning flood damage to roads and bridges was obtained from road officials and supplemented by local farmers.

Damages from flood plain erosion and sediment deposition were computed for existing conditions on the basis of loss in productivity which has occurred. Expected reduction in flood plain erosion damage is related to reduced depth and area of flooding after installation of the project. Expected reduction in damages from sediment deposition is related to drainage area controlled above floodwater retarding structures and reduced area of flooding with the project.

Indirect damages involve such items as additional travel time for farmers, rerouting of school buses and mail deliveries, extra cost of feed for livestock following floods, and losses in business sustained by dealers and industry in the area. It was determined that 10 percent of the direct damages would be an equitable estimate for indirect damage.

Restoration of Former Productivity

During the course of field investigations, information was obtained on land use changes made on flood plain lands as a result of past flooding. Farmers were also asked what changes in land use and crop distribution might be expected if flooding was reduced 50 percent. Analysis of these responses provided the basis for estimating benefits from restoration of former productivity on the flood plain. Only that portion of flood plain which is expected to be flooded on an average of less than once in three years after installation of project is considered as subject to restoration or more intensive use. Land use in the portion of flood plain not subject to such change was assumed to remain the same.

Restoration benefits after allowing for added damage and discounting for time lag in Reaches I and II were estimated to be $5,128 annually (table B). No benefits from restoration or more intensive use were claimed in Reach IV. These benefits have been included in the reduction of crop and pasture damage in table 5. The increase in acreage of cotton on flood plain will be more than offset by reduction of acreage in this crop on upland by retirement to pasture.

Benefits from Reduction of Damages

Average annual damages within the watershed were calculated for conditions without a project, with land treatment installed, and after installation of the complete project. The difference in damages computed for each progressive increment of the project constitutes benefits brought about by that increment through reduction of damages.

Benefits from reduction of crop and pasture damages and flood plain scour resulted from combined effect of reduced area flooded and depth of inundation.

Benefits from reduction in sediment deposition are related to the area controlled by structures which trap most of the sediment. With a reduced area inundated, less flood plain is subjected to sediment deposition, thereby affecting the extent of damage from this source. Benefits from reduction of damage to Mountain Creek Lake by sediment deposition are brought about by extending the useful life and reducing cost of maintenance. This was based on the straight line method using cost per acre-foot for installation cost adjusted to current price level.

Secondary Benefits

Secondary benefits resulting from the project were estimated to be 10 percent of the primary flood prevention benefits exclusive of reduction of indirect damage accruing to the structural measures, 10 percent of the increased production costs associated with restoration of flood plain lands to former productivity, and 10 percent of recreation benefits. These totaled $15,365 annually.

Municipal Water

The value of municipal water storage was determined to be equivalent to the alternate cost of constructing an adequate single-purpose reservoir. The cost of a reservoir having a total storage of 9,000 acre-feet, which provides 4,000 acre-feet of conservation storage and 5,000 acre-feet of flood storage permitting the use of a vegetated spillway, was estimated to be $521,100 according to the consulting engineer's report. This was amortized to an annual equivalent cost of $20,255.

Recreation Benefits

On the basis of information obtained regarding recreational use from municipal lakes at Waxahachie, Corsicana, Weatherford, and Arlington, estimates were made of expected use of the proposed recreation facilities for the multiple-purpose site. Benefits from recreation are based on anticipated use for boating, fishing, swimming, and picnicking. Anticipated use was estimated at 5,000 visitors per week for the peak season of June through September or 75,000 visitors annually, based on information from other municipal reservoirs in the area. Value of recreational use was placed at $1.50 per visitor-day, making an annual benefit of $112,500.

Table A - Basic Recreational Facilities
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)
Site 28

Item	Unit	Number	Unit Cost (dollars)	Amount 1/ (dollars)
1. Roads - Rock Base with Gravel Surface	Mile	4.6	3,000	13,800
2. Parking Lots (90,000 Square Feet) (Rock Base with Gravel Surface)	Each	2	4,500	9,000
3. Water Supply				
Wells Cased with Pump and Motor	Each	5	900	4,500
4. Sanitary Facilities				
a. Single Seat Pit Toilets	Each	2	700	1,400
b. Double Seat Pit Toilets	Each	6	1,000	6,000
5. Electrical and Lighting				
a. Boat Docks	Each	3	175	525
b. Picnic Areas	Each	4	100	400
c. Beach	Each	1	225	225
d. Water Wells	Each	5	25	125
6. Beach Development				
a. Bathhouse (Includes flush toilets)	Each	1	8,500	8,500
b. Sand	Cu.Yd.	1,600	3	4,800
7. Boat Docks	Each	3	500	1,500
8. Boat Ramps	Each	5	176	880
9. Picnic Facilities				
a. Table and Benches, Concrete	Each	30	370	11,100
b. Cooking Fireplace	Each	30	100	3,000
c. Garbage Receiver, Concrete slab	Each	30	25	750
d. Parking Spurs	Each	30	40	1,200
10. Land	Acre	182	250	45,500
Total				113,205

1/ Includes installation services.

Supplement
July 1963

Table B - Summary of Primary Benefits from Restoration of Former Productivity
Walnut Creek - Mountain Creek Watershed, Texas
(Trinity River Watershed)
Reaches I and II

Crop	Acres	Yield Per Acre	Production	Gross Income	Production Cost	Net Return
				(dollars)	(dollars)	(dollars)
Without Project						
Cotton	61	325 lbs.	19,825	5,948	4,098	1,850
Grain Sorghum	24	35 cwt.	840	1,537	456	1,081
Alfalfa	9	3 tons	27	737	254	483
Sorghum Hay	194	4 tons	776	17,460	8,713	8,747
Forage Sorghum	96	10 tons	960	7,680	1,287	6,393
Oats	(102)	45 bu.	4,590	3,764	2,022	1,742
Oats, Pasture	(348)	1 ton	348	9,500	7,506	1,994
Clover & Sudan Pasture	292	6 AUM	1,752	3,627	1,688	1,939
Pasture	810	3 AUM	2,430	5,030	-	5,030
Woods Pasture	563	2.4 AUM	1,351	2,797	-	2,797
Improved Pasture	85	6 AUM	510	1,056	-	1,056
Clover Pasture	17	4 AUM	68	141	-	141
Pecans	(68)	500 lbs.	34,000	6,800	3,400	3,400
Truck	6	$250/ac.	-	1,500	900	600
Idle & Miscellaneous	19	-	-	-	-	-
Total	2,176			67,577	30,324	37,253
With Project						
Cotton	84	325 lbs.	27,300	8,190	5,643	2,547
Grain Sorghum	68	35 cwt.	2,380	4,355	1,293	3,062
Alfalfa	43	3 tons	129	3,522	1,215	2,307
Sorghum Hay	210	4 tons	840	18,900	9,431	9,469
Forage Sorghum	112	10 tons	1,120	8,960	1,502	7,458
Oats	(88)	45 bu.	3,960	3,247	1,744	1,503
Oats, Pasture	(312)	1 ton	312	8,518	6,730	1,788
Clover & Sudan Pasture	234	6 AUM	1,404	2,906	1,353	1,553
Pasture	655	3 AUM	1,965	4,068	-	4,068
Woods Pasture	563	2.4 AUM	1,351	2,797	-	2,797
Improved Pasture	158	6 AUM	948	1,962	-	1,962
Clover Pasture	28	4 AUM	112	232	-	232
Pecans	(68)	500 lbs.	34,000	6,800	3,400	3,400
Truck	9	$250/ac.	-	2,250	1,350	900
Idle & Miscellaneous	12	-	-	-	-	-
Total	2,176			76,707	33,661	43,046

Net increase in project	5,793
Less added damage	183
	5,610
Discounted Increased Net Return	5,128

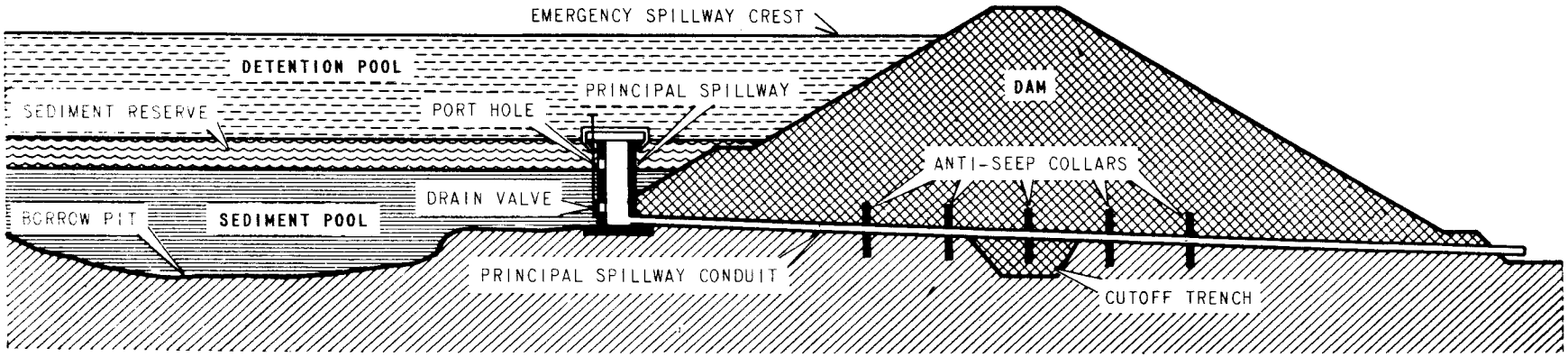


Figure 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

Emergency Spillway Diversion: 18" effective height, 3:1 side slopes, minimum base, 13'. Cost of diversion to be subsidiary to other items of work.

A minimum of 6" topsoil to be placed in Emergency Spillway and on all "Compacted Fill Areas". See the specifications.

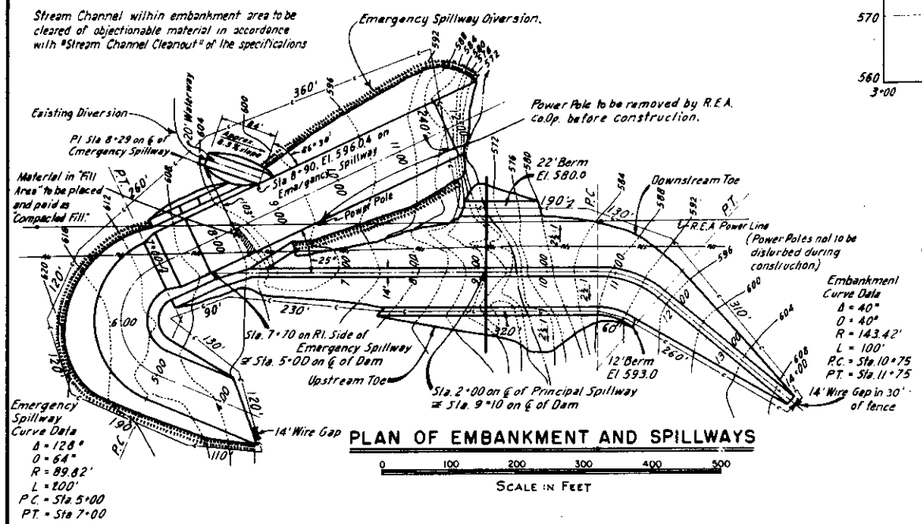
Stream Channel within embankment area to be cleared of objectionable material in accordance with "Stream Channel Cleanout" of the specifications

FENCE LEGEND

—L—C— Fence to be constructed under this contract.

—R—W— Fence in construction area to be removed and salvaged by the contractor.

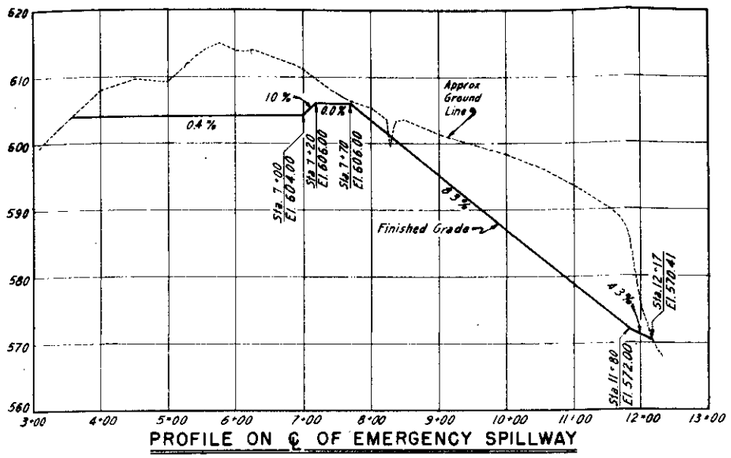
Pull panels shall be set at the P.C. and P.T. of the fence on the upstream berm. Intermediate post shall be set in concrete.



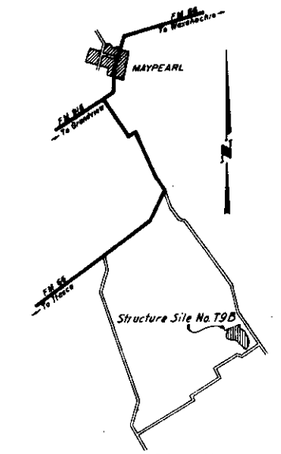
PLAN OF EMBANKMENT AND SPILLWAYS

0 100 200 300 400 500

SCALE IN FEET



PROFILE ON ℄ OF EMERGENCY SPILLWAY

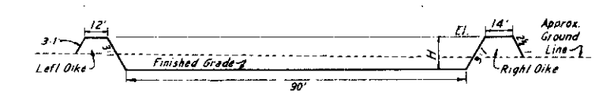


Structure Site No 79B located four miles south and one mile east of Maypearl, Ellis County, Texas

VICINITY MAP

0 1 2 3 4

SCALE IN MILES

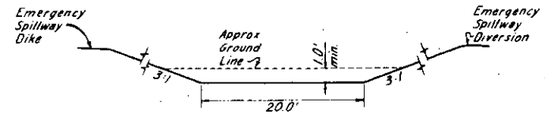


Left Dike
Approx Sta 7+20 to Sta 7+70, El 609.2.
Sta 7+70 to Sta. 8+00, Transition.
Sta. 8+00 to ground line @ approx. Sta. 8+40, H = 3'

Right Dike
Sta. 7+00 to Embankment @ El 609.30.
Embankment to Ground Line @ approx Sta 9+00, Transition
At approx Sta. 9+00, H = 1'

Material forming dikes to be placed and paid as "Compacted Fill".

TYPICAL SECTION - EMERGENCY SPILLWAY

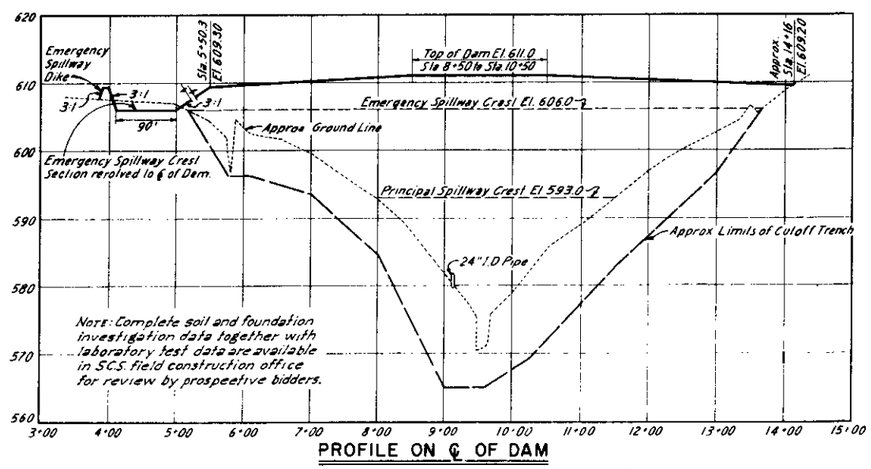


Lines and grades of the Waterway shall be staked and constructed to establish a level bottom in the transverse direction, with longitudinal grade approximating the grade shown in "PLAN OF EMBANKMENT AND SPILLWAYS". Final constructed surfaces of the Waterway shall be dressed by blading. Any excess excavation may be used for "Compacted Fill" as directed by the Engineer. Payment for Waterway will be made by the square yard, computed by the product of the 20'11. bottom width and the accomplished ℄ length.

TYPICAL SECTION - WATERWAY

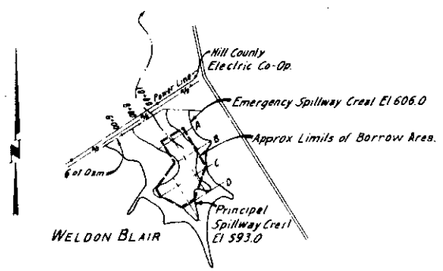
Elevation	Surface Acres	Storage	
		Acre Feet	Inches
580	1	1	0.03
584	2	7	0.20
588	3	17	0.49
592	5	33	0.95
593	6	38.5	1.11
596	9	61	1.76
600	12	103	2.97
604	16	159	4.59
606	18.5	193.5	5.58
608	21	233	6.72

Top of Dam (Effective) Elev.	609.2
Emergency Spillway Crest Elev.	606.0
Principal Spillway Crest Elev.	593.0
Sediment Pool Elev.	593.0
Drainage Area, Acres	416
Sediment Storage, Acre Feet	42.5
Floodwater Storage, Acre Feet	151
Max. Emergency Spillway Cap., c.f.s.	1,190



Note: Complete soil and foundation investigation data together with laboratory test data are available in S.C.S. field construction office for review by prospective bidders.

PROFILE ON ℄ OF DAM



GENERAL PLAN OF RESERVOIR

0 660 1320 1980 2640

SCALE IN FEET

Figure 2

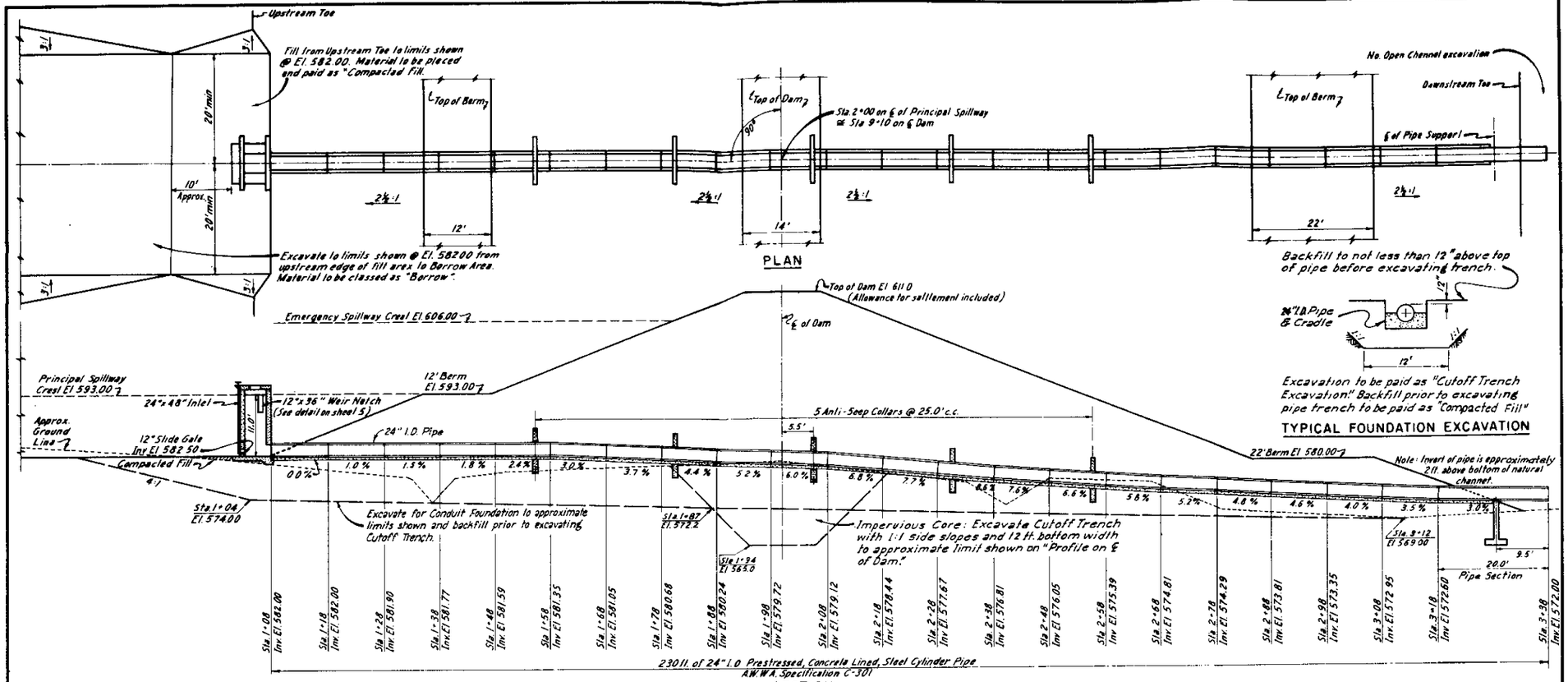
TYPICAL

FLOODWATER RETARDING STRUCTURE

GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed G. J. M.	3-63	Approved by ...
Drawn G. J. M.	3-63	...
Traced F. L. B.	5-63	TEMPLE, TEXAS
Checked G. J. M. & G. W. T.	5-63	Sheet No 2 of 7 — Drawing No 4-E-17,857



MATERIAL PLACEMENT DATA									
EMBANKMENT SECTION	SOURCE OF FILL MATERIAL			LAB TEST		COMPACTION REQUIREMENTS			Lab. Curve
				Modified		Min. Dry Density	Moisture Range Percent		
Description	Location	Ave. Depth Feet From	Ave. Depth Feet To	Max Dry Den.	Optm Moist.	Lbs Per Cu Ft.	From	To	No.
Interior and Outer Portions of Dam	Borrow Area Excavation	0	12	122.5	11.5	107.0	12.0	Up	1
	" " "	0	5	116.0	13.5	104.5	14.0	Up	2
Interior of Dam	Emergency Spillway Exca.	0	Grade	113.0	15.5	96.0	16.0	Up	3
	Borrow Area - Excavation	5	9	Material like that under Curve No 3					

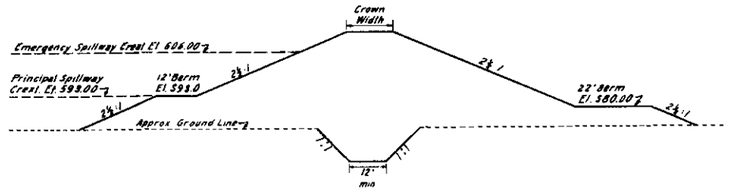
Note:
Cutoff Trench excavation should be placed in the Embankment in accordance with the compaction requirements for like material from Borrow excavation.

The Engineer will direct a selective placement of all fill materials in consideration of the preferred uses shown in the table.

No upward limits of placement moisture are established. Upper limits of placement moisture will be established during construction by the engineer, based on the workability aspects of the materials being placed in the fill and the densities reached.

Maximum dry density, optimum moisture, minimum acceptable dry density and moisture range shown are for material particles passing the number 4 sieve.

EMBANKMENT DATA



TYPICAL SECTION

Figure 2A
TYPICAL
FLOODWATER RETARDING STRUCTURE
PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date
Designed G. J. M.	4-63
Drawn G. J. M.	4-63
Traced F. L. B.	5-63
Checked G. J. M. & G. W. T.	5-63

Approved by: ... AREA ENGINEERING & MATERIALS ENGINEER, FORT WORTH, TEXAS
... STATE CONSERVATION ENGINEER, TEMPLE, TEXAS

Sheet No. 3 of 7
Drawing No. 4-E-17,857

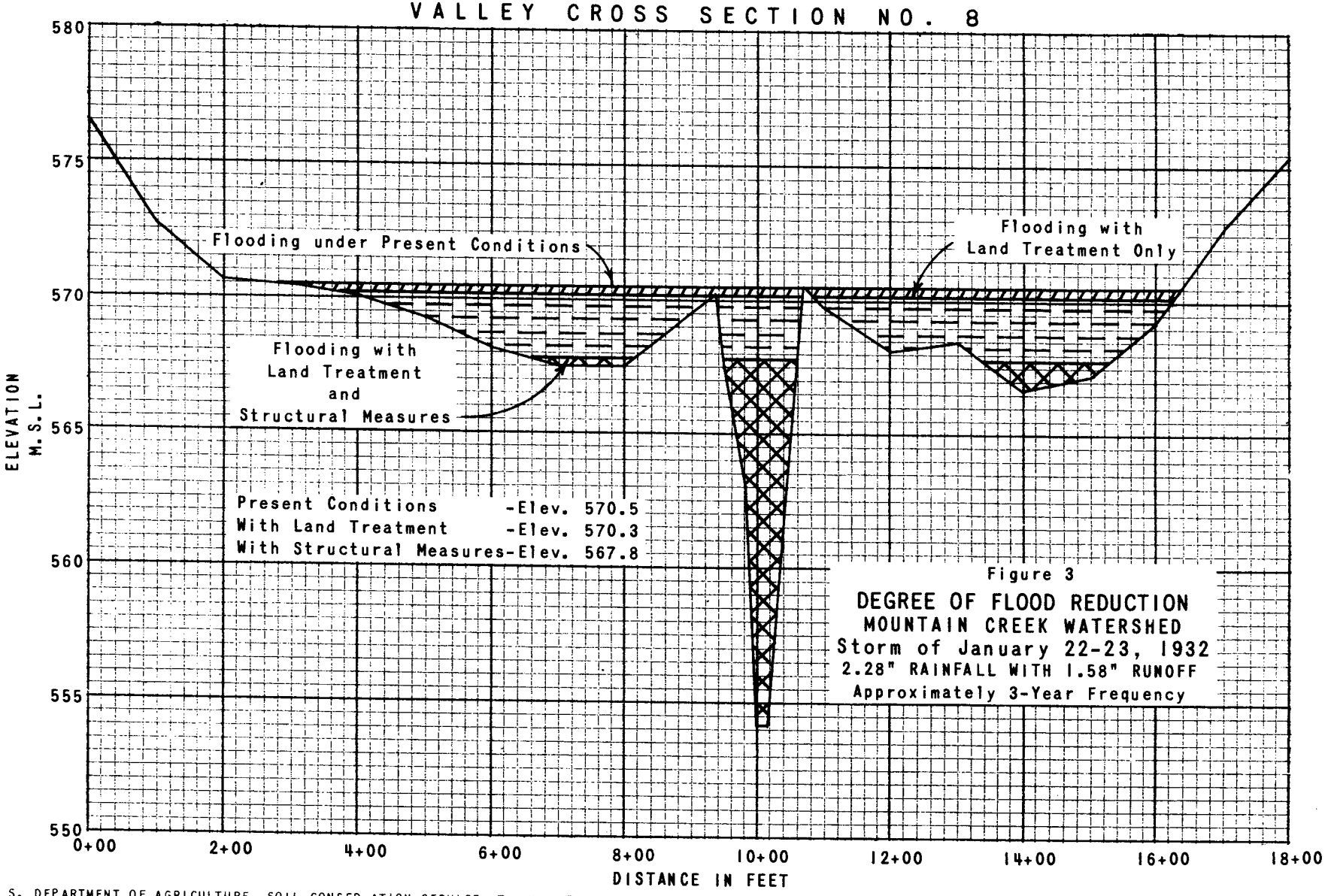
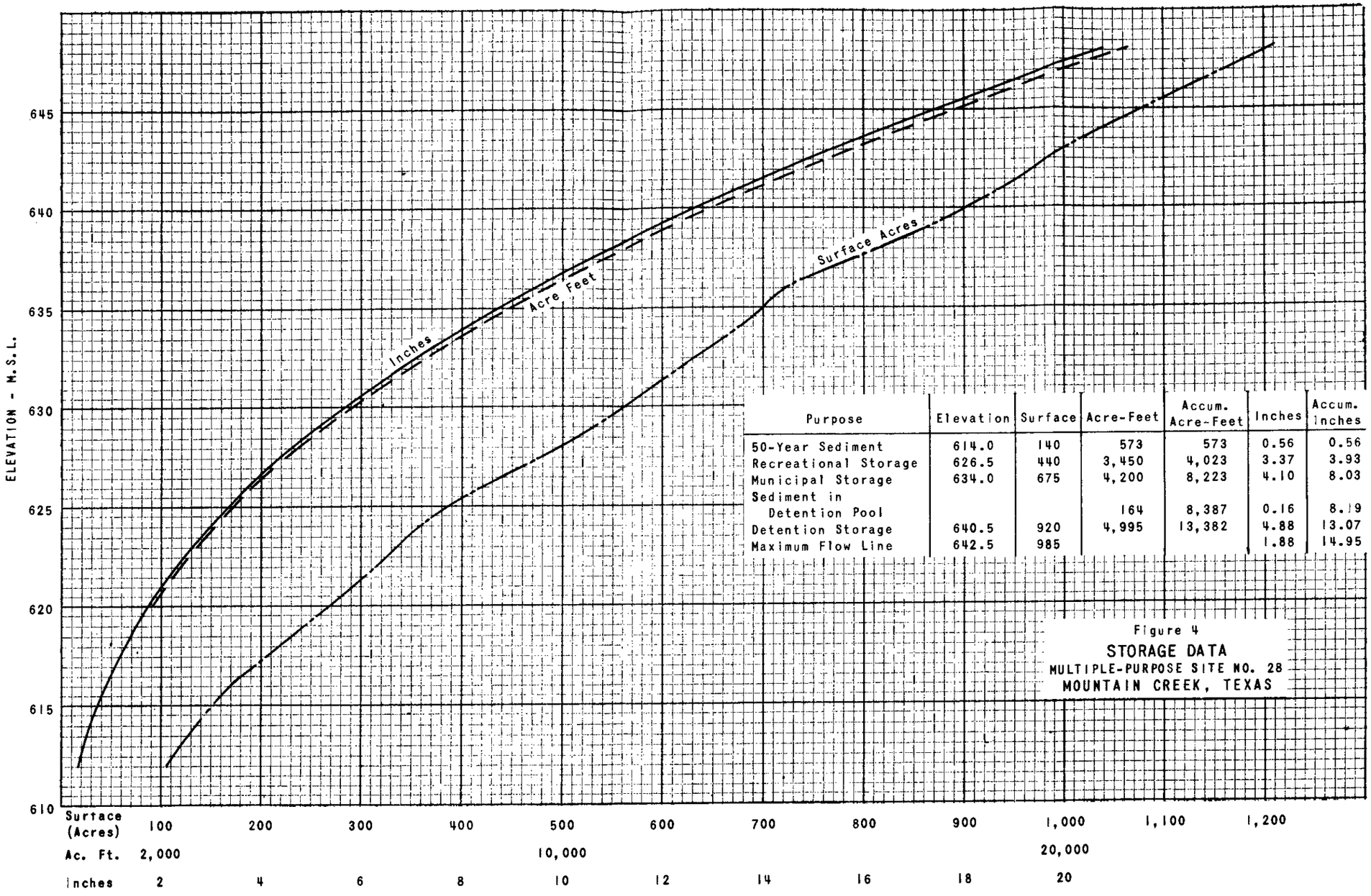


Figure 3

DEGREE OF FLOOD REDUCTION
MOUNTAIN CREEK WATERSHED
Storm of January 22-23, 1932
2.28" RAINFALL WITH 1.58" RUNOFF
Approximately 3-Year Frequency

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSER ATION SERVICE, Temple, Texas

10-63 4-L-18385



Purpose	Elevation	Surface	Acre-Feet	Accum. Acre-Feet	Inches	Accum. Inches
50-Year Sediment	614.0	140	573	573	0.56	0.56
Recreational Storage	626.5	440	3,450	4,023	3.37	3.93
Municipal Storage	634.0	675	4,200	8,223	4.10	8.03
Sediment in Detention Pool			164	8,387	0.16	8.19
Detention Storage	640.5	920	4,995	13,382	4.88	13.07
Maximum Flow Line	642.5	985			1.88	14.95

Figure 4
STORAGE DATA
MULTIPLE-PURPOSE SITE NO. 28
MOUNTAIN CREEK, TEXAS

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas

10-63 4-N-18387

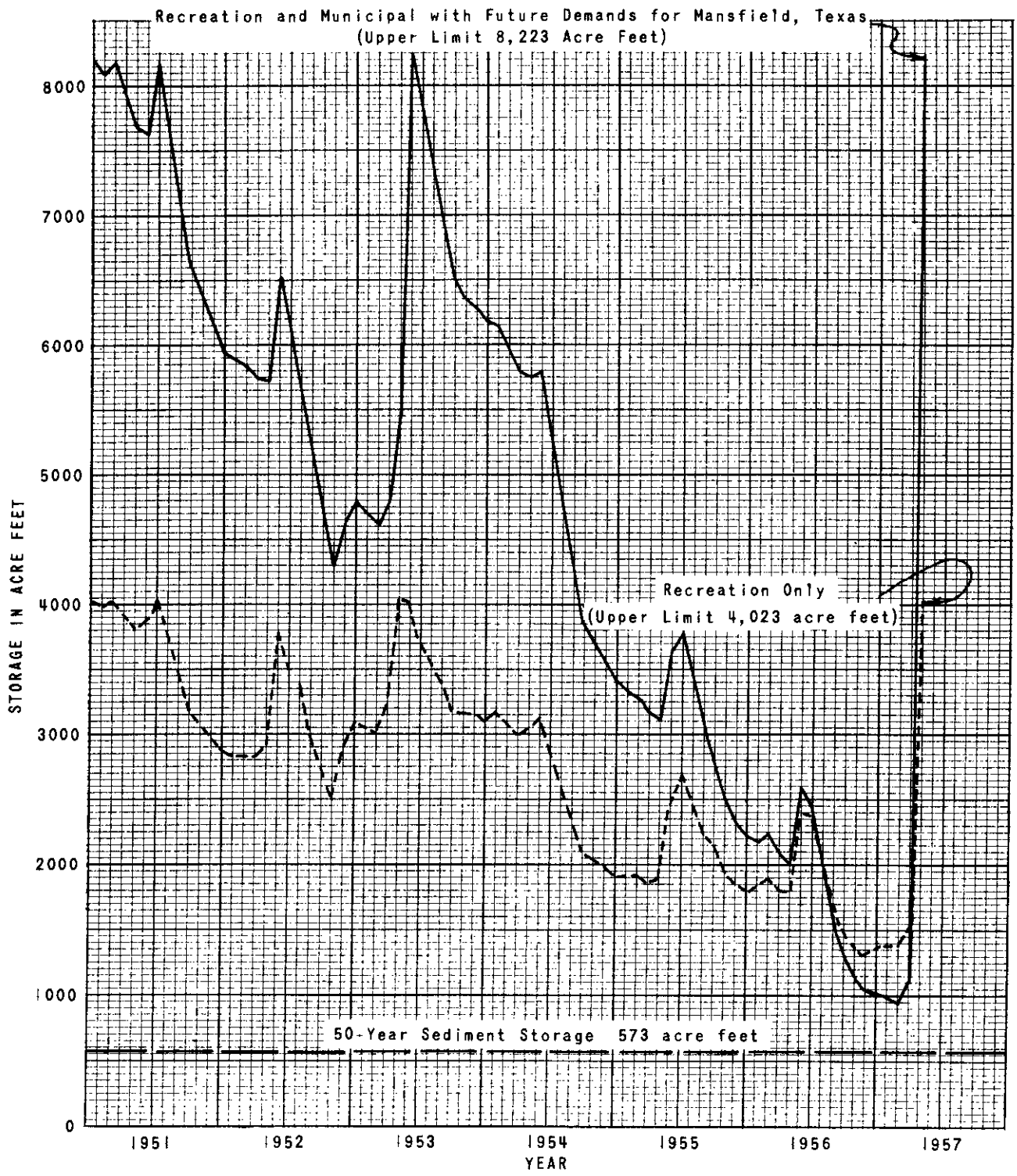


Figure 5

RESERVOIR OPERATION STUDY
Multiple Purpose Site 28
WALNUT CREEK
MOUNTAIN CREEK WATERSHED, TEXAS

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas 10-63 4-L-18386

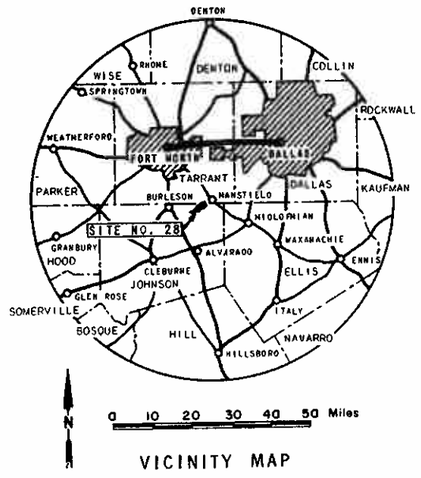
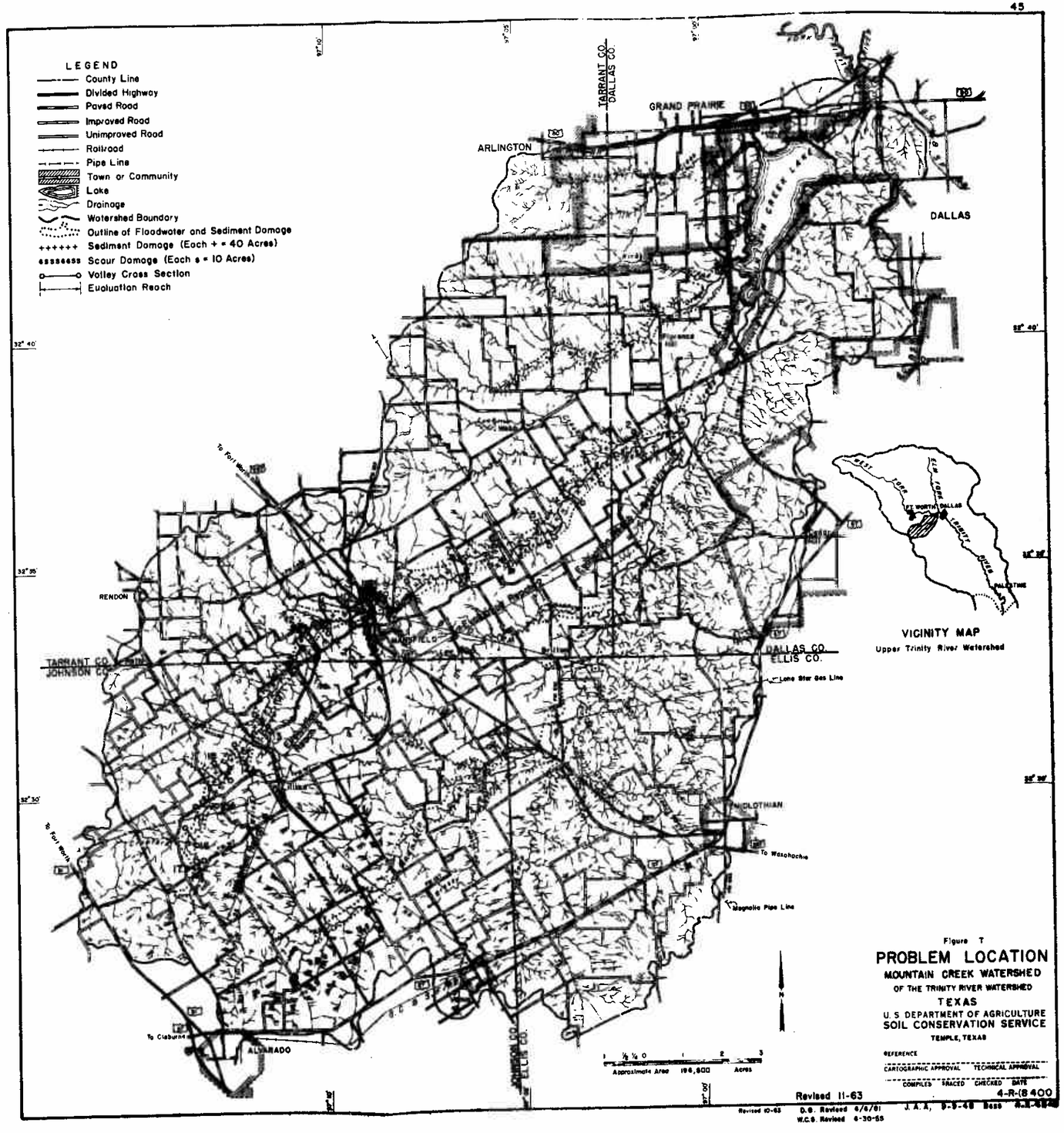
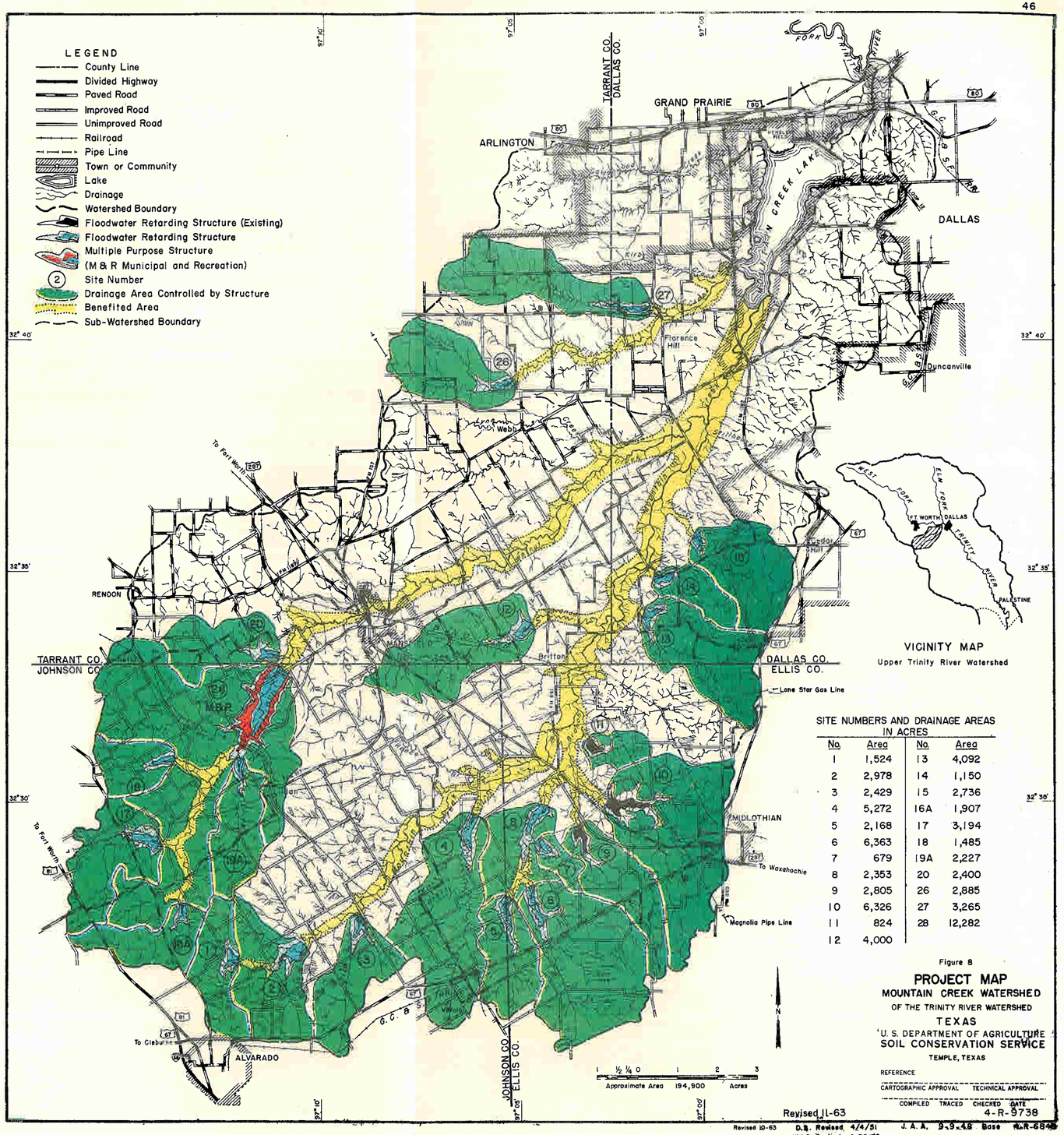


Figure 6
RECREATIONAL DEVELOPMENT
MOUNTAIN CREEK WATERSHED
SITE No. 28
JOHNSON AND TARRANT COUNTIES, TEXAS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

10-63 4-R-18,389


LEGEND
County Line
Divided Highway
Paved Road
Improved Road
Unimproved Road
Railroad
Pipe Line
Town or Community
Lake
Drainage
Watershed Boundary
Outline of Floodwater and Sediment Damage
Sediment Damage (Each + = 40 Acres)
Scour Damage (Each s = 10 Acres)
Valley Cross Section
Evaluation Reach
TARRANT CO.
DALLAS CO.
GRAND PRAIRIE
ARLINGTON
DALLAS
RENDON
MIDLOTHIAN
ALVARADO
To Cleburne
To Waxahachie
Magnolia Pipe Line
Lone Star Gas Line
VICINITY MAP
Upper Trinity River Watershed
Figure 1
PROBLEM LOCATION
MOUNTAIN CREEK WATERSHED
OF THE TRINITY RIVER WATERSHED
TEXAS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS
Approximate Area 196,800 Acres
Revised 11-63
4-R-(8400



VICINITY MAP
Upper Trinity River Watershed

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area
1	1,524	13	4,092
2	2,978	14	1,150
3	2,429	15	2,736
4	5,272	16A	1,907
5	2,168	17	3,194
6	6,363	18	1,485
7	679	19A	2,227
8	2,353	20	2,400
9	2,805	26	2,885
10	6,326	27	3,265
11	824	28	12,282
12	4,000		

Figure 8

PROJECT MAP
MOUNTAIN CREEK WATERSHED
OF THE TRINITY RIVER WATERSHED
TEXAS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

REFERENCE

CARTOGRAPHIC APPROVAL	TECHNICAL APPROVAL

COMPILED	TRACED	CHECKED	DATE
			4-R-9738

Revised 11-63
Revised 10-63
D.B. Revised 4/4/51
W.C.B. Revised 4-30-58
J. A. A. 9-9-48 Base 4-R-6848