WORK PLAN

DENTON CREEK WATERSHED

OF THE TRINITY RIVER WATERSHED

Montague, Cooke, Wise, Denton and Tarrant Counties, Texas
(Revised June 1956)

Prepared By

SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE

Temple, Texas
June 1956

WATERSHED WORK PLAN

AGREEMENT

between the

DENTON-WISE SOIL CONSERVATION DISTRICT

(name of local organization)

UPPER ELM-RED SOIL CONSERVATION DISTRICT

(name of local organization)

(name of local organization)

STATE OF TEXAS,
(hereinafter referred to as the local organization)

and the

SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
(hereinafter referred to as the Service)

Whereas, the responsibility for administration of the Flood Prevention Program authorized by the Flood Control Act of 1936, as amended and supplemented, has been assigned by the Secretary of Agriculture to the Soil Conservation Service; and

Whereas, there has been developed through the cooperative efforts of the local organization and the Service a mutually satisfactory plan for works of improvement for said watershed, designated as the watershed work plan for Denton Creek Watershed, State of Texas, which watershed work plan is annexed to and made a part of this agreement; and

Whereas, the watershed work plan describes the watershed and its problems, and sets forth a plan for works of improvement including a schedule of operations, the kinds and quantities of measures to be installed, the estimated cost, cost-sharing arrangements, maintenance and other responsibilities of those participating in the project, and economic justification for installing, operating and maintaining the works of improvement; and

UPPER ELM-RED SOIL CONSERVATION DISTRICT
(name of local organization)

By J. W. Hess
J. W. Hess

Title Chairman of Board

Date July 5th, 1956

signing of this agreement was authorized by a resolution of the governing
y of the Upper Elm-Red Soil Conservation District
(name of local organization)

pted at a meeting held on July 5, 1956.

Richard Humphrey
(Secretary, local organization)

Date July 5, 1956

Upper Elm Red SCD
(name of local organization)

By _____

Title _____

Date _____, 195___

signing of this agreement was authorized by a resolution of the governing
of the _____
(name of local organization)

ted at a meeting held on _____, 195___.

_____
(Secretary, local organization)

Date _____, 195___

Soil Conservation Service
United States Department of Agriculture

By _____
(State Conservationist)

Date _____, 195___

WATERSHED WORK PLAN
DENTON CREEK WATERSHED
(Trinity River Watershed)
Montague, Wise, Denton and Tarrant Counties, Texas
(Revised June, 1956)

Participating Agencies

Upper Elm Red Soil Conservation District
Denton-Wise Soil Conservation District
Dalworth Soil Conservation District
Agricultural Stabilization and Conservation Office, USDA
Extension Service, USDA
Soil Conservation Service, USDA

Prepared by

Soil Conservation Service
United States Department of Agriculture
June, 1956

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Revised June, 1956

INTRODUCTION

uthority

he Denton Creek Watershed Flood Prevention Project will be carried out under he authority of the Soil Conservation Act of 1935 (Public Law No. 46, 74th ongress), the Flood Control Act of June 22, 1936 (Public Law No. 738, 74th ongress) and the Flood Control Act of December 22, 1944 (Public Law No. 534, 8th Congress, 2nd Session).

urpose and Scope of Plan

e Upper Elm Red, Denton-Wise, and the Dalworth Soil Conservation Districts rovide, through their programs and work plans, for the application of a omplete program of soil and water conservation and improved plant manage- nt within this watershed. Their objectives are to use each acre of gricultural land in accordance with its capabilities for sustained agricul- ural production and to treat each acre in accordance with its needs for otection and improvement. Such a program, when applied and maintained the land within the watershed, will be effective in reducing runoff from all rains and will effect some reduction in peak runoff from excessive ins. An effective land treatment program will have a major effect in the duction of upland erosion rates which in turn will reduce sediment damages. ditional structural measures for flood prevention are needed to complete e soil and water conservation and plant management program in the watershed d provide effective reductions in flood damage.

e purpose of this plan is (1) to state specifically the land treatment and ructural practices and measures which are designed primarily for, or ntribute directly to flood prevention, and (2) to specify how, when, and whom they will be carried out to achieve the maximum practicable reduction erosion, floodwater and sediment damages. Measures and practices planned rein constitute an integral part of the complete soil and water conserva- on and plant management program in this watershed and have been incorporated the work plan of each of the soil conservation districts concerned.

plication of this mutually developed plan will provide the maximum protection and improvement of land and water resources which can be justified economi- lly and undertaken at this time with the combined facilities of local terests and State and Federal agencies. Upon completion and continued intenance of the measures set forth in this plan a material contribution ll be made toward increasing agricultural production to a level consistent th the capability of the land, thereby promoting the welfare of the

landowners and operators, the community, the State and the Nation. The watershed includes parts of Montague, Wise, Denton and Tarrant Counties, and contains 424,600 acres (663.4 square miles).

SUMMARY OF PLAN

This plan is a combination of land treatment practices and flood prevention measures which contribute directly to soil and water conservation and flood prevention. The works of improvement listed in Table 1 are planned to be installed at an estimated total cost of $7,848,143, of which $4,115,722 is to be borne by State and local interests and $3,732,421 by the Federal Government.

The Upper Elm Red and the Denton-Wise Soil Conservation Districts, under provisions of State enabling legislation, have agreed to assume responsibility for overall periodic inspections and maintenance of all flood prevention structural measures at an estimated annual cost of $5,717. The landowners and operators will maintain the land treatment measures at an estimated annual cost of $77,080 in accordance with provisions of the farmer-district cooperative agreements.

Comparisons of Benefit and Cost

When the works of improvement are applied and operating at full effectiveness, the ratio of the estimated average annual benefit from the structural measures, $284,590, to the estimated average annual equivalent costs, 134,310, is 2.12 to 1, based on 1955 price levels for costs and long-term prices, based on BAE price projections made in 1951, for benefits.

DESCRIPTION OF WATERSHED

Physical Data

Denton Creek rises midway between the towns of Bowie and Montague in Montague County, Texas, and flows in a southeasterly direction for 50 miles, emptying into Grapevine Reservoir. The watershed includes Grapevine Reservoir and comprises its drainage area. The average width of the watershed is 10 miles, with variations in width from 5 to 15 miles. The major tributaries are Ivy Valley, Maillard, Pittman Hollow, Jones Valley, Braden Branch, Panther, Cottonwood, Rush, Cissell, Hart, Black, Catlett, Sweetwater, Morris, Oliver, Trail, Quail, Graham, Harriett, Elizabeth and Henrietta Creeks.

The watershed has an area of 424,600 acres (663.4 square miles), of which 395,880 acres are in farms and ranches and 18,720 acres are in urban areas, reservoirs, roads and other miscellaneous uses. There are 26,942 acres of flood plain. Under present conditions the entire flood plain would be inundated by the runoff from a 25-year frequency storm which would produce 3.10 inches of runoff. The largest rain that occurred in the 20-year period of study was one of 6.66 inches which produced 3.17 inches of runoff. Under present conditions 25,389 acres of the flood plain would be inundated by this storm.

he Denton Creek watershed lies within three problem areas in soil conservation. About 39 percent of the area is in the Cross Timbers, 55 percent in he Grand Prairie and 6 percent in the Forested Coastal Plains.

he watershed includes two broad groups of soils that are vastly different n characteristics and capabilities. The Cross Timbers is in the upper art of the watershed and includes deep, light-colored soils of medium to oarse textures developed largely from unconsolidated sands. Of a similar ature are the Forested Coastal Plains soils found in a small area at the outh of the watershed. They are developed from sandstones and shales. The oils of the Grand Prairie are dark-colored fine textured and well-aggregated. hey are about evenly distributed between very shallow, shallow and deep lassifications These soils are immature and developed from limestones nd marls.

here fields have been used for cultivation the soils are in fair to poor hysical condition and some have lost as much as 4 to 8 inches of topsoil. uch of the sandy land has been severely damaged by accelerated gully rosion and is unsuitable for further cultivation. Prairie soils are more esistant to erosion under cultivation than the sandy soils and some very roductive uplands of this group occur in the watershed. The condition of he soils is good where adequate cover has been maintained on grazing lands y proper management. A considerable area of formerly cultivated sandy and is in poor condition, and improvement of the vegetative cover will equire reseeding to native grasses.

e topography of the lower one-third of the watershed is largely undulating, lthough sharp breaks frequently occur at the heads of lateral tributaries. he middle portion is strongly rolling and has many sharp breaks adjacent to ributary streams. This area is used largely for grazing. The upper sandy nds are gently to strongly rolling. Many of the tributaries that drain he northeastern part of the watershed have short, extremely steep slopes ecause of a "backbone" of high elevation extending along the eastern ivide. Most of this area has remained in woody pasture. Elevations nge from 535 feet above mean sea level at the conservation pool elevation Grapevine Reservoir to 1,294 feet at Jim Ned Lookout northeast of illard. The main valley of Denton Creek ranges in width from approxiately 4,000 feet in the lower reaches to less than 800 feet near the adwaters.

pproximately 11 percent of the sandy land and 45 percent of the prairie nd is in cultivation at the present time. However, in former years as gh as 70 percent of the sandy land was utilized intensively for cotton d truck crops. Because of its inherent erodibility large areas of this nd became severely denuded and characterized by deep, dendritic gully stems Cropping in the prairie uplands consists mostly of small grains d grain sorghums. Sweetclover is well-adapted and has found considerable e for grazing and seed production.

Present land use in the watershed is estimated as follows:

Land Use	Acres	Percent
Cultivation	120,801	28.5
Pasture and Range	155,469	36.6
Wooded Pasture	51,798	12.2
Formerly Cultivated	76,117	17.9
Stream Channels	1,695	0.4
Grapevine Reservoir	12,740	3.0
Miscellaneous 1/	5,980	1.4
Total	424,600	100.0

1/ Includes roads, highways, railroad rights-of-way, towns, etc.

'he Denton Creek watershed is underlain by formations of Cretaceous age. The ormations of the lower Cretaceous (Comanche series) are in the Trinity, redericksburg and Washita groups. The upper Cretaceous (Gulf series) is epresented by one formation, the Woodbine sand. All of these formations ip to the southeast at rates of 40 to 47 feet to the mile.

he Trinity group outcrops in the upper part of the watershed and includes and formations, most notable of which is the Paluxy formation. The group s composed almost entirely of fine quartz sand, although some clay and ven calcareous deposits form occasional lenticular strata. Reservoirs onstructed in this area will require foundation and toe drains and relief ells. The vegetation established in the emergency spillways will have to e maintained with heavy turf in order to prevent erosion.

he Fredericksburg group is of small areal extent but forms an important longated contact between broad expanses of sandy and calcareous deposits. : is distinguished by erosion resistant beds which form prominent escarp- ents, mounds and a generally hummocky landscape. The formations of this roup overlie the Trinity and include the Walnut limestone, Goodland lime- tone and Kiamichi clay. These formations will provide good foundations or structures. In some cases spillway excavation in hard rock will result i high construction costs.

e Washita group, located in the lower part of the watershed, lies con- rmably upon the Fredericksburg and consists of a succession of easily eathered formations. The Duck Creek formation consists of soft marl d massive limestone. The Fort Worth is made up of alternating beds of mestone and seamy marl. The Denton-Weno-Pawpaw formations are ssiliferous limestone, blue-gray shale and reddish clay interbedded th red sandstone. The Grayson-Main Street formations consist of massive mestone and light-colored marl. No floodwater retarding structures e planned in the area occupied by this group.

e Woodbine sand formation occupies a small area adjacent to the Grapevine

Reservoir at the bottom of the watershed. It consists of interbedded sand and sandstone. No floodwater retarding structures are planned in this area.

Rangeland is of two general types: true prairie land and the post oak-savannah. The present condition of the grass is poor to excellent. Excellent and good condition ranges are in the minority due to drought and excessive use. There are seven range sites in the watershed. These are described as follows:

The Deep Site is the most productive site in the Grand Prairie Problem Area. The topography is almost flat to gently rolling. The soils are deep, fine to medium textured and slowly to moderately permeable. Little bluestem, big bluestem, Indiangrass, switchgrass, tall dropseed and gramas made up the original grass cover. The principal invading plants are silver bluestem, threeawns, Texas grama, weeds, post oak, elm and pecan. Generally this site is in fair condition.

The Medium Site lies in the Grand Prairie area and is characterized by sloping to hilly topography having outcrops of limestone "chunk" rock. The presence of rock and the moderately permeable soil along with a degree of inaccessibility to grazing have tended to keep this site in good to excellent condition. The climax plants are similar to the tall and mid-grasses of the Deep Site; however, a greater percentage of sideoats grama, tall dropseed and decreasing forbs is evident.

The Shallow Site comprises the remainder of the Grand Prairie rangeland. The topography varies from flat hilltops to steep slopes, and the soil is very shallow and fine textured. The climax vegetation includes little bluestem, big bluestem, Indiangrass, sideoats grama, hairy grama, tall dropseed and buffalograss. Under overuse the bluestems disappear. Sideoats grama, tall dropseed and hairy grama are the principal increasers. Considerable cactus accompanies severe overuse. Most of this site is in poor to fair condition.

The Bottomland Site is the most productive site in the Cross Timbers Problem Area. The topography is level to gently sloping. The soils are deep, fine to coarse textured and slowly to moderately permeable. The original grass cover was composed of little bluestem, big bluestem, Indiangrass, switch grass, wildrye, purpletop, dropseeds and lovegrasses. The principal invading plants are the lovegrasses, paspalums, green briar, post oak, blackjack oak, elm and pecan. This site is generally in fair to poor condition.

The Upland Site of the Cross Timbers area occurs on flat to gently rolling topography. This site makes up a large percent of the Cross Timbers rangeland. The soils include deep and shallow profiles that range through a variety of textures and permeabilities. The predominant vegetation is tall and mid-grasses such as little bluestem, big bluestem, Indiangrass, switchgrass, wildrye, purpletop, lovegrasses, sideoats grama and tall dropseed. About two-thirds of the area of this site has been cultivated in the past. Present cover is predominantly threeawns, dropseeds,

lovegrasses and splitbeard bluestem. The site generally is in poor condition. Post oak and blackjack oak are heavy invaders where the land has not been cultivated.

The Deep Sand Site is also in the Cross Timbers area. Its topography is level to rolling and the soil is deep and coarse textured with a wide variation in subsoil permeability. Originally this site was a savannah, but under present conditions woody plants, post oak, blackjack oak and green briar dominate the site. The major grasses are little bluestem, Indiangrass, gramas, lovegrasses, wildrye and tall dropseed. Much of this site is in poor condition.

The Shallow Site constitutes the remainder of the Cross Timbers rangeland and is of small extent. The topography is level to steeply rolling, and the soils are very shallow and stony. The climax grasses include little bluestem, Indiangrass, gramas, dropseeds and lovegrasses. Post oak and blackjack oak are the primary invaders. It is in fair to poor condition.

The following table describes the rangeland by range sites and condition class:

Range Site	Condition Class	Acres
Deep Site	Excellent	2,071
Deep Site	Good	5,697
Deep Site	Fair	29,519
Deep Site	Poor	14,500
Total		51,787
Medium Site	Excellent	1,554
Medium Site	Good	3,625
Medium Site	Fair	971
Medium Site	Poor	324
Total		6,474
Shallow Site	Excellent	820
Shallow Site	Good	1,230
Shallow Site	Fair	6,423
Shallow Site	Poor	5,193
Total		13,666
Bottomland Site	Excellent	-
Bottomland Site	Good	14
Bottomland Site	Fair	180
Bottomland Site	Poor	153
Total		347

Range Site	Condition Class	Acres
Upland Site	Excellent	198
Upland Site	Good	792
Upland Site	Fair	3,236
Upland Site	Poor	2,377
Total		6,603
Deep Sand Site	Excellent	50
Deep Sand Site	Good	132
Deep Sand Site	Fair	594
Deep Sand Site	Poor	875
Total		1,651
Shallow Site (Cross Timbers)	Fair	48
Shallow Site (Cross Timbers)	Poor	39
Total		87
Total Acres Native Rangeland		80,615

ean temperatures range from 41 degrees Fahrenheit for January to 83 degrees or July. The extreme recorded temperatures are 3 degrees below zero and 13 degrees above zero. The average date of the first killing frost is ovember 11 and that of the last killing frost is March 26, a normal frost-ee period of 228 days.

ne mean annual precipitation of 31.21 inches is fairly well distributed er the growing season, with the larger monthly average rainfalls occurring April, May, June and October. Occasional periods of prolonged drouth use subsoil moisture to become severely depleted and have more than a asonal effect upon crop yields. Individual rains of excessive amounts y occur during any season and cause erosion and serious flood damage. e minimum recorded annual rainfall of 18.49 inches occurred in 1948, and e maximum annual rainfall of 49.94 inches occurred in 1920.

ter for livestock and domestic uses in rural areas is supplied largely by allow wells and small farm ponds. Water for urban areas is obtained om wells in adequate quantities to meet the present demand. Grapevine servoir is a major flood control and water impounding structure. It pplements the municipal water supply for the cities of Dallas, Highland rk and University Park.

e Denton Creek watershed is served by six Soil Conservation Service work its which are assisting the Upper Elm-Red, Denton-Wise, and Dalworth Soil nservation Districts. These work units have assisted farmers and ranchers preparing 887 conservation plans on 255,269 acres within the watershed undaries. Where land treatment measures have been applied and maintained r as long as two or three years, crop yields have increased as much as to 30 percent. The Soil Conservation Districts furnish technical assist-ce on 37 pasture units totaling about 10,000 acres of Government-owned

land which is under the supervision of the United States Forest Service.

Economic Data

The economy of the Denton Creek watershed is principally agricultural but many of the residents of the lower portion of the watershed earn additional income through employment in Dallas and Fort Worth. The watershed contains an estimated 1,757 farms with an average size of 230 acres. Although the Cross Timbers area in the upper part of the watershed was formerly devoted largely to general crop farming, much of it has been retired from cultivation due to erosion and depletion of soil fertility. Dairy farming is predominant in the central part of the watershed and the lower portion is used for livestock and feed production. Approximately 70 percent of the cattle in the watershed are used for beef production and 30 percent are dairy cattle.

The principal crops grown include small grains, corn, and hay crops in the Grand Prairie, and peanuts and watermelons in the Cross Timbers Problem Area. Supplemental grazing is also obtained from small grains, vetch, clover and Johnsongrass.

Decatur, with a population of 2,922 is the largest town in the watershed and is situated on the western divide. A milk processing plant and meat processing plant are two industries helping to make it a dairying and farming center. Other towns located wholly or partially in the watershed are Rhome, Justin, Roanoke, Grapevine, Ponder and Forestburg.

Extensive oil and gas operations are carried on in the Montague County portion of the Denton Creek watershed. These operations include producing oil and gas wells, a large gas processing plant and many feeder gas and oil pipelines. Extensive oil and gas exploration activities are being carried on in Montague and Wise Counties portions of the watershed. This oil activity tends to raise the economy of this portion of the watershed, which would otherwise be lower as a result of the depleted condition of the soils.

Urban influence upon the economy of the watershed is provided by the following cities and towns: Denton, located 22 miles east of the geographical center has a population of 21,345; Fort Worth, located 40 miles southwest, has a population of 277,047. Railroads serve Decatur, Rhome, Roanoke, Justin, Grapevine and Ponder.

Transportation needs in the watershed, are served by a network of 61 miles of State and Federal highways, 80 miles of farm roads, 200 miles of improved county roads, and 234 miles of unimproved county roads, which provide access to most of the area. However, floods frequently make many of these roads impassable and cause delay in getting to market centers with harvested crops and other agricultural products.

WATERSHED PROBLEMS

'loodwater Damage

'he upper reaches of the watershed are subject to frequent flooding and igh annual damages. Devastating floods have occurred as often as twice n one year, the last such year being 1950. During the selected 20-year valuation period, 1923-1942 inclusive, there were 30 floods on Denton reek and its tributaries which inundated more than 50 percent of the lood plain, and 47 smaller floods. Floods occur more frequently on Denton reek above State Highway 51 than on the lower portion. The flood plain s wide and flat, and some reaches of the channel are filled with sediment. onsequently, small rains cause large areas to be flooded. Floods occurring uring the growing season have caused damage to growing crops. Many floods ave occurred during the harvest season causing damage to matured crops. or the floods experienced during the 20-year period studied, the total irect floodwater, sediment and erosion damages were estimated to average 529,577 annually under present conditions, of which $284,232 is crop and asture damage. No flood plain is inundated by the proposed floodwater etarding structures. In addition, there are numerous indirect damages ich as the interruption of travel, depreciation of property values, and imilar items. The total annual value of these indirect damages is stimated to be $53,007. The average annual monetary flood damages are mmarized in Table 4.

ediment Damage

ediment damage is of major significance on the flood plains of Denton eek and its tributary valleys upstream from State Highway 24. The erage annual damage ranges from 10 to 60 percent on 11,401 acres, as llows:

Land Use	Extent of Damaging Modern Deposition on Valley Lands 1/ (Percent of Damage and Acres Affected)			
	10 Percent	20 Percent	40 Percent	60 Percent
Cropland	1,274	691	438	423
Pasture	2,875	1,986	1,822	1,892

1/ Estimated average annual damage in terms of decreased field crop and pasture grass yields.

ove State Highway 24 sediment deposits range in thickness from 1 to 12 et, and cover an average of 90 percent of the flood plain. The deposits ve their greatest depth along the channel and decrease in thickness ward the edge of the flood plain. Most of the modern deposition is in e form of uniform valley wide accumulations, with natural levees and ood plain splays along the channel banks. Alluvial fans occur along

he edge and extend into the flood plain where tributary streams, carrying high concentration of coarse sediments, enter the main valley.

ownstream from State Highway 24 only slight overbank deposition has ccurred. The deposits in this area are mostly the product of erosion rom the rather fine textured Grand Prairie soils. These deposits have uch higher fertility than the sandy deposits that originate from the ross Timbers soils. They range in thickness from 2 inches to about 2 feet, nd have caused little damage.

hannel-fill deposits have accumulated at an accelerated rate in the stream hannels above Highway 24. The velocity of the floodflows has been insuffiient to transport the sand as rapidly as it has been delivered to the channels. hannel deposits comprise only a small volume of the total modern deposits, ut they have been of major importance in causing increased overbank flooding. onsequently, increased flood plain deposition and sanding of the bottomlands as resulted. Channel filling upstream from Highway 24 has reduced the cross ectional area of the main stream channel 20 to 95 percent. This reduction channel capacity has caused an estimated increase of 300 to 700 percent the frequency of minor floods. Available evidence from old time settlers d buried soil horizons indicate that rapid channel filling was not in ogress before accelerated erosion began about 1890. Accelerated upland il erosion probably reached its peak during the period 1920 to 1930. Below ghway 24 only slight channel filling has occurred. This is due to the rger channel capacity and higher stream velocity that is capable of transrting large quantities of fine textured sediments. Most of the coarse xtured sediments are being deposited upstream.

ndage or swamping as a result of scour channels and excessive sedimentaon is estimated to have affected 336 acres of bottom land. This area cludes 101 acres of cropland, with 97 acres damaged 50 percent and 4 res damaged 90 percent. In addition 235 acres of pastureland have been maged as follows: 100 acres, 20 percent; 25 acres, 30 percent; and 0 acres, 90 percent.

amping is due mostly to: (1) filling of stream channels, which has used the ground water table to rise; and (2) to the formation of natural vees and alluvial fans, which obstruct the free runoff of floodwater m the valley and into the stream channel. In some places permanent nds have been formed by the plugging of scour channels. Such ponds cur about 5 miles above Highway 24. These swamped areas, in general, pport only a growth of willows and other relatively worthless types of getation and no flood damages were calculated on these areas. Some merly cultivated fields have been abandoned, and yields in even larger as are low and uncertain. Damages caused by channel filling, swamping ponding were included with overbank deposition.

pevine Reservoir in the lower reaches of the Denton Creek watershed l receive sediment from approximately 643 square miles 1/ of the

1/ Excludes surface area of Grapevine Lake (20 square miles).

drainage area. It is estimated that this reservoir will receive sediment accumulations at an average annual rate of 1.5 acre-feet per square mile of drainage area under present watershed conditions. This estimate is based on the sedimentation survey of Lake Dallas by the Soil Conservation Service in 1938, with adjustments made for soil conservation problem areas and size of the drainage area involved. The total annual accumulation in the reservoir will be approximately 974 acre-feet.

It is estimated that the application of land treatment measures on the watershed lands will reduce the annual sediment accumulation by 268 acre-feet, or 28 percent. The 56 proposed floodwater retarding structures controlling 26 percent of the watershed, will reduce the annual sediment accumulation in the reservoir by an additional 167 acre-feet, or 17 percent. Thus, the combined reduction in annual sediment accumulations to the Grapevine Reservoir will be approximately 45 percent.

Under present conditions annual sedimentation damages to Grapevine Reservoir are expected to be $22,820 2/. Annual sedimentation reduction benefits from land treatment are estimated to be $6,278, and from floodwater retarding structures $3,913. This gives a combined annual benefit of $10,191 to the reservoir.

Erosion Damage

Soil erosion is very severe in the critical areas of the Cross Timbers. Severe gully erosion is occurring at accelerated rates on the steeper, unprotected slopes. Most of the areas of severe erosion are directly related to the type of cultivation practices, or to roads, improper terrace systems and other water channels. Overgrazing has made the range-land more vulnerable to accelerated runoff and erosion. Sheet erosion ranges from moderate on some of the rangeland and wooded pastures to severe on cultivated lands with slopes of 3 to 6 percent. A large area of once productive land has been ruined as a result of continuous row cropping. Much of the land is unsuitable for further cultivation. Approximately 50 percent of the Cross Timbers area is affected by severe to very severe erosion.

Erosion in the Grand Prairie Problem Area ranges from slight to moderately severe on the cultivated lands in the lower portion of the watershed, and from slight to moderate on the shallow grazing lands in the central section. Sheet erosion is the dominant process in this area.

The present annual sediment production rates for the watershed range from 1.0 acre-foot per square mile in the Grand Prairie area to 10.0 acre-feet per square mile in the Cross Timbers area. Some of the small drainage areas (100 to 300 acres) in the critical Cross Timbers area have estimated sediment production rates as high as 15.0 acre-feet annually per square mile.

2/ Based on estimated cost of $23.43 per acre-foot of storage. (1955 Corps of Engineers' Report).

Scour damage has been moderate on the flood plains of the watershed. The lower reaches of the flood plain, downstream from State Highway 24, have been damaged to a higher degree than any other part of the flood plain. Scour channels in this section are wide and shallow, but occur mostly in cultivated land. The flood plain in the Cross Timbers contains numerous scour channels in the areas of heavy deposition. However, the damage in this area is low. It is estimated that annual scour damages of 10 to 80 percent are occurring on 1,401 acres of cropland, and damages of 10 to 20 percent are occurring on 736 acres of pastureland.

Streambank erosion is not generally severe in the Denton Creek drainage system. However, some lateral bank erosion is occurring in the headwater tributaries that originate in the critical areas of the Cross Timbers.

The Denton Creek main channel is filling in the central and upper reaches of the drainage system. In the lower reaches, the channel is affected by only minor bank erosion along the outside of the channel meanders. This erosion, in most cases, is offset by deposicion along the inside of the meanders. The net change in channel capacity in the lower reaches is believed to have been negligible since 1939.

Problems Relating to Methods now used in the Conservation, Development, Utilization and Disposal of Water.

Farmers throughout the Denton Creek flood plain have constructed dikes on an individual basis to protect their land from flooding. The high silting rate in the Cross Timbers area caused most of the dikes to fail.

Prior to the original work plan on the Denton Creek watershed, 25 drop inlet structures and 36 gully plugs were constructed on Government-owned lands, formerly under the supervision of the Soil Conservation Service and now under the jurisdiction of the United States Forest Service, for the purpose of sediment control and gully stabilization. These structures, built at a total cost of $55,729, have helped in stabilizing the gullies and controlling sediment production in the areas where they were located.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now being carried out by the Upper Elm-Red, Denton-Wise, and Dalworth Soil Conservation Districts, is essential to a sound and continuing flood prevention program in the watershed. Basic to the attainment of this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices. Emphasis will be placed on accelerating the establishment of these land treatment practices which have a measurable effect on the reduction of floodwater and sediment damages.

An important phase of the work is the establishing of 1,328 acres of vegetative waterways to facilitate the construction of 614 miles of terraces and 104 miles of diversions. These waterways must be established before the terracing program can progress. The seeding of 4,098 acres to range and planting 75,535 acres of formerly cultivated or idle land to pasture will be necessary in order to use the land within its capability. These measures will be installed by the landowners and operators in the watershed.

Other land treatment measures which will have a direct effect on flood prevention and which will be applied include contour cultivation, stock ponds, conservation crop rotation, rotation hay and pasture, and proper use of both pasture and rangeland.

An estimated 1,237 additional stock ponds will be constructed to assure adequate distribution of grazing on the grassland. Legumes in a conservation crop rotation will be planted on 139,894 acres to improve waterholding capacity of the soils, increase infiltration rates, and reduce erosion. Rotation hay and pasture will be practiced on 53,215 acres. Proper use will be practiced on 137,163 acres of pasture and rangeland. One hundred eighty-three stabilizing structures such as gully plugs and diversions for controlling gullies will be needed. These measures will be installed only on these areas where the landowners feel they can economically control and prevent further erosion and sediment damages to their land. The estimated total cost of planning and installing the land treatment measures is $4,231,066, as shown in Table 1.

Structural Measures for Flood Prevention

and Stabilization Measures.

Special land stabilization measures will be applied on a total of 100 acres of critically eroding land located above six floodwater retarding structures which have sediment rates in excess of 3.00 inches. The sites selected and the area to be treated above each are Nos. 2D, 10 acres; 2F, 10 acres; 3A, 3 acres; 3B, 20 acres; 7A, 17 acres and 10A, 20 acres.

The stabilization measures will consist of gully plugs and diversion terraces to control runoff and reduce sediment by preventing further head-cutting of active gullies. In addition plantings of wild plum, sumac, K. R. Bluestem, Bermuda grass (fertilized) and switch grass will be made on 100 acres of critical sediment-producing areas, including gully bottoms, gully plugs and diversions. The treatment of these critical areas is necessary to protect the life of the floodwater retarding structures. The highest sediment source in these areas is gully bank erosion

The treatment of these critical areas has been substituted in this plan for the construction of excessively large capacities for sediment storage in the floodwater retarding structures below them. When all costs are considered, the treatment is found to be more economical and more beneficial to the watershed than the provision for excessive sediment storage. Therefore in the economic analysis the treatment of critical areas is

considered as an appurtenance to the appropriate floodwater retarding structure.

Waterflow Control Measures:

The floodwater retarding structures needed to provide flood protection for the flood plain, roads, bridges, and rural improvements are listed with their cost in Table 1. The plan of a typical floodwater retarding structure is shown in Figures 1 and 1a. To comply with existing Texas State laws no water will be stored in the sediment pool in excess of 200 acre-feet without the landowner receiving prior approval from the State Board of Water Engineers. The sediment pool and a portion of the detention pool will be designed to store the sediment yield expected from the drainage area of the structure during the 50-year period following installation.

A system of 56 floodwater retarding structures is to be installed to protect the flood plain along the main stem of Denton Creek and Dry Valley, Mallard, Jones Valley, Stillhouse Hollow, Panther Creek, Little Dry Valley, Braden Branch, Pitman Hollow, Cottonwood, Rush, Cissell, Hart, Black, Catlett, Pecan and Morris Creeks. The structures will be constructed at or near the location shown on the Structure Location Map, Figure 2. Data concerning the floodwater structures are summarized in Tables 6 and 6A.

The floodwater retarding structures will temporarily detain runoff from 47 percent of the watershed above Highway 51 (Hydrologic Valley Section 21-A) and 28 percent of the watershed above Hydrologic Valley Section No. 2 which is located just above the flood pool of Grapevine Lake. Sufficient detention storage can be developed at all structure sites to make possible the use of vegetative spillways, thereby effecting a substantial reduction in cost over concrete or similar type spillways.

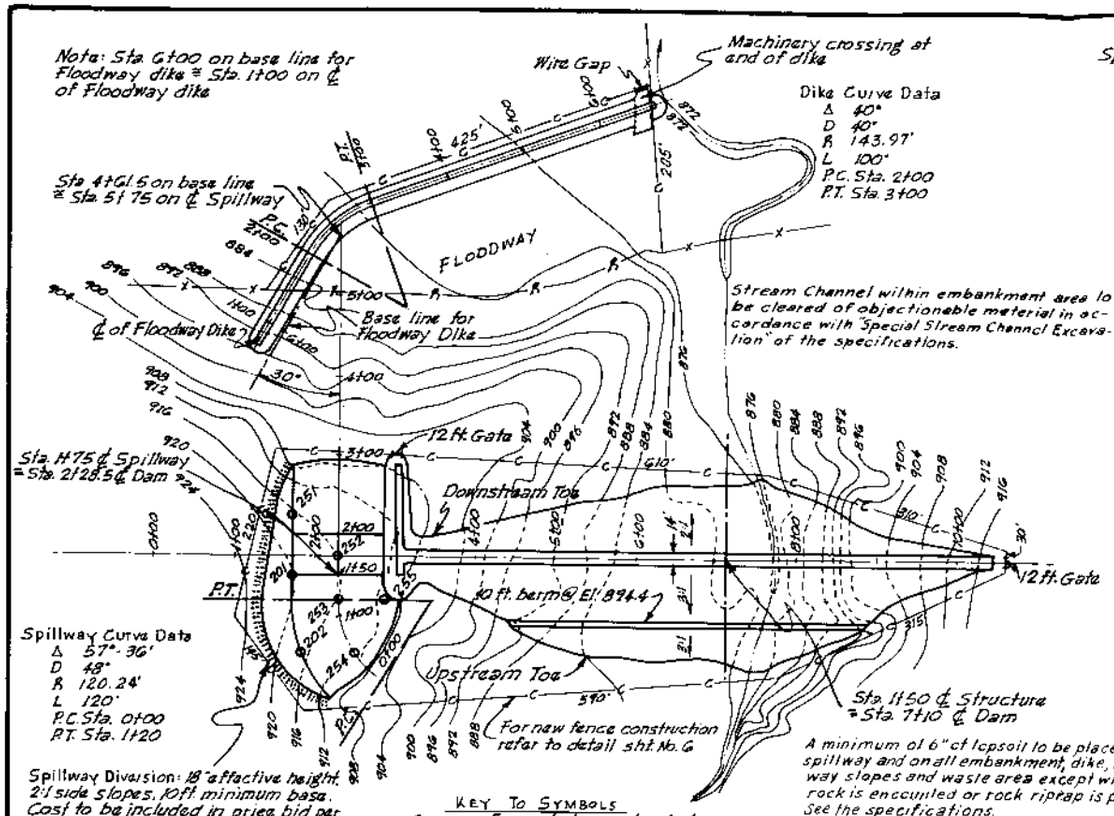
The total estimated cost for installing the floodwater retarding structures is $3,550,881, or an annual equivalent cost, including operation and maintenance, of $133,536.

Effect on Damages and Benefits

The combined program of land treatment and structural measures for flood prevention would eliminate damage on Denton Creek and its major tributary flood plain lands from 8 minor floods such as occurred in the 20-year period 1923-1942 inclusive. Of the 30 major floods, 23 would be reduced to minor floods.

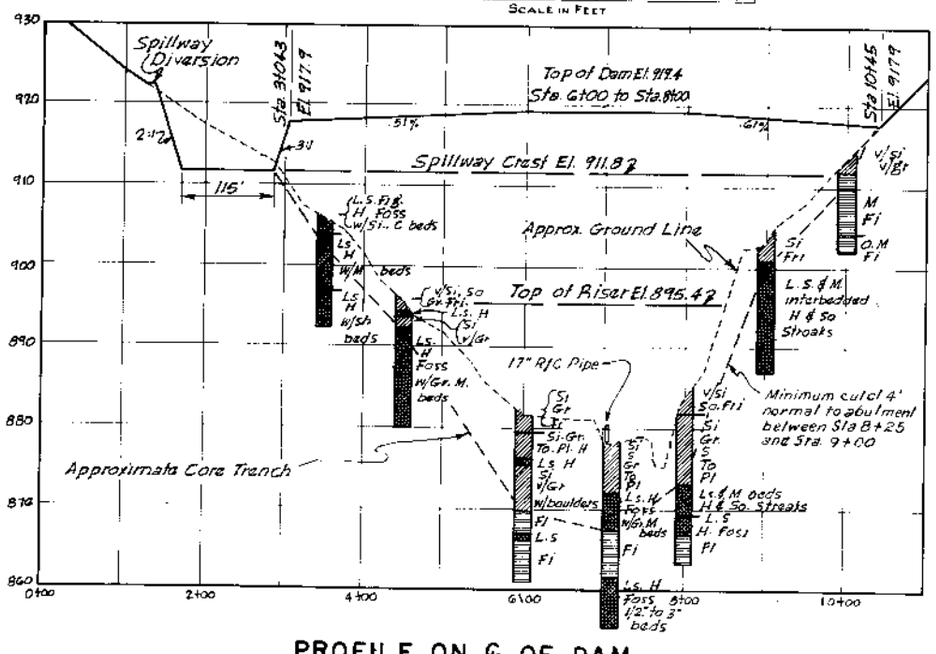
Average annual flooding throughout the watershed would be reduced from 4,155 to approximately 16,780 acres. The estimated average annual flood-water damage based on the floods experienced in the 20-year period of study will be reduced from $403,197 to $131,031, or a reduction of 67 percent.

Approximately 42 percent of the expected reduction in average annual flood-water and sediment damage within the Denton Creek watershed caused by storms

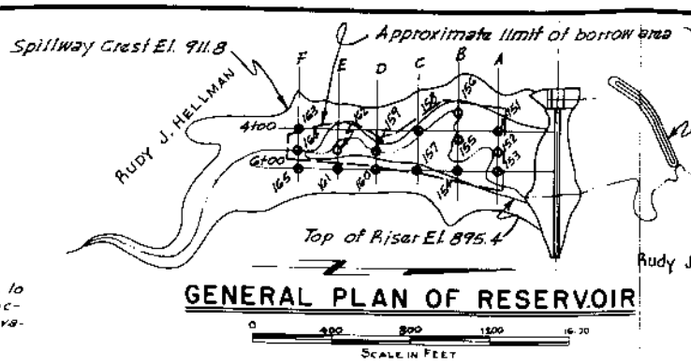


PLAN OF EMBANKMENT AND SPILLWAY

SCALE IN FEET

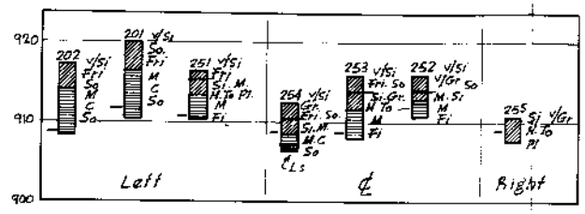


PROFILE ON ℄ OF DAM



GENERAL PLAN OF RESERVOIR

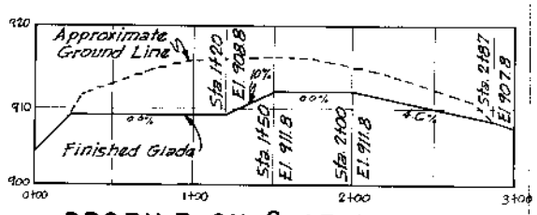
SCALE IN FEET



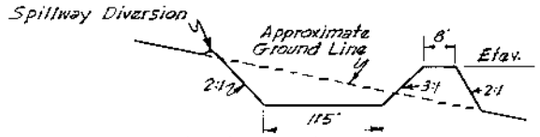
Note: Bar at left of boring is at spillway grade.

LOG OF SPILLWAY BORINGS

SEE PLAN OF EMBANKMENT AND SPILLWAY



PROFILE ON ℄ OF SPILLWAY



Top of Dike El 917.9 from Sta. 11+50 to Sta. 21+00 (Crest Section)
Top of Dike El. 911.8 @ Sta. 21+87. Grade top of dike between Sta. 21+00 and Sta. 21+87.

TYPICAL SPILLWAY SECTION

Clay — S Sandy - Sandy; Si Silt - Silty; C Clay - Clayey; Gr Gravel - Gravelly
Rock — Sh Shale - Shaley; M. Marl - Marly; O.M. Organic Matter; L.S. Limestone
Shale — Frg. Fragments
H Hard; Foss Fossiliferous; W/ With; V/ Very; So Soft; Fri. Friable; Fi. Firm; To. Tough; Pl. Plastic

LEGEND OF BORINGS

Located 1 mile west and 1.7 miles south of Myra, Cooke County, Texas

VICINITY MAP

SCALE IN MILES

Elevation	Surface Acres	Storage Acre Ft.	Storage Inches
895.4	7.5	64.0	1.31
898	10.0	86.5	1.78
902	13.2	132.9	2.73
906	17.5	174.3	3.99
910	22.1	273.5	5.62
911.8	24.3	315.2	6.47
914	27.0	377.7	7.64
918	33.7	493.1	10.13

Top of Dam (Effective) Elev.	917.9
Spillway Crest Elev.	911.8
Top of Riser Elev.	895.4
Sediment Pool Elev.	895.4
Drainage Area, Acres	584
Sediment Storage, Ac. Ft.	73
Floodwater Storage, Ac. Ft.	251

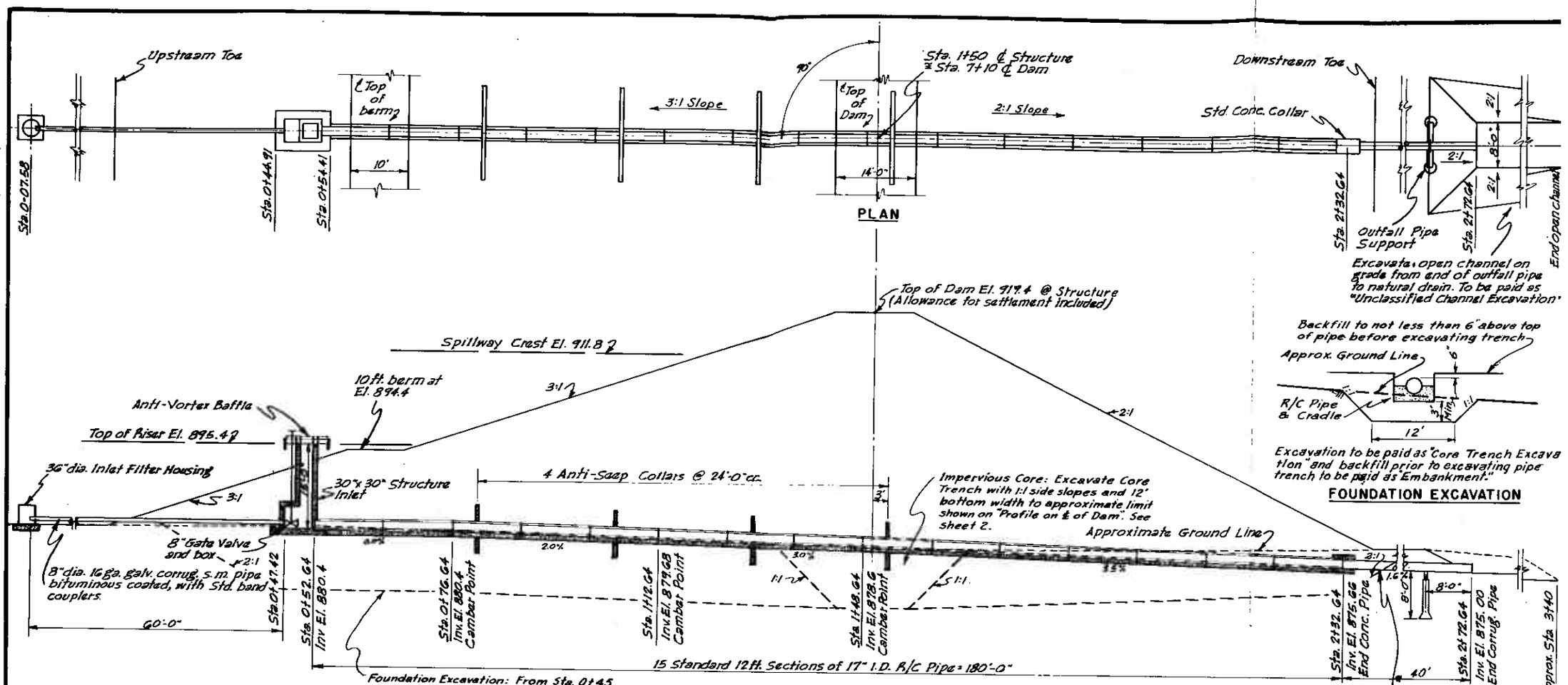
Figure 1

GENERAL PLAN AND PROFILE
FLOODWATER RETARDING STRUCTURE SITE No. 6-K-2
ELM FORK WATERSHED
OF THE
TRINITY RIVER WATERSHED - TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	G.W.T.	11/54	Approved by:
Drawn	G.W.T. & D.S.		
Traced	D.S.	12/55	
Checked	G.W.T.	4/56	

Sheet No. 2 of 6
Drawing No. 4-E-10,184



FLOODWAY DIKE

Figure 1a

STRUCTURE — PLAN AND SECTION
FLOODWATER RETARDING STRUCTURE SITE No. 6-K-2
ELM FORK WATERSHED
OF THE
TRINITY RIVER WATERSHED—TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	G.W.T.	Date 11/54	Approved by H. M.
Drawn	G.W.T. & D.S.		
Traced	D.S.	12/55	
Checked	G.W.T.	5/56	Sheet No. 3 of 6

Drawing No. 4-E-10,184

n the 20-year period investigated would result from the system of floodwater etarding structures. The annual value of this reduction is estimated to be 235,284 out of the total of $386,673 as shown in Table 4.

wners and operators of flood plain lands say that if adequate flood protec-ion is provided they will be able to increase their income by growing higher alue crops, principally alfalfa and watermelons. It is estimated that this ore intensive use would increase the net income, after all associated xpenses are deducted, by $49,306.

he total flood prevention benefits, including both the reductions in flood-ater and sediment damages and the benefits from more intensive use of flood lain lands, are estimated to be $284,590.

COMPARISON OF BENEFITS AND COSTS

ne ratio of the average annual benefit from structural measures for flood revention, $284,590, to the annual average value of the costs of the easures, $134,310, is about 2.12:1. In addition to these monetary benefits ther intangible benefits will be created through opportunities for more mplete utilization of existing resources, increased opportunities for ecreation, improved living conditions, protection of public health and afeguarding human life. These benefits are not measurable in monetary erms.

ACCOMPLISHING THE PLAN

nd Treatment Measures

nd treatment measures itemized in Table 1 will be established on the land farmers in cooperation with the Upper Elm-Red, Denton-Wise, and Dalworth il Conservation Districts. The cost of applying these measures will be rne by the owners and operators of the land. It is expected that the ners and operators will be reimbursed, based on the current program, for portion of this cost through the existing Agricultural Conservation ogram. The farmer cost, less the expected ACP payment, is shown for ch land treatment measure in Table 1. The soil conservation districts e giving assistance in the planning and application of these measures der their going programs. This assistance is being accelerated through e Soil Conservation Service work units to assure installation of the eded measures as rapidly as possible.

e governing bodies of the Upper Elm-Red, Denton-Wise and Dalworth Soil nservation Districts will arrange for meetings according to a definite hedule, and by individual contacts will encourage the landowners and erators within the Denton Creek watershed to adopt and carry out soil d water conservation plans on their farms. District-owned equipment ll be made available to the landowners in accordance with the existing rangements for equipment usage in the districts. Each district govern-g body will make periodic inspections of the completed conservation

easures within its district and follow through to see that needed mainte-
ance is performed.

he Soil Conservation Service work units at Bowie, Munster, Decatur, Denton,
rapevine and Fort Worth will assist landowners and operators cooperating
ith the districts in accelerating the preparation and application of soil
nd water conservation plans.

he extension Service will carry out the educational phase of the program
y conducting general information and local farm meetings, the preparation
f radio and press releases, and the use of other methods of disseminating
nformation to reach the landowners and operators in the Denton Creek
atershed to help achieve understanding and stimulate participation in
arrying out the entire plan.

ıe Farmers Home Administration soil and water conservation loan program
s available to all eligible individual farmers and ranchers in the area.
ducational meetings will be held in cooperation with other agencies out-
ining the services available and eligibility requirements. Present FHA
lients will be encouraged to cooperate in the program.

ıe County ASC Committees will cooperate with the governing bodies of the
oil conservation districts by selecting and providing financial assistance
or those ACPS practices which will accomplish the conservation objectives
ı the shortest possible time.

tructural Measures for Flood Prevention

ıe land stabilization measures, which include tree planting and seeding and
odding of 100 acres of badly eroded land and gullies, will be established
ıder the supervision of the Soil Conservation Service. The soil conserva-
ion districts, will furnish rights-of-way for the establishment of these
easures and will restrict the use of the area. Since the sites for these
easures are raw and gullied and not suitable for the commercial production
f any type crop, no monetary value is assigned to them.

ıe Soil Conservation Service will contract for the construction of the 56
oodwater retarding structures and treatment of critical areas. It will
so provide technical specialists to plan, design, prepare specifications,
ıpervise construction, prepare contract payment estimates, make final
spection, certify completion and perform related duties for the installa-
on of these structural measures.

ıe Upper Elm-Red and Denton-Wise Soil Conservation Districts will furnish
ıe land easements and rights-of-way for all the structural measures at no
ost to the Federal government. These easements and rights-of-way will be
tained insofar as possible by private donation. In those instances where
ch donations would create excessive hardship, easements and rights-of-way
y be obtained by purchase or other means.

Table 1 indicates the planned schedule of operations for each phase of the project. The cooperating parties have agreed that this schedule should be followed to achieve the most efficient prosecution of the work. This schedule will be adjusted year-by-year on the basis of any significant changes in the plan found to be mutually desired and in light of current appropriations and accomplishments. The various features of cooperation between the cooperating parties have been covered in appropriate memoranda of understanding and working agreements.

The following is a grouping of structures for construction purposes and their benefit-cost ratios. Groups 1, 4, 5, 7 and 9 have favorable benefit-cost ratios, based on those benefits that will accrue to each group exclusive of their portion of the overall benefits to the main stem of Denton Creek.

Construction Unit	Sites	No. Sites	Annual Benefits (dollars)	Annual Cost (dollars)	Benefit-Cost Ratio
1	1-A, 1-B1, 1-B-2, 1-C 1-D, 2-A, and 2B	7	15,191	12,877	1.18
2	Unit 1 together with Sites 2-C, 2-D, 2-E, 2-E-1, 2F, 3, 3-A, 3-B, 4, 5, 6, 7-A, 7-B, and 8	21 1/	48,902	47,076	1.04
3	Unit 2 together with Sites 8-A, 8-B, 9-A, 9-B, 10 10-A, 11-A, 11-B, 11-C, 11-D, 11-E, 11-F, 12, 13, and 16	36 1/	113,688	79,698	1.43
4	17 (Hart's Creek)	1	5,592	4,741	1.18
5	18-A-1 (Black Creek	1	5,832	2,981	1.96
6	Units 3, 4, and 5 together with Sites 20-A, 21, 21-A, 21-B, 21-C, 21-D, and 25	45 1/	183,906	105,510	1.74
7	25-A, 24, 24-A, 23, 23-A, 23-B, 23-D, and 23-E (Catlett Creek)	8	25,776	22,037	1.17
8	Unit 6 and 7 together with Site 25-B	54 1/	212,598	129,553	1.64
9	26 and 27-A (Morris Creek)	2	6,018	4,757	1.27

1/ Total number of structures in and above unit.

Construction can be started on any group of structures when all easements and rights-of-way in and above the unit have been cleared and money for construction is available.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

The land treatment measures will be operated and maintained by the landowners or operators of the farms on which the measures are installed under agreements with the Upper Elm-Red, Denton-Wise, Dalworth Soil Conservation Districts. Representatives of the soil conservation districts will make periodic inspections of the land treatment measures to determine maintenance needs and will encourage landowners and operators to perform needed maintenance. District-owned equipment will be made available for this purpose.

Structural Measures for Flood Prevention

The land stabilization measures and 56 floodwater retarding structures will be operated and maintained by the Upper-Elm-Red and Denton-Wise Soil Conservation Districts.

All floodwater retarding structures will be inspected at least annually and after each heavy rain or streamflow. Items of inspection will include but not be limited to the conditions of the principal spillway and its appurtenances, the emergency spillway, the earth fill, the vegetative cover of the emergency spillway, and fences and gates installed as a part of the floodwater retarding structures. The sponsoring local organization will maintain a record of all maintenance inspections and work done.

Provisions will be made by the Soil Conservation Districts for free access of District and Federal representatives to inspect the 56 floodwater retarding structures and land stabilization works of improvement.

The estimated annual operation and maintenance cost is $5,717. The necessary maintenance work will be accomplished through the use of contributed labor and equipment, by contract or by force account, or a combination of these methods.

TABLE 1 - ESTIMATED INSTALLATION COST
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: 7/1/51 to 6/30/56

(Trinity River Watershed)

em	Unit	Number Applied	Estimated Cost		Total
			Federal (dollars)	Non-Federal (dollars)	(dollars)
TREATMENT					
l Conservation Service					
nd Treatment Measures					
ontour Farming	Acre	4,621	-	4,621	4,621
over Cropping	Acre	54,955	-	549,550	549,550
otation Hay and Pasture	Acre	31,738	-	380,856	380,856
rop Residue Utilization	Acre	38,182	-	19,091	19,091
roper Use	Acre	40,704	-	81,408	81,408
ange Seeding	Acre	575	-	7,475	7,475
asture Planting	Acre	9,492	-	132,888	132,888
erracing	Mile	101	-	10,100	10,100
iversion Construction	Mile	17	-	4,250	4,250
aterway Development	Acre	246	-	8,610	8,610
ond Construction	Each	384	-	57,600	57,600
tabilizing Measures	Each	21	-	2,310	2,310
hnical Assistance (Accl.)			153,314	-	153,314
CS Subtotal			153,314	1,258,759	1,412,073
LAND TREATMENT			153,314	1,258,759	1,412,073
TURAL MEASURES					
l Conservation Service					
id Stabilization					
tabilization of Critical Runoff					
and Sediment-Producing Areas					
(Tree Planting, Seeding, Sodding)	Acre	-	-	-	-
terflow Control					
loodwater Retarding Structures	Each	-	-	-	-
CONSTRUCTION COST		-	-	-	-
INSTALLATION SERVICES		-	-	-	-
OTHER COSTS		-	-	-	-
STRUCTURAL MEASURES		-	-	-	-
lan Preparation		-	45,788	-	45,788
TOTAL		-	199,102	1,258,759	1,457,861
Y					
l SCS			199,102	1,258,759	1,457,861
			199,102	1,258,759	1,457,861

Date: June, 1956

TABLE 1 - ESTIMATED INSTALLATION COSTS
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: Fiscal Year 1957

(Trinity River Watershed)

:em	: Unit	: Number : to be : Applied:	Estimated Cost : Federal (dollars)	: Non- Federal (dollars)	: Total (dollars)
TREATMENT					
Conservation Service					
d Treatment Measures					
ontour Farming	Acre	1,464	-	1,464	1,464
over Cropping	Acre	11,437	-	114,370	114,370
otation Hay and Pasture	Acre	4,096	-	49,152	49,152
rop Residue Utilization	Acre	9,272	-	4,636	4,636
roper Use	Acre	18,921	-	37,842	37,842
ange Seeding	Acre	141	-	1,833	1,833
asture Planting	Acre	4,011	-	56,154	56,154
erracing	Mile	31	-	3,100	3,100
iversion Construction	Mile	4	-	1,000	1,000
aterway Development	Acre	109	-	3,815	3,815
ond Construction	Each	64	-	9,600	9,600
tabilizing Measures	Each	6	-	660	660
nical Assistance (Accl.)			23,800	-	23,800
CS Subtotal			23,800	283,626	307,426
LAND TREATMENT			23,800	283,626	307,426
URAL MEASURES					
Conservation Service					
l Stabilization					
tabilization of Critical Runoff					
nd Sediment-Producing Areas					
Tree Planting, Seeding, Sodding)	Acre	-	-	-	-
rflow Control					
oodwater Retarding Structures	Each	2	105,543	-	105,543
CONSTRUCTION COST			105,543	-	105,543
INSTALLATION SERVICES			31,662	-	31,662
OTHER COSTS			-	21,559	21,559
STRUCTURAL MEASURES			137,205	21,559	158,764
lan Preparation			-	-	-
TOTAL			161,005	305,185	466,190
Y					
l SCS			161,005	305,185	466,190
			161,005	305,185	466,190

Date: June, 1956

TABLE 1 - ESTIMATED INSTALLATION COSTS
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: Fiscal Year 1958

(Trinity River Watershed)

Item	Unit	Number to be Applied	Estimated Cost		Total
			Federal (dollars)	Non-Federal (dollars)	(dollars)
TREATMENT					
. Conservation Service					
d Treatment Measures					
ontour Farming	Acre	1,684	-	1,684	1,684
over Cropping	Acre	12,762	-	127,620	127,620
otation Hay and Pasture	Acre	4,509	-	54,108	54,108
rop Residue Utilization	Acre	10,020	-	5,010	5,010
roper Use	Acre	20,784	-	41,568	41,568
ange Seeding	Acre	162	-	2,106	2,106
asture Planting	Acre	4,576	-	64,064	64,064
erracing	Mile	36	-	3,600	3,600
iversion Construction	Mile	4	-	1,000	1,000
aterway Development	Acre	122	-	4,270	4,270
ond Construction	Each	72	-	10,800	10,800
tabilizing Measures	Each	7	-	770	770
hnical Assistance (Accl.)			20,950	-	20,950
CS Subtotal			20,950	316,600	337,550
LAND TREATMENT			20,950	316,600	337,550
TURAL MEASURES					
l Conservation Service					
id Stabilization					
tabilization of Critical Runoff					
ind Sediment-Producing Areas					
(Tree Planting, Seeding, Sodding)	Acre	100	15,384	-	15,384
erflow Control					
Floodwater Retarding Structures	Each	7	305,505	-	305,505
CONSTRUCTION COST			320,889	-	320,889
INSTALLATION SERVICES			96,267	-	96,267
OTHER COSTS			-	38,613	38,613
STRUCTURAL MEASURES			417,156	38,613	455,769
lan Preparation			-	-	-
TOTAL			438,106	355,213	793,319
Y					
1 SCS			438,106	355,213	793,319
			438,106	355,213	793,319

Date: June, 1956

TABLE 1 - ESTIMATED INSTALLATION COSTS
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: Fiscal Year 1959

(Trinity River Watershed)

em	Unit	Number to be Applied	Estimated Cost Federal (dollars)	Non-Federal (dollars)	Total (dollars)
TREATMENT					
Conservation Service					
d Treatment Measures					
ontour Farming	Acre	1,904	-	1,904	1,904
over Cropping	Acre	13,187	-	131,870	131,870
otation Hay and Pasture	Acre	4,787	-	57,444	57,444
rop Residue Utilization	Acre	10,682	-	5,341	5,341
roper Use	Acre	22,413	-	44,826	44,826
ange Seeding	Acre	184	-	2,392	2,392
asture Planting	Acre	3,182	-	44,548	44,548
erracing	Mile	41	-	4,100	4,100
iversion Construction	Mile	4	-	1,000	1,000
aterway Development	Acre	101	-	3,535	3,535
ond Construction	Each	67	-	10,050	10,050
tabilizing Measures	Each	8	-	880	880
nical Assistance (Accl.)			20,950	-	20,950
S Subtotal			20,950	307,890	328,840
LAND TREATMENT			20,950	307,890	328,840
URAL MEASURES					
Conservation Service					
d Stabilization					
tabilization of Critical Runoff and					
ediment-Producing Areas (Tree					
lanting, Seeding, Sodding)	Acre	-	-	-	-
erflow Control					
loodwater Retarding					
Structures	Each	8	381,336	-	381,336
CONSTRUCTION COST		-	381,336	-	381,336
INSTALLATION SERVICES			114,400	-	114,400
OTHER COSTS			-	31,764	31,764
STRUCTURAL MEASURES			495,736	31,764	527,500
lan Preparation			-	-	-
TOTAL			516,686	339,654	856,340
Y					
al SCS			516,686	339,654	856,340
			516,686	339,654	856,340

Date: June, 1956

TABLE 1 - ESTIMATED INSTALLATION COSTS
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: Remaining to be Done

(Trinity River Watershed)

tem	Unit	Number to be Applied	Estimated Cost		Total
			Federal (dollars)	Non-Federal (dollars)	(dollars)
TREATMENT					
. Conservation Service					
id Treatment Measures					
ontour Farming	Acre	39,499	-	39,499	39,499
over Cropping	Acre	47,553	-	475,530	475,530
otation Hay and Pasture	Acre	8,085	-	97,020	97,020
rop Residue Utilization	Acre	39,964	-	19,982	19,982
roper Use	Acre	34,341	-	68,682	68,682
ange Seeding	Acre	3,036	-	39,468	39,468
asture Planting	Acre	54,274	-	759,836	759,836
erracing	Mile	405	-	40,500	40,500
iversion Construction	Mile	75	-	18,750	18,750
aterway Development	Acre	750	-	26,250	26,250
ond Construction	Each	650	-	97,500	97,500
tabilizing Measures	Each	141	-	15,510	15,510
hnical Assistance (Accl.)			146,650	-	146,650
CS Subtotal			146,650	1,698,527	1,845,177
LAND TREATMENT			146,650	1,698,527	1,845,177
TURAL MEASURES					
Conservation Service					
d Stabilization					
tabilization of Critical Runoff and Sediment-Producing Areas (Tree Planting, Seeding, Sodding)	Acre		-	-	-
erflow Control					
loodwater Retarding Structures	Each	39	1,746,823	-	1,746,823
CONSTRUCTION COST			1,746,823	-	1,746,823
INSTALLATION SERVICES			524,049	-	524,049
OTHER COSTS			-	158,384	158,384
STRUCTURAL MEASURES			2,270,872	158,384	2,429,256
Plan Preparation			-	-	-
TOTAL			2,417,522	1,856,911	4,274,433
Y					
l SCS			2,417,522	1,856,911	4,274,433
			2,417,522	1,856,911	4,274,433

Date: June, 1956

TABLE 1 - ESTIMATED INSTALLATION COSTS
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

For: Total Project

(Trinity River Watershed)

Item	Unit	Total to be Applied	Estimated Cost			
			Federal (dollars)	Non-Federal (dollars)	Total (dollars)	
TREATMENT						
. Conservation Service						
id Treatment Measures						
:ontour Farming	Acre	49,172	-	49,172	49,172	
:over Cropping	Acre	139,894	-	1,398,940	1,398,940	
.otation Hay and Pasture	Acre	53,215	-	638,580	638,580	
rop Residue Utilization	Acre	108,120	-	54,060	54,060	
roper Use	Acre	137,163	-	274,326	274,326	
ange Seeding	Acre	4,098	-	53,274	53,274	
asture Planting	Acre	75,535	-	1,057,490	1,057,490	
erracing	Mile	614	-	61,400	61,400	
iversion Construction	Mile	104	-	26,000	26,000	
aterway Development	Acre	1,328	-	46,480	46,480	
ond Construction	Each	1,237	-	185,550	185,550	
tabilizing Measures	Each	183	-	20,130	20,130	
hnical Assistance (Accl.)			365,664	-	365,664	
CS Subtotal			365,664	3,865,402	4,231,066	1/
LAND TREATMENT			365,664	3,865,402	4,231,066	
TURAL MEASURES						
l Conservation Service						
id Stabilization						
tabilization of Critical Runoff and Sediment-Producing Areas (Tree Planting, Seeding, Sodding)	Acre	100	15,384	-	15,384	
erflow Control						
Floodwater Retarding Structure	Each	56	2,539,207	-	2,539,207	
CONSTRUCTION COST			2,554,591	-	2,554,591	
INSTALLATION SERVICES			766,378	-	766,378	
OTHER COSTS			-	250,320	250,320	
STRUCTURAL MEASURES			3,320,969	250,320	3,571,289	
lan Preparation			45,788	-	45,788	2/
TOTAL			3,732,421	4,115,722	7,848,143	
Y						
l SCS			3,732,421	4,115,722	7,848,143	
			3,732,421	4,115,722	7,848,143	

timated $567,526 reimbursement by ACPS to local interests not included.
cludes $19,272 cost of preparation of original plan.

Date: June, 1956

TABLE 2
STATUS OF FLOOD PREVENTION JOB PRIOR TO FIRST YEAR OF WORK PLAN
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas

(Trinity River Watershed)

easure	Unit	Number	Federal Cost 1/	Non-Federal: Construc-tion 2/	Total Cost
			(dollars)	(dollars)	(dollars)
TREATMENT MEASURES					
tour Farming	Acre	14,000	-	14,000	14,000
er Cropping	Acre	26,000	-	260,000	260,000
ation Hay and Pasture	Acre	107	-	1,284	1,284
p Residue Utilization	Acre	39,000	-	19,500	19,500
per Use	Acre	44,000	-	88,000	88,000
ge Seeding	Acre	2,300	-	29,900	29,900
ture Planting	Acre	3,200	-	44,800	44,800
racing	Mile	400	-	40,000	40,000
ersions	Mile	55	-	13,750	13,750
erway Development	Acre	750	-	26,250	26,250
d Construction	Each	180	-	27,000	27,000
ical Assistance (Accl.)	-	-	86,087	-	86,087
total			86,087	564,484	650,571
TURAL MEASURES					
) Inlets	Each	25	52,172	-	52,172
ly Plugs	Each	36	3,557	-	3,557
:otal			55,729	-	55,729
			141,816	564,484	706,300

.ood Prevention Funds including acceleration funds.
es not include an estimated $93,750 by which private interests were
imbursed by ACPS.

Date: June, 1956

Denton Creek Watershed, Texas
(Trinity River Watershed)

Measures	AMORTIZATION OF INSTALLATION COSTS 1/			OPERATION AND MAINTENANCE COSTS 2/			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Waterflow Control							
1. Floodwater Retarding Structure No. 1A	3,483	577	4,060	-	154	154	4,214
2. Floodwater Retarding Structure No. 1B-1	665	208	873	-	77	77	950
3. Floodwater Retarding Structure No. 1B-2	1,072	180	1,252	-	77	77	1,329
4. Floodwater Retarding Structure No. 1C	1,176	60	1,236	-	77	77	1,313
5. Floodwater Retarding Structure No. 1D	1,190	367	1,557	-	77	77	1,634
6. Floodwater Retarding Structure No. 2A	1,378	132	1,510	-	77	77	1,587
7. Floodwater Retarding Structure No. 2B	1,672	101	1,773	-	77	77	1,850
8. Floodwater Retarding Structure No. 2C	1,806	72	1,878	-	77	77	1,955
9. Floodwater Retarding Structure No. 2D, in combination with treatment of critical areas	1,570	116	1,686	-	82	82	1,768
10. Floodwater Retarding Structures Nos. 2E, 2E1, 2F and 3, in combination with treatment of critical areas	9,367	1,269	10,636	-	467	467	11,103
11. Floodwater Retarding Structures Nos. 3A, 3B and 4, in combination with treatment of critical areas	7,457	1,055	8,512	-	331	331	8,843
12. Floodwater Retarding Structure No. 5	1,796	148	1,944	-	77	77	2,021
13. Floodwater Retarding Structure No. 6	2,153	368	2,521	-	116	116	2,637
14. Floodwater Retarding Structure No. 7A, in combination with treatment of critical areas	1,453	71	1,524	-	85	85	1,609
15. Floodwater Retarding Structure No. 7B	2,084	59	2,143	-	116	116	2,259
16. Floodwater Retarding Structure No. 8	1,585	342	1,927	-	77	77	2,004
17. Floodwater Retarding Structure No. 8A	1,583	76	1,659	-	77	77	1,736
18. Floodwater Retarding Structure No. 8B	1,652	91	1,743	-	77	77	1,820
19. Floodwater Retarding Structure No. 9A	1,664	75	1,739	-	77	77	1,816
20. Floodwater Retarding Structure No. 9B	1,315	45	1,360	-	77	77	1,437

TABLE 3 - ANNUAL COSTS - Continued
Denton Creek Watershed, Texas
(Trinity River Watershed)

Measures	AMORTIZATION OF INSTALLATION COSTS 1/			OPERATION AND MAINTENANCE COSTS 2/			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Waterflow Control							
21. Floodwater Retarding Structure No. 10	2,505	187	2,692	-	116	116	2,808
22. Floodwater Retarding Structure No. 10A, in combination with treatment of critical areas	1,925	204	2,129	-	87	87	2,216
23. Floodwater Retarding Structure No. 11A	1,380	85	1,465	-	77	77	1,542
24. Floodwater Retarding Structure No. 11B	2,202	144	2,346	-	116	116	2,462
25. Floodwater Retarding Structure No. 11C	1,685	69	1,754	-	77	77	1,831
26. Floodwater Retarding Structure No. 11D	1,266	53	1,319	-	77	77	1,396
27. Floodwater Retarding Structure No. 11E	1,063	43	1,106	-	77	77	1,183
28. Floodwater Retarding Structure No. 11F	1,051	64	1,115	-	77	77	1,192
29. Floodwater Retarding Structure No. 12	3,754	322	4,076	-	154	154	4,230
30. Floodwater Retarding Structure No. 13	3,193	195	3,388	-	154	154	3,542
31. Floodwater Retarding Structure No. 16	3,044	213	3,257	-	154	154	3,411
32. Floodwater Retarding Structure No. 17	4,493	132	4,625	-	116	116	4,741
33. Floodwater Retarding Structure No. 18A-1	2,671	194	2,865	-	116	116	2,981
34. Floodwater Retarding Structure No. 20A	1,812	111	1,923	-	77	77	2,000
35. Floodwater Retarding Structure No. 21	3,211	406	3,617	-	154	154	3,771
36. Floodwater Retarding Structure No. 21A	3,059	125	3,184	-	116	116	3,300
37. Floodwater Retarding Structure No. 21B	3,340	195	3,535	-	116	116	3,651
38. Floodwater Retarding Structure No. 21C	1,532	126	1,658	-	77	77	1,735
39. Floodwater Retarding Structure No. 21D	1,329	69	1,398	-	77	77	1,475
40. Floodwater Retarding Structure No. 25	1,879	223	2,102	-	116	116	2,218
41. Floodwater Retarding Structure No. 23	2,880	228	3,108	-	154	154	3,262
42. Floodwater Retarding Structure No. 23A	2,141	467	2,608	-	116	116	2,724
43. Floodwater Retarding Structure No. 23B	2,696	483	3,179	-	116	116	3.295

TABLE 3 - ANNUAL COSTS - Continued
Denton Creek Watershed, Texas
(Trinity River Watershed)

Measures	AMORTIZATION OF INSTALLATION COSTS 1/			OPERATION AND MAINTENANCE COSTS 2/			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Waterflow Control							
44. Floodwater Retarding Structure No. 23D	2,327	285	2,612	-	116	116	2,728
45. Floodwater Retarding Structure No. 23E	1,629	118	1,747	-	77	77	1,824
46. Floodwater Retarding Structure No. 24	3,300	302	3,602	-	154	154	3,756
47. Floodwater Retarding Structure No. 24A	1,946	168	2,114	-	116	116	2,230
48. Floodwater Retarding Structure No. 25A	1,599	178	1,777	-	77	77	1,854
49. Floodwater Retarding Structure No. 25B	2,107	126	2,233	-	77	77	2,310
50. Floodwater Retarding Structure No. 26	2,738	420	3,158	-	154	154	3,312
51. Floodwater Retarding Structure No. 27A	1,214	154	1,368	-	77	77	1,445
Subtotal	117,092	11,501	128,593	-	5,717	5,717	134,310
TOTAL STRUCTURAL MEASURES FOR FLOOD PREVENTION	117,092	11,501	128,593	-	5,717	5,717	134,310
GRAND TOTAL	117,092	11,501	128,593	-	5,717	5,717	134,310

1/ Based on 1955 price levels.
2/ Based on long-term price levels.

Date: June, 1956

TABLE 4 - SUMMARY OF BENEFITS
(Based on Long-Term Price Levels)
Denton Creek Watershed, Texas

(Trinity River Watershed)

Item	Estimated Average Annual Damage Without Project (dollars)	Estimated Average Annual Damage Without Structural Measures (dollars)	Estimated Average Annual Damage With Project (dollars)	Benefits From Structural Measures (dollars)
Floodwater	403,197	301,875	131,031	170,844
Sediment	111,576	78,988	41,959	37,029
Erosion	14,804	11,103	5,181	5,922
Indirect	53,007	39,229	17,740	21,489
Subtotal	582,584	431,195	195,911	235,284
Benefit from changed use of land	xxx	xxx	xxx	49,306
TOTAL FLOOD PREVENTION BENEFITS	xxx	xxx	xxx	284,590

Date: June, 1956

(Trinity River Watershed)

Measures	AVERAGE ANNUAL BENEFITS							
	Flood-water (dollars)	Sediment (dollars)	Erosion (dollars)	Indirect (dollars)	Land Use Change (dollars)	Total (dollars)	Annual Cost (dollars)	Bene Cos Rati
STRUCTURAL MEASURES FOR FLOOD PREVENTION								
Waterflow Control								
1. Floodwater Retarding Structure No. 1A	8,610	1,866	299	1,083	2,485	14,343	4,214	3.40
2. Floodwater Retarding Structure No. 1B-1	1,158	251	40	146	334	1,929	950	2.03
3. Floodwater Retarding Structure No. 1B-2	967	210	34	122	279	1,612	1,329	1.21
4. Floodwater Retarding Structure No. 1C	1,279	277	44	161	369	2,130	1,313	1.62
5. Floodwater Retarding Structure No. 1D	1,752	380	61	220	506	2,919	1,634	1.79
6. Floodwater Retarding Structure No. 2A	1,561	338	54	196	450	2,599	1,587	1.64
7. Floodwater Retarding Structure No. 2B	2,085	452	72	262	602	3,473	1,850	1.88
8. Floodwater Retarding Structure No. 2C	1,692	366	59	213	488	2,818	1,955	1.44
9. Floodwater Retarding Structure No. 2D, in combination with treatment of critical areas	1,208	262	42	152	349	2,013	1,768	1.14
10. Floodwater Retarding Structure Nos. 2E, 2E-1, 2F, and 3, in combination with treatment of critical areas	16,767	3,634	581	2,109	4,839	27,930	11,103	2.52
11. Floodwater Retarding Structure Nos. 3A, 3B, and 4, in combination with treatment of critical areas	13,313	2,886	462	1,675	3,842	22,178	8,843	2.51
12. Floodwater Retarding Structure No. 5	2,961	642	103	372	854	4,932	2,021	2.44
13. Floodwater Retarding Structure No. 6	4,119	893	143	518	1,189	6,862	2,637	2.60
14. Floodwater Retarding Structure No. 7A, in combination with treatment of critical areas	1,057	229	37	133	305	1,761	1,609	1.09
15. Floodwater Retarding Structure No. 7B	1,390	301	48	175	401	2,315	2,259	1.02
16. Floodwater Retarding Structure No. 8	3,515	762	122	442	1,014	5,855	2,004	2.92
17. Floodwater Retarding Structure No. 8A	1,510	328	52	190	436	2,516	1,736	1.45
18. Floodwater Retarding Structure No. 8B	1,319	286	46	166	381	2,198	1,820	1.21
19. Floodwater Retarding Structure No. 9A	1,682	364	58	212	485	2,801	1,816	1.54

Denton Creek Watershed, Texas
(Trinity River Watershed)

Measures	AVERAGE ANNUAL BENEFITS						Annual Cost	Benefi Cost Ratio
	Flood-water	Sediment	Erosion	Indirect	Land Use Change	Total		
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars
STRUCTURAL MEASURES FOR FLOOD PREVENTION								
Waterflow Control								
20. Floodwater Retarding Structure No. 9B	916	198	32	115	264	1,525	1,437	1.06:1
21. Floodwater Retarding Structure No. 10	3,494	757	121	440	1,008	5,820	2,808	2.07:1
22. Floodwater Retarding Structure No. 10A, in combination with treatment of critical areas	2,195	476	76	276	634	3,657	2,216	1.65:1
23. Floodwater Retarding Structure No. 11A	1,551	336	54	195	448	2,584	1,542	1.68:1
24. Floodwater Retarding Structure No. 11B	3,142	681	109	395	907	5,234	2,462	2.13:1
25. Floodwater Retarding Structure No. 11C	1,239	268	43	156	358	2,064	1,831	1.13:1
26. Floodwater Retarding Structure No. 11D	876	190	30	110	253	1,459	1,396	1.05:1
27. Floodwater Retarding Structure No. 11E	826	179	29	104	238	1,376	1,183	1.16:1
28. Floodwater Retarding Structure No. 11F	1,178	255	41	148	340	1,962	1,192	1.65:1
29. Floodwater Retarding Structure No. 12	8,600	1,864	298	1,082	2,482	14,326	4,230	3.39:1
30. Floodwater Retarding Structure No. 13	5,861	1,270	203	737	1,691	9,762	3,542	2.76:1
31. Floodwater Retarding Structure No. 16	5,670	1,229	197	713	1,636	9,445	3,411	2.77:1
32. Floodwater Retarding Structure No. 17	3,857	836	134	485	1,113	6,425	4,741	1.36:1
33. Floodwater Retarding Structure No. 18A-1	3,051	661	106	384	881	5,083	2,981	1.71:1
34. Floodwater Retarding Structure No. 20A	1,641	356	57	206	474	2,734	2,000	1.37:1
35. Floodwater Retarding Structure No. 21	7,684	1,665	266	966	2,218	12,799	3,771	3.39:1
36. Floodwater Retarding Structure No. 21A	2,407	522	84	303	694	4,010	3,300	1.22:1
37. Floodwater Retarding Structure No. 21B	3,474	753	120	437	1,002	5,786	3,651	1.58:1
38. Floodwater Retarding Structure No. 21C	1,974	428	68	248	570	3,288	1,735	1.90:1
39. Floodwater Retarding Structure No. 21D	936	203	32	118	270	1,559	1,475	1.06:1
40. Floodwater Retarding Structure No. 25	3,535	766	122	445	1,020	5,888	2,218	2.65:1
41. Floodwater Retarding Structure No. 23	5,146	1,115	178	647	1,485	8,571	3,262	2.63:1
42. Floodwater Retarding Structure No. 23A	5,378	1,166	186	676	1,552	8,958	2,724	3.29:1

Denton Creek Watershed, Texas
(Trinity River Watershed)

Measures	AVERAGE ANNUAL BENEFITS						Annual Cost	Benef : Cost Ratio
	Flood-water	Sediment	Erosion	Indirect	Land Use Change	Total		
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dolla
STRUCTURAL MEASURES FOR FLOOD PREVENTION								
Waterflow Control								
43. Floodwater Retarding Structure No.23B	4,109	891	142	517	1,186	6,845	3,295	2.08:
44. Floodwater Retarding Structure No.23D	3,464	751	120	436	1,000	5,771	2,728	2.12:
45. Floodwater Retarding Structure No.23E	1,974	428	68	248	570	3,288	1,824	1.80:
46. Floodwater Retarding Structure No.24	6,042	1,310	209	760	1,744	10,065	3,756	2.68:
47. Floodwater Retarding Structure No.24A	2,105	456	73	265	608	3,507	2,230	1.57:
48. Floodwater Retarding Structure No.25A	2,175	472	75	274	628	3,624	1,854	1.95:
49. Floodwater Retarding Structure No.25B	1,672	362	58	210	482	2,784	2,310	1.21:
50. Floodwater Retarding Structure No.26	5,065	1,098	176	637	1,462	8,438	3,312	2.55:
51. Floodwater Retarding Structure No.27A	1,662	360	58	209	480	2,769	1,445	1.92:
Subtotal	170,844	37,029	5,922	21,489	49,306	284,590	134,310	2.12:
TOTAL STRUCTURAL MEASURES FOR FLOOD PREVENTION	170,844	37,029	5,922	21,489	49,306	284,590	134,310	2.12:
GRAND TOTAL	170,844	37,029	5,922	21,489	49,306	284,590	134,310	2.12:

Date: June, 1956

Denton Creek Watershed, Texas
(Trinity River Watershed)

Site No.	Drainage Area	STORAGE CAPACITY								SURFACE AREA				PRINCIPAL SPILLWAY	
		Sediment													
		Sed. Pool	Res. Below Riser	Res. Above Riser	Det. Pool	Total	Total Sed. Stor.	Total Det. Stor.	Total	Top of Riser	Top of Det. Pool	Max. Ht. of Dam	Volume of Fill	Max. Disch. Cap.	
	sq.mi.	acre-feet					inches			acres		ft.	cu. yd.	c.f.s.	
1A	8.55	196	49	49	3,132	3,426	0.60	6.40	7.00	63	234	38	190,908	43	
1B-1	1.15	73	-	18	301	392	1.50	4.90	6.40	18	54	24	38,096	8	
1B-2	0.96	56	-	5	251	312	1.20	4.90	6.10	12	30	32	61,444	9	
1C	1.27	68	-	13	331	412	1.20	4.90	6.10	13	35	30	61,586	9	
1D	1.74	74	-	18	455	547	1.00	4.90	5.90	15	53	28	68,194	9	
2A	1.55	66	-	16	404	486	1.00	4.90	5.90	17	49	28	73,168	9	
2B	2.07	143	-	44	541	728	1.70	4.90	6.60	27	54	28	87,110	11	
2C	1.68	54	-	18	438	510	0.80	4.90	5.70	12	45	31	94,834	9	
2D	1.20	161	-	39	314	514	3.10	4.90	8.00	27	52	29	78,644	9	
2E-1	1.97	84	-	21	515	620	1.00	4.90	5.90	17	70	28	78,444	10	
2E	2.84	197	90	60	741	1,088	2.30	4.90	7.20	39	100	34	80,222	25 1/	
2F	5.00	199	440	160	1,305	2,104	3.00	4.90	7.90	74	160	36	185,982	25	
3	6.84	199	347	146	1,898	2,590	1.90	5.20	7.10	89	256	29	164,862	85 2/	
3A	2.50	200	213	93	653	1,159	3.80	4.90	8.70	48	91	32	87,024	13	
3B	2.71	199	884	260	708	2,051	9.30	4.90	14.20	82	93	39	153,032	14	
4	8.01	196	786	256	2,434	3,672	2.90	5.70	8.60	165	343	33	145,247	67 3/	
5	2.94	199	52	63	769	1,083	2.00	4.90	6.90	42	93	31	92,818	15	
6	4.09	198	194	87	1,068	1,547	2.20	4.90	7.10	68	152	29	113,224	21	
7A	1.05	101	-	22	280	403	2.20	5.00	7.20	19	41	24	67,708	8	
7B	1.38	198	22	51	359	630	3.70	4.90	8.60	16	36	27	112,174	8	
8	3.49	195	121	75	913	1,304	2.10	4.90	7.00	71	139	29	80,702	18	
8A	1.50	104	-	32	399	535	1.70	5.00	6.70	20	50	30	83,456	9	
8B	1.31	112	-	28	343	483	2.00	4.90	6.90	21	51	26	87,436	8	
9A	1.67	89	-	18	438	545	1.20	4.90	6.10	15	56	34	91,000	9	
9B	0.91	38	-	5	242	285	0.90	5.00	5.90	7	31	29	71,033	9	
10	3.47	194	102	74	888	1,258	2.00	4.80	6.80	33	97	36	134,889	18	
10A	2.18	198	128	70	570	966	3.40	4.90	8.30	43	95	33	93,560	11	

Denton Creek Watershed, Texas
(Trinity River Watershed)

Site No.	Drainage Area	STORAGE CAPACITY								SURFACE AREA				PRINCIP. SPILLWA
		Sediment					Total Sed.	Total Det.	Total	Top of Riser	Top of Det. Pool	Max. Ht. of Dam	Volume of Fill	Max. Disch Cap.
	sq.mi.	acre-feet					inches			acres		ft.	cu. yd.	c.f.s.
		Sed. Pool	Res. Below Riser	Res. Above Riser	Det. Pool	Total								
11A	1.54	74	-	16	412	502	1.10	5.00	6.10	16	45	29	71,828	9
11B	3.12	199	67	67	815	1,148	2.00	4.90	6.90	29	88	32	118,926	16
11C	1.23	104	-	26	321	451	2.00	4.90	6.90	15	41	36	92,194	10
11D	0.87	78	-	19	228	325	2.10	4.90	7.00	11	30	30	68,221	9
11E	0.82	44	-	8	215	267	1.20	4.90	6.10	6	27	26	56,572	8
11F	1.17	70	-	17	284	371	1.50	4.90	6.40	12	36	29	55,874	9
12	8.54	200	301	137	2,824	3,462	1.40	6.20	7.60	52	237	40	204,978	43
13	5.82	186	62	31	1,553	1,832	0.90	5.00	5.90	40	116	38	172,866	30
16	5.63	180	90	30	1,500	1,800	1.00	5.00	6.00	47	120	36	165,762	29
17	3.83	184	-	20	1,023	1,227	1.00	5.00	6.00	33	70	40	132,750	20
18A-1	3.03	194	64	65	807	1,130	2.00	5.00	7.00	37	101	34	144,345	16
20A	1.63	61	-	8	434	503	0.80	5.00	5.80	12	41	26	96,600	9
21	7.63	195	49	41	2,280	2,565	0.70	5.60	6.30	50	163	36	173,856	39
21A	2.39	76	-	13	638	727	0.70	5.00	5.70	15	50	38	112,918	12
21B	3.45	110	-	18	919	1,047	0.70	5.00	5.70	25	77	37	122,206	18
21C	1.96	63	-	10	523	596	0.70	5.00	5.70	17	48	30	83,446	10
21D	0.93	30	-	5	247	282	0.70	5.00	5.70	6	26	30	40,482	9
25	3.51	149	-	19	935	1,103	0.90	5.00	5.90	27	81	35	107,673	18
23	5.11	191	27	27	1,362	1,607	0.90	5.00	5.90	27	91	36	154,906	26
23A	5.34	199	57	28	1,425	1,709	1.00	5.00	6.00	52	156	33	114,028	27
23B	4.08	196	43	44	1,088	1,371	1.30	5.00	6.30	32	103	40	145,822	21
23D	3.44	183	37	37	917	1,174	1.40	5.00	6.40	39	104	33	124,672	18
23E	1.96	73	-	10	523	606	0.80	5.00	5.80	14	51	34	86,134	10
24	6.00	192	32	32	1,599	1,855	0.80	5.00	5.80	36	125	44	178,998	30
24A	2.09	100	-	11	569	680	1.00	5.10	6.10	17	70	36	107,173	11

TABLE 6 - STRUCTURE DATA - Continued
Preliminary Estimates for Floodwater Retarding Structures
Denton Creek Watershed, Texas
(Trinity River Watershed)

Site No.	Drainage Area	STORAGE CAPACITY								SURFACE AREA				PRINCIP SPILLWA
		Sediment					Total Sed.	Total Det.		Top of Riser	Top of Det. Pool	Max. Ht. of Dam	Volume of Fill	Max. Disch Cap.
		Sed. Pool	Res. Below Riser	Res. Above Riser	Det. Pool	Total			Total					
	sq.mi.	acre-feet					inches			acres		ft.	cu.yd.	c.f.s.
25A	2.16	92	-	11	575	678	0.90	5.00	5.90	13	59	33	91,627	11
25B	1.66	98	-	8	451	557	1.20	5.10	6.30	17	46	32	67,578	9
26	5.03	198	43	27	1,340	1,608	1.00	5.00	6.00	50	152	35	156,900	26
27A	1.65	62	-	9	441	512	0.80	5.00	5.80	18	60	25	69,548	9
Total	169.65	7,572	4,300	2,535	46,938	61,345				1,838	4,974		5,995,680	

1/ Site No. 2E is below Site No. 2E-1 in series.
2/ Site No. 3 is below Sites Nos. 2E, 2E-1 and 2F in series.
3/ Site No. 4 is below Sites Nos. 3A and 3B in series.

Note: No flood plain area is inundated by these structures.
Vegetative emergency spillways provided for all structures.

Date: June, 1956

(Based on 1955 Price Levels)
Denton Creek Watershed, Texas
(Trinity River Watershed)

Structure Site Number or Name	FEDERAL INSTALLATION COST					NON-FEDERAL INSTALLATION COST				Estimated Total Cost
	Contract	Installation Services	Contingencies	Adm. and Misc.	Total Federal	Easements (Land Value)	Legal Fees	Removing Obstacles	Total Non-Federal	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
FLOODWATER RETARDING STRUCTURES										
1A	69,084	13,817	6,908	8,981	98,790	9,000	476	3,000	12,476	111,266
1B-1	13,187	2,637	1,319	1,714	18,857	1,804	204	2,500	4,508	23,365
1B-2	21,269	4,254	2,127	2,765	30,415	1,074	204	2,625	3,903	34,318
1C	23,318	4.664	2,332	3,031	33,345	1,220	68	-	1,288	34,633
1D	23,606	4,721	2,361	3,069	33,757	1,656	204	6,055	7,915	41,672
2A	27,327	5,465	2,733	3,552	39,077	1,658	136	1,060	2,854	41,931
2B	33,153	6,631	3,315	4,310	47,409	1,930	272	-	2,202	49,611
2C	35,827	7,165	3,583	4,657	51,232	1,380	204	-	1,584	52,816
2D	29,723	5,945	2,972	3,864	42,504	2,114	136	200	2,450	44,954
2E-1	27,154	5,431	2,715	3,530	38,830	1,820	272	-	2,092	40,922
2E	29,769	5,954	2,977	3,870	42,570	4,450	340	1,516	6,306	48,876
2F	66,378	13,276	6,638	8,629	94,921	6,160	204	4,200	10,564	105,485
3	61,068	12,214	6,107	7,939	87,328	8,340	340	-	8,680	96,008
3A	32,124	6,425	3,212	4,176	45,937	3,274	204	-	3,478	49,415
3B	55,473	11,095	5,547	7,211	79,326	5,250	340	-	5,590	84,916
4	54,278	10,856	5,428	7,056	77,618	13,466	136	-	13,602	91,220
5	35,629	7,126	3,562	4,632	50,949	3,115	68	-	3,183	54,132
6	42,693	8,539	4,269	5,550	61,051	7,210	476	300	7,986	69,037
7A	26,437	5,287	2,644	3,437	37,805	1,399	68	-	1,467	39,272
7B	41,329	8,266	4,133	5,373	59,101	1,193	68	-	1,261	60,362
8	31,435	6,287	3,144	4,087	44,953	7,025	408	-	7,433	52,386
8A	31,389	6,278	3,139	4,081	44,887	1,575	68	-	1,643	46,530
8B	32,766	6,553	3,277	4,260	46,856	1,860	136	-	1,996	48,852
9A	33,000	6,600	3,300	4,290	47,190	1,505	136	-	1,641	48,831
9B	26,088	5,218	2,609	3,391	37,306	788	204	-	992	38,298

Estimate Structure Cost Distribution
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas
(Trinity River Watershed)

Structure Site Number or Name	FEDERAL INSTALLATION COST					NON-FEDERAL INSTALLATION COST				Estimated Total Cost
	Contract	Installation Services	Contingencies	Adm. and Misc.	Total Federal	Easements (Land Value)	Legal Fees	Removing Obstacles	Total Non-Federal	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
FLOODWATER RETARDING STRUCTURES										
10	49,692	9,938	4,969	6,460	71,059	3,691	408	-	4,099	75,158
10A	35,386	7,077	3,539	4,600	50,602	4,083	272	-	4,355	54,957
11A	27,364	5,473	2,736	3,557	39,130	1,765	68	-	1,833	40,963
11B	43,667	8,733	4,367	5,677	62,444	2,928	204	-	3,132	65,576
11C	33,413	6,683	3,341	4,344	47,781	1,412	68	-	1,480	49,261
11D	25,115	5,022	2,511	3,265	35,913	1,070	68	-	1,138	37,051
11E	21,083	4,217	2,108	2,741	30,149	756	204	-	960	31,109
11F	20,841	4,168	2,084	2,709	29,802	1,200	204	-	1,404	31,206
12	74,454	14,891	7,445	9,679	106,469	6,802	136	-	6,938	113,407
13	63,338	12,668	6,334	8,234	90,574	3,910	340	-	4,250	94,824
16	60,379	12,076	6,038	7,849	86,342	4,290	340	-	4,630	90,972
17	89,120	17,824	8,912	11,586	127,442	2,720	136	-	2,856	130,298
18A-1	52,966	10,593	5,297	6,886	75,742	3,508	204	500	4,212	79,954
20A	35,938	7,188	3,594	4,672	51,392	2,275	136	-	2,411	53,803
21	63,681	12,736	6,368	8,278	91,063	8,547	204	-	8,751	99,814
21A	60,664	12,133	6,066	7,886	86,749	2,615	68	-	2,683	89,432
21B	66,241	13,248	6,624	8,611	94,724	4,127	68	-	4,195	98,919
21C	30,385	6,076	3,039	3,950	43,450	2,652	68	-	2,720	46,170
21D	26,375	5,275	2,637	3,429	37,716	1,248	272	-	1,520	39,236
25	37,271	7,454	3,727	4,845	53,297	4,725	68	-	4,793	58,090
23	57,121	11,424	5,712	7,426	81,683	4,527	340	100	4,967	86,650
23A	42,471	8,494	4,247	5,521	60,733	8,485	340	1,492	10,317	71,050
23B	53,477	10,695	5,348	6,952	76,472	5,401	408	5,433	11,242	87,714
23D	46,156	9,231	4,616	6,000	66,003	5,941	204	-	6,145	72,148
23E	32,316	6,463	3,232	4,201	46,212	2,366	204	-	2,570	48,782

Estimate Structure Cost Distribution
(Based on 1955 Price Levels)
Denton Creek Watershed, Texas
(Trinity River Watershed)

Structure Site Number or Name	FEDERAL INSTALLATION COST					NON-FEDERAL INSTALLATION COST				
	Contract	Installation Services	Contingencies	Adm. and Misc.	Total Federal	Easements (Land Value)	Legal Fees	Removing Obstacles	Total Non-Federal	Estimat Total Cost
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
FLOODWATER RETARDING STRUCTURES										
24	65,461	13,092	6,546	8,510	93,609	6,415	68	-	6,483	100,09
24A	38,598	7,720	3,860	5,018	55,196	3,500	136	-	3,636	58,83
25A	31,717	6,343	3,172	4,123	45,355	2,975	204	775	3,954	49,30
25B	41,790	8,358	4,179	5,433	59,760	2,603	136	-	2,739	62,49
26	54,312	10,862	5,431	7,061	77,666	8,788	272	-	9,060	86,72
27A	24,074	4,815	2,407	3,130	34,426	3,209	136	-	3,345	37,77
Total	2,308,370	461,674	230,837	300,088	3,300,969	208,800	11,356	29,756	249,912	3,550,88
LAND STABILIZATION										
Stabilization of Critical Areas	13,984	2,797	1,400	1,819	20,000	-	408	-	408	20,40
Total	13,984	2,797	1,400	1,819	20,000	-	408	-	408	20,40
GRAND TOTAL	2,322,354	464,471	232,237	301,907	3,320,969	208,800	11,764	29,756	250,320	3,571,28

Date: June, 1956

TABLE 7 - SUMMARY OF PHYSICAL DATA
Denton Creek Watershed, Texas
(Trinity River Watershed)

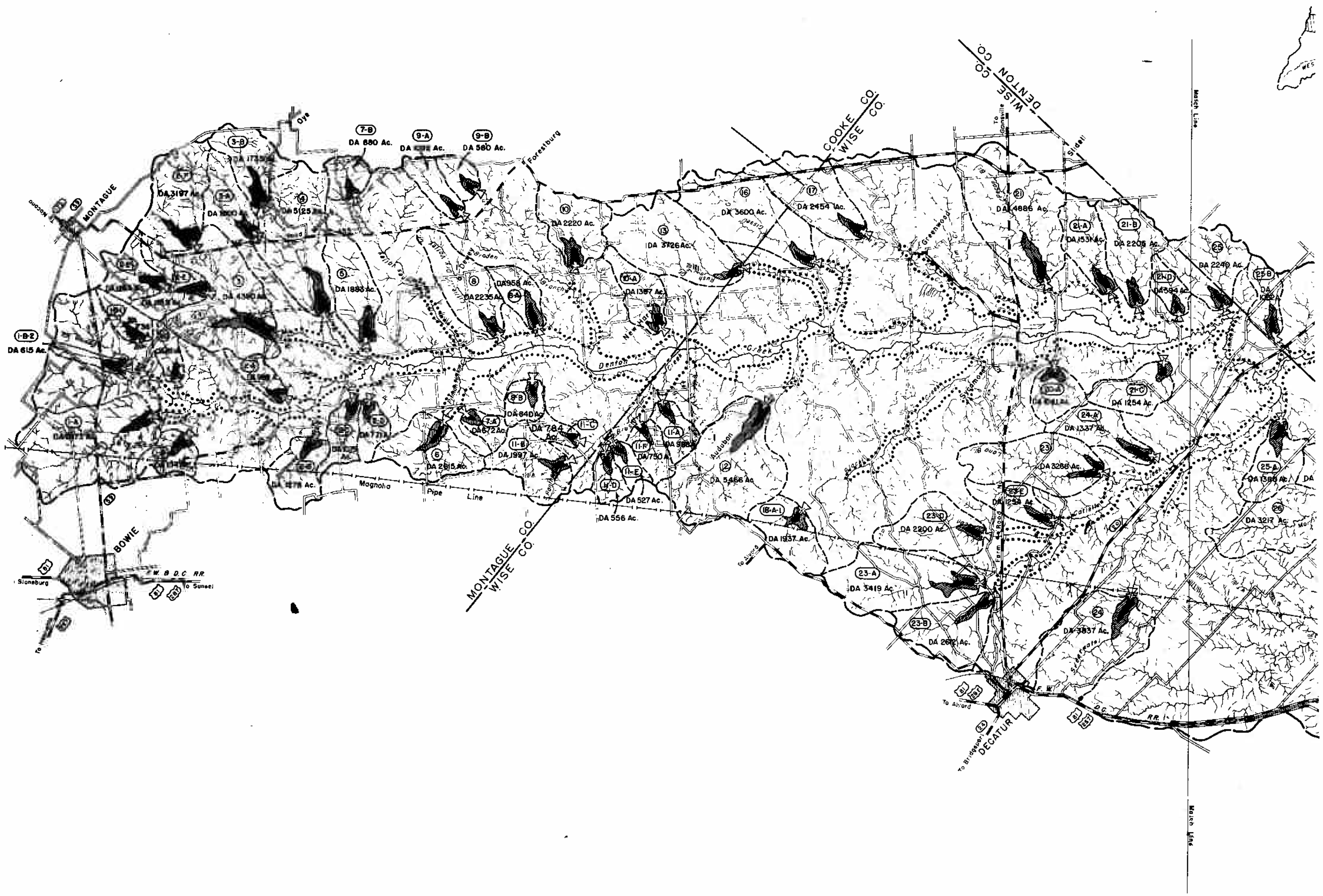
Item	Unit	Quantity At Time of Revision	Quantity With Program
atershed area	Sq. Mi.	663.4	663.4
atershed Area	Acres	424,600	424,600
rea of Cropland	Acres	120,801	120,801
rea of Pastureland	Acres	74,854	151,971
rea of Wooded Pastureland	Acres	51,798	46,[illegible]
rea of Rangeland	Acres	80,615	84,615
rmerly Cultivated	Acres	76,117	-
ream Channels	Acres	1,695	1,695
apevine Reservoir	Acres	12,740	12,740
scellaneous	Acres	5,980	5,980
erflow Area Subject to Damage by Design Storm	Acres	26,942	23,512
ea Damaged Annually by:			
Sediment	Acres	11,401	4,332
Sheet Erosion	Acres	262,653	102,733
Flood Plain Scour	Acres	2,137	748
Stream Bank Erosion	Acres	Negligible	Negligible
erage Annual Rainfall	Inches	31.21	31.21

Date: June, 1956

TABLE 8 - SUMMARY OF PLAN DATA
Denton Creek Watershed, Texas
(Trinity River Watershed)

Item	Unit	Quantity
ears to Complete Program	Year	10
otal Installation Cost		
Federal	Dollar	3,732,421
Non-Federal	Dollar	4,115,722
nual O and M (Structural Measures)		
Federal	Dollar	-
Non-Federal	Dollar	5,717
nual Benefits	Dollar	284,590
ructural Measures		
Floodwater Retarding Structures	Each	56
ea Inundated by Structures		
Flood Plain		
Detention Pool	Acre	0
Sediment Pool	Acre	0
Upland		
Detention Pool	Acre	3,136
Sediment Pool	Acre	1,838
tershed Area above Structures	Acre	108,576
duction of Floodwater Damage		
Land Treatment Measures	Percent	25
Structural Measures	Percent	42
duction of Sediment Damage		
Land Treatment Measures	Percent	29
Structural Measures	Percent	33
nefit from More Intensive Use of Land Resulting from Reduction of Flood Hazard	Dollar	49,306

Date: June, 1956



MONTAGUE
BOWIE
Forestburg
COOKE CO.
WISE CO.
WISE CO.
DENTON CO.
MONTAGUE CO.
WISE CO.
DECATUR
Match Line
Denton Creek
Magnolia Pipe Line
Audubon
Greenwood
Slidell
F. W. & D. C. RR.
To Alvord
To Bridgeport
Stoneburg
To Sunset
DA 615 Ac.
DA 880 Ac.
DA 580 Ac.
DA 3197 Ac.
DA 1883 Ac.
DA 2235 Ac.
DA 958 Ac.
DA 2220 Ac.
DA 3600 Ac.
DA 3726 Ac.
DA 1387 Ac.
DA 2454 Ac.
DA 4886 Ac.
DA 2205 Ac.
DA 2249 Ac.
DA 2615 Ac.
DA 1997 Ac.
DA 672 Ac.
DA 840 Ac.
DA 527 Ac.
DA 556 Ac.
DA 5466 Ac.
DA 1937 Ac.
DA 2200 Ac.
DA 3419 Ac.
DA 1254 Ac.
DA 1337 Ac.
DA 3286 Ac.
DA 3837 Ac.
DA 3217 Ac.

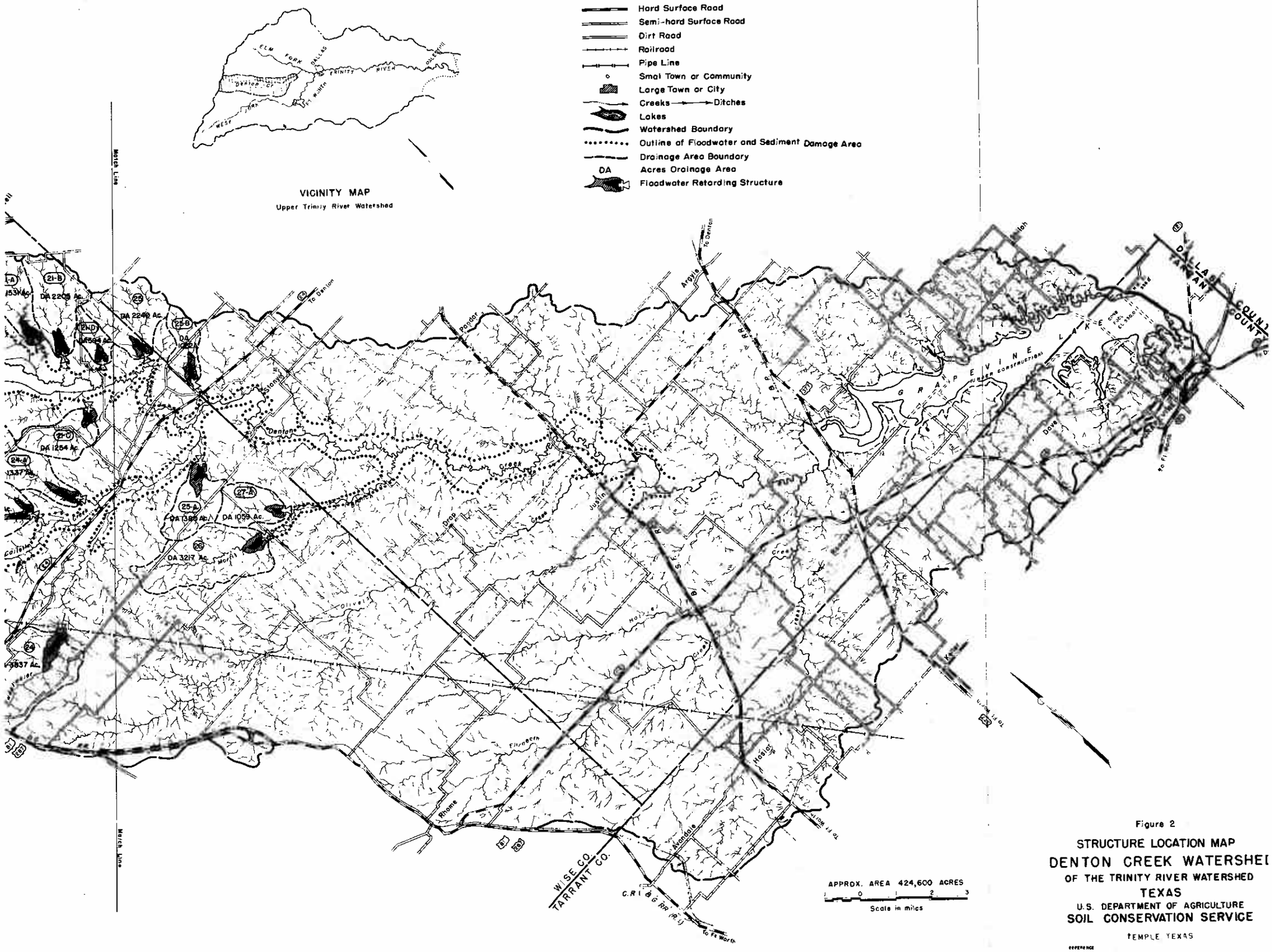


Figure 2

STRUCTURE LOCATION MAP

DENTON CREEK WATERSHED

OF THE TRINITY RIVER WATERSHED

TEXAS

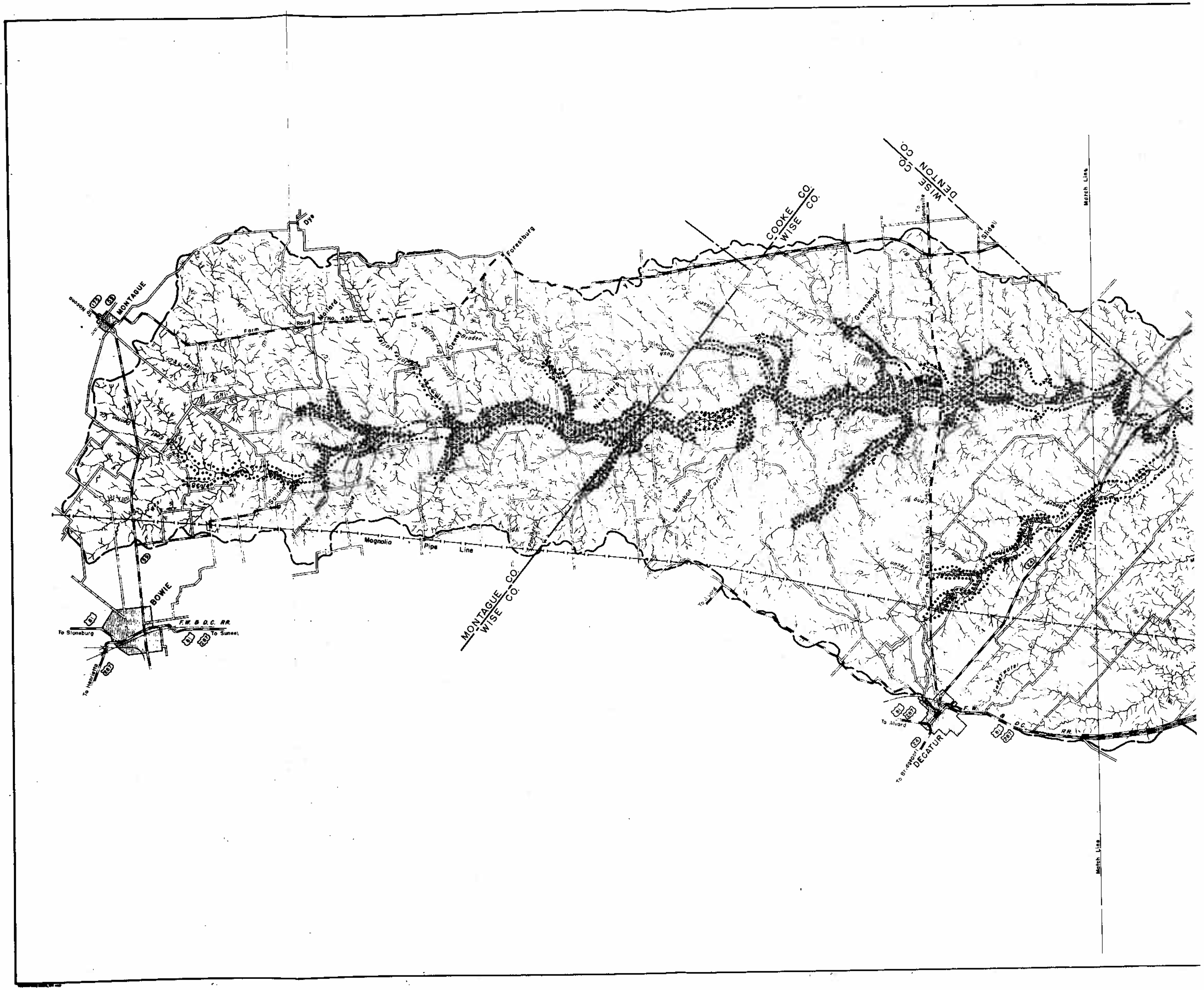
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

TEMPLE, TEXAS

REFERENCE		
CARTOGRAPHIC APPROVAL		TECHNICAL APPROVAL
COMPILED	CHECKED	DATE
H.W.		8/20/75

4-R-10,75



MONTAGUE
BOWIE
DECATUR
COOKE CO.
WISE CO.
MONTAGUE CO.
WISE CO.
WISE CO.
DENTON CO.
F.W. & D.C. RR.
To Stoneburg
To Sunset
To Alvord
Forestburg
Dye
Magnolia
Pipe
Line
Match Line
Match Line

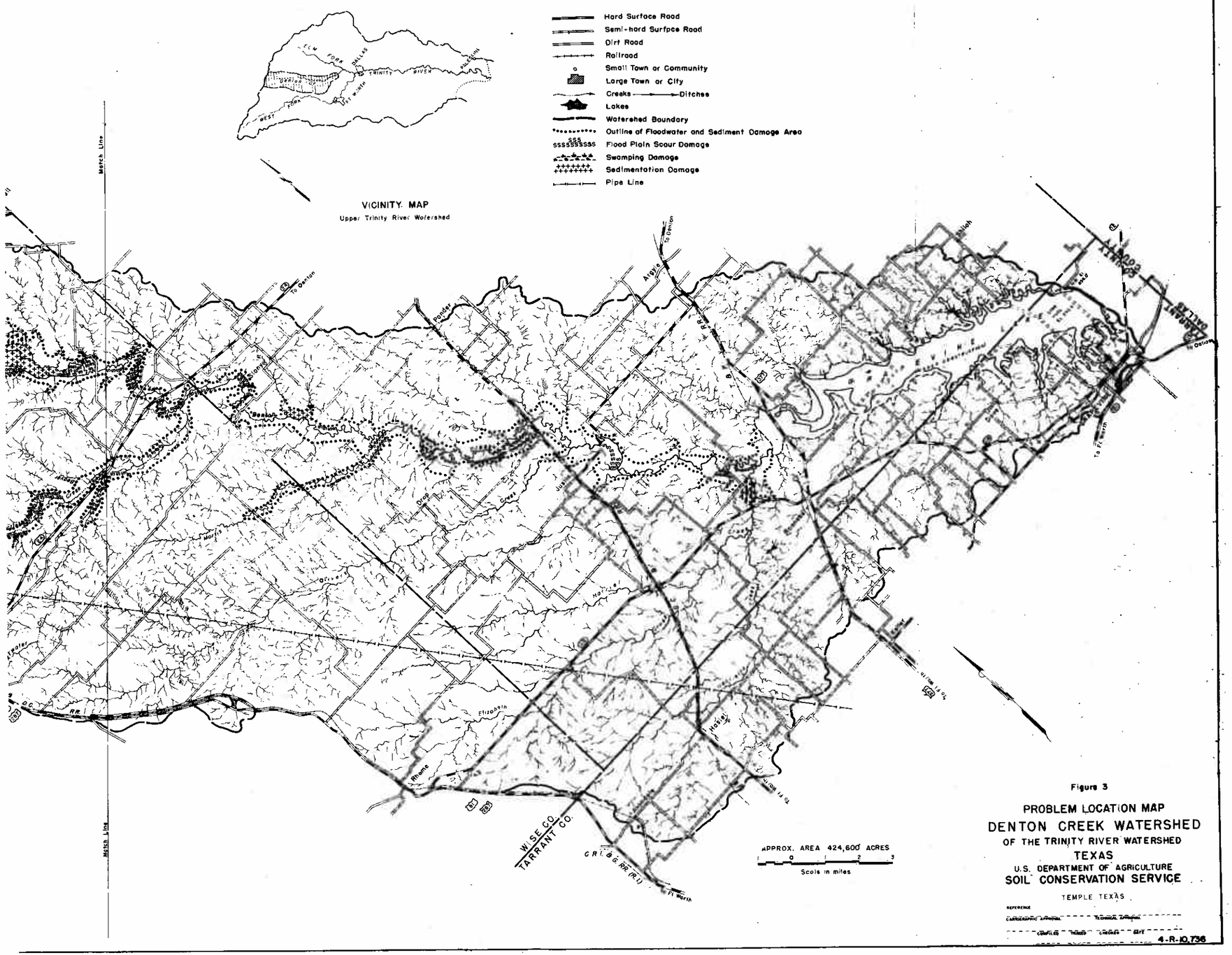


Figure 3

PROBLEM LOCATION MAP

DENTON CREEK WATERSHED

OF THE TRINITY RIVER WATERSHED

TEXAS

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

TEMPLE, TEXAS

4-R-10,736