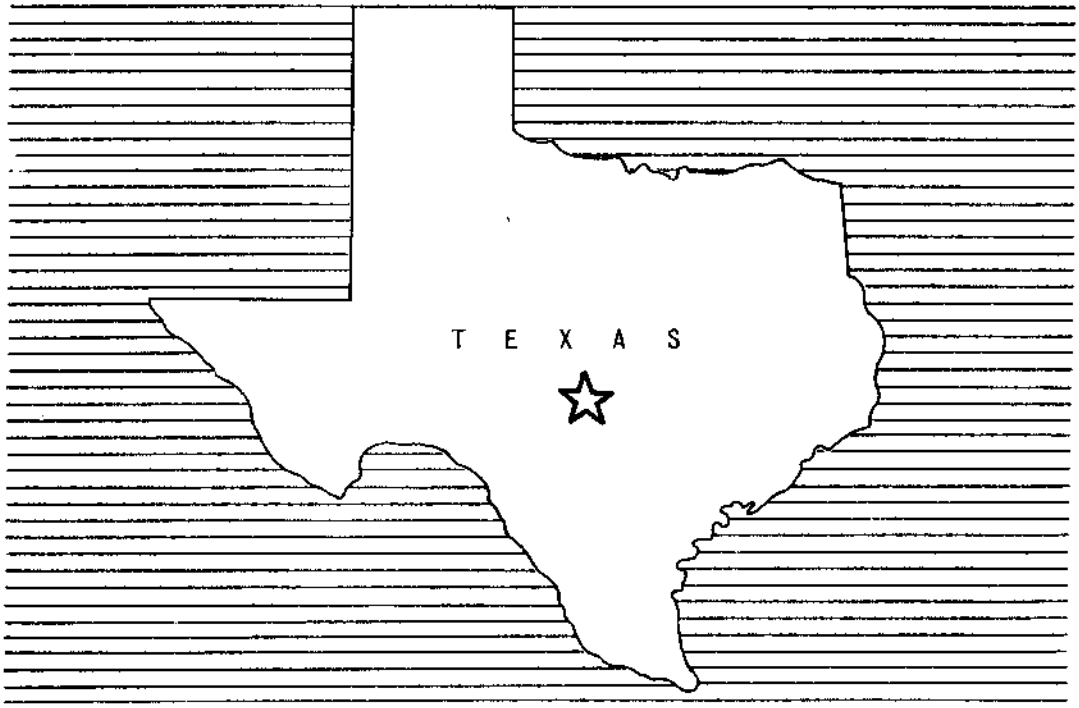
WORK PLAN

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

MARTINEZ CREEK WATERSHED

BEXAR COUNTY, TEXAS



OCTOBER 1958

SCS-FORT WORTH, TEX. 358

WATERSHED WORK PLAN AGREEMENT

between the

Alamo Soil Conservation District
Local Organization

Local Organization

San Antonio River Authority
Local Organization

In the 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, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the **Martinez Creek** Watershed, State of **Texas** under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended by the Act of August 7, 1956 (Public Law 1018, 84th Congress; 70 Stat. 1088); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, 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 **Martinez Creek** Watershed, State of **Texas**, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan will be installed, within 5 years, and operated and maintained substantially in accordance with the terms, conditions, and stipulations provided for therein.

It is mutually agreed that in installing and operating and maintaining the works of improvement described in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost $ 134,942 .)

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 and land treatment measures for flood prevention 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)
6 Floodwater Retarding Structures	0	100	313,507

The Sponsoring Local Organization will pay all of the costs allocated to purposes other than flood prevention, and irrigation, drainage, and other agricultural water management.

4. The Service will bear the cost of all installation services applicable to works of improvement for flood prevention. (Estimated cost $ 98,441 .)

   The Service will bear _____ percent of the cost of installation services applicable to works of improvement for agricultural water management and the Sponsoring Local Organization will bear _____ percent of the cost of such services. (Estimated cost $ None .)

   The Sponsoring Local Organization will bear the cost of all installation services applicable to works of improvement for nonagricultural water management. (Estimated cost $ None .)

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost $ 3,000 .)

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 conservation farm or ranch plans on their land

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners 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 watershed work plan is contingent on the appropriation of funds for this purpose.

    Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

13. 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.

Alamo Soil Conservation District
Local Organization

By M P Coleman

Title Chairman

Date **February 20, 1959**

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

adopted at a meeting held on **February 20, 1959**

Mod. F. Braunhaver
(Secretary, Local Organization)

Date **February 20, 1959**

San Antonio River Authority
Local Organization

By [signature]

Title Chairman

Date **February ~~20~~ 24, 1959**

The signing of this agreement was authorized by a resolution of the governing body of the **San Antonio River Authority**
Local Organization

adopted at a meeting held on February 24, 1959

[signature]
(Secretary, Local Organization)

Date **February ~~20~~ 24, 1959**

_____
Local Organization

By _____

Title _____

Date _____

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

adopted at a meeting held on _____

_____
(Secretary, Local Organization)

Date _____

Soil Conservation Service
United States Department of Agriculture

By _____
Administrator

Date _____

M-45-FTW-58

WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

MARTINEZ CREEK WATERSHED
Bexar County, Texas
October 1958

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act. (Public Law 566, 83rd Congress; 68 Stat. 666 as Amended by Public Law 1018, 84th Congress; 70 Stat. 1088).

Prepared By: Alamo Soil Conservation District
(Cosponsor)

San Antonio River Authority
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
October 1958

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WATERSHED WORK PLAN

MARTINEZ CREEK WATERSHED
Bexar County, Texas
October, 1958

SUMMARY OF PLAN

General Summary

The work plan for watershed protection and flood prevention for the Martinez Creek watershed was prepared by the Alamo Soil Conservation District and the San Antonio River Authority as cosponsoring local organizations. Technical assistance was provided by the Soil Conservation Service of the United States Department of Agriculture.

The watershed covers an area of approximately 87.50 square miles, or 56,000 acres in Bexar County, Texas. Approximately 60 percent of the watershed is cropland, 34 percent is grassland and 6 percent is in miscellaneous uses, such as towns, industrial areas, roads, stream channels, and railroads.

There are no Federal agricultural lands in the watershed. The only Federally-owned land is a portion of the Randolph Air Force Base.

The work plan proposes installing, in a 5-year period a project for the protection and development of the watershed at a total estimated installation cost of $1,143,481. The share of this cost to be borne by other than Public Law 566 funds is $706,533. In addition, local interest will bear the entire cost of operation and maintenance, with a capitalized value of $22,974. Of the total project cost of $1,166,455, the Public Law 566 share will be $436,948 and local and other funds will bear $729,507.

Land Treatment Measures

The cost for land treatment measures is estimated to be $593,591, of which the other than Public Law 566 share is $568,591, including $21,850 to be spent by the Soil Conservation Service under its going program for technical assistance during the project period. The Public Law 566 share, consisting entirely of accelerated technical assistance, is $25,000. Only those land treatment measures that will be installed during the 5-year project period are included in the work plan.

Structural Measures

The structural measures included in the plan consist of 6 floodwater retarding structures having a total sediment storage and floodwater

detention capacity of 8,989 acre-feet. The total cost of these measures, including the capitalized value of operation and maintenance, is $572,864, of which the local share is $160,916, and the Public Law 566 share is $411,948. The local share of the total cost of structural measures includes; land, easements, and rights-of-way, 84 percent; operation and maintenance, 14 percent; and administering contracts, 2 percent.

Damages and Benefits

The estimated average annual floodwater, sediment, flood plain erosion, and indirect damage without the project is $38,782 at long-term price levels. The estimated average annual floodwater, sediment, flood plain erosion and indirect damage with the project installed, including land treatment and structural measures is $15,006, a reduction of 61 percent. The average annual primary benefits accruing to structural measures are $23,046, which are distributed as follows:

Floodwater damage reduction	$ 17,691
Sediment damage reduction	232
Erosion damage reduction (flood plain)	1,489
Indirect damage reduction	1,941
Benefits outside watershed	1,693

The ratio of the average annual benefits ($23,046) to the average annual costs of structural measures ($20,198) is 1.14 to 1.

The total benefits of land treatment measures were not evaluated in monetary terms since experience has shown that these soil and water conservation measures produce benefits in excess of their costs.

Provisions for Financing Construction

An ad valorem tax has been voted in Bexar County for the purpose of flood control and is presently being collected. Revenue from this tax is provided to the San Antonio River Authority for carrying out flood control commitments.

Operation and Maintenance

Land treatment measures will be installed, operated, and maintained by the landowners or operators of the farms on which the measures will be installed, under agreements with the Alamo Soil Conservation District. Local sponsoring organizations will be responsible for the operation and maintenance of the six floodwater retarding structures. The San Antonio River Authority is provided funds for the purpose of flood control from revenue obtained from an ad valorem tax being collected in Bexar County. These funds are adequate and will be available for this purpose. The estimated average annual cost of operation and maintenance of the structures is $810.

DESCRIPTION OF WATERSHED

Physical Data

Martinez Creek heads approximately 3 miles west of the community of Converse, Bexar County, Texas and flows in a southeasterly direction for approximately 18 miles before entering Cibolo Creek. Salatrillo Creek, the principal tributary, heads approximately 4 miles northwest of Converse and flows in a southeasterly direction approximately 12 miles to its confluence with Martinez Creek. The watershed has an area of 56,000 acres.

The topography ranges from steeply sloping to gently rolling in the upland areas and is nearly level along the alluvial valleys, which are poorly defined. The combined flood plain area is 4,001 acres. Flood plain as referred to in this plan is the area inundated by the runoff from a 25-year frequency storm.

Geologic formations outcropping within the watershed, from oldest to youngest, are the Anacacho (Taylor), Taylor (undivided), Corsicana, Kemp, Wills Point, and Wilcox. The Anacacho, Taylor (undivided), Corsicana, and Kemp formations belong to the Upper Cretaceous System, while the Wills Point and Wilcox formations belong to the Tertiary System. These formations dip toward the southeast at approximately 40 to 50 feet per mile. The major area of the Balcones Fault zone lies just to the north of the watershed, but only scattered faults are known to be present in the watershed. These are confined to the upper reaches of the watershed.

Elevations range from 490 feet to slightly more than 1,000 feet above mean sea level.

Approximately 86 percent of the watershed lies within the Blackland Prairies Land Resource Area. The Rio Grande Plain Land Resource Area, which comprises the remaining 14 percent of the watershed, is located in the vicinity of the confluence of Martinez and Cibolo Creeks. The soils in the Blackland Prairies consist of light gray to black clays and gravelly clays of the Houston series. The soils in the Rio Grande Plain are predominantly fine sandy loams of the Webb series. The soils within the Martinez Creek watershed are predominantly deep and slowly permeable with some isolated areas of shallow soils. They are in fair to poor physical condition.

The overall land use for the watershed is as follows:

Land Use	Acres	Percent
Cropland	33,600	60
Grassland	19,040	34
Miscellaneous 1/	3,360	6
Total	56,000	100

1/ Includes roads, highways, railroads, urban areas, and airfields.

Land use in the flood plain is 56 percent cropland, 41 percent grassland, and 3 percent in miscellaneous uses.

The average annual rainfall is 29.55 inches as recorded at U. S. Weather Bureau gages at San Antonio and Seguin, Texas over a 30-year period. The monthly average ranges from 1.40 inches in November to 3.52 inches in May. Normal temperatures range from 84.2 degrees Fahrenheit in July to 50.6 degrees in January. The normal frost-free period of 279 days extends from February 24 to November 30.

Water for livestock and rural domestic use is obtained from surface ponds and wells.

Economic Data

The economy of the watershed is almost entirely agricultural. Production of cash crops, chiefly grain sorghum, corn, and cotton, is the predominant enterprise of farm operators. Beef cattle production, along with a few scattered dairy operations, is found throughout the watershed.

The average size farm in the watershed is approximately 130 acres, sufficient for an economic family unit. Owners of smaller tracts have in many instances secured employment in nearby towns, Randolph Air Force Base, and other military installations.

Converse, population 800, is the only town situated entirely within the watershed, Universal City, population 100, and Martinez, population 50, are partially in the watershed. San Antonio, with a population of 545,000, is within 20 miles of any point in the watershed and provides excellent cultural, recreational, medical, and commercial facilities for the people in neighboring communities.

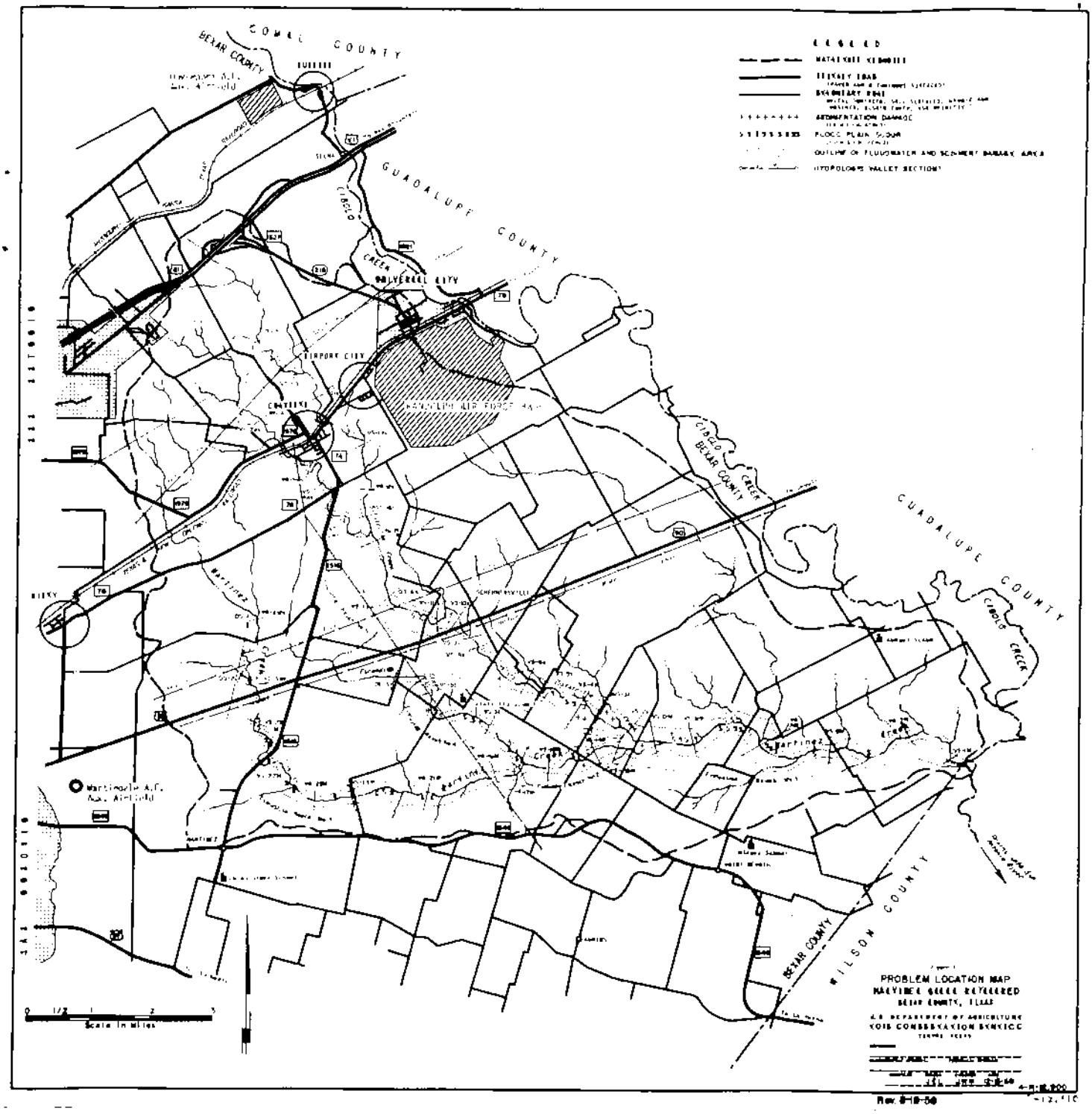
The area is adequately served by 134 miles of Federal, State, and County roads, of which 41 miles are hard surfaced. Adequate rail service is provided by the Texas and New Orleans Railroad with good loading and shipping facilities at Converse.

WATERSHED PROBLEMS

Floodwater Damages

Flooding occurs very frequently in the Martinez Creek watershed and causes severe damage. During the 30-year period studied, 1923 to 1952, inclusive which is representative of normal rainfall in this area, there were 26 floods that inundated more than half of the flood plain (figure 1), as well as 53 smaller floods. Fifty-eight of the floods occurred during the growing season and caused severe damage to growing crops.

It is estimated that the average annual direct floodwater damage under existing conditions is $31,372, of which $20,473 is crop and pasture damage, $7,397 is other agricultural damage and $3,502 is nonagricultural damage,


COMAL COUNTY
BEXAR COUNTY
GUADALUPE COUNTY
WILSON COUNTY
SAN ANTONIO
KIRBY
CIBOLO CREEK
CIBOLO BEXAR COUNTY CREEK
Martindale A.F. Aux. Airfield
0 1/2 1 2 3
Scale in miles
PROBLEM LOCATION MAP
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

primarily to roads and bridges. Also, there are numerous indirect damages, such as interruption of travel and initial losses suffered by dealers and industries in the area, and similar losses, which are estimated to average $3,525 per year.

Sediment Damage

Overbank deposition in the flood plain has damaged only 144 acres. This damage is estimated to have reduced crop and pasture production by 10 percent on 84 acres and by 20 percent on 60 acres, with an average annual monetary damage of $755, at long-term price levels.

The damaging sediment consists of silty clays, clays, and gravelly clays which are relatively low in organic matter. This sediment puddles and crusts readily.

There are no large reservoirs in the watershed, but the numerous farm ponds have suffered moderate damage due to sedimentation.

Erosion Damage

Upland erosion rates in the watershed are moderate. When a protective vegetative cover is established, these rates become moderate to low. Sheet erosion accounts for 93 percent of the total gross erosion. Gully and streambank erosion account for 1 percent, with the remaining 6 percent attributed to flood plain scour. The average annual rate of upland gross erosion is 4.21 acre feet per square mile.

Removal of surface soil in the flood plain by scouring ranges from 0.3 to 5 feet in depth. Approximately 520 acres are damaged annually by this process. The damage is estimated as follows: 312 acres, 10 percent; 129 acres, 20 percent; 65 acres, 30 percent; 10 acres, 40 percent, and 4 acres, 50 percent, in terms of reduced productivity. This represents an annual monetary damage of $3,132, at long-term price levels.

Problems Relating to Water Management

There is no activity relative to drainage or irrigation in the watershed. No individual landowner or group of landowners or municipality has indicated an interest in providing additional storage in any of the floodwater retarding structures for agricultural or nonagricultural water management purposes.

EXISTING OR PROPOSED WORKS OF IMPROVEMENT

The Martinez Creek watershed is served by the Soil Conservation Service Work Unit at San Antonio which is assisting the Alamo Soil Conservation District. This work unit has assisted farmers and ranchers in preparing 203 soil and water conservation plans on 32,978 acres (62.6 percent of the agricultural land) within the watershed and in giving technical assistance in establishing and maintaining planned measures.

Efforts to control or prevent flooding of agricultural lands have been minor. Some attempts to rectify channels and levee fields have been made but with little success in reducing flood damages.

There are no existing or proposed works of improvement by other authorities in the watershed.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures for Watershed Protection

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 Alamo Soil Conservation District is necessary for a sound flood prevention program on the watershed. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices essential to proper land use. Emphasis will be placed on accelerating the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment and erosion damages.

Of the total watershed area of 56,000 acres, 18,483 acres lie above planned floodwater retarding structures. Land treatment is especially important for protection of these watershed lands to support and supplement the structural measures. There are another 33,516 acres of upland in the watershed for which no structural control has been planned and for which establishment of land treatment measures constitute the only planned measures in this plan. Land treatment measures on the 3,799 acres of flood plain remaining after installation of floodwater retarding structures are also important in reducing floodwater, sediment, and erosion damage.

The amounts and estimated costs of the measures that will be installed by the landowners and operators are shown in table 1. The estimated total cost of planning and installing these measures is $593,591, including $25,000 from Public Law 566 funds during the 5-year installation period for technical assistance to landowners and operators to accelerate the planning and application of conservation practices. Landowners and operators will maintain these measures in accordance with provisions of the farmer-district cooperative agreements with the Alamo Soil Conservation District.

Land treatment measures will decrease erosion damage and sediment production from fields and pastures by providing improved soil cover conditions. These measures also effectively improve soil conditions which allow rainfall to soak into the soil at a more rapid rate.

In addition to the soil improvement and cover measures, land treatment includes contour farming, terracing, diversion construction, and the waterway development to serve these measures, which in combination have a measurable effect in reducing peak discharge by slowing runoff water from fields. These measures also help the soil improvement and cover measures to reduce erosion damage and sediment production.

Land Treatment Cultivated Land
Terracing and Contour Farming

Land Treatment Grass Land
Blue panic grass seeding following root-plowing.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST 1/

Martinez Creek Watershed, Texas
Price Base: 1958

Installation Cost Item	Unit	No. to be Applied Non-Federal Land	Estimated Cost Public Law 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
LAND TREATMENT FOR					
Watershed Protection					
Soil Conservation Service					
Contour Farming	Acre	12,000	-	18,000	18,000
Cover Cropping	Acre	11,088	-	109,771	109,771
Crop Residue Utilization	Acre	20,000	-	30,000	30,000
Conservation Cropping System	Acre	14,000	-	-	-
Rotation Hay & Pasture	Acre	5,000	-	42,000	42,000
Brush Control	Acre	9,000	-	171,000	171,000
Pasture Planting	Acre	6,000	-	50,400	50,400
Proper Use	Acre	8,500	-	17,000	17,000
Rotation Grazing	Acre	5,000	-	2,500	2,500
Wildlife Area Improvement	Acre	700	-	14,000	14,000
Diversion Construction	Mile	16	-	8,000	8,000
Pond Construction	Each	120	-	60,000	60,000
Terracing	Mile	110	-	22,000	22,000
Waterway Development	Acre	115	-	2,070	2,070
Technical Assistance			25,000	21,850	47,850
SCS Subtotal			25,000	568,591	593,591
TOTAL LAND TREATMENT			25,000	568,591	593,591
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	6	313,507	-	313,507
SCS Subtotal			313,507	-	313,507
Subtotal - Construction			313,507	-	313,507
Installation Services					
Soil Conservation Service					
Engineering Service			62,701	-	62,701
Other			35,740	-	35,740
SCS Subtotal			98,441	-	98,441
Subtotal - Installation Services			98,441	-	98,441
Other Costs					
Land, Easements & R/W			-	134,942	134,942
Administration of Contracts			-	3,000	3,000
Subtotal - Other				137,942	137,942
TOTAL STRUCTURAL MEASURES			411,948	137,942	549,890
TOTAL PROJECT			436,948	706,533	1,143,481
SUMMARY					
Subtotal SCS			436,948	706,533	1,143,481
TOTAL PROJECT			436,948	706,533	1,143,481

1/ No Federal lands involved.

October 1958

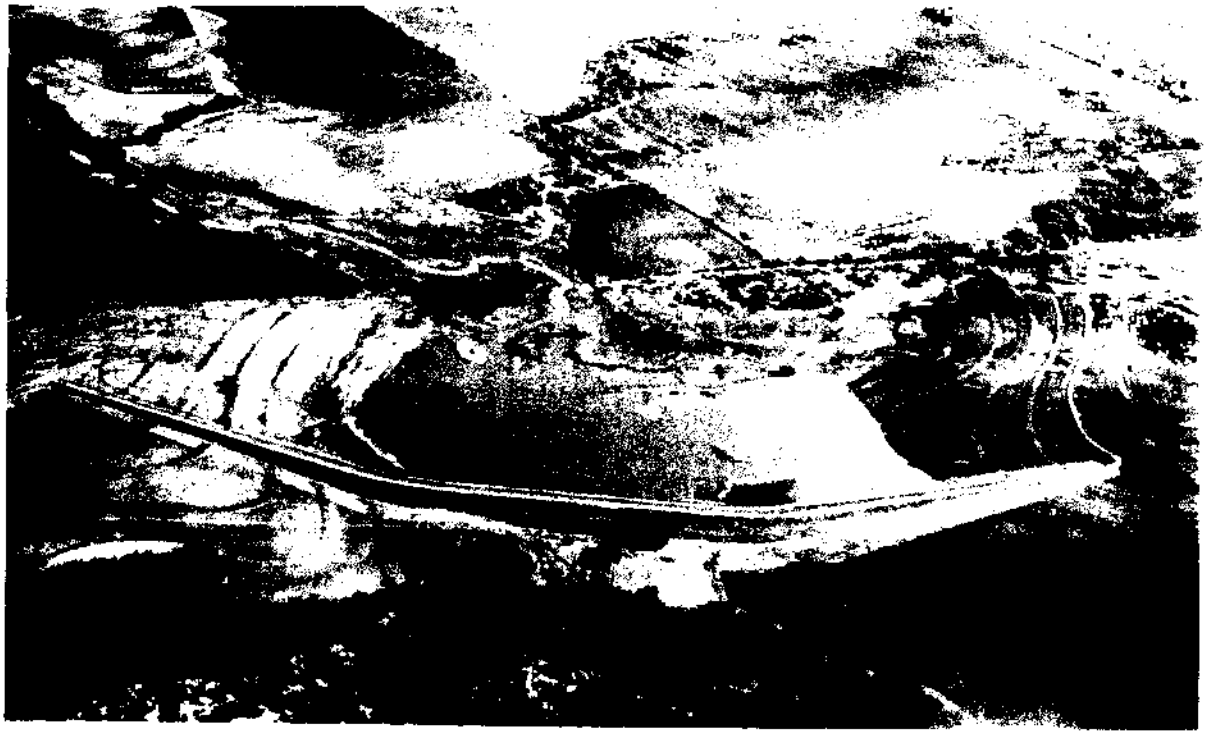
Structural Measures

A system of 6 floodwater retarding structures will be installed in the watershed to afford the needed protection to flood plain lands which cannot be provided by land treatment measures alone.

The 6 structures will detain temporarily the runoff from 48 percent of the watershed at valley section No. 12 (figure 1). Floodwater detention capacity equivalents of the individual sites will range from 3.5 to 5.19 inches of runoff from their watersheds. The total of 6,511 acre-feet of floodwater detention capacity of the 6 structures is sufficient to detain an average of 4.23 inches of runoff from the area above structures.

Figure 2 shows a section of a typical floodwater retarding structure.

There are 6 low-water crossings on public roads crossing Salatrillo Creek, a tributary to Martinez Creek, and 9 on Martinez Creek. In addition, there are numerous low-water crossings on private field roads that will be affected by the release flow from the floodwater retarding structures. Under present conditions these crossings are inundated during flood flows and for short periods following all rains. After the structures are in operation the flow peaks will be reduced but the flow will be greatly prolonged. The local sponsoring organizations will obtain court orders from the Commissioners



Floodwater Retarding Structures
Typical of those proposed in Martinez Creek Watershed.

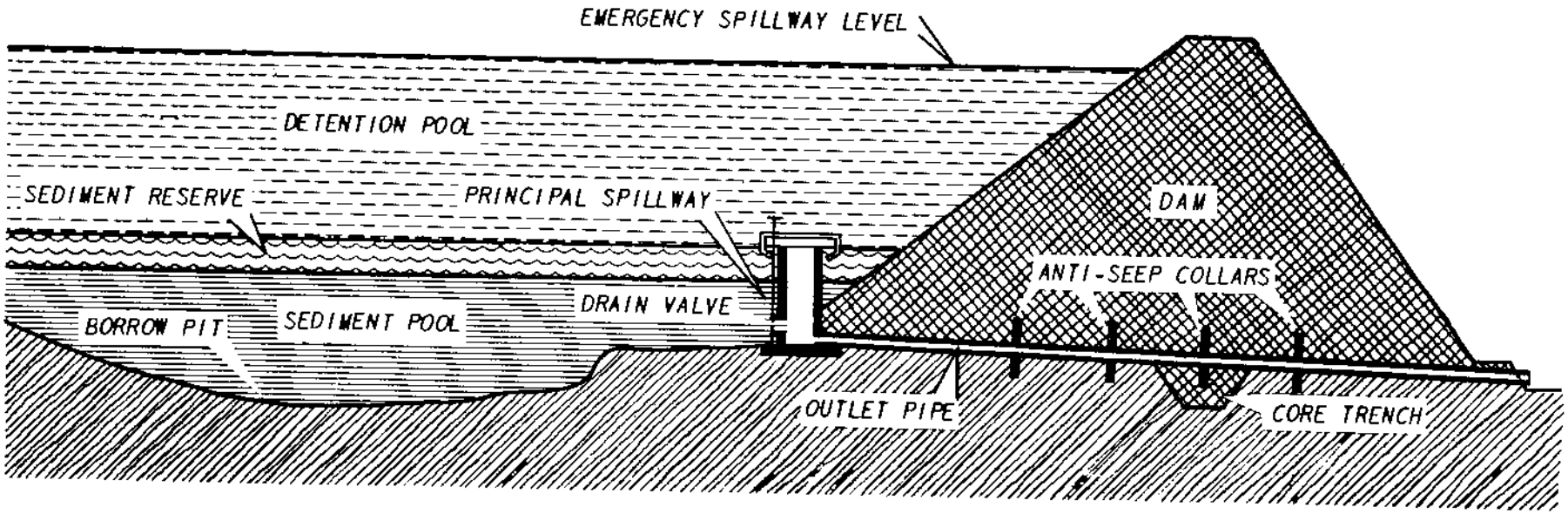


Figure 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

Revised 10-24-57 4-L-10,071

Court of Bexar County stating that improvements needed will be made to keep the public road crossings passable during the periods of floodwater release or granting permission to inundate roads provided equal alternate routes can be designated. The local sponsors will obtain flowage easements from owners of private roads affected by structure release flows.

The location of the floodwater retarding structures are shown on the Planned Structural Measures map, figure 3.

The total estimated cost of establishing these works of improvement is $549,890, of which $137,942 will be borne by local interest and $411,948 by Public Law 566 funds (table 1). The estimated annual equivalent cost for installation is $19,388 and the estimated annual operations and maintenance cost is $810, making a total annual cost of $20,198.

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 on similar types of spillways.

All applicable state water laws will be complied with in the design and construction of the floodwater retarding structures.

BENEFITS FROM WORKS OF IMPROVEMENT

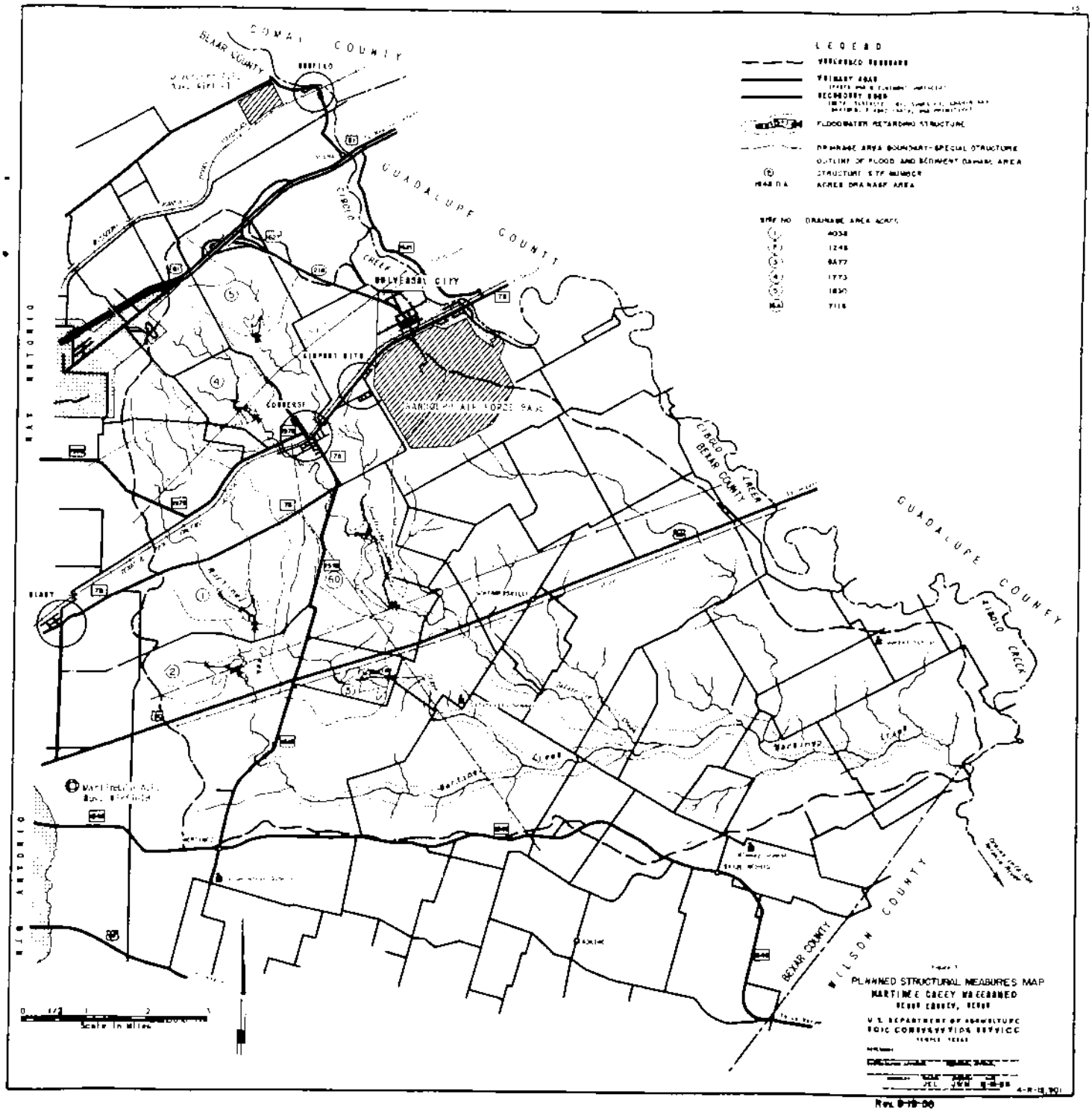
The combined program of land treatment and structural measures described above would confine damage from 31 of the total of 79 floods, such as occurred in this watershed from 1923 to 1952, to areas of less than one-tenth of the flood plain. Of the 26 major floods that inundated more than one-half of the flood plain, 21 would be reduced to minor floods, inundating less than one-half the flood plain. Average annual flooding would be reduced from 3,797 acres to 1,895 acres.

The area on which sediment damage from overbank deposition will occur annually can be expected to be reduced from 144 acres to 39 acres, a reduction of 73 percent. About 36 percent of the expected reduction will result from land treatment and 64 percent from the structural measures.

The area on which flood plain scour damage will occur can be expected to be reduced from an average annual of 520 acres to 187 acres, a reduction of 64 percent.

With the planned land treatment program, total gross erosion from the watershed will be reduced from 365.09 acre-feet to 229.07 acre-feet annually.

The estimated average annual flood, erosion, sediment, and indirect damages within the watershed would be reduced from $38,782 to $15,006, a 61 percent reduction. About 89 percent of the expected reduction in the average annual damage would result from the system of floodwater retarding structures.


COMAL COUNTY
BEXAR COUNTY
GUADALUPE COUNTY
BOERNE
BOERNE CITY
CIBOLO CREEK
SAN ANTONIO
CONVERSE
RANDOLPH AIR FORCE BASE
OLMOS CREEK
SALADO CREEK
WILSON COUNTY
LEGEND
PROPOSED ROADWAY
PRIMARY AREA
SECONDARY AREA
FLOODWATER RETARDING STRUCTURE
DRAINAGE AREA BOUNDARY-SPECIAL STRUCTURE
OUTLINE OF FLOOD AND SEDIMENT DAMAGE AREA
STRUCTURE STP NUMBER
ACRES DRAINAGE AREA
STP NO
DRAINAGE AREA ACRES
4038
1248
8477
1773
1835
7116
Scale in Miles
PLANNED STRUCTURAL MEASURES MAP
MARTINEZ CREEK WATERSHED
BEXAR COUNTY, TEXAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Rev. 8-18-80

AVERAGE ANNUAL AREA INUNDATED

Evaluation Reach	Location	Without Project (acres)	With Project (acres)	Reduction (percent)
1	Lower Martinez Creek	867	522	40
2	Middle Martinez Creek	378	229	40
3	Upper Martinez Creek	939	433	54
4	Escondido Creek	335	125	63
5	Salatrillo Creek	1,278	586	54
	Total	3,797	1,895	

AVERAGE ANNUAL DAMAGES

Evaluation Reach	Location	Without Project (dollars)	With Project (dollars)	Reduction (percent)
1	Lower Martinez Creek	9,131	5,177	43
2	Middle Martinez Creek	3,755	2,001	47
3	Upper Martinez Creek	9,898	3,061	69
4	Escondido Creek	3,413	812	76
5	Salatrillo Creek	12,585	3,955	69
	Total	38,782	15,006	

Operators of flood plain land say that if adequate flood protection is provided, they will restore land now idle or in temporary pasture to production of high value crops such as grain sorghum, corn, and cotton. All of this land was in production of cultivated crops until very recent years, but is now either idle or in production of low value crops because of excessive floodwater damage. It is estimated that the net increase in income from such restoration of productivity will amount to $1,249 (long-term price levels) annually. Consideration was given to the effect of acreage allotment restrictions in the analysis of benefits from restoration. The calculated benefit excludes increases in the acreage of these crops above present restrictions. This loss from the original production has been considered a crop and pasture damage and its restoration a benefit in table 7.

The total flood prevention benefits as a result of structural measures are estimated to be $23,046 annually. Of this amount, $1,693 represents benefits resulting from reduction of floodwater damages on the mainstem flood plains of Lower Cibolo Creek.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measures (converted from total

installation cost) plus operation and maintenance cost is estimated to be $20,198. When the project is completely installed, it is expected to produce benefits of $1.14 for each dollar of cost. In addition to the direct monetary benefits, there are other substantial values which will accrue from the project, such as an increased opportunity for recreation, improved wildlife conditions, better living conditions, and a sense of security, none of which have been used for project justification.

ACCOMPLISHING THE PLAN

Federal assistance for carrying out the works of improvement on non-Federal land, as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666, as amended by Public Law 1018, 84th Congress; 70 Stat. 1088).

Land Treatment Measures

The land treatment measures itemized in table 1 will be established by farmers and ranchers over a 5-year period in cooperation with the Alamo Soil Conservation District, which is giving assistance in the planning and application of these measures under its going program. This assistance will be accelerated to assure application of the planned measures within the 5-year project installation period.

The governing body of the Alamo Soil Conservation District will assume aggressive leadership in getting an accelerated land treatment program underway, with the assistance of the Martinez Creek Watershed Association and the San Antonio River Authority in arranging for meetings according to a definite schedule. By this means and by individual contacts, the landowners within the watershed will be encouraged to adopt and carry out soil and water conservation plans on their farms. District-owned equipment will be made available to the landowners in accordance with existing arrangements for equipment usage in the district. The soil conservation district governing body will make, or cause to be made, periodic inspections of the completed conservation measures within the watershed. The Soil Conservation Service will provide additional technical assistance to the Alamo Soil Conservation District to assist landowners and operators cooperating with the district in accelerating the preparation and application of soil, plant, and water conservation plans.

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 FHA clients will be encouraged to cooperate in the program.

The county ASC Committee will cooperate with the governing body of the soil conservation district by selecting and providing financial assistance for those ACPS practices which will accomplish the conservation objectives in the shortest possible time.

The Extension Service will assist with the educational phase of the program by conducting general information and local farm meetings, preparing radio, television and press releases, and using other methods of getting information to landowners and operators in the Martinez Creek watershed. This activity will help to get the land treatment practices and the structural measures for flood prevention carried out.

Structural Measures for Flood Prevention

Land, easements, rights-of-way, and utility changes necessary for the construction of 6 floodwater retarding structures and flowage easements for areas subject to inundation by structure release flows will be provided by the local sponsoring organizations. Revenue from an ad valorem tax now being collected in Bexar County for use by the San Antonio River Authority for flood control is adequate and available for these costs. The local sponsoring organizations will obtain a court order from the Commissioners Court of Bexar County providing for the necessary improvement of low water road crossings to make them passable during prolonged release flow from the structures or granting permission to inundate road crossings where equal alternate routes can be designated for use during periods of inundation.

The easements will be dedicated jointly to the local sponsoring organizations.

The San Antonio River Authority will be the contracting agency and will let and service all contracts for the 6 floodwater retarding structures included in this work plan. The cost of administering contracts will be paid by the San Antonio River Authority. These costs will be paid from revenue from the ad valorem tax which has been voted in Bexar County and made available to the San Antonio River Authority for the purpose of flood control.

The structural measures will be constructed during a 2-year installation period pursuant to the following conditions:

1. The required land treatment in the drainage area above structures has been applied or is in the process of being applied.

2. The necessary easements have been obtained.

3. Court orders have been obtained from the Bexar County Commissioners Court granting permission to inundate low water crossings provided equal alternate routes are available for use during periods when these crossings are impassable due to prolonged flow from the principal spillways of the floodwater retarding structures. If equal alternate routes are not available, the court order will specify that necessary improvements will be made, at no cost to the Federal Government, to make the crossings passable during prolonged periods of release flows from the structures.

4. The contracting agency is equipped to handle its responsibilities.

5. Operation and maintenance agreements have been executed.

6. Public Law 566 funds are available.

This project was determined to be one construction unit. All land, easements, and rights-of-way will be provided for this construction unit before Federal funds are made available for construction.

Technical assistance will be provided by the Soil Conservation Service to assist in planning, design, preparation of specifications, supervision of construction, preparation of contract payment estimates, final inspection, execution of certificate of completion and related tasks necessary to establish the planned structural measures for flood prevention.

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

The estimated schedule of obligation for the complete 5-year installation period, covering installation of both land treatment and structural measures, is as follows:

Fiscal Year	Public Law 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
1st	197,739	172,698	370,437
2nd	224,209	192,680	416,889
3rd	5,000	113,718	118,718
4th	5,000	113,718	118,718
5th	5,000	113,719	118,719
Total	436,948	706,533	1,143,481

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by landowners and operators of the farms on which the measures are applied, under agreement with the Alamo Soil Conservation District. Representatives of the Alamo Soil Conservation District will make periodic inspections of the land treatment measures to determine maintenance needs and encourage landowners and operators to perform management practices and maintenance. They will make district-owned equipment available for this purpose.

Structural Measures for Flood Prevention

The 6 floodwater retarding structures will be operated and maintained by the local sponsoring organizations. The San Antonio River Authority is

provided funds for the purpose of flood control from revenue obtained from an ad valorem tax being collected in Bexar County. These funds are adequate and will be available for this purpose.

A maintenance fund of $10,000 will be established by the San Antonio River Authority for this purpose.

The Alamo Soil Conservation District and the Martinez Creek Watershed Association will assist the San Antonio River Authority in the operation and maintenance of the floodwater retarding structures The district will furnish and operate district-owned equipment in maintenance operations. District funds are available for this purpose. Between periodic inspections, the watershed association will report maintenance needs to the cosponsors.

All structural measures will be inspected at least annually and after each heavy rain by representatives of the San Antonio River Authority, Alamo Soil Conservation District and Martinez Creek Watershed Association. A Soil Conservation Service representative will participate in these inspections at least annually. For the floodwater retarding structures, 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 earth fill and the emergency spillway, and fences and gates installed as a part of the floodwater retarding structures.

The Soil Conservation Service, through the Alamo Soil Conservation District, will participate in the operation and maintenance only to the extent of furnishing technical assistance to aid in inspection and furnishing technical guidance and information necessary for the operation and maintenance program.

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

The cosponsoring local organizations will maintain a record of all maintenance inspections made and maintenance performed and have it available for review by Soil Conservation Service personnel.

The cosponsoring local organizations fully understand their obligations for maintenance and will execute specific maintenance agreements prior to the issuance of invitation to bid on construction of the structural measures.

The estimated annual operation and maintenance cost of all structural measures is $810, based on long-term prices. The necessary maintenance work will be accomplished either by contract, force account, or district-owned equipment.

COST SHARING

Public Law 566 funds will provide technical assistance in the amount of $25,000 during the 5-year installation period to accelerate the installation of land treatment measures included in the plan for watershed protection. These measures will be installed through funds other than Public Law 566 at an estimated cost of $568,591 (table 1). This cost includes ACPS payments based on present program criteria and technical assistance under the going district program. The required local costs for structural measures ($160,916) consists of the value of the land, easements, and rights-of-way, $134,942, the capitalized value of operation and maintenance of works of improvement $22,974, and the cost of administering contracts $3,000.

The entire cost of constructing structural measures, amounting to $313,507, will be borne by Public Law 566 funds. In addition, the installation services cost of $98,441 will be a Public Law 566 expense. This is a total Public Law 566 cost of $411,948 for the installation of structural measures.

The total project cost of $1,166,455, including capitalized value of structure operation and maintenance will be shared 37.5 percent ($436,948) by Public Law 566 funds and 62.5 percent ($729,507) by other than Public Law 566 funds.

CONFORMANCE OF PLAN TO FEDERAL LAWS AND REGULATIONS

This project plan conforms to all Federal laws and regulations and will have no known detrimental effects on any downstream projects which are now in existence or that might be constructed in the future.

For a period of three years from May 28, 1956, surplus crops grown on lands reclaimed by flood prevention and the lands so reclaimed, shall be ineligible for any benefits under the soil bank provisions of the Soil Bank Act and under price support legislation.

SECTION 2

INVESTIGATIONS, ANALYSES, AND SUPPORTING TABLES

INVESTIGATIONS AND ANALYSES

Land Treatment

Soil Conditions

The physical condition of the soils in the Martinez Creek watershed range from fair to poor. The areas where row crops are grown continuously have poor soil conditions, while in the areas where soil-improving grasses and legumes are grown in rotations the soils are in fair condition. The soils within the Blackland Prairies Land Resource Area are light gray to black clays and gravelly clays of the Houston series. They are usually slowly permeable, with small areas of moderately permeable soils. The soils within the Rio Grande Plain Land Resource Area are predominantly fine sandy loams of the Webb series, slowly permeable, and deep.

Cover Conditions

Studies of the present cover condition, land use, crop distribution, land treatment, and hydrologic soil groups were made. Land treatment needs and anticipated application of land treatment measures were projected from these present soil-cover complex conditions to determine the expected future conditions. These studies indicate that approximately 60 percent of the watershed is in cultivation and 34 percent in pasture. The hydrologic cover condition of the pasture land is: 42 percent poor condition, 43 percent fair condition, and 15 percent good condition.

The predominant grasses, at present, are Johnsongrass, Bermudagrass, buffalograss, and annual grasses. On the uppermost portion of the watershed some native grasses are coming back. Predominant among these grasses are sideoats grama, curly bluestem, feather bluestem, and Texas wintergrass.

Land Use and Treatment Needs

The needed land treatment for the watershed, as shown in table 1, was developed by the Soil Conservation Service work unit at San Antonio. Conservation needs data were compiled from existing conservation plans within the watershed. These data were expanded to represent the conservation needs of the entire watershed and computed for each land treatment practice to be applied during the 5-year project period.

Program Determination

Flood problems and program objectives were reviewed with representatives of the Alamo Soil Conservation District, San Antonio River Authority and the Martinez Creek Watershed Association.

Determination was made, first, of the needed land treatment measures, based on current needs, which remain to be applied in the watershed and which contribute directly to flood prevention. The hydraulic, hydrologic, sedimentation and economic investigations provided data as to the effects of these measures in terms of the reduction of flood damages resulting from land treatment. Although significant benefits would result from application of these needed land treatment measures, it was apparent that other flood prevention measures would be required to attain the degree of watershed protection and flood damage reduction desired by the local people.

Determinations were then made of structural measures for flood prevention which would be feasible to install. The study made and the procedures used in that determination were as follows:

1. A base map of the watershed was prepared showing watershed boundary, drainage pattern, system of roads and railroads, and other pertinent information. A stereoscopic study of 4-inch consecutive aerial photographs located all probable floodwater retarding structure sites, the limits and the area of the flood plain, and points where valley cross sections should be taken for the determination of hydraulic characteristics and for flood-routing purposes. This information was placed on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations. Data developed from these cross sections permitted the computation of peak discharge-damage relationships for various flood flows. A map was prepared of the flood plain on which land use, cross section locations, and other pertinent information were recorded.

2. A field examination was made of all probable floodwater retarding structure sites previously located stereoscopically. Sites which did not have sufficient storage capacities were dropped from further consideration. From the remaining sites, a system of floodwater retarding structures was selected for further consideration and detailed survey. Sites 4 and 5 are in series with Site 6A to provide protection for intervening flood plain lands and to secure the needed degree of control. Plans of a floodwater retarding structure, typical of those planned for the watershed, are illustrated by figures 4 and 4A.

3. A topographic map was made of the pool area of each of the proposed sites to determine the storage capacity of the site, the estimated cost of the dam and the area of flood plain and upland that would be inundated by the sediment and flood pools. The height of the dams and the size of the pools were determined by the criteria outlined in Soil Conservation Service, Washington Engineering Memorandum No. 27 and Texas State Manual Supplement 240.4.2. The limits of the flood pools

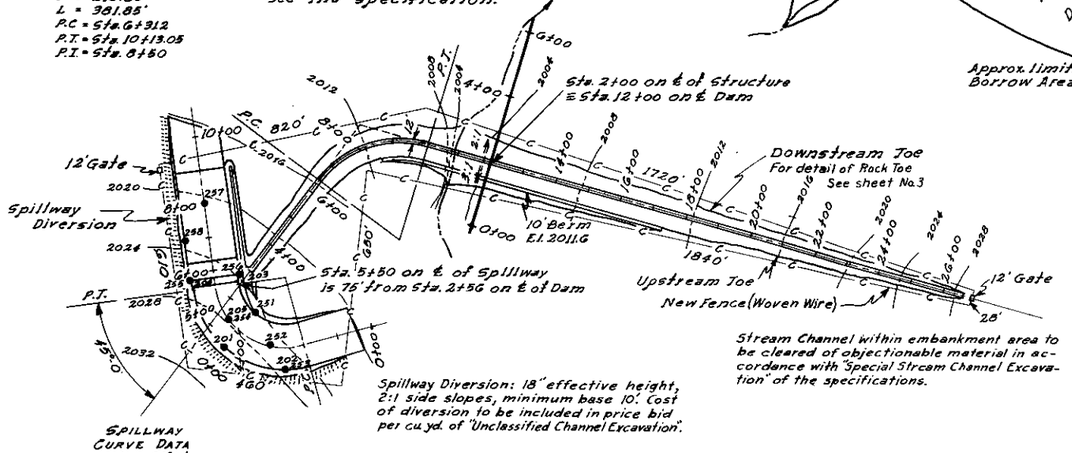
Clay
Silt
Limestone
Flagstone & Cobbles
Lime

C.	Clay	Clayey	Cal.	Calcareous
Si.	Silt	Silty	Vug.	Vugular
Ch.	Chalk	Chalky	Fc.	Fractured
S.	Sandy	Sandy	Fri.	Friable
Gr.	Gravel	Gravelly	Fl.	Firm
M.	Marl	Marly	Vl.	Very
Ls.	Limestone		So.	Soft
Flg.	Flagstone		H.	Hard
Mas.	Massive		Cob	Cobbles
Mat	Matrix			

LEGEND OF BORINGS

EMBANKMENT CURVE DATA
Δ = 69°-0'
D = 18°-04.8'
R = 318.36'
T = 218.80'
L = 381.85'
P.C. = Sta. 6+31.2
P.T. = Sta. 10+13.05
P.I. = Sta. 8+50

A minimum of 6" of topsoil to be placed in spillway and on all embankment, dike, spillway slopes and waste area except where rock is encountered or rock rip rap is placed. See the specification.

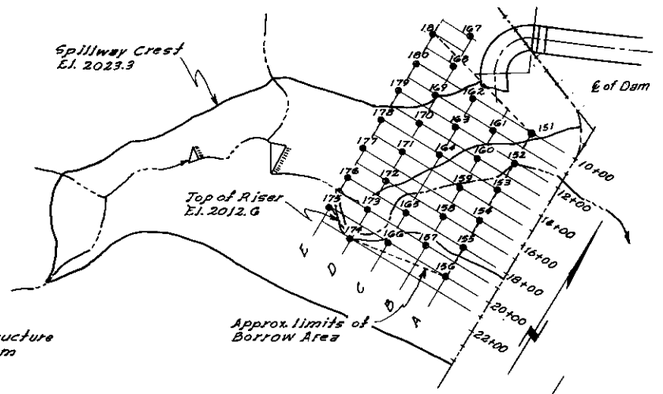


Spillway Diversion: 18" effective height, 2:1 side slopes, minimum base 10'. Cost of diversion to be included in price bid per cu. yd. of "Unclassified Channel Excavation".

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

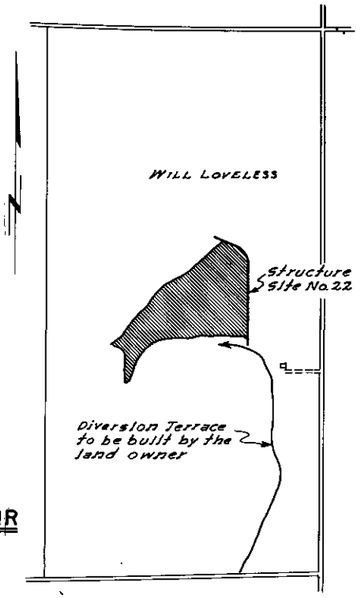
PLAN OF EMBANKMENT AND SPILLWAY

0 200 400 1000
SCALE IN FEET



GENERAL PLAN OF RESERVOIR

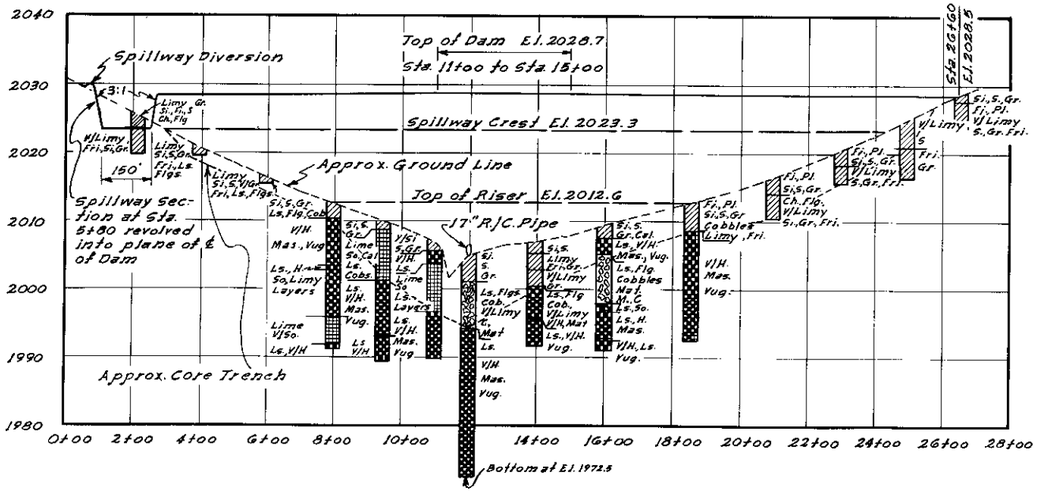
0 400 800 1600
SCALE IN FEET



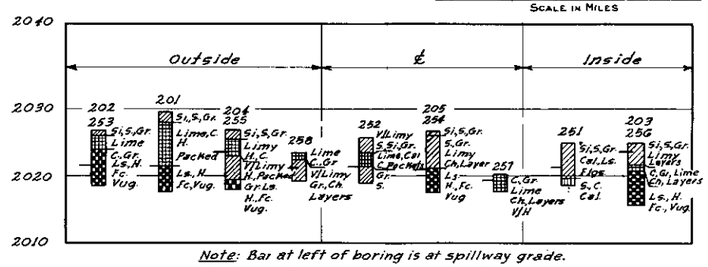
Located 5½ mi. East and 4 mi. South of Eden, Concho County, Texas

VICINITY MAP

0 ¼ ½ 1
SCALE IN MILES



PROFILE ON ℄ OF DAM



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

LOG OF SPILLWAY BORINGS

SEE PLAN OF EMBANKMENT AND SPILLWAY

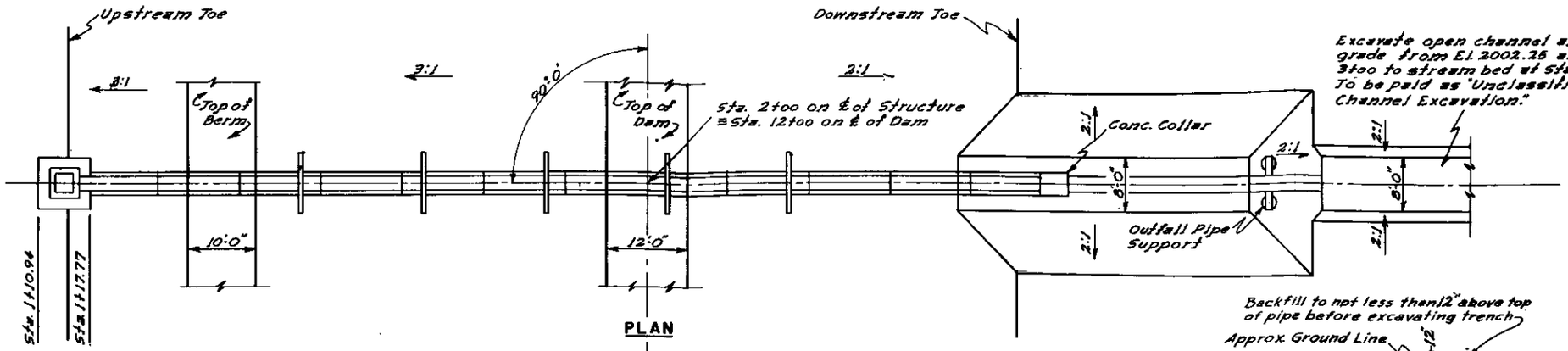
Elevation	Surface Acres	Storage Acre Ft.	Storage Inches
2012.6	16.84	51.70	0.50
2016.0	30.76	132.66	1.28
2020.0	54.21	302.60	2.92
2023.3	74.94	515.68	5.00
2024.0	79.33	569.68	5.50
2028.0	108.17	944.68	9.13

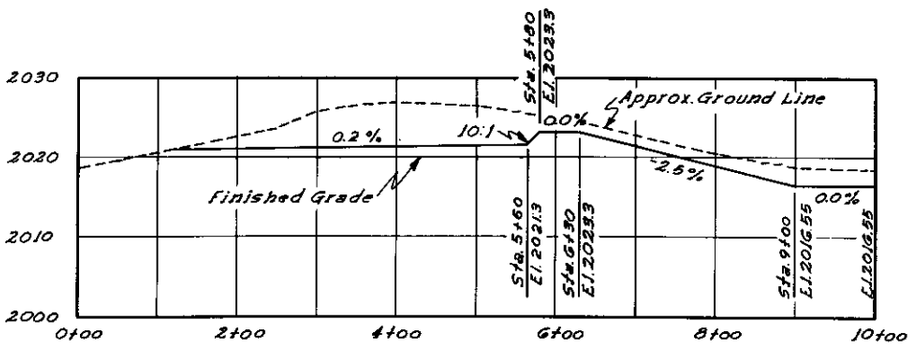
Top of Dam (Effective) Elev.	2028.5
Spillway Crest Elev.	2023.3
Top of Riser Elev.	2012.6
Sediment Pool Elev.	2012.6
Drainage Area, Acres	1242.0
Sediment Storage, Ac. Ft.	51.7
Floodwater Storage, Ac. Ft.	464.0

Figure 4
TYPICAL
FLOODWATER RETARDING STRUCTURE
PLAN AND PROFILE

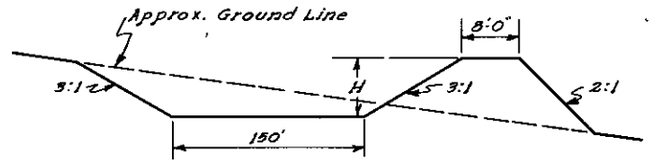
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	H.C.N.	8-56	Approved by: HEAD, ENGINEERING & WATERSHED PLANNING UNIT, FORT WORTH, TEXAS
Drawn	H.C.N. & G.R.	8-56	STATE CONSERVATION ENGINEER
Traced	G.R.	8-56	
Checked	H.C.N. & H.H.L.	9/56	Sheet No. 2 of 7 — Drawing No. 4-E-10,760





PROFILE ON ℄ OF SPILLWAY



Top of Dike, El. 2028.55 from Sta. 5+00 to Sta. 6+30
12 ft. top width with 10:1 end slope.
Transition from El. 2028.55 at Sta. 6+30 to 4 ft. height at Sta. 7+00, top width 8 ft.
H = 4 ft. from Sta. 7+00 to Sta. 9+00, top width 8 ft. with 10:1 end slope.

TYPICAL SPILLWAY SECTION

Figure 14-A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed H.C.N.	Date 8-56	Approved by	
Drawn H.C.N. & G.R.	8-56	AREA ENGINEERING & WATERSHED PLANNING UNIT, FORT WORTH, TEXAS	
Traced G.R.	8-56	STATE CONSERVATION ENGINEER, T. C. S. TEMPLE, TEXAS	
Checked H.C.N. & H.M.L.	9/56	Sheet No. 3 of 7 sheets	Drawing No. 4-E-10,760

and sediment pools of the proposed sites and the flood plain of the stream were drawn to scale on a copy of the base map.

Structure data tables were developed from engineering surveys to show for each structure, the drainage area, the capacity needed for detention and for sediment storage in acre-feet and in inches of runoff from the drainage area, the release rate of the principal spillway, the acres of flood plain and upland inundated by the sediment and detention pools, the volume of fill in the dams, the estimated cost of the structures, and other pertinent data (tables 2 and 3).

4. A detailed analysis was made of state, county, and farm roads which have low-water road crossings on the streams below the floodwater retarding structures. Where there are no equal alternate routes, determinations were made of the requirements to provide passage during periods of prolonged floodwater release from structures.

5. Damages resulting from floodwater, sediment and erosion were determined from damage schedules, surveys of sample areas, and flood routings under present conditions.

Reductions in these damages resulting from proposed works of improvement were estimated on the basis of reduction in peak discharges as determined by flood routing under future conditions for which it was assumed that the proposed works of improvement had been installed. Benefits so determined were allocated to individual measures, or groups of interdependent measures on the basis of the effect of each on reduction of damages. In this manner it was determined that a system of floodwater retarding structures could be economically justified. By further analysis those individual and interdependent floodwater retarding structures which had favorable benefit to cost ratios were determined. Those which were unfavorable were dropped from further consideration and alternate sites were investigated until a system of 6 interdependent floodwater retarding structures were developed. These were included in the plan.

6. Because of the limited availability of floodwater retarding structure sites to afford protection for Reaches 1 and 2, the degree of flood protection is lower than that originally desired by the local people. Available data were used to make an investigation of preliminary examination scope to determine if additional measures, such as channel improvement, through channel enlargement and re-alignment, could be justified in Reaches 1 and 2. The large amount of excavation which would be required and the high average annual maintenance costs made channel improvement too costly to be economically justified,

so it was dropped from further consideration. The degree of control that could be obtained by economically justified structural works of improvement was discussed with the local sponsoring organizations and accepced by them.

When the stcuctural measures for flood prevention had been determined, a table was developed to show the total cost of each type of measure. The summation of the total costs for all works of improvement represented the estimated cost of the planned wacershed protection and flood prevention project (table 1). A second cost table was developed to show separately the annual installation cost, annual maintenance cost, and total annual cost of the structural measures (table 6).

Hydraulic and Hydrologic Investigations

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

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau and Water Supply Papers, and U. S. Geological Survey. These data were analyzed to determine average precipitation depth-duracion relationships, seasonal distribution of precipitation, the historical flood series to be used in the evaluation of the project, rainfall-runoff relationships, runoff-peak discharge relationship of geology, soils and climate to runoff depth frequency for single storm events.

2. Engineering surveys were made of channel and valley cross sections selecced to adequately represent the stream hydraulics and flood plain area. Preliminary locations for cross sections were made by stereoscopic examination of aerial photographs of the flood plain. The final locations were selected on the ground, giving due consideration to the needs of the economist and sedimentation specialist. The evaluation reaches were delineated in conference with the economist and sedimentation specialist. The composite acre damageable values are homogeneous within each evaluation reach.

3. Hydrologic conditions of the watershed were studied by considering such factors as climate, geology, topography, soils, land use, and cover. Soil-cover complex data were assembled from which curve numbers were computed for use in determining depth of runoff from individual storms, using monthly soil moisture indices. These data were compared to the best available gaged runoff data.

4. Cross section rating curves were computed from field survey data collected as described in 2, above, by solving water surface profiles for various discharges. The water surface profiles were computed by the Doubt method described on pages 3.14 - 7 - 13, Soil Conservation Service National Engineering Handbook Section 4, Supplement A.

5. The theory of concordant flow was used to determine the relationship of peak discharge to the volume of runoff at selected points in the watershed. The exponent of the concordant flow equstion was determined from reliable highwater marks left by recent floods compared to the volume of runoff computed from rainfall records of each flood studied.

6. Stage-area inundation curves were developed from field survey data for each portion of the valley represented by a cross section. Composite runoff-area inundation curves, by incremental depths of flooding, were developed for each evaluation reach by routing incremental volumes of runoff downstream using the peak discharge, volume relationship determined by the concordant flow as developed above and summating the area flooded for each portion of the valley represented by a cross section in the evaluation reach. Similarly, a family of runoff-area inundation curves were developed to reflect the effect of the proposed system of floodwater retarding structures.

7. The 30 years of precipitation records collected by the U. S. Weather Bureau at San Antonio and Seguin, Texas, were used to prepare a cumulative departure from normal precipitation graph.

   From this graph the period 1923 to 1952, inclusive, was selected as the most representative of normal precipitation on the watershed and was the period from which the historical evaluation flood series was developed.

8. 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. The present conditions of the watershed remaining static.

   b. The installation of land treatment measures for watershed protection.

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

9. The appropriate spillway design storm and storm pattern was selected from figures 3.21-1 and 3.21-4, NEH Section 4, Supplement A, in accordance with criteria contained in Washington Engineering Memorandum No. 27, and Texas State Mannual Supplement 2404.2.

10. Spillway design storm hydrographs were developed for each of the floodwater retarding structures by the distribution graph method. The combination of emergency spillway width, depth, and elevation for the most economical structure was determined approximately by an empirical equation. The final preliminary

design was obtained by the Goodrich flood routing method described on page 5.8-12,NEH, Section 5.

Emergency spillway capacities were designed in accordance with Washington Engineering Memorandum No. 27, and Section 3.21 of the Hydrology Guide and Texas State Manual Supplement 2404.2. Runoff from the maximum recorded 6-hour storm used for structure spillway design for safe velocity ranged from 4.58 to 5.61 inches.

Maximum release rates for the principal spillways of the floodwater retarding structures were determined by a thorough study of the channel, and the effect of release rates on the design of structures and emergency spillways. The maximum release rates for sites 1, 2, 3, and 5 will be 10 c.s.m. In order to decrease the frequency of use of the emergency spillway, and to remove water from good agricultural lands at a more rapid rate, the maximum release rates for sites 4 and 6A were increased to 15 c.s.m. Since investigations revealed that channel improvement was not economically justified, determination was made of areas that will be flooded by structure release for use by local people in securing flowage easements.

The largest rain which occurred during the 30-year period was a storm of 5.08 inches on September 7 - 8, 1942. If soil moisture condition III is assumed, the computed runoff from a storm of this size is 4.62 inches. The annual flood frequency line developed by means of the computed runoff from 30 years of record indicated a frequency of 42 years for this storm.

From this annual flood frequency line it was found that the rainfall from the 25-year frequency storm, would be 5.90 inches which would produce 4.00 inches of runoff under Moisture Condition No. II. This storm, under present conditions, would flood the entire 4,001 acres of flood plain. With the land treatment and structure program installed, 2,348 acres of the flood plain would be inundated. In addition to the latter figure, 202 acres would be inundated by the pools of the floodwater retarding structures.

The minimum floodwater detention volume in the structures was determined in accordance with Washington Engineering Memorandum No. 27, using Yarnell's 6-hour, 25-year frequency rainfall amount.

The following table shows the minimum detention required and the actual detention planned for each structure.

Site No.	Structure Classification	Minimum Floodwater Detention Required	Actual Floodwater Detention Planned
1	A	3.37	5.04
2	A	3.37	5.19
3	A	3.47	4.00
4	A	3.17	4.04
5	A	3.26	5.09
6A	A	3.26	3.50

Sedimentation Investigation

The field survey of the sedimentation problems of the Martinez Creek watershed was made in accordance with methods prescribed in the "Sedimentation Section of Procedures for Developing Flood Prevention Work Plans", Water Conservation - 6, SCS, Region 4, Revised February 1954. Field studies of overbank deposits, flood plain scour, streambank erosion, and the nature of the channels and valleys were made. Areal mapping procedures of sample sections of the flood plain were used. The nature and thickness of the sediment deposits were studied and classified as to percent loss of productivity. These figures were used by the economist as the basis for calculating monetary damages.

Sediment Source Studies

Investigations of sediment sources in the drainage areas above three of the proposed floodwater retarding structures were made according to standard procedures. Estimates were then made for both present and future sediment production in the drainage areas above the remaining sites. The sediment derived from sheet erosion was estimated by the use of a formula shown in "Suggested Criteria for Estimating Gross Sheet Erosion and Sediment Delivery Rates for the Blackland Prairie Problem Area in Soil Conservation", Soil Conservation Service, Region 4, February, 1953.

The sediment derived from gully and streambank erosion was estimated by field studies and the use of aerial photographs.

The total annual sediment yield above the 6 planned floodwater retarding structures was calculated to be 40.59 acre feet. The average rate of sediment production above structures is 1.75 acre-feet per square mile annually. It is estimated that 93 percent of the sediment yield is derived from sheet erosion, 6 percent from flood plain scour, and 1 percent from modern gully and streambank erosion.

Effect of Watershed Treatment on Sediment Yield

Analysis of present conditions indicates that the major portion of the annual sediment yield results from sheet erosion of cultivated land. Areas damaged 30 percent or less by overbank deposition and flood plain scour should regain full productivity after installation of works of improvement. After installation of the land treatment measures shown on table 1, the annual sediment yield will be reduced approximately 36 percent. With installation of both land treatment measures and floodwater retarding structures, the total reduction of sediment damage will be approximately 62 percent.

Geologic Investigations

Reconnaissance geologic investigations were made of all of the planned floodwater retarding structure sites. These investigations included brief

lithologic and stratigraphic studies of the valley slopes, alluvium, channel banks and exposed geologic formations. Hand auger borings were made in the channel beds and representative areas of the spillway, borrow, and foundation of the dam sites to determine the nature and extent of fill material, and other possible problems that might be encountered in construction.

Description of Problems

The Martinez Creek watershed is underlain by the following geologic formations: Anacacho (Taylor), Taylor (undivided), Corsicana, Kemp, Wills Point and Wilcox. The first four formations are in the Upper Cretaceous System while the Wills Point and Wilcox formations are in the Tertiary System. The regional dip of these formations is 40 to 50 feet per mile toward the southeast.

Four of the floodwater retarding structures, Nos. 1, 4, 5, and 6A (figure 3) will be located within the Taylor formation (undivided). One site, No. 2, will be located within the Kemp formation, and one, No. 3, will be located within the Wills Point formation. Within the watershed, the Taylor (undivided) is characterized by calcareous clays and shaley marl; The Kemp is made up of calcareous clays with isolated sandy areas; and the Wills Point is characterized by silty clays.

Gypsum was found at sites 2, 3, and 4. At sites 3 and 4 the gypsum was observed in the form of small crystals and as stains of dispersed gypsum on the channel banks.

At site 2, large crystals of gypsum were found in the area of the emergency spillway. If emergency spillway excavation exposes this gypsiferous material, it will be necessary to excavate below grade, backfill with suitable fill material for establishing a good vegetative cover. Prior to construction detailed investigations with core drilling equipment will be made on all sites. Laboratory tests will be made to determine the stability of foundation strata and the suitability and methods of handling the materials to be used in the embankment.

Economic Investigations

Determination of Annual Benefits from Reduction in Damage

Damage schedules covering approximately 53 percent of the flood plain area of Martinez Creek and its tributaries were obtained from landowners or operators. These schedules covered land use and crop distribution, yields, and historical data on flooding and flood damages. Most of the flood damage information obtained was for floods which occurred in 1942, 1957, and 1958. Analysis of the information contained therein formed the basis for determining damage rates for various depths and seasons of flooding. In the calculation of crop and pasture damage, expenses saved, such as cost of harvesting, were deducted from the gross value of the damage. Information on other agricultural damages was also obtained on the damage schedules and correlated with sizes of floods. The major item of nonagricultural damage was that sustained by roads and bridges. Estimates of these damages

were based on information supplied by County Commissioners, County Engineers, and State Highway Department officials, supplemented by that from local farmers.

The proper rates of damage were applied, flood by flood, to the floods covering the historical period 1923 to 1952, and adjustments were made to take into account the effect of recurrent flooding when more than one flood occurred within the same year. The flood plain land use was mapped in the field. Normal flood-free yields were based on data obtained from schedules, supplemented by information obtained from other agricultural workers in the area.

In analyzing flood plain land use, yields, and frequency of flooding it was found that significant variations existed with respect to location within the watershed. Therefore, the flood plain was divided into five evaluation reaches, each with its own damageable value.

Evaluation Reach No. 1 - From bottom of watershed upstream to confluence with Salatrillo Creek

Evaluation Reach No. 2 - From confluence with Salatrillo Creek upstream to confluence with Escondido Creek.

Evaluation Reach No. 3 - From confluence with Escondido Creek upstream to headwaters.

Evaluation Reach No. 4 - Flood plain of Escondido Creek.

Evaluation Reach No. 5 - Flood plain of Salatrillo Creek.

The monetary value of the physical damage to the flood plain from erosion and deposition of sediment was based on the value of production lost, taking into account the time lag for recovery and the cost of operations necessary to speed recovery.

Indirect damages in this watershed primarily involve additional travel time for farmers, school bus transportation and mail delivery, and extra cost for food. Upon analysis, it appeared that these damages are about 10 percent of the direct damage.

Farmers in the flood plain were asked to state changes made in land use as a result of past flooding. Operators were also asked what changes they would make in their use of flood plain lands if flooding were reduced. Analysis of these responses provided the basis for estimating benefits from restoration of lands to their former use. Additional factors considered in this analysis were the size and location of the area affected, land capability, reduction in frequency of flooding and similar factors. All benefits from restoration of productivity are net benefits remaining after production, harvesting and all other allied

costs were considered. These benefits are included as crop and pasture benefits after appropriate adjustment for possibility of damage by the remaining floods to the higher production values, and were discounted for an expected 5-year lag in conversion. No benefits from changed land use were claimed.

Careful consideration was given to the status of crops for which acreage allotments are in effect in evaluation of the project. The acreage in cotton, the principal allotment crop, has been declining for several years, largely because other crops are better suited to the area and are more profitable. Therefore, it was determined that the benefits claimed can be attained even though the cotton acreage is not increased.

Areas that will be inundated by the sediment and detention pools of floodwater retarding structures were excluded from damage calculations. An estimate was made, however, of the value of the production lost in these areas after installation of the program. In this appraisal it was considered that there would be no production in the sediment pools. The land covered by the detention pools was assumed to be converted to grassland under project conditions. The costs of land, easements and rights-of-way for the six floodwater retarding structures were determined by individual appraisal in conjunction with representatives of the sponsoring organizations. Floodwater retarding structure site costs were based on full land value for the sediment pools and one-half value for the detention pools, since the latter will remain in use as grazing land.

The average annual net loss in production, based on long-term prices, within the sites was calculated and their value compared with the amortized cost of the structure sites. To assure conservative evaluation, the larger amount was used in the economic evaluation of the program.

Determination of Annual Benefits Outside Watershed Resulting From Project

Benefits outside the watershed were estimated from data obtained from "Survey Reports of the San Antonio River Watershed", dated November 1952. Analysis of this data indicated that average annual benefits of $0.26, at long term prices, would accrue downstream from this watershed for each acre-foot of detention storage.

Details of Methodology

Details of the procedures used in the investigations are described in the Interim Economics Guide for Watershed Protection and Flood Prevention, Revised April 1, 1956.

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Martinez Creek Watershed, Texas
Price Base: 1958

Structure Site No.	Public Law 566 Installation Cost					Other Installation Cost			
	Construction		Installation Services						
	Engineering Estimates (dollars)	Contingencies (dollars)	Engineering (dollars)	Other (dollars)	Total Public Law 566 (dollars)	Adm. of Contracts (dollars)	Easements and R/W (dollars)	Total Other Cost (dollars)	Estimated Total Cost (dollars)
1	66,164	6,616	14,556	8,297	95,633	500	22,313	22,813	118,446
2	31,142	3,114	6,851	3,905	45,012	500	19,561	20,061	65,073
3	36,041	3,604	7,929	4,520	52,094	500	15,606	16,106	68,200
4	46,755	4,676	10,286	5,863	67,580	500	14,968	15,468	83,048
5	52,431	5,243	11,535	6,575	75,784	500	10,816	11,316	87,100
6A	52,474	5,247	11,544	6,580	75,845	500	51,678	52,178	128,023
GRAND TOTAL	285,007	28,500	62,701	35,740	411,948	3,000	134,942	137,942	549,890

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TABLE 3 - STRUCTURE DATA
FLOODWATER RETARDING STRUCTURES
Martinez Creek Watershed, Texas

Item	Unit	STRUCTURE NUMBER 1	2	3	4	5	6A	Total
Drainage Area	sq.mi.	6.31	1.95	3.87	2.77	2.86	2/ 11.12	28.88
Storage Capacity								
Sediment Pool	ac.ft.	200	158	200	200	200	200	1,158
Sediment Reserve Below Riser	ac.ft.	332	-	60	27	30	593	1,042
Sediment in Detention Pool	ac.ft.	67	20	33	28	29	101	278
Floodwater Detention	ac.ft.	1,696	540	826	597	776	2,076	6,511
Total	ac.ft.	2,295	718	1,119	852	1,035	2,970	8,989
Surface Area								
Sediment Pool(top of riser)	acre	82	30	47	37	33	141	370
Floodwater Detention Pool	acre	202	90	125	97	93	370	977
Maximum Height of Dam	foot	34	27	28	27	33	32	xxx
Volume of Fill	cu.yd.	164,870	63,810	87,980	112,500	123,060	99,010	651,230
Emergency Spillway								
Type	-	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Frequency of Use 5/	year	32	31	17	25	37	22	xxx
Design Storm (emergency spillway hydrograph)								
Duration	hour	6	6	6	6	6	6	xxx
Rainfall 3/	inches	7.01	7.39	7.19	7.30	7.30	6.53	xxx
Runoff	inches	5.15	5.61	5.44	5.20	5.31	4.58	xxx
Bottom Width	foot	300	250	1/ 400	200	300	1/ 800	xxx
Design Depth	foot	0.6	0.5	1.1	0.7	0.5	0.7	xxx
Design Capacity	c.f.s.	120	100	600	110	110	400	xxx
Freeboard 4/	foot	3.2	2.3	1.8	2.8	2.1	2.4	xxx
Total Capacity	c.f.s.	6,040	2,550	5,350	3,580	3,450	11,820	xxx
Principal Spillway								
Capacity (Maximum)	c.f.s.	63	20	39	42	29	237	xxx
Capacity Equivalents								
Sediment Volume	inches	1.78	1.71	1.42	1.73	1.70	1.51	xxx
Detention Volume	inches	5.04	5.19	4.00	4.04	5.09	3.50	xxx
Spillway Storage	inches	2.63	2.60	1.98	2.53	1.71	1.94	xxx
Class of Structure		A	A	A	A	A	A	xxx

1/ Equal spillways on each end of dam. Combined bottom width shown.
2/ Does not include drainage area of sites 4 and 5.
3/ 0.5 P - From figure 3.21-1, NEH 4 - A.
4/ (H_p for 1.0 P) - (H_p for 0.5 P) + 1.0'
5/ Based on gaged runoff, and in all cases exceeds the minimum 6-hour 25-year frequency volume as set forth in Washington Engineering Memo. No. 27.

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TABLE 4 - SUMMARY OF PHYSICAL DATA

Martinez Creek Watershed, Texas

Item	Unit	Quantity Without Project	Quantity With Project
Watershed Area	Sq. Mi.	87.50	xxx
Watershed Area	Acre	56,000	xxx
Area of Cropland	Acre	33,600	33,141
Area of Grassland	Acre	19,040	19,127
Area of Miscellaneous Uses	Acre	3,360	3,732
Overflow Area Subject to Damage	Acre	4,001	2,348 1/
Overflow Area Damaged Annually By:			
Sediment	Acre	144 2/	39 3/
Flood Plain Scour	Acre	520 2/	187 3/
Streambank Erosion	Acre	xxx	xxx
Annual Rate of Erosion:			
Sheet	Acre-Feet	340.25	218.38
Gully	Acre-Feet	2.45	1.64
Streambank	Acre-Feet	1.64	1.64
Scour	Acre-Feet	20.75	7.41
Average Annual Rainfall	Inches	29.55	xxx

1/ Does not include 202 acres of flood plain within structure pool areas.
2/ Acreage on which some production loss occurs each year.
3/ Acreage on which production loss will occur each year after all recovery has taken place.

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TABLE 5 - SUMMARY OF PLAN DATA
Martinez Creek Watershed, Texas

Item	Unit	Quantity
Years to Complete Project	Year	5
Total Installation Cost		
Public Law 566 Funds	Dollar	436,948
Other	Dollar	706,533
Annual O & M Cost		
Public Law 566 Funds	Dollar	-
Other	Dollar	810
Average Annual Monetary Benefits 1/	Dollar	23,046
Agricultural	Percent	86.5
Nonagricultural	Percent	13.5
Structural Measures		
Floodwater Retarding Structures	Each	6
Area Inundated by Structures		
Flood Plain		
Sediment Pool	Acre	112
Detention Pool	Acre	90
Upland		
Sediment Pool	Acre	260
Detention Pool	Acre	515
Watershed Area Above Structures	Acre	18,483
Reduction of Floodwater Damage	Dollar	19,494
By Land Treatment Measures		
Watershed Protection	Percent	5.7
By Structural Measures	Percent	56.4
Reduction of Sediment Damage	Dollar	462
By Land Treatment Measures		
Watershed Protection	Percent	30.5
By Structural Measures	Percent	30.8
Reduction of Erosion Damage	Dollar	1,659
By Land Treatment Measures		
Watershed Protection	Percent	5.4
By Structural Measures	Percent	47.5
Flood Prevention Benefit from Changed Land Use	Dollar	-

1/ From structural measures.

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TABLE 6 - ANNUAL COSTS

Martinez Creek Watershed, Texas

Measures	Amortization of Installation Cost 1/	Operation & Maintenance Costs 2/			Total Annual Costs
		Public Law 566	Other	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Retarding Structures					
1 through 6A	19,388	-	810	810	20,198
TOTAL	19,388	-	810	810	20,198

1/ Price Base: 1958 prices, amortized for 50 years at 2.5 percent.
2/ Long-term prices as projected by ARS, September 1957.

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TABLE 7 - MONETARY BENEFITS FROM STRUCTURAL MEASURES

Martinez Creek Watershed, Texas

Price Base: Long-Term 1/

Item	Estimated Average Annual Damage			Average Annual Monetary Benefits
	Without Project	After Land Treatment for W/S Protection	With Project	
	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Damage				
Crop and Pasture	20,473	19,409	9,050	10,359
Other Agricultural	7,397	6,886	1,804	5,082
Road and Bridge	3,502	3,274	1,024	2,250
Subtotal	31,372	29,569	11,878	17,691
Sediment Damage				
Overbank Deposition	753	523	291	232
Subtotal	753	523	291	232
Erosion Damage				
Flood Plain Scour	3,132	2,962	1,473	1,489
Subtotal	3,132	2,962	1,473	1,489
Indirect Damage	3,525	3,305	1,364	1,941
Total, All Damage	38,782	36,359	15,006	21,353
Benefits Outside of Watershed 2/	xxx	xxx	xxx	1,693
TOTAL FLOOD PREVENTION BENEFITS	xxx	xxx	xxx	23,046
TOTAL PRIMARY BENEFITS	xxx	xxx	xxx	23,046
TOTAL MONETARY BENEFITS	xxx	xxx	xxx	23,046

1/ As projected by ARS, September 1957.

2/ From reduction of floodwater damages to the Lower Ciblo Section of the San Antonio River Watershed.

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TABLE 8 - BENEFIT COST ANALYSIS

Martinez Creek Watershed, Texas

Measures	AVERAGE ANNUAL BENEFITS 1/ Flood Prevention						Average Annual Cost 2/	Benefit Cost Ratio
	Floodwater	Sediment	Erosion	Indirect	Other 3/	Total		
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
Floodwater Retarding Structures								
1 through 6A 4/	17,691	232	1,489	1,941	1,693	23,046	20,198	1.14:1
GRAND TOTAL	17,691	232	1,489	1,941	1,693	23,046	20,198	1.14:1

1/ Price Base: Long-term prices as projected by ARS, September 1957.
2/ Derived from installation costs based on 1958 price level and operation and maintenance cost based on long-term price levels, as projected by ARS, September 1957.
3/ Includes benefits from reduction of floodwater damages to the Lower Ciblo Section of the San Antonio River Watershed.
4/ All floodwater retarding structures are interdependent.

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TABLE 9 - COST-SHARING SUMMARY

Martinez Creek Watershed, Texas
Price Base: 1958 1/

Type of Cost	P. L. 566 Funds		Other Funds		Total Cost	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
Land Treatment						
Non-federal Land For Watershed Protection	25,000	4.2	568,591	95.8	593,591	50.9
Subtotal	25,000	4.2	568,591	95.8	593,591	50.9
Structural Measures						
Installation Flood Prevention	411,948	74.9	137,942	25.1	549,890	47.1
Subtotal	411,948	74.9	137,942	25.1	549,890	47.1
Total Installation Cost	436,948	38.2	706,533	61.8	1,143,481	98.0
Operation & Maintenance 2/	-	-	22,974	100.0	22,974	2.0
Total Structural Cost	411,948	71.9	160,916	28.1	572,864	49.1
TOTAL PROJECT COST	436,948	37.5	729,507	62.5	1,166,455	100.0

1/ Except operation and maintenance which is based on long-term prices, as projected by ARS, September 1957.
2/ Capitalized for 50 years at 2.5 percent.

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