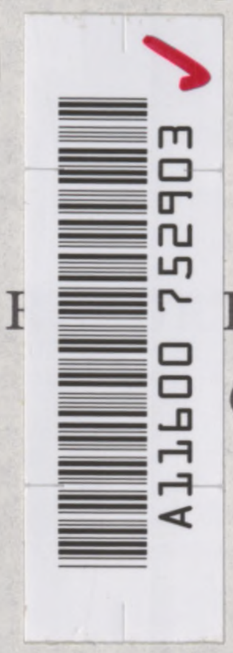
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92d Congress
1st Session

COMMITTEE PRINT

WATERSHED WORK PLAN FOR WATERSHED PROTECTION, AND FLOOD PREVENTION, ECLETO CREEK WATERSHED, GUADALUPE, WILSON, KARNES, AND DEWITT COUNTIES, TEXAS

REPORT OF THE SOIL CONSERVATION SERVICE, DEPARTMENT OF AGRICULTURE, IN ACCORDANCE WITH THE PROVISIONS OF PUBLIC LAW 83-566

COMMITTEE ON PUBLIC WORKS
UNITED STATES SENATE

FEBRUARY 1971

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LETTER OF SUBMITTAL

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

December 23, 1970

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C. 20510

Dear Mr. President:

Pursuant to the authority vested in the President by section 5 of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1005), and delegated to the Director of the Office of Management and Budget by Executive Order No. 10654 of January 20, 1956, there are transmitted herewith the following plans for works of improvement which have been prepared under the provisions of that Act:

State	Watershed
Alabama	Tallaseehatchie Creek*
Texas	Ecleto Creek
Texas	Pond Creek*
Texas	Sanderson Canyon*
Virginia	Ni River*

Each of the above listed plans involves at least one structure which provides more than 4,000 acre-feet of total capacity.

Sincerely,

Caspar W. Weinberger
Acting Director

Note: Referred to the Committee on Public Works by the Secretary of the Senate on December 30, 1970, Executive Communication No. 125.
*Printed separately.

ENVIRONMENTAL STATEMENT

ECLETO CREEK WATERSHED, TEXAS

Background

Ecleto Creek Watershed is located in Guadalupe, Wilson, Karnes and DeWitt Counties, Texas. The project would be carried out with Federal assistance under authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566. Sponsoring organizations are: Karnes-Goliad, Wilson County, DeWitt County and Comal-Hays-Guadalupe Soil and Water Conservation Districts; Ecleto Watershed District, and San Antonio River Authority.

Approximately 33 percent of the watershed is used for cropland, 62 percent range and pasture, and the remaining 5 percent is in miscellaneous uses.

The economy of the watershed is largely agricultural. Cash crops and livestock are the primary sources of farm income. The most important crops are flax, grain sorghum, peanuts and watermelons. There are approximately 680 farms and ranches in the watershed averaging 400 acres in size. Almost half the farms in Karnes and Wilson Counties gross less than $2,500 annually from agricultural sales.

Conservation farming is in evidence over the entire watershed. About 40 percent of the needed conservation has been applied. It is estimated that erosion on 70 percent of the land is approaching a practical minimum rate of soil-loss per acre.

Wildlife resources consist of deer, bobwhite, dove, turkey, rabbit, squirrel, etc. White-tailed deer and mourning doves provide most of the hunting. Hunting privileges are obtained by lease. Lands open to free public hunting are negligible. Fishery resources are insignificant.

Moderate to severe flooding occurs frequently. About 12,900 acres would be flooded by a flood that would occur once in 100 years, on the average.

Erosion in the upland areas of the watershed averages just under 6 tons soil-loss per acre each year, which approaches acceptable maximum tolerances. Scouring action of floodwaters removes an additional 155,000 tons of soil each year from bottomland fields. A total of 2,760 acres in the flood plain have been damaged to varying degrees by scour. An additional 2,360 acres of flood plain land have been damaged by sediment deposits ranging from 0.5 to 6.0 feet. About 220,600 tons of sediment leave the watershed annually.

The plan proposes that an additional 40 percent of the needed conservation practices will be installed during the 5-year installation period. These measures will be supplemented by 11 floodwater retarding structures. All construction areas where vegetation is disturbed will be reseeded immediately after construction with vegetative plantings that will serve as good pasture grasses and also be valuable for wildlife habitat.

I. Impact of the Proposed Action on the Environment

Land treatment is expected to reduce erosion significantly. The combined programs of land treatment and structural measures will reduce flooding by about 66 percent each year. Flood plain scour damages will be reduced about 75 percent, and sediment damages will be reduced by more than 80 percent. With the flood protection provided by this project, it is expected that about 5,000 acres of the flood plain will be cropped more intensively. About 150 farms will directly benefit from reduced flood damages.

The floodwater retarding structures will initially provide 569 surface acres of water for recreational and livestock use and scenic enjoyment. These sediment pools will gradually fill with sediment. The lake will provide an opportunity for development of facilities for family and group recreation. The sponsors have indicated that at least five structures will be open to the general public on either a free or fee basis. These facilities are expected to furnish at least 3,500 visitor-days each year. Sanitary facilities will be provided at each site used for recreation.

The Bureau of Sports Fisheries and Wildlife has indicated that wildlife resources will be slightly benefited by the installation of this project.

Floodwater damages along the San Antonio River immediately downstream from this project will be reduced by installation of works of improvement in Ecleto Creek Watershed.

II. Adverse Environmental Effects

During construction of the floodwater retarding structures, much of the vegetative cover at the sites will be temporarily destroyed until the revegetation becomes fully effective. The sediment pools will take about 835 acres from agricultural production.of which about 90 acres are cropland. No archeological or historical features are known to be affected by this project.

III. Alternatives to the Proposed Action

One alternative to the planned action is no project. This would permit continued flooding with only limited abatement of erosion and sedimentation. This would result in further loss of natural resources and foregoing of net benefits of about $40,000 per year.

IV. Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity.

The plan provides a level of protection consistent with agricultural uses in the flood-prone areas. The projected long-term use of watershed lands is expected to remain in agriculture or essentially as it is at present.

The primary objective of this plan is to preserve the lands for use by future generations and provide adequate conservation treatment and improvement to maintain high productivity.

V. Irreversible and Irretrievable Commitments of Resources

Construction of dams and spillways will inundate or change the land use of 835 acres, of which 90 acres are used for crop production and the remainder for range or pasture. No other commitment of resources is known to be required for this project.

VI. A. Consultation with Appropriate Federal Agencies

No problems or objections were noted by reviewing Federal agencies.

B. Review by State and Local Agencies Developing and Enforcing Environmental Standards

No problems or objections were noted by reviewing State and local agencies.

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COMMENTS OF THE STATE OF TEXAS

PRESTON SMITH
GOVERNOR

EXECUTIVE DEPARTMENT
AUSTIN, TEXAS 78711
March 24, 1970

Mr. Kenneth E. Grant
Administrator
United States Department
of Agriculture
Soil Conservation Service
Washington, D. C. 20250

Dear Mr. Grant:

The work plan for the Ecleto Creek watershed has been received by the Division of Planning Coordination, Office of the Governor (the State Planning and Development Clearinghouse). The draft of this work plan was favorably reviewed by the State Clearinghouse on October 27, 1969, and by the metropolitan and regional clearinghouses concerned (the Alamo Area Council of Governments, the Coastal Bend Regional Planning Commission, and the Golden Crescent Council of Governments).

As there appears to be no substantive change between the draft and final work plans, and since no unfavorable information concerning the project has been received subsequent of our review of the draft work plan, the State Clearinghouse finds the work plan to be consistent with planning and development policies and objectives of the State of Texas.

Each phase of this project should continue to be closely coordinated with Texas state agencies, regional councils of governments, and local governments whose plans and programs are affected.

Thank you for the opportunity to review this work plan.

Sincerely,

Dan S. Petty
Director, Division of
Planning Coordination

x

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

April 14, 1970

Honorable Thomas K. Cowden
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Dr. Cowden:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Administrator of the Soil Conservation Service, by letter of 6 March 1970, requested the views of the Secretary of the Army on the work plan for Ecleto Creek Watershed, Guadalupe, Wilson, Karnes, and DeWitt Counties, Texas.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department.

Sincerely yours,

Robert E. Jordan, III
Special Assistant to the Secretary of the Army
(Civil Functions)

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
~~CONSUMER PROTECTION AND~~ ENVIRONMENTAL HEALTH SERVICE
ROCKVILLE, MARYLAND 20352

ENVIRONMENTAL CONTROL
ADMINISTRATION

April 21, 1970

Mr. Kenneth E. Grant
Administrator
U.S. Soil Conservation Service
Department of Agriculture
Washington, D.C. 20250

Dear Mr. Grant:

As requested in your letter of March 6, 1970, the Work Plan for the Ecleto Watershed, Texas has been reviewed. The Department's concerns with this Project are summarized in the enclosed report by the Bureau of Water Hygiene of the Environmental Control Administration.

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as departmental interests and responsibilities are concerned.

Sincerely yours,

for Raymond T. Moore, M.D.
Acting Commissioner

Enclosure

BUREAU
OF
WATER HYGIENE

HEW Agency Review of Water and Related Land Resources Projects

TITLE:

U.S. Soil Conservation Service Work Plan For the Ecleto Creek Watershed, Guadalupe, Wilson, Karnes, and DeWitt Counties, Texas.

PROJECT SUMMARY:

The following is a summary of the U.S. Soil Conservation Service Report. The Bureau of Water Hygiene has not determined the validity of the indicated costs or of the benefit cost ratios:

The 267 square mile Ecleto Watershed is located in the coastal plain of south central Texas about 30 miles west of San Antonio. The major problem in the watershed is frequent and extensive flooding resulting in floodwater sediment and erosion damages. The Watershed Work Plan provides for construction of eleven floodwater retarding structures estimated at $2,406,844 and installation of various land treatment measures estimated at $2,546,512. The proposed Project, with a benefit cost ratio calculated at 1.3 to 1.0 will be installed over a ten year period.

DISCUSSION OF HEALTH-RELATED FEATURES OF THE PROJECT:

Recreational development is not included in the Soil Conservation Service Work Plan as a project purpose. On-farm income producing recreation will be developed however by the sponsors at some of the structures. Annual incidental recreation benefits estimated in the Watershed Work Plan total $2,420. The report states that landowners and other private interests have indicated to the sponsors that they will develop sanitary facilities meeting State and local health agency requirements prior to making the sites available to the general public, and that water quality will be investigated to determine its adequacy for the intended recreational uses. No water supply storage is planned.

We recommend that the planning, development, construction, maintenance, and operation of the project have the full cognizance and approval of the Texas State Department of Health, and that the DHEW-PHS publication "Prevention and Control of Vector Problems Associated with Water Resources" dated January 1965, be used as a guide for vector control.

RECOMMENDATIONS ON PROPOSED PROJECT:

Recommend HEW concurrence in proposed project.

16 April 1970
Date

James E. Warren
Staff Engineer

ENDORSEMENT:

HEW concurrence recommended.

17 April 1970
Date

Director,
Bureau of Water Hygiene

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

SOIL CONS. SERVICE

MAY 6 1970

Dear Mr. Secretary:

This is in reply to letter of March 6, 1970, from the Administrator of Soil Conservation Service, submitting for our review and comment the work plan for Ecleto Creek Watershed, Texas. In accordance with Section 2 of Executive Order 10913 and provisions of Section 5 of the Watershed Protection and Flood Prevention Act, as amended, this work plan has been reviewed by interested agencies of the Department of the Interior and the following comments are offered.

In our initial review of the watershed work plan, we found that the plan did not recognize mineral involvement in the area of Structure No. 5. This structure, on Rhymes Creek about 1-1/4 miles west of the Town of Harmony in Karnes County, incorporates part of a uranium prospect in mineralized sandstone. Leases on the partly drilled property are held by Susquehanna-Western, Inc. and by Atlantic Richfield Uranium Division.

The mineral involvement was brought to the attention of Mr. R. Neil Lane, Director of the S.C.S. Watershed Planning Division, in April 1970. This was followed by a transmittal dated April 17, 1970, to Mr. John Neuberger, Director of Project Review and Coordination, in which the importance of the mineral involvement was recognized by revision to page 24 of the work plan. The new statement incorporated into the work plan is acceptable, providing the relationship of the proposed project to the mineral leases will be given further consideration prior to installing the watershed project.

The project will have slight beneficial effects on fish and wildlife resources. Substantially greater opportunities for sport fishing than now exist will be provided by the project impoundments.

With the revision to page 24, we offer no objection to the subject watershed work plan. The opportunity to review and comment on this report is appreciated.

Honorable Clifford M. Hardin
Secretary of Agriculture
Washington, D.C. 20250

Sincerely yours,

Deputy Assistant Secretary of the Interior

WATERSHED WORK PLAN AGREEMENT

between the

Karnes-Goliad Soil and Water Conservation District
Local Organization

Wilson County Soil and Water Conservation District
Local Organization

DeWitt County Soil and Water Conservation District
Local Organization

Comal-Hays-Guadalupe Soil and Water Conservation District
Local Organization

Ecleto Creek Watershed District
Local Organization

San Antonio River Authority
Local Organization

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

and the

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

Whereas, 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 Ecleto 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; 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 Ecleto 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 can be installed in about _____ years.

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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 can be installed in about 10 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the 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 $ 471,260.)

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

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

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
11 Floodwater Retarding Structures	0	100	1,586,326

4. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Engineering Cost (dollars)
11 Floodwater Retarding Structures	0	100	89,894

5. The Sponsoring Local Organization and the Service will each bear their costs for project administration, estimated at $5,250 and $254,114, respectively.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and 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 issuring 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.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. 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.

14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

Karnes-Goliad Soil and Water Conservation District
Local Organization

By Elmer C. Jacob
Elmer C. Jacob
Title Chairman
Address Rt. 2, Box 288, Goliad, Texas 77963
Date September 25, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Karnes-Goliad Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 2, 1969

Clarence F. Schendel
(Secretary, Local Organization)
Acting Clarence F. Schendel

Date September 25, 1969

- -

Wilson County Soil and Water Conservation District
Local Organization

By I. B. Ray
I. B. Ray
Title ~~Chairman~~
Address Rt. 1, Box 103, Pleasanton, Texas 78064
Date September 25, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Wilson County Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 5, 1969

Alex Richter
(Secretary, Local Organization)
Alex Richter

Date September 25, 1969

DeWitt County Soil and Water Conservation District
Local Organization

By Heinie Bade
Heinie Bade

Title Chairman

Address Rt. 2, Cuero, Texas 77954

Date September 25, 1969

The signing of this agreement was authorized by a resolution of the governing body of the DeWitt County Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 4, 1969

Hugo Bachle
(Secretary, Local Organization)
Hugo Bachle

Date September 25, 1969

- -

Comal-Hays-Guadalupe Soil and Water Conservation District
Local Organization

By Herman Blank
Herman Blank

Title Chairman

Address Rt. 3, Box 505, San Antonio, Texas 78218

Date September 25, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Comal-Hays-Guadalupe Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 3, 1969

Milton Dietert
(Secretary, Local Organization)
Milton Dietert

Date September 25, 1969

Ecleto Creek Watershed District
Local Organization

By T. E. Sistrunk

T. E. Sistrunk
Title President
Address Box 173, Runge, Texas 78151
Date September 25, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Ecleto Creek Watershed District
Local Organization

adopted at a meeting held on September 5, 1969

Louis Mueller
(Secretary, Local Organization)
Louis Mueller
Date September 25, 1969

San Antonio River Authority
Local Organization

By L. H. Von Dohlen

L. H. Von Dohlen
Title Chairman
Address 430 Three A Life Bldg., San Antonio, Texas 78205
Date September 25, 1969

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 September 17, 1969

Hugh B. Ruckman, Jr.
(Secretary, Local Organization)
Hugh B. Ruckman, Jr.
Date September 25, 1969

Soil Conservation Service
United States Department of Agriculture

By

Acting Administrator
Soil Conservation Service
Date SEP 9 - 1970

WATERSHED WORK PLAN

ECLETO CREEK WATERSHED

GUADALUPE, WILSON, KARNES, AND DEWITT COUNTIES, TEXAS

56-934 O - 71 - 4

WATERSHED WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

ECLETO CREEK WATERSHED

Guadalupe, Wilson, Karnes, and DeWitt Counties, Texas

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act, (Public Law 566, 83rd Congress, 68 Stat. 666), as amended.

Prepared By:

Karnes-Goliad Soil and Water Conservation District
(Sponsor)

Wilson County Soil and Water Conservation District
(Sponsor)

DeWitt County Soil and Water Conservation District
(Sponsor)

Comal-Hays-Guadalupe Soil and Water Conservation District
(Sponsor)

Ecleto Creek Watershed District
(Sponsor)

San Antonio River Authority
(Sponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
April 1969

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WATERSHED WORK PLAN

Ecleto Creek Watershed

April 1969

SUMMARY OF PLAN

The work plan for watershed protection and flood prevention for Ecleto Creek watershed has been prepared by the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts; the Ecleto Creek Watershed District; and the San Antonio River Authority as sponsoring local organizations. Technical assistance has been provided by the Soil Conservation Service, United States Department of Agriculture. The Bureau of Sport Fisheries and Wildlife of the United States Department of the Interior, in cooperation with the Texas Parks and Wildlife Department, made a reconnaissance study of the fish and wildlife resources of the watershed. Financial assistance in developing the work plan was provided by the Texas State Soil and Water Conservation Board, the Ecleto Creek Watershed District, and the San Antonio River Authority. Office space for Soil Conservation Service personnel assisting in development of this work plan was furnished by the San Antonio River Authority.

Ecleto Creek watershed comprises an area of 267 square miles in portions of Guadalupe, Wilson, Karnes, and DeWitt Counties. It is estimated that 33.4 percent of the watershed is cropland, 15.5 percent is pasture and hayland, 46.9 percent is rangeland, 0.5 percent is wildlife land, and 3.7 percent is in miscellaneous uses such as towns, public roads, railroads, farmsteads, and stream channels. There is no Federal land in the watershed.

The principal problem within the watershed is one of frequent and extensive flooding on portions of the 12,868 acres of flood plain which results in damages to crops, grasses, soils, agricultural properties, roads, and bridges. The total floodwater, sediment, erosion, and indirect damages are estimated to be $81,636 annually.

The work plan proposes installing in a ten-year period, needed land treatment measures and 11 floodwater retarding structures. Land treatment measures included are those which contribute directly to watershed protection and reduction of floodwater, sediment, and scour damages.

The total project installation cost is estimated to be $4,953,356, including $2,546,512 for installation of planned land treatment and $2,406,844 for the structural measures. The cost for land treatment includes $69,717 from Public Law 566 funds to accelerate application of needed measures. The share of total project installation cost from sources other than Public Law 566 funds is estimated to be $2,953,305, and the Public Law 566 share is estimated to be $2,000,051. The Public Law 566 cost share for structural measures is estimated to be $1,930,334, and the local share is estimated to be $476,510.

Average annual damages will be reduced from $81,636 to $19,498 by the proposed project. Average annual benefits accruing to structural measures in the watershed will be $157,890, which includes $60,740 damage reduction benefits, $58,183 more intensive use benefits, $4,200 incidental benefits, $5,420 redevelopment benefits, $5,820 other benefits from reduction of damages to the San Antonio River flood plain, and $23,527 secondary benefits. The ratio of the average annual benefits accruing to structural measures ($157,890) to the average annual cost of these measures ($117,051) is 1.3:1.0.

Land treatment measures will be operated and maintained by owners and operators of the land upon which the measures will be applied under agreements with the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts. The Ecleto Creek Watershed District will be responsible for operation and maintenance of structural measures. The cost of operation and maintenance for structural measures is estimated to be $4,505 annually.

DESCRIPTION OF WATERSHED

Physical Data

Ecleto Creek watershed lies on the coastal plain of south central Texas in portions of Guadalupe, Wilson, Karnes, and DeWitt Counties. It comprises an area of 267 square miles (170,880 acres), of which 7 percent is in Guadalupe County, 32 percent is in Wilson County, 55 percent is in Karnes County, and 6 percent is in DeWitt County. The communities of Caddo, Pandora, Gillett, Harmony, and Ecleto lie within the watershed. The town of Runge is located across the southern watershed divide and Stockdale lies just to the west of the upper portion of the watershed. San Antonio is about 30 miles west of the headwater area.

Ecleto Creek is an intermittent stream originating in southern Guadalupe County about 10 miles south of Seguin. It flows generally toward the southeast across eastern Wilson and Karnes Counties and enters the San Antonio River 2-1/2 miles west of Runge. The watershed length is about 40 miles. The width ranges from 4 miles in the upper portion to 12 miles in the lower portion. Principal tributaries are Rhymes, Dry Ecleto, and McTennel Creeks, all of which are located in the lower portion of the watershed.

There are two major land resource areas represented in the watershed. The Texas Claypan Area occupies the upper 28 percent, and the remaining 72 percent lies within the Rio Grande Plain Land Resource Area. The topography throughout the watershed is gently rolling with very few prominant features. Elevations range from about 730 feet above mean sea level along the northern divide to about 200 feet at the mouth.

The underlying geologic strata are composed of Eocene, Oligocene, and Miocene sediments which dip in an offlapping fashion toward the southeast at angles slightly steeper than the land surface. Geologic outcrops occur as bands crossing the watershed from southwest to northeast becoming increasingly younger toward the Gulf of Mexico.

The Texas Claypan Area is underlain, in ascending order (northwest to southeast in outcrop) by the Carrizo Sand, clay and sandstone of the Reklaw Formation, Queen City Sand, Weches Greensand, and Sparta Sand. The surface soils are primarily medium to coarse textured, but fine textured subsoils with slow to very slow permeability rates are predominant. A major exception is the Carrizo Sand outcrop which is characterized by very thick surface sands with rapid permeability rates. Soil series commonly found in the Texas Claypan Area include Eufaula, Stidham, Demona, Axtell, Tabor, Bonham, and Crockett.

The Rio Grande Plain is underlain, in ascending order, by the Cook Mountain and Yegua Formations, the Jackson Group, the Catahoula Tuff, and the Oakville Sandstone. The strata of the Cook Mountain and Yegua Formations and the Jackson Group mainly consist of alternating beds and lenses of sand and clay. Soil textures are predominantly fine sandy loam, clay loam, and clay. Subsoil permeability rates are primarily slow to very slow, but

areas of moderate permeability occur. Predominant soil series are Orelia, Miguel, Webb, Monteola, Heiden, Burleson, and Trinity.

The use of watershed land is shown in the following tabulation:

Land Use	Acres	Percent
Cropland	56,999	33.4
Pasture and Hayland	26,486	15.5
Rangeland	80,149	46.9
Wildlife Land	906	0.5
Miscellaneous 1/	6,340	3.7
Total	170,880	100.0

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

Hydrologic cover conditions on rangeland and pasture are mainly poor to fair. Good to excellent cover of coastal bermudagrass exists on much of the improved pastureland, but this represents a minor percentage of total grassland. Range sites within the watershed are Tight Sandy Loam, Deep Sand, Sandy, Sandy Savannnah, Oak Sandy, Stony Ridge, Mixed Loam, Rolling Blackland, Hardland, and Bottomland. When the uplands are in top condition, the predominant grasses include little bluestem, brown-seed paspalum, switchgrass, crinkleawn, sideoats grama, purple lovegrass, Indiangrass, Texas bristlegrass, Texas wintergrass, Arizona cottontop, Texas cottontop, plains bristlegrass, fringeleaf paspalum, and trichloris. Scattered post oak, blackjack oak, and live oak are part of climax vegetation on most sites. As the upland sites become depleted through overgrazing, the better grasses are replaced by red lovegrass, fringed signalgrass, threeawns, Texas grama, red grama, tumble windmillgrass, grassburs, bullnettle, prairie cone flower, mesquite, huisache, spiny hackberry, and underbrush.

Climax vegetation on the flood plain includes switchgrass, little bluestem, big bluestem, Indiangrass, Canada wildrye, and elm, hackberry, pecan, and live oak trees. The better grasses are replaced by such vegetation as Texas grama, tumble windmillgrass, spiny aster, and giant ragweed when overgrazed. Common bermudagrass moves into the bottomland naturally and furnishes good quality grazing.

The climate is warm and sub-humid. Winters are fairly mild, but subject to rapid temperature changes with the passage of cold fronts. Summers are warm to hot. Temperatures range from a mean monthly maximum of 96 degrees Fahrenheit in July to a mean monthly minimum of 42 degrees in January. The normal growing season is about 270 days in the northern part of the watershed and gradually increases to 280 days in the southern part. Average annual rainfall ranges from 29 to 32 inches. Rainfall is fairly well distributed throughout the year, but the heaviest precipitation usually occurs in spring and fall.

Wells are presently an adequate source of water for the towns and communities of the watershed. The Carrizo Sand, the Catahoula Tuff, and the Oakville Sandstone are major aquifers supplying good quality water to a large portion of the coastal plain. The Queen City Sand, the Sparta Sand, the Yegua Formation, and the Jackson Group are minor aquifers which supply water to farms and small towns. The Reklaw Formation and Weches Greensand are not important aquifers, and the water contained in them is generally of poor quality. Water for livestock and rural domestic use is supplied mostly by wells and surface ponds. Springs sustain flow much of the time in Ecleto Creek, providing another source of water for livestock, but this source is not dependable during drought periods.

Economic Data

The economy of the watershed is dependent largely on its agricultural production. Production and sale of cash crops and livestock is the primary source of farm income. The most important crops produced for direct sale are flax, grain sorghum, peanuts, and watermelons. Oats and forage sorghums are grown primarily in support of livestock enterprises. During recent years the trend has been toward increased livestock production and significant acreages of cropland have been converted to improved pastures.

There are approximately 680 farms and ranches, wholly or partially within the watershed, averaging 400 acres in size. About 55 percent of the farms and ranches are smaller than 220 acres. About 54 percent of the farms and ranches in Wilson County and 47 percent in Karnes County, which are representative of the watershed, gross less than $2,500 annually from agricultural sales. Approximately 36 percent of the farm and ranch operators worked off-the-farm for 100 days or more in 1964.

Karnes County has been designated as an area of underemployment under the Public Works and Redevelopment Act of 1965. Shortage of jobs for unskilled labor is most acute. Farm resources presently are insufficient to provide full employment for the typical farm operator. Therefore the lack of employment in the agricultural sector is particularly damaging to the economy.

It is estimated that less than 5 percent of the agricultural land in the benefited area is devoted to farms and ranches using 1-1/2 man-years or more of hired labor.

The average value of land and buildings per farm or ranch is estimated at about $42,000 (based on 1964 agricultural census data). The estimated current market price of land ranges from $100 to $300 per acre. The range in land prices depends primarily on location and accessibility. Agricultural land is largely owner-operated with only about 18 percent being leased or rented.

Runge, estimated population 961 in 1966, is the largest town in the watershed. It is primarily an agricultural community. Karnes City, located 17 miles west of Runge, and Kenedy, located 11 miles southwest of Runge, are the principal marketing and supply centers for the southern portion of the

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watershed. Floresville, located 24 miles northwest of Karnes City, and Stockdale, located 15 miles northeast of Floresville, are the principal marketing and supply centers for the northern portion of the watershed.

The watershed is served adequately by approximately 160 miles of Federal, State, and county roads of which 56 miles are hard surfaced. The Southern Pacific Railroad has loading facilities at Pandora, Runge, and Stockdale.

Land Treatment Data

Soil and water conservation measures are being applied on Ecleto Creek watershed by farmers and ranchers in cooperation with the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts. Soil Conservation Service personnel at Kenedy, Floresville, Seguin, and Yorktown are assisting the districts in the preparation and application of basic soil and water conservation plans.

There are approximately 680 operating units wholly or partially within the watershed, of which 356 (103,163 acres) are under district agreement. Sixty percent of the agricultural land is under basic plan.

Soil surveys, essential for development of sound conservation plans, have been completed on 100,790 acres. Soil surveys are needed on the remaining 63,750 acres of agricultural land.

About 37 percent of needed land treatment practices on cropland, 35 percent on pasture and hayland, 22 percent on rangeland, and 16 percent on wildlife land have been applied. An estimated 70 percent of the land is adequately protected from erosion. Gully erosion is not a major problem, but small gullied areas are scattered over the watershed, mostly on formerly cultivated land in land capability classes III and IV. Approximately 80 acres of these high sediment source areas have been successfully treated with vegetative measures to reduce erosion and sediment damages. There is a trend toward conversion of these areas to coastal bermudagrass pasture which is bringing much of this erosion under control. Another 1,560 acres of such land are in need of treatment. Adequate treatment can be accomplished by accelerating the going programs of the soil and water conservation districts.

As a result of the planned 10 year accelerated land treatment program, the level of accomplishments for needed practices is expected to reach 75 to 80 percent.

Fish and Wildlife Resource Data

Fish and wildlife habitat and population are described by the Bureau of Sport Fisheries and Wildlife as follows:

> "Wildlife resources consist of white-tailed deer, bobwhites, mourning doves, turkeys, cottontails, fox squirrels, black-tailed jackrabbits, raccoons, opossums, skunks, minks, armadillos, and occasionally white-winged doves. White-tailed deer and mourning doves provide most of the hunting for those who desire to lease lands

on which to hunt. Lands open to free public hunting are negligible. Fish resources in the watershed are insignificant."

WATERSHED PROBLEMS

Floodwater Damage

An estimated 12,868 acres of the watershed, excluding stream channels, is flood plain. This is the area that would be inundated by a 100-year frequency flood.

Present flood plain land use is as follows: cropland, 19 percent; pasture and hayland, 33 percent; rangeland, 47 percent; miscellaneous uses, including roads, highways, and farmsteads, 1 percent. Current trends are toward increased acreage of permanent grasses.

Some landowners, on an individual basis, have attempted to enlarge, straighten, and levee some streams with very little reduction of flood damage. The adverse economic and physical effect of flooding has been felt throughout the entire watershed and will prompt local participation in the alleviation of the flood problem.

Flooding occurs frequently in the watershed and causes moderate to severe damages to growing crops and to other agricultural and nonagricultural properties. Major floods inundating more than half the flood plain occur on the average of once every two to three years. Minor floods, inundating less than half the flood plain, occur on the average of about twice a year in some locations. Cumulative totals of recurrent flooding show an average of 6,270 acres flooded annually during the evaluation period. Damage to flood plain lands from deposition of sediment and flood plain erosion has resulted in appreciable reductions in crop yields.

Over 65 percent of flood plain lands are used far below their potential. Farm and ranch operators are not able to establish improved grasses, or fertilize to any significant extent on most of the flood plain, because flooding may occur at any time and result in severe damage or reduce greatly the effectiveness of fertilizer.

The most disastrous flood in recent years occurred on September 21-22, 1967, as a result of Hurricane Beulah. The total storm rainfall varied from 11 inches in the upper portion of the watershed, to 26 inches at Runge, located in the lower portion. The recurrence interval of resulting flood peaks were estimated to range from 50 years to 83 years. About 12,700 acres of flood plain in the watershed were inundated. Two persons drowned as they attempted to flee from the raging waters. Several farm homes and buildings were damaged by floodwater. Numerous highways and county roads were closed, some for several months before repairs could be made. The direct monetary floodwater damage from this flood was in excess of $162,000.

Other recent large floods that caused severe floodwater damages occurred in 1946, 1951, 1956, and 1958.



Average annual acres flooded exceeds 6,200 acres.



Average annual crop and pasture, other agricultural, sediment, and scour damages exceed $71,000.



Average annual damages to roads and bridges exceed $2,700.

A flood resulting from a 100-year frequency storm event would cause direct floodwater damages in excess of $169,000.

For the floods expected to occur during the evaluation period, which includes floods up to the 100-year frequency, the total direct floodwater damage is estimated to average $53,536 annually at adjusted normalized prices (table 5). Of this amount, $24,012 is crop and pasture damage, $26,769 is other agricultural damage, and $2,755 is nonagricultural damages to roads and bridges.

Indirect damages such as interruption of travel, the re-routing of school bus and mail routes, losses sustained by businesses in the area, and similar losses are estimated to average $7,421 annually.

Sediment Damage

The estimated average annual sediment yield at the mouth of Ecleto Creek is 220,600 tons, equivalent to an annual sediment production rate of 1.3 tons per acre or about 0.4 acre-feet per square mile. This sediment yield contributes to the pollution of the San Antonio River and San Antonio Bay lowering the quality of water for such uses as municipal and industrial water supply, irrigation, recreation, and fish and wildlife habitat. Future downstream reservoirs on the San Antonio River will suffer loss of storage capacity as a result of sediment yield from Ecleto Creek watershed.

Within the watershed, damaging sediment deposits occur in stream channels, on roads and bridges, in farm ponds, and on productive agricultural flood plain land.

The latter type of damage consits primarily of silty sand, fine sand, and medium sand depostied on cropland, pasture, and rangeland. These deposits range from 0.5 foot to 6.0 feet in thickness. Examination of the deposits indicates that most of the sediment has accumulated gradually over an extended period of time, but occasionally sediment has been deposited as much as 2.0 feet thick by a single flood event. More than 18 percent of the flood plain is covered by overbank deposits of damaging sediment which cause losses in productive capacity ranging from 10 to 50 percent. The following tabulation shows the area damaged within each evaluation reach:

Average Annual Area Damaged by Overbank Deposition of Sediment

Evaluation Reach (figure 1):	Percent Reduction in Productive Capacity 10 (acres)	20 (acres)	30 (acres)	40 (acres)	50 (acres)	Total Acres
1	513	40	72	0	0	625
2	197	0	0	0	0	197
3	34	165	16	27	63	305
4	561	88	0	88	0	737
5	233	14	253	0	0	500
Total Acres	1,538	307	341	115	63	2,364

The average annual value of this damage is estimated to be $8,422 (table 5).

Overbank deposition is estimated to be in equilibrium, in that recovery is occurring at about the same rate as additional damages.

Erosion Damage

The estimated average annual rate of upland erosion is 5.87 tons per acre. Of this, sheet erosion accounts for 95 percent and gully and streambank erosion account for 5 percent.

The highest rate of erosion is occurring on formerly cultivated fields. The loss of soil, in conjunction with depleted soil fertility, resulted in loss of productive capacity and eventual abandonment. The present vegetation on the abandoned fields is primarily weeds. Although gullying is not a major watershed problem, some active gully erosion is taking place on the more rolling portions of these fields and is found in small areas scattered over the watershed. There is a trend toward conversion of such fields to coastal bermudagrass pasture. Special emphasis is being placed on shaping and vegetating the gullied areas. This type of treatment along with proper management is slowly bringing gully and sheet erosion under control.

Floodwaters remove an estimated average of 155,000 tons of soil annually by the process of flood plain scour. More than 21 percent of the flood plain is damaged by scour. Damaged areas range from broad depressions less than one foot deep to narrow channels from one to nine feet deep. This type of damage not only removes valuable soil but hampers and sometimes prohibits farm operations. The following tabulation shows the acres damaged in terms of reduced soil productive capacity by evaluation reach:

Average Annual Area Damaged by Flood Plain Scour

Evaluation Reach (figure 1):	Percent Reduction in Productive Capacity: 10 (acres)	20 (acres)	30 (acres)	40 (acres)	50 (acres)	Total Acres
1	941	0	83	0	0	1,024
2	116	24	0	0	0	140
3	0	0	0	0	0	0
4	425	247	126	0	31	829
5	483	282	0	0	0	765
Total Acres	1,965	553	209	0	31	2,758

Annual recovery from flood plain scour is approximately in balance with new damage. The average annual monetary value of this damage is estimated to be $12,257 (table 5).

Problems Relating to Water Management

Water for livestock is obtained from wells and surface ponds. Rural domestic and municipal and industrial water supplies are obtained from wells. The Carrizo Sand, the Oakville Sandstone, and the Catahoula Tuff are the primary water-bearing formations. These, along with several minor aquifers, are adequate sources for present needs within the watershed. Needs for additional ground water development or surface water storage are not expected in the near future.

Water-based recreational opportunities in the watershed are limited to small ponds and potholes in Ecleto Creek. These opportunities do not meet demands. Present population in the immediate area of the watershed is about 17,500. The projected rate of growth indicates a slight, but continued increase in the future. The nearest water-based recreational opportunities of significance are located about 50 miles northwest of the watershed in the San Antonio area, and consist of man-made lakes with adjoining recreational facilities.

Landowners are interested in developing facilities for incidental water-based recreation at several of the proposed floodwater retarding structures.

Sediment derived from the watershed is a pollutant, reducing the water quality for such uses as municipal water supply, recreation, and fish and wildlife habitat in the San Antonio River Basin.

PROJECTS OF OTHER AGENCIES

There are no existing or proposed works of improvement of other agencies in the watershed. However, the San Antonio River Authority is charged by State law with the following water conservation powers within more than 4,000 square miles of the San Antonio River Basin: navigation; flood control; conservation, storage, procurement, distribution, and supply of water; irrigation; soil conservation; sewage treatment; pollution prevention; recreation; and forestation and reforestation. Karnes and Wilson Counties lie within the 4,000 square mile area.

The Texas State Plan for water resource development includes Goliad Reservoir. This reservoir would be located on the San Antonio River about 15 miles below Ecleto Creek and provide 42,000 acre-feet of sediment storage, 958,000 acre-feet of conservation storage, and 702,000 acre-feet of flood control storage. Also included, some 30 miles below the Goliad Reservoir, is the Confluence Reservoir. The reservoir would be located at the confluence of the San Antonio and Guadalupe Rivers and provide 33,000 acre-feet of sediment and 277,000 acre-feet of conservation storage.

Increases in population, commerce, and industry would require expansion of transportation systems and could justify construction of a barge navigation canal on the San Antonio River. A shallow-draft navigation project to extend from the Gulf Intercoastal Waterway upstream to a turning basin south of San Antonio is included in long range plans.

The works of improvement included in this plan will have no known detrimental effects on any existing or proposed downstream improvements, and will constitute a harmonious element in the full development of the San Antonio River Basin.

PROJECT FORMULATION

There is a history of extensive flood damage to agricultural properties, roads, and bridges throughout the watershed. Realizing the social and economic impact of these problems, foresighted local people sought assistance. Representatives of the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts; Ecleto Creek Watershed District; San Antonio River Authority; and the Soil Conservation Service initially made studies and held meetings to identify existing flood problems and reach agreement on water and land resource development needs. Desires of sponsoring local organizations were discussed and project objectives were formulated. Watershed protection, flood prevention, recreation, and municipal water supply were the primary objectives expressed by the sponsors.

The following specific objectives were agreed to:

1. Reduce erosion and increase rainfall infiltration on the watershed through an accelerated program of land treatment. The goal is to establish 75 to 80 percent of needed land treatment measures. For this purpose, only those practices which contribute to watershed protection and flood prevention are included. The land treatment program is to include conversion of marginal cropland to grassland.

2. Attain a 70 to 75 percent reduction in average annual flood damages.

3. Investigate the feasibility of including storage of water for recreational use in one or two multiple-purpose structures. After estimated local costs were available and the probability of obtaining water rights was investigated, sponsoring local organizations decided against addition of this storage.

4. Investigate the feasibility of including water storage for municipal use in a floodwater retarding structure in the vicinity of the Gillett community. Gillett is unincorporated and has approximately 50 inhabitants.

Three floodwater retarding structure sites ranging from 1.5 miles to 2.5 miles from Gillett were investigated for possible inclusion of water storage for municipal and industrial use. Subdued relief at all three sites would result in broad and shallow conservation pools. Additional information indicated that the present source provides sufficient water for future needs of the Gillett community. The local expense of including water supply in any of the sites considered, along with the

associated cost of providing a water treatment facility and a pipeline, was greater than the leaders of Gillett wished to invest in at this time.

Nine alternate systems of floodwater retarding structures were investigated in order to select the least costly system needed to provide the agreed upon level of protection. In selecting sites for floodwater retarding structures, consideration was given to locations which would provide maximum protection to areas most subject to damage. Topographic, geologic, and other physical conditions also had considerable influence upon the size, number, design, and cost of structures included in the work plan.

The following alternative systems of floodwater retarding structures were investigated and analyzed, but were not selected for inclusion in the final project.

Wilson County Portion

Nine floodwater retarding structure sites were investigated on tributaries which drain into evaluation reach 5 (figure 1). These sites, with a total combined drainage area of 30.8 square miles, were located near confluences with Ecleto Creek on the following named branches: one each on East Fork Ecleto, Gold Pool Branch, and Steel Branch; one each on four unnamed tributaries which join Ecleto Creek from the west above the Caddo community; and one each on two unnamed tributaries which flow into Ecleto Creek from the west below Farm Road 1347.

This combination of structural control, along with Sites Nos. 3 through 11, would provide less than 50 percent reduction in average annual damages. This would not meet minimum project objectives. For the Wilson County portion of the watershed, the combination of Sites Nos. 1 and 2 on the main stem of Ecleto Creek (figure 4) was selected for inclusion in the final project in place of the nine tributary sites described above. The two site system is a less costly alternative, involves less acreage and fewer land owners, and results in greater damage reduction benefits than the nine site system.

Dees Branch and Unnamed Tributary

The feasibility of including three sites on Dees Branch and one site on an unnamed tributary, just east of U. S. Highway 80 and south of Dees Branch, was investigated. These sites were not included because their drainage areas do not significantly contribute to the peak flow of Ecleto Creek.

Cooper Creek

A study was made of the feasiblity of including a floodwater retarding structure just upstream from Farm Road 887 on Cooper

Creek, a tributary of Rhymes Creek. The site was considered both separately and in series with Site No. 5. The study showed that the Rhymes Creek drainage area could be more economically controlled by Sites Nos. 4 and 5 in series (figure 4) than by both Site No. 4 and the Cooper Site in series with Site No. 5. Also, flood damages between the Cooper Site and Site No. 5 are not significant.

A site on Cooper Creek together with Site No. 4 (not including Site No. 5) did not control sufficient drainage area to adequately reduce expected peak flows from Rhymes Creek.

McTennel Creek

Two additional sites were investigated on a tributary to McTennel Creek just south of Site No. 9 (figure 4). The total drainage area above the two sites is 4.5 square miles. The reduction of damages between these sites and Site No. 11 would be insignificant. Also, this drainage area could be more economically controlled by Site No. 11. For these reasons, the two sites were not included in the planned project.

Salt Creek

A site was investigated on Salt Creek just above Highway 81 and Farm Road 742 (figure 4). The drainage area of this site does not contribute significantly to peak flows on Ecleto Creek.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Farmers and ranchers of the watershed are applying and maintaining basic soil and water conservation plans on their land with assistance from the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts. These plans are essential to a sound program for watershed protection and flood prevention. They are based on the use of each acre within its capabilities and its treatment in accordance with its needs. Needed land treatment measures have been applied to date at an estimated expenditure of $1,742,638 by landowners and operators (table 1A).

Increased application and maintenance of land treatment measures is particularly important for protection of the 159.17 square miles which comprise the drainage areas of the eleven planned floodwater retarding structures. This treatment will reduce the capacities required for sediment accumulation and will retard runoff into the structures.

There are 107.83 square miles downstream from floodwater retarding structures that will continue to contribute sediment and runoff to flood plain areas. Land treatment on these lands will further reduce floodwater and sediment damages.



Grassed waterway established to coastal bermudagrass serves terraced cropland.



Quail nest in coastal bermudagrass.



Rootplowing land to be seeded to good quality grass.



Cattle grazing on properly managed coastal bermudagrass pasture.

The acreage in each major land use, on which land treatment measures will be established during the ten-year project installation period, is included in table 1. These measures will be established and maintained by landowners and operators in cooperation with the Karnes-Goliad, DeWitt County, Wilson County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts.

It is expected that approximately 2,700 acres of steeply sloping cropland will be converted to improved pasture during the project installation period. Also, about 23,000 acres of poor and wooded rangeland are expected to be converted to improved pasture.

Cultivated land will be treated with a combination of measures in keeping with a conservation cropping system for soil conditioning and protection from erosion. Conservation cropping systems in this watershed include crop residue management and contour farming. Terraces with grassed waterways or outlets will be installed to control erosion and retard runoff from the more rolling areas.

A good base cover of desirable forage plants will be attained by pasture and hayland planting and pasture and hayland management.

Proper grazing use, range seeding, and deferred grazing will be practiced to improve the quality of vegetation and maintain adequate cover for soil protection. Rangeland with infestations of woody plants will be either bulldozed, root plowed, chained, or sprayed to control brush. Destruction of cover caused by over-use around present watering places will be reduced by establishing farm ponds on both rangeland and pasture.

Damage to land caused by rapid runoff from steeper areas will be reduced by construction of diversions.

Gullied areas will receive critical area planting to reduce erosion and sediment damages. Such treatment can be accomplished under the going programs of the soil and water conservation districts, and no project type action is needed.

On wildlife land, the protection of existing wildlife habitat and the establishment of additional food, cover, and water for wildlife will be provided through the practices of critical area planting and wildlife habitat management.

Adequate soil surveys are necessary for development of soil and water conservation plans. Public Law 566 funds in the amount of $8,400 will be provided for accelerated completion of a soil survey of the watershed.

In addition to funds for soil surveying, $61,317 will be available from Public Law 566 funds for accelerated technical assistance in planning and applying land treatment. Public Law 566 funds are in addition to funds presently available for technical assistance.

Local people will continue to install and maintain measures needed in the watershed following the project installation period.

The application of land treatment planned for the installation period will reduce average annual erosion by about 15 percent and increase infiltration of rainfall as a result of improved ground cover in cultivated areas and increased grass vigor on pasture and rangeland.

Structural Measures

A system of 11 floodwater retarding structures will be constructed in the Ecleto Creek watershed. Figure 2 shows a section of a typical floodwater retarding structure. A general plan and profile of a typical structure is shown on figure 3. The locations of structural measures to be installed are shown on the Project Map (figure 4). These structures will provide flood protection to agricultural land in the flood plain of Ecleto Creek watershed, reduce sediment yields, and improve water quality to the San Antonio River.

The principal spillways will be on yielding foundations and will have monolithic rectangular, reinforced concrete inlets. Structures Nos. 1, 2, 5, 8, and 11 will have monolithic rectangular, reinforced concrete outlets and structures Nos. 3, 4, 6, 7, 9, and 10 will have prestressed, concrete lined, steel cylinder pipe outlets. Plunge basins are needed for all sites.

The principal spillway capacities and floodwater detention storage for all planned structures provided for a range of 2.0 to 3.7 percent chance of emergency spillway use. See table 3 for individual structure data.

The on-site material for use in the embankments will require zoning or selective placement at most sites. There should be little, if any, wastage required.

Foundation drainage features will be needed at Sites Nos. 1, 4, 5, 6, 9, 10, and 11. The need for foundation drains, including vertical relief drains, is anticipated for Site No. 1.

All structures are designed with sufficient capacities to provide 100-year project life. All planned structure pools will have both submerged and aerated sediment. Principal spillway crests will be set at the elevation of the 50-year sediment pool. Where the 50-year sediment storage exceeds 200 acre-feet, the principal spillway will be ported at the 200 acre-feet elevation. There will be 1,996 acre-feet of sediment storage capacity provided below the lowest ungated principal spillway openings of the floodwater retarding structures.

The eleven planned floodwater retarding structures will detain an average of 4.03 inches of runoff per acre from 159.17 square miles of drainage area. These structures will control runoff from approximately 60 percent of the total watershed.

Tables 1, 2, and 3 show details on quanities, costs, and design for each structure.

Installation of floodwater retarding structures will require relocation or modification of existing improvements as follows: pipeline at Site No. 2;

buildings at Sites Nos. 1, 5, 7, 8, and 11; utility lines at Sites Nos. 1, 4, 5, 8, and 9; fences at Sites Nos. 1, 2, 5, 6, 7, 9, and 11; water wells at Sites Nos. 1, 2, 6, 7, and 11; private roads at Sites Nos. 1 and 2; and county roads at Sites Nos. 1, 4, 5, 8, 9, and 11.

All applicable State laws will be complied with in the design and construction and in storage and use of water for all structural measures.

EXPLANATION OF INSTALLATION COSTS

The total project installation cost is estimated to be $4,953,356, including $2,546,512 for land treatment measures and $2,406,844 for structural measures. The share from sources other than Public Law 566 funds is estimated to be $2,953,305, and the Public Law 566 share is estimated to be $2,000,051 (table 1).

Included in the local share of project installation costs are $2,317,878 for landowners and operators expenses in applying land treatment measures (including anticipated reimbursement from Agricultural Conservation Program Service funds); $158,917 for technical assistance in planning and application of land treatment under the going Public Law 46 program; $471,260 for land rights expenses; and $5,250 for project administration.

Included in the Public Law 566 share of project installation costs are $69,717 for accelerated technical assistance, $1,586,326 for construction, $89,894 for engineering services of structural measures, and $254,114 for project administration. The $69,717 for technical assistance includes $8,400 for completion of standard soil surveys and $61,317 for stepped up planning and application of land treatment for watershed protection.

The cost of applying land treatment practices was based on present prices being paid by landowners and operators to establish the measures and was estimated by sponsoring local organizations.

The costs of land rights were determined by appraisal in cooperation with representatives of the sponsoring local organizations. These costs include $383,560 for value of land needed for installation of structural measures; $83,900 for relocation and modification of improvements such as utility lines, homes and buildings, water wells, fences, private roads, county roads, and low water crossings; and $3,800 for value of legal services.

Relocation and modification of existing improvements involve an underground pipeline ($15,000), utilities ($14,600), buildings ($27,150), county roads ($12,200), private roads ($1,750), water wells ($6,150), and fences ($7,050).

Construction costs include the engineer's estimates and contingencies for constructing floodwater retarding structures. The engineer's estimates were based on unit costs of structural measures in similar areas modified by special conditions inherent to each individual site location. Included are such items as permeable foundation conditions, special placement of embankment materials, and site preparation. Ten percent of the estimate was added as a contingency to provide funds for unpredictable construction costs.

Engineering services costs and project administration costs were based on an analysis of previous work in similar areas. Engineering services costs consist of, but are not limited to, detailed surveys, geologic investigations, laboratory analyses and reports, designs, and cartographic services. Public Law 566 project administration costs consist of construction inspection and supervision, contract administration assistance, maintenance of State Office records and accounts, and Washington Office and E&WP Unit costs. The local costs for project administration include sponsors costs related to contract administration, overhead, and organizational administrative costs, and whatever construction inspection the sponsors desire to make at their own expense.

The following is the estimated schedule of obligations for the ten-year installation period.

Schedule of Obligations

Fiscal Year	Measures	Public Law 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
First	Land Treatment	3,486	123,840	127,326
Second	Land Treatment	3,486	123,840	127,326
Third	Land Treatment	3,486	123,840	127,326
	Structures Nos. 3 and 7	264,476	61,200	325,676
Fourth	Land Treatment	10,458	371,520	381,978
	Structures Nos. 9 and 1	400,535	103,885	504,420
Fifth	Land Treatment	10,458	371,520	381,978
	Structures Nos. 4 and 10	210,491	49,500	259,991
Sixth	Land Treatment	10,458	371,519	381,977
	Structures Nos. 2 and 6	451,797	128,350	580,147
Seventh	Land Treatment	10,457	371,519	381,976
	Structures Nos. 8 and 5	357,129	91,400	448,529
Eighth	Land Treatment	10,457	371,519	381,976
	Structure No. 11	245,906	42,175	288,081
Ninth	Land Treatment	3,486	123,839	127,325
Tenth	Land Treatment	3,485	123,839	127,324
	Total	2,000,051	2,953,305	4,953,356

This schedule may be changed from year to year to conform with appropriations, actual accomplishments, and any significant mutually desirable change.

EFFECTS OF WORKS OF IMPROVEMENT

This project will benefit directly the owners and operators of approximately 150 farms and ranches in the flood plain. In addition, the owners and operators of the farms along the San Antonio River immediately below Ecleto Creek will receive some benefit from the project.

After installation of the combined program of land treatment and structural measures described above, average annual flooding will be reduced from 6,270 acres to 2,124 acres, a reduction of 66 percent.

Reduction in area inundated varies with respect to location within the watershed. The general locations of the areas to be benefited as a result of reduced flooding caused by the combined program of land treatment and structural measures are presented in the following tabulations:

Average Annual Area Inundated

Evaluation: Reach (figure 1):	Location	Without Project (acres)	With Project (acres)	Reduction (percent)
1	Confluence of San Antonio River to V.S. E-8	2,375	499	79
2	McTennel Creek	564	297	53
3	Dry Ecleto Creek	119	23	81
4	V.S. E-9 to V.S. E-18	1,612	521	68
5	V.S. E-19 to Site No. 1	1,600	784	51
	Total	6,270	2,124	66

Area Inundated

Evaluation Reach (figure 1)	2-Year Without Project (acres)	2-Year With Project (acres)	5-Year Without Project (acres)	5-Year With Project (acres)	25-Year Without Project (acres)	25-Year With Project (acres)	100-Year Without Project (acres)	100-Year With Project (acres)
	Average Recurrence Interval							
1	2,325	147	3,149	850	3,438	2,175	3,620	2,797
2	454	267	628	345	773	443	855	598
3	74	5	162	57	345	72	461	95
4	1,174	352	2,383	737	3,974	1,197	4,911	2,329
5	1,451	603	2,066	1,140	2,651	1,535	3,021	2,006
Total	5,478	1,374	8,388	3,129	11,154	5,422	12,868	7,825

Application of the planned land treatment program is expected to reduce annual upland erosion from about 1,000,000 tons to 846,000 tons, a reduction of 15 percent. Annual flood plain scour damage on 2,758 acres is expected to be reduced about 75 percent.

After the complete program is installed, an 84 percent reduction in overbank sediment deposition damages on 2,364 acres will be effected.

It is expected that intensification will occur on about 5,000 acres of the flood plain on which flooding is expected not more than once in three years on the average. This change will be from pasture and wooded pasture to improved pasture and hayland. Allotted crops are minor and no significant changes are expected.

Excellent opportunities for the development of on-farm income producing recreation will become available at and in the vicinity of all of the planned floodwater retarding structures. The sponsors have indicated that at least five of these structures will be open to the general public on either a free or fee basis. These developments will provide water-based recreation such as swimming, fishing, hunting, picnicking, and camping. Such facilities are used extensively by youth organizations such as Boy Scouts, Girl Scouts, church groups, etc. These facilities are expected to furnish at least 3,500 visitor days of recreation annually.

Sanitary facilities will be necessary in order to prevent contamination of water to be used for recreational purposes. Landowners and other private interests have indicated to the sponsors that they will develop sanitary facilities meeting State and local health agency requirements prior to making the sites available to the general public. Water quality will be investigated to determine its adequacy for the intended recreational uses.

The sediment pools of the floodwater retarding structures not expected to be open for recreational use will provide a more dependable water supply for livestock. Livestock water use will in no way jeopardize water quality in those sites to be used for recreation.

The effects of the works of improvement on mineral resources have been considered. The sponsors recognize the importance of natural gas, petroleum, natural gas liquids, stone, sand and gravel, clays, and the indication of uranium in the watershed and vicinity. The project will not adversely affect or be adversely affected by the extraction of mineral resources, assuming precautionary measures are taken.

The effects of the works of improvement on fish and wildlife habitat are described by the Bureau of Sport Fisheries and Wildlife as follows:

"Our reconnaissance review of the proposed project for Ecleto Creek watershed indicates that wildlife resources will be slightly benefited from the watershed protection and the soil and water conservation improvement measures contemplated."

The project will create additional employment opportunities for local residents. The firms contracting for installation of the structures will employ some of their employees locally. The operation and maintenance of project measures over the life of the project will also provide employment opportunities for the local residents.

Benefits will accrue to the floodwater retarding structures in the watershed from reduction of floodwater damages on the main stem flood plain of the San Antonio River immediately below its confluence with Ecleto Creek.

The structural measures are a compatible part of the long-range program of the San Antonio River Authority for flood control and water conservation in the San Antonio River Basin.

A total of 835 acres of land in sediment pools will be retired from agricultural production. Only 90 acres of this is presently in cultivation.

Secondary benefits, including increased business activity and improved economic conditions in the surrounding communities, will result from the installation of the complete project for flood prevention. The increased agricultural production will provide added income for farm families, thereby improving their standard of living. These secondary benefits will have a favorable effect on the watershed and in the surrounding area. In addition, there are intangible benefits such as increased sense of security, better living conditions, and improved wildlife habitat.

PROJECT BENEFITS

The estimated average annual monetary floodwater, sediment, erosion, and indirect damages (table 5) within the watershed will be reduced from $81,636 to $19,498 by the proposed project. This is a reduction of 76 percent.

Benefits to landowners and operators from the planned land treatment measures were not evaluated in monetary terms since experience has shown that conservation practices produce benefits in excess of their costs.

Reductions in monetary flood damages vary with respect to locations within the watershed. The following tabulations show the general locations of damage reduction benefits attributed to the combined program of land treatment and structural measures.

Evaluation: Reach (figure 1):	Location	Average Annual Damage: Without Project (dollars)	With Project (dollars)	Reduction (percent)
1	Confluence of San Antonio River to V.S. E-8	36,675	5,623	85
2	McTennel Creek	9,288	3,957	57
3	Dry Ecleto Creek	4,342	598	86
4	V.S. E-9 to V.S. E-18	17,019	4,042	76
5	V.S. E-19 to Site No. 1	14,312	5,278	63
	Total	81,636	19,498	76

Direct Monetary Floodwater Damage

Evaluation: Reach (figure 1):	Average Recurrence Interval: 2-Year: Without Project (dollars)	2-Year: With Project (dollars)	10-Year: Without Project (dollars)	10-Year: With Project (dollars)	25-Year: Without Project (dollars)	25-Year: With Project (dollars)	100-Year: Without Project (dollars)	100-Year: With Project (dollars)
1	22,292	1,120	49,712	12,211	58,703	20,017	69,019	32,401
2	4,638	2,366	10,295	4,603	12,264	5,843	16,283	8,292
3	1,305	17	4,340	891	6,011	1,225	9,800	2,431
4	6,767	1,169	22,032	6,176	30,545	9,358	44,408	15,355
5	6,844	2,300	17,474	6,842	22,164	9,188	29,811	13,173
Total	41,846	6,972	103,853	30,723	129,687	45,631	169,321	71,652

Annual net income will increase an estimated $59,520 to owners and operators of flood plain land from more intensive land use.

The monetary value of the incidental recreational benefits from use of the sediment pools of floodwater retarding structures open for public use is estimated to be $2,420 annually after deduction of associated costs for replacement of recreation and sanitary facilities, repair, and clean up. A gross value of $1.00 per visitor-day was used for evaluation. Benefits are expected to accrue at full level for the first 40 years of the project, diminish to zero by the end of the 50th year, and to be nonexistent for the balance of the evaluation period. Incidental livestock water benefits from

use of the sediment pools of floodwater retarding structures not expected to be used for recreation is estimated to be $1,780 annually.

Redevelopment benefits stemming from employment of local labor during the project installation and operation and maintenance will amount to an amortized value of $5,420 annually.

Benefits averaging $5,820 annually will accrue to the floodwater retarding structures from reduction of floodwater, sediment, and flood plain erosion damages on the main stem of the San Antonio River below the watershed. These damage reduction benefits are distributed as follows:

Crop and pasture	$1,374
Other agricultural	2,137
Nonagricultural	1,703
Sediment	84
Flood plain erosion	522

It is estimated that the project will produce local secondary benefits, which excludes indirect benefits in any form, averaging $23,527 annually. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures (amortized total installation and project administration cost, plus operation and maintenance) is $117,051. These measures are expected to produce average annual benefits, excluding secondary benefits, of $134,363, resulting in a benefit-cost ratio of 1.1:1.0.

The ratio of total average annual project benefits, accruing to structural measures ($157,890) to the average annual cost of structural measures ($117,051) is 1.3:1.0 (table 6).

PROJECT INSTALLATION

Landowners and operators will establish planned land treatment (table 1) in cooperation with the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts during a ten-year period. Technical assistance in planning and application of land treatment is provided under the going program of the districts. A soil survey is in progress and has been completed on 100,790 acres.

Approximately 32 percent of the agricultural land is adequately treated with practices properly maintained. The goal is to increase the level of land adequately treated to 75 percent or greater during the installation period.

In reaching this goal, it is expected that accomplishments of additional adequate treatment will progress as shown in the following tabulation:

Land Use	Fiscal Year					
	1st	2nd	3rd	4th	5th	6th
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Cropland	1,125	1,125	1,125	3,375	3,375	3,375
Pasture and Hayland	1,693	1,693	1,693	5,078	5,078	5,078
Rangeland	1,312	1,312	1,312	3,936	3,936	3,936
Wildlife Land	56	56	56	168	168	168
Total	4,186	4,186	4,186	12,557	12,557	12,557

Land Use	Fiscal Year - Continued				
	7th	8th	9th	10th	Total
	(acres)	(acres)	(acres)	(acres)	(acres)
Cropland	3,375	3,376	1,126	1,132	22,509
Pasture and Hayland	5,078	5,078	1,693	1,695	33,857
Rangeland	3,936	3,936	1,312	1,302	26,230
Wildlife Land	168	168	56	55	1,119
Total	12,557	12,558	4,187	4,184	83,715

The governing bodies of the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts will assume agressive leadership in getting an accelerated land treatment program underway. Landowners and operators will be encouraged to apply and maintain soil and water conservation measures on their farms and ranches. District owned equipment will be made available to landowners in accordance with existing agreements for equipment usage in the district. The Soil Conservation Service will provide technical assistance in accelerating completion of the soil survey and the planning and application of soil, plant, and water conservation measures.

Special emphasis will first be placed on getting a higher degree of land treatment in the drainage areas of floodwater retarding structures. Then the emphasis will be on land outside drainage areas of structures.

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The Extension Service will assist with the educational phase of the program by providing information to landowners and operators in the watershed.

The Ecleto Creek Watershed District has the right of eminent domain under applicable State law and has the financial resources to fulfill its responsibilities.

The Ecleto Creek Watershed District will have the following responsibilities pertaining to the eleven planned floodwater retarding structures.

1. Obtain the necessary land rights;

2. Provide for the relocation or modification of utility lines and systems, roads, and privately owned improvements necessary for installation of structural measures;

3. Provide for the necessary improvement of low water crossings on public and private roads to make them passable during prolonged release flows from structures or obtain permission to inundate such roads where equal alternate routes are designated for use during periods of inundation;

4. Determine legal adequacy of easements and permits for construction of the structural measures;

5. Obtain a court order from the DeWitt County Commissioners Court showing that the county road affected by the detention pool of floodwater retarding structure No. 9 will either be closed or relocated at no expense to the Federal Government;

6. Obtain court orders from the Karnes County Commissioners Court showing that the county road affected by the sediment and detention pools of floodwater retarding structure No. 8; the county roads affected by the embankment, sediment pool, and detention pool of floodwater retarding structure No. 5; and the county roads affected by the detention pools of floodwater retarding structures Nos. 4 and 11 will be closed or relocated at no expense to the Federal Government; and

7. Obtain court orders from the Wilson County Commissioners Court showing that the northwest-southeast county road affected by the detention pool of floodwater retarding structure No. 1 will be closed or relocated at no expense to the Federal Government; and that the southwest-northeast county road affected by emergency spillway flow of floodwater retarding structure No. 1 will be raised to an elevation of 474.0 feet mean sea level at no expense to the Federal Government.

The Soil Conservation Service in compliance with the request of the sponsors will provide the necessary legal, administrative, and clerical personnel, facilities, supplies, and equipment to advertise, award, and administer contracts and will be the contracting agency to let and service contracts. The Ecleto Creek Watershed District will represent sponsoring local organizations in coordination with the Soil Conservation Service on matters concerning construction.

Technical assistance will be provided by the Soil Conservation Service in preparation of plans and specificiations, supervision of construction, preparation of contract payment estimates, final inspection, execution of certificate of completion, and related tasks necessary to install planned structural measures.

The eleven floodwater retarding structures will be constructed during the third, fourth, fifth, sixth, seventh, and eighth years of a ten-year project installation period in the general sequence as follows:

Third Year	-	Floodwater Retarding Structures Nos. 3 and 7
Fourth Year	-	Floodwater Retarding Structures Nos. 9 and 1
Fifth Year	-	Floodwater Retarding Structures Nos. 4 and 10
Sixth Year	-	Floodwater Retarding Structures Nos. 2 and 6
Seventh Year	-	Floodwater Retarding Structures Nos. 8 and 5
Eighth Year	-	Floodwater Retarding Structure No. 11

In order for construction to proceed according to schedule, all land rights for floodwater retarding structures are scheduled by the Ecleto Creek Watershed District to be secured by the end of the time periods as shown in the following tabulation. The schedule will begin when the work plan is approved for operations.

Time Period	Floodwater Retarding Structures
First six months	Nos. 2, 3, and 10
Second six months	Nos. 4, 7, and 9
Third six months	Nos. 1, 6, and 8
Fourth six months	Nos. 5 and 11

FINANCING PROJECT INSTALLATION

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

The cost of applying land treatment measures will be borne by landowners and operators. Public Law 566 funds will be used for technical assistance in accelerating the planning and application of soil and water conservation measures.

The Ecleto Creek Watershed District will be responsible for providing funds for the local share of the cost for installation of the eleven planned floodwater retarding structures. The District has analyzed its financial needs in consideration of the scheduled works of improvement and is willing and able to carry out its responsibilities. Residents of the Ecleto Creek Watershed District have approved a tax which is being levied and collected annually to secure bond funds in the amount of $75,000. An additional tax of $0.15 per $100 valuation has been voted for operations, maintenance, and other needs of the District. This tax is being collected presently at the annual rate of $0.10 per $100 valuation and revenues are accumulating. Funds

available to the District will be adequate to provide for the local share of installation costs of structural measures in accordance with the agreed upon schedule of installation.

It is anticipated that about 90 percent of the easements for floodwater retarding structures will be donated. Out-of-pocket costs for land rights which will not be donated, legal expenses, and project administration is estimated to be $131,300.

The sponsoring local organizations do not plan to use the loan provisions of the Act.

Structural measures will be constructed in a six-year period within the ten-year project installation period pursuant to the following conditions:

1. Requirements for land treatment in drainage areas of floodwater retarding structures have been satisfied.

2. All land rights have been obtained for all structural measures, or a written statement is furnished by the Ecleto Creek Watershed District that its right of eminent domain will be used, if needed, to secure any remaining land rights within the project installation period and that sufficient funds are available for purchasing them.

3. Project agreements have been executed.

4. Operation and maintenance agreements have been executed.

5. Public Law 566 funds are available.

Various features of cooperation between the cooperating parties have been covered in appropriate memorandums of understanding and working agreements.

The soil and water conservation loan program sponsored by the Farmers Home Administration is available to eligible farmers in the area.

Educational meetings will be held in cooperation with other agencies to outline available services and eligibility requirements. Present FHA clients will be encouraged to cooperate in the program.

The County Agricultural Stabilization and Conservation committees will cooperate with the governing bodies of the soil and water conservation districts by continuing to provide financial assistance for selected conservation practices.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by landowners and operators of farms on which measures are applied under agreement with the Karnes-Goliad,

Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts. Representatives of the districts will make periodic inspections of land treatment measures to determine maintenance needs and encourage landowners and operators to perform maintenance. They will make district-owned equipment available for this purpose in accordance with existing working arrangements.

Structural Measures

The Ecleto Creek Watershed District will be responsible for operation and maintenance of the eleven floodwater retarding structures. The estimated annual operation and maintenance cost is $4,505. A maintenance tax has been voted and is being collected presently. Revenue from this tax is available and will be adequate for this purpose.

Specific operation and maintenance agreements will be executed prior to the issuance of invitation to bid on construction of any of the floodwater retarding structures.

Floodwater retarding structures will be inspected at least annually and after each heavy rain by representatives of the San Antonio River Authority, Ecleto Creek Watershed District, and the Karnes-Goliad, DeWitt County, Wilson County, and Comal-Hays, Guadalupe Soil and Water Conservation Districts. A Soil Conservation Service representative will participate in these inspections for a period of at least three years following construction. The Soil Conservation Service will participate in inspections as often as it elects to do so after the third year. Items of inspection will include, but will not be limited to, conditions of principal spillways and their appurtenances, emergency spillways, earth fills, and vegetative growth in the reservoirs. The items of inspection are those most likely to require maintenance.

Upon acceptance of the completed works of improvements from the contractor, the Ecleto Creek Watershed District will be totally responsible for all maintenance. Maintenance will be performed promptly as the need arises.

The Soil Conservation Service will assist in operation and maintenance only to the extent of furnishing technical guidance.

Provisions will be made for unrestricted access of representatives of sponsoring local organizations and the Federal Government to inspect all structural measures and their appurtenances at any time and for sponsoring local organizations to operate and maintain them.

The Ecleto Creek Watershed District will maintain a record of all maintenance inspections made and maintenance performed and have it available for inspection by Soil Conservation Service personnel.

The necessary maintenance work will be accomplished either by contract, force account, or equipment owned by sponsoring local organizations.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Ecleto Creek Watershed, Texas

Installation Cost Item	Unit	Number Non-Federal Land	Estimated Cost (Dollars) 1/ Public Law 566 Funds Non-Federal	Other Non-Federal Land	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Acre	22,509	-	589,693	589,693
Pasture and Hayland	Acre	33,857	-	1,329,968	1,329,968
Rangeland	Acre	26,230	-	394,300	394,300
Wildlife Land	Acre	1,119	-	3,917	3,917
Technical Assistance			69,717	158,917	228,634
TOTAL LAND TREATMENT			69,717	2,476,795	2,546,512
STRUCTURAL MEASURES					
Construction					
Soil Conservation Service					
Floodwater Retarding Structures No.		11	1,586,326	-	1,586,326
Subtotal - Construction			1,586,326	-	1,586,326
Engineering Services					
Soil Conservation Service			89,894	-	89,894
Subtotal - Engineering Services			89,894	-	89,894
Project Administration					
Soil Conservation Service					
Construction Inspection			116,606	-	116,606
Other			137,508	5,250	142,758
Subtotal - Administration			254,114	5,250	259,364
Other Costs					
Land Rights			-	471,260	471,260
Subtotal - Other			-	471,260	471,260
TOTAL STRUCTURAL MEASURES			1,930,334	476,510	2,406,844
TOTAL PROJECT			2,000,051	2,953,305	4,953,356

1/ Price Base: 1968

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of work plan preparation)

Ecleto Creek Watershed, Texas

Measures	Unit	Number Applied To Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Conservation Cropping System	Acre	18,963	213,657
Crop Residue Mangement	Acre	25,533	51,066
Terraces 2/	Foot	3,461,968	173,098
Contour Farming	Acre	16,741	16,741
Grassed Waterway or Outlet	Acre	718	53,850
Diversion	Foot	114,703	17,205
Pasture and Hayland Management	Acre	5,278	17,936
Pasture and Hayland Planting	Acre	8,644	444,700
Pond	No.	407	244,200
Critical Area Planting	Acre	82	9,348
Brush Control	Acre	14,199	212,985
Proper Grazing Use	Acre	17,614	132,105
Deferred Grazing	Acre	17,866	133,995
Range Seeding	Acre	1,722	20,664
Wildlife Habitat Management	Acre	145	1,088
TOTAL			1,742,638

1/ Price Base: 1968

2/ Includes parallel, level, and gradient terraces.

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Ecleto Creek Watershed, Texas
(Dollars) 1/

Item	Installation Cost P. L. 566 Funds: Construction	Engineering	Total P. L. 566	Installation Cost Other Funds: Land Rights	Total Other	Total Installation Cost
Floodwater Retarding Structures						
1	208,188	10,409	218,597	74,260	74,260	292,857
2	293,280	14,664	307,944	109,650	109,650	417,594
3	81,235	5,686	86,921	22,600	22,600	109,521
4	96,619	6,763	103,382	35,400	35,400	138,782
5	139,623	8,377	148,000	42,550	42,550	190,550
6	81,096	5,677	86,773	17,800	17,800	104,573
7	132,809	7,969	140,778	37,750	37,750	178,528
8	154,035	7,702	161,737	47,850	47,850	209,587
9	123,609	7,417	131,026	28,425	28,425	159,451
10	71,913	5,034	76,947	13,300	13,300	90,247
11	203,919	10,196	214,115	41,675	41,675	255,790
Subtotal	1,586,326	89,894	1,676,220	471,260	471,260	2,147,480
Project Administration			254,114 2/		5,250	259,364
GRAND TOTAL	1,586,326	89,894	1,930,334	471,260 3/	476,510	2,406,844

1/ Price Base: 1968
2/ Includes $116,606 for construction inspection.
3/ Includes $27,150 for relocation of buildings, $29,600 for utility lines and pipelines, $12,200 for county roads, and $14,950 for other fixed improvements.

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES

Ecleto Creek Watershed, Texas

Item	Unit	Structure Number 1	2	3	4	5	6	7	8	9	10	11	Total
Class of Structure		B	B	A	A	A	A	A	A	A	A	A	xxx
Drainage Area	Sq.Mi.	40.92	38.21	6.17	7.39	10.59	3.77	13.26	12.85	7.53	3.38	15.10	159.17
Controlled	Sq.Mi.	-	40.92	-	-	7.39	-	-	13.26	-	-	10.91	xxx
Curve No. (1-day)(AMC II)		66	81	81	82	82	82	81	81	79	79	79	xxx
T_c	Hrs.	9.65	5.76	1.90	2.71	2.70	1.64	2.97	2.56	2.38	1.52	3.78	xxx
Elevation Top of Dam	Ft.	478.6	392.5	404.4	341.1	314.4	325.0	380.0	313.2	379.6	367.2	310.0	xxx
Elevation Crest Emergency Spillway	Ft.	471.0	386.6	400.5	336.5	309.8	321.5	375.6	308.3	374.5	363.3	305.0	xxx
Elevation Crest Principal Spillway	Ft.	454.7	369.0	389.1	324.3	299.7	312.5	359.5	295.7	360.8	349.5	289.0	xxx
Elevation Crest Lowest Ungated Outlet	Ft.	454.7	365.0	388.6	324.3	298.8	312.5	355.5	291.8	358.6	349.5	283.3	xxx
Maximum Height of Dam	Ft.	34	40	31	27	28	19	42	40	33	29	44	xxx
Volume of Fill	Cu.Yd.	275,400	356,100	119,500	103,600	131,500	80,450	204,600	155,000	179,900	91,600	228,800	1,926,450
Total Capacity	Ac.Ft.	6,547	9,737	2,014	2,228	3,305	1,258	4,327	4,110	2,652	1,146	4,832	42,156
Sediment Pool (Lowest Ungated Outlet) 1/	Ac.Ft.	196	200	200	173	198	123	198	199	197	112	200	1,996
Sediment Submerged 1st 50 years	Ac.Ft.	196	444	230	173	288	123	445	521	334	112	652	3,518
Sediment Submerged 2nd 50 years	Ac.Ft.	219	469	253	178	294	124	453	527	329	112	653	3,611
Sediment in Detention Pool-Aerated	Ac.Ft.	65	122	70	39	68	28	85	103	64	21	120	785
Retarding Pool	Ac.Ft.	6,067	8,702	1,461	1,838	2,655	983	3,344	2,959	1,925	901	3,407	34,242
Surface Area													
Sediment Pool (Lowest Ungated Outlet)	Acres	70	45	53	53	75	52	43	45	52	30	51	569
Sediment Pool-Principal Spillway Crest	Acres	70	90	58	53	94	52	84	122	72	30	110	835
Retarding Pool	Acres	735	1,180	287	304	570	204	470	470	291	134	448	5,093
Principal Spillway													
Rainfall Volume (areal)(1-day)	In.	8.67	8.62	8.20	8.20	8.73	8.20	8.85	8.65	9.00	8.40	8.65	xxx
Rainfall Volume (areal)(10-day)	In.	14.85	14.81	13.50	13.60	16.30	13.60	16.40	16.20	16.20	13.90	16.20	xxx
Runoff Volume (10-day)	In.	4.66	6.52	7.42	7.57	8.58	8.12	8.75	7.95	8.78	7.97	7.70	xxx
Capacity (Maximum)	cfs	544	1,014	123	158	334	81	234	517	175	56	587	xxx
Frequency Operation-Emergency Spillway	% chance	2.0	2.0	3.7	3.3	2.0	3.2	2.0	2.0	2.0	3.0	2.0	xxx
Size of Conduit	In.	60x60	72x72	30	36	48x48	36	42	54x54	36	24	54x54	xxx
Emergency Spillway													
Rainfall Volume (ESH)(areal)	In.	10.48	10.90	7.40	10.08	10.47	7.50	9.72	10.34	9.73	9.73	9.73	xxx
Runoff Volume (ESH)	In.	6.20	8.51	5.17	7.85	8.23	5.39	7.37	7.97	7.14	7.14	7.14	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Bottom Width	Ft.	600	1,100	300	300	300	200	400	400	200	200	600	xxx
Velocity of Flow (V_e)	Ft./Sec.	7.9	6.9	1.2	6.9	6.9	0.7	6.5	5.3	6.6	5.7	7.1	xxx
Slope of Exit Channel	Ft./Ft.	0.050	0.029	0.040	0.038	0.029	0.050	0.039	0.030	0.040	0.040	0.060	xxx
Maximum Water Surface Elevation	Ft.	474.0	388.9	401.0	338.7	311.9	321.8	377.6	310.0	376.5	365.0	307.3	xxx
Freeboard													
Rainfall Volume (FH)(areal)	In.	22.29	23.38	15.20	16.51	17.15	15.30	15.83	16.84	15.94	15.94	15.94	xxx
Runoff Volume (FH)	In.	17.12	20.79	12.69	14.13	14.77	12.94	13.32	14.31	13.13	13.13	13.13	xxx
Maximum Water Surface Elevation	Ft.	478.6	392.5	404.4	341.1	314.4	325.0	380.0	313.2	379.6	367.2	310.0	xxx
Capacity Equivalents													
Sediment Volume	In.	0.22	0.51	1.68	0.99	1.15	1.37	1.39	1.68	1.81	1.36	1.77	xxx
Retarding Volume	In.	2.78	4.27	4.44	4.66	4.70	4.89	4.73	4.32	4.79	5.00	4.23	xxx

1/ Volume included in submerged sediment.

TABLE 4 - ANNUAL COST

Ecleto Creek Watershed, Texas

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost	Total
Floodwater Retarding Structures Numbers 1 through 11	100,664	4,505	105,169
Project Administration	11,882		11,882
GRAND TOTAL	112,546	4,505	117,051

1/ Price Base: Installation - 1968, O&M - Adjusted normalized prices, April 1966.

2/ 100-years at 4.625 percent interest.

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Ecleto Creek Watershed, Texas

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	24,012	7,102	16,910
Other Agricultural	26,769	5,332	21,437
Nonagricultural			
Road and Bridge	2,755	580	2,175
Subtotal	53,536	13,014	40,522
Sediment			
Overbank Deposition	8,422	1,476	6,946
Erosion			
Flood Plain Scour	12,257	3,236	9,021
Indirect	7,421	1,772	5,649
Total	81,636	19,498	62,138

1/ Price Base: Adjusted normalized prices, April 1966.

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Ecleto Creek Watershed, Texas

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 4/	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Incidental 2/	Redevelop-ment	Other 3/	Secondary	Total		
Floodwater Retarding Structures Numbers 1 through 11	60,740	58,183	4,200	5,420	5,820	23,527	157,890	105,169	1.5:1.0
Project Administration								11,882	
GRAND TOTAL	60,740 5/	58,183	4,200	5,420	5,820	23,527	157,890	117,051	1.3:1.0

1/ Price Base: Adjusted normalized prices, April 1966.

2/ Includes $2,420 benefits from recreation and $1,780 benefits from livestock water.

3/ Benefits from reduction of damages to San Antonio River flood plain.

4/ From Table 4.

5/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $1,398 annually.

INVESTIGATIONS AND ANALYSES

Land Use and Treatment

The status of land treatment for the watershed was developed by the Karnes-Goliad, Wilson County, DeWitt County, and Comal-Hays-Guadalupe Soil and Water Conservation Districts assisted by personnel from the Soil Conservation Service at Kenedy, Floresville, Yorktown, and Seguin. Conservation needs data were compiled from existing conservation plans within the watershed and expanded to represent conservation needs of the entire watershed. The quantity of each land treatment practice, or combination of practices, necessary for essential conservation treatment was estimated for each land use by capability class. Acres, by land use, to be treated during the project installation period were estimated (table 1). Hydraulic, hydrologic, sedimentation, and economic investigations provided data as to the effects of land treatment measures on reduced flood damage. Although measurable benefits would result from application of planned 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 local people.

Hydrologic soil and cover conditions were determined by detailed mapping of a 20 percent sample of the watershed.

Present hydrologic cover conditions for rangeland and pasture were determined on the basis of the percentage of vegetative ground cover and litter. On cropland, present hydrologic cover conditions were determined after consultation with local Soil Conservation Service personnel concerning crops grown and rotations followed.

Future hydrologic cover conditions were estimated on the basis of the expected percentage of needed land treatment to be applied during the installation period and the probable effectiveness of the application.

Hydrology

Basic meteorologic and hydrologic data were tabulated from U.S. Weather Bureau Climatological Bulletins for the rainfall gage at Kenedy, Texas; U.S. Weather Bureau Technical Papers Nos. 40 and 49; and from U.S. Geological Survey surface water records. These data were analyzed to determine seasonal distribution of precipitation, rainfall volume-duration frequencies, rainfall-runoff relationships, and monthly rainfall and runoff volumes.

The present hydrologic conditions of the watershed were determined on the basis of land use and treatment, hydrologic soil groups, and hydrologic conditions. A condition II curve number of 79 for the hydrologic soil-cover complex was based on a 20 percent sample of the watershed. Analysis of land treatment to be applied during the installation period revealed that a condition II curve number of 78 is applicable for future project conditions.

Engineering surveys were made of valley cross-sections, high water marks, bridges, and other features pertinent in determining the extent of flooding.

The cross sections were selected to represent stream hydraulics and flood plain area. Final locations were made after joint study with the economist and geologist.

Water surface profiles for various csm (cubic feet per second per square mile) values were determined by using the computer service at the South Regional Technical Service Center. Cross section rating curves and stage-area inundated curves were developed from the water surface profiles. Area inundated data by incremental depths of flooding were developed for each evaluation reach, using runoff-peak discharge relationship for storms in the frequency series.

Present and project condition runoff discharge relationships were determined by flood routing the 50, 25, 10, and 2 year, 24-hour duration, storm runoff. These routings were accomplished by use of Technical Release No. 20, Project Formulation Program-Hydrology. Present and project condition peak discharges were then determined from these routings for the selected events of the frequency series.

Determinations were made of the area that would be inundated by storms of the frequency series under each of the following conditions: without project; with land treatment measures for watershed protection installed; and with land treatment and structural measures installed.

The maximum release rates for the principal spillways of floodwater retarding structures were designed to drawdown the detention pool volume in 10 days or less.

The appropriate emergency spillway and freeboard design storms were selected in accordance with criteria contained in NEH, Chapter 21, Section 4, Hydrology, Part I-Watershed Planning.

Engineering

Studies were made in the agricultural areas along and adjacent to the main Ecleto Creek channel and its tributaries to locate areas subject to flood damage. These areas were separated into evaluation reaches, making it possible to plan a system of structural measures which would reduce the damages to an acceptable level.

Investigations were made on several sites for multiple-purpose storage. The feasibility of including storage of water for recreational use in Sites Nos. 8 and 9 was investigated. After considering their share of construction costs and the difficulty of obtaining water rights, the sponsoring local organizations decided against inclusion of recreational water storage in either site. The feasibility of providing municipal water storage for the community of Gillett was investigated at several floodwater retarding structure sites which were not included in the final plan. Local leaders determined that the present source provides adequate water for future needs.

Intensive investigations and field surveys were made within the watershed in order to formulate the most feasible system of structural measures

necessary to meet project objectives. Thirty-one floodwater retarding structure sites were surveyed, topographic site maps developed, and basic structure design data prepared. These maps, related surveys, and basic site data provided necessary information to determine if required sediment and floodwater detention capacity could be obtained. The limits of pool areas, estimated installation costs, and the most economical design for each structure were analyzed.

Multiple routings for principal spillway sizings to determine floodwater retarding storage were made. Also, multiple routings of freeboard hydrographs were made to determine spillway proportions and height of dam which would result in the most economical and feasible design of structures. These investigations provided valuable information for comparison of benefits and construction costs with alternate systems of control.

Eleven floodwater retarding structures were selected for inclusion in the final work plan. Their locations are shown on Figure 4. Table 3 provides specific site information.

The most feasible system of floodwater retarding structures needed to meet project objectives made it necessary to plan a number of structures in series. Site No. 1 was necessary to afford protection to the intervening flood plain above Site No. 2. Site No. 4 was necessary in order to avoid costly obstacles that would be involved if only Site No. 5 were considered. Site No. 7 was necessary to provide protection to intervening flood plain above Site No. 8. Sites Nos. 9 and 10 were planned in series with Site No. 11 in order to provide maximum flood protection at minimum total cost.

Sediment and floodwater storage, structure classification, and emergency spillway layout and design meets or exceeds criteria outlined in Engineering Memorandum SCS-27 (Rev.) and Texas State Manual Supplement 2441.

Detail surveys and investigations were made of State, county, and farm roads having crossings on streams below floodwater retarding structures. Detail investigations were also made to see what effect floodwater retarding structures would have on State highways above sites.

Release rates for principal spillways of the floodwater retarding structures are designed to drain the detention pools in 10 days or less after inflow ceases.

When the structural measures for flood prevention had been determined, a table was developed to show the total cost of each structure (table 2).

A second cost table was developed to show separately the annual installation cost, annual maintenance cost, and total annual cost of structural measures (table 4).

Geology

Soils and Foundations

Preliminary geologic investigations were made at each of the floodwater retarding structure sites to obtain information on the nature and extent of embankment and foundation materials, types of material in emergency spillway excavation, emergency spillway stability, and other problems that might be encountered during construction. These investigations included hand auger borings and surface observations of valley slopes, alluvium, channel banks, and exposed geologic formations. Geologic maps and reports pertaining to the watershed vicinity were studied.

Findings of these investigations were used in making cost estimates of structures and to assure that sites selected are feasible for construction.

Detailed investigations, including exploration with core drilling equipment, will be made at all sites prior to final design. Laboratory tests will be made to determine suitability and methods of handling foundation and embankment materials.

The topography at all sites is gently rolling. The only significant relief occurs where streams have migrated into the upland leaving steep bluffs.

Sites are located on outcrops of poorly consolidated continental and marine Tertiary sediments which were deposited in or near the Gulf of Mexico. These strata range from Eocene to Miocene in age and dip gently gulfward beneath progressively younger strata.

The following tabulation shows the geologic outcrops on which floodwater retarding structure sites occur.

Site No.	Outcrop			
	Age	Group	Formation	Member
1	Eocene	Claiborne	Mt. Selman	Queen City Sand
2, 3	Eocene	Claiborne	Cook Mountain	-
4, 5, 6	Eocene	Jackson (undifferentiated)	-	-
7, 8	Oligocene	Gueydan	Catahoula Tuff	-
9, 10, 11	Miocene	Fleming	Oakville Sandstone	-

The Queen City Sand is composed primarily of continental deposits of poorly to moderately indurated, yellowish gray sandstone bearing appreciable amounts of clay and silt in some beds. Beds of shale and siltstone are not uncommon. Site No. 1 is the only site on outcrop of the Queen City Sand. It is located across an aggrading segment of the main stem of Ecleto Creek. Surface material on both the upland and flood plain is predominantly silty sand ranging from one to five feet in thickness. The foundation consists of alluvial beds and lenses of silty clay, sandy clay, silty sand, and fine to medium grained sand, ranging from five to twelve feet thick. This is

underlain by the Queen City bedrock. On abutments, the depth to bedrock ranges from three to eight feet. Soils available for use in the embankment, including those to be excavated from the emergency spillway, are silty CL, sandy CL, SM, CH, and SC as classified in accordance with the Unified Soil Classification System.

Sites Nos. 2 and 3 are located on the outcrop of the Cook Mountain Formation. This formation consists of marine and continental deposits of stiff red, gray, and yellow clays and shales interbedded with beds and lenses of dense clayey sand and thin sandstone. The two sites are characterized by alluvial beds and lenses of sandy clay, silty clay, and clayey sand in the flood plain, ranging up to 15 feet in depth. Some silty sand beds are included in the alluvium at Site No. 2 which is located on the main stem of Ecleto Creek. Abutments are underlain at shallow depths by shaley clay, shale, and claystone of the Cook Mountain Formation. A relatively positive cutoff can be attained at moderate depths of both sites. Soils available for use in the embankment of Site No. 2 are sandy CL, silty CL, SM, SC, and CH. The Site No. 2 embankment will consist primarily of sandy CL with minor amounts of CH and ML.

Sites Nos. 4, 5, and 6 are located on the outcrop of the Jackson Group which is composed of shallow water marine and beach deposits of compact clays interbedded with siltstones, sands, and sandstones. Abutments are composed of fine to medium textured surface soils underlain by bedrock at depths ranging from one to five feet. Flood plain alluvium is composed mostly of beds and lenses of sandy clay, clayey sand, and silty sand. Parent material at Site No. 4 contains minor pockets of gypseous soils. Although no bentonitic soils were noted during preliminary investigations, there is a better then remote probability that some will be encountered during detailed investigations. Soils available for embankment use are primarily sandy CL, SC, and SM.

The Catahoula Tuff consists of continental sands, clays, and pyroclastics. At Sites Nos. 7 and 8, the formation is characterized by dense beds of olive-green tuff containing beds and lenses of compact clay and poorly consolidated silty sand. The depth to bedrock ranges from a few feet on abutments to about 20 feet in the flood plains. It is overlain by alluvial silty clays, sandy clays, and silty sands on the flood plain and fine to medium textured residual soils on abutments. It is believed that cutoffs extending to bedrock will eliminate the need for drainage measures. Although no highly bentonitic soils were noted during preliminary investigations, it is probable that such soils will be encountered during the detailed investigations. Soils available for the Site No. 7 embankment are sandy CL, CH, and SM. The Site No. 8 embankment will consist primarily of sandy CL.

Sites Nos. 9, 10, and 11 are located on the outcrop of the Oakville Sandstone. Continental deposits of poorly cemented calcareous sand, sandy clay, and marl make up the major part of the formation. Alluvial deposits, ranging to 15 feet in thickness and consisting of silty clay, sandy clay, clayey sand, and silty sand, overlie bedrock in the flood plain. On abutments, bedrock is overlain by two to five feet of fine textured soils. Soils available for embankments will be primarily alluvial sandy CL, SM, and

SC from the sediment pool. Emergency spillway excavation will yield mostly silty CL with minor amounts of CH, SC, and SM.

No rock excavation is expected in emergency spillway excavation at any of the floodwater retarding structure sites. However, some isolated zones of well cemented sandstone spheriods may be encountered within the Jackson Group at Site No. 4. The volume of such rock excavation would be very minor.

It is expected that Sites Nos. 1, 2, 4, 5, 6, 7, 9, and 10 will have zoned embankments because of the wide range in engineering properties of soils available. At Sites Nos. 3, 8, and 11, selective placement of soils should be sufficient. If it becomes necessary to use highly gypseous, bentonitic, or silty soils, extreme caution will be taken in their placement.

If construction takes place during rainy periods, the depth of borrow excavation could be limited at Sites Nos. 1, 9, and 10 because of high water tables.

The need for foundation drainage measures is anticipated for all planned floodwater retarding structures except those located on the Catahoula and Cook Mountain Formations. At Site No. 1, the need for a combination foundation and embankment drain is expected.

Sedimentation

Determinations of the 100-year sediment storage requirements for the eleven planned floodwater retarding structures were made according to the following procedure:

Detailed investigations were made within sample areas selected to represent each of ten geologic formations. Average annual sheet erosion rates, for both present and future conditions, were computed for each land use within each formation outcrop. The soil loss equation by Musgrave was used.

Geologic and land use maps were made for drainage areas of all floodwater retarding structure sites. Estimates of average annual sheet erosion within the drainage areas of structure sites were based on the appropriate erosion rates applied to the area of each corresponding land use within each formation outcrop.

Computations of gully and streambank erosion were based on estimated lateral bank erosion rates, bank heights, and channel lengths affected by erosion.

Sediment delivery ratios and trap efficiency adjustments were applied to computed average annual erosion to arrive at estimates of sediment volumes to be deposited in reservoirs.

Allowances were made for differences in density between soil in place and sediment. These densities were based on volume weights

of 56 to 95 pounds per cubic foot for submerged sediment and 85 to 98 pounds per cubic foot for soil in place.

Allocation of sediment to the pools of floodwater retarding structures was based on sediment texture and reservoir topography. The allocations were 40 to 45 percent in sediment pools, 45 percent in sediment reserve pools, and 10 to 15 percent in detention pools.

Investigations and computations to determine the nature and extent of physical damage to flood plain lands were made in accordance with the cross section method.

Estimated reductions of damaging sediment yield were based on detailed sediment source studies. Sediment yields to evaluation reaches were computed for without-project conditions, with land treatment measures applied, and with the combined program of land treatment and structural measures installed. The reductions in sediment yields were adjusted to reflect the relative importance of each sediment source as a contributor of damage.

Economics

Basic methods used in the economic investigations and analyses are outlined in the "Economics Guide for Watershed Protection and Flood Prevention", U. S. Department of Agriculture, Soil Conservation Service, March 1964.

Evaluation of Damages

For evaluation purposes, the flood plain was divided into five reaches based on significant differences in land use, drainage pattern, and characteristics of flooding. Owners and operators of approximately 60 percent of the flood plain land were interviewed concerning flooding and flood damage; past, present, and intended future use; and yield data. The views of experienced local agricultural workers were also obtained and considered in estimating future yields and land use changes.

The synthetic frequency method of analysis of damages was used, and the the occurrence of more than one flood in a growing season was considered in determining crop and pasture damage. The computed damages were discounted for the recurrence with allowance for partial recovery of crops between floods.

Other agricultural damages to fences and farm roads, livestock losses, and the cost of removing debris from fields were estimated from information collected in the field and correlated with area and depth of flooding.

Road and bridge damages in the flood plain were based on information obtained from county commissioners, state highway officials, and supplemented by information from local residents.

Monetary damages to the flood plain from scour and overbank deposition were based on the value of production losses. Scour damage reductions were related to the area of flooding, and influenced by the increased scouring effect from deeper flows. Reduction in monetary damages from sediment deposition was based on the effectiveness of land treatment measures, trap efficiency of planned floodwater retarding structures, and the average annual area flooded under each progressive phase of the project.

Benefits from Reduction of Damages

Average annual damages within the watershed were calculated for conditions without a project, with planned land treatment, and after installation of the complete project.

The difference between the damages after the installation of a phase of the project and that before its installation constitued the benefit from reduction of damages creditable to that phase.

Installation of this project will result in damage reduction benefits on the main stem flood plain of the San Antonio River. Analysis of data contained in "Survey Reports of the San Antonio River Watershed", Soil Conservation Service, November 1952, indicated that average annual damage reduction benefits of $0.17, at adjusted normalized prices, would accrue downstream from this watershed for each acre-foot of detention capacity in floodwater retarding structures installed in Ecleto Creek watershed.

Evaluation of More Intensive Land Use

During field investigations, farmers were asked what changes had been made in their flood plain land use as a result of past flooding. It was found that some cropland has been returned to pasture as a result of flooding and crops less susceptible to damage were being planted. They were also asked what changes they would make in their use of the flood plain if flooding were reduced. Farmers indicated that when flooding is reduced, woods and brush will be cleared. This land, plus some of the open pasture land, will be planted to hay and coastal bermudagrass.

Estimates of benefits from more intensive land use of the flood plain were based on changes indicated by farmers, land capabilities, and the general agricultural economy. Consideration was given for added damage expected to the higher value production from the remaining flooding. Additional costs of production, harvesting, and associated costs were deducted from the expected increase in production. Benefits were discounted to allow for a 5-year lag in accrual. Prices were converted to adjusted normalized price levels. The average annual net benefits from intensification are estimated to be $59,520.

Incidental Recreation Benefits

Incidental recreation benefits were evaluated for sediment pools of floodwater retarding structures expected to be open to the public. A gross value of $1.00 per visitor-day in keeping with recommendations in Watersheds

Memorandum-57, dated October 3, 1962, was used to evaluate the 3,500 visitor-days of recreation. Associated costs of development, including replacement, operations, and maintenance, were deducted from the gross value of benefits. Present worth benefits were calculated allowing for full use and attractiveness during the first 40 years, with a gradual diminishing of attractiveness during the next 10 years to zero at the end of 50 years and thereafter.

Incidental Livestock Water Benefits

Incidental livestock water benefits were evaluated for sediment pools of floodwater retarding structures not expected to be used for recreation. The annual benefits were considered to be equal to the annual equivalent costs, including maintenance costs, of providing the same water resource in numerous smaller livestock ponds. Benefits were discounted to allow for full level of use during the first 40 years with a gradual diminishing of use during the next 10 years to zero at the end of 50 years and thereafter.

Redevelopment Benefits

Redevelopment benefits which would accrue during project installation and from operation and maintenance were calculated by applying prevailing wage rates to the amount of local labor by classes and types that will be used by contractors. This estimate was converted to an average annual equivalent value by the application of appropriate amortization factors. The estimate of the amount of local labor which will be used was based on an analysis of recent contracts. Karnes County has been designated as a county eligible for assistance under provisions of the Economic Development Act.

Negative Project Benefits

Areas that will be used for project construction and areas to be inundated by pools of reservoirs were excluded from damage calculations. Net income from production to be lost in these areas after installation of the project was compared with the appraised value of the land amortized over the period of project life. No production in sediment pools was considered and the land covered by detention pools was assumed to be grassland under project conditions. The annual value of the loss of net income from these areas was less than the amortized value of the land; therefore, the easement value was used in economic justification.

Secondary Benefits

The value of local secondary benefits stemming from the project were estimated to be equal to 10 percent of direct primary benefits, including those from reduction of damages, incidental recreation, and intensification. The value of local secondary benefits induced by the project were estimated to be equal to 10 percent of the increased expenditures associated with more intensive land use. This excludes all indirect benefits from the computation of secondary benefits.

Fish and Wildlife

The Bureau of Sport Fisheries and Wildlife, in cooperation with the Texas Parks and Wildlife Department, has completed a reconnaissance study of Ecleto Creek watershed. This report was valuable in work plan development pertaining to fish and wildlife. In addition to data presented in other parts of the work plan, the following is reproduced from the Bureau of Sport Fisheries and Wildlife reconnaissance survey report:

> "No special measures to prevent damages to the resources that would result from project work are required, nor are there any particular measures that should be incorporated in project work plans that would benefit these resources substantially."

A detailed study of the watershed by the Bureau of Sport Fisheries and Wildlife was not considered necessary at this time. Should the sponsors desire, the Bureau, in cooperation with the Texas Parks and Wildlife Department, would be happy to be of further assistance.

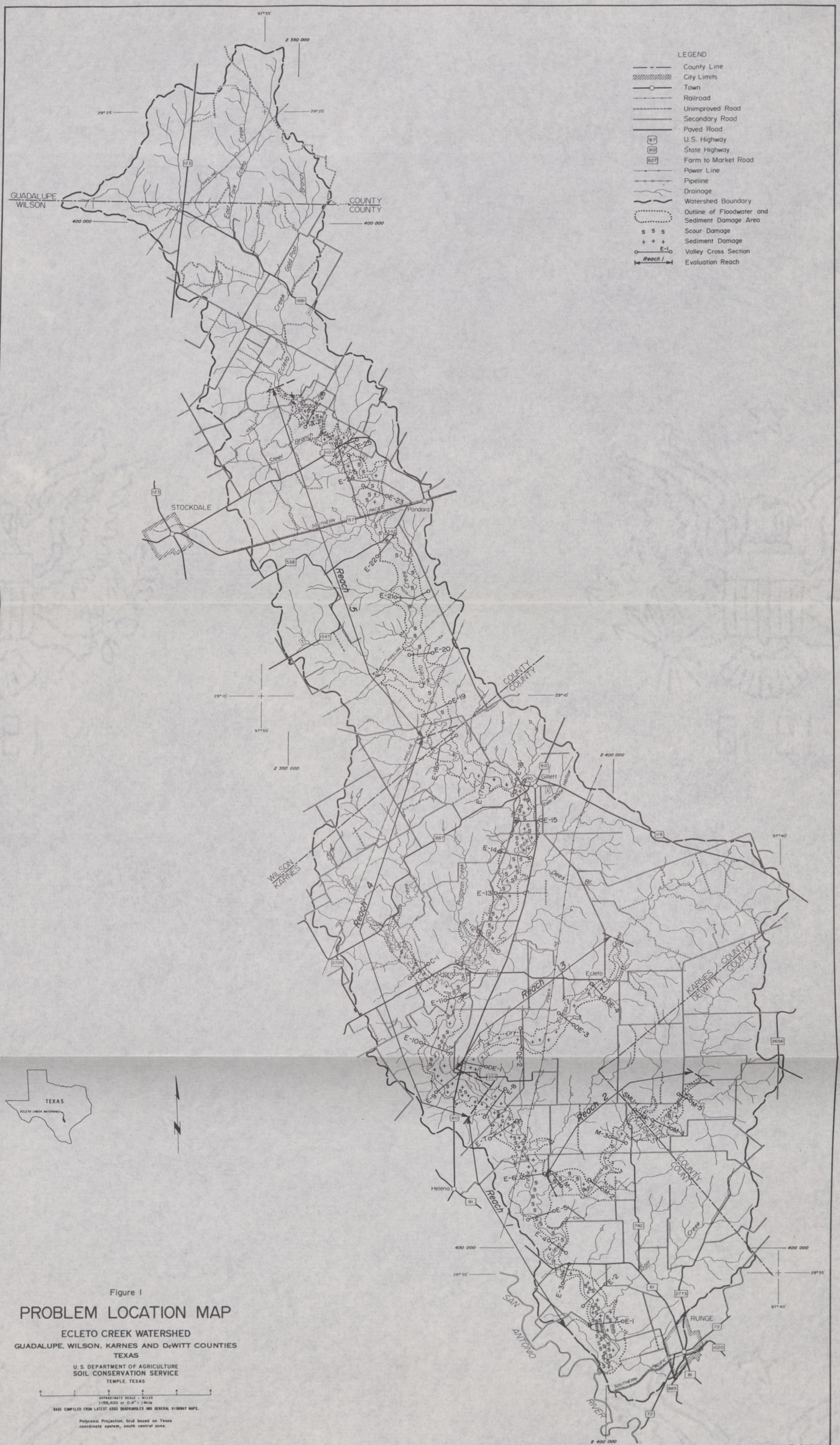


Figure 1

PROBLEM LOCATION MAP

ECLETO CREEK WATERSHED

GUADALUPE, WILSON, KARNES AND DeWITT COUNTIES

TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

APPROXIMATE SCALE — MILES
1:158,400 or 0.4" = 1 Mile

BASE COMPILED FROM LATEST USGS QUADRANGLES AND GENERAL HIGHWAY MAPS.

Polyconic Projection. Grid based on Texas coordinate system, south central zone.

USDA SCS-FORT WORTH, TEX. 1968

Nov. 1968 4-R-27332
Rev. Dec. 1968 Dec. 1966 4-R-23175

ГЛАВНЫЙ ГЕОДЕЗИЧЕСКИЙ ИЗДАТЕЛЬСКИЙ ОТДЕЛ

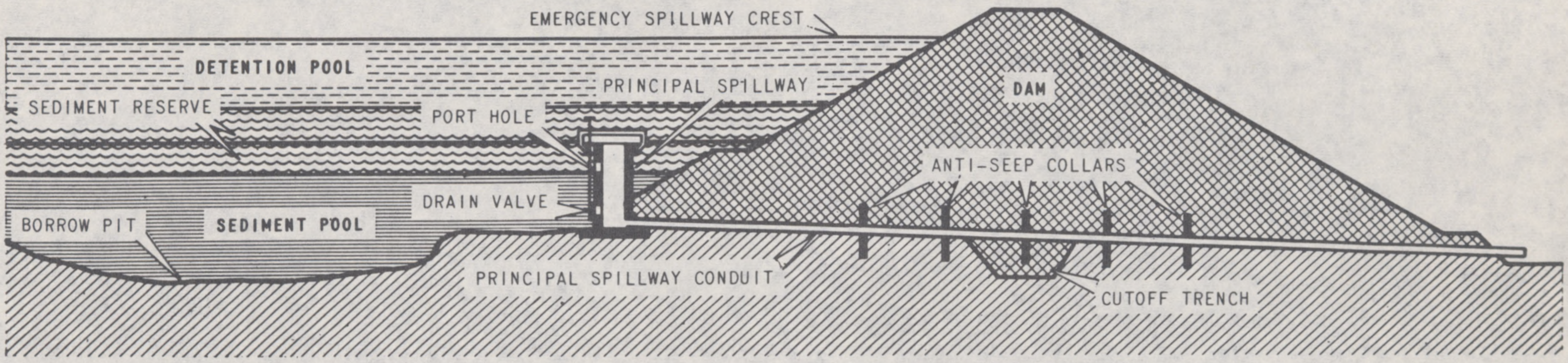


Figure 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

NOTES:

1. Emergency Spillway Diversions and Stub Diversions (S.D.): 18" effective height, 3:1 side slopes, minimum Base 13 ft., shall be constructed at the approximate locations shown on Plan; final locations to be determined by the Engineer. (See Construction Specification 5).
2. A minimum of 6" topsoil shall be placed in Emergency Spillway and on all Earth Fill Areas. (See Construction Specification 20C).

EMERGENCY SPILLWAY CURVE DATA
Δ = 129°30'
D = 32°00'
R = 179.19'
L = 404.7
P.C. = Sta. 11+75.3
P.T. = Sta. 15+80

ELEVATION	SURFACE ACRES	STORAGE ACRE FEET	STORAGE INCHES
276	2.0	4	0.02
280	3.5	15	0.06
284	12.0	46	0.20
288	19.5	109	0.47
290.3	28.0	166	0.72
292	36.0	220	0.95
294.5	52.0	325	1.41
296	61.0	414	1.79
300	87.0	710	3.07
304	120.5	1125	4.87
304.9	129.0	1242	5.38
308	160.5	1687	7.31
312	207.5	2423	10.49

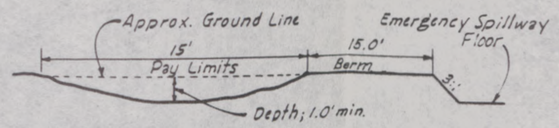
Top of Dam (Effective) Elev.	309.4
Emergency Spillway Crest Elev.	304.9
Principal Spillway Crest Elev.	290.3
Sediment Pool Elev.	290.3
Drainage Area, Acres	2771
Sediment Storage, Acre Feet	381
Floodwater Storage, Acre Feet	861
Max. Emergency Spillway Cap. cfs	5640

Emergency Spillway Diversion
14' Gap
15' Berm
Waterway No. 1
Emergency Spillway Diversion
Upstream Toe
18' Berm, El. 283.0 @ Principal Spillway Grade berm from right to left @ approx. 0.2 % grade.
12' Berm El. 289.8
Sta. 1+50 on ℄ of Principal Spillway ≅ Sta. 17+47 on ℄ of Dam
Sta. 15+80 Right side Emergency Spillway ≅ Sta. 10+00 ℄ Dam
Downstream Toe
Waterway No. 2
14' Gap in 30' of Fence

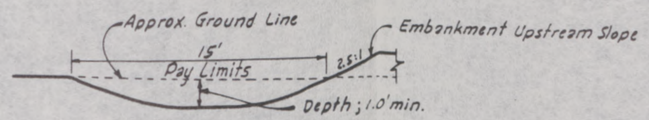
PLAN OF EMBANKMENT AND SPILLWAYS

0 100 200 300 400 500
SCALE IN FEET

EMBANKMENT CURVE DATA
Δ = 66°30'
D = 15°
R = 382.0'
L = 443.33'
P.C. = Sta. 19+40
P.T. = Sta. 23+83.33



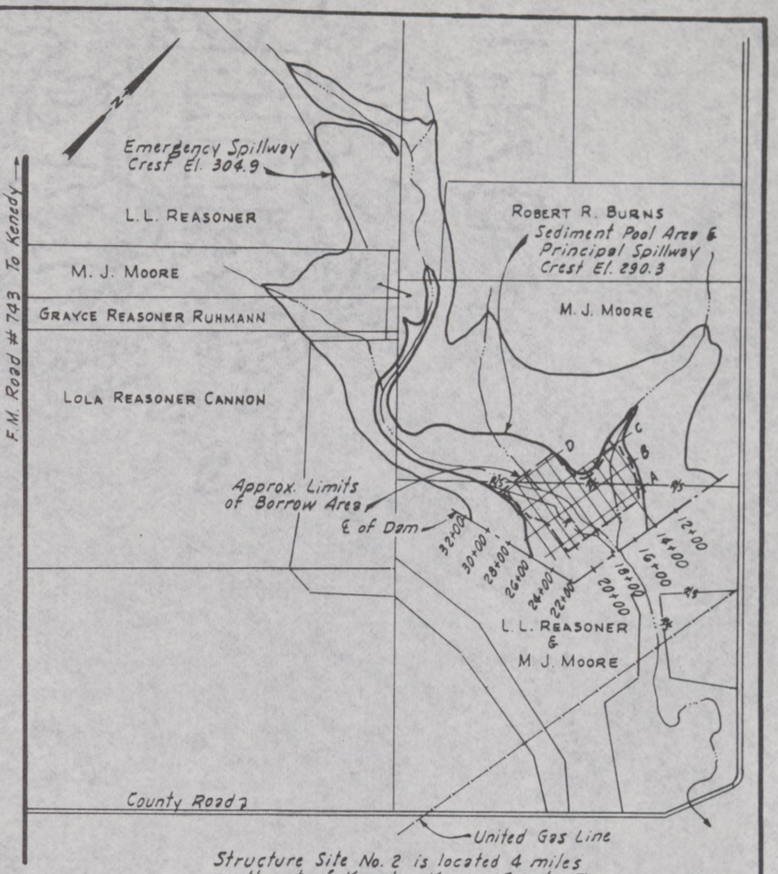
WATERWAY NO. 1 (PARABOLIC)



WATERWAY NO. 2 (PARABOLIC)

Lines and grades of Waterways Nos. 1 & 2 shall be staked and constructed to establish a parabolic bottom in the transverse direction, with longitudinal grade approximating the grade of natural ground, as staked by the Engineer. Final Constructed surfaces of the Waterways shall be dressed by blading. Any excess excavation may be used for "Earth Fill, Embankment" as directed by the Engineer. (See Construction Specification 203).

TYPICAL SECTIONS - WATERWAYS NO. 1 AND NO. 2



Structure Site No. 2 is located 4 miles southeast of Kenedy, Karnes County, Texas.
For limits of clearing, and clearing and grubbing, see Construction Specifications 1 and 2.

VICINITY MAP & GENERAL PLAN OF RESERVOIR

0 500 1000 1500 2000
SCALE IN FEET

FENCE LEGEND

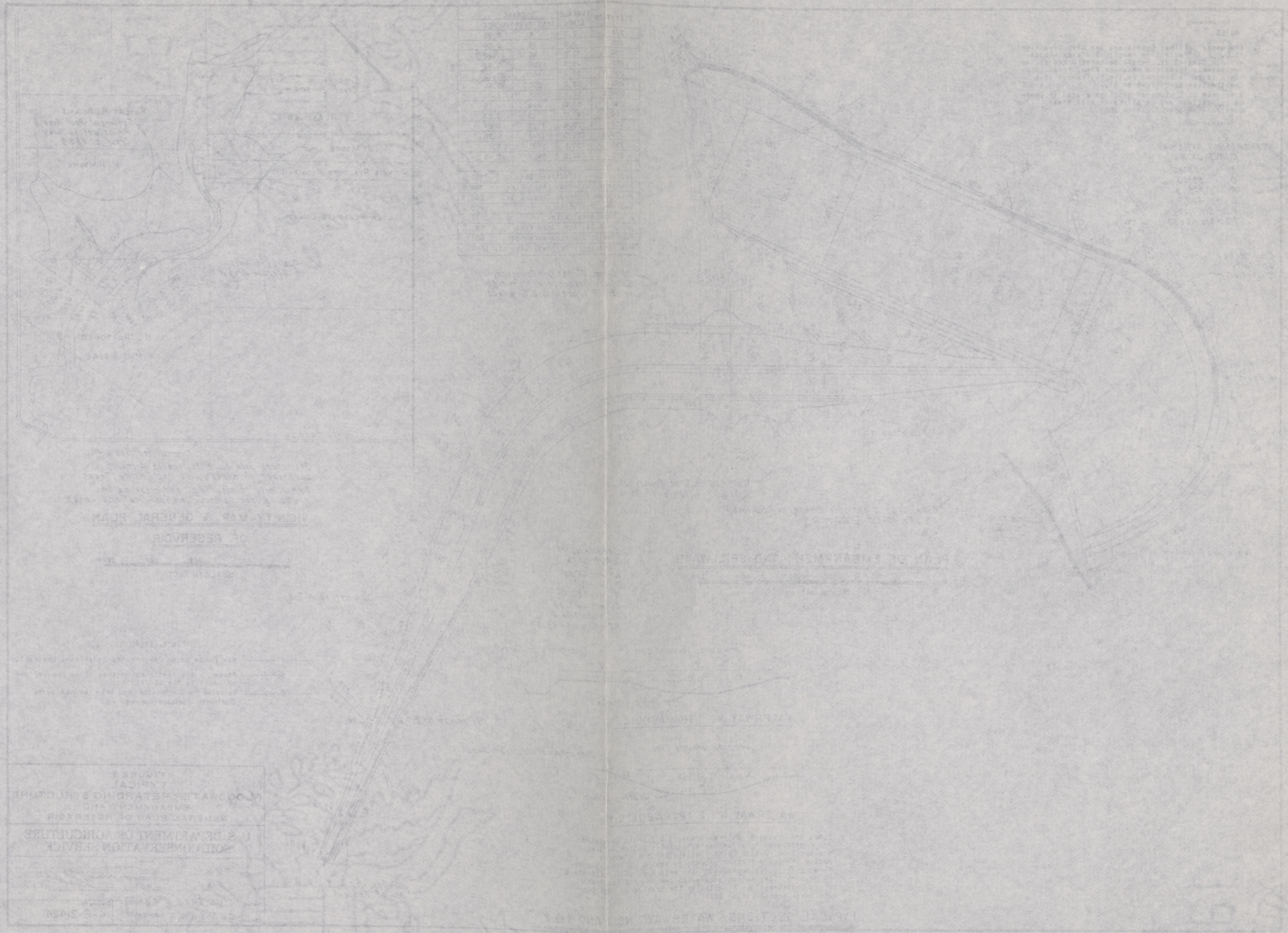
C	New Fence to be Constructed under this Contract.
R	Fence in the construction area to be removed and salvaged by the Contractor.
R	Fence in the Construction area to be removed by the Contractor. (Salvage not required.)

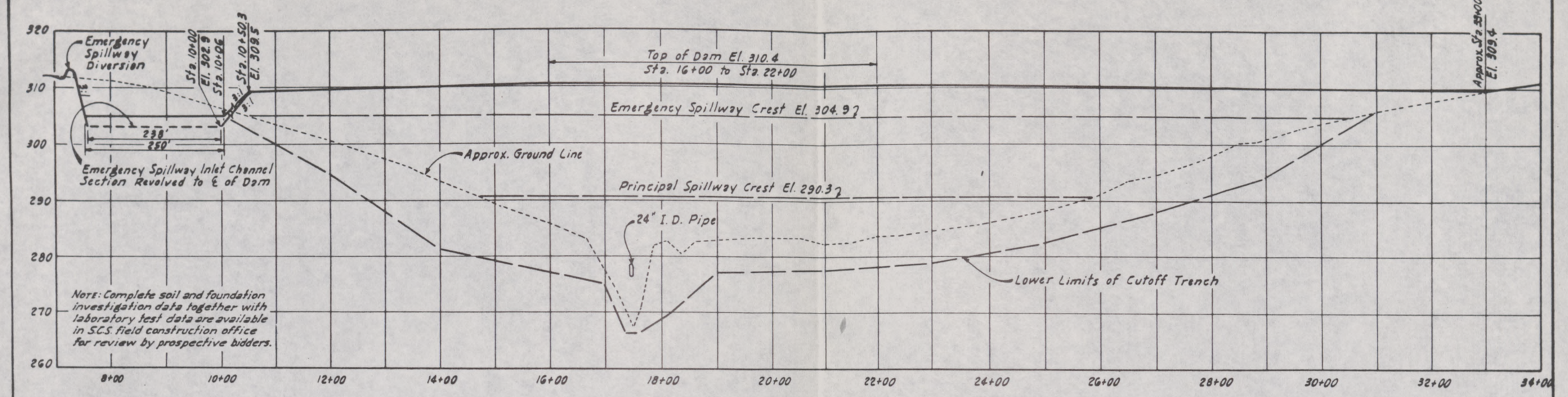
FIGURE 3
TYPICAL
FLOODWATER RETARDING STRUCTURE
EMBANKMENT AND
GENERAL PLAN OF RESERVOIR

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

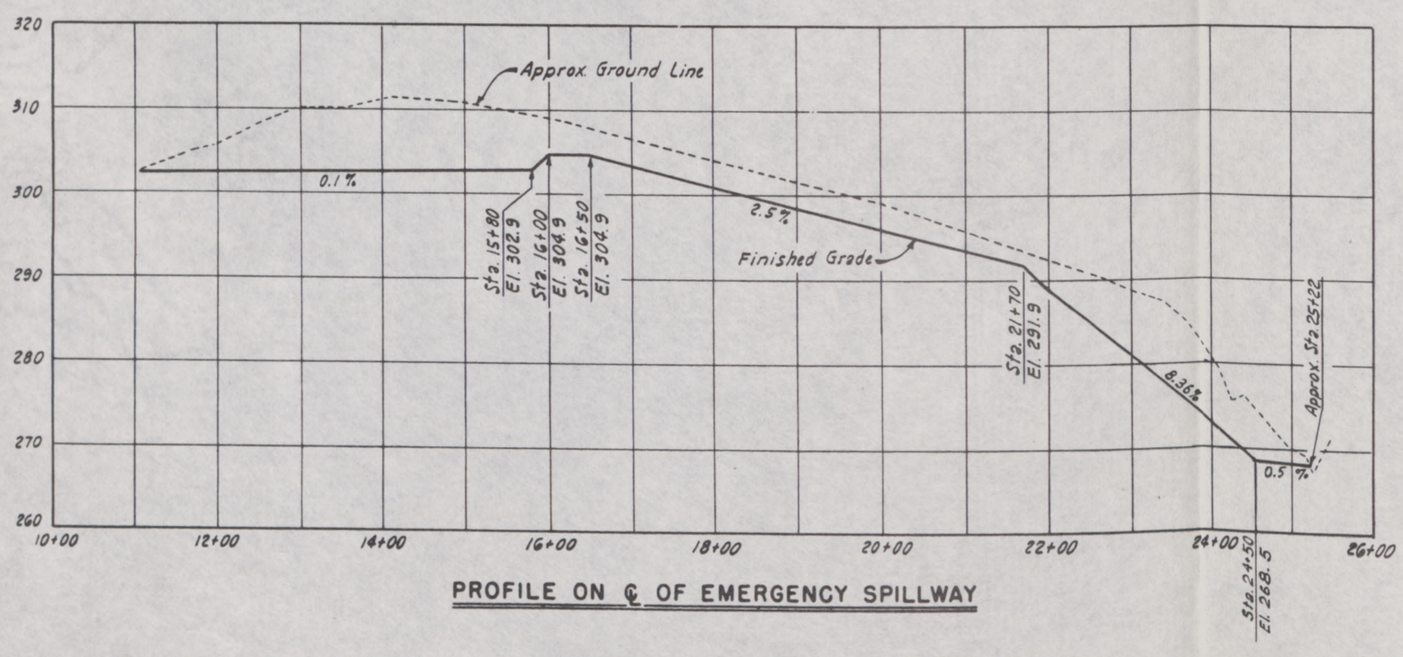
	Date	Approved by
Designed G.V.M.	3-66	HEAD ENGINEERING & WATERSHED PLANNING UNIT FORT WORTH, TEXAS
Drawn G.V.M.	3-66	STATE CONSERVATION ENGINEER S.C.S. TEMPLE, TEXAS
Traced G.V.C. E.A.L.C.	4-66	Sheet No. 2 of 13
Checked G.J.M. E.G.W.T.	4-66	Drawing No. 4-E-21424

56-934 O-71 (Face blank p. 52) No. 1

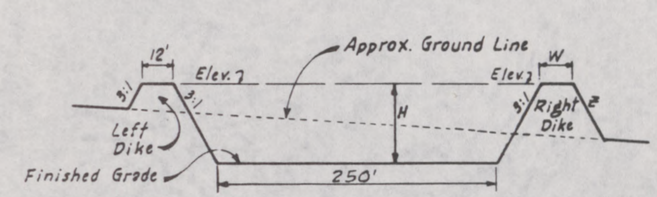




PROFILE ON ℄ OF DAM



PROFILE ON ℄ OF EMERGENCY SPILLWAY



Left Dike:
From ground line @ approx. Sta. 19+00 to ground line @ approx. Sta. 21+85, H = 3'.

Right Dike:
Approx. Sta. 15+80 to Embankment; Elev. 309.5, W = 14', Z = 2.5:1.
Transition from Embankment to Sta. 17+00.
From Sta. 17+00 to ground line @ approx. Sta. 22+50; W = 12', Z = 3:1, H = 3.

Material forming dikes shall be placed and paid as "Earth Fill, Embankment."

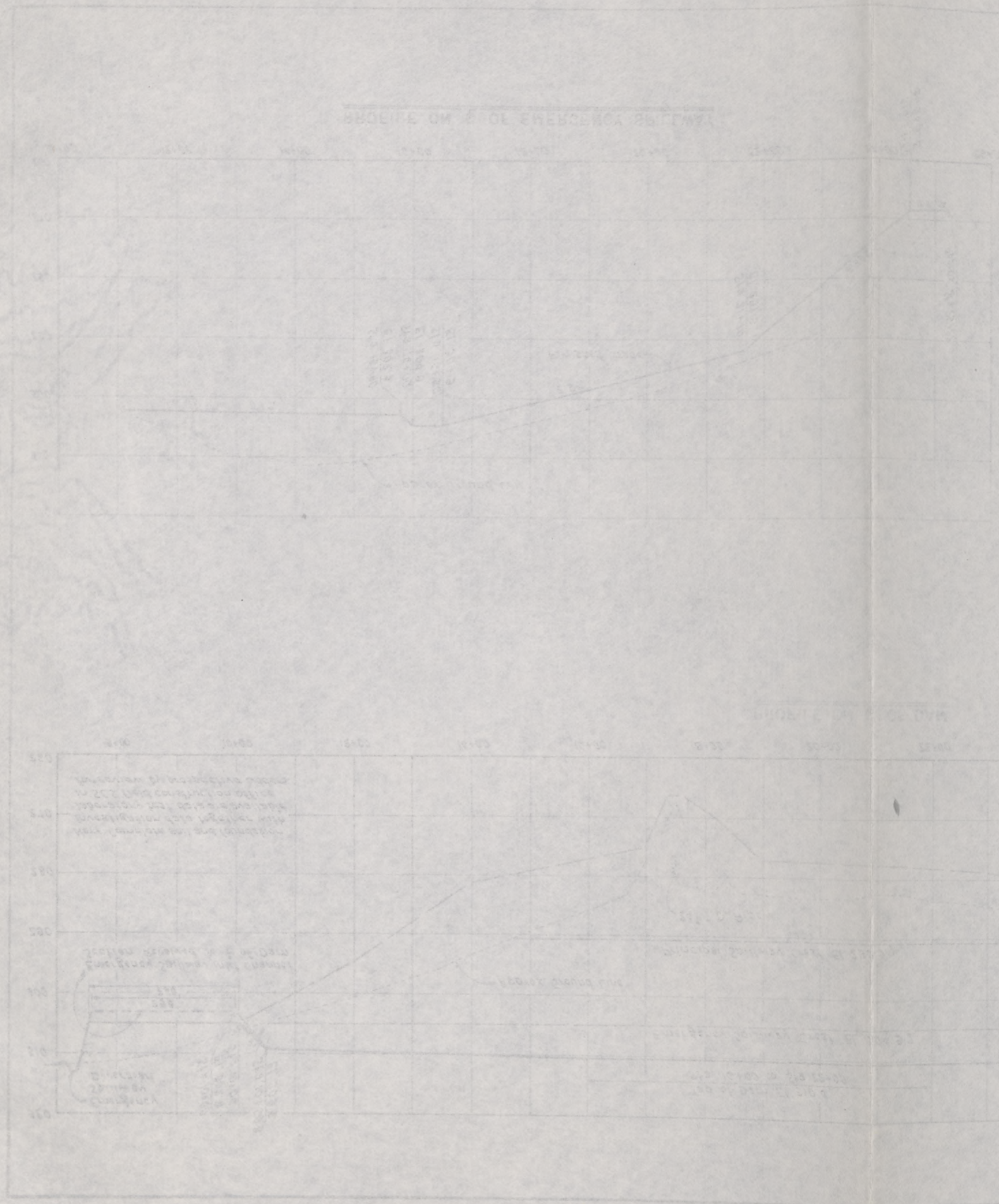
TYPICAL SECTION - EMERGENCY SPILLWAY

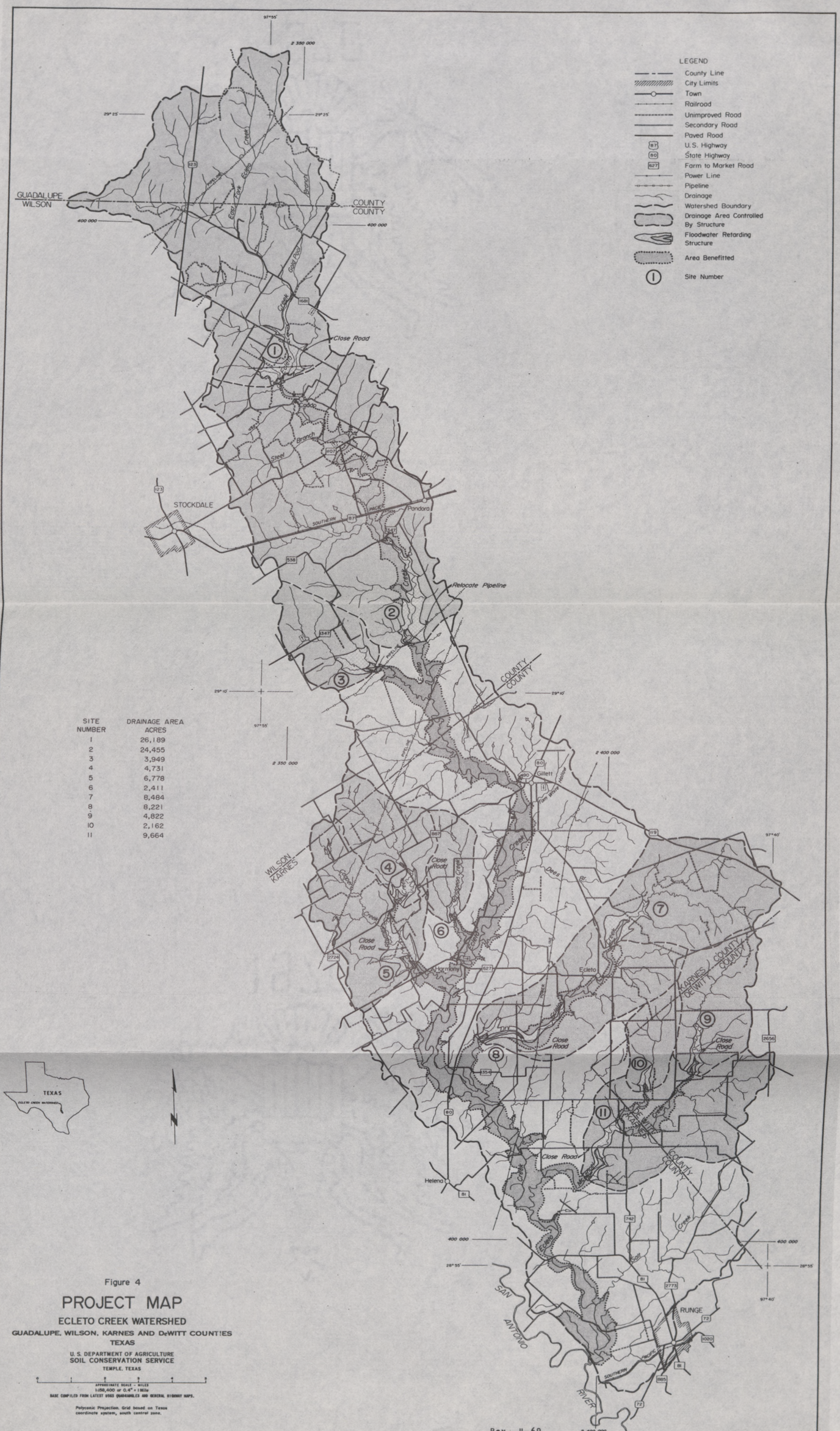
FIGURE 3A
TYPICAL
FLOODWATER RETARDING STRUCTURE
SECTION AND PROFILES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	G.V.M.	3-66	Approved by HEAD ENGINEERING & HAZARD ANALYSIS UNIT FORT WORTH, TEXAS
Drawn	G.V.M.	3-66	STATE CONSERVATION ENGINEER, TEXAS
Traced	G.V.C. & A.L.G.	4-66	Sheet No. 3 of 13
Checked	G.J.M. & G.W.T.	4-66	Drawing No. 4-E-21424

56-934 O-71 (Face blank p. 52) No. 2





SITE NUMBER	DRAINAGE AREA ACRES
1	26,189
2	24,455
3	3,949
4	4,731
5	6,778
6	2,411
7	8,484
8	8,221
9	4,822
10	2,162
11	9,664

Figure 4

PROJECT MAP

ECLETO CREEK WATERSHED

GUADALUPE, WILSON, KARNES AND DeWITT COUNTIES
TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

APPROXIMATE SCALE - MILES
1:158,400 or 0.4" = 1 Mile

BASE COMPILED FROM LATEST USGS QUADRANGLES AND GENERAL HIGHWAY MAPS.

Polyconic Projection. Grid based on Texas coordinate system, south central zone.

Rev. 4-69

Nov. 1968 4-R-27331
Rev. Dec. 1968 Dec. 1966 4-R-23175

PROJECT MAP

WATERSHED WORK PLAN

ECLETO CREEK WATERSHED

Guadalupe, Wilson, Karnes, and DeWitt Counties, Texas

ADDENDUM

This Addendum shows the project costs, benefits, and benefit-cost ratio based on a 5-1/8 percent interest rate. Annual project costs, benefits, and benefit-cost ratio are as follows:

1. Project costs are $128,674
2. Project benefits are 157,758
3. The project benefit-cost ratio is 1.2 to 1

Since the preparation of this watershed work plan, the Federal interest rate for benefit and cost evaluations has been increased from 4.625 percent to 4.875 percent.

As a result, annual equivalent costs for the installation of these structural measures will increase from $112,546 to $118,344. The total average annual cost of structural measures (amortized total installation cost, plus operation and maintenance costs) will be increased to $122,849. Average annual benefits, excluding secondary benefits, accruing to structural measures will change to $134,298, resulting in a benefit-cost ratio of 1.1 to 1.0.

Total average annual project benefits, including secondary benefits, will change to $157,793, resulting in a benefit-cost ratio of 1.3 to 1.0.