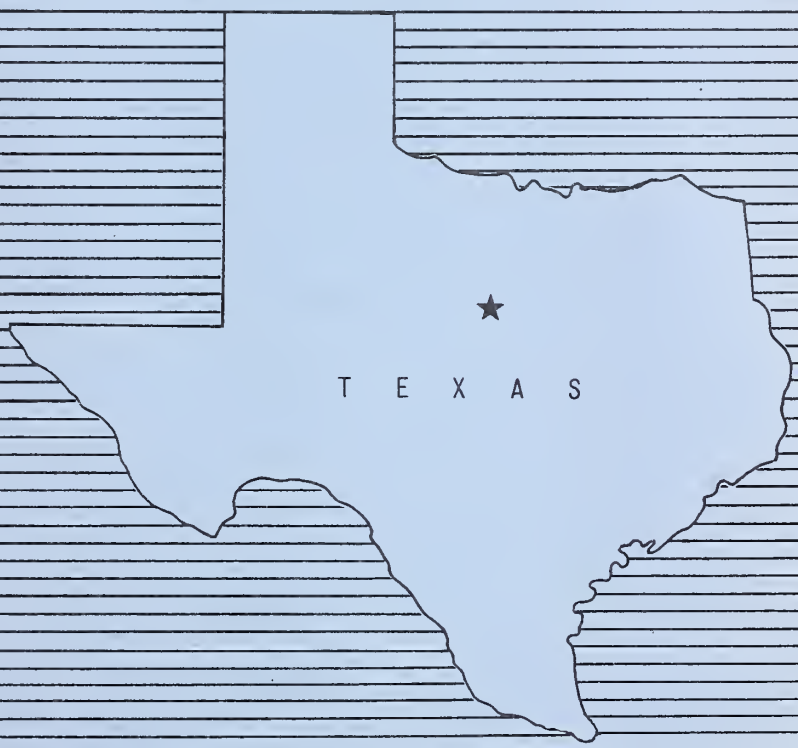
WORK PLAN

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

POLLARD CREEK WATERSHED

PALO PINTO COUNTY, TEXAS



JULY 1975

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ADDENDUM

POLLARD CREEK WATERSHED, TEXAS

INTRODUCTION

This addendum is based on the Water Resource Council's "Principles and Standards for Planning Water and Related Land Resources," which became effective October 30, 1973. It is prepared to be consistent with the requirements of the Water Resource Council's Procedure No. 1 for the phase-in of the Principles and Standards. The information presented is:

Part I - Benefits to Cost Comparison

An evaluation of the selected plan using current normalized prices, current construction costs, and the current interest rate.

Part II - Four Account Displays

Evaluated effects of the selected plan are displayed under separate accounts for (1) National Economic Development, (2) Environmental Quality, (3) Regional Development, and (4) Social Well-Being. The displays are consistent with the intent of the Principles and Standards.

Part III - Abbreviated Environmental Quality Plan

An environmental quality plan, consistent with the intent of the Principles and Standards, but which is abridged in detail, has been developed by an interdisciplinary team. It is an alternative plan to the selected plan and is formulated to enhance environmental quality by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. This plan was formulated from information and data obtained during the investigative and analysis phases of project planning. Formulation began with the inventory and recognition of the watershed problems and needs. Desired environmental effects, as translated from the problems and needs, provided a basis for examining appropriate water and land resource use and management opportunities. Opportunities that emphasized contributions to the component needs were selected and are shown as plan elements of the abbreviated environmental quality plan. The cost of $907,880 for its installation is a preliminary estimate.

Implementation of features of this environmental quality plan would require acceptance by the local people. Adequate legal authorities do exist for installation; however, funding for all plan elements is presently not available through existing legislative authorities.

PART I

This addendum shows the project cost, benefits, and benefit-cost ratio based on a 6-1/8 percent interest rate, current normalized prices and the 1974 price base. Annual project costs, benefits, and benefit-cost ratio are as follows:

1.	Project costs are	$ 41,700
2.	Project benefits are	64,370
3.	The project benefit-cost ratio is	1.5 to 1.0
4.	The project benefit-cost ratio excluding secondary benefits is	1.5 to 1.0

PART II

Selected Plan

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Pollard Creek Watershed, Texas

Components	Measures of effects[1/]
Beneficial effects:	
A. The value to users of increased outputs of goods and services	
1. Flood prevention	$64,100
Total beneficial effects	$64,100

Components	Measures of effects[1]
Adverse effects:	
A. The value of resources required for a plan	
1. Two floodwater retarding structures	
a. Project installation	$35,340
b. Project administration	4,280
c. Operation and maintenance	420
Total adverse effects	$40,040
Net beneficial effects	$24,060

1/ Average annual

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Selected Plan

ENVIRONMENTAL QUALITY ACCOUNT

Pollard Creek Watershed, Texas

Components	Measures of effects
Beneficial and adverse effects:	
A. Areas of natural beauty.	1. Restore and improve the native prairie and savannah ecosystem on 2,000 acres of rangeland.
	2. Create 41 surface acres of water.
	3. Require 175 acres of grassland and 10 acres of stream channel for installation of structural measures.
	4. Beneficially modify and improve the degraded ecosystem on 600 acres of pastureland.
	5. Encourage park and open space development in Mineral Wells by management of the flood plain.
B. Quality considerations of water, land, and air resources.	1. Reduce flood plain erosion on 10 acres of agricultural land by 71 percent.
	2. Reduce sediment deposition on 18 acres of agricultural land by 50 percent.
	3. Reduce the volume of sediment delivered to the Brazos River by 3,000 tons annually.
	4. Reduce the suspended sediment concentration carried by runoff water leaving the watershed from 2,300 mg/1 to 900 mg/1.
	5. Result in an initial reduction of 3.9 percent in the runoff from the watershed.

Components	Measures of effects
	6. Cause a slight increase in air and water pollution during the construction of the structural measures.
C. Biological resources and selected ecosystems.	1. Enhance habitat and food supply and provide improved distribution of water for big game animals, game and non-game birds throughout the watershed.
	2. Create 41 surface acres of lake fish habitat.
	3. Provide 41 surface acres at the reservoirs for migratory waterfowl resting areas.
	4. Cause the destruction of 41 acres of poor to fair quality wildlife habitat to be covered by water in the sediment pools.
	5. Result in the replacement of 10 acres of existing poor to fair wildlife habitat which will be destroyed by construction of the dams and emergency spillways with an altered habitat.
	6. Improve fish habitat in 17 farm and ranch ponds.
D. Irreversible or irretrievable commitments.	1. Convert 51 acres of rangeland, pastureland, and intermittent stream channels to dams, emergency spillways, and sediment pools.

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT

Pollard Creek Watershed, Texas

Components	Measures of effects[1]	
	Region[2]	Rest of Nation
A. Income:		
Beneficial effects:		
1. The value of increased output of goods and services to users residing in the region.		
a. Flood prevention	$64,100	-
b. Secondary	270	-
Total beneficial effects	$64,370	-

Components	Measures of effects[1]	
	Region[2]	Rest of Nation
A. Income:		
Adverse effects:		
1. The value of resources contributed from within the region to achieve the outputs.		
a. Two floodwater retarding structures.		
Project installation (structural measures)	$ 6,030	$29,310
Project administration	60	4,220
Operation and maintenance	420	-
Total adverse effects	$ 6,510	$33,530
Net beneficial effects	$57,860	-$33,530

1/ Average annual
2/ The region consists of Palo Pinto County, Texas

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Selected Plan

REGIONAL DEVELOPMENT ACCOUNT (continued-2)

Pollard Creek Watershed, Texas

Components	Measures of effects	
	Region 1/	Rest of Nation
B. Employment:		
Beneficial effects:		
1. Increase in the number and types of jobs.		
a. Agricultural employment.	0	---
b. Employment for project construction.	23 man-years of semi-skilled employment during the installation period (3 years).	---
Total beneficial effects	0	---
	23 man-years of semi-skilled employment over the installation period (3 years).	---

Components	Measures of effects	
	Region 1/	Rest of Nation
B. Employment:		
Adverse effects:		
1. Decrease in number and types of jobs.	0	---
Total adverse effects	0	---
Net beneficial effects	0 permanent semi-skilled jobs.	
	23 man-years of semi-skilled employment over the installation period (3 years).	

1/ The region consists of Palo Pinto County, Texas

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Selected Plan

REGIONAL DEVELOPMENT ACCOUNT (Continued-3)

Pollard Creek Watershed, Texas

Components	Measures of effects	
	Region 1/	Rest of Nation
C. Population Distribution		
Beneficial effects	Create 23 man-years of semi-skilled employment over the installation period (3 years)	---
Adverse effects	---	---
D. Regional Economic Base and Stability		
Beneficial effects	Provide flood protection to residents of 50 houses and the owners of 10 businesses on 157 acres of urban and built-up flood plain land. A total of 1.4 million dollars of urban property will be protected. The construction of the project will create 23 man-years of semi-skilled employment over the installation period (3 years). Provide flood protection to 181 acres of agricultural flood plain land. Minimize interruptions of travel and disruption and evacuation of houses and businesses. Increase local business activity through reduction of flood damages.	
Adverse effects	---	---

1/ The region consists of Palo Pinto County, Texas

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Selected Plan

SOCIAL WELL-BEING ACCOUNT

Pollard Creek Watershed, Texas

Components	Measures of effects
Beneficial and adverse effects:	
A. Real Income distribution	1. Create 23 man-years of semi-skilled employment over the installation period (3 years).
	2. Create regional income benefit distribution of $64,370 benefits by income class as follows:

Income Class (dollars)	Percentage of Adjusted Gross Income in Class	Percentage Benefits in Class
Less than 3,000	4	20
3,000 - 10,000	43	51
More than 10,000	53	29

	3. Local average annual costs of $6,510 will be borne equally by Palo Pinto County and the City of Mineral Wells. Funds for this purpose will be provided from the general funds of the county and the city, which are supported by revenue from existing tax sources. The percentage of contributions to local costs, by income classes, is not readily available.
B. Life, health, and safety	1. Provide protection from the 100-year event to 50 houses and 10 businesses in Mineral Wells with population of 18,411 in 1970. Minimize interruptions of travel and disruption and evacuation of houses and businesses. Reduce flood damages and associated risks to utilities and old sanitary landfill. Reduce flooding in city park.
C. Recreational opportunities	1. Create 41 surface acres of water which can be used for recreation, lake fisheries, and waterfowl resting areas.

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PART III

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

Pollard Creek Watershed, Texas

The goals of this environmental quality plan for the Pollard Creek watershed are to preserve and enhance areas of natural beauty; maintain and improve the quality of the water, land, and air resources; and preserve and enhance the biological resources and ecosystems of the watershed so that man can live in an esthetically and culturally pleasing environment.

The principal environmental quality problems in the watershed are the deterioration of the land, plant, and water resources associated with intensified agricultural use, urban growth, and the threat of loss of life, property, and source of livelihood by flooding in the urbanized area of the flood plain.

The watershed lies in a scenic area of prominent mesa-like hills, steep-walled valleys and nearly level flood plains incised into a bench-like (cuesta) topography. The sub-humid climate originally supported a tall and mid grass prairie vegetation interspersed with post oak and grass savannah vegetation. Introduction of man and domestic animals disrupted the delicate natural balance which existed between the original perennial grasses, browse, and tree species. Part of the vegetation was plowed-up for cropland and a large area has been altered by urban development. Vivid changes have occurred on the remaining rangeland vegetation because of continued heavy grazing rates, lack of technical knowledge in plant management, and an inability to recognize gradual regressive trends in the plant communities. Widespread stands of annual plants, the spread of woody plants into dense stands, and a general lowering of quality and quantity of plant cover has occurred. This deterioration has reduced the food supply for domestic livestock and for many species of wildlife.

Sheet erosion is a problem on areas of poorly vegetated former cropland and small areas of almost bare rangeland. Streambank erosion is occurring on small isolated reaches. Flooding of urban developments on the flood plain in Mineral Wells poses a threat to the lives, property, and livelihood of the residents. Flooding of the city park damages swimming pool facilities and interrupts recreational use. Flooding of the old refuse disposal area downstream from Mineral Wells is a potential source of pollution. Improperly installed septic tanks in the suburban areas pose a potential pollution problem. The trend towards development of small units of ownership near the city of Mineral Wells tends to degrade environmental quality. Domesticated livestock, human, and vehicular traffic usually increases proportionately as the acreages are reduced, thus reducing plant cover, increasing soil erosion and downstream sedimentation, and reducing downstream water quality.

Component needs for solving problems relating to specific environmental conditiins are listed below:

1. Areas of Natural Beauty

    a. Reduce erosion in the uplands.

    b. Reduce streambank erosion on Pollard Creek.

2. Quality of Water, Land, and Air Resources

    a. Improve the quality of the streamflow of Pollard Creek and its tributaries by reducing the sediment being delivered to the streams and lakes from streambank erosion, and sheet erosion.

    b. Prevent future potential pollution from old refuse disposal in the flood plain of Pollard Creek area.

    c. Prevent future potential pollution caused by increased density due to urbanization.

    d. Protect the land resource base from deterioration by reducing sheet erosion, streambank erosion, and sediment deposition.

    e. Maintain and enhance the productivity of the land resource base.

    f. Prevent destruction of houses, businesses, transportation systems, and sources of livelihood of human inhabitants by flooding.

3. Biological Resources and Ecosystems

    a. Restore the ecosystem of the native prairie and post oak and grass savannah vegetative patterns of the watershed on the land presently used as rangeland.

    b. Preserve and enhance the habitat conditions for other species of fish and wildlife present in the watershed by:

        (1) Providing more dependable food supplies.

        (2) Reducing damage to habitat from flooding, sedimentation, scour, etc.

        (3) Creating additional cover for selected species of wildlife.

        (4) Creating additional habitat for fish.

The plan elements for environmental quality consist of a system of management practices, land treatment measures, structural measures, and land acquisition. Cropland treatment measures would include conservation cropping systems (use of diversified crops in rotation and management of residues), grassed waterways and terraces, contour tillage, and fertilizing as needed.

Grassland treatment consists of grazing management to improve or maintain the more desirable forage plants, including rotating or systematically grazing pastures while others are rested to permit the better plants to recover vigor and grow, and grazing at intensities that will not damage the vigor of the forage plants. Where weedy or undesirable woody plants are a problem, they would be controlled to avoid competition with the more desirable forage plants, but leaving ample amounts to maintain desirable wildlife habitat and aesthetic values. Some 20 acres of cropland, 600 acres of pastureland, and 2,000 acres of rangeland remain to be treated. Land users would be encouraged to apply and maintain these measures by the local soil and water conservation district with technical assistance to be supplied by the Soil Conservation Service. Financial assistance, usually on a cost-share basis, is available through programs such as the Rural Environmental Conservation Program administered by the Agricultural Stabilization and Conservation Service and the Great Plains Conservation Program administered by the Soil Conservation Service.

Installation of 2 single purpose floodwater retarding structures would reduce flood stages on Pollard Creek. Streambank stabilization measures consisting of the necessary shaping, vegetation, and mechanical measures would be installed to prevent further erosion of Pollard Creek downstream from the old lakebed of former Lake Pinto. These elements would be implemented by the county government, the local soil and water conservation district, and the private landowners. Cost sharing funds are available under Public Law 566.

Grading, placement of topsoil in some areas, and establishment of vegetation is needed to stabilize the old refuse disposal area. This element would be implemented by the city of Mineral Wells. Properly designed septic tank systems need to be installed to replace improperly installed systems, and specially designed systems are needed to replace conventional systems which have been installed in soils which are not suitable for the conventional systems. This element would be implemented by the homeowners with home improvement loans obtained through established lending institutions.

The flood plain management program would consist of managing the flood hazards to prevent encroachment of damage-prone improvements such as urban buildup. The flood plain would be used for recreation, most forms of agriculture, wildlife areas, etc. Urban buildup would be managed to prevent encroachment of damage-prone improvements into the flood plain. This element would be implemented through the county and city governments.

The estimated installation costs of the elements of the environmental quality plan are as follows:

1. Completion of the application of land treatment measures: $50,200

2. Two single purpose floodwater retarding structures: $672,180

3. Streambank stabilization of one area: $2,500

4. Stabilization of old refuse disposal area: $12,500

5. Flood plain management program for Pollard Creek and its tributaries: $90,500

6. Installation of adequate septic tanks in suburban areas: $80,000

The total installation cost of the environmental quality plan is estimated to be $907,880.

The environmental effects that would result from installation of the environmental plan are as follows:

1. Areas of Natural Beauty

   a. Enhance the appearance of the 29 farms and ranches in the watershed through application and maintenance of land treatment measures.

   b. Maintain the diversity of the landscape through the preservation and enhancement of the land resource base which sustains this diversity.

   c. Improve or enhance the scenic quality of Pollard Creek by revegetation of bare rangeland areas and areas of active streambank erosion.

   d. Provide greater diversity of landscape by superimposing the embankment and water impoundment of floodwater retarding structures into the setting of the watershed.

2. Quality of Water, Land, and Air Resources

   a. Reduce the sediment load carried by the Pollard Creek and its tributaries through reduction of sheet erosion and streambank erosion.

   b. Reduce potential for waterborne pollution and contamination by stabilization of the old refuse disposal area.

c. Reduce potential for waterborne pollution and contamination by installation of adequate septic tank systems.

d. Prevent the deterioration of the land resource base by providing protection from erosion by installing needed vegetative and mechanical treatment measures.

e. Maintain and enhance the productivity of the land resource base by applying agronomic and vegetative management practices.

f. Reduce flooding on 157 acres of urban land in Mineral Wells, including the city park, and 362 acres of agricultural land.

g. Prevent destruction of lives, urban and agricultural properties, and source of livelihood for about 60 owners of property on the flood plain of Pollard Creek.

h. Reduce the interruption of the transportation systems at crossings along the flood plain.

i. Encourage preservation of open space on the flood plain through zoning, restrictions, or management programs. Also reduce the possibility of increased damages due to future developments on the flood plain.

j. Result in initial reduction in average annual runoff of about 3.9 percent from the watershed due to evaporation and seepage losses from the sediment pools.

k. Reduce sediment load carried downstream into the Brazos River and deposited in Lake Granbury.

3. Biological Resources and Selected Ecological Systems

a. Restore and stabilize the vegetative composition of the native prairie and the post oak and grass savannah ecosystems.

b. Enhance the fishery habitat in the streams and in farm and ranch ponds by reducing sediment content of runoff.

c. Improve habitat for some wildlife species as the result of improvement of plant composition.

d. Improve wildlife habitat on upland through installation of certain land treatment measures.

e. Change 41 acres of fair to poor wildlife habitat to fish habitat and waterfowl resting areas.

4. Irreversible or Irretrievable Commitments

a. Require loss of 38 acres of pastureland, and rangeland, and 3 acres or 0.9 miles of intermittent stream channels.

b. Interrupt agricultural use on 137 acres of pastureland and rangeland and 7 acres or 2.1 miles of intermittent stream channels.

WATERSHED WORK PLAN AGREEMENT

between the

Palo Pinto Soil and Water Conservation District

Palo Pinto County Commissioners Court

City of Mineral Wells

(hereinafter referred to as the Sponsoring Local Organization)

State of Texas

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 Pollard Creek Watershed, State of Texas, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 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 Pollard 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 3 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, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost $ 102,280)

2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

	Sponsoring Local Organization (percent)	Service (percent)	Estimated Relocation Payment Costs 1/ (dollars)
Relocation Payments	20.35	79.65	$0.00

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. 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.

4. 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)
Floodwater Retarding Structures	-	100.00	471,800

5. 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 Costs (dollars)
Floodwater Retarding Structures	-	100.00	25,470

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be $1,000 and $71,630 respectively.

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

8. 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.

9. 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.

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

11. 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.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations 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.

13. 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 except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.

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

15. 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. 15.1-15-15.12), 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.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Palo Pinto Soil and Water Conservation District
Local Organization

1201 W 6 Avenue
Mineral Wells, Texas 76067
Address Zip Code

By Hermon L. Petty
Hermon L. Petty
Title Chairman
Chairman
Date Sept 22, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Palo Pinto Soil and Water Conservation District
Local Organization
adopted at a meeting held on September 22, 1975

W. M. Sanders
Secretary, Local Organization
W. M. Sanders
Date September 22, 1975

Star Route, Strawn, Texas 76475
Address Zip Code

Palo Pinto County
Commissioners Court
Local Organization

By John H. Smith
John H. Smith
Title County Judge
Date Sept. 22, 1975

Palo Pinto, Tx 76072
Address Box 116 Zip Code
Box 116 Palo Pinto, Texas 76072

The signing of this agreement was authorized by a resolution of the governing body of the Palo Pinto County Commissioners Court
Local Organization
adopted at a meeting held on September 22, 1975

C. V. Botkin
Secretary, Local Organization
C. V. Botkin, County Clerk
Date September 22, 1975

P.O. Box 8, Palo Pinto, TX 76072
Address Zip Code

City of Mineral Wells
Local Organization

By Ellis H. White
Ellis H. White
Title Mayor
Date Oct. 10, 1975

Mineral Wells, Texas 76067
Address Zip Code
PO#339 Mineral Wells, Texas 76067

The signing of this agreement was authorized by a resolution of the governing body of the City of Mineral Wells
Local Organization
adopted at a meeting held on Sept. 26, 1975

Sarah F. Scott
Secretary, Local Organization
Sara h F. Scott, City Clerk
Date Oct. 10, 1975

Mineral Wells, Texas 76067
Address Zip Code
PO#339 Mineral Wells, Texas 76067

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by: Acting

State Conservationist

OCT 17 1975
Date

WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

POLLARD CREEK WATERSHED
Palo Pinto County, 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:

City of Mineral Wells

Palo Pinto County Commissioners Court

Palo Pinto Soil and Water Conservation District

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service

July 1975

WATERSHED WORK PLAN

POLLARD CREEK WATERSHED
Palo Pinto County, Texas

SUMMARY OF PLAN

General Summary

The work plan for watershed protection and flood prevention for the Pollard Creek watershed was prepared by the Palo Pinto Soil and Water Conservation District, the City of Mineral Wells, and the Palo Pinto County Commissioners Court. Technical assistance was provided by the Soil Conservation Service of the U. S. Department of Agriculture. The Fish and Wildlife Service of the U. S. Department of the Interior collaborated with the Texas Parks and Wildlife Department in the preparation of a reconnaissance report of the fish and wildlife aspects of the watershed. Archeological information was developed by the Archaeology Research Program, Department of Anthropology, Southern Methodist University. Financial assistance for development of the work plan was provided by the Texas State Soil and Water Conservation Board and the Soil Conservation Service.

Pollard Creek watershed comprises an area of 7,260 acres, or 11.34 square miles, in the Brazos River Basin in North Central Texas. It drains the northeastern portion of Palo Pinto County (figure 5). Approximately one percent of the watershed is cropland, 17 percent is pastureland, 50 percent is rangeland, and 32 percent is in miscellaneous uses such as urban areas, roads, farmsteads, etc.

The major soil and water problems in the watershed are erosion on the uplands and floodwater and sediment damages on 519 acres of flood plain land, of which 362 acres are agricultural land and 157 acres are urban and built-up land in Mineral Wells. Without the project, the average annual floodwater, sediment, erosion, and indirect damages total $68,450.

Project objectives are the proper use, treatment, and management of soil and water resources in the watershed, the protection of flood plain lands and property, and the stimulation of the economic development of the area as the result of project installation. The project as formulated meets these objectives.

The work plan proposes the installation, during a 3-year period, of a project for the protection and development of the watershed at a total cost of $722,380. The share of the cost to be borne by Public Law 566 funds is $575,400. The share to be borne by other than Public Law 566 funds is $146,980. In addition, the local interests will bear the entire cost of operation and maintenance.

Land Treatment Measures

Land users will be encouraged to complete the establishment and to maintain needed land treatment measures on 20 acres of cropland, 600 acres of pastureland, and 2,000 acres of rangeland at an accelerated rate during the 3-year installation period, in addition to the maintenance of those measures already applied. These measures will improve the hydrologic condition of both cropland and grassland. This improvement in soil condition and cover will reduce sediment to floodwater retarding structures and will effect some reduction in flooding. The installation cost of these land treatment measures is estimated to be $50,200, of which $43,700 will be from funds other than Public Law 566. Public Law 566 funds will provide $6,500 in order to accelerate technical assistance needed for the application and maintenance of these measures.

Structural Measures

The structural measures included in this plan consist of 2 floodwater retarding structures. The estimated total cost of structural measures is $672,180, of which the local share is $103,280 and the Public Law 566 share is $568,900. The local share of the cost consists of land rights and project administration.

Environmental Impact

The project action will contribute to the conservation, development, and productive use of the watershed's soil, water, and related resources.

The project will reduce flooding to agricultural land and the private and public properties in the Pollard Creek flood plain within the city of Mineral Wells.

Sediment contributed to the flood plain of Pollard Creek and the Brazos River will be reduced. The watershed lands will be protected from erosion and the productivity maintained and increased. Additional water impoundment areas will be created and can be used for waterfowl feeding and resting areas, development of fisheries, and livestock watering areas.

The project will preserve and enhance the habitat for most species of wildlife.

Installation of the project will require the use of 185 acres of land, of which 10 acres are needed for dams and emergency spillways, 41 acres are needed for sediment pools, and 134 acres are needed for detention pools.

The existing vegetation will be destroyed on the 10 acres of land needed for construction of dams and emergency spillways and on most of the 41 acres of land needed for the sediment pools. All land exposed by construction and not permanently inundated by water in the sediment pools will be revegetated.

Initially, the project will cause a minor reduction in streamflow because of seepage and evaporation losses in the sediment pools. However, as sediment accumulates in the sediment pools the streamflow is expected to approach pre-Public Law 566 project conditions.

Additional opportunities for employment will be created, and income to households and demand for services will be increased.

The average annual primary benefits accruing to structural measures are estimated to be $64,100. Secondary benefits will amount to $270. The ratio of total annual benefits ($64,370) resulting from the installation of structural measures to the annual cost ($40,040) is 1.6 to 1.0.

Provisions for Financing Local Share of Installation Cost

The cost of installing the needed land treatment measures during the 3-year installation period will be borne by the landowners and operators of the land on which these measures are installed. Cost sharing assistance is available for the establishment of approved conservation measures through the Great Plains Conservation Program (GPCP) administered by the Soil Conservation Service and the Rural Environmental Conservation Program (RECP) administered by the Agricultural Stabilization and Conservation Service. The Farmers Home Administration, local banks, and other lending institutions can arrange financing for the landowner's or operators' share of the cost.

Funds for the local share of the cost of installing the structural measures will be provided jointly by the Palo Pinto County Commissioners Court and the city of Mineral Wells. These funds will be provided from the general funds of the county and city, which are supported by revenue from existing tax sources. These funds are adequate for financing the sponsors' share of the project installation costs.

Operation and Maintenance

Land treatment measures for watershed protection will be maintained by landowners or operators of the farms or ranches upon which the measures will be installed under agreements with the soil and water conservation district. The Palo Pinto County Commissioners Court and the city of Mineral Wells will be jointly responsible for the operation and maintenance of the structural measures.

The estimated average annual cost of operation and maintenance is $420.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING[1/]

Physical Resources

Pollard Creek watershed comprises an area of 7,260 acres, or 11.34 square miles, in northeastern Palo Pinto County, Texas. It lies about 40 miles west of the large metropolitan area of Fort Worth. The western portion of the city of Mineral Wells, population 18,411,[2/] lies within the watershed.

Approximately 2,150 acres of urban and built-up areas of the city of Mineral Wells and adjoining suburbs lie within the central portion of the watershed. Much of the remainder of the watershed is densely populated with residents who live on small acreages and work in Mineral Wells.

The watershed is in the Texas-Gulf Water Resource Region.[3/] Pollard Creek is a tributary of the Brazos River. It flows into the Brazos River 45 river miles downstream from the Possum Kingdom Reservoir and about 65 river miles upstream from Lake Granbury.

The climate is subhumid and warm. The average annual rainfall is about 28 inches. Rainfall is fairly well distributed throughout the year; however, the months of April and May normally receive the greatest amounts. The average temperatures for January and July are 46° and 84° Fahrenheit, respectively.[4/]

Flooding occurs on 519 acres of flood plain land on Pollard Creek. About 50 residences and 10 businesses are located on 157 acres of urban land lying within the flood plain. Associated facilities such as utilities, roads, two city parks, and a city sewage treatment plant are also located within this area. Most of the remaining 362 acres of flood plain land is used for agricultural production.

1/ All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigation by the Soil Conservation Service, U. S. Department of Agriculture.

2/ U. S Department of Commerce, Bureau of the Census, 1970 Census of Population, January 1974.

3/ U. S. Department of Agriculture, Soil Conservation Service, Atlas of River Basins of the United States, Washington, D. C., June 1971.

4/ U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Climatological Data, Texas, Annual Summary, Vol. 75, No. 13, Asheville, N. C., 1970.

The watershed lies in a region of bench-like (cuesta) topography. This topography consists of a succession of gently northwestwardly sloping plains terminated by steep southeastward facing scarps. The lower portion of the watershed is dominated by a prominent scarp which extends across the watershed and through Mineral Wells in a northeast to southwest direction. A unique scenic area of steep-walled valleys, nearly level flood plain, and prominent outlying mesa-like remnants of the scarp is formed by Pollard Creek and its tributaries, which lie within deep valleys incised into the scarp. A gently rolling plain occurs in the upper portion of the watershed above the scarp. The northwestern edge of this plain is bordered by the next successive scarp, which also forms the watershed divide. Elevations above mean sea level range from 1,140 feet in the headwaters to about 800 feet near the Brazos River.

The watershed is underlain by sedimentary rocks of the Mineral Wells Formation of Pennsylvanian age.[5/] These rocks consist mainly of thick beds of soft shale of 100 feet or more thickness interbedded with thin beds of hard sandstone and limestone of 25 feet or less thickness. Quaternary age sandy terrace deposits occur in the lower portion of the watershed and sandy clay alluvium occurs in narrow bands along streams of the watershed.

The watershed lies within the North Central Prairies Land Resource Area of Texas.[6/] The soils of this area were formed over sandstone and shale of Pennsylvanian age. The upland soils are composed of deep soils of the Truce, Thurber, and Leeray series, moderately deep soils of the Bonti and Vashti series, and shallow soils of the Owens series. The major bottomland soils are the Bunyan and Frio series.

The Bonti and Truce soils are the dominant soils in the uplands. These soils have fine sandy loam topsoils over clay subsoils. They occur on gentle to steep slopes, with the Bonti series occurring on the sandstone bedrock and the Truce series occurring on the shale bedrock. Clay and clay loam textured soils of the Thurber and Leeray series occur on smaller areas of the uplands. These soils occur on gently to moderately sloping areas over shale bedrock. The Bonti and Truce soils are used mainly for rangeland and pastureland. The Thurber soils are now used mainly for pastureland, but many areas were once cultivated. Most of the presently cultivated land is on the Leeray soils.

5/ Bureau of Economic Geology, The University of Texas at Austin, Geologic Atlas of Texas, Abilene Sheet, Austin, Texas, June 1970.

6/ Texas Agricultural Experiment Station, Texas A&M University, in cooperation with U. S. Department of Agriculture, Soil Conservation Service, General Soil Map of Texas, College Station, Texas, 1973.

Moderately deep sandy soils of the Vashti series occur on sandstone bedrock on gentle to moderate slopes. These soils are found on high ridge tops over small areas and are used mainly as rangeland.

Shallow clay soils of the Owens series occur on the steep hillsides and lower slopes of the southeastward facing shaly scarps in the watershed. These soils are used mainly for rangeland and are easily eroded when overgrazed.

The bottomland soils consist mainly of the Bunyan series with small areas of the Frio series. The Bunyan soils occupy the flood plain areas along and adjacent to stream channels. These soils have light colored, fine sandy loam surface layers over sandy loam, sandy clay loam, and clay loam lower layers. The Frio soils have silty clay loam surfaces and occupy smaller areas of the flood plain favoring clayey deposition. The flood plain soils are used for pastureland, rangeland, parks, and urban development.

The present land use in the watershed is as follows:

Land Use	Acres	Percent
Cropland	90	1
Pastureland	1,260	17
Rangeland	3,600	50
Miscellaneous 1/	2,310	32
Total	7,260	100

1/ Urban areas, roads, farmsteads, etc.

Proven mineral resources in the watershed are limited to deposits of clay shales, mineralized ground water, and limited quantities of sand and gravel. There is no production of clay or sand within the watershed; however, clay is mined outside the watershed in eastern Mineral Wells for the production of brick. Some mining of gravel has been reported in the northeastern part of the watershed. The production of mineralized ground water containing high amounts of sodium sulphate and other salts 7/ was important in the development of a thriving health resort complex in Mineral Wells during the early 1900's. Heavy usage of the ground water for its therapeutic properties during this period resulted in many wells going dry and others suffering drastic reduction in yields. Bottled mineral water and packaged mineral crystals are still sold in limited quantities.

7/ Turner, Samuel F., Mineral-Water Supply of the Mineral Wells Area, Texas, U. S. Department of the Interior, Geological Survey, Circular 6, Washington, D. C., 1934.

Natural gas liquids, natural gas, and petroleum are produced nearby, and oil shales have been reported at Mineral Wells. The Thurber coalbed outcrops along Rock Creek about four miles east of Mineral Wells. The coal seam is 18 to 24 inches thick at this point and has been mined locally. The coalbed is projected at depths of 400 feet or more below the surface at the sites of proposed floodwater retarding structures.[8/]

Streamflow in Pollard Creek is intermittent under natural conditions. This flow condition is altered by the sewage effluent that is released into the lower 2 miles of stream from the Mineral Wells sewage treatment plant. Most of the stream channels can be classified as natural except for about a 1/2-mile segment which has been altered in the old lake bed of former Lake Pinto and another 1/2-mile segment which has been straightened downstream from the city park in Mineral Wells.

The overall quality of runoff from the watershed is unknown. The estimated average sediment concentration in runoff from the watershed is 2,300 milligrams per liter. The quality of runoff from the agricultural land is believed to be of higher quality than that from the urban and suburban areas. A new sewage treatment plant was installed by Mineral Wells to treat sewage to meet state water quality standards. An average annual volume of 3,800 acre-feet of effluent is being released into Pollard Creek. This volume greatly exceeds the annual runoff from the watershed, which is estimated to average 1,600 acre-feet.

The old refuse disposal area of Mineral Wells is located on the flood plain downstream from the sewage treatment plant. This area contributes polluting debris to floodwaters which overflow the banks of the stream. Erosion on the agricultural land and urban and suburban areas contributes an average concentration of about 2,300 milligrams per liter of sediment in the annual runoff from the watershed.

Present and Projected Population

The population of Mineral Wells is assumed to remain static to 1980, due to the closure of Fort Wolters. After 1980, based on OBERS data for water resource subarea[9/] and BEA economic area,[10/] the population

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8/ Information provided as input by United States Department of the Interior, Bureau of Mines.

9/ U. S. Water Resources Council, OBERS Projections; Regional Economic Activity in the U.S., Volume 4, Water Resources Regions, 9-20; Washington, D. C., 1972.

10/ U. S. Water Resources Council, OBERS Projections; Regional Economic Activity in the U. S., Volume 2, BEA Economic Areas, Washington, D. C., 1972.

is expected to increase by 10 percent each decade to the year 2000 and by 15 percent each decade to the year 2020. This would result in an estimated population of about 30,000 in the year 2020.

Economic Resources

The economy generated within the watershed is based primarily on the activity associated with Mineral Wells. Mineral Wells became famous for the discovery of mineral water on the present townsite in 1880. The reputation of this mineral water and the packaged mineral cyrstals spread throughout both this country and abroad. Thousands of people came to Mineral Wells for health reasons. A resort city developed quickly and was incorporated in 1882. In the early 1900's, many hotels and rooming houses sprang up to take care of the 15,000 guests visiting Mineral Wells annually.

Mineral Wells has emerged as an industrial city, having recently established its 37th manufacturing concern. The industries employ 1,500 people in manufacturing and 4,000 people in non-manufacturing.

Mineral Wells today has manufacturing, tourist and resort business, and ranching and agriculture to promote a balanced economy.

The city of Mineral Wells, with a population in 1970 of 18,411, is the main marketing center for watershed residents. The city offers good schools, hospital facilities, churches, services, and supplies. About 25 miles of paved roads and 40 miles of all-weather roads link the watershed with other population and marketing centers in all directions.

Nearly all the agricultural land is owner-operated. There are about 43 farms and ranches, averaging about 240 acres, either wholly or partially within the watershed. Size of individual operating units range from but a few acres to nearly 3,000 acres. About 30 of these are family-type units employing less than 1-1/2 man-years of outside labor. About 15 are small, low-income-producing units whose operators work off the farm in order to maintain an acceptable standard of living. This varies from full-time employment to a day or so a week or seasonal employment such as custom harvesting of crops or feeding of livestock.

Agricultural land values range from $300 to $700 per acres, depending upon soil capability and location. Urban land values range from a few thousand dollars for a city lot to many thousands of dollars for commercial property.

Over two-thirds of the agricultural income of the watershed is derived from livestock and its associated products and the balance from crops. Principal crops grown and average yields per acres are: Oats, 40 bushels and 2 animal unit months of grazing; and forage sorghums, 4 tons of hay.

The Work Force Estimates for Nonmetropolitan Counties in Texas for April 1973,[11/] the latest statistics which are available, shows a labor force of 8,970, or 31 percent, from a total population of 28,962 for Palo Pinto County, within which the watershed is located. Approximately 3.1 percent (280 workers) are unemployed. This is below the state and national rates of unemployment. Approximately 8 percent (685 workers) are employed in the agricultural sector.

Plant and Animal Resources

The watershed occurs in the North Central Prairies vegetational region. According to Dr. Frank Gould[12/] the native vegetative understory of this area is predominantly tall and mid grasses characterized by little bluestem (Andropogon scoparius), big bluestem (Andropogon gerardi), yellow indiangrass (Sorghastrum nutans), purpletop (Tridens flavus), sideoats grama (Bouteloua curtipendula), hairy grama (Bouteloua hirsuta), tall dropseed (Sporobolus asper), and Texas wintergrass (Stipa leucotricha). The vegetative overstory is characterized by post oak (Quercus stellata), blackjack oak (Quercus marilandica), cedar elm (Ulmus crassifolia), and bumelia (Bumelia lanuginosa oblongifolia).

Originally, a delicate natural balance existed between perennial grasses, browse, and tree species. Introduction of man and domestic animals disrupted this balance. The present existing plant communities reflect the harsh use of native vegetative resources. Widespread stands of annual plants, the spread of woody plants into dense stands, and the reduction of total forage vegetation are indications of past mismanagement.

Three native vegetation types of the broad North Central Prairies vegetational region occur in the watershed. These occur on sandy loam upland and bottomland sites, clay and clay loam footslopes and bench sites, and sandstone hillside sites.

11/ Texas Employment Commission, Work Force Estimates for Nonmetropolitan Counties in Texas for April 1973, Austin, Texas, July, 1973.

12/ Gould, F. W., Texas Plants, A Checklist and Ecological Summary, Texas A&M University, TAES, College Station, Texas, 1962.

The sandy loam sites comprise 59 percent of the native vegetational area of the watershed. The original vegetation found on these sites was made up mainly of sideoats grama, little bluestem, plains bristlegrass (Setaria macrostachya), Arizona cottontop (Trichachne californica), vine-mesquite (Panicum obtusum), heath aster (Aster ericoides), dotted gayfeather (Liatris punctata), engelmanndaisy (Engelmannia pinnatifida), halfshrub sundrops (Oenothera serrulata), catclaw sensitivebrier (Schrankia uncinata), sagewort (Artemisia ludoviciana), fragrant sumac (Rhus aromatica), bumelia, elbowbush (Forestiera pubescens), saw greenbrier (Smilax bona-nox), post oak, ashe juniper (Juniperus ashei), sugar hackberry (Celtis laevigata), and cedar elm. Lesser amounts of big bluestem, indiangrass, purpletop, pitcher sage (Salvia pitcheri), switchgrass (Panicum virgatum), maximilian sunflower (Helianthus maximiliani), and pecan (Carya illinoesis) occurred in areas of more favorable soil moisture such as bottomlands and seep areas. These areas are some of the most productive native vegetational sites in the watershed. They are potentially capable of producing up to 3,500 pounds of air dry herbage on the uplands and 6,000 pounds of air dry herbage on the bottomlands annually.

The clay and clay loam footslopes and benches make up 18 percent of the native vegetational area of the watershed. The original vegetation on these sites was comprised mainly of sideoats grama, vine-mesquite, cane bluestem (Andropogon barbinodis), silver bluestem (Andropogon saccharoides torreyanus), buffalograss (Buchloe dactyloides), Texas wintergrass, meadow dropseed (Sporobolus asper hookeri), yellow neptunia (Neptunia lutea), catclaw sensitivebrier, engelmanndaisy, curlycup gumweed (Grindelia squarrosa), heath aster, feather dalea (Dalea formosa), vine ephedra (Ephedra antisyphilitica), cedar elm, and sugar hackberry. These sites are capable of producing up to 4,500 pounds of air dry herbage annually. The footslopes portion of these areas present more shallow soils than normal for the sites and tend to produce more sparse vegetation than the benches.

Sandstone hillsides make up 23 percent of the watershed and produce a heavy cover of trees. This woody vegetation consists primarily of post oak, blackjack oak, cedar elm, bumelia, and Texas ash (Fraxinum texensis) with a dense undergrowth of browse plants such as saw greenbrier, fragrant sumac, white honeysuckle (Lonicera albiflora), elbowbush, and pricklyash (Zanthoxylum clava-herculis). Grass growth is generally sparse and includes purpletop, Texas wintergrass, sideoats grama, little bluestem, indiangrass, sand lovegrass (Eragrostis trichodes), scribner panicum (Panicum scribnerianum), and tall dropseed. Other plants of the understory include velvet bundleflower (Desmanthus velutinus), roundhead lespedeza (Lespedeza capitata), engelmanndaisy, and sedge (Carex austrina). These hillsides are strewn with sandstone rocks and boulders. These rocks

greatly reduce the amount of soil surface available for producing vegetation. The amount of soil covered by rocks and the continuous shade created by dense tree canopy severely affect the ability of these areas to produce other vegetation. Up to 3,000 pounds of air dry herbage may be produced annually. As much as 15 percent of this herbage yield is produced by woody plants.

The vegetation on pastureland consists of improved perennial grasses. The land in this use was converted from cropland or rangeland and planted to grasses adapted to intensive grazing use. The main grass grown is bermudagrass (Cynodon dactylon). A few acres of kleingrass-75 (Panicum coloratum) and wintergreen hardinggrass (Phalaris tuberosa stenoptera) have also been planted. Pasturelands are generally in a good state of cover; however, weed encroachment does occur where adequate fertility is not maintained or where heavy grazing by livestock occurs.

The watershed lies in the Texas Parks and Wildlife Department's Possum Kingdom Game Management Area.[13/]

The quality of plant communities in the watershed for wildlife habitat ranges from poor to fair. Major wildlife species found in the watershed are white-tailed deer, bobwhite, mourning dove, raccoon, opossum, jackrabbit, cottontail, fox squirrel, migrating ducks, and various species of songbirds, rodents, and predators. At this time, there are no known threatened wildlife species which occur in the watershed.

Wildlife populations are generally low throughout the watershed. Bobwhites, mourning doves, raccoons, opossums, jackrabbits, and cottontails are found in low to moderate numbers. Deer and fox squirrel populations are low.

Some waterfowl frequent the project area during spring and fall migrations.

Fish habitat in the watershed consists of about 16 ponds averaging about one-half acre in size and the lower 2-mile reach of Pollard Creek. The quality of the habitat in the ponds is good, while that in the stream is poor.

The ponds are stocked with largemouth bass and channel catfish. One pond is open to the public on a fee basis. The other ponds are fished lightly by landowners and their friends.

13/ Information relevant to fish and wildlife resources extracted from the fish and wildlife reconnaissance report by the Fish and Wildlife Service, USDI, in cooperation with the Texas Parks and Wildlife Department, to the State Conservationist, Soil Conservation Service, USDA, Temple, Texas, dated January 22, 1974, concerning a detailed study of the Pollard Creek watershed.

Effluent from the Mineral Wells sewage treatment plant maintains perennial flow in the lower 2-mile reach of Pollard Creek. The creek has not supported a significant fish population because of the poor quality of the effluent released from the old treatment plant and the polluting effects of the old refuse disposal area which is located immediately downstream from the sewage treatment plant. However, the fish population is expected to increase because of the improved quality of the effluent released from a newly completed treatment plant and the development of a new solid waste disposal site. The water quality report submitted to the Texas Water Quality Board by the city for effluent discharged from the plant in March 1974 shows the following quality:

Item	Average of Data Collected During the Month (milligrams/liter)	Highest Value Measured for Month (milligrams/liter)
B.O.D.	5	6
Total Suspended Solids	3	5
Chlorine Residual	1.2	0.9*

*Lowest value measured for month.

There is no commercial fishery in the watershed and none is expected to develop.

Recreational Resources

Opportunities for outdoor recreation are provided at two city parks located in the flood plain of Pollard Creek. Limited opportunities for hunting and fishing are available on agricultural land and farm and ranch ponds on a fee basis. Excellent opportunities for all forms of outdoor recreation and water-based recreation are available at nearby Possum Kingdom State Park, Possum Kingdom Reservoir, Lake Palo Pinto, the Brazos River, and other small lakes.

Archeological, Historical, and Unique Scenic Resources

There are no known historic sites within the watershed either listed in, or in process of nomination to, the National Register of Historic Places, according to the Texas State Historical Commission. The Palo Pinto Historical Society advised that there are no known sites or structures within the watershed. Archeological studies by archeologists of the Archeology Research Program, Department of Anthropology, Southern Methodist University,[14/] indicate that archeological resources are limited to surface evidence of chipping activities.

14/ Mosca, Herbert P., III, Archeological Survey of Texas Watersheds in Central Texas, Archeology Research Program, Department of Anthropology, Southern Methodist University, January 1974.

Soil, Water, and Plant Management Status

There is a gradual trend in land use change toward more intensified production of forage plants. This is identified by an expected 50 percent change in cropland to pastureland and an expected change of 11 percent of rangeland to pastureland during the next 3 years. Pastureland is increasing in acreage because of increased forage producing ability, favorable livestock markets, and the reduced need for labor and farm machinery.

Urban expansion has continued with an increase in both business and dwelling structures. This trend is expected to continue in the future. However, the recent closing of the Fort Wolters military installation near Mineral Wells may cause a temporary slowdown of this trend for the next several years.

There are presently 29 soil and water conservation district cooperators in the watershed, whose conservation plans with the Palo Pinto Soil and Water Conservation District cover 4,292 acres. Nearly 88 percent of the rural lands are covered by soil, water, and plant conservation plans. It is estimated that the soil, water, and related plant resources on approximately 75 percent (3,670 acres) of the agricultural land are adequately protected from deterioration, either naturally or by action of the land user. However, it is estimated that only about 14 percent of the land in the watershed is adequately treated. This level of conservation treatment describes land that is used within its productive capability and on which conservation practices essential to its protection and planned improvement have been applied.

At the present, many of the agricultural programs are complementary to the achievement of planned goals for land treatment. These include the Great Plains Conservation Program, Rural Environmental Conservation Program, Rural Environmental Assistance Program, and various types of loans administered by the Farmers Home Administration. Some delay could be encountered in land use conversions because of the emphasis being given to increased production of food and fiber crops. However, the total long-range effect is expected to be minimal in this watershed.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

The broad concept of resource conservation has been accepted by farmers and ranchers as evidenced by their individual progress in applying conservation measures to their lands. Although there is opportunity to improve management on all land uses, there appear to be no inhibitions or prejudices to the use of new technology in resource conservation.

Many of the farms and ranches are marginal to submarginal as an economic unit. The trend is toward smaller units due to the proximity of the city of Mineral Wells. These smaller units tend to degrade environmental quality. Domesticated livestock, human, and vehicular traffic usually increases proportionately as the acreages are reduced, thus reducing plant cover, increasing soil erosion and downstream sedimentation, and reducing downstream water quality. Land users must be educated and motivated to use a more resistant vegetal cover such as turf grasses to prevent this degradation. This frequently involves land use changes, more intensive land treatment and a greater economic and managerial input by the land user.

There are adequate assistance programs to make it possible and feasible for land users to apply needed conservation treatment and effect needed land use changes. Small land users normally have off-the-farm employment which improves their financial ability to carry out basic resource conservation programs on their lands.

Floodwater Damage

The principal problem in the watershed is frequent damage to urban properties on the Pollard Creek flood plain within the developed area of Mineral Wells. Flooding on the agricultural flood plain of Pollard Creek between the developed urban area and the Brazos River causes moderate to severe damages to crops and pastures, other agricultural properties, and to public roads and bridges. Flooding also occurs on the Pollard Creek flood plain above the site location of floodwater retarding structure No. 1 and on the flood plain of an unnamed tributary stream that joins Pollard Creek below Mineral Wells. Although portions of these flood plain areas are within the corporate limits of Mineral Wells, there are no urban developments subject to floodwater damages. Damages are minor and are limited to pastures and other agricultural properties.

An estimated 519 acres of the watershed, excluding stream channels, is flood plain. Of the 519 acres of flood plain, 157 acres are within the developed area of Mineral Wells, 181 acres are between the developed urban area and the Brazos River. Another 119 acres occur along Pollard Creek in and above the site location of floodwater retarding structure No. 1 and 62 acres along an unnamed tributary stream that joins Pollard Creek below Mineral Wells.

At the present time, land use of the flood plain is about 4 percent cropland, 41 percent pastureland, 14 percent rangeland, 38 percent urban and built-up, and 3 percent miscellaneous. Current trends are toward improvement of pastureland and native rangeland.

Figure 4 shows the flood plain that is subject to flood damage. The urban area of the city of Mineral Wells that will be damaged by the 100-year frequency flood is shown in figure 3.

Some land users, on an individual basis, have attempted to enlarge and straighten segments of the stream. However, this has resulted in very little reduction of flood damage. The adverse economic and physical effect of flooding has been felt throughout the watershed and will prompt local participation in the alleviation of the flood problem.

Agricultural flood plain lands have a market value of $300 to $700 per acre, depending upon location and productivity. Urban properties subject to flood damage are valued in excess of $1,000,000.

Floods are caused by runoff from high intensity, short-duration storms which may occur over the entire drainage area of the watershed. The steep terrain in the upper portion of the watershed causes a rapid rate of runoff. Because of the rapid runoff and comparatively small watershed size, people have little or no notice of severe flooding and insufficient time to remove property and perhaps their persons to safety. Depths of up to 5.5 feet can be expected in some residences and businesses. Such depths of rapidly flowing water present a serious hazard to life.

Floods which inundate less than half of the flood plain and result in minor damage occur on the average of once each year. Major floods which inundated more than half of the flood plain and resulted in moderate to severe damage in recent years occurred in 1957, 1959, 1962, 1966, and 1970.

Information obtained from local residents indicated that the flood event of March 1970 was caused by approximately 5 inches of rainfall. It is estimated that this storm inundated approximately 277 acres of flood plain in the watershed, of which 92 acres are located inside the urban area of Mineral Wells. Damages were estimated at $92,000, of which $90,000 would be to urban properties in reach 1 (figure 4). Storms of this magnitude can be expected to occur about once each 5 years.

A flood resulting from the one percent chance event would cause direct floodwater damages estimated at $345,000. Flood damages in the urban area of Mineral Wells are estimated at $340,000 based upon present development. About 10 businesses and 50 residences in the city of Mineral Wells and about 25 agricultural land users suffer floodwater damages.

Under nonproject conditions the estimated average annual direct monetary damage by floodwater is $56,900. Of this amount, $580 is crop and pasture; $170, other agricultural; $360, road and bridge; and $55,790 is urban damage.

Indirect damages such as interruption of travel, losses sustained by businesses, evacuation of premises when floods threaten, and similar losses are estimated to average $11,310 annually.

Erosion Damage

Erosion rates and associated damages are low. The present gross erosion rate in the watershed averages about 3 tons per acre. This rate varies from less than one ton per acre on rangeland and pastureland having good vegetative cover to more than 10 tons per acre on small isolated areas of poorly vegetated soils on steep slopes. These small isolated areas comprise a total of slightly less than 100 acres.

Streambank erosion on small, isolated areas is occurring in reaches of channel which have been straightened. The most active area is in the upper reaches of the man-made channel in the old lake bed of former Lake Pinto.

Flood plain scour is minor and has caused erosion damages on less than 10 acres of bottomland soils. The average annual value of this damage is $140.

Sediment Damage

The sediment load carried into the Brazos River by Pollard Creek averages about 5,000 tons (4.9 acre-feet) annually. This volume of sediment represents an average sediment concentration of 2,300 milligrams per liter in

the estimated 1,600 acre-feet of annual runoff from the watershed. It is estimated that approximately one acre-foot of sediment derived from Pollard Creek is deposited in Lake Granbury annually.

Overbank deposition of sandy loam sediment occurs in the form of natural levees on the flood plain adjacent to the streambanks of Pollard Creek. This depositional process has resulted in a 10 to 20 percent reduction in soil productivity on 18 acres of agricultural land. The average annual value of this damage is $100. A more severe type of sediment damage occurs in the urban areas where the sediment is left as a thin coating in homes and businesses, and on equipment. The damage caused by this process is reflected as part of the floodwater damages.

Municipal and Industrial Water Problems

The city of Mineral Wells obtains its water from surface supplies outside the watershed. These sources are adequate for present and future needs. Rural, domestic, and livestock water is obtained from ground water and surface ponds.

Plant and Animal Problems

From the time of introduction of domestic livestock prior to 1900, land users have caused vivid changes in native plant communities in the watershed. These changes have been brought about by continued heavy grazing rates, lack of technical knowledge in plant management, and an inability to recognize gradual regressive trends occurring in plant communities. As a result, existing plant cover reflects a pronounced change from that which existed prior to 1900. These changes in general have resulted in native rangelands of the watershed producing a lower quality and quantity of plant cover in relation to recorded original conditions.[1/] Although the existing plant cover on native rangelands is now inferior in quality and quantity to that produced decades ago, it does provide a base from which it is possible to achieve an acceptable level of soil erosion control when properly managed for medium levels of forage production.

The changes in existing vegetative conditions are most pronounced in the native vegetative type areas which are more easily accessible to livestock. On the uplands area of the sandy loam site, such palatable species as sideoats grama, little bluestem, Arizona cottontop, plains bristlegrass, vine-mesquite, engelmanndaisy, falsegaura (Stenosiphon linifolium), and heath aster have given way to an increase in buffalograss, sand dropseed (Sporobolus crytandrus), purple threeawn (Aristida purpurea), fall witchgrass (Leptoloma cognatum), and silver bluestem. Many woody plants have either increased or invaded. These are honey mesquite (Prosopis juliflora glandulosa), ashe juniper, lotebush (Condalia obtusifolia), buckley yucca (Yucca constricta), and Texas pricklypear (Opuntia lindheimeri). The per acre annual air dry herbage yields rarely exceed 3,500 pounds now.

1/ Turney, Henry, Texas Range and Pasture, page 31, Tarleton State College.

The grazable plants on the bottomlands area of the sandy loam site have been severely changed as a result of livestock accessibility. Luxuriant stands of tall grass intermingled by a colorful array of perennial forbs and overstoried by pecan, cedar elm, and sugar hackberry have given way to dense stands of head high underbrush, sparse stands of short and mid grasses and an invasion of woody plants. Plants which typify existing vegetative conditions are Texas wintergrass, buffalograss, purpletop, silver bluestem, tall dropseed, western ragweed (Ambrosia psilostachya), baldwin ironweed (Vernonia baldwini), falsegaura, sedge, saw greenbriar, berlandier wolfberry (lycium berlandieri), elbowbush, ashe juniper, post oak, and cedar elm. The annual air dry herbage yield rarely exceeds 3,500 pounds per acre now.

The dominant species such as sideoats grama, vine-mesquite, and Texas wintergrass on the clay and clay loam site, have been replaced in large part by an increase of purple threeawn, Texas grama (Bouteloua rigidiseta), buffalograss, and an invasion of Texas pricklypear, lotebush, honey mesquite, and western ragweed. Following periods of increased rainfall, there is an abundant growth of annual plants characterized by Japanese brome (Bromus japonicus), common broomweed (Gutierrezia dracunculoides), and Texas filaree (Erodium texanum). The annual air dry herbage yield seldom exceeds 2,500 pounds per acre now.

The sandstone hills site has changed less vegetatively than others in the watershed since the turn of the century. This is due to the steepness of topography which discourages concentrated grazing and by the boulders and rocks which provide protection from grazing to many of the plants. As the other more accessible vegetative type areas are "grazed out" by livestock, this site serves as a source of secondary forage supplies. When these areas regress vegetatively, sideoats grama and little bluestem are the first grasses to be grazed out. They are replaced by silver bluestem, hairy grama, fragrant sumac, and an increase in post oak and purpletop. Further regression results in an invasion of purple threeawn, red lovegrass (Eragrostis oxylepis), sand dropseed, annual grasses and forbs. Eventually, these areas are invaded by honey mesquite. An overstory of cedar elm and an understory of saw greenbriar increase with the honey mesquite invasion. Occasionally fragrant sumac will dominate the site in the lower stages of plant succession. Annual air dry herbage yield will seldom exceed 2,500 pounds per acre under these circumstances.

Only one endangered plant species is listed as occurring in the vegetative area within which this watershed lies.2/ This is the heartleaf adderstongue (Ophioglossum crotalophoroides). This plant has not been specifically identified as occurring within this watershed.

2/ Texas Organization of Rare and Endangered Species, Plant Committee, Preliminary List of Texas Rare and Endangered Species, March 1973.

Water Quality Problems

Present sources of pollution in the watershed are associated with suburban growth. Seepage and overflow from improperly installed septic tanks in the suburban areas; manure from pets, horses, and other livestock concentrated in small areas; and the washing of fertilizers, insecticides, and other wastes from gardens and lawns in the urban and suburban areas will become increasingly greater sources of water pollution as the watershed develops and the number of their occurrences increases. Flooding of the old refuse disposal area for the city of Mineral Wells downstream from the sewage treatment plant results in polluting debris being picked up and carried into the Brazos River.

Recreation Problems

The park facilities of Mineral Wells are located on the flood plain of Pollard Creek. Swimming pool facilities at the main city park are subject to damages by flooding. Picnic and other outdoor recreational facilities at this park and at Lions Park are less likely to be damaged by flooding, but are subject to interrupted recreational use because of flooding.

Economic and Social

About 20 operating units in the flood plain are family-type farm operations employing less than 1-1/2 man-years of outside labor. About one-half, or 10, of these units are low income producing units which require outside employment by their operators to maintain an adequate standard of living.

There is a need for additional employment opportunities for the 280 unemployed in the watershed area.

Residents of Mineral Wells who suffer flood damage are burdened with flood losses that result in a lower standard of living. Along with the monetary losses, there exists the future threats of loss of life and displacements during floods.

A potential source of pollution of floodwater and downstream areas exists along Pollard Creek at the sewer plant and sanitary landfill.

The damages caused by flooding of two parks in the city of Mineral Wells result in the loss of recreational opportunities and an expenditure of funds which could be used for other public improvements.

Other problems are the control of diseases, vectors, and the cleanup of debris which is spread along the flood plain by floodwaters.

PROJECTS OF OTHER AGENCIES

There are no known existing or soon to be constructed water resource development projects within the watershed which have a direct relationship to the works of improvement included in this project.

A study of the flood hazard areas in Mineral Wells, both inside and outside of the watershed, was made for the Federal Insurance Administration, U. S. Department of Housing and Urban Development, by the Soil Conservation Service, U. S. Department of Agriculture, to determine where flood insurance is to be made available to residents.

The Farmers Home Administration has initiated a program for lending money to suburban homeowners to solve septic tank problems. The city of Mineral Wells received financial assistance from the Environmental Protection Agency under provisions of Public Law 660 for the construction of a new sewage treatment plant.

PROJECT FORMULATION

The application for assistance for the Pollard Creek watershed was submitted to the Secretary of Agriculture through the Texas State Soil and Water Conservation Board (designated state agency). A field examination was made by the Soil Conservation Service and representatives of appropriate state agencies to determine that, within the requirements of national standards, there were no apparent obstacles to planning and carrying out a watershed project. The Texas State Soil and Water Conservation Board held a public hearing to solicit public reaction. The board then recommended that the Soil Conservation Service furnish planning assistance.

The work plan was developed in full consultation and cooperation with all interested agencies and individuals. Written notification of initiation of work plan development was sent to all federal, state, and local agencies that might have an interest in the project, soliciting information and comments. The Fish and Wildlife Service of the U. S. Department of the Interior, in cooperation with the Texas Parks and Wildlife Department, made a reconnaissance survey of the fish and wildlife resources of the watershed. This report was used in plan formulation. A study of the watershed was made by a representative of the Texas Forest Service to determine if there were any forest management possibilities. Archeologists from the Department of Anthropology, Archeology Research Program, Southern Methodist University, made archeological studies in the watershed. The Palo Pinto Historical Society supplied information on the watershed.

An active public information program was carried out by the sponsors in an effort to keep the public informed as the project was formulated. Representatives of the sponsoring local organizations contacted land users for permission to survey and to explain how the program would affect their land.

Objectives

The conservation land treatment measures and structural measures selected for inclusion in this plan are those which will meet the goals of the sponsors, the public, and the Soil Conservation Service in achieving:

1. Quality in the natural resource base for sustained use.

2. Quality in the environment to provide attractive, convenient, and satisfying places to live, work, and play.

3. Quality in family standards of living based on community improvement, economic opportunity, wholesome leisure, and cultural and eductional opportunities.

The goals are to accelerate the establishment of conservation land treatment measures to increase the total applied on the land to 80 percent and achieve adequate treatment (complete installation of all needed conservation measures) on 70 percent of the land during a 3-year installation period. These measures are needed on poorly vegetated and eroding lands to prevent further degradation of the natural resource base.

The permissible soil loss rates for cropland and pastureland soils range from 2 to 5 tons per acre per year. These rates are correlated to soil depth and other physical and chemical characteristics of the soils. The land treatment measures planned for cropland will be of a type and applied at an intensity that will keep soil losses within this range. The expected conversion of about one-half of the present acreage of cropland will remove much of the more erodible land from cultivation. Most of this land will go to improved pastures. This type of cover will improve the already modified ecosystem caused by man's demands on the land. Approximately 150 acres of rangeland are also expected to be converted to improved pastureland since the present cover of low-producing grasses, brush, and trees cannot meet the demands for producing adequate forage for domestic livestock which are being placed upon it.

The management goals established during planning for treatment of the rangeland are aimed toward improving the quantity of the plant cover for soil erosion control and the quality of this cover to better balance the harmony of the needs of man, wildlife, and domestic farm animals. The grazing pressure exerted on the rangeland has tended to reduce the matted effect of vegetative cover on the surface of the soil. The permissible soil loss rates for the rangeland soils range from 1 to 3 tons per acre per year. The existing vegetative cover is adequate to protect the soil from erosion in all areas except on some of the clayey footslopes and sandstone hillsides. Erosion on approximately 100 acres of these sites exceeds the allowable rates.

Absentee ownership of land is expected to increase from the present number of four absentee owners and 1,121 acres of land. The complexity of economic conditions, adjacent community development, esthetic appeal resulting from developments within the watershed, and other undetermined factors will affect the trend of ownership. It will be a goal to contract and work with these owners to develop sound land use and conservation treatment on their properties.

The Soil Conservation Service will encourage the Palo Pinto Soil and Water Conservation District to take positive educational and advisory actions with the municipality of Mineral Wells in safeguarding the quality of the Pollard Creek watershed. This will include the vegetating of areas of accelerated erosion resulting from urban development. Installation of mechanical practices will be encouraged where vegetation will not suffice. The Soil Conservation Service will also make available needed soils interpretative data pertinent to road construction, building sites, and the installation of septic tanks and other sanitary facilities to assist in reducing or preventing the degradation of downstream water quality and sedimentation of stream channels and water impounded in the sediment pools of the floodwater retarding structures.

The flood prevention goals are:

1. Prevent flooding of the 50 residential units and 10 businesses located on the 157 acres of Pollard Creek flood plain within the urban and built-up area of Mineral Wells.

2. Reduce floodwater, sediment, and erosion damage on the 181 acres of agricultural flood plain along Pollard Creek, between the developed area of Mineral Wells and the Brazos River, which are subject to moderate to severe damage.

3. Identify other flood prone areas, not now developed, so that hazards can be prevented through flood plain regulations where state law permits or through public information programs where state law does not permit.

The goals to be achieved in preserving, improving, and developing fish and wildlife habitat are as follows:

1. The improvement of fish habitat in the existing ponds and the lower reach of Pollard Creek and the Brazos River by applying land treatment measures in the watershed which will effectively control erosion and reduce the sediment load in runoff water.

2. The addition of approximately 41 acres of good fish habitat in the sediment pools of the two floodwater retarding structures.

3. The improvement of wildlife forage conditions in the watershed by properly grazing the native plant communities with domestic livestock. This will permit some of the more palatable legumes and forbs, which are important deer food plants, to reproduce and increase.

4. The retention of optimum cover conditions for most species of wildlife by selectively applying brush management in a strip

or block pattern while removing some of the brush for increased production of food plants such as legumes, forbs, and grasses.

Environmental Considerations

The sponsors carefully considered the impacts, both favorable and adverse, in developing the plan for meeting the project objectives. Adverse effects were avoided when possible if project objectives could be achieved. The sponsors recognized that a certain amount of land would need to be committed to the project. The structure sites were selected and structures were planned to minimize adverse effects to existing built-up areas, the city park, wildlife habitat, etc., as much as was practical. The scenic qualities of the steep hillsides at floodwater retarding structure No. 1 will be preserved through use of a concrete emergency spillway in place of making a deep cut into one hillside for an earth spillway. Multiuse plants will be used in vegetating the structures, disturbed areas, and idle areas around the sites to prevent erosion and for use by wildlife and livestock.

Based on experience on similar structures in nearby watersheds, it is not anticipated that any health or water quality problems will arise at any of the sediment pools of the floodwater retarding structures used for livestock water, lake fisheries, and/or incidental recreation. However, land users will be discouraged from using any bodies of water created by the project for incidental recreation until sanitary facilities meeting local and state health requirements are installed.

The sponsoring local organizations considered the inclusion of recreational development at the structure sites. The City of Mineral Wells is currently involved in several recreation oriented projects, including the operation of the recently obtained greenbelt properties of Fort Wolters. The proximity of Possum Kingdom and Palo Pinto Lakes and Lake Mineral Wells provides recreational opportunities to the residents of the watershed. The financial obligations associated with any additional recreational development were considered to be excessive in view of the limited need for such additional developments.

The minor reduction in average annual runoff from the watershed due to evaporation and seepage losses in the sediment pools of the floodwater retarding structures will become insignificant as sediment accumulation reduces the amount of water stored. All of the structures will have provisions to release impounded floodwater if it becomes necessary to avoid encroachment upon prior downstream water rights.

Alternatives

The considered alternatives to the proposed action in planning for the development, conservation, and productive use of the soil, water, and related resources are:

1. A program of accelerated application of land treatment measures for watershed protection.

2. A program consisting of flood-proofing to minimize flood losses.

3. A program of accelerated application of land treatment measures and channel work.

4. Foregoing the implementation of the project.

A discussion of each alternative follows:

Alternative No. 1 - Alternative No. 1 consists of applying the land treatment measures included in the selected plan. These measures and the environmental impacts are the same as discussed under "Planned Project - Land Treatment Measures" and under "Environmental Impact - Conservation Land Treatment." These measures would reduce average annual monetary damages from floodwater by 5 percent. Flood insurance, which is available through the flood insurance program administered by the Federal Insurance Administration, U. S. Department of Housing and Urban Development, would reduce the economic impact to an individual or a business from a flood. Other problems, such as interruption of business and travel during and after the floods, would continue to occur. The threat of loss of life would also remain.

The cost of installing alternative No. 1 is $50,200, which does not include the cost for the flood insurance program.

Alternative No. 2 - Alternative No. 2 consists of applying land treatment measures as discussed in alternative No. 1 and flood-proofing buildings and improvements on the flood plain. Flood-proofing can be used to reduce floodwater damages to improvements on the flood plain. One homeowner has installed such measures to reduce damage to his property from the smaller floods. Similar measures could be used to reduce flood damages to other property; however, flood-proofing of all existing structures would be impractical. About 15 residences and 2 businesses of the 50 residences and 10 businesses in the flood plain probably could be flood-proofed. The remaining 35 residences and 8 businessss would be impractical to flood-proof because of their construction. Other damages, such as interruption of travel and business and the threat of loss of life, would continue to exist in the flood plain. Flood insurance will reduce the economic impact to individuals and businesses whose properties cannot be flood-proofed.

The cost of installing alternative No. 2 is $70,200, which does not include the cost of flood insurance.

Alternative No. 3 - Alternative No. 3 consists of applying land treatment measures at an accelerated rate and installing channel work. The land treatment measures and the environmental impact of these measures are the same as those included in the selected plan. About 2.5 miles of channel work would need to be installed to provide the desired level of protection. Flow velocities of up to 10 cubic feet per second would be experienced in the channel to achieve about the same level of protection as provided by the

measures included in the selected plan. Rock riprap and/or concrete would be required for channel stability with velocities of this magnitude. Approximately 45 acres of land would be required for installation. Existing woody habitat along about 2.0 miles of the channel would be destroyed. Two bridges would need to be modified or replaced. Runoff from the watershed would be moved through this portion of the watershed at a slightly faster rate. Increased flooding would occur within the deep narrow gorge section of Pollard Creek downstream from the sewage treatment plant and old landfill area.

The total cost of installing alternative No. 3 is $2,057,200, of which $50,200 is for land treatment and $2,007,000 is for channel work.

Alternative No. 4 - Alternative No. 4 consists of foregoing the implementation of the project. Land treatment measures would continue to be applied for watershed protection under the on-going program. It is reasonable to expect that land users would eventually install many of these measures to maintain the productivity of their lands. However, the level and rate of application of these measures would be lower than in the selected plan due to limited availability of technical assistance and associated motivation.

The environmental impacts of installing the land treatment measures under the going program would be generally the same as those discussed under "Environmental Impacts - Land Treatment Measures." However, the magnitude of the impact of these measures would be less due to the lower level and rate of application.

Average annual floodwater damages would be reduced by about 3 percent as a result of the land treatment measures expected to be applied without accelerated technical assistance. The economic impact of the remaining floodwater damages to individuals and businesses will be reduced by flood insurance.

The selection of alternative No. 4 would forego the opportunity to realize about $24,330 in average annual net benefits.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Planned land treatment measures (conservation practices) will be applied on private lands in the watershed by land users on a voluntary basis. These measures are based upon a resource conservation plan developed by the land user in cooperation with the Palo Pinto Soil and Water Conservation District. The Soil Conservation Service will provide technical assistance to the land user in planning and application of all soil, plant, and water conservation measures. This assistance is based upon a working agreement contained in a Memorandum of Understanding between the Soil Conservation Service and the Palo Pinto Soil and Water Conservation District.[1/]

1/ Memorandum of Understanding Between United States Department of Agriculture and Palo Pinto Soil and Water Conservation District, September 1962 (Rev.); Supplemental Memorandum of Understanding Between U. S. Department of Agriculture, Soil Conservation Service, and Palo Pinto Soil and Water Conservation District, July 1967.

Land treatment measures are to be applied at an accelerated rate over a 3-year installation period. Complete treatment is to be applied on 20 acres of cropland, 600 acres of pastureland, and 2,000 acres of rangeland in addition to maintaining the treatment measures already established on other lands. This rate of application will increase the amount of land adequately treated in the watershed to 70 percent.

The land treatment measures to be installed include conservation cropping systems on the cropland; pasture planting, pasture management, and brush management on pastureland; range seeding, proper grazing use, ponds, and brush management on rangeland; and wildlife upland habitat management and fishpond management for fish and wildlife habitat improvement. These measures are defined in the Soil Conservation Service National Handbook of Conservation Practices.[2/]

Conservation cropping systems are to be applied to the cropland which is expected to remain in this use in the future. These systems consist of crop rotations of small grain with and without legumes, grain sorghums, and forage sorghums.

Conservation treatment measures are to be applied to 600 acres of pastureland to maintain a year-round cover of forage plants for protection against erosion and to maintain the soil resource while providing the volume of forage desired by the land user. Pasture planting is applied to former cropland and areas of overused rangeland to restore cover and forage producing plants. The plants most commonly chosen by the land users for seeding or reseeding of pasturelands are Coastal bermudagrass, lovegrass, and kleingrass. Other pasture management practices include fertilization, and grazing of plants at periods of time and at intensities which are compatible with the physiological needs, and the control of undesirable plants which interfere with the intensive grazing use of these lands through their competition for moisture and space.

Rangeland which does not have the desired quantity or quality of native plants will receive range seeding in addition to other conservation treatment measures. Range seeding is to be applied on about 960 acres of rangeland which cannot be improved within a reasonable period of time by grazing management practices due to the absence of a satisfactory seed source. Reseeding is to be accomplished with seeding mixtures of plants compatible with the native plant community on adjacent areas. Proper grazing use, deferred grazing, and planned grazing systems involve the grazing of forage plants at period of time and at intensities which are compatible with the physiological needs of the plant. Application of these practices assure the continued growth and survival of desired plant

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2/ U. S. Department of Agriculture, Soil Conservation Service, National Handbook of Conservation Practices, July 1971.

species. Rangeland which has satisfactory composition of native plants for forage production will be managed to maintain or improve the existing range condition.

Brush management is to be applied on about 1,630 acres of rangeland for the selective control of undesirable woody species in order to reduce competition and allow the reestablishment of desired native vegetation. Mechanical methods of control such as tree dozing and root plowing will be used to achieve the desired selectivity. Patterns of application which will enhance wildlife habitat and preserve esthetic values will be encouraged. The recommended method of implementing brush management in areas having populations of wildlife is to retain units and patterns of brush of good habitat value in favorable locations for use as browse and cover. Post oak, blackjack oak, cedar elm, and pecan compose about 10 percent of the present composition on the bottomland. These species will be retained. Brush management on the upland will leave about 20 percent of the woody species for wildlife cover.

Conservation land treatment measures which will have a direct effect on fish and wildlife include fishpond management and wildlife upland habitat management. The ponds in the watershed will be managed by controlling aquatic plants, fertilizing pond waters to increase plantonic and zootic growth for more fish food, controlling overpopulations of sunfish and other undesirable species, and by the use of other pond management techniques to increase fish production for the landowners and others who may fish in the ponds.

The application of wildlife upland habitat management on about 2,000 acres of agricultural land will enhance the value of plant communities on rangeland for habitat for certain species of wildlife, principally game birds and mammals. Domestic livestock grazing will be limited to such a degree as to permit the more palatable grasses, legumes, woody plants, and other plants eaten by livestock, deer, and other wildlife species to increase in abundance. In areas where woody plants produce such thick canopy as to shade out the herbaceous ground cover, brush clearing will be applied in strip or block pattern to produce alternating strips or blocks of brush and open areas. This technique will increase the food supply for wildlife species such as white-tailed deer, rabbits, quail, dove, etc., yet retain the necessary cover types needed by these species. This will also increase the "edge effect" as described by Aldo Leopold[3/] as being essential in the habitat of many wildlife species.

Structural Measures

A system of two floodwater retarding structures is planned for construction during the 3-year installation period. Runoff from 58 percent of

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3/ Leopold, Aldo, Game Management, Charles Schribner's Sons, N.Y., N.Y., 1933.

the watershed will be retarded by the structures. The location of the floodwater retarding structures is shown on the project map (figure 5).

The floodwater retarding structures are planned with capacity for sediment accumulation and floodwater. The total capacity allocated for the anticipated 100-year accumulation of sediment is 245 acre-feet with 173 acre-feet in structure No. 1 and 72 acre-feet in structure No. 2. The principal spillway crest of both structures will be set at the capacity of the 100-year sediment volume predicted to be deposited as submerged sediment. The principal spillways for both structures will be the drop inlet type with cantilever outlets. The inlets of both structures will be ungated to operate automatically, and will have provisions to release impounded water in order to perform maintenance, and if it becomes necessary, to avoid encroachment upon prior downstream water rights.

The total floodwater retarding capacity in the two floodwater retarding structures is 1,998 acre-feet, provided for in the space between the sediment pools and the emergency spillway crests. The emergency spillway for structure No. 1 will be a concrete chute over the dam; and it will have less than a 2-percent chance of use at the end of 100 years after construction. The emergency spillway discharge resulting from the 1-percent chance of event storm will not cause any significant downstream urban damages. The emergency spillway of structure No. 2 will be a vegetated channel excavated in earth around the end of the embankment; and it will have less than a 1-percent chance of use. The embankments of both structures, the emergency spillway at structure No. 2, disturbed areas, and odd areas on or adjacent to the works of improvement will be vegetated to control erosion, provide wildlife food and cover, to minimize habitat loss resulting from construction, and to enhance the remaining habitat. Plant species will be selected, sited, and planted in accordance with SCS Technical Specifications for Establishment of Wildlife Habitat on or Adjacent to Watershed Works of Improvement.

The type of vegetation to be used will include annual and perennial vegetation of native and introduced grasses, forbs, shrubs, and trees. Sod forming vegetation such as bermudagrass will be used as the base vegetation on embankments and spillways. Bunchgrasses, forbs, and shrubs such as bluestem species, kleingrass, maximilian sunflower, bushsunflower, dewberry, bush honeysuckle, buttonbush, and indigobush will be planted on disturbed areas and odd areas and overseeded or planted at some locations. Woody species such as crabapple, autumnolive, russianolive, mulberry, walnut, oaks, and pecan will also be planted in odd areas within the rights-of-way. These plantings will be sited and planned in detail during the final design stage in consideration of specific site conditions. The selection of exact species to be used will be from the adapted species of seed and plant stock available at the time of construction. Fences will be constructed around the embankment and emergency spillway of each structure to protect the vegetation from damage by grazing.

The foundations contain 10 to 12 feet of yielding clayey alluvium over non-yielding, moderately soft shale bedrock. Preliminary site investigations indicate that all needed fill material for the embankment for structure No. 1 should be obtainable from the sediment pool area and

from the embankment of old Lake Pinto. Investigations indicate that embankment materials for structure No. 2 should be obtainable from the emergency spillway and sediment pool areas. These materials consist mainly of silty clay (CL), clayey sand (SC), and some clayey gravel (GC) in the lower horizons. Some scattered sandstone cobbles and boulders derived from the sandstone capped abutments occur in the alluvium near the base of the slopes.

Installation of the structural measures will require 185 acres of land. This area on which the dams will be constructed and on which sediment and floodwater will be impounded consists of 175 acres of pastureland and rangeland, and 10 acres (3.0 miles) of intermittent stream channels under present land use conditions. Construction of the dams and emergency spillways will require 10 acres of land, which includes 9 acres of pastureland and rangeland, and 1 acre (0.3 mile) of intermittent stream channel. The sediment pools which will initially impound water will inundate 41 acres of land, which includes 38 acres of pastureland and rangeland and 3 acres (0.9 mile) of intermittent stream channels.

The retarding pools will temporarily inundate 134 acres of land, which includes 128 acres of pastureland and rangeland, and 6 acres (1.8 miles) of intermittent stream channels.

The sediment pools of both floodwater retarding structures are expected to hold water. The pools and surrounding areas have a good potential for incidental recreational use. However, the sponsors do not plan to assure public access to either of the structures; therefore, public recreation use will be prohibited at both sites. If at some future time public access is provided at either of the sites, the sponsors will assure that adequate sanitary facilities, in compliance with public health laws, are installed prior to making the areas available for public use.

During construction operations, the areas needed for construction of the dams and emergency spillways and the borrow areas will be cleared of all existing vegetation. In addition, all large woody vegetation within the reservoir areas below the elevation of the lowest ungated outlet will be cleared, except any large trees in the upper fringes of the sediment pools that will not interfere with the operation of the structure will be retained. It is estimated that 14 acres of large woody vegetation will be cleared. The dams, emergency spillways, and all areas disturbed during construction, except water impoundment areas, will be vegetated with adaptable multiuse plants for erosion control, wildlife use, and grazing of livestock.

In order to install the floodwater retarding structures, it will be necessary to relocate approximately 2,000 feet of county road and a portion of a powerline and a telephone line affected by structure No. 2. Under present conditions, there will be no apparent displacements or relocations of persons, businesses, or farm operations as a result of installation of structural measures. If relocations or displacements become necessary, they will be

carried out under the provisions of Public Law 91-646, and Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

The minimum land rights required will be those necessary to construct, operate, maintain, and inspect the works of improvement; to provide for flowage of water in or upon or through the structures; and to provide for the permanent storage and temporary detention, either or both, of any sediment or water.

The environment will be protected from soil erosion and water and air pollution during construction. Contractors will be required to adhere to strict guidelines set forth in each construction contract to minimize soil erosion and water and air pollution during construction. Excavation and construction operations will be scheduled and controlled to prevent exposure of excessive amounts of unprotected soil to erosion and the resulting translocation of sediment. Measures to control erosion will be uniquely specified at each work site and will include, as applicable, use of temporary vegetation or mulches, diversions, mechanical retardation of runoff, and traps. Harmful dust and other pollutants inherent to the construction process will be held to minimum practical limits. Haul roads and excavation areas and other work sites will be sprinkled with water as needed to keep dust within tolerable limits. Contract specifications will require that fuel, lubricants, and chemicals be adequately labeled and stored safely in protected areas, and disposal at work sites will be by approved methods and procedures. All construction equipment will have safety and health features in compliance with the Safety and Health Act. Clearing and disposal of brush and vegetation will be carried out in accordance with Regulation 1, Rule 101.25 of the Texas Air Control Board's applicable laws, ordinances, and regulations pertaining to burning. Each contract will set forth specific stipulations to prevent uncontrolled grass or brush fires. Disposal of brush and vegetation will be by burying, hauling to approved off-site locations, or controlled burning, as applicable.

Efforts will be made to avoid creating conditions which will increase populations of vectors that affect public health. Prevention and control measures will be implemented, if needed, in cooperation with appropriate federal, state, and local health agencies to suppress proliferation of vectors such as aquatic insects, terrestrial arthropods and rodents, etc. that could occur with installation of the structure.

Necessary sanitary facilities, including garbage disposal facilities, will be located to prohibit such facilities being injuriously adjacent to wells or springs in conformance with federal, state, and local water pollution control regulations. Conformance to all environmental control

requirements will be monitored constantly by a construction inspector who will be on-site during all periods of construction operations.

The environment will continue to be protected from erosion and water pollution following completion of construction. Project sponsors will operate and maintain the structural measures in accordance with a specific operation and maintenance agreement The agreement will set forth the inspections to be made and the maintenance to be performed to prevent soil erosion and water pollution.

Figures 1, 2, and 2A show structures which are typical of those planned for the watershed. Table 3 shows details on quantities and design features of the structural measures.

All applicable state water laws will be complied with in the design and construction of the structural measures, as well as those pertaining to the storage, maintenance of quality, and use of water.

Nonstructural Measures

The City of Mineral Wells, on December 17, 1974, enacted a zoning ordinance that complies fully with the provisions of Section 1910.3 of Public Law 92-234. The ordinance regulates urban expansion below the 100-year, with-project floodwater elevation along Pollard Creek within the corporate limits of the city.

No sponsoring local organization has authority under state law to enact zoning ordinances or flood plain regulations outside the corporate limits of Mineral Wells. The City of Mineral Wells and the Palo Pinto County Commissioners Court will, therefore, jointly develop and initiate a public information program to publicize, at least annually, the areas outside the corporate limits of Mineral Wells still subject to flooding from a 100-year event.

EXPLANATION OF INSTALLATION COSTS

Land treatment measures listed in table 1 will be applied at an estimated cost of $50,200. This includes funds for Public Law 46 and Public Law 566 technical assistance to be provided by the Soil Conservation Service.

Included in the above sum is $6,500 of Public Law 566 funds to accelerate technical assistance in order that planning and application of needed land treatment measures included in this plan may be accomplished.

by the end of the 3-year installation period. The estimated cost of application of the various measures is based on current prices being paid by land users in the area.

The total installation cost of the structural measures is estimated to be $672,180, of which Public Law 566 costs are $568,900 and local costs are $103,280.

Public Law 566 costs include $471,800 for construction, $25,470 for engineering services, and $71,630 for project administration.

The local costs consist of $102,280 for land rights and $1,000 for project administration. The estimated cost of land rights includes $750 for legal fees, $94,020 for value of easements, and $7,510 for modifications or replacements of existing improvements.

The local costs for project administration include sponsors' cost relative to contract administration, overhead and organization costs, and whatever construction inspections they desire to make at their own expense.

The construction cost includes the engineer's estimate and a 10 percent allowance for contingencies. The engineer's estimate was made by determining the amount or quantity of specific items that will be needed for construction of each individual structure. Such items include, but are limited to, land clearing, embankment fill, excavation, concrete pipe, concrete, fencing, and vegetation. The unit cost for the specific items was based on actual cost of structural measures in similar areas modified to conditions found in this watershed.

Engineering services and project administration costs are based on an analysis of previous work in similar areas. Engineering services costs include, but are not limited to, detailed surveys, geological investigations, soil testing and analyses, designs, and cartographic services. Project administration costs include the cost of construction inspections, contract administration, and maintenance of Soil Conservation Service records and accounts.

Value of land, easements, and rights-of-way was estimated by representatives of the local sponsors and concurred in by the Soil Conservation Service. The estimated costs for moving or modifying the powerline and telephone line were furnished by the respective companies owning these lines. The Palo Pinto County Commissioners Court furnished the estimated cost for altering the county road.

Under present conditions there are no apparent displacements of persons, farm operations, or businesses as a result of installation of the project. However, in the event that displacements do occur,

all associated relocation costs will be shared, with Public Law 566 funds providing 79.65 percent and local funds providing 20.35 percent. These cost-sharing percentages are based upon the ratio of Public Law 566 funds and other funds, less relocation payments, to the total project cost. All costs for needed relocation assistance advisory services will be borne by the sponsors.

The estimated schedule of obligations for the 3-year installation period, covering installation of land treatment and structural measures, is as follows:

Schedule of Obligations

Fiscal Year	Measure	PL 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
1st	Land Treatment	2,170	14,570	16,740
2nd	Land Treatment	2,160	14,560	16,720
	Floodwater Retarding Structures Nos. 1 and 2	568,900	103,280	672,180
3rd	Land Treatment	2,170	14,570	16,740
TOTAL		575,400	146,980	722,380

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

The application of land treatment measures to complete the treatment on 20 acres of cropland, 600 acres of pastureland, and 2,000 acres of rangeland during the 3-year installation period will increase land adequately treated in the watershed to 70 percent. Many of these measures would eventually be installed by the land users under the present going program. However, they would be applied at a slower rate, over a longer period of time, due to lack of sufficient technical assistance for planning and applying these measures.

Installation of conservation treatment on the land which is to remain in cropland in the future will provide for a continuous soil cover of growing vegetation and plant residues on or near the surface of the soil. This will reduce erosion to within the permissible soil loss rate of 5 tons or less per acre annually by protecting

the soil from the impact of the energy of falling raindrops and by preventing the washing of soil from the fields. Needed plant residues will also be returned to the soil to sustain the biological activity necessary for maintenance and improvement of the soil resource.

The application of pastureland conservation treatment measures on former cropland and areas of intensively used former rangeland will beneficially modify an already disrupted or degraded ecosystem on these lands. The environment will be improved on this land through the establishment of a denser and more productive soil cover which will reduce soil erosion and return the needed volume of plant residues for biological activity in the soil.

The conservation land treatment and management practices to be applied to rangeland will improve the quantity and quality of the native vegetation. The application of brush management on rangeland will restore open areas for recovery of the desirable native grasses, forbs, and browse plants. The use of grazing management practices to control grazing by livestock during specified periods through the growing season will allow natural reseeding of the rangeland by the native plants. Range seeding will reestablish many of the native grasses on areas of rangeland which do not have sufficient plants for natural reseeding. These practices will also allow the restoration of a denser and more productive soil cover for erosion prevention while improving the savannah and prairie ecosystem.

The reduction in upland erosion by the application of land treatment measures on cropland, pastureland, and hayland will decrease the volume of infertile sediment delivered to the flood plain and downstream channels.

The use of fertilizer is expected to continue on both the cropland and pastureland in the future. Fertilization is needed to maintain the productivity of the soil by replacing elements removed from the soil by crops and the forage plants consumed by livestock. The rates of fertilization, however, are not expected to be high in this subhumid climatic area. Fertilization should have no significant adverse impacts on the quality of the water impounded in the structures.

Improvements in watershed cover conditions during the installation period are expected to reduce annual gross erosion by about 20 percent, or 4,600 tons annually. These measures are expected to reduce sedimentation damages by 10 percent. These measures are also expected to reduce peak runoff from the uplands and reduce downstream floodwater damages by about 5 percent.

The installation of the floodwater retarding structures will provide flood protection to the 338 acres of flood plain lands having moderate to severe flood problems under the existing level of development. The remaining 181

acres, which are not provided flood prevention by structural measures, have only a very minor flood problem under the existing level of development and do not warrant project type action. These areas are identified, however, as potential flood hazard areas if urban type developments are not prevented. To prevent or minimize future damages, the sponsoring local organizations will enforce flood plain regulations on all areas still subject to flooding from a 100-year frequency flood event where they have authority under state law, or will initiate a public information program to publicize the hazards remaining after project installation where they do not have regulatory authority.

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 are shown in the following tabulation:

Acres Inundated

Evaluation Reach (figure 4)	Average Recurrence Interval: 5-Year Without Project	5-Year With Project	25-Year Without Project	25-Year With Project	100-Year Without Project	100-Year With Project
1	96	0	137	5	157	14
2	86	16	145	36	181	54
Subtotal (Area benefited by structural measures)	182	16	282	41	338	68
X 1/	74	70	101	96	119	113
Y 2/	35	33	54	51	62	59
TOTAL	291	119	437	188	519	240

1/ Area in and above site not benefited by structural measures.
2/ Area on unnamed tributary not benefited by structural measures.

Figure 3 shows the urban area of Mineral Wells that will be inundated by the 100-year frequency flood for without and with project conditions. With the project installed, damages in the urban area of Mineral Wells will be reduced by 99 percent.

After installation of the combined program of land treatment and structural measures, the reduction in flooding and floodwater depths and velocities, sediment deposition, and erosion will reduce crop and pasture damages by 66 percent; other agricultural damages, 94 percent; road and bridge damages, 83 percent; urban damages, 99 percent; overbank deposition damages, 50 percent; flood plain scour, 71 percent; and indirect damages by 99 percent.

The project will benefit directly the owners and operators of 25 farms and ranches in the agricultural land of the flood plain and the owners and operators of about 60 residential and business units in Mineral Wells.

The planned project will provide protection from the 100-year event to all existing urban properties except three garages and yards which are at extremely low elevations. The depth of flooding in one garage will be limited to a depth of 0.7 foot from the 100-year event. The other two will be flooded less than 0.2 foot deep from the 100-year event. The damage will be very minor due to shallow depths, slow velocities, and the small areal extent of flooding.

After installation of the planned program of land treatment and structural measures, the direct monetary floodwater damage resulting from a recurrence of a flood similar to the one that occurred in March 1970 will be eliminated in the urban area (Reach 1)(figure 4). An 88 percent reduction will be provided for Reach 2.

The average annual volume of sediment delivered to the Brazos River with the total project installed will be reduced from an estimated 5,000 tons under without project conditions to 2,000 tons with the project installed. This sediment load represents a sediment concentration of 2,300 mg/1 in the estimated 1,600 acre-feet of average annual runoff from the watershed, excluding the sewage effluent released into Pollard Creek, and 900 mg/1 after the project is installed. It is estimated that the volume of sediment deposited in Lake Granbury from Pollard Creek will be reduced by about 0.5 acre-foot annually.

The quality of streamflow will be improved through the reduction of sediment that will result from project installation. Streamflow quality below the old refuse disposal area will also be improved somewhat. Polluting debris and soluble pollutants now being transported into the stream system will be reduced as a result of a 62 percent reduction in average annual flooding over the refuse area. Other than the effects caused by reduction of sediment and flooding of the refuse area, the project will have no measurable effect on water quality within the watershed. During the initial filling of the sediment pools and the occasional extreme dry periods when the sediment pools are below the emergency spillway elevation, the tendency will be toward a lowering of the water quality due to the reduced runoff. During normal operations, the tendency will be toward improving the water quality due to the longer duration flows. Either way the changes will be insignificant and are not quantifiable.

Initially, the project will cause a 3.9 percent reduction in the average annual volume of streamflow from the watershed because of evaporation and seepage losses in the sediment pools. However, as

sediment accumulates in the sediment pools, the streamflow will again approach pre-Public Law 566 project conditions.

Increased flood protection afforded by the proposed structures may increase the rate of urbanization in the protected areas below the structures. Increased urbanization in this area would reduce growth in other areas of the watershed.

During construction of the structural works of improvement, air and water pollution will increase from dust and sediment inherent to the construction process. This increase will be kept within tolerable limits. Permanent vegetation for erosion control will be established on the embankments and any disturbed areas not permanently inundated by water in the sediment pools.

Impoundment of water in the sediment pools will take 41 acres of pastureland and rangeland out of further agricultural production. Another 10 acres of pastureland and rangeland will be converted to use for dams and emergency spillways and will have restricted agricultural use as pastureland. It is expected that most of the 134 acres of pastureland and rangeland in the detention pools will remain in present use with only limited interruption when inundated. The total net loss of agricultural production resulting from inundation and construction of the structural measures is about $200. No measurable effect is anticipated on the management operation of the individuals affected.

The installation of this project will have no adverse effect on any endangered plant species.

Fish and Wildlife and Recreation

Most of the land treatment measures to be applied will generally benefit wildlife. The application of wildlife upland habitat management practices on about 2,000 acres of agricultural land will improve wildlife habitat by the following means:

1. Use of seed producing grasses such as kleingrass or lovegrass in pasture planting to furnish seed eaten by many species of birds and small mammals.

2. Application of brush management by leaving patterns of brush surrounding open areas for edge habitat for deer.

3. Retention and improvement of woody vegetation along creeks, fence rows, etc., to improve food supply and cover in cropland and pastureland areas.

The application of fishpond management in ponds in the watershed will benefit the fisheries.

The two proposed floodwater retarding structures will in general be beneficial to fish and wildlife. About 51 acres of poor-to-fair quality habitat for upland wildlife species will be destroyed or altered. The existing vegetation on 10 acres will be destroyed for construction of the dams and emergency spillways and replaced with a suitable vegetation for erosion control, grazing use, and wildlife food value. The existing vegetation on the other 41 acres will be destroyed through permanent inundation by water impounded in the sediment pools. These water areas will furnish good quality fish habitat and feeding and resting areas for migrating waterfowl, shorebirds, and wading birds, as well as a few resident species, such as the killdeer, great blue heron, etc.

The quality of fish habitat in lower Pollard Creek will be improved by the reduction of sediment in the runoff and a reduction of polluting debris carried away from the old sanitary landfill area by floodwater.

Archeological, Historic, and Scientific

There are no archeological or historical sites listed in or nominated to the National Register of Historic Places that will be adversely affected by the installation of the structural measures. An archeological survey, made by the Archaeology Research Program of Southern Methodist University, found that there are no significant archeological resources within the pool areas or construction areas of the planned floodwater retarding structues. This study concluded that additional studies of the archeology should not be necessary before construction begins. Interagency Archeological Services-Denver, National Park Service, will be kept informed of the progress of the plan. If archeological sites are located during construction activities, a trained archeologist will be called to the site to investigate, record, and collect material to mitigate any possible loss of information.

Economic and Social

The installation of land treatment and structural measures will reduce substantially the direct income losses due to floodwater damage suffered by farm and ranch operators and residents in the urban area of Mineral Wells. Indirect losses such as displacements due to flooding, rerouting of traffic, and individual efforts to alleviate flood losses will be eliminated for residents of the watershed. The future threats of loss of life to residents of the watershed due to floodwater will be minimized.

The installation of structural measures will not adversely affect recovery of known mineral resources in the watershed or preclude exploration for additional mineral resources which may exist there. The project could commit an estimated 500,000 tons of bituminous coal, but the proximity of the Mineral Wells community and the depth of the Thurber coalbed at this location indicate that development of this resource would be unlikely during the economic life of the project.[4/]

Damage to the sanitary landfill will be eliminated, thus eliminating the possibility of debris being delivered downstream to Pollard Creek and the Brazos River.

Flood damages will be reduced substantially to the city park. The reduced damages will make public funds available for other uses.

The net economic impact of the project from the reduction of crop and pasture, sediment, and erosion damages will result in an expansion of the local economy by $270 annually. In addition, the expenditure of funds for the construction of the works of improvement will create approximately 23 man-years of employment.

PROJECT BENEFITS

The estimated average annual monetary damages (table 5) will be reduced from $68,450 to $920, or 99 percent. The following tabulation shows the reduction of damages by reach:

Evaluation Reach (figure 4)	Direct Monetary Floodwater Damage: Total Average Annual Damage: Without Project (dollars)	With Project (dollars)	Benefits (dollars)	Reduction (percent)
1	66,950	520	66,430	99
2	1,360	270	1,090	80
Subtotal	68,310	790	67,520	99
X & Y	140	130	10	7
TOTAL	68,450	920	67,530	99

4/ Information provided as input by United States Department of the Interior, Bureau of Mines.

The following tabulation shows the actual direct floodwater damages by reaches for the selected recurrence intervals:

Direct Monetary Floodwater Damages

Evaluation Reach (figure 4)	Average Recurrence Interval: 5-Year Without Project (dollars)	5-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	83,010	800	209,870	1,740	305,760	3,020
2	1,400	220	2,670	590	3,560	960
Subtotal	84,410	1,020	212,540	2,330	309,320	3,980
X & Y	160	150	250	240	310	290
TOTAL	84,570	1,170	212,790	2,570	309,630	4,270

Indirect damages were estimated to be 10 percent of direct agricultural damages, 15 percent of road and bridge damages, and 20 percent for urban damages. Indirect benefits amount to $11,180 annually, resulting from a reduction in damages of $11,310 to $130.

Although not considered pertinent from a national viewpoint, net secondary benefits resulting from increased business activity in the watershed area will average $270 annually.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures (amortized total installation and project administration costs plus annual operation and maintenance costs) is $40,040. These measures are expected to produce average annual primary benefits of $64,100. The benefit-cost ratio excluding secondary benefits is 1.6 to 1.0. The ratio of total annual project benefits accruing to structural measures, $64,370, to the average annual cost of structural measures, $40,040, is 1.6 to 1.0 (table 6).

PROJECT INSTALLATION

The project installation period will be 3 years. The general sequence of installation is shown under the schedule of obligations, "Explanation of Installation Costs."

Planned land treatment (table 1) will be accomplished by farm and ranch owners or operators in cooperation with the Palo Pinto Soil and

Water Conservation District during the 3-year installation period. The goal is the completion of the installation of adequate treatment measures on 20 additional acres of cropland, 2,000 additional acres of rangeland, and 600 additional acres of pastureland by the end of the installation period. The district directors of the soil and water conservation district will assume aggressive leadership in accelerating the land treatment program now being applied.

The installation of land treatment measures which will benefit wildlife will be encouraged at every opportunity. Land users will be encouraged to seek assistance from the Texas Parks and Wildlife Department in the management and stocking of their reservoirs and farm ponds for fish and the management of the water bodies for wildlife.

The Soil Conservation Service will provide additional technical assistance to the soil and water conservation district to accelerate the planning and application of soil, plant, and water conservation measures. The Extension Service will assist in the educational phase of the program by holding local farm meetings, preparing press, radio, and television releases, and using other methods of getting information to land users in the watershed. Soil and water conservation loans available through the Farmers Home Administration will be given special emphasis. Present FHA clients in the watershed will be encouraged to cooperate in the program.

The Palo Pinto County Commissioners Court and the city of Mineral Wells have the power of eminent domain under applicable state laws. The city, in cooperation with the county, will be responsible for the installation of the structural measures.

The city will take the following actions pertaining to the structural measures:

1. Be responsible for working with the Service during construction of the structural measures. They will designate an individual to serve as liaison between the city and the Service.

2. In cooperation with the county, obtain all land rights needed legally for construction, operation, and maintenance, and take related land rights action, if needed, in conformance with Service policy requirements and the requirements of Public Law 91-646, Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

3. Determine the legal adequacy of land rights and use its power of eminent domain to obtain all land rights not donated or obtained through negotiation.

4. Provide for the modification of the utility lines, the county road, and privately owned improvements as may be necessary for the installation of structural measures.

5. Enforce flood plain zoning ordinances.

The city and the county will jointly initiate a public information program to publicize remaining flood hazards.

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

The Soil Conservation Service, in compliance with the request made by the sponsors, will provide the necessary administrative and clerical personnel, facilities, and supplies to advertise, award, and administer contracts, and will be the contracting agency.

As required by Public Law 86-523, the Service will keep the Secretary of the Interior informed through the Interagency Archeological Services-Denver, National Park Service, of the construction schedule. Further, if any archeological materials are found during construction, the Secretary will be similarly notified.

FINANCING PROJECT INSTALLATION

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

The cost of installing the needed land treatment measures during the 3-year installation period will be borne by the users of the land on which these measures are installed. Financial assistance for the land treatment measures which are eligible is available through the Rural Environmental Conservation Program and the Great Plains Conservation Program. The Farmers Home Administration, local banks, and other lending institutions can arrange financing for the land users' share of the cost.

The Soil Conservation Service will provide funds in the estimated amount of $8,600 to finance the cost of technical assistance in planning and application of the land treatment measures. This consists of $6,500 from Public Law 566 funds and $2,100 to be provided from Public Law 46 funds (table 1).

The local share of the cost of installing the structural measures will be shared equally by Palo Pinto County and the City of Mineral Wells. Funds for this purpose will be provided from the general funds of the county and the city, which are supported by revenue from existing tax sources. These funds are adequate for financing the sponsors' share of the project installation costs.

Financial and other assistance to be furnished by the Soil Conservation Service is contingent on the appropriation of funds for this purpose. In addition, the following prerequisite conditions will be met before federal funds will be made available for the installation of the structural measures:

1. The requirements for land treatment in the drainage areas above the floodwater retarding structures have been met.

2. All necessary land and water rights have been obtained for all structural measures consistent with the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and USDA Rules and Regulations (Title 7, Part 21), or the sponsors have furnished a written statement to the effect that they have the means of obtaining land rights and the exact date by which all land rights will have been obtained. It is planned to obtain all needed land rights during the first six months of the installation period.

3. The county road affected by floodwater retarding structure No. 2 has been rerouted.

4. The power line and telephone line affected by floodwater retarding structure No. 2 have been modified or permission has been granted to inundate these properties.

5. Operation and maintenance agreements have been executed.

6. Project agreements have been executed.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the land users on whose land the measures are installed under agreements with the Palo Pinto Soil and Water Conservation District. The district will encourage land owners to maintain the land treatment measures.

The city of Mineral Wells will be responsible for coordinating the operation and maintenance of the floodwater retarding structures. Financial responsibility will be shared by the city and Palo Pinto County. Funds for this purpose will come from the general funds of the county and the city. These general funds are supported by existing taxes and are adequate and available for this purpose. The estimated average annual cost of operation and maintenance is $420, based on current prices.

Immediately following completion of the structures by the contractor, the sponsors will be responsible for and promptly perform, or have performed, without cost to the Service, all maintenance of the structural measures as determined to be needed by either the sponsors or the Service. The sponsors will be responsible for maintenance of vegetation associated with structural measures after the initital vegetation work is adequately completed, as determined by the Service, but no later than three years following completion of each structural measure.

The sponsors will make an inspection of the structural measures annually and after unusually severe floods or other events of unusual nature that may adversely affect the structures. The Service will participate in the inspections for the first three years following the installation of each structure and as often as it elects to do so after the third year. Inspection items are those items which may need maintenance. Items of inspection and maintenance will include, but will not be limited to, condition of principal spillways, earth fills, emergency spillways, vegetative cover, fences, gates, and vegetative growth in reservoirs. Also, the structures will be monitored to determine that there are no water pollution problems being created by livestock watering, etc.

Sponsors will control the handling, storage, and application of herbicides and pesticides that may be necessary for operation and maintenance of the structural measures. Only approved and authorized reagents and compounds will be used. These applications will be compatible with current laws regulating their use. In addition to sound and prudent judgment, ordinances and standards concerned with the disposal or storage of unused chemicals, empty containers, contaminated paraphernalia, etc., will be observed and applied.

Provisions will be made for free access of representatives of the sponsoring local organizations and of federal representatives to inspect and provide for maintenance of the structures and their appurtenances at any time.

The city of Mineral Wells will prepare a report of all maintenance inspections. A copy of this report will be submitted to the Service representative. The city will keep summary control records in support of proper maintenance having been performed on these works of improvement.

An operation and maintenance agreement will be executed by the parties hereto prior to the signing of the initial project agreement and the issuance of invitations to bid on construction of the structural measures. The agreement will set forth specific details on procedure in line with recognized assignments of responsibility and will be in accordance with the Texas Watersheds Operation and Maintenance Handbook. An operations and maintenance plan will be prepared for each structural measure. The operations and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with Public Law 566 financial assistance.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Pollard Creek Watershed, Texas

Installation Cost Item	Unit	Number Non-Federal Land	Estimated Cost (Dollars) 1/ PL 566 Funds Non-Federal Land SCS 2/	Other Non-Federal Land SCS 2/	Total
LAND TREATMENT					
Land Areas 3/					
Cropland	Acre	20	-	200	200
Pastureland	Acre	600	-	11,000	11,000
Rangeland	Acre	2,000	-	30,400	30,400
Technical Assistance			6,500	2,100	8,600
TOTAL LAND TREATMENT			6,500	43,700	50,200
STRUCTURAL MEASURES					
Construction					
Floodwater Retarding Structure	No.	2	471,800	-	471,800
Engineering Services			25,470	-	25,470
Project Administration					
Construction Inspection			31,120	-	31,120
Other			40,510	1,000	41,510
Subtotal - Administration			71,630	1,000	72,630
Other Costs					
Land Rights			-	102,280	102,280
TOTAL STRUCTURAL MEASURES			568,900	103,280	672,180
TOTAL PROJECT			575,400	146,980	722,380

1/ Price Base: 1974
2/ Federal agency responsible for assisting in installation of works of improvement.
3/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
Pollard Creek Watershed, Texas

Measure	Unit	Applied to Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Conservation Cropping System	Acre	15	150
Pasture Planting	Acre	938	18,760
Pasture Management	Acre	1,251	5,000
Brush Management	Acre	254	5,080
Range Seeding	Acre	150	2,700
Proper Grazing Use	Acre	1,650	4,950
Wildlife Upland Habitat Management	Acre	200	400
Ponds	No.	16	6,400
Fishpond Management	No.	10	200
TOTAL			43,640

1/ Price Base: 1974

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Pollard Creek Watershed, Texas
(Dollars)[1/]

Item	Installation Cost - PL 566 Funds				Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Relocation Payments	Total PL 566	Land Rights[2/]	Relocation Payments	Total Other	
Floodwater Retarding Structures Nos.								
1	378,300	18,920	-	397,220	66,670	-	66,670	463,890
2	93,500	6,550	-	100,050	35,610	-	35,610	135,660
Subtotal	471,800	25,470	-	497,270	102,280	-	102,280	599,550
Project Administration	xxx	xxx	xxx	71,630	xxx	xxx	1,000	72,630
GRAND TOTAL	471,800	25,470	-	568,900	102,280	-	103,280	672,180

1/ Price Base: 1974
2/ Includes $750 for legal fees and $7,510 for modification or rerouting of fixed improvements.

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TABLE 3 - STRUCTURAL DATA - STRUCTURES WITH PLANNED STORAGE CAPACITY
Pollard Creek Watershed, Texas

Item	Unit	Structure No. 1	Structure No. 2	Total
Class of Structure		C	C	
Drainage Area (Total)	Sq. Mi.	5.41	1.18	6.59
Curve No. (1-Day)(AMC II)		82	82	xxx
TC	Hr.	1.57	0.59	xxx
Elevation Top of Dam	Ft.	926.2	921.7	xxx
Elevation Crest Emergency Spillway	Ft.	913.5	915.5	xxx
Elevation Crest Principal Spillway	Ft.	893.5	898.3	xxx
Elevation Crest Lowest Ungated Outlet	Ft.	893.5	898.3	xxx
Maximum Height of Dam	Ft.	53	41	xxx
Volume of Fill	Cu. Yd.	160,000	104,000	264,000
Total Capacity[1/]	Ac. Ft.	1,598	645	2,243
Sediment (100 Years)	Ac. Ft.	173	72	245
Sediment Submerged[2/]	Ac. Ft.	144	60	204
Sediment Aerated	Ac. Ft.	29	12	41
Sediment Pool (Lowest Ungated Outlet)	Ac. Ft.	144	60	204
Retarding	Ac. Ft.	1,425	573	1,998
Surface Area				
Sediment Pool (Lowest Ungated Outlet)	Acre	27	14	41
Sediment Pool (Principal Spillway Crest)	Acre	27	14	41
Retarding Pool	Acre	118	57	175
Principal Spillway Design				
Rainfall Volume (Areal)(1-Day)	Inch	8.35	11.20	xxx
Rainfall Volume (Areal)(10-Day)	Inch	13.50	17.80	xxx
Runoff Volume (10-Day)	Inch	8.13	13.05	xxx
Capacity (Maximum)	C.F.S	112	117	xxx
Frequency Operation - Emer. Spillway	% Chance	1.8	0.2	xxx
Size of Conduit	Inch	30	30	xxx
Emergency Spillway Design				
Rainfall Volume (ESH)(Areal)	Inch	12.80	12.80	xxx
Runoff Volume (ESH)	Inch	10.49	10.49	xxx
Storm Duration	Hours	6	6	xxx
Type		Conc. Chute	Veg.	xxx
Bottom Width	Ft.	160	100	xxx
Velocity of Flow (V_e)	Ft./Sec.	12.4	6.3	xxx
Slope of Exit Channel	Ft./Ft.	0.333	0.117	xxx
Maximum Reservoir Water Surface Elev.	Ft.	918.1	916.7	xxx
Freeboard Design				
Rainfall Volume (FH)(Areal)	Inch	30.40	30.40	xxx
Runoff Volume (FH)	Inch	27.80	27.80	xxx
Storm Duration	Hr.	6	6	xxx
Maximum Reservoir Water Surface Elev.	Ft.	926.2	921.7	xxx
Capacity Equivalents				
Sediment Volume	Inch	0.60	1.14	xxx
Retarding Volume	Inch	4.94	9.11	xxx

1/ Crest of emergency spillway
2/ Includes volume in sediment pool (lowest ungated outlet)

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TABLE 4 - ANNUAL COST

Pollard Creek Watershed, Texas

(Dollars)1/

Evaluation Unit	Amortization of Installation Cost2/	Operation and Maintenance Cost	Total
2 Floodwater Retarding Structures	35,340	420	35,760
Project Administration	4,280	xxx	4,280
GRAND TOTAL	39,620	420	40,040

1/ Price Base: 1974
2/ 100 years at 5.875 percent interest

July 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Pollard Creek Watershed, Texas

(Dollars)[1/]

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefit
Floodwater			
Crop and Pasture	580	200	380
Other Agricultural	170	10	160
Non-Agricultural			
Road and Bridge	360	60	300
Urban			
Residential Property	41,260	30	41,230
Commercial Property	10,320	0	10,320
Municipal Property	4,210	400	3,810
Subtotal	56,900	700	56,200
Sediment			
Overbank Deposition	100	50	50
Erosion			
Flood Plain Scour	140	40	100
Indirect	11,310	130	11,180
TOTAL	68,450	920	67,530

1/ Price Base: Current normalized prices for agricultural damages and 1974 prices for nonagricultural damages.

July 1975

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Pollard Creek Watershed, Texas
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS[1/]			Average Annual Cost[2/]	Benefit-Cost Ratio
	Damage Reduction	Secondary	Total		
Two Floodwater Retarding Structures	64,100	270	64,370	35,760	1.8:1.0
Project Administration	xxx	xxx	xxx	4,280	xxx
GRAND TOTAL[3/]	64,100	270	64,370	40,040	1.6:1.0

1/ Price Base: Current normalized prices for agricultural damages and 1974 prices for nonagriculture damages.
2/ From table 4.
3/ In addition, it is estimated that planned land treatment measures will provide flood damage reduction benefits of $3,430 annually.

July 1975

INVESTIGATIONS AND ANALYSES

Land Use and Treatment

The status of land treatment measures for the watershed was developed by directors of the Palo Pinto Soil and Water Conservation District with assistance from Soil Conservation Service personnel headquartered at Mineral Wells. Soil and water conservation plans were analysed and findings expanded for the entire watershed.

This analysis provided pertinent data on total conservation needs, including accomplishments to date and that remaining to be applied. This data was used in the establishment of priorities for planning, application, and maintenance of needed land treatment measures.

The funds for accelerated technical assistance represent the difference in the amount of funds now being expended and those which will be required to meet the project goal of increasing conservation measures applied to 80 percent and the amount of land adequately treated to 70 percent by the end of the 3-year installation period.

Engineering Investigations

The procedures used to develop the most feasible plan of structural measures to meet the objectives of the sponsoring local organizations that could not be accomplished by land treatment measures were as follows:

1. Possible sites for structural measures that would accomplish project objectives were found by use of topographic maps and aerial photographs, supplemented by field investigations. Preliminary studies were made to determine the physical feasibility and involvement of land and improvements and to provide data for laying out field surveys.

2. Surveys - Engineering surveys were made after preliminary agreement was reached with the sponsoring local organizations on the potential sites to be studied. Only two sites were selected for further study. Property lines and ownership of the land involved were furnished by the sponsors.

    a. Vertical control - Existing U. S. Geological Survey and U.S. Coast & Geodetic Survey bench marks were supplemented with temporary bench marks set at strategic locations for use in making surveys.

    b. Floodwater retarding structures - Field surveys were made in two stages. First, topographic maps of potential sites were prepared. Second, after preliminary designs

and layouts of the floodwater retarding structures that would be feasible to install were reviewed and accepted by the sponsors, detailed topographic surveys of the emergency spillway areas were made. A profile survey of the centerline of each dam site was made. These surveys provided the data necessary to determine the most economical and feasible design, to make estimates of the installation cost, and to prepare the land rights work maps. Procedures outlined in current watershed memoranda were used in making all surveys.

3. Designs - Design of structural measures was a continuous process during work plan development. Designs were made of each individual structure as information was collected and surveys were completed. Classification for limiting design criteria of the potential sites for floodwater retarding structures was made considering the damages that might result from a sudden breach of the earth embankment. Both structures were given a "c" hazard classification because of urban development and improvements existing on the flood plain within one mile below each structure. A breach of either of the structures might cause considerable damage and possible loss of life.

   Hydrologic criteria used in design of the floodwater retarding structures equal or exceed the criteria specified in Engineering Memorandum-27 (Revised). Procedures outlined in chapter 21 of National Engineering Handbook, Section 4, Hydrology, U. S. Department of Agriculture, Soil Conservation Service, and Technical Release No. 33, Simplified Method for Determining Floodwater Retarding Storage, U. S. Department of Agriculture, Soil Conservation Service, August 1966, were used to determine floodwater retarding capacity requirements and hydrograph development. For each structure, the appropriate spillway design and freeboard storms were flood routed to determine the elevation of the emergency spillway, dimensions of the emergency spillway, and elevation of the top of the dam.

   A detailed study was made to determine the most feasible and economical design of the emergency spillway of structure No. 1. Both abutments are steep and high and the excavation of an adequate size spillway channel in either would result in excessive excavation, spoil material, and cost. Adding more floodwater capacity affords the proportionment of a narrower spillway, which is feasible; however, land rights requirements are impracticable and too costly. An attempt was made to utilize a two-stage inlet design for the principal spillway to reduce the size requirement for the emergency spillway; however, the effect of the two-stage inlet was insignificant.

A concrete, chute-type emergency spillway over the dam was used in the final design. This type proved to be most feasible and economical and had the least impact on the environment.

4. Construction costs for the structural measures were based on current unit prices being expended at similar sites, experience, and values furnished by local organizations and utility companies.

   Annual operation and maintenance costs were estimated considering such costs as fertilization, reestablishment and maintenance of vegetation, weed control, and frequency of use of the emergency spillways. Current prices for 1974 were used.

Hydraulic and Hydrologic Investigations

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

1. The without-project hydrologic conditions were determined from a 58-percent sampling of soil and cover complex conditions. The antecedent moisture condition II curve number for the watershed was determined to be 82. This was verified by studying the rainfall-runoff relationship at stream gages in the vicinity. The with-project hydrologic conditions were determined by considering the effect of changes in land use and treatment that are expected during the installation period.

2. Hydrologic and economic watershed evaluations were based on frequency methods. Rainfall frequency data were obtained from Rainfall Frequency Atlas of The United States.1/

3. The area subject to damage from flooding was determined by stereoscopic photo study, supplemented with information obtained from field investigations and from residents of the watershed.

4. Engineering surveys were made of 63 valley sections selected to represent the stream hydraulics and the flood plain area. Preliminary locations for sections were made on aerial photos of the flood plain. The final locations were selected on the ground, giving due consideration to the needs of the economist and geologist.

1/ U. S. Department of Commerce, Rainfall Frequency Atlas of The United States, U. S. Weather Bureau Technical Paper No. 40, Washington, D. C., May 1961.

5. Water surface profiles were developed by a computer program based on the Modified Step Method, which takes into account velocity head changes. The effects of bridges on the stream hydraulics were determined by use of the Bureau of Public Roads (BPR) Method.2/ Computations were made by the Automatic Data Processing Unit, South Technical Service Center, Fort Worth, Texas. Using the water surface profile data, rating curves were plotted for each valley section. These showed the relationship between stage and discharge, and stage and area flooded.

6. The relationship of peak discharge to runoff volume was developed at each proposed floodwater retarding structure and at each valley section by routing the runoff from the 100-year storm. The peak discharges for eight other storms used in the evaluations were determined by multiplying the peak discharge per inch of runoff for the routed storm by the runoff for each of these storms to obtain the peaks at each structure site and at each valley section. The routings were accomplished by the Automatic Data Processing Unit, South Technical Service Center, Fort Worth, Texas. The Project Formulation Program - Hydrology outlined in Technical Release No. 20, U. S. Department of Agriculture, Soil Conservation Service, June 1968, was used. Various combinations of structural measures were analyzed to determine the system of structural measures which would accomplish the project objectives most efficiently. The routing results were substantiated by studies of five major storms that occurred in 1957, 1959, 1962, 1966, and 1970. Rainfall information was obtained from Climatological Data publications.3/ Flood information was obtained from local residents.

7. Stage-area inundated curves were developed for each portion of the agricultural flood plain represented by a single valley cross section. Acres inundated by 0-1, 1-3, and 3 feet plus depth increments were determined for the routed floods. Composite runoff area inundated curves were developed for without-project conditions and to reflect the effects of planned works of improvement.

8. Determinations were made of the area that would be flooded by each routed flood under each of the following conditions:

   a. Future condition without project.

   b. The needed land treatment practices applied.

   c. The needed land treatment practices applied and installation of various combinations of floodwater retarding structures.

2/ U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, Hydraulics of Bridge Waterways, 1970.

3/ U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Climatological Data, Texas, Asheville, North Carolina.

9. The effect that the project will have on the volume of runoff from the watershed was determined from a relationship of runoff depletion by floodwater retarding structures to average annual precipitation.4/

10. The principal spillway design hydrographs used to determine retarding storage volumes were developed using the procedures shown in chapter 21 of SCS National Engineering Handbook, Section 4, Hydrology.

11. The emergency spillway and freeboard hydrographs used to determine dimensions of the emergency spillway and elevation of top of dam were developed using the procedures shown in chapter 21 of National Engineering Handbook, Section 4, Hydrology.

Sedimentation Investigations

Sedimentation investigations were made as follows:

1. The 100-year sediment storage requirements for both floodwater retarding structures were made according to procedures outlined in Technical Release No. 12 (Revised), Sediment Storage Requirements for Reservoirs, U. S. Department of Agriculture, Soil Conservation Service, January 1968. The following field and office studies were made:

   a. Erosion rates for each floodwater retarding structure were developed by mapping of soil, slope, cover, and land treatment conditions in the drainage area. These data were summarized for use of the Musgrave soil loss equation to calculate gross sheet erosion. Streambank erosion was calculated from data obtained in field and study of aerial photographs.

   b. The estimated gross erosion occurring within the drainage area of each structure was adjusted to reflect the estimated delivery and the trap efficiency of the reservoir. The delivery ratio was determined by the relief-length ratio method, and the trap efficiency was estimated to be 90 percent.

   c. Allowances for differences in density of aerated and submerged sediment are based on an average weight of 82 pounds per cubic foot for completely aerated sediment to 50 pounds per cubic foot for submerged sediment.

   d. Allocation of sediment in the structure pools for 100 years is as follows:

4/ McGill, H. N., and R. H. Whisenant, The Effects of Upstream Floodwater Retarding Structures on Downstream Yield, American Society of Agricultural Engineers Paper No. 67-714.

Pool	Condition	Percent By Weight
Sediment	Submerged	75
Detention	Aerated	25

2. Sediment and erosion damage investigations on the flood plain were made by the valley cross section sampling method. Streambank erosion damage was investigated by field study, supplemented by study of aerial photographs.

   All sources of sediment causing or contributing to damages on the flood plain were summarized for without and with project conditions for evaluating the effects of the project on sediment damage reduction.

3. The sediment load carried out of the watershed was estimated by applying a delivery ratio of 20 percent to the gross erosion under existing conditions and with applied land treatment conditions. A delivery ratio of 24 percent was used to estimate the sediment load which will be carried out of the watershed from the uncontrolled area under with project conditions after installation of the floodwater retarding structures.

Geologic Investigations

Preliminary geologic dam site investigations were made at each of the floodwater retarding structure sites. The investigations included studies of valley slopes, alluvium, and exposed geologic formations.

Both of the planned floodwater retarding structures are located on soft shale bedrock of the Mineral Wells Formation. A cap of moderately soft to hard sandstone of the Lake Pinto Sandstone Member of the Mineral Wells Formation occurs on the steep shale slopes above the abutments of the embankments. The dip of these beds is northwestward at about 75 feet per mile.

Detailed investigations, including exploration with core drilling equipment, will be made at each floodwater retarding structure site prior to construction to determine the suitability and methods of handling foundation and embankment materials.

Economic Investigations

Basic methods used in 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.

Selection of Evaluation Reaches

Because of the diversity of damageable values and flood plain use, the flood plain was divided into four reaches. Agricultural damages occur in three reaches, while one reach sustains urban damage.

Determination of Damages

All damages were calculated by using the frequency method. Land users of agricultural flood plain lands were interviewed to obtain information relative to past, present, and future land use; crop distribution under normal conditions; planting dates, harvesting dates, and yields; and historical data on flooding and resultant damages to crops and pastures, as well as to other agricultural property. The land use of the flood plain was obtained by field mapping.

Crop and pasture damages were determined by applying damage rates by depth and season to the acres inundated by selected frequency storms to obtain an average annual damage for each agricultural reach.

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 were based on information obtained from the county commissioner, the city engineer, and highway department officials, supplemented by information gathered from local residents.

Owners and residents of urban property were interviewed to obtain information relative to past depths of flooding, damages, and market value of buildings and contents. Urban damages were determined by using the Econ-2 (Urban) Program, Automatic Data Processing Unit, South Technical Service Center.

Secondary Benefits

Secondary benefits were estimated by an adaptation of interdependence coefficients of appropriate agricultural and industrial sectors as calculated in the Input-Output Model of the North Central Region of Texas, which was developed as part of the Texas Interindustry Project, Office of the Governor, Division of Planning Coordination, April 1972.

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. A comparison of the net value of agricultural production lost in the pool areas as a result of the project to the amortized value of the easements, determined by local appraisal, giving full consideration to current real estate market values, showed the latter to be greater. The value of the easements was, therefore, used in the economic investigations.

Fish and Wildlife Resource Investigations

A field reconnaissance survey was made by an aquatic biologist and a wildlife biologist from the Texas Parks and Wildlife Department, a biologist from the Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior, and a biologist from the Soil Conservation Service during the preliminary investigation stage of watershed planning. This survey, along with a detailed study report by the Bureau of Sport Fisheries and Wildlife and a follow-up detailed study during plan development by SCS biologists, was used in an interdisciplinary approach for the conservation and development of the fish and wildlife resources of the watershed.

A detailed map of wildlife habitat within the watershed was made from aerial photographs. The habitat was then field checked and rated to determine carrying capacities and limiting factors. A separate detailed survey was made of each proposed floodwater retarding structure to determine types and conditions of vegetation and habitat. The information was recorded on aerial photographs and overlays for use in assessing the impact of the project on wildlife.

Archeological and Historical Investigations

An archeological survey of the watershed was made by the Archeology Research Program, Department of Anthropology, Southern Methodist University, under funding by the National Park Service.

The archeological survey was concerned with locating sites within the areas to be affected by the floodwater retarding structures and in determining the significance of these sites. The areas surveyed consisted of that amount of land to be inundated when the structures are completed. The specifications for each structure delineate three water levels: the elevation crest of the lowest ungated outlet; the elevation crest of the principal spillway; and the elevation crest of the emergency spillway. The land surveyed was that which had a lower elevation than the emergency spillway crest. The archeological survey crew determined this area by consulting USGS topographic maps and surveying the land upstream from the dam sites that falls within the prescribed elevations.

The crew surveyed both proposed dam sites and found three archeological sites. All of these sites were recorded on survey forms utilized by the Archeology Research Program at Southern Methodist University. The artifactual assemblages were recorded, maps of the areas were drawn, the environment was described, diagnostic artifacts were recorded, collected, and drawn, and photographs of the sites were taken.

The results of the survey are contained in the report entitled Archeological Survey of Texas Watersheds in Central Texas, by Herbert P. Mosca III, Archeology Research Program, Southern Methodist University. It was concluded that additional archeological studies are not needed before construction or impoundment begins.

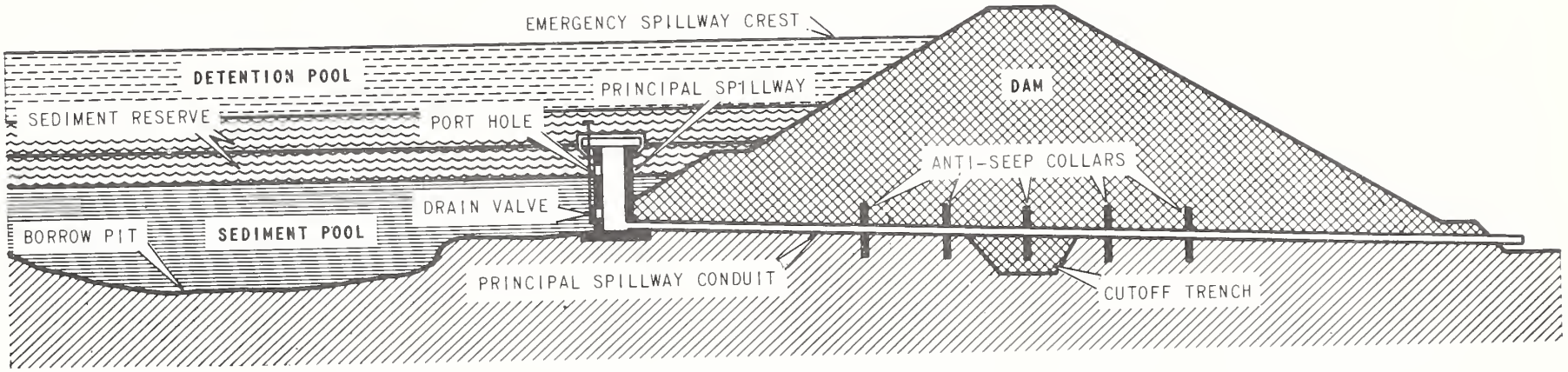
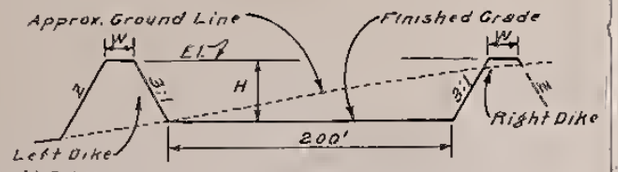


Figure 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE



Left Dike:
From Sta. 4+30 to Sta 5+00-El.= 1962.2, W=16.0', Z= 2.5:1
From Sta.5+00 to Sta. 5+50 - a transition section.
From Sta. 5+50 to approx. Sta. 6+30-W=10.0', Z=3:1, H=4.5'
Right Dike:
From Sta. 4+30 to Sta. 5+00-El.= 1962.2, W=16.0', Z=2.5:1
From Sta. 5+00 to Sta. 5+50 - transition to W=10.0', Z=3:1, H=4.5'
Material forming dikes shall be placed and paid as "Earth Fill, Embankment".

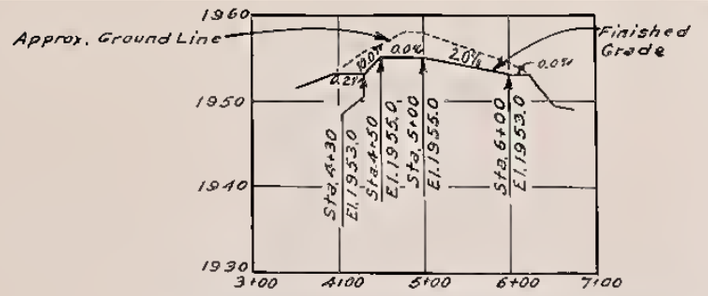
TYPICAL SECTION — EMERGENCY SPILLWAY

Emergency Spillway Diversions and Stub Diversions (S.D.): 18" effective height, 3:1 side slopes and 13 ft., minimum base, shall be constructed at the approximate locations shown on the plans. Final locations of the Stub Diversions shall be determined by the Engineer (See Construction Specification 5).

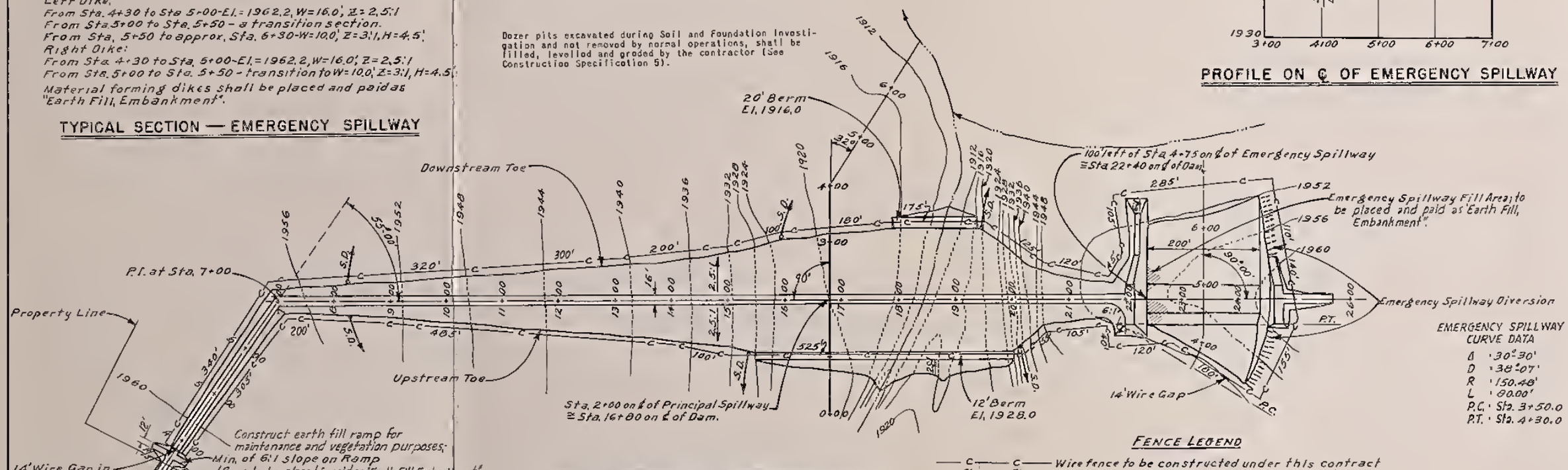
A minimum of 6" topsoil shall be placed in Emergency Spillway and on all Earth Fill Areas (See Construction Specification 20C).

Stream Channel within embankment area shall be shaped and cleared of objectionable material (see sheet 12 and Construction Specification 4).

Dozer pits excavated during Soil and Foundation Investigation and not removed by normal operations, shall be filled, levelled and graded by the contractor (See Construction Specification 5).



PROFILE ON ℄ OF EMERGENCY SPILLWAY



PLAN OF EMBANKMENT AND SPILLWAYS

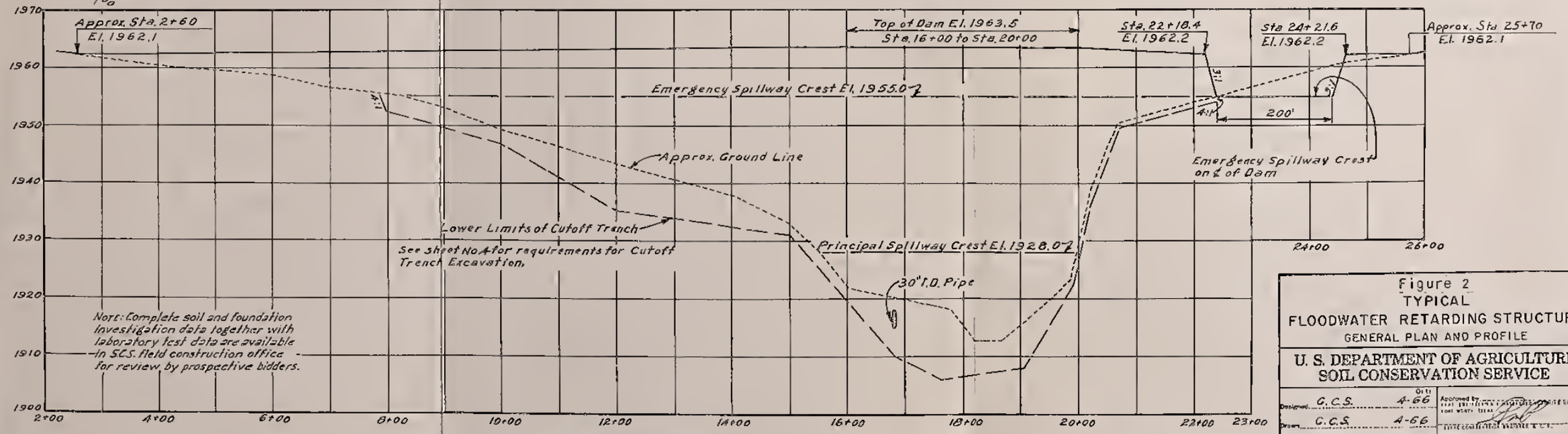
0 100 200 300 400 500
SCALE IN FEET

FENCE LEGEND

—C—C— Wire fence to be constructed under this contract
—P/S—P/S— Fence in construction area to be removed and salvaged by the Contractor.

EMERGENCY SPILLWAY CURVE DATA

Δ = 30°30'
D = 38°07'
R = 150.48'
L = 80.00'
P.C. = Sta. 3+50.0
P.T. = Sta. 4+30.0



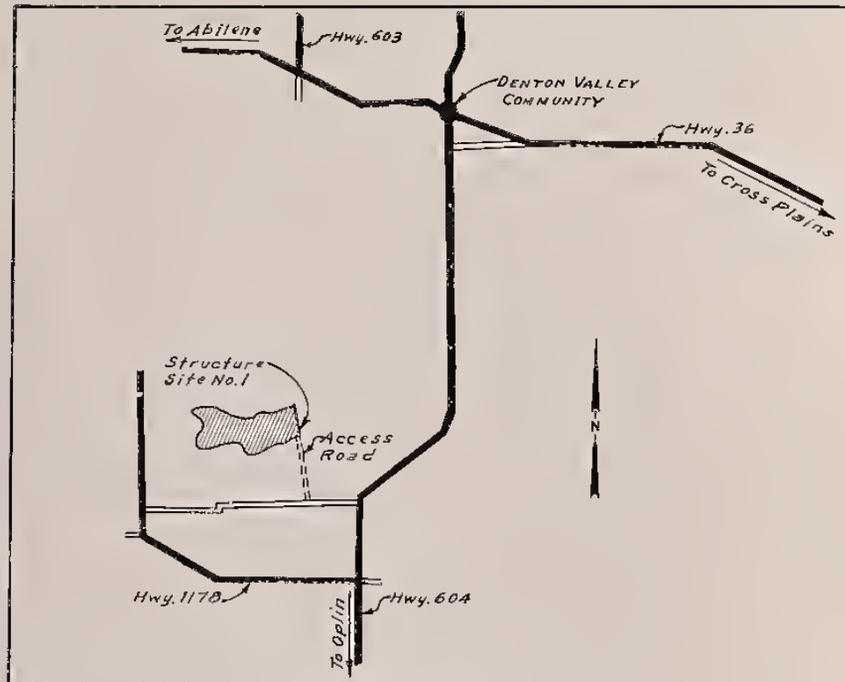
PROFILE ON ℄ OF DAM

Figure 2
TYPICAL
FLOODWATER RETARDING STRUCTURE
GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	G.C.S.	4-66	Approved by: [illegible]
Drawn	G.C.S.	4-66	
Traced	T.F.R.	5-66	
Checked	G.C.S.	5-66	Sheet No. 2 of 13 sheets

Drawing No. 4-E-21,594

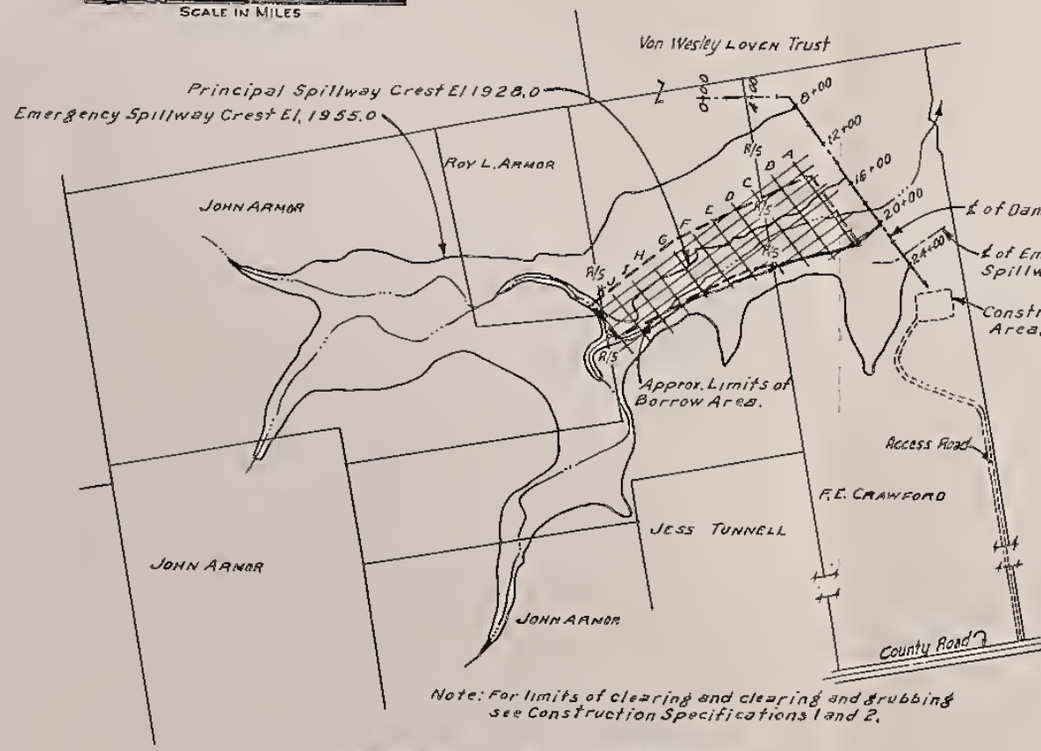


Structure site is located approx. 7 miles southwest of Denton Valley Community, Callahan County, Texas.

VICINITY MAP

0 1 2 3 4

SCALE IN MILES

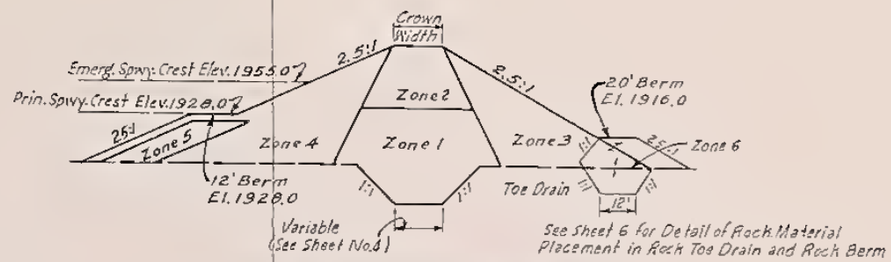


Note: For limits of clearing and clearing and grubbing see Construction Specifications 1 and 2.

GENERAL PLAN OF RESERVOIR

0 660 1320 1980 2640

SCALE IN FEET



See Sheet 6 for Detail of Rock Material Placement in Rock Toe Drain and Rock Berm

TYPICAL SECTION - ZONED EMBANKMENT

MATERIALS PLACEMENT DATA

Embankment Zone No. 1/	Source of Fill Materials: Material Location 2/	Average Depth, feet: From	To	Type or Unified Classification	Field Control Test: ASTM Test Number	Method	Placement and Compaction Requirements: Max. Allowable Particle Size	Max. Uncompacted Layer Thickness	Specified Compaction Class	Min. Dry Density, Percent of Field Test Max. Dry Density	Moisture Limits, Relative to Field Test Optimum: From	To	Laboratory Test Data: ASTM Test Number	Method	Curve No.	Max. Dry Density, p.c.f.	Optimum Moisture, %
1	Borrow	0	3	CL	D698	A or B	6"	9"	A	95	-2	+4	D698	A	5	101.5	20.5
	Borrow	0	6	CL	D698	A or B	6"	9"	A	95	-2	+3	D698	A	5	113.0	14.0
	Borrow	0	4	SC	D698	A or B	6"	9"	A	95	-1	+3	D698	A	3	116.5	13.0
2 & 3	Borrow	4	12	GC	D698	D	6"	9"	A	95	Opt.	+4	D698	C	2	130.0	7.0
4	Borrow	0	7	SM	D698	A or B	6"	9"	A	95	-1	+4	D698	A	4	121.5	11.0
5	Borrow	0	4	SM	D698	A or B	6"	9"	A	95	-1	+4	D698	A	1	116.0	11.5
2 & 3	Emerg. Spwy.	0	Grade	GC	D698	D	6"	9"	A	95	Opt.	4	Not Tested				
6	3/	Durable Rock					24"	36"									

1/ The zone boundaries shown in the typical section are approximate. Adjustments will be made by the Engineer to permit the use, within the neat lines of the embankment, of all suitable materials from the required excavations.

2/ Materials from the required excavations that are not tabulated in the table above and that are suitable and acceptable for earth fill shall have the same placement and control requirements as that specified for like materials under Materials Placement Data.

3/ Rock Material to be used for the Rock Toe Drain, Berm, and Channel liner shall be procured from required excavations.

Additional rock materials required in excess of that obtained from specified excavations shall be combed, raked or otherwise harvested from the sediment pool, detention pool, or surrounding areas. (See Construction Specification 5).

ZONED EMBANKMENT DATA

All usable material from within the sediment pool shall be used prior to enlarging borrow area outside these limits. Borrow from outside the sediment pool shall be obtained only as directed by the Engineer.

Elevation	Surface Acres	Storage: Acre Feet	Inches
1918	1	3	.0
1920	3	11	.02
1924	9	35	.05
1928	13	79	.12
1932	22	149	.23
1934.1	27	207	.32
1936	32	257	.40
1940	47	415	.65
1944	71	651	1.01
1948	96	985	1.53
1952	130	1437	2.24
1955	153	1864	2.90
1956	163	2023	3.15
1960	197	2743	4.27
1962.1	221	3182	4.95
1964	243	3623	5.64

Top of Dam (Effective) Elev.	1962.1
Emergency Spillway Crest Elev.	1955.0
Principal Spillway Crest Elev.	1928.0
Sediment Pool Elev.	1928.0
Drainage Area, Acres	7706.
Sediment Storage, Acre Feet	207.
Floodwater Storage, Acre Feet	1657.
Max. Emergency Spillway Cap., c.f.s.	10,820.

Figure 2

TYPICAL

FLOODWATER RETARDING STRUCTURE

GENERAL PLAN AND PROFILE

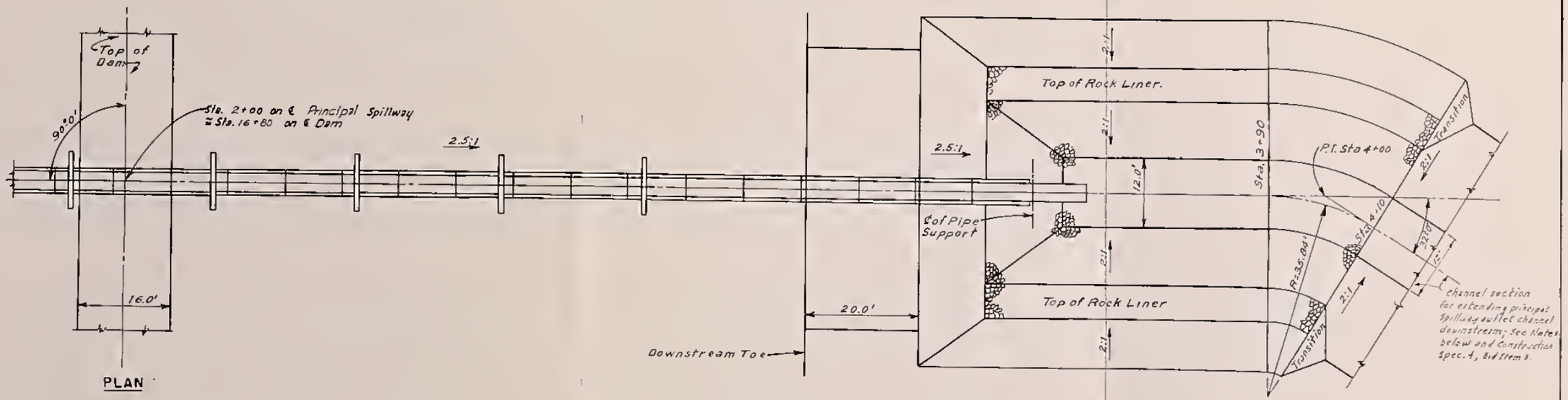
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

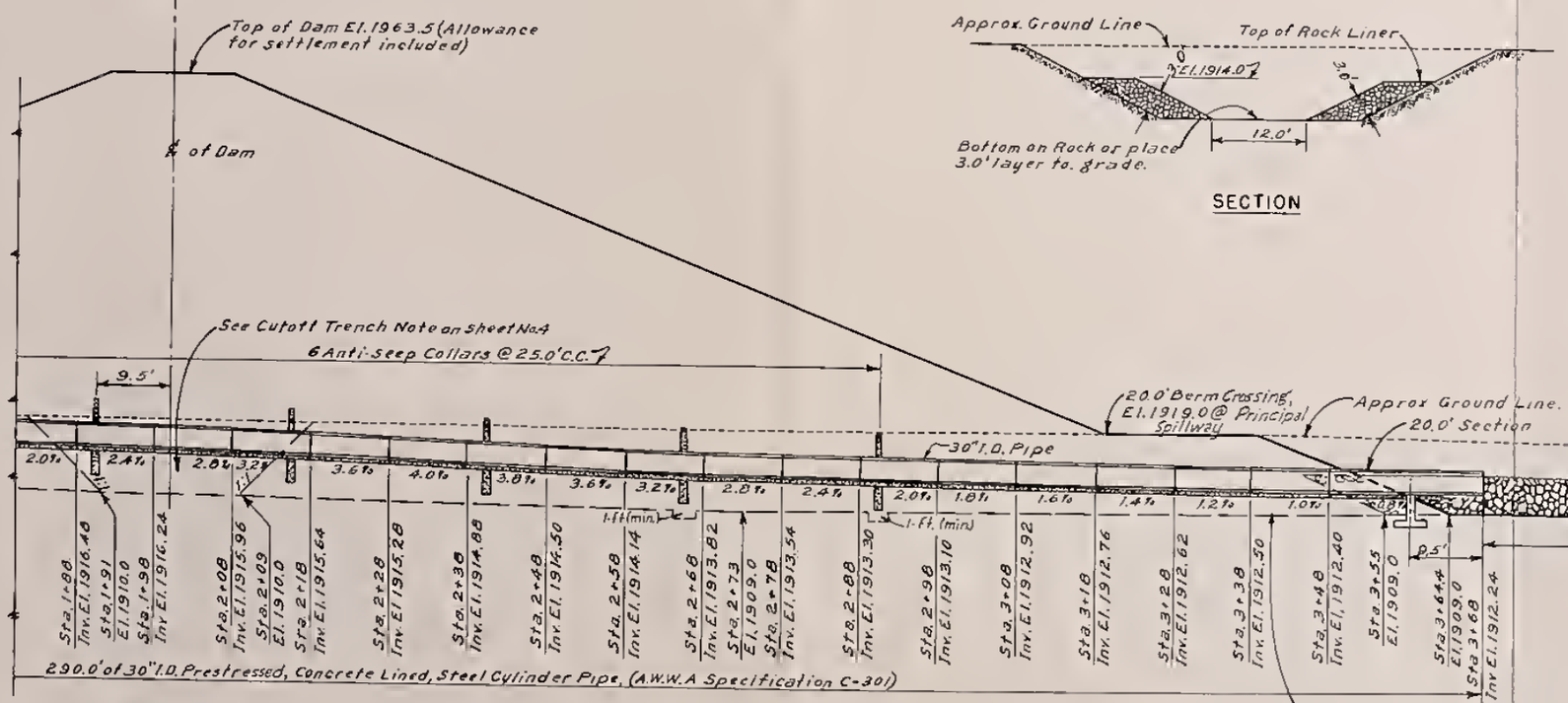
		Date
Designed	G.C.S.	4-66
Drawn	G.C.S.	4-66
Traced	T.F.R.	5-66
Checked	G.C.S.	566

Approved by: [illegible] Engineering Staff, SCS

Sheet 3 of 13

Drawing No. 4-E-21,594





SECTION

PRINCIPAL SPILLWAY

SECTION

NOTE: Excavation for the Rock lined Channel shall be paid as "Excavation, Unclassified". Place a 3.0 ft. thickness of dumped rock to dimensions shown in the drawings with rock size grading from small at subgrade to large at finished grade. Placement of spalls and cobbles shall precede dumping of boulders. Rock material shall be placed to reasonably neat lines of the finished grade. Payment for placing rock fill in channel is not a separate item; such cost shall be considered "Earth Fill, Embankment" and paid for as such. Rock against Principal Spillway shall be placed so as to avoid damage to pipe and other structural works. See sheet 3 for sources of Rock Material.

Figure 2A

TYPICAL

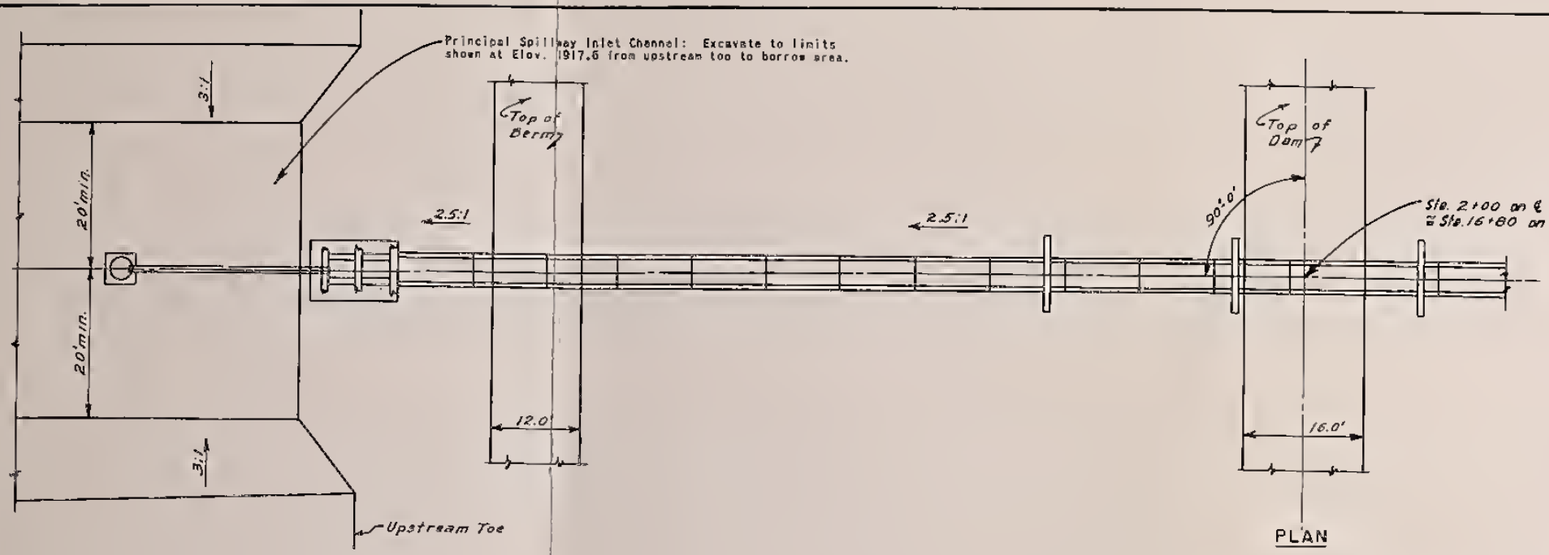
FLOODWATER RETARDING STRUCTURE

STRUCTURE PLAN AND SECTION

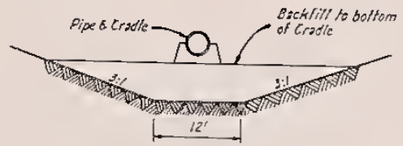
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed C.C.S.	Date 4-66	Approved by: ...
Drawn G.C.S.	4-66	
Traced T.F.R.	5-66	
Checked G.C.S.	5-66	Sheet No. 5 of 13 sheets

Drawing No. 4-E-21,594



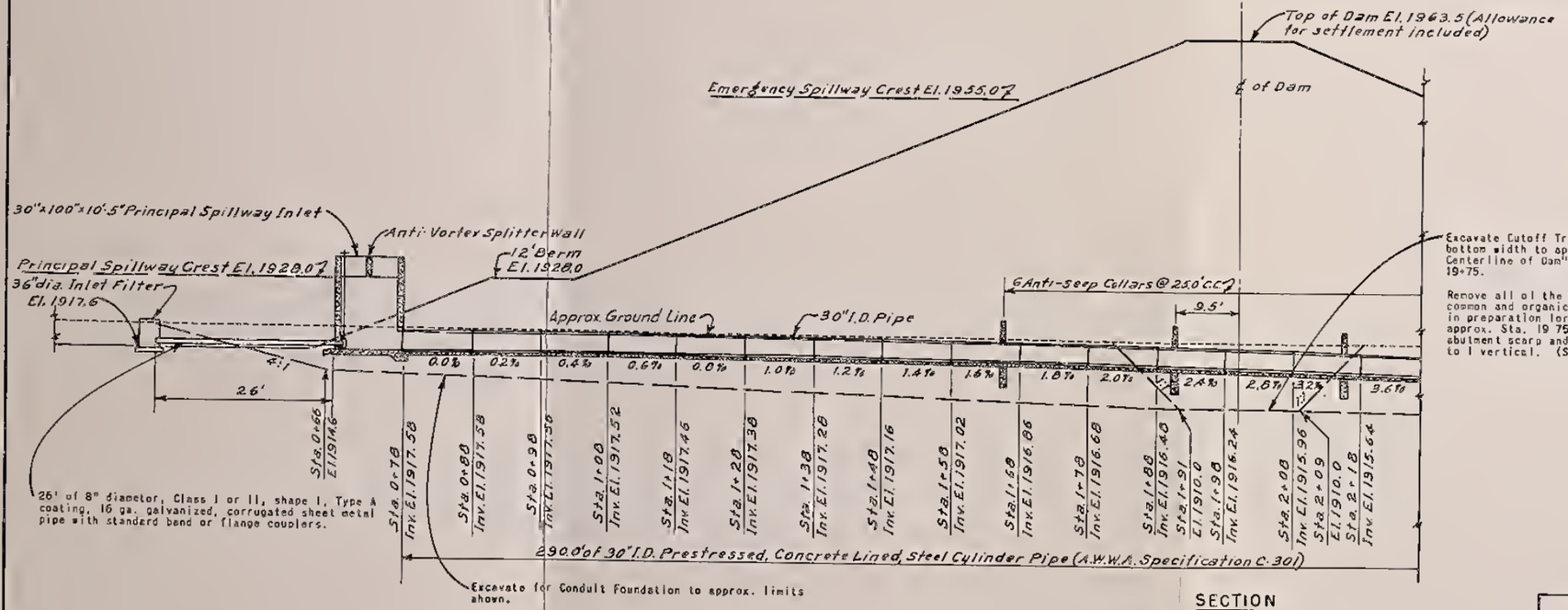
PLAN



Excavation to be paid as "Excavation, Unclassified".

Prior to placing backfill around the structure, the surface layer of the in-place fill material shall be reworked as necessary, and to the depth necessary, to restore and satisfy the density and moisture requirements specified for that fill material.

TYPICAL CONDUIT FOUNDATION EXCAVATION



SECTION

PRINCIPAL SPILLWAY

Excavate Cutoff Trench with 1:1 side slopes and 18 ft. bottom width to approximate limit shown on "Profile on Centerline of Dam" from Sta. 8+00 to approximate Sta. 19+75.

Remove all of the slide rock, boulders, flags, cobbles, common and organic material to hard unfragmented rock in preparation for base of dam on the right abutment, approx. Sta. 19 75 to Sta. 22 40. Remove the right abutment scarp and slope to not steeper than 2 horizontal to 1 vertical. (See Construction Spec. 4).

Figure 2A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	G.C.S.	4-66
Drawn	C.C.S.	4-66
Traced	T.F.A.	5-66
Checked	G.C.S.	5-66

Approved by: [illegible]
[illegible] SOIL CONSERVATION SERVICE
Sheet No. 4 of 13
Drawing No. 4-E-21,594

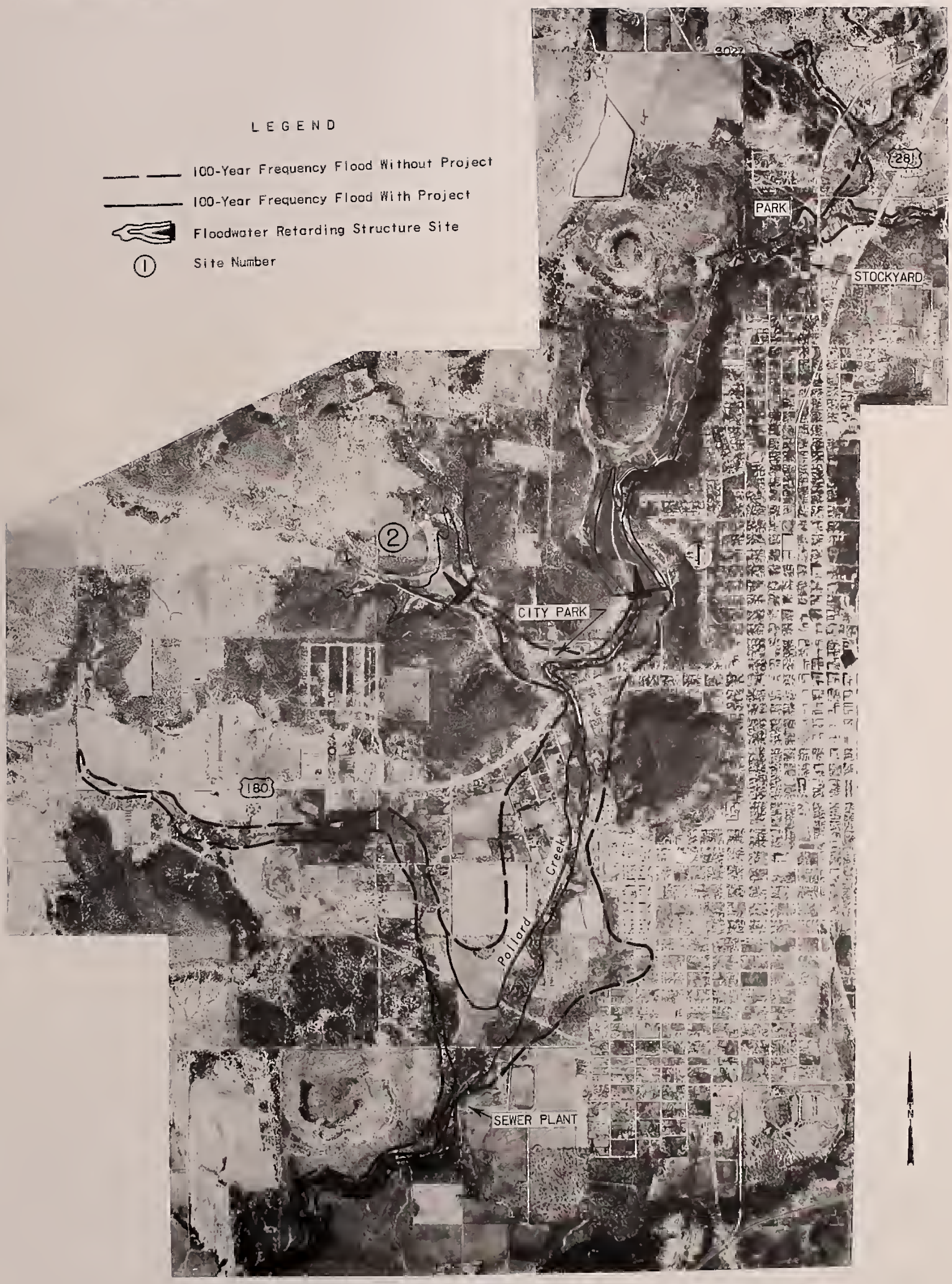


Figure 3

URBAN FLOOD PLAIN

CITY OF MINERAL WELLS

POLLARD CREEK WATERSHED

PALO PINTO COUNTY, TEXAS

Uncontrolled mosaic of 1966 photography.

0 1

APPROXIMATE SCALE – FEET

Compiled at 1:15,840 (1" = 1320') and reproduced at 1:20,400 (1" = 1700').

April 1974

U.S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE, TEMPLE, TEXAS

LEGEND

- Primary Roads
- Secondary Roads
- 281 U.S. Highway
- 337 State Highway
- 3027 Farm or Ranch to Market Road
- City Limits
- Watershed Boundary
- Outline of Floodwater Damage
- Reach X Valley Cross Section
- A-11 Evaluation Reach

Figure 4

PROBLEM LOCATION MAP
POLLARD CREEK WATERSHED
PALO PINTO COUNTY, TEXAS

APPROXIMATE SCALE - MILES

Polyconic Projection compiled at 1:15,840 (4 Mile) and reproduced at 1:33,000 (.63 Mile)

Base compiled from USGS Quadrangle, Field Information and General Highway Map, 1973 Revision, Texas State Highway Dept. and USDT, Bureau of Public Roads.

OCTOBER 1974 4-R-34404

MAY 1974 4-R-33931

U.S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE, TEMPLE, TEXAS

98°07'30"

32°50'

TEXAS

POLLARD CREEK WATERSHED

3027

281

POWER LINE

PIPELINE

DA 3,462 ACRES

DA 755 ACRES

1

2

Lake Pinto

MINERAL WELLS

337

180

Pollard Creek

BRAZOS RIVER

LEGEND

- Primary Roads
- Secondary Roads
- 281 U.S. Highway
- 337 State Highway
- 3027 Farm or Ranch to Market Road
- City Limits
- Watershed Boundary
- Area Benefited
- Drainage Area Controlled by Structure
- Floodwater Retarding Structure
- (1) Site Number

N

Figure 5

PROJECT MAP

POLLARD CREEK WATERSHED

PALO PINTO COUNTY, TEXAS

APPROXIMATE SCALE - MILES

Polyconic Projection compiled at 1:15,840 (4 Miles) and reproduced at 1:38,000 (1.68 Miles)

Base compiled from USGS Quadrangle, Field Information and General Highway Map, 1973 Revision, Texas State Highway Dept. and USDT, Bureau of Public Roads.

REVISED OCTOBER 1974 4-R-33980

MAY 1974 4-R-33931