SCS-IA-880317-F

United States
Department of
Agriculture

Soil
Conservation
Service

Des Moines,
Iowa

SOAP CREEK WATERSHED

Appanoose, Davis, Monroe & Wapello Counties, Iowa

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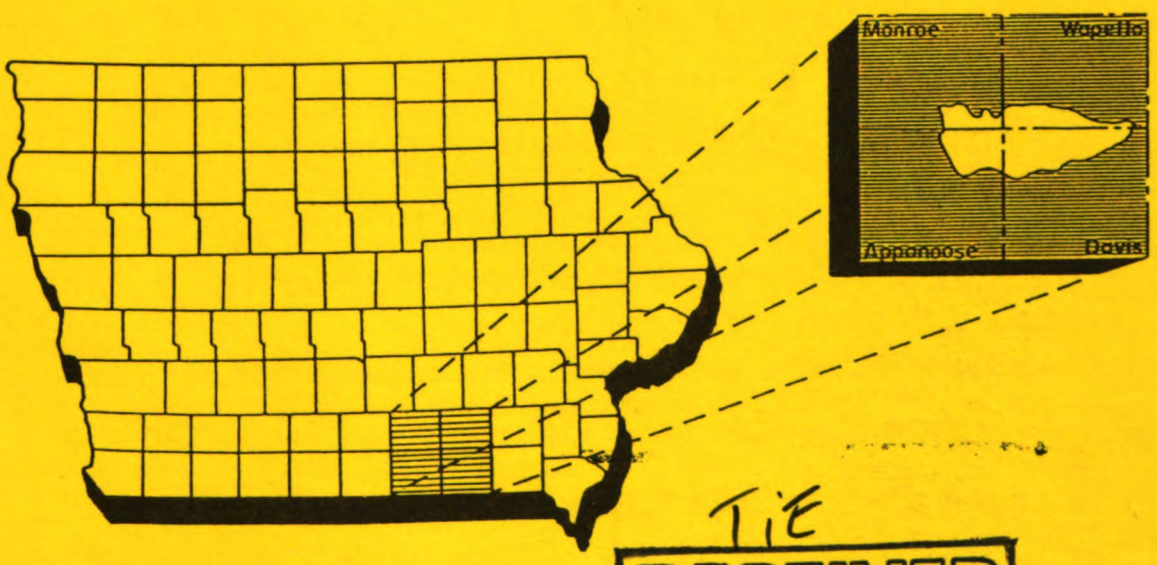
Watershed Plan - Environmental Impact Statement



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WATERSHED PLAN

SOAP CREEK WATERSHED

Appanoose County, Iowa
Davis County, Iowa
Monroe County, Iowa
Wapello County, Iowa

Abstract:

This document describes a proposal for reducing flood damages. Alternative plans were considered to solve identified problems. Benefits will be realized from reduced floodwater damages. The recommended plan includes 154 floodwater-retarding structures for which benefits exceed costs. Sponsors will pay seven percent of the $6,517,280 installation costs.

This document is intended to fulfill requirements of the National Environmental Policy Act and to be considered for authorization under Public Law 83-566 funding.

Prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1001-1008) and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.).

Prepared by: Appanoose County Soil and Water Conservation District
Appanoose County Board of Supervisors
Davis County Soil and Water Conservation District
Davis County Board of Supervisors
Monroe County Soil and Water Conservation District
Monroe County Board of Supervisors
Wapello County Soil and Water Conservation District
Wapello County Board of Supervisors
Soap Creek Watershed Board
U.S. Dept. of Agriculture, Soil Conservation Service
U.S. Dept. of Agriculture, Forest Service

Cooperating Agencies: Iowa Department of Natural Resources, Fish and Wildlife and Forests and Forestry Divisions
Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
U.S. Department of the Interior, Fish and Wildlife Service

For additional information contact: J. Michael Nethery, State Conservationist, Soil Conservation Service, Room 693, Federal Building, 210 Walnut Street, Des Moines, Iowa 50309 Phone (515) 284-4260.

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WATERSHED AGREEMENT

between

Appanoose County Soil and Water Conservation District
Appanoose County Board of Supervisors
Davis County Soil and Water Conservation District
Davis County Board of Supervisors
Monroe County Soil and Water Conservation District
Monroe County Board of Supervisors
Wapello County Soil and Water Conservation District
Wapello County Board of Supervisors
Soap Creek Watershed Board

(hereinafter referred to as Sponsors)

in the State of Iowa

and the

Soil Conservation Service

United States Department of Agriculture

(hereinafter referred to as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by sponsors for assistance in preparing a plan for works of improvement for the Soap Creek Watershed, State of Iowa, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); 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 SCS; and

Whereas, there has been developed through the cooperative efforts of the Sponsors and SCS a plan for works of improvement for the Soap Creek Watershed, State of Iowa, hereinafter referred to as the Watershed Plan - Environmental Impact Statement which plan is annexed to and made a part of this agreement.

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through the SCS, and the Sponsors hereby agree on this Watershed Plan - Enviromental Impact Statement and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this Watershed Plan - Enviromental Impact Statement and including the following:

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1. The Sponsors will acquire, with other than P.L. 83-566 funds, such landrights as will be needed in connection with the works of improvement. (Estimated cost $455,970)

2. The Sponsors hereby agree that they will comply with all the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this federally assisted project. If the Sponsors are legally unable to comply with the real property acquisition requirements of the Act, they agree that, before any federal financial assistance is furnished, they will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the Sponsors agree that they will reimburse owners for necessary expenses as specified in 7 C.F.R. 21, 1006 (c) and 21.007.

The cost of relocation payments in connection with the displacements under the Uniform Act will be shared by the Sponsors and SCS as follows:

	Sponsors (percent)	SCS (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	7	93	0 1/

1/ Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost shared in accordance with the percentages shown.

3. The Sponsors 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 works of improvement.

4. The Sponsors will obtain all necessary federal, state, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

5. The percentages of construction costs to be paid by the Sponsors and by SCS for floodwater-retarding structures are as follows:

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Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Construction Costs (dollars)
Structure 4-46	7	93	75,200
Structure 26-38	7	93	32,710
Structure 26-55	8	92	55,030
Structure 90-87	7	93	23,230
All Other Structural Measures	0	100	4,503,430

6. The percentages of the engineering services costs to be borne by the Sponsors and SCS are as follows:

Works of Improvement or Work	Sponsors (percent)	SCS (percent)	Estimated Engineering Service Costs (dollars)
Structure 4-46	7	93	13,230
Structure 26-38	7	93	5,760
Structure 26-55	8	92	9,670
Structure 90-87	7	93	4,080
All Other Structural Measures	0	100	791,890
Construction inspection			101,920 1/

1/ Sponsors and SCS will bear the cost of construction inspection that each incurs.

7. The Sponsors and the SCS will each bear the costs of Project Administration that each incurs, estimated to be $1,400 and $461,880 respectively.

8. The Soil and Water Conservation Districts will obtain agreements from owners of not less than 75 percent of the land above each floodwater-retarding structure in the county they represent. These agreements state that the owners will carry out conservation plans on their land and ensure that a minimum of 75 percent of the land above each floodwater-retarding structure is adequately protected before construction.

9. The Soil and Water Conservation Districts will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the watershed plan.

10. The Soil and Water Conservation Districts will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

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11. The Sponsors will be responsible for the operation, maintenance, and replacement of the works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into before issuing invitations to bid for construction work.

12. The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto, will be the actual costs incurred in the installation of works of improvement.

13. This agreement is not a fund obligating document. Financial and other assistance to be furnished by SCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

14. A separate agreement will be entered into between SCS and Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

15. This plan may be amended or revised only by mutual agreement of the parties hereto, except that SCS may deauthorize or terminate funding at any time it determines that the Sponsors have failed to comply with the conditions of this agreement. In this case, SCS shall promptly notify the Sponsors in writing of the determination and the reasons for deauthorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by SCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the Sponsors having specific responsibilities for the measure involved.

16. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, 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.

17. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15) which provide that no person in the United States shall, on the grounds of race, color, national origin, sex, age, handicap, or religion be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity conducted or assisted by the Department of Agriculture.

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APPANOOSE COUNTY SOIL AND WATER
CONSERVATION DISTRICT
12th and Washington Street
Agricultural Building
Centerville, Iowa 52544

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Appanoose County Soil and Water Conservation District at a meeting held on _____.

_____ _____
Secretary Address Zip Code

_____
Date

_____

_____

APPANOOSE COUNTY BOARD OF SUPERVISORS
Courthouse
Centerville, Iowa 52544

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Appanoose County Board of Supervisors adopted at a meeting held on _____.

_____ _____
Secretary Address Zip Code

_____
Date

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DAVIS COUNTY SOIL AND WATER
CONSERVATION DISTRICT
106-108 N. Dodge Street
USDA Building
Bloomfield, Iowa 52537

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Davis County Soil and Water Conservation District at a meeting held on _____.

_____
Secretary

_____
Address Zip Code

_____
Date

_____

_____

DAVIS COUNTY BOARD OF SUPERVISORS
Courthouse
Bloomfield, Iowa 52537

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Davis County Board of Supervisors adopted at a meeting held on _____.

_____
Secretary

_____
Address Zip Code

_____
Date

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MONROE COUNTY SOIL AND WATER
CONSERVATION DISTRICT
14B - 2nd Avenue West
Albia, Iowa 52531

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Monroe County Soil and Water Conservation District at a meeting held on _____.

_____ _____
Secretary Address Zip Code

_____
Date

_____
_____

MONROE COUNTY BOARD OF SUPERVISORS
Courthouse
Albia, Iowa 52531

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Monroe County Board of Supervisors adopted at a meeting held on _____.

_____ _____
Secretary Address Zip Code

_____
Date

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WAPELLO COUNTY SOIL AND WATER
CONSERVATION DISTRICT
700 Farm Credit Drive
Ottumwa, Iowa 52544

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Wapello County Soil and Water Conservation District at a meeting held on _____.

_____
Secretary

_____
Address Zip Code

_____
Date

WAPELLO COUNTY BOARD OF SUPERVISORS
Courthouse
Ottumwa, Iowa 52544

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the governing body of the Wapello County Board of Supervisors adopted at a meeting held on _____.

_____
Secretary

_____
Address Zip Code

_____
Date

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SOAP CREEK WATERSHED BOARD
c/o Davis County SCD
106-108 Dodge Building
USDA Building
Bloomfield, Iowa 52537

By _____

Title _____

Date _____

The signing of this plan was authorized by a resolution of the Soap Creek Watershed Board at a meeting held on _____.

_____
Secretary

_____
Address Zip Code

_____
Date

Soil Conservation Service

United States Department of Agriculture

Approved by:

_____
J. Michael Nethery
State Conservationist

Date _____

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(continued)

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SUMMARY OF WATERSHED PLAN - EIS

Project Name:	County:	State:
Soap Creek Watershed	Appanoose	Iowa
	Davis	Iowa
	Monroe	Iowa
	Wapello	Iowa

Sponsors:

Appanoose County Soil and Water Conservation District
Appanoose County Board of Supervisors
Davis County Soil and Water Conservation District
Davis County Board of Supervisors
Monroe County Soil and Water Conservation District
Monroe County Board of Supervisors
Wapello County Soil And Water Conservation District
Wapello County Board of Supervisors
Soap Creek Watershed Board

Description of Recommended Plan:

The recommended plan consists of 154 floodwater-retarding structures.

Resource Information:

Size of Watershed (acres) 162,000

The following table summarizes land use in the watershed.

		Total Watershed	Flood Plain
		(acre)	
Land Use -	Cropland	53,850	10,680
	Pasture	75,360	1,670
	Forest Land	26,370	970
	Other	6,420	830
Total		162,000	14,150

Land Ownership:	
Private	96 percent
State - Local	4 percent
Federal	0 percent

Number of Farms - 550 (wholly or partially within the watershed);
Average size 323 acres.

Prime Farmland - 21,600 acres in upland; 6,290 acres in flood plain.

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Wetlands - An undetermined amount of Food Security Act (FSA) defined wetlands exist in the flood plain. US Fish and Wildlife Circular 39 would classify most of these wetlands as types 1 and 2. Ninety-four acres of types 3 and 4 wetlands were identified. No seasonally flooded wetlands, by FSA definition, exist in the flood plain. No FSA defined wetlands are expected to be adversely affected.

Flood Plain - 14,150 acres, Cropland 75 percent, Pasture 12 percent, Forest Land 7 percent, Other 6 percent.

Endangered Species - The Indiana bat and bald eagle are found in the watershed. None expected to be adversely affected.

Cultural Resources - None expected to be adversely affected.

Problem Identification:

Problems identified in the watershed are floodwater, land, and non-agricultural damages.

Candidate Plans Considered:

The no-action and National Economic Development (NED) plans were considered in formulation.

Project Purposes:

The project purpose is flood prevention.

Principal Project Measures:

Principal project measures are 154 floodwater-retarding structures.

Project Costs:	P.L.-566 Funds		Other Funds	
	(dollar)	(percent)	(dollar)	(percent)
Structural Measures:				
Flood Prevention	4,675,670	77		
Engineering	923,760	15		
Project Administration	461,880	8		
Other			455,970	100

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Project Benefits:	Average Annual Dollars (Annualized Value)	(Percent)
Floodwater		
Crop and Pasture	214,870	40
Other Agricultural	194,310	36
Land Damage		
Sedimentation	33,890	6
Scour	3,810	1
Swamping	1,090	1
Non-Agricultural		
Road and Bridge	88,060	16
Total	536,030	100

Acres Benefitted - Total 14,150; Structural 14,150 (Flood Plain)

Impacts:

Land Use Changes (acres)

From:		To: Dams	To: Water
Crop	50	0	50
Grass	650	220	430
Forest	570	90	480

Natural Resources Changed or Lost:

Wooded Flood Plain - 570 acres will be lost to dams, emergency spillways, and sediment pools with the project.

Wetlands - No FSA defined wetlands will be adversely impacted by the project action.

Cultural Resources - None expected to be adversely affected.

Wildlife Habitat - No net change in habitat units of woody cover due to installation of 1,090 acres of mitigation areas. Approximately 20 habitat units of cropland cover will be lost to pools and dams. An estimated 30 habitat units of grassland cover will be gained on dams and spillways.

Fisheries - 960 acres of water in sediment pools available for fish stocking.

Prime Farmland - Dams, spillways, and pools convert 60 acres to non-prime farmland. 5,540 flood plain acres changed to prime farmland.

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Acres Benefitted - Total 14,150; Structural 14,150 (Flood Plain)

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Prime Farmland - Dams, spillways, and pools convert 60 acres to non-prime farmland. 5,540 flood plain acres changed to prime farmland.

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Other Impacts:

Major Conclusions:

Areas of Controversy: None

Issues to be Resolved: None

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INTRODUCTION

This Watershed Plan - Enviromental Impact Statement, hereinafter called the Plan, describes soil and water resource problems, plan formulation, plan elements, operation and maintenance procedures, provides an inventory and analysis of resources, and discloses expected environmental and economic impacts. The purpose of this Plan is flood prevention to reduce the magnitude of flood damages. It provides the basis for authorizing federal assistance for implementation.

Sponsors who developed the Plan are:

Appanoose County Soil and Water Conservation District
Appanoose County Board of Supervisors
Davis County Soil and Water Conservation District
Davis County Board of Supervisors
Monroe County Soil and Water Conservation District
Monroe County Board of Supervisors
Wapello County Soil and Water Conservation District
Wapello County Board of Supervisors
Soap Creek Watershed Board

The U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) and Forest Service (FS) provided assistance to the Sponsors in developing the plan. Other federal, state, and local agencies, principally the Iowa Department of Natural Resources, Fish and Wildlife Division (FWD), Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation (DSC), and U.S. Department of Interior, Fish and Wildlife Service (FWS) provided input in the planning process.

The Plan was prepared under the authority of the Watershed Protection and FLood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1001-1008) and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.). Responsibility for compliance with the National Environmental Policy Act rests with the SCS.

All information and data, except as otherwise noted, were collected during watershed investigations by the SCS.

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PROJECT SETTING

Soap Creek Watershed is located in Appanoose, Davis, Monroe, and Wapello Counties in Southeastern Iowa. The drainage area is 162,000 acres, distributed by county as follows:

Appanoose	37,780 acres
Davis	66,580 acres
Monroe	21,160 acres
Wapello	36,480 acres

Soap Creek flows eastward to its outlet, approximately 12 miles southeast of Ottumwa, into the Des Moines River (Hydrologic Unit 07100009). Soap Creek below Little Soap Creek and Little Soap Creek below U.S. 63 are classified as Class "B" Waters by the Iowa Department of Natural Resources, (IDNR). Class "B" waters are protected for wildlife, fish, aquatic and semi-aquatic life, and secondary (human) contact. Little Soap Creek, Brush Creek, Bear Creek, and South Soap Creek are the principal Soap Creek tributaries. The watershed configuration is long (32 miles) and narrow (4-12 miles).

Soap Creek Watershed is centrally located within a rectangle formed by the county seat cities of Ottumwa (population 27,381), Albia, (population 4,184), Centerville, (population 6,558), and Bloomfield (population 2,849). Small cities within the watershed are Blakesburg (population 400), Moravia (population 700), Unionville (population 160), and Floris (population 145). Population of the four county area is 74,065. All population numbers are from the 1980 Census. These cities and the rural community are provided potable water from either the Rathbun Regional Rural Water or Wapello Rural Water Districts.

The topography is characterized by irregular narrow ridges with steep slopes and narrow gullied valleys. Flow conditions are classified as intermittent on the lower 18 miles of Little Soap Creek, Soap Creek below Mormon Creek, South Soap Creek below Lake Sundown, and the lower end of the larger tributaries. Flow conditions in other channels are classified as ephemeral. Elevations range from 1,004 feet (MSL) at the apex to 600 feet (MSL) at the outlet.

The climate is midcontinental type. Average annual precipitation is 34 inches with 24 inches occuring as rain during the months of April through September. The spring season may fluctuate from extremely wet to fairly dry. Hot winds and periods of high temperatures are common in the summer season. Snowfall averages 25 inches annually. Average frost-free growing season is 167 days, from April 26 through October 10. Mean annual temperature is 52 degrees Fahrenheit with recorded extremes of -36 and 115 degrees Fahrenheit. Runoff from periods of short duration excessive rainfall, typical of this climate, causes flooding and erosion problems. Present condition watershed land use is shown in Table A.

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TABLE A - PRESENT LAND USE

Land Use	Total Watershed		Floodplain	
	(acre)	(percent)	(acre)	(percent)
Cropland	53,850	33	10,680	75
Pasture	75,360	47	1,670	12
Forest Land	26,370	16	970	7
Other	6,420	4	830	6
Total	162,000	100	14,150	100

Land ownership is private, except for transportation rights-of-way and FWD land used for game areas, a state park, and a state forest, and Wapello County land used for a county park. There is one minority landowner identified in the watershed.

There are an estimated 550 farms entirely or partially within the watershed 1/. Corn and soybeans are the principal crops on the bottomlands and ridge tops. Most of the remaining land is used for pasture and forest land.

The cities of Floris, Unionville, Moravia, and Blakesburg comprise 580 acres. The incorporated area of these cities has not recently changed.

Several state highways, U.S. Highway 63, and numerous county roads serving the agricultural community traverse the watershed.

Soap Creek is a major tributary of the Des Moines River. The Des Moines River was a pathway for movement of Native Americans into the Prairie-Peninsula from the Mississippi Valley, and contains numerous occupation sites. Diagnostic cultural materials indicate that humans have occupied the area for at least the last 11,000 years. Soap Creek is known to local residents as an area rich in archeological materials. A recently completed historic properties survey discovered 20 archeological sites in a survey of 83 of the Soap Creek Watershed structure sites 2/.

Lake Wapello State Park is located six miles west of Drakesville in Davis County in the south central part of the watershed. It is an 1,168-acre park which includes a 287-acre lake. The lake is classified by the Iowa Department of Natural Resources (IDNR) as Class "A", "B" warm, and "C" Waters. Class "A" waters are to be protected for primary (human) contact use, the strictest level of protection Iowa law requires.

Lake Sundown is a privately owned lake of about 470 acres. It is located 2 miles northwest of Unionville on County Highway J3T. The IDNR has not classified Lake Sundown for any specific water use.

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The state owns two wildlife areas in the watershed. The Eldon Game Area is located three miles southwest of Eldon, near the mouth of the watershed. It is about 920 acres, and provides habitat for both upland and forest wildlife. Principal game species hunted there are quail, squirrel, and deer. The Soap Creek Wildlife Area is located near Soap Creek in Davis County. It is about 520 acres of forest habitat. Principal game species hunted there included squirrel, turkey, and deer.

About 2,640 acres of the Stephens State Forest are located in scattered tracts throughout the west part of the watershed in Davis and Appanoose Counties. The areas are basically oak-hickory forest and provide forest products as well as wildlife habitat. Principal game species hunted there include squirrel, turkey, and deer.

Pioneer Ridge is a Wapello County Conservation Board area. It consists of 740 acres located on U.S. Highway 63 near the north edge of the watershed. It is managed as a multiple-purpose recreation area, with hunting, hiking, primitive camping, small pond fishing, and picnicking available.

Mineral resources, principally coal, are present throughout the watershed. Fourteen underground coal mines are known to have operated, most of them before 1925, in the watershed area controlled by the dams. Several strip mines have operated in the eastern half of the watershed. The last coal mine ceased operations in 1951. Most of the coal is deep and has potential for underground mining with strip mining marginally feasible in some areas.

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PROBLEM AND OPPORTUNITY IDENTIFICATION

The values and figures in this section are for future-without-project conditions, unless otherwise noted. The major problems are reduced farm income and increased road and bridge costs caused by floodwater, erosion, and sediment damage on the 14,150 acre flood plain of Soap Creek and its main tributaries.

Average annual damages are summarized in Table B.

TABLE B - AVERAGE ANNUAL DAMAGES

Type of Damage	Average Annual Damages (dollar)
Crop and Pasture	570,260
Other Agricultural	478,540
Land Damage	
Sedimentation	96,760
Scour	10,670
Swamping	3,800
Non-Agricultural	
Road and Bridge	219,120
Total	1,379,150

Floodwater Related Problems

Floodwater damages crops, pasture, other agricultural facilities such as fences and farm crossings, and non-agricultural facilities such as roads, bridges, and public utilities.

Floodwater damage on cropland consists of complete or partial loss of crops, reduction of yields, delay of tillage operations, and substitution of lower value crops. Pasture damages consists of reduction of quality and quantity of forage. Removal of debris deposited on both cropland and pasture is required for their continual use. Fences and farm crossings are damaged by partial or complete removal and debris deposition. Roads and bridges are damaged by removal of surfacing and embankment, sediment and debris deposition, and occasional removal of a bridge.

One wood bridge over Bear Creek is such a safety hazard that the school bus must take a 3.5 mile longer, alternate route. The safety of this bridge, as in the case of many other bridges, is jeopardized by floodwaters undermining support structures.

Underground rural water and gas pipelines are located along many bridges and roads subject to flooding. These pipelines have been exposed subjecting them to damages.

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The flood plain subject to flooding consists of 14,150 acres of agricultural land. Major floods have occurred in 1947, 1965, 1978, 1982, and 1986. Two major floods occurred within 2 weeks in July 1982. The flood which occurred on July 4, 1982, had an estimated recurrence interval of 100 years. Floodwater covered the total flood plain. Crops were totally destroyed. Roads were overtopped removing surfacing and embankments. Several roads were closed more than one year before repairs could be completed. Sediment deposition was up to three feet thick and flood plain scour up to five feet deep. On July 14, 1982, a flood with an estimated recurrence interval of 25 years partially covered the flood plain. This latter flood prevented seeding short-season lower value crops. Estimated damages for both floods totaled $1,746,000 consisting of $1,200,000 crop and pasture damage and $546,000 road and bridge, fence, and other agricultural damages. Soap Creek flooded seven times in 1986 with major flooding occurring on April 30. Rainfall of 2.5 to 4.0 inches over the upper end of the watershed caused the flooding.

The lowest areas of the Soap Creek flood plain are inundated for only about 40 hours per storm event during the growing season. Since this is only one percent of the growing season, none of the flood plain meets the seasonally flooded definition of P.L. 99-198, (16 U.S.C. 3801 et seq., as implemented under 7 C.F.R., Part 12), the Food Security Act of 1985 (FSA).

Crop and Pasture

Flooding from Soap Creek and its tributaries occurs nearly every year and more often in some reaches. The flooding varies in depth and duration by reaches.

Some farmers, on an individual basis, have attempted to straighten the channel and clear it of debris. In some areas they have built levees. This has had little effect on the reduction of flood damages. The economic effect of flooding has been felt through-out the entire watershed. This has prompted local participation in trying to alleviate this problem by group action.

It is estimated that 66 percent of the floods occur during the months of March, April, May, and June. Floods during these months will reduce yields and cause problems in tillage operations needing to be completed during this time. Crops may sometimes be destroyed. The crop may be replanted or an alternative crop may be planted.

Approximately 23 percent of the floods occur during July, August, and September. Floods occurring in these periods often destroy the entire crop. This causes severe economic hardship for farmers on the flood plain.

Only 11 percent of the floods occur during the fall and winter months. Floods at this time of year do not generally cause high monetary losses. Some damage may be done to grasses, new seedings, and other agricultural facilities.

Table C summarizes estimated crop and pasture flood damages by flood frequency.

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TABLE C - CROP AND PASTURE FLOOD DAMAGES BY FLOOD FREQUENCY

Frequency (years)	Area Flooded (acres)	Crop and Pasture Damage (dollars)
100	14,150	1,035,400
50	13,690	985,550
25	13,070	914,390
10	11,860	791,800
5	10,590	670,670
2	7,860	438,870
1	5,380	267,160
0.5	960	34,890

The average annual area flooded is 11,310 acres and crop and pasture damages are $570,260. Crop damages begin with floods that occur more frequently than twice a year. Flood plain land use is shown in Table D.

TABLE D - FLOOD PLAIN LAND USE

Land Use	Area (acres)
Cropland	
Corn	6,420
Soybeans	3,770
Hay	490
Pasture	1,670
Forest Land	970
Other	830
Total	14,150

Flood free yields on flood plain soils for all reaches are shown in Table E.

TABLE E - FLOOD FREE CROP YIELDS

Crop	Yield per Acre *
Corn	122 - 157 bu
Soybeans	41 - 53 bu
Hay	4.2 - 6.4 tons
Pasture	4.6 - 6.2 A.U.M.**

* Yields are from soil survey data 4/.

** Animal Unit Month

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The percent chance flooding begins ranges from one percent in Reach M to 287 percent in Reach B. See Appendix E, Figure 2.

Other Agricultural

Other agricultural damages identified in the Soap Creek Watershed include: debris removal, fence damage, field roads and crossings, field efficiency, and machinery damage.

Other agricultural damage rates per acre by depth increments of inundation for all reaches are shown in Table F.

TABLE F - OTHER AGRICULTURAL FLOOD DAMAGES BY DEPTH OF INUNDATION

Depth Increment (feet)	Damage Rate per Acre (dollars)
0-1	8.52-10.70
1-2	24.58-29.18
2-4	60.68-68.32
4+	76.68-86.96

Table G summarizes other agricultural flood damage by flood frequency.

TABLE G - OTHER AGRICULTURAL FLOOD DAMAGES BY FLOOD FREQUENCY

Frequency (years)	Area Flooded (acres)	Other Agricultural Damages (dollars)
100	14,150	914,100
50	13,690	852,770
25	13,070	769,180
10	11,860	637,230
5	10,590	510,160
2	7,860	293,500
1	5,380	148,580
0.5	960	16,340

Average annual other agicultural damages are $478,540.

Land Damage

This section discusses sources and rates of erosion that are components of gross erosion. Sediment delivery to Soap Creek is also discussed.

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Both gross erosion and sediment delivery are indirect components of the land damage component caused by flooding. The three categories of land damages discussed in detail are sedimentation, scour, and swamping.

Sedimentation will not adversely affect the planned uses of Lake Wapello and Lake Sundown during their design lives. Turbidity has not been identified as a serious problem in Lake Wapello by the IDNR. Total sediment contributed to main stream channels annually is 637,200 tons. Annual sediment yield to the watershed outlet is 102,700 tons. The resultant 534,500 tons of sediment that does not reach the watershed outlet annually is in transit as bedload in the channels, is in temporary storage along the channel banks, or is deposited on the flood plain during out of bank flows. Gross erosion is summarized in Table H.

TABLE H - GROSS EROSION

Land Use	Area (acres)	Sheet & Rill	Ephemeral Gully	Gully	Stream Bank	Total
		(tons/year)				
Cropland	53,580	225,000	37,500	80,400	123,200	466,100
Pasture	75,920	91,100	0	113,900	174,600	379,600
Forest Land	26,370	36,900	0	39,600	60,600	137,100
Other	6,130	20,800	0	9,200	14,100	44,100
Total	162,000	373,800	37,500	243,100	372,500	1,026,900

Excessive sheet and rill erosion occurs on sloping cropland soils that are not adequately protected. Excessive sheet and rill erosion is not a problem on other land uses. Erosion rates will be excessive on 7,800 acres of upland cropland and will average 10 tons per acre per year. Erosion rates will be within tolerable on 35,100 acres of upland cropland. Sediment contributed to the main stream channels from upland sheet and rill erosion from all land uses is 74,800 tons annually.

Ephemeral cropland gully erosion occurs on inadequately treated sloping cropland. Total ephemeral cropland gully erosion is 37,500 tons per year. Total sediment contributed to the main channels is 7,500 tons annually.

Average annual gully erosion voids 17 acres and depreciates 68 acres of pasture and cropland. Over the 50-year evaluated life of the project 850 acres will be voided and 3,300 acres will be depreciated.

Approximately 243,000 tons of soil are lost annually to gully erosion of which 182,300 tons are contributed to main stream channels. Sediment delivered is equivalent to 1.2 tons per acre from the contributing upland area.

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Sedimentation

Sediment deposition on the flood plain causes damages by deteriorating agricultural productivity on an estimated 5,130 acres of cropland annually. Infertile material is deposited on the flood plain by major floods. Removal of deep deposits from cropland is required to maintain productivity. Average annual damages are $96,760.

Scour

Flood plain scour damages an approximately 770 acres of cropland annually. Scouring usually removes soil to tillage depth causing substantial crop loss along with loss of fertile soil materials. Scour also cuts channels that are too deep to cross with farm machinery and require filling with heavy construction equipment. Average annual damages are $10,670.

Swamping

Swamping damages an estimated 50 acres of cropland annually by reducing yields and in some years preventing planting and harvesting of crops. Sediment deposition in areas subject to swamping degrades internal soil drainage. Average annual damages are $3,800.

Non-Agricultural

-Road and Bridge

Non-agricultural property damaged by floodwater consists of 0.2 miles of U.S. highway and 5.3 miles of county roads. Bridges and culverts at 43 locations are subject to damage. Damages to roads include costs of replacement of embankments and surfacing materials and cost of sediment and debris removal. Roads closed by floodwater and for repairs cause traffic delays and rerouting of traffic. Farmers with land on both sides of creeks either lose access to land or must travel long distances while roads are closed for repair. These damages are estimated to be $81,710 annually.

-Savings in Operations, Maintenance, and Replacement Costs

Bridges and culverts at 65 locations have high operation and maintenance costs plus a need for replacement in the near future. These locations are at or immediately below structure sites and are out of the evaluated flood plain. These large bridges and culverts are expensive to replace and savings in operation, maintenance, and replacement costs can be realized by downsizing with the installation of the project. These future-without-project damages are estimated at $137,410 annually.

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INVENTORY AND FORECASTING

Scoping of Concerns

The main concern of the sponsors and local residents is floodwater and sediment damage on the 14,150 acres of flood plain. Flooding affects crops, pasture, land quality, roads, bridges, rural water lines, and fences.

Soil and water resources were significant to decision making while formulating this plan. Associated with each of these natural resources are environmental concerns related to both quality and quantity of soil and water resources. These resources and environmental concerns were identified and their significance ranked as low, medium, or high in the environmental evaluation and scoping process.

Land use, water quantity, water quality, groundwater, air quality, sheet and rill erosion, ephemeral cropland gully erosion, gully erosion, streambank erosion, prime farmland, and visual quality are of a low degree of significance to the formulation of this plan.

Land use is generally within the capability of the soils and was not a negative factor in project formulation. Water quantity is not a concern of the Sponsors. Although water quality is not a project purpose, surface water quality will be improved due to decreased sedimentation. There will be some local ground water recharge afforded by each reservoir, however, the overall impact will be minor. Air quality will temporarily be affected by dust and exhaust from construction machinery.

Sheet and rill erosion and ephemeral cropland gully erosion are concerns to local landusers but are of low significance to project decision making. The on-going program is adequate to meet the remaining land treatment needs. Land treatment above structure sites will be adequate in most cases, because of a high percentage of pasture, forest land, and cropland land treatment.

Damages occurring from gully and streambank erosion are not of a magnitude that supports project action, therefore, this project was not formulated to solve these problems. Floodwater-retarding structures, hereinafter called dams, have some grade control and streambank erosion control benefits.

Prime farmland has a low degree of significance to decision making in this project. Floodwater damages to prime farmland are reduced. Protection will allow some non-prime farmland to become prime through flood frequency reduction. Most structures will not utilize prime farmland.

Visual quality will not be impaired by the project. Flood damage reduction will improve visual quality of the flood plain. Lack of landscape diversity or objectionable landscape features are not problems.

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Floodwater damages to crops, pastures, agricultural facilities, roads, bridges, utlities, and flood plain scour and sedimentation are all problems with a high degree of concern to decision making. The above items of concern are the major economic damages occuring in Soap Creek Watershed and are most important to Sponsors.

Wildlife habitat is of high concern because habitat is abundant and the quality is high. Endangered species are of high concern as the Indiana bat is a summer resident of the area.

Potential loss of FSA wetlands (as defined in the implementation rules 7 C.F.R., Part 12, for P.L. 99-198) is of a high degree of concern. There are no wetlands that meet the seasonally flooded criteria of FSA. The project will not affect the saturated soil conditions, or manipulate in other ways, any FSA defined wetlands.

Fish habitat is a medium concern. Fish habitat will not be negatively impacted as dams are on small upland tributaries where no fishery is present. Sustained flows will be increased and sediment load decreased by structures which will improve fish habitat.

Cultural resources are of a high concern as numerous archeological sites are present. Cultural resources may affect final location of dams.

Gully erosion is of medium concern. Voiding and depreciation is a problem but projected rates are low. Dams have some grade control benefits.

Human health and safety is of medium concern. Flood damages to roads and bridges are a safety concern. Flooding also results in increased vector habitat.

Social concerns are of medium significance. Flood damages result in stressfull situations for entire neighborhoods such as replanting destroyed crops. Apprehension lingers as to when crops will again be damaged by flooding. Floodwater damages result in loss of income which affects the entire community.

Mineral resources are of medium significance. Coal resources are present as are known historic underground and strip coal mines. Little or no adverse effects are expected from project action.

Only resources and concerns with a high or medium significance will be discussed in the balance of the Plan. Environmental and other concerns are summarized in Table I.

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TABLE I - EVALUATION OF IDENTIFIED CONCERNS

Economic, Social, Environmental and Cultural Concerns	Degree of Significance to Decision Making **	Remarks
Floodwater	High	Reduced
Flood Plain Scour	High	Reduced
Sedimentation	High	Reduced
Transportation	High	Flood damages reduced to roads and bridges
Cultural Resources	High	Numerous existing resources in watershed
Wetlands	High	Are present on flood plain
Wildlife Habitat	High	Watershed area is generally high quality habitat
Endangered Species	High	Indiana bat maternity colonies are present
Fish Habitat	Medium	Flood frequency and sediment load reduction may lead to more stable instream habitat condition
Human Health and Safety	Medium	Road and bridge damages reduced. Reduced flooding of vector habitat
Mineral Resources	Medium	Coal resources and known historic coal mining not affected by project
Social	Medium	Flooding causes stress to residents of watershed
Water Quantity	Low	No Effect
Water Quality	Low	Sediment levels reduced
Groundwater	Low	No anticipated effect
Air Quality	Low	Temporary construction impact
Sheet and Rill Erosion	Low	Ongoing program will control
Ephemeral Cropland Gully Erosion	Low	Ongoing program will control
Gully Erosion	Low	Rates are very low. Reduction by flood control structures
Streambank Erosion	Low	Reduction by flood control structures
Prime Farmland	Low	Flooding reduced
Visual Quality	Low	Floodwater impoundment will add diversity
Land Use	Low	Diverse agriculture and wildlife uses

** High - Must be considered in the analysis of alternatives.
Medium - May be affected by some alternative solutions.
Low - Consider, but not too significant.

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Existing Resources

Existing data sources were used to develop all information in this section with the exceptions of land use and erosion rates. Flood plain land use was determined by field investigation. Upland land use and sheet and rill erosion rate were determined by expansion of sample data from an inventory developed by the district conservationist in each county.

The area has a predominantly rural agricultural character with pleasant visual quality. Primary land uses are cropland, pasture, and forest land. The area is dependent upon the productivity of the soil resource. The primary crops on bottomlands and ridgetops are corn and soybeans. The steep sloping uplands and drainageways are used for pasture, hay, timber, and wildlife.

With approximately 80 percent of the four-county area in farms, the economy of Soap Creek Watershed is heavily dependent upon agriculture. The average market value of agricultural products per farm is $37,400 with an average farm size of approximately 320 acres 3/.

Major flood plain soils are Nodaway, Landes, Colo, Vesser, and Lawson. Flatter ridgetop soils are Edina, Pershing, and Keswick. Steeper upland soils are Lindley, Weller, Shelby, and Adair. Under high management bottomland soils have potential for yields of 122 to 157 bushels per acre of corn and 41 to 53 bushels per acre of soybeans 4/. Present land use is shown in Table J.

TABLE J - PRESENT LAND USE

Land Use	Upland	Flood Plain	Total
	(acres)		
Cropland	43,170	10,680	53,850
Pasture	73,690	1,670	75,360
Forest Land	25,400	970	26,370
Other	5,590	830	6,420
Total	147,850	14,150	162,000

There are 21,600 acres of prime farmland in the uplands. An additional 7,400 acres on the flood plain would be prime farmland if they were not subject to flooding.

Forest land is 16 percent of land use. Ninety percent of forest land is upland type with an oak-hickory forest ecosystem. The remaining 10 percent is an elm-ash-cottonwood ecosystem. Most of the privately owned forest land is grazed by livestock.

Pasture is 46 percent of land use. Typical vegetation is cool-season grasses, usually bluegrass. Some improved pastures have orchard grass, fescue, trefoil, and other legumes. Invasion by multiflora rose and other brushy species is common. Grazing is usually heavy, leaving little residue for winter wildlife cover and soil protection.

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The distribution and intermix of land uses provides good wildlife habitat conditions for a variety of species. Extensive grazing of pasture and forest land reduces the value of these areas, as does fall tillage of cropland. However, habitat conditions remain better than average for the state.

Wildlife species commonly found where suitable habitat is available include: raccoon, bobwhite quail, wild turkey, and white-tailed deer. Less common species which may occur include: grey fox, pheasant, bluebird, and belted kingfisher. Other species occur where proper habitat is present.

The Indiana bat, Myotis sodalis, a federally-listed endangered species, occurs throughout the watershed. It was found in a 1986 cooperative survey by the SCS and Iowa Cooperative Fish and Wildlife Research Unit. Both juveniles and pregnant females were netted even though maternity colonies were not found. The project area is located within the known summer range of this bat.

The majority of the existing ponds support a population of largemouth bass, bluegill, channel catfish, and/or bullhead.

No inventory of fish species is available for Soap Creek, but it is likely that it supports a fishery of carp, bullhead, and channel catfish when flows are high enough. Other species are also likely to be present.

Most fish and wildlife resources are used locally. Turkey, deer, and quail hunting attracts residents from other areas of Iowa. The majority of all hunting takes place on privately-owned land where access is controlled by the land owner. However, about 5,000 acres are available for public hunting at the Eldon Game Area, Soap Creek Wildlife Area, Pioneer Ridge Recreation Area, and units of Stephens State Forest.

FSA, P.L. 99-198, (16 U.S.C. 3801 et seq., as implemented by 7 C.F.R., Part 12), defines wetlands as areas that have a predominance of hydric soils and are inundated or saturated by surface or ground water at a frequency and duration sufficent to support, and under normal conditions do support, a predominance of hydrophytic vegetation typically adapted for life in saturated soil conditions. No areas of the flood plain meet the seasonally flooded definition under FSA. Most wetlands in the benefitted area of Soap Creek were altered prior to FSA. However, there does exist an undetermined amount of FSA wetlands in the flood plain. Most of these are small areas of type 1 or 2 wetlands. Ninety-four acres of types 3 and 4 wetlands were quantified, mostly old oxbows below U.S. Highway 63.

Lake Wapello State Park is an 1,168-acre park with a 287-acre lake. Park facilities are available for boating, picnicking, swimming, fishing, and camping.

It is estimated that 87 percent of the 550 farms wholly or partially in the watershed are owner-operated and 300 are cooperators with Soil and Water Conservation Districts. Federal and state cost-share funds for conservation practices are available.

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The preliminary search of state records revealed only six prehistoric sites in the project area. Scientific values of these cultural resources have not been systematically evaluated. Previous archeological research suggested that the region had been occupied for approximately the last 11,000 years.

A historic property review was conducted late in 1982. Twelve stream reaches of Soap Creek were investigated to determine whether prehistoric sites are buried by alluvium. Borings of valley sediment showed that flood plains contain sites, some of them buried by thick and relatively young alluvial deposits. A geological field study of Holocene alluvial stratigraphy and landscape development was done in 1986 which provided a model to aid in locating and evaluating archeological sites in Soap Creek Watershed. A historic properties survey was done in 1987 on 83 of 154 structure sites. Twenty archeological sites were discovered at planned structures, including five archeological sites potentially eligible for inclusion in the National Register of Historic Places.

Forecasted Conditions

Forecasting was done in full consideration of state and county forecasts and other plans, concerns, policies, and regulations that would have an influence on future conditions. An interagency group of federal and state agencies, local representatives, and land owners developed the projected conditions.

Average annual floodwater damage rates are not expected to change significantly during the project evaluation period. Major changes in land use and cropping patterns on the flood plain are not expected. Dams will not be installed by upland landowners because of high cost and benefits generally being located on other ownerships downstream.

Due to their high cost, few additional gully control structures will be installed under the ongoing program. Soil loss from gully erosion and yield to the watershed outlet is expected to continue at the present annual rate. Streambank erosion is also expected to continue at the current rate. Future-without-project rates of both gully and streambank erosion are shown in the problems and opportunities section. Sediment contributed by Soap Creek to the Des Moines River is estimated to be 102,700 tons annually and is not expected to change significantly without project action. Sediment will continue to be deposited on the flood plain and will damage agricultural production 5,130 acres annually.

The destruction rate of cultural resources by erosion will not be expected to change during future-without-project conditions.

Twenty-nine percent of the upland will be cropland in the projected future-without-project condition. Sheet and rill erosion rates will be excessive on 7,800 acres of upland cropland and will average 10 tons per acre per year. Erosion rate will be within tolerable limits on 35,100 acres of upland cropland. All of the pasture, forest land, and other land, and 82 percent of the cropland will be adequately treated. This will result in 95 percent of the upland having erosion controlled. This high level of treatment will be due to landowners complying with the conservation compliance provisions of the FSA.

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It is expected that overall land use will remain about the same. Hay, pasture, and timber will remain on sloping upland soils. Corn and soybeans will remain the principal crops on the ridgetops and bottomland. Some upland forest land will be cleared and converted to pasture and cropland. Other areas, primarily pasture, will revert to forest land. Grazing of forest land and pasture will remain about the same. More land will be acquired by the state and counties for wildlife and forest management purposes. Wildlife populations and number of species will remain about the same, unless game management activities such as bag limits and season lengths are changed dramatically. More of the hunting and other use of wildlife is likely to occur on public lands.

Existing ponds during their life will have an imbalance of fish species, with a predominance of bluegill and bullhead. A few new ponds will be built and most will be stocked with bass, bluegill, and channel catfish. The fishery in Soap Creek and its major tributaries is not expected to change.

Most existing wetlands will gradually decrease in size due to sedimentation. The wetland provisions of FSA, Public Law 99-198, (16 U.S.C. 3801, as implemented under 7 C.F.R. Part 12) will apply to all existing wetlands in the watershed. This will prevent most landowners from converting wetlands to production of agricultural commodities.

Habitat for the Indiana bat will be the same for future-without-project conditions.

Lake Wapello State Park will continue to serve as the center for recreation. Pioneer Ridge Recreation Area, Eldon Game Area, Soap Creek Wildlife Area, and the Stephens State Forest will all increase in importance as recreation areas as statewide demand for recreation continues to increase.

Lake Sundown will be maintained as a privately owned lake during the project life. It will continue to provide incidental flood prevention benefits to the Soap Creek flood plain.

Crop yields are expected to continue to increase during the project evaluation period. However, projected yields were not used in the evaluation.

Crop damages due to floodwater and sediment damages will continue at present rates.

Flood damages to other agricultural facilities such as fences and farm crossings will remain at the same level because the current type of agricultural practices are expected to continue to be used for future-without-project conditions

The number of farmers will not change in the future because of flood damages. The local population has accepted flooding as a way of life. Loss of life in the future because of flooding is not expected. There are no residences in the flood plain.

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FORMULATION OF ALTERNATIVES

General

Project formulation followed identification of water and land resource problems and opportunities associated with the National Economic Development (NED) objective. Inventory, forecast, and analysis of water and related land resource conditions relevant to the identified problems and opportunities also preceded formulation of alternative plans.

Formulation Process

Problems identified as significant to plan formulation were floodwater damages to crops, pastures, agricultural facilities, utilities, transportation facilities, and sedimentation and scour damages to flood plain soils. Identified sheet and rill erosion problems will be controlled by ongoing cost-share programs.

Several alternative plans were considered to relieve the identified problems. Non-structural measures such as flood proofing, flood warning systems, and flood plain acquisition were not considered since they either would not reduce damages, are too expensive, or not locally acceptable. Land treatment measures were not considered because low remaining needs would not significantly reduce flooding. An alternative consisting of several large dams was evaluated during the 1980 Des Moines Rivers Basin Study and found to be not economically feasible or socially acceptable. During formulation it became apparent that smaller dams were the most acceptable measures to consider in developing a recommended plan.

Dams were located so they would solve problems at least cost. Several systems of dams with benefits greater than their costs were considered in formulating the NED plan. Initially about 300 small dams were identified. Early studies eliminated 142 dams from detailed study because of their location, size, high costs, or low potential benefits. The remaining 158 sites were evaluated in detailed studies.

The NED plan includes all increments that had incremental benefits greater than costs. The incremental analysis is shown in Table K.

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TABLE K - INCREMENTAL ANALYSIS OF NED PLAN

Increment Number	Dams per Increment	Total Dams	Annual Costs: Incremental Cost	Annual Costs: Total Cost	Annual Benefits: Incremental Benefit	Annual Benefits: Total Benefit	Net Benefit
	(number)		(dollars)				
1.	9	9	36,150	36,150	127,860	127,860	91,710
2.	7	16	32,470	68,620	72,090	199,950	39,620
3.	29	45	97,750	166,370	135,830	335,780	38,080
4.	31	76	106,930	273,300	150,160	485,940	43,230
5.	3	79	29,080	302,380	90,720	576,660	61,640
6.	17	96	64,350	366,730	77,230	653,890	12,880
7.	24	120	83,280	450,010	124,840	778,730	41,560
8.	10	130	38,380	488,390	57,630	836,360	19,250
9.	7	137	30,400	518,790	31,120	867,480	720
10.	9	146	46,290	565,080	77,240	944,720	30,950
11.	8	154	39,040	604,120	41,500	986,220	2,460
12.	3	157	14,080	618,200	5,430	991,650	-8,650
13.	1	158	9,500	627,700	3,830	995,480	-5,670

Evaluation of Alternative Plans

Changes resulting from activities associated with the ongoing soil and water conservation program, the conservation compliance provision of the FSA, and those due to existing trends are recognized in the without-project condition. Without implementation of a project, existing floodwater, sediment, erosion problems, and most resource impairment or deterioration would continue. Average annual flooding damages are estimated to be $1,379,150 annually.

Alternative 1 is the no-action plan.

The forecasted future-without-project conditions will prevail under this alternative. Flooding will continue to result in future damages to crops, pasture, roads, bridges, other rural property, and other public property. Sedimentation, scour, and swamping will continue to degrade the soil resource on the flood plain with associated effects on fish and wildlife habitat.

Alternative 2 is the NED Plan

Components: This alternative consists of 154 small dams. Dams are distributed by drainage area size as shown in Table L.

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TABLE L - DAMS BY DRAINAGE AREA CLASS

Dams (number)	Drainage Area (acres)
62	30-160
55	161-360
21	361-820
16	821-2000

Costs: Total project cost - $6,517,280: PL 83-566 share - $6,061,310; Other - $455,970; Average annual installation cost - $571,240; Average annual operation, maintenance and replacement cost - $31,610.

Effects: Installation of this alternative will provide flood protection for 14,150 acres of agricultural land. Average annual benefits of $986,230 will accrue. Net benefits are $383,380. Sediment yield to the Des Moines River from Soap Creek will be reduced by 30,500 tons per year (30 percent). Fish and wildlife management potential will be increased on 1,090 acres of pasture and forest land as a result of the development of mitigation plans. An additional 960 acres of surface water will be created in sediment pool areas of the dams.

Comparison of Candidate Plans

Table M compares the no-action plan with the recommended plan (NED).

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TABLE M - SUMMARY AND COMPARISON OF CANDIDATE PLANS

Effects	Without-Project	Recommended Plan (NED)
Measures		One hundred fifty-four small flood control structures.
Project Investment	$0	$6,517,280
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT		
Beneficial, Annualized		$536,030
Adverse, Annualized		327,660
Net beneficial		208,370
ENVIROMENTAL QUALITY ACCOUNT		
Beneficial	Continued degradation of wetland habitat.	Reduction of sediment deposition in flood plain wetlands.
	Runoff events will increase suspended solids concentration and unstable sand bedload.	Reduction of sediment yield by 30 percent.
	Decrease in wildlife habitat.	Habitat quality will not change from present conditions. Woody habitat losses due to the project will be offset by mitigation on 1,090 acres.
	6,290 acres of prime farmland on flood plain.	Reduce flood damage on 6,290 acres of prime farmland and convert 5,540 acres to prime farmland by flood frequency reduction.
	Continued degradation of soil resource base in flood plain by excessive sedimentation.	Reduction in sedimentation damages to flood plain cropland by 64 percent.
	Cultural resources at NRHP sites continue to be destroyed at present rate by streambank and gully voiding.	Damage to NRHP archeological sites is reduced by 1,330 square feet annually.

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TABLE M - SUMMARY AND COMPARISON OF CANDIDATE PLANS (continued)

	Without-Project	Recommended Plan (NED)
Beneficial		
	Continued degradation of soil resource base in flood plain by excessive floodwater scour.	Reduction in scour damage to flood plain cropland by 66 percent.
	Continued degradation of soil resource base in flood plain by swamping caused by floodwater.	Reduces swamping damages to flood-plain cropland by 53 percent.
		Structures create 960 acres of water available for fish stocking.
		Structures create 120 miles of shoreline available for use by semi-aquatic species.
		Structures will temporarily create 340 acres of type 3 & 4 and 470 acres of type 5 wetlands, as defined by Circular 39, over the project life.
	Sediment yield to outlet of Soap Creek remains at 102,700 tons annually.	Sediment yield to outlet is reduced by 30,500 tons annually.
Adverse	Terrestial wildlife use: 53,580 acres of cropland 75,920 acres of pastureland 26,370 acres of forest land	Terrestial wildlife use on 50 acres of cropland, 430 acres of pasture, and 480 acres of forest land will be lost to sediment pools. Construction of dams and spillways will temporarily interrupt wildlife use on 310 acres, consisting of 220 acres of pasture land and 90 acres of forest land during construction. Floodwater pools will interupt wildlife use on 10 acres of cropland, 570 acres of pasture, and 560 acres of forest land.

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TABLE M - SUMMARY AND COMPARISON OF CANDIDATE PLANS (continued)

	Without-Project	Recommended plan (NED)
Adverse	No change in ephemeral streams.	Sixty miles of ephemeral streams will be covered by pools.
OTHER SOCIAL EFFECTS ACCOUNT		
	Poor land management degrades visual resource.	Structures and associated land treatment improves quality of landscape.
	Flood damages to 14,150 acre flood plain.	Reduce crop and pasture flood damages by 69 percent on 14,150 acres.
	Forty-three road crossings and five and one-half miles of road continue to be damaged by flooding.	Reduces road and bridge flood damages by 74 percent.
	Flood plain continues to be damaged by sedimentation, swamping, and scouring.	Land damages from sedimentation, swamping, and scour, reduced by 64 percent.
REGIONAL ECONOMIC DEVELOPMENT ACCOUNT		
Positive Effect, Annualized		
Region		$95,480
Rest of Nation		0
Negative Effect, Annualized		
Region		$ 2,540
Rest of Nation		57,940

Notes:
Interest Rate -- All alternatives evaluated at 8-5/8 percent interest.
Period of Analysis -- All plans evaluated over 50 years.
Price Levels -- Current Normalized Prices for crop and pasture; other items are 1987 prices.

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Benefits are all based on current values and currently attainable yields. The evaluation assumed no future shortage of either land or commodities. Prices for agricultural commodities are current normalized prices. Changes in the real cost of measures should be small and should not affect structure justification.

Project Interaction

Existing or expected federal and non-federal projects have no significant economic, environmental, or physical interaction with candidate plans.

Risk and Uncertainty

Justification of the proposed plan is not sensitive to moderate variations in number of dams installed. A group of dams providing maximum positive net benefits was selected as the first increment. Groups of dams with lower net benefits were added until the last increment did not provide positive net benefits. All dams included in the NED plan provided benefits in excess of their costs.

Location of planned dams is shown on the Project Map, Figure 1 in Appendix E. Slight location adjustments on the same drainage may be made during design. Movement of dams from one drainage to another would affect their justification. The participation rate will be high. This was determined during the investigation process, at which time landowners of 97 potential dams supported the locations and two landowners did not commit.

Rationale for Plan Selection

The NED plan was selected because it reasonably maximizes net national economic benefits. Sponsors would prefer added structural measures to further reduce flood damages. Added control was not economically justified nor was a rationale present to seek an exception from the Secretary of Agriculture to selection of the NED plan. The NED plan meets most of the Sponsors objectives.

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RECOMMENDED PLAN

Purpose and Summary

The NED plan is the recommended plan. Purpose of the Plan is to reduce floodwater damage. Plan measures include 154 dams which will be constructed during the 15-year project installation period. Project measures will be properly maintained over the 50-year project life. Land treatment measures will be installed under the on-going program using state and federal cost-sharing funds.

Plan Elements

Structural measures consist of 154 dams. All dams will be earthfill embankments with planned storage capacity. They will reduce downstream peak flows and flood damages.

Dams are classified according to the potential hazard to life and property sho
uld the dam suddenly breach or fail. Existing and future flood plain development including controls for future development must be considered when classifying the dam. The classification of a dam is determined only by its potential hazard to fail. The following rationale was used to determine the hazard classification for the 154 dams.

Class (a) -- Dams located in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and county roads.

Class (b) -- Dams located in predominantly rural or agricultural area where failure may damage isolated homes, main highways, or minor railroads or cause interruption in service of relatively important public utilities.

Class (c) -- Dams located where failure may cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads.

All dams will be Class (a) hazard classification. Class (a) dams are designed for less than the maximum runoff. None of the dams in this project are expected to fail; however, if one should fail, damage would be limited to farm buildings, agricultural land, or county roads.

Areas subject to damage, if any of the dams should fail, are shown on the Generalized Breach Inundation Map, Figures 1 through 4, Appendix B. No additional development should occur in the flood hazzard areas because of the possibility of flood damage. Before developing in the breach inundation area, specific site evaluation studies should be done to reduce the possibility of creating an unsafe condition.

Structural data for 64 sample dams are shown in Table 3. Statistics for the 154 dams are shown in Table N.

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TABLE N - AVERAGE STRUCTURAL DATA FOR DAMS BY DRAINAGE AREA

Drainage Area (acres)	Dams (no.)	Prin. Spwy Release Size (in)	Prin. Spwy Release Capacity (csm)*	Average Sed. Pool Area (ac)	Average Sed. Pool Storage (ac ft)	Average Floodwater Retarding Pool Area (ac)	Average Floodwater Retarding Pool Storage (ac ft)	Average Fill Height (ft)	Average Fill Volume (cu yds)
30-160	62	10	20-55	2.4	9	4.4	20	22	10,200
161-360	55	15	26-44	4.5	22	9.5	57	26	16,000
361-820	21	18	17-35	10.4	48	22.7	148	31	27,500
821-2000	16	24	18-32	21.7	123	51.4	412	28	30,800

* Cubic feet per second per square mile of drainage area.

All dams will be constructed of earth available at the site. They will be founded on alluvial material overlying glacial till and have glacial till abutments. Most earthfills will be constructed with 2.5 to 1 side slopes. Detail investigations may require a few earthfills to have 3:1 sideslope. Level or sloping berms, as needed, will protect earthfills from wave action damage. Principal spillway crest elevations will be established to provide volume for 50 years of sediment storage below the crest. All dams will be designed for a 50-year life.

The results of preliminary field investigations indicated a high percentage of dams to be located in the upper reaches of the watershed. The foundations and abutments were found to be in sound glacial till with sporadic lenses of sand. Good borrow materials are available for each site.

Foundation drainage will be needed for some dams. Trench drains should be used to relieve pressures and control seepage and piping. Detail foundation investigations will identify those sites requiring drains. A pro-rata cost has been included in the cost estimate for each dams to provide for those that will need drains.

Most dams will have principal spillways of polymer coated corrugated metal pipe or a material with equivalent resistance to electrical and chemical corrosion. They will all have trash racks, propped outlets and most have hood inlets similar to Sketch 1, Appendix C. Dams 4-31, 26-42, 26-43, 26-51, 26-55, 26-63, 26-65, 68-80, 90-79, 90-83, 90-84, and 90-85 will have reinforced concrete pipe principal spillways with either standard reinforced concrete risers or hood inlets. They will have propped outlets and trash racks similar to Sketches 2 and 3, Appendix C. All corrugated metal pipe principal spillways will have cathodic protection to extend pipe life.

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Dams 4-46, 26-38, 26-55, and 90-87 will be constructed on county roads and widened to serve as roadways. Sponsors will have non-project costs at these locations. They will be designed to meet SCS standards and county road criteria similar to Sketches 2 and 4, Appendix C.

Depending upon hazard and classification, these dams will be designed to store, as a minimum, the runoff from a 10-, 25-, or 50-year storm between the principal and emergency spillway crests. Open vegetated emergency spillways are provided for all except dams 26-38 and 90-87, to convey runoff from larger storms without overtopping earthfills. Dams 26-38 and 90-87 will pass a 100-year storm through the principal spillway. Emergency spillway design data are shown in Table 3. Current state and SCS criteria will be followed when dams are designed and constructed.

Sediment pool drawdowns will be provided on dams where cost of installing the drawdown is significantly less than the difference in cost of wildlife habitat mitigation without and with drawdown. Drawdowns are planned on dams 4-45, 4-46, 4-50, 4-113, 68-33A, 68-34, 68-54, 68-66, 68-75, 90-90, and 90-112 individually listed on Table 3. They are illustrated on Sketches 5 and 6, Appendix C.

Present use of land required for structural measures is shown in Table 0.

TABLE 0 - PRESENT USE OF LAND REQUIRED FOR STRUCTURAL MEASURES

Project Land Use	Cropland	Pasture	Forest Land	Total
	(acres)			
Dam & Emergency Spillway	0	220	90	310
Sediment Pool	50	430	480	960
Floodwater-Retarding Pool	10	570	560	1,140
Total	60	1,220	1,130	2,410

Clearing and grubbing of stumps will be done on 90 acres. Clearing below principal spillway crest elevation will be done 400 feet upstream of spillways. This will involve 210 acres of forest land.

Vegetation will be established on and around the earthfills, earth emergency spillways, and other areas disturbed by construction to control erosion from these areas, provide wildlife food and cover, and improve esthetic values. Sediment pools and any additional borrow areas will be cleared as determined during field design.

Table 2 of this Plan sets forth data about cost of the dams. Individual construction quantities and design features for 64 sample dams are shown on Table 3. The remaining 90 dams will have construction quantities and design features similar to the 64 sample dams.

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Sponsoring local organizations will secure all landrights needed for installation of the dams. Landrights for approximately 2,560 acres will be obtained for the dams, their associated spillways, and pools. Subordination agreements may be needed at sites underlain by layered mineral deposits. There are no anticipated relocations associated with installation of the dams.

Construction of the dams with planned storage will create pools that cover a total of 960 acres with water and have 120 miles of shoreline. Floodwater retarding pools will cover an additional 1,140 acres for short periods following excessive rainfall.

Impacts on terrestrial wildlife habitat were evaluated on sample sites using Iowa modifications of the FWS 1980 Habitat Evaluation Procedure (HEP). The HEP quantifies impacts using habitat units. A habitat suitability index is determined and multiplied by the total area affected, providing habitat units. The suitability index is determined by a team of biologists from the SCS, FWD, and FWS.

Construction of the dams and sediment pools will require the replacement of an estimated 380 habitat units of woody cover. This will be mitigated by excluding livestock from an estimated 1,090 acres and letting natural succession establish woody vegetation. Sponsors will obtain and record 50-year legal easements for all mitigation areas. Mitigation quantities required will be determined for each site during final design. Wildlife habitat mitigation areas may be located anywhere within the watershed. In order to provide maximum edge and diversity for wildlife species, mitigation areas will be prioritized for acceptance by the tri-agency biologists.

Any hunting opportunities which are displaced by the structures will be provided by the wildlife mitigation areas. Landowners will continue to control access to their property including mitigation areas and structure sites.

Safety and sanitation features at dams are the responsibility of landowners.

The dams will be designed to minimize potential vector problems. Foundation drains will be installed to eliminate seepy or marshy areas below the dams and surface drainage will be provided for all exposed borrow areas to aid in mosquito control.

In the event of a significant cultural resource discovery, SCS will follow its procedures to insure important resources are not destroyed. Archeological and historic surveys and evaluations will be necessary on lands where significant resources are expected to be present. Eighty-three of the 154 dam locations have been archeologically investigated. The remaining dam locations will be archeologically surveyed before construction.

There will be no effect on the five archeological sites potentially eligible for the National Register of Historic Places. Two archeological sites, 13DV46 (dam 26-68) and 13M064 (dam 68-31) will have the dams moved upstream to avoid the archeological sites. Efforts will be made to put

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wildlife mitigation areas at the locations of these two archeological sites to provide extra protection. The three remaining significant archeological sites: 13AN97 (dam 4-31), 13AN94 (dam 4-85), and 13WP297 (dam 90-84) will be in the permanent pools of dams located nearby. These three archeological sites consist of a few lithic materials deeply buried in the alluvium with no significant cultural material exposed. The archeological sites are presently subject to sedimentation. A permanent pool will continue to cover them with sediment and thus not change the environment of the cultural material. Profiles of permanent pools of small reservoirs in Iowa have been studied through time and show that erosion is not a problem in submerged areas. A maintenance clause will be included stating that any project plans and specifications for repairs or modifications be submitted for review by the cultural resource coordinator of SCS before beginning work. This will be done to ensure that there will be no effect on these cultural resources in the future.

Construction operations will be in compliance with applicable federal, state, and local laws and regulations concerning environmental pollution control and abatement. Water and air pollution that might be caused by construction operations will be minimized by the following methods as needed:

1. Leaving existing vegetation on work areas as long as possible.
2. Constructing debris basins.
3. Diverting runoff water from highly erodible areas.
4. Establishing temporary vegetative cover.
5. Controlling smoke during burning.
6. Suppressing dust on haul roads.
7. Scheduling operations so unvegetated areas are not exposed over long periods of time.

Erosion and pollution control measures are integral parts of the design of each dam. Permanent vegetation will be established on all disturbed areas above the normal pool elevation after construction is completed. Construction contracts will include measures for these purposes as necessary.

Mitigation Features

Features of the Plan which help to reduce impacts on wildlife include: locating structures in areas where wildlife habitat quality is poor, limiting clearing to the minimum area necessary for the construction of the dam, reducing initial sediment pool size with drawdowns, and limiting the work limits at each site to the minimum needed.

Other features planned to mitigate impacts on wildlife include replacing an estimated 380 habitat units of woody habitat on about 1,090 acres of wildlife mitigation areas, establishing grass-legume mixtures or native warm-season grasses on dams and emergency spillways, and protecting those areas from grazing. Mitigation areas will be located adjacent to other cover types so edge effects and diversity will be maximized.

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Sponsors in each county will prepare and maintain a list of potential mitigation sites. The tri-agency biology team will prioritize these sites for installation as per the criteria shown on page D-18, Appendix D. Mitigation shall not lag, by more than three years, the accumulated mitigation required due to construction. Sponsors are responsible for assuring that adequate mitigation acres are identified and set aside. Availability of construction dollars will be dependent upon a balanced acquisition of mitigation areas as the project proceeds.

The Indiana bat has been found in some areas that will be cleared. Areas that have potential nesting trees for the bat will be cleared only during the September 1 to April 30 period when the bat is not breeding or raising young. This 'no-cut' period may be waived on an individual site basis with the concurrence of the tri-agency biologists.

Permits and Compliance

Federal Clean Water Act, Section 404 permit for the project will not be required because project measures qualify under the nationwide permit published in the Federal Register dated 13 November 1986, under 33 C.F.R. 323.4. No other known federal permits or licenses will be required. Construction permits and water storage permits from the Iowa Department of Natural Resources, Environmental Protection Division (EPD), are required for most of the dams. Only those on the smallest drainage areas will be exempt from state permits. Permission was requested and received to deviate from minimum principal spillway size requirements of EPD.

Federal Fish and Wildlife Coordination Act procedures were used to insure important fish and wildlife resources are not lost. The Plan has been prepared to be in compliance with the National Environmental Policy Act and Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

Project measure installation will be in compliance with applicable federal, state, and local laws and regulations concerning environmental pollution control and abatement.

Costs

The total estimated cost of installing the project is $6,517,280 which includes $4,675,670 for construction, $923,760 for engineering services, $455,970 for landrights, and $461,880 for project administration. All costs are for the purpose of flood prevention. See Tables 1 and 2 for details. The annualized installation cost of the project measures is $310,480, see Table 4. Annualized operation, maintenance, and replacement (OM&R) costs are $17,180.

Construction costs for labor, equipment, and materials are the engineer's estimated costs which include an allowance for contingencies. The estimates were made by applying appropriate unit costs to detailed quantity estimates. Unit costs, based on the most recent contract bid schedules and actual construction costs of similar projects in Iowa, were adjusted to the 1987

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average price level. Cost allowances for contingencies of ten percent are included to offset unknown conditions which may appear during construction. Estimated culture resources costs of $56,850 and estimated cost to establish wildlife mitigation of $337,560 are included in the construction costs.

Engineering services costs include the direct cost of design surveys, investigations, design, preparation of drawings and specifications for project measures, and construction inspection.

Project administration costs are associated with the installation of project measures, including the cost of contract administration, government representatives, obtaining permits, relocation assistance advisory services, and administrative functions connected with relocation payments. The SCS and the Sponsors will pay the administrative costs each incurs.

OM&R costs are the costs of materials, equipment, services, and facilities needed to operate the project, and make repairs and replacements necessary to maintain project measures in sound operating condition during the evaluated life of the project. Included are the cost of repairs, replacements, or additions and an appropriate charge for inspection, engineering, supervision, and general overhead. OM&R costs will be paid from local funds.

Landrights costs include all expenditures made to acquire land or easements for construction of dams and establishing mitigation areas. The values have been estimated by the Sponsors and concurred in by the SCS.

At present, no P.L. 83-566 or other costs associated with the requirements of the Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (P.L. 646, 91st Congress) are foreseen. If they are needed later these payments will be cost shared as shown in item 2 of the Agreement. Relocation payments are applicable to a displaced person, business, or farm operation.

Installation and Financing

Project measures will be installed by contracts awarded and administered by the Soap Creek Watershed Board unless Sponsors request the SCS to award and administer any one or all contracts. Engineering services for all project measures will be performed by the SCS. Wildlife mitigation measures will be installed using average-cost method by agreement with each SWCD.

Each SWCD and County Board of Supervisors will jointly provide landrights for dams and wildlife mitigation measures located in their county. The Board of Supervisors in each county has the power of eminent domain and agrees to use it, with concurrence of the Soap Creek Watershed Board, if needed to acquire landrights for project measures. Construction and water storage permits required by Iowa law will be acquired by each SWCD for dams in the county it represents.

An estimated schedule of federal and non-federal obligations during the 15-year installation period is tabulated in Table P.

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TABLE P - SCHEDULE OF OBLIGATIONS

Year	Measures	Federal	Local	Total
		(dollars)		
1	Structural	140,270		140,270
	Landrights		13,680	13,680
	Engineering	27,710		27,710
	Project Administration	13,860		13,860
2	Structural	187,030		187,030
	Landrights		18,240	18,240
	Engineering	36,950		36,950
	Project Administration	18,480		18,480
3	Structural	233,780		233,780
	Landrights		22,800	22,800
	Engineering	46,190		46,190
	Project Administration	23,090		23,090
4	Structural	280,540		280,540
	Landrights		27,360	27,360
	Engineering	55,420		55,420
	Project Administration	27,710		27,710
5	Structural	374,050		374,050
	Landrights		36,480	36,480
	Engineering	73,900		73,900
	Project Administration	36,950		36,950
6	Structural	467,570		467,570
	Landrights		45,600	45,600
	Engineering	92,370		92,370
	Project Administration	46,190		46,190
7	Structural	561,080		561,080
	Landrights		54,710	54,710
	Engineering	110,850		110,850
	Project Administration	55,430		55,430
8	Structural	467,570		467,570
	Landrights		45,600	45,600
	Engineering	92,370		92,370
	Project Administration	46,190		46,190
9	Structural	420,810		420,810
	Landrights		41,030	41,030
	Engineering	83,140		83,140
	Project Administration	41,570		41,570

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TABLE P - SCHEDULE OF OBLIGATIONS (continued)

Year	Measures	Federal	Local	Total
		(dollars)		
10	Structural	420,810		420,810
	Landrights		41,030	41,030
	Engineering	83,140		83,140
	Project Administration	41,570		41,570
11	Structural	280,540		280,540
	Landrights		27,360	27,360
	Engineering	55,430		55,430
	Project Administration	27,710		27,710
12	Structural	280,540		280,540
	Landrights		27,360	27,360
	Engineering	55,430		55,430
	Project Administration	27,710		27,710
13	Structural	280,540		280,540
	Landrights		27,360	27,360
	Engineering	55,430		55,430
	Project Administration	27,710		27,710
14	Structural	187,030		187,030
	Landrights		18,240	18,240
	Engineering	36,950		36,950
	Project Administration	18,480		18,480
15	Structural	93,510		93,510
	Landrights		9,120	9,120
	Engineering	18,480		18,480
	Project Administration	9,230		9,230

Federal assistance will be provided under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress 68 Stat. 666), as amended. Federal assistance in carrying out this Plan is contingent on appropriation of funds for that purpose and securing landrights and permits for installation of project measures.

Five archeological sites in the vicinity of the project sites shall be considered eligible for Section 106 purposes (36 C.F.R. Part 800: Protection of Historic Properties) for the National Register of Historic Places by the SCS and the State Historic Preservation Officer.

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If cultural resources are discovered during construction, appropriate notice will be given to the Secretary of the Interior (through the Department's Consulting Archeologist) in accordance with Section 3 of Public Law 93-291. SCS will take action to protect significant cultural resources discovered during construction.

Dams 4-46, 26-38, 26-55, and 90-87 will be located on existing county roads with costs for construction, mitigation, engineering, and project administration shared by the county in which it is located and the SCS. Each county, where road structures are located, will be the responsibile contracting agency. Costs will be shared as shown in Table Q.

TABLE Q - COST ALLOCATIONS FOR ROAD STRUCTURES

Dam	Cost	
	SCS	County
	-------(percent)-------	
4-46	87	13
26-38	87	13
26-55	84	16
90-87	86	14

Agreements will be executed between the counties and SCS setting forth work and costs to be incurred by each. Federal funds will be used for the flood prevention portion of construction, engineering services, and project administration costs of all project measures. Non-project costs will be a local cost. Other funds required for project installation will be obtained from tax levies assessed by the four county boards of supervisors. Soap Creek Watershed Board will use these funds for landrights acquisition and OM&R costs.

Operation, Maintenance, and Replacement

Total benefits to be derived from installation of dams cannot be realized unless they are operated and maintained to serve the full purpose for which they are installed. Replacement includes the planned periodic replacement of facilities, parts of project measures, or complete project measures. Operation includes the administration, management, and performance of non-maintenance actions needed to keep a completed measure safe and functioning as planned. Maintenance includes the performance of work and application of measures to: repair damage to project measures, prevent deterioration of project measures, and replace a measure if one or more of its components fail. Repair of damages to completed measures caused by normal deterioration, drought, and flooding caused by rainfall in excess of design rainfall, or vandalism is considered maintenance. Maintenance consists of routine and recurring needs such as:

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1. Replacing soil removed by erosion and burrowing animals on earthfills and emergency spillways.
2. Re-establishing vegetative cover on earthfills, emergency spillways, and borrow areas.
3. Removing debris accumulations in sediment and retarding pools.
4. Keeping trash racks in proper working order.
5. Replacing or repairing damaged or depleted principal spillways.
6. Stabilizing spillway outlets.
7. Removing undesirable vegetation from earthfills and emergency spillways.
8. Repairing or replacing damaged sections of fence around embankments, pools, and mitigation areas.

Maintenance work will generally be done by mechanical means such as mowing, seeding, planting, and earthmoving. Undesirable vegetation will be controlled by mechanical methods. However, to prevent the resprouting of brush or trees that have been cut down, spot application of herbicide may be needed. Mowing will be done only between July 15 and September 1.

Sponsors will be responsible for all operation, maintenance,and replacement (OM&R) of the installed project measures. OM&R requires effort and expenditures throughout the life of the project to maintain safe conditions and assure proper functioning.

The Sponsors' responsibility for OM&R of a measure begins when any segment of the installation is completed and accepted by the Sponsors and SCS. Sponsors' liability extends throughout the actual life of the measure, until the measure is modified to remove potential risk of loss of life and property, or as may be required by federal, state, and local laws.

OM&R of dams 4-46, 26-48, 26-55, and 90-87 will be performed by the Board of Supervisors in each county in which the dam is located. Maintenance of these dams will be financed from county road funds. OM&R of all other project measures will be performed by the Soap Creek Watershed Board and financed by levies assessed by the Boards of Supervisors.

A specific OM&R agreement will be made for each measure before signing a landrights, relocation, project agreement, or long-term contract. The agreements will provide for inspections, reports, and procedures for performing the OM&R items. The agreements will include specific provisions for retention, use, and disposal of property acquired or improved with P.L. 83-566 financial assistance.

OM&R agreements will be based on the SCS National Operation and Maintenance Manual. OM&R plans will be prepared for each measure before installation and made a part of the OM&R agreement for that measure.

Inspections are necessary to ensure that the installed project measures are safe and functioning properly. Inspections are to assess the adequacy of the OM&R activities, identify needed OM&R work, identify unsafe conditions, specify means of relieving unsafe work or performing other needed work, review adequacy of land treatment above dams, set action dates for performing corrective actions, and review hazard classification of dams.

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Sponsors are responsible for making the necessary inspections. Inspections will be made annually for the life of the practice or as specified in the OM&R agreement. SCS may, depending on the availability of resources, assist the Sponsors with their inspections. A written record of all inspections of project practices will be maintained by the Sponsors. The record will identify features of the practice that were inspected, relate the conditions observed, and specify OM&R work needed and when this work should be done by setting action dates. After each inspection the Sponsors will furnish a written report to the SCS. Project measures will be inspected on a regularly scheduled basis as follows:

1. During or immediately after the initial filling of a reservoir.
2. Annually for all structural and mitigation measures.
3. After major storms, earthquakes, or occurrence of any unusual condition that might adversely affect the project measures.

Average annual OM&R costs are estimated to be $31,610.

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TABLE 1 - ESTIMATED INSTALLATION COST
Soap Creek Watershed, Iowa

Installation Cost Item	Unit	No.	Estimated Cost (Dollars) 1/				
			Public Law 83-566 Funds		Other Funds		
			Non-Federal Land SCS 2/	Total	Non-Federal Land	Total	TOTAL
STRUCTURAL MEASURES							
Floodwater Retarding Structures	No.	154	6,061,310	6,061,310	455,970	455,970	6,517,280
TOTAL PROJECT			6,061,310	6,061,310	455,970	455,970	6,517,280

1/ Price Base 1987
2/ Federal agency responsible for assisting in installation of works of improvement.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Soap Creek Watershed, Iowa
(Dollars) 1/

	Installation Cost P.L.-566 Funds			Installation Cost - Other Funds				
Item	Construction 4/	Engineering	Total PL-566	Construction	Engineering	Land-rights	Total Other	Total Installation Cost
STRUCTURAL MEASURES								
154 Floodwater Retarding Structures	4,675,670	923,760	5,599,430			455,970 3/	455,970	6,055,400
				(13,930)	(2,790)		(16,720)	(16,720) 2/
Subtotal	4,675,670	923,760	5,599,430			455,970	455,970	6,055,400
				(13,930)	(2,790)		(16,720)	(16,720) 2/
Project Administration			461,880					461,880
							(1,400)	(1,400) 2/
GRAND TOTAL	4,675,670	923,760	6,061,310			455,970	455,970	6,517,280
				(13,930)	(2,790)		(18,120)	(18,120) 2/

1/ Price Base 1987
2/ Non-project costs for road purposes.
3/ Includes $136,110 of landrights cost for wildlife mitigation.
4/ Construction includes wildlife mitigation costs of $337,560 and cultural resources costs of 56,850.

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-37	4-38A	4-39	4-40A	4-40B
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.16	0.45	0.33	0.30	0.23
Total Drainage Area	Sq. Mi.	0.16	0.45	0.33	0.30	0.23
Runoff Curve No. (1-Day) (AMC II)		78	78	78	80	80
Time of Concentration (Tc)	Hrs.	0.19	0.31	0.33	0.28	0.29
Elevation Top of Dam	Ft.	832.0	832.4	827.0	856.7	849.4
Elevation Crest Emergency Spillway	Ft.	830.0	830.4	825.0	854.7	847.4
Elevation Crest High Stage Inlet	Ft.	824.3	822.0	817.0	847.0	840.6
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	20	20	20	20
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	23	30	21	25	24
Volume of Fill	Cu. Yd.	9,300	17,100	15,600	12,800	9,000
Total Capacity	Ac. Ft.	27	95	66	61	45
Sediment Submerged	Ac. Ft.	9	25	18	16	13
Sediment Aerated	Ac. Ft.	2	6	5	4	3
Floodwater Retarding	Ac. Ft.	16	64	43	41	29
Surface Area						
Sediment Pool	Acres	1.0	4	2.2	3.6	1.5
Floodwater Retarding Pool	Acres	2.5	11.3	6.4	6.9	4.8
Principal Spillway						
Rainfall Volume (1 Day)	In.	4.8	5.6	5.6	5.6	4.8
Runoff Volume (1 Day)	In.	2.54	3.23	3.23	3.42	2.72
Capacity of High Stage (Max.)	cfs	5	14	14	13	5
Dimensions of Conduit	In.	10	15	15	15	10
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	10	4	4	4	10
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	6.2	6.2	6.2	6.2
Runoff Volume	In.	3.76	3.76	3.76	3.96	3.96
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.8	3.1	3.0	3.1	3.9
Max. Reservoir Water Surface Elevation	Ft.	830.6	830.8	825.4	855.1	848.1
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	1.9	2.7	2.4	2.6	2.4

1/ Structure numbers are county coded by prefix:

Appanoose	4-
Davis	26-
Monroe	68-
Wapello	90-

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
SOAP CREEK WATERSHED

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-40C	4-47	4-49	4-51	4-53
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.16	0.53	0.11	0.09	0.13
Total Drainage Area	Sq. Mi.	0.16	0.53	0.11	0.09	0.13
Runoff Curve No. (1-Day) (AMC II)		80	81	78	78	78
Time of Concentration (Tc)	Hrs.	0.20	0.68	0.18	0.18	0.24
Elevation Top of Dam	Ft.	846.4	868.6	857.5	852.1	840.7
Elevation Crest Emergency Spillway	Ft.	844.4	866.6	855.5	850.1	838.7
Elevation Crest High Stage Inlet	Ft.	838.5	858.0	851.0	845.6	834.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	20	20	10	20
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	23	27	20	20	22
Volume of Fill	Cu. Yd.	11,230	14,740	9,000	7,600	10,400
Total Capacity	Ac. Ft.	29	122	19	15	23
Sediment Submerged	Ac. Ft.	9	29	6	5	8
Sediment Aerated	Ac. Ft.	2	7	2	1	2
Floodwater Retarding	Ac. Ft.	18	86	11	9	13
Surface Area						
Sediment Pool	Acres	2.2	6.3	1.7	1.2	2.8
Floodwater Retarding Pool	Acres	4.3	13.5	3.1	2.4	3.9
Principal Spillway						
Rainfall Volume (1 Day)	In.	4.8	5.6	4.8	4.8	4.8
Runoff Volume (1 Day)	In.	2.72	3.52	2.54	2.54	2.54
Capacity of High Stage (Max.)	cfs	4	14	4	5	4
Dimensions of Conduit	In.	10	15	10	10	10
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	10	4	10	10	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	6.2	5.6	5.6	6.2
Runoff Volume	In.	3.96	4.07	3.23	3.23	3.23
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.6	3.2	2.8	3.3	2.8
Max. Reservoir Water Surface Elevation	Ft.	845.0	867.1	855.9	850.3	839.0
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.4	1.3	1.4
Floodwater Retarding Volume	In.	2.1	3.0	1.9	1.9	1.9

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-54	4-55	4-58	4-79	4-84
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.18	0.09	0.34	0.38	0.42
Total Drainage Area	Sq. Mi.	0.18	0.09	0.34	0.38	0.42
Runoff Curve No. (1-Day) (AMC II)		78	78	80	81	81
Time of Concentration (Tc)	Hrs.	0.20	0.17	0.32	0.41	0.46
Elevation Top of Dam	Ft.	838.2	853.9	806.0	870.0	841.7
Elevation Crest Emergency Spillway	Ft.	836.2	851.9	804.0	868.0	839.7
Elevation Crest High Stage Inlet	Ft.	830.0	847.0	797.0	859.5	832.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	10	20	20	20
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	24	18	26	29	28
Volume of Fill	Cu. Yd.	12,500	7,400	18,800	15,800	20,900
Total Capacity	Ac. Ft.	37	15	76	82	97
Sediment Submerged	Ac. Ft.	11	5	19	21	23
Sediment Aerated	Ac. Ft.	3	1	5	5	6
Floodwater Retarding	Ac. Ft.	23	9	52	56	68
Surface Area						
Sediment Pool	Acres	2.3	1.3	4.5	4.1	5.5
Floodwater Retarding Pool	Acres	3.7	2.2	9.6	9.2	11.4
Principal Spillway						
Rainfall Volume (1 Day)	In.	4.8	4.8	5.6	5.6	5.6
Runoff Volume (1 Day)	In.	2.54	2.54	3.42	3.52	3.52
Capacity of High Stage (Max.)	cfs	5	4	13	14	14
Dimensions of Conduit	In.	10	10	15	15	15
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	10	10	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	5.6	6.2	6.2	6.2
Runoff Volume	In.	3.76	3.23	3.96	4.07	4.07
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.7	3.1	2.8	2.9	2.9
Max. Reservoir Water Surface Elevation	Ft.	836.8	852.3	804.4	868.4	840.1
Capacity Equivalents						
Sediment Volume	In.	1.5	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.4	1.8	2.9	2.8	3.0

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-92	4-94	4-95	4-109	4-111
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.10	0.33	0.30	0.23	0.28
Total Drainage Area	Sq. Mi.	0.10	0.33	0.30	0.23	0.28
Runoff Curve No. (1-Day) (AMC II)		81	81	81	78	78
Time of Concentration (Tc)	Hrs.	0.15	0.48	0.26	0.29	0.35
Elevation Top of Dam	Ft.	808.5	814.7	809.4	836.7	846.4
Elevation Crest Emergency Spillway	Ft.	806.5	812.7	807.4	834.7	844.4
Elevation Crest High Stage Inlet	Ft.	802.0	804.0	798.0	829.0	838.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	10	20	20	20	20
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	15	19	27	22	25
Volume of Fill	Cu. Yd.	9,640	10,700	13,720	9,450	11,400
Total Capacity	Ac. Ft.	19	69	70	43	56
Sediment Submerged	Ac. Ft.	6	18	17	13	16
Sediment Aerated	Ac. Ft.	1	5	4	3	4
Floodwater Retarding	Ac. Ft.	12	46	49	27	36
Surface Area						
Sediment Pool	Acres	1.8	3.6	3.1	3.2	3.6
Floodwater Retarding Pool	Acres	3.3	7.1	6.9	6.2	7.7
Principal Spillway						
Rainfall Volume (1 Day)	In.	4.8	5.6	5.6	4.8	5.6
Runoff Volume (1 Day)	In.	2.81	3.52	3.52	2.54	3.23
Capacity of High Stage (Max.)	cfs	3	13	4	4	13
Dimensions of Conduit	In.	10	15	10	10	15
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	10	4	4	10	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.6	6.2	6.2	6.2	6.2
Runoff Volume	In.	3.52	4.07	4.07	3.23	3.76
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	2.9	2.9	2.7	2.8	2.8
Max. Reservoir Water Surface Elevation	Ft.	806.9	813.1	807.7	835.0	844.8
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.2	2.6	3.1	2.2	2.4

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-112	68-33B	68-38	68-42	68-47
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.41	0.27	0.23	0.23	0.25
Total Drainage Area	Sq. Mi.	0.41	0.27	0.23	0.23	0.25
Runoff Curve No. (1-Day) (AMC II)		78	81	81	81	81
Time of Concentration (Tc)	Hrs.	0.37	0.46	0.35	0.54	0.54
Elevation Top of Dam	Ft.	837.4	932.1	868.1	889.1	898.0
Elevation Crest Emergency Spillway	Ft.	835.4	930.1	866.1	887.1	896.0
Elevation Crest High Stage Inlet	Ft.	828.5	921.5	861.5	880.0	890.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	20	10	20	20
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	27	29.5	16	31	24
Volume of Fill	Cu. Yd.	21,100	15,500	6,950	16,300	13,400
Total Capacity	Ac. Ft.	84	55	47	46	51
Sediment Submerged	Ac. Ft.	23	15	13	13	14
Sediment Aerated	Ac. Ft.	6	3	3	3	3
Floodwater Retarding	Ac. Ft.	55	37	31	30	34
Surface Area						
Sediment Pool	Acres	5.4	2.8	5.0	2.7	4.0
Floodwater Retarding Pool	Acres	10.7	5.5	7.7	5.8	7.2
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	4.8	4.8	4.8
Runoff Volume (1 Day)	In.	3.23	3.52	2.81	2.81	2.81
Capacity of High Stage (Max.)	cfs	13	14	5	5	5
Dimensions of Conduit	Ft./In.	15	15	10	10	10
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	10	10	10
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	6.2	5.6	6.2	6.2
Runoff Volume	In.	3.76	4.07	3.52	4.07	4.07
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	2.8	3.2	3.0	4.0	3.6
Max. Reservoir Water Surface Elevation	Ft.	835.7	930.6	866.6	887.8	896.6
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.5	2.6	2.5	2.4	2.6

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 68-61	68-63	68-68	68-75	68-78
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.39	0.22	0.10	0.41	0.20
Total Drainage Area	Sq. Mi.	0.39	0.22	0.10	0.41	0.20
Runoff Curve No. (1-Day) (AMC II)		81	81	81	81	81
Time of Concentration (Tc)	Hrs.	0.44	0.46	0.40	0.40	0.43
Elevation Top of Dam	Ft.	855.4	849.6	874.7	836.5	826.4
Elevation Crest Emergency Spillway	Ft.	853.4	847.6	872.7	834.5	824.4
Elevation Crest High Stage Inlet	Ft.	845.0	839.0	865.0	827.0	818.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	20	14	20	14
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	26	28	23	28	27
Volume of Fill	Cu. Yd.	23,700	13,000	6,100	20,300	15,800
Total Capacity	Ac. Ft.	85	42	17	95	39
Sediment Submerged	Ac. Ft.	22	12	6	23	11
Sediment Aerated	Ac. Ft.	5	3	1	6	3
Floodwater Retarding	Ac. Ft.	58	27	10	66	25
Surface Area						
Sediment Pool	Acres	4.4	2.1	0.9	5.5	2.4
Floodwater Retarding Pool	Acres	10.0	4.9	1.9	11.2	5.5
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	4.8	4.8	5.6	4.8
Runoff Volume (1 Day)	In.	3.52	2.81	2.81	3.52	2.81
Capacity of High Stage (Max.)	cfs	14	5	4	14	5
Dimensions of Conduit	In.	15	10	10	15	10
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	10	10	4	10
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	6.2	6.2	6.2	6.2
Runoff Volume	In.	4.07	4.07	4.07	4.07	4.07
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.0	4.1	4.3	3.0	3.9
Max. Reservoir Water Surface Elevation	Ft.	853.8	848.4	873.4	834.8	825.1
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.8	2.3	1.9	3.0	2.3

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 68-89	90-86	90-87	90-88	90-89A
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.47	0.12	0.30	0.19	0.49
Total Drainage Area	Sq. Mi.	0.47	0.12	0.30	0.19	0.49
Runoff Curve No. (1-Day) (AMC II)		81	82	82	82	82
Time of Concentration (Tc)	Hrs.	0.89	0.37	0.50	0.40	0.72
Elevation Top of Dam	Ft.	916.4	847.0	834.2	831.2	847.0
Elevation Crest Emergency Spillway	Ft.	914.4	845.0	-- 2/	829.2	845.0
Elevation Crest High Stage Inlet	Ft.	906.0	839.0	827.0	823.0	837.0
Emergency Spillway Type		VEG	VEG	2/	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	10	2/	10	20
Emergency Spillway Exit Slope	%	4	4	2/	4	4
Maximum Height of Dam	Ft.	26	20	19	17	25
Volume of Fill	Cu. Yd.	15,200	6,180	8,600	7,830	20,280
Total Capacity	Ac. Ft.	109	23	74	37	113
Sediment Submerged	Ac. Ft.	26	6	16	10	27
Sediment Aerated	Ac. Ft.	6	2	4	3	7
Floodwater Retarding	Ac. Ft.	77	15	54	24	79
Surface Area						
Sediment Pool	Acres	6.0	1.6	4.0	2.8	6.0
Floodwater Retarding Pool	Acres	11.8	3.0	9.2	5.3	14.0
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	4.8	5.6	4.8	5.6
Runoff Volume (1 Day)	In.	3.52	2.9	3.62	2.9	3.62
Capacity of High Stage (Max.)	cfs	14	4	36	4	13
Dimensions of Conduit	In.	15	10	24	10	15
Type of Conduit		CMP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	10	1 3/	10	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	6.2	6.2	6.2	5.6	6.2
Runoff Volume	In.	4.07	3.62	4.17	3.62	4.17
Storm Duration	Hrs.	24	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.1	3.2	0	3.2	3.0
Max. Reservoir Water Surface Elevation	Ft.	914.8	845.4	833.0	829.6	845.4
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	3.1	2.3	3.4	2.4	3.0

2/ Site 90-87 No Emergency Spillway
3/ Emergency flow-exceeds 1% chance use

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 90-89B	90-91	90-113	68-88
Class of Structure		a	a	a	a
Seismic Zone		1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.27	0.34	0.47	0.42
Total Drainage Area	Sq. Mi.	0.27	0.34	0.47	0.42
Runoff Curve No. (1-Day) (AMC II)		82	82	82	81
Time of Concentration (Tc)	Hrs.	0.44	0.65	0.57	0.79
Elevation Top of Dam	Ft.	850.9	821.7	847.9	923.1
Elevation Crest Emergency Spillway	Ft.	848.9	819.7	845.9	921.1
Elevation Crest High Stage Inlet	Ft.	840.5	812.0	838.0	912.0
Emergency Spillway Type		VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	20	20	20	20
Emergency Spillway Exit Slope	%	4	4	4	4
Maximum Height of Dam	Ft.	26	26	23	26
Volume of Fill	Cu. Yd.	13,720	13,340	16,320	17,600
Total Capacity	Ac. Ft.	56	75	110	94
Sediment Submerged	Ac. Ft.	15	19	26	24
Sediment Aerated	Ac. Ft.	3	5	6	6
Floodwater Retarding	Ac. Ft.	38	51	78	64
Surface Area					
Sediment Pool	Acres	2.5	4.2	6.0	6.0
Floodwater Retarding Pool	Acres	6.5	9.3	14.0	9.8
Principal Spillway					
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6
Runoff Volume (1 Day)	In.	3.62	3.62	3.62	3.16
Capacity of High Stage (Max.)	cfs	13	14	13	13
Dimensions of Conduit	In.	15	15	15	15
Type of Conduit		CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4
Emergency Spillway Hydrograph					
Rainfall Volume	In.	6.2	6.2	6.2	6.2
Runoff Volume	In.	4.17	4.17	4.17	4.17
Storm Duration	Hrs.	24	24	24	24
Velocity of Flow (Ve)	Ft./Sec.	3.0	3.0	3.0	3.0
Max. Reservoir Water Surface Elevation	Ft.	849.3	820.1	846.3	921.6
Capacity Equivalents					
Sediment Volume	In.	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.6	2.8	3.1	2.9

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-31	4-45	4-46	4-50	4-110
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	1.81	1.52	1.41	0.89	0.77
Total Drainage Area	Sq. Mi.	1.81	1.52	1.41	0.89	0.77
Runoff Curve No. (1-Day) (AMC II)		78	80	81	78	78
Time of Concentration (Tc)	Hrs.	0.74	0.97	1.1	0.51	0.39
Elevation Top of Dam	Ft.	802.5	872.6	887.6	830.3	848.8
Elevation Crest Emergency Spillway	Ft.	799.5	869.2	884.6	827.3	845.8
Elevation Crest High Stage Inlet	Ft.	790.0	861.0	874.5	820.0	838.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	30	40	30	30
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	30	32	31	29	28
Volume of Fill	Cu. Yd.	41,640	32,130	50,400	28,490	24,770
Total Capacity	Ac. Ft.	401	338	331	190	172
Sediment Submerged	Ac. Ft.	101	84	76	49	43
Sediment Aerated	Ac. Ft.	25	21	20	12	11
Floodwater Retarding	Ac. Ft.	275	233	235	129	118
Surface Area						
Sediment Pool	Acres	18.8	17.9	15.3	11.6	10.0
Floodwater Retarding Pool	Acres	40.5	36.2	31.2	23.0	20.2
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.08	5.48	5.61	5.08	5.08
Capacity of High Stage (Max.)	cfs	66	45	75	21	21
Dimensions of Conduit	In.	24	24	30	18	18
Type of Conduit		RCP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	2.88	3.07	3.16	2.88	2.88
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	2.3	2.9	2.8	2.4	0
Max. Reservoir Water Surface Elevation	Ft.	799.7	869.6	884.2	827.5	845.8
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.21	5.44	5.55	5.21	5.21
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	802.3	872.3	887.4	829.6	848.2
Discharge per Foot of Width (Qe/b)	Ac. Ft.	5.9	5.6	4.2	3.3	2.6
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.8	2.9	3.1	2.7	2.9

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-31	4-45	4-46	4-50	4-110
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	1.81	1.52	1.41	0.89	0.77
Total Drainage Area	Sq. Mi.	1.81	1.52	1.41	0.89	0.77
Runoff Curve No. (1-Day) (AMC II)		78	80	81	78	78
Time of Concentration (Tc)	Hrs.	0.74	0.97	1.1	0.51	0.39
Elevation Top of Dam	Ft.	802.5	872.6	887.6	830.3	848.8
Elevation Crest Emergency Spillway	Ft.	799.5	869.2	884.6	827.3	845.8
Elevation Crest High Stage Inlet	Ft.	790.0	861.0	874.5	820.0	838.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	30	40	30	30
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	30	32	31	29	28
Volume of Fill	Cu. Yd.	41,640	32,130	50,400	28,490	24,770
Total Capacity	Ac. Ft.	401	338	331	190	172
Sediment Submerged	Ac. Ft.	101	84	76	49	43
Sediment Aerated	Ac. Ft.	25	21	20	12	11
Floodwater Retarding	Ac. Ft.	275	233	235	129	118
Surface Area						
Sediment Pool	Acres	18.8	17.9	15.3	11.6	10.0
Floodwater Retarding Pool	Acres	40.5	36.2	31.2	23.0	20.2
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.08	5.48	5.61	5.08	5.08
Capacity of High Stage (Max.)	cfs	66	45	75	21	21
Dimensions of Conduit	In.	24	24	30	18	18
Type of Conduit		RCP	CMP	CMP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	2.88	3.07	3.16	2.88	2.88
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	2.3	2.9	2.8	2.4	0
Max. Reservoir Water Surface Elevation	Ft.	799.7	869.6	884.2	827.5	845.8
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.21	5.44	5.55	5.21	5.21
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	802.3	872.3	887.4	829.6	848.2
Discharge per Foot of Width (Qe/b)	Ac. Ft.	5.9	5.6	4.2	3.3	2.6
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.8	2.9	3.1	2.7	2.9

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-113	4-114	26-42	26-43	26-51
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.84	0.63	3.13	2.67	2.47
Total Drainage Area	Sq. Mi.	0.84	0.63	3.13	2.67	2.47
Runoff Curve No. (1-Day) (AMC II)		78	81	82	82	78
Time of Concentration (Tc)	Hrs.	0.49	0.74	1.38	1.18	0.98
Elevation Top of Dam	Ft.	828.6	821.1	806.0	797.0	757.9
Elevation Crest Emergency Spillway	Ft.	825.6	818.1	803.0	794.0	754.9
Elevation Crest High Stage Inlet	Ft.	818.0	809.0	792.0	782.0	743.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	30	40	40	60
Emergency Spillway Exit Slope	%	4	4.2	4	4	4
Maximum Height of Dam	Ft.	28	30	30	26	27
Volume of Fill	Cu. Yd.	26,250	34,350	36,210	33,960	31,010
Total Capacity	Ac. Ft.	177	146	825	856	695
Sediment Submerged	Ac. Ft.	47	35	173	148	137
Sediment Aerated	Ac. Ft.	12	9	43	37	34
Floodwater Retarding	Ac. Ft.	118	102	609	671	524
Surface Area						
Sediment Pool	Acres	10.4	6.8	31.0	25.0	21.0
Floodwater Retarding Pool	Acres	21.0	14.9	80.0	70.0	51.0
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.08	5.61	5.87	5.87	5.08
Capacity of High Stage (Max.)	cfs	22	22	63	58	60
Dimensions of Conduit	In.	30	18	24	24	24
Type of Conduit		CMP	CMP	RCP	RCP	RCP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	2.88	3.16	3.26	3.26	2.88
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	2.8	2.3	0	0	0
Max. Reservoir Water Surface Elevation	Ft.	825.9	818.3	801.7	791.9	753.1
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.21	5.55	5.67	5.67	5.21
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	828.0	820.3	804.3	796.8	757.7
Discharge per Foot of Width (Qe/b)	Ac. Ft.	3.3	2.5	6.4	4.4	4.7
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.6	3.0	3.7	4.7	4.0

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 4-113	4-114	26-42	26-43	26-51
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.84	0.63	3.13	2.67	2.47
Total Drainage Area	Sq. Mi.	0.84	0.63	3.13	2.67	2.47
Runoff Curve No. (1-Day) (AMC II)		78	81	82	82	78
Time of Concentration (Tc)	Hrs.	0.49	0.74	1.38	1.18	0.98
Elevation Top of Dam	Ft.	828.6	821.1	806.0	797.0	757.9
Elevation Crest Emergency Spillway	Ft.	825.6	818.1	803.0	794.0	754.9
Elevation Crest High Stage Inlet	Ft.	818.0	809.0	792.0	782.0	743.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	30	40	40	60
Emergency Spillway Exit Slope	%	4	4.2	4	4	4
Maximum Height of Dam	Ft.	28	30	30	26	27
Volume of Fill	Cu. Yd.	26,250	34,350	36,210	33,960	31,010
Total Capacity	Ac. Ft.	177	146	825	856	695
Sediment Submerged	Ac. Ft.	47	35	173	148	137
Sediment Aerated	Ac. Ft.	12	9	43	37	34
Floodwater Retarding	Ac. Ft.	118	102	609	671	524
Surface Area						
Sediment Pool	Acres	10.4	6.8	31.0	25.0	21.0
Floodwater Retarding Pool	Acres	21.0	14.9	80.0	70.0	51.0
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.08	5.61	5.87	5.87	5.08
Capacity of High Stage (Max.)	cfs	22	22	63	58	60
Dimensions of Conduit	In.	30	18	24	24	24
Type of Conduit		CMP	CMP	RCP	RCP	RCP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	2.88	3.16	3.26	3.26	2.88
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	2.8	2.3	0	0	0
Max. Reservoir Water Surface Elevation	Ft.	825.9	818.3	801.7	791.9	753.1
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.21	5.55	5.67	5.67	5.21
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	828.0	820.3	804.3	796.8	757.7
Discharge per Foot of Width (Qe/b)	Ac. Ft.	3.3	2.5	6.4	4.4	4.7
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.6	3.0	3.7	4.7	4.0

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 26-55	26-63	26-65	68-30	68-33A
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	1.72	2.03	2.05	0.94	1.28
Total Drainage Area	Sq. Mi.	1.72	2.03	2.05	0.94	1.28
Runoff Curve No. (1-Day) (AMC II)		82	78	78	81	81
Time of Concentration (Tc)	Hrs.	1.04	0.96	0.76	1.08	0.96
Elevation Top of Dam	Ft.	798.2	757.0	764.1	891.5	924.4
Elevation Crest Emergency Spillway	Ft.	795.2	754.0	761.1	888.5	921.4
Elevation Crest High Stage Inlet	Ft.	784.0	743.0	748.0	877.0	909.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	50	60	30	20	40
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	20	30	29	33	33
Volume of Fill	Cu. Yd.	18,600	31,600	27,020	29,700	37,340
Total Capacity	Ac. Ft.	448	518	466	225	300
Sediment Submerged	Ac. Ft.	95	113	114	52	71
Sediment Aerated	Ac. Ft.	24	28	28	13	18
Floodwater Retarding	Ac. Ft.	329	377	324	160	211
Surface Area						
Sediment Pool	Acres	12.5	19.0	15.0	9.2	11.7
Floodwater Retarding Pool	Acres	41.0	50.0	40.0	19.3	22.6
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.87	5.08	5.08	5.61	5.61
Capacity of High Stage (Max.)	cfs	59	64	62	22	21
Dimensions of Conduit	In.	30	24	24	18	18
Type of Conduit		RCP	RCP	RCP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	3.26	2.88	2.88	3.16	3.16
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	0	0	1.9	0	0
Max. Reservoir Water Surface Elevation	Ft.	795.1	752.6	761.2	888.4	921.3
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.67	5.21	5.21	5.55	5.55
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	798.1	756.0	763.9	891.4	924.2
Discharge per Foot of Width (Qe/b)	Ac. Ft.	3.9	2.1	5.9	5.1	3.7
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	3.6	3.5	3.0	3.2	3.1

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 68-34	68-54	68-66	68-80	90-79
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	0.77	1.64	1.11	1.88	3.06
Total Drainage Area	Sq. Mi.	0.77	1.64	1.11	1.88	3.06
Runoff Curve No. (1-Day) (AMC II)		81	81	81	81	82
Time of Concentration (Tc)	Hrs.	0.82	1.07	0.91	1.31	1.34
Elevation Top of Dam	Ft.	911.9	924.6	880.8	836.5	806.0
Elevation Crest Emergency Spillway	Ft.	908.9	921.6	877.8	833.5	803.0
Elevation Crest High Stage Inlet	Ft.	899.0	913.0	868.0	823.0	792.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	30	40	30	30	40
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	31	29	32	27	24
Volume of Fill	Cu. Yd.	20,480	33,760	22,600	31,150	26,840
Total Capacity	Ac. Ft.	168	358	258	490	830
Sediment Submerged	Ac. Ft.	42	91	61	104	170
Sediment Aerated	Ac. Ft.	11	22	15	26	42
Floodwater Retarding	Ac. Ft.	115	245	182	360	618
Surface Area						
Sediment Pool	Acres	6.3	19.0	11.8	16.0	28.0
Floodwater Retarding Pool	Acres	14.2	38.6	25.4	44.0	72.0
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.61	5.61	5.61	5.61	5.87
Capacity of High Stage (Max.)	cfs	19	44	21	68	56
Dimensions of Conduit	In.	18	24	18	24	24
Type of Conduit		CMP	CMP	CMP	RCP	RCP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.2	5.2
Runoff Volume	In.	3.16	3.16	3.16	3.16	3.26
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	2.8	2.7	0	0	0
Max. Reservoir Water Surface Elevation	Ft.	909.2	921.9	877.8	833.4	802.8
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.55	5.55	5.55	5.55	5.67
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	911.3	924.4	880.4	836.4	805.5
Discharge per Foot of Width (Qe/b)	Ac. Ft.	3.2	4.6	4.2	5.7	6.5
Bulk Length	Ft.	250	250	250	250	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	2.8	2.8	3.1	3.6	3.8

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TABLE 3 - STRUCTURAL DATA
DAMS WITH PLANNED STORAGE CAPACITY
Soap Creek Watershed, Iowa

ITEM	UNIT	STRUCTURE NUMBER 1/ 90-83	90-84	90-85	90-90	90-112
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	Sq. Mi.	2.39	2.37	2.42	0.84	1.20
Total Drainage Area	Sq. Mi.	2.39	2.37	2.42	0.84	1.20
Runoff Curve No. (1-Day) (AMC II)		82	82	82	82	82
Time of Concentration (Tc)	Hrs.	1.90	1.05	1.79	0.75	1.21
Elevation Top of Dam	Ft.	841.0	857.3	851.4	819.8	852.6
Elevation Crest Emergency Spillway	Ft.	838.0	854.3	848.2	816.8	849.6
Elevation Crest High Stage Inlet	Ft.	830.0	844.0	839.0	804.5	841.0
Emergency Spillway Type		VEG	VEG	VEG	VEG	VEG
Emergency Spillway Bottom Width	Ft.	60	50	50	40	30
Emergency Spillway Exit Slope	%	4	4	4	4	4
Maximum Height of Dam	Ft.	27	32	29	34	28
Volume of Fill	Cu. Yd.	40,370	41,720	35,010	32,800	31,170
Total Capacity	Ac. Ft.	550	730	624	195	290
Sediment Submerged	Ac. Ft.	132	132	134	47	67
Sediment Aerated	Ac. Ft.	33	33	34	12	16
Floodwater Retarding	Ac. Ft.	385	565	456	136	207
Surface Area						
Sediment Pool	Acres	31.0	31.9	30.0	10.5	14.5
Floodwater Retarding Pool	Acres	64.0	74.0	68.0	29.5	34.5
Principal Spillway						
Rainfall Volume (1 Day)	In.	5.6	5.6	5.6	5.6	5.6
Rainfall Volume (10 Day)	In.	9.9	9.9	9.9	9.9	9.9
Runoff Volume (10 Day)	In.	5.87	5.87	5.87	5.87	5.87
Capacity of High Stage (Max.)	cfs	63	36	34	22	21
Dimensions of Conduit	In.	24	18	18	18	18
Type of Conduit		RCP	RCP	RCP	CMP	CMP
Frequency Operation - Emergency Spillway	% Chance	4	4	4	4	4
Emergency Spillway Hydrograph						
Rainfall Volume	In.	5.2	5.2	5.2	5.6	5.2
Runoff Volume	In.	3.26	3.26	3.26	3.26	3.26
Storm Duration	Hrs.	6	6	6	6	6
Velocity of Flow (Ve)	Ft./Sec.	1.6	0	1.5	2.1	0
Max. Reservoir Water Surface Elevation	Ft.	838.2	853.2	848.4	816.9	849.5
Freeboard Hydrograph						
Rainfall Volume	In.	7.8	7.8	7.8	7.8	7.8
Runoff Volume	In.	5.67	5.67	5.67	5.67	5.67
Storm Duration	Hrs.	6	6	6	6	6
Max. Reservoir Water Surface Elevation	Ft.	839.8	856.7	851.2	819.0	852.2
Discharge per Foot of Width (Qe/b)	Ac. Ft.	4.8	3.3	5.2	2.4	4.2
Bulk Length	Ft.	250	250	250	200	250
Capacity Equivalents						
Sediment Volume	In.	1.3	1.3	1.3	1.3	1.3
Floodwater Retarding Volume	In.	3.0	4.5	3.5	3.0	3.2

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TABLE 4 - ANNUALIZED ADVERSE NED EFFECTS
Soap Creek Watershed, Iowa
(Dollars) 1/

Evaluation Unit	Project Outlays: Amortization of Installation Cost	Project Outlays: Operation Maintenance and Replacement Cost	TOTAL
154 Floodwater Retarding Structures	310,480	17,180	327,660
TOTAL	310,480	17,180	327,660

1/ Price Base 1987, Discounted and annualized at 8-5/8 percent discount rate for 50 years.

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TABLE 5
ESTIMATED ANNUALIZED FLOOD DAMAGE REDUCTION BENEFITS
Soap Creek Watershed
(Dollars) 1/

Item	Estimated Annualized Damage		Damage Reduction Benefit
	Without-Project	With-Project	
Floodwater			
Crop and Pasture	531,040	316,170	214,870
Other Agricultural	445,620	251,310	194,310
Land Damage			
Sedimentation	90,110	56,220	33,890
Scour	9,030	6,120	3,810
Swamping	3,530	2,440	1,090
Non-Agricultural			
Road and Bridge	204,050	115,990	88,060
TOTAL	1,284,280	748,250	536,030

1/ Price base: 1987 Current Normalized Prices for crop and pasture; 1987 price for all other.

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TABLE 6 - COMPARISON OF NED BENEFITS AND COSTS
Soap Creek Watershed, Iowa
(Dollars) 1/

Evaluation Unit	Agricultural Damage Reduction Flood Prevention	Total Annualized Benefits 2/	Annualized 3/ Cost	Benefit to Cost Ratio
154 Floodwater Retarding Structures	536,030	536,030	327,660	1.6:1.0
TOTAL	536,030	536,030	327,660	1.6:1.0

1/ Price Base 1987
2/ From Table 5
3/ From Table 4

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EFFECTS OF RECOMMENDED PLAN

General effects

Average annual area flooded will be reduced from 11,310 to 3,360 acres. Floodwater damages on the 14,150 acre flood plain will be reduced 72 percent. Long term productivity on cropland and pasture will be improved by reduction in flooding. Table R shows flood plain land use and expected changes.

TABLE R - IN FLOOD PLAIN LAND USE

Flood Plain Land Use	Without-Project (acres)	With-Project (acres)
Cropland	10,680	10,680
Pasture	1,670	1,670
Forest Land	970	970
Other	830	830
Total	14,150	14,150

Table S shows the difference in flood hazard area without- and with-project for various flood frequencies.

TABLE S - REDUCTION IN FLOODED AREA BY FREQUENCY

Frequency (years)	Without-Project (acres)	With-Project (acres)	Reduction (acres)
100	14,150	11,140	3,010
50	13,690	10,000	3,690
25	13,070	8,900	4,170
10	11,860	7,360	4,500
5	10,590	6,000	4,590
2	7,860	2,330	5,530
1	5,380	400	4,980
0.5	960	0	960

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Land damaged by sedimentation, scour, and swamping is shown in Table T.

TABLE T - FLOODWATER LAND DAMAGES

Damage	Without-Project	With-Project	Reduction
	(average annual acres)		
Sedimentation	5,130	1,310	3,820
Scour	773	229	544
Swamping	50	12	38

Reduction in peak flood flows will be as shown in Table U.

TABLE U - REDUCTIONS IN PEAK FLOWS

	Soap Creek			Little Soap Creek
Frequency (years)	At Junction With South Soap	2 Miles Above Highway 63	At Mouth	3 Miles Upstream of Highway 63
	(percent)			
100	42	37	30	48
50	45	38	30	48
25	46	38	28	49
10	49	37	26	51
5	51	38	21	46
2	53	42	27	58
1	54	46	36	61
0.5	50	44	41	61

Dams will control flood runoff from 33 percent of the watershed, reducing peak flood flows by temporarily storing runoff water and releasing it over an extended period. This storage will not materially affect water yield but will extend time water flows in the channels. Water yield could be reduced slightly by increased water loss due to evaporation from sediment pools compared to evapo-transpiration from present land use in those areas. Project measures are not expected to have a measurable effect on low flows in either Soap Creek or its tributaries. Embankment and foundation seepage could slightly increase prolonged flows downstream of dams.

Floodwater and sediment damage to crops will be reduced. Corn and soybeans are the main crops produced. No increase in cropland acres is forecast for the flood plain. A comparison of damages without- and with-project, and net benefits are shown in Table V.

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TABLE V - COMPARISON OF DAMAGES

	Damage		
	Without-Project	With-Project	Benefits
	(dollars)		
Crop and Pasture	570,260	174,930	395,330
Other Agricultural	478,540	121,030	357,510
Land Damage			
Sedimentation	96,760	34,420	62,340
Scour	10,670	3,660	7,010
Swamping	3,800	1,780	2,020
Non-Agricultural			
Road and Bridge	219,120	57,100	162,020
Total	1,379,150	392,920	986,230

Other agricultural damages will be reduced 75 percent on the 14,150 acre flood plain. Damages to fences, debris removal, and damage to farm crossings are included in other agricultural damages.

Annualized primary benefits to the project are $536,030 compared with annualized costs of $327,660 which gives a benefit to cost ratio of 1.6 to 1.0 Monetary resources of $6,535,400 will be committed for project installation.

Flood Damages will be reduced at 43 bridge and culvert locations.

Debris and sediment trapped by the dams and reduced peak flood flows will reduce operation, maintenance, and replacement costs at culverts and bridges. Reduced peak flows reduces the size of road culverts and their appurtenances. They also decrease erosion on road side slopes and ditches. These damages will be reduced at 65 locations. Four of these 65 locations will be on-road sites and will replace existing culverts.

Peak flows reduced by dams lessens the size and need for maintenance of downstream farm crossings. Grade stabilization by sediment pools eliminates the need for some farm crossings and reduces or eliminates the need for outlet works on others. A dam may be used for a field crossing. Farm crossing benefits will be realized at 27 locations.

The planned 154 dams will create 960 acres of water of which most will be available as fish habitat. Owners may stock the pools with fish. Species most likely to be used are largemouth bass, bluegill, and channel catfish. Owners will control access for fishing and any other incidental recreation.

About 60 miles of ephemeral stream channel will be inundated by pools and the wetland habitat modified. Riparian habitat associated with these streams will be lost. Stream fisheries will not be adversely affected by pools.

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Crop production on 50 acres, and terrestrial wildlife use on 960 acres will be lost to sediment pools. The water area will provide a visual contrast to the predominantly vegetated landscape. Dams will temporarily interrupt wildlife use of 310 acres. After dams are revegetated they will be available as herbaceous habitat for wildlife. Temporary flooding of 1,140 acres in the floodwater pools will interrupt terrestrial wildlife use of these areas.

Woody cover on 570 acres will be affected by dams and sediment pools. The habitat units lost on these acres will be replaced by an equal number of woody habitat units. These units will be obtained by improving habitat quality on approximately 1,090 acres of dedicated mitigation areas.

The existing wetlands in the watershed will not be negatively affected by project activities. All existing wetlands will be subject to the wetlands provisions of FSA, P.L. 99-198, (16 U.S.C. 3801 et seq., as implemented in 7 C.F.R., Part 12). The Act provides that any landowner who drains a FSA defined wetland after December 23, 1985, and plants a commodity crop on the area, loses eligibility for all USDA benefits. Applicability of these FSA criteria to existing wetlands in the watershed will be done on an individual farm basis by the SCS field offices.

All 960 acres of water created by the dams will be available as waterfowl resting areas. Four hundred seventy acres of the sediment pools would be classified by Circular 39 as type 5 wetlands and 340 acres as type 3 and 4 wetlands immediately after construction. As sediment fills the pools, type 5 wetlands will become type 3 and 4 wetlands. The sediment pools will create about 120 miles of shoreline. Creation of wetlands and shoreline will increase available habitat for semi-aquatic species like mink, beaver, raccoon, and several shorebird species. It also improves habitat for reptile and amphibian species occurring in the area.

Because clearing will be limited to the minimum required, this will leave about 270 acres of standing trees within the sediment pools. This will enhance fish habitat created, as well as create nesting cavities for wood duck, flicker, bluebird, and other cavity nesting species at dam sites.

A biological evaluation conducted by FWD and SCS biologists, and concurred in by the FWS, has determined that the project will have no adverse impact on the Indiana bat, bald eagle, or other threatened and endangered species of plants or animals.

Of the total land required by the project, 50 acres of prime farmland will be committed to sediment pools and dams. An additional 10 acres will be temporarily inundated in the floodwater pools. About 5,540 acres of bottomland will become prime farmland because of reduction in the frequency of flooding. Approximately 6,290 acres of existing prime farmland will receive flood damage reduction benefits.

Sediment delivered to the watershed outlet will be reduced from 102,700 tons to 72,200 tons annually for a reduction of 30,500 tons.

Construction of the dams will reduce gully voiding by 6 acres annually, or 320 acres over the project life.

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There will be less stream degradation in the upper end of main streams and the upper end of principal streams due to a reduction of flood peaks.

Reduced flood flows will result in decreased vector habitats.

The proposed dams in the recommended Plan are expected to have little or no impact on coal resources available in the watershed.

The possibilty exists, however, that some of the planned dams could be adversely affected by their proximity to abandoned underground mines. Subsidence over abandoned mines does occur in Iowa, although it has not yet been observed in Soap Creek Watershed. Several dams on the north end of upper Soap Creek, above its confluence with Kinser Creek, are located above or adjacent to known abandoned mines. Table W lists sites where abandoned mines may lead to potential subsidence problems.

TABLE W - DAMS WITH POTENTIAL SUBSIDENCE PROBLEMS

Dams	Mine	Proximity of Dams
68-47	Phillips Coal - #1	Above known mined area
68-49	Name Unknown	Above mine of unknown extent
68-50	Name Unknown	Above mine of unknown extent
68-40	Deep Vein Coal Drift #1&2	Above mine of unknown extent
68-41	Excelsior Coal Co.	Above mine of unknown extent
68-42	Excelsior Coal Co.	Above mine of unknown extent

It should be noted that records of abandoned mines exists on only about one-third of the mines which have operated in the state. Additional abandoned mines may exist in the watershed and each site will have to be evaluated for potential mine induced subsidence at time of design.

Dust from construction operations will get into the atmosphere; however, all possible precautions will be taken to minimize the amount of airborne soil particles.

Dams may be located near farmsteads. Construction noise at these sites may be bothersome. Noise at sites away from farmsteads should not annoy people.

Installation of the dams will create approximately 4,370 days of employment for semi-skilled laborers. Operation and maintenance of these measures will create approximately 150 days of employment annually.

Sediment pools will provide a water supply that will be available for livestock consumption and fire fighting.

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Rural water lines and other public utilities will receive flood protection as a result of the project. Farm fences below dams but not in the flood plain will receive flood prevention benefits.

Installation of the measures in this Plan will result in a reduction of 100-year frequency flooding from 14,150 acres to 11,140 acres. Storms larger than a 100-year event were not analyzed. It is possible that an event larger than once in 100 years could occur and resulting flooding may affect an area greater than 11,140 acres.

Table X lists effects of the recommended Plan on particular types of resources that are recognized by certain federal policies.

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TABLE X - EFFECTS OF THE RECOMMENDED PLAN ON RESOURCES OF PRINCIPAL NATIONAL RECOGNITION

Type of resources	Principal sources of national recognition	Measurement of effect
Air Quality	Clean Air Act, as amended (42 U.S.C. 185h-7 et seq.).	No Effect.
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.).	Not present in planning area.
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).	No habitat critical to the survival of any endangered species will be affected.
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.).	No net loss of habitat values. 380 H.U. of woody cover will be replaced on 1,090 acres of mitigation areas. Grassland will increase by 30 H.U. and cropland will decrease by 20 H.U.
Flood plains	Executive Order 11988, Floodplain Mgmt.	No acres will be affected by sediment or floodwater pools. Flood frequency reduced to less than two years on 5,540 acres.
Historic and cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec. 470 et seq.).	There will be no adverse effect on 5 properties eligible for the National Register, or on eligible sites to be identified during installation.
Prime and unique farmland	CEQ Memorandum of August 1, 1980: Analysis of impacts on Prime or Unique Agricultural Land in Implementing the National Environmental Policy Act.	Sixty acres of prime farmland will be required for dams, spillways, and sediment and floodwater pools. Flood damages will be reduced on 6,290 acres. Flood frequency reduction on an additional 5,540 acres will convert these acres to prime farmland. No unique farmland present.
Water quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.).	Sediment delivered to the outlet of Soap Creek will be reduced by 30,500 tons annually.
Wetlands	Executive Order 11990, Protection of Wetlands, Clean Water Act of 1977. (42 U.S.C. 185th-7 et seq.).	No negative effect. Ninety-four acres of existing type 3 and 4 wetlands in flood plain will not be impacted.
	Food and Security Act of 1985 (16 U.S.C. 3801 et seq.).	Project will have no adverse impact on existing FSA defined wetlands.
Wild and scenic rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 et seq.).	Not present in planning area.

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SHORT TERM VS. LONG-TERM USE OF RESOURCES

Trends in the watershed indicate future land use will be agricultural. The recommended Plan is expected to be compatible with short-term uses of land, water, and other natural resources in the watershed without precluding any significant long-term options. Short-term food and fiber needs can be met through continuation of the present allocation of land resources. The acceleration of flood prevention measures is essential to preserve the quality of the land resource base in the flood plain for use in meeting long-term needs. Continued flooding would have serious detrimental effects on the capacity to sustain food and fiber production for future generations.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An estimated 3,650 acres of land will be committed to the installation of 154 dams. Of this total, about 1,130 acres are forest land and about 2,520 acres are in pasture and row crops. Production lost on the land committed to impoundments and mitigation areas are expected to be offset by benefits that will require an initial irretrievable commitment of labor for construction and additional labor for operation and maintenance of plan elements.

RELATIONSHIP TO OTHER PLANS, POLICIES, AND CONTROLS

The Appanoose, Davis, Monroe, and Wapello SWCD's have established soil loss limits to implement the Iowa erosion control law. Planned measures will be designed to conform to these limits. Adequate protection is required on 75 percent of the land above structures.

Appanoose, Davis, Monroe, and Wapello Counties are in the Area XV Regional Planning Commission area. This group functions as a regional planning agency. The planned measures are compatible with the aims of the group. The four counties are in the Des Moines River Basin. The Plan is compatible with findings of the 1980 Des Moines River Basin Study.

The proposed project will not impact any FSA defined wetlands. However, FSA, P.L. 99-198, (16 U.S.C. 3801 et seq., as implemented by 7 C.F.R. Part 12) still applies to all existing wetlands. This Act denies USDA benefits to any landowner that drains wetlands and plants them to commodity crops. These provisions apply to all wetlands that are not exempted or on which drainage had not been completed or commenced proior to December 23, 1985. Applicability of the FSA criteria to any wetland conversions will be judged on an individual farm basis by the SCS field offices.

There are no other known federal, state or local land-use plans, policies, or controls.

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CONSULTATION AND PUBLIC PARTICIPATION

The first application which included all of Soap Creek Watershed was submitted in July 1971, and approved by the State Soil Conservation Committee September 2, 1971. Sponsors for the watershed application included the Boards of Supervisors and Soil and Water Conservation Districts in Appanoose, Davis, Monroe, and Wapello Counties.

Soap Creek Watershed was studied as part of the Des Moines River Basin Study and an evaluation report prepared in July 1980. Results of this report were presented to the Davis County Soil Conservation District and Board of Supervisors at a public meeting on February 5, 1981.

After a large flood on the July 4, 1982, a number of farmers requested a meeting with SCS representatives to look at damages and explore potential solutions. A meeting was held on a farm in Davis County on July 9, 1982, with about 50 farmers in attendance. They expressed support for any program that could be devised to alleviate flood damages and indicated preference for small structures.

During data gathering and analysis for this report, district conservationists have kept Sponsors informed of progress made. Personal contacts with landowners during field surveys have been used to inform them of the status of investigations.

Meetings were held with the Soil Conservation District Commissioners and Board of Supervisors in each county as follows: Davis County on June 26, 1984; Appanoose County on June 26, 1984; Wapello County on June 27, 1984; and Monroe County on June 27, 1984. Results of preauthorization studies were presented to these groups and landowners who were present. These Sponsors expressed support for the project if landowners would support it. They decided to sponsor meetings in each county to determine interest.

Public meetings were held to explain the project and determine landowner interest. The 180 landowners attending these meetings supported the concept of a flood control project. As a result of the landowner interest the Sponsors are supporting the project. They held preliminary talks to establish a four county organization to coordinate and assist them in carrying out their responsibilities. Public meetings were held as shown in Table Y.

TABLE Y - PUBLIC MEETINGS

Location	Date
Blakesburg, Monroe County	July 18, 1984
Moravia, Monroe County	July 25, 1984
Blakesburg, Wapello County	July 30, 1984
Moravia, Monroe County	August 1, 1984
Moravia, Appanoose County	August 16, 1984
Ottumwa, Wapello County	September 4, 1984
Bloomfield, Davis County	September 5, 1984

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Additional meetings to develop a four-county organization charter and to advise Sponsors of the planning status were held as follows:

January 18, 1985
February 15, 1985
August 22, 1985
February 25, 1986
March 25, 1986
April 17, 1986

On May 20, 1986, watershed directors finalized a joint agreement to create a watershed organization for the purpose of providing a vehicle for land rights acquisition and operation and maintenance of Soap Creek Watershed structures. This agreement is pursuant to Iowa Code Chapter 28E and creates the Soap Creek Watershed Board. The Board consists of one member from each of the eight Sponsors which includes four county Board of Supervisors and four SWCD's. All Board of Supervisors and SWCD's Sponsors have signed this joint agreement. The Soap Creek Watershed Board is also a Sponsor.

The Soap Creek Watershed Board conducted meetings on June 24, 1986, September 24, 1986, February 12, 1987, December 8, 1987, February 2, 1988, and March 22, 1988.

A public meeting to review the draft Soap Creek Watershed Plan - Enviromental Impact Statement was held on April 12, 1988. One-hundred-fourteen people attended including 98 local residents. Representatives from each of the local Sponsors and the Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation were present.

The Chief of the Soil Conservation Service granted Planning Authorization for Soap Creek Watershed on March 18, 1985. Notice of this planning authorization was provided to appropriate congressmen, state legislators, and federal and state agencies.

Eighty letters of invitation were mailed by SCS to invite participation in the environmental evaluation. Those invited include local, stste, and federal agencies and enviromental groups. Residents of the watershed were invited by newspaper and radio notices.The environmental evaluation was initiated by a public meeting, tour, and scoping meeting on May 7, 1985. The interdisciplinary team represented: Iowa Conservation Commission (presently Iowa Department of Natural Resources), Iowa Geological Survey, State Historic Preservation Office, Iowa Department of Soil Conservation (presently Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation), Cooperative Extension Service, and the U.S. Forest Service. A total of 48 people attended including many local farmers, SWCD commissioners, and county Boards of Supervisors.

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A tri-agency biology review was conducted in 1986 and 1987. Biologists participating in this study were from the FWD, FWS, and SCS.

The following agencies were requested to provide written comments.

Department of the Army - Corps of Engineers
Department of Health and Human Resources
Department of the Interior
Department of Transportation
Environmental Protection Agency
Advisory Council of Historic Preservation
Office of Equal Opportunity, USDA
Governor of Iowa
U.S. Fish and Wildlife Service
Department of Housing and Urban Development
Forest Service, USDA
National Park Service
Agricultural Stabilization and Conservation Service, USDA
Farmers Home Administration, USDA
Iowa Department of Natural Resources, Environmental Protection Div.
Iowa Department of Natural Resources, Fish and Wildlife Division
Iowa Department of Natural Resources, Forests and Forestry Division
Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
Cooperative Extension Service
Energy and Geological Resources Division, Geological Survey Bureau
Iowa Association of Soil and Water Conservation District Commissioners

Other written comments were requested from the following individuals and groups:

Natural Resources Defense Council, Inc.
National Wildlife Federation
National Audubon Society
Sierra Club
The Wildlife Society, Iowa Chapter

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LIST OF PREPARERS

This watershed plan was prepared by an interdisciplinary team composed of the following specialists, Soil Conservation Service, Iowa:

Name	Present Title	Education	Experience	Other
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Dean M. Thompson	Archeologist	BA Anthropology MA Anthropology	Archeologist 3 SCS Archeologist 6	
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Consultative assistance was provided by the following SCS specialists:

Hershel R. Read, Deputy State Conservationist, Des Moines, Iowa
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Ronald J. Kuehl, State Soil Scientist, Des Moines, Iowa
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P. Stan Mitchem, Geologist, Casper, Wyoming
John R. Nixon, Assistant State Soil Scientist, Des Moines, Iowa
Conrad T. Killian, Geologist, Retired

Direct assistance and consultation were also provided by personnel from federal and state agencies, as follows:

U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Environmental Protection Agency
Iowa State University
    Cooperative Extension Service
    Iowa Agriculture and Home Economics Experiment Station
    Iowa Cooperative Fish and Wildlife Research Unit
Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
Iowa Department of Natural Resources
    Environmental Protection Division
    Fish and Wildlife Division
    Forests and Forestry Division
Iowa State Historic Preservation Office

Project sponsors and other local organizations, agencies, and individuals have provided assistance.

The draft Plan was reviewed and concurred in by state staff specialists having responsibility for engineering, soils, agronomy, biology, forestry, and geology. The review of the document and supporting data was done concurrently by the Midwest National Technical Center staff, Lincoln Nebraska.

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APPENDICES

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APPENDIX A

Letters and Oral Comments

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Working for the Nature of Tomorrow

NATIONAL WILDLIFE FEDERATION

1412 Sixteenth Street, N.W., Washington, D.C. 20036-2266 (202) 797-6800

August 12, 1988

J. Michael Nethery
State Conservationist
USDA-Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery,

Please include these comments for the record on the draft Watershed Plan-Environmental Impact Statement for the Soap Creek Watershed. The National Wildlife Federation is the nation's largest conservation education organization, with over 5.1 million members and supporters. We have a continuing interest in the PL 83-566 Small Watershed Program. These comments reflect the opinions of both the National Wildlife Federation and the Iowa Wildlife Federation on the draft plan.

The draft plan proposes construction of 154 small floodwater retention structures within Appanoose, Davis, Monroe, and Wappello Counties, Iowa. The stated purpose of the plan is rural flood damage reduction on the 14,150 acre floodplain, with incidental erosion reduction benefits. The 154 farm ponds will provide stock water, stocked fish habitat, and other aesthetic and practical benefits to individual farmers. The four counties' Soil and Water Conservation Districts and Boards of Supervisors, and the Soap Creek Watershed Board, are sponsoring the plan. The draft report/EIS estimates the cost to be $6,517,280, with PL 83-566 funding 93% of the cost, and sponsors paying the remaining 7% plus annual operation, maintenance, and repair (OM&R) expenses.

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Implementation of the proposed plan will result in several land use changes, including the loss of 1220 acres of pasture and forest land and 50 acres of farmland. The sediment pools formed by the 154 structures will cover 960 of the 1270 acres lost. The remaining 310 acres will be cleared for use as emergency spillways. An additional 1140 acres, primarily forest and pasture, will be set aside as floodwater-retarding areas that will flood periodically according to storm severity.

The Soil Conservation Service (SCS) should not adopt the plan as proposed. The recommended plan would generate benefits through flood damage reduction, but will not significantly reduce high rates of erosion throughout the watershed. Moreover, we believe that the benefits may be overestimated. The proposed wildlife habitat mitigation is inadequate for the permanently altered and seasonally disrupted forest and pasture land. The report does not adequately describe, analyze, nor propose compensation for the loss of ephemeral stream habitat. The report contains no inventory of aquatic habitat or aquatic species in the watershed that may be affected.

In our opinion, the SCS should have studied alternatives to this plan more thoroughly, and presented them in the plan. The plan offers only a no action alternative and does not adequately explore other alternatives to the proposal.

The benefits of the plan appear to be overstated. We believe that calculation of the plan's benefits according to the land value analysis method would show that the costs of the impoundments exceed the increase in land value of the protected acreage. The land value analysis method is an alternative, and a good check, to estimating the benefits of flood damage reduction measures by comparing the per acre market value of the land with and without the proposal. Only 14,150 floodplain acres would benefit as a result of $6 million in PL 83-566 funds, an average cost of $428 per acre, of

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which 10,680 acres are currently cropland, and the remaining 3470 acres are primarily pasture and forest. The benefits will vary among types of soil and susceptibility to flooding so that some or many parcels of land are likely to increase in value less than the costs of incremental flood damage reduction measures.

The purposes of PL 83-566 are reduction in erosion, sedimentation, and flood damages. The National Wildlife Federation believes that the limited funds should be spent on programs where at least 25% of benefits consist of soil erosion reduction. The main purpose of the recommended Soap Creek Watershed Plan is flood damage reduction, with only incidental erosion reduction. The report states that the gross annual erosion rate for the 162,000 acre watershed is 1,026,900 tons, and will continue at this rate even with current land treatment practices. Because of the high erosion rate in the watershed, sheet and rill erosion, and gully and streambank erosion should be a focus of this program. The SCS should provide more assistance to landowners and expand the existing land treatment program in order to reduce erosion in the watershed.

The report's outdated wetland classification system places too much emphasis on whether or not the wetland is used by waterfowl and not enough on other wetland values. SCS should use the U.S. Fish and Wildlife Service's (USFWS) Classification of Wetlands and Deepwater Habitats of the United States to determine the types of wetlands present in the proposal area. The report uses the Circular 39 classification system, which was superseded in 1979 by the USFWS because it lacked adequate distinctions between wetland types. The plan should also quantify the amount of wetlands present in the floodplain.

The amount of proposed mitigation is insufficient to compensate for habitat loss. Over 2300 acres of pasture and forest land would be either permanently lost or seasonally flooded, and the plan proposes only 1090 acres of habitat mitigation. The proposed plan would also result in the loss of 60 miles of ephemeral streams.

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The streams vary in duration and habitat provided, and the plan does not distinguish between storm runoff, which may last a few hours, and larger streams, which may be an important temporary source of water for local species. The plan does not compensate for the loss of any of this riparian habitat.

The report should include a survey of the aquatic habitat and and fish species located in the waterways to be impounded. No inventory of the fish species found in Soap Creek is present in the proposal. There is no quantitative information regarding aquatic species that may be affected by the impoundments. The tri-agency biology team agreed that aquatic habitat would not be damaged and that aquatic life would probably benefit, without quantifying either the habitat changes that could be expected or the possible effects of the plan on fish populations.

In our view, the proposed program does not make the best use of PL 83-566 funds and we do not support the draft watershed plan and environmental impact statement. The SCS should carefully review each of the proposed impoundment sites and eliminate those with marginal benefits, according to a revised benefits calculation using the land value analysis method. The SCS should also identify those areas in the watershed which provide riparian habitat and consider eliminating them as possible impoundment sites.

Sincerely,

David C. Campbell, Ph. D.
Water Resources Division

Jean Battle
Water Resources Division

cc: Loren Forbes, President
Iowa Wildlife Federation

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United States Department of Agriculture

Soil Conservation Service

693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

September 9, 1988

Mr. David C. Campbell
Water Resource Division
National Wildlife Federation
1412 Sixteenth Street
Washington, DC 20036-2266

Dear Mr. Campbell:

The following letter is in reply to your letter of comment dated August 12, 1988 on Soap Creek PL-566 Watershed Plan-EIS.

PL-566 funds can be used to pay 100 percent of the construction costs of single purpose flood prevention structures. In the case of Soap Creek Watershed the sponsors pay 100 percent of the land rights costs plus 100 percent of the annual operation, maintenance and replacement (OM&R) costs estimated to be $31,610. During the life of the project the sponsor will contribute an estimated $1,580,000 for OM&R costs plus $455,970 for land rights. The sponsors will pay more than 25 percent of all costs during the life of the project. The OM&R costs are not part of the $6.5 million capitol costs.

The first paragraph of page 2 of your letter states that 310 acres will be cleared for use as emergency spillways. Ninety acres of forest land and 220 acres of grassland will be converted for use as dams and spillways.

The principles and guidelines for planning water resource projects require the identification of a plan that reasonably maximizes national economic development. This requires an effort to be made to include only increments that provide net NED benefits. Using the evaluation methods which are acceptable to our agency we have identified that plan. In each case, the group of structures listed have benefits which exceed the cost.

Section 2.3.2 of Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation studies (P&G) identifies land value analysis as an alternative measurement of benefits. However, it only identifies intensification benefits as a category which may be measured by this procedure. Land value analysis is not an alternative for damage reduction benefits.

Section 2.3.2 of P&G identifies reduction in damage costs as NED benefits. Computer programs are available to analyze water surface profiles, flood routings and economic data to evaluate flood damages without and with project. These procedures are acceptable to the Soil Conservation Service. Examples of input data include current normalized prices, current yields, current land use, surveyed cross-sections, roughness coefficients and channel profiles.

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Annualized flood damages are shown in Table 5 and include crop and pasture, other agricultural, road and bridge and land damage including sedimentation, scour and swamping. All of these categories are computed by the damage reduction methods.

The purpose of the Soap Creek Watershed Plan is flood damage reduction which is in accordance with the Sponsors' needs and desires. The 1,026,900 tons is gross erosion from all sources in the watershed including sheet and rill erosion, ephemeral cropland gully erosion, and streambank erosion.

Sheet and rill erosion rates for the entire watershed of 162,000 acres are low, 2.3 tons per acre per year. The average sheet and rill erosion rate for all cropland, 53,580 acres, is 4.2 tons per acre per year and well within the tolerable levels. Of the 53,580 acres of cropland, 7,800 acres erode at excessive rates. However, this is a very small percentage of the watershed, 4.8 percent, and based upon on-going application rates of land treatment this problem does not warrant project action.

The on-going land treatment programs, including state and federal cost-sharing, and SCS technical assistance are likely to continue throughout the 50 year project life. These programs are adequate to control sheet and rill erosion and ephemeral cropland gully erosion.

The SCS requires that at least 75 percent of the land above a dam have adequate land treatment to control sheet and rill erosion prior to construction. This policy will also result in additional land treatment.

Gully erosion is a problem, but voiding and depreciation rates are low. Streambank erosion is a problem but erosion rates are low. Solutions to both gully and streambank erosion were evaluated and found not to be economically feasible.

Sheet and rill erosion, ephemeral cropland gully erosion, gully erosion, and streambank erosion were scoped out in the planning process because of the preceding reasons. The scoping of concerns section on page 17 discusses these actions.

The SCS conducted field trials of the U.S. Fish and Wildlife Service's Classification of wetlands and deep water habitats of the United States, Cowarden et al during 1984. Based on problems encountered during these field trials, the SCS in National Bulletin #190-15-13 dated March 8, 1985, administratively decided to continue to use circular 39 for wetland classification.

Type 3 and 4 wetlands were quantified for the floodplain. Type 1 and 2 wetlands were not quantified for the plan since the project will not adversely impact any wetlands in the floodplain. However, all wetlands will be identified by the field offices as part of the Food Security Act process.

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The rationale for the mitigation needs of the project are summarized in Appendix D, on pages D-9 to D-13 of the Investigation and Analysis Report. The tri-agency biology team agreed that only the loss of woody habitat would cause significant environmental damages. The 1090 acres of mitigation is required to replace lost woody habitat values on the 570 acres of woody cover affected by project action.

The team decided that the loss of overgrazed, cool-season grass pastures would not significantly affect habitat quality in the watershed. This habitat type composes 47 percent of the watershed. Location of structures with pools and their perimeters will add diversity to existing grassland areas and improve habitat values on these pastures. Also the 310 acres of structure fills seeded to grasses and fenced to exclude cattle will provide habitat of a higher quality than existing grassland. The dedicated mitigation areas will be small, 5-10 acres, and located close to other habitat types. This will increase interspersion, edge, and enhance food availability for wildlife species.

The mitigation acres in the plan-EIS are from sample expansion and more or less than 1090 acres may be needed for the actual project. All structure sites will have a habitat appraisal (done by the tri-agency team) at time of construction to evaluate actual habitat units lost to the project at each site. Site location may be adjusted up or downstream to minimize adverse affects on wildlife. All mitigation areas offered will also be evaluated and prioritized for acceptance to insure the best areas are developed first. The outcome of this process will be to actually balance habitat units lost with those replaced on mitigation sites.

Most structures are to be located on small drainage areas, 117 are on areas with less than 360 acres of drainage. These structures are built on water courses which only carry storm runoff, i.e. ephemeral flows. The remaining sites are on courses that have ephemeral flows but sometimes have small pools left between flows. There is no fishery on any of these ephemeral water courses. There is a fishery on the main stem of Soap Creek and at the mouth of several of the major tributaries. These areas will be enhanced by the removal of 30,500 tons of sediment annually from the stream system. Many areas downstream of the structures may also benefit from extended flows from the structures. No aquatic species are being negatively affected by the structures. The 'riparian areas' are being replaced as part of the woodland mitigation.

Section 1.6.2 of the Principles and Guidelines states that alternative plans should be formulated in consideration of four criteria: completeness, efficiency, effectiveness and acceptability. The alternatives that are shown in the Soap Creek Watershed plan meet those criteria. Several alternatives including flood proofing, flood warning systems and flood plain acquisition were not studied because these alternatives were not acceptable to the sponsors of the watershed and therefore a complete analysis and comparison of effects was not shown in the Plan.

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Large structures were evaluated during the Des Moines River Basin Study. They were not economically feasible and were not locally acceptable because they flooded to much land. Non-structural measures were not considered because they would not meet project objectives of flood prevention on ag-lands.

The NED or selected plan is the plan that reasonably maximizes net national economic development benefits. The groups of structures identified in the plan were evaluated incrementally and are considered to be the best use of public money. This is the most economically feasible Plan available to the public and sponsors.

We wish to thank you for your comments and feel that these responses address the issues you have raised.

Sincerely,

J. Michael Nethery
State Conservationist

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Iowa State University of Science and Technology
Cooperative Extension Service
Ames, Iowa 50011

Administrative Offices
Curtiss Hall
Telephone: 515-294-7801

July 27, 1988

J. Michael Nethery
State Conservationist
Soil Conservation Service
693 Federal Building
210 Walnut St.
Des Moines, Iowa 50309

Dear Mike:

Enclosed are comments that were prepared by Drs. Gerald Miller and Regis Voss concerning the Soap Creek Watershed Plan-Environmental Impact Statement.

Present land use is discussed in detail on pages 8-10 and 25-26. However, no mention is made about acreage that has been enrolled into the Conservation Reserve Program (CRP) or the acreage that has potential for enrollment into the program. Is this an important consideration for planning future land use as it relates to potential runoff and flooding?

Flood control dams in this project are designed for a 50 year time period. The document (page 43) indicates 154 structures will be required to meet the project objective, reduction of floodwater damage. It is not evident whether the number and design of these structures are planned in concert with the conservation compliance needs on highly erodible lands required by the 1985 Food Security Act (FSA), or whether the design and number of dams are based on past land use and treatment, or lack of treatment, for erodible lands.

If you have questions concerning these comments please feel free to contact Reg or Jerry. Thanks for the opportunity to participate in this process.

Sincerely,

Jerry Dewitt
Associate Director

JD/rs

cc: Dr. Gerald A. Miller
Dr. Regis Voss

and justice for all
The Iowa Cooperative Extension Service's programs and policies are consistent with pertinent federal and state laws and regulations on non-discrimination regarding race, color, national origin, religion, sex, age, and handicap.

Iowa State University and U. S. Department of Agriculture cooperating

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United States Department of Agriculture
Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

September 7, 1988

Dr. Jerald R. DeWitt
Associate Director
Cooperative Extension Service
108 Curtiss Hall
Iowa State University
Ames, Iowa 50011

Dear Jerry:

The following is in response to your comments on Soap Creek Watershed Plan-EIS.

Acreage enrolled in the Conservation Reserve Program will affect runoff and erosion during the 10-year enrollment period. However, the use of the CRP land following the enrollment period is uncertain. The evaluation period for Soap Creek is 50 years and cropland is only 29 percent of the upland portion of the watershed. CRP land use changes will not significantly affect flooding in the Soap Creek Watershed.

Presently 80 percent of the upland portion of the watershed is adequately protected. Projected conditions indicate that 95 percent of the upland portion of the watershed will be adequately protected. Due to this high level of land treatment, any additional CRP enrollment will not significantly affect runoff.

The watershed plan is based on projected conditions. The cross-compliance provisions of the FSA were considered by the district conservationists as they developed projected conditions. These and other considerations are discussed in the forecasted conditions section on page 29 and in the Investigation and Analysis Report, page D-35.

During the 15-year project installation period, an inventory of land use and land treatment will be conducted above each dam site prior to final design and construction. This inventory will be conducted to insure that our land treatment requirement is met. We require that at least 75 percent of the land above each dam have adequate erosion control measures in place prior to construction. This inventory will identify land use and land treatment including CRP land.

Thank you for reviewing the plan and providing comments.

Sincerely,

J. Michael Nethery
State Conservationist

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DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING—P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF:

August 2, 1988

Planning Division

Mr. J. Michael Nethery
Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery:

Rock Island District staff members have reviewed the draft Watershed Plan Environmental Impact Statement for the Soap Creek Watershed. We have the following comments to offer.

Page 50, paragraph 3: Current regulations concerning the Clean Water Act were published November 13, 1986, in the Federal Register. These activities are exempt from regulations under Section 404 in accordance with 33 CFR 323.4.

No Corps land is involved, so no real estate outgrants or permission will be needed. The cultural, environmental, and floodplain aspects of the plan are adequately covered. We cannot predict water quality impacts with the information provided. We would need some water quality data, depth, and volume information to make these determinations.

The District review did not provide any objections or other comments. Thank you for the opportunity to review the Plan/EIS.

Sincerely,

Charles R [signature]
Dudley M. Hanson, P.E.
Chief, Planning Division for

A-13

RESPONSE: Changes made as indicated.

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STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

July 29, 1988

Mr. J. Michael Nethery
State Conservationist
USDA, Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery:

The Department of Natural Resources has completed their review of the draft watershed plan environment impact statement for the Soap Creek Watershed and offer the following comments:

-- Appendix D-13 through D-19 is a discussion of the biological review conducted throughout the watershed. This section includes the process that will be used to determine mitigation. Since development of this project will occur over a long period of time (20+ years), we feel it important that the mitigation process be documented for the benefits of any of our successors that may be required to work on this project. We request that this section, or the Tri-agency report, be included in the final plan.

Sincerely,

LARRY J. WILSON, DIRECTOR
DEPARTMENT OF NATURAL RESOURCES

L13.rlt

RESPONSE: Appendix D is included with the final Plan.

WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319 / 515-281-5145

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

August 17, 1988

Mr. J. Michael Nethery
Soil Conservation Service
Federal Building
210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery:

RE: Soap Creek Watershed, Appanoose, Davies, Monroe and Wapello Counties, Iowa

In accordance with our responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, we have reviewed the draft Watershed Plan-Environmental Impact Statement for the project referenced above. The project and document have been rated "LO" (Lack of Objections).

Thank you for the opportunity to comment.

Sincerely yours,

Michael J. Bronoski
for Lawrence M. Cavin
Chief, Environmental Review
and Coordination Section

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
ROCK ISLAND FIELD OFFICE (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

IN REPLY REFER TO:
COM: 309/793-5800
FTS: 386-5800

August 5, 1988

Mr. J. Michael Nethery, State Conservationist
Soil Conservation Service
693 Federal Building, 210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery:

We have reviewed the draft watershed plan environmental statement for the Soap Creek Watershed, Iowa, as requested in your letter of June 20, 1988.

We have no specific comments to offer at this time, and we look forward to continuing our coordination with your staff as construction funds become available for the proposed structures in the watershed.

These comments are provided under the authority of Section 12 of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and the National Environmental Policy Act of 1969 (Public Law 91-190).

Sincerely,

Charles P. Davis
Assistant Field Supervisor

cc: AE/ESS
BFA (Washington)

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United States Department of Agriculture
Forest Service
Northeastern Area, State and Private Forestry
1992 Folwell Avenue, St. Paul, MN 55108

Reply to: 3510

Date: July 14, 1988

Mr. J. Michael Nethery, State Conservationist
USDA Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, IA 50309

Dear Mike:

Thanks for the opportunity to comment on the draft Soap Creek Watershed plan (ref. your letter of June 20, 1988).

The plan adequately covers the forestry and woodland concerns of the watershed.

Sincerely,

LEROY C. JOHNSON
Field Representative
Forest Management and Utilization

FS-6200-28(7-82)
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United States Department of Agriculture | Forest Service | Northeastern Area State and Private Forestry | 370 Reed Road Broomall, PA 19008

Reply To: 3510

Date: August 2, 1988

Mr. J. Michael Nethery
State Conservationist
Soil Conservation Service
693 Federal Bldg.
210 Walnut Street
Des Moines, IA 50309

Dear Mr. Nethery:

We have reviewed the draft Soap Creek Watershed Plan-Environmental Impact Statement for Appanoose, Davis, Monroe and Wapello Counties, Iowa and concur with the selection of the recommended plan to construct floodwater-retarding structures. These structures will control flood water runoff, thereby reducing damages to homes, commercial properties, public utilities and main highways.

Thank you for the opportunity of reviewing this Watershed Plan-Environmental Impact Statement.

Sincerely,

Duane L. Green

DUANE L. GREEN
Acting Area Director

Caring for the Land and Serving People

FS-6200-28(7-82)

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United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

IN REPLY REFER TO
EO:FAP

AUG 2 1988

Mr. J. Michael Nethery
State Conservationist
U.S. Department of Agriculture
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

Dear Mr. Nethery:

This office has reviewed the draft Watershed Plan - Environmental Impact Statement for the Soap Creek Watershed Project. Our review shows that the actions taken and planned by the U.S. Department of Agriculture regarding the Soap Creek Watershed Project sufficiently address the applicable nondiscrimination requirements of this Department.

Thank you for affording this office the opportunity, in the preaward stage, to review and comment on this important reclamation project.

Sincerely,

Carmen R. Maymi, Director
Office for Equal Opportunity

Celebrating the United States Constitution

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State Historical Society of Iowa

The Historical Division of the Department of Cultural Affairs

September 8, 1988

Mr. J. Michael Nethery
USDA Soil Conservation Service
693 Federal Building
210 Walnut Street
Des Moines, Iowa 50309

RE: SCS - DRAFT WATERSHED PLAN - EIS - SOAP CREEK WATERSHED, IOWA. NO EFFECT ON ARCHEOLOGICAL SITES 13DV46, 13MO64, 13AN97, 13AN94, AND 13WP297.

Dear Mr. Nethery:

Thank you for providing additional information on the effect of the proposed watershed project on the five archeological sites determined eligible for the National Register. In our letter of December 2, 1987 we felt that the dam construction would have had an adverse effect on archeological sites (Conditional No Adverse Effect). However, based on your research on sedimentation and erosion at spillway outlet reservoirs and the provisions outlined in your EIS to protect the sites, we concur that your actions will have No Effect on Sites 13DV46, 13MO64, 13AN97, 13AN94, and 13WP297. Site 13AN90 has been removed from the project.

Should you have any questions or if the office can be of further assistance to you, please contact the Review & Compliance program at 515-281-8743.

Sincerely,

Kay Simpson

Kay Simpson
Review and Compliance Program
Bureau of Historic Preservation

cc: Charlene Dwin, ACHP

RESPONSE: Material included on Pages 36-37.

☐ 402 Iowa Avenue
Iowa City, Iowa 52240
(319) 335-3916

☐ Capitol Complex
Des Moines, Iowa 50319
(515) 281-5111

☐ Montauk
Box 372
Clermont, Iowa 52135
(319) 423-7173

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AREA XV | REGIONAL PLANNING COMMISSION

P.O. Box 1110 • Ottumwa, IA 52501 • (515) 684-6551

REGIONAL CLEARINGHOUSE
PROJECT NOTIFICATION AND REVIEW SIGNOFF

Date Received: 7/11/88

Regional Application Identifier: IA890715004

Review Completed: 7/26/88

****

APPLICANT PROJECT TITLE:

Soap Creek Watershed Environmental Impact Statement/Funding Application

APPLICANT AGENCY: USDA - SCS

Address: 693 Federal Bldg. - 210 Walnut St.
Des Moines, Iowa 50309

FEDERAL PROGRAM TITLE/AGENCY AND CATALOG NUMBER:

Watershed Protection & Flood Prevention Act Public Law 83-566
U.S. Dept. of Agriculture

PROJECT DESCRIPTION:
Draft plan and environmental impact statement for the Soap Creek Watershed. This project includes portions of Appanoose, Davis, Monroe and Wapello counties. The recommended plan includes 154 floodwater-retarding structures intended to reduce flood damage. The project area covers 162,000 acres.

The Regional Clearinghouse makes the following disposition concerning this application:

[XX] No Comment Necessary. The application must be submitted as received by the Clearinghouse with this form attached as evidence that the required review has been performed.

[ ] Comments are attached. The application must be submitted with this form, plus the attached comments as evidence that the required review has been performed.

REGIONAL CLEARINGHOUSE COMMENTS ATTACHED, IF ANY.

Area XV Regional Planning Commission

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APPENDIX B

Breach Inundation Maps

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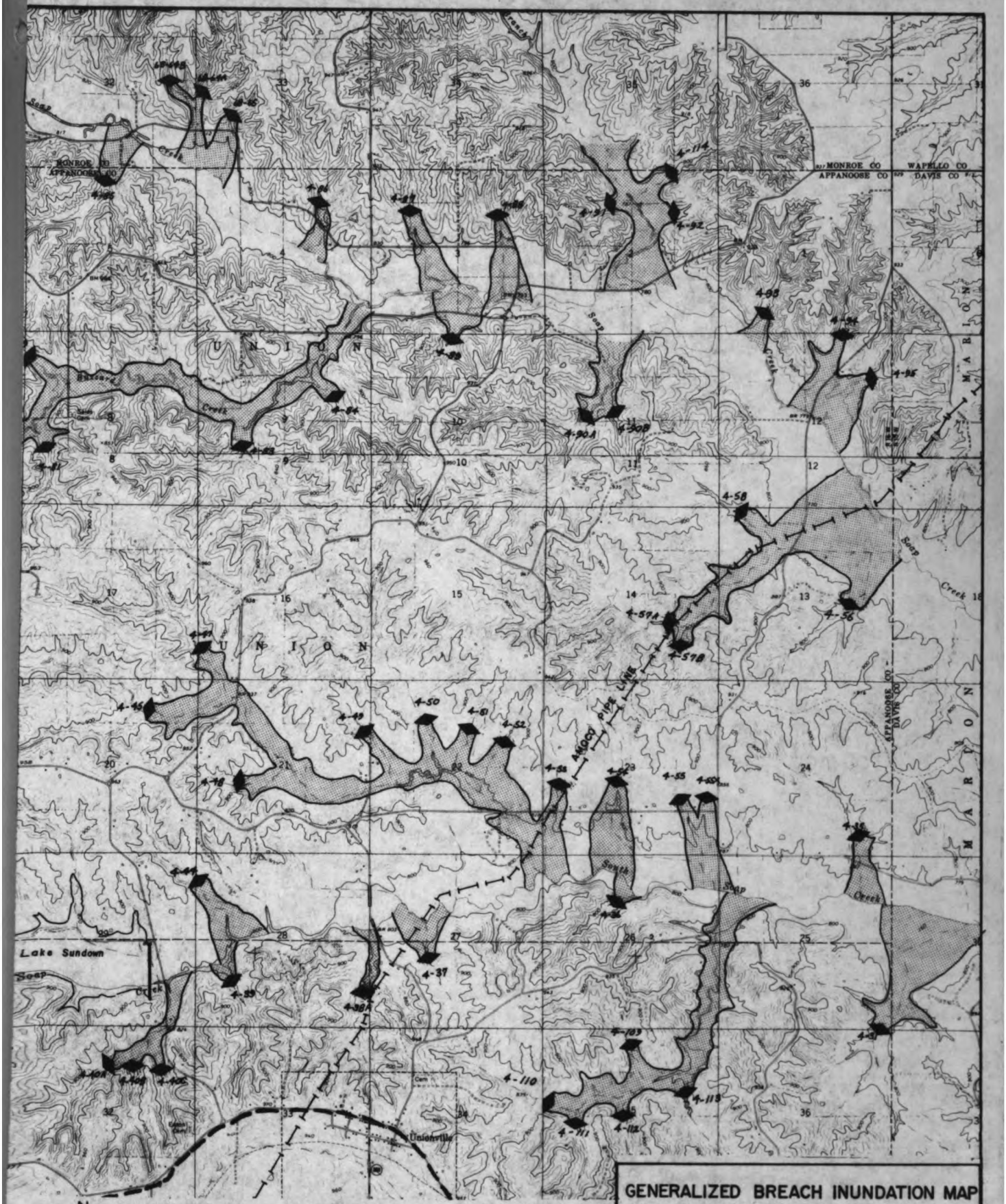

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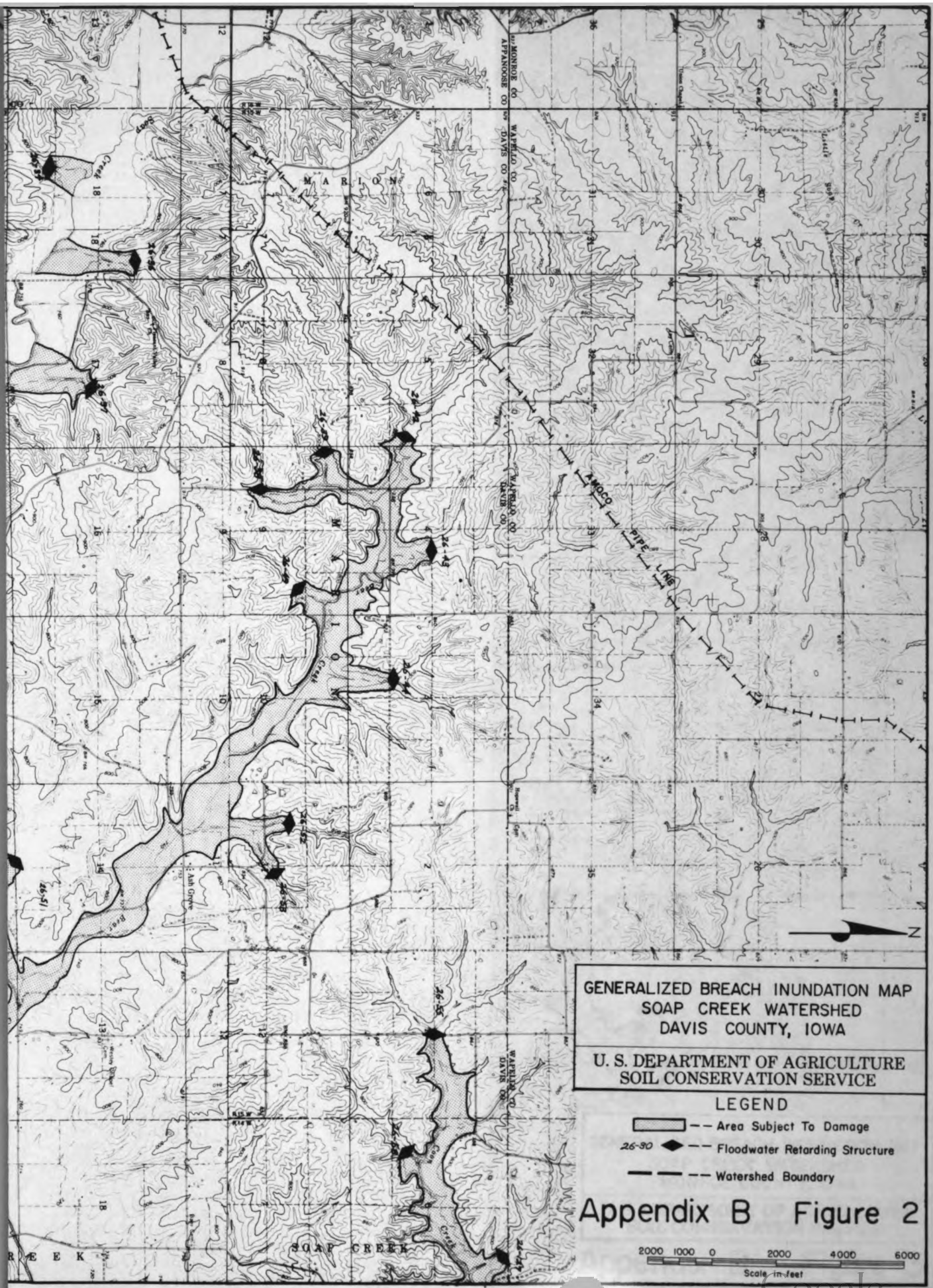

GENERALIZED BREACH INUNDATION MAP
SOAP CREEK WATERSHED
DAVIS COUNTY, IOWA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LEGEND

- Area Subject To Damage
- 26-30 Floodwater Retarding Structure
- Watershed Boundary

Appendix B Figure 2

2000 1000 0 2000 4000 6000
Scale in Feet

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GENERALIZED BREACH INUNDATION MAP
SOAP CREEK WATERSHED
MONROE COUNTY, IOWA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Appendix B Figure 3

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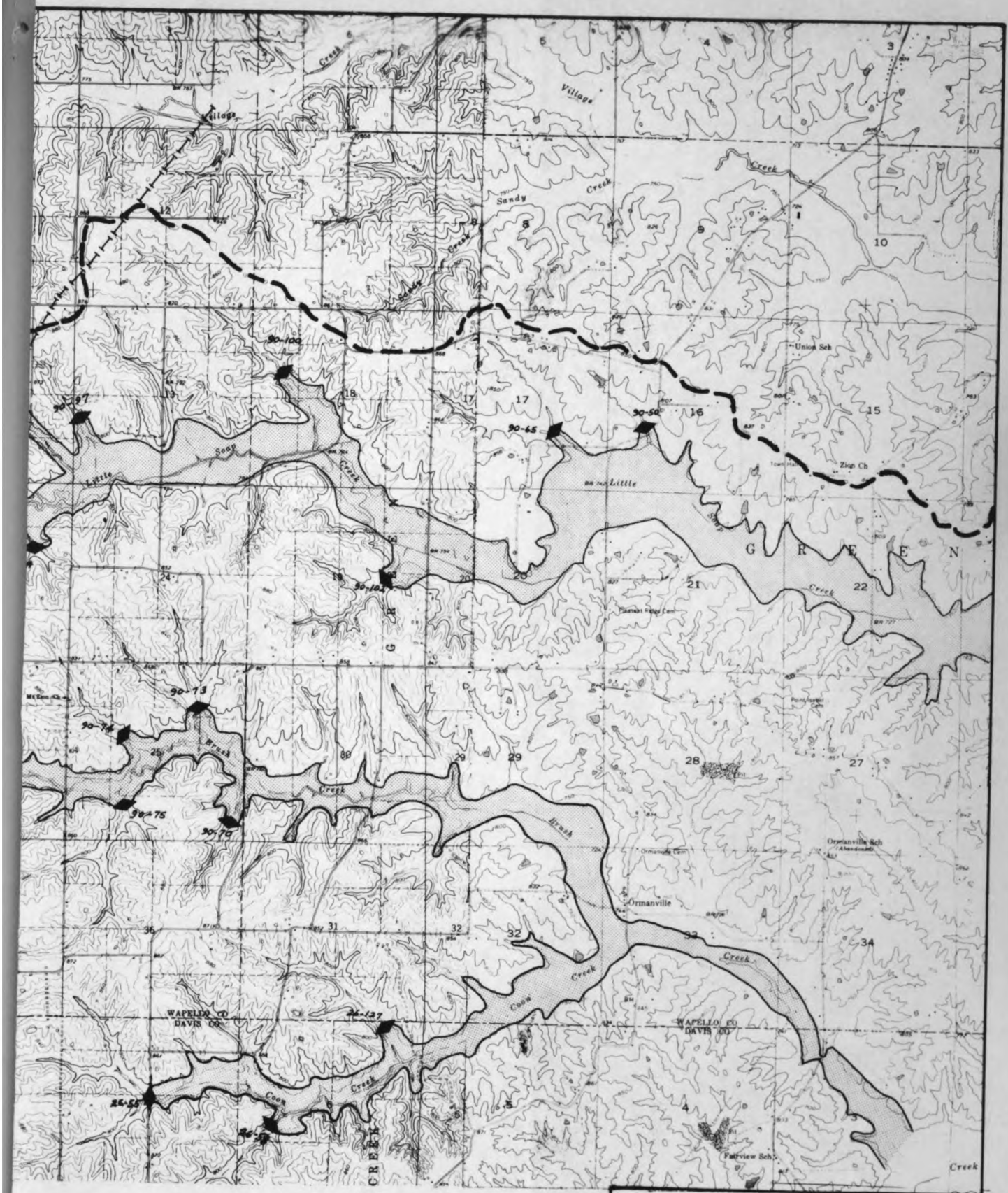

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APPENDIX C

Sketches

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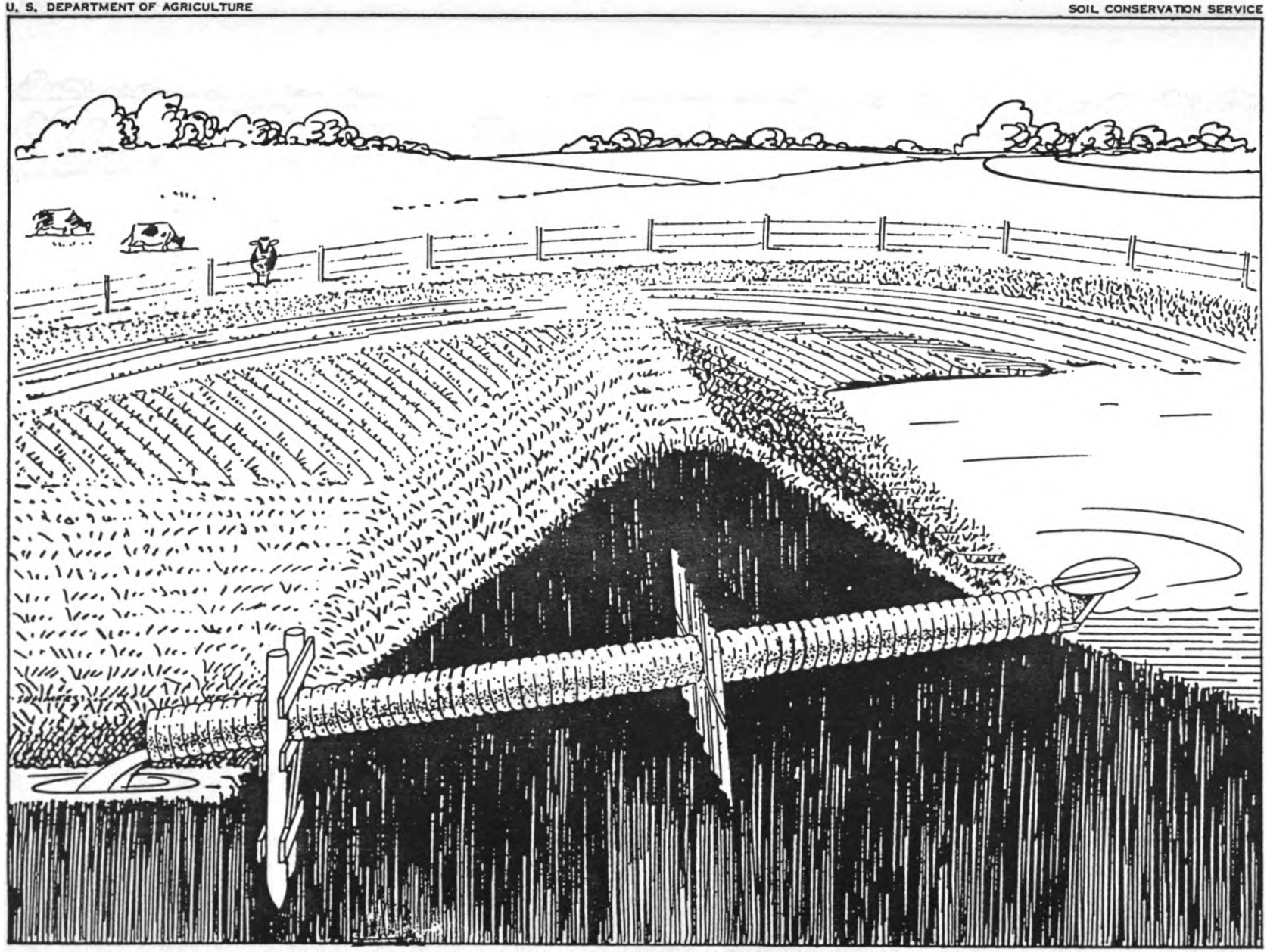

Metal pipe with hooded inlet.

Sketch 1

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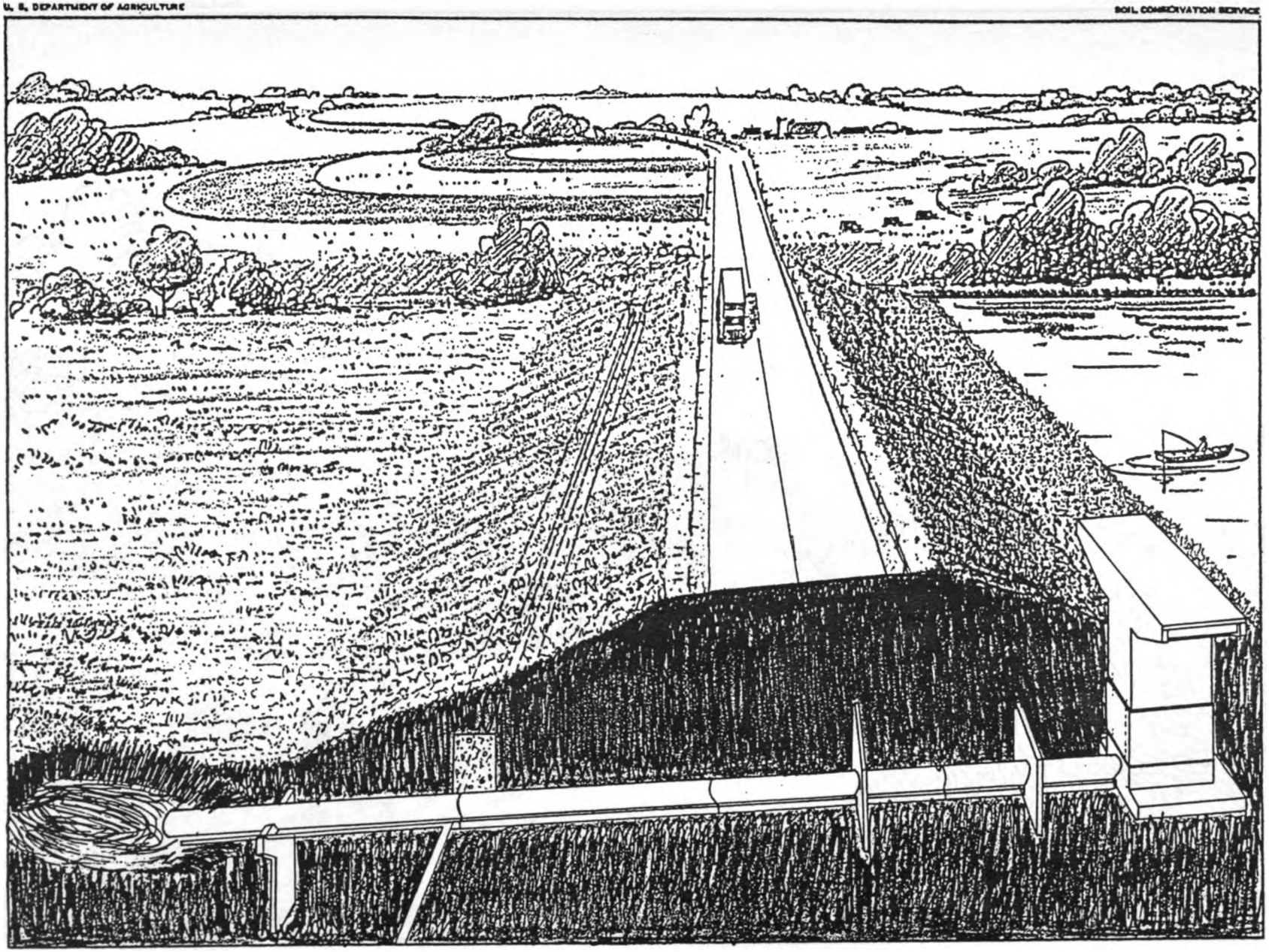

Sketch 2

Earth fill dam on roadway with baffle inlet and propped outlet.

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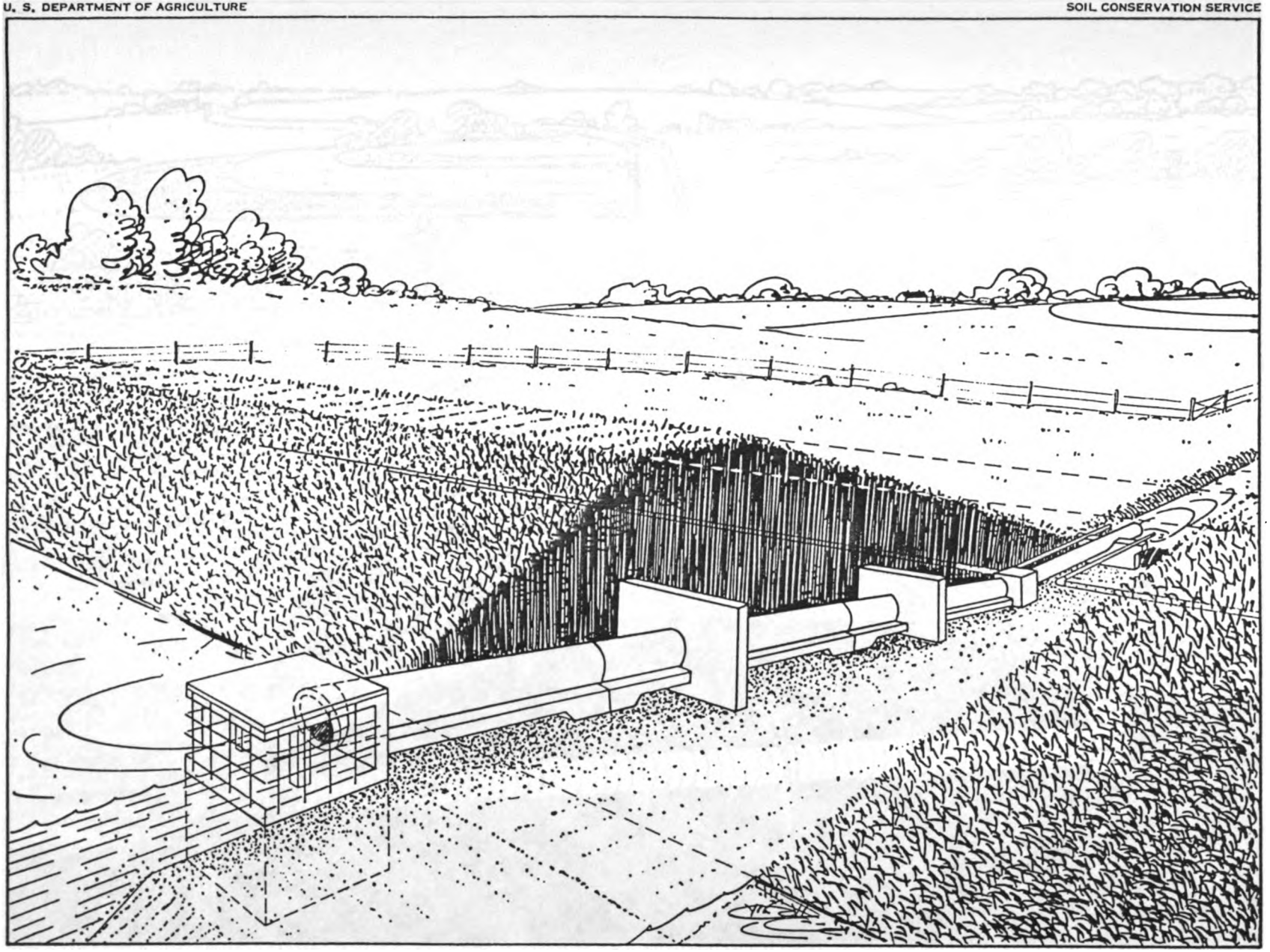
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



Reinforced concrete pipe with hooded inlet.

Sketch 3

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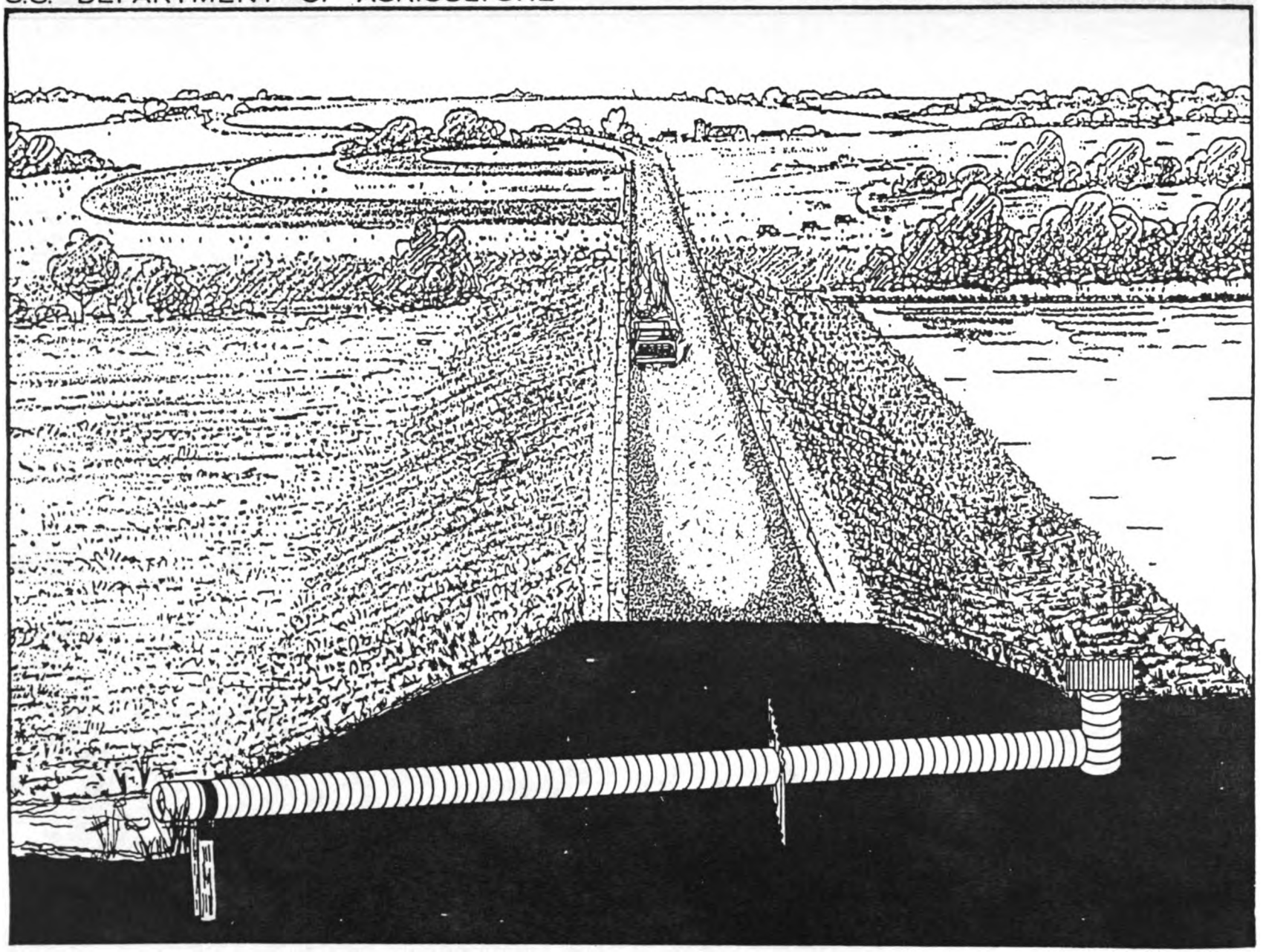
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



Sketch 4

Earth fill dam on roadway with Vertical Metal Pipe Inlet and Propped Outlet.

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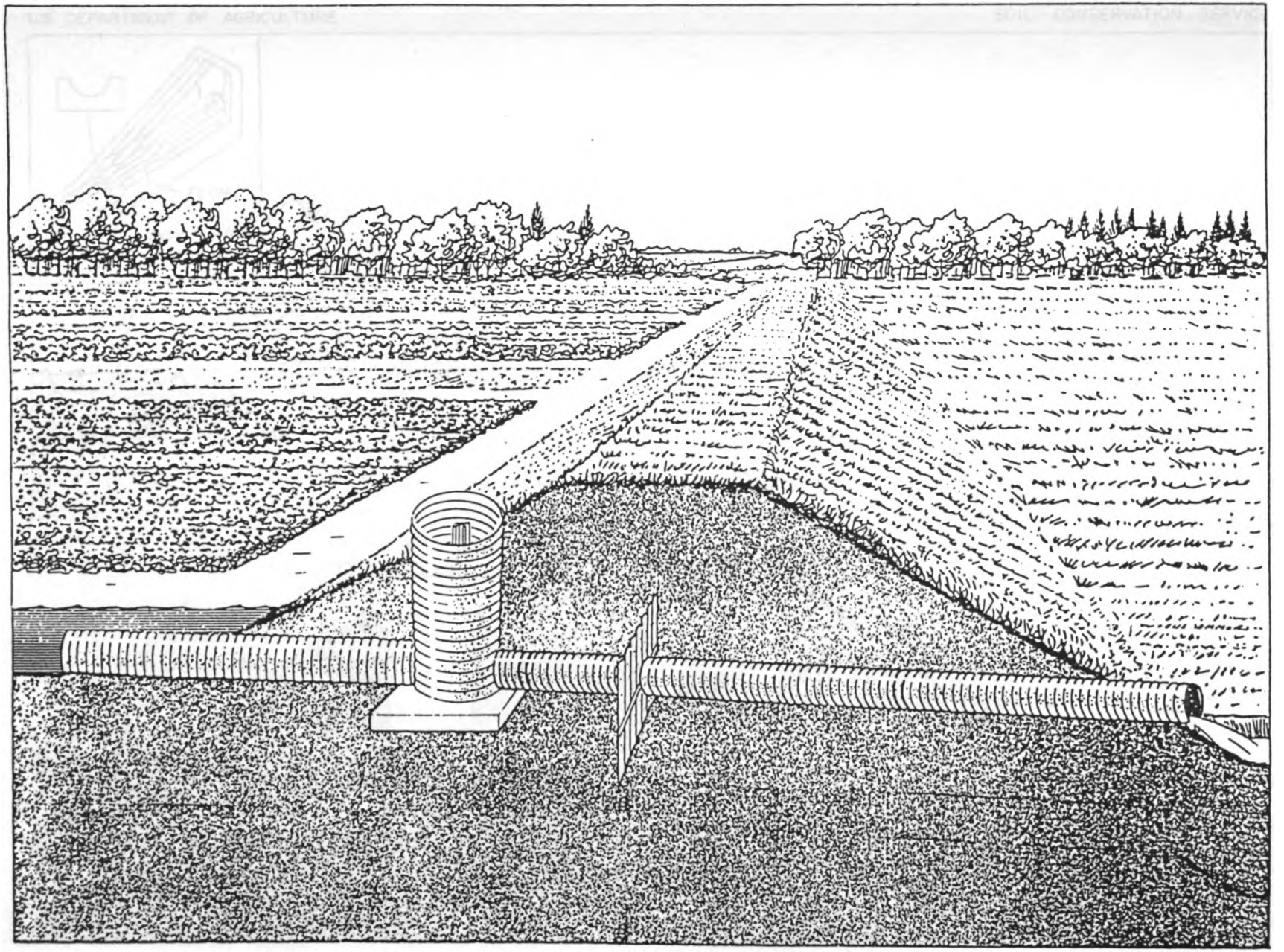

Earth fill dam with Metal Pipe Riser and Drawdown Pipe.

Sketch 5

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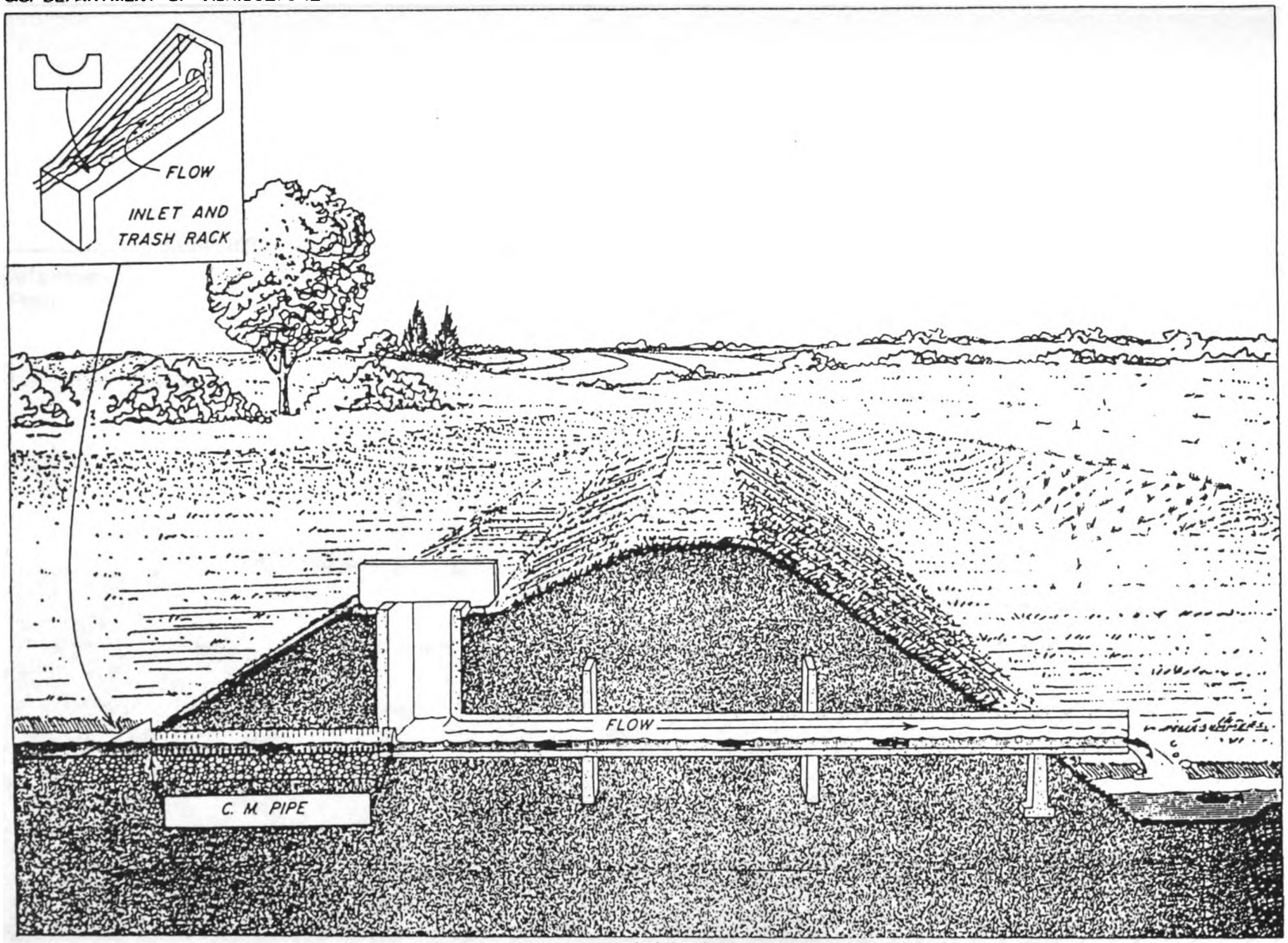
Digitized by Google

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



Sketch 6

Earth fill dam with Concrete Pipe Riser and Drawdown Pipe.

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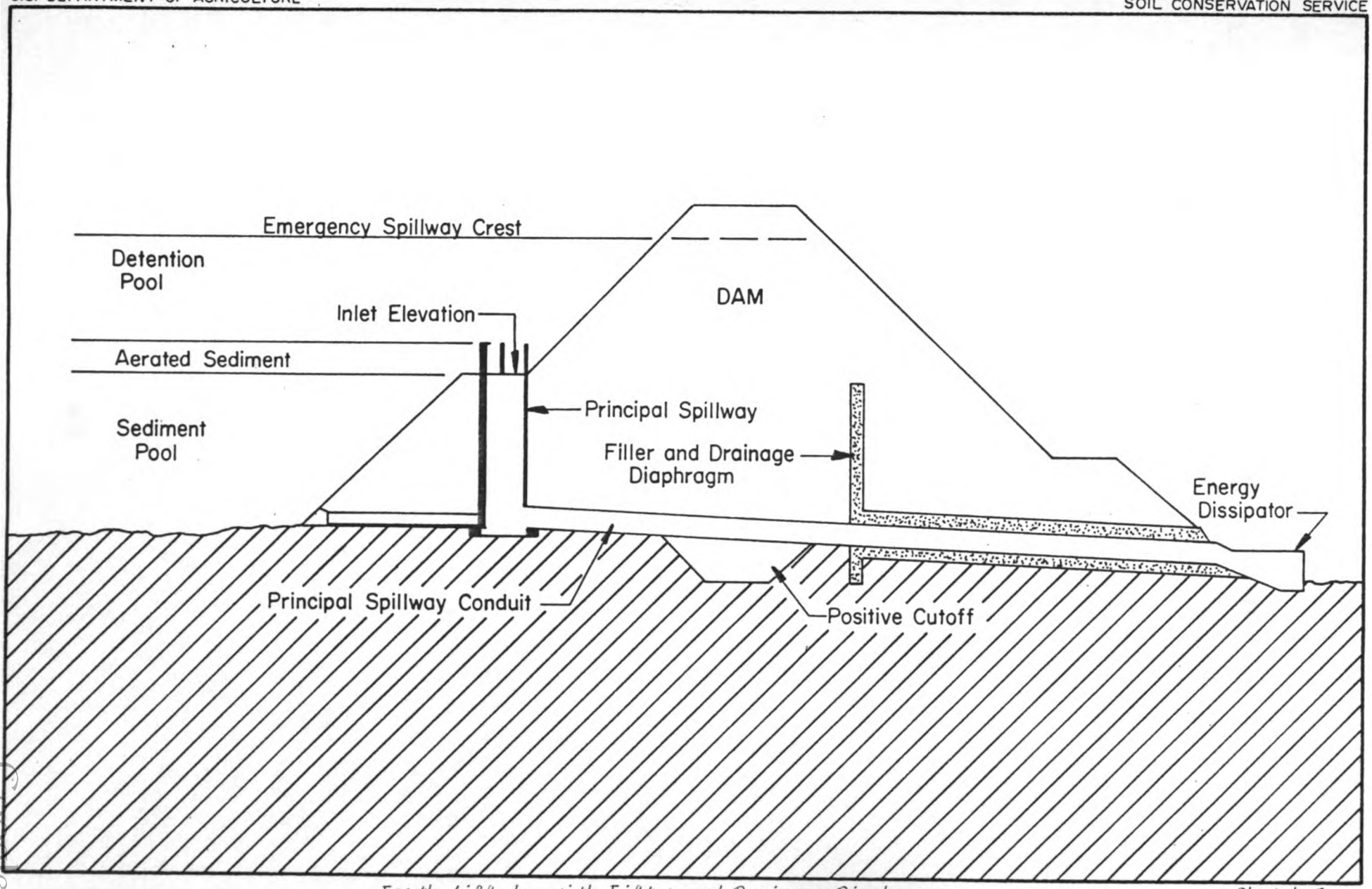
Digitized by Google

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



Earth fill dam with Filter and Drainage Diaphragm.

Sketch 7

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APPENDIX D

INVESTIGATION AND ANALYSIS REPORT

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Project Formulation

The future-without-project conditions were forecasted using present conditions as a base and considering trends shown by statistical summaries, such as the Census of Agriculture. Water resource planners worked closely with other local agency personnel. This insured that opinions of the local agency personnel were considered.

An interdisciplinary team approach was used to reflect a cross section of viewpoints. Considerable information about forecasting is included in the Watershed Plan-Environmental Impact Statement, hereinafter called the Plan.

The major objective outlined in the Preauthorization report for the watershed was reduced flooding. The earlier planning study proposed 112 dams ranging in drainage area from approximately 80 acres to over 1,160 acres. Preliminary benefit-cost estimates indicated this alternative would produce benefits in excess of costs.

The most desirable solution to the principal watershed problems proposed the installation of 154 dams controlling drainage areas ranging from 30 to 2,000 acres and serving the purpose of flood prevention. Aerial photos and USGS topographic maps were used to locate the potential dam sites. The benefits to the dams would be from flood damage reduction. The primary factors influencing dam location were the size of the drainage area controlled and similiar topographic features. A total of 300 potential dams were located.

The major step in formulation was to analyze the potential dams according to their individual ability to contribute to overall objectives. This is basically a process of identifying which individual dams generate benefits that exceed their costs. All benefit categories were used in the individual structure analysis to determine individual feasibility.

Groups of dams on tributaries were formed into increments and studied to determine which increments could provide the greatest net benefits. Additional groups of structures on tributaries were added using technical judgement until net benefits were negative. The addition of succeeding increments was based on criteria including: net benefits, flood plain protection, and the likelihood of getting all structures installed in a tributary group. The selected alternative included eleven dams increments. All eleven increments provided positive net benefits. The selected alternative included 154 dams.

Two additional structural increments were analyzed. No additional structural increments could be found which would provide additional positive net benefits. The display of incremental analysis is in the Formulation of Alternatives section of the Watershed Plan-Environmental Impact Statement.

Non-structural measures such as flood proofing, flood warning systems and flood plain acquisition were discussed. They were not considered viable alternatives because they are not locally acceptable. Land treatment measures were not considered because low remaining needs would not significantly reduce flooding.

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Wildlife habitat analysis has generally been conducted on a detailed impact site analysis for mitigation needs. The selection of wildlife species for evaluation was based on availability of predictive models for those species that would best portray watershed conditions. The species selected for evaluation in Soap Creek Watershed were ring-necked pheasant, bob-white quail, and white-tailed deer. Bobwhite quail were the principle species used to assess the Plan's effect on woody habitat and for mitigation computation.

The triagency biology team (SCS, FWD, FWS) analyzed the project effect of structures. A sample of dams and their associated drainage areas was used to analyze Plan conditions. Cover types within each sample site were rated with the species' models to obtain present habitat condition. An average Habitat Suitability Index (HSI) for each species was obtained for each site. These HSI's were then multiplied by the acres affected by each alternative to produce habitat units. Total habitat units were then summed by species and displayed for each alternative plan.

Included in the computations were results of the habitat type losses in the dams. The impact of the total project was then obtained for all dams.

Only those acres impacted by project action were evaluated during the wildlife habitat analysis and include 56 acres of cropland, 1,218 acres of pasture, and 1,125 acres of forest land. The 2,399 acres of land to be changed to dams and pools were included in impact analysis. Only the 569 acres of woody habitat lost to sediment pools and dams were evaluated in the mitigation analysis.

The change in land use distribution, and quality of the land management were used to to reflect project habitat losses or gains in future-without-project conditions. This land use distribution and HSI were used to compute habitat units for projected plan conditions as it affected each evaluation species.

The major effect on the stream resource recognized during the project formulation was that of sediment yield to the stream. These effects were forecasted and used to establish both future-without-project and future-with-project conditions.

Cost Allocation

All costs associated with the dams were allocated to flood prevention.

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Archeology

The first published research on the archeology of Soap Creek Watershed was a description of projectile points found by collectors 1/ . These artifacts were further investigated by an SCS archeologist 2/. The associated survey accounted for the context of the artifacts and the thickness of the very young alluvium in the area. Through an SCS cooperative study effort, the Iowa Geological Survey Bureau investigated the Holocene alluvium at several locations in the watershed 3/. A model of Holocene landscape change was created to aid future surveys to identify and evaluate archeological sites. Results of the work indicated the existence in the area of four Holocene alluvial fills (the Gunder Member, Corrington Member, Roberts Creek Member, and Camp Creek Member). These fills could be recognized in a significant portion of the watershed. The potential that this alluvial stratigraphy presented for analyzing the archeological record was noted.

An extensive historic properties survey was completed, using the model developed from the work described above 4/. Eighty-three of the 154 structure sites were surveyed. Twenty archeological sites and 35 isolated finds were discovered at planned dams. Five of the archeological sites are considered by the SCS and the State Historic Preservation Officer to be eligible for the National Register of Historic Places. One of these archeological sites is located at each of the five dam locations: 68-31 (13M064*), 4-31 (13AN97*), 4-85 (13AN94*), 90-84 (13WP297*), and 26-68 (13DV46*). Seventy-eight dams listed below were archeologically surveyed but yielded no archeological sites with potential eligibility for the National Register of Historic Places:

4-98	4-38A	68-63	26-37	68-89
4-73	4-37	68-64A	26-73	68-44
4-74	4-54	68-64B	68-61	68-46
68-30A	4-53	4-114	4-56	68-40
68-30	4-55	4-92	4-58	68-42
68-32	4-55X	4-89	90-85	68-33B
4-81	4-35	4-88	90-87	68-34
4-48	26-33	4-87	90-86	68-58A
4-47	26-32	4-90A	90-88	68-60
4-50	26-74	4-90B	90-112	68-71
4-49	4-112	4-95	90-91	68-72
4-40B	4-113	4-94	90-94	68-74
4-44	4-111	4-57A	90-95	68-73
4-40C	4-110	4-57B	90-97	26-71
4-40A	68-80	26-36	90-102	26-67
	26-34	68-50	26-51	

The remaining structure sites have not been archeologically surveyed.

The following technique was used to estimate the off-site area of cultural resources saved by with-plan reductions of streambank and gully voiding in the Soap Creek Watershed. This technique provides a quantified, not just a qualitative, assessment of damage to cultural resources. The damages to cultural resources are calculated separately for streambank and gully voiding, and then added to provide an overall estimate of damages.

* Archeological Site Numbers

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Streambank Voiding and Cultural Resources

1. Archeological site densities along streambanks in Soap Creek Watershed were calculated using archeological data from Ray and Benn 4/. A total of 13,400 feet of stream channel were archeologically surveyed in the watershed. This length of stream channel yielded 82 feet of archeological site eligible for the National Register of Historic Places (NRHP) and exposed to streambank voiding. The length of archeological site divided by the length of channel surveyed provides a factor to calculate archeological site density in other length of stream channel in the watershed.

$$\frac{82 \text{ (feet of arch. site)}}{13{,}400 \text{ (feet of surveyed channel)}} = .0061194$$

The factor .0061194 is the length in feet of NRHP archeological sites one should expect to find per foot of stream channel in Soap Creek Watershed. Because a considerable portion of the stream channel was obscured when the archeological survey in Soap Creek was made, the actual number of sites is certainly much higher, and therefore the figure used is a minimal one.

2. The length of channel in the watershed downstream from the planned structures is 317,326 feet. This stream channel length is multiplied by the factor .0061194 to yield the length of off-site NRHP archeological sites in eroding channels that will be affected by the planned structures. This calculation yields:

$$317{,}326 \times .0061194 = 1941.8447 \text{ linear feet of NRHP archeological sites}$$

3. The off-site area voided by streambank erosion in the Soap Creek Watershed is reduced by 5.05 acres per year with-project. This benefit occurs downstream from with-project structures and includes 317,326 linear feet of channel. The annual area saved per linear unit of channel in this portion of the watershed is:

$$\frac{219{,}978 \text{ square feet of erosion (5.05 acres)}}{317{,}326 \text{ linear feet of channel}} = .693224 \text{ square feet of off-site erosion per linear foot of channel per year.}$$

This figure is multiplied by the projected length of NRHP archeological sites along the channel and divided by 2 because an archeological site is usually on only one side of the stream channel.

$$1941.8447 \times \frac{.693224}{2} = 673.06667 \text{ square feet}$$

This yields the annual number of square feet of NRHP sites being saved from streambank voiding by with-project measures.

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Gully Voiding and Cultural Resources

1. More archeological sites are exposed to gully voiding than streambank voiding. Archeological site densities were calculated using archeological data from the work of Ray and Benn 4/. A total of 411,842 feet of gullies were archeologically surveyed and yielded 1984.9291 feet of NRHP eligible archeological sites exposed to gully voiding. This provides data to calculate archeological site density per length of gully:

$$\frac{1984.9291 \text{ (feet of arch. sites)}}{411{,}842 \text{ (feet of surveyed gully)}} = .0048196 \text{ feet of NRHP archeological site per foot of gully.}$$

2. The off-site length of gullies in the watershed is 9,113,758 feet. This amount is multiplied by the length of NRHP archeological site per foot of gully which equals:

$$9{,}113{,}758 \times .0048196 = 43{,}924.668 \text{ feet}$$

This is the length of off-site NRHP sites in eroding gullies that will be affected by the planned structures.

3. The annual off-site area saved from gully voiding with-project in Soap Creek is 6.3 acres. This annual off-site benefit equals 274,428 square feet. This area is divided by off-site length of gullies to yield:

$$\frac{274{,}428 \text{ sq. ft. gully voiding}}{9{,}113{,}758 \text{ linear ft. of gullies}} = .0301113 \text{ sq. feet of annual gully voiding per foot of gully.}$$

This is divided by two (sites are usually on only one side of the gully) and multiplied by off-site length of NRHP sites.

$$43{,}924.668 \times \frac{.0301113}{2} = 661.31223 \text{ sq. feet.}$$

This yields the square feet of off-site NRHP sites saved annually from gully voiding by with-project measures.

Area of Cultural Resources Saved by Reduction of Streambank and Gully Voiding

The area of cultural resources saved by reductions of channel and gully voiding resulting from with-project measures were added to give the total area of off-site cultural resources saved annually.

	673	square feet of streambank benefits
+	661	square feet of gully benefits
	1,334	square feet of significant off-site cultural resources saved annually.

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REFERENCES

1/ (Site Report). D.G. Spears, 1973, Newsletter of the Iowa Archaeological Society, 70:9.

2/ Soap Creek Archeology. D.M. Thompson, 1984, Office of Historic Preservation, State Historical Department of Iowa, Des Moines.

3/ Holocene Alluvial Stratigraphy and Landscape Development in Soap Creek Watershed Appanoose, Davis, Monroe, and Wapello Counties, Iowa. E.A. Bettis III and J.P. Littke, 1987. Iowa Department of Natural Resources, Iowa Quaternary Studies Group Contribution Number 14.

4/ Historic Properties Survey in the Soap Creek Watershed, South-Central Iowa. J.H. Ray and D.W. Benn, 1987, Center for Archaeological Research, Southwest Missouri State University, Springfield.

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Biology

Since 1984, numerous meetings and field reviews have been held involving biologists from the Iowa Department of Natural Resources, Fish and Wildlife Division (FWD), the U.S. Fish and Wildlife Service (FWS), and the Soil Conservation Service (SCS). The purpose of these activities was to evaluate impacts of the proposed P.L. 83-566 project on fish and wildlife resources in the Soap Creek Watershed.

The team agreed that project action would not damage aquatic habitat and likely will benefit the aquatic life in the streams. During their 50-year project life, structures will trap sediment that would otherwise be carried into the streams. Stream flows will not be reduced and may be enhanced in low flow situations. Aquatic habitat changes and effects on fish populations were not quantified.

An unquantified amount of FSA defined wetlands occur in the flood plain. Most of these are classified as types 1 and 2 wetlands by Circular 39. Project actions will not alter hydrologic conditions enough to allow landowners to convert these wetlands to production of agriculutral commodities.

Ninety-four acres of Circular 39 defined type 3 and 4 wetlands were identified in the flood plain. Most of these are old channel and ox-bow areas. Many occur on lateral drainage ways and will still have water moving through them after project installation. It was felt that no adverse impact would occur to these areas from the installation of the 154 dams.

Since no areas of the flood plain are flooded for more than one percent of the growing season, the seasonally flooded criteria of FSA do not apply to the flood plain. Since no impact to FSA wetlands are anticipated from the project, any wetland changes will be reviewed through individual landowner determinations conducted by the SCS field offices.

Terrestrial habitat in the watershed can be placed into three broad categories: cropland, grassland, and woodland.

After a watershed tour, the tri-agency biologists decided that woody cover was the most valuable wildlife habitat type. Since most structures will be built in either pastures with woody draws or in woodland, it was felt that the project had potential to adversely impact both distribution and density of wildlife species utilizing woody habitat. The team decided that all unavoidable losses of woody habitat due to project action would require replacement. The team agreed that losses of grassland could be offset by fencing the structures and limiting grazing. The undisturbed grass on the dams would provide better quality habitat than the overgrazed pasture that was flooded. Grasslands were evaluated using the ring-necked pheasant model.

Very little cropland would be impacted by the project. The team agreed that any loss of cropland would be small and it would be replaced by establishing woody mitigation areas adjacent to cropland.

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The DNR expressed concern over potential impacts on bobhite quail habitat. The team agreed to use the quail model as the indicator of impacts on woody draws and would use white-tailed deer for impacts on large blocks of timber.

Not all dams were evaluated in detail. The engineers designed 64 of the 154 dams in detail. They used this information to develop curves to estimate costs for the remaining dams.

These 64 sites were also used by the biologists to estimate wildlife impacts. Aerial photographs were used to separate the woody habitat at these sites into one of five woodland groups, '0', 'MP', 'MPC', 'MC', and 'W'. Group '0' are sites without woody habitat. Group 'MP' is woody cover in pasture with no cropland within a quarter mile radius. Group 'MPC' is woody cover in pasture within a quarter mile of cropland. Group 'MC' is woody cover within or adjacent to cropland. Group 'W' is solid woodland cover.

The range and average H.S.I. for each Habitat Group is shown below.

HABITAT SUITABILITY INDEXES
by Woodland Habitat Groups

Group	Structure Number	Computed H.S.I.*	Average H.S.I.*
0+	4-89	0+	0+
	68-38		
MP	4-40B	.50	
	4-40C	.56	
	4-50	.45	.51
	4-51	.51	
MPC	68-66A	.63	
	4-53	.78	
	4-49	.51	.59
	68-35	.58	
	90-74	.45	
MC	90-86	.88	
	26-33	.93	
	68-41	.79	.81
	68-31	.79	
	90-90A	.86	
	68-60	.58	
W	26-32	.76	
	4-84	.85	.68
	90-84	.56	
	68-85	.66	
	68-40	.56	

Note: * HSI based on scale of 0-1.0, with 1.0 being optimum value.
+ Group '0' has an H.S.I. of 0 since it has no woody cover.

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The biologist selected 22 of the 64 samples for field review. The team used Iowa modification of the FWS 1980 Habitat Evaluation Procedures (H.E.P.). The quail model was used to derive average Habitat Suitability Indexes (H.S.I.)for groups 'O', 'MP', 'MPC', 'MC'. The white-tailed deer model was used to develop the average H.S.I. for group 'W'.

The affected acres for each of the 64 sample structures were measured from aerial photos. These areas include the dam, sediment pool, borrow areas, etc. All woody habitat value is lost on these acres. The impacted acres for each dam were multiplied by the average HSI lost due to project action. The larger sites (TR-60 Design Structures) impacts were also taken for part of the floodwater retarding pool. The sites will have water stored in the floodpool more frequently and for longer duration than non TR-60 sites. The model showed a 0.1 H.U./woody acre loss in habitat value in the first four feet of elevation above the principal spillway.

Several dams had large areas of woodland that would be flooded by sediment pools. A sediment pool drawdown was planned for some of these to reduce wildlife impacts. These dams are designed like other dams except a secondary pipe spillway is installed to draw the pool size down to a lower elevation. The zone between the secondary and principal spillways will fill with water after rains, but will be drawn down to the lower level over a period of days. The zone between the principal and secondary spillways will be flooded from one to ten days depending on amount of runoff. One-half of the area between the sediment pool and the drawdown pool was considered to lose all habitat value. The model showed a 0.2 H.U./acre of woody habitat lost due to frequent flooding. This was applied to the remaining one-half of the difference in areas between the pools. The borrow areas, construction areas, dams, sediment pool, drawdown pool, and 50% of the area between the sediment and drawdown pool were considered to lose all habitat value. The rest of the areas were multiplied by the H.U. changes determined from the model.

The team agreed to use 0.35 H.U./acre for the average gain in habitat quality per acre of mitigation established. This value was based on average increase in HSI from fencing to preclude grazing. This value was divided into the H.U.'s lost per dam to obtain acres of mitigation required for each.

The acre figures were assigned a cost based on average cost of fencing and landrights. The engineers used these figures to develop their costs curves for estimating costs on the non-sample structures. The cost curve plotted costs vs. drainage area. Mitigation was assigned to non-sample dams based on an average cost for sample dams of a similar drainage area.

All mitigation acres listed here-in and in the Plan are estimates only. During design of each dam the tri-agency team will do a HEP evaluation at the site to determine actual changes in habitat units. The team will work with the design engineers to minimize damages to wildlife habitat.

SCS consulted with the FWS on endangered species. The bald Eagle (Haliaeetus leucocephalus) passes through the area during migrations. Many pools will be adjacent to timber areas and available for roosting and feeding. No habitat critical to the survival of bald eagles will be impacted.

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The Indiana bat (Myotis soldalis) also occurs in the watershed. The SCS and Iowa Cooperative Fish and Wildlife Research Unit at Ames conducted a survey during the summer of 1986. Indiana bats were captured at four of 19 sample locations. Juveniles and pregnant and lactating females were captured. This indicated the presence of one or more maternity colonies in the area. The watershed is within the bat's summer range only. Removal of trees during construction could impact nursery trees. To prevent damage to maternity colonies, a 'no-cut' period from May 1 to August 31 will be established. This will be waived only with the tri-agency biologists approval on an individual basis. Dam construction will not impact riparian corridors that provide feeding. However, since the riparian timber is of high value to upland wildlife and the bats, the team assigned a high priority for acquiring riparian areas for mitigation. With the 'no-cut' period and the biologists examining each site before construction no habitat critical to the bats survival will be impacted by the project.

Tri-agency biologists will also do a HEP on mitigation areas to determine H.U. gains from fencing the area and excluding grazing. The H.U. loss due to the project and the H.U. gain from mitigation will both be determined during construction. These determinations will be done to ensure no net loss in woodland H.U. The team felt this was a better system than trying to predict an acre figure based on average habitat conditions.

Total mitigation that will be required is estimated at 1,090 acres. Actual acres required for the project will depend on the HEP reviews of dam sites and mitigation areas and may be higher or lower than the estimates.

The biologists also recommended a priority for acquiring mitigation areas as follows:

1. Bottomland 'stringers' - wooded drainage ways or gullies connecting uplands with streams and crossing or abutting cropland.

2. Riparian Timber - corridors along major tributaries and Soap Creek.

3. Ox-bows - wooded wetland areas in bottomland fields.

4. Upland draws - wooded gullies, strips or odd areas in pasture that are less than 1/4 mile to cropland.

5. Structure areas - fenced periphery of project pools. Count all areas that are more than four feet above principal spillway elevation. Again highest priority if less than 1/4 mile to cropland.

6. Any area between 1/4 - 1/2 mile to cropland.

7. Existing timber - has low priority since has relatively high H.S.I. and proposed mitigation action will have little effect on the H.S.I., too many acres would be required per H.U.

8. Any other areas.

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This priority list reflects the DNR concern over potential loss of bobwhite quail habitat, and the fact that most large timber areas will not be impacted by project activity. The biologists will also give priority to areas between 5 and 20 acres in size in order to increase both edge and spatial diversity of mitigation areas. A few very large areas would not be as desirable as many, scattered, smaller areas of high quality habitat.

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Economics

Crop and Pasture

Crop and pasture damages were evaluated using the SCS ECON II computer program. Input for the program came from numerous sources. Storm frequencies studied included the 100-, 50-, 25-, 10-, 5-, 2-, 1-, .5-, .25-year events. The 100-year frequency flood was the maximum analyzed as watershed damages are mostly agricultural. Distribution of floods throughout the year came from the study of stream gage and National Weather Service records.

The value for agricultural commodities are current normalized. The price for pasture is ten dollars per animal unit month.

The depth/damage factors by months were developed for this area from interview data. Replanting cost and alternate crops were considered in developing the factors.

Economic reaches for flood plain analysis were selected to aggregrate the area of comparable cropping pattern and productivity. Distribution of crops by reaches was determined from field observation and noted on aerial photos. The cropping system and land use data were tabulated by reach for input in the SCS ECON II program. The land use distributions and cropping systems were used in the flood damage analysis.

Yields by crops for flood-free conditions under present conditions were determined. These yields were used for the future-without-project conditions.

Other Agricultural

An inventory was made to determine the type of other agricultural property located in the flood plain. The inventory revealed the principal other agricultural damage was to fences. Another major damage category was debris removal. Stage-damage relationships were developed. The damage expected for flood depth (stage) came from landowners' experiences with past flood events. Fence cost used in the analysis was obtained from the Field Office Technical Guide. Costs for debris removal are from the crop budget system.

Information needed for farm fences and farm crossings were obtained from field observation. Information needed for debris removal was obtained from interviews.

Length of fence affected by floodwater per acre by depth increment was determined and multiplied by the cost per foot to determine damages. Debris removal damages were computed by depth increment per acre to determine damages.

Farm crossings were evaluated from the standpoint of reduction in maintenance costs. This is due to reduction in peak flows.

Fences outside of the evaluated flood plain but below the dams were evaluated. Benefits included damage reduction and savings in operation, maintenance, and replacement costs.

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Land Damage

The SCS land damage analysis program was used to determine damages from sedimentation, swamping, and scour.

The interest rate is 8-5/8 percent. Fixed and variable production costs are from the crop budget for each crop.

Reach damage rates, acres damaged for each damage category, and number of years for recovery for sedimentation, swamping, and scour were provided from analysis of the flood plain by the geologist.

Project evaluation period is 50 years. Evaluation of land damage was projected for 50 years by the geologist to develop an annual rate for project evaluation.

Crop distribution and yield for land damage analysis are the same as those used in the ECON II Evaluation. The future-with- and future-without-project, average annual acres flooded by depth increments, and totals for reaches are from the SCS ECON II output.

Road and Bridge

Information for roads and bridges was obtained by field observation, use of information from other watersheds and from interview with the four county engineers. Reduction in costs for maintenance, repair, and replacements were considered as a benefit to the project.

Road and bridge damages were analyzed using a stage-damage procedure. This requires the development of a stage damage curve as input for each bridge to be evaluated.

Data for development of the stage-damage curves were obtained from the county highway engineers. Their estimates were used to estimate dollar damages by stage and frequency.

Bridges outside of the evaluated flood plain but below the structures were evaluated. Benefits included a savings in operation and maintenance costs. In addition many bridges can be replaced with ones of a smaller size or with culverts in the future. The benefits from a savings in replacement costs were evaluated.

Other

Installation costs of structural measures were amortized at 8-5/8 percent interest for a period of 50-years. Operation and maintenance costs were computed at 0.35 percent of the estimated construction costs of the dams and an inspection fee of one hundred dollars annually for each dam.

The economic base data used in evaluation of benefits are as follows: Current normalized prices were used in computing benefits. Production costs, including the cost for labor, are local costs. The federal discount rate was used in computing annual and annualized values. The methodology and procedures

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used in measuring the problems and computing benefits are outlined in the Economics Guide and Principles and Guidelines. Damage reduction benefits were determined by computing the difference in damages for the future without-project condition and the damages expected with each alternative in place.

Basis for the assumptions concerning future-without- and future-with-project conditions are covered in the Plan under forecasted conditions.

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Engineering Design and Cost Estimates

Aerial photographs, soils maps, and USGS topographic maps were studied to select potential floodwater retarding structure sites. Other information used in selection of sites included, drainage area, property lines, wildlife habitat, and farm field crossings.

Field investigations of 97 sites with members of the interdisciplinary team at times were made to evaluate the physical conditions, abutment conditions, habitat, cultural resource considerations, and timber and brush density.

Topographic maps with four-foot contours developed by photogrammetric methods from low level flights were used to compute and plot stage-storage data for principal and emergency spillway designs of the 64 representative structure sites.

The basis for design will be the SCS Field Office Technical Guide, Section IV, Practice Standards and Specifications. All dams will be designed under the Floodwater Retarding Dams Standard (402) and shall meet or exceed the criteria as called for in the Pond Standard (378) or Earth Dams and Reservoirs (TR-60). Hydrologic and Hydraulic design was completed using Technical Release Number 48 Structure Site Analysis Computer Program (DAMS2). Provisions were made for a 50 year sediment volume (1.3 watershed inches) for all structures. For structure routings, all sediment was considered to be below the crest of the principal spillway.

All dams except 90-87, will be provided with a designed vegetated emergency spillway.

For wave erosion protection, 10 foot wide berms will be constructed at or near crest elevation of all dams designed with 378 criteria, the larger dams designed with TR-60 criteria will have 30 foot or larger sloping berms.

Sixty-four dams were selected to represent the range of drainage areas (40-2100 acres). Physical conditions effecting the selection were land use, soils, land slopes, drainage area configuration, available fill material, foundation conditions, and timber and brush density.

Detailed designs and cost estimates were made for the 64 sites. The annual cost was plotted against the drainage area. The equation of the curve of best fit was used to calculate the estimated annual cost for the remaining 90 structures. The reliance factor R equals 0.92.

The dam sites, were assessed for habitat destruction in the emergency spillway and pool areas. Where possible, the dam location and sediment drawdown facilities will be utilized to minimize the habitat damage.

The earth fills and pool areas will be located so as not to disturb any known archeological sites.

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Field investigation and interviews with county engineers indicated a high rate of corrosion to corrugated metal pipe. All corrugated metal pipe principal spillways will be polymer coated with cathodic protection and will have propped outlets.

The geologic borings and surficial investigations indicated that good fill materials are available for each dam. The abutments were found to be sound glacial till with sporadic lenses of sand. The investigation of foundation conditions indicated a positive cutoff core trench will be needed on all sites. Trench drains may be needed on the larger drainage area dams. See sketch 7, Appendix C. The need will be determined on a site by site basis at time of final design. For planning purposes an estimated trench drain cost was included for all structures with drainage areas greater than 350 acres.

The geology study indicated the possibility of potential subsidence at six structure sites due to abandoned underground coal mines at or near these sites. During on-site investigations with landowners, no physical evidence of subsidence was observed. The landowners stated the mines were closed around 1900 due to labor problems, coal quality, and excess water. The preliminary breach inundation studies indicate a hazard classification "a" for all involved sites. Prior to final design a geologic investigation will be made for each structure. The structures will be located where subsidence will not be a problem.

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Geology

A flood plain damage survey using the range method was completed, as outlined in Chapter 6, Section 3, of the National Engineering Handbook. This work was done to determine rates of modern sedimentation (infertile deposits), swamping, flood plain scour, and streambank erosion. The sedimentation, swamping, and scour rates were used as input in the Land Damage Analysis program.

Three sample subwatersheds with a combined drainage area of 1896 acres were studied in the field to determine gully voiding rates for the watershed. Gully dimensions were recorded in terms of annual growth. The average growth rate for the total sampled area was then expanded to the upland portion of the watershed. The voiding in the flood plain portion of the watershed is considered part of the streambank erosion rate. A depreciation rate of 4 acres for each acre of gully voided was used based on previously measured rates in other Iowa watersheds.

Field observations indicated Ephemeral Cropland Gully Erosion to be a minor problem in the watershed. Significant ephemeral cropland gully erosion is limited to cropland that has sheet and rill erosion rates greater than T (tolerable soil loss). The voiding rate calculated is based on these acres only. The total voiding amount was then divided by the total cropland acres to establish an overall rate.

Procedures for determining streambank and gully damage reduction resulting from installation of structural measures are provided in: "Interim Guidelines for Predicting Gully Erosion Effects Downstream from Selected Sites in Iowa" by the Iowa Water Resources Planning Staff, November 1984.

An inventory of known coal resources and abandoned mines in Soap Creek Watershed was provided by the Geological Survey Bureau (GSB) of the Iowa Department of Natural Resources. An analysis of possible impacts that the planned watershed project will have on the coal resources, provided by the GSB research geologist, concluded there would be no adverse effects on deep coal deposits and only minimal impacts on shallow strippable coal.

Existing notes, papers, etc. were reviewed, and discussions were held with staff members who had visited that area, including the previous planning staff geologist. Downstream and at-a-station changes in sediment transport and flow regime were modeled using the cross sections, sediment sizes, discharges, and energy gradients. Froude numbers and bed velocities were calculated. The Schocklish and Haywood computer programs for sediment transport were used.

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Hydraulics and Hydrology

Several alternative plans consisting of various combinations of floodwater retarding dams were investigated during plan development.

Water surface profiles were developed using SCS Technical Release No. 61 (TR61), WSP2 computer program. Surveys on 117 valley and channel cross-sections were used to represent the 21 evaluation reaches selected. Extensive road and bridge flood damages were identified in early investigations so 39 bridges on Soap Creek and Little Soap Creek were surveyed. These cross-sections were used for hydraulic studies, economic analysis, and land damage studies. Channel sections were not modified for sediment deposition even though at times channel capacity could be decreased by the deposition. The surveyed sections were assumed to represent an average condition and capacity for evaluation.

Hydraulic characteristics for the cross-sections were determined using available guidelines. Manning's roughness coefficient "n" was evaluated using National Engineering Handbook, Section 5, Supplement B, and checked against "Guide for Selecting Roughness Coefficient "n" Values for Channels" compiled by Guy Fasken in 1963. Flood plain "n" values were based on predominant land use and modified for obstructions such as fences, standing timber, and brush. Cropland planted to corn is the predominant flood plain land use and it was assumed that corn would not be flattened by flood flows. Factors affecting hydraulic characteristics of bridges were obtained from TR-61 and publications referenced by it.

Most of the Soap Creek channel has been straightened and has deepened and enlarged after the straightening. Bedrock is presently exposed at numerous locations on the stream bed and at some locations on both the stream bed and banks. Bedrock and erosion resistant clays control channel depth. Some stream reaches were significantly smaller than others because of the bedrock control.

Flood plain area and width were determined stereoscopically from the most recent photographs available. The width was field checked and also checked against the surveyed sections. After water surface profiles were developed, Project Formulation - Hydrology (TR-20) was used to determine an array of flood discharges at many locations. Flood plain width and area were adjusted where necessary against the 100-year flood. Flood plain lengths were measured from either recent aerial photographs or U.S.G.S topographic maps.

Weather Bureau Technical Paper No. 40 was used to determine amount and frequency of rainfall to be expected for storms of different durations. Rainfall data were adjusted for drainage area on Soap Creek. Since major damages start where the drainage area is 100 square miles adjustment factors for that drainage area were made to Technical Paper 40 rainfall depths. Rainfall data for damage evaluations on Little Soap Creek were not adjusted because the Little Soap Creek drainage area is much smaller.

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Times of Concentration were computed for each structure drainage area using procedures in Chapter 15 of National Engineering Handbook, Section 4, and Iowa Technical Note 10. Times of Concentration for uncontrolled drainage areas were computed using the above procedures plus bankfull velocities from WSP-2 where available.

Hydrologic Runoff Curve Numbers were computed for four general areas of the watershed. Delineation of these areas was based primarily on soil types. Land use and topography varied by soil type. Land use was estimated for each area. Curve Numbers used varied from the general number where observed land use and cover conditions varied greatly from estimates used to develop the general numbers. National Engineering Handbook, Section 4, procedures were used.

Nine rainfall amounts ranging from 0.25 years to 100 years in frequency were used in Technical Release 20 (TR-20) Computer Program for Project Formulation-Hydrology to determine peak flood discharges at different locations. The convex routing method was used in TR-20 since this method correlated well with regional stream gage analysis during pre-authorization studies. Extent and frequency of flooding determined by the computer program agreed with information supplied by flood plain farmers for present conditions. Results of present condition TR-20 modeling for 10-year and 100-year rainfalls were compared with a regional analysis of stream gage records. This comparison showed the model yielded results consistent with the regional analysis.

Peak without-project flow-frequencies for the 10-year and 100-year events as computed by the model were plotted on log-log graph paper together with statistics from 18 selected stream flow records. Data from the upper main stem, the lower main, and Little Soap Creek plot within the envelope of 'high-flow' watersheds and 'low-flow' Watersheds water Resources Council method estimates. The Soap Creek Watershed modeled peaks also were compared with the upper and lower 95 percent confidence limits. A smooth curve of these limits also envelopes the Soap Creek Watershed data.

Because the number of dam sites investigated exceeds limits in TR-20 several adjacent sites that affected the same flood plain reaches were added together and treated as one structure to determine their effect on flood peaks. Hydrologic and hydraulic structure design was completed using Technical Release Number 48 (TR-48) Structure Site Analysis Computer Program (DAMS2). Principal spillway and emergency spillway hydraulic design parameters were obtained from Technical Release 60, Practice Standard 378, and other SCS engineering publications.

Lake Sundown and Lake Wapello are two large lakes in Soap Creek Watershed. Assumptions were made that the present dams and spillways will be maintained such that watershed hydraulics and hydrology at those locations will remain as at present throughout the evaluation period.

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Soil Conservation

District Conservationists in Soap Creek Watershed provided detailed information on sheet and rill erosion for present and projected conditions on about 11,000 acres above sample dam sites. This information included land uses, cropping systems, tillage systems, conservation practices, and other factors for the Universal Soil Loss Equation. The land use data was then expanded to determine land use in the total upland area. Sheet and rill erosion rates in tons per acre per year were predicted using the Universal Soil Loss Equation. These erosion rates were then used to estimate the gross sheet and rill erosion for the upland area.

The effect of the on-going land treatment program and conservation provisions of the 1985 Food Security Act were considered by District Conservationists as they developed future without conditions. These future without conditions indicate that 75 percent land treatment required will be met above each proposed dam.

Land use and cropping systems in the flood plain were determined by a detailed study involving field observations, aerial photographs, and farmer interviews. Future without conditions are based upon interviews with farmers and district conservationists.

The extent of each soil mapping unit was determined in each flood plain reach by using soil survey maps. The general soils description of the upland area was also obtained from soil survey information.

Soil survey maps and lists of soil mapping units that quality as prime farmland in Iowa were used to indentify prime farmland.

Prime farmland required for dams and pools was determined by comparing engineering plans, aerial photographs, and soil maps. Field frequency was considered when determining prime farmland flooded and potential prime farmland. The decrease in the two-year frequency flooded area with project is the amount of land changed to a prime farmland designation.

Crop yields and pasture production levels used in the analysis are based on data developed by soils specialists from Iowa State University and the SCS, Des Moines, Iowa. These yields and production levels are assigned to each soil mapping unit.

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Public Participation

Local public meetings have been held in Soap Creek Watershed since the 1960's when meetings were first held for residents of the watershed to discuss flooding problems and possible solutions. These meetings are held by local sponsors to gather public input and keep the public informed of the project status.

Sponsors of the watershed include the Boards of Supervisors and the Soil and Water Conservation Districts in Appanoose, Davis, Monroe, and Wapello counties and the Soap Creek Watershed Board which was organized in 1986 and consists of a representative from each sponsor. The board will conduct the business of the watershed at public meetings.

Residents of the project area have input to planning and decision making through the Soap Creek Watershed Board. Residents are also represented by the nine sponsors. Members of both Boards of Supervisors and Commissioners of each Soil and Water Conservation District are elected by residents of their respective counties.

A summary of recent public meetings is presented in the "Consultation and Public Participation" section of the Plan. This section also discusses SCS efforts to involve other agencies and groups in the Environmental Evaluation process. A list of those agencies and groups invited to comment on the draft plan is also shown.

A fact sheet that summarizes the Plan was developed by SCS as a part of the overall information program to encourage participation in the local review of the draft plan. A series of three press releases for local media and a letter to residents of the watershed were also prepared.

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APPENDIX E

Project Map

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SOIL CONSERVATION SERVICE

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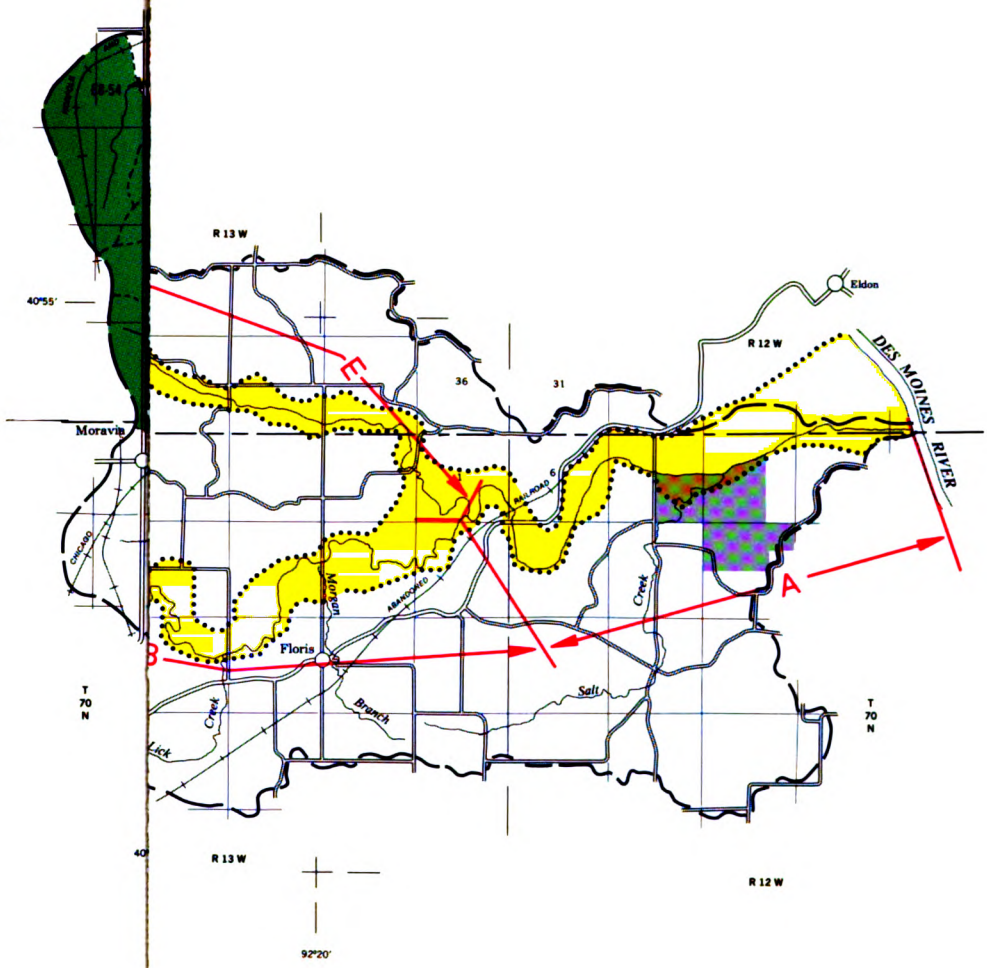

PROJECT MAP

SOAP CREEK WATERSHED

APPANOOSE, DAVIS, MONROE AND WAPELLO COUNTIES, IOWA

0 1 2 3
MILES

0 1 2 3 4
KILOMETERS

BASE COMPILED FROM U S G S QUADRANGLE SHEETS
AND COUNTY HIGHWAY MAPS, POLYCONIC PROJECTION

FEB. 1988 1003492

USDA-SCS-NATIONAL CARTOGRAPHIC CEN

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