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DAM # 139

YEAR/MONTH 1968 / May

DAM NAME Piney Run

REPORT TITLE Work Plan for Watershed

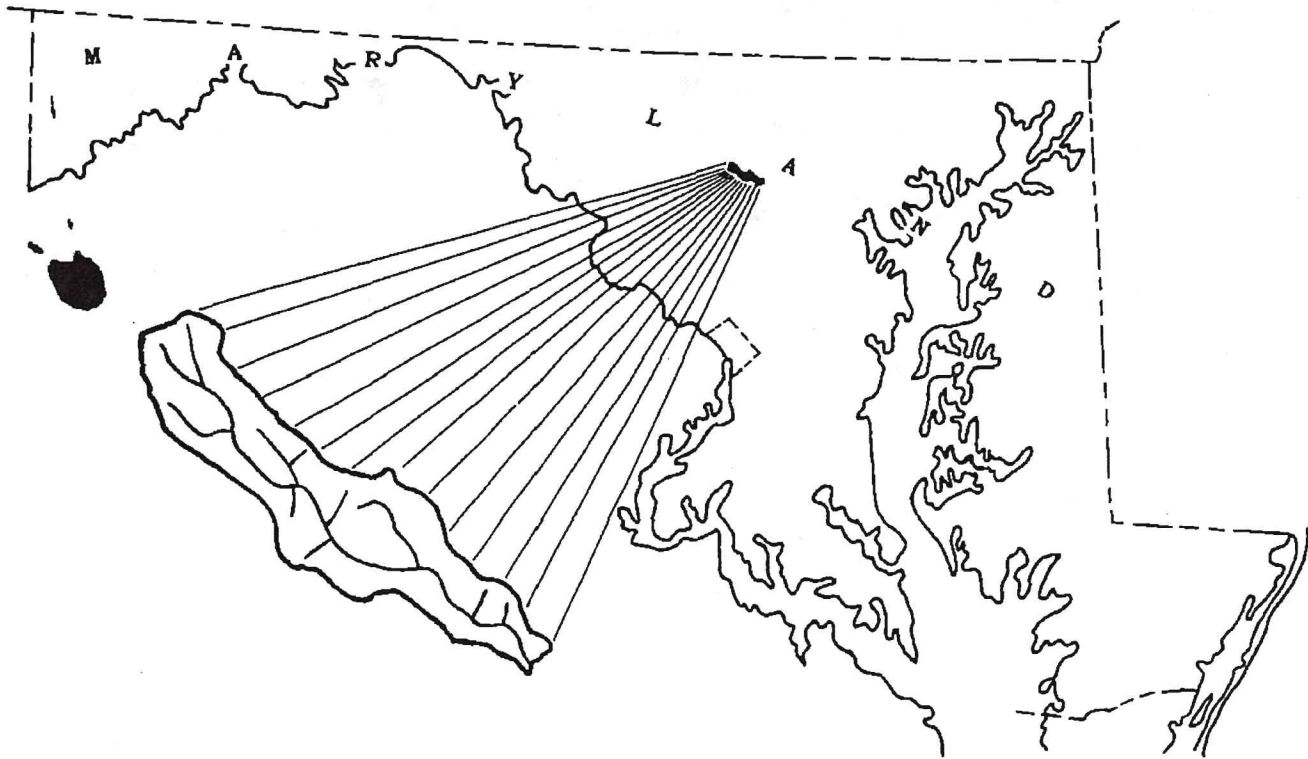
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WORK PLAN for the PINEY RUN WATERSHED



CARROLL COUNTY, MARYLAND

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MAY 1968

WATERSHED WORK PLAN

Piney Run Watershed
Carroll County, Maryland

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

Prepared by

Carroll Soil Conservation District
Carroll County Commissioners
Carroll County Parks and Recreation Board
State of Maryland
With Assistance by:

U. S. Department of Agriculture, Soil Conservation Service

U. S. Department of Agriculture, Forest Service

May 1968

PINEY RUN

TABLE OF CONTENTS

SUMMARY OF PLAN	1
DESCRIPTION OF THE WATERSHED	2
Physical Data	2
Economic Data	3
WATERSHED PROBLEMS	5
Floodwater Damage	5
Sediment Damage	6
Erosion Damage	6
Problems Relating to Water Management	7
PROJECTS OF OTHER AGENCIES	7
PROJECT FORMULATION	7
WORKS OF IMPROVEMENT TO BE INSTALLED	9
Land Treatment Measures	9
Structural Measures	10
EXPLANATION OF INSTALLATION COSTS	11
EFFECTS OF WORKS OF IMPROVEMENT	13
PROJECT BENEFITS	14
COMPARISON OF BENEFITS AND COSTS	15
PROJECT INSTALLATION	15
FINANCING PROJECT INSTALLATION	18
PROVISIONS FOR OPERATION AND MAINTENANCE	19
TABLES	
Table 1 - Estimated Project Installation Costs	21
Table 1A- Status of Watershed Works of Improvement	22
Table 2 - Estimated Structural Cost Distribution	23
Table 2A- Cost Allocation and Cost Sharing Summary	24
Table 2B- Basic Recreation Facilities - Estimated Construction Costs	25
Table 3 - Structure Data	26
Table 4 - Annual Cost	27
Table 5 - Estimated Average Annual Flood Damage Reduction Benefits	28
Table 6 - Comparison of Benefits and Costs for Structural Measures	29
INVESTIGATIONS AND ANALYSES	31
MAPS	
Flood Plain	Fig. 1
Recreational Development	Fig. 2
Project	Fig. 3

May 1968

WATERSHED WORK PLAN

Piney Run Watershed
Carroll County, Maryland

May 1968

SUMMARY OF THE PLAN

The Piney Run Watershed as described in this plan has a drainage area of 11,700 acres and flows in a southeasterly direction into the South Branch of the Patapsco River. The Piney Run Watershed is located in the southeastern part of Carroll County, Maryland.

The sponsoring local organizations are: The Carroll Soil Conservation District, the Carroll County Commissioners, the Carroll County Parks and Recreation Board, the Carroll County Sanitary Commission, and the State of Maryland.

The primary problem in the watershed is floodwater damages to roads, bridges, residences, industrial, and commercial enterprises.

Other problems include agricultural damages on the flood plains, sediment damage to Baltimore Harbor, and erosion in areas undergoing development. In addition, an expanded water supply is needed to assist in the development of communities, industrial developments, and water-oriented recreational facilities within the watershed.

The Springfield State Hospital and vicinity suffer periodically from flooding of Piney Run. Several damaging floods have occurred in the past 40 years. The flood of record occurred on July 20, 1956 and was used as the key flood. The recurrence of the 1956 storm would cause an estimated flood damage of \$118,200. The average annual direct flood damage in the watershed is \$11,280.

A comprehensive plan for development of the water and related resources has been prepared by the sponsors with the assistance of the U. S. Soil Conservation Service, and the U. S. Forest Service.

Other federal, state, and county agencies participating in the planning include the Bureau of Sport Fisheries of the U. S. Fish and Wildlife Service, Farmers Home Administration, Maryland Department of Game and Inland Fish, Maryland Department of Forests and Parks, Maryland Department of Water Resources, Maryland Extension Service, Carroll County Agricultural Stabilization and Conservation Committee, Carroll County Park and Recreation Board, and the Carroll County Sanitary Commission.

The plan includes conservation land treatment and provides for a multiple purpose flood prevention, water supply, and recreation structure with basic recreational facilities.

The work plan proposes installing, within a five year period, a project for protection and development of the watershed with a total installation cost of \$2,057,296. The share of this cost to be borne by Public Law 566 is \$563,766 with the remaining \$1,493,530 borne by other funds. The sponsors are also responsible for operation and maintenance costs.

The cost for land treatment is estimated to be \$100,710, of which \$78,490 will be borne by other funds. Public Law 566 funds in the amount of \$22,220 will be used for accelerating technical assistance, of which all will be used by the Soil Conservation Service.

The multiple purpose, flood prevention, water supply, and recreational structure will control 10.43 square miles of drainage area and provide for 3,145 acre feet of floodwater and sediment storage, 3,357 ac. ft. of water supply, and 2,340 ac. ft. of recreational water storage.

A 146 acre lake will be created for recreational use. Five hundred and fourteen (514) acres will be acquired for the multiple purpose structure.

Recreational facilities will be constructed on an additional 196.4 acres. These facilities are expected to accommodate 100,330 users annually.

The average annual benefits accruing to the structural measures is \$279,256. These benefits include \$21,125 for floodwater and sediment damage reduction, \$3,470 for changed land use, \$75,920 for municipal water, \$150,495 for recreation, and \$28,246 for local secondary benefits.

The ratio of the average annual structural benefits to the estimated average annual cost is 2.8 to 1.0.

The annual cost of \$100,596 consists of \$66,289 amortized structure installation cost and \$34,307 O&M costs.

The County Commissioners, through County agencies, will be responsible for construction, operation and maintenance of the project. In so doing, they will provide for the financing of the local costs of the project, also provide for administration of contracts, obtain the land rights, develop recreational facilities, and provide for operation and maintenance of the structural measures for the life of the project.

DESCRIPTION OF THE WATERSHED

Physical Data

The Piney Run Watershed is located in the southeastern part of Carroll County, about 25 miles west of Baltimore, Maryland. This watershed consists of approximately 11,700 acres or 18.3 square miles. The stream flows in a southeasterly direction from its headwaters near Winfield to its confluence with the South Branch of the Patapsco River just north of Marriottsville.

The Piney Run Watershed lies in the Piedmont Region of Maryland. The area is characterized as gently rolling to steep uplands with streams of fairly steep gradient feeding into wide bottomlands. The elevation range is from 292 feet above sea level, at the confluence with the South Branch of the Patapsco, to 790 feet at Winfield, Maryland.

The watershed acreage is composed of 4,629 acres of cropland, 3,382 acres of pasture, 2,568 acres of woodland, and 1,121 acres in other uses.

The major soils of the watershed include Glenelg, Glenville, Mt. Airy, and Baile. These soils developed from materials weathered in place, mainly mica schist, and gneiss formations. The soils range in depth from deep to shallow and are generally suited for agricultural uses as limited by slope, drainage, and stoniness. Comus, Codorus and Hatboro are found on the flood plains of the watershed. These soils are alluvial in nature resulting from erosion of the upland soils of the watershed. With necessary drainage, the flood plain soils will produce good agricultural yields.

The normal growing season is 170 days and ranges from mid-April to early October. Average annual temperature is about 54 degrees F. January has the lowest monthly average at 33 degrees F. and July has the highest at 73 degrees F.

Average annual precipitation is 41 inches and is fairly well distributed throughout the year. Heavier rainfall occurs during July, August, and September.

Precipitation in July and August is due primarily to high intensity thunderstorms of rather short duration. August, September and October are the months for tropical or hurricane storms of long duration.

Approximately 22 percent of the watershed (2,568 acres) is in forest cover. It has been determined that 15 percent of the forest land is in good hydrologic condition, 45 percent in fair condition, and 40 percent in poor hydrologic condition. With continued protection and more intensified management, most of the forest should be in fair to good hydrologic condition within the evaluation period.

Economic Data

The watershed is predominantly an agricultural area with an urban development around Sykesville on the southern border and Eldersburg on the northern border of the watershed. The flood plain is presently in grass with some wooded area. Springfield State Hospital is located in the watershed along the flood plain below State Highway Route 32. A rock crushing plant is located on the stream about one mile above its confluence with the Patapsco River at Marriottsville. Also located within the watershed is a butchering plant in Eldersburg and a Westinghouse Manufacturing Plant near the Springfield State Hospital. Both industrial and residential areas are expected to expand within the

watershed with the works of improvement installed. Total population is presently estimated to be 10,000 with 80 percent living in or near the Springfield State Hospital.

The watershed is primarily agricultural with corn, wheat, barley, hay, truck crops, and pasture being the principal crops. The agricultural products are processed locally through livestock, canning and dairy cooperatives and are sent to nearby markets in Baltimore and Washington, D. C.

There are 11,700 acres in the watershed which comprises about 53 farms. The farms, generally of the family owner type, have an average size of 130 acres. Approximately 96 of the 130 acres per farm (75 percent) are open land, with about 75 percent of this in crops and 25 percent in pasture. The average value per farm, including buildings, is approximately \$91,000 (\$700 per acre). There are approximately 1,500 acres of State owned land in the watershed of which 1,235 comprise the Springfield State Hospital and 265 are a portion of the Patapsco State Park.

Existing forest stands, occupying about 22 percent of the total watershed area are of one major forest cover type which is oak-hickory.

The sub-type white - red oak, hickory comprises about 55 percent of the total forest cover. The remaining area supports various combinations of chestnut oak, tulip popular, and other mixed hardwoods. About 60 percent of the forest land supports stands of sawtimber size and 35 percent in pole-sized stands with the remaining 5 percent in sapling-sized stands.

Very good markets exist for hardwood sawtimber and veneer, and white oak stavewood. Fair to good markets exist for pallet and dunnage quality sawtimber, posts, and ties along with some pine pulpwood.

The large majority of the forest land is held by approximately 130 private landowners. About 360 acres of forest land is State-owned. There is no federally-owned forest land within the watershed.

Adequate forest fire protection is provided by the Maryland Department of Forests and Parks in cooperation with the U. S. Forest Service through the Clarke-McNary Cooperative Fire Control Program. Neither present nor expected future fire occurrence justifies additional measures beyond the going program. Other current Federal-State forestry programs include Cooperative Forest Management, Cooperative Forestation, and Cooperative Insect and Disease Control. Given protection, care and management, the forest stands are expected to contribute to the general economy and future recreational development of the watershed.

The watershed is serviced by several State highways, Maryland #32, #26, and #97 connect with secondary roads throughout the watershed. These State highways intersect with interstate highways giving good access from all directions.

There are a total of 28 active soil conservation district cooperators in the watershed. These cooperators have developed 25 conservation farm plans involving 5,233 acres. Essential conservation treatments have been established on 3,000 acres of cropland, 1,500 acres of pasture, and 733 acres of woodland.

The conservation measures used to treat these acreages are shown in Table 1A. Water quality in Piney Run will support a trout fishery in the upper reaches. The stream is regularly stocked and heavily fished. Small game species including squirrel, rabbit, quail and ringneck pheasant are abundant in the watershed. A limited number of deer and migratory species including mourning doves and woodcock are also found. Hunting of the small game species is enjoyed by a large number of sportsmen.

WATERSHED PROBLEMS

Floodwater Damage

Flooding is a serious problem in the watershed. Major floods have occurred in 1946, 1956, and 1967. The flood of July 20, 1956 is the flood of record and is used as the key flood for damage analysis. Its frequency of occurrence is estimated to be considerably greater than 100 years.

Average annual direct damage from flooding in the watershed is estimated to be \$11,280.

A recurrence of the 1956 storm would inundate approximately 150 acres and cause damages estimated at \$118,200. Most of these damages will occur to roads and bridges throughout the watershed; also damages will occur to a water supply facility at the Springfield State Hospital, and a rock crushing plant near the lower end of the watershed. Damage to residences, agricultural buildings and equipment is negligible.

About 80 acres of valuable agricultural flood plain is affected by frequent flooding. This flooding occurs annually and the use of this land is restricted to pasture because of the flood hazard. With protection from flooding, the flood plain soils can be used for intensive agricultural purposes and the pasture and hay production can be shifted to

the upland soils of the watershed. This land use adjustment would result in increased efficiency of production and reduced erosion and sediment damage.

Indirect Damages

Indirect damages are estimated to be 20 percent of the direct non-agricultural damages and 10 percent of the direct sediment damages. These damages include delay in shipment of materials and products, loss of wages to employees, increased costs due to rerouting traffic, interruption of public utilities, and other similar services.

Sediment Damage

Sediment damage to the agricultural flood plain is slight. Most of the material deposited is fine and does not result in reduced productivity of the land. Sediment damage to roads and other improvements in the watershed is not extensive and was evaluated with the floodwater damage to these facilities. Water quality of the stream would be improved by reduction of erosion and resulting sediment content in the stream.

The major damage from sediment occurs downstream at the mouth of the Patapsco River and the Baltimore Inner Harbor and navigation channels. These facilities are maintained by dredging with the major cleanouts performed by the U. S. Army Corps of Engineers. The estimated average annual sediment damage from the Piney Run Watershed is \$14,840. The proposed structure will assist in the reduction of harbor maintenance costs and improve water quality in the Patapsco River.

Erosion Damage

Erosion problems on the agricultural lands in the watershed are not critical. Sheet erosion does occur to some extent and minor gully erosion is evident on some of the steeper cropland slopes. The shift of some intensive crop production to the flood plain made possible by the project will alleviate some erosion problems. An active soil conservation program is being carried out in the watershed and about 50 percent of the cropland, pasture, and woodland is receiving adequate treatment.

The most serious erosion problems occur in areas undergoing development. Generally these areas, including road banks, areas around new buildings, and areas left without vegetation by the installation of underground utilities, are being adequately treated.

Streambank erosion occurs to some extent throughout the watershed. This erosion is taking place on lower value lands resulting in low monetary damage. A detailed analysis of this damage was not made, however, it was considered as a sediment source in the design of the proposed reservoir.

PROBLEMS RELATING TO WATER MANAGEMENT

Municipal Water Supply

Water shortages have been experienced in the past during drought years. In 1966, the stream stopped flowing entirely below the intake to the State Hospital Water Supply System. At that time approximately 1 mgd. was being withdrawn for consumptive use. It has been determined by a consulting firm that water requirements of the watershed will be 3 1/2 mgd. by the year 2010. In addition, it is required that at least 1 mgd. by-pass the structure at all times to maintain stream flow.

Recreation

There is an urgent need for water-oriented recreation in the watershed. Some state park land is located near the lower end of the watershed and Liberty Lake is located nearby. However, this lake is used only for water supply for Baltimore and vicinity and its recreational use is quite limited. The watershed is within an hour's drive from Baltimore, and Frederick, Maryland; Washington, D. C.; and York, Pa., which makes it accessible to several million people. The area around the proposed lake will have suitable cover and topography for the development of recreational facilities. Local interest in developing recreation facilities has been expressed and a plan for these has been developed.

Water Quality

The only sewerage treatment system in the watershed is at the Springfield State Hospital. Other communities and rural residents depend on individual septic systems. A need exists for more and better sewerage treatment facilities throughout the watershed.

PROJECTS OF OTHER AGENCIES

There are no other proposed or existing works of improvement for water resource development which will affect or be affected by the works of improvement in this work plan.

PROJECT FORMULATION

The flood problems in this watershed have been serious and have caused considerable concern for many years. Likewise, the need for additional water for municipal and recreational uses does exist and is becoming more critical each year. Sedimentation of the stream channel and farther downstream, Baltimore Harbor, is also a problem. The opportunity to provide a solution to these four Carroll County problems is provided in the proposed structure.

It has been mutually agreed by the sponsors and the Service to develop the Piney Run Structure Site to its maximum optimum potential incorporating flood prevention, sediment storage, municipal water supply, and

recreation into the multiple purpose structure.

Since 1931 the City of Baltimore has had exclusive water rights to that portion of the Patapsco River Basin located in Carroll County. Authority to construct a dam was obtained through Bill No. 699 passed June 1, 1967 in the Maryland State Legislature. Provisions in the Bill require Carroll County to release at all times a minimum base flow to be determined by Baltimore City. The amount of this release has been set at 1 mgd.

Flood protection will consist of that level suitable for intensive agricultural use of the flood plain and it will be adequate to prevent major damage to other flood plain facilities. All land in the watershed will be used within its capability and flood plain development will be compatible with the degree of flood protection provided. The Carroll Soil Conservation District is an aggressive organization and its influence is apparent in the conservation already installed in this watershed. The District plans to accomplish at least 66 percent of all the required land treatment measures by the end of the project installation period. The agricultural lands in the flood plain valley below the structure, when protected and adequately treated with drainage measures, will provide for the optimum use of these lands. The flood plain will be provided a 7 year protection.

In addition to the flood protection and sediment storage provided, the structure will also furnish water storage needed up to the year 2010. The water supply features have been developed in consultation with the county's water consultant.

Recreation development is designed to use the site to its full potential. Basic facilities are planned for 3 of the 5 service areas during the 5 year project installation period. The county recognizes the need to make maximum use of all structure sites that are planned and developed in the county from public monies. Consideration has also been given to maintaining or improving fish and wildlife resources in the watershed. The Maryland Department of Game and Inland Fish recommend the sponsors acquire and secure easements to a strip of land from 10 to 50 feet wide on either side of the stream from White Rock Road upstream to permit public access for put and take trout fishing. The sponsors have agreed to take this under consideration.

Alternative sources of water were considered including the development of ground water supplies and the purchase of water from existing impoundments. It was determined that surface type impoundment storage on Piney Run would be the most practical and economical supply. Additional and alternative structure sites suitable to meet the project objectives were considered but found to be not feasible based on geology, engineering or economic studies.

Corrections

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures will be installed for both watershed protection and flood prevention purposes. Land will be used within its capabilities and land treatment measures installed will be in accordance with needs and objectives to be accomplished.

Land treatment measures are the basic element of the watershed project, and are considered as the initial increment for project formulation. Emphasis will be placed on accelerating those measures which significantly affect the reduction of floodwaters and sediment yields.

A program to meet the land treatment needs has been developed as follows:

Open Land

Vegetative measures will be established to improve soil cover conditions and physical characteristics of the soil. This will decrease runoff and erosion, will assist in preventing sediment from filling stream channels and will result in less deposition on the flood plains. These measures include conservation cropping systems, stripcropping, seeding of improved grasses and legumes, and hayland and pasture renovation.

Establishment of diversions and grassed waterways will have a measurable effect in reducing peak discharge by slowing runoff and will augment the soil improvement cover measures in reducing erosion damage and sediment yields. Installation of drainage measures on the poorly drained, more level soils will result in beneficial adjustments in land use by permitting retirement of upland soils which have a greater erodibility potential. The establishment of farm ponds will make livestock water more available and permit more intense pasture management which will result in less overgrazing, higher infiltration capacities, and a reduction in the erosion hazard.

The establishment and development of wildlife practices, such as wildlife habitat development, will provide improved cover conditions and will contribute to the perpetuation and expansion of wildlife resources in the watershed.

Forest Land

The forestry practices included in the plan to treat forest land with essential measures are tree planting and hydrologic cultural operations. These forestry practices will improve hydrologic conditions which will reduce flood peaks, sedimentation and facilitate groundwater recharge.

To insure proper forest land treatment and maximum watershed protection, the forest land owners will be provided with technical assistance for

installing measures affecting 150 acres of forest land. Technical assistance will also be used for preparing about 21 management plans involving 220 acres which will outline practical measures to maintain and improve the hydrologic condition of the forest land.

Structural Measures

The structural measures consist of one multiple purpose reservoir for flood prevention, recreation and municipal water supply. The structure is located on Piney Run approximately 3,100 feet upstream of State Route 32 and will control 10.43 square miles. The dam will be 73 feet high and consist of 180,000 cubic yards of earth fill. It will be designed with a single-stage open top riser and a 36-inch pipe principal spillway having a maximum release rate of 209 cubic feet per second. The dam will store 3,145 acre feet of floodwater and sediment (the equivalent of 5.65 inches of runoff below the crest of the emergency spillway). The vegetated emergency spillway will be 250 feet wide and located on the right abutment. The structure and the adjacent disturbed area not to be flooded will be seeded to adapted mixtures to provide protection against erosion and will increase aesthetic values, and furnish improved opportunities for recreational uses. The total area to be seeded will be approximately 17.2 acres.

The water storage reserved for municipal use is 3,357 acre feet including storage to offset seepage and evaporation losses and to insure a safe yield of 3 1/2 million gallons a day. Water storage capacity for present use and to satisfy the estimated demand until 1980 is 572 feet. The remaining 2,785 acre feet is allocated to future use. A water intake tower, separate from the principal spillway riser, would be located on the left abutment with a raw water pipeline through the dam. Facilities would be provided as a part of the intake tower to bypass the minimum base flow of one million gallons a day and record the flow released. The intake tower and its facilities would be needed for immediate use. The planned features will meet the requirements of the State and local health agencies.

The storage reserved for recreational use is approximately 2,340 acre feet and will provide a minimum surface area of 146 acres at all times. The elevation of the recreational pool is 505.0 m.s.l. The associated recreational facilities will be constructed on five service areas as shown on the recreational development map. In addition to the 514 acres of land required for the structure and four acres of flowage easements, the County will acquire an additional 196.4 acres for the basic facilities. The design load capacity of the recreational development will be 2,000 users per day. The type and amount of facilities to be installed and locations are shown in Table 2B, and the recreational development map.

An area approximately 10 acres in size will be located where the reservoir bank slopes are gradual and smooth and will be clear of all stumps to permit use of haul seines. This location would provide access to the recreation pool. Stumps, snags and other obstructions

such as foundations should be allowed to remain as additional fishery habitat in the upper 1/4 of the impoundment.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The unit costs for installation of land treatment measures are based on current costs of materials, equipment, and services for similar work being done in the area.

The cost of technical assistance for the installation of land treatment measures is based upon analysis of recent expenditures and accomplishments for this type of assistance.

Costs for the installation of forest land treatment measures are based on current costs of supervision, labor, equipment and materials needed to perform the particular measures.

Costs of technical assistance for the installation of forest land treatment measures on private land are based on actual expenditures and accomplishments of the Maryland Department of Forests and Parks. An analysis of costs against accomplishments was made for each measure to determine unit costs for technical assistance.

Structural Measures

Construction costs for the multiple purpose structure were based upon unit prices from recent contracts for similar work. These estimates were based on a summation of the costs for clearing, clearing and grubbing, common excavation, rock excavation, compacted earth fill, filter material, rock riprap, grouting, concrete, concrete pipe, seeding and mulching. The total construction costs include 12 percent for contingencies. The construction cost was developed and concurred in jointly by the Engineering Consultant and the Service. Engineering services costs include an estimate for a detailed geologic investigation of the site. Other engineering services, including designs and specifications, are estimated as a percentage of the construction cost based on records of recent experience for similar work.

Construction costs for the basic recreation facilities were estimated by the Service and concurred in by the sponsors. These costs are based on recent estimates for similar facilities in water resource developments; and basic standard data were used to determine unit costs. The engineering services for the basic recreation facilities were estimated as a percentage of the construction cost which was provided by the sponsors. Land rights costs, which includes the cost of buildings, were based on local appraisals and recent sale transactions, and were adjusted to account for the rising trend in Carroll County land values. Property survey and legal costs were estimated by the Consultant based on experience for similar work.

Project administration costs including State and Washington administration, inspection by the Service, the Engineering Consultant, and the sponsors, and administration of contracts were estimated for this project based on present expenditures for these services in similar type projects.

The multiple purpose flood prevention, water supply, and recreation structure will be installed with PL-566 financial assistance.

PL-566 funds will bear all of the construction costs for flood prevention, and 50 percent of the construction cost for recreation in the multiple purpose structure. They will also bear all of the engineering services costs for flood prevention and recreation in the structure.

In addition, 50 percent of the land rights costs for the multiple purpose structure, allocated to recreation, for which fee title will be obtained, will be borne by PL-566 funds. The cost of land surveys, legal fees, and other costs incidental to acquiring these rights are not subject to PL-566 cost sharing.

Fee title will be obtained for 514.0 acres associated with the multiple purpose structure, of which 362.0 will be used for recreation and 152.0 will be associated with the water supply. In addition, 196.4 acres will be acquired in fee title for the recreation facilities. Flowage easements will be acquired on 4 acres. Federal funds will not be used for acquisition of flowage easements.

All of the municipal water supply and recreation facility costs including construction, engineering services, and land rights will be borne by other funds.

The joint costs of the structure were allocated by the use of facilities method which apportioned 35.6 percent to flood prevention, 38.0 percent to water supply and 26.4 percent to recreation.

The land rights for the multiple purpose structure to the minimum taking line were allocated on an area basis and were apportioned 70.4 percent to recreation and 29.6 percent to water supply. Specific cost items serving only one purpose were allocated in total to that purpose.

Table 2A shows a summary of the cost allocation and cost sharing. The following table shows the schedule of fund obligations during the project period:

Year	PL-566		Other	
	Land Treatment	Structure	Land Treatment	Structure
1st	3,500	222,600	5,620	614,090
2nd	6,000	157,280	15,720	238,060 ^{1/}
3rd	6,000	114,700	19,850	165,030
4th	4,000	23,530	18,850	202,690
5th	2,720	23,530	18,450	195,070

^{1/} Includes \$151,500 advance from PL-566 funds for deferred water supply.

EFFECTS OF WORKS OF IMPROVEMENT

Floodwater damage and frequency of flooding will be reduced by varying degrees along the main channel of Piney Run.

Near the lower end of the watershed, in Reach G, the peak discharge from the projected 100 year flood will be reduced from 5,200 cfs to about 3,000 cfs by the proposed works of improvement. In the vicinity of the Springfield State Hospital, in Reach B, the peak discharge from a similar flood will be reduced from 4,100 cfs to 500 cfs. Total estimated damage from a 100 year event would be reduced by 60 percent and average annual damages in the watershed will be reduced by 83 percent by the project.

Carroll County has enacted a zoning ordinance which prohibits the construction of permanent improvements on all flood plains in the county up to the 50 year frequency flood elevation. The effects of the proposed works of improvement will be considered in determining the excluded area in the Piney Run Watershed. Refer to Flood Plain Map.

The frequency of flooding on agricultural land would be reduced from annually without the project to about once in seven years with the project in most areas. In Reach C where most of the changed land use is expected to occur, about 55 acres will be protected from flooding. Significant damage to roads, bridges, and other property will be eliminated for all floods up to the 15-year frequency by the proposed works of improvement. At least 5 farms in addition to the Springfield State Hospital will benefit from reduced frequency of flooding and reduced sediment deposition on agricultural lands. A rock quarry, water supply system, and numerous roads and bridges will benefit from reduced frequency and depth of flooding. A total of about 150 acres of land will receive protection.

The land treatment measures will substantially reduce runoff and resulting erosion.

Without the structural measures installed the sediment production is estimated to be 6,688 tons per year, with 6,020 tons delivered to the mouth of the Patapsco River and Baltimore Harbor. With the structure installed the sediment yield will be reduced 63.6 percent or 2,185 tons per year will be delivered to the harbor.

A reliable, adequate, and high quality water supply will be obtained from the proposed structure. All foreseeable needs, including base flow maintenance, to the year 2010, can be met by the proposed impoundment.

Recreation

The multiple purpose structure will provide as a minimum a 146 acre lake for recreational use. This lake will be located near Springfield State Hospital and will greatly increase water-oriented recreational facilities in the area.

Fishing, boating, picnicking, hiking, and sightseeing opportunities will be provided for residents of Sykesville and vicinity, as well as vacationers from Baltimore, Washington, and more distant points.

The recreational facility will be used throughout the year with major use anticipated during the summer season. The peak daily use is expected to be about 2,000 visits while the total annual use is estimated to be 100,330 visits.

Water Supply

The construction of a multiple purpose structure, that includes 3,357 feet of storage for municipal water supply, will provide a dependable supply of 3.5 million gallons of water per day. This assures an adequate amount for drought periods and for any anticipated increase in future needs. A reliable water supply will assist in the orderly development of communities within the watershed, and will serve to encourage industrial development of the area. The by-passing of a minimum of 1.5 cfs (1 mgd.) through the reservoir is reserved for maintaining non-consumptive base flow in Piney Run below the water intake for the state hospital. This flow is equal or exceeds the 0.5 percent chance of flows of less magnitude. In addition to the above, approximately 1.2 mgd. will be required for consumptive use at the state hospital treatment plant for the next ten years. The major portion of this water use will be returned to the stream through the hospital treatment plant located along side Piney Run. These guaranteed flows and reservoir seepage losses will provide incidental benefits to the stream by stabilizing flows, improving water quality and aid in maintenance of fishing habitat during critical flows. At the same time, reservoir type fish habitat in the watershed will be significantly increased by the creation of the 298 acre lake. Projected water needs in the future indicate that a portion of the reservoir storage may be diverted out of the watershed for use in other areas. The effects of this diversion on downstream flows cannot be determined at this time.

PROJECT BENEFITS

The total average annual project benefit is \$279,798. This total includes \$279,256 from the structural measures and \$542 from the land treatment measures. The multiple purpose structure will provide damage reduction benefits of \$21,125 annually. Of this amount \$10,719 will accrue to flood water and \$10,406 will come from sediment reduction. Sediment benefits were based on reduced cleaning cost in the Baltimore Harbor and a value of \$2.00 per cubic yard was used.

Agricultural enhancement benefits through changed land use are estimated to be \$3,470 annually. Average annual benefits of \$75,920 were assigned to municipal water supply. Benefits for water supply were derived by the amortization of the cost of an alternative system capable of providing the desired amount of water at the same location.

Annual recreation benefits of \$150,495 were assigned to the multiple purpose structure and associated recreation development. These benefits were based on the estimated annual use of the development and a value of \$1.50 was used per visit.

Local secondary benefits, amounting to \$28,246 annually, were estimated to be 10 percent of the direct primary benefits plus 10 percent of the annual O&M costs. They include probable expansion of residential development adjacent to the recreational lake and increased commercial and industrial activity brought about by the project. Secondary benefits from a national standpoint were not considered to be pertinent to the evaluation.

The proposed forest land treatment measures will improve the hydrologic condition of the forest land. This in effect will reduce sedimentation and retard storm runoff. Good forest management and continued fire protection will increase the productivity of the forest land in the watershed.

Additional benefits to fish and wildlife will result from habitat improvement ~~in~~ the increased use of these resources made available to the public. *and*

COMPARISON OF BENEFITS AND COSTS

The structural measures described in this work plan are economically justified. The ratio of the primary average annual structural benefits, \$251,010 excluding local secondary benefits, to the estimated average annual cost \$100,596, is 2.5 to 1. The ratio of the total annual benefits including secondary benefits to the average annual cost is 2.8:1. The annual benefits and costs are compared in Table 6.

PROJECT INSTALLATION

Land Treatment Measures

The land treatment measures will be installed by the landowners and operators under agreement with the Carroll Soil Conservation District. The sponsors will assure the Service that the owners of not less than 50 percent of the land above the reservoir and floodwater retarding structure will carry out conservation farm plans on the lands above the structure.

Technical assistance for the preparation of conservation plans including the determination of all land uses and for the application of land treatment on other than woodland will be furnished by the Soil Conservation District. The forest land treatment measures will be installed by the landowners with technical assistance furnished by the Maryland Department of Forests and Parks in cooperation with the U. S. Forest Service under the going Cooperative Forest Management Program. The Carroll County Forestry Board will cooperate with the Maryland Department of Forests

Correction

and Parks in the promotion and encouragement of sound forest land practices in the watershed.

The Maryland Department of Game and Inland Fish will assist landowners and the Soil Conservation District by providing technical assistance for evaluating and improving wildlife habitat and management of fishery resources in this watershed.

Other agencies, including the Maryland Extension Service, the Farmers Home Administration and the County Agricultural Stabilization and Conservation Committee will provide their services and support to the establishment of the land treatment measures and the project as a whole.

Local newspapers will be used to disseminate information about the land treatment and structural phases of the project. Notification of specific meetings and particular items of information will be supplied to the landowners through the mail by the agencies assisting in the installation of the project.

Structural Measures

The works of improvement consist of one multiple purpose structure for flood protection, municipal water supply, recreation, and a recreation development including recreational facilities, to be installed within a five year period. The Commissioners of Carroll County have the authority to construct, operate, and maintain the project. The Commissioners will carry out the recreational development features of the plan through the Carroll County Park and Recreation Board and the water supply features through the Carroll County Sanitary Commission.

The Commissioners of Carroll County, with assistance from the State of Maryland, will provide the following:

1. 51.2 percent of the joint construction cost of the multiple purpose structure estimated to be \$212,828, and 100 percent of the specific construction cost allocated to water supply estimated to be \$156,000, 38.0 percent of the joint engineering costs of the multiple purpose structure estimated to be \$24,594 and 100 percent of the specific engineering costs allocated to water supply estimated to be \$11,540.

64.8 percent of the land costs, which includes buildings, paid to each owner for the minimum taking area, including the area allocated to water supply estimated to be \$333,072.

100 percent of the cost of additional land for the recreational facilities, 100 percent of the cost of installing the recreational facilities, and 100 percent of the cost of legal fees, surveying costs, and flowage easements.

2. Assurance that, as a representative of the land-owners or water users, they have acquired such water rights pursuant to State Law as needed.
3. The services and costs of administration of contracts.
4. The operation and maintenance of the structure including the municipal and industrial water supply features and the public recreational development.
5. All necessary lands, easements and rights of way to install, operate and maintain the structure, municipal and industrial water supply features, and the public recreational development with agreed to PL-566 and State participation in cost sharing.

The Soil Conservation Service will furnish the Federal assistance provided for under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666, as amended). Technical assistance will include funding for an A&E contract for final engineering costs and project administration costs. This assistance will also include federal cost-sharing such as:

1. 48.8 percent of the joint construction costs of the multiple purpose structure.
2. 62.0 percent of the joint engineering costs of an A&E contract for final surveys, investigations, design and preparation of plans and specifications.
3. 100 percent of the costs of project administration that includes SCS review of plans by others, Government Representative and inspection during construction.
4. 35.2 percent of the land costs, which include buildings, paid to each landowner for the minimum taking area including the land allocated to municipal water supply estimated to be \$180,928.

The Maryland Department of Game and Inland Fish will provide for the stocking and management of the reservoir fishery resources. They will also provide technical assistance to the Park and Recreation Board to improve, protect, and preserve the wildlife and fishery resources of the lake and surrounding park lands.

The preparation, award, and administration of contracts will be under the direction of a contracting officer appointed by the local contracting organization for the sponsors. The local contracting organization will enter into contracts for the works of improvement by competitive bid procedures.

FINANCING PROJECT INSTALLATION

Land Treatment

The total estimated cost of the land treatment is \$100,710. PL-566 funds will bear \$22,220 of this cost and \$78,490 will be borne by other funds. The cropland treatment is estimated to cost \$95,810. The portion of this cost for accelerated technical services, to be borne by PL-566, is \$22,220. The other cost, \$73,590, includes \$62,650 land-owner costs, with assistance from the Agricultural Conservation Program for installation of conservation measures and \$10,940 for technical services costs from the going conservation program. Loans are available for soil and water conservation purposes from the Farmers Home Administration.

The total cost of installing forest land treatment measures is estimated to be \$4,900. Technical assistance to forest landowners for the installation of these measures will cost \$1,500 and will be provided for under the Cooperative Forest Management Program. The remaining \$3,400 includes \$2,800 as installation costs to the landowners and \$600 contributed by the Maryland Department of Forests and Parks toward the cost of tree seedlings furnished to landowners. It is expected that Agricultural Conservation Program cost sharing will be available to qualified landowners installing these measures.

Structural Measures

PL-566 Funds, not to exceed 30 percent of the installation cost of the structure, and estimated to be about \$151,500 will be advanced to pay the construction and engineering cost allocated to future water supply. Repayment of the deferred cost through water use revenues will be made by the Carroll Sanitary District as approved by the County Commissioners beginning when the water is first used, or ten years after the year the structure is completed. The sponsors do intend to use the water from the storage capacity provided within the life of the structure. The State Director of the FHA has tentatively concurred in the proposed advance for future water supply. The sponsors will enter into an agreement for repayment of the advance, approved by the FHA, prior to the execution of a project agreement for construction.

All local costs necessary to install the multiple purpose structure, and not included in the deferred cost, shall be financed with a PL-566 loan administered by the Farmers Home Administration. The County Commissioners have filed an application for a loan and will execute an agreement for repayment of the loan with the Farmers Home Administration before a project agreement for construction is executed. Funds to repay the loan and to operate and maintain the structure will be paid from water, and other revenues collected by the Commissioners. The State of Maryland will reimburse the Carroll County Commissioners for 50 percent of the local costs, up to \$135,000, except those costs pertaining to municipal water supply and the recreational facilities.

Federal and State assistance to the local organization is contingent upon approval of the plan by the State and Soil Conservation Service. This work plan does not constitute a financial document for the obligation of Federal or State funds. Financial and other assistance to be furnished by the Soil Conservation Service in carrying out the Watershed Work Plan is contingent upon the annual appropriation of funds for the installation of watershed protection and flood prevention projects.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be operated and maintained by the landowners or operators of the farms on which the measures are installed, under agreements with the Carroll Soil Conservation District. The District will make periodic inspections of the land treatment measures to determine maintenance needs and will encourage the landowners and operators to perform the maintenance.

The forest land treatment measures will be operated and maintained by the landowners with technical assistance provided by the Maryland Department of Forests and Parks in cooperation with the U. S. Forest Service through the Cooperative Forest Management Program.

Structural Measures

The flood prevention, municipal water supply and recreation structure and the public recreational development will be operated and maintained by the County Commissioners through the Carroll County Park and Recreation Board and the Carroll Sanitary District with funds provided for this purpose by the Commissioners.

Operation Requirements

In order to operate and maintain the recreational features of the plan, the sponsors may charge admission or use fees. If such charges are made to use the recreational area, they will not exceed the amount necessary to amortize the initial investment and to operate and maintain the facility.

The reservoir will be operated so as to provide for the release of water for municipal water uses and for a minimum base flow of 1 mgd. required to satisfy water rights.

Water stored in the recreation pool of the multi-purpose structure with PL-566 assistance should not be withdrawn and used for any other purpose. The storage capacity for municipal water supply is estimated to be 3,357 acre feet ranging from elevation 524.0' downward to elevation 508.5' msl covering an area of approximately 128 acres including a cushion for the losses figured for seepage and evaporation. The storage capacity for recreational use, 2,340 acre feet, provides for the minimum recreation pool area of 146 acres at elevation 505' msl during all seasons. Facilities

installed in the intake tower will permit releases of 1 mgd. The reservoir does not provide storage capacity for base flow requirements.

The County Commissioners will notify the Service, through the State Conservationist, whenever the reservoir is operated below the specified ranges, and will participate with him in determining whether there is a continuing need to so operate it. If there is a continuing need for the use of recreational storage for municipal water supply, the sponsoring local organization will reimburse the federal government for all PL-566 funds used for public recreation associated with the structure.

Piney Run presently supplies an average annual demand of 1.08 mgd. for municipal use. After the structure is installed the average annual demand is not expected to increase more than 5% to approximately 1.2 mgd. until the end of the 10th year of operation. This demand will not cause the elevation of the water supply pool to fall below 522.0 ft. MSL. This includes approximately 572 acre ft. for present use and an additional 2,785 acre ft. for future use making a total of approximately 3,357 acre ft. of municipal storage.

The annual operation and maintenance cost for the multiple purpose structure is estimated to be \$2,520. This figure includes \$1,820 for maintenance of the water intake feature.

The sponsors and the Service will jointly make annual inspections to determine maintenance needs. More frequent inspections will be made if unusual conditions prevail. A record will be kept of all maintenance inspections. After the third year, inspections will be made annually by the sponsors a report furnished to the Service.

Operation and maintenance of the recreational facilities will include cleanup, mowing, repairs, normal maintenance such as painting, policing, life guards, supervision of activities, and replacement of the facilities when necessary. Estimated useful life of the various features with proper maintenance is 20 years for picnic tables, boat docks, refuse canholders, and metal fireplaces, and 50 years for the comfort stations, picnic shelters, and water distribution system. The annual operation and maintenance cost including \$1,787 for replacement costs is estimated to be \$31,787.

A maintenance agreement will be executed prior to issuance of invitations to bid which will provide for annual maintenance checks. The Soil Conservation Service will participate in maintenance only to the extent of (1) furnishing technical assistance to aid in the inspection, (2) furnishing technical design information necessary for the maintenance program. Maintenance includes, but is not limited to such measures as mowing, debris removal, brush control and stabilization measures.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

Piney Run Watershed, Maryland

Installation Cost Item	Unit	Number Estimated Cost (Dollars) 1/			Total Installation
		Non-Fed Land	PL-566 Funds	Other Funds	
<u>LAND TREATMENT</u>					
Soil Conservation Service					
Cropland	Ac.	934		14,590	14,590
Grassland	Ac.	1,374		48,060	48,060
Technical Assistance			22,220	10,940	33,160
SCS Subtotal			22,220	73,590	95,810
Forest Service					
Woodland	Ac.	150		3,400	3,400
Technical Assistance				1,500	1,500
Forest Service Subtotal				4,900	4,900
TOTAL LAND TREATMENT			22,220	78,490	100,710
<u>STRUCTURAL MEASURES</u>					
Soil Conservation Service					
Multiple Purpose Str.	Ea.	1	202,852	212,828	415,680
Water Intake	Ea.	1		156,000	156,000
Basic Recreation Fac.	Ea.	1		363,030	363,030
Subtotal - Construction			202,851	731,859	934,710
<u>ENGINEERING SERVICES</u>					
Soil Conservation Service					
Engineering			40,126	61,544	101,670
<u>PROJECT ADMINISTRATION</u>					
Soil Conservation Service					
Construction Inspection			59,860	6,760	66,620
Review of Eng. Specifications & Contracts			11,400		11,400 ^{2/}
Other			46,380	22,890	69,270
Subtotal - Administration			117,640	29,650	147,290
<u>OTHER COSTS</u>					
Land Rights			180,928	591,988	772,916
TOTAL STRUCTURAL MEASURES			541,546	1,415,040	1,956,586
TOTAL PROJECT			563,766	1,493,530	2,057,296
<u>SUMMARY</u>					
Subtotal SCS			563,766	1,488,630	2,052,396
Subtotal FS				4,900	4,900
TOTAL PROJECT			563,766	1,493,530	2,057,296

1/ Price Base 1967

2/ \$11,400 is estimated cost of review of eng. plans, specification & contracts prepared by the Consultant.

May, 1968

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

Piney Run Watershed, Maryland

Measures	Unit	Applied To Date	Total Cost Dollars 1/
Soil Conservation Service			
Conservation Cropping System	Ac.	3,000	
Strip Cropping	Ac.	1,368	2,052
Crop Residue Use	Ac.	1,100	2,750
Mains & Laterals	Lin. Ft.	2,350	1,410
Tile	Lin. Ft.	3,106	1,864
Grassed Waterway	Ac.	1.8	1,080
Pasture Management	Ac.	2,032	15,850
Ponds	No.	6	9,000
SCS Subtotal			34,006
Forest Service			
Tree Planting	Ac.	50	1,800
Hydr. Cultural Oper	Ac.	93	560
Fire Control	Ac.	2,568	2,340
FS Subtotal			4,700
TOTAL			38,706

1/ Price Base 1967

May, 1968

TABLE 2
Estimated Structural Cost Distribution

Piney Run Watershed, Maryland

(Dollars) 1/

Item	Installation Cost P. L. 566 Funds				Installation Cost - Other Funds				Total Installation Cost
	Construction	Eng.	Land Rights	Total PL-566	Construction	Eng.	Land Rights	Total Other	
Multiple Purpose Structure #1	202,852	40,126 ^{2/}	180,928	423,906	212,828	24,594 ^{2/}	378,898 ^{3/}	616,320	1,040,226
Water Intake					156,000	11,540		167,540	167,540
Recreational Facilities					363,030	25,410	213,090 ^{4/}	601,530	601,530
Subtotal	202,852	40,126	180,928	423,906	731,858	61,544	591,988	1,385,390	1,809,296
Project Administration				117,640				29,650	147,290
GRAND TOTAL	202,852	40,126	180,928	541,546	731,858	61,544	591,988	1,415,040	1,956,586

^{1/} Price Base 1967

^{2/} A&E Contract Costs

^{3/} Includes \$100 for flowage easements and \$45,726 for property survey and legal fees.

^{4/} Includes \$16,690 for property survey and legal fees

May, 1968

TABLE 2A
 Cost Allocation and Cost Sharing Summary

Piney Run Watershed, Maryland

(Dollars) 1/

Item	Cost Allocation				Cost Sharing						
	Flood Preven- tion	Purpose			PL-566			Other			
		Rec.	M&I Water Supply	Total	Flood Preven- tion	Rec.	Total	Flood Preven. tion	Rec.	M&I Water Supply	Total
Multiple Purpose Struct.	171,122	520,873	348,231	1,040,226	171,022	252,884	423,906	100	267,989	348,231	616,320
Water Intake			167,540	167,540						167,540	167,540
Rec. Fac.		601,530		601,530					601,530		601,530
GRAND TOTAL	171,122	1,122,403	515,771	1,809,296	171,022	252,884	423,906	100	869,519	515,771	1,385,390

1/ Price Base 1967

May, 1968

TABLE 2B

Basic Recreation Facilities
Estimated Construction Costs

Piney Run Watershed, Maryland

(Dollars) 1/

Items	Number	Estimated Unit Cost	Total Construction Cost
Access Road - 18' wide - paved (L.F.)	7,300	12	87,600
Trail - 3' wide - paved (L.F.)	12,000	3	36,000
Parking Area - Gravel (Spaces)	440		58,000
Parking Area for boats and trailer - Gravel (Spaces)	150		30,000
Boat Ramp - Concrete - 10' wide - 250' long (No)	2	5,000	10,000
Boat Deck (No)	2		4,500
Comfort Stations - two unit Concrete Block (No)	10	4,000	40,000
Picnic Shelters (No)	37	1,500	55,500
Picnic Tables (No)	292	60	17,520
Grills or Fireplaces (No)	146	60	8,760
Refuse Can Holders (No)	96	20	1,920
Water Supply Wells (No)	3	1,000	3,000
Water Supply Distribution System			1,800
Land Clearing (Ac)	36.5	100	3,650
Miscellaneous			4,780
TOTAL			363,030

1/ Price Base 1967

May, 1968

TABLE 3
Structure Data

Piney Run Watershed, Maryland

ITEM	UNIT	TOTAL
Class of Structure		c
Drainage Area	Sq. Mi.	10.43
Curve No. (1 Day) (AMC II)		75
Tc	Hrs.	3.5
Elevation Top of Dam	Ft. MSL	540.5
Elevation Crest of Emergency Spillway	Ft. MSL	532.0
Elevation Crest of Single Stage	Ft. MSL	524.0
Maximum Height of Dam	Ft.	73
Volume of Fill	Cu. Yards	180,000
Total Capacity	Ac. Ft.	8,842
Sediment Submerged	Ac. Ft.	303
Sediment Aerated	Ac. Ft.	36
Beneficial Use (W.S. & Rec.)	Ac. Ft.	5,697
Water Supply	Ac. Ft.	3,357
Recreation	Ac. Ft.	2,340
Retarding	Ac. Ft.	2,806
Surface Area		
Sediment Pool	Acres	55
Beneficial Pool (W.S. & Rec.)	Acres	298
Water Supply	Acres	298
Recreation	Acres	146
Retarding Pool	Acres	384
Principal Spillway		
Rainfall Volume (Areal 1 Day)	Inches	7.2 - 100yr
Rainfall Volume (Areal 10 Day)	Inches	12.0
Runoff Vol. (10 Day)	Inches	6.26
Capacity Single Stage (Max.)	cfs.	209
Frequency Operation - Emer. Spillway	% chance	1
Size of Conduit	Dim.	36"
Emergency Spillway		
Rainfall Vol. (ESH) (Areal)	Inches	10.8 - 6 hours
Runoff Vol. (ESH)	Inches	7.63
Type	Vegetated	
Bottom Width	Ft.	250
Velocity of Flow (Ve)	Ft./Sec.	6.0
Slope of Exit Channel	Ft./Ft.	.025
Maximum Water Surface Elevation	Ft. MSL	534.0
Freeboard		
Rainfall Vol. (FH) (Areal)	Inches	26.8 - PAF
Runoff Vol. (FH)	Inches	23.17
Maximum Water Surface Elevation	Ft. MSL	540.5
Capacity Equivalents		
Sediment Volume	Inches	0.60
Retarding Volume	Inches	5.05

May, 1968

10,800 cfs intake

TABLE 4

Annual Cost

Piney Run Watershed, Maryland

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Multiple Purpose Structure & Basic Rec. Facilities	61,299	34,307 <u>3/</u>	95,606
Project Administration			4,990
GRAND TOTAL	61,299	34,307	100,596

1/ Price Base 1967 for installation, O & M - Adjusted Normalized Price.

2/ 100 years @ 3-1/4 percent interest.

3/ Includes \$31,787 for O & M and replacement costs for Basic Recreational Facilities, and \$1,820 for O & M of water supply features.

May, 1968

TABLE 5
Estimated Average Annual Flood Damage Reduction Benefits

Piney Run Watershed, Maryland
(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Non-Agricultural:			
Industrial	1,466	246	1,220
Road & Bridge	9,476	1,593	7,883
Municipal	338	57	281
Subtotal:	11,280	1,896	9,384
Sediment			
Harbor & Channels	14,840	5,380	9,460
Indirect	3,740	917	2,823
Total:	29,860	8,193	21,667

1/ Adjusted Normalized Price

May, 1968

TABLE 6
Comparisons of Benefits and Costs for Structural Measures

Piney Run Watershed, Maryland

(Dollars)

Evaluation Unit	Average Annual Benefits <u>1/</u>					Total	Average <u>3/</u> Annual Cost	Benefit Cost Ratio
	Damage Reduction	Changed Land Use Agri.	Municipal Water Supply	Recreation	Secondary			
Multiple Pur. Structure & Basic Rec. Facilities	21,125	3,470	75,920	150,495	28,246	279,256	95,606	2.9:1
Project Administration							4,990	
GRAND TOTAL	21,125 <u>2/</u>	3,470	75,920	150,495	28,246	279,256	100,596	2.8:1

1/ Price Base - Adjusted Normalized

2/ In addition it is estimated that land treatment measures will provide flood damage reduction benefits of \$542 annually.

3/ From Table 4

May, 1968

INVESTIGATIONS AND ANALYSES

The Soil Conservation Service, in assisting the sponsoring local organizations, employed the following data, sources, methods and procedures in the preparation of this plan.

Hydrology-Evaluation

The watershed was analyzed using the Computer Program for Project Formulation - Hydrology developed by the Central Technical Unit of the Soil Conservation Service. Runoff curve numbers and times of concentration for the five sub-watersheds were computed using data obtained in the sedimentation analysis and Standard Drawing ES-1015.

Streamflow on Piney Run has been recorded from September 1931 to September 1958 at a point just below State Route 32. A discharge frequency curve based on the annual series was developed from the data and was used to relate the results of the computer routing to frequency of occurrence. The storm of record for Piney Run occurred on July 21, 1956 when an intense thunderstorm moved over the watershed. Approximately 5.8 inches of rain fell in about four hours and the resultant flood washed away the gaging station. Later measurements by the U. S. Geological Survey disclosed a discharge of 7,380 cfs at the gage site which is considerably greater than the 100 year event. Daily rainfall records are available for the period 1893 to present at the town of Woodstock, Maryland, located approximately two miles southeast of the watershed.

For purposes of evaluation, the 100 year, 10 year, and 2 year - 24 hour rainfall amounts from the U. S. Weather Bureau's Technical Paper 40 were routed over the watershed by use of the computer program.

The rainfall measured at the Woodstock gage during the 1956 storm and distributed according to an hourly recording gage at Baltimore, 20 miles away, was also routed. The results of the routings were used to plot discharge frequency curves for each evaluation reach in the watershed.

Hydraulics

A total of three damage reaches was used to evaluate damage reduction in the watershed. Cross-sections were then surveyed to analyze the stage discharge relationships in these reaches. Water surface profiles calculated by the Step Method were run to show the protection provided with the project. The presence of an adverse tailwater condition from the Patapsco River will influence flood conditions at the lower end of the watershed.

Hydrology-Design

The structure was designed according to the limiting criteria for proportioning earth dams and associated spillways contained in SCS Engineering Memorandum-27 (rev.). Because of the serious damage that could occur

downstream in the event of a failure, the structure was designed according to class "C" criteria.

It was determined that a single stage riser with a 36-inch diameter principal spillway was the most economical outlet that would meet draw-down criteria and provide the needed protection downstream. The required flood storage based on a 1 percent chance of use emergency spillway was determined according to the procedures set forth in Chapter 21, Section 4-1 of the National Engineering Handbook.

The emergency spillway design and freeboard hydrographs were routed through the reservoir using the method of SCS Technical Release 35. From a normal pool elevation of 524.0, the spillway crest and top of dam elevations were set at the minimums allowed according to SCS design criteria.

A water budget analysis was run to show the effect of seepage and evaporation during a period of drouth. The period of record low flow on Piney Run (1930-33) was used for the analysis. Seepage through the foundation of the dam, with the expected foundation treatment, was estimated by the geologist.

Monthly evaporation amounts were taken from SCS-ES 1016 charts. The deficit at the end of the drouth period between the water budgets run with and without evaporation and seepage was that volume of water attributed to evaporation and seepage loss.

The analysis was run using a design demand of 4.5 mgd. for water supply purposes. This figure was provided by the water supply consultant for the sponsors and includes a 1.0 mgd. release to downstream users.

Engineering

A third order bench level net was established from USGS "L44 1941" BM at Marriottsville to the dam site and along the Piney Run floodplain. A closed traverse loop was run around the perimeter of the dam site and levels carried to the traverse hubs. A 5 ft. contour interval photogrammetric map of Carroll County was furnished by the sponsors and supplemented by a detailed topo survey at the vicinity of the dam site. This map was used to plot stage-storage and stage-area curves and to show the extent of the beneficial and flood prevention pools for easement purposes.

Valley cross sections were run along the flood plain of the Piney Run Watershed. Also, locations and elevations of buildings, roads, bridges, culverts, and other structures were obtained.

Geologic investigations were tied in by level and traverse surveys to the dam site topographic map.

In working with the Carroll County Commissioners and their water supply consultant, it was decided to use elev. 524.0 msl. for the water supply pool and elev. 505.0 msl. for the recreation pool. This provides for a year around permanent recreation lake of 146 acres in surface area.

The dam will be of the zoned earth fill type with a 22 foot top width and three to one side slopes upstream and downstream. The fill will consist of material excavated from the emergency spillway and selected core material to be obtained from a borrow area downstream from the site. The upstream face of the dam will be protected by rock riprap between the normal pool and the recreation pool.

The principal spillway system will consist of a single stage open top riser, a 36-inch reinforced concrete pipe and an impact basin outlet.

The foundation of the dam site presents two alternatives. The first includes excavating the undesirable material along the cutoff trench and partially grouting the left abutment, with a 20 ft. wide concrete pad along the cutoff trench below elevations 524.0 msl. The second includes excavating the soil material and grouting all the dam site. Also, an outcrop area in the left abutment will be removed and blanketed.

A drainage system to take care of anticipated seepage through the dam and abutments is included in the downstream section of the dam.

A 250 foot-wide vegetated emergency spillway with 3:1 side slopes will be constructed on the right abutment. A 12 foot berm on the right side of the emergency spillway will be provided to divert the slope water out of the spillway channel.

The water supply intake tower, its appurtenances and a 24-inch waterline through the dam will be located on the left abutment separate from the principal spillway.

Geology

The preliminary geologic investigation of the site included examination of maps and geologic literature relative to the area, a field surface reconnaissance, seismic soundings, backhoe test pits, power auger sampling, and embankment foundation core boring and testing. Sufficient data have been obtained to indicate the depth to and approximate configuration of unweathered rock, thickness and character of weathered bedrock, presence of fractured rock material, thickness and character of soils overlying bedrock, evidence of past mining activity in the vicinity, and the complexity of foundation conditions.

The structure site is located within the Peters Creek Formation, believed to be Pre-Cambrian age, and consisting mostly of quartzite and schist rock types.

The site consists of a hodgepodge of predominantly highly micaceous schist interbedded with Chlorite schist and quartzite, with serpentine and talc encountered at unpredictable locations. Quartzite veins generally 1 to 2 inches thick are scattered throughout subparallel with schistosity and remnants of original bedding.

In general, the geologic investigation revealed residual soils, composed mostly of clays and silts of low plasticity, from five to six feet deep covering highly weathered mica schist ranging in thickness from 10 to 40 feet.

Soil removed from the emergency spillway will be suitable for the zoned earth fill of the structure and more impervious material needed for the cutoff is available near the site.

Additional geologic investigation is planned prior to construction.

A summary of the core and seismic data is shown below:

Piney Run, Site #1

Summary of Geologic Data from Drill and Seismic Investigations

	Left Abutment	Center	Right Abutment	Emergency Spillway	Special Borrow
Soils	Residuum CL-ML Avg. 0-5' depth	Alluvium 5'- 10' Top CL w/GCs + GMs beneath	Residuum CL- ML 5' - 10' depth	Residuum 6' Avg. Sapro- lite CL-ML 6' to 15'	15' + CL
Wea.					
RX	Wea. Schist + Qtzt. Far left abut. 15-40' depth	Less than 5' thickness Schist + Qtzt.	Exceeds 15' depth wea. Schist	Exceeds 40' depth. Exca- vates as cobbly GM be- low 15' depth	Wea. Shale 15' + Ex- cavates as CL - GC
Sound					
Rock	Outcrop Qtzt + Schist near left abut.	Qtzt + Schist beneath soils + thin wea. RX	Mod. wea. Schist 15' to 20' depth	Schist (Mica) below spillway design cut	
Excess Seepage	20 - 40' depth from ground sur- face	Less than 20' depth from ground sur- face	Less than 20' from ground surface		

Economics

The basic information on flood damage was obtained from personal interviews with property owners and county officials and recorded on flood damage schedules. This information is related to the flood of July 20, 1956. The sponsoring organizations cooperated in contacting the owners of all commercial, industrial and residential property on the Piney Run flood plain. Damages for stages above and below the 1956 flood level were appraised in one foot increments.

The damage estimates were tabulated by stages and converted to adjusted normalized prices.

All costs to be incurred during the 5-year project installation period were based on the November 1967 price level. Operation and maintenance costs have been converted to adjusted normalized values.

Floodwater damages and benefits were computed using the frequency method as described in Chapter 3, Page 2, of the Economics Guide, Soil Conservation Service. Separate damage frequency analyses were developed for each reach using the frequency stage data provided by the hydrologic study. Damages and benefits affecting residential, municipal and industrial property were computed under (1) conditions without the project; (2) conditions after the installation of the proposed land treatment; and (3) conditions with all measures installed. Indirect damages were estimated to be 20 percent of direct non-agricultural damages and 10 percent of the direct sediment damages.

Changed land use benefits were estimated based on shifting of truck crop production from the uplands to the floodplain and replacing them with hay and pasture. Benefits were calculated based on the difference in net income from both areas for before and after the adjustment. Yield data for present conditions were gathered in the field and crop production data used were based on figures taken from the Maryland Farm Planning Handbook, Department of Agricultural Economics, University of Maryland. Estimated flood free yields were based on information contained in the SCS Technical Guide for the soils involved considering a high level of management. About 55 acres of flood plain will be converted to truck crops as a result of the project.

Sediment benefits were based on the cost of maintaining the Baltimore Harbor and Channel pro-rated to Piney Run on the basis of drainage area controlled in proportion to the total drainage area contributing sediment. Cost estimates per cubic yard of sediment removal were obtained from the Corp of Engineers, Baltimore District. Trap efficiency of the present structures in the watershed was considered.

Recreation benefits were assigned to the multiple purpose structure based on guidelines from the Maryland Department of Forests and Parks. The population is within one hour driving distance or a 50 mile radius exceeds 2,500,000. Availability of similar water-oriented facilities in the area, and the design-load capacity of the proposed development were considered.

The total annual demand for day use recreational facilities will exceed the design capacity of the facility. It is estimated that visits to the recreational lake would be 100,300 annually. A value of \$1.50 per visit was used to calculate the recreational benefits. The value of local secondary benefits stemming from, and induced by the project were estimated to be 10 percent of the direct primary benefits and 10 percent of the annual operation and maintenance cost respectively.

Fish and Wildlife

The Bureau of Sport Fisheries and Wildlife, U. S. Department of Interior, in cooperation with the Maryland Department of Game and Inland Fish, made a reconnaissance study of the watershed. They have expressed concern that future withdrawal of water for consumptive use will be diverted into adjoining watersheds where its final disposal will also be outside the Piney Run watershed. During extended periods of drouth and drawdown the base flow will depend entirely on seepage and ground water supplies augmented by the 1.5 cfs by-passed through the structure. The extent and severity of future damages to fishing habitat cannot be determined at this time.

The habitat provided in the impoundment will support similar species of fish as are in the stream and will more than offset the loss of fishing opportunity. Damage to wildlife will be limited to small game species and is expected to be minor. The impoundment which will vary in surface area from 146 to 298 acres will provide a moderate quality lake fishery. Specific impoundment clearing plans and provision for haul seine areas will aid in management of the fishery resource in the multiple purpose structure.

Water Supply

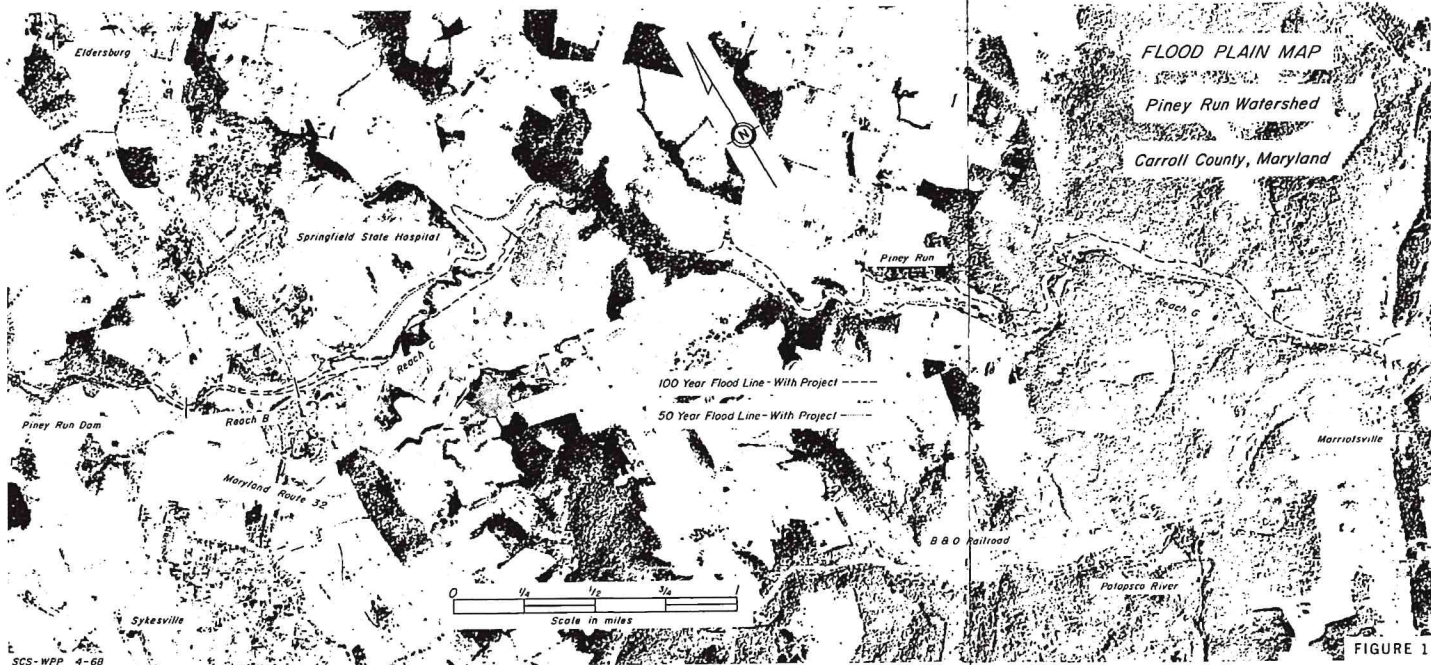
The sponsors retained Matz, Childs and Associates of Baltimore, Maryland, as engineering consultants to prepare the work plan water supply features of the proposed project. Estimates of present and future needs for water storage capacity needed in the structure, costs for the water supply features and engineering services costs were provided by the consultant. Estimates of water supply costs for alternative sources of supply were also made by the consultant. These were used to estimate water supply benefits and confirm the fact that the Piney Run structure provides the most feasible and economical source of water supply. Cooperation between the consultant and the Service has resulted in mutual concurrence in all figures pertaining to the cost and proportions of the multiple purpose structure.

Land Treatment

Land treatment to be applied as part of this work plan is expressed as the number of acres in each general land use which will receive essential treatment during the project period. Farm owners and operators were interviewed to determine the needed conservation treatments.

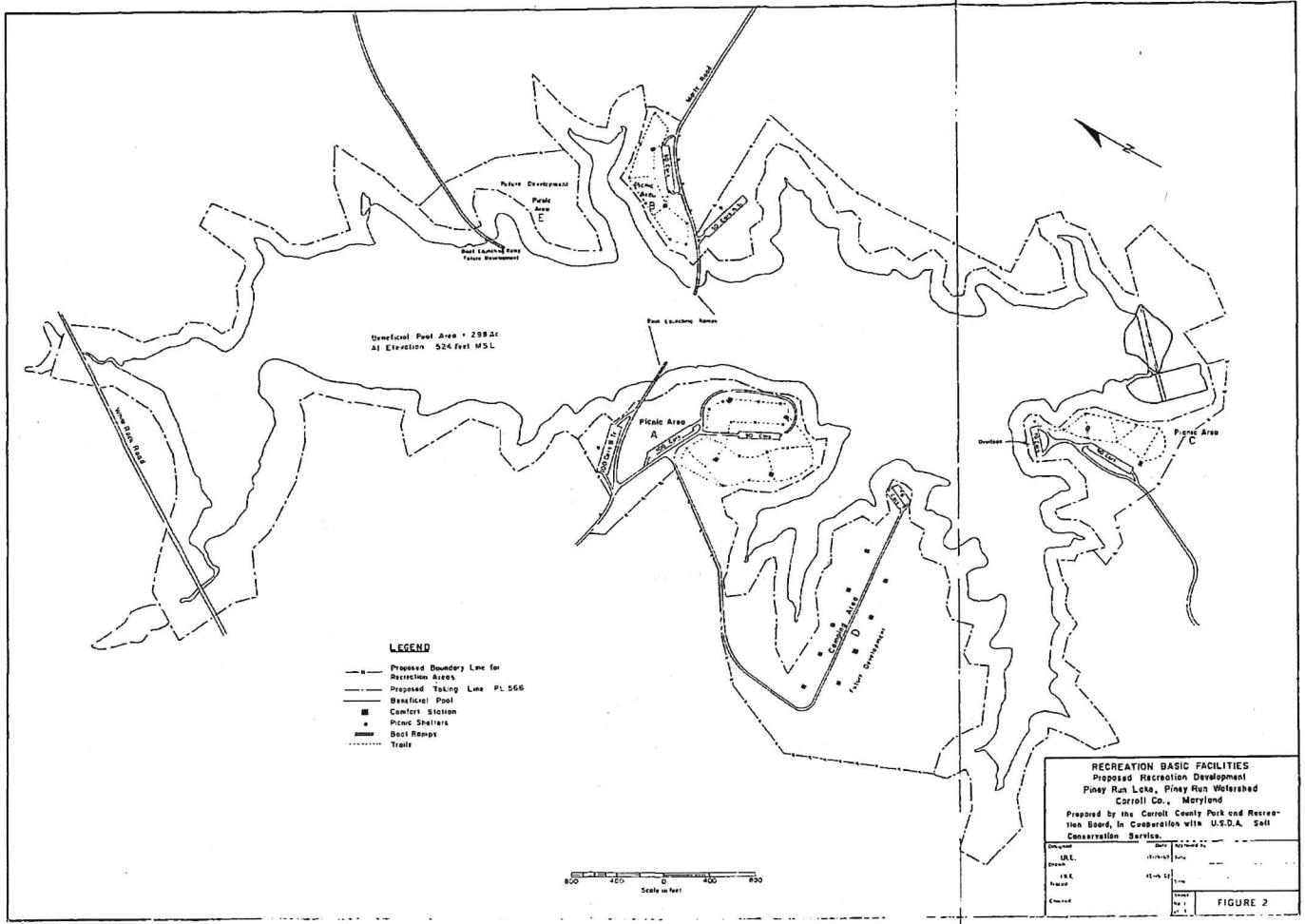
The forest land treatment program was cooperatively developed by the Maryland Department of Forests and Parks and the U. S. Forest Service from field data collected by these agencies and from soil and land use recommendations provided by the Soil Conservation Service. The program includes those measures that can be reasonably installed by the landowners during the 5-year installation period. The measures include 100 acres of tree planting and 50 acres of hydrologic stand improvement. This will involve the preparation of 21 management plans.

Information on the hydrologic condition of the forest land in the watershed and the reasons for the present hydrologic condition were obtained in a series of systematically selected field plots. The information obtained included measurements of litter and humus layers, determination of soil type and other hydrologic factors, and recording the presence or absence of disturbance factors such as fire, grazing, cutting, logging and the abnormal infestation of insects or disease which might adversely affect hydrologic condition or increase fire hazard. This information formed the basis for developing the forestry program and the precipitation - runoff curve numbers for the forest land.

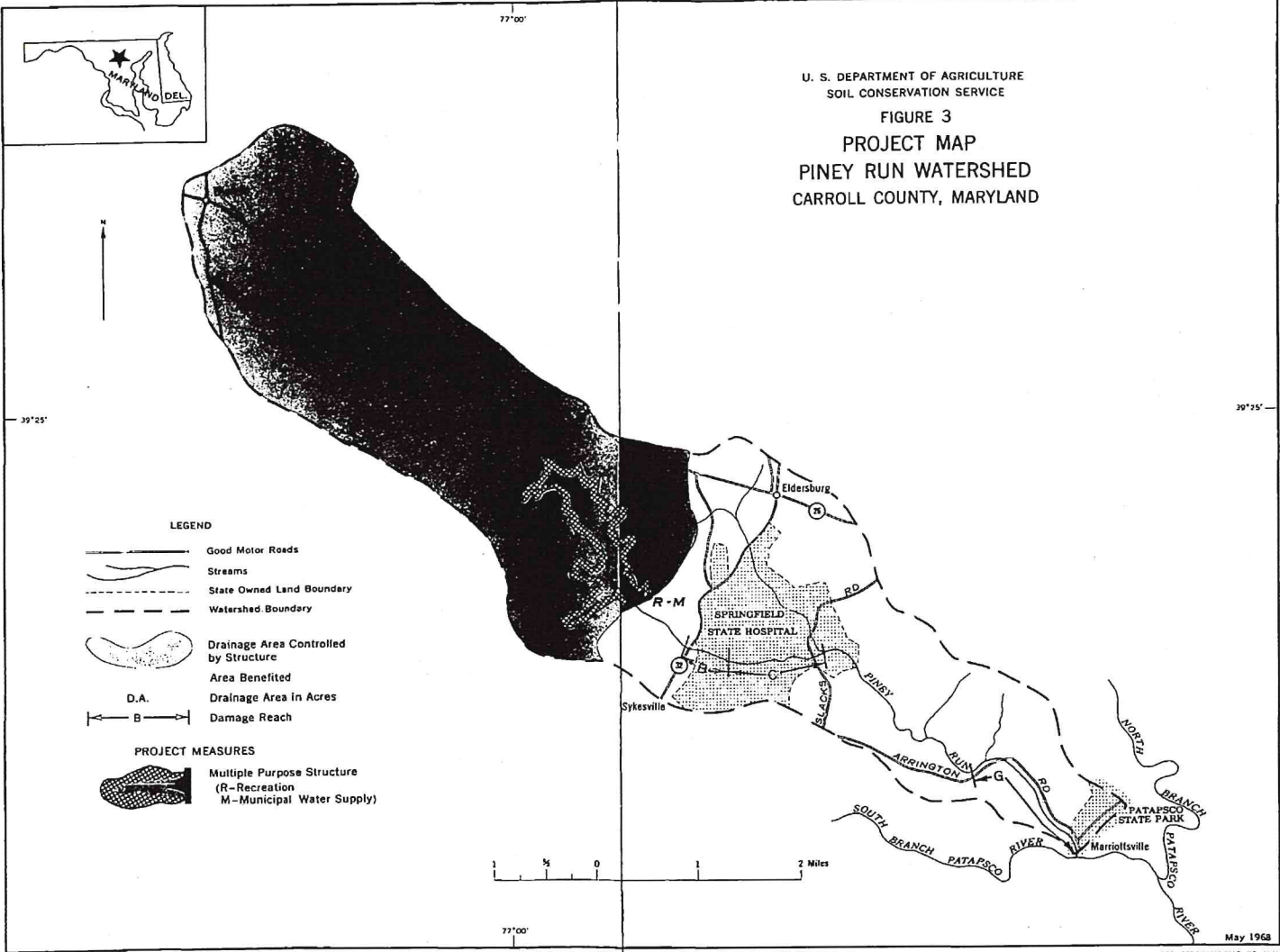


SCS-WPP 4-68

FIGURE 1



U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 FIGURE 3
 PROJECT MAP
 PINEY RUN WATERSHED
 CARROLL COUNTY, MARYLAND



- LEGEND**
- Good Motor Roads
 - Streams
 - State Owned Land Boundary
 - Watershed Boundary
 - Drainage Area Controlled by Structure
 - Area Benefited
 - Drainage Area in Acres
 - Damage Reach
- PROJECT MEASURES**
- Multiple Purpose Structure
(R-Recreation
M-Municipal Water Supply)

