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REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF TH--ETC(U)
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U.S. ARMY ENGINEER DISTRICT PHILADELPHIA
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DELAWARE RIVER BASIN REPORT

DEC. 1960

VOL. XI

APPENDIX V. BENEFITS AND COST ALLOCATIONS

APPENDIX W. RECREATION NEEDS AND APPRAISALS

APPENDIX X. STUDY OF THE GOVERNMENTAL ORGANIZATION FOR THE WATER RESOURCES OF THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN REPORT

APPENDIX V ERRATA SHEET 3 January 1961

1. Page V-2, line 9. - After the words "year 1958" insert the symbol "1/". At the bottom of the page add footnote: "1/ Adjusted to 1959 price levels as stated in paragraph 2".

2. Table V-5. - Amend footnote to read: "1/ Total project costs include 1959 estimated cost of flood control project under construction".

DELAWARE RIVER BASIN REPORT

ERRATA SHEET

APPENDIX W

3 January 1961

1. Paragraph 37, line 18. - Delete "876,000" and insert "786,000".

2. Paragraph 53c, line 2. - After the word "unit" insert the words "per 200 persons".

(6)

REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF THE DELAWARE RIVER BASIN

Volume XI.

APPENDIX V thru X.

BENEFITS AND COST ALLOCATIONS

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APPENDIX V

BENEFITS AND COST ALLOCATIONS

SECTION I - INTRODUCTION

1. SCOPE. In comprehensive water resources developments involving a multiplicity of project functions encompassing Federal and non-Federal interests, the project costs must be allocated among project purposes to provide sound bases for economic appraisals and for sharing of project costs. There are presented in this appendix the estimated average annual benefits for each purpose, analyses of individual project costs, and the allocation of project costs to the various purposes served by the major control projects in the Water Control Plan. The overall plan of development for the Delaware River Basin consists of 58 elements. This appendix treats in detail only the eleven major control impoundments for multi-purpose development as identified in appendix Q and as summarized in table V-1. Details of benefits and costs for the other elements of the plan of development are given in appendices R, U, and W.

SECTION II - BENEFITS

2. BASIC ASSUMPTION FOR MEASUREMENT. The benefits discussed herein are the values of the goods and services associated with the long and short-term storage capacities in the major control impoundments. They are measured at their point of production and reflect the cost of obtaining the same quality and quantity of the goods or services from alternative developments that would most likely be utilized in the absence of projects under investigation or from projects currently being utilized to satisfy these needs. All benefits have been converted to a common time basis and adjusted to 1959 price levels. In those cases where the benefits accrue on other than a uniform annual basis they have been converted to equivalent annual amounts by applying appropriate discounting techniques. The benefits for the individual goods and services are described below and summarized in table V-2.

3. Reduction of Flood Damages. The flood control effects of short-term storage allocations in the proposed projects were determined by routing experienced and hypothetical floods on the various streams, assuming existing reservoirs and those under construction to be fully effective, with and without the proposed projects in place. The results of the routing computations were used to define modified flood discharge-frequency relationships. The latter were used to derive damage frequency curves modified for the effects of short-term storage allocations in each project. The average annual flood damages,

with the proposed projects in place, were computed for damage reaches below each project in the same manner as that used for computing average annual damages with existing and under construction projects in place, as described in appendix D. The differences in average annual flood damages without and with the proposed projects in place are the flood control benefits credited to each proposed project. Details of these determinations are given in table V-3. These benefits reflect the level of physical development in the affected areas for the year 1958.1/ Annual benefits were then projected over the 50-year economic life of the individual projects based on trends of flood plain development discussed in appendix D. The actual time period during which these benefits will accrue and the order of project development are in accordance with the time phasing as presented in appendix Q. Future projection curves of average annual benefits were converted to equivalent uniform annual series by compound interest methods using a 2-1/2% interest rate. Average annual benefits from reduction of flood damages are summarized in table V-4.

4. Insofar as the level of flood control benefits is a function of the time period over which these benefits accrue and the order in which projects are developed, it was also necessary to evaluate the justification of flood control purpose within each project under conditions of minimum benefit accrual. Assuming that each project would be the last project added to the system and the benefits from reduction of flood damages would accrue over a 50-year period, it was possible to simulate the condition for minimum benefit accrual for flood control. It was considered that a last added project would not be required prior to 1980. The phasing of the other projects with regard to the demands for supplies of water preclude the development of any last added project before that time. Studies made utilizing the above conditions demonstrated that the benefits from flood control based on their minimum level of accrual were still of sufficient magnitude in each case to cover all costs allocated to that purpose.

5. In addition to the annual flood benefits listed above, estimates were made of benefits attributable to the increased or higher utilization of property made possible through provision of reductions of floods. To obtain expected increases in the market value of land as a result of flood reduction, a field survey was undertaken in the affected areas which included appraisals of expected changes in land values by local real estate personnel and planning commissions. These expected changes could not be pinpointed to specific areas but were found to be applicable to widespread reaches of the streams under consideration. These benefits reflect increased market values of lands throughout the 50-year economic life that would otherwise remain unchanged in the absence of measures for reducing flooding. These increased market values were converted to annual values by application of a long-term financing rate of 5 percent, the approximate rate at which the market capitalizes net income into land value.

1/ Adjusted to 1959 price levels as stated in paragraph 2.

6. Supplies of Water. Average annual water supply benefits associated with the long-term storage allocations for the projects in the recommended plan of development were derived from and limited by experienced costs of obtaining the same quantity and quality of water by alternative means throughout the Delaware River Basin. This procedure afforded a limiting minimum measure of benefits reflecting the present costs to the users of water supplies in the areas involved. Procedures for evaluating supplies of water on an absolute or intrinsic value basis have not been devised. The adopted method of evaluation provided a control on the costs which reasonably may be incurred for water supply features in the water control plan. These costs were based on non-Federal practices for alternative works and non-Federal financing and interest rates. Costs for eleven existing non-Federal water supply storage projects were obtained from public and private water supply companies, and adjusted to 1959 price levels. Estimated costs for two potential water supply storage projects studied in this and prior reports were also developed. These costs were converted to average annual values by amortizing the estimated investment costs over a 50-year period at an interest rate of 4 percent. To these were added estimated charges for operation and maintenance. These average annual costs for the thirteen projects were related to net yields in cubic feet per second (cfs) for each of these projects. The measure of water supply benefit to be assigned to each project would be the value of providing an equivalent net yield from the existing and potential sources of supplies of water that would be utilized in the absence of a given project. From the data obtained on average annual project costs and associated net yields, a generalized relationship was established between total project net yields and annual costs per cfs for these thirteen projects. This revealed an inverse relationship between cost per cfs and total net yield. Specific average annual water supply benefits for each project in the recommended plan of improvement discussed in this appendix were obtained initially by determining for each project the average value per cfs for that site alone. From the relationship discussed above an average value per cfs for a given site was obtained by using the estimated total net yield from that project to select the appropriate cost per cfs from the generalized relationship. For instance, the average value per cfs for the Aquashicola project with a net yield of 63 cfs computed from the relationship was $10,100 while for the Tocks Island project with a net yield of 968 cfs, the average value per cfs was $4,900. These values are summarized below:

Project	Net Yield in cfs	Average Annual Value per cfs (From Relationship)
Aquashicola	63	$10,100
Beltzville	80	9,500
Trexler	55	10,500
Bear Creek	196	7,400
Blue Marsh	65	10,000
Maiden Creek	134	8,200
Prompton	57	10,400
Tocks Island	968	4,900
Hawk Mountain	465	5,900
Newark	43	20,200 1/
Christiana	34	20,200 1/

7. These projects were then grouped into subbasin categories according to their general locations. Aquashicola, Beltzville, Trexler and Bear Creek were placed in the Lehigh; Blue Marsh and Maiden Creek in the Schuylkill; Newark and Christiana in the Christina; and Prompton, Tocks Island, and Hawk Mountain in the Main Stem (Delaware River). Total initial annual benefits for each site were then computed by multiplying total net yield by average value per cfs for each project. Next, the weighted average for each subbasin group was computed as follows:

Project Grouping	Total Group Net Yield (cfs)	Total Group Benefits	Average Annual Value per cfs for Group
Lehigh, 4 projects	394	$3,424,200	$ 8,700
Schuylkill, 2 projects	199	1,748,800	8,800
Christina, 2 projects	77	1,555,400	20,200
Main Stem, 3 projects	1,490	8,079,500	5,400

It was reasoned that, while estimates of costs for specific alternatives for each project considered herein would undoubtedly result in varying values per cfs, the determination of an overall average value for supplies of water, measured in cost per cfs, for a given group of projects would best reflect the overall comparative worth of producing supplies of water within the area served by that group of projects.

1/ Based upon the average value per cfs for the Octoraro project on Octoraro Creek, the Pickering project on Pickering Creek, and the Springton project on Crum Creek.

It is noted that the worth or benefits per cfs for projects in the Schuylkill, Lehigh, and Christina basins are substantially greater than the overall average value estimated for the three projects on the main stem of the Delaware River. This does not mean that supplies of water in the former areas are intrinsically worth more than similar supplies on the main stem. The variation essentially reflects that the geographic limitations to scale of developments in these areas preclude the development of projects, located therein, to achieve the savings resulting from major economies of large scale development to be secured from the larger projects such as Tocks Island and Hawk Mountain. That the benefit per cfs is greater in the Lehigh, Schuylkill, and Christina than on the main stem must be viewed from the standpoint of the alternative costs of making available supplies of water in a given area and not from some intrinsic evaluation of the true worth of a cubic foot of water.

8. These average values computed in the above fashion for each of the four project groups were used in the final measurement of average annual water supply benefits for the projects considered. The total average annual benefits for each project were obtained by multiplying the total net yield at a given project by the appropriate value per cfs depending upon the group in which the project was located. These values were then modified by appropriate discounting techniques to adequately account for the period of time required before the full benefits from supplies of water can be realized at a given project. For this purpose a 2-1/2 percent discount rate was employed in accordance with the time sequence of projects presented in appendix Q. These benefits were discounted for that period in which the net yield for a given project exceeded the requirements for flow augmentation.

9. Irrigation. Supplies of water for irrigation have been accounted for in assigning long-term storage capacities for the major impoundment projects as explained in appendix P. The benefits to irrigation as a result of providing supplies of water were included in the overall estimates of benefits accruing to water supplies as discussed in paragraph 8.

10. Fish and Wildlife. The effects of the Water Control Plan on fish and wildlife resources are discussed in appendix J. It is stated therein that no beneficial wildlife effects may be expected. Certain incidental fishery benefits are contemplated in connection with combined cold and warm water fisheries that would develop in the impoundments. No monetary equivalent of these values is presented.

11. Recreation. Recreation benefits are associated with the long-term storage surface areas for the individual projects. Monetary benefits assigned to recreation were based on a visitor-day rate of $1.60 as discussed in appendix W. This rate represents a weighted average visitor-day value for such recreation activities as picnicking, swimming, fishing, boating, camping, sight-seeing, nature study and other outdoor pursuits. To arrive at the average annual recreation benefits for each project this rate was applied to the total annual net attendance expected at the project upon its completion. Net annual attendance is defined as the difference between the total annual attendance at the completed project and the visitation estimated for the project locality prior to construction of the project.

12. Power. Power benefits to be secured from the Water Control Plan will be derived from the proposed hydroelectric installation in Tocks Island and Hawk Mountain projects as discussed in appendix F. The value of this power is measured by the cost of providing an equivalent supply of power for the market under consideration from the most likely alternative source. The values are expressed in dollars per year per kilowatt of dependable capacity and mills per kilowatt-hour of average annual energy. Interruptible capacity, the difference between the dependable capacity and the rated capacity, is evaluated at one-half the value of dependable capacity. Existing generating capacity in the Delaware River Service Area is predominantly privately-owned, steam-electric capacity, and current expansion programs call for the addition of considerable amounts of thermal capacity to meet future needs. For this study, therefore, privately-owned steam-electric plants of sizes and characteristics likely to be used by utilities in the area are taken as the source of power value alternatives to the Tocks Island and Hawk Mountain projects. The final capacity and energy values for the power produced at the Hawk Mountain and Tocks Island sites and for conventional plants were determined in power valuation studies made by the Federal Power Commission as discussed in appendix F, and by two Power Work Groups for the pumped-storage plant as discussed in appendix T. The following are the annual unit values of power at the high tension bus bars of the steam-electric plants assumed as an alternative measure to the two projects.

		Tocks Island		
Item	Unit	Conventional Power	Pumped-Storage Power	Hawk Mtn.
Capacity Value	$/kw	28.00	24.74	29.00
Energy Value	Mills/kw-hr.	3.2	3.125	3.1

These values were applied to the power capacities and average annual energy for the hydroelectric power facilities listed below:

Project	Installed Capacity (kw)	Dependable Capacity (kw)	Average Annual Energy (million kw-hr)
Tocks Island			
Conventional Installation	46,000	20,000	281.5
Pumped-storage	366,000	342,000	732.0
Hawk Mountain	21,000	11,000	93.8

13. Navigation. Studies made to determine the effects of the Water Control Plan revealed there would be no additional navigation benefits over and above those resulting from existing or proposed navigation improvements. The effects of the Water Control Plan on the Delaware River above Trenton would not improve the economic feasibility for navigation in that reach, nor would the resulting flow augmentations below Trenton have any effect on channel shoaling or the cost of maintenance dredging. These studies are discussed in detail in appendix E.

14. Pollution Abatement. In assessing the needs for the control of pollution, it was determined that primary means for satisfying this requirement placed on water resources must be a continuation of the present standards of waste treatment in all states of the basin with higher standards ultimately required. The resulting low flow augmentation will not reduce the degree of treatment presently required nor the degree of additional treatment in the future. It was impractical to credit the low flow augmentation with savings from possible delayed investments in future treatment facilities. Accordingly, no monetary benefits have been assigned to the elements of the plan for pollution abatement.

15. Detrimental Project Effects. In evaluating the overall benefits described above, account was taken of the detrimental or adverse effects of the plan of improvement on such uses of the water resources as recreation, fish and wildlife, transportation, and supplies of water. In those cases where such detrimental effects might occur, consideration was given to adjusting the total benefits so as to reflect only the net average annual benefits. appendix J contains a generalized treatment of the damages expected to fish and wildlife resources as a result of the Water Control Plan, together with the acres of land and miles of stream that would be required to replace these resources in kind. As with fish and wildlife benefits, no monetary equivalent for these means of recovering such damages is presented. In the case of the Tocks Island project some facilities for fisheries have been included and are considered in the overall cost of joint use facilities.

16. Intangible Benefits. The estimates of benefits consist of only the monetary evaluation of the goods and services produced by the proposed plan of improvement. In addition, there will be secured from this plan other real benefits not susceptible of monetary evaluation which have been taken into consideration in the formation of the plan of development. These include the prevention of loss of life, which amounted to 99 lives in the August 1955 flood; the assurance values from assigning of short-term storage capacities somewhat in excess of levels defined by maximized net monetary benefits so as to avoid a false sense of flood security to the residents in the urban downstream reaches; and the value of the esthetics and geography in providing site developments to insure the realization of optimum recreational benefits.

17. The evaluation of the various monetary benefits listed above serves as a measure of their individual contribution to the economic and social well-being of the region. In addition there is also an intangible benefit realized from the collective contribution of developing projects to serve as many water resource functions as economically feasible. This is an essential element of the balanced program approach employed in the formation of the plan of development throughout this report.

SECTION III - ANALYSIS OF COSTS

18. PROJECT COSTS. Project costs include estimates of first cost, investment cost, annual economic cost, and annual financial cost. All costs have been adjusted to the 1959 price level. As a basis for allocation of costs to project purposes, annual charges are computed at a consistent interest rate of 2-1/2 percent. All costs and annual charges for the eleven major control impoundments are summarized in table V-5.

19. Estimate of Investment Cost. Investment costs are the sum of project first costs and the accrued interest on those costs up to the time the project services become available. First costs consist of the costs of such items as lands and damages, relocations, reservoir clearing, dam and appurtenant works, dikes, access roads, building and utilities, engineering and design, and supervision and administration. Total first costs are shown on line 1 of table V-5 and the details are given in appendix T, appendix U, and appendix W. These costs are shown as either joint-use facility costs or as specific costs. Joint-use facility costs are defined as the cost of facilities used for more than one purpose, such as the dam and reservoir. Specific costs are defined as the costs of project features normally serving only one specific project purpose, such as the cost of a powerhouse or a picnic table. This breakdown of costs is carried through all estimates shown in table V-5. Accrued interest during construction was computed by applying the 2-1/2 percent interest rate to the total first cost estimate over one-half the construction period in years. The estimated construction periods for the major control impoundments are shown below:

	Construction Period (in years)		
Project	Joint-Use Facilities	Recreation	Power
Hawk Mountain	4	2	4
Prompton	2	2	-
Tocks Island	5	4	4
Bear Creek	3	2	-
Beltzville	3	2	-
Aquashicola	3	2	-
Trexler	2	2	-
Maiden Creek	3	2	-
Blue Marsh	2	2	-
Newark	2	2	-
Christiana	2	2	-

20. Annual Charges. For the purposes of project evaluation and cost allocation studies, estimates of annual charges were computed using the following items:

a. Interest and Amortization. Annual amortization and interest charges were computed over the economic life of the project estimated at 50 years, using 2-1/2 percent as the interest rate.

b. Operation and Maintenance. Estimates were made of annual operation and maintenance charges which would prevail over the economic life of the project. Separate estimates were computed for joint-use facilities and specific facilities.

c. Major Replacements. Estimates were made of equipment or other project features which would require replacement during the life of the project, such as pumps, generators, and other major items beyond the normal operation and maintenance.

d. Economic Cost of Land. This is the value of the land and alternative uses which are foregone as a result of these lands being required for the project. Estimates of these economic values were based on the market value of such lands, exclusive of acquisition costs, converted to an annual loss of net income by amortizing at 5 percent over the 50-year period.

e. Taxes Foregone. For those projects with power facilities the economic costs of taxes foregone were computed. This is the value of the amount of all taxes which would not be collected as a result of a Federal power development rather than the most likely non-Federal development. These values were determined by the Federal Power Commission and are discussed in detail in appendix F.

f. Annual Economic Costs. The sum of the above items gives the total annual economic costs. These are the costs of the establishment, operation, maintenance, and replacement of the projects including any losses due to adverse effects whether or not these are paid for directly. These differ from the annual financial costs by the value of economic cost of land and taxes foregone which are subtracted from the annual economic costs.

21. ALTERNATIVE COSTS. Estimates of alternative costs for individual single purpose projects were used in cost allocation studies as bases for limiting the benefits and for identification of separable costs in the separable cost-remaining benefit cost allocation analyses. The average annual economic charges for alternative single purpose projects are given in table V-6. These

costs consist of similar charges to those considered for the proposed multiple purpose projects. The bases for computing those alternative costs are described in subsequent paragraphs.

22. Alternative Cost for Reduction of Flood Damages and for Supplies of Water. The bases for selecting alternative single purpose projects for flood control and water supply were: (1) that the alternatives would produce the same level of benefits as provided for these purposes in the multiple purpose projects, and (2) that the alternatives considered be the most economical projects to be developed for these purposes. In the formation of the plan of development it has been demonstrated that the projects selected had the best potentials for either long and/or short-term storage capacities in the area served by these projects. Consequently, the best alternative single purpose projects would be at the sites of the proposed projects. In the case of the existing Prompton and Bear Creek flood control projects proposed for modification to include long-term storage for water supplies, the best alternative single purpose projects would assume the existing sites to be undeveloped. Estimates were made of costs of alternative flood control and water supply projects and reduced to annual charges by amortizing the investment costs at 2-1/2 and 4 percent, respectively. The 4 percent rate was used for supplies of water to be consistent with the benefits assumed. For use in identifying separable costs, as explained below, the annual costs of alternative single purpose water supply projects were computed also at 2-1/2 percent interest. The alternative cost developed here should not be confused with the benefits which were computed on the basis of overall experienced costs of existing projects used as alternatives. In the cost allocations which follow, costs to be allocated to supplies of water are based upon either the benefit or alternate cost, whichever is less. In order to identify separable costs for power installations at the Tocks Island project, an estimate was made for a flood control and water supply dual-purpose project at the site. The dimensions and estimated costs for single purpose projects for reduction of flood damages and supplies of water are shown in table V-7.

23. Alternative Cost for Recreation. The alternative cost for the recreation features in each project was based upon $1.05 per visitor-day which is the average per visitor-day charge for state parks in the region as presented in appendix W. This estimate consists of similar charges to those specific recreation costs for the multiple purpose projects. The total annual alternative recreation cost was arrived at by applying this rate ($1.05 per visitor-day) to the total annual net attendance expected at the proposed project.

24. Alternate Cost for Power. The alternative costs for obtaining the same energy output from conventional power facilities at the Hawk Mountain and Tocks Island projects are the same as the power benefits described in paragraph 12 and appendix F. The alternative cost for the pumped-storage facilities at Tocks Island was based upon an alternative pumped-storage plant without the Tocks Island dam and reservoir. The estimated cost of this alternate pumped-storage project was based on an estimate, by a firm of consultants, for private development of the project. To the basic estimate of cost for 366,000 kw installed capacity in a pumped-storage project, costs were added for land and damages for the upper and lower reservoirs, for clearing both reservoirs, for engineering and design (in accordance with methods followed in estimates by Corps of Engineers) and for supervision and administration (in accordance with estimates by Corps of Engineers). Including the interest during construction (at 6% interest rate) the estimated investment cost for the alternate project was determined to be $57,200,000. This estimated cost was used to establish the annual charges for alternate pumped-storage facilities for the Tocks Island project.

SECTION IV - COST ALLOCATIONS

25. SEPARABLE COSTS - REMAINING BENEFITS METHOD. Allocation of costs for each major impounding project was made to obtain the equitable distribution of the costs of a multiple-purpose project among the purposes served. All project costs were allocated by the separable costs-remaining benefits method wherein each function is assigned at least its separable cost, and not more than its alternative cost or benefit, whichever is the lesser. An amortization period of 50 years at 2-1/2 percent was used in these allocations. This method provides for an equitable sharing among the purposes in the savings resulting from multiple-purpose development. The cost allocations for each project are given in tables V-8 to V-18, inclusive. For the purposes of comparison, a cost allocation for Tocks Island project with pumped-storage omitted as a project purpose is shown in table V-19. The recreation costs and benefits used in the cost allocation studies are only those portions of the costs and benefits which are directly associated with the multiple-purpose development at each project. The determination of those recreation features directly associated with each multiple-purpose project is presented in detail in appendix W.

26. Separable Costs. The separable cost for each project purpose is the difference between the cost (at 2-1/2% interest) of the multiple-purpose project and the cost (at 2-1/2% interest) of the most economical alternative project to obtain the same benefits of the other purposes with the specified purpose omitted. Since a recreation potential was inherent at each site because of the attraction afforded by open areas and limited impoundments for conservation or sediment accumulation purposes, specific costs for directly related recreation were used in lieu of separable costs. Separable costs for power include specific costs for power facilities plus the identifiable additional cost of including that purpose in the project.

27. Allocation of Costs for Modifying Existing Projects. According to the time sequence for project development given in appendix Q, the modifications required at Prompton and Bear Creek will be made after the existing flood control projects have been in operation for 15 and 29 years, respectively. For purposes of allocating costs on a consistent basis and to assure that the savings from multiple-purpose projects at these sites would be shared equitably by all purposes, it was necessary to allocate the total costs for each project, including the cost of the completed flood control project and modification costs, as if the project were to be developed for full multiple-purpose potential at the time of modification.

28. Reallocation of Operation and Maintenance Costs for Future Supplies of Water. Under the provisions of the Water Supply Act of 1958 (Title III of Public Law 85-500), an amount not to exceed 30 percent of the total project cost would be allocated to future supplies of water in the Federal interest projects of the Water Control Plan, and repayment of this amount would be deferred until use of future supplies is initiated. The operation and maintenance costs allocated to supplies of water for each project were suballocated to initial and future supplies by direct assignment of the specific portion of these costs and by distribution of the remainder or joint-use portion on the basis of the first costs assigned to these two purposes. The operation and maintenance costs related to future supplies of water were then reallocated to other project purposes for the deferral period as shown in table V-20. An example of the procedure followed in determining operation and maintenance costs for current and future water supply, and the procedure used to suballocate those costs for future water supply to the operation and maintenance costs for other project purposes is shown in table V-21 for the Beltzville Project.

TABLE V-1

MAJOR CONTROL IMPOUNDMENTS

Project	Location	Purposes Served (See Legend)
Hawk Mountain	East Br. Delaware River, N. Y.	W.S., Rec., F.&W., Pwr.
Prompton 1/	Lackawaxen River, Pa.	F.C., W.S., Rec., F.&W.
Tocks Island	Delaware River, N. J., Pa.	F.C., W.S., Rec., F.&W., Pwr.
Bear Creek 1/	Lehigh River, Pa.	F.C., W.S., Rec., F.&W.
Beltzville	Pohopoco Creek, Pa.	F.C., W.S., Rec., F.&W.
Aquashicola	Aquashicola Creek, Pa.	F.C., W.S., Rec., F.&W.
Trexler	Jordan Creek, Pa.	F.C., W.S., Rec., F.&W.
Maiden Creek	Maiden Creek, Pa.	F.C., W.S., Rec., F.&W.
Blue Marsh	Tulpehocken Creek, Pa.	F.C., W.S., Rec., F.&W.
Newark	White Clay Creek, Del.	W.S., Rec., F.&W.
Christiana	Christina River, Del.	W.S., Rec., F.&W.

LEGEND:

F.C. - Reduction of flood damages

W.S. - Supplies of water

Rec. - Recreation

F.&W. - Fish & Wildlife

Pwr. - Power

1/ Modification of existing project

TABLE V-2

SUMMARY OF ANNUAL BENEFITS
(in dollars)

	Hawk Mountain	Prompton	Tocks Island	Bear Creek	Beltzville	Aquashicola
REDUCTION OF FLOOD DAMAGES	-	$ 295,400 1/	$1,457,300	$1,063,000 1/	$ 286,100	$ 293,000
SUPPLIES OF WATER	$ 2,180,600	307,200	3,805,400	1,298,500	669,400	485,200
RECREATION, TOTAL	291,200	248,000	10,000,000	396,800	792,500	247,700
Direct	(291,200)	(129,900)	(3,659,200)	(160,600)	(174,400)	(159,200)
Indirect	(-)	(118,100)	(6,340,800)	(236,200)	(618,100)	(88,500)
FISH AND WILDLIFE 2/						
POWER	755,000	-	1,825,000 Conventional 11,046,000 Pumped Storage		-	-
TOTAL PROJECT BENEFITS	3,226,800	850,600	28,133,700	2,758,300	1,748,000	1,025,900

	Trexler	Maiden Creek	Blue Marsh	Newark	Christiana	Total (11 projects)
REDUCTION OF FLOOD DAMAGES	113,800	243,800	301,500	-	-	4,053,900
SUPPLIES OF WATER	463,600	832,700	530,900	794,200	639,400	12,007,100
RECREATION, TOTAL	496,000	992,000	694,000	1,482,400	2,975,000	18,615,600
Direct	(281,300)	(424,500)	(217,200)	(876,000)	(1,734,400)	(8,107,900)
Indirect	(214,700	(567,500)	(476,800)	(606,400)	(1,240,600)	(10,507,700)
FISH AND WILDLIFE 2/						
POWER	-	-	-	-	-	13,626,000
TOTAL PROJECT BENEFITS	1,073,400	2,068,500	1,526,400	2,276,600	3,614,400	48,302,600

1/ Existing flood control storage at this project was assumed fully effective at the present time.
2/ Fish and wildlife benefits are discussed in Appendix J. No monetary equivalent is presented.

TABLE V-3

DETERMINATION OF BENEFITS FROM REDUCTION OF FLOOD DAMAGES
(in dollars at the 1958 level of development)

Reach 1/	Average Annual Damages								Average Annual Benefits						
	Natural (1)	Net 2/ (2)	Modified by Beltzville (3)	Modified by Beltzville and Trexler (4)	Modified by Beltzville, Trexler & Tocks Island (5)	Modified by Beltzville, Trexler, Tocks Is. & Aquashicola (6)	Modified by Blue Marsh (7)	Modified by Blue Marsh & Maiden Creek (8)	Beltzville (2) - (3) (9)	Trexler (3) - (4) (10)	Tocks Island (4) - (5) (11)	Aquash-icola (5) - (6) (12)	Blue Marsh (1) - (7) (13)	Maiden Creek (7) - (8) (14)	Total (15)
Lehigh River															
2 3/	$ 110,500	$ 53,000	$ 44,500	$ 42,700	$ 42,700	$ 35,900			$ 8,500	$ 1,800		$ 6,800			$ 17,100
3	1,436,300	635,700	514,800	466,200	466,200	403,300			120,900	48,600		62,900			232,400
4	627,700	267,000	223,100	214,900	214,900	187,900			43,900	8,200		27,000			79,100
5	139,100	79,800	65,800	65,800	65,800	59,400			14,000	-		6,400			20,400
Pohopoco Creek	3,500	3,500	100	100	100	100			3,400	-		-			3,400
Jordan Creek	8,000	8,000	8,000	500	500	500			-	7,500		-			7,500
Aquashicola Creek	136,800	136,800	136,800	136,800	136,800	100			-	-		136,700			136,700
Sub Total	2,461,900	1,183,800	993,100	927,000	927,000	687,200			190,700	66,100		239,800			496,600
Delaware River															
B-2a	32,800	20,300	20,300	20,300	6,500	6,500			-	-	13,800	-			13,800
B-2b	269,400	191,000	191,000	191,000	79,400	79,400			-	-	111,600	-			111,600
C-1	323,400	185,800	185,800	185,800	50,900	50,900			-	-	134,900	-			134,900
C-2a	395,100	272,400	272,400	272,400	106,800	106,800			-	-	165,600	-			165,600
2 (Lehigh R.)	197,400	144,700	144,700	144,700	56,900	56,900			-	-	87,800	-			87,800
C-2b	189,800	121,000	114,700	111,500	45,200	44,400			6,300	3,200	66,300	800			76,600
D	1,264,400	855,000	814,900	794,900	370,700	365,500			40,100	20,000	424,200	5,200			489,500
E	524,000	391,200	376,000	368,400	207,300	205,400			15,200	7,600	161,100	1,900			185,800
Sub Total	3,196,300	2,181,400	2,119,800	2,089,000	923,700	915,800			61,600	30,800	1,165,300	7,900			1,265,600
Total (Lehigh & Delaware)	5,658,200	3,365,200	3,112,900	3,016,000	1,850,700	1,603,000			252,300	96,900	1,165,300	247,700			1,762,200
Schuylkill River															
1, 2, & 3	410,400	410,400					392,500	370,100					17,900	22,400	40,300
4b	288,500	288,500					268,900	248,000					19,600	20,900	40,500
4a	8,200	8,200					7,800	7,100					400	700	1,100
5	437,400	437,400					304,100	221,600					133,300	82,500	215,800
6b	131,200	131,200					80,800	49,300					50,400	31,500	81,900
6a-2	12,200	12,200					12,200	6,600					-	5,600	5,600
Maiden Creek	1,400	1,400					1,400	100					-	1,300	1,300
Tulpehocken Creek 4/	4,000	4,000					500	500					3,500	-	3,500
Total (Schuylkill)	1,293,300	1,293,300					1,068,200	903,300					225,100	164,900	390,000

1/ Refer to Appendix D for reach descriptions.
2/ Excludes damages eliminated by existing flood control measures and flood control projects under construction.
3/ Affected by backwater from the Delaware River.
4/ Portion of reach below Blue Marsh dam site.

TABLE V-4

SUMMARY OF BENEFITS FROM REDUCTION OF FLOOD DAMAGES
(in dollars)

Project	Annual Benefits				
	1958 Level of Development (1)	First Year of Operation (2)	Discounted Value - 50 Years (3)	Increased Land Utilization (4)	Total (3) + (4) (5)
Beltzville (First Year 1965)					
Lehigh River	190,700	196,400	212,400	-	212,400
Delaware River	61,600	64,200	71,800	1,900	73,700
					286,100
Blue Marsh (First Year 1969)					
Schuylkill River	225,100	251,000	298,500	3,000	301,500
Trexler (First Year 1972)					
Lehigh River	66,100	70,000	75,600	-	75,600
Delaware River	30,800	33,400	37,200	1,000	38,200
					113,800
Tocks Island (First Year 1975)					
Delaware River					
Above Easton, Pa.	513,700	566,500	629,300	8,300	637,600
Below Easton, Pa.	651,600	718,500	798,200	21,500	819,700
					1,457,300
Aquashicola (First Year 1981)					
Lehigh River	239,800	262,600	282,700	-	282,700
Delaware River	7,900	9,000	10,000	300	10,300
					293,000
Maiden Creek (First Year 1982)					
Schuylkill River	164,900	206,200	241,300	2,500	243,800

SUMMARY OF PROJECT COSTS

(in dollars)

Cost Item	HAWK MOUNTAIN PROJECT				PROMPTON PROJECT 1/				TOCKS ISLAND PROJECT					
	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Conventional Power	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Specific Costs: Pumped Storage	Specific Costs: Conventional Power	Total Costs
Investment Costs														
1. First costs	35,502,000	1,415,000	5,079,000	41,996,000	7,619,000	427,000	387,000	8,433,000	61,373,000	18,228,000	31,597,000	53,849,000	12,334,000	177,381,000
2. Interest during construction	1,775,100	35,400	242,000	2,052,500	190,500	10,700	9,700	210,900	3,835,800	911,400	1,579,800	2,692,000	591,000	9,610,000
3. Total investment costs	37,277,100	1,450,400	5,321,000	44,048,500	7,809,500	437,700	396,700	8,643,900	65,208,800	19,139,400	33,176,800	56,541,000	12,925,000	186,991,000
Annual Charges														
4. Interest and amortization	1,314,400	51,100	189,000	1,554,500	275,300	15,400	14,000	304,700	2,299,300	674,800	1,169,800	1,994,000	460,000	6,597,900
5. Operation and maintenance	100,000	37,500	138,000	275,500	65,400	16,400	14,900	96,700	193,000	494,100	855,900	3,553,000	216,000	5,312,000
6. Major replacement	-	4,900	11,000	15,900	-	1,800	2,100	3,900	-	64,400	115,500	113,000	27,000	319,900
7. Economic cost of land	31,200	8,900	-	40,100	23,100	2,800	1,200	27,100	198,800	134,500	363,900	2,400	-	699,600
8. Taxes foregone	-	-	169,000	169,000	-	-	-	-	-	-	-	2,906,000	335,000	3,241,000
9. Total economic costs	1,445,600	102,400	507,000	2,055,000	363,800	36,400	32,200	432,400	2,691,100	1,367,800	2,505,100	8,568,400	1,038,000	16,170,400
10. Total financial costs	1,414,400	93,500	338,000	1,845,900	340,700	33,600	31,000	405,300	2,492,700	1,233,300	2,141,200	5,660,000	703,000	12,229,800

Cost Item	BEAR CREEK PROJECT 1/				BELTZVILLE PROJECT				AQUASHICOLA PROJECT			
	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs
Investment Costs												
1. First costs	19,491,000	595,000	875,000	20,961,000	12,526,000	1,287,000	1,187,000	15,000,000	18,108,000	878,000	488,000	19,474,000
2. Interest during construction	730,900	14,900	21,900	767,700	469,700	32,200	29,700	531,600	679,000	22,000	12,200	713,200
3. Total investment costs	20,221,900	609,900	896,900	21,728,700	12,995,700	1,319,200	1,216,700	15,531,600	18,787,000	900,000	500,200	20,187,200
Annual Charges												
4. Interest and amortization	713,100	21,500	31,600	766,200	458,200	46,500	42,900	547,600	662,400	31,700	17,700	711,800
5. Operation and Maintenance	96,500	20,600	30,200	147,300	80,000	22,000	20,300	122,300	77,000	5,500	3,000	85,500
6. Major replacement	-	2,600	4,900	7,500	-	5,600	7,300	12,900	-	2,100	2,400	4,500
7. Economic cost of land	13,400	3,900	2,100	19,400	8,100	7,900	1,400	17,400	14,500	6,500	3,400	24,400
8. Taxes foregone	-	-	-	-	-	-	-	-	-	-	-	-
9. Total economic costs	823,000	48,600	68,800	940,400	546,300	82,000	71,900	700,200	753,900	45,800	26,500	826,200
10. Total financial costs	809,600	44,700	66,700	921,000	538,200	74,100	70,500	682,800	739,400	39,300	23,100	801,800

Cost Item	TREXLER PROJECT				MAIDEN CREEK PROJECT				BLUE MARSH PROJECT			
	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs
Investment Costs												
1. First costs	8,566,000	1,497,000	1,141,000	11,204,000	25,159,000	2,437,000	3,252,000	30,848,000	11,010,000	1,496,000	3,286,000	15,792,000
2. Interest during construction	214,200	37,400	28,500	280,100	943,500	60,900	81,300	1,085,700	275,200	37,400	82,200	394,800
3. Total investment costs	8,780,200	1,534,400	1,169,500	11,484,100	26,102,500	2,497,900	3,333,300	31,933,700	11,285,200	1,533,400	3,368,200	16,186,800
Annual Charges												
4. Interest and amortization	309,600	54,100	41,200	404,900	920,400	88,100	117,500	1,126,000	397,900	54,100	118,800	570,800
5. Operation and Maintenance	70,000	31,200	23,800	125,000	77,000	53,500	71,500	202,000	78,000	27,400	60,100	165,500
6. Major replacement	-	3,100	6,300	9,400	-	7,400	11,600	19,000	-	5,300	7,900	13,200
7. Economic cost of land	11,600	31,900	3,100	46,600	37,600	37,900	23,300	98,800	36,500	12,000	31,000	79,500
8. Taxes foregone	-	-	-	-	-	-	-	-	-	-	-	-
9. Total economic costs	391,200	120,300	74,400	585,900	1,035,000	186,900	223,900	1,445,800	512,400	98,800	217,800	829,000
10. Total financial costs	379,600	88,400	71,300	539,300	997,400	149,000	200,600	1,347,000	475,900	86,800	186,800	749,500

Cost Item	NEWARK PROJECT				CHRISTIANA PROJECT			
	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs	Joint Use Facilities	Specific Costs: Recreation (Direct)	Specific Costs: Recreation (Indirect)	Total Costs
Investment Costs								
1. First costs	10,118,000	5,140,000	3,553,000	18,811,000	10,479,000	7,565,000	5,420,000	23,464,000
2. Interest during construction	253,000	128,500	88,800	470,300	262,000	189,100	135,500	586,600
3. Total investment costs	10,371,000	5,288,500	3,641,800	19,281,300	10,741,000	7,754,100	5,555,500	24,050,600
Annual Charges								
4. Interest and amortization	365,700	185,800	128,400	679,900	378,700	273,400	195,900	848,000
5. Operation and Maintenance	67,000	110,800	76,700	254,500	66,000	218,600	156,400	441,000
6. Major replacement	-	12,000	13,600	25,600	-	17,700	22,800	40,500
7. Economic cost of land	19,500	94,800	35,300	149,600	63,500	86,900	48,500	198,900
8. Taxes foregone	-	-	-	-	-	-	-	-
9. Total economic costs	452,200	403,400	254,000	1,109,600	508,200	596,600	423,600	1,528,400
10. Total financial costs	432,700	308,600	218,700	960,000	444,700	509,700	375,100	1,329,500

1/ Total project costs include 1959 estimated cost of ~~one~~ flood control project under construction.

TABLE V-5
(Rev. Nov. 1960)

TABLE V-6

SUMMARY OF ALTERNATIVE COSTS
(All costs are average annual values)

	Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Power
Hawk Mountain	$ -	$ 191,100	$ -	$ 1,771,000	$ 755,000 1/
Prompton	168,100	85,300	77,500	323,900	-
Tocks Island	2,143,300	2,401,300	4,161,200	2,998,800	1,825,000 1/ 10,062,400 2/
Bear Creek	453,600	105,400	155,000	547,200	-
Beltzville	318,100	114,400	405,600	500,200	-
Aquashicola	560,600	104,500	58,000	770,000	-
Trexler	243,900	184,600	140,900	391,300	-
Maiden Creek	604,800	278,600	372,400	1,096,700	-
Blue Marsh	422,000	142,500	312,900	419,800	-
Newark	-	574,900	397,900	569,300	-
Christiana	-	1,138,200	814,200	629,500	-

1/ Alternate for conventional hydroplant based on steam plant financed at 6 percent.
2/ Alternate for pumped-storage plant based on a pumped-storage plant financed at 6 percent. Costs based on estimate prepared in June 1959 for New Jersey Power & Light Co. by EBASCO Services, Inc.

TABLE V-7

DIMENSIONS AND COSTS FOR ALTERNATIVE PROJECTS

Project	Location of Project Alternative	Drainage Area Gross (Sq. mi.)	Drainage Area Net (Sq. mi.)	Storage and Pool Elevations: Inactive Capacity (ac.-ft.)	Inactive Elevation Top of Pool (Ft. M.S.L.)	Active 5/ Capacity (ac.-ft.)	Active 5/ Elevation Top of Pool (Ft. M.S.L.)	Total Capacity (ac.-ft.)	Total Elevation Top of Pool (Ft. M.S.L.)	Costs: Construction Expenditures (dollars)	Costs: Annual Charges (dollars)
				1. FOR REDUCTION OF FLOOD DAMAGES							
Prompton	at existing site	60	60	3,400	1,125	20,300	1,168	23,700	1,168	3,700,000	168,100
Tocks Island	at proposed site	3,827	2,412 1/	20,000	334	275,000	390	295,000	390	49,182,000	2,143,300
Bear Creek	at existing site	288	288	2,000	1,300	108,000	1,450	110,000	1,450	11,100,000	453,600
Beltzville	at proposed site	97	75 2/	1,200	525	27,000	599	28,200	599	7,252,000	318,100
Aquashicola	at proposed site	66	66	1,000	435	20,000	478	21,000	478	13,501,000	560,600
Trexler	at proposed site	51	51	800	416	14,000	465	14,800	465	5,286,000	243,900
Maiden Creek	at proposed site	161	161	2,000	323	38,000	364	40,000	364	14,770,000	604,800
Blue Marsh	at proposed site	174.5	174.5	1,500	249	33,000	294	34,500	294	9,042,000	422,000
				2. FOR SUPPLIES OF WATER							
Prompton	at existing site	60	60	3,400	1,125	28,000	1,180	31,400	1,180	5,100,000	323,900 4/
Tocks Island	at proposed site	3,827	2,412 1/	20,000	334	410,000	405	430,000	405	52,071,000	2,998,800 4/
Bear Creek	at existing site	288	288	2,000	1,300	70,000	1,425	72,000	1,425	9,570,000	547,200 4/
Beltzville	at proposed site	97	75 2/	1,200	525	40,000	615	41,200	615	8,859,000	500,200 4/
Aquashicola	at proposed site	66	66	1,000	435	24,000	483	25,000	483	14,185,000	770,000 4/
Trexler	at proposed site	51	51	800	416	24,200	479	25,000	479	6,736,000	391,300 4/
Maiden Creek	at proposed site	161	161	2,000	323	74,000	381	76,000	381	20,390,000	1,096,700 4/
Blue Marsh	at proposed site	174.5	174.5	1,500	249	14,500	279	16,000	279	7,136,000	419,800 4/
Newark	at proposed site	67	67	1,000	98	30,000	156	31,000	156	10,118,000	569,300 4/
Christiana	at proposed site	41	41	1,000	23	36,000	49	37,000	49	10,479,000	629,500 4/
Hawk Mountain	at proposed site	812	440 3/	3,000	935	233,000	1,071	236,000	1,071	32,700,000	1,771,000 4/

1/ Below Cannonsville, Pepacton, Hawk Mountain, Neversink and Prompton Reservoirs.
2/ Below Wild Creek Reservoir.
3/ Below Pepacton Reservoir.
4/ Amortization and interest at 4% for 50 years.
5/ Short-term storage for reduction of flood damages; long-term storage for supplies of water.

TABLE V-7

TABLE V-8

HAWK MOUNTAIN PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Power	Recreation	Fish & Wildlife 1/	Supplies of Water	Total
	ALLOCATION OF ANNUAL CHARGES					
1	Benefits	$ 755,000	$ 291,200		$ 2,180,600	$ 3,226,800
2	Alternative cost	755,000	191,100		1,771,000	2,717,100
3	Benefits limited by alternate cost	755,000	191,100		1,771,000	2,717,100
4	Separable cost	615,000 3/	102,400		1,275,000	1,992,400
5	Remaining benefits	140,000	88,700		496,000	724,700
6	Allocated joint cost	12,100	7,600		42,900	62,600
7	Total allocation, economic cost	627,100	110,000		1,317,900	2,055,000
8	Economic cost of land	4,500	9,100		26,500	40,100
9	Taxes foregone	169,000	-		-	169,000
10	Total allocation, financial cost	453,600	100,900		1,291,400	1,845,900
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS					
11	Separable cost	138,000	37,500		90,000	265,500
12	Allocated joint cost 2/	1,900	1,200		6,900	10,000
13	Total allocation, O. & M.	139,900	38,700		96,900	275,500
	ALLOCATION OF MAJOR REPLACEMENTS					
14	Allocation, major replacements	11,000	4,900		-	15,900
	ALLOCATION OF INVESTMENT					
15	Annual investment cost	302,700	57,300		1,194,500	1,554,500
16	Allocated investment	8,545,600	1,626,200		33,876,700	44,048,500
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)					
17	Specific investment	5,321,000	1,450,400		-	6,771,400
18	Interest during construction for specific investment	242,000	35,400		-	277,400
19	Allocation, specific construction expenditures	5,079,000	1,415,000		-	6,494,000
20	Investment in joint use facilities	3,224,600	175,800		33,876,700	37,277,100
21	Interest during construction on joint use facilities	153,500	8,400		1,613,200	1,775,100
22	Construction expenditures in joint use facilities	3,071,100	167,400		32,263,500	35,502,000
23	Total construction expenditures (First Cost)	8,150,100	1,582,400		32,263,500	41,996,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.
3/ Specific power costs of $507,000 plus separable power costs of $108,00.

TABLE V-9

PROMPTON PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation		Supplies of Water	Fish & Wildlife 1/	Total
			Direct	Indirect			
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 295,400	$ 129,900	$ 118,100	$ 307,200		$ 850,600
2	Alternative cost	168,100	85,300	77,500	323,900		654,800
3	Benefits limited by alternate cost	168,100	85,300	77,500	307,200		638,100
4	Separable cost	102,500	36,400	32,200	195,700		366,800
5	Remaining benefits	65,600	48,900	45,300	111,500		271,300
6	Allocated joint cost	19,000	14,200	-	32,400		65,600
7	Total allocation, economic cost	121,500	50,600	32,200	228,100		432,400
8	Economic cost of land	8,300	6,700	1,200	10,900		27,100
9	Total allocation, financial cost	113,200	43,900	31,000	217,200		405,300
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable cost	8,400	16,400	14,900	52,000		91,700
11	Allocated joint cost 2/	1,400	1,100	-	2,500		5,000
12	Total allocation, O.& M.	9,800	17,500	14,900	54,500		96,700
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	1,800	2,100	-		3,900
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	103,400	24,600	14,000	162,700		304,700
15	Allocated investment	2,933,600	697,900	396,700	4,615,700		8,643,900
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	437,700	396,700	-		834,400
17	Interest during construction for specific investment	-	10,700	9,700	-		20,400
18	Allocation, specific construction expenditures	-	427,000	387,000	-		814,000
19	Investment in joint use facilities	2,933,600	260,200	-	4,615,700		7,809,500
20	Interest during construction for joint use facilities	71,600	6,300	-	112,600		190,500
21	Construction expenditures in joint use facilities	2,862,000	253,900	-	4,503,100		7,619,000
22	Total construction expenditures (First Cost)	2,862,000	680,900	387,000	4,503,100		8,433,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalents given.
2/ In proportion to remaining benefits, line 5.

TABLE V-10

TOCKS ISLAND PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Fish & Wildlife 1/	Supplies of Water	Power Conventional	Power Pumped Storage	Total
ALLOCATION OF ANNUAL CHARGES									
1	Benefits	$1,457,300	$3,659,200	$ 6,340,800		$ 3,805,400	$ 1,825,000	$11,046,000	$28,133,700
2	Alternative cost	2,143,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	23,592,000
3	Benefits limited by alternative cost	1,457,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	22,906,000
4	Separable cost	206,800	1,367,800	2,505,100		346,800	1,196,600 3/	8,610,800	14,233,900
5	Remaining benefits	1,250,500	1,033,500	1,656,100		2,652,000	628,400	1,451,600	8,672,100
6	Allocated joint cost	344,700	284,700	-		732,000	174,300	400,800	1,936,500
7	Total allocation, economic cost	551,500	1,652,500	2,505,100		1,078,800	1,370,900	9,011,600	16,170,400
8	Taxes foregone	-	-	-		-	335,000	2,906,000	3,241,000
9	Economic cost of land	44,800	152,700	363,900		92,100	18,100	28,000	699,600
10	Total allocation, financial cost	506,700	1,499,800	2,141,200		986,700	1,017,800	6,077,600	12,229,800
ALLOCATION OF OPERATION AND MAINTENANCE COSTS									
11	Separable cost	29,500	494,100	855,900		38,600	216,000	3,553,000	5,187,100
12	Allocated joint cost 2/	22,200	18,400	-		47,200	11,200	25,900	124,900
13	Total allocation, O. & M.	51,700	512,500	855,900		85,800	227,200	3,578,900	5,312,000
ALLOCATION OF MAJOR REPLACEMENTS									
14	Allocation, Major replacements	-	64,400	115,500		-	27,000	113,000	319,900
ALLOCATION OF INVESTMENT									
15	Annual investment cost	455,000	922,900	1,169,800		900,900	763,600	2,385,700	6,597,900
16	Allocated investment	12,904,000	26,175,500	33,176,800		25,549,800	21,535,200	67,649,700	186,991,000
ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)									
17	Specific investment	-	19,139,400	33,176,800		-	12,925,000	56,541,000	121,782,200
18	Interest during construction for specific investment	-	911,400	1,579,800		-	591,000	2,692,000	5,774,200
19	Allocation, specific construction expenditures	-	18,228,000	31,597,000		-	12,334,000	53,849,000	116,008,000
20	Investment in joint use facilities	12,904,000	7,036,100	-		25,549,800	8,610,200	11,108,700	65,208,800
21	Interest during construction on joint use facilities	759,100	413,900	-		1,502,900	506,500	653,400	3,835,800
22	Construction expenditures in joint use facilities	12,144,900	6,622,200	-		24,046,900	8,103,700	10,455,300	61,373,000
23	Total construction expenditures (First Cost)	12,144,900	24,850,200	31,597,000		24,046,900	20,437,700	64,304,300	177,381,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent given.
2/ In proportion to remaining benefits, line 5.
3/ Includes specific power costs of $1,038,000 plus separable power costs of $158,600.

TABLE V-10
(Rev. Nov. 1960)

TABLE V-10a

TOCKS ISLAND PROJECT - MODIFIED ALLOCATION [4]

COST ALLOCATION STUDIES

ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Fish & Wildlife [1]	Supplies of Water	Power Conventional	Power Pumped Storage	Total
	ALLOCATION OF ANNUAL CHARGES								
1	Benefits	$1,457,300	$3,659,200	$ 6,340,800		$ 3,805,400	$ 1,825,000	$11,046,000	$28,133,700
2	Alternative cost	2,143,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	23,592,000
3	Benefits limited by alternative cost	1,457,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	22,906,000
4	Separable cost	206,800	1,367,800	2,505,100		346,800	1,196,600 [3]	8,610,800	14,233,900
5	Remaining benefits	1,250,500	1,033,500	1,656,100		2,652,000	628,400	1,451,600	8,672,100
6	Allocated joint cost	344,700	284,700	-		732,000	174,300	400,800	1,936,500
7	Total allocation, economic cost	551,500	1,652,500	2,505,100		1,078,800	1,370,900	9,011,600	16,170,400
8	Taxes foregone	-	-	-		-	335,000	2,906,000	3,241,000
9	Economic cost of land	44,800	152,700	363,900		92,100	18,100	28,000	699,600
10	Total allocation, financial cost	506,700	1,499,800	2,141,200		986,700	1,017,800	6,077,600	12,229,800
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS								
11	Separable cost	29,500	494,100	855,900		38,600	216,000	3,553,000	5,187,100
12	Allocated joint cost [2]	22,200	18,400	-		47,200	11,200	25,900	124,900
13	Total allocation, O. & M.	51,700	512,500	855,900		85,800	227,200	3,578,900	5,312,000
	ALLOCATION OF MAJOR REPLACEMENTS								
14	Allocation, Major replacements	-	64,400	115,500		-	27,000	113,000	319,900
	ALLOCATION OF INVESTMENT								
15	Annual investment cost	455,000	922,900	1,169,800		900,900	763,600	2,385,700	6,597,900
16	Allocated investment	12,904,000	26,175,500	33,176,800		25,549,800	21,535,200	67,649,700	186,991,000
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)								
17	Specific investment	-	19,139,400	33,176,800		-	12,925,000	56,541,000	121,782,200
18	Interest during construction for specific investment	-	911,400	1,579,800		-	591,000	2,692,000	5,774,200
19	Allocation, specific construction expenditures	-	18,228,000	31,597,000		-	12,334,000	53,849,000	116,008,000
20	Investment in joint use facilities	12,904,000	7,036,100	-		25,549,800	8,610,200	11,108,700	65,208,800
21	Interest during construction on joint use facilities	759,100	413,900	-		1,502,900	506,500	653,400	3,835,800
22	Construction expenditures in joint use facilities	12,144,900	6,622,200	-		24,046,900	8,103,700	10,455,300	61,373,000
23	Total construction expenditures (First Cost)	12,144,900	24,850,200	31,597,000		24,046,900	20,437,700	64,304,300	177,381,000
24	Redistribution of joint costs allocated to pumped-storage power [5]	1,635,100	891,600	-		3,237,600	1,091,000	3,600,000 [6]	10,455,300
25	Total construction expenditures (First Cost)	13,780,000	25,741,800	31,597,000		27,284,500	21,528,700	57,449,000	177,381,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent given.
2/ In proportion to remaining benefits, line 5.
3/ Includes specific power costs of $1,038,000 plus separable power costs of $158,600.
4/ Allocation applicable for project with non-Federal development of pumped-storage hydropower.
5/ In proportion to construction expenditures in joint use facilities, line 22.
6/ Limited by alternative cost for pumped-storage development by non-Federal interests.

TABLE V-10a
(Added May 1961)

TABLE V-11

BEAR CREEK PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 1,063,000	$ 160,600	$ 236,200	$ 1,298,500		$ 2,758,300
2	Alternative cost	453,600	105,400	155,000	547,200		1,261,200
3	Benefits limited by alternative cost	453,600	105,400	155,000	547,200		1,261,200
4	Separable cost	398,000	48,600	68,800	369,400		884,800
5	Remaining benefits	55,600	56,800	86,200	177,800		376,400
6	Allocated joint cost	10,600	10,900	-	34,100		55,600
7	Total allocation, economic cost	408,600	59,300	68,800	403,500		940,400
8	Economic cost of land	6,500	5,000	2,100	5,800		19,400
9	Total allocation, financial cost	402,100	54,500	66,700	397,700		921,000
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable cost	29,500	20,600	30,200	60,000		140,300
11	Allocated joint cost 2/	1,300	1,400	-	4,300		7,000
12	Total allocation, O. & M.	30,800	22,000	30,200	64,300		147,300
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	2,600	4,900	-		7,500
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	371,300	29,900	31,600	333,400		766,200
15	Allocated investment	10,529,300	847,900	896,900	9,454,600		21,728,700
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	609,900	896,900	-		1,506,800
17	Interest during construction for specific investment	-	14,900	21,900	-		36,800
18	Allocation specific construction expenditures	-	595,000	875,000	-		1,470,000
19	Investment in joint use facilities	10,529,300	238,000	-	9,454,600		20,221,900
20	Interest during construction for joint use facilities	380,600	8,600	-	341,700		730,900
21	Construction expenditures in joint use facilities	10,148,700	229,400	-	9,112,900		19,491,000
22	Total construction expenditures (First Cost)	10,148,700	824,400	875,000	9,112,900		20,961,000

1/ Benefits and costs discussed Appendix J. No monetary equivalents presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-12

BELTZVILLE PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 286,100	$ 174,400	$ 618,100	$ 669,400		$ 1,748,000
2	Alternative cost	318,100	114,400	405,600	500,200		1,338,300
3	Benefits limited by alternative cost	286,100	114,400	405,600	500,200		1,306,300
4	Separable cost	159,100	82,000	71,900	228,200		541,200
5	Remaining benefits	127,000	32,400	333,700	272,000		765,100
6	Allocated joint cost	46,800	11,900	-	100,300		159,000
7	Total allocation, economic cost	205,900	93,900	71,900	328,500		700,200
8	Economic cost of land	3,100	8,300	1,400	4,600		17,400
9	Total allocation, financial cost	202,800	85,600	70,500	323,900		682,800
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable cost	23,400	22,000	20,300	33,700		99,400
11	Allocated joint cost 2/	6,700	1,700	-	14,500		22,900
12	Total allocation, O. & M.	30,100	23,700	20,300	48,200		122,300
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	5,600	7,300	-		12,900
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	172,700	56,300	42,900	275,700		547,600
15	Allocated investment	4,898,300	1,596,900	1,216,700	7,819,700		15,531,600
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	1,319,200	1,216,700	-		2,535,900
17	Interest during construction for specific investment	-	32,200	29,700	-		61,900
18	Allocation, specific construction expenditures	-	1,287,000	1,187,000	-		2,474,000
19	Investment in joint use facilities	4,898,300	277,700	-	7,819,700		12,995,700
20	Interest during construction on joint use facilities	177,100	10,000	-	282,600		469,700
21	Construction expenditures in joint use facilities	4,721,200	267,700	-	7,537,100		12,526,000
22	Total construction expenditures (First Cost)	4,721,200	1,554,700	1,187,000	7,537,100		15,000,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-12
(Rev. Nov. 1960)

TABLE V-13

AQUASHICOLA PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 293,000	$ 159,200	$ 88,500	$ 485,200		$ 1,025,900
2	Alternative cost	560,600	104,500	58,000	770,000		1,493,100
3	Benefits limited by alternative cost	293,000	104,500	58,000	485,200		940,700
4	Separable cost	164,900	45,800	26,500	193,300		430,500
5	Remaining benefits	128,100	58,700	31,500	291,900		510,200
6	Allocated joint cost	105,900	48,500	-	241,300		395,700
7	Total allocation, economic cost	270,800	94,300	26,500	434,600		826,200
8	Economic cost of land	5,900	7,100	3,400	8,000		24,400
9	Total allocation, financial cost	264,900	87,200	23,100	426,600		801,800
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable cost	16,700	5,500	3,000	19,600		44,800
11	Allocated joint cost 2/	10,900	5,000	-	24,800		40,700
12	Total allocation, O. & M.	27,600	10,500	3,000	44,400		85,500
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	2,100	2,400	-		4,500
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	237,300	74,600	17,700	382,200		711,800
15	Allocated investment	6,730,600	2,115,900	500,200	10,840,500		20,187,200
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	900,000	500,200	-		1,400,200
17	Interest during construction for specific investment	-	22,000	12,200	-		34,200
18	Allocation, specific construction expenditures	-	878,000	488,000	-		1,366,000
19	Investment in joint use facilities	6,730,600	1,215,900	-	10,840,500		18,787,000
20	Interest during construction on joint use facilities	243,300	43,900	-	391,800		679,000
21	Construction expenditures in joint use facilities	6,487,300	1,172,000	-	10,448,700		18,108,000
22	Total construction expenditures (First Cost)	6,487,300	2,050,000	488,000	10,448,700		19,474,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-13

TABLE V-14

TREXLER PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 113,800	$ 281,300	$ 214,700	$ 463,600		$ 1,073,400
2	Alternative cost	243,900	184,600	140,900	391,300		960,700
3	Benefits limited by alternative cost	113,800	184,600	140,900	391,300		830,600
4	Separable cost	82,600	120,300	74,400	147,300		424,600
5	Remaining benefits	31,200	64,300	66,500	244,000		406,000
6	Allocated joint cost	14,800	30,500	-	116,000		161,300
7	Total allocation, economic cost	97,400	150,800	74,400	263,300		585,900
8	Economic cost of land	2,200	33,500	3,100	7,800		46,600
9	Total allocation, financial cost	95,200	117,300	71,300	255,500		539,300
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable cost	15,000	31,200	23,800	26,800		96,800
11	Allocated joint cost 2/	2,600	5,300	-	20,300		28,200
12	Total allocation, O. & M.	17,600	36,500	23,800	47,100		125,000
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	3,100	6,300	-		9,400
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	77,600	77,700	41,200	208,400		404,900
15	Allocated investment	2,200,800	2,203,600	1,169,500	5,910,200		11,484,100
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	1,534,400	1,169,500	-		2,703,900
17	Interest during construction for specific investment	-	37,400	28,500	-		65,900
18	Allocation, specific construction expenditures	-	1,497,000	1,141,000	-		2,638,000
19	Investment in joint use facilities	2,200,800	669,200	-	5,910,200		8,780,200
20	Interest during construction on joint use facilities	53,700	16,300	-	144,200		214,200
21	Construction expenditures in joint use facilities	2,147,100	652,900	-	5,766,000		8,566,000
22	Total construction expenditures (First Cost)	2,147,100	2,149,900	1,141,000	5,766,000		11,204,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-15

MAIDEN CREEK PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 243,800	$ 424,500	$ 567,500	$ 832,700		$ 2,068,500
2	Alternate Cost	604,800	278,600	372,400	1,096,700		2,352,500
3	Benefits limited by alternate cost	243,800	278,600	372,400	832,700		1,727,500
4	Separable cost	198,500	186,900	223,900	430,200		1,039,500
5	Remaining benefits	45,300	91,700	148,500	402,500		688,000
6	Allocated joint cost	34,100	69,100	-	303,100		406,300
7	Total allocation, economic cost	232,600	256,000	223,900	733,300		1,445,800
8	Economic cost of land	10,200	39,600	23,300	25,700		98,800
9	Total allocation, financial cost	222,400	216,400	200,600	707,600		1,347,000
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS						
10	Separable costs	14,600	53,500	71,500	31,800		171,400
11	Allocated joint cost 2/	2,600	5,200	-	22,800		30,600
12	Total allocation, O. & M.	17,200	58,700	71,500	54,600		202,000
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	7,400	11,600	-		19,000
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	205,200	150,300	117,500	653,000		1,126,000
15	Allocated investment	5,819,300	4,262,400	3,333,300	18,518,700		31,933,700
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	2,497,900	3,333,300	-		5,831,200
17	Interest during construction for specific investment	-	60,900	81,300	-		142,200
18	Allocation, specific construction expenditures	-	2,437,000	3,252,000	-		5,689,000
19	Investment in joint use facilities	5,819,300	1,764,500	-	18,518,700		26,102,500
20	Interest during construction on joint use facilities	210,300	63,800	-	669,400		943,500
21	Construction expenditures in joint use facilities	5,609,000	1,700,700	-	17,849,300		25,159,000
22	Total construction expenditures (First Cost)	5,609,000	4,137,700	3,252,000	17,849,300		30,848,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-16

BLUE MARSH PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES						
1	Benefits	$ 301,500	$ 217,200	$ 476,800	$ 530,900		$ 1,526,400
2	Alternative cost	422,000	142,500	312,900	419,800		1,297,200
3	Benefits limited by alternate cost	301,500	142,500	312,900	419,800		1,176,700
4	Separable cost	180,100	98,800	217,800	90,400		587,100
5	Remaining benefits	121,400	43,700	95,100	329,400		589,600
6	Allocated joint cost	59,500	21,300	-	161,100		241,900
7	Total allocation, economic cost	239,600	120,100	217,800	251,500		829,000
8	Economic cost of land	17,300	13,600	31,000	17,600		79,500
9	Total allocation, financial cost	222,300	106,500	186,800	233,900		749,500
	ALLOCATION OF OPERATION AND MAINTENANCE COST						
10	Separable cost	27,400	27,400	60,100	14,000		128,900
11	Allocated joint cost 2/	9,000	3,200	-	24,400		36,600
12	Total allocation, O. & M.	36,400	30,600	60,100	38,400		165,500
	ALLOCATION OF MAJOR REPLACEMENTS						
13	Allocation, major replacements	-	5,300	7,900	-		13,200
	ALLOCATION OF INVESTMENT						
14	Annual investment cost	185,900	70,600	118,800	195,500		570,800
15	Allocated investment	5,272,100	2,002,200	3,368,200	5,544,300		16,186,800
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)						
16	Specific investment	-	1,533,400	3,368,200	-		4,901,600
17	Interest during construction for specific investment	-	37,400	82,200	-		119,600
18	Allocation, specific construction expenditures	-	1,496,000	3,286,000	-		4,782,000
19	Investment in joint use facilities	5,272,100	468,800	-	5,544,300		11,285,200
20	Interest during construction on joint use facilities	128,600	11,400	-	135,200		275,200
21	Construction expenditures in joint use facilities	5,143,500	457,400	-	5,409,100		11,010,000
22	Total construction expenditures (First Cost)	5,143,500	1,953,400	3,286,000	5,409,100		15,792,000

1/ Benefits and costs discussed in Appendix J. No monetary equivalent presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-17

NEWARK PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Recreation Direct	Recreation Indirect	Supplies of Water	Fish & Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES					
1	Benefits	$ 876,000	$ 606,400	$ 794,200		$ 2,276,600
2	Alternative cost	574,900	397,900	569,300		1,542,100
3	Benefits limited by alternative cost	574,900	397,900	569,300		1,542,100
4	Separable cost	403,400	254,000	419,200		1,076,600
5	Remaining benefits	171,500	143,900	150,100		465,500
6	Allocated joint cost	17,600	-	15,400		33,000
7	Total allocation, economic cost	421,000	254,000	434,600		1,109,600
8	Economic cost of land	47,700	35,300	16,600		149,600
9	Total allocation, financial cost	323,300	218,700	418,000		960,000
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS					
10	Separable cost	110,800	76,700	59,000		246,500
11	Allocated joint cost 2/	4,300	-	3,700		8,000
12	Total allocation, O. & M.	115,100	76,700	62,700		254,500
	ALLOCATION OF MAJOR REPLACEMENTS					
13	Allocation, major replacements	12,000	13,600	-		25,600
	ALLOCATION OF INVESTMENT					
14	Annual investment cost	196,200	128,400	355,300		679,900
15	Allocated investment	5,563,800	3,641,800	10,075,700		19,281,300
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)					
16	Specific investment	5,268,500	3,641,800	-		8,910,300
17	Interest during construction for specific investment	128,500	88,800	-		217,300
18	Allocation, specific construction expenditures	5,140,000	3,553,000	-		8,693,000
19	Investment in joint use facilities	295,300	-	10,075,700		10,371,000
20	Interest during construction on joint use facilities	7,200	-	245,800		253,000
21	Construction expenditures in joint use facilities	288,100	-	9,829,900		10,118,000
22	Total construction expenditures (First Cost)	5,428,100	3,553,000	9,829,900		18,811,000

1/ Benefits & costs discussed in Appendix J. No monetary equivalents presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-17

TABLE V-18

CHRISTIANA PROJECT
COST ALLOCATION STUDIES
ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Recreation		Supplies	Fish &	
		Direct	Indirect	of Water	Wildlife 1/	Total
	ALLOCATION OF ANNUAL CHARGES					
1	Benefits	$1,734,400	$ 1,240,600	$ 639,400		$ 3,614,400
2	Alternative cost	1,138,200	814,200	629,500		2,581,900
3	Benefits limited by alternative cost	1,138,200	814,200	629,500		2,581,900
4	Separable cost	596,600	423,600	485,900		1,506,100
5	Remaining benefits	541,600	390,600	143,600		1,075,800
6	Allocated joint cost	17,600	-	4,700		22,300
7	Total allocation, economic cost	614,200	423,600	490,600		1,528,400
8	Economic cost of land	92,100	48,500	58,300		198,900
9	Total allocation, financial cost	522,100	375,100	432,300		1,329,500
	ALLOCATION OF OPERATION AND MAINTENANCE COSTS					
10	Separable cost	218,600	156,400	60,000		435,000
11	Allocated joint cost 2/	4,700	-	1,300		6,000
12	Total allocation, O. & M.	223,300	156,400	61,300		441,000
	ALLOCATION OF MAJOR REPLACEMENTS					
13	Allocation, major replacements	17,700	22,800	-		40,500
	ALLOCATION OF INVESTMENT					
14	Annual investment cost	281,100	195,900	371,000		848,000
15	Allocated investment	7,972,700	5,555,500	10,522,400		24,050,600
	ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)					
16	Specific investment	7,754,100	5,555,500	-		13,309,600
17	Interest during construction for specific investment	189,100	135,500	-		324,600
18	Allocation, specific construction expenditures	7,565,000	5,420,000	-		12,985,000
19	Investment on joint use facilities	218,600	-	10,522,400		10,741,000
20	Interest during construction on joint use facilities	5,300	-	256,700		262,000
21	Construction expenditures in joint use facilities	213,300	-	10,265,700		10,479,000
22	Total construction expenditures (First Cost)	7,778,300	5,420,000	10,265,700		23,464,000

1/ Benefits & costs discussed in Appendix J. No monetary equivalents presented.
2/ In proportion to remaining benefits, line 5.

TABLE V-18

TABLE V-19

TOCKS ISLAND PROJECT-MODIFIED ALLOCATION 1/
COST ALLOCATION STUDIES

ALLOCATION BY SEPARABLE COSTS-REMAINING BENEFITS METHOD

		Reduction of Flood Damages	Recreation		Fish and Wildlife 2/	Supplies of Water	Power		Total
			Direct	Indirect			Conventional	Pumped-Storage	
ALLOCATION OF ANNUAL CHARGES									
1	Benefits	$ 1,457,300	$ 3,659,200	$ 6,340,800		$ 3,805,400	$ 1,825,000	$11,046,000	$ 28,133,700
2	Alternative cost	2,143,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	23,592,000
3	Benefits limited by alternative cost	1,457,300	2,401,300	4,161,200		2,998,800	1,825,000	10,062,400	22,906,000
4	Separable cost	206,800	1,367,800	2,505,100		346,800	1,196,600 4/	8,610,800	14,233,900
5	Remaining benefits	1,250,500	1,033,500	1,656,100		2,652,000	628,400	1,451,600	8,672,100
6	Allocated joint cost	435,200	359,700	-		922,900	218,700	-	1,936,500
7	Total allocation, economic cost	642,000	1,727,500	2,505,100		1,269,700	1,415,300	8,610,800	16,170,400
8	Taxes foregone	-	-	-		-	335,000	2,906,000	3,241,000
9	Economic cost of land	50,600	157,400	363,900		104,300	21,000	2,400	699,600
10	Total allocation, financial cost	591,400	1,570,100	2,141,200		1,165,400	1,059,300	5,702,400	12,229,800
ALLOCATION OF OPERATION AND MAINTENANCE COSTS									
11	Separable cost	29,500	494,100	855,900		38,600	216,000	3,553,000	5,187,100
12	Allocated joint cost 3/	28,100	23,200	-		59,500	14,100	-	124,900
13	Total allocation, O. & M.	57,600	517,300	855,900		98,100	230,100	3,553,000	5,312,000
ALLOCATION OF MAJOR REPLACEMENTS									
14	Allocation, major replacements	-	64,400	115,500		-	27,000	113,000	319,900
ALLOCATION OF INVESTMENT									
15	Annual investment cost	533,800	988,400	1,169,800		1,067,300	802,200	2,036,400	6,597,900
16	Allocated investment	15,139,200	28,032,200	33,176,800		30,269,900	22,630,200	57,742,700	186,991,000
ALLOCATION OF CONSTRUCTION EXPENDITURES (FIRST COST)									
17	Specific investment	-	19,139,400	33,176,800		-	12,925,000	56,541,000	121,782,200
18	Interest during construction for specific investment	-	911,400	1,579,800		-	591,000	2,692,000	5,774,200
19	Allocation, specific construction expenditures	-	18,228,000	31,597,000		-	12,334,000	53,849,000	116,008,000
20	Investment in joint-use facilities	15,139,200	8,892,800	-		30,269,900	9,705,200	1,201,700	65,208,800
21	Interest during construction on joint-use facilities	890,500	523,100	-		1,780,600	570,900	70,700	3,835,800
22	Construction expenditures in joint-use facilities	14,248,700	8,369,700	-		28,489,300	9,134,300	1,131,000	61,373,000
23	Total construction expenditures (First Cost)	14,248,700	26,597,700	31,597,000		28,489,300	21,468,300	54,980,000	177,381,000

1/ Pumped-storage hydropower not included as a project purpose.
2/ Benefits and costs discussed in Appendix J. No monetary equivalents given.
3/ In proportion to remaining benefits line 5.
4/ Includes specific power costs of $1,038,000 plus separable power costs of $158,600.

TABLE V-20

ALLOCATIONS OF OPERATION AND MAINTENANCE COSTS
FOR PERIOD OF WATER SUPPLY DEFERRAL

	Reduction of Flood Damages	Recreation		Supplies of Water			Fish and Wildlife 1/	Power		Total
		Direct	Indirect	Initial	Deferred	Total		Conventional	Pumped-Storage	
					PROMPTON					
Total Construction Expenditures	$ 2,862,000	$ 680,900	$ 387,000	$ 2,089,300	$ 2,413,800	$ 4,503,100	-	-	-	$ 8,433,000
Total Allocation, O. & M.	9,800	17,500	14,900	28,700	25,800	54,500	-	-	-	96,700
Temporary Allocation O. & M. 2/	22,900	20,600	14,900	38,300	-	38,300	-	-	-	96,700
					TOCKS ISLAND					
Total Construction Expenditures	12,144,900	24,850,200	31,597,000	-	24,046,900	24,046,900	-	20,437,700	64,304,300	177,381,000
Total Allocation, O.& M.	51,700	512,500	855,900	-	85,800	85,800	-	227,200	3,578,900	5,312,000
Temporary Allocation, O. & M. 2/	60,300	530,000	855,900	-	-	-	-	241,600	3,624,200	5,312,000
					BEAR CREEK					
Total Construction Expenditures	10,148,700	824,400	875,000	3,087,100	6,025,800	9,112,900	-	-	-	20,961,000
Total Allocation, O. & M.	30,800	22,000	30,200	26,000	38,300	64,300	-	-	-	147,300
Temporary Allocation, O. & M. 2/	58,500	24,200	30,200	34,400	-	34,400	-	-	-	147,300
					BELTZVILLE					
Total Construction Expenditures	4,721,200	1,554,700	1,187,000	3,393,200	4,143,900	7,537,100	-	-	-	15,000,000
Total Allocation, O. & M.	30,100	23,700	20,300	26,400	21,800	48,200	-	-	-	122,300
Temporary Allocation, O. & M. 2/	40,700	27,200	20,300	34,100	-	34,100	-	-	-	122,300
					AQUASHICOLA					
Total Construction Expenditures	6,487,300	2,050,000	488,000	4,752,900	5,695,800	10,448,700	-	-	-	19,474,000
Total Allocation, O. & M.	27,600	10,500	3,000	27,600	16,800	44,400	-	-	-	85,500
Temporary Allocation, O. & M. 2/	35,800	13,100	3,000	33,600	-	33,600	-	-	-	85,500
					TREXLER					
Total Construction Expenditures	2,147,100	2,149,900	1,141,000	2,747,100	3,018,900	5,766,000	-	-	-	11,204,000
Total Allocation, O. & M.	17,600	36,500	23,800	27,900	19,200	47,100	-	-	-	125,000
Temporary Allocation, O. & M. 2/	23,400	42,400	23,800	35,400	-	35,400	-	-	-	125,000
					MAIDEN CREEK					
Total Construction Expenditures	5,609,000	4,137,700	3,252,000	9,570,500	8,278,800	17,849,300	-	-	-	30,848,000
Total Allocation, O. & M.	17,200	58,700	71,500	34,100	20,500	54,600	-	-	-	202,000
Temporary Allocation, O. & M. 2/	23,200	63,100	71,500	44,200	-	44,200	-	-	-	202,000
					BLUE MARSH					
Total Construction Expenditures	5,143,500	1,953,400	3,286,000	1,657,300	3,751,800	5,409,100	-	-	-	15,792,000
Total Allocation, O. & M.	36,400	30,600	60,100	23,200	15,200	38,400	-	-	-	165,500
Temporary Allocation, O. & M. 2/	45,300	34,000	60,100	26,100	-	26,100	-	-	-	165,500

1/ Benefits and costs discussed in Appendix J. No monetary equivalents presented.
2/ O. & M. for deferred water supply allocated to other purposes on the basis of total construction expenditures.

TABLE V-20
(Rev. Nov. 1960)

TABLE V-21

SAMPLE COMPUTATION

OPERATION AND MAINTENANCE COSTS
FOR CURRENT AND FUTURE SUPPLIES OF WATER - BELTZVILLE PROJECT

Total first cost of supplies of water - $7,537,100 (Table V-12)
Cost of future supplies of water is 30% of total project cost without cost of indirectly related recreation =
0.30 x $13,813,000 - 4,143,900
Cost of current supplies of water - $3,393,200

Total annual cost of O&M for supplies of water
Separable cost - $33,700 (Table V-12)
Allocated cost - 14,500 (Table V-12)
Total cost - $48,200 (Table V-12)
Specific cost (water supply operator) - $ 6,000

Annual cost of O&M for future supplies of water
$33,700 - $6,000 = $27,700
$14,500 x 27,700/33,700 = 11,900
39,600 (Joint-use cost)

4,143,900/7,537,100 x $39,600 = $ 21,800(future)

Annual cost of O&M for current supplies of water
$48,200 - $21,800 = $ 26,400(current)

Suballocation of O&M for future supplies of water to other project purposes on basis of first costs.

Table Allocation for O&M	Reduction of Flood Damages	Recreation, Directly Related	Supplies of Water,Current	Total
Table V-12	$ 30,100	$ 23,700	$ 26,400	$ 80,200
Suballocation, for O&M for future supplies of water	10,600	3,500	7,700	21,800
Total	$ 40,700	$ 27,200	$ 34,100	$ 102,000

(Added Nov. 1960)

REPORT ON THE

COMPREHENSIVE SURVEY

OF THE

WATER RESOURCES

OF THE

DELAWARE RIVER BASIN

APPENDIX W

RECREATION NEEDS AND APPRAISALS

PREPARED BY

U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA
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U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PHILADELPHIA, PA.

MAY 1960

REPORT ON THE COMPREHENSIVE SURVEY
OF THE
WATER RESOURCES OF THE DELAWARE RIVER BASIN

APPENDIX W - RECREATION NEEDS AND APPRAISALS

Contents (Continued)

Contents (Continued)

TABLES

TABLES (Continued)

PLATES

Plate No.

SYLLABUS

In 1955 the 21,589,000 people residing in the Delaware River Water Service Area participated in about 137,700,000 visitor-days of one-day outings, 75,800,000 visitor-days of overnight outings and about 132,000,000 visitor-days of vacations away from home. These activities included swimming, boating, picnicking, sight-seeing, weekend visiting of friends and relatives, hiking, hunting, photography, camping, visiting museums and historical sites, going to the beach and participation in various outdoor sports and games. They were engaged in at state parks, state forests, state game and fish lands and waters, county and municipal parks, picnic grounds, Federal areas, historical museums and sites, at resorts, in travel and at the seashore. This total recreation activity, which to a large extent makes use of outdoor resources and facilities, is expected to increase by more than 6-1/2 times between 1955 and 2010.

This appendix finds that the recreation products of multiple-purpose dam and reservoir projects for the development of the water resources of the Delaware River Basin would make their principal contribution to the satisfaction of the above indicated recreation demands by providing opportunities for one-day outings. More specifically these projects would provide for activities of the kinds found at certain state parks and related state park type of establishments. In segregating such activity from the total recreation demand, it is seen that there was a potential demand for such facilities to support a visitation of 33,570,000 inherent in the population of the Delaware River Water Service Area in 1955. For this same year there was an actual recorded attendance at state park type of establishments located within or immediately available to the population of the Delaware River Water Service Area of 26,837,000 visits. Thus there was a need for facilities to support 6,733,000 visits in 1955 over the existing capacity. About 1/3 of the recorded use of these state park type facilities was in excess of the standard capacity of such areas, resulting in serious overuse and deterioration of many public facilities. Thus the total needs above existing facilities for 1955, was for capacity to support about 15,680,000 visits. If the annual use of state park type of establishments per capita of population continues to increase in the future as it has over the past, and the projections of populations increase, and economic expansion appears to support the assumption that it will, the demand for capacity at state park type of establishments would reach 55,800,000 annual visits by 1965. By 1980 the total annual visitation would reach 98,700,000 and by 2010 would be expected to reach 227,000,000 visits a year.

The plan for outdoor recreation presented herein complements existing and going programs which are being vigorously expanded in response to the increasing demands on facilities at all levels of government by the people of the Delaware River Water Service Area. This plan emphasizes the place of facilities for one-day outings, with the additional consideration for overnight camping. The recreation potentials for a combined total of 60 water resources projects have been defined and reported upon in Appendix I, "Recreation Resources", Appendix R, "Water Control at Intermediate Upstream Levels", and in the present Appendix W, "Recreation Needs and Appraisals". The total recreation potentials that could be developed at all these projects would support about 38,000,000 visits annually. Within the present appendix a total of 22 dam and reservoir projects are reported upon. The recreation plans for these projects would provide capacity to support a total of about 23,980,000 visits a year. These projects would increase the total recreation area of the Delaware River Basin by about 162,800 acres of which 41,400 would be impounded waters.

RECREATION NEEDS AND APPRAISALS

I INTRODUCTION

1. Scope. Described here are the methods and techniques employed in the present report to meet the requirements placed upon recreation planning as a coequal physical and economic purpose served by the multiple-purpose plan of development for the water resources of the Delaware River basin. These studies have been concluded through the use of data and technical facilities of the National Park Service and the Corps of Engineers and have supported analysis of the recreation purpose that entered into all steps of the planning described in Appendix Q 1/ to this report, and in the various other appendices which support the recommended plan of development.

2. These studies originated in close collaboration between the resources planner seeking tools for his task and the expert in one particular field of recreation with data and knowledge from which to fashion the tools. Such collaboration led to a series of procedures contributing to the method presented here.

3. Essentially this series of procedures comprises a method for analysis of the recreation purpose in comprehensive water resource planning. It provides that each agency would pursue those studies related to its normal area of responsibility in accordance with the scheduling of specific assignments that would assure an orderly report procedure.

1/ Appendix Q, "Formation of the Plan of Development", prepared by the U. S. Army Engineer District, Philadelphia, Department of the Army.

II DEFINITION OF THE PROBLEM

4. Recreation as a Planning Purpose. In accordance with the basic authority contained in Congressional actions discussed in Appendix A 2/ to this report, and as stated in Appendix Q, the concept in support of formation of the plan recommended for development and use of the water resources of the Delaware River basin considers that public recreation use of these waters constitutes a purpose of the planning. Such a planning status for recreation, coequal with planning purposes of hydroelectric power, flood control, irrigation, navigation, and municipal and industrial water supply, appears to be consistent with human needs imposed by the indicated social and economic trends of the region. Justification for the magnitude of recreation proposed herein derives primarily from the existence of a population which is predominantly urban and which is engaged for the most part in a kind of economic growth that encourages increasing emphasis on use of available lands and waters for economic purposes. Thus the ratio between the increasing population and its increasing economic demands on land and water on the one hand, and its increasing need for land and water for recreation on the other presents a situation already considered critical and requires that recreation resources be given adequate consideration.

5. Planning Conditions Imposed on Recreation Purpose. The general condition arising out of recreation as a planning purpose is one of placing upon the planning effort a requirement to develop, adapt and make use of acceptable methods of planning analysis in order that recreational use of water in such a program may submit to all appropriate measurements of public investments against public returns. By such a definition, the requirements of recreation analysis enter into the formulation of multiple-purpose programs on a basis of justification comparable with other water uses wherein recreation is quantitatively defined in terms of market, costs and benefits.

6. Special Problems of Analysis. A principal difficulty arising out of such requirements of recreation analysis is that as a product of water resource development, the available data and sources of information concerning recreation are not such as to lend readily to quantitative analysis, and certainly not always with the same degree of confidence as do data regarding other products of water resources development.

2/ Appendix A, "History of Investigation", prepared by the U.S.Army Engineer District, Philadelphia, Department of the Army

Economic analysis of recreation as a purpose of water use planning is a relatively recent undertaking, and a backlog of basic procedure has not been accumulated as is the case with other water uses While it is possible, as shown later, to reduce to quantitative terms a considerable amount of what is known about recreation as it relates to the present report, there remain areas of uncertainty. Among these is the uncertainty as to what are the appropriate and possible alternative kinds of recreation opportunities that go into the evaluation of recreation as a planning purpose. The quality of recreation resources does not seem to be expressible in quantitative terms. ~~It~~ It appears, generally, from information collected in connection with this report, that preferences in recreational activities are largely a matter of individual taste, experience. desire and the personal investment required. The extent of participation in any activity is controlled to a considerable degree by the availability of opportunities.

7. Basic Unit of Measurement Employed. It is sought here to measure the effectiveness and justification of proposals and recommended expenditures for recreation features in terms of net annual visitor days of recreation opportunity provided in an area for which a need is indicated. This report does not attempt to equate benefits among such activities as camping, fishing, swimming, picnicking, hunting and boating except to attempt to maximize outdoor recreation opportunity provided in terms of the greatest range of choice among various activities for the participation of the greatest number of people

III MEASUREMENTS OF THE RECREATION MARKET

8. Discussion. The demand or market for recreation considered in this appendix resides in the people and the economy of the service area. An attempt is made to define this market quantitatively in terms of expected growth, in terms of its geographic characteristics, and in terms of magnitude as well as in terms of seasonality and other peculiarities. Such measurements are pertinent to determinations of the extent to which development of the water resources of the Delaware River drainage area may be justified for the purpose of satisfying this market. The types of activity included here and within which the recreation products of water development must be evaluated are those generally classified as one-day outings, overnight outings and vacations away from home. Specifically, they may include swimming, picnicking, sight-seeing, hiking, photography, going to the beach, fishing, hunting, camping, visiting museums, boating, and other outdoor activities. They may be engaged in at state parks, state forests, and game and fish lands, county parks, municipal parks, picnic grounds, Federal areas, historical sites and museums, resorts, in travel and at the seashore. In the main, activities of principal concern in this report are those generally considered non-revenue producing, of benefit to the public welfare and most often provided at public expense.

9. Geographic Characteristics of the Recreation Market. While the resource under consideration here is limited to the drainage area of the Delaware River and is therefore subject to exact definition of geographic boundary, the market for the recreation products expected as a result of the resource development is less easily defined. In the present case, wherein the basic assignment carries the requirement of a basinwide study incorporating recreational use of water as one of the purposes under study, the problem of market identification is distinctly different from that encountered in the case of a single independent project to which recreation might be added as an incremental or collateral function. It was necessary, in the present study, to make some determinations of the existence of the market for outdoor recreation, evaluate its needs, and measure these against the capacity of water development within the Delaware River basin for meeting the demands of such a market. Briefly stated, the market for recreation was found to take on geographic peculiarities reflecting at least three major conditions of market activity. One is that a large number of people living within the Delaware River Water Service Area make important use of recreation resources and facilities both within and outside the Delaware River drainage area, but within the Delaware River Water Service Area. The second is that a large number of people living within the Delaware River drainage area make important

use of recreation resources and facilities both within and outside the drainage area but within the Delaware River Water Service Area. These were considered to be the influence of greatest impact on resources use. However, a third activity is that of tourists and vacationists who are attracted to the region in large numbers from all over the United States and whose demand is pronounced at the major resort areas, on the historical interests of the region, and on at least the cities of New York and Philadelphia. In addition there is movement between the Service Area and such areas as Chesapeake Bay and New England, and other areas of attraction. The detailed definition of these latter conditions proved to be beyond the capacity and need of the present study.

10. Population of the Market. The basic population considered here is composed of the people living within what is defined in Appendix B 3/ of this report as the Delaware River Water Service Area. Included are the States of New Jersey and Delaware; 13 counties of Pennsylvania within the Delaware drainage area; the New York City Standard Metropolitan Area including New York City and four counties in New York State, together with eight counties in New Jersey; and the New York City Expanded Metropolitan Area, including three counties in New York State, one county in Connecticut, and one county in New Jersey. (See plate 1 at the end of this appendix). The economic characteristics of the population are discussed in Appendix B. It is note that the population of the Water Service Area is predominantly urban and is employed in the mills, factories and offices of the area. This population is recorded as 21,589,000 for 1955. It is expected to reach 25,000,000 by 1965, 30,000,000 by 1980 and 42,000,000 by 2010

11. Magnitude of the Recreation Market. The population defined above supports the basis for deriving the magnitude of the gross demand on outdoor recreation resources and facilities. In order to make use of available basic data contained in published sources 4/ concerning the recreation habits of the population above and in the interest of consistency among such data, the total population figures contained in Appendix B were adapted to reflect that part assumed to generate the principal demand on recreation

3/ Appendix B, "Economic Base Survey", prepared by the Office of Business Economics, U. S. Department of Commerce.

4/ A Study of Outdoor Recreation Activities - Preferences of the Population Living in the Region of the Delaware River Basin, prepared for the National Park Service under the auspices of the National Recreational School by Audience Research Inc., Princeton, New Jersey, January 1958.

resources and facilities. This part is arbitrarily selected as consisting of the age group of 10 years and above or about 80% of the population. The data referred to in 4/above were obtained by interview of a sampling of the adult (21 through 65 age group) population within the Delaware River Water Service Area including all of the state of New Jersey, the Pennsylvania counties of Berks, Bucks, Carbon, Chester, Delaware, Lehigh, Monroe, Montgomery, Northampton, Philadelphia, Pike, Schuylkill, and Wayne; the New York counties of Schoharie and Sullivan; and Delaware counties of New Castle and Kent. These data generally expressed in percentages of both the participating adult population and the total adult population, have been applied here to the population of the entire Delaware River Water Service Area age group of 10 years and above. It is to be noted that whereas the data reflecting recreation habits and preferences are for the 1957 calendar year, they are applied here to the 1955 population figures, since most other information was consistent at this point. No adjustment was made for the increase between 1955 and 1957, which over a long series of years will be seen in later paragraphs to amount to more than 2-1/2 percent a year. Application of the findings contained in reference 4/ above to the adjusted population figures of 1955 is contained in table W-1.

TABLE W-1

DELAWARE RIVER WATER SERVICE AREA
OUTDOOR RECREATION ACTIVITY FOR 1955 in VISITOR-DAYS
(See plates 2 and 4 for types of recreation activities included.)

One-Day Outings (1000's)	Overnight Outings (1000's)	Vacations Away from Home (1000's)	Total (1000's)
137,700	75,800	132,000	345,500

From these data it is concluded that the demand for the general category of outdoor recreation originating in the 1955 population of the Delaware River Water Service Area, classified generally as one-day outings, overnight outings and vacations away from home, was a total of 345,500,000 visitor-days.

12. Types of Recreation Activities Participated In. The types of recreation activity of principal interest in this appendix, represented by the above indicated market, are those engaged in on one-day outings and, to a growing extent, overnight and weekend outings. While, as pointed out in paragraph 6, the flexibility for choice among specific recreation activities by people

would appear to render inconclusive any attempt at precise measurement of importance among such activities, nevertheless the relative importance of these are of value in planning. Accordingly, presented here in plate 2, figures 1, 2 and 3 are the graphic results of interviews contained in published material 4/ above and reported on in Appendix I 5/. In the event one or more of the limitations shown in plate 3, figures 1 and 2, were removed, it is expected that these relationships would be readjusted accordingly. In any case these data support, along with known conditions at existing recreation areas, the strong position of picnic facilities, swimming facilities, and boating and fishing facilities in the plan of development.

13. Types of Recreation Areas Used. Analyses of data contained in reference 4/ and 5/, and presented in plate 4, figures 1 and 2, show the relative magnitude of use for recreation activity distributed among types of areas within the Service Area. These figures indicate the relatively high place impoundments would be expected to occupy in providing recreation opportunity among several of the categories indicated. Furthermore, they support the ocean beach as the most popular recreation resource available for use by the people of the area, which fact is apparent in all the data collected in connection with this appendix.

14. Seasonal Characteristics of the Recreation Market. Information in support of conclusions arrived at regarding the significance of the seasonal characteristics of recreation within the region was obtained primarily from Appendix I and from published studies by the Reserve Bank of Philadelphia 6/. The latter studies, covering the travel and vacation industry of the principal resort counties of Bedford, Pike and Monroe in Pennsylvania; Ocean, Atlantic and Cape May in New Jersey; and Sussex in Delaware, appear to be highly indicative of the outdoor nonurban recreation activity as a whole. These studies all point out the imbalance of demand throughout the year as well as during the weekdays within the principal portion of the recreation season, which is from the 4th of July through Labor Day. It is seen in plate 5, figure 2, that 40% of the luxury tax collections of Atlantic City, New Jersey, occur in July and August. Figure 1 shows that less than 30% of the retail and service establishments of Cape May county, New Jersey, are open for business throughout the year. Plate 6, figure 2, shows that about 70% of the vacation activity occurs in July and August. Figure 1 presents data showing that almost 77% of the one-day outings occur over Saturday and Sunday. This seasonal and daily imbalance on recreation

5/ Appendix I, "Recreation Resources", prepared by the National Park Service, U. S. Department of the Interior

6/ "Business Review", April and May 1958, Federal Reserve Bank of Philadelphia.

resource use is reflected in the criteria for design of facilities discussed later in this report.

15. Growth of the Recreation Market. The growth of the demand for outdoor recreation originating in the population of the Delaware River Water Service Area is considered in this appendix primarily as a reflection of combined effects of increasing population together with an increasing economic productivity of this population. While such a consideration does not imply that recreation activity does not contribute to the economy of the area, particularly in such areas as the New Jersey seashore and the Pocono and Catskill Mountains, it does place the emphasis on the responsibility of the present planning effort to provide recreation opportunity primarily to meet the demands of people who would participate in such recreation. In light of such emphasis the projection of the recreation activity to the future would rest upon projections of populations and economic growth of the area. For the period extending from 1800 to about 1940 published historical works 7/ and technical papers 8/ 9/, and the economic data contained in Appendix B, yield a general indication of the impact of the changing economic and social conditions on the growth of the recreation demand by the people of the Service Area. These works show that participation by these people in outdoor recreation has, like the use and consumption of other products of natural resources, increased over the period of economic and social development of the country. It is pointed out in Appendix I that such growth is an expression of the changing economy which is tending toward the support of more people earning more money, working fewer hours and, consequently, affording more recreation. In meeting the demands of this growing recreation market the long range development of facilities has been one of gradual adjustment in response to the desire of a population which has not only long been essentially urban in origin, but which has exhibited a marked change in economic composition over the years.

16. Historical Growth. Probably no section of the country bears such evidence of the socio-economic based growth of the outdoor recreation demand as the New Jersey shore, which has long been the most important recreation resource utilized by the people of the Delaware River basin and service area. The shore was instrumental, along with the Pocono and Catskill Mountains, in establishing

7/ "The Jersey Shore-A Social and Economic History of the Counties of Atlantic, Cape May, Monmouth and Ocean", by Harold F. Wilson, Lewis Historical Publishing Co., Inc., N.Y., 3 Vols. - 1953.

8/ "Mass Leisure", edited by Eric Larrabee and Rolf Meyersohn, The Free Press, Glencoe, Ill., 1958.

9/ "Future Demands for Timber", reprinted from Timber Resources for America's Future, Forest Resources Report, Vol. 14, U.S. Department of Agriculture, 1958.

an early pattern of outdoor activity among the people of Philadelphia, Camden, Trenton, New York City and Wilmington. The first stagecoach line which appears to have served vacationists extended from Philadelphia to Tuckerton, New Jersey, and was established in 1816. Prior to that, and as late as 1800, only the more hardy men of Philadelphia undertook a ride to the shore, and this was in oyster wagons returning to Little Egg Harbor after delivering salted oysters and fish to city markets. In 1801 a newly established hotel in Cape May advertised in Philadelphia newspapers offering accommodations to shore visitors. The trip was made by sailing vessels carrying both freight and passengers. At that time the average workweek in industry consisted of 84 hours, and paid vacations were unheard of. Until around 1900 resorts were established largely with a view to serving what was termed "fashionable society", and there was considerable growth of such places. Long Branch and Atlantic City began to attract visitors in 1819 and 1854, respectively. Early in the 19th century, Perth Amboy became a fashionable resort. Ocean Grove was founded in 1869. In non-agricultural industries the workweek declined by about 10 hours between 1850 and 1900, and the population of the Delaware River Water Service Area increased to 8,737,000 people, of which almost 7,000,000 lived in the New York City and Philadelphia metropolitan areas. While emphasis at the shore was on "elegant hospitality", this was also a period during which railroads arrived, and the first real growth of the shore was initiated. In the next few decades reductions in the workweek were much more pronounced. Between 1900 and 1940 the workweek in non-agricultural industry declined from 56 hours to about 41 hours. By 1920 railraods began to feel the competition brought about by increased ownership of automobiles and improved highways, and the years between 1925 and 1929 experienced a building boom which indicated that the recreation industry of the shore was awakening to the change in the market. The combination of factors, including a relatively rapid rate of decline in working hours per week following 1900, increased railroad facilities and then automobile traffic, increasing incomes and populations all tended to fix the shore and the resort areas of the Catskills and Poconos as major influences in the recreation habits of the people of the Delaware basin. While the resort areas in the Catskill and Pocono Mountains experienced very much the same pattern of development, they nowhere reached the colorful and spectacular success of the "shore" with the growing population of workers in offices, mills and factories living within the Delaware basin and the surrounding area. The gradual disappearance of the luxury type resort and summer mansion, and their replacement by facilities designed to serve the expanding middle income segment of the population, together with vast areas of development of medium priced cottages is evidence of the changed economic character of the demand for recreation not only on the New Jersey shore, but on recreation resources of the entire area.

17. Rate of Growth of the Recreation Market. In order to interpret the growth of outdoor recreation as it is indicated above in terms that would permit projections of such activity as an expression of population growth and economic expansion, use was made of published state park attendance for the four states of the Delaware River basin 10/ 11/. The vulnerability inherent in such projections is recognized. However, in behalf of the procedures employed here, it is pointed out that outdoor recreation of prime importance in this appendix is that classified generally as one-day outings. A comparison of specific activities considered among the most important by the people of the basin, with activities that may be provided in multiple water use development, shows that such projects considered in this report approach state park conditions insofar as meeting the demands of the market is concerned. Such similarity suggests that outdoor recreation needs and projections may be more accurately indicated by trends noted in state park use than would be the case with other sources of data. Accordingly, it has been assumed that the rate of change noted in attendance per 1,000 population at state parks may provide a reasonably accurate reflection of the tendency of people to convert such economic factors as gains in non-working hours, increased mobility, increased personal incomes and the like into the kind of outdoor recreational activity considered in this report. The principal difficulty encountered in such a procedure lies in the selection of a series of years from available data from which to compute the rate of change in the recreational market. The selection of these data, available generally from 1941 through 1956, should, in order to be consistent with the basis for utilizing the procedure, be representative of a series of years during which the general economic conditions do not depart significantly from the long range economic trends supporting the economic projections contained in Appendix B of this report. From published information on attendance records at state parks and populations for the States of New York, New Jersey, Pennsylvania and Delaware for the years 1941 through 1958, it is possible to select any of several series of years and arrive at substantially different rates of growth. However, the relatively high rate of visits for 1941, together with the fact that this level was not exceeded until 1953 suggests that a more accurate trend in rate of growth might be indicated by selection of a later base year following World War II.

10/"State Park Statistics" - 1957 & 1958, U.S. Department of the Interior, National Park Service.

11/"Statistics on Outdoor Recreation", by Marion Clawson, Resources for the Future, Inc., Washington, D.C., 1958.

For use here, the longest continuous series of years of record following World War II for which both populations and park attendance exceed the first previous year, which is 1945, has been selected. This series begins with the year 1946 and was plotted against year of occurrence to develop the computed line of trend shown in plate 7. These data indicate an average annual gain per 1,000 population of 70.5 visitor-days for the Delaware basin states. Accordingly, this figure was used and applied against the Delaware River Water Service Area populations.

18. The base year establishing the series of years from which to compute the average annual change in sales of fishing and hunting licenses, was selected somewhat arbitrarily as 1946 with knowledge of the fact that the license sales per 1,000 population is not so direct an indicator of visitor-days of market demand as the record visits to state parks, or as would be the average annual change in actual fishing and hunting days per 1,000 population were such data available. Plate 8 shows the trend of license purchases per 1,000 population for the four state areas from 1946 through 1957. The average annual increase in fishing license purchases from 1946 through 1957 per 1,000 population was determined therefrom to be 0.71 licenses per 1,000 population, and that for hunting licenses was found to be 0.61 licenses per 1,000 population.

19. The effects of population increase alone in the growth of outdoor recreation is indicated in plate 9, figures 1 and 2, wherein constant rates per 1,000 population have been assumed for state park attendance and for combined sales of fishing and hunting licenses for the four states of the Delaware River basin from 1946 through 1957, and compared with actual recorded state park attendance and license sales for this same period. In figure 1 of plate 9 it is seen that had the rate of state park attendance per 1,000 population for 1946 of 860 visits remained constant throughout the period of study the attendance in 1957 would have been about 28,800,000 visitor-days instead of the 54,900,000 actually recorded. Fishing and hunting license sales which have increased at a much reduced rate per 1,000 population show a somewhat similar if much less positive reaction in figure 2.

20. Comparison with National Growth. The Delaware River Water Service Area, with about 1% of the continental area of the country excluding Alaska and above 13% of the population (excluding Alaska), accounts for about 18% of the state park use recorded and about 8% of the total number of fishing and hunting licenses sold. In the case of state park attendance, the plotting on plate 7 shows that the rate of attendance for state parks first exceeded one visit per capita in the Delaware River basin states in 1948, while the same rate was not reached in the rest of

the country until 1955. The rate of visits per capita to state parks in the Delaware River basin states has remained consistently higher than that for the rest of the nation. In the case of purchase of fishing and hunting licenses somewhat the reverse is true. The rate of license sale per capita in the Delaware River basin states has not only remained consistently below that for the remainder of the United States but exhibits a far lower rate of increase in sales per capita per year for the period of study. These data are presented in plate 10.

21. Projection of the Market for Public Outdoor Recreation. In order to project the general magnitudes of the gross outdoor recreation market for the years 1965, 1980 and 2010, it was necessary to make flexible use of the above available data. The rate of increase in state park attendance per 1,000 population as derived and shown on plate 7 was used to compute the rate of attendance per 1,000 population for each of the years of 1965, 1980 and 2010. These rates of attendance per 1,000 population were applied against populations for the projected years to derive the projected total state park attendance expected for each year, as shown in table W-2. It is seen that the projected state park attendance for 1965 is 1.66 times that for 1955. The attendance for 1980 and 2010 is 2.94 and 6.76 times respectively that for 1955.

TABLE W-2

DELAWARE RIVER WATER SERVICE AREA
STATE PARK DEMAND

Item	Actual 1955		Projected 1965	1980	2010
Delaware River Service Area population (in 1000's)	21,589		25,000	30,000	42,000
State park attendance (per 1000 population)	1,555	70.5 *	2,235	3,292	5,407
State park attendance (in 1000's)	33,570		55,800	98,700	227,000

* Average annual increase of visitor-days/1,000 population.
NOTE: Projection made from 1945 base. (Refer to upper equation in plate 7.)

22. Although limited by scarcity of available data, fishing and hunting activity has been treated here to give an indication of the proportionate importance such recreation bears to the total activity, and to identify so far as possible the components of the totals contained in table W-4. In order to project total fishing and hunting days for the years 1965, 1980 and 2010 the average annual rate of increase for fishing and hunting license sales was computed from published data 11/. (See plate 8, previously mentioned.

23. The annual number of fishing and hunting days in the Service Area for 1955 was computed from basic data contained in published reports 11/. The number of fishermen and hunters was determined by applying percentages applicable to the Middle Atlantic States. The average number of days of participation was determined by applying national averages in each case for 1955 12/. Projections were computed by applying the indicated rate of fishing and hunting days engaged in per license buyer for 1955 to the years 1965, 1980 and 2010. (See table W-3). Even though such figures represent, at best, rough approximations of such activities, they have the additional shortcoming of lack of any indications of the rate of change in the number of fishing days and hunting days participated in by fishermen and hunters, except as may be implied in the presentation in plate 9, figure 2.

24. These figures indicate that of the total projected recreation activity demand inherent in the populations included in the Delaware River Water Service Area there exists a minimum potential demand on fishing facilities and resources amounting to 43,200,000, 61,200,000 and 111,900,000 fishing days for the years 1965, 1980 and 2010, respectively. The indicated potential hunting demand, similarly arrived at is in the magnitude of 18,400,000, 25,000,000 and 43,000,000 hunting days, respectively, for those years.

25. These projected estimates of fishing, hunting and state park demands would appear to represent the potential market the projected population and associated economy could be expected to generate on the basis of the rate of growth experienced in population and economy of the area since 1945.

12/ National Survey of Fishing and Hunting - 1955, United States Department of the Interior, Fish and Wildlife Service, Circular 44.

TABLE W-3

DELAWARE RIVER WATER SERVICE AREA
FISHING AND HUNTING ACTIVITIES
1955 - 2010

Item	Actual 1955		Projections 1965	1980	2010
Delaware River Water Service Area population (in 1000's)	21,589		25,000	30,000	42,000
Licenses/1000 population	52.4	0.71 a/	58.6	69.25	90.35
Fishing licenses (in 1000's)	1,131		1,465	2,077	3,794
Fishing man-days (in 1000's)	33,386	29.5 b/	43,200	61,200	111,900
Licenses/1000 population	62.3	0.61 a/	70.10	79.6	97.9
Hunting licenses (in 1000's)	1,345		1,752	2,388	4,112
Hunting man-days (in 1000's)	14,240	10.5 b/	18,400	25,000	43,000

a/ Average annual increase in licenses/1000 population.
b/ Total including unlicensed, of fishing and hunting-days per license purchased.

NOTE: Projection made from 1945 base. (Refer to lower equation in plate 8.)

TABLE W-4

DELAWARE RIVER WATER SERVICE AREA
OUTDOOR RECREATION DEMAND
FOR STATE PARK FACILITIES AND FISHING
AND HUNTING OPPORTUNITIES

Item	Actual 1955	Projected 1965	1980	2010
Delaware River Water Service Area Population(in 1000's)	21,589	25,000	30,000	42,000
State park attendance (in 1000 visitor-days)	33,570	55,800	98,700	227,000
Fishing (in 1000 visitor-days)	33,380	43,200	61,200	111,900
Hunting (in 1000 visitor-days)	14,240	18,400	25,000	43,000
TOTALS (in 1000 visitor-days)	81,190	117,400	184,900	381,900
Visitor-days per capita of participating population a/	4.7	5.9	7.7	11.4

a/ Participating population is 80% of total population.

26. Summary. In addition to providing a degree of measurement of the magnitude and characteristics of the market for which projects proposed in this report are to yield satisfaction, these studies also suggest that the outdoor recreation market demand of the Delaware River Water Service Area will increase by more than 6-1/2 times between 1955 and 2010. However, the composition of this market would not necessarily reflect a demand to provide for types of activity in the relative proportions indicated here. Rather it would appear that the challenge implied herein is to provide for outdoor recreation opportunity under the best conditions possible for the maximum number of people. It is recognized here that the increase in outdoor recreation per 1,000 population of participation as projected is only a general indication of trends, and that per capita participation must eventually decline in the number of days so spent per year. The time factor alone would eventually deflect the upward trend. For example, there is good evidence that increased leisure time may reflect in more people holding two jobs rather than in a proportionate increase in recreation. However, for the period of study and for the scope of this appendix these projections are considered adequately indicative to provide a practical basis for measuring needs for the recreation products of water resource development of the Delaware basin over the fifty-year period.

IV DETERMINATION OF OUTDOOR RECREATION NEEDS

27. Discussion. In the foregoing paragraphs a basis for evaluating the magnitude, rate of growth and projections of the outdoor recreation market or demand residing in the Delaware River Water Service Area was presented. Considered here are the recreation needs of this market, wherein needs are defined as that part of the demand in excess of the capacities of existing and going projects and programs supplying outdoor recreation. It has previously been noted that the multiple-purpose projects examined in this appendix have a potential capacity for providing recreation opportunity in three broad categories; namely one-day outings, overnight outings and vacations away from home. Appendix I points out that the greatest need for facilities is for one-day outings within travel distance of metropolitan areas. Much of the overnight and most of the vacation activity is associated with commercial and private facilities and therefore is not considered here in connection with recreation needs that would be satisfied by multiple-purpose projects supplying public recreation. However, of the overnight or weekend activities there is evidence that interest in camping, which is generally provided at public expense, is growing in importance at a rate greater than many of the activities normally participated in on one-day outings. It is concluded, therefore, that the primary area of concern relative to recreation needs to be examined here is in connection with the capacity of multiple-purpose projects to provide for one-day outings, plus the additional facility for camping where projects lend themselves to such use.

28. In seeking a method for comparing in quantitative terms the demands, needs and capacities relative to one-day outings, it has been concluded that state parks and state park type of establishments constituted the principal source of supply of opportunity most comparable to that afforded by multiple-purpose reservoirs. It is recognized that the distribution of the use-load among types of activities such as picnicking, boating, fishing, etc., between state park type establishments and reservoirs would vary, but the kinds of activities are essentially the same at both kinds of projects. Therefore, recreation needs would appear to be best determined upon examination of capacities of state park type projects and their relation to the demand. Accordingly, considered here are projects and programs variously classified among the several states of the Delaware River basin as state parks, state forests, and forest park preserves. An attempt has been made to include all areas offering the types of activities under study here, regardless of the administration or primary purpose, as long as general state park standards are adhered to.

29. Several approaches were explored in an effort to determine the extent to which existing recreation developments in the area are capable of meeting existing and projected demands. The most convincing of such approaches was obtained by integrating data obtained from several sources in the development of a "design load" basis for analysis. This procedure employs the use of the empirical formula $\frac{1/14\ (AV \times .80)}{1.5} \times .60$ [a/] to derive from annual visitor-days the use expected at any one time on a normal summer Sunday. As used here it measures the design load equivalent of visitor-days of demand in the population, the design load equivalent of recorded use at park establishments and the design load equivalent of overuse of such parks. It does not measure such holiday loads as the Fourth of July or other holiday loads not representative of a normal summer Sunday. For the purpose of broad analysis consistent with the scope of this appendix, and because the relationships of population density centers to geographic locations of recreation resources reasonably support it, it has been assumed here to be a practical objective to relate the demand for one-day outings at state park type of facility generated by the populations of the Service Area to the recreation facilities and resources within and adjacent to the Service Area. It is assumed further in application of such a procedure that the total demand per capita for state park type of facility inherent in the population of the Service Area is at least equal to the average recorded attendance per capita at state park type establishments for the four states comprising the Service Area. While a reasonable degree of isolation of the above factors supports such an assumption for purposes of overall measurement it will be noted that in later analyses of individual projects and groups of projects the overlapping effects of certain metropolitan populations had to be considered. This is particularly true in the case of Wilkes-Barre and Scranton, and of the case of populations to the south in Maryland. In accordance with this assumption the application of the above formula to the measurement of recreation needs of the Delaware River Water Service Area is accomplished in the following steps.

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a/ AV - annual attendance
80% - percent of attendance that will use facilities during normal season of 14 weeks.
60% - percent of weekly visitors on a normal summer Sunday
1.5% - rate of turnover on use of facilities on a normal summer Sunday

30. Steps in Analysis - Recreation Needs - Delaware River Water Service Area.

a. Design load equivalent (DL) of demand inherent in 1955 population of Delaware River Water Service Area.

$$\frac{1}{14}\left(\frac{(21,589,000 \times 1.555) \times .80}{}\right) \times \frac{.60}{1.5} \quad DL = 767,000$$

b. Design load equivalent of 1955 recorded park use in Delaware River Water Service Area.

$$\frac{1}{14}\left(\frac{26,837,000\ ^{a/} \times .80}{}\right) \times \frac{.60}{1.5} \quad DL = 613,000$$

c. Design load equivalent of demand over recorded use.

DL = 154,000

d. Overuse at 1/3 of recorded use. DL = 204,000

e. Design load equivalent of needs. DL = 358,000

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a/ From attendance records at state parks in and adjacent to Delaware River Water Service Area.

31. The steps of analysis described in paragraph 30 show that if the potential per capita demand for state park type of facilities inherent in the population of the Delaware River Water Service Area is at least equal to that shown by the record to be indicated by the population of the four states of which the Service Area is a part, then there was an excess demand over capacity equivalent of facilities required to accommodate 358,000 people at one time on a normal summer Sunday in 1955. This is defined as the need for outdoor recreation facilities for the Delaware River Water Service Area at the 1955 level.

32. To determine the overuse of facilities provided in state parks in the Delaware River Water Service Area, the recorded annual attendance of selected state parks was used where activities and facilities were comparable to those proposed in the plan of development and where the major attraction was the recreation resources and not historical or unusual natural features. The design load criteria described above was used to provide the desirable design load of the recorded annual attendance on a normal summer Sunday. Comparing the

design load equivalent of the recorded attendance with the capacity of existing facilities listed for these parks, a percentage of overuse was determined. An examination of table W-5 shows a range from 8% to 100% of use above capacity for the seven state parks selected as representing areas whose facilities and activities are similar to those proposed for development in the Delaware River basin. This table also indicates an overuse of 60% for the total use above optimum capacity of the seven parks. Taking into account possible errors in estimating attendance where actual counts were not available and assuming that design load is the desirable but not necessarily maximum capacity, a conservative measure of overuse for all parks in the Service Area is estimated to be about one-third. The New York Conservation Department in its recent publication Outdoor Recreation Survey, stated, "A recorded daily attendance that exceeds capacity by more than 50% is almost sure to mean that somewhere in the system people are being turned away from use of park facilities and in many cases denied entry to the park itself." Discounting immeasurable factors such as people denied entry into state parks and the impact of known overcrowding on prospective park users, the survey stated that, "The day-use capacity in the New York State Park System is at least 20% short of current needs." These figures indicate that on hot summer Sundays and holidays overuse is at least 50% and daily overuse is at least 20%.

TABLE W-5

DELAWARE RIVER WATER SERVICE AREA
OVERUSE OF EXISTING STATE PARK FACILITIES

Recorded Annual Attendance	Design Load of Annual Attendance	Optimum Capacity of Existing Facilities	Percent of Overuse
1,882,000	48,000	24,000	100
479,000	12,300	9,000	37
465,000	12,000	8,500	41
1,539,000	39,600	30,000	32
148,000	3,800	3,100	23
148,000	3,800	3,400	12
160,000	4,100	3,800	8

33. Projected Outdoor Recreation Needs - Delaware River Water Service Area. Table W-6 shows the projected needs for state park type of facilities from 1955 through 2010. The accumulated design load equivalent of demand and the projected increments thereof are indicated. These analyses suggest that the Delaware River Water Service Area could have used almost double the capacity for outdoor recreation that was available for 1955. In considering the problem of the 1955 needs over capacity, Appendix I points out the possibilities of increasing and expanding existing facilities and programs. Thus the indicated deficit for 1955 is treated here as the increment of needs for that year, with the assumption that existing facilities, lands and other resources furnishing outdoor recreation will continue to be vigorously developed to provide more capacity. This capacity of existing and going programs is not appraised quantitatively, and the measurement in this appendix concerns itself primarily with the capacities of multiple-purpose reservoirs to meet only the projected needs that would result of the increasing population and expanding economy over the 1955 level of supply and demand. Table W-6 shows that the needs generated by the expected population and expanding economy between 1955 and 1965 amounts to a demand on facilities necessary to accommodate 506,000 visitors at one time on a normal summer Sunday. An additional need of 983,000 visitor accommodations for 1980 and 2,933,000 visitor accommodations for 2010 is indicated for the populations of the entire Service Area.

TABLE W-6

DELAWARE RIVER WATER SERVICE AREA
SUMMARY OF PRESENT AND PROJECTED RECREATION FACILITY NEEDS
(in 1000's)

Item	Actual	Projected		
	1955	1965	1980	2010
Annual state park potential demand (visitor-days)	33,570	55,700	98,700	227,000
Design load equivalent (visitors)	767	1,273	2,256	5,189
Increments of design load equivalent (visitors)	358 a/	506	983	2,933

a/ Deficit in facilities over 1955 facilities.

34. Determination of Recreation Needs Associated with Projects. In the examination of recreation needs in relation to individual multiple-purpose reservoirs it was found that the complexities could be simplified to some extent by grouping together those projects located in close proximity to one another and serving overlapping metropolitan populations. An analysis of recreation needs of populations associated with these projects, together with use expected to originate in populations outside the Service Area, is presented in the following paragraphs. It will be noted that the sum of the needs of populations associated with projects is not precisely the same as the needs indicated for the Delaware River Water Service Area shown in table W-6. This discrepancy arises because project effects would be felt beyond the limits of Service Area in some instances. In other instances populations of the Service Area reside beyond day-use distance of projects studied here.

35. Recreation Needs Associated with Projects of the Middle Basin in Pennsylvania and Delaware. Considered here are recreation needs associated primarily with the populations residing in an area limited on the east by Delaware River and on the west, north and south, by a series of arcs of 25-mile radii centered on the principal multiple-purpose projects included in the plan of development. (See plate 11). This population, not including a considerable influx of residents of Maryland, Virginia and Washington, D. C., was recorded as 5,780,000 in 1955. The steps of analysis presented here are in accordance with procedures outlined above.

36. Steps of Analysis - Recreation Needs Associated with Projects of the Middle Basin in Pennsylvania and Delaware.

a. Design load equivalent of demand inherent in population in area.

$$\frac{1}{14}\left(\frac{(5{,}780{,}000 \times 1.555) \times .80}{}\right) \times \frac{.60}{1.5} \qquad DL = 205{,}400$$

b. Design load equivalent of recorded park use in area.

$$\frac{1}{14}\left(\frac{3{,}000{,}000 \times .80}{}\right) \times \frac{.60}{1.5} \qquad DL = 68{,}600$$

c. Design load equivalent of demand over recorded use.

DL = 136,800

d. Overuse at 1/3 of recorded use DL = 22,900

e. Design load equivalent of total needs. (rounded) DL = 159,000

37. Because populations are included here for which projections are not available in Appendix B, and because of the difficulty of extracting projected rates of increase for various segments of the population above, it has been assumed that the increase on state park visits for the years 1965, 1980 and 2010 will retain the same relationships to the 1955 attendance for the middle basin populations in Pennsylvania and Delaware that the projected park attendance for the entire Service Area bears to the 1955 attendance. These projections of design load equivalent of demand together with increments of increase of design load at each of the projection points are shown in table W-7. Such design load estimates represent the needs that specific projects proposed herein would seek to satisfy. It will be noted that facilities to support a design load of 159,000 people at any one time are required to bring the 1955 facilities up to the 1955 design. The increments of capacity of design load equivalent indicated for the projected years are 135,000, 263,000, and ~~876~~ 786,000, respectively, for 1965, 1980 and 2010.

TABLE W-7

PRESENT AND PROJECTED NEEDS FOR DAY-USE FACILITIES
MIDDLE BASIN - PENNSYLVANIA AND DELAWARE
(in 1000's)

Item	Actual	Projected		
	1955	1965	1980	2010
Annual state park potential demand (visitor-days)	8,988	14,900	26,400	60,800
Design load equivalent (visitors)	205	340	603	1,389
Increments of design load equivalent (visitors)	159 a/	135	263	786

a/ Deficit in facilities over 1955 capacity.

38. Needs Associated with Projects of the Upper Basin in New York. Only one project is considered here; the Hawk Mountain multiple-purpose dam and reservoir. A population of 75,000 people resided within a 25-mile radius of the project in 1955. It is not expected that the Hawk Mountain project would serve any of the critical demands indicated by the metropolitan populations of the basin or Service Area which exert a heavy demand

on the general area's commercial overnight and vacation accommodations. However, for local and vacation use the project is included here with facilities based on a computed design load of 8,500.

39. Needs Associated with Projects of the Middle Basin in New Jersey. Multiple-purpose projects studied and included here are Hackettstown, Paulina, Pequest and New Hampton. (See plate 11.) Projects intended primarily for recreation in the lower basin are Higbee Beach, Pedricktown Depot of the Raritan Arsenal, North Hereford Inlet Beach, West Cape May Beach and Cox Hall Creek, as discussed in Appendix I. Other projects which bear upon the recreation activities of the area located outside the basin are also discussed in Appendix I. Of primary concern in this appendix are the projects with multi-purpose potentials, including Hackettstown, Paulina, Pequest and New Hampton. These four projects are considered for estimating purposes to provide recreation opportunity primarily for the people of the eleven surrounding counties of New Jersey and the two counties of Orange and Rockland in New York.

40. Steps of Analysis - Recreation Needs Associated with Projects of the Middle Basin in New Jersey.

a. Design load equivalent of demand inherent in population in area.

$$\frac{1}{14} \frac{(4{,}125{,}000 \times 1.555 \times .80)}{} \times \frac{.60}{1.5} \qquad DL = 146{,}000$$

b. Design load equivalent of recorded park use in area.

$$\frac{1}{14} \frac{(6{,}000{,}000 \times .80)}{} \times \frac{.60}{1.5} \qquad DL = 137{,}300$$

c. Design load equivalent of demand over recorded use.

DL = 8,700

d. Overuse at 1/3 of recorded use. DL = 46,000

e. Design load equivalent of total needs DL = 54,700

41. The 1955 population of this area was 4,125,000. A total of 6,414,000 potential state park visits by this population is indicated for 1955, which would amount to an instant use of facilities by 146,000 people. Recorded state park attendance at parks located within this area in 1955 amounts to an instant use of facilities by 137,300 people. Estimating an overuse of 1/3 of the

of the actual use, there is a need for facilities to support an instant use by 54,700 people over the existing capacities for the 1955 level of participation. Facilities that would be required to provide for the increment of increased demand at each of the projected years are shown, in table W-8, to be 97,000, 188,000 and 560,000 visits each for 1965, 1980 and 2010, respectively.

TABLE W-8

PRESENT AND PROJECTED NEEDS FOR DAY-USE FACILITIES
THE MIDDLE BASIN IN NEW JERSEY
(in 1000's)

Item	Actual 1955	Projected 1965	1980	2010
Annual state park potential demand (visitor-days)	6,414	10,647	18,857	43,358
Demand in design load equivalent (visitors)	146	243	431	991
Increments of design load equivalent (visitors)	54.7	97	188	560

42. Needs Associated with the Tocks Island Project. Because of its size, recreation potential, superior scenic qualities, ease of access and proximity to large urban populations of the region, and the physical capacity of the project for development of recreation facilities, emphasis is placed on the regional and national significance of the Tocks Island project. The importance of contributions by the project that would be made to the region as a whole is discussed at length in Appendix I. The problem approached in this appendix is the measurement of these effects as a basis for estimating the number of people for which the project would provide outdoor recreation opportunity.

43. The populations considered here in relation to the Tocks Island project are those discussed in Appendix I, where it is stated that the project would be expected to draw heavily upon populations as far as 200 miles distant, and that its effects would be felt beyond that. This greater range of effects is in part attributable to

the attractiveness of the project for boating, overnight and week-end use, including camping for which a considerable unsatisfied demand exists within the region. However, the principal analysis here is concerned with the capacity of the project to satisfy one-day outings because these are the activities creating the greatest demand for fulfillment by public facilities.

44. The 1955 populations residing within each of the 25, 50, 75 and 100-mile radii of the Tocks Island project are shown in table W-9. The percentage distribution of the population within each radius residing in the separate states is also shown. Within the 100-mile radius of the project resides about 14 percent of the population of the United States. (See plate 12.).

TABLE W-9

DISTRIBUTION OF POPULATION WITHIN 100 MILES OF TOCKS ISLAND DAM AND RESERVOIR

State	1955 Population (1000's)	Total %	2010 Projected Population (1000's)	Total %
Population				
25-Mile Radius				
New York	127	24	331	31
New Jersey	285	54	517	49
Pennsylvania	115	22	212	20
Total	527	100	1,060	100
50-Mile Radius				
New York	768	14	1,548	15
New Jersey	3,617	65	6,525	63
Pennsylvania	1,171	21	2,242	22
Total	5,556	100	10,315	100
75-Mile Radius				
New York	10,664	54	19,561	52
New Jersey	4,321	22	8,136	22
Pennsylvania	4,491	22	8,577	23
Connecticut	424	2	1,179	3
Total	19,900	100	37,453	100
100-Mile Radius				
New York	11,150	46.3	20,494	43.4
New Jersey	5,191	21.6	10,110	21.4
Pennsylvania	5,861	24.3	12,297	26.1
Connecticut	1,561	6.4	3,350	7.1
Massachusetts	39	0.2	108	0.2
Delaware	277	1.2	842	1.8
Total	24,079	100.0	47,201	100.0

45. Table W-10 presents the steps of analysis indicating the magnitude of unsatisfied needs for outdoor recreation opportunities for people residing within a 100-mile radius of Tocks Island project, for which the project has a capacity for partial satisfaction. This table compares the recorded attendance at state parks located within each distance zone with the potential demand presented in column 2, which is derived by applying the annual rate of visits per 1,000 population for the 1955 populations of New Jersey, New York, Pennsylvania and Delaware to the population under study here. Also applied here is the consideration that the recorded attendance constitutes an overload of at least 1/3 on existing facilities. The potential or unsatisfied demand derived by these steps for each of the zones is claimed as the possible visitation at Tocks Island as limited by the effects of the distance people would be willing to drive for one-day outings indicated in column 9. The effects of distance are developed from the basic data contained in footnote 4/ above, and the method is described in paragraph 11, wherein the sampled population was questioned as to the driving distances that would limit use of one-day outing facilities. This measurement is, therefore, only a partial, or general, indicator of the attractiveness of the Tocks Island project to meet the needs at the 1955 level, since the overnight or weekend use which would be indicated by different factors for distance has not been segregated in this table. About five percent of the 1955 state park visitor-days of attendance in the four state study area was composed of visitor-days of overnight users, and while it can be argued that such use should be determined and projected in the present study, it is not felt that reduction to such detail is warranted in view of the amount of additional study involved. The regional significance of the Tocks Island project is fully substantiated in the present data which show that the needs for the recreation products of the project reside in a population of about 19,300,000 people who live farther than 25 miles from the project but less than 75 miles, being residents for the most part of urban areas of New York, Pennsylvania and New Jersey. The figures in table W-10 show a total need over existing capacity by people willing to travel the distance to Tocks Island amounting to 401,900 visitors at any one time. If the surplus of capacity of existing facilities included in the zones 0-25 miles, and 75-100 miles is deducted, there remains a net need of facilities to support a total of 365,500 people at any one time, all of whom would be willing to drive the distance to Tocks Island for one-day outing opportunity. The problem remaining is one of developing the Tocks Island water, land and scenic resource to provide for a use by the greatest number of people within the limitations of a balanced program of activities and within the basic capacity of the project to support use without deterioration of the fundamental values inherent in the site.

TABLE W-10

DETERMINATION OF PRESENT RECREATION NEEDS THAT COULD BE SATISFIED AT TOCKS ISLAND PROJECT

Zones Miles Distance From Tocks Island	Total Demand on Existing Facilities (1) 1955 Population (1,000's)	(2) Potential State Park Visits by Population (1,000's)	Capacity of Existing Facilities (3) Recorded Attendance at Existing Parks (Visits in 1,000's)	(4) Design Load Equivalent of Recorded Attendance (visits)	(5) Overuse in Design Load Equivalent (visits)	(6) Design Capacity Existing Parks (visits)	Needs in Excess of Existing Capacity (7) Design Load Equivalent of Total Demand for Column 2 (visits)	(8) Design Load Equivalent of Needs (visits)	Needs That Could Be Satisfied by Tocks Island Project (9) Percent of Needs in Driving Distance of Tocks Island	(10) Potential Users of Tocks Island Design Load Equivalent (visits)
0-25	527	819	1,353	31,000	10,300	20,700	18,700	+2,000	100	+2,000
25-50	5,029	7,820	4,375	100,000	33,300	66,700	178,700	-112,000	92	-103,000
50-75	14,344	22,305	7,979	182,400	60,800	121,600	509,800	-388,200	77	-298,900
75-100	4,179	6,420	15,002	342,900	114,300	228,600	146,700	+81,900	42	+34,400

Col. (1) Populations residing within each of the defined zones.

Col. (2) Derived by assuming rate of 1,555 visits per 1,000 population for populations and recorded State park visits for the States of New York, Pennsylvania, New Jersey, and Delaware.

Col. (3) Recorded attendance at State park type facility at parks located within each of defined zones. Includes parks outside but adjacent to 100-mile radius.

Col. (4) Design load equivalent of attendance in Column 3.

Col. (5) Design load equivalent of overuse at 1/3 of recorded visits.

Col. (6) Column (4) minus Column (5).

Col. (7) Design load equivalent of Column (2).

Col. (8) Difference between Col. (6) and Col. (7) + = excess facilities
- = excess demand.

Col. (9) Percent of people in each zone willing to drive distance to Tocks Island project for one-day outing.

Col. (10) Shows capacity located in 0-25 mi. and 75-100 mi. zones with excesses of +2,000 and 34,400 visitors over demand of population in this zone of those willing to drive to Tocks Island. Expressed in design load equivalent. For 25-50 mi. and 50-75 mile zones needs are indicated for 103,000 and 298,000 visitors willing to drive distance to Tocks Island. Expressed in design load equivalent.

46. Table W-11 projects the above findings presented in table W-10 assuming that the rate of increase in demand for such facilities by the population surrounding Tocks Island is the same as the rate for the population of the entire population of the Delaware River Water Service Area. These figures indicate that local needs enter into the problem by 1965, and that the percentage of people living beyond 75 miles and up to 100 miles of the project, willing to drive such a distance is in excess of the 1955 capacity of facilities within that zone and may, therefore, be considered as additional users who would visit Tocks Island.

TABLE W-11

PRESENT AND PROJECTED NEEDS OF POPULATION WILLING TO DRIVE DISTANCE TO TOCKS ISLAND PROJECT

Origin of Demand (Zones in miles)	DESIGN LOAD EQUIVALENT			
	Present	Projected Demands		
	1955	1965 f/	1980 g/	2010 h/
0- 25 at 100% b/	18,700	31,000	54,900	126,400
25- 50 at 92% c/	164,400	272,900	483,300	1,111,400
50- 75 at 77% d/	392,500	651,500	1,153,900	2,653,300
75-100 at 42% e/	61,614	102,200	181,100	416,600
Totals	637,214	1,057,600	1,873,200	4,307,700

Projected Increments of Recreation Needs over Existing Facility Capacities a/

(Zones in miles)	1955 i/	1965	1980	2010
0- 25	+ 2,000	- 10,300	- 23,900	- 71,500
25- 50	- 103,000	- 108,500	- 210,400	- 628,800
50- 75	- 298,900	- 259,000	- 502,400	- 1,499,400
75-100	+ 34,400	- 6,200	- 78,900	- 235,500
Net Needs	- 365,500	- 384,300	- 815,600	- 2,435,200

a/ = Expressed in design load equivalent
b/ = 100% col. 7, table W-9, Demand for which Tocks Island is competitive.
c/ = 92% col. 7, table W-9, Demand for which Tocks Island is competitive.
d/ = 77% col. 7, table W-9, Demand for which Tocks Island is competitive.
e/ = 42% col. 7, table W-9, Demand for which Tocks Island is competitive
f/ = 1.66 of 1955 demand.
g/ = 2.94 of 1955 demand.
h/ = 6.76 of 1955 demand.
i/ = From table W-10 (+ = park capacities in excess of local needs)
(- = local needs in excess of park capacities)

47. In the foregoing analyses the objective was to relate the individual or selected groups of projects to an associated population. At this point it was not pertinent to the analysis that an overlapping of such effects would exist, as for example between the Tocks Island projects and projects located in the middle basin of Pennsylvania and Delaware. Such overlapping does become significant in later discussions which present the scheduling of these projects over the years and the relationship they bear from point of initiation to the projected demands indicated above. At the present stage in the analysis there appears to be evidence that each project studied could be expected to satisfy a part of the indicated needs for outdoor recreation over and above the capacity of existing facilities at both the 1955 level and at those projected for future years.

48. Conclusions. The basic conclusions derived from the foregoing analyses is that the needs for outdoor recreation will increase by more than 6-1/2 times between 1955 and 2010. There is a probability that this increase will be greater. Associated with these projections is the observable fact that the available areas for public use in 1955 were in many cases in a condition of critical overuse. Furthermore, possibilities for obtaining additional recreation capacity by increasing public land holdings in the Service Area, including consideration of the New Jersey and Delaware beach lands, are limited.

49. The application of the concept of "needs," outlined in the foregoing paragraphs, to the problem of resource planning herein requires certain caution in order that the projectable effects of the economy upon "needs" are not confused with the needs as supported by the economy of the base year of 1955. Such an inquiry would arise in relation to an examination into the factors that limit the rate of recreation participation, which for state park use for the Delaware basin states in 1955 was 1,555 visits per 1,000 population. To consider state park use as a part of the whole recreation activity, it is assumed here to be a reasonably sound planning assumption that the total of one-day outings, overnight outings and vacations away from home, and probably the total of each for all kinds of activity is an indication of the capacity of the economy to support such recreation demand in terms of mobility, income and leisure time. This would suggest that at a given economic level the distribution of participation among types of areas and kinds of activities would depend upon the availability of the particular resource and facility. Thus emphasis upon providing an additional type of area or kind of activity would result mainly in a redistribution of the total participation among such types and kinds. In fact, such a condition is suggested in the data contained in the previously referenced study on recreation preferences 4/, where it

it is indicated that of the factors limiting one-day outings, those that are economy-based account for more than 81 percent of the lack of participation by people who would like to so participate. About 15 percent of the lack of participation is indicated as due to inadequate facilities. For these reasons the concept of a deficit in 1955 facilities to meet needs afforded by the economy would appear to be reasonably supported.

V RECREATION IN PROJECT FORMULATION

50. Procedures. In the formulation of the recreation plan of development as a purpose in the multiple-purpose projects contained in this report it was necessary to develop quantitative values at each step of the planning process comparable to the requirements upon the other water use purposes served by the projects. Primarily these values are those associated with the criteria of design by which the magnitude of the recreation plan was determined and with the fitting of this recreation plan into the physical and economic make-up of the projects. The elements of these appraisals are described in the following paragraphs.

51. Design Criteria. Criteria supporting the estimates of costs for recreation elements herein have been developed from attendance and facility data derived of existing state park type of establishments in eastern United States and adjusted to reflect reservoir conditions. These criteria serve primarily to determine the expected use-load and to arrive at cost estimates of survey scope. They contemplate the preparation of a master plan for each project, when authorized, comparable in scope to design memorandum utilized in dam and reservoir planning. At such time the details of each plan would be developed. These criteria are described in the following paragraphs.

52. Attendance. Attendance data utilized in this appendix consists of the following definitions:

a. Total annual attendance is the total visitation expected at the project for one year for all purposes including sightseeing. Estimates of total annual attendance used in this appendix have been derived by two procedures, consistent with the level of planning. Initially in establishing the general magnitude of attendance that could be expected for each project a formula, developed empirically from attendance data from state parks in the eastern United States, was used as a general guide. This formula employed values for levels of general attractiveness of the project area, population of the contributing community, effects of urbanization, road mileage from the population to the project and the economic level of the population. These estimates were then adjusted by judgment in some cases where it was felt all values were not equitably represented. However, in later stages of planning, and when the magnitude of recreation needs became more firmly established the attendance at each project was re-examined. At this time attendance was fixed at the capacity of the project to support visitation without overcrowding and deterioration of the basic resource. Therefore, annual attendance credited to each project in this appendix reflects to a considerable extent a professional judgment of the capacity of the

project arrived at through study of each project's physical characteristics. The suitability and extent of adjacent terrain for recreation development, and its adaptability to the several kinds of recreation activity in proper distribution of a balanced program were considered.

b. Annual design attendance is the annual attendance for which specific facilities are provided. Sightseeing assumed at 25 percent of total annual attendance is excluded.

c. Design load is the number of people expected to use an area at any one time on a normal summer Sunday and is the number for which facilities would be needed. Design load is computed from the formula

$$\frac{1}{14} \text{ (AV x .80) } \times \frac{.60}{1.5} \text{ a/}$$

d. Present attendance is the visitation estimated as making use of the project area for recreation before development, for which facilities would be provided but benefits not claimed.

e. Net attendance is the difference between total annual attendance and present attendance, and is the recreation attendance for which benefits are claimed.

53. Facilities.

a. Picnicking facilities are provided for 40 percent of the design load at the rate of 20 people per unit of four tables, a fireplace, a trashcan and site preparation. Where picnic shelters are indicated they are provided at the rate of one shelter of eight tables and two fireplaces for every 25 picnic units.

b. Swimming facilities in the form of beach preparations are provided at the rate of 55 percent of the design load at 50 square feet per person. Where indicated a public service building is included.

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a/ AV = estimated annual attendance.
80% = percent of annual visitation that will use facilities during normal recreation season.
14 = number of weeks, normal recreation season.
60% = percent of weekly visitation expected on a normal summer Sunday.
1.5 = estimated turnover on day use facilities on a normal summer Sunday.

c. Boating and fishing facilities are provided at the rate of 15 percent of the design load with one access unit per 320 persons consisting of a boat ramp and a parking area for 40 cars. Where indicated a boat dock is included.

d. Parking facilities are provided at the rate of 80 percent of the design load at the rate of four people per car.

e. Sanitation facilities are provided for 100 percent of the design load with one unit of five water closets and one urinal for every 320 people. Flush type toilets are contemplated in all cases in view of the heavy use indicated.

f. Water facilities are provided for 100 percent of the design load at the rate of one faucet per 75 visitors, including water supply, pipelines, storage tanks and outlets.

g. Camping facilities, where provided, are on the basis of 10 percent of the design load at the rate of one unit per five people. One unit consists of a picnic table, fireplace, trashcan, site preparation, parking space, and a proportionate share of water, sanitation, circulator roads, landscaping, signs and markers.

h. Administration unit, where indicated, includes residence, maintenance garage, workshop, equipment storage building and utilities.

i. Road requirements were determined by preliminary study of topographic maps.

j. Trail facilities, where indicated, are at the rate of one mile per 5,000 visitations.

k. Land proposed for recreation use is shown on project maps contained in Appendix U 13/ to this report. The acquisition provides for public ownership of the shoreline and strategically located areas essential for public recreation use and for protection and preservation of the potential of the project for its full recreation development. These lands are described in a later part of this appendix in connection with each project studied.

13/ Appendix U, "Project Design and Cost Estimates", prepared by U. S. Army Engineer District, Philadelphia, Department of the Army

54. Recreation Benefits. Monetary benefits claimed for attendance estimated for projects contained in this appendix are at the rate of $1.60 per visitor of net attendance. This rate represents a weighted day-use derived from all activities participated in at projects, including picnicking, swimming, fishing, boating, camping, sightseeing, outdoor sports and games, nature study and camping. Actual benefits claimed in cost allocation studies are a pro rata share of total recreation benefits consistent with the costs for real estate and facilities in the directly water related part of the total recreation plan as described in later paragraphs.

55. Alternate Costs for Recreation Analysis. In accordance with standard procedures of analysis in water resource planning, the cost of providing outdoor recreation at sites or projects, or in programs serving the same population as the multiple-purpose projects under investigation here, was utilized as a measure of the effectiveness of such multiple-purpose projects to serve the recreation purposes. The use of such data was based upon the consideration that so long as an unsatisfied market for outdoor recreation remains, the recreation purpose in multiple-purpose projects should be served at a cost not exceeding that by which it may be obtained in alternate programs. In instances where the demand for outdoor recreation may be satisfied by going programs, the cost of recreation in multiple-purpose projects should be less than the alternate cost.

56. Defining the Alternate Situation. It was concluded that the alternate situation should be one that represents the present and future principal real source of such recreation. It should be a source reasonably expected to develop and to provide similar activities to a similar cross-section of the population as the situation under study. Obviously then, the alternate source resides in state park systems and similar establishments because these represent investments actually made to provide such activities. The present alternate situation was observed to consist of providing new state parks and of expanding the land and facilities of existing state parks, the product of which is measured in visitor-days of outdoor recreation. Thus it was concluded that the alternate cost supporting the most realistic measurement would be the alternate cost per visitor-day of providing the types of recreation activity produced by the multiple-purpose projects under study here. Therefore, it is seen that there is no alternate recreation project to such a project as Trexler, Tocks Island, or Maiden Creek, or other multiple-purpose projects reported upon here, but that there are realistic alternate sources of the same recreation product, namely visitor-days of opportunity.

57. Accordingly, estimates of replacement costs, in 1959 prices, for eight state parks located in Pennsylvania and New York were secured from state park agencies. These parks were selected by the agencies as a representative sample of the range of quality of recreation facilities in the general area. Recent and current construction

experience in both states was relied upon to develop such costs estimates. The data received were an inventory of facilities, the unit cost of replacing each facility, the number of units, operation and maintenance costs and land values per acre without improvements. Included also is the cost of replacing the impoundment in each park containing an artificial lake based upon average cost per surface acre invested by the Pennsylvania Fish Commission in similar type projects. The average cost per surface acre of water impounded for recreation is considered here as the most realistic appraisal since such investments are actually evaluated in terms of surface acres of water obtained rather than in acre-feet of storage. These basic cost items were reduced to annual investment charges in accordance with standard procedures employed in survey scope studies. To the basic land values obtained were added the average percentage of difference between market land values and total acquisition costs as determined in obtaining cost estimates for multiple-purpose recreation lands from a total of 54,079 acres in 13 different locations in Pennsylvania, New Jersey, New York and Delaware made in connection with this report. Discrepancies and unreported costs for items submitted were estimated on basis of experienced costs and cost criteria used in this report, or on the basis of costs included elsewhere in the state reports as judgment indicated. An interest rate of 2-1/2% on amortized investment was used. Annual attendance data for each park were compared with annual investment charges to obtain the annual cost per visitor-day of attendance.

58. These data, tabulated in table W-12, show that for individual state parks the annual investment per visitor-day ranged from extremes of $0.547 to $1.337 with a weighted average of $1.05 for the eight state parks. These costs are considered as constituting the range of alternate costs permissible in the evaluation of mulitple-purpose projects being considered.

TABLE W-12

SUMMARY OF ALTERNATE RECREATION COSTS

Project	Annual Attendance	Annual Charges	Annual Charges Per Visitor-Day
A	139,000	$ 149,600	$1.076
B	834,000	465,500	0.547
C	427,000	405,000	0.948
D	55,000	43,000	0,781
E	396,000	529,500	1.337
F	347,000	196,300	0,565
G	6,080,000	6,937,000	1.140
	8,278,000	8,725,900	

Weighted Average...$1.05

59. Recreation Costs. Cost estimates for recreation development are contained in Section VI of this appendix. Detailed estimates are presented for Tocks Island, Beltzville, Aquashicola, Trexler, Maiden, Blue Marsh, Prompton and Bear Creek projects where both Federal and non-Federal participation in the multiple-purpose project is indicated. Detailed cost estimates are provided for Newark, Christiana and Hawk Mountain projects because these projects support multiple-purpose features, the needs for which are indicated prior to 2010. For the above eleven projects, these costs have been reduced to equivalent annual charges for purpose of full project evaluation. Included in the annual charges are construction and real estate costs amortized over a 50-year period at 2-1/2 percent, operation and maintenance costs, and annual costs for replacing one-third of the facilities every 25-years. The annual value of production of land foregone because of recreation development and interest on investment during construction have been computed in this appendix for further analysis in Appendix V 14/ where comparable data treating all project purposes are contained. Table W-13 shows the total amounts of specific recreation costs associated with each project. Cost estimates for the Tohickon, Newtown, Evansburg, French Creek, Pequest, Paulina, Hackettstown and New Hampton projects are included in table W-14. This indicates the relative cost of site acquisition with a view to long range development, and compares recreation costs among projects.

60. Basis for Cost Allocations. Costs allocated to the recreation purpose of multiple-purpose projects contained herein consist of those specific recreation costs for land that serves only the recreation purpose and the cost of specific recreation facilities that serve to support the recreation use of the project. Land costs include purchase in fee of those lands lying above the acquisition for flood control purposes and, where significant costs are involved, the cost of purchase in fee, in excess of the cost of flowage easement, of those lands on which the flood control purpose requires only flowage rights. These costs are considered specific and separable costs for recreation in cost allocation procedures, and are shown in tables W-13 and W-14. In addition to such specific or separable costs, there is allocated to the recreation purpose a share of the costs for those project features of which recreation shares the use along with one or more other purposes.

61. In the application of cost allocation procedures a determination had to be made regarding the proper level of recreation investment that would reflect on one hand the equitable indebtedness on the part of the recreation purpose in jointly used project features, and on the other hand, would be of such magnitude as to support the position of recreation purpose in assuring that the jointly used project pool be made available and preserved for its full public use and development. It was apparent that the full desirable recreation development of a project to the level of a modern state park

complex, as approached in the full development of each project presented in this appendix, would exceed in investment that level that would yield an equitable indication of the recreation purpose's direct dependence on the jointly used pool. On the other hand, the acquisition of a limited number of access points of a few acres each and the provision of a minimum level of basic facilities would not satisfy the requirements of project purpose as defined above and, when considered in connection with population density and growth of the region, would reflect an inadequate exploitation of the resource for public recreation use.

62. Accordingly, that part of the recreation plan determined to be directly associated with the multiple-purpose project is defined here as an integral part of the water control project and, therefore, constitutes that part of the total recreation investment and recreation benefit that directly reflects the economic advantages secured by the recreation purpose in sharing the use of project features. To support this definition of recreation purpose, it is required that the real estate surrounding the jointly used pool that is directly related to the preservation of the public use of the pool be acquired for public ownership. Furthermore, it is required that in connection with such real estate there also be provided those facilities of acceptable standard to meet the needs of the people who visit the project because of the existence of the pool. These are the conditions met in the "direct" elements of the recreation development as contained in this appendix which provide the benefits and costs utilized in the allocation of project costs to the recreation purpose. The basis for cost allocations is contained in table W-13. "Indirect real estate or facilities" are those additional elements determined to be essential to the full utilization of the recreation potential of the project. They are considered an integral part of the overall recreation development of the project.

63. "Direct" and "Indirect" Elements - Specific Recreation Facilities. Consistent with the concept advanced in paragraphs 60 through 62 for defining elements of recreation investment for purposes of providing a basis for allocating project costs, table W-13 presents first cost investments, equivalent annual charges and expenses, and annual monetary benefits segregated to the recreation features that are directly associated with the multiple-purpose project and to those that are but indirectly associated with the multiple-purpose project. These will be referred to as "direct" and "indirect" elements of the recreation plan for each multiple-purpose project henceforth. The basis for specific selection of cost items and the distribution of the other items of economic analysis is discussed in the following paragraphs. It is emphasized that these determinations do not constitute the allocation of project costs to the recreation purpose, nor do they constitute the sharing of such costs among Federal and non-Federal interests. They merely determine the magnitude of the recreation investment that should enter into cost allocation studies contained in Appendix V and the main body of the report where such determinations are made.

TABLE W-13
ECONOMIC ANALYSIS - SPECIFIC RECREATION FEATURES
MULTIPLE-PURPOSE PROJECTS
DELAWARE RIVER BASIN

Project Feature	AQUASHICOLA			BELTZVILLE			TREXLER			MAIDEN CREEK			BLUE MARSH		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Investment															
1. Real Estate	$549,500	$103,400	$652,900	$411,000	$ 34,000	$ 445,000	$1,011,500	$141,300	$1,152,800	$1,277,500	$1,424,600	$2,702,100	$664,100	$2,043,400	$2,707,500
2. Facilities	328,900	384,500	713,400	876,400	1,152,500	2,028,900	485,600	1,000,000	1,482,600	1,159,900	1,827,300	2,987,200	832,000	1,242,200	2,074,200
3. Total (Rounded)	878,000	488,000	1,366,000	1,287,000	1,187,000	2,474,000	1,497,000	1,144,000	2,638,000	2,437,000	3,252,000	5,689,000	1,496,000	3,286,000	4,782,000
4. Int. During Cons. (2 yrs.)	22,000	12,200	34,200	32,200	29,700	61,900	37,400	28,500	65,900	60,900	81,300	142,200	37,400	82,200	119,600
5. Total Investment	900,000	500,200	1,400,200	1,319,200	1,216,700	2,535,900	1,534,400	1,169,500	2,703,900	2,497,900	3,333,300	5,831,200	1,533,400	3,368,200	4,901,600
Annual Charges															
1. Interest & Amortization	31,700	17,700	49,400	46,500	42,900	89,400	54,100	41,200	95,300	88,100	117,500	205,600	54,100	118,800	172,900
2. Operation & Maintenance	5,500	3,000	8,500	22,000	20,300	42,300	31,200	23,800	55,000	53,500	71,500	125,000	27,400	60,100	87,500
3. Major Replacements	2,100	2,400	4,500	5,600	7,300	12,900	3,100	6,300	9,400	7,400	11,600	19,000	5,300	7,900	13,200
4. Econ. Value of Land	6,500	3,400	9,900	7,900	1,400	9,300	31,900	3,100	35,000	37,900	23,300	61,200	12,000	31,000	43,000
5. Total Annual Charges	45,800	26,500	72,300	82,000	71,900	153,900	120,300	74,400	194,700	186,900	223,900	410,800	98,800	217,800	316,600
Total Benefits															
1. Total Annual Attendance			156,300			500,000			312,500			625,000			437,500
2. Present Attendance			-1,500			-4,700			-2,500			-5,000			-3,750
3. Diat. Attendance(Net) a/	99,500	55,300	154,800	109,000	386,300	495,300	175,800	134,200	310,000	265,300	354,700	620,000	135,750	298,000	433,750
4. Ben. at $1.60/visitor day	$159,200	$88,500	$247,700	$174,400	$618,100	$792,500	$281,300	$214,700	$496,000	$424,500	$567,500	$992,000	$217,200	$476,800	$694,000
5. Ben. Limited by Alt. Cost at $1.05/visitor day	$104,500	$58,000	$162,500	$114,400	$405,600	$520,000	$184,600	$140,900	$325,500	$278,600	$372,400	$651,000	$142,500	$312,900	$455,400
6. Excess Benefits	$58,700	$31,500	$90,200	$32,400	$333,700	$366,100	$64,300	$66,500	$130,800	$91,700	$148,500	$240,200	$43,700	$95,100	$138,800

a/ Benefits claimed for difference between estimated recreation use of area before development and total annual attendance after development.

TABLE W-13 - Continued
ECONOMIC ANALYSIS - SPECIFIC RECREATION FEATURES
MULTIPLE-PURPOSE PROJECTS
DELAWARE RIVER BASIN

Project Feature	TOCKS ISLAND			BEAR CREEK			PROMPTON			CHRISTIANA			NEWARK			HAWK MOUNTAIN
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Total Direct
Investment																
1. Real Estate	$8,075,200	$13,367,300	$21,442,500	$189,800	$102,200	$292,000	$144,300	$62,400	$206,700	$4,772,900	$1,818,000	$6,590,000	$3,251,100	$1,399,900	$4,651,000	$637,400
2. Facilities	10,152,600	18,229,200	28,381,800	405,000	773,200	1,178,200	282,700	324,500	607,200	2,792,300	3,601,800	6,394,100	1,888,860	2,152,800	4,041,600	777,900
3. Total (Rounded)	18,228,000	31,597,000	49,825,000	595,000	875,000	1,470,000	427,000	387,000	814,000	7,565,000	5,420,000	12,985,000	5,140,000	3,553,000	8,693,000	1,415,000
4. Int. during Cons.(2 yrs.)	911,400	1,579,800	2,491,200	14,900	21,900	36,800	10,700	9,700	20,400	189,100	135,500	324,600	128,500	88,800	217,300	35,400
5. Total Investment	19,139,400	33,176,800	52,316,200	609,900	896,900	1,506,800	437,700	396,700	834,400	7,754,100	5,555,500	13,309,600	5,268,500	3,641,800	8,910,300	1,450,400
Annual Charges																
1. Interest and Amort.	674,800	1,169,800	1,844,600	21,500	31,600	53,100	15,400	14,000	29,400	273,400	195,900	469,300	185,800	128,400	314,200	51,100
2. Operation & Maintenance	494,100	855,900	1,350,000	20,600	30,200	50,800	16,400	14,900	31,300	218,600	156,400	375,000	110,800	76,700	187,500	37,500
3. Major Replacements	64,400	115,500	179,900	2,600	4,900	7,500	1,800	2,100	3,900	17,700	22,800	40,500	12,000	13,600	25,600	4,900
4. Economic Value of Land	134,500	363,900	498,400	3,900	2,100	6,000	2,800	1,200	4,000	86,900	48,500	135,400	94,800	35,300	130,100	8,900
5. Total Annual Charges	1,367,800	2,505,100	3,872,900	48,600	68,800	117,400	36,400	32,200	68,600	596,600	423,600	1,020,200	403,400	254,000	657,400	102,400
Total Benefits																
1. Total Annual Attendance			6,750,000			250,000			156,250			1,875,000			937,500	187,000
2. Present Attendance			-500,000			-2,000			-1,250			-15,600			-11,000	-5,000
3. Dist. Attendance (Net) a/	2,287,000	3,963,000	6,250,000	100,400	147,600	248,000	81,200	73,800	155,000	1,084,000	775,400	1,859,400	547,500	379,000	926,500	182,000
4. Ben. at $1.60/visitor day	$3,659,200	$6,340,800	$10,000,000	$160,600	$236,200	$396,800	$129,900	$118,100	$248,000	$1,734,400	$1,240,600	$2,975,000	$876,000	$606,400	$1,482,400	$291,200
5. Ben. Limited by Alt. Cost at $1.05/visitor day	$2,401,300	$4,161,200	$6,562,500	$105,400	$155,000	$260,400	$85,300	$77,500	$162,800	$1,138,200	$814,200	$1,962,400	$574,900	$397,900	$972,800	$191,100
6. Excess Benefits	$1,033,500	$1,656,100	$2,689,600	$56,800	$86,200	$143,000	$48,900	$45,300	$94,200	$541,600	$390,600	$932,200	$171,500	$143,900	$315,400	$88,700

a/ *Benefits claimed for difference between estimated recreation use of area before development and total annual attendance after development.*

TABLE W-14

ECONOMIC COSTS FOR RECREATION REAL ESTATE AND FACILITIES
MAJOR DAM AND RESERVOIR PROJECTS

	First Costs a/			Total Annual Economic Charges			Annual Economic Charges per Visitor Day of Total Annual Attendance
	Direct	Indirect	Total	Direct	Indirect	Total	
1. Beltzville	$1,287,000	$1,187,000	$2,474,000	$ 82,000	$ 71,900	$ 153,900	$0.308
2. Blue Marsh	1,496,000	3,286,000	4,782,000	98,800	217,800	316,600	0.724
3. Trexler	1,497,000	1,141,000	2,638,000	120,300	74,400	194,700	0.625
4. Prompton	427,000	387,000	814,000	36,400	32,200	68,600	0.439
5. Aquashicola	878,000	488,000	1,366,000	45,800	26,500	72,300	0.463
6. Maiden	2,437,000	3,252,000	5,689,000	186,900	223,900	410,800	0.657
7. Bear Creek	595,000	875,000	1,470,000	48,600	,68,800	117,400	0.462
8. Tocks Island	18,228,000	31,597,000	49,825,000	1,367,800	2,505,100	3,872,900	0.574
Subtotal	26,845,000	42,213,000	69,058,000	1,986,600	3,220,600	5,207,200	
9. Newark	5,140,000	3,553,000	8,693,000	403,400	254,000	657,400	0.701
10. Christiana	7,565,000	5,420,000	12,985,000	596,600	423,600	1,020,200	0.544
11. Hawk Mountain	1,415,000	-	1,415,000	102,400	-	102,400	0.683
Subtotal	14,120,000	8,973,000	23,093,000	1,101,900	677,600	1,780,000	
			b/			c/	
12. Tohickon	-	-	6,900,000	-	-	811,000	0.649
13. Newtown	-	-	12,130,000	-	-	1,533,000	0.820
14. Evansburg	-	-	6,720,000	-	-	951,900	0.610
15. French Creek	-	-	3,938,000	-	-	729,000	0.486
Subtotal	-	-	29,688,000	-	-	4,024,900	
			b/			c/	
16. Paulina	-	-	3,540,000	-	-	533,000	0.533
17. New Hampton	-	-	3,957,000	-	-	724,000	0.482
18. Pequest	-	-	1,212,000	-	-	260,000	0.500
19. Hackettstown	-	-	5,095,000	-	-	1,229,000	0.492
Subtotal	-	-	13,804,000	-	-	2,746,000	
TOTAL			135,643,000			13,758,100	

a/ Exclusive of interest during construction.
b/ Real estate acquisition for recreation lands only.
c/ Recreation facilities and expenses are based on preliminary average cost of $3.40 per visitor-day estimate.

64. Real Estate. The segregation of the "direct" real estate cost element at most projects is based on field appraisals of survey scope wherein the "direct" and "indirect" real estate was appraised separately. In some instances the initially defined "direct" real estate was later adjusted in area, based on an average cost per acre for total acquisition.

65. Facilities. Facility costs assigned to the "direct" elements of the recreation plan are those facilities located on the " "direct" real estate, with exception of the costs for the administration area, which is assigned to the "indirect" element. In the case of Hawk Mountain project no "indirect" costs are indicated.

66. Annual Charges. Interest and amortization costs are distributed directly with the segregation of first costs as described above. Operation and maintenance costs have been distributed on a percentage basis of total first costs with "direct" and "indirect" elements of the plan. Major replacements are computed separately for each of the "direct" and "indirect" elements at a rate of replacing 1/3 of the facilities every 25 years. Charges for loss of the production of land are charged directly to each of the "direct" and "indirect" elements.

67. Annual Benefits. Attendance and monetary benefits are distributed in accordance with the percent of first costs of the total recreation plan for each project assigned to the "direct" and "indirect" elements. Facilities in the first costs were determined on the basis of design load criteria and therefore would suggest the feasibility of segregating attendance by re-analysis of the facility capacity in the "direct" element. However, such a distribution is not consistent with and would depart from a proper evaluation of the total recreation plan, which is essentially a unit so far as balance and program are concerned.

68. Steps of Planning. The above described basic procedures and criteria were applied in modified form and where pertinent to all steps of the planning process described for multiple-purpose projects in Appendix Q. Recreation appraisals were developed for the small dam and reservoir projects contained in Appendix R 15/ and for the major water control structures contained in Appendix U.

15/ Appendix R, "Water Control at Intermediate Upstream Levels," prepared by Soil Conservation Service, U. S. Department of Agriculture and U. S. Army Engineer District, Philadelphia, Department of the Army.

69. Small Dams and Reservoirs. Recreation appraisals, as discussed in Appendix R, were prepared for the two categories of small dam projects reported on. For those projecs that may be initiated under existing authority, three hypothetical sites, representing typical ranges of conditions of storage and terrain were developed for recreation study. One such hypothetical site was eliminated because of unsuitable topography and storage conditions. For the remaining two projects real estate requirements were determined and cost estimates prepared, based on the average cost per acre of land included in the dam site and flood pool. Facilities were described at a quality level of lower investment than is provided in this appendix for major control structures, but consistent with good park standards serving immediate local needs. No alternate cost studies were conducted for these projects. However, it is proposed that such studies would be accomplished at such time as any of these projects are initiated for construction. These projects are presented in Appendix R.

70. Three small dam projects contained in Appendix R, identified as Jim Thorpe, Swiftwater and Parkside, because of their magnitude of cost and drainage area served, require additional authorization for construction. Recreation planning for these projects were of more detail. These studies provided for a comparison of costs for each project to determine the economic feasibility of recreation utilizing the sediment pool of the basic flood control projects with added increments of minimum real estate and facilities for recreation. In addition, the incremental costs of adding to the basic flood control project, recreation pools of 50 surface acres and 100 surface acres each, together with approximate real estate and facilities were determined. The results of these studies are shown in Appendix R.

71. Major Water Control Structures. In the initial studies leading to the selection of major control structures contained in the recommended plan of improvement, the objective was to rate each potential site in relation to the total list of possible sites. For this step potential annual recreation attendance was estimated for each site based on procedures described above. Estimates were prepared for a total of 48 such projects within which the variable factor was annual attendance credited at a rate of $1.60 per visitor-day. Costs were computed at a constant rate per visitor-day based on a first cost investment rate of $10.00 per visitor-day of annual attendance. The effect of such appraisal was to rank projects according to total annual attendance potential. The monetary expression of the attendance and associated constant rate of cost per visitor-day provided a basis for utilizing the recreation purpose in planning as described in Appendix Q.

72. For the step of planning designated in Appendix Q as constituting selection of the basic plan the above data were refined and considerably more study was conducted on projects under investigation. Two levels of recreation development were assumed at this stage of planning. One level, designated as the optimum level of development for a typical state park type of establishment was applied to those projects indicating a high annual attendance potential. For the remaining projects whose characteristics on examination appeared to be of lesser value for recreation development, a minimum basic level of recreation investment was assumed. This minimum level included facilities necessary for the health and safety of the visiting public, orderly administration of the project, sufficient land to provide access to the project, and preservation of the recreation resources created. Topographic maps were used to determine land requirements for each project.

73. Facilities were estimated at a cost of $10.00 per visitor-day of total annual attendance and $2.00 per visitor-day of total annual attendance for the optimum and minimum levels, respectively. The former rate was developed on the basis of facility costs at optimum level and the latter was derived from average costs experienced at operating Corps of Engineers' reservoirs adjusted upward by judgment. Accordingly, real estate requirements at the maximum level reflected state park type developments while at the minimum level only the land requirements for public access and use of the impoundment were considered. Costs were derived by applying average cost per acre estimates utilized for cost estimates for the dam and reservoir. First cost investments were amortized over a 50-year period at 2-1/2 percent interest for both levels of development. Annual operation and maintenance costs were computed at $0.35 and $0.05 per visitor-day at optimum and minimum levels of development, respectively. In the latter a joint operation for all project purposes was assumed. Benefits at the optimum level were claimed at a rate of $1.60 per visitor-day. In the absence of alternate cost studies, benefits for the minimum level were assumed at this stage of planning to bear the same proportionate relationship to the $2.00 rate of cost for facilities as the $1.60 per visitor-day benefit at the optimum level of facilities bears to the $10.00 cost rate. This resulted in a benefit index of $0.32 per visitor-day for the minimum level of development. Annual charges for replacement of facilities were computed at a rate of replacing one-third of the facilities every 25 years. Thus, annual attendance and real estate costs provided the principal variables in influencing the ratings of projects and plans at this step of analysis.

74. Recreation in Maximization of Net Benefits at Project Sites. For these studies, reported on in Appendix Q, it was considered that the principal area of function of the multiple-purpose project wherein the recreation purpose derives its economic advantages, is in what has been defined in this report as the long-term storage

of water. The determination to be made is the magnitude of the long-term storage feature of the project at which all users thereof, including those seeking recreation, obtain the maximum return in net benefits.

75. Basis of Analysis for Maximization Study. The most responsive single factor of the recreation purpose to varying pool sizes at the same project site is recreation attendance. If detailed recreation plans were prepared for each pool size studied at the same site it would be found that total real estate requirements for recreation would vary in intervals among several pool sizes. However, for these studies land requirements were assumed to vary directly with attendance from the basic land requirement characteristics of the individual project. The general magnitudes of both attendance and land requirements are characteristics of the site and present ranges of conditions within which each pool size studied may react. Recreation features consisting of beaches, picnic units, boating facilities, operation and maintenance, and the costs thereof, relate directly to visitor-day analysis. The costs of these are relatively constant per visitor-day for any project at the same quality level of recreation development among sizes of pools studied.

76. The above conditions of analysis are reflected in the procedures that were developed and which are described here. A map examination of each site was made to determine whether important changes in the land adjacent to the pool studied occurred with changing elevations. If important areas required to support recreation attendance were inundated, exposed or importantly modified, adjustments based on judgment were made.

77. Procedure Used in Maximization Study. In the application of these requirements on analysis of an individual project site, the range of long-term pool elevations to be studied and related surface acres of water impounded were distributed among three to five levels of storage for each project site. At a storage elevation about midway between the extremes studied a pool size was selected and a preliminary recreation plan of development was defined. For most sites studied these plans and costs thereof were based on survey report scope real estate estimates for recreation lands and on field studies of the terrain. For a few sites office data were relied on. Two stages of recreation development were provided; one reflecting the ultimate full development of the project, and the other consisting of what is considered as the directly water related part, wherein the land necessary to protect and assure the ultimate development is acquired and basic facilities provided.

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78. The above costs together with operation and maintenance costs were reduced to annual charges for the two levels of investment of recreation development. Annual benefits claimed for attendance for each of these levels of recreation development were limited by average cost per visitor-day of providing similar facilities at state parks in the region, as described elsewhere herein.

79. To apply these basic cost and benefit data of recreation development to the full range of pool sizes of a site under investigation, use was made of a generalized attendance curve developed empirically by plotting reservoir pools in surface acres against annual attendance for 61 Corps of Engineers' reservoirs for which data were available. This curve, plotted by visual fit, was assumed to represent the angle of the trend of effects of pool size on attendance. The difference between attendance at the pool size at which the preliminary recreation plan above was developed for the project and the attendance indicated at the same pool size on the curve provided a factor for converting curve-indicated attendance for each pool size studied at the project site to creditable attendance.

80. To attendance figures derived for each pool size at the site under study, only the average annual costs per visitor-day and the average annual benefits per visitor-day for recreation were applied. The excess benefits over specific recreation costs at each pool size provided an indication of the net effects derived by the recreation purpose at various pool elevations studied.

81. In order to reflect long range effects, the recreation benefits and recreation costs for the two levels of recreation development were averaged, and generalized curves were constructed for use in maximization studies of each project. These data are presented in Appendix Q, where their pertinent applications are shown in connection with other water uses studied.

VI PLAN OF DEVELOPMENT

82. Discussion. Described here in several degrees of detail are 22 dam and reservoir projects in which recreation is one of the purposes served. Three of these projects are "small dam" projects for which the detailed presentation of recreation is contained in Appendix R. Beltzville, Blue Marsh, Trexler, Prompton, Aquashicola, Maiden, Bear Creek, Tocks Island, Hawk Mountain, Christiana and Newark dam and reservoir projects serve purposes in addition to recreation, the needs for which are indicated before 2010. The recreation element of these projects has been considered in detail in this appendix. Tohickon, Newtown, Evansburg, French Creek, Paulina, New Hampton, Pequest and Hackettstown, would serve immediate recreation needs, but the remaining multiple-purpose features are not indicated until after 2010. Real estate appraisals of survey scope are presented for these projects, together with some preliminary examination of the other cost features for purposes of cost comparisons.

83. Scheduling of Projects. In order to obtain some measure of the effects of the recreation capacities that would be provided by the projects reported herein, it was necessary to schedule their completion against the projected recreation needs as developed in section IV. Subsequent conclusions show that the capacities so provided for recreation alone would be needed in the near future. However, for purposes of practical appraisal, it must be considered that these projects are multiple-purpose projects in which other needs are scheduled over the 50-year period of study and beyond. Of the purposes served, industrial and municipal water supply appeared to be the most critical in establishing a basis for project scheduling. Therefore, for the analysis here, it has been assumed tha that projects would be completed for the year at which such water supplies are indicated and would then provide the full recreation capacity. Table W-15 shows these projects scheduled on such a basis. For the small dam projects of Jim Thorpe, Swiftwater and Parkside, it is assumed that the recreation capacity would be provided within the 50-year period of study. For the projects of Beltzville, Blue Marsh, Trexler, Prompton, Newark, Christiana, Aquashicola, Maiden, Bear Creek, Hawk Mountain and Tocks Island, full recreation capacity is assumed for the year indicated for each project in table W-15. For the projects of Tohickon, Newtown, Evansburg, French Creek, Paulina, New Hampton, Pequest and Hackettstown, water supplies other than for recreation are not indicated until 2010. However, the sites have high recreation value in relation to immediate recreation needs. Because of their proximity to areas of metropolitan expansion they will become more expensive. At the same time they will become more valuable as recreation assets

TABLE W-15
PROJECT CAPACITIES FOR RECREATION
DELAWARE RIVER BASIN WATER SERVICE AREA

Project	Pool Area (Acres)	Total Proj. Area (Acres)	Total Annual Gross Attendance (Vis.-Days)	Design Load Equivalent	Year
Middle Basin in Pennsylvania and Delaware					
Beltzville	870	2,413	500,000	11,400	1965
Blue Marsh	870	5,296	437,500	10,000	1969
Trexler	880	3,587	312,500	7,100	1972
Prompton	720	2,055	156,250	3,500	1974
Newark	1,060	6,490	937,500	21,400	1975
Christiana	2,900	8,080	1,875,000	42,900	1980
Aquashicola	840	2,150	156,300	3,500	1981
Maiden Creek	2,500	8,450	625,000	14,300	1982
Bear Creek	1,280	3,950	250,000	5,800	1989
Tohickon	1,250	7,475	1,250,000	28,600	1/
Newtown	2,120	7,200	1,875,000	42,900	1/
Evansburg	1,120	4,654	1,560,000	35,700	1/
French Creek	1,250	4,270	1,500,000	34,300	1/
Jim Thorpe 3/	100	162	37,500	850	2/
Swiftwater 3/	50	150	12,500	280	2/
Parkside 3/	100	188	37,500	850	2/
Subtotal	17,910	66,570	11,522,600	263,380	
Middle Basin New Jersey					
Paulina	1,650	5,717	1,000,000	22,800	1/
New Hampton	1,850	5,518	1,500,000	34,300	1/
Pequest	1,260	4,520	520,000	11,900	1/
Hackettstown	1,200	10,362	2,500,000	57,200	1/
Subtotal	5,960	26,117	5,520,000	126,200	
Hawk Mountain	5,400	7,800	187,000	4,700	2001
Tocks Island	12,100	62,370	6,750,000	154,300	1975
Total Multiple-Purpose Projects	41,370	162,857	23,979,600	548,600	
Remaining Projects in Appendix I			14,210,000	324,800	
TOTAL ALL PROJECTS			38,189,600	873,400	

1/ Early development for recreation is indicated with multi-purpose development after the year 2010.
2/ Requires authorization to permit scheduling as may be desired by local interests.
3/ Data shown for multi-purpose project for flood control and recreation.

as the populations associated with them continue to grow. For these reasons they are considered here for real estate acquisition as the principal immediate objective. The development of facilities for recreation would be introduced and expanded as the accumulation of acreage permits. It is considered here for the purpose of appraisal that the projects would be essentially complete as multiple-purpose projects at 2010, even though their effects on recreation needs would be felt before that time. The remaining recreation projects contained in Appendix I have been included here as contributing to the total recreation capacity by 2010.

84. Project Capacities and Recreation Needs. The concept in support of recreation as a project purpose in this appendix requires that each project so formulated satisfy a need for outdoor recreation over that provided by existing projects and programs. These needs were measured in section IV. Examined here are the capacities of the projects prepared in this report in relation to such needs. It should be noted that project capacities indicated are expressed in terms of design load equivalent of total annual attendance, and not in terms of design load equivalent of the design attendance as defined above. Thus sightseeing, for which specific facilities were not provided, is included in total project capacity. The comparisons between recreation needs and project capacities presented here are in accordance with the identification of recreation needs contained in section IV. The needs and capacities associated with each of these areas isolated for study are not additive. These studies merely indicate the magnitude of needs as they may relate to the capacities of projects and groups of projects so that in no case may needs be claimed for projects for which no need exists. In making these comparisons consideration was given to all specific projects for recreation contained in Appendix I and Appendix W. While Appendix I considers the importance of added outdoor recreation capacity that would be obtained by the continued improvement and expansion of going recreation projects and programs, no attempt has been made in this study to estimate the quantity of capacity involved. However, to provide a conservative basis for evaluating the needs for the specific projects considered here, it was assumed that these going projects and programs would essentially meet that part of the total project need that had accumulated to 1955 and is indicated as a "deficit" in the preceding section. Therefore, the comparison here is concerned with the projected increments of needs arising from the population increase and expanded economy from 1955 to 1965, from 1965 to 1980, and from 1980 to 2010.

85. Capacities of Projects in Association with Recreation Needs of the Delaware River Water Service Area. Considered here are all specific new projects contained in Appendix I and Appendix W. When the capacities of these projects as contained in table W-14 are compared graphically with the projected increments of recreation needs as shown in table W-6, the relationship shown in plate 13 results. These projects have a capacity to provide for a total of about 38,189,000 annual visitor-days of recreation. The design load equivalent of this capacity is 873,000 visitors. Of this total, the multiple-purpose dam and reservoir projects reported upon in this study provide a capacity for about 23,980,000 annual visitors or a design load equivalent of 548,600 visitors. Thus the projects proposed herein offer a very important source of outdoor recreation by providing a substantial magnitude of capacity and for the study area as a whole nowhere approach satisfaction of the total magnitude of needs indicated.

86. The Tocks Island Recreation Project. The Tocks Island project would provide a capacity to support 6,750,000 visitors annually. This capacity represents a design load equivalent of 154,300 visitors. Recreation at this project would be in association with 12,100 acres of impounded water or a total added recreation area of about 62,400 acres. The Tocks Island project is considered in detail in section IV in connection with recreation needs of a population residing within a 100-mile radius of the project, and again in plate 13, where the total capacities of all projects considered is shown in relation to the recreation needs of the populations of the Delaware River Water Service Area. These studies amply justify the capacity of the Tocks Island project within the criteria applied in this appendix.

87. Capacities of Projects of the Middle Basin in Pennsylvania and Delaware in Relation to Associated Needs. To provide a measurement of needs and capacities on a somewhat more localized basis the capacities of Beltzville, Blue Marsh, Trexler, Prompton, Newark, Christiana, Aquashicola, Maiden, Bear Creek, Jim Thorpe, Swiftwater and Parkside are considered here in association with the recreation needs defined for the above designated areas in the preceding section. These projects have a total capacity to support about 11,522,000 visitors annually, representing a design load equivalent of 263,400 visitors, This recreation would be in association with 17,800 acres of added recreation water. When these capacities are compared graphically as scheduled for realization with the projected needs for this area the relationship shown in plate 13 results. While these projects would provide an important source of outdoor recreation to compliment existing and going programs, they do not approach total satisfaction of such needs as determined in this study.

88. Capacities of Projects of the Middle Basin in New Jersey with Associated Recreation Needs. Here the projects Paulina, New Hampton, Pequest and Hackettstown would have a total capacity to support 5,520,000 visitors annually when completed. This capacity amounts to a design load equivalent of 126,200 visitors. The recreation would be associated with the impoundment of about 6,000 acres of water and a total added recreation area of about 26,000 acres. Assuming a gradual realization of capacity for recreation which would reach full development at or following 2010, at which time the other purposes to be served by these projects would assure the ultimate impoundment feature, these projects would serve to meet an important share of the recreation needs of the area as determined in this study. This relationship is shown in plate 13.

89. Hawk Mountain Project. The Hawk Mountain project appears to be somewhat isolated in its day-use effects, except that it is expected to provide attractive recreation opportunity for vacationists and weekend recreationists who visit the general area in large numbers from the metropolitan centers of population. While no special study was conducted in connection with the Hawk Mountain project, the general magnitude of projected recreation needs indicated for the entire Delaware River Water Service Area, and particularly the northern section, would make it reasonable to assume that the recreation purpose and capacity provided at this project is fully justified.

90. Recreation Costs and Benefits. Table W-13 presents the first cost investments, annual charges and annual benefits for recreation at the 11 projects comprising the basic plan for water development to 2010. These projects are Beltzville, Blue Marsh, Trexler, Prompton, Aquashicola, Maiden, Bear Creek, Tocks Island, Newark, Christiana and Hawk Mountain. Detailed cost estimates for the recreation feature of these projects are contained in the following descriptions of each of these projects. For the eight major control projects to be developed initially for recreation, preliminary estimates of facility costs were based on an average cost of about $3.40 per unit of gross visitation.

91. Variation in Recreation Costs Among Projects. Table W-15 presents cost comparisons among projects for specific recreation features. The cost per visitor-day of attendance is seen to range from $0.439 at Prompton to $0.82 at Newtown. While it is not intended that such cost indices would provide inflexible criteria to project feasibility, the indicated cost per visitor-day of providing recreation at the Newtown project would suggest that there is a cheaper single-purpose alternate source of recreation to be found. However, it is pointed out that expensiveness of the Newtown site, due to real estate costs, is merely an indication of what can be expected at most of the remaining seven projects in this same category as demands for urban and industrial real estate continue to grow. The Evansburg site is approaching a cost at which alternate limitations used in this appendix would affect both the level of

recreation investment in facilities and the financial capacity of the recreation purpose to participate in its share of joint project costs when the multiple-purpose features are introduced. French Creek, Hackettstown, Pequest, Paulina, Christiana and Tohickon projects indicate a good margin of justifiability. It would appear, in fact, that superior recreation sites of the quality represented in these eight projects are rapidly becoming scarce and will eventually become unobtainable. The remaining projects included in the plan of development all show indications of being good investments for recreation purposes.

92. The Tocks Island Recreation Area.

a. Location and description. The location and description of the project, the region served, the geographic and physiographic merits of the project and other factors supporting the development of Tocks Island reservoir as a recreation area, regional and national in scope, are presented in detail in section IX of Appendix I. In section V of the present appendix there is presented a detailed analysis of the widespread needs for nonurban recreation within 100 miles of the project that would be served by the project. Plate 15 of this appendix shows the location of the project and the details of the areas included in the plan of development.

b. Plan of improvement. The plan of improvement as contained herein provides land and facilities for achieving the full development of the recreation potential inherent to this project without deterioration of the natural resources. Land and facilities required for the full development of this project are as follows: (see table W-16)

(1) Land. Optimum recreation development of the project requires the acquisition of 47,570 acres of land, including ten different tracts as described in following paragraphs, and fee title to other lands to which only a flowage easement will be acquired for flood control needs. Included in the proposed land acquisition of 47,570 acres, but in addition to the ten tracts for recreation development, is land for preservation and protection of scenic and natural resources. This is necessary to provide an administrative unit limited by natural boundaries and to prohibit the encroachment of uses incompatible both with the natural esthetic value of the project and with areas to be developed for general public enjoyment and use.

(2) Facilities. The facilities proposed for development on this project would include the full scope of activities associated with non-urban recreation. It is anticipated that development will be a continuing program and that initial development will be of sufficient magnitude to provide for the immediate

TABLE W-16
TOCKS ISLAND RECREATION AREA
TOCKS ISLAND DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Picnicking	unit	951	$380,400	1,311	$524,400	2,262	$904,800
Beach Development	s.f.	2,879,400	717,600	-	-	2,879,400	717,600
Tent Camping	unit	790	1,070,000	1,066	1,748,200	1,856	2,818,200
Boat Ramps	unit	91	1,138,100	-	-	91	1,138,100
Boat Docks	unit	52	285,500	-	-	52	285,500
Picnic Shelters	unit	38	190,000	47	235,000	85	425,000
Bathhouses	l.s.	-	275,000	-	-	-	275,000
Parking	unit	9,510	1,902,000	13,110	2,622,000	22,620	4,524,000
Roads	mile	5	300,000	11.9	775,000	17	1,075,000
Water	unit	636	636,000	875	875,000	1,511	1,511,000
Sanitary	unit	149	1,119,000	206	1,542,800	355	2,661,800
Group Camp	-	-	-	30	6,000,000	30	6,000,000
Signs and Markers	l.s.	-	11,900	-	16,700	-	28,600
Walks and Trails	mile	9.7	25,200	18	45,800	27.7	71,000
Misc. Landscaping	l.s.	-	71,400	-	98,500	-	169,900
Administration Area	-	-	-	-	100,000	-	100,000
Subtotal			8,122,100		14,583,400		22,705,500
Contingencies 5%			406,100		729,200		1,135,300
Engineering & Design 10%			812,200		1,458,300		2,270,500
Supervision & Administration 10%			812,200		1,458,300		2,270,500
Total Cost Facilities			10,152,600		18,229,200		28,381,800
Real Estate							
Land	acre	6,465	1,446,800	41,105	6,824,000	47,570	8,270,800
Severance	l.s.	-	217,000	-	682,400	-	899,400
Easement Value a/	l.s.	-	66,000	-	-	-	66,000
Improvements	l.s.	-	2,953,000	-	6,333,000	-	9,286,000
Resettlement	l.s.	-	145,600	-	658,700	-	448,300
Contingencies 10%	-	-	482,800	-	1,414,200	-	1,897,000
Total Cost Land & Improvements			5,311,200 b/		15,556,300		20,867,500
Acquisition Cost			245,000		330,000		575,000
Total Cost Real Estate			5,556,200		15,886,300		21,442,500
Adjusted upward 3,035 acres c/		+3,035	2,519,000				
Adjusted down 3,035 acres @ $830				-3,035	-2,519,000		
Total Adjusted Cost of Real Estate		9,500	8,075,200	38,070 d/	13,367,300 d/	47,570	21,442,500
Total Cost of Facilities & Real Estate			18,228,000		31,597,000		49,825,000

a/ Fee purchase of "after" value of flowage easement area of 1,100 acres.
b/ Includes $1,095,000 for acquisition of two small villages. This acquisition would be obviated or limited, and the cost would be eliminated or reduced substantially, if local interests adopted zoning regulations meeting National Park Service criteria subsequent to authorization of the project.
c/ $830 mean average value of average cost per acre of lands in adjusting real estate acreage appraisals.
d/ Includes 6,880 acres of state-owned lands at $172 per acre.

need for recreation facilities generated by the inception of the Tocks Island project and would be under development simultaneously with the construction of the dam and related reservoir. The completed plan of development would provide facilities for the estimated maximum attendance and be directed toward the full use of the resources available under present planning standards. The development of facilities as proposed herein would proceed in an orderly manner and would utilize a broad concept of planning whereby the redevelopment of any facility or area would not be required to complete the subsequent development. It is contemplated that revenue producing goods and services required in connection with the recreation activities at the project would be provided through lease arrangements with private interests under standards imposed by the administering agency. Such facilities as boat rentals, marinas other than public, cabins, lodges, restaurants and similar services necessary to the visiting public would be provided.

c. Annual Attendance and Design Load. The estimated annual attendance and the design load for the Tocks Island recreation area are as follows:

	Optimum Development
Annual design attendance	5,400,000
Sightseeing	1,350,000
Total annual attendance	6,750,000
Design load	123,500

d. Description of Sites. A description of the ten areas proposed for recreation development and the facilities to be provided thereon are as follows (see plate 14):

(1) Poxono Recreation Area is located on the west shore of the reservoir extending from the dam site up to a point just south of Depew Island. This area has about 3-1/2 miles of reservoir frontage, approximately 2,000-feet of which would support beach development in an area northeast of Poxono Island. The remainder of the shoreline, from moderate to steep in slope, would support facilities for boating at Zion Church, and at another site about 1/2 mile north of the church. A plateau, approximately 2,000-feet wide and 500-feet distant from and parallel to the water line consisting of active and abandoned farm plots, orchards and farm wood lots, would provide ample space for extensive day use and overnight developments. Facilities provided would be for picnicking, swimming, boating, camping hiking and fishing. A vantage point providing an excellent view of the reservoir is located about 3/4 mile north of the dam. Picnic and sanitary facilities and safe

drinking water would be provided at this site. The secondary road in this area that would be inundated would be relocated from a point just west of the proposed beach proceeding south, holding near the base of the hill, to the intersection of an existing road due east of Zion Church. This would preserve the natural resource that enhances the recreation development of this area. One of the administration areas would be developed in this area at a site near the dam. The Poxono recreation area would provide for the major portion of the day-use activities on the Pennsylvania side of the project. It is anticipated that most users of this area will originate in the metropolitan areas of east central and southeastern Pennsylvania. It is contemplated that an elaborate boating marina would be developed in the large bay formed by Bush Kill, including extensive facilities for boat launching, docking and anchorage.

(2) Wallpack Bend Recreation Area is the major recreation area on the east shore for development. This area would extend along the east shore from a point near Poxono Island up to a point 1/2 mile south of the Flatbrook arm of the reservoir. This area is one of the better areas for recreation development found on the reservoir. The topography is varied, the shoreline is irregular and for the most part has a gradual slope providing access to the water on most of its five miles of reservoir frontage. The area south of Vancampens Brook would be developed as a day-use area with an extensive beach development. The terrain slopes gradually from the water line back 1/2 mile to the base of Kittatinny Mountain, and it is composed mainly of abandoned farm plots with second growth tree cover. The cove formed by Vancampen Brook would be developed as a large bating area with launching ramps, docks and anchorage. The ridge to the north lying between Vancampens Brook and the reservoir would support tent and trailer camping developments. Toward the lower end of this ridge, a small beach area would be developed for the users of the overnight area only. The ridge is presently traversed by a road that would be relocated along the base of the mountain. A second administrative area will be required in this area to provide adequate administration.

(3) Dingmans Gorge Recreation Area is in the vicinity of the village of Dingmans Ferry, Pennsylvania, and encompasses the major portion of the scenic gorge and Dingmans Falls created by Dingmans Creek. This hemlock covered gorge is the outstanding feature of this area. South of Dingmans Creek there are approximately 3,500-feet of water frontage for beach development. In back of the beach area and extending up Dingmans Creek is ample space for picnic development. The cove formed by the creek would be developed as a boat launching area. Picturesque

trails and limited picnic facilities will be developed at vantage points for natural scenic spots that prevail throughout the gorge. The facilities developed at this area will be primarily for picnicking, hiking, swimming, nature study and boating.

(4) The Namonock Recreation Area is located on the east side of the reservoir, from a point opposite Dingmans Gorge north to a point just south of Namonock Island. There are about 3 miles of shoreline which afford ample opportunity for beach development. The area is bounded on the east by state route 521 and is accessible to the large population centers of northeast New Jersey and New York City. The terrain in this area is relatively flat farmland. It appears that over 60% of this agricultural land has been abandoned and has reverted to scrub growth. The nature and location of this area make it particularly adaptable for extensive development for day-use and weekend activities. The development of this area would provide facilities for swimming, picnicking, tent camping, boating, fishing and hiking.

(5) The Flatbrook Group Camping Area located on the east side of the reservoir on the peninsula formed by the Flatbrook arm of the reservoir would consist of 3,000 acres of land which includes approximately 800 acres of land acquired in the peripheral strip in the initial stage. Shoreline of suitable character is available in this area for beach development for use by the group camps. Activities in this area would be those normally associated with this type of development.

(6) The Egypt Mills Recreation Area is located on the west side of the reservoir about 2 miles above the town of Bushkill, Pennsylvania. The development of this area will provide facilities for picnicking, tent camping, swimming, boating, fishing, hiking, nature study and group camping. The area will have approximately 4-1/2 miles of shoreline which for the most part is relatively rugged. Access to the water is limited to valleys formed by lateral streams. The hemlock covered gorges formed by these lateral streams are very scenic and attractive. Day-use and camping facilities would be in settings of scenic beauty rarely found in this section of the country.

(7) The Hornbeck Gorge Recreation Area is located on the west side of the reservoir 2-1/2 miles south of Dingmans Ferry, and 1-1/2 miles north of the Egypt Mills area. This also consists of a scenic hemlock covered gorge similar to the Egypt Mills area. Picnicking, tent camping and nature study would be the primary activities in this area. Facilities would also be provided for swimming and boating.

(8) The Knob Recreation Area is located on the west side of the reservoir in the vicinity of the Milford bridge. The bridge carries Federal route 206 and is located 1/2 mile south of the town of Milford, Pennsylvania. The primary purpose of this area would be to afford access to the upper reaches of the long-term storage pool. Facilities would be provided for picnicking, boating and swimming.

(9) The Tom Quick Boat Launching Area is located on the New Jersey side of the Milford bridge. This site provides access to the upper reaches of the long-term storage pool for residents to the east of the project. Extensive facilities for boating would be developed on this site, plus ample facilities for picnicking. Provisions have been made in table W-16 for the development of boat launching sites according to the needs of the estimated attendance. The exact location of these sites can best be determined by observation of boating pressure and demands; however, numerous sites have been tentatively located for development.

(10) The Delaware Water Gap Scenic Area consists primarily of the tract of land in New Jersey known as the Worthington Forest Park Reservation. Inholdings in this presently state-owned tract would be required to provide a contiguous project area from the dam site to the Water Gap. Also a tract of land on the west side of the Water Gap in the vicinity of Mt. Minsi would be acquired. Besides the scenic quality and geological features of this area, it is rich in history relative to Indians and Indian-settler relationships. This area and the project site were "Delaware Country," more particularly, the habitat of the Minsi branch of the Delaware Indians, at one time equal to the mighty Iroquois. Many of the geographic names in the area reflect the passing of the Indians; Mt. Tommany on the New Jersey shore was named for Tamanend, great chief of the Delaware; Minisink Island was then stronghold of Minsi Tribe, the word "Minisink", which means "water is gone," perhaps had reference to the Water Gap itself. There are four aspects of this general area relative to Indian-settler relationships which are noteworthy, namely: (1) The "Walking Purchase" of 1737; (2) the frontier trouble of the 1750's; (3) the Moravian missionary activities of 1740-60; and (4) the Sullivan expedition of the Revolutionary War period which was prompted by the Wyoming Massacre. The Water Gap area and the associated lands described herein with their scenic qualities and historical aspects, would be inseparable parts of the project for development as a national recreation area. In keeping with previous proposals, the area north of the Delaware Water Gap would be developed as a wilderness area, with foot and bridle paths and primitive type campsites; while the area on the south would be developed as a picnic area.

93. Beltzville Recreation Area.

a. Location. The Beltzville Recreation Area is located on Pohopoco Creek in Carbon County, Pennsylvania, 19 miles northwest of Allentown-Bethlehem and 18 miles southeast of Hazelton.

b. Scenic qualities. The scenic values of the site and immediate surroundings are fair, having no unusually outstanding points of interest. The steep hillsides of dense hemlock on the south side of the reservoir would provide a desirable scenic feature that would enhance the attractiveness of the more gently rising north side.

c. General project characteristics. For the most part land adjoining the north shore of the project is suitable for recreation development, with the entire shore line suitable for all activities. The total project area comprises about 2,413 acres, with 870 acres occupied by the long-term storage pool. In addition to jointly used project lands, a total of 1,383 acres is included for recreation development. The impoundment would be about 5.5 miles in length and about 1/4 mile wide at the main body of the reservoir.

d. Types of recreation for which the project is suited. The project and the surrounding terrain are particularly well suited for the development of nonurban recreation use, including some facilities for camping.

e. Region served. The present population residing within 25 miles of the project is about 600,000. This population is expected to increase to about 825,000 by 1980 and 1,160,000 by 2010. The industrial areas of Allentown-Bethlehem and in the vicinity of Hazelton, Pennsylvania, fall within the 25-mile radius. This radius also covers the vacation and resort area in the lower Pocono Mountain Access to the project area would be very good. The Northeast Extension of the Pennsylvania Turnpike would provide direct access from Allentown, Bethlehem, Wilkes-Barre and Scranton. The Mahoning Valley interchange of the Northeast Extension of the Pennsylvania Turnpike is located two miles west of the project site. U. S. route 209 parallels the project site and would provide access from the Stroudsburg area, while state route 29 would provide access from Allentown and Hazelton. In addition, numerous state roads interlace the general region and would bring the smaller towns within a short driving distance of the project site. Within a 25-mile radius of this project are the Hickory Run State Park and the Big Pocono State Park. The former contains 13,000 acres of land and offers a variety of recreation opportunities. Water areas, however, are limited. Big Pocono Park offers picnic facilities. The resorts cater primarily to vacationists and would not be in competition with recreation development at the project site.

f. Plan of improvement. The plan of improvement as contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. (see table W-17)

(1) Land. Optimum recreation development of the project includes acquisition of 1,383 acres of land as indicated on the Beltzville project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would provide for a wide variety of nonurban recreation activities including picnicking, swimming, boating, hiking, fishing and nature study. It is assumed that facility development will be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project's sphere of influence. The optimum development would provide facilities for the estimated maximum attendance and be directed toward full use of the recreation resources under present planning standards.

g. Annual attendance and design load.

	Optimum Development
Annual design attendance	400,000
Sightseeing	100,000
Total annual attendance	500,000
Design load	9,100

h. Description of sites. Descriptions of sites and major types of facilities to be provided are as follows:

(1) A site located between the dam site and Pine Run would be developed as the major day-use area with facilities for swimming, picnicking, fishing, hiking, boating and boat launching.

(2) A site on Pine Run and another near Lovett School would be developed as boat launching sites.

(3) A site directly east of Pine Run would be developed as a small overnight area with a limited beach development.

(4) A site on the south side of the reservoir and 3 miles above the dam, would be developed as a day-use and boat launching area with facilities for swimming, picnicking, boating and hiking. This site would provide access for users residing to the south of the project.

TABLE W-17
BELTZVILLE RESERVOIR RECREATION AREA
BELTZVILLE DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Picnicking	unit	70	$28,000	115	$46,000	185	$74,000
Picnic Shelters	unit	3	15,000	4	20,000	7	35,000
Swimming Beach	s.f.	251,350	62,900	-	-	251,350	62,900
Bath House	l.s.	-	65,000	-	-	-	65,000
Tent Camping	unit	65	81,200	110	181,300	175	262,500
Boat Ramps	unit	8	80,000	-	-	8	80,000
Boat Docks	unit	4	30,000	-	-	4	30,000
Water	unit	46	46,000	76	76,000	122	122,000
Sanitary	unit	11	82,500	19	142,500	30	225,000
Roads	mile	1	65,000	2	170,000	3	235,000
Parking	unit	688	137,600	1,140	228,000	1,828	365,600
Administration	l.s.	-	-	1	45,000	1	45,000
Signs and Markers	l.s.	-	900	-	1,700	-	2,600
Walks and Trails	mile	0.3	1,800	0.6	3,000	0.9	4,800
Misc. Landscaping	l.s.	-	5,200	-	8,600	-	13,800
Subtotal - Facilities			701,100		922,100		1,623,200
Contingencies 5%			35,100		46,600		81,100
Engineering & Design 10%			70,100		92,200		162,300
Supervision & Administration 10%			70,100		92,200		162,300
Total Cost Facilities			876,400		1,152,500		2,028,900
Real Estate							
Lands	acre	723	126,000	660	23,000	1,383	149,000
Severance @ 20%			25,200		5,000		30,200
Improvement			185,000		-		185,000
Resettlement			9,000		-		9,000
Contingencies 15%			51,800		4,200		56,000
Total Cost of Land & Improvements			397,000		32,200		429,200
Acquisition Cost			14,000		1,800		15,800
Total Cost of Real Estate			411,000		34,000		445,000
Total Cost of Facilities & Real Estate			1,287,000		1,187,000		2,474,000

(Rev. Nov. 1960)

(5) A site at the upper reaches of the reservoir would be developed as a day-use area with facilities for picnicking, fishing, vehicle parking and necessary utilities.

(6) Also included in the 1,383 acres are lands considered essential for the protection of the resources and incidental public use of the major portion of the remaining shoreline.

94. Blue Marsh Recreation Area.

a. Location. The Blue Marsh Recreation Area is located on Tulpehocken Creek in Berks County, Pennsylvania, 6 miles northwest of Reading and 45 miles northeast of Harrisburg.

b. Scenic qualities. The project area contains no features of outstanding scenic quality. The principal feature would be the impoundment which would provide a lake with an attractive irregularity of shoreline.

c. General project characteristics. The reservoir would have a surface area of about 870 acres of extreme irregularity, forming many peninsulas and arms, and making this project desirably adapted to recreation development. The total project area comprises a total of 5,296 acres of which 3,776 acres are contained in the land above the short-term storage pool for recreation development. The area, in general, is suited for intensive recreation development to provide for picnicking, swimming, boating, hiking, fishing, tent camping and group camping.

d. Region served. Included within the reservoir zone of local influence are the metropolitan area of Reading, the towns of Lebanon and Bernville, the numerous small rural communities lying between Lebanon and Lancaster. A population of about 530,000 resides within a radius of approximately 25 miles of the project. This population may be expected to increase to 729,900 by 1980, and 1,034,000 by 2010. Access to the project area is good. A network of Federal, state and county roads makes the area readily accessible from all directions. The Reading interchange of the Pennsylvania Turnpike is to the south and provides direct access to the project from the large metropolitan area of Southeastern Pennsylvania. French Creek State Park and Hopewell Village National Historic Site are within the radius of local use of the project. French Creek Park, an area of 5,794 acres with 91 acres of water in three small lakes, has facilities for picnicking, swimming, boating, camping and group camps, and nature trails. Visitors to the park are far in excess of its capacity, and it has been estimated that as many as one-half of them are from out-of-state, principally from the south.

e. Plan of improvement. The plan of improvement as contained herein provides land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required for the development of this project are as follows:(see table W-18)

(1) Land. Optimum recreation development of the project includes acquisition of 3,776 acres of land, shown on the Blue Marsh project map in Appendix U.

(2) Facilities. The facilities proposed for development on this project would cover a wide range of non-urban recreation activities such as swimming, boating, fishing, picnicking and tent and trailer camping. Also provision would be made for organized group camping. It is assumed facility development would be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and be directed toward full use of the recreation resources under present planning standards.

f. Annual attendance and design load. The estimated annual attendance and the design load for the Blue Marsh recreation project are as follows:

	Optimum Development
Annual design attendance	350,000
Sightseeing	87,500
Total annual attendance	437,500
Design load	8,000

g. Description of sites. The areas and types of recreation facilities to be developed are as follows:

(1) The area on the west side of the reservoir and south of the Spring Creek arm would have the major portion of day-use development with limited overnight facilities. Facilities developed on this site would provide for swimming, picnicking, boating, fishing, hiking and tent camping.

(2) A site on the east side and the north side opposite the above area, and on the peninsula formed by the reservoir in the vicinity of the village of Bern, would be developed as a day-use and overnight area with facilities for swimming, picnicking, boating, fishing and tent camping.

TABLE W-18
BLUE MARSH RESERVOIR RECREATION AREA
BLUE MARSH DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Swimming Beach	s.f.	221,100	$55,400	-	-	221,100	$55,400
Picnicking	unit	80	32,000	90	$36,000	170	68,000
Boat Ramps	unit	7	87,500	-	-	7	87,500
Tent Camping	unit	60	75,000	100	165,000	160	240,000
Picnic Shelter	unit	3	15,000	4	20,000	7	35,000
Change House	l.s.	1	45,000	-	-	1	45,000
Boat Dock	unit	3	16,500	-	-	3	16,500
Parking	unit	688	137,600	920	184,000	1,608	321,600
Roads	mile	1	65,000	2.5	162,500	3.5	227,500
Water	unit	46	46,000	61	61,000	107	107,000
Sanitary	unit	11	82,500	14	105,000	25	187,500
Signs and Markers	l.s.	-	900	-	1,200	-	2,100
Walks and Trails	mile	0.7	1,900	1.0	2,500	1.7	4,400
Misc. Landscaping	l.s.	-	5,200	-	6,900	-	12,100
Group Camping	unit	-	-	1	200,000	1	200,000
Administration Area	l.s.	-	-	1	50,000	1	50,000
Subtotal - Facilities			665,500		994,100		1,659,600
Contingencies 5%			33,300		49,600		82,900
Engineering & Design 10%			66,600		99,400		166,000
Supervision & Administration 10%			66,600		99,400		166,000
Total Cost Facilities			832,000		1,242,500		2,074,500
Real Estate							
Lands	acre	1,093	189,700	2,683	492,300	3,776	682,000
Severance			37,900		58,500		96,400
Improvements			314,000		1,116,000		1,430,000
Resettlement			11,500		37,000		48,500
Contingencies			83,000		255,600		338,600
Total Cost Land & Improvements			636,100		1,959,400		2,595,500
Acquisition Costs			28,000		84,000		112,000
Total Cost Real Estate			664,100		2,043,400		2,707,500
Total Cost Facilities & Real Estate (rounded)			1,496,000		3,286,000		4,782,000

(3) The peninsula formed by the reservoir on the south side near the dam site would be developed primarily as an overnight area with facilities for tent and trailer camping, swimming, hiking and boating.

(4) A site on the north side of the reservoir southwest of Mt. Pleasant would be developed as a day-use area with facilities for swimming, picnicking, boating and hiking.

(5) The peninsula formed by Spring Creek arm and Tulpehocken Creek on the south side of the reservoir would be development as an organized group camping area with facilities for swimming and boating.

(6) The area immediately below the dam would be developed as a day-use area with facilities for fishing, limited picnicking and vehicular parking.

(7) Also included in the 3,776 acres of land are those areas necessary for incidental public use and the protection of recreation resources.

95. Trexler Recreation Area.

a. Location. The Trexler Recreation Area is located on Jordan Creek in the center of Lehigh County, Pennsylvania, 10 miles northwest of Allentown and 5 miles north of the Lehigh Valley interchange of the Northeast Extension of the Pennsylvania Turnpike.

b. Scenic qualities. The Trexler dam would impound a lake in a narrow, winding valley with steep shores that rise to moderately rolling uplands. The shores would have intermittent coverage of hard woods, with the uplands being in agricultural use. The scenic qualities of the project are of moderate value.

c. General characteristics of the project. The Trexler project would serve water supply, recreation and flood control purposes. Generally, the reservoir shorelands would be excellent for most types of outdoor recreation. The shorelands vary from steep to moderate in slope, providing adequate access to the water surface. While the absence of adequate tree cover would limit the suitability of shorelands for some recreation uses, reforestation of such sites would make them excellent areas for extensive recreation development. The project would have a total of 3,587 acres, of which 880 acres would be in the long-term storage pool and 2,627 acres added for the recreation development in addition to lands required for other purposes. The flood storage would have a significant adverse effect if flood conditions required

its full use during the recreation season. All permanent type facilities would be located above the top of flood control storage. The depth of the water from the top of the long-term storage pool at the dam would be 95-feet, and the average overall depth of the reservoir would be about 50-feet. The main body of the reservoir would be about 4 miles long with many finger-like arms extending up the tributaries. The pool would be about 1,500-feet wide at its greatest width with the average width less than 1,000-feet. In addition to the main body of the reservoir, two long narrow arms, two miles in length, would be formed.

d. Types of recreation for which the project is suited. The project site and surrounding terrain are suitable for day-use recreation activities. Picnicking and swimming would be the most popular activities. Boating, fishing and other related outdoor activities would follow. Camping demands would develop with restoration of forest cover.

e. Region served. Within 25 miles of the project site resides a population of approximately 650,000. The Allentown-Bethlehem-Easton metropolitan complex and a portion of the coal mining district of the upper Lehigh Valley are within this radius. The Reading industrial area and the southern portion of the Pocono Mountains will be near the fringe of the 25-mile radius. Based on the Office of Business Economics population projection for the Allentown-Bethlehem-Reading metropolitan area, a population of 894,000 can be anticipated by 1980 and 1,277,000 by the year 2010. The Trexler project would serve both local and regional recreation needs. Access to the project is excellent. The area is served by state highways 29 and 309, and is interlaced with numerous hard, or gravel, surfaced country roads. The accessibility of this area to the Allentown-Bethlehem-Easton metropolitan complex by existing road systems makes it extremely attractive for recreation development. The proximity of the area to the Northeast extension of the Pennsylvania Turnpike is particularly favorable to population centers to the south. There are no state parks or recreation areas within the 25 mile radius of the project. Hickory Run, the nearest state park, is over 30 miles from the project. While this park has a large land area and a relatively small pool for swimming and bathing it lacks water suitable for extensive water supported recreation activities.

f. Plan of improvement. The plan of improvement as contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required are as follows: (see table W-19)

TABLE W-19
TREXLER RECREATION AREA
TREXLER DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Picnicking	unit	46	$18,400	69	$27,600	115	$46,000
Swimming Beach	s.f.	157,500	39,400	-	-	-	39,400
Tent Camping	unit	25	31,300	69	115,000	94	146,300
Boat Ramps	unit	5	78,000	-	-	5	78,000
Parking	unit	456	91,000	690	138,000	1,146	229,000
Sanitary	unit	7	52,500	11	80,500	18	133,000
Water	unit	30	30,000	46	46,000	76	76,000
Roads	mile	1.5	22,500	1	140,000	2.5	162,500
Signs and Markers	l.s.	-	600	-	900	-	1,500
Landscaping	l.s.	-	3,500	-	5,200	-	8,700
Bathhouse	l.s.	-	20,000	-	-	-	20,000
Walks and Trails	mile	0.5	1,200	0.7	1,800	1.2	3,000
Administration Area	l.s.	-	-	-	45,000	-	45,000
Group Camping	unit	-	-	1	200,000	1	200,000
Subtotal - Facilities			388,400		800,000		1,188,400
Contingencies 5%			19,400		40,000		59,400
Engineering & Design 10%			38,900		80,000		118,900
Supervision & Administration 10%			38,900		80,000		118,900
Total Cost Facilities			485,600		1,000,000		1,485,600
Real Estate							
Lands	acre	1,546	515,500				
Severance @ 20%	-	-	103,100				
Improvements	l.s.		209,100				
Contingencies @ 15%			124,200				
Total Cost Land & Improvements			952,300				
Acquisition Costs	tract	30	21,000				
Real Estate Adjusted Upward	acre	230 @ $166	38,200				
Total Cost Real Estate			1,011,500	851	141,300	2,627	1,152,800
Total Cost Facilities & Real Estate (rounded)			1,497,000		1,141,000		2,638,000

(1) Land. Optimum recreation development of the project includes acquisition of 2,627 acres of land indicated on the Trexler project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities such as swimming, boating, picnicking, fishing and hiking with minor development for tent and trailer camping. It is assumed that facility development will be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and bedirected toward full use of the recreation resources under present planning standards.

g. Annual attendance and design load. The estimated annual attendance and the design load for the Trexler Recreation Area are as follows:

	Optimum Development
Annual design attendance	250,000
Sightseeing	62,500
Total annual attendance	312,500
Design load	5,700

h. Description of sites. Descriptions of sites and major types of facilities to be provided are as follows:

(1) A site on the south shore of the Lyon Creek area of the impoundment, between Weidasville and Lyon Valley, would be developed to provide for the major portion of day-use activities on the project. Facilities developed on this site would provide for swimming, picnicking, boating, fishing and other related recreation activities.

(2) A site on the west shore near the confluence of Lyon and Jordan Creeks would be developed as a boat launching and docking site with limited facilities for picnicking and vehicle parking.

(3) A site north of the impoundment, on the peninsula formed by Mill and Jordan Creeks, would be developed as an extensive recreation area, with facilities for swimming, picnicking, tent camping, hiking and fishing.

(4) A site on the south shore about 1/2 mile above the dam site would be developed as a unit for organized and group camping.

(5) The area below the dam site would be developed primarily for fishing, with limited facilities for picnicking and parking.

(6) Additional boat launching facilities would be developed on the numerous arms of the reservoir at the ends of existing roads.

(7) Included within the 2,627 acres of land are those lands necessary for the protection and preservation of the recreation potential of the project for public use.

96. Prompton Recreation Area.

a. Location. The Prompton Recreation Area is located in the central portion of Wayne County, Pennsylvania, partly within the limits of the Borough of Prompton, 4 miles west and north of Honesdale and 22 air miles northeast of Scranton.

b. Scenic qualities. The project is located in a relatively narrow valley between steep ridges. For the most part, the hillsides are wooded and rugged in character, providing an esthetic setting for the reservoir area.

c. General project characteristics. The Prompton project would include a total area of 2,055 acres, of which 720 acres would constitute the area of the long-term storage pool. In addition to jointly used lands, a total of 1,325 acres is included for recreation development and preservation of the shoreline for public use. The rugged topography limits the extent of recreation development in this project. The reservoir would be about 3 miles long with an average width of about 1/2 mile. The shoreline is steep and for the most part straight with few irregularities.

d. Types of recreation for which project is suited. Due to the lack of suitable terrain, recreation potential at this project is somewhat limited. However, lands suitable for day-use recreation including swimming, picnicking, hiking, fishing and boating, with limited facilities for camping, are available.

e. Region served. This project would serve the upper portion of the Lehigh Valley, the metropolitan area of Scranton, and a portion of the popular Pocono Mountain resort region in Wayne and Pike Counties. In 1955 a year-round population of approximately 300,000 resided within 25 miles of the project. Based on the Office of Business Economics population projections, a resident population of approximately 400,000 and 500,000 can be anticipated by the years 1980 and 2010, respectively. The Scranton interchange of the Northeast Extension of the Pennsylvania Turn-

pike is about 25 miles from the project. Federal routes 6 and 106 provide immediate access to the project from Scranton to the west and Milford, Pa. and Port Jervis, New York, to the east. State route 170 provides access from the north. Promised Land State Park is the only recreation area within a 25-mile radius of the project. This park provides extensive recreation opportunities and facilities provided are grossly overused.

f. Plan of improvement. The plan of improvement as contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required are as follows: (see table W-20)

(1) Land. Optimum recreation development of the project includes acquisition of 1,325 acres of land indicated on the Prompton project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities such as picnicking, boating, swimming, fishing and hiking with limited facilities for tent camping. It is assumed that facility development will be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and be directed toward full use of the recreation resources under present planning standards.

g. Annual attendance and design load. The estimated annual attendance and the design load for the Prompton recreation project are as follows:

	Optimum Development
Annual design attendance	125,000
Sightseeing	31,250
Total annual attendance	156,250
Design load	2,800

h. Description of sites. Description of areas and major types of facilities to be provided are as follows:

(1) A site on the west side in the vicinity of the dam will be developed as an extensive day-use area with facilities for picnicking, hiking, nature study, fishing and possibly swimming.

(2) A site on the west side on the upper portion of the reservoir will provide facilities for swimming, boat launching, picnicking, tent camping, fishing and nature study.

(3) A boat launching ramp will be developed in the vicinity of Aldenville with parking, sanitation and limited picnicking facilities.

(4) A site on the east, midway along the length of the reservoir would be developed as a boat launching site with limited picnicking facilities.

(5) The area immediately below the dam would be developed for limited day-use with sanitation, drinking water and parking facilities.

(6) A site on the west side about a mile north of the dam would be developed as a tent camping area with nature trails, boating and possible swimming.

(7) Also included in the 1,325 acres of land are those lands necessary for the protection and preservation of the recreation resources and incidental public use of the major portion of the remaining shoreline.

97. Mason-Dixon Interstate Park Area (Newark Dam and Reservoir).

a. Location. The Mason-Dixon Interstate Park Area is located on White Clay Creek, 17 miles southwest of West Chester, Pennsylvania, 36 miles southwest of Philadelphia, Pennsylvania, one mile north of Newark, Delaware and 12 miles west of Wilmington, Delaware.

b. Scenic qualities. The site is located in the Piedmont hills, one of the most scenic areas of the basin. The topography varies from rolling meadowland to steep forest covered hillsides. This irregular terrain provides a topographic variety found only in the Piedmont area.

c. Project characteristics. The proposed dam would impound a reservoir having an area of 1,060 acres of which 60 percent is in Delaware and 40 percent is in Pennsylvania. The shoreline would be extremely irregular with long necks and promontories of land overlooking the reservoir. The point of beginning of the Mason-Dixon line, a feature of historical interest, with some of the original markers, is still to be found in the project area. The project would serve water supply and recreation purposes.

TABLE W-20
PROMPTON RECREATION AREA
PROMPTON DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Picnicking	unit	22	$8,800	34	$13,600	56	$22,400
Boat Ramps	unit	3	37,500	-	-	3	37,500
Swimming Beach	s.f.	41,950	19,300	-	-	41,950	19,300
Tent Camping	unit	22	27,500	34	51,000	56	78,500
Boat Docks	unit	1	5,500	-	-	1	5,500
Picnic Shelter	unit	-	-	1	5,000	1	5,000
Bathhouse	l.s.	1	20,000	-	-	1	20,000
Roads	mile	1	20,000	1.5	30,000	2.5	50,000
Parking	unit	220	44,000	340	68,000	560	112,000
Water	unit	15	15,000	23	23,000	38	38,000
Sanitary	unit	4	26,000	5	40,000	9	66,000
Signs & Markers	l.s.	-	300	-	400	-	700
Walks & Trails	mile	0.2	600	0.3	900	0.5	1,500
Misc. Landscaping	l.s.	-	1,700	-	2,600	-	4,300
Administration Bldg.	-	-	-	1	25,000	-	25,000
Subtotal - Facilities			226,200		259,500		485,700
Contingencies 5%			11,300		13,000		24,300
Engineering & Design 10%			22,600		26,000		48,600
Supervision & Administration 10%			22,600		26,000		48,600
Total Cost Facilities			282,700		324,500		607,200
Real Estate							
Total Cost of Acquisition @ $156/acre	acre	925	144,300	400	62,400	1,325	206,700
Total Cost Facilities & Real Estate (rounded)			427,000		387,000		814,000

d. Region served. An existing network of state and Federal highways provides access to the project area from centers of population. Within day-outing reach of the Newark project are Newark and Wilmington, Delaware; and Philadelphia and Lancaster, Pennsylvania. Approximately five million people live within day-use driving distance of the project. Five state parks and one state historic site are within 25 miles of the project. These are: the Brandywine Battlefield State Park in Pennsylvania; Brandywine Springs and Fort Delaware State Parks in Delaware; Elk Neck State Park in Maryland; and Fort Mott State Park and Hancock House State Historic Site in New Jersey. With the exception of Brandywine Springs and Elk Neck State Parks in Delaware and Maryland, respectively, the above are essentially historic sites, with limited picnic facilities secondary to historic significance. Brandywine Springs State Park, urban in character, has an area of 59 acres and facilities for picnicking, and a visitor-day capacity of less than 2,000. Elk Neck State Park is the only area within 25 miles of the project with extensive nonurban development.

e. Plan of improvement. The plan of improvement as contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required are as follows: (See table W-21)

(1) Land. Optimum recreation development of the project includes acquisition of 5,400 acres of land above elevation 156 as indicated on the Newark project map in Appendix U. 3,000 acres of this land are in Delaware and the remaining 2,400 acres are in Pennsylvania.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities such as swimming, boating, picnicking, fishing and hiking with minor development for tent and trailer camping. It is assumed that facility development will be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project's sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and be directed towards full use of the recreation resources under present planning standards.

f. Annual attendance and design load.

	Optimum Development
Annual design attendance	750,000
Sightseeing	187,500
Total annual attendance	937,500
Design load	17,100

g. Description of sites. Descriptions of sites and major types of facilities to be provided are as follows:

(1) The site due east of the town of McClellandville on the west side of the reservoir and another site near London Tract Church would provide facilities for swimming, picnicking, boating, hiking and other related day-use activities.

(2) A site due east of Mechanicsville on the west side of the reservoir would be developed to provide facilities for tent and trailer camping, swimming and boating.

(3) A boat launching and limited picnicking site would be developed at a cove 1-1/4 miles above the dam site on the east side of the reservoir.

(4) A site on the east side of the reservoir 1-1/2 miles above the dam site would be developed as a day-use area with facilities for swimming, picnicking and boating.

(5) A site in Pennsylvania on the east side of the reservoir southeast of London Tract Church would be provided with facilities for tent and trailer camping, swimming, boating and hiking.

(6) The large cove north of the point where the eastwest boundary between Delaware and Pennsylvania and the arc between these two states intersect, would be developed as an extensive marina.

(7) Boat launching sites would be developed at numerous access points.

98. Christiana Recreation Area.

a. Location. The Christiana project is located on Christina River, New Castle County, Delaware, about 10 miles south of the city of Wilmington. Philadelphia, Pa. is about 35 miles to the northeast.

b. Scenic qualities. The project area is located on the coastal plain which has typical rolling topographic features. The terrain adjacent to the project is well adapted to extensive development of recreation facilities, even though the scenery is of moderate value.

c. Project characteristics. The project would serve water supply and recreation purposes. The dam would impound a pool of 2,900 acres. In addition to jointly used project lands, about 5,030 acres would be acquired to serve recreation needs.

TABLE W-21
MASON-DIXON INTERSTATE PARK AREA
NEWARK DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Swimming Beach	s.f.	473,000	$118,300	-	-	473,000	$118,300
Picnicking	unit	160	64,000	180	$72,000	340	136,000
Tent Camping	unit	150	187,500	200	337,500	350	525,000
Boat Ramps	unit	16	200,000	-	-	16	200,000
Boat Docks	unit	9	49,500	-	-	9	49,500
Picnic Shelters	unit	4	20,000	8	40,000	12	60,000
Bathhouses	l.s.	-	45,000	-	-	-	45,000
Parking	unit	1,600	320,000	1,800	360,000	3,400	680,000
Roads	unit	3	195,000	1.5	97,500	4.5	292,500
Water	unit	106	106,000	122	122,000	228	228,000
Sanitary	unit	25	187,500	29	217,500	54	405,000
Signs & Markers	l.s.	-	2,000	-	2,300	-	4,300
Walks & Trails	mile	1.6	4,200	1.8	4,800	3.4	9,000
Group Camping	unit	-	-	2	400,000	2	400,000
Misc. Landscaping	l.s.	-	12,000	-	13,700	-	25,700
Administration Area	l.s.	-	-	-	55,000	-	55,000
Subtotal - Facilities			1,511,000		1,722,300		3,233,300
Contingencies 5%			75,600		86,100		161,700
Engineering & Design 10%			151,100		172,200		323,300
Supervision & Administration 10%			151,100		172,200		323,300
Total Cost Facilities			1,888,800		2,152,800		4,041,600
Real Estate							
Land	acre	4,000	1,504,000	1,400	560,800	5,400	2,064,800
Severance			151,300		56,100		207,400
Improvements			1,088,000		548,000		1,636,000
Resettlement			35,000		22,000		57,000
Contingencies			416,800		178,000		594,800
Cost Land & Improvements			3,195,100		1,368,900		4,561,400
Acquisition Costs			56,000		35,000		91,000
Total Cost Real Estate			3,251,100		1,399,900		4,651,000
Total Cost Facilities & Real Estate (rounded)			5,140,000		3,553,000		8,693,000

d. Region served. An existing network of state and Federal highways, including highway U. S. 40 on the south and state highway 896 that crosses the area on the west, provides excellent access to the project for the population of the Wilmington and Philadelphia metropolitan areas. More than 5,000,000 people live within easy day-use driving distance of the project. The project would provide for a heavy regional use, particularly from the States of Pennsylvania and Maryland. The situation as regards existing recreation areas that would relate to the Christiana project is much the same as that described for the Newark project.

e. Plan of improvement. The plan of improvement contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required are as follows: (See table W-22)

(1) Land. Optimum recreation development of the project includes acquisition of 5,030 acres of land above elevation 49 as indicated on the Christiana project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities. Facilities for overnight use would be limited. The proximity of the project to a large population, the desirable terrain, accessibility by existing roads, and the size and desirable quality of the reservoir would require that this area be developed for intensive use similar to that associated with large urban parks. The optimum development of this project would be directed towards full use of the recreation resources under present planning standards.

f. Annual attendance and design load. The estimated annual attendance and the design load for the Christiana recreation area are as follows:

	Optimum Development
Annual design attendance	1,500,000
Sightseeing	375,000
Total annual attendance	1,875,000
Design load	34,300

g. Description of sites. The areas and types of recreation facilities to be developed are as follows:

(1) The area on the south side one mile above the dam site and bounded by highway 40 on the south, would be developed as an extensive day-use area with facilities for swimming, picnicking, boating and fishing.

(2) The area on the north side of the reservoir in the vicinity of Salem Church would be developed also as a day-use area.

(3) Limited overnight facilities would be developed on the peninsula formed by Muddy Run and Belltown Run, providing for tent and trailer camping, swimming and boating.

99. Aquashicola Recreation Area.

a. Location. The Aquashicola Recreation Area is located on Aquashicola Creek in Carbon County, 15 miles northwest of the Allentown-Bethlehem complex in Pennsylvania.

b. Scenic qualities. The project area is located in a relatively narrow valley between steep ridges. Blue Mountain rises directly from the south shoreline to an elevation of 1,000 feet above the reservoir, which together with the steep forested hillsides give this project an excellent scenic quality.

c. General project characteristics. Aquashicola project would comprise a total project area of 2,150 acres of which 840 acres would constitute the area of the long-term storage pool and would serve water supply, recreation and flood control purposes. In addition to jointly used project lands, a total of 1,250 acres are included for recreation development. Due to the lack of suitable terrain, the recreation potential at this project is somewhat limited. However, lands available for day-use recreation would include swimming, hiking, picnicking, fishing and boating, with some facilities for tent camping.

d. Region served. A population of 600,000 resides within a 25-mile radius of the project. This population is expected to increase to 825,000 by 1980 and 1,160,000 by 2010. Access to the project area is good. The Northeast extension of the Pennsylvania Turnpike provides general access from the north and the south, and other existing highways provide direct access to the site. The three of the four areas selected as suitable for recreation development are served by existing roads. Within a 25-mile radius of the Aquashicola project are two state parks, namely, Hickory Run and Big Pocono. Hickory Run State Park has 13,000 acres, and

TABLE W-22
CHRISTIANA RECREATION AREA
CHRISTIANA DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Swimming Beach	s.f.	943,300	$236,100	-	-	943,300	$236,100
Bathhouse	l.s.	-	50,000	-	-	-	50,000
Picnicking	unit	228	91,200	458	$103,200	686	194,400
Picnic Shelters	unit	6	30,000	20	100,000	26	130,000
Boat Ramps	unit	31	387,500	-	-	31	387,500
Boat Docks	unit	15	82,500	-	-	15	82,500
Tent Camping	unit	200	250,000	450	675,000	650	925,000
Water Supply	unit	152	152,000	305	305,000	457	457,000
Sanitary	unit	37	277,500	72	540,000	109	817,500
Roads	mile	3	195,000	2	130,000	5	325,000
Parking	unit	2,280	456,000	4,580	916,000	6,860	1,372,000
Signs & Markers	l.s.	-	2,800	-	5,700	-	8,500
Walks & Trails	mile	2.3	6,100	4.6	12,100	6.9	18,200
Misc. Landscaping	l.s.	-	17,100	-	34,400	-	51,500
Administration Area	l.s.	-	-	-	60,000	-	60,000
Subtotal - Facilities			2,233,800		2,881,400		5,115,200
Contingencies 5%			111,700		144,000		255,700
Engineering & Design 10%			223,400		288,200		511,600
Supervision & Administration 10%			223,400		288,200		511,600
Total Cost Facilities			2,792,300		3,601,800		6,394,100
Real Estate							
Land	acre	3,057	1,380,000	1,973	770,000	5,030	2,150,000
Severance			138,000		77,000		215,000
Improvements			2,324,000		659,000		2,983,000
Resettlement			144,000		32,300		176,300
Contingencies			597,900		230,700		828,600
Total Cost Land & Improvements			4,583,900		1,769,000		6,352,900
Acquisition			189,000		49,000		238,000
Total Cost Real Estate			4,772,900		1,818,000		6,590,000
Total Cost Facilities & Real Estate (rounded)			7,565,000 (58.3%)		5,420,000 (41.7%)		12,985,000
TOTAL NET ATTENDANCE			1,084,000		775,400		1,859,400

while offering a variety of recreational opportunity, it is deficient in water areas for recreation activity. Big Pocono State Park offers picnic facilities and panoramic sightseeing. There are numerous privately-owned resorts in the Pocono Mountain area. The privately-owned resorts vary from lavish, self-contained establishments to resort farms, catering primarily to vacation trade.

e. Plan of improvement. The plan of improvement as contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without abbreviation of the natural resources. At this particular project site land suitable for recreation is the determining factor. (See table W-23)

(1) Land. Optimum recreation development of the project includes acquisition of 1,250 acres of land as delineated on the Aquashicola project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities, such as swimming, boating, picnicking, fishing and hiking, with some minor development for primative type tent camping. It is assumed that facility development will be a continuing program with the initial development of sufficient magnitude to provide for the immediate needs for recreation within the project sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and be directed towards full use of the recreation resources under present planning standards.

f. Annual attendance and design load. The estimated annual attendance and the design load for the Aquashicola recreation project are as follows:

	Optimum Development
Annual design attendance	125,000
Sightseeing	31,300
Total annual attendance	156,300
Design load	2,900

g. Description of sites. Description of areas and major types of facilities to be provided are as follows:

(1) A site on the east shore of the cove at the mouth of Buckwha Creek would be developed as an extensive day-use area with facilities for swimming, picnicking, fishing, hiking, boating and boat launching.

(2) A site on the south shore of the main reservoir opposite the day-use area would be an extensive boat launching and docking area, with picnicking and tent camping facilities provided.

(3) A site below the dam would be developed for fishing and picnicking.

(4) A site in the vicinity of Little Gap would be developed as a boat launching area with limited facilities for picnicking.

100. Maiden Creek Recreation Area.

a. Location. The Maiden Creek Recreation Area is located in northern Berks County, Pennsylvania, 10 miles north of Reading and 20 miles southwest of Allentown.

b. Scenic qualities. On the east side of the reservoir site the terrain is forested and has a rugged appearance, with hills rising to 600 feet in moderate to steep slopes. Blue Mountain, five miles to the northwest, towers over the surrounding countryside and greatly enhances the qualities of the region, giving the project a scenic quality of moderate value.

c. General project characteristics. The Maiden Creek project would serve flood control, water supply and recreation purposes. The total project area covers 8,450 acres, of which 2,500 acres would be occupied by the impounded pool. In addition to jointly used lands, a total of 5,600 acres are proposed for recreation development. The main body of the reservoir would be over 6-1/2 miles in length with a major arm of 4-1/2 miles. The lake would be 68 feet deep at the dam and have a maximum width of about one mile. The shoreline would be irregular and have numerous arms extending 1/2 to 1-1/2 miles. The west shore has a gentle slope readily useable for day-use facilities, while the east shore is more rugged.

d. Region served. A population of about 625,000 resides within a 25 mile radius of the project. It is expected that this number will increase to about 855,000 by 1980, and 1,218,000 by 2010. However, the Maiden Creek project is expected to attract people from beyond the 25-mile radius. While studies were not completed that would indicate the magnitude of such use, state park authorities point out that the out-of-state use of French Creek State Park, originating in northern Maryland and Delaware, constitutes as much as 50 percent of the total attendance. The Maiden Creek project would require an

TABLE W-23
AQUASHICOLA RECREATION AREA
AQUASHICOLA DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Swimming Beach	s.f.	79,500	$20,000	-	-	79,500	$20,000
Boat Ramps	unit	2	20,000	-	-	2	20,000
Picnicking	unit	32	12,400	30	$12,000	62	24,400
Tent Camping 1/	unit	10	7,500	48	79,500	58	87,000
Parking	unit	200	40,000	320	74,000	520	114,000
Sanitary	unit	4 2/	27,000	5	40,000	9	67,000
Water	unit	18	18,000	20	20,000	38	38,000
Roads	unit	1.5	70,000	1.5	65,000	3	135,000
Signs & Markers	l.s.	-	500	-	200	-	700
Change House	unit	1	35,000	-	-	1	35,000
Walks & Trails	l.s.	-	700	-	600	-	1,300
Misc. Landscaping	l.s.	-	2,000	-	2,500	-	4,500
Picnic Shelter	unit	-	-	2	14,000	2	14,000
Boat Dock	unit	1	10,000	-	-	1	10,000
Subtotal - Facilities			263,100		307,800		570,900
Contingencies 5%			13,200		15,300		28,500
Engineering & Design 10%			26,300		30,700		57,000
Supervision & Administration 10%			26,300		30,700		57,000
Total Cost Facilities			328,900		384,500		713,400
Real Estate							
Land	acre	698	97,600	480		1,250	
Severance @ 15%			14,600				
Improvements			280,000				
Resettlement			16,500				
Contingencies @ 15%			61,300				
Total Cost Land & Improvements			470,000				
Acquisition Costs			28,000				
Total Cost Real Estate			498,000				
Adjustment upward 72 acre 3/		72	51,500				
Total Adjusted Cost Real Estate			549,500		103,400		652,900
Total Cost Facilities & Real Estate (rounded)			878,000		488,000		1,366,000

1/ Primitive walk-in type.
2/ Includes one pit type and three flush type.
3/ 72 acres added at total average cost of $715/acre.

additional 20 miles of travel by these people. It has been assumed that such out-of-state use might account for 20% of the total use of the project. In addition, some use is expected to originate with the population of the Philadelphia metropolitan area.

e. Plan of improvement. The plan of improvement as contained herein includes the acquisition of lands and the development of facilities necessary to provide for the immediate and future needs for recreation in the project vicinity and to protect and preserve the recreation potential of the project site. Land and facilities required are as follows: (see table W-24)

(1) Land. Optimum recreation development of the project includes acquisition of 5,600 acres of land including fee title to those lands between elevations 482 and 500 and above elevation 500 to line indicated on the Maiden Creek project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities, such as swimming, picnicking, fishing, boating and hiking, with development for tent and trailer camping and an organized group camp. It is assumed that facility development will be a continuing program with the initial development to provide facilities for the immediate needs within the project sphere of influence. Optimum development would provide facilities for the estimated maximum attendance and be directed toward full use of the recreation resources under present planning standards.

f. Annual attendance and design load. The estimated annual attendance and the design load for the Maiden Creek Recreation Area are as follows:

	Optimum Development
Annual design attendance	500,000
Sightseeing	125,000
Total annual attendance	625,000
Design load	11,700

g. Description of sites. Description of areas and major types of facilities to be developed are as follows:

(1) The west side of the main body of the reservoir from Dreibelbis, south to the vicinity of the dam would be developed for extensive day-use activities, with facilities for swimming, picnicking, fishing and boating. The shoreline and immediate submerged

lands at numerous points in this area are suitable for beach development. Fingers formed on this portion of the reservoir provide protected coves for boat launching and marina facilities. One cove, particularly favorable for development is immediately above the dam site.

(2) A site on the east shore of the reservoir near Dreibelbis would be developed as a day-use area to accommodate visitors residing in or near the Allentown-Bethlehem area. Facilities provided at this site would be for swimming, picnicking, hiking and boating.

(3) A site on the south side of the Sacony Creek arm in the vicinity of Virginville would provide for the major portion of overnight-use, with facilities for camping, swimming and boat launching.

(4) Numerous sites on the reservoir are suitable for boat launching development. These sites would be located so as to provide convenient access from the surrounding area and to provide safety for the boater as well as the swimmer using beach facilities.

(5) A site on the east shore of the main body of the reservoir south of the New Jerusalem Church would be developed as day-use area with facilities for swimming, picnicking, hiking, fishing and boating.

(6) A site on the south shore of the Sacony Creek arm, in the vicinity of Heffners Bridge, would include facilities for tent and trailer camping, and organized group camping with beach development in the vicinity for use of the campers.

(7) A site on the north side of Sacony Creek arm would be developed as an additional overnight-use area with access to the north. Facilities provided would be for camping, fishing, boating and limited picnicking.

(8) The area below the dam site would be developed primarily for fishing, with limited facilities for picnicking and parking.

(9) Also included in the 5,600 acres of land, are those lands necessary for incidental public use and the protection of the recreation potential.

TABLE W-24
MAIDEN CREEK RECREATION AREA
MAIDEN CREEK DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Swimming Beach	s.f.	316,300	$79,300	-	-	316,300	$79,300
Picnicking	unit	92	36,800	138	$55,200	230	92,000
Boat Ramps	unit	10.5	131,000	-	-	10.5	131,000
Tent Camping	unit	90	135,000	140	210,000	230	345,000
Parking	unit	920	184,000	1,380	276,000	2,392	460,000
Water	unit	61	61,000	92	92,000	153	153,000
Sanitary	unit	14	105,000	22	165,000	36	270,000
Group Camping	l.s.	-	-	-	400,000	-	400,000
Boat Docks	unit	5	27,500	-	-	5	27,500
Picnic Shelters	unit	3	15,000	6	30,000	9	45,000
Bathhouse	l.s.	-	45,000	-	-	1	45,000
Roads	mile	1.5	97,500	2.5	162,500	4	260,000
Signs and Markers	l.s.	-	1,200	-	1,700	-	2,900
Walks and Trails	mile	1	2,700	1.5	4,000	2.5	6,700
Miscellaneous Landscaping	l.s.	-	6,900	-	10,400	-	17,300
Administration Area	l.s.	-	-	-	55,000	-	55,000
Subtotal - Facilities			927,900		1,461,800		2,389,700
Contingencies 5%			46,400		73,100		119,500
Engineering & Design 10%			92,800		146,200		239,000
Supervision & Administration 10%			92,800		146,200		239,000
Total Cost Facilities			1,159,900		1,827,300		2,987,200
Real Estate							
Lands	acre	2,255	601,700	3,345	370,100	5,600	971,800
Severance			90,300		55,500		145,800
Improvements			347,500		770,000		1,117,500
Resettlement			18,400		23,100		41,500
Contingencies			158,700		182,800		341,500
Total Cost Land and Improvements			1,216,600		1,401,500		2,618,100
Acquisition			60,900		23,100		84,000
Total Cost Real Estate			1,277,500		1,424,600		2,702,100
Total Cost Facilities & Real Estate (rounded)			2,437,000		3,252,000		5,689,000

101. Bear Creek Recreation Area.

a. Location. The Bear Creek Recreation Area would be located along the courses of Bear Creek, Tobyhanna Creek and Lehigh River, in Luzerne and Carbon Counties, Pennsylvania, 22 miles south of Scranton and 10 miles southeast of Wilkes-Barre, Pennsylvania.

b. Scenic qualities. The scenic qualities of the project area are related to that of the Pocono Mountain area of Northeastern Pennsylvania, with steep hillsides, fast flowing streams, cut-over woodland and irregular terrain. These qualities make the area desirable for and conducive to recreation development.

c. General project characteristics. The proposed project consists of a modification of an existing flood control reservoir under which the present pool of 90 acres would be increased to 1,280 acres. The total project would then comprise a total of 3,950 which includes 2,000 acres for recreation development. The reservoir would have relatively steep shores and would be surrounded by rugged terrain, which provides a scenic backdrop. The area, except for its rugged terrain which limits access to the reservoir, is excellent for recreation development.

d. Types of recreation for which project is suited. The project is adaptable for intensive day-use and overnight recreation activities. Boating, picnicking, and swimming would be the major activities, with tent and trailer camping next in order of demand. Due to the nature of the project, primitive camping would be provided. If good fishing should develop, this would undoubtedly be one of the popular activities.

e. Region served. The project would serve the upper portion of the industrial Lehigh Valley and adjacent areas which would include the Wilkes-Barre, Scranton and Hazelton areas. In 1955 a year-round population of approximately 600,000 resided within the sphere of influence of the Bear Creek project. Based on trends indicated in the Office of Business Economics population projections, resident populations of approximately 880,000 and 1,000,000 can be anticipated by 1980 and the year 2010, respectively. The Pocono interchange of the Northeast extension of the Pennsylvania Turnpike is about 3 miles from the project and would provide access from the large metropolitan areas of Southeastern Pennsylvania. State routes 115 and 740, as well as several gravel and hard surfaced county roads, provide good access to the vicinity of the project. Within a 25-mile radius of this project there are four state parks, namely, Gouldsboro, Tobyhanna, Big Pocono and Hickory Run. The Gouldsboro and Tobyhanna State Parks have a total of 7,300 acres of land and 455 acres of water useable for recreation. These parks are designed primarily for local use. Big Pocono State Park is primarily a vantage point for visitors

attracted by the scenery of the area. Hickory Run State Park is a relatively large park with an area in excess of 13,000 acres. It is also the nearest state park to the Bear Creek reservoir, being about 4 air miles south of the project. Much of the use of this park originates in the metropolitan areas of Southeastern Pennsylvania. This park has many features which make it attractive for state park use but the area has only a small water impoundment for recreation use.

f. Plan of improvement. Estimates of attendance herein are based upon the assumption that the present need for an interconnecting road between the Bear Creek project and Hickory Run State Park would be satisfied prior to or concurrently with the recreation development proposed herein. The need for the initial recreation development relies on the project's proximity and accessibility to Hickory Run State Park and its capability to satisfy the need for recreation waters now apparent at this state park. The aforementioned road could be provided for approximately $20,000 by making use of existing county, state and Corps of Engineers' access roads. The plan of improvement contained herein provides for land and facilities for maximum development of the recreation potential inherent in this project without deterioration of the natural resources. Land and facilities required are as follows: (See table W-25)

(1) Land. Optimum recreation development of the project includes acquisition of 2,000 acres of land including fee title to those lands between elevation 1,425 and 1,481 and above elevation 1,481 as delineated on the Bear Creek project map in Appendix U.

(2) Facilities. Facilities proposed for development on this project would be primarily for day-use activities with limited overnight use. These facilities would provide for a variety of nonurban recreation activities such as boating, picnicking, swimming, fishing, hiking and tent camping. It is assumed that facility development will be a continuing program with the initial development meeting the needs as set forth above with optimum development providing facilities for the estimated maximum attendance and be directed towards full use of the recreation resources under present planning standards.

g. Annual attendance and design load. The estimated annual attendance and the design load for the Bear Creek Recreation Area are as follows:

TABLE W-25
BEAR CREEK RECREATION AREA
BEAR CREEK DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Item	Unit	Direct		Indirect		Total	
		No. Units	Cost	No. Units	Cost	No. Units	Cost
Facility							
Picnicking	unit	34	$13,600	38	$23,200	62	$36,800
Swimming Beach	s.f.	126,500	31,700	-	-	126,500	31,700
Boat Ramps	unit	5	62,500	-	-	5	62,500
Tent Camping	unit	34	42,500	58	95,500	92	138,000
Parking	unit	340	22,500	580	161,500	920	184,000
Water	unit	23	23,000	39	39,000	62	62,000
Sanitary	unit	5	37,500	9	67,500	14	105,000
Picnic Shelters	unit	1	5,000	3	15,000	4	20,000
Boat Docks	unit	3	16,500	-	-	3	16,500
Roads	mile	1	30,000	2	165,000	3	195,000
Bathhouse	l.s.	-	35,000	-	-	-	35,000
Signs & Markers	l.s.	-	500	-	800	-	1,300
Walks & Trails	mile	0.4	1,100	0.6	1,600	1	2,700
Misc. Landscaping	l.s.	-	2,600	-	4,400	-	7,000
Administration Area	l.s.	-	-	-	45,000	-	45,000
Subtotal - Facilities			324,000		618,500		942,500
Contingencies 5%			16,200		30,900		47,100
Engineering & Design 10%			32,400		61,900		94,300
Supervision & Administration 10%			32,400		61,900		94,300
Total Cost Facilities			405,000		773,200		1,178,200
Real Estate							
Total Cost Land & Improvements	acre	1,300	189,800	700	102,200	2,000	292,000
Total Cost Facilities & Real Estate (rounded)			595,000		875,000		1,470,000

	Optimum Development
Annual design attendance	200,000
Sightseeing	50,000
Total annual attendance	250,000
Design load	4,600

h. Description of sites. The areas and types of recreation facilities to be developed are as follows:

(1) A site on the east side of the reservoir just above the dam site would be developed as a day-use area with facilities for swimming, boating, picnicking, fishing and hiking.

(2) A site on the west side near the dam site would provide a small day-use area with picnicking and swimming facilities.

(3) Boat launching sites would be provided near Shades Creek on the Bear Creek arm of the reservoir and near Stoddartsville. In addition to boat launching facilities, limited picnicking and sanitation facilities would be provided at these sites.

(4) The point lying between the Bear Creek arm and the Lehigh River arm will be developed as an extensive overnight area with facilities for tent and trailer camping, swimming, boating and fishing.

(5) A site below the dam would be developed as a day-use area, primarily for fishing, but with limited facilities for picnicking, vehicle parking, sanitation and drinking water.

(6) Also included in the 2,000 acres of land are those lands necessary for the protection and preservation of the recreation resources and incidental public use of the major portion of the remaining shoreline.

102. Hawk Mountain Project.

a. Location. The Hawk Mountain Recreation Project is located on the East Branch of the Delaware River in Delaware County, New York, 35 miles east of Binghamton and 50 miles northeast of Scranton, Pennsylvania.

b. Scenic qualities. The site and surrounding country are of high scenic quality with high peaks and rugged ridges rising to over 1,400 feet above the valley floor. The valley slopes adjacent to the pool are steep; in some areas the valley walls are almost perpendicular.

c, General project characteristics. The Hawk Mountain project would serve water supply, hydroelectric power and recreation purposes. A total of 7,800 acres would comprise the entire project area, with the lake occupying an area of 5,400 acres. A total of 2,000 acres would be the area acquired specifically for recreation use. The lake at the dam would be about 152 feet deep and the mean depth over the reservoir would be about 60 feet. The overall length of the main body of water would be about 19 miles. A 3 mile arm would extend up Beaver Kill. The greatest width would be 3/4 of a mile with an average width of about 3/8 of a mile. There would be three sites, each of limited size, which would provide access to the reservoir and where recreation facilities would be installed. One of these is on the south shore of the main body of the reservoir at the confluence of Fish Creek. Another is on the Beaver Kill arm along the south shore and the third is on the north shore near the upper end of the Beaver Kill arm. Because of the steep terrain, recreation activities would be principally boating and fishing. Some picnicking, hiking, nature studying and camping would occur.

d. Region served. The project would serve the lower Catskill Moutain area. Within a 25-mile radius of the project there reside about 75,000 people. The expected year-round resident population for 1980 is 102,000, and for the year 2010 it is 130,000. Summer residents and visitors, however, greatly exceed these numbers, since the greater portion of the Catskill Mountain resort area of New York State and the upper Pocono region of Pennsylvania lie within a 25-mile radius of the project. State routes 17, 97 and 30 provide approaches from population centers to the general project region. Access to the shoreline, however, is extremely limited and difficult by way of secondary roads over rough terrain. A small portion of the Catskill Mountain forest-park preserve is within a 25-mile radius of the project. There is one public-use area within this portion of the preserve offering limited facilities for camping, picnicking, and swimming. The Pepacton reservoir, a large water supply project for New York City and the Cannonsville reservoir, now under construction, are within the 25-mile zone.

e. Plan of improvement. The plan of improvement would provide for acquisition of land for access and development, and facilities for boating, fishing, picnicking, hiking, nature study and some camping, based upon the attendance analysis as follows:

	Optimum Development
Annual design attendance	150,000
Sightseeing	37,000
Total annual attendance	187,000
Design load	3,400

f. Description of feasible development. Development of the project area for recreation use would include the following:

(1) The site on the south side of the main reservoir at Fishs Eddy, though limited, would permit development of boat launching and vehicle parking facilities. The bay formed at this point would make an excellent mooring basin. The limiting factor governing the use of this area is parking space for vehicles. It is accessible by Fish Creek Road from state routes 178 and 97.

(2) The site surrounding the reservoir arm at Peakville on the south side of Beaver Kill offers the best access and terrain suitable for development. Although limited in size, there is space for picnicking and parking facilities. The protected cove would make an excellent boat basin. The site is accessible by Trout Brook Road.

(3) The site on the north shore of Beaver Kill extending from Twaddel Brook to the upper extremity of the pool area would be suitable for day-use development, including picnicking, swimming and boating. This site is accessible by route 17 Existing minor roads provide access to other parts of the reservoir area at the ends of which boat launching facilities could be installed.

(4) The Reed Creek, Baxter Brook, Trout Brook and Campbell Brook arms of the proposed reservoir are examples of locations where camground developments could be provided.

(5) Camping facilities would be very much in demand if good fishing were developed in this large reserve area even if some of the sites were removed some distance from the shore of the proposed impoundment. At Tar Hallow and Morrison Brook, campgrounds of the primitive type, accessible by boat, could be developed.

g. Cost estimates. The estimate of cost for the development of the recreation potential of the Hawk Mountain reservoir project area is given in table W-28. The table shows the facilities to be provided and the real estate to be acquired, and their respective costs.

TABLE W-26

HAWK MOUNTAIN RESERVOIR RECREATION AREA
HAWK MOUNTAIN DAM AND RESERVOIR
ESTIMATED COST OF FACILITIES AND REAL ESTATE

Facilities	Unit	Number Units	Cost
Boat Ramps	unit	5	$ 62,500
Boat Docks	unit	3	16,500
picnicking	unit	70	27,600
Picnic Shelters	unit	3	15,000
Swimming Beach	sq. ft.	62,700	15,700
Bath House	l.s.	-	15,000
Tent Camping	unit	25	31,300
Parking	unit	590	118,000
Roads	mile	2.5	162,500
Water Supply	unit	45	45,000
Sanitary	unit	10.6	80,300
Walks and Trails	mile	0.7	2,000
Signs and Markers	l.s.	-	900
Miscellaneous Landscaping	l.s.	-	5,100
Administration Area	l.s.	-	25,000
Subtotal			622,400
Contingencies 5%			31,100
Engineering and Design 10%			62,200
Supervision and Administration 10%			62,200
Total - Facilities			777,900
Real Estate			
Land	acre	2,000	142,000
Severance			28,400
Improvements			299,000
Resettlements			24,000
Contingencies			74,000
Total Cost - Land and Improvement			567,400
Acquisition			70,000
Sotal - Real Estate			637,400
TOTAL COST - FACILITIES AND REAL ESTATE			1,415,000

103. The French Creek Project. The recreation features of the French Creek project, located on French Creek in Chester County, Pennsylvania, are described in Appendix I. The water supply needs to be served by the French Creek project are those required after year 2010, while the recreation needs are seen to be immediate, suggesting the desirability of initiating a land acquisition program in the near future. The total project area, shown on the French Creek project map in Appendix U, would comprise 4,270 acres, of which 1,250 acres would be inundated by the long-term storage pool. Total lands desirable for recreation comprise 2,520 acres. These recreation lands have been appraised in a preliminary real estate study. Real estate indicated for the recreation development would cost about $3,938,000. This project upon completion would have a capacity for about 1,500,000 visitor-days of recreation annually. The lands included in this project are shown on the project map in Appendix U.

104. The Tohickon Project. The Tohickon multiple-purpose project is located on Tohickon Creek below the confluence with Haycock Creek in Upper Bucks County, Pennsylvania. It would be required for water supply needs some time after the year 2010, and to meet recreation needs after 1980. The total project area would consist of 7,475 acres. About 1,250 acres would be inundated by the permanent pool. Lands indicated as desirable for recreation at this project would include 6,100 acres. Preliminary field real estate appraisals indicate that the cost of acquisition would be about $6,900,000 at 1959 prices including all acquisition costs. The project would have a capacity of about 1,250,000 visitor-days of recreation use annually. The areal dimensions of this project are shown on the project map in Appendix U.

105. The Evansburg Project. The Evansburg multiple-purpose project, located on Skippack Creek in Montgomery County, Pennsylvania, is described in Appendix I. This reservoir would be needed to meet water supply needs some time after 2010, and recreation needs following 1980. The total project area would consist of 4,654 acres, of which 1,120 acres would be inundated by the permanent pool. Lands indicated as desirable for recreation at this project would include 3,364 acres. Preliminary field real estate appraisals indicate that the cost of acquiring this land at 1959 prices would be $6,720,000 including all acquisition costs. This project would have a capacity for 1,560,000 visitor-days of recreation annually. A map in Appendix U shows the areal dimensions of the Evansburg project.

106. The Hackettstown Project. The Hackettstown project, located on Musconetcong River in Warren and Morris Counties, New Jersey, is described in Appendix I. It would serve water supply needs indicated after 2010 and recreation presently needed, suggesting the desirability of initiating land acquisition for this project in the immediate future. A total of 10,362 acres, shown on the project map in Appendix U, would be included in the project area with 1,200 acres inundated by a long-term storage pool serving both recreation and water supply needs. Land in addition to the joint project lands would include 8,992 acres for recreation. Preliminary field real estate appraisals indicate that the cost for acquiring the land at 1959 prices would be $5,095,000 including all acquisition costs. This project would have a capacity for 2,500,000 annual recreation visitors.

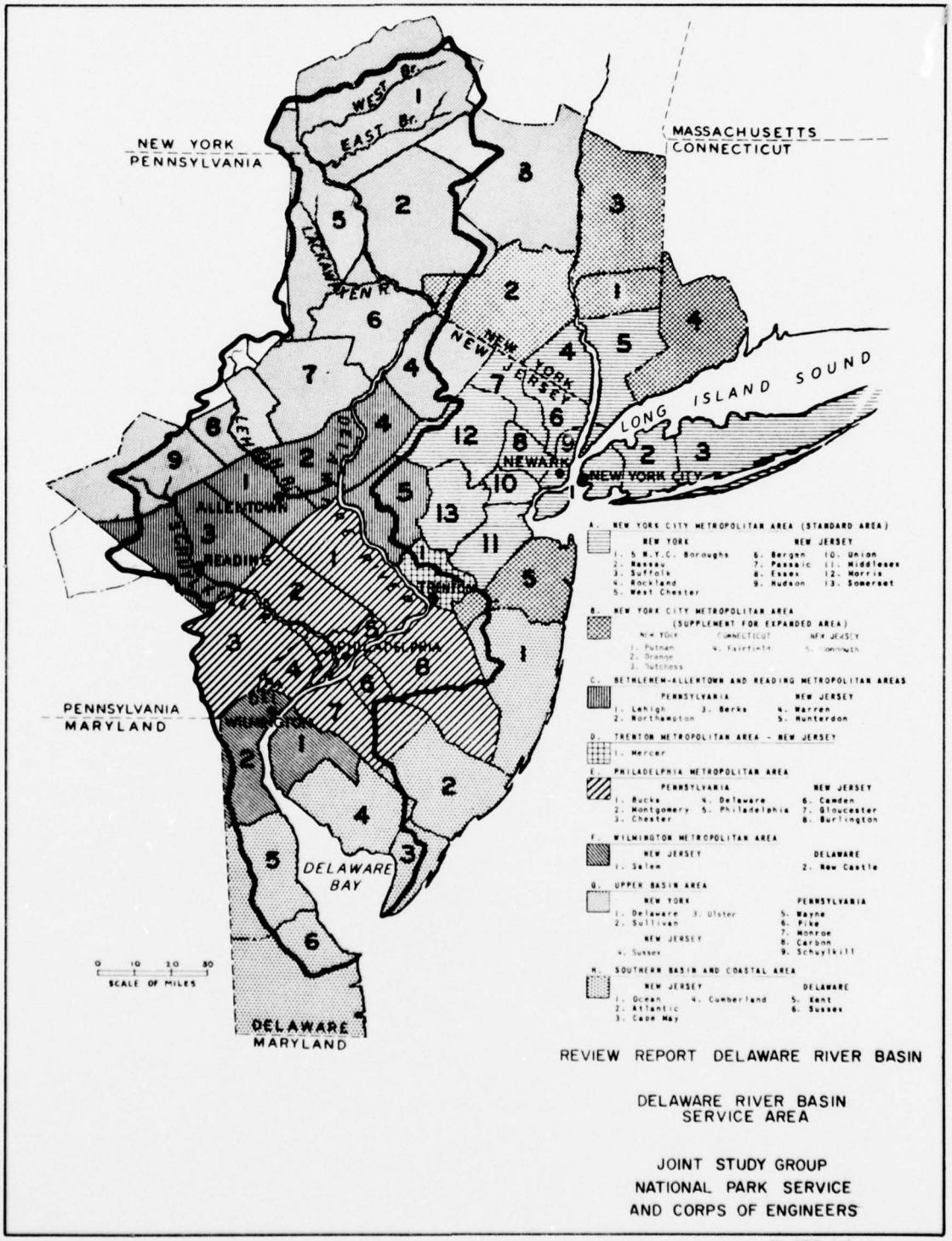
107. The Pequest Project. The Pequest multiple-purpose project, located on Pequest River in Warren County, New Jersey, is described in Appendix I. It would serve water supply needs indicated for some time after 2010, and recreation needs after 1980. The project would have a total area of 4,520 acres, of which about 1,260 acres would be inundated by the permanent pool. Studies indicate that land desirable for recreation at this project would include a total of 3,000 acres. Preliminary field real estate appraisals indicate that the cost of acquiring this land would be about $1,212,000 at 1959 prices including all acquisition costs. This project would provide capacity for 520,000 visitor-days annually. The areal magnitude of the project is shown in Appendix U.

108. The New Hampton Project. The New Hampton multiple-purpose project, located on Musconetcong River in Warren and Hunterdon Counties, New Jersey, is described in Appendix I. It would be needed to meet water supply needs indicated for some time following 2010, and recreation needs following 1980. The total area of the project would consist of 5,518 acres, of which 1,850 acres would comprise the area of impounded water. Studies of the project indicate that the acquisition of 3,448 acres of land for recreation would provide the best basis for development of facilities. Preliminary field real estate appraisals indicate that the cost of acquiring this land at 1959 prices would be $3,957,000 including all acquisition costs. This project would provide capacity for about 1,500,000 visitor-days of recreation use per year. A map showing the project is contained in Appendix U.

109. The Paulina Project. The Paulina multiple-purpose project, located on Paulins Kill in Warren and Sussex Counties, New Jersey, is described in Appendix I. It would meet water supply needs indicated for some time after 2010, and recreation needs after 1980. The project would have a total area of 5,717 acres, of which 1,650 acres would consist of an impoundment. Lands desirable for recreation use at this project would amount to 3,777 acres. Preliminary field real estate appraisals indicate that the cost of acquisition for this land

would be $3,540,000 at 1959 prices including all acquisition costs. This project would provide capacity for about 1,000,000 visitor-days of recreation use annually. This project is shown on the project map in Appendix U.

110. The Newtown Project. The Newtown multiple-purpose project is located in Bucks County, Pennsylvania, on Neshaminy Creek 19 miles upstream from its confluence with the Delaware River. The recreation aspects are described in Appendix I. The project would provide supplies of water for various uses after 2010 with recreation use during the interim period. Land acquisition is the principal immediate activity indicated, in order to preserve the site for its ultimate multiple-purpose development. The real estate requirements determined for optimum development would consist of 2,400 acres of jointly used lands including a pool of 2,120 acres plus 4,800 acres for additional recreation facilities. The cost for the recreation lands, at $12,130,000, and with facilities of the standard presented in this report would amount to an annual economic charge of $0.82 per visitor-day, apart from any share in the cost of jointly used facilities the recreation purpose might bear. The value of the site as a storage site, warrants its serious consideration for providing all purposes served by water impoundments in this area. At the optimum physical level of development the project has a capacity to serve 1,875,000 visitors a year.



REVIEW REPORT DELAWARE RIVER BASIN

DELAWARE RIVER BASIN
SERVICE AREA

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 1

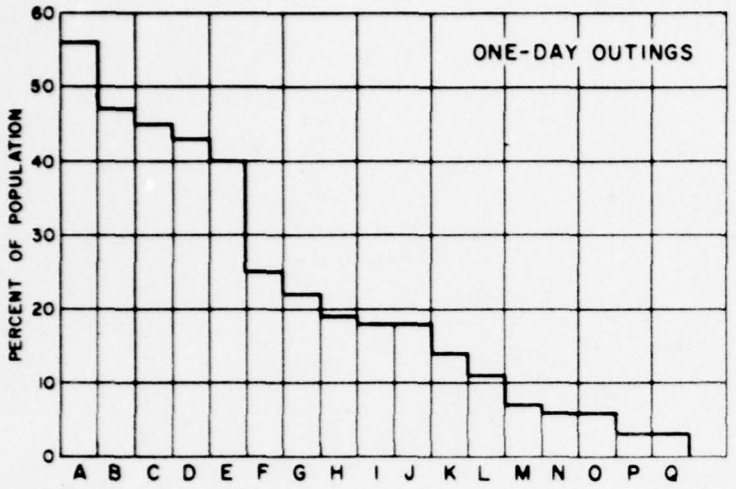


Fig. 1

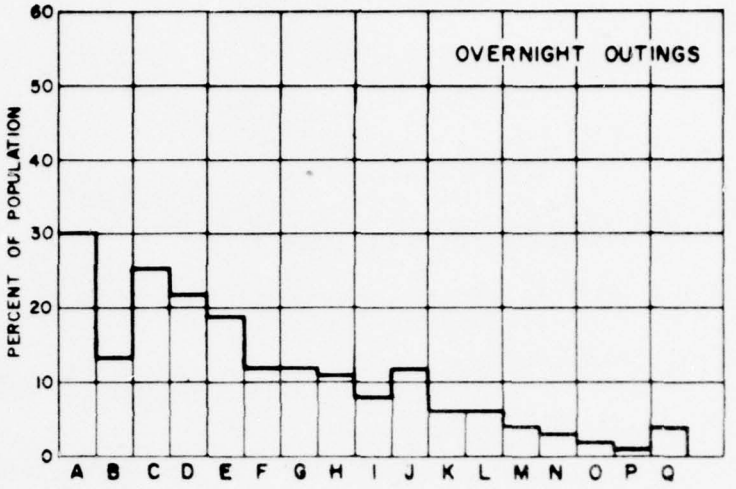


Fig. 2

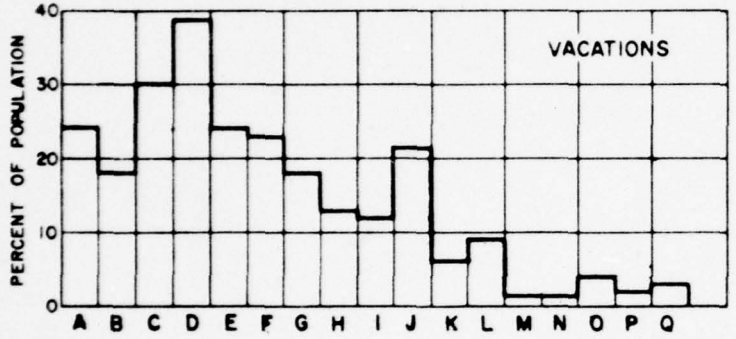


Fig. 3

OUTDOOR RECREATION ACTIVITIVES PARTICIPATED IN

A - - VISITED FRIENDS AND RELATIVES
B - - PICNICKING
C - - TO THE BEACH
D - - SWIMMING
E - - SIGHTSEEING IN THE COUNTRY
F - - FISHING
G - - SIGHTSEEING IN THE CITY
H - - VISITED HISTORIC PLACE
I - - OUTDOOR SPORTS & GAMES
J - - BOATING
K - - TO MUSEUM
L - - HIKING
M - - HUNTING
N - - WINTER SPORTS
O - - NATURE STUDY
P - - HORSEBACK RIDING
Q - - MISCELLANEOUS

REVIEW REPORT DELAWARE RIVER BASIN

OUTDOOR RECREATION ACTIVITIVES

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 2

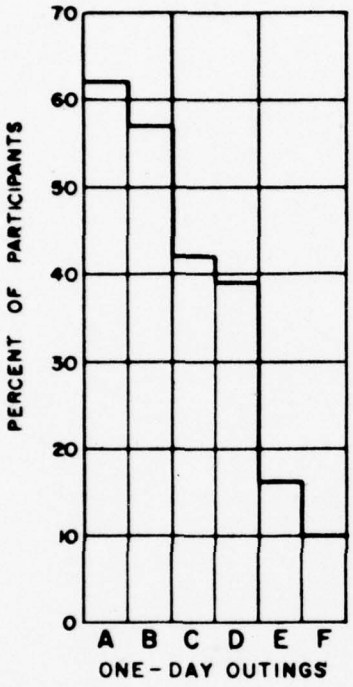


Fig. 1

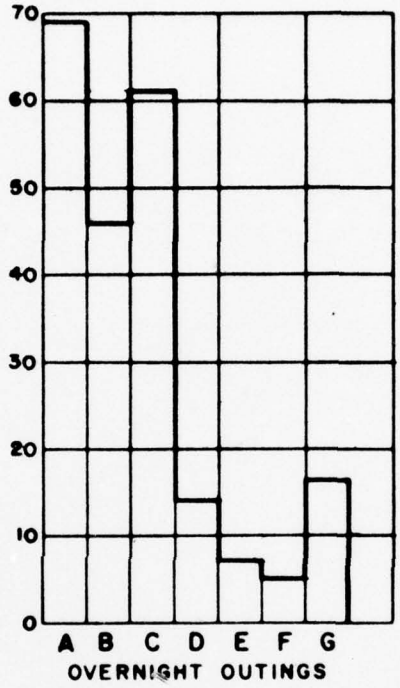


Fig. 2

A - - TIME AVAILABLE
B - - HEAVY TRAFFIC
C - - COST INVOLVED
D - - CROWDED AREAS
E - - LACK OF RECREATIONAL AREAS
F - - UNCLEAN AREAS AND FACILITIES
G - - LACK OF SATISFACTORY OVER-NIGHT ACCOMODATIONS

REVIEW REPORT DELAWARE RIVER BASIN

FACTORS LIMITING
OUTDOOR RECREATION

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 3

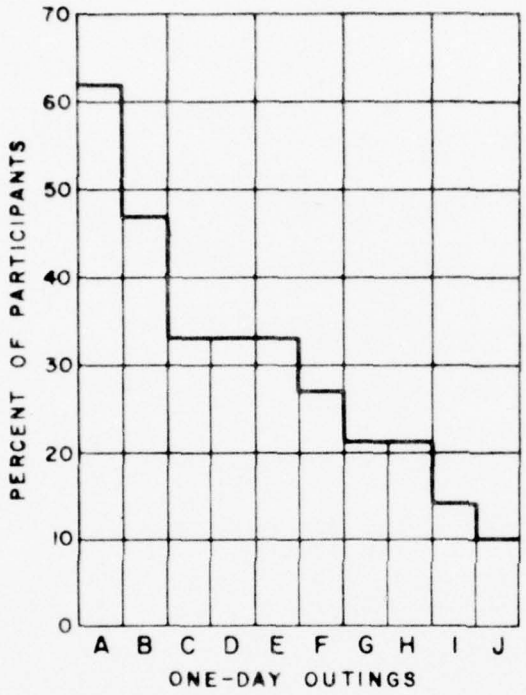


Fig. 1

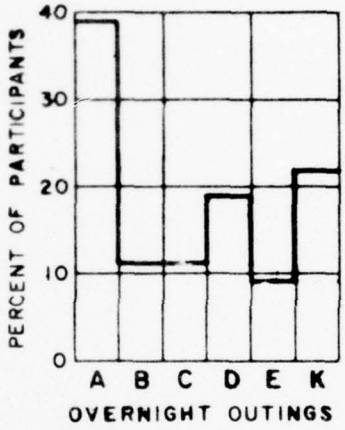


Fig. 2

A__OCEAN BEACH
B__PICNIC AREA
C__STATE PARK OR FOREST
D__LAKE
E__HISTORIC PLACE
F__AMUSEMENT PARK
G__SCENIC PLACE
H__CITY PARK
I__COUNTY PARK
J__ROADSIDE PARK
K__MOUNTAINS

REVIEW REPORT DELAWARE RIVER BASIN

TYPES OF OUTDOOR
RECREATION AREAS VISITED

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 4

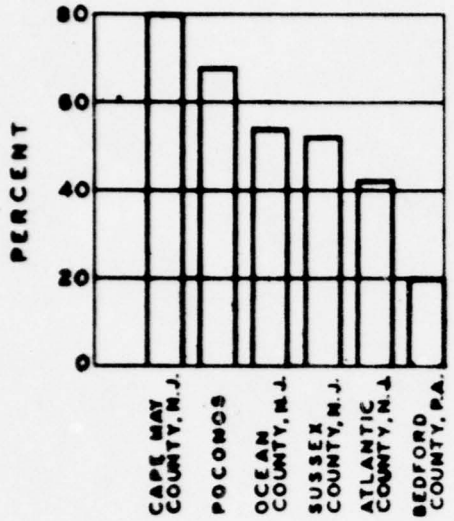


Fig. 1 PERCENT OF RETAIL AND SERVICE ESTABLISHMENTS NOT OPEN ALL YEAR - 1956 1/

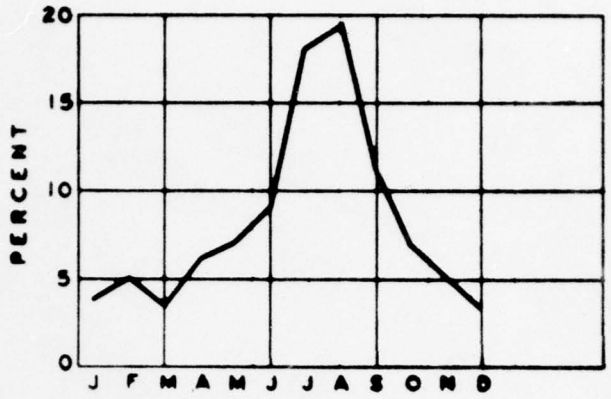


Fig. 2 MONTHLY COLLECTION OF LUXURY TAX, ATLANTIC CITY, NEW JERSEY - 1956 1/

1/ BUSINESS REVIEW -- FEDERAL RESERVE BANK OF PHILADELPHIA, MAY 1958

REVIEW REPORT DELAWARE RIVER BASIN

SEASONAL DISTRUBITION OF RECREATION ACTIVITY - - DELAWARE R. SERVICE AREA

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO 5

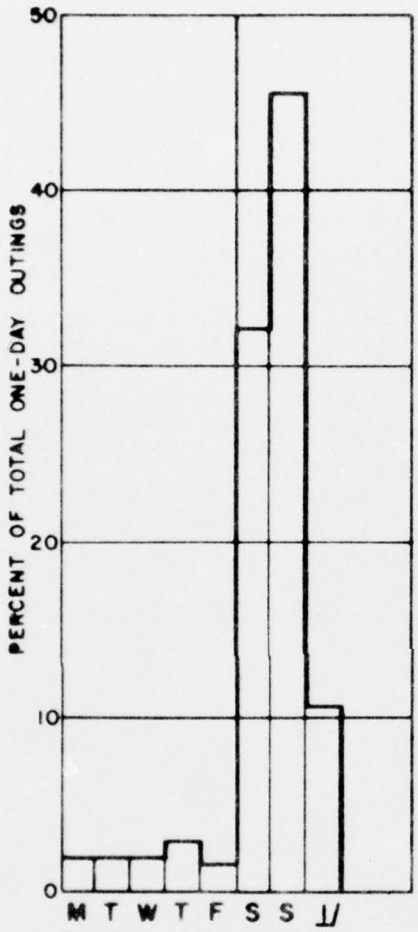


Fig. 1

DISTRIBUTION OF DAY OUTINGS THROUGH THE WEEK

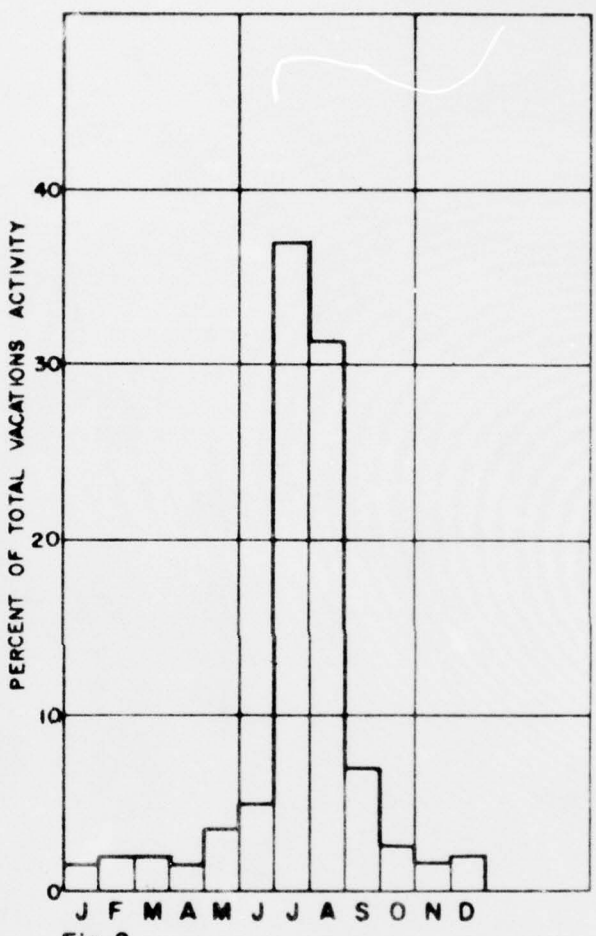


Fig. 2

DISTRIBUTION OF VACATION ACTIVITY THROUGH THE CALANDER YEAR

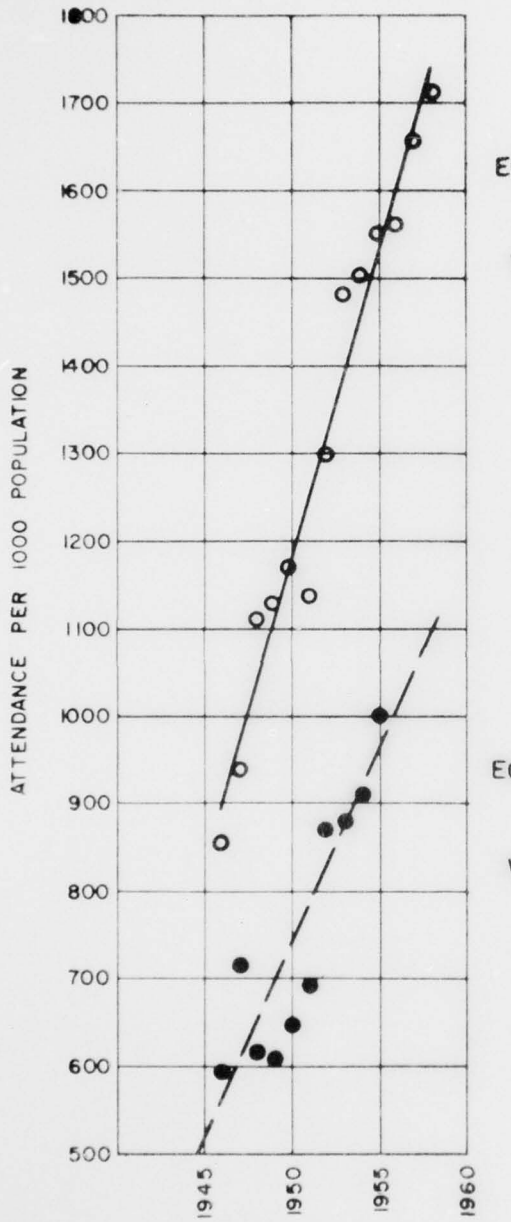
1/ NO SPECIAL DAY

REVIEW REPORT DELAWARE RIVER BASIN

DAILY & MONTHLY DISTRIBUTION OF RECREATION ACTIVITY DEL. R. SERVICE AREA

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 6



EQUATION:
$Y = 825 + 70.6\,X$
WITH ORIGIN AT 1945
WHERE Y = ATTENDANCE PER 1000 POPULATION
X = YEARS

EQUATION:
$Y = 522 + 43\,X$
WITH ORIGIN AT 1945
WHERE Y = ATTENDANCE PER 1000 POPULATION
X = YEARS

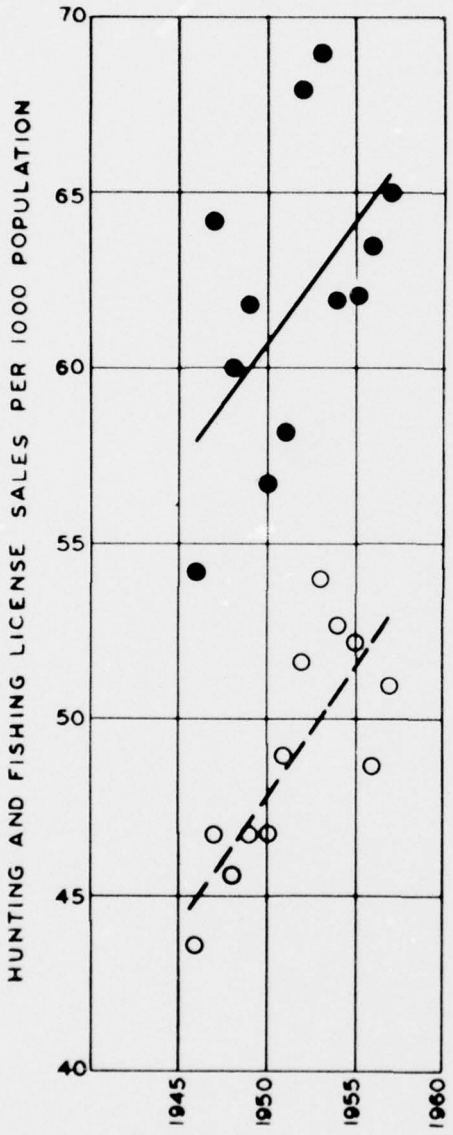
○ DELAWARE RIVER BASIN STATES
● REMAINDER OF UNITED STATES

REVIEW REPORT DELAWARE RIVER BASIN

TREND IN STATE PARK ATTENDANCE PER 1000 POPULATION

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 7



EQUATION:
$Y = 58.2 + .61X$
WITH ORIGIN AT 1945
WHERE Y = LICENSE SALES PER 1000 POPULATION
X = YEARS

EQUATION:
$Y = 44.5 + .71X$
WITH ORIGIN AT 1945
WHERE Y = LICENSE SALES PER 1000 POPULATION
X = YEARS

● HUNTING LICENSE SALES PER 1000 POPULATION

○ FISHING LICENSE SALES PER 1000 POPULATION

REVIEW REPORT DELAWARE RIVER BASIN

COMPARISON--TRENDS OF HUNTING AND FISHING LICENSE SALES PER 1000 POPULATION DELAWARE RIVER BASIN STATES

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 8

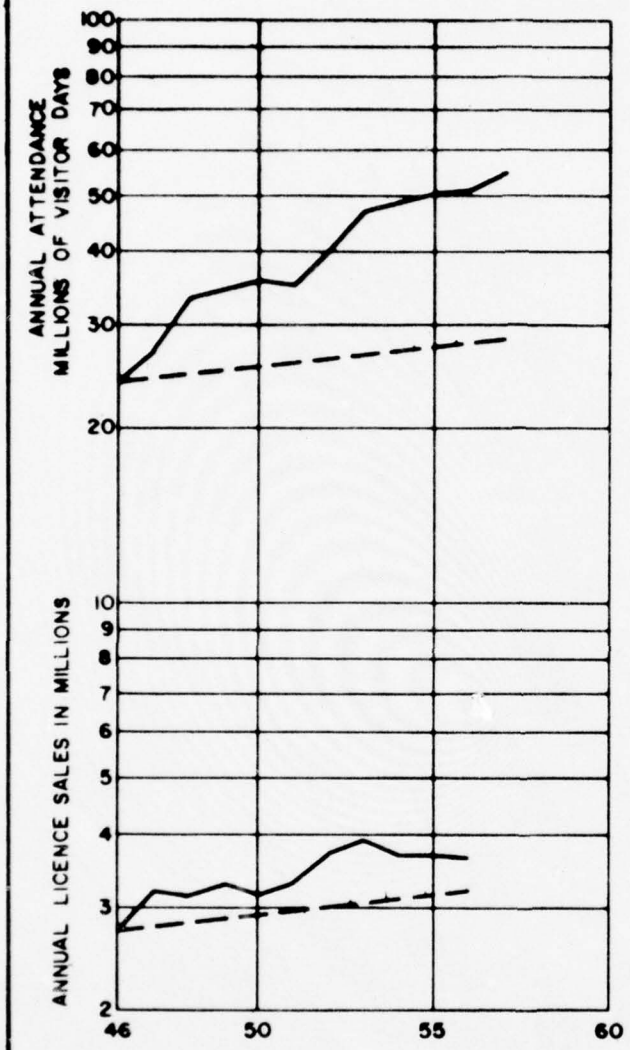


Fig. 1
STATE PARK ATTENDANCE

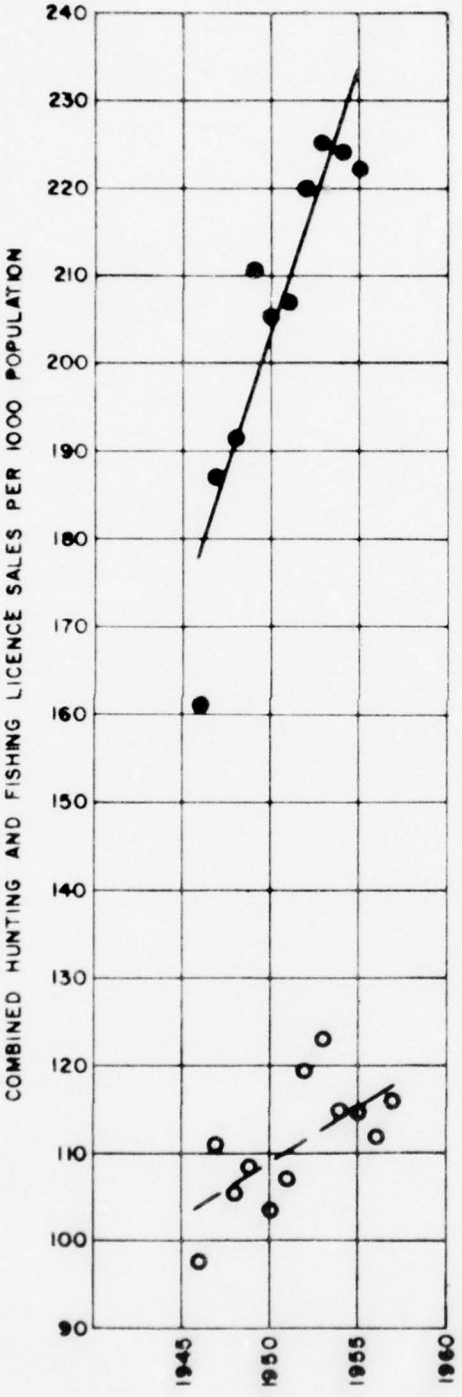
Fig. 2
FISHING AND HUNTING LICENSE SALES

REVIEW REPORT DELAWARE RIVER BASIN

EFFECTS OF POPULATION INCREASE ON RECREATION ACTIVITY DEL. R. BASIN STATES

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 9



EQUATION:

$Y = 172.1 + 6.1X$

WITH ORIGIN AT 1945

WHERE Y = LICENSE SALES PER 1000 POPULATION

X = YEARS

EQUATION:

$Y = 102.7 + 1.3X$

WITH ORIGIN AT 1945

WHERE Y = LICENSE SALES PER 1000 POPULATION

X = YEARS

○ DELAWARE RIVER BASIN STATES

● REMAINDER OF UNITED STATES

REVIEW REPORT DELAWARE RIVER BASIN

COMBINED HUNTING & FISHING LICENSE SALES PER 1000 POPULATION

JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 10

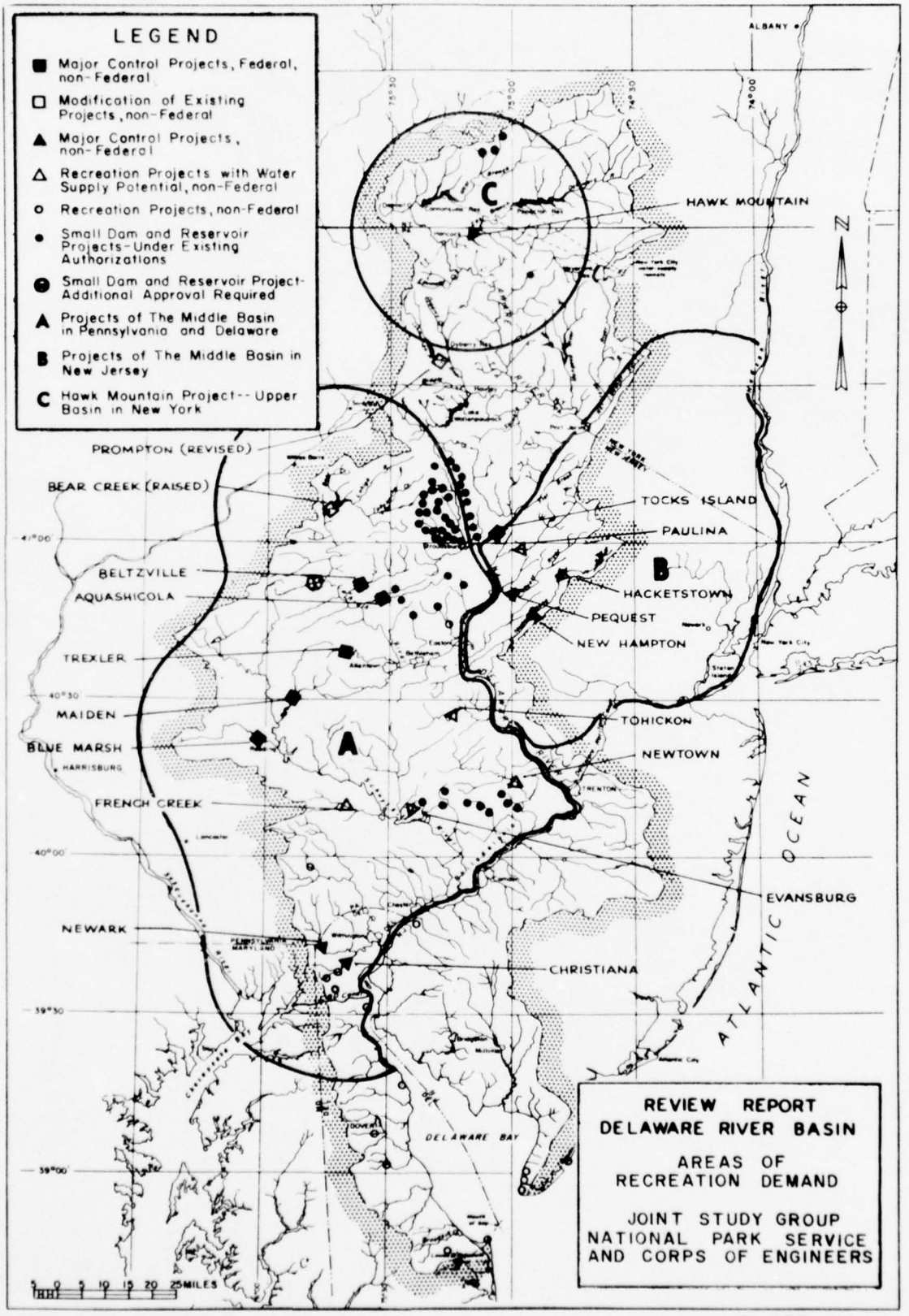

LEGEND
Major Control Projects, Federal, non-Federal
Modification of Existing Projects, non-Federal
Major Control Projects, non-Federal
Recreation Projects with Water Supply Potential, non-Federal
Recreation Projects, non-Federal
Small Dam and Reservoir Projects-Under Existing Authorizations
Small Dam and Reservoir Project-Additional Approval Required
A Projects of The Middle Basin in Pennsylvania and Delaware
B Projects of The Middle Basin in New Jersey
C Hawk Mountain Project--Upper Basin in New York
ALBANY
HAWK MOUNTAIN
PROMPTON (REVISED)
BEAR CREEK (RAISED)
BELTZVILLE
AQUASHICOLA
TREXLER
MAIDEN
BLUE MARSH
HARRISBURG
FRENCH CREEK
NEWARK
TOCKS ISLAND
PAULINA
HACKETTSTOWN
PEQUEST
NEW HAMPTON
TOHICKON
NEWTOWN
TRENTON
EVANSBURG
CHRISTIANA
DELAWARE BAY
DOVER
ATLANTIC OCEAN
41°00'
40°30'
40°00'
39°30'
39°00'
75°30'
75°00'
74°30'
74°00'
N
A
B
C
0 5 10 15 20 25 MILES
REVIEW REPORT
DELAWARE RIVER BASIN
AREAS OF
RECREATION DEMAND
JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO. 11

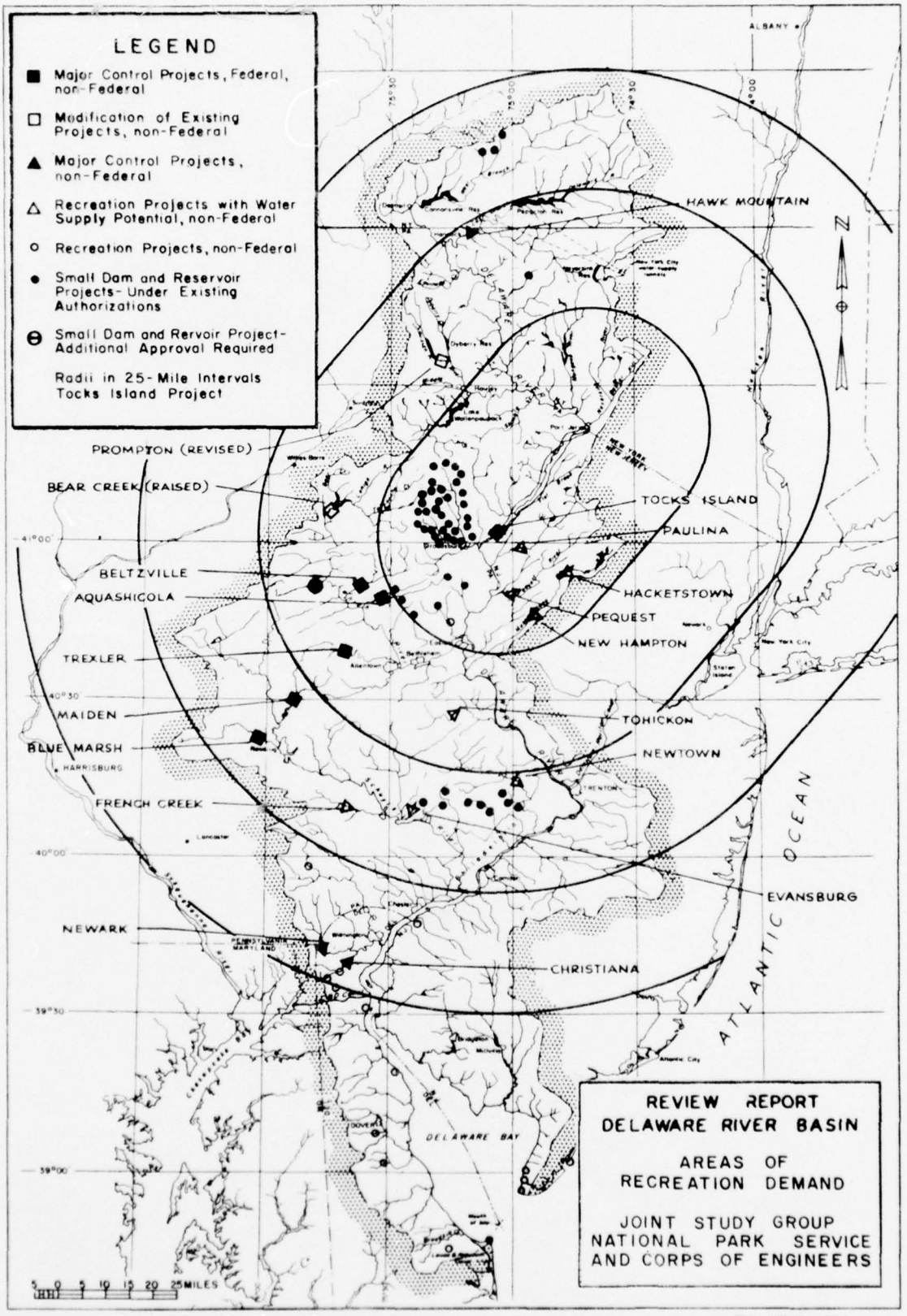

LEGEND
Major Control Projects, Federal, non-Federal
Modification of Existing Projects, non-Federal
Major Control Projects, non-Federal
Recreation Projects with Water Supply Potential, non-Federal
Recreation Projects, non-Federal
Small Dam and Reservoir Projects- Under Existing Authorizations
Small Dam and Rervoir Project- Additional Approval Required
Radii in 25-Mile Intervals
Tocks Island Project
ALBANY
HAWK MOUNTAIN
N
PROMPTON (REVISED)
BEAR CREEK (RAISED)
TOCKS ISLAND
PAULINA
41°00'
BELTZVILLE
AQUASHICOLA
HACKETTSTOWN
PEQUEST
NEW HAMPTON
TREXLER
40°30'
MAIDEN
TOHICKON
BLUE MARSH
NEWTOWN
HARRISBURG
FRENCH CREEK
TRENTON
40°00'
EVANSBURG
ATLANTIC OCEAN
NEWARK
CHRISTIANA
39°30'
DELAWARE BAY
39°00'
5 0 5 10 15 20 25 MILES
REVIEW REPORT
DELAWARE RIVER BASIN
AREAS OF
RECREATION DEMAND
JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO.12

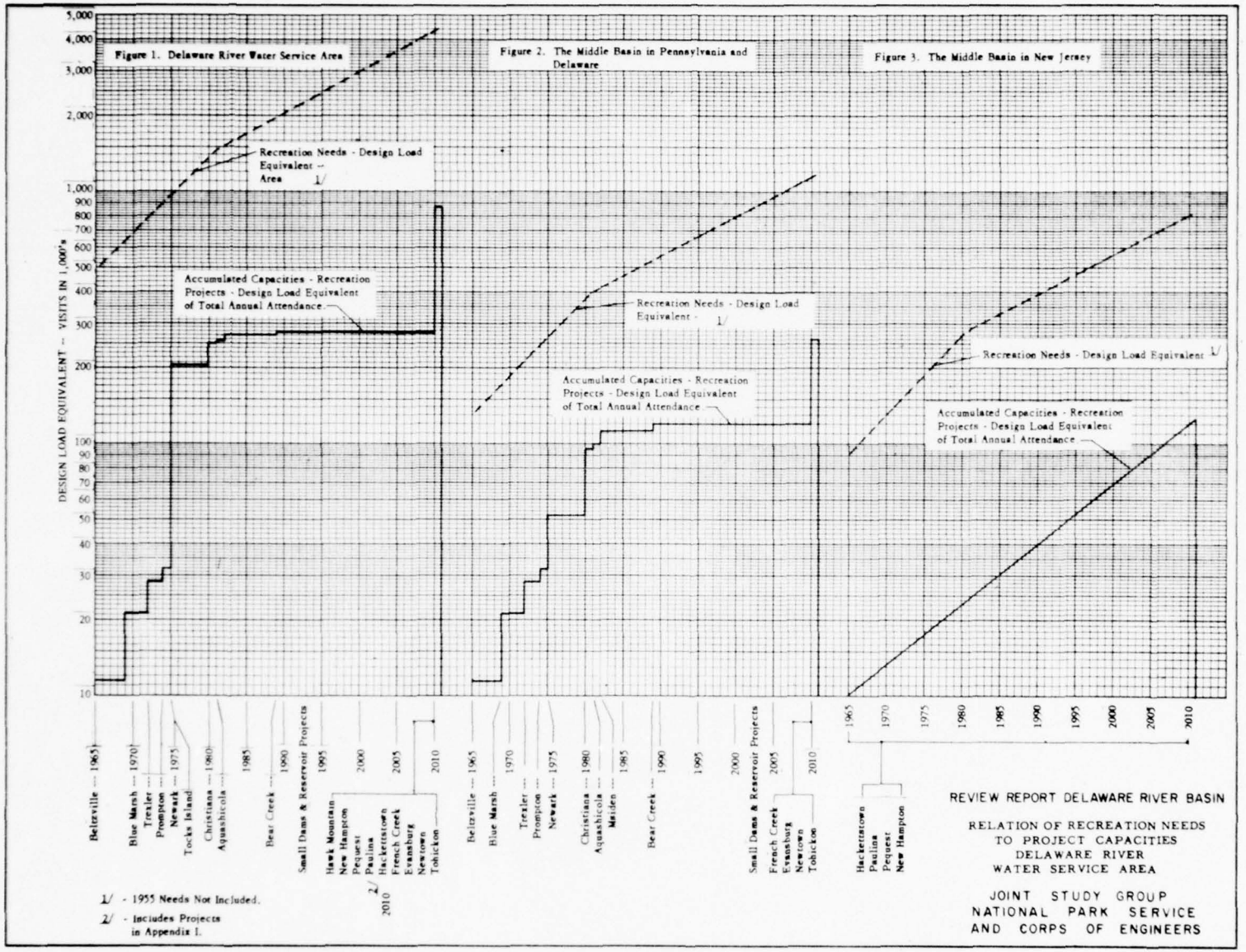
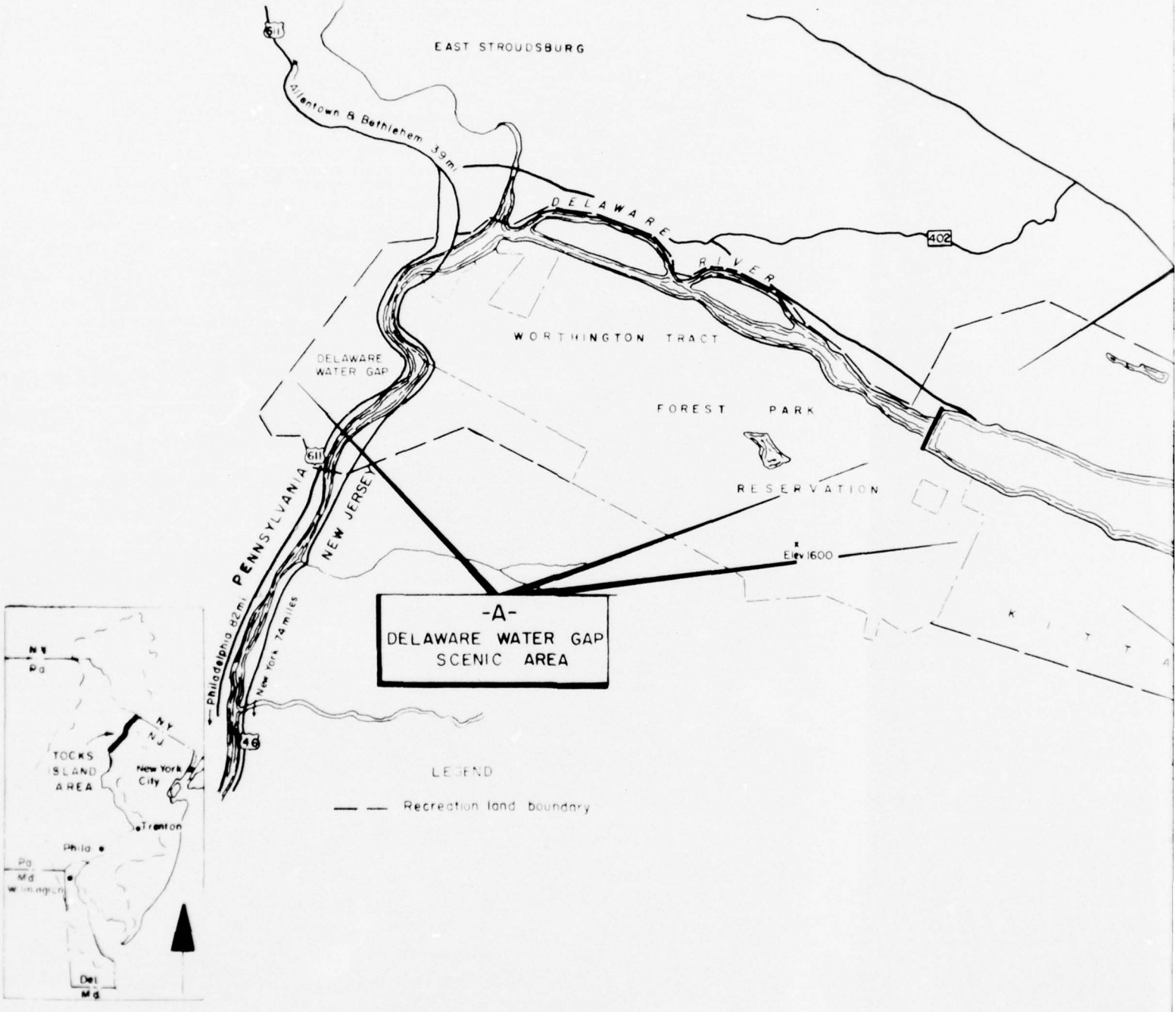
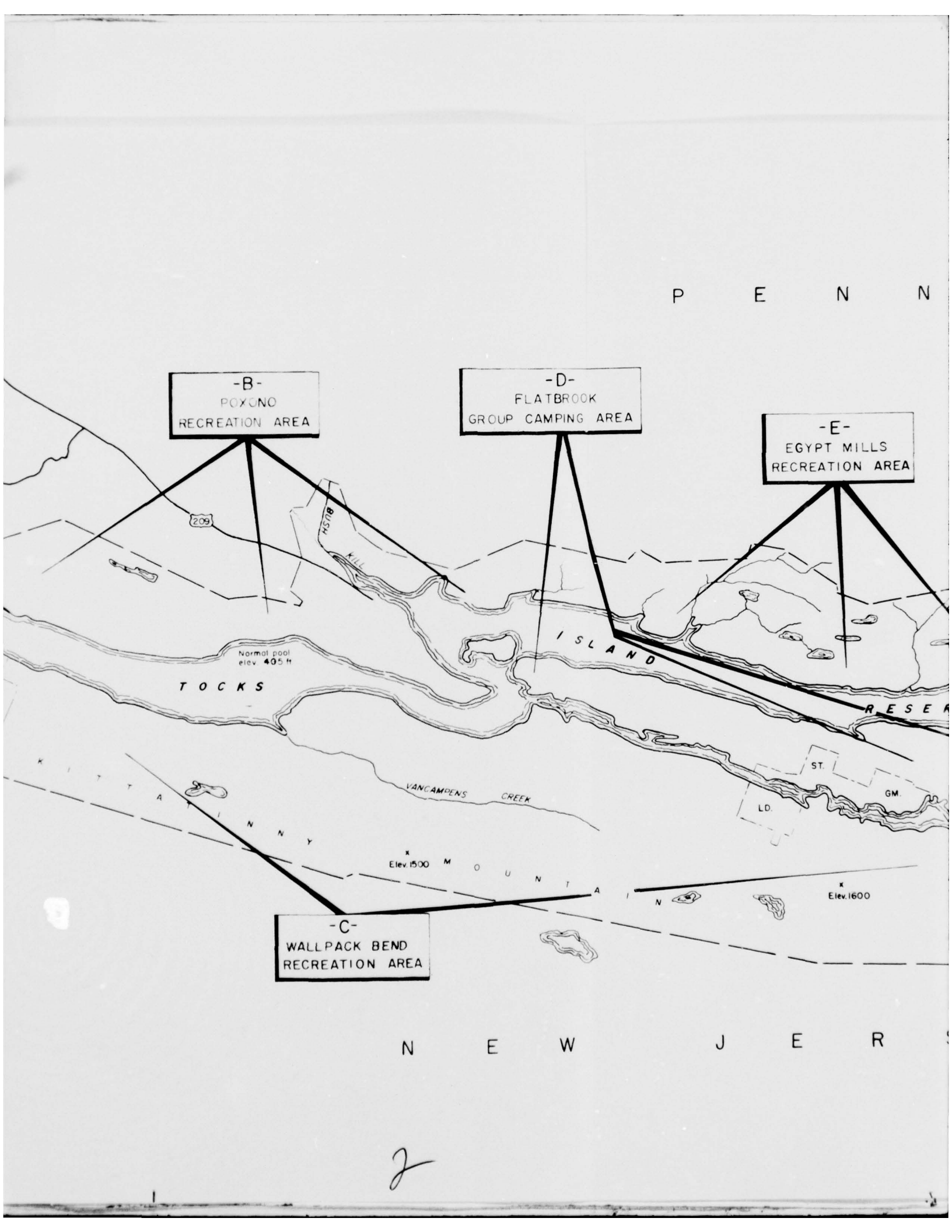
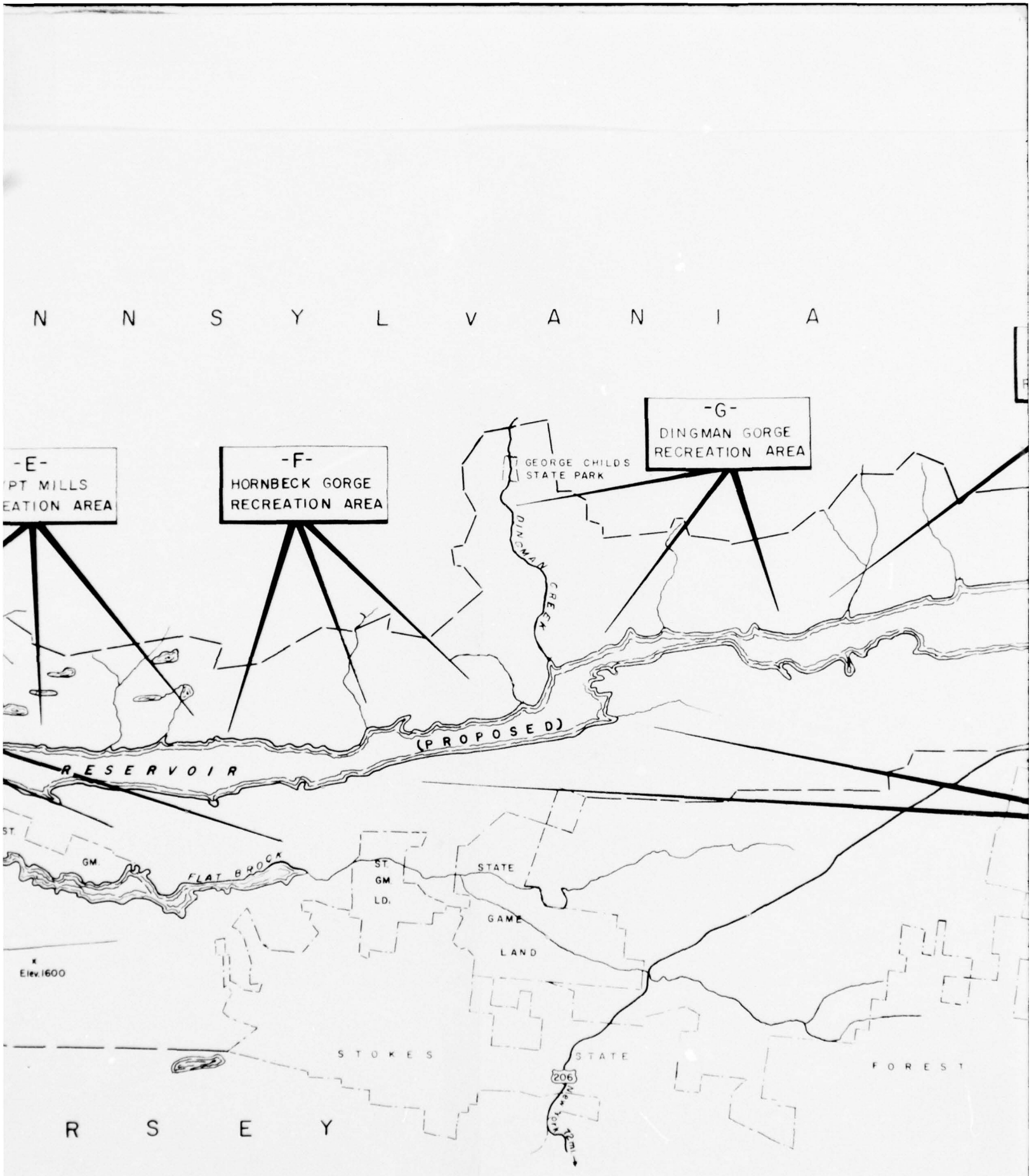


Figure 1. Delaware River Water Service Area
Figure 2. The Middle Basin in Pennsylvania and Delaware
Figure 3. The Middle Basin in New Jersey
DESIGN LOAD EQUIVALENT -- VISITS IN 1,000's
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
Recreation Needs - Design Load Equivalent -- Area 1/
Accumulated Capacities - Recreation Projects - Design Load Equivalent of Total Annual Attendance
Recreation Needs - Design Load Equivalent - 1/
Accumulated Capacities - Recreation Projects - Design Load Equivalent of Total Annual Attendance
Recreation Needs - Design Load Equivalent 1/
Accumulated Capacities - Recreation Projects - Design Load Equivalent of Total Annual Attendance
Belleville — 1965
Blue Marsh — 1970
Trexler —
Prompton —
Newark — 1975
Tocks Island
Christiana — 1980
Aquashicola —
1985
Bear Creek —
1990
Small Dams & Reservoir Projects
1995
Hawk Mountain
New Hampton
Pequest
2000
Paulina
Hackettstown
2005
French Creek
Evansburg
Newtown
2010
Tohickon
Belleville — 1965
Blue Marsh —
1970
Trexler —
Prompton —
Newark — 1975
Christiana — 1980
Aquashicola —
Maiden —
1985
Bear Creek —
1990
1995
2000
Small Dams & Reservoir Projects
French Creek
2005
Evansburg
Newtown
2010
Tohickon
Hackettstown
Paulina
Pequest
New Hampton
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
1/ - 1955 Needs Not Included.
2/ - Includes Projects in Appendix I.
REVIEW REPORT DELAWARE RIVER BASIN
RELATION OF RECREATION NEEDS TO PROJECT CAPACITIES DELAWARE RIVER WATER SERVICE AREA
JOINT STUDY GROUP
NATIONAL PARK SERVICE
AND CORPS OF ENGINEERS

PLATE NO 13


EAST STROUDSBURG
Allentown & Bethlehem 39 mi.
DELAWARE RIVER
402
WORTHINGTON TRACT
DELAWARE WATER GAP
FOREST PARK
RESERVATION
611
PENNSYLVANIA
NEW JERSEY
Elev 1600
-A-
DELAWARE WATER GAP SCENIC AREA
Philadelphia 82 mi.
New York 74 miles
46
LEGEND
Recreation land boundary
NY
Pa
NY
NJ
TOCKS ISLAND AREA
New York City
Trenton
Philo
Pa
Md
Del
Md


P E N N
-B-
POXONO
RECREATION AREA
-D-
FLATBROOK
GROUP CAMPING AREA
-E-
EGYPT MILLS
RECREATION AREA
209
BUSH
KILL
Normal pool
elev. 405 ft
TOCKS
ISLAND
RESER
ST.
GM.
LD.
VANCAMPENS CREEK
K I T T A T I N N Y
Elev. 1500
M O U N T A I N
Elev. 1600
-C-
WALLPACK BEND
RECREATION AREA
N E W J E R


N N S Y L V A N I A
-E-
PT MILLS
EATION AREA
-F-
HORNBECK GORGE
RECREATION AREA
GEORGE CHILDS
STATE PARK
-G-
DINGMAN GORGE
RECREATION AREA
DINGMAN CREEK
(PROPOSED)
RESERVOIR
ST.
GM
FLAT BROCK
ST.
GM
LD.
STATE
GAME
LAND
Elev. 1600
STOKES
STATE
FOREST
206
R S E Y

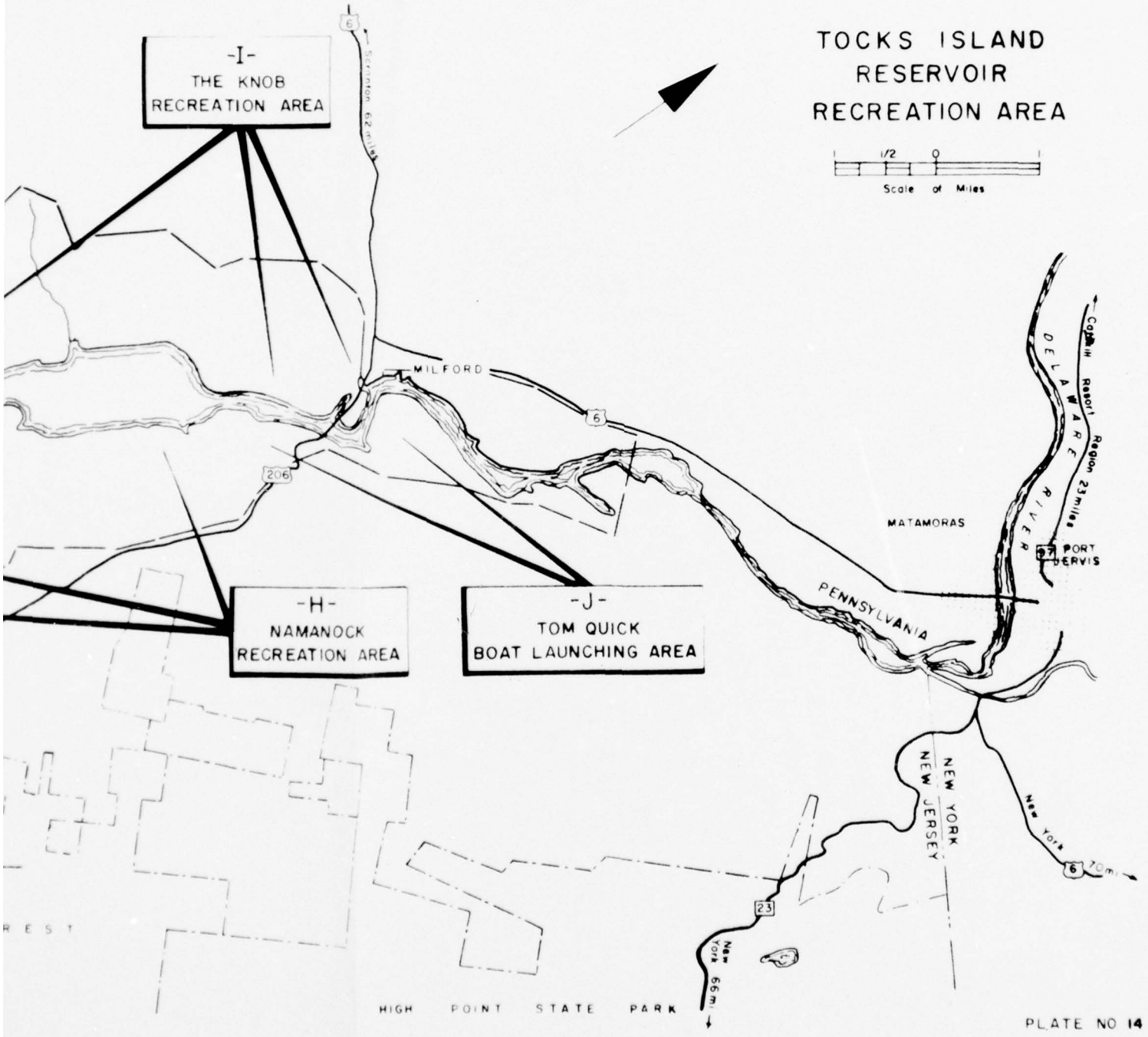

TOCKS ISLAND
RESERVOIR
RECREATION AREA
1/2
0
Scale of Miles
-I-
THE KNOB
RECREATION AREA
-H-
NAMANOCK
RECREATION AREA
-J-
TOM QUICK
BOAT LAUNCHING AREA
MILFORD
MATAMORAS
PORT JERVIS
PENNSYLVANIA
NEW YORK
NEW JERSEY
DELAWARE RIVER
HIGH POINT STATE PARK
6
206
23

PLATE NO 14

REPORT OF THE
COMPREHENSIVE SURVEY
OF THE
WATER RESOURCES
OF THE
DELAWARE RIVER BASIN

APPENDIX X

STUDY OF THE GOVERNMENTAL ORGANIZATION
FOR THE WATER RESOURCES
OF THE DELAWARE RIVER BASIN

BASED ON REPORT PREPARED BY
SYRACUSE UNIVERSITY RESEARCH GROUP
AS SUBMITTED TO
WATER RESEARCH FOUNDATION FOR THE DELAWARE RIVER BASIN
UNDER DATE OF 1 AUGUST 1959

U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA
CORPS OF ENGINEERS
PHILADELPHIA, PA.
OCTOBER 1959

DELAWARE RIVER BASIN ADVISORY COMMITTEE

930 • SUBURBAN STATION BUILDING

PHILADELPHIA 3, PENNA.

RITTENHOUSE 6-8286-7

December 29, 1959.

Colonel Truman H. Setliffe
District Engineer
Corps of Engineers
P. O. Box 8629
Philadelphia 1, Pa.

Dear Colonel Setliffe:

In accordance with the decision reached at the October 9, 1959 meeting of the Coordinating Committee, and earlier agreements with your office, I am transmitting a copy of "A Brief Report On the Study of Governmental Organization for the Water Resources of the Delaware River Basin", for publication as Appendix X of your survey report on the Delaware.

This "Brief Report" was prepared by the Water Research Foundation for the Delaware River Basin. It reviews most of the findings and recommendations of the study of water resources administration carried out over the past two years by the Maxwell Graduate School of Syracuse University. The Syracuse study, as you know, was sponsored by the Water Research Foundation and financed by a grant from The Ford Foundation.

The complete report of the Syracuse study, entitled "The Problems of Water Resources Administration, With Special Reference to the Delaware River Basin", has been made available to your office in mimeograph. It will be published in book form in the spring of 1960 by the Syracuse University Press.

On September 30, 1959 the recommendations of the Syracuse study were presented to the Governors of Delaware, New Jersey, New York and Pennsylvania, and the Mayors of New York City and Philadelphia. It was agreed by these chief executives that there is a need for a unified water resources agency to be charged with important responsibilities in regard to the management and development of certain of the waters of the Delaware River Basin. The Governors and Mayors subsequently directed the Delaware River Basin Advisory Committee to prepare draft legislation for the creation of such a basin agency by interstate-federal compact. This work is now going forward and it is expected that proposed compact legislation will be ready for public consideration in the course of the year 1960.

Sincerely,

John P. Robin, Chairman
Delaware River Basin Advisory Committee.

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Foreword

The staff of the Water Research Foundation has prepared for public distribution this brief report of the study of governmental administration for the water resources of the Delaware River Basin, made at the Maxwell Graduate School of Public Administration of Syracuse University under the direction of Dr. Roscoe C. Martin. Working with him were Professors Guthrie S. Birkhead, Jesse V. Burkhead and Frank J. Munger.

The complete study, of approximately 500 pages, will be published under the direction of the Syracuse University group, which has sole responsibility for its research, findings and recommendations under a contract with the Water Research Foundation, made possible by a $131,000 grant from the Ford Foundation.

Introduction

The Delaware River is only 326 miles from its headwaters in the Catskill Mountains to the Atlantic Ocean, virtually nothing compared with the lengths of the Mississippi or the Colorado Rivers. But the Delaware River Basin service area contains 22,000,000 people from Kent County, Delaware, to Suffolk County, on Long Island, and Fairfield County, Connecticut. The U. S. Census Bureau estimates that this population will grow to 30,000,000 by 1980.

In order to plan intelligently, data on water resources and water uses must be gathered continuously. Water planning, like city planning, is a day-to-day job. Structures to conserve and use the water must be designed, built, operated and maintained. The public must be kept informed. The "water job" does not do itself. It must be kept after so that floods like that in 1955 following Hurricane Diane will not again kill a hundred persons and do millions of dollars of damage in the Delaware Basin. Equally serious are droughts, of which there were recent examples in the summers of 1949 and 1957.

Concern with the problem of governmental organization for the administration of Delaware Basin water is not new. Two efforts were made during the 1920's to negotiate a tri-state compact creating a commission with broad powers. The Corps of Engineers, in a 1934 survey report on the Delaware, noted the economies that could result from unified control in the planning, design, and construction of water resource projects, and indicated that an interstate agency established for these purposes would be advisable. The water supply plan including a governmental organization proposed by the Interstate Commission on the Delaware River Basin (Incodel), came closest to an over-all plan for the Basin, but fell through in 1953 because one of the four states in the Basin did not join in the agreement. It is proper to assume, however, that Incodel's work has been a forerunner of any over-all Delaware River Basin development.

In the absence of an accepted, comprehensive plan, the water resources of the Basin continued the subject of serious

interstate conflict which in 1931 had led to a Supreme Court decision granting 440 million gallons a day to New York City. In 1954, the Supreme Court decreed that New York City would be permitted to withdraw up to 800 million gallons daily and New Jersey permitted to take 100 million gallons daily out of the Delaware River Basin. The Court appointed a River Master to supervise these diversions and other requirements under its continuing jurisdiction.

In 1955 the Governors of New York, Pennsylvania, New Jersey and Delaware and the Mayors of New York City and Philadelphia established the Delaware River Basin Advisory Committee to review the water resources problems of the Basin and adjacent areas. The committee is comprised of one appointee of each of these four Governors and two Mayors.

Shortly after this action Hurricane Diane roared in, spreading damage through much of the Delaware Basin. The loss of life and property persuaded Congress to request a restudy of the Delaware Basin by the U. S. Army Corps of Engineers. An extensive three-year $2,000,000 physical survey was undertaken by the Corps with the aid of numerous other Federal and State agencies.

The concern of the Corps of Engineers and the Federal and State agencies associated with it is to evolve a physical plan of water development. It is not their function to investigate what governmental organization for water resources administration may be necessary to carry out the planned development and plan ahead as needs change. Yet this problem is a paramount one. There is a total of 25 Federal agencies that have a major concern with water resources. In the Delaware Basin survey, 19 different Federal agencies have been involved. Proposals for the reorganization of the Federal agencies involved in water have come from two Hoover Commissions and at least four other studies. Yet virtually nothing has been done to bring order out of the chaos at the Federal level. In addition there are at present 14 interstate agencies and 43 State departments, boards and commissions having some concern with water resources of the Delaware. On the local level there are more than 250 public and private water companies. At the present time government deals with Delaware Basin water prob-

lems through a multiplicity of agencies with a splintering of responsibilities.

Faced with this situation, the Delaware River Basin Advisory Committee helped a number of citizens to establish the Water Research Foundation of the Delaware River Basin, a non-profit private corporation independent of government. As part of its program, it instituted a study of governmental organization needed for water resources planning, development, and operation in the Basin. Financed by a $131,000 grant from the Ford Foundation, the study was made by a research group from the Maxwell Graduate School under a contract entered into by the Water Research Foundation and the Syracuse University Research Institute.

This is the origin and background of the Syracuse study. What follows is a brief report on the basic recommendations of that study and the reasoning behind them.

Functions of Water Resources Administration

Developing and controlling the water resources of the Delaware Basin involves many different but related activities. The sum total of these activities makes up the job of water resources administration. The Syracuse recommendations concerning the structure of an administrative organization for the Delaware are closely tailored to the pattern of functions that will have to be performed. This pattern is outlined below. How the proposed new basin agency is to discharge these functions and the powers it must have to do so are explained in the last section of this report.

1. Data Collection—A solid foundation of facts about all aspects of water and its use by man is essential. Data must be gathered, correlated, and interpreted continuously. Where gaps exist, research must be undertaken.

2. Planning—Comprehensive plans covering all phases of water development and control must be prepared and kept current. The plan for surface water control of the Delaware, soon to be completed by the Federal Government, will be a point of departure. It must be supplemented, and kept up to date, and open to continuous revision as conditions change.

3. Building Water Use and Control Structures—To help meet demands for water supply, recreation, reduction of flood damages, water quality improvement, hydroelectric power, fish and wildlife improvement and other water services, numerous water control structures must be designed, built, operated and maintained. Dams, pipelines, levees, wells, power plants, treatment plants, fish hatcheries, pumping stations and recreation facilities illustrate the wide variety of structures that will be needed. For maximum efficiency each structure must fit into the system as a whole, and the operation of existing structures must eventually be integrated with the whole system.

4. Application of Non-Structural Water Use and Control Measures—In conjunction with the major structures, a wide variety of essentially non-structural measures must be planned and administered. The functions involved here include:

a. land acquisition for reservoirs, recreation, wildlife and other purposes;
b. soil conservation, forestation, and other land treatment measures;
c. distribution of municipal, industrial and irrigation water supplies, and of hdyroelectric power;
d. establishment and enforcement of water quality standards; quality monitoring; regulation of effluent discharges;
e. establishment of flood warning systems, flood plain zoning, and other flood damage avoidance;
f. control of withdrawals and diversions from surface and ground water sources;
g. ground water recharge and development;
h. channel dredging and straightening.

5. Co-ordination—Programs of Federal, State, local, and private agencies must be made to operate in harmony if the full value of these efforts is to be realized. The preparation of an annual financial summary of all water programs, and an annual water use and supply budget will assist this co-ordination.

6. Representation and Information—The interests of the Basin with respect to water resources administration will need to be represented before government agencies, private groups or persons, and generally in the public.

American Experience in River Basin Organization

On the Federal level the responsibilities for various water resources functions are dispersed widely among many agencies. This has been a target of investigation, analysis, and recommendation for many years. Despite these many studies and commissions, few recommendations have been applied and little reorganization accomplished. Given this disinclination for reorganization on the Federal level, there are three possibilities for the Delaware River Basin using existing types of mechanisms for *Federal* water resources administration.

The first would be to use an existing Federal agency, the Corps of Engineers, since it has the broadest scope of action as far as eastern river basins are concerned. This possibility is rejected on the basis of the organizational structure of the Corps, the functional orientation of the Corps, and past history of its administrative responsibility.

The second would be to utilize an inter-agency committee, similar to those in the Missouri and Columbia Basins. The record is clear with respect to this possibility. With regard to the planning, development, and administration of water resources, the inter-agency mechanism leaves much to be desired. The most publicized product of such an organization, the Pick-Sloan plan for the Missouri Basin, on objective analysis appears to be nothing more than a division of construction responsibilities, rather than an integrated plan for basin water resources development. Widespread disagreement and disillusionment with the inter-agency device is evidenced by the many and varied attempts to establish something different. It should also be noted that such committees have not achieved integrated operation of a total water resources program.

The third possibility on the Federal level would be to establish a separate regional agency reporting directly to the President, similar to the Tennessee Valley Authority. As a regional water resources agency and as the only existing example of this possibility, TVA merits objective consideration. TVA has emphasized a regional focus and consequently the people in the area consider it a local agency.

It chose to work through the existing governmental mechanisms, rather than becoming a super-state. In so doing, it stimulated local and State agencies, many of which were dormant or non-existent at the time of its origin. By focusing on regional problems even though a Federal agency, and becoming knowledgeable about local conditions, it attained a competence on functional problems in the region, such as forestry, greater than the Federal agencies in the same functional programs.

Despite this record, the general acclaim it has received for its outstanding technical job—especially outside the country, and the co-operation and support it has engendered from the local and State governments in the region, TVA has not been successful in building a political base sufficient to ensure its general, continuous support at the national level. This result suggests caution with respect to wholly Federal river basin organizations.

Turning now to State efforts in the water resources field, the record shows their efforts to have been poor. No State department has prepared a comprehensive, multiple-purpose plan for a river basin, with the possible exception of the California Department of Water Resources in its current efforts. State programs in water resources have been limited generally to a single function and often to a segment of that function, as for example, passing on the quality of public water supplies or the review of plans developed by Federal agencies.

Perhaps the most notable example to date of a State agency in the water resources field is the Lower Colorado River Authority of Texas. This agency administers a multiple-purpose program including hydropower, flood control, water supply, irrigation, recreation, and conservation. The extent of its program varies from function to function, with its deepest involvement being in power, where it generates both hydro and steam energy, transmits, markets, and distributes. In recreation on the other hand, the LCRA merely makes arrangements for other agencies to develop and operate recreation facilities. Other effective intrastate agencies, though much more limited as to functions, are the Grand River Dam Authority and the Muskingum Watershed

Conservancy District. The former functions only with regard to power, the latter flood control and recreation.

All three of these intrastate agencies evolved under special conditions and their capital investments were financed largely with Federal money. The combination of depression days and consequent need for spending outlets, flood damage, and strategic representation in Congress brought about the LCRA. The same first two factors spawned the Muskingum District. These factors suggest that none of these agencies provides a good example of what a multiple-purpose State water resources agency might be.

In the Delaware Basin states, there are certain significant active programs in water resources, such as those of the New York Power Authority, the Pennsylvania Department of Forests and Waters, and the New Jersey Department of Conservation and Economic Development. In no one of these states, however, are the function of water resources administration, as described herein, performed by a single water agency.

The reasons for limited State action are apparent. First, there is in general a paucity of leadership. Second, there is a lack of adequate departmental organization. Third, there are inadequate financial resources. Fourth, the states are limited in geographical jurisdiction. For State departments in the east this last is an unconquerable hurdle, since all the major rivers in the east drain more than one state.

Attempting to surmount the limitation of State boundaries in interstate river basins has logically led to interstate action, primarily through interstate compact agencies. But the record here is clear also. The interstate compact has not been productive of either broad water programs or of administrative structures. There is no case of a broad water program administered by an interstate agency.

The primary examples of interstate compact activity in water resources are in the field of water pollution in the east and in water allocation in the west, the latter being an even more limited function than the former. The Interstate Sanitation Commission (New York, New Jersey and Connecticut) and the Ohio River Valley Sanitation Commission

are excellent examples of single-purpose interstate water agencies. In the Missouri basin where a broad, interstate compact water resources agency has been proposed and discussed at length, the proposal has been dropped because of lack of interest on the part of the states.

Legal Bases for Water Resources Organization

Four legal bases for regional organization exist: (1) executive orders or agreements; (2) parallel State statutes; (3) Federal statute; and (4) interstate compact. Experience with the first two indicates their inadequacy and ineffectiveness in regard to the range of functions an agency for water resources administration must perform.

The third basis, the Federal statute, meets the criterion of adequate powers more than any other legal basis. It also makes available, at least theoretically, all the financial resources of the Federal Government. Its advantages are: (1) sufficient geographic jurisdiction; (2) permanence; (3) adaptation to change; (4) adequate powers; (5) fiscal adequacy; and (6) sufficient prestige and possibilities for fitting into the framework of Federalism.

The interstate compact likewise provides a legal basis that meets the test of adequate geographic reach. Legally all powers available to the states individually are available to them collectively through the compact. Generally in interstate compact negotiations relating to water resources, there is Federal representation. On some of the agencies established by such compacts, Federal representation is accorded voting rights. The record of many compact negotiations reveals a strong interest in trying to make the compact an instrument for experimentation with new forms of governmental organization.

There is no guide for the extent of Federal participation in interstate compact agencies. There is no decision by the Supreme Court in this regard. Certainly there is and should be much leeway in discussing the possibilities, always remembering the existing paramount position of the national government. Despite the non-existence of any full-fledged precedent for multiple purpose planning and development by a compact agency with or without Federal

participation, the interstate compact remains the best vehicle for State participation in the administration of interstate water resources.

One note is necessary on the role of the courts in interstate water resources. The Supreme Court is not a planning and administrative agency. The issue at point is not, "which States shall get how much water," but rather, "how can the water resources best be used"? The judicial process has been used to answer the former, but is not amenable to answer the second question. Rational answers to it are far more likely to stem from the administrative process, given an adequate administrative agency.

Neither legal foundation nor form determines the success or failure of a basin water resources organization. The level of government taking action appears to be a good deal more important. In almost all significant basin developments the Federal Government has been active in providing a legal base, establishing an agency, and contributing all or a large part of the funds. The reasons for this are not far to seek. The Federal Government has the jurisdictional and legal competence for the job, the ability to take a broad view, and the resources adequate to the task.

This is not to say that there are not difficulties facing a Federal regional agency. One possible difficulty would be in gaining co-operation of local and State agencies. That this is not necessarily a problem is evidenced by TVA's success in this regard. A second difficulty would stem from unco-operative and resisting Federal agencies and their client groups. A third is that the prevailing congressional structure does not accord representation to a regional agency, that is, an agency that has no recognized geographical base. Governors, city councilmen, congressmen all owe loyalty to areas other than river basins. National support for a regional undertaking is slow to form and quick to dissolve, while State and local support, even if it could be fashioned, is not alone sufficient as a political base for a regional agency. Such a base must be constructed in the Congress, and State and local officials are not up to that responsibility. The failure of TVA to develop continuous, general support on the national level illustrates this problem.

Financing Water Resources Administration

Fundamental to establishing an agency for water resources administration for the Delaware River Basin is adequate financing. Without such financing an integrated and efficient administration will founder.

Not only will funds be required for the major structures such as reservoirs, pipelines, and power plants, but also for staff and facilities to carry out the many operating programs described in the discussion of functions. These include such programs as water quality monitoring and enforcement, recreation planning, flood damage reduction activities, operating the system of structures, public information, and research of various types. In addition, relatively large sums will be required in order to acquire lands for future reservoir sites, in order to prevent economic development thereon which would make future use of such sites for reservoirs economically infeasible. Likewise, lands around reservoirs must be acquired if the maximum recreational values are to be obtained from recreation development. In the early years of the existence of a Delaware Basin water resources agency, the funds required for the agency's staff alone, excluding any capital funds, might be on the order of $500,000 to $1,000,000 annually.

In considering sources of funds, it is assumed that the objective of a government agency is to provide services to the people with maximum economic and social efficiency. To achieve such a goal, four basic "planks" are suggested for a financial program. First, the sources of funds should be diversified. No one group in the population should have to shoulder an excessive share of the financial burden. Further, the costs allocated to any particular group should bear some relation to the benefits received. In computing benefits to be derived from water resources development, a definite expression of willingness to pay will serve as a check on such computations. Second, the control of funds for water resources administration should be centralized insofar as possible, in the hands of a single agency. Dispersion of control of funds tends to breed inefficiency, undesirable allocation of resources, and something less than the


DELAWARE RIVER BASIN
AND SERVICE AREA
State boundary
River basin boundary
Service area boundary
Miles
0
16
32
48
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ATLANTIC OCEAN
LONG ISLAND SOUND
NEW YORK CITY
PHILADELPHIA
TRENTON
WILMINGTON
BALTIMORE
WASHINGTON
ALLENTOWN
BETHLEHEM
READING
SCRANTON
WILKES-BARRE
BINGHAMTON
ALBANY
Troy
Schenectady
Gloversville
UTICA
SPRINGFIELD
HARTFORD
NEW HAVEN
BRIDGEPORT
PROVIDENCE
New London
Waterbury
Danbury
Kingston
Poughkeepsie
Beacon
Middletown
Port Jervis
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Sidney
Carbondale
Stroudsburg
Bangor
Easton
Hazleton
Tamaqua
Pottsville
Shamokin
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Hagerstown
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Charles Town
Annapolis
Cambridge
Salisbury
DELAWARE RIVER
SUSQUEHANNA RIVER
SCHUYLKILL RIVER
LEHIGH RIVER
HUDSON RIVER
MOHAWK RIVER
POTOMAC
DELAWARE BAY
CHESAPEAKE BAY
NEW YORK
PENNSYLVANIA
NEW JERSEY
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
MARYLAND
DELAWARE
VIRGINIA
Pepacton Reservoir
Cannonsville Reservoir
Neversink Reservoir
Rondout Reservoir
Ashokan Reservoir
Schoharie Reservoir
Lake Wallenpaupack
Lake Hopatcong
Lake Mohawk

most desirable development. Third, it is appropriate for the Federal Government to provide funds that are subject to a measure of State or regional control. Precedence for this exists in various grant-in-aid programs, highway programs, social welfare programs, etc. Fourth, there should be a high degree of flexibility in the application of revenues to water resources programs in the Basin. The rapidly changing character of the highly urban-industrial area in and adjacent to the Delaware Basin results in a continuously changing complex of water demands. Fixing irrevocably the uses to which certain funds can be put will preclude the best administration.

Before enumerating specific sources of funds, one aspect of economic analysis, namely reimbursement, requires clarification. There are two ultimate sources of funds for planning, developing, and operating a governmental water resources system—the general public and the direct user. In the first case, a governmental unit—Federal, State, local—provides the funds without anticipation of any repayment. Such programs are known as non-reimbursable. The rationale in this case is that the benefits are widespread, general, and that it is in the public interest to expend funds for such water programs. In the latter case, regardless of the source of the original funds for investment—the government, or private enterprise through the market—the funds are to be repaid by the beneficiaries or direct users. Such programs are termed reimbursable.

Potential sources of funds for water resources administration in the Delaware River Basin are listed and discussed in the following paragraphs.

1. Appropriations from the Federal Government for water programs for which the Federal Government traditionally has assumed major responsibility, i. e., flood control, navigation, pollution abatement, upstream watershed protection and various water data collection programs. Such appropriations could be made on a lump sum or an annual basis to either a Federal or interstate agency. Precedents for grants from the Federal Government for disbursement by other than Federal agencies do exist. Further, legis-

lation is currently being considered in Congress for broadening this procedure.

2. Potential appropriations from the Federal Government for water programs wherein the national responsibility appears to be expanding, i. e., water supply, recreation, and low flow augmentation. Recent legislation now enables Federal agencies to include provision for water supply storage for future use in Federal developments wherever assurance is made that the cost of such storage will eventually be repaid. The procedures to carry out this new legislation have not been defined as yet. With respect to recreation, Federal practice in the past has been to provide funds for minimum facilities in connection with most Federal reservoir developments. However, there is a trend towards increasing non-reimbursable Federal contributions for recreation developments. Again, this "emerging responsibility" is in a state of flux. Legislation has been introduced to include low flow augmentation as a primary function in water resources development for which costs may be incurred. To the extent such costs provide benefits which are widespread, general, and accrue to non-identifiable beneficiaries, the legislation provides that such costs may be borne by the Federal Government. No action has been taken on this legislation as yet.

3. Appropriations from the various State Governments in the Basin. Such appropriations could be annual or lump sum and in whatever magnitudes decided upon or agreed to by the states. Existing water programs of the states indicate that the states are willing to expend funds in this field. Further, the approval of the Incodel plan by three of the four Basin states indicated willingness to undertake some financial responsibility.

4. Sale of end products of water resources development

   (a) Sale of municipal and industrial water

   Perhaps the most important long-range economic objective to be served by water resources development in the Delaware Basin is that of providing municipal and industrial water. However

at the present time, and for the next one or two decades, there appears to be no significant market for municipal and industrial water. Until the demand for such water develops, no major revenues can be expected from this source.

(b) In the early years of water resources development and integrated administration in the Delaware Basin, the major source of revenue from the sale of an end product appears to be hydroelectric power. The demand for power in the Delaware Basin power marketing area has been estimated to double by 1980. As a consequence, large expansion of power facilities will be necessary. In the main, such expansions will come through construction of large thermal generating units. Such units achieve their optimum efficiency when operated continuously. As a consequence, there is a need for some flexible source of power which can handle rapid variations in a power load demand. Hydropower meets this requirement. Although there appears to be only a small amount of conventional hydropower which is economically feasible at the present time, there appears to be a significant pumped-storage potential in the Basin. Such potential would find its maximum utilization as peaking power. If pumped-storage hydropower can be produced at costs less than the value of such power to the users, a potential source exists for net revenues to a Basin agency, if the agency can sell the power for the maximum going rate. Such a rate would, of necessity, be established by bargaining with the users which, in the Delaware Basin power marketing area, would be the interconnected grid, or individual private utilities.

If the power facilities were installed by a Federal agency, the power output would have to be marketed in accord with present Federal Government policies. These policies include the preference clause and the requirement that rates be set at the cost of producing the power. As far as the preference clause provisions are concerned, these could be met by various wheeling and firming agreements with the private utilities, such as those negotiated by the Southeastern

Power Administration. The second policy, i. e., selling power at cost, would of course have to be modified if any net revenue were to be available to the Basin agency. A primarily interstate agency, would not have to adhere to Federal Government policies with respect to the marketing of power. With the demand for hydropower likely to be the largest in the next 20-25 years, an interstate agency could adopt such marketing policies as would optimize its net power revenues.

(c) Traditionally charges for the use of recreation facilities have been minimal and far from sufficient to cover even the operation, maintenance, and replacement costs of recreation facilities themselves. However, a basin agency could and should experiment with different pricing policies for recreation, in order to ascertain what revenues might be available from this source. Such policies should be flexible and varied to meet different conditions and different needs. Three revenue goals with regard to recreation can be defined:

(1) Obtain revenues sufficient to cover all operating maintenance, and replacement costs of recreation facilities; (2) obtain revenues sufficient to cover the above plus the capital costs of recreation facilities; and (3) obtain revenues sufficient to cover the above plus some equitable portion of the costs of jointly used facilities in multiple purpose water developments, i. e., dams, reservoirs, access roads, and the like. In time it may be possible to attain the first and second goal but it appears highly unlikely that the third goal will ever be achieved.

5. Withdrawal Charges. The possibility of obtaining revenues by levying charges on water withdrawals in the Basin should be considered carefully by a water resources administration agency. There are two legal bases for making such charges. The first relies on the concept of private benefit. The rationalization here is that an improvement in water supply yields widespread indirect and secondary benefits over and above the benefits to the direct users. Such a technique is

carried out through a formation of some sort of special district such as a water reclamation district, a flood control district, an irrigation district, a sewer district, and the like, and the assessment of all property in the district, regardless of the extent of water use on each property. Such an approach conceivably could be applied in the Delaware Basin. However, assessment on the basis of property bears no necessary or direct relation to the benefits from the use of water. The second basis rests on the concept of social damage. In this case, the rationalization is that all water is for public use and benefit, and that any damage to such waters, brought about by an individual user—industrial, municipal, or whatever—should be penalized. The method would be to make a charge for all water withdrawals. Charges would be based on magnitude of withdrawals, time pattern of withdrawals, and/or quality of effluent. One direct benefit of such an approach would be that the charges imposed would discourage wasteful water use.

Structure for a Delaware River Basin Administration

Existing government in the Delaware basin is not adapted to the administration of an integrated, basin-wide water resources program. State and local political jurisdictions are concerned only with pieces of the basin and cannot act for the whole. The Federal Government's responsibility, though adequate in scope, is restricted to a few specified water resource functions. In effect then, there is no machinery of government to meet growing water problems in a comprehensive fashion. The need is for a central agency to give unified administration to the basin water resources.

It is suggested that such an administration should be created in two steps. The first would be a Federal law to create a new Delaware River Agency for Water (DRAW), which would be a transitional agency having State representation along with the Federal Government. The second step should begin when the four basin states and the Federal Government have established by interstate compact a new Delaware River Commission (DRC). There are three reasons for this phasing.

First, the speed of Federal legislation appears to be faster than the time required for negotiating and ratifying a compact. For 19 successful compacts around the nation dealing with various aspects of water resources administration, the average time was eight years, nine months. The compact to establish an agency with the powers outlined here is considerably more complex than any of the these compacts. However, the interstate compact recommended by Incodel, passed seven of the eight legislative houses in the four basin states, and failed in 1953 only in the Pennsylvania senate. There is, therefore, a record of appreciation by the legislatures of water resources needs. In addition, the Delaware River Basin Advisory Committee has developed and maintained a working relationship among the chief executives of the basin states, and the cities of New York and Philadelphia. While Federal legislation offers the possibility of getting the new agency established fairly promptly, the process of negotiating a compact can go forward on a prepared basis without delay.

Second, it seems apparent that the main financial source for Delaware development in the early years of the new basin agency will be the Federal Government. It seems logical that Congress will be more willing to vote money for a Federal agency than for a non-Federal one.

Third, it would be impossible as well as undesirable to avoid broad Federal action in water resources, for which there are many precedents. On the other hand, the states traditionally retain some of the basic water resource functions, such as quality control and control over diversions and withdrawals, whose immediate importance will grow in the years ahead.

Establishing DRAW

The composition of DRAW is a matter for public discussion and debate. It should have Federal representation appointed by the President and State representation nominated by the respective Governors and appointed by the President.

It might be felt that the great metropolitan areas centering in New York and Philadelphia should be represented

on the agency, but there are two overriding difficulties. Constitutionally the states have sovereignty over the cities, and only the states, not the cities, have the legal right to enter agreements with the Federal Government. Secondly, the metropolitan areas are not political units. The New York metropolitan region includes suburban counties in New York, northeast New Jersey and a fringe of Connecticut. The Philadelphia metropolitan region includes not only suburban counties of Pennsylvania, but the Camden area of New Jersey and the Wilmington area of Delaware. It is patently impossible that each of these metropolitan complexes could have a single, formal representative on the agency board.

It is most important that the commission be of a manageable size. One suggestion for its composition would be an agency with one Federal representative and four State representatives. It should cause little dispute that the President should name the Federal member as chairman of DRAW. The membership of DRAW and DRC will be responsive if they are subject to removal by their individual appointing and nominating authorities.

Members of DRAW or DRC might receive annual salaries, or a per diem payment, or no compensation. Both the Federal and more often the State's interest have been served excellently by citizens giving their services on public boards without expectation of compensation. Such appointments can command the services of citizens who would be unable or unwilling to accept full-time paid positions.

Both DRAW and DRC are conceived as policy bodies which would organize and operate along the unitary lines so successful in private enterprise and in many public agencies. The agency should appoint a general manager with full administrative powers to employ a staff based on merit alone with salaries high enough to attract talented personnel. Of course an annual audit of accounts would be mandatory.

Establishing DRC

The President and the Governors of Delaware, Pennsylvania, New Jersey, and New York, should immediately

appoint a study commission to draft and submit for approval an interstate-Federal compact to create the Delaware River Commission (DRC). Such a temporary commission might need a small staff and budget to complete its studies.

This plan should meet a warm response in the four basin states. If any states are capable of taking the lead in creating new and improved administration of water resources, it should be the states of the Delaware Basin, which rate high among all the states in co-ordinated resources administration. The Council of State Governments has encouraged the states to move in the direction of such an interstate compact. There are ample precedents for Federal representation on such an interstate Commission.

It is fundamental that DRC should completely replace DRAW, with a transfer of all staff, finances, facilities and powers to DRC. The transfer will be simpler if the composition of DRC is the same as DRAW. There seem to be no constitutional or administrative reasons why such a transfer from a basically Federal to a basically interstate agency cannot be made, although this aspect will doubtless receive public examination and consideration in the Congress and State Legislatures.

An Intergovernmental Advisory Committee

Consultation and co-operation with the multitude of water interests in the Delaware River Basin requires the appointment of an Intergovernmental Advisory Committee (IAC) which would have representatives of the public and of national, State and local water resources agencies, water-using industries, water-interest groups, labor and agriculture.

The IAC should be a quasi-public body rendering important advisory and auxiliary services to the basin agency. Nearly all the present water-related programs in the basin are making positive contributions to better water use. Any development program for the basin water resources should continue not only uninterrupted but improve the existing programs in agriculture, forestry, fish and wildlife, small watersheds and soil conservation, local flood control structures, water supply systems, sewage disposal plants, and recreation developments.

Powers of a Delaware River Basin Administration

A responsible, central agency such as DRAW or DRC can give unified administration to a basin water program only if it has necessary powers.

Research and Data Collection

It is not the objective of DRAW or DRC to supplant activities of Federal, State and local agencies. But data on water resources from various agencies with programs in the basin need to be continuously compiled and correlated to provide an over-all picture that will always be current. There is no central point where this is done at the present time. In addition, there are gaps in the necessary knowledge of such matters as ground-water movement in the basin, industrial water technology, and the relation between water demand and price. DRAW or DRC should have the power to obtain special studies, advise and consult existing agencies, and gather scientific information for the development of the Delaware River Basin.

Planning

DRAW or DRC should have the power to provide the over-all plan and incorporate existing and future plans of other public as well as private agencies into its plan to best serve the beneficial purposes of all related development of water and land resources in the basin; to review and evaluate existing and future projects and programs both during design and after completion.

Each year there should be prepared a water-use budget and a financial budget, consistent with the comprehensive plan and clearly showing the relationship between current activities and proposals for the future. These budgets should be drawn in close co-operation with other public and private agencies and principal water users. The financial budget should be divided into current and capital sections.

Designing, Building, Operating

DRAW or DRC should have over-all control and supervisory authority over all structures affecting water re-

sources in the basin regardless of the operating agency in any particular case.

The plans, and policies of DRAW or DRC should be controlling in case any operation of an existing project or plan for a proposed project is deemed to have a substantial adverse affect. All possible means of negotiating conflicts should be employed, but, failing in this, the agency should be able to seek enforcement of its rulings in the courts.

It is not necessary that ownership of existing structures be obtained in the immediate future, but as the demands for water increase, negotiations can be undertaken and supervising arrangements made to implement the power of the basin agency to integrate all of the water control structures in the basin. Incident to this power DRAW or DRC should be authorized to acquire property by purchase and eminent domain, particularly to reserve land at reservoir sites for recreation, fish and wildlife, and watershed management purposes until funds are available for dams and related facilities. It should negotiate agreements with State and local bodies for administration of these functions.

Quality Control

DRAW or DRC should have power to collect data on water quality and maintain a water quality monitoring system; stimulate research where necessary disseminate information on water quality; establish reasonable physical, chemical and bacteriological standards for various uses of water and with respect to waste effluents; classify the basin water according to changing uses; and enforce standards with regard to quality control. These powers should be exercised in full co-operation with the U. S. Public Health Service, State and local governments, and private industry.

Representation and Information

DRAW or DRC should have the power to represent the over-all regional interest in water resources development, to report regularly to public officials and the public generally, to promote water conservation measures, and to create public understanding of water problems.

Co-ordination

DRAW or DRC should have power to promote and aid the co-ordination of activities of Federal, State, local and private agencies concerned with water and other related resources; advise, consult and make payments to any and all such agencies in the development and management of the water and related resources of the Delaware Basin.

Withdrawal and Diversion Control

DRAW or DRC should be given powers to approve, license or otherwise control withdrawals or diversion. In the exercise of such a strong power it will probably be necessary to appoint a Water Apportionment Appeals Board, from which further appeals could be provided to the Basin agency and thence to the courts. The basic statute might specify existing riparian and prescriptive rights or judicially allocated diversions, although it is likely a Basin agency would respect these rights without such a guarantee.

Maximum efficiency in the operation of a system of structures and in water resources administration can never be achieved without administrative control of withdrawals and diversions. If the situation makes it impossible for the basin agency to exercise this power immediately, the best alternative would be to incorporate the power in the organic law establishing the agency but reserve its exercise until a later date. This would be preferable to depending on passage of a separate law for this power at some future time.

Appropriations

DRAW or DRC should expect and receive financial support from the National and all the State Governments, in the forms of both capital and operating funds for navigation, water supply, flood control, data-gathering, recreation, activities, plans and surveys.

Reimbursement

DRAW or DRC should have the power to measure, assess and collect from such beneficiaries of water development as are subject to reimbursement. The Federal Government is moving toward expanded responsibilities in water supply, recreation and low-flow augmentation. Payments for such

of these benefits as are reimbursable should be made to and through a basin agency.

Sale of Water

DRAW or DRC should have the power to study and possibly undertake negotiation with water distribution agencies, public and private, to obtain revenue from the sale of water for municipal, industrial, commercial and agricultural use.

Hydroelectric Power

DRAW or DRC should be given the power to establish wholesale power rates for both conventional and pumped-storage power at levels above minimum assignable costs. There are a number of arrangements across the country for the development and sale of power to the advantage of the public and the power customers.

Charges for Recreational Use

DRAW or DRC should have the power to investigate and establish the price policy with respect to recreation facilities and programs carried on by the basin agency or other public or private agencies. While traditionally charges for recreation use have been minimal, the agency could and should experiment with different pricing policies to ascertain what revenues might be available from recreation.

Appendix

The Problem of Water Resources Administration, With Special Reference to the Delaware Basin

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END
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