89th Congress, 1st Session - - - - - - - - - - House Document No. 175

NEUSE RIVER BASIN, NORTH CAROLINA

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED MARCH 9, 1965, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON A REVIEW OF THE REPORTS ON THE NEUSE RIVER, NORTH CAROLINA, REQUESTED BY A RESOLUTION OF THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, ADOPTED APRIL 13, 1950, RESOLUTIONS OF THE COMMITTEE ON PUBLIC WORKS, HOUSE OF REPRESENTATIVES, ADOPTED APRIL 21, 1950 AND JUNE 13, 1956, AND A RESOLUTION OF THE COMMITTEE ON FLOOD CONTROL, HOUSE OF REPRESENTATIVES, ADOPTED MARCH 1, 1946

MAY 17, 1965.—Referred to the Committee on Public Works and ordered to be printed with twelve illustrations

---

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1965

47-829 O

CONTENTS

ILLUSTRATIONS ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER
(Only Plates 1, 2 and 3 printed)

ATTACHMENTS TO THE REPORT OF THE DISTRICT ENGINEER

APPENDIXES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER
(Only Appendixes VI and IX printed)

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C.

IN REPLY REFER TO:

May 12, 1965

Honorable John W. McCormack
Speaker of the House of Representatives

Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 9 March 1965, from the Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on a review of the reports on the Neuse River, North Carolina, requested by a resolution of the Committee on Public Works, United States Senate, adopted 13 April 1950, resolutions of the Committee on Public Works, House of Representatives, adopted 21 April 1950 and 13 June 1956, and a resolution of the Committee on Flood Control, House of Representatives, adopted 1 March 1946.

The views of the State of North Carolina, the Departments of the Interior, Agriculture, Commerce, and Health, Education, and Welfare, the Public Health Service and the Federal Power Commission are set forth in the inclosed communications, together with pertinent replies of the Chief of Engineers.

The Bureau of the Budget advises that, while there would be no objection to submission of the report to the Chief of Engineers to Congress, it requests that consideration be given to certain comments by the Department of the Interior concerning the appropriateness of the proposed recreation development to meet future demands for outdoor recreation; the lack of data concerning cost allocation; and the possibility that all costs, both Federal and non-Federal, have not been included in the project evaluation analysis. These comments will be given further consideration during the preconstruction planning stage if the project is authorized.

The Bureau further advises that no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation. A copy of the letter from the Bureau of the Budget is inclosed.

Sincerely yours,

STEPHEN AILES
Secretary of the Army

1 Incl
Report

COMMENTS OF THE BUREAU OF THE BUDGET

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

April 22, 1965

Honorable Stephen Ailes
Secretary of the Army
Washington, D. C. 20310

Dear Mr. Secretary:

Mr. Alfred B. Fitt's letter of March 10, 1965, submitted the favorable report of the Chief of Engineers on the Neuse River Basin, North Carolina. The report was prepared in response to several authorities which are listed therein.

We note that the Department of the Interior, in commenting on the report, raised several questions concerning (1) the appropriateness of the proposed recreation development to meet future demands for outdoor recreation; (2) the lack of data concerning cost allocations; and (3) the possibility that all costs, both Federal and non-Federal, have not been included in the project evaluation analysis. Although we understand that overall project feasibility would not be affected, we recommend that further consideration be given to the comments of the Department of the Interior.

Subject to your consideration of this matter, I am authorized by the Director of the Bureau of the Budget to advise you that there would be no objection to the submission of the proposed report to the Congress. However, no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation.

Sincerely yours,

Carl H. Schwartz, Jr.
Chief, Resources and
Civil Works Division

COMMENTS OF THE STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA

DEPARTMENT OF WATER RESOURCES

TERRY SANFORD, Governor

P. D. DAVIS
WAYNE MABRY
DAN K. MOORE

J. R. TOWNSEND, CHAIRMAN

C. H. PRUDEN, JR.
S. VERNON STEVENS, JR.
GLENN M. TUCKER

WALTER E. FULLER, Director
P. O. BOX 9282
RALEIGH, N. C. 27603

OFFICE OF THE DIRECTOR

July 10, 1964

Chief of Engineers
Department of the Army
Washington, D. C. 20315

Dear Sir:

This is in reference to your letter of April 24, 1964, File ENGCW-PD, transmitting the report on the Neuse River, North Carolina.

The report has been reviewed by the Department of Water Resources, Department of Conservation and Development, Wildlife Resources Commission, and the Highway Commission. All are in accord with the planned development and the Director of the Wildlife Resources Commission has reaffirmed his general agreement with the letter of November 25, 1963, signed by Regional Director Walter A. Gresh of the Bureau of Sport Fisheries and Wildlife.

We feel that vigorous prosecution of the Falls Project as the first stage of the plan is essential. The City of Raleigh is already taking measures to obtain water from the Neuse above the Falls Dam site by construction of interim intake works. Any unreasonable delay of the project will have an adverse effect.

Sincerely,

Walter E. Fuller

Walter E. Fuller

COMMENTS OF THE DEPARTMENT OF THE INTERIOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

11 August 1964

Dear General Wilson:

This is in reply to your letter of April 24, 1964, requesting our views on a review of the reports on the Neuse River, North Carolina.

You propose that a general plan for development be approved as a guide for immediate and future development of the water resources in the basin. The Falls Dam and reservoir project is recommended for construction at this time.

The need for hydroelectric power in North Carolina and the shortage of possible sites in the basin are recognized, but the District Engineer's report does not include evidence that the basin's power potentials have been thoroughly investigated. Apparently hydroelectric power facilities can be installed in the Falls Project if the reservoir elevation is raised to around 290 feet as discussed briefly in Plan 3. Power may be installed in the Wilson Mills Project if this project is ever needed. If power is not included in these two projects, it does not appear that hydroelectric power will be a part of the development of the basin's natural resources. About 30,000 kw. can be installed at Falls if Plan 3 is used. We believe that Plan 3 should be investigated thoroughly. If the results of such an investigation prove that power development is feasible, the plan to develop the Falls site should be revised to include hydroelectric power.

The U. S. Fish and Wildlife Service advises that the proposed general framework plan for the development of the Neuse River Basin, North Carolina, does not provide sufficient consideration for fish and wildlife conservation. A detailed report of the Service as required by Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) has not been submitted due to the Corps of Engineers' accelerated reporting schedule. The preliminary report of the Service, submitted November 25, 1963, was based on limited engineering data and contained only a partial analysis of project effects. The use of data from this report results in several major discrepancies relating to fish and wildlife in the District Engineer's report and also inadequate recognition of wildlife losses involved.

The District Engineer indicates that construction of the reservoirs would have only minor detrimental effects on the wildlife resources. However, the Service has determined that the flood plains of the Neuse River main stem, Little River and Contentnea Creek contain approximately 150,000 acres

of valuable wildlife habitat. Construction of the proposed reservoirs would cause damages to this habitat not only by inundation, but also by changes in vegetation and land use in the downstream flood plains due to reduction in flooding. The loss of habitat at the Falls Reservoir through inundation alone would result in a loss of 7,200 man-days of hunting annually. Moreover, in the future there will be a deficit of available hunting opportunities and project-occasioned wildlife losses would accentuate this deficit.

The Service advises that a portion of the losses attributable to construction and operation of the Falls Reservoir can be mitigated by developing selected project lands and making them available to the North Carolina Wildlife Resources Commission for wildlife management purposes. Preliminary studies indicate that nine feasible subimpoundment sites totaling approximately 840 acres occur on project lands and could be developed in conjunction with other wildlife management practices to replace some of the wildlife losses. By development and management, project lands could support additional wildlife resources. These subimpoundments would cost an estimated $166,000.

The Service further advises that, should the Falls Dam and Reservoir project or other units of the general framework plan for development of the Neuse River Basin be approved for further study or for construction, the Service would conduct the necessary fish and wildlife studies and provide appropriate recommendations for the conservation and development of fish and wildlife resources. Among the items which would be considered are timber clearing, public access, recreational zoning, effects of downstream flows in the flood plain and estuary, and general plans for fish and wildlife management and conservation.

In the interest of fish and wildlife resources, we therefore recommend that your report be modified as follows:

1. Provisions should be made to mitigate wildlife losses involved in the construction and operation of the Falls Reservoir. The estimated cost of the necessary measures is $166,000 and this cost should be assumed as a project expense to be borne by the Federal Government or by project beneficiaries, as appropriate.

2. Provisions should be made for additional detailed studies of fish and wildlife resources to be conducted, as necessary, after the project is authorized, in accordance with the Fish and Wildlife Coordination Act, and provisions for such reasonable modifications should be made in the authorized project facilities as may be agreed upon by the Director of the Bureau of Sport Fisheries and Wildlife and the Chief of Engineers, for the conservation, improvement, and development of these resources.

Review of your proposal by the Bureau of Outdoor Recreation raises serious questions regarding the advisability of apportioning to the Federal Government all costs allocated to recreation. Also, there is some question as to the magnitude of use to be expected. The District Engineer's report refers to an annual average visitation of 3,200,000 persons during the 100-year evaluation period. The National Park Service report estimates the average annual attendance would be 2,000,000 at the Falls project, and 3,200,000 total at the four projects studied by National Park Service in the Neuse River Basin.

Recreation would yield the greatest benefits to any function served. Of the total $2.73 million benefits assigned to the Falls project, $1.86 million or 68 percent would be derived from recreation. The value of recreation benefits is based on an average annual attendance of 2,000,000 general recreationists and 227,300 fishermen.

In the absence of a comprehensive recreation plan for the Neuse River Basin and tributary recreation service area, the Bureau does not know whether the Falls Reservoir project affords the best opportunity for both Federal and non-Federal investment to meet future demands for outdoor recreation opportunity. An $8.8 million alternative means of meeting recreation needs is shown only in dollar terms in tables VII - 4. There is no description of the proposed alternative; therefore, it cannot be evaluated.

From data contained in the District Engineer's report, the Falls project provides a very economical means of developing outdoor recreation opportunity. Of the total initial construction costs of the project, amounting to $18,600,000, only $2,996,000 or about 16.1 percent has been allocated to recreation. Of the total annual operation, maintenance, and replacement costs of $120,000, about $67,000 or 55.8 percent has been allocated to recreation. Annual charges on the investment for all project purposes have been determined to be $734,000, of which $166,000 or 22.6 percent has been apportioned to recreation. Thus, the cost per recreation day during the 100-year period of analysis based on an average annual visitation of 2,000,000 is only eight cents ($0.08). The unit cost, as a matter of fact, is so low that it poses the following question: "Have all costs of all lands and facilities, both Federal and non-Federal, essential to obtaining benefits assigned, been included in the project evaluation analysis?" For example, the National Park Service report estimates the average annual O&M cost at $600,000. If all costs have not been considered, then the total benefits claimed should be discounted by at least the annual charges associated with essential lands and facilities but which are not included in the project evaluation analysis.

The Bureau notes that all of the project development costs allocated to recreation are apportioned to the Federal Government. The District Engineer's report does not adequately reflect the standards employed in making this apportionment. The following computations utilizing data contained in the report tend to verify the views of the Board of Engineers that "...application of the cost-sharing standards under the Administration's policy as set forth in H.R. 9032...would not affect the cost-sharing recommended by the reporting officers," insofar as apportionment of initial costs is concerned.

$18,600,000 = total costs of project (joint use land and facilities)
10,000,000
$ 8,600,000
15%
$ 1,290,000
2,500,000
$ 3,790,000 = maximum amount of joint costs which could be allocated to recreation on nonreimbursable basis

$ 1,196,000 = amount of joint costs actually allocated to recreation on a nonreimbursable basis

The Bureau questions the advisability of apportioning all costs of operating, maintaining, and replacing basic recreation facilities,- including those constructed initially at Federal expense - to the Federal Government since this deviates from stated Administration Policy, promulgated by the Bureau of the Budget, of encouraging greater non-Federal participation in "local influence" projects of this type.

Of the total $120,000 project costs for annual operation, maintenance, and replacement, the amount of $67,000 is estimated as being required for operating, maintaining, and replacing recreation facilities, and apparently for a proportionate share of these costs for the dam and reservoir. In substantiation of this arragement, the District Engineer's report cites Section 4 of the Flood Control Act of December 22, 1944 (Public Law 534, 78th Congress), which authorizes construction, operation, and maintenance by the Federal Government of basic recreation facilities for public use and access for general recreation. Reference is not made to the Administration's Policy as set forth in H.R. 9032. Section 1(a)(3) of H.R. 9032 requires that the project construction agency encourage non-Federal public bodies to assume responsibility for the administration and additional development of project land and water areas for recreation and fish and wildlife enhancement purposes, including operation, maintenance, and replacement of basic facilities provided initially at Federal cost, except in certain instances as are described in the legislation.

The $67,000 referred to above amounts to only 3-1/3 cents per annual visitor for operation and maintenance, as compared with a nationwide average in 1962 of 38 cents per visitor at over 30,000 State owned and operated areas (State Outdoor Recreation Statistics, 1962; Bureau of Outdoor Recreation, December 1963). The National Park Service has estimated annual O&M at $600,000, or 30 cents per visitor, which appears to be a more realistic estimate of the actual expenses which would be involved. H.R. 9032 would apportion all these costs to non-Federal interests.

Should the Falls Reservoir be authorized as recommended by the Corps, the project will be fully financed by the Federal Government and administered by a Federal agency throughout the life of the project. A precedent would thus be established which for all practical purposes would not only deviate from the spirit if not the letter of H.R. 9032, but would circumvent the requirements,as set forth in Recreation Advisory Council Policy Circular No. 1, for establishing a National Recreation Area.

Thank you for the opportunity of commenting on the recommended improvements.

Sincerely yours,

Kenneth Holum
Assistant Secretary of the Interior

Lt. General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington, D. C. 20315

LETTER TO THE SECRETARY OF THE INTERIOR

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO

ENGCW-PD

8 February 1965

The Honorable Stewart L. Udall

The Secretary of the Interior

Dear Mr. Secretary:

Reference is made to your letter of 11 August 1964 commenting on my proposed report on the Neuse River Basin, North Carolina.

Our studies for this report included an investigation of hydroelectric power as a primary purpose of the Falls project. It was determined that the cost of enlarging the project to include power would exceed the cost of alternative power, computed on the same basis of interest and taxes as used for the project, so power was not included. With regard to the mitigation of fish and wildlife losses and additional studies of the problem at the Falls project, the conservation and enhancement of fish and wildlife resources will be given further consideration in the preconstruction planning stage if the project is authorized.

The report of the Chief of Engineers has been revised to recommend that the overall plan for the Neuse River be approved as a guide for future development, subject to the understanding that it will not preclude modifications and adjustments later determined to be desirable in order to accommodate changed conditions or plans developed by other agencies. A copy of the revised report is inclosed.

Referring to your comments on recreation the study indicates that the Falls reservoir would provide an excellent initial facility for water-based recreation and an economical one. You may note from the report that recreation does not require additional storage beyond that required for other purposes, also that the project is economically justified without recreation benefits. If the project is authorized by Congress, every effort will be made to encourage non-Federal public bodies to assume responsibility for the administration and additional

development of project land and water areas for recreation and fish and wildlife enhancement purposes.

We appreciate your courtesy in commenting on the report.

Sincerely yours,

(Signed)

1 Incl
Rev CofEngrs
report

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE
WASHINGTON 25, D.C.

January 11, 1965

Honorable Stephen Ailes
Secretary of the Army

Dear Mr. Secretary:

This is in reply to the Chief of Engineers' letter of April 24, 1964, transmitting for our review and comment his proposed review survey report on the Neuse River Basin, North Carolina.

The report recommends that the Falls Dam and Reservoir on the Neuse River be authorized for construction, subject to certain stated conditions of local cooperation, and that the remainder of the overall plan set forth in the report be approved as a guide for future development of water resources in the Neuse River Basin, subject to the understanding that such approval will not preclude subsequent cooperative and coordinated planning within the basin by Federal, State and local agencies, or the improvement and broadening of the approved plan to bring it into consonance with the results of such subsequent planning.

The report states that the recommended dam and reservoir at the Falls site would be a key project in the proposed plan of development for the Neuse River Basin. Accordingly, the report recommends the immediate authorization of that dam and reservoir for flood control, water supply, water quality control, recreation and other purposes at an estimated first cost of $18,600,000, provided responsible local interests agree to pay the United States, in accordance with the Water Supply Act of 1958, as amended, the entire amount of the construction cost allocated to water supply, presently estimated to be $1,455,000, and the entire amount of the operation, maintenance and major replacement costs allocated to water supply, presently estimated at $10,000 annually.

The recommended Falls Reservoir would provide reservoir storage of 403,000 acre-feet, of which 243,000 acre-feet would be for flood control, 35,000 acre-feet for water supply for the city of Raleigh, and the remaining 120,000 acre-feet for conservation. Average annual benefits from this dam and reservoir are estimated in the report to be $2,732,000, consisting of $564,000 for flood control, $195,000 for water quality control, $112,000 for water supply, $1,690,000 for general recreation, and $171,000 for fishing and hunting.

Approximately 66 percent of the flood control benefits attributed to the Falls project are agricultural, with additional benefits expected to accrue

47-829 O-65—2

to agricultural interests from land enhancement. We note that cropland acreage in Reach No. 2 of the Neuse River is expected to increase by about 46 percent after project installation. Specific information concerning conditions in other reaches is not included. Consequently, the report does not provide sufficient information to permit us to appraise whether expected land use changes due to the project would be in harmony with anticipated national food and fiber requirements.

The Department of Agriculture has received nine applications for assistance under the provisions of the Watershed Protection and Flood Prevention Act, Public Law 566, 83d Congress, as amended, from local organizations in the Neuse River Basin. Watershed work plans have been approved for five of these watersheds and Federal assistance is being provided for the installation of the works of improvement. This Department is currently providing technical assistance to the sponsoring organizations in developing a watershed work plan for a sixth watershed in the Neuse River Basin. Local organizations also have indicated interests in the development of watershed work plans and the installation of improvements in a number of other watersheds throughout the basin.

The proposed Falls Dam and Reservoir apparently would not seriously affect water and related land resource projects or programs of this Department, and from this standpoint the Department of Agriculture would have no objection to the authorization of this dam and reservoir.

Since most of the remaining 12 reservoirs recommended in the Chief of Engineers' report will be within drainage areas of less than 250,000 acres, it would seem desirable that the concerned agencies of our respective Departments give careful consideration to the most appropriate manner of providing for the development of the water and related land resources of the Neuse River Basin. Such further study would determine the best combination of local watershed projects with Federal assistance under the provisions of Public Law 566 and of additional reservoir projects such as proposed in the Chief of Engineers' report to meet the needs of the basin. We shall be glad to participate in such a study.

We appreciate the opportunity to review the report.

Sincerely yours,

John A. Baker

John A. Baker
Assistant Secretary

LETTER TO THE SECRETARY OF AGRICULTURE

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO
ENGCW-PD

8 February 1965

The Honorable Orville L. Freeman

The Secretary of Agriculture

Dear Mr. Secretary:

Thank you for your comments on the review of the reports on the Neuse River Basin, North Carolina, as expressed in your letter of 11 January 1965.

We shall be pleased to cooperate during the planning stage in further studies of the development of the Neuse River Basin that are desirable to accommodate changed conditions and plans developed by your Department.

A copy of the revised report of the Chief of Engineers is inclosed.

Sincerely yours,

(Signed)

1 Incl
as

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF COMMERCE

THE UNDER SECRETARY OF COMMERCE
FOR TRANSPORTATION
WASHINGTON, D.C. 20230

July 14, 1964

Lieutenant General W. K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington, D.C. 20315

Dear General Wilson:

This is in further reply to the letter of the Acting Chief of Engineers dated April 24, 1964 transmitting for our information and comment copies of the proposed report of the Chief of Engineers, together with the reports of the Board of Engineers for Rivers and Harbors, and of the District and Division Engineers, on a review of the reports on the Neuse River, North Carolina.

These reports recommend that their general plan for development of the Neuse River basin be approved as a guide for immediate and future development of the water resources in the basin. They further recommend that the Falls Dam and Reservoir project on the Neuse River be authorized for construction in the interest of flood control, water supply, water quality control, recreation, and other purposes at an estimated cost of $18,600,000 for construction and $120,000 annually for operation, maintenance, and replacements.

The Bureau of Public Roads' review of the report indicates that the construction of Falls Reservoir, the only item of the report for which a definite plan is available, will require the reconstruction of portions of Interstate 85, State Highways 21, 50, 98, and a number of other primary and secondary roads and that the cost of these relocations, approximately $2,500,000, has been made a part of the project cost. It is expected that these highways will be reconstructed to current standards for current traffic as required by existing legislation and that the alignment of the highway relocations will be submitted to the State highway department and, when applicable, to the division office of the Bureau of Public Roads for their approval.

In consideration of the anticipated recreational uses, the Coast and Geodetic Survey's review of the report indicates the need for a nautical chart of Falls Reservoir and it recommends that funds for this purpose should be included in the project costs. Likewise the Survey suggests that funds for the nautical charting of the Wilson Mills, Buckhorn and Beulahtown Reservoirs should be included in their project costs estimates when they are considered for authorization and construction.

Vertical and horizontal controls exist in the project area but it appears that more control, both horizontal and particularly vertical, would be desirable in the vicinity of the dam sites. If additional control should be required for the project, advance notice is requested so that cost estimates can be furnished.

We appreciate the opportunity to comment on this report.

Sincerely,

Clarence D. Martin, Jr.

LETTER TO THE SECRETARY OF COMMERCE

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO
ENGCW-PD

13 August 1964

The Honorable Luther H. Hodges

The Secretary of Commerce

Dear Mr. Secretary:

This is in reply to the recent letter from the Under Secretary of Commerce for Transportation commenting on my proposed report on the development of the water and related land resources of the Neuse River Basin, North Carolina.

If the recommended project is authorized and construction funds are made available, the necessary modification or relocation of highways and roads in the reservoir area will be coordinated with the North Carolina State Highway Commission and the Bureau of Public Roads to insure reconstruction of a road network conforming to State Highway and Bureau of Public Roads standards.

As a matter of normal procedure, detailed topographic mapping of the project area will be undertaken after project authorization and funding. At that time, sufficient horizontal and vertical control will be established in both the damsite and reservoir areas. Topographic mapping would be accomplished prior to the filling of the reservoir, thereby providing detailed information required for the preparation of nautical charts for the reservoir. The cost of topographic mapping is included in the cost estimate for each project considered in the Neuse River report.

In the event the Falls project is authorized and funded for construction, it is anticipated that the establishment of the additional horizontal and vertical control in the Falls project area will be accomplished as a part of topographic mapping contract administered by the Corps of Engineers.

Sincerely yours,

(Signed)

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
WASHINGTON

August 20, 1964

Dear Mr. Fitt:

In accordance with Section 2 (b) of the Federal Water Pollution Control Act, we are pleased to supply the following information on the Neuse River Basin, North Carolina.

An investigation was made and a report entitled "Water Resources Study, Neuse River Basin, North Carolina," dated May 1964 was prepared by the Water Supply and Pollution Control staff, Department of Health, Education, and Welfare, Region III, Charlottesville, Virginia, in cooperation with the U. S. Army Engineer District, Wilmington, North Carolina. The report noted that:

1. The comprehensive river basin development plan of the Corps of Engineers comprises the following reservoirs: the Falls and Wilson Mills Reservoirs on the Neuse River; the Hillsboro Reservoir on the Eno River; the Orange Beulahtown, Little Buffalo, and Bakers Mill Reservoirs on the Little River; and the Buckhorn, Wiggins Mill, Stantonsburg, Great Swamp, Black Creek, and Aycock Swamp Reservoirs on Contentnea Creek.

2. There is need for storage for flow regulation for water quality control to provide the following annual releases from the proposed Falls Reservoir and Wiggins Mill Reservoir.

	Year	Draft on Storage Acre-feet/Yr.
Falls Reservoir	2010	23,300
	2060	31,300
Wiggins Mill	2010	6,500
	2060	8,800

These estimates are based on present conditions and projections of population and industrial growth in the affected areas.

3. The value of benefits assignable to the recommended storage for water quality control purposes is estimated to be $144,000 annually for Falls Reservoir and $13,120 annually for the Wiggins Mill Reservoir.

4. The above estimates are based on the assumption that adequate treatment will be provided for all wastes at their source, and that flow regulation will not be a substitute for such treatment but will be required to provide additional water quality control.

5. The benefits of water quality control storage in the two reservoirs will be widely distributed among municipal, industrial, and individual users in the Neuse River Basin.

The detailed results of investigations upon which the foregoing findings are based are contained in the aforementioned report, a copy of which has been transmitted to the U. S. Army Engineer District, Wilmington, North Carolina.

We appreciate the opportunity to provide this information.

Sincerely yours,

James M. Quigley

James M. Quigley
Assistant Secretary

Mr. Alfred B. Fitt
Special Assistant to the Secretary
of the Army for Civil Functions
Washington 25, D. C.

LETTER TO THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO
ENGCW-PD

8 February 1965

The Honorable Anthony J. Celebrezze

The Secretary of Health, Education,
and Welfare

Dear Mr. Secretary:

Thank you for the comments of the Assistant Secretary of Health, Education, and Welfare on the review of reports on the Neuse River Basin, North Carolina, as expressed in his letter of 20 August 1964.

The Falls project will afford an effective source of low flow augmentation for the Neuse River. The survey report studies resulted in the provision of 82,000 acre-feet of storage in the reservoir which would be available to increase stream flow in critical low-flow periods. However, further consideration will be given to the magnitude of the water quality control storage to be included in the Falls project during the preconstruction planning stage if construction of the project is authorized by Congress. Full consideration would be given to such factors as the growth of population and industry in the Raleigh-Durham area and possible delays in recommending and constructing other projects in the general plan of development for the basin.

The report of the Chief of Engineers has been revised to recommend that the overall plan for the Neuse River be approved as a guide for future development subject to the understanding that it will not preclude modifications and adjustments later determined to be desirable in order to accommodate changed conditions or plans developed by other agencies. Further consideration will be given to the desirability of adding water quality control storage in these projects, including the Wiggins Mill Reservoir mentioned in your letter, at such time that further survey reports are prepared for submission to Congress.

A copy of the revised report of the Chief of Engineers is inclosed for your information.

Sincerely yours,

(Signed)

1 Incl
Rev CofEngrs Rept

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
WASHINGTON, D.C. 20201

BUREAU OF STATE SERVICES

REFER TO:

July 24, 1964

Lieutenant General W. K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

This is in reply to General MacDonnell's letter of April 24, 1964, requesting comments on the Survey Report on Neuse River Basin, North Carolina, Corps of Engineers.

It is noted that this report was prepared prior to completion of the Public Health Service study of needs for storage for water supply and water quality control. Preliminary data developed in the course of the study formed the basis for the portions of the Corps plan concerning water supply and water quality control. While minor differences exist in figures used in the Corps report and the Public Health Service report, we believe adequate consideration has been given to our recommendations on these aspects of the plan.

The final Public Health Service report has been submitted to the U. S. Army Engineer District, Wilmington, North Carolina. This report can be used in making any needed adjustments to the plan of development during construction planning.

In our letter of April 7, 1964, on the Interim Hurricane Survey of New Bern and Vicinity, the need for detailed study of the effects of the proposed barrier on water quality was pointed out. The estuary portion of the Basin was not included in the report here under review. We believe that development in the lower Neuse River should be considered in conjunction with proposed upstream development.

The opportunity to review the report is appreciated. We stand ready to supply further consultation on request.

Sincerely yours,

Keith S. Krause

Keith S. Krause
Chief, Technical Services Branch
Division of Water Supply and
Pollution Control

COMMENTS OF THE FEDERAL POWER COMMISSION

FEDERAL POWER COMMISSION
WASHINGTON 25, D.C. 20426

July 17, 1964

Lieutenant General W. K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington, D. C. 20315

Reference: ENGCW-PD

Dear General Wilson:

This is in reply to General MacDonnell's letter of April 24, 1964, inviting comments by the Commission relative to your proposed report and to the reports of the Board of Engineers for Rivers and Harbors and of the District and Division Engineers on the Neuse River, North Carolina.

The cited reports present a general plan for development of the Neuse River basin and recommend approval of the plan as a guide for immediate and future development of the water resources in the basin. The reports further recommend that the Falls reservoir project on the Neuse River be authorized for construction in the interest of flood control, water supply, water quality control, recreation, and other purposes, at an estimated cost of $18,600,000 for construction. The proposed Falls project would consist of an earth and concrete dam with gated spillway, and a reservoir with total storage capacity of 408,000 acre-feet.

The Commission staff has reviewed your Department's reports and has made studies of the possibility of developing hydroelectric power at the recommended Falls project. Although detailed operating procedures are not given in the reports, the staff studies indicate that with the project constructed as planned a firm power output of about 450 kilowatts could be produced. With an installed capacity of 5,000 kilowatts, the average annual generation would be approximately 15,000,000 kilowatt-hours. Should further developments or operating experience make possible the use of the planned conservation storage capacity in the interest of power, an installation of some 10,000 kilowatts might be made at the project. Staff studies show that the added costs of such power installations would exceed the resulting power benefits.

Studies were also made by the staff of the feasibility of raising the top of the dam about 15 feet in order to increase the power potential. Under such condition a firm power output of about 2,500 kilowatts could be produced. With an installed capacity of 25,000 kilowatts, the average annual generation would amount to approximately 25,000,000 kilowatt-hours. The studies indicate, however, that the power benefits would not justify the added costs for such a development, the estimated benefit-cost ratio amounting to about 0.7 to 1.0.

Based on its consideration of the reports of your Department and the studies of its own staff, the Commission concludes that the development of hydroelectric power would not be economically justified at the proposed Falls reservoir project. An increase in the scope of the project for power purposes also would not be economically justified.

Sincerely,

Joseph C. Swidler
Chairman

NEUSE RIVER BASIN, NORTH CAROLINA

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO
ENGCW-PD

9 March 1965

SUBJECT: Neuse River Basin, North Carolina

TO: THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress the report of the Board of Engineers for Rivers and Harbors accompanied by the reports of the District and Division Engineers in response to resolutions adopted by the Committee on Public Works of the House of Representatives on 13 June 1956 and on 21 April 1950, by the Committee on Public Works of the United States Senate on 13 April 1950, and by the Committee on Flood Control of the House of Representatives on 1 March 1946 concerning improvements in the interest of flood control and allied purposes in the Neuse River Basin, North Carolina.

2. The District and Division Engineers recommend that their general plan for development of the Neuse River basin be approved as a guide for immediate and future development of the water resources in the basin. They further recommend that the Falls Dam and Reservoir project on the Neuse River be authorized for construction in the interest of flood control, water supply, water quality control, recreation, and other purposes at an estimated cost of $18,600,000 for construction and $120,000 annually for operation, maintenance, and replacements. In accordance with the Water Supply Act of 1958, as amended, the cost of construction and annual cost of operation, maintenance, and replacements allocated to water supply, presently estimated at $1,455,000 and $10,000, respectively, would be non-Federal. Annual charges are estimated at $822,000. With annual benefits estimated at $2,732,000, the benefit-cost ratio is 3.3.

3. The Board of Engineers for Rivers and Harbors concurs generally in the findings and recommendations of the reporting officers.

4. The North Carolina State Highway Commission has recently advised the District Engineer that reconstruction of State Highway

No. 98, which passes through the Falls Reservoir, will be initiated early in 1966. The Commission requested that provision be made for financial participation in the construction of that portion of the highway affected by the Falls Dam and Reservoir, in advance of construction of the dam. The District Engineer's report and estimates provide for relocation of this highway. After review of the matter it was determined that advance participation in this highway construction is desirable to avoid increased costs.

5. I concur in the recommendation of the Board that the Falls Dam and Reservoir on the Neuse River in North Carolina be authorized for construction, subject to the conditions of local cooperation set forth therein and the additional conditions of local cooperation with respect to recreation and fish and wildlife enhancement set forth below. I also concur in the recommendation of the Board that the remainder of the over-all plan set forth in the report of the District Engineer be approved as a guide for future development of water resources in the Neuse River Basin, subject to the understanding that such approval will not preclude subsequent cooperative and coordinated planning within the basin by Federal, State and local agencies, or the improvement and broadening of the approved plan to bring it into consonance with the results of such subsequent planning.

6. During and subsequent to completion of the District and Division Engineers' reports, policies and procedures with respect to division of responsibility between Federal and non-Federal interests regarding recreation and fish and wildlife enhancement features of Federal multiple-purpose reservoirs have been in a continuing state of transition. The policies and procedures set forth in House of Representatives Bill Numbered 9032, introduced in the 88th Congress, First Session, on 6 November 1963, were a part of this transition. The Congress did not act on H. R. 9032. In the most recent action on this matter proposed legislation was introduced with Administration sponsorship, as House of Representatives Bill Numbered 5269, 89th Congress, First Session, cited as the "Federal Water Project Recreation Act." The Bureau of the Budget has advised that it expects the agencies concerned to implement immediately the policies and procedures set forth in the proposed Act.

7. Fundamentally, the proposed Act provides for a substantial level of Federal participation in the cost of development for recreation and fish and wildlife enhancement at projects such as the Falls Dam and Reservoir if non-Federal interests agree to administer project land and water areas for these purposes, bear not less than one-half of the separable project costs allocated thereto, and bear all the costs of operation, maintenance, and replacement of recreation and fish and wildlife lands and facilities. The proposed Act includes provisions responsive to problems of adjustment to a new policy in the case of projects for which pre-authorization planning is well advanced, and for adoption of plans to

reflect the intentions of non-Federal interests with respect to participation in the cost of recreation and fish and wildlife enhancement activities at various stages of project planning and implementation.

8. On the basis of the Administration's position I recommend that prior to construction of Falls Dam and Reservoir local interests furnish assurances satisfactory to the Secretary of the Army that, in accordance with the proposed Federal Water Project Recreation Act cited above, they will:

a. Administer project land and water areas for recreation and fish and wildlife enhancement;

b. Pay, contribute in kind, or repay (which may be through user fees) with interest one-half of the separable cost of the project allocated to recreation and fish and wildlife enhancement, the amount involved currently being estimated at $900,000; and

c. Bear all costs of operation, maintenance, and replacement of recreation and fish and wildlife lands and facilities, the amount involved currently being estimated at $35,000 on an average annual basis.

Provided that the sizing and responsibility for development, operation, maintenance, and replacement of the recreation and fish and wildlife enhancement features of the reservoir may be modified in accordance with the alternatives provided in the proposed Federal Water Project Recreation Act cited above, depending upon the intentions of non-Federal interests regarding participation in the costs of these features at the time of reservoir construction and subsequent thereto, and that appropriate adjustments reflecting such modifications may be made in the allocation of costs to other project purposes.

9. I also recommend participation with the State of North Carolina in the relocation and reconstruction of State Highway No. 98 in advance of construction of the Falls Dam and Reservoir in order to meet reservoir operation requirements of that project.

10. The net cost to the United States for Falls Dam and Reservoir is estimated at $16,245,000 for construction and $75,000 annually for operation, maintenance, and major replacements, after payment by local interests of costs allocated to water supply, recreation, and fish and wildlife enhancement, based on the presently planned level of development for these purposes.

47-829 O-65—3

11. Use of the presently prescribed interest rate of 3-1/8 percent would result in no appreciable change in the benefit-cost ratio.

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

CORPS OF ENGINEERS, U.S. ARMY
BOARD OF ENGINEERS FOR RIVERS AND HARBORS
WASHINGTON, D.C. 20315

ENGBR 19 February 1964

SUBJECT: Neuse River Basin, North Carolina

TO: Chief of Engineers
Department of the Army

1. Authority and scope.--This report is in response to the following resolution adopted 13 June 1956:

> Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Neuse River, North Carolina, published in House Document No. 500, 72d Congress, 2d Session, and other pertinent reports, with a view to determining whether improvements for flood control, conservation of water resources in the interests of water supply, and for allied purposes, are advisable at this time.

It is also fully responsive to prior resolutions adopted by the Committee on Flood Control of the House of Representatives, United States, on 1 March 1946, by the Committee on Public Works of the House of Representatives, United States, on 21 April 1950, and by the Committee on Public Works of the United States Senate on 13 April 1950, all as quoted in the District Engineer's report. The study covers the needs for flood protection, municipal and industrial water supply, water-quality control, power, irrigation, and recreation, and presents a plan of improvement to meet these needs.

2. Description.--The Neuse River basin, situated in the eastern part of North Carolina, is roughly oblong in shape, approximately 180 miles long, with a maximum width of about 46 miles. The Neuse River is formed by the confluence of the Eno and Flat Rivers, about 8 miles north of the city of Durham, and has a drainage area of approximately 5,710 square miles.

3. General economy.--The basin is primarily an agricultural region, but contains many small towns and several cities which are important commercial centers. The land area of the basin amounts to about 11 percent of the entire State of North Carolina and consists of all or portions of 16 counties. The population of the

basin was estimated to be approximately 634,000 in 1960. Substantial industrial development has taken place in the upper and central portions of the basin and to a lesser extent in the eastern portions. The most important economic activity is the production, buying and selling of tobacco, and the manufacture of tobacco products. Other principal crops grown in the basin and corn, cotton, soybeans, sweet potatoes, hay, wheat, peanuts, truck, and pasture. Principal industries, other than tobacco, include the manufacture of textiles, rayon and synthetic fibers, paper products, and chemical and allied products. Two large military installations, Cherry Point Marine Air Station near New Bern and Seymour Johnson Air Base at Goldsboro, are located in the basin.

4. Existing improvements.--A flood-control project near Goldsboro was completed in December 1947, consisting of a flood channel across two adjoining bends of the Neuse River, shortening the stream by about 6.5 miles. The Soil Conservation Service, United States Department of Agriculture, has completed several small reservoirs in the Bear Creek watershed, located in the central part of the basin, which will provide flood protection along Bear Creek.

5. Water problems.--Through the fall zone and in the Piedmont area of the basin, the flood plain is relatively narrow and flood damages are light. From the vicinity of Smithfield to the coast the flood plain is broad and flat and is subject to significant flood damages. The total flood plain area of the Neuse River basin consists of approximately 235,000 acres, of which 68 percent is along the main stem of the Neuse River and 22 percent is along Contentnea Creek. Average annual agricultural flood damages throughout the basin amount to $915,000, of which 71 percent, or $651,000, occurs along the main stem of the Neuse River. The city of Goldsboro and nearby facilities, including Seymour Johnson Air Force Base and a State hospital complex, are subject to greatest urban flood damages in the basin. Average annual non-agricultural flood damages in the basin amount to $341,000, of which 82 percent, or $278,000, occurs along the main stem of the Neuse River.

6. There is an abundance of water in the Neuse River basin, both in the main stem and in its larger tributaries; however, this resource needs to be developed and conserved to meet the present and future needs of the basin. The growing basin population, increasing per capita consumption rates, industrial expansion, and the widespread installation of irrigation equipment have caused an upsurge in the use of water. Smithfield is the only municipality presently using the Neuse River as a source of domestic water supply; however, the

city of Raleigh is in the process of expanding its supply system to take water from the Neuse River. The adverse effects of industrial and domestic effluents upon the streams of the basin are becoming serious and indicate that immediate improvement of water quality is essential to meet the water supply needs of the basin.

7. Hydroelectric power.--The power needs of the basin are met principally by steam-electric generating plants supplemented by a few small hydroelectric plants. Although additional hydropower could be used in supplying the demand, further development within the Neuse River basin is not considered to be economically justified because of streamflow and head conditions.

8. Recreation.--There is a definite need for expanded recreational facilities to serve the quarter of a million people living in and near the upper Neuse River basin. The nearest reservoir with adequate recreational facilities is the John H. Kerr project on the Roanoke River about 50 miles to the northeast. The expected future growth of the area would further enhance the recreational potential of major reservoirs in this region.

9. Plan of improvement.--The District Engineer finds that there is an immediate and urgent need for improvements to provide flood protection, water supply, water-quality control, and recreation in the Neuse River basin. He notes that treatment of wastes by known methods will not alone suffice to bring the stream to acceptable standards of water quality, and considers dilution of industrial and domestic wastes a necessary factor in maintaining acceptable streamflow conditions. He recommends a general plan of improvement and proposes the construction of reservoirs as needed on the Neuse River and its principal tributaries, and complementary conservation programs by other Federal and State agencies. He proposes as the first step of development the construction of an earth and concrete dam on the Neuse River near the village of Falls in Wake County to provide reservoir storage of 408,000 acre-feet, including 243,000 acre-feet for flood control, 45,000 acre-feet for water supply for the city of Raleigh, and the remaining 120,000 acre-feet for conservation. The estimated first cost of the Falls dam and reservoir is $18,600,000, of which $1,455,000 would be reimbursed by local interests for water supply in accordance with the Water Supply Act of 1958. The annual charges would be $822,000, including $10,000 to be borne by local interests for operation and maintenance of the water supply features. The average annual benefits are estimated at $2,732,000, consisting of $564,000 for flood control, $195,000 for water-quality control, $112,000 for water supply, $1,690,000 for general recreation, and $171,000 for fishing and hunting. The benefit-cost ratio is 3.3 based on a 100-year period of analysis. Table 1 indicates the probable costs and benefits for the 12 remaining reservoirs included in the general plan of improvement, but not recommended for construction at this time.

ENGBR
SUBJECT: Neuse River Basin, North Carolina

TABLE 1
Reservoirs Included in General Plan but not Recommended for Construction

Project	Stream	County	Gross storage (Acre-feet)	First cost	Annual charges	Annual benefits			
						Flood control	Conservation (1)	Recreation (2)	Total
Wilson Mills	Neuse River	Johnston	201,000	$ 9,800,000	$ 427,000	$ 400,000	$ 144,000	$ 387,000	$ 931,000
Beulahtown	Little River	Johnston	81,000	6,200,000	261,000	239,000	24,000	118,000	381,000
Bakers Mill	Little River	Johnston	36,000	6,600,000	263,000	70,000	36,000	97,000	203,000
Little Buffalo	Little Buffalo Creek	Johnston	13,000	1,100,000	48,000	20,000	10,000	42,000	72,000
Buckhorn	Contentnea Creek	Wilson	119,000	4,500,000	193,000	151,000	122,000	492,000	765,000
Wiggins Mill	Contentnea Creek	Wilson	35,000	6,700,000	277,000	80,000	18,000	255,000	353,000
Stantonsburg	Toisnot Swamp	Wilson	48,000	5,100,000	224,000	99,000	16,000	230,000	345,000
Great Swamp	Great Swamp	Wilson	18,000	1,800,000	77,000	25,000	8,000	115,000	148,000
Black Creek	Black Creek	Wilson	17,000	1,500,000	64,000	28,000	4,000	95,000	127,000
Aycock Swamp	Aycock Swamp	Wilson	7,000	550,000	26,000	8,000	5,000	35,000	48,000
Hillsboro	Eno River	Durham	123,000	8,100,000	330,000	100,000	154,000	301,000	555,000
Orange	Little River	Durham	57,000	3,500,000	143,000	70,000	52,000	106,000	228,000
Total			755,000	$55,450,000	$2,333,000	$1,290,000	$ 593,000	$2,273,000	$4,156,000

(1) Includes water supply, low-flow augmentation and irrigation.
(2) Includes fish and wildlife enhancement.

10. Public notice.--The Division Engineer issued a public notice stating the recommendations of the reporting officers and affording interested parties an opportunity to present additional information to the Board. Careful consideration has been given to the communications received.

Views and Recommendations of the Board of Engineers for Rivers and Harbors.

11. Views.--The Board of Engineers for Rivers and Harbors concurs in general in the views and recommendations of the reporting officers. It is the view of the Board that the general plan developed by the District Engineer should be adopted as a framework or guide for the immediate and future water resource developments in the Neuse River basin. The Board concurs with the reporting officers that there is immediate need for the Falls Reservoir, that the project is economically justified, and that the requirements of local cooperation are appropriate. With respect to recreation and fish and wildlife enhancement, the Board notes that application of the cost-sharing standards under the Administration's policy as set forth in H.R. 9032, Eighty-eighth Congress, first session, would not affect the cost sharing recommended by the reporting officers.

12. Recommendations.--Accordingly, the Board recommends that the plan of the District Engineer be approved as a guide for immediate and future development of water resources in the basin; that the Falls dam and reservoir on the Neuse River in North Carolina be authorized for construction for flood control, water supply, water-quality control, recreation, and other purposes, at an estimated cost of $18,600,000 for construction and $120,000 annually for operation, maintenance, and major replacements, generally in accordance with the plan of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable: Provided that, prior to construction of the Falls Reservoir, local interests furnish assurances satisfactory to the Secretary of the Army that they will:

a. Prevent encroachment on the downstream channels that would interfere with the operation of the reservoir; and

b. Pay the United States, in accordance with the Water Supply Act of 1958, as amended, the entire amount of the construction cost allocated to water supply, presently estimated at $1,455,000 and the entire amount of the operation, maintenance, and major replacement costs allocated to water supply, presently estimated at $10,000 annually, the final amounts to be determined after actual costs are known.

The Board further recommends that immediately following authorization of the Falls project detailed site investigations and design be made for the purpose of accurately defining the project lands required; that subsequently, advance acquisition be made of such title to such lands as may be required to preserve the site against incompatible developments; and that the Chief of Engineers be authorized to participate in the construction or reconstruction of transportation and utility facilities in advance of project construction, as required to preserve such areas from encroachments and avoid increased costs for relocations.

13. The net cost to the United States for the Falls dam and reservoir is estimated at $17,145,000 for construction and $110,000 annually for operation, maintenance, and major replacements, after payment by local interests of the costs allocated to water supply.

FOR THE BOARD:

R. G. MacDONNELL
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

SYLLABUS

The District Engineer finds that there is a present need for flood protection, water supply, water-quality control, and recreation in the Neuse River basin, North Carolina. He has determined that the most practical, feasible, and economic means for providing for the water-resource needs of the Neuse River basin over the next 100 years is a general plan consisting of multiple-purpose reservoirs, to be supplemented as needed by local protection projects and complementary conservation programs of other Federal and State agencies. The plan of reservoir development consists of 13 reservoir projects as follows: the Falls and Wilson Mills projects on the Neuse River; the Beulahtown, Bakers Mill, and Little Buffalo projects on Little River; the Buckhorn, Wiggins Mill, Stantonsburg, Great Swamp, Black Creek, and Aycock Swamp projects in the Contentnea Creek basin; the Orange project on Little River in Orange and Durham Counties; and the Hillsboro project on Eno River.

The District Engineer recommends that the general plan for development of the Neuse River basin be approved as a guide for immediate and future development of the basin's water resources. He recommends the immediate construction of the Falls project, located about 1 mile above the village of Falls, N. C., as the initial step of development. He further recommends that development of the water resources of the Neuse River basin be continued, recognizing that a long-range program of development will necessarily require future review and reevaluation to keep it in phase with the ever-changing economic activities of the basin.

The District Engineer finds that the recommended Falls reservoir project would be the key project of any effective plan of development for the Neuse River basin and should be the initial project to be constructed. He estimates that the Falls project would prevent 37 percent of the average annual flood damages in the Neuse River basin, provide a dependable source of water supply for the city of Raleigh, N. C., and provide significant recreation benefits and downstream water-quality-control improvement. He estimates that the total construction cost of the Falls project, at 1963 prices, will be about $18,600,000, with annual costs of $120,000 for operation, maintenance, and replacements. The average annual benefits will exceed the average annual costs by a wide margin. In accordance with the Water Supply Act of 1958, as amended, the city of Raleigh would be required to repay all costs allocated to water supply for the city.

U. S. ARMY ENGINEER DISTRICT, WILMINGTON
CORPS OF ENGINEERS
308 CUSTOMHOUSE
WILMINGTON, NORTH CAROLINA

SAWRM 31 December 1963

SUBJECT: Neuse River Basin, North Carolina; Survey Report

TO: Division Engineer
U. S. Army Engineer Division, South Atlantic

SECTION I - AUTHORITY AND BACKGROUND

1. Purpose. The purpose of this report is to present a general plan of development of the water and related land resources of the Neuse River basin for flood control, water supply, water-quality control, and recreation to meet current and future water-resource needs in the basin.

2. Authority. Authority for this report is contained in the following resolutions:

a. A resolution adopted March 1, 1946:

> Resolved by the Committee on Flood Control, House of Representatives, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be and is hereby requested to review the report on the Neuse River and tributaries, printed in House Document No. 500, 72nd Congress, 2nd Session, with a view to determining whether improvement of the Neuse River between Smithfield and the Wayne County line, North Carolina, in the interest of flood control and allied purposes, is advisable at this time.

A survey report was partly completed under this authority, but work was suspended in early 1950. (The Chief of Engineers authorized the submission of a combined report covering this authority and the following authorities):

b. The following resolution of the Senate Public Works Committee, adopted April 13, 1950, and a companion resolution of the House Public Works Committee, adopted April 21, 1950:

> Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for

Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on Neuse River and tributaries, North Carolina, published as House Document Numbered 500, Seventy-second Congress, Second Session, and subsequent reports, with a view to determining whether any modification of the recommendations contained therein is advisable at this time.

Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the improvement and development of the Neuse River, North Carolina, contained in House Document Numbered 500, Seventy-Second Congress, Second Session, with a view to determining whether any modifications of the recommendations for flood control, navigation, and other purposes, contained therein are advisable at this time.

c. A resolution adopted June 13, 1956:

Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Neuse River, North Carolina, published in House Document No. 500, 72d Congress, 2d Session, and other pertinent reports, with a view to determining whether improvements for flood control, conservation of water resources in the interests of water supply, and for allied purposes, are advisable at this time.

A preliminary-examination report covering this resolution and the two resolutions of 1950 was submitted to the Chief of Engineers in late 1957 recommending that a survey report be made. On February 13, 1958, the Chief of Engineers authorized preparation of a survey report on these three resolutions. On July 28, 1958, the Chief of Engineers authorized combining in that report the survey report on the resolution of March 1, 1946, covering the Neuse River between Smithfield and the Wayne County line. The combined report covering the four resolutions is this present report.

3. Scope of investigations - current report.

a. Scope of report. This report covers the needs for flood protection, municipal and industrial water supply, water-quality control, power, irrigation, and recreation, and presents a general plan of development to meet these needs.

b. Surveys, investigations, and studies. A preliminary

reconnaissance of the Neuse River basin was made by the District Engineer. Field and office surveys, investigations, and studies were made as follows:

(1) Hydrology. This study includes an evaluation of available meteorological and hydrological records, and the analyses of these data with regards to the formulation of a general plan of development for conservation of the water resources of the Neuse River basin. The studies include unit-hydrograph computations, development of flood-routing procedures, peak-flow-frequency analyses, low-flow studies, and the development of hydrologic design criteria for the projects investigated. Hydrologic studies are summarized and presented as appendix I to this report.

(2) Geology. This study includes general information on the geology of the Neuse River basin as well as a geologic investigation including core borings along the centerline of the Falls damsite. The geologic investigation of the foundation conditions at the Falls site was made by the Savannah District. The results of these studies are summarized and presented as appendix II to this report.

(3) Economic base survey. This study, made by the Wilmington District, analyzes the present and expected future economic development of the Neuse River basin in relation to the State and national economic development. This study was based on data furnished by the North Carolina Department of Conservation and Development and from applicable data extracted from publications of various Federal and State agencies. Estimates of general economic trends for the next 50 years were based on these data. Future water-resource needs were correlated to the anticipated economic-development trends. This study is summarized and discussed in appendix IV to this report.

(4) Flood-damage evaluation. These studies, based on detailed field observations along the Neuse River and tributaries, evaluate the average annual flood damages in the basin. The methods and procedures used and the results of this evaluation are summarized in appendix III to this report.

(5) Water supply and water-quality control. This study develops requirements and economic values of water supply and water-quality control. Evaluations for this phase of the study were derived from data prepared by the United States Public Health Service, Department of Health, Education and Welfare. The results of these studies are summarized and presented as appendix V to this report.

(6) Recreation. An analysis of the recreation needs and an evaluation of the potential recreational features of selected project areas were made by the National Park Service, U. S. Department of Interior. The results of their studies are included in this report as appendix IX.

(7) Fish and wildlife. Analysis of the effect of river

development on fish and wildlife resources and measures for enhancement of these resources were provided by the Fish and Wildlife Service, U. S. Department of Interior. Their report is included as appendix VI to this report.

(8) Real estate. Field appraisals of the Falls and Wilson Mills reservoir areas on Neuse River established the land costs, including improvements. These field surveys were conducted by the Savannah District.

(9) Hydroelectric power. The possibility of inclusion of hydroelectric-power generation in the plan was studied in cooperation with the Federal Power Commission.

(10) Mineral resources. The effect of water development on mineral resources is considered negligible at this time.

(11) Project data and cost estimates. Detailed field surveys were made at the Falls damsite by the Wilmington District. Cross sections at Wilson Mills, Bakers Mill, and Wiggins Mill were taken from surveys for prior reports. U. S. Geological Survey maps were used for topography at other damsites. Relocation estimates for roads and bridges for the Falls project were made by the State Highway Commission, Raleigh, N. C. Other relocation estimates were made from field surveys and through contact with utility companies. Preliminary design studies, cost estimates, and cost allocations were made by experienced personnel and were based on investigations and field studies in sufficient detail to support reasonable conclusions. Details of these studies are presented in appendix VII.

(12) Consulation with interested parties. A public hearing was held on April 27, 1957, in Goldsboro, N. C. A detailed summary of this hearing is included in appendix VIII. A complete transcript is available in the office of the District Engineer, Wilmington, N. C.

4. Prior reports.

a. Reports under review. The principal report under review is House Document No. 500, 72d Congress, 2d session, which was submitted to Congress on June 1, 1932, in compliance with the provisions of the River and Harbor Act of January 21, 1927, which directed "Surveys in accordance with House Document No. 308, 69th Congress, 1st session." That report considered the development of waterpower, the control of floods, the need for irrigation, and the improvement of the stream for navigation. The District Engineer concluded that construction of four flood control reservoirs in the basin was economically justifiable on the basis of reported flood losses, and that the costs of such reservoirs should be borne by local interests. It was pointed out, however, that the cost of such projects was greater than the sum that could be assessed against the lands benefited. The Chief of Engineers concurred with the Board of Engineers

for Rivers and Harbors that further improvement of the Neuse River, N. C., by the Federal Government for navigation, in connection with power development, the control of floods, or the needs of irrigation, was not justified at that time.

b. Neuse River, North Carolina, flood control study, preliminary examination. This report, submitted by the District Engineer on October 16, 1957, was the initial step in review of House Document No. 500, 72d Congress, 2d session, in response to the resolution adopted in 1950 and 1956. The report includes data on hydrology, flood damages, power studies, economic development, and land enhancement. The District Engineer concluded that a satisfactory plan of improvement might be economically justified for development of the Neuse River basin, and recommended that a survey report be made. The recommendation of the District Engineer was concurred in by the Division Engineer and the Chief of Engineers who in turn directed that the present survey be made.

c. Other reports. Other recent reports of limited scope, covering a specific project or watershed projects within the Neuse River basin, are briefly described below.

(1) Core Creek. A survey report was authorized in 1945 on flood control along Core Creek, a minor tributary of the Neuse River below Kinston, N. C. Intermittent studies were made under the authority until December 1956, when the Chief of Engineers approved study under the special continuing authority for small projects not specifically authorized by Congress contained in Section 205 of the Flood Control Act of 1948, as amended. In January 1959 the Chief of Engineers approved a project under the Section 205 authority which would reduce minor flooding on 6,000 acres of agricultural land. Local interests have formed the Core Creek Drainage District to furnish required local cooperation. Construction began in late 1963 and completion is expected in the fall of 1964.

(2) Swift Creek. An investigation was begun in late 1960 under the special continuing authority in Section 205 of the Flood Control Act of 1948, as amended, to determine whether flood control is warranted on Swift Creek, a major tributary of the Neuse River entering above New Bern, N. C. In September 1955, Hurricane Ione flooded about 22,100 acres along Swift Creek. In June 1963 the Chief of Engineers approved a project estimated to have a Federal cost of $877,000. The project provides for clearing and snagging of the lower 16.5 miles of Swift Creek and realigning and enlarging about 16.2 miles in the upper portion. Construction planning is in progress.

(3) Neuse River barrier project. Local interests in and around New Bern, N. C., desire hurricane-flood protection, and have indorsed a proposal for a barrier across the Neuse River estuary from Wilkinson Point to Cherry Point. The District Engineer's report on this project was submitted to higher authority on 15 August 1963

and is now under review. This project would provide for a barrier of dredged fill, about 10,400 feet in length. A navigation opening, 350 feet wide at its bottom, 18 feet below mean sea level, would be armored by stone on its sides and bottom. The first cost of the structure is estimated as $14,900,000.

SECTION II - DESCRIPTION OF BASIN

5. Neuse River Basin. The Neuse River basin lies wholly within the eastern part of North Carolina. It is approximately 180 miles long and has a maximum width near the center of approximately 46 miles. The Neuse River is formed by the confluence of the Eno and Flat Rivers about 8 miles north of the city of Durham, N. C. The Neuse River basin has a total drainage area of approximately 5,710 square miles. A map of the basin is shown as plate 1.

6. Stream characteristics. The Neuse River and its headwater tributaries rise in the hilly Piedmont section of North Carolina, then flow through a belt, or zone, known as the "Fall Line," where the streams flatten in slope as they reach the Coastal Plain. Streams in the lower reaches of the Coastal Plain tend to be sluggish in flow, and swamps and marshes are predominant. Profiles of the Neuse River and principal tributaries are shown on plate 4, and pertinent data on streams are given in table 1.

TABLE 1

Pertinent data on Neuse River and tributaries

Stream	River mile above New Bern (mi.)	Drainage area (sq. mi.)	Elevation at low water (ft., m.s.l.)
Flat River	222	184	232
Eno River	222	260	232
Neuse River:			
Falls damsite	192	760	212
Wilson Mills damsite	150	1,170	114
Smithfield, N. C.	145	1,251	103
Goldsboro, N. C.	95	2,390	45
Kinston, N. C.	47	2,690	10
New Bern, N. C.	0	4,467	0

TABLE 1--Continued

Pertinent data on Neuse River and tributaries

Stream	River mile above New Bern (mi.)	Drainage area (sq. mi.)	Elevation at low water (ft., m.s.l.)
Neuse River at mouth	-37	5,710	0
Crabtree Creek	172	150	158
Swift Creek (upper) and Middle Creek	143	295	100
Little River	95	323	45
Contentnea Creek	30	849	7
Swift Creek (lower)	8	322	0
Trent River	0	519	0

7. Topography. The Neuse River basin lies within the Piedmont Plateau and Coastal Plain. The boundary between these two regions is a belt, or zone, about 40 miles in width, known as the "Fall Line." The northwestern boundary of this zone crosses the basin near Raleigh and the southeastern edge passes near Wilson. The Piedmont Plateau consists largely of rolling hills and deeply eroded valleys. The tops of the hills are remnants of a former peneplain which has been greatly weathered. The elevation of the Piedmont Plateau varies in the Neuse River basin from 800 feet above mean sea level at the headwaters of the stream to about 200 feet where it merges into the Coastal Plain. The remainder of the drainage area of the Neuse River is in the Coastal Plain. The topography in this region varies from rolling sandhills at its western boundary to almost level land as it approaches the Atlantic Ocean, its larger portion being gently rolling in character. The stream valleys are relatively wide, with large areas subject to overflow.

8. Geology.

a. The Piedmont Plateau. The surface mantle of the Piedmont Plateau consists largely of soils of slate or granite origin, the principal types being composed of sand and clay in varying mixtures. The topsoils are usually shallow and are underlain by slate, sandstone, quartz, and granite, or other igneous material. The large streams have, in general, cut their beds down to basement rocks which are igneous in origin. Faults and fractures are unusual in this

region, and there are generally good foundations for dams. It is in this region that most of the reservoir sites are found.

b. The Coastal Plain. The Coastal Plain is composed largely of sand, gravel, and marine deposits of comparatively recent origin. The whole is underlain by the basement rocks.

SECTION III - ECONOMIC DEVELOPMENT

9. As a background for an assessment of the water-resource-development needs of the Neuse River basin, a comprehensive economic study was made of existing conditions and the future outlook.

10. Several indices of the national economic scene were related to those for North Carolina and for the Neuse River area. These relationships were based on past performance, modified to account for anticipated changes in the economic environment both nationally and locally.

11. The economic study for the Neuse River basin was based on economic information available for the 16 counties which are wholly or partly in the Nuese River basin. The 16 counties, referred to as the "Neuse River area", have a total area of 8,120 square miles and a population of 897,606. The Neuse River basin itself has an area of 5,710 square miles and a population of about 634,000. Figure 1 is a map showing the Neuse River area and its relation to the Neuse River basin.

12. Table 2 is a summary of the population of the principal municipalities in the basin in 1960.

TABLE 2

Population of principal municipalities

	1960 population
Raleigh	93,931
Durham [1]	78,302
Goldsboro	28,873
Wilson	28,753
Kinston	24,819
New Bern	15,717
Smithfield	6,117
Roxboro	5,147

[1]City of Durham is on the divide between the Neuse and Cape Fear basins. About 50 percent of the 78,302 population is in the Neuse basin.

47-829 O-65—4

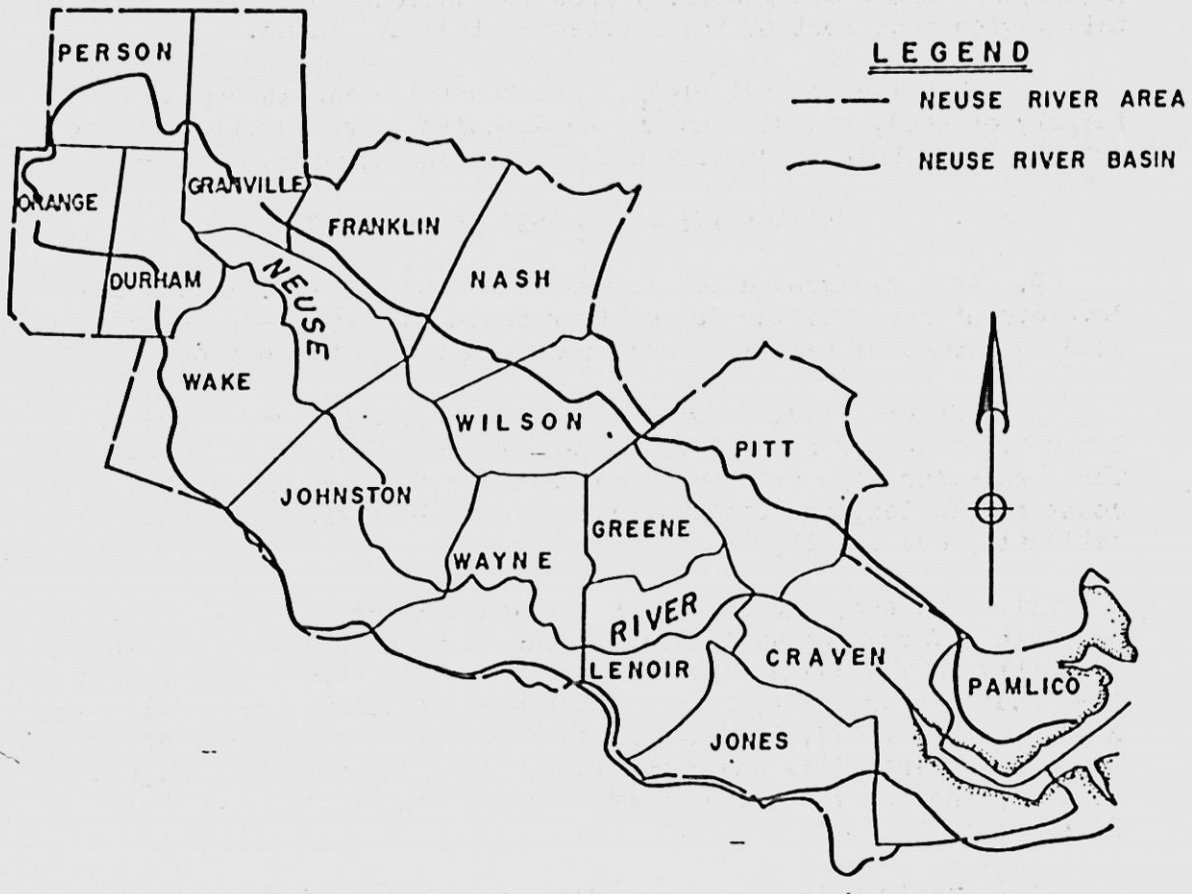


FIGURE 1. NEUSE RIVER AREA IN RELATION TO NEUSE RIVER BASIN

13. Table 3 is a summary of economic projections for the Neuse River area.

TABLE 3

Summary of projections for Neuse River area
(monetary values, in constant 1960 dollars)

Item	Unit	1960 (actual)	1970	2020 (projection)
Population	Thousands	897.6	1,040	2,200
Personal income				
Total	$ Millions	1,085	1,770	17,200
Per capita	Dollars	1,209	1,700	7,800
Employment	Thousands	302.2	350	740
Number of households	Thousands	230.3	270	600

14. Results of the study point to an expected acceleration of economic life in the basin and the importance of the basin's development to the State. Details of the economic study are in appendix IV.

SECTION IV - HYDROLOGY

CLIMATOLOGY

15. Climate. The Neuse River basin has a temperate climate, with warm summers and usually mild winters. Extreme temperatures are modified by the effects of the Atlantic Ocean and prevailing moist winds from the southwest. The Appalachian Mountain Range, located to the west of the basin, forms a partial barrier to the cold masses moving southeastward from the interior of the country. The average annual temperature ranges from about 60° F. in the western portion of the basin to about 63° F. near the coast. Subfreezing temperatures are of short duration, and the freeze-free growing season ranges from about 200 days in the west to about 240 days near the coast. The extreme temperatures of record in the basin are 108° and -2° F.

16. Precipitation. There are approximately 30 stations located in or near the Neuse River basin at which precipitation data are collected. The locations and types of stations currently operating in the area are shown on plate I-1, appendix I. Showers and thunderstorms produce most of the precipitation during the spring and summer, while the heaviest and most extended rains in the region are experienced from hurricanes and tropical storms, which usually occur during late summer and autumn. Light snow is not unusual, but it constitutes a negligible portion of precipitation and does not affect runoff appreciably. The mean annual precipitation ranges from about 44 inches at the northwestern end of the basin to 56 inches near the coast at New Bern. The rainfall is generally well distributed throughout the year, but is greatest during the summer and early fall. Occasional droughts cause damage to crops in the basin and shortages of public water supply. Precipitation extremes affecting the basin are tabulated in table I-2, appendix I, and total monthly and annual data are presented in table I-3, appendix I.

17. Storms. Flood-producing storms have occurred in all seasons of the year in the Neuse River basin. Two general types of storms which produce major floods over the basin are thunderstorms and hurricanes. Thunderstorms, accompanied by torrential rains of short or sustained duration, may occur over the basin during any season of the year. North Carolina lies in the path of tropical hurricanes as they move northerly from their origin north of the Equator in the Atlantic Ocean. These hurricanes usually occur in the late summer and fall and have caused the heaviest rainfall and largest floods throughout the basin. Storms which have produced the most severe floods in the Neuse River basin are described in appendix I.

RUNOFF AND STREAMFLOW DATA

18. General. The U. S. Geological Survey is the Federal agency primarily responsible for the collection and tabulation of surface-water and ground-water data and presently operates 15 stream-gaging stations in the Neuse River basin. The U. S. Weather Bureau also records daily river stages at four locations along the Neuse River. Data collected and compiled by both agencies are readily available in annual publications and are considered adequate for this study. The locations of stream-gaging stations within the Neuse River basin are shown on plate I-1, appendix I; and table I-4, appendix I, presents essential gaging-station descriptive data.

19. The long-term average of runoff for the basin amounts to about 30 percent of the annual rainfall. At the Northside gaging station in the upper portion of the basin, runoff amounts to about 13.8 inches of rainfall annually, or about 31 percent of the average annual rainfall in that locality. At New Bern, near the coast, the annual runoff for the basin amounts to about 14.5 inches of rainfall, or about 29 percent of the average annual rainfall for the eastern portion of the basin.

20. Floods of record. Most of the stream-recording network throughout the Neuse River basin was installed between 1927 and 1930. Prior to that time, reliable information with which to adequately define the magnitude and behavior of major floods throughout the basin is incomplete. From old news records and information from long-time residents of the basin, severe flooding is known to have occurred in the basin during the years 1865, 1877, and 1901, but there is very little definite information on these floods. In 1908, one of the greatest, if not the greatest, floods known to have occurred in the Neuse River basin produced a stage of 27.1 feet at Smithfield and did widespread damage. Since the installation of the stream-recording network (1927-1930), the September 1945 flood caused the highest flood stages along the Neuse River. The September 1945 flood was a hurricane-associated storm, and flood stages were exceeded for 5 days along the Eno and Flat Rivers and from 10 to 21 days along the Neuse River. At Smithfield, a peak stage of 26.4 feet was reached during the 1945 flood. Estimates indicate that this flood was probably exceeded by August 1908, July 1919, and October 1929 events along the Neuse River at Goldsboro and Kinston. Major flood events of record, in order of magnitude and at various gaging stations, are shown in table 4.

TABLE 4

Major flood events of record, in order of magnitude, at various gaging stations, Neuse River basin, N. C.

Gaging station	Known magnitude	Beginning of event	Flood stage exceeded (days)	Peak stage (ft.)	Peak discharge (c.f.s.)	Runoff (in.)
Eno River at Hillsboro	1	18 Sept. 45	5	20.0	11,000	5.14
	2	2 Oct. 29	4	18.0	6,750	2.51
	3	15 July 44	2	17.3	5,530	1.31
Neuse River at Northside	1	18 Sept. 45	10	31.0	36,600	6.62
	2	3 Oct. 29	6	28.6	26,600	4.60
	3	27 July 38	8	26.9	22,100	1.56
	4	28 April 28	5	24.4	15,800	1.69
Clayton	1	19 Sept. 45	13	22.1	22,900	5.41
	2	3 Oct. 29	7	21.6	22,000	4.05
	3	23 July 19	-	21.2	21,200	-
	4	1 Dec. 34	9	18.7	17,000	3.02
Goldsboro	1	5 Oct. 29	-	27.3	38,600	-
	2	23 Sept. 45	17	26.7	30,700	4.06
	3	11 April 36	18	25.3	26,300	3.88
	4	8 Sept. 55	12	24.4	23,200	2.62
Kinston	1	July 19	-	25.0	39,000	-
	2	9 Oct. 29	-	22.5	28,000	-
	3	27 Sept. 45	21	22.4	25,900	4.05
	4	14 April 36	38	20.9	24,400	6.02
	5	12 Sept. 55	13	20.8	21,100	2.43

21. Minimum flows. Although there is usually an abundance of precipitation throughout the Neuse River basin, dry spells with near-drought conditions are not uncommon occurrences. The most severe and sustained drought periods usually occur in late summer or fall. Record low flows along most of the streams in the basin were recorded at gaging stations in the fall of 1932 and 1954, as shown in table I-4, appendix I. Precipitation for the months of June through September in 1932 averaged between 25 and 60 percent below normal throughout the basin, and for the same period in 1954, precipitation averaged between 50 and 60 percent below normal over the basin. On each of these occasions, several public water supplies were at critical lows, requiring rationing in some areas; many wells were seriously low and some became dry; and no flow to close-to-no flow was recorded at a number of stream-recording stations in the basin.

STANDARD PROJECT FLOOD

22. The standard project flood is an estimated, or hypothetical, flood which represents the most severe flood-producing storm that is considered reasonably characteristic of the region in which the drainage basin is located, excluding extremely rare combinations. The flood, developed from generalized studies of meteorological and hydrological conditions in the region, serves as a standard in comparing the degree of protection provided by flood control projects in different localities. For the projects evaluated in the Neuse River basin, the standard project flood was used as the criterion for establishing the upper limits of reservoir relocations and as the spillway design flood for small sites in rural areas.

PROBABLE MAXIMUM FLOOD

23. The probable maximum flood represents the most severe flood-producing storm that would result from the most critical combination of meteorological and hydrological conditions that are considered probable to occur over an area. The critical meteorological conditions are based on a generalized evaluation of regional storm events maximized to produce the most effective combination of factors controlling precipitation intensity. A probable maximum flood, developed for the drainage area above reservoir sites studied in the Nuese River basin, was adopted as the spillway design flood and, therefore, was used as the basic criteria for spillway design and for the establishing of freeboard allowances. Detailed evaluations of probable maximum floods and spillway design floods are included in appendix I.

SECTION V - THE FLOOD PROBLEM

EXTENT AND CHARACTER OF FLOODED AREA

24. General. Above the fall line and in the Piedmont area the basin is hilly, with narrow flood plains. Below Smithfield the basin generally flattens and the flood plains become wider. Flood damage is primarily rural and consists of destroyed crops and reduced yields, and damage from inundation or impairment of drainage. In general, all the main highways and railroads that cross the flood plains throughout the basin have been elevated so that they are flooded only by extreme stages. However, many miles of secondary roads are flooded frequently. The amount of cultivated land and wooded land, as well as the determination of current and expected future farming practices, was derived from data obtained directly from county agents, other State and Federal agricultural agencies, and farmers cultivating the areas subject to floods.

25. Urban flooding. Considerable urban flooding is experienced in the Neuse River basin during larger floods in the Coastal Plain. The greatest urban flooding is at Goldsboro, Kinston, and Smithfield.

26. Rural development. The flood plains of the minor tributaries are generally well developed, primarily because of the heavier, more fertile soils on the flood plains as compared to the adjacent uplands. Johnston and Wayne Counties contain the principal agricultural areas of the Neuse River basin. The principal crops are tobacco, cotton, corn, soybeans, wheat, and hay.

27. Extent of flood plain. The total flood-plain area under the scope of this study is approximately 235,000 acres. This area is the area of preponderant damage for which flood-protection measures were considered in this report. As shown on figure 2, 68 percent of this area, or 159,000 acres, lies along the main stem of the Neuse River; 22 percent, or 51,000 acres, is on Contentnea Creek; 6 percent, or 15,000 acres, is on Trent River; and 4 percent, or 9,000 acres, lies along Little River. A breakdown of agricultural and non-agricultural land use, by tributaries and stream reaches, is shown in table III-2, appendix III.

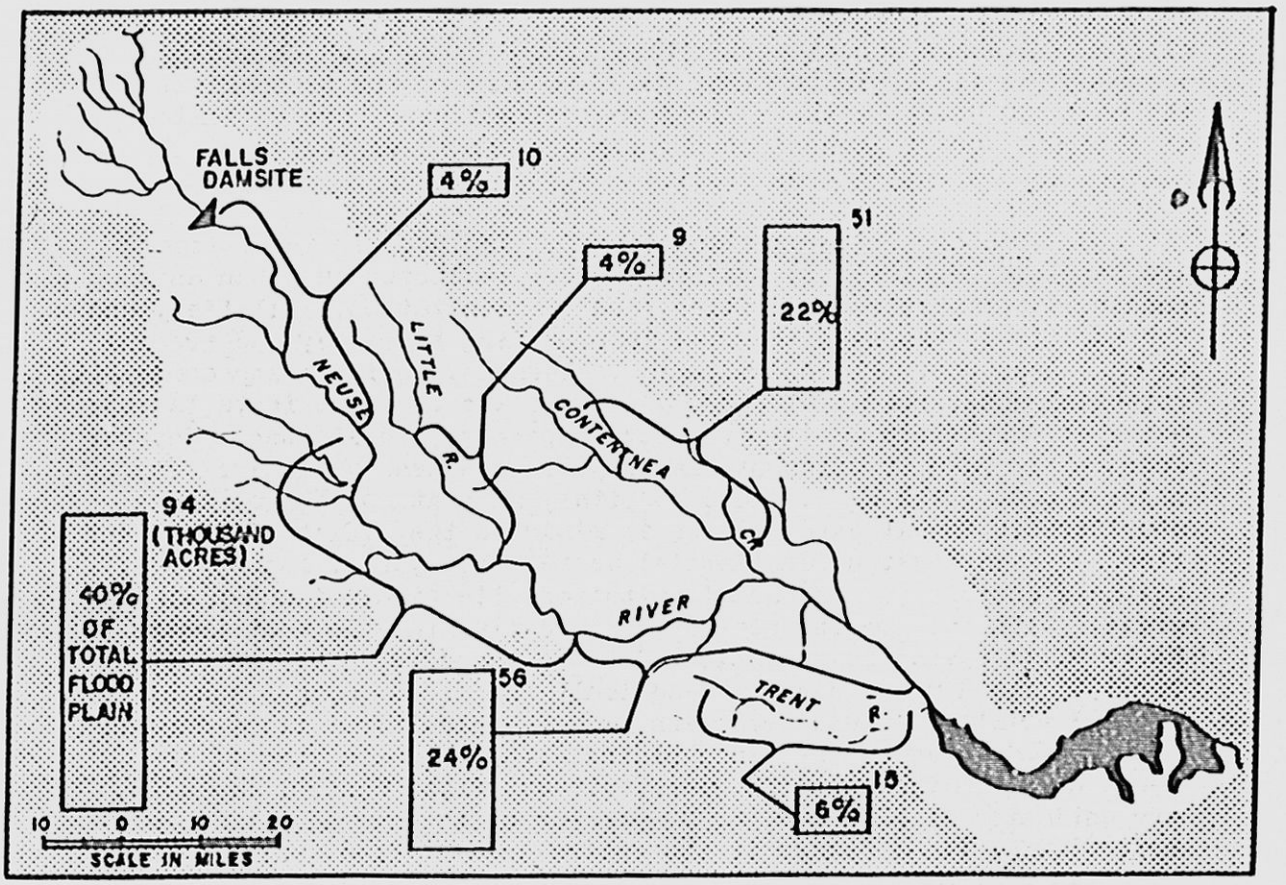


FIGURE 2. DISTRIBUTION OF FLOOD-PLAIN LAND ALONG THE MAIN STEM AND MAJOR TRIBUTARIES OF THE NEUSE RIVER, IN THOUSANDS OF ACRES.

FLOOD DAMAGES

28. General. A considerable amount of flood damage occurs annually throughout the Neuse River basin. Most of the flood damage occurs on the broad flood plains of the Neuse River below Smithfield and on Contentnea Creek below Wilson. The losses result from tangible physical damage to agricultural property and crops, public roads and utilities, and urban property. The average annual losses used in this report are based on detailed property surveys, statistical data, and consultations with farmers and State agricultural and urban officials.

29. Agricultural flood losses. The value of a crop in the field depends significantly upon its maturity; therefore, the damage from flooding varies, not only with the area flooded but also with the season of the year. For example, it is estimated that a recurrence of the September 1945 flood would cause $2.4 million damage to agricultural properties along the main stem of the Neuse River. This flood is the maximum flood of record on the Neuse River main stem. Should a flood of this magnitude occur in July instead of September, agricultural damages would amount to an estimated $4.4 million. Average annual agricultural flood damages which would occur on the flood plains along the main stem of the Neuse River in the next 100 years, without flood control measures, are estimated at $651,000, or 71 percent of the average annual agricultural flood damages in the entire area studied - $915,000.

30. Non-agricultural flood losses. Included in these losses are tangible physical and business losses inflicted on urban and industrial properties, utilities, and transportation facilities, and the additional expenses incurred in providing emergency and precautionary measures. Flood damage to residences, business and commercial establishments, roads, streets, and water and sewerage installations occur at Smithfield, Goldsboro, Seven Springs, and Kinston. Seymour Johnson Air Base at Goldsboro is subject to extensive damage from major floods. The N. C. State Hospital, also at Goldsboro, makes considerable annual expenditures to minimize the effects of frequent flooding. In Kinston, residential areas, brickyards, lumberyards, business establishments, and institutions lie within flood-plain areas. With the present non-rural flood-plain development in the Neuse River basin, it is estimated that a recurrence of the September 1945 flood would cause non-agricultural flood damages amounting to $1.3 million. The average annual non-agricultural flood damages which would occur on the flood plains along the main stem of the Neuse River in the next 100 years, without flood control measures, are estimated at $278,000, or 82 percent of the average annual non-agricultural flood damage in the entire area studied, which is estimated at $341,000.

31. Summary of flood-damage-evaluation studies. Table 5 summarizes the results of the flood-damage-evaluation studies, without flood control improvement, for the flood plain in its 1962 stage of

development; then in its stage of development expected to be reached in 50 years; and the average annual damage over 100 years in the future, discounted to an average annual equivalent present value. The estimates of the future flood damages are based on anticipated future growth up to 50 years, and the same level of development from then to the end of 100 years. Evaluation of these damages is discussed in detail in appendix III.

TABLE 5

Summary of average annual flood damages in the Neuse River basin

Location and item	Annual damages		
	Based on current flood-plain development	Based on flood-plain development 50 years hence	Discounted average annual flood damages (100-yr. period)
1. Neuse River main stem			
a. Agricultural	$500,500	$ 798,800	$ 650,800
b. Non-agricultural	229,900	324,700	277,800
c. Total	$730,400	$1,123,500	$ 928,600
2. Contentnea Creek			
a. Agricultural	$159,400	$ 251,200	$ 205,600
b. Non-agricultural	46,600	58,000	52,400
c. Total	$206,000	$ 309,200	$ 258,000
3. Little River			
a. Agricultural	$ 31,800	$ 50,200	$ 41,100
b. Non-agricultural	3,400	4,300	3,800
c. Total	$ 35,200	$ 54,500	$ 44,900
4. Trent River			
a. Agricultural	$ 14,000	$ 23,900	$ 17,900
b. Non-agricultural	5,600	8,300	6,800
c. Total	$ 19,600	$ 32,200	$ 24,700
5. Neuse River basin			
a. Agricultural	$706,000	$1,124,000	$ 915,000
b. Non-agricultural	285,000	395,000	341,000
c. Total	$991,000	$1,519,000	$1,256,000

SECTION VI - EXISTING FLOOD CONTROL AND NAVIGATION PROJECTS

CORPS OF ENGINEERS FLOOD CONTROL PROJECTS

32. The only existing flood control project of a permanent nature constructed on the Neuse River by the Corps of Engineers is the

cutoff at Goldsboro. This project, authorized by the Flood Control Act of August 18, 1941, consists of a flood channel across two adjoining bends of the river. The project was constructed in 1947-1948 at a cost of $50,400. It was estimated that the cutoff reduced damages from the 1955 hurricanes by as much as $57,000.

33. Under the emergency stream-clearing authority granted the Chief of Engineers in the Flood Control Act of 1938, as amended, a total of $42,300 has been spent on Contentnea Creek and $49,769 on Trent River. This work was done at various times between 1941 and 1957.

CORPS OF ENGINEERS NAVIGATION PROJECT

34. The existing navigation project provides for a channel 12 feet deep and 300 feet wide from Pamlico Sound to New Bern, thence 4 feet deep to Kinston, and 3 feet deep to Smithfield during 9 months of the year. For all practical purposes, it may be said that the Neuse River is open to shallow-draft commercial vessels from the Intracoastal Waterway below New Bern to New Bern and immediate vicinity. Due to low bridge clearances and shallow depths, the remaining portion of the navigable waters is confined to small boats and barges.

IMPROVEMENTS BY OTHER FEDERAL AGENCIES

35. Improvements by U. S. Department of Agriculture. The Soil Conservation Service, U. S. Department of Agriculture, cooperates with local soil-conservation districts which cover the entire watershed of the Neuse River. This agency works with individual farmers in preparation of plans for using agricultural lands most efficiently and for treating the land according to its needs for protection and improvement, which may also include construction of farm ponds, drainage improvements, and flood-detention structures. Several small reservoirs were recently completed on Bear Creek and tributaries in the central part of the basin, which will provide flood protection along Bear Creek.

VIEWS OF LOCAL INTERESTS

36. Public hearing. A public hearing was held by the District Engineer, Wilmington District, in Goldsboro, N. C., on April 27, 1957, with over a hundred people in attendance. It was the common desire of those attending the hearing that the United States undertake flood control improvements. A digest of the public hearing is included as appendix VIII.

SECTION VII - NEEDS FOR WATER-RESOURCES DEVELOPMENT

WATER-SUPPLY NEEDS

37. General. There is usually an abundance of water in the Neuse River basin for present needs, both in the main stem and in its

larger tributaries; however, additional water supply is required to meet the present and future needs of the basin in dry years. The growing basin population, increasing per-capita consumption rates, industrial expansion, and the widespread installation of irrigation equipment have caused an upsurge in the use of water.

38. In the Piedmont section of the basin, large water users such as the cities of Durham and Raleigh must obtain their water from surface streams. Large mills and industrial plants must also obtain most of their water from private or public surface supplies. Several small towns and industries in the Piedmont section obtain their water from wells.

39. In the Coastal Plain, high-yielding wells serve as the major source of water supply for urban areas as well as for large industry. Goldsboro is the only city in the Coastal Plain region of the Neuse River basin which obtains its water from a surface source; however, it can be expected to become increasingly difficult in the future for the other cities in the Coastal Plain to continue satisfying all of their water needs from ground-water supplies.

40. Municipal water supply. Public water supplies, such as those maintained by cities and towns, include water for domestic, commercial, industrial, public, and municipal uses. In 1950, there were 12 public surface-water supplies in the basin, which served an extimated population of 245,000 people with 26.5 million gallons of water per day. In addition to this, there were 40 communities that were served by ground-water supplies. These communities served an estimated population of 121,300 people with 12 million gallons of water daily. Thus, the per-capita consumption rate of water for the basin in 1950 averaged about 105 gallons per day.

41. The national average of municipal water use in 1954 was estimated to be 147 gallons per capita per day, with the possibility of this increasing to 185 gallons per capita per day by 1980 and to 225 gallons per capita per day by the year 2000, with a possible leveling off thereafter. Municipal requirements for the Neuse River basin are expected to follow the national trend, although at more conservative rates. The basin consumption rate was estimated to be 123 gallons per capita per day in 1960, 131 gallons per capita per day by 1980, and 144 gallons per capita per day by 2010. Based on an annual urban population growth in the basin of 2.2 percent, projected municipal water requirements are presented in table 6.

TABLE 6

Projected municipal water requirements in the Neuse River basin

Item	1960	1980	2010
Population served	356,000	615,000	1,055,000
Estimated per-capia use (in gallons per day)	123	131	144
Total requirement (in million gallons per day)	44	74	152
Estimated requirements from surface supplies (in million gallons per day)	31	52	106

42. Raleigh water needs. The above data show the overall municipal water requirements, some of which will require development of new surface-water supplies. The greatest immediate need for additional municipal water supply is at Raleigh. At present the city of Raleigh gets its water from small reservoirs on Walnut and Swift Creeks. The 1960 average daily use was about 9.8 million gallons and the maximum daily use was 14.8 million gallons. The safe yield of the present supply will be exceeded in a relatively short time. A new source adequate for long-range expansion is needed, and the Neuse River is being considered as the logical choice. The average daily water requirement is predicted by the United States Public Health Service to be about 45 million gallons by 2010 and 112 by 2060.

43. Durham water requirement. The city of Durham gets its water supply from its reservoir, Lake Michie, on Flat River. This source is adequate for immediate needs and is capable of enlargement to meet the needs for some time in the near future. After that, an additional source will be needed. The present average daily use at Durham is 16 million gallons. The Public Health Service predicts the 2010 use to be 29 million gallons and the 2060 use to be 65 million gallons.

44. Industrial water requirements. This category includes water requirements for self-owned and self-operated water supplies, such as manufacturing and processing industries, Federal and State installations, and industrial cooling. By 1950, 33 industries throughout the Neuse River basin were using 5.7 million gallons of water per day from surface supplies and 3.8 million gallons per day from ground water. In addition to this, four steam-electric generating plants were using approximately 240 million gallons of surface water each day for cooling. The largest requirement for cooling

water is at the generating plant of the Carolina Power and Light Company which uses up to 158 million gallons per day from the Neuse River. The factors that have brought about the present industrial development of the Neuse River basin are expected to continue in the future. The expected future industrial growth includes industries requiring large amounts of water, such as textile, chemical, and pulp and paper products industries. Some of the future water requirements cannot be met in dry years without additional supply from reservoir storage. Table 7 shows the estimated requirements for industry in the Neuse River basin.

TABLE 7

Projected industrial water requirements in the Neuse River basin (in millions of gallons per day)

Item	1960	1980	2010
Total process and consumption requirements	12	20	42
Estimated demand from surface supplies	7	12	25
Estimated cooling requirements	300	500	1,100

45. Agricultural water needs. Since agriculture plays a very important role in the overall economy of the Neuse River basin, there is an accelerating trend toward using surface water for irrigation. In 1960, there were approximately 17,000 acres of agricultural land being irrigated in the basin. The projected agricultural irrigation needs are estimated by assuming an average annual rate of increase of irrigable land of 2½ percent and a use rate of 2 acre-feet of water for each acre of crop irrigated. The use rate includes an allowance for evaporation and seepage losses. The projected needs for agricultural irrigation needs are shown in table 8.

46. Summary of water needs. The following table summarizes the estimated total water-supply requirements for the Neuse River basin to the year 2010; investigations were also made to the year 2060, the total evaluation period of this report. It is imperative that these requirements be met in order for the general economy of the Neuse River basin to achieve its potential. Criteria used in determining storage requirements to meet the estimated water-supply needs of the basin are presented in appendix V.

TABLE 8

Summary of annual water supply needs for the Neuse River basin (in millions of gallons per day)

Item	1960	1980	2010
Municipal water supply	44	74	152
Industrial process water[1]	12	20	42
Agricultural water supply	30	49	101
Total water supply needs[1]	86	143	295

[1]Does not include water for cooling.

WATER-QUALITY-CONTROL NEEDS

47. Present stream-water quality. The waters of the main stem of the Neuse River have been adversely affected by municipal and industrial waste discharge originating in the highly developed areas. Dyes and chemicals discharged into the Neuse River at a number of places are not only detrimental to fish and aquatic life, but also discolor the water and make it unsuitable for practically all uses. A survey and classification report prepared by the Wildlife Resources Commission, Raleigh, N. C., in 1962 states that certain industrial wastes are affecting the flavor of fishes to such a degree that the fishermen will not take these fish for human consumption. Fish populations in the Piedmont area of Neuse River are now practically reduced to the hardier species such as catfish and suckers. The General Assembly of North Carolina created the North Carolina State Stream Sanitation Committee on April 6, 1951, to protect the State's water supplies, from the standpoint of health, recreation, fishing, agriculture, industry, and animal life. Although some progress has been made in abating pollution since initial pollution studies by this Committee began in 1954, continued growth in these areas requires an abundance of water of a quality satisfactory for both industrial and domestic consumption. The major sources of pollution in the basin come from the Durham and Raleigh areas, and according to the Committee Pollution Survey Report, dated 1959, the total pollution load of the Neuse River basin has a domestic population equivalent in excess of 494,000 before treatment while serving a total population of approximately 300,000. This indicates that approximately 40 percent of the basin pollution population equivalent is industrial waste.

48. Existing treatment works. According to the N. C. State Stream Sanitation Committee's Pollution Survey Report, dated 1959, there are 88 significant sources of pollution within the Neuse River basin. Seven of these are quarries where stone-washing operations result in a highly turbid waste, relatively free from organic matter. Six of these quarries provide treatment for this waste in the form of settling ponds. Of the remaining 81 sources of pollution(largely organic in character), 37 provide no type of treatment; 19 provide secondary-type treatment, with an overall reduction in pollution of 77 percent; while 25 provide primary-type treatment, with an overall reduction of only 18 percent. The overall reduction in pollution, resulting from all treatment in the basin, is but 26 percent. The type of treatment varies from the well-operated sand-filter system that removes up to 90 percent or more of the population equivalent, to the grease trap that removes only a token amount.

49. Stream-quality objectives. The State Stream Sanitation Committee has established criteria for classifying streams according to best usages of water and quality and purity requirements to meet Public Health Service standards. Under this program the streams are to be brought to the required standards by additional treatment works within a reasonable length of time.

50. Need for increased streamflow. There is a definite movement of the population from the rural areas of the Neuse River basin to the urban areas. This is indicated by the steady growth of the towns and cities and the decrease in the number of farms. Industrial development of the basin is expected to continue at an increasing rate. This development will increase the volume of waste discharged into the streams, while simultaneously increasing the need. To maintain present water quality, additional treatment plants will have to be provided at a rate commensurate with the population and industrial growth. Even with the most efficient treatment plants operating at near 90 percent efficiency, there will still be a growing amount of pollution entering the streams of the basin as the industrial development increases. This is particularly true where there is growth of textile, chemical, and woodpulp industries. The effluent of these industries is very difficult to treat, and it is practically impossible to remove all objectionable materials. Unless means are provided to increase minimum streamflows, these residual wastes could make the maintenance of high water-quality standards very difficult.

HYDROELECTRIC POWER NEEDS

51. The power needs of the basin are met principally by steam-electric generating plants. A small amount of power is generated by a few small hydroelectric plants. A 1,500-kilowatt hydroelectric plant at Lake Michie is the largest hydroelectric plant in the basin. The power demand is growing steadily in the Neuse River basin, as elsewhere. Any additional hydropower which could be generated economically in competition with modern steam-electric powerplants could be used to assist in supplying the demand. However, the conditions

of streamflow and head for generating hydroelectric power in this basin are unfavorable in comparison with neighboring basins which have their headwaters in the mountains. No very appreciable amount of future power requirements could be met by hydroelectric plants in this basin. The possibility of developing a small amount of hydroelectric power is discussed in later paragraphs.

NAVIGATION NEEDS

52. An existing 12-foot-depth Federal navigation channel provides access between New Bern and the Atlantic Intracoastal Waterway at the mouth of the Neuse River. This channel is used for commercial navigation. Above New Bern, there are minor authorized shallow-draft channels for 3- to 4-foot depth to Smithfield on the Neuse and for 4-foot depth to Trenton on the Trent River which are not in active use for commerce. There is no demonstrated need or justification for improvement of the Neuse River other than in the locality of New Bern. Some interest was expressed in 1957 in promoting commercial navigation to the vicinity of Raleigh. This would require an extensive system of locks and dams which would require for its justification a very large commerce. No prospect for large movements of commerce of the type which would use such a waterway is known of at this time.

FISH AND WILDLIFE NEEDS

53. Stream pollution has had a detrimental effect on fish and wildlife resources, particularly in the upper reaches of the Neuse River. Fishing and hunting are carried on most extensively in the lower reaches of the main stem of the Neuse River, upon its tributaries, and in the various lakes and ponds. The fishery resource consists chiefly of white perch, yellow perch, striped bass, weakfish, hickory shad, chain pickerel (jack), largemouthed and smallmouthed bass, warmouth, bream, and other sunfishes, catfish, and suckers. Wildlife consists of both large and small game, including deer, squirrel, turkey, quail, dove, and a variety of waterfowl. Construction of reservoirs would destroy some wildlife habitat and some of the stream fishery. This would be replaced by a reservoir fishery which would have much more productivity and utilization. There are no public game preserves or wildlife refuges presently located in the basin.

OUTDOOR-RECREATION NEEDS

54. Three small State parks, a number of municipal parks, approximately 30 small natural lakes, and about the same number of manmade lakes afford a variety of forms of recreation on a rather limited scale in proportion to the population. The largest lake in the watershed is Lake Michie on Flat River in Durham County, which has an area of approximately 550 acres. Hunting, fishing, and camping are the sporting activities generally engaged in along the lower reaches of the main stem of the Neuse River and along the Trent River. Contentnea Creek is one of the most noted fishing creeks in the

basin. About a quarter of a million people live within easy driving distance of the proposed Falls reservoir, later considered, and the ever-increasing population will bring increasing demands for recreational facilities. The nearest reservoir with adequate recreational facilities is the John H. Kerr on the Roanoke River. This project is located about 50 miles northeast of the Falls project. There is a definite need for expanded recreational facilities in the Neuse River basin.

CONSERVATION AND LAND-MANAGEMENT NEEDS

55. Erosion. Erosion within the Neuse River basin varies from slight to very severe. Areas of shallow soils and subsoils of low permeability which have been used for cropland are generally severely eroded. Both sheet and gully-type erosion have been active in the destruction of former areas of croplands and in substantially reducing crop and forage yields on land presently being farmed. Effects of erosion are more evident throughout the upper part of the basin. Stream channels have been adversely affected by having their carrying capacities seriously impaired by depositions from eroding uplands. Erosion-control practices have been effective in controlling excessive soil losses on some of the cropland, but there are still many areas that are subject to heavy annual soil losses.

56. Forestation. The watershed of the Neuse River was formerly heavily forested with virgin stands of hardwoods and pines. Of the original forest cover, little pine remains, except in the coastal region, and the supply of hardwoods in commercial quantities has also been largely exhausted. However, much of this area, which was once cleared and cultivated, has been allowed to revert to forests; this second growth consists largely of shortleaf pine. It is estimated that about 50 percent of the entire basin is forested, although about 70 percent of it is classed as woodland. The principal species of timber found are oak, hickory, ash, gum, juniper, cypress, and several varieties of pine, the shortleaf type predominating.

57. Soil conservation. Improved soil cover and proper land and forest management are expected to become an economic necessity in the Neuse River basin, to provide for expanding industrial development and as a means of water-resource enhancement. This phase of development can be achieved through the Soil Conservation Service, Department of Agriculture, which now has a number of projects underway in the basin.

SECTION VIII - SOLUTIONS CONSIDERED

GENERAL

58. The various methods considered to meet the water-conservation needs of the Neuse River basin include reservoirs to provide flood control, water supply, low-flow regulation, and recreation; local protection works by cutoffs and channel improvements for flood control; flood-plain zoning and evacuation; and combinations thereof.

47-829 O-65—5

59. Flood control reservoirs. Adequate sites for the development of storage of surface water for flood control purposes exist in sufficient number to provide a large degree of flood protection throughout the basin. Thirteen reservoir sites have been selected for study. The sites are distributed generally throughout the basin. The largest reservoirs, Falls and Wilson Mills, are on the main stem of Neuse River; the other reservoirs are on tributary streams. The reservoirs were studied individually and in combination.

60. Local protection works. The survey report under the March 1, 1946, authority, to determine the feasibility of providing local flood protection between Smithfield and the Wayne County line, N. C., was partly completed at the time this basin-wide study was undertaken. The first study considered has been incorporated into this report. The Smithfield to Wayne County line studies were concerned with that portion of the Neuse River main stem which is essentially that designated as Reach 4 in the flood-damage studies for this report. (see pl. III-1). Channel improvement, clearing and snagging, and a levee system were considered in the Smithfield to Wayne County line survey report studies. These measures would reduce local flood damages in the reach. The need for these measures, however, would be eliminated by the use of reservoir projects proposed upstream from the reach. The proposed Falls reservoir project alone would reduce flood damages in Reach 4 by about 65 percent. The Falls and Wilson Mills reservoir projects in combination would provide substantially complete flood protection to Reach 4. The reservoir projects would also provide for other water-resource needs, such as water supply, water-quality control, and recreation. Therefore, local protection for the Smithfield-Wayne County reach is not included in the plan of improvement. Local protection works, such as cutoffs and clearing and other channel improvements, were considered for development of the Trent River and tributaries. Minor clearing and snagging was found to be the only type of improvement economically justifiable. This can be considered for accomplishment expeditiously under special continuing authorities provided by Congress.

61. Flood-plain zoning and evacuation. A reduction in flood damages could be accomplished by completely redistricting the use of the flood plains or evacuating the flood plains entirely. Neither of these solutions is considered practical in view of the highly developed economy based on installations presently located within the flood plains. Complete restriction of further development in highly developed flood plains is considered impractical because such zoning would in no way provide protection for those installations and communities now subject to flood damages. Flood-zone regulation for undeveloped flood plains would certainly be a practical means to lessen future potential flood damages. Flood-resistant construction may also be a solution to eliminate future flood damages, if the cost is not prohibitive.

SOLUTION TO THE WATER-SUPPLY PROBLEM

62. General. Possible solutions for the water-supply problems are the development of ground-water supplies, diversion from adjacent watersheds, and storage of surface water in reservoirs.

63. Ground water. Ground-water yields are relatively abundant in the Coastal Plain portion of the Neuse River basin. Most ground-water supplies are obtained from wells which, if properly located and constructed, provide a dependable and economical source of water. The amount and availability of ground water depends upon a number of geologic factors, such as type of rock, the way the grains are held together, and the way the rocks are fractured. In the Piedmont area, the rocks are close to the surface, and wells average about 40 feet in depth and yield 25 to 50 gallons per minute. In the Coastal Plain province, good wells may have a depth of as much as 300 to 500 feet and yield 50 to 500 gallons per minute. Near the coast, a limiting factor in development of ground water is the encroachment of salt water into heavily pumped wells. Although there is more ground water available than surface water in the Neuse River basin, ground-water supplies cannot be depended upon to yield very large amounts in short periods of time, and wells would have to be spaced so that they would not interfere with the yields of other wells. Therefore, very large, concentrated uses require a surface-water supply.

64. Surface water. The conservation of the surface-water resource is considered to be the most economical means of increasing the dependable water supply in the basin, particularly for a long-range plan of development. A dependable supply of water can be made available through the development of the multiple-purpose reservoir-storage plan, the details of which are presented later in this report. The plan will include reservoir storage for water-quality control as well as water supply.

65. Diversion from other watersheds. Due to the urgent need for water supplies in the neighboring Cape Fear basin, it is unlikely that a significant amount of water could be diverted from that basin. The Tar River basin, adjacent to the eastern side of the Neuse River basin, may be developed at some future date, but increasing demands will probably absorb all available water in that area. Large-scale diversion from other watersheds is not considered to be needed or practicable as a means for obtaining additional water supply in the Neuse River basin.

WATER-QUALITY CONTROL

66. General. The reduction of pollution in rivers and streams may be accomplished by two practical methods - the treatment of wastes at their source and improved dilution of the discharged wastes through regulation of streamflow.

67. Treatment at source. The treatment of wastes at their source is essential in the reduction of pollution. Requirements governing waste treatment are the responsibility of the State of North Carolina and local agencies. The quality of water in the streams

of the Neuse River basin is expected to be improved appreciably in the next few years as a result of the pollution-abatement program now underway by the N. C. State Stream Sanitation Committee. Present technology permits a high degree of treatment of domestic sewage and some industrial wastes. Further retreatment of industrial wastes to virtually eliminate residual pollutants would be extremely expensive at the present time. Certain colored wastes and persistent chemicals from industrial plants are not susceptible to existing or foreseeable practical methods of treatment. As industrial development continues throughout the basin, these residual wastes in the stream will continue to build up. Whether pollution abatement can progress rapidly enough to offset the increases in residual wastes is a problem worthy of much consideration.

68. Dilution. Dilution is a practical method of controlling residual wastes in streams. The plan of water-resource development of the Neuse River basin includes storage of surface water for water-quality control which will provide adequate streamflow to effect a reasonable amount of dilution. The key to a high degree of water-quality control in the basin is considered to be complete secondary treatment at all pollution sources and adequate dilution of residual wastes.

SOLUTION TO OTHER PROBLEMS

69. Recreation. The construction of surface-water storage reservoirs at strategic points throughout the basin would provide the necessary facilities for fishing, bathing, camping, boating, and other water-related recreational activities. The proximity of the Falls and Wilson Mills reservoir sites to the major population centers of the basin enhances the recreational potential of these projects.

70. Fish and wildlife. Fish and wildlife problems can be solved by the creation of new fisheries, increased utilization of existing fisheries, and conservation and improvement of wildlife habitat. The reduction of pollution and the increases in low flow provided by the proposed reservoirs would improve existing fisheries and would create additional areas suitable for fisheries development. Reservoirs could be stocked with suitable varieties of fish, and the reservoirs themselves would have only minor detrimental effects on the existing wildlife resources. Losses to the wildlife habitat due to reservoir construction could be mitigated by more extensive and better management practices in other areas in the basin.

71. Hydroelectric power. The generation of hydroelectric power in substantial quantities in the Neuse River basin is believed not feasible, for the reasons stated in paragraph 51. In initial studies for this report, a plan of development with power as the major purpose was studied at the Falls site in cooperation with the Federal Power Commission Regional Office in Atlanta, Georgia. That plan required a much higher pool elevation than the adopted plan, and involved major

reservoir relocation costs. It was found that power as a major purpose is not warranted at the Falls site and that power should not be included except for a possible small powerplant to operate in conjunction with release of water incidental to other purposes.

72. Soil conservation. The solution to the soil-conservation problem is land-treatment measures, such as reforestation, contour plowing, strip planting of row crops, and terracing. As stated previously, reforestation and soil-conservation problems are being investigated in the Neuse River basin by the Department of Agriculture under continuous long-range programs. Any soil-conservation measures adopted as a result of these programs will be supplementary to, and have no adverse effect on, other proposals covered by this report.

SECTION IX - GENERAL PLAN OF DEVELOPMENT

DESCRIPTION OF PLAN

73. General. The general plan of water-resource development in the Neuse River basin is designed to meet the long-term water-resource needs for the next 100 years. This plan is proposed as a guide for the efficient development and conservation of the water resources. Storage in reservoirs would be impounded by two relatively large dams on the main stem of the Neuse River, and smaller dams on the tributaries. The general plan would afford a high degree of flood control; water supply for the projected expansion of municipal and industrial users; water for additional irrigation; increased flow for water-quality control; and water and related land areas for recreation, fish, and wildlife. It is expected that land-treatment measures will be installed which will supplement the plan.

74. Reservoir projects included in the plan. The principal features of reservoirs included in the general plan are described in the following paragraphs. The locations of the damsites are shown on plate 1. Initial and ultimate storage capacities and surface areas for these reservoir projects are shown in table 9.

a. Falls reservoir. Falls reservoir is the largest of the reservoirs studied and would be formed by the construction of a dam across the Neuse River, about 1 mile above the village of Falls, N. C. This project is described in detail in section X.

b. Wilson Mills reservoir. This reservoir would be formed by the construction of a dam across the Neuse River, about 2 miles northeast of the village of Wilson Mills and about 3 miles upstream from the Southern Railway bridge. The drainage area at the site is 1,170 square miles. The dam would control the flow of the 410 square miles of drainage area below Falls. The dam would have a length of approximately 3,980 feet at its top and a maximum height of about 81 feet. High discharges would be released through a 200-foot spillway controlled by five 40-foot by 36-foot tainter gates. Low-flow releases would be controlled by a 6-foot-diameter

conduit through the dam. The reservoir would have a flood-control-storage capacity of 131,000 acre-feet and a conservation storage of 50,000 acre-feet at time of initial construction.

c. Beaulahtown reservoir. The reservoir would be formed by construction of a dam across Little River in Johnston County, about 2 miles northwest of Kenly, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control, water supply, and irrigation. The drainage area above the dam would be 187 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximatley 10,500 feet long and would have a maximum height of 50 feet.

d. Little Buffalo reservoir. The reservoir would be formed by the construction of a dam across Little Buffalo Creek in Johnston County, about 1 mile north of Kenly, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control and irrigation. The drainage area above the dam would be 22 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 3,600 feet long and would have a maximum height of 45 feet.

e. Bakers Mill reservoir. The reservoir would be formed by construction of a dam across Little River in Johnston County, about 1 mile northeast of Princeton, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control, water supply, water-quality control, and irrigation. The drainage area above the dam would be 261 square miles. This project would control the 52 square miles below Beulahtown and Little Buffalo dams, and above Bakers Mill dam. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 4,400 feet long and would have a maximum height of 53 feet.

f. Buckhorn reservoir. The reservoir would be formed by construction of a dam across Contentnea Creek in Wilson County, about 12 miles west of Wilson, N. C., and immediately west of State Highway 581. This would be a multiple-purpose project, providing reservoir storage for flood control, water supply, water-quality control, and irrigation. The drainage area above the dam would be 153 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 3,600 feet long and would have a maximum height of 60 feet.

g. Wiggins Mill reservoir. The reservoir would be formed by construction of a dam just east of Wilson, N. C., on Contentnea Creek and immediately upstream from an existing low concrete dam. This would be a multiple-purpose project, providing reservoir storage

for flood control, water supply, and irrigation. The drainage area above the dam would be 223 square miles. This project would be located downstream from the Buckhorn dam and would control the 70 square miles between the two dams. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 9,800 feet long and would have a maximum height of 41 feet.

h. Stantonsburg reservoir. The reservoir would be formed by the construction of a dam across Toisnot Swamp, a tributary to Contentnea Creek, in Wilson County, about 1 mile northeast of Stantonsburg, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control, water supply, and irrigation. The drainage area above the dam would be 105 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 4,800 feet long and would have a maximum height of 33 feet.

i. Black Creek reservoir. The reservoir would be formed by the construction of a dam across Black Creek, a tributary to Contentnea Creek, in Wilson County, about 7 miles west of Stantonsburg, N. C., and about 7 miles south of Wilson, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control and irrigation. The drainage area above the dam would be 40 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 2,600 feet long and would have a maximum height of 34 feet.

j. Great Swamp reservoir. The reservoir would be formed by the construction of a dam across Great Swamp, a tributary to Black Creek, in Wilson County, about 7 miles west of Stantonsburg, N. C., and about 5 miles north of Fremont, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control and irrigation. The drainage area above the dam would be 37 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 3,300 feet long and would have a maximum height of 39 feet.

k. Aycock Swamp reservoir. The reservoir would be formed by the construction of a dam across Aycock Swamp, a tributary to Black Creek, in Wilson County, about 5 miles southwest of Stantonsburg, N. C., and about 5 miles northeast of Fremont, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control and irrigation. The drainage area above the dam would be 11 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 1,900 feet long and would have a maximum height of 36 feet.

l. Hillsboro reservoir. The reservoir would be formed by the construction of a dam across Eno River in Durham County, about 3 miles north of Durham, N. C. This would be a multiple-purpose

project, providing reservoir storage for flood control, water supply, water-quality control and irrigation. The drainage area above the dam would be 125 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 6400 feet long and would have a maximum height of 136 feet.

m. Orange reservoir. The reservoir would be formed by the construction of a dam across Little River in Durham County, about 8 miles north of Durham, N. C. This would be a multiple-purpose project, providing reservoir storage for flood control, water-quality control, and irrigation. The drainage area above the dam would be 85 square miles. The dam would be constructed of a rolled earthfill and would have an ungated spillway adjacent to the structure. The dam would be approximately 1,700 feet long and would have a maximum height of 107 feet.

TABLE 9

Pertinent data relative to the general plan of reservoir development in the Neuse River basin, N. C. (reservoir data)

Name of reservoir project	Storage capacity (in acre-feet)						Surface area (in acres)		
	Flood control		Conservation[1]		Gross storage	At maximum pool elevation	Top of flood control pool	Top of conservation pool	
	Initially	Ultimately	Initially	Ultimately				Initially	Ultimately
Falls	243,000	191,000	165,000	217,000	408,000	732,000	23,200	11,800	14,000
Wilson Mills	131,000	116,000	70,000	85,000	201,000	352,000	8,100	4,100	4,800
Boulahtown	60,000	40,000	21,000	41,000	81,000	124,000	5,900	2,300	3,700
Bakers Mill	17,000	17,000	19,000	19,000	36,000	64,000	3,100	1,900	1,900
Little Buffalo	7,000	7,000	6,000	6,000	13,000	20,000	1,100	700	700
Buckhorn	49,000	49,000	70,000	70,000	119,000	155,000	6,000	4,000	4,000
Wiggins Mill	22,000	12,000	13,000	23,000	35,000	54,000	4,400	2,100	3,100
Stantonsburg	34,000	23,000	14,000	25,000	48,000	67,000	5,600	2,100	3,100
Great Swamp	12,000	12,000	6,000	6,000	18,000	28,000	2,300	900	900
Black Creek	13,000	13,000	4,000	4,000	17,000	26,000	2,300	600	600
Aycock Swamp	4,000	4,000	3,000	3,000	7,000	9,000	800	300	300
Hillsboro	40,000	40,000	83,000	83,000	123,000	149,000	4,200	3,000	3,000
Orange	27,000	27,000	30,000	30,000	57,000	75,000	2,600	1,200	1,200
Total		551,000		612,000	1,163,000	1,855,000	69,500		41,300

[1]Includes storage for water supply, water-quality control, irrigation, and sedimentation.

75. Other improvements included in the plan. A system of reservoir projects consisting of selected projects described above would constitute the basic core of water-resource development in the Neuse River basin. In addition to the system of reservoirs, other measures would be necessary to obtain a high degree of water-resource conservation required for the full development of the economic potential of the basin. These additional measures include the following.

a. Local flood-protection works. Projects similar to those approved for Core Creek and Swift Creek, providing local flood control by means of channel improvements, are expected to be initiated in the basin, where warranted and approved under applicable public laws, as specific needs arise in the future. Such projects would be initiated in those areas where flood protection cannot be achieved practically or economically by the reservoir projects of the general plan.

b. Small watershed-management and treatment programs. These programs, initiated under Public Law 566, should be developed as rapidly as the needs dictate. These programs, consisting of land-treatment measures, soil-conservation management, flood-detention reservoirs, and other local watershed-improvement measures, would provide needed upstream water- and land-conservation improvements. This program would be complementary to the overall basin plan and should be integrated therein so as to increase the effectiveness of other projects in the basin.

c. Additional sewage-treatment works. The low-flow-augmentation features of the multiple-purpose reservoirs can provide a high degree of water-quality control as a supplement to adequate sewage-treatment measures.

EFFECTS OF THE GENERAL PLAN

76. Operation of the plan. The reservoir system would operate under a regulation plan designed to obtain the maximum water supply consistent with the most advantageous operation for project needs. Release schedules would be established to maintain needed minimum flows and yet maintain reservoir levels as stable as possible so as to contribute to a high degree of utilization of the reservoirs for recreation. The flood control operation of the system would be based on minimizing the flood damages.

77. Flood control effects of the plan. The reservoirs included in the plan would control about 36 percent of the drainage area of the basin. Channel-improvement projects such as those on Core Creek and Swift Creek would suffice on streams without reservoir control. The ultimate flood control storage, amounting to 551,000 acre-feet, included in the general plan of development would be sufficient to control the runoff from the maximum flood of record above structures. Approximately 88 percent of the average annual flood damages in the flood-plain areas in the scope of the study would be expected to be eliminated. Flood peaks and stages caused by major flood events would be expected to be reduced in the order shown in table 10.

TABLE 10

Flood control effects of general plan of reservoir development, Neuse River basin, N. C.
(100-year-frequency flood event)

Item	Index stations			
	Smithfield	Goldsboro	Kinston	Hookerton
Zero-damage stage, feet	17.0	16.2	14.6	13.0
Unregulated:				
Peak discharge, c.f.s.	34,000	39,500	39,500	19,800
Peak stage, feet	29.6	27.4	24.7	24.2
Reservoir regulated:				
Peak discharge, c.f.s.	5,600	21,000	18,000	9,300
Peak stage, feet	14.3	23.7	19.6	17.6
Stage reduction, feet	15.3	3.7	5.1	6.6

78. Water-supply storage. The general plan of development for the basin includes 312,000 acre-feet of water-supply storage. This storage would be provided ultimately in several of the 13 reservoirs, and would be expected to satisfy most of the water-supply needs for municipal, industrial, and agricultural purposes of the basin for the next 100 years.

79. Low-flow augmentation. A total of 197,000 acre-feet of storage is included in the general reservoir-development plan for pollution abatement throughout the basin. This water-quality-control feature will assure increased minimum flows downstream from the reservoirs, which in turn will provide significant increases in the water quality of the streams. The increasing demands for water supplies, brought about by rapid population growth and industrial expansion, will result in the attendant demand for more and more sewage-treatment measures. There are no known completely effective methods of treating waste products which would be economically practicable. Dilution of stream pollutants would provide a means to control the margin of stream pollution that cannot be controlled at the source.

80. Recreational opportunities provided. The general plan of reservoir development in the Neuse River basin will provide a total

of 41,300 acres of water area which can be developed for recreational purposes.

BENEFITS FROM THE GENERAL RESERVOIR PLAN

81. General. Benefits that would accrue from the general plan of development result from flood control, provisions for water-supply storage, water-quality improvement, provision of recreational facilities, and fish and wildlife conservation measures. Benefits for each project were discounted to present worth and were distributed over the 100-year evaluation period in an equivalent annual series. Except for the Falls project, the benefits other than flood control are not firm, but would depend on growth of needs. A summary of project benefits is given in table 11.

82. Flood control benefits. Flood control benefits result from the reduction of flood damages and the enhancement of flood-plain lands due to the protection afforded by the plan of improvement. Flood-damage-reduction benefits were determined as the difference between the estimated average annual damages with and without the projects. Land-enhancement benefits, expressed in average annual values, were based on the projected changes in flood-plain utilization resulting in higher type uses. The agricultural-enhancement benefits were determined as the difference in net returns from protected and unprotected agricultural lands. The flood control benefits were adjusted to reflect normal development of the area in the absence of the projects. The total average annual flood control benefits credited to the general plan of reservoir development are estimated to be $1,854,000.

83. Water-supply benefits. The plan would provide for immediate and future water-supply storage for municipal, industrial, and agricultural water uses. Water-supply benefits were estimated as the cost of providing water supply by the most economical alternative method. The total average annual water-supply benefits, from data supplied by the United States Public Health Service, are estimated to be $900,000, of which 36 percent would be municipal and industrial water-supply benefits, 14 percent would be irrigation benefits, and the remainder would include water-quality-control benefits. The benefits at Falls, $307,000, could be realized immediately, but the benefits for the other projects would depend largely on growth of needs.

84. Water-quality-control benefits. The low-flow augmentation afforded by the general reservoir plan will dilute wastes, thus improving the quality of water in the streams affected. In accordance with Public Law 87-88, 87th Congress, July 20, 1961, the estimated benefit produced is considered to be the benefit from water-quality improvement after adequate treatment is provided at the source by local interests. The water-quality-control benefit from the general reservoir plan, as estimated from data supplied by the United States Public Health Service, is included in the low-flow-augmentation benefits shown in table 11.

85. Recreation benefits. Recreation benefits are expected to accrue from the proposed water-resources-development plan in two categories of recreational activities: general recreation and fishing. The average annual recreation benefits attributable to the proposed projects are estimated to be $4,134,000. These benefits were based on estimates of projected annual attendance and use of recreational facilities provided.

86. Other benefits. There are certain intangible benefits, not subject to direct monetary evaluations, which would be realized in addition to the previously evaluated benefits attributable to the water-resources-development plan for the Neuse River basin. The flood control provided by the plan would help to prevent loss of human life. Flash floods which occur in the upper reaches of the basin, often with little or no warning, would be retarded and considerably reduced in magnitude by the proposed reservoirs. The relatively abundant supply of water in the Neuse River basin should be a major factor in promoting expansion of industry, particularly with controlled water supplies. Other factors, such as adequate labor supply, climate, and a wide variety of available sites, provide strong stimulation for continuing industrial growth. Improved water quality, in addition to its monetary value, would provide an overall improvement in general sanitation and improve the appearance of the streams. Land-treatment measures, as well as the reservoirs themselves, would reduce the sediment load of the streams and would aid in channel stabilization. Additional benefits to the basin would result from the recreational facilities provided under the plan. Sporting-goods stores, motels, restaurants, concession stands, bait suppliers, and many other commercial activities would develop to support the recreational activities of both the resident and non-resident population; however, these benefits would be secondary and have not been evaluated. Benefits such as the general welfare, economy, and security of the people in the Neuse River basin cannot be predetermined nor evaluated in monetary terms.

TABLE 11

Summary of average annual benefits from the general plan of reservoir development, Neuse River basin, N. C.
(100-year evaluation period - 1963 price level)

Project	Flood control benefits	Water-supply benefits				General recreation benefits	Fish and wildlife enhancement	Total benefits
		Water supply	Low-flow augmentation[1]	Irrigation	Subtotal			
Falls	$ 564,000	$112,000	$195,000		$307,000	$1,690,000	$171,000	$2,732,000
Wilson Mills	400,000		140,000	$ 4,000	144,000	368,000	19,000	931,000
Beulahtown	239,000			24,000	24,000	74,000	44,000	381,000
Bakers Mill	70,000	12,000	14,000	10,000	36,000	70,000	27,000	203,000
Little Buffalo	20,000			10,000	10,000	30,000	12,000	72,000
Buckhorn	151,000	60,000	42,000	20,000	122,000	452,000	40,000	765,000
Wiggins Mill	80,000	10,000		8,000	18,000	225,000	30,000	353,000
Stantonsburg	99,000			16,000	16,000	200,000	30,000	345,000
Great Swamp	25,000			8,000	8,000	95,000	20,000	148,000
Black Creek	28,000			4,000	4,000	80,000	15,000	127,000
Aycock Swamp	8,000			5,000	5,000	30,000	5,000	48,000
Hillsboro	100,000	130,000	20,000	4,000	154,000	276,000	25,000	555,000
Orange	70,000		40,000	12,000	52,000	90,000	16,000	228,000
Total	$1,854,000	$324,000	$451,000	$125,000	$900,000	$3,680,000	$454,000	$6,888,000

[1] Includes water-quality-control benefits

ESTIMATE OF COSTS OF THE GENERAL RESERVOIR PLAN

87. Estimated construction costs of reservoirs. The total estimated first cost of the reservoir plan is $74,050,000 at 1963 price levels. Construction costs are summarized in table 12.

88. Estimated investment for reservoirs. The total estimated investment cost for the plan is $77,420,000 at 1963 price levels. The investment costs are also summarized in table 12.

89. Estimated annual charges for reservoirs. The total estimated annual charge for the plan is $3,155,000 at 1963 price levels. Annual charges are shown in table 12.

TABLE 12

Summary of estimated costs of the general plan of reservoir development, Neuse River basin, N. C. (100-year-evaluation period) (in thousands of dollars - 1963 price level)

Item	Reservoir projects													Total plan
	Falls	Wilson Mills	Beulah-town	Bakers Mill	Little Buffalo	Buckhorn	Wiggins Mill	Stantons-burg	Great Swamp	Black Creek	Aycock Swamp	Hillsboro	Orange	
1. Construction costs:														
a. Total first cost	$18,600	$ 9,800	$6,200	$6,600	$1,100	$4,500	$6,700	$5,100	$1,800	$1,500	$ 550	$8,100	$3,500	$74,050
2. Investment costs:														
a. Interest during construction	800	400	200	200	20	140	200	150	30	20	10	250	50	2,470
b. Total investment costs	$19,400	$10,200	$6,400	$6,800	$1,120	$4,640	$6,900	$5,250	$1,830	$1,520	$ 560	$8,350	$3,550	$76,520
c. Deferred construction costs[1]	1,200	600												1,800
d. Present worth of future additions	600	300												900
e. Total economic investment	$20,000	$10,500	$6,400	$6,800	$1,120	$4,640	$6,900	$5,250	$1,830	$1,520	$ 560	$8,350	$3,550	$77,420
3. Annual charges:														
a. Interest on investment	$ 582	$ 306	$ 195	$ 207	$ 34	$ 141	$ 210	$ 160	$ 56	$ 46	$ 17	$ 254	$ 108	$ 2,316
b. Amortization of investment (100 yrs.)	32	17	11	11	2	8	12	9	3	3	1	14	6	129
c. Operation and maintenance	100	60	30	30	6	25	30	35	10	8	5	40	20	399
d. Major replacements	20	10	5	5	1	4	5	5	2	1	1	10	3	72
e. Economic cost of future additions	18	9												27
f. Economic cost of land	70	25	20	10	5	15	20	15	6	6	2	12	6	212
g. Total economic annual charges	$ 822	$ 427	$ 261	$ 263	$ 48	$ 193	$ 277	$ 224	$ 77	$ 64	$ 26	$ 330	$ 143	$ 3,155
4. Total average annual project benefits (table 11)	$ 2,732	$ 931	$ 381	$ 203	$ 72	$ 765	$ 353	$ 345	$ 148	$ 127	$ 48	$ 555	$ 228	$ 6,888
5. Benefit-cost ratio	[2]3.3													

[1] Future recreational facilities.

[2] Benefit-cost ratios of projects other than Falls not shown, as their benefits depend on growth of needs.

SEQUENTIAL DEVELOPMENT

90. Program formulation. The various reservoir projects were analyzed singly and in various combinations or programs to determine the basin-wide effects. This analysis, based on a 100-year-evaluation period, indicated that all but one of the reservoir projects (Bakers Mill) shown in table 12 were economically feasible or would become feasible during the course of the 100-year-study period. Since this type of program evaluation is based largely on anticipated future needs for water-resource development in the basin, construction of all projects indicated to be economically justified would not be warranted at the present time. The analysis indicates the magnitude of water-resource needs that may be expected in the basin during the next century, and that the various reservoir projects studied in conbination would provide an economically feasible means of alleviating these needs. The uncertainties of estimating the timing of the various types of water-resource needs, and the specific portions of the basin in which the needs may first become critical, preclude the establishment of a firm schedule of sequential development for the entire plan. Periodic review to determine the growth of water-resource needs in the basin is necessary to finalize the schedule of project construction.

91. Priority of construction. The analysis of reservoir project effects in the Neuse River basin clearly indicates that the Falls project is the key project of the long-term water-resource-development program in the basin and should be the first project provided. This project alone would prevent about 50 percent of the average annual flood damage occurring along the main stem of the Neuse River below the damsite, which is equivalent to preventing about 37 percent of the average annual flood damages in the flood-plain area studied. Water-quality-control is particularly needed in the river below the Falls damsite. This need could be alleviated significantly by the low-flow-augmentation features of the Falls reservoir project. About 43 percent of the low-flow-augmentation benefits estimated to be derived from the total basin-development program are creditable to the Falls project.

92. The Falls project would alleviate a critical water-supply problem in the basin by providing a source for municipal and industrial water supply for the city of Raleigh. The city of Raleigh has completed preliminary engineering plans for the construction of intakes and pipelines to obtain water directly from the Falls reservoir in the anticipation that a multiple-purpose reservoir will be constructed soon by the Federal Government, or, if such a project is not built, a smaller dam could be built at the site by the city. A bond issue to finance the intakes and pipelines has been approved. In addition to alleviating these immediate needs, the Falls project would also provide about 35 percent of the storage capacity of the total program for municipal, industrial, and agricultural water supply and water-quality control for the basin. Because of its strategic location near the major population centers of the basin, it would provide a

47-829 O-65—6

significant resource for much-needed recreational development. No other single project in the general reservoir plan could achieve similarly significant results.

93. After analysis had shown that Falls reservoir would satisfy the most pressing water-resource needs of the basin, and a rigorous examination had affirmed its economic justification, Falls was selected for construction as the first unit of the Neuse River development plan.

94. Continued analysis of other potential reservoir projects in the basin showed that Wilson Mills, Buckhorn, and Beulahtown should be considered of secondary magnitude in importance. Their inferiority to the Falls lies in the lack of present urgency for their construction. After continued economic growth in the area, these sites should be examined in more detail and their feasibility should be reassessed.

95. The other nine projects will be needed as the basin development continues. At this time, it appears unlikely that the nine projects will be urgently needed for many years. A reappraisal should be made at the time detailed studies are made of the three projects discussed in the preceding paragraph.

SECTION X - PLAN OF DEVELOPMENT WARRANTING IMMEDIATE CONSTRUCTION

GENERAL

96. When it became apparent that Falls reservoir was the only project in the plan for which the immediate needs are firmly established, a more detailed evaluation was made of that project. Results of that analysis are presented in this section.

LOCATION

97. The proposed Falls damsite is located on the Neuse River, in Wake County, about 1 mile above the town of Falls, N. C., and about 10 miles northeast of the city of Raleigh. The main body of the reservoir would lie principally in Wake and Durham Counties, but some of the tributary portions would extend into Granville County. The general location of the reservoir is shown on plate 1, and the details are on plate 3.

DESCRIPTION OF PROJECT

98. General. A summary of pertinent data for the project is shown in appendix VII, table VII-1.

99. Description of the dam. The Falls project would have a concrete and earth dam with an overall length of 1,000 feet and a maximum height of 83 feet. The 140-foot ogee spillway would have a crest elevation of 228 feet above mean sea level and would be controlled by three 40-foot by 36-foot tainter gates. Concrete abutment

sections totalling 300 feet in length connect to each end of the spillway. A conduit would be provided to discharge the controlled normal streamflow. The 560-foot earth section joining the concrete abutment to the right-bank hillside would have a top width of 30 feet and 3:1 side slopes. The dam would have an impervious core (10 feet wide at top), a rock toe on the downstream side, and the upstream side would be riprapped above elevation 245.0 feet above mean sea level (see pl. 2). There is a possibility of installing a small hydroelectric powerplant utilizing the flows released in the water-quality-control features of the project. It will not be possible to determine whether the power unit should be installed until details of the operating conditions are fully known.

100. Description of the reservoir. The full reservoir, top of the flood control pool, would reach an elevation of 262.7 feet above mean sea level. At this elevation, approximately 23,200 acres of land would be inundated, and the gross storage of the reservoir would amount to 408,000 acre-feet. Land to be purchased in fee is estimated to amount to about 31,500 acres, and installations subject to relocation within the reservoir area would be affected below elevation 267.7 feet above mean sea level. The reservoir would include 38,000 acre-feet of sediment storage, which would establish the bottom of the usable pool at elevation 232.5 feet above mean sea level. Storage amounting to 82,000 acre-feet for water-quality control and 45,000 acre-feet for water supply would establish the top of the conservation pool at elevation 249.0 feet above mean sea level. At the top of the conservation pool, approximately 11,800 acres of land would be inundated, and the total reservoir storage would amount to 165,000 acre-feet. Reservoir lands to be cleared are presently estimated as about 10,900 acres. Between elevations 249.0 and 262.7 feet above mean sea level, 243,000 acre-feet of storage would be available for flood control. If the general plan of development for the Neuse River basin is completed as envisioned in this study, storages in Falls reservoir would be ultimately allocated to 217,000 acre-feet for conservation and 191,000 acre-feet for flood control. This flexibility would be possible by shifting some of the Falls reservoir initial flood control storage to other reservoirs, either upstream or downstream.

ESTIMATE OF COST

101. Estimated construction cost of the Falls project. The estimated cost of the Falls project presented in this section is based upon quantity estimates wherein use was made of latest field surveys, land appraisals, and foundation investigations shown in appendix II, plate II-1. Cost estimates were based on past experience and use of 1963 contract prices applied to the estimated quantities. Costs covering contingencies, engineering and design, and supervision and administration are included in the above-mentioned estimates. A detailed cost estimate of the best plan for the Falls reservoir is given in table VII-2 of appendix VII. The total construction first cost of the project is estimated to be $18,600,000 and is summarized in table 13 below.

102. Estimated investment for Falls project. The estimated total investment for the Falls project is $19,400,000 "financial" and $20,000,000 "economic." The "financial" investment is the initial investment; the "economic" investment includes the present worth of future additions for recreation. The interest during construction was computed using an interest rate of 3 percent per year for one-half the estimated construction time. The total construction time is estimated to be 3 years.

103. Estimated annual charges for the Falls project. The total estimated annual financial charge is $734,000 and the economic charge is $822,000, based on 1963 price levels. The economic charge includes the charge for future additions for recreation and a charge for net loss of the ordinary productivity on land taken for the project. Annual charges were computed at the current interest rate of 3 percent and were amortized assuming a 100-year useful project life. Cost summaries are shown in appendix VII to this report.

TABLE 13

Summary of estimated first costs of Falls project
(in 1963 dollars)

Feature	Cost
1. Lands and damages	$ 5,713,000
2. Relocations	4,263,000
3. Reservoir and pool preparation	1,962,000
4. Dam and appurtenances	3,131,000
5. Access road	36,000
6. Recreational facilities	1,200,000
7. Buildings, grounds, and utilities	87,000
8. Permanent operating equipment	170,000
9. Engineering and design	651,000
10. Supervision and administration	1,387,000
Total first cost of project	$18,600,000

ESTIMATE OF BENEFITS

104. General. Construction of the Falls project would satisfy the most urgent present-day water-resources needs of the Neuse River basin. The results of benefit-evaluation studies relative to the Falls project are discussed in the following paragraphs.

105. Flood control benefits. Details of the computation of the flood control benefits to be derived from the Falls project are presented in appendix III. Tangible flood control benefits from Falls reservoir would be flood-damage-reduction benefits and land-enhancement benefits.

a. Flood-damage-reduction benefits. If no flood protection is provided for the flood plains along the main stem of the Neuse River, the annual flood damages, estimated to amount to $730,000 under present conditions of development of the flood plain, are expected to increase, with normal increase of development in the flood plain, at a uniform rate during the next 50 years to about $1,124,000. Due to limitations in very long-range estimating, no further increase is assumed in annual damages during the second half of the 100-year-evaluation period. The estimated average annual flood damages on the main stem throughout the 100-year-evaluation period, averaged by discount methods, are $928,000. Operation of the Falls project would reduce these damages to $460,000. (see fig. 3). The flood-damage-reduction benefits are therefore estimated at an average of $468,000 annually. Of these benefits, 66 percent accrue to agricultural properties and 34 percent to non-agricultural properties. Details of the methods and procedures used to evaluate flood damages and flood-damage-reduction benefits are presented in appendix III.

b. Land-enhancement benefits. Falls reservoir would provide sufficient reduction to create substantial agricultural land-enchancement benefits, resulting from the stimulation of increased utilization of flood-plain lands due to reduced flooding. It is estimated that these land-enhancement benefits would amount to $96,000 annually. These benefits would be general in nature, distributed throughout the main-stem area benefited, and would therefore not entail local-cooperation contributions. No benefit is claimed for enhancement of land in urban areas, since only partial protection would be afforded by Falls reservoir alone; therefore, changed land uses in urban areas, by reason of Falls reservoir, are not expected or claimed. Details of the computation and methods used to determine the agricultural land-enhancement benefits are given in appendix III.

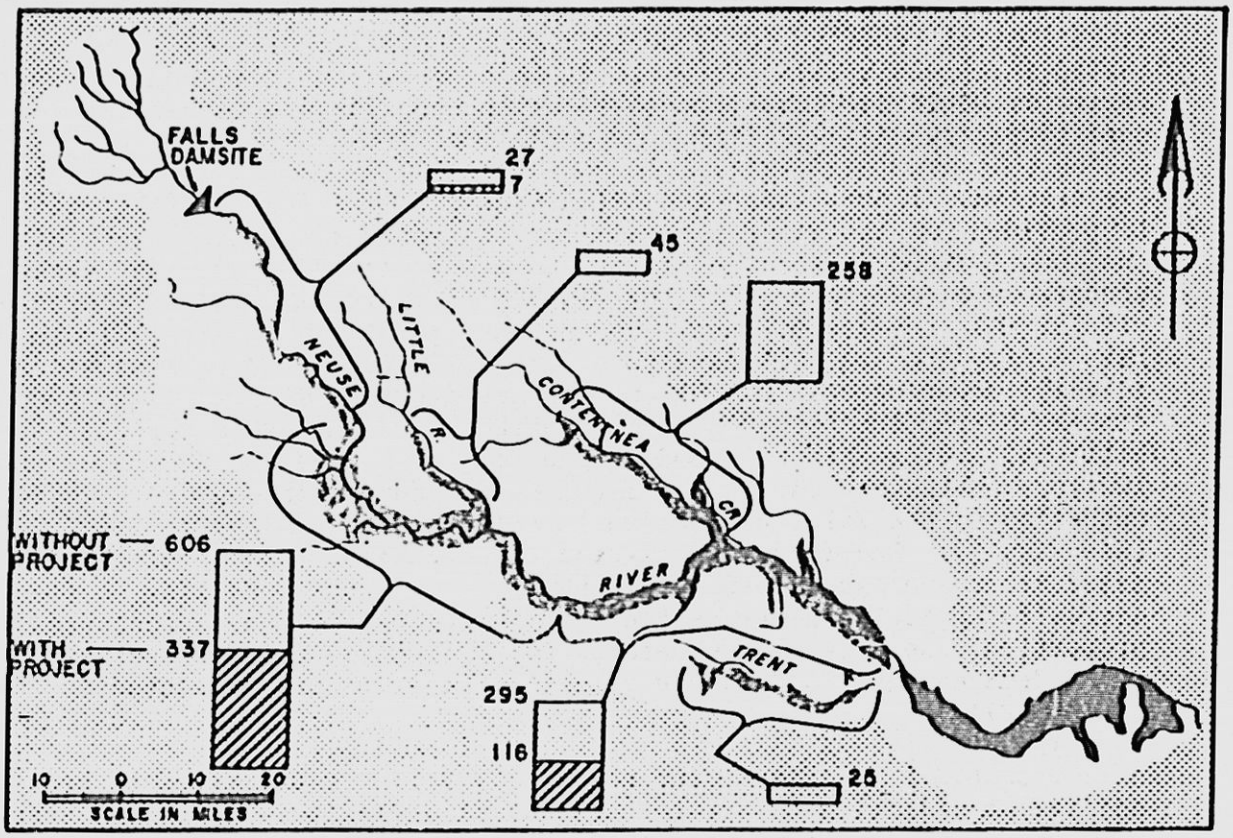


FIGURE 3. FLOOD-DAMAGE-REDUCTION EFFECTS OF THE FALLS RESERVOIR PROJECT (average annual damages shown in thousands of dollars)

106. Local water-supply benefits. Storage of 45,000 acre-feet allocated in the Falls reservoir project for use as a water-supply source for the city of Raleigh would provide local water-supply benefits estimated at $112,000 annually, based on a 100-year-evaluation period, or $102,000 annually if based on a 50-year-evaluation period. These benefits were considered as equal to the annual charges for an alternate single-purpose water-supply reservoir project utilizing the same damsite as the multiple-purpose project at Falls. This project site would be the nearest site available and suitable for a single-purpose water-supply project.

107. Water-quality-control benefits. Discharge-regulation features of the Falls project include 82,000 acre-feet of storage for low-flow augmentation, which would provide substantial water-quality-control benefits. The dependable flow of the Neuse at Falls would be increased from near-zero flow to 165 cubic feet per second in the most critical period. In accordance with recommendations from the U. S. Public Health Service, the water-quality benefits were considered as equal to the annual charges for an alternate single-purpose low-flow-augmentation reservoir project utilizing the same damsite as for the Falls multiple-purpose project. The results of the above study indicate that the average annual water-quality-control benefits from the Falls project over a 100-year period would amount to $195,000.

108. Hydroelectric-power benefits. As discussed previously, large-scale hydroelectric-power generation was not found warranted at the Falls site. The possibility exists of a small powerplant to operate with the release of water for other purposes. It is not considered practicable to determine at this time what the schedule of such releases would be and whether the resulting power output would fit the needs of power users who might purchase the small output. Therefore, no hydroelectric-power benefits are estimated for the Falls site at this time. The practicability and justification of a small hydroelectric powerplant at Falls would be a matter to investigate in the detailed planning if the project were authorized. The Federal Power Commission and the Southeastern Power Administration would be requested to furnish advice on the benefits and revenues of such a plant.

109. Recreation benefits.

a. General. The Falls reservoir would provide a facility for general water-based recreational purposes which would undoubtedly develop rapidly. The reservoir would be strategically located in relation to several major population centers. In 1960, about one-quarter of a million people lived within a 75-mile highway distance of the reservoir site, and population within this zone is increasing. The reservoir would have an initial surface area of about 11,800 acres at the top of the conservation pool and an ultimate area of 14,000 acres. The water impounded in the reservoir would be suitable for boating and fishing, and beautiful scenery would be enjoyed from the many access points. Much of the shoreline could be developed for use as parks, boat harbors, group camps, and fishing camps. The development of the Falls reservoir boundaries for public recreation would involve careful planning in cooperation with appropriate agencies, including the North Carolina Recreation Commission, North Carolina Wildlife Resources Commission, State Board of Conservation and Development, U. S. National Park Service, U. S. Bureau of Outdoor Recreation, U. S. Forest Service, and U. S. Fish and Wildlife Service, and with the various counties and municipalities involved. Recreation benefits from the Falls project were evaluated in two categories; general recreation, which includes bathing, boating, picnicking, etc.; and hunting and fishing.

b. General recreation benefits. The U. S. National Park Service has prepared a report evaluating the general recreation benefits for this report. Their report is included as appendix IX. The National Park Service estimated the recreation benefits to be $1,690,000 annually, based upon a 100-year-evaluation period and an average annual visitation of 3,200,000 persons.

c. Hunting and fishing benefits. The U. S. Fish and Wildlife Service has prepared a report presenting data for the evaluation of the hunting and fishing benefits to be derived from the Falls project. A copy of this report is included as appendix VI. The Fish and Wildlife Service reports that the Falls project would be beneficial to the fishery aspects within the reservoir. They emphasized that reservoir water released to downstream areas be of such quality as to preclude adverse

effects to the downstream fishery. The Fish and Wildlife Service also reported that there would be a loss of large game, upland game, and waterfowl in the project area, due to losses in habitat. They further suggested partial mitigation of those losses by creation of wildlife-management areas. Suggestions by the Fish and Wildlife Service for management, control, and construction of facilities to mitigate wildlife losses will be given careful consideration in the detailed planning if the Falls project is authorized. The net fishing and hunting benefits for the 100-year-evaluation period are estimated at $171,000.

110. Summary of benefits. A summary of the project benefits creditable to the Falls project, for the 100-year-evaluation period, is shown in table 14 below.

TABLE 14

Summary of average annual benefits to be derived from the Falls reservoir project (1963 price level)

	Benefits
1. Flood control	
a. Flood-damage-reduction benefits	$ 468,000
b. Land-enhancement benefits	96,000
c. Subtotal	$ 564,000
2. Local water supply	$ 112,000
3. Low-flow regulation for water-quality control	$ 195,000
4. Recreation	
a. General recreation	$1,690,000
b. Hunting and fishing	171,000
c. Subtotal	$1,861,000
5. Total project benefits	$2,732,000

ALLOCATION OF COSTS

111. General. Allocations of costs of the multiple-purpose features in the Falls project plans, for flood control, local water supply, low-flow augmentation, and recreation, were made by the separable-cost remaining-benefits method. Details of the cost allocation are presented in appendix VII, and a summary is in table 15.

APPORTIONMENT OF COSTS AMONG INTERESTS

112. General. The division of project costs for the Falls project, between Federal and non-Federal interests, is summarized in table 15 and was based on presently applicable laws and regulations governing cost-sharing practices. These regulations are discussed briefly in the following paragraphs.

TABLE 15

Apportionment of costs for the Falls project

Project purposes	Federal		Non-Federal		Total cost	Percent of total cost
	Cost	Percent	Cost	Percent		
Total construction cost:						
Flood control	$11,725,000	63.1			$11,725,000	63.1
Local water supply			$1,455,000	7.8	1,455,000	7.8
Low-flow augmentation, water-quality control	2,424,000	13.0			2,424,000	13.0
Recreation						
Specific costs	1,800,000	9.7			1,800,000	9.7
Joint costs	1,196,000	6.4			1,196,000	6.4
Total	$17,145,000	92.2	$1,455,000	7.8	$18,600,000	100.0
Annual operation, maintenance, and replacement costs:						
Flood control	$ 23,000	19.2			$ 23,000	19.2
Local water supply			$ 10,000	8.3	10,000	8.3
Low-flow augmentation, water-quality control	20,000	16.7			20,000	16.7
Recreation	67,000	55.8			67,000	55.8
Total	$ 110,000	91.7	$ 10,000	8.3	$ 120,000	100.0

TABLE 15--Continued

Apportionment of costs for the Falls project

Project purposes	Federal Cost	Federal Percent	Non-Federal Cost	Non-Federal Percent	Total cost	Percent of total cost
Annual charges:						
Flood control	$ 410,000	55.9			$ 410,000	55.9
Local water supply			$ 58,000	7.9	58,000	7.9
Low-flow augmentation, water-quality control	100,000	13.6			100,000	13.6
Recreation	166,000	22.6			166,000	22.6
Total	$ 676,000	92.1	$ 58,000	7.9	$ 734,000	100.0

113. Apportionment of flood control costs. Costs allocated to flood control were apportioned in accordance with Section 201 of the Flood Control Act of 1962 (Public Law 87-874). Costs allocated to flood control are considered to be all Federal.

114. Apportionment of water-supply costs.

a. General. The costs of providing water-supply storage for immediate and anticipated future use must be apportioned to State or local non-Federal interests in accordance with the Water Supply Act of 1958 (Title III of Public Law 85-500). All construction, operation and maintenance, and replacement and interest costs incurred by the Federal Government and allocated to water supply are to be repaid by the water users. No interest is required to be charged on the investment costs allocated to future water supply until use is initiated, except for the payment of current interest charges on the unpaid balance after the interest-free period. The investment allocable to future water supply is limited to 30 percent of the project cost. All costs for future water supply, including interest, incurred after the interest-free period, which shall not exceed 10 years, must be repaid within 50 years after use is initiated.

b. Water supply for the city of Raleigh, N. C. The city of Raleigh is the local agency which has requested that water supply be included in the Falls project. Raleigh has provided satisfactory assurances of repayment of the allocated cost. The city is installing an intake in the reach of Neuse River above the Falls site, and it is expected that use of the Falls project for water supply would begin as soon as the project is completed.

115. Apportionment of water-quality-control costs. The streamflow augmentation from the Falls reservoir in low-flow periods would improve the water quality. In accordance with the Federal Water Pollution Control Act Amendments of 1961 (Public Law 87-88), the cost incurred for water-quality control may be nonreimbursable if the benefits are widespread. In this case, benefits would accrue along the main stem below Falls to the mouth and are considered widespread and, therefore, nonreimbursable.

116. Apportionment of recreation costs.

a. General recreation costs. Section 4 of the Flood Control Act of December 22, 1944 (Public Law 534, 78th Cong.), authorizes construction, operation, and maintenance by the Federal Government of basic facilities for public use and access for general recreation. Under this authority the cost allocated to general recreation is apportioned to the Federal Government. However, the State, adjoining counties, and nearby cities are known to be interested in developing general recreational areas on the reservoir, utilizing the general recreational opportunity which the project would afford. It is believed that a considerable amount of such development will take place if the project is built, although no definite plans exist for it at this time.

b. Fish and wildlife costs. The conservation pool included in the Falls project would provide storage for water supply and low-flow-augmentation. The fish and wildlife benefits also resulting from the conservation pool, while substantial, would be generally incidental. Neither modifications in the project nor the acquisition of lands for fish and wildlife purposes is proposed for the Falls project at the present time. The only costs required to obtain net benefits to fish and wildlife would be those incurred for recreation under authority of the Flood Control Act of 1944. The State of North Carolina is interested in utilizing the reservoir for fish and wildlife purposes, and it is believed that substantial non-Federal expenditure will be made for these purposes if the project is built. The U. S. Fish and Wildlife Service report finds that the Falls project may produce fishery benefits of more than local significance. Therefore, no costs are allocated to non-Federal interests for fish and wildlife purposes.

LOCAL COOPERATION

117. In the preceding paragraphs, the extent to which non-Federal interests are required to cooperate financially in implementation of the Falls project has been discussed. The items and amounts of non-Federal cost are shown in table 15. Repayment of costs allocated to water supply may be made either by sharing construction costs during project construction plus annual payments of operation and maintenance costs and payment of replacement costs when incurred, or by annual payments for the construction costs, including interest during construction and interest on the unpaid balance plus annual payment for operation and maintenance and payment of replacement costs when incurred. Reasonable assurance that these obligations for water-supply storages

will be assumed has been received. This assurance is included as attachment No. 2 to this report. Local interests will be expected to prevent obstruction and encroachment on the channels downstream of the reservoir which would interfere with operation of the project. Satisfactory assurances to that effect, from the State or other responsible agencies, will be a required item of local cooperation.

COOPERATING AGENCIES

118. General. Federal, State, and municipal agencies were consulted during the investigations and during the preparation of this report. The Federal agencies most concerned with various phases of the development plan are as follows.

119. Department of Health, Education, and Welfare. The Public Health Service, an agency of this Department, is preparing a detailed report on present and future needs for water supply and water-quality control in the Neuse River basin. Preliminary data on present and future water supply and water-quality-control needs, furnished by the Public Health Service for use in determining the needs to be met by the Falls reservoir, are tabulated in tables V-1 and V-2 of appendix V.

120. Department of the Interior.

a. The National Park Service. This agency prepared a report on the general recreation benefits expected from the Falls reservoir and other reservoirs in the general plan of development. This report is included as appendix IX.

b. The U. S. Fish and Wildlife Service. This agency prepared a report on fish and wildlife resources within the Neuse River basin, and evaluated benefits and damages to fish and wildlife attributable to the proposed Falls project. This report is included as appendix VI.

c. The U. S. Geological Survey. This agency operates stream-gaging stations throughout the basin, and furnished streamflow records and topographic maps which were used during the preparation of this report.

121. Department of Agriculture. Various agencies of this Department cooperated with the Wilmington District by furnishing pertinent data relative to crop production, average yields, and values.

122. Department of Commerce. The U. S. Weather Bureau, an agency of this Department, furnished climatological and meteorological data as well as river stages for various stations throughout the basin.

123. Federal Power Commission. The Regional Engineer of the Atlanta office of this agency cooperated in investigating the power potential at the Falls site and other sites in the basin, and furnished unit-power values used in estimating benefits.

SECTION XI - SUMMARY AND DISCUSSION

THE PROBLEMS

124. Flood control. The need for protection of the flood plains of the Neuse River basin from disastrous floods has long been recognized. Major floods which have caused extensive damage in the Neuse River basin have emphasized the urgent need for flood protection.

125. Water supply. The Neuse River and tributaries are a potential source of ample water supply for long-range future needs if the flow in dry seasons is augmented by reservoir storage. Very few municipalities presently get their water from the Neuse River, so the current supply for domestic consumption is, on the whole, fairly adequate. The city of Raleigh needs an additional source of supply, and is planning to utilize the Neuse River. The use of water for irrigation is developing rapidly in the Neuse River basin, and it is anticipated that, in the foreseeable future, irrigation facilities will be a primary and urgent need throughout the basin.

126. Water-quality control. Pollution of streams in the Neuse River basin by industrial effluents and domestic sewage is a problem of serious concern. Treatment alone, by known methods, will not suffice to bring the streams up to acceptable standards of quality. The amount of water flowing during dry periods is insufficient to provide adequate dilution.

127. Recreation. The growth of population in the Neuse River basin, especially in the upper portion of the basin, has increased the need for additional facilities for public recreation. Facilities for water sports, fishing, and activities such as picnicking and sightseeing would help to meet the needs.

THE SOLUTION

128. The general plan of development. The general plan of water-resources development presented in this report would solve most of the long-range water problems in the basin. The immediate needs are for flood protection, local water supply, low-flow augmentation, and recreation. Construction of the Falls project would be the most effective initial step toward fulfilling the immediate needs. Additional reservoirs throughout the basin would be phased into the plan to provide solutions to the anticipated future water-conservation needs. This arrangement provides sufficient flexibility in scheduling of the latter projects to offset any inaccuracies that might occur in the projection of anticipated needs.

129. Solution of immediate needs. Approximately 74 percent of the basin-wide average annual flood damage occurs on the flood plains of the Neuse River below the Falls damsite. The Falls reservoir is capable of reducing the flood damages on the flood plains below the site by about 50 percent, which is equivalent to a reduction of about 37 percent of all basin damage. The Falls reservoir would not afford

complete protection from large floods in the lower basin; therefore, urban development on the flood plain would be subject to damages. Local regulation of the flood plain is needed to discourage further urban development which might be subject to floods. The greatest water-quality-control needs occur primarily on the main stem of the Neuse River. The low-flow augmentation from the Falls project would assure a dependable minimum flow of 165 cubic feet per second near Raleigh, N. C., and would provide a significant measure of water-quality control. Falls reservoir would be a dependable source of water supply for Raleigh for the long-range future. The immediate recreation needs for the basin are primarily centered in the more heavily populated upper basin area. Since the Falls reservoir is located in this area, the 11,800-acre reservoir would substantially satisfy the immediate recreation needs of the area.

130. Solution of future needs. The Wilson Mills, Buckhorn, and Beulahtown projects, when constructed later in the general plan of development, would practically satisfy most of the remaining needs of the Neuse River basin and would provide a desirable hydrologic plan around which other reservoirs could be added as needs increase.

131. Related basin programs of other agencies. The watershed programs of other Federal and State agencies were given consideration in the general plan of basin development, such as the conservation programs under the Department of Agriculture and the conservation plans of the State of North Carolina. The program by the Department of Agriculture could produce significant water-control effects on the land itself and on the smaller tributary streams in the Neuse River basin. These facilities, when provided, would complement the overall plan and would create additional benefits. Additional programs of State and Federal agencies responsible for pollution control, recreation, and fish and wildlife conservation could be developed as supplemental beneficial features to the general plan of development.

132. Additional information. Additional information on recommended and alternative projects, called for in Senate Resolution 148, 85th Congress, adopted January 28, 1958, is contained in attachment No. 1 to this report.

SECTION XII - CONCLUSIONS

133. The general plan of development presented in this report is designed to meet the water-resource needs of the basin over a long-range period. This plan is presented for approval as a general framework, or guide.

134. The four principal reservoirs, Falls and Wilson Mills on the Neuse River, Buckhorn on Contentnea Creek, and Beulahtown on Little River, would provide the major storage capacity for flood control and water supply for the Neuse River basin. No significant amount of storage for these purposes exists at the present time. The releases from the proposed reservoirs during low-flow periods would, if adequate

sewage treatment were provided by local interests, afford water-quality control which would enhance the use of streams for water supply, fishing, and recreation. The water areas of the reservoirs would provide excellent recreation areas accessible to the general public.

135. The four main reservoirs would be supplemented by nine smaller reservoirs which would provide additional flood control, water supply, water-quality control, and other uses as the needs dictate. It is contemplated that soil-conservation measures under the Department of Agriculture would be extended throughout much of the basin and would be a benefit to the streams as well as the land.

136. The Falls project is the most important project of the general plan and is the only project in the plan for which the immediate need is firmly established. The next projects should follow as the needs develop. Falls reservoir will meet the most immediate and urgent needs for flood control, water-quality control, water supply for Raleigh, and recreation, as well as being a source for local municipal water supply which is needed now. The Falls reservoir project would provide the foundation upon which the general plan could be efficiently and expeditiously developed, and should be constructed as quickly as possible.

137. The water-resource development of the Neuse River basin should be continued. A long-range program of development will necessarily require future review and reevaluation to keep it in phase with the ever-changing economic activities of the basin.

SECTION XIII - RECOMMENDATIONS

138. The District Engineer recommends:

a. That the general plan of development of the Neuse River basin, as presented herein, be approved as a guide for immediate and future development of the basin's water resources.

b. That the Falls project on Neuse River in North Carolina be authorized for construction in the interest of flood control, water supply, water-quality control, recreation, and other purposes, in general accordance with the plans outlined in this report; at an estimated cost of $18,600,000 for construction and $120,000 annually for operation, maintenance, and replacements; provided that, before construction is initiated, local interests agree to:

(1) Prevent encroachment on downstream channels that would interfere with the operation of the reservoir; and

(2) Pay the United States, in accordance with the Water Supply Act of 1958, as amended, the entire amount of construction cost allocated to water supply, presently estimated at $1,455,000, and the entire amount of operation, maintenance, and replacement costs allocated to water supply, presently estimated at $10,000 annually, the final

amounts to be determined after actual costs are known. The net cost to the United States is estimated at $17,145,000 for construction and $110,000 annually for operation, maintenance, and replacements.

J. S. GRYGIEL
Colonel, Corps of Engineers
District Engineer

[First endorsement]

SADER (31 Dec 63)
SUBJECT: Neuse River Basin, North Carolina; Survey Report

U. S. Army Engr Div, South Atlantic, Atlanta, Ga., 2 January 1964

TO: Chief of Engineers, Department of the Army, Washington, D. C.

Concur in the recommendations of the District Engineer.

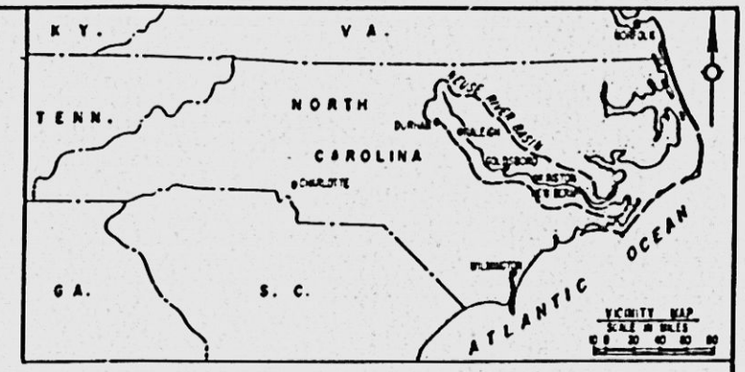
s/ A. C. Welling

A. C. WELLING
Major General, USA
Division Engineer

47-829 O-65—7

CORPS OF ENGINEERS

U. S. ARMY



DAMSITE INDEX

1 FALLS
2 WILSON MILLS
3 BEULAHTOWN
4 LITTLE BUFFALO
5 BAKERS MILL
6 BUCKHORN
7 WIGGINS MILL
8 STANTONSBURG
9 BLACK CREEK
10 GREAT SWAMP
11 AYCOCK SWAMP
12 HILLSBORO
13 ORANGE

LEGEND

- INTERSTATE HIGHWAY
- FEDERAL HIGHWAY
- STATE HIGHWAY
- RAILROAD
- COUNTY LINE
- DRAINAGE BASIN LIMIT
- DAMSITE INDEX NUMBER
- DAMSITE FOR PROJECT RECOMMENDED FOR INITIAL CONSTRUCTION
- DAMSITE FOR PROJECT STUDIED.

NEUSE RIVER, NORTH CAROLINA

GENERAL BASIN MAP

SCALE IN MILES

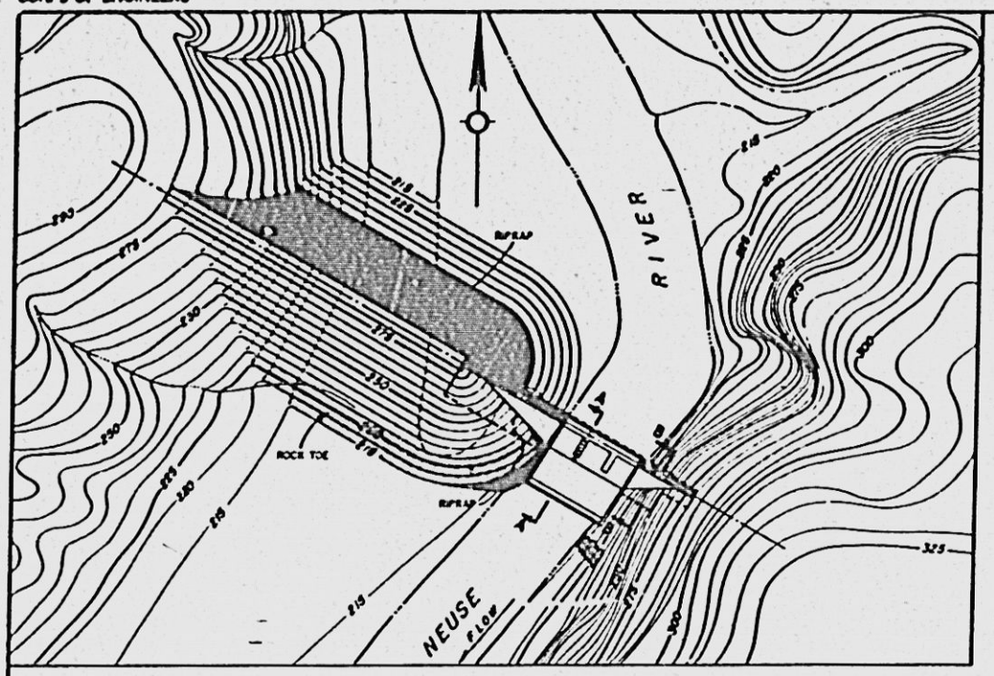
U. S. ARMY ENGINEER DISTRICT, WILMINGTON, N. C.

SUBMITTED APPROVAL RECOMMENDED APPROVED

FILE NO. 33

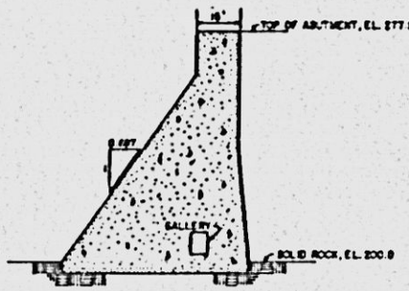
PLATE 1

47-829 O-65 (Face blank p. 68) No. 1



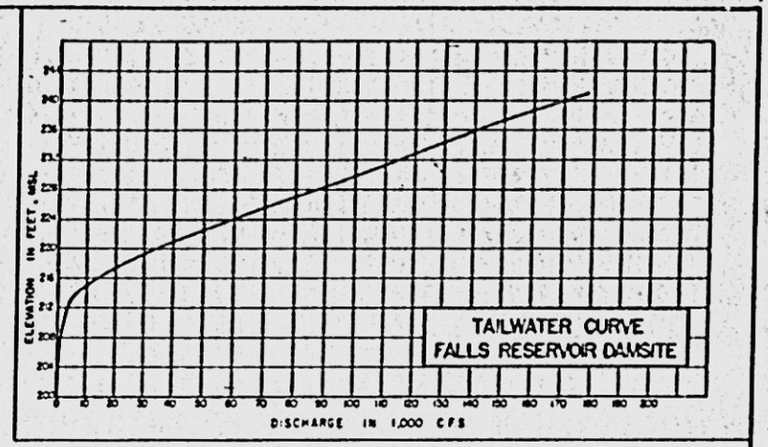
PLAN

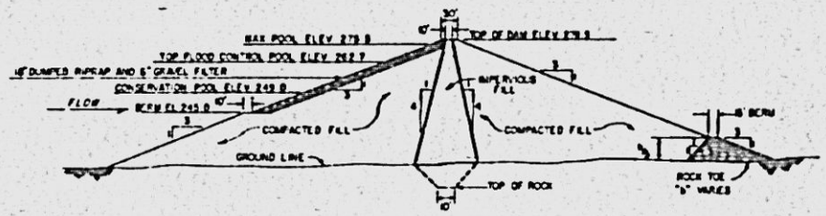
SCALE IN FEET
(CONTOUR INTERVAL 5 FEET)



SECTION B-B

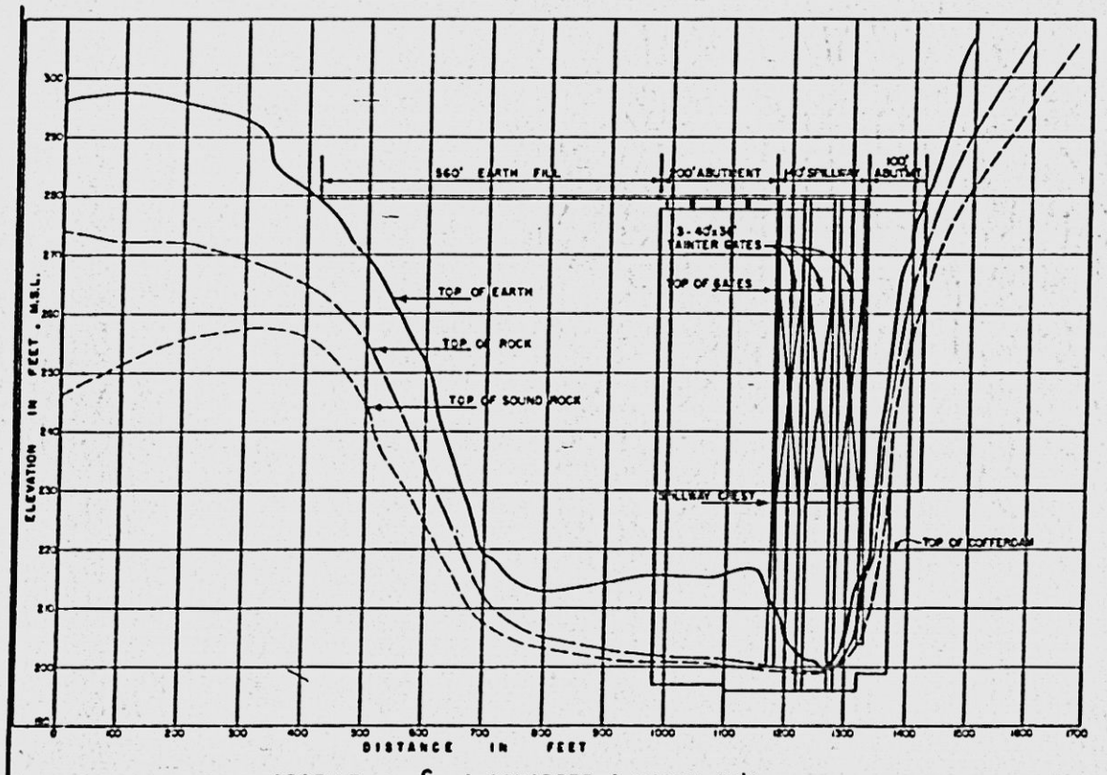
SCALE 1" = 20'



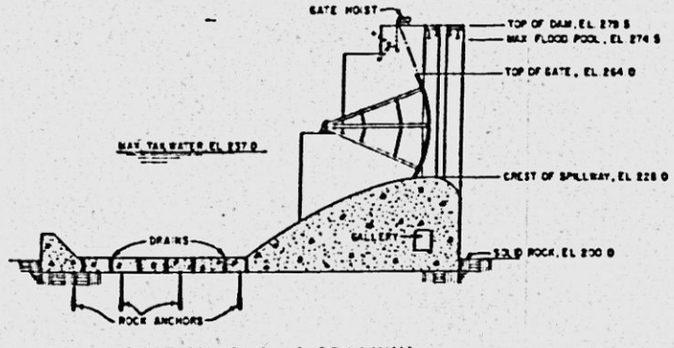


EARTH DAM SECTION

NOT TO SCALE



PROFILE on ℄ of CONCRETE & EARTH DAM



SECTION A-A of SPILLWAY

SCALE 1" = 20'

REUSE RIVER BASIN, NORTH CAROLINA

PLAN AND SECTIONS
FALLS RESERVOIR DAMSITE

SCALES AS SHOWN

U. S. ARMY ENGINEER DISTRICT, WILMINGTON, N. C.

SUBMITTED APPROVAL RECOMMENDED APPROVED

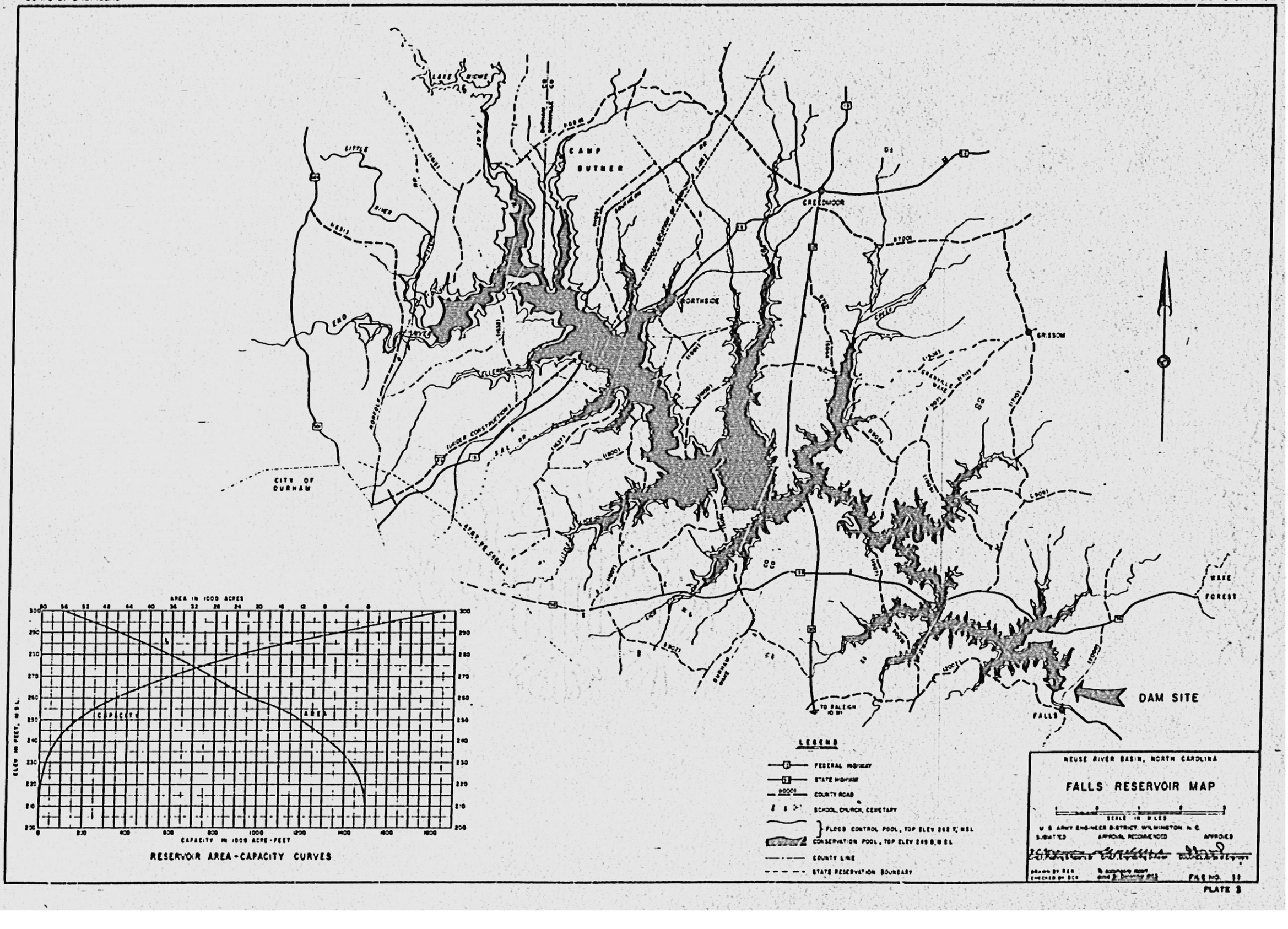
DRAWN BY R.I.B. CHECKED BY E.D.B. FILE NO. 11

PLATE 2

47-829 O-65 (Face blank p. 68) No. 2

CORPS OF ENGINEERS

U. S. ARMY



RESERVOIR AREA-CAPACITY CURVES

REUSE RIVER BASIN, NORTH CAROLINA

FALLS RESERVOIR MAP

SCALE IN MILES

U. S. ARMY ENGINEER DISTRICT, WILMINGTON, N. C.

SUBMITTED APPROVAL RECOMMENDED APPROVED

DRAWN BY B&R CHECKED BY BCB FAS NO. 11

PLATE 3

47-829 O-65 (Face blank p. 68) No. 3

APPENDIX VI

FISHING & HUNTING - U. S. FISH & WILDLIFE SERVICE

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA 23, GEORGIA

November 25, 1963

CE-MA-tn

District Engineer
U. S. Army, Corps of Engineers
Wilmington, North Carolina

Dear Sir:

In accordance with our letter of June 19, 1962, we are providing preliminary data relative to proposed reservoir sites and future fish and wildlife needs in the Neuse River Basin, North Carolina. Our studies were made in cooperation with the North Carolina Wildlife Resources Commission and are based on project data transmitted by your letters of November 5, 1962, and January 9, 1963.

The water development plan you are considering will include all or combinations of 14 reservoirs located on the Neuse River and tributary streams for purposes of flood control, power, water supply, low-flow augmentation and recreation (plate 1). This letter does not constitute our project report as required by Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Bureau's project report will be submitted when sufficient data are available to permit a detailed evaluation of your final plan.

We have confined our studies to the 10 counties lying primarily in the basin above New Bern, North Carolina. Information presented herein does not include consideration of possible project effects on estuarine or anadromous fishery resources. The importance of quality and quantity of downstream flows to these resources was mentioned in our report, dated June 26, 1957. Reliable land-use projections are available only to the year 1975, therefore, anticipated fish and wildlife habitat is calculated as a constant beyond this date.

Fishery resources in the basin are composed primarily of warm-water species such as largemouth bass, other sunfishes, catfishes, carp, and suckers. Anadromous species such as striped bass and shad are present seasonally in the lower segments of Neuse River and tributaries. The stream fishery consists of 8,500 surface acres and small impoundments provide an additional 15,000 acres. The United States Soil Conservation Service has predicted that by 1975 the total surface area

of small impoundments will be 30,200 acres. It is estimated that the total fresh-water fishery habitat available in 1975 will have the productive potential to support an estimated 3.4 million man-days of fishing (table 1).

The construction and operation of any combination of the considered reservoirs will increase and diversify fish habitat, although the reservoirs will contain essentially the same species as do the present habitats. Effects of individual reservoirs on fishery resources are shown in table 2. Downstream areas were excluded from consideration, owing to lack of information necessary to determine project effects. Consideration should be given in project planning to the release of water in sufficient quantity and quality to prevent adverse effects in these areas.

Wildlife resources are comprised of farm and forest game, migratory birds and fur animals. The flood plains of the Neuse River and tributary streams contain the most diversified and productive wildlife habitat in the basin. Present wildlife habitat in the basin consists of 1.90 million acres of woodland and 1.26 million acres of crop, pasture, and other farm lands. The North Carolina Conservation Needs Committee[1/] predicts a reduction of approximately 30,000 acres in these land-use categories by 1975. In view of these expected changes, it is estimated that remaining wildlife habitat will have the productive potential to support 1.88 million man-days of hunting annually (table 1).

Development of the considered reservoir sites will inundate wildlife habitat and reduce hunting opportunities. These damages are evaluated in man-day losses (table 3). The data do not include possible effects on downstream flood plain wildlife habitat resulting from changes in overflow regimen.

Our study indicates that considered project development will have the general effect of increasing and diversifying fishery resources and decreasing wildlife resources. Future fishing and hunting needs will meet and surpass the productive potential of the fish and wildlife habitat (table 1). Therefore, in formulating any water resource development plan, we urge that careful and adequate consideration be given to conservation and development of fish and wildlife resources.

When sufficient project data are available, this Bureau will reevaluate effects on fish and wildlife resources and make appropriate recommendations. Your final plan should define anticipated streamflow regulations and resulting land-use changes to facilitate our studies.

1/ North Carolina Soil and Water Conservation Needs Inventory -- February 1962

This letter has been reviewed by the North Carolina Wildlife Resources Commission and Department of Conservation and Development. Copies of their letters of concurrence are attached.

The opportunity to provide you with comments at this phase of your project planning is appreciated.

Sincerely yours,

Walter A. Gresh

Walter A. Gresh
Regional Director

Attachments 2

TABLE 1

FISHING AND HUNTING NEEDS AS RELATED TO HABITAT POTENTIAL,
NEUSE RIVER BASIN, NORTH CAROLINA

(Millions)

Item	1960		1975		2010		2060	
	Fishing	Hunting	Fishing	Hunting	Fishing	Hunting	Fishing	Hunting
	Man-days		Man-days		Man-days		Man-days	
Habitat Potential[1/] Without the Project	2.03	1.89	3.40	1.88	3.40	1.88	3.40	1.88
Needs	1.47	.80	2.00	1.08	3.46	1.86	6.08	3.28
Surplus or Deficit	/.56	/1.09	/1.40	/.80	-.06	/.02	-2.68	-1.40

1/ Based on available land-use changes projected for 1975.

TABLE 2

ESTIMATED AVERAGE ANNUAL FISHERY VALUES
FOR CONSIDERED RESERVOIRS, NEUSE RIVER BASIN, N. C. 1/

Reservoirs	Without the Project			With the Project		
	Acres	Man-days	Value 2/ $	Acres	Man-days	Value 2/ $
Falls	860	35,600	41,100	10,800	227,300	227,300
Buckhorn	70	3,300	6,000	4,000	45,800	45,800
Wiggins Mill	90	5,600	11,000	2,100	41,300	41,300
Bakers Mill	120	5,300	10,600	1,900	37,900	37,900
Beulahtown	30	1,300	1,900	2,250	45,700	45,700
Stantonsburg	40	2,500	4,900	2,100	34,800	34,800
Great Swamp	10	600	800	860	20,500	20,500
Nahunta Swamp	20	500	500	800	20,000	20,000
Black Creek	10	600	600	620	15,200	15,200
Little Buffalo	3	70	70	690	11,800	11,800
Aycock Swamp	6	100	100	300	5,400	5,400
Wilson Mills	780	35,300	35,600	3,200	54,800	54,800
Hillsboro	30	2,000	4,000	2,980	28,700	28,700
Orange	20	1,000	1,200	1,200	17,000	17,000

1/ Values, based on 50-year project analysis, pertain to reservoirs only and exclude tailwater areas.

2/ Monetary expressions of noncommercial use of fish and wildlife resources are based on the "Interim Schedule of Values for Recreational Aspects of Fish and Wildlife," adopted by the Inter-Agency Committee on Water Resources on October 18, 1960.

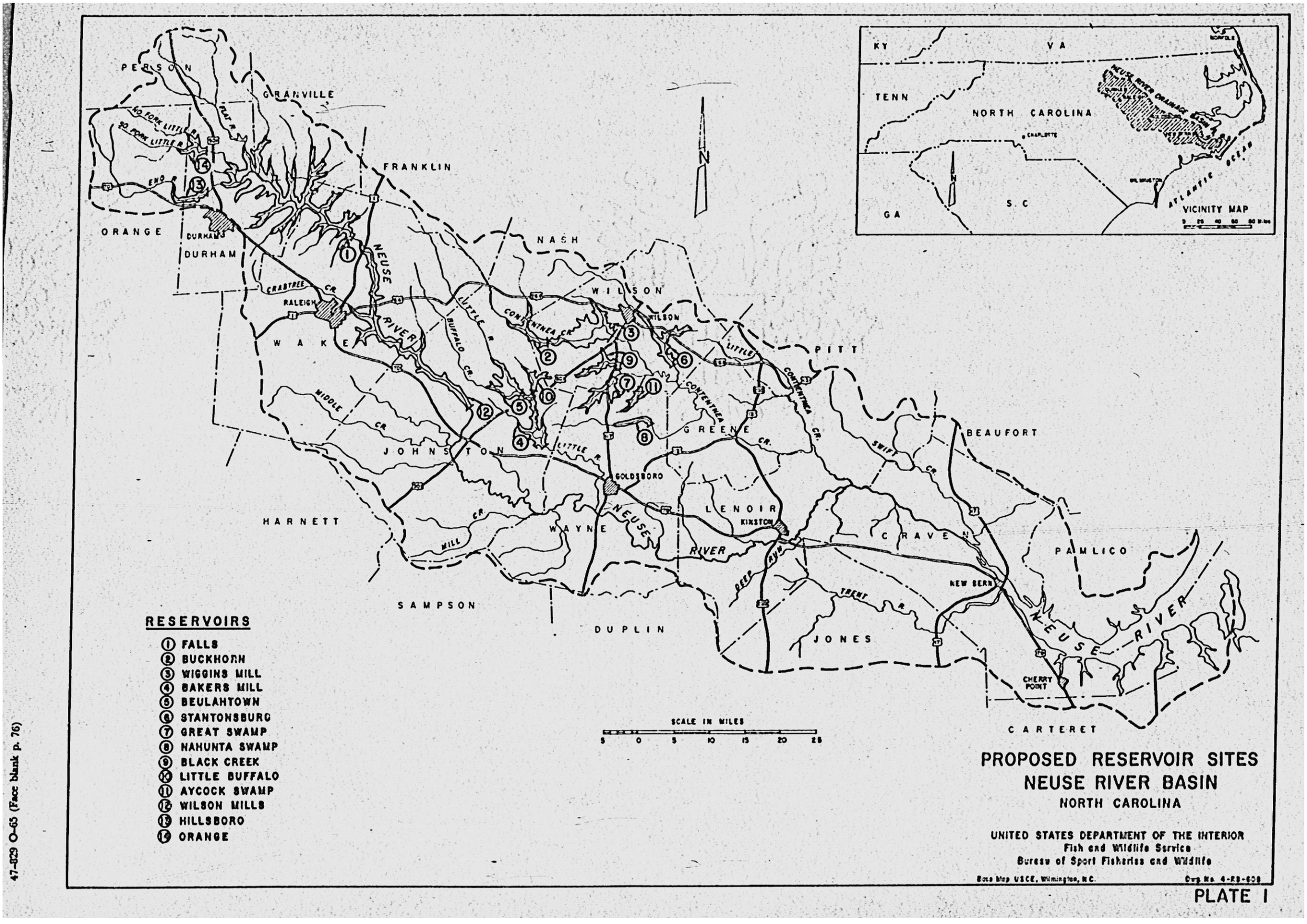
TABLE 3

ESTIMATED AVERAGE ANNUAL WILDLIFE LOSSES
FOR INDIVIDUAL RESERVOIR SITES

NEUSE RIVER BASIN, N. C.[1/]

Reservoirs	Habitat Affected	Hunting Effort Lost
	Acres	Man-days
Falls	21,300	7,200
Buckhorn	5,800	2,500
Wiggins Mill	4,200	1,100
Bakers Mill	4,100	1,000
Beulahtown	5,800	1,500
Stantonsburg	5,500	1,000
Great Swamp	2,300	500
Nahunta Swamp	2,200	400
Black Creek	2,200	400
Little Buffalo	1,100	400
Aycock Swamp	700	200
Wilson Mills	7,600	2,000
Hillsboro	4,200	2,300
Orange	2,500	1,100

1/ Values, based on 50-year project analysis, pertain to inundated reservoir areas and exclude effects on downstream flood plain areas.



PROPOSED RESERVOIR SITES
NEUSE RIVER BASIN
NORTH CAROLINA

UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife

Base Map USCE, Wilmington, N.C. Drg No. 4-RB-608

PLATE 1

47-829 O-65 (Face blank p. 76)

State of North Carolina
Wildlife Resources Commission
RALEIGH, N. C. 27602

November 12, 1963

Mr. Walter A. Gresh, Regional Director
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta 23, Georgia

Dear Mr. Gresh:

Reference is made to Dr. Watson's letter of October 29, 1963, enclosing a preliminary draft of a letter report to be forwarded to the District Engineer, U. S. Army Corps of Engineers, relative to the proposed Neuse River Basin Project.

We are in general agreement with the wording of the draft.

Very truly yours,

Eugene E. Schwall

Eugene E. Schwall
Assistant Director

EES/gh

STATE OF NORTH CAROLINA
DEPARTMENT OF
CONSERVATION AND DEVELOPMENT
RALEIGH, N. C.

DIVISION OF
COMMERCIAL FISHERIES
DAVID A. ADAMS
FISHERIES COMMISSIONER

November 14, 1963

Mr. C. W. Watson, Acting Chief
Division of Technical Services
U. S. Department of the Interior
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta 23, Georgia

Dear Mr. Watson:

I concur, in general, with the text of the proposed report on the Neuse River Basin project.

I would like, however, to reserve final comments until more data are available. I am particularly interested in the change in quality and quantity of downstream flows as a result of the proposed structures. We are particularly concerned about the possible influence that the rate of flow may have upon anadromous fish downstream from the dams.

Sincerely,

David A. Adams

DAA:dag

NEUSE RIVER BASIN, NORTH CAROLINA

Information called for by
Senate Resolution 148, 85th Congress, 1st session
Adopted 28 January 1958

GENERAL

(1) Local interests requested that a study be made of the Neuse River basin to determine the best method of conserving and developing the water resources of the basin with regard to flood control, water supply, low-flow augmentation, recreation, and/or other needs that may arise.

(2) The project recommended for initial construction is a dam and reservoir at the Falls site on the Neuse River, about 10 miles northeast of Raleigh, N. C. The project would provide storage for flood control, water supply, and low-flow augmentation, and would afford recreational opportunities in and adjacent to the reservoir.

(3) There is no alternative damsite in the Neuse River basin that could take the place of the Falls site from the standpoint of amount of storage capacity, topography, geology of the area, economic aspects, and ability to fulfill present and future needs.

RECOMMENDED PLAN OF IMPROVEMENT

(4) Project description.

a. General. The Neuse River, which is formed by the confluence of the Eno and Flat Rivers, drains all or part of 16 counties in northeastern North Carolina. The river flows generally southeast for a distance of 222 miles and empties into Pamlico Sound, about 34 miles below New Bern, N. C. The Neuse River basin has a total area of 5,710 square miles, of which 760 square miles lie above the Falls site. The principal tributaries to Neuse River below the Falls site are Little River, Contentnea Creek, and Trent River. Little River has a length of approximately 69 miles and a drainage area of 323 square miles. Contentnea Creek has a length of approximately 82.5 miles and a drainage area of 849 square miles. Trent River, which enters the Neuse River near New Bern, N. C., has a length of about 80 miles and a drainage area of about 319 square miles.

b. Falls project. The Falls damsite is located on Neuse River, in Wake County, North Carolina, about 1 mile above the town of Falls and about 10 miles northeast of Raleigh, N. C. A dam built at this site would form a reservoir lying principally within the Neuse River valley in the counties of Wake and Durham. The project area would lie in a region of rolling hills and deeply eroded valleys known as the Piedmont Plateau, and is noted for good foundations for dams. The reservoir would provide storages of 243,000 acre-feet in the flood control pool, 82,000 acre-feet for low-flow augmentation,

and 45,000 acre-feet for water supply; 38,000 acre-feet would be reserved for sedimentation, making a total of 408,000 acre-feet in the reservoir. The conservation pool would contain 165,000 acre-feet.

(5) Project costs and benefits. The cost of the Falls project was based on estimates using 1963 cost levels. Annual charges were computed using interest on the Federal investment of 3 percent and an economic life of 100 years. Table 1 shows a summary of first costs, annual charges, and benefit-to-cost ratios for the Falls project for both a 50-year and 100-year economic life.

(6) Intangible benefits. Based on experience at other Corps of Engineers projects, certain benefits would accrue from the Falls reservoir which are hard to evaluate in monetary terms. Among these are the conservation of soil, water, and forest resources downstream from the project. New industries would be attracted to the area and others would be created, not only because of the assured water supply, but also for worker recreational opportunities which would be provided by the extensive water areas. The in-migration of workers needed by new industries would also increase the demand for agricultural products which are grown in the area. There would be an increase in land values in the vicinity of the reservoir.

(7) Future needs. The Falls project would provide for the major foreseeable water-use needs of the general area. This plan could be expanded to care for other needs that might arise in the future with the additional construction of other reservoirs which would take care of some of the demands which would presently be taken care of by the Falls project.

(8) Allocation of costs. Table 2 summarizes the allocation of the Federal cost for the Falls reservoir, based on the separable-cost remaining-benefits method, priority-of-use method, and incremental-cost method for the 50-year and 100-year economic project lives. The earliest date of completion for the Falls project is expected to be during the year of 1970.

TABLE 1

Summary of first costs, annual charges, benefits, and benefit-to-cost ratios for the Falls project
(values in thousands of dollars)

Item	50-year project economic life	100-year project economic life
First costs		
Construction cost	$18,600	$18,600
Interest during construction	800	800
Initial investment	$19,400	$19,400
Present worth of future additions for recreational facilities	470	600
Total economic investment	$19,870	$20,000
Annual charges		
Interest	$ 582	$ 582
Amortization	172	32
Operation and maintenance	100	100
Major replacements	20	20
Economic cost of future additions	18	18
Economic cost of land	70	70
Total annual charges	$ 962	$ 822
Annual benefits		
Flood control	$ 520	$ 564
Local water supply	102	112
Low-flow augmentation	140	195
Recreation:		
General	1,146	1,690
Fishing	116	171
Total annual benefits	$ 2,024	$ 2,732
Benefit-to-cost ratio	2.1	3.3

TABLE 2

Summary of allocated costs for the Falls project
(values in thousands of dollars)

Item	Flood control	Local water supply	Low-flow augmentation	Recreation	Total
Allocated cost based on separable-costs remaining-benefits method of allocations:					
50-year economic life					
First cost	11,029	1,431	2,195	3,945	18,600
Interest during construction	473	61	94	172	800
Economic cost of land	37	4	6	23	70
Present worth of future additions				18	18
Investment	447	58	89	160	754
Operation, maintenance, and major replacements	15	10	15	80	120
Total annual economic charges	499	72	110	281	962
100-year economic life					
First cost	11,725	1,455	2,424	2,996	18,600
Interest during construction	503	62	104	131	800
Economic cost of land	39	4	7	20	70
Present worth of future additions				18	18
Investment	387	48	80	99	614
Operation, maintenance, and major replacements	23	10	20	67	120
Total annual economic charges	449	62	107	204	822

TABLE 2--Continued

Summary of allocated costs for the Falls project
(values in thousands of dollars)

Item	Flood control	Local water supply	Low-flow augmentation	Recreation	Total
Allocated cost based on priority-of-use method of allocations:					
50-year economic life					
First cost	11,720	149	1,430	5,301	18,600
Interest during construction	502	6	62	230	800
Economic cost of land	41	1	6	22	70
Present worth of future additions				18	18
Investment	475	6	58	215	754
Operation, maintenance, and major replacements	45	4	13	58	120
Total annual economic charges	561	11	77	313	962
100-year economic life					
First cost	15,118	182	879	2,421	18,600
Interest during construction	648	8	37	107	800
Economic cost of land	52	1	4	13	70
Present worth of future additions				18	18
Investment	499	6	29	80	614
Operation, maintenance, and major replacements	54	4	11	51	120
Total annual economic cost	605	11	44	162	822

TABLE 2--Continued

Summary of allocated costs for the Falls project
(values in thousands of dollars)

Item	Flood control	Local water supply	Low-flow augmentation	Recreation	Total
Allocated cost based on incremental-cost method:					
50-year economic life					
First cost	14,136	1,085	1,900	1,479	18,600
Interest during construction	606	47	81	66	800
Economic cost of land	59	1		10	70
Present worth of future additions				18	18
Investment	573	44	77	60	754
Operation, maintenance, and major replacements	61	4	8	47	120
Total annual economic cost	693	49	85	135	962
100-year economic life					
First cost	14,150	1,122	1,908	1,420	18,600
Interest during construction	606	48	82	64	800
Economic cost of land	58	1	1	10	70
Present worth of future additions				18	18
Investment	467	37	63	47	614
Operation, maintenance, and major replacements	60	4	8	48	120
Total annual economic cost	585	42	72	123	822

ATTACHMENT NO. 2

Letter from City of Raleigh, North Carolina

CITY OF RALEIGH

NORTH CAROLINA

March 9, 1964

Col. J. S. Grygiel, District Engineer
U. S. Army Engineer District, Wilmington
P. O. Box 1890
Wilmington, North Carolina 28402

Dear Colonel Grygiel:

Reference is made to the reports by the Wilmington District and the South Atlantic Division on the Neuse River Basin dated 31 December 1963 and 2 January 1964, respectively.

The City of Raleigh is cognizant of the recommendation in the report that local interests (the City of Raleigh) agree to pay the United States in accordance with the Water Supply Act of 1958, as amended: the entire amount of construction costs allocated to water supply presently estimated at $1,455,000 and the entire amount of operation, maintenance and replacements costs allocated to water supply presently estimated at $10,000, annually, the final amounts to be determined after actual costs are known.

The report states that the cost allocation is based on allocating 45,000 acre-feet of storage in the Falls Reservoir to water supply which is estimated to provide a water supply of about 100 million gallons per day.

If the Falls Reservoir is authorized and funded by the Congress, it is the intention of the City of Raleigh to furnish assurances that the City will participate in the project in accordance with the recommendation of the District and Division Engineers.

Sincerely yours,

s/ W. H. Carper

W. H. Carper
City Manager

WHC:gwc

APPENDIX IX

RECREATION RESOURCES - U. S. NATIONAL PARK SERVICE

RECONNAISSANCE REPORT

on the

RECREATION RESOURCES

of the proposed

FALLS, WILSON MILLS, BEULAHTOWN AND BUCKHORN RESERVOIRS

NEUSE RIVER BASIN

NORTH CAROLINA

Prepared by

UNITED STATES DEPARTMENT OF THE INTERIOR

National Park Service
Southeast Regional Office
Richmond 40, Virginia

Bureau of Outdoor Recreation
Southeast Regional Office
Atlanta 1, Georgia

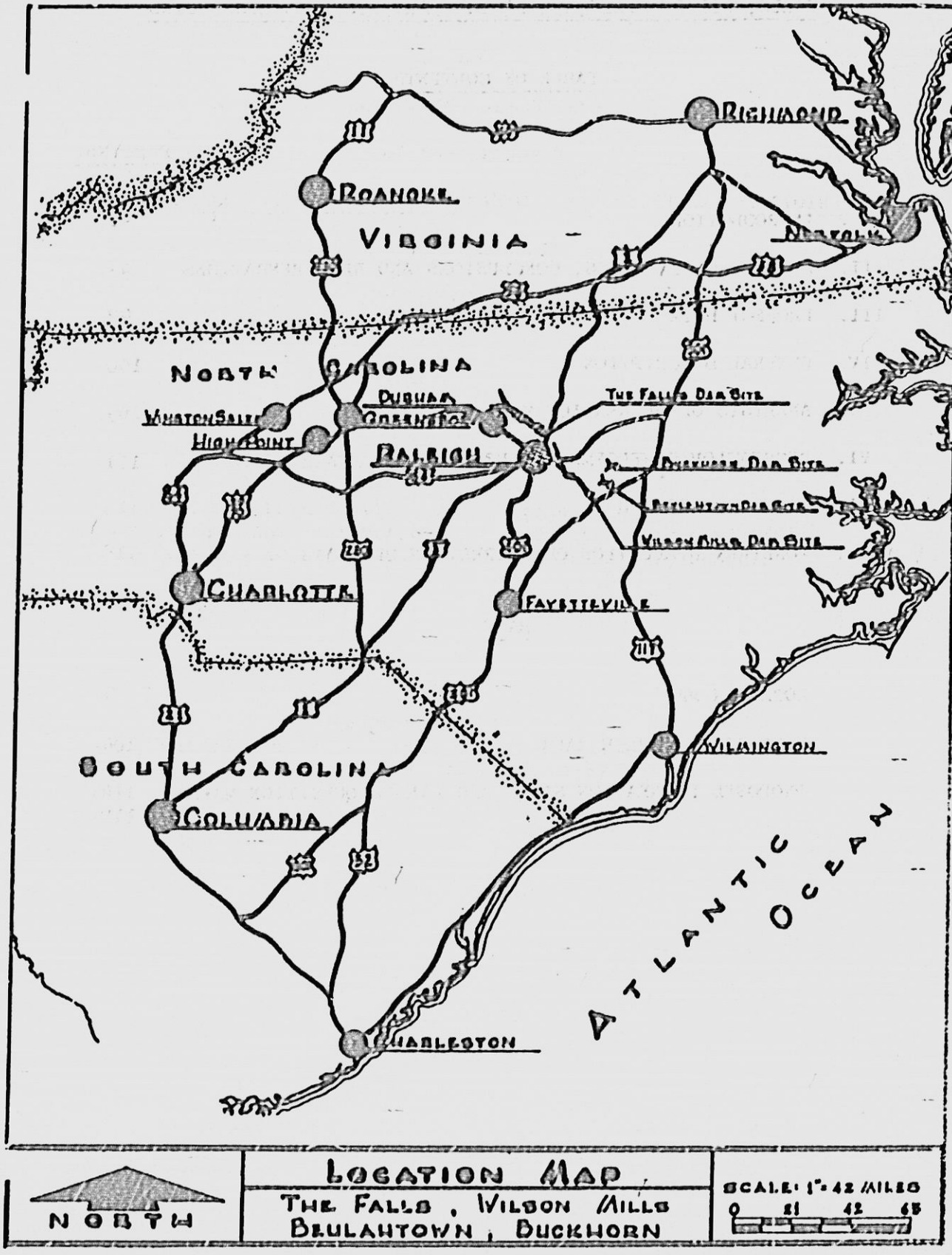
for

Department of the Army
United States Army Engineer District, Wilmington
Wilmington, North Carolina

December 1963

TABLE OF CONTENTS

MAPS


RICHMOND
ROANOKE
VIRGINIA
NORFOLK
NORTH CAROLINA
DURHAM
THE FALLS DAM SITE
WINSTON-SALEM
GREENSBORO
HIGH POINT
RALEIGH
BUCKHORN DAM SITE
BEULAHTOWN DAM SITE
WILSON MILLS DAM SITE
CHARLOTTE
FAYETTEVILLE
WILMINGTON
SOUTH CAROLINA
COLUMBIA
CHARLESTON
ATLANTIC OCEAN
NORTH
LOCATION MAP
THE FALLS, WILSON MILLS
BEULAHTOWN, BUCKHORN
SCALE: 1" = 42 MILES
0 21 42 63

I. INTRODUCTION

A. AUTHORITY

This report has been prepared in response to a request of August 9, 1962 from U. S. Army Engineer District, Wilmington. Participation by the Bureau of Outdoor Recreation in the preparation of this report is authorized by Section 2.g. of PL 88-29, May 28, 1963. Participation by the National Park Service in the preparation of this report is authorized by the Park, Parkway and Recreation Area Study Act of June 23, 1936.

B. PURPOSE

The purpose of this report is to present a preliminary appraisal of the recreation aspects of the proposed Falls, Wilson Mills, Beulahtown and Buckhorn Reservoirs, including their impact upon existing and potential recreation resources, estimated monetary recreation benefits and development costs, and general material which may be useful to the District Engineer in further planning and programing for the wise utilization of the recreation values of the project areas.

C. DESCRIPTION OF THE PROJECTS

Falls and Wilson Mills Reservoirs are proposed multipurpose projects on the Neuse River in Wake and Johnston Counties, North Carolina.

Beulahtown Reservoir is a proposed multipurpose project on a tributary of the Neuse River, namely Little River and its tributaries.

Buckhorn Reservoir is a proposed multipurpose project on a tributary of the Neuse River, namely Contentnea Creek and its tributaries.

D. INVESTIGATION

Field investigation of the reservoir sites was made during the period February - September 1963 by representatives of the Southeast Region, National Park Service.

II. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

A. IT HAS BEEN FOUND THAT:

1. There is no large body of water in the immediate vicinity of the proposed reservoirs available for full public recreation use.

2. The general area in which the proposed reservoirs are located is an area of increasing population, urbanization and industrialization. Population projections furnished by the United States Public Health Service indicate that population within the zones of influence of the four proposed projects will more than double during the period 1960-2010 and will almost double again during the period 2010-2060.

3. On the Neuse River in particular, present stream conditions are so variable and of such quality as to preclude extensive recreation development and use.

4. No existing recreation developments will be destroyed by inundation of the proposed reservoir sites nor will any significant scenic values.

5. Access to the proposed reservoir sites is adequate over all weather state and federal highways and state secondary roads. Interstate 95 will run across the Neuse River Basin near Wilson and Smithfield and will provide rapid north and south access, as will Interstate 85 which will pass near Durham.

B. IT IS CONCLUDED THAT:

1. All four proposed reservoirs are suitable for planned recreation

development and would add significantly to the recreation base of the area.

2. Recreation needs in the zones of influence of the proposed reservoirs will increase as population, urbanization and industrialization increase.

3. The proposed reservoirs would be significant primarily as day use areas for residents of the zones of influence and are not expected to be significant vacation targets.

4. Because of their close proximity to each other, each of the four reservoirs will compliment the others and, to some extent, compete with the others.

5. It is estimated that initial and optimum development of the four proposed reservoirs will result in annual visitation as follows:

Reservoir	Initial Annual Visitation	Average Annual Visitation 1970-2070
Falls	400,000	2,000,000
Wilson Mills	150,000	500,000
Beulahtown	50,000	100,000
Buckhorn	200,000	600,000

6. With optimum development, the average annual net recreation benefits are estimated to have a monetary value of $955,000 for Falls, $163,500 for Wilson Mills, $21,500 for Beulahtown, and $248,000 for Buckhorn.

7. These estimates of annual visitation and benefits are based

on the assumptions that (1) the entire shoreline of each reservoir will be publicly owned, (2) there will be an adequate acreage of publicly owned land, (3) high quality visitor facilities will be provided in optimum quantity, (4) drawdown will be held to 5' or less from May 15 to September 15 and (5) water quality will be suitable for swimming and other water contact activities.

C. IT IS RECOMMENDED THAT:

1. At least 7,500 acres of land on Falls, 2,000 acres on Wilson Mills, 500 acres on Beulahtown and 2,500 acres on Buckhorn be purchased for recreation purposes outside the 300-foot strip above maximum flood pool. This land should be acquired as a project cost.

2. Recreation facilities be provided for swimming, picnicking, boating, hiking and camping.

3. Boating be prohibited in areas set aside for swimming, and that reasonable power and speed limitations be set on motorized boats, expecially in designated fishing areas.

4. During preconstruction and construction periods, the Corps maintain close liaison with public agencies, organizations, and individuals interested in the recreation development and coordinate objectives in the best interest of the public.

5. Shoreland use and reservoir zoning plans to protect the recreation inherent to this project be formulated through the cooperative efforts of interested agencies.

6. Land for recreation developments be acquired in blocks that make possible good management practices.

7. Agencies of the State of North Carolina, the counties in which the proposed reservoir sites lie, and the major cities in the zones of influence be informed of any opportunities to administer recreation developments.

8. Comprehensive field work be accomplished with particular attention given to specific site locations for recreation facilities.

III. PROJECT DATA

A. STATUS

All four projects are currently in the survey stage.

B. PURPOSE

Project purposes under consideration are as follows:

Falls: flood control, water supply, low flow regulation.

Wilson Mills: flood control, water supply, low flow regulation.

Beulahtown: flood control, irrigation, municipal water supply.

Buckhorn: flood control, municipal water supply, irrigation, low flow regulation.

C. PROPOSED DAMS

The Falls dam site is on the Neuse River in Wake County, North Carolina, near the community of Falls. The concrete and earth dam would be 1045 feet long and 82 feet high.

The Wilson Mills dam site is on the Neuse River in Wake and Johnson Counties, North Carolina, about a mile and a half east of Wilson Mills, North Carolina. The concrete and earth dam would be 3980 feet long and 87 feet high.

The Beulahtown dam site is on the Little River in Johnson County, North Carolina, about two miles northeast of Micro, North Carolina. The earth dam would be 10,480 feet long and 49 feet high.

The Buckhorn dam site is on Contentnea Creek in Wilson County, North Carolina, about a mile northwest of Buckhorn Crossroads. The earth dam would be 3610 feet long and 60 feet high.

D. POOL DATA

Falls

	Elevation		Water Area (Acres)	
	Initial	Ultimate	Initial	Ultimate
Flood Pool (Maximum)	277.0	277.0	22,800	22,800
Conservation Pool (Full)	247.0	253.0	10,800	14,200
Minimum Pool (Dead Storage)	232.5	232.5	3,600	3,600

Wilson Mills

	Elevation		Water Area (Acres)	
	Initial	Ultimate	Initial	Ultimate
Flood Pool (Maximum)	189.7	189.7	8,500	8,500
Conservation Pool (Full)	155.4	159.6	3,200	3,800
Minimum Pool (Dead Storage)	145.0	145.0	1,900	1,900

Beulahtown

	Elevation		Water Area (Acres)	
	Initial	Ultimate	Initial	Ultimate
Flood Pool (Maximum)	184.6	184.6	5,900	5,900
Conservation Pool (Full)	159.0	165.5	2,250	3,750
Minimum Pool (Dead Storage)	153.0	153.0	1,300	1,300

Buckhorn

	Elevation		Water Area (Acres)	
	Initial	Ultimate	Initial	Ultimate
Flood Pool (Maximum)	175.4	175.4	6,000	6,000
Conservation Pool (Full)	160.0	160.0	4,000	4,000
Minimum Pool (Dead Storage)	136.0	136.0	1,110	1,110

E. OPERATION

The estimates of recreation use made in this report are based on the assumption that drawdown during the season of heaviest use (May - September) will not exceed five feet at any reservoir. If drawdown exceeds five feet, recreation use will be adversely affected.

F. PRESENT STREAM FLOW

Although no figures were obtained on stream flow, observation indicates the flow of each stream is quite variable.

47-829 O-65—9

IV. GENERAL DESCRIPTION

A. LOCATION

The Falls reservoir site is located along the Neuse River in Wake, Granville, and Durham Counties, North Carolina. It extends from the community of Falls, north of Raleigh, up into the Eno and Flat Rivers, northeast of Durham.

The Wilson Mills reservoir site is located along the Neuse River in Wake and Johnston Counties, North Carolina and extends from a point east of Wilson Mills almost to the Falls reservoir site.

The Beulahtown reservoir site is located in Johnston County, North Carolina along the Little River and Long and Buffalo Creeks. From a point about two miles northeast of Micro and about one-half-mile below the junction of Buffalo Creek with Little River, it extends northwestward about seven miles along Little River, about five miles along Long Creek, and between four and five miles along Buffalo Creek.

The Buckhorn reservoir site is located in Johnston, Nash and Wilson Counties, North Carolina. From a point about a mile northwest of Buckhorn Crossroads in Wilson County, it extends northwestward almost seven miles up Mocassin Creek, and from Mocassin Creek some distance up Turkey Creek and its tributaries.

B. PHYSICAL CHARACTERISTICS

The Falls reservoir site and most of that part of the Wilson Mills

reservoir site in Wake County are in the eastern edge of the Piedmont. The topography is typical of the eastern Piedmont, being for the most part rolling. Most of the land around the Falls reservoir site is wooded with second growth timber. Some wooded areas are all pine, some all hardwood, especially along the stream beds, and some mixed pine and hardwood. Timber growths vary greatly in age. Some are twenty years or less, a few are almost mature. Although the greater part of land adjoining the reservoir site is wooded, there are some farms and some residential areas.

The part of Wilson Mills reservoir site in Johnston County is in the western edge of the Coastal Plain. Topography varies from fairly rolling to fairly flat. Some of the land around the reservoir site is wooded, but a greater portion is farmland. The wooded areas vary in age from young to fairly mature growths, and in composition from pure pine to bottom hardwoods along stream courses.

The Beulahtown and Buckhorn reservoir sites are in the Coastal Plain where the topography is generally flat. There are few wooded areas adjacent to these reservoir sites since most of the land is farmed and rather thickly settled.

C. CLIMATE

The climate of the general area is moderate and favorable to a long recreation season. Swimming, water skiing and similar activities may

be comfortably engaged in from mid-May to mid-September, and boating, fishing and land based activities for a considerably longer period.

D. HIGHWAY ACCESS

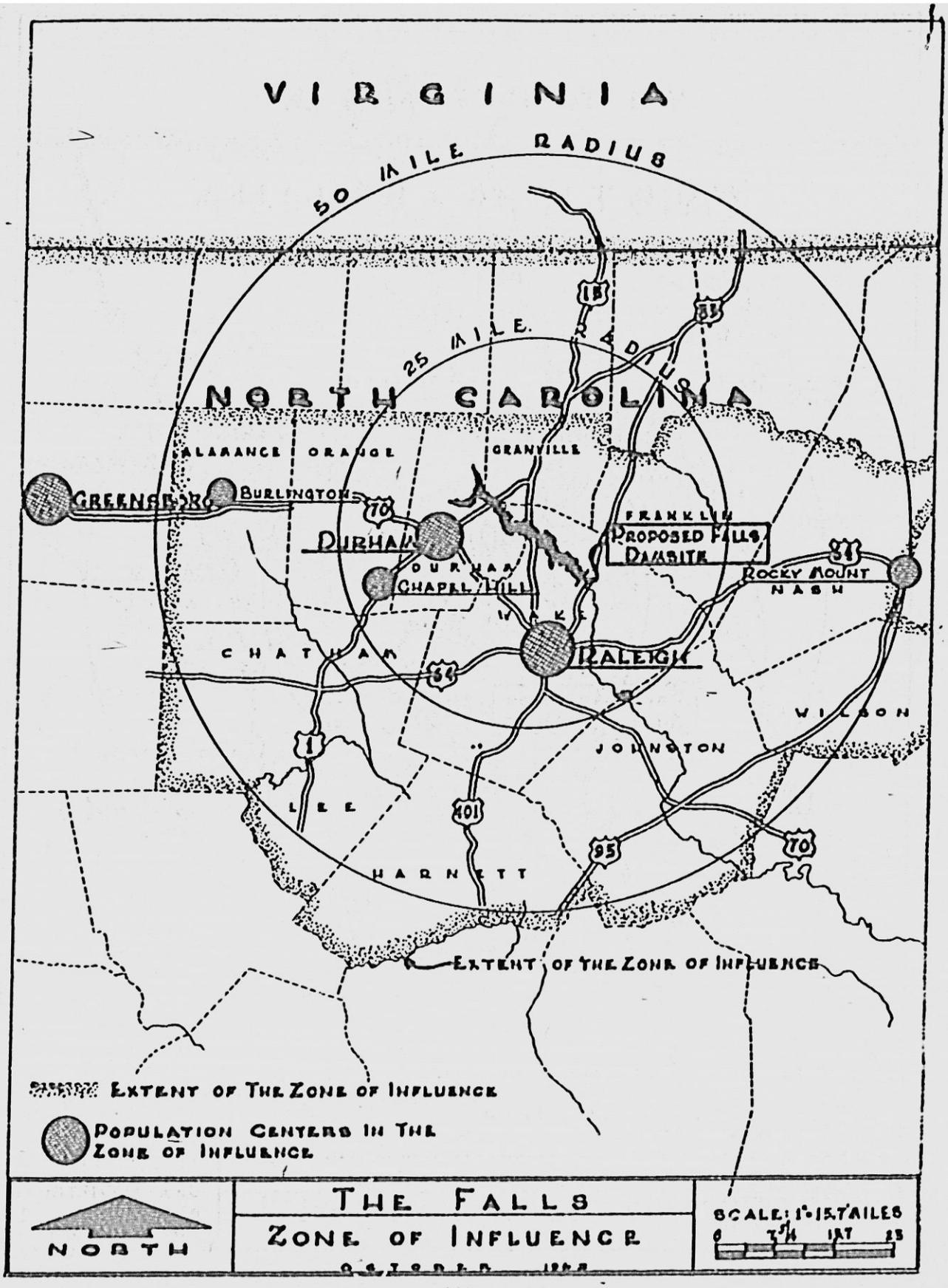
Highway access to all reservoir sites is excellent. Interstate 95 will pass within a few miles of the Wilson Mills, Beulahtown, and Buckhorn reservoir sites. Interstate 85 crosses the upper end of the Falls reservoir site. U. S. Highways 70, 501, 64, 1, 301 and 15 all provide access to the reservoir sites. A network of state highways and secondary roads, most hardsurfaced, crisscrosses the entire area.

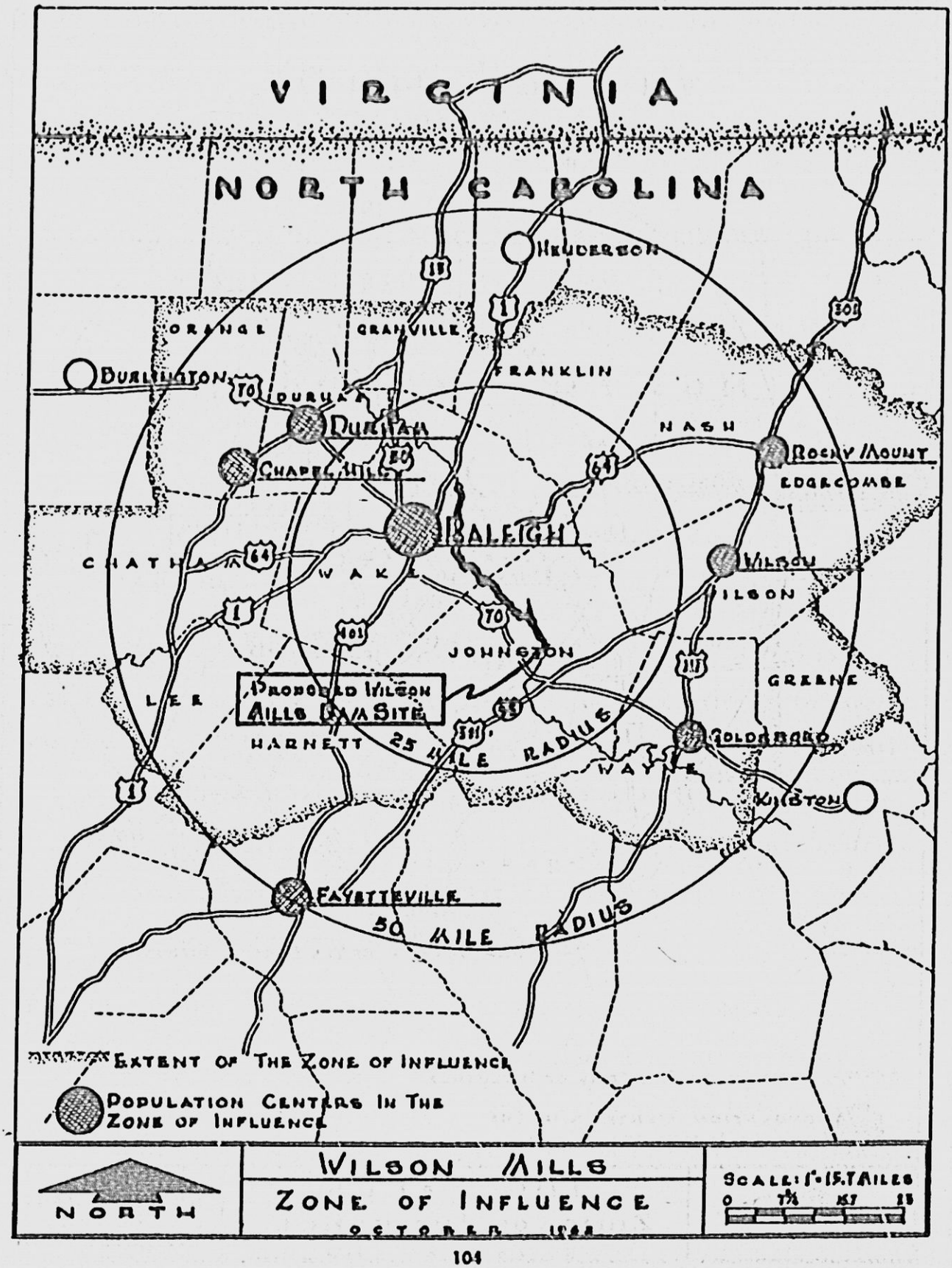
E. POPULATION

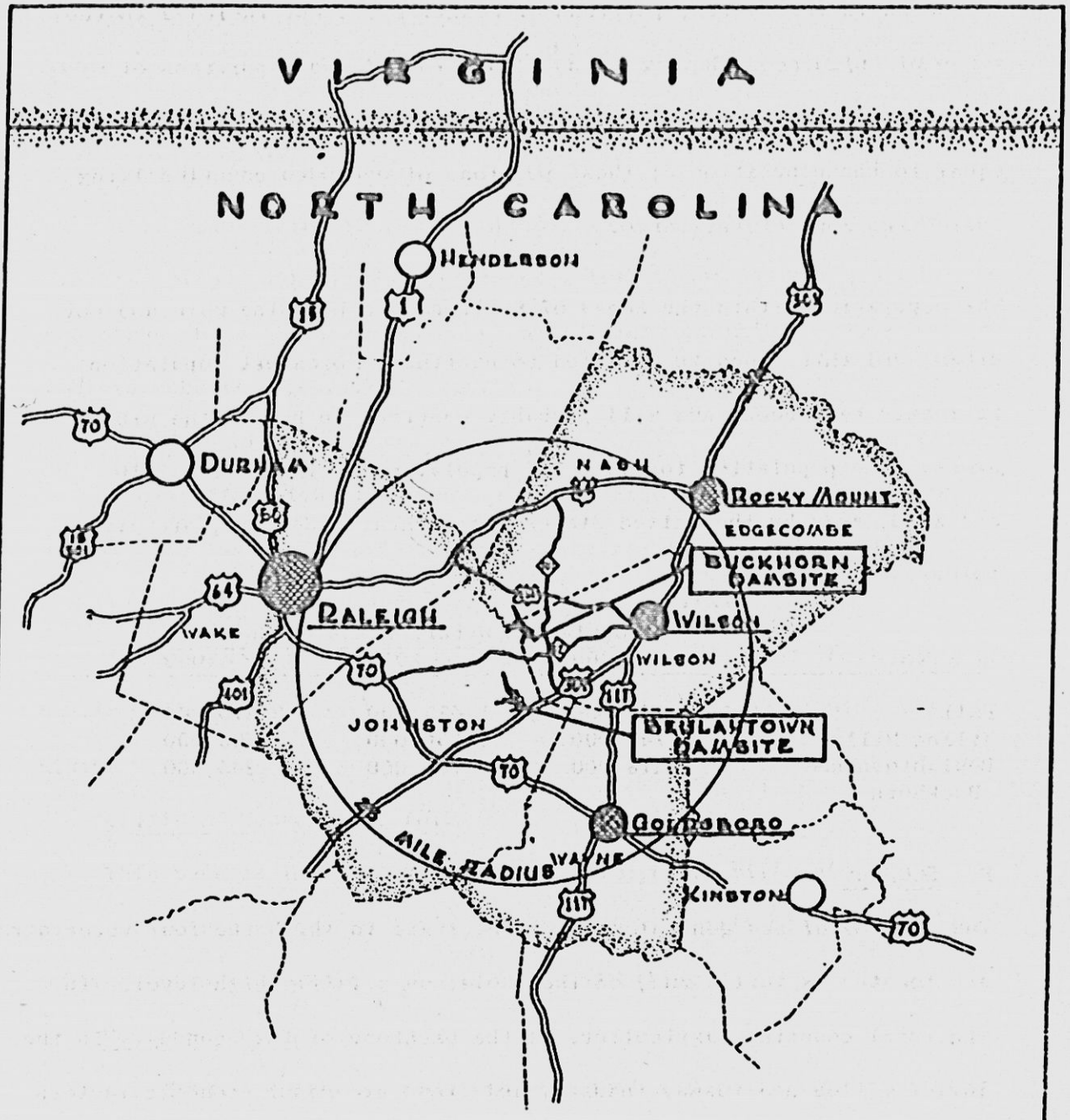
The zone of influence of each proposed reservoir is shown on the following three maps.

For the purpose of estimating recreation use, reservoirs of the size and type of the Falls and Wilson Mills are usually considered to have zones of influence of fifty miles However, the John H. Kerr Reservoir, a major competing water recreation resource, reduces the north portion of the zone of influence of both the Falls and Wilson Mills Reservoirs. White Lake, Lake Waccamaw, Jones Lake, and Singletary Lake reduce the south portion of the zone of influence of Wilson Mills.

Because population data are available only for entire counties, arbitrary modifications of the zones of influence for all reservoirs have been made along county lines Except for Granville County, about a third of which is included, and Wake County in the case of Beulahtown


VIRGINIA
50 MILE RADIUS
25 MILE RADIUS
NORTH CAROLINA
ALAMANCE
ORANGE
GRANVILLE
GREENSBORO
BURLINGTON
70
DURHAM
DURHAM
CHAPEL HILL
FRANKLIN
PROPOSED FALLS DAMSITE
64
ROCKY MOUNT
NASH
WAKE
CHATHAM
64
RALEIGH
WILSON
JOHNSTON
1
LEE
401
95
70
HARNETT
EXTENT OF THE ZONE OF INFLUENCE
EXTENT OF THE ZONE OF INFLUENCE
POPULATION CENTERS IN THE ZONE OF INFLUENCE
NORTH
THE FALLS
ZONE OF INFLUENCE
SCALE: 1" = 15 STATUTE MILES
0
7 1/2
15
23


VIRGINIA
NORTH CAROLINA
HENDERSON
ORANGE
GRANVILLE
FRANKLIN
BURLINGTON
DURHAM
NASH
ROCKY MOUNT
EDGECOMBE
CHAPEL HILL
RALEIGH
CHATHAM
WAKE
WILSON
JOHNSTON
GREENE
LEE
PROPOSED WILSON MILLS DAVA SITE
HARNETT
25 MILE RADIUS
GOLDSBORO
WAYNE
KINSTON
FAYETTEVILLE
50 MILE RADIUS
EXTENT OF THE ZONE OF INFLUENCE
POPULATION CENTERS IN THE ZONE OF INFLUENCE
NORTH
WILSON MILLS
ZONE OF INFLUENCE
OCTOBER 1948
SCALE: 1" = 15.7 MILES
0
7¾
15.7
23


VIRGINIA
NORTH CAROLINA
HENDERSON
DURHAM
RALEIGH
WAKE
NASH
ROCKY MOUNT
EDGECOMBE
BUCKHORN DAMSITE
WILSON
WILSON
JOHNSTON
BEULAHTOWN DAMSITE
GOLDSBORO
WAYNE
KINSTON
50 MILE RADIUS
70
64
401
264
301
111
158
1
Extent of The Zone of Influence
Population Centers In The Zone of Influence
NORTH
BEULAHTOWN & BUCKHORN
ZONE OF INFLUENCE
SCALE 1" = 15.7 MILES
0
7½
15?
23

and Buckhorn reservoirs, portions of counties are not included in the zones of influence. However, the population of those portions of included counties lying outside the zone of influence is at least equal to the population of those portions of excluded counties lying inside the zone of influence.

The population within the zones of influence is becoming more and more urban, and this trend is expected to continue. Greatest population increases have been, and will probably continue to be, in the urban areas. The population for 1960 and population estimates for 2010 and 2060, made by the United States Public Health Service, are given below:

Reservoir	Population within zones of influence		
	1960	2010	2060
Falls	739,000	1,685,000	2,870,000
Wilson Mills	745,000	1,650,000	2,795,000
Beulahtown and Buckhorn	418,000	765,000	1,345,000

F. ECONOMY

The economy of the general area of the state in which the four reservoirs are located is varied and, on the whole, on a fairly high level. In the rural counties, agriculture is the backbone of the economy. In the larger cities and towns, industry and trade are major economic factors. In Raleigh, Durham, and Chapel Hill, institutions of higher learning have a considerable influence on the economy. The economy of the Raleigh area is greatly influenced by the fact that it is the state capital.

G. RELATED RECREATION AREAS

There are a number of existing recreation areas within fifty miles of the various reservoirs. These include:

John H. Kerr Reservoir

This major water recreation resource is less than fifty miles from the proposed Falls Reservoir and within about fifty miles of the other three. Its size, the accommodations available, and other factors make it a powerful competitor.

The City of Raleigh Reservoir Lakes

These offer fishing and one at least also offers boating, water skiing, and land based activities such as picnicking and camping.

William B. Umstead and Reedy Creek State Parks

These parks are in Wake County. Facilities include those for boating, fishing, picnicking, camping, organized group camping and hiking.

Cliffs of Neuse State Park

This park is in Wayne County and within fifty miles of all of the reservoirs except the Falls. It provides facilitites for swimming, boating, fishing, camping, picnicking, and hiking.

Municipal Parks

All the major cities and towns have park and recreation programs. Swimming is the major water based recreation activity.

Private Developments

There are many privately owned lakes and ponds operated for

public use in the general area of the four proposed reservoirs. Most of these provide mainly fishing, but some also provide swimming and a few are large enough to permit operation of motor boats.

V. ANALYSIS OF RECREATION VALUES

A. SCENIC AND RECREATION VALUES

1. Pre-Project Values

Scenic qualities of the areas to be impounded are not outstanding. In the project area, the Neuse River is muddy and has a widely varying volume of stream flow. Consequently, in its present state it receives a low volume of recreation use. Some canoeing is done on it, but long canoe trips down river are usually begun at Smithfield. There are no existing recreation developments within the proposed reservoir sites.

2. Post-Project Values

The four proposed reservoirs will provide a needed increase in recreation water in the immediate project area. However, the full recreation potential of these reservoirs will be realized only if pollution is abated sufficiently to permit swimming.

The proposed Falls Reservoir, because of its size, shape, and the characteristics of the land surrounding it would offer the most recreational value and would support the greatest volume of recreation use.

Recreation use of the proposed Wilson Mills Reservoir will be limited by its long and narrow shape. Its size and shape will probably make it necessary to enforce restrictions on the number of boats permitted on it at any one time. There will also need to be restrictions on where and

at what speeds boats may be operated. It is likely that optimum recreation use will be reached before 2010.

The proposed Beulahtown reservoir site will be surrounded for the most part by open fields, will be relatively small in size, will be shallow, and will when drawn down have a large expanse of bottom exposed. The shallow water and small size will be drawbacks to boaters and skiers, and the large expanse of reservoir bottom exposed when the water is drawn down to conservation pool and below may seriously reduce recreation values. Despite these adverse factors, this reservoir would be a major recreation resource for those living within 20-25 miles of it

The land surrounding the proposed Buckhorn reservoir site is mostly flat and much of it is under cultivation or in pasture. However, there is more wooded land around this reservoir site than around the Beulahtown site. It is also better suited to boating and water skiing than Beulahtown.

B. HISTORICAL VALUES

So far as could be determined during the course of the field reconnaissance, there are no historic sites within the four reservoir areas which are of more than local importance.

C. ARCHEOLOGICAL VALUES

Although specific detailed information on the number and extent of archeological sites within the four reservoir areas is not available, it is expected that such sites exist. Archeological survey and, if necessary, salvage under the interagency archeological salvage program, should precede inundation of the reservoirs.

VI. RECREATION DEVELOPMENT ASPECTS

All four reservoirs are suitable for planned recreation development. Since they are so close together they can be considered as complimentary to each other in meeting the total recreation demand of the area. This same closeness also makes each reservoir to some extent competitive with the other reservoirs. It must be emphasized that the full recreation potential of the reservoirs can be realized only if pollution is abated to the point that the waters are suitable for swimming.

The proposed Falls Reservoir, because of its closeness to the Raleigh and Durham metropolitan areas, the comparatively large amount of land suitable for development for recreation use, and the size and shape of the reservoir, would be the most important and valuable of the four reservoirs for outdoor recreation use. It could be developed for camping and a wide range of day use activities including swimming, picnicking, hiking, nature study, boating and water skiing. If so developed, it would be the principal day use and camping reservoir.

The volume of recreation use at the proposed Wilson Mills Reservoir would be limited by its shape and size. About the same activities could be provided for here as at the Falls Reservoir, but on a much more limited scale.

Because of its characteristics and those of the land surrounding it, the proposed Beulahtown reservoir has the lowest potential recreation

value of the four reservoirs. It appears suitable for limited day use development.

The proposed Buckhorn Reservoir is suited to fairly intensive recreation use and could be developed for camping and day use activities.

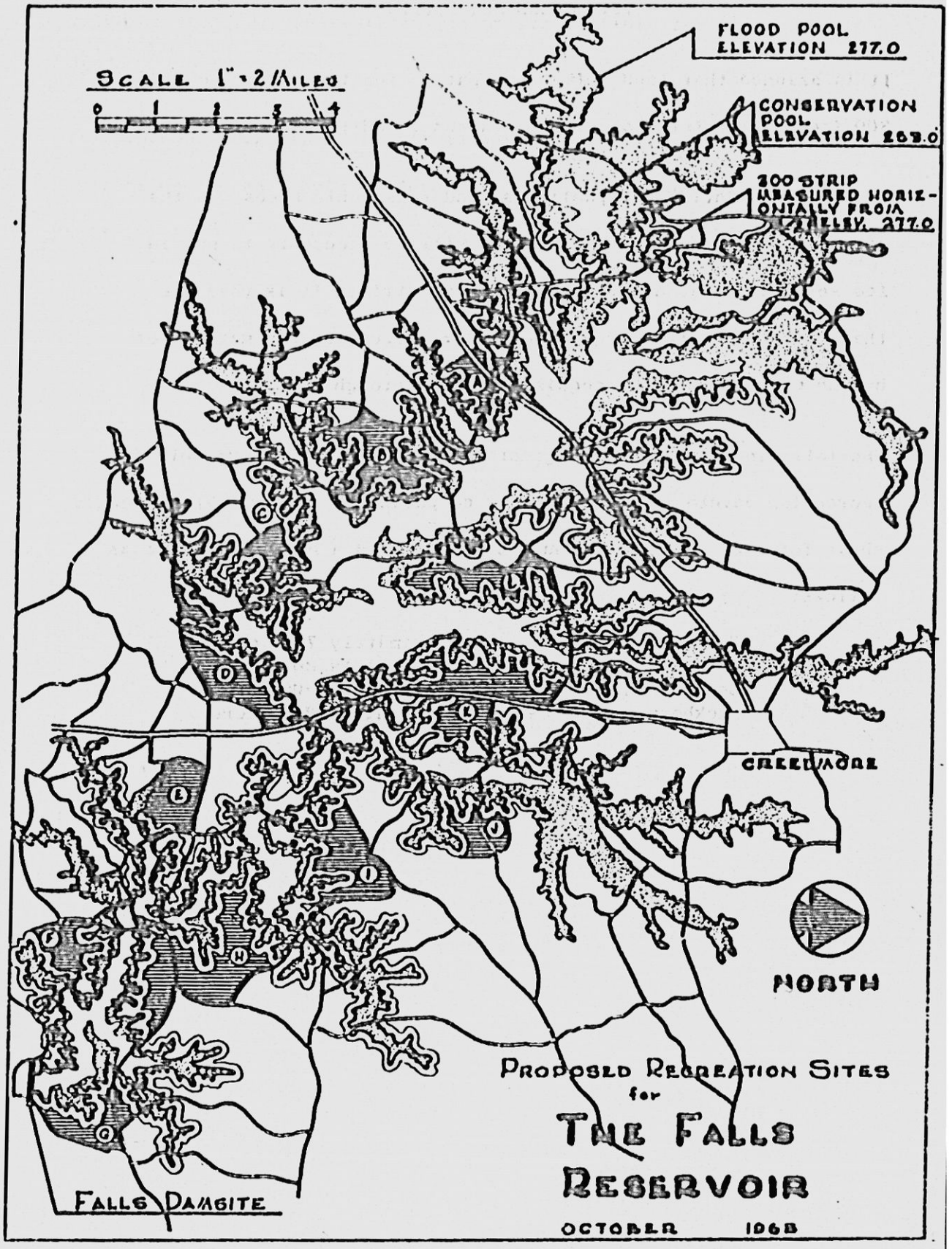
VII. LAND ACQUISITION

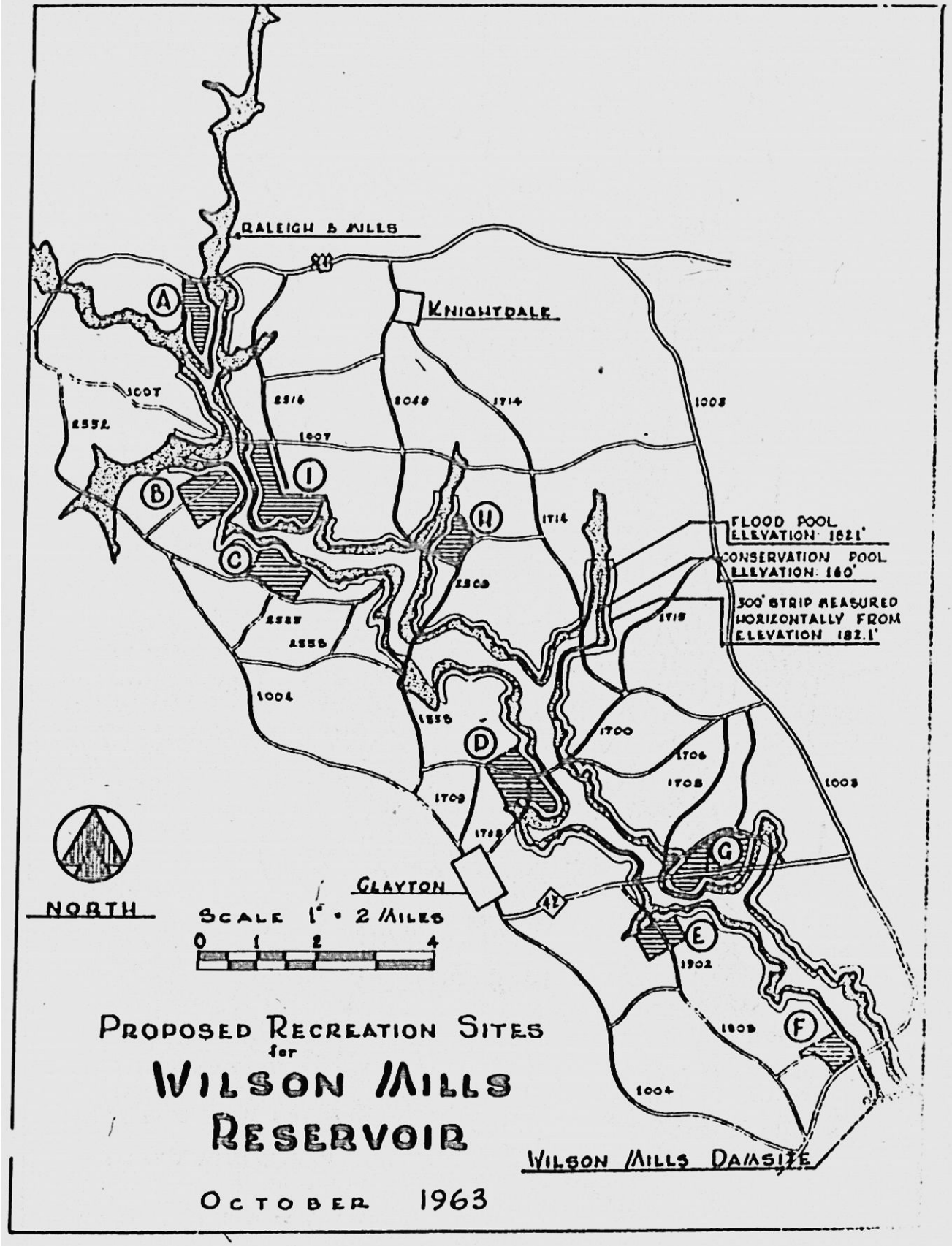
It is assumed that land will be bought in fee to a line located 300 feet horizontally above the maximum flood pool elevation.

In order to provide for public use and reasonable access to the reservoirs at appropriate sites, it will be necessary to buy in fee selected areas outside the 300-foot strip. It is possible that some of the land requirements for recreation use may be met by the Corps' policy of acquisition and through severance.

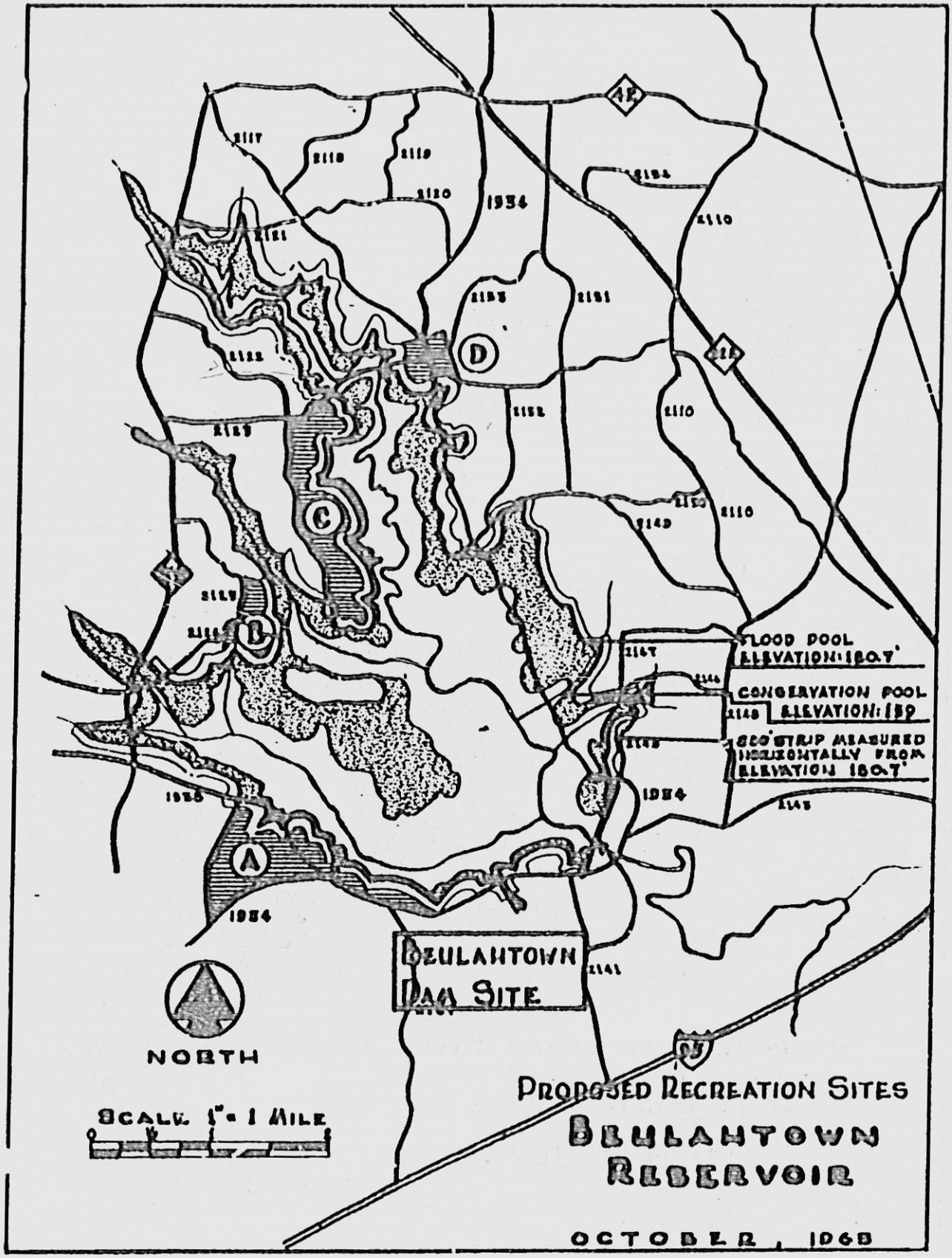
The following maps show the general location of areas suitable for recreation development that should be purchased in fee. The acreages shown for each reservoir should be considered a minimum and are as follows:

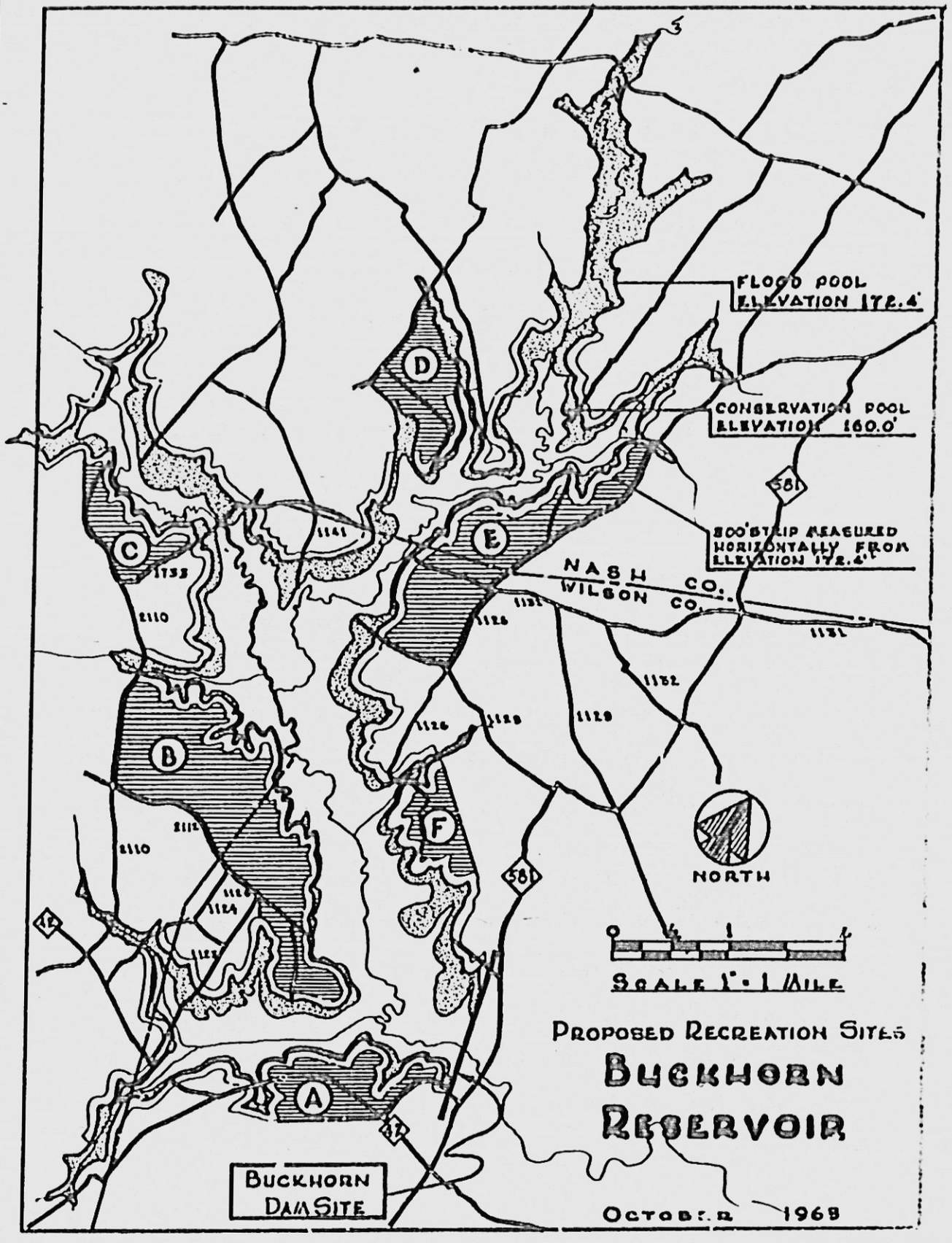
Falls	-	approximately 7500 acres
Wilson Mills	-	approximately 2000 acres
Beulahtown	-	approximately 500 acres
Buckhorn	-	approximately 2500 acres.


FLOOD POOL ELEVATION 277.0
CONSERVATION POOL ELEVATION 263.0
200 STRIP MEASURED HORIZONTALLY FROM ELEV. 277.0
SCALE 1" = 2 MILES
0 1 2 3 4
CREEDMORE
NORTH
PROPOSED RECREATION SITES for
THE FALLS RESERVOIR
OCTOBER 1968
FALLS DAMSITE


RALEIGH 5 MILES
KNIGHTDALE
A
B
C
D
E
F
G
H
I
FLOOD POOL ELEVATION 182.1'
CONSERVATION POOL ELEVATION 160'
300' STRIP MEASURED HORIZONTALLY FROM ELEVATION 182.1'
CLAYTON
NORTH
SCALE 1" = 2 MILES
0 1 2 4
PROPOSED RECREATION SITES for
WILSON MILLS RESERVOIR
OCTOBER 1963
WILSON MILLS DAMSITE

47-829 O 65-10


FLOOD POOL
ELEVATION: 1804'
CONSERVATION POOL
ELEVATION: 1759
600' STRIP MEASURED
HORIZONTALLY FROM
ELEVATION 1804'
BEULAHTOWN
DAM SITE
NORTH
SCALE 1" = 1 MILE
PROPOSED RECREATION SITES
BEULAHTOWN
RESERVOIR
OCTOBER, 1968


FLOOD POOL
ELEVATION 172.4'
CONSERVATION POOL
ELEVATION 160.0'
581
500' STRIP MEASURED
HORIZONTALLY FROM
ELEVATION 172.4'
NASH CO.
WILSON CO.
A
B
C
D
E
F
1141
1135
1110
1126
1131
1132
1129
1128
1112
1124
1123
NORTH
0
½
1
SCALE 1" = 1 MILE
PROPOSED RECREATION SITES
BUCKHORN
RESERVOIR
BUCKHORN
DAM SITE
OCTOBER 1968

VIII. MONETARY EVALUATION OF RECREATION BENEFITS

A. INTRODUCTION

Primary benefits resulting from provision of recreation facilities are intangible and are not subject to usual methods of measurement. However, the need for comparison of recreational values with other values for use in water-control project planning makes it necessary to translate the beneficial and adverse effects of such projects on recreation into monetary terms, insofar as possible.

Primary benefits from recreation consist of the personal welfare gains accruing to the consumers of recreation services. To the extent that these primary benefits of water-control projects can be measured, they consist of the value of any increase in the amount of recreational use expected as a result of the construction of water-control projects. To provide a monetary measurement of these benefits, the values are expressed in terms of estimated or derived values comparable to market values, since market prices are not available for a monetary evaluation of increases or decreases in recreational use.

In addition to the primary benefits, other benefits may arise from increased values of adjacent lands and from such supporting activities as motels, camps and restaurants, which provide goods or services to recreationists. There is some question, however, of the validity and usefulness of figures derived to estimate secondary benefits. The calculations in this report, therefore, are limited to a determination

of the monetary equivalent of the primary benefits attributable to the project.

The primary benefits evaluated in this report include those arising from all reservoir recreation activities except hunting, fishing, and sightseeing.

B. ANTICIPATED ANNUAL ATTENDANCE

Estimates of annual visitation are set forth in the tables following this section, and include all types of recreation pursuits except hunting, fishing, and sightseeing. It should be noted that these estimates are optimum use figures, based on what now seems to be the carrying capacity of the lands and water acreage of each reservoir.

It is possible that the total recreation demand could exceed the carrying capacity of the reservoirs, thereby resulting in overuse. This overuse would be detrimental to the recreation resource created and cannot be classified as project benefits.

Present recreation use of the reservoir sites other than hunting and fishing is negligible and is not considered in benefit calculations.

The estimates assume that adequate land will be acquired, adequate public use facilities will be provided and properly maintained, and that the newly created recreation area will be administered in such a way that recreation values will not be destroyed through improper shoreline uses or unrestricted conflicting uses of the water surface.

ESTIMATED ANNUAL VISITATION

Reservoir	Attendance	
	Initial	Average 1970-2070
Falls	400,000	2,000,000
Wilson Mills	150,000	500,000
Beulahtown	50,000	100,000
Buckhorn	200,000	600,000

C. RECREATION DEVELOPMENT COSTS

The following table enumerates cost involved to provide adequate access to the shoreline and water surface, for domestic water supplies and sanitary facilities for the various water-related activities such as swimming, boating, water skiing, camping, and picnicking. The annual equivalent of construction costs is amortized at 2.5% interest over a 25-year period, the estimated life of recreation facilities. The cost of acquiring land has not been included in these estimates. It should be borne in mind that some of these costs should be shared by other activities; for example, roads, launching ramps, utility systems, and other facilities will be used by persons other than the recreationists as defined in this report.

ESTIMATED RECREATION DEVELOPMENT COSTS AND BENEFITS

FALLS RESERVOIR

	INITIAL	AVERAGE 1970-2070	
Cost of Facilities less Land	1,200,000	7,500,000	1/
Annual Equivalent of Construction Costs	64,800	135,000	2/
Annual Operation and Maintenance Cost	90,000	600,000	
Total Annual Cost	154,800	735,000	
Total Annual Benefits	305,500	1,690,000	

1/ Estimated recreation development costs of $2,500,000 replaced three times over 75-year period.
2/ Based on development costs of $2,500,000.

WILSON MILLS RESERVOIR

	INITIAL	AVERAGE 1970-2070	
Cost of Facilities less Land	500,000	3,000,000	1/
Annual Equivalent of Construction Costs	27,000	54,000	2/
Annual Operation and Maintenance Cost	35,000	150,000	
Total Annual Cost	62,000	204,000	
Total Annual Benefits	111,500	367,500	

1/ Estimated recreation development costs of $1,000,000 replaced three times over 75-year period.
2/ Based on development costs of $1,000,000.

BEULAHTOWN RESERVOIR

	INITIAL	AVERAGE 1970-2070	
Cost of Facilities less land	200,000	1,500,000	1/
Annual Equivalent of Construction Costs	10,800	27,000	2/
Annual Operation and Maintenance Cost	12,000	25,000	
Total Annual Cost	22,800	52,000	
Total Annual Benefits	35,250	73,500	

1/ Estimated recreation development costs of $500,000 replaced three times over 75-year period.
2/ Based on development costs of $500,000.

BUCKHORN RESERVOIR

	INITIAL	AVERAGE 1970-2070	
Cost of Facilities less Land	500,000	3,000,000	1/
Annual Equivalent of Construction Costs	27,000	54,000	2/
Annual Operation and Maintenance Cost	45,000	150,000	
Total Annual Cost	72,000	204,000	
Total Annual Benefits	140,200	452,000	

1/ Estimated recreation development costs of $1,000,000 replaced three times over 75-year period.
2/ Based on development costs of $1,000,000.

D. RECREATION BENEFITS

To obtain an estimate of primary tangible benefits, use is made of unit benefit figures furnished by the Secretary of the Interior to Chairman Wayne Aspinall of the House Interior and Insular Affairs Committee in April 1963. These figures reflect estimated benefits for various recreation activities. The following estimated benefit values are net, allow for associated or induced costs, and have been adjusted to the 1962 Consumer Price Index.

1. General Use of Grounds - sightseeing, picnicking, swimming - $0.52
2. Boating, water skiing - $0.55
3. Camping - $0.50

In order to determine the monetary benefits from these activities, the number of persons estimated to engage in each activity annually is multiplied by the appropriate price factor. From this total benefit is then deducted the annual value of existing recreation use of the project area, if any, which would be displaced by the project. For the four projects covered by this report this value is negligible.

Estimated recreation benefits for the four proposed reservoirs are as follows:

ESTIMATED ANNUAL RECREATION BENEFITS

FALLS RESERVOIR

Activity	Value/Day	Activity Days		Gross Benefits	
		Initial	Average 1/	Initial	Average 1/
General Use	$0.52	400,000	2,000,000	$208,000	$1,040,000
Boating and water skiing	$0.55	150,000	1,000,000	$ 82,500	$ 550,000
Camping	$0.50	30,000	200,000	$ 15,000	$ 100,000
Totals				$305,500	$1,690,000

WILSON MILLS RESERVOIR

Activity	Value/Day	Activity Days		Gross Benefits	
		Initial	Average 1/	Initial	Average 1/
General Use	$0.52	150,000	500,000	$ 78,000	$ 260,000
Boating and water skiing	$0.55	50,000	150,000	$ 27,500	$ 82,500
Camping	$0.50	12,000	50,000	$ 6,000	$ 25,000
Totals				$111,500	$ 367,500

BEULAHTOWN RESERVOIR

Activity	Value/Day	Activity Days		Gross Benefits	
		Initial	Average 1/	Initial	Average 1/
General Use	$0.52	50,000	100,000	$ 26,000	$ 52,000
Boating and water skiing	$0.55	15,000	30,000	$ 8,250	$ 16,500
Camping	$0.50	2,000	10,000	$ 1,000	$ 5,000
Totals				$ 35,250	$ 73,500

BUCKHORN RESERVOIR

Activity	Value/Day	Activity Days		Gross Benefits	
		Initial	Average 1/	Initial	Average 1/
General Use	$0.52	200,000	600,000	$104,000	$ 312,000
Boating and water skiing	$0.55	60,000	200,000	$ 31,200	$ 110,000
Camping	$0.50	10,000	60,000	$ 5,000	$ 30,000
Totals				$140,200	$ 452,000

1/ Average annual benefits 1970-2070.