SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED OCTOBER 26, 1970, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA REQUESTED BY A RESOLUTION OF THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES DATED JUNE 3, 1959, AND TO TWO RESOLUTIONS OF THE COMMITTEE ON FLOOD CONTROL, HOUSE OF REPRESENTATIVES ADOPTED MARCH 20, 1954

DECEMBER 16, 1970.—Referred to the Committee on Public Works and ordered to be printed with illustrations

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1971

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CONTENTS

TABLES LISTED IN CONNECTION WITH THE REPORT OF THE DISTRICT ENGINEER

ILLUSTRATIONS ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

APPENDIXES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

December 11, 1970

Honorable John W. McCormack
Speaker of the House of Representatives
Washington, D. C. 20515

Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 26 October 1970, from the Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on the Sabine River and Tributaries, Texas and Louisiana, requested by a resolution of the Committee on Public Works, House of Representatives, adopted 3 June 1959 and to two resolutions of the Committee on Flood Control, House of Representatives, adopted 20 March 1945.

The views of the Governor of Texas, the State of Louisiana, the Departments of the Interior, Transportation, Commerce, Agriculture, Housing and Urban Development, and Health, Education, and Welfare, the Federal Power Commission and the Water Resources Council are set forth in the inclosed communications. Also inclosed are the replies of the Chief of Engineers to the State of Louisiana, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of the Interior and the Secretary of Transportation.

The Chief of Engineers recommends construction of the Mineola, Lake Fork and Big Sandy multiple purpose dam and reservoir projects for flood control, water supply and recreation; a local flood protection project at Greenville, Texas; and a commercial barge navigation channel from Echo to Morgan Bluff, Texas. I concur in the recommendations of the Chief of Engineers, however, since the local protection and navigation projects meet all the requirements of Section 201 of the Flood Control Act of 1965 and involve little or no controversy, I recommend that these projects be approved for appropriations.

As suggested by the Office of Management and Budget, should the projects be authorized, the Chief of Engineers will reevaluate benefit estimates during preconstruction planning for each authorized reservoir and will establish priority for their construction to prevent investment too far in advance of requirements. The complete views of the Office of Management and Budget are inclosed.

Subject to the above, the Office of Management and Budget advises that there is no objection to the submission of the proposed report to the Congress; however, it states that no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the projects, 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,

Stanley R. Resor

1 Incl
Report

STANLEY R. RESOR
Secretary of the Army

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

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

Honorable Stanley R. Resor
Secretary of the Army
Washington, D. C. 20310

7 December 1970

Dear Mr. Secretary:

Mr. Robert E. Jordan's letter of November 4, 1970, submitted the favorable report of the Chief of Engineers on the Sabine River and Tributaries, Texas and Louisiana, requested by a resolution of the Committee on Public Works, House of Representatives, approved June 3, 1959.

The report includes three reservoirs which are largely justified on the basis of needs that are estimated not to occur until the distant future. Particularly, we note that the Big Sandy Reservoir is not required until 1990 to 2000. Therefore, there appears to be little reason to authorize this project at this time. We also note that near-term needs of the people in the basin can be met by Mineola Reservoir alone. However, if out-of-basin requirements develop as indicated by the Texas Water Development Board, Lake Fork Reservoir may also be needed by 1980. If these two projects are authorized, we would expect the Chief of Engineers to establish priority for their construction to prevent investment too far in advance of requirements.

Establishment of priority of construction would also permit review of flood control benefits assigned to each reservoir. As currently written, the report assigns flood control benefits on the assumption that each project becomes operational as the first-added project in the basin. This assumption may overstate flood control benefits for any particular project and result in inequitable cost allocation and cost sharing. Reevaluation of benefit estimates should be made during preconstruction planning for each authorized reservoir.

Subject to the above, you are advised that there would be no objection to the submission of the proposed report to the Congress. No commitment, however, 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,

Donald B. Rice

Donald B. Rice
Assistant Director

COMMENTS OF THE GOVERNOR OF TEXAS

PRESTON SMITH
GOVERNOR OF TEXAS

Lieutenant General F. J. Clarke
Chief of Engineers
Department of the Army
Building T-7, Gravelly Point
Washington, D. C. 20310

September 2, 1970

Dear General Clarke:

I inclose a copy of the order of the Texas Water Rights Commission, following its study and public hearing as provided in Article 7472e, VTCS, on your report relating to the multipurpose reservoir projects (Mineola, Lake Fork and Big Sandy); Greenville local flood protection project, Greenville, Texas and navigation channel from Echo to Morgan Bluff, Texas.

I concur in the findings and the recommendations of the Texas Water Rights Commission of September 1, 1970, and approve the aforesaid proposed projects, subject to the conditions therein stated and recommend that they be adopted and specifically included in the Congressional authorization Act.

Your comments on the five-points posed under the National Environmental Protection Act of 1969 credit the proposed projects as enhancing the environment and providing beneficial impact on fish, wildlife, and the public welfare.

In concurring with the report concerning the aforesaid five projects, I request that the federal effort in final planning and development be fully coordinated with the Texas natural resources agencies and the respective project sponsors.

With kindest regards.

Sincerely,

Preston Smith

x

TEXAS WATER RIGHTS COMMISSION

AN ORDER relating to recommended Federal improvements consisting of three multipurpose dam and reservoir projects (Mineola, Lake Fork and Big Sandy); a local flood-protection project at Greenville, Texas; and an extension of an authorized navigation channel in the tidal reach of the Sabine River, as proposed by the Department of the Army, Corps of Engineers' report "Comprehensive Basin Study Sabine River and Tributaries, Texas and Louisiana".

BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION,

Section 1. Statement of Authority. Article 7472e, VTCS, provides that upon receipt of any engineering report submitted by a Federal agency seeking the Governor's action on a Federal project, the Texas Water Rights Commission shall study and make recommendations to the Governor as to the approval or disapproval of the feasibility of the Federal project and that the Commission shall cause a public hearing to be held to receive the views of persons or groups who might be affected by the Federal project.

Section 2. Statement of Jurisdiction. On August 10, 1970, the Honorable Preston Smith, Governor of Texas, requested that the Texas Water Rights Commission investigate and make recommendations concerning portions of "Report on Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana", prepared by the Department of the Army, Corps of Engineers, in which are recommended improvements consisting of three multipurpose dam and reservoir projects (Mineola, Lake Fork and Big Sandy); Greenville, Texas, local flood protection project and navigation channel from Echo to Morgan Bluff, Texas.

In accordance with the provisions of Article 7472e, supra, due notice having been given, the Commission conducted a public hearing on September 1, 1970, at 10:00 o'clock a.m., in the offices of the Commission,

Sam Houston State Office Building, Austin, Texas, on said projects, at which time, in accordance with public notice duly published in the Longview Daily News, all interested parties were requested to appear and give testimony and submit evidence either for or against these projects.

Section 3. After fully considering the aforesaid five projects, included in the report of the Department of the Army, Corps of Engineers, entitled "Report on Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana", and all evidence and exhibits introduced and presented at the hearing, the Commission finds that all of the criteria set forth in Section 4, Article 7472e, supra, relating to the feasibility of the three multipurpose reservoir projects, viz., Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek and Big Sandy Reservoir on Big Sandy Creek (Par. 33, Report, etc., page 16), have been met and that portion of said report which encompasses a local flood protection project on Long Branch at Greenville, Texas, and extension of the navigation project in the Sabine River 5.3 miles from Echo to Morgan Bluff, Texas, is feasible and that the public interest would be served thereby, subject to the following:

(a) That in accordance with the views and recommendations by the Board of Engineers for Rivers and Harbors,

(1) "The Chief of Engineers be authorized to enter into an agreement with the non-Federal entities in advance of construction of Mineola, Lake Fork, and Big Sandy Reservoirs to provide for credit toward reimbursable costs of lands acquired or land-taking surveys made by such entities when such local expenditures are sound contributions to the project: Provided such agreement with non-Federal entities is not to be interpreted that the projects will be constructed by the United States. (Par. 35b, Report, etc., page 20).

(2) ". . . Federal authorization should not be construed to constitute a preemption of a site or to prohibit development of a site by local interests." (Par. 30, Report, etc., page 15 at page 16).

(b) That in the design, development and operation of the three aforesaid reservoir projects, viz., Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek, and Big Sandy Reservoir on Big Sandy Creek (Par. 33, Report, etc., page 16),

(1) Texas' interest in its waters and the prior water rights in the Sabine River Basin, Texas, shall be fully considered, recognized and respected. Further, in the operation of Mineola Reservoir, Lake Fork Reservoir and Big Sandy Reservoir, when completed, the terms and conditions of the Sabine River Compact between Texas and Louisiana shall also be recognized and respected to the end that a minimum flow of 36 cfs shall be maintained at State line.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION, that subject to the foregoing recommendations the portion of the aforesaid Federal report concerning the construction of the five proposed projects: viz., Greenville, Texas, local flood protection project; Mineola Reservoir project on the Sabine River; Lake Fork Reservoir project on Lake Fork Creek; Big Sandy Reservoir project on Big Sandy Creek; and the Navigation Channel from Echo to Morgan Bluff, Texas, be, and the same is hereby, approved and recommended to the Governor as feasible and in the public interest; and that early authorization and funding of these projects by Congress are respectfully urged.

Executed and entered of record, this the 1st day of September, 1970.

TEXAS WATER RIGHTS COMMISSION

/s/ O. F. Dent
O. F. Dent, Chairman

/s/ Joe D. Carter
Joe D. Carter, Commissioner

/s/ Leslie R. Neal
Leslie R. Neal, Commissioner

ATTEST:

/s/ Audrey Strandtman
Audrey Strandtman, Secretary

STATE OF TEXAS I
I
COUNTY OF TRAVIS I

I, Audrey Strandtman, Secretary of the Texas Water Rights Commission, do hereby certify that the foregoing and attached is a true and correct copy of an order of said Commission, the original of which is filed in the permanent records of said Commission.

Given under my hand and the seal of the Texas Water Rights Commission, this the 1st day of September, A.D. 1970.

Audrey Strandtman

Audrey Strandtman, Secretary

COMMENTS OF THE STATE OF LOUISIANA

STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE, LA. 70804

September 16, 1970

C. H. DOWNS
DIRECTOR

General F. J. Clarke
Chief of Engineers
Department of the Army
Office of the Chief Engineers
Washington, D. C. 20314

Dear General Clarke:

Reference is made to your letter of August 7, 1970, requesting comments on your proposed report on the Sabine River Basin, Texas and Louisiana. The State of Louisiana, Department of Public Works, has been designated by Governor McKeithen as his representative in the review and coordination of water resources.

We would be derelict in our responsibility to the State of Louisiana if we did not call to your attention the importance of the Toledo Bend Reservoir, a $70,000,000.00 joint state project of the Sabine River Authority of Louisiana and the Sabine River Authority of Texas. This tremendous water supply, hydroelectric, fish and wild life and recreation project is financed and constructed from state funds and from the sale of hydroelectric power. In order to protect the interest of the State of Louisiana in the Toledo Bend Reservoir Project we must insist that any development upstream from this project be designed and operated so as not to cause any reduction or depletion in this water supply, recreation and fish and wild life capabilities or in its operation and generation of hydroelectric power.

After reviewing the data furnished us by the U. S. Army, Corps of Engineers, Fort Worth District, pertaining to power routing studies and the Sabine River Basin Report we find that the results are based on certain assumptions and conditions. If other possible assumptions are used, certain detrimental effects could result to the Toledo Bend Reservoir Project. This is discussed in my letter of June 3, 1970, to the Board of Engineers for Rivers and Harbors which I am enclosing for your information.

For these reasons the State of Louisiana can only concur with the plan of construction as proposed in the survey report, provided the following recommendations are made a part of the aurhorization report for this plan.

1. Not more than 200,000 acre feet per year will be diverted from the three reservoirs to another basin outside of the Sabine River Watershed.

2. Any cost incurred by the Toledo Bend Dam and Reservoir Project due to a reduction in power sales caused by the proposed project shall be borne by the Sabine River Authority of Texas.

3. A rule curve operation shall be adopted for the three reservoirs whereby sufficient flood flows shall be impounded at the end of the critical flood period and released during the drought periods to supplement the inflows into the Toledo Bend Reservoir.

Copies of your draft environment statement have been distributed to the Louisiana Wild Life and Fisheries Commission and the State Parks and Recreation Commission for their review and comments. We will forward their comments as soon as possible.

It is requested that a copy of this letter be made a part of the report when it is transmitted to Congress.

Sincerely yours,

C. H. Downs

C. H. DOWNS
DIRECTOR

/mal
Attachment

STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE, LA. 70804

C. H. DOWNS
DIRECTOR

June 3, 1970

Board of Engineers for Rivers and Harbors
Washington, D. C. 20315

Gentlemen:

Since requesting a 45 day delay in furnishing our comments to the Board of Rivers and Harbors on the Survey Report on Sabine River and Tributaries, Texas and Louisiana, we have had the opportunity to review additional data furnished us by the U.S. Army, Corps of Engineers, Fort Worth District and to meet with personnel from that office for discussion of the projects in the report.

The results of the Corps of Engineers studies and other information furnished us are based on certain assumptions. Basically it was assumed that two (2) reservoirs, Mineola and Lake Fork would be operative by 1980 with no out of basin diversions; by year 2000 three (3) reservoirs, Mineola, Lake Fork and Big Sandy would be operative with 100,000 Ac. Ft. per year diverted from the basin; and by 2020, diversion from the basin would increase to 200,000 Ac. Ft. per year. Also, the inflows into the Toledo Bend Reservoir would include releases from these reservoirs for in-basin uses, return flows, and reservoir spills.

Using these assumptions the power routing studies conducted by the Corps of Engineers show a negligible effect on the Toledo Bend Reservoir's power operation and other features by the construction of the three (3) upstream reservoirs.

But other possible assumptions, such as, diversion of the total dependable yield of the three (3) reservoirs from the basin will substantially reduce the water available for inflow into the Toledo Bend Reservoir during periods of critical low flow and, as shown in the comprehensive report, cause a depletion in the reservoir's dependable water supply yield as well as reducing the power generation and have an adverse effect on the recreation and fish and wildlife features of the Toledo Bend Reservoir. This will cause a reduction in the revenues anticipated for the construction program and operation of the project.

The State of Louisiana concurs with the plan of construction as proposed in the survey report, provided the following recommendations be made a part of the authorization report for this plan:

1. No more than 200,000 Ac. Ft. per year will be diverted from the three (3) reservoirs to another basin.

2. Any cost incurred by the Toledo Bend Dam and Reservoir

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Project due to a reduction in power sales caused by the proposed project shall be borne by the Sabine River Authority of Texas.

3. A rule curve operation shall be adopted for the three (3) reservoirs whereby sufficient flood flows shall be impounded at the end of the critical flood period and released during the drought periods to supplement the inflows into the Toledo Bend Reservoir.

The recommendations have been reviewed and agreed to by the Sabine River Authority of Texas. A copy of a letter from John W. Simmons, General Manager, Sabine River Authority of Texas relative to their concurrence is attached.

The Toledo Bend Reservoir, a $70,000,000 joint project of the Sabine River Authority of Louisiana and the Sabine River Authority of Texas is of prime importance to the State of Louisiana. This tremendous water supply, hudroelectric and recreation project is financed and constructed from state funds and from the sale of hydroelectric power. In order to protect the interest of the State of Louisiana in the Toledo Bend Reservoir project, we must insist that any development upstream from this project be designed and operated so as not to cause any reduction in its water supply, recreation and fish and wildlife capabilities or in its operation and generation of hydroelectric power.

Sincerely yours,

C. H. DOWNS
DIRECTOR

/dh

LETTER TO THE STATE OF LOUISIANA

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO
ENGCW-PI

26 October 1970

The Director
Department of Public Works
P. O. Box 44155 Capitol Station
Baton Rouge, Louisiana 70804

Dear Sir:

Thank you for your letters of 16 September and 5 October 1970 commenting on my proposed report on the Sabine River and Tributaries, Texas and Louisiana.

As you correctly note, certain adverse effects on the Toledo Bend project capabilities could result if the proposed projects were designed and operated based on assumptions other than those considered in the report. As a result, it is your view that adequate protection of Louisiana's interests can be assured only if certain recommendations are made a part of the authorization report.

It should be recognized that the recommendations pertaining to interbasin diversions and assumption of any loss of power revenues are beyond the purview of the Chief of Engineers. These matters, as they relate to the Toledo Bend project, are covered by provisions of the Sabine River Basin Compact. Also, it is noted that the Sabine River Authority of Texas has furnished a letter to the Louisiana Department of Public Works agreeing to these recommendations as well as the remaining recommendation pertaining to development of a rule curve operation for the three proposed projects.

With respect to the latter recommendation, it should be recognized that one of the primary purposes of the plan of development is the prevention of flood damages in the basin. Therefore exclusive and inviolate storage for flood control operations is necessary in order to insure accomplishment of the envisioned protection. As a result, it is not considered practicable to develop a rule curve operation for the three proposed projects to enhance the Toledo project power operation at this time. In this connection, it should be recognized that any benefits accruing to the Toledo Bend project due to construction and operation of upstream projects by the Federal Government must

be shared with the Federal Government under provisions of Section 10f of the Federal Power Act. In accordance with usual procedures further consideration will be given to various methods of operation, including your proposal, during advance planning and design studies should the projects be authorized.

The comments of the State Park and Recreation Commission on the draft environmental statement will be considered in the preparation of our final statement.

Copies of your letters and this reply discussing these matters will accompany my report to the Congress.

Sincerely yours,

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

WATER RESOURCES COUNCIL
SUITE 900
1025 VERMONT AVENUE NW.
WASHINGTON, D.C. 20005

October 2, 1970

Major General F. P. Koisch
Director of Civil Works
U. S. Army Corps of Engineers
Room 4G-066, Forrestal Building
1000 Independence Avenue, S. W.
Washington, D. C. 20314

Dear General Koisch:

I appreciate the opportunity to comment on the proposed report of the Chief of Engineers on the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana, as transmitted to me by the Acting Director on August 7, 1970. This is the first Federal authorization report resulting from a comprehensive river basin study under the program of coordination sponsored by the Water Resources Council. The report has been reviewed to determine the relationship of the present plan to the plan and the views, findings, and recommendations presented in the Council's report of April 1970.

As the Water Resources Council report and the report of the Sabine Coordinating Committee will be made available to the Congress with the authorization report, I will not restate the Water Resources Council views, findings, and recommendations. I do suggest that the "Summary of Consideration Given in the Authorization Report to the Views and Recommendations of the Water Resources Council on a Comprehensive Basin Study, Sabine River, Texas and Louisiana," be included with the report of the Chief of Engineers when it is sent to the Congress. This

summary contains the statement concerning the accomplishment of the plan with respect to locally recognized objectives and the established national goals for full employment, public health, and environmental qualities.

The plan proposed for authorization is in general accordance with the plan presented in the April 1970 report of the Water Resources Council. Principal changes include the elimination of flood release channels below the reservoir sites and an increase of flood storage in each of the three reservoir projects. At Greenville, a nonstructural floodplain management option has been substituted for channel improvement along Cowleech Fork. Channel improvements on Long Branch in Greenville have been reduced in scope and a nonstructural floodplain management option added. The proposed navigation channel has been extended about 4,000 feet to Morgan Bluff.

The revised plan includes a proposal that intensive management and development of 40,000 acres of land for wildlife be accomplished to compensate for the loss of 62,000 acres of wildlife habitat to be flooded by the conservation pools in the three reservoirs.

As requested in the Water Resources Council's report, the authorization report contains a preliminary analysis of the expected effects of the three proposed reservoirs on hydroelectric power generation, water supply, and fish and wildlife features at the existing Toledo Bend Project. Generally, the preliminary analysis shows that the effect of these reservoirs on Toledo Bend Reservoir cannot be specifically determined until operational procedures are adopted for those reservoirs on the basis of detailed studies.

The changes which have been made in the plan do not significantly change the fresh water flow into the estuary as determined in the previous Coordinating Committee's analyses.

It is noted that the recommended Lake Fork and Mineola Reservoirs would adversely affect several authorized and partially constructed Public Law 566 projects. Discussions are currently underway between the Corps of Engineers and the Department of Agriculture to resolve this issue.

The economic analyses were made on the basis of 4-7/8 percent interest as established by the Water Resources Council for Fiscal Year 1970. I understand that a reanalysis is being made upon the basis of the current 5-1/8 percent interest rate and such reanalysis will be made available to the Water Resources Council and the Congress.

We have been advised that the environmental statement is being revised to better meet the requirements of the National Environmental Policy Act of 1969.

The Water Resources Council endorses the authorization proposals of the Chief of Engineers as an updating and an implementation of elements of the Comprehensive Plan for the conservation, development, and utilization of the water and related land resources of the Sabine River Basin, Louisiana and Texas, with the assumption that conflicts with the authorized watershed protection projects will be satisfactorily resolved. To assist in the coordination with plans of regional and local governing bodies, it is suggested that your report be made available to the appropriate clearing house established pursuant to regulations promulgated by the Office of Management and Budget Circular No. 95.

Sincerely yours,

Reuben J. Johnson
Acting Director

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

7 October 1970

Dear General Clarke:

This responds to your letter of August 7, 1970, requesting our comments on the Corps of Engineers' proposed report and draft environmental statement on the Sabine River Basin, Texas and Louisiana.

We have reviewed the report and in general concur with your recommendations. We offer the following comments for your information and use.

Since the three proposed reservoirs will add 62,000 acres of water at the conservation pool levels, an evaporation loss is expected which will cause an increase in total dissolved solids (TDS) during periods of low flow. In addition, there may be an increase in TDS during spill periods. During periods of critical low streamflow, we recommend that at least as much water entering the reservoirs be released from the reservoirs to provide for downstream uses and to maintain a beneficial equilibrium of biological organisms.

We note that because of reservoir depth, stratification of temperatures as well as dissolved oxygen will occur. We therefore recommend that multilevel outlets be provided at each reservoir to help maintain good quality water downstream from the projects.

A large number of cities and communities are located in the drainage area of the reservoirs. The sewage from the cities and communities is treated, but care must be taken and proper controls implemented so that a buildup of nutrients will not occur.

The construction of the three reservoirs is expected to reduce the water yield entering Toledo Bend Reservoir, located downstream from the proposed projects. We note that use of the yield of the three proposed reservoirs is left to the discretion of the State of Texas. The Texas Water Plan indicates that a large amount of this yield is to be transferred out of the basin. The effect of this transfer of water on the quality of the receiving streams and reservoirs, on the remaining water in the basin, and on the needed inflow to the bay and estuaries should be evaluated in the report.

To protect water quality during the construction period in accordance with provisions of Section 21(a) of the Federal Water Pollution Control Act, as amended, and Executive Order 11507, we recommend that contract specifications require all contractors and subcontractors to:

1. Exercise care in the relocation of any petroleum product pipelines and take precautions in the handling and storage of hazardous materials, such as petroleum, herbicides, and pesticides, to prevent accidental spillages or usage that would result in water pollution.

2. Provide and operate sanitary facilities to adequately treat and dispose of domestic wastes in conformance with Federal and State water pollution control regulations.

3. Perform all construction operations so that they will keep erosion, turbidity and siltation at the lowest levels possible.

From a fish and wildlife standpoint, the plan of development is compatible with the plan set forth in the Interagency Coordinating Committee's report on the Comprehensive Basin Study, Sabine River and Tributaries.

The evaluation of mineral involvement contained in the report is based on a 1962 field examination that was subsequently updated in 1967. We recommend that field investigations of mineral involvement be made at or just before the time of preconstruction planning in order to reassess the extent of mineral involvement and any necessary protection, subordination, or mitigation of mineral installations and access to mineral resources.

We recommend that the report be modified to include the need to reanalyze the outdoor recreation aspects of the reservoir projects during the post-authorization planning and construction phases so that construction of recreation facilities can be timed to coincide with the occurrence of future needs for such facilities.

The environmental statement could be improved by discussing the quantity and quality, including present and future use, of the general outdoor recreation and scenic values of the natural stream areas which will be permanently lost as a result of reservoir construction. It is also recommended that the effects of the proposed projects on water quality in the project areas and below the reservoirs be characterized and quantified as to their long-term environmental effects.

We appreciate the opportunity of presenting our views.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Lt. General F. J. Clarke
Chief of Engineers
U.S. Department of the Army
Washington, D.C. 20314

LETTER TO THE SECRETARY OF THE INTERIOR

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO

ENGCW-PI

26 October 1970

Honorable Walter J. Hickel
Secretary of the Interior
Washington, D. C. 20240

Dear Mr. Secretary:

Reference is made to the Department of the Interior's letter of 7 October 1970 commenting on my proposed report on the Sabine River and Tributaries, Texas and Louisiana.

The Department of the Interior notes that the recommended projects should be operated to maintain or enhance the quality of the water in streams and reservoirs in the basin. Multilevel outlets will be considered during advance planning and design studies if the recommended reservoirs are authorized. Studies made in connection with the subject report indicate that the effect of the recommended reservoirs on the existing Toledo Bend Reservoir will be minimal and in fact the recreation potential should be enhanced. With regard to the effect of the proposed projects on the bay and estuarine areas, it is noted that the interagency comprehensive (Type 2) study concluded that the projects included in the proposed early-action plan and recommended in this report would not adversely affect these areas.

We have issued revised regulations to provide for compliance with Section 21(a) of the Federal Water Pollution Control Act, as amended. Also, we have issued guide specifications to provide for protection of water quality during project construction covering the requirements which you list, as well as others, in the interest of protecting the environment.

With regard to the reevaluation of mineral involvement and the development of recreational facilities, if the recommended projects are authorized, the Corps will in accordance with our normal procedure review these and other features of the projects during advance planning and design studies to take into account data then available and applicable.

The comments on the draft environmental statement will be considered in the preparation of our final statement.

Copies of the letter of the Department of the Interior and this reply will accompany my report to Congress.

Sincerely yours,

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

Honorable Stanley R. Resor
Secretary of the Army

September 22 1970

Dear Mr. Secretary:

This is in reply to the Chief of Engineers' letter of August 7, 1970, transmitting for our review and comment his proposed report and pertinent papers on the Sabine River basin, Texas and Louisiana.

The recommended plan of development includes three multiple-purpose dam and reservoir projects, a local protection project at Greenville, Texas, and an extension of an authorized navigation channel in the tidal reach of the Sabine River. These proposed developments were included in the Comprehensive Plan for the Sabine River Basin (Type 2). However, the three proposed reservoir projects were modified without coordination with the Soil Conservation Service, and two adversely affect three upstream watershed projects which were also included in the Type 2 plan.

The proposed Mineola Reservoir has an elevation about 7 feet higher than that included in the Comprehensive River Basin Plan (Type 2). This increase in elevation will adversely affect the potential McBee Creek Watershed Project and the authorized Mill Creek Watershed Project which the Kaufman-Van Zandt Soil and Water Conservation District, the City of Canton, Texas, and Van Zandt County Commissioners Court, assisted by the Soil Conservation Service, have planned consistent with the provisions of the Comprehensive Plan. Recommendations of the District Engineer concerning advance acquisition of Mineola Reservoir project lands and channel construction and flowage easements across these lands appear to provide an adequate basis for coordination of these two projects. If these recommended actions are carried out, this Department has no objection to the construction of the Mineola Reservoir.

The proposed Lake Fork Reservoir apparently will remove from one-third to one-half of the 12,582 acres of flood plain lands benefited by the Upper Lake Fork Watershed Project from the tax rolls of the Lake Fork Water Control and Improvement District No. 1. The Upper Lake Fork Watershed Work Plan has been in operation since July 25, 1958. Eighteen floodwater retarding structures have been installed at a federal construction cost of $1,272,974 and local cost of $109,235. The operation and maintenance of these structural measures and others to be built in the

watershed are the responsibility of the Lake Fork Water Control and Improvement District No. 1, funds for which are derived from taxes collected on the benefited acres.

Since these investments were made and obligations accepted in good faith by local cooperators with the Soil Conservation Service prior to the development of the plans for the proposed Lake Fork Reservoir, the Department of Agriculture cannot agree with including the Lake Fork Reservoir in this proposal for authorization unless a satisfactory arrangement is made with the Lake Fork Water Control and Improvement District No. 1 and the Department of Agriculture to reimburse the District for tax losses incurred consistent with the amount of benefited flood plain lands which will be removed from its tax rolls based on final design of the proposed structure.

Additional consideration of flood plain management in the report would allow for minimizing the losses to the forest resources as a result of the project and for regulating the type and degree of growth on the flood plain.

It would be helpful if the report included specific data on timber production and other forest land values lost and explained how these losses are accounted for in determining project costs. It is recommended that timber clearing be kept to a minimum and that all merchantable timber cut be salvaged.

The economic and population projections used in determining the future level of development are considerably higher than those developed by OBERS for the region. The rate of economic growth was assumed to be the same for the entire study area. All or parts of six OBE water resource planning areas are included in the study. OBERS has indicated that the present variations in the patterns of development among the six planning areas are expected to continue into the foreseeable future. The report would be strengthened if the economic analysis were expanded to show the differences in water resource requirements and the subsequent levels of development for the two sets of projections.

It would be helpful if the draft environmental statement could clarify the basis for assuming that the beneficial effects associated with the proposed project would more than offset environmental and economic losses.

Thank you for the opportunity to review and comment on this report.

Sincerely,

T. K. COWDEN
Assistant Secretary

LETTER TO THE SECRETARY OF AGRICULTURE

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO

ENGCW-PI

26 October 1970

Honorable Clifford M. Hardin
Secretary of Agriculture
Washington, D. C. 20250

Dear Mr. Secretary:

Reference is made to the letter of 22 September 1970 from the Department of Agriculture commenting on my proposed report on the Sabine River and Tributaries, Texas and Louisiana.

The Department of Agriculture notes that the proposed Lake Fork project will remove one-third to one-half of the 12,582 acres of flood plain lands benefited by the P.L. 566 Upper Lake Fork Watershed project from the tax rolls of the Lake Fork Water Control and Improvement District No. 1, and points out that operation and maintenance of the P.L. 566 measures are the responsibility of the Watershed District, the funds for which are derived from taxes collected on the benefited acres. Based on guide contours for real estate acquisition presented in the report, it appears that about 4,500 acres of lands benefited by the P.L. 566 project will be affected by the Lake Fork project, which is only about 200 acres more than the project presented in the Type 2 study. However, this is a preliminary estimate based on survey scope data. A more precise figure will be developed as part of the detailed real estate studies to be made during advance planning and design, which will consider blocking out requirements, use of flood easements in the upper arms of the reservoir in lieu of fee simple acquisition, and other factors. The detailed investigations will be coordinated with the Watershed District and all other interested agencies.

In order to compensate the District for revenue losses resulting from the Lake Fork project, I propose to make the following item of local cooperation a part of my report:

> That prior to initiation of construction, responsible local interests give assurances satisfactory to the Secretary of Army that they will, with respect to the recommended Lake Fork project, based on its final design, reimburse the Lake Fork Water Control and Improvement District No. 1 for tax

revenue losses incurred by removal from the tax rolls of lands benefited by the existing Upper Lake Fork Watershed project. Based on current interest rates and available project data, the repayment is presently estimated at $2,000 annually or alternatively the single payment lump sum amount is estimated at $35,000.

The Department of Agriculture further notes that economic and population projections used in determining future levels of development are higher than those developed by OBERS for the region. Economic indicators used for evaluating future needs were compared to those developed from OBERS data. The results of these comparisons, which are shown in Appendix C of the report, indicate that, in general, certain indicators such as total population and disposable income are lower using OBERS data while others such as per capita income and mineral production are higher. The net effect of these differences on the growth allowance for flood damage prevention, for example, are largely offsetting since agricultural factors decline while non-agricultural factors increase. In accordance with our normal procedures for projects of this nature, the Corps will review the project economics during advance planning and design studies to take into account economic data then available and applicable. As part of these studies, land requirements, as related to timber clearing and salvage, will be investigated in cooperation with all appropriate interests.

Copies of the letter from the Department of Agriculture and this reply will accompany my report to Congress.

Sincerely yours,

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF COMMERCE

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

Lieutenant General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

2 October 1970

Dear General Clarke:

This is in reply to your letter of August 7, 1970, to Secretary Maurice H. Stans, requesting comments of the Department of Commerce on your proposed report on the Sabine River Basin, Texas and Louisiana. In preparing comments we have considered the Type 2 interagency report on the comprehensive study of the Sabine River Basin as well as the report and environmental statement that accompanied your letter since these documents will be transmitted together to Congress by the Secretary of the Army.

We note that the Corps of Engineers has decided in favor of Plan A which provides additional flood storage as a substitute for the complementary downstream channels, levees, and flowage easement that had been proposed in the comprehensive basin study.

The proposed report generally involves three multiple-purpose dam and reservoir projects, a local flood protection project, and a shallow-draft navigational improvement project at an estimated net cost to the Federal Government of $106,201,000 for construction and $279,500 annually for maintenance and operation costs for the total recommended plan. With the exception of the $1,765,200 Federal navigation, short-range improvement portion of the overall plan, the remaining projects are primarily designed to meet needs for flood control, municipal and industrial water supply, and water based recreation.

Specifically, the recommended short-range navigational improvement plan of the subject report proposes that the existing Federally authorized shallow-draft barge channel in the lower Sabine River basin from the deep draft Port of Orange to Echo, Texas, which has not been constructed, be extended from Echo to Morgan Bluff, Texas, in the Sabine River. This would provide a shallow-draft sea level channel

extending upstream about 5 1/4 miles in the Sabine River from Echo to Morgan Bluff, Texas, with a channel depth of 12 feet and a minimum width of 125 feet, terminating in a turning basis 600 feet by 600 feet in size at Morgan Bluff. The long-range plan (1975 to 2025) would provide for ultimate development of the water transportation potential of the Sabine River basin by extension of a barge channel from Morgan Bluff to the vicinity of Longview, Texas, some 180 miles upstream.

Although it appears at the present time the only potential commercial user of the proposed channel from Echo to Morgan Bluff would be a paper mill, it is assumed that due to the steady growth of the adjacent industrial area of Orange, Texas, and to the construction of the proposed channel extension new industries would develop and thus give the project a more diversified comme rce than that presently available. A number of potential plant sites along the proposed channel should attract additional industry to locate in this area. Not to be overlooked, are some of the more important natural resources in the Sabine River basin such as petroleum, natural gas, natural gas liquids, water, timber, iron ore, clays, sand, and gravel. Consequently, the proposed channel should encourage new industry, barge transportation, and the development of the area's natural resources. However, even in the absence of any firm commitments by any additional industry the prospective commerce on the proposed barge channel generated by the future growth plans of the Owens-Illinois paper mill should more than triple the tonnage of paper products presently being exported overseas from the Port of Orange, Texas. In this connection, the advent of ocean barge carrier systems, combining the advantages of inland waterway and ocean transportation, should further enhance future industrial development along the proposed channel. Moreover, the channel would provide a direct barge link with the Gulf Intracoastal Waterway, presently 12 feet deep and 125 feet wide, but authorized for increase to a depth of 16 feet and a width of 150 feet between the Sabine River and the Houston Ship Channel. Accordingly, the manufacturers of some of the large and complex mechanisms that are now being assembled for transportation in the country's rapidly expanding scientific development, e.g., space exploration equipment such as large rocket boosters that can move only by water, would be attracted to locate in the project area.

53-522 O-71—3

From such plants the space equipment could be barged via the extensive Gulf and Atlantic Intracoastal Waterways to any point thoughout the space industry's broad geographical domain which ranges from Houston, Texas, along the Gulf Coast to Cape Kennedy, Florida.

Finally, beyond the immediate savings in transportation charges to the existing and potential commercial and industrial interests bordering the segment of the Sabine River under study, the proposed project should contribute significantly to the general improvement of the entire economy of the river basin area including the Port of Orange, Texas.

In summary, focusing only on the commercial and economic importance to the study area of the Port of Orange and its local connecting channels, and considering a comparison of total annual charges (Federal/Non-Federal) estimated at $170,000 for accomplishing the proposed navigational improvement with estimated average annual benefits of $616,000 producing a benefit/cost ratio of 3.6 to 1 for the subject project, plus the private industries development taking place in the area and the potential increase in tonnage of cargo moving over the Sabine River waterway and through the Port of Orange, we concur with the proposals set forth in the Comprehensive Study.

The format of the Statement follows the organization prescribed in PL 91-190, and elaborated upon in the Interim Guidelines prepared by the Council on Environmental Quality to implement Section 102(2)(C) of the Act.

The selection of Plan A will lessen the adverse environmental effects of the river basin development. There is, however, one aspect of the development plan which may have an unnecessary environmental side effect that we would like clarified. The adverse environmental effects of the basin development associated with the inundation of valley lands may be larger than necessary, since it appears that the storage to be provided for municipal and industrial water supply is overstated. The apparent overstatement results from

the inclusion in the Sabine River Basin Plan, water needs that lie outside the basin and that are expected to be met by the development of other river basins.

The municipal and industrial water requirements of the following seventeen counties and parishes which are accounted for in the requirements assessment of the Red River below Dennison Basin Comprehensive Study, are duplicated as requirements to be met by the Sabine River plan.

Sabine Parish,	Louisiana	Natchitakes Parish,	Louisiana
Desoto Parish	"	Red River Parish	"
Bassier Parish	"	Caddo Parish	"
Harrison County,	Texas	Upsheer County,	Texas
Cass County	"	Morris County	"
Titus County	"	Camps County	"
Franklin County	"	Hopkins County	"
Hunt County	"	Marion County	"
Gregg County	"		

If, as it now appears, a significant portion of the water supply requirements proposed to be met by the Sabine River Basin projects are already included in the proposed development of the Red River Basin, the scale of the reservoirs should be reduced and the benefit/cost analysis and cost allocation schedule should be re-examined. Of the total storage capacity of the reservoir system proposed in the Sabine River Basin, 42 percent or 1.2 million acre feet is for water supply. The expected value in terms of annual benefits of municipal and industrial water supply is approximately $8.7 million or 56 percent of the total annual benefits derived from the three reservoirs. In the allocation of costs required for purposes of establishing reimbursable levels, pricing policies and cost sharing between the Federal Government and non-Federal interests, approximated 89 percent (76.2 million) of total non-Federal first costs and 31 percent (0.4 million) of maintenance, operation and replacement non-Federal costs is assigned to water supply. These benefits and costs could be reduced significantly if there is a serious overstatement of water supply needs.

Unfortunately, we were not involved in the original meetings on the comprehensive Sabine River Basin Study so that we are not familiar with any clarifying statements that might have been made on this matter. We do believe that some elaboration of the issues mentioned here is required. There is a possibility that the adverse environmental effects of the plan could be reduced by flooding less bottom land while still providing the water necessary for industrial and municipal purposes.

It is our understanding that the Big Sandy Reservoir will not be constructed until the water supply requirements exceed supplies available from the Mineola and Lake Fork Reservoirs. Since this situation is not anticipated within the next ten years, there will be ample opportunity to accommodate to needs made evident with time. Any adjustments to the water storage capacity that may be justified could be best accomplished in subsequent implementation and design studies, and would not compromise the overall validity of the development plan formulated in this authorization report.

Similar environmental considerations relative to the navigation channel should be continuously assessed as the channel is dredged.

Sincerely,

William D. Lee
Deputy Assistant Secretary

LETTER TO THE SECRETARY OF COMMERCE

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO
ENGCW-PI

26 October 1970

Honorable Maurice H. Stans
Secretary of Commerce
Washington, D. C. 20230

Dear Mr. Secretary:

Reference is made to the Department of Commerce's letter of 20 October 1970 commenting on my proposed report on the Sabine River and Tributaries, Texas and Louisiana.

The Department of Commerce expresses concern that the water supply needs are overstated and therefore the size of the reservoir projects could be reduced, with a resultant reduction in the adverse environmental effects through a lesser inundation of valley lands.

The assumption that the Sabine River Basin Plan will provide water for needs outside the basin that are expected to be met by the development of other river basins is not correct. In accordance with the Texas Water Plan the proposed reservoir development will permit the diversion of 200,000 acre-feet per year to the water-short western areas of the State, with the balance of the development for in-basin needs.

With regard to the question as to the Sabine River Basin projects furnishing the water supply requirements for the same areas that are included in the plan of development proposed in the Comprehensive Basin Study of the Red River below Denison, it is desired to point out that of the seventeen counties and parishes listed as being duplicative, only eight are partially in the Sabine Basin. In determing the water requirements for the Red River Basin, the needs of those portions of the Sabine Basin were excluded from the Red River Basin Study.

As you point out, the proposed sequence of construction of the reservoir projects will provide opportunities for any modifications to the project plan to accommodate changes in needs made evident with time.

Sincerely yours,

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT (AWL)
U.S. COAST GUARD
WASHINGTON, D.C.
20591

18 September 1970

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Clarke:

This is in response to your letter of 7 August 1970, addressed to Secretary Volpe, requesting comments concerning Sabine River Basin, Texas and Louisiana.

The concerned operating administrations of the Department of Transportation have reviewed your proposed report and the draft environmental statement and concur in general with your recommendations for extending navigation upon the Sabine River, the construction of three multi-purpose reservoirs in Texas for flood control, water supply and recreation and the local protection project on the Long Branch at Greenville, Texas. No comment is made concerning the draft environmental statement nor upon the environmental impact of the proposed project.

It is noted that the project makes no reference to navigational aids that will be required in the navigationally extended portion of the Sabine River. The draft environmental statement indicates that further assessment of the environmental values relating to the navigation channel and disposal areas will be made during preconstruction planning when construction plans are finalized. This aspect of the project should be coordinated with Commander, Eighth Coast Guard District in New Orleans, La.

It is noted by the Federal Highway Administration that the construction of the reservoirs will require the alteration of approximately 64 miles of Federal-aid and Non-Federal-aid roads and highways. The proposed report does not identify the estimated cost of this work but it is assumed that the cost is included in the project. It is also assumed that the proposed work will be coordinated with the Texas Highway Department. If either of these assumptions is incorrect it is requested that this Department be advised accordingly. Advance acquisition of the land necessary to preserve the reservoir site and authorization to

participate in the cost of reconstructing transportation and utility facilities in advance of project construction as required to preserve the site and avoid increased costs are recommended.

It is noted in the Federal Railroad Administration review of the proposed study that the Association of American Railroads and the Texas Railroad Association have requested that the extension of navigation from Echo to Morgans Bluff, Texas be not authorized. These associations recommend a reanalysis of the project following completion of the already authorized project from Orange to Echo, Texas. Attached is a copy of the 19 May 1970 letter of Mr. J. G. Tangerose on behalf of the Texas Railroad Association and the Association of American Railroads to Col. Alvin D. Wilder, Resident Member, Board of Engineers for Rivers and Harbors. This letter has not been responded to by the Corps of Engineers. It is the Federal Railroad Administration's role to see that railroads receive proper consideration in all areas of the Federal establishment and in this case it appears that the railroads' interest may have been overlooked. While the Federal Railroad Administration is not commenting upon the validity of the Association of American Railroads' argument, they feel that a proper response from the Corps of Engineers be made in order for the Federal Railroad Administration to consider its responsibilities as having been fulfilled.

Hopefully the matter will be resolved. It is felt by the Department of Transportation, however, that comment by the Corps of Engineers concerning this objection to extension of navigation on the Sabine River should be incorporated in the proposed report prior to transmittal to the Congress.

The proposed project is in agreement with the policy of the Water Resources Council as per the Water and Related Land Resources Planning policy statement of 22 July 1970.

The opportunity afforded this Department to review and comment on your proposed project is appreciated.

Sincerely,

R. Y. Edwards

R. Y. EDWARDS
Rear Admiral, U.S. Coast Guard
Chief, Office of Public and
International Affairs

Enclosure

May 19, 1970

Colonel Alvin D. Wilder
Resident Member
Board of Engineers for Rivers and Harbors
Temporary Building C
Second & Q Street, S. W.
Washington, D. C. 20315

Dear Colonel Wilder:

This letter is on behalf of the Texas Railroad Association and the Association of American Railroads and concerns the recommendation to extend navigation from Echo to Morgan Bulff, Texas, contained in the Survey Report on the Sabine River.

We have reviewed the traffic and transportation savings associated with the Owens-Illinois Corporation's plant at Morgan Bluff and submit the following comments.

A review of the Comprehensive Basin Study revealed that there was no basis for including turpentine as outbound barge traffic, principally as a result of limited annual production and numerous destinations. Consequently, we were gratified to note that the Survey Report did not accept turpentine as prospective barge traffic.

The plant to be served by the proposed navigation project commenced production in November 1967. Our review of traffic is based on 1969 production and shipments. This review revealed that 90 to 95 percent of the traffic in 1969 moved by rail and the balance by truck. Traffic which moved by truck was essentially to Gulf ports for export. Rail shipments were to numerous destinations, many to off-river plants. In addition, many rail shipments were in such quantities as to preclude barge transportation.

An analysis of tall oil production and shipments indicates that this commodity is not likely to move by barge because of limited production and the location and number of receivers. Production during 1969 was equal to about one barge load per month. Consequently the Survey Report should include the cost of inventory at both origin and destination in computing navigation benefits. This would clearly indicate that rail is the least costly alternative for numerous movements. Our analysis also revealed that the truck-barge as well as the all-barge movement would result in certain terminal costs not incurred by shippers and receivers when movement is by rail. We urge the Board to carefully analyze tall oil traffic, taking into account the findings set forth in this paragraph.

Your attention is invited to traffic during 1968 of Commodity Code 2861, Gum and Wood Chemicals, via the Mississippi River System of 29,923 tons. Commodity Code 2861 includes such commodities as Pine Oil, Rosin Oil, Rosin, Pitch, Tall Oil, etc. In view of the numerous producing plants on or adjacent to the Mississippi River System, the subject Survey Report clearly overstates prospective movements of tall oil.

Pulpboard is by far the principal product shipped from the Owens-Illinois plant. Pulpboard is distributed over a wide domestic market and in most instances, in less-than-bargeload quantities. Consequently, most of the output of pulpboard would not be susceptible to movement by barge. Moreover, it is unlikely that the all-barge route would result in the elimination of one transfer or handling charge. This results from the fact that pulpboard will have to be moved from storage to barge docks. Moreover, even when pulpboard moves to a riverside plant there is a cost incurred in moving the product from barge dock to plant. If adequate terminal charges and inventory costs are included in the analysis of transportation savings, the all-rail route is a less costly alternative than truck-barge for all but a few movements.

Because of the uncertainties surrounding the estimate of traffic, computation of benefits, and the shippers' use of barge transportation, we respectfully request that the extension of navigation from Echo to Morgan Bluff, Texas, not be authorized at this time. In lieu thereof, we recommend a reanalysis of the project following completion of the authorized project from Orange to Echo, Texas.

Very truly yours,

JGT:a

James G. Tangerose

bc: Mr. R. S. Crossman
Mr. G. N. Fondren
Mr. B. E. Fortwood
Mr. Walter Caven

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO
ENGCW-PI

26 October 1970

Honorable John A. Volpe
Secretary of Transportation
Washington, D. C. 20590

Dear Mr. Secretary:

Reference is made to the letter of 18 September 1970 from the Department of Transportation commenting on my proposed report on the Sabine River and Tributaries, Texas and Louisiana.

The Department of Transportation notes that requirements for navigational aids should be coordinated with the Commander, Eighth Coast Guard District in New Orleans and that alterations of Federal aid and non-Federal aid roads and highways should be coordinated with the Texas Highway Department. As indicated on page 109 of the report, estimates of the number of aids and their construction and maintenance costs were furnished by the Commander, Eighth Coast Guard District. The costs of aids, which are estimated at $27,300 as shown on page 241 of the report, are included as part of the cost of the navigation improvement. With respect to the Department's question on the costs of road and highway alterations, these are estimated at $21,518,000 and are included as part of the reservoir project costs. Requirements for navigation aids and alteration of roads and highways will be reviewed in detail during advance planning and design and this detailed review will be fully coordinated with all appropriate interests.

The Board of Engineers for Rivers and Harbors, in its review of the Sabine River report, carefully considered the comments of the Texas Railway Association on the proposed barge navigation channel from Echo to Morgan Bluff. Specific questions raised by the Association on the economic evaluations were given special attention by the Board. Based on a careful assessment of all factors, it is believed that evaluations of prospective commerce and savings in transportation charges presented in the report are based on reasonable conclusions and the best information on hand at this time. However, if the project is authorized and in accordance with normal procedures for projects of this nature, the project economics will be reanalyzed during advance

planning and design prior to any construction to take into account the effects of any changes in criteria and economic conditions that have taken place since preparation of the report. These investigations will be fully coordinated with all appropriate interests.

Copies of the letter from the Department of Transportation and this reply will accompany my report to Congress.

Sincerely yours,

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

29 September 1970

Lt. General F. J. Clarke, USA
Chief of Engineers
U.S. Corps of Engineers
Department of the Army
Washington, D.C. 20315

Dear General Clarke:

As requested in your letter of August 7, 1970, the proposed report and the draft environmental statement for the "Report on Comprehensive Basin Study - Sabine River and Tributaries, Texas and Louisiana", have been reviewed by the appropriate environmental health agencies of the Public Health Service.

We note that the District and Division Engineers of your agency find that a system of projects consisting of three multiple-purpose dam and reservoir projects, a local flood protection project, and extension of an authorized commercial navigation channel will provide practical means for meeting existing and foreseeable needs for flood control, water supply, water based recreation, and waterway transportation. They note that the recommended improvements would be consistent with the comprehensive plan for the control, conservation, and best use of the basin's water and related land resources formulated by the Sabine River Coordinating Committee and approved by the Water Resources Council.

With respect to the environmental impact statement, it is suggested that you should provide for compliance in the planning, design, construction, operation, and maintenance phases of the projects with appropriate health guidelines, including those set forth in the following:

A. For any drinking water systems: the Public Health Service Drinking Water Standards (Public Health Service Publication Number 956) and the Manual for Evaluating Public Drinking Water Supplies (Public Health Service Publication Number 1820).

B. For recreational areas: Environmental Health Practices in Recreational Areas (Public Health Service Publication Number 1195).

C. For control of disease vector problems: Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as departmental interests and responsibilities are concerned.

Sincerely yours,

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D. C. 20410

28 August 1970

OFFICE OF THE UNDER SECRETARY

IN REPLY REFER TO:

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

Dear General Clarke:

This is in reply to your letter to Secretary Romney, dated August 7, 1970, requesting comments on the Environmental Statement on your proposed actions on the Sabine River Basin and Tributaries, Texas and Louisiana. I am responding in accordance with my delegated responsibility for administering PL 91-190 within HUD.

The Environmental Statement relates to the implementation of improvements of the Sabine River and Tributaries, Texas and Louisiana, by construction of three multiple-purpose reservoirs, Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek and Big Sandy Reservoir on Big Sandy Creek for flood control, water supply, and recreation; a local flood protection project at Greenville, Texas; and an extension of an authorized navigation channel in the tidal reach of the Sabine River.

The projects are to meet needs for flood control, municipal and industrial water supply, recreation and commercial navigation in accordance with the early action plan of the Comprehensive River Basin Study submitted to Congress April 15, 1970.

HUD Comment

Our consideration of the environmental impact on the urban areas of this river basin falls into three major areas; (1) the extent of coordination with relevant local or regional comprehensive development plans, (2) the study of the various alternatives that would change the environmental impact, and (3) the specific assessment of impact of the project plan presented in the report.

Except for reservations noted below, some of which may be crucial, we believe this Environmental Statement indicates a reasonable treatment of environmental consequence of interest to this Department.

HUD Reservations

1. The Environmental Statement suggests certain benefits to urban areas and potential enhancement of the well-being of the Region, but it should also indicate consistency with the relevant comprehensive regional and local development plans. In general, we believe that coordination with regional and local bodies should be initiated before drafting the Environmental Statement and that circulation of these draft Environmental Statements in some review and coordination process, such as the procedures established by U. S. Bureau of the Budget Circular A-95, should afford local agencies an opportunity to comment on the adequacy of response to local needs before the final Environmental Statement is filed with the Council on Environmental Quality. A copy of the State listing of Clearinghouses for Louisiana and Texas is enclosed.

2. Complementary non-structural programs to be developed through cooperative State and local participation to encourage prudent use and management of the urban flood plains, should be assessed in relation to their impact on the environment and the enhancement of the proposed developments.

3. The consideration of reasonable alternatives, possible combinations and identification of non-structural measures, as recommended in Water Resources Council's report on the Type II comprehensive study, should be fully documented in support of the proposed plan. The statement (paragraph 3C, p.12) cites only the non-development alternative as a comparison, and the higher cost of all other alternatives having similar benefits. The possible use of flood plain management options to obtain comparable flood damage reduction (paragraph 3C, p.13) should be further discussed in reference to urban environmental improvement, open space uses and recreational facilities.

4. Further assessment of the environmental values relating to the navigation channel and disposal areas (paragraph 3b, p.12) would appear to be useful as part of this document, prior to authorization of the project.

* * * * *

It is requested that Environmental Statements be sent to the HUD Regional Administrator in whose territory the proposed action would take place. A list of HUD Regional Offices is attached. The project under review falls within the Fort Worth Regional Office whose Administrator is Richard L. Morgan.

Sincerely yours,

Charles J. Orlebeke
Deputy Under Secretary

Attachments

COMMENTS FROM THE FEDERAL POWER COMMISSION

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

IN REPLY REFER TO:

30 September 1970

Lieutenant General F.J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

Reference: ENGCW-PI

Dear General Clarke:

This is in reply to your letter of August 7, 1970, 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 Sabine River and Tributaries, Texas and Louisiana. Included as part of your proposed report is a draft environmental statement pursuant to Public Law 91-190.

The cited reports recommend construction of three reservoir projects, a local flood protection project, and a navigation project in the Sabine River basin. The total construction cost of the recommended improvements is estimated to be $192,203,000, of which $86,001,500 would be reimbursable by non-federal interests. The reservoir projects and the local flood protection project would be located in the upper basin in northeastern Texas. The navigation project would be along the lower Sabine River and would permit shallow draft navigations between Echo and Morgan Bluff, Texas. The local flood protection project would protect the city of Greenville, Texas. The three proposed reservoirs, Mineola, Lake Fork, and Big Sandy, would provide controlled storage capacities of 1,375,000, 1,113,000, and 418,200 acre feet, respectively. The purposes of all proposed reservoirs are flood control, water supply, recreation, and fish and wildlife enhancement.

The Commission staff has made studies of the hydroelectric power possibilities of the reservoir projects as currently proposed. The yields available for power generation from the three reservoirs utilized through the heads available at these projects would produce dependable peaking capacities amounting to about 1,400 kilowatts at Lake Fork reservoir, 1,600 kilowatts at Big Sandy reservoir, and less than 100 kilowatts at Mineola reservoir. Development of these small amounts of power would not

be economically justified. In addition, enlarging the projects would not provide for economical power development. Topography in the vicinities of the proposed projects is not suitable for pumped storage development.

Operation of the proposed reservoir projects could affect the power output of the existing downstream Toledo Bend reservoir, licensed by the Federal Power Commission as Project No. 2305. Diversions of water from the proposed reservoir projects for water supply purposes would reduce the flows available at Toledo Bend. However, the regulation of flows by the upstream projects could increase the inflows to the Toledo Bend reservoir during low-inflow periods. Thus, it is not possible at this time to predict precisely the net effect of the proposed reservoirs on the power production at Toledo Bend. If, after the projects are placed in operation, they have a beneficial effect on the power output at Toledo Bend, the reimbursement therefor would be determined by the Commission pursuant to Section 10(f) of the Federal Power Act.

Based on its consideration of the reports of your Department and the studies of its own staff, the Commission concludes that the recommended Mineola, Lake Fork, and Big Sandy reservoir projects in the Sabine River basin would not provide opportunity for economical hydroelectric power development. The Commission has no specific comments with regard to the draft environmental statement included with your report.

Sincerely,

John N. Nassikas

John N. Nassikas
Chairman

53-522 O—71——4

SABINE RIVER BASIN, TEXAS AND LOUISIANA

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

26 October 1970

IN REPLY REFER TO
ENGCW-PI

SUBJECT: Sabine River and Tributaries, Texas and Louisiana

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, on the Sabine River and Tributaries, in response to a resolution adopted 3 June 1959 by the Committee on Public Works of the House of Representatives and to resolutions of the House Flood Control Committee listed in the Board's report. The resolutions requested review of the report on the Sabine River submitted to Congress on 5 April 1944, with a view to determining whether any modifications should be made in the recommendations contained in that report with respect to flood control, navigation, the development of power, and other water resources purposes.

2. The District and Division Engineers find that a system of projects consisting of three multiple-purpose dam and reservoir projects, a local flood protection project and extension of an authorized commercial navigation channel will provide practical means for meeting existing and foreseeable needs for flood control, water supply, water based recreation and waterway transportation. They note that the recommended improvements would be consistent with the comprehensive plan for the control, conservation and best use of the basin's water and related land resources formulated by the Sabine River Basin Coordinating Committee and approved by the Water Resources Council. The District and Division Engineers recommend construction of the improvements, contingent upon certain items of local cooperation, at an estimated Federal first cost of construction of $191,834,000 of which $85,633,000 would be repaid by non-Federal interests for reservoir water supply storage and recreation facilities. In addition, non-Federal interests would be required to provide lands, easements, rights-of-way and relocation for the local protection and navigation improvements, estimated to cost $369,000. The annual charges and benefits for the reservoir and local protection projects, which are evaluated on a 100-year economic life, are estimated at $10,416,400 and $15,604,800

respectively; the resulting benefit-cost ratio is 1.5. Annual charges and benefits for the navigation improvement, which is evaluated on a 50-year economic life, are estimated at $170,000 and $616,000, respectively; the resulting benefit-cost ratio is 3.6.

3. The Board of Engineers for Rivers and Harbors concurs generally in the findings of the District and Division Engineers and recommends the improvements subject to certain conditions of local cooperation.

4. I concur in the views and recommendations of the Board provided that prior to construction, responsible local interests give assurances satisfactory to the Secretary of the Army that they will, with respect to the Lake Fork project, based on its final design, reimburse the Lake Fork Water Control and Improvement District No. 1 for tax revenue losses incurred by removal from the tax rolls of lands benefited by the existing Upper Lake Fork Watershed project. Based on current interest rates and available project data, the repayment is presently estimated at $2,000 annually or, alternatively, $35,000 if payment is made in a single lump sum amount. The addition of this item to the requirements of local cooperation set forth in the Board's report will not cause any changes in the Federal cost of the recommended projects. However, use of the currently prescribed interest rate of 5 1/8 percent used in computing annual charges and benefits would result in benefit-cost ratios as follows:

Mineola Dam and Reservoir	1.2
Lake Fork Dam and Reservoir	1.6
Big Sandy Dam and Reservoir	1.5
Greenville local protection	1.1
Navigation Channel, Echo to Morgan Bluff	3.5

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

ENVIRONMENTAL STATEMENT

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO
ENGCW-PI

26 October 1970

SUMMARY
COORDINATION OF ENVIRONMENTAL STATEMENT
ON
SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA

1. Coordination of Environmental Statement:

Agency	Date of Transmittal	Date of Comments
State of Louisiana Dept. of Public Works	7 Aug. 70	16 Sep. & 5 Oct. 70
Wildlife & Fisheries Commission		25 Sep. 70
State Parks and Recreation Comm.		23 Sep. 70
State of Texas	7 Aug. 70	2 Sep. 70
Department of Interior	7 Aug. 70	7 Oct. 70
Department of Commerce	7 Aug. 70	2 Oct. 70
Department of Housing and Urban Development	7 Aug. 70	28 Aug. 70
Department of Health, Education and Welfare	7 Aug. 70	29 Sep. 70
Federal Power Commission	7 Aug. 70	30 Sep. 70
Water Resources Council	7 Aug. 70	2 Oct. 70
Department of Transportation	7 Aug. 70	18 Sep. 70
Department of Agriculture	7 Aug. 70	22 Sep. 70

2. Summary of Agency Comments and Views of the Chief of Engineers:

The correspondence from the interested State and Federal agencies is attached as an inclosure to the environmental statement. The agency comments concerning the environmental aspects of the project and the response of the Chief of Engineers are discussed below.

State of Louisiana.

Comment: The compensatory lands for mitigation of wildlife losses should be described in more detail.

Response: Habitat losses resulting from construction of the three reservoir projects could not be replaced, but hunting losses could be compensated for by the acquisition, development and management, at project cost, of about 25,000 acres of reservoir project lands above the conservation pools and 15,000 acres of flood plain lands immediately below the Mineola dam site. The costs of acquisition and development are estimated at $3,080,000 and management is estimated to cost $80,000 annually. These measures would mitigate 14,800 annual man-days of big game hunting, 16,800 annual man-days of upland game hunting, and 3,600 annual man-days of other wildlife hunting losses due to the proposed reservoir projects. Details as to site acquisition and development will be worked out during advance planning and design studies, if the projects are authorized, in cooperation with appropriate State and Federal agencies. The entire shoreline of the reservoirs would be acquired, assuring access.

Comment: Mention is not made concerning the environmental impact of the Greenville, Texas flood protection project on the upstream watershed and surrounding area.

Response: The effects of the Greenville local flood protection project on the environment in the upstream watershed and surrounding area would be insignificant. The environmental impacts of the channel improvement project are associated with urban activities in flood plain areas along Long Branch in the city of Greenville. Reduced flood heights would result in less destruction, hardship, unpleasant odors, and health problems in the protected area, while improving opportunities for green belt and open space development. It should be noted that the recommended plan modifies that proposed in the Interagency Comprehensive Plan by substituting non-structural measures for some of the originally proposed channel improvements.

Comment: The proposed reservoir system is described in terms of size and public access but not in terms of actual environmental impact of the construction of the reservoirs, including the upstream and downstream impacts on fish, wildlife, water quality, hydrology, recreation, etc. From a strictly recreational standpoint it is possible that a higher and better use could be realized by leaving the streams in their natural free-flowing state.

Response: In formulating the plan of development, the physical effects, both beneficial and adverse, of all elements and purposes of water and related land resource developments were measured and evaluated.

The proposed reservoir system would convert about 90 miles of free-flowing stream to slackwater impoundments and would inundate about 62,000 acres of pastureland, woodland and cropland. About 30 percent of the project lands would be in woodland, 58 percent in pastureland, 11 percent in cropland and the remaining 1 percent in physical improvements. Inundation of wildlife habitat would result in a net loss of 14,800 annual man-days of big game hunting, 16,800 annual man-days of upland game hunting, and 3,600 annual man-days of other wildlife losses. On the other hand, slackwater impoundments would provide a net gain of over 700,000 annual man-days of sportsfishing and 1,100 annual man-days of water fowl hunting by the year 2020. With respect to water quality effects, the projects are not designed to supply releases for water quality improvement. This is based on FWQA findings in the Type 2 study that the surface waters of the Sabine River Basin will not be degraded below acceptable limits and storage for water quality control will not be needed in the foreseeable future. However, operation of the projects is subject to the provision of the Sabine River Compact that the minimum flow of 36 cubic feet per second will be maintained at the State line. During flood periods, the projects will be operated to take full advantage of the systems flood reducing capability with releases limited by downstream channel capacities. The resulting effects of the foregoing operation procedures on the river hydrology is an increase in low flows during drought periods and a decrease in high flows during flood periods. This should lead to improved sediment and erosion control and improved recreational use of the free flowing stream. The 62,000 acres of lake surface formed by the projects, together with facilities and access, will provide outdoor recreation opportunities for up to 3.3 million visits annually. Without development, the 90 miles of free-flowing stream, which would be inundated by the projects, would support only limited recreational use since lands are privately owned and access is limited.

Comment: Concern is expressed regarding the effect of the proposed reservoirs on Toledo Bend Reservoir in regard to water flow and to total ecology of the lake.

Response: Studies indicate that the effect of the recommended reservoirs on Toledo Bend Reservoir would not be significant in terms of recreation, and fish and wildlife. Releases from upstream reservoirs and return flows will increase the efficiency of water use at Toledo Bend Reservoir.

State of Texas.

Comment: The Governor noted only that the draft statement credits the proposed projects as enhancing the environment and providing beneficial import on fish, wildlife, and the public welfare.

Department of the Interior

Comment: The environmental statement should cover the quantity and quality, including present and future use, of the general outdoor recreation and scenic values of the natural stream areas which will be lost as a result of reservoir installation.

Response: About 90 miles of warm water streams, out of about 400 miles on those streams above the Toledo Bend Reservoir, and 62,000 acres of pastureland, cropland and woodland would be inundated by the projects. The project areas are rural in character with woodlands and pastures interspersed with cropland and farmsteads, with no unusual scenic value. Since similar features and characteristics exist throughout the basin area, the projects would result in a loss of only a small portion of the basin's rural scenic setting. Inundation of wildlife habitat would result in a loss of 14,800 annual man-days of big game hunting, 16,800 annual man-days of upland game hunting, and 3,600 annual man-days of other wildlife hunting opportunities, all of which would be mitigated by the proposed acquisition and management program. On the other hand, the reservoir pools would provide a net gain of over 700,000 annual man-days of sports fishing, 1,100 annual man-days of waterfowl hunting and up to 3.3 million man-days annually of outdoor recreation use by the year 2020.

Comment: The Department of the Interior further recommends that the effects of the proposed projects on water quality in the project areas and below the reservoirs be characterized and quantified as to their long-term environmental effects.

Response: According to the study performed by the Federal Water Pollution Control Administration, results of the quality computations showed that surface waters of the Sabine River basin will not be degraded below acceptable limits between the present and year 2020 and that storage of water for dilution would not be required. However, quality requirements should be reevaluated during project design.

Department of Commerce

Comment: The water supply needs are overstated and therefore the size of the reservoir impoundments could be reduced with a lesser inundation of valley lands. The apparent overstatement results from the inclusions in the Sabine River Basin Plan of water needs that lie outside the basin and are expected to be met by development of other river basins; that some 17 counties and parishes which are accounted for in the requirements of the Red River below Denison Basin Comprehensive Study are duplicated as requirements to be met by the Sabine River Plan.

Response: The Sabine River Basin projects have not been planned to provide water for these peripheral areas outside the basin. In determining the water requirements for the Red River Basin, the needs for those portions of the counties and parishes in the Sabine Basin were

excluded from the Red River basin study. Also in accordance with the Texas Water Plan, the proposed Sabine basin reservoir development will permit the diversion of 200,000 acre-feet per year to water-short western areas of the State.

Department of Housing and Urban Development

Comment: Coordination should be made with regional and local bodies before drafting the Environmental Statement, and circulation of these draft Environmental Statements should afford local agencies an opportunity to comment. Also, circulation of these drafts should be made in some review and coordination process such as the "clearinghouse" established by Bureau of the Budget Circular A-95.

Response: The Comprehensive Report (Type 2) was prepared by a field coordinating committee composed of representatives of the involved States and Federal agencies. Subsequently, the authorization report and the draft environmental statement were provided the States of Texas and Louisiana and to the heads of the interested Federal agencies for review and comment. In view of the foregoing coordination and since "clearinghouse" coordination pertains to beach erosion or shore protection projects, the "clearinghouse" procedure is not applicable to this report. If the projects are authorized, the Corps will coordinate further with all appropriate interests during advance engineering and design stage and during construction and subsequent operation stages.

Comment: Complementary non-structural programs to be developed through menagement of the urban flood plains should be assessed in relation to their impact on the environment and the enhancement of the proposed developments; that they be considered as reasonable alternatives.

Response: The proposed project at Greenville does include flood plain management as an integral part of the plan of flood protection and, prior to construction, responsible local interests must provide assurances that appropriate regulations will be adopted governing the proper development of the flood plain. Under the Flood Plain Management Services Program the Corps will provide planning assistance to the City of Greenville through flood plain information reports on flood hazards, thus providing the basis for regulating flood plain development. In the Sabine Basin, flood proofing and flood plain development would alleviate some of the damages to structural development within the flood plain, but its effect on damages to agricultural areas would be negligible.

Comment: Further assessment of the environmental values relating to the navigation channel and disposal areas would be a useful part of the document.

Response: Environmental assessments of the effects of navigational facilities are dependent upon detailed studies. Locating suitable disposal areas that will be best suited to the environment and local requirements will be done at the time of preconstruction planning.

Department of Health, Education and Welfare

Comment: It is suggested that the Corps of Engineers provide for compliance in the planning, design, construction, operation and maintenance phases of the projects with appropriate health guidelines including drinking water systems, recreational areas, and for control of disease vector problems.

Response: We have issued regulations on these items and we insist that state health standards are adhered to as well.

Federal Power Commission

Comment: The Commission had no specific comments with regard to the draft environmental statement.

Water Resources Council

Comment: The Council noted that the environmental statement would be revised to better meet the requirements of the National Environmental Policy Act of 1969.

Response: The comments of the states and agencies on the draft environmental statement have been answered by replying to each comment individually. These responses included in this summary are provided in lieu of revising the original statement.

Department of Transportation

Comment: No comment is made concerning the draft environmental statement nor upon the environmental impact of the proposed project.

Department of Agriculture

Comment: It would be helpful if the draft environmental statement could clarify the basis for assuming that beneficial effects associated with the proposed project would more than offset environmental and economic losses.

Response: Beneficial effects of the projects more than offset their economic costs. This excess together with reduced risks to health and safety, the increased recreational opportunities, and gains in economic opportunities that would be expected by provision of adequate water supply and flood protection more than offset environmental losses. Environmental losses would consist of inundation of 90 miles of warm water streams, 62,000 acres of cropland, pastureland and woodland and the loss of a small portion of the basin's pastoral scenery. Economic losses are included in the economic costs of the projects measured in terms of the differential in the risk-free federal rate and the land mortgage discount rate applied to the cost of the project lands.

2 Attachments
1. Statement
2. Cpys of State and Agency Comments

26 October 1970

ENVIRONMENTAL STATEMENT
FOR
SABINE RIVER AND TRIBUTARIES
LOUISIANA AND TEXAS

PREPARED IN CONNECTION WITH
A SURVEY REPORT OF
THE FORT WORTH AND GALVESTON DISTRICTS

SABINE RIVER BASIN, TEXAS AND LOUISIANA

ENVIRONMENTAL STATEMENT

1. Project Description. The recommended improvements consist of three multiple-purpose dam and reservoir projects (Mineola, Lake Fork and Big Sandy); a local protection project at Greenville, Texas; and an extension of an authorized navigation channel in the tidal reach of the Sabine River. The projects are designed to meet needs for flood control, municipal and industrial water supply, recreation and commercial navigation. The Mineola dam site would be located at river mile 476 on the Sabine River and about 6 miles west of Mineola, Texas. The reservoir would be located in Woods, Raines and Van Zandt Counties. The Lake Fork dam site would be located on Lake Fork Creek about 28 miles above its confluence with the Sabine River and about 3½ miles west of Quitman, Texas. The reservoir formed by the dam would lie in parts of Woods, Raines and Hopkins Counties. The Big Sandy dam site would be located on Big Sandy Creek about 15 miles above its confluence with the Sabine River and about 6 miles northwest of Big Sandy, Texas. The reservoir would lie in Wood and Upshur Counties. The local flood protection project at Greenville, Texas would consist of channel improvements along Long Branch and a flood plain management program on Cowleech Fork. The navigation project in the lower basin would consist of a commercial navigation channel 5.25 miles long and 12 feet deep extending from Echo to Morgan Bluff, Texas. Development and management of 25,000 acres of project lands at the three reservoir sites plus acquisition, development and management of 15,000 acres of flood plain lands downstream of Mineola dam, would compensate for wildlife habitat losses resulting from construction of the three dam and reservoir projects.

2. Environmental Setting Without the Project. The Sabine River Basin is a crescent shaped area arising in the Blackland Prairie just northeast of Dallas, Texas where about half of the area is cultivated and the rest supports vegetative cover in the form of pastures, native grasses, and scattered elm and hackberry trees. As the basin bends to the east and south through eastern Texas and western Louisiana it passes from the Blackland Prairies through the hilly and undulating terrain of the Southern Coastal Plains and the Gulf Coast Prairies. The latter areas are dominated by pine-hardwood forests and pastureland, and dotted with farms and towns. The river finally comes to rest in the flat Gulf Marshes at the head of Sabine Lake. The mild climate and abundance of rainfall throughout the basin contribute to the growth of a wide variety of vegetative species. The hardwoods and southern pines, with an understory of shrubs, vines, herbs, and grasses along with the marshes, provide an excellent habitat for indigenous wildlife and a winter sanctuary for the migratory birds and waterfowl from the north.

The streams wind and meander in their broad flood plains from an elevation of about 700 feet to sea level. They support an abundance of catfish, bass, bluegill, and a wide varity of minnows and commercial fish. The water is of fairly high quality.

MINEOLA RESERVOIR. The Mineola Reservoir will rest in a broad, nearly level valley in the Post Oak belt of the East Texas timber country. The valley floor supports a mixed stand of cut-over hardwoods and small deciduous trees. There is a dense understory of shrubs, vines and herbs. This mixture of vegetative cover provides a habitat for deer squirrels, quail, dove, furbearing animals and songbirds. The stream in the reservoir area supports a warm water fishery with game fish such as bass, crappie, bluegill, and catfish, and non-game species such as gar, buffalo, carp and shad. The Mineola Reservoir area is rural in nature and is predominantly woodland pasture with some bottom croplands in the valley. The scenery is generally pleasing with rolling hills, pastures, and forested areas.

LAKE FORK RESERVOIR. The Lake Fork Reservoir will rest in the broad valley of the Lake Fork Creek and the arms of major tributaries, Little Fork, Garrett, Burket and Caney Creeks. The area is rural in nature with bottom croplands predominating in the valley. The forested areas are predominantly hardwood species of oak, elm, hackberry, willow, and gum, with a scattering of shortleaf pine. The pastureland, rangeland, and forested areas, with the understory of shrubs, vines and herbs, provide habitat for wildlife similar to those found in the Mineola Reservoir site. The scenery is rolling hills of farmland, pastures and woodland.

BIG SANDY RESERVOIR. The Big Sandy Reservoir will occupy a relatively narrow valley of Big Sandy Creek. The area is a rural setting with woodland pastures predominating, broken by cropland and farmsteads. The vegetative and wildlife resources are comparable to those of the Lake Fork area, except that habitat is of better quality and more wildlife is found in the Big Sandy area; and the shortleaf pine is more prevalent, as the site is at the western edge of the Pine Belt.

3. Impact Statement. The following information is furnished in response to Section 102 (2) (c) of the National Environmental Policy Act of 1969.

a. Identify "the environmental impact of the proposed action." The flood protection and prevention measures proposed for Greenville, Texas, will have a beneficial and complimentary environmental impact. It will help to provide for a cleaner, safer stream through the city. There will be less destruction, hardship, unpleasant odors and health problems.

The proposed reservoir system would dedicate about 62,000 acres of water surface area in the conservation pools and about 72,000 acres of land above these pools to public ownership and access for the benefit of present and future generations. Access would be convenient to the public in close proximity, to people in nearby metropolitan areas, and to the traveling public passing through.

The projects would provide opportunities for up to 3.3 million recreation user days annually and 0.8 million fisherman days annually. Increased water supply will enable the people in the cities to develop and maintain more pleasant surroundings, open areas and municipal parks, as well as provide for future water needs. The flood control features will help to eliminate unsafe, unsightly, and unhealthy conditions, particularly in the more densely inhabited areas. They will help to control movement of sediment and stream scour, and regulation of stream flow in the downstream areas will help to preserve the integrity of the streams and their natural attributes. Adverse effects are discussed in the following subparagraph.

b. Identify "any adverse environmental effects which cannot be avoided should the proposal be implemented." The three reservoir projects would convert approximately 90 miles of free-flowing streams to slackwater impoundments and substitute a reservoir fishery for the existing stream fishery which has a present use estimated at 76,000 fisherman days annually. Maintenance of the conservation pools would result in inundation of about 62,000 acres of pastureland, woodland and cropland. The most adverse environmental effect of this inundation may well be the loss of game habitat. The projects would replace present uses of pastureland, cropland, and woodland with reservoir recreation and open space use. The sea level navigation channel from Echo to Morgan Bluff would extend along the river bottom and would have little or no effect on marsh drainage and estuarine resources. A further assessment of the environmental values relating to the navigation channel and disposal areas will be made during preconstruction planning when construction activities are finalized.

c. Identify "alternatives to the proposed action." One alternative to the recommended reservoir projects would be to forego the improvements. This course of action would result in water associated constraints on local and regional economic development and a loss of project services estimated at $16 million annually when measured in terms of net benefits foregone. The lost flood control opportunity measured by the monetary value of preventable flood damages is $3.9 million annually. The lost opportunity to store surplus flows, which when measured in terms of municipal and industrial water supply, has a monetary value of $8.7 million annually. A loss of up to 4.1 million man days of recreation and fishing opportunities having a value of $2.8 million annually would result from a no-development alternative. From an environmental viewpoint, a no-development alternative would eliminate the adverse impacts cited in subparagraph "b" at the expense of the gains cited in subparagraph "a".

Any alternative system of projects which would provide the needed water supply, flood damage reduction and recreational opportunties would be more expensive than the recommended multiple-purpose reservoir system and the environmental effects of such alternatives would be essentially similar to that of the recommended projects.

Flood damage reduction benefits comparable to that afforded by the recommended plan could be provided by alternative combinations of flood plain management options. Combinations including flood proofing and flood plain development limitations would be relatively ineffective in reducing flood damages to agricultural property.

d. Discuss "the relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity." The Sabine Basin valley and tributary stream flood plains are presently being used for farming, manufacturing, and oil and timber production and the area supports a wide variety of wildlife and plant communities. However, the basin is characterized by periodic flooding and all the associated losses of life and property. Reduction of the incidence of flooding along the valleys below the sites and more efficient use of lands in agricultural production than now possible would enhance long-term productivity. Enhancement of the well-being of the region will, in the long run, result from removal of water associated constraints on local and regional economic development. Such urban areas as Dallas, where the potential for severe water supply shortages already exists, would receive long-term benefits from improved dependable water supplies resulting from the projects. Provision of water-oriented public use recreation opportunities associated with creation of the reservoir pools and adjacent project lands is considered a long-term enhancement of the social as well as the physical environment. The region and nearby urban areas would receive long-term benefits from improved recreational opportunities and the resulting increased tourist income.

e. Identify "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." As is the case in any large scale project, the environmental effects of the Sabine project will be irreversible. The proposed reservoir projects would inundate about 90 miles of warm water streams and about 62,000 acres of cropland, pastureland and woodland. The commitment of labor and material associated with construction of the projects would also be irreversible and irretrievable.

STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE, LA. 70804

September 16, 1970

C. H. DOWNS
DIRECTOR

General F. J. Clarke
Chief of Engineers
Department of the Army
Office of the Chief Engineers
Washington, D. C. 20314

Dear General Clarke:

Reference is made to your letter of August 7, 1970, requesting comments on your proposed report on the Sabine River Basin, Texas and Louisiana. The State of Louisiana, Department of Public Works, has been designated by Governor McKeithen as his representative in the review and coordination of water resources.

We would be derelict in our responsibility to the State of Louisiana if we did not call to your attention the importance of the Toledo Bend Reservoir, a $70,000,000.00 joint state project of the Sabine River Authority of Louisiana and the Sabine River Authority of Texas. This tremendous water supply, hydroelectric, fish and wild life and recreation project is financed and oonstructed from state funds and from the sale of hydroelectric power. In order to protect the interest of the State of Louisiana in the Toledo Bend Reservoir Project we must insist that any development upstream from this project be designed and operated so as not to cause any reduction or depletion in this water supply, recreation and fish and wild life capabilities or in its operation and generation of hydroelectric power.

After reviewing the data furnished us by the U. S. Army, Corps of Engineers, Fort Worth District, pertaining to power routing studies and the Sabine River Basin Report we find that the results are based on certain assumptions and conditions. If other possible assumptions are used, certain detrimental effects could result to the Toledo Bend Reservoir Project. This is discussed in my letter of June 3, 1970, to the Board of Engineers for Rivers and Harbors which I am enclosing for your information.

For these reasons the State of Louisiana can only concur with the plan of construction as proposed in the survey report, provided the following recommendations are made a part of the aurhorization report for this plan.

1. Not more than 200,000 acre feet per year will be diverted from the three reservoirs to another basin outside of the Sabine River Watershed.

2. Any cost incurred by the Toledo Bend Dam and Reservoir Project due to a reduction in power sales caused by the proposed project shall be borne by the Sabine River Authority of Texas.

3. A rule curve operation shall be adopted for the three reservoirs whereby sufficient flood flows shall be impounded at the end of the critical flood period and released during the drought periods to supplement the inflows into the Toledo Bend Reservoir.

Copies of your draft environment statement have been distributed to the Louisiana Wild Life and Fisheries Commission and the State Parks and Recreation Commission for their review and comments. We will forward their comments as soon as possible.

It is requested that a copy of this letter be made a part of the report when it is transmitted to Congress.

Sincerely yours,

C. H. Downs

C. H. DOWNS
DIRECTOR

/mal
Attachment

STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE, LA. 70804

C. H. DOWNS
DIRECTOR

October 5, 1970

General F. J. Clarke
Chief of Engineers - Department of the Army
James S. Forestal Building
1000 Independence Avenue
Washington, D. C. 20314

Dear General Clarke:

Please refer to our letter dated September 16, 1970 in which comments were submitted on the project, Sabine River Basin, Texas and Louisiana. According to that letter, we are pleased to transmit copies of comments on the draft environmental statement by the Louisiana Wildlife & Fisheries Commission and the State Parks & Recreation Commission.

We appreciate this opportunity to further comment on this project.

Sincerely yours,

C. H. Downs

C. H. DOWNS
Director

Attachments

/pal

LOUISIANA WILD LIFE AND FISHERIES COMMISSION
P. O. BOX 44095
CAPITOL STATION
BATON ROUGE, LOUISIANA 70804

September 25, 1970

Mr. C. H. Downs
Director
Department of Public Works
P. O. Box 44155 Capitol Station
Baton Rouge, Louisiana 70804

Dear Mr. Downs:

Reference is made to your letter of September 17, 1970, concerning the proposed report on the Sabine River Basin, Texas and Louisiana.

Members of my staff have reviewed the Chief of Engineers draft copy of the enviromental statement, concerning the Sabine River comprehensive, and we have found that most of enviromental impact deals with the proposed reservoirs to be constructed in Texas, and will have little effect on Louisiana fish and wildlife resources.

On that portion of the enviromental statement concerning the navigation channel in the neighborhood of Echo, Texas, we feel that the subject of enviromental impact has been adequately covered.

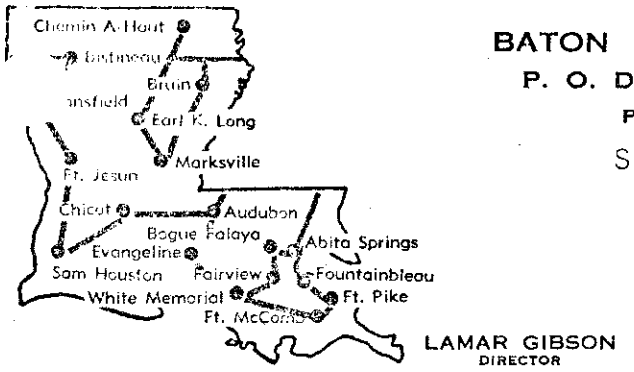
We appreciate the opportunity to review the comment on this proposed enviromental statement.

Sincerely yours,

Clark M. Hoffpauer

Clark M. Hoffpauer
Director

STATE PARKS AND RECREATION COMMISSION



BATON ROUGE, LOUISIANA
P. O. DRAWER 1111 – 70821
PHONE 389-5761

SEPTEMBER 23, 1970

WALLACE W. KING
ASST. DIRECTOR

LAMAR GIBSON
DIRECTOR

MR. C. H. DOWNS, DIRECTOR
STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE, LOUISIANA 70804

DEAR MR. DOWNS:

A DRAFT ENVIRONMENTAL STATEMENT AS A PART OF THE U.S. ARMY CORPS OF ENGINEERS SABINE RIVER BASIN STUDY HAS BEEN RECEIVED AND REVIEWED BY THIS OFFICE. OUR COMMENTS ARE AS FOLLOWS:

1) PAGE **10** UNDER ITEM 1. PROJECT DESCRIPTION, MENTION IS MADE OF THE DEVELOPMENT AND MANAGEMENT OF 25,000 ACRES OF PROJECT LANDS AT THE THREE RESERVOIR SITES PLUS THE ACQUISITION OF 15,000 ACRES DOWNSTREAM OF THE MINEOLA DAM WHICH WOULD COMPENSATE THE WILDLIFE HABITAT LOSSES RESULTING FROM THE CONSTRUCTION OF THE THREE DAM AND RESERVOIR PROJECTS. IT WOULD BE BENEFICIAL IF THE "COMPENSATORY LANDS" WERE DESCRIBED IN MORE DETAIL. FOR INSTANCE, IS THE 25,000 ACRES PRIMARILY SHORELINE ACREAGE? IS THE 15,000 ACRES COMPARABLE IN QUALITY AS WILDLIFE HABITAT TO THE 61,110 BEING LOST TO WILDLIFE HABITAT? IN REGARD TO RECREATIONAL DEVELOPMENT ON THE PROPOSED IMPOUNDMENTS, OWNERSHIP OF THE ENTIRE SHORELINE IS THE IDEAL SITUATION AND IN LIEU OF OWNERSHIP, CONTROL OF SOME SORT IN RELATION TO ZONING IS IMPERATIVE.

2) PAGE **11** UNDER ITEM 3. IMPACT STATEMENT, MENTION IS MADE OF THE GREENVILLE, TEXAS FLOOD PROTECTION AND PREVENTION PROJECT TO THE EXTENT THAT IT WOULD PROVIDE A BENEFICIAL AND COMPLIMENTARY ENVIRONMENTAL IMPACT BY IMPROVING THE STREAM WITHIN THE CITY OF GREENVILLE. MENTION IS NOT MADE IN THIS PARAGRAPH CONCERNING THE ENVIRONMENTAL IMPACT OF THE PROPOSED PROJECT ON THE UPSTREAM WATERSHED AND SURROUNDING AREA.

IN THE NEXT PARAGRAPH, MENTION IS MADE OF THE PROPOSED RESERVOIR SYSTEM IN TERMS OF SIZE AND PUBLIC ACCESS, BUT AGAIN NO MENTION IS MADE OF THE ACTUAL ENVIRONMENTAL IMPACT OF THE CONSTRUCTION OF THE RESERVOIRS. INCLUDING THE UPSTREAM AND DOWNSTREAM IMPACTS ON FISH, WILDLIFE, WATER QUALITY, HYDROLOGY, RECREATION, ETC.

3) PAGE 12, UNDER ITEM 2A. MENTION IS MADE AS TO RECREATIONAL OPPORTUNITIES PROVIDED BY THE RESERVOIR SYSTEM. IN VIEW OF THE PROXIMITY OF TOLEDO BEND, SAM RAYBORN'S, AND NUMEROUS OTHER IMPOUNDMENTS IN EAST TEXAS, IT IS FELT THAT CONSIDERATION SHOULD BE GIVEN IN THIS SECTION, AT LEAST IN DISCUSSION, TO RECREATION PRESENTLY PROVIDED BY THE FREE-FLOWING STREAMS. IN OTHER WORDS, VIEWING THE PROPOSED RESERVOIRS FROM A STRICTLY RECREATIONAL STANDPOINT, IT IS POSSIBLE THAT A HIGHER AND BETTER USE COULD BE REALIZED BY LEAVING THE STREAMS IN THEIR NATURAL FREE-FLOWING STATE.

4) PAGE 12, ITEM 2B. THE ADVERSE ENVIRONMENTAL EFFECTS HAVE BEEN BRIEFLY MENTIONED BUT NOT COVERED IN DETAIL. WE CONCUR THAT FURTHER ASSESSMENT OF ENVIRONMENTAL VALUES RELATING TO THE NAVIGATION CHANNEL IS NECESSARY.

GENERAL COMMENTS:

WE ARE CONCERNED AS TO THE EFFECT OF THE PROPOSED RESERVOIRS ON TOLEDO BEND RESERVOIR IN REGARD TO WATER FLOW AND THE TOTAL ECOLOGY OF THE LAKE. WE FEEL THAT A STATEMENT OR DISCUSSION OF THE MATTER IS PERTINENT AND SHOULD BE INCLUDED.

WE APPRECIATE THIS OPPORTUNITY TO REVIEW AND COMMENT ON THIS PROJECT.

SINCERELY,

LAMAR GIBSON
DIRECTOR-LIAISON OFFICER

GUS STACY III
RESEARCH STATISTICIAN

GS/PD

PRESTON SMITH

GOVERNOR OF TEXAS

September 2, 1970

Lieutenant General F. J. Clarke
Chief of Engineers
Department of the Army
Building T-7, Gravelly Point
Washington, D. C. 20310

Dear General Clarke:

I inclose a copy of the order of the Texas Water Rights Commission, following its study and public hearing as provided in Article 7472e, VTCS, on your report relating to the multipurpose reservoir projects (Mineola, Lake Fork and Big Sandy); Greenville local flood protection project, Greenville, Texas and navigation channel from Echo to Morgan Bluff, Texas.

I concur in the findings and the recommendations of the Texas Water Rights Commission of September 1, 1970, and approve the aforesaid proposed projects, subject to the conditions therein stated and recommend that they be adopted and specifically included in the Congressional authorization Act.

Your comments on the five-points posed under the National Environmental Protection Act of 1969 credit the proposed projects as enhancing the environment and providing beneficial impact on fish, wildlife, and the public welfare.

In concurring with the report concerning the aforesaid five projects, I request that the federal effort in final planning and development be fully coordinated with the Texas natural resources agencies and the respective project sponsors.

With kindest regards.

Sincerely,

Preston Smith

Preston Smith

TEXAS WATER RIGHTS COMMISSION

AN ORDER relating to recommended Federal improvements consisting of three multipurpose dam and reservoir projects (Mineola, Lake Fork and Big Sandy); a local flood-protection project at Greenville, Texas; and an extension of an authorized navigation channel in the tidal reach of the Sabine River, as proposed by the Department of the Army, Corps of Engineers' report "Comprehensive Basin Study Sabine River and Tributaries, Texas and Louisiana".

BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION,

Section 1. Statement of Authority. Article 7472e, VTCS, provides that upon receipt of any engineering report submitted by a Federal agency seeking the Governor's action on a Federal project, the Texas Water Rights Commission shall study and make recommendations to the Governor as to the approval or disapproval of the feasibility of the Federal project and that the Commission shall cause a public hearing to be held to receive the views of persons or groups who might be affected by the Federal project.

Section 2. Statement of Jurisdiction. On August 10, 1970, the Honorable Preston Smith, Governor of Texas, requested that the Texas Water Rights Commission investigate and make recommendations concerning portions of "Report on Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana", prepared by the Department of the Army, Corps of Engineers, in which are recommended improvements consisting of three multipurpose dam and reservoir projects (Mineola, Lake Fork and Big Sandy); Greenville, Texas, local flood protection project and navigation channel from Echo to Morgan Bluff, Texas.

In accordance with the provisions of Article 7472e, supra, due notice having been given, the Commission conducted a public hearing on September 1, 1970, at 10:00 o'clock a.m., in the offices of the Commission, Sam Houston State Office Building, Austin, Texas, on said projects, at which time, in accordance with public notice duly published in the Longview Daily News, all interested parties were requested to appear and give testimony

and submit evidence either for or against these projects.

Section 3. After fully considering the aforesaid five projects, included in the report of the Department of the Army, Corps of Engineers, entitled "Report on Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana", and all evidence and exhibits introduced and presented at the hearing, the Commission finds that all of the criteria set forth in Section 4, Article 7472e, supra, relating to the feasibility of the three multipurpose reservoir projects, viz., Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek and Big Sandy Reservoir on Big Sandy Creek (Par. 33, Report, etc., page 16), have been met and that portion of said report which encompasses a local flood protection project on Long Branch at Greenville, Texas, and extension of the navigation project in the Sabine River 5.3 miles from Echo to Morgan Bluff, Texas, is feasible and that the public interest would be served thereby, subject to the following:

(a) That in accordance with the views and recommendations by the Board of Engineers for Rivers and Harbors,

(1) "The Chief of Engineers be authorized to enter into an agreement with the non-Federal entities in advance of construction of Mineola, Lake Fork, and Big Sandy Reservoirs to provide for credit toward reimbursable costs of lands acquired or land-taking surveys made by such entities when such local expenditures are sound contributions to the project: Provided such agreement with non-Federal entities is not to be interpreted that the projects will be constructed by the United States. (Par. 35b, Report, etc., page 20).

(2) ". . . Federal authorization should not be construed to constitute a preemption of a site or to prohibit development of a site by local interests." (Par. 30, Report, etc., page 15 at page 16).

(b) That in the design, development and operation of the three aforesaid reservoir projects, viz., Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek, and Big Sandy Reservoir on Big Sandy Creek (Par. 33, Report, etc., page 16),

(1) Texas' interest in its waters and the prior water rights in the Sabine River Basin, Texas, shall be fully considered, recognized and respected. Further, in the operation of Mineola Reservoir, Lake Fork Reservoir and Big Sandy Reservoir, when completed, the terms and conditions of the Sabine River Compact between Texas and Louisiana shall also be recognized and respected to the end that a minimum flow of 36 cfs shall be maintained at State line.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS WATER RIGHTS COMMISSION, that subject to the foregoing recommendations the portion of the aforesaid Federal report concerning the construction of the five proposed projects: viz., Greenville, Texas, local flood protection project; Mineola Reservoir project on the Sabine River; Lake Fork Reservoir project on Lake Fork Creek; Big Sandy Reservoir project on Big Sandy Creek; and the Navigation Channel from Echo to Morgan Bluff, Texas, be, and the same is hereby, approved and recommended to the Governor as feasible and in the public interest; and that early authorization and funding of these projects by Congress are respectfully urged.

Executed and entered of record, this the 1st day of September, 1970.

TEXAS WATER RIGHTS COMMISSION

/s/ O. F. Dent
O. F. Dent, Chairman

/s/ Joe D. Carter
Joe D. Carter, Commissioner

/s/ Leslie R. Neal
Leslie R. Neal, Commissioner

ATTEST:

/s/ Audrey Strandtman
Audrey Strandtman, Secretary

STATE OF TEXAS §
§
COUNTY OF TRAVIS §

I, Audrey Strandtman, Secretary of the Texas Water Rights Commission, do hereby certify that the foregoing and attached is a true and correct copy of an order of said Commission, the original of which is filed in the permanent records of said Commission.

Given under my hand and the seal of the Texas Water Rights Commission, this the 1st day of September, A.D. 1970.

Audrey Strandtman

Audrey Strandtman, Secretary

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

October 7, 1970

Dear General Clarke:

This responds to your letter of August 7, 1970, requesting our comments on the Corps of Engineers' proposed report and draft environmental statement on the Sabine River Basin, Texas and Louisiana.

We have reviewed the report and in general concur with your recommendations. We offer the following comments for your information and use.

Since the three proposed reservoirs will add 62,000 acres of water at the conservation pool levels, an evaporation loss is expected which will cause an increase in total dissolved solids (TDS) during periods of low flow. In addition, there may be an increase in TDS during spill periods. During periods of critical low streamflow, we recommend that at least as much water entering the reservoirs be released from the reservoirs to provide for downstream uses and to maintain a beneficial equilibrium of biological organisms.

We note that because of reservoir depth, stratification of temperatures as well as dissolved oxygen will occur. We therefore recommend that multilevel outlets be provided at each reservoir to help maintain good quality water downstream from the projects.

A large number of cities and communities are located in the drainage area of the reservoirs. The sewage from the cities and communities is treated, but care must be taken and proper controls implemented so that a buildup of nutrients will not occur.

The construction of the three reservoirs is expected to reduce the water yield entering Toledo Bend Reservoir, located downstream from the proposed projects. We note that use of the yield of the three proposed reservoirs is left to the discretion of the State of Texas. The Texas Water Plan indicates that a large amount of this yield is to be transferred out of the basin. The effect of this transfer of water on the quality of the receiving streams and reservoirs, on the remaining water in the basin, and on the needed inflow to the bay and estuaries should be evaluated in the report.

To protect water quality during the construction period in accordance with provisions of Section 21(a) of the Federal Water Pollution Control Act, as amended, and Executive Order 11507, we recommend that contract specifications require all contractors and subcontractors to:

1. Exercise care in the relocation of any petroleum product pipelines and take precautions in the handling and storage of hazardous materials, such as petroleum, herbicides, and pesticides, to prevent accidental spillages or usage that would result in water pollution.

2. Provide and operate sanitary facilities to adequately treat and dispose of domestic wastes in conformance with Federal and State water pollution control regulations.

3. Perform all construction operations so that they will keep erosion, turbidity and siltation at the lowest levels possible.

From a fish and wildlife standpoint, the plan of development is compatible with the plan set forth in the Interagency Coordinating Committee's report on the Comprehensive Basin Study, Sabine River and Tributaries.

The evaluation of mineral involvement contained in the report is based on a 1962 field examination that was subsequently updated in 1967. We recommend that field investigations of mineral involvement be made at or just before the time of preconstruction planning in order to reassess the extent of mineral involvement and any necessary protection, subordination, or mitigation of mineral installations and access to mineral resources.

We recommend that the report be modified to include the need to reanalyze the outdoor recreation aspects of the reservoir projects during the post-authorization planning and construction phases so that construction of recreation facilities can be timed to coincide with the occurrence of future needs for such facilities.

The environmental statement could be improved by discussing the quantity and quality, including present and future use, of the general outdoor recreation and scenic values of the natural stream areas which will be permanently lost as a result of reservoir construction. It is also recommended that the effects of the proposed projects on water quality in the project areas and below the reservoirs be characterized and quantified as to their long-term environmental effects.

We appreciate the opportunity of presenting our views.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Lt. General F. J. Clarke
Chief of Engineers
U.S. Department of the Army
Washington, D.C. 20314

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

October 2, 1970

Lieutenant General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

Dear General Clarke:

This is in reply to your letter of August 7, 1970, to Secretary Maurice H. Stans, requesting comments of the Department of Commerce on your proposed report on the Sabine River Basin, Texas and Louisiana. In preparing comments we have considered the Type 2 interagency report on the comprehensive study of the Sabine River Basin as well as the report and environmental statement that accompanied your letter since these documents will be transmitted together to Congress by the Secretary of the Army.

We note that the Corps of Engineers has decided in favor of Plan A which provides additional flood storage as a substitute for the complementary downstream channels, levees, and flowage easement that had been proposed in the comprehensive basin study.

The proposed report generally involves three multiple-purpose dam and reservoir projects, a local flood protection project, and a shallow-draft navigational improvement project at an estimated net cost to the Federal Government of $106,201,000 for construction and $279,500 annually for maintenance and operation costs for the total recommended plan. With the exception of the $1,765,200 Federal navigation, short-range improvement portion of the overall plan, the remaining projects are primarily designed to meet needs for flood control, municipal and industrial water supply, and water based recreation.

Specifically, the recommended short-range navigational improvement plan of the subject report proposes that the existing Federally authorized shallow-draft barge channel in the lower Sabine River basin from the deep draft Port of Orange to Echo, Texas, which has not been constructed, be extended from Echo to Morgan Bluff, Texas, in the Sabine River. This would provide a shallow-draft sea level channel

extending upstream about 5 1/4 miles in the Sabine River from Echo to Morgan Bluff, Texas, with a channel depth of 12 feet and a minimum width of 125 feet, terminating in a turning basis 600 feet by 600 feet in size at Morgan Bluff. The long-range plan (1975 to 2025) would provide for ultimate development of the water transportation potential of the Sabine River basin by extension of a barge channel from Morgan Bluff to the vicinity of Longview, Texas, some 180 miles upstream.

Although it appears at the present time the only potential commercial user of the proposed channel from Echo to Morgan Bluff would be a paper mill, it is assumed that due to the steady growth of the adjacent industrial area of Orange, Texas, and to the construction of the proposed channel extension new industries would develop and thus give the project a more diversified comme rce than that presently available. A number of potential plant sites along the proposed channel should attract additional industry to locate in this area. Not to be overlooked, are some of the more important natural resources in the Sabine River basin such as petroleum, natural gas, natural gas liquids, water, timber, iron ore, clays, sand, and gravel. Consequently, the proposed channel should encourage new industry, barge transportation, and the development of the area's natural resources. However, even in the absence of any firm commitments by any additional industry the prospective commerce on the proposed barge channel generated by the future growth plans of the Owens-Illinois paper mill should more than triple the tonnage of paper products presently being exported overseas from the Port of Orange, Texas. In this connection, the advent of ocean barge carrier systems, combining the advantages of inland waterway and ocean transportation, should further enhance future industrial development along the proposed channel. Moreover, the channel would provide a direct barge link with the Gulf Intracoastal Waterway, presently 12 feet deep and 125 feet wide, but authorized for increase to a depth of 16 feet and a width of 150 feet between the Sabine River and the Houston Ship Channel. Accordingly, the manufacturers of some of the large and complex mechanisms that are now being assembled for transportation in the country's rapidly expanding scientific development, e.g., space exploration equipment such as large rocket boosters that can move only by water, would be attracted to locate in the project area.

From such plants the space equipment could be barged via the extensive Gulf and Atlantic Intracoastal Waterways to any point thoughout the space industry's broad geographical domain which ranges from Houston, Texas, along the Gulf Coast to Cape Kennedy, Florida.

Finally, beyond the immediate savings in transportation charges to the existing and potential commercial and industrial interests bordering the segment of the Sabine River under study, the proposed project should contribute significantly to the general improvement of the entire economy of the river basin area including the Port of Orange, Texas.

In summary, focusing only on the commercial and economic importance to the study area of the Port of Orange and its local connecting channels, and considering a comparison of total annual charges (Federal/Non-Federal) estimated at $170,000 for accomplishing the proposed navigational improvement with estimated average annual benefits of $616,000 producing a benefit/cost ratio of 3.6 to 1 for the subject project, plus the private industries development taking place in the area and the potential increase in tonnage of cargo moving over the Sabine River waterway and through the Port of Orange, we concur with the proposals set forth in the Comprehensive Study.

The format of the Statement follows the organization prescribed in PL 91-190, and elaborated upon in the Interim Guidelines prepared by the Council on Environmental Quality to implement Section 102(2)(C) of the Act.

The selection of Plan A will lessen the adverse environmental effects of the river basin development. There is, however, one aspect of the development plan which may have an unnecessary environmental side effect that we would like clarified. The adverse environmental effects of the basin development associated with the inundation of valley lands may be larger than necessary, since it appears that the storage to be provided for municipal and industrial water supply is overstated. The apparent overstatement results from

the inclusion in the Sabine River Basin Plan, water needs that lie outside the basin and that are expected to be met by the development of other river basins.

The municipal and industrial water requirements of the following seventeen counties and parishes which are accounted for in the requirements assessment of the Red River below Dennison Basin Comprehensive Study, are duplicated as requirements to be met by the Sabine River plan.

Sabine Parish,	Louisiana	Natchitakes Parish,	Louisiana
Desoto Parish	"	Red River Parish	"
Bassier Parish	"	Caddo Parish	"
Harrison County,	Texas	Upsheer County,	Texas
Cass County	"	Morris County	"
Titus County	"	Camps County	"
Franklin County	"	Hopkins County	"
Hunt County	"	Marion County	"
Gregg County	"		

If, as it now appears, a significant portion of the water supply requirements proposed to be met by the Sabine River Basin projects are already included in the proposed development of the Red River Basin, the scale of the reservoirs should be reduced and the benefit/cost analysis and cost allocation schedule should be re-examined. Of the total storage capacity of the reservoir system proposed in the Sabine River Basin, 42 percent or 1.2 million acre feet is for water supply. The expected value in terms of annual benefits of municipal and industrial water supply is approximately $8.7 million or 56 percent of the total annual benefits derived from the three reservoirs. In the allocation of costs required for purposes of establishing reimbursable levels, pricing policies and cost sharing between the Federal Government and non-Federal interests, approximated 89 percent (76.2 million) of total non-Federal first costs and 31 percent (0.4 million) of maintenance, operation and replacement non-Federal costs is assigned to water supply. These benefits and costs could be reduced significantly if there is a serious overstatement of water supply needs.

Unfortunately, we were not involved in the original meetings on the comprehensive Sabine River Basin Study so that we are not familiar with any clarifying statements that might have been made on this matter. We do believe that some elaboration of the issues mentioned here is required. There is a possibility that the adverse environmental effects of the plan could be reduced by flooding less bottom land while still providing the water necessary for industrial and municipal purposes.

It is our understanding that the Big Sandy Reservoir will not be constructed until the water supply requirements exceed supplies available from the Mineola and Lake Fork Reservoirs. Since this situation is not anticipated within the next ten years, there will be ample opportunity to accommodate to needs made evident with time. Any adjustments to the water storage capacity that may be justified could be best accomplished in subsequent implementation and design studies, and would not compromise the overall validity of the development plan formulated in this authorization report.

Similar environmental considerations relative to the navigation channel should be continuously assessed as the channel is dredged.

Sincerely,

William D. Lee
Deputy Assistant Secretary

53-522 O-71——6

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

WASHINGTON, D. C. 20410

OFFICE OF THE UNDER SECRETARY

IN REPLY REFER TO:

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

August 28, 1970

Dear General Clarke:

This is in reply to your letter to Secretary Romney, dated August 7, 1970, requesting comments on the Environmental Statement on your proposed actions on the Sabine River Basin and Tributaries, Texas and Louisiana. I am responding in accordance with my delegated responsibility for administering PL 91-190 within HUD.

The Environmental Statement relates to the implementation of improvements of the Sabine River and Tributaries, Texas and Louisiana, by construction of three multiple-purpose reservoirs, Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek and Big Sandy Reservoir on Big Sandy Creek for flood control, water supply, and recreation; a local flood protection project at Greenville, Texas; and an extension of an authorized navigation channel in the tidal reach of the Sabine River.

The projects are to meet needs for flood control, municipal and industrial water supply, recreation and commercial navigation in accordance with the early action plan of the Comprehensive River Basin Study submitted to Congress April 15, 1970.

HUD Comment

Our consideration of the environmental impact on the urban areas of this river basin falls into three major areas; (1) the extent of coordination with relevant local or regional comprehensive development plans, (2) the study of the various alternatives that would change the environmental impact, and (3) the specific assessment of impact of the project plan presented in the report.

Except for reservations noted below, some of which may be crucial, we believe this Environmental Statement indicates a reasonable treatment of environmental consequence of interest to this Department.

HUD Reservations

1. The Environmental Statement suggests certain benefits to urban areas and potential enhancement of the well-being of the Region, but it should also indicate consistency with the relevant comprehensive regional and local development plans. In general, we believe that coordination with regional and local bodies should be initiated before drafting the Environmental Statement and that circulation of these draft Environmental Statements in some review and coordination process, such as the procedures established by U. S. Bureau of the Budget Circular A-95, should afford local agencies an opportunity to comment on the adequacy of response to local needs before the final Environmental Statement is filed with the Council on Environmental Quality. A copy of the State listing of Clearinghouses for Louisiana and Texas is enclosed.

2. Complementary non-structural programs to be developed through cooperative State and local participation to encourage prudent use and management of the urban flood plains, should be assessed in relation to their impact on the environment and the enhancement of the proposed developments.

3. The consideration of reasonable alternatives, possible combinations and identification of non-structural measures, as recommended in Water Resources Council's report on the Type II comprehensive study, should be fully documented in support of the proposed plan. The statement (paragraph 3C, p.12) cites only the non-development alternative as a comparison, and the higher cost of all other alternatives having similar benefits. The possible use of flood plain management options to obtain comparable flood damage reduction (paragraph 3C, p.13) should be further discussed in reference to urban environmental improvement, open space uses and recreational facilities.

4. Further assessment of the environmental values relating to the navigation channel and disposal areas (paragraph 3b, p.12) would appear to be useful as part of this document, prior to authorization of the project.

* * * * *

It is requested that Environmental Statements be sent to the HUD Regional Administrator in whose territory the proposed action would take place. A list of HUD Regional Offices is attached. The project under review falls within the Fort Worth Regional Office whose Administrator is Richard L. Morgan.

Sincerely yours,

Charles O. Orlebeke
Deputy Under Secretary

Attachments

EXECUTIVE OFFICE OF THE PRESIDENT

BUREAU OF THE BUDGET

WASHINGTON, D.C. 20503

October 1, 1969

DIRECTORY OF STATE, METROPOLITAN, AND REGIONAL CLEARINGHOUSES UNDER BUREAU OF THE BUDGET CIRCULAR NO. A-95

Attached is a State by State listing of clearinghouses established pursuant to Part I of the Regulations promulgated by Bureau of the Budget Circular No. A-95.

Metropolitan clearinghouses are established pursuant to the requirements of section 204 of the Demonstration Cities and Metropolitan Development Act of 1966. State and regional (non-metropolitan) clearinghouses are designated by Governors of the States pursuant to rules and regulations developed by the Bureau under authority of Title IV of the Intergovernmental Cooperation Act of 1968.

Metropolitan clearinghouses have been established in all but a few of the metropolitan areas. Not all Governors have yet designated State clearinghouses, and relatively few regional clearinghouses have been designated as yet. As new designations are made from time to time or changes made to existing designations, the Bureau will send out addenda and amendments to this Directory.

BUREAU OF THE BUDGET CIRCULAR NO. A-95
STATE, METROPOLITAN, AND REGIONAL CLEARINGHOUSES

LOUISIANA

STATE CLEARINGHOUSE

Commission on Intergovernmental Relations
P.O. Box 44316
Baton Rouge, Louisiana 70804

METROPOLITAN CLEARINGHOUSE

Metropolitan Area and Clearinghouse	Jurisdiction
Baton Rouge	
Capital Region/Planning Commission Suite 205, 101 St. Ferdinand Baton Rouge, Louisiana 70801	East Baton Rouge Parish West Baton Rouge Parish Iberville Parish Ascension Parish
Lafayette	
Lafayette City-Parish Metropolitan Planning Commission P.O. Box 2154 Lafayette, Louisiana 70501	Lafayette Parish
Lake Charles	
Calcasieu Regional Planning Commission P.O. Box 1027 Lake Charles, Louisiana 70601	Calcasieu Parish (part): Ward 3 Ward 4
Monroe	
Ouachita Council of Governments Monroe City Plaza Monroe, Louisiana	Ouachita Parish

Metropolitan Area and Clearinghouse	Jurisdiction
New Orleans	
Regional Planning Commission for Jefferson, Orleans, and St. Bernard Parish 909 Masonic Temple Building 333 St. Charles Avenue New Orleans, Louisiana 70130	Jefferson Parish Orleans Parish St. Bernard Parish
Shreveport	
Caddo-Bossier Council of Local Governments Room 304, City Hall Shreveport, Louisiana 71101	Caddo Parish Bossier Parish

REGIONAL CLEARINGHOUSES

Clearinghouse	Jurisdiction

BUREAU OF THE BUDGET CIRCULAR NO. A-95
STATE, METROPOLITAN, AND REGIONAL CLEARINGHOUSES

TEXAS

STATE CLEARINGHOUSE

Office of the Governor
Division of Planning Coordination
Capitol Station
Austin, Texas 78711

METROPOLITAN CLEARINGHOUSE

Metropolitan Area and Clearinghouse	Jurisdiction
Abilene	
West Central Texas Council of Governments P.O. Box 3195 Abilene, Texas 79604	Brown County Callahan County Coleman County Eastland County Fisher County Haskell County Jones County Kent County Knox County Mitchell County Nolan County Runnels County Shackelford County Stephens County Stonewall County Taylor County Throckmorton County
Amarillo	
Division of Planning Coordination Office of the Governor Drawer P, Capitol Station Austin, Texas 78711	Potter County Randall County

Metropolitan Area and Clearinghouse	Jurisdiction
Austin	
Austin-Travis County Organization for Regional Planning P.O. Box 1088 Austin, Texas 78767	Travis County
Beaumont/Port Arthur/Orange	
Division of Planning Coordination Office of the Governor Drawer P, Capitol Austin, Texas 78711	Jefferson County Orange County
Brownsville/Harlingen/San Benito, and McAllen/Pharr/Edenburg	
Lower Rio Grande Valley Development Council 411 First National Bank Building McAllen, Texas 78501	Cameron County Hidalgo County Willacy County
Corpus Christi	
Coastal Bend Regional Planning Commission 4225 South Port Avenue P.O. Box 2350 Corpus Christi, Texas 78403	Aransas County Bee County Brooks County Duval County Jim Wells County Karnes County Kleberg County Live Oak County McMullen County Nueces County Refugio County San Patricio County

Metropolitan Area and Clearinghouse	Jurisdiction
Dallas and Fort Worth	
North Central Texas Council of Governments El Patio East P.O. Box 888 Arlington, Texas 76010	Collin County Dallas County Denton County Ellis County Johnson County Kaufman County Parker County Rockwall County Tarrant County Wise County
El Paso	
El Paso Council of Governments Suite 511, Electric Building El Paso, Texas 79901	El Paso County
Houston and Galveston/Texas City	
Houston-Galveston Area Council 430 Lamar Avenue Houston, Texas 77002	Brazoria County Chambers County Fort Bend County Galveston County Harris County Liberty County Montgomery County Waller County
Laredo	
South Texas Council of Governments P.O. Box 1365 Laredo, Texas 78040	Jim Hogg County Starr County Webb County Zapata County
Lubbock	
South Plains Association of Governments 513 Lubbock National Bank Building Lubbock, Texas 78205	Lubbock County

Metropolitan Area and Clearinghouse	Jurisdiction
Midland and Odessa	
Division of Planning Coordination Office of the Governor Drawer P, Capitol Station Austin, Texas 78711	Ector County Midland County
San Antonio	
Alamo Area Council of Governments 422 Three A Life Building San Antonio, Texas 78205	Atascosa County Bandera County Bexar County Comal County Guadalupe County Wilson County
San Angelo	
Concho Valley Council of Governments 7 W. Twohig Building, Room 406 San Angelo, Texas 76901	Coke County Concho County Tom Green County
Sherman/Denison	
TEXOMA Regional Planning Commission 600 N. Highland Avenue Sherman, Texas 75090	Grayson County
Texarkana, Tex./Ark.	
Ark.-Tex. Council of Governments P.O. Box 2907 Texarkana, Texas 75501	Texas portion: Bowie County Cass County Morris County Red River County Arkansas portion: Miller County
Tyler	
Smith County-Tyler Area Council of Governments P.O. Box 2039 Tyler, Texas 75701	Smith County

Metropolitan Area and Clearinghouse	Jurisdiction
Waco	
Heart of Texas Council of Governments 110 South 12th Street Waco, Texas 76701	McLennan County
Wichita Falls	
Nortex Regional Planning Commission 810 American Trust Center Wichita Falls, Texas 76301	Archer County Clay County Wichita County

REGIONAL CLEARINGHOUSES

Clearinghouse	Jurisdiction
Brazos Valley Development Council P.O. Box 3067 Bryan, Texas 77801	Brazos County Burleson County Grimes County Leon County Madison County Robertson County Washington County
Central Texas Council of Governments P.O. Box 729 Belton, Texas 76513	Bell County Coryell County Hamilton County Lampasas County
Deep East Texas Development Council 205 North Temple Drive Diboll, Texas 75941	Angelina County Hardin County Houston County Jasper County Nacogdoches County Newton County Polk County Sabine County San Augustine County San Jacinto County Shelby County Trinity County Tyler County

Clearinghouse	Jurisdiction
Golden Crescent Council of Governments P.O. Box 1758 Victoria, Texas 77901	Calhoun County DeWitt County Goliad County Victoria County

LISTING OF

HUD REGIONAL OFFICE OFFICIALS

AS OF JUNE 18, 1970

Boston Regional Office

James J. Barry
Regional Administrator

Harold G. Thompson
Deputy Regional Administrator

Department of Housing and Urban Development
Room 405 John F. Kennedy Federal Building
Boston, Massachusetts 02203

Telephone: (617) 223-4066

New York Regional Office

S. William Green
Regional Administrator

Anne M. Roberts
Deputy Regional Administrator

Department of Housing and Urban Development
26 Federal Plaza
New York, New York 10007

Telephone: (212) 264-8068

Puerto Rico Regional Office

Jose E. Febres-Silva
Regional Administrator

Alonzo G. Moron
Deputy Regional Administrator

Department of Housing and Urban Development
255 Ponce de Leon Avenue, Hato Rey, Puerto Rico
(Mailing Address: P.O. Box 3869 GPO, San Juan,
Puerto Rico 00936)

Telephone: (Dial Code 106--Ask Operator for 622-0201)

Philadelphia Regional Office

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

September 29, 1970

Lt. General F. J. Clarke, USA
Chief of Engineers
U.S. Corps of Engineers
Department of the Army
Washington, D.C. 20315

Dear General Clarke:

As requested in your letter of August 7, 1970, the proposed report and the draft environmental statement for the "Report on Comprehensive Basin Study - Sabine River and Tributaries, Texas and Louisiana", have been reviewed by the appropriate environmental health agencies of the Public Health Service.

We note that the District and Division Engineers of your agency find that a system of projects consisting of three multiple-purpose dam and reservoir projects, a local flood protection project, and extension of an authorized commercial navigation channel will provide practical means for meeting existing and foreseeable needs for flood control, water supply, water based recreation, and waterway transportation. They note that the recommended improvements would be consistent with the comprehensive plan for the control, conservation, and best use of the basin's water and related land resources formulated by the Sabine River Coordinating Committee and approved by the Water Resources Council.

With respect to the environmental impact statement, it is suggested that you should provide for compliance in the planning, design, construction, operation, and maintenance phases of the projects with appropriate health guidelines, including those set forth in the following:

A. For any drinking water systems: the Public Health Service Drinking Water Standards (Public Health Service Publication Number 956) and the Manual for Evaluating Public Drinking Water Supplies (Public Health Service Publication Number 1820).

B. For recreational areas: Environmental Health Practices in Recreational Areas (Public Health Service Publication Number 1195).

C. For control of disease vector problems: Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as departmental interests and responsibilities are concerned.

Sincerely yours,

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

53-522 O—71——7

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

IN REPLY REFER TO:

September 30, 1970

Lieutenant General F.J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20315

Reference: ENGCW-PI

Dear General Clarke:

This is in reply to your letter of August 7, 1970, 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 Sabine River and Tributaries, Texas and Louisiana. Included as part of your proposed report is a draft environmental statement pursuant to Public Law 91-190.

The cited reports recommend construction of three reservoir projects, a local flood protection project, and a navigation project in the Sabine River basin. The total construction cost of the recommended improvements is estimated to be $192,203,000, of which $86,001,500 would be reimbursable by non-federal interests. The reservoir projects and the local flood protection project would be located in the upper basin in northeastern Texas. The navigation project would be along the lower Sabine River and would permit shallow draft navigations between Echo and Morgan Bluff, Texas. The local flood protection project would protect the city of Greenville, Texas. The three proposed reservoirs, Mineola, Lake Fork, and Big Sandy, would provide controlled storage capacities of 1,375,000, 1,113,000, and 418,200 acre feet, respectively. The purposes of all proposed reservoirs are flood control, water supply, recreation, and fish and wildlife enhancement.

The Commission staff has made studies of the hydroelectric power possibilities of the reservoir projects as currently proposed. The yields available for power generation from the three reservoirs utilized through the heads available at these projects would produce dependable peaking capacities amounting to about 1,400 kilowatts at Lake Fork reservoir, 1,600 kilowatts at Big Sandy reservoir, and less than 100 kilowatts at Mineola reservoir. Development of these small amounts of power would not

be economically justified. In addition, enlarging the projects would not provide for economical power development. Topography in the vicinities of the proposed projects is not suitable for pumped storage development.

Operation of the proposed reservoir projects could affect the power output of the existing downstream Toledo Bend reservoir, licensed by the Federal Power Commission as Project No. 2305. Diversions of water from the proposed reservoir projects for water supply purposes would reduce the flows available at Toledo Bend. However, the regulation of flows by the upstream projects could increase the inflows to the Toledo Bend reservoir during low-inflow periods. Thus, it is not possible at this time to predict precisely the net effect of the proposed reservoirs on the power production at Toledo Bend. If, after the projects are placed in operation, they have a beneficial effect on the power output at Toledo Bend, the reimbursement therefor would be determined by the Commission pursuant to Section 10(f) of the Federal Power Act.

Based on its consideration of the reports of your Department and the studies of its own staff, the Commission concludes that the recommended Mineola, Lake Fork, and Big Sandy reservoir projects in the Sabine River basin would not provide opportunity for economical hydroelectric power development. The Commission has no specific comments with regard to the draft environmental statement included with your report.

Sincerely,

John N. Nassikas

John N. Nassikas
Chairman

WATER RESOURCES COUNCIL
SUITE 900
1025 VERMONT AVENUE NW.
WASHINGTON, D.C. 20005

October 2, 1970

Major General F. P. Koisch
Director of Civil Works
U. S. Army Corps of Engineers
Room 4G-066, Forrestal Building
1000 Independence Avenue, S. W.
Washington, D. C. 20314

Dear General Koisch:

I appreciate the opportunity to comment on the proposed report of the Chief of Engineers on the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana, as transmitted to me by the Acting Director on August 7, 1970. This is the first Federal authorization report resulting from a comprehensive river basin study under the program of coordination sponsored by the Water Resources Council. The report has been reviewed to determine the relationship of the present plan to the plan and the views, findings, and recommendations presented in the Council's report of April 1970.

As the Water Resources Council report and the report of the Sabine Coordinating Committee will be made available to the Congress with the authorization report, I will not restate the Water Resources Council views, findings, and recommendations. I do suggest that the "Summary of Consideration Given in the Authorization Report to the Views and Recommendations of the Water Resources Council on a Comprehensive Basin Study, Sabine River, Texas and Louisiana," be included with the report of the Chief of Engineers when it is sent to the Congress. This summary contains the statement concerning the accomplishment of the

plan with respect to locally recognized objectives and the established national goals for full employment, public health, and environmental qualities.

The plan proposed for authorization is in general accordance with the plan presented in the April 1970 report of the Water Resources Council. Principal changes include the elimination of flood release channels below the reservoir sites and an increase of flood storage in each of the three reservoir projects. At Greenville, a nonstructural floodplain management option has been substituted for channel improvement along Cowleech Fork. Channel improvements on Long Branch in Greenville have been reduced in scope and a nonstructural floodplain management option added. The proposed navigation channel has been extended about 4,000 feet to Morgan Bluff.

The revised plan includes a proposal that intensive management and development of 40,000 acres of land for wildlife be accomplished to compensate for the loss of 62,000 acres of wildlife habitat to be flooded by the conservation pools in the three reservoirs.

As requested in the Water Resources Council's report, the authorization report contains a preliminary analysis of the expected effects of the three proposed reservoirs on hydroelectric power generation, water supply, and fish and wildlife features at the existing Toledo Bend Project. Generally, the preliminary analysis shows that the effect of these reservoirs on Toledo Bend Reservoir cannot be specifically determined until operational procedures are adopted for those reservoirs on the basis of detailed studies.

The changes which have been made in the plan do not significantly change the fresh water flow into the estuary as determined in the previous Coordinating Committee's analyses.

It is noted that the recommended Lake Fork and Mineola Reservoirs would adversely affect several authorized and partially constructed Public Law 566 projects. Discussions are currently underway between the Corps of Engineers and the Department of Agriculture to resolve this issue.

The economic analyses were made on the basis of 4-7/8 percent interest as established by the Water Resources Council for Fiscal Year 1970. I understand that a reanalysis is being made upon the basis of the current 5-1/8 percent interest rate and such reanalysis will be made available to the Water Resources Council and the Congress.

We have been advised that the environmental statement is being revised to better meet the requirements of the National Environmental Policy Act of 1969.

The Water Resources Council endorses the authorization proposals of the Chief of Engineers as an updating and an implementation of elements of the Comprehensive Plan for the conservation, development, and utilization of the water and related land resources of the Sabine River Basin, Louisiana and Texas, with the assumption that conflicts with the authorized watershed protection projects will be satisfactorily resolved. To assist in the coordination with plans of regional and local governing bodies, it is suggested that your report be made available to the appropriate clearing house established pursuant to regulations promulgated by the Office of Management and Budget Circular No. 95.

Sincerely yours,

Reuben J. Johnson
Acting Director

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT (AWL)
U.S. COAST GUARD
WASHINGTON, D.C.
20591

18 September 1970

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Clarke:

This is in response to your letter of 7 August 1970, addressed to Secretary Volpe, requesting comments concerning Sabine River Basin, Texas and Louisiana.

The concerned operating administrations of the Department of Transportation have reviewed your proposed report and the draft environmental statement and concur in general with your recommendations for extending navigation upon the Sabine River, the construction of three multi-purpose reservoirs in Texas for flood control, water supply and recreation and the local protection project on the Long Branch at Greenville, Texas. No comment is made concerning the draft environmental statement nor upon the environmental impact of the proposed project.

It is noted that the project makes no reference to navigational aids that will be required in the navigationally extended portion of the Sabine River. The draft environmental statement indicates that further assessment of the environmental values relating to the navigation channel and disposal areas will be made during preconstruction planning when construction plans are finalized. This aspect of the project should be coordinated with Commander, Eighth Coast Guard District in New Orleans, La.

It is noted by the Federal Highway Administration that the construction of the reservoirs will require the alteration of approximately 64 miles of Federal-aid and Non-Federal-aid roads and highways. The proposed report does not identify the estimated cost of this work but it is assumed that the cost is included in the project. It is also assumed that the proposed work will be coordinated with the Texas Highway Department. If either of these assumptions is incorrect it is requested that this Department be advised accordingly. Advance acquisition of the land necessary to preserve the reservoir site and authorization to

participate in the cost of reconstructing transportation and utility facilities in advance of project construction as required to preserve the site and avoid increased costs are recommended.

It is noted in the Federal Railroad Administration review of the proposed study that the Association of American Railroads and the Texas Railroad Association have requested that the extension of navigation from Echo to Morgans Bluff, Texas be not authorized. These associations recommend a reanalysis of the project following completion of the already authorized project from Orange to Echo, Texas. Attached is a copy of the 19 May 1970 letter of Mr. J. G. Tangerose on behalf of the Texas Railroad Association and the Association of American Railroads to Col. Alvin D. Wilder, Resident Member, Board of Engineers for Rivers and Harbors. This letter has not been responded to by the Corps of Engineers. It is the Federal Railroad Administration's role to see that railroads receive proper consideration in all areas of the Federal establishment and in this case it appears that the railroads' interest may have been overlooked. While the Federal Railroad Administration is not commenting upon the validity of the Association of American Railroads' argument, they feel that a proper response from the Corps of Engineers be made in order for the Federal Railroad Administration to consider its responsibilities as having been fulfilled.

Hopefully the matter will be resolved. It is felt by the Department of Transportation, however, that comment by the Corps of Engineers concerning this objection to extension of navigation on the Sabine River should be incorporated in the proposed report prior to transmittal to the Congress.

The proposed project is in agreement with the policy of the Water Resources Council as per the Water and Related Land Resources Planning policy statement of 22 July 1970.

The opportunity afforded this Department to review and comment on your proposed project is appreciated.

Sincerely,

R. Y. Edwards

R. Y. EDWARDS
Rear Admiral, U.S. Coast Guard
Chief, Office of Public and
International Affairs

Enclosure

May 19, 1970

Colonel Alvin D. Wilder
Resident Member
Board of Engineers for Rivers and Harbors
Temporary Building C
Second & Q Street, S. W.
Washington, D. C. 20315

Dear Colonel Wilder:

This letter is on behalf of the Texas Railroad Association and the Association of American Railroads and concerns the recommendation to extend navigation from Echo to Morgan Bulff, Texas, contained in the Survey Report on the Sabine River.

We have reviewed the traffic and transportation savings associated with the Owens-Illinois Corporation's plant at Morgan Bluff and submit the following comments.

A review of the Comprehensive Basin Study revealed that there was no basis for including turpentine as outbound barge traffic, principally as a result of limited annual production and numerous destinations. Consequently, we were gratified to note that the Survey Report did not accept turpentine as prospective barge traffic.

The plant to be served by the proposed navigation project commenced production in November 1967. Our review of traffic is based on 1969 production and shipments. This review revealed that 90 to 95 percent of the traffic in 1969 moved by rail and the balance by truck. Traffic which moved by truck was essentially to Gulf ports for export. Rail shipments were to numerous destinations, many to off-river plants. In addition, many rail shipments were in such quantities as to preclude barge transportation.

An analysis of tall oil production and shipments indicates that this commodity is not likely to move by barge because of limited production and the location and number of receivers. Production during 1969 was equal to about one barge load per month. Consequently the Survey Report should include the cost of inventory at both origin and destination in computing navigation benefits. This would clearly indicate that rail is the least costly alternative for numerous movements. Our analysis also revealed that the truck-barge as well as the all-barge movement would result in certain terminal costs not incurred by shippers and receivers when movement is by rail. We urge the Board to carefully analyze tall oil traffic, taking into account the findings set forth in this paragraph.

Your attention is invited to traffic during 1968 of Commodity Code 2861, Gum and Wood Chemicals, via the Mississippi River System of 29,923 tons. Commodity Code 2861 includes such commodities as Pine Oil, Rosin Oil, Rosin, Pitch, Tall Oil, etc. In view of the numerous producing plants on or adjacent to the Mississippi River System, the subject Survey Report clearly overstates prospective movements of tall oil.

Pulpboard is by far the principal product shipped from the Owens-Illinois plant. Pulpboard is distributed over a wide domestic market and in most instances, in less-than-bargeload quantities. Consequently, most of the output of pulpboard would not be susceptible to movement by barge. Moreover, it is unlikely that the all-barge route would result in the elimination of one transfer or handling charge. This results from the fact that pulpboard will have to be moved from storage to barge docks. Moreover, even when pulpboard moves to a riverside plant there is a cost incurred in moving the product from barge dock to plant. If adequate terminal charges and inventory costs are included in the analysis of transportation savings, the all-rail route is a less costly alternative than truck-barge for all but a few movements.

Because of the uncertainties surrounding the estimate of traffic, computation of benefits, and the shippers' use of barge transportation, we respectfully request that the extension of navigation from Echo to Morgan Bluff, Texas, not be authorized at this time. In lieu thereof, we recommend a reanalysis of the project following completion of the authorized project from Orange to Echo, Texas.

Very truly yours,

JGT:a

James G. Tangerose

bc: Mr. R. S. Crossman
Mr. G. N. Fondren
Mr. B. E. Fortwood
Mr. Walter Caven

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

Honorable Stanley R. Resor
Secretary of the Army

Dear Mr. Secretary:

This is in reply to the Chief of Engineers' letter of August 7, 1970, transmitting for our review and comment his proposed report and pertinent papers on the Sabine River basin, Texas and Louisiana.

The recommended plan of development includes three multiple-purpose dam and reservoir projects, a local protection project at Greenville, Texas, and an extension of an authorized navigation channel in the tidal reach of the Sabine River. These proposed developments were included in the Comprehensive Plan for the Sabine River Basin (Type 2). However, the three proposed reservoir projects were modified without coordination with the Soil Conservation Service, and two adversely affect three upstream watershed projects which were also included in the Type 2 plan.

The proposed Mineola Reservoir has an elevation about 7 feet higher than that included in the Comprehensive River Basin Plan (Type 2). This increase in elevation will adversely affect the potential McBee Creek Watershed Project and the authorized Mill Creek Watershed Project which the Kaufman-Van Zandt Soil and Water Conservation District, the City of Canton, Texas, and Van Zandt County Commissioners Court, assisted by the Soil Conservation Service, have planned consistent with the provisions of the Comprehensive Plan. Recommendations of the District Engineer concerning advance acquisition of Mineola Reservoir project lands and channel construction and flowage easements across these lands appear to provide an adequate basis for coordination of these two projects. If these recommended actions are carried out, this Department has no objection to the construction of the Mineola Reservoir.

The proposed Lake Fork Reservoir apparently will remove from one-third to one-half of the 12,582 acres of flood plain lands benefited by the Upper Lake Fork Watershed Project from the tax rolls of the Lake Fork Water Control and Improvement District No. 1. The Upper Lake Fork Watershed Work Plan has been in operation since July 25, 1958. Eighteen floodwater retarding structures have been installed at a federal construction cost of $1,272,974 and local cost of $109,235. The operation and maintenance of these structural measures and others to be built in the

watershed are the responsibility of the Lake Fork Water Control and Improvement District No. 1, funds for which are derived from taxes collected on the benefited acres.

Since these investments were made and obligations accepted in good faith by local cooperators with the Soil Conservation Service prior to the development of the plans for the proposed Lake Fork Reservoir, the Department of Agriculture cannot agree with including the Lake Fork Reservoir in this proposal for authorization unless a satisfactory arrangement is made with the Lake Fork Water Control and Improvement District No. 1 and the Department of Agriculture to reimburse the District for tax losses incurred consistent with the amount of benefited flood plain lands which will be removed from its tax rolls based on final design of the proposed structure.

Additional consideration of flood plain management in the report would allow for minimizing the losses to the forest resources as a result of the project and for regulating the type and degree of growth on the flood plain.

It would be helpful if the report included specific data on timber production and other forest land values lost and explained how these losses are accounted for in determining project costs. It is recommended that timber clearing be kept to a minimum and that all merchantable timber cut be salvaged.

The economic and population projections used in determining the future level of development are considerably higher than those developed by OBERS for the region. The rate of economic growth was assumed to be the same for the entire study area. All or parts of six OBE water resource planning areas are included in the study. OBERS has indicated that the present variations in the patterns of development among the six planning areas are expected to continue into the foreseeable future. The report would be strengthened if the economic analysis were expanded to show the differences in water resource requirements and the subsequent levels of development for the two sets of projections.

It would be helpful if the draft environmental statement could clarify the basis for assuming that the beneficial effects associated with the proposed project would more than offset environmental and economic losses.

Thank you for the opportunity to review and comment on this report.

Sincerely,

T. K. COWDEN
Assistant Secretary

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
BOARD OF ENGINEERS FOR RIVERS AND HARBORS
WASHINGTON, D.C. 20315

IN REPLY REFER TO

ENGBR 28 July 1970

SUBJECT: Sabine River and Tributaries, Texas and Louisiana

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

1. Authority.--This report is in response to the following resolutions:

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 Sabine River, Texas, submitted to Congress on April 5, 1944, with a view to determining whether any modifications of the recommendations contained therein with respect to flood control and the utilization of water for power development are advisable at this time.
Adopted 20 March 1945

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 Sabine River, Texas, submitted to Congress on April 5, 1944, in the interest of preventing floods and overflows and the utilization of the water for power development in Big Sandy Creek.
Adopted 20 March 1945

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 unpublished report of the Chief of Engineers on Sabine River, Texas, dated September 17, 1943, and submitted to Congress on April 5, 1944, with a view to determining whether any modifications should be made in the recommendations contained in that report with respect to flood control, navigation, the development of power, and other water resource purposes are advisable at this time, with particular reference to the Toledo Bend dam site.
Adopted 3 June 1959

This report presents the program recommended for implementation by the Corps of Engineers in response to the basin's needs and problems presented in, and supported by, the Comprehensive Basin Study (Type 2) report which was a cooperative effort of Federal agencies and the States of Texas and Louisiana. The Type 2 report defines a balanced comprehensive plan for the best use and control of the water and related land resources of the Sabine River Basin. Subsequent to submission of the Type 2 report, a reevaluation of certain projects has been made and the resulting program presented in the report recommending authorization. The comments of the Water Resources Council regarding the Type 2 comprehensive report have been considered in the preparation of this authorization report.

2. Basin description.--The Sabine River Basin lies in the eastern part of Texas and the western part of Louisiana. It is bounded by the basins of the Neches River on the west, the Trinity River on the northwest, the Red River on the north and northeast, and the Calcasieu River on the east. It extends from eastern Collin County, about 35 miles northeast of Dallas, Texas, about 165 miles southeast to the eastern boundary of Texas; thence southerly in Texas and Louisiana about 145 miles to the head of Sabine Lake near Orange, Texas. The basin is about 300 miles long and varies in width from 16 miles to 48 miles. Its area is about 9,756 square miles, of which 2,330 square miles are in Louisiana and 7,426 square miles are in Texas.

3. The Sabine River rises in northwestern Hunt County and flows southeasterly through the city of Greenville, about 60 river miles to join Caddo Creek and the South Fork within Lake Tawakoni. The river flows about 250 river miles to the state line near the town of Logansport, Louisiana; then southerly through Toledo Bend Reservoir and along the state line about 265 river miles to Sabine Lake. Tide water extends up the river about 33 miles.

4. Economic development.--The Sabine River Basin includes all or portions of 20 Texas counties, and seven Louisiana parishes. Forty-five Texas counties and 12 parishes in Louisiana were included in the economic base study area. The population of the study area in 1960 was 1,866,800, of which 350,500 were estimated to reside within the basin. The metropolitan areas of Houston and Dallas-Fort Worth lie within the basin's area of influence. The important industries of the basin include agriculture, petroleum production, mining, manufacturing, sawmilling and timber production, chemical production, and distribution of their products. In the upper portion of the basin, many of the industries are engaged in processing, manufacturing, and shipping the products and by-products obtained from oil, gas, and other natural resources of the basin. Other industries in this area are cottonseed oil mills, foundries, machine shops, and many types of small manufacturing plants. Sawmilling and timber production are important industries in the area; however, these activities are located principally in the central and lower portions of the basin. In the lower basin near Orange, Texas, the principal industries are chemical processing, boat and shipbuilding, miscellaneous manufacturing, and shipping of many products through the port of Orange.

5. Water resource development.--Existing navigation projects in the Sabine River Basin include the main channel of the Gulf Intracoastal Waterway and a portion of the Sabine-Neches Waterway. The River and Harbor Act of 1962 authorized enlargement of the reach of the Gulf Intracoastal Waterway between the Atchafalaya River, the Sabine River, and the Houston Ship Channel. This authorized enlargement has not been constructed. Within the limits of the Sabine River Basin, the Gulf Intracoastal Waterway follows portions of the Lake Charles deep-water channel and the Sabine River channel.

6. The deep-draft Sabine River channel to Orange, Texas, and the shallow-draft channel in Adams and Cow Bayous are existing portions of the Sabine-Neches Waterway Project. The Cow Bayou channel serves the dual purpose of flood control and navigation. The River and Harbor Act of 1962 authorized a shallow-draft channel in the Sabine River from Orange to Echo, Texas, which has not been constructed.

7. There are no existing or authorized major Federal flood control or multiple-purpose reservoirs in the basin. There are, however, 11 non-Federal reservoirs each having an individual storage capacity of more than 5,000 acre-feet, and one group of five off-channel reservoirs that serve as sources of municipal and industrial water supply and recreation for the city of Greenville, Texas. The Sabine River Authority of Texas has developed a major project, Lake Tawakoni, for water supply and recreation. Toledo Bend Reservoir was developed by the Sabine River Authorities of Texas and Louisiana for water supply, hydroelectric power, and recreation.

8. An Upper Lake Fork Creek Project for watershed protection and flood prevention on agricultural lands was approved by the Secretary of Agriculture under the authority of Public Law 566 on 25 July 1958. The watershed, located in parts of Hopkins, Rains, and Hunt Counties, Texas, has a drainage area of 227 square miles and includes 23 floodwater retarding structures, of which 18 have been completed. This project, when completed, will provide flood protection for 12,600 acres of flood plain lands. The program of development for Mill Creek Watershed has been approved under Public Law 566 and applications for Federal assistance have been made for Upper Sabine, Irons Bayou, and Lower Sabine Watersheds.

9. Water resource problems.--Flooding is experienced annually in the Sabine River Basin and may occur at any time during the year. Historical flood information and recorded flood stages and discharges show that flooding most frequently occurs during the first half of the year. The maximum flood of record in the upper basin, April 1945, produced a discharge of 138,000 cubic feet per second at Gladewater, Texas, and the May 1953 flood produced the maximum discharge of 121,000 cubic feet per second at Ruliff, Texas, in the lower basin. There are approximately 952,900 acres of land subject to flooding in the Sabine River Basin, of which 508,100 acres are located along the main stem and lower reaches of the major tributaries, and for which flood damage was evaluated by the Corps of Engineers. Average annual damages on the 508,100 acres along the main stem

and lower reaches of the major tributaries are estimated at approximately $5,243,000 under 1964 conditions of flood plain protection and development and January 1970 price levels.

10. About 77.4 million gallons of water per day were used for municipal and industrial purposes in the Sabine River Basin in 1960. It is expected that this requirement will increase significantly in the future. By the year 2020, for instance, municipal and industrial needs are expected to be more than nine times the 1960 use, and by year 2075, it is estimated that the need will have increased by more than 19 times over the 1960 use. Municipal and industrial water resources development existing and under construction, including present ground water usage and imports, exceeds the total requirements in the basin. However, as the demand increases in specific areas to satisfy the increasing population and industrial expansion, additional increments of water resources will be needed. The request of the Texas Water Development Board for an additional diversion of 200,000 acre-feet per year from the upper basin on or before 1980 also was included in the demand.

11. The authorized Federal navigation project in the Sabine River terminates at river mile 18.2, at the entrance to the channel leading to the Phillips Chemical Company and Alpha Portland Cement Company plants at Echo, Texas. Some of the more important natural resources in the basin are petroleum, natural gas, natural gas liquids, water, timber, iron ore, clays, sand, and gravel. The availability of barge transportation would encourage the utilization of these natural resources.

12. Recreation demands in and adjacent to the Sabine River Basin are rapidly expanding because of increases in population, urbanization, income and education levels, leisure time, and other factors contributing to recreational activity. This expansion is expected to continue. Adequate opportunities for fulfillment of recreational desires are needed to complement the area's improved standard of living. Present water-oriented outdoor recreational demands on the basin are about 7.5 million recreation-days. Fishing accounts for about half of this figure. These demands are expected to double by 1980. By 2020, nearly a five-fold increase can be expected, and by 2075, an eight-fold increase is estimated. Existing water bodies in the Sabine River Basin are not sufficient to support the outdoor recreational use expected in the future.

53-522 O-71——8

13. Results of quality computations by the Federal Water Quality Administration indicate that storage for water quality control will not be needed in the foreseeable future. However, the Sabine River Authority, through the Texas Water Development Board, and the Federal Water Quality Administration, are currently engaged in a cooperative study to develop a Water Quality Management Plan for the basin. The objective of the study is to identify and solve existing pollution problems and develop a long-range plan for the basin.

14. Improvements desired.--Public hearings were held by the District Engineer in various parts of the basin in June 1946 and in May and July 1962. The views expressed at these hearings, at conferences, and in correspondence indicate that local interests were concerned about the flood problems in the basin and wanted flood protection by various methods. Interest was also expressed in developing the water supply and recreational resources of the basin, in extending the shallow-draft Sabine River channel from Echo to Longview, Texas, and in construction of a salt water barrier on the lower Sabine River.

15. Investigated plans.--The plan for flood control selected for the Sabine River main stem is based on a detailed study of alternatives, including multiple-purpose reservoirs, channel enlargement, flowage easements, levees, flood plain management, and combinations thereof. All alternative reservoir systems considered included Mineola, Lake Fork, and Big Sandy Reservoirs. Water supply storage was included in each reservoir to achieve full resource development. Consideration also was given to the needs for general recreation, fish and wildlife enhancement, and navigation.

16. Applicable floodproofing measures were considered in all alternative systems to reduce the remaining damages to the maximum extent practicable. The floodproofing concept is limited to protecting isolated structures such as highways, bridges, and buildings.

a. Alternative reservoir systems considered:

Plan A. - Plan A consists of the three-reservoir system with flood control storage in each reservoir capable of controlling the 50-year flood at the respective damsites to within the existing downstream channel capacities. Additional flood storage is provided as a substitute for complementary downstream channels, levees, or flowage easements.

Plan B. - This plan consists of the three-reservoir system with Lake Fork and Big Sandy Reservoirs identical to those in Plan A, and with Mineola Reservoir identical in storage to Plan D. Flowage easements would be provided for releases from Mineola Reservoir.

Plan C. - In Plan C, the capacities of storage would be identical to those of Plan D. However, in this plan, flowage easements would be provided for flood release purposes rather than downstream channel improvements.

Plan D. - This is the plan selected in the Comprehensive Basin Study (Type 2) report. In the formulation of Plan D, the objective was to find the most efficient and economical combination of reservoir storage and downstream channel capacity to effectively control the 50-year flood at the respective damsites.

Plan E. - In Plan E, no flood control storage would be included. The same three-reservoir sites would be utilized for water supply storage only. The flooding downstream therefrom would be handled through a combination of channel improvements and flood plain management.

Plan F. - Plan F consists of three water supply reservoirs in combination with continuous parallel levees extending from the respective damsites to the head of the Toledo Bend Reservoir.

b. Greenville local flood protection: The two separate watersheds, Cowleech Fork of the Sabine River and Long Branch, contribute to Greenville's flood problem and were considered separately. Plans evaluated for Long Branch included protection against a flood of a 200-year frequency and a smaller channel that would provide 100-year protection. On Cowleech Fork, two alternative plans were studied. The first was a plan that would afford 200-year protection with the Soil Conservation Service program in operation. The second plan would have a smaller channel in combination with flood plain management. This plan together with the plan of the Soil Conservation Service would provide protection to two areas which lie within the 100-year flood plain.

c. Navigation channel from Echo to Morgan Bluff: Consideration was given to several alternative modes of shipment from Morgan Bluff, including rail, barge, and truck-barge through Echo. The benefits to be derived from a channel from Echo to Morgan Bluff are based on a comparison with the least costly alternative of shipment by truck-barge through Echo.

17. Recommended plan.--The District Engineer finds that there is a need for multiple-purpose reservoirs at Mineola, Lake Fork, and Big Sandy for flood control, water supply, and general recreation and fish and wildlife enhancement, and that Plan A is the most suitable reservoir plan to meet these needs. Storage data and other pertinent information on the recommended reservoirs are as follows:

Item	Mineola Reservoir	Lake Fork Reservoir	Big Sandy Reservoir
Location	On Sabine River, mile 475.6	On Lake Fork Creek, mile 28.1	On Big Sandy Creek, mile 15.3
Storage, acre-feet			
Sedimentation	20,400	18,900	6,900
Water supply	370,100	621,500	215,300
Flood control	984,500	472,600	196,000
Total	1,375,000	1,113,000	418,200
Water supply, dependable yield - million gallons per day	83.4	157.7	65.9
Elevation, feet above mean sea level, top of water supply pool	372.5	397.0	367.5
Acres, top of water supply pool	23,900	26,400	10,810

18. He finds that the most suitable plan for providing flood protection for the city of Greenville, Texas, consists of channel rectification and flood plain management on Long Branch and flood plain management on Cowleech Fork, Sabine River.

19. The District Engineer also finds that extension of the authorized navigation project in the Sabine River, about 5.3 miles from Echo to Morgan Bluff, Texas,is economically justified.

20. Economic evaluation.--The estimated first cost, annual charges, average annual benefits, and benefit-cost ratios for the proposed improvements are given in Table 1.

Table 1

COSTS, ANNUAL CHARGES, BENEFITS, AND BENEFIT-COST RATIOS

Item	Mineola Reservoir ($1,000)	Lake Fork Reservoir ($1,000)	Big Sandy Reservoir ($1,000)	Greenville Local Flood Protection ($1,000)	Navigation Channel - Echo to Morgan Bluff ($1,000)
First cost					
Total	87,869.0	68,589.0	33,511.0	181.0	2,053.0
Annual charges					
Total	4,877.2	3,599.0	1,928.4	11.8	170.0
Maintenance, operation, and replacement component	(676.0)	(463.4)	(454.7)	(2.1)	(59.8)
Annual benefits					
Flood control	2,105.0	1,405.5	425.7	13.0	--
Water supply	2,961.4	3,949.1	1,766.7	--	--
Recreation	799.8	372.4	612.1	--	--
Fish and wildlife	429.6	419.8	181.1	--	--
Navigation	--	--	--	--	616.0
Redevelopment	75.1	57.7	30.8	--	--
Total	6,370.9	6,204.5	3,016.4	13.0	616.0
Benefit-cost ratios	1.3	1.7	1.6	1.1	3.6

The apportionment of the project costs to Federal and non-Federal interests is shown in Table 2.

Table 2

APPORTIONMENT OF COSTS

Item	Mineola Reservoir ($1,000)	Lake Fork Reservoir ($1,000)	Big Sandy Reservoir ($1,000)	Greenville Local Flood Protection ($1,000)	Navigation Channel ($1,000)
First cost					
Federal	54,191.0	33,465.0	16,680.0	100.3	1,765.2
Non-Federal	33,678.0	35,124.0	16,831.0	80.7	287.8
Water supply	(29,224.0)	(33,079.0)	(13,908.0)	-	-
Recreation	(4,454.0)	(2,045.0)	(2,923.0)	-	-
Flood control	-	-	-	(80.7)	-
Navigation	-	-	-	-	(287.8)
Total	87,869.0	68,589.0	33,511.0	181.0	2,053.0
Maintenance, operation, and replacements					
Federal	91.8	121.3	35.4	-	31.0
Non-Federal	584.2	342.1	419.3	2.1	28.8
Water supply	(155.2)	(115.7)	(144.6)	-	-
Recreation	(429.0)	(226.4)	(274.7)	-	-
Flood control	-	-	-	(2.1)	-
Navigation	-	-	-	-	(28.8)
Total	676.0	463.4	454.7	2.1	59.8

21. The District Engineer recommends authorization of the multiple-purpose project in accordance with his plan, subject to certain requirements of local cooperation. The Division Engineer concurs.

22. Public notice and public hearing.--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. Because of the public interest in the proposed improvements and in response to requests of local interests, a public hearing was held for the Board at Longview, Texas, on 25 June 1970, giving interested parties further opportunity to express their views on the proposed plan of improvement. The hearing was attended by representatives of Federal, State, and local agencies, conservation and civic groups, and individuals. The views expressed varied from complete endorsement to complete rejection of not only the improvements recommended in this report, but the entire comprehensive (Type 2) plan.

23. Numerous Federal, State, and local officials, public and quasi-public organizations, and interested individuals expressed support for the proposed improvements. The beneficial aspects of flood control, water supply, recreation, and navigation were cited in addition to economic development, improvement of the environment, and opportunity to augment low flow during the low-yield periods. A representative of a United States Congressman emphasized the serious flood threat, including the loss of 12 lives in the Longview area during the 1966 flood. Appropriate entities of the State of Texas indicated their willingness to sponsor the recommended improvements. The Governor of Texas urged the Board to give favorable and prompt consideration to the recommended projects. The Texas Water Development Board noted that the proposed developments are compatible with the Texas Water Plan. The Louisiana Department of Public Works concurred in the proposed plan provided that: (a) not more than 200,000 acre-feet of water per year will be diverted from the three reservoirs to another basin; (b) any reduction in Toledo Bend power sales by the project be borne by the Sabine River Authority of Texas; and (c) a rule curve operation be adopted for the flood control storage in the three reservoirs. Also, a letter was furnished from the Sabine River Authority of Texas to the Louisiana Department of Public Works agreeing to these provisions. Most of those supporting the project emphasized a need for expeditious action in implementing the proposed plan.

24. Concern was expressed that the proposed Mineola Reservoir might adversely affect the approved Public Law 566 project for Mill Creek Watershed and that the proposed Lake Fork Reservoir would result in encroachment on the benefitted flood plain in the Upper Lake Fork Watershed where 18

of 23 structures have been completed. Interest also was expressed in maintaining adequate low flow in the Sabine River during dry periods.

25. Views expressed by the National Audubon Society, Bayou Chapter - Ozark Society, Texas Committee on Natural Resources, and others were in opposition to the proposed improvements and to the comprehensive (Type 2) basin plan prepared by the interagency Field Coordinating Committee. The opposition testimony included statements that the flood problem is not serious and should be resolved by flood plain management; water supply is not needed within the basin; additional reservoir recreation is not needed in the area; and navigation is for a single-user and the products are presently being shipped by other available modes of transportation. Much of the opposition involved the following considerations: Preservation of a semi-natural river basin; the adverse effects of inundation by reservoirs on wildlife; use of the river for wild river type recreation such as float trips; and the expected reduction of flow at the mouth of the river resulting in salinity problems in the Sabine Lake and coastal marshes.

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

26. Views.--The Board of Engineers for Rivers and Harbors has carefully considered the views expressed at public hearings on the recommended improvements as well as the views expressed in communications to the Board. The Board notes that the Sabine River Authority of Texas has agreed to the provisions recommended by the Louisiana Department of Public Works. However, because of the demonstrated need for exclusive and inviolate flood control storage, it is the view of the Board that adoption of a rule curve operation is not considered practicable at this time, but further consideration should be given to such operation procedures during advanced planning studies should the reservoirs be authorized. Representatives of the District Engineer have met with the local interests associated with the two Public Law 566 projects to discuss the possible effects of Mineola and Lake Fork Reservoirs on the projects. The recommendations of the reporting officers include provisions of advance acquisition of project lands for the three reservoirs. These provisions appear to be adequate to permit the necessary coordination of the two programs within the area required for Mineola Reservoir. Channel construction and flowage easements can be provided to pass flood releases from detention structures across Mineola Reservoir project lands. In the case of the effect of Lake

Fork Reservoir on the project for the Upper Lake Fork Watershed, the reservoir encroachment on the benefitted flood plain is not as great as reported, but approximately one-third of the benefitted flood plain would be required for the reservoir. The Board notes that storage for low-flow augmentation has not been included in the reservoirs since studies by the Federal Water Quality Administration indicated that such storage would not be needed in the foreseeable future. The reservoirs are designed to develop the practical full yield of the sites, and the use of such yields may be determined by the State. In addition, a cooperative study by the Sabine River Authority of Texas, Texas Water Quality Board, Federal Water Quality Administration, and the State of Louisiana is now in progress to develop a water quality management plan for the entire basin.

27. The Board further notes that the recommended plan of improvement includes extensive measures (including 15,000 acres of land) for mitigation of wildlife losses associated with the reservoirs. The reporting officers believe that the regulated flows with the reservoirs in operation would actually enhance float trips and similar recreation, especially during naturally dry periods. Concerning the effect of the improvements on the estuarine and marsh ecosystems, the Federal and State fish and wildlife agencies that participated in the interagency comprehensive (Type 2) study concluded that the projects now included in the proposed early-action plan and recommended in this report would not adversely affect these areas. Fresh water inflow to the coastal marshes and estuaries is an important consideration in the comprehensive study. In evaluating the needs and utilization of the basin's water, a minimum fresh water discharge of 600,000 acre-feet annually from the Sabine River into Sabine Lake was made a part of the water demand to preserve the estuarine fisheries. In addition, 50,000 acre-feet of water annually was included in the demands to control salinity on coastal marshes, not only to prevent project-related damages but to prevent adverse effects expected to occur in the future even without Federal water project development. Further, engineering and biological studies that will be required prior to implementation of the long-range plan are expected to improve the plan to protect and enhance these resources. The Board noted that reevaluation of the comprehensive (Type 2) plan indicated that the previously proposed 180 miles of flood release channels extending below the three multiple-purpose reservoirs could be deleted from the proposed plan by increasing the flood control capacities of the three reservoirs.

Excluding these floodwater release channels provides the opportunity for preservation of the environmental integrity of the stream and its natural features. However, action will be needed by the State and local governmental entities to zone or acquire an interest in lands along the more significant reaches of the stream for further protection and enhancement of the natural resources and endangered species of wildlife.

28. The Board notes the relationship of the proposed improvements to the plan of development of the Sabine River Basin presented in the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana (Type 2 study), prepared by the interagency Field Coordinating Committee. The Board believes that the recommended improvements generally conform to the comprehensive basin plan. It further notes that the Governor of Texas has furnished comments to the Water Resources Council indicating that the comprehensive basin plan is in general agreement with the Texas Water Plan. The Board believes that there is a definite flood threat to the lives and property of the people of the Sabine River Basin. About 1,000,000 acres are subject to flooding, and the average annual damages amount to several million dollars. The proposed reservoirs have been found to be economically justified for flood control and water supply alone. Although the region presently contains a number of large reservoirs, they are not sufficient to support the outdoor recreational use expected in the future and development of the recreational potential of the three proposed reservoirs would serve to satisfy a portion of the increased future demand for such opportunities.

29. The Board notes that there is only one prospective commercial user of the barge channel from Echo to Morgan Bluff at the present time, but that other industries are expected to locate on waterfront property in northwestern Orange County and at Nibletts Bluff, Louisiana, in the near future. In the absence of more definitive plans for this future development, the Board concurs in the reporting officers' recommendation that local interests contribute annually, until such time as multiple use of the channel actually occurs, 50 percent of the annual charges for interest and amortization of the Federal investment in the improvements involved, such annual cost presently estimated at $47,400.

30. The Board considers the provisions and recommendations that would enable the Chief of Engineers to cooperate with responsible local interests to keep lands on local tax rolls and to exercise control over development

in the reservoir areas until needed for project purposes to be important and highly commendable. The Board further notes that recommendations have been included to provide for non-Federal participation in the site-preservation objective. The Board notes that substantial water resources development has been constructed in the basin by non-Federal interests. It concurs that Federal authorization should not be construed to constitute a preemption of a site or to prohibit development of a site by local interests.

31. The Board also notes that the flood plain along Cowleech Fork in Greenville, Texas, is relatively undeveloped and that appropriate guidance and flood plain management measures would preclude a more serious flood problem in this area.

32. After carefully considering the many tangible and intangible values involved, the Board concurs in general in the views and recommendations of the reporting officers. The proposed improvements are economically justified and the requirements of local cooperation are appropriate.

33. Recommendations.--Accordingly, the Board recommends further improvement of Sabine River and tributaries, Texas and Louisiana, by construction of three multiple-purpose reservoirs, Mineola Reservoir on the Sabine River, Lake Fork Reservoir on Lake Fork Creek, and Big Sandy Reservoir on Big Sandy Creek, for flood control, water supply, and recreation; a local flood protection project on Long Branch at Greenville, Texas; and extension of the navigation project in the Sabine River 5.3 miles from Echo to Morgan Bluff, Texas, at an estimated cost to the United States of $191,834,000 for construction (excludes $369,000 for land and other items to be furnished by local interests in connection with the local flood protection and navigation improvements) and $695,000 annually for operation, maintenance, and major replacements (excludes $961,000 annually for operation, maintenance, and major replacements to be performed by local interests in connection with the local flood protection and navigation improvements and the recreation and fish and wildlife enhancement purposes at the reservoirs); all 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, local interests furnish assurances satisfactory to the Secretary of the Army that they will:

a. With respect to each of the reservoirs:

(1) Repay all costs allocated to water supply in accordance with the Water Supply Act of 1958, as amended, such costs presently estimated as follows:

Project	First Cost		Average annual operation, maintenance, and replacement cost	
	Amount	Percent	Amount	Percent
Mineola	$29,224,000	37.8	$155,200	23.0
Lake Fork	$33,079,000	56.5	$115,700	25.0
Big Sandy	$13,908,000	49.2	$144,600	31.8

(2) In accordance with the Federal Water Project Recreation Act:

(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 allocated to recreation and fish and wildlife enhancement, such costs presently estimated as shown in item (c) below;

(c) Bear all costs of operation, maintenance, and replacement of recreation and fish and wildlife lands and facilities, such costs presently estimated as shown below:

Project	One-half separable first cost			Average annual operation, maintenance, and replacement cost
	Initial	Future	Total	
	($1,000)	($1,000)	($1,000)	($1,000)
Mineola	3,146	1,308	4,454	429.0
Lake Fork	1,648	397	2,045	226.4
Big Sandy	1,993	930	2,923	274.7

(3) Obtain without cost to the United States all water rights necessary for operation of the project in the interest of water supply;

b. With respect to the local flood protection project at Greenville:

(1) Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project;

(2) Provide without cost to the United States all relocations of buildings and utilities, bridges (except railroads), sewers, pipelines, and any other alterations of existing improvements which may be required for the construction of the project;

(3) Provide assurances that encroachment on improved channels and floodways will not be permitted;

(4) Hold and save the United States free from damages due to the construction works;

(5) Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army;

(6) Agree to consider the degree of protection afforded in connection with future development within, or adjacent to, the corporate limits, including adoption of such regulations or dissemination of basic flood information, as may be necessary to insure compatibility between development and protection levels; and

(7) Adequately inform affected interests, at least annually, that the project will not provide complete flood protection;

c. With respect to the navigation channel, Echo to Morgan Bluff, Texas:

(1) Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such retaining works;

(2) Hold and save the United States free from damages due to construction and maintenance of the project;

(3) Provide and maintain at local expense, when and as required, adequate public terminal and transfer facilities open to all on equal terms;

(4) Provide and maintain without cost to the United States depths in berthing areas and local access channels serving the terminals commensurate with the depths provided in the related project areas;

(5) Accomplish without cost to the United States such alterations of buildings, roads, and pipelines, and sewer, water supply, drainage, and other utility facilities, as well as their maintenance, as required for construction and subsequent maintenance of the project;

(6) Provide a proportionate share of the cost of bridge alterations over existing channels in accordance with the principles of Section 6 of the Bridge Alteration Act (Truman-Hobbs) of 21 June 1940, as amended;

(7) Assume all obligations of owning, maintaining, and operating all railway and highway bridges altered or constructed as part of the navigation project, with such obligation for each bridge to be assumed by local interests upon final completion or construction of that bridge;

(8) Prohibit erection of any structure within 75 feet of the project channels or turning basins;

(9) Establish regulations prohibiting discharge of pollutants into the waters of the improved channels by users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State, and local authorities responsible for pollution prevention and control; and

(10) Contribute annually, until such time as multiple use of the channel from Echo to Morgan Bluff actually occurs, 50 percent of the annual charge for interest and amortization of the Federal investment in the improvements involved, as determined by the Chief of Engineers, such 50-percent share presently estimated at $47,400, such annual contributions shall commence upon completion of the work and shall end when the Chief of Engineers determines that multiple use of the channel has commenced.

34. On the foregoing basis and excluding any reimbursement that may be required with respect to the navigation channel, the net cost to the United States for the recommended improvements is estimated at $106,201,000 for construction and $279,500 annually for operation, maintenance, and major replacements.

35. The Board further recommends that:

a. Following authorization of the reservoirs, 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 sites 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; and

b. The Chief of Engineers be authorized to enter into an agreement with the non-Federal entities in advance of construction of Mineola, Lake Fork, and Big Sandy Reservoirs to provide for credit toward reimbursable costs of lands acquired or land-taking surveys made by such entities when such local expenditures are sound contributions to the projects: Provided such agreement with non-Federal entities is not to be interpreted that the projects will be constructed by the United States.

FOR THE BOARD:

C. H. DUNN
Major General, USA
Chairman

SUMMARY OF CONSIDERATION GIVEN IN THE AUTHORIZATION REPORT TO THE VIEWS AND RECOMMENDATIONS OF THE WATER RESOURCES COUNCIL ON THE COMPREHENSIVE BASIN STUDY, SABINE RIVER, TEXAS AND LOUISIANA

Potential Corps of Engineers projects, which were recommended as part of the early-action plan in the type 2 report, have been reevaluated taking into account up-to-date criteria and other factors, and the views and recommendations of the Water Resources Council. As a result of the reevaluations the scope of the project proposals have been modified. Flood release channels have been eliminated below the reservoir sites and flood storage increased in each of the three reservoir projects as a substitute for operational efficiency foregone by elimination of the downstream channel works. At Greenville, a flood plain management option has been substituted for channel improvements along Cowleech Fork. Channel improvement on Long Branch in Greenville has been reduced in scope and a flood plain management option added. The proposed navigation channel has been extended about 4,000 feet to Morgan Bluff. The results of the reevaluations are contained in the "authorization" report and summarized herein for ready reference.

PLANNING OBJECTIVES

Full development. Construction and operation of the three multiple-purpose reservoirs, a local flood protection project, and a shallow draft navigation project will provide job opportunities for inhabitants of the Sabine Basin and surrounding area. Construction will provide extensive employment on a short term basis; project operation and maintenance will provide extended employment for a smaller work force. Annual job opportunities to be provided during construction of Mineola, and Lake Fork Reservoirs are expected to total about 1,000 workers to be drawn from the unemployed work force. These workers will in turn generate supportive secondary employment. Prevention of flood damages will free economic resources for new enterprises rather than replacement of losses. Less interruption to transportation will reduce costs, and improved transportation in the lower basin will reduce costs of moving commodities from the producer to the consumer. Development of water resources for in-basin use will create new living and working opportunities in less congested areas, and provide stimulus for increased economic activity. Recreation opportunities will create imported demands for locally supplied goods and services. Paragraph 16 of Appendix C addresses projected employment effects of the authorization report plan.

Public health. Results of water quality computations by the Federal Water Quality Administration showed that storage of water for quality control will not be needed in the foreseeable future. Presently, however, the Sabine River Authority, through the Texas Water Development Board and the Federal Water Quality Administration, is engaged in developing a water quality management plan to identify and solve existing pollution problems and develop a long range plan for the basin. These safeguards will assure, through the recommended plan, ample quantities of high quality water for municipal use,

53-522 O—71——9

and pollution control through properly treated municipal and industrial return flows, thereby contributing to public health, and the preservation of the natural succession of the basin's ecology. Flood control features will aid in eliminating unsafe and unsightly conditions, help to control the movement of sediment and stream scour, and to regulate stream flow. Vector prevention and control measures will be incorporated, to the extent feasible, into the design, construction and operational phases of the water resources developments proposed for the Sabine Basin.

Environmental qualities. Although the National Environmental Policy Act of 1969, Public Law 91-190, was enacted subsequent to completion of the type 2 report, the spirit of the act and its objectives were observed in planning. Details of the environmental features, including considerations and evaluations, and the effects of the proposed plan can be found throughout the report.

The type 2 report presents appraisals of present and potential supplies of fresh water fish, estuarine fish, wildlife and estimates of losses and gains expected to result from proposed developments. Recommendations were made and included as mitigative and enhancive features to control salinity in estuaries, for bringing fresh water to coastal marshes, modification to hurricane protection projects to provide salinity control, and measures to compensate for project induced losses in upland-game, and big game habitat. Also recommended were provisions for fishery management studies at short- and long-range Corps and Soil Conservation Service projects. Forestry management practices were studied and recommended to project full realization of potential on commercial forest land, including improved wildlife habitat. An appraisal was also made of the program's effect on agricultural and forest lands. Short- and long-range recreation goals were related to the report's program, and provisions were made to incorporate vector prevention and control measures into the design, and operational phases of the water resource developments. An appraisal of the quality of the Sabine River water for the foreseeable future was made, and found to be within acceptable limits. Areas rich in archeological and historical resources were identified and related to the plan of development. The report acknowledges the lower basin to be unexplored archeologically and recommends archeological salvage in all basin areas in advance of construction.

The authorization report proposes the mitigation of wildlife losses induced by the recommended plan. The proposal provides for managing wildlife habitat on 25,000 acres of multipurpose project lands and acquisition and improved management on 15,000 acres of additional flood plain lands to offset the effects of losing approximately 62,000 acres of land and its associated wildlife habitat. Costs for the mitigation program are included in the recommended plan of improvement. Environmental considerations are presented in Appendix E of the authorization report and a draft environmental statement responsive to Public Law 91-190 is attached to the proposed report of the Chief of Engineers.

CONSIDERATION OF ALTERNATIVES

The early action program selected for recommendation in the type 2 report consisted of three multiple purpose reservoirs, Mineola, Lake Fork and Big Sandy and their associated flood release channels; a channel improvement program at Greenville, Texas; and a shallow draft navigation project extending 4.5 miles above Echo, Texas. Selection of this plan involved the elimination of less efficient structural alternatives. A wider range of investigations were conducted for the authorization report to include structural and non-structural measures, and combinations thereof. Flowage easements were considered in lieu of flood release channels, zoning of a floodway and flood proofing of transportation facilities were non-structural alternatives considered. Structural measures included multiple-purpose reservoirs, flood release and flood control channels, single-purpose reservoirs, and levees. The reservoir system recommended consists of the three multiple-purpose reservoirs, identified above, capable of regulating the 50 year flood to within existing channel capacities. In this plan additional flood storage is provided in lieu of complementary channels, levees or flowage easements; for the Greenville local flood protection project, flood plain management is now recommended for the Cowleech Fork of the Sabine River element in lieu of channel improvement. Structural measures, or channel improvement, is recommended for the Long Branch portion of the project. Enabling Texas legislation is now provided by S. B. 668, signed June 1969 for counties to regulate the use of lands in flood plains within their jurisdiction. This, in addition to existing authority by cities and towns, affords a means of establishing flood plain management practices throughout Texas. Protection of the existing Lake Tawakoni (Iron Bridge Dam) was necessary in order to accommodate the proposed Mineola Reservoir. Water supply studies revealed the Sabine to be surplus basin, and planning considered and provided for diversion requirements of the Texas Water Plan. Ground water development was planned and integrated into the total supply system for in-basin use. Because of the excessive cost, and surplus supplies in the basin, desalination was not considered as an alternative. Appendix A of the authorization report presents the formulation and selection of the basin plan of development.

EVALUATION OF MAIN STEM FLOOD PROTECTION PROJECTS

The plan of development of the type 2 report did propose the reservoir system, Mineola, Lake Fork, and Big Sandy, including complementary flood release channels. Cost of channel improvements were proportioned on a basis of total all-purpose benefits. In the authorization report restudy of this plan, costs of channel improvements were proportioned according to the flood reduction potential of each reservoir. This plan was not selected for recommendation, however, because of its failure to achieve economic justification, and because of adverse environmental impacts. The alternate plan providing increased flood control storage in lieu of complementary flood release channels was selected as the plan recommended for authorization. Refer to Appendix A of the Authorization Report.

FLOOD PLAIN MANAGEMENT

Guidance on treatment of non-structural programs emerged during and after the final stages of preparation of the type 2 report. These planning considerations were recognized and acknowledged in the report to the degree possible in keeping with the report's scheduled completion date. After the report's submission the State of Texas provided legislation in June 1969, enabling counties to regulate the use of lands in flood plains within their jurisdiction. This, in addition to the existing authority of cities and towns, provides a means of establishing flood plain management practices throughout Texas. Accordingly, the City of Orange has requested a flood plain information report on reaches of Adams Bayou and the Sabine River. Also, in the authorization report restudy of the Greenville local flood project, flood plain management is recommended in lieu of channel improvement for the Cowleech Fork element of the plan. Structural measures are recommended for the Long Branch element. Because of the extent, and agricultural use, of flood plains below planned reservoir developments these structural measures, including flood control as a function, were considered necessary. However, with the enabling legislation now available, flood plain management practices are recommended in conjunction with, and complementary to, recommended flood protection structures.

WILDLIFE LOSSES

The adoption of the plan to provide increased flood control storage in Mineola, Lake Fork, and Big Sandy Reservoirs in lieu of complementary flood release channels reduces potential wildlife habitat losses. Losses at the proposed reservoir sites and related man-days of hunting can be mitigated by development and management of 25,000 acres of reservoir site lands, and 15,000 acres of additional lands in the flood plain immediately downstream from Mineola Reservoir. Costs, considered as costs of related projects, were included in the plan recommended for authorization to provide for additional lands, and management of project lands, to mitigate wildlife losses. This proposal will offset the effects of losing approximately 62,000 acres of land and its associated wildlife habitat at project sites. Refer to paragraph 41 of the Main Report and Appendix E, Recreation and Environmental Considerations, of the Authorization Report.

CONSTRUCTION SEQUENCE

The plan of development now recommends multiple purpose reservoirs; Mineola, Lake Fork and Big Sandy, with sufficient flood control storage to regulate the 50-year flood to within existing channel capacities. Thus, with the elimination of channels, the problem of channel sizing in relation to flood plain management below dams is also eliminated. The construction sequence of the three reservoirs established in the type 2 report have not been changed as a result of the review of projections conducted for the authorization report. Mineola and Lake Fork Reservoirs are estimated to be needed by 1980 to provide essential flood control, water for in-basin needs and recreation, and to furnish 200,000 acre-feet annually for export through

the Texas Water System. Big Sandy Reservoir is estimated to be needed during the 1990-2000 decade, or at the appropriate time to supply additional intra-basin water supply needs, flood control, and recreation.

Operation of the three proposed reservoir projects for water supply and flood control will have little effect on power generation, water supply, recreation and fish and wildlife features of the Toledo Bend project. Refer to paragraph 40 of the authorization report.

ESTUARINE AND COASTAL MARSH AREAS

Investigations for the Sabine type 2 report included special studies by sub-committees or work groups. Fish and Wildlife and Water Quality Control Work Groups were formed, having included in their responsibilities the establishment of fresh water requirements for bays and estuaries (Sabine Lake) and environmental quality of coastal marshes. Appropriate Federal agencies and agencies of the States of Texas and Louisiana participated. Volumes of annual fresh water flow into Sabine Lake, including properly treated return flows, were established. Fresh water contributions to the coastal marshes were also established in connection with the long-range plan recommended for the basin. Goals for dissolved oxygen content of Sabine Basin water to support growth of fish and shell fish were stated. The type 2 report provides for the Sabine Basin's share of 600,000 acre-feet annually of a combination of properly treated return and uncontrolled flow into Sabine Lake. Also provided are 50,000 acre-feet annually to control salinity on coastal marshes.

CHANGING CRITERIA AND OTHER FACTORS

The State of Texas has adopted water quality standards which were approved by the Secretary of the Interior on 27 January 1968. State and Federal agencies are currently engaged in a cooperative study to develop a Water Quality Management Plan for the basin. The study's objective is to identify and solve existing pollution problems and to develop a long-range plan for the basin. Flood plain management has been incorporated into the basin plan, and an interest rate of 4-7/8 percent was used in developing annual costs for the authorization report's program. OBERS projections released by the Water Resources Council for use in resources planning were compared with projections contained in the type 2 report which were based on projections published by the Economic Task Group of the President's Water Resources Council, 1963. Application of the OBERS data substantiated projections in the type 2 report. Tabulations of the results of the two sets of projections are presented in Appendix C of the authorization report. The first step in recognition of the proposed Eastern New Mexico-West Texas Diversion Study is included in the authorization report. Paragraph 35 of the Main Report provides for the diversion of 200,000 acre-feet annually from the Sabine Basin through the Texas Water System.

CORPS OF ENGINEERS REPORT ON THE COMPREHENSIVE BASIN STUDY SABINE RIVER AND TRIBUTARIES TEXAS AND LOUISIANA

SYLLABUS

This report presents a Corps of Engineer's plan of development for the Sabine River Basin supported by the summary report and technical appendices of the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana. The Comprehensive Study was presented to the Water Resources Council by the Field Coordinating Committee on December 22, 1967, and to the President by the Water Resources Council on December 16, 1969.

In this report structural changes, non-structural measures, and provisions for environmental protection represent modifications with respect to the Corps' portion of the plan of the Type II Report. Changes include elimination of flood release channels and compensatory increase in flood control storage, flood plain management in lieu of channel improvement, and mitigation of wildlife habitat losses.

The plan provides specific short-range measures for flood control, water supply, navigation, recreation, and fish and wildlife conservation, and recommends the fully justified program for authorization and construction. Projects recommended for authorization at this time are: Multiple purpose reservoirs - Mineola, Lake Fork, and Big Sandy; a local flood protection project at Greenville, Texas; and an improved shallow-draft navigation channel extending from Echo to Morgan Bluff, Texas.

Preservation and enhancement of environmental and esthetical features have been considered in formulating the projects. Further emphasis will be given in the detailed planning stage for the natural features of the project sites, structural and facility design, project regulation, land use and project management guidelines.

Water requirements and supply for irrigation in the basin and water cooling for thermoelectric power facilities are also included. Land stabilization and drainage will be handled by existing programs and continuing Federal authorizations.

The Total estimated construction cost of projects recommended for authorization is $192,203,000 with an annual operation, maintenance, and replacement cost of $1,656,000. The net Federal Government costs are $106,201,500 and $279,500 annually for operation, maintenance and replacement.

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102

April 16, 1970

SUBJECT: Survey Report on Sabine River and Tributaries, Texas and Louisiana

THRU: Division Engineer, Southwestern

TO: Chief of Engineers

INTRODUCTION

1. AUTHORITY.- This report is in response to two Resolutions by the Committee on Flood Control, United States House of Representatives, adopted March 20, 1945; Resolution by the Committee on Public Works, United States House of Representatives, adopted June 3, 1959. The structural program has been modified with respect to that presented in the comprehensive study, and the views, considerations, and recommendations of the Water Resources Council have been taken into account.

2. PURPOSE OF THIS REPORT.- The purpose of this report is to define the Corps of Engineers' program with respect to the basin's needs and problems presented in, and supported by, the main report and technical appendixes of the comprehensive basin study, and to recommend a short-range improvement program for authorization. The report addresses alternatives of plan and design and the physical and economic effects of the short-range program on existing improvements.

3. SABINE RIVER COMPACT.- The Sabine River Compact was signed by representatives of the states of Texas and Louisiana, and the United States on January 26, 1953, and subsequently was ratified by the legislatures of the states and approved by the Congress of the United States. The major purposes of the Compact are to provide for an equitable apportionment between the states of Louisiana and Texas of the waters of the Sabine River and its tributaries; and to establish a basis for cooperative planning and action by the states for the construction, operation and maintenance of projects for water conservation and utilization on the reach of the Sabine River common to both states, and for the apportionment of the benefits therefrom. The Compact recognized that pollution abatement and salt water intrusion are problems which are of concern to the states of Louisiana and Texas,

but does not undertake solutions of these problems. To provide for its administrative needs, the Compact created an interstate administrative agency designated as the 'Sabine River Compact Administration.' As used in this Compact, the word stateline means the point on the Sabine River where its waters in downstream flow first touch the states of both Louisiana and Texas. The essentials of water apportionment provisions of the Compact are as follows:

a. Texas retains free and unrestricted use of the water of the Sabine River and its tributaries above the stateline, subject only to the provisions that the minimum flow of 36 cubic feet per second must be maintained at the stateline.

b. Any reservoir constructed in the watershed above the stateline subsequent to January 1, 1953, will be liable for its pro rata share of the guaranteed minimum flow.

c. Texas may either use the yield of these upper reservoirs above the stateline or allow it to flow downstream in the stateline reach to a desired point of removal without loss of ownership.

d. All free water in the stateline reach, without reference to origin, will be divided equally between the two states.

e. Neither state may construct a dam on the stateline reach without the consent of the other state.

f. Water stored in reservoirs constructed by the states in the stateline reach shall be shared by each state in proportion to its contribution to the cost of storage.

g. Should either state construct a reservoir on a stream tributary to the stateline reach of the Sabine River, that state is entitled to the yield of the reservoir, but its share of the flow of the Sabine River is reduced by the reduction in flow resulting from the operation of the reservoir.

h. Water consumed for domestic and stock water purposes is excluded from apportionment under the Compact.

4. PUBLIC HEARINGS.- Since submission of the 1940 report on survey of Sabine River and tributaries, Texas and Louisiana, four public hearings have been held to ascertain the views and desires of local interests with respect to improvements for flood control and allied purposes. Pursuant to the authorizing resolution for the re-study of the Sabine River Basin, public hearings were held in Longview, Texas, on June 24, 1946; in San Augustine, Texas, on June 25, 1946; in Orange, Texas, on May 29, 1962; and in Longview, Texas, on July 18, 1962. Digests of the two 1962 Corps of Engineers hearings appear in appendix Q of the comprehensive study.

5. CONGRESSIONAL HEARING.- A formal hearing on flood problems of the Sabine River Basin was convened in Longview, Texas, on February 28, 1969, by the Flood Control Subcommittee of the House Committee on Public Works. During this hearing, a summary of the Corps of Engineers plan of improvement proposed in the comprehensive Sabine Basin study was presented to the assembly.

6. HEARINGS BY OTHERS.- Hearings were convened before the Texas Water Development Board and the Texas Water Pollution Control Board in June 1966 at Longview and Orange, Texas. Included in the Texas Water Development Board's presentation at both hearings were statements in support of the plan, then being formulated, for the comprehensive Sabine Basin study.

BASIN DESCRIPTION AND CHARACTERISTICS

7. GENERAL LOCATION AND SIZE.- The Sabine River Basin lies in the eastern part of Texas and the western part of Louisiana. It is bounded by the basins of the Neches River on the west, the Trinity River on the northwest, the Red River on the north and northeast, and Calcasieu River on the east. It extends in a general northwest-southeast direction from eastern Collin and Rockwall Counties about 35 miles northeast of Dallas, Texas, about 165 miles to the eastern boundary of the state; thence southerly in Texas and Louisiana about 145 miles to the head of Sabine Lake near Orange, Texas. The basin is about 300 miles long and varies in width from a minimum of 16 miles to a maximum of 48 miles. Its drainage area is about 9,756 square miles, of which 2,330 square miles are in Louisiana and 7,426 square miles are in Texas. The Sabine River Basin under existing conditions of development is shown on plate 1.

8. PHYSICAL CHARACTERISTICS.- The basin lies within the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The land elevation within the basin varies from a few feet above sea level near the coast to about 730 feet above sea level in the headwaters. In the extreme upper end of the basin, the land surface is undulating to gently rolling and the streams lie in shallow valleys. In the lower 60 miles along the coast, the land surface is flat to undulating. In the remainder of the area, the land surface is rolling to hilly, with occasional flat areas along the interstream divide. In the hilly section, the principal streams are entrenched in broad flat valleys. Four major land resource areas comprise the Sabine Basin: Texas Blackland Prairie, Southern Coastal Plain, Gulf Coast Prairies, and Gulf Coast Marsh.

9. STREAMS.- The Sabine River rises in northwestern Hunt County and flows southeasterly through the city of Greenville, about 60 channel miles to join Caddo Creek and the South Fork within Lake Tawakoni. The river flows about 250 river miles to the stateline near the town of Logansport, Louisiana; then southerly through Toledo Bend Reservoir and along the stateline about 265 miles to Sabine Lake. Tide water extends up the river about 33 miles. There are numerous tributary streams discharging into the Sabine River, most of them small. Channels of the stream tributaries are generally poorly defined, crooked and badly obstructed by brush and drift. In rolling hilly sections of the basin, tributaries have relatively steep slopes and shallow valleys in their upper reaches, and flatter slopes and deeper valleys in the lower reaches. Tributaries in the Gulf Coast Prairies have flat slopes and shallow valleys throughout the greater part of their lengths. Floods on these streams cover wide areas and, in some instances, flood waters flow across interstream divides.

10. FLOODS.- Observed rainfall and runoff data in the Sabine River Basin reveals a wide variation from minimum to maximum annual amounts, illustrating extremes which produce water management problems. Historical and observed records, though covering a relatively short period, show a recurring pattern of moderate to severe droughts interspersed with periods of flood producing rainfall. During an 83-year historical period beginning in 1884, many floods affected only limited areas of the basin; 18 floods covered larger areas and are identified as general floods. Floods of May 1844, April 1913, and April-June 1953 produced maximum flood stages along the Sabine River below Bon Wier. The flood of March-April 1945 produced maximum flood stages along the central and upper Sabine River.

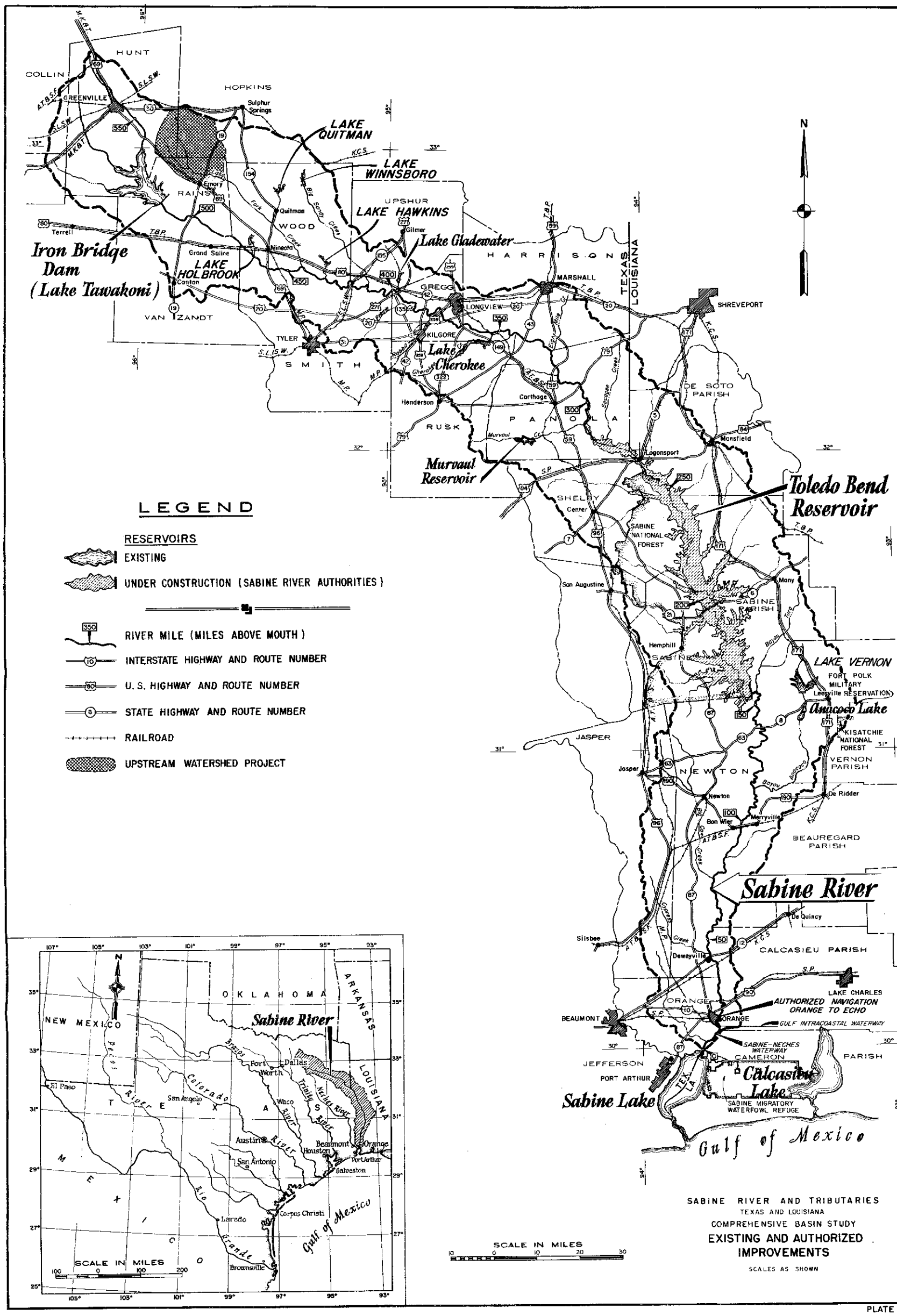
11. DROUGHTS.- Several drought periods have been experienced in the Sabine River Basin since about 1900. There is evidence of an historical drought during the period 1908-1913. However, there are insufficient detailed records available to permit analysis of the 1908-1913 period. Investigations for this report were, therefore, limited to a study of the streamflow records for the period 1924 through 1968. During these years of record, three periods were critical with respect to water supply for most reservoirs, 1924-1925, 1950-1956, and 1962-1968. However, since deficient flow may be experienced past 1968, conclusive firm yield for the period cannot be developed until additional records become available. Detailed yield studies covering the later period will be made in connection with preconstruction planning. Indications from the incomplete records available are that the 1962-1968 period will not be critical for the recommended reservoirs.

12. EXISTING AND AUTHORIZED IMPROVEMENTS.- Existing navigation projects in the Sabine River Basin include the main channel of the Gulf Intracoastal Waterway and a portion of the Sabine-Neches Waterway. The River and Harbor Act approved October 23, 1962, authorized enlargement of the reach of the Gulf Intracoastal Waterway between the Atchafalaya River, the Sabine River, and the Houston Ship Channel. This authorized enlargement has not been constructed. Within the limits of the Sabine Basin, the Gulf Intracoastal Waterway shares portions of the Lake Charles deep water channel and the Sabine River channel.

The deep draft Sabine River channel to Orange, Texas, and the shallow draft channel in Adams and Cow Bayous are existing portions of the Sabine-Neches Waterway Project. The Cow Bayou channel serves the dual purposes of flood control and navigation. River and Harbor Act approved October 23, 1962, authorized a shallow draft channel in the Sabine River from Orange to Echo, Texas. This project has not been constructed.

Presently major Federal flood control or multiple purpose reservoirs do not exist in the basin, nor have such projects been authorized. There are, however, 11 non-Federal reservoirs having individual total storage capacity of more than 5,000 acre-feet, and one group of five off-channel reservoirs having an aggregate storage of 7,550 acre-feet serves the city of Greenville, Texas. These projects serve as sources of municipal and industrial water supply, and recreation. A major project, Lake Tawakoni has been developed by the Sabine River Authority of Texas, for water supply and recreation, and Toledo Bend Reservoir, developed by the Sabine River Authorities of Texas and Louisiana, provides water supply, hydroelectric power, and recreation. The locations of these reservoirs are shown on plate 1.

An upper Lake Fork Creek project for watershed protection and flood prevention on agricultural lands was approved for operations under the authority of P.L. 566 on July 25, 1958. The watershed, located in parts of Hopkins, Rains, and Hunt Counties, Texas, has a drainage area of 227 square miles and includes 23 floodwater retarding structures, of which 18 have been completed. This project, when completed, will provide flood protection to 12,600 acres of flood plain lands. The program of development for Mill Creek Watershed has been approved for operation under P.L. 566 and applications for Federal assistance have been made for Upper Sabine, Irons Bayou, and Lower Sabine Watersheds.



SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
EXISTING AND AUTHORIZED IMPROVEMENTS
SCALES AS SHOWN

PLATE I

RELATION OF ECONOMIC DEVELOPMENT TO WATER AND RELATED RESOURCE

13. INTRODUCTION.- Evaluation of the demands on water resources involved consideration of all available information on present and projected needs as developed by the State of Texas and Federal agencies, together with the expressed wishes of local interests and directives from the Congress.

14. MUNICIPAL AND INDUSTRIAL WATER SUPPLY.- The projected increase in population and industrial expansion must be supported by water supply not only adequate in quantity but of suitable quality and at a reasonable cost. Water resources must be developed sufficiently in advance to satisfy projected needs as they develop. In the Sabine River Basin about 77.4 million gallons of water per day were used for municipal and industrial purposes in 1960. It is expected that this requirement will increase significantly in the future. By the year 2020, for instance, municipal and industrial needs will be more than nine times the 1960 use and by year 2075 it is estimated the need will have increased by more than 19 times over the 1960 use. It is estimated that municipal and industrial water storage facilities existing and under construction, including present ground water usage and imports, and assuming the Soil Conservation Service program in operation, will produce about 1,723.0 million gallons of water per day. As needs arise in certain areas to satisfy increasing population and industrial expansion, additional increments of water resources must be developed.

Water for livestock and rural domestic use is about 14.6 million gallons per day, or 13 percent of the total average daily usage in the basin. About 85 percent of the rural water supply is obtained from privately owned wells. Other sources are farm ponds, cisterns, and streams. The lower half of the basin generally has adequate supplies of rural water, while the upper half is deficient.

15. FLOOD CONTROL.- Frequent flooding occurs throughout the Sabine River Basin. Individual efforts to protect flood plain lands by construction of levees or channel straightening have been ineffective and costly since the improvements have been repeatedly overtopped, broken, or destroyed.

There are approximately 952,900 acres of land subject to flooding in the Sabine River Basin, of which 508,100 acres are located along the main stem and lower reaches of the major tributaries. These areas, along which the flood damage was evaluated by the Corps of Engineers, are described as follows: main stem from its mouth to Lake Tawakoni; Lake Fork Creek from its mouth upstream to the proposed Lake Fork Dam site; Big Sandy Creek from its mouth upstream to Big Sandy Dam site; Rabbit Creek from its mouth upstream to a point 0.9 miles downstream from Rusk-Smith County line; Prairie Creek from its mouth to

Kilgore No. 2 Dam site; Big Cow Creek from its mouth to a point 0.7 miles upstream from U. S. Highway 190; Anacoco Bayou from its mouth to Anacoco Lake Dam; Bayou Toro from its mouth to a point 1.4 miles upstream from Vernon-Sabine Parish line; Adams Bayou from its mouth upstream to Interstate Highway No. 10, and Cow Bayou from its mouth upstream to Interstate Highway No. 10. The Corps evaluated damages for the Greenville urban area, consisting of the Sabine River flood plain from a point 1,000 feet downstream from Interstate Highway No. 30 upstream to the Greenville city water supply reservoirs, and the flood plain of Long Branch in Greenville.

The Soil Conservation Service evaluated the flood damages on all other tributary flood plain areas of the Sabine River Basin amounting to 444,800 acres. The areas subject to flooding by upstream tributaries have been considered for protection under the watershed protection and flood prevention program administered by the Soil Conservation Service. The total value of physical property in the flood plain of the main stem and major tributaries is estimated at approximately 212.4 million dollars under 1964 conditions of development.

The average annual damages on the Sabine River and tributaries, including Adams and Cow Bayous, are estimated at approximately $5,512,000 under 1964 conditions of flood plain protection and development, and January 1970 price levels.

Present and future flood problems of the basin may be prevented most effectively by protective measures such as reservoirs, local flood protection projects, channel improvement, levee systems with appurtenant interior drainage facilities, land treatment and upstream floodwater retarding structures. The flood control effectiveness of these works of improvement would be enhanced through flood forecasting and improved flood warning systems of the U. S. Weather Bureau and through flood plain information studies of the Corps of Engineers.

To encourage the prudent use of urban flood plains, Congress, in the Flood Control Act of 1960, authorized a national program of flood plain information studies. Under this authority, the Corps of Engineers will provide technical assistance needed for planning proper management of urban flood plains. Flood plain information is published for several basic purposes: (1) to enable the public to determine limits of the probable flood risk to insure against unwise development in the flood hazard area; (2) to provide a technical basis to local governing authorities for regulating flood plain use; (3) to provide a technical basis of flood risk for construction of structural floodproofing measures; and (4) to furnish a guide for using early warning measures to initiate emergency evacuation of the flood plain under conditions of impending flood.

Much of our nation's flood damages can be attributed to increasing development on flood plains of rivers and streams. In the Sabine River watershed, flooding of valley lowlands has been a recurring problem. In the past, when valley lowlands were underdeveloped, flooding caused relatively minor damage. Increased utilization of the flood plains has resulted in severe flood damages in recent years. Nationally, this encroachment is occurring faster than flood protection can be provided, and expenditures for flood control and protection have not been able to keep pace with mounting flood losses.

The flood plain investigated for this report consisted of areas inundated by floods of record for various reaches of the Sabine River and its tributaries. See plate 1 in appendix J of the comprehensive basin study for delineation of the area subject to flooding, and plate 2 of this report for flood plain areas investigated. These areas are predominantly rural; however, sizable urban areas are flooded in the cities of Orange, Deweyville, Logansport, Gladewater, Greenville, and Longview. With the exception of Greenville, the flood problems are not acutely severe from a monetary standpoint at the present time, but could well become major problems unless usage of the undeveloped flood plain is restricted. In accordance with the authorization quoted above, the City of Orange, Texas has requested through the Texas Water Development Board to the Corps of Engineers that a flood plain information report be prepared on reaches of Adams Bayou and the Sabine River for guidance in planning engineering studies, construction, and other action as may be necessary for wise use of flood plains.

Any long range planning for the Sabine River Basin should include plans for flood plain information studies related to all urban areas with present or anticipated flood problems as alternate measures for adoption by local interests to minimize or preclude the need for structural measures to prevent or reduce future flood damages.

16. NAVIGATION.- The authorized Federal navigation project in the Sabine River terminates at river mile 18.2, at the entrance to the channel leading to the Phillips Chemical Company and Alpha Portland Cement Company plants at Echo, Texas.

Some of the more important natural resources in the basin are petroleum, natural gas, natural gas liquids, water, timber, iron ore, clays, sand and gravel. The availability of barge transportation would encourage the utilization of these natural resources. Waterway transportation offers the only feasible method of transporting some of the large and complex mechanisms that are now being assembled for transportation in the country's rapidly expanding scientific development. In view of the superiority of water transportation for some

elements of the mass transportation market, an objective evaluation was made of the need, prospective use and economic feasibility of channels from Echo to Morgan Bluff, and from Morgan Bluff to Longview.

a. Potential use of waterway.- To evaluate potential commerce for an improved channel on the Sabine River above Echo, a traffic survey was made of an area comprised of 14 counties in Texas and five parishes in Louisiana, which would constitute the tributary area for traffic on the Sabine River. The area is limited by the areas of the authorized navigation channels in the Trinity River on the west, the Red River on the east, and the Arkansas-White Rivers on the north. A field canvas of traffic was made during the period December 1964 - January 1965 by traffic and transportation specialists, and included personal interviews and corrrspondence with about 160 shippers and receivers of commodities in the tributary area. The total potential waterborne commerce reported for a navigable channel from Morgan Bluff to Longview amounted to 4,656,000 tons annually for the base year 1964, which was reduced to 690,000 tons after screening and analysis. As stated in appendix K to the report on the comprehensive basin study, this commerce was projected to increase to 13,333,000 tons by the year 2020. The channel from Morgan Bluff to Longview is included in the long range plan for construction after 2020.

During the period 1966 - 1968, a large linerboard mill was constructed at Morgan Bluff on the Sabine River. A field contact was made in 1966 with representatives of the firm constructing the mill to determine the commerce to be generated by this mill. The total potential waterborne commerce reported for a navigable channel from Echo to Morgan Bluff amounted to 497,000 tons annually for the base year 1968, comprised of linerboard, turpentine, and tall oil. The operators of the mill were contacted again in March 1970 and reported 1970 potential waterborne commerce of 315,000 tons of linerboard and 17,000 tons of tall oil.

b. Potential commerce.- The 1970 potential of 332,000 tons for a channel from Echo to Morgan Bluff was subjected to a rigorous analysis to eliminate those commodities that would not move on the waterway. A total of 212,000 tons of the reported commerce was eliminated from the channel from Echo to Morgan Bluff after screening and rate analysis, leaving a total of 120,000 tons of prospective commerce that would move by barge to Morgan Bluff on the improved channel. The prospective commerce on a channel from Echo to Morgan Bluff consists of 110,000 tons of linerboard and 10,000 tons of tall oil.

c. Projected prospective commerce.- Although additional industries are expected to locate along the proposed channel from Echo to Morgan Bluff during the period 1970-1975, the estimate of projected

commerce is based on future growth plans for the paper mill recently constructed at Morgan Bluff. The total prospective commerce for the channel to Morgan Bluff amounts to 186,300 tons in 1975 and 269,400 tons in 1980, and would remain at that level until 2025.

17. RECREATION.- Recreation demands in and adjacent to the Sabine River Basin are rapidly expanding because of increases in population, urbanization, income and education levels, leisure time, and other factors contributing to recreational activity. This expansion is expected to continue. Adequate opportunities for fulfillment of recreational desires are needed to complement the areas's improved standard of living. Water-oriented recreation opportunities are particularly important for demand satisfaction.

The location of the Sabine River Basin is such that it can offer recreational opportunities not only to its residents but also to the major urban centers of Dallas, Tyler, Shreveport, Beaumont, and Lake Charles. Presently, the basin has two major attractions in Lake Tawakoni, in the northern portion of the basin, and Toledo Bend Reservoir, located in the mid-basin area. Both are river authority projects. Lake Tawakoni provided opportunities for approximately one million visitors in 1969, and Toledo Bend Reservoir two million in 1969.

Present water-oriented outdoor recreational demands on the basin are about 7.5 million recreation-days. Fishing accounts for about half of this figure. These demands are expected to double by 1980. By 2020, nearly a five-fold increase can be expected, and by 2075, an eight-fold increase is estimated.

Existing water bodies in the Sabine Basin are not sufficient to support the outdoor recreational use expected. The proposed plan of water resource development for the basin is expected to provide significantly for demand satisfaction.

18. FISH AND WILDLIFE.- Aquatic and terrestrial habitats in the Sabine River Basin and the fish and wildlife they support are extremely important to the well-being of the people. Currently, these resources provide about 6.8 million man-days of sport fishing and hunting annually, and the commercial aspects have a primary annual value of about $4.4 million. By year 2020, fish and wildlife resources are expected to be able to provide about 10.2 million man-days of sport fishing and hunting annually, and the commercial aspects to have an annual value of about $5.4 million.

19. WATER QUALITY CONTROL.- The quality of water is of critical concern in planning for the use of this resource, for example, toxic or obnoxious pollutants may render the water unfit for human consumption, and chemical or mineral pollutants may make it unsuitable for

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industrial and agricultural purposes. Water pollutants may be classified according to eight general categories: (1) sewage and other oxygen-demanding wastes, (2) infectious agents, (3) plant nutrients, (4) organic chemical exotics, (5) other mineral and chemical substances, (6) sediments, (7) radioactive substances, and (8) heat. Although none of the above are consequential at the present time, it is recognized that they could cause problems of great concern and will increase many-fold in the future.

In general, the chemical quality of the waters of the Sabine River Basin is good to excellent. Local changes in the quality occur due to natural salt sources, oilfield brine, municipal and industrial wastes, and salt water intrusion from the Gulf of Mexico. As development proceeds, however, municipal and industrial waste loads will increase; demand on water will become more prevalent; and increased concentrations of pollutants can be expected throughout the basin.

All municipalities of significant size in the Sabine River Basin provide secondary waste treatment. Most smaller cities are either providing secondary treatment at present, or have plants under construction, or in the planning stage. In 1960, there were 22 industrial waste discharges to the Sabine River and tributaries. Most of the industries provide some form of treatment for their wastes or have treatment facilities in the planning stage.

Results of quality computations by the Federal Water Quality Administration indicate that storage of water for quality control will not be needed in the foreseeable future. However, the Sabine River Authority, through the Texas Water Development Board, and the Federal Water Quality Administration, is currently engaged in a cooperative study to develop a Water Quality Management Plan for the basin. The objective of the study is to identify and solve existing pollution problems and develop a long range plan for the basin.

It is expected that increased upstream water uses will decrease the flow in the Sabine River to such an extent that surface water intakes in Orange County and Calcasieu Parish will be contaminated by salt water intruding up the river. At that time, it will be necessary to construct a salt water barrier dam across the river in the vicinity of river mile 19.4. A navigation lock would be constructed adjacent to the dam.

20. HYDROELECTRIC POWER.- Need for electric capacity in the market area which included the Sabine River Basin has been forecast for the years 1980, 2000 and 2020. In view of the present status of development, there is little likelihood that sufficient hydroelectric power will be developed in the market area to satisfy the need for the 1980 area load. In view of the advantages of hydroelectric power, it is obvious that any proposed hydroelectric facility in the Sabine River Basin which meets the economic criteria for development could be adapted to the projected future loads of the market area.

COMPREHENSIVE BASIN STUDY

21. GENERAL.- A comprehensive basin study for the Sabine River and Tributaries, Texas and Louisiana, one of the 16 Type II studies for the United States selected by the Interdepartmental Staff Committee of the Ad Hoc Water Resources Council, serves as the supporting document for agency authorization reports. The Coordinating Committee report on the basin study was transmitted to the Water Resources Council on December 22, 1967, and to the President by the Council on December 16, 1969.

The comprehensive study consists of a basinwide investigation of the water and related land resource problems of the Sabine River Basin and its coastal areas, and the basin's effect upon its physical and economic area of influence. In formulating the plan, the well-being of the basin's people and those of the region and nation, was the influencing determinant in the near future and long-range development, utilization, and preservation of the basin's resources. Also considered were the preservation of unique areas of natural beauty, and of historical and scientific interests. The Sabine River comprehensive study provides a basis for: current and near future action programs, and an appraisal of longer range water and related land resource development needs and potentials as a guide to future planning and action programs, including construction.

Comprehensive planning for the Sabine River Basin was guided by Senate Document No. 97, 87th Congress, and by recent Federal legislation and policies. Planning included needs for flood control, water supply, water quality control, recreational, hydropower, and fish and wildlife conservation. Studies, investigations, and preparation of the Sabine comprehensive study were performed under the leadership of a Field Coordinating Committee. The Fort Worth District, Corps of Engineers, was chair agency of this Field Coordinating Committee composed of U. S. Departments of Army; Agriculture; Interior; Health, Education, and Welfare: Commerce; the Federal Power Commission; and the states of Texas and Louisiana. Texas was represented by its Water Development Board and Louisiana by its Department of Public Works.

The comprehensive report is arranged into a main or summary report, and a series of specialized technical appendixes covering specific areas of investigation with respect to water and related land resources. The main report summarizes physical and economic findings presented in detail in technical appendixes. Table 1 presents a list of technical appendixes. The states of Texas and Louisiana were major contributors in formulating the plan of development.

22. OBJECTIVES.- In seeking the most favorable projects for a basinwide plan, it is essential that flexibility and adaptability be

TABLE 1

TECHNICAL APPENDIXES

	Appendix	Responsible Agency	Cooperating Agency
A	PROJECT FORMULATION	CE	SCS, CE, PHS, BOR, BSF&WL, TEXAS, LOUISIANA
B	DESIGN INFORMATION AND COST ESTIMATES	CE	SCS
C	HYDROLOGY	CE	SCS, USGS, WB, BR, TEXAS
D	HYDRAULIC DESIGN	CE	SCS
E	WATER SUPPLY AND WATER QUALITY CONTROL	FWPCA	SCS, BR, TEXAS, LOUISIANA
F	LAND USE AND DEVELOPMENT	SCS	ERS, FS, TEXAS
G	DRAINAGE	SCS	CE, FS
H	IRRIGATION	SCS	ERS, BR, TEXAS, LOUISIANA
I	FLOOD PREVENTION AND UPSTREAM WATER RESOURCE DEVELOPMENT	SCS	
J	FLOOD CONTROL EVALUATION	CE	
K	NAVIGATION	CE	
L	HYDROELECTRIC POWER	FPC	SPA, CE, TEXAS
M	GEOLOGY AND SEDIMENTATION	SCS	CE, USGS
N	RECREATION	BOR	NPS, CE, SCS, FS, TEXAS, LOUISIANA
O	FISH AND WILDLIFE	BSF&WL	TEXAS, LOUISIANA
P	ECONOMIC BASE STUDY	CE	ERS, SCS, FS, BM, FWPCA, TEXAS
Q	MISCELLANEOUS DATA	CE	SCS
R	STATE AGENCIES	CE	SCS, BOR, BSF&WL, FPC, TEXAS, LOUISIANA

* * *

Dept. of the Army	CE	Corps of Engineers
Dept. of Agriculture	SCS	Soil Conservation Service
	ERS	Economic Research Service
	FS	Forest Service
Dept. of Commerce	WB	Weather Bureau
Dept. of Interior	BM	Bureau of Mines
	BOR	Bureau of Outdoor Recreation
	BSF&WL	Bureau of Sport Fisheries and Wildlife
	FWPCA	Federal Water Pollution Control Adm.
	BR	Bureau of Reclamation
	SPA	Southwestern Power Administration
	NPS	National Park Service
	USGS	U. S. Geological Survey
Dept. of Health, Education, and Welfare	PHS	Public Health Service
Federal Power Commission	FPC	Federal Power Commission

provided for possible modifications of use. An example is the possible adaptation and use of major basin developments in connection with the interstate and intrastate transfer of water proposed by the Texas Water Plan. The projects included in the long-range plan of development were formulated to maintain a balanced system and meet future water and related land resources needs to the maximum practicable extent. The important physical, legal, and design objectives and constraints are presented below by project purposes.

a. Flood control and flood prevention.-

(1) Protection of urban areas against floods of standard project flood magnitude would be provided if economically feasible.

(2) Rural areas affected by the main stem and major tributaries would be provided protection against floods with a 50-year recurrence interval to the extent feasible.

(3) A period of approximately 30-60 days was considered necessary for evacuation of flood control storage in proposed Corps of Engineers reservoir projects in recognition of the basin's runoff characteristics.

(4) Hurricane protection for the Port Arthur area has been authorized by the 1962 Flood Control Act as described in House Document 505, 87th Congress, 2d Session. However, there does exist a tidal condition upstream on the Sabine River at Orange and on the Neches River at Beaumont; therefore, studies in the Sabine Lake area would possibly justify hurricane protection projects for inland communities in addition to those fronting inland bays such as Port Arthur and vicinity. The Comprehensive Texas Coast Hurricane Studies now in progress will give consideration to individual protective structures, as well as a unitized protective system along the beaches and barrier islands along the Texas Gulf Coast, projecting 100 years into the future with emphasis on the first 50 years. The initial survey report of which the Sabine Lake area will be a part is tentatively scheduled for submission in 1977.

(5) The beneficial effects that will occur from flood plain information studies authorized by Public Law 86-645, July 1960, were considered. Also considered were the beneficial effects of existing and proposed flood warning and flood forecasting programs of the United States Weather Bureau.

b. Water supply.-

(1) In planning for water resources development, consideration was given to all types of needs for water use and services that may be projected to develop within the 100-year economic life of the project.

(2) Each reservoir in the study program was investigated in terms of cost of water supply storage and the constant rate of withdrawal or yield produced, the period of analysis being the longest completely recorded period of sustained low flows occurring during the study period 1924-1965. Storages selected for recommended projects were tempered by existing and projected water resource needs of the reservoir's immediate area of influence, for the basin as a whole, and for a wider area of influence outside the basin.

(3) Demands for water supply in the Sabine River Basin were met with ground water and with resources from within and outside the basin.

(4) Existing water rights and priorities of use established by the States of Texas and Louisiana, including the Sabine River Compact, were recognized. Planning for future water supply development has been fully coordinated with municipalities, water control and improvement districts, and the Texas Water Development Board.

c. Hydroelectric power.- Consideration was given to the hydroelectric power potential at all reservoir projects. Criteria for these investigations were those established by the Federal Power Commission in Appendix L, of the Comprehensive Basin Study.

d. Navigation.-

(1) Waterway channel dimensions and alignment in the Sabine River Basin were investigated to be compatible with the interconnected inland waterways system of the United States and the efficient accommodation of the barge traffic expected to use the waterway.

(2) The long-range plan provides for ultimate development of the water transportation potential of the basin by extension of a barge channel from Pruitt Bluff to the vicinity of Longview, Texas.

(3) There is a present need for water transportation to service the existing industries in the Pruitt Bluff area, and such an improvement is economically justified. The short range plan provides for construction of a barge channel from Echo to Pruitt Bluff.

(4) Increasing use of the river by recreational craft requires that this activity must be considered as an important potential user of any inland waterway system.

e. Recreation and fish and wildlife.-

(1) Water-based recreation as a parallel purpose for each project studied was investigated and facilities provided to the maximum practicable extent to accommodate projected participation. The plan so developed encompassed the useful life of each recommended project.

(2) Recommendations of the Fish and Wildlife Service, the Louisiana Wildlife and Fisheries Commission, and the Texas Parks and Wildlife Department for the conservation and enhancement of fish and wildlife resources of the basin were incorporated in the planning where feasible. Included in this consideration is the Sabine Basin's share of 600,000 acre-feet annually of fresh water flow into Sabine Lake, and 50,000 acre-feet per year to control salinity on coastal marshes.

23. COMPREHENSIVE PLAN.- The comprehensive plan developed for the Sabine River Basin in the type II report includes existing, under construction, and authorized water control facilities, and additional improvements required to meet near future and long range needs. Tables 35 and 43, appendix A of the type II report, show Federal and non-Federal schedules for reservoir construction and the total comprehensive plan of development, short and long range. In the interim since the type II study, changes have occurred in the non-Federal reservoir schedule. Stages I and II Highway 322 Reservoirs are now rescheduled, stage I to be constructed immediately and stage II circa 2010. It is probable that further development may indicate needs for local adjustment or supplements to the comprehensive plan which may be done with little or no loss in overall efficiency It is believed that as water requirements both in and out of basin develop to the extent that these projects are needed, further analysis will be made to assure that the projects would serve all purposes found desirable and justified at that time. The Corps of Engineers' short and long range plan of the type II report is re-identified as follows:

a. Short range projects.- Short range projects were those found to be needed now, in the near future, or which, although beyond a 10- to 15-year period of need, play a unique or important role in a planned system for the basin. Selected in this category were: multiple purpose reservoirs, Mineola, Lake Fork and Big Sandy Reservoirs, including their associated flood release channels; Greenville local flood protection; and navigation from Echo to Pruitt Bluff, Texas.

b. Long range projects.- Projects in the long range plan included two main stem multiple purpose reservoirs, navigation above Pruitt Bluff, and a local flood protection project. Carthage Reservoir, located at Sabine River mile 321.3, is included in the long range plan as needs for its flood control, water supply, recreation, navigation and/or hydropower potentials develop. The project is planned for the period 2000-2020. Bon Wier Reservoir, located at Sabine River mile 101.9, is included in the long range plan for navigation, hydropower, and recreation when lower basin demands for its water supply accrue. This project is scheduled after 2020. Navigation above Pruitt Bluff, Texas, to Longview, Texas, is included in the long range plan for construction after 2020; a local flood protection project at Orange, and a salt water barrier dam are also long range elements of the comprehensive plan. When flows have been reduced to such an extent near the river's mouth as to permit salt water intrusion, a salt water barrier will be necessary in the vicinity of Sabine River mile 19.4.

PROJECTS SELECTED FOR RECOMMENDATION

24. GENERAL.- A reassessment of potential Corps' projects in the type II report short range plan did not produce a change in projects selected for this category. Accordingly, multiple purpose reservoirs at Mineola, Lake Fork and Big Sandy sites; a local flood protection project at Greenville, Texas; and a shallow draft navigation project extending from Echo to Pruitt Bluff in the short range plan remain for further analysis. Tests were conducted for these basic projects in combination with one another and with other structural and nonstructural measures to determine the most efficient system, or plan, to meet short range needs. Plans were evaluated in terms of meeting basin objectives, national goals for full employment, economic efficiency, and environmental quality.

25. SCOPE OF PROJECT DEVELOPMENT.- Maximization studies were conducted in the type II report for Mineola, Lake Fork, and Big Sandy Reservoirs and the Greenville, Texas local flood protection project. Flood control storages in all reservoirs maximized at less than 20-year frequency. This point of maximization was based upon the assumption that future development in the flood plain would not increase more rapidly with the improvements than without them. If only 20-year protection were provided, more damageable developments could take place throughout the flood plain because of a false sense of security that may be created among land owners, thus causing more damages from the larger floods. For this reason, and because of the scarcity of good reservoir sites and the need to make proper use of those remaining, all three reservoirs were designed to regulate the 50-year flood, in this instance the flood of record.

Results of maximization studies for water supply and yield developments of the type II report and this report are presented below. Water supply storages for the three reservoirs are identical in both reports. Changes in yields are the result of additional discharge records. Maximization studies were not repeated for this report.

	Reservoir yield (cfs)		
	Type II report		This report
Reservoir	Maximized	Adopted	Adopted
Mineola	110	129	129
Lake Fork	250	250	244
Big Sandy	102	102	102

26. CONDITIONS OF PLAN ANALYSIS.-

a. General.- In exploring combinations of structural and nonstructural alternatives, water supply storage in multiple purpose

reservoirs was established to produce yields shown in the previous tabulation. These storages were held constant for all analyses. Variables in all plans were the structural and nonstructural measures tested for flood control purposes. Costs for mitigation of wildlife losses are included in the analyses, as structural measures tested impose these losses. In all cases, mitigation measures are estimated to at least replace losses.

b. Nonstructural alternatives.-

(1) General.- The general problem of preventing flood damages has no complete solution. The Federal Government is actively engaged in a widespread flood control construction program, but the extent of protection provided by these facilities is limited by location, economic considerations, and the cooperation of local authorities. In spite of these projects, no low-lying area is completely free of a flood threat, and many areas are unable to qualify for any flood protection works. By development of flood plain information, flood damages can be reduced by indicating flood hazards and encouraging proper use of the flood plains. The Corps of Engineers is authorized to provide flood plain management services by Section 206 of the 1960 Flood Control Act, PL 86-645, as amended (33 USC 709a). Flood plain management services (FPMS) will be provided upon request to states, local governmental agencies, and Federal agencies. The purpose of the FPMS is to provide flood plain information and technical assistance needed for planning the best use of land subject to flooding by streams and lakes. The following paragraphs outline a program of nonstructural measures that would become a part of the plan of improvement for the prevention of future flood damages.

Enabling state legislation is provided in S.B. 668, signed June 1969, for counties to regulate the use of lands in flood plains of streams within their jurisdiction. This, in addition to the existing authority by cities and towns, affords a means of establishing flood plain management practices throughout all of Texas. Implementation of this means of further flood damage reduction should be hastened throughout the Sabine River watershed.

(2) Flood plain regulations.- Flood plain regulations as an integral part of an overall program for community development are considered the most useful of the preventive tools for reducing loss of life, property damage, and the ultimate cost of flood control to prevent flood damages. They involve the use of powers available to a state or community to guide and control the use and development of flood hazard areas. Zoning, subdivision regulations, channel and other encroachment statutes, and building codes are examples of the type of flood plain regulations that can be used to regulate the flood plain and prevent future flood damages.

(3) Urban redevelopment.- Urban renewal can be used in flood blighted areas that are a drain on the economic life and welfare of the community and do not lend themselves to other methods of regulation and control.

(4) Development policies.- Resistance to the extending of utilities and to the construction of local streets will deter development in flood plains, as will many other day-to-day policy and action decisions. Construction of schools and other public facilities outside the flood plain would wield a negative influence on flood plain exploitation.

(5) Creating open spaces.- Great emphasis is being placed on the growing need for vastly increased areas for recreational and other open space uses. Areas adjacent to streams and other bodies of water have a natural attraction and are readily adaptable to recreation and other open areas. Parks, playgrounds, and picnic areas can utilize lands which would not be suitable for facilities with a high damage potential. Development rights, easements, or fee title to undeveloped flood prone areas could be acquired to provide the needed open space areas at reasonable costs.

(6) Tax adjustments.- Tax adjustments for land dedicated to agricultural, recreation, conservation, or other open space uses may be effective in preserving existing floodways along streams.

(7) Warning signs.- A method which may be used to discourage development in a flood hazard area is the erection of flood warning signs in prominent places that have experienced high water levels. These signs would carry no enforcement but would serve to inform prospective developers that a flood hazard exists.

27. RESERVOIR PLANS INVESTIGATED.-

a. Plan A.- Plan A consists of the Mineola, Lake Fork, and Big Sandy reservoir system with flood control storage capable of controlling the 50-year flood at the dam sites to existing channel capacities. In this plan, flood control storage is sufficiently large to obviate the need for complementary channels, levees, or flowage easements during flood operation.

b. Plan B.- This plan consists of the three-reservoir system with Lake Fork and Big Sandy Reservoirs identical in storage and operation to those in Plan A and with Mineola Reservoir identical in storage to Plan C. Flowage easements would be provided for flood releases from Mineola Reservoir for this plan. Releases from the project would be regulated to 8,500 cfs until a 25-year flood storage of 549,750 acre-feet was available. Releases for the remaining 124,750

acre feet of flood storage would be regulated to the existing channel capacity of 2,000 cfs. Since reservoir releases resulting from minor floods would be limited to the existing channel capacity, few benefits would be lost to the downstream flowage area.

c. Plan C.- Plan C capacities of storage are identical to those of the recommended plan in the type II report. However, flowage easements would be provided in place of channels for flood releases.

d. Plan D.- This is the plan selected in the type II report. The objective in this plan was to find the most efficient and economical combination of reservoir storages and channel capacities necessary for reservoir releases to provide the approximate same degree of control as provided in plan A.

e. Plan E.- Flood control storage is not included in plan E. The same three reservoir sites would be used for water supply storage only. Downstream flooding would be handled through a combination of channel improvements and flood plain management. Under this plan, the major portion of average annual flood damages would still occur.

f. Plan F.- Plan F consists of three water supply reservoirs in combination with continuous parallel levees extending below respective dam sites to the head of Toledo Bend Reservoir. The objective in selection of levees was to control reservoir spills resulting from the 50-year flood.

28. SELECTION OF RESERVOIR PLAN.- Cost and benefit analyses conducted for reservoir plans A through D showed that on a total system basis, each plan was economically justified. Plans E and F did not develop benefits equal to costs and were eliminated from the program. Further tests were required to assure that each project in plans A through D were economically justified, as well as each purpose in the project. Incremental flood control analyses, shown in appendix A, resulted in plan A returning the greatest excess of flood control benefits over costs for each reservoir in its most critical position while providing the same degree of protection as all other systems. Benefits were also found to be in excess of costs for incremental water supply and recreation and fish and wildlife purposes. For these reasons and because plan A tended to minimize downstream adverse impacts on fish and wildlife values, plan A was selected as the plan of development.

29. PROJECTS RECOMMENDED FOR AUTHORIZATION.- Projects formulated and designed to fulfill existing and near-future water control and related land resource requirements are proposed for authorization. In this plan are major multiple purpose reservoirs to provide flood control, water supply, recreation, and fish and wildlife conservation.

Navigation above Echo to Morgan Bluff has been found to be fully justified as an element in the plan. A channel rectification project at Greenville, Texas, is recommended on Long Branch, together with flood plain management. Plan of development is shown on plate 2.

a. Mineola Reservoir.- Mineola dam site is located at river mile 475.6 on the Sabine River, about 38.9 miles downstream from the existing Iron Bridge Dam, and about two miles upstream from U. S. Highway 80. The reservoir would be in parts of Wood, Rains, and Van Zandt Counties. The project would be formed by an earth and rock fill dam with a maximum height of 90.5 feet above the streambed and a total length of 26,300 feet, including a concrete spillway 232 feet long. The spillway, with a net opening of 200 feet and located in a saddle on the right bank, would be a gate-controlled ogee weir controlled by five 40- x 35-foot tainter gates separated by 8-foot piers. The outlet works would consist of two 4- x 8-foot conduits controlled by two 4- x 8-foot slide gates.

The reservoir would have a total controlled storage of 1,375,000 acre-feet and a water surface area of 46,900 acres at elevation 400.0, top of flood control pool. Top of the water supply pool would be at elevation 372.5 with an area of 23,900 acres and a capacity of 386,000 acre-feet. Total allowance for a 100-year accumulation of sediment would be 20,400 acre-feet. The net water supply storage of 370,100 acre-feet would provide a dependable yield of 83.4 million gallons per day under 2020 conditions of watershed development during a recurrence of the most severe drought of record. Land requirements for construction of the dam and operation of the reservoir for the several purposes would be about 57,000 acres in fee simple. Additional lands required in fee simple for public use and access would be about 600 acres.

b. Lake Fork Reservoir.- Lake Fork dam site is located at river mile 28.1 on Lake Fork Creek, about three and one-half miles west of Quitman, Texas. The reservoir would lie in parts of Wood, Rains, and Hopkins Counties. This project would be formed by an earth and rock fill dam with a maximum height of 106.5 feet above streambed and a total length of 16,130 feet, including a 100-foot concrete spillway. The spillway, located in a saddle on the left bank, is an uncontrolled broadcrested weir; and the outlet works is a 12-foot diameter conduit controlled by two 5.5- x 12-foot slide gates.

Lake Fork Reservoir would have a total controlled storage of 1,113,000 acre-feet and a water surface area of 40,065 acres at elevation 411.5 top of flood control pool. At elevation 397.0, top of water supply pool, the reservoir would have an area of 26,400 acres and a storage capacity of 638,100 acre-feet. Total allowance for a

100-year accumulation of sediment would be 18,900 acre-feet. The net water supply storage of 621,500 acre-feet would provide a dependable yield of 157.7 million gallons per day under 2020 conditions of watershed development during a recurrence of the most severe drought of record. Land requirements for construction of the dam and operation of the reservoir for the several purposes would be about 54,200 acres in fee simple. Additional lands required in fee simple for public use and access would be about 200 acres.

c. Big Sandy Reservoir.- Big Sandy dam site is located at mile 15.3 on Big Sandy Creek about six miles northwest of Big Sandy, Texas. The reservoir would be virtually contained in Wood County, with a small area extending into Upshur County. This project would be formed by an earth and rock fill dam with a maximum height of 94.5 feet above streambed and a total length of 6,200 feet, including the concrete spillway. The spillway is a 100-foot uncontrolled broadcrested weir; and the outlet works is a 9-foot diameter conduit controlled by two 4.25- x 9-foot slide gates.

Big Sandy Reservoir would have a total controlled storage of 418,200 acre-feet and a water surface area of 16,580 acres at elevation 382.0, top of flood control pool. At elevation 367.5, top of water supply pool, the reservoir would have an area of 10,810 acres and a storage capacity of 221,200 acre-feet. Total allowance for a 100-year accumulation of sediment would be 6,900 acre-feet. The net water supply storage of 215,300 acre-feet would provide a dependable yield of 65.9 million gallons per day under 2020 conditions of watershed development during a recurrence of the most severe drought of record. Land requirements for construction of the dam and operation of the reservoir for the several purposes would be about 21,400 acres in fee simple. Additional lands required in fee for public use and access would be about 400 acres.

d. Navigation-Echo to Morgan Bluff.- The short range navigation plan presented in appendix K, volume 4, of the report on the comprehensive basin study, proposed the construction of a 12- by 125-foot channel extending from Echo about 4.5 miles upstream to and including a turning basin at Pruitt Bluff, Orange County, Texas. The initial potential user of the channel would be the paper mill constructed at Morgan Bluff in 1966-67 by the Forest Products Division of the Owens-Illinois Company. Morgan Bluff was considered for the turning basin site in 1966. However, the company stated that this site was being reserved for future construction, and the turning basin was relocated to Pruitt Bluff, about one mile southeast of the paper mill. Conditions are presently such that the company prefers the closer location at Morgan Bluff, and the proposed turning basin has been moved back to this location. The channel to Morgan Bluff would be a sea level extension of the authorized channel from Orange to Echo, which will be 12 feet deep and 125 feet wide. The

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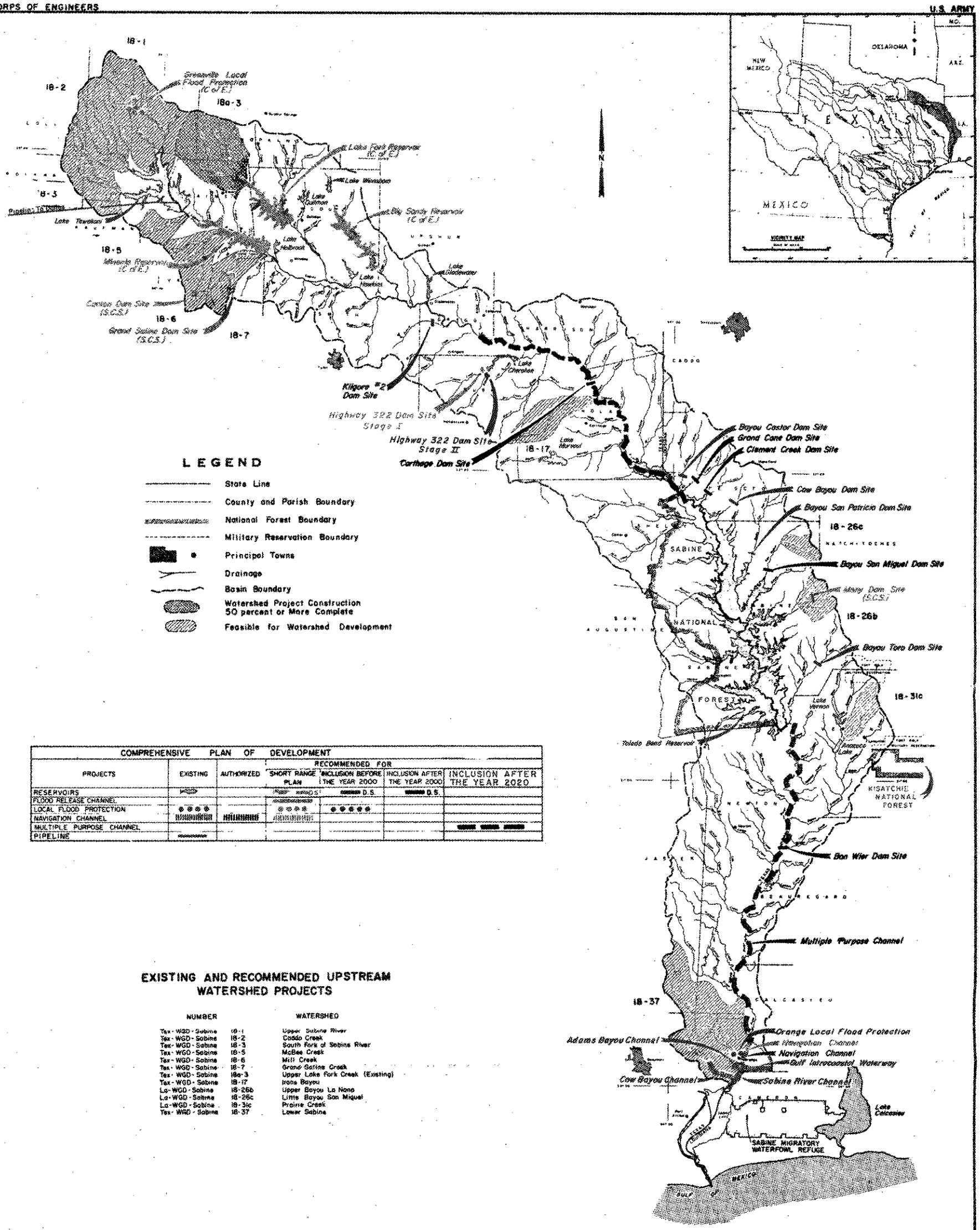

COMPREHENSIVE PLAN OF DEVELOPMENT						
PROJECTS	EXISTING	AUTHORIZED	RECOMMENDED FOR SHORT RANGE PLAN	INCLUSION BEFORE THE YEAR 2000	INCLUSION AFTER THE YEAR 2000	INCLUSION AFTER THE YEAR 2020
RESERVOIRS					D.S.	D.S.
FLOOD RELEASE CHANNEL						
LOCAL FLOOD PROTECTION						
NAVIGATION CHANNEL						
MULTIPLE PURPOSE CHANNEL						
PIPELINE						

EXISTING AND RECOMMENDED UPSTREAM WATERSHED PROJECTS

NUMBER		WATERSHED
Tex-WGD-Sabine	18-1	Upper Sabine River
Tex-WGD-Sabine	18-2	Caddo Creek
Tex-WGD-Sabine	18-3	South Fork of Sabine River
Tex-WGD-Sabine	18-5	McBee Creek
Tex-WGD-Sabine	18-6	Mill Creek
Tex-WGD-Sabine	18-7	Grand Saline Creek
Tex-WGD-Sabine	18a-3	Upper Lake Fork Creek (Existing)
Tex-WGD-Sabine	18-17	Irons Bayou
La-WGD-Sabine	18-26b	Upper Bayou La Nana
La-WGD-Sabine	18-26c	Little Bayou San Miguel
La-WGD-Sabine	18-31c	Prairie Creek
Tex-WGD-Sabine	18-37	Lower Sabine

10 0 10 20 30 Miles
Approximate Scale

BASE MAP COMPILED BY USDA SOIL CONSERVATION SERVICE FT. WORTH, TEXAS FROM USGS 1:500,000 BASE AND AMS 1:250,000 MAPS

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
PLAN OF DEVELOPMENT

channel would provide a direct barge link with the Gulf Intracoastal Waterway, presently 12 feet deep and 125 feet wide, but authorized for enlargement to a depth of 16 feet and a width of 150 feet between the Sabine River and the Houston Ship Channel. It is considered that the channel to Morgan Bluff should be designed for limited two-way traffic, initially by two-barge push tows. The design barge size considered is 35 feet wide and 195 feet long.

To accommodate the prospective commerce to industries located along the Sabine River above Echo, the waterway project should be extended to provide a 12- by 125-foot channel in the Sabine River from a point on the authorized channel to Echo upstream to and including a turning basin 600 feet square at Morgan Bluff, Texas, a channel distance of about 5.25 miles. Estimates of the number of aids to navigation and estimates of their construction cost and maintenance cost were furnished by the Commander, Eighth Coast Guard District, New Orleans, Louisiana.

Channel rights-of-way were based on a channel 12 feet deep and 200 feet wide, with side slopes one vertical on three horizontal, plus an additional 50-foot strip outside the top-of-slope on both sides of the channel. Spoil disposal areas would be acquired for disposal of materials from the proposed dredging work and subsequent maintenance. Estimated spoil disposal area requirements were based on disposal of dredged material to an average height of five feet in leveed areas adjacent to the channels. Land area requirements for the proposed navigation project total 630 acres, 250 acres in fee simple for rights-of-way and 380 acres in easements for spoil disposal areas. This reach of the Sabine River is devoid of mineral industry installations except for several pipelines that cross the river from Texas into Louisiana.

e. Local flood protection, Greenville, Texas.-

(1) Cowleech Fork of Sabine River.- Two alternative plans of protection were studied for Cowleech Fork of the Sabine River. The first was a restudy of the original plan presented in the type II report. This channel had a 100-foot bottom width extending three miles from 1,000 feet south of Interstate Highway 30 upstream to the city of Greenville water supply reservoir. The plan would have provided 200-year protection for the reach with the proposed upstream project for watershed protection planned by the Soil Conservation Service in operation. The second study provided a 30-foot bottom width channel, extending through the same reach, in combination with flood plain management. This plan would have provided 100-year protection to two areas in the city within the 100-year flood plain zone. The results of studies made during the reassessment indicated that both plans are unjustified economically, incremental to the Soil Conservation Service program.

A map is provided in appendix D, plate number 13 showing the 100-year flood limits to be expected on Cowleech Fork under existing conditions. Since the Cowleech Fork flood plain is largely undeveloped at this time regulations of the land use in this flood plain should be effected in order to prevent future flood damage pending possible improvements in the reduction of flood discharges by upstream developments.

Consideration should be given to providing a designated floodway including the channel (or conservation zone) to be reserved, by zoning or the establishment of encroachment lines, which should be adequate for the passage of a selected flood of a specific size, or magnitude, without unduly raising water surface elevations upstream. Then the zone outside the encroachment lines (development zone) would be available for use by new construction using fill or establishing elevations above the selected flood water surface elevations.

Recreational areas, open space uses, parks and playgrounds are suggested for possible development of these flood areas.

(2) Long Branch.- Two plans were studied on Long Branch, which passes through Greenville. The first was a restudy of the type II report plan. When structural programs on the Cowleech Fork of the Sabine River failed to return benefits in excess of costs, reformulation of the Long Branch program was required. Under the new, or flood plain management program, along Cowleech Fork, channel improvement on the lower reach of Long Branch would have no beneficial effect. The plan now recommended for authorization provides for a 25-foot bottom width channel providing 100-year protection extending 3.34 miles on Long Branch from a point 3,600 feet below Interstate Highway 30 upstream to O'Neal Street.

29A. SCHEDULE OF DEVELOPMENT.- Needs for navigation on the lower Sabine River from Echo to Morgan Bluff, and flood protection for the city of Greenville, are considered to be immediate. Projects to supply these needs are, therefore, recommended for authorization and immediate construction.

As set forth in this report, and supported by the type II report, the need for major flood control developments in the Sabine Basin is also immediate. Multiple purpose reservoirs Mineola, Lake Fork, and Big Sandy are recommended to supply this need when there is a demand for their water supply development. Mineola and Lake Fork Reservoirs are estimated to be needed to meet in-basin and out-of-basin demands on or before 1980; Big Sandy during the decade 1990-2000. These projects are accordingly recommended for authorizations and construction on this basis.

ECONOMIC EVALUATION OF PROJECTS SELECTED FOR RECOMMENDATION

30. GENERAL.- Economic evaluations were made of the projects selected for recommendation in this report. The projects were appraised to assure that: (a) project benefits exceed costs; (b) each separable unit or purpose provides benefits at least equal to its cost; (c) each element of the plan provides the maximum net benefits consistent with development of a balanced plan; and (d) there is no more economical means, evaluated on a comparable basis, of accomplishing the same purpose or purposes. Project costs and benefits are based on January 1970 prices.

31. COSTS.- First costs include all initial expenditures for project construction, including lands and damages, relocations, reservoir clearing, hydrologic instrumentation, engineering and design, and supervision and administration. Annual charges include amortization of the investment at an interest rate of 4-7/8 percent for a 100-year period, with one exception, plus annual operation and maintenance charges which include hydrologic instrumentation and the annual equivalent cost of major replacements. The exception refers to the 50-year amortization for the Echo to Morgan Bluff navigation project. Federal and non-Federal economic and financial first costs are shown in table 2 for all projects in the recommended plan. First cost and annual charges for all recommended projects are shown in table 2A.

32. BENEFITS.- Benefits which will result from the projects recommended for authorization have been estimated on the basis of a useful project life of 100 years, except for the Echo-Morgan Bluff navigation project, which was estimated on the basis of a 50-year life. Estimates of average annual benefits assigned to each of the projects are shown in table 2A. The benefits expected to accrue from future flood plain development, future use of water supplies, and future savings in transportation costs have been expressed as an average annual equivalent value by compound interest methods. A summary of annual benefits for the system is described below and is shown in table 3.

a. Flood control.-

(1) Damage prevention.- The average annual benefits from flood damage reduction accruing to the projects recommended by the Corps of Engineers were determined by use of discharge-damage and discharge-frequency relations, with allowances to reflect economic trends and future development in the flood plain (without the projects) during the period 1975 and 2075. Average annual damages of $5,243,200 would be reduced by the recommended main stem and tributary projects to $1,504,000, producing a benefit of $3,739,200. The benefit area below the recommended system of reservoirs extends about 250 river miles to the head of Toledo Bend Reservoir, and about 156 river miles

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TABLE 2

ECONOMIC AND FINANCIAL FIRST COSTS
RECOMMENDED PLAN OF DEVELOPMENT
($1,000)

	Minoola Reservoir	Lake Fork Reservoir	Big Sandy Reservoir	Greenville Local Flood Protection	Navigation Echo to Morgan Bluff	Total
Federal						
Economic Cost	44,802.0	23,647.0	12,221.0	100.3	1,765.2	82,535.5
Δ Recreation (1)	1,113.0	244.0	791.0	--	--	2,148.0
Δ Relocations (2)	8,276.0	9,574.0	3,668.0	--	--	21,518.0
Financial Cost	54,191.0	33,465.0	16,680.0	100.3	1,765.2	106,201.5
Non-Federal						
Economic Cost	32,564.0	34,880.0	16,040.0	80.7	287.8	83,852.5
Δ Recreation (1)	1,114.0	244.0	791.0	--	--	2,149.0
Financial Cost	33,678.0	35,124.0	16,831.0	80.7	287.8	86,001.5
Total						
Economic Cost	77,366.0	58,527.0	28,261.0	181.0	2,053.0	166,388.0
Δ Recreation (1)	2,227.0	488.0	1,582.0	--	--	4,297.0
Δ Relocations (2)	8,276.0	9,574.0	3,668.0	--	--	21,518.0
Financial Cost	87,869.0	68,589.0	33,511.0	181.0	2,053.0	192,203.0

(1) Δ Recreation is the difference in future facilities discounted and not discounted.

(2) Δ Relocations is the difference in replacement "in-kind" and replacement to 1970 standards.

TABLE 2A

ECONOMIC SUMMARY OF PROJECTS IN PLAN OF IMPROVEMENT
SABINE RIVER AND TRIBUTARIES
(Values shown in $1,000)

Project	Estimated First Cost	Annual Economic Costs	Annual Benefits			Excess Benefits Over Costs	B/C Ratio
			Excluding EDA	EDA	Total		
Multiple purpose reservoirs							
Mineola	87,869.0	4,877.2	6,295.8	75.1	6,370.9	1,493.7	1.3
Lake Fork	68,589.0	3,599.0	6,146.8	57.7	6,204.5	2,605.5	1.7
Big Sandy	33,511.0	1,928.5	2,985.6	30.8	3,016.4	1,087.9	1.6
Total - reservoirs	189,969.0	10,404.7	15,428.2	163.6	15,591.8	5,187.1	1.5
Greenville Local Protection	181.0	11.8	13.0	0	13.0	1.2	1.1
Navigation channel from Echo to Morgan Bluff	2,053.0	170.0	616.0	0	616.0	446.0	3.6

TABLE 3

SUMMARY OF BENEFITS
(Annual values in dollars)

FLOOD CONTROL	
Damage prevention	$ 3,739,200
Improved agricultural efficiency	$ 200,000
Sediment reduction in Toledo Bend	$ 10,000
TOTAL FLOOD CONTROL BENEFITS	$ 3,949,200
WATER SUPPLY	
Basin water supply	$ 8,677,200
Effects on power production at Toledo Bend	(insignificant)*
TOTAL WATER SUPPLY BENEFITS	$ 8,677,200
GENERAL RECREATION	$ 1,784,300
FISH AND WILDLIFE	$ 1,030,500
NAVIGATION	$ 616,000
SUBTOTAL	$16,057,200
ECONOMIC DEVELOPMENT ADMINISTRATION	$ 163,600**
TOTAL BENEFITS	$16,220,800

*See paragraph 40, Main Report.
**Not used in cost allocation studies.

below Toledo Bend Dam to the river's mouth. The recommended Greenville local flood protection project provides a high degree of protection to residential areas and will affect many beneficiaries.

(2) Improved agricultural efficiency.- Flood protection features of the recommended structural measures will result in an increased effectiveness of improved technology applied on the agricultural flood plain. The response to technological improvements in flood plain farming has been small or nil under existing conditions due to frequent flooding. With the structural works installed, operators of Sabine River flood plain lands above Toledo Bend Reservoir will obtain results more commensurate with their inputs associated with applied technology.

Crop and pasture yield data developed by the Texas Agricultural Experiment Station for predominant soils of the Sabine flood plain were analyzed to determine the effect of applied technology. The increases in the average yields of major crops and pasture in each stream reach were converted to production and the net monetary return to flood plain operators over that realized under existing conditions. The total average annual benefit from improved effectiveness of applied technology is estimated at $200,000. It is recognized further that the reduced flooding and more timely removal of excess water will encourage increased use of available technology, including management and cultural practices for which no benefits have been estimated.

(3) Sediment reduction in Toledo Bend.- Construction of the recommended reservoirs in the upper portion of the Sabine will result in a reduction of sediment deposition in Toledo Bend Reservoir, thereby conserving valuable storage space or increasing the effective life of the downstream facility. Sediment studies completed on the Sabine River showed that sediment deposition in Toledo Bend Reservoir will be reduced on the average by 171 acre-feet annually with the three upstream reservoirs in place. The estimated average annual value of this reduction is $10,000.

b. Water supply.-

(1) Basin water supply.- The value of water supply benefits was based on the least alternative costs (single purpose reservoirs) for development of supplies of like quantity and quality. Recent sales of local municipal and state revenue bonds indicated that a 6-1/2 percent interest rate for amortization should be adequate to cover repayment, interest, and associated financing charges. Thus, water supply benefits were estimated to be $8,677,200 annually.

c. Recreation.- Benefits for general recreation were computed on the basis of estimated annual attendance at each project locality, using a unit value per recreation-day. One dollar was used as the value of a general recreation-day at Mineola and Big Sandy Reservoirs, and $1.50 at Lake Fork Reservoir for the preferred atypical development. Benefits accruing to the three reservoirs amount to $1,784,300.

d. Fish and wildlife.- Fish and wildlife benefits were established in accordance with procedures and policies set forth in Senate Document No. 97, and Supplement No. 1, Evaluation Standards for Primary Outdoor Recreation Benefits.

The value used for fresh water sport fishing and most small game hunting was one dollar per man-day. Specialized hunting activity such as hunting for white tailed deer, turkey, some upland game, and waterfowl ranged in value from $2.00 to $6.00 per man-day. The lower range of values was used for upland bird hunting, the middle range for turkey and waterfowl hunting, and the upper range for deer hunting. Net fish and wildlife benefits for all Corps of Engineers works proposed in short range category would be approximately $1,030,500, with provision for recommended access and fishery management works.

e. Navigation.- Projected annual benefits from the movement of shallow draft traffic over the improved channel in the lower Sabine River between Echo and Morgan Bluff, Texas, were based on 1970 price levels. Benefits were converted to an average annual equivalent benefit, with a compound interest rate of 4-7/8 percent and a period of 50 years. The benefits attributable to the proposed channel from Echo to Morgan Bluff will be derived through savings in transportation costs. These savings were computed as the difference between costs at the minimum prevailing rates for movement of goods by the alternative means and those which would be charged on the proposed channel. Average annual equivalent benefits for the 50-year life of the project are estimated at $616,000.

f. Economic Development Administration.- The recommended projects will provide job opportunities in construction and operation for local labor within commuting distance from seven counties designated by the Economic Development Administration as areas of unemployment or underemployment. Estimates of the value of available unskilled and semi-skilled labor which could be utilized were prepared in accordance with ER 1165-2-6. Area employment effects were based on the estimated periods for construction and a 20-year straight line reduction to zero for project operation and maintenance. The total average annual redevelopment benefits expected to result from the recommended projects are estimated to approximate $164,000.

33. ECONOMIC JUSTIFICATION.- Estimates of annual charges and benefits and ratios of benefits to costs in table 2 show that the annual benefits would exceed the annual costs for the projects considered individually and as a system.

PHYSICAL AND ECONOMIC IMPACT OF PLAN

34. INTRODUCTION.- In formulating a comprehensive plan of development, the physical effects, both beneficial and adverse, of all elements and purposes of water and land resource application are necessarily measured and evaluated. Where possible, such effects are expressed in economic terms and these, together with unquantified effects, including minimization or mitigation, where feasible, of adverse effects, are utilized in the decision making process. The upper Sabine Basin crosses the southern portion of the Caddoan archeological area; the lower Sabine courses through a region that is virtually unexplored archeologically. Studies by the National Park Service will be requested for the preservation and enhancement of areas of archeological, historic, scientific, and visual interest when advanced engineering and design work are initiated for the recommended projects.

35. WATER SUPPLY.- Water supply requirements for the Sabine River Basin were projected to estimate in-basin needs for municipal, industrial, rural, irrigation, navigation, and fish and wildlife demands for the years 1980, 2000, 2020, and 2075. Also considered were diversion demands to be placed on the basin's water resources, estimated to occur from the upper basin on or before 1980, and from the lower basin in accordance with the Sabine River Compact.

Water quality analyses showed that surface waters of the Sabine River Basin will not be degraded below approved water standards in the foreseeable future; therefore, no flow augmentation demands are included for this purpose. Mineola, Lake Fork, and Big Sandy Reservoirs, in the recommended plan, would yield 307.0 million gallons per day, and three upstream watershed projects, 4.8 million gallons per day.

The Texas Water Plan Report of November 1968 proposes the export of 200,000 acre-feet annually from Mineola and Lake Fork Reservoirs for diversion through the Texas Water System. The Texas Water Plan Report states, "Final selection of the routing must await the negotiation of water service contracts for the Fort Worth-Dallas metropolitan area under the Texas Water System."

The development of 83.4 million gallons per day at Mineola Reservoir and 157.7 at the Lake Fork site scheduled on or before 1980 represents full development at these sites. This development will permit the diversion of 200,000 acre-feet per year (178.4 million gallons per day) from the basin, and provide 62.7 million gallons per day to meet in-basin needs until some time during the 1990-2000 decade. As this point of need approaches, the timely construction of the third component of the upstream system, Big Sandy Reservoir, with its yield of 65.9 million gallons per day, should be undertaken to meet basin requirements.

36. WATER QUALITY CONTROL.- The water quality analyses made during the comprehensive study showed that surface waters would not be degraded below approved water quality standards in the foreseeable future. With respect to the esturine and coastal marsh areas, the proposed Sabine River developments in the early-action portion of the comprehensive plan would not adversely affect these areas. No changes in the early-action program are contemplated in this survey report that would affect findings in the comprehensive study relative to either surface flows or the esturine and coastal marsh areas.

37. FLOOD PROTECTION.- Main stem and tributary projects recommended for authorization to provide structural flood protection are Mineola, Lake Fork, and Big Sandy Reservoirs, and the Greenville local flood protection project. Plan A reservoir system selected for recommendation regulates the 50-year flood but provides increased flood control storage in lieu of the flood release channels of plan D, the type II report plan.

Discharges under existing conditions and conditions modified by flood control storages of proposed multiple purpose reservoirs are shown in the following tabulation for 10-year and 25-year frequencies. Locations shown are stream gaging stations. The Mineola gage is affected by Mineola Reservoir only; Quitman by Lake Fork Reservoir only; and Big Sandy by Big Sandy Reservoir only. The Logansport gage is affected by all three reservoirs. Modified effects also include the effects of the Soil Conservation Service program. The reduction in peak discharges as a result of proposed improvements for the March-April 1945 flood are also shown in table 4.

FLOOD CONTROL EFFECTS

		Flood Data			
		10-year frequency		25-year frequency	
Stream	Location	Existing	Modified	Existing	Modified
Sabine River	Mineola	46,000	8,500	74,000	13,600
Lake Fork Creek	Quitman	42,000	6,000	67,000	9,400
Big Sandy Creek	Big Sandy	21,000	2,900	32,000	4,500
Sabine River	Logansport	58,000	24,000	82,000	35,000

The Greenville local flood protection project has been reformulated and plans now recommend nonstructural measures for the Cowleech Fork of the Sabine River reach through Greenville and a modified structural program to provide 100-year protection on Long Branch Creek.

TABLE 4

FLOOD CONTROL EFFECTS OF THE PLAN

Date of flood and location	Peak discharges (cfs)			
	Existing channel capacities	Observed	Modified by projects recommended for authorization	Reduction in water surface level (feet)
Flood of March-April 1945				
Sabine River near Gladewater	6,000	138,000	43,400	4.3
Sabine River at Logansport	10,000	92,000	47,300	7.0
Sabine River near Bon Wier	20,000	75,500	45,700	1.5
Sabine River near Ruliff	18,000	85,300	52,000	1.5

38. HYDROELECTRIC POWER.- There are no sites in the Sabine River Basin suitable for the economical development of single-purpose hydroelectric power projects. Thus, for a power plant to be economically feasible, it must be included in a multiple-purpose project. None of the sites proposed for development by the year 2000 have a potential for the economic development of hydroelectric power.

39. NAVIGATION.- The recommended short range plan includes extension of barge navigation in the Sabine River from Echo to Morgan Bluff in Orange County. The extension will serve a paper mill completed in November 1967 and other industries expected to locate in northwestern Orange County and near Niblett Bluff in western Calcasieu Parish in the near future. Through the Sabine River channel, connection is afforded to the Gulf Intracoastal Waterway and the vast inland waterways systems of the United States. The papermill is expected to produce 315,000 tons of linerboard and 17,000 tons of tall oil in 1970, of which an estimated 110,000 tons of linerboard and 10,000 tons of tall oil could be more economically transported by barge. The prospective waterborne commerce for the channel to Morgan Bluff is estimated at 186,800 tons in 1975 and 267,400 tons in 2025. The recommended long range plan includes further extension of barge navigation from Morgan Bluff to Longview, Texas, after 2020.

40. EFFECTS OF UPSTREAM RESERVOIR DEVELOPMENT ON TOLEDO BEND RESERVOIR.-

a. Power generation.- Studies were conducted to determine the effect of the recommended upstream reservoir development on the power operation of Toledo Bend Reservoir. The sequence of construction of the proposed reservoirs, Mineola, Lake Fork, and Big Sandy, is that of the Type II report which is not changed in the Corps' report. Mineola and Lake Fork Reservoirs are assumed operative in 1980, Big Sandy during the 1990-2000 decade. The proposed diversion of 200,000 acre-feet annually from the basin through the Texas Water System, is assumed to be zero in 1980, 100,000 acre-feet in the year 2000, and 200,000 acre-feet in the year 2020. Return flow from in-basin use is considered and residual reservoir yields are returned to the streams. The operating rule curve used is that prepared during the final design phase of Toledo Bend Reservoir. Results of power routings are shown below for existing and proposed conditions. In evaluating the change in energy production 2.3 mills per kwh was used, for changes in dependable capacity $18.00 per kilowatt.

b. Water supply.- Water supply impoundments at Mineola, Lake Fork, and Big Sandy were not modified in the Corps' report, and their effects on Toledo Bend Reservoir's yield remains as shown in the Type II report. Releases from upstream developments, and return flows will increase volumes of water passing through Toledo Bend Reservoir.

c. Recreation, fish and wildlife.- The effect of upstream development on Toledo Bend Reservoir's recreation, and fish and wildlife for the 42-year evaluation period is indicated by variations in average pool elevations for existing and proposed conditions, and the maximum change in elevations and consequent pool areas. These data presented below show that changes induced by the recommended plan of development would not be significant in terms of recreation and fish and wildlife for Toledo Bend.

EFFECT ON TOLEDO BEND RESERVOIR'S POWER OPERATION

	Conditions			
	Existing	1980	2000	2020
Flow return, ac-ft/mo	0	25,000	22,400	14,400
Power production, gwh/year				
Scheduled	158.71	161.34	158.62	154.21
Unscheduled	56.70	56.25	52.88	51.49
Storage change correction	- 0.08	+ 0.30	+ 0.03	- 0.32
Total	215.33	217.89	211.53	205.38
Minimum peaking capability, mw	85.0	90.0	88.6	86.6
Energy change				
gwh/year	--	+ 2.56	- 3.80	- 9.95
Value, 2.3 mills/kwh	--	$5,888	$8,740	$22,885
Change in dependable capacity				
mw	--	+ 5.0	+ 3.6	+ 1.6
Value, $18/kw	--	$90,000	$64,800	$28,800

EFFECT ON RECREATION AND
FISH AND WILDLIFE AT TOLEDO BEND RESERVOIR

	Existing	1980	2000	2020
Pool elev. feet, msl				
Average	169.01	169.33	169.24	169.01
Minimum	157.73	160.78	159.95	158.66
Difference	--	+ 3.05	+ 2.22	+ 0.93
Change in surface area, acres	--	+12,670	+9,230	+3,770

41. ENVIRONMENTAL IMPACT.-

a. Response to National Environmental Policy Act of 1969 (PL 91-190).- Planning for the Sabine Basin considered man's total environmental needs and sought to achieve a betterment while inflicting minimum losses. Although the National Environmental Policy Act

of 1969, Public Law 91-190, was enacted subsequent to completion of the type II report, the spirit of the act and its cardinal objectives were observed in planning. An appraisal of the plan's effect is presented in appendix E, Recreation and Environmental Considerations. This appendix further relates to the type II report. An appraisal of the impact of the recommended plan in response to specific subsections of Section 102, PL 91-190, is as follows:

(1) Subsection (C)(i).- The flood protection and prevention measures proposed for Greenville, Texas, may have a beneficial and complementary environmental impact. It can help to provide for a cleaner, safer stream through the city. There can be less destruction, hardship, unpleasant odors, and health problems. Greenbelt and open space areas can be retained, along with recreational opportunities. Opportunities will exist for the people of Greenville to further enhance the areas for their visual and physical enjoyment. The three recommended reservoir projects will inundate approximately 90 miles of warm water streams and about 62,000 acres of cropland, pastureland, and woodland. However, the overall environmental impact can be beneficial and complementary. The reservoir areas will provide resource areas for pleasure, study, training, and research, along with a variety of outdoor recreational opportunities. The flood control features will help to eliminate unsafe, unsightly, and unhealthy conditions, particularly in the more densely inhabited areas. They will help to control movement of sediment, stream scour, and to sustain stream flows. The downstream areas without channels or levees will help to preserve the integrity of the streams and their natural attributes for the well-being of the people who use the area for living and enjoyment. This preserved integrity will enable the ecological succession of the stream to progress in a more natural way with less environmental impact than would be imparted by other alternative plan proposal.

(2) Subsection (C)(ii).- There will be approximately 90 miles of free-flowing streams inundated in the three reservoir sites, along with the associated warm water fishery and the adjacent wildlife habitat, pastureland, woodland, and cropland. The lost warm water stream fishery, which is not unique to this area, will be greatly expanded by the reservoir fishery. The most adverse environmental effect may well be the loss of big game and upland game habitat. The loss of production from the pastureland, cropland, and woodland in the reservoir areas will be an economic loss, but the environmental loss is not considered to be severe because the same general features and characteristics exist throughout the area. The navigation channel from Echo to Morgan Bluff will have a bottom width of 125 feet and will be about 5-1/4 miles long. This channel will extend along the river bottom with little or no effect on marsh drainage. Also, this sea level channel will not significantly affect estuarine resources.

(3) Subsection (C)(iii).- From the recreational, fish and wildlife viewpoint, and for preservation of natural vegetative resources, archeological and historical sites, ecosystems and for overall total environmental considerations, the development of reservoirs with downstream flow regulations is believed to be one of the better solutions in the upper portion of the Sabine Basin to provide for the water supply and flood control needs. Flood plain zoning or flowage easements in lieu of flood water storage and regulation would also be acceptable solutions, if feasible. The local flood protection project at Greenville will provide not only flood protection, but also provide a greenbelt, open space, and recreational opportunities. The reservoirs will provide for water supply, streamflow regulation, and flood control. Adding water to a natural setting can provide esthetically pleasing areas with opportunities for recreation. In this proposal, the stream valleys will be retained in their natural condition which will benefit the fishery, wildlife, and vegetation.

(4) Subsection (C)(iv).- The Sabine Basin valley and tributary stream flood plains, dotted with cities and towns, are presently being used for farming, manufacturing, and oil and timber production. The area supports an abundant variety of wildlife and plant communities. The basin is characterized by periodic flooding and all the associated losses of life and property. The maintenance and enhancement of the long term productivity of the environment will require watershed protection, flood plain management and flood prevention, maintenance of natural areas, and the multiple use of water and other resources with the objectives of improving quality and recycling. All of this can be accomplished by the judicious application of engineering tempered by environmental considerations. This basin and its environmental resources are important not only on a local level, but on a regional basis.

(5) Subsection (C)(v).- As is the case in any large scale project, the environmental effects of the Sabine project will be irreversible. Therefore, very strong consideration should be given to any proposal before its initiation.

b. Recreation.- Existing water bodies are capable of supporting much of the short range recreational needs in all but the southernmost portion of the basin. Ultimate development of the existing water-oriented areas is expected to support an annual visitation of about 10 million. The plan of development, as proposed in this report, is expected to satisfy the remaining short range needs for land and water acreage with the one exception of the southern end of the basin. When in place, the total plan, plus the existing areas, should provide an adequate resource base for the land and water needs in all portions of the basin except for the distant period approaching year 2075. It has been estimated that no losses will occur to general outdoor recreation opportunities as a result of the proposed plan of development. Project areas, both water surface and lands, will be available to the public for recreational purposes.

Mineola Reservoir is expected to receive a visitation of 1.6 million 40 years after an initial annual visitation of about 0.9 million. Lake Fork visitation estimates are placed at 0.7 million expected in about year 2020 after an initial total visitation of 0.4 million. Visitation estimates for Big Sandy Reservoir are placed at about one million 40 years after an initial total annual visitation of about 0.6 million. General recreation is estimated to amount to from two-thirds to three-fourths of the total visitation for all three projects. Channelization only is considered for the navigation project extending from Echo to Morgan Bluff, and it is believed that the project would result in little increase in recreational use of the river.

c. Fish and wildlife.- The detailed analysis of the fish and wildlife resources and the impact of the proposed short range development is contained in appendix O of the comprehensive basin study. Wildlife habitat losses at the reservoir sites and the related man-days of hunting can be mitigated by development and management of 25,000 acres of project lands at the reservoir sites, and on 15,000 acres of additional flood plain lands immediately downstream from Mineola Reservoir. These lands downstream from Mineola Reservoir will provide for greater flexibility in reservoir regulation, as well as providing for mitigation of wildlife habitat losses. The estimated cost to mitigate 14,800 annual man-days of big game hunting, 16,800 annual man-days of upland game hunting, and 3,600 annual man-days of other wildlife hunting losses due to the proposed development is as follows:

Costs (wildlife mitigation)	
Flood plain lands immediately below Mineola Reservoir -- 15,000 acres @ $200	$3,000,000
Development -- 40,000 acres @ $2.00	80,000
Annual management -- 40,000 acres @ $2.00	80,000

The above proposal of improving and managing the wildlife habitat on 25,000 acres of multipurpose project lands and acquisition and improved management of 15,000 acres of additional flood plain lands will offset the effects of losing approximately 62,000 acres of land and its associated wildlife habitat at the project sites.

Appendix O of the comprehensive basin study presents data related to supplies and demands for fishing and hunting and measures necessary to fulfill demands. Also considered are the effects of Federal project proposals on fish and wildlife and possible means to offset losses and to enhance fish and wildlife resources. Recommendations presented in appendix O and comments thereto by the Corps of Engineers are presented below.

(1) Recommendation No. 1.- Conservation and development of fish and wildlife resources be included among the purposes for which water resources projects within the Sabine River Basin are authorized.

Comment.- Conservation and development of fish and wildlife resources are included as a portion of the broad recreation purpose.

(2) Recommendation No. 2.- The Corps of Engineers design stilling basins and discharge channels at Mineola, Lake Fork, Big Sandy and Carthage Reservoirs to prevent stranding and subsequent loss of fish in shallow water in these areas upon cessation of releases or spills from these reservoirs.

Comment.- Designs of stilling basins and discharge channels at all the projects will prevent stranding of fish upon cessation of releases.

(3) Recommendation No. 3- Detailed studies be planned and conducted by the Corps of Engineers cooperatively with the Bureau of Sport Fisheries and Wildlife and funded by the Federal plan of development or otherwise as appropriate to determine the most feasible measures required for protecting the 110,000-acre Louisiana coastal marsh, including 50,000 acres of the Sabine National Wildlife Refuge, from encroachment of saline waters; and that provision for these measures be included as mitigative and enhancive features of the plan. These may consist of the following possible measures, singly or in combination: (1) devices in Sabine Lake to control encroachment of saline water, (2) salinity control structures in marsh streams and canals, (3) a lakeshore dike, (4) a diversion system to bring a supply of fresh water to the marshes, and (5) modification of any hurricane protection project to provide salinity control.

Comment.- The Corps of Engineers and the Bureau of Sport Fisheries and Wildlife will conduct the necessary studies in coordination with other investigations involving the long range plan. There are a number of investigations being conducted on similar areas in Texas and Louisiana that will provide additional information by the time the detailed studies are needed.

(4) Recommendation No. 4.- The Corps of Engineers provide for acquisition and development of two access-parking sites below each of Mineola, Lake Fork, Big Sandy and Carthage Dams for the enhancement of sport fishing at a total estimated cost of $88,000.

Comment.- Access and parking areas below Mineola, Lake Fork, Big Sandy and Carthage Dams will be included as part of the recreation development plan.

(5) Recommendation No. 5.- The Corps of Engineers provide eight access areas at Mineola Reservoir, eight areas at Lake Fork Reservoir, six areas at Big Sandy Reservoir, eight areas at Carthage Reservoir, 10 areas at Bon Wier Reservoir, and eight areas at the four major navigation pools, at a total estimated cost of $1,830,000 for the enhancements of reservoir sport fishing.

Comment.- Access and public use areas will be included in the recreation development plan.

(6) Recommendation No. 6.- The Federal construction agencies provide funds to the Texas Parks and Wildlife Department and the Louisiana Wild Life and Fisheries Commission for fishery management studies of five years duration at each, Mineola, Lake Fork, Big Sandy, Bon Wier, and Carthage Reservoirs and at each of the five multiple-purpose reservoirs of the Soil Conservation Service for the enhancement of reservoir sport fishing at an estimated total cost of $225,000.

Comment.- For the projects authorized to be constructed by the Corps of Engineers, joint fishery management studies will be made by the Corps of Engineers, the Bureau of Sport Fisheries and Wildlife, the Texas Parks and Wildlife Department, and the Louisiana Wild Life and Fisheries Commission under the existing authorities and budgetary procedures of each agency. Any special study required for project engineering and design will be considered in budgetary requests. Research and management studies currently being conducted on reservoirs may preclude the need for long term studies at each project.

(7) Recommendation No. 7.- Local sponsoring organizations, in cooperation with the Soil Conservation Service, encourage landowners to plant waterfowl foods and to provide shooting areas at suitable floodwater retarding structure sites for the enhancement of waterfowl hunting in the following small watersheds: Prairie Creek, Louisiana; Upper Bayou La Nana, Louisiana; Little Bayou San Miguel, Louisiana; Mill Creek, Texas; Grand Saline Creek, Texas; Upper Sabine River, Texas; Irons Bayou, Texas; McBee Creek, Texas; South Fork of Sabine River, Texas; and Caddo Creek, Texas.

Comment.- At Corps constructed and administered projects, the Corps personnel will cooperate with local organizations, the Soil Conservation Service, and wildlife interests to protect and develop wildlife habitat which will provide desirable waterfowl and upland game hunting. Development of the small watersheds mentioned will be the responsibility of the Soil Conservation Service and non-Federal interests.

(8) Recommendation No. 8.- Studies be carried out by the Texas Parks and Wildlife Department and the Bureau of Sport Fisheries and Wildlife following project authorization to develop appropriate mitigation measures as a part of the project to compensate for upland game and big game habitat losses.

Comment.- Provisions have been made to mitigate the wildlife habitat losses for the projects in the short range plan. Corps personnel will work with the Texas Parks and Wildlife Department and the Bureau of Sport Fisheries and Wildlife in developing management plans for the wildlife habitat on 25,000 acres of project lands and 15,000 acres of additional lands in the flood plain immediately downstream from the Mineola Reservoir.

d. Public health.- Vector prevention and control measures will be incorporated, to the extent feasible, into the design, construction and operational phases of the water resources developments proposed for the Sabine Basin. Measures to be taken would include preimpoundment clearing, water level variations to provide vegetation and mosquito control, borrow pit drainage, and drainage of seep areas. In recreation areas, the control and removal of refuse; the provision for rodent-proofed buildings; removal of brush and weeds along paths, trails, and roadways; and the provision for supplemental use of insecticides and rodenticides where adequate vector control is not obtained through source reductions. Provisions have also been made for continuous surveillance of vectors and routine appraisal of control operations.

42. ECONOMIC IMPACT.- The plan of development presented in this report meets the expressed desires of local interests for a short range plan of development for water and related land resources in the Sabine River Basin as discussed in the comprehensive report. In view of the local request for a feasibility study for flood control, recreation, water transportation, and industrial water supply, it is considered that their general desire for economic improvement, including expanded employment opportunities, is being satisfied. Specifically, construction and operation of the project measures will provide job opportunities for unemployed and underemployed workers throughout the basin. Construction of the individual reservoir projects is expected to provide extensive employment on a short range basis, while operation and maintenance activities will furnish extended employment for a smaller work force. Annual job opportunities provided during construction of Mineola and Lake Fork Reservoirs are expected to total 986 on the average, with the workers coming from the unemployed work force within commuting distance of the projects.

Prevention of flood damages will permit the use of available economic resources for development rather than for replacement of losses. Improvement of transportation in the lower basin is evaluated to reduce the cost of moving commodities from the producer to the consumer. The expanded water supply provided by the plan will permit municipal and industrial expansion with the associated increase in job opportunities. Also, developments associated with the increased recreational opportunities will provide additional jobs in the area. These accomplishments meet local objectives and expand employment to more nearly meet the national goals of full employment.

53-522 O-71——12

43. PROPOSED LOCAL COOPERATION.- Projects recommended for authorization include three major multiple purpose reservoirs, a navigation channel, and a local flood protection project. Proposed requirements of local cooperation are discussed in the following paragraphs.

a. Reservoirs.- The proposed requirements of local cooperation for the multiple-purpose reservoirs are as follows:

(1) Provide the share of cost of reservoirs allocated to municipal and industrial water supply in accordance with the provisions of the 1958 Water Supply Act, as amended.

(2) Provide the share of cost of reservoirs allocated to recreation and fish and wildlife enhancement in accordance with Public Law 89-72, cited as the Federal Water Project Recreation Act.

(3) Obtain without cost to the United States all water rights necessary for operation of the project in the interest of water supply.

b. Local flood protection projects.- The project recommended for construction is the local flood protection project for Greenville, Texas. The requirements for local cooperation are as follows:

(1) Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction, maintenance, and operation of the project.

(2) Provide without cost to the United States all relocations of buildings and utilities, bridges (except railroad), sewers, pipelines, and any other alterations of existing improvements which may be required for the construction of the project.

(3) Provide assurances that encroachment on improved channels and floodways or ponding areas will not be permitted.

(4) Hold and save the United States free from damages due to the construction works.

(5) Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

(6) Agree to publicize flood plain information in the area concerned and to provide this information to zoning and other regulatory agencies and public information media for their guidance

and appropriate action including adoption of such regulations as may be necessary to insure compatibility between future developments and protection levels provided by the project.

c. Navigation channel - Echo to Morgan Bluff.-

(1) Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such retaining works.

(2) Hold and save the United States free from damages due to the construction and maintenance of the project.

(3) Provide, maintain and operate at local expense, when and as required, adequate public terminal and transfer facilities open to all on equal terms.

(4) Accomplish, without cost to the United States, all alterations of structures and other existing improvements, including buildings, roads, pipelines, sewers, powerlines, and other utilities, when and as required for construction of the project, but excluding the necessary alteration or new construction of certain railroad facilities and highway bridges to the extent specified in paragraphs 20a(3) and 20d of appendix C; and

(5) Contribute annually, until such time as multiple use of the channel from Echo to Morgan Bluff actually occurs, 50 percent of the annual charge for interest and amortization of the Federal investment in the improvements involved, as determined by the Chief of Engineers, an amount presently estimated at $47,400. The payment period for such annual contributions shall commence upon completion of the work, and shall end when the Chief of Engineers determines that multiple use of the channel has commenced.

43A. APPORTIONMENT OF COST.- On the foregoing basis the project cost would be apportioned to Federal and non-Federal interests as shown in table 5.

44. LOCAL COOPERATION OFFERED.- The Executive Director of the Texas Water Development Board, in a letter dated September 8, 1966, expressed the following: (1) Projects which will be needed within 20 to 25 years be considered for authorization for construction; (2) that recommendations for authorization should include both Mineola and Lake For multiple-purpose reservoir projects; (3) that in the event local interests are not prepared to undertake sponsorship of either Mineola or Lake Fork Reservoirs, or both, in whole or in part, the Board will provide necessary assurances and sponsorship in whole

TABLE 5

APPORTIONMENT OF PROJECT COSTS TO FEDERAL AND NON-FEDERAL INTERESTS

Item	Project: Mineola Reservoir ($1,000)	Lake Fork Reservoir ($1,000)	Big Sandy Reservoir ($1,000)	Greenville Local Flood ($1,000)	Navigation Channel ($1,000)	Total ($1,000)
FIRST COST						
Federal	54,191.0	33,465.0	16,680.0	100.3	1,765.2	106,201.5
Flood control	(44,522.0)	(27,661.0)	(9,910.0)	(100.3)	-	(82,193.3)
Recreation	(9,669.0)	(5,804.0)	(6,770.0)	-	-	(22,243.0)
Navigation	-	-	-	-	(1,765.2)	(1,765.2)
Non-Federal	33,678.0	35,124.0	16,831.0	80.7	287.8	86,001.5
Water supply	(29,224.0)	(33,079.0)	(13,908.0)	-	-	(76,211.0)
Recreation	(4,454.0)	(2,045.0)	(2,923.0)	-	-	(9,422.0)
Flood control	-	-	-	(80.7)	-	(80.7)
Navigation	-	-	-	-	(287.8)	(287.8)
Total	87,869.0	68,589.0	33,511.0	181.0	2,053.0	192,203.0
MAINTENANCE, OPERATION AND REPLACEMENTS						
Federal	91.8	121.3	35.4	-	31.0	279.5
Flood control	(60.4)	(104.7)	(21.0)	-	-	(186.1)
Water supply	(31.4)	(16.6)	(14.4)	-	-	(62.4)
Navigation	-	-	-	-	(31.0)	(31.0)
Non-Federal	584.2	342.1	419.3	2.1	28.8	1,376.5
Water supply	(155.2)	(115.7)	(144.6)	-	-	(415.5)
Recreation	(429.0)	(226.4)	(274.7)	-	-	(930.1)
Flood control	-	-	-	(2.1)	-	(2.1)
Navigation	-	-	-	-	(28.8)	(28.8)
Total	676.0	463.4	454.7	2.1	59.8	1,656.0

or in part; and that it is not intended to exclude from consideration any recommendations pertaining to navigation facilities, local flood protection projects, or any mainstream projects downstream from Toledo Bend Dam.

The Texas Water Development Board in a statement made at the Congressional hearing held in Longview, Texas on February 28, 1969, stated that refined planning has now demonstrated that Big Sandy Reservoir merits the provision of assurances and sponsorship by the Board.

By letters dated October 6, 1966, and April 21, 1967, the Executive Vice President and General Manager of the Sabine River Authority of Texas stated: (1) the Authority felt that all available resources at Mineola and Lake Fork Reservoir sites should be developed, and that it was willing and able to act either separately, or in conjunction with the Texas Water Development Board as local sponsors for these projects; and (2) that the Authority has concluded that it can, should and will undertake the administration of project recreation development for each Texas reservoir project proposed in the plan and authorized by Congress, and at the appropriate time, enter into a cost-sharing agreement with the Corps of Engineers in accordance with provisions of the Federal Water Project Recreation Act.

By letter dated June 27, 1967, the President of the Orange County Navigation and Port District stated that the District would provide local cooperation, as outlined by the District Engineer of the Galveston District, Corps of Engineers, in a letter dated May 5, 1967, on the proposed barge channel from Echo to Pruitt Bluff, Texas.

By letter dated February 20, 1968, the mayor of the City of Greenville, Texas, stated that the City Council of the City of Greenville, Texas, decided in favor of undertaking sponsorship for the local flood protection project planned for Greenville, as outlined by the District Engineer in a letter dated February 1, 1968.

AGENCY COORDINATION

45. GENERAL.- Preparation of the Sabine Basin comprehensive study was accomplished under the leadership of a Field Coordinating Committee. The Fort Worth District, Corps of Engineers, was chair agency of the Committee composed of U. S. Departments of Agriculture; Army; Commerce; Health, Education and Welfare; Interior; the Federal Power Commission; and the states of Louisiana and Texas. Louisiana was represented by its Department of Public Works, and Texas by its Water Development Board. Appropriate agencies of Federal Departments were assigned responsibility for appendix preparation and cooperation in preparation of the main report. Agencies of Federal Departments and the states attended and participated in Coordinating Committee meetings, work group meetings, and field level review of the report. The structural program is compatible with that presented in the comprehensive study taking into account the Water Resources Council views and recommendations thereon. Preparation of this report has been fully coordinated with the Galveston District of the Corps of Engineers.

DISCUSSION AND CONCLUSIONS

46. DISCUSSION.- This report presents a review of the Corps of Engineers short range program of the comprehensive type II report, with modifications, and recommends a plan of development for authorization. The economic and physical analyses of projects so recommended is presented. The elimination of flood release channels, and the compensatory increase in reservoir flood control storage, represent the major, but not only, modification. Mitigation of habitat losses at reservoir sites and related man-days of hunting by development and management of 25,000 acres of project lands and on 15,000 acres of additional purchased lands in the flood plain immediately downstream from Mineola Reservoir is recommended in this report. These lands could also provide flexibility in reservoir regulation. Costs were included in Mineola, Lake Fork, and Big Sandy Reservoirs for this mitigation. The substitution of flood plain management in lieu of channel improvement along Cowleech Fork of the Sabine River in the vicinity of Greenville is proposed in this report.

Flooding is experienced annually in the Sabine River Basin, and the basin experiences major flooding of long duration. Reservoir sites capable of providing efficient control of flood flows and impoundment of water supply and recreation storage are not unlimited in the Sabine River Basin. It is, therefore, necessary that the best possible use be made of those available to insure that full economic and social potentialities are realized both initially and for long range use.

A hurricane protection study is now in progress, including the Sabine Coastal Area, and is scheduled for completion in 1977.

Future water demands were projected for the Sabine Basin to satisfy needs to the year 2075. Demands were projected for municipal, industrial, and rural needs. Consideration was also given to thermal power generation consumptive use, irrigation, and long range navigation. Also considered was the exportation of water to the Trinity River Basin for use by the cities of Dallas and Terrell, as presently provided by permit, and the provision for importing water from the Cypress Creek Basin to meet projected 2020 requirements of the city of Marshall. The Texas Water Development Board's request for an additional diversion of 200,000 acre-feet per year from the Sabine River Basin on or before 1980 was also included in demands. Additional demands include 600,000 acre-feet annually of a combination of properly treated return and local flow into Sabine Lake, and 50,000 acre-feet annually to control salinity on coastal marshes. These demands were included in the water balance prepared for the Sabine Basin in the type II study. These studies showed that during the critical period of flow, a coastal demand of 650,000 acre-feet annually could be supplied from runoff originating below the long range Bon Wier Reservoir project, to the year 2075. Investigations showed that the short and long range reservoirs, ground

water, return flow, imports and flows originating below reservoirs in the lower river will combine to meet demands and provide a basin surplus to 2075. Results of water quality computations showed that surface waters of the Sabine River Basin will not be degraded below approved water quality standards between the present and the foreseeable future.

The channel to Morgan Bluff would be a sea level extension of the authorized channel from Orange to Echo, and is proposed to have a depth of 12 feet and width of 125 feet. It is considered that the channel should be designed initially for limited two-way traffic for two-barge push tows. Ultimately it is believed that barge traffic on the Sabine River will be a mixture of two- or three-barge tows and five-barge tows, requiring a channel 12 feet deep and 200 feet wide. Navigation above Morgan Bluff to Longview was estimated to be feasible after 2020.

At the present time, the only prospective commercial user of the barge channel from Echo to Morgan Bluff would be Owens-Illinois, but other industries are expected to locate in the near future on waterfront property in northwestern Orange County and at Niblett Bluff, Louisiana. It is proposed that local interests contribute annually, until such time as multiple use of the channel from Echo to Morgan Bluff actually occurs, 50 percent of the annual charges for interest and amortization of the Federal investment in the improvements involved (such 50% share presently estimated at $47,400).

Administrative records currently list the lower 97 miles of the Sabine River as a navigable river. Works proposed for authorization in this report include approximately 5.25 miles of channel improvements primarily for navigation, which are located within this 97-mile reach. Federal Government rights in servitude of navigation shall be exercised to compel the owners of lands and improvements affected by this channel improvement to provide any required local cooperation regarding their individual respective ownerships.

With regard to the necessary alteration of railroad bridges and public highway bridges crossing the lower 97-mile navigable reach of the Sabine River, the cost sharing principles of the Bridge Alteration Act (Truman-Hobbs) of June 21, 1940, as amended, are to be applied in providing navigation channel improvements. When the cost sharing principles of the Bridge Alteration Act are to be applied in the necessary alteration of public highway bridges, Section 207 of the

Flood Control Act of 1960, as amended, shall also be applied to incorporate currently applicable design standards at Federal expense notwithstanding the Bridge Alteration Act prohibition against providing betterments at Federal expense.

Economic expansion will occur along proposed alignments of navigation channels and adjacent to local flood protection projects in advance of construction. The time sequence of expanding transportation and utility work should, where practicable, be phased with the design and construction of such works. Every effort should be made to advance design and construction of the works proposed herein in phase with transportation and utility relocations to effect savings in public funds and to minimize adverse effects on the orderly development of the basin.

Planning for the Sabine River Basin recognized the need for consideration of flood plain information studies related to all urban areas with present or anticipated flood problems with a view to developing alternate measures for adoption by local interests to minimize the need for structural measures to prevent or reduce future flood damages.

The needs for flood control and navigation are immediate, and it is anticipated that projects involving these purposes would be initiated soon after authorization. In scheduling the accomplishment of individual units of the program, consideration would be given to the requirements for all purposes, with particular attention given to provision of water supply storage in order to meet the projected needs as they develop. Since construction is determined by appropriation of funds by Congress, no assurance can be given herein that Federal construction would be undertaken in accordance with a particular schedule. Under these circumstances, it should not be construed that Federal authorization only would constitute a preemption of a site or would prohibit development of a site by local interests if water supply needs develop in advance of Federal appropriations for a project.

Economic activity in the vicinity of Mineola, Lake Fork, and Big Sandy Reservoirs indicates that extensive development can be expected to take place before these projects can be constructed. Such development, if not limited, could preclude the construction of the reservoirs because of high cost of lands, relocations and damages. It is believed that fee title with mineral rights subordinated to the right to flood should be obtained in the necessary lands in advance of construction so as to preserve the dam sites and reservoir areas from encroachment. Prior to construction, tenancy would be preserved where practical with development for recreation and fish and wildlife on areas where outright purchase was necessary. Measures also should be provided for advance participation in construction or reconstruction of transportation facilities to minimize costs for relocations.

Consideration should be given to provide authority for the Corps of Engineers to enter into an agreement with non-Federal entities for acquisition of reservoir project land in advance of project construction of Mineola, Lake Fork and Big Sandy Reservoirs. This authority should provide for credit toward reimbursable costs for the costs of lands acquired, or land-taking surveys made by such entities, when such advance local expenditures are sound contributions to the projects and contribute to overall project economy. Such an agreement with non-Federal entities should not be interpreted as a commitment that the projects would be constructed by the United States.

Survey scope details were not developed for the flood problems at Longview and at Orange; however, sufficient information was presented in the comprehensive study to indicate that significant problems do exist. Further studies, which are authorized for these areas, should be accomplished as soon as practicable.

Studies have shown that the Sabine River valley is an area of rich archeological resources essential to the ultimate solution of major problems in American archeology. The upper Sabine crosses the southern part of the Caddoan archeological area; the lower Sabine courses through a region that is virtually unexplored archeologically. When reservoir construction, channel straightening, or other such projects are undertaken, provision will be made for necessary studies and salvage at archeological resources in cooperation with the National Park Service.

Preservation and enhancement of environmental and esthetical features have been considered in formulating the projects. Further emphasis will be given in the detailed planning stage for the natural features of the project sites, structural and facility design, project regulation, land use and project management guidelines.

In designing the storage space in the proposed reservoirs, it was assumed that the dependable water supply yield would be withdrawn from each project on a continuous basis. This continuous withdrawal would create drawdowns during dry periods which would store all or substantial portions of subsequent flood runoff events. If the yield is not withdrawn throughout the period of record, much more frequent usage is made of the flood-control storage space. This frequent use of the flood-control space increases the probability that a major flood might occur with a substantial part of the flood-control storage space already utilized. For this reason, it is considered that, subsequent to the initial filling of the conservation pools, releases be made in amounts which, when combined with the withdrawals, would equal the total computed dependable yield of the projects.

The discharge of inadequately treated sewage and other pollutants into the reservoirs and downstream channels should be prohibited in accordance with applicable laws or regulations of Federal, State, and local authorities responsible for pollution prevention and control.

The hydrologic instrumentation and network recommended in the comprehensive study by the U. S. Geological Survey and the U.S. Weather Bureau are included in the proposed improvements.

Each of the affected and concerned Federal and state agencies should keep current the segments of the plan for which it is or may be, under law, assigned responsibility.

47. CONCLUSION.- Projects presented in this report are consistent with the comprehensive plan for basin development and are multiple purpose in scope. They are well justified, both individually and as a system, and each purpose served by the projects is fully justified.

RECOMMENDATIONS

48. RECOMMENDED PLAN.- It is recommended that elements of the Corps of Engineers short-range plan for authorization include and provide:

a. Multiple purpose reservoirs:

(1) Mineola Reservoir

(2) Lake Fork Reservoir

(3) Big Sandy Reservoir

b. Greenville local flood protection project

c. Navigation project extending 5.25 miles from Echo to Morgan Bluff, Texas.

d. That the foregoing elements, comprising the Corps' short-range plan, be considered for authorization and construction, subject to such changes and modifications as the Chief of Engineers may deem advisable. That Mineola, Lake Fork, and Big Sandy Reservoirs, Greenville Local Flood Protection Project, and the navigation project extending 5.25 miles from Echo to Morgan Bluff, Texas, be authorized for construction to meet near term needs. Total estimated construction cost for the recommended projects is $192,203,000 and $1,656,000 annually for maintenance and operation. Construction costs, and annual operation and maintenance costs have been apportioned between Federal and non-Federal interests in accordance with existing enactments. The net cost to the Federal Government for construction and annual maintenance and operation costs for the total recommended plan is estimated to be $106,201,500 and $279,500, respectively.

e. That, prior to initiation of construction, responsible local interests give assurances satisfactory to the Secretary of the Army that they will:

(1) With respect to Mineola, Lake Fork, and Big Sandy Reservoirs:

(a) Repay all costs allocated to water supply in accordance with the Water Supply Act of 1958, Public Law 85-500, as

amended, which are presently estimated as follows:

Project	First Cost		Average annual operation, maintenance, and replacement cost	
	Amount	Percent	Amount	Percent
Mineola	$29,224,000	37.8	$155,000	23.0
Lake Fork	$33,079,000	56.5	$116,000	25.0
Big Sandy	$13,908,000	49.2	$145,000	31.8

(b) Provide the share of cost of reservoirs allocated to recreation and fish and wildlife enhancement in accordance with the Federal Water Project Recreation Act, Public Law 89-72, as follows:

1 Administer project lands, facilities, and water areas for recreation, including fish and wildlife enhancement, and assure access to such development to all on equal terms;

2 Pay, contribute in kind, or repay (which may be through user fees) with interest, no less than one-half of the separable cost allocated to recreation, including fish and wildlife enhancement;

3 Bear all costs of operation, maintenance, and replacement of fish and wildlife and recreation use lands and facilities.

The presently estimated cost for 2 and 3 above are:

Project	One-half separable first cost	Average annual operation, maintenance, and replacement cost
Mineola	$4,454,000	$429,000
Lake Fork	$2,045,000	$226,400
Big Sandy	$2,923,000	$274,700

(c) Obtain without costs to the United States all water rights necessary for operation of the project in the interest of water supply.

(2) With respect to the Greenville Local Flood Protection Project:

(a) Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project;

(b) Provide without cost to the United States all relocation of buildings and utilities, bridges (except railroads), sewers, pipelines, and any other alterations of existing improvements which may be required for the construction of the project;

(c) Provide assurances that encroachment on improved channels and floodways or ponding areas will not be permitted;

(d) Hold and save the United States free from damages due to the construction works;

(e) Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army;

(f) Agree to consider the degree of protection afforded in connection with future development within, or adjacent to, the corporate limits, including adoption of such regulations or dissemination of basic flood information, as may be necessary to insure compatibility between development and protection levels.

(3) With respect to the navigation channel, Echo to Morgan Bluff, Texas:

(a) Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such retaining works;

(b) Hold and save the United States free from damages due to the construction and maintenance of project;

(c) Provide, maintain, and operate at local expense, when and as required, adequate public terminal and transfer facilities open to all on equal terms;

(d) Accomplish, without cost to the United States, all alterations of structures and other existing improvements, including buildings, roads, pipelines, sewers, powerlines, and other

utilities, when and as required for construction of the project, but excluding the necessary alterations or new construction of certain railroad facilities and highway bridges to the extent specified in the report; and

(e) Contribute annually, until such time as multiple use of the channel from Echo to Morgan Bluff actually occurs, 50 percent of the annual charge for interest and amortization of the Federal investment in the improvements involved, as determined by the Chief of Engineers, such 50 percent share presently estimated at $47,400. The payment periods for such annual contributions shall commence upon completion of the work, and shall end when the Chief of Engineers determines that multiple use of the channel has commenced.

49. RECOMMENDATIONS.- It is further recommended that:

a. Authorization be provided for the Chief of Engineers to acquire an interest in the reservoir and dam site lands and to participate in construction or reconstruction of transportation and utility facilities for Mineola, Lake Fork, and Big Sandy Reservoirs in advance of construction as required to preserve such areas from encroachment and to avoid increased costs for relocation. The interest in lands to be acquired would be the minimum necessary consistent with the objective of reservoir and dam site preservation. This authorization would enable the Chief of Engineers to cooperate with responsible local interests to keep lands on local tax rolls and to exercise control over development in the reservoir and dam site area until needed for project purposes;

b. Authority be provided to enter into an agreement with the non-Federal entities in advance of construction of Mineola, Lake Fork, and Big Sandy Reservoirs to provide for credit toward reimbursable costs of lands acquired or land-taking surveys made by such entities when such local expenditures are sound contributions to the projects. Such an agreement with non-Federal entities not to be interpreted that the projects will be constructed by the United States;

c. In view of the one-user aspect of the navigation channel extension from Echo to Morgan Bluff and because studies concerning barge delivery are continuing to be made by the paper company, a reanalysis of the traffic and savings should be made during preconstruction planning; and

d. That approval of this plan shall not be considered to preclude development of other projects not included herein which may

be approved by the States of Texas and Louisiana in conformity with state laws.

R. S. KRISTOFERSON
Colonel, CE
District Engineer

[First endorsement]

SWDPL-F
SUBJECT: Survey Report on Sabine River and Tributaries, Texas and Louisiana

DA, Southwestern Division, Corps of Engineers, 1114 Commerce Street, Dallas, Texas 75202 17 Apr 70

TO: Chief of Engineers

I concur in the conclusions and recommendations of the District Engineer.

H. R. Barnett

H. R. PARROTT
Brigadier General, USA
Division Engineer

55-522 O-71—13

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX A

FORMULATION OF PROJECTS

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX A
FORMULATION OF PROJECTS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX A
FORMULATION OF PROJECTS

INTRODUCTION

1. PURPOSE.- The purpose of this appendix is to discuss the principal differences in the formulation of the selected short-range plan as contained in Appendix A of the comprehensive type II report as compared with that of the Corps of Engineers report. A review of Appendix A of the type II report disclosed that the first portion of Appendix A through the section on "Additional Factors Pertinent to Water Problems," paragraph 21, remains applicable to the formulation of the projects to be selected in this Corps report. The portion of the above-referenced Appendix A beyond paragraph 21 should not be followed in all respects for purposes of the Corps report because of certain pertinent basic changes that have taken place since the type II studies were made, along with the necessary response to the comments of the Water Resources Council and other interested agencies. In addition, more emphasis is being placed on the environmental aspects of each project considered, to be in keeping with the provisions of the Environmental Policy Act.

PLANS CONSIDERED TO SATISFY NEEDS

2. FLOOD CONTROL NEEDS.- Throughout the Sabine River Basin flood problems have been in evidence in varying degrees. Along the main stem of the Sabine River there is general periodic flooding which causes damages mainly to agricultural property and to structures rather uniformly distributed throughout the flood plain. It was found that flood damages in the main stem flood plain could be most effectively reduced by systems of reservoirs, improved channels, levees, or combinations thereof. Local protection improvements were considered at Greenville since the city is situated above the reservoirs considered for main stem protection. Flood plain management, including flood proofing, was also considered as an adjunct to structural measures. The flood reduction objective for the main stem of the Sabine River was determined through rationalization of maximization results of flood storages combined with water supply in multiple purpose reservoirs, as demonstrated in Appendix A of the type II report. Since maximization comparisons are essentially unchanged, they were not repeated for the Corps report.

3. WATER SUPPLY NEEDS.- The water supply needs within the Sabine Basin as well as the needs outside of the basin which could be supplied by the Sabine River and tributary impoundments were developed in the type II report. Since water supply requirements were not materially affected by updated projections the storage for water supply in each of the proposed reservoirs in the type II report remain unchanged and are kept constant for formulation purposes in this report. The proposed multiple-purpose reservoirs selected for inclusion of water supply were Mineola, Lake Fork, and Big Sandy.

4. OTHER WATER RESOURCES NEEDS.- In addition to the needs for flood control and water supply, other water resources needs were discussed in paragraphs 8 through 16, Appendix A of the type II report, and no further discussion thereon is deemed necessary at this time. The particular purposes of water resources development for which needs are in evidence, in addition to flood control and water supply, include recreational development, fish and wildlife enhancement, and navigation. These purposes are included for consideration in the projects to be selected in the formulated plan. With the exception of navigation, the purposes mentioned above are most efficiently handled in multiple-purpose reservoir systems.

ALTERNATIVE RESERVOIR SYSTEMS CONSIDERED

5. GENERAL.- The greater portion of the flood problems in the Sabine River Basin may be alleviated in a number of ways and with varying degrees of effectiveness. The plan for flood control selected for the Sabine River main stem is based on a detailed study of alternatives. Principal alternatives were multiple-purpose reservoirs, channel enlargement, flowage easements, levees, flood plain management and combinations thereof. All alternative reservoir systems considered included Mineola, Lake Fork, and Big Sandy Reservoirs. The alternative systems, though not achieving equivalent results, would all serve to reduce flood damages. Applicable flood proofing measures were considered in all alternate systems to reduce the remaining damages to the maximum extent practicable. The flood proofing concept is limited to protecting isolated structures such as highways, bridges, and buildings. Alternative system plans as described in the paragraphs to follow are each listed in table 1. Data presented in table 1 provide economic comparisons of each alternative multiple-purpose plan in terms of total first cost, annual economic costs and benefits, B/C ratios, and excess benefits over costs.

6. PLAN A.- Plan A consists of the three-reservoir system with flood control storage in each reservoir capable of controlling the 50-year flood at the respective dam sites to within the existing channel

TABLE 1

ALTERNATIVE RESERVOIR SYSTEMS CONSIDERED
(Annual benefits and cost in $1,000)

SYSTEM	1,000 Acre-feet		Costs -		Annual Benefits -				B/C Ratio	Excess Benefits Over Costs
	F.C. Storage	W.S. Storage	First Cost	Annual Economic Cost	F. C.	W. S.	Rec. F & WL	Total		
PLAN A	1,653.1	1,206.9	189,969.0	10,404.7	3,936.2	8,677.2	2,814.8	15,428.2	1.48	5,023.5
PLAN B	1,343.1	1,206.9	194,492.0	10,501.2	3,733.3	8,677.2	2,814.8	15,225.3	1.45	4,724.1
PLAN C	1,251.4	1,206.9	193,627.0	10,467.9	3,362.5	8,677.2	2,814.8	14,854.5	1.42	4,386.6
PLAN D	1,251.4	1,206.9	225,723.0	12,672.5	4,173.7	8,677.2	2,495.2	15,346.1	1.21	2,673.6
PLAN E	0	1,206.9	319,525.0	21,673.8	4,210.1	8,677.2	2,495.2	15,382.5	0.71	-6,291.3
PLAN F	0	1,206.9	261,965.0	16,738.5	3,726.1	8,677.2	2,814.8	15,218.1	0.91	-1,520.4

capacities. In this plan, additional flood storage is provided as a substitute for complementary channels, levees, or flowage easements. The flood control storage and corresponding emptying time for each reservoir would be as follows:

Reservoir	FC Storage	Emptying Time
Mineola	984,500 Ac. Ft.	742 days
Lake Fork	472,600 Ac. Ft.	139 days
Big Sandy	196,000 Ac. Ft.	149 days

7. PLAN B.- This plan consists of the three-reservoir system with Lake Fork and Big Sandy Reservoirs identical in storage and operation to those in Plan A and with Mineola Reservoir identical in storage to Plan C. Flowage easements would be provided for flood releases from Mineola Reservoir for this plan. Releases from the project would be regulated to 8,500 cfs until a 25-year flood storage of 549,750 acre-feet was available. Releases for the remaining 124,750 acre feet of flood storage would be regulated to the existing channel capacity of 2,000 cfs. A maximum emptying time of 43 days would be required to evacuate the 549,750 acre-foot flood storage and 87 days for the remaining 124,750 acre foot flood storage. Since reservoir releases resulting from minor floods would be limited to the existing channel capacity, few benefits would be lost to the downstream flowage area.

8. PLAN C.- In Plan C the capacities of storage would be identical to those of the recommended plan in the comprehensive type II report. In this plan flowage easements for flood releases would be provided. Flood releases would be limited to the capacity of the flood easement channel; however, during ordinary flood periods an attempt would be made to keep release rates within existing channel capacities as would be done in Plan B. The maximum emptying time would be 53 days for Mineola, 50 days for Lake Fork, and 58 days for Big Sandy.

9. PLAN D.- This is the plan selected in the type II report. In the formulation of Plan D, the objective was to find the most efficient and economical combination of reservoir storages and channel capacities necessary for the respective reservoir flood releases. This plan results in approximately the same degree of control as would be provided under Plan A. The emptying time for this plan would be regulated to 53 days for Mineola, 50 days for Lake Fork, and 58 days for Big Sandy.

10. PLAN E.- In Plan E no flood control storage would be included. The same three-reservoir sites would be utilized for water supply storage only. The flooding downstream therefrom would be handled through a combination of channel improvements and flood plain management. However, it must be recognized that without flood storage in

the reservoirs the major portion of the average annual flood damages would still remain. The channel improvements for this plan, along with the peak dampening effect of the water supply reservoirs would control only the flood magnitudes up to and including those which are expected to occur once in 5 years. Flood proofing and flood plain development limitations, would alleviate some of the damages to the structural development within the flood plain, but its effect on damages to agricultural property would be negligible.

11. PLAN F.- Plan F consists of three water supply reservoirs in combination with continuous parallel levees extending from the respective dam sites to the head of the Toledo Bend Reservoir. The objective in the selection of the size of the levees was to control the reservoir spills to the extent that full protection against the 50-year flood throughout the entire leveed distance could be accomplished. The average height of the levee would be about 12 feet with 1 on 3 side slopes, and a crown width of 20 feet. In selecting the levee section dimensions a freeboard allowance of 3 feet was made. In reaches where urban property is involved a design criteria of once in 100 years discharge was assumed. If the limit of the three-foot freeboard is utilized without overtopping of the levee, 100-year protection could be expected for the entire leveed distance.

SELECTION OF SYSTEM PLAN

12. GENERAL.- The various systems presented in table 1 are composed of structural and non-structural measures designed to meet existing and projected Sabine Basin's needs for flood control, water supply, and recreation and fish and wildlife. Water supply diversions from the basin established by the Texas Water Plan report of November 1968 were also considered. Those systems, which did not develop benefits equal to, or in excess of costs, were eliminated from the program. Further economic analyses were made to determine whether each purpose and each project in the retained systems was economically justified. Results of these analyses which provide a basis for selection of the plan are shown in table 2. In plans A, B, C, and D, Mineola, Lake Fork, and Big Sandy Reservoirs are common to all four plans. Water supply developments were held constant in all projects in all plans tested for flood control. Flood control storage and downstream structural and non-structural measures were the variables. Plan D,which is the plan recommended in the type II study, has been reformulated taking into account analyses of the projects tested in the last added position; project costs based on January 1970 prices; the Federal interest rate change from 3-1/8 to 4-7/8 percent and the effects of OBERS projections in estimating benefits. Flood control and water supply storage maximization studies conducted in the type II report continue to be valid and are not repeated in this report. Costs required to mitigate

damages to fish and wildlife resources from the construction of each of the plans analyzed were included in the estimated cost of each project.

13. SELECTED SYSTEM OF RESERVOIRS.- It is evident that, through comparisons of flood control benefits and costs incremental to water supply for the four systems listed as shown in table 2, Plan A is the most favorable plan for flood control. This system would contain reservoir storages to approach near maximum development of the water yields that the controlled drainage areas would generate. Added flexibility in reservoir operations would be gained through Plan A as compared with any of the other plans. Adverse fish and wildlife impacts downstream from the proposed reservoirs would be held to a minimum under Plan A and mitigation costs would be minimized. In view of the foregoing, the Plan A system was selected for final economic testing.

14. FINAL ECONOMIC TESTS ON PLAN A.- A last added analysis showing the economic feasibility of flood control increments in the three reservoirs in the selected plan are presented in table 2. The results indicate that for each project of Plan A in the last added position, flood control is incrementally justified. Also, a fair share analysis was made in which the combined flood control benefits were divided among the reservoirs in proportion to the flood control benefits each reservoir would produce operating individually. This latter analysis was also made in the type II report, for the reservoir-channel plan. Incremental economic analyses were made for the other purposes of each reservoir in Plan A, the results of which are presented in table 3. Tables 2 and 3 show that Plan A is economically justified on an incremental and fair share basis and provides the greatest excess of benefits over costs of the plans investigated. Accordingly, Plan A has been included in the overall plan of improvement.

LOCAL FLOOD PROTECTION AT GREENVILLE, TEXAS

15. GENERAL.- The formulation of the plan of improvement for flood protection of Greenville, Texas, was presented in detail in Appendix A of the type II report. The plan of improvement for Greenville recommended in the type II report consisted of channel improvements on two watersheds, namely Cowleech Fork of the Sabine River and Long Branch, a tributary. These channels were designed to carry discharges which would be generated by 200-year frequency storms. On Cowleech Fork this degree of protection would be afforded with the Corps of Engineers channel operating in conjunction with the flood detention reservoirs which would be located above the city as planned

by the Soil Conservation Service. In a review of the formulation analyses employing the 4-7/8 percent interest rate, it was found that this combined plan covering Cowleech Fork and Long Branch was economically justified if the total benefits for the Corps plan and the SCS plan were shared between the Corps and the SCS. However, on the basis of the Corps plan operating incrementally to the SCS plan, the Corps plan carried a B/C ratio of only 0.8 to 1.

16. ALTERNATIVE PLANS INVESTIGATED.- Because of the unfavorable incremental justification of the originally recommended plan, the flooding situation at Greenville was reexamined and it was decided that the two separate watersheds, Cowleech Fork of the Sabine River and Long Branch, which contribute to the flood problem should be handled separately. Since a plan for Long Branch would not involve the SCS, its analysis was relatively simple. This portion of the plan recommended in the type II report provided for a 30-foot bottom width channel that would give protection against a flood of a 200-year frequency was reanalyzed. A smaller channel of a 25-foot bottom width giving 100-year protection was also analyzed. The proposed length of channel improvement was shortened by about one mile at the lower end since it was determined that the benefits at the lower extremity would not justify the cost of improving that portion of the channel. On Cowleech Fork two alternative plans were studied. The first was a restudy of the original plan presented in the type II report. This plan would provide a 100-foot bottom width which would afford 200-year protection. The second plan would have 30-foot bottom width channel in combination with flood-plain management. This plan together with the plan of the SCS would provide protection to two areas which lie within the 100-year flood plain. The results of these economic analyses pertaining to both Cowleech Fork and Long Branch are presented in table 4. From this table it is apparent that structural improvements incremental to the SCS plan on the Cowleech Fork is not justified. Since the Corps plan for improvement on Long Branch would be justified for both 100-year and 200-year protection, a maximization curve was developed and is presented as figure 1.

17. SELECTION OF PLAN.- The maximization curve indicates that the degree of protection of the Long Branch improvement maximizes the net benefits at a frequency of once in 100 years, with a B/C ratio of 1.1. Therefore, the 25-foot bottom-width channel on Long Branch was selected as the plan of improvement for Greenville. In addition to the structural plan selected, non-structural alternatives through flood plain management would be encouraged among local interests to prevent further development of damageable property in the 100-year flood plain for both Long Branch and Cowleech Fork.

TABLE 2

LAST ADDED ANALYSIS SHOWING FLOOD CONTROL INCREMENTS OF RESERVOIR PLANS

FLOOD CONTROL INCREMENTAL TO WATER SUPPLY IN ALL INSTANCES

(Annual benefits and costs in $1,000)

Reservoir Combination	Flood Control Storage (Ac.Ft.)	Annual Benefits	Annual Charges	B/C Ratio	Flood Control Storage (Ac.Ft.)	Annual Benefits	Annual Charges	B/C Ratio	Flood Control Storage (Ac.Ft.)	Annual Benefits	Annual Charges	B/C Ratio	Flood Control Storage (Ac.Ft.)	Annual Benefits	Annual Charges	B/C Ratio
		PLAN A				PLAN B				PLAN C				PLAN D		
Mineola only		2,916.3	1,869.8	1.56		2,611.3	1,815.7	1.43		2,177.6	1,815.7	1.20		2,727.2	2,714.7	1.00
Mineola and Lake Fork		3,702.9	2,387.5	1.55		3,500.0	2,467.0	1.42		3,110.1	2,462.5	1.26		3,890.6	4,157.2	0.94
Mineola, Lake Fork and Big Sandy		3,936.2	2,530.0	1.56		3,733.3	2,676.8	1.39		3,362.5	2,643.5	1.27		4,173.7	4,595.1	0.91
Mineola and Lake Fork		3,702.9	2,387.5	1.55		3,500.0	2,467.0	1.42		3,110.1	2,462.5	1.26		3,890.6	4,157.2	0.94
Big Sandy as last added	196,000	233.3	142.5	1.64	196,000	233.3	209.8	1.21	163,700	252.4	181.0	1.39	163,700	283.1	437.9	0.65
Mineola and Big Sandy		3,149.9	2,012.3	1.57		2,947.0	2,046.4	1.44		2,531.2	2,044.7	1.24		3,138.0	3,247.2	0.97
Lake Fork as last added	472,600	786.3	517.7	1.52	472,600	786.3	630.4	1.25	413,200	831.3	598.8	1.39	413,200	1,035.7	1,347.9	0.77
Lake Fork and Big Sandy		1,879.8	660.2	2.85		1,879.8	660.2	2.85		1,857.8	915.8	2.03		2,292.6	1,915.2	1.20
Mineola as last added	984,500	2,056.4	1,869.8	1.10	674,500	1,853.5	2,016.6	0.92	674,500	1,504.7	1,727.7	0.87	674,500	1,881.1	2,679.9	0.70

53-522 O-71 (Face p. 154) No. 1

TABLE 3

INCREMENTAL TESTS FOR WATER SUPPLY AND RECREATION
(Annual benefits and costs in $1,000)

Purpose	Mineola Reservoir				Lake Fork Reservoir				Big Sandy Reservoir			
	Benefits	Costs	Excess benefits over costs	B/C ratio	Benefits	Costs	Excess benefits over costs	B/C ratio	Benefits	Costs	Excess benefits over costs	B/C ratio
Water supply only	2,961.4	2,203.4	757.9	1.34	3,949.1	2,654.5	1,294.6	1.49	1,766.7	1,231.3	535.4	1.43
Flood control added	2,105.0	1,869.8	235.2	1.13	1,405.5	517.7	887.8	2.71	425.7	142.5	283.2	2.99
Dual purpose - Water supply and flood control	5,066.4	4,073.2	993.1	1.24	5,354.6	3,172.2	2,182.4	1.69	2,192.4	1,373.8	818.6	1.60
Recreation and Fish and Wildlife added	1,229.4	804.0	425.4	1.53	792.2	426.8	365.4	1.86	793.2	554.7	238.5	1.43
Multiple purpose - All purposes	6,295.8	4,877.2	1,418.5	1.29	6,146.8	3,599.0	2,547.8	1.71	2,985.6	1,928.5	1,057.1	1.55
Flood control only	2,105.0	3,071.2	- 966.2	0.69	1,405.0	1,800.5	- 395.5	0.78	425.7	897.6	- 471.9	0.47
Water supply added	2,961.4	1,002.0	1,959.4	2.96	3,949.1	1,371.7	2,577.4	2.88	1,766.7	476.2	1,290.5	3.71

53-522 O-71 (Face p. 154) No. 2

TABLE 4

ALTERNATIVES ANALYZED FOR
PROTECTION OF GREENVILLE, TEXAS
ECONOMIC VALUES IN $1,000

Alternative and basis of its analysis	Degree of protection	First cost	Annual costs	Annual benefits	Excess benefits over costs	B/C ratio
Cowleech Fork and Long Branch Combined						
Plan in Type II Report incremental to SCS plan	200-yr	797.0	44.7	35.0	-9.7	0.78
Long Branch Only						
Same as in Type II Report with channel 1 mile shorter	200-yr	201.3	13.5	14.1	0.6	1.04
Same as above but having a channel of less capacity	100-yr	181.0	11.8	13.0	1.2	1.10
Cowleech Fork Only						
Same as in Type II Report incremental to SCS plan	200-yr	600.0	31.6	20.6	-11.0	0.65
Same as in Type II Report with smaller channel, incremental to SCS plan and with FP management	100-yr	429.8	25.7	19.7	-6.0	0.76

Note: January 1970 price level.

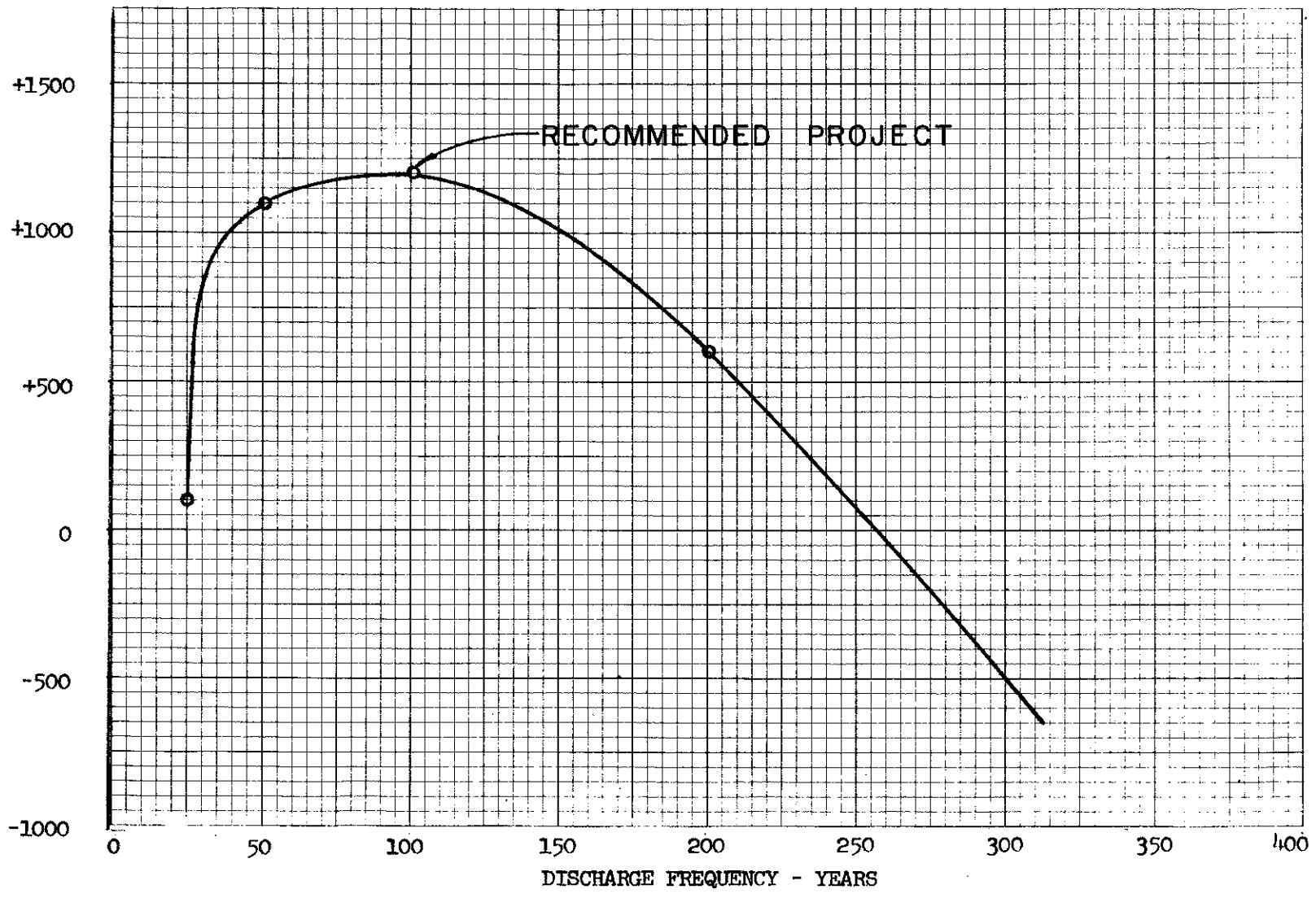


FIGURE 1

GREENVILLE LOCAL FLOOD PROTECTION - LONG BRANCH
MAXIMIZATION OF EXCESS BENEFITS OVER COSTS

NAVIGATION

18. GENERAL.- The type II report recommended a short-range navigation plan for a barge channel in the Sabine River from Echo to Pruitt Bluff, and a long-range plan for enlargement of this channel and extension of it to Longview, Texas, after 2020. The formulation of the long-range navigation plan is covered in Appendix K of the type II report, and is unchanged. It has been necessary, however, to reformulate the short-range navigation plan.

19. CHANNEL FROM ECHO TO MORGAN BLUFF.- In 1965 the Forest Products Division of Owens-Illinois announced the proposed construction of a paper mill on the Sabine River at Morgan Bluff in Orange County, Texas, and the Orange County Navigation District requested that the comprehensive basin study consider construction of a barge channel from Echo to Morgan Bluff, Texas, to serve the proposed mill. The mill subsequently was constructed in 1966-1967. Morgan Bluff was considered for the turning basin site in 1966. However, the company stated that this site was being reserved for future construction, and the turning basin was relocated to Pruitt Bluff, about one mile southeast of the paper mill. Conditions are presently such that the company prefers the nearer location Morgan Bluff; therefore, the proposed turning basin has been moved back to this location.

20. DESCRIPTION OF IMPROVEMENT.- The proposed channel from Echo to Morgan Bluff would be about 4,000 feet longer than the channel from Echo to Pruitt Bluff recommended in the type II report. The remainder of the project formulation for the channel is unchanged, and is covered in Appendix K of the type II report. The turning basin would be 600 feet by 600 feet in size and the channel would have initial authorized dimensions of 12 feet by 125 feet. The total length of the project, including the turning basin, would be 5.25 miles. Ultimately, it is expected that the channel would have a width of 200 feet, and it is considered that it would be more economical to acquire adequate right-of-way initially to accommodate the ultimate project.

21. ALTERNATIVES.- During the preparation of this report, consideration was given to several alternative modes of shipment from Morgan Bluff, including rail, barge, and truck-barge through Echo, as described in Appendix C. The benefits to be derived from a channel from Echo to Morgan Bluff are based on a comparison with the least costly alternative of shipment by truck-barge through Echo.

22. ECONOMIC JUSTIFICATION.- The estimated first costs, annual charges, average annual benefits, and the B/C ratio for the selected channel from Echo to Morgan Bluff are shown in table 5. The project is considered well justified having a B/C ratio of 3.6 to 1. Accordingly, the project is included in the plan of improvement of the Corps report.

TABLE 5

ESTIMATED COSTS AND BENEFITS
NAVIGATION CHANNEL FROM ECHO TO MORGAN BLUFF, TEXAS
SABINE RIVER

FIRST COST	
Federal	$1,765,200
Non-Federal public	276,000
Non-Federal private	11,800
Total first cost	$2,053,000
ANNUAL CHARGES*	
Federal:	
Interest and amortization	94,700
Maintenance, operation and major replacement	31,000
Subtotal Federal annual charges	$ 125,700
Non-Federal public:	
Interest and amortization	14,800
Maintenance and operation	3,900
Subtotal non-Federal public annual charges	$ 18,700
Non-Federal private:	
Interest and amortization	700
Maintenance and operation	24,900
Subtotal non-Federal private annual charges	$ 25,600
TOTAL ANNUAL CHARGES	$ 170,000
AVERAGE ANNUAL EQUIVALENT BENEFITS*	$ 616,000
B/C RATIO	3.6

*Based on 50-year period of economic analysis, and an interest rate of 4-7/8 percent.

23. PROJECTS INCLUDED IN RECOMMENDED PLAN.- The economic summary of the projects in the plan of improvement of the Corps report is presented in table 6. It should be noted that the benefits in the column headed EDA which apply to the three reservoirs of the selected plan have been added to the benefits utilized throughout this formulation appendix. The EDA benefits are those which would be realized through the projects construction, operation, and maintenance in areas designated by the Economic Development Administration as areas of unemployment or underemployment. The EDA benefits are developed in detail in Appendix C - Economics. The B/C ratios developed in table 6 are regarded as the B/C ratios of the individual projects recommended in the Corps report.

53-522 O-71——14

TABLE 6

ECONOMIC SUMMARY OF PROJECTS IN PLAN OF IMPROVEMENT
SABINE RIVER AND TRIBUTARIES
(Values shown in $1,000)

Project	Estimated First Cost	Annual Economic Costs	Annual Benefits Excluding EDA	Annual Benefits EDA	Annual Benefits Total	Excess Benefits Over Costs	B/C Ratio
Multiple purpose reservoirs							
Mineola	87,869.0	4,877.2	6,295.8	75.1	6,370.9	1,493.7	1.3
Lake Fork	68,589.0	3,599.0	6,146.8	57.7	6,204.5	2,605.5	1.7
Big Sandy	33,511.0	1,928.5	2,985.6	30.8	3,016.4	1,087.9	1.6
Total - reservoirs	189,969.0	10,404.7	15,428.2	163.6	15,591.8	5,187.1	1.5
Greenville Local Protection	181.0	11.8	13.0	0	13.0	1.2	1.1
Navigation channel from Echo to Morgan Bluff	2,053.0	170.0	616.0	0	616.0	446.0	3.6

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX B

HYDROLOGY AND HYDRAULIC DESIGN

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY

SABINE RIVER AND TRIBUTARIES, TEXAS AND LOUISIANA

APPENDIX B

HYDROLOGY AND HYDRAULIC DESIGN

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

LIST OF PLATES

TABLE OF CONTENTS (CONT'D)

LIST OF PLATES (CONT'D)

COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX B

HYDROLOGY AND HYDRAULIC DESIGN

GENERAL

1. SCOPE.- Appendix C of the Comprehensive Basin Study on the Sabine River and Tributaries, Texas and Louisiana, (hereafter referred to as the Type II Report) contains detailed analyses concerning hydrologic aspects of water problems in the basin and a presentation of hydrologic design criteria for the facilities recommended to alleviate these problems. The recommendations presented in this report differ in some respects from those presented in the Type II Report. In addition, certain questions have been raised in the review process which were not discussed in the Type II Report. Using Appendix C and Appendix D of the Type II Report as source documents, the present Hydrology and Hydraulic Design Appendix will only discuss those hydrologic and hydraulic design aspects that will be affected by departures from the plan presented in the Type II Report and add information necessary for the clarification of items presented in that report.

2. DATA IN COMPREHENSIVE STUDY.- General watershed and hydrologic data available for reference in paragraphs 1 through 43 and 66 through 76, Appendix C, of the Type II Report are applicable as well to the present Hydrology Appendix and will, therefore, not be repeated here. General watershed data within this category are as follows: basin description, existing Federal and non-Federal improvements, floodwater retarding structures, water resource data and requirements, and flood problems. General hydrologic data within the same category are: climate, humidity, winds, temperature, growing season, precipitation, evaporation, streamflow, droughts, and storms.

3. PLANS INVESTIGATED.- In reviewing the plan of development recommended in the Type II Report, various alternatives were examined in light of review comments, changing conditions, and additional data collected in the interim. Alternatives considered in project formulation studies for the selection of a short-range plan for the main stem of the Sabine River were as follows:

Plan A - Multiple-purpose reservoirs with 50-year flood-control storage in Mineola, Lake Fork, and Big Sandy Reservoirs and existing channels only.

Plan B - Lake Fork and Big Sandy Reservoirs same as Plan A. Mineola Reservoir same as Type II Report, but with 25-year inviolate flood-control storage. Easements for channel reach downstream from Mineola Reservoir.

Plan C - Same as Type II Report, but with easements in lieu of enlarged channels.

Plan D - Same as Type II Report.

Plan E - Mineola, Lake Fork, and Big Sandy Reservoirs for water supply only with downstream channels to carry flood of 5-year frequency.

Plan F - Mineola, Lake Fork, and Big Sandy Reservoirs for water-supply only with downstream levees to pass flood of 50-year frequency.

Modifications of the local flood protection project at Greenville and the navigation project were also investigated.

4. RECOMMENDED PLAN OF IMPROVEMENT.- As a result of project formulation studies for the alternatives listed in the preceding paragraph, a plan of improvement has been recommended for authorization which would consist of the Mineola, Lake Fork, and Big Sandy multiple-purpose reservoirs with 50-year flood control and no downstream channel enlargement for flood releases (alternative A above); a local flood protection project at Greenville; and a navigation project from Echo to Morgan Bluff. The adoption of a plan without channel enlargements will prolong flood-control releases over extremely long periods of time during the passage of major floods and require that additional flood-control storage be provided to control the 50-year flood. However, without channelization, the integrity of the stream environment will be preserved and the stream valleys will be more in keeping with their natural condition for the benefit of the fishery, wildlife, natural vegetation, and the people using the area.

5. Inundation of the stream and lands upstream of the three reservoir projects will result in wildlife habitat losses at the reservoir sites. The recommended plan of improvement will provide for the acquisition of some lands along the downstream channels to mitigate these losses. It is probable that use of these mitigation lands for reservoir releases during flood periods may affect a reduction in the flood-control storage requirements and emptying time of the upstream reservoirs. However, possible alternative reservoir operations that might take advantage of this situation will be deferred until advanced planning studies when detailed acquisition plans are developed.

6. DEPARTURES FROM TYPE II REPORT.- Major departures in the hydrologic and hydraulic design aspects of the plan now recommended for authorization from those of the short-range plan presented in the Type II Report are noted in table 1.

RESERVOIRS

7. AREA AND CAPACITY.- Area and capacity data for Mineola, Lake Fork, and Big Sandy Reservoirs are presented in paragraph 49 and tables 25-27, Appendix C, of the Type II Report.

TABLE 1

COMPARISON OF COMPREHENSIVE STUDY PLAN AND SELECTED PLAN

Item	Comprehensive Study			Recommended for Authorization		
	Mineola	Lake Fork	Big Sandy	Mineola	Lake Fork	Big Sandy
Top of dam (ft msl)	404.0	430.5	400.5	410.5	431.5	401.5
Maximum design water surface (ft msl)	398.2	424.7	395.0	404.7	425.7	396.3
Maximum routed outflow (cfs)	186,000	21,000	18,600	185,000	20,400	17,800
Top of flood-control pool (ft msl)	393.0	410.0	380.0	400.0	411.5	382.0
Storage at top of flood-control pool (ac ft)	1,065,000	1,053,600	385,900	1,375,000	1,113,000	418,200
Flood-control storage (ac ft)	674,500	413,200	163,700	984,500	472,600	196,000
Reservoir yield (cfs)	129	250	102	129	244	102
Minimum downstream channel capacity (cfs)	8,500	5,000	2,100	2,000	3,000	1,000
Routing data - flood of record (1945)						
Emptying time (days)						
Ideal, no downstream runoff	40	41	41	247	79	99
Actual, based on routing	53	50	58	742	139	149
Total time actually in flood operation (days)	97	97	94	894	461	561
Channel capacities (cfs)						
Gladewater		16,400			6,000	
Logansport		18,000			10,000	
Greenville local protection project						
Long Branch						
Plan		Channels			Channels	
Design flood		70% Standard Project Flood			100-year	
Design flood discharges (cfs)						
Above Interstate Highway 30		2,800			2,300	
At mouth		4,200			3,400	
Cowleech Fork of Sabine River						
Plan		Channels			Flood Plain Management	
Design flood		70% Standard Project Flood			100-year	
Condition		with SCS program			without SCS program	
Design flood discharges (cfs)						
Above Horse Creek		8,900			12,700	
Above Long Branch		9,800			15,100	
Below Long Branch		11,200			17,500	

8. DETERMINATION OF RESERVOIR INFLOWS.- The method for the determination of monthly and annual inflows to Mineola, Lake Fork, and Big Sandy Reservoirs and tabulations of these inflows are presented in paragraph 50 and tables 32-34, Appendix C of the Type II Report.

9. SEDIMENT STORAGE.- The method for the determination of the total sediment requirement, its distribution, and tabulation of the sediment storage to be provided in the conservation and flood-control pools of Mineola, Lake Fork, and Big Sandy Reservoirs are presented in paragraphs 51-53, Appendix C, of the Type II Report.

10. CONSERVATION STORAGE AND YIELD.- Conservation storage capacities and yields for Mineola, Lake Fork, and Big Sandy Reservoirs were established as set forth in paragraph 54, Appendix C, of the Type II Report. Critical period data and conservation storage requirements are also identical with those presented in the Type II Report. However, in the interim, it was discovered that the yield of 250 second-feet given for Lake Fork Reservoir in the Type II Report was for the 1950-1957 drought period rather than the more critical 1924-1940 period, when a yield of only 244 second feet was obtained. Conservation storages and yields for the three reservoirs under the conditions established in Appendix C of the Type II Report are as follows:

Mineola Reservoir, 370,100 acre-feet, 129 second-feet.
Lake Fork Reservoir, 621,500 acre-feet, 244 second-feet.
Big Sandy, 215,300 acre-feet, 102 second-feet.

11. FLOOD-CONTROL STORAGE.- The flood-control storage requirements for Mineola, Lake Fork, and Big Sandy Reservoirs were established as set forth in paragraph 55, Appendix C, of the Type II Report with regulation to existing downstream channel capacities. Also, flood-control storage requirements were based on the assumption that yields from the reservoirs would not initially be required for water supply and that these yields would be temporarily stored in the reservoirs during flood periods and subsquently released when downstream conditions permit. Therefore, by not adjusting for these yields, we have automatically provided for the temporary storage and subsequent evacuation of this additional accumulation of storage during flood periods at rates consistent with existing downstream channel capacities. At such times as these yields are required for water supply, the routing of the 50-year flood can be adjusted to allow for that portion of the reservoir yields required to meet upstream in-basin and out-of-basin needs and reservoir storage space thus made available could then be used for additional flood-control or conservation storage. The 50-year flood-control storage requirements established by routing the March-April 1945 (50-year) flood

with regulation to existing channel capacities, the actual emptying time (based on the flood routing), the minimum emptying time (based on the assumption of no downstream runoff), and the existing downstream channel capacities are shown on table 2.

TABLE 2

FLOOD-CONTROL STORAGE REQUIREMENTS
50-YEAR FLOOD

Reservoir	Drainage area (sq mi)	Storage requirements (acre-feet)	Storage requirements (inches)	Emptying time (days) Actual	Emptying time (days) Minimum
Mineola	1,146	984,500	16.11	742	247
Lake Fork	507	472,600	17.48	139	79
Big Sandy	196	196,000	18.75	149	99

Stream	Reach	Existing channel capacity (cfs)
Sabine River	Mineola DS to mouth Lake Fork Cr	2,000
Lake Fork Cr	Lake Fork DS to mouth	3,000
Big Sandy Cr	Big Sandy DS to mouth	1,000
Sabine River	Mouth Lake Fork Cr, mile 444.9 to mile 397.5	6;000
Sabine River	Mile 397.5 to mile 327.0	10,000
Sabine River	Mile 327.0 to mile 267.1	10,000

12. The 1945 flood was the maximum flood of record on the Sabine River Basin. The second largest flood occurred in 1957. However, the 1957 flood occurred after a severe drought when drawdown storage was available in the conservation pools of the reservoirs; consequently, the 1957 flood did not produce high reservoir elevations. Based upon continuous operation of the reservoirs through the period of record, the floods of 1950 and 1958 would be considered the second and third largest floods in terms of maximum reservoir level attained and flood-control storage utilized. Table 3 shows the maximum reservoir elevation, flood-control storage utilized, and actual emptying time for each of the three reservoirs during passage of the floods of 1950 and 1958.

TABLE 3

RESULTS OF FLOOD ROUTING
OTHER MAJOR FLOODS

Reservoir	Flood-control storage utilized (acre-feet)	Maximum reservoir elevation (ft msl)	Emptying time (days)
	1950 flood		
Mineola	314,400	383.4	189
Lake Fork	114,400	401.1	30
Big Sandy	34,500	370.6	29
	1958 flood		
Mineola	517,100	389.0	144
Lake Fork	257,700	405.6	47
Big Sandy	0	367.5	0

13. UTILIZATION OF DRAWDOWN STORAGE.- The 50-year flood-control storage recommended for the three reservoir projects has been based upon the occurrence of the 50-year project design flood on a full conservation pool. However, the conservation pools of the three reservoirs have been sized to fully develop the resources of their contributing watersheds; consequently, frequent and substantial drawdowns of the conservation pool will occur during the life of each project. The relatively short time that the three reservoirs would be in flood-control operation is indicated by the pool elevation-duration curves for Mineola, Lake Fork, and Big Sandy Reservoirs shown on plates A, B, and C, respectively. To determine the effect of these drawdowns on the ability of the reservoirs to control floods in excess of their project design floods, the procedures recommended in paragraph 8-06 of Leo R. Beard's "Statistical Methods in Hydrology" were followed. These procedures, reflecting the coincident frequency of runoff and reservoir drawdown, indicate that the flood-control storage recommended for the Sabine River reservoirs, although nominally 50-year storage, would effectively provide a considerably higher degree of downstream control.

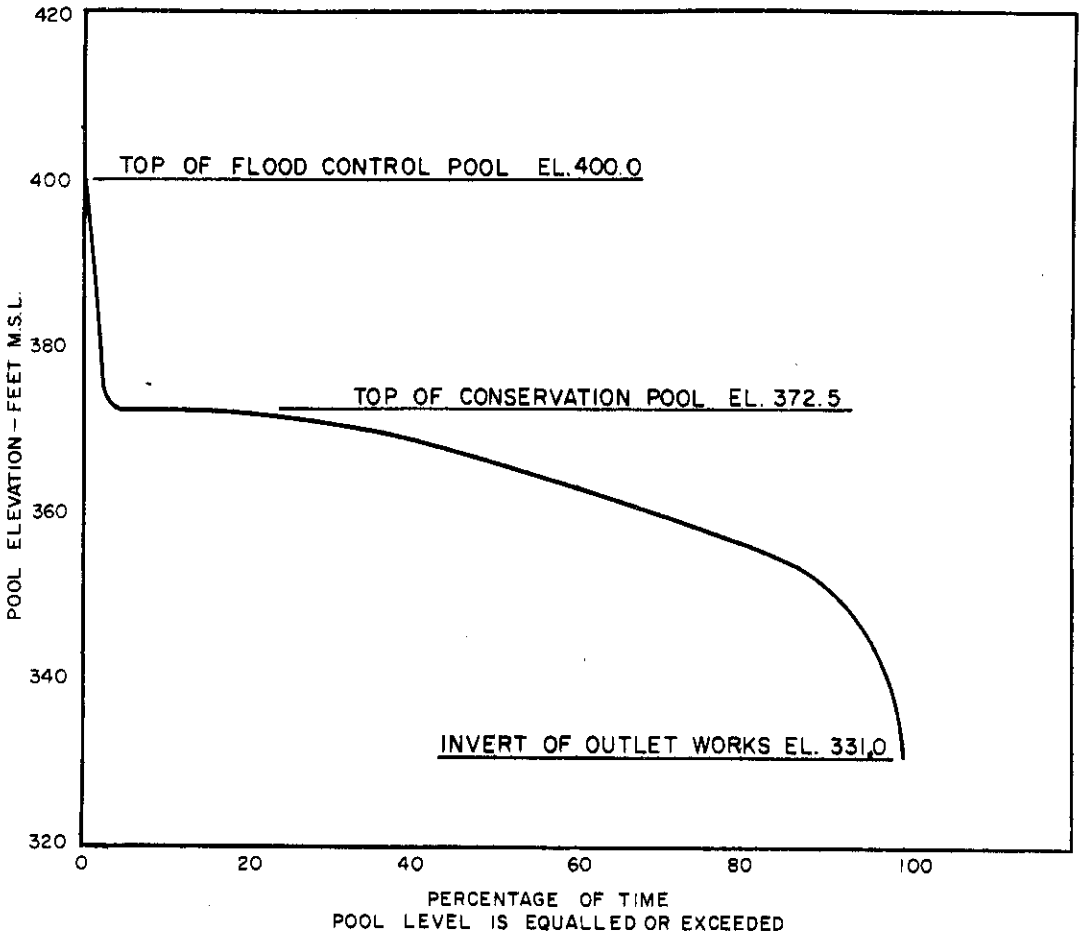
14. FLOOD-CONTROL STORAGE ANALYSIS.- A further analysis of the flood-control storage requirements for the three reservoirs was made by comparing these requirements with average annual and maximum annual runoff from the areas above the reservoirs. As indicated in the preceding paragraph, drawdown storage available in the conservation pools of the reservoirs will often augment

the flood-control storage during the passage of major floods. Therefore, the comparison was made on the basis of total controlled storage (excluding sedimentation) as well as flood-control storage. Also, in order that the data for total controlled storage be comparable in all three areas, the conservation storage in Tawakoni Reservoir has been included for the area above Mineola Reservoir. The results of this analysis are presented in table 4.

15. INTERIM RESERVOIR OPERATION.- Flood-control storage requirements for the three reservoirs were based on the assumption that yields from the reservoirs would not initially be required for water supply and that these yields would be temporarily stored in the reservoirs during flood periods and subsequently released when downstream conditions permit (see paragraph 11). However, the flood-control storage requirements established in this manner are sufficient only if the reservoir elevation does not exceed the top of conservation pool at the beginning of the 50-year flood. Period of record routings, assuming full utilization of the reservoir yields, have shown that the reservoir elevations would not exceed the top of conservation pool at the beginning of the 50-year (1945) flood. On the other hand, period of record routings, assuming no utilization of the reservoir yields, indicate that there would be encroachment on the flood-control storage at the beginning of the 50-year flood and that the recommended flood-control storages in the three reservoirs would not control the 50-year flood. In order to keep the recommended flood-control storage space inviolate during the interim period prior to full utilization of reservoir yields, it is recommended that, subsequent to the initial filling, continuous releases be made at the established yield rates even during drawdown periods when the reservoirs are below the top of conservation pools. It is possible that alternate methods of accomplishing the same objective are available. Detailed investigations of these alternatives will be made during advanced planning studies.

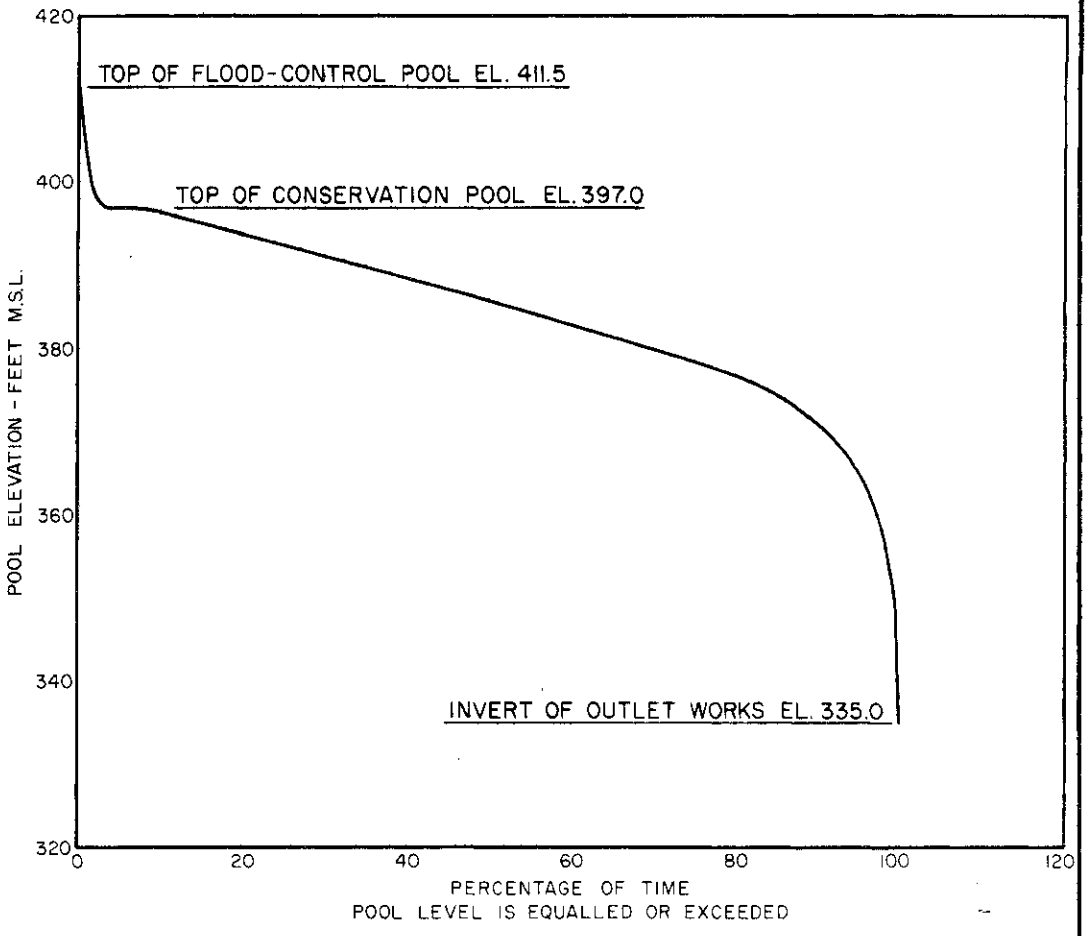
16. UTILIZATION OF SURCHARGE STORAGE.- The three recommended reservoirs will also be effective in reducing downstream flood peaks during the passage of floods in excess of the project design flood. At the Mineola project, equipped with a gated spillway, induced surcharge operation can be employed to reduce the outflow from such floods. As a result of economic studies weighing spillway versus embankment costs, the Lake Fork and Big Sandy Reservoirs have been provided with very narrow uncontrolled spillways that will effectively reduce the outflow from floods whose storage utilization exceeds the controlled storage space.

17. FLOOD-CONTROL EFFECTS.- In order to evaluate the flood-control effects of the reservoirs in the recommended plan of improvement for the Sabine River Basin, the peak discharges for the damaging floods of record were determined under post-project conditions at the principal gaging stations within the affected areas by flood-routing



SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
POOL ELEVATION DURATION
MINEOLA RESERVIOR

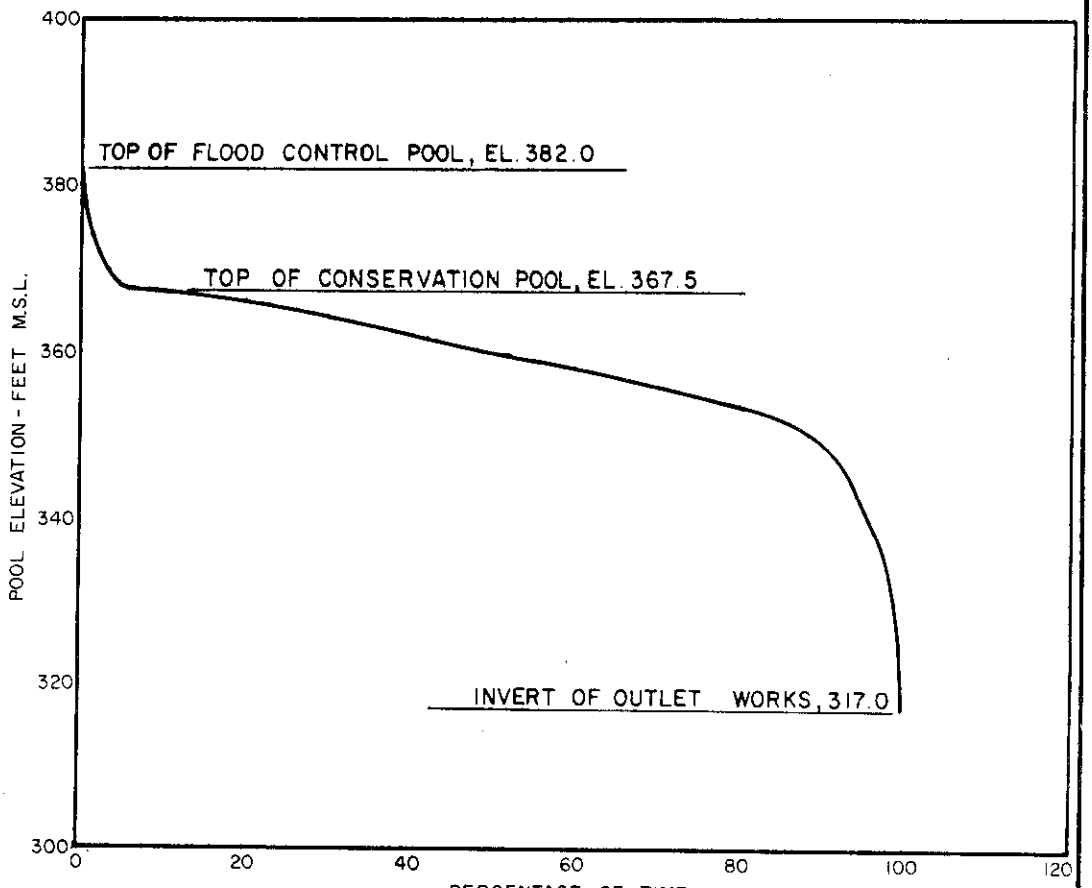
PLATE A



SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
POOL ELEVATION DURATION
LAKE FORK RESERVOIR

PLATE B

CORPS OF ENGINEERS U.S. ARMY



SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
POOL ELEVATION DURATION
BIG SANDY RESERVOIR

PLATE C

53-522 O—71——15

TABLE 4

ANALYSIS OF FLOOD-CONTROL STORAGE

Runoff or storage considered	1,000 acre-feet			Inches		
	Mineola	Lake Fork	Big Sandy	Mineola	Lake Fork	Big Sandy
			Runoff			
Mean annual	471.0	227.6	97.0	7.71	8.42	9.28
Maximum annual	1576.0(1)	775.0(2)	303.1(2)	25.79	28.66	29.01
			Storage			
Flood-control	984.5	472.6	196.0	16.11	17.48	18.75
Total controlled	2311.2(3)	1113.0	418.2	37.81	41.16	40.01

(1) Calendar year 1957
(2) Calendar year 1945
(3) Includes 936,200 acre-feet in Lake Tawakoni

Data in the above table indicate that the flood-control storage in each of the three reservoirs is equivalent to about 200 percent of their average annual runoff and that the total controlled storage in each of the reservoirs is about 140 percent of their maximum annual runoff.

procedures using the existing channel capacities as operating discharges. These procedures are explained in paragraph 57, Appendix C, of the Type II Report. The results of these flood routings for the maximum known general flood (March-April 1945) in the Sabine River Basin are summarized in table 5.

TABLE 5

RESULTS OF ROUTING
FLOOD OF MARCH-APRIL 1945

Reservoir or stream gage	Maximum reservoir elevation (ft msl)	Peak discharge (cfs) Existing	Modified
Mineola Reservoir	400.0	63,800	2,000
Lake Fork Reservoir	411.5	65,800	3,000
Big Sandy Reservoir	382.0	32,300	1,000
Gladewater		138,000	43,400
Logansport		92,000	47,300
Bon Wier		75,500	45,700
Ruliff		85,300	52,000

18. STANDARD PROJECT FLOOD.- The Standard Project Storm rainfalls for the areas above Mineola, Lake Fork and Big Sandy Reservoirs were determined in accordance with EM 1110-2-1411 (Civil Works Engineer Bulletin No. 52-8, dated 26 March 1952, subject: "Standard Project Flood Determinations"). An initial loss of 0.5 inch and a uniform infiltration rate of 0.05 inch per hour were applied to the 6-hour increments of Standard Project Storm rainfall to obtain inflows of 13.23, 14.79, and 16.60 inches to Mineola, Lake Fork, and Big Sandy Reservoirs, respectively. No Standard Project Flood hydrographs were constructed and routed through the reservoirs since the runoff volumes given above are less than the flood-control storages of 16.11, 17.48, and 18.75 inches recommended for Mineola, Lake Fork, and Big Sandy Reservoirs, respectively.

19. SPILLWAY DESIGN FLOOD HYDROGRAPHS.- The derivations of the spillway design storms and spillway design flood hydrographs for Mineola, Lake Fork, and Big Sandy Reservoirs are presented in detail in paragraphs 58-61, Appendix C, of the Type II Report. Although the reservoir projects presently recommended for authorization would have a larger surface area at full pool elevation and consequently higher runoff from the reservoir surface than the projects recommended in the Type II Report, this increase would amount to only about 0.1 percent of the total flood volume. Therefore, the spillway design flood hydrographs presented in Appendix C of the Type II Report are also considered applicable to the present study.

20. SPILLWAY DESIGN FLOOD ROUTINGS.- The spillway design flood hydrographs for flow into full reservoir were routed through Mineola, Lake Fork, and Big Sandy Reservoirs under the assumptions set forth in paragraph 62, Appendix C, of the Type II Report. Spillway design flood routings made under these assumptions resulted in reservoir levels and peak outflows as shown in table 6.

TABLE 6

RESULTS OF SPILLWAY DESIGN FLOOD ROUTINGS

Reservoir	Maximum design water surface (ft msl)	Peak outflow (cfs)
Mineola	404.7	185,000
Lake Fork	425.7	20,400
Big Sandy	396.3	17,800

21. GUIDE CONTOUR.- The guide contours for real estate acquisition at Mineola, Lake Fork, and Big Sandy Reservoirs were established in accordance with the procedures set forth in paragraph 63, Appendix C, of the Type II Report. The adopted elevations for the guide contour are summarized in table 7.

TABLE 7

GUIDE CONTOUR ELEVATIONS

Reservoir	Elevation (ft msl)
Mineola	403.0
Lake Fork	416.5
Big Sandy	387.0

22. RELOCATION CRITERIA.- The criteria for alterations and relocations are set forth in paragraph 64, Appendix C, of the Type II Report. However, for the purpose of this report (as in the Type II Report), the elevations adopted for the guide contour in table 7 above, have also been adopted as the basis for relocation estimates.

23. FREEBOARD REQUIREMENTS.- The bases for the establishment of freeboard requirements at Mineola, Lake Fork, and Big Sandy Reservoirs are set forth in paragraph 65, Appendix C, of the Type II Report. The computed wave heights and total freeboard requirements are shown in table 8.

TABLE 8

FREEBOARD REQUIREMENTS

Reservoir	Maximum design water surface elevation (ft msl)	Wave height (feet)	Total required freeboard (feet)	Freeboard provided (feet)	Elev of top dam (ft msl)
Mineola	404.7	4.9	5.9	5.8	410.5
Lake Fork	425.7	5.2	5.9	5.8	431.5
Big Sandy	396.3	3.8	5.3	5.2	401.5

24. RESERVOIR DATA.- Pertinent data for each of the three reservoir projects recommended in this report are given in tables 9, 10, and 11 for the Mineola, Lake Fork, and Big Sandy projects, respectively. The hydraulic features and general hydraulic design data are shown on plates 1 through 4, 5 through 8, and 9 through 12 for the Mineola, Lake Fork, and Big Sandy projects, respectively.

25. SYSTEM FLEXIBILITY.- In areas such as the southwest where future water demands are expected to exceed available supplies, it is imperative that each new water supply project be sized to fully develop, insofar as possible, the resources of the basin. Inherent in this type of development are frequent and sometimes substantial drawdowns. These drawdowns, though possibly undesirable from the standpoint of the recreation user, add a considerable flexibility to the system operation. We have already discussed one aspect of this flexibility whereby a higher degree of flood-control storage is made available. The Sabine River reservoirs offer another potential advantage. The Texas Water Plan proposed the importation of water to meet future needs. At present, the most likely source of such water appears to be the Mississippi River. Any practical import scheme will require a holding storage facility somewhere along the distribution system to allow for variations in the magnitude and timing of supply and demand. Because of the relatively low evaporation losses, there is no location in Texas more favorable for surface water storage than the Sabine River Basin. There is also no cheaper location for such holding storage than in an already existing reservoir. The drawdown storage spaces in the Sabine River Basin reservoirs thus appear to offer themselves as possible adjuncts to any plan of importation from the east.

TABLE 9
PERTINENT DATA
MINEOLA RESERVOIR
(RECOMMENDED)

LOCATION:
R.M. 475.6 on Sabine River in Van Zandt, Wood and Raines Counties. About 6 mi. northwest of Mineola

DRAINAGE AREA: 1,146 sq. mi.
(includes 756 sq. mi. above Iron Bridge Dam)

DAM:
Type: Earth and rock fill
Length: 26,300 ft. (including spillway)
Maximum height: 90.5 ft.
Top width: 30 ft.

SPILLWAY:
Crest: 365.0 ft. msl
Length: 200.0 ft.
Type: Controlled
Control: 5 - 40' x 35' tainter gates

INFLOW:
Spillway design flood peak, cfs 423,400
Spillway design flood volume, ac-ft 1,689,700
Spillway design flood runoff, in. 27.64

OUTFLOW:
Total routed peak outflow, cfs 185,000
Spillway
Outlet works 0 (1)

OUTLET WORKS:
Type: 2 sluices
Dimension: Each 4'0" x 8'0"
Control: 2 - 4'0" x 8'0" slide gates
Invert: 331.0 ft. msl

POWER FEATURES:
None

RESERVOIR DATA

Feature	Elev. feet msl	Reservoir Area (acres)	Reservoir Capacity: Accumulative (ac-ft)	Runoff (inches)	Reservoir Capacity: Incremental (ac-ft)	Spillway Capacity (cfs)	Outlet Works Capacity (cfs) (1)
Top of Dam	410.5						
Maximum Water Surface	404.7	50,290	1,603,000	26.23		185,000	
Flood Control Pool	400.0	46,900	1,375,000	22.50	984,500	0	2,800
Conservation Pool	372.5	23,900	386,000	6.32	370,100	0	2,000
Spillway Crest	365.0	17,420	230,800	3.78			1,800
Sediment					20,400*		
Total Storage					1,375,000		
Maximum Tailwater	358.3						
Streambed	320.0						

* Sediment distributed as follows: 15,900 ac-ft below el. 372.5: 4,500 ac-ft between el. 372.5 and 400.0.

(1) Outlet works inoperative during passage of Spillway Design Flood.

TABLE 10
PERTINENT DATA
LAKE FORK RESERVOIR
(RECOMMENDED)

LOCATION:
R.M. 28.1 on Lake Fork Creek, a tributary of the Sabine River in Hopkins County. About 2 mi. northwest of Quitman.

DRAINAGE AREA: 507 sq. mi.

DAM:

Type:	Earth and rock fill
Length:	16,130 ft. (including spillway)
Max. Height:	106.5 ft.
Top Width:	46 ft.

SPILLWAY:

Crest:	411.5 ft msl
Length:	100.0 ft.
Type:	Broadcrested
Control:	None

INFLOW:

Spillway design flood peak, cfs	435,600
Spillway design flood volume, ac-ft	817,300
Spillway design flood runoff, in.	30.23

OUTFLOW:

Total routed peak outflow, cfs	20,400
Spillway	13,900
Outlet Works	6,500

OUTLET WORKS:

Type:	1 gate controlled conduit
Dimension:	12' diameter
Control:	2 - 5'6" x 12'0" slide gates
Invert:	335 ft. msl

POWER FEATURES:
None

RESERVOIR DATA

Feature	Elev. feet msl	Reservoir Area (acres)	Reservoir Capacity: Accumulative (ac-ft)	Runoff (inches)	Reservoir Capacity: Incremental (ac-ft)	Spillway Capacity (cfs)	Outlet Works Capacity (cfs)
Top of dam	431.5						
Maximum water surface	425.7	59,300	1,816,400	67.17		13,900	6,500
Flood control pool	411.5	40,060	1,113,000	41.16	472,600	0	5,900
Spillway crest	411.5	40,060	1,113,000	41.16		0	5,900
Conservation pool	397.0	26,400	638,000	23.60	621,500	0	5,300
Sediment					18,900*		
Total					1,113,000		
Maximum tailwater	345.0						
Streambed	325.0						

* Sediment distributed as follows: 16,600 acre-feet below el. 397.0; 2,300 ac-ft between el. 397.0 and 411.5.

TABLE .11
PERTINENT DATA
BIG SANDY RESERVOIR
(RECOMMENDED)

LOCATION:
R.M. 15.3 on Big Sandy Creek, a tributary of the Sabine River in Wood County and about 4 miles northeast of Hawkins, Texas

DRAINAGE AREA: 196 sq. mi.

DAM:
- Type: Earth and rock fill
- Length: 6,200 ft. (including spillway)
- Max. height: 94.5 ft.
- Top width: 42 ft.

SPILLWAY:
- Crest: 382.0 ft msl
- Length: 100.0 ft.
- Type: Broadcrested
- Control: None

INFLOW:
- Spillway design flood peak, cfs 266,700
- Spillway design flood volume, ac-ft 341,600
- Spillway design flood runoff, in. 32.68

OUTFLOW:
- Total routed peak outflow, cfs 17,800
- Spillway 14,500
- Outlet works 3,300

OUTLET WORKS:
- Type: 1 gate controlled conduit
- Dimension: 9' diameter
- Control: 2 - 4'3" x 9'0" slide gates
- Invert: 317.0 ft. msl

POWER FEATURES:
None

RESERVOIR DATA

Feature	Elev. feet msl	Reservoir Area (acres)	Reservoir Capacity: Accumulative (ac-ft)	Runoff (inches)	Reservoir Capacity: Incremental (ac-ft)	Spillway Capacity (cfs)	Outlet Works Capacity (cfs)
Top of dam	401.5						
Maximum water surface	396.3	23,000	698,600	66.83		14,500	3,300
Flood control pool	382.0	16,580	418,200	40.01	196,000	0	3,000
Spillway crest	382.0	16,580	418,200	40.01		0	3,000
Conservation pool	367.5	10,810	221,200	21.16		0	2.600
Sediment					6,900*		
Total storage					418,200		
Maximum tailwater	322.5						
Streambed	307.0						

* Sediment distributed as follows: 5,900 ac-ft below el. 367.5; 1,000 ac-ft between el. 367.5 and 382.0.

26. However, the availability of drawdown storage for this purpose would require additional studies to evaluate the effect on the flood control aspects of the reservoir system.

27. DESIGN CONSIDERATIONS - MINEOLA RESERVOIR.- The pool created by the Mineola Reservoir would extend up the Sabine River to the Iron Bridge Dam (Lake Tawakoni). If the water surface level were at the top of conservation storage in Mineola Reservoir, it would extend almost to the toe of the Iron Bridge Dam. The flood-control pool would fluctuate over a range of 18.5 feet and the surcharge pool over an additional 5 feet to the maximum design surface level. Storage within this 23.5-foot range would subject the downstream face of the Iron Bridge Dam to potential wave action. To eliminate the possible damage to the embankment, the Iron Bridge Dam will require protection in the form of a properly designed riprap blanket. The riprap was designed on the basis of the assumption of the occurrence of a 40-mile-per-wind velocity from a critical direction occurring coincidentally with the maximum design water surface at the Mineola project. The resulting wave action would require the placing of a 24-inch riprap thickness on a 9-inch bedding material layer on the stripped embankment. Costs of this protection were included in the overall costs of the Mineola project.

28. The protection of the Iron Bridge embankment is important in reducing future damage claims and maintenance costs. An over-riding reason, however, is that the safety of the structure is vital to the Mineola project. Located immediately upstream from the Mineola pool, as it is, any failure could produce an emergency situation which would require immediate and careful operating procedures to reduce the danger to the Mineola project.

29. Accordingly, studies were made of the design of the Iron Bridge embankment and the effect of the Mineola project operation. No alteration in the embankment slope was found necessary, but it was recommended that provisions for additional drainage be added to the existing spillway. Costs for this improvement are included in the cost of the Mineola project.

30. As a further check against the safety of the project, a spillway design flood was developed for Iron Bridge based on Corps' criteria. The probable maximum storm, centered on the 756 square-mile area above the Iron Bridge project, resulted in a total storm rainfall of 32.7 inches in a 72-hour period. Application of an initial loss of 1.00 inch and an infiltration loss of 0.05 inch per hour result in a total rainfall excess of 28.5 inches with a maximum 6-hour value of 16.4 inches. The rainfall excess was applied to the flow-into-full reservoir unit graph presented in table 52 of Appendix C of the Comprehensive Study to develop the inflow hydrograph. The hydrograph was routed through the existing Lake Tawakoni, assuming the pool at the spillway crest, elevation 437.5,

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LAKE TAWAKONI
SPILLWAY CREST
EL. 4375

IRON BRIDGE DAM

CLARKS CHAPEL

EMORY

HUNT CO.
VAN ZANDT CO.

RAINS CO.
WOOD CO.

ALBA

GOLDEN

GRAND SALINE

VAN ZANDT CO.
SMITH CO.

SABINE RIVER

Shuffle Cr.
Reader Cr.
Brushy Cr.
Woodbury Cr.
Long Br.
Muscadine Br.
Briar Br.
Little Slough
Steer Slough
Yellow Slough
McBee Cr.
Cedar Cr.
McInturff Cr.
Stewart Br.
Leatherman Cr.
Simpkins Cr.
Lake Louise
Cedar Lake
Gilladon Cr.
Mill Cr.
Crooked Cr.
Canet Cr.
City Lake
Goose Lake

2 Pipelines 18" & 14" United Gas
PIPELINE 20" MAGNOLIA
T. & P. R.R.

VICINITY MAP

SCALE IN MILES 50 0 30 60

LEGEND

- U.S. HIGHWAY
- STATE HIGHWAY
- FARM TO MARKET HIGHWAY
- RIVER MILE (MILE ABOVE MOUTH)
- PIPE LINE
- RAILROAD
- POWER TRANSMISSION LINE
- TOP OF WATER SUPPLY STORAGE EL. 372.5
- TOP OF FLOOD CONTROL STORAGE EL. 400.0
- HIGHWAY RELOCATION OR ALTERATION

AREA-CAPACITY CURVES

AREA IN THOUSAND ACRES

CAPACITY

AREA

ELEVATION IN FEET ABOVE M.S.L.

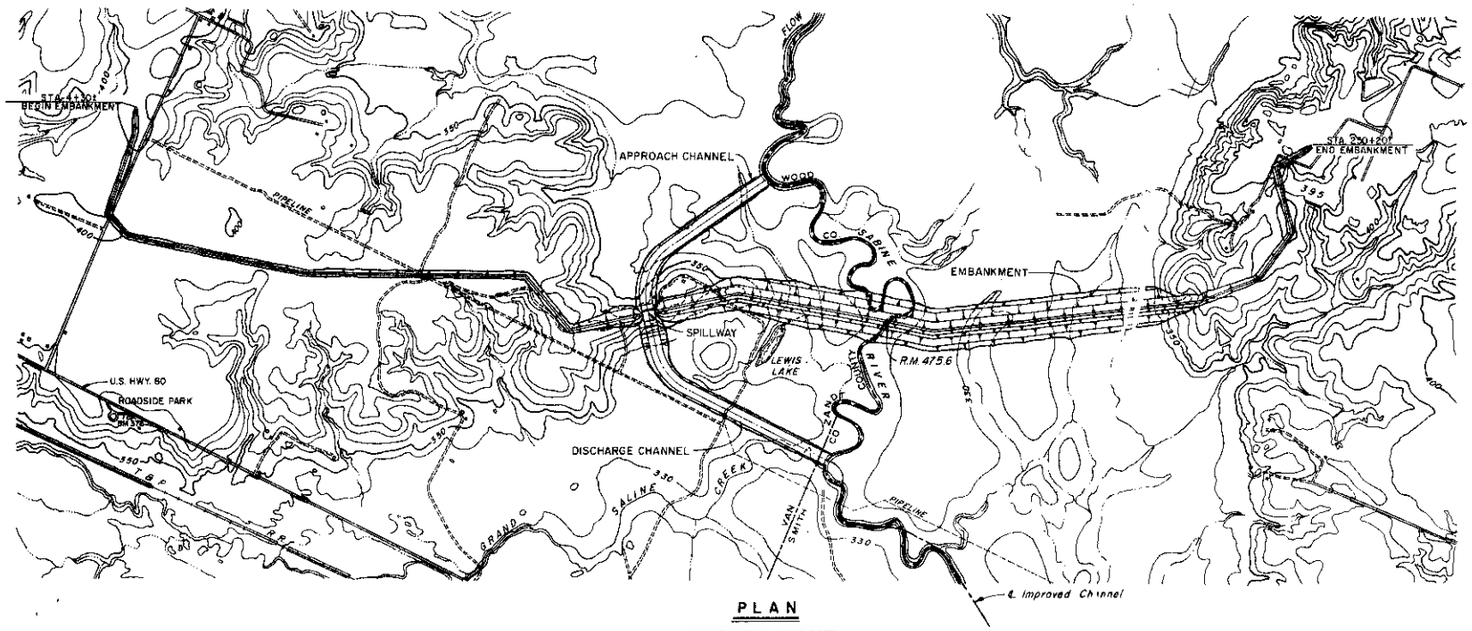
CAPACITY IN THOUSAND ACRE-FEET

SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
MINEOLA RESERVOIR
RESERVOIR AREA MAP
SCALE AS SHOWN
PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE I

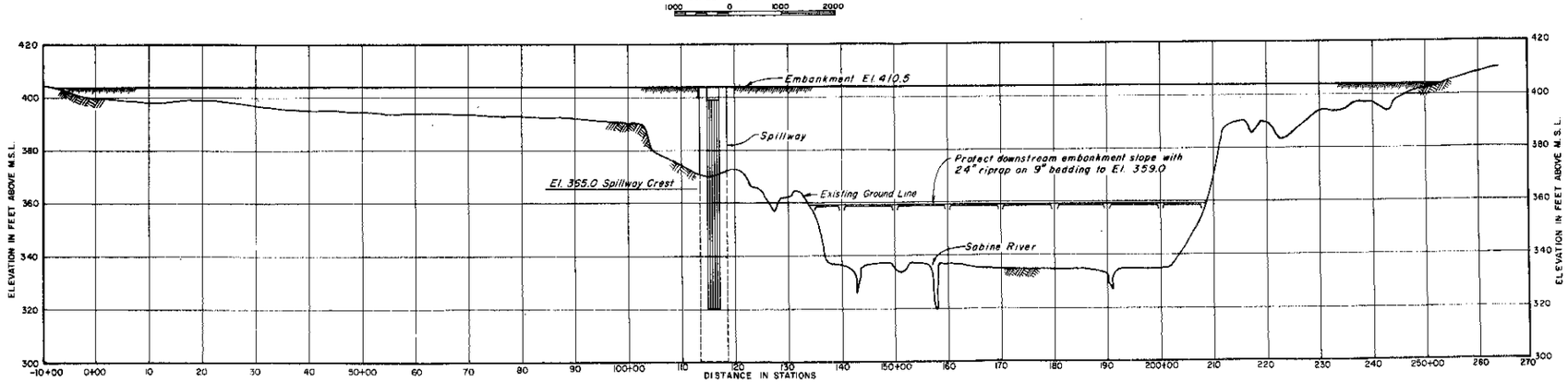
53-522 O-71 (Face p. 182) No. 1



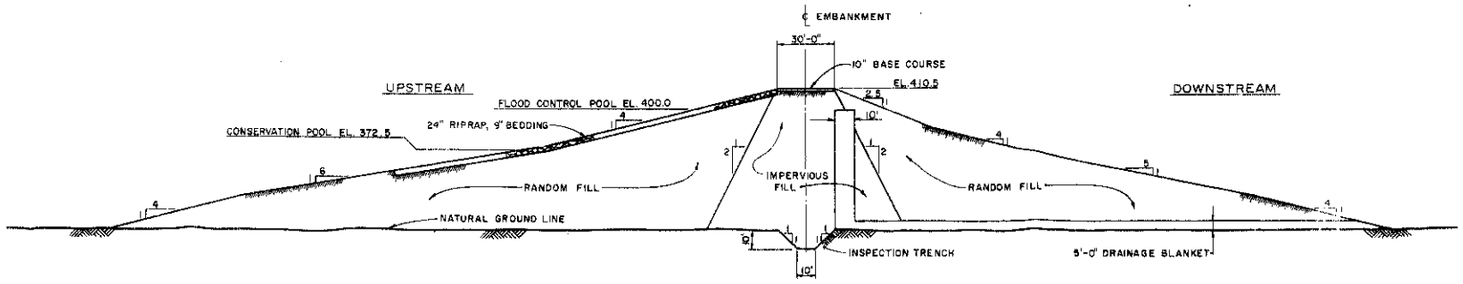
PLAN

SCALE 1 INCH = 1000 FEET

1000 0 1000 2000



PROFILE



TYPICAL EMBANKMENT SECTION

SCALE 1 INCH = 30 FEET

30 0 30 60

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

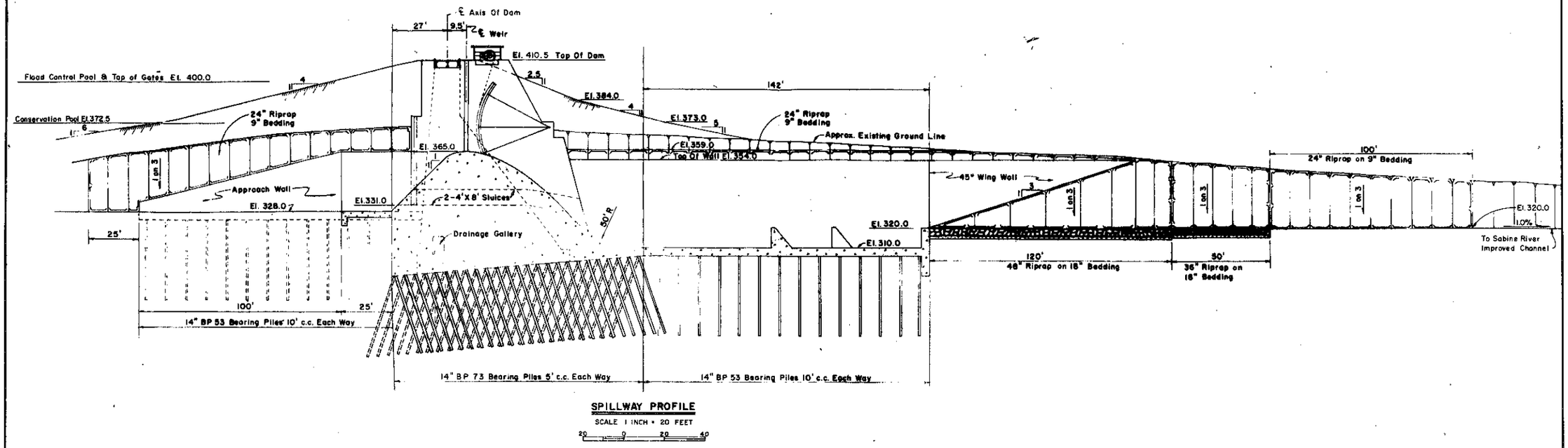
MINEOLA RESERVOIR
PLAN, PROFILE AND SECTION

SCALES AS SHOWN

PREPARED BY U. S. ARMY
ENGINEER DISTRICT,
FORT WORTH

PLATE 2

53-522 O-71 (Face p. 182) No. 2



SPILLWAY PROFILE

SCALE 1 INCH = 20 FEET

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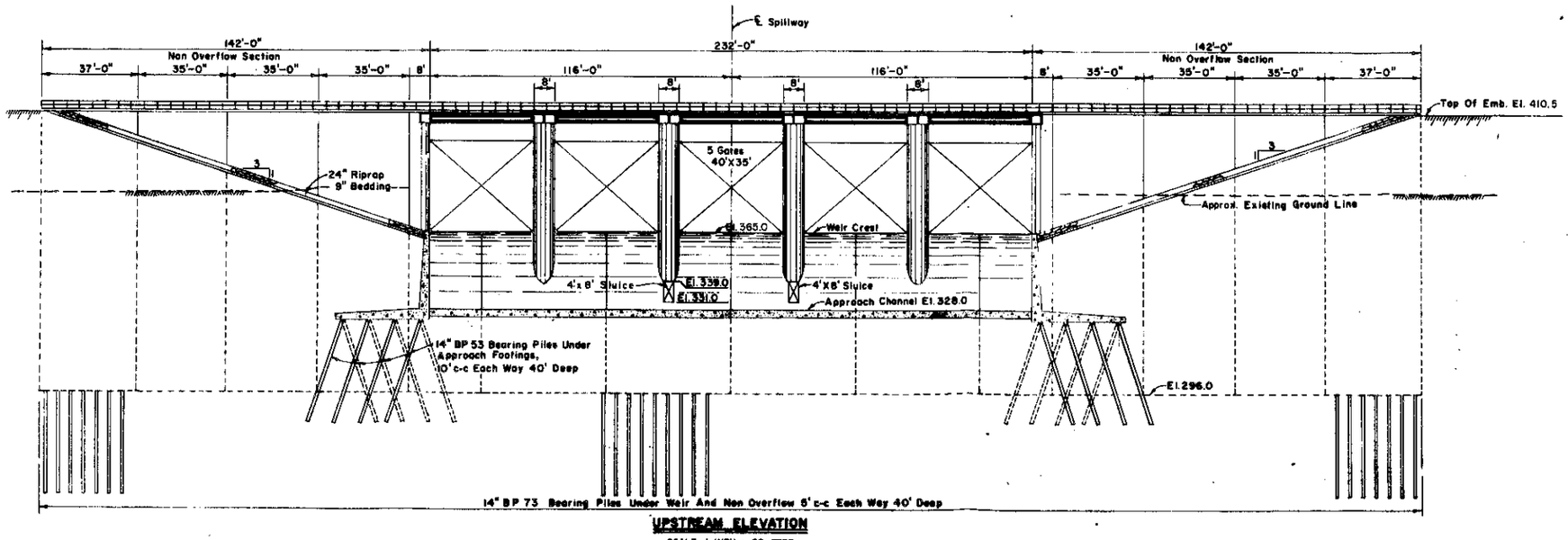
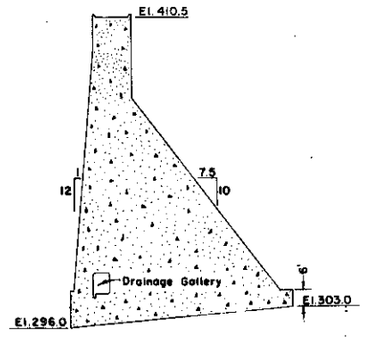


UPSTREAM ELEVATION

SCALE 1 INCH = 20 FEET



NON-OVERFLOW SECTION

SCALE 1 INCH = 20 FEET

SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

MINEOLA RESERVOIR

SPILLWAY-ELEVATION, PROFILE & SECTION

SCALES AS SHOWN

PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE 3

53-522 O-71 (Face p. 182) No. 3

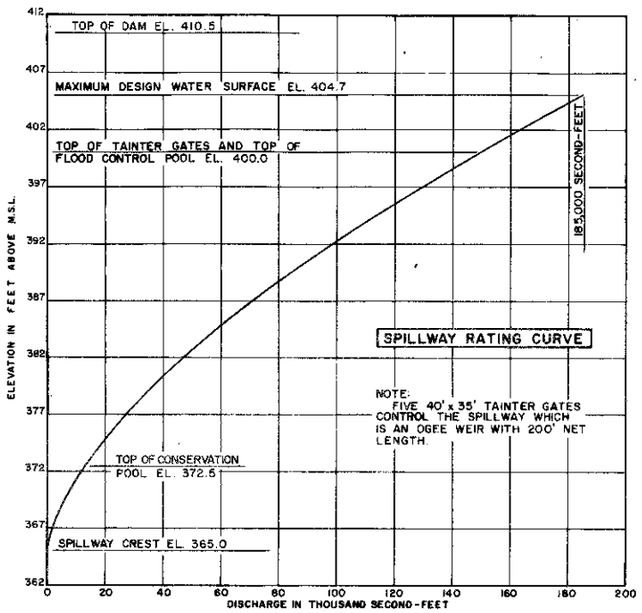


FIG. 1

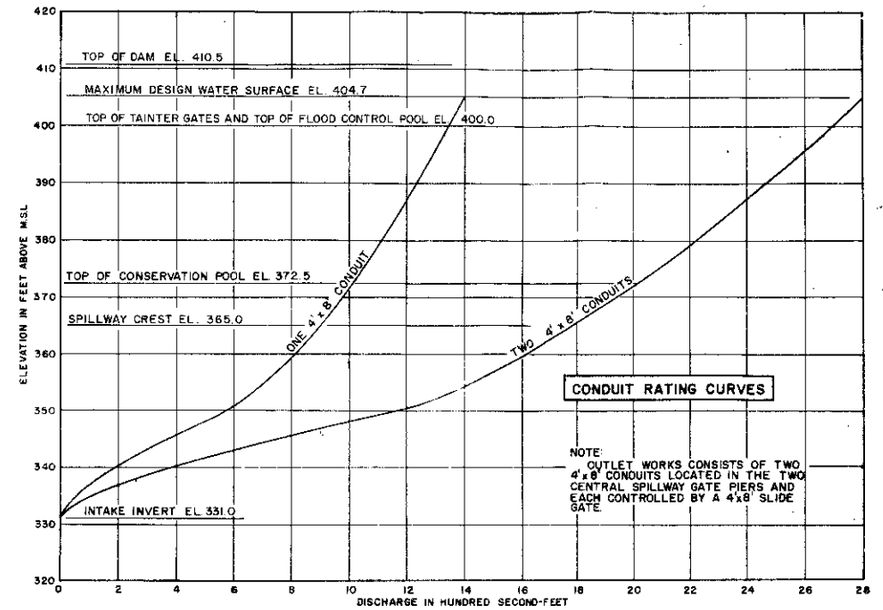


FIG. 2

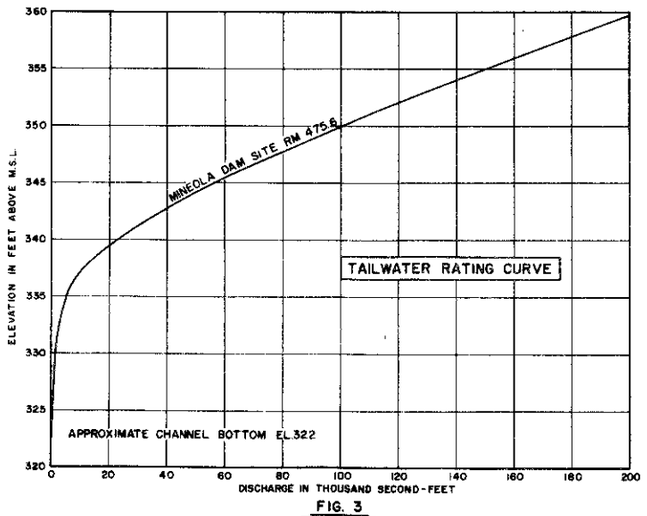
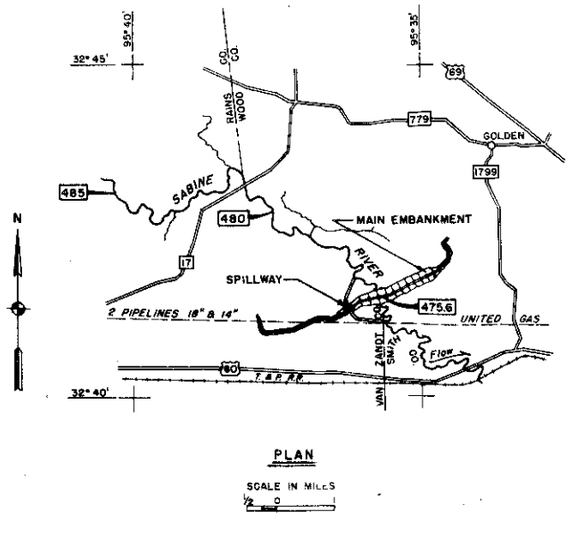


FIG. 3



PLAN

SCALE IN MILES

½ 0 1

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

MINEOLA RESERVOIR
GENERAL HYDRAULIC DATA

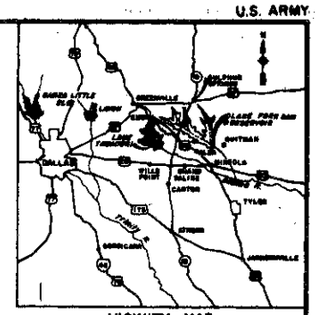
SCALES AS SHOWN

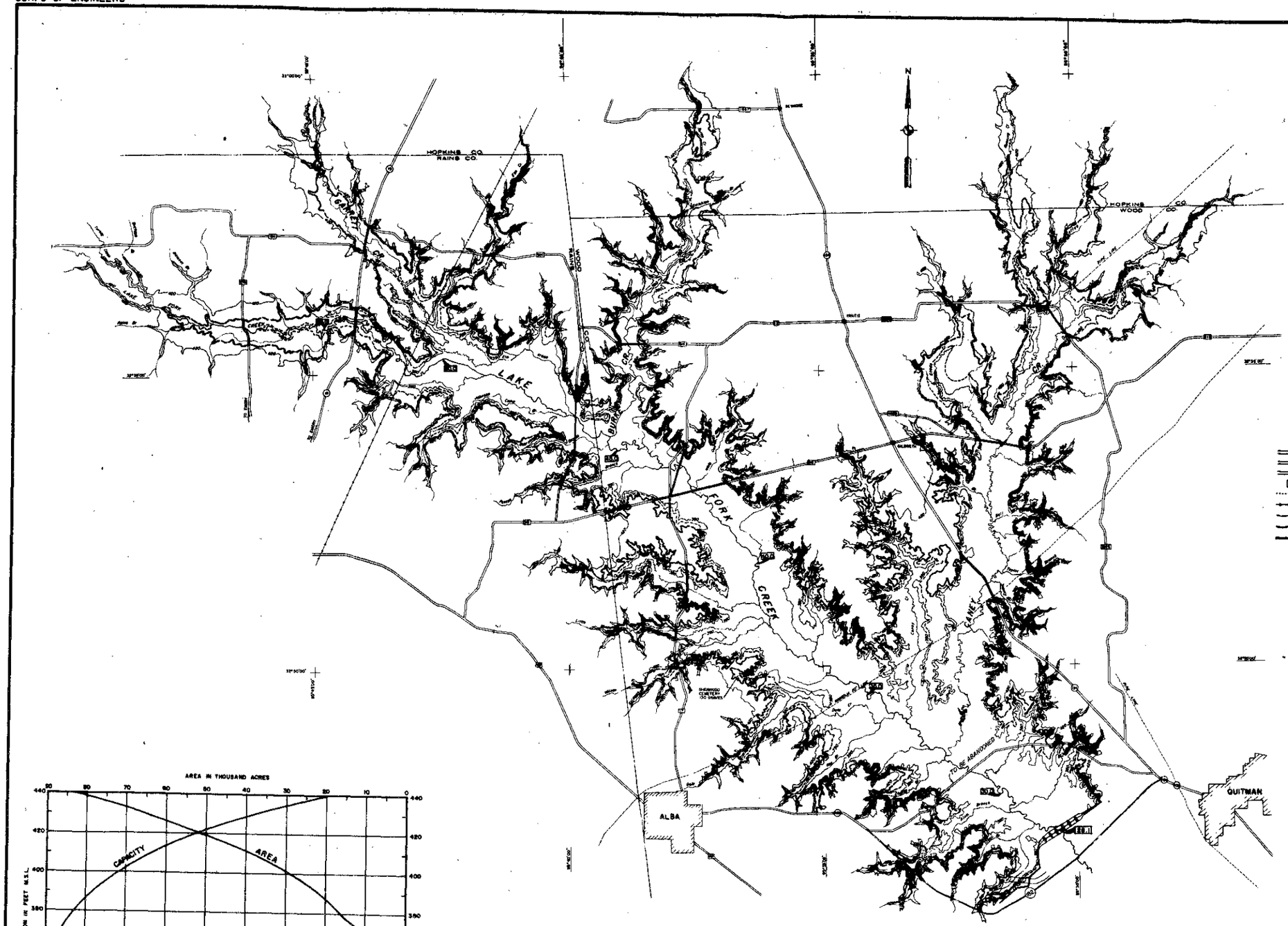
PREPARED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH

53-522 O-71 (Face p. 182) No. 4

CORPS OF ENGINEERS

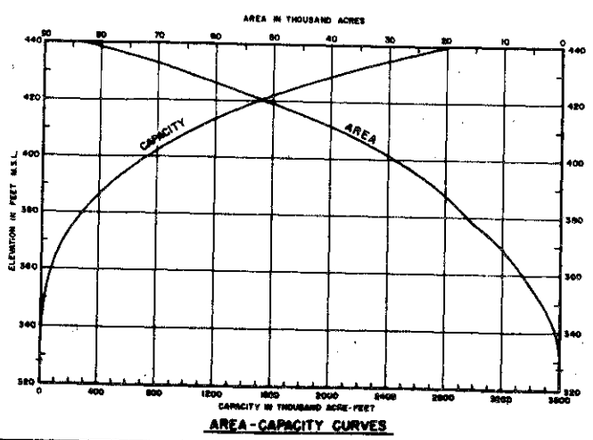
U.S. ARMY





LEGEND

- U.S. HIGHWAY
- STATE HIGHWAY
- FARM TO MARKET HIGHWAY
- 500 RIVER MILE (MILE ABOVE MOUTH)
- PIPE LINE
- POWER TRANSMISSION LINE
- TOP OF WATER SUPPLY STORAGE EL. 397.0
- TOP OF FLOOD CONTROL STORAGE EL. 411.5
- HIGHWAY RELOCATION OR ALTERATION



AREA-CAPACITY CURVES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

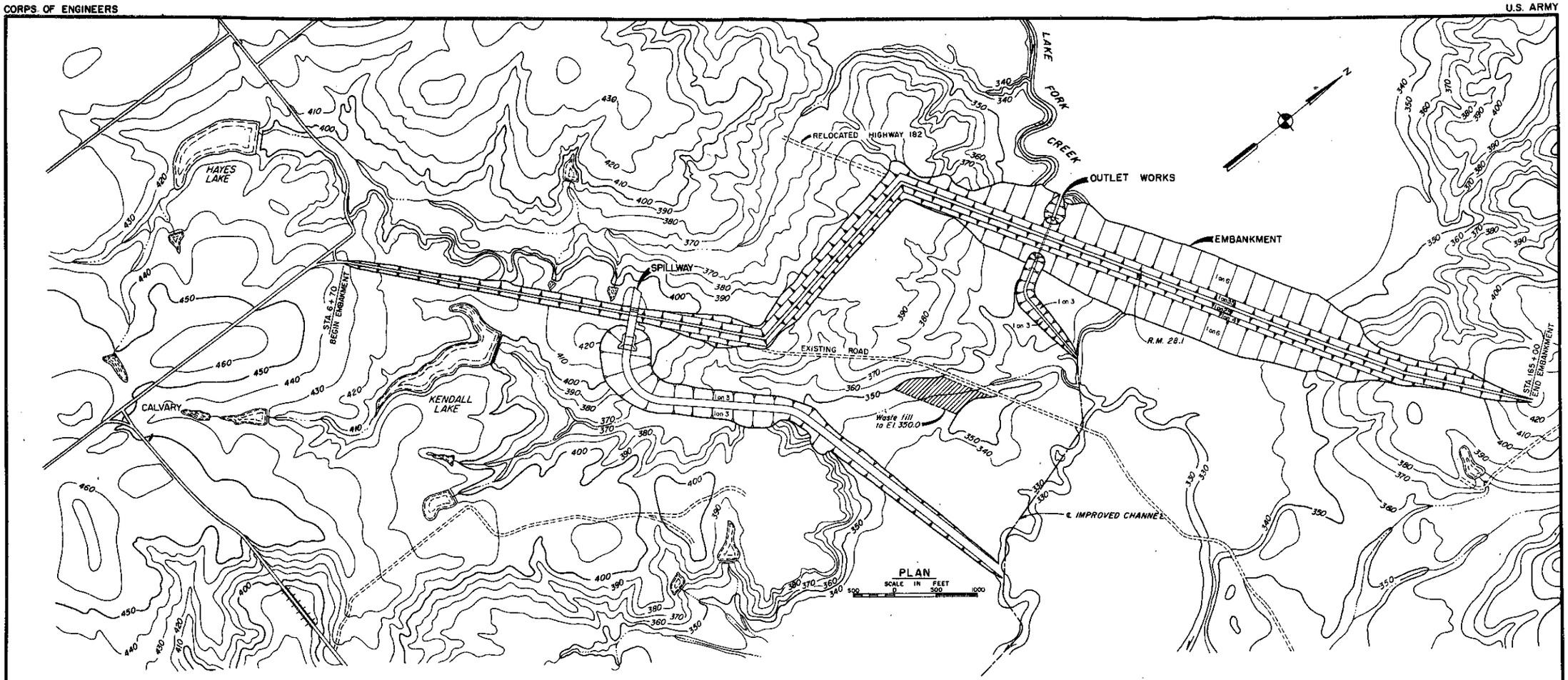
LAKE FORK RESERVOIR
RESERVOIR AREA MAP

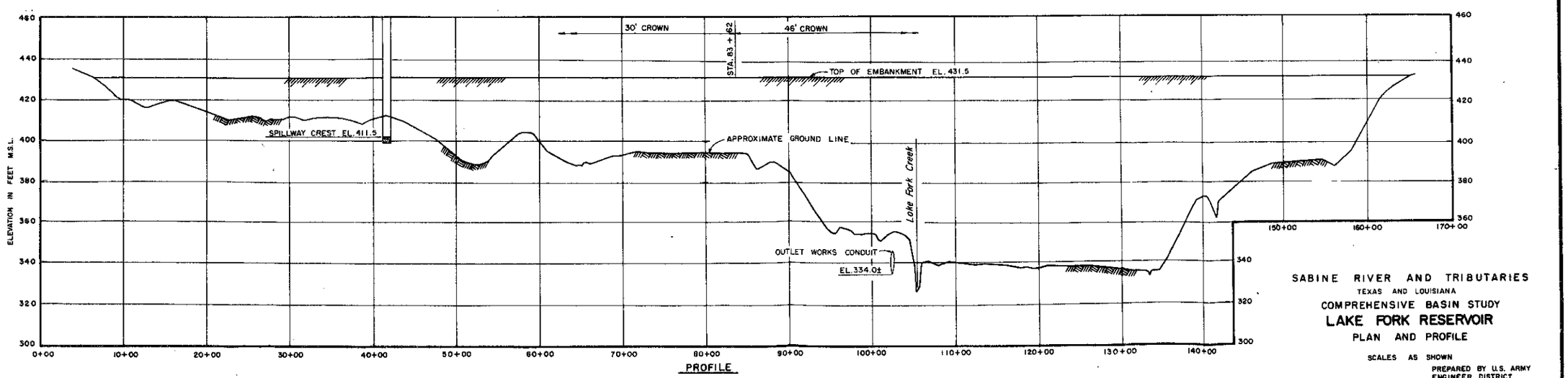
SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 5

53-522 O-71 (Face p. 182) No. 5





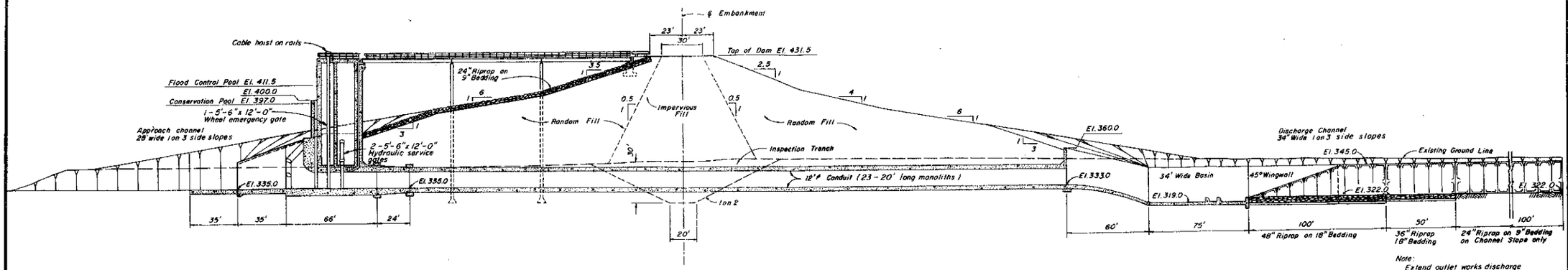
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
LAKE FORK RESERVOIR
PLAN AND PROFILE

SCALES AS SHOWN

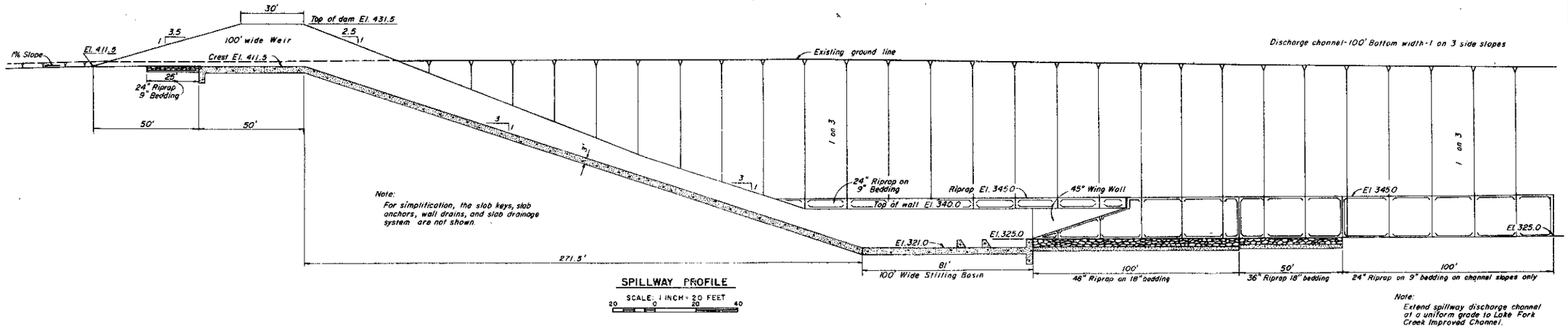
PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 6

53-522 O-71 (Face p. 182) No. 6



EMBANKMENT SECTION
AND
OUTLET WORKS PROFILE
SCALE: 1 INCH = 30 FEET



SPILLWAY PROFILE
SCALE: 1 INCH = 20 FEET

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
LAKE FORK RESERVOIR
EMBANKMENT SECTION, OUTLET WORKS PROFILE AND SPILLWAY PROFILE
SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 7

53-522 O-71 (Face p. 182) No. 7

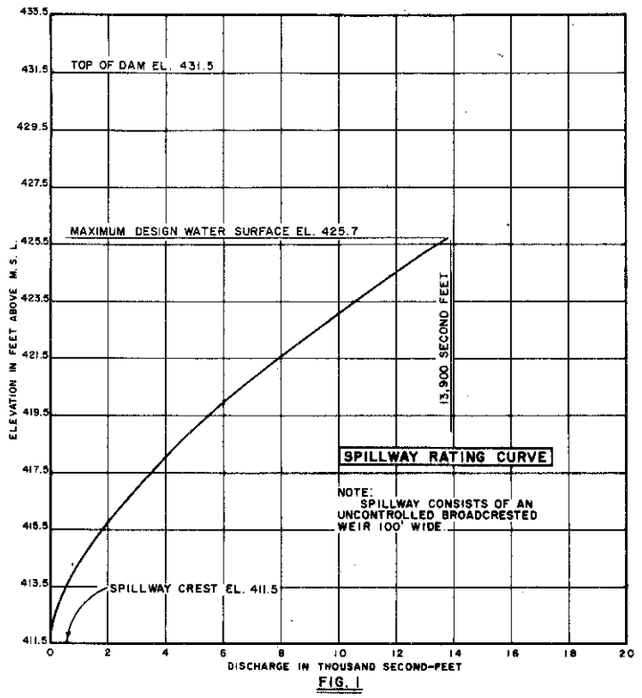


FIG. 1

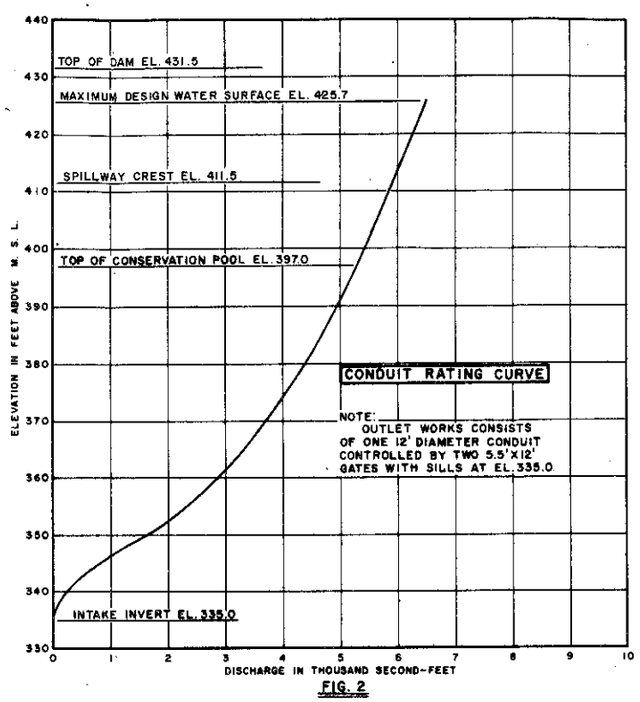


FIG. 2

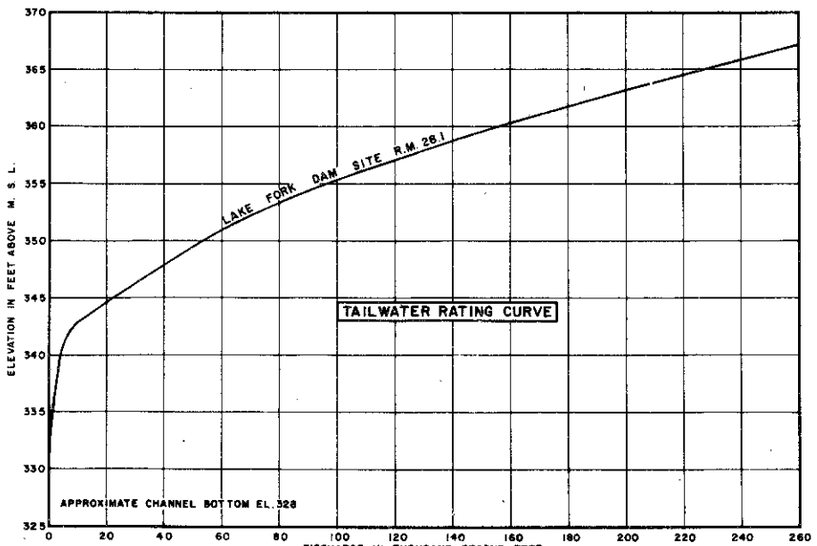
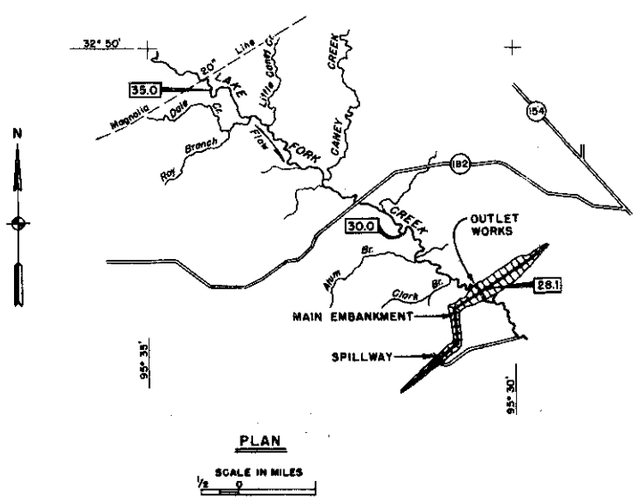


FIG. 3



PLAN
SCALE IN MILES
1/2 0

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

LAKE FORK RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE 8

53-522 O-71 (Face p. 182) No. 8

U.S. ARMY

CORPS OF ENGINEERS

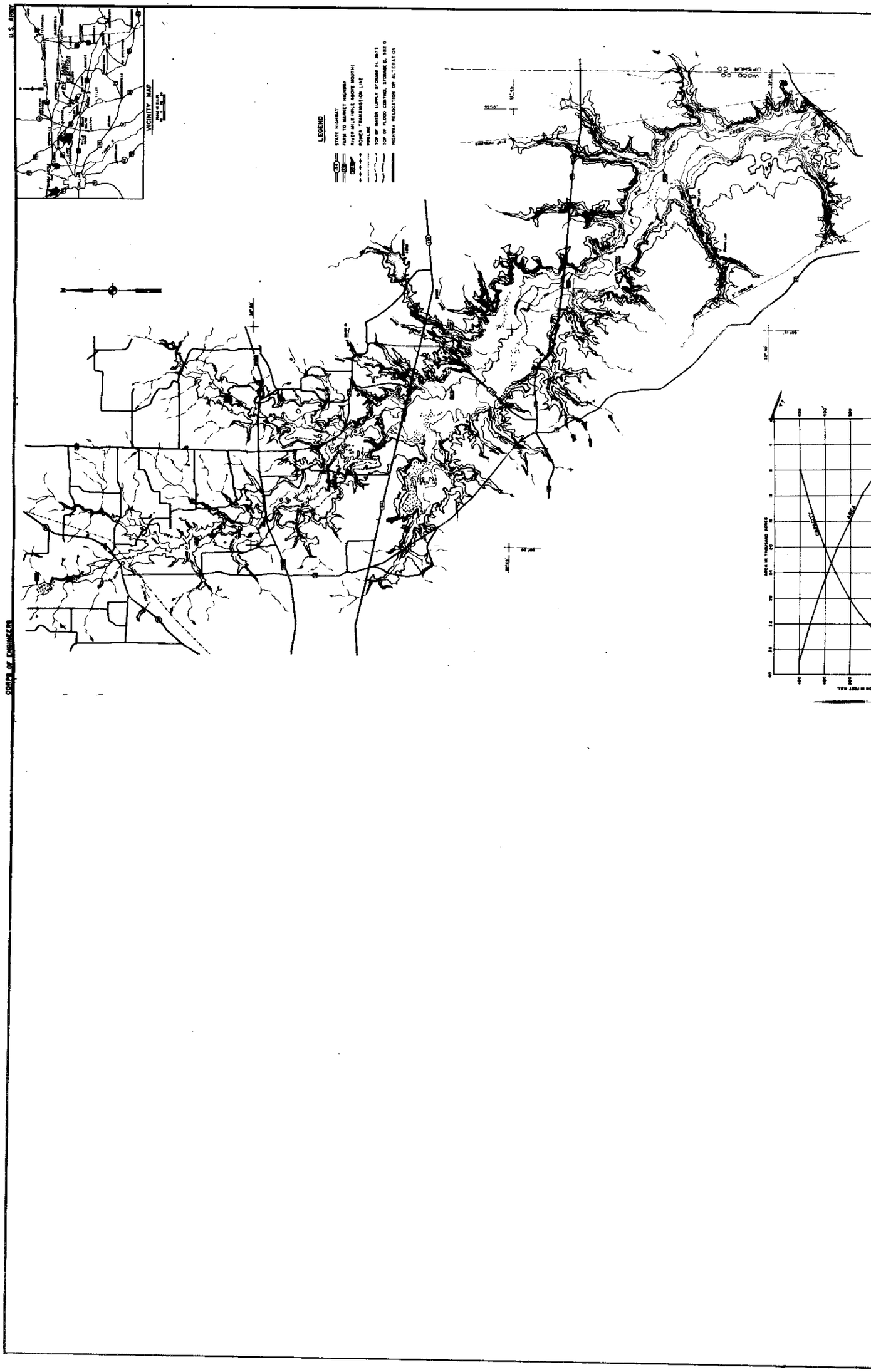
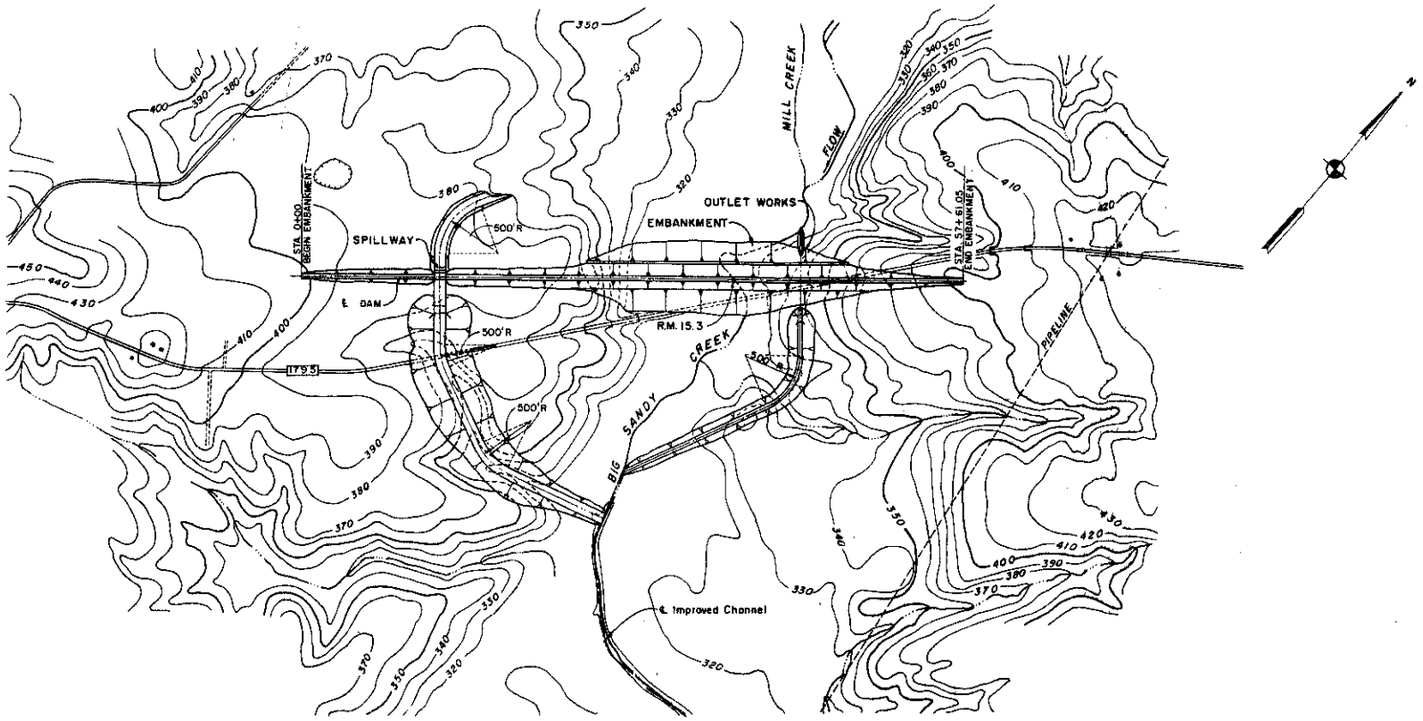


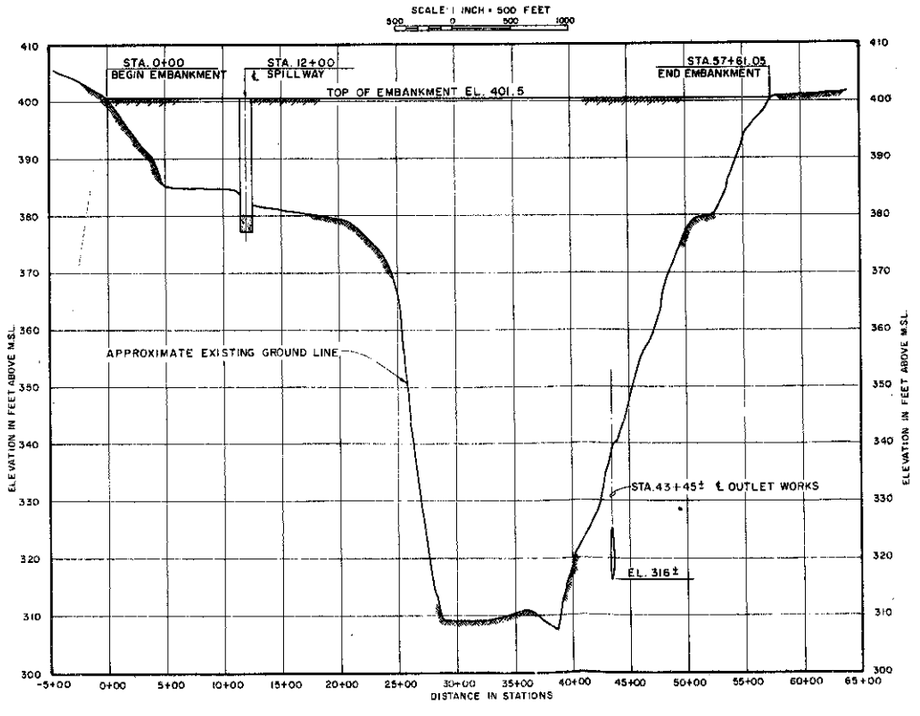
PLATE 9

53-522 O-71 (Face p. 182) No. 9



PLAN

SCALE: 1 INCH = 500 FEET



PROFILE

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

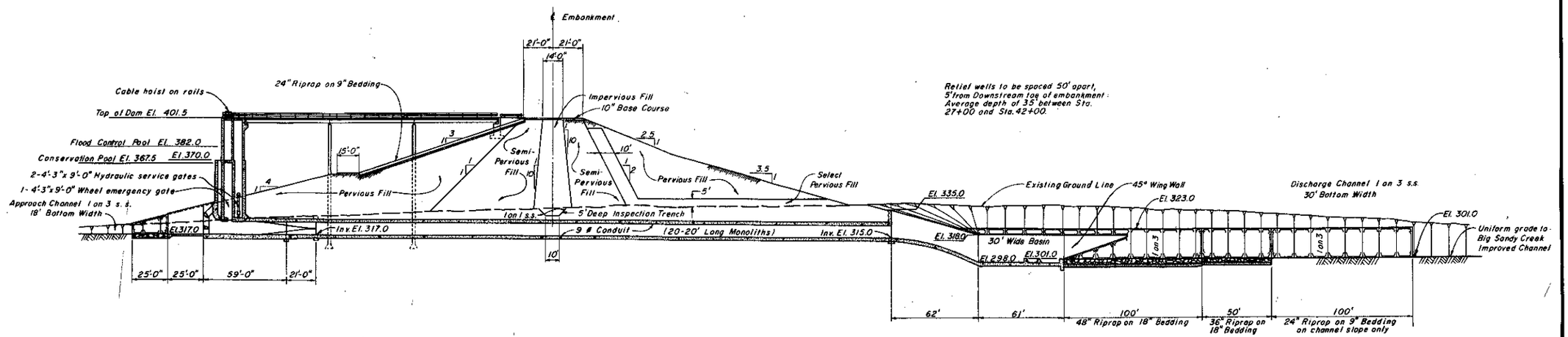
BIG SANDY RESERVOIR

PLAN AND PROFILE

SCALES AS SHOWN
PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE 10

53-522 O-71 (Face p. 182) No. 10



EMBANKMENT SECTION AND OUTLET WORKS PROFILE

SCALE: 1 INCH = 30 FEET

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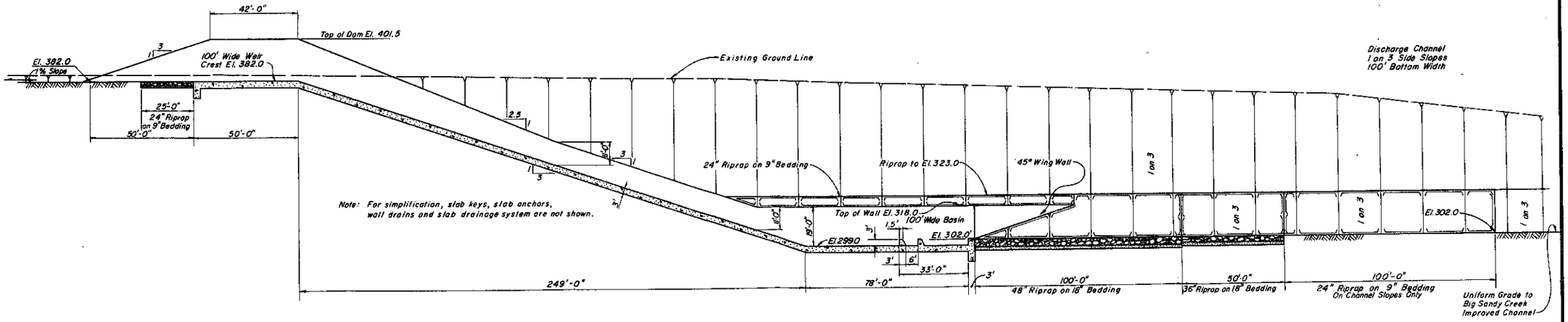


SPILLWAY PROFILE

SCALE: 1 INCH = 20 FEET

20 10 0 20 40

SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

EMBANKMENT SECTION, OUTLET WORKS AND SPILLWAY PROFILES

SCALES AS SHOWN

PREPARED BY U. S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE II

53-522 O-71 (Face p. 182) No. 11

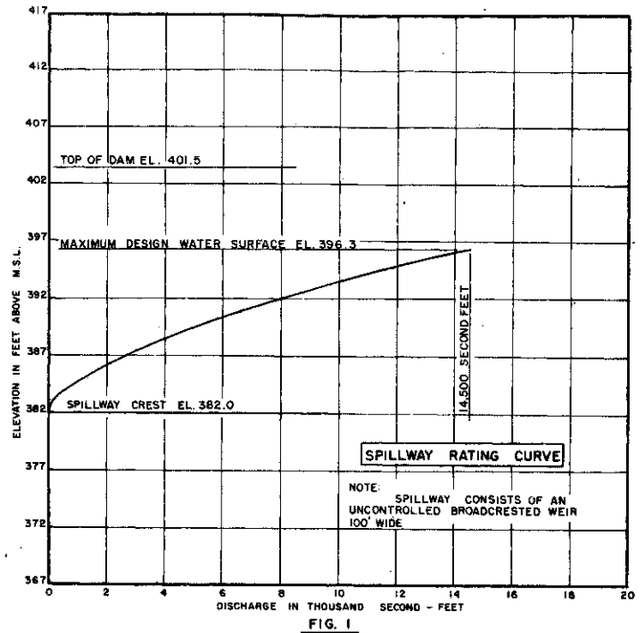


FIG. 1

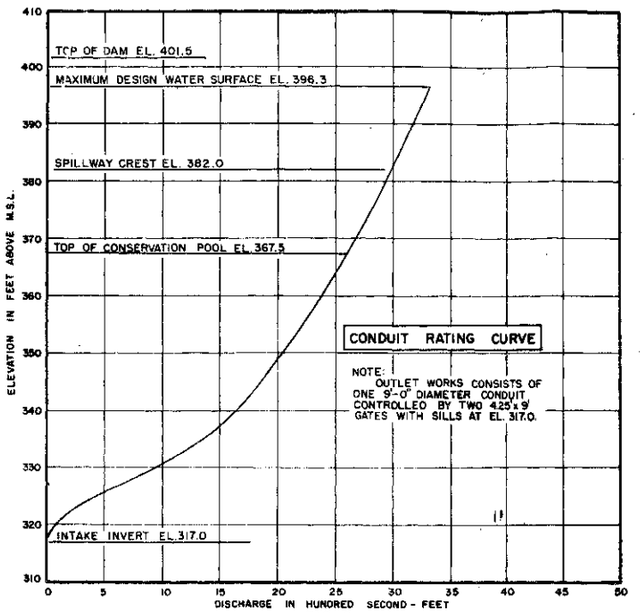


FIG. 2

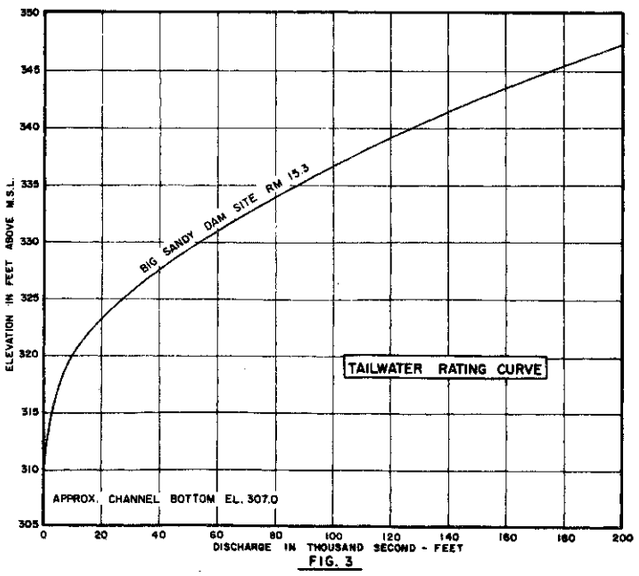
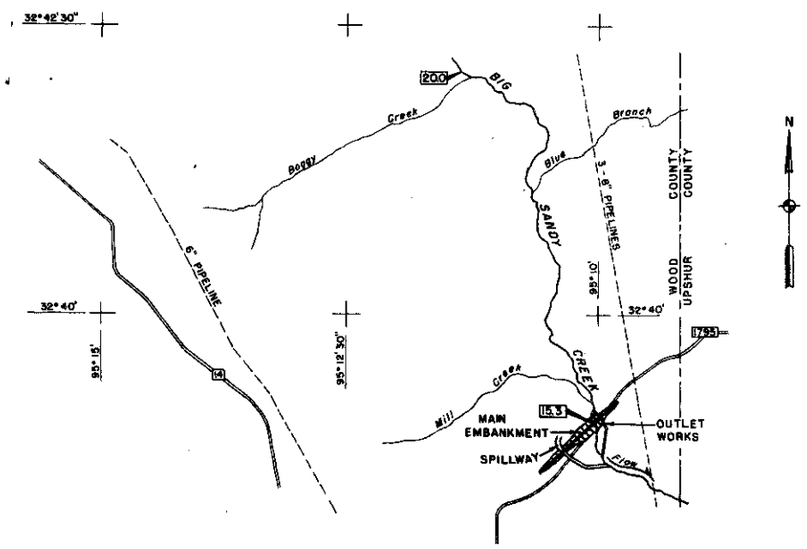


FIG. 3



PLAN
SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

PREPARED BY U. S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE 12

53-522 O-71 (Face p. 182) No. 12

under initial conditions. The peak inflow of 309,600 second-feet was reduced to a maximum outflow of 123,400 second-feet. The maximum reservoir level produced was 453.0 feet, mean sea level, with one foot of freeboard remaining below the top of dam. In this routing, the two 4-foot by 6-foot sluices, invert elevation 378.0, were considered operative along with the 480-foot uncontrolled ogee weir.

31. As a result of these studies, the Iron Bridge Dam was adjudged to present no foreseeable hazard to the proposed Mineola project. No additional studies of the effect of the failure of the Iron Bridge project are recommended. A coordinated reservoir regulation plan will be required upon construction of the Mineola project.

LOCAL PROTECTION PROJECTS

32. PLAN OF IMPROVEMENT.- A reanalysis of the local flood protection project at Greenville led to the adoption of a plan which would provide for flood plain management below the 100-year flood flow line within the project area on the Cowleech Fork of the Sabine River and a channel with sufficient capacity to pass the 100-year flood within the project area on Long Branch. Also, in view of the uncertainty of the completion data of the proposed Soil Conservation Service program on the Cowleech Fork watershed upstream from the project area, the 100-year flood flow line (below which flood plain management has been recommended) was based on discharges that would be experienced without the Soil Conservation Service program in operation. Except for the assumption with regard to the Soil Conservation Service program and the change in design discharges, most of the hydrologic data presented in paragraph 78 of the Type II Report are still applicable. The water surface profiles and flood plain delineations resulting from this plan are shown on plates 13 and 14.

33. DESIGN DISCHARGES.- Peak discharges for the Standard Project Flood, shown on plate 27 of the Type II Report under existing conditions (without SCS) are also applicable to the plan now being recommended. Design (100-year) discharges for the recommended plan are shown in table 12.

TABLE 12

DESIGN (100-YEAR) DISCHARGES
GREENVILLE LOCAL PROTECTION PROJECT

Stream	Location	Peak discharge (cfs)
Long Branch	Above Interstate Hwy 30	2,300
Long Branch	At mouth	3,400
Cowleech Fork	Above Horse Creek	12,700*
Cowleech Fork	Above Long Branch	15,100*
Cowleech Fork	Below Long Branch	17,500*

*Flood plain management only.

HYDROLOGIC NETWORKS AND STUDIES

34. GENERAL.- The data on hydrologic networks and studies presented in paragraphs 86 through 90 of the Type II Report are also applicable to the present report.

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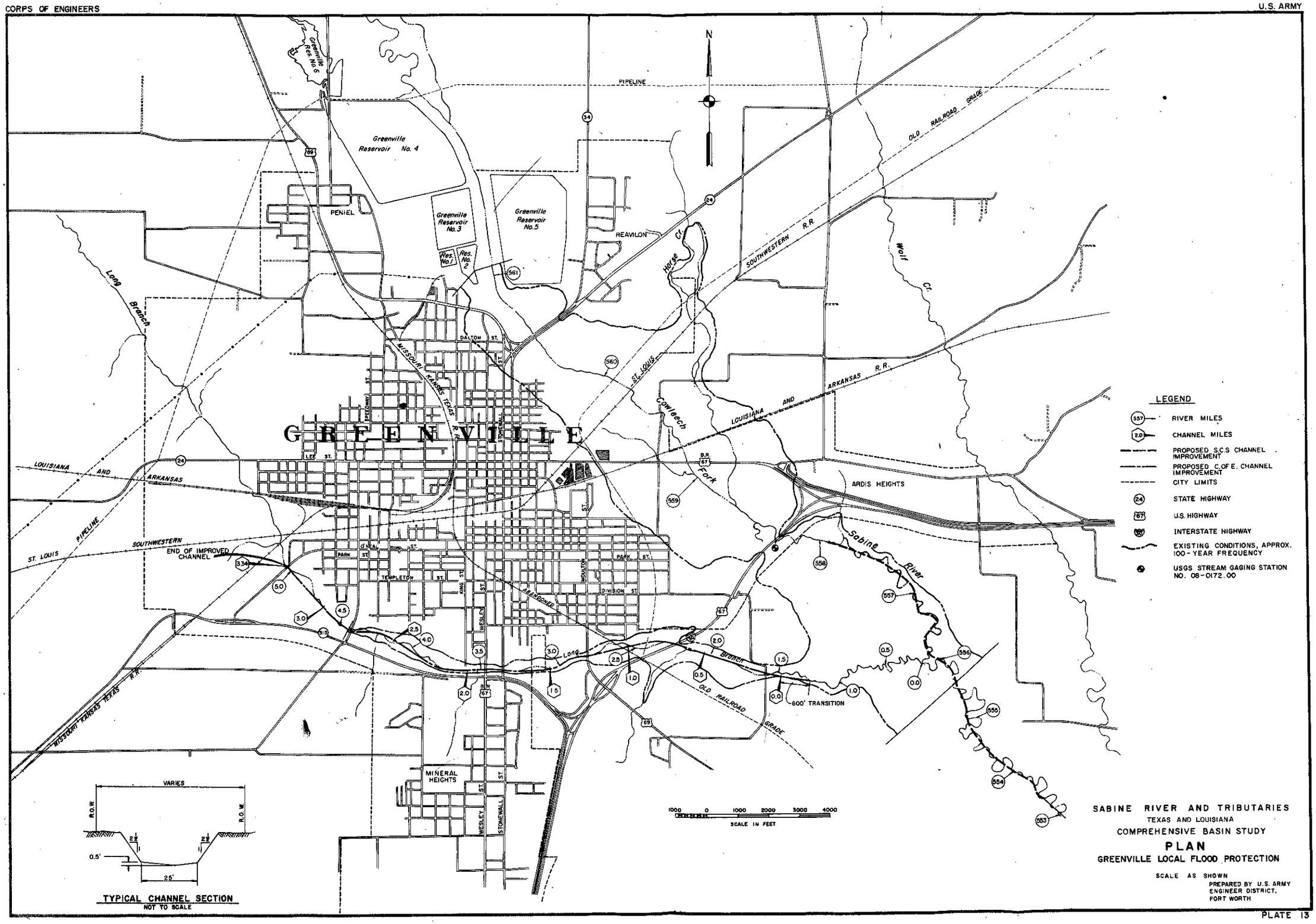

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

PLAN
GREENVILLE LOCAL FLOOD PROTECTION

SCALE AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 13

53-522 O-71 (Face p. 184) No. 1

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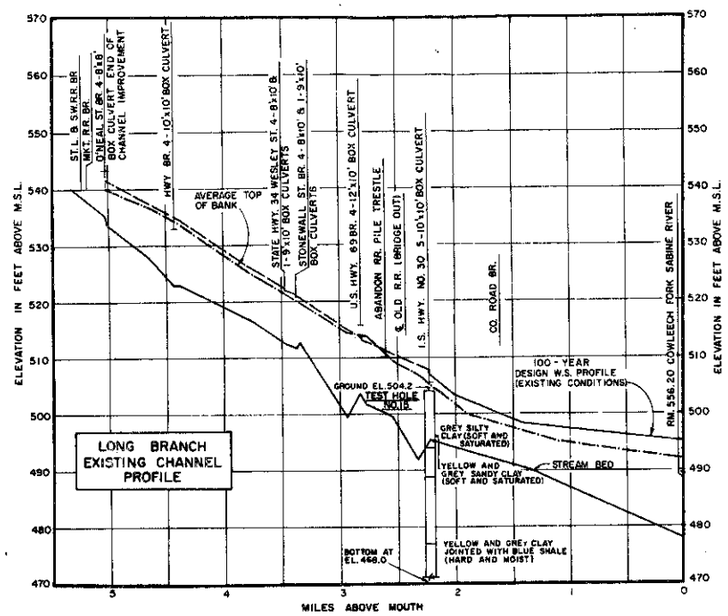
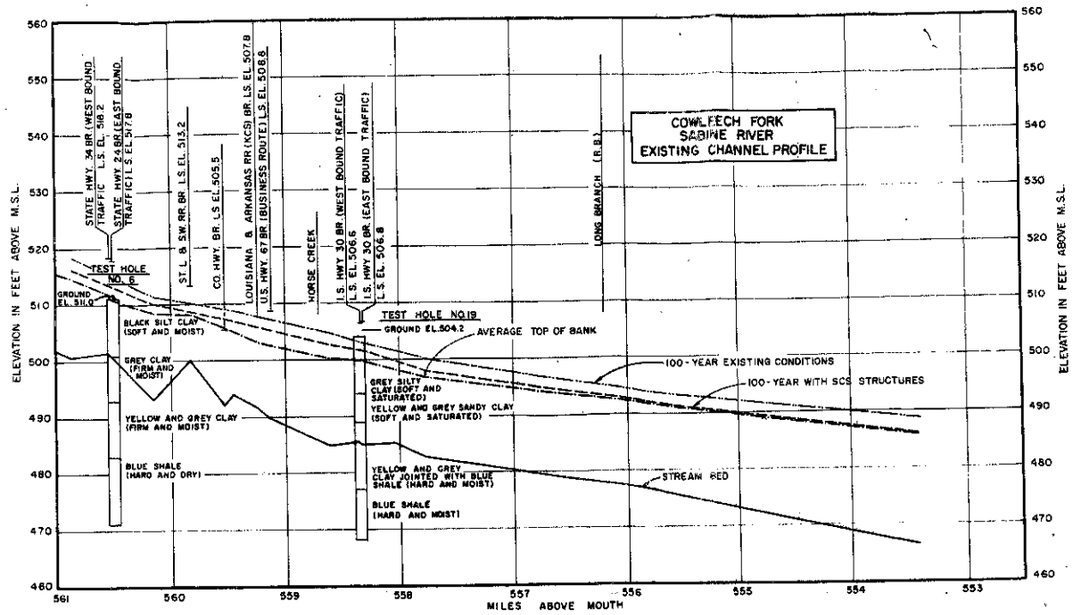
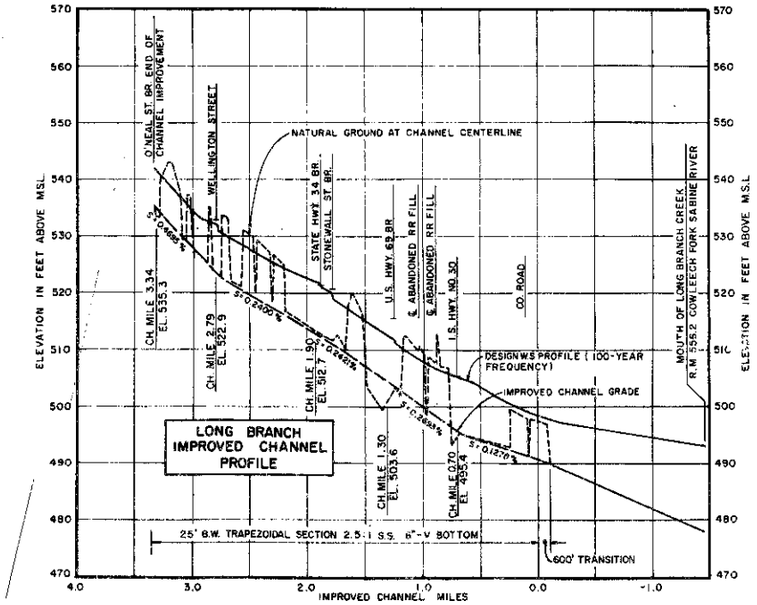
U.S. ARMY







SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

EXISTING & PROPOSED PROFILES

GREENVILLE LOCAL FLOOD PROTECTION

SCALE AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 14

53-522 O-71 (Face p. 184) No. 2

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX C

ECONOMICS

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX C
ECONOMICS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF PLATES

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX C
ECONOMICS

INTRODUCTION

The purpose of this appendix is to present detailed information pertinent to the economic aspects of the structural plan of improvement recommended by the Corps of Engineers. The plan is designed to alleviate local problems recognized during development of the comprehensive basin plan to be of such nature and sufficient magnitude to require early corrective action. The lapse in time between completion of the comprehensive type II study and this specific report to provide authorization for measures included in the short-range plan makes it desirable that needed revisions, changes, and modifications be incorporated to reflect currently applicable criteria, price levels, and discount rates.

FLOOD CONTROL EVALUATION

1. SCOPE.- The following information and data supplement material presented in the flood control evaluation section of the comprehensive study report to reflect updating, revisions and current criteria.

2. PERTINENT INFORMATION AND DATA.- Information contained in paragraphs 1 through 6, appendix J, of the comprehensive type II report describes flood problems existing in the basin, the areas subject to inundation, and the general character or makeup of the flood plain. Plate 1 shows the areas subject to flooding from the mouth to Lake Tawakoni dam and within the city of Greenville. Also shown on this plate are the stream reaches selected for evaluation purposes. Flood plain acreages by major land uses are presented for each evaluation reach in table 1. Methods and procedures used in determination of estimated average annual flood damages in the Sabine River Basin are described and illustrated in appendix J of the comprehensive report.

3. PHYSICAL PROPERTY IN THE FLOOD PLAIN.- Existing properties located in the flood plain were inventoried and evaluated during field investigations. The estimated total value of the property located in reaches investigated by the Corps of Engineers approximates $308,710,000, based on January 1970 prices. Values of the various classes or categories of properties in each reach are shown in table 2.

CORPS OF ENGINEERS

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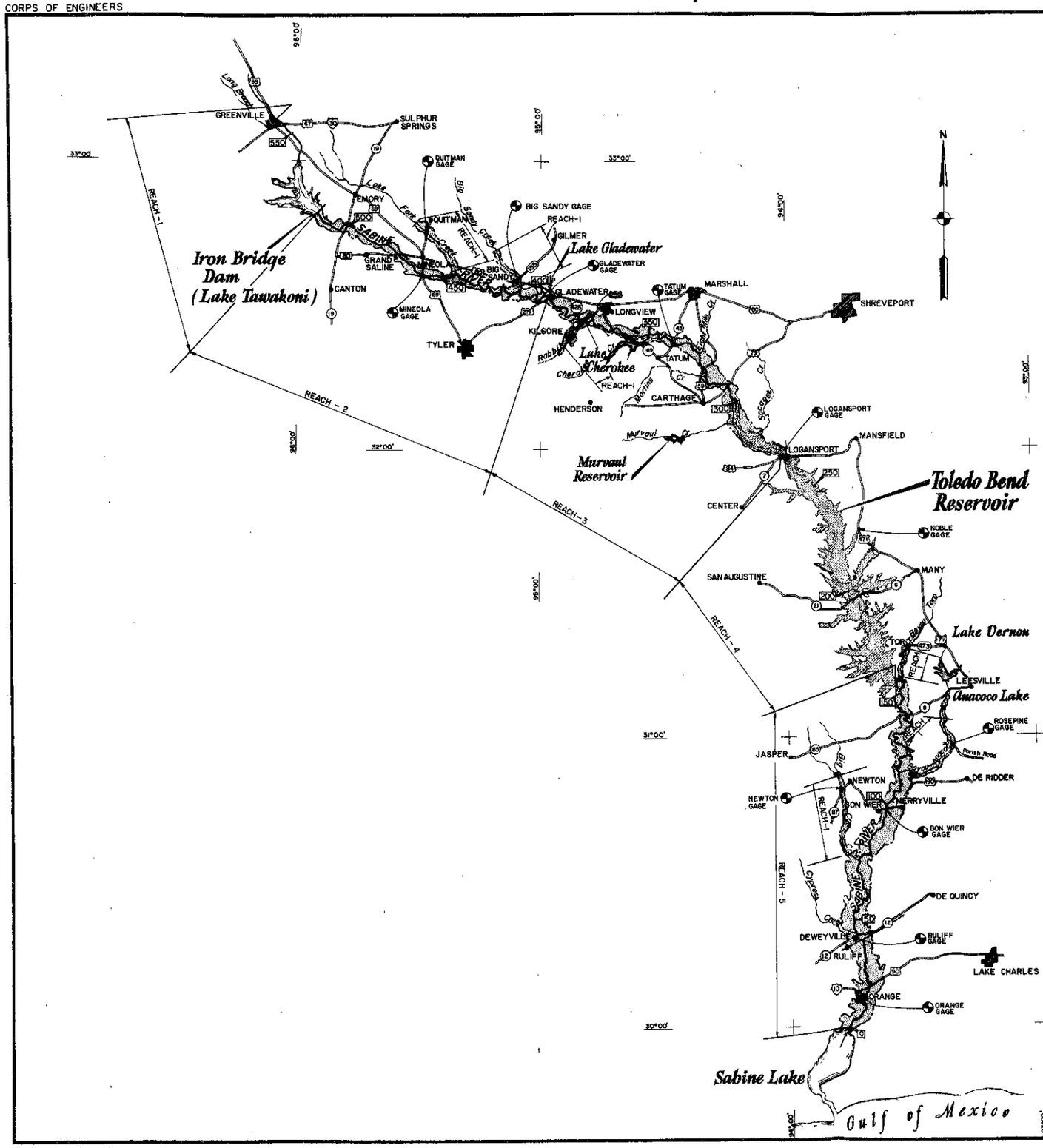
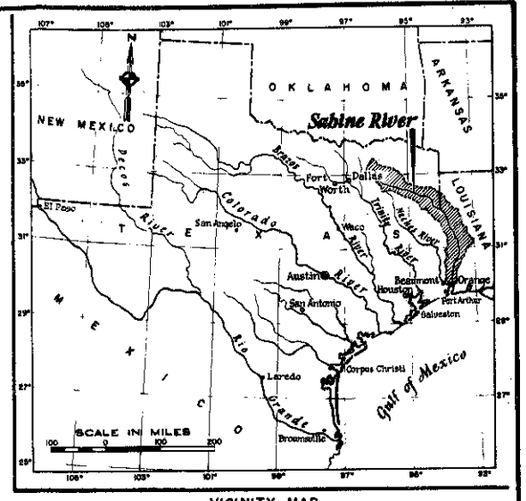




VICINITY MAP

LEGEND

- EXISTING RESERVOIR (NON-FEDERAL)
- RESERVOIR UNDER CONSTRUCTION (SABINE RIVER AUTHORITIES)
- 1000 RIVER MILE (MILES ABOVE MOUTH)
- (10) INTERSTATE HIGHWAY AND ROUTE NUMBER
- (80) U.S. HIGHWAY AND ROUTE NUMBER
- (8) STATE HIGHWAY AND ROUTE NUMBER

SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
AREA SUBJECT TO FLOODING

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE I

53-522 O-71 (Face p. 188)

TABLE 1

LAND AREAS IN THE FLOOD PLAIN

Stream	Reach	Stream mile From	Stream mile To	Agricultural: Improved (acres)	Agricultural: Unimproved grazing (acres)	Urban & Suburban (acres)	Total (acres)
Sabine River	1	(1)	(1)	-	-	2,445	2,445
	2-B-2	476.0	514.5	6,043	16,788	-	22,831
	2-B-1	461.0	476.0	1,731	7,973	-	9,704
	2-A-3	445.0	461.0	2,805	5,825	-	8,630
	2-A-2	414.0	445.0	3,389	17,106	-	20,495
	2-A-1	397.5	414.0	1,798	7,386	1,237	10,421
	3	267.1	397.5	21,010	94,430	200	115,640
	4	(2)	267.1	1,236	1,901	-	3,137
	5	0.0	156.5	2,595	225,935	2,146	230,676
Total Sabine River				40,607	377,344	6,028	423,979
Lake Fork Creek	1	1.0	28.1	3,556	9,838	-	13,394
Big Sandy Creek	1	2.8	15.3	1,026	2,175	-	3,201
Rabbit Creek	1	5.3	23.1	1,235	3,078	-	4,313
Big Cow Creek	1	6.2	34.7	65	6,947	-	7,012
Bayou Toro	1	3.7	12.5	36	1,904	-	1,940
Bayou Anacoco	1	5.5	32.3	91	11,178	-	11,269
Adams Bayou	1	0.2	7.7	-	-	7,872	7,872
Cow Bayou	1	2.0	27.0	1,382	26,291	7,450	35,123
Total Sabine River and Major Tributaries				47,998	438,755	21,350	508,103

(1) Area upstream from Iron Bridge Dam site, with the exception of the Greenville area, was not included in this study.

(2) Most of this reach is inundated by Toledo Bend Reservoir.

TABLE 2

VALUE IN DOLLARS OF PHYSICAL PROPERTY IN THE FLOOD PLAIN
1964 Conditions of Development
January 1970 Price Levels

Stream	Reach	Agriculture property	Rural non-agricultural property	Transportation facilities	Utilities	Urban and suburban property	Total
Sabine River	1 (1)	0	0	0	0	$ 10,530,300	$ 10,530,300
	2-B-2	$ 3,373,600	$ 18,100	$ 1,306,600	$ 285,500	0	4,983,800
	2-B-1	1,262,500	3,000	2,366,500	344,500	0	3,976,500
	2-A-3	1,246,700	63,200	1,917,700	70,900	0	3,298,500
	2-A-2	2,279,100	508,700	2,039,700	804,900	0	5,632,400
	2-A-1	1,234,500	18,100	1,288,300	703,400	2,627,900	5,872,200
	3	12,223,000	35,297,100	16,843,400	3,765,200	1,414,500	69,543,200
	4 (2)	480,700	0	217,200	74,500	0	772,400
	5	17,718,500	30,395,900	6,650,400	6,304,300	95,858,600	156,927,700
Total Sabine River		$39,818,600	$66,304,100	$32,629,800	$12,353,200	$110,431,300	$261,537,000
Lake Fork Creek	1	1,830,600	39,900	3,570,800	388,600	0	5,829,900
Big Sandy Creek	1	474,900	28,600	583,300	238,200	0	1,325,000
Rabbit Creek	1	537,800	4,954,500	2,818,900	346,000	0	8,657,200
Big Cow Creek	1	381,200	79,300	599,700	253,600	0	1,313,800
Bayou Toro	1	157,700	0	63,800	2,700	0	224,200
Bayou Anacoco	1	599,900	21,100	383,200	79,500	0	1,083,700
Adams Bayou	1	0	0	840,800	155,500	16,070,400	17,066,700
Cow Bayou	1	201,700	6,669,900	1,344,400	936,700	2,519,500	11,672,200
Total Sabine River and major tributaries		$44,002,400	$78,097,400	$42,834,700	$14,754,000	$129,021,200	$308,709,700

(1) Area evaluated in this reach was restricted to Long Branch and Sabine River in the city of Greenville.
(2) Most of this reach will be inundated by the Toledo Bend Reservoir.

4. TYPES OF FLOOD DAMAGE.- Material presented in paragraphs 9 and 10 of appendix J, comprehensive report, describes in detail the classification of damages. These classifications are unchanged.

5. DAMAGE FROM MAXIMUM FLOODS OF RECORD.- The estimated damages which would result from a recurrence of the maximum flood experienced in each stream reach are $13,004,000, based on 1964 conditions of development and January 1970 price levels. Table 3 shows these damages by principal property classes for the different evaluation reaches, together with the year of flood occurrence.

6. ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE, EXISTING CONDITIONS.- Flood damages under 1964 levels of development and non-project conditions were determined for each evaluation reach as described in paragraph 12, appendix J, of the comprehensive report. These damages were adjusted to January 1970 price levels on the basis of the 1964 and 1970 indices appropriate to each damage category. The estimated total average annual damages based on January 1970 prices is $3,244,300. Table 4 summarizes by reach the 1970 value of average annual damages.

7. INDICATED FUTURE AVERAGE ANNUAL DAMAGE.- During planning activities in connection with the comprehensive basin study, it was recognized that flood damage sustained under present flood plain development was greater than that which resulted from comparable size floods which occurred many years earlier. Analyses of field information and data obtained in damage investigations and studies revealed that values subject to flood damage had increased as a result of encroachment, changed land uses, and additional improvements. Consequently, the estimated average annual damages, based on existing improvements and damageable values, would not be representative of average damages over an extended period of years in the future.

As a part of the economic effort completed in preparation of the comprehensive type II report, factors relevant to historical, present and future economic growth within the study area were identified and analyzed. The completed area economic studies presented data pertinent to established trends and indicators of anticipated economic activity for the study area and its smaller subdivisions. In order that estimated average damages might reflect adequately the developments expected to occur in absence of flood protection, indicators related to the different property classifications were selected to project the changes which can be expected. Details regarding the selection and application of economic indicators in determination of estimated average annual damages expected to prevail during the selected period of analysis are presented in appendix J of the comprehensive report.

53-522 O-71——16

TABLE 3

ESTIMATED DAMAGES FROM MAXIMUM FLOOD OF RECORD
1964 Conditions of Development
January 1970 Price Levels

Stream	Reach	Year of flood	Agricultural damages - $			Nonagricultural damages - $			Total
			Crops	Other agricultural	Total	Urban and suburban	Other non-agricultural	Total	
Sabine River	1	1935	$ 0	$ 0	$ 0	$ 264,900	$ 0	$ 264,900	$ 264,900
	2-B-2	1945	197,200	184,700	381,900	0	57,200	57,200	439,100
	2-B-1	1945	56,200	61,200	117,400	0	64,700	64,700	182,100
	2-A-3	1945	82,300	62,400	145,200	0	76,800	76,800	222,000
	2-A-2	1945	111,400	121,100	232,500	0	185,100	185,100	417,600
	2-A-1	1945	58,300	23,700	82,000	118,900	132,400	251,300	333,300
	3	1945	683,700	693,900	1,377,600	407,900	3,434,400	3,842,300	5,219,900
	4	1945	40,900	30,000	70,900	0	16,600	16,600	87,500
	5	1913 & 1953(1)	59,300	222,100	281,400	1,176,900	2,161,200	3,338,100	3,619,500
Total Sabine River			$1,289,800	$1,399,100	$2,688,900	$1,968,600	$6,128,400	$8,097,000	$10,785,900
Lake Fork Creek	1	1945	116,500	104,800	221,300	0	91,800	91,800	313,100
Big Sandy Creek	1	1945	33,700	28,700	62,400	0	43,600	43,600	106,000
Rabbit Creek	1	1945	30,700	34,900	65,600	0	249,800	249,800	315,400
Big Cow Creek	1	1953	1,000	15,000	16,000	0	88,800	88,800	104,800
Bayou Toro	1	1961	1,000	5,000	6,000	0	3,000	3,000	9,000
Bayou Anacoco	1	1953	1,000	21,200	22,200	0	27,100	27,100	49,300
Adams Bayou	1	1958	0	0	0	75,300	872,900	948,200	948,200
Cow Bayou	1	1964	1,000	11,200	12,200	323,600	36,100	359,700	371,900
Total Sabine River and major tributaries			$1,474,700	$1,619,900	$3,094,600	$2,367,500	$7,541,500	$9,909,000	$13,003,600

(1) Combination of 1913 and 1953 floods but no duplication of damages reflected.

TABLE 4

AVERAGE ANNUAL DAMAGES
1964 Development
January 1970 Price Levels

Stream	Reach	Average annual damages
Sabine River	1 (1)	$ 15,600
	2-B-1	141,500
	2-A-3	90,100
	2-A-2	167,900
	2-A-1	76,100
	3	1,419,500
	4	104,900
	5	740,100
Lake Fork Creek	1	201,500
Big Sandy Creek	1	52,500
Subtotal		$3,009,700
Other tributaries studied		234,600
Total area studied		$3,244,300

(1) Includes the Greenville area only.

The flood control area was analyzed separately with detailed field surveys conducted in the different flood plain reaches to appraise the extent of damages from flooding. The flood control area economy was evaluated from the standpoint of its past performance and its potential for future growth. Individual evaluations were completed for each reach into which the river was divided for the purpose of flood damage analysis. Agricultural production in a flood control area is influenced to a large extent by the two-state demand for agricultural commodities. In general, it is expected that the value of farm products sold on a constant dollar base would increase as the two-state demand increases. However, agricultural competition from other producing areas could increase the supply to the extent that agriculture in the basin would expand at a slower rate than that substantiated by the two-state population alone. Therefore, population estimates for the two-state area were used, along with the estimated value of farm products sold, in projection of agricultural development. For projection of nonagricultural development, population estimates for the immediate flood control area were used, together with estimates for mineral production and disposable income for the same geographical area. The damageable nonagricultural property includes extensive rail, highway and county road improvements. The projected mineral production indicates to a degree the expected movement of crude oil, petroleum products, and building materials which would expand the need for transportation facilities. Population and disposable income projections reflect the expected demand for goods hauled by truck or railroad cars as well as the automobile demand for highways to serve a mobile population.

Indicators of expected growth used in connection with existing flood problems and flood control evaluation were felt to be reasonable when analyzed on the basis of field data obtained, current trends, and available secondary source information. However, a further analysis was completed in light of the more recent OBERS projections. Application of the OBERS data to the flood control areas showed that future growth allowances presented in appendix J of the comprehensive report would be substantiated. An analysis of the use of OBERS projections is presented as a separate section of this appendix.

8. ESTIMATED DAMAGES WITHOUT PROTECTION.- Flood damages under average levels of development expected to prevail during the 100-year analysis period are estimated to average $5,243,200 annually. Table 5 summarizes by reach the estimated average annual damages based on 1970 price levels and without flood protection.

9. DAMAGE REDUCTION BENEFITS.- The estimated average annual flood damages were computed using the procedures described in appendix J of the comprehensive report and supplemental information presented earlier in this appendix. First, estimates of damage were

FLOOD CONTROL BENEFITS*

Stream	Reach	Average annual damages: Existing	Modified	Total	1975-2075 Flood control benefits: Mineola Reservoir	Lake Fork Reservoir	Big Sandy Reservoir	Greenville Local Prot
Sabine River	1 (1)	$						
(Long Branch)		(14,800)	(1.800)	(13,000)	(0)	(0)	(0)	(13,000)
(Sabine River)	(2)	(79,600)	(79,600)		(0)	(0)	(0)	
	2-B-1	263,100	35,100	228,000	228,000	0	0	0
	2-A-3	169,800	16,200	153,600	153,600	0	0	0
	2-A-2	322,400	29,600	292,800	184,200	108,600	0	0
	2-A-1	144,200	4,800	139,400	76,200	46,300	16,900	0
	3	2,238,000	304,100	1,933,900	1,037,200	680,600	216,100	0
	4	103,000	21,800	81,200	46,400	24,300	10,500	0
	5	1,423,700	980,100	443,600	238,700	131,800	73,100	0
Lake Fork Creek	1	381,300	22,000	359,300	0	359,300	0	0
Big Sandy Creek	1	103,300	8,900	94,400	0	0	94,400	0
Total		$5,243,200	$1,504,000	$3,739,200	$1,964,300	$1,350,900	$411,000	$13,000

(1) Includes Greenville area only. Excludes benefits accruing to upstream retardation structures.
(2) No structural improvement recommended.
*Flood damage reductions only.

based on nonproject conditions and 1964 levels of flood plain development and January 1970 prices (table 4). Average annual damages estimated for each evaluation reach were then adjusted through application of the appropriate economic growth indicator to determine the value of average annual damages for the analysis period under nonproject conditions. Similar computations were then made with the recommended improvements in place. The difference in the average annual damages without and with flood control improvements constitutes the damage reduction benefits attributable to flood control. Table 5 shows damages prevented by evaluation reach and the value of benefits accruing to each of the recommended projects. The projects were assigned fair share benefits based on the relative effect each project would produce when operating in a first added position in the basin.

10. OTHER FLOOD CONTROL BENEFITS.- In addition to flood damage reductions, other flood control benefits will accrue to recommended structural measures. The following types of benefits were not evaluated for the recommended projects in the comprehensive report.

a. Reduced reservoir sedimentation.- Sediment studies were completed to determine the effect of the Mineola, Lake Fork, and Big Sandy projects on sediment deposition in the downstream Toledo Bend Reservoir. Under nonproject conditions, the 100-year sediment storage capacity requirement was estimated to approximate 111,000 acre-feet. With the three recommended reservoir projects in place to intercept sediment originating in their respective drainage areas, it was estimated that the net sediment delivery to Toledo Bend would be about 94,000 acre-feet, based on contributing drainage areas and after adjustments for reservoir sediment trap efficiencies and stream distances involved. This difference represents an average annual reduction of 171 acre-feet, which is attributable to the three recommended reservoirs to be located upstream from Toledo Bend. Using the estimated January 1970 replacement value for Toledo Bend Reservoir as a measure, the average annual sediment reduction benefits are: Mineola, $6,700; Lake Fork, $2,600; and Big Sandy, $700, for a total of $10,000.

b. Improved flood plain efficiency.- The high frequency of flooding has prevented operators of agricultural flood plain land from receiving benefits from technology they are applying during farm operations. With flood protection, these benefits will be realized through higher yields and improved quality accompanying a more sustained agricultural production. Field data used to compute estimates of flood damage to crops and pasture in the original study did not include either the costs for applied technology or the production increases resulting from such application under normal flood free conditions. Farm operators state they continue to apply technological advancements on flood plain lands because the practices are carried out on an entire field, only part of which may be in the flood plain. Also the usually more productive bottom land soils make the chance worthwhile with significantly higher yields in flood free years.

Texas Agricultural Experiment Station data for crop and pasture yields on predominant soils of the Sabine River flood plain showed the effect of applied technology on flood free yields. It was estimated from the study that approximately 30 percent of the technology applicable to this area is being practiced currently. The increase in crop and pasture average yields attributable to application of improved technology in each stream reach was converted to production units and net monetary returns. Differences in net between project and nonproject conditions constitute the estimated benefits from improved effectiveness of applied technology. The average annual monetary value of these benefits is estimated to be $200,000, attributable to Mineola Reservoir, $134,000; Lake Fork Reservoir, $52,000; and Big Sandy Reservoir, $14,000; based on flood protection provided by each project as the last added increment of improvement.

11. TOTAL FLOOD CONTROL BENEFITS.- The estimated total flood control benefits attributable to the recommended improvements average approximately $3,949,200 annually. This total consists of flood damage reductions, $3,739,200; reduced reservoir sedimentation, $10,000; and improved agricultural efficiency, 200,000.

12. WATER SUPPLY.- Future water demands for municipal and industrial purposes were projected during the comprehensive basin study as set forth in appendix E of the comprehensive report. In evaluation of the water supply benefits to be realized through incorporation of water supply as a purpose in the three recommended reservoirs, the annual cost of the most likely alternative was employed. The capacity needed for water to satisfy demands was developed at each of the multiple purpose reservoir sites. These water storage capacities were: Mineola, 370,100 acre-feet; Lake Fork, 621,500 acre-feet; and Big Sandy, 215,300 acre-feet.

a. Cost estimates.- Single purpose reservoir cost estimates were developed for impoundments at each of the multiple purpose reservoir sites which would provide capacities for water supplies in the amounts set forth in the preceding paragraph. The estimated total costs for the single purpose reservoirs, based on January 1970 prices, were:

Mineola	$42,650,000
Lake Fork	$57,726,000
Big Sandy	$24,781,000

b. Benefit estimates.- Recognizing that the single purpose reservoirs would provide the most likely alternative means of achieving the water supply goals, the annual equivalent values of the reservoir costs were computed to measure the water supply benefits. An interest rate of 6.5 percent was used for amortization purposes since this yield

was found to be representative of current water improvement bond sales in the area. The annual value of operation and maintenance was added to the annual equivalent value of the installation cost to determine the estimated total average annual benefits. These benefits are:

Mineola	$2,961,400
Lake Fork	$3,949,100
Big Sandy	$1,766,700

13. RECREATION.- Recreational needs, analysis of the market area, projections of future demands, and general descriptions pertinent to recreation are presented in appendix N of the comprehensive report. The short range plan for recreation is presented in this Corps of Engineers report.

a. Departures from comprehensive basin plan.- The unit value for a recreation-day at the recommended Mineola and Big Sandy Reservoirs has been increased from ninety cents to one dollar, a value considered to be more representative of the recreation experience to be afforded by the planned developments and available facilities. The value of $1.50 was retained for Lake Fork Reservoir, although it is believed to be very conservative for the development as planned, especially in view of the current prices for quality experiences.

Recreation development costs have been increased substantially to reflect more adequately the current value of recreation costs.

b. Estimates of cost.- Appendix E of this report presents the revised cost estimates for recreation, including land cost, OM&R, and facilities at each of the three recommended reservoirs.

14. FISH AND WILDLIFE.- A detailed analysis of the fish and wildlife resources and the impact of the recommended short range development is contained in appendix O of the comprehensive report. Unit values used in evaluation of fish and wildlife benefits during the comprehensive study have not been changed.

15. NAVIGATION.- The proposed project considered in this report is a 12- by 125-foot channel extending upstream about 5.25 miles in the Sabine River from Echo to and including a turning basin 600 feet square at Morgan Bluff, Orange County, Texas.

a. Departures from comprehensive basin plan.- The short range navigation plan presented in appendix K, volume 4, of the report on the comprehensive basin study, proposed the construction of a 12- by 125-foot channel extending from Echo about 4.5 miles upstream to and including a turning basin at Pruitt Bluff, Orange County, Texas.

The initial potential user of the channel would be the paper mill constructed at Morgan Bluff in 1966-67 by the Forest Products Division of the Owens-Illinois Company. Morgan Bluff was considered for the turning basin site in 1966. However, the company stated that this site was being reserved for future construction, and the turning basin was relocated to Pruitt Bluff, about one mile southeast of the paper mill. Conditions are presently such that the company prefers the closer location at Morgan Bluff, and the proposed turning basin has been moved back to this location.

b. Prospective commerce.- In the report on the comprehensive basin study, page K-47, it was estimated that the prospective waterborne commerce in 1968, the initial year of operation for the paper mill, would be 453,000 tons of linerboard, turpentine and tall oil (a resinous by-product from the manufacture of chemical wood pulp used in the manufacture of soap, varnishes, etc.). A recheck of potential waterborne commerce was made in March 1970, which resulted in revision of these estimates to 315,000 tons of linerboard and 17,000 tons of tall oil. Turpentine is not being shipped in barge-load quantities and is eliminated from further consideration. After rate analysis and screening to eliminate less than barge load quantity movements, 110,000 tons of linerboard and 10,000 tons of tall oil were accepted as 1970 prospective waterborne commerce for a channel from Echo to Morgan Bluff.

c. Projected commerce.- Although at the present time (1970) the only potential commercial user of a channel from Echo to Morgan Bluff would be the paper mill, the Sabine River Authority of Texas and the Orange County Navigation District anticipate that, due to the steady growth of the adjacent industrial area of Orange, Texas, and the proposed channel extension, new industries would develop and thus give the project a more diversified commerce than that presently available. Potential plant sites are available at West Bluff in Orange County and Niblett Bluff in Calcasieu Parish, Louisiana. However, in the absence of any firm commitments by any additional industry, the projection of prospective commerce for the channel is based on future growth plans of Owens-Illinois. Table 6 shows the prospective commerce for the years 1970, 1975 (assumed initial year of project operation), 1980, 2000, 2020, and 2025. The totals estimated in 1967 for the report on the comprehensive basin study are shown for comparison.

TABLE 6

SABINE RIVER
PROSPECTIVE ANNUAL COMMERCE FOR SELECTED YEARS
CHANNEL FROM ECHO TO MORGAN BLUFF
(short tons)

Year	Commodity		Total	Prior estimate (1967)
	Linerboard	Tall oil		
1970	110,000	10,000	120,000	-
1975	171,500	15,300	186,800	679,500
1980	245,000	22,400	267,400	906,000
2000	245,000	22,400	267,400	983,000
2020	245,000	22,400	267,400	983,000
2025	245,000	22,400	267,400	983,000

d. Estimates of benefits.- At the present time, approximately 95 percent of the domestic tonnage of linerboard and tall oil from Morgan Bluff is shipped by rail, with the remaining 5 percent moving by truck. The export shipments, which amounted to 39,809 tons of linerboard in 1968, moved by truck to Orange, and by deep-draft vessels from the Port of Orange. The authorized 12- by 125-foot channel from Orange to Echo has not yet been constructed, but the company indicates that it will consider converting to barge shipments upon completion of that channel.

March 1970 rail rates were obtained for all movements of linerboard and tall oil considered. The rail rates exceed the charges for shipping by barge from either Morgan Bluff or Echo. Since rail transportation is the currently used mode, a comparison could be made for this alternative as compared to shipping by barge from Morgan Bluff. Such a comparison would indicate a unit benefit of $3.66 per ton of tall oil and unit benefits ranging from $4.11 to $7.71 per ton for linerboard. However, it is considered that a comparison of rail rates to barge rates would not give a realistic estimate of the economic efficiency of the proposed project, since the company probably would be shipping at least a portion of its output by barge during the period of analysis (1975-2025).

The benefits attributable to a channel from Echo to Morgan Bluff would be the savings in transportation charges computed as the difference between charges for barge shipments from the proposed turning basin at Morgan Bluff and the charges for movement by the most likely alternative that would be expected to be utilized in the absence of the proposed extension. The most likely alternative was determined to be shipment by truck from the paper mill to the authorized head of navigation at Echo, Texas, a one-way haul distance of 6.5 miles, and shipment from Echo by barge.

The unit savings in transportation charges on this basis is estimated at $2.37 per ton for linerboard and $2.38 per ton for tall oil. The estimate of savings was computed as follows:

Item	Linerboard	Tall oil
Elimination of one handling charge	$ 1.72	$ 0.90
Elimination of truck haul (6.5 miles)	.67	1.50
Increase in barge haul (4 miles)	(-) .02	(-) .02
Net savings per ton	$ 2.37	$ 2.38

The annual benefit levels to be realized from savings in transportation cost for selected years are shown in table 7.

TABLE 7

SABINE RIVER
ANNUAL BENEFITS
CHANNEL FROM ECHO TO MORGAN BLUFF, TEXAS

Year	Commerce in tons	Annual benefits
1975	186,800	$442,900
1980	267,400	634,000
2000	267,400	634,000
2020	267,400	634,000
2025	267,400	634,000

The average annual equivalent benefits from the movement of shallow-draft traffic over the improved channel in the lower Sabine River between Echo and Morgan Bluff, Texas, were estimated with the assumption that the initial year of project operation would be 1975 and were based on 1970 price levels. Benefits from future commerce during the period 1975-2025 were converted to an average annual equivalent value using procedures contained in Engineer Manual 1120-2-118, with a compound interest rate of 4-7/8 percent and a period of 50 years. The total average annual equivalent benefits for the 50-year life of the project are estimated at $616,000.

16. LABOR RESOURCES.- Economic activity will be stimulated in the local employment sector, both as the direct result of installation of the three recommended reservoirs, and activities induced by or stemming from incorporated project purposes.

a. Redevelopment.- Job opportunities will be provided local labor during construction and in operation and maintenance of the reservoir projects recommended for authorization. Five counties within commuting distance to the projects have been designated by the Economic Development Administration as areas of unemployment or underemployment. Estimates of the value of available unskilled and semi-skilled labor which could be utilized were prepared under provisions of ER 1165-2-6. Area employment effects were based on the estimated project construction periods and a 20-year straight line reduction to zero for project operation and maintenance. Redevelopment benefits resulting from construction and operation and maintenance of projects can be placed in two categories, including national benefits computed as the value of wages and salaries paid to unemployed workers, and regional benefits which are measured as the value of all wages and salaries relating to the projects. The total average annual national redevelopment (EDA) benefits expected to result from the recommended projects are estimated at $163,600. The annual regional benefit would amount to $3,958,200, which includes $771,300 in wages and salaries related to operation and maintenance of the reservoir projects. The redevelopment benefits are evaluated without any allowance for the multiplier effect of the wage earners' expenditures on the economy.

Counties which are expected to realize redevelopment benefits are Delta, Fannin, Marion, Rains, and Red River. Approximately 116 unemployed persons in these five counties will be employed during project construction, and an average of about four persons will be employed in operation and maintenance. The following tabulation shows estimated redevelopment benefits by project.

Project	Average annual benefits		
	From construction	From O&M	Total
Mineola	$ 68,832	$ 6,250	$ 75,082
Lake Fork	51,624	6,048	57,672
Big Sandy	22,944	7,862	30,806
Total	$143,400	$20,160	$163,560

b. Development.- National and regional benefits are expected to accrue from the expansion of recreational activities, expanded water supply, and reduction of flood damage. The number of job opportunities or the number of unemployed persons to be provided employment related to recreation is unknown: however, employment will be generated at the boat docks, sports equipment stores, grocery stores, service stations,

and other service facilities in vicinity of the projects. Current employment information indicates a decline in unemployment since 1962. However, estimates show over 600 now unemployed in those counties designated by the Economic Development Administration as areas of unemployment or underemployment, and over 4,600 total unemployed within commuting distance of the reservoir projects. It is expected that job opportunities will result from the expanded recreational activities.

The expanded municipal and industrial water supply will permit orderly expansion of municipalities in the Sabine Basin and continued growth in the Dallas-Fort Worth area. This growth will provide jobs in residential and industrial construction over an extended period of time, as well as jobs in industrial production and required service activities.

17. EFFECT ON POWER.- Power routings were completed without and with the three recommended reservoirs in place to determine their effect on the power operation at Toledo Bend Reservoir. Mineola and Lake Fork Reservoirs were considered to be in operation in 1980 with the Big Sandy Reservoir operative during the 1990-2000 decade. The proposed annual diversion from the basin through the Texas Water System was assumed to reach 100,000 acre-feet in the year 2000 and the full 200,000 acre-feet in the year 2020. Results of the studies, together with tabulations of pertinent data, are presented in the EFFECTS OF UPSTREAM RESERVOIR DEVELOPMENT ON TOLEDO BEND RESERVOIR section of the main report.

18. OBERS PROJECTIONS COMPARISON.- The comprehensive basin report (type II) included project evaluation based on historical and projected data for population, income, employment, value of mineral production, value of new construction, value added by manufacture, and value of farm products sold. In order to make comparisons and reach conclusions, it was necessary to disaggregate OBERS data for economic areas and water resources planning areas. The most significant changes occur in population, disposable income, per capita income, and value of mineral production. The general reduction in population results from application of the assumption that the birth rate would be lower than that used in previous projections. The disposable income is also projected to increase at a slower rate. However, the disposable income divided by population results in per capita income being projected to a higher level than that which was used prior to the distribution of OBERS projections. The OBERS projections are for areas rather than counties, and mineral production as such is not projected. Therefore, it was necessary to develop projections for this indicator by use of

earnings per employee in the industry; then disaggregate the area projections to counties included in the base study area. The expected effects of application of OBERS projections on future growth allowances and benefit determinations are discussed in the following paragraphs. The following tables reflect projections for the above listed indicators as presented in the comprehensive report and as developed from the OBERS data.

a. Greenville urban flood protection.- Greenville, Texas is located in Hunt County, which is a part of OBE Economic Area 08121. Historically, the county population has declined from 3.74 percent of the area 121 population in 1940 to 1.91 percent of the area population in 1960. This downward trend was continued to develop a projected population of 71,000 in Hunt County in 2020, which is 1.80 times the 1960 population. Extrapolation for 100 years at the 1960-2020 rate results in a 2060 population estimate of 104,000 for the county. Historically, Greenville has increased its share of the Hunt County population from 25.3 percent in 1930 to 48.4 percent of the county population in 1960. A continuation of this trend would indicate that the total Hunt County population would reside in Greenville by the year 2000. Assuming that this trend of urban development would moderate so that Greenville only grows to be 75 percent of the county population in 2060 would result in a city population of 78,000, which is 400 percent of the 1960 Greenville population reflected in census data. With urban growth at this high rate, there will be continuing pressure to develop all available areas in and around Greenville.

Per capita disposable income, in 1960 constant dollars, for the base study area projected at the rate of 3.18 percent per year for a 60-year period on the basis of OBERS data amounts to $9,575 in 2020, which is 126 percent of the projection used in the type II report. Projections of per capita disposable income in the type II report for subarea V, which includes Hunt County and Greenville, indicate that income will increase from $1,438 per year in 1960 to $6,663 per year in 2020, or at the annual rate of 2.59 percent per year and the 2020 income is 463 percent of the 1960 amount. Extrapolation of the subarea V data indicates a per capita income amounting to over $18,000 in 2060, which is 12.9 times the 1960 per capita income level.

Based on the above information relative to the increasing population and per capita income, it is considered that reanalysis of future development of Greenville and vicinity using OBERS data would substantiate the future growth allowances as presented in appendix J of the comprehensive report.

b. Sabine River and tributaries, Lake Tawakoni to Toledo Bend Reservoir.-

TABLE 8

INDICATOR COMPARISONS
(Sabine River Comprehensive Report & Obers Data)

Year	Comprehensive Report: Number	Comprehensive Report: Average Annual Percent Change	OBERS DATA: Number	OBERS DATA: Average Annual Percent Change
	Population - United States			
1960	179,323,175		179,323,175	
		1.73		1.36
1980	252,377,000		234,193,000	
		1.74		1.36
2000	356,154,600		306,757,000	
		1.70		1.30
2020	498,903,100		397,562,000	
	Population - Texas and Louisiana			
1960	12,836,699		12,836,699 1/	
		1.98		1.40
1980	18,999,300		16,929,000 1/	
		1.83		1.39
2000	27,320,200		22,304,000 1/	
		1.77		1.36
2020	38,783,800		29,217,000 1/	
	Population in the Base Study Area			
1960	1,866,838		1,866,838 1/	
		1.65		0.85
1980	2,589,200		2,209,600 1/	
		1.74		1.05
2000	3,659,500		2,724,400 1/	
		1.86		1.12
2020	5,290,300		3,416,700 1/	

Note: See footnotes at end of the table

TABLE 8 (Cont'd)

INDICATOR COMPARISONS
(Sabine River Comprehensive Report & Obers Data)

Year	Comprehensive Report: Number	Comprehensive Report: Average Annual Percent Change	OBERS DATA 1/: Number	OBERS DATA 1/: Average Annual Percent Change
	Population - Hunt County, Texas			
1960	39,399		39,399	
		2.18		1.15
1980	60,600		49,500	
		2.16		0.77
2000	93,000		57,800	
		2.17		1.03
2020	142,900		71,000	
	Population - Greenville, Texas			
1960	24,876 2/		19,087	
		2.57		1.50
1980	41,300 2/		25,700	
		2.89		1.24
2000	73,100 2/		32,900	
		2.67		1.46
2020	123,900 2/		44,000	
	Employment in the Base Study Area			
1960	618,919		618,919	
		1.92		1.27
1980	905,300		796,000	
		1.94		1.17
2000	1,328,600		1,003,600	
		2.04		1.20
2020	1,990,800		1,277,300	

Note: See footnotes at end of the table

TABLE 8 (Cont'd)

INDICATOR COMPARISONS

(Sabine River Comprehensive Report & Obers Data)

Year	Comprehensive Report: Value	Comprehensive Report: Average Annual Percent Change	OBERS DATA 1/: Value	OBERS DATA 1/: Average Annual Percent Change
	Disposable Income - Base Study Area			
1960	2,743,900 3/		2,743,900 3/	
		4.19		4.31
1980	6,180,000 3/		6,376,200 3/	
		4.54		4.17
2000	15,017,000 3/		14,436,100 3/	
		5.06		4.18
2020	40,264,400 3/		32,714,100 3/	
	Per Capita Disposable Income - Base Study Area			
1960	1,470 4/		1,470 4/	
		2.45		3.43
1980	2,387 4/		2,886 4/	
		2.75		3.08
2000	4,104 4/		5,299 4/	
		3.14		3.00
2020	7,611 4/		9,575 4/	
	Value of Farm Products Sold - Base Study Area			
1960	278.0 5/		278.00 5/	
		2.23		0.97
1980	432.0 5/		337.44 5/	
		1.81		0.97
2000	619.0 5/		409.17 5/	
		1.34		1.60
2020	807.0 5/		562.37 5/	

Note: See footnotes at end of the table

53-522 O-71——17

TABLE 8 (Cont'd)

INDICATOR COMPARISONS
(Sabine River Comprehensive Report & Obers Data)

Year	Comprehensive Report Value	Comprehensive Report Average Annual Percent Change	OBERS DATA (1) Value	OBERS DATA (1) Average Annual Percent Change
	Value of Minerals Produced - Base Study Area			
1960	1,022.0 6/		955.0 5/	
1980	930.0 6/	-0.55	1,682.34 5/	2.87
2000	692.0 6/	-1.47	2,828.31 5/	2.63
2020	630.0 6/	-0.47	4,641.12 5/	2.51
	Value of New Construction Contracts - Base Study Area			
1960	384.2 5/		384.16 5/	
1980	743.0 5/	3.35	932.75 5/	4.53
2000	1,383.1 5/	3.16	2,082.24 5/	4.10
2020	2,560.3 5/	3.13	4,588.09 5/	4.03
	Value Added by Manufacture - Base Study Area			
1960	1,197.24 5/		1,197.24 5/	
1980	3,590.57 5/	5.65	2,918.03 5/	4.56
2000	10,571.00 5/	5.55	6,201.97 5/	3.84
2020	30,578.39 5/	5.46	12,035.66 5/	3.37

1/ Computed by Southwestern Division based on OBERS data
2/ Urban population of Hunt County
3/ 1960 dollars in thousands
4/ Amount in 1960 dollars
5/ 1960 dollars in millions
6/ 1963 dollars in millions

(1) Flood control.- The future growth allowances for average annual damages in the flood plains in this part of the Sabine River Basin were developed for agricultural properties and for non-agricultural properties.

(a) Agricultural.- The type II report evaluated future growth of agricultural damages on the basis of projected changes in the two-state (Texas and Louisiana) populations and value of farm products sold. In view of the fact that OBERS data is for geographic areas, it was necessary to develop projections of these two indicators on the basis of adjusted OBERS data. The resulting population projections for the two-state area are 29,217,000 people in 2020, which is 75 percent of the number used in the type II report. The projection of value of farm products sold based on OBERS data is consistently lower than the comprehensive report data. The value in 2020 is projected to 562.37 millions of 1960 constant dollars, which is only 70 percent of the projected value used in the type II report. On the basis of these projections, a computation was made to determine the average annual equivalent factor for comparison with the factor developed for reach 3 as shown in table 5 of appendix J of the comprehensive report. The factor, based on OBERS data, is 1.64, or 79 percent of the 2.07 computed in the type II report.

(b) Nonagricultural.- The future growth allowance for use in the type II report for nonagricultural damages was determined from projection of population for the base study area, projected value of minerals produced in reach 3, and the projected disposable income. Projections based on OBERS data show the 2020 population to be 3,416,700 or 65 percent of the population used in the type II report. Mineral production was projected to decline drastically in value in the type II report. The greatest decline was shown between 1980 and 2000, when the annual rate of decline was a minus 1.47 percent. Projections developed from OBERS data on earnings per employee in mining in economic area 08123 indicate a growth in the value of mineral production. The value has been projected in 1960 constant dollars to increase from $361,534,000 in 1960 to $1,863,162,100 in 2020, or over 5.0 times in 60 years. Disposable income in the base study area, based on OBERS data, is projected from $2,743,900,000 in 1960 to $32,714,100,000 in 2020, which is at a rate of over 4.0 percent per year compounded. The 2020 amount using OBERS data is 81 percent of the corresponding amount used in the type II report. Computation of the average annual equivalent factor for the future growth allowance, based on OBERS data, for nonagricultural damages resulted in a factor of 3.07, which is 1.84 times the allowance developed for reach 3 in the type II report. In view of the fact that the factor for agricultural damages declined, the factor for nonagricultural damage increased, and nonagricultural damages are considerably greater than agricultural damages, it is considered that use of OBERS data

would support the future growth allowance for flood damage prevention benefits. The following tabulation shows factors based on OBERS projections which may be compared with those presented in table 5, appendix J, comprehensive report.

DEVELOPMENT FACTORS

Item	Factors				
	1960	1964	1975	2025	2075
Agricultural:					
Population - two-state	1.00	1.06	1.24	2.49	
Value of farm products sold	1.00	1.04	1.15	2.14	
Development factors (geometric mean) 1960 = 1.00	1.00	1.05	1.19	2.31	3.43
Development factors (geometric mean) 1964 = 1.00		1.00	1.13	2.20	3.27
Average annual equivalent 1964 - 2075	1.64				
Comprehensive report factor	2.07				
Nonagricultural:					
Population (base study area)	1.00	1.02	1.12	1.93	
Value of mineral production (OBE 123)	1.00	1.13	1.60	5.83	
Disposable income (BSA)	1.00	1.19	1.89	14.72	
Development factors (geometric mean) 1960 = 1.00	1.00	1.11	1.50	5.49	9.48
Development factors (geometric mean) 1964 = 1.00		1.00	1.35	4.95	8.54
Average annual equivalent 1964 - 2075	3.07				
Comprehensive report factor	1.67				

(2) Water supply.- Future water demands were projected for the Sabine Basin to satisfy needs to the year 2075. The Texas Water Development Board requested an additional 200,000 acre-feet annually on or before 1980 for diversion to the Dallas area. Population projections for the basin based on OBERS data are 3,416,700 in 2020, which is 65 percent of the type II report projection. Population projections for the Dallas-Fort Worth area based on OBERS data are 3,019,800 in 1980, or 26 percent greater than the projection in the comprehensive report, and the 2020 population of 6,832,000 is 40 percent greater than that used in the type II report. When the population projections for the base study area and the Dallas-Fort Worth area are combined, they are

greater than the projections in the type II report. In view of the higher population projections, it is expected that the application of OBERS data would substantiate or increase the demand for water supply.

(3) Recreation.- Recreational activity historically has increased rapidly. Two reasons for this increase are the population growth and the mobility of the population as a result of higher per capita incomes. As discussed in the preceding paragraph, population projections developed from OBERS data reflect a higher population than was shown in the type II report for the Dallas-Fort Worth area, which is the primary source of demand for the Sabine Basin. The combined population projection for the base study area and the Sabine Basin is also higher than shown in the type II report to the year 2020. Per capita income projections for the base study area based on OBERS data amount to $9,575 in 2020, which is 25 percent higher than the projection in the comprehensive report, and based on OBERS data, the 2020 per capita income for the Dallas-Fort Worth area will be $11,184, which is 47 percent higher than the type II report projection for the base study area. It is considered that application of OBERS data would support or increase the demand for recreational activities at reservoir projects in the Sabine Basin.

(4) Navigation.- The navigation benefits evaluated in this report are based on present industrial production and planned business expansions not related to a specific indicator. Prospective commerce is projected to increase to 267,400 tons of linerboard and tall oil by 1980, and remain constant thereafter. This is an increase of 123 percent over the 1970 commerce considered in the benefit analysis. Population projections by OBERS for the United States indicate increases over the 1960 population of 31 percent by 1980, 71 percent by 2000, and 122 percent in 2020. Historical data relative to the production of paper and board indicate that total production has increased from 24,375,000 short tons in 1950 to 46,892,000 short tons in 1967. The production on a pounds per capita basis has increased from about 320 in 1950 to approximately 480 in 1967, or a 50 percent increase in per capita production during the 17-year period. In view of the historically increasing per capita production and the United States population projections by OBERS, it is considered that the application of OBERS data to the determination of navigation benefits would substantiate the project evaluation.

19. SUMMARY OF BENEFITS.- The average annual monetary value of evaluated benefits which will accrue to each of the recommended projects is presented in table 9.

TABLE 9

SUMMARY OF BENEFITS

Project	Benefit Categories					
	Flood Control	Water Supply	Recreation	Fish and Wildlife	Navigation	Redevelopment
Reservoir System	1/					
Mineola	$2,105,000	$2,961,400	$ 799,800	$ 429,600	--	$ 75,100
Lake Fork	1,405,500	3,949,100	372,400	419,800	--	57,700
Big Sandy	425,700	1,766,700	612,100	181,100	--	30,800
Subtotal:	$3,936,200	$8,677,200	$1,784,300	$1,030,500	--	163,600
Navigation:						
Channel, Echo to Morgan Bluff			--	--	$616,000	--
Greenville Local Flood Protection	13,000		--	--		
Total Benefits	$3,949,200	$8,677,200	$1,784,300	$1,030,500	$616,000	$163,600

1/ System benefits assigned

20. COST ALLOCATION TO PROJECT PURPOSES.-

a. General.- Cost allocations for multiple-purpose projects were made to determine the equitable distribution of the costs to be credited to each project purpose and to determine the apportionment of these costs to Federal and non-Federal interests. Construction costs, annual operation, maintenance, and replacement costs allocated to flood control have been apportioned between Federal and non-Federal interests in accordance with the general policy given in the Flood Control Act of 1936 (Public Law 738, 74th Congress), as subsequently amended. Costs allocated to water supply are apportioned to non-Federal interests in accordance with the provisions of the Water Supply Act of 1958, Public Law 85-500, as amended. Costs allocated to recreation and fish and wildlife enhancement are apportioned to Federal and non-Federal interests in accordance with Public Law 89-72, cited as the Federal Water Project Recreation Act.

(1) Reservoir projects.- For reservoir projects, the Separable Costs - Remaining Benefit method is the generally accepted procedure wherein separable costs are charged to the various purposes and the joint use costs are distributed so that each purpose shares equitably in the fair share benefits of multiple-purpose construction, with the allocated cost of water supply being charged to non-Federal interest.

(2) Local flood protection projects.- The division of costs between Federal and non-Federal interests are subject to requirements of local cooperation as generally specified for such projects in which all construction costs are the responsibility of the Federal Government except for rights-of-way and relocation costs (excluding railroads) which are the responsibility of local interests.

(3) Navigation.- The Federal Government will be responsible for all construction costs except for relocation construction. Appropriate non-Federal interests will be responsible for all costs of rights-of-way and of relocation construction. Three exceptions are: The construction of alterations to railroad and public highway bridges crossing the existing navigable river where the cost sharing principles of the Bridge Alteration Act of June 21, 1940 (Truman - Hobbs Act), as amended, will be applied; the necessary alteration of all other railroad facilities would be at Federal expense except that any necessary additional interest in lands shall be a local interest expense; and the provision at Federal expense of public highway bridges (excluding land costs) crossing new land cuts for the navigation channel when necessary as part of a project highway relocation.

b. Reservoirs.- Mineola, Lake Fork, and Big Sandy Reservoir costs were allocated to flood control, water supply, and recreation with local interest cost being that allocated to water supply and recreation, as cited in paragraph 20a(1).

c. Local flood protection.- The costs of local flood protection projects have been apportioned between Federal and non-Federal interests in accordance with the general policy given in the Flood Control Act of 1936 (Public Law 738, 74th Congress as amended) and as stated in paragraph 20a(2).

d. Navigation.- The apportionment of first costs for the navigation channel improvements between the Federal Government and the local interests would be in accordance with Federal law applicable to navigation projects. Under these requirements, the first costs of all lands, easements and rights-of-way, including spoil disposal area dikes, bulkheads, and embankments necessary for construction of the proposed navigation improvements would be borne by local interests. All costs of necessary relocations or alterations of structures and other existing improvements, including buildings, roads, pipelines, sewers, and other utilities, would be borne by local interests; exceptions are the three typical situations specified in paragraph 20a(3) above, wherein local interests will provide for any necessary land interests but the Federal Government will provide entirely or in part for necessary construction of certain public highway bridges and all railroad facilities. Existing rights in servitude of navigation will be exercised whenever applicable to require that owners of project affected lands and improvements provide, regarding their respective individual ownerships, the local cooperation that is otherwise required of local interests. All other first costs for construction of the proposed improvements and all preauthorization survey costs would be borne by the Federal Government. Until such time as multiple use of the channel from Echo to Morgan Bluff occurs, local interests would be required to contribute annually one-half the annual charges for interest and amortization of the improvements. All costs for maintenance and operation of the project channel would be borne by the Federal Government. All costs for maintenance and advance replacement of the aids to navigation constructed by the local interests would be borne by the Federal Government.

21. COST ALLOCATION SUMMARY.- Table 10 shows the allocation of costs to each purpose for Mineola, Lake Fork, and Big Sandy Reservoirs by the separable Costs-Remaining Benefits method. Table 11 shows the apportionment of costs to Federal and non-Federal interest for the plan of improvement recommended for authorization. Table 12 shows allocated first costs, annual charges, annual benefits, and benefit-cost ratios for the recommended projects. Tables 13 through 18 show the first cost, annual charges, benefits, and allocations of cost computations.

TABLE 10

SUMMARY OF RESERVOIR COST ALLOCATION STUDIES
(Cost in 1,000 dollars)

Project and Purpose	First Cost	Operation & Maintenance	Annual Charges	Annual Benefits	Allocated Water Supply Cost per 1000 gallons
Mineola Reservoir					
Flood Control	36,246.4	60.4	2,028.7	2,105.0	
Water Supply	29,223.5	155.2	1,742.1	2,961.4	0.057
Recreation and Fish and Wildlife	11,896.1	460.4	1,106.4	1,229.4	
TOTAL	77,366.0	676.0	4,877.2	6,295.8	
Lake Fork Reservoir					
Flood Control	18,087.4	104.7	1,073.7	1,405.5	
Water Supply	33,078.5	115.7	1,887.9	3,949.1	0.033
Recreation and Fish and Wildlife	7,361.1	243.0	637.4	792.2	
TOTAL	58,527.0	463.4	3,599.0	6,146.8	
Big Sandy Reservoir					
Flood Control	6,242.0	21.0	346.5	425.7	
Water Supply	13,907.6	144.6	869.8	1,766.7	0.036
Recreation and Fish and Wildlife	8,111.4	289.1	712.1	793.2	
TOTAL	28,261.0	454.7	1,928.4	2,985.6	

TABLE 11

APPORTIONMENT OF COSTS

Item	Project: Mineola Reservoir	Lake Fork Reservoir	Big Sandy Reservoir	Greenville Local Flood Protection	Navigation Echo to Morgan Bluff
FIRST COST					
Federal					
Flood Control	$36,246,000	$18,087,000	$ 6,242,000	$ 100,300	---
Recreation	8,556,000	5,560,000	5,979,000	---	---
General	(5,570,000)	(2,613,200)	(4,615,800)	---	---
Fish and Wildlife	(2,986,000)	(2,986,800)	(1,363,200)	---	---
Navigation	---	---	---	---	$ 1,765,200
TOTAL ECONOMIC COST	$44,802,000	$23,647,000	$12,221,000	$ 100,300	$ 1,765,200
Δ Recreation (1)	1,113,000	244,000	791,000	---	---
Δ Relocations (2)	8,276,000	9,574,000	3,668,000	---	---
TOTAL FINANCIAL COST	$54,191,000	$33,465,000	$16,680,000	$ 100,300	$ 1,765,200
Non-Federal					
Flood Control	---	---	---	$ 80,700	---
Water Supply	$29,224,000	$33,079,000	$13,908,000	---	---
Recreation	3,340,000	1,801,000	2,132,000	---	---
General	(2,174,300)	(846,500)	(1,645,900)	---	---
Fish and Wildlife	(1,165,700	(954,500)	(486,100)	---	---
Navigation	---	---	---	---	$ 287,800
TOTAL ECONOMIC COST	$32,564,000	$34,880,000	$16,040,000	$ 80,700	$ 287,800
Δ Recreation (2)	1,114,000	244,000	791,000	---	---
TOTAL FINANCIAL COST	$33,678,000	$35,124,000	$16,831,000	$ 80,700	$ 287,800
TOTAL FIRST COST, ECONOMIC	$77,366,000	$58,527,000	$28,261,000	$ 181,000	$ 2,053,000
Δ Recreation (1)	2,227,000	488,000	1,582,000	---	---
Δ Relocation (2)	8,276,000	9,574,000	3,668,000	---	---
TOTAL FIRST COST, FINANCIAL	$87,869,000	$68,589,000	$33,511,000	$ 181,000	$ 2,053,000
OPERATION, MAINTENANCE AND REPLACEMENTS					
Federal					
Flood Control	$ 60,400	$ 104,700	$ 21,000	---	---
Recreation	31,400	16,600	14,400	---	---
General	(20,400)	(7,800)	(11,100)	---	---
Fish and wildlife	(11,000)	(8,800)	(3,300)	---	---
Navigation	---	---	---	---	$ 31,000
TOTAL	$ 91,800	$ 121,300	$ 35,400		$ 31,000
Non-Federal					
Flood Control	---	---	---	$ 2,100	---
Water Supply	$ 155,200	$ 115,700	$ 144,600	---	---
Recreation	429,000	226,400	274,700	---	---
General	(279,300)	(106,400)	(212,100)	---	---
Fish and wildlife	(149,700	(120,000)	(62,600)	---	---
Navigation	---	---	---	---	28,800
TOTAL	$ 584,200	$ 342,100	$ 419,300	$ 2,100	$ 28,800
TOTAL OPERATION, MAINTENANCE AND REPLACEMENT	$ 676,000	$ 463,400	$ 454,700	$ 2,100	$ 59,800
ANNUAL CHARGES					
Federal					
Flood Control	$ 2,028,700	$ 1,073,700	$ 346,500	$ 5,400	---
Recreation	496,600	314,400	327,400	---	---
General	(323,300)	(147,800)	(252,800)	---	---
Fish and wildlife	(173,300)	(166,600)	(74,600)	---	---
Navigation	---	---	---	---	$ 125,700
TOTAL	$ 2,525,300	$ 1,388,100	$ 673,900	$ 5,400	$ 125,700
Non-Federal					
Flood Control	---	---	---	$ 6,400	---
Water Supply	$ 1,742,100	$ 1,887,900	$ 869,800	$ ---	---
Recreation	609,800	323,000	384,700	---	---
General	(397,000)	(151,800)	(297,000)	---	---
Fish and wildlife	(212,800)	(171,200)	(87,700)	---	---
Navigation	---	---	---	---	$ 44,300
TOTAL	$ 2,351,900	$ 2,210,900	$ 1,254,500	$ 6,400	$ 44,300
TOTAL ANNUAL CHARGES	$ 4,877,200	$ 3,599,000	$ 1,928,400	$ 11,800	$ 170,000

(1) Δ Recreation is the difference in future facilities discounted and not discounted.

(2) Δ Relocations is the difference in replacement "in-kind" and replacement to 1970 standards.

TABLE 12

ALLOCATED FIRST COST, ANNUAL CHARGES, ANNUAL BENEFITS AND BENEFIT-COST RATIOS
PROJECTS RECOMMENDED FOR AUTHORIZATION (IN 1,000 DOLLARS)

Purpose	Mineola Reservoir	Lake Fork Reservoir	Big Sandy Reservoir	Greenville Local Flood Protection	Navigation Channel - Echo to Morgan Bluff
FIRST COST					
Flood control	36,246.4	18,087.4	6,242.0	181.0	
Water supply	29,223.5	33,078.5	13,907.6		
Recreation	7,744.4	3,459.7	6,262.0		
Fish and wildlife	4,151.7	3,901.4	1,849.4		
Navigation	--	--	--		2,053.0
Total	77,366.0	58,527.0	28,261.0	181.0	2,053.0
ANNUAL CHARGES					
Flood control	2,028.7	1,073.7	346.5	11.8	
Water supply	1,742.1	1,887.9	869.8		
Recreation	720.3	299.6	549.7		
Fish and wildlife	386.1	337.8	162.4		
Navigation	--	--	--		170.0
Total	4,877.2	3,599.0	1,928.4	11.8	170.0
ANNUAL BENEFITS					
Flood control	2,105.0	1,405.5	425.7	13.0	
Water supply	2,961.4	3,949.1	1,766.7		
Recreation	799.8	372.4	612.1		
Fish and wildlife	429.6	419.8	181.1		
Navigation	--	--	--		616.0
Total	6,295.8	6,146.8	2,985.6	13.0	616.0
BENEFIT-COST RATIOS	1.29	1.71	1.55	1.10	3.62

TABLE 13

MINEOLA RESERVOIR

FIRST CØST - INVESTMENT - ANNUAL CHARGES - ANNUAL BENEFITS
(100 - YEAR ANALYSIS IN THØUSANDS ØF DØLLARS)

ITEM	FC	WS	REC	MP	MP-FC	MP-WS	MP-REC
1.FIRST CØST							
A. DAM & RESERVØIR	37783.00	25550.00	18700.00	48758.00	25550.00	39983.00	48758.00
B. DØWNSTREAM CHANNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. RECREATIØN	0.00	0.00	6459.00	6459.00	6459.00	6459.00	0.00
SUB - TØTAL	37783.00	25550.00	25159.00	55217.00	32009.00	46442.00	48758.00
D. REAL ESTATE	17150.00	10769.00	5503.00	22149.00	12918.00	17565.00	21927.00
TØTAL FIRST CØST	54933.00	36319.00	30662.00	77366.00	44927.00	64007.00	70685.00
CØNSTRUCTIØN PERIØD	5.5	5.0	4.0	6.0	5.0	5.5	6.0
INTEREST DURING CØNSTRUCTIØN	5065.28	3113.91	2453.00	8075.49	3901.10	6226.13	7130.86
TØTAL INVESTMENT	59998.28	39432.91	33115.00	85441.49	48828.10	70233.13	77815.86
2. ANNUAL CHARGES							
A. INTEREST ØN INVESTMENT	2924.92	1922.35	1614.36	4165.27	2380.37	3423.87	3793.52
B. AMØRTIZATIØN	25.26	16.60	13.94	35.97	20.56	29.57	32.76
C. ANNUAL Ø,M & R	121.00	184.00	484.00	676.00	635.00	618.00	247.00
TØTAL ANNUAL CHARGES	3071.18	2122.96	2112.30	4877.24	3035.93	4071.43	4073.28
3. ANNUAL BENEFITS							
A. FLØØD CØNTRØL	2105.00	0.00	0.00	2105.00	0.00	2105.00	2105.00
B. WATER SUPPLY	0.00	2961.40	0.00	2961.40	2961.40	0.00	2961.40
C. RECREATIØN,F&WL	0.00	0.00	1229.40	1229.40	1229.40	1229.40	0.00
TØTAL ANNUAL BENEFITS	2105.00	2961.40	1229.40	6295.80	4190.80	3334.40	5066.40

TABLE 14 - MINEOLA RESERVOIR - COST - ALLOCATION BY SEPARABLE COST - REMAINING BENEFITS METHOD
(100 - YEAR ANALYSIS IN THOUSANDS OF DOLLARS)

ITEM	FC	WS	REC	TOTAL
1. ALLOCATION OF ANNUAL CHARGES				
A. BENEFITS	2105.00	2961.40	1229.40	6295.80
B. ALTERNATE COST	3071.18	2122.96	2112.30	4877.24
C. BENEFITS LIMITED BY ALTERNATE COST	2105.00	2122.96	1229.40	5457.36
D. SEPARABLE COST	1841.32	805.81	803.96	3451.09
E. REMAINING BENEFITS	263.68	1317.15	425.44	2006.27
F. DISTRIBUTION	0.13143	0.65651	0.21206	1.00000
G. ALLOCATED JOINT COST	187.44	936.29	302.42	1426.16
H. TOTAL ALLOCATION	2028.76	1742.10	1106.38	4877.24
I. DISTRIBUTION	0.41596	0.35719	0.22685	1.00000
2. ALLOCATION OF ANNUAL OPER. &MAINT. COSTS				
A. SEPARABLE COST	41.00	58.00	429.00	528.00
B. DISTRIBUTION (FROM 1.F)	0.13143	0.65651	0.21206	1.00000
C. ALLOCATED JOINT COST	19.45	97.16	31.38	148.00
D. TOTAL ALLOCATION	60.45	155.16	460.38	676.00
E. DISTRIBUTION	0.08943	0.22953	0.68104	1.00000
3. ALLOCATION OF FIRST COST & INVESTMENT				
A. ALLOCATED ANNUAL CHARGES	2028.76	1742.10	1106.38	4877.24
B. ALLOCATED O & M	60.45	155.16	460.38	676.00
C. REMAINDER	1968.30	1586.94	646.00	4201.24
D. DISTRIBUTION	0.46851	0.37773	0.15376	1.00000
E. ALLOCATED INVESTMENT	40029.78	32273.88	13137.82	85441.49
F. ALLOCATED FIRST COST	36246.38	29223.52	11896.10	77366.00
BENEFIT - COST RATIO	1.038	1.700	1.111	1.291

ALLOCATED UNIT CONSTRUCTION COST IN AF	
FLOOD CONTROL STORAGE	36.65
WATER SUPPLY STORAGE	74.84
ALLOCATED WATER COST PER THOUSAND GALLONS	0.0572
EXCESS BENEFITS OVER ANNUAL CHARGES	1418.56

TABLE 15 - LAKE FORK RESERVOIR - FIRST COST - INVESTMENT - ANNUAL CHARGES - ANNUAL BENEFITS
(100 - YEAR ANALYSIS IN THOUSANDS OF DOLLARS)

ITEM	FC	WS	REC	MP	MP-FC	MP-WS	MP-REC
1. FIRST COST							
A. DAM & RESERVOIR	22805.00	30219.00	14500.00	35572.00	30219.00	26110.00	35572.00
B. DOWNSTREAM CHANNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. RECREATION	0.00	0.00	3527.00	3527.00	3527.00	3527.00	0.00
SUB - TOTAL	22805.00	30219.00	18027.00	39099.00	33746.00	29637.00	35572.00
D. REAL ESTATE	9400.00	14582.00	5576.00	19428.00	14658.00	11962.00	19352.00
TOTAL FIRST COST	32205.00	44801.00	23603.00	58527.00	48404.00	41599.00	54924.00
CONSTRUCTION PERIOD	4.5	5.0	4.0	5.5	5.0	5.0	5.5
INTEREST DURING CONSTRUCTION	2501.42	3682.94	1757.63	5241.71	4112.79	3612.01	4768.87
TOTAL INVESTMENT	34706.42	48483.94	25360.63	63768.71	52516.79	45211.01	59692.87
2. ANNUAL CHARGES							
A. INTEREST ON INVESTMENT	1691.94	2363.59	1236.33	3108.72	2560.19	2204.04	2910.03
B. AMORTIZATION	14.61	20.41	10.68	26.85	22.11	19.03	25.13
C. ANNUAL O,M & R	94.00	190.00	270.40	463.40	394.40	421.40	237.00
TOTAL ANNUAL CHARGES	1800.55	2574.00	1517.41	3598.97	2976.70	2644.47	3172.16
3. ANNUAL BENEFITS							
A. FLOOD CONTROL	1405.50	0.00	0.00	1405.50	0.00	1405.50	1405.50
B. WATER SUPPLY	0.00	3949.10	0.00	3949.10	3949.10	0.00	3949.10
C. RECREATION,F&WL	0.00	0.00	792.20	792.20	792.20	792.20	0.00
TOTAL ANNUAL BENEFITS	1405.50	3949.10	792.20	6146.80	4741.30	2197.70	5354.60

TABLE 16 - LAKE FORK RESERVOIR - COST - ALLOCATION BY SEPARABLE COST - REMAINING BENEFITS METHOD
(100 - YEAR ANALYSIS IN THOUSANDS OF DOLLARS)

ITEM	FC	WS	REC	TOTAL
1. ALLOCATION OF ANNUAL CHARGES				
A. BENEFITS	1405.50	3949.10	792.20	6146.80
B. ALTERNATE COST	1800.55	2574.00	1517.41	3598.97
C. BENEFITS LIMITED BY ALTERNATE COST	1405.50	2574.00	792.20	4771.70
D. SEPARABLE COST	622.27	954.50	426.81	2003.58
E. REMAINING BENEFITS	783.23	1619.50	365.39	2768.12
F. DISTRIBUTION	0.28295	0.58505	0.13200	1.00000
G. ALLOCATED JOINT COST	451.41	933.39	210.59	1595.39
H. TOTAL ALLOCATION	1073.68	1887.89	637.40	3598.97
I. DISTRIBUTION	0.29833	0.52456	0.17711	1.00000
2. ALLOCATION OF ANNUAL OPER. &MAINT. COSTS				
A. SEPARABLE COST	69.00	42.00	226.40	337.40
B. DISTRIBUTION (FROM 1.F)	0.28295	0.58505	0.13200	1.00000
C. ALLOCATED JOINT COST	35.65	73.72	16.63	126.00
D. TOTAL ALLOCATION	104.65	115.72	243.03	463.40
E. DISTRIBUTION	0.22583	0.24971	0.52445	1.00000
3. ALLOCATION OF FIRST COST & INVESTMENT				
A. ALLOCATED ANNUAL CHARGES	1073.68	1887.89	637.40	3598.97
B. ALLOCATED O & M	104.65	115.72	243.03	463.40
C. REMAINDER	969.03	1772.17	394.37	3135.57
D. DISTRIBUTION	0.30904	0.56518	0.12577	1.00000
E. ALLOCATED INVESTMENT	19707.30	36041.04	8020.37	63768.71
F. ALLOCATED FIRST COST	18087.38	33078.51	7361.11	58527.00
BENEFIT - COST RATIO	1.309	2.092	1.243	1.708
ALLOCATED UNIT CONSTRUCTION COST IN AF				
FLOOD CONTROL STORAGE				38.09
WATER SUPPLY STORAGE				51.84
ALLOCATED WATER COST PER THOUSAND GALLONS				0.0328
EXCESS BENEFITS OVER ANNUAL CHARGES				2547.83

TABLE 17

BIG SANDY RESERVOIR

FIRST CØST - INVESTMENT - ANNUAL CHARGES - ANNUAL BENEFITS
(100 - YEAR ANALYSIS IN THØUSANDS ØF DØLLARS)

ITEM	FC	WS	REC	MP	MP-FC	MP-WS	MP-REC
1. FIRST CØST							
A. DAM & RESERVØIR	9183.00	11394.00	7150.00	13420.00	11394.00	12180.00	13420.00
B. DØWNSTREAM CHANNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. RECREATIØN	0.00	0.00	4128.00	4128.00	4128.00	4128.00	0.00
SUB - TØTAL	9183.00	11394.00	11278.00	17548.00	15522.00	16308.00	13420.00
D. REAL ESTATE	6600.00	7992.00	3076.00	10713.00	9155.00	7759.00	9550.00
TØTAL FIRST CØST	15783.00	19386.00	14354.00	28261.00	24677.00	24067.00	22970.00
CØNSTRUCTIØN PERIØD	3.5	4.0	3.0	4.0	4.0	4.0	4.0
INTEREST DURING CØNSTRUCTIØN	783.42	1110.91	824.70	1710.93	1513.39	1590.03	1308.45
TØTAL INVESTMENT	16566.42	20496.91	15178.70	29971.93	26190.39	25657.03	24278.45
2. ANNUAL CHARGES							
A. INTEREST ØN INVESTMENT	807.61	999.22	739.96	1461.13	1276.78	1250.78	1183.57
B. AMØRTIZATIØN	6.97	8.63	6.39	12.62	11.03	10.80	10.22
C. ANNUAL Ø,M & R	83.00	153.00	314.70	454.70	447.70	361.70	180.00
TØTAL ANNUAL CHARGES	897.59	1160.85	1061.05	1928.45	1735.51	1623.28	1373.80
3. ANNUAL BENEFITS							
A. FLØØD CØNTRØL	425.70	0.00	0.00	425.70	0.00	425.70	425.70
B. WATER SUPPLY	0.00	1766.70	0.00	1766.70	1766.70	0.00	1766.70
C. RECREATIØN,F&WL	0.00	0.00	793.20	793.20	793.20	793.20	0.00
TØTAL ANNUAL BENEFITS	425.70	1766.70	793.20	2985.60	2559.90	1218.90	2192.40

TABLE 18 - BIG SANDY RESERVOIR - COST - ALLOCATION BY SEPARABLE COST - REMAINING BENEFITS METHOD
(100 - YEAR ANALYSIS IN THOUSANDS OF DOLLARS)

ITEM	FC	WS	REC	TØTAL
1. ALLØCATIØN ØF ANNUAL CHARGES				
A. BENEFITS	425.70	1766.70	793.20	2985.60
B. ALTERNATE CØST	897.59	1160.85	1061.05	1928.45
C. BENEFITS LIMITED BY ALTERNATE CØST	425.70	1160.85	793.20	2379.75
D. SEPARABLE CØST	192.94	305.17	554.65	1052.76
E. REMAINING BENEFITS	232.76	855.69	238.55	1326.99
F. DISTRIBUTIØN	0.17540	0.64483	0.17976	1.00000
G. ALLØCATED JOINT CØST	153.60	564.67	157.42	875.69
H. TOTAL ALLØCATIØN	346.54	869.84	712.07	1928.45
I. DISTRIBUTIØN	0.17970	0.45106	0.36925	1.00000
2. ALLØCATIØN ØF ANNUAL ØPER. &MAINT. CØSTS				
A. SEPARABLE CØST	7.00	93.00	274.70	374.70
B. DISTRIBUTIØN (FRØM 1.F)	0.17540	0.64483	0.17976	1.00000
C. ALLØCATED JOINT CØST	14.03	51.59	14.38	80.00
D. TØTAL ALLØCATIØN	21.03	144.59	289.08	454.70
E. DISTRIBUTIØN	0.04626	0.31798	0.63576	1.00000
3. ALLØCATIØN ØF FIRST CØST & INVESTMENT				
A. ALLØCATED ANNUAL CHARGES	346.54	869.84	712.07	1928.45
B. ALLØCATED Ø & M	21.03	144.59	289.08	454.70
C. REMAINDER	325.51	725.25	422.99	1473.75
D. DISTRIBUTIØN	0.22087	0.49211	0.28702	1.00000
E. ALLØCATED INVESTMENT	6619.91	14749.58	8602.43	29971.93
F. ALLØCATED FIRST CØST	6242.02	13907.61	8111.37	28261.00
BENEFIT - CØST RATIØ	1.228	2.031	1.114	1.548
ALLØCATED UNIT CØNSTRUCTIØN CØST IN AF				
FLØØD CØNTRØL STØRAGE				31.69
WATER SUPPLY STØRAGE				62.87
ALLØCATED WATER CØST PER THØUSAND GALLØNS				0.0361
EXCESS BENEFITS OVER ANNUAL CHARGES				1057.15

53-522 O-71—18

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX D

DESIGN INFORMATION AND COST ESTIMATES

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES,
TEXAS AND LOUISIANA

APPENDIX D
DESIGN INFORMATION AND COST ESTIMATES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX D
DESIGN INFORMATION AND COST ESTIMATES

1. GENERAL.- Summaries of design information and cost estimates presented in this appendix provide the basis of cost for the plan recommended for authorization in this report. Projects included in this analysis include Mineola, Lake Fork, and Big Sandy Reservoirs; Greenville Local Flood Protection Project; and Navigation from Echo to Morgan Bluff. January 1970 price base was used for revision of costs from those presented in the type II study.

2. DESIGN.- The plan of improvement has been modified from that presented in the type II report. Larger flood control storages are being recommended, and the flood release channel is being deleted from the plan as presented in the type II report. Water supply requirements remain the same as presented in the type II report. New design criteria resulting from larger flood control storages for Mineola, Lake Fork, and Big Sandy Reservoirs in the form of higher elevations for flood control pool, spillway crest, maximum design water surface, and top of dam are shown on plates 1 through 12. Pertinent data resulting from the above-mentioned modifications for Mineola, Lake Fork, and Big Sandy Reservoirs are shown on tables 1, 3, and 5, respectively.

Local flood protection to the city of Greenville has been reduced in scope from that presented in the type II report. Channel improvements along the Cowleech Fork of the Sabine River recommended in the type II report have been deleted from the recommended local flood control protection plan. Flood plain management is now recommended in lieu of the channel improvements along the Sabine River. Channel improvements along Long Branch have been reduced from a two-hundred-year frequency level of protection to a one-hundred-year frequency, and the lower mile of channel improvement has been deleted from the plan. Lowering the level of protection reduced the channel bottom width from 30 to 25 feet. Design information on the Greenville local flood protection project is presented on plates 13 and 14.

Plate 15 presents design information pertaining to the navigation channel from Echo to Morgan Bluff. The navigation channel has been extended beyond the recommended improvement presented in the type II report for a distance of 4,000 feet from Pruitt Bluff to Morgan Bluff. Channel design otherwise remains the same as presented in the type II report.

3. COST.- Cost for the purpose of allocation and economic analysis were based on relocations in kind. However, cost as shown in this appendix are based on actual cost of replacements to present day standards, and future recreational facilities are shown both discounted and actual cost. Cost estimates for Mineola, Lake Fork, and Big Sandy Reservoirs; Greenville Local Flood Protection and Navigation from Echo to Morgan Bluff are shown on tables 2, 4, 6, 7, 8, and 9, respectively.

The cost estimate for Mineola Reservoir includes $831,000 for protection of the downstream slope and spillway of Iron Bridge Dam. This protection consists of 24" riprap on 9" bedding from 5' below conservation pool level in Mineola Reservoir to maximum design water surface plus estimated wave height and an improved drainage system for Iron Bridge spillway. Maximum design water surface for Mineola Reservoir in the project selected for recommendation is 6.5 feet higher than that recommended in the type II report, and this change is reflected in the increased costs.

Cost for mitigation of project-caused wildlife losses is included in the multiple purpose reservoir projects and allocated to the project purposes. A total of $1,027,000 was charged to each project and is discussed in appendix E. The total first cost of the projects recommended for authorization is $192,203,000. A summary of the estimated first cost of the individual elements is given in the following tabulation:

PROJECTS	ESTIMATED FIRST COST
Mineola Dam and Reservoir	$ 87,869,000
Lake Fork Dam and Reservoir	68,589,000
Big Sandy Dam and Reservoir	33,511,000
Total Reservoirs	$189,969,000
Navigation - Echo to Morgan Bluff	2,053,000
Greenville Local Flood Protection	181,000
Total First Cost	$192,203,000

TABLE 1

PERTINENT DATA
PROPOSED MINEOLA RESERVOIR
SABINE RIVER

Item	: Flood control, water conservation and recreation
Miscellaneous	
Dam location, river mile	475.6
Drainage area, square miles	1,146
Flood control storage, acre-feet	984,500
Water conservation storage, acre-feet	370,100
Sediment storage, acre-feet	20,400
Yield, CFS	129
Million gallons daily	83.4
Spillway design flood	
Peak inflow, CFS	423,400
Volume, acre-feet	1,689,700
Volume, inches	27.64
Peak outflow, CFS	185,000 (1)

Reservoir	Elevation (feet)	Area (Acres)	Capacity (Acre-feet)
Spillway crest	365.0	17,400	230,800
Top of conservation storage	372.5	23,900	386,000
Top of gates	400.0	46,900	1,375,000
Maximum design water surface	404.7	50,300	1,603,000
Top of dam	410.5		
Maximum tailwater at dam	358.3		

Dam	
Type of dam	Rock and earth fill
Total length, feet (including spillway)	26,300
Embankment section:	
Type	Compacted earth fill
Total length, feet (minus spillway)	25,784
Height above streambed, feet	90.5
Freeboard, feet	5.8
Crown width, feet	30
Side slopes:	
Upstream	1:4, 1:6, 1:4
Downstream	1:2-1/2, 1:4, 1:5, 1:4
Non-over flow sections	
Type	Gravity
Total length, feet	284
Height above end sill, feet	90.5
Top width, feet	30

(1) Outlet works inoperative during spillway design flood

TABLE 1 (Cont'd)

PERTINENT DATA
PROPOSED MINEOLA RESERVOIR
SABINE RIVER

Item	: Flood control, water conservation and recreation
Spillway section	
Type	Ogee
Gross length, feet	232
Net length, feet	200
Crest height above apron, feet	55
Gates:	
Type	Tainter
Number	5
Size (width X height), feet	40 X 35
Outlet works	
Type	2 Sluices
Dimension	Each 4'0" X 8'0"
Invert elevations, feet	331.0
Control	2-4'0" X 8' 0" slide gates
Relocations	
Roads and highways, miles	22.6
Railroads, miles	1.4
Power lines (138 KV), miles	2.4
REA distribution lines, miles	20.0
Telephone lines, miles	20.0
Pipelines, miles	11.4
Cemeteries, number of graves	150
Towns, number	0
Refinery	1
Lands	
Dam and reservoir:	
Clearing, acres	14,583
Land acquisition:	
Fee simple, acres	57,000
(Guide taking line)	403.0
Recreation:	
Land acquisition:	
Fee simple, acres	600

TABLE 2

SUMMARY OF FIRST COST
PROPOSED MINEOLA RESERVOIR
SABINE RIVER

Item	Cost
1. Federal First Cost	
Lands and damages	$21,122,000 (1)
Relocations	20,950,000
Reservoir and pool preparation	
a. Reservoir clearing	1,721,000
b. Protection of Iron Bridge Dam	813,000
Dam	
a. Embankment	16,880,000
b. Spillway	8,986,000
Access road	40,000
Buildings, grounds, and utilities	241,000
Permanent operating equipment	189,000
Engineering and design	4,309,000
Supervision and administration	2,905,000
Recreation and fish and wildlife facilities	
a. Mitigation	1,027,000 (1)
b. Initial development	6,069,000
c. Future development ($2,617,000 future facilities discounted)	390,000
Total estimated Federal first cost	$85,642,000
2. Non-Federal First Cost	None
3. Total Estimated First Cost of Project	$85,642,000
4. Total Estimated First Cost of Project (with future recreational facilities not discounted)	$87,869,000

NOTE: January 1970 price level.
(1) Not included in computing interest during construction.

CORPS OF ENGINEERS

U.S. ARMY

LAKE TAWAKONI
SPILLWAY CREST
EL. 437.5

IRON BRIDGE DAM

CLARKS CHAPEL

EMORY

ALBA

GOLDEN

GRAND SALINE

HUNT CO.
VAN ZANDT CO.
RAINS CO.
WOOD CO.
SMITH CO.

SABINE RIVER

Shuffle Cr.
Reader Cr.
Woodbull Cr.
Long Br.
Brushy Cr.
Briar Br.
Muscadine Br.
Little Slough
Yellow Steel Slough
Stewart Br.
McBee Cr.
Cedar Cr.
McInturff Cr.
Gilsdon Cr.
Mill Cr.
Crooked Cr.
Caney Cr.
Simpkins Cr.
Leatherman Cr.
Lake Louise
Cedar Lake
City Lake

T&P R.R.

2 Pipelines 18" & 14" United Gas

PIPELINE 20" MAGNOLIA

TO MINEOLA

VICINITY MAP

SCALE IN MILES
30 0 30 60

LEGEND

- U.S. HIGHWAY
- STATE HIGHWAY
- FARM TO MARKET HIGHWAY
- RIVER MILE (MILE ABOVE MOUTH)
- PIPE LINE
- RAILROAD
- POWER TRANSMISSION LINE
- TOP OF WATER SUPPLY STORAGE EL. 372.5
- TOP OF FLOOD CONTROL STORAGE EL. 400.0
- HIGHWAY RELOCATION OR ALTERATION

AREA-CAPACITY CURVES

AREA IN THOUSAND ACRES
55 50 45 40 35 30 25 20 15 10 5 0

ELEVATION IN FEET ABOVE M.S.L.
410 400 390 380 370 360 350 340 330 320

CAPACITY

AREA

0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200
CAPACITY IN THOUSAND ACRE-FEET

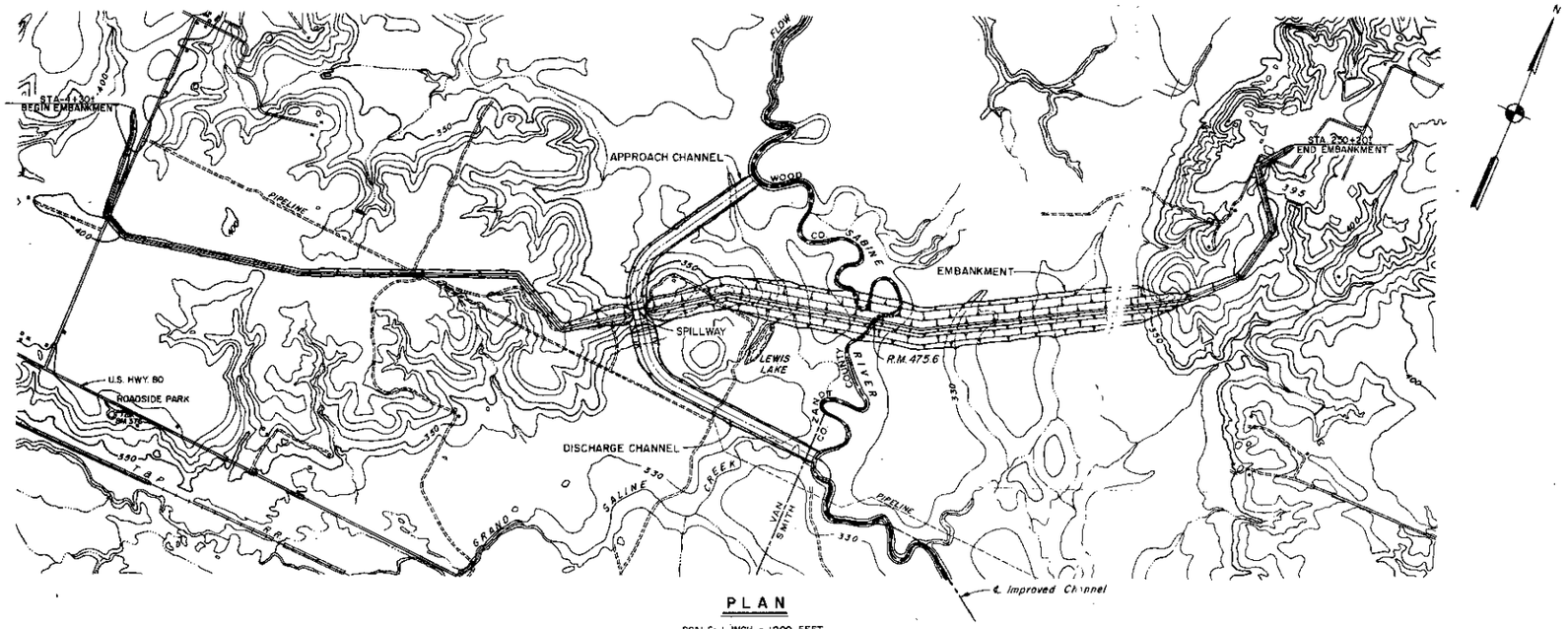
SCALE IN MILES
0 1 2 3 4

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
MINEOLA RESERVOIR
RESERVOIR AREA MAP
SCALE AS SHOWN

PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

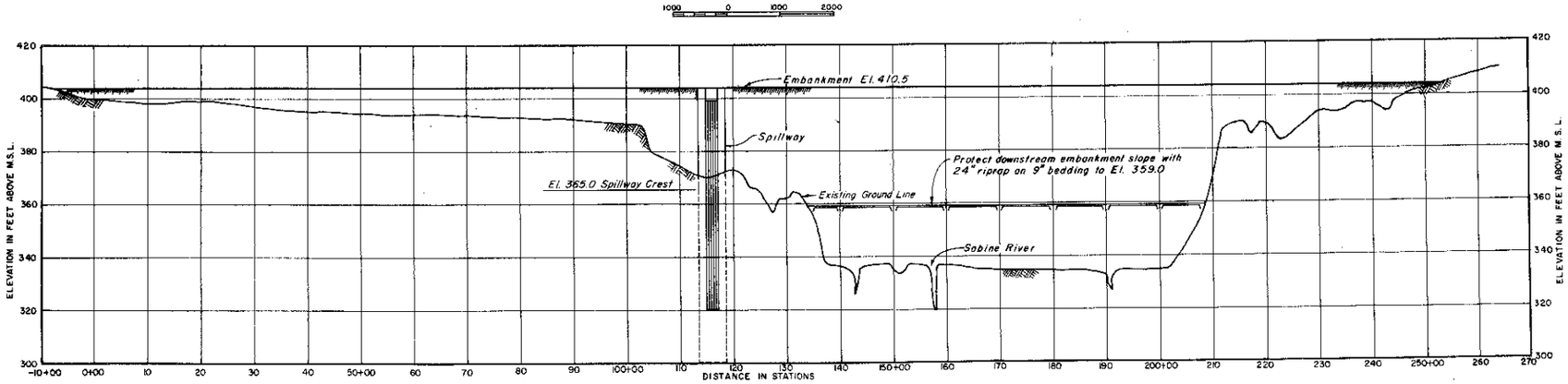
PLATE I

53-522 O-71 (Face p. 232) No. 1

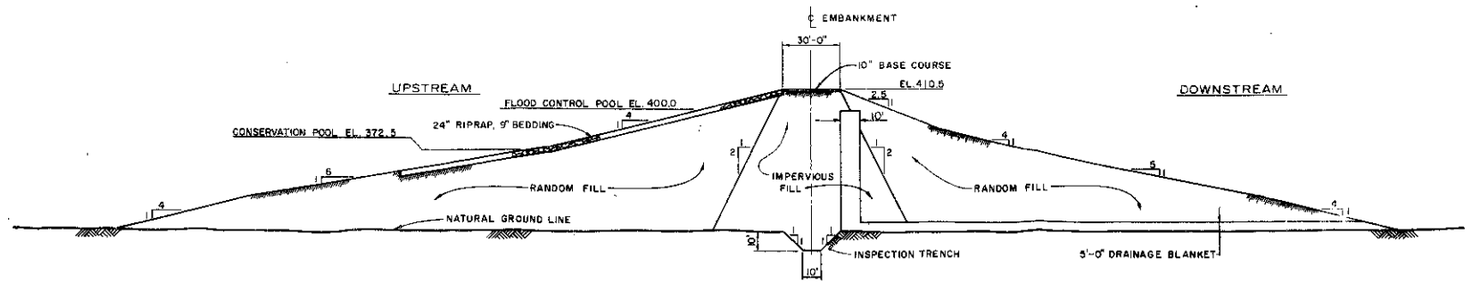


PLAN

SCALE: 1 INCH = 1000 FEET



PROFILE



TYPICAL EMBANKMENT SECTION

SCALE 1 INCH = 30 FEET

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

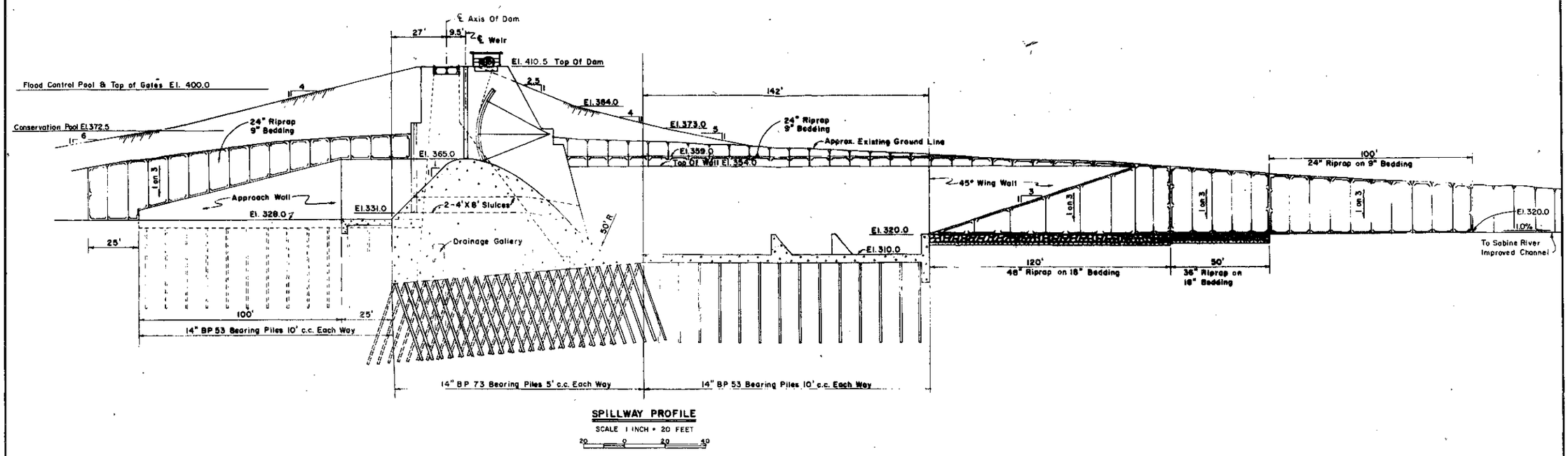
MINEOLA RESERVOIR
PLAN, PROFILE AND SECTION

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 2

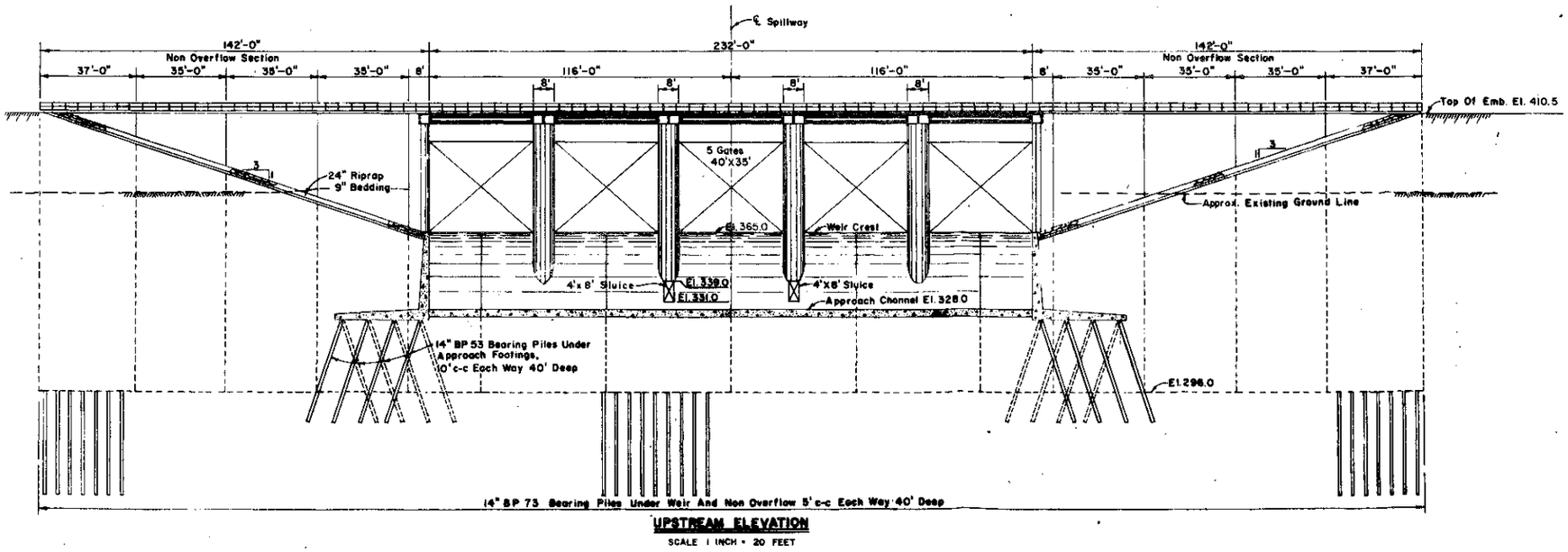
53-522 O-71 (Face p. 232) No. 2



SPILLWAY PROFILE

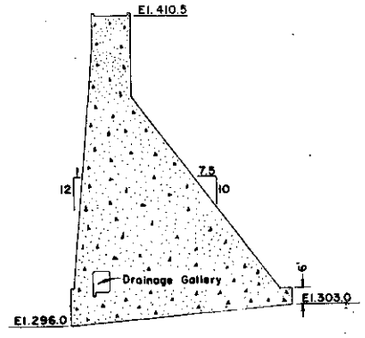
SCALE 1 INCH = 20 FEET

20 0 20 40



UPSTREAM ELEVATION

SCALE 1 INCH = 20 FEET



NON-OVERFLOW SECTION

SCALE 1 INCH = 20 FEET

SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

MINEOLA RESERVOIR

SPILLWAY-ELEVATION, PROFILE & SECTION

SCALES AS SHOWN

PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE 3

53-522 O-71 (Face p. 232) No. 3

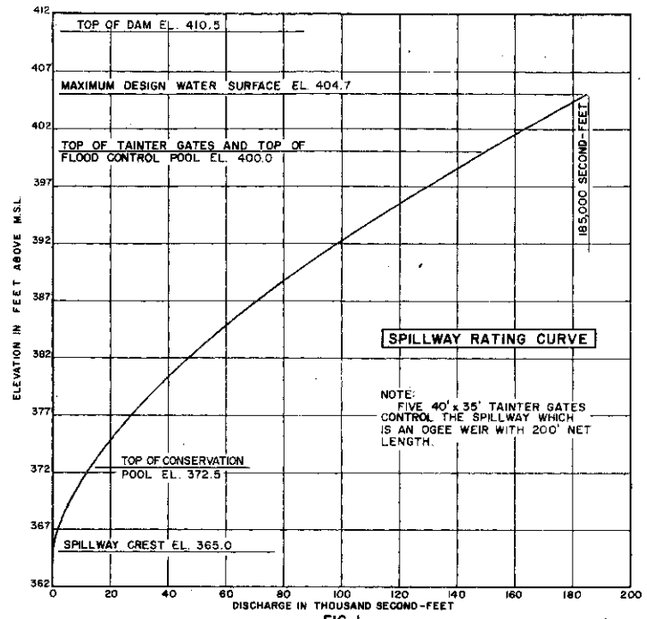


FIG. 1

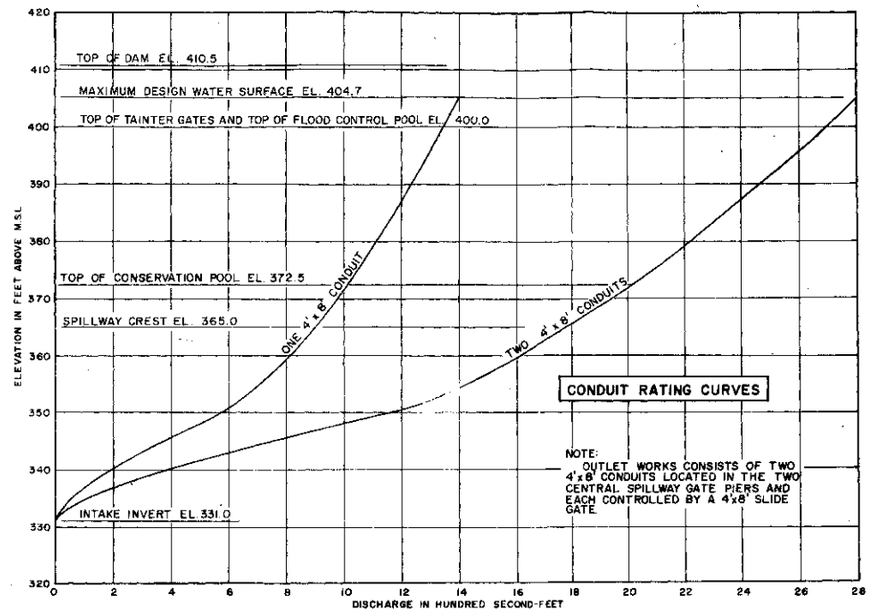


FIG. 2

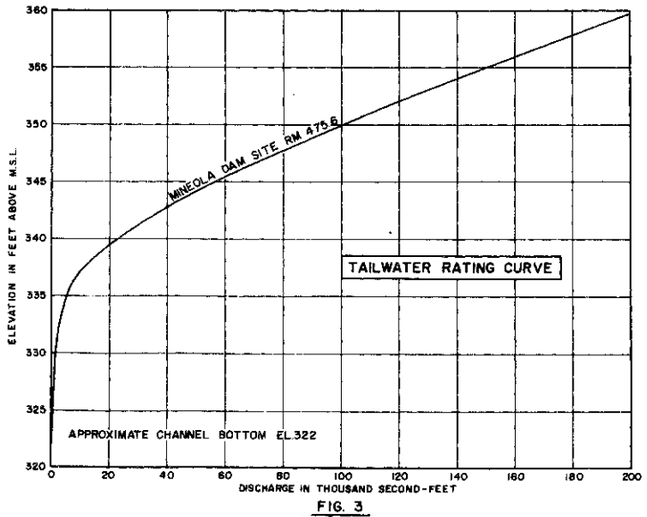
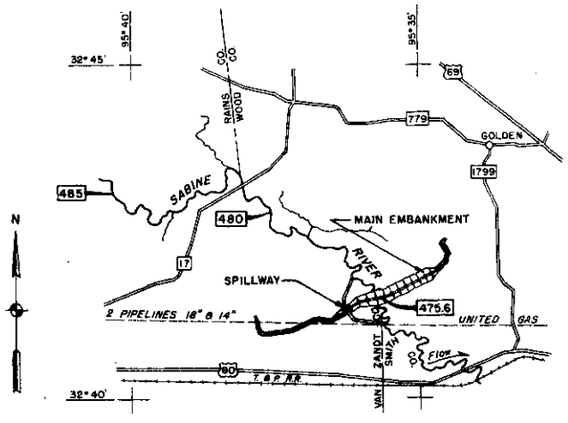


FIG. 3



PLAN

SCALE IN MILES
½ 0 1

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

MINEOLA RESERVOIR
GENERAL HYDRAULIC DATA

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE 4

53-522 O-71 (Face p. 232) No. 4

TABLE 3

PERTINENT DATA
PROPOSED LAKE FORK RESERVOIR
SABINE RIVER

Item	: Flood control, water : conservation and recreation
Miscellaneous	
Dam location, creek mile	28.1
Drainage area, square miles	507
Flood control storage, acre-feet	472,600
Water conservation storage, acre-feet	621,500
Sediment storage, acre-feet	18,900
Yield, CFS	244
Million gallons daily	157.7
Spillway design flood	
Peak inflow, CFS	435,600
Volume, acre-feet	817,300
Volume, inches	30.23
Peak outflow, CFS	20,400 (1)

Reservoir	Elevation (feet)	Area (Acres)	Capacity (Acre-feet)
Top of conservation storage	397.0	26,400	638,100
Spillway crest	411.5	40,065	1,113,000
Maximum design water surface	425.7	59,300	1,816,400
Top of dam	431.5		
Maximum tailwater at dam	344.6		

Dam	
Type of dam	Rock and earth fill
Total length, feet (including spillway)	16,130
Embankment section:	
Type	Compacted earth fill
Height above streambed, feet	106.5
Freeboard, feet	5.8
Crownwidth, feet	46
Side slopes:	
Upstream	1:3-1/2, 1:6
Downstream	1:2-1/2, 1:4, 1:6
Total length, feet (minus spillway)	16,030

(1) Includes 6,500 CFS through outlet works

TABLE 3 (Cont'd)

PERTINENT DATA
PROPOSED LAKE FORK RESERVOIR
SABINE RIVER

Item	: Flood control, water : conservation and recreation
Spillway section	
Type	Uncontrolled broadcrested weir
Gross length, feet	100
Net length, feet	100
Crest height above apron, feet	90.5
Outlet works	
Type	Conduit
Number of conduits	1
Diameter, feet	12
Invert elevations, feet	335.0
Conduit control	Two - 5'6" x 12' gates
Relocations	
Roads and highways, miles	20.6
Railroads, miles	0
Power lines (138 KV), miles	2.8
REA distribution line, miles	25.0
Telephone lines, miles	25.0
Pipelines, miles	6.8
Cemeteries, number of graves	40
Towns, number	0
Lands	
Dam and reservoir:	
Clearing, acres	16,080
Land acquisition:	
Fee simple, acres	54,200
(Guide taking line)	416.5
Recreation:	
Land acquisition:	
Fee simple, acres	200

TABLE 4

SUMMARY OF FIRST COST
PROPOSED LAKE FORK RESERVOIR
SABINE RIVER

Item	Cost
1. Federal First Cost	
Lands and damages	$18,401,000 (1)
Relocations	24,250,000
Reservoir (clearing)	1,901,000
Dam	
a. Embankment	9,075,000
b. Spillway	2,103,000
c. Outlet works	1,418,000
Access road	46,000
Buildings, grounds, and utilities	244,000
Permanent operating equipment	179,000
Engineering and design	3,569,000
Supervision and administration	2,361,000
Recreation and fish and wildlife facilities	
a. Mitigation	1,027,000 (1)
b. Initial development	3,221,000
c. Future development ($794,000 future development discounted)	306,000
Total estimated Federal first cost	$68,101,000
2. Non-Federal First Cost	None
3. Total Estimated First Cost of Project	$68,101,000
4. Total Estimated First Cost of Project (with future facilities not discounted)	$68,589,000

NOTE: January 1970 price level
(1) Not included in computing interest during construction

TABLE 5

PERTINENT DATA
PROPOSED BIG SANDY RESERVOIR
SABINE RIVER

Item	: Flood control, water : conservation, and recreation
Miscellaneous	
Dam location, creek mile	15.3
Drainage area, square miles	196
Flood control storage, acre-feet	196,000
Water conservation storage, acre-feet	215,300
Sediment storage, acre-feet	6,900
Yield, CFS	102
Million gallons daily	65.9
Spillway design flood	
Peak inflow, CFS	266,700
Volume, acre-feet	341,600
Volume, inches	32.68
Peak outflow, CFS	17,800 (1)

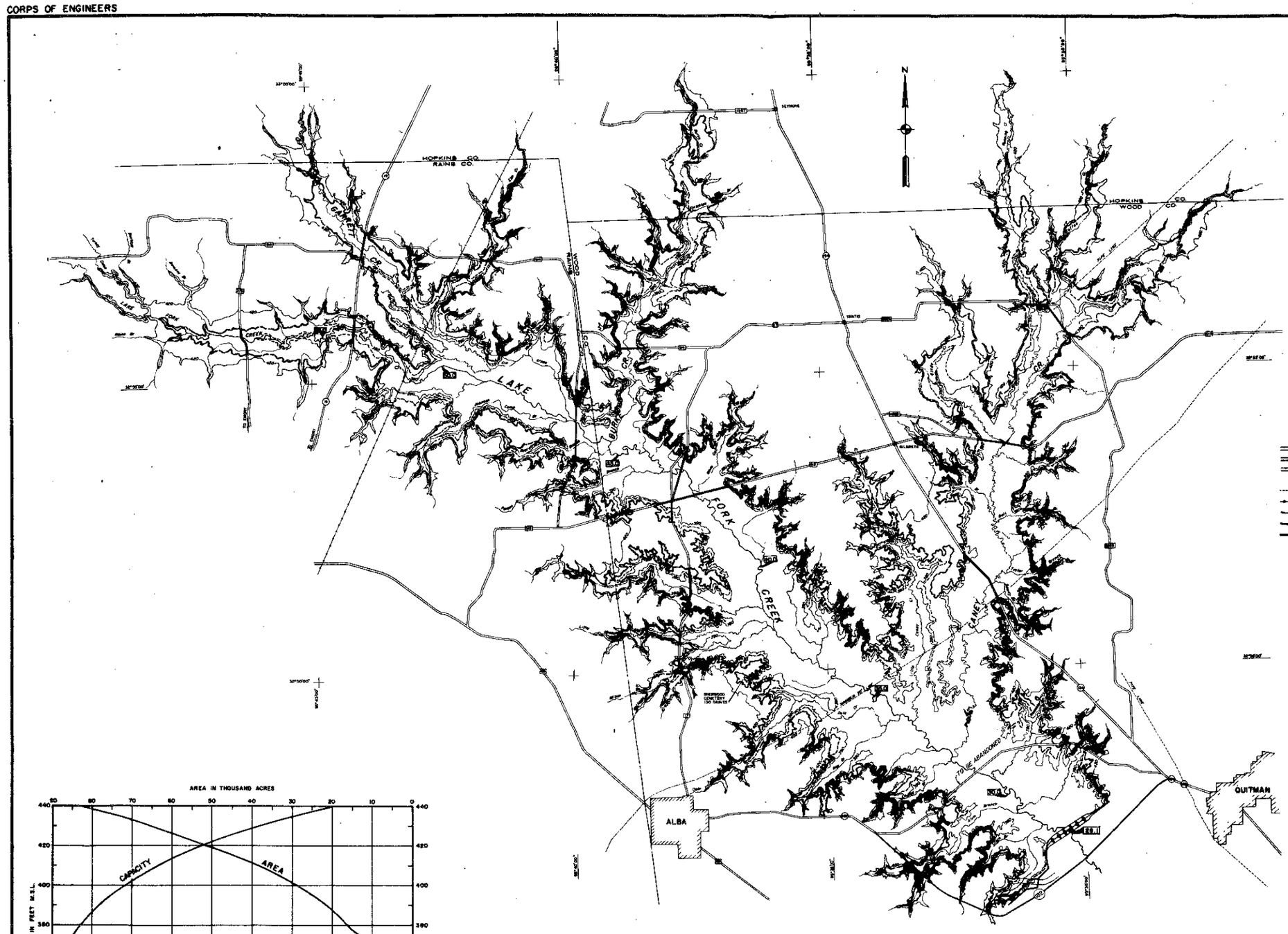
Reservoir	Elevation (feet)	Area (Acres)	Capacity (Acre-feet)
Top of conservation storage	367.5	10,810	221,200
Spillway crest	382.0	16,580	418,200
Maximum design water surface	396.3	23,000	698,600
Top of dam	401.5		
Maximum tailwater at dam	322.5		

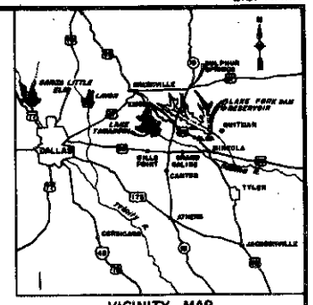
Dam	
Type of dam	Rock and earth fill
Total length, feet (including spillway)	6,200
Embankment section:	
Type	Compacted earth fill
Total length, feet (minus spillway)	6,100
Height above streambed, feet	94.5
Freeboard, feet	5.2
Crown width, feet	42
Side slopes:	
Upstream	1:3, 1:4
Downstream	1:2-1/2, 1:3-1/2

(1) Includes 3,300 CFS discharge through the outlet works.

CORPS OF ENGINEERS

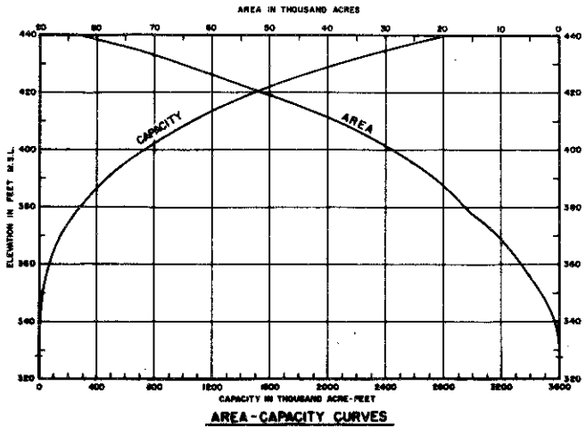
U.S. ARMY





LEGEND

- U.S. HIGHWAY
- STATE HIGHWAY
- FARM TO MARKET HIGHWAY
- 30.0 RIVER MILE (MILE ABOVE MOUTH)
- PIPE LINE
- POWER TRANSMISSION LINE
- TOP OF WATER SUPPLY STORAGE EL. 397.0
- TOP OF FLOOD CONTROL STORAGE EL. 411.5
- HIGHWAY RELOCATION OR ALTERATION



AREA-CAPACITY CURVES

SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

LAKE FORK RESERVOIR

RESERVOIR AREA MAP

SCALES AS SHOWN

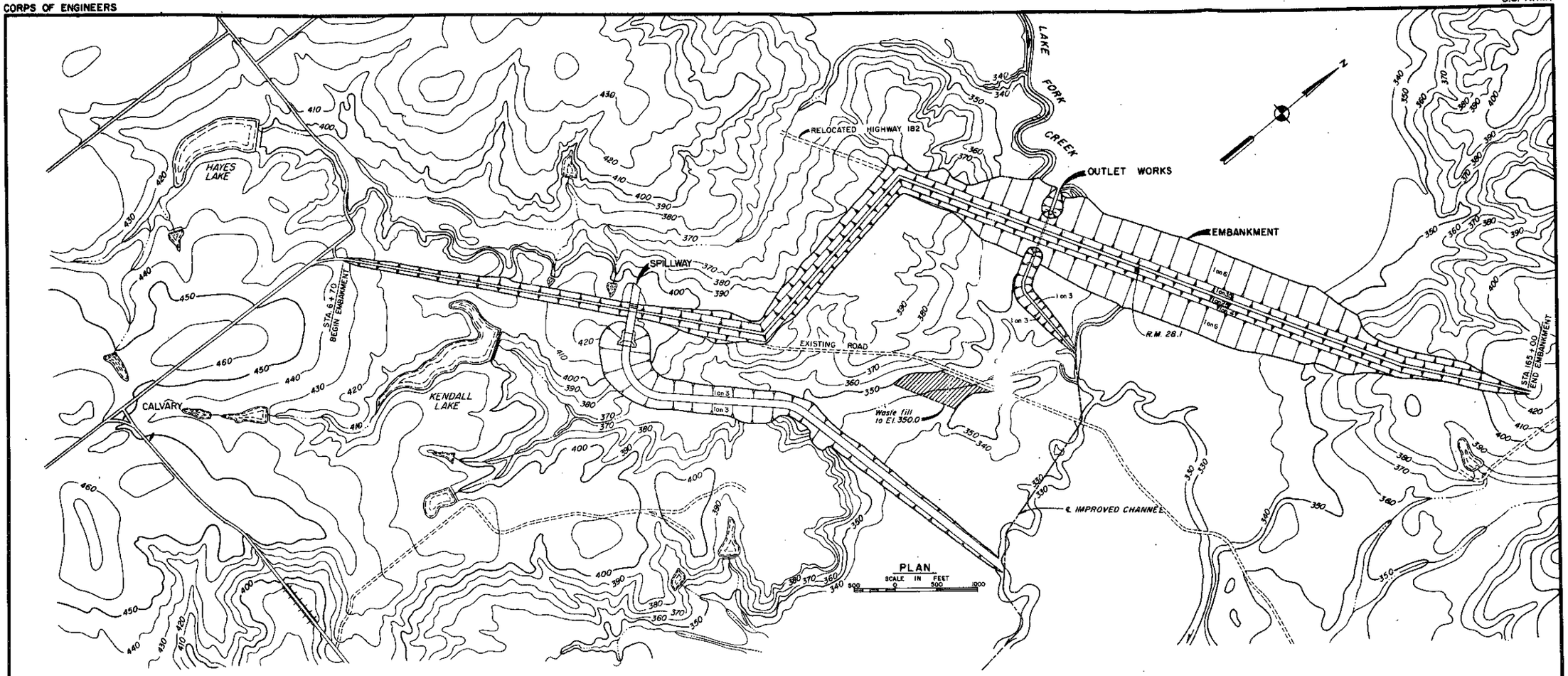
PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

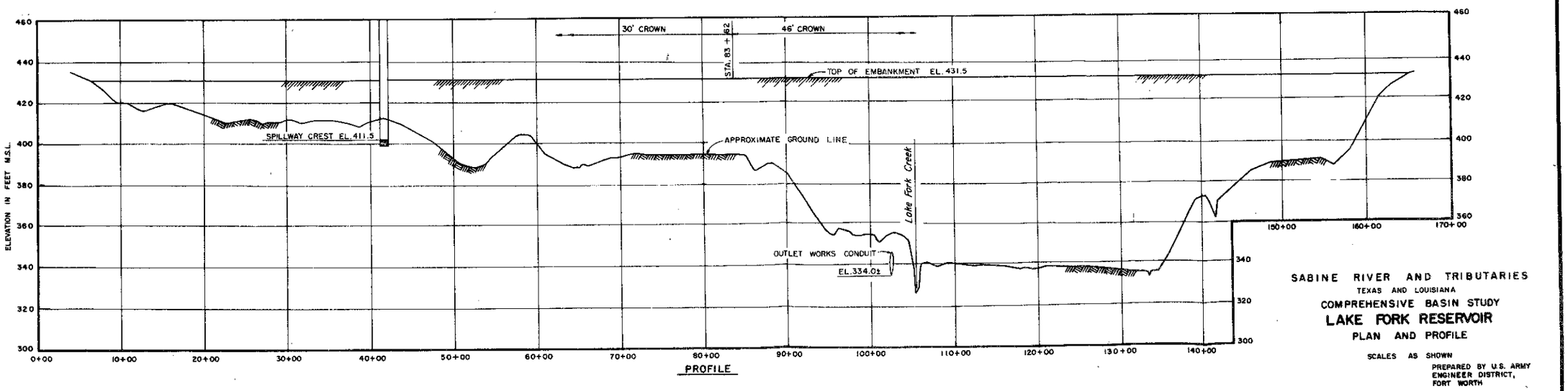
PLATE 5

53-522 O-71 (Face p. 236) No. 1

CORPS OF ENGINEERS

U.S. ARMY





SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

LAKE FORK RESERVOIR

PLAN AND PROFILE

SCALES AS SHOWN

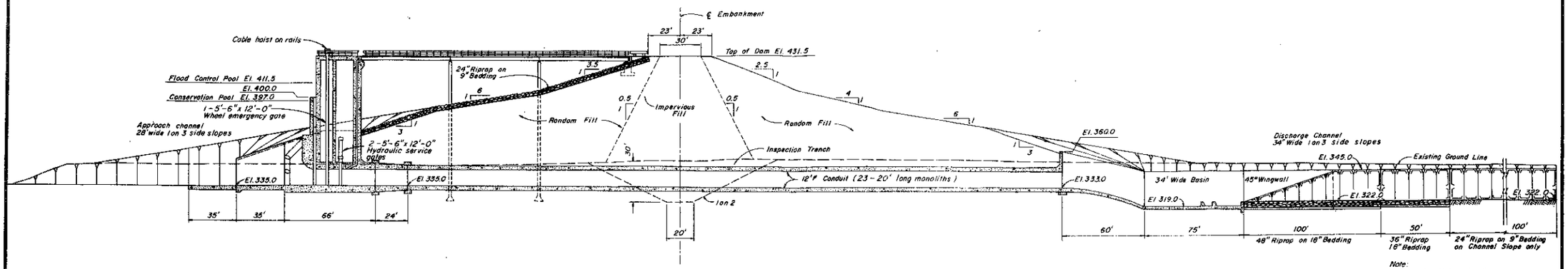
PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 6

53-522 O-71 (Face p. 236) No. 2

CORPS OF ENGINEERS

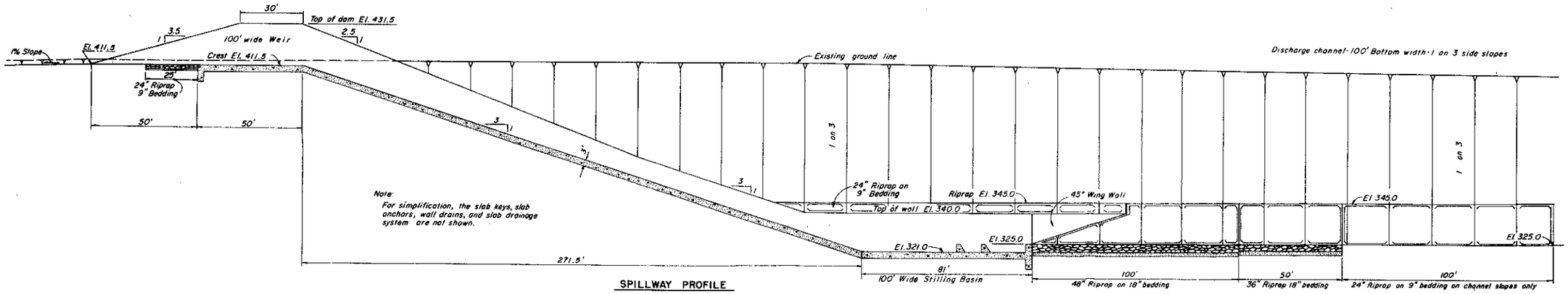
U.S. ARMY



EMBANKMENT SECTION
AND
OUTLET WORKS PROFILE

SCALE 1 INCH = 30 FEET

Note:
Extend outlet works discharge channel at a uniform grade to Lake Fork Creek Improved Channel.



Note:
For simplification, the slab keys, slab anchors, wall drains, and slab drainage system are not shown.

SPILLWAY PROFILE

SCALE: 1 INCH = 20 FEET

Note:
Extend spillway discharge channel at a uniform grade to Lake Fork Creek Improved Channel.

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY
LAKE FORK RESERVOIR
EMBANKMENT SECTION, OUTLET WORKS PROFILE AND SPILLWAY PROFILE
SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 7

53-522 O-71 (Face p. 236) No. 3

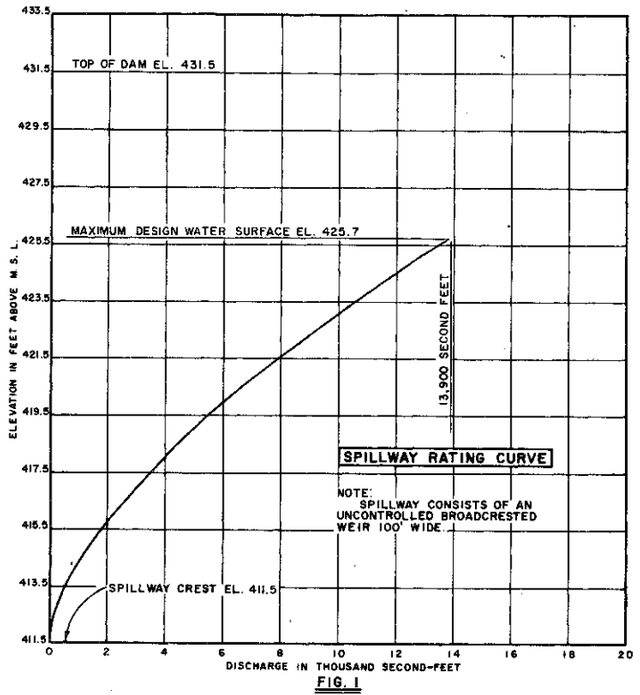


FIG. 1

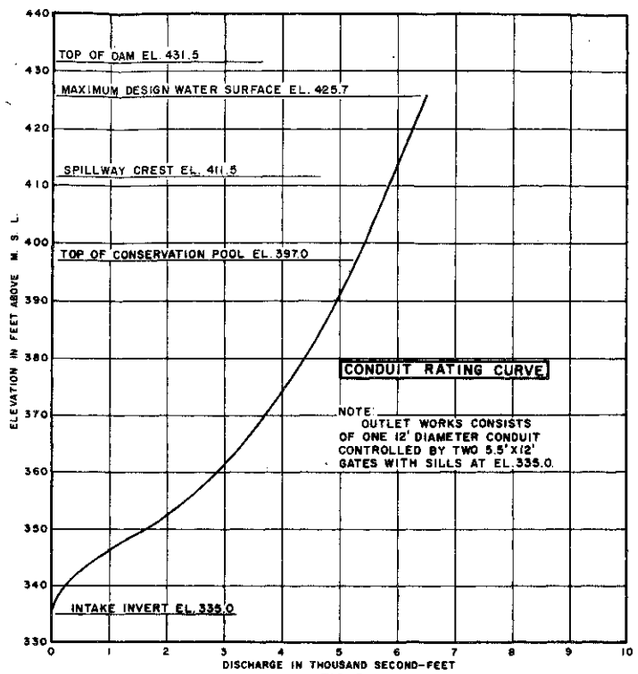


FIG. 2

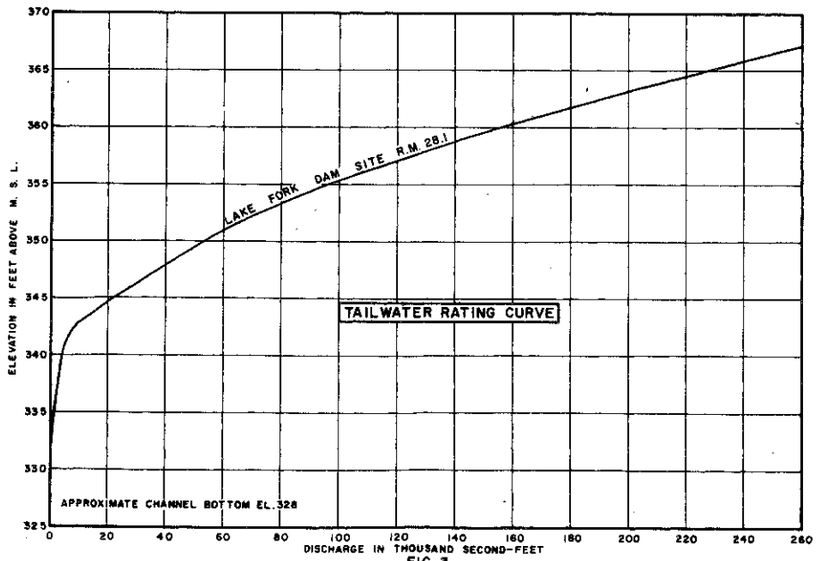
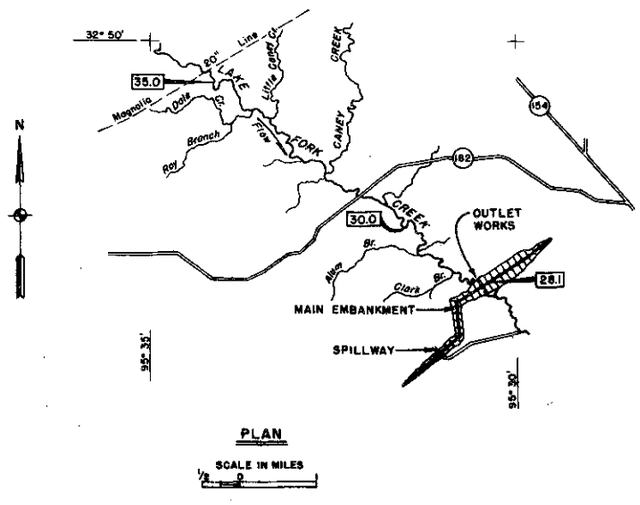


FIG. 3



PLAN

SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

LAKE FORK RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE 8

53-522 O-71 (Face p. 236) No. 4

TABLE 5 (Cont'd)

PERTINENT DATA
PROPOSED BIG SANDY RESERVOIR
SABINE RIVER

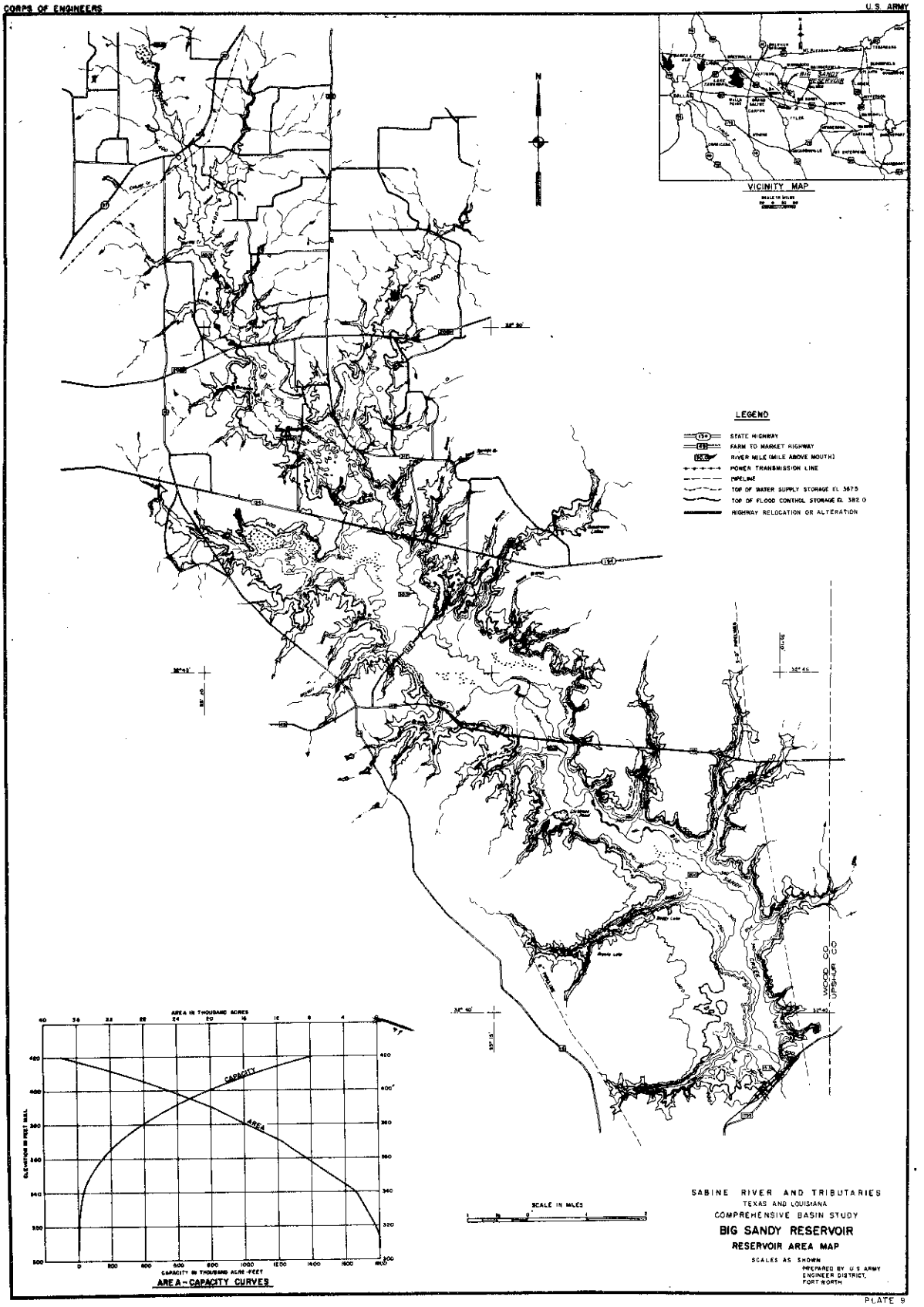
Item	: Flood control, water conservation and recreation
Spillway section	
Type	Uncontrolled Broadcrested weir
Gross length, feet	100
Net length, feet	100
Crest height, above apron, feet	83
Outlet works	
Type	Conduit
Number of conduits	1
Diameter, feet	9
Invert elevation, feet	317.0
Conduit control	Two 4'3" x 9'0" gates
Relocations	
Roads and highways, miles	20.8
Railroads, miles	0
Power lines (138 KV), miles	0
REA, Distribution lines, miles	6.0
Telephone lines, miles	6.0
Pipe lines, miles	0.8
Cemeteries, number	0
Towns, number	0
Lands	
Dam and reservoir	
Clearing, acres	6,565
Land acquisition:	
Fee simple, acres	21,400
(Guide taking line)	387.0
Recreation:	
Land acquisition:	
Fee simple, acres	400

TABLE 6

SUMMARY OF FIRST COST
PROPOSED BIG SANDY RESERVOIR
SABINE RIVER

Item	Cost
1. Federal First Cost	
Lands and damages	$ 9,688,000 (1)
Relocations	9,110,000
Reservoir (clearing)	778,000
Dam	
a. Embankment	2,061,000
b. Spillway	1,277,000
c. Outlet works	860,000
Buildings, grounds and utilities	241,000
Permanent operating equipment	171,000
Engineering and design	1,566,000
Supervision and administration	1,022,000
Recreation and fish and wildlife	
a. Mitigation	1,027,000 (1)
b. Initial development	3,851,000
c. Future development ($1,859,000 future facilities discounted)	277,000
Total estimated Federal First Cost	$31,929,000
2. Non-Federal First Cost	None
3. Total Estimated First Cost of Project	$31,929,000
4. Total Estimated First Cost of Project (with future facilities not discounted)	$33,511,000

NOTE: January 1970 price level
(1) Not included in computing interest during construction



SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

RESERVOIR AREA MAP

SCALES AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 9

53-522 O—71——19

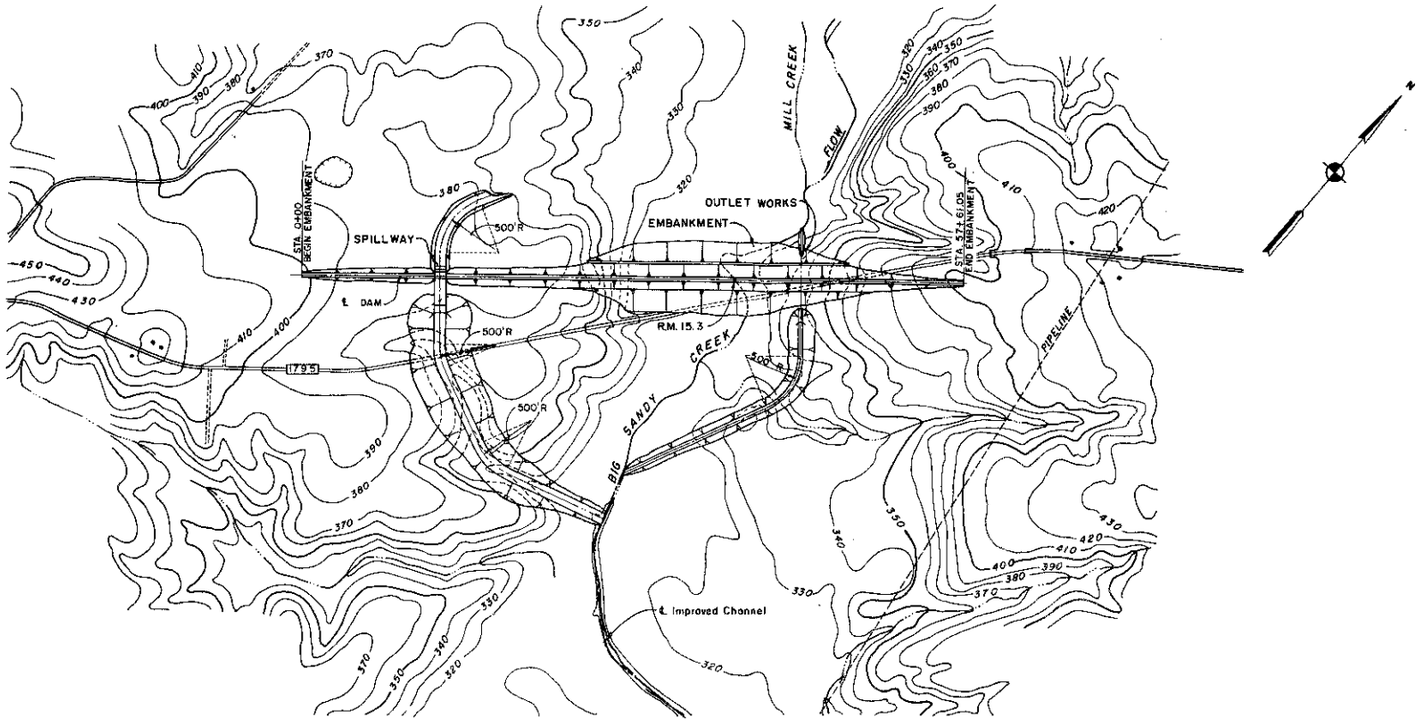
TABLE 7

SUMMARY OF FIRST COST AND ANNUAL CHARGES
GREENVILLE, TEXAS - LOCAL FLOOD PROTECTION PROJECT
LONG BRANCH

Item	: Cost
FIRST COST	
1. Federal First Cost	
Land acquisition expense	$ 4,500
Channel	81,200
Engineering and design	9,700
Supervision and administration	4,900
Total estimated Federal First Cost	$100,300
2. Non-Federal First Cost	
Lands and damages	$ 57,100
Relocations and alterations	20,000
Engineering and design	2,400
Supervision and administration	1,200
Total estimated Non-Federal First Cost	$ 80,700
3. Total Estimated First Cost of Project	$181,000
ANNUAL CHARGES	
1. Federal Investment	
a. Federal first cost	$100,300
b. Interest during construction	none
Total - Federal Investment	$100,300
2. Non-Federal Investment	
a. Non-Federal first cost	80,700
b. Interest during construction	none
Total - Non-Federal Investment	$ 80,700
3. Federal Annual Charges	
a. Interest on Federal Investment	$ 4,900
b. Amortization charge	500
c. Operation and maintenance	none
Total - Federal Annual Charge	$ 5,400
4. Non-Federal Annual Charges	
a. Interest on non-Federal investment	$ 3,900
b. Amortization charge	400
c. Operation and maintenance	2,100
Total - Non-Federal Annual Charge	$ 6,400
5. Total - Estimated Annual Charges	$ 11,800

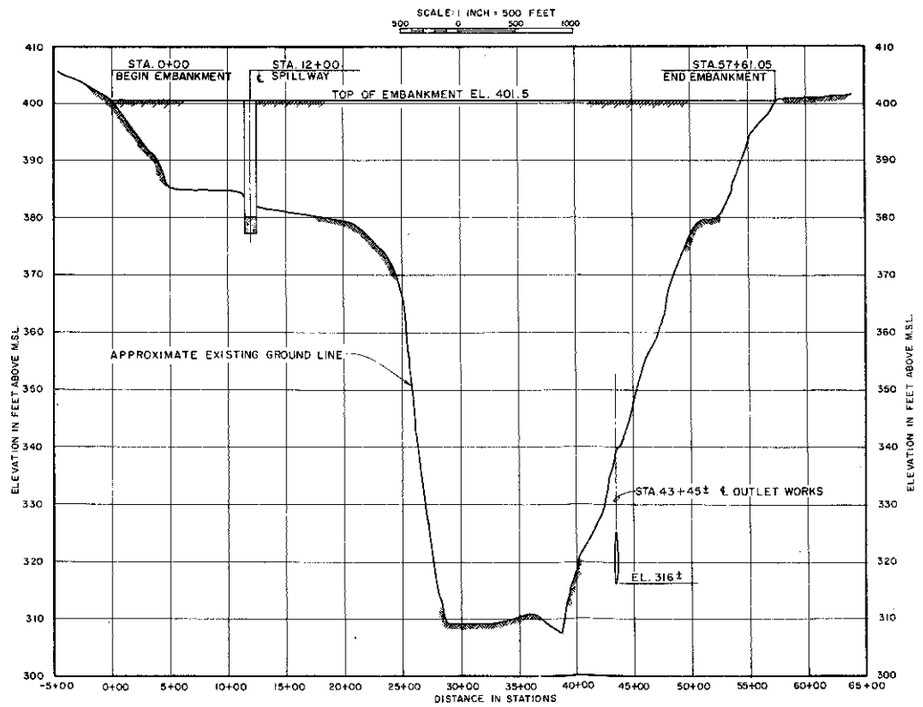
January 1970 price level

Construction period - 2 yrs or less, 100 yr amortization, 4-7/8% Federal interest rate, 4-7/8 % non-Federal interest rate



PLAN

SCALE: 1 INCH = 500 FEET



PROFILE

SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

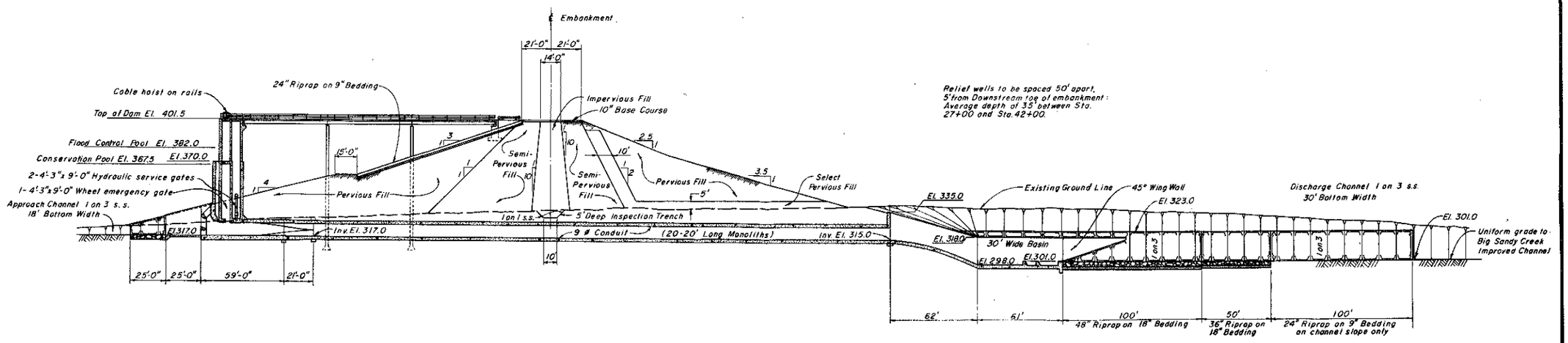
PLAN AND PROFILE

SCALES AS SHOWN

PREPARED BY U.S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE 10

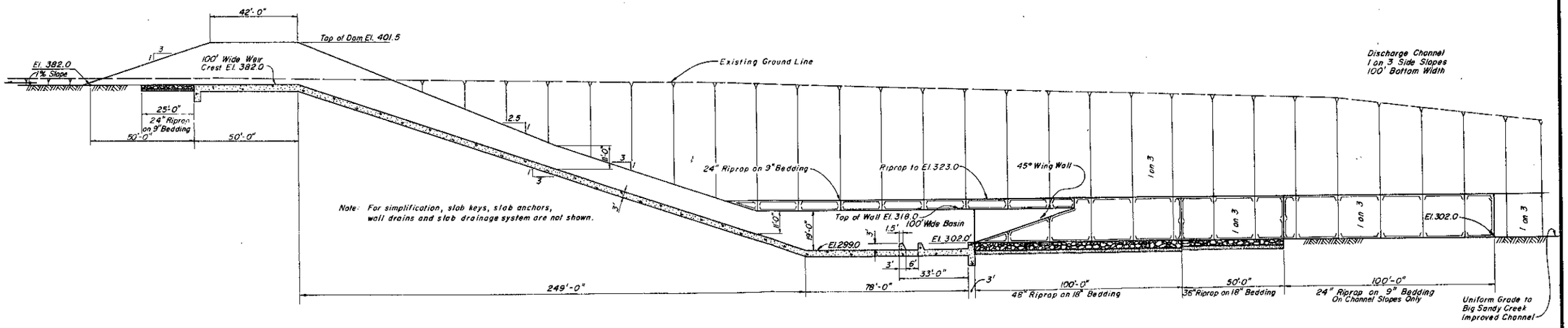
53-522 O-71 (Face p. 240) No. 1



EMBANKMENT SECTION AND OUTLET WORKS PROFILE

SCALE: 1 INCH = 30 FEET

30 0 30 60



SPILLWAY PROFILE

SCALE: 1 INCH = 20 FEET

20 10 0 20 40

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

EMBANKMENT SECTION,
OUTLET WORKS AND SPILLWAY PROFILES

SCALES AS SHOWN

PREPARED BY U. S. ARMY
ENGINEER DISTRICT
FORT WORTH

PLATE II

53-522 O-71 (Face p. 240) No. 2

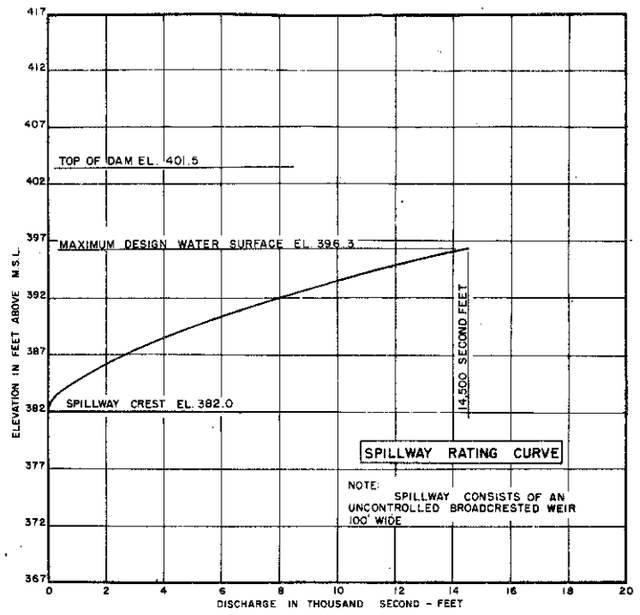


FIG. 1

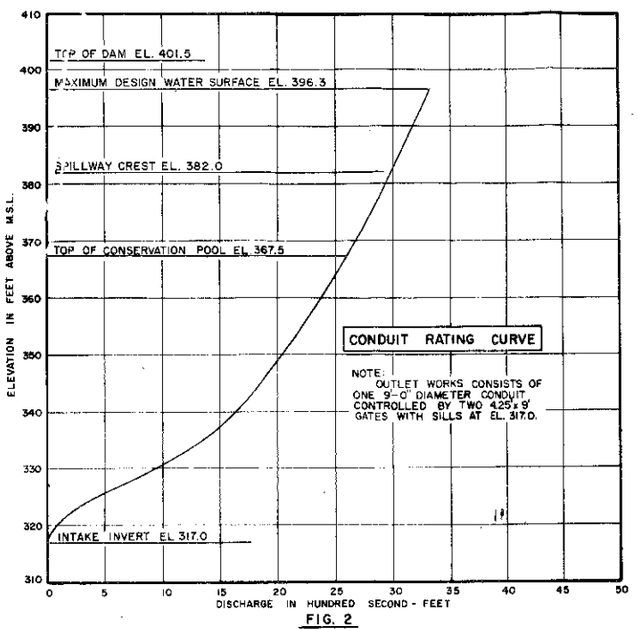
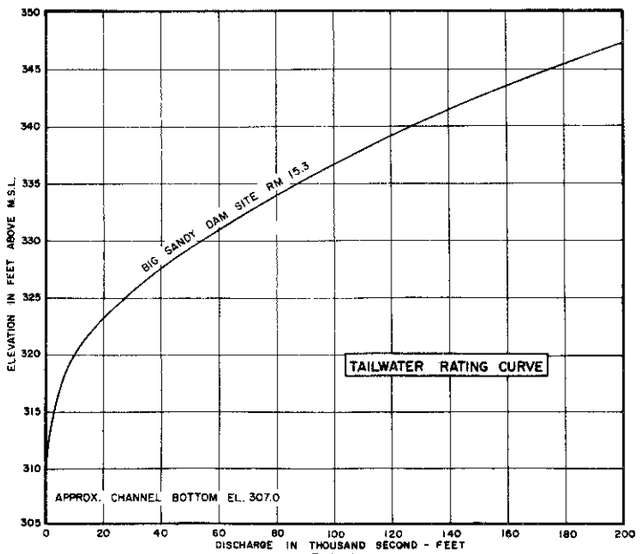


FIG. 2



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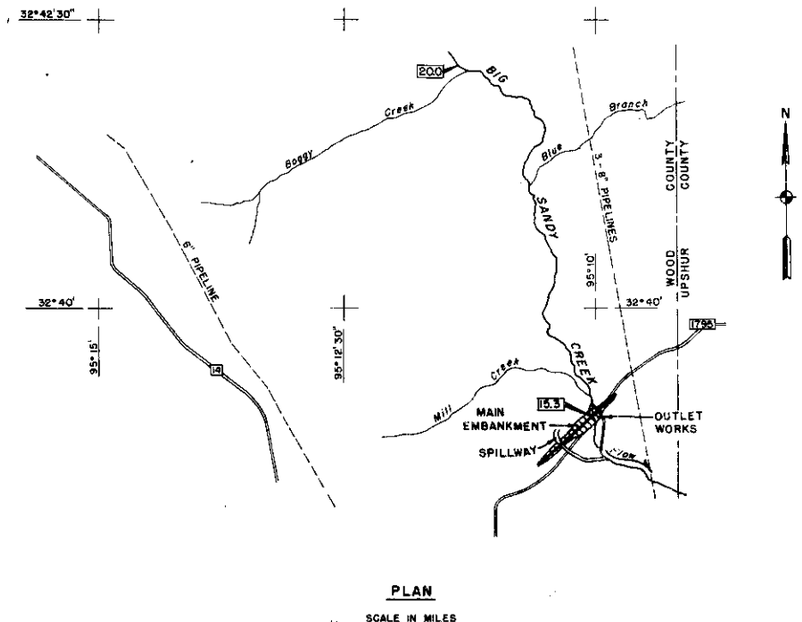


PLAN

SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

BIG SANDY RESERVOIR

GENERAL HYDRAULIC DATA

SCALES AS SHOWN

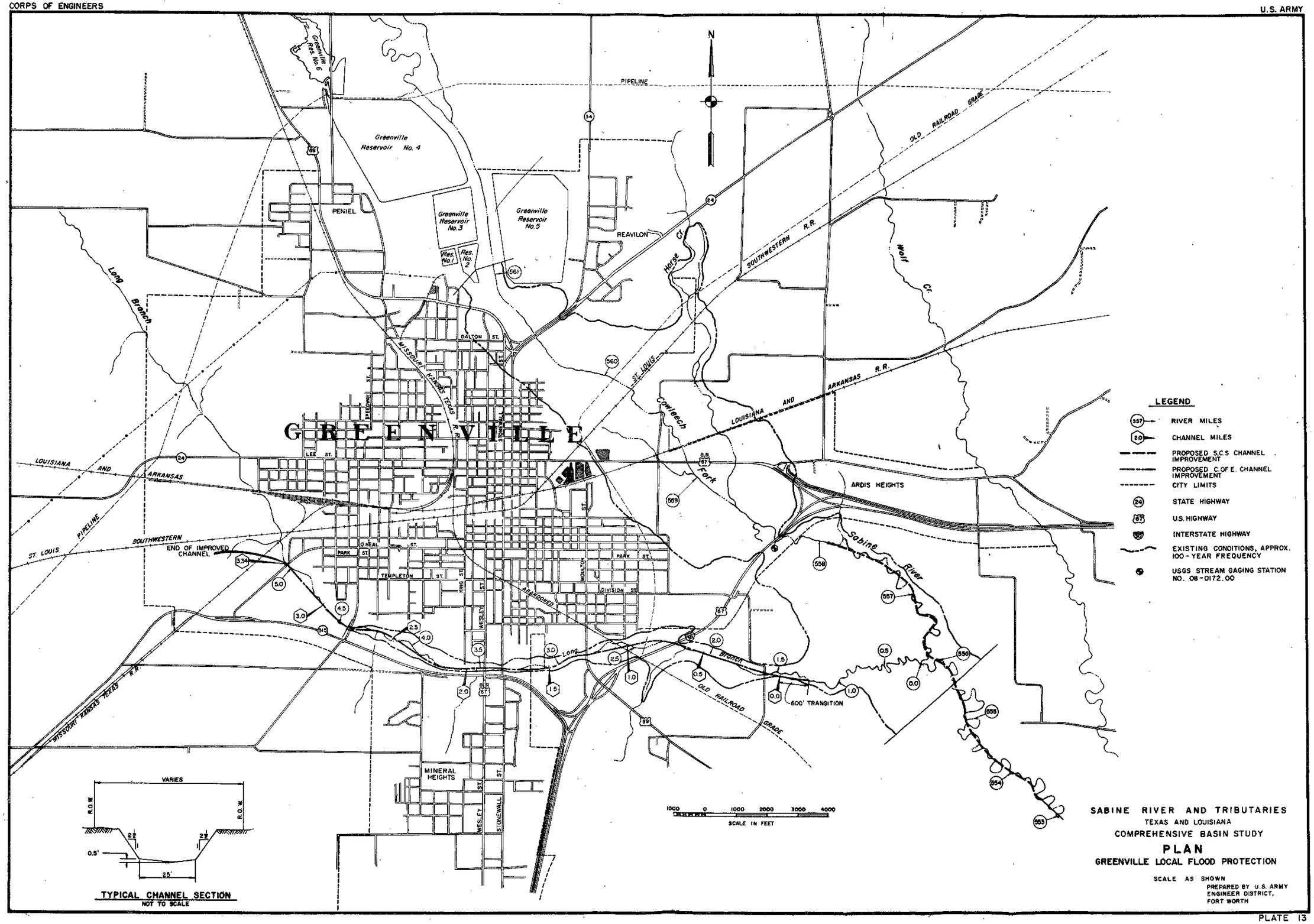
PREPARED BY U.S. ARMY ENGINEER DISTRICT FORT WORTH

PLATE 12

53-522 O-71 (Face p. 240) No. 3

CORPS OF ENGINEERS

U.S. ARMY



SABINE RIVER AND TRIBUTARIES

TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

PLAN

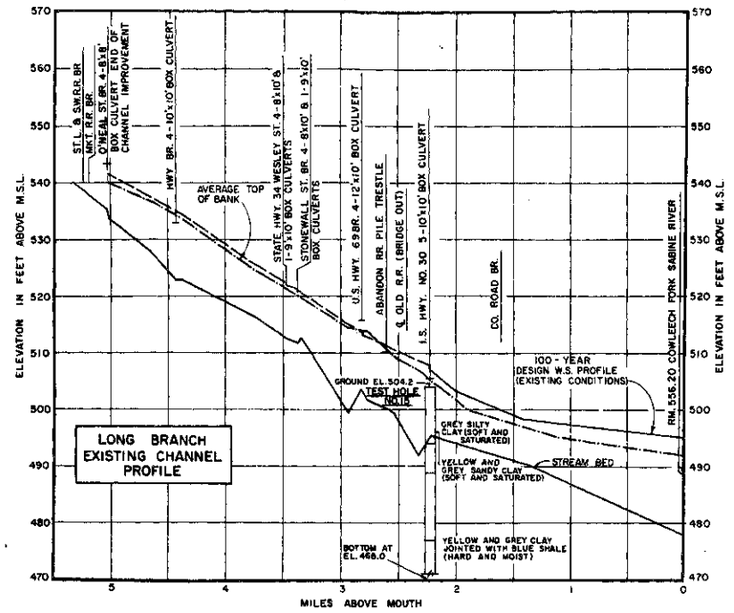
GREENVILLE LOCAL FLOOD PROTECTION

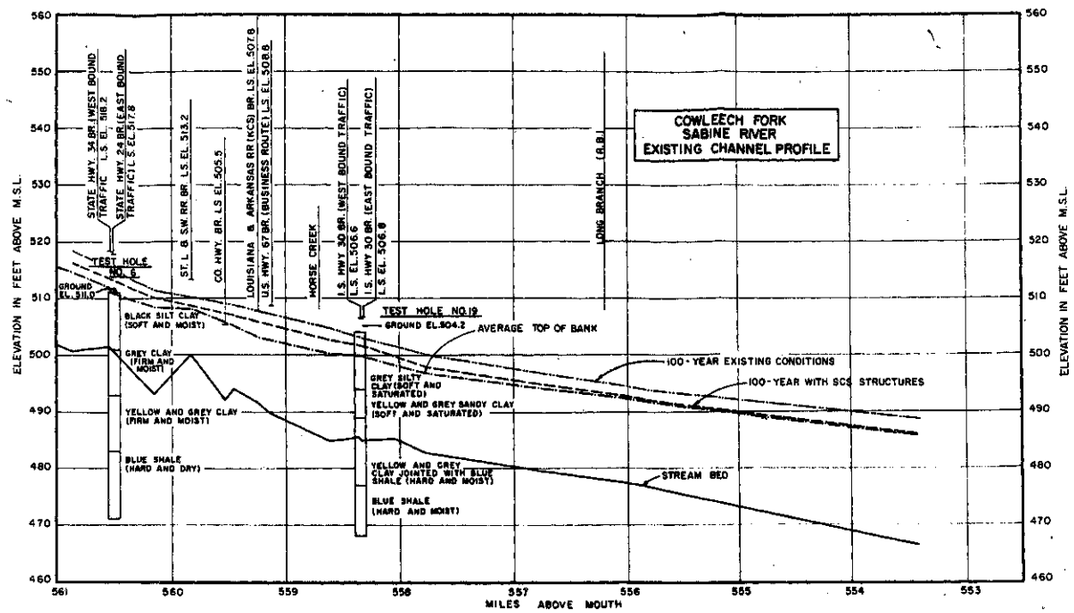
SCALE AS SHOWN

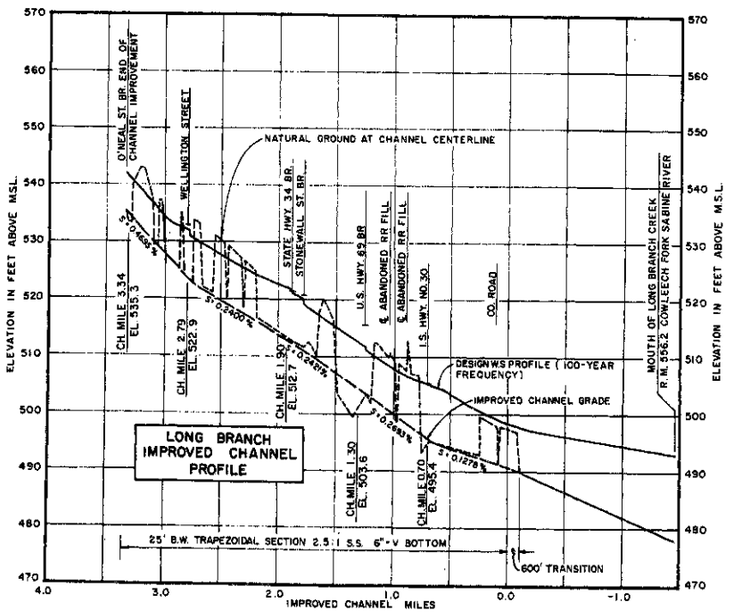
PREPARED BY U.S. ARMY ENGINEER DISTRICT, FORT WORTH

PLATE 13

58-522 O-71 (Face p. 240) No. 4







SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA
COMPREHENSIVE BASIN STUDY

EXISTING & PROPOSED PROFILES

GREENVILLE LOCAL FLOOD PROTECTION

SCALE AS SHOWN

PREPARED BY U.S. ARMY
ENGINEER DISTRICT,
FORT WORTH

PLATE 14

53-522 O-71 (Face p. 240) No. 5

CORPS OF ENGINEERS

U. S. ARMY

OWENS-ILLINOIS PAPER MILL

600' X 600' TURNING BASIN

1-10" LIQUID PETROLEUM GAS PIPELINE DIXIE PIPELINE CO. NO ALTERATION REQUIRED

PROPOSED 12' x 125' CHANNEL TO MORGAN BLUFF

PROPOSED FUTURE CHANNEL TO NIBLETT BLUFF

24" NATURAL GAS PIPELINE FLORIDA GAS TRANSMISSION CO. NO ALTERATION REQUIRED

12" OIL PIPELINE ARKANSAS PIPELINE CORP.
6" PIPELINE TEXAS EASTERN TRANSMISSION CORP.
18" OIL PIPELINE CITIES SERVICE PIPE LINE CO.
NO ALTERATION REQUIRED

S.P. R.R. BRIDGE SWING SPAN CLEARANCE HORIZ. 94'

1-8" PIPELINE GULF PIPELINE CO.

1-10" PIPELINE SHELL PIPELINE CORP.

AUTHORIZED 12 x 125' CHANNEL TO ECHO

SUBMARINE CABLE CROSSING SOUTHWESTERN BELL TELE. CO. NO ALTERATION REQUIRED

BRIDGE CLEARANCE HORIZ. 157' VERT. 50'

SUBMARINE CABLE CROSSING SOUTHWESTERN BELL TELE. CO. NO ALTERATION REQUIRED

LEGEND

- RIVER MILES
- CHANNEL MILES ABOVE INTERSECTION WITH AUTHORIZED FEDERAL PROJECT

SCALE IN MILES

SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

COMPREHENSIVE BASIN STUDY

CHANNEL TO MORGAN BLUFF

SCALE AS SHOWN

PREPARED BY U.S. ARMY ENGINEER DISTRICT, GALVESTON

FILE SN 129-44

PLATE 15

53-522 O-71 (Face p. 240) No. 6

TABLE 8

SUMMARY OF FIRST COST AND ANNUAL CHARGES
NAVIGATION CHANNEL FROM ECHO TO MORGAN BLUFF, TEXAS
SABINE RIVER

Item		Cost
	FIRST COST	
1.	**Federal First Cost**	
	Corps of Engineers	$ 1,737,900
	U. S. Coast Guard	27,300
	Total Estimated Federal First Cost	$ 1,765,200
2.	**Non-Federal First Cost**	
	Non-Federal public	$ 276,000
	Non-Federal private	11,800
	Total Estimated Non-Federal First Cost	$ 287,800
3.	**Total Estimated First Cost of Project**	$ 2,053,000
	ANNUAL CHARGES	
1.	**Investment**	
	a. Total estimated first cost	$ 2,053,000
	b. Interest during construction	None
	Total investment	$ 2,053,000
2.	**Federal Annual Charges**	
	Corps of Engineers	
	a. Interest on investment	$ 84,700
	b. Amortization	8,600
	c. Operation and maintenance	28,000
	Total Corps of Engineers annual charges	$ 121,300
	U. S. Coast Guard	
	a. Interest on investment	1,300
	b. Amortization	100
	c. Operation, maintenance and major replacement	3,000
	Total U. S. Coast Guard annual charges	$ 4,400
	Total Federal annual charges	$ 125,700

TABLE 8 (Cont'd)

SUMMARY OF FIRST COST AND ANNUAL CHARGES
NAVIGATION CHANNEL FROM ECHO TO MORGAN BLUFF, TEXAS
SABINE RIVER

Item	Cost
ANNUAL CHARGES (Cont'd)	
3. Non-Federal Annual Charges	
Non-Federal public	
a. Interest on investment	$ 13,400
b. Amortization	1,400
c. Operation and maintenance	3,900
Total non-Federal public annual charges	$ 18,700
Non-Federal private	
a. Interest on investment	600
b. Amortization	100
c. Operation and maintenance	24,900
Total non-Federal private annual charges	$ 25,600
Total non-Federal annual charges	$ 44,300
4. Total Annual Charges	$ 170,000

NOTE: January 1970 price level

Construction period - 10 mo., 50-yr amortization, 4-7/8% interest rate

TABLE 9

SABINE RIVER
ESTIMATES OF FIRST COST
CHANNEL FROM ECHO TO MORGAN BLUFF

Item No.	Item	Unit	Quantity	Unit Cost	Cost
1.	Federal First Cost				
a.	Corps of Engineers				
	(01.0) Lands and damages	Ownership	22	$ 850.00	$ 18,700
	(09.0) Channels				
	(1) Excavation	CY	3,000,000	0.40	$1,200,000
	(2) Clearing & grubbing rights-of way	Acres	250	400.00	100,000
	Subtotal, Channels				$1,300,000
	Contingencies, 15% ±				195,000
	Total, Channels				$1,495,000
	(30.0) Engineering and design				82,200
	(31.0) Supervision and administration				142,000
	Total Corps of Engineers				$1,737,900
b.	U. S. Coast Guard				27,300
c.	Federal First Cost				
	(1) Corps of Engineers				$1,737,900
	(2) U. S. Coast Guard				27,300
	Total Federal First Cost				$1,765,200
2.	Non-Federal First Cost				
a.	Non-Federal public				
	(1) Acquisition cost	Ownership	22	150.00	3,500
	(2) Rights-of-way	Acres	250	300.00	75,000
	(3) Improvements	Dwellings	6	10,000.00	60,000
	(4) Spoil disposal areas	Acres	380	60.00	23,000
	(5) Levees and spillways	LS			60,000
	Subtotal				221,100
	Contingencies, 25%± (excluding acquisition cost)				54,500
	Subtotal non-Federal Public				$ 276,000
b.	Non-Federal private				
	Rehabilitate operating machinery Southern Pacific Pacific RR Co. bridge	LS			11,800
	Subtotal non-Federal private				$ 11,800
c.	Total non-Federal First Cost				$ 287,800
3.	Total First Cost				
a.	Federal				$1,765,200
b.	Non-Federal				287,800
	Total First Cost				$2,053,000

NOTE: January 1970 price level

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX E

RECREATION AND ENVIRONMENTAL CONSIDERATIONS

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX E
RECREATION AND ENVIRONMENTAL CONSIDERATIONS

TABLE OF CONTENTS

LIST OF TABLES

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX I
RECREATION AND ENVIRONMENTAL CONSIDERATIONS

1. PURPOSE AND SCOPE.- The purpose of this appendix is to provide a transition from the comprehensive basin study to the current proposed plan of development for the water-oriented outdoor recreational features including sport fishing and hunting, and to deal with additional considerations required by the recently enacted National Environmental Policy Act of 1969, Public Law 91-190, 83 Stat, 852-856, approved 1 January 1970. This appendix covers only the short range plan of development as proposed in the comprehensive basin study.

2. RECREATION - GENERAL.- The general description, project features, and complete analysis of the market area, demand projections, existing and planned recreational areas, and the recreational needs are covered in appendix N of the comprehensive study. The short range recreation plan developed in the comprehensive study, along with the public health, water quality, and pollution control considerations, is supported and recommended in the proposed plan of development in this report.

3. FISH AND WILDLIFE.- The detailed analysis of the fish and wildlife resources and the impact of the proposed short range development is contained in appendix O of the comprehensive basin study. Wildlife habitat losses at the reservoir sites and the related man-days of hunting can be mitigated by development and management of 25,000 acres of project lands at the reservoir sites, and on 15,000 acres of additional lands in the flood plain immediately downstream from Mineola Reservoir. These lands downstream from Mineola Reservoir will provide an opportunity for greater flexibility in reservoir regulation, as well as providing for mitigation of wildlife habitat losses. The estimated cost to mitigate 14,800 annual man-days of big game hunting, 16,800 annual man-days of upland game hunting, and 3,600 annual man-days of other wildlife hunting losses due to the proposed development is as follows:

Costs (wildlife mitigation)

Flood plain lands immediately below Mineola Reservoir -- 15,000 acres @ $200	$3,000,000
Development -- 40,000 acres @ $2.00	80,000
Annual management -- 40,000 acres @ $2.00	80,000

The above proposal of improving and managing the wildlife habitat on 25,000 acres of multipurpose project lands and 15,000 additional flood plain lands will offset the effects of losing approximately 62,000 acres of land and its associated wildlife habitat at the project sites.

Cost allocations for mitigation should be divided equally between the three projects because the carrying capacity of the inundated habitat at the three reservoir sites are comparable.

An alternative to mitigation at project sites would be to provide mitigative measures in conjunction with a state wildlife management area within the basin, if such an area should be developed.

Under the proposed plan of development, reservoirs without channelization, there would be no wildlife losses downstream that can be determined at this time, providing the land use in the flood plain remains essentially the same or continues the present trend of converting cropland into pasture, range and forest. The only foreseeable impact on the ecological succession in the flood plain would be those temporary effects caused by controlled releases of the reservoirs.

Mitigative measures are justified on the basis that tangible benefits offset approximately 70 percent of the cost and 30 percent of the cost is offset by the intangible benefits consisting of conservation of wildlife species; pleasure derived by children and adults alike observing wildlife in their natural habitat; the opportunities to use the area for biological and environmental studies, training and research; and the fact that the project areas are in close proximity to metropolitan areas.

The water stored and regulated by the Mineola, Lake Fork and Big Sandy Reservoirs can contribute to the downstream wildlife and habitat needs in the long range plan, if required for that purpose.

4. DEPARTURES FROM COMPREHENSIVE STUDY PLAN.- The unit value for a recreation-day at Mineola and Big Sandy Reservoirs has been increased from ninety cents to one dollar.

The unit value for a recreation-day at the Lake Fork Reservoir, which is recommended for a special natural recreational development, has been retained at $1.50, although it is on the conservative side compared to current prices for experiences of equal quality.

In keeping with other current development costs, the development costs for recreation have been increased substantially, as shown below:

RECREATION COSTS

Mineola Reservoir

Lands - 600 acres @ $370		$ 222,000
Development (see table 1)		
Initial, General	$5,758,000	
Initial, Fish & Wildlife	311,000	
Future	2,617,000	
Total		$8,686,000
OM&R (General, Fish & Wildlife)		$ 429,000

Lake Fork Reservoir

Lands - 200 acres @ $380		$ 76,000
Development (see table 1)		
Initial, General	$2,910,000	
Initial, Fish and Wildlife	311,000	
Future	794,000	
Total		$4,015,000
OM&R (General, Fish & Wildlife)		226,400

Big Sandy Reservoir

Lands - 400 acres @ $340		$ 136,000
Development (see table 1)		
Initial, General	$3,608,000	
Initial, Fish and Wildlife	243,000	
Future	1,859,000	
Total		$5,710,000
OM&R (General, Fish & Wildlife)		$ 274,700

The proposed development of reservoirs and streamflow regulations will result in less disturbance to environmental integrity of the stream than other alternatives consisting of stream channelization or levees. The regulated flows should enhance float fishing and stream recreation. The natural conditions of the stream, the quality of water and the environmental features above Toledo Bend Reservoir have the attributes which merit further consideration for a scenic and recreation river of state or national significance. An example of this possibility is the river below Toledo Bend Dam. As a result of the regulated releases and the natural beauty of the stream, it has been unofficially recognized as a canoeing stream by the Texas Parks and Wildlife Department, and may be considered as a state wild river. A further coordinated study should be made to determine the feasibility for such a designation and development above Toledo Bend Reservoir.

5. ARCHEOLOGICAL AND HISTORICAL RESOURCES.- Past studies and surveys have shown that the Sabine River valley is an area rich in archeological resources that may provide major contributions toward the better understanding of American archeology. The upper Sabine crosses the southern part of the Caddoan archeological area. The lower Sabine Basin is virtually unexplored. Cooperation will continue with the National Park Service, state agencies and universities, and the historical societies to preserve and explore the rich heritage that exists in the basin.

TABLE 1

RECREATIONAL FACILITIES

ESTIMATE OF COST

Item	Planned Development: Initial	Future	Total
Mineola			
Roads (paved)	$1,832,200	$ 785,000	$2,617,200
Parking areas	492,900	244,300	737,200
Sanitary facilities	772,000	357,700	1,129,800
Boat launching ramps	122,000	---	122,100
Picnic facilities (tables & shelters in picnic & camp areas)	604,100	294,400	898,500
Water systems (underground service lines & drinking fountains)	171,000	94,200	265,200
Site improvement (underbrushing, vegetation, landscaping, and turfing)	427,900	378,200	806,100
Miscellaneous (signs, buoys, sidewalks, electric service lines, beach improvements, bathhouses, service bldgs, overlook shelters, trails and courtesy docks)	812,200	201,500	1,013,700
Organized group camps	174,500	87,200	261,700
Marinas (site development)	349,000	174,500	523,700
Fish & wildlife facilities	311,000	---	311,000
	$6,069,000	$2,617,000 1/	$8,686,000
Lake Fork			
Roads (paved)	$ 793,700	$ 264,600	$1,058,300
Parking areas	231,500	77,200	308,700
Sanitary facilities	370,300	176,400	546,700
Boat launching ramps	61,700	---	61,700
Picnic facilities (tables and shelters in picnic & camp areas)	423,300	141,300	564,600
Water systems (underground service lines & drinking fountains)	95,200	30,000	125,200
Site improvement (underbrush, vegetation, landscaping, and turfing)	117,700	29,500	147,200
Miscellaneous (signs, buoys, sidewalks, electric service lines, beach improvements, bathhouses, service bldgs, overlook shelters, trails and courtesy docks)	552,000	75,000	627,000
Organized group camps	88,200	---	88,200
Marinas (site development)	176,400	---	176,400
Fish & wildlife facilities	311,000	---	311,000
	$3,221,000	$ 794,000 2/	$4,015,000

TABLE 1 (CONT'd)

RECREATIONAL FACILITIES

ESTIMATE OF COST

Item	Planned Development: Initial	Future	Total
	Big Sandy		
Roads (paved)	$1,093,300	$ 546,800	$1,640,100
Parking areas	226,400	79,700	306,100
Sanitary facilities	470,200	277,000	747,200
Boat launching ramps	89,300	---	89,300
Picnic facilities (tables and shelters in picnic & camp areas)	396,400	161,800	558,200
Water systems (underground service lines & drinking fountains)	129,400	31,000	160,400
Site improvement (underbrushing, vegetation, landscaping and turfing)	380,300	264,300	644,600
Miscellaneous (signs, buoys, sidewalks, electric service lines, beach improvement, bathhouses, service bldgs, overlook shelters, trails and courtesy docks)	549,400	225,100	774,500
Organized group camps	91,100	91,100	182,200
Marinas (site development	182,200	182,200	364,400
Fish & wildlife facilities	243,000	---	243,000
	$3,851,000	$1,859,000 1/	$5,710,000

1/ Recreational development required in 40 years.

2/ Recreational development required in 20 years.

ENVIRONMENTAL CONSIDERATIONS

1. GENERAL.- This section has been prepared in response to the National Environmental Policy Act of 1969, Public Law 91-190. The planners have given careful attention to the spirit of the Act in their planning efforts. The objectives set forth in the Act were foremost in the planners' evaluations and for the convenience of the reader are here reiterated:

a. Encourage productive and enjoyable harmony between man and his environment.

b. Prevent or eliminate damage to the environment and biosphere and stimulate health and welfare of man.

c. Enrich the understanding of the ecological systems and natural resources important to the nation.

Although the comprehensive river basin planning was completed prior to the enactment of the National Environmental Policy Act, the coordinated efforts of the multidiscipline Coordinating Committee and the planning work groups demonstrate concern for environmental policy objectives in the comprehensive basin study. Details of the environmental features, including considerations and evaluations, and the effects of the proposed plan and alternatives can be found throughout the comprehensive report.

2. BASIN CHARACTERISTICS.- The Sabine River Basin is a crescent-shaped area arising in the Blackland Prairie just northeast of Dallas, Texas, where about half of the area is cultivated and the rest supports vegetative cover in the form of pastures, native grasses, and scattered elms and hackberry trees. As the basin bends to the east and south through eastern Texas and western Louisiana, from the Blackland Prairies through the hilly and undulating terrain of the Southern Coastal Plains and the Gulf Coast Prairies, dominated by pine-hardwood forests and pastureland, and dotted with farms and towns, it finally comes to rest in the flat Gulf Coast Marshes at the head of Sabine Lake. The mild climate and abundance of rainfall throughout the basin contribute to the needs of a wide variety of wildlife and vegetative species which make the basin a pleasant and enjoyable area in which man can work and play throughout each season of the year. The variety of species of plants and animals can be found in appendixes F and O of the comprehensive study. The hardwoods and southern pines, with an understory of shrubs, vines, herbs, and grasses along with the marshes, provide an excellent habitat for indigenous wildlife and a winter sanctuary for the migratory birds and waterfowl from the north.

The streams, as they flow, wind and meander in their broad flood plains from an elevation of about 700 feet to sea level, support an

abundance of catfish, bass, bluegill, and a wide variety of minnows and commercial fish. The water, while sometimes murky, is of fairly high quality.

3. MINEOLA RESERVOIR.- The Mineola Reservoir on the main stem of the Sabine River will rest in a broad, nearly level valley in the Post Oak belt of the East Texas timber country. The valley floor supports a mixed stand of cut-over hardwoods and small deciduous trees. There is a dense understory of shrubs, vines and herbs. This mixture of vegetative cover provides a habitat for deer, rabbits, squirrels, quail, dove, fur bearing animals, and songbirds. The streams in the reservoir area support a warm water fishery with game fish such as bass, crappie, bluegill, and catfish, and nongame species such as gar, buffalofish, carp and shad.

The Mineola Reservoir area is rural in nature and is predominantly woodland pasture with some bottom croplands in the valley. The scenery is generally pleasing with rolling hills, pastures, and forested areas. Access to the area is provided by a major east-west highway, making it convenient for the people in the metropolitan areas of Dallas-Fort Worth and Shreveport to use and enjoy the recreational opportunities provided by the project.

By providing recreational opportunities and enhancing the natural features of the area, the reservoir will attract many recreationists, fishermen, hunters, and naturalists.

4. LAKE FORK RESERVOIR.- The Lake Fork Reservoir will rest in the broad valley of the Lake Fork Creek and the arms of major tributaries, Little Fork, Garrett, Burket and Caney Creeks, about 28 miles upstream from its confluence with the Sabine River. The area is rural in nature with bottom croplands predominating in the valley. The forested areas are predominantly hardwood species of oak, elm, hackberry, willow, and gum, with a scattering of shortleaf pine. The pastureland, rangeland, and forested areas, with the understory of shrubs, vines, and herbs, provide habitat for wildlife similar to those found in the Mineola Reservoir site. The scenery is rolling hills of farmland, pastures and woodland. Access in and through the area is convenient for the people in the Dallas metropolitan area to enjoy the colorful seasonal changing panorama. The reservoir will enhance the natural features of the area and provide for a wide variety of outdoor recreational opportunities.

5. BIG SANDY RESERVOIR.- The Big Sandy Reservoir will occupy a relatively narrow valley of Big Sandy Creek about 15 miles above its confluence with the Sabine River. The area is a rural setting with woodland pastures predominating, broken by cropland and farmsteads. The vegetative and wildlife resources are comparable to those of the

Lake Fork area, except that habitat is of better quality and more wildlife abound in the Big Sandy area. The shortleaf pine is more prevalent, as the site is at the western edge of the Pine Belt. The pines enhance the scenery, especially in the winter months when the deciduous trees are bare and the pines show up as a scattering of green throughout the wooded areas. It is a pleasurable sight to the people who live and work in the less forested areas just a short distance to the west as they visit or travel through the area.

6. RESPONSE TO PL 91-190.- The information presented hereafter is referenced to the specific subsections of Section 102, PL 91-190.

a. Subsection (C)(i), "The environmental impact of the proposed action." The flood protection and prevention measures proposed for Greenville, Texas, may have a beneficial and complementary environmental impact. It can help to provide for a cleaner, safer stream through the city. There can be less destruction, hardship, unpleasant odors, and health problems. Greenbelt and open space areas can be retained, along with recreational opportunities. Opportunities will exist for the people of Greenville to further enhance the areas for their visual and physical enjoyment. The three recommended reservoir projects will inundate approximately 90 miles of warm water streams and about 62,000 acres of cropland, pastureland, and woodland. However, the overall environmental impact can be beneficial and complementary. The water areas in a natural rural setting can provide opportunities for visual and physical pleasure of not only the people in close proximity, but also for people in nearby metropolitan areas and the traveling public passing through. The reservoir areas will provide resource areas for pleasure, study, training, and research, along with a variety of outdoor recreational opportunities. Increased water supply will enable the people in the cities to develop and maintain more pleasant surroundings, open areas and municipal parks, as well as provide for future water needs. The flood control features will help to eliminate unsafe, unsightly, and unhealthy conditions, particularly in the more densely inhabited areas. They will help to control movement of sediment, stream scour, and to regulate stream flows in the downstream areas will help to preserve the integrity of the streams and their natural attributes for the well-being of the people who use the area for living and enjoyment. This preserved integrity will enable the ecological succession of the stream to progress in a more natural way with less environmental impact than would be imparted by other alternative proposals. It would remain a pleasant area to travel in or through, as many people will discover and enjoy while going from city to city. The reduced environmental impact of this proposal will help to minimize losses to plant and animal communities in the area.

b. Subsection (C)(ii), "Any adverse environmental effects which cannot be avoided should the proposal be implemented." Approximately 90 miles of free-flowing streams will be inundated in the three reservoir sites, along with the associated warm water fishery and the adjacent wildlife habitat, pastureland, woodland, and cropland. The lost warm water stream fishery, which is not unique to this area, will be greatly expanded by the reservoir fishery. The most adverse environmental effect may well be the loss of big game and upland game habitat. Every effort will be made to compensate for this loss by improving the habitat in other areas, subject to limitation due to space requirements per animal. The loss of production from the pastureland, cropland, and woodland in the reservoir areas will be an economic loss, but the environmental loss is not considered to be severe because the same general features and characteristics exist throughout the area. The navigation channel from Echo to Morgan Bluff will have a bottom width of 125 feet and will be about 5-1/4 miles long. This channel will extend along the river bottom with little or no effect on marsh drainage. Also, this sea level channel will not significantly affect estuarine resources.

c. Subsection (C)(iii), "Alternatives to the proposed action." Alternatives to the action recommended by the District Engineer are discussed under Project Formulation.

From the recreational, fish and wildlife viewpoint, and for preservation of natural vegetative resources, archeological and historical sites, ecosystems and for overall total environmental considerations, the development of reservoirs with downstream flow regulations is believed to be one of the better solutions in the upper portion of the Sabine Basin to provide for the water supply and flood control needs. Flood plain zoning or flowage easements in lieu of flood water storage and regulation would also be acceptable solutions. The combination of structural and nonstructural features is recommended to be the best alternative to accomplish resource development objectives with a lesser degree of environmental displacement. The local flood protection project at Greenville will provide not only flood protection, but also provide a greenbelt, open space, and recreational opportunities. The reservoirs will provide for water supply, streamflow regulation, and flood control. Adding water to a natural setting can provide esthetically pleasing areas with opportunities for recreation. In this proposal, the stream valleys will be retained in their natural condition which will benefit the fishery, wildlife, and vegetation.

d. Subsection (C)(iv), "The relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity." The Sabine Basin valley and tributary stream flood plains, dotted with cities and towns, are presently being used for farming, manufacturing, and oil and timber production. The area supports an

53-522 O-71——20

abundant variety of wildlife and plant communities. The basin is characterized by periodic flooding and all the associated losses of life and property. The maintenance and enhancement of the long term productivity of the environment will require watershed protection, flood plain management and flood prevention, maintenance of natural areas, and the multiple use of water and other resources with the objectives of improving quality and recycling. All of this can be accomplished by the judicious application of engineering tempered by environmental considerations. This basin and its environmental resources are important not only on a local level, but on a regional basis. The local short term uses are further discussed in the Basin Description, and the maintenance and enhancement of long term productivity are discussed in Project Formulation and Economic Analysis.

e. Subsection (C)(v), "Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." As is the case in any large scale project, the environmental effects of the Sabine project will be irreversible. Therefore, very strong consideration should be given to any proposal before its initiation. The resources to be committed to the proposed development and the benefits to be received are covered in the report. The District Engineer, in the course of preparing his report, has consulted with and obtained comments from local, state, and federal interests, most of whom have a measure of jurisdiction with respect to the environmental impact of the proposed development, and consideration was given to their views in developing the recommended plan.

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX F

DOCUMENTARY ASSURANCES

DEPARTMENT OF THE ARMY
U. S. CORPS OF ENGINEERS
FORT WORTH DISTRICT

CORPS OF ENGINEERS REPORT
ON THE
COMPREHENSIVE BASIN STUDY
SABINE RIVER AND TRIBUTARIES
TEXAS AND LOUISIANA

APPENDIX F

TABLE OF CONTENTS

TEXAS WATER DEVELOPMENT BOARD

SAM HOUSTON
STATE OFFICE BUILDING
201 EAST 14TH STREET

P. O. BOX 12386
CAPITOL STATION
AUSTIN, TEXAS 78711

AREA CODE 512
GREENWOOD 5-3187

September 8, 1966

Colonel Jack Fickessen, District Engineer
United States Army Corps of Engineers
Post Office Box 1600
Fort Worth, Texas

Dear Colonel Fickessen:

The Texas Water Development Board has been represented in the activities of the Coordinating Committee for the Comprehensive Basin Study on Sabine River Basin, Texas and Louisiana. During this past two years the State has accelerated its water resources planning program and has prepared a preliminary Texas Water Plan. In some areas of Texas, river authorities or other political subdivisions have carried on planning programs. In the Sabine River Basin, planning studies have been carried on by the Sabine River Authority of Texas, the Texas Water Development Board, the Corps of Engineers and other Federal agencies.

With a number of independent studies it would not be unusual to have significant variations. However, the results of the separate investigations of the Sabine River Basin by local, State and Federal agencies are in reasonably close agreement. The size, location and multiple purposes of proposed reservoir projects are not greatly different. The quantity, location and timing of projected water requirements vary somewhat between these studies.

The preliminary plan for the Sabine River Basin proposed by the Texas Water Development Board includes both the Mineola and Lake Fork Reservoirs as proposed multiple-purpose reservoir projects. Both of these projects would include flood control storage and downstream channel improvements, and are shown to be needed during the decade 1980 through 1990.

The present timing of the Sabine River Basin investigation report of your office suggests its submittal to the Congress in the period 1968 to 1970. Projects which are economically justified, in which there is a federal government interest, and which will be needed within 20 to 25 years should be considered in recommendations for authorization of construction. Projects needed before 1995 would be in that catagory.

The Corps of Engineers is requested to include in its recommendations for authorization in the Sabine River Basin report both the Mineola and Lake Fork multiple-purpose reservoir projects and associated downstream channel improvements.

The Texas Water Development Board is designated by Texas statute as "the state agency to cooperate with the Corps of Engineers of the United States Army . . . in the planning of water resource development projects in this state." In the event appropriate local interests are not prepared to undertake the sponsorship of either the Mineola or the Lake Fork Project, or both, in whole or in part, the Board will provide necessary assurances and sponsorship in whole or in part.

This request is not intended to exclude from consideration any recommendations pertaining to navigation facilities, local flood protection projects, or any mainstream projects downstream from Toledo Bend Dam.

With kindest regards,

Very truly yours,

Joe G. Moore, Jr.

Joe G. Moore, Jr.
Executive Director

JGMjr:bj
cc: Mr. John Simmons

SABINE RIVER AUTHORITY of Texas

A GOVERNMENTAL AGENCY OF THE State of Texas

P. O. BOX 579
ORANGE, TEXAS

April 21, 1967

Colonel Jack W. Fickessen
District Engineer, Fort Worth District
U.S. Army Corps of Engineers
P. O. Box 17300
Fort Worth, Texas 76102

RE: Comprehensive Basin Study
Sabine River and Tributaries

Dear Colonel Fickessen:

The Sabine River Authority of Texas has reviewed with interest the draft copy of Appendix N, "Recreation," Comprehensive Basin Study, Sabine River and Tributaries, distributed by letter dated March 7, 1967, U.S. Department of Interior, Bureau of Outdoor Recreation.. After due consideration of this Appendix and the many other aspects of the Comprehensive Basin Plan as it has developed to date, the Authority has concluded that it can, should and will undertake the administration of project recreation development for each Texas reservoir project proposed in the Plan and Authorized by Congress, and at the appropriate time, enter into a cost-sharing agreement with the Corps of Engineers in accordance with provisions of the Federal Water Project Recreation Act.

The Sabine River Authority of Texas, a conservation and reclamation district, was created in 1949 as a governmental agency by the Legislature of the State of Texas, and given the power to control, store, preserve and distribute the waters of the Sabine River and its tributaries within the State for all beneficial purposes. With respect to recreation, the "...district is authorized to establish or otherwise provide for public parks and recreation facilities, and to acquire land for such purposes." (From Vernon's Annotated Civil Statutes, Article 8280-133, Sec. 27.)

Having been granted the right to participate in recreational developments, the Authority has become actively involved in the planning, design, construction and operation of recreational facilities at its existing Tawakoni Reservoir and at Toledo Bend Reservoir, currently under construction and jointly owned with its Louisiana counterpart, the Sabine River Authority, State of Louisiana.

At Tawakoni Reservoir, the Authority, with its own funds, has developed six public use areas, including fifteen boat launching lanes and numerous picnic tables, grills and associated facilities. In addition, it has currently under construction, a 180-acre recreation area "Wind Point Park", financed, in part, by a Federal Grant from the Land and Water Conservation Fund. This park will contain a water treatment and distribution system, sewage treatment facilities, restrooms with showers, a headquarters building, concession building, and caretakers residence, and boat launching, picnic and camping facilities to serve estimated annual and peak-day attendance figures according to criteria given in Corps of Engineer's Manual No. EM 1130-2-312. The estimated cost of this development is $249,500.

The Toledo Bend Reservoir will be a hydroelectric power and water supply project operated under a Federal Power Commission license. A license requirement was that a Master Plan Report for recreational development be prepared. This report was completed by the Authority. In addition to the Authority's plans for seven public use sites with an estimated 10-year development cost of $1,550,000, the report contained plans of the U. S. Forest Service and S.R.A., State of Louisiana. The total estimated cost for recreation facilities by the three agencies is $11,631,000.

The above information is included to show that the Sabine River Authority of Texas is seriously interested in providing adequate recreational opportunity in the basin and that it has gained considerable experience in the maintenance and operation of public use areas on reservoirs.

Yours very truly,

John W. Simmons
Executive Vice President
and General Manager

JWS/mm/sp

cc: U.S. Dept. of the Interior
Bureau of Outdoor Recreation

Texas Water Development Board

N. VIGATION AND PORT DISTRICT

COUNTY DOCKS - P. O. BOX 516 - P[illegible]ONE TU 3-4363
ORANGE, TEXAS, 77630

June 27, 1967

John E. Unverferth
Colonel, CE
District Engineer
Department of the Army
Galveston District, Corps of Engineers
P. O. Box 1229
Galveston, Texas 77550

Dear Colonel Unverferth:

Referring further to yours of May 5, 1967, under your File No. SWGED-B.

At a special meeting of the Board of Commissioners of the Orange County Navigation and Port District held June 23, 1967, it was decided that the Orange County Navigation and Port District would provide local cooperation as outlined in your above referred letter of May 5, 1967, on the proposed Barge Channel from Echo to Pruitt Bluff, Texas.

We will appreciate you keeping us advised on the progress of this project.

Yours very truly,

W. J. Butler

W. J. Butler, President

WJB:nh

City of Greenville

Growing GREENVILLE

Greenville, Texas
February 20, 1968

Colonel Jack W. Fickessen
District Engineer
Corps of Engineers
Fort Worth District
P. O. Box 17300
Fort Worth, Texas 76102

Dear Colonel Fickessen:

Reference is made to your letter dated 1 February 1968, inclosing data on the flood protection project proposed for the City of Greenville, by the Corps of Engineers, in the report, "Comprehensive Basin Study, Sabine River and Tributaries, Texas and Lousiana."

The City Council of the City of Greenville, Texas, has decided in favor of undertaking sponsorship for the proposed project and will provide local cooperation as outlined in the inclosure to your letter dated 1 February 1963, referred to above.

In determining to sponsor this project the City of Greenville wishes to emphasize the extreme inportance to this City of flood retention dam structures upstream and channel improvement downstream to the end that no detriment results to downstream landowners and the City. We wish to encourage consideration of this portion of the project in the light of development of the Sabine River entirely into Lake Tawakoni.

Very truly yours,

Roy L. Warren, Jr.
Mayor, City of Greenville, Texas

RLW:ev

STATEMENT
TEXAS WATER DEVELOPMENT BOARD
AT
HEARING ON FLOOD CONTROL ON THE SABINE RIVER
LONGVIEW, TEXAS
February 28, 1969

TO: Honorable Robert E. Jones, MC
and Members of the Flood Control Subcommittee
U. S. House of Representatives
Public Works Committee

The Water Development Board wishes to thank for the Subcommittee for an opportunity to appear at this hearing.

Mr. Howard Boswell, Executive Director of the Board, asked that his regrets be conveyed to you for his inability to be here in person and that I present this statement in his behalf. Prior commitments including a meeting of the Water Development Board and a heavy schedule of Legislative appointments precluded his attending.

The Texas Water Development Board had active representation in the activities of the Coordinating Committee for the Comprehensive Basin Study on the Sabine River Basin, Texas and Louisiana. In general the Texas Water Development Board fully endorses the report on the Comprehensive Study and takes note of its compatibility with the Texas Water Plan.

On September 8, 1966, the Water Development Board, in its statutorily designated capacity as the State agency to cooperate with the Corp of Engineers of the United States Army in the plan of water resource development projects in Texas, provided a letter of assurance for inclusion in the report on the Comprehensive Study. This letter indicated that in the event appropriate local interests were not prepared to undertake the sponsorship of either or both the Mineola or Lake Fork multi-purpose reservoir projects and associated downstream channel improvements the Water Development Board would provide necessary assurances and sponsorship to the degree required. Refined planning has now demonstrated that the Big Sandy Reservoir multi-purpose project merits providing such assurances and sponsorship by the Water Development Board.

In requesting the Corp of Engineers to include Mineola, Lake Fork, and Big Sandy Reservoirs in its recommendations for authorization, the Water Development Board wishes to make clear that such request is not intended to exclude from consideration any recommendations pertaining to navigation facilities, local flood protection projects, or any mainstream projects downstream from Toledo Bend Dam.

The Texas Water Development Board respectfully requests that this Subcommittee carefully weigh the facts presented in this hearing and give such support as may be possible toward expediting consideration of the Comprehensive Report.

(Statement before the Subcommittee of the House Public Works Committee Hearing at Longview, Texas, by Mr. Ivan M. Stout, Interstate Planning Engineer of the Texas Water Development Board.)

EXECUTIVE DEPARTMENT
AUSTIN, TEXAS 78711

September 24, 1969

Mr. Henry P. Caulfield, Jr.
Executive Director
Water Resources Council
Suite 900
1025 Vermont Avenue, N.W.
Washington, D.C. 20005

Dear Mr. Caulfield:

The State of Texas has reviewed and commented favorably on the Report of the Water Resources Council on the Comprehensive Study of the Sabine River Basin, Louisiana and Texas, May 15, 1969.

The document agrees substantially with the comments of the Texas Parks and Wildlife Department which are included in the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana, dated December, 1967. Recreation elements are substantially in accord with the current State Comprehensive Outdoor Recreation Plan as it is related to basic outdoor recreation needs.

A flexible guide to orderly development in the Sabine basin, with fully justified multiple-purpose projects, is provided for in the report. It includes Water Resources Council recommendations that the Sabine Study be accepted as a basis for developing Federal agency authorizing efforts for implementation of the comprehensive plan. The document indicates that subsequent authorizations should include further discussion of the relationships of recommended projects in the best interests of the basin, of Texas and Louisiana, and the nation.

The report desirably stresses the consideration of alternatives and nonstructural programs and combinations of these with existing and proposed projects. Each element of water resources development should be restudied and evaluated in detail in relation to all matters concerning the basin at any time of project proposal in the future. Proposed authorization to enable the Chief of Engineers to cooperate with responsible local interests to keep lands on local tax rolls and to exercise control over development in the reservoir-and-dam-site area until needed for project purposes is commendable.

The Texas Water Plan, November, 1968, utilized the report recommendations in formulating State plans for the future development of water and related land resources in the Sabine and in determining basin surplus water. Recommendations in the document concerning future reservoir construction in the Texas portion of the Sabine River Basin are in general agreement with the Texas Water Plan. It should be pointed out that the yield of Toledo Bend Reservoir is subject in the future to diminution by development of the five reservoirs proposed in the Sabine River Basin Plan to be developed on Louisiana tributaries to Toledo Bend Reservoir.

Since water quality standards have been established for the Sabine River, these will have to be respected in any future development of the River. Also, it is gratifying to note that the report finds that the proposed Sabine developments appear to have no adverse affect upon the estuarine and coastal marsh areas. In regard to flood plain management and implementing practical measures to accomplish it, the Texas Legislature recently passed an Act which is designed to encourage sound land use among other things, in qualifying for coverage under the National Flood Insurance Act of 1968.

The established State procedure for submitting feasibility studies on all federally-supported water projects to the Governor under Article 7472e, Vernon's Civil Statutes, will need to be continued. Subsequent Federal programs and project reports to be undertaken in implementation of the comprehensive report must be forwarded to the Governor for his review and recommendations.

Since the report is consistent with State planning and program activities for the area, I endorse it.

Thank you for the opportunity to receive and evaluate this recommended undertaking.

Sincerely,

Preston Smith

Preston Smith
Governor of Texas

PS/mpp

State of Louisiana

EXECUTIVE DEPARTMENT

Baton Rouge

JOHN J. McKEITHEN
GOVERNOR

October 13, 1969

RECEIVED
OCT 14 1969
WATER
RESOURCES COUNCIL

Mr. Harry A. Steele
Acting Executive Director
Water Resources Council
1025 Vermont Avenue, N.W. Suite 900
Washington, D. C. 20005

Dear Mr. Steele:

On May 23, 1969 the Water Resources Council transmitted to me for comment copy of a proposed report on the Comprehensive Study of the Sabine River Basin, Louisiana and Texas.

The conclusions and recommendations of your report, as they relate to items affecting Louisiana, have been carefully considered by the Louisiana State Department of Public Works. The Department of Public Works concurs in the recommendations of your report provided it includes the statement contained in your letter of October 7, 1969 to Mr. Calvin T. Watts, Acting Director of that department. The statement is as follows:

> "Subsequent authorizing documents for these three reservoirs should consider and report on the effects of these reservoirs on power generation, water supply, recreation, and fish and wildlife features at Toledo Bend Reservoir."

With this modification, I am pleased to endorse the report on behalf of the State of Louisiana for submission by the Council to the President and the Congress.

Sincerely yours,

JOHN J. McKEITHEN
Governor

REPORT OF THE WATER RESOURCES COUNCIL

WATER RESOURCES COUNCIL

WATER RESOURCES COUNCIL REPORT

ON THE

COMPREHENSIVE BASIN STUDY

SABINE RIVER, TEXAS AND LOUISIANA

APRIL 1970

Published by

Water Resources Council, 1025 Vermont Avenue, N.W.
Washington, D.C. 20005

THE WATER RESOURCES COUNCIL

It is the function of the Council to effectuate the policy of the United States, as stated in the Water Resources Planning Act approved July 22, 1965, to encourage the conservation, development, and use of water and related land resources of the United States. This is to be done on a comprehensive and coordinated basis by the Federal Government, States, localities, and private enterprise with the cooperation of all affected Federal agencies, States, local governments, individuals, corporations, business enterprises, and others concerned.

The officers and members of the Council are:

Walter J. Hickel, Secretary of the Interior, Chairman
Clifford M. Hardin, Secretary of Agriculture
Stanley R. Resor, Secretary of the Army
Robert H. Finch, Secretary of Health, Education and Welfare
John A. Volpe, Secretary of Transportation
John N. Nassikas, Chairman, Federal Power Commission
Maurice H. Stans, Secretary of Commerce, Associate Member
George M. Romney, Secretary of Housing and Urban Development, Associate Member
John N. Mitchell, Attorney General of the United States, Department of Justice, Observer
Robert P. Mayo, Director, Bureau of the Budget, Observer

W. Don Maughan, Executive Director

1025 Vermont Avenue, N. W.
Suite 900
Washington, D. C. 20005

WATER RESOURCES COUNCIL
SUITE 900
1025 VERMONT AVENUE NW.
WASHINGTON, D.C. 20005

April 15, 1970

Dear Mr. President:

I am pleased to transmit to the Congress under provisions of the Water Resources Planning Act (P. L. 89-80) the Water Resources Council report and the comprehensive plan for the Sabine River Basin, Louisiana and Texas.

The Council's report, as supplemented and amended by subsequent Council action, will be the basis for Council review and approval of Federal agency proposals to carry out specific elements of the plan. The States which have participated in the study have endorsed the report of the Water Resources Council.

Study participants were the States of Louisiana and Texas; the Federal Departments of Army, Agriculture, Health, Education, and Welfare, Interior, and Commerce; and the Federal Power Commission.

Included with the report of the Water Resources Council are the comments of the Governors of the States of Louisiana and Texas.

The Bureau of the Budget has no objection to the transmittal of this report to the Congress for its information, as indicated in the attached letter dated April 8, 1970.

Sincerely yours,

Walter J. Hickel
Chairman

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C.

Enclosures

53-522 O—71——21

WATER RESOURCES COUNCIL
SUITE 900
1025 VERMONT AVENUE NW.
WASHINGTON, D.C. 20005

April 15, 1970

Dear Mr. Speaker:

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Sincerely yours,

Walter J. Hickel
Chairman

Honorable John W. McCormack
Speaker of the House of Representatives
Washington, D. C.

Enclosures

EXECUTIVE OFFICE OF THE PRESIDENT

BUREAU OF THE BUDGET
WASHINGTON, D.C. 20503

RECEIVED

APR 14 1970

WATER
RESOURCES COUNCIL

April 8, 1970

Honorable Walter J. Hickel
Chairman
Water Resources Council
Washington, D. C.

Dear Mr. Chairman:

Your letters of December 16, 1969, transmitted the reports of the Water Resources Council on the Comprehensive Studies of the White River Basin, Arkansas and Missouri, the Pascagoula River Basin, Alabama and Mississippi and the Sabine River Basin, Louisiana and Texas.

You are advised that there would be no objection to the submission of the reports to the Congress for its information. It is our understanding that the reports are not documents leading directly to authorization of the projects discussed therein. Rather, the reports are to be used as information in consideration of future proposals which may be presented for congressional authorization.

Sincerely,

James R. Schlesinger

Acting Deputy Director

DEPT. OF THE INTERIOR
1970 APR 15 PM 5 07
ASSISTANT SECRETARY
WATER AND POWER
DEVELOPMENT

PRESTON SMITH
GOVERNOR

EXECUTIVE DEPARTMENT
AUSTIN, TEXAS 78711

September 24, 1969

Mr. Henry P. Caulfield, Jr.
Executive Director
Water Resources Council
Suite 900
1025 Vermont Avenue, N.W.
Washington, D.C. 20005

Dear Mr. Caulfield:

The State of Texas has reviewed and commented favorably on the Report of the Water Resources Council on the Comprehensive Study of the Sabine River Basin, Louisiana and Texas, May 15, 1969.

The document agrees substantially with the comments of the Texas Parks and Wildlife Department which are included in the Comprehensive Basin Study, Sabine River and Tributaries, Texas and Louisiana, dated December, 1967. Recreation elements are substantially in accord with the current State Comprehensive Outdoor Recreation Plan as it is related to basic outdoor recreation needs.

A flexible guide to orderly development in the Sabine basin, with fully justified multiple-purpose projects, is provided for in the report. It includes Water Resources Council recommendations that the Sabine Study be accepted as a basis for developing Federal agency authorizing efforts for implementation of the comprehensive plan. The document indicates that subsequent authorizations should include further discussion of the relationships of recommended projects in the best interests of the basin, of Texas and Louisiana, and the nation.

The report desirably stresses the consideration of alternatives and nonstructural programs and combinations of these with existing and proposed projects. Each element of water resources development should be restudied and evaluated in detail in relation to all matters concerning the basin at any time of project proposal in the future. Proposed authorization to enable the Chief of Engineers to cooperate with responsible local interests to keep lands on local tax rolls and to exercise control over development in the reservoir-and-dam-site area until needed for project purposes is commendable.

The Texas Water Plan, November, 1968, utilized the report recommendations in formulating State plans for the future development of water and related land resources in the Sabine and in determining basin surplus water. Recommendations in the document concerning future reservoir construction in the Texas portion of the Sabine River Basin are in general agreement with the Texas Water Plan. It should be pointed out that the yield of Toledo Bend Reservoir is subject in the future to diminution by development of the five reservoirs proposed in the Sabine River Basin Plan to be developed on Louisiana tributaries to Toledo Bend Reservoir.

Since water quality standards have been established for the Sabine River, these will have to be respected in any future development of the River. Also, it is gratifying to note that the report finds that the proposed Sabine developments appear to have no adverse affect upon the estuarine and coastal marsh areas. In regard to flood plain management and implementing practical measures to accomplish it, the Texas Legislature recently passed an Act which is designed to encourage sound land use among other things, in qualifying for coverage under the National Flood Insurance Act of 1968.

The established State procedure for submitting feasibility studies on all federally-supported water projects to the Governor under Article 7472e, Vernon's Civil Statutes, will need to be continued. Subsequent Federal programs and project reports to be undertaken in implementation of the comprehensive report must be forwarded to the Governor for his review and recommendations.

Since the report is consistent with State planning and program activities for the area, I endorse it.

Thank you for the opportunity to receive and evaluate this recommended undertaking.

Sincerely,

Preston Smith

Preston Smith
Governor of Texas

PS/mpp

State of Louisiana

EXECUTIVE DEPARTMENT

Baton Rouge

JOHN J. McKEITHEN
GOVERNOR

October 13, 1969

RECEIVED
OCT 14 1969
WATER
RESOURCES COUNCIL

Mr. Harry A. Steele
Acting Executive Director
Water Resources Council
1025 Vermont Avenue, N.W. Suite 900
Washington, D. C. 20005

Dear Mr. Steele:

On May 23, 1969 the Water Resources Council transmitted to me for comment copy of a proposed report on the Comprehensive Study of the Sabine River Basin, Louisiana and Texas.

The conclusions and recommendations of your report, as they relate to items affecting Louisiana, have been carefully considered by the Louisiana State Department of Public Works. The Department of Public Works concurs in the recommendations of your report provided it includes the statement contained in your letter of October 7, 1969 to Mr. Calvin T. Watts, Acting Director of that department. The statement is as follows:

> "Subsequent authorizing documents for these three reservoirs should consider and report on the effects of these reservoirs on power generation, water supply, recreation, and fish and wildlife features at Toledo Bend Reservoir."

With this modification, I am pleased to endorse the report on behalf of the State of Louisiana for submission by the Council to the President and the Congress.

Sincerely yours,

JOHN J. McKEITHEN
Governor

WATER RESOURCES COUNCIL REPORT ON THE COMPREHENSIVE BASIN STUDY SABINE RIVER, TEXAS AND LOUISIANA

INTRODUCTION

The Sabine River Basin Comprehensive Study was initiated in 1962 as one of the individual river basin studies (type 2) undertaken by the Water Resources Council to meet the goal of having comprehensive studies for the major basins of the country. 1/ The study was a cooperative effort of Federal agencies and the States of Louisiana and Texas, accomplished under the general guidance of the Sabine Basin Coordinating Committee. The Coordinating Committee was composed of representatives of the U.S. Departments of Agriculture, Army, Commerce, Health, Education, and Welfare, and Interior; the Federal Power Commission; and the States of Louisiana and Texas, and was chaired by the District Engineer, Fort Worth District, Corps of Engineers.

DESCRIPTION OF THE BASIN

The Sabine River Basin, located in the eastern part of Texas and the western part of Louisiana, has an area of about 9,756 square miles--2,330 square miles in Louisiana and 7,426 square miles in Texas. The Basin lies within the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The land elevation within the Basin varies from a few feet above sea level near the coast to about 730 feet above sea level in the headwaters. About 60 percent of the total land area of the Basin is forested; 17 percent is cropland; 18 percent is pasture, range, and other land; and 5 percent is in urban, built-up, and small water areas.

1/ Type 2 studies, defined by the Water Resources Council, are studies of feasibility or survey scope for individual river basins, tributary basins, or subregions. They are undertaken for areas with complex problems needing concerted multiagency actions, Federal and non-Federal, for their solution. These studies define and evaluate projects and programs in sufficient detail to comprise a basis for authorization or implementation of those projects that should be initiated in the next 10 to 15 years.

The main economic activities in the Basin are agriculture, forest products, manufacturing, and mineral production. Principal crops grown are cotton, wheat, rice, feed grains, and hay. Pulp and paper, plywood, and lumber are the primary forest products. Principal types of manufacturing industries are chemicals and plastics, petrochemical, aircraft, food processing, and small appliances. Mineral production primarily consists of petroleum, natural gas, and natural gas liquids.

The 1960 population of the study area was about 1,867,000. This is projected to increase to about 5,290,000 by 2020. Per capita disposable income in 1960 was about $1,470, 76 percent of the national average. This is projected to increase in the future, gradually approaching the national average by the year 2000. During the period 1939 to 1966, the area has experienced an expansion of economy which is best illustrated by rapid urbanization and growth of manufacturing. The rate of increase in per capita income for the study area has been 77 percent greater than for the Nation. It is anticipated that growth rates of all economic indicators for the study area will increase at a greater rate than those for the Nation with the exceptions of the value of mineral production and new construction.

Climate over the Basin is generally mild, varying from the moderate Gulf Coast conditions to continental conditions in the north. Mean annual precipitation over the Basin averages about 50 inches and varies from about 40 inches in the northwestern extremity of the Basin to about 57 inches near the Gulf Coast.

Since 1884 there have been 18 general floods in the Basin and many more local type floods. Several drought periods have been experienced in the Basin since about 1900.

PRESENT WATER RESOURCE DEVELOPMENT

Existing navigation projects in the Sabine River Basin include the main channel of the Gulf Intracoastal Waterway and a portion of the Sabine-Neches Waterway. An enlargement of the reach of the Gulf Intracoastal Waterway between the Atchafalaya and the Houston Ship Channel has been authorized but not constructed. A shallow-draft channel has also been authorized in the Sabine River from Orange to Echo, Texas.

The Soil Conservation Service has an authorized plan for the Upper Lake Fork Creek watershed consisting of 23 floodwater retarding structures of which 17 were completed as of July 1, 1966.

As of the date of this report there were no major Federal flood control or multiple-purpose reservoirs existing, under construction, or authorized. There are a few isolated levees in the upper Basin and a locally owned levee joining a levee owned by the U. S. Navy which protects the Naval Station at Orange, Texas, in the lower basin. Existing non-Federal flood control works are local in character affording no general flood protection to the Basin.

The City of Greenville has a system of five reservoirs providing 7,550 acre-feet of water supply storage and there are 11 additional water supply and allied purpose reservoirs having storage capacities in excess of 5,000 acre-feet, which have been constructed by State and local agencies. These reservoirs have a total storage of 5,633,510 acre-feet and those constructed for water supply presently have a yield of 1,646.4 million gallons per day. The largest, Toledo Bend Reservoir, with 4,477,000 acre-feet of storage capacity, was developed by the Sabine River Authorities of Texas and Louisiana under Federal Power Commission license and provides hydroelectric power, water supply, improvement to navigation, fish and wildlife enhancement, and recreation facilities.

There are 18 minor reservoirs constructed by State agencies and local interests having a total capacity of 18,376 acre-feet serving various purposes, including municipal-industrial water supply, irrigation, and power.

PROBLEMS AND NEEDS

On the basis of projections of trends in economic activities, the study reveals that there exists an increasing need for flood protection; water supply for municipal, industrial, rural, cooling, irrigation, navigation, and fish and wildlife uses; land treatment and management; navigation facilities; water-oriented recreation opportunities; and conservation and improvement of fish and wildlife resources within the area served by the Sabine River Basin.

1. Estimated average annual flood damages on the Sabine River and major tributaries under 1964 conditions of protection and development are approximately $2,367,000. Eleven percent of this total is urban; 49 percent is losses sustained by highways, railroads, utilities, and other nonagricultural development; and the remaining 40 percent is attributable to agricultural losses. These average annual damages have been estimated to double for the period of analysis.

2. In the upstream watershed areas, potential average annual damages are estimated to be $1,473,000. About 58 percent of this is damage to crops and pasture; 18 percent is damage to other agricultural properties; 10 percent to roads, bridges, and other nonagricultural properties; 2 percent from flood-plain scour; 3 percent from sediment; and 9 percent indirect damages.

3. In-basin water supply requirements for municipal, industrial, rural, irrigation, navigation, and fish and wildlife demands were estimated for the years 1980, 2000, and 2020. Also considered were diversion demands to be placed on the Basin's water resources. By the year 1980, total average annual water supply requirements, including exports of 1,500 million gallons per day, were estimated to reach 2,400 million gallons per day and by 2020 to exceed 2,900 million gallons per day, including 1,400 mgd exports.

4. An evaluation was made of the need for, and prospective use of, a navigation channel from Echo to Pruitt Bluff, Texas, and from Pruitt Bluff to Longview, Texas. The total prospective commerce that would likely use barge transportation was estimated to reach 680,000 tons by 1975 and 983,000 tons by 2025 for the channel to Pruitt Bluff. The total prospective commerce for the channel to Longview amounts to 1,230,000 tons in 1975 and 17,359,000 tons in 2025.

5. The location of the Sabine River Basin is such that it can offer recreational opportunities to residents of the Basin and to the major urban centers of Beaumont, Dallas, and Tyler, Texas, and Shreveport and Lake Charles, Louisiana. Present total water-oriented recreational demands on the Basin are about 4 1/2 million recreation days annually, excluding fishing and hunting. Future recreation demands are projected to reach 11 million by 1980, and 29 million by 2020. Present demands for sport fishing and hunting amount to about 6.8 million man-days annually. Projected demands are estimated to exceed 10 million man-days by 2020.

6. Results of water quality computations by the Federal Water Pollution Control Administration indicate that the surface waters of the Sabine River Basin will not be degraded below acceptable limits and storage for water quality control will not be needed in the foreseeable future.

7. About 4,826,000 acres of agricultural and forested land in the Basin need further application of land treatment measures. Approximately 1,173,000 acres of agricultural and forest lands of the Basin lie within the drainage problem area; however, only about 195,000 acres are considered feasible for drainage. About 95,000 acres within the Basin have a physical potential for irrigation. Of this amount, 16,000 acres are either presently irrigated or have been irrigated in the past. In addition, approximately 172,000 acres outside the Basin, in Louisiana, could be irrigated with water from the Sabine River. About 21,000 of these acres are presently being supplied with water from the Sabine.

PLANNING CONCEPTS

The purpose of the study was to examine and analyze the physical and economic possibilities for improvement or development of the Sabine River Basin's water and related land resources to meet existing and projected needs and objectives. The end result was a determination of the time sequence and points of application of the use of land, labor, and materials in planning a program of water and related land resource projects which would most efficiently produce goods and services to meet human needs and wants.

The need and planning objectives were defined as the short- and long-term demand for water supply for municipal, industrial, rural, and irrigation use; water quality control; navigation in relation to the Nation's transportation system; hydroelectric power; flood control; land stabilization; drainage, including salinity control; watershed protection and upstream flood prevention; forest and mineral production; grazing and cropland improvements; outdoor recreation; and sport and commercial fish and wildlife enhancement. Local objectives were based on statements of local interests who expressed desires for Federal improvement projects to include the following: flood control along Sabine River; flood and conservation problems along Lake Fork Creek; flood and water conservation on Big Sandy Creek; flood control along Long Branch Creek in Greenville; a reservoir near Grand Saline for flood control and conservation; Sabine River barge traffic from Highway 190 to Longview; a feasibility survey of the Sabine River for recreation, flood control, transportation, and water for industrial use; barge traffic from Echo to Longview; protection of existing water supplies; flood protection by levees along Sabine River in Orange County and a portion of Adams Bayou; and planning assistance for watershed development for Upper Sabine watershed, Mill Creek, Irons Bayou, and Lower Sabine.

The study was performed through a series of specialized studies conducted by agencies having interests and responsibilities in various technical phases of water and related land resources development. The results of each technical study are reported in appendices attached to the summary report.

The recommended improvements were formulated into a Basin plan for development by a Formulation Work Group under the direction of the field Coordinating Committee. The Formulation Work Group considered the advantages and disadvantages of the various physical alternatives, compared their resultant benefits and costs, and formulated a plan considered to be the most efficient in providing the needed goods and services.

COMPREHENSIVE PLAN

The Coordinating Committee has presented a plan for the orderly development of the water and related land resources of the Sabine River Basin to meet short- and long-range needs not being met by existing facilities or activities. The field Coordinating Committee concluded that the projects included in the plan are multiple-purpose in scope, are justified individually and as a system, and each purpose served by the projects is justified.

The field Coordinating Committee recommended that:

1. The land and water resource development plan set forth in its report be followed as a flexible guide in the detailed planning of projects for the development of the land and water resources of the Sabine Basin;

2. Approval of the plan not be considered to preclude development of other projects not included in the report which may be approved by the States of Texas and Louisiana in conformity with State laws;

3. Each of the affected and concerned Federal and State agencies keep current the segments of the plan for which it is or may be, under law, assigned responsibility; and

4. The report of the Coordinating Committee be used as a supporting document to substantiate requests of the construction agencies for authorization.

Early-Action Plan

The Coordinating Committee recommended that the projects and programs in the following short-range plan for development be constructed or otherwise implemented within the next 10 to 15 years:

1. Three major multiple-purpose reservoirs for flood control, water supply, and recreation in conjunction with 180 miles of flood release channels extending below the dams to the head of Toledo Bend Reservoir.

2. A local flood protection project at Greenville, Texas.

3. A navigation project extending 4.5 miles from Echo to Pruitt Bluff, Texas.

4. Eleven upstream watershed protection projects, including 140 flood water retarding structures, 282 miles of channel improvement, 5 multiple-purpose reservoirs, and associated land treatment measures.

5. Consideration of acquisition of reservoir and damsite lands for the 3 multiple-purpose reservoir projects in advance of construction as required to preserve such areas from encroachment and to avoid increased costs for relocation.

6. Provision for a program of hydrologic instrumentation and network recommended by the Geological Survey and Weather Bureau in connection with the proposed plan of improvement.

7. Provision for a program of fishery management studies on specific multiple-purpose reservoirs.

The estimated benefits and costs of the major elements of the early-action plan are as follows:

	Total investment cost	Average annual cost	Average annual benefit
Major reservoirs	$170,391,000	$7,614,400	$ 9,508,400
Upstream watershed projects	21,576,000	836,700	1,356,400
Navigation, Echo to Pruitt Bluff	1,712,000	125,600	251,000
Greenville local protection	723,000	28,700	34,900
Fishery management studies	225,000	---	---
Total	$194,627,000	$8,605,400	$11,150,700

Effects of the Early-Action Plan

1. Flood protection

The estimated average annual flood losses that would be prevented by all the flood control and prevention projects recommended in the early-action plan are summarized in the table below. The damages prevented are based on the long-term average annual damages expected to occur in the Sabine River Basin reflecting economic trends and future development in the flood plain.

Average annual flood losses prevented

Means of prevention	Amount
Major reservoirs	$3,427,500
Upstream watershed projects	672,500
Land treatment	59,400
Local flood protection project	34,900
Total for Basin	$4,194,300

Total estimated average annual flood damages for the Basin would be reduced 70 percent

2. Water supply

The system of reservoirs proposed in the early-action plan, when combined with groundwater development and the reuse and recycling of water, will meet projected in-basin demands beyond the year 2000, and diversion demands that have been presently established. Existing development, planned importations, and projects included in the early-action plan are expected to yield a surface water supply of about 1,736 million gallons per day.

3. Navigation

The recommended early-action plan includes extension of barge navigation on the Sabine River from Echo to Pruitt Bluff, Texas. Through the Sabine River channel, connection is afforded to the Gulf Intracoastal Waterway and the vast inland waterways systems of the United States. The prospective waterborne commerce for the channel to Pruitt Bluff is estimated at 680,000 tons in 1975 and 983,000 tons in 2025.

4. Irrigation

Typical East Texas conditions prevail in most of the Sabine River Basin, where generally adequate and evenly distributed rainfall makes irrigation seem unnecessary much of the time. Future increase in irrigation is expected to be from private, non-project type developments. It is not contemplated that there will be project type development in the Basin with irrigation as the primary purpose.

5. Recreation

Existing water bodies are capable of supporting much of the short-range recreational need. Ultimate development of the existing water-oriented areas is expected to support an annual visitation of about 10 million. The plan of development as proposed in the report is expected to satisfy the remaining short-range needs for land and water acreage with the one exception of the southern end of the Basin. It is expected that water-based recreational developments in upstream watersheds would attract a total of at least 91,000 recreation days of use annually. The sediment pools of flood water retarding structures would be satisfactory for recreation use and could be developed as income-producing enterprises. These pools are expected to attract at least 48,000 recreation days of use annually during the first 40 years after installation. General recreational use of the three main stem reservoirs is estimated to reach about 2.5 million visitors annually within 40 years after project construction.

6. Fish and wildlife

a. Reservoirs created by development of the water resources in the Sabine Basin would greatly increase the acreages of fishable water. While important stream fisheries, including both sport fisheries and commercial fisheries for bait minnows, would be lost, important new fisheries would be created. It is anticipated that sport fishing would be increased by about 1.9 million man-days annually. This could be increased to about 2.7 million man-days annually with development of public access to the reservoirs and reservoir tailwaters and provision of funding for reservoir fishery management. Fresh water commercial fish catches would be increased by about 500,000 pounds annually although about 62 million bait minnows would be lost.

b. Works of improvement in the early-action plan would inundate or otherwise destroy about 93,000 acres of wildlife habitat. These losses are estimated as follows: Corps of Engineers works, 65,900 acres; Soil Conservation Service works, 6,200 acres; and non-Federal works, 21,000 acres. Federal and non-Federal works would cause a reduction in the quality of habitat for most wildlife species on about 635,500 acres, including 110,000 acres of the Louisiana coastal marsh adjacent to Sabine Lake.

While hunting would be provided on some project lands, the overall result of Basin development would be to reduce future basinwide hunting opportunities up to about 10 percent beyond 2020. The report states that there would be no practical way to compensate for the loss of wildlife habitat. However, some of the hunting losses could be offset by provision of State-operated public hunting areas and intensified management for wildlife on remaining habitats in the Basin.

7. Vector control

Vector prevention and control measures will be incorporated into the design, construction, and operational phases of the water resources development proposed for the Sabine Basin. Measures to be taken include clearing, varying water level to provide vegetation and mosquito control, and draining borrow-pits and seep areas. Provisions have also been made for continuous surveillance of vectors and routine appraisal of control operations.

Long-Range Plan

In addition to the features included in the short-range plan, the Coordinating Committee included the following proposals in the long-range plan for meeting future needs beyond the next 10 to 15 years:

1. Two main stem multiple-purpose reservoirs--one at River Mile 321.3 for flood control, water supply, recreation, navigation and/or hydroelectric power; and the other at River Mile 101.9 for navigation, hydroelectric power, and recreation.

2. Navigation development above Pruitt Bluff to Longview, Texas.

3. Local flood protection for Orange, Texas.

4. A salt water barrier dam in the vicinity of River Mile 19.4.

5. Further analysis of these projects as needed to assure projects would serve all purposes found desirable to the extent that needs for water and related land resources development are identified.

Effects of the Long-Range Plan

Projects included in the long-range plan would provide additional reduction of flood damages, increase the water supply yield of the Basin to meet estimated needs to year 2075, provide additional navigation from Pruitt Bluff to Longview, Texas, and provide for additional water-oriented outdoor recreation and fish and wildlife enhancement. The inclusion of a salt water barrier is contemplated to prevent salt water intrusion in fresh water intakes for Orange, Texas. It is anticipated that as in- and out-of-Basin water requirements develop to the extent that the projects in the long-range plan are needed, further analysis will be made to assure that the projects would serve all purposes found desirable and justified at that time.

PUBLIC HEARINGS

With initiation of the study, public hearings were held in 1962 in Orange, Texas, and Longview, Texas, to ascertain the views and desires of local interests with respect to improvements in the Basin. In 1967, an informal hearing was held in Orange, Texas, by the Coordinating Committee. On February 28-March 1, 1969, the Subcommittee on Flood Control of the Committee on Public Works, U.S. House of Representatives, held a hearing at Longview, Texas. The general reaction to the proposed projects in the early-action program of the Sabine River Basin Study was favorable and no general public objection has been expressed to the comprehensive plan as a whole.

53-522 O-71—22

WATER RESOURCES COUNCIL VIEWS AND FINDINGS

In the implementation of the Federal and Federally assisted portion of the recommended plan, the following findings of the Water Resources Council should be appropriately considered in further Federal agency program actions or in authorizing documents:

1. Planning objectives

The report presents a group of projects selected to meet the locally recognized short- and long-term water and related land resources development requirements. It also states that the recommended plan is in the best interest of the people of the Basin, the States of Louisiana and Texas, and the Nation. Subsequent authorizing documents and plans, however, should include a further discussion of these relationships and how the recommended plan fulfills both the locally recognized objectives and established national goals for full employment, public health, and environmental qualities.

2. Consideration of alternatives

The comprehensive plan as presented in the report appears to be primarily a compilation of programs developed by the cooperating agencies which are compatible with each other and also are compatible with State programs. The report sets forth a series of structural measures for which each of the agencies investigated alternative sites and alternative scales of development. In implementing the comprehensive plan, it is considered pertinent and necessary that future action programs of the respective agencies, as well as project documents seeking authorization of elements of the plan, consider reasonable alternative and complementary nonstructural programs; the relationship between possible combinations of constructed, under construction, and proposed projects or possible modifications thereof; and the identification and consideration of nonstructural alternatives which might replace, supplement, or complement proposed structural measures. These considerations by States and appropriate Federal agencies should be extended to the physical, economic, and legal relationships necessary to implement such nonstructural measures as may result from this further consideration of alternatives. Future program actions and authorizing reports will indicate the alternatives considered and the rationale for the alternative selected.

3. Evaluation of main stem flood protection projects

The proposed short-term plan of development would cope with the flood problems of the main stem through the retention of excess flood flows in a system of three reservoirs in upper portions of the Basin. In order to

increase the effectiveness of the flood storage in these reservoirs, the plan also includes improvements to increase the in-bank capacities of streams below the reservoirs to permit evacuation of the stored flood water within a reasonable time period. The cost of channel improvements for such purposes properly will be proportioned according to the flood reduction potentials of individual reservoir proposals for the Basin on the basis of estimated flood control benefits on the main stem rather than on the basis of the total all-purpose benefits accruing from multiple-purpose use of reservoir storage.

4. Flood plain management

Estimates of flood damages for future years were projected on the basis of population, value of mineral production, and disposable income. Average annual flood damages on the Sabine River and major tributaries are estimated to double for the analysis period as compared with average annual damages at the 1964 level of development. These future damages should be less if appropriate steps are taken to regulate flood plain use and development.

It is noted that a study of complementary measures for flood plain management was not incorporated in the report. However, assurances have been given that flood plain management will be considered in the authorization report for the local protection project at Greenville, Texas. Also a flood plain information study is currently under way for Orange, Texas. Information has been received indicating that State enabling authority to plan, regulate, restrict, and control the use of flood plains along the main stem of the Sabine River and tributaries is not available at this time. It is recognized that flood plain management has limitations as a method of relieving flood damages to existing developments. It is also recognized that there are instances whereby future development can be guided by appropriate management to avoid exposure to floods. Thus, prior to the construction of flood control storage and channel improvement in both the upstream and downstream areas, reasonable assurances should be obtained from the State or local interests that enabling legislation is available or in the process of being obtained and that flood plain management practices will be implemented in conjunction with the proposed flood protection structures.

5. Wildlife losses

The report indicates that of the 170,000 man-days of hunting that would be lost annually, 159,800 would result from Federal water resource project development by impoundments inundating wildlife areas. The

report further indicates that additional studies during definite planning stages for individual project units should provide for mitigation measures and include estimates of their costs to remedy the loss of these 159,800 man-days of hunting. The Texas Parks and Wildlife Department and the Federal Bureau of Sport Fisheries and Wildlife have been seeking means and measures for mitigating these losses through acquisition, development, and management of suitable lands within the Sabine River Basin. The costs of appropriate mitigation measures should be considered costs of the related project and any losses not mitigated should be evaluated and subtracted from the benefits attributable to the project. These determinations will precede any report to Congress recommending authorization of projects which will result in the loss of hunting opportunities.

6. Construction sequence

It appears that the timing involved and the sequence of construction of projects for flood control on the main stem are sufficiently flexible to permit a study of flood plain management and not inhibit an orderly implementation program. Thus, with the approval of the comprehensive plan, consideration should be given in the authorization reports to the phasing of construction of the 3 dams and the channel. Also while engineering studies and construction of these dams are under way, the sizing of the channel below the dams can be reviewed in light of the results of flood plain management studies. Further review of the timing and storage uses of the Big Sandy reservoir can be made with the flood plain management possibility in mind. It is noted that the Texas Water Plan supports this concept in that it states that "These reservoirs (Lake Fork, Mineola, and Big Sandy) would provide essential flood control, supply additional water for future in-basin needs and recreation, and furnish approximately 200,000 acre-feet of surplus water annually for export through the Texas Water System . . . Big Sandy Reservoir would be built at the appropriate time to supply intra-basin needs and flood control after the yields of Mineola and Lake Fork Reservoirs are fully utilized."

Subsequent authorizing documents for these three reservoirs should consider and report on the effects of these reservoirs on power generation, water supply, and fish and wildlife features at Toledo Bend Reservoir.

7. Estuarine and coastal marsh areas

The streamflows of both the Sabine and Neches Rivers have an effect on the estuarine and coastal marsh areas. It appears that neither the

proposed Sabine River developments in the early-action plan or contemplated developments on the Neches River would adversely affect these areas. If any change in the plan occurs that may significantly reduce the streamflow, the effect on the estuarine and coastal marsh areas must be considered.

8. Changing criteria and other factors

During the conduct of this study, criteria to be used in the planning process changed considerably. Several other factors may also affect the plan. Examples are establishment of water quality standards, increased emphasis on flood plain management and pollution control, the recent increase in the discount rate and issuance by the Water Resources Council of economic projections for use in water and related land resource development planning. It will also be necessary to consider any effect the East New Mexico-West Texas Diversion Study may have on this plan. These new criteria and factors will be considered in the preparation of the agency authorizing documents and by the Water Resources Council in its review of the documents.

WATER RESOURCES COUNCIL RECOMMENDATIONS

The summary report adequately records the coordinated Federal-State effort in identifying existing problems and needs and providing estimates of future needs for further development of the water and related land resources of the Basin, based on projections of the trends of economic development. The report has further identified a plan of water control structures which is expected to provide for these needs and presents recommendations relative to the use of the plan as a flexible guide for the development and use of the water and related land resources of the Basin. The summary report and appendices are adequate to serve as supporting documents for the various agency authorizing reports.

In view of the existing problems and needs and the estimate of future needs for development of water and related land resources of the Sabine River Basin, as identified in the Sabine River Basin Report, the Water Resources Council recommends that:

1. The report be accepted as a basis for developing authorizing report proposals of the various Federal agencies for implementing a comprehensive basin plan;

2. Subsequent reports requesting authorization of Federal projects and subsequent Federal programs to be undertaken in implementation of the comprehensive plan specifically include consideration of all applicable points included in the Water Resources Council views and findings;

3. The States of Texas and Louisiana enact legislation that would enable local government entities to provide effective flood plain management to complement the proposed flood control storage and take appropriate legislative and other action utilizing available Federal assistance to implement those portions of the comprehensive plan considered to be a non-Federal responsibility; and

4. In future planning in the Basin, features of the comprehensive plan be reviewed and updated to the extent appropriate in connection with the specific planning effort and the comprehensive plan be reviewed and updated after a reasonable period.