

Chocolate Bayou, Texas

CHOCOLATE BAYOU, TEXAS

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED MARCH 29, 1965, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND AN ILLUSTRATION, ON A REVIEW OF THE REPORT ON CHOCOLATE BAYOU, TEXAS, REQUESTED BY RESOLUTIONS OF THE COMMITTEES ON PUBLIC WORKS, UNITED STATES SENATE AND HOUSE OF REPRESENTATIVES, ADOPTED JUNE 30, 1960

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JUNE 23, 1965.—Referred to the Committee on Public Works and ordered to be printed with one illustration

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to provide a copy of all
available records regarding

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LETTER OF TRANSMITTAL



DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C.

IN REPLY REFER TO:

June 17, 1965

Honorable John W. McCormack
Speaker of the House of Representatives

Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 29 March 1965, from the Chief of Engineers, Department of the Army, together with accompanying papers and an illustration, on a review of the report on Chocolate Bayou, Texas, requested by resolutions of the Committees on Public Works, United States Senate and House of Representatives, adopted 30 June 1960.

The views of the Governor of Texas, the Departments of the Interior, Agriculture and Commerce, and the Public Health Service are set forth in the inclosed communications.

With respect to local cooperation requirements in the recommended plan, the Bureau of the Budget noted that the Corps of Engineers normally recommends against Federal participation in any harbor project that would at the onset serve but a single shipper, unless it appears that it will be used by other shippers within a reasonable period of time, and even then generally recommends that the initial single user assume a substantial share of the construction cost on the grounds that he will receive a "special" benefit. The Bureau believes this is a sound policy and that it is necessary to insure that expenditure of Federal funds for the expansion of navigation facilities provides relatively broad benefits to the public. Further, the Bureau believes that single-user projects, almost by definition, fail to meet that criterion.

Also, the Bureau of the Budget noted that the report assumes there will be multiple-users of the proposed improvements in the future, and based on anticipated growth projections, indicated that this seems a reasonable assumption. The Bureau observed that the lower reach would initially benefit only the Monsanto Chemical Company and the upper reach, at least initially, benefit only the Matagorda Shell Company, without a clear indication just how soon additional shippers would benefit from the modified channel.

Under these circumstances the Bureau of the Budget expects that prior to the expenditure of Federal construction funds the probability of multiple-users within a reasonable period of time should be reassessed and confirmed by the Secretary of the Army. Further, if either reach of the project is to benefit initially only a single shipper, the Bureau believes that, in addition to the conditions of local cooperation recommended by the Chief of Engineers, and in accord with established policy, some provision for special cost sharing should be required. A reasonable basis of such special sharing would be payment by local interests, annually until such time as multiple use of the channel actually occurs, of 50 percent of the annual charge for interest and amortization of the Federal first cost of the facilities involved. The Bureau considers that if such cost sharing is not provided, construction of the channel and barrier should not commence until there is convincing evidence that there will be additional users in the reach to be constructed by the time construction is completed.

I concur in general with the views of the Bureau of the Budget on the single-beneficiary question presented by this report and therefore recommend that the authorization, in addition to the conditions recommended by the Chief of Engineers, require a finding by the Secretary of the Army as to appropriate single-beneficiary contributions, if any, prior to appropriation of construction funds.

Also, the Bureau of the Budget comments on the enhancement benefits from the proposed salt water barrier, and in view of the lack of sufficient data to identify specific incremental damages, concurs in the cost-sharing recommendation presented in the report.

Subject to consideration of the foregoing recommendations the Bureau of the Budget has no objection to submission of the 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 project modification, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation. A copy of the letter from the Bureau of the Budget is inclosed.

Sincerely yours,


STEPHEN AILES
Secretary of the Army

1 Incl
Report

COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT

BUREAU OF THE BUDGET

WASHINGTON, D.C. 20503

June 8, 1965

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

Dear Mr. Secretary:

Mr. Alfred B. Fitt's letter of February 5, 1965, submitted the favorable report of the Chief of Engineers on Chocolate Bayou, Texas, requested by resolutions of the Committees on Public Works, United States Senate and House of Representatives, adopted June 30, 1960.

Subject to certain standard conditions of local cooperation, the Chief of Engineers recommends modification of the existing Federal navigation project to provide (1) a 12' x 125' channel from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project mile 8.2 and, thence (2) a 9' x 100' channel to a 9' x 600' square turning basin near mile 13.2, and (3) a salt water barrier about 3.7 miles above the turning basin.

The favorable benefit-cost ratio indicates that the project would be a feasible undertaking. But, with respect to local cooperation requirements, we understand that the Corps of Engineers normally recommends against Federal participation in any harbor project that would at the outset serve but a single shipper, unless it appears that it will be used by other shippers within a reasonable period of time; and even then generally recommends that the initial single user assume a substantial share of the construction cost on the grounds that he will receive a "special" benefit. This seems to us to be a sound policy which should generally guide the Corps of Engineers in its recommendations for local cost sharing. We believe it is necessary to insure that expenditure of Federal funds for the expansion of navigation facilities provides relatively broad benefits to the public. Single-user projects, almost by definition, fail to meet that criterion.

The report assumes that there will be multiple-users of the proposed improvements in the future. From the anticipated growth projections this seems a reasonable assumption. However, it appears that the lower reach would initially benefit only the Monsanto Chemical Company and the upper reach would, at least initially, benefit only the Matagorda Shell Company. It is unclear just how soon additional shippers would benefit from the modified channel.

Given these circumstances, if the Chocolate Bayou project is authorized by the Congress, the Bureau of the Budget would expect that, prior to the expenditure of Federal construction funds, the probability of multiple-users within a reasonable period of time should be reassessed and confirmed by the Secretary of the Army. Further, if either reach of the project is to benefit initially only a single shipper, the Bureau of the Budget believes that, in addition to the conditions of local cooperation recommended by the Chief of Engineers, and, in accord with established policy, some provision for special cost sharing should be required. A reasonable basis of such special sharing would be payment by local interests annually, until such time as multiple use of the channel actually occurs, of 50 percent of the annual charge for interest and amortization of the Federal first cost of the facilities involved.

We consider that if such cost sharing is not provided, construction of the channel and barrier should not commence until there is convincing evidence that there will be additional users in the reach to be constructed by the time construction is completed.

We note that the proposed salt water barrier would mitigate all damages from increased intrusion of salt water into the fresh water irrigation supply of Chocolate Bayou that otherwise would result from the construction of this project modification. Further, it would eliminate all existing damages, including those resulting from construction of the locally dredged navigation channel.

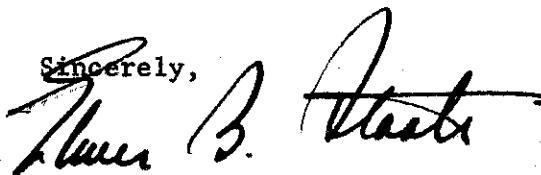
By virtually eliminating all current intrusion, it would develop enhancement benefits estimated to be equivalent to the total annual charges for the barrier. We note, further, that the District Engineers' report states that the costs of this facility should be apportioned equitably between Federal and non-Federal interests. In the absence of sufficient data for a determination of the damages incurred from each incremental improvement the Chief of Engineers considers it equitable, in this instance, for the Federal Government to bear the first cost of construction of the barrier and for local interests to bear all costs of lands, easements, rights-of-way and relocations, and to assume all costs and obligations of ownership, operation and maintenance upon its completion.

Such a division of responsibility results in a fifty-fifty distribution of annual costs over the estimated life of the project. In view of the lack of sufficient data to identify specific incremental damages, we concur in this recommendation.

You are advised that the Bureau of the Budget, subject to consideration of the recommendations made in this letter, would have no objection to the submission of the 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 modification, 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,

A handwritten signature in cursive script, appearing to read "Elmer B. Staats". The signature is written in dark ink and is positioned to the right of the word "Sincerely,".

ELMER B. STAATS
Deputy Director

COMMENTS OF THE GOVERNOR OF TEXAS



EXECUTIVE DEPARTMENT
AUSTIN 11, TEXAS

JOHN CONNALLY
GOVERNOR

September 16, 1964

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

Dear General Wilson:

This is in regard to the "Review of Reports on Chocolate Bayou, Texas" prepared by the Corps of Engineers, Department of the Army. I have requested this Report to be reviewed for me by the Texas Water Commission and the Parks and Wildlife Department. For additional information, I am enclosing copies of their comments and recommendations for the record.

The Texas Water Commission recommends approval and further recommends Congress of the United States take action to expedite authorization and appropriate funds for this project. The Parks and Wildlife Department recommendations concur with Exhibit I of the Appendix III as follows:

1. That all cutoff and tributary channels of Chocolate Bayou be kept open and that spoil be prevented from entering them.
2. That spoil placement from future maintenance dredging operations be confined to those areas established during dredging under Public Notice W-N-243-41, Permit 4817 for the portion south of the Monsanto Chemical Company plant and to areas as proposed on the map accompanying Mr. Heagy's letter of January 4, 1963, for the portion north of the Chemical plant.

Based upon the Commission's and Department's recommendations and reservations as noted in their letters attached, I hereby approve the Report on Chocolate Bayou on behalf of the State of Texas.

Sincerely,

A large, stylized handwritten signature in black ink that reads "John Connally".
John Connally

PARKS AND WILDLIFE DEPARTMENT

COMMISSIONERS

WILL E. ODOM

CHAIRMAN, AUSTIN

A. W. MOURSUND

MEMBER, JOHNSON CITY

JAMES M. DELLINGER

MEMBER, CORPUS CHRISTI



WELDON WATSON
EXECUTIVE DIRECTOR

JOHN H. REAGAN BUILDING
AUSTIN, TEXAS 78701

August 18, 1964

The Honorable John Connally
Governor of Texas
Capitol Station
Austin, Texas

Dear Governor Connally:

Reference is made to your letter of July 21, 1964, to which was attached for review the U. S. Army Corps of Engineer's report on Chocolate Bayou, Texas.

The Texas Parks and Wildlife Department has participated in the preparation of a joint report on this project with the Bureau of Sports Fisheries and Wildlife, U. S. Fish and Wildlife Service, Department of the Interior. The results of this cooperative effort appear in the Chocolate Bayou report as Exhibit I of Appendix III. Recommendations included are as follows:

1. That all cutoff and tributary channels of Chocolate Bayou be kept open and that spoil be prevented from entering them.

2. That spoil placement from future maintenance dredging operations be confined to those areas established during dredging under Public Notice W-N-243-41, Permit 4817 for the portion south of the Monsanto Chemical Company plant and to areas as proposed on the map accompanying Mr. Heagy's letter of January 4, 1963, for the portion north of the Monsanto Chemical Company plant.

If these recommendations are followed, it is our opinion that no detrimental effects on the valuable fish and wildlife resources of the project area will result.

Sincerely yours,

J. Weldon Watson

JWW:EAW:vl

Enclosure - Bound Report fr Lt Gen W. K. Wilson, Jr., CE,
Subj: Chocolate, Bayou, Texas, dtd 6/19/64-3/24/64

TEXAS WATER COMMISSION



AN ORDER approving the feasibility
of the Chocolate Bay and Chocolate
Bayou Navigation Project proposed
in a U. S. Corps of Engineers Report.

BE IT ORDERED BY THE TEXAS WATER COMMISSION:

Section 1. Statement of Authority. Article 7472e, Vernon's Annotated Civil Statutes, provides that upon receipt of any engineering report submitted by a Federal Agency seeking the Governor's approval of a Federal Project, the Texas Water Commission shall study and make recommendations to the Governor as to the feasibility of the Federal Project. The Commission shall cause a public hearing to be held to receive the views of persons or groups who might be affected should the Federal Project be initiated and completed.

Section 2. Statement of Jurisdiction. (a) The Honorable John Connally has requested that the Texas Water Commission review the report of the Corps of Engineers, U. S. Army, entitled "Review of Reports on Chocolate Bayou, Texas" and to enter its order finding the project recommended therein to be feasible or not feasible. (b) In accordance with Article 7472e, and after due notice by publication, the Commission caused a public hearing to be held on August 26, 1964, at 10:00 o'clock a.m., in the offices of the Texas Water Commission, 201 East 14th Street, Austin, Texas, on said report, at which time

all those interested or who may be affected should the project recommended in said report be initiated and completed were requested to come forward and give testimony.

Section 3. After fully considering all the evidence presented by persons and groups who may be affected should the project be initiated and completed, including the matters set forth in Section 4 of Article 7472e, the assurance of financial participation in the project by local interests, and the recommendations by the Chief Engineer of the Texas Water Commission, the Texas Water Commission finds that the project is feasible and the public interest will be served thereby.

Section 4. The Commission recommends:

(1) That the proposed project as recommended in said report by the U. S. Corps of Engineers relating to navigation in Chocolate Bay and Chocolate Bayou, a salt water barrier in Chocolate Bayou and an access park with recreational facilities along Chocolate Bayou be approved;

(2) That the Congress of the United States take action as expeditiously as possible to authorize and fund this urgently needed project to protect existing and future facilities in this important and rapidly developing area;

(3) That ownership by the State of Texas of the waters involved be fully recognized by all interested parties and that lawful rights to the use of such waters, vested pursuant to State law, be respected, protected and preserved.

Section 5. It is further ordered that a certified copy of this order be transmitted to the Governor.

Section 6. This order shall take effect on the 26th day of August, 1964, the date of its passage, and it is so ordered.

SIGNED IN THE PRESENCE OF THE
TEXAS WATER COMMISSION

ATTEST:

/s/ Audrey Strandtman
Audrey Strandtman, Secretary

/s/ Joe D. Carter
Joe D. Carter, Chairman

STATE OF TEXAS §
§
COUNTY OF TRAVIS §

I, Audrey Strandtman, Secretary of the Texas Water 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 Commission, this the 1st day of September, A. D., 1964.

Audrey Strandtman
Audrey Strandtman, Secretary

COMMENTS OF THE DEPARTMENT OF THE INTERIOR



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

September 25, 1964

Dear General Wilson:

This is in reply to your letter of June 19, 1964, requesting our views on a review of the report on Chocolate Bayou, Texas.

The Bureau of Sport Fisheries and Wildlife advises that the proposed navigation improvements for Chocolate Bayou, Texas, would not significantly affect fish and wildlife resources if spoil disposal areas used in conjunction with project construction and maintenance are judiciously selected.

The Department recommends that your report be modified to provide for the selection of spoil disposal areas by the Corps of Engineers in cooperation with the Bureau of Sport Fisheries and Wildlife and Texas Parks and Wildlife Department.

If this project is approved, an archeological survey of the construction zone will be necessary. It is unlikely that sites on the line of the existing channel will be affected, but if any areas are developed for recreation, the work may impinge upon shell mounds or other sites. The Regional Director, Southwest Regional Office, National Park Service, P. O. Box 1728, Santa Fe, New Mexico 87501, should be kept advised as to the progress on the project in order to program and initiate such surveys, salvage, and preservation of historic and archeological evidence as may exist, in accordance with provisions of the Act of June 27, 1960 (74 Stat. 220).

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

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Kenneth Holum", is written over a horizontal line.

KENNETH HOLUM
Assistant Secretary of the Interior

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

COMMENTS OF THE DEPARTMENT OF AGRICULTURE



DEPARTMENT OF AGRICULTURE
WASHINGTON 25, D.C.

September 21, 1964

Honorable Stephen Ailes
Secretary of the Army

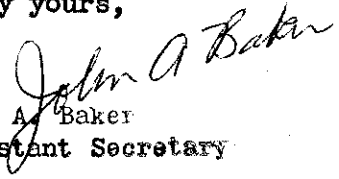
Dear Mr. Secretary:

This is in reply to the Chief of Engineers' letter of June 19, 1964, transmitting for our review and comment his proposed review report on Chocolate Bayou, Texas.

The report concerns the advisability of navigation improvements on Chocolate Bayou, Texas. Since the proposed improvements would not affect projects or programs of the Department of Agriculture, this Department has no comments to offer.

Thank you for providing this report for our review.

Sincerely yours,


John A. Baker
Assistant Secretary

COMMENTS OF THE DEPARTMENT OF COMMERCE



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

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

December 28, 1964

Dear General Wilson:

On June 19, 1964 you transmitted for our information and comment copies of your proposed report, along with the reports of the Board of Engineers for Rivers and Harbors, and of the District and Division Engineers, concerning the advisability of navigation improvements on Chocolate Bayou, Texas, with particular reference to increased channel dimensions and extension of the channel upstream from an existing connection with the Gulf and Intracoastal Waterway.

You recommend modification of the existing Federal navigation project to provide a channel 12 feet deep and 125 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin 9 feet deep and 600 feet square near channel mile 13.2; a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin; and an access park with minimum recreational facilities in the improved reach. Estimated cost of the proposed modifications is \$1,675,000; \$1,319,000 would be Federal construction cost, and \$356,000 would be the non-Federal cost for lands, damages, and relocations. The benefit-cost ratio is 3.2. Construction of the improvements would be subject to certain conditions of local cooperation. You further recommend that the Chocolate Bayou project be incorporated into the Gulf Intracoastal Waterway project and discontinued as a separate project.

The report indicates that the area considered commercially tributary to the improvements under investigation is that portion of Brazoria County lying east of Bastrop Bayou and extending 25 miles inland from the coast and a small area in southwestern Galveston County. The only cities of consequence in the area are Alvin and Angleton, with populations in 1960 of 5,643 and 7,312, respectively. The unincorporated community of Liverpool, at the head of the proposed navigation improvement on Chocolate Bayou, has a population of about 100. In general, there is little development in the low marshy area within 10 miles of the coast. Farther inland, farming, cattle raising, the production of crude oil, and sulphur mining have constituted the important industries until recent times. In 1962, the Monsanto Chemical Company constructed a multi-million dollar chemical manufacturing plant on the east bank of Chocolate Bayou. There are definite indications that a major chemical industrial complex will develop in the vicinity of the initial plant. Prior to construction of the Monsanto Chemical Company plant, the only commerce on Chocolate Bayou was seashells. Commerce in this commodity increased from 120,163 tons in 1953

to 242,800 tons in 1962. During the last seven months of 1962, the first petroleum and chemical movements in the amount of 298,000 tons were reported. The total commerce for the waterway in 1962 was 570,950 tons.

The economic base study for this report used the least squares projection method on data available through the year 1960, for the area including both Brazoria County and the Texas City complex, to which the new industrial operations on Chocolate Bayou are linked.

There is therefore some question as to the "conservative" nature of this economic estimate, since the base data include the period of most rapid growth for the Texas City area.

A pipeline connection already exists between the new industry on the Chocolate Bayou and the Texas City complex, and it is noted that the general economic future of the area is more closely tied to the east than to existing deep-water facilities at Freeport.

It appears obvious that increased land transportation will be developed to serve the needs of the area; but until this is done, the proposed project should benefit the area by fostering its economic development.

The economic analysis, predicated upon a 50-year projection, shows that it appears reasonable to defer more extensive development of the upper reaches of the Chocolate Bayou until more diversified industrial needs become apparent.

It is unfortunate that more complete data on future economic development could not be specifically developed, but this area has not come within the program scope of the Area Redevelopment Administration under either the Area Redevelopment Act or the Accelerated Public Works Program. On the other hand, this in itself is indicative of the present condition and future prospects of the area. It is also unfortunate that the water needs of the agricultural interests in the area conflict with the improvement of the Bayou for commercial and recreational uses; but the additional cost of the proposed salt barrier is minimal in comparison to the commercial benefits identified.

Thus, while the projected base study data do not appear to be as conservative as reported, the advantages to the area from the standpoint of economic development, and the natural association with and proposed incorporation of the project into existing development of the Gulf and Intracoastal Waterway appear to be decisive factors.

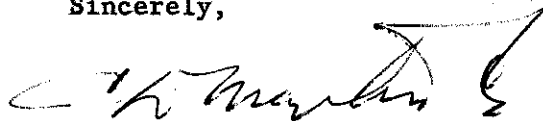
The navigation improvements considered in this report would not be incompatible with the hurricane-flood protection project for the area if found justified by the later studies. Part of the area is covered by Coast and Geodetic Charts Nos. 87 and 1282. Completion of the extensive improvements proposed in the report for navigation and recreation will

create a requirement for additional charts and revision of existing charts. Accordingly, the cost of such charting should be included in the project cost, and advance notice of the charting requirements is requested by the Coast and Geodetic Survey in order that cost estimates may be submitted.

Since the proposed improvement would most directly benefit the Monsanto Chemical Corporation and prior work by the Corporation undertaken on its own initiative has already made possible the extensive use of barge transport in connection with its operations on the Chocolate Bayou, it is only reasonable that the Corporation be expected to assume the costs it has expended to date in improving the waterway, and to further agree to provide at its expense suitable terminal and transfer facilities at its Chocolate Bayou property, including turning basins when required. Other local cooperation provided for by the project proposal appears beneficial to all parties, and advantageous to the development of this area.

We appreciate the opportunity to comment on this report.

Sincerely,



Clarence D. Martin, Jr.

COMMENTS OF THE PUBLIC HEALTH SERVICE



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

BUREAU OF STATE SERVICES

REFER TO:

September 2, 1964

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

Dear General Wilson:

This is in reply to your letter of June 19, 1964, requesting comments on the Survey Report on Chocolate Bayou, Texas.

Inclusion of a salt water control barrier is considered a desirable feature in the protection of the water resources in this area.

In connection with the proposed recreational facilities, it is recommended that care be exercised in construction of refuse and sanitary waste disposal facilities to provide adequate safeguards against vector and rodent production. It is further recommended that routine sampling of the public water supply be conducted to assure that contamination is not present. Close cooperation such as is normally maintained between the Corps of Engineers and the Texas State Department of Health will assure that these recommendations are carried out.

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

Sincerely yours,

A handwritten signature in cursive script that reads "Keith S. Krause".

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

CHOCOLATE BAYOU, TEXAS

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY



IN REPLY REFER TO

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

ENGCW-PD

29 March 1965

SUBJECT: Chocolate Bayou, Texas

TO: THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers, in response to resolutions of the Committees on Public Works of the United States Senate and House of Representatives, United States, adopted 30 June 1960, concerning the advisability of navigation improvements on Chocolate Bayou, Texas, with particular reference to increased channel dimensions and extension of the channel upstream.

2. The District and Division Engineers recommend modification of the existing Federal navigation project to provide a channel 12 feet deep and 125 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin 9 feet deep and 600 feet square near channel mile 13.2; a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin; and an access park with minimum recreational facilities in the improved reach. They estimate the cost of the proposed modifications at \$1,675,000, of which \$1,319,000 would be Federal for construction and \$356,000 would be the non-Federal cost for lands, damages, and relocations. The benefit-cost ratio is 3.2. They further recommend that the Chocolate Bayou project be incorporated into the Gulf Intracoastal Waterway project and discontinued as a separate project. Construction of the improvements would be subject to certain conditions of local cooperation.

3. The Board concurs in general in the findings of the reporting officers, but considers that Federal participation in the proposed recreational facilities should be limited to provision of a boat-launching ramp, and that local interests should provide the lands, access roads, parking areas, and necessary adjacent facilities for the ramp. The Board accordingly recommends the proposed work generally in accordance with the plan of the District Engineer, at an estimated

cost to the United States of \$1,257,000 for new work and \$15,000 annually for maintenance in addition to that now required, subject to specified requirements of local cooperation.

4. I concur generally with the recommendations of the Board with respect to the channel improvement and the salt water barrier. I am cognizant of the need for assuring public access to water areas created or enhanced by Federal works. I note, however, that the facility proposed as the Federal responsibility to provide access to Chocolate Bayou, a boat launching ramp, is not dependent upon the proposed navigation channel improvement for feasibility. I therefore consider that provision of the boat launching ramp should not be included as part of the proposed improvement.

5. The estimated cost of constructing the channel improvement and salt water barrier is \$1,605,000 of which \$1,254,000 is Federal and \$351,000 is non-Federal for lands, damages, and relocations. The annual charges are estimated at \$77,000 and the annual benefits \$259,000, without recreation. The benefit-cost ratio is 3.4. Use of the recently prescribed interest rate of 3-1/8 percent in computing annual charges and benefits would result in no appreciable change in the benefit-cost ratio.

6. Therefore, I recommend that the existing project for Chocolate Bayou, Texas, be deauthorized and, in lieu thereof, that the existing project for the Gulf Intracoastal Waterway be modified to provide for a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin 9 feet deep by 600 feet square near project mile 13.2; and a salt water barrier near mile 16.9; 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, at an estimated cost to the United States of \$1,254,000 for new work, and an annual cost for maintenance of \$15,000 in addition to that now required: Provided that, prior to construction, local interests agree to:

a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the improvements 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 costs of such retaining works;

b. Hold and save the United States free from damages due to the construction and maintenance of the improvements;

c. Provide and maintain at local expense adequate public terminal and transfer facilities open to all on equal terms;

d. Accomplish without cost to the United States all alterations of pipelines, powerlines, utility lines, cables, and highway facilities, when and as required for construction of the project;

e. Assume all obligations of ownership, operation, and maintenance of the salt water barrier and appurtenances upon its completion.



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

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS



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

ENGBR

24 March 1964

SUBJECT: Chocolate Bayou, Texas

TO: Chief of Engineers
Department of the Army

1. Authority.--This report is in response to the following resolutions adopted 30 June 1960:

Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 12, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on Chocolate Bayou, Texas, published as House Document Numbered 768, Eightieth Congress, second session, with a view to determining whether the existing project should be modified in any way at the present time, with particular reference to increased channel dimensions and extension of the channel upstream.

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 report of the Chief of Engineers on Chocolate Bayou, Texas, contained in House Document No. 768, Eightieth Congress, Second Session, and prior reports with a view to determining if the existing project should be modified in any way at this time, particularly with regard to increased channel dimensions and extension of the channel upstream.

2. Description.--Chocolate Bayou is in southeastern Texas, between the Brazos River and Galveston Bay. The bayou rises about 20 miles southwest of Houston, Texas, flows southeasterly across Brazoria County and empties into Chocolate Bay. The Gulf Intracoastal Waterway, 12 feet deep and 125 feet wide, crosses Chocolate Bay about 26 miles west of Galveston, Texas, and 17 miles east of Freeport, Texas. The authorized Chocolate Bayou project provides for a channel 4 feet deep and 100 feet wide extending from the Gulf Intracoastal Waterway

through Chocolate Bay to the 4-foot depth in Chocolate Bayou. In 1962, the Monsanto Chemical Company dredged a channel 10 feet deep and 100 feet wide from the Gulf Intracoastal Waterway 8.2 miles to a basin at their new plant on Chocolate Bayou.

3. Tributary area and commerce.--The area considered commercially tributary to the improvements under investigation is that portion of Brazoria County lying east of Bastrop Bayou and extending 25 miles inland from the coast, and a small area in southwestern Galveston County. The only cities of consequence in the area are Alvin and Angleton, with populations in 1960 of 5,643 and 7,312, respectively. The unincorporated community of Liverpool, at the head of the proposed navigation improvement on Chocolate Bayou, has a population of about 100. In general, there is little development in the low marshy area within 10 miles of the coast. Farther inland, farming, cattle raising, the production of crude oil, and sulphur mining have constituted the important industries until recent times. In 1962, the Monsanto Chemical Company constructed a multi-million dollar chemical manufacturing plant on the east bank of Chocolate Bayou. There are definite indications that a major chemical industrial complex will develop in the vicinity of the initial plant. Prior to construction of the Monsanto Chemical Company plant, the only commerce on Chocolate Bayou was seashells. Commerce in this commodity increased from 120,163 tons in 1953 to 242,800 tons in 1962. During the last seven months of 1962, the first petroleum and chemical movements in the amount of 298,000 tons were reported. The total commerce for the waterway in 1962 was 570,950 tons.

4. Improvements desired.--The navigation improvements desired by local interests include enlargement of the existing locally dredged channel and extension as necessary to afford the Chocolate Bayou area the same accommodations for barge service as are available on the Gulf Intracoastal Waterway. Local interests also requested that the Federal Government assume maintenance of the locally dredged 10-foot by 100-foot channel from the Gulf Intracoastal Waterway to the Monsanto Chemical Company basin.

5. The Texas Water Commission and representatives of rice-growing interests suggested that a salt water intrusion study be made a part of the overall Chocolate Bayou investigation and, if necessary, that a salt water gate be included as a feature of the project. The Commission also requested that hurricane protection measures be considered.

6. Although no specific request was made at the public hearing for reimbursement of funds expended by the Monsanto Chemical Company in dredging the 10-foot by 100-foot local channel, statements by several

individuals supporting requests for additional improvements indicated that the company desired reimbursement of its expenditures and expressed support of this desire.

7. Plan of improvement.--The District Engineer finds that delays to existing barge traffic and hazards to navigation would be reduced by channel improvements, and that further transportation savings would accrue to prospective future commerce. He believes that any additional improvement of the channel for navigation must include a salt water barrier to mitigate damages from salt water intrusion. He also finds that there are no public recreation or access areas along the bayou and that the surrounding area does not have an adequate number of suitable facilities of this nature. He further finds that Chocolate Bayou is functioning as an important tributary of the Gulf Intracoastal Waterway and should be incorporated as a part of that project. After careful consideration of the desire for reimbursement of the Monsanto Chemical Company's expenditure for channel dredging, the District Engineer believes that such reimbursement would be contrary to current Federal policies. With respect to the desire for hurricane protection measures, the District Engineer reports that the Chocolate Bayou area will be considered for protection along with the remainder of the Texas coast; and that the navigation improvements considered in this report would not be incompatible with the hurricane-flood protection project for the area if found justified by the later studies.

8. Accordingly, the District Engineer proposes a plan of improvement to provide a channel 12 feet deep and 125 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin 9 feet deep and 600 feet square near channel mile 13.2; a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin; and an access park with minimum recreational facilities in the improved reach.

9. Costs and justification.--Based on January 1964 prices, the District Engineer estimates the first cost of the proposed improvements at \$1,675,000, of which \$1,319,000 would be Federal (excluding \$28,000 for preauthorization studies) and \$356,000 would be non-Federal for lands, damages, and relocations. The annual charges are estimated at \$87,000 including \$13,000 for non-Federal operation and maintenance. He estimates the average annual benefits at \$278,000 consisting of \$73,000 for savings in the transportation of seashells, \$147,000 for savings in the transportation of petroleum and chemicals, \$30,000 for reductions in hazards to navigation, \$19,000 for recreational benefits, and \$9,000 for the prevention of damages from salt water intrusion.

The benefit-cost ratio is 3.2, based on a 50-year period of analysis. The District Engineer recommends the improvements in accordance with his plan, subject to certain conditions of local cooperation. He further recommends that the Chocolate Bayou project be incorporated into the Gulf Intracoastal Waterway project and discontinued as a separate project. The Division Engineer concurs.

10. Public notice.--The Division Engineer issued a public notice stating the recommendations of the reporting officers and affording interested parties an opportunity to present additional information to the Board. Careful consideration has been given to the communications received. These include a request from the Monsanto Chemical Company for reimbursement of expenditures in the amount of \$564,200 for dredging the Chocolate Bayou channel. The company states that it is otherwise in accord with the proposals of the District Engineer and that consideration of its request for reimbursement should be without prejudice to consideration and approval of the other recommendations of the District Engineer.

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

11. Views.--The Board of Engineers for Rivers and Harbors concurs in general in the views and recommendations of the reporting officers. The improvements proposed by the District Engineer are economically justified and the requirements of local cooperation are appropriate, except as modified herein.

12. The Board is cognizant of the need for assuring public access to water areas created or enhanced by Federal works. It believes, however, that for navigation improvements of the nature proposed by the reporting officers, the recreational facilities to be provided by the Federal Government should be limited to those which bear a functional relationship to the project. Therefore, the Board considers that Federal participation in the recreation facilities proposed by the District Engineer should be limited to provision of the boat-launching ramp, and that local interests should provide the lands, access roads, parking areas, and necessary adjacent facilities for the ramp. This change reduces the estimated Federal first cost of the project from \$1,319,000 to \$1,257,000, based on supplemental cost estimates furnished by the reporting officers.

13. The Board has considered carefully the request of the Monsanto Chemical Company for reimbursement of expenditures made in improving Chocolate Bayou for navigation. However, the Board notes that it has been an accepted and long-standing policy that work accomplished or

undertaken with local funds should not, at a later date, be incorporated in a Federal project with provision for reimbursement of local expenditures. States and local interests have undertaken many public works similar to Federal projects or later incorporated in Federal improvements recommended for authorization. In each case, local interests proceeded on the assumption that their immediate gain would outweigh their cost. The Board considers that Federal projects of this type should be reviewed and authorized by the Congress before funds are committed for construction and that reimbursement should not be recommended for work undertaken by local interests prior to such authorization.

14. Recommendations.--Accordingly, the Board recommends that the existing project for Chocolate Bayou, Texas, be deauthorized and, in lieu thereof, that the existing project for the Gulf Intracoastal Waterway be modified to provide for a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin 9 feet deep by 600 feet square near project mile 13.2; a salt water barrier near mile 16.9; and a boat-launching ramp; 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, at an estimated cost to the United States of \$1,257,000 for new work, and an annual cost for maintenance of \$15,000 in addition to that now required: Provided that, prior to construction, local interests agree to:

a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the improvements 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 costs of such retaining works;

b. Hold and save the United States free from damages due to the construction and maintenance of the improvements;

c. Provide and maintain at local expense adequate public terminal and transfer facilities open to all on equal terms;

d. Accomplish without cost to the United States all alterations of pipelines, powerlines, utility lines, cables, and highway facilities, when and as required for construction of the project;

e. Assume all obligations of ownership, operation, and maintenance of the salt water barrier and appurtenances upon its completion; and

f. Assume all obligations of ownership, operation, and maintenance of the boat-launching ramp upon completion, and provide adequate access and parking areas to assure full public use;

And provided further, that construction of the boat-launching ramp should be concurrent with or subsequent to, and be independent of, construction of other project features when funds for that purpose are available and the prescribed local cooperation therefor has been furnished.

FOR THE BOARD:

A handwritten signature in cursive script, appearing to read "R. G. MacDONNELL".

R. G. MacDONNELL
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

REVIEW OF REPORTS ON CHOCOLATE BAYOU, TEXAS

SYLLABUS

This report comprises the results of an investigation to determine the advisability of modifying the authorized navigation project for Chocolate Bayou, Texas. It was found that:

- a. Modification of the existing project to provide for a 12-foot waterway between the Gulf Intracoastal Waterway main channel and project channel mile 8.2, for a 9-foot waterway thence to project channel mile 13.2, for a salt water barrier, and for an access park is justified. Navigation benefits would result from savings in the transportation of petroleum, chemicals and seashells and in a reduction in the hazards of navigation. The proposed improvements are justified with a benefits to cost ratio of 3.2.
- b. Extension of the channel upstream above project channel mile 13.2 is not warranted at this time.

Accordingly, it is recommended that the existing project for Chocolate Bayou, Texas, be modified to provide for a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; for a channel 9 feet deep and 100 feet wide thence to a turning basin with 9-foot depth in the vicinity of project channel mile 13.2; for a salt water barrier in the vicinity of mile 16.9; and for an access park with minimum recreational facilities at an estimated first cost to the United States of \$1,319,000 for new work, and an increase of \$14,000 in the cost of annual maintenance, subject to certain provisions of local cooperation. It is further recommended that the project for Chocolate Bayou, Texas, be incorporated into the Gulf Intracoastal Waterway project as a tributary and discontinued as a separate project.

U. S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

January 21, 1964

SUBJECT: Review of Reports on
Chocolate Bayou, Texas

TO: Chief of Engineers, Department of the Army
Washington, D. C., through
Division Engineer, U. S. Army Engineer Division, Southwestern
Dallas, Texas

AUTHORITY

1. This review of reports on Chocolate Bayou, Texas, is submitted pursuant to the following resolutions adopted June 30, 1960 by the Committee on Public Works of the United States Senate and of the House of Representatives, United States.

"Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 12, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on Chocolate Bayou, Texas, published as House Document Numbered 768, Eightieth Congress, second session, with a view to determining whether the existing project should be modified in any way at the present time, with particular reference to increased channel dimensions and extension of the channel upstream."

"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 report of the Chief of Engineers on Chocolate Bayou, Texas, contained in House Document No. 768, Eightieth Congress, second session, and prior reports with a view to determining if the existing project should be modified in any way at this time, particularly with regard to increased channel dimensions and extension of the channel upstream."

PURPOSE AND EXTENT OF STUDY

2. This report comprises an investigation of survey scope and considers the advisability of modifying the existing project for

Chocolate Bayou to provide for enlarging an existing locally constructed channel extending from the Gulf Intracoastal Waterway to the Monsanto Chemical Company slip, and for extension of an improved channel upstream to and including a turning basin near Liverpool, Texas.

3. The views of local interests regarding the proposed improvements were obtained at a public hearing held in Angleton, Texas, on February 21, 1962 and by subsequent conferences and correspondence. The improvements desired by local interests are discussed in paragraphs 21 through 25. The views of Federal, State and other agencies are presented in paragraphs 70 and 71.

DESCRIPTION

4. Chocolate Bayou is a small coastal stream in southeastern Texas, lying between the Brazos River and Galveston Bay. The bayou rises about 20 miles southwest of Houston, Texas, flows southeasterly across Brazoria County and empties into Chocolate Bay. The watershed slopes gently toward the Gulf of Mexico from an elevation of about 70 feet above mean low tide to the coastal marshes a few feet above mean low tide. Plates 1 and 2 of this report, and United States Coast and Geodetic Survey charts Nos. 887, 1117 and 1282 show Chocolate Bayou and the adjacent area.

5. The natural channel of Chocolate Bayou has a total length of about 40 miles and drains an area of about 160 square miles. The bayou empties into Chocolate Bay, a small shallow bay with natural depths of from 2.5 to 4.5 feet at mean low tide. The Gulf Intracoastal Waterway crosses the lower end of Chocolate Bay. Chocolate Bayou is tidal for a distance of about 18 miles above its mouth. The tidal portion of the bayou has a well developed channel with depths ranging from 6 feet to 20 feet at mean low tide. Below Liverpool, mile 14 on the natural channel, the bayou has a controlling depth of 6 feet at mean low tide over a width of 60 feet. The banks are steep and well defined in the middle reaches of the bayou, being about 15 to 20 feet high at mean low tide in the vicinity of Liverpool and decreasing to a foot or two in height at the mouth of the bayou. Present navigation is generally restricted to the portion of the bayou located at and below Liverpool.

6. Under ordinary conditions the mean tidal range near the mouth of the bayou is about 1 foot. The water level in the bay and the lower portion of the bayou is affected to a considerable extent by wind, being occasionally depressed as much as 2 feet below mean low tide by strong north winds during the winter and raised as much as 3 feet by prolonged south winds in the summer. Hurricanes have raised the water surface as much as 15 feet above mean low tide. Floods cause rises of up to 20 feet on Chocolate Bayou in the vicinity of Liverpool. The area adjacent to Chocolate Bayou is subject to overflow from extreme floods on the Brazos River.

7. The authorized project for the Gulf Intracoastal Waterway provides for a channel 12 feet deep and 125 feet wide through Chocolate Bay. The authorized project channel for Chocolate Bayou joins the Gulf Intracoastal Waterway about 26 miles west from Galveston, Texas, and 17 miles east from Freeport, Texas. The project provides for a channel 4 feet deep and 100 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay to water of 4-foot depth in Chocolate Bayou.

TRIBUTARY AREA

8. The area considered to be commercially tributary to the improvements under investigation comprises that portion of Brazoria County lying east of Bastrop Bayou and extending approximately 25 miles inland from the coast, and a small area in southwestern Galveston County.

9. In general there is little development in the low marshy area within 10 miles of the coast. Farther inland, farming, cattle raising, the production of crude oil and sulfur mining have constituted the important industries until recent times. In 1962 the Monsanto Chemical Company constructed a multi-million dollar chemical manufacturing plant along the east bank of Chocolate Bayou. There are definite indications that a major chemical industrial complex will develop in the vicinity of the initial plant. The only cities of consequence in the area are Alvin and Angleton with populations in 1960 of 5,643 and 7,312, respectively. The unincorporated community of Liverpool, at the head of the proposed navigation improvement on Chocolate Bayou, has a population of about 100.

10. The area is served by State Highway No. 35, several county roads, and branch lines of the Missouri Pacific Railroad.

11. The streams, bays and marshes in the area afford excellent opportunities for fishing, hunting, boating, and other water related recreation activities.

BRIDGES

12. There are three existing bridges and one proposed bridge crossing reaches of the bayou considered herein. Table 1 gives for each bridge the location, owner, type and clearances of the channel span, and the date the plans were approved by the Department of the Army. None of the bridges would be affected by proposed improvements considered in this report.

TABLE 1

BRIDGES ACROSS CHOCOLATE BAYOU

Name and location 1/	Owner	Type	Clearance (feet)			Date of approval of plans
			Hori- zontal:	Vertical above MLT:	Open :	
FM 1561 (Mi. 6.4)	Texas Highway Department	Fixed (Highway)	200	52.2	-	<u>2/</u> Pending
Co. Rd. 171 (Mi. 15.0)	Brazoria County	Fixed (Road)	46	9.2	-	Aug 4, 1911
MP RR (Mi. 15.4)	Missouri Pacific Railroad	Fixed (Railroad)	54	26.0	-	Nov. 5, 1946
St. Hwy 35 (Mi. 20.4)	Texas Highway Department	Fixed (Highway)	33	28.0	-	<u>3/</u>

1/ Project channel miles.

2/ Application made for approval of plans.

3/ At head of navigation. No instrument of approval issued.

PRIOR REPORTS

13. The three prior reports on Chocolate Bayou are House Document No. 445, 56th Congress, first session (River and Harbor Act of March 2, 1907); House Document No. 337, 76th Congress, first session (River and Harbor Act of March 2, 1945); and the report under review, House Document No. 768, 80th Congress, second session (River and Harbor Act of May 17, 1950).

EXISTING CORPS OF ENGINEERS' PROJECT

14. The initial project for the improvement of Chocolate Bayou was adopted by the River and Harbor Act of March 2, 1907 and provided for a channel 4 feet deep and 100 feet wide from West Galveston Bay across Chocolate Bay to 4 feet of water in Chocolate Bayou, and for removing overhanging timber and snags. This project was modified by the River and Harbor Act of March 2, 1945, to provide for a channel 6 feet deep and 60 feet wide from the Gulf Intracoastal Waterway to the county highway bridge at Liverpool, Texas, including a land cut 4.8 miles long.

However, prior to construction of this modification, the authority was revoked by the River and Harbor Act of May 17, 1950, and the previously existing 4-foot by 100-foot project was reauthorized to the extent necessary to afford a connection between Chocolate Bayou and the Gulf Intracoastal Waterway.

15. The channel was initially dredged 5-1/2 feet deep and 40 feet wide, at a cost of \$6,512.77, in 1907-1909. Snagging was performed in 1913 and 1914 on 22 miles of the bayou, and some maintenance dredging was done in 1914. In 1920 the channel was redredged, 7 feet deep and 70 feet wide. The channel was dredged last in 1950, 6 feet deep and 60 feet wide. The existing Federal project is 12 percent complete. The total cost of the existing project to June 30, 1963 was \$75,727, of which \$6,512 was for new work and \$69,215 was for maintenance.

16. The current estimated total construction cost of the uncompleted portion of the existing project is \$47,500, all Federal. During the 5-year period ending June 30, 1963 the only work performed on the project was condition surveys and miscellaneous inspections and reports at an average annual cost of \$376.

LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

17. No local cooperation was required or furnished on the existing project. The project authorized by the River and Harbor Act of March 2, 1945 required that local interests furnish, free of cost to the United States, as and when required, all lands, easements, and rights-of-way, and spoil disposal areas for the initial work and for subsequent maintenance, and hold and save the United States free from claims for damages resulting from the improvement. None of these items had been furnished when the project was revoked by the River and Harbor Act of May 17, 1950.

OTHER IMPROVEMENTS

18. Under authority of a Department of the Army permit, dated September 1, 1961, the Monsanto Chemical Company constructed a channel 10 feet deep and 100 feet wide from the Gulf Intracoastal Waterway to and including a basin 200 feet wide and 550 feet long at its plant site on the left descending side of Chocolate Bayou. The channel generally follows the alignment of the Federal project channel in Chocolate Bay and includes several cutoffs between the bayou mouth and the entrance to the basin at project channel mile 8.2. The cutoffs shortened the navigation distance between the entrance to the basin and the head of the bay by approximately 2.2 miles.

TERMINAL AND TRANSFER FACILITIES

19. The existing terminal and transfer facilities for commercial traffic consist of three petroleum and chemicals barge wharves located in the slip at the Monsanto Chemical Company plant, one seashells unloading wharf at mile 12.5, and temporary shell unloading areas on the old bend of the bayou near mile 8.3 and at mile 11.6. There are accommodations for pleasure craft, including slips, wharves, storage sheds, marine-ways, boat lifts, repair and paint shops and fueling stations, at various points along the bayou. All facilities available to pleasure craft are privately owned. There are no public recreation or access areas along the reach of the bayou considered in this report.

20. The facilities are adequate for the existing traffic. The bayou has potential for attracting additional water-based recreation activities. A public access park with small boat launching ramp and minimum recreation facilities is considered in this report.

IMPROVEMENTS DESIRED

21. A public hearing was held in Angleton, Texas, on February 21, 1962, to determine the nature and extent of the improvements desired by local interests and to afford all interested persons an opportunity to express their views regarding the requested improvements. The hearing was attended by 78 persons including Federal, State, county, municipal, and local officials; representatives of civic organizations, businesses, industries, shipping and navigation interests; and other interested parties.

22. The navigation improvements requested by local interests include enlargement of the existing locally dredged channel and extension as necessary to afford the Chocolate Bayou area the same barge service accommodation as is available on the Gulf Intracoastal Waterway. Local interests also requested that the maintenance requirements of the locally dredged 10-foot by 100-foot channel extending from the main channel of the Gulf Intracoastal Waterway to the Monsanto Chemical Company slip at mile 8.2 be assumed by the Federal Government. The requests were supported by the Commissioner's Court of Brazoria County, Brazos River Harbor Navigation District, Intracoastal Canal Association of Louisiana and Texas, The American Waterways Operators, Inc., Texas Water Commission, Alvin Chamber of Commerce, Angleton Chamber of Commerce, and various landowners, associations and firms interested in water transportation.

23. The Monsanto Chemical Company in its brief and in the statements by its representative at the public hearing made no specific request for reimbursement of the funds expended in dredging the 10-foot by 100-foot local channel. However, statements made by several individuals supporting requests

for additional improvements also indicated that the Monsanto Chemical Company desired reimbursement of its expenditures, and expressed support of this desire. The question of reimbursement of the local expenditure is discussed in paragraph 80.

24. The Texas Water Commission suggested that a salt water intrusion study be made a part of the overall Chocolate Bayou investigation and, if necessary, that a salt water gate be included as a feature of the project. They also requested that hurricane protection measures be considered. Representatives of rice growing interests concurred with the Texas Water Commission that a salt water intrusion study should be made, and desired that a salt water barrier be placed on Chocolate Bayou to prevent any increase in the salinity of the water in the bayou. With respect to the request for hurricane protection measures, the Chocolate Bayou area will be studied along with the remainder of the Texas coast for hurricane flood protection under the Texas Coast hurricane study program. The navigation improvements considered in this report would not be incompatible with a hurricane flood protection project for the area if found justified by the later studies. Accordingly, this request is not considered further in this report.

25. In support of the requested improvements, local interests furnished data and information which indicates:

a. Modification of the authorized 4-foot by 100-foot navigation project is necessary to accommodate present barge traffic to and from existing terminals.

b. Modification of the authorized project is necessary to accommodate prospective barge traffic that would be generated by the expansion of industrial operations at Monsanto Chemical Company's plant, and by other industries that would be attracted to the area.

c. Under existing conditions there is a threat that salt water will intrude upstream in the bayou to irrigation water pumping plant intakes. Any further improvement of the bayou for navigation would seriously aggravate the salt water intrusion problem.

EXISTING AND PROSPECTIVE COMMERCE

26. Existing commerce.- During the past 10 years commerce on Chocolate Bayou has increased from 120,163 tons in 1953 to 570,950 tons in 1962. Prior to 1962 the traffic consisted entirely of the movement of seashells dredged from the nearby bays. In 1962 the volume of seashells amounted to 242,800 tons. During the last seven months of 1962, the first petroleum and chemical movements in the amount of 298,000 tons were reported. The total commerce moved on the waterway during the period 1953-1962 is listed in table 2.

TABLE 2

ANNUAL COMMERCE
CHOCOLATE BAYOU, TEXAS

Calendar years	Commerce in tons (2000 lbs.)	Calendar years	Commerce in tons (2000 lbs.)
1953	120,163	1958	295,239
1954	115,045	1959	134,360
1955	88,235	1960	150,752
1956	119,210	1961	309,482
1957	126,712	1962	570,950

27. Prior to construction of the Monsanto Chemical Co. plant, the principal occupations of the inhabitants of the tributary area were those associated with ranching, farming, and businesses related to storage, repair and servicing of pleasure craft. The only commodity of commercial waterborne commerce on Chocolate Bayou was seashells, used principally for construction and maintenance of roads. There is no doubt that location of the new Monsanto plant on Chocolate Bayou has initiated a drastic and lasting pattern of change in the economy of the immediate area. The initial plant is one that processes natural raw materials into intermediate products requiring further processing into finished products. Initially the new plant is integrated into complex processing operations with the huge Monsanto Chemical plants at nearby Texas City. However, the company has acquired a large acreage of land adjacent to its new plant which can serve both for plant expansion and location sites for the satellite plants of a complete chemical manufacturing and processing complex. In recent years, as major elements of the chemical industry have migrated to the Gulf coast, this has been evidenced as a common pattern of development at several other locations. One large expansion program of the plant on Chocolate Bayou has been started since completion of the original plant. It is understood that other enlargements are in the study or planning stages. There is every reason to believe that large increases in the waterborne commerce on Chocolate Bayou will occur in future years.

28. The economic base study for Brazoria and Galveston Counties shows that the trend projections of all basic indicators for which data are readily available would predict a more rapid future economic growth for the two counties than either the state or the nation. However, the indicated trends of the larger areas are not believed to be necessarily indicative of the prospects for the small and localized Chocolate Bayou tributary area. This area is apparently to be converted from a basically rural and agricultural economy to one based principally upon industrial manufacturing and processing. Because of the short period since the starting of this conversion, there are not sufficient statistics to permit a valid analysis of trends in the particular area. Accordingly, the prospective commerce for an improved channel in Chocolate Bayou has been estimated, partly considering the trends indicated by future industrial plans in the immediate area and partly by analysis of trends indicated by the actual growth patterns of several other older and more mature industrial complexes along the Texas Coast.

29. Prospective commerce.- As industrialization of the area progresses, it is expected that, during the early years, marked fluctuations and changes in the annual commerce would be experienced. However, for the project analysis period of 50 years, it is anticipated that prospective commerce in petroleum, chemicals and chemical products will increase at a uniform rate to about 4.0 million tons annually at the end of the 50th year following completion of the proposed channel improvements. Estimates of the prospective commerce are based on an improved channel that would permit fully loaded operation of equipment normally used by this traffic. It is estimated that the seashell commerce on the improved channel would also show a similar uniform growth of about 17,600 tons annually from the present commerce of 170,000 tons annually to a total of about 1.0 million tons at the end of 50 years. Estimates of the useful life of seashell resources before exhaustion vary from 40 to 100 years. For the purposes of this report, this uncertainty is not considered to be a critical factor. Even though the seashell resource should become drastically curtailed or exhausted, the need for materials to serve the same uses will continue. Substitute materials such as limestone, sand and gravel are available from a number of sources for waterborne movement. The actual material used is determined largely by the delivered cost. If the seashells are not available, it is believed that the use of the other materials will increase and will offset the decrease in seashell movement.

30. Records of commerce on existing shallow-draft channel projects in Texas show that most of the waterways carry varying amounts of miscellaneous commodities to serve the needs of the area. The Chocolate Bayou project undoubtedly would develop considerable commerce in miscellaneous commodities. However, since these commodities cannot be identified at this time, this traffic has not been evaluated for the purposes of this report.

31. Summary - prospective commerce.- The total prospective commerce for the Chocolate Bayou improvement represents a uniform increase of the existing commerce to a total of 5.0 million tons at the end of the 50th year following completion of the improved channels. The 5.0 million tons would comprise 4.0 million tons of petroleum, chemicals and chemical products and one million tons of seashells or substitutes therefor.

VESSEL TRAFFIC

32. Existing vessel traffic.- A summary of the trips, drafts, and direction of movement of commercial vessel traffic on Chocolate Bayou is given in table 3. In addition there is extensive use of the channel by small recreational craft for which no statistics or records of vessel traffic are available.

TABLE 3

CHOCOLATE BAYOU, TEXAS
TRIPS AND DRAFTS OF VESSELS - CALENDAR YEAR 1962

Draft (in feet)	Number of trips of vessels					
	Inbound			Outbound		
	Towboats	Barges	Total	Towboats	Barges	Total
8	125	284	409	121	43	164
7	13	32	45	12	1	13
6	84	11	95	90	3	93
5	26	45	71	26	0	26
3	0	1	1	0	1	1
2	0	32	32	0	354	354
Total	248	405	653	249	402	651

33. Practically all of the existing traffic consists of barge tows of one towboat with one or two barges arranged in tandem. Traffic on the bayou was relatively stable and averaged 719 vessel trips annually during the period 1953-1962. The traffic increased sharply in 1962 following completion of the Monsanto Chemical Company plant. Seashells are moved in tows of one 600-horsepower towboat and two open barges with capacities up to 2,200 tons. These barges are light loaded to about 1,360 tons because available depths in contiguous waters limit the equipment to a 7-foot draft. The petroleum and chemicals are moved in tows of one 1,200-horsepower towboat and two tank barges of about 3,000-tons capacity each.

34. Prospective traffic.- It is anticipated that the vessel traffic will diminish slightly through the more efficient loading of existing equipment and the use of larger capacity equipment. However, this period would be of comparatively short duration. As the industrial economy of the area develops, greater demands for the commodities would result in a gradual increase in the vessel trips. It is estimated that the number of trips by vessels with loaded drafts of 7 feet or greater will average about 2,500 trips annually over a period of 50 years.

DIFFICULTIES ATTENDING NAVIGATION

35. Chocolate Bayou in its original state was a relatively narrow stream, with many sharp bends, emptying into the shallow water area of Chocolate Bay. Although the bayou normally had useable water depths of from 10 to 12 feet, navigation to and from the bayou often was obstructed by bars that formed at the mouth of the bayou. The existing Federal project, which provides for a 4-foot by 100-foot channel from the Gulf Intra-coastal Waterway to the natural 4-foot depth in the bayou, afforded adequate navigation to the pleasure craft and fishing boats using the waterway at the time of the project authorization. In recent times there has been a considerable movement of seashells from nearby bays to landings on Chocolate Bayou. These movements were made with difficulty because of the lack of water depth in Chocolate Bay and the sharp bends in Chocolate Bayou. Only by light-loading the barges, and by double-tripping between the mouth of the bayou and the shell unloading terminals, were such movements possible. These operations occasioned numerous groundings, collisions, and bottom or bank scrapings with resultant damage to vessels and to properties along the bayou.

36. The 10-foot by 100-foot locally dredged channel completed in 1962 rectified the lower five miles of Chocolate Bayou. The hazards to navigation in this reach are now greatly reduced. Upstream from the locally dredged channel, sharp bends restrict commercial vessel traffic to single barge tows. Under existing conditions there are usually sufficient water depths to accommodate the equipment now operated on the waterway. However, local interests state that numerous accidents have occurred in the unimproved reach of the bayou, because of the sharp bends and inadequate channel widths. No records are available on the number of accidents or amount of damages resulting therefrom.

WATER POWER AND OTHER SPECIAL SUBJECTS

37. The proposed improvements under consideration in this report would have no bearing on water power, flood control, municipal or industrial water supply, abatement of pollution, or any other purposes involving the control of conservation of water resources except fish and wildlife, salt water intrusion and recreation. Comments of the U. S. Fish and Wildlife Service are discussed in paragraph 71 of this report. The problem of salt water intrusion and recreation are discussed in the following paragraphs.

38. Salt water intrusion.- About 30,000 acres of rice are cultivated annually in the Chocolate Bayou watershed. The total rice land, however, is considerably greater since rice ordinarily is not grown on the same land in successive years. Irrigation water for the rice is obtained both from the Brazos River and from Chocolate Bayou. Water from Chocolate Bayou, because of its lesser cost, is used to the maximum practicable extent. In this

area rice requires irrigation from about April through September and each acre of crop will require from two to four acre-feet of irrigation water during the season, depending upon the amount and time occurrence of rainfall during the period. In ordinary years about 4,000 acres of rice depend upon Chocolate Bayou water for irrigation. At a reasonable raw water value of 6 mills per thousand gallons, the value of this water would be about \$40,000 per year. At the present time two commercial irrigation supply companies pump water from the bayou with pump intakes at stream miles 14.4 and 17.0.

39. During the irrigation season, the fresh water supply from Chocolate Bayou includes both the runoff from rainfall in its watershed and a return flow of Brazos River water from drainage of rice fields irrigated from that source. The quality of the water, with respect to salt content, depends upon a number of factors including tidal and wind influenced water levels in Chocolate Bay, rainfall runoff and other fresh water inflow to the stream, rates of withdrawal of irrigation water and mixing of fresh and salt water by vessel traffic in the bayou. Records are not available to permit evaluation of the overall problem of salt water intrusion at the present time, as compared with the problem prior to construction of the improved navigation channel to the Monsanto Chemical Co. plant. There is little doubt, however, that the problem was aggravated by construction of this channel. It is well known that deepening and enlargement of the tidal reaches of coastal streams increases the upstream movement of a salt water wedge and, all other factors remaining equal, increases the magnitude of any existing salt water intrusion problem.

40. As the development of the Chocolate Bayou watershed for industrial, commercial and residential uses continues in future years, it is expected that agricultural use will be drastically reduced. However, so long as water from Chocolate Bayou was available, its use would continue for the remaining irrigation needs because of its lesser cost, compared with the imported Brazos River water. During the project analysis period of 50 years, it is expected that irrigation demands would continue at a level that would fully utilize the available Chocolate Bayou water. Accordingly, it is believed that any additional improvement of the channel for navigation must include provision of a salt water barrier to mitigate the damages that otherwise would occur from aggravation of the salt water intrusion problem.

41. Recreation.- Chocolate Bayou provides operators of recreation and small fishing boats with a ready access to Chocolate Bay and through the Gulf Intracoastal Waterway and San Luis Pass to adjacent larger bays and the Gulf of Mexico. An adequate road system makes the bayou well located for ready access by residents of a service area of up to 50 miles in all directions. At the present time about 1.25 million people reside in this service area. Although many other similar facilities are available in the general area, the extensive increase in water-based recreation in recent years has resulted in a chronically overcrowded condition and additional facilities are needed to supplement those now available. As the

population continues to increase, the need for added facilities will become more acute.

42. Several commercial establishments offering service facilities for small boats, including fueling stations, marine ways, launching ramps, boat lifts and storage sheds are located on Chocolate Bayou. Numerous small private piers and shore facilities have been constructed along the bayou. There are, however, no public recreation or access areas along the reach of waterway considered in this report. There are several sites along the bayou well suited for development into attractive and useful recreational access parks. In conformance with current policies designed to promote and insure adequate access to public bodies of water for recreational purposes, it is believed that any development of Chocolate Bayou as a Federal navigation project should include a public access park with small boat launching and minimum recreational facilities. The minimum facilities for initial installation at the park should include picnic tables, sanitary facilities, fireplaces, car-trailer parking areas, and boat landing structures.

PROJECT FORMULATION

43. Plans considered.- Three general plans were given engineering and economic consideration to determine the most feasible plan of improvement of Chocolate Bayou to the vicinity of Liverpool, Texas, for navigation and related purposes. Since the channel has been improved from the Gulf Intracoastal Waterway to channel mile 8.2 by the Monsanto Chemical Co., each plan was considered in two reaches, with Reach 1 being the locally improved section and Reach 2 being an upstream extension to the vicinity of Liverpool. The proposed channel would be tributary to the Gulf Intracoastal Waterway in a reach having authorized dimensions of 12-foot depth and 125-foot width. Accordingly, no larger dimensions were considered for the Chocolate Bayou channel. The three plans are summarized as follows:

Plan 1.- Maintain the locally dredged channel to a depth of 9 feet and a width of 100 feet in Reach 1 and construct an improved channel 9 feet deep by 100 feet wide, in Reach 2. Although the local channel was dredged 10 feet deep initially, no allowance for overdepth dredging was included. Thus, a 9-foot channel with an allowance for overdepth is equivalent to maintenance of the local channel.

Plan 2.- Enlarge the locally dredged channel to provide a depth of 12 feet and a width of 125 feet in Reach 1 and construct an improved channel, 9 feet deep by 100 feet wide, in Reach 2.

Plan 3.- Enlarge the locally dredged channel to provide a depth of 12 feet and a width of 125 feet in Reach 1 and construct an improved channel, 12 feet deep by 125 feet wide, in Reach 2.

44. All of the plans follow the same alignment for the navigation channel and differ, within each reach, only in the depth and width proposed for the channel. In Reach 2, each plan includes a public turning basin of appropriate size at the upper end of the proposed improvement and a public access park with minimum basic facilities for recreational use adjacent to the project. Each plan also includes construction of a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin.

45. Each plan was considered with respect to its adequacy to serve the navigation needs of prospective commerce for the project. In making this determination, it was assumed that, since all of the unloading sites for seashells are now located along Reach 2, all of the prospective commerce in seashells would move in both Reaches 1 and 2. All of the existing commerce in petroleum and chemicals is now moving only in Reach 1. However, the recently completed Monsanto Chemical Co. plant is believed to be only the first of a number of related and integrated industrial facilities that will develop in this area and it is reasonable to assume that some of the added facilities will be built in areas adjacent to Reach 2. Accordingly, for project formulation, it was assumed that 25 percent of the projected future increase in petroleum and chemicals commerce would move in both Reaches 1 and 2.

46. Comparison of plans.- Based on the assumptions described above, annual benefits and costs were estimated for increments of improvement by reaches for each of the three basic plans. The estimated annual benefits, annual charges and excess of benefits over charges for each degree of improvement considered for the two reaches are as follows:

Plan	Channel size		Annual benefits(2)	Annual charges(2)	Excess benefits over costs	Benefits to costs ratio
	Reach 1	Reach 2				
1	9'x100'(1)	9'x100'	\$102,000	\$50,000	\$ 52,000	2.0
2	12'x125'	9'x100'	250,000	68,000	182,000	3.7
3	12'x125'	12'x125'	275,000	94,000	181,000	2.9

(1) Existing locally dredged channel, benefits and annual charges not included in estimates shown.

(2) Excluding salt water barrier and access recreational park in each plan.

47. Comparison of the items in the above tabulation shows that the annual benefits and charges shown for plan 1 are the incremental benefits and charges for extending the 9x100-foot channel in Reach 2. The differences in annual benefits and annual charges between plans 1 and 2 represent the incremental benefits and charges for enlarging the 9x100-foot locally dredged channel in Reach 1 to a 12x125-foot channel.

The differences in annual benefits and charges between plans 2 and 3 represent the incremental benefits and charges for enlarging the 9x100-foot channel in Reach 2 to a 12x125-foot channel. The incremental benefits and charges for the improvements considered in each of the two reaches are tabulated as follows:

<u>Increment of improvement</u>	<u>Annual benefits(1)</u>	<u>Annual charges(1)</u>	<u>Excess benefits over costs</u>
<u>Reach 1</u>			
9'x100' chan. to 12'x125' chan.	\$149,000	\$18,000	\$131,000
<u>Reach 2</u>			
Unimproved to 9'x100' chan.	102,000	50,000	52,000
9'x100' chan. to 12'x125' chan.	24,000	26,000	(-2,000)

(1) Does not include benefits or charges for salt water barrier or access recreational park.

48. Selection of plan.- It is apparent that the maximum excess of benefits over costs is obtained by enlargement to provide a 12'x125-foot channel in Reach 1 and a 9x100-foot channel in Reach 2. This combination is provided in plan 2 and, accordingly, this plan is adopted as the plan of improvement. Plans for the salt water barrier and the recreational access park were formulated on the basis of providing the minimum facility that would satisfactorily serve the purpose and no investigation of larger scale development is considered necessary for either facility.

PLAN OF IMPROVEMENT

49. Plan of improvement.- The plan of improvement provides for modifying the existing Federal navigation project to provide a channel 12 feet deep and 125 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence 9 feet deep and 100 feet wide to a turning basin, 9 feet deep and 600 feet square near channel mile 13.2; for a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin; and for an access park with minimum recreational facilities. The general plan of improvement is shown on plate 2.

50. The materials to be encountered in dredging the channel improvements would consist of sands, clays and silts which offer no unusual difficulties for hydraulic dredging. Some clearing of brush and trees would be required in the upper reaches of the project. Excavated material

from the lower reaches of the project would be placed in spoil disposal areas in Chocolate Bay, or in marsh areas along Chocolate Bayou, that were used during construction of the existing 9-foot by 100-foot channel. In the middle and upper reaches of the project, the excavated material would be placed in land disposal areas within reasonable pipeline distances from the channel. The proposed improvements would require about 160 acres of rights-of-way for channel dredging, 325 acres for spoil disposal areas, 6 acres for the salt water barrier, and about 7 acres for the access park.

51. Construction of the plan of improvement would not require alteration of any bridges, either existing or proposed. Three 4-inch submarine pipelines, one 12KV aerial powerline, and one 138KV aerial powerline would require alteration. The U. S. Coast Guard furnished information that the existing locally constructed aids to navigation would be adequate for the proposed channel improvements, and furnished estimates of maintenance and major replacement costs. These data are included in the estimates of first cost and annual charges for the plan of improvement.

52. Salt water barrier.- The salt water barrier, to be located in the natural bayou channel about 3.7 miles upstream from the turning basin, would be a fixed, low-level weir-type structure constructed of concrete sheet piles. Details of the proposed structure are shown on plate 3. The top of the concrete sheet pile weir would be set at elevation 3.0 feet above mean low tide, which would prevent upstream movement of salt water at all normal tide levels. Flood flows would pass over the structure and only minor effects would be experienced by a slight rise in floodwater levels for a short distance upstream from the structure. A hand-operated boat lifting crane on the left bank abutment of the structure would provide for passage of the very small recreational boats that occasionally use the bayou above this point.

53. The site selected for the salt water barrier is immediately downstream from the intake for the irrigation water pumping plant of the Chocolate Bayou Rice and Canal Co. The pumping plant intake for another irrigation company, Brazoria County Rice Co., is located about 2.6 miles downstream from the site proposed for the salt water barrier. Most of the recreational boat traffic on the bayou is in reaches below the upper pumping plant intake, but there is extensive use by such traffic in the reach between the two pumping plant intakes. The distribution systems of the two water companies are so located that water for both companies can be taken from the upper intake. Officials of the two companies indicate that they would not object to a plan for permanent use of the upper intake by both companies. Accordingly, because of the extensive recreational boat traffic, the salt water barrier site was selected to be immediately downstream from the upper pumping plant intake.

54. Access recreational park.- The Chocolate Bayou navigation improvement would be located in an area that is highly attractive for outdoor, water-oriented recreation and recreational boating activities. To insure adequate public access to the improvement, an access park of about 7 acres is proposed in a natural, timbered setting on the right descending bank of one of the cutoff bends near mile 11.5. An access road, about 0.3 mile long, would connect the park with county road No. 203. Minimum basic facilities for use of the park and public access to the improved navigation channel would be provided. The minimum basic facilities would include, a parking area for vehicles and boat trailers, picnic tables, fireplace units, boat-launching ramp, boat landing wharf and sanitary facilities. Layout details of the access park are shown on plate 3.

SHORELINE CHANGES

55. The improvements considered herein would have no appreciable effect on the configuration of existing natural shorelines.

ECONOMIC EVALUATION OF PROJECT

56. General.- The economic evaluation of the proposed project for navigation on Chocolate Bayou included several comparisons of estimated benefits and costs to insure that: (a) the best plan had been developed, (b) the proper scale of development had been selected, and (c) construction of the proposed improvements was fully justified from an economic standpoint. The various factors entering into these determinations are discussed in paragraphs 43 through 48.

57. Estimates of first cost of plan of improvement.- Detailed estimates of first cost for constructing the plan of improvement for affording navigation on Chocolate Bayou are summarized in table 4. The estimates are based on January 1964 price levels. The division of first costs is based on the requirements of local cooperation set forth in paragraph 69.

TABLE 4

ESTIMATES OF FIRST COST FOR
PLAN OF IMPROVEMENT

Item	:	Cost
<u>Federal first cost:</u>		
Corps of Engineers		
Channels	\$	999,000
Salt water barrier		85,000
Access park		<u>52,000</u>
Subtotal		1,136,000
Engineering and design		69,000
Supervision and administration		<u>114,000</u>
Total Federal first cost		1,319,000
<u>Non-Federal first cost:</u>		
Non-Federal, public		
Lands and damages		188,000
Spoil area dikes, bulkheads, etc.		118,000
Non-Federal, private		
Alteration of pipelines and powerlines		<u>50,000</u>
Total non-Federal first cost		356,000
<u>Total estimated first cost:</u>		1,675,000

Note: Above estimates of first costs do not include the Federal preauthorization study cost of \$28,000.

58. Estimates of annual charges.- Detailed estimates of investment and annual charges for the plan of improvement are summarized in table 5.

TABLE 5

ESTIMATES OF INVESTMENT AND ANNUAL CHARGES
FOR PLAN OF IMPROVEMENT

Item	:	Total
<u>Investment:</u>		
Federal		\$1,319,000
Non-Federal		<u>356,000</u>
Total investment		1,675,000
<u>Annual charges:</u>		
Federal		
Corps of Engineers		
Interest and amortization		51,000
Additional cost of maintenance		<u>9,000(1)</u>
Total, Corps of Engineers		60,000
U. S. Coast Guard		
Additional cost of maintenance and advance replacement		None (1)
Total Federal annual charges		60,000(1)
Non-Federal		
Interest and amortization		14,000
Maintenance and operation		<u>13,000</u>
Total non-Federal annual charges		27,000
Total annual charges		87,000

(1) Does not include annual cost of \$6,000 for maintenance dredging of local channel, or \$5,000 for maintenance and advance replacement of aids to navigation constructed by local interests.

59. Benefits.- The benefits which would be derived from the navigation improvements proposed in the plan of improvement would consist of savings in transportation costs through shortened travel distance, use of larger towboats and barges and more efficient operations of tows, and by reduction in hazards to navigation. A savings in transportation costs for shipping petroleum and chemical products would result from operating larger capacity equipment. Transportation savings in the movement of seashells would result through shortened travel distance in the bayou, and by elimination of the double tripping in the natural bayou upstream from the locally dredged channel. The proposed channel improvements would reduce the difficulties and hazards to navigation in the locally dredged channel because the larger dimensions would permit increased speed and improved steerageway for barge tows. In the existing natural bayou channel, the hazards would be reduced because of the improved alignment and larger channel dimensions, which would reduce the danger of collisions between the tows and other vessels operated on the waterway, and would reduce the damages from groundings and bank scrapings.

60. The benefits from savings in transportation costs were estimated for each item of prospective commerce and are shown in detail in appendix I. The benefits from savings in transportation costs and reduction in navigation hazards to present commerce are estimated at \$81,000 annually. Based on the estimates of prospective commerce during the analysis period of 50 years, the average annual equivalent benefits are estimated at \$250,000 annually, as shown in table 6.

61. Salt water barrier.- The salt water barrier would eliminate damages caused by salt water intrusion into irrigation water pumped from Chocolate Bayou during all ordinary and normal stages of tides. The barrier would be overtopped by storm tides and some residual damages would still be experienced because of these infrequent occurrences. Such damages would not be large, however, because of the short duration of the storm tides and the fact that Brazos River water could be substituted for irrigation until natural runoff and flows had restored the quality of the Chocolate Bayou water. Many variables enter into the problem of determining the actual damages caused by intrusion of salt water into Chocolate Bayou. The absence of definitive data on the severity, frequency and duration of salt water intrusion, as related to fresh water inflow and the seasonal cycle of irrigation requirements, makes a monetary evaluation of the damages very difficult. The proposed salt water barrier would not only mitigate additional damages caused by the proposed navigation improvements, but would virtually eliminate the damages that may have resulted from the locally dredged navigation improvement, as well as any that may have existed in the natural bayou prior to any improvement. The cost of the proposed salt water barrier is small, with estimated annual charges of \$9,000. Its construction is considered necessary in order to mitigate any additional damages from salt water intrusion that may be caused by the proposed navigation improvements. It would also virtually eliminate salt water intrusion damages that are now experienced under existing conditions and, thus, would develop benefits. The existing damages vary

considerably from year to year and available data is not sufficient to permit an accurate evaluation, but there is no doubt that the damages exceed the estimated annual cost of \$9,000 for the salt water barrier. However, for the purposes of this report, the benefits from prevention of existing damages by the salt water barrier have been equated to its estimated annual cost of \$9,000.

62. Access recreational park.- Use of the access recreational park and its appurtenant facilities was estimated by giving consideration to the total population within a 50-mile service area and to the numbers and location of existing alternative facilities in the same general area that would be competitive from a use standpoint. It was concluded that the service area does not have an adequate number of suitable facilities of this nature either now or in the foreseeable future and that the proposed access park on Chocolate Bayou would be a needed facility that would receive virtually full use from the time of its construction. The estimates indicated that about 38,000 visitor days per year would be experienced for such water oriented recreational activities as fishing, hunting, pleasure boating, water skiing and picnicking. Based on an estimated value of \$0.50 per visitor day, the average annual recreational benefits are estimated at \$19,000.

63. Summary of benefits.- The benefits that would accrue to construction of the plan of improvement, reduced to average annual equivalent benefits for a project life of 50-years where appropriate, are estimated at \$278,000 annually. The benefits that would accrue to navigation, prevention of damages from salt water intrusion into irrigation water, and to recreation are summarized in table 6.

TABLE 6

ESTIMATED ANNUAL BENEFITS
FOR PLAN OF IMPROVEMENT

<u>Item</u>	<u>Benefits to present commerce</u>	<u>Average annual equivalent value of prospective benefits</u>
<u>Navigation</u>		
Savings in petroleum and chemicals transportation	\$43,000	\$147,000
Savings in shell transportation	25,000	73,000
Reduction in hazards to navigation	<u>13,000</u>	<u>30,000</u>
Subtotal, navigation benefits	81,000	250,000
<u>Salt water intrusion - prevention of damages</u>		9,000
<u>Recreation - access park</u>		19,000
Total estimated annual benefits		278,000

64. Comparison of benefits and costs.- The estimated first costs, annual charges and annual benefits and the ratio of annual benefits to annual charges for the plan of improvement proposed for Chocolate Bayou, based on January 1964 price levels, are as follows:

	<u>First costs</u>	<u>Annual charges</u>	<u>Annual benefits</u>	<u>B/C ratio</u>
Enlarge and improve navigation channels	\$1,480,000	\$68,000	\$250,000	3.7
Salt water barrier	125,000	9,000	9,000	1.0
Access recreational park	<u>70,000</u>	<u>10,000</u>	<u>19,000</u>	1.9
Total	1,675,000	87,000	278,000	3.2

APPORTIONMENT OF COSTS AMONG INTERESTS

65. Navigation channel.- 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 for multi-use channels, and with the proposed requirements of local cooperation set forth in paragraph 69. Under these requirements, the first costs of all lands, easements and rights-of-way necessary for construction of the proposed navigation improvements would be borne by local interests. The cost of all necessary relocations or alterations of structures, including buildings, pipelines, sewers, utilities and bridges, except railroad bridges, would be borne by local interests. All first costs for construction of the proposed improvements and all preauthorization survey costs would be borne by the Federal Government. All costs for maintenance and operation of the project channel, except for spoil disposal area dikes, bulkheads, and embankments, 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.

66. Salt water barrier.- The proposed salt water barrier would prevent all of the damages from increased intrusion of salt water into the fresh water irrigation supply of Chocolate Bayou that would otherwise result from construction of the proposed navigation improvements. The barrier would also serve to eliminate the damages that may have resulted from construction of the locally dredged navigation channel, as well as most of the damages that were experienced in the natural bayou channel prior to any navigation improvements. It is believed that the costs of this facility should be apportioned between the Federal and non-Federal interests on an equitable basis. Sufficient data are not available for determination of the damages incurred from

each of the improvement increments. In the absence of such a determination, it is considered that an equitable division of costs would apportion the costs of all lands, easements, rights-of-way and relocations necessary for construction and all costs and obligations of ownership, operation and maintenance of the facility to the local interests. The first cost for construction of the salt water barrier would be borne by the Federal Government.

67. Access recreational park.- This improvement is proposed to facilitate public recreational use of the navigation improvements and to fill a need for additional outdoor recreational facilities for the general public in the service area. It is proposed that the costs for this improvement would be shared in a manner similar to that proposed for the salt water barrier. The first cost for construction and provision of the basic facilities proposed would be borne by the Federal Government. The first costs for all lands, easements, rights-of-way and relocations necessary for construction and all costs and obligations of ownership, operation and maintenance would be borne by the local interests.

68. A summary of the estimated first costs and the estimated additional maintenance costs, with the proposed apportionment between Federal and non-Federal interests, for the proposed improvements is shown in table 7.

TABLE 7

APPORTIONMENT OF FIRST COST AND ANNUAL MAINTENANCE
FOR PLAN OF IMPROVEMENT

Item	:	:	:	:
	:	Federal	:	Non-Federal
	:	:	:	Total
<u>First costs</u>				
Channels		\$1,139,000		\$341,000
Salt water barrier		115,000		10,000
Access park		<u>65,000</u>		<u>5,000</u>
				<u>70,000</u>
Total first cost		1,319,000		356,000
				1,675,000
<u>Additional annual cost of maintenance and operation</u>				
Channels		\$ 19,000(1)		\$ 1,500
Salt water barrier		0		4,000
Access park		<u>0</u>		<u>7,500</u>
				<u>7,500</u>
Total additional cost of maintenance and operation		19,000		13,000
				32,000

(1) Includes \$6,000 for maintenance dredging of local channel, and \$5,000 for maintenance and advance replacement of aids to navigation constructed by local interests.

LOCAL COOPERATION

69. Proposed local cooperation.- Modification of the existing project for Chocolate Bayou would be subject to the requirements of local cooperation generally specified by law for Federal navigation projects. It is proposed that local interests shall be required to participate in the project as follows:

a. Provide without cost to the United States all lands, easements and right-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 costs of such retaining works;

b. Hold and save the United States free from damages due to the construction works;

c. Provide and maintain 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 pipelines, powerlines, utility lines, cables, and highway facilities, when and as required for construction of the project;

e. Assume all obligations of ownership, operation, and maintenance of the salt water barrier and appurtenances upon its completion; and

f. Assume all obligations of ownership, operation, and maintenance of the access park and minimum recreational facilities upon its completion, and maintain free and ready public access to the water areas adjacent to the park at all times.

COORDINATION WITH OTHER AGENCIES

70. Initiation of studies.- Copies of the notice of public hearing held in Angleton, Texas, on February 21, 1962 were sent to all known Federal, State, and local agencies that were believed to have a possible interest in the proposed navigation improvements for Chocolate Bayou.

71. The U. S. Fish and Wildlife Service; Texas Game and Fish Commission; the U. S. Department of Health, Education, and Welfare; U. S. Department of Agriculture, Soil Conservation Service; and the U. S. Department of the Interior, Bureau of Mines were advised of the proposed improvements and the views and comments of those agencies were requested. Copies of the comments of these agencies are included in appendix III and are summarized as follows:

a. U. S. Fish and Wildlife Service and Texas Parks and Wildlife Department.- A letter report from the Acting Southwest Regional Director, U. S. Fish and Wildlife Service, containing the coordinated comments by that agency and the Texas Game and Fish Commission (now Texas Parks and Wildlife Department) recommends: (1) that all cutoff and tributary channels of Chocolate Bayou be kept open and that spoil be prevented from entering them, and (2) that spoil placement from future maintenance dredging be confined to those areas established during dredging of the locally-dredged channel, and to land spoil areas for channel improvements upstream from the Monsanto Chemical Company plant. These recommendations would not materially affect the cost of constructing the proposed navigation improvements, and will be considered during the preconstruction planning for any improvements which might be authorized for construction.

b. U. S. Department of Health, Education and Welfare.- The Regional Program Director (Region VII), Water Supply & Pollution Control, advises that the proposed improvements appear to have no effects on public health aspects of the area.

c. U. S. Department of Agriculture, Soil Conservation Service.- The State Conservationist (Texas) advises that the proposed improvements will not have any detrimental effect on projects, existing or proposed, under programs administered by the Soil Conservation Service.

d. U. S. Department of the Interior, Bureau of Mines.- The Acting Area Director, Area IV Mineral Resources Office, advises that: available office data indicates that the proposed project would be beneficial to the mineral industries in the area; the enlarged channel will provide cheaper transportation for the expanding petroleum and petrochemical industries in the area; and the Area IV Mineral Resources Office has no objection to the proposed project.

DISCUSSION

72. This report comprises the results of an investigation to determine whether the existing navigation project for Chocolate Bayou, Texas, should be modified in any way at this time. The existing project provides for a channel 4 feet deep and 100 feet wide extending from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay to water of 4-foot depth in Chocolate Bayou. Local interests have dredged a channel 10 feet deep and 100 feet wide along the alignment of the existing Federal project in Chocolate Bay, thence up Chocolate Bayou via several cutoffs for a distance of 2.8 miles. The depth of dredging for the local channel of 10 feet did not include an allowance for overdepth dredging; thus, this depth is equivalent to that of a channel 9 feet deep with an allowance for overdepth.

73. Local interests desire that the 8.2 miles of locally dredged channel be enlarged and extended about 5 miles upstream to the vicinity of Liverpool. The requested improvements in general were those that would be necessary to afford the Chocolate Bayou area the same barge service accommodations as are available on the Gulf Intracoastal Waterway. Local interests also requested that future maintenance of the locally dredged channel be assumed by the Federal Government, and that a salt water barrier be placed in Chocolate Bayou to prevent damages from the intrusion of salt water into the fresh water irrigation supply which is pumped from the bayou.

74. The investigation found that enlargement of the local channel to a depth of 12 feet over a bottom width of 125 feet, and extension of the channel at a depth of 9 feet over a width of 100 feet to the vicinity of Liverpool, is required to meet the needs of existing and prospective commerce on Chocolate Bayou. Various increments of channel sizes were studied to determine the plan that would realize the maximum excess of benefits over costs. Each plan included a public turning basin at the upper end of the proposed channel improvement, and a public access park with minimum basic facilities for recreational use adjacent to the project. Each plan also included construction of a salt water barrier in Chocolate Bayou about 3.7 miles upstream from the turning basin.

75. Existing commerce on the waterway consists of petroleum and chemicals moving over the locally dredged channel, and seashells which move through the local channel to unloading sites upstream along the natural channel of Chocolate Bayou. The recently completed Monsanto Chemical Co. plant, located at the upper end of the local channel, is believed to be only the first of a number of related and integrated industrial facilities that will develop in the area. It is expected that large increases in waterborne commerce on Chocolate Bayou will occur in future years.

76. Water for irrigation is pumped from Chocolate Bayou at two locations near Liverpool. Data are not available to determine the extent that the local channel has affected the quality of water, with respect to salt content, at the two pumping plant intakes. However, there is little doubt that a problem of this type existed in the natural bayou and that the local channel aggravated the problem to some extent. Further improvement of the channel for navigation would also increase the magnitude of the salt water intrusion problem. When Chocolate Bayou water of good quality is available, it is the most economical source of irrigation water for the adjacent area. It is expected that the irrigation demands would fully utilize all available water in Chocolate Bayou throughout the project analysis period of 50 years. The proposed plan of improvement includes provision for a salt water barrier to mitigate the additional damages that otherwise would occur. The barrier would also eliminate any damages that may have resulted from construction of the local channel as well as most of the damages that were occasioned by salt water intrusion into the natural bayou channel.

77. Chocolate Bayou is used extensively by small recreation and fishing boats which are based at or enter the bayou at private piers or slips. There are no public recreation or access areas along the bayou at this time. Several sites along the bayou are well suited for development into attractive access parks. The current demand for facilities of this type indicates that a public access park is needed and upon completion would be fully used. To insure adequate public access to the waterway for recreational and fishing boats, the plan of improvement includes a public access park with small boat launching and minimum recreational facilities.

78. The total first cost of the improvements is estimated at \$1,675,000, of which \$1,319,000 would be Federal cost and \$356,000 would be non-Federal, in accordance with the apportionment of costs described in paragraph 68. The total annual charges are estimated at \$87,000, exclusive of \$6,000 for annual maintenance dredging of the local channel, and \$5,000 for annual maintenance and advance replacement of the aids to navigation constructed by local interests. Total average annual benefits from the proposed improvements are estimated at \$278,000. The benefits to cost ratio is estimated at 3.2.

79. The estimated annual charges for the local channel are \$35,000, including \$6,000 for annual maintenance dredging and \$5,000 for maintenance and advance replacement of aids to navigation. Existing commerce is sufficient to justify continued maintenance of the channel and its navigation aids, which now is a responsibility of the local interests. It is proposed that the Federal Government assume the responsibility for maintenance of the local channel and the aids to navigation as well as the additional maintenance occasioned by the work included in the plan of improvement. The total estimated annual maintenance costs to the Federal Government would be \$19,000 of which \$14,000 would be apportioned to the Corps of Engineers and \$5,000 would be apportioned to the U. S. Coast Guard.

80. The desire of the Monsanto Chemical Co. for reimbursement of its expenditures for dredging the local 10 x 100-foot channel from the Gulf Intracoastal Waterway to mile 8.2 was carefully considered. Benefits from this improvement accrue to all commerce moving to and from the Monsanto plant, as well as to the commerce in seashells moving to points on Chocolate Bayou upstream from the Monsanto plant. Monsanto Chemical Co. reports that its expenditures for construction of the channel were \$564,200. With the development of initial commerce in petroleum and chemicals approaching an annual rate of about 500,000 tons at the end of 1962, there is no doubt that the costs of the improvement are fully justified by the benefits realized from this commerce alone. In the past many such navigation channels have been constructed by private concerns or local government agencies to fulfill an immediate need for water transportation. At the present time, at least two additional channels of this nature are under construction or in the planning stage in the Galveston District. Many of these channels serve the needs of general navigation to some degree. If a policy of Federal reimbursement for the construction of such channels were generally applied, the prerogative of planning and authorization of Federal projects would be seriously compromised and probably lost by the Federal Government. This would be contrary to long established policies, whereby the Congress has reserved the sole right to authorize and exercise rigid control of construction of Federal projects. Accordingly, it is believed that reimbursement of the Monsanto Chemical Co.'s expenditure for construction of the local channel, either wholly or in part, would be contrary to current Federal policies.

81. The requirements of local cooperation are described in paragraph 69. The Commissioners' Court of Brazoria County, Texas, has indicated its willingness to meet the requirements of local cooperation.

82. The investigations for this report found that Chocolate Bayou channel is functioning as an important tributary to the Gulf Intracoastal Waterway, and that it will have greater future importance as the industrial development in the area increases. For this reason it is believed that the project for Chocolate Bayou should be incorporated into the Gulf Intracoastal Waterway and discontinued as a separate project.

83. Additional information called for by Senate Resolution 148, 85th Congress, adopted January 28, 1958, is contained in an attachment to this report.

CONCLUSIONS

84. Based on the findings of this investigation, it is concluded that:

a. The dimensions of the authorized project channel for Chocolate Bayou are not adequate to accommodate existing and prospective commerce on the waterway.

b. To mitigate salt water intrusion damages which may have resulted from the construction of the locally dredged channel, and those damages which could be expected by further improvement of the bayou for navigation, any modification of the authorized Federal project should include provision for the construction of a salt water barrier in Chocolate Bayou.

c. A public access park with small boat launching and recreational facilities should be located on Chocolate Bayou to insure public access to the waterway for recreational and fishing boats.

d. Modification of the authorized project channel for Chocolate Bayou as described in the plan of improvement of this report would accommodate existing and prospective commerce on the waterway; would eliminate damages caused by salt water intrusion into irrigation water pumped from Chocolate Bayou during all ordinary and normal stages of tides; and would provide adequate public access to the waterway for water oriented recreational activities.

e. The improvements proposed herein would have estimated total annual charges of \$87,000, annual benefits of \$278,000, and a benefits to costs ratio of 3.2, based on January 1964 price levels.

f. The total first cost of the improvements proposed herein is estimated at \$1,675,000, of which the Federal share would be \$1,319,000 and the non-Federal share would be \$356,000. The total annual cost of maintenance and operation is estimated at \$32,000, of which \$19,000 would be borne by the Federal Government and \$13,000 would be borne by the local interests. The Federal maintenance costs would be apportioned in the amounts of \$14,000 to the Corps of Engineers and \$5,000 to the U. S. Coast Guard.

85. It is further concluded that the project for Chocolate Bayou, Texas, should be incorporated into the Gulf Intracoastal Waterway project and discontinued as a separate project.

RECOMMENDATIONS

86. Accordingly, it is recommended that the existing project for Chocolate Bayou, Texas, be modified to provide for the following improvements, generally as described in the plan of improvement of this report:

a. A channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; thence, 9 feet deep and 100 feet wide to a turning basin, 9 feet deep by 600 feet square in the vicinity of project channel mile 13.2;

b. A salt water barrier in the vicinity of mile 16.9; and

- c. An access park with minimum recreational facilities.

All of the above to be constructed, with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated total first cost to the United States of \$1,319,000 for new work, and an increase of \$14,000 in the cost of annual maintenance.

87. The foregoing recommendation shall be subject to the condition that local interests agree to:

a. Provide without cost to the United States all lands, easements and right-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 costs of such retaining works;

b. Hold and save the United States free from damages due to the construction works;

c. Provide and maintain at local expense adequate public terminal and transfer facilities open to all on equal terms;

d. Accomplish, without cost to the United States, all alterations of pipelines, powerlines, utility lines, cables, and highway facilities, when and as required for construction of the project;

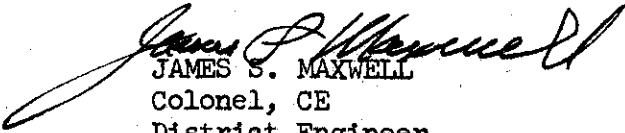
e. Assume all obligations of ownership, operation, and maintenance of the salt water barrier and appurtenances upon its completion; and

f. Assume all obligations of ownership, operation, and maintenance of the access park and minimum recreational facilities upon its completion, and maintain free and ready public access to the water areas adjacent to the park at all times.

88. It is further recommended that the project for Chocolate Bayou, Texas, be incorporated into the Gulf Intracoastal Waterway project as a tributary and discontinued as a separate project.

3 Incls

1. Plates 1 and 2
2. Appendixes I thru III
3. Attachment


JAMES S. MAXWELL
Colonel, CE
District Engineer

[First endorsement]

SWDGW-4

SUBJECT: Review of Reports on Gulf Intracoastal Waterway, Chocolate Bayou, Texas

United States Army Engineer Division, Southwestern, Dallas, Texas
February 6, 1964

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

I concur in the conclusions and recommendations of the District Engineer.



C. H. DUNN
Brigadier General, USA
Division Engineer

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

APPENDIX I

ECONOMIC EVALUATION

1. General.- This appendix contains economic data and analyses of the benefits that would be attributable to navigation improvement of Chocolate Bayou from the Gulf Intracoastal Waterway to the mouth in Chocolate Bay, thence upstream to a point near Liverpool, Texas. Three plans have been evaluated to determine the project effect with respect to navigation, salinity control, and recreation, and the benefits, if any, of each function of the proposed waterway under each plan of improvement.

2. The analyses and computations contained herein are based on data and statistics compiled from a survey of the waterway and the tributary area, records and statistical data furnished by maritime, industry, and business representatives; and interviews with local interests. Reports of waterborne commerce compiled annually by the Corps of Engineers and other applicable economic statistics were consulted for information pertinent to the project.

3. Project area.- Chocolate Bayou rises at a point about 20 miles southwest of Houston, Texas, and flows some 36 miles in a southeasterly direction across the eastern section of Brazoria County before emptying into Chocolate Bay, an arm of West Bay. The watershed slopes gently to the Gulf from an elevation of about 70 feet above mean sea level, to the coastal marshes of the bay and drains an area of approximately 160 square miles. The stream meanders through the project area with depths ranging from 6 to 20 feet below mean low tide, and is tidal for a distance of about 18 miles from its mouth. The area is sparsely settled and, except for a new chemical plant recently constructed by the Monsanto Chemical Co., agricultural production is the primary economic activity in the area under existing conditions. A more detailed discussion of the economics of the area is given in exhibit 2 of this appendix.

NAVIGATION

4. Existing channel.- Local interests have improved the natural stream by dredging a channel 10 feet deep by 100 feet wide, extending from about mile 376 on the Gulf Intracoastal Waterway through Chocolate and Lost Bays upstream for a distance of about 8 miles to the Monsanto Chemical plant.

5. Existing commerce.- Through the year 1961 unmanufactured seashell was the only commodity moving over Chocolate Bayou. The movement of petroleum and chemical products was started in 1962, following completion of the Monsanto plant and, in that year, about 298,000 tons of these commodities and about 243,000 tons of seashells were moved on the waterway. A summary of the commerce reported in the "Waterborne Commerce of the United States, 1962," on this waterway for the decade 1953 through 1962 is shown in table A.

TABLE A

ANNUAL COMMERCE - 1953 through 1962

Year	Total tonnage (2000 lbs.)	Year	Total tonnage (2000 lbs.)
1953	120,163	1958	295,239
1954	115,045	1959	134,360
1955	88,235	1960	150,752
1956	119,210	1961	309,482
1957	126,718	1962	570,950

6. As shown in table A, the volume of seashell commerce moved on the previously unimproved channel through 1961 has steadily increased over the past years. A study of seashell movement disclosed that the seashells were used mostly for construction materials for county and state highways. For the 10-year period 1953-1962, the annual commerce in seashells averaged about 170,000 tons.

7. The volume of petroleum and chemical products reported in the Corps of Engineers' "Waterborne Statistics - 1962," amounts to about 327,000 tons. The new plant was activated during the year and representatives of the local industry indicate that about 298,000 tons of this commerce were moved during the last 7-month period of the year. It is estimated that the commerce in petroleum and chemical products is now moving at an annual rate of about 500,000 tons.

8. Prospective commerce.- The principal commodities of prospective commerce that would move on the improved waterway consist of seashells or similar construction materials, crude petroleum, petroleum and chemical intermediate and end products, and diversified commerce generated on the canalized waterway from industrial and commercial development during the 50-year period of analysis used for project evaluation.

9. Seashells.- According to local interests the prospective commerce in seashells on Chocolate Bayou will total about 1.25 million tons annually

at the end of the first 25 years of the period of analysis. Studies of movements of seashells over similar waterways in the area indicate that this estimate is not unreasonable, particularly in view of the comparatively rapid growth that occurs in an area in the initial stages of industrialization. The initial development of a diversified economy in an area along the Texas Gulf Coast generates a substantial demand for seashells for new roads, enlargement of existing highways, roads, and municipal streets, shell concrete for parking areas, ramps and miscellaneous structures, subbase for heavy industry plant sites and many other uses. These demands will level off as the new economy matures until movement of these materials is primarily on a sustaining basis with a small increment of tonnage to provide for normal growth. It is considered that a conservative estimate of the prospective commerce in seashells, adjusted for the factors discussed above, would amount to a uniform growth of about 16,600 tons annually to a maximum of about 1.0 million tons at the end of the 50-year period of analysis.

10. Authorities on seashell resources along the Texas Gulf Coast are not in agreement as to the expected commercial life of these resources under existing and anticipated future depletion rates. Estimates of the useful life of seashell resources before depletion vary from 40 to 100 years. For the purpose of this report, however, this uncertainty is not considered to be a critical factor. Even though the seashell resource should become drastically curtailed or exhausted, the need for materials to serve the same uses will continue. Substitute materials such as limestone, and sand and gravel, are available from a number of sources for waterborne movement. The actual material used is determined largely by the delivered cost. If the seashells are not available it is believed that use of the other materials will increase and will offset the decrease in seashell movement; accordingly, prospective commerce in seashells has been estimated to increase uniformly and reach a total of 1.0 million tons annually at the end of the 50th year.

11. Petroleum and chemicals. - Local interests estimate that prospective petroleum and chemical products will amount to 1.5 million tons annually by the end of the year 1964. The annual rate at the end of 1962 was about 0.5 million tons. Based on a straight line projection, the estimates of local interests indicate that this commerce would amount to about 25 million tons by the 50th year. In view of the transitional phase of the industry and economy of the area, a straight line projection from the tonnage in 1962 to 1.5 million tons in 1964 would give undue emphasis to the characteristic rapid growth in commerce generated by a new industrial complex, and would not reflect normal leveling of growth of this commerce after initial production volumes have been attained. Investigations in the Chocolate Bayou area show that one plant is producing, one is under construction, and a third is in the planning stage. These plants are or will be interrelated either in

their feed stocks or end products in a manner typical of several similar industrial complexes of varying stages of maturity along the Texas Gulf Coast. Based on statistics of more mature industrial complexes in contiguous areas, it is considered that a very conservative estimate of the prospective commerce in petroleum and chemicals at this time would amount to a uniform increase of about 70,000 tons annually to a maximum of about 4.0 million tons at the end of the 50-year period of analysis.

12. Miscellaneous commerce. - Records of commerce on existing shallow-draft channel projects in the Galveston District show that most of the waterways carry varying amounts of miscellaneous commodities to serve the needs of the area. These miscellaneous commodities vary in class and quantity on each channel. The Chocolate Bayou project undoubtedly would develop a considerable commerce in miscellaneous commodities, however, since these commodities cannot be identified at this time this traffic is not evaluated for the purposes of this report.

13. Summary of prospective commerce. - In summary, the total estimated prospective commerce that would move over the improved Chocolate Bayou channel is estimated to amount to 4.0 million tons of petroleum and chemical commodities and 1.0 million tons of seashells, or a total of 5.0 million tons of commerce by the end of the 50-year period of analysis.

14. Existing vessel traffic. - A detailed tabulation of the trips, drafts, and direction of movement of vessel traffic on Chocolate Bayou for the calendar year 1962 is given in table B.

TABLE B

TRIPS AND DRAFTS OF VESSELS
(Calendar year 1962)

<u>INBOUND</u>						
Draft (ft.)	Self-	Non-self		Other	Total	
	propelled vessels	propelled vessels				
	Towboat or tugboat	Dry cargo	Tanker			
8	125	163	121	-	409	
7	13	32	-	-	45	
6	84	8	-	3	95	
5	26	1	44	-	71	
3	-	-	1	-	1	
2	-	-	32	-	32	
Total	248	204	198	3	653	

<u>OUTBOUND</u>						
Draft (ft.)	Self-	Non-self		Other	Total	
	propelled vessels	propelled vessels				
	Towboat or tugboat	Dry cargo	Tanker			
8	121	4	39	-	164	
7	12	1	-	-	13	
6	90	-	-	3	93	
5	26	-	-	-	26	
3	-	-	1	-	1	
2	-	197	157	-	354	
Total	249	202	197	3	651	

15. Practically all of the existing traffic consists of barge tows of one towboat with one or two barges arranged in tandem. These tows are utilized in the movement of seashells from reefs in both Galveston and San Antonio Bays into the Chocolate Bayou area, and in the movement of petroleum and chemical products through the Gulf Intracoastal Waterway into Chocolate Bayou.

16. Under existing conditions local interests report that damages to vessel traffic occur mainly in the unimproved channel above the locally improved channel. According to the local interests these marine accidents consist of collisions and groundings which involve damage to propellers, broken shafts or transmissions, sinkings and damage to fixed piers and other shore facilities.

17. A summary of the trips, drafts, and direction of movement of vessel traffic on Chocolate Bayou for the decade 1953-1962 is given in table C.

TABLE C

SUMMARY OF TRIPS AND DRAFTS OF VESSELS
(1953-1962)

Year:	VESSEL TRIPS												Total inbound and outbound
	Total inbound (drafts in feet)						Total outbound (drafts in feet)						
	8	7	6	5	4 & less	Total trips	8	7	6	5	4 & less	Total trips	
1953:	40	207	179	16	2	444	-	86	54	15	283	438	882
1954:	53	155	189	-	1	398	1	35	98	-	262	396	794
1955:	34	95	161	2	-	292	-	25	71	2	192	290	582
1956:	-	130	188	-	-	318	-	8	101	-	210	319	637
1957:	13	76	205	2	-	296	-	7	119	-	170	296	592
1958:	161	112	256	-	-	529	-	4	214	-	311	529	1058
1959:	69	54	141	-	1	265	-	3	112	-	150	265	530
1960:	118	46	131	-	-	295	1	3	118	-	173	295	590
1961:	201	36	165	-	-	402	37	3	116	-	246	402	804
1962:	409	45	95	71	33	653	164	13	93	26	355	651	1304

18. Traffic on the bayou was relatively stable and averaged about 719 vessel trips annually over the period 1953-1962. The traffic increased sharply in 1962 following completion of the Monsanto plant.

19. Prospective vessel traffic.- It is anticipated that the number of trips of vessels on an improved waterway would diminish initially through more efficient loading of existing equipment and the use of larger capacity equipment that could transport the same tonnage in fewer trips. However, it is estimated that the period of this decrease in vessel traffic would be of comparatively short duration and that the increasing movement of commerce would be reflected in a uniform increase in vessel trips as the economy of the area develops. It is estimated that the number of trips of vessels with loaded drafts of 7 feet or over will average about 2,500 trips annually, over the 50-year period.

20. Estimates of benefits to navigation.- Benefits that would be attributable to an improved channel in Chocolate Bayou are the savings in transportation cost of barge movement of prospective commerce in fully loaded barges or by more efficient use of equipment on the improved channel as compared to the cost of moving this commerce over the existing channel in reach 1 and over the original unimproved channel in reach 2. Additional navigation savings would be realized from the reduction in hazards to navigation from deepening, widening and curve easing in the existing channel. Maintenance of reach 1 is justified by savings from the locally dredged channel attributable to existing petroleum commerce of 500,000 tons and existing seashell commerce of 170,000 tons.

21. Operation of shell barges.- Seashells dredged from reefs in both San Antonio Bay and Galveston Bay are moved inland through Chocolate Bayou to shell material yards on the bayou. This commerce is presently being transported in tows of one 600-HP towboat and two 2,000-ton open barges partially loaded. The barges are loaded to an average of about 1,360 tons. Present conditions of the unimproved channel necessitate reducing this volume to about 1,000 tons per barge during the winter months. Barges are loaded to about 1,600 tons during the summer months. Sharp bends in the unimproved channel limit the length of tows to less than 250 feet and limit the speed to 3 miles per hour. The two-barge tow is split up before entering the unimproved channel at mile 8.2 and the barges are moved separately upstream to the seashell material yards.

22. The available depths of waters in the bays at the points of origin of the seashells limit transportation equipment used in the movement of seashells to a maximum 7-foot draft. The 12- x 125-foot channel proposed for reach 2 in plan 3 would provide some additional efficiency in operation of this equipment through more maneuver room and some increase in operating

speed but these additional benefits are considered minor. For the purposes of this report, estimates of benefits from a reduction in cost of transporting seashells are to be considered the same for all three plans. Savings in transportation costs attributable to the proposed improvements are derived from elimination of splitting the tows in Chocolate Bayou and the ability to operate tows more efficiently. These savings for the prospective commerce in seashells are reduced to an average annual equivalent benefit for each of the three plans.

23. Estimates of benefits are based on the difference in the cost of transporting the prospective commerce in seashells over reach 2 of the existing bayou channel, as compared to the channel proposed under each of the three plans. Savings to navigation derived from the movement of 170,000 tons of existing commerce are estimated to amount to \$25,200 annually. Movement of the future increased commerce in seashells, which would reach a total of one million tons annually in the 50th year of the project, would derive additional savings in the amount of \$122,800 in that year. The equivalent average annual value of these additional savings based on a 3 percent interest rate for the 50-year period amounts to about \$48,000 annually. The total benefits from savings in transportation of the prospective commerce in seashells for plans 1, 2, and 3 are estimated at \$73,200 annually.

24. Operation of petroleum barges.- Additional benefits have been estimated from the movement of 500,000 tons of existing commerce of petroleum and chemical products in reach 1 only for the improvements proposed in plans 2 and 3 of this report. Benefits from the movement of 875,000 tons of prospective petroleum commerce over reach 2 in plans 1 and 2 are based on the difference in transportation cost of moving this traffic over the unimproved channel as compared to moving this traffic over the improved 9- x 100-foot channel. The movement of petroleum and chemical products would be handled via tows made up of one 600-HP towboat and two tank barges of about 10,000 barrels - 1,500 tons capacity each. Under the present unimproved channel conditions, the handling of these tows on reach 2 of the bayou would, of necessity, be in the same manner as that used by the seashell barges. The two-barge tow would be split in Chocolate Bayou, at mile 8.2, and the barges would move individually up the bayou. Benefits from the movement of 3,125,000 tons of prospective petroleum commerce over reach 1 in plans 2 and 3, and 875,000 tons of prospective commerce over reach 2 in plan 3, a 12- x 125-foot channel, are based on the difference in transportation cost of moving this traffic in larger and faster tows with the average tow being made up of one 1200-HP towboat and two tank barges of about 20,000 bbls. capacity each. A summary of the estimated savings to navigation on the movement of the existing petroleum and chemical commerce over Chocolate Bayou for the plans investigate is given in table D.

TABLE D

SUMMARY OF ESTIMATED SAVINGS TO NAVIGATION IN
PETROLEUM AND PETROLEUM PRODUCTS TRANSPORTATION COSTS

Reach	Cost per hour	Hours per round trip	Cost per round trip	Cost per ton	Average savings per ton	Total savings (500,000 tons)
<u>EXISTING CHANNEL CONDITIONS</u>						
(ONE 600-HP TOWBOAT WITH TWO 1500-TON TANK BARGES)						
1	\$37.27	13.6	\$507	\$0.169	-	-
2	37.27	19.0	708	0.236	-	-
<u>PLAN NO. 1</u>						
(ONE 600-HP TOWBOAT WITH TWO 1500-TON TANK BARGES)						
1	\$37.27	13.6	\$507	\$0.169	-	-
2	37.27	15.1	563	0.188	\$0.048	-
<u>PLAN NO. 2</u>						
(ONE 1200-HP TOWBOAT AND TWO 3000-TON TANK BARGES - REACH 1; ONE 600-HP TOWBOAT WITH TWO 1500-TON TANK BARGES - REACH 2)						
1	\$54.77	9.1	\$498	\$0.083	\$0.086	\$43,000
2	37.27	15.1	563	0.188	0.048	-
<u>PLAN NO. 3</u>						
(ONE 1200-HP TOWBOAT AND TWO 3000-TON TANK BARGES)						
1	\$54.77	9.1	\$498	\$0.083	\$0.086	\$43,000
2	54.77	10.1	553	0.092	0.096	-

25. Estimates of the total benefits from savings in the transportation costs of the prospective commerce in petroleum and chemicals are reduced to an equivalent average annual benefit for each of the plans investigated.

26. Plan No. 1.- a. Reach 1: No additional savings have been estimated from a reduction in transportation costs of the 500,000 tons of existing, or 2,625,000 tons of increased petroleum and chemical commerce attributable to this reach of the channel.

b. Reach 2: At this time there is no petroleum commerce transiting reach 2; however, movement of an estimated 875,000 tons of prospective commerce in petroleum and chemicals attributable to improvements in this reach would derive a savings in the amount of \$42,000 in the 50th year of the project life. The additional savings reduced to an average annual equivalent benefit, using a 3 percent interest rate would amount to about \$16,400 annually over the 50-year period. The total benefits from a reduction in cost of transportation of petroleum and chemicals attributable to reach 2 of plan 1 is estimated at \$16,400 annually.

27. Plan No. 2.- a. Reach 1: Based on a similar analysis and the use of larger and more efficient equipment, initial savings to transportation in the movement of existing commerce over this reach amount to about \$43,000 annually. The additional savings in the movement of 2,625,000 tons of increased commerce in petroleum and chemicals would amount to \$225,700 in the 50th year of the project. These savings, reduced to an equivalent average annual benefit at 3 percent interest rate would amount to about \$88,300 annually.

b. Reach 2: As in plan 1, estimated savings in the movement of 875,000 tons of prospective commerce in petroleum and chemicals attributable to improvements in this reach would amount to \$42,000 in the 50th year of the project life. These savings, reduced to an average annual equivalent benefit, would amount to about \$16,400 annually.

c. Total benefits attributable to the channels proposed under plan 2 from reduced cost in transporting the prospective commerce in petroleum and chemicals amount to about \$147,700 annually over the 50 years of the project life.

28. Plan No. 3.- a. Reach 1: The estimated savings attributable to improvements to reach 1 would amount to \$43,000 annually for 500,000 tons of existing petroleum and chemical commerce and \$88,300 annually for 2,625,000 tons of increased petroleum and chemical commerce.

b. Reach 2: Based on the use of larger and more efficient equipment, savings in transportation cost in the movement of 875,000 tons of prospective commerce over reach 2 amount to \$84,000 in the 50th year of the project life. These savings, reduced to an average annual equivalent benefit, would amount to about \$32,900 annually.

c. Total benefits attributable to the channel proposed under plan 3 from reduced cost in transporting the prospective commerce in petroleum and chemicals are estimated at \$164,200 annually over the 50-year project life.

29. Hazards to navigation.- The existing stream in reach 2 has a narrow, meandering channel and the navigational accidents have been quite frequent in the past with damages to pleasure craft, private piers and commercial equipment. These accidents have ranged from slight damages to complete replacements of pleasure craft and the salvage of a sunken towboat. Often, while making a sharp bend in the bayou, a towboat will damage its propeller, shaft, or transmission when the tow would inadvertently move too close and strike the stream bank. In December 1961 the tug "Joyce" struck an unknown submerged object and sank at about channel mile 10.4. The salvage cost for this accident amounted to approximately \$40,000. During that year alone, losses of operating time, labor and equipments rentals amounted to more than \$50,000, however, there are no available records of all damages to navigation that have occurred due to the hazardous conditions of the channel. Estimates of benefits from a reduction in hazards to navigation are based on the amount of traffic congestion, type of traffic, and operating speeds of vessels engaged in the movement of the existing and prospective commerce and in pleasure craft operating in and out of the Chocolate Bayou area. These factors are considered in relation to channel size and alignment. The estimated average annual benefits from reduction in hazards to navigation to existing and prospective traffic in reaches 1 and 2 are shown in table E:

TABLE E

SUMMARY OF ESTIMATED AVERAGE ANNUAL BENEFITS FROM
REDUCTION IN HAZARDS TO NAVIGATION
OVER 50-YEAR PERIOD OF ANALYSIS

Item	PLAN NO. 1		PLAN NO. 2		PLAN NO. 3	
	Reach 1	Reach 2	Reach 1	Reach 2	Reach 1	Reach 2
Existing traffic	-	\$5,000	\$8,000	\$5,000	\$8,000	\$8,000
Future additional traffic	-	7,000	10,000	7,000	10,000	12,000
Total prospective for reach	-	12,000	18,000	12,000	18,000	20,000
Total prospective for plan	\$12,000		\$30,000		\$38,000	

30. Summary of navigation benefits.- The total benefits creditable to navigation improvements proposed under the three plans considered as estimated in the preceding paragraphs are summarized in table F, as follows:

TABLE F
SUMMARY OF TOTAL ESTIMATED AVERAGE ANNUAL NAVIGATION BENEFITS

Item	Existing commerce		Future increase in commerce*		Total prospective commerce	
	Reach 1	Reach 2	Reach 1	Reach 2	Reach 1	Reach 2
<u>PLAN NO. 1</u>						
Savings in seashells transportation	-	\$25,200	-	\$48,000	-	\$73,200
Savings in petroleum & chemical transportation	-	-	-	16,400	-	16,400
Reduction in hazards to navigation	-	5,000	-	7,000	-	12,000
Total	-	30,200	-	71,400	-	101,600
					TOTAL PLAN NO. 1-----\$101,600	
<u>PLAN NO. 2</u>						
Savings in seashells transportation	-	\$25,200	-	\$48,000	-	\$73,200
Savings in petroleum & chemical transportation	\$43,000	-	\$88,300	\$16,400	\$131,300	\$16,400
Reduction in hazards to navigation	8,000	5,000	10,000	7,000	18,000	12,000
Total	51,000	30,200	98,300	71,400	149,300	101,600
					TOTAL PLAN NO. 2-----\$250,900	
<u>PLAN NO. 3</u>						
Savings in seashells transportation	-	\$25,200	-	\$48,000	-	\$73,200
Savings in petroleum & chemical transportation	\$43,000	-	\$88,300	32,900	131,300	32,900
Reduction in hazards to navigation	8,000	8,000	10,000	12,000	18,000	20,000
Total	51,000	33,200	98,300	92,900	149,300	126,100
					TOTAL PLAN NO. 3-----\$275,400	

*Equivalent average annual values

RECREATION

31. General.- Chocolate Bayou provides an easy access to small boats of water sports enthusiasts and recreational boaters to the Gulf Intracoastal Waterway in West Bay and from the Gulf of Mexico through San Luis Pass. The bayou is also well located for ready access by residents of the area over an adequate system of county roads and state highways. For these reasons, development of additional recreational facilities in connection with improvement of the bayou for navigation are considered in this study.

32. Present recreational facilities.- At present there are several commercial small boat facilities situated on Chocolate Bayou. They include Chocolate Bayou Marina, Johnsons Marina, Petersons Yacht Basin, and Snug Harbor Marina. These establishments offer service facilities that include fuel and oil, launching ramps, launching slings, sleeping accommodations, food and drinks, and marine repair services. In addition numerous private piers and shore facilities have been constructed by owners of homes along both banks of the bayou.

33. Proposed recreational facilities.- The growing popularity of boating as a form of outdoor recreation has greatly increased the need for adequate public access to bodies of water. For this reason, an access park with minimum recreational facilities is proposed for construction in conjunction with the navigation project. Facilities to be provided for initial installation at the access park would consist of a boat launching ramp, picnic tables, fireplaces, and sanitary facilities.

34. Future recreational development.- Based upon a formula contained in the Delaware River Basin Report, and the 1.25 million people residing in the proposed project's zone of influence (50-mile radius of the project), a potential of 29,000 visitors for water based recreation could be estimated for the project area on a normal summer Sunday. With numerous other facilities being located in the general service area, it would not be expected that visitation to the Chocolate Bayou facility would even approach the potential computed in this manner. However, the facility would be well located and undoubtedly would attract a considerable number of visitors from facilities that are now crowded beyond reasonable capacity. It is expected that the proposed access park will experience full initial use. At least two other suitable sites along Chocolate Bayou are presently undeveloped. When visitation to the proposed park constantly exceeds its capacity, the development of additional access parks should be considered.

35. Recreational benefits.- The recreational benefits for the proposed access park are based upon an estimated 38,000 visitor days per year. The

38,000 visitor days were derived under the assumptions that an average of 28 family units would visit the park each day for 340 days (365 days/year (-) 25 days/year of inclement weather), and that each family unit would average four people. The unit value of the recreational activities is estimated at \$0.50 per visitor day. Therefore, the annual recreational benefits for the proposed access park are estimated at \$19,000.

SALINITY CONTROL

36. General.- Project evaluation studies pertaining to the proposed navigation channel in Chocolate Bayou include consideration of crop damage incurred by rice growers from salt contamination of rice irrigation water taken from Chocolate Bayou and the effect that the proposed channel improvements will have on the salt contamination problem.

37. Irrigation.- The rice industry in the project area began in the middle '30's when growing cotton was no longer profitable. Two irrigation companies, the Brazoria County Rice Co., and Duward Harper Canal (now known as the Chocolate Bayou Rice and Canal Co.) started at almost the same time. The Brazoria County Rice Co. takes irrigation water from Chocolate Bayou at mile 14.4. The Chocolate Bayou Rice and Canal Co. takes water for its canals at about mile 17.0. There are 30,000 acres of rice under cultivation in the drainage area, of which about 4,000 acres are usually irrigated from Chocolate Bayou. The remainder is normally irrigated with water diverted from the Brazos River to the west. Irrigation water generally is needed during the period from April thru September, with the peak demands occurring either in July or August. While the quality of water required for irrigating rice varies with the seasons and growth stage of the crop, the required volume depends principally upon the amount and distribution of local rainfall. In wet years good crops have been produced by pumping only one or two acre-feet of water per acre of crop while during dry years, which are accompanied by low flows in the bayou, optimum production may require about 4 acre-feet of water per acre of crop.

38. Saltwater intrusion.- Studies have been made of the saltwater intrusion problem. It was found that, under both the former natural conditions and the existing conditions of channel improvement to the Monsanto Chemical Co. plant, there is no consistent or predictable condition of movement or behavior of the saltwater wedge in Chocolate Bayou. The degree of salinity in bayou water will be affected by tidal and wind influenced water levels in Chocolate Bay, rainfall runoff into the bayou, pumping rates related to the growing cycle which will affect fresh water storage in the bayou; and return flow into the bayou from both the Chocolate Bayou water and the water imported from the Brazos River. Generally the Chocolate Bayou

water will be utilized so long as it is suitable. However, when this water becomes too saline, its use will be discontinued and the more costly Brazos River water use will be increased.

39. Prevention of damages from saltwater intrusion.- In the absence reliable data that would permit a realistic analysis of the saltwater damage to rice crops under original unimproved, existing, and improved conditions, quantitative evaluation of the damages that would be eliminated, reduced or prevented by a structure designed to solve the problem can be made. However it is a well known fact that deepening and/or widening of the tidal reaches coastal streams increases the upstream movement of a saltwater wedge and, a other factors remaining the same, increases the magnitude of any existing saltwater intrusion problem.

40. Installation of a saltwater barrier would serve to mitigate any damages that might be induced by additional enlargement or extension of the existing navigation improvements. It would also eliminate practically all of the damages that may have been incurred by construction of the existing improved channel as well as damages that may have existed under the natural conditions of the bayou prior to any navigation improvement. There are no available data that would permit a reasonable evaluation or identification of damages attributable to each of these conditions. It is known, however, that the Chocolate Bayou water used for irrigation has a value of many thousands of dollars per year compared to the cost of alternative water supplied from the Brazos River. Since a simple barrier structure can be constructed at comparatively small cost, for the purpose of this report the overall benefits from prevention of damages from saltwater intrusion under existing conditions are evaluated as being at least equal to the annual charges for construction, operation and maintenance of the barrier, which are estimated at \$9,000.

BENEFITS

41. Average annual equivalent benefits.- The benefits derived from the increments of future growth of prospective commerce were reduced to average annual equivalent benefits, with computations based on a compound interest rate of 3 percent over a project analysis period of 50 years. For example, under plan No. 1 the navigation benefits from a reduction in transportation cost of the existing commerce of 170,000 tons of seashells transiting reach 2 are estimated to amount to \$25,200 annually. Based on the analysis of prospective seashell commerce over reach 2, this benefit would increase uniformly to \$122,800 at the end of the 50-year period of analysis. The reduction factor, taken from EM-1120-2-118, is .39115. Thus, the average annual equivalent value of the \$122,800 increase reached in 50 years would be \$48,000. This amount, added to the estimate of benefits to be derived from existing commerce, gives a total average annual benefit over

the 50-year period of \$73,200. Average annual equivalent benefits for all estimates based on prospective commerce were computed in the same manner.

42. Summary of benefits.- The benefits creditable to all improvements proposed under the plans considered in this report have been estimated on the basis of January 1964 prices. Estimates of the total average annual benefits creditable to each plan of improvement are summarized in table G.

TABLE G
SUMMARY OF TOTAL ESTIMATED AVERAGE ANNUAL BENEFITS*

(in thousands of dollars)

Item	Plans considered		
	No. 1	No. 2	No. 3
Savings to transportation	\$ 89.6	\$220.9	\$237.4
Reduction in hazards to navigation	12.0	30.0	38.0
Prevention of damages from saltwater intrusion	9.0	9.0	9.0
Recreation	19.0	19.0	19.0
Total benefits	129.6	278.9	303.4

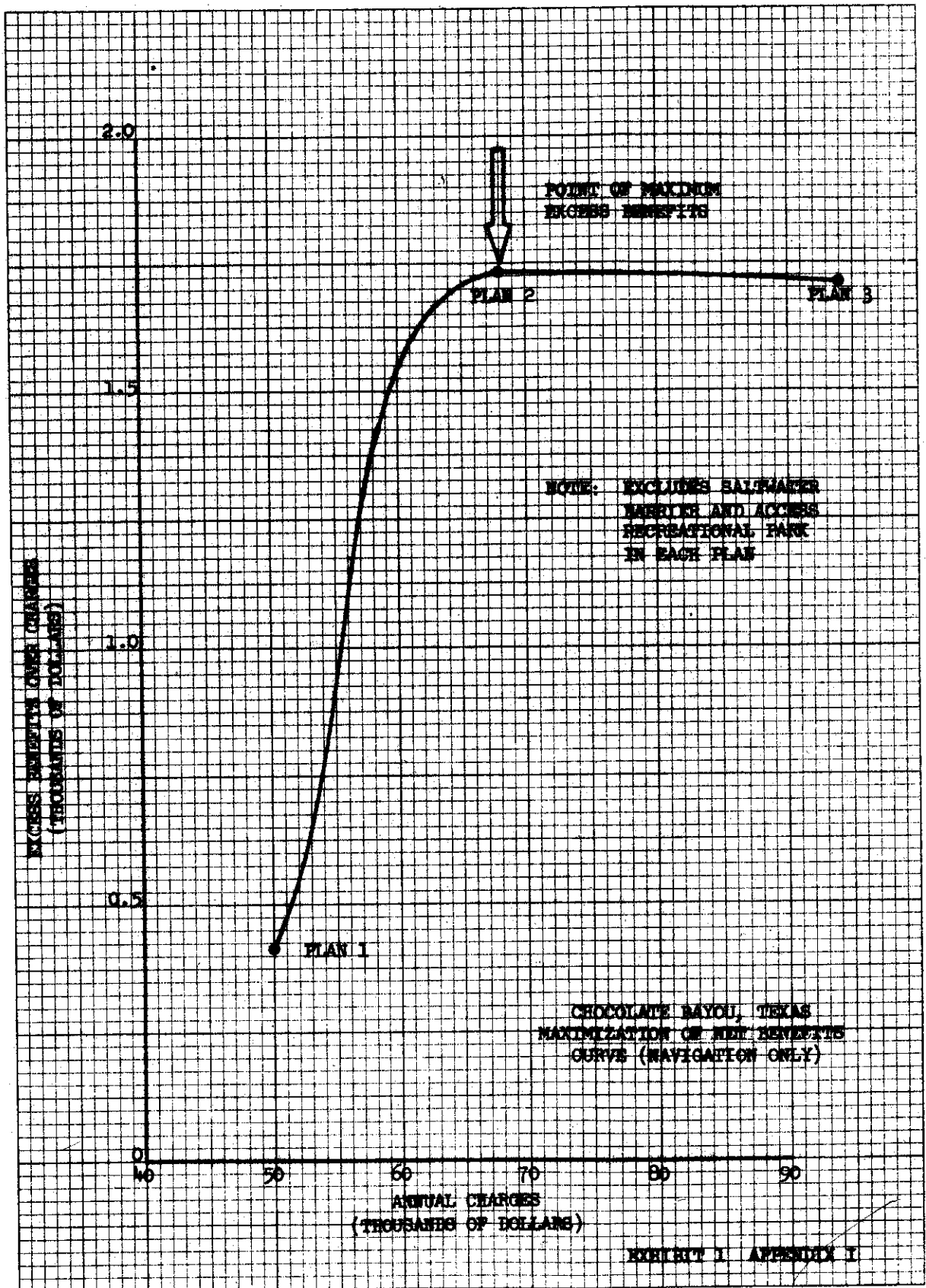
*Includes equivalent average annual benefits

43. Comparison of benefits and costs.- The estimated annual charges for the recommended plan of improvement are presented in detail in appendix II to this report. The annual charges include the estimated costs for operating and maintaining the proposed project. The average annual benefits, as estimated in this appendix, are \$278,900, the annual charges \$87,000, and the benefit-to-cost ratio is 3.2.

PROJECT FORMULATION

44. General.- Each of the three channels considered for navigation improvement was examined in two separate reaches in order to consider the benefits that would be realized by the existing and prospective commerce. Examination of project values by separate reaches for each channel size considered provided economic data for use in the formulation of the project. To determine the optimum scale of development, a curve was constructed for each of the plans considered, by plotting the excess benefits over charges. This curve is shown on exhibit 1 to this appendix. Inspection of this curve shows that the plan with the maximum excess of benefits over charges would be

in the vicinity of plan 2, with a 12- by 125-foot channel for reach 1, and a 9- by 100-foot channel for reach 2. Additional information describing the three plans considered, the comparison of the plans, and selection of a plan, can be found in paragraphs 43 through 48 of the text.



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APPENDIX II

ENGINEERING AND COST DATA

1. General.- This appendix presents information pertaining to detailed estimates of first cost, investment, and annual charges for the proposed plan of improvement.

2. Plans of improvement.- Three plans of improvement referred to as plans 1, 2, and 3 were investigated during this study and are described in paragraphs 43 through 45 of the text. Plan 1 includes maintenance of the locally dredged channel to a depth of 9 feet over a bottom width of 100 feet, and extension of the 9-foot by 100-foot channel upstream in Chocolate Bayou to a turning basin of 9-foot depth in the vicinity of Liverpool. Plan 2 would enlarge the locally dredged channel to a depth of 12 feet over a bottom width of 125 feet, and would construct a 9-foot by 100-foot channel to a turning basin in the vicinity of Liverpool. Plan 3 would enlarge the locally dredged channel to 12 feet over a bottom width of 125 feet, and would construct a 12-foot by 125-foot channel to a turning basin in the vicinity of Liverpool.

3. All plans follow the same alignment for the navigation channel and differ only in the depth and width of the two reaches of the waterway. Each plan includes a public access park with minimum basic facilities for recreational use adjacent to the project. Each plan also includes the construction of a salt water barrier. The channel dimensions for each plan of improvement are as follows:

		<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
Reach 1 - locally dredged channel from GIWW to mile 8.2	Depth (ft)	9	12	12
	Width (ft)	100	125	125
	Length (mi)	8.2	8.2	8.2
Reach 2 - channel extension in Chocolate Bayou from mile 8.2 to turning basin at mile 13.2	Depth (ft)	9	9	12
	Width (ft)	100	100	125
	Length (mi)	5.2	5.2	5.2

4. Cost estimates.- The detailed estimates of first cost include the costs for construction, lands, rights-of-way and damages, contingencies, engineering, supervision, administration, and overhead. Estimates of annual charges for the improvements include interest and amortization of the investment over a 50-year period, and the costs of annual maintenance, operation and advance replacement of the improvements.

5. Unit prices.- The unit prices used in the construction cost estimates are based on costs for similar work in the area prevailing during January 1964. The unit price for dredging was based on the estimated costs for a modern 20-inch pipeline dredge with average monthly output of 385,000 cubic yards. The estimate of costs for maintenance, operation, and advance replacement of the locally constructed aids to navigation were furnished by the U. S. Coast Guard.

6. Interest rates.- An interest rate of 3.0 percent for Federal investment, 3.0 percent for non-Federal public investment, and 4.0 percent for non-Federal private investment were used in computing the annual charges for a 50-year period.

7. Rights-of-way and spoil disposal areas.- Estimates of the costs of rights-of-way required for enlarging and extending the Chocolate Bayou channel, and for constructing the salt water barrier and the access park, were based on the estimated present value of the lands. Spoil disposal areas used in the construction of the local channel would be used for the disposal of materials during the construction and maintenance of the 12-foot by 125-foot channel in reach 1. Material excavated during the construction and maintenance of the 9-foot by 100-foot channel in reach 2 would be placed in spoil areas on land, located at intervals where the pipeline costs for the dredging operations would not be excessive.

8. Materials.- The materials to be encountered in dredging the channel improvements, and in constructing the salt water barrier and the access park, would consist of various combinations of sand, silt, and clay. The materials should offer no unusual dredging or construction difficulties.

9. Maintenance.- Estimates of the quantities of maintenance dredging to be removed annually were based on experienced shoaling rates of similar channels and basins in the district. The cost estimates for maintenance dredging and for maintenance and operation of the salt water barrier and the access park, were based on the costs for similar work and structures in the district prevailing during January 1964.

10. Overdepth and side slopes.- All estimates of quantities for dredging include allowances for overdepth dredging. The allowances include 2 feet of advance maintenance plus 2 feet of allowable overdepth in the bay channel or 1 foot of allowable overdepth in the landlocked reaches. Quantities were computed for channel side slopes of 1 vertical on 5 horizontal in the bay, and 1 vertical on 3 horizontal in land cuts. The side slopes would extend from the bottom limits of the allowable overdepth for advance maintenance.

11. Salt water barrier.- The estimates of costs for the salt water barrier generally described in paragraphs 52 and 53 of the text and detailed on plate 3 included the following engineering and design considerations:

a. The weir section would consist of prestressed concrete piling grouted after driving to reduce leakage through the barrier. The piles would be capped with reinforced concrete to provide a consolidated unit having a uniform top elevation. Concrete piling were selected in lieu of steel sheet piling because they offer better flow characteristics for a weir, would allow less leakage when the joints are grouted, and would be affected less by brackish water corrosion.

b. Steel sheet piling were used for the circular cell abutments because of their ability to resist ring tension, and because of their economy. The steel sheet piling would be treated above the mud line with an epoxy-coal tar treatment to prevent corrosion. Piling for both the weir and the abutments can be driven without the cost of dewatering which would be required for a concrete structure.

c. A hoist with a hand-operated winch would be provided on the left hand cell, looking downstream, to enable small, shallow-draft boats to be lifted across the barrier. To prevent scouring, the channel would be riprapped for 25 feet on the downstream side of the barrier. To insure sufficient depth of water at the boat hoist, the channel would be excavated to elevation -3 feet on the side near the hoist. A floodlight would be provided to illuminate the boat hoist area at night, and to identify the structure as a hazard to navigation.

12. Access park, recreational facilities.- The estimates of cost for constructing the recreational facilities at the access park described in paragraph 54 of the text, and indicated on plate 3, were based generally on similar facilities included in the drawing folio entitled: "Standard plans for recreational facilities, Corps of Engineers, Civil Works, 1961."

13. Contingencies and allowances.- The estimates include allowances to cover contingencies during construction, and the estimated engineering and overhead costs separated into engineering and design costs and supervision and administration costs. An allowance of 15 percent was used to cover contingencies in connection with the dredging operations. A 20 percent contingency allowance was used in the cost estimates for land acquisition; construction of spoil area embankments, dikes, etc.; relocation of utility crossings; construction of the salt water barrier; and construction of the access park recreational facilities. The allowances for engineering and overhead costs were estimated on the basis of current costs in the district.

14. Preauthorization study costs.- The sum of \$28,000 has been expended for preauthorization survey and study costs, including the preparation of this report. The cost estimates in this appendix are exclusive of the preauthorization study costs.

15. Estimates of first costs and annual charges.- A summary of the first costs and annual charges for the various plans considered in this report is shown in table "A" of this appendix. Detailed estimates of first costs and annual charges for the proposed plan of improvement are shown in tables B through I of this appendix.

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TABLE A

FIRST COSTS AND ANNUAL CHARGES
FOR PLANS CONSIDERED
(in thousands of dollars)

Item	Plans considered		
	No. 1	No. 2(1)	No. 3
1. Federal first costs			
a. Corps of Engineers	923.0	1,319.0	1,839.0
b. U. S. Coast Guard	None	None	None
c. Total Federal first cost	<u>923.0</u>	<u>1,319.0</u>	<u>1,839.0</u>
2. Non-Federal first costs			
a. Non-Federal, public	278.0	306.0	395.0
b. Non-Federal, private	50.0	50.0	94.0
c. Total non-Federal first cost	<u>328.0</u>	<u>356.0</u>	<u>489.0</u>
3. Total first cost			
a. Federal	923.0	1,319.0	1,839.0
b. Non-Federal	328.0	356.0	489.0
c. Total first cost	<u>1,251.0</u>	<u>1,675.0</u>	<u>2,328.0</u>
4. Federal investment			
a. Corps of Engineers	923.0	1,319.0	1,839.0
5. Federal annual charges			
a. Corps of Engineers	43.0(2)	60.0(2)	80.0(2)
6. Non-Federal investment			
a. Non-Federal, public	278.0	306.0	395.0
b. Non-Federal, private	50.0	50.0	94.0
c. Total non-Federal investment	<u>328.0</u>	<u>356.0</u>	<u>489.0</u>
7. Non-Federal annual charges			
a. Non-Federal, public	23.4	24.7	28.3
b. Non-Federal, private	2.3	2.3	4.4
c. Total non-Federal annual charges	<u>25.7</u>	<u>27.0</u>	<u>32.7</u>
8. Total annual charges			
a. Federal	43.0(2)	60.0(2)	80.0(2)
b. Non-Federal	26.0	27.0	33.0
c. Total annual charges	<u>69.0</u>	<u>87.0</u>	<u>113.0</u>

(1) Recommended plan.

(2) Does not include annual cost of \$6,000 for maintenance dredging of local channel, or \$5,000 for maintenance and advance replacement of aids to navigation constructed by local interests.

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TABLE B
ESTIMATES OF FIRST COST FOR
RECOMMENDED CHANNEL IMPROVEMENTS

(12' x 125' channel in reach 1; 9' x 100' channel and 9' x 600' x 600' turning basin in reach 2)

Item:	:	:	:	Unit	:
No. :	Item	:Unit	: Quantity	: cost	: Cost
1. Federal first cost					
a. Corps of Engineers					
	(01.0) Lands & damages				
	Acquisition cost	Ownership	30	\$150.00	\$4,500
	Contingencies				900
	Total, land and damages				<u>5,400</u>
	(09.0) Channels				
	Dredging				
	Reach 1	C.Y.	1,588,000	0.19	301,720
	Reach 2	C.Y.	2,010,000	0.28	<u>562,800</u>
	Subtotal channels				864,520
	Contingencies				<u>129,080</u>
	Total channels				<u>993,600</u>
	(30.0) Engineering & Design				49,000
	(31.0) Supervision & Administration				<u>91,000</u>
	Total Corps of Engineers				<u>1,139,000</u>
	b. U. S. Coast Guard				<u>None</u>
	c. Federal first cost				1,139,000
2. Non-Federal first cost					
a. Non-Federal public					
	(1) Acquisition cost	Ownership	30	650.00	19,500
	(2) Rights-of-way				
	Reach 1	Acres	28	250.00	7,000
	Reach 2	Acres	131	700.00	91,700
	(3) Spoil areas				
	Reach 1	Acres	56	60.00	3,360
	Reach 2	Acres	270	90.00	24,300
	(4) Levees & spillways	Job	LS	98,000.00	<u>98,000</u>
	Subtotal				243,860
	Contingencies				<u>47,140</u>
	Total, non-Federal Public				<u>291,000</u>

TABLE B (CONT'D)

Item:	:	:	:	Unit :
No. :	Item	:	Unit :	Quantity : Cost : Cost
b.	Non-Federal private			
	(1) Relocations (utilities)			
	(a) Relocate Dow Chemical Co. 2-4" pipelines at Mile 8.8			\$ 13,200
	(b) Relocate Pan American Refinery Co. 1-4" products pipeline at Mile 9.6			10,400
	(c) Relocate Houston Lighting & Power Co. 138 KV aerial crossing at Mile 9.6			16,000
	(d) Relocate Houston Lighting & Power Co. 12 KV aerial crossing at Mile 11.9			1,800
	Subtotal			<u>41,400</u>
	Contingencies			8,600
	Total, non-Federal Private			<u>50,000</u>
c.	Total non-Federal First Cost			341,000
3.	Total first cost			
a.	Federal			1,139,000
b.	Non-Federal			<u>341,000</u>
	Total first cost			1,480,000

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TABLE C

ESTIMATES OF FIRST COST FOR
RECOMMENDED SALT WATER BARRIER

Item:	:	:	:	Unit	:			
No. :	Item	:	Unit	Quantity	:	cost	:	Cost
1	Federal first cost							
	a. Corps of Engineers							
	(01.0) Lands & damages	Ownership		1		\$ 150.00	\$	150
	Contingencies							50
	Total, lands & damages							<u>200</u>
	(04.0) Dam, salt water barrier							
	(1) Structural steel	Lb.		2,000		.40		800
	(2) Reinforcing steel	Lb.		400		.15		60
	(3) Concrete	C.Y.		8		40.00		320
	(4) Steel sheet piling	S.F.		5,550		3.80		21,090
	(5) Steel sheet piling connection	Ft.		40		11.00		440
	(6) Prestressed concrete sheet piling	S.F.		3,800		5.25		19,950
	(7) Excavation	C.Y.		16,000		.80		12,800
	(8) Structural backfill	C.Y.		7,500		1.00		7,500
	(9) Riprap, rubble	Ton		260		10.00		2,600
	(10) Filter blanket	C.Y.		80		7.00		560
	(11) Shell	C.Y.		30		5.00		150
	(12) Hoist	Job		L.S.		3000.00		3,000
	(13) Grubbing	Acre		3		200.00		600
	(14) Floodlight on pole	Job		L.S.		200.00		200
	(15) Powerline	Mile		.5		3000.00		1,500
	Subtotal, construction							<u>71,570</u>
	Contingencies							<u>13,230</u>
	Total							<u>84,800</u>
	(30.0) Engineering & design							15,000
	(31.0) Supervision & administration							<u>15,000</u>
	Total Corps of Engineers							115,000
	b. Coast Guard							<u>None</u>
	c. Total Federal first cost							115,000

TABLE C (Cont'd)

Item:	:	:	:	Unit	:
No. :	Item	: Unit	: Quantity	: cost	: Cost
2	Non-Federal first cost				
	a. Non-Federal public				
	(1) Acquisition cost	Ownership	1	\$ 650.00	\$ 650
	(2) Rights-of-way	Acre	6	1300.00	7,800
	Subtotal				<u>8,450</u>
	Contingencies				1,550
	Total non-Federal public				<u>10,000</u>
	b. Non-Federal private				<u>None</u>
	c. Total, non-Federal first cost				10,000
3	Total first cost				
	a. Federal				115,000
	b. Non-Federal				<u>10,000</u>
	Total first cost				125,000

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE D

ESTIMATES OF FIRST COST
RECOMMENDED ACCESS PARK

Item:	:	:	:	Unit	:	
No. :	Item	:	Unit	Quantity	: cost	: Cost
1	Federal first cost					
	a. Corps of Engineers					
	(01.0) Lands & damages	Ownership		1	\$ 150.00	\$ 150
	Contingencies					50
	Total, lands & damages					<u>200</u>
	(14.0) Recreation facilities					
	(1) 28' Hard surface road	L.F.		2,000	10.00	20,000
	(2) Hard surface parking & turnout areas	S.F.		30,000	0.35	10,500
	(3) Picnic tables	Ea.		28	150.00	4,200
	(4) Water well w/pump	Ea.		1	900.00	900
	(5) Comfort stations	Ea.		2	200.00	400
	(6) Refuse containers	Ea.		14	50.00	700
	(7) Fireplaces	Ea.		14	40.00	560
	(8) Launching ramp	Ea.		1	1,500.00	1,500
	(9) Timber T-head wharf	Ea.		1	1,500.00	1,500
	(10) Brush removal	Job	L.S.		350.00	350
	(11) Directional sign	Ea.		1	150.00	150
	(12) 4' x 40' timber wharf	Ea.		1	1,500.00	1,500
	(13) Landscaping	Job	L.S.		500.00	500
	Subtotal, construction					<u>42,760</u>
	Contingencies					<u>9,040</u>
	Subtotal, access park					<u>51,800</u>
	(30.0) Engineering & design					5,000
	(31.0) Supervision & administration					<u>8,000</u>
	Total Corps of Engineers					65,000
	b. U. S. Coast Guard					None
	c. Total Federal first cost					65,000

TABLE D (Cont'd)

Item:	:	:	:	Unit	:
No. :	Item	: Unit	: Quantity	: cost	: Cost
2	Non-Federal first cost				
	a. Non-Federal public				
	Lands and damages	Acres	7	\$ 600.00	\$ 4,200
	Contingencies				<u>800</u>
	Total non-Federal public				5,000
	b. Non-Federal private				None
	c. Total non-Federal first cost				5,000
3	Total first cost				
	a. Federal				65,000
	b. Non-Federal				<u>5,000</u>
	Total first cost				70,000

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE E

TOTAL ESTIMATED FIRST COSTS FOR
RECOMMENDED PLAN OF IMPROVEMENT

Item	: Channel : improvements:	: Salt water: : barrier	: Access: : Park	: Total
1. Federal first costs				
a. Corps of Engineers				
Construction (1)	\$ 999,000	\$ 85,000	\$52,000	\$1,136,000
Engineering and design	49,000	15,000	5,000	69,000
Supervision and administration	<u>91,000</u>	<u>15,000</u>	<u>8,000</u>	<u>114,000</u>
Subtotal, Corps of Engineers	1,139,000	115,000	65,000	1,319,000
b. U.S. Coast Guard	None	None	None	None
c. Total Federal first cost	1,139,000	115,000	65,000	1,319,000
2. Non-Federal first costs				
a. Non-Federal, public	291,000	10,000	5,000	306,000
b. Non-Federal, private	50,000	None	None	50,000
c. Total non-Federal first cost	<u>341,000</u>	<u>10,000</u>	<u>5,000</u>	<u>356,000</u>
3. Total first cost				
a. Federal	1,139,000	115,000	65,000	1,319,000
b. Non-Federal	<u>341,000</u>	<u>10,000</u>	<u>5,000</u>	<u>356,000</u>
c. Total first cost	<u>1,480,000</u>	<u>125,000</u>	<u>70,000</u>	<u>1,675,000</u>

(1) Includes lands and damages (title review)

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE F
ESTIMATES OF ANNUAL CHARGES FOR
RECOMMENDED NAVIGATION IMPROVEMENTS
(12' x 125' channel in reach 1; 9' x 100' channel and 9' x 600' x 600'
turning basin in reach 2)

Item:	:	:
No. :	Item	Cost
	Estimated construction period (months)	6
1	<u>Federal investment</u>	
	a. Corps of Engineers	\$ 1,139,000
	b. U.S. Coast Guard	None
	c. Total Federal investment	<u>1,139,000</u>
2	<u>Federal annual charges</u>	
	a. Corps of Engineers	
	1. Interest on investment, 3%	34,200
	2. Amortization, 50-yrs	10,100
	3. Maintenance	8,700
	Total Corps of Engineers	<u>53,000 (1)</u>
3	<u>Non-Federal investment</u>	
	a. Non-Federal public	291,000
	b. Non-Federal private	50,000
	c. Total non-Federal investment	<u>341,000</u>
4	<u>Non-Federal annual charges</u>	
	a. Non-Federal public	
	1. Interest on investment, 3%	8,700
	2. Amortization, 50-yrs	2,600
	3. Maintenance	1,400
	Total non-Federal public	<u>12,700</u>
	b. Non-Federal private	
	1. Interest on investment, 4%	2,000
	2. Amortization, 50-yrs	300
	Total non-Federal private	<u>2,300</u>
	c. Total non-Federal annual charges	15,000
5	<u>Total annual charges</u>	
	a. Federal	53,000 (1)
	b. Non-Federal	15,000
	c. Total annual charges	<u>68,000</u>

(1) Does not include annual cost of \$6,000 for maintenance dredging of local channel, or \$5,000 maintenance and advance replacement of aids to navigation constructed by local interests.

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE G
ESTIMATES OF ANNUAL CHARGES FOR
RECOMMENDED SALT WATER BARRIER

Item	:	Cost
Estimated construction period (months)	:	6
1. <u>Federal investment</u>		
a. Corps of Engineers		\$115,000
b. U. S. Coast Guard		<u>None</u>
c. Total Federal investment		<u>115,000</u>
2. <u>Federal annual charges</u>		
a. Corps of Engineers		
(1) Interest on investment, 3%		3,500
(2) Amortization, 50-yrs		<u>1,000</u>
Total, Corps of Engineers		4,500
b. U. S. Coast Guard		<u>None</u>
c. Total, Federal annual charges		4,500
3. <u>Non-Federal investment</u>		
a. Non-Federal public		10,000
b. Non-Federal private		<u>None</u>
c. Total non-Federal investment		<u>10,000</u>
4. <u>Non-Federal annual charges</u>		
a. Non-Federal public		
(1) Interest on investment, 3%		300
(2) Amortization, 50-yrs		100
(3) Maintenance		<u>4,100</u>
Total non-Federal public		4,500
b. Non-Federal private		<u>None</u>
c. Total non-Federal annual charges		4,500
5. <u>Total annual charges</u>		
a. Federal		4,500
b. Non-Federal		<u>4,500</u>
c. Total annual charges		<u>9,000</u>

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE H
ESTIMATES OF ANNUAL CHARGES FOR
RECOMMENDED ACCESS PARK

Item	:	Cost
Estimated construction period (months)	:	4
1. <u>Federal investment</u>		
Corps of Engineers		\$65,000
2. <u>Federal annual charges</u>		
Corps of Engineers		
(1) Interest on investment, 3%		1,900
(2) Amortization, 50-yrs		600
Total, Corps of Engineers		<u>2,500</u>
3. <u>Non-Federal investment</u>		5,000
4. <u>Non-Federal annual charges</u>		
Non-Federal public		
(1) Interest on investment, 3%		150
(2) Amortization, 50-yrs		50
(3) Maintenance		<u>7,300</u>
Total, non-Federal		<u>7,500</u>
5. <u>Total annual charges</u>		
a. Federal		2,500
b. Non-Federal		<u>7,500</u>
c. Total annual charges		<u>10,000</u>

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

TABLE I
TOTAL ESTIMATED ANNUAL CHARGES FOR
RECOMMENDED PLAN OF IMPROVEMENT

Item	:Channel :improvement	:Salt water: :barrier	:Access: : park :	Total
1. Federal investment				
a. Corps of Engineers	\$1,139,000	\$115,000	\$65,000	\$1,319,000
b. U.S. Coast Guard	None	None	None	None
c. Total Federal investment	<u>1,139,000</u>	<u>115,000</u>	<u>65,000</u>	<u>1,319,000</u>
2. Federal annual charges				
a. Corps of Engineers	53,000	4,500	2,500	60,000(1)
3. Non-Federal investment				
a. Non-Federal, public	291,000	10,000	5,000	306,000
b. Non-Federal, private	50,000	None	None	50,000
c. Total non-Federal investment	<u>341,000</u>	<u>10,000</u>	<u>5,000</u>	<u>356,000</u>
4. Non-Federal annual charges				
a. Non-Federal, public	12,700	4,500	7,500	24,700
b. Non-Federal, private	2,300	None	None	2,300
c. Total non-Federal annual charges	<u>15,000</u>	<u>4,500</u>	<u>7,500</u>	<u>27,000</u>
5. Total annual charges				
a. Federal	53,000	4,500	2,500	60,000(1)
b. Non-Federal	<u>15,000</u>	<u>4,500</u>	<u>7,500</u>	<u>27,000</u>
c. Total annual charges	<u>68,000</u>	<u>9,000</u>	<u>10,000</u>	<u>87,000</u>

(1) Does not include annual cost of \$6,000 for maintenance dredging of local channel, or \$5,000 for maintenance and advance replacement of aids to navigation constructed by local interests.

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

APPENDIX III

COMMENTS BY OTHER AGENCIES

INTRODUCTION

In accordance with the Interagency Agreement on Coordination of Water and Related Land Resources Activities approved by the President on May 26, 1954, draft copies of the Main Report and appendixes were sent to other Federal agencies at field level for review. Letters from these agencies containing their comments and replies where appropriate are presented in this appendix.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

P. O. BOX 1306
ALBUQUERQUE, NEW MEXICO

March 4, 1963

District Engineer
Corps of Engineers, U. S. Army
Post Office Box 1229
Galveston, Texas

Dear Sir:

Mr. Kenneth Heagy's letter of January 4, 1963, reference SWNGW-2b, requested our comments on a survey study of proposed improvements to Chocolate Bayou, Brazoria County, Texas. The study was authorized by resolutions adopted by Public Works Committees of the Senate and House, June 30, 1960.

This letter, which constitutes our report on the proposed improvements, has been prepared under the authority and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and has been coordinated with the Bureau of Commercial Fisheries. It has received the concurrence of the Texas Game and Fish Commission, as indicated by the enclosed copy of a letter dated February 5, 1963, signed by Mr. Eugene A. Walker, Director of Program Planning.

The Bureau of Sport Fisheries and Wildlife has prepared two reports which pertained to dredging a channel in Chocolate Bayou under Public Notice W-N-243-41-Permit-4817, issued to Monsanto Chemical Company. These reports, dated June 29, 1960, and October 11, 1961, made specific recommendations for the placement of spoil while constructing the channel.

It is our understanding that improvements by the Corps of Engineers will include:

1. Assumption by the Federal Government of maintenance of the 10- by 100-foot channel dredged by Monsanto Chemical Company from the Gulf Intracoastal Waterway to the Monsanto plant on Chocolate Bayou, a distance of 8.6 miles.

2. Extension of the 10- by 100-foot Chocolate Bayou Channel upstream from the Monsanto Chemical Company plant to a point near Liverpool, Texas, including a 600- by 600-foot public turning basin. Portions of the Bayou will be rectified to form a 5-mile extension.
3. Construction of a salt-water barrier on Chocolate Bayou about 1.5 miles north of Liverpool, Texas, and 0.5 mile northwest of the Missouri Pacific Railroad.

Material dredged from the extension of the channel will be placed on land. During future maintenance dredging operations, material dredged from the existing channel will be placed on existing spoil areas.

The existing channel extends northerly from the Gulf Intracoastal Waterway at Mile 379.7 west from Harvey Lock, Louisiana, across Chocolate Bay and along an improved channel alignment of Chocolate Bayou to the Monsanto Chemical Company plant. The proposed extension will follow an improved channel alignment of the Bayou for an additional 5 miles.

West Bay, Chocolate Bay, and the lower portion of Chocolate Bayou have estuarine fishery habitat of high quality. These areas are important to many species of fish and crustaceans valued by sport and commercial fishermen. Beds of marine vegetation in Chocolate Bay are used for spawning by red drum and spotted seatrout. These beds also are used as nursery and feeding grounds by many fish and shrimp and as winter feeding grounds by waterfowl. Spotted seatrout and many other estuarine species migrate freely up and down Chocolate Bayou in the project area and are taken by sport fishermen.

The proposed channel extension will not significantly affect fish or wildlife resources in Chocolate Bayou, provided care is taken to prevent closing of cutoff or tributary channels of the Bayou. These passageways are important for access to the Bayou from fishing camps and private boat docks located along the natural stream course.

Spoil placement from the dredging of the existing channel was planned so that minimal damage to fish and wildlife resources will result. It is important that spoil placement in future maintenance dredging be restricted to established spoil disposal areas.

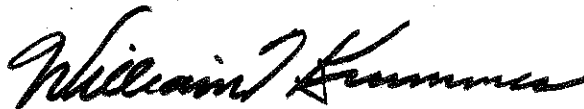
It is recommended:

1. That all cutoff and tributary channels of Chocolate Bayou be kept open and that spoil be prevented from entering them.
2. That spoil placement from future maintenance dredging operations be confined to those areas established during dredging under Public Notice W-N-243-41-Permit-4817 for the portion south of the Monsanto Chemical Company plant and to areas as proposed on the map accompanying Mr. Heagy's letter of January 4, 1963, for the portion north of the Monsanto Chemical Company plant.

This report is based on information available to us as of January 7, 1963, and any change in project plans should be called to the attention of the Bureau of Sport Fisheries and Wildlife and the Texas Game and Fish Commission.

We appreciate the opportunity extended to us to comment on the effects of the proposed project on fish and wildlife.

Sincerely yours,



William T. Krummes
Acting Regional Director

Enclosure

Copies (10)

Distribution:

- (4) Executive Secretary, Texas Game and Fish Commission, Austin, Texas
- (2) Regional Director, Bureau of Commercial Fisheries, Region 2, St. Petersburg Beach, Florida
- (2) Director, Biological Laboratory, Bureau of Commercial Fisheries, Galveston, Texas
- (2) Field Supervisor, Branch of River Basin Studies, Bureau of Sport Fisheries and Wildlife, Fort Worth, Texas
- (1) Chairman, Southwest Field Committee, U. S. Department of the Interior, Muskogee, Oklahoma
- (2) Regional Director, Bureau of Mines, Region 4, Bartlesville, Oklahoma

HOWARD CARNEY, VICE-CHAIRMAN
ATLANTA

BEN F. VAUGHAN, JR., CHAIRMAN
CORPUS CHRISTI

MORRIS HIGLEY
CHILDRESS

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HOWARD D. DODGEN
EXECUTIVE SECRETARY
AUSTIN



W. J. CUTBIRTH, JR.
ASST. EXECUTIVE SECY.
AUSTIN

W. O. REED
DALLAS

WILSON SOUTHWELL
SAN ANTONIO

FRANK M. WOOD
WICHITA FALLS

H. A. WALSH
EL PASO

AUSTIN, TEXAS

February 5, 1963

Regional Director
U. S. Fish and Wildlife Service
Post Office Box 1306
Albuquerque, New Mexico

Attention Carey H. Bennett

Dear Mr. Bennett:

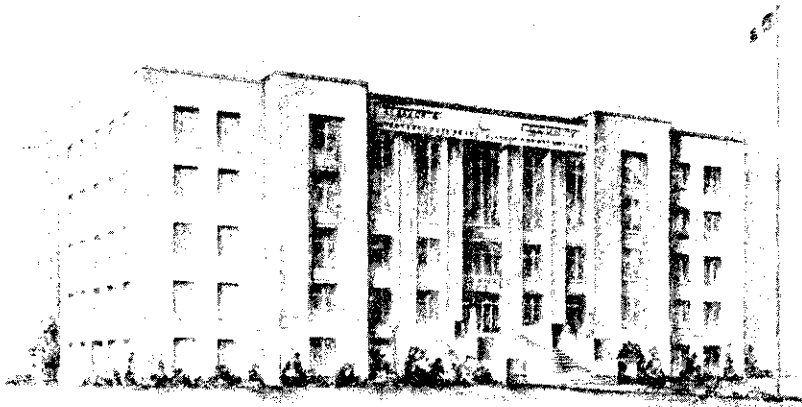
Reference is made to the draft of your report concerning the Corps of Engineers investigation of Chocolate Bayou, Brazoria County, Texas.

We have reviewed and are in concurrence with the finding of this report.

Sincerely yours,

Eugene A. Walker
Eugene A. Walker
Director, Program Planning

ep
Copy to John Degani



BRAZORIA COUNTY

ANGLETON, TEXAS

November 27, 1963

Mr. Howard L. Heald
Chief of Projects
Reports Section
U. S. Corps of Engineers
Santa Fe Building
Galveston, Texas

Dear Mr. Heald:

The members of the Commissioners' Court of Brazoria County, Texas, have requested me to notify you that they are thoroughly in accord with your proposed project of widening Chocolate Bayou for barge traffic and that they wish to endorse your plans as heretofore outlined to them on November 13, 1963, here at Angleton in the Commissioners' Courtroom.

It is the hopes of the Commissioners' Court that you will proceed to have the plans approved with the understanding that the Commissioners' Court will act as sponsor for this project.

Very truly yours,

ALTON C. ARNOLD
COUNTY JUDGE

ACA/cb

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE

PUBLIC HEALTH SERVICE

Tenth Floor - 1114 Commerce Street
Dallas 2, Texas

January 8, 1964

District Engineer
U. S. Army Engineer District, Galveston
Corps of Engineer
606 Santa Fe Building
P. O. Box 1229
Galveston, Texas

Attention: Mr. T. W. Elam, Chief
Engineering Division

Dear Sir:

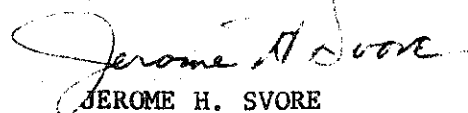
In accordance with your request dated December 27, 1963, we have reviewed the review of reports on the Gulf Intracoastal Waterway, Chocolate Bayou, Texas.

The proposed plan of improvement provides for modifying the existing Federal navigation project to provide a channel 12 feet deep and 125 feet wide extending from the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 3.2; thence 9 feet deep and 100 feet wide to a turning basin, 9 feet deep and 100 feet square near channel mile 13.2; for a salt water barrier in Chocolate Bayou about 3.6 miles upstream from the turning basin; and for an access park with minimum recreational facilities.

Water supply for municipal and industrial use is not included as a project purpose in this report. The proposed plan appears to have no affects on public health aspects of the area.

Thank you for the opportunity to review this report.

Sincerely yours,



JEROME H. SVORE
Regional Program Director
Water Supply & Pollution Control

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

P. O. Box 648

Temple, Texas 76502

January 10, 1964

Colonel James S. Maxwell
District Engineer
U. S. Army Corps of Engineers
606 Santa Fe Building
P. O. Box 1229
Galveston, Texas

Dear Colonel Maxwell:

Thank you for the opportunity to review an advance copy of the review of reports on the Intracoastal Waterway, Chocolate Bayou, Texas.

The report presents the results of an investigation to determine the advisability of modifying the authorized navigation project for Chocolate Bayou.

Based on results of the investigation, it is recommended that the existing project be modified to provide for a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; for a channel 9 feet deep and 100 feet wide thence to a turning basin with 9-foot depth in the vicinity of mile 16.8; and for an access park with minimum recreational facilities at an estimated first cost to the United States of \$1,319,000 for new work, and an increase of \$14,000 in the cost of annual maintenance, subject to certain provisions of local cooperation. The report further recommends that the Chocolate Bayou, Texas, project be incorporated into the Gulf Intracoastal Waterway project as a tributary and discontinued as a separate project.

Information presented in Exhibit 2 of Appendix 1 states that based on data analyzed during completion of the economic base study, it is expected that "----- most of the agricultural land in Brazoria County is expected to remain as agricultural land until some time after 2020."

Drainage survey investigations completed in Brazoria County by technicians of the Soil Conservation Service in 1960 showed agricultural lands along Chocolate Bayou from Chocolate Bay to the vicinity of Farm Road 1462 to be in need of surface drainage and less than 50 percent of the problem area to be drained at that time. The survey showed that outlets for needed drainage were adequate.

It is not felt that improvements proposed for Chocolate Bayou will affect adversely the installation of needed on-farm drainage in the area.

The report, in Table 6, page 31, shows irrigation benefits estimated to be \$9,000 annually. These will accrue as a result of prevention of damages from salt water intrusion after installation of the salt water barrier. Irrigation water is pumped from Chocolate Bayou at two points near Liverpool.

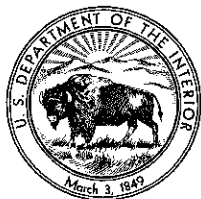
Our review of the review of reports on the Gulf Intracoastal Waterway, Chocolate Bayou, Texas, indicates that modification of the existing project for Chocolate Bayou, Texas, will not have any detrimental effect on projects, existing or proposed, under programs administered by the Soil Conservation Service.

We are returning the copy of the report as requested in your letter of transmittal. If we can assist you in any way, please let me know.

Very truly yours,



H. N. Smith
State Conservationist



UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

~~REGIONAL~~

AREA IV

MINERAL RESOURCE OFFICE

ROOM 206 FEDERAL BUILDING
BARTLESVILLE, OKLAHOMA

OFFICE OF

~~REGIONAL DIRECTOR~~

AREA DIRECTOR

January 13, 1964

Mr. T. W. Elam, Chief
Engineering Division
Corps of Engineers
U.S. Army Engineer District
P.O. Box 1229
Galveston, Texas

Reference: SWGGW-2b

Dear Mr. Elam:

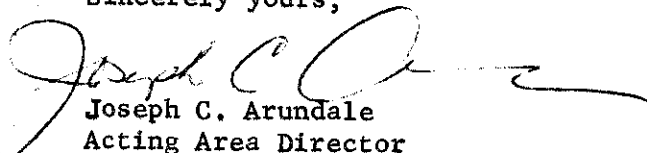
Thank you for sending us an advance copy of the Review of Reports on Gulf Intracoastal Waterway, Chocolate Bayou, Texas, for field level review.

The recommended improvements provide for a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2; for a channel 9 feet deep and 100 feet wide thence to a turning basin with 9-foot depth in the vicinity of mile 16.8; for a salt water barrier in the vicinity of mile 16.8; and for an access park with minimum recreational facilities. The ratio of average annual benefits to average annual costs is 3.1 to 1.0.

A review of all available office data indicates that the proposed project would be beneficial to the mineral industries in the area. The enlarged channel will provide cheaper transportation for the expanding petroleum and petrochemical industries in the area.

The Area IV Mineral Resource Office has no objection to the proposed project.

Sincerely yours,


Joseph C. Arundale
Acting Area Director

REVIEW OF REPORTS
ON
CHOCOLATE BAYOU, TEXAS

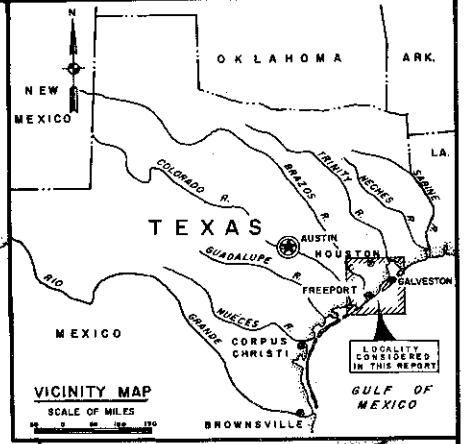
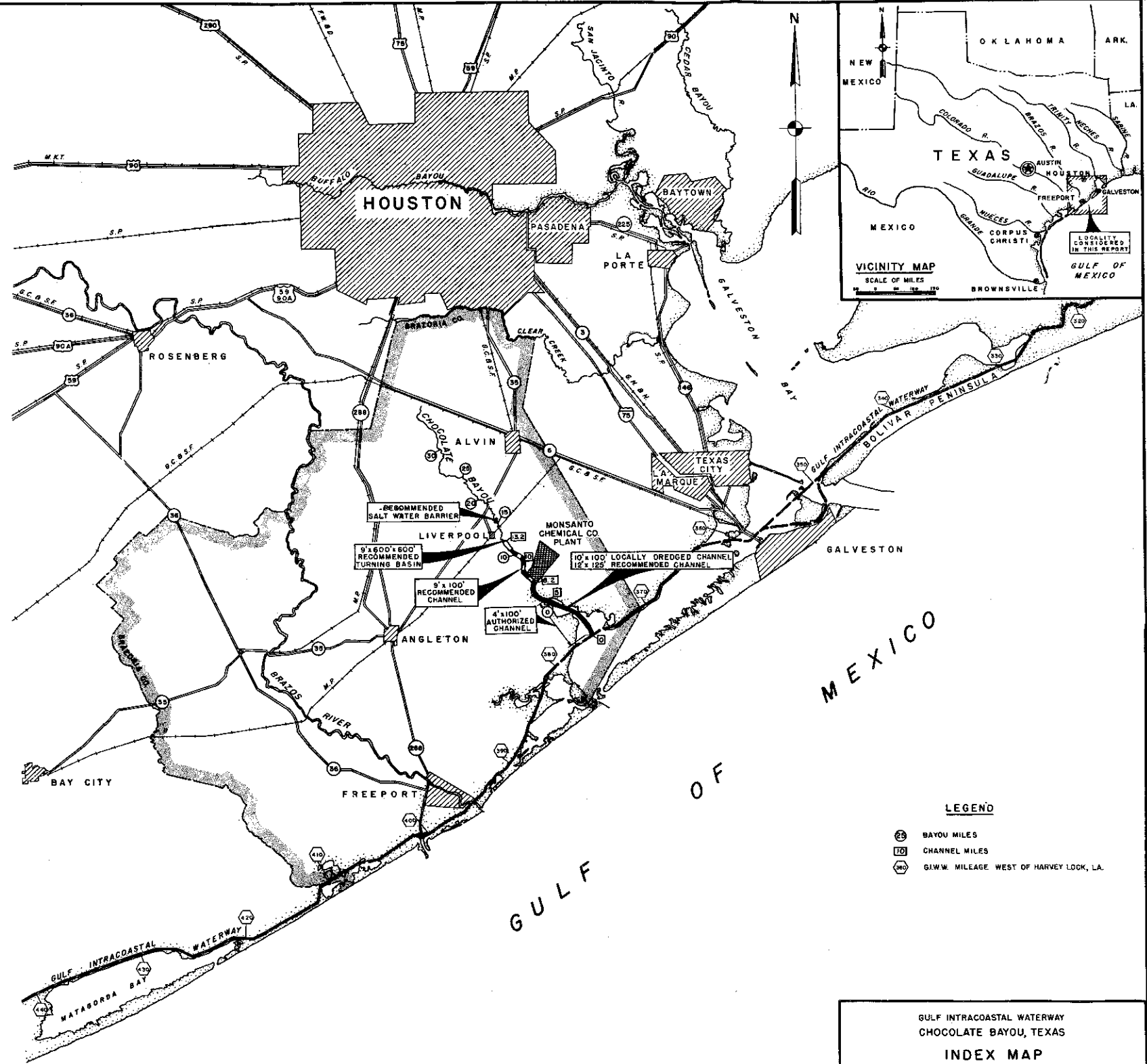
INFORMATION CALLED FOR BY
SENATE RESOLUTION 148, 85TH CONGRESS
ADOPTED JANUARY 28, 1958

1. Authority.- The following information is furnished in response to Senate Resolution 148, 85th Congress, adopted January 28, 1958.

2. Requests of local interests.- The navigation improvements requested by local interests at a public hearing in Angleton, Texas, on February 21, 1962, included enlargement of the existing locally dredged channel, and extension as necessary to afford the Chocolate Bayou area the same barge service accommodation as is available on the Gulf Intracoastal Waterway. Local interests also requested that the maintenance requirements of the locally dredged 10-foot by 100-foot channel extending from the main channel of the Gulf Intracoastal Waterway to the Monsanto Chemical Company slip at mile 8.2 be assumed by the Federal Government.

3. Certain interests requested that the investigations for navigation improvements also include a salt water intrusion study and, if necessary, that a salt water barrier be included as a feature of the project.

4. Improvements considered.- The report considers all navigation improvements, including the construction of a salt water barrier, requested by local interests. The improvements proposed under the recommended plan of improvement have been discussed with the local interests that would provide the cooperation required for the improvements if and when adopted. They have expressed satisfaction with the recommended plan of improvement.



- LEGEND**
- BAYOU MILES
 - CHANNEL MILES
 - G.I.W. MILEAGE WEST OF HARVEY LOCK, LA.

**GULF INTRACOASTAL WATERWAY
CHOCOLATE BAYOU, TEXAS
INDEX MAP**

SCALE OF MILES

U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS JANUARY 1964

SUBMITTED <i>[Signature]</i> ENGINEER	APPROVAL RECOMMENDED <i>[Signature]</i> ENGINEER	APPROVED <i>[Signature]</i> CHIEF ENGINEER DISTRICT
---	--	---

PREPARED UNDER THE DIRECTION OF
 JAMES S. MAXWELL, COLONEL, C.E.
 DISTRICT ENGINEER

DRAWN BY W.P.A.
 CHECKED BY W.A.
 CHECKER BY L.E.A.

AS APPROVED BY THE DISTRICT ENGINEER
 DATE: JANUARY 21, 1964

FILE: I.W.W. 1125-79

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