PROJECT NO. BS-4

WHITE'S DITCH DIVERSION SIPHON
OUTFALL MANAGEMENT PLAN
PLAQUEMINES PARISH, LOUISIANA

FEASIBILITY REPORT

Completed by
USDA-Soil Conservation Service
for
LA. DNR - Coastal Restoration Division

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WHITE'S DITCH DIVERSION SIPHON
TABLE OF CONTENTS

Project Location Map 1

Vicinity Map 2

Project Description 3-11

a. Location
b. Justification
c. Hydrology
d. Vegetation
e. Soils
f. Salinity
g. Wetland Changes
h. Shoreline Erosion

Project Objectives & Goals 12

Outfall Management Alternative #1 13-16

Outfall Management Alternative #2 17-19

Outfall Management Alternative #3 20-22

Outfall Management Alternative #4 23-26

Critical Management Considerations 27

Comparison of Outfall Management Alternatives 28

Evaluation of Selected Plan 29-30

a. Plan Components
b. Water Management Scheme

Socioeconomic Concerns 31-32

a. Social Impacts and Concerns
b. Protected Cultural & Environmental Resources

Comments and Recommendations 33

Estimated Cost of Selected Plan 34

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Alexandria, Louisiana

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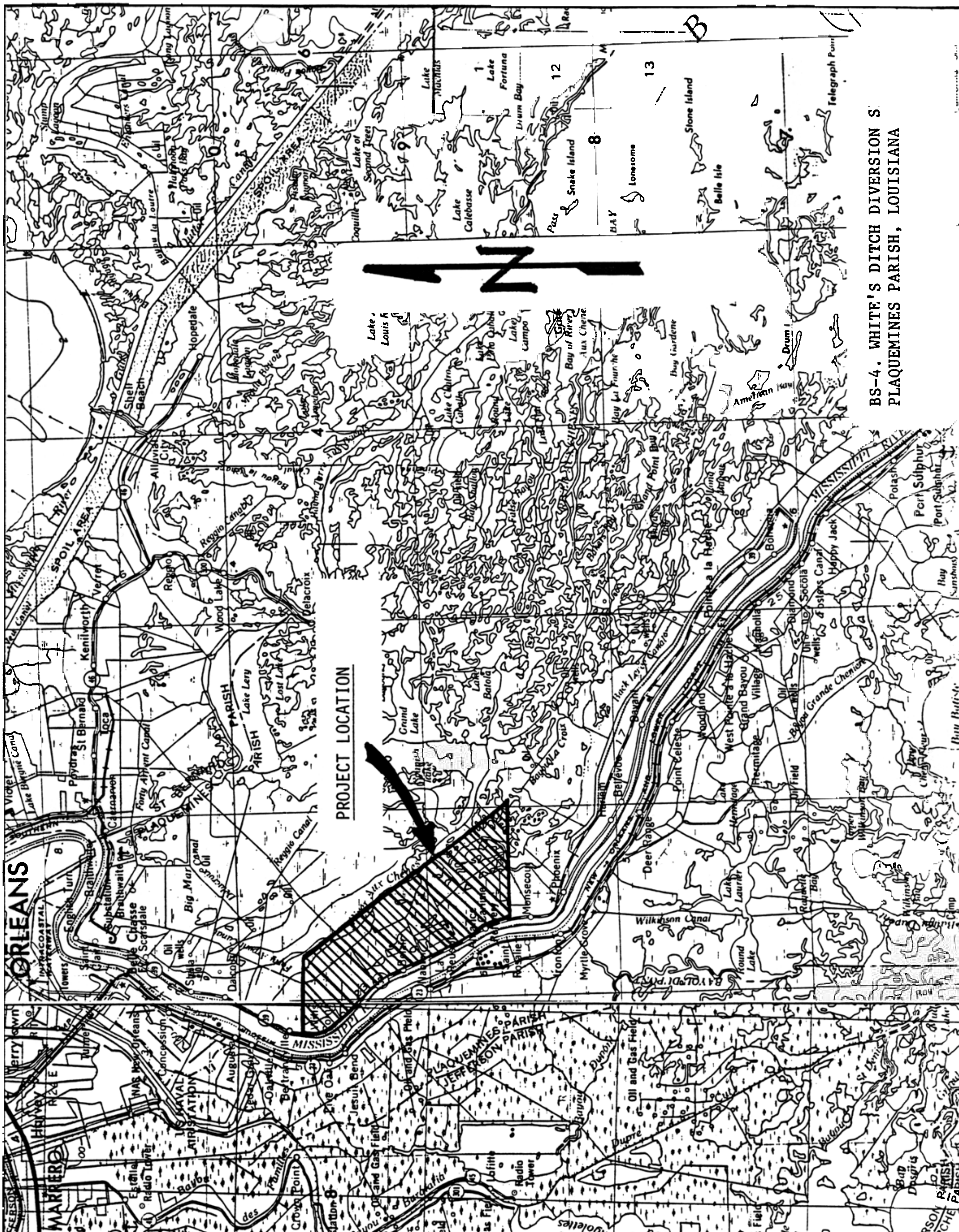
USDA-SCS-FORT WORTH, TEX. 1965

WHITE'S DITCH
DIVERSION SIPHON PROJECT

PROJECT LOCATION MAP



VICINITY MAP

PROJECT DESCRIPTION

Location

The White's Ditch Diversion Siphon is located on the east side of the Mississippi River, approximately three miles downriver from the small community of Belair, Louisiana, in Plaquemines Parish. The project is expected to directly benefit approximately 10,500 acres of brackish marsh. The project area encompasses all or parts of sections 12-18, and 31-39 of T15S, R12E; sections 1-6 of T16S, R12E; sections 19, 29-33, 37, and 38 of T15S, R13E; and sections 4-9, 18, and 37-42 of T16S, R13E.

The project area is bound on the north by a pipeline canal and pumping station near Wills Point, on the south by Bayou Garelle and Joe Gravolet Canal, on the west by the Mississippi River protection levee, and on the east by River Aux Chenes. The approximate center of the project area is located at latitude 29 degrees, 42', 23", and longitude 90 degrees, 57', 30".

Justification

Installation of the White's Ditch diversion siphon was completed in 1963 with the objective of enhancing muskrat habitat. In the absence of an outfall management plan, the surrounding marsh receives limited benefits from the diverted river water. Two 50 inch steel culverts divert water from the Mississippi River through the Belair Canal and into the River Aux Chenes where it continues south and out of the project area.

Wetlands in the project area are deteriorating for several reasons: 1) subsidence, 2) lack of sediment and nutrient deposition, 3) erosion via tidal exchange, 4) channelization, and 5) saltwater intrusion. These activities have resulted in the loss of approximately 1300 acres of solid, vegetated marsh from 1940 - 1980. Deterioration will continue unless preventative measures are taken.

In the absence of supplemental freshwater and sediment from the Mississippi River, subsidence, sea-level rise, wave erosion, and saltwater intrusion will continue to be problems. Protection and enhancement of this area are dependent on providing a hydrologic regime that: 1) minimizes the physiological stress to wetland vegetation

from saltwater intrusion and tidal energy, and 2) is conducive to the retention of locally provided freshwater and sediments. The objective of this report is to identify and describe outfall management alternatives for the Whites's Ditch siphon expansion project. This report does not provide suggestions for the expansion of the siphon project, but addresses outfall management measures necessary for managing the outfall waters of the siphon discharge.

Hydrology

The historic hydrology of the project area indicates that the current course of the river has remained the same for the last 700 years and has directly influenced the development of the entire area. The project area is located on the east side of the Mississippi River and was formed between two natural levee ridge systems, River Aux Chenes on the east and the Mississippi River on the west. There are also two unnamed bayou ridges found within the project area. These ridges formed along the old natural bayous which were distributary channels of the modern Mississippi River. These natural bayous once carried sediments and nutrients into the project area during high river stages when the natural ridges were seasonally topped. When the floodwaters from the river receded; sediments and nutrients were deposited in the interdistributary basins located between these ridges. During normal or low river stages the ridges along the distributary channels served like levees which buffered the basin areas from the daily tidal influence. This buffering effect created a low energy freshwater environment in these interdistributary basins, forming the deep organic soils. Drainage to the project area was provided by a high water event breaching the River Aux Chenes ridge in the southern part of the project area. This event caused the development of the Bayou Garelle tributary channel. The present-day hydrology of the project area has been altered and no longer functions, as discussed above, due to the following man-made changes:

1 The Mississippi River can no longer overflow its banks into the project area because of the construction of the Mississippi River protection levee.

2) Several channels have been dredged which cut through the natural ridges increasing both drainage and tidal exchange in the project area, exposing the organic soils to erosive forces.

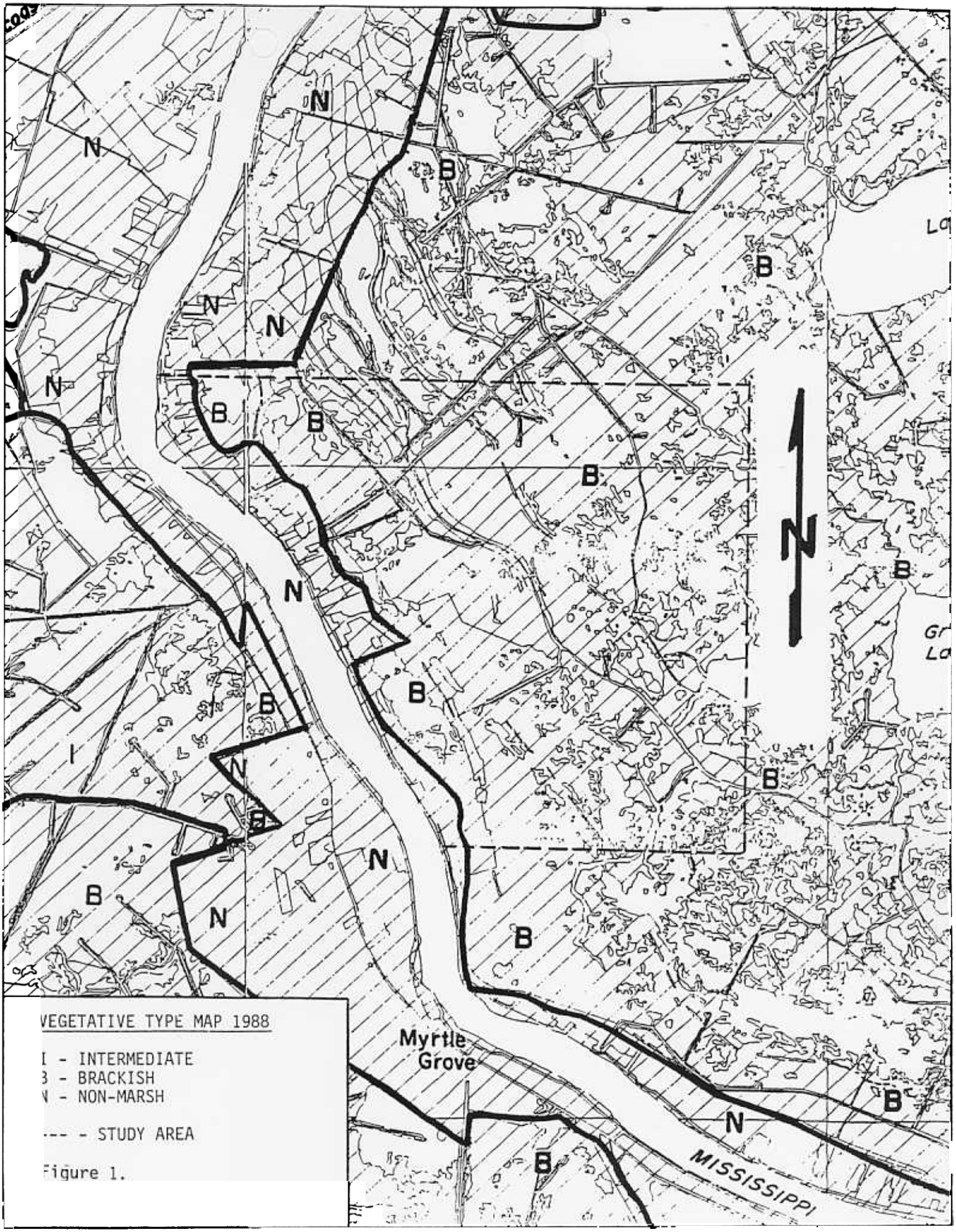
Vegetation

In 1949, Ted O'Neil classified the project area as approximately 80% brackish and 20% intermediate marsh. In 1968, Chabreck, Joanen, and Palmisano mapped the area as 90% brackish and only 10% intermediate. By 1978, the entire study area was classified as brackish marsh, as well as in 1988 (Chabreck and Linscombe, Figure 1.).

Ocular estimates of marsh vegetation were conducted by a SCS planning team on August 11, 1992, and September 15, 1992. Marshhay cordgrass (*Spartina patens*) was the dominant species throughout the entire project area. Other common species include marsh morningglory (*Ipoemea sagittata*), camphorweed (*Pluchea camphorata*), saltmarsh loosestrife (*Lythrum lineare*), Olney bulrush (*Scirpus olneyi*), and eastern baccharis (*Baccharis halimifolia*). Several species occur as scattered individuals, such as smartweed (*Polygonum* sp.), coastal waterhyssop (*Bacopa monnieri*), giant foxtail (*Setaria magna*), and deerpea (*Vigna luteola*). The species noted above seem to indicate the area contains both intermediate and brackish marsh types.

Aquatic plant communities consist of coontail (*Ceratophyllum demersum*), duckweed (*Lemna* sp.), and Eurasian watermilfoil (*Myriophyllum spicatum*). Some ponds and areas of abandoned, pump-off farmland contained dense stands of coontail.

Spoil bank communities consist of eastern baccharis (*Baccharis halimifolia*), live oak (*Quercus virginiana*), sugarberry (*Celtis laevigata*), and goldenrod (*Solidago sempervirens*).



VEGETATIVE TYPE MAP 1988

Soils

There are several different soils mapped in the project area. They are Commerce, Sharkey, Clovelly, Lafitte, and Gentilly. The following is a brief description of these soils:

(Commerce)

These soils consist of somewhat poorly drained, moderately permeable, firm, mineral soils that formed in loamy alluvium. These soils are found along some of the natural ridges which are Mississippi River abandoned distributary channels. These soils are present in very small quantities in the project area mainly due to the elevations at which these soils are found which range from 5' to 7' above sea level. Typically, the surface layer is 4" to 9" thick and consists of a grayish brown silt loam. The underlying base down to 60" is also grayish brown in color and is a stratified mineral deposit consisting of silt loam, silty clay loam and very fine sandy loam. These soils are classified in the unified system as CL or ML.

(Sharkey)

These soils consist of very poorly drained, very slowly permeable, firm, mineral soils that formed in clayey alluvium. The Sharkey soils in the project area are found adjacent to the natural ridges which are the abandoned distributary channels. They are generally found at a slightly higher elevation than the Gentilly soils and are rarely flooded. Typically, the surface layer is very dark gray and approximately 7" thick. The underlying base down to 60" is mineral in nature, gray in color and consists of clay and silty clay. These soils have a high shrink/swell potential. The soil is classified in the unified system as CH or CL.

(Gentilly)

These soils consist of very poorly drained, very slowly permeable, semi-fluid, mineral soils that formed in clayey alluvium. These soils are found in the submerged natural ridges of abandoned distributary channels. They are frequently flooded and are found at elevations from sea level to 2' above sea level. Typically, the surface layer is 0" to 5" thick and is grayish brown in color consisting mainly of muck. The underlying base down to 60" is dark gray to greenish gray and clayey in nature. These soils have low strengths and high shrink/swell potential. They are classified in the unified system as CH, OH, MH, and CL.

(Clovelly)

These soils are level, very poorly drained, semi-fluid, organic soils. They were formed in moderately thick accumulations of decomposed herbaceous materials with an underlying clayey alluvium in brackish marshes. They are flooded or ponded most of the time with elevations ranging from 1' above sea level to 5' below sea level in drained settings. Typically, the surface layer from 0" to 6" is organic muck containing 60% fiber and is very dark grayish brown. The underlying stratum is also organic and ranges from 16" to 57" deep and dark brown. The underlying mineral material is predominantly clay and mucky clay. The soil has poor strength and poor trafficability and has a unified classification of PT, OH-MH, and CH. The permeability is generally rapid in the organic surface layer and very slow in the lower mineral clayey layers. If the organic surface layers are allowed to dry, the subsidence potential becomes high with the organic material shrinking to about half the original thickness. Further subsidence occurs as a result of compaction and oxidation.

(Lafitte)

These soils are level, very poorly drained, semifluid, organic soils. They were formed in herbaceous plant material in brackish marshes. These soils are flooded or ponded most of the time with their elevations ranging from about 1' above sea level to 5' below sea level in drained settings. Typically, the organic surface layer, from 0" to 12", is predominantly herbaceous fiber and very dark gray. The stratum below this is predominantly organic, black muck down to 80". These soils have poor strengths and trafficability and are classified in the unified system as PT, OH-MH. The permeability is generally rapid in the organic layers and very slow in the underlying mineral layers. If the organic layers are allowed to dry, the subsidence potential is high with the organic material shrinking to about half its original thickness and then further subsidence occurs as a result of oxidation and compaction.

The surface layers of the Clovelly and Lafitte soils are organic and very susceptible to erosion, especially when not protected by vegetation. This is mainly because of the following characteristics:

1 The general composition is unconsolidated material with largely undecomposed organic matter that has accumulated under excessive moisture and minimal water movements.

2) The high water saturations and water tables found in these soils promote very little water infiltration when outside water sources are introduced to the soil.

3) Elevation at which these soils were formed and the general location in respect to mean sea level.

These factors combine to give the soils a high runoff potential, whether from rainfall or tidal movements. The organic surface layers are also very susceptible to subsidence if they are allowed to dry, which makes the construction of overflow banks difficult and very expensive. Generally, these soils have very poor strength and extreme limitations which should be considered in the water management plan and site selection of structural locations.

All proposed structures should be designed with the following parameters in mind:

1) Control water flow patterns across the management area so as not to destroy existing vegetation while introducing a new source of suspended sediments and nutrients.

2) Minimize the daily tidal exchange in the outfall area so as not to erode or remove suspended sediments introduced into the management area.

3) Prevent excessive velocities across the fragile organic soils to prevent erosion or re-suspension of sediments deposited into the area.

All of these parameters will be extremely important if this project is to accomplish its goals and objectives. An extensive geo-technical investigation will be required at all structure sites before construction or installation begins.

Salinity

Salinity readings taken throughout the project area on August 11, 1992, by an SCS planning team ranged from 2.0 to 4.0 ppt with an average of 2.9 ppt. Salinity data (Louisiana Department of Health and Hospitals (L.D.H.H.) monitoring stations) indicates average salinities in the project area to be in the 6-10 ppt range from 1979 - 1990. From March through August over the same time period, L.D.H.H. records indicate an average salinity range of 0-5 ppt over the project area; with the remainder of the year (Sept.-Feb.) in the 6-10 ppt range. It is important to

realize that these are only average salinities and that salinities often spike above these averages. Most plant communities are unable to adjust to sudden increases in salinity which often result physiological stress and mortality.

Salinity data indicates no severe influences on the vegetative community by saltwater intrusion. However, this data reflects average conditions over the past 20 years and does not indicate yearly extremes in salinity ranges. The selected plan should incorporate weirs in locations that will limit saltwater intrusion over a majority of the area during months that the siphon is not in use.

Wetland Changes

The project area has historically been intermediate to brackish marsh and is now classified as predominantly brackish. Plant communities are indicative of brackish marsh with a shift toward more intermediate-type communities in the northern portion of the area.

Table 1 shows marsh habitat changes for 1956, 1978 and 1984. Figures for the 1956 and 1978 habitat changes are from U.S. Fish & Wildlife Service habitat data using aerial photography. Figures for the 1984 data are from land-sat photography; therefore, the computations do not reveal exact habitat changes. The difference is that the 1956 and 1978 information is line data from aerial photography and the 1984 data has been collected by satellite in 75 foot squares.

Table 1. Wetland Changes

Wetland Type	1956 (%)	1978 (%)	1984 (%)
Water	11	19	24
Marsh	77	73	66
Other (swamp, spoil	12	8	10

Shoreline Erosion

Shoreline erosion rates were calculated from the Mississippi River Deltaic Plain Land Loss & Accretion Technical Report by the U.S. Army Corps of Engineers. Most shoreline erosion in the project area has occurred along the shorelines of ponds, lakes, and other open water bodies. Erosion rates along Little Oak Pond averaged 3.0 ft/yr from 1932 to 1983. Rates along Little Oak Pond were similar to rates measured along other bodies of open water. Little or no erosion was noted along River Aux Chenes in the project area.

Major causes of erosion in these areas are daily tidal exchange, boat wakes, and wind-generated wave action. These processes have caused open water bodies to enlarge as the shoreline progresses into the adjacent marsh.

PROJECT OBJECTIVES & GOALS

Objective

The primary objective of this project is to re-establish hydrologic conditions that will permit increased retention and distribution of freshwater, sediments, and nutrients from the White's Ditch Diversion Siphon.

Goals

1) Increase freshwater, sediments, and nutrients into the project area.

2) Reduce influx of saltwater; therefore, maintaining the area as a brackish/intermediate marsh and stabilizing salinities.

3) Improve habitat conditions for fish and wildlife.

4) Reduce erosion, and encourage reclamation of eroded areas by allowing sediments to be dispersed by outfall waters into these areas.

5) Allow ingress/egress of marine organisms without compromising the integrity of the management system.

6) Reduce erosive velocities associated with extreme tidal fluctuations.

7) Maximize the distribution of outfall waters in the project area.

8) Establish conditions that will increase plant vigor of the plant community and promote establishment of emergent vegetation in eroded areas.

9) Improve water quality of outfall waters by promoting sheet flow as opposed to direct discharge through the existing watercourses.

10) Maintain access within the project area without adversely affecting the integrity of the management system.

OUTFALL MANAGEMENT ALTERNATIVE #1

This alternative corresponds to the project plan in the 1990-91 Coastal Wetlands Conservation and Restoration Plan submitted to the House of Representatives and Senate Natural Resource Committee by the Wetland Conservation and Restoration Task Force.

Project Description

The five phases of this alternative are as follows:

1 Enlarge the capacity of the existing siphon by installing four new six foot diameter siphon pipes at the site. This expansion will increase the discharge of the siphon an additional 1000 cfs.

2) Dredging of selected ditches and trenasses to the north and south of the Belair Canal (see plan map)

3) Maintenance of the west bank of River Aux Chenes from the southern edge of its natural levee ridge to Shayots Canal.

4) Installation of variable crested weirs at the following locations:

Across the River Aux Chenes, north of the Belair Canal where the natural levee ridge begins (see plan map)

- At the juncture of the west bank of the River Aux Chenes and the small bayou which runs east-west between Fairview Canal and Belair Canal (see plan map)

The juncture of the west bank of River Aux Chenes and Bayou Garelle

5) Installation of earthen dams at the following locations:

The juncture of Shayots Canal and the west bank of River Aux Chenes

The juncture of Williams Canals and the west bank of River Aux Chenes

- Two breeches on the west bank of River Aux Chenes located between Williams Canal and Bayou Garelle (see plan map)

Structural Components

1) Expansion of existing siphon (four 6 ft. diameter pipes)

2) Three variable crested weirs

3) Four earthen dams

4) Utilization of pumping station located at the pipeline canal on the north boundary of the project area

Non-structural Components

1) Dredging of trenasses and ditches to the north and south of Belair Canal

2) Maintenance of the west bank of River Aux Chenes

Project Advantages

1 The dredging of selected areas to the north and south of the Belair Canal will distribute outfall waters, sediments, and nutrients over a large portion of the project area.

2) The use of variable crest weirs will allow for greater flexibility in water management. Retaining outfall waters in strategic areas for longer periods will allow sediments to accumulate, promote water quality, and provide a means of deterrence to saltwater intrusion.

3) Fish and wildlife habitat will be enhanced by a reduction in tidal fluctuations and velocities.

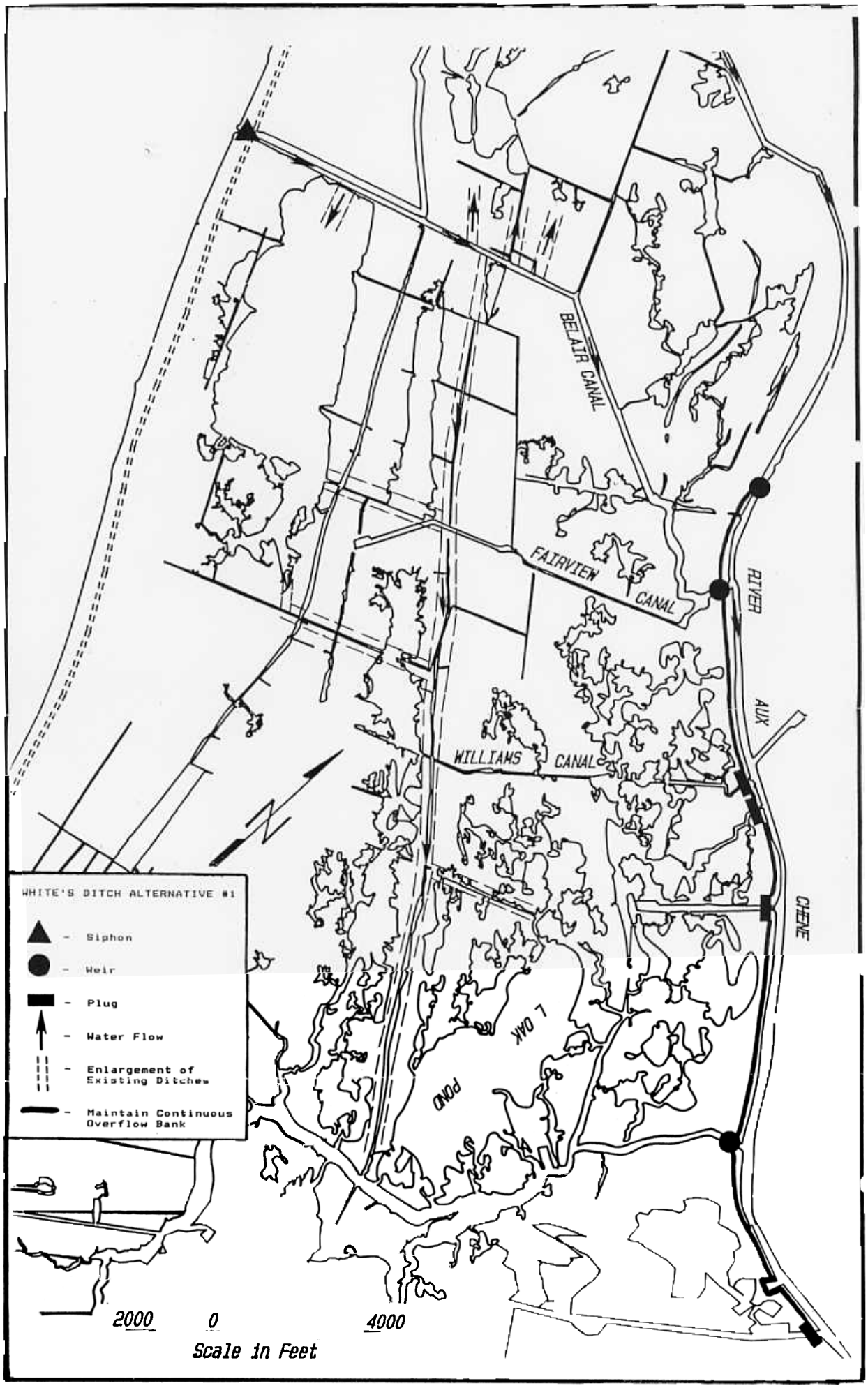
4) Salinity levels will be reduced during periods of freshwater introduction.

Project Disadvantages

1) Access to the interior of the project area will be limited due to the number of dams and weirs across major watercourses.

2) The use of variable crest weirs is management intensive and is more prone to vandalism than fixed crest weirs.

3) Dredging of ditches to the north of Belair Canal provides for limited benefits. Most of the selected sites will require constant maintenance due to subsidence, and traditional flow patterns suggest that most of the outfall waters will have to come from the pumping station near Wills Point. Water conveyed through the proposed ditches will cross through an existing crawfish pond.


WHITE'S DITCH ALTERNATIVE #1
- Siphon
- Weir
- Plug
- Water Flow
- Enlargement of Existing Ditches
- Maintain Continuous Overflow Bank
BELAIR CANAL
FAIRVIEW CANAL
WILLIAMS CANAL
L. OAK POND
CHENE AUX RIVER
2000 0 4000
Scale in Feet

OUTFALL MANAGEMENT ALTERNATIVE #2

This alternative is comprised of enlarging the siphon capacity at White's Ditch an additional 1000 cfs and allowing the diversion waters to flow freely with no outfall management.

Project Description

1) Enlarge the capacity of the existing siphon by installing four new six foot diameter siphon pipes at the site. This expansion will increase the discharge of the siphon an additional 1000 cfs.

Structural Components

1) Expansion of existing siphon (four 6 ft. diameter pipes)

2) Utilization of pumping station located at the pipeline canal on the north boundary of the project area

Non-structural Components

1) Maintenance dredging of White's Ditch and portions of Belair Canal as warranted by silt accumulations

Project Advantages

1) Freshwater introduction will supply nutrients and sediments to the area to promote accretion and establishment of emergent vegetation.

2) Salinity levels will be reduced during periods of freshwater introduction.

3) Access throughout the project area will not be affected.

4) Minimal structural components will afford a high degree of opportunity for ingress/egress of marine organisms.

Project Disadvantages

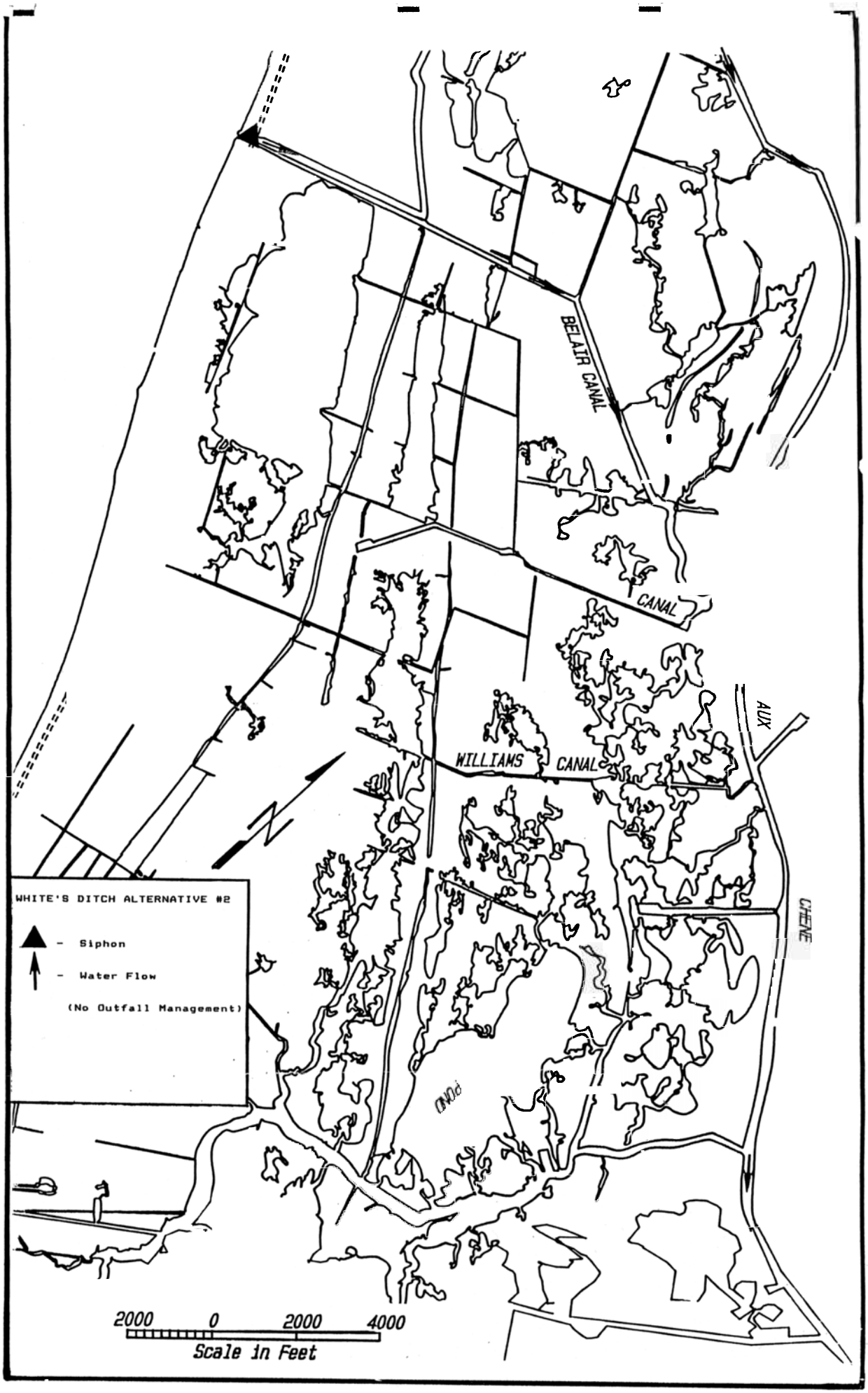
1) Outfall waters may flow directly down Belair Canal south through River Aux Chenes and out of the project area with no appreciable overland flow.

2) During periods when the siphon is not running, there will be no deterrence to saltwater intrusion into the project area.

3) With no outfall management, overland distribution of outfall waters will be minimal and flow may not be to areas where it can be best utilized.

4) Without distributing outfall waters over the marsh through outfall management, water quality benefits will be minimal.

5) Erosive velocities associated with extreme tidal fluctuations will continue when the siphon is not in use.


BELAIR CANAL
CANAL
WILLIAMS CANAL
AUX
CHENE
WHITE'S DITCH ALTERNATIVE #2
- Siphon
- Water Flow
(No Outfall Management)
2000 0 2000 4000
Scale in Feet

OUTFALL MANAGEMENT ALTERNATIVE #3

This alternative is comprised of enlarging the siphon at White's Ditch an additional 1000 cfs in combination with minimal outfall management.

Project Description

The four phases of this alternative are as follows:

1 Enlarge the capacity of the existing siphon by installing four new six foot diameter siphon pipes at the site. This expansion will increase the discharge of the siphon an additional 1000 cfs.

2) Installation of fixed crest weirs with boat bays at the following locations:

   Across River Aux Chenes, north of the Belair Canal where the natural levee ridge begins (see plan map)

   At the junction of the west bank of River Aux Chenes and the small bayou which runs east-west between Fairview Canal and Belair Canal (see plan map)

3 Maintenance of the west bank of River Aux Chenes from the southern edge of its natural levee ridge to Shayots Canal.

4) Dredging of three inlet channels which will be used to convey outfall waters into the marshes south of Belair and Fairview Canals. Armoring of these channels will also be necessary to prevent further erosion (see plan map).

Structural Components

1) Expansion of existing siphon (four 6 ft. diameter pipes)

2) Two fixed crest weirs with boat bays

3) Utilization of pumping station located at the pipeline canal on the north boundary of the project area

Non-structural Components

1) Dredging of three inlet channels

Project Advantages

1) Planned inlet channels will route outfall waters and sediments through eroded areas where they can be of best use.

2) The effect on ingress/egress of marine organisms will be minimal due to the small amount of outfall management structures.

3) Tidal energies will be reduced north of the structure across River Aux Chenes.

4) Salinity levels will be reduced during periods of freshwater introduction.

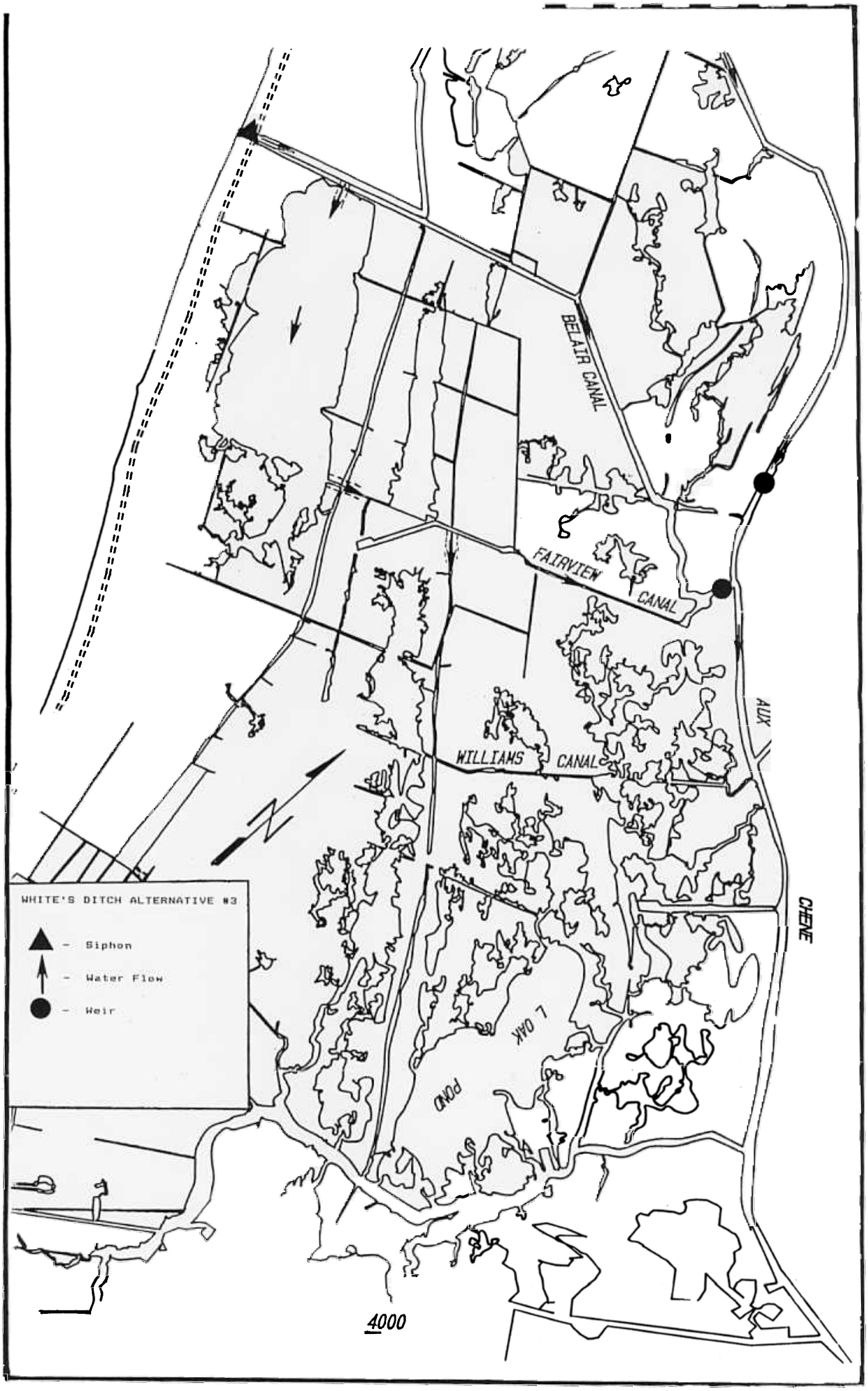
5) Distribution of outfall waters may have a beneficial effect on water quality.

Project Disadvantages

1) Access to the interior of the project area will be limited due to the number of dams and weirs across major watercourses.

2) Saltwater intrusion will be a concern during periods when the siphon is not in use due to the small amount of outfall management structures.

3) Marshes south of the structure across River Aux Chenes will be subjected to tidal energies during periods when the siphon is not in use.


WHITE'S DITCH ALTERNATIVE #3
- Siphon
- Water Flow
- Weir
BELAIR CANAL
FAIRVIEW CANAL
WILLIAMS CANAL
AUX CHENE
L OAK POND
4000

OUTFALL MANAGEMENT ALTERNATIVE #4

This alternative is comprised of enlarging the siphon at White's Ditch an additional 1000 cfs in combination with outfall management.

Project Description

The six phases of this alternative are as follows:

1) Enlarge the capacity of the existing siphon by installing four new six foot diameter siphon pipes at the site. This expansion will increase the discharge of the siphon an additional 1000 cfs.

2) Installation of fixed crest weirs with boat bays at the following locations:

   Across River Aux Chenes, between the forty arpent canal and the southern extremes of the natural levee ridge of River Aux Chenes (see plan map)

   At the junction of the west bank of River Aux Chenes and the small bayou which runs east-west between Fairview Canal and Belair Canal (see plan map)

   At the juncture of the canal south of the pipeline canal near Wills Point, and the forty arpent canal (see plan map)

   At the juncture of the west bank of River Aux Chenes and Bayou Garelle

3) Maintenance of the west bank of River Aux Chenes from the southern edge of its natural levee ridge to Shayots Canal.

4) Dredging of three inlet channels which will be used to convey outfall waters into the marshes south of Belair and Fairview Canals. Armoring of these channels will also be necessary to prevent further erosion (see plan map).

5) Installation of earthen dams at the following locations:

   The juncture of Shayots Canal and the west bank of River Aux Chenes.

- The juncture of Williams Canals and the west bank of River Aux Chenes.

  Two breeches on the west bank of River Aux Chenes located between Williams Canal and Bayou Garelle (see plan map).

6) Installation of a flap-gated structure on the south bank of the east end of Fairview Canal.

Structural Components

1) Expansion of existing siphon (four 6 ft. diameter pipes).

2) Four fixed crest weirs with boat bays.

3) Four earthen dams

4) Utilization of pumping station located at the pipeline canal on the north boundary of the project area.

5) One flap-gated structure.

Non-structural Components

1) Dredging of three inlet channels

2) Maintenance of west bank of River Aux Chenes.

Project Advantages

1) Planned inlet channels will route outfall waters and sediments through eroded areas where they can be of best use.

2) Distribution of outfall waters, sediments, and nutrients will be maximized.

3) Tidal energies will be reduced over most of the project area.

4) Salinity levels will be reduced during periods of freshwater introduction.

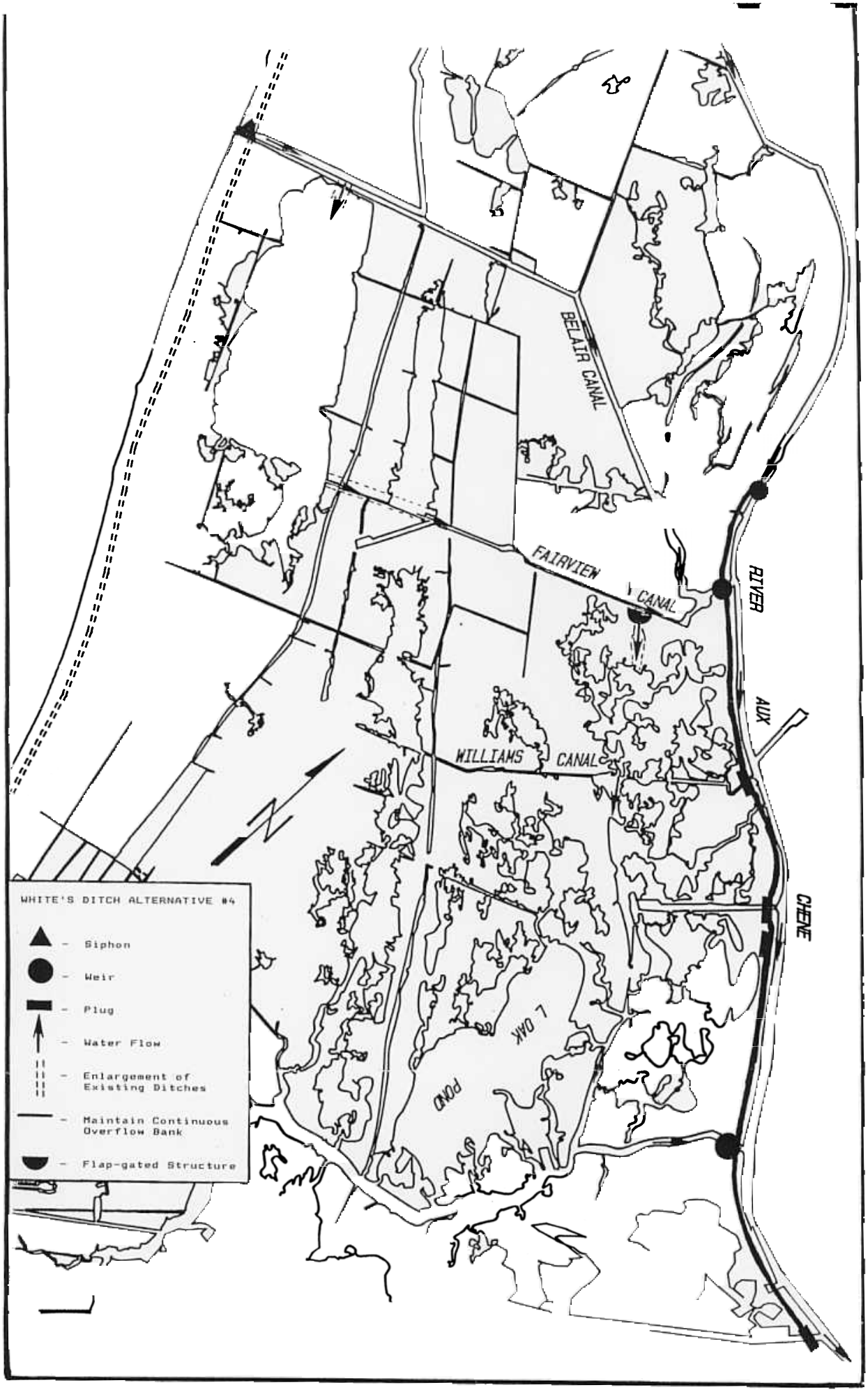
5) Distribution of outfall waters may have a beneficial effect on water quality.

6) Fixed crest weirs and earthen dams will provide a deterrence to saltwater intrusion when the siphon is not in use.

Project Disadvantages

1) Access to the interior of the project area will be limited due to the number of dams and weirs across major watercourses.

2) Ingress/egress of marine organisms may be hindered due to the amount of outfall management structures.


WHITE'S DITCH ALTERNATIVE #4
- Siphon
- Weir
- Plug
- Water Flow
- Enlargement of Existing Ditches
- Maintain Continuous Overflow Bank
- Flap-gated Structure
BELAIR CANAL
FAIRVIEW CANAL
WILLIAMS CANAL
L OAK POND
AUX CHENE RIVER
N

CRITICAL MANAGEMENT CONSIDERATIONS

When developing a management plan for any land resource area, marsh or upland, certain features of the project area must be considered. Areas of consideration may be access, plant communities, wildlife and fisheries, commercial resources, recreation, and aesthetic qualities. Field investigations, background research, and meetings with landowners and landusers have provided valuable insight for determining which features of the project area require special attention.

All weirs, plugs, etc. should be designed to maintain water levels which are conducive to plant growth. Marshhay cordgrass (Spartina patens) is the dominant species of the emergent vegetative community in the project area. Ideal conditions for marshhay cordgrass are provided when water levels are -4" to +2" and salinities from 2.0 ppt to 14.0 ppt. Care should be taken through subsequent monitoring to insure the health of the plant community.

Areas to the south and east of the project area contain oyster (Crassostrea virginica) leases which provide an important source of income for many communities along the Mississippi River. Oysters thrive in waters with salinity ranging from 10 to 15 ppt such as in the highly brackish and saline marshes to the south of this area.

When salinities are above 15 ppt, predation by the southern oyster drill (Thais haemostoma) increases as they invade these areas in search of food. Also, oyster reproduction only occurs at salinities above 10 ppt and salinities below 5 ppt are fatal to all stages of oyster development.

Careful operation of the diversion structure and management of outfall waters could aid in maintaining salinities in the 10 to 15 ppt range in oyster beds to the south and east of the project area.

Freshwater input from the Mississippi River may also adversely impact oyster populations from high sediment loads or pollutants. If sedimentation occurs over large areas of oyster beds, high mortality rates could result causing great economic loss to the industry. Also, pollutants such as heavy metals or fecal coliforms could contaminate oyster beds making them unsafe for human consumption and subsequent closure of the leases.

All of these factors will contribute to the acceptability of outfall management from the White's Ditch Diversion Siphon.

COMPARISON OF
OUTFALL MANAGEMENT ALTERNATIVES

PROJECT GOALS	OUTFALL MANAGEMENT ALTERNATIVES * (1)	(2)	(3)	(4)
1) Increase freshwater, sediments and nutrients in the area.	+	+	+	+
2) Stabilize salinity levels.	+	-	0	+
3) Enhance fish/wildlife habitat.	+	0	+	+
4) Reduce erosion and reclaim eroded areas.	+	0	+	++
5) Provide ingress/egress for marine organisms.	0	++	+	0
6) Reduce tidal energies within the project area	+	-	0	+
7) Maximize freshwater distribution	++	0	+	++
8) Increase vegetated marshland	+	0	+	+
9) Improve water quality	+	0	+	+
10) Maintain access to project area.	0	++	0	0

Table 2.

* Degree to which alternative meets project goals:
Optimum Results: (++)
Meets Desired Results: (+)
Minimal Desired Results: (0)
Adverse Results: (-)

EVALUATION OF SELECTED PLAN

The selected plan (alternative #4) was chosen based on its merits of meeting the above goals (Table 2.) in comparison with all plan alternatives.

Plan Components

The selected plan is composed of the following components:

Structural Components

1) Expansion of existing siphon (four 6 ft. diameter pipes).

2) Four fixed crest weirs with boat bays.

3) Four earthen dams.

4) Utilization of pumping station located at the pipeline canal on the north boundary of the project area.

5) One flap-gated structure.

Non-structural Components

1) Dredging of three inlet channels.

2) Maintenance of west bank of River aux Chenes

Water Management Scheme

The water management scheme is a combination of passive and active elements. Passive elements include: (1) fixed-crest weirs with boat bays, (2) earthen plugs, (3) maintained banklines, and (4) a flap-gated structure. Once installed, these components will function without manipulation except for periodic maintenance; hence, no operational schedule is required. The sill heights, elevations, and widths determine the capacity of the passive elements to regulate salinity, water levels, and sediment loads.

The White's Ditch siphon and a pumping station near Wills Point make up the active water control system. The operational schedule for the active measures is as follows:

Active element	Schedule of Operation
Pumping station	When periodic drainage of land west of the back protection levee is warranted.
White's Ditch siphon	When a minimum river stage of +4 ft is met at the New Orleans gauge.

SOCIOECONOMIC CONCERNS

Social Impacts and Concerns

A public scoping meeting concerning this project was held by the U.S.D.A. Soil Conservation Service. Attending this meeting were representatives of the principle landowners in the project area. Several concerns were recognized as a result of this meeting.

There was some opposition voiced against constructing a weir across the River Aux Chenes. This concern was due in part to the failure of a previous structure at the juncture of the forty arpent canal and the River Aux Chenes. By constructing a weir further south on the River Aux Chenes, justified by historic banklines on both sides, a new structure would be less prone to subsequent failure.

Landowners are also concerned about the prospects of heavy silt accumulations in the Belair Canal as a result of increasing the discharge capacity of the White's Ditch Siphon. In order to meet the objective of distributing freshwater across the area, and maintaining some protection against saltwater intrusion by initiating the use of this siphon, some silt loading will certainly occur and canal maintenance through dredging will be a necessary component of the selected plan alternative.

Three sets of pipe crossings were installed in the late 1980's under Highway 39 for future river water diversion considerations. Several landowners expressed the possibility of utilizing these pipe crossings for diverting river water instead of increasing the capacity of the White's Ditch Siphon. Utilizing these structures in this capacity would necessitate the construction of outfall channels through two natural ridges in order to distribute the diverted river water across the project area. This would significantly alter the hydrology of the area and present the possibility of adverse affects to the drainage of surrounding marshlands.

The scenario of installing a siphon at Joe Brown Canal, which is located approximately 4.6 miles upriver of the White's Ditch Siphon, was also discussed. A siphon at this location would benefit broken marsh in the northern extremes of the project area. However, this option was not considered due to structural inefficiencies associated with conveying siphoned river water approximately .4 of a mile to the point of deposition.

Protected Cultural and Environmental Resources

There are five archaeological sites within the project area. Project implementation is not expected to significantly impact the cultural resources in the area. A listing of these sites along with their historical significance is listed below.

Site Number	Site Type	Significance
16PL27	fort	National Historic Landmark
16PL106	sugarhouse & quarters	undetermined
16PL108	plantation	not sig.
16PL112	plantation	undetermined
16PL142	barn	not sig.

The project area provides habitat for the endangered bald eagle (*Haliaeetus leucocephalus*), and the threatened peregrine falcon (*Falco peregrinus*) and piping plover (*Charadrius melodus*). Habitat for these species must be maintained/improved to insure their continued existence. Project implementation is not expected to adversely affect the above species nor damage critical habitat. The proposed plan is expected to sustain and/or increase suitable habitat for these and all other wetland-dependent wildlife species.

COMMENTS & RECOMMENDATIONS

It is believed that all goals of the project can be met with the exception of minimal desired results concerning ingress/egress of marine organisms, and access within the project area.

The expansion of the flow capacity of the White's Ditch siphon along with the planned outfall management should benefit the project area in many ways. An increase in overland flow, reduced saltwater intrusion, increased sediments and nutrients to the area, and better distribution and utilization of these resources will be chief advantages of this plan. Plugs and fixed crest weirs will reduce rapid tidal exchange and provide a deterrence to saltwater intrusion when the siphon is not in use.

The northern extremes of the project area exhibit a high degree of degradation. This area will not receive direct benefits from this plan to the degree anticipated for the area south of Belair Canal. Concerns over this issue were tabled and alternatives to remedy this situation proved unfeasible with the management of the White's Ditch siphon. This area would be better served by installation of a siphon located further upriver and would therefore be addressed as a separate project.

ESTIMATED COST OF SELECTED PLAN

Engineer Services:	Initial Cost:	Annual Cost:
Engineering Design	$ 190,000	
E & D Sup. & Admin.	$ 50,000	
SUBTOTAL	$ 240,000	
Construction:		
Structures	$ 2,000,000	
Sup. & Inspect.	$ 200,000	
SUBTOTAL	$ 2,200,000	
Monitoring:		
Equipment Cost	$ 35,000	
Installation Cost	$ 21,000	
Platform construction	$ 36,000	
Miscellaneous material	$ 5,000	$ 5,000
Photography	$ 500	$ 500
Operation, maintenance, data collection	$ 48,000	$ 48,000
Annual manpower	$ 20,000	$ 15,000
SUBTOTAL	$ 165,500	$ 68,500
TOTAL PROJECT COST	$ 2,605,500	$ 68,500