RECONSTRUCTION OF THE IMPOUNDMENT 3 WEST LEVEE
SABINE NATIONAL WILDLIFE REFUGE

Candidate Project
for the
Priority Project List
of the
Coastal Wetlands Planning, Protection, and Restoration Act

PROPOSED BY

U.S. Fish and Wildlife Service, Sabine National Wildlife Refuge

November 14, 1991

POINT OF CONTACT: Ronny Paille, Sabine National Wildlife Refuge
PHONE: (318) 762-3816

PROJECT DESCRIPTION

A. Location

The proposed project would be located on Sabine National Wildlife Refuge in western Cameron Parish, Louisiana (see Figure 1). Five and one-half miles of the existing Burton Canal levee would be cleared, rip-rapped, and planted with Spartina alterniflora. Eroded portions of the levee would also be reconstructed . The center of the project area would be located at latitude 29° 55′ north, and longitude 93° 37′40" west.

B. Justification

The existing Impoundment 3 levee was constructed in 1951. Although sections of eroded levee have been repaired in the past, many portions of the existing levee have deteriorated due to boat wake erosion and subsequent sloughing of levee material into the adjacent Burton Canal. Continued erosion will soon result in multiple breaches of the existing levee. Subsequent saltwater intrusion and increased tidal exchange would adversely affect approximately 13,000 acres of existing fresh marsh and shallow open water habitat. Because much of the affected fresh marsh existing within Impoundment 3 is highly organic and floating, multiple breaches in the west impoundment levee would likely result in the conversion of those marshes to shallow open water. Existing beds of submerged and floating-leaved aquatic vegetation within Impoundment 3 would also suffer extensive losses due to increased salinity, turbidity, and water exchange. Loss of that aquatic vegetation would also result in greater wind-induced wave erosion of remaining marsh within the impoundment.

Reconstruction and armoring of the existing levee would be the most effective project alternative for the conservation of project-area marshes.

C. Objectives

The objective of the proposed project is to maintain and protect existing fresh marsh within Impoundment 3.

D. Project Features

The existing west levee is 5.5 miles long. Where eroded, the levee would be restored to 6-foot-high, 8-foot-wide crown, and 1 on 3 side slopes. A 25-foot-wide strip of man-size rip-rap would be placed along the Burton Canal side of the levee. Material for reconstruction of eroded portions of the levee would be taken from either Burton Canal or the marsh immediately east of the levee. One-gallon containers of Spartina alterniflora will be planted every 5 feet along the Burton Canal side of the levee for erosion control.

ANTICIPATED BENEFITS

The proposed project would protect approximately 13,000 acres of existing Impoundment 3 fresh marsh from deterioration associated with the anticipated failure of the existing west levee. The above-mentioned project benefits are expected to last at least 20 years.

Fresh marshes currently existing within Impoundment 3 are the last major remnant of a once vast coastal fresh marsh located in western Cameron Parish. Impoundment 3 fresh marshes provide habitat for American alligator, alligator snapping turtle, bullfrog, and numerous other species of reptiles and amphibians. Those marshes also provide habitat for ibis, herons, egrets, bitterns, gallinules, rails, migratory and resident waterfowl, raptors, nutria, muskrat, raccoon, mink, river otter, swamp rabbit, and white-tailed deer. Impoundment 3 marshes may also support the endangered red wolf; however, no recent reports have been verified. Additionally, Impoundment 3 provides habitat for largemouth bass, crappie, sunfishes, blue catfish, channel catfish, alligator gar, and spotted gar.

ANTICIPATED ADVERSE EFFECTS

Dredging for levee reconstruction would adversely impact approximately 10 acres of project-area emergent, floating-leaved, and submergent vegetation.

COSTS

Engineering and design: $276,000 (12% of total construction costs)

Supervision and administration of engineering and design:
Refuge personnel will supervise and administer; No Cost

Project construction: $3,000,000

Supervision and inspection of construction contract(s):
Refuge personnel will supervise and administer; No Cost

Operation and maintenance: $690,000 (30% of total construction cost)

Project monitoring: Refuge-conducted GIS monitoring - $10,000

STATUS OF ENVIRONMENTAL COMPLIANCE

A. NEPA
A NEPA review of the proposed project has not been conducted.

B. Section 10/404
The proposed project is authorized under the refuge's General Permit NOD-25, therefore, a Section 10/404 review would not be required.

C. Louisiana Coastal Management/Consistency Program
The proposed project has not been reviewed by the state's consistency program.

D. Louisiana Water Quality Certification
Since the proposed project is authorized under the refuge's General Permit NOD-25, a separate Louisiana Water Quality Certification is not required.

E. Endangered Species Act
The proposed project is not expected to affect any threatened or endangered species.

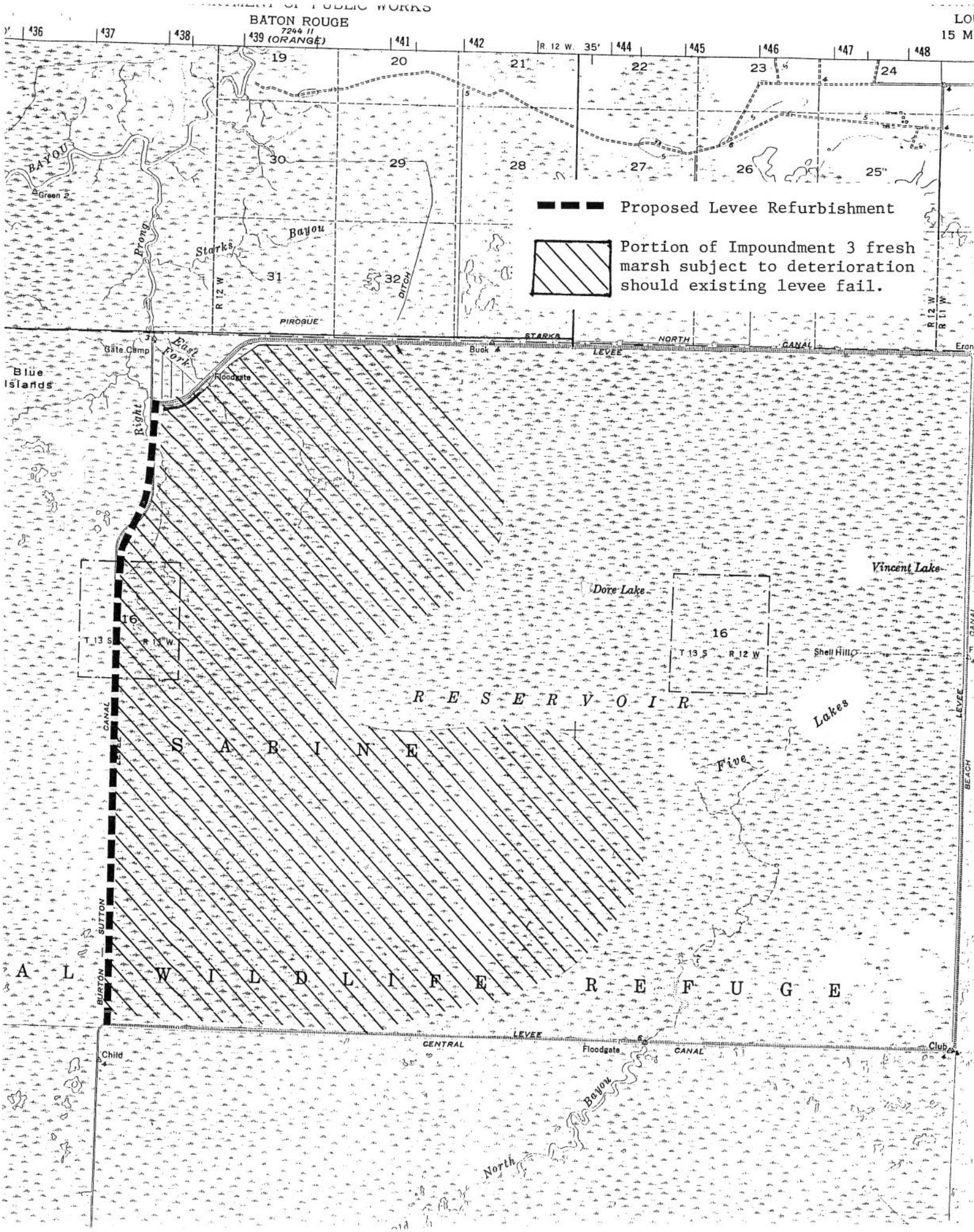
PROJECT IMPLEMENTATION SCHEDULE

Engineering and design start date:	28 November 1991
Engineering and design finish date:	28 November 1992
Construction start date:	1 May 1993
Construction finish date:	1 May 1994

POTENTIAL FUNDING SOURCES

Federal funding source: Coastal Wetlands Planning, Protection, and Restoration Act

Non-Federal funding source: State of Louisiana - Coastal Restoration Division Trust Fund



BATON ROUGE
7244 II
(ORANGE)
Proposed Levee Refurbishment
Portion of Impoundment 3 fresh marsh subject to deterioration should existing levee fail.
BAYOU
Green 2
Prong
Starks
Bayou
DITCH
PIROGUE
STARKS
NORTH
CANAL
LEVEE
Buck
Gate Camp
East Fork
Floodgate
Blue Islands
Right
Vincent Lake
Dore Lake
Shell Hill
T 13 S
R 13 W
R 12 W
R 11 W
R E S E R V O I R
S A B I N E
Lakes
Five
CANAL
LEVEE
BURTON
SUTTON
A L W I L D L I F E R E F U G E
CENTRAL
LEVEE
CANAL
Floodgate
Child
Club
Bayou
North

COASTAL WETLANDS PLANNING, PROTECTION, AND RESTORATION ACT

Proposed Project Information Sheet

Project Name: Reconstruction of the Impoundment 3 West Levee

Submitted by: U.S. Fish and Wildlife Service, Sabine National Wildlife Refuge

Project Area Size: 13,000 acres

Marsh Type: Fresh marsh Acres: 13,000

Present Conditions

1. The project area includes 8,450 acres of emergent freshmarsh. In order of decreasing abundance, the emergent plant species are: giant cutgrass, cattail, bulltongue, bullwhip, smartweed, alligatorweed, spikerushes, bagscale, bidens, ludwigia, pennywort, and rattlebox.

   Common submergent plant species include bladderwort, milfoil, Vallisneria, sago pondweed, southern naiad, and cabomba. Beds of submergent vegetation occupy 1,365 acres of the project area.

   Common floating-leaved plant species include white water lily, American lotus, banana water lily, frogbit, watershield, duckweed, azolla, and Wolffia. Beds of floating-leaved vegetation occupy 1,365 acres of the project area.

2. The project area includes 4,550 acres of open water.

3. Sixty percent (2,730 acres) of project-area open water is dominated by aquatic plants.

4. Little historical marsh loss data is available for the project area. Construction of Impoundment 3 was completed in 1951. Upon completion, water levels were maintained at 2.5 to 3.0 feet MSL. Tidal surges of Hurricane Audrey (1957) and Hurricane Carla (1959) breached impoundment levees and destroyed hundreds of acres of marsh. Following those storms, the resulting open water areas continued to expand. To reverse marsh loss, refuge personnel implemented a drawdown beginning in 1981. Flapgates were utilized to gravity drain the impoundment. Following the drawdown, impoundment water levels were maintained at approximately 2.0 feet MSL. Refuge personnel observed that the drawdown was successful in restoring emergent vegetation in some areas (John Walther 1991, personal communication). A GIS analysis revealed that between 1984 and 1987, 3% of the emergent marsh within the

impoundment was lost to open water (Sabine National Wildlife Refuge 1989).

5. The only hydrologic change affecting marshes within impoundment 3 was the maintenance of lower water levels during and following the early 1980's drawdown. For additional information, see above answer for question 4.

6. According to observations by refuge personnel, the Burton Canal side of the impoundment 3 west levee has eroded at a rate of approximately 3 feet over the last 11 years (0.27 ft/yr).

7. Approximately 30% of the project-area open water is between 0.5 and 1.5 feet deep at a pool elevation of approximately 2.5 ft. MSL. Approximately 70% of the project-area open water exceeds 1.5 feet in depth.

8. Refuge personnel have not regularly monitored salinities within impoundment 3. From occasional checks, refuge personnel believe that impoundment 3 salinities remain stable at 1.0 ppt or less. Refuge personnel monitor salinities in the tidally-influenced Burton Canal at the northwest (station BUN) and southwest (station BUC) corners of impoundment 3. Over the last 5 years, salinity maximums of 14.7 ppt and 12.8 ppt have been recorded at stations BUC and BUN, respectively

9. Water levels within impoundment 3 are regulated by 3 90-foot-long variable-crest water control structures (see attached map). Those structures will likely be managed to maintain water levels at approximately 2.0 feet MSL or lower if it is determined that lower water levels are needed to maintain emergent vegetation. Additionally, should it become apparent that emergent vegetation is experiencing widespread deterioration, refuge personnel may elect to implement a 1 or 2-year-long drawdown.

10. Regarding the permitting of Impoundment 3 water control structures and their operation, they are "grandfathered".

11. Currently, the Impoundment 3 west levee is intact. However, several badly eroded sections exist along the northern reach.

12. The Chenier Plain subsidence rate is approximately 0.6 cm/yr.

Future Conditions

1. The proposed project includes only the refurbishment of eroded portions of the Impoundment 3 west levee, rip-rapping and vegetative plantings along Burton Canal side of the west levee.

2. Implementation of the proposed project would serve to maintain the present hydrology within Impoundment 3.

3a. Without the proposed project, the existing west levee may soon fail in several places. The resulting saltwater intrusion, and increased tidal exchange will likely destroy much of the floating fresh marsh within the project area. Dominant emergent species such as giant cutgrass, cattail, and bullwhip are rooted in firm soil approximately 1.5 to 2.0 feet below the water surface. Despite the anticipated lower water levels, relatively minor amounts of saltwater intrusion into such deep-water freshmarsh plant community would result in a substantial die-off and a conversion of emergent vegetation to open water. Beds and submergent and floating-leaved vegetation would also deteriorate. Loss of those communities would also allow greater wave energies to be generated across open water areas. Consequently, marsh edges would also experience greater erosion rates. Considering the above, plus observed vegetation, hydrologic, and substrate differences between project-area and adjacent tidally-influenced marshes, refuge personnel estimate that without project implementation, 80% (6,670 acres) of the project-area emergent vegetation would be lost.

Implementation of the proposed project would allow mangers to manage impoundment water levels and maintain existing freshmarsh hydrology. Through drawdowns and proper water level maintenance, refuge personnel believe that the existing acreage of emergent marsh can be maintained (0 acres lost, 0 acres gained).

3b. Considering differences in vegetation, hydrology, and water quality, between project-area and adjacent tidally-influenced marshes, refuge personnel estimate that 75% of the project-area floating-leaved vegetation will be lost without project implementation.

Refuge personnel estimate that with project implementation, the existing acreage of floating-leaved vegetation can be maintained (0 acres lost, 0 acres gained).

3c. Considering differences in vegetation, hydrology, and water quality, between project-area and adjacent tidally-influenced marshes, refuge personnel estimate that 60% of the submergent vegetation will be lost without project implementation.

Refuge personnel estimate that with project implementation, the existing acreage of submergent vegetation can be maintained (0 acres lost, 0 acres gained).

4. Refuge personnel anticipate that implementation of the proposed project will serve to maintain present plant communities.

Based upon anticipated salinities and vegetative composition of adjacent tidally-influenced marshes, refuge personnel believe that without project implementation, project-area emergent plant species will include wiregrass, seashore

paspalum, three-corner grass, and cattail. Floating-leaved vegetation would consist of white water lily. Submergent project-area vegetation would include widgeon grass and milfoil.

5. Upon implementation of the proposed project, depth of project area open water would vary depending upon management of impoundment water levels. Refuge personnel anticipate however, that present depths (70% greater than 1.5 feet, 30% between 0.5 to 1.5 feet), or shallower depths shall be maintained. Water levels shall be maintained at levels that serve to maintain existing emergent vegetation or restore emergent vegetation in existing open water areas.

6. Implementation of the proposed project will serve to maintain existing salinities (less than 1.0 ppt).

   Without the proposed project, project-area salinities would vary depending upon tides and rainfall. Additionally, salinities within the project area would vary with proximity to Burton Canal. Near Burton Canal, project area salinities would be expected to range from 0 to 13 ppt. At the eastern extreme of the project area, salinities would range from 0 to 3 ppt.

LITERATURE CITED

Sabine National Wildlife Refuge 1989. Annual Narrative, Calendar Year 1989. Sabine National Wildlife Refuge, Hackberry, Louisiana. U.S. Department of the Interior, National Wildlife Refuge System.

COASTAL WETLAND PLANNING, PROTECTION AND RESTORATION ACT

Proposed Project WVA Evaluation

Supplemental Information

Project: Sabine NWR- Restoration of Impoundment 3 West Levee

Introductory Information and Assumptions

* Project area consists of the 13,000-acre area predicted to be affected (protected) by the proposed project. Project area boundaries are irregular on the east side, a reflection of marsh/open water ratios, water depths, and hydraulic characteristics of the area.

* Project area consists of highly organic fresh marsh and open water. Marsh is a combination of flotant and deepwater emergents such as rice cutgrass and cattail rooted in firm soil 1.5 to 2 feet below average water level.

* Future-without-project (FWOP) conditions assume that breaches will develop in several locations along the levee's five-mile length due to storm damage. Breaches are assumed to develop immediately after Target Year (TY) 5. That year was selected based on the present condition of the levee and the assumption that one or more storms of sufficient intensity (sub-tropical or hurricane strength) will occur in the project area within 5 years. Levee failure will subject the project area to tidal scouring and boat wakes from Burton Canal, and to increased turbidity and salinities, all of which will result in loss of emergent marsh and open-water aquatic vegetation, and deepening of the organic substrate.

* Future-with-project (FWP) conditions assume that the levee will be repaired and fortified, thus insuring that the protection currently afforded the project area by the levee will continue for at least 20 years into the future.

* Project benefits will be derived solely from protection of the project area from habitat losses predicted to occur under FWOP conditions.

* Target years were developed as follows:

TY	Year	Conditions
0	1993	Baseline (pre-project) environmental conditions
1	1994	Levee repair completed (FWP)
5	1998	Last year of intact levee, FWOP
10	2003	Intermediate TY chosen to illustrate habitat changes
15	2008	Intermediate TY chosen to illustrate habitat changes
20	2013	End of project life

* The project area emergent marsh will be subject to an annual marsh loss of 1.01% for the entire project life under FWP conditions, and through TY5 under FWOP conditions. Those losses will be due, in part, to erosion along the margins of existing large open water areas via wind-generated waves. The 1.01% annual loss rate is based on actual losses observed in Impoundment 3 between 1984 and 1987, as cited in the Proj. Info. Sheet (Page 1, Item 4).

* Because levee is not predicted to fail until immediately after TY5, all TY1 and TY5 values under FWOP conditions will be identical to those under FWP conditions.

Target Year (TY) 0 Conditions

* V_1- In Project Information Sheet (Page 1, Item 1).

* V_2- In Proj. Info. Sheet (Page 1, Item 3).

* V_3- Examination of 1981 and 1983 color infra-red aerial photography indicates that approximately 45% (5,850 ac) of the project area is monotypic enough to be placed in Interspersion Category 4; most of that area is comprised of the large expanses of open water existing in the project area. The remainder of the project area (7,150 ac) exhibits enough interspersion and edge to be placed in Category 2.

  SIV_3 was calculated directly using a weighted average, as follows:

  $SIV_3 = ((7150\ ac)(0.8) + (5,850\ ac)(0.2))/13,000$
  $SIV_3 = 0.53$

* V_4- Based on the description of present vegetation given in the Proj. Info. Sheet (Page 1, Item 1), with particular emphasis given to the fact that 3 of the 4 most abundant plants are those listed as typical for Water Duration Category 1. Ronnie Paille (Sabine NWR, pers. comm.) estimated that approximately 65% (5492 ac) of the existing marsh is made up of the cattail-bullwhip-rice cut grass

community, and the remaining 35% (2958 ac) is flotant marsh. All of the flotant acreage was assigned to Water Duration Category 3 and the cattail-bullwhip-cut grass acreage was assigned to Category 1.

* V_5- From Proj. Info. Sheet (Page 2, Item 7). Those measurements were taken at a pool stage of 2.5 ft MSL (Ronnie Paille, Sabine NWR, pers. comm.).

* V_6- From Proj. Info. Sheet (Page 2, Item 8).

* V_7- Based on knowledge of the type and operation of existing water control structures on Impoundment 3, it is assumed that there is no access into the project area by estuarine organisms.

Future With Project (FWP) Conditions

* V_1- Losses between TY0 and TY1 include the 1.01% annual loss plus the conversion of 10 acres of emergent marsh to deep open water due to borrowing from within the project area levee refurbishment material. The 10 acre figure is based on the estimation that approximately one-fifth (1 mile) of the total levee length is eroded badly enough to require obtaining material from the inside of the levee. Assuming a borrow area 50 ft wide and 1 mile long, the total borrow area equals 6 ac. That figure was increased to 10 ac to be conservative.

Acres of emergent marsh existing in the project area through the project life are as follows:

TY	Emergent Marsh (ac)	Percent of Study Area	Acres Lost Since Previous TY	Annual Loss Rate Between TY's
0	8,450	65	--	--
1	8,355	64	95	1.01%
5	8,022	62	333	1.01%
10	7,625	59	397	1.01%
15	7,248	56	377	1.01%
20	6,889	53	+ 359	1.01%
			1,561	

* V_2- Assume that the percentage of open water dominated by aquatic vegetation will remain unchanged from TY0 conditions.

* V_3- The loss of 1,551 ac (1,561 ac less 10 ac lost due to levee refurbishment) of emergent marsh over the project life is predicted to occur predominately at the fringes of the large open water areas due to wave-induced erosion. Based on that expectation, 70% of marsh losses for each TY will add to large open water areas, and thus will be apportioned to Interspersion Category 4. The remaining 30% of marsh losses for each TY will occur in the marsh interior, and will not, over the life of the project, result in a shift in Interspersion Category for that area. The SIV_3 was calculated using a weighted average, as was done under TY0 conditions, according to the following:

TY	Marsh Lost Between TY's	Acres Lost Apportioned to Interspersion Categories		Total Acres in Interspersion Categories		SI
		2	4	2	4	
0	--	--	--	7,150	5,850	0.53
1	85	25	60	7,090	5,910	0.53
5	333	100	233	6,857	6,143	0.52
10	397	119	278	6,579	6,421	0.50
15	377	113	264	6,315	6,685	0.49
20	+ 359	+ 108	+ 251	6,064	6,936	0.48
	1551	465	1086			

* V_4- Sixty percenty of the marsh loss is assumed to come from the flotant marsh in Category 3, and the remainder is assumed to come from the cattail-bullwhip-cut grass marsh in Category 1.

* V_5- Marsh acreage that is converted to open water is predicted to go into Depth Category 2 (0.5 to 1.5 ft deep). No acreage is predicted to move into Depth Category 1 (less than 0.5 ft deep) because the marsh lost will be flotant or deepwater emergents and the substrate is already deeper than 0.5 ft, as documented under TY0 Conditions above. Shifts in acreage from Category 2 into Category 3 (greater than 1.5 ft deep) will be limited to the 10 ac converted from marsh to open water during levee refurbishment; within other areas, the relatively low energy wave erosion

experienced under FWP conditions is not expected to be severe enough to scour out deeper bottom sediments.

* V_6- Salinities are not expected to change from TY0 conditions.

* V_7- Access Value is not expected to change from TY0 conditions.

Future Without Project (FWOP) Conditions

* V_1- The Proj. Info. Sheet (Page 3, Item 3a) states that 80% (6,670 ac) of emergent marsh would be lost over the project life under FWOP conditions. That loss will begin in TY6, and thus, is spread out over 15 years. Breaches are predicted to be relatively small during the earlier years of that period. However, loss rates are predicted to be relatively high as flotant marsh and organic substrate nearest the levee is rapidly lost due to wave erosion and high salinities. Through time, the breaches are predicted to widen, but wave action and salinity will have farther to travel to the remaining marsh. However, wider breaches will expose a greater area to damaging conditions (high wave/tidal energy and higher salinities). Therefore, it is assumed that annual loss rate will be constant over the 15 year period at 6,670 ac/15 yr = 445 ac/yr.

Acres of emergent marsh existing in the project area through the project life are as follows:

TY	Emergent Marsh (ac)	Percent of Study Area	Acres Lost Since Previous TY	Annual Loss Rate Between TY's
0	8,450	65	--	--
1	8,355	64	95	1.01%
5	8,022	62	333	1.01%
10	5,797	45	2225	445 ac
15	3,572	28	2225	445 ac
20	1,347	10	+ 2225	445 ac
			7,103	

* V_2- The loss prediction for floating-leaved aquatics as stated in the Proj. Info. Sheet (Page 3, Item 3b) was raised from 50% to 75% on consencus of the Environmental Work Group. Thus, FWOP conditions

assume 75% (1024 ac) of floating leaved aquatic habitat will be lost, and 60% (819 ac) of submerged aquatic habitat will be lost, for a total of 1843 ac of open water dominated by aquatic vegetation lost over the project life. Because the percentage of open water dominated by aquatic vegetation is predicted to remain at 60% until the levee fails after TY5, and TY5 open water acreage is 4978 ac, the loss of 1843 acres of aquatic vegetation will be lost from 4978 * 0.60 = 2977 ac. Due to the sensitive nature of fresh aquatic vegetation to high turbidity and salinity, 50% (922 ac) of that loss is predicted to occur within the first 5 years after levee failure (i.e., between TY5 and TY10). The remaining 50% loss (922 ac) will be spread evenly across the remaining 10 years of the project:

TY	Acres of Open Water	Acres of Open Water Dominated by Aquatics	% of Open Water Dominated by Aquatics
0	4,550	2,730	60
1	4,645	2,777	60
5	4,978	2,977	60
10	7,203	2,055	28
15	9,428	1,594	17
20	11,653	1,133	10

* V_3- As marsh is lost after levee failure, large expanses of open water will continue to enlarge, but at the same time the interior marsh will begin to break up. It is predicted that 70% of the marsh loss will be to the fringes of large open water bodies, and will thus be added to Category 4; the remaining 30% will be added to the interior marshes which, because of the drastic marsh loss, will break up enough to shift from Category 2 to Category 3:

TY	Marsh Lost Between TY's	Acres Lost Apportioned to Interspersion Categories		Total Acres in Interspersion Categories		SI
		2	4	3	4	
5	--	--	--	6,857	6,143	--
10	2,225	668	1,557	5,300	7,700	0.32
15	2,225	668	1,557	3,743	9,257	0.29
20	+ 2,225	+ 668	+ 1,557	2,186	10,814	0.25
	6,675	2,004	4,671			

* V_4- After the levee fails, average water levels will drop approximately 1 ft (Ronnie Paille, Sabine NWR, pers. comm.), and the area will become tidally influenced. That degree of water level drop will result in a shift in the cattail-bullwhip-cut grass acreage from Category 1 into Category 2. The flotant community will remain in Category 3 for as long as it lasts. As with FWP conditoins, 40% of the marsh loss is expected to come from the cattail-bullwhip-cut grass communityu with the remaining 60% coming from the flotant marsh.

* V_5- Average water levels are predicted to drop approximately 1 ft after levee failure. However, most of the present acreage in Depth Category 2 (0.5 to 1.5 ft deep) is closer to 1.5 ft than to 0.5 ft (Ronnie Paille, Sabine NWR, pers. comm.), and it is predicted that 90% of the open water after levee failure will be in Category 2 and 10% will be in Category 3 (greater than 1.5 ft deep). None of the present open water acreage is predicted to move into Category 1 (less than 0.5 ft deep), as the most shallow waters will be most vulnerable to tidal scouring.

* V_6- Average high salinities will vary across the project area, as stated in the Proj. Info. Sheet (Page 4, Item 6). However, average high salinities in the Burton Canal are estimated presently to be approximately 8 ppt (Ronnie Paille, Sabine NWR, pers. comm.). Thus, it appears that, when considering the project area as a whole, average high salinities may be predicted to be 6 ppt.

* V_7- Estuarine organisms would have access to the entire project area if the levee failed (P=1.0, R=1.0, Access Value=1.0).

COASTAL WETLANDS PLANNING, PROTECTION AND RESTORATION ACT

WVA Input Data For First Priority Project List (1991)

PROJECT: Sabine NWR Levee Reconstruction
(fresh marsh; 13,000 ac)

Future With Project

				V4 Category				V5 Category				
TY	V1	V2	* V3	1	2	3	4	1	2	3	V6	V7
0	0.65	0.60	0.53	5492	0	2958	0	0	1365	3185	1	0
1	0.64	0.60	0.53	5454	0	2901	0	0	1450	3195	1	0
5	0.62	0.60	0.52	5321	0	2701	0	0	1783	3195	1	0
10	0.59	0.60	0.50	5162	0	2463	0	0	2180	3195	1	0
15	0.56	0.60	0.49	5011	0	2237	0	0	2557	3195	1	0
20	0.53	0.60	0.48	4867	0	2022	0	0	2916	3195	1	0

Future Without Project

				V4 Category				V5 Category				
TY	V1	V2	* V3	1	2	3	4	1	2	3	V6	V7
0	0.65	0.60	0.53	5492	0	2958	0	0	1365	3185	1	0
1	0.64	0.60	0.53	5454	0	2901	0	0	1450	3195	1	0
5	0.62	0.60	0.52	5321	0	2701	0	0	1783	3195	1	0
10	0.45	0.28	0.32	0	4431	1366	0	0	6483	720	6	1
15	0.28	0.17	0.29	0	3541	31	0	0	8485	943	6	1
20	0.10	0.10	0.25	0	1347	0	0	0	10488	1165	6	1

* V3 values represent the Sutiability Index as calculated from a weighted average Numbers from which the weighted averages are based are given in the project October 2, 1991 Supplemental Information Sheet.

9-25-91 REVISED 9-28-91
SABINE NWR

0.0875	0.1076	WITH PROJECT YEAR	ACRES	HSI	HU'S	PV HU'S	WITHOUT PROJECT YEAR	ACRES	HSI	HU'S	PV HU'S		NET HU'S	PV NET HU'S	NET ACRES	PV NET ACRES
		0	13,000	0.69953	9,093.85	9,093.85	0	13,000	0.69953	9,093.85	9,093.85	0	0	0	0	0
-0.5	0.95893	1	13,000	0.69953	9,093.85	8,720.33	1	13,000	0.69953	9,093.85	8,720.33	1	0	0	0	0
-1.5	0.88177	2	13,000	0.69992	9,098.95	8,023.20	2	13,000	0.69992	9,098.95	8,023.20	2	0	0	0	0
-2.5	0.81082	3	13,000	0.70031	9,104.05	7,381.79	3	13,000	0.70031	9,104.05	7,381.79	3	0	0	0	0
-3.5	0.74559	4	13,000	0.70070	9,109.15	6,791.65	4	13,000	0.70070	9,109.15	6,791.65	4	0	0	0	0
-4.5	0.68560	5	13,000	0.70110	9,114.25	6,248.69	5	13,000	0.70110	9,114.25	6,248.69	5	0	0	0	0
-5.5	0.63043	6	13,000	0.70105	9,113.61	5,745.52	6	13,000	0.68651	8,924.69	5,626.42	6	189	119	366	230
-6.5	0.57971	7	13,000	0.70100	9,112.97	5,282.87	7	13,000	0.67193	8,735.13	5,063.83	7	378	219	731	424
-7.5	0.53307	8	13,000	0.70095	9,112.34	4,857.47	8	13,000	0.65735	8,545.57	4,555.35	8	567	302	1,097	585
-8.5	0.49018	9	13,000	0.70090	9,111.70	4,466.33	9	13,000	0.64277	8,356.01	4,095.91	9	756	370	1,462	717
-9.5	0.45074	10	13,000	0.70085	9,111.06	4,106.68	10	13,000	0.62819	8,166.45	3,680.91	10	945	426	1,828	824
-10.5	0.41447	11	13,000	0.70089	9,111.54	3,776.45	11	13,000	0.60021	7,802.72	3,233.99	11	1,309	542	2,198	911
-11.5	0.38112	12	13,000	0.70092	9,112.01	3,472.78	12	13,000	0.57223	7,438.99	2,835.16	12	1,673	638	2,567	978
-12.5	0.35046	13	13,000	0.70096	9,112.49	3,193.53	13	13,000	0.54425	7,075.26	2,479.57	13	2,037	714	2,937	1,029
-13.5	0.32226	14	13,000	0.70100	9,112.96	2,936.73	14	13,000	0.51627	6,711.53	2,162.85	14	2,401	774	3,306	1,066
-14.5	0.29633	15	13,000	0.70103	9,113.44	2,700.59	15	13,000	0.48829	6,347.80	1,881.04	15	2,766	820	3,676	1,089
-15.5	0.27249	16	13,000	0.70093	9,112.09	2,482.93	16	13,000	0.45617	5,930.19	1,615.90	16	3,182	867	4,049	1,103
-16.5	0.25056	17	13,000	0.70083	9,110.75	2,282.82	17	13,000	0.42404	5,512.58	1,381.25	17	3,598	902	4,422	1,108
-17.5	0.23040	18	13,000	0.70072	9,109.40	2,098.83	18	13,000	0.39192	5,094.96	1,173.89	18	4,014	925	4,796	1,105
-18.5	0.21186	19	13,000	0.70062	9,108.06	1,929.68	19	13,000	0.35980	4,677.35	990.97	19	4,431	939	5,169	1,095
-19.5	0.19482	20	13,000	0.70052	9,106.71	1,774.15	20	13,000	0.32767	4,259.74	829.87	20	4,847	944	5,542	1,080
		TOTAL YEARS 1-20			182,191.38	88,273.03	TOTAL YEARS 1-20			149,099.22	78,772.58		33,092.16	9,500.45	44,146.00	13,344.25
					0.05	0.1076 I&A,20,8-3/4%				0.05	0.1076 I&A,20,8-3/4%		0.05	0.1076	0.05	0.1076
					9,109.57	9,498.18 AAHU WITH PROJ				7,454.96	8,475.93 AAHU W/O PROJ		1,654.61	1,022.25	2,207	1,436

FUTURE WITH		FUTURE WITHOUT		BENEFIT
9,109.57	MINUS	7,454.96	EQUALS	1,654.61 AAHU BENEFIT UNDISCOUNTED
9,498.18	MINUS	8,475.93	EQUALS	1,022.25 AAHU BENEFIT DISCOUNTED