Wetland Value Assessment Revised Project Information Sheet
May 2001

Project Name: Diversion into the Swamps South of Lake Maurepas

Sponsoring Agency: U.S. Environmental Protection Agency (EPA)
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Project Area: The project is proposed for the upper Pontchartrain Basin, Coast 2050 Region 1, Amite/Blind Rivers Mapping Unit; St. John the Baptist, St. James and Ascension Parishes. The approximately 36,121-acre project boundary is divided into 7 sub-areas for WVA evaluation (see Figure 1).

Rationale for Project Area. Two major areas are being considered for WVA benefits: 1) the area that directly receives diverted water ("receiving area"); and 2) an area that will receive benefits from reduced salinities ("Lake margin").

Receiving Area. The area that will see measurable amounts of diverted water, i.e., in amounts expected to convey measurable benefits to the receiving swamps, is defined by the UNET modeling effort and associated hydrographic surveys. This area is bounded by I-10 on the south, by Blind River and the Amite Diversion Canal on the west and north, and by Reserve Relief Canal on the east. It includes areas 1, 2, and 3 on Figure 1.

The UNET modeling has shown that once water is delivered to the point in Hope Canal immediately north of I-10, the diverted water leaves the channel rapidly (Figure 2). Figure 2 shows that 90%-95% of the diverted water has entered the swamps immediately east and west of Hope Canal before it reaches Tent Bayou. Thus, UNET modeling cells 17 and 25 to the west of Hope Canal and cells 18 and 26 to the east of Hope Canal (Figure 3) are the first to receive the great majority of the diverted water. The rapid and effective distribution of diverted water from Hope Canal is largely due to the numerous breaks in banks and small bayous connecting the swamps that were surveyed during this study (Figure 4), as well as to the relatively small natural conveyance capacity of this canal.

Figure 5 shows the general flow pattern of the water through the swamps. Water flows west from units 17 and 25 to units 16 and 24, and north to units 32 and 33. Similarly, water east of Hope Canal moves east from units 18 and 26 to units 19 and 27, and continues east and north. Overall, more water flows west than east. More than half of the water (about 800 cfs) cycles through the swamps and eventually re-enters the Hope Canal/Tent Bayou/Dutch Bayou system, and then enters the lake. Some of the water (about 600 cfs) that moves west through the swamps enters Blind River, and goes to the lake through that waterway. The balance of the diverted water (about 100 cfs) enters Reserve Relief Canal. It is assumed that there is minimal incremental increase in loss through evapotranspiration.

Figure 1

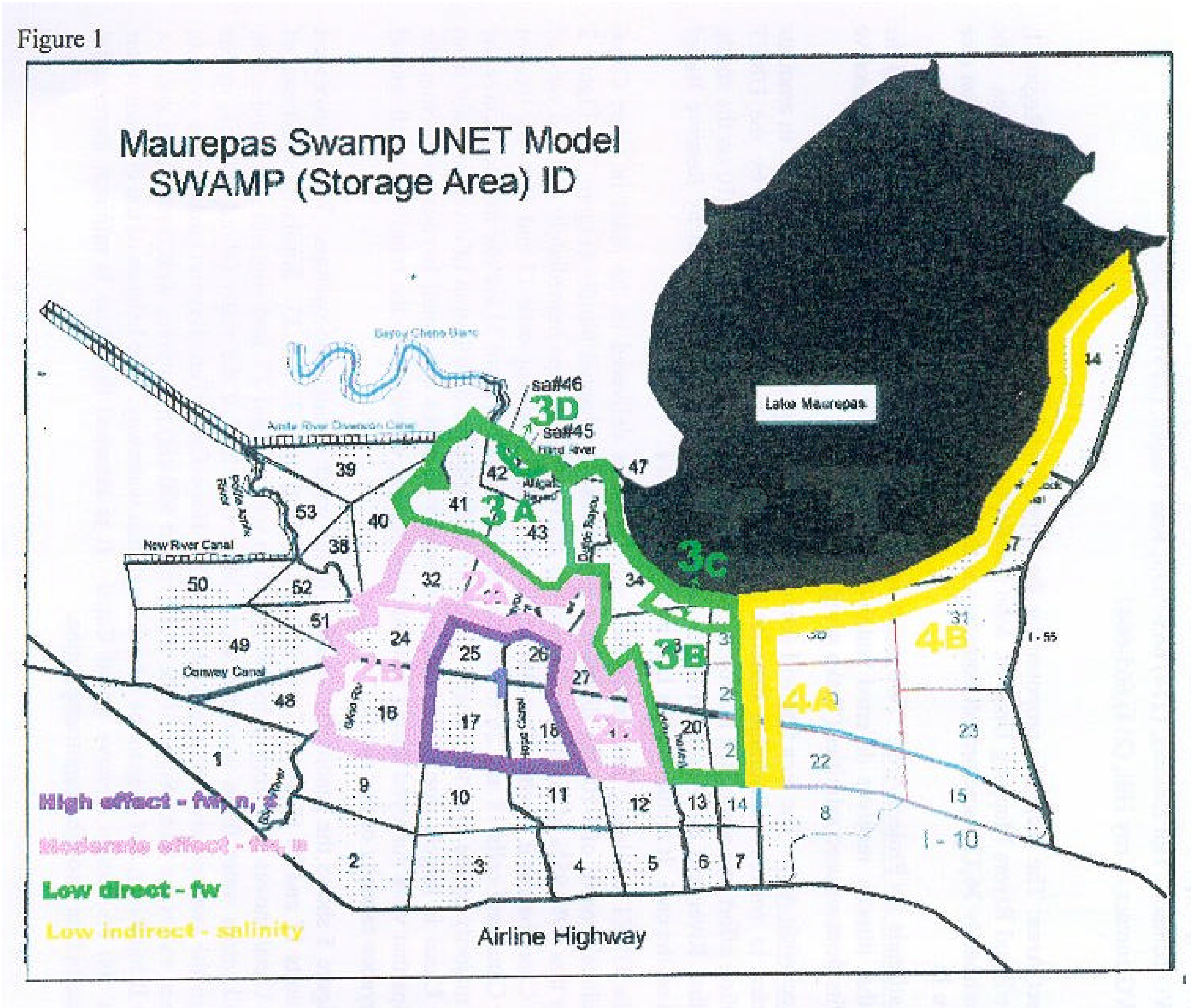
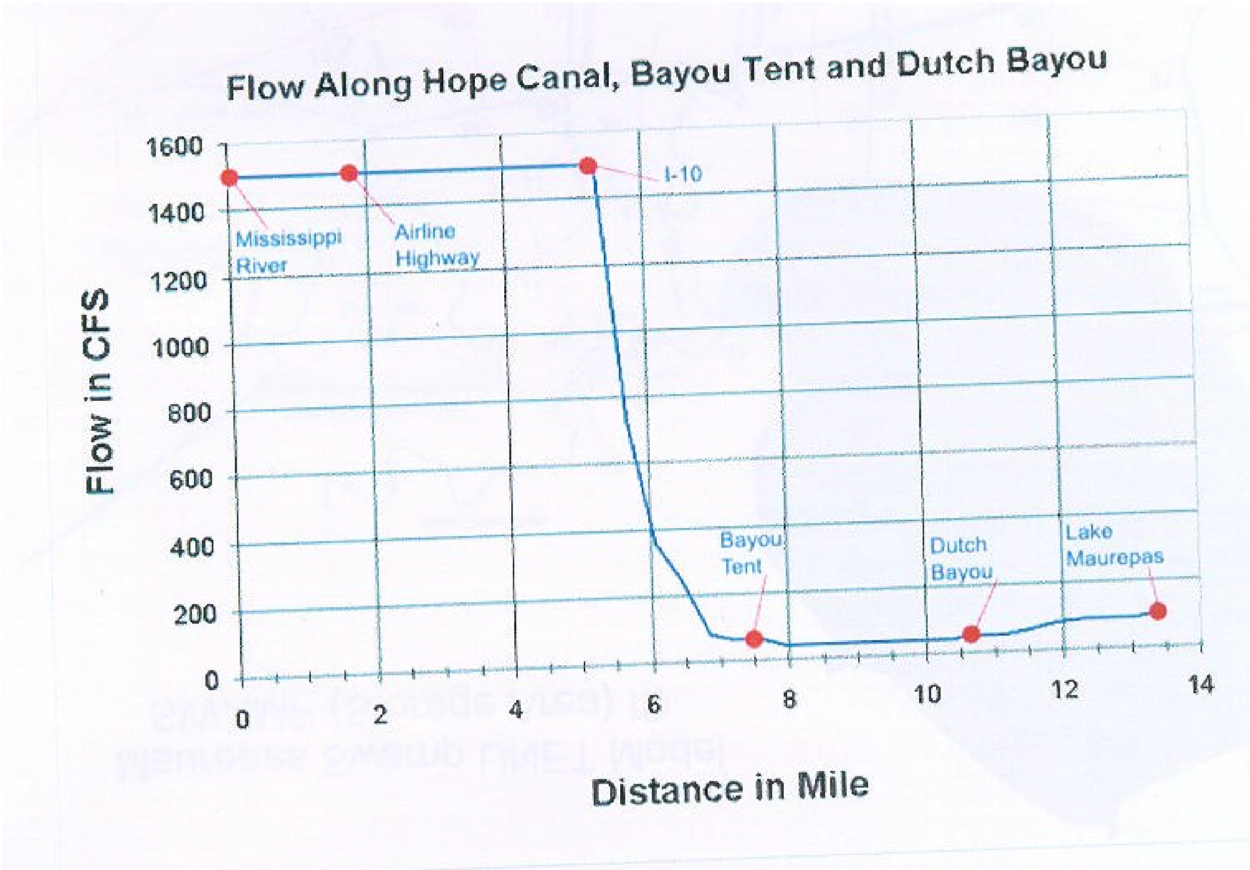


Figure 1
Maurepas Swamp UNET Model
SWAMP (Storage Area) ID
Lake Maurepas
sa#46
3D
sa#45
3A
3C
3B
4A
4B
2B
New River Canal
Conway Canal
Low direct - fw
Low indirect - salinity
Airline Highway
I - 10
I - 55

Figure 2



Flow Along Hope Canal, Bayou Tent and Dutch Bayou
Flow in CFS
1600
1400
1200
1000
800
600
400
200
0
0
2
4
6
8
10
12
14
Distance in Mile
Mississippi River
Airline Highway
I-10
Bayou Tent
Dutch Bayou
Lake Maurepas

Figure 3

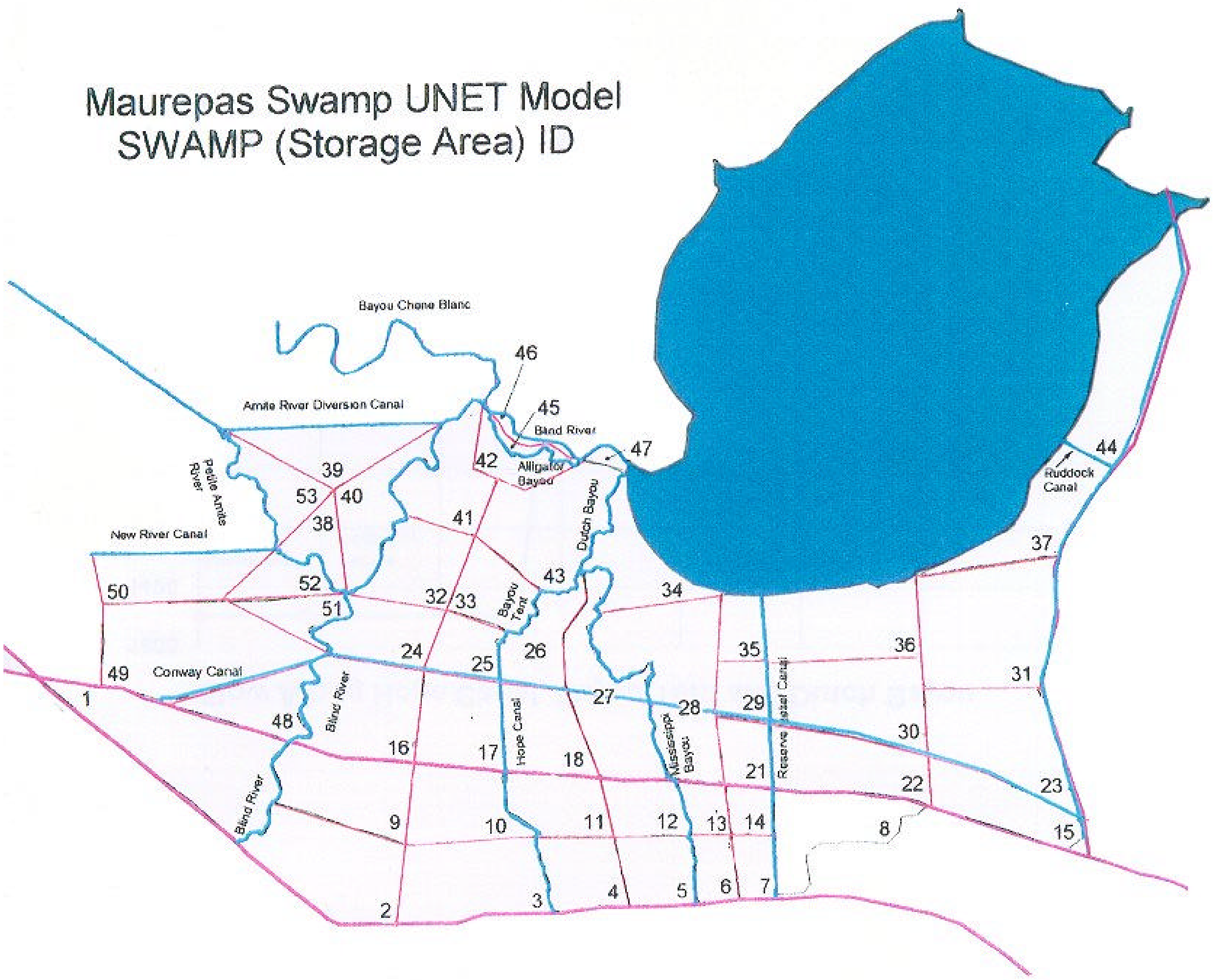

Maurepas Swamp UNET Model
SWAMP (Storage Area) ID
Bayou Chene Blanc
Amite River Diversion Canal
Blind River
Alligator Bayou
Petite Amite River
New River Canal
Dutch Bayou
Bayou Tent
Ruddock Canal
Conway Canal
Blind River
Hope Canal
Mississippi Bayou
Reserve Relief Canal
Blind River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
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Figure 4

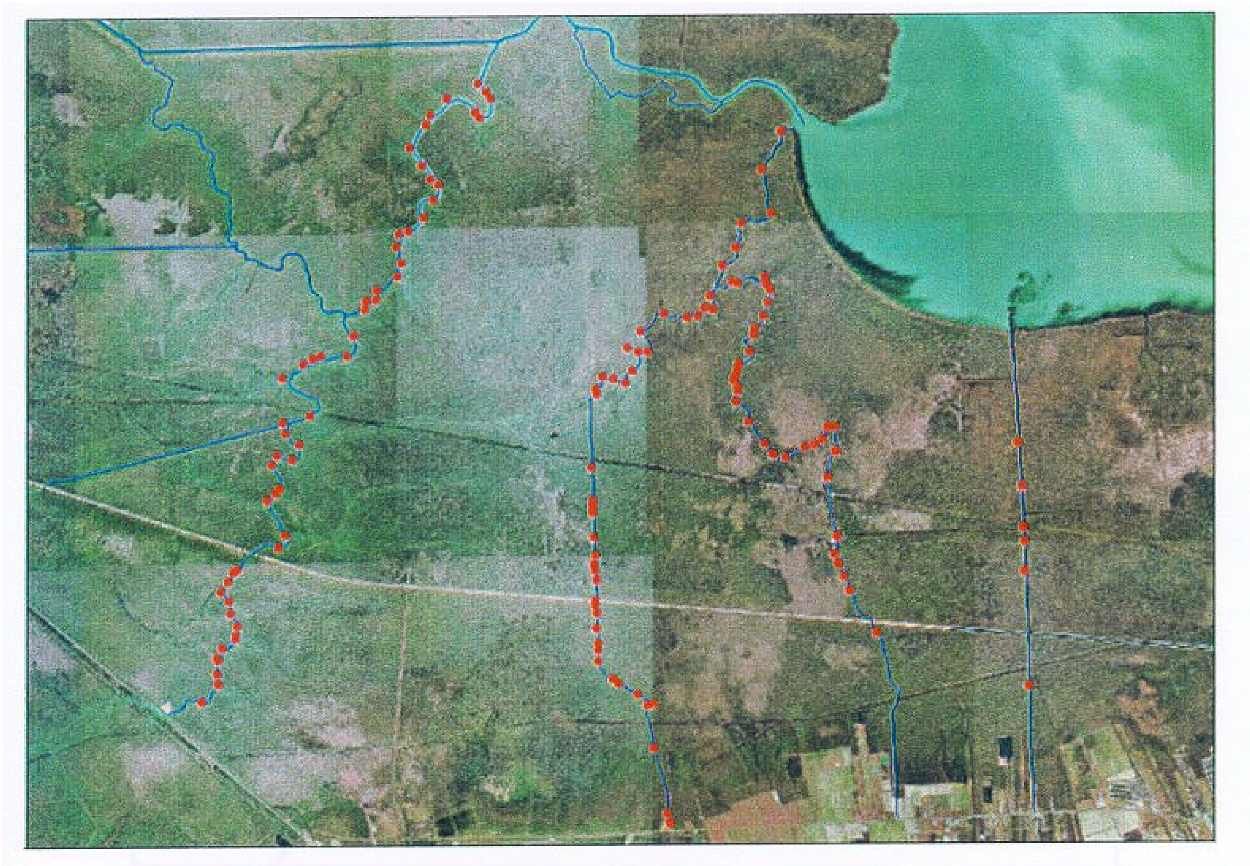
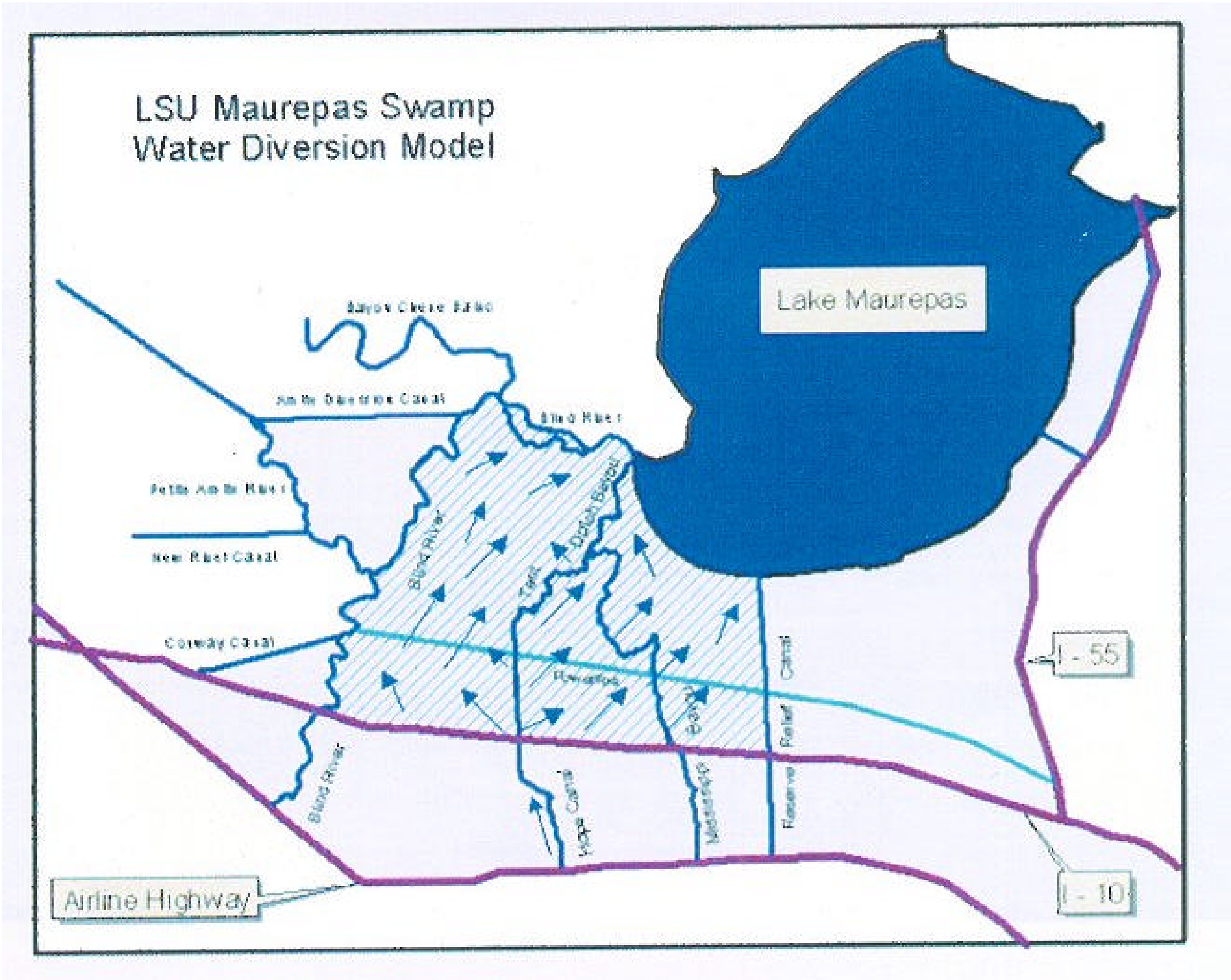


Figure 5



LSU Maurepas Swamp
Water Diversion Model
Lake Maurepas
Blind River
Hope Canal
Reserve Relief Canal
I - 55
I - 10
Airline Highway

Figure 6 shows water levels along a western and an eastern transect through the swamp from the point of release to the edge of the proposed project area. After the diversion has been running for about one month, the farthest edge of the project area to the west will see an approximately 5 inch increase in water level, and the farthest edge of the project area to the east will see an approximately 6 inch increase in water level. Thus, the area proposed for direct benefits clearly will receive substantial (i.e., measurable) influence from diverted water.

It should be noted that once river water is released just north of I-10 in Hope Canal, some relatively small proportion of the water will move south through any culverts and bayous that pass under I-10. Thus, UNET model units 10, 11, 12, 3, 4, and 5 will receive some diverted water (Figure 7). Because this is a relatively large area receiving relatively little water, the area is not proposed for inclusion in the WVA project area. Nevertheless, it is likely that the first of these units to receive the water (e.g., units 10 and 11) will derive some benefit from the diversion.

Lake Margin. There are estimates based on water budget for the Lake Maurepas area that strongly suggest the proposed diversion at 1,500 cfs will have a measurable capacity to freshen the lake system, especially along the southern shoreline. Based on comparison to the rating curve developed for Davis Pond, and adjusting for the cross-sectional area of the proposed Maurepas box culverts, it is estimated that with only 1 foot of head (i.e., the difference between the river and lake surface water elevations) the Maurepas diversion should be able to flow at least 1,100 cfs. With 0.5 feet of head, a flow of at least 780 cfs would be expected. Such low head differences would rarely be expected to occur at the Maurepas diversion site. Thus it is anticipated that in most years, the proposed diversion will be able to operate at or near capacity all year long. Also, the diversion is expected to be shut down during storms; however, this will not severely limit operations.

On the average, Lake Maurepas receives <3,400 cfs of freshwater inflow (including the Amite/Comite system, the Tickfaw, and the Natalbany) (E. Swenson, personal communication, March 14, 2001). A 1,500 cfs diversion capable of running year-round represents, as a maximum, a 45% increase in average freshwater input to the lake. The majority of existing freshwater inputs come during spring runoff, while it is the summer to fall low flow periods that represent the time of most severe salinity problems. The diversion running during these times would be contributing proportionately more freshwater inflows to the lake, and would thus have significant freshening capabilities.

The total average volume of Lake Maurepas is about 533,741 acre-feet (E. Swenson, personal communication, March 14, 2001). A 1,500 cfs diversion running year-round would contribute, again as a maximum, about 1,085,950 acre-feet of fresh water, or 2 complete turnovers of total lake volume. This magnitude of input represents a substantial freshening capacity within this system.

Figure 6

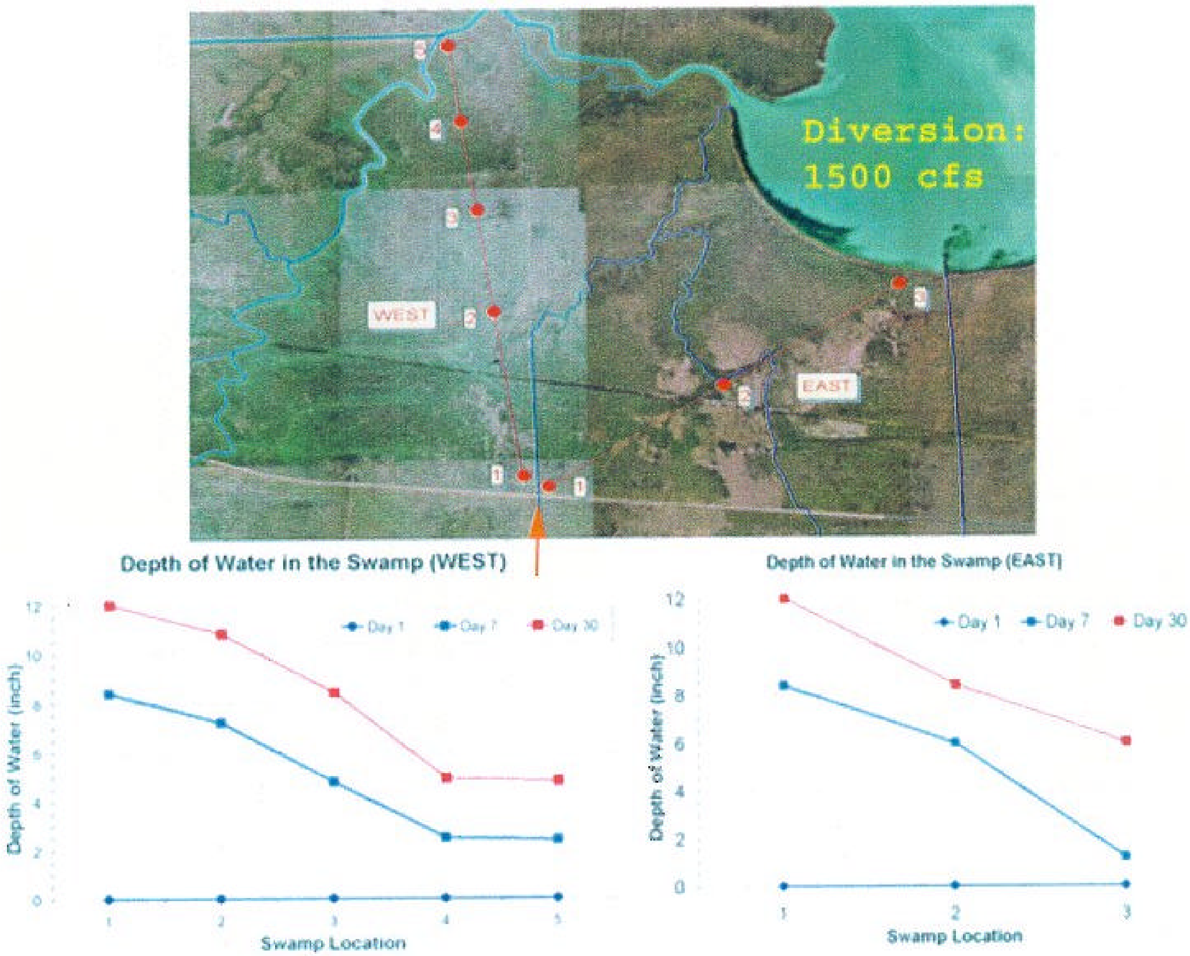
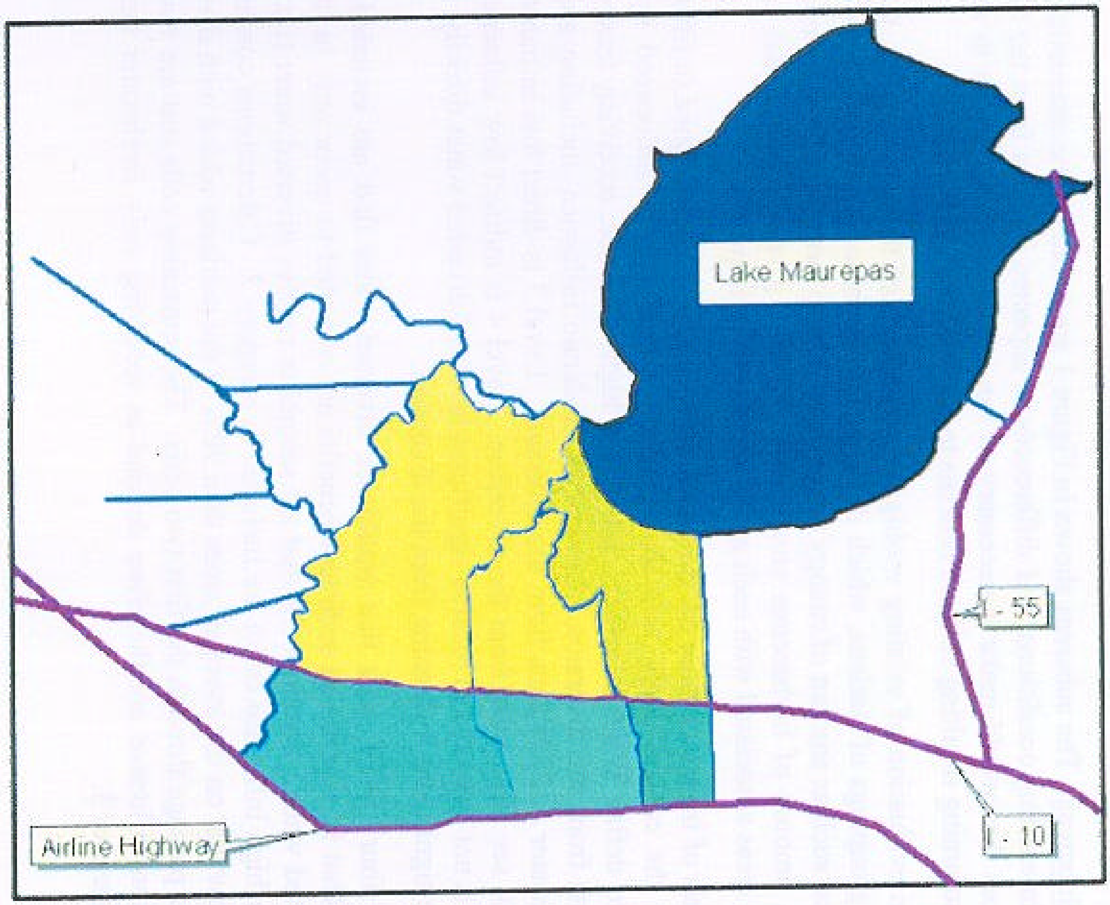

Diversion:
1500 cfs
WEST
EAST
Depth of Water in the Swamp (WEST)
Day 1
Day 7
Day 30
Depth of Water (inch)
Swamp Location
Depth of Water in the Swamp (EAST)
Day 1
Day 7
Day 30
Depth of Water (inch)
Swamp Location

Figure 7



In relation to this, there is the question of whether the lake is fully mixed or not. Some believe Lake Maurepas must be well mixed because it is shallow. In a personal communication with Dennis Demcheck of USGS in early December of 2000, Dennis suggested that the lake may not be well mixed, based on observations that sediment plumes out of the Amite Diversion Canal tend to move out and south, and are discernable for a substantial distance toward the passes, where Lake Maurepas water ultimately exits. Even if the lake is not well mixed, it is probable that water diverted into the southern part of the system would tend to hug the south shore as is moves toward the passes, and so freshen these areas in proportion greater than would be expected from nominal mixing.

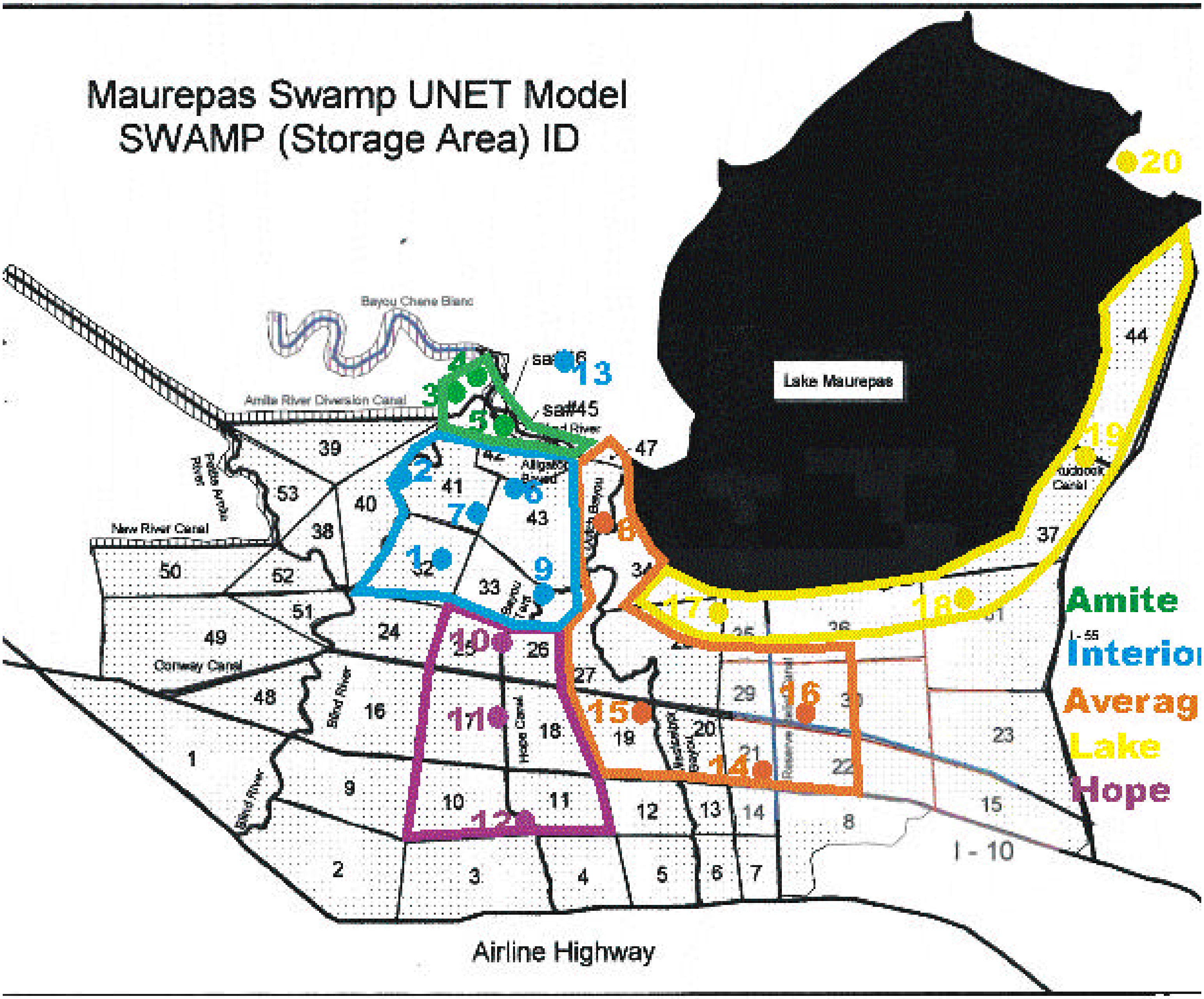
Project Subareas. The subareas shown in Figure 1 are based on the interaction of two things - differences in existing conditions, and differences in expected impacts from the diversion. These are the factors that would make it necessary to run separate WVA models to estimate benefits (ultimately summing resulting subarea benefits to get total project benefits).

Based on evaluation of existing ecological conditions of the swamps, Dr. Gary Shaffer has described 5 groupings of stations, which differ in the combination of factors that define existing level of stress, such as amount of canopy cover, level of tree mortality, level of tree growth, nature of substrate, amount of herbaceous cover, etc. Table 1 gives characteristics of the 5 station groups. The areas associated with each group are shown in Figure 8.

Four levels of influence from the proposed diversion have been defined (a fifth category is for areas within the current study area that probably would not be influenced by the diversion sufficiently to define WVA benefits). Level 1 is high influence, receiving freshwater, nutrients and sediments from the diversion. Level 2 is moderate influence, including areas expected to receive freshwater and nutrients from the diversion. Level 3 is direct low influence, representing areas that will see freshwater from the diversion. Level 4 is indirect low influence, representing the area that is not expected to receive significant levels of diverted water directly, but is expected to experience significant freshening from the diversion.

Only the four UNET cells that would see diverted water first are included in category 1 (Figure 1). That is, significant sediment benefits are expected to occur only in the first units to receive diverted water. Swamp cells that are second to receive diverted water (i.e., receive water from the four high influence cells) are included in category 2. Calculations conducted as part of this study show that on the average, more than 90% of the nutrients added with diverted water are removed after passage through the first two cells. The remaining cells that are within the area of direct diversion influence are therefore defined as receiving only freshwater benefits, and are included in category 3.

Figure 8



Maurepas Swamp UNET Model
SWAMP (Storage Area) ID
Lake Maurepas
Bayou Chene Blanc
Amite River Diversion Canal
New River Canal
Conway Canal
Airline Highway
I - 10
Amite
Interior
Averag
Lake
Hope

Table 1. Station Groupings

	Reference	Different levels (categories) of degraded conditions			
Groupings	Amite	Interior	Average	Lake	Hope
Stations	3, 4, 5	1, 2, 6, 7, 9, 13	8, 14, 15, 16	17, 18, 19, 20	10, 11, 12
Characterization	Better health than other classes; still relatively unproductive compared to healthy swamp	Moderately degraded	Degraded	Highly degraded	Less degraded
Specific characteristics	• more mineral sediment than other classes, bulk density relatively high compared to other sites; • higher productivity than other sites (highest forested productivity of all sites) • unconsolidated substrate, except for site 5 • moderate to >75% canopy cover (what about poor canopy at 4, and good canopy 5?) • moderate to open herbaceous cover; • moderately good growth (moderate to large average tree size); • most sites have low mortality, but tupelo are stressed.	• unconsolidated substrate • moderate canopy cover • moderate to moderately high herbaceous cover; • moderate growth (moderate average tree size); • relatively low tree mortality, but tupelo clearly stressed, near-future mortality expected.	• unconsolidated to highly unconsolidated substrate; • partial to moderate canopy cover; • moderate to moderately high herbaceous cover; • moderately poor growth (small to moderate average tree size); • relatively low tree mortality, but tupelo clearly stressed, near-future mortality expected.	• unconsolidated to highly unconsolidated substrate; • open (poor) canopy cover; • variable herbaceous cover – open (ponded) to moderate herbaceous cover at most sites, but some with >75% herbaceous cover (subsidence expected to change higher cover sites to moderate and then ponded); at present, these generally have the highest herbaceous cover; • poor tree growth (stunted to moderate average tree size); • high tree mortality (some include total mortality of all but cypress)	• more mineral sediment than other classes, bulk density relatively high compared to other sites; • higher productivity than other sites (highest forested productivity of all sites) • unconsolidated substrate, except for site 12; • moderate to >75% canopy cover • moderate to open herbaceous cover; • moderately good growth (moderate to large average tree size); • most sites have low mortality, but tupelo are stressed.

	Reference	Different levels (categories) of degraded conditions			
Groupings	Amite	Interior	Average	Lake	Hope
Stations	3, 4, 5	1, 2, 6, 7, 9, 13	8, 14, 15, 16	17, 18, 19, 20	10, 11, 12
Influences	Amite diversion			Salinity from Pontchartrain	Non-point source runoff (e.g., storm water) - sites doing better than expected
Expected level of impact from diversion	Direct low (5) No substantial influence (3 & 4).	Medium (1, 9); direct low (2, 6, 7); or none (13)	Medium (15); direct low (8, 14); or indirect low (16)	Direct low (17) or indirect low (18, 19, 20)	High (10, 11) 12 will get some influence (small amounts of freshwater and nutrients), but not included in WVA project area.
Types of diversion influences	Freshwater (5) Sites 3 & 4 are north of the Amite Diversion Canal, and therefore not expected to get measurable WVA benefits.	Freshwater and nutrients (1, 2, 6, 7, 9); freshwater 13 is north of the Amite Diversion Canal, and therefore not expected to get measurable WVA benefits.	Freshwater and nutrients (15) to freshwater (8, 14), or indirect freshwater/salinity benefits (16)	Freshwater (17), to indirect freshwater/salinity benefits (18, 19, 20)	Freshwater, nutrients, sediments (10, 11) Site 12 will get some freshwater (and nutrients) from backflow under I-10, but the swamps south of I-10 will not be included in the WVA project area at this time.

Category of Diversion Impact	Types of Diversion Influence	Representative Stations
High	FW, N, S	10, 11
Moderate	FW, N	1, 9, 15
Direct Low	FW	2, 5, 6, 7, 8, 14, 17
Indirect Low	FW	16, 18, 19, 20
Out of WVA project area		3, 4 (north of the Amite Diversion Canal - not included in WVA project area) 12 (will get some freshwater under I-10, but not included in project area) 13 (north of Amite Diversion Canal - not included in WVA project area)

The intersection of the resulting matrix of station types by projected diversion influence has stations in 9 cells, leading to 9 subareas that would be evaluated separately in a WVA (Table 2). However, subareas 3D (including only Alligator Island) and 3C (classified with the "Lake" station group, but falling in the low direct influence category) are relatively small compared to the larger subareas within which they fall (subareas 3B and 3A, respectively). The Environmental Workgroup recommended that for WVA evaluation, subarea 3C be lumped with 3B, and subarea 3D be lumped with 3A. Thus, only 7 subareas will be evaluated for WVA benefits. Note that on Figure 1, levels of diversion influence are shown by numbers 1 through 4 (as described above), and subareas reflecting existing ecological differences are shown by letters. Table 3 lists each subarea, the UNET cells included in each, and the acreages for each.

Subarea 1. This area includes UNET swamp cells 17 and 18 immediately west of Hope Canal, and cells 25 and about 60% of 26 immediately east of Hope Canal. It contains approximately 6,032 acres of cypress/tupelo swamp that is less degraded than several other portions of the project area. This subarea of swamp is less productive than a healthy swamp (about 2-3 times less), but has a somewhat higher productivity than the Interior, Average, and Lake areas. It is expected that this subarea receives some storm water runoff from the Hope Canal. See the description of the Amite (=Diversion) station group in Table 1 for other ecological characteristics. A portion of the remnant railroad levee runs along the west side of Hope Canal through this subarea; the levee has existing gaps, and would be gapped further as part of the project. The Hope subarea receives storm drainage through Hope Canal, but is far enough removed from Lake Maurepas to make water exchange with the lake minimal. Though none of the subareas within the Maurepas project area are completely impounded, currently the Maurepas swamps are often lower in elevation than the lake, rendering flooding semi-permanent, with low to very low water exchange and throughput. This subarea is expected to receive the highest influence from the diversion, getting freshwater, nutrient, and sediment benefits.

Subarea 2A. This area includes UNET swamp cells 16 and 24 to the west of Subarea 1, as well as cells 32, 33, and the upper approximately 40% of cell 26 to the north of Subarea 1. It totals about 8,048 acres of moderately degraded cypress/tupelo swamp, classified in the "Interior" station group. Interior sites are located remotely from any direct water exchange with Lake Maurepas. This subarea is expected to receive moderate (freshwater and nutrient) influence from the diversion, because it will receive diverted water mainly from the high influenced area units immediately to its east and/or south. However, the area also will receive flow of diverted water from other "secondary recipient" cells, and so some cells (e.g., cell 32) may not get as much nutrient loading as others (e.g. cell 16).

Subarea 2B. This area includes UNET cells 19 and 27 to the east of Subarea 1. It totals about 4,181 acres of degraded cypress/tupelo swamp, classified in the "Average" station group. Average locations are closer to the lake than Interior sites, and are in the vicinity of larger bayous or canals that make direct water exchange with the lake probable. This subarea is expected to receive moderate (freshwater and nutrient) influence from the diversion, because it will receive diverted water from the immediately adjacent high influence cells.

Table 2. Stations that fill various categories to be viewed on WVA trip

		Degree of Influence from Diversion				
		High - FW, N, S	Medium - FW, N	Direct Low - FW	Indirect Low - FW	Not included in WVA project area
Present Conditions	Amite - less degraded			5		3, 4
	Interior - moderately degraded		1, 9	2, 6, 7		13
	Average - degraded		15	8, 14	16	
	Lake - highly degraded			17	18, 19, 20	
	Hope - less degraded	10, 11				12

Table 3. Maurepas Diversion, WVA Project Area

Subarea	Unet Cell	proportion	acres in cell	acres in subarea
1	17		2,319	
	18		1,870	6,032
	25		1,040	
	26	0.60	1,338	
2A	16		2,667	
	24		1,383	
	26	0.40	1,338	
	32		1,885	8,048
	33		1,578	
2B	19		1,467	4,181
	27		2,714	
3A	41		2,069	
	42		1,005	5,406
	43	0.67	3,059	
	45		157	
	46		125	
3B	28		3,968	
	29		760	
	34		1,682	8,470
	35		852	
	43	0.33	3,059	
	47		199	
			subtotal	32,137
4A			(2.75 x.0.5)sq.mi	880
4B			(9.7 x 0.5)sq.mi.	3,104
			total	36,121

Subarea 3A. This subarea includes UNET swamp cells 41, 42, about 2/3 of 43, 45, and 46. It total about 5,406 acres of moderately degraded tupelo/tupelo swamp, classified in the "Interior" station group. Note that as indicated above, this subarea incorporates a small portion of less degraded swamp that classifies in the "Amite" station group, the 282 acres on Alligator Island represented by UNET cells 45 and 46.

Subarea 3B. This subarea includes UNET swamp cells 28, 29, 34, 35, the eastern third of 43, and 47. It totals about 8,470 acres of degraded tupelo/tupelo swamp, classified in the "Average" station group. As mentioned above, it also includes a small strip of swamp on the eastern side of this subarea along the lake (covering small portions of cells 28, 34, and 35) that actually classifies as highly degraded swamp in the "Lake" station group.

Subarea 4A. This subarea is an approximately ½ mile wide strip along the eastern bank of Reserve Relief Canal from I-10 to within about ½ mile of the lake. It is included because Reserve Relief Canal is not completely efficient at capturing diverted water moving east and transporting it to the lake. Therefore, it is expected that a small amount of freshwater will spill over into this area. Based on a ½ mile width and an estimated 2.75-mile length, this subarea includes about 880 acres of degraded tupelo/tupelo swamp, classified in the "Average" station group.

Subarea 4B. This subarea is an approximately ½ mile wide strip along the southern shore of Lake Maurepas from Reserve Relief Canal east to Pass Manchac. Based on a ½ width and a length of about 9.7 miles, this subarea includes about 3,104 acres of highly degraded swamp classified in the "Lake" station group. Lake locations are more likely to be influenced by Pass Manchac, the main waterway between Lake Maurepas and Lake Pontchartrain. It is included because it is expected that the loading of freshwater from the diversion to Lake Maurepas will have a substantial freshening effect on the lake, especially along the southern shore (see discussion above).

All subareas are subsiding and have insufficient sediment and nutrient input for accretion of inorganic sediment and organic production to keep pace with subsidence and sea level rise.

Problem: Since the construction of the Mississippi River flood control levees, the Maurepas swamps have been virtually cut off from any freshwater, sediment, or nutrient input. Thus, the only soil building has come from organic production within the wetlands; and preliminary evaluations suggest that productivity in the stressed Maurepas swamps may be substantially depressed compared to normal conditions. Subsidence in this area is classified as intermediate, at about 1.1 to 2.0 feet/century. With minimal soil building and moderately high subsidence, there has been a net lowering of ground surface elevation, leading to a doubling in flood frequency over the last four decades (Thomson, 2000), so that now the swamps are persistently flooded.

With minimal ability to drain and persistent flooding, the typical seasonal drying of the swamp does not usually occur. Cypress and tupelo trees are able to grow in flooded conditions. Apparently, tupelo trees are more competitive in permanently flooded conditions (Conner et al., 1981, Dicke and Tolliver, 1990), a condition that may explain the recent dominance of tupelo in the south Maurepas swamps. However, a high mortality of tupelo trees also has occurred in the last few years within the Maurepas study area.

Neither cypress nor tupelo seeds can germinate when flooded. Seeds of both species remain viable when submerged in water and can germinate readily when floodwaters recede (Kozlowski, 1984). The potential for re-establishment seems to be hindered by the relatively low numbers of viable seeds observed in swamp seed banks and by herbivory, as well as by flooding (Conner et al., 1986).

In addition, the existing trees are highly stressed, which appears to decrease productivity, increase mortality, and increase susceptibility to herbivory and other parasites. Saltwater intrusion has increased, at least in part due to a progressive combination of net subsidence and the lack of riverine freshwater inputs. Persistent saltwater intrusion events observed in 1999 and 2000 caused >97% mortality of tens of thousands of cypress seedlings planted as part of ongoing SLU research (Dr. Gary Shaffer) in the northwestern portion of Maurepas swamps. In a South Carolina swamp, Conner (1993) observed 66% mortality of trees after one year of exposure to 2 ppt salinity trapped in the swamp after Hurricane Hugo; another portion of the swamp exposed only to a pulse of salinity after the hurricane experienced 41% tree mortality. Salinity of 3 ppt can reduce growth of both cypress and tupelo saplings (Pezeshki, 1990); and when combined with flooding stress, growth reduction in cypress was substantial. In contrast, Myers et al. (1995) observed high survival of cypress in 3 ppt salinity if the trees were protected from grazing and overgrowth by vines. Clearly salinity can be a significant factor contributing to swamp deterioration, especially combined with other stressors (e.g., flooding, herbivory).

Herbivory appears to be a potentially important stressor in the south Maurepas swamps. Tupelo trees are susceptible to grazing by tent caterpillars and cypress by leaf rollers, which can result in almost total defoliation in the spring. Caterpillar grazing can reduce production of litter by about 13.5% (Conner and Day, 1976). Cypress and tupelo are both very susceptible to grazing by nutria, deer, and crawfish (Conner et al., 1986; Shaffer et al., 2000).

The potential benefits of a river diversion are evident in an area of swamp affected by sediments and nutrients delivered via the Amite River Diversion Canal. This includes the area immediately south of the Blind River between the confluence of the Blind and the diversion canal, and the mouth of the river where it discharges to the west end of the lake. The area is maintained in somewhat better condition than the remaining tract of south Maurepas swamps, and also presents an exception to the pattern observed of no regeneration. Several cohorts of cypress seedlings have colonized and established in this area, demonstrating on a small scale the positive impacts that are expected from a proposed diversion of Mississippi River water into the south Maurepas swamps.

A question significant to the evaluation of this area is what happens if and when the swamp dies? From observations made during field visits to this area that were part of the MRSNFR study (as well as field observations made in this study and discussed later in the report), it appears that many areas of interior swamp that have substantially opened and stressed or dying overstory vegetation also have bulltongue as understory vegetation. There are also some areas of stable fresh marsh within larger regions of swamp that can be identified as long-term features of the region. However, it is clear that not all or even most areas of dying swamp are converting to stable and healthy fresh marsh. Rather, it is expected that the vast majority of swamp in south Maurepas will convert to open water. In many areas of south Maurepas bulltongue marsh has already converted to fragile spikerush floatant. Factors contributing to this, as mentioned above, include the much greater tolerance of cypress and tupelo trees compared to herbaceous understory vegetation for deeper flooding of longer duration; and the increasingly unconsolidated nature of the substrate in these swamps that is almost certainly due to the demise of below-ground productivity.

It is expected that without restoration, the factors and processes that are contributing to stress and deterioration of the south Maurepas swamps will continue and result in loss of the swamp, with succession to open water. These remaining swamps are composed of about 80% tupelo trees and 20% cypress trees, and as of 1990, covered an area within the Amite/Blind Rivers mapping unit of about 138,900 acres of swamp and 3,440 acres of fresh marsh. The wetland loss rates for the Amite/Blind Rivers mapping unit for 1974-90 were estimated by USACE to be 0.83% per year for the swamps, and 0.02% per year for fresh marsh. Based on these rates, about 50% or 69,450 acres of swamp, and 1.2% or about 40 acres of fresh marsh will be lost in 60 years.

The south Maurepas swamps are a major coastal wetland -- one of the largest remaining tracts of coastal freshwater swamp in Louisiana. For a combination of reasons, including lack of certainty about how swamps might respond to restoration efforts classically applied to marshes, and lack of clear-cut opportunities to implement large-scale swamp restoration, very few swamp restoration projects have been considered (and none implemented) within CWPPRA. The proximity of the south Maurepas swamps to the river represents a unique opportunity for useful redistribution of river resources to initiate restoration of the south Maurepas swamps, as recommended in the Coast 2050 plan. Few, if any, other major tracts of coastal swamp offer a similar opportunity for large-scale restoration and associated evaluation of success.

Goal: The goal of the south Maurepas diversion concept is to restore and protect the health and productivity of the swamps south of Lake Maurepas, through re-introduction of Mississippi River water with its sediments and nutrients.

Objectives: As set forth in the PDP, the specific objectives of the Maurepas project concept are to:

1. retain (i.e., minimize loss of) existing areas of swamp vegetation;
2. retain and preferably increase overstory cover;
3. decrease the morbidity rate of tupelo trees;
4. increase the density of the dominant tree species;
5. increase the primary productivity of trees;
6. increase accretion of substrate in the swamp;
7. restore and maintain characteristics of natural swamp hydrology (e.g., flooding regime, drainage patterns, through-flow);
8. reduce salinity levels in the swamp;
9. increase sediment loading to the swamp;
10. increase nutrient loading to the swamp;
11. increase dissolved oxygen concentrations in swamp water;
12. maximize nutrient removal from river water diverted to the swamp;
13. ensure that diversion of river water does not result in increased nuisance algal blooms in Lake Maurepas; and

14. reduce nutrient loading from the Mississippi River to the Gulf of Mexico.

Project Features: The project would consist of:

- Diversion Structure - Box Culverts (for cost estimation purposes, assumed to be sized approximately 2,000 cfs)
  - Two 10x10 foot box culverts (number and size of culverts assumed based on comparison to Myrtle Grove 5,000 cfs diversion proposal; actual number and size of culverts would be defined in Phase 1).
  - Receiving pond: Rectangular bottom 100 ft X 100 ft, with 20" layer of riprap.
  - Modifications and features to accommodate intercepted local drainage (e.g., lateral canals).
  - Outflow channel: approximately 27,500 ft, from river to I-10, with levees to contain diverted flow created from excavation of channel cross-section. Channel dimensions: bottom width 50 ft, top width 110 ft, average depth 10 ft, 3:1 side slopes. Cross-section areas average depth of cut 17.5' on upland and 12.5' in swamp. Improvements to existing channels were assumed to require excavation of 60% of the channel cross-section. Total excavation estimated at 1,032,300 cy. Also include a structure of 4 (72") flap-gated culverts at the point where the new diversion joins Hope Canal just north of Airline Highway, to prevent backflow of diverted water up Hope Canal (toward the river). The channel under I-10 will be reinforced with riprap.

- Outfall Management
  - Gaps will be added in remnant railroad bed running along west side of Hope Canal from I-10 north (some gaps already exist).
  - Costs for two channel constrictions have been included to maximize sheet flow of diverted water through the swamps, and minimize the amount of water able to remain in the channel from the point of diversion to the lake. These are planned as riprap placements to decrease channel cross-section, though other management options exist, such as adjustable weirs with boat bays, and will be further considered in Phase 1.

- Relocations
  - Major relocation costs for Airline Highway, the Illinois Central and the Kansas City railroad. Assumed existing culverts would be replaced with bridge structures.
  - Relocations included for 17 other water mains, sewer lines, product and utility pipelines identified.

Monitoring Information: To our knowledge, no CWPPRA projects have attempted to restore cypress-tupelo swamp before, so there is no CWPPRA monitoring data to report. However, as a complex project, this project concept has been studied over the preceding year. The Maurepas Phase 0 study has been a reconnaissance-level effort to develop and compare project alternatives, and select the most appropriate project to be recommended for further evaluation. The main goals of the study have been to identify and evaluate the following.

- *Siting* alternatives for the candidate diversion, incorporating real estate, utility relocations, drainage, and flooding considerations.
- *Sizing* alternatives for the candidate diversion, including preliminary, site-specific estimates of how much water, sediments, and nutrients the swamp needs for significant enhancement of productivity and accretion, and how much water and nutrients it can assimilate, while avoiding flooding and drainage problems, and without causing algal blooms in the adjacent lake.
- *Benefits* of a diversion. This project concept is generally widely endorsed, because anticipated benefits of a diversion include enhanced productivity, enhanced accretion, reduced swamp loss, increased regeneration and associated self-maintenance, a relatively high nutrient assimilation capacity, and improved water quality (e.g., periodic freshening, improved dissolved oxygen concentrations). However, high natural variability and differences among wetland types that have previously been studied makes it imperative that decisions about such a large-scale project be based on site-specific information.

Activities within the scope of this study have included the following.

- Preliminary site reviews, including real estate estimates, which contributed to preliminary comparisons among possible diversion locations.
- Hydrologic modeling of existing conditions and basic diversion scenarios, which focused on assessing how much water could be put into the swamps and defining where it would go.
- Baseline ecological field studies, which are providing preliminary information to examine nutrient assimilation and swamp productivity, and help estimate expected benefits from a diversion.
- Surveying of elevations and cross-sections, using a Global Positioning System (GPS) network established throughout the study area, to support hydrologic modeling efforts as well as some aspects of the ecological studies.

The general methodologies applied in the ecological components of the Maurepas Phase 0 study are as follows.

- Sampling stations were set at locations in a gradient away from the existing influence of the Amite Diversion Canal; in locations in the swamps south of Lake Maurepas between the river and the lake; and at locations to serve as controls.
- Sampling for most of the ecological components of the study was on a bimonthly basis, to assure that seasonal and possibly some periodic variations (such as frontal passage, strong storms, floods) could be measured, and that temporally dynamic processes (e.g., productivity instead of just biomass; nutrient assimilation instead of just concentration) as well as seasonal patterns could be estimated.

- Measurements of nutrients were made in soil waters, overlying swamp water, canals and bayous, the river (using existing data), and the lake to assess spatial patterns potentially related to a diversion, support forecast of the No Action alternative, and predict effects of the diversion. Input and assimilation of nutrients from the Amite Diversion Canal were considered especially important in providing estimates of nutrient assimilation capacity. In addition, 80 of the 160 herbaceous plots were fertilized to demonstrate potential benefits of a diversion.
- Measurements of litterfall, stem growth, changes in tree band circumference, and clip plots were made periodically over time to estimate baseline overstory and understory productivity in the swamp. Stem growth measurements had to commence during the dormant season so that annual woody growth could be calculated.

The general methodologies applied in the hydrologic modeling component of the Maurepas Phase 0 study are as follows.

- A UNET model was developed to simulate existing conditions in the study area, and to simulate hydrologic effects on this area of a proposed river diversion.
- The study area included in the model was bounded on the north by Lake Maurepas, on the south Airline Highway, on the west by the Blind River, and on the east by Interstate 55.
- Channels, reaches, and storage areas to be included in the model were identified and digitized from quarter quads using digitizing software. Numerous field surveys, including GPS, were used to obtain elevations, channel cross-sections, bank heights, locations of breaks in banks, and openings in the swamps. Staff gages were installed in the lake and in channels throughout the study area to provide snap shot water level data. Estimates of tree densities and other obstructions to flow were also incorporated in the model.
- Initial directions of flow of almost all of the channels were assumed to be north or east, eventually toward Lake Maurepas; these initial flow directions were defined as positive in the model.
- Maurepas swamp was divided into small storage areas based on their proximity to the channel as well as elevation of the swamp. Swamp elevations were determined based on the USGS Digital Elevation Model (DEM) data and field observations. When LIDAR data becomes available, these will be incorporated in the model.

The Phase 0 study was modestly funded, and was not intended to answer all questions that are legitimately a part of project development and final design. For example, an operational model, which would be needed to support engineering and design, including more specific evaluations of flooding potential and project responses to these, was not part of this Phase 0 study. It was considered that such an effort belongs in the Phase 1 (design) portion of a project. Flooding issues, which are a particular concern, are addressed at the Phase 0 level by more basic design and operational considerations. However, results of the study that are related to evaluation of expected project benefits have been incorporated in the estimates of values for WVA variables.

In addition, there is a history of research on the cypress-tupelo swamps in the Barataria basin, including work by Dr. Will Conner, formerly of the LSU Coastal Ecology Institute (now at the Baruch Forest Science Institute of Clemson University) and by Dr. John W. Day, Jr. of the LSU Coastal Ecology Institute, who also is a member of the Maurepas study team. These research results also have been incorporated, as appropriate, in evaluation and projection of benefits for the proposed Maurepas diversion.

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V1 - Stand Structure

Phase 0 study results show that the amounts of overstory and midstory canopy cover as well as herbaceous cover are quite variable among locations within the broad expanse of south Maurepas swamps. There is a fair amount of variation in present values of this variable among stations within a station group, as well as for stations between station groups. But overall, this variable tends to separate major areas within the Maurepas swamp, reflecting broad levels of degradation of the swamp. Degree of degradation appears to represent a progression related to proximity to the lake and to the passes. This is consistent with the idea that swamp degradation is impacted by the broad controlling factors of subsidence and lack of freshwater, sediment, and nutrient input and flow through, as well as by the more specific but related factor of saltwater intrusion.

On the average, the “Lake” station group, represented by subarea 4B, is the most degraded, with the most open canopy, and most herbaceous cover. This area has the fewest number of trees, and the furthest progression of mortality of tupelo, due to a complex set of factors that are tied together by subsidence and saltwater intrusion. Present cover of overstory canopy about 10% in this subarea.

The “Average” station group, which is proximal to the Lake group and next closest to the lake, represents the next most degraded swamp area. Subareas 2B and 3B fall within this classification. The average number of trees remaining in these areas is not substantially different from the number of trees in the “Interior” areas. Present cover of overstory canopy about 40% in this subarea.

The “Interior” station group is categorized as moderately degraded, and includes subareas 2A and 3A. Present cover of overstory canopy about 35% in this subarea.

The Hope (subarea 1) (and Amite) areas are less degraded and have more canopy cover. The overstory canopy cover for all these subareas falls within the 33-50% range. Present cover of overstory in the Hope station group is about 40-45%. However, the density of trees, the health and productivity of the trees, and the expectation for future mortality of the trees (including susceptibility to saltwater intrusion) differ sufficiently to lead to differing expectations for future conditions in the absence of restoration.

The Average, Interior, and Hope areas are all expected to continue to degrade and have canopy open up in the future without a project. Because of the lower tree density, more degraded condition, and expectation for mortality especially of tupelo, the Average and Interior swamps are expected to drop below 33% canopy cover well within 20 years FWOP. While it is easily imaginable that the Hope subarea, could also drop below 33% overstory canopy in 20 years FWOP, it is predicted for this WVA that the Hope area will open up only to the lower end of the 33-50% canopy cover range.

Maurepas Diversion

V1	Stand Structure			
			Class	SI
Area 1	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	3	0.4
		FWP	6	1.0
Area 2A	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	1	0.4
		FWP	5	0.8
Area 2B	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	1	0.1
		FWP	5	0.8
Area 3A	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	1	0.1
		FWP	4	0.6
Area 3B	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	1	0.1
		FWP	4	0.6
Area 4A	year 0		3	0.4
	year 1		3	0.4
	year 20	FWOP	1	0.1
		FWP	3	0.4
Area 4B	year 0		1	0.1
	year 1		1	0.1
	year 20	FWOP	1	0.1
		FWP	1	0.1

V2 - Stand Maturity

Values for existing conditions. Evaluation of this variable requires estimates of average tree diameter (DBH) by species, and estimates of abundance of each species based on average basal area per acre, and projections of future size and area. For this project, results from the Phase 0 studies can be used to for to estimate these values.

DBH was measured at each station over time. Since 3 to 6 stations fall within each station group, station group DBH for each species were calculated as the mean of values from at least 3 stations. Mean change in diameter over the study year (by species) was calculated to estimate growth. It is recognized that to get a reliable idea of average growth for these different regions of the Maurepas swamps, multiple years of data would be needed. Nevertheless, one year of real data was considered better than no data on which to base future projections.

Basal area by species also was taken from study measurements (summed from calculated basal area of each tree per plot). Percent composition of cypress and tupelo (plus other canopy species) was calculated from counts of the number of trees of each species in each study plot.

Projection of future variable values, FWOP. For the FWOP, it was assumed that observed growth rates would continue unchanged over the next 20 years. This is a potentially conservative assumption, since subsidence is expected to continue unabated, and saltwater intrusion and related stresses (e.g., herbivory by caterpillars) are expected to increase in the FWOP. Mean DBH for each species for each subarea was estimated as the mean existing DBH plus the existing mean annual growth rate times 20 years.

Increase in basal area was estimated, again by species and subarea, as the increase in area expected from the measured growth rates. Note that there can be substantial variation in the sizes (and basal areas) of individual trees within any one area, and it was considered unnecessarily complicated to grow each individual tree by the measured growth rate, calculate the difference in basal area according to the beginning and ending diameters, and sum the incremental areas to estimate basal area in the future. Instead, average increase was estimated by calculating the average basal diameter of a single tree of the existing average diameter for each species and subarea. Total basal area was divided by this single tree basal area to calculate average number of trees. The "average tree" was then increased in diameter by the measured growth rate over 20 years, and a final single tree basal area calculated from the final average diameter. This single tree final basal area was multiplied by the average number of trees to get estimated basal area in the FWOP.

Percent composition of canopy trees in the FWOP was estimated based on best professional judgment of expected mortality of cypress and tupelo among the various subareas. For most of the swamp subareas (including 1, 2A&B, and 2A&B) the best estimate was that about 50% of the tupelo would die over the next 20 years FWOP, but that actual mortality of cypress would be minimal.

Projection of future variable values, FWP. In the FWP, the diversion is expected to substantially stimulate productivity, and so stimulate growth of the cypress and tupelo (as well as other species). The amount of stimulation is assumed to be related to level of effect from the diversion. Subarea 1 will get the highest impact from the diversion, receiving freshwater, nutrients, and sediments; so it is assumed this subarea will get see the greatest increase in growth. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold. Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing levels of productivity in Maurepas are ⅙ to ¼ of average values.

As a very conservative projection, a 2-fold increase in growth rate was applied to Area 1 to capture the anticipated stimulation of growth from the diversion. For Area 2 (A&B), a lesser increase of 1.7x was assumed. Similarly for Area 3 (A&B) a still lesser increase of 1.3x was assumed. No increase in growth was applied to Area 4. DBH and basal area in the FWP were estimated as for FWOP, but applying the increased growth rates.

Maurepas Diversion
Calculation of SI for V2 by project subarea

V2 Stand Maturity

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 1[1]	year 0		14.57	0.91	44%	12.38	1.00	56%	214	Dense	1.0	0.96
	year 1		14.57	0.91	44%	12.38	1.00	56%	214	Dense	1.0	0.96
	year 20	FWOP	15.97	1.00	72%	13.74	1.00	28%	198	Dense	1.0	1.00
		FWP	17.37	1.00	44%	15.11	1.00	56%	312	Dense	1.0	1.00

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 2A[2]	year 0		10.76	0.56	29%	9.88	0.79	71%	114	Moderate	0.6	0.43
	year 1		10.76	0.56	29%	9.88	0.79	71%	114	Moderate	0.6	0.43
	year 20	FWOP	12.96	0.80	64.5%	11.48	0.95	35.5%	104	Moderate	0.6	0.51
		FWP	14.50	0.90	29%	12.60	1.00	71%	191	Dense	1.0	0.97

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 2B[2]	year 0		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 1		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 20	FWOP	9.93	0.4	74.0%	11.21	0.92	26.0%	94	Moderate	0.6	0.34
		FWP	10.77	0.6	48%	11.37	0.94	52%	143	Mod. Dense	0.8	0.61

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 3A[3]	year 0		10.76	0.6	29%	9.88	0.79	71%	114	Moderate	0.6	0.43
	year 1		10.76	0.6	29%	9.88	0.79	71%	114	Moderate	0.6	0.43
	year 20	FWOP	12.96	0.8	64.5%	11.48	0.95	35.5%	104	Moderate	0.6	0.51
		FWP	13.62	0.8	29%	12.05	1.00	71%	173	Dense	1.0	0.96

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 3B[3]	year 0		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 1		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 20	FWOP	9.93	0.4	74.0%	10.81	0.88	26.0%	92	Moderate	0.6	0.33
		FWP	10.29	0.5	48%	11.05	0.91	52%	133	Mod. Dense	0.8	0.57

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 4A[4]	year 0		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 1		8.73	0.3	48%	10.01	0.80	52%	103	Moderate	0.6	0.33
	year 20	FWOP	9.93	0.4	74%	10.81	0.88	26%	92	Moderate	0.6	0.33
		FWP	9.93	0.4	61%	10.81	0.88	39%	109	Moderate	0.6	0.37

			Cypress Size	SI	% Comp.	Tupelo Size	SI	% Comp.	Basal Area	Basal Area Class	Basal Area Factor	Overall SI
Area 4B[5]	year 0		7.23	0.1	81%	9.44	0.74	19%	41	Mod. Open	0.4	0.10
	year 1		7.23	0.1	81%	9.44	0.74	19%	41	Mod. Open	0.4	0.10
	year 20	FWOP	8.63	0.3	100%	10.44	0.84	0%	45	Mod. Open	0.4	0.11
		FWP	8.63	0.3	86%	10.44	0.84	14%	53	Mod. Open	0.4	0.14

1 - Assumes 2X increases in growth (and production) in 20 years in th FWP over existing conditions;
assumes loss (mortality) of 50% of the tupelo in 20 years in the FWOP.

2 - Assumes 1.7X increases in growth (and production) in 20 years in th FWP over existing conditions;
assumes loss (mortality) of 50% of the tupelo in 20 years in the FWOP.

3 - Assumes 1.3X increases in growth (and production) in 20 years in th FWP over existing conditions;
assumes loss (mortality) of 50% of the tupelo in 20 years in the FWOP.

4 - Assumes no increases in growth (or production) in 20 years in the FWP over existing conditions (or FWOP);
assumes loss (mortality) of 50% of the tupelo in 20 years in the FWOP, and only 25% loss in 20 years in the FWP.

5 - Assumes no increases in growth (or production) in 20 years in the FWP over existing conditions (or FWOP);
assumes 100% loss (mortality) of the tupelo in 20 years in the FWOP, and only 25% loss in 20 years in the FWP.

V3 - Water Regime

This variable accounts for both the duration of swamp flooding, and the extent of flow-through in the swamp. With the exception of the subarea (4B) along the shore of the lake, all of the Maurepas swamps within the project area are at present semi-permanently flooded, and have low flow-through or exchange. Subarea 4B also is semi-permanently flooded, but due to its proximity to the lake, it is assumed this subarea has moderate water exchange.

The gradient of elevations within the Maurepas swamp already is very low. In the FWOP, subsidence will continue, and within 20 years, it is assumed that these swamps will become permanently flooded. Level of water exchanged was assumed to remain unchanged.

In the FWP, it was assumed that subarea 1 will see a substantial increase in substrate accretion, based on the fact that Subarea 1 will get the most direct benefits from the diversion, will receive sediments as well as nutrients and freshwater, and where both the direct fertilization by nutrients and sediments and the improved water quality and dissolved oxygen stimulation from greater flow-through will increase productivity. A comparison to the swamp in the immediate vicinity of the Amite Diversion Canal (Amite station group) shows that with only trivial "diversion" inputs compared to that expected from the proposed Maurepas diversion, Amite stations have significantly higher substrate bulk densities (see Table 3), and have periodic episodes of regeneration, indicating that swamp elevation and the associated duration of flooding must be improved compared to other regions of the Maurepas swamps. However, the Environmental Workgroup judged that the improvements would not be enough to become seasonally flooded (i.e., subarea 1 remains semi-permanently flooded in the FWP). Being in the immediate receiving area of the diversion, it also is assumed this area will experience a high level of flow-through in the FWP.

Subareas 2 (A&B) and 3 (A&B) also are expected to see improvements in accretion, substrate bulk density, and associated flooding duration, in proportion to the projected level of influence of the diversion. However, it is assumed that for these areas, the improvements will not move the areas out of the category of semi-permanently flooded. It is assumed that the diversion will increase flow-through to the moderate level.

There are no changes proposed to the overall hydrologic regime of Subarea 4 (A&B) in the FWP due to the diversion.

Maurepas Diversion
V3 - Water Regime

		FWOP			FWP		
		Flooding Duration	Flow Exchange	SI	Flooding Duration	Flow Exchange	SI
Area 1	year 0 & 1	semi-permanent	low	0.45	semi-permanent	high	0.75
	year 20	permanent	low	0.30	semi-permanent	high	0.75
Area 2A	year 0 & 1	semi-permanent	low	0.45	semi-permanent	high	0.75
	year 20	permanent	low	0.30	semi-permanent	high	0.75
Area 2B	year 0 & 1	semi-permanent	low	0.45	semi-permanent	moderate	0.65
	year 20	permanent	low	0.30	semi-permanent	moderate	0.65
Area 3A	year 0 & 1	semi-permanent	low	0.45	semi-permanent	moderate	0.65
	year 20	permanent	low	0.30	semi-permanent	moderate	0.65
Area 3B	year 0 & 1	semi-permanent	low	0.45	semi-permanent	moderate	0.65
	year 20	permanent	low	0.30	semi-permanent	moderate	0.65
Area 4A	year 0 & 1	semi-permanent	low	0.45	semi-permanent	low	0.45
	year 20	permanent	low	0.30	permanent	low	0.30
Area 4B	year 0 & 1	semi-permanent	moderate	0.65	semi-permanent	moderate	0.65
	year 20	permanent	moderate	0.45	permanent	moderate	0.45

V4 - Mean High Salinity During the Growing Season

Existing salinities for the Phase 0 study year (2000) are summarized by station group in Table 4. Since 2000 was a significant drought year, these salinities by themselves should not be taken as typical salinities. It is expected that the closer each station group area is to the lake and the passes, and so to the source of saltwater intrusion, the higher last year's salinities will be compared to "typical" values.

Figure 9 shows the mean monthly salinities at Pass Manchac for the period 1955-1981 compared to the period 1998-2000. Note that the data for 2000 only includes January through July, so that fall salinities for the 1998-2000 period may be underestimated. It appears that over the long term, annual average salinities at Manchac are about 1.25 ppt, with the seasonal high salinity during the growing season is about 0.5 (for long term data) to 0.8 (for recent period) ppt higher than annual average salinity. Thus, the overall average salinity for the Lake station group area may be closer to 1.2 ppt than the 4.41 mean calculated from Phase 0 study results. Based on this, the average high salinity for the Lake station group was estimated at 1.8 ppt.

It was judged that the average high salinity during the growing season for the Average station group, which is the next closest to the lake and the source of saltwater intrusion, would be a bit higher than the more interior areas, and was estimated at 1.5 ppt for current conditions.

For the areas of swamp in the Interior and Hope groups, it was assumed that measured salinities were only a little higher than typical. Annual average for these areas measured during Phase 0 studies ranged from 1.57 to 1.68. Based on this, it was estimated that typical high salinity during the growing season would be about 1.4 for these areas.

Table 4. Summary of data supporting evaluation of WVA variables.

		Station Groups				
		Amite	Interior	Average	Lake	Hope
Surface Salinity (ppt)		1.57	1.68	2.87	4.41	1.53
Bulk Density		0.23	0.08	0.11	0.09	0.12
Percent Composition	Cypress	16%	29%	48%	81%	44%
	Tupelo	84%	71%	52%	19%	56%
Basal Area (sq. ft./acre)		91.20	113.64	102.88	40.75	214.35
DBH (inches)	Cypress	15.06	10.76	8.73	7.23	14.57
	Tupelo	8.52	9.88	10.01	9.44	12.38
Growth (inches)	Cypress	0.11	0.11	0.06	0.07	0.07
	Tupelo	0.04	0.08	0.04	0.05	0.07

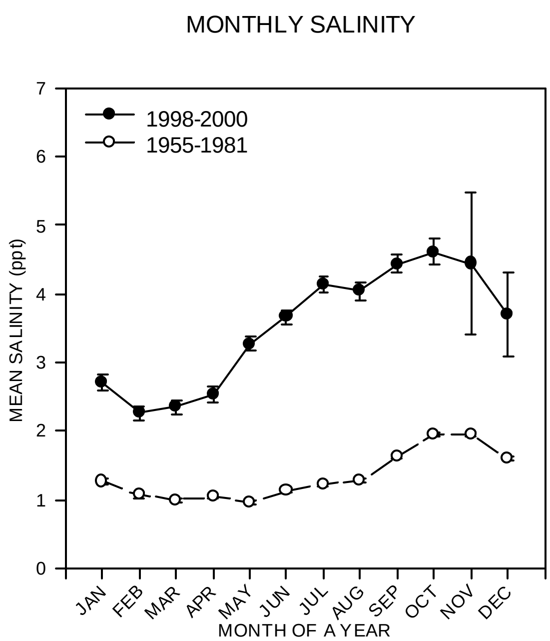

Figure 9.

Salinity trends are difficult to analyze, even from long term data. With continued subsidence, it is assumed that the ability for saltwater to intrude further (and/or more frequently) into the swamps will increase in the FWOP. This should result in more "spiky-ness" in the salinity record, but may not result in an increase in mean salinity. Therefore, it was assumed that in the FWOP, mean high salinity during the growing season would remain the same for all subareas.

To estimate salinities in the FWP, one needs to know when the diversion can be run. This project was planned and costs were estimated based on installation of box culverts, which would allow the diversion to be run year-round, limited only by operational constraints in response to shut-off for storm events. Examination of the rating curve developed for Davis Pond and apportioning estimated flows for specified head differences to the cross-sectional area that would be available in the Maurepas structure suggests that with only a 1-foot head (i.e. the difference in water level elevation between the river and the lake), the two 10' x 10' box culverts assumed for the Maurepas diversion could flow at least 1,100 cfs. Similarly, with only 0.5 feet of head, the diversion could flow about 780 cfs. Thus, it is anticipated that the proposed Maurepas diversion will be capable of running at or near full capacity all year long in most years.

It is also necessary to see whether running the diversion during some times of the year would too great an increase in water levels, thereby contributing to flooding concerns, and possibly limiting operation of the diversion. Figure 10 shows a frequency distribution curve for lake water levels measured at Pass Manchac over the last half century. It shows that the median water level was slightly greater than 1.5 ft, and that a 2.0-ft water level was the high average stage (approximately 75th percentile).

The UNET model was run with the lake water level at 2.0 feet, simulating high tidal conditions and/or strong east or southeastern, or even southern winds that would increase lake water levels (as well as at 1 ft, simulating a low average tidal condition). Results show that the receiving area can absorb 1,500 cfs of flow without unacceptable water level increases. For example, at fully developed flow (i.e., after the model is run for a one-month period and water level stages have reached equilibrium), water levels at the Airline Highway crossing are about 4.3 feet in the low-tide scenario (i.e., with lake water level at 1 foot), and 4.5 feet in the high-tide scenario (i.e., with the lake level at 2 feet) (Figure 11). Clearly, lake level does not have a substantial impact on backwater levels in the upper 5 miles of the Hope Canal system (the conveyance channel up to I-10).

Conversely, a 1,500 cfs diversion run continuously to equilibrium does not have a substantial effect on stages near the lake, another indication that such a diversion in not too large for the receiving system. After a 30-day model run under the high tide scenario (the lake at 2 feet), water level at the end of Hope Canal (about 6 miles from the lake, at the beginning of Bayou Tent) is about 2.25 feet, only about 0.25 feet above lake level (Figure 11); and no increase in water level over that of the lake is predicted for Dutch Bayou. The greatest increase in water level over that of the lake is predicted to be 0.3 to 0.5 feet for the reach from I-10 to the power line, about two-thirds of the way from I-10 to the end of Hope Canal. In addition, it has been estimated that the average elevations of camps in the swamps north of I-10 are about +4 feet (Dr. Gary Shaffer, personal communication in coordination with Glen Martin). Based on this, it is not expected that stage increases in the swamps from the diversion will substantially limit diversion operations. More detailed operational planning is, however, a requisite part of Phase 1 Engineering and Design.

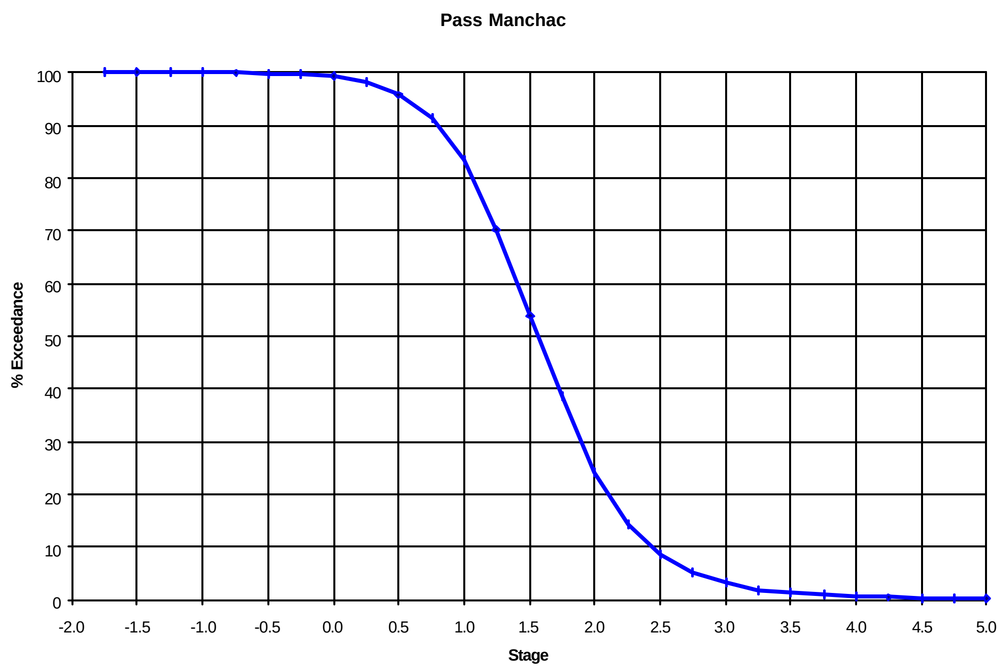

Figure 10.

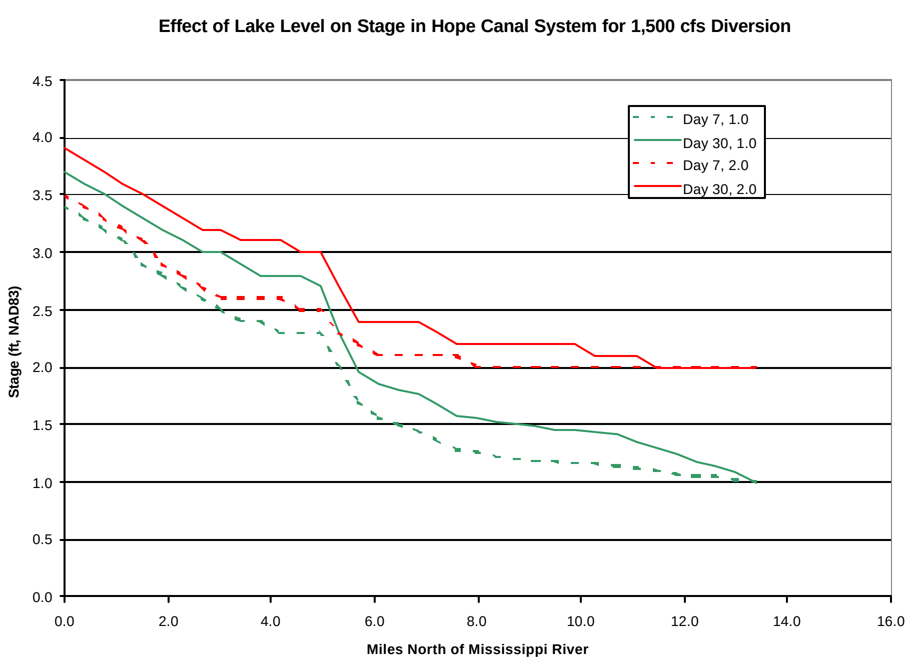

Figure 11

For the FWP, it was assumed that the diversion would freshen Subarea 1 the most, and Subarea 4B the least. For Subarea 1, it was estimated that the substantial flow of river water year-round, but especially in the fall, would reduce salinities from 1.4 ppt to 0 ppt. Since the volumes of diverted water are spreading over ever greater areas as it moves from primary to secondary and tertiary receiving areas, it was assumed that mean high salinity would be reduced from 1.4 to 0 ppt for 2A, and from 1.5 to 0.5 ppt for 2B. Similarly, it was assumed that for subarea 3, diverted water would decrease mean high salinity from 1.4 to 0.25 ppt for 3A, and from 1.5 to 0.75 ppt for 3B.

It was assumed that Subarea 4A would receive minimal freshwater, though it will also see less saltwater intrusion from the lake due to the general freshening effect of the diversion on the system. It was estimated that in the FWP, mean high salinity in this subarea would go only from 1.5 to 1.0 ppt. For Subarea 4B, the salinity benefit is expected from the freshening of the southern part of the lake and ability to hold out saltwater due to the relatively large volumes of freshwater being added. In this case, it was assumed that the subarea initially would be freshened from 1.8 to 1.4 ppt.

Maurepas Diversion
V4 - Mean high salinity during growing season

		FWOP		FWP	
		Salinity (ppt)	SI	Salinity (ppt	SI
Area 1	year 0	1.4	0.82	1.4	0.82
	year 1	1.4	0.82	0	1.00
	year 20	1.4	0.82	0	1.00
Area 2A	year 0	1.4	0.82	1.4	0.82
	year 1	1.4	0.82	0	1.00
	year 20	1.4	0.82	0	1.00
Area 2B	year 0	1.5	0.78	1.5	0.78
	year 1	1.5	0.78	0.5	1.23
	year 20	1.5	0.78	0.5	1.23
Area 3A	year 0	1.4	0.82	1.4	0.82
	year 1	1.4	0.82	0.25	1.00
	year 20	1.4	0.82	0.25	1.00
Area 3B	year 0	1.5	0.78	1.5	0.78
	year 1	1.5	0.78	0.75	1.00
	year 20	1.5	0.78	0.75	1.00
Area 4A	year 0	1.5	0.78	1.5	0.78
	year 1	1.5	0.78	1.0	1.00
	year 20	1.5	0.78	1.0	1.00
Area 4B	year 0	1.8	0.64	1.8	0.64
	year 1	1.8	0.64	1.4	0.82
	year 20	1.8	0.64	1.4	0.82

Maurepas Diversion
Total WVA Benefits

Area	AANUs
1	1,504.08
2A	2,541.17
2B	1,064/52
3A	1,369.08
3B	1,886.36
4A	72.66
4B	47.63
Total	8,485.49

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 1 Project Area......... 6,032 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40			
V2	Stand Maturity	Cypress % 44 Cypress dbh 14.57 Tupelo et al. % 56 Tupelo et al dbh 12.38	0.96	Cypress % 44 Cypress dbh 14.57 Tupelo et al. % 56 Tupelo et al dbh 12.38	0.96	Cypress % 72 Cypress dbh 15.97 Tupelo et al. % 28 Tupelo et al dbh 13.74	1.00	0.90519	0.9052	0.999
								1	1	1
		Basal Area 214	0.96	Basal Area 214	0.96	Basal Area 198	1.00			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30			
V4	Mean High Salinity	1.4	0.82	1.4	0.82	1.4	0.82			
		HSI =	0.57	HSI =	0.57	HSI =	0.51			

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 1 — Project Area......... 6,032 acres

Condition: Future With Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY Class/Value	TY SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 6	1.00			
V2	Stand Maturity	Cypress % 44 Cypress dbh 14.57 Tupelo et al. % 56		Cypress % 44 Cypress dbh 14.57 Tupelo et al. % 56		Cypress % 44 Cypress dbh 17.37 Tupelo et al. % 56		0.90519	0.9052	1
		Tupelo et al dbh 12.38	0.96	Tupelo et al dbh 12.38	0.96	Tupelo et al dbh 15.11	1.00	1	1	1
		Basal Area 214	0.96	Basal Area 214	0.96	Basal Area 312	1.00			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange High Flooding Duration Semi-Permanent	0.75	Flow/Exchange High Flooding Duration Semi-Permanent	0.75			
V4	Mean High Salinity	1.4	0.82	0.0	1	0.0	1			
		HSI =	0.57	HSI =	0.69	HSI =	0.92			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 1

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	6032	0.57	3463.29	
1	6032	0.57	3463.29	3463.29
20	6032	0.51	3098.91	62340.88
			Total CHUs =	65804.16
			AAHUs =	3290.21

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	6032	0.57	3463.29	
1	6032	0.69	4158.83	3811.06
20	6032	0.92	5533.24	92074.69
			Total CHUs =	95885.75
			AAHUs =	4794.29

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	4794.29
B. Future Without Project AAHUs =	3290.21
Net Change (FWP - FWOP) =	**1504.08**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 2A   Project Area......... 8,048 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10			
V2	Stand Maturity	Cypress % 29 Cypress dbh 10.76		Cypress % 29 Cypress dbh 10.76		Cypress % 64.5 Cypress dbh 12.96		0.564	0.564	0.796
		Tupelo et al. % 71 Tupelo et al dbh 9.88	0.72	Tupelo et al. % 71 Tupelo et al dbh 9.88	0.72	Tupelo et al. % 35.5 Tupelo et al dbh 11.48	0.85	0.788	0.788	0.948
		Basal Area 114	0.43	Basal Area 114	0.43	Basal Area 104	0.51			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30			
V4	Mean High Salinity	1.4	0.82	1.4	0.82	1.4	0.82			
		HSI =	0.47	HSI =	0.47	HSI =	0.29			

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 2A Project Area......... 8,048 acres

Condition: Future With Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY Class/Value	TY SI			
V1	Stand Structure	% Cover		% Cover		% Cover				
		Overstory		Overstory		Overstory				
		Scrub-shrub		Scrub-shrub		Scrub-shrub				
		Herbaceous		Herbaceous		Herbaceous				
		Class 3	0.40	Class 3	0.40	Class 5	0.80			
V2	Stand Maturity	Cypress % 29		Cypress % 29		Cypress % 29				
		Cypress dbh 10.76		Cypress dbh 10.76		Cypress dbh 14.5		0.564	0.564	0.9005
		Tupelo et al. % 71		Tupelo et al. % 71		Tupelo et al. % 71				
		Tupelo et al dbh 9.88	0.72	Tupelo et al dbh 9.88	0.72	Tupelo et al dbh 12.6	0.97	0.788	0.788	1
		Basal Area 114	0.43	Basal Area 114	0.43	Basal Area 191	0.97			
V3	Water Regime	Flow/Exchange Low		Flow/Exchange High		Flow/Exchange High				
		Flooding Duration Semi-Permanent	0.45	Flooding Duration Semi-Permanent	0.75	Flooding Duration Semi-Permanent	0.75			
V4	Mean High Salinity	1.4	0.82	0.0	1	0.0	1			
		HSI =	**0.47**	**HSI =**	**0.57**	**HSI =**	**0.85**			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 2A

Future Without Project			**Total**	**Cummulative**
TY	**Acres**	**x HSI**	**HUs**	**HUs**
0	8048	0.47	3790.27	
1	8048	0.47	3790.27	3790.27
20	8048	0.29	2305.60	57910.76
			Total CHUs =	**61701.03**
			AAHUs =	**3085.05**

Future With Project			**Total**	**Cummulative**
TY	**Acres**	**x HSI**	**HUs**	**HUs**
0	8048	0.47	3790.27	
1	8048	0.57	4551.48	4170.88
20	8048	0.85	6854.16	108353.61
			Total CHUs =	**112524.48**
			AAHUs =	**5626.22**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	5626.22
B. Future Without Project AAHUs =	3085.05
Net Change (FWP - FWOP) =	**2541.17**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 2B   Project Area......... 4,181 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI	
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10	
V2	Stand Maturity	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 74 Cypress dbh 9.93 Tupelo et al. % 26 Tupelo et al dbh 11.21	0.53	0.273 0.273 0.393 0.801 0.801 0.921
		Basal Area 103	0.33	Basal Area 103	0.33	Basal Area 94	0.32	
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30	
V4	Mean High Salinity	1.5	0.775	1.5	0.775	1.5	0.775	
		HSI =	0.44	HSI =	0.44	HSI =	0.25	

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 2B Project Area......... 4,181 acres

Condition: Future With Project

		TY 0		TY 1		TY				
Variable		Class/Value	SI	Class/Value	SI	Class/Value	SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 5	0.80			
V2	Stand Maturity	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 48 Cypress dbh 10.77 Tupelo et al. % 52 Tupelo et al dbh 11.37	0.72	0.273 0.801	0.273 0.801	0.477 0.937
		Basal Area 103	0.33	Basal Area 103	0.33	Basal Area 143	0.57			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65			
V4	Mean High Salinity	1.5	0.775	0.5	1	0.5	1			
		HSI =	0.44	HSI =	0.51	HSI =	0.72			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 2B

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	4181	0.44	1821.39	
1	4181	0.44	1821.39	1821.39
20	4181	0.25	1055.54	27330.86
			Total CHUs =	29152.25
			AAHUs =	1457.61

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	4181	0.44	1821.39	
1	4181	0.51	2113.09	1967.24
20	4181	0.72	2989.59	48475.50
			Total CHUs =	50442.74
			AAHUs =	2522.14

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	2522.14
B. Future Without Project AAHUs =	1457.61
Net Change (FWP - FWOP) =	1064.52

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Swamp

Project... Maurepas Diversion, Subarea 3A Project Area......... 5,406 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10
V2	Stand Maturity	Cypress % 29 Cypress dbh 10.76 Tupelo et al. % 71 Tupelo et al dbh 9.88	0.72	Cypress % 29 Cypress dbh 10.76 Tupelo et al. % 71 Tupelo et al dbh 9.88	0.72	Cypress % 64.5 Cypress dbh 12.96 Tupelo et al. % 35.5 Tupelo et al dbh 11.48	0.85
		Basal Area 114	0.43	Basal Area 114	0.43	Basal Area 104	0.51
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30
V4	Mean High Salinity	1.4	0.82	1.4	0.82	1.4	0.82
		HSI =	0.47	HSI =	0.47	HSI =	0.29

0.564 0.564 0.796

0.788 0.788 0.948

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Swamp

Project... Maurepas Diversion, Subarea 3A   Project Area......... 5,406 acres

Condition: Future With Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY Class/Value	TY SI			
V1	Stand Structure	% Cover		% Cover		% Cover				
		Overstory		Overstory		Overstory				
		Scrub-shrub		Scrub-shrub		Scrub-shrub				
		Herbaceous		Herbaceous		Herbaceous				
		Class		Class		Class				
		3	0.40	3	0.40	4	0.60			
V2	Stand Maturity	Cypress %		Cypress %		Cypress %				
		29		29		29				
		Cypress dbh		Cypress dbh		Cypress dbh				
		10.76		10.76		13.62		0.564	0.564	0.8415
		Tupelo et al. %		Tupelo et al. %		Tupelo et al. %				
		71		71		71				
		Tupelo et al dbh		Tupelo et al dbh		Tupelo et al dbh				
		9.88	0.72	9.88	0.72	12.05	0.95	0.788	0.788	1
		Basal Area		Basal Area		Basal Area				
		114	0.43	114	0.43	183	0.95			
V3	Water Regime	Flow/Exchange		Flow/Exchange		Flow/Exchange				
		Low		Moderate		Moderate				
		Flooding Duration		Flooding Duration		Flooding Duration				
		Semi-Permanent	0.45	Semi-Permanent	0.65	Semi-Permanent	0.65			
V4	Mean High Salinity	1.4	0.82	0.25	1	0.25	1			
		HSI =	0.47	HSI =	0.54	HSI =	0.75			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 3A

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	5406	0.47	2546.00	
1	5406	0.47	2546.00	2546.00
20	5406	0.29	1548.72	38899.80
			Total CHUs =	41445.80
			AAHUs =	2072.29

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	5406	0.47	2546.00	
1	5406	0.54	2928.85	2737.42
20	5406	0.75	4027.98	66089.89
			Total CHUs =	68827.31
			AAHUs =	3441.37

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	3441.37
B. Future Without Project AAHUs =	2072.29
Net Change (FWP - FWOP) =	**1369.08**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Swamp

Project... Maurepas Diversion, Subarea 3B — Project Area......... 8,470 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10
V2	Stand Maturity	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0:55	Cypress % 74 Cypress dbh 9.93 Tupelo et al. % 26 Tupelo et al dbh 10.81	0.52
		Basal Area 103	0.33	Basal Area 103	0.33	Basal Area 92	0.31
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30
V4	Mean High Salinity	1.5	0.775	1.5	0.775	1.5	0.775
		HSI =	0.44	HSI =	0.44	HSI =	0.25

0.273 0.273 0.393

0.801 0.801 0.881

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 3B Project Area......... 8,470 acres

Condition: Future With Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY Class/Value	TY SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 4	0.60			
V2	Stand Maturity	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52		Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52		Cypress % 48 Cypress dbh 10.29 Tupelo et al. % 52		0.273	0.273	0.429
		Tupelo et al dbh 10.01	0.55	Tupelo et al dbh 10.01	0.55	Tupelo et al dbh 11.05	0.68	0.801	0.801	0.905
		Basal Area 103	0.33	Basal Area 103	0.33	Basal Area 133	0.54			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65			
V4	Mean High Salinity	1.5	0.775	0.75	1	0.75	1			
		HSI =	**0.44**	**HSI =**	**0.51**	**HSI =**	**0.65**			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 3B

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	8470	0.44	3689.83	
1	8470	0.44	3689.83	3689.83
20	8470	0.25	2127.79	55267.37
			Total CHUs =	58957.20
			AAHUs =	2947.86

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	8470	0.44	3689.83	
1	8470	0.51	4280.76	3985.30
20	8470	0.65	5477.03	92699.07
			Total CHUs =	96684.37
			AAHUs =	4834.22

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	4834.22
B. Future Without Project AAHUs =	2947.86
Net Change (FWP - FWOP) =	1886.36

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 4A   Project Area......... 880 acres

Condition: Future Without Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 20 Class/Value	TY 20 SI			
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 3	0.40	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10			
V2	Stand Maturity	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 48 Cypress dbh 8.73 Tupelo et al. % 52 Tupelo et al dbh 10.01	0.55	Cypress % 74 Cypress dbh 9.93 Tupelo et al. % 26 Tupelo et al dbh 10.81	0.52	0.273 0.801	0.273 0.801	0.393 0.881
		Basal Area 103	0.33	Basal Area 103	0.33	Basal Area 92	0.31			
V3	Water Regime	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Semi-Permanent	0.45	Flow/Exchange Low Flooding Duration Permanent	0.30			
V4	Mean High Salinity	1.5	0.775	1.5	0.775	1.5	0.775			
		HSI =	0.44	HSI =	0.44	HSI =	0.25			

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 4A — Project Area......... 880 acres

Condition: Future With Project

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY Class/Value	TY SI			
V1	Stand Structure	% Cover		% Cover		% Cover				
		Overstory		Overstory		Overstory				
		Scrub-shrub		Scrub-shrub		Scrub-shrub				
		Herbaceous		Herbaceous		Herbaceous				
		Class		Class		Class				
		3	0.40	3	0.40	3	0.40			
V2	Stand Maturity	Cypress %		Cypress %		Cypress %				
		48		48		61				
		Cypress dbh		Cypress dbh		Cypress dbh				
		8.73		8.73		9.93		0.273	0.273	0.393
		Tupelo et al. %		Tupelo et al. %		Tupelo et al. %				
		52		52		39				
		Tupelo et al dbh		Tupelo et al dbh		Tupelo et al dbh				
		10.01	0.55	10.01	0.55	10.81	0.58	0.801	0.801	0.881
		Basal Area		Basal Area		Basal Area				
		103	0.33	103	0.33	109	0.35			
V3	Water Regime	Flow/Exchange		Flow/Exchange		Flow/Exchange				
		Low		Low		Low				
		Flooding Duration		Flooding Duration		Flooding Duration				
		Semi-Permanent	0.45	Semi-Permanent	0.45	Permanent	0.30			
V4	Mean High Salinity	1.5	0.775	1.0	1	1.0	1			
		HSI =	0.44	HSI =	0.45	HSI =	0.41			

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 4A

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	880	0.44	383.36	
1	880	0.44	383.36	383.36
20	880	0.25	221.07	5742.06
			Total CHUs =	6125.42
			AAHUs =	306.27

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	880	0.44	383.36	
1	880	0.45	398.30	390.83
20	880	0.41	358.30	7187.74
			Total CHUs =	7578.57
			AAHUs =	378.93

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	378.93
B. Future Without Project AAHUs =	306.27
Net Change (FWP - FWOP) =	72.66

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 4B   Project Area........ 3,104 acres

Condition: Future Without Project

		TY 0		TY 1		TY 20				
Variable		Class/Value	SI	Class/Value	SI	Class/Value	SI			
V1	Stand Structure	% Cover		% Cover		% Cover				
		Overstory		Overstory		Overstory				
		Scrub-shrub		Scrub-shrub		Scrub-shrub				
		Herbaceous		Herbaceous		Herbaceous				
		Class 1	0.10	Class 1	0.10	Class 1	0.10			
V2	Stand Maturity	Cypress % 81		Cypress % 81		Cypress % 100				
		Cypress dbh 7.23		Cypress dbh 7.23		Cypress dbh 8.63		0.123	0.123	0.263
		Tupelo et al. % 19		Tupelo et al. % 19		Tupelo et al. % 0				
		Tupelo et al dbh 9.44	0.24	Tupelo et al dbh 9.44	0.24	Tupelo et al dbh 10.44	0.26	0.744	0.744	0.844
		Basal Area 41	0.10	Basal Area 41	0.10	Basal Area 45	0.11			
V3	Water Regime	Flow/Exchange Moderate		Flow/Exchange Moderate		Flow/Exchange Moderate				
		Flooding Duration Semi-Permanent	0.65	Flooding Duration Semi-Permanent	0.65	Flooding Duration Permanent	0.45			
V4	Mean High Salinity	1.8	0.64	1.8	0.64	1.8	0.64			
		HSI =	0.23	HSI =	0.23	HSI =	0.21			

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Swamp

Project... Maurepas Diversion, Subarea 4B   Project Area......... 3,104 acres

Condition: Future With Project

Variable		TY 0		TY 1		TY	
		Class/Value	SI	Class/Value	SI	Class/Value	SI
V1	Stand Structure	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10	% Cover Overstory Scrub-shrub Herbaceous Class 1	0.10
V2	Stand Maturity	Cypress % 81 Cypress dbh 7.23 Tupelo et al. % 19 Tupelo et al dbh 9.44	0.24	Cypress % 81 Cypress dbh 7.23 Tupelo et al. % 19 Tupelo et al dbh 9.44	0.24	Cypress % 86 Cypress dbh 8.63 Tupelo et al. % 14 Tupelo et al dbh 10.44	0.34
		Basal Area 41	0.10	Basal Area 41	0.10	Basal Area 53	0.14
V3	Water Regime	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65	Flow/Exchange Moderate Flooding Duration Semi-Permanent	0.65	Flow/Exchange Moderate Flooding Duration Permanent	0.45
V4	Mean High Salinity	1.8	0.64	1.4	0.82	1.4	0.82
		HSI =	0.23	HSI =	0.24	HSI =	0.23

0.123 0.123 0.263

0.744 0.744 0.844

AAHU CALCULATION

Project: Maurepas Diversion, Subarea 4B

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	3104	0.23	712.42	
1	3104	0.23	712.42	712.42
20	3104	0.21	652.10	12962.99
			Total CHUs =	13675.41
			AAHUs =	683.77

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	3104	0.23	712.42	
1	3104	0.24	739.41	725.91
20	3104	0.23	723.97	13902.05
			Total CHUs =	14627.96
			AAHUs =	731.40

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	731.40
B. Future Without Project AAHUs =	683.77
Net Change (FWP - FWOP) =	**47.63**