THE EFFECTS OF END-ON CONSTRUCTION ON A COASTAL WETLAND

FINAL REPORT

By

EDWARD BODKER
CHIEF ENVIRONMENTAL SPECIALIST

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ABSTRACT

This study was intended to provide a data base of environmental considerations relating to the use of end-on con for building elevated highways in coastal wetlands. Efforts to quantify general environmental changes occurri study area using aerial photography proceeded according to the preconstruction data collection plan. Preliminary revealed salinity to be the most influential environmental factor in the vicinity of the LaBranche Wetland. I monitoring procedures were determined necessary to statistically quantify environmental changes resulting from influence. During an extended period of construction delays activities unrelated to highway construction have a entire ecosystem of the research study area. Until the end-on section of the I-310 roadway is completed, environmental impacts can be evaluated.

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INTRODUCTION

The LaBranche Wetland, located in St. Charles Parish between Lake Pontchartrain and U.S. 61, is an importan subject to environmental changes caused by both natural and human influences (see Study Area Map - Appen

The placement of the I-310 corridor (Alternate 6b) was chosen in an effort to avoid the open marsh located Duncan Canal and the Bonnet Carre Spillway. The alignment traverses a changing cypress/tupelo swamp just e LaBranche marsh. The end-on construction technique was selected because of the environmental concern for p this wetland.

As stated in the Final EIS (Environmental Impact Statement):

"The end-on construction technique to be used between U.S. 61 and I-10 is the least disturbing to hy systems since it does not produce major alterations of the ground surface. The roadway-support p little obstruction to existing water flow. The method avoids filling and modification of existing chan Although widely viewed as the most environmentally "safe" type of highway construction, there is little or no to quantify this assumption.

This research study attempted to systematically quantify the environmental effects of end-on construction in the L Wetland. Initial investigations have revealed the LaBranche swamps and marshes to be typical coastal w many respects. Like other wetlands bordering Lake Pontchartrain, the LaBranche Wetland is subject to predictab influences affecting hydrology, land composition and vegetation patterns. In other respects, however, the rese is subject to influences due to specific, man-made features and activities.

Hydrological changes result from the combined effects of precipitation and lake water fluctuations. Drainage into Pontchartrain Basin has accelerated with activities associated with urbanization. The increase in drainage c paved surfaces facilitates the rapid flow of surface runoff into the rivers and canals which feed Lake Pontchar freshwater.

Opening the Bonnet Carre Spillway has extreme and often long-term impacts on Lake Pontchartrain and its su wetlands. During infrequent periods when the Bonnet Carre Spillway is opened for flood control, large volume from the Mississippi River are discharged into Lake Pontchartrain. The latest opening of the Bonnet Carre occurred between May 20, 1983 and June 23, 1983 (U.S. Army Corps of Engineers). This opening was comp the 1979 discharge during which the spillway was open for 38 days and allowed a volume of 1.6 x 10^{10} m^3 of ri to flow into Lake Pontchartrain. The total volume of water passing through the spillway represented a volum greater than the capacity of Lake Pontchartrain.(2)

The study area represents a mixing zone between saltwater from Lake Pontchartrain and freshwater from the adjacent to U.S. 61. Prior to the opening of the spillway, saltwater influence extended approximately 0.7 n southerly direction from where the I-310 right-of-way meets the ICG (Illinois Central Gulf) Railroad. Bey distance, the water was essentially fresh with salinity levels approaching zero.

After the opening of the spillway salinity concentrations were significantly lowered in Lake Pontchartrain. The r of lake salinity in turn lowered concentrations of salinity in the project area. This lowering of salinity represent in which the extent of freshwater dominance expanded in a northerly direction toward Lake Pontchartrain. Furt salinity levels remained low for some time after the spillway closing, supporting Gagliano's observation that th level at any particular location is affected by its past salinity history.(3) Salinity levels eventually returned to spillway opening levels. The retention of freshwater and subsequent re-diffusion of salt water into the stud referred to as a "lag effect." The time interval between salinity fluctuations in the study area due in lake salinity i as the "lag time." Such lag times can be determined by studying the diffusion of salt water in and out of the st Lag times are essential in this study for analyzing such a specific impact as the construction of I-310. A change in would indicate a change in the rate of diffusion of saltwater in and out of the study area. In order to establish all significant sub-variables (weather, tide, human activity, etc.) must be considered. The linkage between this construction and the rate and extent of saltwater influence is, therefore, possible as a portion of the larger equa

PURPOSE AND SCOPE

The objective of this research project was to provide a data base for analyzing construction techniques in cons of cost and environmental benefits.

The scope of this research was to identify and quantify both general and specific environmental influences w associated with end-on construction. In a broad perspective, this research addressed the general environmental and influences which impacted the overall wetland in the vicinity of the project area. The more narrowly defin of this study focused on the specific environmental factors which could be isolated within the boundaries of the st Even more specifically, the scope of this research was revised to include a study of salinity fluctuations as the environmental effects brought about by the construction of I-310.

METHODOLOGY

The research plan was structured in three distinct phases: preconstruction, construction and post-construction. of the preconstruction phases represented the effort to accumulate and interpret data before construction activiti This preconstruction phase consisted of an initial water quality survey, an accumulation of historical data, an sampling, testing and monitoring program, and photographic studies.

All water quality testing was done according to Standard Methods for the Examination of Water and Wastewater (edition). Water quality monitoring was performed with Yellow Spring Instruments, Models 33 and 51B photography consisted of historical black-and-white photographs and recent false-color infrared photography.

DISCUSSION OF RESULTS

WORK COMPLETED

Field work began in July 1981. On-site reconnaissance was necessary to locate the alignment and to gain a f familiarity of the area. Early trips into the study area provided the opportunity to identify land features, drainage vegetation communities and animal populations. Four site-specific plots adjacent to the alignment and seven a monitoring stations were established in the spring of 1982. Beginning in April of 1982, readings for salinity conc dissolved oxygen and temperature were routinely taken. As of March 6, 1985, a total of 48 field trips were accumulate data for the preconstruction phase of this research. Water samples were periodically taken and teste nitrate, total phosphate, and sulfate.

An initial survey was made in 1982 in order to identify any unusual or sensitive areas which might warra consideration. This initial effort constituted the sampling and testing of a wide range of water quality paramete metals, pH, nitrate, hardness, alkalinity, chloride, sulfate, total phosphate, salinity, conductivity, temperature, and oxygen), ground level observations and a study of aerial photography. As a result of this survey, salinity was i as the parameter warranting primary consideration.

Under natural conditions, wetland soil surfaces (0-2 ft Above Mean Sea Level) are built up through the growth a of annual vegetation.(2) This loosely compacted soil is held together by the root systems of living wetlands ve Depending on plant populations, surface areas change according to the conditions governing the health and rang wetland vegetation. There is a myriad of complex environmental factors affecting the vegetation, and consequ soil characteristics which in turn influence and shape land features.

Salinity is the greatest factor contributing to the loss and degradation of this wetland. Salinity entering this e from Lake Pontchartrain waters has stressed some plant species and has killed others. Established freshwa communities undergoing stress from saltwater intrusion are subject to breakup and are replaced with open wat

Infrared aerial photography was used over the project area beginning in November of 1981 and was used each sp fall until 1985. The use of these photographs comprises a significant portion of this research by providing documentation of contemporary habit change.

A study of historical aerial photographs revealed that between 1955 and 1978, dramatic changes took place in wh acres of wetland were lost to open water. In 1955 habitat composition consisted of 10,682 acres (94%) of we 664 acres (6%) of open water. Approximately 25% (165) acres of the 664 acres of open water was man-made wat (see Appendix D).

SALINITY ANALYSIS

Gagliano, Stone et. al. have determined that salinity plays a dominant role in shaping the characteristics of surrounding Lake Pontchartrain. Fluctuations in the freshwater-saltwater balance become an important ind possible shifts taking place in the development of the LaBranche Wetland. Such shifts, or the lack of them, could be reflected as an effort of I-310 construction on saltwater distribution.

The study area is currently classified as freshwater since salinity concentrations were generally less than 5 ppt (thousand). Because of the close proximity of the open waters of Lake Pontchartrain, which is classified as br to 15 ppt), there is the possibility that the construction of I-310, by providing a channel for the rapid mixing of the and freshwaters, could facilitate saltwater encroachment.

It should be noted that most freshwater-saltwater mixing takes place in estuaries where higher concentrations o (ocean salinity = 34 ppt) come in contact with discharged freshwater. Such mixing zones usually demonstrat pronounced contrast between freshwater and saltwater than was found in the study area.

In order to determine the effect of I-310 on the salinity levels occurring in the study area, a myriad of driving forc affect salinity levels must be considered. Gagliano et. al. have suggested that such factors as wind direction freshwater run-off, temperature, groundwater seepage, tide, Gulf of Mexico salinity and seasonal flooding all to determine the salinity concentrations in Louisiana's coastal wetlands. Additionally, they determined that th change of salinity and the actual measured salinity was controlled by the previous salinity history of an area and with which water could diffuse across the wetland, i.e., sheet flow.

Given the complex dynamics affecting salinity, a statistical sampling scheme is essential in order to mea determine any significant shift in the salinity balance. Since salinity is affected by factors which fluctuate on var

scales (hours to decades - Gagliano, et. al.), the monitoring technique and sampling frequency are of primary im
Based on preliminary analysis of salinity levels in the study area and attempts to correlate these levels with activ
weather patterns occurring within the Pontchartrain Basin, it was determined that it is paramount to upgrade th
monitoring program.

Instrumentation capable of recording continuous levels of salinity is required so correlation with the co
environmental and climatological data available from outside sources can be made. Such instrumentation wou
for the simultaneous measurement of salinity at two or more sites for extended periods of time. Data obtained
would be sufficient for developing salinity correlations and statistical models of the salinity movement which
adequate to reflect possible changes caused by the construction and use of I-310.

Salinity monitoring to date has been accomplished with the use of a Y.S.I. Model 33 salinity-conductivity-ten
meter. This hand-held instrument is limited to instantaneous monitoring and as such is not capable of rec
monitoring data over the period of time necessary to determine time or spatial rate of change of salinity concen
Spatial and temporal control are essential if any change in the study area is to be related to the impact. If these
are absent, it is possible that a significant change may have occurred anyway and be unrelated to the impact.

Although time intervals between salinity recordings to date were greater than desired, the following gr
correlations were made (refer to Appendix C for a review of these findings).

1. Fluctuations of salinity concentrations at sites one through four.
2. Fluctuations of salinity concentrations at bridges one through seven.
3. Relationship between calculated salinity using conductivity and temperature, and measured salin instrumentation under laboratory conditions. A correlation coefficient of .997 demonstrated tha at lower concentrations, could be calculated more accurately using conductivity and temperature than could be read directly from the meter as salinity in ppt.
4. Correlation between salinity concentrations at bridge no. 6 and site no. 1 ($r = 0.90$).
5. Comparison of salinity levels before and after the Bonnet Carre Spillway was opened at sites one four. This comparison was made using a statistical t test. It was shown that the difference in salinity readings at sites one and two was significant but was not significant at sites three and fou

findings indicated sites 3 and 4 were not affected by the spillway discharge.

6. Correlation between site No. 4 and rainfall one week before salinity concentrations were monitore a linear relationship as a first order of approximation, it was found that S(ppt) = 0.918 - 0.9 (rainfall in inches).

An expansion of this analysis using continuous monitoring techniques, compensating for lag time and taking int the driving forces in the area is needed.

OBSERVATIONS AND GENERAL TRENDS

Monitoring has shown that concentrations of salinity tend to diminish in a southerly direction throughout the sw marsh of the study area. Background levels of salinity with concentrations below 1 ppt are usually recorded wit south of the Illinois Central Gulf Railroad.

It was observed that the channels at bridges six and seven were the major conduits for the flow of lake wate project area. Also noted was water movement which traveled in an east-west direction along the embankment o Railroad and then shifted towards a north-south direction wherever there was a man-made or natural channel lea the swamp.

Annual vegetation patterns have varied each year since 1981. Ground level photography showed that water hyaci a relatively uniform cover during the spring of 1981. By the fall of 1982, a uniform population of bur-marigold laevis) had replaced the water hyacinth. The dominant annual populations during 1983 and 1984 were a mixtu marigold, duck weed, pennywort, walter's millet, alligatorweed and various small populations of other sp resurgence of water hyacinth had moved into the area by the spring of 1985.

The preconstruction activities of marking and partially clearing the alignment produced two minor but noticeab The first effect was the alteration of floating plant distribution caused by debris from clearing activities. migration of floating vegetation was restricted as a result of this barrier of displaced trees and shrubs. The debris on the east side of the right-of-way created a new habitat for certain wildlife species, especially nutria. The seco was the slight change in the directional movement of water. Brought about by the ruts formed by heavy equipment, this minimal alteration of hydrology was observed as water currents moved in and out of the align

suggested the beginnings of shallow channelization. The carcasses of nutria and other dead animals observed a
right-of-way made it evident that clearing operations were sufficient to provide access for small boats.

PROBLEMS AFFECTING THIS RESEARCH

An "Optimal Impact Study Design and Analysis" as described by Green is characterized by the following crite

> An optimal impact study design is possible if (1) the impact has not yet happened, (2) the type of impact and when and where it will happen are known, (3) measurements on both biological and environmental variables can be obtained from the samples, and (4) an area which will not receive the impact, but is otherwise similar to the impact area, is available to serve as a control.(4)

The research plan in its original form met all but the second criterion. Green's second criterion makes it eviden
original research plan was too broad and did not identify the specific impact. Rather than studying a range of
and chemical effects as originally proposed in the "micro-study," it is recommended that the focus of the "micr
be limited to the effects relating to changes in salinity concentrations, the extent of saltwater intrusion and th
fluctuations in salinity concentrations. In this manner, the primary factor influencing the character of the wetlar
studied in detail. With the specific impact being recognized, salinity rather than a biological species becomes the
parameter. As such, other environmental considerations (i.e., changes in the flora and fauna) may be gauged
magnitude of the changes of salinity.

To accomplish this specific aim, a demonstration of salinity diffusion coefficients, including the incorporation of I
will be made. Data to determine these parameters come from selected sites which could be monitored at fre
capable of yielding a correlation coefficient high enough to warrant statistical confidence. This data may be ana
a before, during and after basis to see if differences in diffusion coefficients are related to construction activities.
to follow this procedure, it is necessary to update the present instrumentation so that continuous measurem
recording of salinity concentrations at set intervals over an extended period of time can be obtained.

This research is designed to study the general change occurring in the LaBranche Wetlands and more speci
determine the environmental role of I-310 and relate possible impacts attributable to its construction. Four

unrelated to the construction of I-310 have the potential to impact comparisons with baseline data. The most i activity could be the opening of a Bonnet Carre site for freshwater diversion from the Mississippi River i Pontchartrain and surrounding wetlands. As a conservation measure to combat saltwater intrusion and to declining wetlands, the introduction of such vast amounts of freshwater would dominate all other environmenta Preconstruction baseline data taken to study the effects of I-310, if developed before the introduction of this fr discharge, could not serve as a valid comparison with data taken after such an event.

Because of delays in the construction of I-310 and the indefinite date for the construction of the Bonnet Carre fr diversion project, it is not known if the two projects will overlap. It should be noted, however, that the L Department of Wildlife and Fisheries plans to build a freshwater diversion structure at Caernarvon before con the Bonnet Carre structure. It is highly possible that this research could be completed before the freshwater project becomes a problem.(5)

The second major factor which could possibly alter baseline conditions in the study area is the action taken b Charles Coastal Zone Management Program. The purpose of this program is to manage the LaBranche We initiating measures to fight against saltwater intrusion. Under consideration by this group are the construction and directional weirs. One dam at the mouth of Walker Canal has been constructed. The alteration of bac conditions by such methods could make pre-construction data unrepresentative as a baseline for comparison. Inf concerning the details and plans of these activities are not presently available.

The expansion of the New Orleans International Airport, having displaced a large section of the wetland in the portion of the project area, is the third potential factor to impact baseline data. One of the original sampling sites in this area.

The fourth major human factor impacting the project area and jeopardizing the baseline data is the expansion of th and Pelican landfills. These landfills have displaced or drastically altered approximately one square mile of wetla the southwest portion of the I-310 alignment.

CONCLUSIONS

The research intended by this effort is incomplete. In part, this research could not be completed due to e construction delays which drastically altered the timing of the study. Additionally, this research failed due to oth activities which altered the surrounding environment and thus overshadowed the possible impacts cause construction of I-310.

During the last days of this research study, a design problem became evident which existed from the concepti project. This research effort became problematic in part because of the failure to recognize the degree of associated with quantifying unique environmental effects in a given wetland ecosystem. The study of this coasta became unexpectedly complicated because specific environmental impacts strongly interacted and overlappe particular environmental impacts are easy to recognize; however, they are also very difficult to quantify and e difficult if not impossible to evaluate as isolated factors. Effects determined from individual, isolated impacts construction) invariably become distorted when they are factored out of the overall concept of highway impac

The construction of a highway through a wetland ecosystem brings about a qualitative change in the natural envi Such changes are subject to human evaluation and judgment. Using scientific data to quantify the effects of a con technique eventually becomes dependent on an ability to separate the total effects caused by the construction and of a highway from the specific effects caused by the construction technique. Both the total effects of the highwa specific effects of the construction technique can further be quantified only to the extent they can be separated other natural and human impacts affecting a given site.

As evidenced by the public controversy surrounding this project, the social value of the highway and the social the unaltered wetland became highly subject to interpretation. Quantifying the mitigation potential of a con technique becomes a function of separating subjective values from objective measurements; yet the highwa construction technique are best understood as an integral part of the environment rather than separate factors sh environment. This is a subtle but very important recognition. Mitigation measures for reducing negative envir impact have an important place in highway construction, but beyond a certain practicality, such measures c quantified to represent a specific environmental value.

This research effort brought to light the problematic nature of the subjective decision to use end-on constructio objective effort to evaluate this decision by scientific research. Because of the controversial nature of this highwa impacting a popular wetland, the decision was made to use end-on construction assuming it to be th environmentally safe" construction technique. There was no data to support this assumption; therefore, the project was conceived and assumed to be adequate to provide "hard evidence" for evaluating mitigation associ construction techniques.

The initiation of this research began with observation and general data collection. As an understanding of the c of the study area began to grow, evidence mounted towards the impracticality of proceeding with the study by res the general nature of features and processes. Useful information derived from such a generalized approach cou managed within the scope of the research. Due to this recognition, a decision was reached to study salinity as t most important indication which could be analyzed in greater detail. After closely monitoring and studying this p for over a year, statistical evidence made it clear that the data was not precise enough to quantify changes and c a specific expression of salinity. Further investigation indicated more precise readings could be collected using co monitoring equipment.

Because of extensive construction delays and the magnitude of either human activities in the project area, this project was frozen. The decision not to proceed using continuous salinity monitoring also took into account the e nature of this instrumentation and the likelihood of such equipment being subject to vandalism. Additionally, t no assurance that continuous monitoring would provide sufficient data to quantify the role of end-on construc relationship to salinity fluctuation.

During the course of this research, an extensive collection of aerial and ground-level photography was taken. T color infrared aerial photographs taken for this research are available through the Photogrammetric Unit of the L Department of Transportation and Development.

RECOMMENDATIONS

Many wetland environments are so complex that a comprehensive understanding of their ecological dynamics is u
Research designed to be carried out in complex ecosystems should be evaluated through a feasibility study. Tl
any such research should be evaluated against the backdrop of the particular environment in question. A feasibi
would be a useful tool for anticipating the significance of construction effects as compared to the significance of
factors impacting a particular project area.

Environmental guidelines used to consider highway construction technique in wetlands is weighted more towar
consideration than scientific investigation. Scientific research of wetlands is best suited for the study of
parameters which relate to particular aspects of a given study area. Hard data derived from such research, ho
extremely difficult to quantify as an isolated effect impacting the overall nature of a wetland ecosystem. As a m
measure, a construction technique is better understood in light of projected land use. Therefore, an in depth an
land use would be pivotal in a feasibility study aimed at projecting the mitigation potential of a construction te

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APPENDIX A

Study Area Map

APPENDIX B

Research Study Area List of Flights and Outputs

The following is a list of flights and outputs covering part or all of the research study area that are available upon

1. Graphic files delineating land and water
2. Infrared film:
   - A. 3- 8-82, 1"=500'
     1"=1,000'
   - B. 11- 5-82, 1"=1,000'
     1"=1,667'
   - C. 3-11-83, 1"=1,000'
   - D. 10-27-83, 1"=500'
     1"=1,000'
   - E. 4- 4-84, 1"=500'
     1"=1,000'
   - F. 11- 7-84, 1"=500'
     1"=1,000'
   - G. 4-26-85, 1"=1,667'
3. Interstate 10
   - A. 2- 8-67, 9,000' wide
   - B. 1-14-68, 4,500' wide
   - C. 1- 6-69, 4,500' wide
   - D. 4-14-70, 4,500' wide
   - E. 3- 4-71, 4,500' wide
   - F. 12-12-78, 4,500' wide
4. Junction I-310 & US 61
   - A. 8-23-73, 1"=500'
   - B. 10-15-86, 1"=500'
     1"=1,000'
5. US 61 to I-10
   - A. 10-16-69, 13,500' wide

B. 1-12-73, 1,000' wide

C. 12- 7-77, entire area

6. US 61

A. 12- 4-74, 4,500' wide

B. 10-19-81, 9,000' wide

APPENDIX C

Graph and Correlation Studies

Site #1

	(Measured Salinity)			(Calculated Salinity)	
Date	S O/00	umho	t°C	S*0/00	
04/28/82-118	3.25	5750	25	3.11	
07/08/82-189	3.0	7000	38	3.0	
08/05/82-217	2.5	4700	31.5	2.2	
08/26/82-238	2.2	5000	35	2.3	*
09/28/82-271	4.0	7000	23	4.0	
10/22/82-295	4.0	6000	20	3.6	*
11/16/82-320	2.8	3500	17	2.2	
12/06/82-340	1.5	2600	19	1.5	
01/12/83-012	1.7	2000	11	1.4	
01/26/83-026	2.5	3000	15	2.0	
03/15/83-074	1.3	2210	19	1.3	
03/29/83-088	1.1	1620	20	0.9	*
04/28/83-118	0.8	1150	27	0.5	
06/07/83-158	0.7	2180	26	1.1	*
07/06/83-187	0.6	1550	31	0.7	
07/20/83-201	1.8	3100	29	1.5	
08/23/83-235	1.2	2400	32	1.1	
10/19/83-292	0.9	2100	26	1.0	
11/08/83-312	0.8	1700	21	0.9	
01/31/84-031	1.0	1300	15	0.8	
02/23/84-054	0.2	900	20	0.4	
07/12/84-194	1.5	3200	36	1.3	
08/09/84-222	1.5	3200	31	1.5	
10/24/84-298	1.8	3800	25	2.0	1.12 ± 0.44

1.78 ± 1.05	1.65 ± 0.91

12=0.833

14=0.494

SITE #2

	(Measured Salinity)			(Calculated Salinity)
Date	S 0/00	umho	t°C	S*O/00
04/28/82-118	1.5	2500	25	1.3
07/08/82-189	2.0	4000	35	1.7
08/05/82-217	1.0	2250	30	1.0
08/26/82-238	2.0	4200	30	2.0
09/28/82-271	3.1	5300	30	2.6
10/22/82-295	3.0	4800	21	2.8
11/16/82-320	2.0	2500	19	1.5
12/06/82-340	0.8	1350	18	0.8
01/12/83-012	1.0	1000	12	0.6
01/26/83-026	2.0	2250	15	1.4
03/15/83-074	1.0	1650	19	0.9
03/29/83-088	1.2	1750	17	1.0 *
04/28/83-118	0.5	950	24	0.4
06/07/83-158	0.4	1050	28	0.4
07/06/83-187	0.5	1380	31	0.6
07/20/83-201	0.9	2350	29	1.1
08/23/83-235	0.8	2000	32	0.9
10/19/83-292	---	----	--	---
11/08/83-312	0.6	1400	23	0.7
01/31/84-031	0.3	800	17	0.4
02/23/84-054	0.4	750	21	0.3
07/12/84-194	1.2	2750	35	1.2
08/09/84-222	1.3	2200	30	1.0
10/24/84-298	1.6	3600	25	1.9

1.23±0.86	1.20±0.80

12=0.833

SITE #3

Date	(Measured Salinity) S 0/00	umho	t°C	(Calculated Salinity) S*0/00
04/28/82-118	1.0	1500	25	0.7
07/08/82-189	1.0	1900	28	0.9
08/05/82-217	1.0	2200	32	1.0
08/26/82-238	1.7	3100	33	1.4
09/28/82-271	1.4	2600	24	1.4
10/22/82-295	2.2	3300	21	1.9
11/16/82-320	1.2	1700	17	1.0
12/06/82-340	0.5	800	19	0.4
01/12/83-012	1.0	850	11	0.5
01/26/83-026	1.5	1750	15	1.1
03/15/83-074	1.0	1430	16	0.8
03/29/83-088	1.0	1320	17	0.8
04/28/83-118	0.4	620	26	0.2
06/07/83-158	0.5	1080	25	0.5
07/06/83-187	0.5	1200	32	0.5
07/20/83-201	0.9	2000	29	0.9
08/23/83-235	1.0	2050	35	0.8
11/08/83-312	0.5	1100	23	0.5
01/31/84-031	0.2	700	15	0.4
02/23/84-054	0.6	1000	21	0.5
07/12/84-194	0.8	2000	35	0.8
08/09/84-222	0.4	1500	30	0.6
10/24/84-298	1.2	3200	26	1.6

0.93±0.47	0.83±0.42

23=0.791

SITE #4

Date	(Measured Salinity) S 0/00	umho	t°C	(Calculated Salinity) S*0/00
04/28/82-118	0.5	1500	25	4.72
07/08/82-189	0	950	30	0.10
08/05/82-217	0.5	1600	30	2.72
08/26/82-238	0.8	1600	29	0.00
09/28/82-271	1.5	3200	30	0.00
10/22/82-295	2.1	3200	21	0.00
11/16/82-320	1.0	1500	17	0.07
12/06/82-340	0.5	800	19	5.76
01/12/83-012	1.0	775	11	0.09
01/26/83-026	1.5	1900	14	0.72
03/15/83-074	1.0	1470	16	0.00
03/29/83-088	0.8	1175	17	2.95
04/28/83-118	0.5	775	25	5.31
06/07/83-158	0.8	1530	27	1.31
07/06/83-187	0.5	1300	29	2.10
07/20/83-201	1.0	2000	29	0.39
08/23/83-235	1.0	1600	30	0.30
11/08/83-312	0.5	1100	20	1.90
01/31/84-031	0.2	700	15	0.91
02/23/84-054	0.5	850	23	1.63
07/12/84-194	0.9	1650	30	1.18
08/09/84-222	0.2	1000	29	5.98
10/24/84-298	1.1	2700	29	0.04

0.8±0.47	0.76±0.38
34=0.855	S*0/00 = 0.918 - 0.975R
14=0.499	= -0.512

APPENDIX D

Historical Map and Photographic Study

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HISTORICAL MAP AND PHOTOGRAPHIC STUDY, VICINITY OF I-310

(Alternate 6b)

ST. CHARLES PARISH, LOUISIANA

Introduction

The objective of this study is to document the areal and spatial distribution changes in habitat types in the vicinity (Alternate 6b) between 1955 and 1978 (Figure 1). This type of information will provide a historic data comparison with future changes in the area that may occur during and immediately after construction of t (Alternate 6b) highway. This report documents the methodology utilized in the fulfillment of this project and area data on habitat changes through tabulation of habitat area measurements for three years: 1955, 1974, and comparison of the three habitat maps (submitted as separate maps at a scale of 1:24,000) that accompany this repo the changes in spatial distribution of various habitat types for the three time-periods that were mapped.

The study area contains 11,346 acres and is located in the northeastern, terrestrial portion of St. Charles Par adjacent to and west of Jefferson Parish and stretches northward from La. 61 to Lake Pontchartrain. The boundary is the power transmission line paralleling the Lake Pontchartrain shoreline. The eastern boundary is bank of the Duncan Canal, and the western boundary is the unnamed pipeline canal west of Walker Canal.

Methodology

Interpretation and Map Construction

Construction of the habitat maps for 1955, 1974, and 1978 consisted of three steps:

1) interpretation and labeling of habitats on aerial photographs,
2) transfer of habitat boundaries and labels to stable mylar overlain on a paper print of the 7.5 minu topographic map base. (The two USGS maps covering the study area - LaBranche and Lulin spliced together so that the study area could be shown on one map base.)
3) cartographic preparation of a final camera-ready copy of each habitat map.

Data on the aerial photographs used in this study are shown in Table 1. Habitat interpretation was based on photographic signatures for different habitat types, the interpreter's awareness of the area's habitats based on prev investigations and collateral data sources, especially habitat maps published by O'Neil (1949), Chabreck (1972), C and Linscombe (1978), and the United States Geological Survey (USGS) 7.5 minute topographic maps. Th labeling system (Table 2) was consistent with the hierarchical classification system devised by the U.S. Fish and Service (USFWS) (Cowardin et al. 1979, USFWS n.d.) (Table 3). This system was modified by the addition of s to the cypress-tupelo swamp label (PFO1/2) to indicate special conditions in different areas of this habitat type (s 2).

Once the habitat boundaries had been delineated on a mylar overlay of the three sets of aerial photographs, ea draft maps was projected (using a map-o-graph) onto a mylar overlay of the stable base, 7.5 minute USGS top map of the study area. A second draft map was created and habitat boundaries were rectified to the topograp Then the three draft maps for 1955, 1974, and 1978, were overlain with each other to further check the acc boundary alignment and consistency of interpretation among the three time periods.

The final, or camera-ready, copy of each habitat map was created by overlaying mylar on the penciled draft map ar in all map features. Each habitat polygon was labeled using press-on letters. A legend was affixed to the top habitat map giving the map date, habitat symbols and definitions.

Measurement and Tabulation

Habitat areas for each map were manually planimetered using a Numonics 1224 Digitizer. The data (shown in a presented in tabular form in Table 4. These measurements reflect direct measurements from overlays of paper the USGS, 7.5 minute topographic maps and may differ slightly from measurements of a stable base USGS 7. topographic map. This difference is due to the fact that paper prints are distorted in the printing process and are no the same size as the stable base film positives from which the prints are made.

Table 1. Aerial Photographs Used for Interpretation.

DATE	SOURCE	TYPE	FRAME	SCA

1955	Petroleum Information Service San Antonio, TX	2 quad-centered black & white controlled mosaics	LaBranche, La.quad.	1:24,000
1974	NASA, EROS Data Center Sioux Falls, SD	1 nonquad-centered color infrared 36" x 36" print	Unknown*	1:30,000
1978	NASA, EROS Data Center Sioux Falls, SD	2 nonquad-centered color infrared 9" x 9" transparencies	Roll 2693 Frames 702 & 782	1:123,000

*The frame used was a print CEI obtained for a previous report and the frame number was not shown on the print.

Table 2. Habitat Labels and Descriptions.

LABEL	DEFINITION
ElOW	Estuarine water body; natural
E1OWx	Estuarine water body; dredged
E1OWo	Estuarine water body; dredged by mineral industry
E1OWt	Estuarine water body; tidal channel
E2EM5P5	Brackish marsh
E2EM5P6	Intermediate marsh
L2OW	Shallow, fresh water body; 20 acres
PEM	Fresh marsh
PFO1/2^{o}	Cypress-tupelo swamp; mostly tupelo
PFO1/2	Cypress-tupelo swamp; mostly cypress; stressed
PFO1/2	Cypress-tupelo swamp; mostly cypress; dying
POW	Fresh water body; 20 acres
R1OW	Fresh water channel; natural; tidal
R1OWx	Fresh water channel; dredged; tidal
R1OWo	Fresh water channel; dredged by mineral industry; tidal
R2OW*	Fresh water channel; natural; non-tidal
R2OWx	Fresh water channel; dredged; non-tidal
R2OWo*	Fresh water channel; dredged by mineral industry; non-tidal
UDV1	Developed; roads; levees
UDV1o	Developed; mineral industry
UDV2	Agriculture; pasture
UDV3	Bare ground; landfill
USS1s	Broad-leaved deciduous shrubs on spoil bank
USS1/3	Broad-leaved deciduous and broad-leaved evergreen shrubs on beach ridge

*Not identified in the study area.

Table 3. Hierarchical Structure of Habitat Classification System Used in Mapping the Mississippi Delt
Region (After USFWS n.d.).

Table 4. Tabulation of Habitat Area for 1955, 1974 and 1978.

HABITAT TYPES	**AREA IN ACRES AND % BY YEAR**						**NET CHANGE IN A**
	1955		1974		1978		**1955 - 1978**
	Ac.	%	Ac.	%	Ac.	%	
E1OW	470	(4)	1788	(16)	1727	(15)	+1257
-E1OWx	90	(<1)	272	(2)	257	(2)	+167
E1OWo	34	(<1)	74	(<1)	73	(<1)	+39
E1OWt	29	(<1)	15	(<1)	52	(<1)	+23
E2EM5P5	2589	(22)	3411	(30)	3409	(30)	+820
E2EM5P6	1956	(17)	1603	(14)	1409	(12)	-552
L2OW	0	(0)	56	(<1)	0	(0)	-*
PEM	1726	(15)	218	(2)	71	(<1)	-1655
PFO1/2	1407	(12)	1175	(10)	933	(8)	-474
PFO1/2	2598	(22)	1427	(12)	1609	(14)	-989
PFO1/2	0	(0)	765	(6)	1143	(10)	+1143
POW	0	(0)	9	(<1)	4	(<1)	+4
R1OW	0	(0)	0	(0)	3	(<1)	+3
R1OWx	19	(<1)	19	(<1)	19	(<1)	0
R1OWo	15	(<1)	9	(<1)	9	(<1)	-6
R2OWx	7	(<1)	6	(<1)	11	(<1)	+4
UDV1	76	(<1)	80	(<1)	124	(1)	+48
UDV1o	4	(<1)	0	(0)	0	(0)	-4
UDV2	306	(2)	0	(0)	0	(0)	-306
UDV3	0	(0)	258	(2)	336	(2)	+336
USS1s	0	(0)	162	(1)	162	(1)	+162
USS1/3	20	(<1)	0	(0)	0	(0)	-20

TOTAL AREA	11,346	11,346	11,346

*Habitat did not exist in 1955 or 1978

Summary

While there were 22 habitats identified in the study area for the entire study period, the number of habitats for a g ranged from 16 in 1955 to 18 in 1974 and 1978. In 1955, the study are habitat types represented marsh, swamp and man-influenced channels which were either estuarine or tidally influenced, developed and agricultural lands drained shrub habitats (spoil). The land habitats comprised 94% (10,682 acres) of the area and 6% (664 acres) o was in open water (Table 5). Of the open water area, about 25% (165 acres) consisted of man-made water bod man-made water bodies consisted of drainage canals and borrow pits (111 acres) and pipeline canals and rig acres). Of the land habitats, only about 3% (386 acres) consisted of man-influenced habitats such as devel agricultural areas.

Marsh habitat covered 6271 acres (55%) of the area and swamp habitats, primarily cypress-tupelogum com covered 4005 acres (35%). Plant species common to the fresh, intermediate, and brackish marsh and swamp ha shown in Table 6.

By 1974, the area had experienced a dramatic increase in open water area as a result of marsh breakup, shoreline canal dredging and the thinning of the swamp canopy due to cypress and tupelogum mortality. The brackish mars increased in area, whereas, the intermediate and fresh marsh habitats as well as the swamp habitats decreased

While the overall trend of a decrease in swamp and fresh to intermediate marsh habitats is characteristic of this are a variety of factors that account for these kinds of habitat changes on a seasonal and a long-term basis. Th mortality appears to be a long term trend and is probably attributable to increases in soil salinities within the st Research into the cause of cypress tree mortalities along the north shore of Lake Pontchartrain, in Tangipah (Wicker et al. 1981) indicate that areas having soil salinities of 2 ppt or greater cannot support viable cypress com

The increase in area of brackish marsh habitats is also a long term trend resulting from the displacement o intermediate marsh species by brackish marsh species. This trend is also in response to rising water salinity leve some previously brackish marsh habitats were changed to open water habitats because of wave erosion and canal the overall rate of erosion was not greater than the rate of marsh displacement, thereby resulting in an overall in brackish marsh habitat. Fresh to intermediate marsh habitats also decreased in area because of wave erosion dredging, as well as because of displacement by brackish marsh species.

The disappearance of fresh to intermediate marsh habitats in some areas may also be a result of flooding in previ (prior to the time of the photography) which destroyed the existing vegetation. It must also be noted that the dis of some fresh to intermediate marsh communities are very seasonal. For this reason, their appearance photography may depend upon the time at which the aerial photography was flown, as well as, the height of stand at the time of the photography. If the vegetation is short or if it has been by high water, this vegetation will not be by the photography during high water periods. Also, low water periods, especially low water conditions that hav for a sufficient period during the growing season, will permit growth of fresh to intermediate vegetation th recorded on aerial photographs. Because there are so many factors influencing the distribution of fresh to inte marsh habitats at any given time, it is difficult to obtain an accurate evaluation of the distribution of these habi However, it is valid to say that the fresh marsh and swamp habitats are decreasing primarily due to increasing which are reaching the interior portions of the study area via excavated canals connected to Lake Pontchartrai

Agricultural habitats disappeared from the study area by 1974, and 258 acres of cleared land appeared. Mu cleared land was serving as landfill sites in 1974. Deposition of spoil along the north shore of the I-10 c subsequent colonization by black willow (Salix nigra) and Chinese tallow (Sapium sebiferum) resulted in a increase in upland scrub/shrub habitat.

Table 5. Comparison of Area and Percentage of Land to Water for 1955, 1974, 1978.

HABITAT	AREA IN ACRES AND % BY YEAR						NET CHANGE IN ACRES
	1955		1974		1978		
	Ac.	%	Ac.	%	Ac.	%	
Land	10,682	94	9098	80	9191	81	-1491
Water	664	6	2248	20	2155	19	+1491
Total:	11,346	100	11,346	100	11,346	100	0

Table 6. Distribution of Vegetation According to Swamp and Marsh Types.

VEGETATION				TYPES					
				Fresh	Intermediate		Brackish		
Marsh									
Alligatorweed (Alternanthera philoxeroides)	X			X					
Bulltongue (Sagittaria spp.)	X			X					
Bullwhip (Scirpus californicus)		X			X				
Cattail (Typha spp.)		X			X				
Coco (Scirpus robutus)									X
Coffeeweed (sesbania exaltata)		X			X				
Cypreus (Cyperus odoratus)		X			X				
Deer pea (Vigna luteola)		X			X			X	
Duckweed (Lemna spp.)			X			X			
Dwarf spikerush (Eleocharis parvula)		X			X			X	
Giant foxtail (setaria magna)	X			X					
Hydrocotlye (Hydrocotyle sp.)		X							
Iris (Iris spp.)		X							
Marshmallow (Hibiscus lasiocarpos)	X								
Morning Glory (Ipomoea sagittata)	X			X			X		
Naiad (Najas quadalupensis)		X			X				
Pigweed (Amaranthus spp.)		X							
Pink hibiscus (Kosteletzkya virginica)	X			X			X		
Roseau cane (Phragmites australis)	X			X			X		
Sawgrass (Cladium jamaicense)	X			X					
Smartweed (Polygonum spp.)			X			X			
Stinking fleabane (Pluchea foetida)	X								
Three-cornered grass (Scirpus olneyi)		X			X			X	
Walter's millet (Echinochloa walteri)		X							
Water hyacinth (Eichhornia crassipes)		X							
Waterhyssop (Bacopa monnieri)					X				
Widgeongrass (Ruppia maritima)								X	
Wiregrass (Spartina patens)					X			X	
Swamp									
Baldcypress (Taxodium distichum)		X							
Buttonbush (Cephalanthus occidentalis)	X								
Green ash (Fraxinus pennsylvanica var. lanceolata)			X						
Palmetto (Sabal minor)			X						

Swamp maple (Acer rubrum var. drum mondii)	X
Tupelogum (Nyssa aquatica)	X
Wax myrtle (Myrica cerifera)	X

Sources: Chabreck 1972, Chabreck and Linscombe 1978, Chabreck and Condrey 1979, O'Neil 1949, U.S. Army E
New Orleans, 1974.

By 1978, marsh covered 4889 acres or 43% of the area and swamp covered 3685 acres or 32% of the site. Ho the marsh habitat, less than 1% (71 acres) consisted of fresh marsh. Brackish marsh covered 3409 acres or 30%, percentage as in 1974, but intermediate marsh had decreased to 1603 acres or 12%. Of the 32% of the area in tupelogum swamp, 24% was in a very stressed or dying condition. Overall, there was little change in open wate between 1974 and 1978.

The slight decrease in open water area was due primarily to the revegetation of exposed flats by the time of the 19 photography.

In the vicinity of LA 61, 124 acres of land were in development and 336 acres of land were cleared for land fill a construction sites. The acreage of vegetated spoil (162 acres) had not changed since 1974.

An overall comparison of maps and tabulated areal measurements of the study area between 1955 and 1978 sh the ratio of land to water (shown in percentage) changed from 94:6 to 81:19. Land loss is directly attributable to erosion along the land-water interface and canal dredging. Some land loss is also attributable to breakup of fre and swamp areas which is probably related to increases in water salinities and dying of the non-salt tolerant ve The higher salinity waters in Lake Pontchartrain are rapidly conveyed into the interior wetlands via dredged ca eroding water bodies. The system of man-made canals and man-made levees and spoil deposits appears to have affected the hydrologic regime and subsequently the natural vegetation zonation of the study area. In the abse effective wetland management program, these detrimental trends can be expected to continue with the end res a massive increase in open water area.

Recommendations

Analysis of long term habitat changes and the establishment of cause and effect relationships for these changes be documented for the study area by intense long term data collection and evaluation. Seasonal and cyclic chan distribution of vegetation communities and salinity regimes in response to weather, climate and man-made cond confuse the issue when one tries to evaluate the effect of a particular type of highway construction on surrounding

Comparison of the habitat maps and tabulated data provides only a general concept of the long term trends i change. However, seasonal and cyclic changes can be understood best with monthly sampling at well established sites along a transect line established in the vicinity of the highway alignment. Items to be sampled should inc and surface water salinities, wind and current conditions, rainfall and vegetation distribution (species compos dominance).

Analysis of existing data indicates that the area is experiencing a deterioration of environmental diversity anc Data assembled from a monitoring program may be conclusive in establishing the impacts of highway construc in addition, would be invaluable as a data base for future wetland management of the area.

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