WEST POINTE A LA HACHE FRESHWATER DIVERSION (BA-04)
BA-04-MSPR-0895-1
PROGRESS REPORT No. 1
for the period
May 28, 1992 to August 15, 1995

Project Description/Status

The West Pointe a la Hache project area contains 13,700 acres of brackish marsh located within Plaquemines Parish, Louisiana. The area is bound to the northwest by Lake Judge Perez, to the southwest by Bayou Grand Cheniere, to the southeast by the Socola Canal, and to the northeast by Grand Bayou, Fosters Canal, and the Mississippi River back protection levee (figure 1). The project area, as is true with the Barataria basin, suffers from a lack of fresh water and sediments because of the building of the flood control levee along the Mississippi River. The freshwater diversion structure is located at river mile 48.9 (above head of passes) at West Pointe a la Hache, Louisiana, and consists of eight 72-in. diameter siphon tubes with a maximum discharge of 2144 cfs. The siphons empty into a designated discharge pond, maintained by 2,500 cu yds of riprap, with four outfall channels (Brown & Root, Inc. 1992). All operational changes in siphon flow are performed by Plaquemines Parish government (PPG) (table 1). These changes are based on an operational scheme developed in 1992 by Brown and Root, Inc., based on a TABS-2 environmental model (table 2).

The main project objective is to protect approximately 13,700 acres of brackish marsh from continued degradation by introducing fresh water into the area through the west bank of the Mississippi River. The Mississippi River water will bring sediment and nutrients into the project area to improve growing conditions for the target plant species (*Spartina patens*).

Specific measurable goals were established to evaluate project effectiveness. The project plans are to increase marsh to open-water ratios, reduce and stabilize mean salinity, and increase relative abundance of the target plant species (*Spartina patens*).

Monitoring Design

Health-related (fecal coliform) and discrete hydrologic variables are monitored biweekly and are available from May 28, 1992, to present. Hydrologic variables include salinity and water temperature (surface and bottom) at 16 stations and water levels at 5 staff gauges surveyed to the

New Cairo or the National Geodetic Vertical Datum (NGVD). Continuous data are logged hourly by Hydrolab Datasonde 3 continuous dataloggers (figure 2) that record salinity, specific conductivity, water temperature, and water level at 6 stations. Time periods of available continuous data are summarized in table 3. Plant species composition/abundance is measured at 21 stations and brown shrimp are sampled at five stations annually (figure 1). An initial vegetative delineation of the project area was performed in June 1992 by Allan Ensminger of Wetlands and Wildlife Management Co. under contract with the Louisiana Department of Natural Resources, Coastal Restoration Division (LDNR/CRD). The vegetation sites are to be visited once a year and compared to the initial preoperational data. Aerial photography is flown biannually and used to calculate marsh to open-water ratios and for vegetative delineations. Change in marsh to open-water ratios from preoperation (1992) to five yr postoperation will be evaluated in 1997. Aerial photographs are also used to delineate the extent of the turbidity plume caused by the siphons. The extent of the turbidity plume will be evaluated on a monthly basis, beginning October 1995, by looking at water transparency with an 8-in. Secchi Disc. Daily siphon discharge in cubic feet per second (cfs) is currently being calculated. Water velocity in each of the four outfall channels will also be measured monthly during siphon operation beginning October 1995.

All discrete biological monitoring is performed biweekly by PPG with LDNR/CRD accompanying PPG on every other trip. On the monthly joint monitoring trips, PPG obtains fecal coliform samples and LDNR/CRD records all hydrologic variables and services the continuous recorders. PPG independently monitors the project on a monthly basis two weeks after the joint monitoring trip. During those trips, PPG obtains fecal coliform samples and records all hydrologic variables. LDNR/CRD performs all vegetative and brown shrimp monitoring. There were several periods of time when the siphons were not functioning after the initial opening on January 12, 1993. Data from these time periods are treated as preoperational.

Results/Discussion

Aerial photographs from February 1993 were used to delineate the extent of the turbidity plume caused by siphon flow. The plume covers the northern half of the project area and extends from station 12 in the west to station 7 in the east. The southernmost extent of the plume is bound by the east-west running pipeline canal that contains stations 11, 4, and 7. Annual reports were written for the 1992 and 1993 monitoring years and are available from the Louisiana Department of Natural Resources (1992) and Plaquemines Parish government (1993).

As might be expected, the freshwater inflow has its greatest influence on the continuous recorder stations that are closest to the immediate outfall pond. Salinity was reduced almost immediately at station 2 when the siphon was first opened on January 12, 1993 (figure 3). Station 2 is located directly on Grand Bayou where it meets the Jefferson Lake canal. Both of these channels are conduits for the fresh water that the siphon introduces into the project area. There was a time delay of approximately two days and a reduced slope of salinity decrease at station 4 (figure 4). Station 4 is located toward the center of the project area and is not in a direct line for the fresh water as is station 2. As a result, the fresh water requires a longer time period to reach this area and the effects are not as pronounced as they are closer to the siphon discharge. Station 7 exhibits large salinity fluctuations that are closely tied to water level when the siphon is operational (figure 5). This pattern is not evident when the siphon is nonoperational (figure 6). There is generally well-defined salinity stratification at this station during siphon operation. Water level increase is due to tidal influences that bring higher saline water into the area in the form of a deep salt wedge. The datalogger may be at a position in the water column that comes into contact with the salt wedge when water levels are high. As the water level decreases with the outgoing tide, the salt wedge is reduced and the datalogger is recording the salinity of the fresher surface water introduced into the area from the siphon structure.

Preliminary statistical analyses of discrete salinities were performed for the 1993 annual report. One such analysis generated contour plots of salinity change from a pre/postoperational comparison of mean salinity. The overall change ranged from a 7 ppt reduction in mean salinities in the north-central region of the project area to a 2–3 ppt reduction in the south. (For a full explanation of the analyses, see the 1993 annual report.)

There was a sharp reduction in mean discrete salinity in the project area following the initial opening of the siphon on January 12, 1993. Another reduction occured between February and March 1994 when the structure operation was increased from 3 pipes to 8 pipes. An increase in mean salinity occured between September and November 1994 (figure 7). It was at this time that the siphon ceased to flow because of a combination of low-river stage and faulty butterfly stop valves. The structure was not restarted again until July 1995 because of pending lawsuits against Plaquemines Parish government and the state of Louisiana by several oyster fishermen.

Overall, mean salinities throughout the entire area have been reduced from 10.66 ppt ($\pm$0.13 SE) (preoperation) to 4.25 ppt ($\pm$0.09 SE) (postoperation). Individual station mean salinity has been reduced in varying degrees as a result of siphon flow. The greatest reductions in salinity are evident in those stations closest to the immediate outfall pond and located on major freshwater conduits (i.e., stations 1, 2, 3, 4, 5, 12, 13, & 16) (figure 8). This agrees with the preliminary statistical analysis performed for the 1993 annual report (see above) that indicated the greatest reduction in mean salinity occurred in the north-central portion of the project area. Mean preoperational water level was 1.20 ft NGVD compared to a postoperational mean of 1.28 ft NGVD. This slight increase is attributable to the error associated with reading the staff gauges. If station 1 is removed from consideration, as it is located within the outfall pond and is thus directly affected by siphon flow, then mean preoperational water level was 1.21 ft NGVD and mean postoperational level was 1.14 ft NGVD. Again, this apparent change is because of the error associated with reading the staff gauges. Overall, mean water levels have not been affected, except at station 1. Mean preoperational water temperature was 22.42^{o}C compared to a postoperational mean of 22.55^{o}C. As with water level, mean water temperatures have not been affected.

Fecal coliform analysis is regulated by the National Shellfish Sanitation Program (NSSP) under the U.S. Department of Health and Human Services Food and Drug Administration. Fecal coliform data are recorded as most probable number (MPN) per 100 ml of sample and can range from 0 to over

1600. Due to the large range of MPN values, data tend to be skewed toward the upper end of the range. NSSP has determined that fecal coliform data must be normalized so as to reduce this skewness. This is accomplished by taking the geometric mean instead of arithmetic mean of a series of samples. Any areas where the geometric mean exceeds 14 MPN would be considered polluted (Brown and Root, Inc. 1991). The geometric mean of the preoperational fecal coliform samples obtained by PPG and LDNR/CRD was 34.1 MPN, while that number increased to 60.8 MPN postoperation. While it seems that fecal coliform values have increased in response to siphon operation, it should be noted that according to NSSP guidelines, the area was considered polluted prior to operation. This is also apparent from an analysis performed by Brown and Root, Inc. (1991) of several Department of Health and Hospital (DHH) Oyster Water Monitoring stations located within the Barataria Basin. Of the 32 stations they evaluated, 7 were located directly within the West Pointe a la Hache project area. According to their report, the NSSP also evaluates oyster harvesting areas using the percent of MPNs over 43 and an estimate of the 90th percentile. These two procedures attempt to take into account variability caused by normal and abnormal sources respectively (Brown and Root, Inc. 1991). Based on percent over 43 MPN and the estimate of the 90th percentile, for the period 1986 to 1990, all 7 stations within the project area would be considered polluted. In addition, 5 of the 7 stations would be characterized as polluted, based on geometric means.

The original 21 vegetative sampling stations were revisited in July 1995 and species composition and percent cover estimates were again measured (table 4). Both the 1992 and 1995 studies found the area to be dominated by *Spartina patens, Spartina alterniflora,* and *Distichlis spicata*. However, while Ensminger found no *Juncus roemerianus*, the 1995 studies found it present at 11 stations with percent cover ranging from a trace to 25%. *Juncus roemerianus* is found in fresh-to-saline marshes but is most common in saline marshes. This increase in occurrence of a saline marsh plant species may indicate that the freshwater input is not yet affecting the vegetation in those areas where *J. roemerianus* is present. However, there were several stations where the 1995 study found less *S. alterniflora* and more *S. patens* than the 1992 study (e.g. stations 1, 2, 18, & 19). Although *S. patens* can occur in saline marsh, it is more common in brackish marsh while *S. alterniflora* is more common in saline marsh. This decrease in *S. alterniflora* and subsequent increase of *S. patens* may indicate somewhat of a freshening effect. In 1995, station 1 also contained two species most common in fresh-to-intermediate marsh that were not present in 1992, *Bacopa monnieri* and *Colocasia esculenta*. This also may indicate that the fresh river water may be affecting vegetation around station 1. However, the flow of the siphon to date has been highly variable, including a 9-mo period of no flow. As a result, it may be too early to speculate on the effects that the diversion is having on the vegetation.

To assess the impacts of the freshwater diversion to the brown shrimp (*Penaeus aztecus*) fishery, five stations were sampled once a month in April, May, and June in both 1994 and 1995, and compared to 10 Louisiana Department of Wildlife and Fisheries (LDWF) stations for those years. To ensure comparability of data to LDWF, a 6-ft trawl was rigged and deployed according to LDWF specifications. Catch per unit effort (CPUE, as raw number of shrimp per trawl) and size (as length from tip of rostrum to tip of telson) were measured. The LDNR/CRD data were compared to that from LDWF area III (Grand Isle/Barataria) between the project area and the Barataria Bay. Average CPUE between LDWF and LDNR/CRD for all three time periods were similar in 1995 but greater for LDWF in 1994 (table 5). However, while LDWF had greater overall CPUE, LDNR/CRD caught a greater number of larger size class shrimp than did LDWF (figure 9). A report was generated on the acquired data and is available.

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Prepared on September 21, 1995, by Ed Haywood.

LDNR Monitoring Manager:	Ed Haywood	(504) 342-9428
LDNR Project Manager:	David Burkholder	(504) 342-6871
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Figure 1. West Pointe a la Hache project area and locations of vegetative and brown shrimp sampling stations.

Figure 2. Locations of hydrologic and health-related sampling stations at West Pointe a la Hache.