COLORADO RIVER DIVERSION PROJECT
RECONNAISSANCE WORK TO ESTABLISH MONITORING STATIONS IN MATAGORDA BAY NEAR THE MOUTH OF THE COLORADO RIVER

William A. White and Thomas R. Calnan

Prepared for the Texas Parks and Wildlife Department
in accordance with Interagency Contract (86-87)-1756

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This report is submitted to the Texas Parks and Wildlife Department in accordance with Interagency Contract (IAC)(86-87)-1756. Field work specified in the contract was conducted during June 22 to June 27, 1987. All tasks listed in the IAC as well as additional tasks not specified were completed. The tasks outlined in the IAC are preparatory to a proposed longer-term study designed to monitor the effects of the Colorado River Diversion Project on Matagorda Bay.

Bay Monitoring Stations

Fifteen monitoring stations were established in the eastern arm of Matagorda Bay west of the Colorado River Delta in the area where the river is to be diverted by the U.S. Army Corps of Engineers (fig. 1). All stations shown on figure 1 were located by triangulation and their positions recorded with respect to features existing on nautical chart 11319 or with respect to features located and plotted on the chart during the field survey. Twenty-foot sections of 2.5-inch PVC pipe were driven into the sediments at eight stations (table 1) to mark selected deep-water and bay-center sites. The PVC pipes extend about 3 ft above the water. Six cedar posts 2-inches in diameter by 6-ft long were placed on land at strategic locations along the bayward side of Matagorda Peninsula. The locations of the posts were confirmed with reference to aerial photographs and were plotted on the nautical chart. The posts were used as reference markers to locate bay-margin sampling sites. The tops of the PVC pipes and fence posts were painted and flagged with orange fluorescent paint and tape. Because the

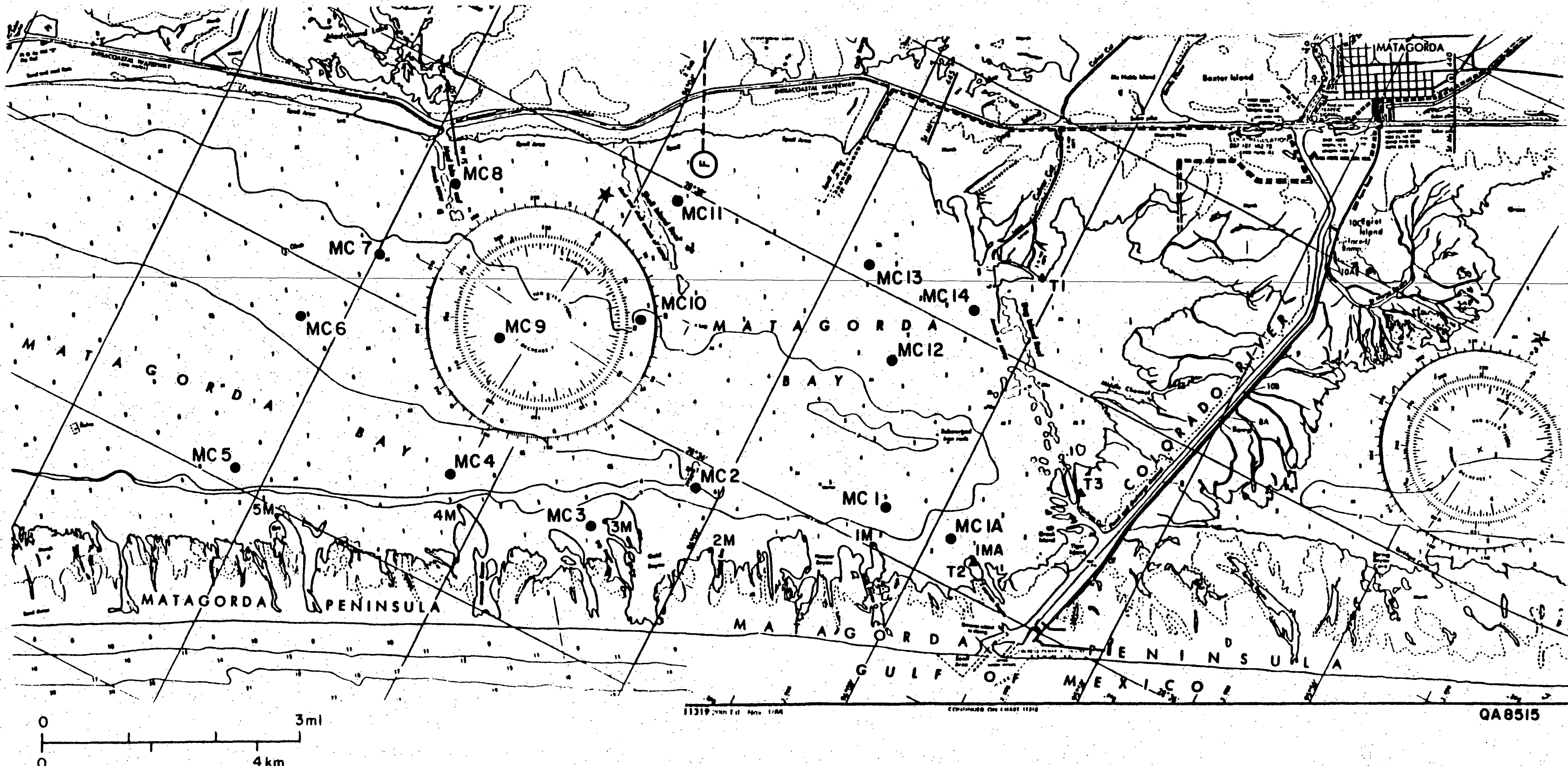


Figure 1. Map of the eastern arm of Matagorda Bay near the Colorado River showing the locations of (1) sample stations (●), (2) cedar-post markers on Matagorda Peninsula (•), and (3) marsh transects (▲).

Table 1. List of sample stations, site-location markers, and data collected at established stations.

Sample station	Types of markers PVC pipe	Cedar post	Hydrographic data collected*	Sediments collected for analysis**	Cores collected
MC1A		X	X	X	X
MC1		X	X	X	X
MC2		X	X	X	X
MC3		X	X	X	
MC4	X	X	X	X	X
MC5		X	X	X	
MC6	X		X	X	
MC7	X		X	X	
MC8	***		X	X	
MC9	X		X	X	
MC10	X		X	X	
MC11	***		X	X	X
MC12	X		X	X	X
MC13	X		X	X	X
MC14	X		X	X	X

*Temperature, salinity, conductivity, depth
**Biological, geochemical, textural
***Located with reference to oyster reef markers

sampling stations were also located by triangulation using more permanent navigation aids such as water tanks, radio antennas, houses, and bay markers, they can be relocated should the PVC pipes or cedar posts be removed.

Benthic Sediments

Benthic sediments were collected at each station using a Ponar grab sampler. At each station, depth of water, temperature, salinity, and conductivity were measured. Sediments were visually described, placed in containers, and stored for future reference and possible analysis. Sediments for geochemical analysis were placed on ice and are now stored in a freezer at the Bureau's Mineral Studies Laboratory.

Three grab samples were taken at each station for macroinvertebrate analyses. Sediment samples were washed through a 1-mm screen, and the benthic fauna were narcotized in a solution of magnesium sulfate. Samples thus processed were stored in a neutral solution of 10 percent formalin containing rose bengal. Laboratory processing will include further washing of the samples and storage in 70 percent ethanol.

Cores

Eight cores were collected at selected sites (table 1) to test our coring methods and to recover some cores for study in the laboratory. In accordance with our plans, we collected cores that were approximately 3 ft (1 m) in length using 2.5-inch PVC pipe. Most of the cores were taken using a customized core-barrel handle and a piston specifically designed for the irregular inner diameters that characterize PVC pipe. The piston, in addition to preventing the core from falling out of the tubing when it was pulled out of the sediment, allowed us to penetrate as much as 2 ft of sand, which is very difficult to penetrate with pipe. For example, the core taken at station MC1 (fig. 1), includes about 1 ft of mud, approximately 2 ft of sand, and underlying mud. The cores were taken to the Bureau's Core Research Center (CRC) where they were sawed in half lengthwise, described, and photographed. Half of each core was placed in plastic protectors and sealed; these cores are stored in the CRC repository.

Some cores provided useful information. For example, the sand bed in the core taken at station MC1 (fig. 2) appears to be part of a washover fan deposited by Hurricane Carla in 1961. If this is the case, it means that the mud above the sand was deposited after Hurricane Carla and the rate of sedimentation can be calculated. This kind of information will help provide baseline data for comparing with sedimentation rates after diversion. Additional cores taken near MC1 would allow us to further define the extent of the sand horizon, including its distribution and thickness farther out in the bay. According to a long-term Matagorda resident who owns a local charter-fishing business, Hurricane Carla destroyed marine grassbeds (grassflats) along Matagorda Peninsula near the Colorado River Delta. The core from station MC1 offers partial documentation of this event. During the storm surge associated with Hurricane Carla, a substantial amount of sand was washed through washover channels into the bay and grassbeds, burying the marine grasses. This transport of sand across the peninsula is also documented in part by aerial photographs taken soon after Hurricane Carla.

Other cores show promise in helping to establish markers for determining future sedimentation rates after diversion. The cores collected at stations MC13 and MC14 are laminated with alternating layers of brown and gray mud (silt and clay) and have distinct sediment horizons near their base. The core from station MC14 was collected near the point where the mouth of the diversion channel will be located. If cores taken at these sites in the future show similar correlatable

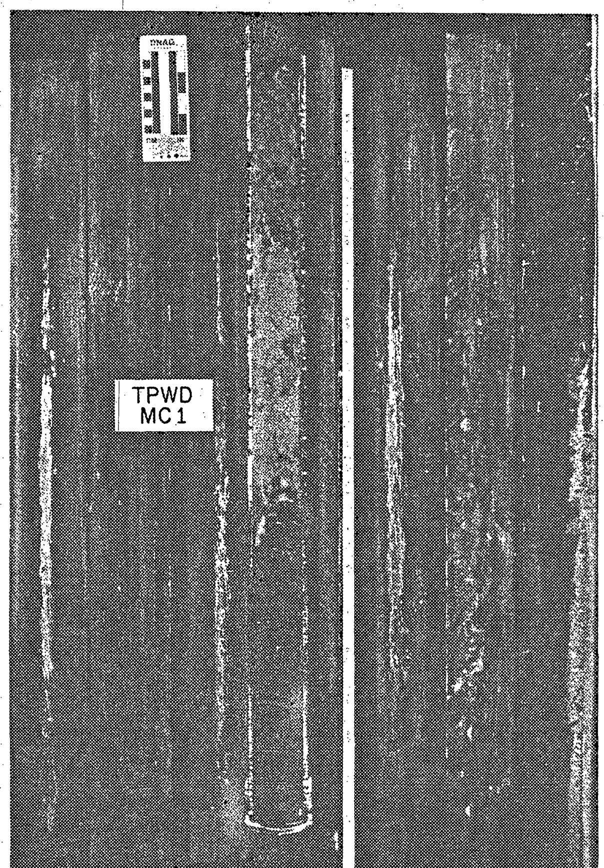


Figure 2. Photograph of core taken at station MC1.

horizons, they could help define future bay sedimentation and delta progradation rates.

Marsh Transects

Three marsh-transect sites were established in the proposed diversion area (table 2). Elevations and bearings of two of the transects were surveyed using a plane table (fig. 3), and one site was surveyed using profiling rods. Vegetation types and heights were recorded, and percentage of cover was estimated at selected sites along the transects. Two 1-m^2 marker beds of white feldspar clay, which will be used to determine sedimentation rates, were established along each of marsh transects 1 and 2. Elevations along marsh transect 1 were tied to a Corps of Engineers bench mark located at the edge of the bay. A profile constructed along part of transect 2 is shown in figure 4. Cedar posts were placed along the marsh transects at strategic locations, including the marker beds, and a 3-ft (1-m) brass rod was driven into the ground near the upper marker bed on transect 2 to serve as a backup sedimentation/erosion marker.

Conclusions

All tasks outlined in IAC(86-87)-1756 have been completed and final invoices for expenses are being prepared. This brief effort helped establish a well-defined network of sediment-sampling and hydrographic-data-collection stations, some of which are near Corps of Engineers fisheries-sampling sites, and marsh transects. The stations, transects, and collected data provide a sound foundation on which to base an expanded sampling program designed to monitor the temporal and spatial effects of Colorado River diversion on benthic sediment textures, geochemistry, benthic macroinvertebrates, delta progradation, and wetlands in Matagorda Bay near the mouth of the Colorado River.

Table 2. Marsh transects

Transect 1

Location: deltaic marsh near Culver Cut
Survey method: plane table and telescopic alidade (tied to Corps of Engineers bench mark)
Length: 300 ft (91.5 m)
Marker beds: 1-m^2 layers of white feldspar clay in:
(1) Scirpus maritimus (100%)
(2) Spartina alterniflora (90%), Scirpus maritimus (10%)

Transect 2

Location: Matagorda Peninsula near Zipprian Bayou
Survey method: plane table and telescopic alidade
Length: 637.9 ft (194.6 m)
Marker beds: 1-m^2 layers of white feldspar clay in:
(1) Spartina alterniflora (100%)
(2) Monanthochloe littoralis (80%), Batis maritima (20%)
Brass pin also set adjacent to clay marker 2

Transect 3

Location: active delta along margin of Parker's Cut
Survey method: profiling rods
Length: 400 ft (122 m)
Marker beds: none
Predominant vegetation along transect:
On levee and levee flank of distributary channel:
Batis maritima and Distichlis spicata codominant, with scattered Borrichia frutescens, Lycium carolinianum, Salicornia virginica, Scirpus maritimus, and Iva frutescens
Grading from levee flank bayward:
Spartina alterniflora (makes up complete marsh community 400 ft [122 m] from beginning of transect at edge of distributary channel)

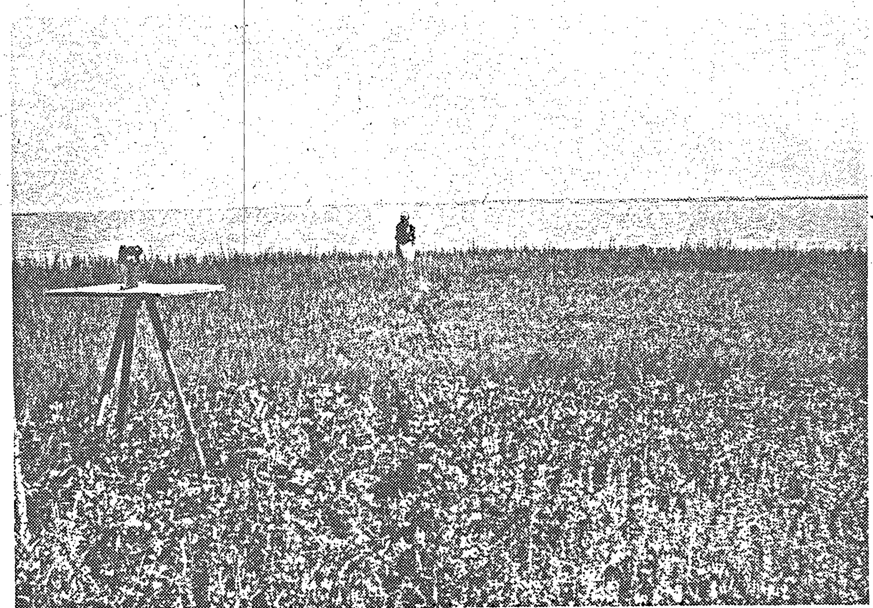
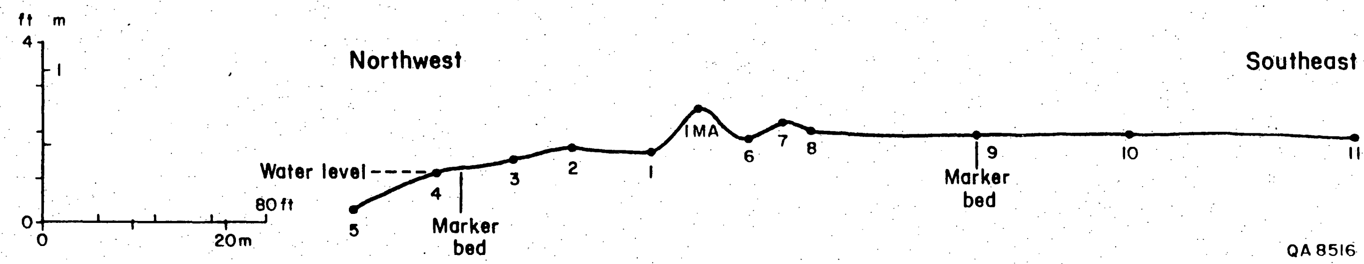


Figure 3. Plane table and telescopic alidade set up at station 1MA on marsh transect 2.



Station # Vegetation types

1MA *Borrichia frutescens* and *Spartina patens* codominant

1 Edge of *Borrichia frutescens* and *Spartina patens*, beginning of *Batis maritima* (composes 90% of community between 1 and 2)

2 *Distichlis spicata* dominant; scattered *Borrichia frutescens* and *Spartina alterniflora*

3 Edge of *Spartina alterniflora* dominance; scattered *Distichlis spicata*, *Salicornia virginica* and *Batis maritima*

4 *Spartina alterniflora*, about 60% cover

5 Edge of marsh; *Spartina alterniflora*, about 20% cover

6 *Batis maritima* dominant; scattered *Spartina patens*, *Salicornia virginica*, and *Borrichia frutescens*

7 *Spartina patens* dominant (75%), *Borrichia frutescens* subdominant (25%)

8 Edge of *Spartina patens*, beginning of *Batis maritima* dominance; scattered *Borrichia frutescens* and *Avicennia germinans*

9 *Monanthochloe littoralis* dominant (80%), *Batis maritima* subdominant (20%); scattered *Salicornia virginica*

10 *Batis maritima* dominant (80%); scattered *Salicornia virginica*, *Distichlis spicata*, and *Spartina alterniflora*

11 *Distichlis spicata* and *Batis maritima* codominant; edge of patch of *Scirpus maritimus*

Figure 4. Profile and vegetation types along one leg (approximately 360 ft or 110 m) of marsh transect 2 on Matagorda Peninsula near Zipprian Bayou.