



BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

University Station, Box X • Austin, Texas 78713-8924 • (512) 471-1534 or 471-7721 • FAX 471-0140
10100 Burnet Road, Bldg. 130 • Austin, Texas 78758-4497

October 13, 1997

Mr. Richard Medina
Chief
Environmental Resource Branch
Galveston District Office
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Reference: Contract No. DACW64-96-C-0018

Dear Mr. Medina:

Attached is a quarterly report for the referenced Contract for the reporting period of July 15, 1997, through October 15, 1997. If you have any questions regarding this report, please contact Dr. Morton, Principal Investigator.

Sincerely,

A handwritten signature in cursive script that reads "Lynda A. Miller".

Lynda A. Miller
Program Coordinator

LAM
Attachment

cc: R. Morton
J. Raney

Attachment 6

SEDIMENT CHARACTERISTICS, HISTORY, AND RECENT TRANSPORT,
LAGUNA MADRE, TEXAS

Bureau of Economic Geology
The University of Texas at Austin

Quarterly Progress Report

July 15 1997 to October 15, 1997

Prepared for the
Galveston District, U.S. Army Corps of Engineers

Task 1. Qualitative Analysis of Regional Sediment Budget

During this reporting period, substantial progress has been made in formulating a computational methodology for estimating eolian transport, to be coupled with the wind-velocity climatology for Laguna Madre. Both the wind profile in the boundary layer and the eolian flux must be computed, the latter being the sum of the suspended and saltation fluxes (that are computed separately). The computational model is sketched in the accompanying figure (attached), in which the lagoon environment is subdivided into three zones: Zone I, the upwind overwater reach (e.g., the ocean) over which the planetary boundary layer (PBL) is assumed to be in equilibrium; Zone II, the reach over the sediment source region (e.g., Padre Island), over which a new boundary layer develops from the leading edge of the island; and Zone III, the reach over the downstream watercourse, the Laguna Madre, into which the sediment is transported and deposited at the water surface. The computation consists of specification of the PBL wind profile in each zone, computing (from the wind-profile characteristics) the associated fluxes of saltation and suspension loads, and determination the net integrated deposition in Zone III. Details of this computation model are being worked out for use with the regional wind climatology data.

Task 2. Redistribution of Dredged Material

Subtask 1. Laboratory Analysis

Continued developing an ordinal ranking for reworking susceptibility at placement areas that considers water depth, composition of dredged material, ratio of submerged and

subaerial surface areas, and location of placement areas with respect to active processes (Table 7 attached).

Subtask 2. Field Investigation

Continued working with the equation ($E=O+M-R$), which compares the volume of material originally dredged (O), the cumulative maintenance dredging (M) and the remaining volume of dredged material in the placement area (R). O is derived from the 1995 bathymetric surveys, R is derived from the integrated 1994 and 1995 surveys as well as the cores analysis, and M is the summary value for the placement area provided by Espey Huston.

Obtained preliminary quantitative comparisons of cumulative volume of sediment dredged from the GIWW and remaining dredged material for the six placement areas using the three data sets that depict the bathymetry in Laguna Madre. The data sets are from the Galveston District Corps of Engineers soundings taken prior to dredging the GIWW and illustrated on the engineering plans of 1931-32, detailed topographic and bathymetric surveys conducted in 1994 in each of the placement areas by the Brownsville office of the Corps of Engineers, and the 1995 bathymetry surveyed by John Chance and Associates for the Waterways Experiment Station, Corps of Engineers.

Prepared tables that summarize the original volume of dredged material from a channel segment, cumulative maintenance dredging, remaining material, loss of dredged material, percent loss, and proportional shoaling in the adjacent channel segment (Table 6 attached). Also prepared a preliminary plot that relates proportional shoaling to the percent loss of dredged material (see Task 6).

Contacted Espey Huston and Associates, Corps of Engineers Waterways Experiment Station, and Texas A&M University Center for Dredging Studies to obtain information regarding in situ densities, water contents, and void ratios of sediments in Laguna Madre. Determined that these data are not available to adjust sediment volumes for time-dependent changes in physical properties in dredged material related to compaction and dewatering in the placement area that are not a function of deposition and erosion. Concluded that representative sediment samples and laboratory measurements would need to be obtained in order to adequately compensate for mass instead of volume in the dredged material reworking calculations (see Task 6). Obtained from WES several modules from the ADDAMS computer package and related technical reports that are relevant to the primary consolidation and desiccation of dredged material. Reviewed the reports and program documentation to see what input variables are needed to run the program modules.

Conducted a preliminary analysis of bathymetric changes at the experimental design sites at placement areas 233 and 234 based on field surveys conducted by the Brownsville office

of the Corps of Engineers. Concluded that additional work would be required to adequately assess the performance of the different designs (see Task 6).

Task 4. Historical Changes in Bathymetry and Sediment Type

Completed writing the analysis of spatial changes in dredged material at the six placement areas based on sequential examination of aerial photographs. Compiled information on land use in the Lower Rio Grande Valley. Began writing the report sections that describe the historical changes in land use practices in the upland areas that border Laguna Madre. Obtained from the Texas Parks and Wildlife Department, copies of original reports that showed the distribution of marine grasses in Laguna Madre in the 1960s.

Conducted literature review and summarized findings of the general biological effects of discharged oil field brines into marine waters. Obtained information from the Texas Railroad Commission regarding specific oil and gas operations in Laguna Madre and the regulations that pertained to discharge of drilling fluids and cuttings, and discharge of produced formation water into Laguna Madre during the 1950s and 1960s when some of the fields were first discovered. Began comparing petroleum field activity with the maps showing losses in marine grasses to see if there are any obvious spatial relationships.

Task 5. Technology Transfer

Continued writing sections of the final contract report including descriptions of each component of the sediment budget, storm effects, descriptions of the placement areas investigated, and core interpretations. Prepared additional graphics including plots of the 1930s and 1995 bathymetry, principal sediment sources, and typical morphologies of open-water disposal sites in Laguna Madre (see attached).

Presented a progress report on project activities at the ICT meeting in Austin on September 4, 1997 and presented a proposal to conduct a detailed analysis of bathymetric changes in PAs 233 and 234 related to construction of experimental designs (submerged levee, subaerial levee, submerged mound) using the field surveys conducted by the Brownsville office of the Corps of Engineers.

ATTACHMENTS

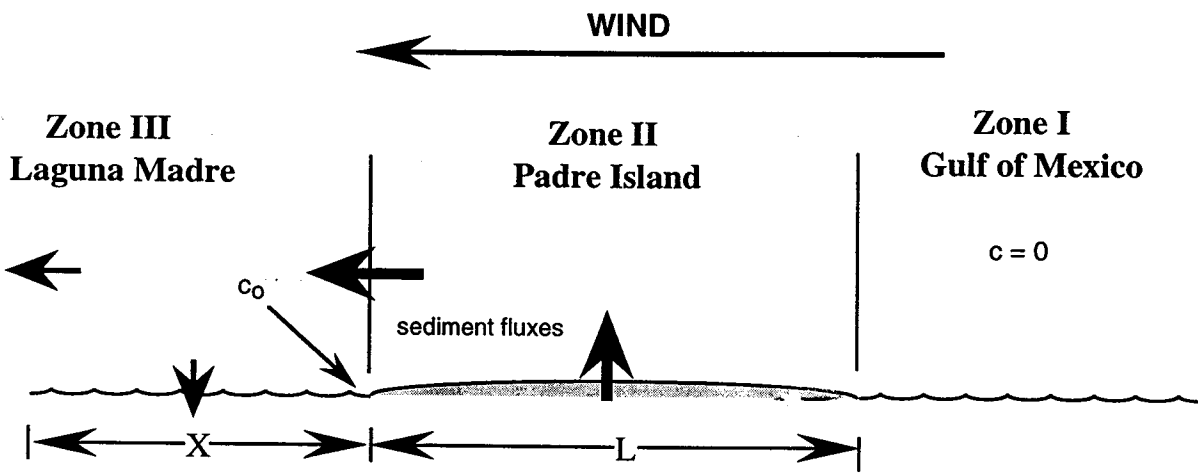


Table 7. Susceptibility of placement areas investigated to sediment reworking and dispersion.

PA	Water Depth (m)	N-NE Fetch (km)	S-SE Fetch (km)	Channel Width (m)	Composition Dredged Matl.	Shoal Rate m ³ /m	A _w /A _l	Rank
187	0.9-1.2	10-30	2-5	76	Shelly sand, muddy sand	534	961	
197	0.4-1.8	5-50	15-35	96	Shelly sand, sandy mud	920	002	
202	0.4-1.5	20-60	0-10	*	Shelly sand, sandy mud	790	001	
211	0.4-1.3	0-2	15-80	98	Muddy sand, sandy mud	616	002	
221	0.8-1.2	20-30	10-45	81	Mud, sandy mud	108	256	
233	0.6-1.5	40-60	15-20	91	Mud, sandy mud	1482	507	

* Water too deep and turbid for measurement

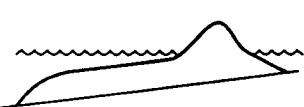
Table 6. Estimated reworking of dredged material at six placement areas along the Gulf Intracoastal Waterway. The original dredging value also includes any sediment eroded around the channel perimeter. Volumetric units, which are m³, have not been adjusted for density differences between higher density original sediments and lower density sediments dredged for channel maintenance.

Placement Area	Original Dredging (O)	Maintenance Dredging (M)	Remaining Material (R)	Loss (O+M-R)	Percent Loss	Proportional Shoaling (m ³ /m)
187	501,497	1,269,938	918,558	852,877	48.1	534
197	1,013,268	3,955,859	1,465,410	3,503,717	70.5	920
202	1,507,652	2,722,628	1,918,708	2,311,572	54.6	790
211	647,225	1,560,665	1,446,720	761,170	34.5	616
221	1,129,778	678,065	1,781,137	26,706	1.5	108
233	899,837	6,779,826	414,613	7,265,050	94.6	1482

PLAN VIEW

Island patterns	Placement area
a) Progressive changes in mounds	
	197, 211
b) Mound to ridge transition	
	202, 233
c) Narrow ridges	
	187, 221

TRANSVERSE CROSS SECTION

d) Decreased thickness	e) Uniform thickness
	
187 North 187 South	197 North A 197 South A
197 North B 197 South B	202 Central 202 South
202 North 221	211 North 211 Central
233 North A 233 North B	211 South 233 South

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