18 Apr 1973
SHORELINE PROCESSES

BE 47.03

CHARACTERISTICS OF GULF BEACHES; MUSTANG ISLAND AND NORTH PADRE ISLAND, TEXAS

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Mustang Island and northern Padre Island lie in a zone that is characterized by convergence of longshore drift. In effect, there is a meeting of nearshore currents moving generally westward from the Texas-Louisiana border and moving northward from the Rio Grand. Most consistent point of convergence of these currents is Latitude 27°N; however, the convergence zone shifts with changing wind conditions, to as far north as the middle of St. Joseph Island, or about Latitude 28°N. Along beaches in zones of longshore convergence, wave approach is virtually parallel to the shoreline and there is little or no lateral movement of water and sand. To the east and south of the zone of convergence, waves approach the shoreline at an angle thereby creating currents that are, in some areas, highly erosive, transporting sand away from a particular shoreline segment. The effect of longshore currents along the Texas coastline is the transport of sand from erosional shorelines to the east and south to the area of convergence between Latitudes 27°N and 28°N.

Beaches on Mustang Island and northern Padre Island are currently in equilibrium with existing physical conditions (wind, waves, currents, and tides) and with the sand supply. This means that over a relatively long period of time the beach neither accretes or erodes; however, over a short period of time any

particular beach segment may experience accretion or erosion, mostly related to storms or periodic (seasonal) changes in physical conditions.

Historical monitoring and on-the-ground measurements conducted by the Bureau of Economic Geology and others indicate that beaches from Aransas Pass southward for about 50 miles are, for the most part, in equilibrium and stable. Over the long period they neither accrete or erode. These beaches are, however, the only such stable beaches on the Texas coast.

Effects of Man-Made Structures

Any structure, large or small, built from the beach outward into the Gulf will intercept sand that moves along the shore. Immediately upcurrent from groins and jetties the beach will accrete and downcurrent from these structures the beach will erode. There are numerous structures on the Texas coast that have rather drastically altered sand transport. However, structures on the beaches of Mustang and north Padre Islands have less effect than elsewhere on the Texas coast, largely because these beach segments are in the zone of longshore convergence. Some modification does occur. An example is the jetty system at Aransas Pass. From the South Jetty southward for about four miles, the beach tends to be accretionary with average accretion of the beach about 10 feet per year. Southward beyond this accretionary area, some beach segments have undergone erosion at a rate ranging from 4 to 10 feet per year.

Damming of rivers inland of Mustang and north Padre Islands would have no direct effect on beach stability, because none of these rivers discharge directly into the Gulf. Hence any modification of the streams would not affect the sediment supply. This applies only to the Gulf beaches in this area.

Storm Effects

Beaches are often drastically changed when hurricanes strike coasts. Where the fore-island dune field is well developed, and in areas where man has not destroyed the dunes, waves generated by the storms expend their energy on the beach and seaward side of the dunes. As hurricanes build up and approach the coast, water level along the Gulf beaches begins to rise as a consequence of (1) a decrease in barometric pressure, and (2) because water is driven ahead of the approaching storm thereby stacking water against the shoreline. Large waves are generated by the storm and the rise in water level (storm tide) allows these waves to break on the beach and along the sea side of the fore-island dunes. Storms shift the swash and breaker zone onto the forebeach and backbeach areas. Breaking waves erode the area in front of the dunes to smooth, gently, seaward sloping surfaces. Sand eroded from the beach and dunes is transported and deposited a short distance offshore by currents generated by the storm tide and breaking waves. After the passage of the storm, the sand that was eroded from the beach and deposited offshore begins to move slowly back toward the beach under normal sea conditions. Bottom

and surface water currents, under normal sea conditions, are predominantly onshore, and in a matter of a few months sand has been restored to the eroded beach and the beach attains a profile virtually the same as before the storm. The effects of storms in terms of erosion and accretion of beaches is, thus, a short term effect rather than a long term one.

Conclusion

Beaches along Mustang and North Padre Islands are relatively stable owing to the fact that they are situated in a zone of longshore convergence and have a sediment supply balanced with physical conditions. As extensive beach segments these beaches are unique; most of the other main beach segments along the Texas coast are erosive. Man-made structures alter the basic circulating pattern and mode of sediment movement; due to reduced longshore drift along Mustang and North Padre, a function of longshore convergence, man-made structures have less effect than on other segments of Texas beaches. Damming of rivers inland of Mustang and North Padre will have no direct effect on the stability of these beaches because these rivers do not discharge sediment directly into the Gulf.