CESAM-EN-HD (1105) Greg Miller/690-3115/23 Jun 97

MEMORANDUM THRU EN-H

FOR PD-EC

SUBJECT: Mobile Harbor - Response to Comments on Beneficial Use Area

1. Reference enclosed subject comments received by ADEM on the proposed area for beneficial use of dredged material as described in Public Notice No. FP97-MH08-2. You requested we provide response to these comments.

2. It appears the location of the beneficial use area as currently identified in the public notice and the special survey should be reviewed, based on the comments. The 30-foot contour referenced in the public notice should be that which more or less parallels the west side of the Mobile Harbor channel in a generally north-south direction.

3. The comments imply that removal of 50 million cubic yards (CY) of material from the channel by dredging over the last century may have caused decreased elevations of the ebb-tidal shoals. Since the total volume of these shoals is estimated at 1.2 billion CY, the quantity removed by dredging would account for less than 5% of the total shoals volume. This volumetric change is not considered to translate into a significantly lower elevation of the shoals area.

4. Regarding suitability of material for placement in the beneficial use area, we have previously recommended an acoustic impedance survey of the project channel area as discussed in our 7 Jan 97 memorandum to OP-P, Subject: Mobile Harbor - Dredged Material Disposal for Water Quality Recertification. This type of survey would provide continuous information on material type throughout the project area. We understand efforts are now underway to obtain this survey for the river and bay sections of the channel.

5. We agree that the rate of disposal material migration would be increased by placement of the material in shallower depths. Our intentions for designation of this beneficial use area generally included cost-efficient disposal within the littoral zone. The operational cost to place the material in average depths of 15 feet as suggested in the comments will likely be increased over that expected for disposal of the material in deeper water. The comments also suggest that placement of material as indicated in the public notice may have negative impacts on Dauphin Island beach fluctuation by changing the incident wave climate. It is our opinion, however, that wave climate changes and consequent adverse impacts to the island shoreline would be more dramatic by placing the material in shallower depths.

6. The location now planned for disposal of suitable dredged material from the Mobile Harbor project channel is within the littoral system, and is therefore considered a beneficial use area. We appreciate the opportunity to respond to the subject comments. Please contact us if you have questions or need additional information.

Stephen R. Collinsworth

Encl
as

STEPHEN R. COLLINSWORTH
Chief, Coastal Engineering and
Hydraulic Design Section

# ADEM

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## DEPARTMENT OF ENVIRONMENTAL MANAGEMENT


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Fob James, Jr.
Governor

May 29, 1997

Dr. Susan Rees
Mobile District Corps of Engineers
P.O. Box 2288
Mobile, AL 36628

RE: FP97-MH08-2, a joint public notice describing the proposed Sand Island Beneficial Use Area

Dear Dr. Rees:

Please find enclosed a letter from Dr. Scott Douglass to ADEM providing his comments regarding the above referenced project proposal. ADEM will need to reconcile Dr. Douglass' comments prior to our providing Coastal Program and Water Quality certifications of the project. The U.S. Army Corps of Engineers consideration of these comments and input regarding them will be appreciated.

Sincerely,

B. Gane

Bradley W. Gane, Chief
Coastal Programs

cc: E. John Williford
John Carlton

Printed on Recycled Paper

Scott L. Douglass, Ph.D., P.E.
850 Cherry Ct.
Fairhope, AL 36532

May 14, 1997

Brad Gane
Chief, Coastal Programs
Alabama Department of Environmental Management
Mobile Field Office
2204 Perimeter Rd.
Mobile, AL 36615-1131

Dear Mr Gane:

This letter contains my comments on the US Army Corps of Engineers proposal to create a Sand Island Beneficial Use Area as requested in your letter of April 23, 1997. In that letter you asked for comments on the proposal based on the public notice and a 1996 bathymetric survey of a portion of the area west of the ship channel south of Dauphin Island. You specifically asked for comments regarding 1) the potential benefits of the proposal, 2) the feasibility that sand place in the "beneficial use area" will positively effect the beaches of Dauphin Island and offshore shoals, and 3) the potential for adverse effects on those beaches. These comments are based my understanding of the proposal, my specific understanding of the sediment dynamics of the Mobile Pass area, and my general knowledge of coastal, tidal inlet hydraulic and sedimentary processes.

I cannot comment on the specific location unless it is identified more clearly. The specific location of the proposed Sand Island Beneficial Use Area is not clearly marked on either document and the two documents show very different locations. The verbal description and map shown in the public notice indicate that the area will be "between Dauphin Island and Little Sand Island." Little Sand Island is not identified in the public notice and I don't know where it is. You have told me that the location description in the public notice is not correct. The 1996 survey "Mobile Bar Special Survey" you provided does not identify any area as the "Sand Island Beneficial Use Area." There are many miles of ocean floor "west of the 30 ft. contour" and there are several such contours in the vicinity.

I can, however, comment on the general concept outlined by the public notice and recommend some specific locations.

The proposal is "conceptually" an improvement for the health of the littoral system of the state including the beaches of Dauphin Island. An attempt to replace the natural sand bypassing across

the throat of the pass that is interrupted by the ship channel is a step in the right direction. The removal of sand from the outer bar of Mobile Pass (part a. of the Mobile Harbor, Alabama navigation project as described in the public notice) has possibly exceeded 50 million cubic yards of sand in the last century. Most of this sand has been removed from the littoral system of the State of Alabama and been disposed of in deeper water. This is a significant amount of sand by most relative measures. The annual removal rate is many times greater than the rate at which sand is moved along the beaches of Alabama to Mobile Pass. It is the same order of magnitude of volume that has been removed from all the federally maintained ship channels in Florida. In Florida, there is a fairly well-established link between the removal of sand at the ship channels and downdrift beach erosion. At Mobile Pass the linkage is not as clear but has been established as due to several mechanisms including removal of sand destined for the west end of Dauphin Island and the indirect exacerbation of the shoreline changes on the east end.[1] This indirect effect is due to the modification of the wave sheltering characteristics of the ebb-tidal shoals due to long-term starvation of sand from the east. Decreased shoal elevations in the vicinity of the ship channel probably result in a modified longshore sand transport climate on the east end of Dauphin Island. This has probably exacerbated the shift of sand from the eastern mile of beaches to the west.

Therefore, if located properly, placement of sands dredged from the outer bar of Mobile Pass in a "Sand Island Beneficial Use Area" is consistent with sound coastal engineering principles and beach management practices. One general coastal engineering principle is to minimize and avoid foreseeable detrimental impacts of coastal engineering works on adjacent areas. Another is to use sand dredged from a navigation project in a manner that is beneficial to society whenever possible. Both of these can be realized by artificially replacing the natural sand bypassing mechanisms that must be interrupted by navigation projects. If all of the sand dredged from the ship channel were placed in these shoals, the channel would have much less potential responsibility for the shoreline fluctuations of Dauphin Island.

It is my understanding from your letter that ADEM will have some control over what material is suitable for placement in the disposal area. The very limited available data on grain size distribution indicates that material dredged from the outer bar is a fine sand. This should be consistent with the sands in the Sand Island shoals. However, I suggest that ADEM develop a mechanism with the Mobile District that clearly and timely samples, analyzes, and reports the grain size distribution of all materials dredged as well as quantities and specific locations (geographical coordinates and depths) of dredging and placement. Although the Mobile District collects some of this information, there is no mechanism at present for its communication to ADEM. There should be such a reporting mechanism as part of the management of the beaches. The natural littoral system that the ship channel must pierce is the same littoral system that includes the beaches. Essentially, the state's coastal zone management program should know this information when any entity artificially moves, removes or adds sand to the state's littoral system.

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[1] Douglass, S.L. 1994 "Beach Erosion and Deposition on Dauphin Island, Alabama, U.S.A." *Journal of Coastal Research* 10:2:306-328.

Although the subject proposal is "conceptually" correct, the specific details are not. First of all, the implied depths are too deep. Coastal engineering research indicates that depths of 30 feet are too deep to expect sand to migrate landward at a reasonable rate. The rate of migration of sand features placed in the nearshore appears to be extremely dependent on depth. Off the Alabama coast the expected value of migration rate in a depth of 30 feet is less than 10 feet per year if the sand is exposed to the full Gulf of Mexico wave climate.[2] The corresponding rate for a depth of 15 ft. is 300 ft./yr. This implies that placing the sand in shallower water will ensure that it moves up into the critical upper portions of the ebb-tidal delta. These upper elevations of the ebb-tidal delta appear to be critical because sand there moves northwestward toward the west end of Dauphin Island while effecting the wave climate on the east end of the Dauphin Island. The natural, pre-ship-channel depths across the Mobile Pass outer bar were about 20 feet. Results of monitoring programs of the fate of nearshore placed sands throughout the US (including much larger wave climates in the Atlantic and Pacific Oceans) indicate that 30 feet is too deep to expect significant onshore migration. Second, the disposal site should be located on the southern facing slope of the ebb-tidal delta and be exposed to the full Gulf wave environment. The above migration rate estimates assume that it is. If it is not exposed to these forces, the fate of sand placed in it is much less certain. Third, if the disposal is in another location (such as that indicated by the public notice), it may have negative impacts on the beach fluctuation on Dauphin Island by changing the incident wave climate.

I suggest the following specific location for the "Sand Island Beneficial Use Area." Sand should be placed on the ebb-tidal shoal in the vicinity of latitude=30°11'08" and longitude=88°03'03". This location was about 15 feet deep on the 1958 bathymetry (1982 version of USGS 7.5 min topographic map for Fort Morgan Quadrangle). It is about 600 feet south of the lighthouse. The horizontal datum is not identified on the 1996 "Mobile Bar Special Survey" you provided and no fixed features are identified so I can't relate it to latitude and longitude. The depth and location in relation to the overall ebb-tidal shoal (on south facing slope) are more important than the specific latitude and longitude. I am guessing that a similar location in terms of these factors on the 1996 survey is N:351300; E:300800. Both factors, depth and location on the shoal, are critical to reasonably ensure migration into the critical upper elevations of the ebb-tidal shoal. A "Sand Island Beneficial Use Area" could be defined as the ocean floor between the following four locations: N=350100,E=306000; N=355200,E=307300; N=356500,E=302200; N=351300,E=300800. This defines about one square mile of ocean floor with depths ranging from 20 to less than 10 feet and an average depth around 15 feet. The east edge if this area is about ½ mile west of the ship channel.

Designating the above described area as the "Sand Island Beneficial Use Area" for sand dredged from the outer bar of the Mobile ship channel will 1) benefit the littoral system of the state, 2) ensure reasonable confidence based on the best available technology that sand will positively effect the shoals and, over the long-term, the shoreline of west Dauphin Island, and 3) minimize

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[2]Douglass, S.L. 1996 "Nearshore Sand Placement" *Proceedings of the 25th International Coastal Engineering Conference*, American Society of Civil Engineers, (in press)

the expected potential adverse effects on shoreline stability due to the dredged sand disposal practices of the ship channel. I think this proposal is consistent with the state's coastal zone management efforts and current guidance from the Office of the Chief Engineer of the Corps of Engineers. It is consistent with both established coastal engineering practice and developing trends in management of dredged sands in the U.S.

The fate of sand placed in these disposal sites should be monitored by the Mobile District. I suggest that this be a requirement of any nearshore placement or beach nourishment. There are a number of basic principles for such monitoring that are well understood by the staff of the Coastal Hydraulics Laboratory of the US Army Engineers Waterways Experiment Station.

It must be strongly noted (and emphasized to the public) that this designation of the "Sand Island Beneficial Use Area" will not provide relief to the beaches of the east end of Dauphin Island that are presently eroding. These beaches need sand. Specifically, the beaches from the flanked groin field south of the Dauphin Island Sea Lab west to the Audubon Place development are presently experiencing a significant loss of sand. The sand appears to be moving via wave-driven longshore sand transport to the beaches to the immediate west in the lee of Pelican Island. This shift of sand including the erosion has probably been exacerbated over the past several decades by a dredging-induced lowering of the shoals in the general vicinity of the lighthouse. The beach erosion will probably continue into the private homes at the Audubon Place and the homeowners are already building some non-engineered bulkheads and seawalls to resist it. This will damage and perhaps destroy the beach.

I suggest that the "most beneficial" use of sand dredged from the outer bar of the ship channel for society may be the direct placement on the eroded beaches west of the groin field. Since large amounts of sand are being handled several miles away, placement on these eroding beaches seems logical. It would be generally consistent with sound coastal engineering and coastal management practices and principles. There are cost issues and public access issues related to these beaches that should be considered with any tax-payer funded beach nourishment project such as suggested here.

Thank you for the opportunity to comment on this aspect of the management of the Alabama coast. The linkage between navigation projects and nearby beaches is an important one. We can, in Alabama, maintain world-class beaches and world-class ship and small-craft navigation channels if we make the commitment. If you have questions about any of the above comments, please call. I would be happy to meet with you or Mobile District personnel to discuss these issues.

Sincerely yours,

Scott L. Douglass

# 2 Theoretical Perspective

## Background

### Sediment transport

Sediment movement and near-bottom water velocities responsible for sediment movement in water depths of interest have been investigated by geologists, oceanographers, and engineers. The depths of interest are those depths beyond the daily surf zone but within a reasonable haul distance for the dredge contractor from shore. Typically, these depths will experience wave-generated currents during major storm events. Although the actual depths vary with wave climate, in general, they range from 2 to 60 m (7 to 197 ft).[1] For the geologist or oceanographer accustomed to considering the deep ocean, these depths might be referred to as the "inner continental shelf" or the "shoreface." For the coastal engineer accustomed to considering the surf zone, these depths of interest might be referred to as "offshore."

Mechanisms that can transport sediment include tidal currents, waves, wave groups, wind-generated currents, wave-current interactions, density-gradient-driven currents, rip currents, shelf circulation patterns driven by barometric pressure gradients, turbulent eddies and gravity. The relative importance of these mechanisms probably varies in time and with location. Wright (1987) and Wright et al. (1991) present a cross-disciplinary literature review focussed on what moves sediments in the cross-shore direction in these depths off the mid-Atlantic coast and specifically questions models for sediment transport which focus exclusively on the wave field while ignoring other current-generating mechanisms. One example of a wave-based conceptual model is Dean's equilibrium profile concept for the surf zone with its explanation based on wave energy dissipation. Another example is the general concept that the asymmetry of the wave orbital velocity field as predicted by nonlinear wave theories can preferentially move sediment onshore. The strong point of such models, their simplicity, is also their potential weakness since the dominant processes driving the phenomenon of

1 A table of factors for converting non-SI units of measurement to SI units can be found on page xi.