PRESENTATION TO THE

55TH COASTAL ENGINEERING RESEARCH BOARD

30 OCT-1 NOV 1991

(NATIONAL BERM DEMONSTRATION/MOBILE HARBOR)

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MOBILE DISTRICT

SLIDE 1 THE CONCEPT OF BERM CONSTRUCTION AND THE NATIONAL DEMONSTRATION HAS BEEN BRIEFLY DISCUSSED AT PREVIOUS CERB MEETINGS INCLUDING THE RECENT ONE IN NEW ORLEANS THAT HIGHLIGHTED THE MONITORING RESULTS.

SLIDE 2 YOU PROBABLY ALL HAVE SEEN THIS SLIDE BEFORE WHICH REPRESENTS THE CONCEPT OF BERM CONSTRUCTION FROM DREDGED MATERIAL.

SLIDE 3 THE DEMONSTRATION PROJECT AT MOBILE HARBOR INVOLVED USE OF MAINTENANCE MATERIAL FROM THE OUTER BAR CHANNEL TO CONSTRUCT A FEEDER BERM AND NEW WORK MATERIAL FROM THE DEEPENING PROJECT TO CONSTRUCT THE STABLE BERM. BEFORE DISCUSSION OF THIS PROJECT, I WILL GIVE SOME BACKGROUND OF HOW MOBILE BECAME PART OF THE NATIONAL DEMONSTRATION.

SLIDE 4 HERE ARE SOME OF THE MOBILE HARBOR FEATURES PRIOR TO THE 1986 WRDA WHICH AUTHORIZED DEEPENING AND WIDENING OF THE PROJECT. THE BAY CHANNEL IS ABOUT 30 MILES IN LENGTH. THE BAR CHANNEL ABOUT 6 MILES LONG. PAST PRACTICES WERE TO PLACE THE BAY MAINTENANCE IN OPEN WATER ADJACENT TO THE CHANNEL AND TO DISPOSE OF THE BEACH QUALITY SAND FROM THE BAR INTO AN EPA DESIGNATED SITE IN ABOUT 40 FEET OF WATER. UNLIKE MANY PROJECTS, OUR OCEAN DISPOSAL SITE WAS EXTREMELY CLOSE TO THE CHANNEL.

SLIDE 5 THE 1986 WRDA INCREASED THE BAY CHANNEL DIMENSIONS FROM 40'X 400' TO 55'X 550' AND THE BAR FROM 42'X 600' TO 57'X 700'. THE ACT REQUIRED THAT THE NEW WORK AND ALL FUTURE MAINTENANCE FROM THE BAY AND BAR BE PLACED INTO THE OCEAN SITE WHICH WAS EXPANDED TREMENDOUSLY TO THE WEST. THERE WERE LONG-STANDING CONCERNS OF EROSION ON DAUPHIN ISLAND AND THE EMERGENT PART OF THE EBB TIDAL SHOAL OFF OF DAUPHIN ISLAND. JUST PRIOR TO OUR INVOLVEMENT IN THE BERM PROJECT, WE WERE PURSUING LITTORAL DISPOSAL OF THE SANDY MATERIAL FROM THE BAR USING SHALLOW DRAFT HOPPER DREDGES THAT HAD BECOME AVAILABLE IN RECENT YEARS IN THE EXPANDING INDUSTRY HOPPER FLEET. FOR THE SHALLOW DRAFT DREDGES THE HAUL DISTANCE WAS ABOUT THE SAME AS TO THE TRADITIONAL SITE. WE HAD GAINED ENVIRONMENTAL ACCEPTANCE OF THE CONCEPT AND IN FACT WERE PRACTICING IT AT OTHER PROJECTS WHERE THE EQUIPMENT WAS AVAILABLE AT NO INCREASED COST. OUR PLAN WAS SIMPLY TO SPECIFY A LARGE AREA IN RELATIVELY SHALLOW WATER AND ALLOW THE SMALLER HOPPERS TO PLACE THE MATERIAL AS CLOSE TO SHORE AS REASONABLE.

SLIDE 6 AT THE MOBILE BAR CHANNEL, DIRECT PLACEMENT ON THE BEACH IS MORE THAN THREE TIMES THE COST OF ROUTINE MAINTENANCE UTILIZING LITTORAL ZONE PLACEMENT. SUCH PLACEMENT WOULD HAVE TO BE PERFORMED BY VERY LARGE PIPELINE DREDGES DUE TO THE EXPOSED SEA CONDITIONS OR BY HOPPER DREDGE WITH DIRECT PUMP-OUT.

SLIDE 7 OUR OBJECTIVE, EVEN BEFORE THE DEMONSTRATION WAS TO ACCOMPLISH THE MISSION COST EFFECTIVELY AND IN AN ENVIRONMENTALLY ACCEPTABLE MANNER. IN MORE RECENT YEARS UNDER GENERAL HATCH'S INITIATIVE, WE HAVE BEEN SEEKING OPPORTUNITIES TO UTILIZE DREDGED MATERIAL IN BENEFICIAL WAYS, CONSISTENT WITH AUTHORITY AND FUNDING CONSIDERATIONS.

SLIDE 8 THEREFORE, WHEN CERC AND WHAT WAS THEN THE DREDGING DIVISION AT FT. BELVOIR APPROACHED US REGARDING PARTICIPATION IN A DEMONSTRATION PROJECT, WE WERE READY AND ANXIOUS TO COOPERATE. WITH THEIR ADVICE, WE CONVERTED THE GENERAL LITTORAL PLACEMENT CONCEPT INTO A DEFINABLE FEATURE WHICH BECAME KNOWN AS THE FEEDER BERM, INTENDED TO PROVIDE A SUPPLEMENTAL SAND SOURCE TO THE SAND ISLAND/DAUPHIN ISLAND COMPLEX. WE ALSO DEVELOPED A DESIGN FOR THE STABLE BERM TO CONTAIN ALL OF THE MATERIAL FROM THE DEEPENING.

SLIDE 9 AT THE TIME OF THE DEMONSTRATION, THERE WAS LITTLE TO NO GUIDANCE FOR BERM CONSTRUCTION. GENERAL KNOWLEDGE OF THE COASTAL PROCESSES IN THE AREA, PAST EXPERIENCES AND THE COMBINED EXPERTISE OF THE DISTRICT AND CERC LED TO THE SPECIFICATIONS FOR CONSTRUCTION OF THE PROJECT. IN THE CASE OF THE FEEDER BERM, THE LOCATION FROM A DEPTH STANDPOINT WAS GOVERNED BY THE DRAFT REQUIREMENTS OF THE SHALLOW HOPPER DREDGES. IN ORDER TO ACCOMPLISH MONITORING SUFFICIENT TO DOCUMENT MOVEMENT OF THE SANDY MATERIAL, A SIGNIFICANT AND DEFINABLE FEATURE WAS NEEDED. THE SPECIFIC LOCATION CONSIDERED PROXIMITY TO THE CHANNEL FOR SHORTENED HAUL DISTANCE BUT SUFFICIENTLY REMOVED TO AVOID REENTRY OF MATERIAL INTO THE CHANNEL. THE STABLE BERM WAS LESS CONTROLLED BY EQUIPMENT LIMITATIONS, BUT DID REQUIRE SUFFICIENT DRAFT FOR THE SEAGOING SCOWS THAT WERE USED FOR CONSTRUCTION. THE DESIGN ESSENTIALLY ACCOMMODATED THE LARGE VOLUME OF MATERIAL WITH ASSUMED SIDE SLOPES OF 1:100 LOCATED WITHIN AN AREA DESIGNATED THROUGH THE EPA OCEAN DUMPING GUIDELINES. THE BERM WAS LOCATED TO MINIMIZE HAUL DISTANCE AND TO LEAST IMPACT OTHER USES OF THE GULF AREA SUCH AS FISHING, OIL AND GAS DEVELOPMENT, GENERAL NAVIGATION, AND AN ARCHAEOLOGICAL SITE. THE MASSIVE FEATURE WAS ALIGNED ALONG EXISTING BATHYMETRIC CONTOURS.

SLIDE 10 BEFORE STARTING THE DEMONSTRATION, THE DISTRICT COORDINATED WITH CONGRESSIONAL OFFICES, THE NON-FEDERAL SPONSOR, STATE AND FEDERAL RESOURCE AGENCIES, AND LOCAL ENVIRONMENTAL AND NAVIGATION INTERESTS. WITHIN A SHORT TIME, WE HAD GAINED THE SUPPORT OF ALL.

SLIDE 11 THE LOCATION OF THE DEMONSTRATION ACTIVITIES ARE OFF THE COAST OF DAUPHIN ISLAND, AL. AS SHOWN.

SLIDE 12 THIS SHOWS THE LOCATIONS OF THE FEEDER AND STABLE BERMS. THE FEEDER BERM WAS LOCATED ON THE FLANK OF THE EXTENSIVE EBB TIDAL SHOAL WITH THE EXPECTATION THAT THE SAND WOULD GRADUALLY MOVE TOWARD DAUPHIN ISLAND AS SHOWN BY THE ARROWS.

SLIDE 13 THE FEEDER BERM WAS CONSTRUCTED WITH SANDY MAINTENANCE MATERIAL FROM THE BAR CHANNEL AS PART OF A ROUTINE MAINTENANCE DREDGING CONTRACT. IN JAN AND FEB 1987 ABOUT 450,000 CY OF MATERIAL WERE PLACED IN 18-19 FEET OF WATER TO FORM A BERM 6 FT IN HEIGHT AND 1 MILE LONG.

SLIDE 14 THESE TWO SHALLOW DRAFT SPLIT HULL HOPPER DREDGES OWNED BY GULF COAST TRAILING PERFORMED THE WORK IN A SUPERB FASHION.

SLIDE 15 THE STABLE BERM WAS CONSTRUCTED FROM MATERIAL FROM PHASE I OF THE DEEPENING PROJECT. IT BEGAN IN FEB 1988, AND WAS COMPLETED IN MAY 1990. SOME 16.6 M CY OF MATERIAL WAS PLACED IN 40 FEET OF WATER CREATING A FEATURE ABOUT 20 FT IN HEIGHT. THE DROP ZONE FOR THE MATERIAL WAS 1,000' BY 9,000', WHICH WITH APPROXIMATELY 1:100 SIDE SLOPES FORMED A BERM ABOUT 1 MILE BY 2 1/2 MILES AT ITS BASE. AS SUCH, IT IS THE LARGEST UNDERWATER FEATURE EVER CONSTRUCTED IN THE UNITED STATES.

SLIDE 16 THIS MAP SHOWS THE LIMITS OF THE PHASE I DEEPENING PROJECT. THE BAY CHANNEL WAS DEEPENED FROM 40 TO 45 FEET; THE BAR CHANNEL FROM 42 TO 47 FEET, A TOTAL DISTANCE OF 36 MILES. THE BAY WORK WAS PERFORMED BY MECHANICAL DREDGE AND DUMP SCOWS WITH AN AVERAGE ROUND TRIP DISTANCE OF 54 MILES. THE BAR DREDGING WAS PERFORMED BY HOPPER DREDGES.

SLIDES 17-20 THESE SLIDES SHOW THE DREDGE CHICAGO WHICH IS THE LARGEST BUCKET DREDGE IN THE WORLD AND THE 6,000 CY SCOWS WHICH WERE USED TO TRANSPORT THE MATERIAL TO THE PLACEMENT AREA. THE DREDGED MATERIAL IN THIS SLIDE CAN BE SEEN TO BE COHESIVE WHICH NO DOUBT CONTRIBUTED TO THE CONSTRUCTABILITY OF THE BERM. IN A GENERAL WAY,THE BAY CHANNEL SOILS WERE PREDOMINATELY SOFT PLASTIC CLAYS AND SILTS, WITH LENSES AND POCKETS OF SANDY AND ORGANIC SOILS AND OYSTER SHELLS.

SLIDE 21 THE BAR CHANNEL WAS MORE VARIABLE CONTAINING MIXTURES OF SANDS, CLAYS, AND SHELLS. THIS PART OF THE PROJECT WAS PERFORMED BY MEDIUM CLASS HOPPER DREDGES.

SLIDE 22 THE MOBILE DEMONSTRATION WAS THE FIRST EVER EXTENSIVELY MONITORED PROGRAM TO ASSESS AND DOCUMENT THE BEHAVIOR OF THE BERMS AND WHETHER BENEFITS WERE PRODUCED. THE MONITORING PROGRAM PRIMARILY WAS DEVELOPED AND CONDUCTED BY THE MOBILE DISTRICT AND CERC. THE ENVIRONMENTAL LAB AT WES AND THE NATIONAL MARINE FISHERIES SERVICE CONTRIBUTED SIGNIFICANTLY TO THE EFFORT. THE DREDGING RESEARCH PROGRAM (DRP) WAS GETTING UNDERWAY DURING THE EARLY STAGES OF THE MONITORING PROGRAM, AND SOON BECAME INVOLVED IN WORK UNIT ACTIVITIES ASSOCIATED WITH AND IN SUPPORT OF THE BERM MONITORING. I WOULD ADD THAT EPA AT THE OUTSET, WAS EXTREMELY COOPERATIVE IN ADAPTING THE OCEAN DUMPING MONITORING REQUIREMENTS FOR THE CONSTRUCTION PROJECT TO THE BERM CONCEPT.

SLIDE 23 MONITORING ON THE FEEDER BERM INCLUDED BATHYMETRY, SEDIMENTS, BOTTOM CURRENTS AND WAVE CLIMATE. WITHIN THE FIRST YEAR, SCATTERED PEAKS HAD BECOME FLATTENED AND THE BERM WAS SLOWLY MOVING NORTHWARD AND WESTWARD. THE BERM IS STILL DEFINABLE, BUT HAS GRADUALLY BROKEN INTO SEVERAL DISTINCT SECTIONS, AND IS NOW MERGING WITH THE EBB TIDAL DELTA.

SLIDE 24 FOR THE STABLE BERM DEMONSTRATION, THE ENTIRE BERM IS NOT BEING MONITORED, BUT ONLY A TEST SECTION THAT WAS THE FIRST PART OF THE BERM CONSTRUCTED. MONITORING ELEMENTS INCLUDED BATHYMETRY, CORES, WAVE DATA, SIDE-SCAN SONAR, SUBBOTTOM PROFILES, BENTHIC AND FISHERIES SURVEYS. AFTER AN INITIAL PERIOD OF ADJUSTMENT, THE TEST AREA HAS BEEN RELATIVELY STABLE SINCE JANUARY 1989.

SLIDE 25 IN SUMMARY, THE DEMONSTRATION HAS REVEALED THE BERM ACTIVITIES TO HAVE RESULTED IN NO WAY NEGATIVELY, WHICH IN ITSELF IS A VERY POSITIVE FINDING CREATING POTENTIAL FOR LARGE DOLLAR SAVINGS AT PROJECTS WHERE HAUL DISTANCE CAN BE REDUCED. THE MOBILE DEMONSTRATION PROJECT WAS VERY SUCCESSFUL AND HAS GAINED BROAD BASED SUPPORT FROM THE RESOURCE AGENCIES AND THE GENERAL PUBLIC. SAND TRANSPORT FROM THE FEEDER BERM IS OCCURRING AS ENVISIONED, WITH A STEADY LANDWARD MIGRATION. THE STABLE BERM IS INDEED RELATIVELY STABLE AND HAS BEEN DOCUMENTED DURING VARIOUS SEA CONDITIONS, TO SIGNIFICANTLY DISSIPATE WAVE ENERGY BY AS MUCH AS 70%. FISHERY BENEFITS ARE ENCOURAGING, PARTICULARILY WITH "AGING" OF THE HABITAT FEATURES. THE MULTI-FACETED DEMONSTRATION WHICH INVOLVED MANY ELEMENTS OF THE CORPS THROUGHOUT THE COUNTRY WAS THE RECIPIENT OF THE SOUTH ATLANTIC DIVISION PLANNING TEAM OF THE YEAR AWARD.

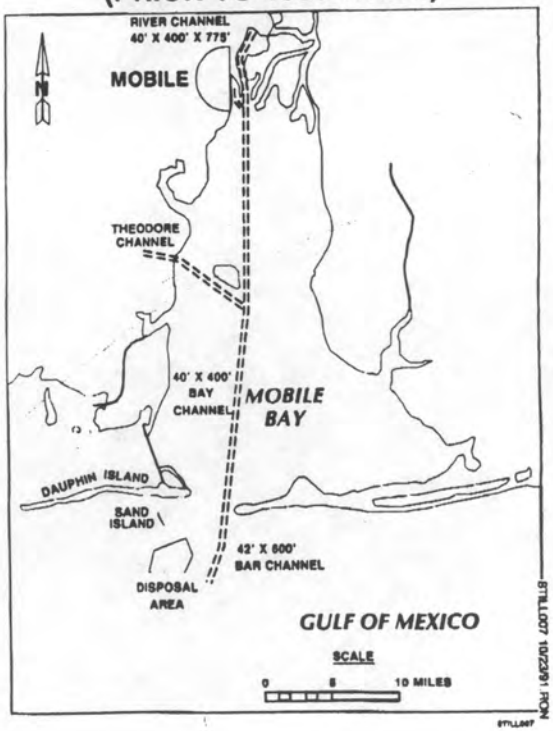
SLIDE 26 THERE HAVE BEEN OTHER SPINOFFS RESULTING FROM THE MOBILE DEMONSTRATION PROJECT, PARTICULARLY ACTIVITIES UNDER THE DRP. THE LARGE SCALE MONITORED FEATURES IN MOBILE HAVE PROVIDED OPPORTUNITY FOR THE DRP TO CONDUCT A MAJOR FIELD DATA COLLECTION EXPERIMENT, TESTING EQUIPMENT, INSTRUMENTATION AND A PLUME MEASURING AND TRACKING SYSTEM. THE DATA COLLECTED FROM THE EXPERIMENT HAVE BEEN USED IN DEVELOPING, CALIBRATING AND VERIFYING NUMERICAL MODELS. THE DATA FROM THE DEMONSTRATION PROJECTS, AS WELL AS FROM OTHER BERM PROJECTS, HAVE ENABLED ESTABLISHMENT OF A PREDICTIVE CORRELATION AS TO WHETHER A SITE WILL BE A FEEDER OR STABLE ENVIRONMENT FOR PLACEMENT OF DREDGED MATERIAL. THE UNDERTAKING AT MOBILE HAS ALSO PROVIDED THE BASIS FOR SIX ADDITIONAL BERMS CONSTRUCTED IN NEW YORK, TEXAS, AND CALIFORNIA.

SLIDE 27 WHILE THE BERMS AT MOBILE HAVE BEEN VERY SUCCESSFUL, AND HAVE PROVIDED GENERAL BERM DESIGN GUIDANCE, ADDITIONAL DESIGN GUIDANCE IS NEEDED TO INCREASE THE USE OF THE CONCEPT. THE PRIMARY NEED FOR CE DISTRICTS IS THE ABILITY TO SELECT THE LEAST COSTLY PLACEMENT LOCATION THAT RESULTS IN AN ENVIRONMENTALLY SUSTAINABLE PROJECT. THEREFORE, ADDITIONAL INFORMATION AND PREDICTIVE TECHNIQUES ARE NEEDED TO CONVINCE OURSELVES AND THE RESOURCE AGENCIES THAT LOWER COST OPTIONS, PROPERLY PLANNED, MAY PRODUCE BETTER SOLUTIONS. THIS WILL REQUIRE MORE STUDY OF PLACMENT TECHNIQUES AND ASSESSMENT OF ENVIRONMENTAL AND ECONOMIC BENEFITS ASSOCIATED WITH BOTH BERM CONCEPTS. PRESENT EQUIPMENT LIMITS CERTAIN BERM LOCATIONS AND CONFIGURATIONS AND SHALLOWER WATER PLACEMENT TECHNIQUES SHOULD BE INVESTIGATED. FOR BERMS INTENDED TO DIRECTLY NOURISH THE BEACH, WE NEED TO KNOW WHEN, WHERE, AND IN WHAT QUANTITIES IT WILL OCCUR. FOR BOTH BERM CONCEPTS, THERE NEEDS TO BE MORE DEFINITIVE INFORMATION ON REDUCTION OF WAVE ENERGY AND A POSSIBLE CORRESPONDING DECREASE IN BEACH EROSION AND FLOODING.

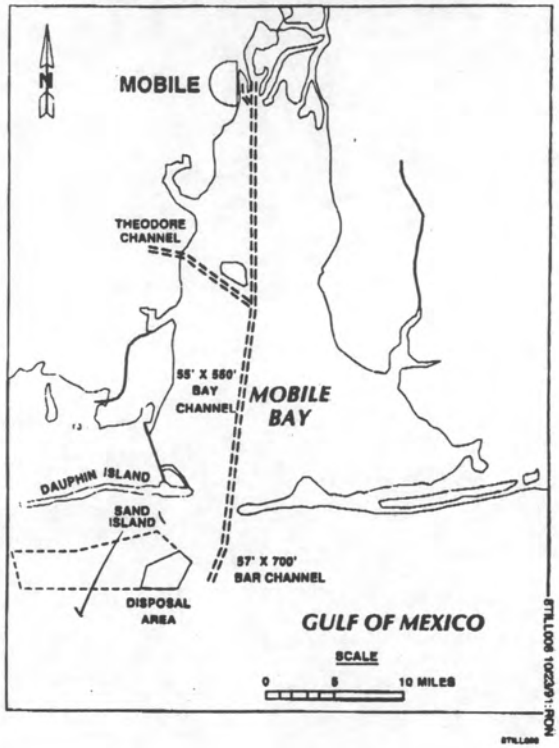
NATIONAL DEMONSTRATION MOBILE HARBOR

- **FEEDER BERM**
  - **MAINTENANCE DREDGING**
  - **450,000 CUBIC YARDS**
- **STABLE BERM**
  - **PHASEI DEEPENING**
  - **16,600,000 CUBIC YARDS**

MOBILE HARBOR, AL
(PRIOR TO 1986 WRDA)

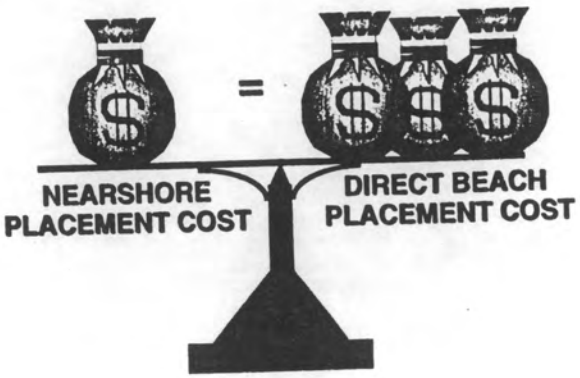


MOBILE HARBOR, AL
(AUTHORIZED BY 1986 WRDA)



ACCOMPLISH MISSION

- COST EFFECTIVE
- ENVIRONMENTALLY RESPONSIBLE
- BENEFICIAL USE



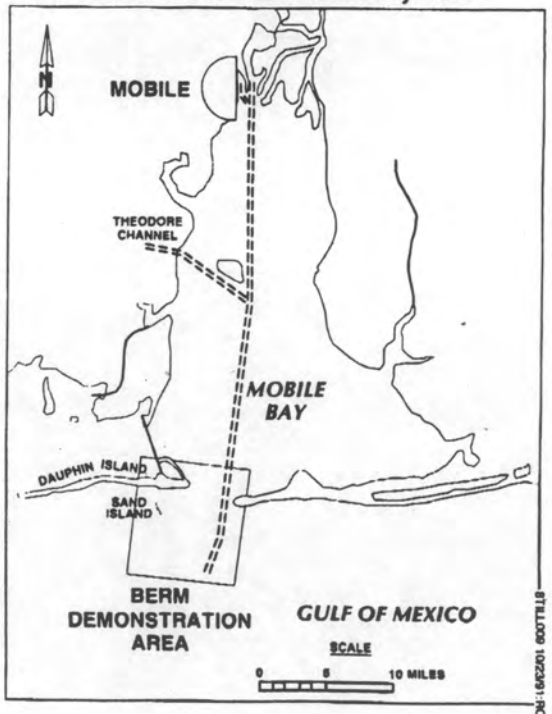
DEMONSTRATION

- GENERAL LITTORAL PLACEMENT CONVERTED TO DEFINABLE FEATURE (FEEDER BERM)
- DEVELOPED STABLE BERM DESIGN

DESIGN GUIDANCE

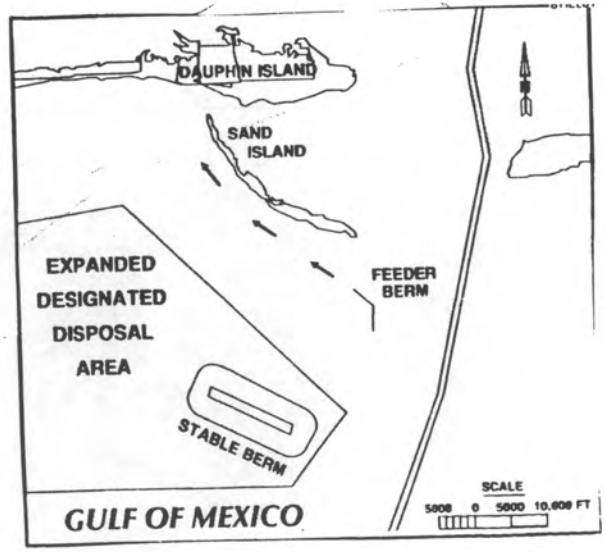
- LITTLE TO NONE AVAILABLE
- FEEDER BERM CONSIDERATIONS
  - DEFINABLE FEATURE
  - CONSTRUCTION EQUIPMENT LIMITATIONS
  - LOCATION (ECONOMY & RE-ENTRY OF MATERIAL)
- STABLE BERM CONSIDERATIONS
  - LESS CONTROLLED BY EQUIPMENT
  - LOCATION (ECONOMY & OTHER USES)
  - ALIGNMENT

MOBILE HARBOR, AL



COORDINATION

- CONGRESSIONAL
- NON-FEDERAL SPONSOR
- STATE/FEDERAL RESOURCE AGENCIES
- LOCAL NAVIGATION/ ENVIRONMENTAL INTERESTS



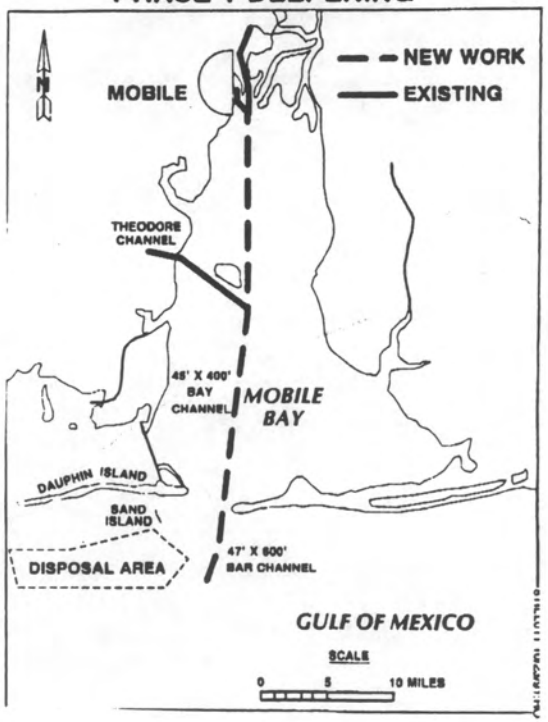
FEEDER BERM

- MAINTENANCE OF BAR CHANNEL
- JAN/FEB 87
- 450,000 CUBIC YARDS SAND
- 18'-19' WATER DEPTH
  - 6' RELIEF
  - ONE MILE LONG

STABLE BERM

- PHASEI HARBOR DEEPENING
- FEB 88 - MAY 90
- 16,600,000 CUBIC YARDS
- 40' WATER DEPTH
  - CREST 1,000' X 9,000'
  - BOTTOM 1 MILE X 2 1/2 MILES
- LARGEST UNDERWATER FEATURE

MOBILE HARBOR, AL
PHASE 1 DEEPENING



MOBILE DEMONSTRATION

- FIRST-EVER EXTENSIVE MONITORING TO ASSESS & DOCUMENT
  - BEHAVIOR OF BERMS
  - BENEFITS PRODUCED
- MOBILE DISTRICT AND COASTAL ENGINEERING RESEARCH CENTER
  - ENVIRONMENTAL LAB
  - NATIONAL MARINE FISHERIES SERVICE
  - DREDGING RESEARCH PROGRAM
  - ENVIRONMENTAL PROTECTION AGENCY

STABLE BERM MONITORING

- HYDROGRAPHIC SURVEYS
- SEDIMENTS/PROFILING
- TELEMETERED WAVE SYSTEM
- BENTHIC STUDIES
- FISHERIES STUDIES

FEEDER BERM MONITORING

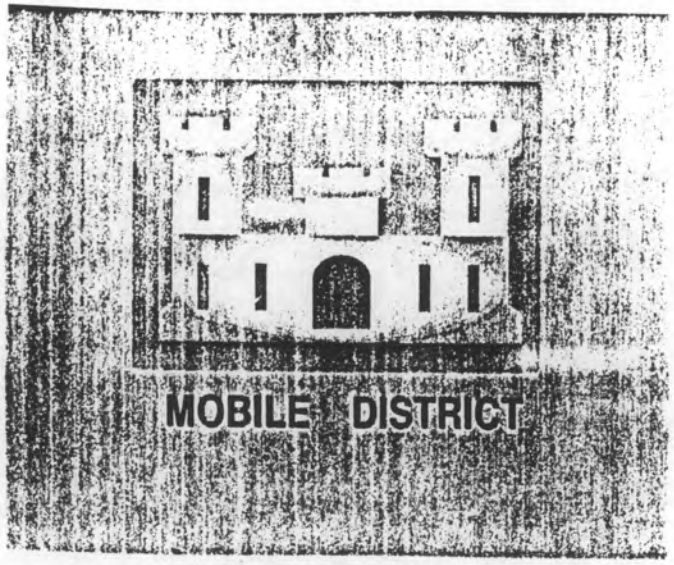
- HYDROGRAPHIC SURVEYS
- SEDIMENTS
- TELEMETERED WAVE/CURRENT SYSTEM
- SEABED DRIFTERS

PROGRAM SUMMARY

- NOTHING BAD CAME FROM IT!
- WAS VERY SUCCESSFUL!
  - BROAD BASED SUPPORT
  - SAND TRANSPORT AS ENVISIONED
  - SIGNIFICANT WAVE ENERGY DISSIPATION
  - FISHERY BENEFITS ENCOURAGING
  - SAD 1990 PLANNING TEAM OF YEAR AWARD

SPINOFFS

- DRP ACTIVITIES
  - PLUME TRACKING
  - INSTRUMENTATION
  - MODEL REFINEMENT
  - PREDICTIVE GUIDANCE
- OTHER BERMS

ADDITIONAL NEEDS

- LEAST COSTLY/ ENVIRONMENTALLY SUSTAINABLE
- BETTER INFORMATION/ PREDICTIVE TECHNIQUES
- PLACEMENT/EQUIPMENT TECHNIQUES