Table 5
Geotechnical Properties of Postplacement Sediments – December 1998

Test Type	Sample Identification PD1 Probe Lab Sample 5	 PD2 NE Lab Sample 3	 PD3 NW Lab Sample 4	 PD4 SW Lab Sample 1	 PD5 SE Lab Sample 2
Initial density g/cm^3 (lb/ft^3)	1.48 (92.69)	1.57 (98.06)	1.51 (94.45)	1.50 (93.36)	1.42 (88.59)
Max. void ratio[1]	5.43	6.28	6.03	6.98	5.19
Classification[2]	CH	CH	CH	CH	CH
Liquid limit [3]	71	69	69	65	62
Plastic limit [4]	25	26	24	25	24
Plasticity index[5]	46	43	45	40	38
Specific gravity[6]	2.76	2.65	2.73	2.74	2.65
% sand	15	27	20	27	21
% silt and clay	85	73	80	73	79

[1] The ratio of the volume of the voids to the volume of solid particles in a given sediment mass.
[2] Unified Soils Classification – Inorganic clays of high plasticity, fat clay (CH).
[3] The water content expressed as a percentage of the weight of oven-dried sediment at which sediment passes from plastic to liquid state based on standard test.
[4] The lowest water content expressed as a percentage of the weight of oven-dried sediment at which sediment remains plastic based on standard test.
[5] The difference between the liquid limit and the plastic limit.
[6] The ratio of the weight of given volume of sediment in air to an equal volume of distilled water at a given temperature.

The sediment was analyzed as before with the laser particle counter and compared to the predisposal sediment sample distribution. All of the previous samples around the mound were resampled using the DGPS positioning. Table 6 gives the means of these samples. The sediment types are shown in Figure 36 with an increase in fine Mobile River sediments in the mound area, scour trough and to the east of the scour trough. Most of the sediments collected within the placement area show sedimentological evidence of mixing river sediments with the native distributions. Specific cohesive, fine-grained river sediment characteristics were found in the grain-size distributions of samples 2-4, 2-5, 3-5, 4-3probe, 4-4, on the mound; and 6-4 and 7-3 to the east of the scour trough. Samples 0-3, 1-1, on the west side of the placement area exhibited a higher percentage of fine river type sediment mixing, as well as samples 5-1, 5-4 in the trough, and 7-1 and 7-4 to the east of the trough. Samples 7-A and 9-A, collected for the first time at the base of the trough exhibited a mixing of fine sand and silt material, more characteristic of the native shelf sediments and not of the river samples. Only a few samples (4-5, 5-5, 6-5 and 7-5), all located near the northern edge of the placement area, retained their native fine sand sediment characteristics. All of the samples above the -9.1-m (-30-ft) contour (north of the placement area) remained unchanged in their fine sand sediment type after placement. Samples to the south and west of the placement area for the most part showed some increase in fine-grained material after placement, most likely from movement of the fines into deeper water on the shoal edge.

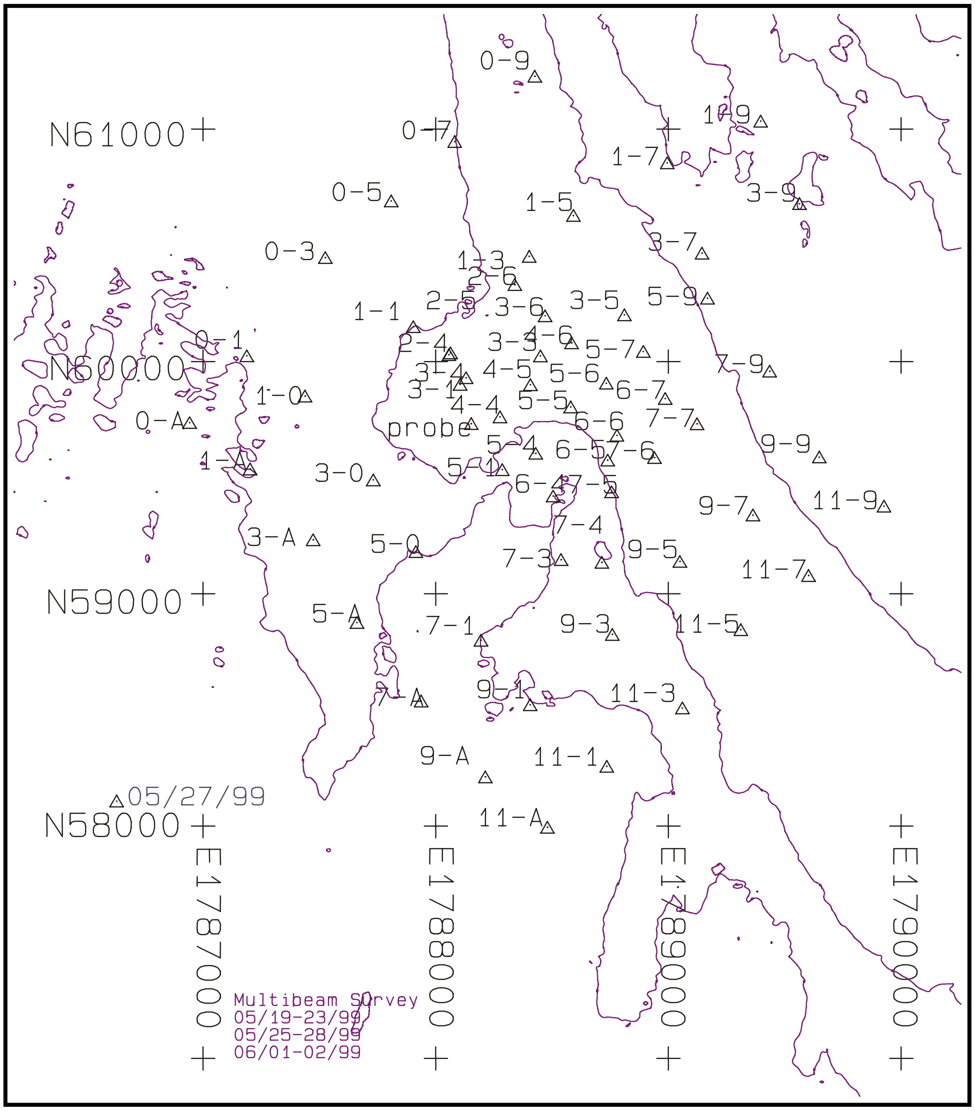

Figure 35. Location of expanded sampling of postplacement sediments – May 1999

Postplacement sediment monitoring - October 1999

An additional set of sediment samples was collected 1 year after placement in October 1999. The full set of samples including the new positions to the west and south were collected, reoccupying the GPS positions of the May 1999 set (Figure 37). Sediment samples collected in October 1999 in the mound area were in conjunction with the sediment study of postplacement of material from the maintenance dredging and widening of the Mobile bar channel on the SIBUA to the north of the mound site. Dredge disposal material from the Mobile bar channel was composed of fine sand material and was placed on the upper part of the SIBUA above the -7.6-m (-25-ft) contour. There is little evidence that this material moved very far from the placement site based on the bathymetric changes and grain-size analysis. There appeared to be little mixing of the placed bar channel sand with the mixed-sediment mound material.

Table 6
Postplacement Sediment Statistics by Laser Particle Counter (27 May 1999)

Sample	Easting	Northing	Depth ft-mlw[1]	Date	Mean,-mm	Mean, phi
0-A	1786942.00	59737.19	-34.7	05/27/99	0.259	1.95
0-1	1787188.00	60024.48	-33.7	05/27/99	0.281	1.83
0-3	1787525.00	60447.70	-33.2	05/27/99	0.103	3.28
0-5	1787808.00	60691.16	-31.8	05/27/99	0.355	1.50
0-7	1788081.00	60946.80	-29.2	05/27/99	0.277	1.85
0-9	1788426.00	61228.15	-24.1	05/27/99	0.300	1.74
1-A	1787202.00	59537.06	-34.0	05/27/99	0.249	2.01
1-0	1787438.00	59851.68	-33.1	05/27/99	0.167	2.58
1-1	1787903.00	60150.00	-28.0	05/26/99	0.121	3.05
1-3	1788402.00	60453.00	-26.3	05/27/99	0.336	1.57
1-5	1788592.00	60628.44	-24.7	05/27/99	0.280	1.83
1-7	1788995.00	60854.96	-20.8	05/27/99	0.284	1.82
1-9	1789396.00	61034.80	-20.7	05/27/99	0.313	1.67
2-4	1788056.00	60029.82	-26.9	05/27/99	0.047	4.40
2-5	1788063.00	60037.06	-27.3	05/27/99	0.076	3.72
2-6	1788340.00	60331.48	-26.9	05/27/99	0.238	2.07
3-A	1787473.00	59232.63	-31.4	05/27/99	0.238	2.07
3-0	1787731.00	59490.16	-30.3	05/27/99	0.269	1.90
3-1	1788104.00	59901.68	-28.4	05/27/99	0.204	2.30
3-3	1788450.00	60024.21	-27.7	05/27/99	0.057	4.12
3-4.2	1788130.00	59930.64	-27.1	05/27/99	0.219	2.19
3-5	1788811.00	60201.23	-26.7	05/27/99	0.289	1.79
3-6	1788470.00	60196.86	-25.9	05/27/99	0.291	1.78
3-7	1789144.00	60466.88	-20.4	05/27/99	0.267	1.91
3-9	1789563.00	60679.38	-20.4	05/27/99	0.324	1.62
PROBE(4.3)	1788152.00	59732.93	-25.2	05/27/99	0.032	4.95
4-4	1788276.00	59762.01	-26.2	05/27/99	0.066	3.91
4-5	1788407.00	59900.17	-27.3	05/27/99	0.192	2.38
4-6	1788584.00	60080.52	-26.4	05/27/99	0.255	1.97
5-A	1787661.00	58875.87	-32.8	05/27/99	0.279	1.84
5-0	1787914.00	59181.31	-33.7	05/27/99	0.244	2.03
5-1	1788286.00	59534.65	-26.7	05/27/99	0.033	4.94
5-4	1788430.00	59604.86	-32.8	05/27/99	0.102	3.29
5-5	1788580.00	59804.75	-27.3	05/27/99	0.256	1.96
5-6	1788733.00	59907.03	-25.8	05/27/99	0.262	1.93
5-7	1788892.00	60043.23	-26.0	05/27/99	0.260	1.94
5-9	1789168.00	60272.79	-21.4	05/27/99	0.320	1.64
6-4	1788505.00	59420.82	-33.6	05/27/99	0.056	4.15
6-5	1788739.00	59575.43	-27.7	05/27/99	0.247	2.01
6-6	1788779.00	59682.52	-26.9	05/27/99	0.239	2.06

(Continued)

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[1] To convert feet to meters, multiply by 0.3048.

Table 6 (Concluded)

Sample	Easting	Northing	Depth ft-mlw	Date	Mean,-mm	Mean, phi
6-7	1788986.00	59840.91	-25.7	05/27/99	0.271	1.88
7-A	1787937.00	58538.07	-34.5	05/27/99	0.051	4.29
7-1	1788194.00	58799.85	-33.8	05/27/99	0.084	3.58
7-3	1788539.00	59147.27	-32.5	05/27/99	0.038	4.73
7-4	1788714.00	59135.49	-28.8	05/27/99	0.087	3.52
7-5	1788756.00	59438.96	-29.1	05/27/99	0.222	2.17
7-6	1788940.00	59586.55	-26.4	05/27/99	0.277	1.85
7-7	1789123.00	59732.33	-26.7	05/27/99	0.250	2.00
7-9	1789435.00	59958.69	-20.9	05/27/99	0.310	1.69
9-1	1788406.00	58522.39	-33.5	05/27/99	0.224	2.16
9-3	1788759.00	58824.91	-30.4	05/27/99	0.163	2.62
9-5	1789049.00	59139.27	-27.5	05/27/99	0.266	1.91
9-7	1789363.00	59338.96	-27.4	05/27/99	0.223	2.17
9-9	1789648.00	59589.09	-21.4	05/27/99	0.308	1.70
11-A	1788480.00	57994.67	-35.5	05/27/99	0.229	2.12
11-1	1788735.00	58257.07	-35.6	05/27/99	0.224	2.16
11-3	1789060.00	58508.21	-32.2	05/27/99	0.204	2.29
11-5	1789311.00	58845.20	-28.1	05/27/99	0.259	1.95
11-7	1789602.00	59078.94	-27.6	05/27/99	0.248	2.01
11-9	1789926.00	59377.38	-21.7	05/27/99	0.302	1.73

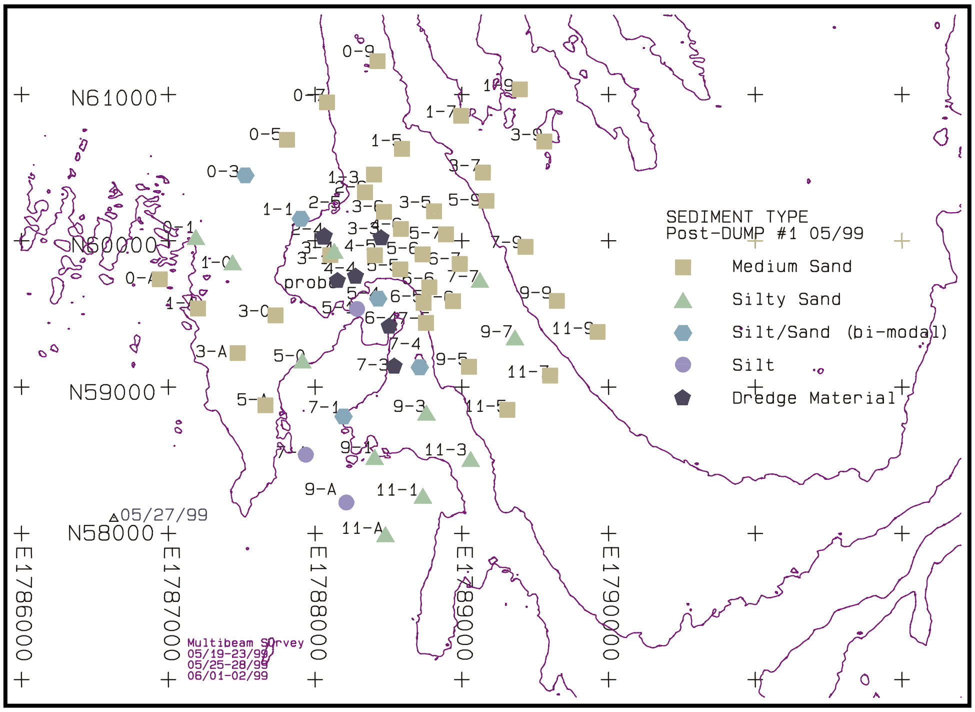

Figure 36. Distribution of postplacement sediment types – May 1999

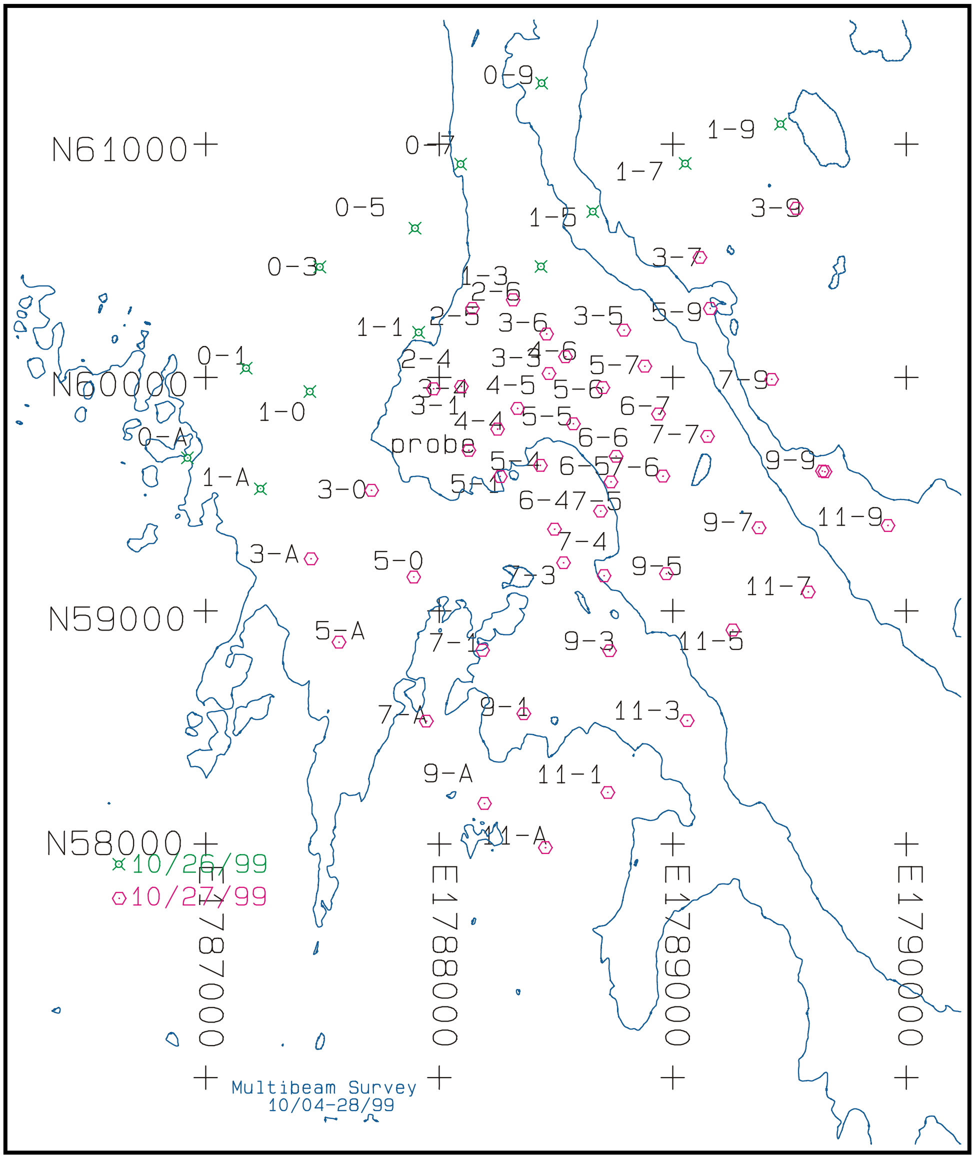

Figure 37. Sediment sample locations of complete postdredging sample set (October 1999)

The mixed-mound sediment samples were again analyzed as before with the laser particle counter and compared to the two previous sediment sample distributions. Table 7 gives the means of these 1-year postplacement samples. The sediment type map of the 1-year postplacement indicates that the fine cohesive river sediments still predominate in the area where they were placed (Figure 38). There appears to be some mixing taking place with the native fine sands and the cohesive silts of the river dredge material. All of the samples identified as having river sediment distributions in the May 1999 data set, have shown an increase in fine sand-size material. Five samples still have a distribution that has the characteristics of the river sediment (3-1, 4-3probe, 4-4, 6-4 and 7-3). Sample 4-3probe exhibits this trend in an increase in sand-size material in this 1-year postplacement time frame (Figure 39). While many of the other fine-grained samples

Table 7
Postplacement Sediment Statistics by Laser Particle Counter (26-27 October 1999)

Sample	Easting	Northing	Depth ft-mlw	Date	Mean,-mm	Mean, phi
0-A	1786921.77	59656.07	-49.0	10/26/99	0.192	2.38
0-1	1787172.84	60040.31	-49.0	10/26/99	0.155	2.69
0-3	1787488.42	60473.94	-47.0	10/26/99	0.191	2.39
0-5	1787895.87	60639.80	-47.0	10/26/99	0.197	2.35
0-7	1788091.07	60914.63	-42.0	10/26/99	0.248	2.01
0-9	1788438.85	61261.42	-33.0	10/26/99	0.307	1.70
1-A	1787234.50	59523.56	-50.0	10/26/99	0.187	2.42
1-0	1787445.70	59940.14	-47.0	10/26/99	0.158	2.66
1-1	1787911.54	60193.60	-45.0	10/26/99	0.207	2.27
1-3	1788435.97	60475.86	-37.0	10/26/99	0.329	1.61
1-5	1788657.84	60711.16	-33.0	10/26/99	0.400	1.32
1-7	1789053.37	60917.09	-27.0	10/26/99	0.322	1.64
1-9	1789461.35	61086.00	-25.0	10/26/99	0.357	1.48
2-4	1787975.11	59952.03	-26.0	10/27/99	0.197	2.34
2-5	1788142.23	60296.70	-27.0	10/27/99	0.223	2.17
2-6	1788316.75	60332.80	-26.0	10/27/99	0.250	2.00
3-A	1787451.06	59223.63	-30.0	10/27/99	0.263	1.92
3-0	1787710.10	59516.93	-29.0	10/27/99	0.183	2.45
3-1	1788094.73	59961.74	-26.0	10/27/99	0.072	3.79
3-3	1788470.55	60017.44	-26.0	10/27/99	0.203	2.30
3-4.2	Not collected					
3-5	1788791.20	60203.14	-27.0	10/27/99	0.288	1.79
3-6	1788460.34	60186.61	-26.0	10/27/99	0.263	1.93
3-7	1789116.67	60514.29	-19.0	10/27/99	0.309	1.69
3-9	1789529.60	60725.00	-19.0	10/27/99	0.310	1.69
PROBE(4.3)	1788126.54	59688.20	-25.0	10/27/99	0.064	3.97
4-4	1788250.25	59779.11	-26.0	10/27/99	0.129	2.96
4-5	1788336.02	59867.79	-26.0	10/27/99	0.209	2.26
4-6	1788540.96	60089.22	-25.0	10/27/99	0.246	2.02
5-A	1787570.93	58865.41	-31.0	10/27/99	0.340	1.56
5-0	1787890.48	59145.06	-32.0	10/27/99	0.057	4.14
5-1	1788261.87	59575.99	-29.0	10/27/99	0.066	3.93
5-4	1788433.82	59623.63	-33.0	10/27/99	0.176	2.50
5-5	1788574.82	59801.74	-29.0	10/27/99	0.215	2.21
5-6	1788700.95	59956.89	-26.0	10/27/99	0.349	1.52
5-7	1788881.00	60048.73	-26.0	10/27/99	0.270	1.89
5-9	1789160.88	60295.86	-20.0	10/27/99	0.331	1.59
6-4	1788494.08	59349.95	-33.0	10/27/99	0.086	3.54
6-5	1788735.81	59553.02	-28.0	10/27/99	0.181	2.46
6-6	1788757.95	59662.62	-26.0	10/27/99	0.268	1.90
6-7	1788939.52	59843.56	-26.0	10/27/99	0.288	1.80

(Continued)

Table 7 (Concluded)

Sample	Easting	Northing	Depth ft-mlw	Date	Mean,-mm	Mean, phi
7-A	1787944.27	58527.12	-33.0	10/27/99	0.084	3.58
7-1	1788185.98	58830.81	-35.0	10/27/99	0.158	2.67
7-3	1788532.87	59206.10	-31.0	10/27/99	0.081	3.63
7-4	1788706.41	59150.68	-30.0	10/27/99	0.186	2.42
7-5	1788691.46	59427.16	-30.0	10/27/99	0.196	2.35
7-6	1788958.21	59577.97	-27.0	10/27/99	0.310	1.69
7-7	1789149.20	59747.96	-27.0	10/27/99	0.266	1.91
7-9	1789423.78	59992.08	-19.0	10/27/99	0.332	1.59
9-A	1788193.30	58174.30	-33.0	10/27/99	0.126	2.99
9-1	1788362.66	58558.97	-33.0	10/27/99	0.232	2.11
9-3	1788730.09	58828.69	-31.0	10/27/99	0.204	2.29
9-5	1788973.50	59159.05	-28.0	10/27/99	0.265	1.92
9-7	1789369.53	59355.89	-27.0	10/27/99	0.305	1.71
9-9	1789640.42	59599.43	-20.0	10/27/99	0.317	1.66
11-A	1788455.13	57985.09	-34.0	10/27/99	0.215	2.22
11-1	1788722.32	58221.37	-35.0	10/27/99	0.061	4.03
11-3	1789062.02	58529.42	-32.0	10/27/99	0.180	2.47
11-5	1789257.26	58917.60	-28.0	10/27/99	0.222	2.17
11-7	1789580.43	59080.86	-27.0	10/27/99	0.239	2.06
11-9	1789921.58	59365.88	-20.0	10/27/99	0.334	1.58

still have the characteristic river grain-size distribution, an increase in fine sand-size material is also present in the latest sample. Other samples (5-0, 5-1, 5-4, 7-A, 9-A and 11-1) also have a high percentage of silt and bimodal silt and fine sand, but much of this fine material has the characteristics of the native silt material present on the shelf. The scour trough has been filling in and the samples in that area have grain-size distribution characteristics of both the fines from the river and native shelf. The sediment above the –9.1-m (-30-ft) contour continued to have a fine sand distribution similar to before placement. The samples to the southwest of the dredge placement area either have the same distribution or have an increase in the fine sand fraction.

Wave Analysis

The history of waves and currents incident to the mound was needed since they produce the primary force driving mound sediment movement. Due to problems with fishing trawlers, wave measurements could not be collected directly at the mound. Instead, a wave gage was installed about 1.609 km (1 mile) west of the mound at a more protected location near an offshore oil production platform. Water level and wave data were collected almost continuously for the period from the end of October 1998 through July 1999. Tidal currents were recorded during that period as well, but problems with mud accumulation on the gage limited the amount of useful data.

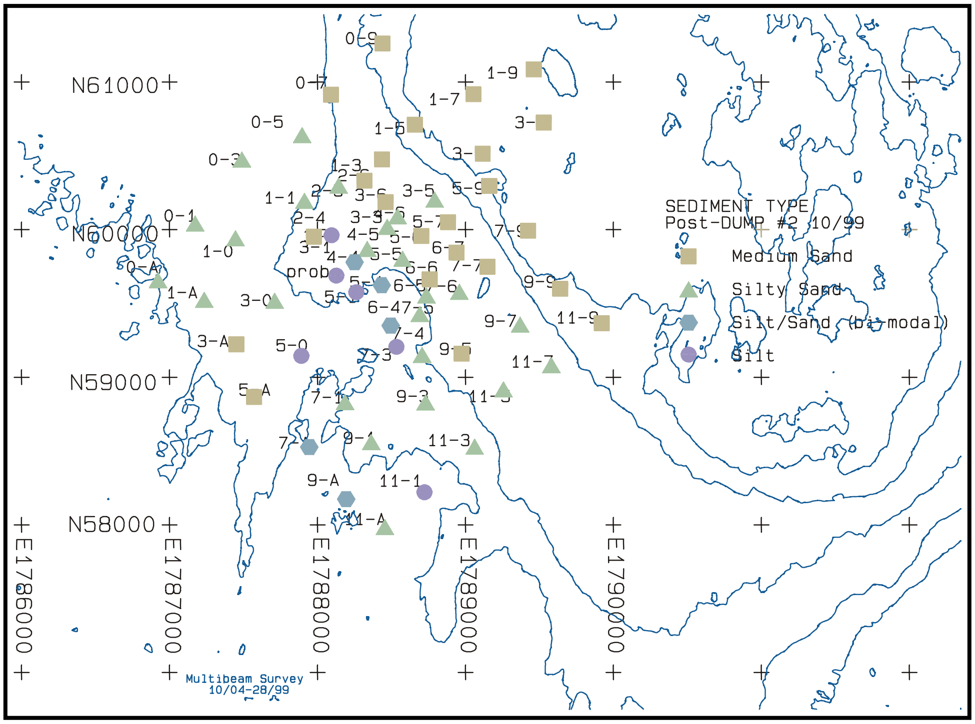

Figure 38. Map of dredged grain-size type distribution and closeup bathymetry of postplacement sediment sample area (October 1999)

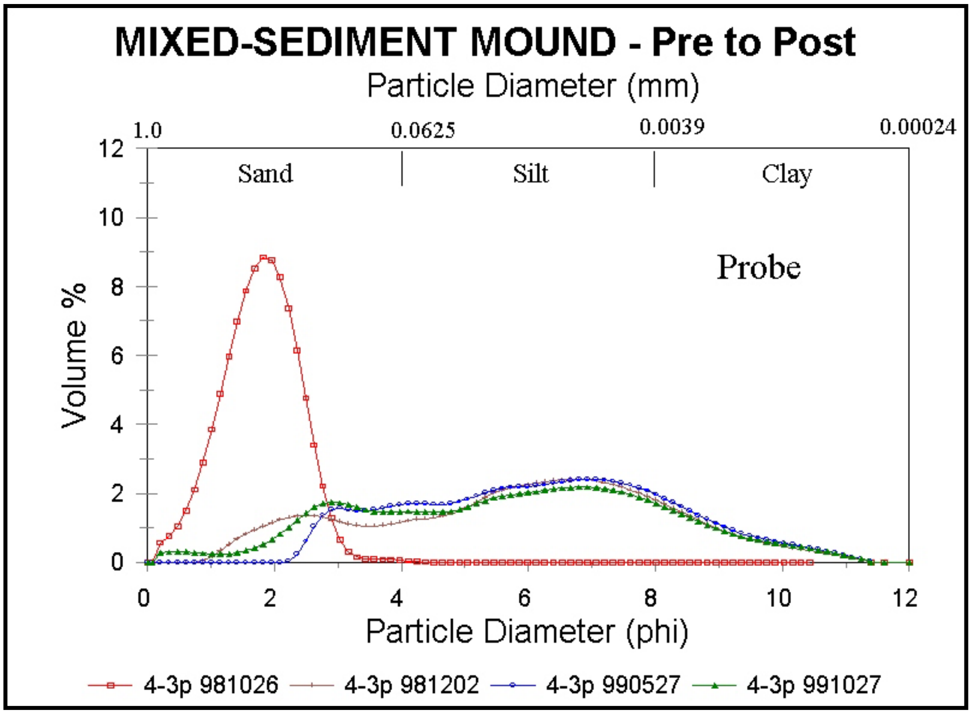

Figure 39. Grain-size distribution plot of Sample 4-3probe from the middle of the mixed-sediment mound showing the change in distribution from a native sand distribution (10/98) to the characteristic Mobile River cohesive sediment curve (12/98 and 5/99) and the increase of more fine sand back into the distribution 1 year later (10/99)

The gage data was initially analyzed from 27 October through December 1998. The surrounding bottom was sufficiently shallow and complex that measurements could not be directly transferred to the mound location, especially for approach directions between east and south. The gage deployment failed to collect directional data as planned, so that important piece of information was missing in the gage record. To enhance the nondirectional measured wave data and to develop local wave information at the mound site, directional waves for the measurement period were modeled by computer simulation.

Wave modeling

The objectives of the wave modeling were twofold. The first objective was to hindcast wave height and direction over the study period from October 1998 to December 1999 based on deepwater wave buoy data and hindcast techniques. Second, a method was developed to estimate the history of wave parameters over the mound site based on transforming measured and hindcast waves from the offshore deepwater location. This method was applied to the mound location for the period from October through December 1998, which brackets the mound construction, for ground truthing to validate the hindcast with the actual wave height measurements collected nearby at the oil platform.

The approach consists of the following steps:

a. Hindcast offshore waves in the Gulf of Mexico for the time period October 1998 to December 1999 using Wave Information Study (WIS) procedures.

b. Develop a grid for numerical wave model STWAVE to transform WIS incident waves to the mound area and wave gage location.

c. Run representative combinations of incident wave height, period, and direction to get wave transformation relationships at several points around the mound.

d. Develop a procedure for correcting WIS time-history to represent waves at the mound and gage locations.

e. Apply the procedure to the WIS time-history to give a time-history of wave parameters at the mound and gage locations.

f. Document the procedure so that it can be used independently for future time periods.

Offshore wave conditions. The WIS has developed wave information along U.S. coasts by computer simulation of past wind and wave conditions. This type of simulation is termed hindcasting. WIS has generated hindcast summary information from 1956 to 1975 (Hubertz and Brooks 1989) for Sta 27 in the Gulf of Mexico, which is 15-20 miles south of the study area. An update of the Gulf of Mexico hindcast for 1994 can be found in Tracy and Cialone (1996). Additional data from 1976 to 1995 for renumbered WIS Sta 47, located at the same site as the old Sta 27, is presented in Table 8 (after WIS Web site at http://bigfoot.wes.army.mil/u023.html). The table provides the monthly

Table 8
Wave Measurements and WIS Hindcast Properties

WIS Significant Wave Height Maximums (m) – 1976 to 1995 at Sta 47

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	1.5	1.7	1.7	1.7	1.7	1.2	0.5	1.4	1.4	2.3	1.4	1.8
1977	2.7	3.1	3.7	2.9	1.5	1.2	0.7	2.3	3.1	1.5	1.7	2.0
1978	3.0	2.2	2.4	1.3	2.3	1.4	1.0	2.2	0.8	1.4	1.5	1.9
1979	3.5	2.4	2.6	2.2	1.2	1.3	3.6	1.0	6.4	2.0	1.7	2.1
1980	1.7	1.6	2.4	3.0	1.5	1.1	0.9	3.7	1.7	2.4	2.4	1.6
1981	1.9	3.2	3.4	1.9	1.2	1.4	0.9	1.1	1.1	1.5	2.0	2.1
1982	2.6	1.6	1.6	1.8	1.4	1.2	0.5	1.4	1.8	1.4	1.4	2.7
1983	3.1	4.0	3.4	2.8	1.6	1.0	1.3	1.3	1.4	1.1	2.4	2.5
1984	2.0	2.9	3.1	2.3	2.6	0.8	0.9	1.5	2.3	1.3	2.4	1.5
1985	1.9	2.6	2.7	2.4	1.1	1.5	1.1	4.6	4.8	6.7	5.3	1.4
1986	1.5	1.9	2.5	1.4	1.1	0.9	1.1	0.9	0.9	1.9	1.6	3.1
1987	2.2	2.1	2.8	1.6	1.1	1.2	1.2	1.2	1.3	1.4	2.1	2.4
1988	2.6	1.9	1.7	2.6	1.5	1.2	1.7	3.1	6.3	1.2	2.7	1.5
1989	1.4	1.9	1.8	1.6	1.3	2.5	2.4	2.4	2.3	2.1	2.4	1.8
1990	1.4	2.2	2.0	1.5	1.3	0.8	1.1	1.1	1.2	1.4	2.6	1.8
1991	1.9	2.0	2.5	2.2	2.7	1.6	0.8	0.8	1.4	1.5	1.4	2.5
1992	2.9	1.9	1.8	1.8	1.1	1.2	1.5	5.5	1.4	2.5	2.2	2.2
1993	1.7	2.1	2.6	2.5	1.6	1.8	0.6	0.8	1.2	2.6	1.5	2.6
1994	2.6	1.6	2.8	1.3	1.2	1.9	2.4	1.2	1.8	2.8	2.1	1.5
1995	2.9	2.3	2.1	2.3	1.5	2.3	2.3	2.7	1.9	5.9	2.1	2.1
Monthly Means (m)												
Hindcast 20-year mean at Sta 47	0.8	0.8	0.9	0.7	0.6	0.5	0.4	0.5	0.6	0.7	0.8	0.8
Hindcast 1998-99 mean at MBAY1	1.0 ‘99	0.8 ‘99	1.0 ‘99	0.9 ‘99	0.7 ‘99	0.7 ’99	0.6 ‘99	0.5 ‘99	0.7 ‘99	0.7 ‘98 0.9 ‘99	0.7 ‘98 0.8 ‘99	0.8 ‘98 1.1 ‘99
Hindcast 1998-99 mean at MBAY2	0.9 ‘99	0.7 ‘99	0.9 ‘99	0.8 ‘99	0.7 ‘99	0.7 ‘99	0.5 ‘99	0.5 ‘99	0.7 ‘99	0.6 ‘98 0.8 ‘99	0.6 ‘98 0.7 ‘99	0.7 ‘98 1.0 ‘99
Measured Maximum (1998/99)	2.5 ‘99	1.3 ‘99	2.4 ‘99	2.2 ’99	2.4 ’99	1.5 ‘99	1.4 ‘99	NA	NA	NA	2.1 ‘98	1.9 ‘98
Measured Mean (1998-99)	0.8 ‘99	0.5 ‘99	0.7 ‘99	0.7 ‘99	0.6 ‘99	0.6 ‘99	0.5 ‘99	NA	NA	NA	0.6 ‘98	0.7 ‘98

maximum significant wave height hindcast for each year between 1976 and 1995 and the means of significant wave height for each month (averaged over the 20-year hindcast record). The significant wave height maximums and means measured by the wave gage and analyzed for the period between October 1998 and July 1999 are provided for comparison. The measured data tend to be just slightly lower than the hindcasts. One reason for this is that WIS Sta 47 is 24.140-32.186 km (15-20 miles) south of the study site. Waves from the north then would be larger at Sta 47 than at the study site because of the longer fetch from the north to the WIS station. Waves from the north occur less frequently (around 3 percent of the time), as the dominant wave direction is from the southeast (around 10 percent of the time) as shown in Figure 40. Waves from the west and northwest are rare, occurring less than 2 percent of the time. Another reason is simply that the weather during the 1998 to 1999 monitoring period was mild.

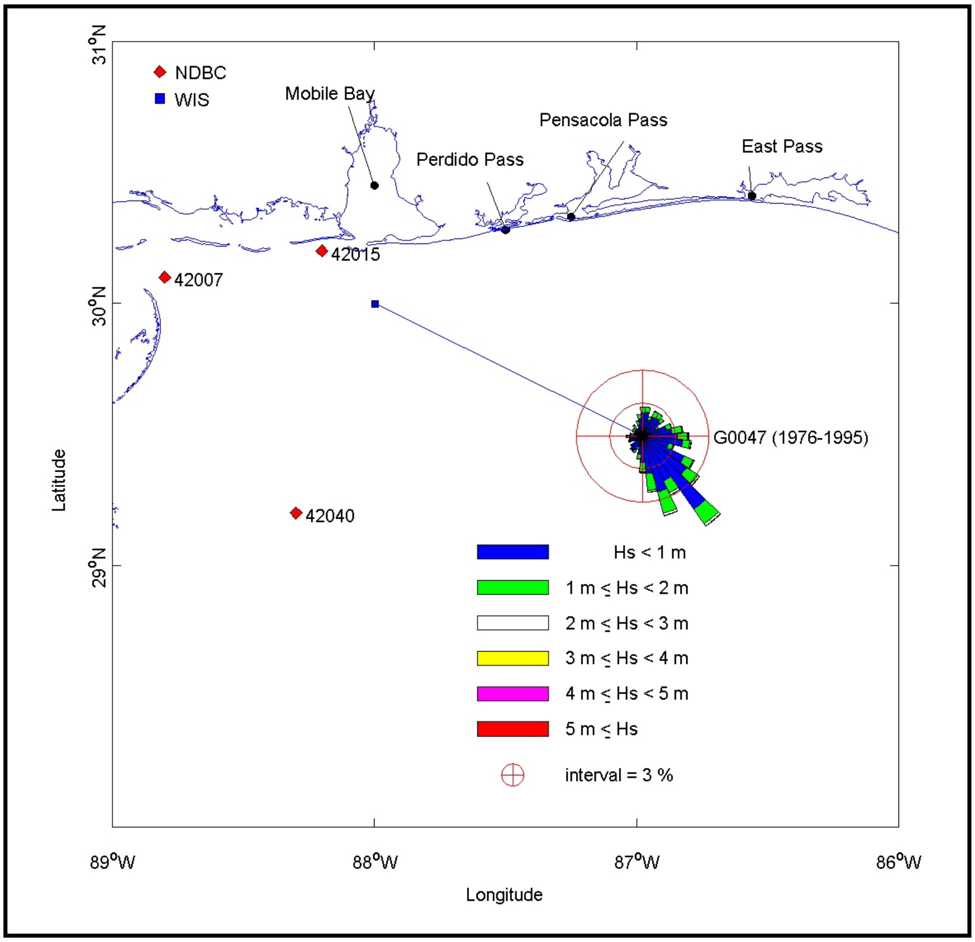

Figure 40. Wave rose from WIS Sta 47 for the years 1976 to 1995

The WIS hindcast information base for the Gulf of Mexico at the time of this study extended only up to 1995, short of the period of interest. A special hindcast effort was done to provide incident wave information for October 1998 through December 1999. Wave simulation was based upon a WIS directional spectral wave model, WISWAVE2, described in WIS Report 27 (Hubertz 1992). The WISWAVE2 is a second-generation, time-dependent, directional spectral model that can operate in either deep or shallow water. This wave model has been used to produce the Gulf of Mexico hindcast information for 1976-1995. In the present study, the model takes wind input information for October 1998 to December 1999 from two sources: (a) a reanalyzed wind project done by the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Prediction (NCEP) and National Center for Atmospheric Research (NCAR), and (b) buoy wind measurements collected by National Data Buoy Center (NDBC). The NCEP reanalyzed winds are the global wind field data set available at 6-hr intervals with a resolution of approximately 1.8 deg. The NDBC buoys winds are available at 1-hr intervals from 12 buoys deployed in the Gulf of Mexico. The buoy-measured winds were assimilated into NCEP/NCAR winds using the Interactive Objective Kinematics Analysis (IOKA) methodology and resultant wind fields were saved on a 0.833-deg (50-min) resolution grid. These wind fields were used to drive a WIS wave model with a 0.25-deg resolution over the entire Gulf of Mexico.

Wave model simulation was conducted on a coarse Level 2 (L2) grid, covering the entire Gulf of Mexico and a finer Level 3 (L3) grid, covering the Mobile Bay entrance channel disposal site (Figure 41). The L3 grid is a subdomain of the L2 grid. The L2 grid encompasses the area in 18.0 N-30.5 N, and 98.0 W-79.5 W with a median resolution of 0.25 deg. The 0.25-deg wave model resolution was considered overly coarse for the coastal margin of the gulf. Nested high-resolution WIS grids were developed to better resolve coastal bathymetry and sheltering. The L3 grid encompasses the area in 28.5 N-30.5N, and 90.0 W-79.5 W with a high resolution of 0.0833 deg (5 min). The L2 grid bathymetry data were taken from the Digital Bathymetric Data Base – 5 min (DBDB5) data set, compiled by the U.S. Naval Ocean Research and Development Agency (NORDA) and the Naval Oceanographic Office (USNOO). The L3 grid bathymetry data were taken from the Digital Nautical Chart (DNC) produced by National Imagery and Mapping Agency (NIMA). The wave model was first run on the L2 grid and wave spectra were saved along the boundaries of the L3 grid to provide incident wave conditions for the L3 grid. The model was next run on the L3 grid. Waves were propagated on this high- resolution grid, under continuing influence of wind, to the immediate vicinity of Mobile Bay entrance. Output wave information was saved at two offshore locations seaward of the entrance channel, in water of 19 m (62.34 ft) at Sta MBAY 1 and 39.37 ft at Sta MBAY2 (Figure 42 and Table 9). These results provide incident waves for the nearshore wave transformation model. Monthly means of the 1998 to 1999 hindcast waves at MBAY 1 and MBAY2 are also presented in Table 8 and are similar to the monthly mean values of the measured waves.

Model results. Wave model results consisted of arrays of significant wave height, peak period, mean period, mean wave direction associated with peak period over the grid, and directional wave spectra at the WIS output locations. The model results were compared to NDBC buoy waves for quality control. Figures 43 and 44 show two samples of time series comparison of model results and buoy data at Buoy 42001 (in the mid Gulf of Mexico) and 42040 (just inside grid L3) locations, respectively, in the period of January to March 1999. It is clearly seen that model wave heights agree exceptionally well to the buoy data. Model wave periods are generally smaller than the buoy-measured wave periods.

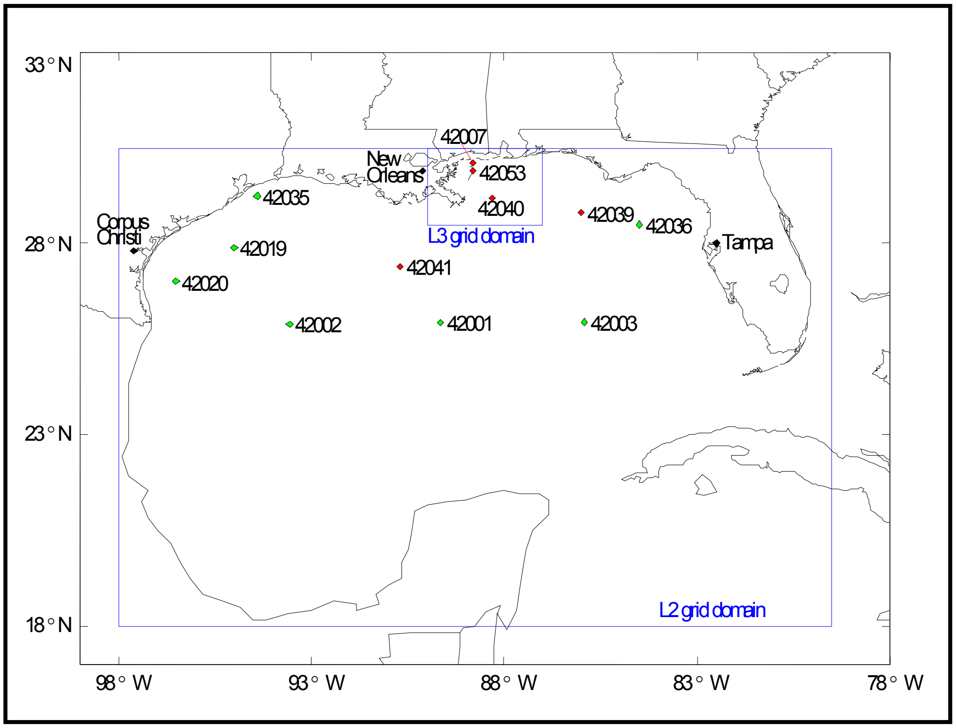

Figure 41. Wave model domains and location of NDBC buoys (green diamond are directional wave measurement and red diamond for non-directional wave measurement)

However, the difference is always insignificant except for those waves generated and propagated from the Bahamas and the Caribbean Sea into the Gulf of Mexico, which are not simulated in the model. Model wave directions also agree well to the buoy data except for the waves coming from the Bahamas and the Caribbean Sea. Waves originated in the Bahamas and the Caribbean Sea are not particularly interesting in wave activities in the gulf since they usually become very weak when they propagate into the gulf. Figure 45 shows the comparison of wave roses at Buoy 42003 and 42036 (on the eastern side of the Gulf of Mexico) locations in the period of January to March 1999. The model wave roses agreed well to buoy data except for waves coming from the south and east, which were originated in the Bahamas and the Caribbean Sea.

Figures 46 to 50 show the time series of model wind and wave information at MBAY1 and MBAY2 locations for the period of October 1998 to December 1999. Figures 51 and 52 show the model wave rose diagrams at MBAY1 and MBAY2 locations in the period of October 1998 to December 1999.

Wave transformation modeling approach

The wave hindcast information generated at MBAY1 and MBAY2 were then transformed into the site where the wave gage was deployed as well as various locations at the mound. This was done to see if there were any differences in modeled wave data as the waves propagated into shallow water over the mound

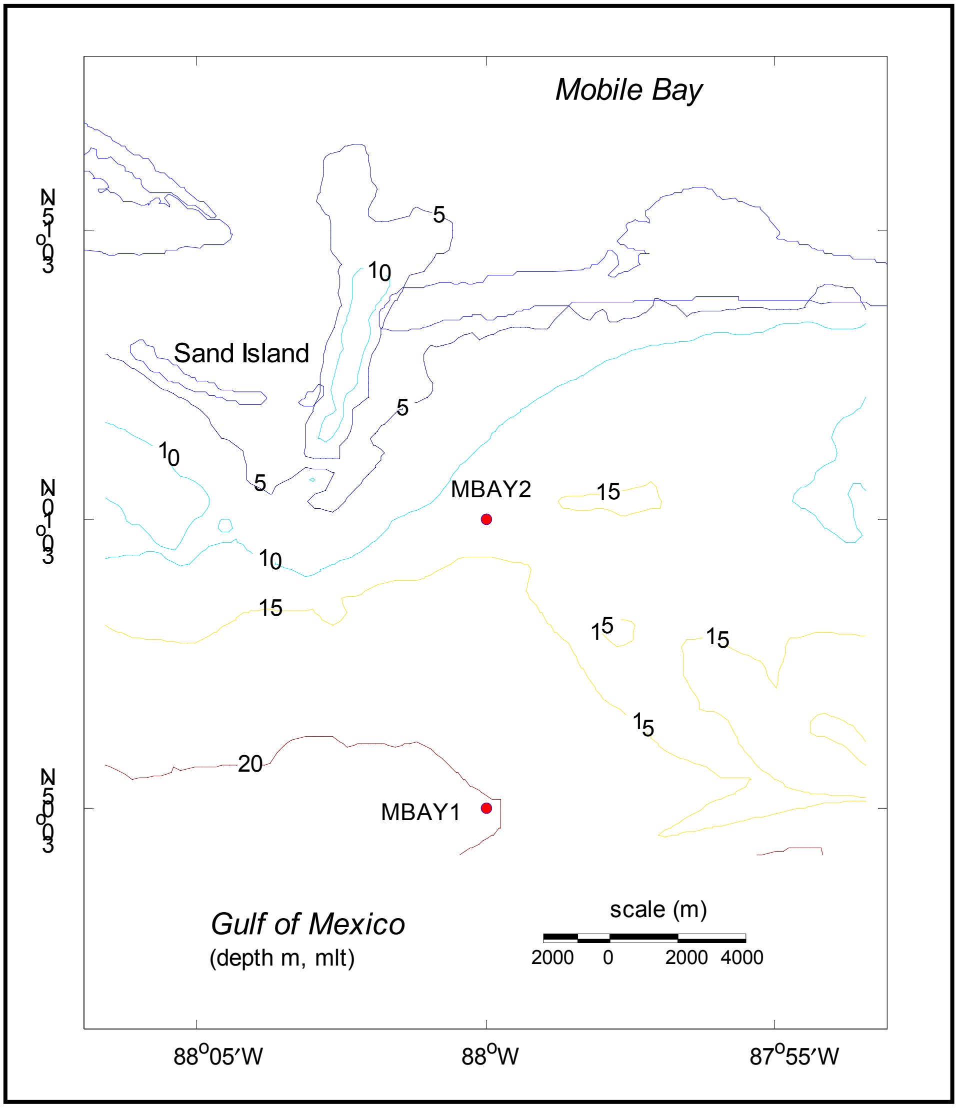

Figure 42. Map of study area showing the two WIS output locations

Table 9
WIS Points with Incident Wave Information

Location ID	Water Depth, ft[1]	Coordinates
WIS Sta 47	84.00	30 00 N 88 00 W
MBAY1	62.34	30 05 N 88 00 W
MBAY2	39.37	30 10 N 88 00 W

[1] To convert feet to meters, multiply by 0.3048.