APPENDIX G

BORROW AREA IMPACT ANALYSIS

Borrow Area Impact Analysis

STWAVE Model

Wave refraction estimates for the study area utilize the STWAVE model (Smith, 2001). STWAVE is a spectral wave model that evaluates the refracted wave height and wave angle based on spectrum of waves instead of a single, monochromatic wave. The model utilizes linear wave theory, assuming negligible bottom friction and steady-state waves, winds, and currents. Inputs to the STWAVE model include the bathymetry, the wave spectra, and the water levels.

Bathymetric Data

Bathymetric data for the refraction model was compiled from

- The October 2000 and September 2002 surveys of Pelican Island and Chaland Headland.
- The 2002 bathymetric surveys of the Quatre Bayou, Empire, and Scofield borrow sites.
- The Coast 2050 survey (MPH, 2001).
- The NOAA GEODAS database (NOAA, 1997), containing soundings collected in the late 1970s.

Due to subsidence, the NOAA data above -20 feet NAVD was generally invalid. Accordingly, primary weight was given to the recent surveys, with the NOAA data providing the deeper bathymetry.

Offshore bathymetry appears in Figure G1. Bathymetric data was split into two grids, corresponding to the two domains utilized in the STWAVE model. The western domain extends from Pass Abel to Shell Island. The eastern domain extends from Shell Island to Bayou Trouve.

Offshore contours generally form an elliptical arc, with the major axis running from west-northwest to east-southeast. Due south of the Empire Waterway, the contours protrude about 1 mile seaward. A similar protrusion is located about 5 ½ miles to the east. The average distance between the Gulf shoreline and the -7 foot NAVD depth of closure is about ½ mile. The average distance between the shoreline and the -15 foot NAVD contour is about 1.4 miles.

The geotechnical investigation has mapped three borrow sites, located approximately 1.4 to 2 miles offshore. The Quatre Bayou borrow site is located closest shore, approximately 2 miles west of the Chaland Headland project area. The cut depth of this site ranges from -29 to -32 feet NAVD. The Empire borrow areas lie 1 mile due south of Pelican Island, with a cut depth of -27 feet NAVD. The Scofield borrow area lies 3 miles southeast of Pelican Island, and has a cut depth of -35 feet NAVD. The excavated conditions appear in Figure G2, and assume all borrow areas have been completely dredged.

Wave Cases

Input wave cases appear in Table G1, and are based on the 1975-1995 wave hindcast at WIS Station G1058. Five cases during average conditions were considered, along with four storm wave cases. Waves during the average conditions govern the long-term erosion and sediment transport. These cases include the average wave and the average onshore wave, both of which fall within the two most common direction bands, southeast and south-southeast.

TABLE G1

STWAVE WAVE CASES
WIS STATION GU1058
BARATARIA BAY COMPLEX, LA

				Direction			
Wave	**Height*** **		**Period**	**Compass**	**STWAVE**	**NAVD Stage**	
Case	**(feet)**	**(m)**	**(sec.)**	**(deg.)**	**(deg.)***	**(feet)**	**(m)**
AVERAGE CONDITIONS:							
	2.5	0.78	5.0	123	57	1.0	0.31
MEAN OF ALL WAVES	2.6	0.78	4.6	131	49	1.0	0.31
MEAN OF ONSHORE WAVES	2.5	0.78	5.0	157	23	1.0	0.31
	2.6	0.78	4.6	165	15	1.0	0.31
	2.5	0.78	5.0	191	-11	1.0	0.31
STORM CONDITIONS:							
H_e, T_e	17.4	5.31	11.0	177	3	1.6	0.48
5-YEAR	18.0	5.49	11.7	173**	7	3.0	0.91
10-YEAR	20.5	6.25	12.4	173**	7	4.9	1.48
20-YEAR	22.9	6.98	13.2	173**	7	6.7	2.04

Notes: * STWAVE direction = 180 deg. - Compass Direction.
** Wave angles for 5, 10, 20 year events based on Jan. 1979 storm, Hurricane Andrew (1992), and Hurricane Juan (1985).
***Reported wave heights are offshore wave conditions.

Waves during storm conditions can result in periods of elevated erosion and sediment transport. The 20 year wave corresponds to the design conditions upon which the dune dimensions are based. The 5 and 10 year waves are severe events which may occur over the project life. Wave directions during these conditions are based on historic storms. The wave height H_e and wave period T_e correspond to the wave exceeded 12 hours per year, representing the conditions during frequent storms. This wave case governs the depth of closure, the elevation below which there is no significant sediment motion (Birkemeier, 1985).

Given the water depths in the vicinity of the borrow areas (on the order of -20 ft NAVD or shallower), the borrow areas are within the influence of wave breaking for storm conditions.

Existing Conditions

STWAVE results given the existing conditions appear in Figures G3-G21. Results are generally realistic except near the northeast corner of study area and the split between the two domains near Shell Island. At the northeast corner of the study area, the bathymetric data is questionable, resulting in unphysical variations in the nearshore wave height. Along the domain split, unphysical variations in the more oblique waves occur due to boundary effects. For the southerly waves, these effects are less noticeable. In spite of such

deficiencies, the magnitudes of the refracted wave heights are reasonable.

In general, waves propagating from the southeast during average conditions maintain their height and direction until reaching the -7 foot NAVD depth of closure. Along the depth of closure, these waves assume a south-southeasterly direction and subsequently break. East of Pelican Island, broken waves decrease to 0.5 feet or less at the shoreline, under the influence of the nearby ebb shoals. Along Pelican Island, broken waves vary from 1.5 feet near Scofield Pass to 2.0 feet near the Empire jetties. Along Chaland Headland, broken waves at the shoreline vary from 0.5 foot near Chaland Pass to 1.8 feet near Pass La Mer. Towards the west, ebb shoals tend to focus wave energy along the islands adjacent to Quatre Bayou and inside Pass Abel. The resulting sediment transport is generally from east to west.

Waves propagating from the south-southeast during average conditions also maintain their height and direction until reaching the -7 foot NAVD depth of closure. Along the depth of closure, these waves assume a southerly direction and subsequently break, except between Quatre Bayou and Pass Abel. Along this section, the wave direction is south-southeasterly all the way to the shoreline. East of Pelican Island, broken waves decrease to 0.5 feet or less at the shoreline, under the influence of the nearby ebb shoals. Along Pelican Island, broken waves at the shoreline vary from 2.0 feet near Scofield Pass to 2.5 feet near the Empire jetties. Along Chaland Headland, broken waves at the shoreline vary from 0.5 foot near Chaland Pass to 2.3 feet near Pass La Mer. Towards the west, ebb shoals tend to focus wave energy along the islands adjacent to Quatre Bayou and inside Pass Abel. The resulting sediment transport is generally from east to west.

Waves propagating from the south to south-southwest under average conditions exhibit similar variations in wave height. After crossing the depth of closure, the waves assume a southerly direction near Pass Abel and a south-southwesterly direction elsewhere. In most locations, this wave direction is perpendicular to the shoreline. As a result, the corresponding sediment transport can occur in either direction between Quatre Bayou and Scofield Pass.

Under storm conditions, waves break before reaching the depth of closure. The depth at which the waves break is approximately equal to their height. Wave focusing occurs where the offshore contours protrude seaward south of Pelican Island. However, after breaking, the waves are depth limited. As a result, waves along a given contour landward of the breaking point are uniform.

Excavated Conditions

STWAVE results given the excavated conditions appear in Figures G3-G21. During average conditions, wave energy near the Quatre Bayou borrow area may be redirected to the shoreline east of the inlet. Nevertheless, changes to the nearshore wave height (-7 feet NAVD) never exceed 0.4 feet. Changes to the wave angle are within 5 to 10 degrees. During storm conditions, the largest wave height changes at -15 feet NAVD are reductions, which never exceed 2 feet. Landward of the -15 feet NAVD contour, the waves are depth limited, and changes to the waves diminish. Given the uncertainties of the 1975-1995 hindcast and the STWAVE model, these changes fall within the margin of error. Accordingly, changes to the littoral drift and the resulting erosion patterns should be small or negligible.

References

Birkemeier, W.A. (1985), "Field Data on Seaward Limit of Profile Change", *Journal of Waterway, Port, Coastal and Ocean Engineering*, volume 111, number 3, pp. 598-602.

National Oceanographic and Atmospheric Administration (1997), *Geophysical Data System for Hydrographic Survey Data, GEODAS Setup, National Ocean Service Hydrographic Survey Data*, CD Vol. 1 & 2, Ver. 4.0.

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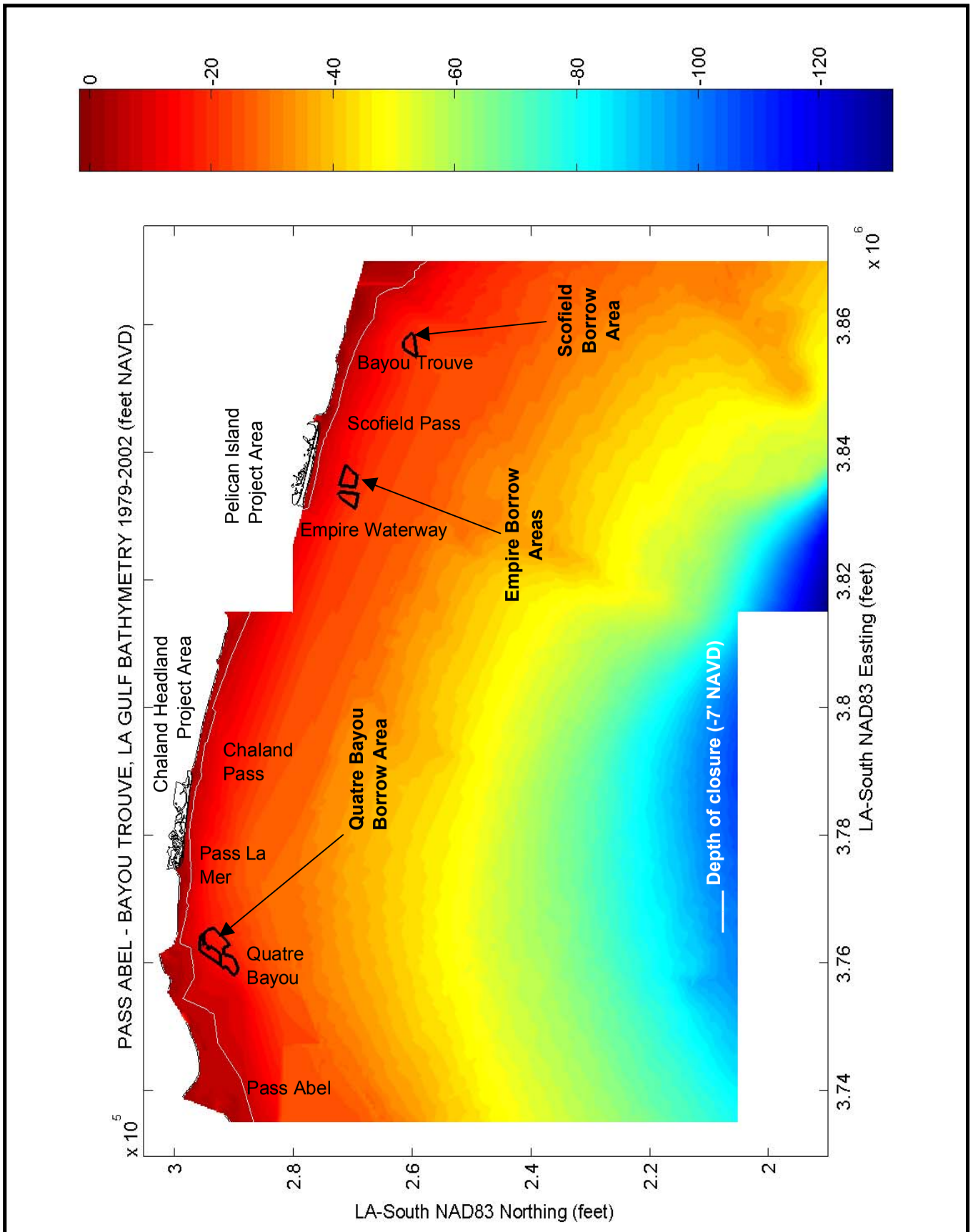
Wave Information System (1997), "Coastal Engineering Data Retrieval System (CEDRS)", U.S. Army Corps of Engineers Coastal and Hydraulics Laboratory, http://bigfoot.wes.army.mil/c201.html.



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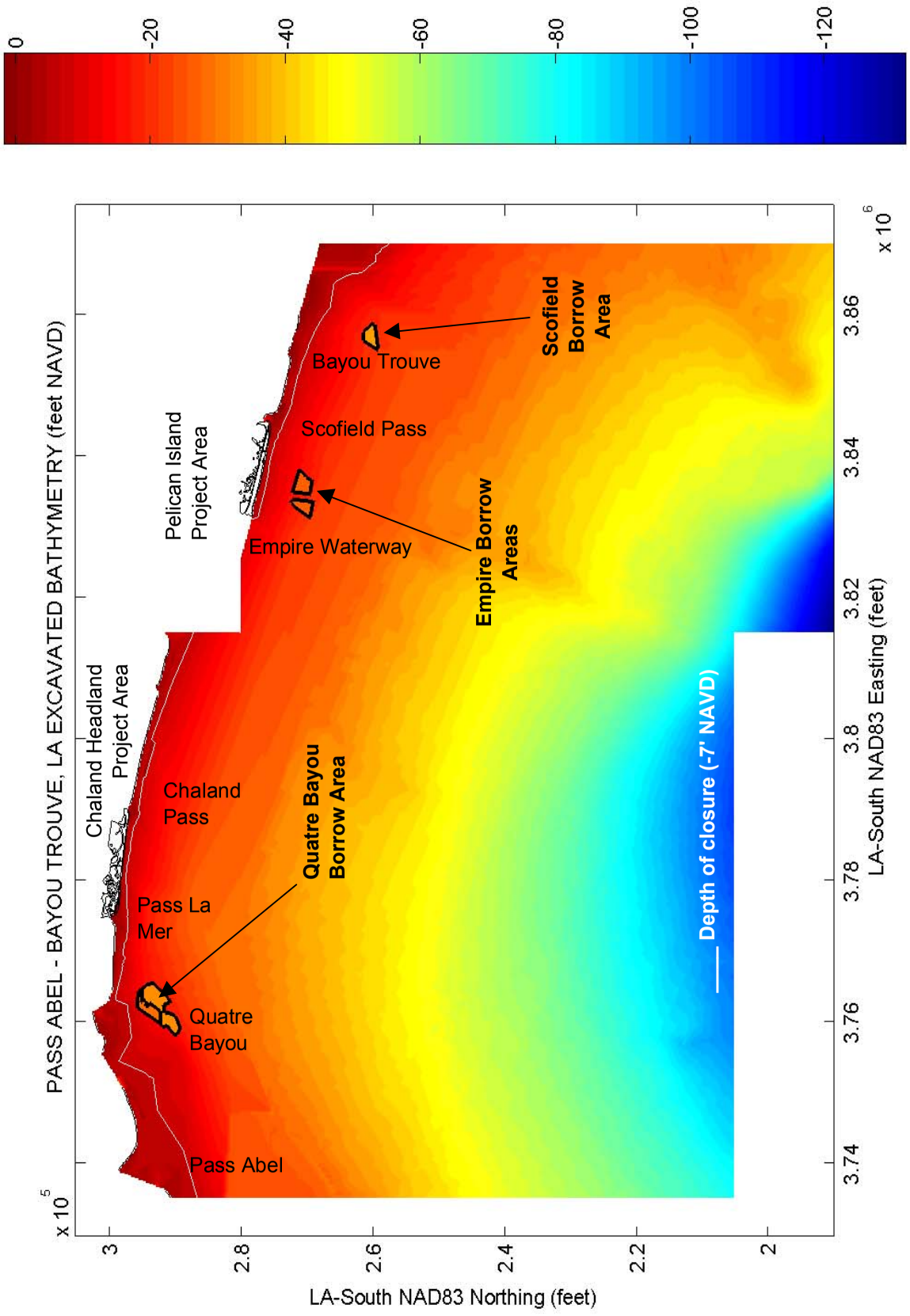
STWAVE MODEL GRID, PASS ABEL - BAYOU TROUVE, LA

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G1



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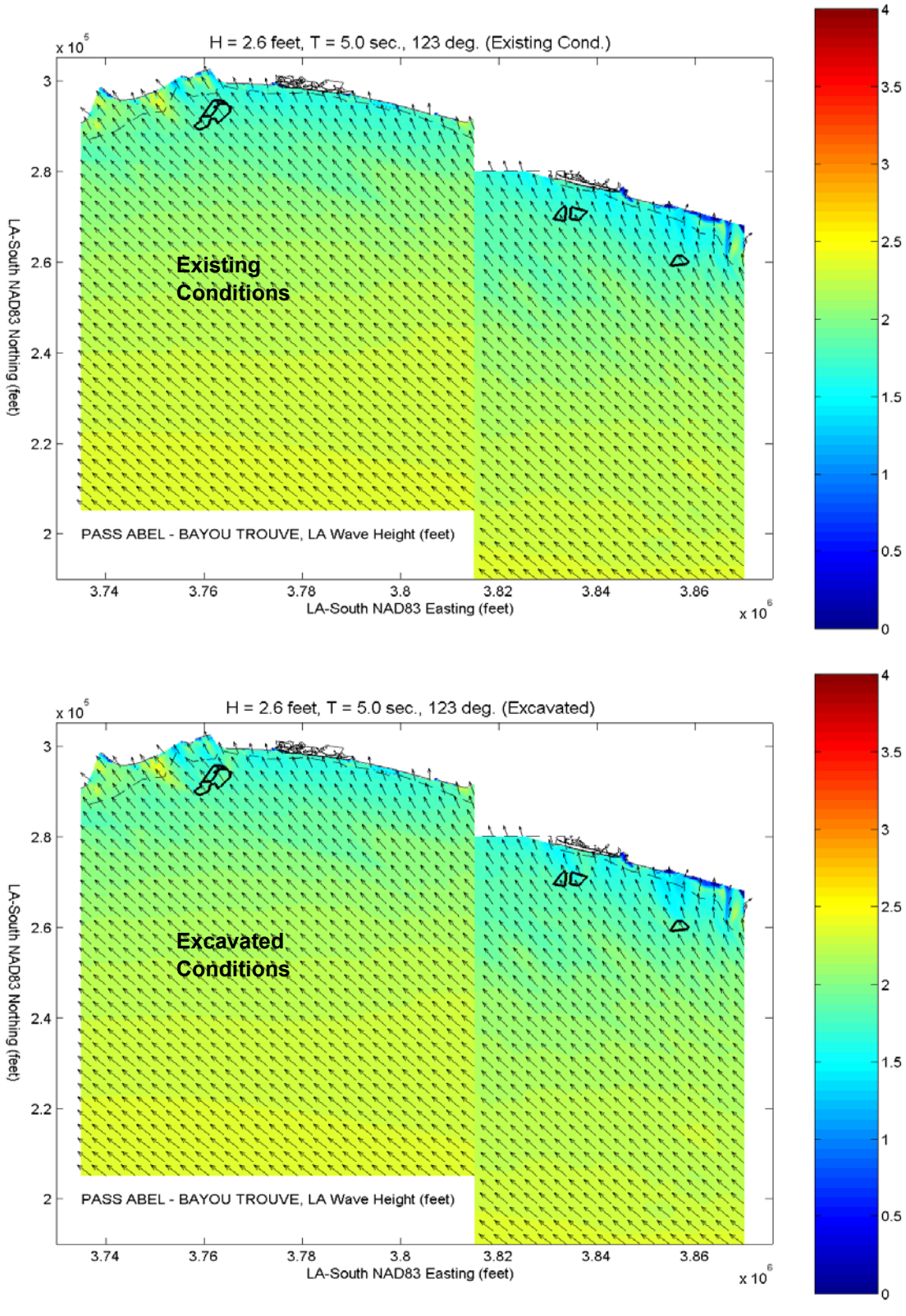
STWAVE MODEL GRID, PASS ABEL - BAYOU TROUVE, LA

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G2



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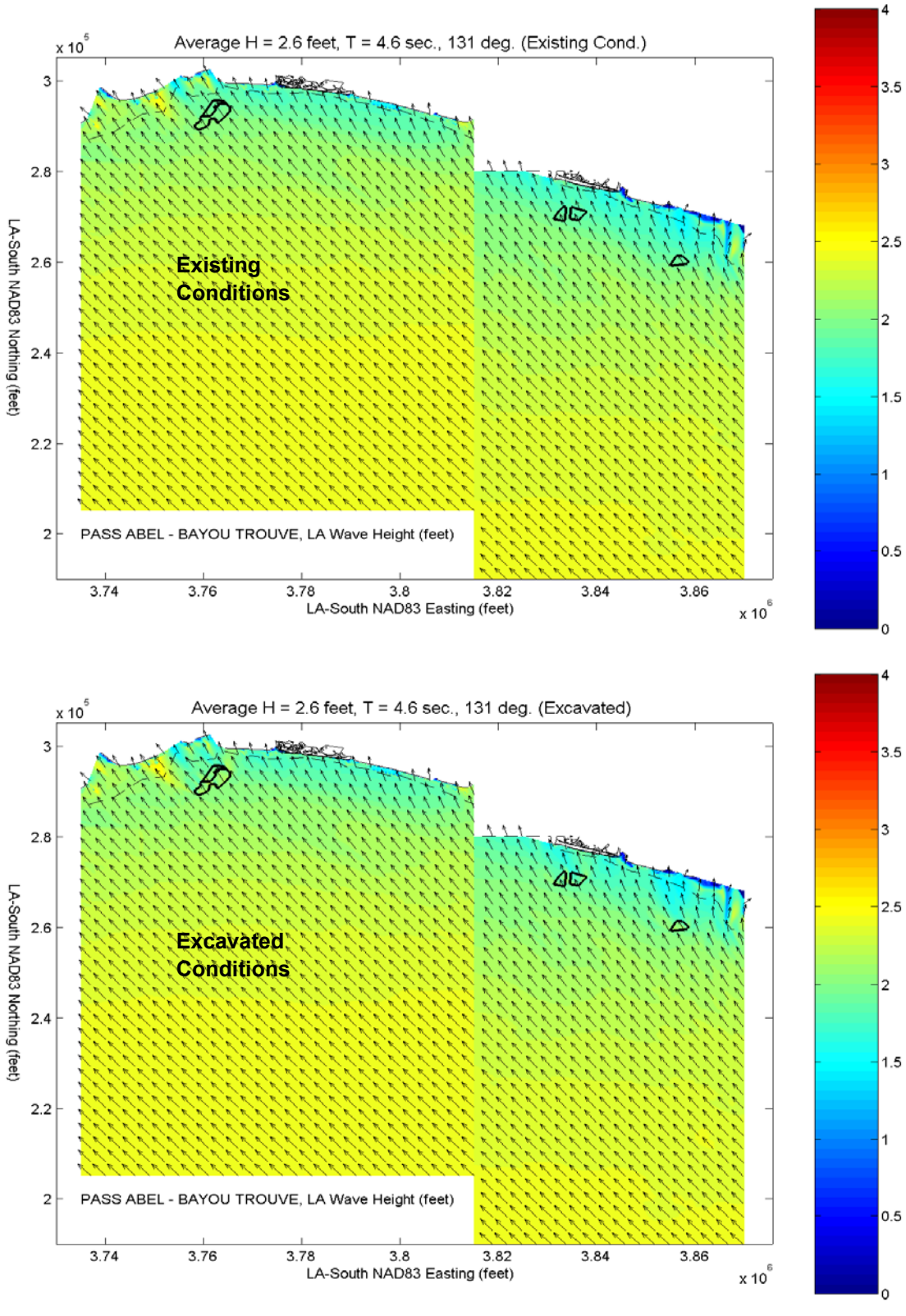
TITLE:

STWAVE RESULTS

PASS ABEL - BAYOU TROUVE, LA

H = 2.5 FEET, T = 5 SEC., 123 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G3



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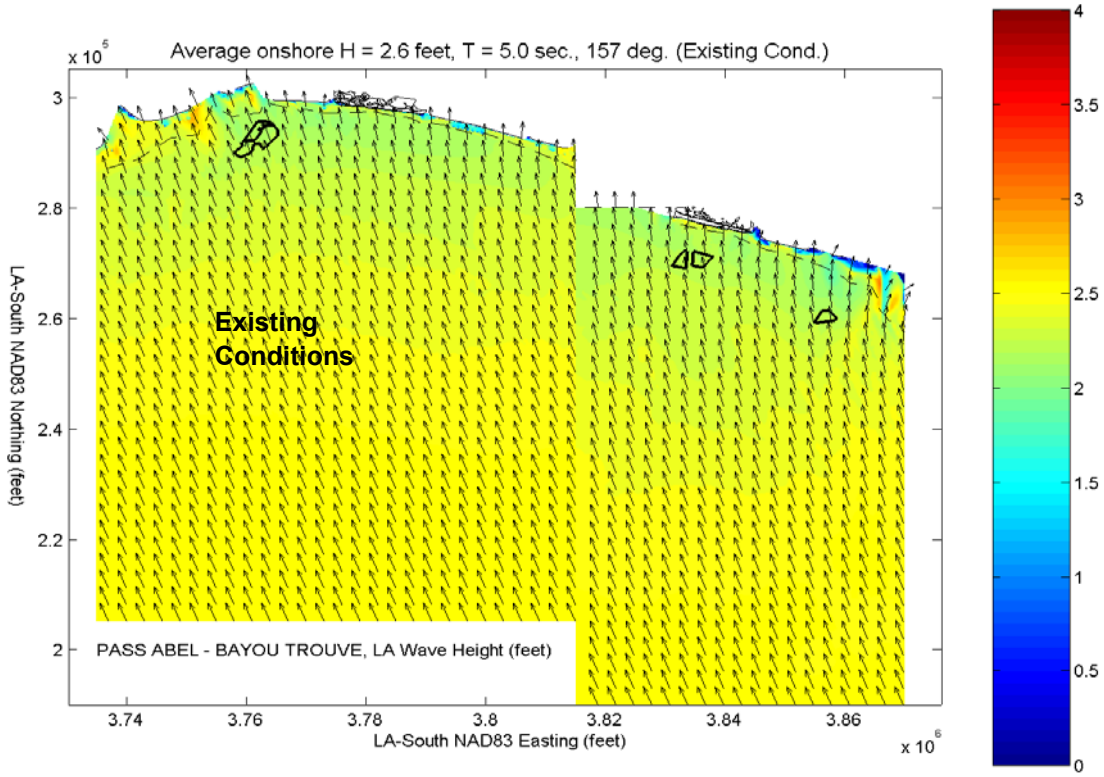
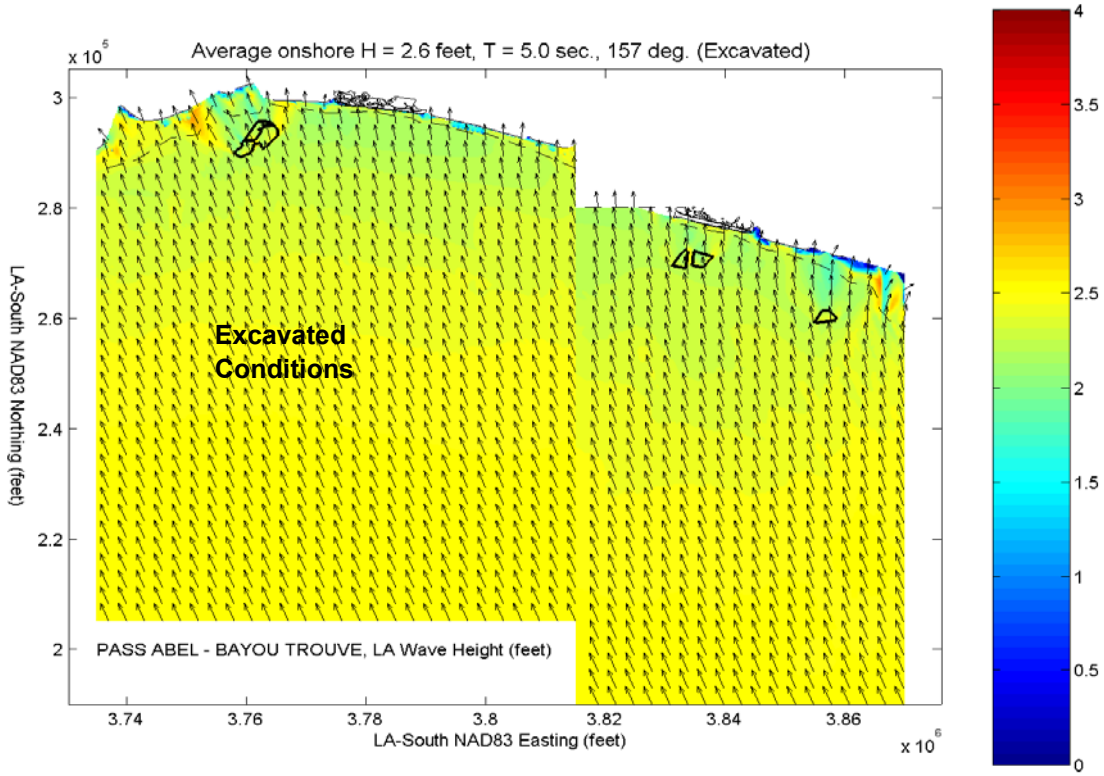
TITLE:

STWAVE RESULTS, AVERAGE WAVE
PASS ABEL - BAYOU TROUVE, LA
H = 2.6 FEET, T = 4.6 SEC., 131 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G4





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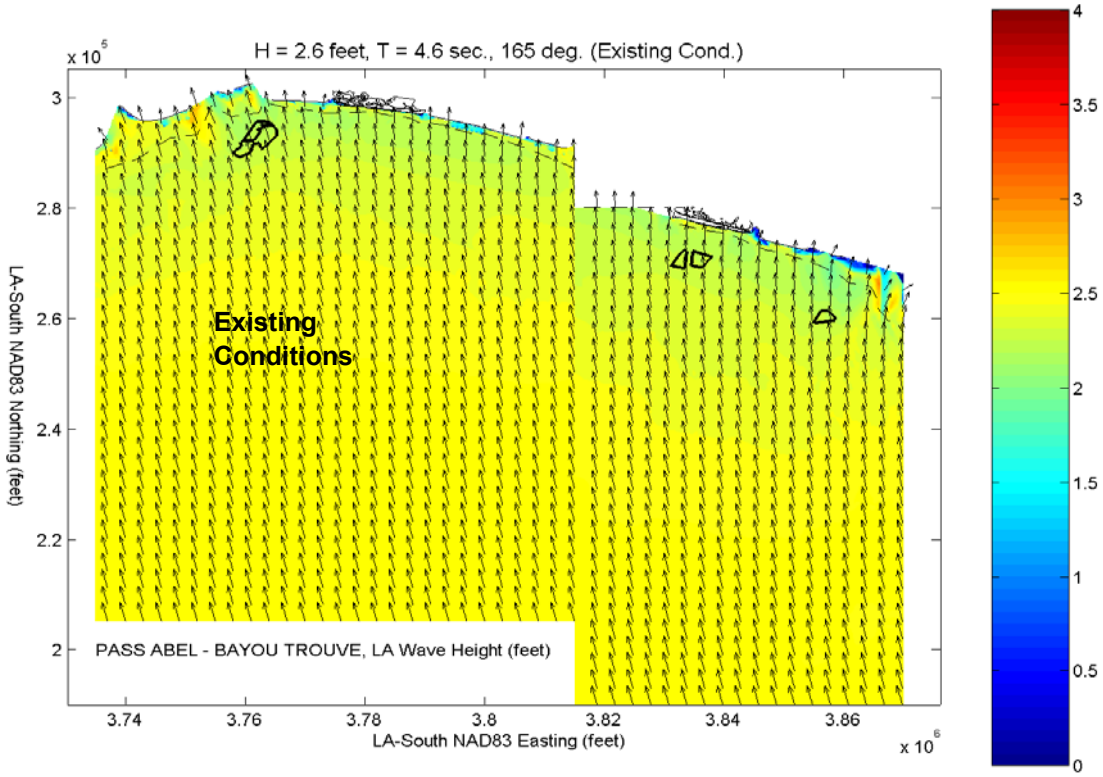
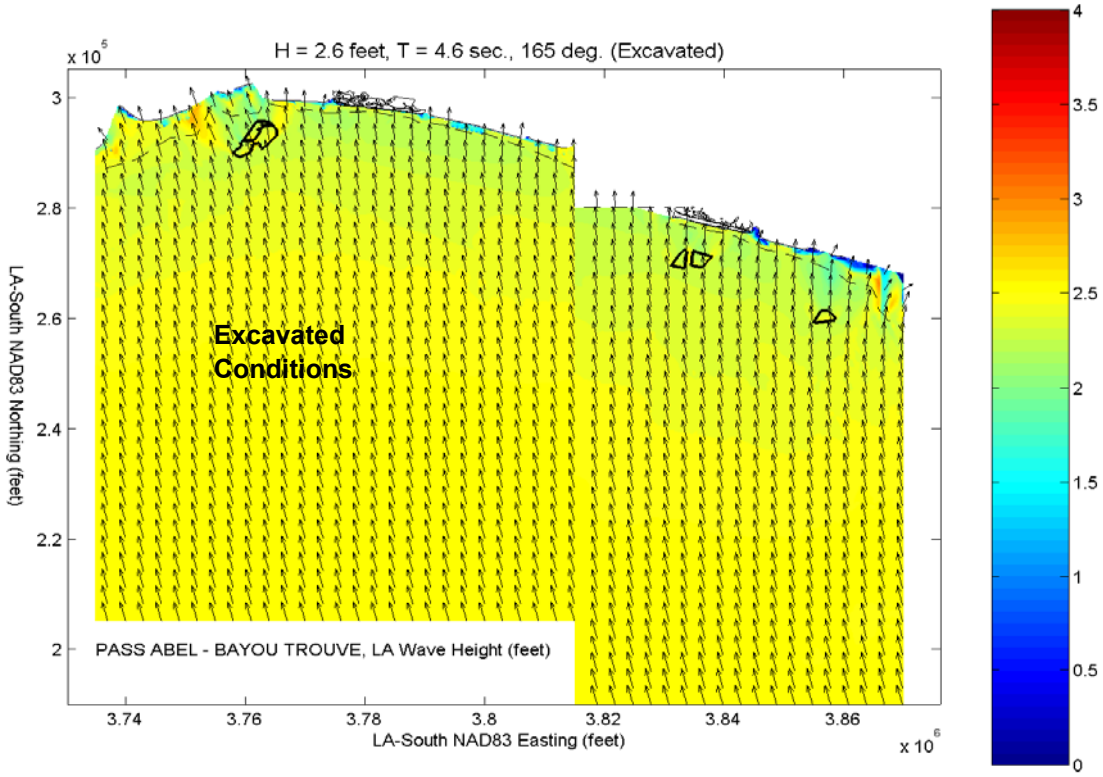
TITLE: **STWAVE RESULTS, AVG. ONSHORE WAVE, PASS ABEL - BAYOU TROUVE, LA H = 2.5 FEET, T = 5 SEC., 157 DEG.**

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G5





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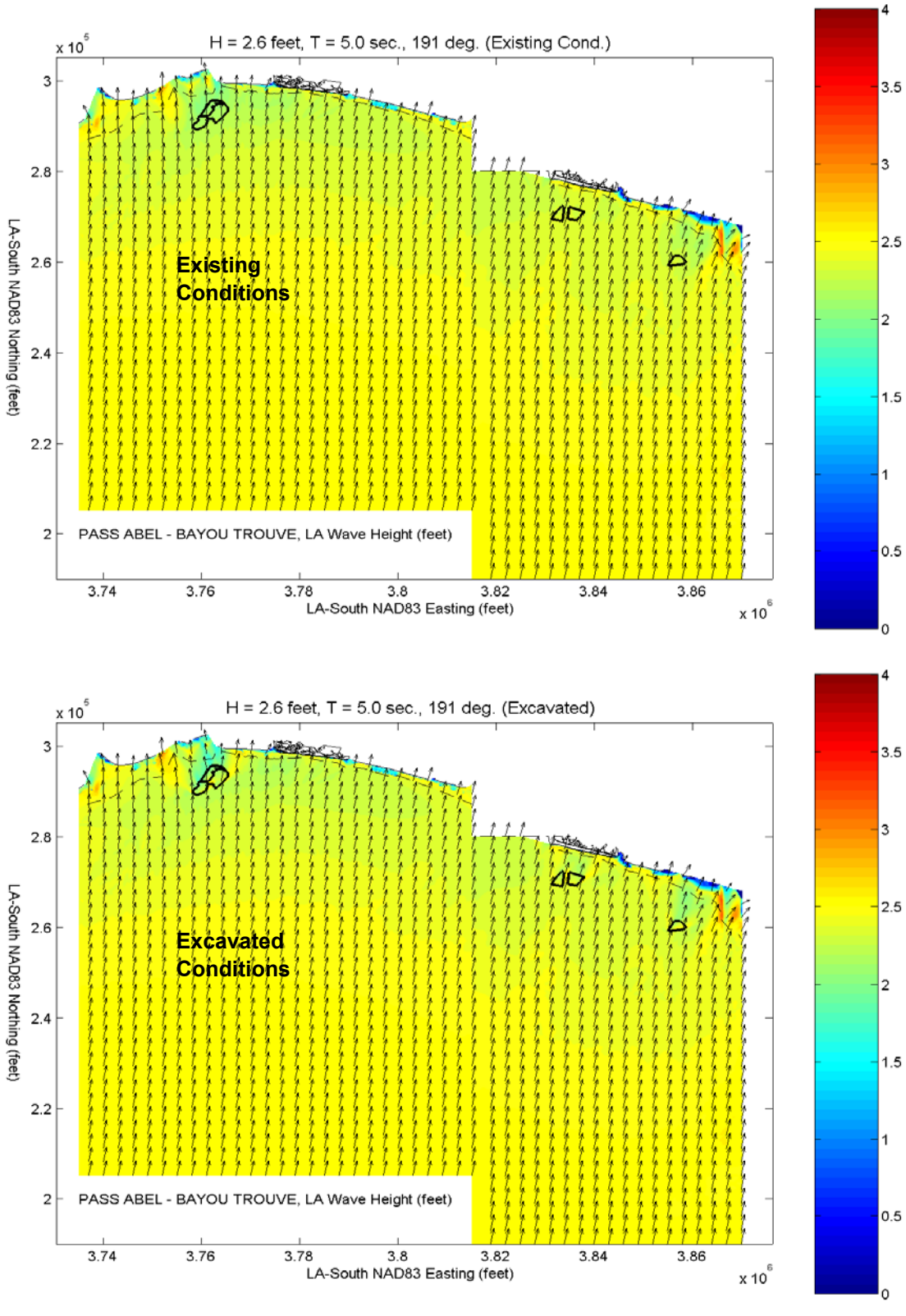
TITLE:

STWAVE RESULTS
PASS ABEL - BAYOU TROUVE, LA
H = 2.6 FEET, T = 4.6 SEC., 165 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G6



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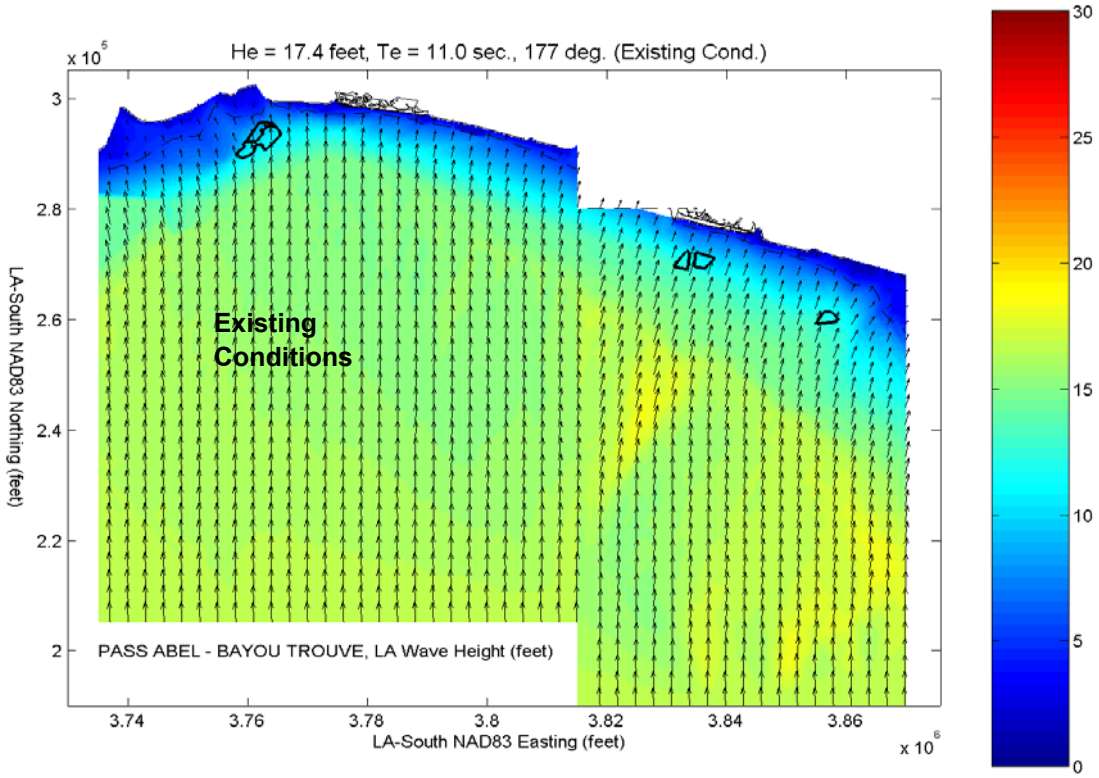
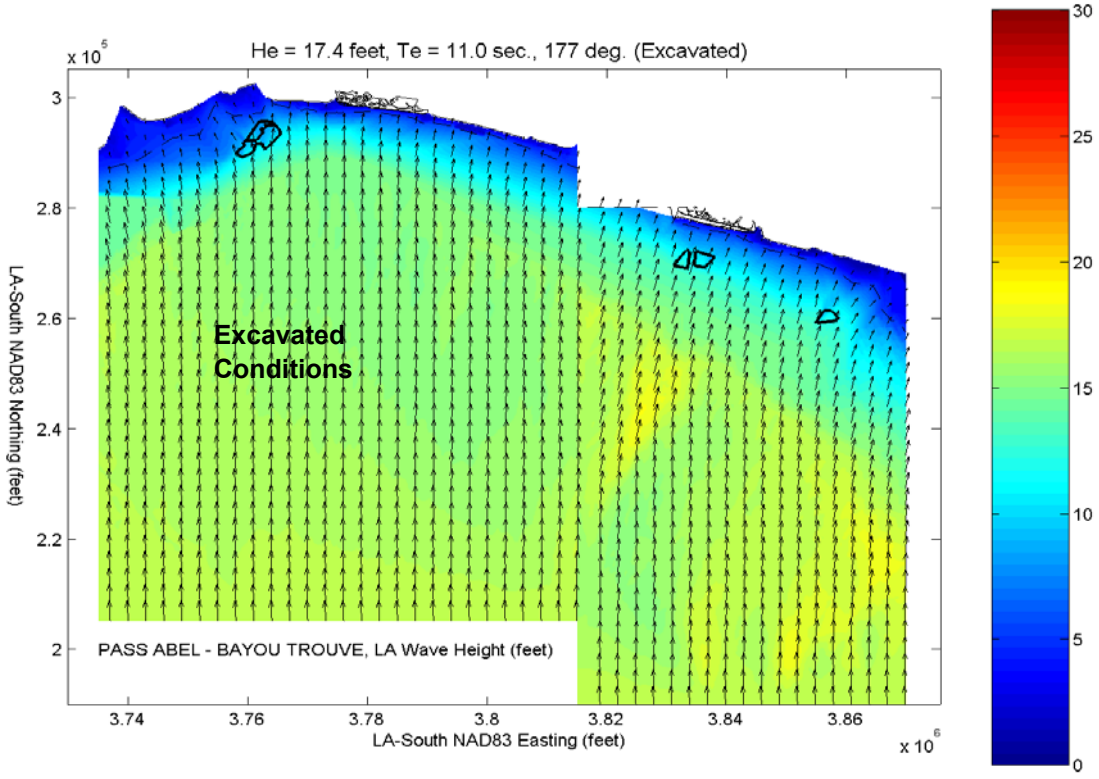
TITLE:

STWAVE RESULTS
PASS ABEL - BAYOU TROUVE, LA
H = 2.5 FEET, T = 5 SEC., 191 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G7





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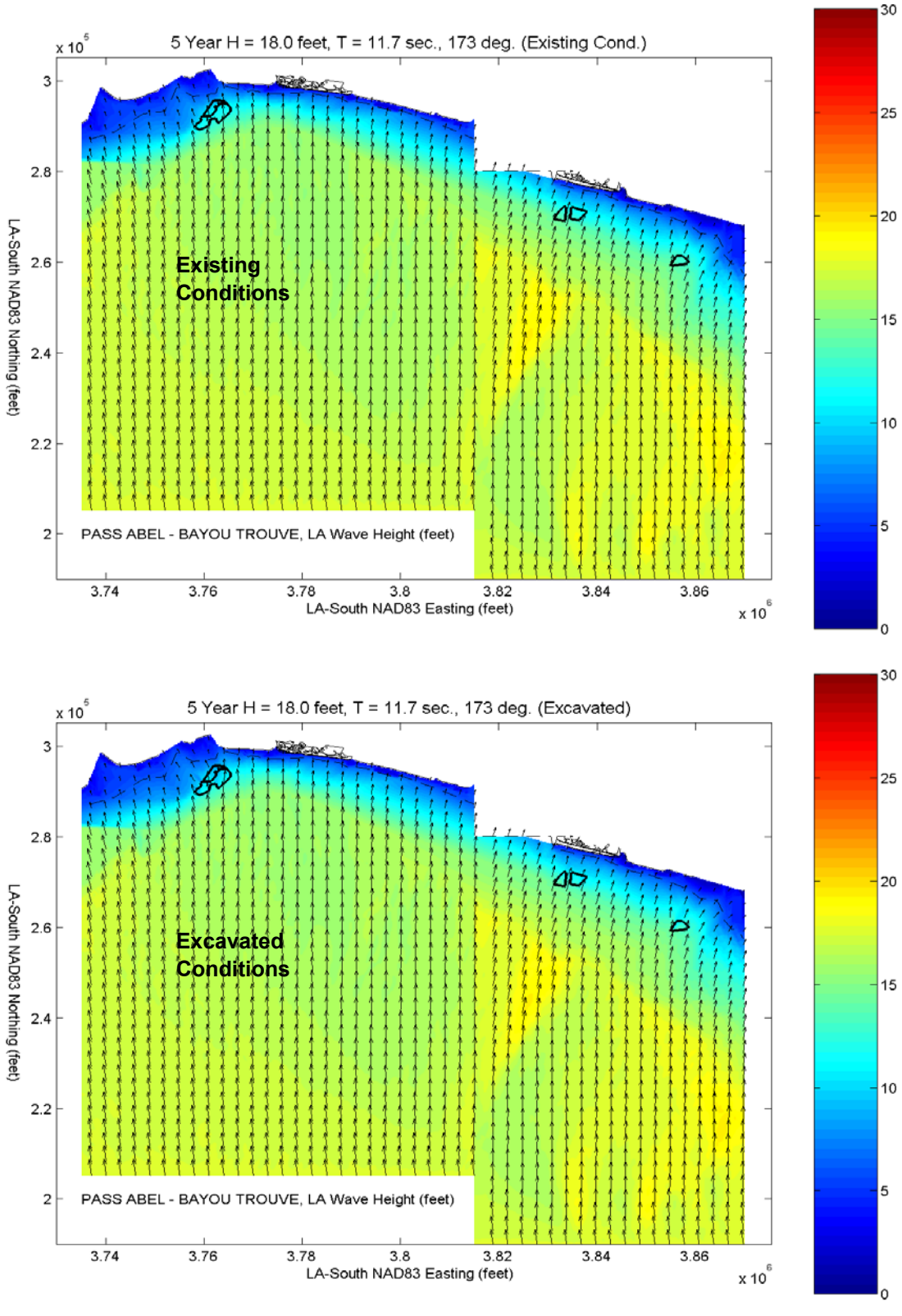
TITLE:

STWAVE RESULTS

PASS ABEL - BAYOU TROUVE, LA

He = 17.4 FEET, Te = 10.9 SEC., 177 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G8



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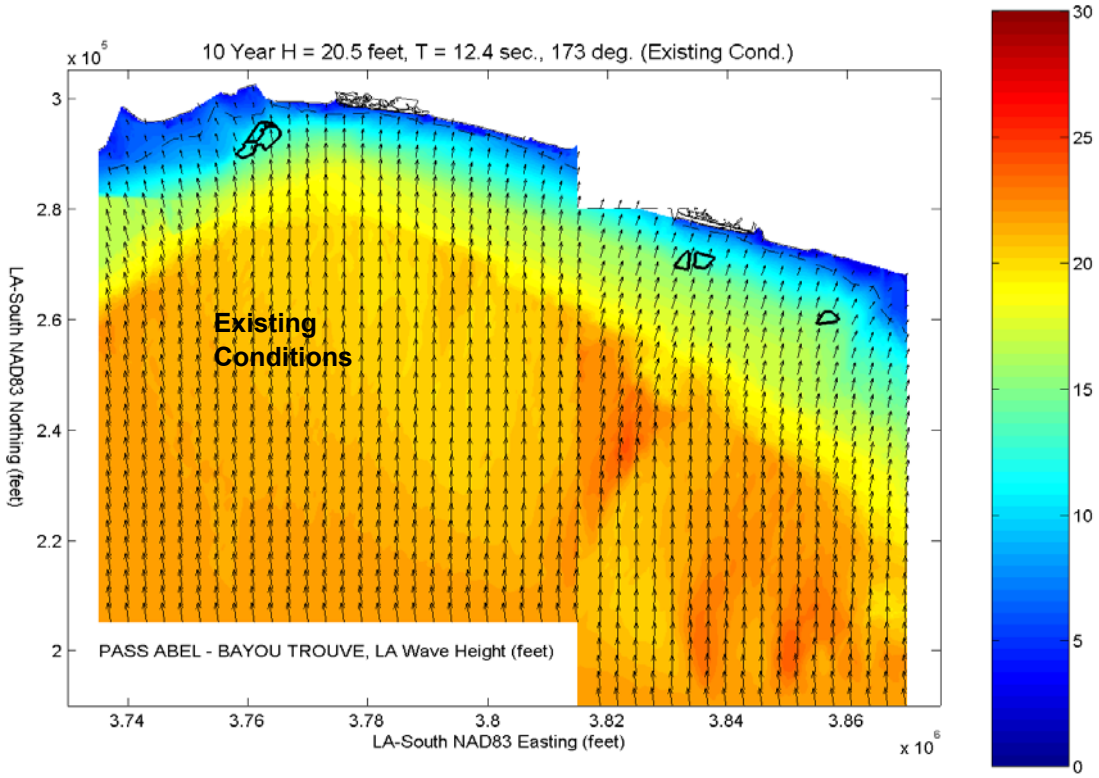
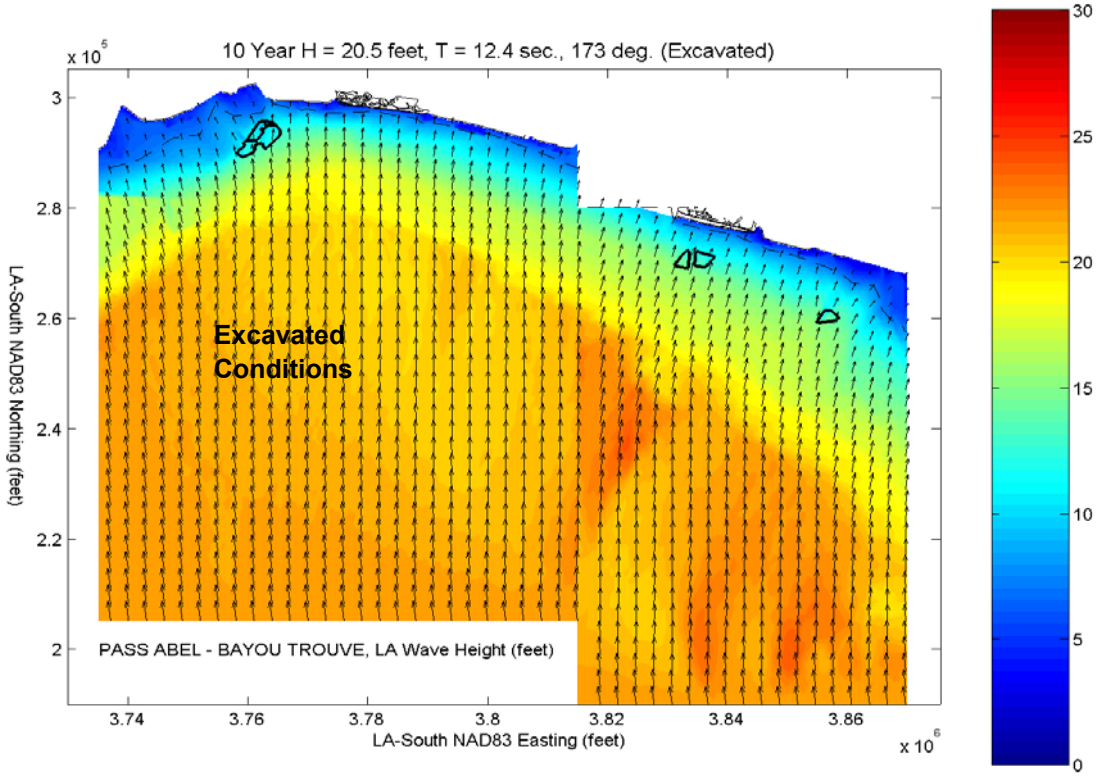
TITLE:

STWAVE RESULTS, 5 YEAR STORM,
PASS ABEL - BAYOU TROUVE, LA
H = 18 FEET, T = 11.7 SEC., 173 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G9





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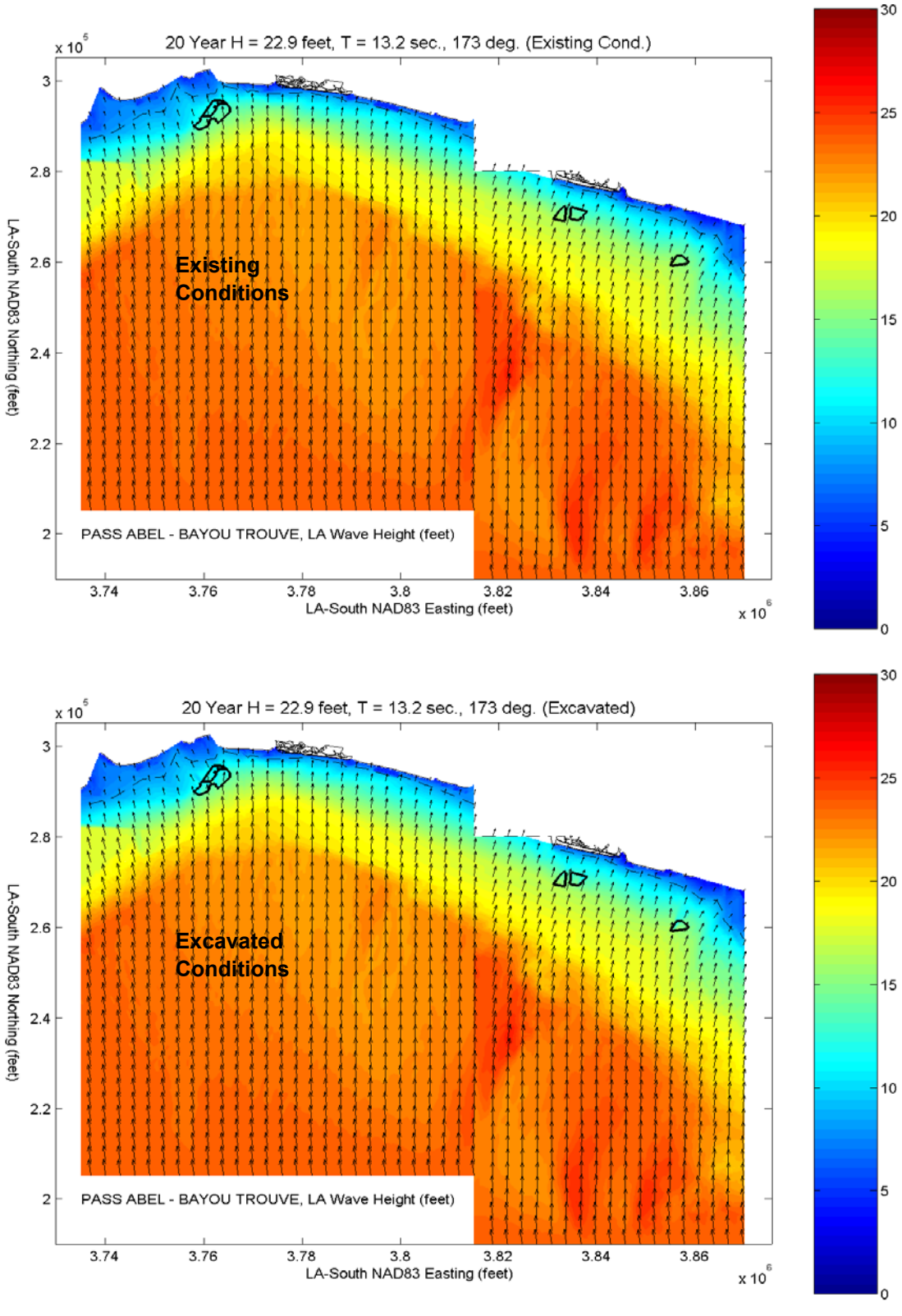
TITLE:

STWAVE RESULTS, 10 YEAR STORM,
PASS ABEL - BAYOU TROUVE, LA
H = 20.5 FEET, T = 12.4 SEC., 173 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G10



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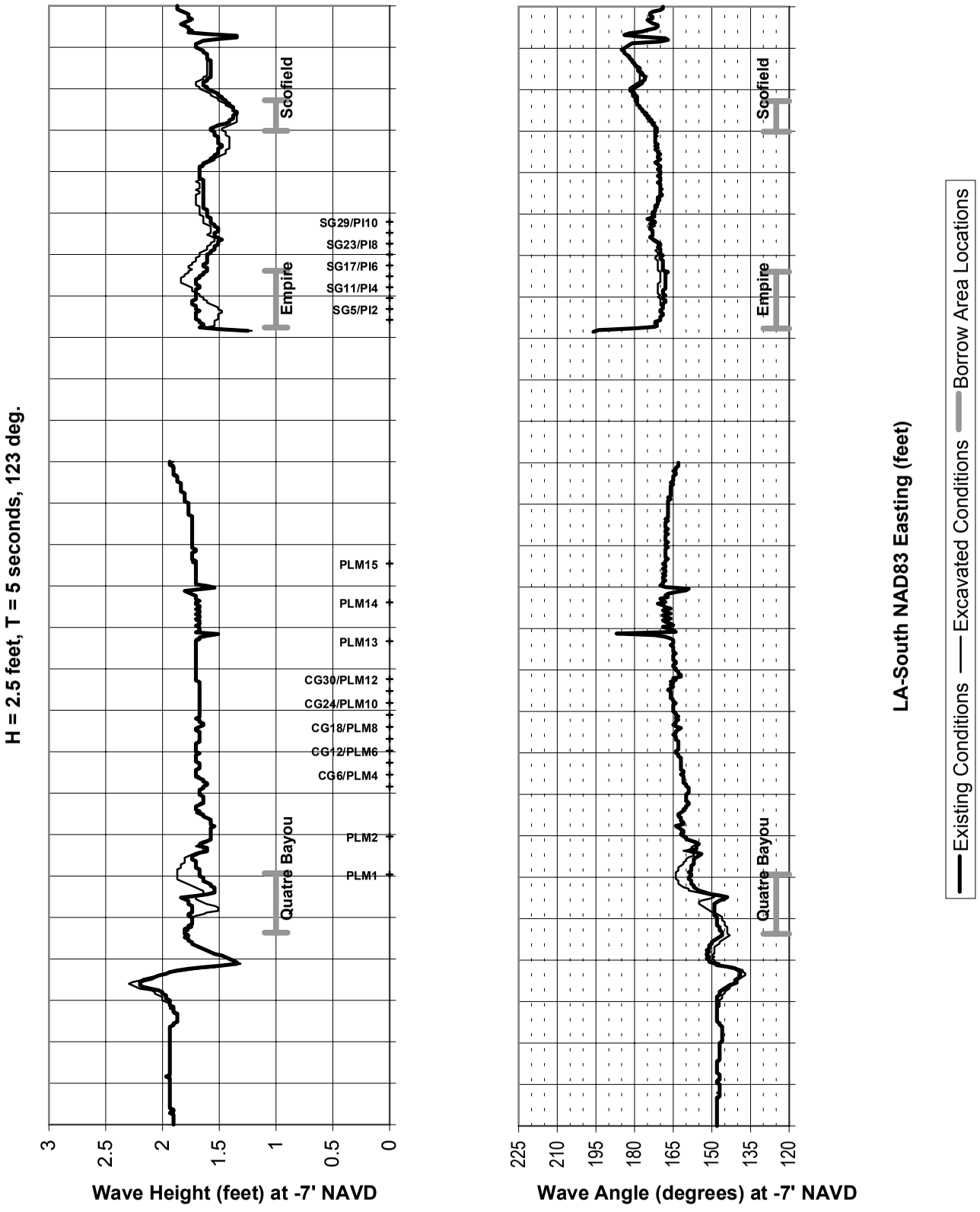
TITLE:

STWAVE RESULTS, 20 YEAR STORM,
PASS ABEL - BAYOU TROUVE, LA
H = 22.9 FEET, T = 13.2 SEC., 173 DEG.

DATE: 6/3/2003	BY: C.DAY	COMM. NO.: 7261.03	FIGURE NO. G11



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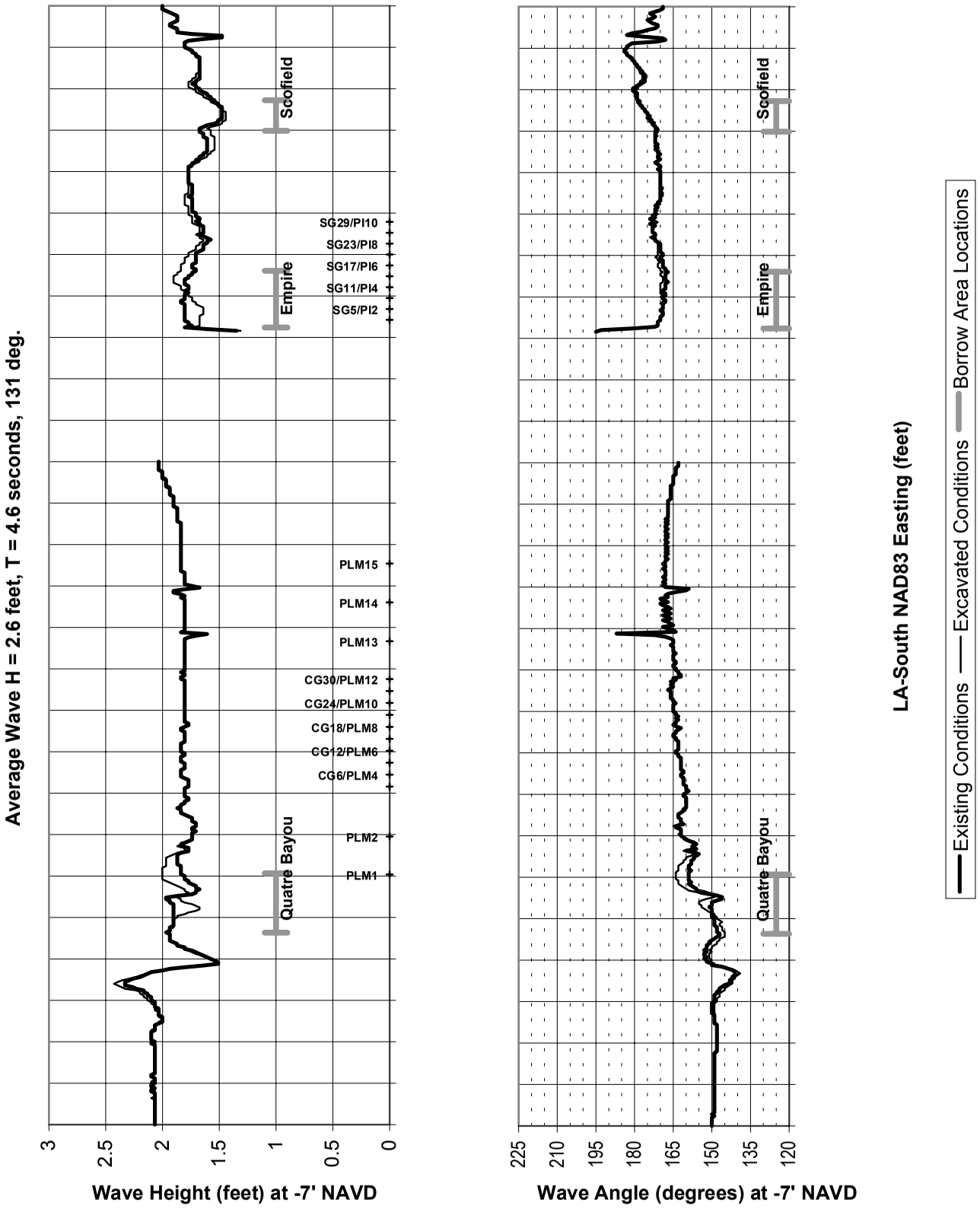
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, H = 2.5 FEET, T = 5 SECONDS, 123 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G12



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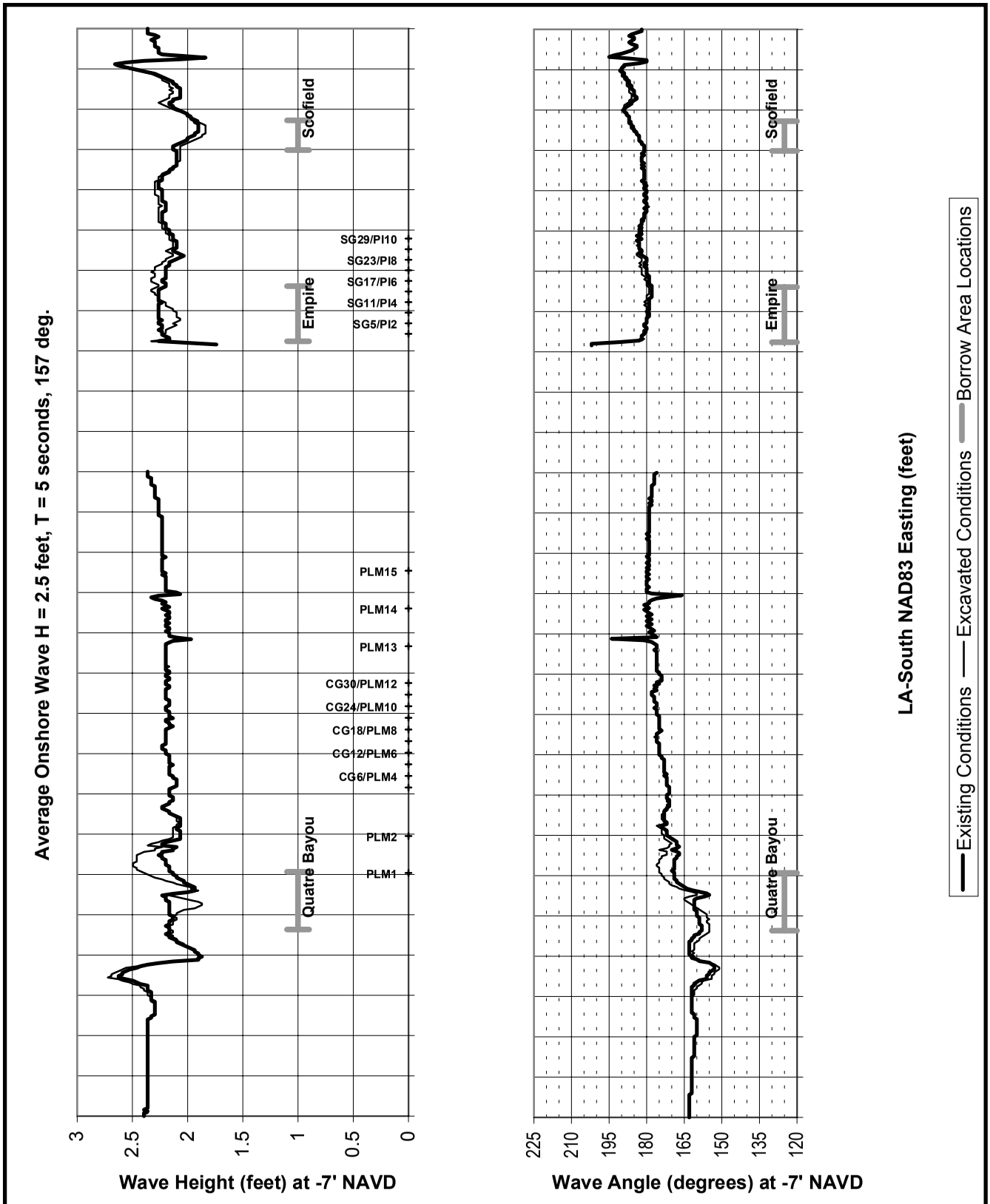
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, AVERAGE WAVE H = 2.6 FEET, T = 4.6 SECONDS, 131 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G13



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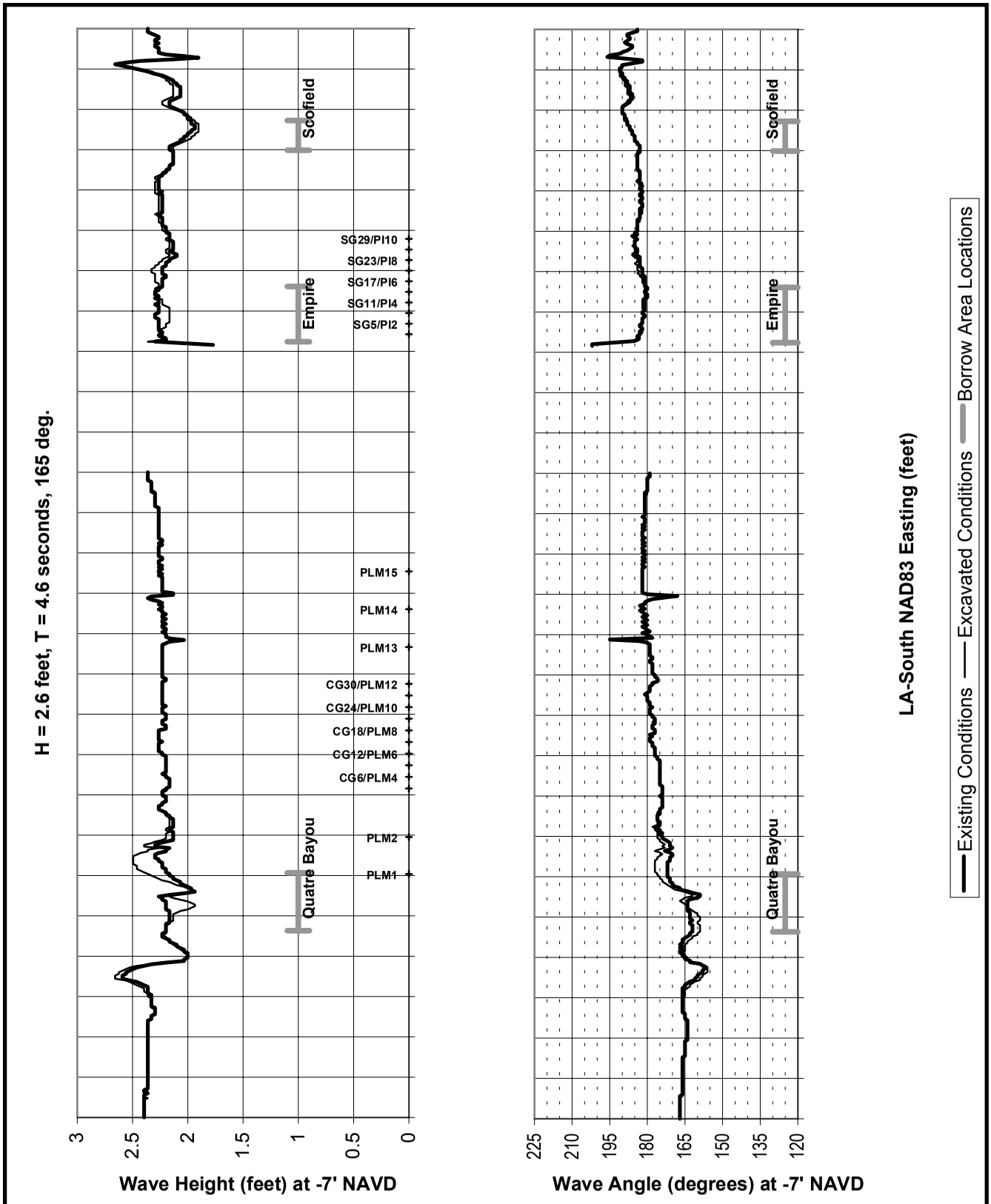
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, AVERAGE ONSHORE WAVE H = 2.5 FEET, T = 5 SECONDS, 157 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G14



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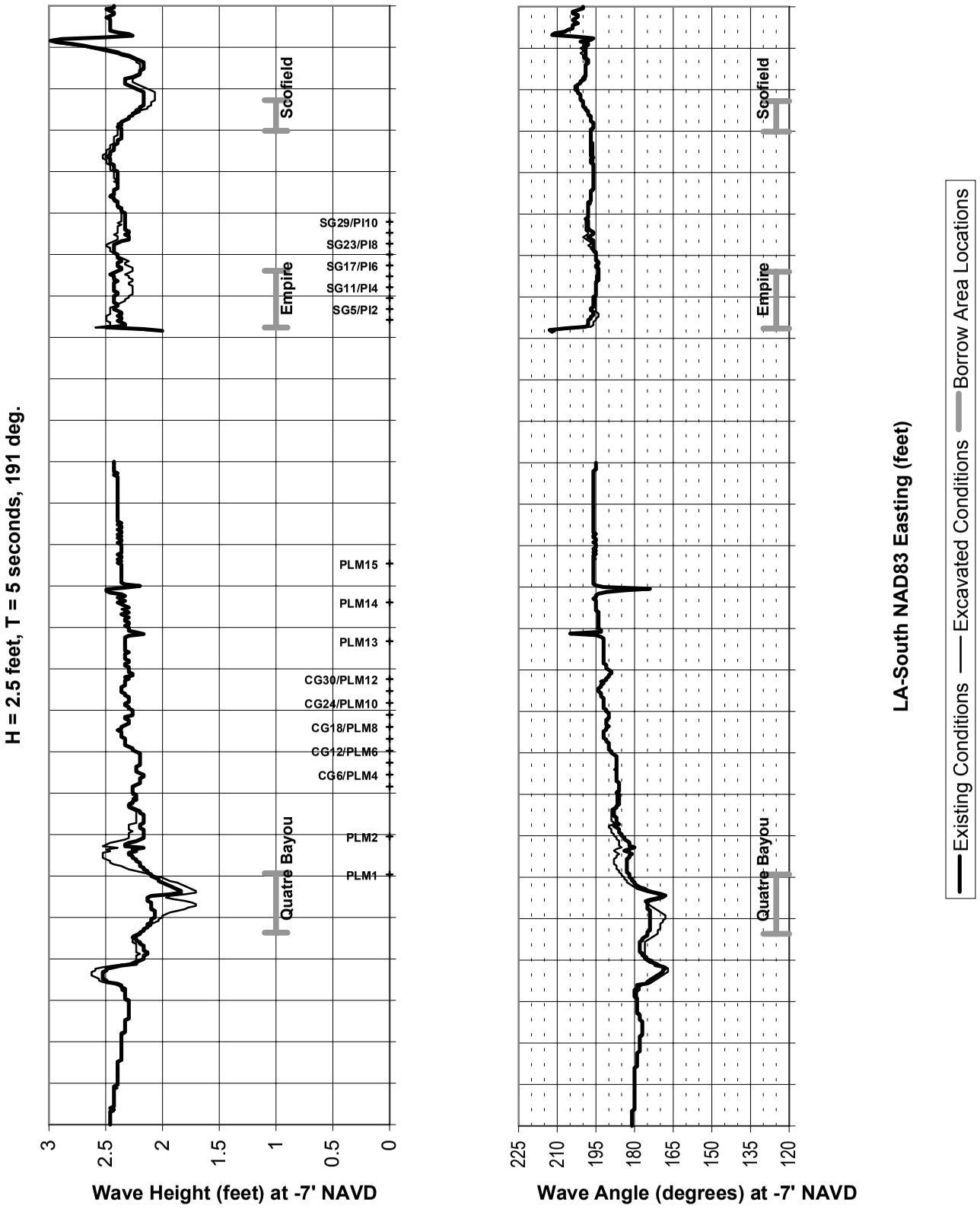
DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G15



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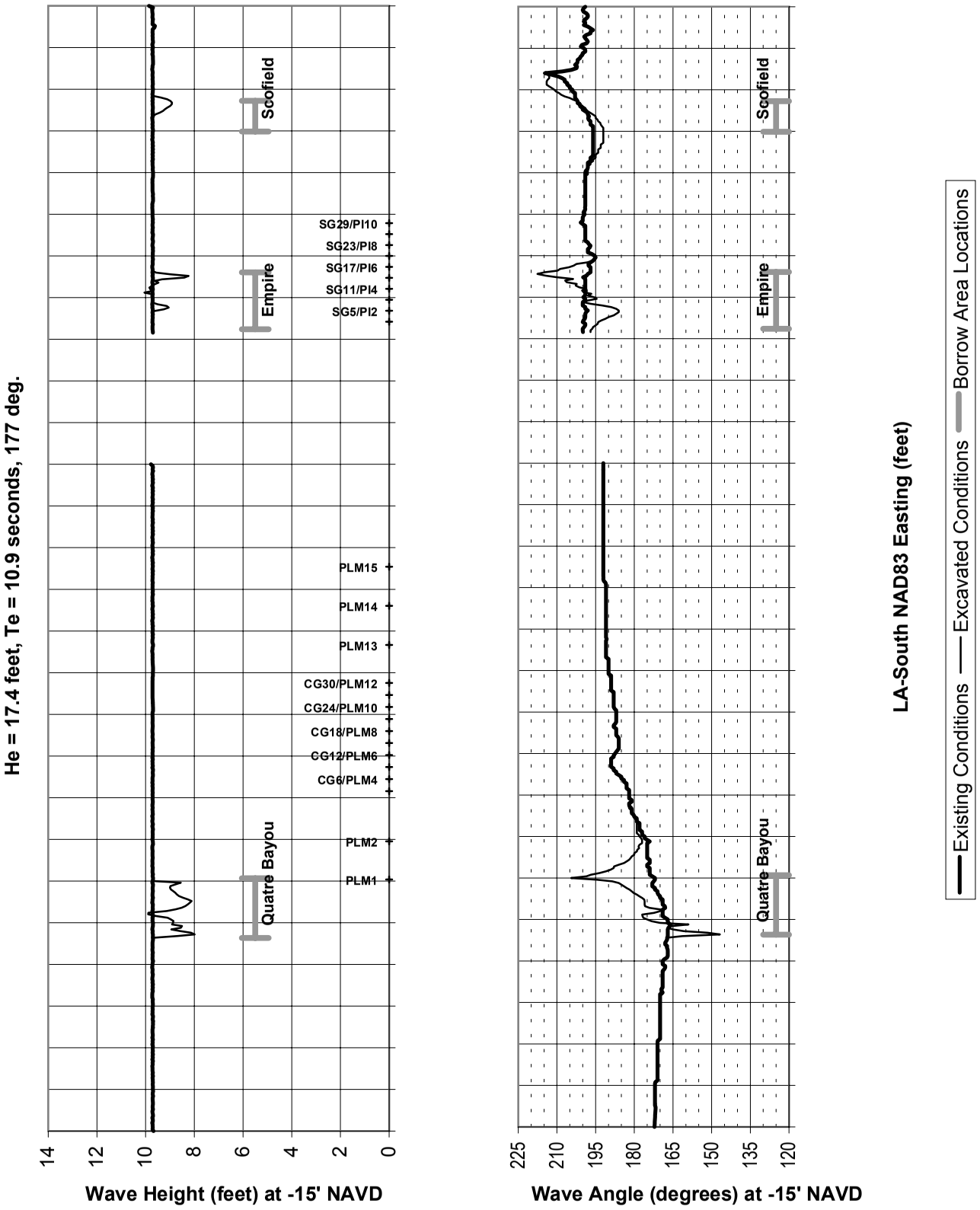
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, H = 2.5 FEET, T = 5 SECONDS, 191 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G16



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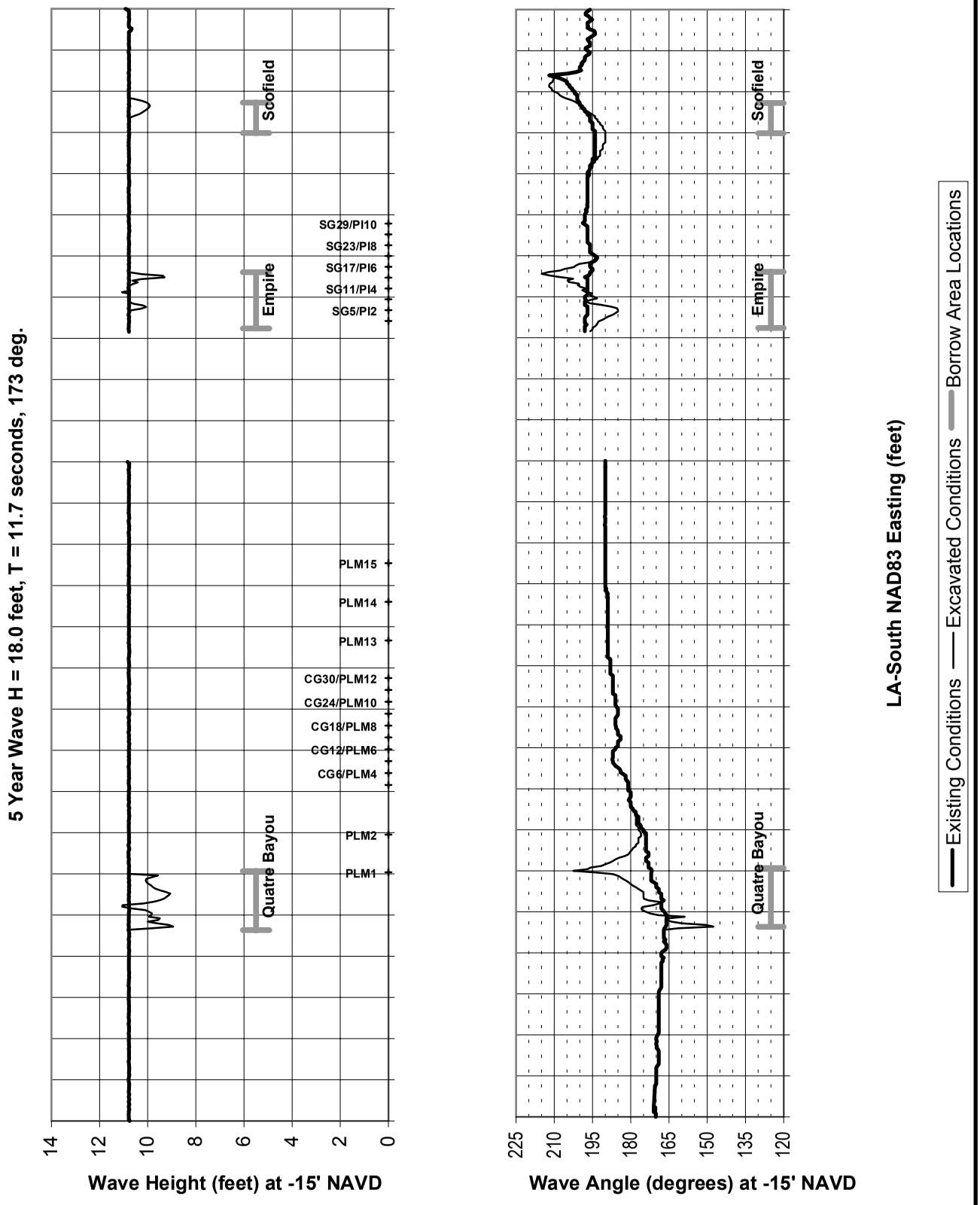
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, He = 17.4 FEET, Te = 10.9 SECONDS, 177 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G17



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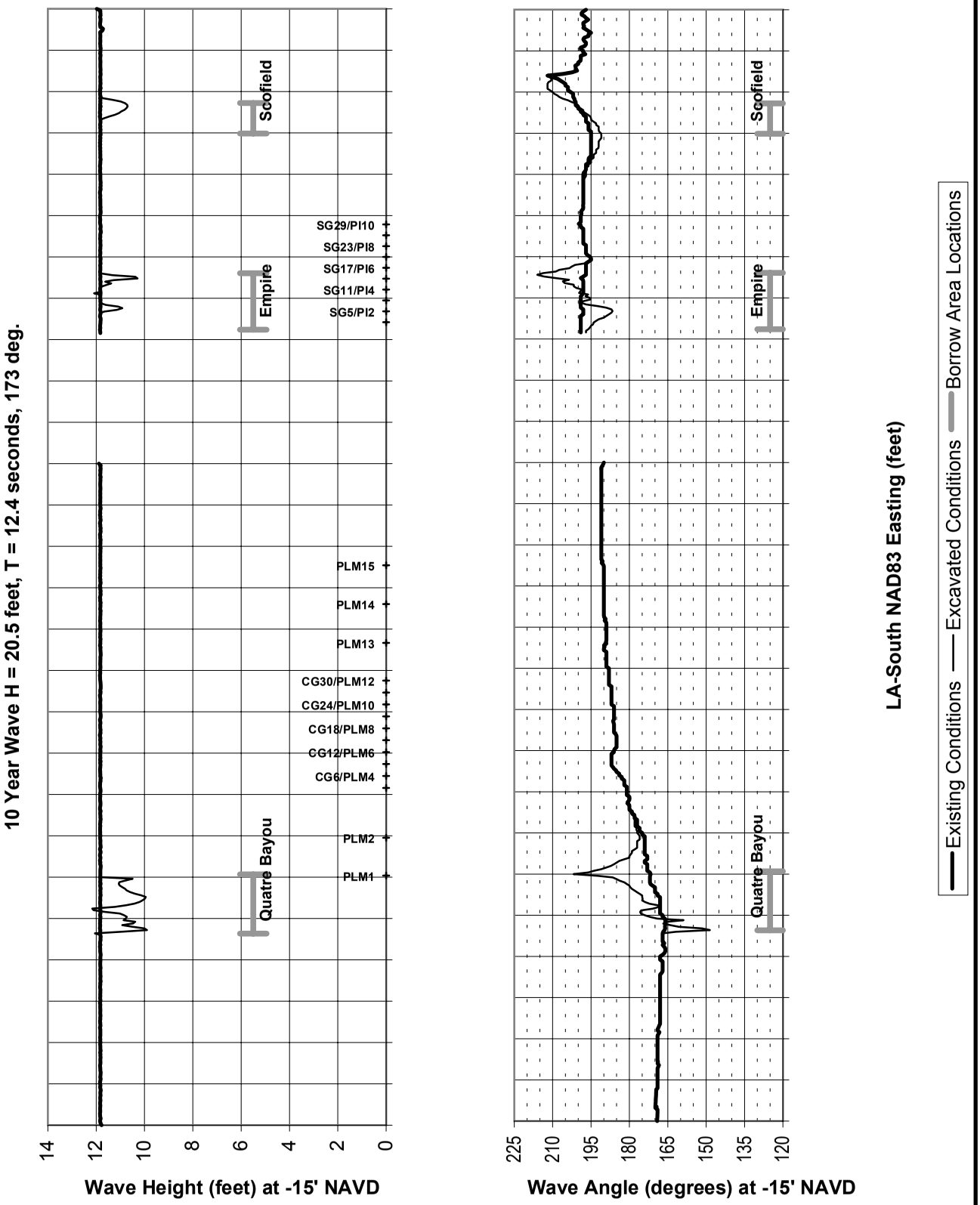
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, 5 YEAR WAVE H = 18.0 FEET, T = 11.7 SECONDS, 173 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G18



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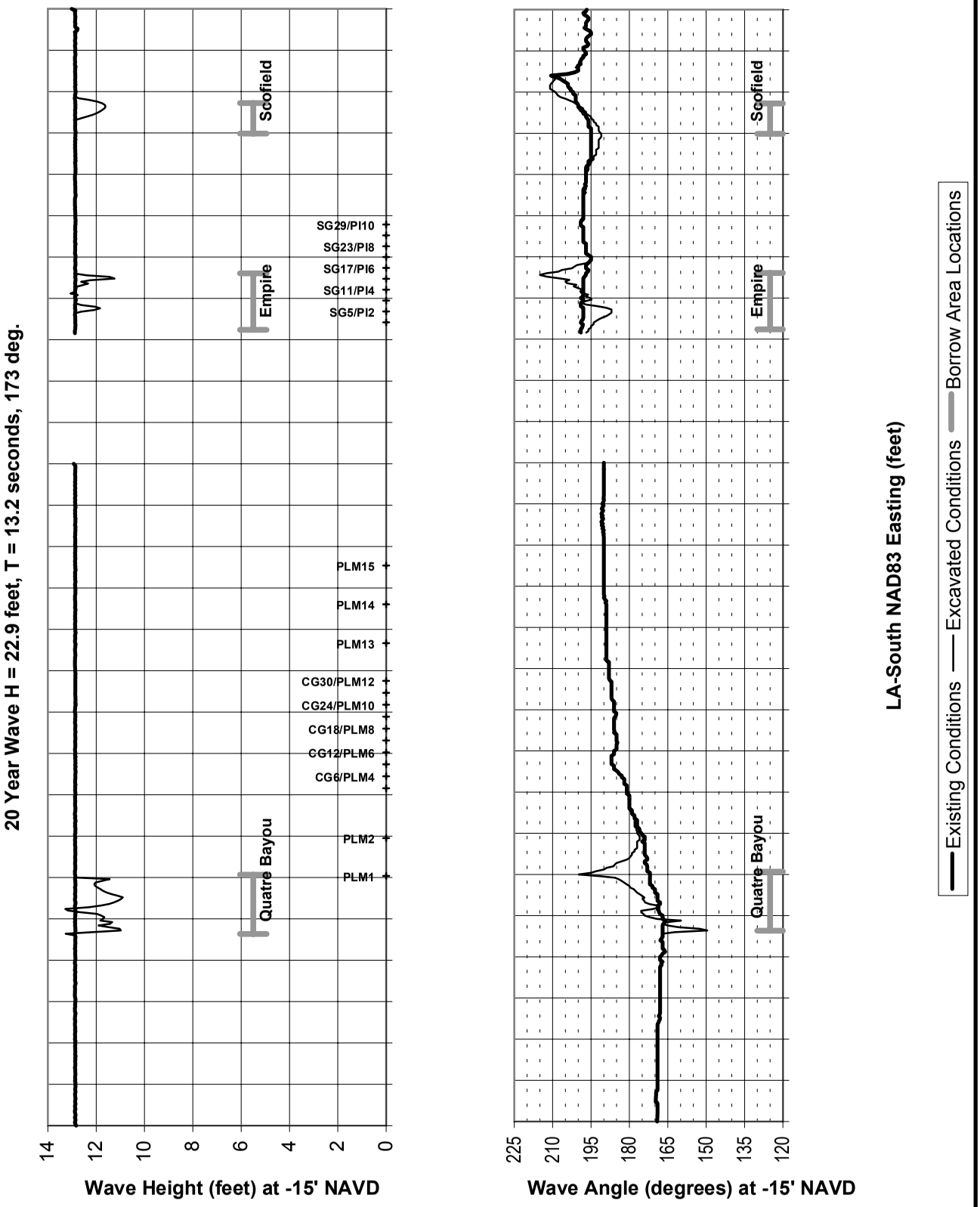
NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, 10 YEAR WAVE H = 20.5 FEET, T = 12.4 SECONDS, 173 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G19



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NEARSHORE WAVES, PASS ABEL - BAYOU TROUVE, LA, 20 YEAR WAVE H = 22.9 FEET, T = 13.2 SECONDS, 173 DEG.

DATE: 6/3/2003	BY: C. DAY	COMM. NO.: 7261.03	FIGURE NO. G20