APPENDIX D

REFLECTED WAVE ANALYSIS FOR ALTERNATIVE 3

Reflected Wave Analysis

for Alternative 2

White Bluff Yacht Club
Lake Whitney, Texas

Submitted By:

Atlantic-MEECO, Inc.
McAlester, Oklahoma

Reflected Wave Analysis

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Lake Whitney, Texas

Purpose:

The purpose of this brief analysis is to provide an estimate of the shore erosion potential of wind driven waves that are reflected off of the proposed attenuators.

Project Location:

The White Bluff development is located on the eastern shores of Lake Whitney approximately 3 miles upstream of the dam. Figure 1 is a vicinity map and aerial photograph that shows the general location of the proposed project site. There is an existing marina located within a man-made basin and the present plans are to move the existing facilities outside and to the north of the entrance to the existing basin so that additional facilities can be added.

Project Description:

This project consists of relocating the existing docks that serve as the White Bluff Marina out of a protected basin and into the open waters adjacent to the entrance to the existing basin. The proposed relocation site is exposed on the south, west and north sides and therefore requires wave attenuators to provide perimeter wave protection for the exposed sides. In addition, one new dock is proposed. Figure 2 shows the proposed harbor plan for "Phase 1" of the future development.

Attenuator Design Analysis Procedure:

After the general location of the project site was selected, the existing docks were arranged in the desired position and the proposed new dock was located. Since the new marina location is exposed to wind driven waves from the southeasterly direction around to the north-northwesterly direction, analyses were performed to determine the forecast wind driven wave climate at the site from the exposed areas. The wave forecasts were based on the straight line fetch lengths, wind data for the weekly, annual and 50- year return event was obtained from the historic data at DFW airport. The wave climate predictions were made using the Corps of Engineers wave generation program called "ACES". From the wave climate predictions, the size, draft and orientation of the perimeter protection attenuators were determined. The following table presents the "Predicted Wave Climate" at the project site from wind driven waves in the longest fetch directions.

Predicted Wave Climate

Fetch Direction (Deg.True)	Fetch Length (miles)	Wind Speed: Weekly, 20 knots		Annual, 39 knots		Extreme, 59 knots	
		H_{mo}	T sec.	H_{mo}	T sec.	H_{mo}	T sec.
144	3.60	1.5	2.6	3.2	3.3	5.0	3.8
240	2.35	1.2	2.2	2.6	2.8	4.0	3.3
290	3.20	1.2	2.3	3.0	3.1	4.7	3.7

The following table presents the theoretical wave height remaining after encountering the attenuator and based on the attenuator having an 8' draft.

Predicted Wave Attenuation

Fetch Direction (Deg.True)	Wind Speed					
	Weekly, 20 knots		Annual, 39 knots		Extreme, 59 knots	
	H_{mo}	H_r	H_{mo}	H_r	H_{mo}	H_r
144	1.5	0.3	3.2	1.4	5.0	2.7
240	1.2	0.3	2.6	1.0	4.0	2.1
290	1.2	0.3	3.0	1.1	4.7	2.4

Reflected Wave Analysis Procedure:

Once the harbor plan was developed, the same wave analysis procedure was used to determine the incident waves for the annual wind speed (39 knots) at angles of the wave crest to the attenuator face of 20, 40 60, and 80 degrees. The reflected wave heights were then calculated using the formula, $H_r^2=H_i^2-H_t^2$. Also, the reflected wave heights were calculated at a distance of two-wave lengths from the attenuator (Xie, 1981). The reflected wave is estimated to be only 70% of its initial height at a distance of two wave lengths from the point of reflection. In addition it is estimated to be fully decayed within a distance of five wave lengths.

Analysis results:

North Attenuator – The north attenuator has its axis oriented along a line from 038^0 and 218^0. The worst exposure is from the northwest. Figure 3 presents the incident waves and reflective waves at angles of 20 degrees.

North Attenuator

Fetch Direction	Fetch Length	Wave Hgt. H_i	Wave Hgt. H_t	Wave Hgt. H_r	Wave Lgth. ft	2 Wave Lengths	Wave Hgt.	Shore Distance
238	2.3 miles	2.5	0.8	2.4	40.1	80.2	1.7	170'
258	1.0 miles	1.7	0.1	1.7	22.6	45.2	1.2	380'
278	0.9 miles	1.6	0.1	1.6	22.6	45.2	1.1	1000'+
298	2.5 miles	2.6	0.9	2.4	42.6	85.2	1.7	1000'+

The "**North Attenuator**" table above shows the fetch directions, lengths, incident wave height, reflected wave height, wave length and wave height at two wave lengths. The reflected wave directional distance to the shoreline is also given. The results show that the wave generated from a bearing of 238^0 will reflect at a

bearing of 018^0 and the shoreline distance is approximately 170'. The calculated wave length is 40.1', therefore 5 wave lengths is approximately 200'. All other generated waves will decay prior to reaching the shoreline.

South Attenuator – The south attenuator has its axis oriented along a line from 078^0 and 258^0. The worst exposure is from the southwest. Figure 3 presents the incident waves and reflective waves at angles of 20 degrees.The following table "**South Attenuator**" shows the fetch directions, lengths, incident wave height, reflected wave height, wave length and wave height at two wave lengths after reflection. The reflected wave directional distance to the shoreline is also given. These results show that the wave generated from a bearing of 238^0 will reflect at a bearing of 098^0 which is reflecting into the entrance channel of the existing basin. The reflection of the 198^0 waves will also enter into the entrance channel. Waves generated from the 218^0 direction will travel a distance of some 380' before encountering the shoreline and therefore will decay prior to arrival. Waves generated from the longest fetch direction of 1440 will be directed outward from the shoreline into open water.

South Attenuator

Fetch Direction	Fetch Length	Wave Hgt. H_i	Wave Hgt. H_t	Wave Hgt. H_r	Wave Lgth. ft	2 Wave Lengths	Wave Hgt.	Shore Distance
178	1.5 miles	2.1	0.4	2.1	31.1	62.2	1.4	1000'+
198	1.3 miles	1.9	0.3	1.9	27.8	55.6	1.3	1000'+
218	1.3 miles	1.9	0.3	1.9	27.8	55.6	1.3	380'
238	1.7 miles	2.2	0.8	2.0	40.1	80.2	1.4	500'

H_i Incident wave height, ft.

H_t Transmitted wave height, ft.

H_r Reflected wave height, ft.

West Attenuator – The west attenuator has its axis oriented along a line from 152^0 and 332^0. The worst exposure is from the southwest through the northwest. All waves reflected from the west attenuator will be directed back into open water and not affect the shoreline which has its nearest point about 1 mile from the attenuator.

Conclusions:

The wave reflection analysis did not consider any reflection, defraction, shoaling, or other effects of the lake bottom, submerged obstacles or any other items that might change or affect the wave patterns. In addition there is no indication of any previous erosion studies that might influence the conclusions of this report.

North Attenuator – The analysis indicates that there will be no appreciable impact of the reflected waves upon the existing shoreline. The only potential impact would be that from waves generated from a direction of 238^0 but it is believed that these waves will have decayed and any impact would be negligible compared to the direct waves.

South Attenuator – The analysis indicates that there will be no appreciable impact of the reflected waves upon the existing shoreline. The only potential impact would be that from waves generated from a direction of 218^0, but it is believed that these waves will have decayed and any impact would be negligible compared to the direct waves.

West Attenuator – There will be no negative impact of waves reflected by the west attenuator.

References:

CEDAS, Version 2.01. Veri-Tech Inc., Vicksburg, Mississippi
SPM, U.S. Army Corps of Engineers, Shore Protection Manual
CEM, U.S. Army Corps of Engineers, Coastal Engineering Manual

0 1 2 3 4 5 km

0 0.8 1.6 2.4 3.2 4 mi

UTM 14 647562E 3542346N (NAD83/WGS84)
Elevation 533.0 ft / 162.5 m (USGS NED)
USGS Lakeside Village (TX) Quadrangle
Projection is UTM Zone 14 NAD83 Datum

M=5.272
G=0.828

FIGURE 1
VICINITY MAP

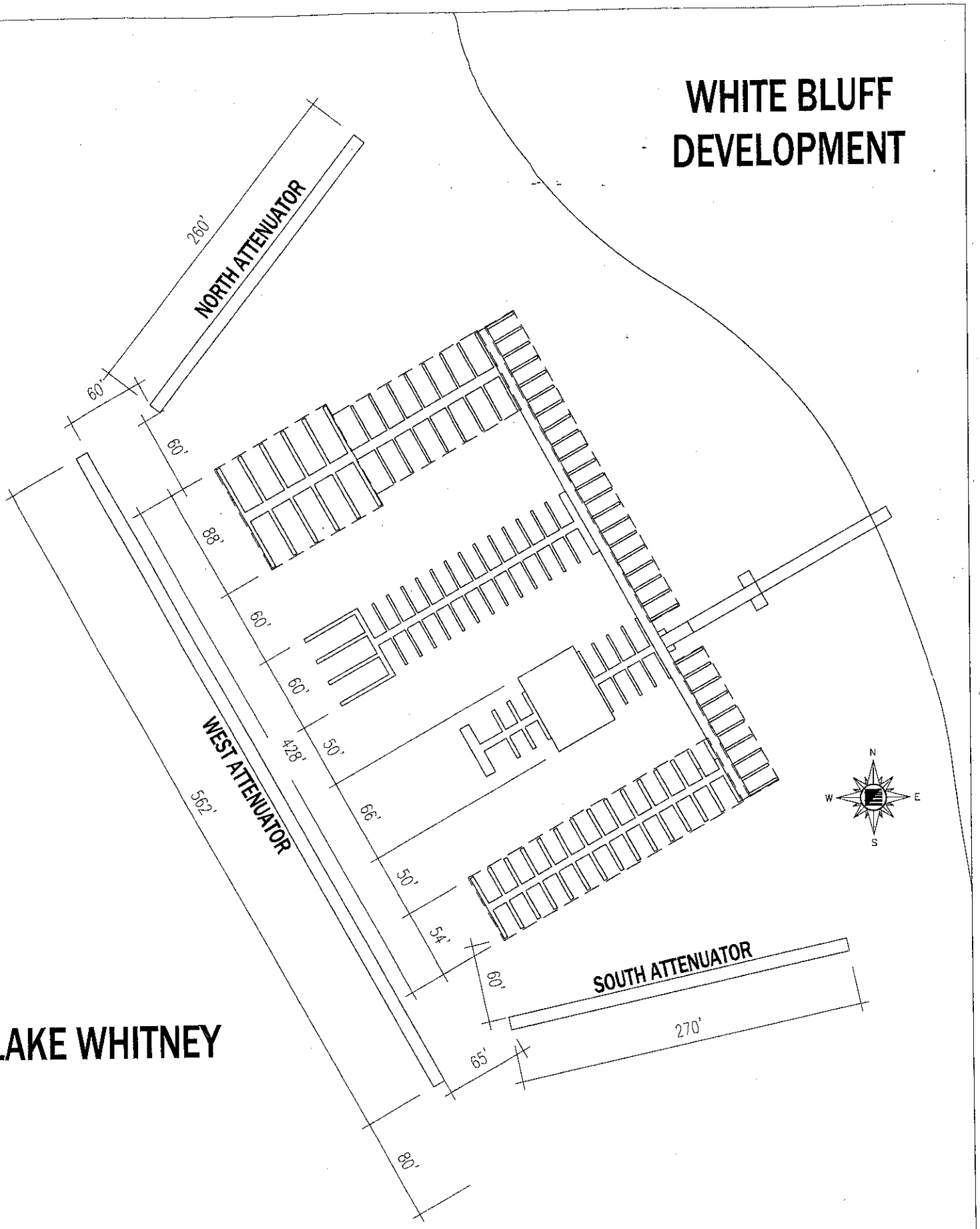

Figure 2

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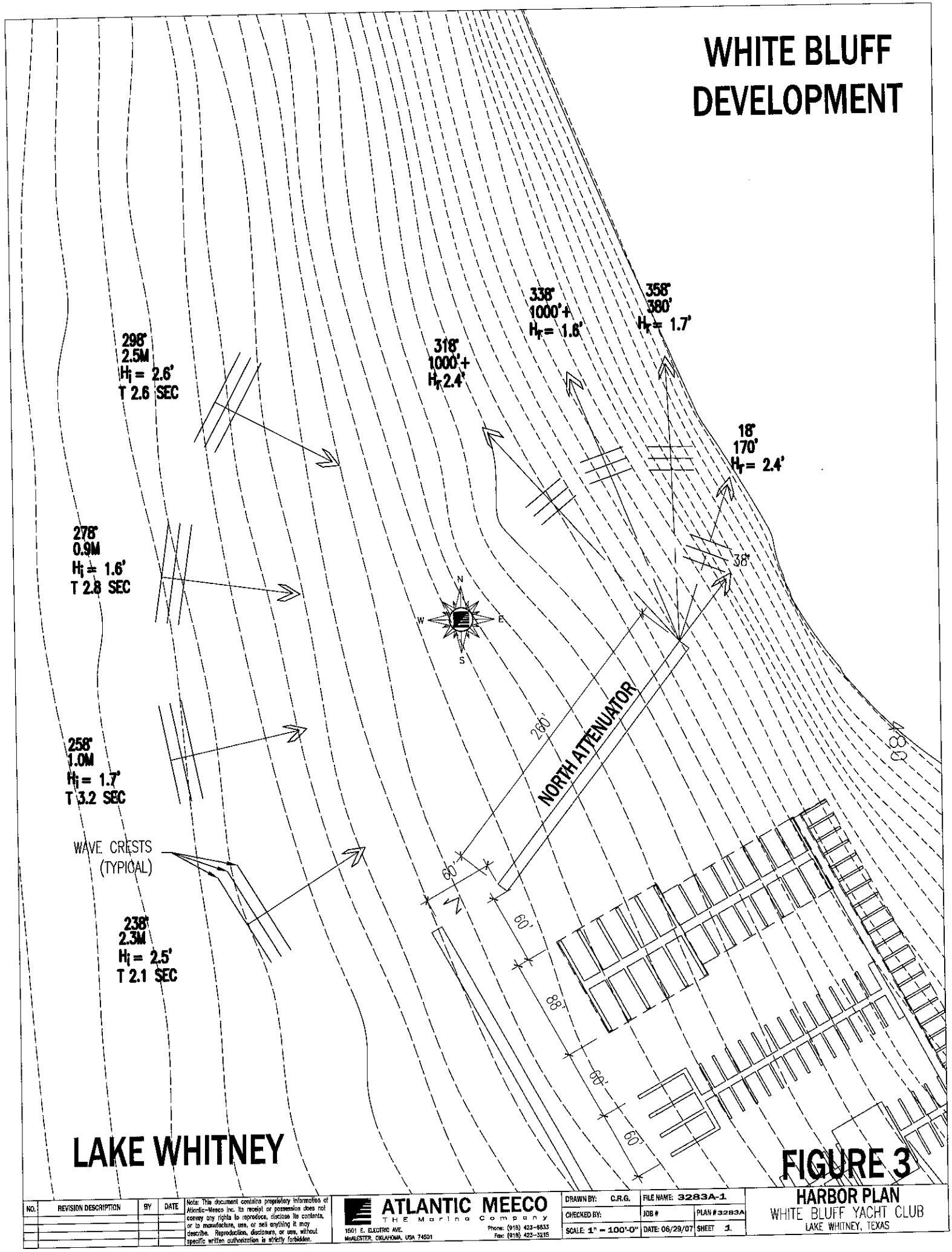
SCALE: 1" = 100'-0"	DATE: 06/29/07	SHEET 1	

HARBOR PLAN
WHITE BLUFF YACHT CLUB
LAKE WHITNEY, TEXAS



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CHECKED BY:	JOB #	PLAN # 3283A	WHITE BLUFF YACHT CLUB
SCALE: 1" = 100'-0"	DATE: 06/29/07	SHEET 1	LAKE WHITNEY, TEXAS

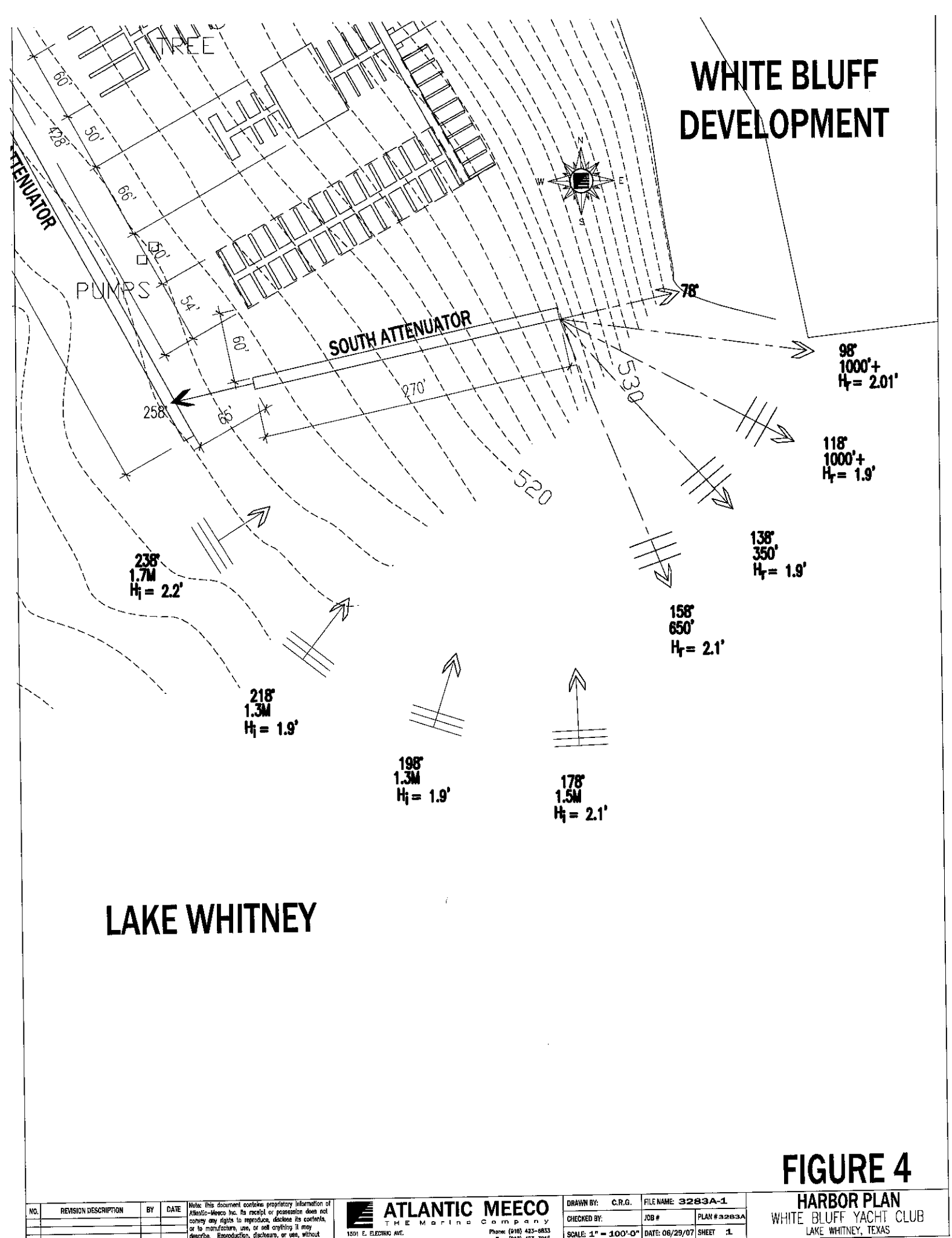

FIGURE 4

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